INSTRUCTIONS–PARTS LIST

GRACO

307–926

Rev. F
Supersedes C and
PCN DEF

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

ELECTRIC, 220/240 VAC

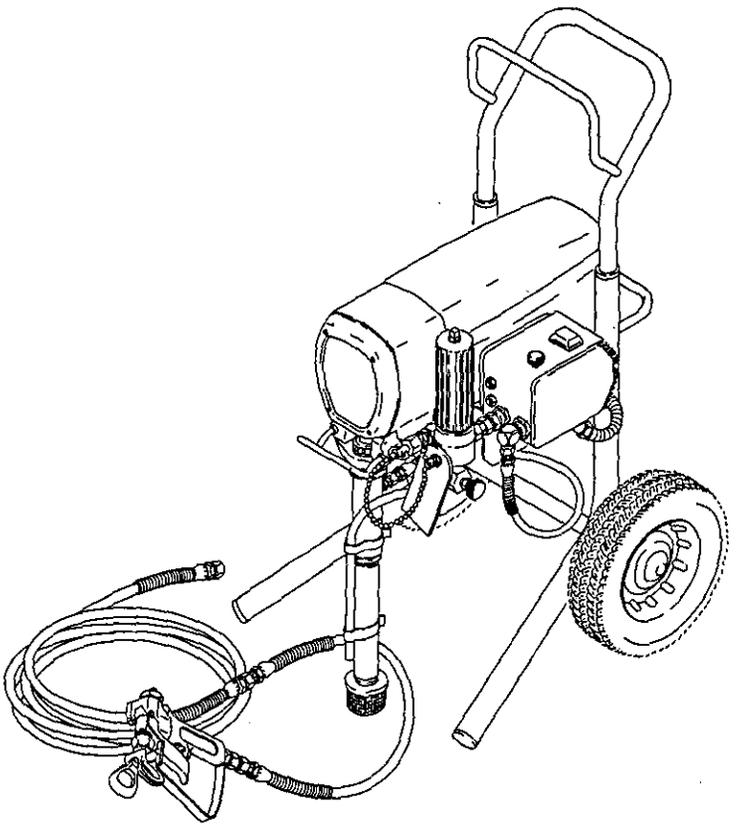
Ultra® 1000 Airless Paint Sprayer

207 bar Maximum Working Pressure

Model 231–082, Series C

Complete sprayer with hose, gun, RAC IV®, DripLess™ Tip Guard and SwitchTip™.

NOTE: See Table of Contents on page 2.



03742

NOTE: This is an example of the DANGER label on your sprayer. This label is available in other languages, free of charge. See page 43 to order.

DANGER

FIRE AND EXPLOSION HAZARD	SKIN INJECTION HAZARD
Spray painting, flushing or cleaning equipment with flammable liquids in confined areas can result in fire or explosion. Use outdoors or in extremely well ventilated areas. Ground equipment, hoses, containers and objects being sprayed. 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. Failure to follow this warning can result in death or serious injury.	Liquids can be injected into the body by high pressure airless spray or leaks – especially hose leaks. 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. Never spray without a tip guard. In case of accidental skin injection, seek immediate "Surgical Treatment". Failure to follow this warning can result in amputation or serious injury.

READ AND UNDERSTAND ALL LABELS AND INSTRUCTION MANUALS BEFORE USE

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

Table of Contents

Introduction

Ultra® 1000 Basic Components

Your new Ultra® 1000 Sprayer functions and operates differently than other airless paint sprayers. This section will help you become familiar with the sprayer before operating it.

Pressure Control

The pressure control (43) includes an ON/OFF switch (303) for the sprayer, the pressure adjusting control knob (A) and a pressure sensing device. Its function is to control the motor speed so that the sprayer maintains constant fluid pressure at the pump outlet.

Motor

The DC motor (1) has sealed bearings and replaceable motor brushes. Its function is to drive the displacement pump at the rate needed to supply sufficient paint volume at the selected pressure. Working together, the pressure control and motor cause the pump to cycle whenever there is fluid or pressure demand. When the pump is cycling, the motor sounds like an automobile starter cranking. When the pump is not cycling, the motor may hum intermittently until the fluid pressure stabilizes, then the motor will shut itself off. However, there will still be power to the sprayer and it will stay pressurized and ready to use unless you manually shut it off and relieve pressure.

Because the motor is DC, it is less sensitive to low voltage or voltage fluctuations than an AC motor, and an extension cord of up to 45 m can be used.

Drive Assembly

The sealed drive assembly (18) transfers power from the DC motor to the displacement pump.

Displacement Pump

The positive displacement, volume–balanced pump (39) provides equal fluid delivery on both the up and down pump strokes. The pump has a wet–cup which, when filled with Graco Throat Seal Liquid, helps prevent damage to the throat packings and piston rod.

Fluid Filter

The fluid filter (48) strains the paint to help avoid clogs in the hose and spray tip. The filter includes a reusable element and a pressure drain valve (50) for relieving fluid pressure.

Hoses

The grounded, nylon spray hoses have spring guards on both ends. The15.2 m (28) hose has a 1/4 in. ID. The 0.9 m, 3/16 in. ID whip hose (56) allows flexible gun movement. The nylon hose material acts as a pulsation dampener to absorb pressure fluctuations.

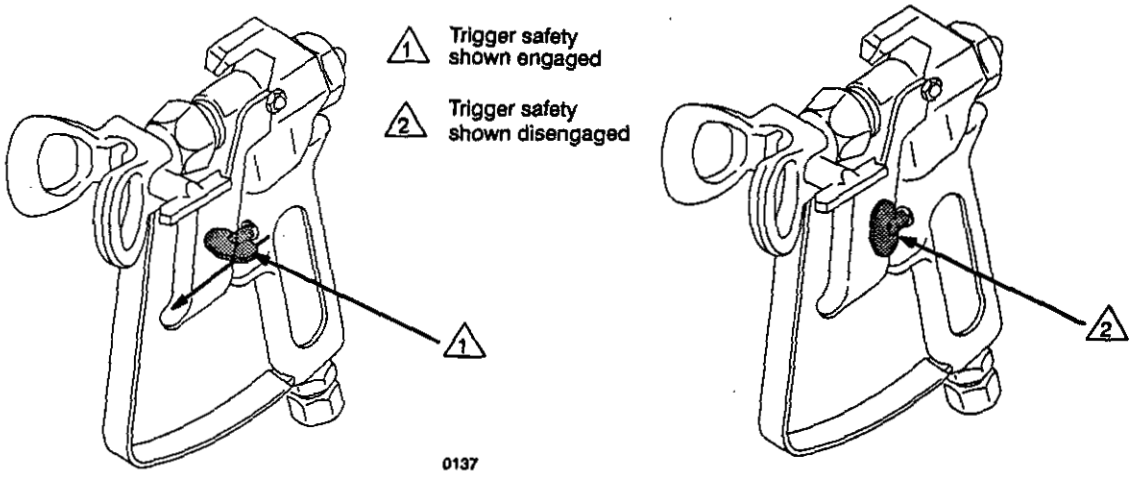

1 Trigger safety shown engaged
2 Trigger safety shown disengaged
1
2
0137

Fig. 1

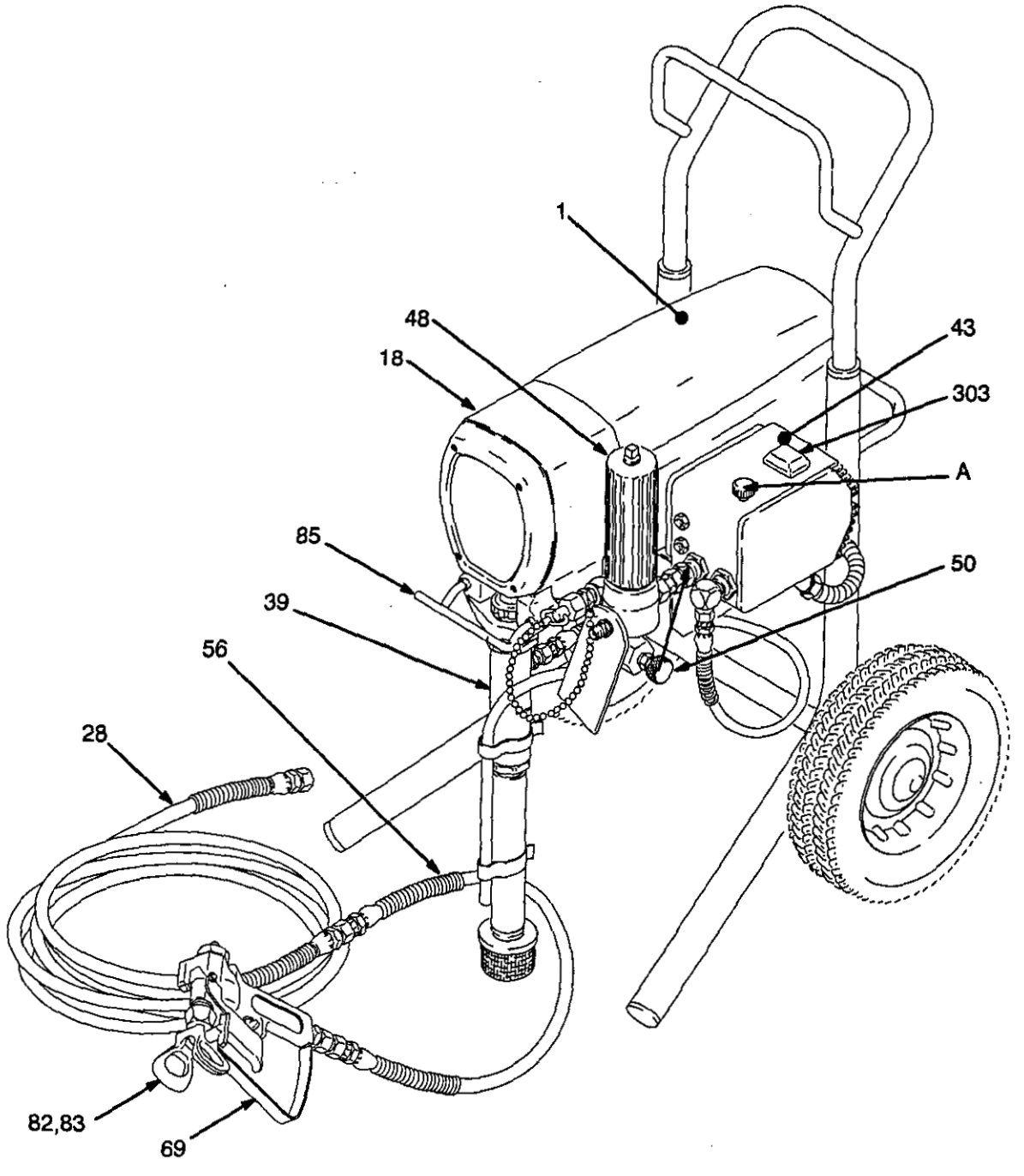

1
48
18
43
303
A
85
50
39
56
28
82,83
69
03742

Fig. 2

WARNINGS

High Pressure Spray Can Cause Serious Injury. For Professional Use Only.
Observe All Warnings. Read and understand all instruction manuals before operating equipment.

FLUID INJECTION HAZARD

General Safety

This equipment generates very high fluid pressure. Spray from the gun, leaks or ruptured components can inject fluid through your skin and into your body and cause extremely serious bodily injury, including the need for amputation. Also, fluid injected or splashed into the eyes or on the skin can cause serious damage.

NEVER point the spray gun at anyone or at any part of the body. NEVER put hand or fingers over the spray tip. NEVER try to "blow back" paint; this is NOT an air spray system.

ALWAYS have the tip guard in place on the spray gun when spraying.

ALWAYS follow the **Pressure Relief Procedure**, below, before cleaning or removing the spray tip or servicing any system equipment.

NEVER try to stop or deflect leaks with your hand or body.

Be sure equipment safety devices are operating properly before each use.

Medical Alert--Airless Spray Wounds

If any fluid appears to penetrate your skin, get **EMERGENCY MEDICAL CARE AT ONCE. DO NOT TREAT AS A SIMPLE CUT.** Tell the doctor exactly what fluid was injected.

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

Spray Gun Safety Devices

Be sure all gun safety devices are operating properly before each use. Do not remove or modify any part of the gun; this can cause a malfunction and result in serious bodily injury.

Safety Latch

Whenever you stop spraying, even for a moment, always set the gun safety latch in the closed or "safe" position, making the gun inoperative. Failure to set the safety latch can result in accidental triggering of the gun.

Diffuser

The gun diffuser breaks up spray and reduces the risk of fluid injection when the tip is not installed. Check diffuser operation regularly. Follow the **Pressure Relief Procedure**, below, then remove the spray tip. Aim the gun into a metal pail, holding the gun firmly to the pail. Using the lowest possible pressure, trigger the gun. If the fluid emitted *is not* diffused into an irregular stream, replace the diffuser immediately.

Tip Guard

ALWAYS have the tip guard in place on the spray gun while spraying. The tip guard alerts you to the fluid injection hazard and helps reduce, but does not prevent, the risk of accidentally placing your fingers or any part of your body close to the spray tip.

Trigger Guard

Always have the trigger guard in place on the gun when spraying to reduce the risk of accidentally triggering the gun if it is dropped or bumped.

Spray Tip Safety

Use extreme caution when cleaning or changing spray tips. If the spray tip clogs while spraying, engage the gun safety latch immediately. ALWAYS follow the **Pressure Relief Procedure** and then remove the spray tip to clean it.

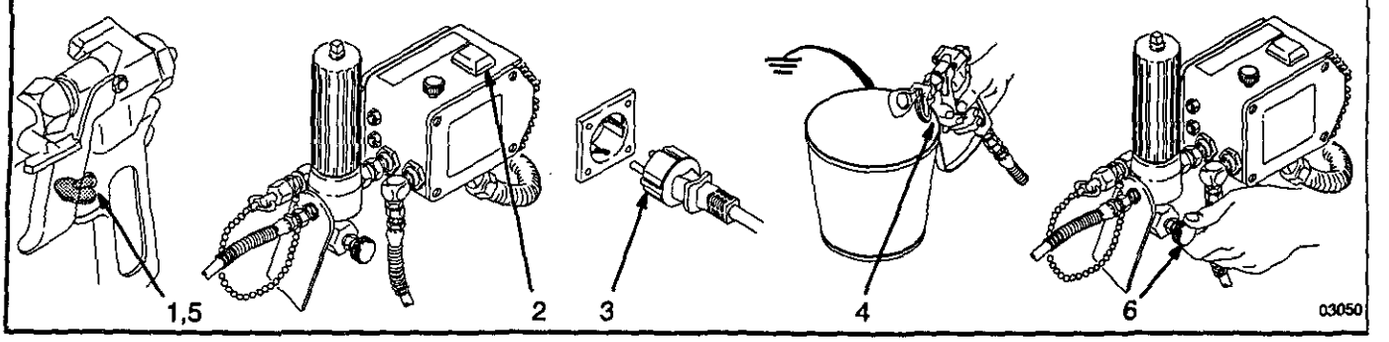
NEVER wipe off build-up around the spray tip until pressure is fully relieved and the gun safety latch is engaged.

Pressure Relief Procedure

To reduce the risk of serious bodily injury, including fluid injection, splashing fluid or solvent in the eyes or on the skin, or injury from moving parts or electric shock, always follow this procedure whenever you shut off the sprayer, when checking or servicing any part of the spray system, when installing, cleaning or changing spray tips, and whenever you stop spraying.

1. Engage the gun safety latch.
2. Turn the ON/OFF switch to OFF.
3. Unplug the sprayer.
4. Disengage the gun safety latch. Hold a metal part of the gun firmly to the side of a grounded metal pail, and trigger the gun to relieve pressure.
5. Engage the gun safety latch.
6. Open the pressure drain valve. Leave the valve open until you are ready to spray again.

If you suspect that the spray tip or hose is completely clogged, or that pressure has not been fully relieved after following the steps above, wrap a rag around the tip guard retaining nut or hose end coupling and VERY SLOWLY loosen the part to relieve pressure gradually, then loosen completely. Now clear the tip or hose.



EQUIPMENT MISUSE HAZARD

General Safety

Any misuse of the spray equipment or accessories, such as overpressurizing, modifying parts, using incompatible chemicals and fluids, or using worn or damaged parts, can cause them to rupture and result in fluid injection, splashing in the eyes or on the skin, or other serious bodily injury, or fire, explosion or property damage.

NEVER alter or modify any part of this equipment; doing so could cause it to malfunction.

CHECK all spray equipment regularly and repair or replace worn or damaged parts immediately.

Always wear protective eyewear, gloves, clothing and respirator as recommended by the fluid and solvent manufacturer.

Fluid and Solvent Compatibility

All chemicals used in the sprayer must be chemically compatible with the wetted parts given in the **TECHNICAL DATA** on page 44. Consult your chemical supplier to ensure compatibility.

Do not use 1,1,1-trichloroethane, methylene chloride, other halogenated hydrocarbon solvents or fluids containing such solvents in this equipment, which contains aluminum and/or zinc parts. Such use could result in a serious chemical reaction, with the possibility of explosion, which could cause death, serious bodily injury and/or substantial property damage.

System Pressure

This sprayer can develop 207 bar MAXIMUM WORKING PRESSURE. Be sure that all spray equipment and accessories used are rated to withstand this pressure. DO NOT exceed the maximum working pressure of any component or accessory used in the system.

HOSE SAFETY

High pressure fluid in the hoses can be very dangerous. If the hose develops a leak, split or rupture due to any kind of wear, damage or misuse, the high pressure spray emitted from it can cause a fluid injection injury or other serious bodily injury or property damage.

All fluid hoses must have spring guards on both ends! The spring guards help protect the hose from kinks or bends at or close to the coupling which can result in hose rupture.

TIGHTEN all fluid connections securely before each use. High pressure fluid can dislodge a loose coupling or allow high pressure spray to be emitted from the coupling.

NEVER use a damaged hose. Before each use, check the entire hose for cuts, leaks, abrasion, bulging cover, or damage or movement of the hose couplings. If any of these conditions exist, replace the hose immediately. DO NOT try to recouple high pressure hose or mend it with tape or any other device. A repaired hose cannot contain the high pressure fluid.

Handle and route hoses carefully. Do not pull on hoses to move equipment. Keep hoses clear of moving parts and hot surfaces of the pump and gas engine. Do not use fluids or solvents which are not compatible with the inner tube and cover of the hose. DO NOT expose Graco hose to temperatures above 82° C or below −40° C.

Hose Grounding Continuity

Proper hose grounding continuity is essential to maintaining a grounded spray system. Check the electrical resistance of your fluid hoses at least once a week. If your hose does not have a tag on it which specifies the maximum electrical resistance, contact the hose supplier or manufacturer for the maximum resistance limits. Use a resistance meter in the appropriate range for your hose to check the resistance. If the resistance exceeds the recommended limits, replace it immediately. An ungrounded or poorly grounded hose can make your system hazardous. Also read **FIRE OR EXPLOSION HAZARD.**

FIRE OR EXPLOSION HAZARD

Static electricity is created by the flow of fluid through the pump and hose. If every part of the spray equipment is not properly grounded, sparking may occur, and the system may become hazardous. Sparking may also occur when plugging in or unplugging a power supply cord or using a gasoline engine. Sparks can ignite fumes from solvents and the fluid being sprayed, dust particles and other flammable substances, whether you are spraying indoors or outdoors, and can cause a fire or explosion and serious bodily injury and property damage.

If you experience any static sparking or even a slight shock while using this equipment, **STOP SPRAYING IMMEDIATELY.** Check the entire system for proper grounding. Do not use the system again until the problem has been identified and corrected.

Grounding

To reduce the risk of static sparking, ground the sprayer and all other spray equipment used or located in the spray area. CHECK your local electrical code for detailed grounding instructions for your area and type of equipment. BE SURE to ground all of this spray equipment:

1. *Sprayer:* connect a ground wire and clamp (supplied) to a true earth ground.
2. *Fluid hoses:* use only grounded hoses with a maximum of 150 m combined hose length to ensure grounding continuity. See **Hose Grounding Continuity**.
3. *Spray gun:* obtain grounding through connection to a properly grounded fluid hose and sprayer.
4. *Object being sprayed:* according to local code.
5. *Fluid supply container:* according to local code.
6. *All solvent pails used when flushing,* according to local code. Use only metal pails, which are conductive. Do not place the pail on a non−conductive surface, such as paper or cardboard, which interrupts the grounding continuity.
7. *To maintain grounding continuity when flushing or relieving pressure,* always hold a metal part of the gun firmly to the side of a grounded metal pail, then trigger the gun.

Flushing Safety

Reduce the risk of fluid injection injury, static sparking, or splashing by following the flushing procedure given on page 11 and 12 of this manual. Follow the **Pressure Relief Procedure** on page 4, and remove the spray tip before flushing. Hold a metal part of the gun firmly to the side of a grounded metal pail and use the lowest possible fluid pressure during flushing.

MOVING PARTS HAZARD

Moving parts can pinch or amputate your fingers or other body parts. KEEP CLEAR of moving parts when starting or operating the sprayer. Follow the **Pressure Relief Procedure** on page 4 before checking or servicing any part of the sprayer, to prevent it from starting accidentally.

IMPORTANT

United States Government safety standards have been adopted under the Occupational Safety and Health Act. These standards – particularly the General Standards, Part 1910, and the Construction Standards, Part 1926 – should be consulted.

Setup

1. **Connect hose and gun.** Refer to Fig. 4.

NOTE: When tightening fittings at the pressure control, hold one wrench firmly on the hex of the pressure control fitting to keep it from rotating. Use another wrench to tighten the mating fitting.

   a. Remove the cap from the filter outlet nipple and screw the 15.2 m main fluid hose (28) onto the nipple.

   b. Connect the whip hose (56 – not shown) between the fluid hose and the gun inlet connection.

   c. Don't use thread sealant, and don't install the spray tip yet!

WARNING

If you are supplying 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 *207 bar Working Pressure*. This is to reduce the risk of serious bodily injury caused by static sparking, fluid injection or over–pressurization and rupture of the hose or gun.

2. **Two gun hookup.** Remove the cap from the 1/4 npsm(m) nipple – See Fig. 3. – and attach an accessory hose (C) and gun. See Fig. 4.

CAUTION

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

1. Always use nylon spray hose at least 15.2 m long.
2. Never use a wire braid hose as it is too rigid to act as a pulsation dampener.
3. Never install any shutoff device between the filter (48) and the main hose (28). See Fig. 3.
4. Always use the main filter outlet (46) for one gun operation. Never plug this outlet. See Fig. 3.

5. **Fill packing nut/wet–cup (216).** See Fig. 3. Fill the packing nut/wet–cup 1/3 full with Graco Throat Seal Liquid (TSL), supplied.

6. **Check the Electrical Service**

   a. Be sure the electrical service is properly rated for your sprayer and that the outlet you use is properly grounded.

   b. Have a licensed electrician attach an appropriate plug to the power supply cord.

   c. Use an extension cord which has 3 wires of a minimum 1.5 mm size, and a maximum of 45 m long. Longer lengths may affect sprayer performance.

⚠1 Do not install any shutoff device here

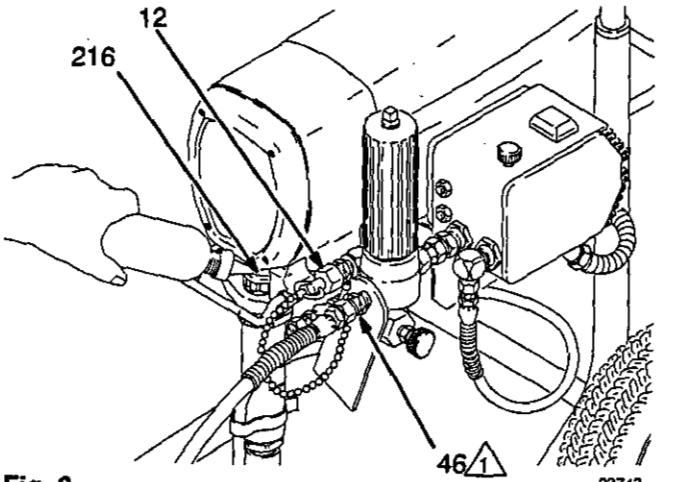


Fig. 3

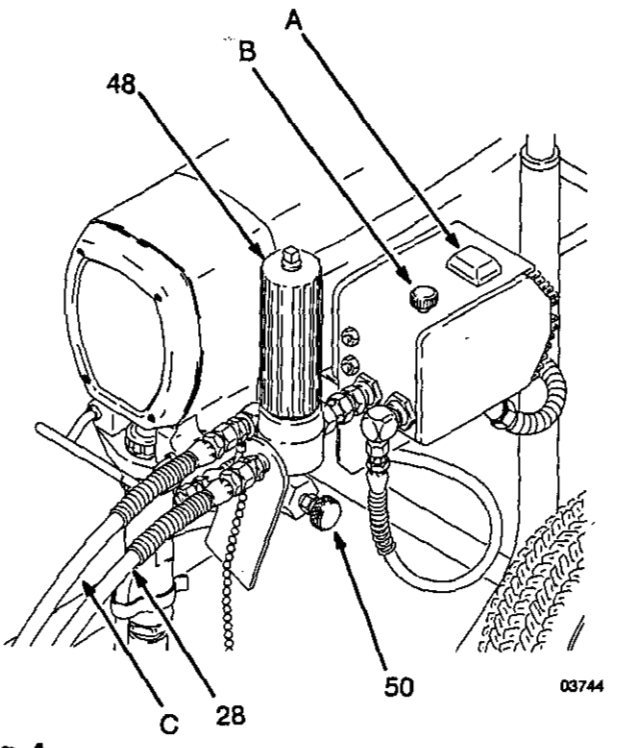


Fig. 4

Setup

7. **Plug in the sprayer .** Be sure the ON/OFF switch (A) is OFF. See Fig. 4. Then plug the cord into a grounded electrical outlet at least 6 m away from the spray area.

WARNING

Proper electrical grounding is essential to reduce the risk of fire or explosion which can result in serious bodily injury and property damage. Refer to the warning section **FIRE OR EXPLOSION HAZARD** on page 5 for more detailed grounding instructions.

8. **Flush the pump** to remove the lightweight oil which was left in to protect pump parts after factory testing.

   a. Before using water–base paint, flush with mineral spirits followed by soapy water, and then a clean water flush.

   b. Before using oil–base paint, flush with mineral spirits only.

   c. See **Flushing** on pages 11 and 12 for the flushing procedure.

9. **Prepare the paint** according to the manufacturer's recommendations.

   a. Remove any skin that may have formed.

   b. Stir the paint to mix pigments.

   c. Strain the paint through a fine nylon mesh bag (available at most paint dealers) to remove particles that could clog the filter or spray tip. This is probably the most important step toward trouble–free spray painting.

Operation

WARNING

Pressure Relief Procedure

To reduce the risk of serious bodily injury, including fluid injection, splashing fluid or solvent in the eyes or on the skin, or injury from moving parts or electric shock, always follow this procedure whenever you shut off the sprayer, when checking or servicing any part of the spray system, when installing, cleaning or changing spray tips, and whenever you stop spraying.

1. Engage the gun safety latch.
2. Turn the ON/OFF switch to OFF.
3. Unplug the sprayer.
4. Disengage the gun safety latch. Hold a metal part of the gun firmly to the side of a grounded metal pail, and trigger the gun to relieve pressure.
5. Engage the gun safety latch.
6. Open the pressure drain valve. Leave the valve open until you are ready to spray again.

If you suspect that the spray tip or hose is completely clogged, or that pressure has not been fully relieved after following the steps above, wrap a rag around the tip guard retaining nut or hose end coupling and VERY SLOWLY loosen the part to relieve pressure gradually, then loosen completely. Now clear the tip or hose.

Startup

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

NOTE: For the first time startup, be sure to flush the sprayer first. See **Flushing** on pages 11 and 12 for the flushing procedure.

1. **If you have not installed a secondary hose**, be sure the nipple is firmly plugged with the cap. See Fig. 5.

2. **Don't install the spray tip yet!**

3. **Put the suction tube into the paint container.**

4. **Open the pressure drain valve (50).**

5. **Lower the pressure setting** by turning the pressure adjusting knob (B) all the way counterclockwise. See Fig. 5.

6. **Disengage the gun safety latch.** See Fig. 7.

7. **To prime the pump**, turn the ON/OFF switch (A) to ON, and slowly increase the pressure setting until the sprayer starts. When fluid flows freely from the pressure drain valve (50), close it.

8. **To prime the hose and gun,** hold a metal part of the gun firmly against and aimed into a metal waste container. See Fig. 6. Squeeze the trigger and hold it open, Keep the gun triggered until all air is forced out of the system and the paint flows freely from the gun. Release the trigger and engage the gun safety latch.

9. **Check all fluid connections for leaks.** If any are found, follow the **Pressure Relief Procedure Warning**, to the left, before tightening connections.

10. **Install the spray tip and tip guard.** Be sure the gun safety latch is engaged. See Fig. 7. Install the spray tip. If using the RAC IV tip guard, refer to manual 307–848, supplied with the gun, for installation instructions.

11. **Adjust the spray pattern**

    a. Increase the pressure adjusting knob (B) setting just until spray from the gun is completely atomized. To avoid excessive overspray and fogging, and to decrease tip wear and extend the life of the sprayer, always use the lowest possible pressure needed to get the desired results.

    b. If more coverage is needed, use a larger tip rather than increasing the pressure.

    c. Test the spray pattern. To adjust the direction of the spray pattern, engage the gun safety latch and loosen the tip guard retaining nut (C). See Fig. 5. Position the tip guard horizontally for a horizontal pattern or vertically for a vertical pattern. Then tighten the retaining nut.

Operation

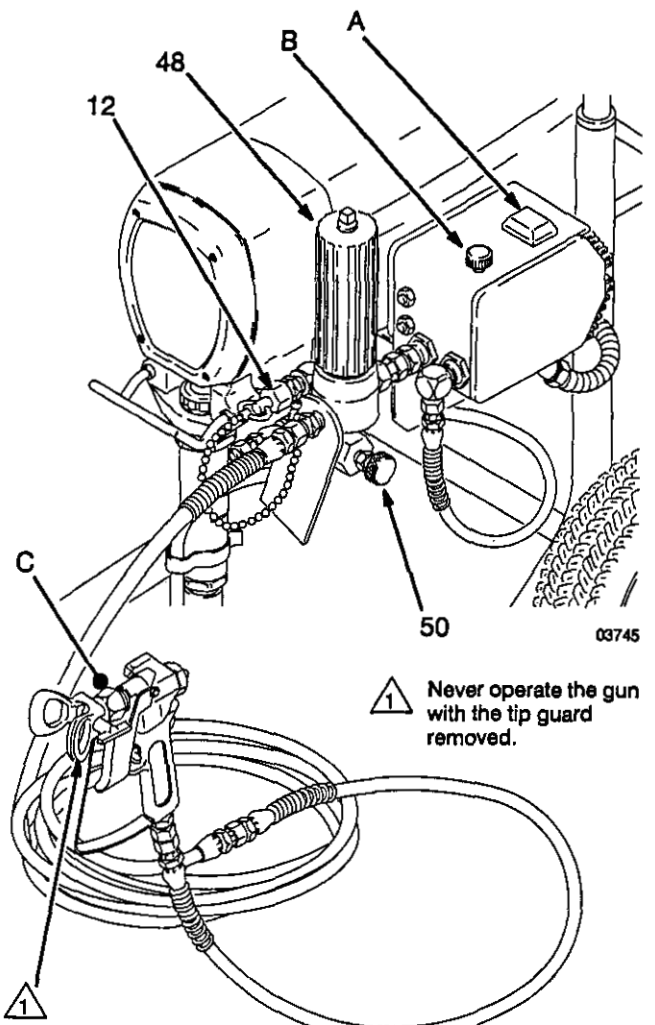


Fig. 5 0160

1 Maintain firm metal–to–metal contact between gun and grounded metal pail when flushing.

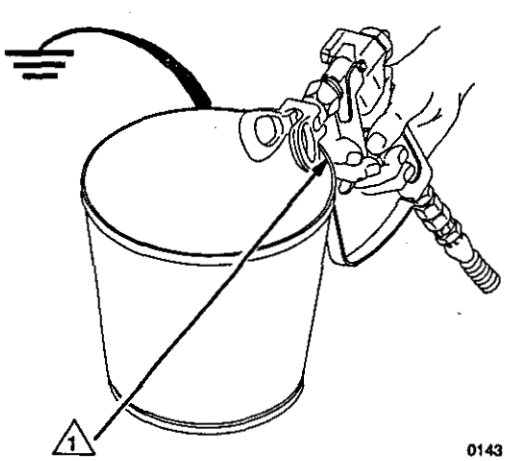


Fig. 6 0143

Cleaning a Clogged Tip

WARNING

To reduce the risk of serious bodily injury from fluid injection:

NEVER operate the spray gun with the tip guard removed.

DO NOT hold your hand, body, or a rag in front of the spray tip when cleaning or checking a clogged tip. Always point the gun toward the ground or into a waste container when checking to see if the tip is clear.

DO NOT try to "blow back" paint; this is NOT an air spray sprayer.

1. Clean the front of the tip frequently during the day's operation. First, follow the **Pressure Relief Procedure Warning** on page 8. Then use a solvent–soaked brush to wipe away fluid build–up, which helps prevent tip clogging.
2. If the spray tip does clog, release the gun trigger, engage the gun safety latch, and rotate the RAC IV handle (D) 180°. See Fig. 7.
3. Disengage the gun safety latch and trigger the gun into a waste container. Engage the gun safety latch again. See Fig. 7.
4. Return the handle (D) to the original position, disengage the gun safety latch, and resume spraying.
5. If the tip is still clogged, engage the gun safety latch, shutoff and unplug the sprayer, and open the pressure drain valve to relieve pressure. Clean the spray tip as shown in manual 307–848, supplied with the RAC IV.

1 Trigger safety shown engaged

2 Trigger safety shown disengaged

3 RAC IV tip handle shown in spraying position. Turn 180°, disengage safety latch and trigger gun to clear clog.

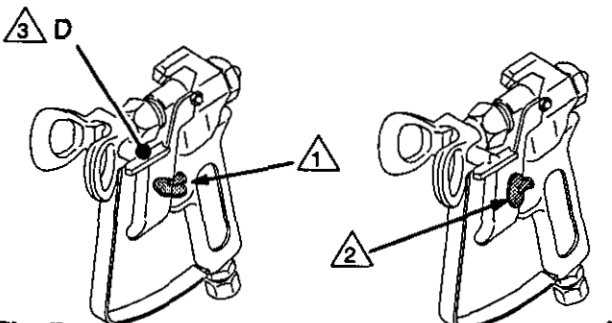


Fig. 7

Shutdown and Care

WARNING

Before doing these procedures, follow the **Pressure Relief Procedure Warning** on page 11 to reduce the risk of a serious injury.

1. Check the packing nut/wet–cup (216) daily. First follow the **Pressure Relief Procedure Warning** on page 11. Be sure the wet–cup is 1/3 full of TSL at all times to help prevent fluid buildup on the piston rod and premature wear of packings. The packing nut should be tight enough to stop leakage, but no tighter. Over tightening may cause binding and excessive packing wear. Use a round punch or brass rod and light hammer to adjust the nut. See Fig. 8.
2. Clean the fluid filter (48) often and whenever the sprayer is stored. First follow the **Pressure Relief Procedure Warning** on page 11. Refer to manual 307–273, supplied, for the cleaning procedure.
3. Lubricate the bearing housing after every 100 hours of operation. Fill the connecting rod cavity (A) with SAE No. 10 non–detergent oil. See Fig. 9.
4. Flush the sprayer at the end of each work day and fill it with mineral spirits to help prevent pump corrosion and freezing. See **Flushing** on page 11.

CAUTION

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

5. For very short shutoff periods, leave the suction tube in the paint, follow the **Pressure Relief Procedure Warning** on page 11, and clean the spray tip.
6. Coil the hose and hang it on the hose rack when storing it, even for overnight, to help protect the hose from kinking, abrasion, coupling damage, etc.

WARNING

Refer to the warning section **HOSE SAFETY** on page 5 for information on the hazard of using damaged hoses.

1. Remove cap to fill. Keep filled with TSL
2. To tighten the packing nut turn it in the direction shown by the arrow.
3. Use a punch and light hammer to turn the notched ring of the packing nut

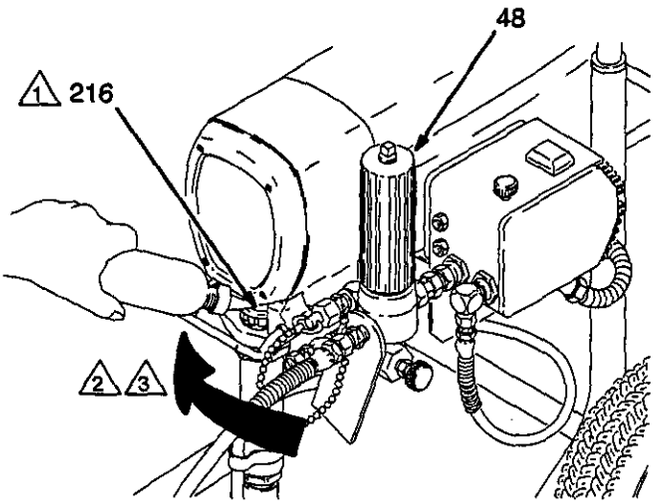


Fig. 8

1. Fill cavity with SAE No.10 non–detergent oil after every 100 hours of operation

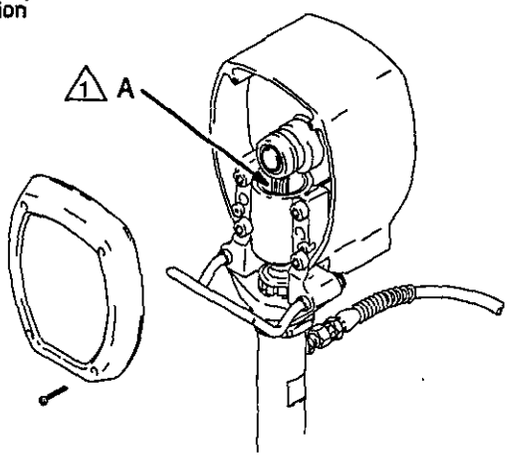


Fig. 9

Flushing

WARNING

Pressure Relief Procedure
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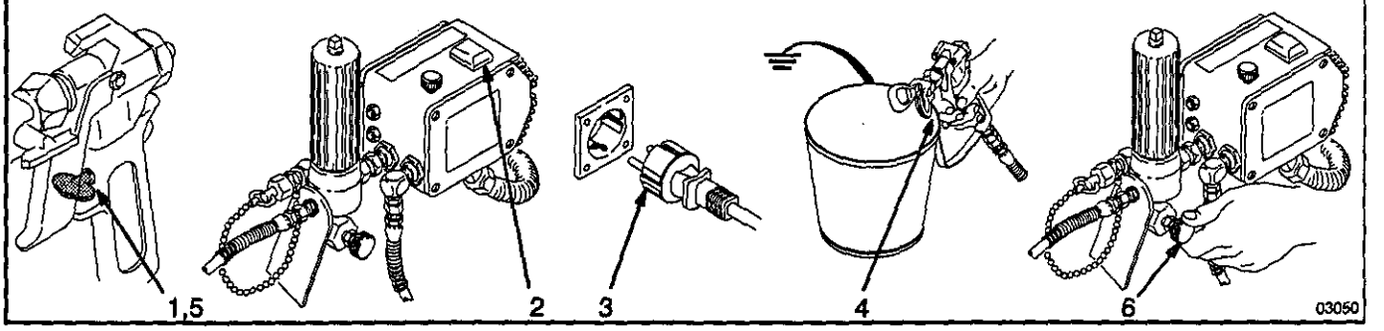


1. **New Sprayer.** Your new sprayer was factory tested in lightweight oil which was left in to protect pump parts.

   Before using water–base paint, flush with mineral spirits followed by soapy water, and then a clean water flush.

   Before using oil–base paint, flush with mineral spirits only.

2. **Changing Colors.** Flush with a compatible solvent such as mineral spirits or water.

3. **Changing from water–base to oil–base paint.** Flush with warm, soapy water, then mineral spirits.

4. **Changing from oil–base to water–base paint.** Flush with mineral spirits, followed by warm, soapy water, then a clean water flush.

5. **Storage.**

   Water–base paint: flush with water, then mineral spirits and leave the pump, hose and gun filled with mineral spirits. Shut off the sprayer, open the pressure drain valve to relieve pressure and leave it open.

   Oil–base paint: flush with mineral spirits. Shut off the sprayer, open the pressure drain valve to relieve pressure and leave it open.

CAUTION

NEVER leave water in the sprayer if there is the slightest chance it could freeze. Push the water out with mineral spirits. Water left to freeze in the pressure control tube prevents the sprayer from being started and causes serious damage to the pressure control.

6. **Startup after storage.**

   Before using water–base paint, flush out mineral spirits with soapy water and then a clean water flush. When using oil–base paint, flush out the mineral spirits with the paint to be sprayed and the sprayer is ready to use.

Continued on page 12.

Flushing

How to Flush

1. Follow the **Pressure Relief Procedure Warning** on page 11.

2. If the sprayer has been used before, remove the filter bowl (C) and screen (D); see manual 307–273, supplied. Clean the screen (D) separately and install the bowl (C) and support (E) without the screen to flush it. See Fig. 10.

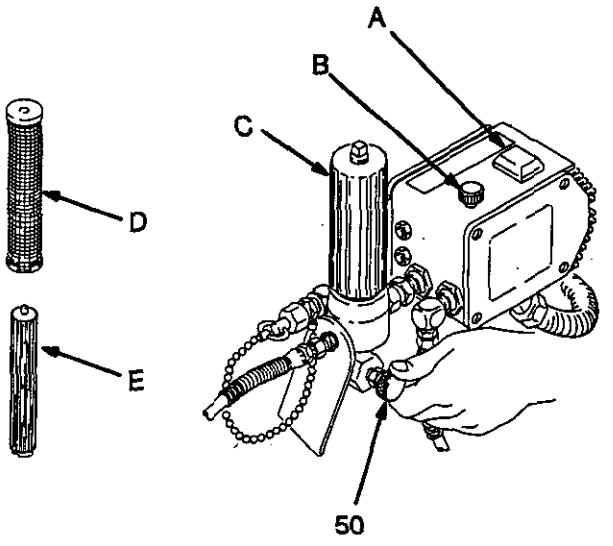


Fig. 10

3. Close the pressure drain valve (50). See Fig. 10.

4. Pour 2 liters of compatible solvent into a grounded metal pail. Put the suction tube in the pail.

5. Remove the spray tip from the gun, if it is installed.

WARNING

To reduce the risk of 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 and aimed into a grounded metal pail when flushing. See Fig. 11.

6. Lower the pressure setting by turning the pressure adjusting knob (B) all the way counterclockwise.

7. Open the pressure drain valve (50). Turn the ON/OFF switch (A) to ON, and slowly increase the pressure setting until the sprayer starts. When solvent is flowing freely, close the pressure drain valve.

8. Hold a metal part of the gun firmly against and aimed into a metal waste container. See Fig. 11. Squeeze the trigger and hold it open until all air is forced out of the system and the solvent flows freely from the gun. Release the trigger and engage the gun safety latch. This procedure helps reduce the risk of static sparking and splashing.

9. Remove the suction tube from the pail. Disengage the gun safety latch and trigger the gun to force solvent from the hose. Do not let the pump run dry for more than 30 seconds to avoid damaging the pump packings! Then follow the **Pressure Relief Procedure Warning** on page 11.

10. Leave the pressure drain valve open until you are ready to use the sprayer again. If the screen was removed, unscrew the filter bowl and reinstall the clean screen. Reinstall the bowl, hand tight only.

11. Remove the suction tube and clean it separately. Flushing may not be sufficient to clean the tube.

12. If you flushed with mineral spirits and are going to use a water–base paint, flush with soapy water followed by a clean water flush. Then follow the **Pressure Relief Procedure Warning** on page 11.

⚠1 Maintain firm metal–to–metal contact between gun and grounded metal pail when flushing.

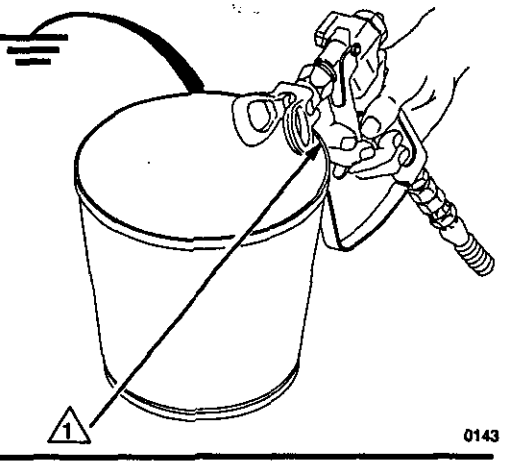


Fig. 11 0143

Troubleshooting

WARNING

Pressure Relief Procedure
To reduce the risk of serious bodily injury, including fluid injection, splashing fluid or solvent in the eyes or on the skin, or injury from moving parts or electric shock, always follow this procedure whenever you shut off the sprayer, when checking or servicing any part of the spray system, when installing, cleaning or changing spray tips, and whenever you stop spraying.

1. Engage the gun safety latch.
2. Turn the ON/OFF switch to OFF.
3. Unplug the sprayer.
4. Disengage the gun safety latch. Hold a metal part of the gun firmly to the side of a grounded metal pail, and trigger the gun to relieve pressure.
5. Engage the gun safety latch.
6. Open the pressure drain valve. Leave the valve open until you are ready to spray again.

If you suspect that the spray tip or hose is completely clogged, or that pressure has not been fully relieved after following the steps above, wrap a rag around the tip guard retaining nut or hose end coupling and VERY SLOWLY loosen the part to relieve pressure gradually, then loosen completely. Now clear the tip or hose.

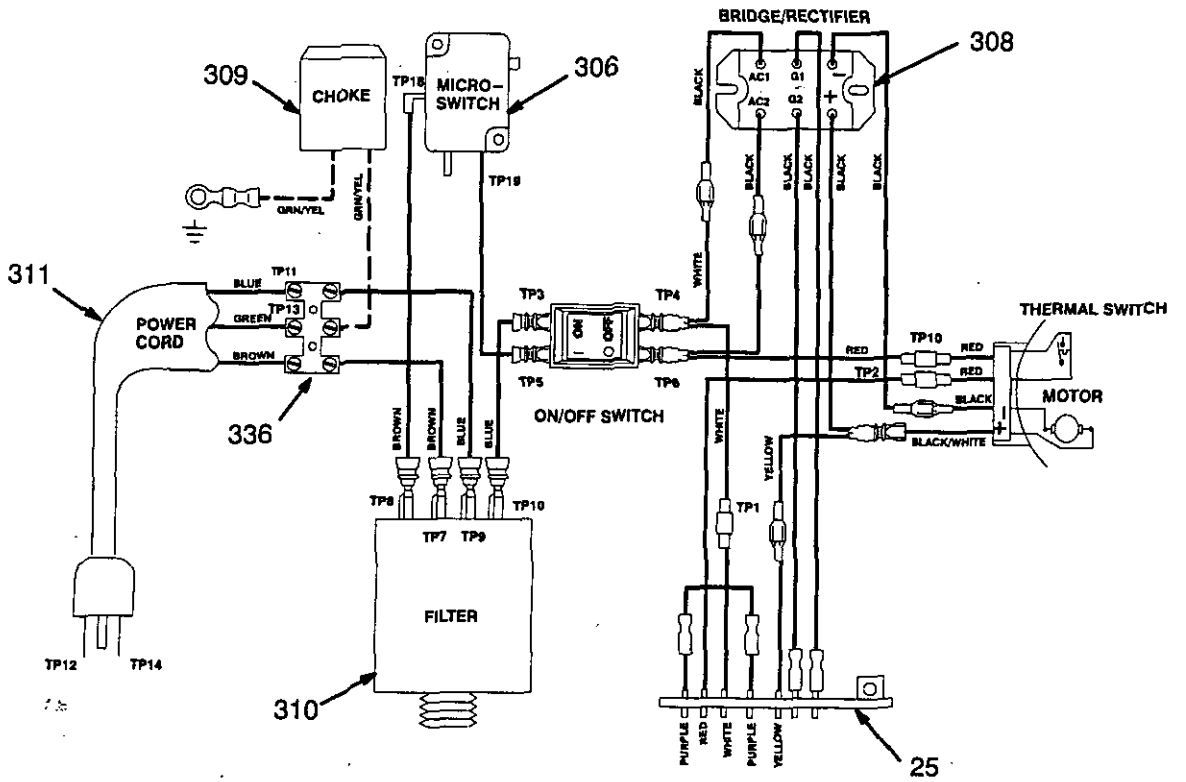
Check everything in the guide before disassembling the sprayer.

Type of Problem	**What to Check** If check is OK, go to the next check	**What to Do** If check is not OK, refer to this column
Basic Fluid Pressure Problems	1. Check the pressure control knob setting. The motor will not run if it is at the minimum setting (fully counterclockwise).	1. Slowly increase the pressure setting to see if the motor starts.
	2. Check for a clogged spray tip. Refer to the separate gun or tip instruction manual.	2. Relieve pressure, refer to your separate gun or tip instruction manual for tip cleaning.
Basic Mechanical Problems	1. Check for frozen or hardened paint in the pump (39) and/or pressure control bourdon tube. Carefully try to rotate fan at back of motor by hand. See page 19.	1. Thaw. Plug in sprayer and turn on. Slowly increase pressure setting to see if motor starts. If it doesn't, replace the displacement pump packings (see page 30) and/or replace the bare pressure control box (300). See page 27.
	2. Check displacement pump connecting rod pin (20). It must be completely pushed into connecting rod (29) and retaining spring (35) should be firmly in groove of connecting rod. See Fig. 34, page 32.	2. Push pin into place and secure with the retaining spring.
	3. Check for motor damage. Remove drive housing assembly (2). See page 34. Try to rotate fan by hand.	3. Replace motor (1) if fan won't turn.
Basic Electrical Problems	1. Check electrical supply with volt meter. Meter should read 190–250 Volts.	1. Reset building circuit breaker; replace building fuse. Try another electrical outlet.
	2. Check extension cord for visible damage. Use a volt meter or test lamp at extension cord outlet to check.	2. Replace extension cord.
	3. Check sprayer power supply cord (311) for visible damage such as broken insulation or wires.	3. Replace power supply cord. See page 22.
	4. Check motor brush leads, terminals and brush length. Brush length should be 10 mm minimum. See page 35.	4. Tighten terminal screws; replace brushes. See page 35.

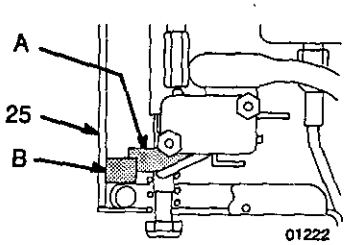
Thaw the sprayer if water or water–based paint has frozen in it, due to exposure to low temperatures, by placing it in a warm area. Do not try to start the sprayer until it has thawed completely. If the bourdon tube was not damaged by the freezing, the pump should operate. If paint hardened (dried) in the sprayer, the pump packings and/or bare pressure control must be replaced. See page 27 or page 30.

Motor Won't Operate

Type of Problem	What to Check If check is OK, go to the next check	What to Do If check is not OK, refer to this column
Diagnosing circuit board indicator lamps. The normal condition is red lamp on, clear lamp *on when board is telling pump to run.* Follow **Pressure Relief Procedure Warning.** Remove gun from hose. Remove pressure control cover and check for faulty condition of circuit board lamps. **Condition A** Both lamps on; pump won't operate and motor is not running	1. Check leads from bridge (308) to motor to be sure they are securely fastened and properly mated.	1. Replace any loose terminals and crimp to leads. Be sure male terminal blades are straight and firmly connected to mating part.
	2. Check G1 and G2 connections between circuit board (25) and bridge (308) for damage or loose terminals.	2. Clean circuit board male terminals. Replace loose or damaged terminals. Securely reconnect leads.
	3. Check for loose motor brush lead connections and terminals. See page 33.	3. Tighten terminal screws. Replace brushes if leads are damaged. See page 33.
	4. Check brush length which should be 10 mm minimum. See page 33. **NOTE:** The brushes do not wear at the same rate on both sides of the motor. Check both brushes.	4. Replace brushes. See page 33.
	5. Check for broken or misaligned motor brush springs. Rolled portion of spring must rest squarely on top of brush. See page 33.	5. Replace spring if broken. Realign spring with brush. See page 33.
	6. Check motor brushes for binding in brush holders. See page 33.	6. Clean brush holders. Remove carbon with small cleaning brush. Align brush leads with slot in brush holder to assure free vertical brush movement.
	7. Check motor armature commutator for burn spots, gouges and extreme roughness. Remove motor cover and brush inspection plates to check. See page 33.	7. Remove motor and have motor shop resurface commutator if possible. See page 36.
	8. Check motor armature for shorts using armature tester (growler) or perform spin test. See page 19.	8. Replace motor. See page 36.
	9. Check bridge (308) by substituting with a good bridge or performing bridge test. See page 20 or 23. **CAUTION:** Do not perform this check until armature is determined to be good. A bad armature will immediately burn out a good bridge.	9. Replace bridge. See page 23.



Motor Won't Operate

Type of Problem	What to Check If check is OK, go to the next check	What to Do If check is not OK, refer to this column
Condition B *(continued)* Both lamps off *REFER TO THE WIRING DIAGRAM ON PAGE 14 TO IDENTIFY TEST POINTS (TP).*	1. Check electrical supply. Connect voltmeter to electrical outlet. Meter should read 190–250 Volts.	1. Reset circuit breaker or replace outlet fuse. If circuit breaker or fuse continues to open, see "Electrical Short", page 18.
	2. Check power supply to circuit board with sprayer turned ON. Measure voltage at TP1 and TP2. Meter should read 190–250 Volts.	2. Unplug sprayer. Check continuity of both poles of ON/OFF switch (302) from TP3 to TP4 and TP5 to TP6. Replace switch if faulty. Check continuity of RFI filter (310) from TP7 to TP8 and TP9 to TP10. Replace filter if faulty. Check power supply cord (311) for continuity from TP11 to TP12 and TP13 to TP14. Replace cord if faulty. Check for any loose connections.
	3. Check all terminals and wires for damage or loose fit.	3. Replace damaged terminals and reconnect securely.
	4. Check motor thermal cutout switch. Unplug sprayer. Allow motor to cool. Disconnect motor thermal switch leads at TP2 and TP10. Use ohmmeter to check continuity. Switch should be closed when motor is cool.	4. Replace electric motor if switch does not close when motor is cool. See page 36.
	5. Check microswitch (306). With no fluid pressure in the pressure control, disconnect wires TP18 and TP19. Check continuity across switch terminals with an ohmmeter. Switch contact should be closed. Depress actuator button. An audible "click" indicates the contacts have opened. Ohmmeter should read infinity.	5. Replace the microswitch. See page 25.
	6. Check circuit board (25) by substituting with a good board. See page 26.	6. Replace circuit board. See page 26.
Condition C Red lamps on, Clear lamp off *Unplug sprayer!*	1. Check circuit board (25) by removing from box *without* disconnecting wires; see page 26 for removal procedure. Place thin cardboard in optical detector slot. Plug in and turn on sprayer *ONLY LONG ENOUGH TO CHECK LAMP CONDITION.* Clear lamp should be on now. Turn off and unplug sprayer. Remove cardboard. **WARNING:** Removing the circuit board while still wired over–rides the optical detector which could cause the sprayer to over–pressurize, if the microswitch does not function properly. **WARNING:** To reduce the risk of electric shock, handle board by edges only! Do not allow any metal objects to come in contact with the board!	1. Replace circuit board. See page 26.
	2. Check bourdon tube flag (A) and detector (B) position. Reinstall circuit board (25 –see page 26). Turn pressure setting to maximum; flag should extend less than half way into optical detector slot from the bottom.  	2. Calibrate pressure control to see if that corrects problem. See page 28. If not, replace bare pressure control box (300). See page 27.

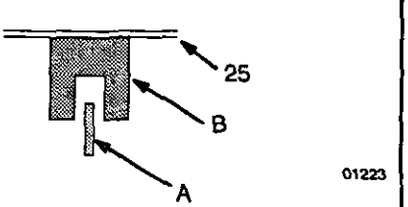
Low Output

Type of Problem	What to Check If check is OK, go to the next check	What to Do If check is not OK, refer to this column
Low output	1. Check for worn spray tip.	1. Follow **Pressure Relief Procedure Warning** then replace tip. See your separate gun or tip manual.
	2. Check to see that pump does not continue to stroke when gun trigger is released. Plug in and turn on sprayer. Prime with paint. Trigger gun momentarily, then release and engage safety latch. Relieve pressure, turn off and unplug sprayer.	2. Service pump. See page 30.
	3. Check electrical supply with volt meter. Meter should read 190–250 Volts.	3. Reset building circuit breaker; replace building fuse. Repair electrical outlet or try another outlet.
	4. Check extension cord size and length; must be at least 12 gauge wire and no longer than 15.2 m .	4. Replace with a correct, grounded extension cord.
	5. Check G1 and G2 leads from bridge (308) to circuit board (25) for damage or loose wires or connectors. Refer to page 26.	5. Clean circuit board male terminals. Replace loose or defective lead terminals. Securely reconnect lead terminals to board.
	6. Check stall pressure. Refer to Calibration Procedure on page 28.	6. Calibrate pressure control. See page 28.
	7. Check bridge (308) + and – leads and terminals to motor. Inspect wiring insulation and terminals for signs of overheating. See page 23.	7. Be sure male terminal blades are centered and firmly connected to female terminals. Replace any loose terminal or damaged wiring. Securely reconnect wires to bridge.
	8. Check for loose motor brush leads and terminals. See page 33.	8. Tighten terminal screws. Replace brushes if leads are damaged. See page 33.
	9. Check for worn motor brushes which should be 10 mm minimum. See page 33.	9. Replace brushes. See page 33.
	10. Check for broken and misaligned motor brush springs. Rolled portion of spring must rest squarely on top of brush.	10. Replace spring if broken. Realign spring with brush. See page 33.
	11. Check motor brushes for binding in brush holders. See page 33.	11. Clean brush holders, remove carbon dust with small cleaning brush. Align brush lead with slot in brush holder to assure free vertical brush movement.
	12. Check circuit board (25) by substituting with a good circuit board. See page 26.	12. Replace circuit board. See page 26.
	13. Check motor armature for shorts by using an armature tester (growler) or perform spin test. See page 19.	13. Replace motor. See page 36.
	14. Check bridge (308) by substituting with a good bridge or by performing the bridge test. See page 20 or 23. **CAUTION**: Do not perform this check until armature is determined to be good. A bad armature will immediately burn out a good bridge.	14. Replace bridge. See page 23.

No Output

Type of Problem	What to Check If check is OK, go to the next check	What to Do If check is not OK, refer to this column
Motor runs and pump strokes	1. Check paint supply.	1. Refill and reprime pump.
	2. Check for clogged intake strainer.	2. Remove and clean, then reinstall.
	3. Check for loose suction tube or fittings.	3. Tighten; use thread sealant or sealing tape on threads, if necessary.
	4. Check to see if intake valve ball and piston ball are seating properly. See page 30.	4. Remove intake valve and clean. Check balls and seats for nicks; replace if necessary. See page 30.
	5. Check for leaking around throat packing nut which may indicate worn or damaged packings. See page 30.	5. Replace packings. See page 30. Also check piston valve sat for hardened paint or nicks and replace, if necessary.
Motor runs but pump does not stroke	1. Check displacement pump connecting rod pin. See Fig. 34, page 32.	1. Replace pin if missing. Be sure retaining spring is fully in groove all around connecting rod.
	2. Check connecting rod assembly for damage. See page 34.	2. Replace connecting rod assembly. See page 34.
	3. Be sure crank in drive housing rotates; plug in sprayer and turn on momentarily to check. Turn off and unplug sprayer. See page 34.	3. Check drive housing assembly for damage and replace if necessary. See page 34.

No Output

Type of Problem	What to Check If check is OK, go to the next check	What to Do If check is not OK, refer to this column
Spray pattern variations	1. Be sure both G1 and G2 leads from bridge (308) to circuit board (25) are firmly connected. See page 26.	1. Reconnect securely. See page 26.
	2. Check stall pressure. Refer to Pressure Control Adjustment procedure on page 28.	2. Adjust pressure control. See page page 28.
	3. Check bourdon tube flag (A) and detector (B) position. Turn pressure setting to maximum; flag should no drag or bind in optical detector slot of circuit board (25).  	3. Carefully bend flag into alignment with detector slot to see if that corrects the problem. If not, replace the bare pressure control assembly (300). Adjust the pressure control after reassembly. See pages 27 and 28.
	4. Check circuit board (25) by substituting with a good board. See page 26.	4. Replace circuit board. See page 26.
	5. Check Low Output section on page 16.	

Motor is Hot and Runs Intermittently

Type of Problem	What to Check If check is OK, go to the next check	What to Do If check is not OK, refer to this column
Hot motor	1. Check to see if sprayer has been operating at high pressure with small tips, which causes low motor RPM and results in excessive heat build up.	1. Decrease pressure setting or increase tip size.
	2. Check to see if ambient temperature where sprayer is located is more than 32° C or if sprayer is located in direct sun.	2. Move sprayer to shaded, cooler area if possible.
	3. Check to see if sprayer has been left in a stalled condition (sprayer turned on, pressurized, but not operating) for long periods of time.	3. Turn off sprayer whenever you stop spraying for a while and relieve fluid pressure.

Electrical Short

Type of Problem	What to Check If check is OK, go to the next check	What to Do If check is not OK, refer to this column
Building circuit breaker opens as soon as sprayer switch is turned on. **CAUTION** Any short in any part of the motor power circuit, which is connected to the output side of the bridge, will cause the bridge to burn out immediately. Correctly diagnose and repair all shorts before checking and replacing bridge.	1. Check all electrical wiring for damaged insulation, and all terminals for loose fit or damage. Be sure to check wires between pressure control and motor which are encased in conduit (22). See page 27.	1. Repair or replace any damaged wiring or terminals. Securely reconnect all wires.
	2. Check for missing inspection plate gasket (see page 33), bent terminal forks or other metal to metal contact points which could cause a short.	2. Correct faulty conditions.
	3. Check motor armature for shorts by using an armature tester (growler) or perform spin test. See page 19. Inspect windings for burns.	3. Replace motor. See page 36.
	4. Check bridge (308) by substituting with a good bridge or by performing bridge test. See page 20 or 23. **CAUTION:** Do not perform this check until armature is determined to be good. A bad armature will immediately burn out a good bridge.	4. Replace bridge. See page 23.
Building circuit breaker opens as soon as sprayer is plugged into outlet and sprayer is NOT turned on.	1. Check 'Basic Electrical Problems' on page 13.	
	2. Check ON/OFF switch (302). See page 22. Be sure the sprayer is unplugged! Disconnect wires from switch and check switch with ohm meter. The ohm meter should read infinity with the ON/OFF switch OFF, and zero with the switch ON. **CAUTION:** A short in the motor circuit will burn the bridge out immediately, which in turn usually causes the ON/OFF switch to fail in the closed mode.	2. Replace ON/OFF switch. See page 22.

Spin Test

WARNING

Pressure Relief Procedure
To reduce the risk of serious bodily injury, including fluid injection, splashing fluid or solvent in the eyes or on the skin, or injury from moving parts or electric shock, always follow this procedure whenever you shut off the sprayer, when checking or servicing any part of the spray system, when installing, cleaning or changing spray tips, and whenever you stop spraying.

1. Engage the gun safety latch.
2. Turn the ON/OFF switch to OFF.
3. Unplug the sprayer.
4. Disengage the gun safety latch. Hold a metal part of the gun firmly to the side of a grounded metal pail, and trigger the gun to relieve pressure.
5. Engage the gun safety latch.
6. Open the pressure drain valve. Leave the valve open until you are ready to spray again.

If you suspect that the spray tip or hose is completely clogged, or that pressure has not been fully relieved after following the steps above, wrap a rag around the tip guard retaining nut or hose end coupling and VERY SLOWLY loosen the part to relieve pressure gradually, then loosen completely. Now clear the tip or hose.

For checking armature, motor winding and brush electrical continuity.

Setup

Remove the drive housing from the sprayer as described in **Drive Housing Replacement**, Steps 1 to 6, page 35.

Remove the pressure control cover and screws, the motor cover, the fan cover (F), and the inspection covers (J). See Fig. 12.

Disconnect the two leads from the motor to the bridge (308). See Fig. 13.

Armature Short Circuit Test

Quickly turn the motor fan by hand. If there are no shorts, the motor will coast two or three revolutions before coming to a complete stop.

If the motor does not spin freely and resists rotation, the armature is shorted and the motor must be replaced. See page 36.

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

Connect the two black motor leads together with a test lead.

Turn the motor fan by hand at about two revolutions per second.

If there is uneven or no turning resistance, check for the following and repair parts as needed. See page 33. Broken brush springs, broken brush lead, loose brush terminal screws, worn brushes, broken motor leads, loosemotor lead terminals.

If there is still uneven or no turning resistance, replace the motor. See page 36.

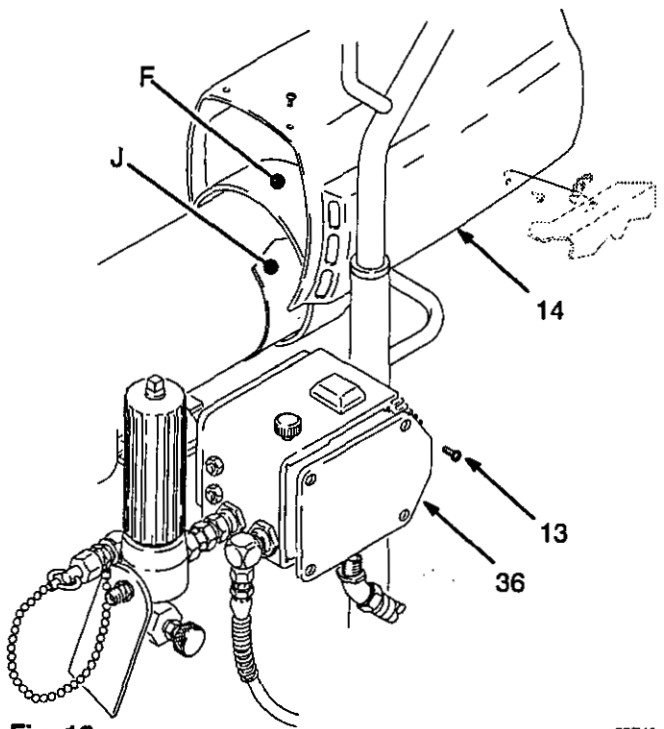


Fig. 12 03746

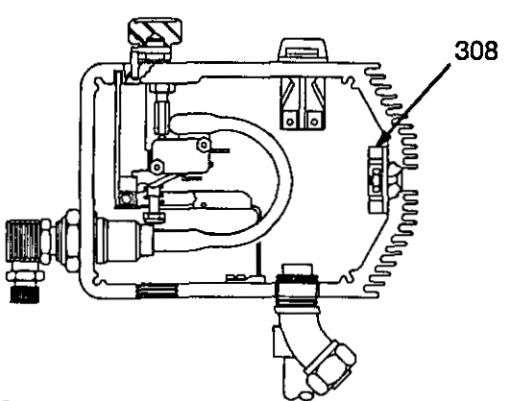


Fig. 13 02362

Bridge Test

Remove the bridge (308) from the pressure control box and perform this test to determine if the bridge is functional. See **Bridge Rectifier Replacement,** page 23. Use a continuity tester, such as multi–meter set on the X1 ohms scale.

All tests must be performed. If the bridge fails even one test, it must be replaced.

Fig. 14 shows the position of the wires on the bridge. Using the chart at the right, connect the meter wires as indicated and then check the continuity.

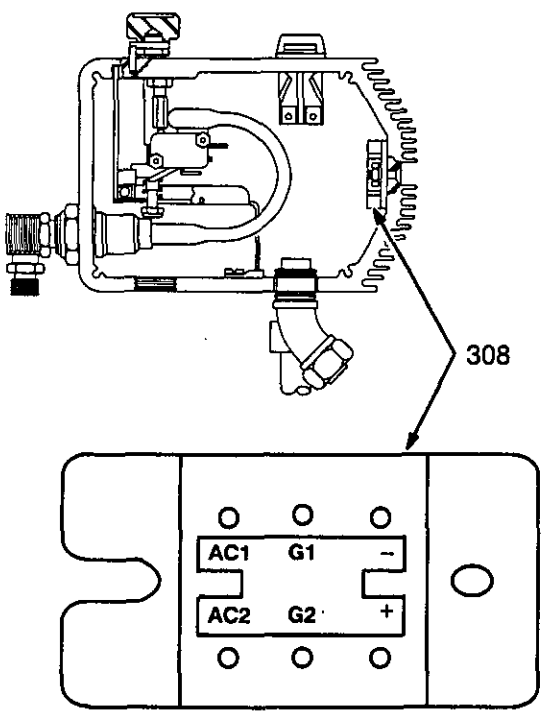


Fig. 14

Check For	Ohmmeter Reading
1. Line short Connect meter + to bridge AC1 Connect meter – to bridge AC2	No continuity
2. Diode 1 Connect meter + to bridge – Connect meter – to bridge AC1	Continuity
Connect meter + to bridge AC1 Connect meter – to bridge –	No continuity
3. Diode 2 Connect meter + to bridge – Connect meter – to bridge AC2	Continuity
Connect meter + to bridge AC2 Connect meter – to bridge –	No continuity
4. Gate 1 Connect meter + to bridge + Connect meter – to bridge AC1	No continuity
5. Gate 2 Connect meter + to bridge + Connect meter – to bridge AC2	No continuity
6. Diode 3 Connect meter + to bridge – Connect meter – to bridge +	Continuity
Connect meter + to bridge + Connect meter – to bridge –	No continuity

General Repair Notes

WARNING

Pressure Relief Procedure

To reduce the risk of serious bodily injury, including fluid injection, splashing fluid or solvent in the eyes or on the skin, or injury from moving parts or electric shock, always follow this procedure whenever you shut off the sprayer, when checking or servicing any part of the spray system, when installing, cleaning or changing spray tips, and whenever you stop spraying.

1. Engage the gun safety latch.
2. Turn the ON/OFF switch to OFF.
3. Unplug the sprayer.
4. Disengage the gun safety latch. Hold a metal part of the gun firmly to the side of a grounded metal pail, and trigger the gun to relieve pressure.
5. Engage the gun safety latch.
6. Open the pressure drain valve. Leave the valve open until you are ready to spray again.

If you suspect that the spray tip or hose is completely clogged, or that pressure has not been fully relieved after following the steps above, wrap a rag around the tip guard retaining nut or hose end coupling and VERY SLOWLY loosen the part to relieve pressure gradually, then loosen completely. Now clear the tip or hose.

1. When disconnecting wires in the pressure control assembly, use needle nose pliers to separate mating connectors.

   When reconnecting the wires, be sure the flat blade of the insulated male connector is centered in the wrap–around blade of the female connector.

CAUTION

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

2. Route wires in the pressure control assembly carefully through the legs of the U–shaped bourdon tube. This is to avoid interfering with the bourdon tube, which moves as the pressure setting changes, and to avoid pinching the wires between the pressure control box and cover.

CAUTION

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

3. Keep all screws, nuts, washers, gaskets, and electrical fittings removed during repair procedures. These parts are not normally provided with replacement assemblies.
4. Test your repair before regular operation of the sprayer to be sure the problem is corrected.

   If the sprayer does not operate properly, review the repair procedure again to verify that everything was done correctly. If necessary, refer to the Troubleshooting Guide, pages 13 to 20, to help identify other possible problems and solutions.

WARNING

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

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

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

CAUTION

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

5. Reinstall the motor cover before regular operation of the sprayer and replace it if it is damaged. The cover directs cooling air around the motor to help prevent overheating. It can also help reduce the risk of burns, fire or explosion; see the **WARNING**, below.

WARNING

During operation, the motor becomes very hot and could burn your skin if touched. Flammable materials spilled on the hot, bare motor could cause a fire or explosion. Always have the motor cover in place during regular operation to reduce the risk of burns, fire or explosion.

Power Supply Cord

WARNING

Before doing this procedure, follow the **Pressure Relief Procedure Warning** on page 21 to reduce the risk of a serious injury.

Refer to Fig. 15 and 16.

1. Remove the nut (337) from the filter stud (310).
2. Remove the three screws (37) holding the pressure control to the frame.
3. Remove the pressure control mounting bracket (16) and screws (15), using a crosshead screwdriver.
4. Disconnect the power supply cord wires from the control box terminal strip (336) using a screwdriver.
5. Install the new power supply cord (311) in the reverse order of disassembly.
6. Have a licensed electrician install a new plug on the other end of the cord. Be sure to follow all local codes regarding the type of plug to use.

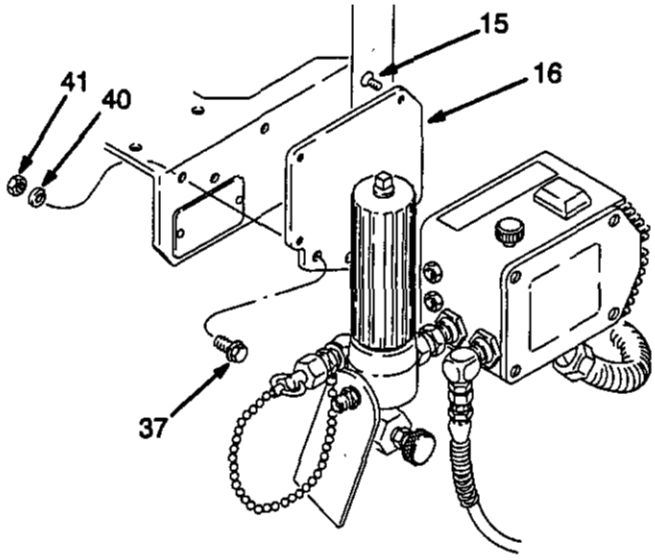


Fig. 15 03053

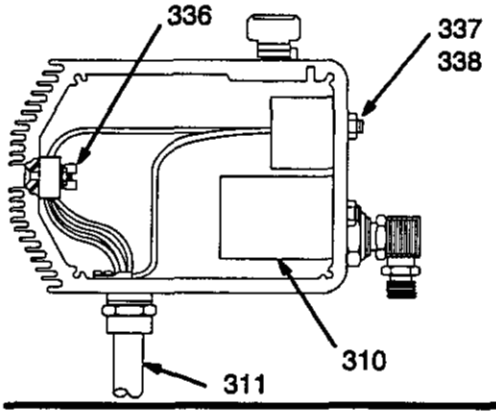


Fig. 16 02362

On/Off Switch

WARNING

Before doing this procedure, follow the **Pressure Relief Procedure Warning** on page 21 to reduce the risk of a serious injury.

Refer to Fig. 17.

1. Remove the pressure control cover and screws.
2. Disconnect the wires from the ON/OFF switch (302).
3. Pry off the retaining clip (303).
4. Remove the ON/OFF switch.
5. Install the new switch as shown in Fig. 17.
6. Reconnect the wires.
7. Reinstall the pressure control cover and screws.

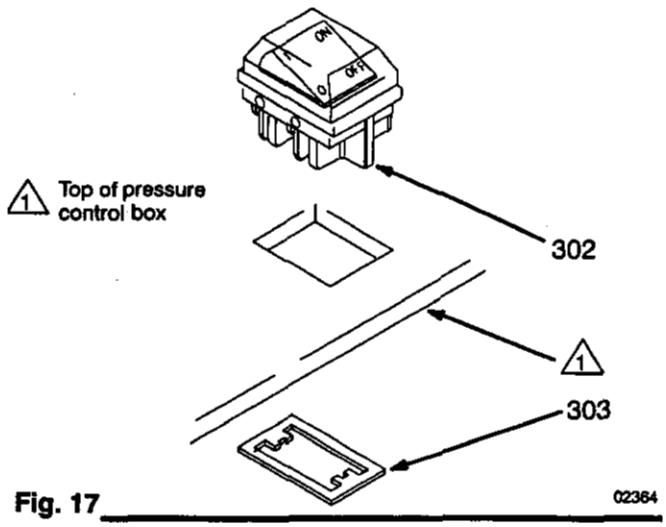


Fig. 17 02364

Bridge/Rectifier

WARNING

Before doing this procedure, follow the **Pressure Relief Procedure Warning** on page 21 to reduce the risk of a serious injury.

CAUTION

The lockwashers (333) must be in front of the bridge to avoid overheating which will result in bridge failure. Refer to the Detail in Fig. 18.

Refer to Fig. 18.

1. Remove the pressure control cover and screws.
2. Disconnect all wires from the bridge (308) at the appropriate terminals.
3. Outside the pressure control box on the right side are two screws (331). Loosen, but don't remove the screw near the back mounting plate (89). Then loosen and remove the front screw. Slide the bridge out.
4. Slide the new bridge (308) into the box being sure the lockwasher (333) on the rear screw (331) is IN FRONT of the bridge.
5. Install the front screw (331), lockwasher (333) and nut (332).
6. Make sure the bridge is flush with the side of the box and tighten the screws securely.
7. Connect all wires. Carefully route the wires.

CAUTION

Be sure the flat blade of the insulated male connector is centered in the wrap–around blade of the female connector when the connections are made. Improper connections may cause the sprayer to malfunction. Route all wires carefully to avoid interference with the movement of the bourdon tube, circuit board, or control box cover which could cause a malfunction.

8. Reinstall the pressure control cover and screws.

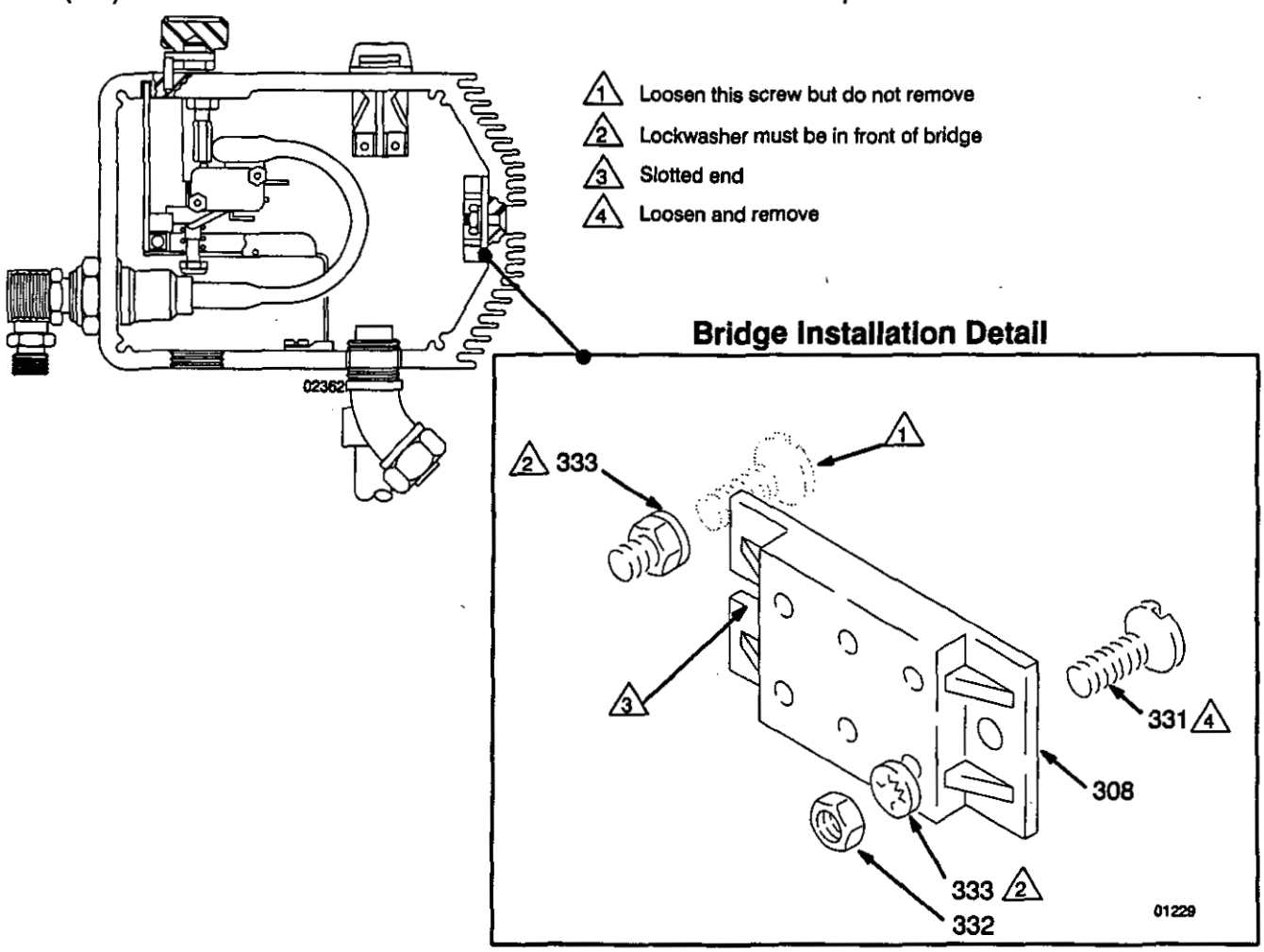


Fig. 18

Choke

WARNING

Before doing this procedure, follow the **Pressure Relief Procedure Warning** on page 21 to reduce the risk of a serious injury.

Refer to Fig. 19 and 20.

1. Remove the pressure control cover and screws.
2. Remove the screws (37), lockwashers (40) and nuts (41) from the mounting bracket (16) and gently pull the pressure control away from the cart. Support the pressure control.
3. Remove the screws (15) and mounting bracket (16) from the back of the pressure control.
4. Remove the grounding screw (312) and remove the lead. Loosen the appropriate screw on the terminal strip (336) and disconnect the yellow/green choke lead.
5. Remove the upper nut and lockwasher (337, 338) on the outside of the pressure control box.
6. Remove the old choke (309) and install a new one in the reverse order of disassembly.

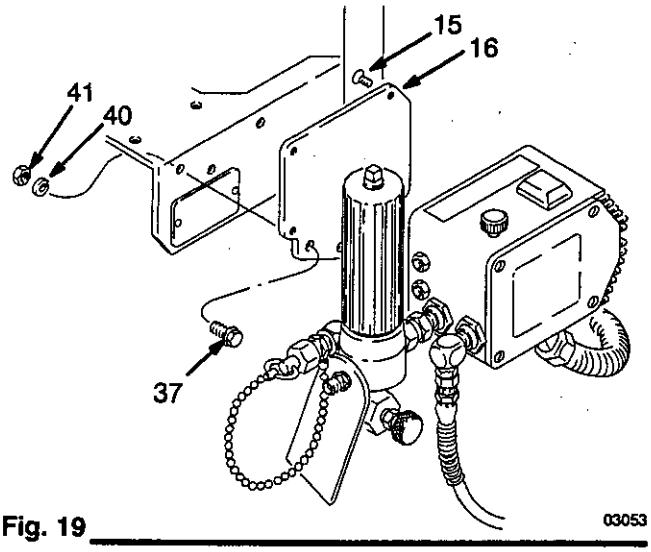


Fig. 19 03053

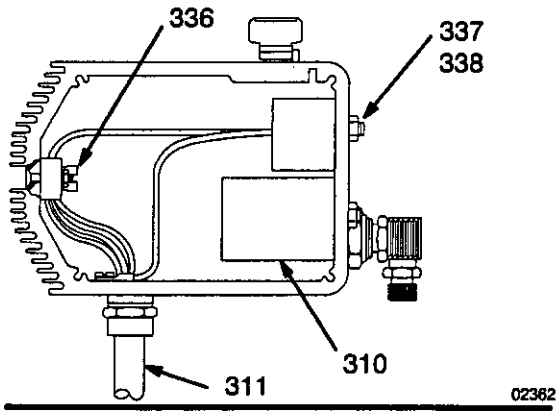


Fig. 20 02362

Filter

WARNING

Before doing this procedure, follow the **Pressure Relief Procedure Warning** on page 21 to reduce the risk of a serious injury.

Refer to Fig. 19 and 20.

1. Remove the pressure control cover and screws.
2. Remove the screws (37), lockwashers (40) and nuts (41) from the mounting bracket (16) and gently pull the pressure control away from the cart. Support the pressure control.
3. Remove the screws (15) and mounting bracket (16) from the back of the pressure control.
4. Use a needle nose pliers to remove the four wires from the filter (310).
5. Remove the lower nut and lockwashers (337, 338) on the outside of the pressure control box.
6. Remove the old filter and install a new one in the reverse order of disassembly.

Microswitch

WARNING

Before doing this procedure, follow the **Pressure Relief Procedure Warning** on page 21 to reduce the risk of a serious injury.

Refer to Fig. 21.

1. Remove the pressure control cover and screws.
2. Disconnect both wires from the microswitch (306).
3. Use the socket wrench to remove the nuts from the microswitch.
4. Check to see if the flag (X) has been loosened. If it has, be sure the fluid pressure is 0 bar, then loosen the hex nuts behind the microswitch. Adjust the distance from the top of the flag to top inside of the pressure control box to 40.79 ± 0.254 mm. Tighten the screws and recheck the dimension.
5. Perform the **Pressure Control Adjustment** on page 28 before regular operation of the sprayer.
6. Reinstall the cover and screws.

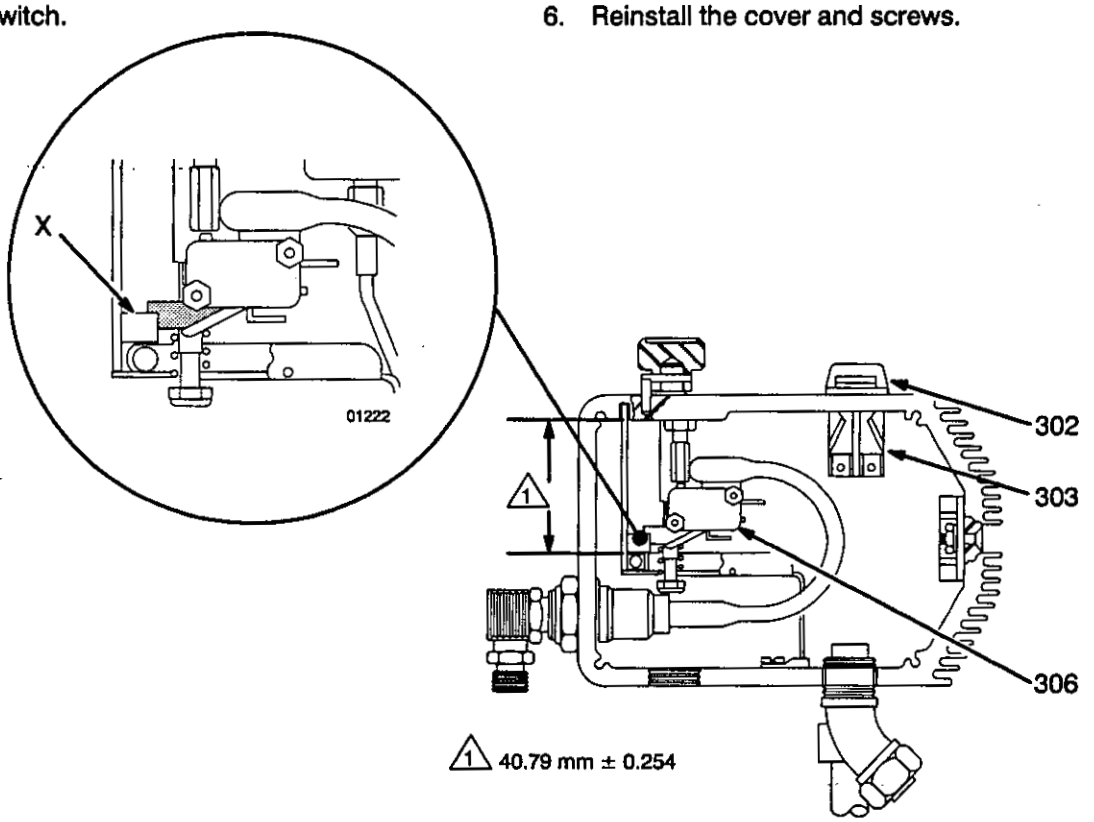


Fig. 21

Circuit Board

WARNING

Before doing this procedure, follow the **Pressure Relief Procedure Warning** on page 21 to reduce the risk of a serious injury.

Refer to Fig. 22 and 23.

1. Remove the pressure control cover and screws.

CAUTION

Step 2 is essential to reduce the risk of damaging the circuit board while removing or installing it.

2. Turn the pressure control knob all the way counterclockwise to the minimum setting to release spring tension on the board. Also check to be sure only three or four threads of the pressure control knob shaft are exposed below the pressure adjustment nut (T). Back down the nut, if necessary. See Fig. 22.

3. Disconnect all the circuit board wires, including the two heavy black wires. Pay close attention to where connections are made. See Fig. 23.

4. To remove the board from the box, pull out the black plastic–tipped pin (330). Push the bottom of the circuit board toward the wall of the box and carefully slide the board out.

5. Install the board in the box at the same angle as it was removed.

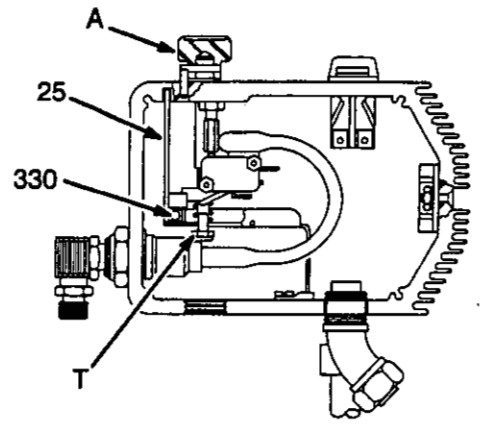


Fig. 22 02362

CAUTION

Be sure the flat blade of the insulated male connector is centered in the wrap–around blade of the female connector when the connections are made.

Route all wires carefully to avoid interference with the circuit board, bourdon tube, or pressure control cover.

These precautions are essential to reduce the risk of a malfunction.

6. Reconnect all wires. Refer to the wiring diagram in Fig. 23.

7. Perform the **Pressure Control Adjustment** starting on page 28, if you installed a new board.

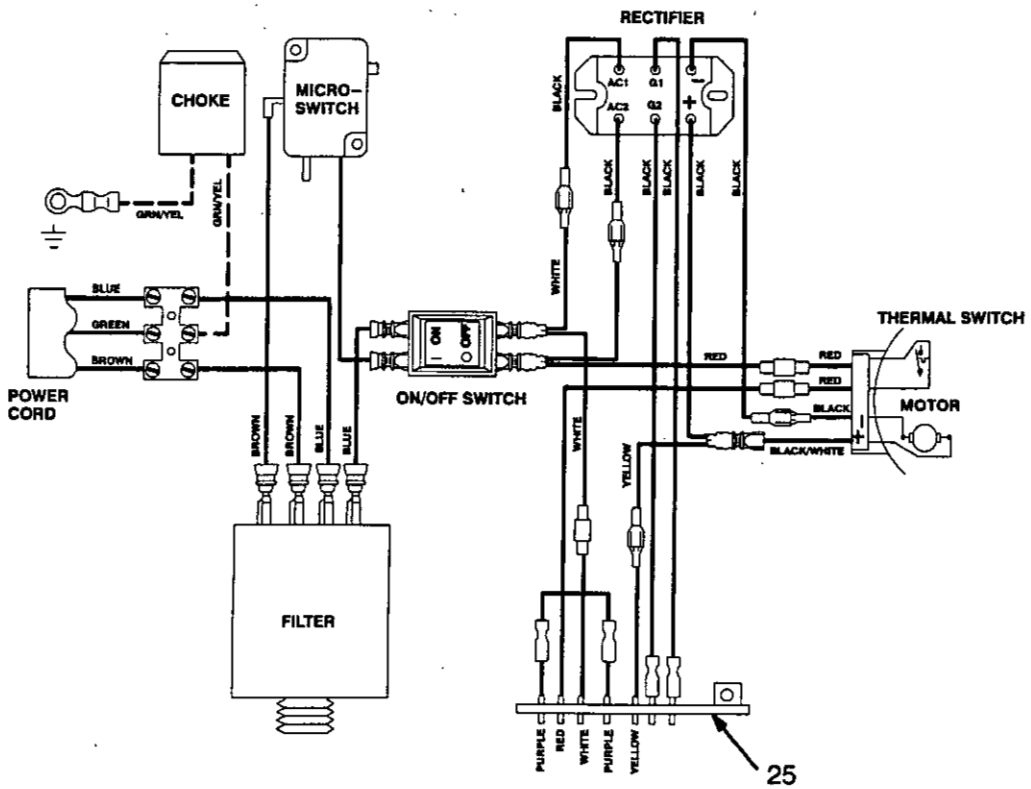


Fig. 23 03754

Pressure Control

WARNING

Before doing this procedure, follow the **Pressure Relief Procedure Warning** on page 21 to reduce the risk of a serious injury.

Refer to Fig. 24.

1. Disconnect the main fluid hose (23) and the secondary fluid hose, if used, from the sprayer.
2. Disconnect the fluid hose (47) from between the displacement pump outlet nipple (46) and pressure control inlet elbow (34).
3. Hold the hex of the pressure control adapter (A) firmly with an open end wrench. Use a wrench to unscrew the fitting (8) and filter.
4. Remove the pressure control cover and screws, and disconnect the four motor leads at the appropriate terminals.
5. Refer to **Circuit Board Replacement** on page 26, and remove the circuit board and retain.
6. Remove the conduit (22).
7. Remove the three pressure control mounting screws (37) and lockwashers (40) and nuts (41) located below the pressure control box. Remove the box. Remove the mounting plate (16) and install it on the new pressure control.
8. Install the new pressure control assembly in the reverse order of disassembly. Reinstall the conduit seal (5) around the wires in the conduit connector (346) to prevent motor contamination from entering the pressure control. See the **Detail** below.
9. Perform the **Pressure Control Adjustment**, page 28, before regular operation of the sprayer.

CAUTION

Do not allow the adapter (A) to turn while installing the new pressure control assembly. Turning it can damage the sensitive bourdon tube. Hold the adapter firmly with a 19 mm open end wrench while screwing in the fitting (8).

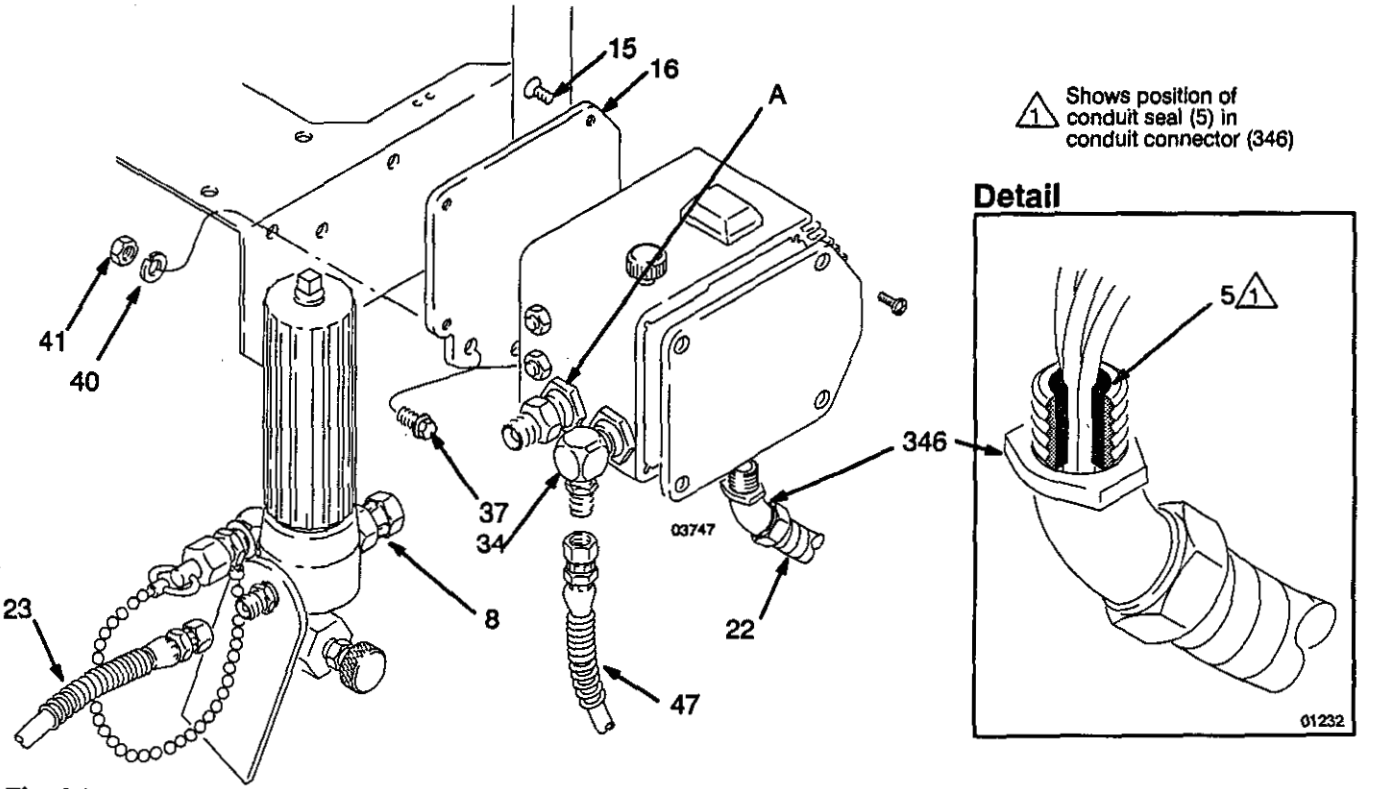


Fig. 24

Pressure Control Adjustment

WARNING

USE EXTREME CAUTION WHEN PERFORMING THIS ADJUSTMENT PROCEDURE to reduce the risk of a fluid injection injury or other serious bodily injury which can result from component rupture, electric shock, fire, explosion, or moving parts.

This procedure sets the sprayer 207 bar MAXIMUM WORKING PRESSURE and sets the overpressurization switch (microswitch) to approximately 3600 psi (242 bar).

Perform this procedure whenever the pressure control assembly is removed and reinstalled or replaced, or a new circuit board is installed.

Improper adjustment can cause the sprayer to overpressurize and result in component rupture, fire or explosion. It may also prevent the sprayer from obtaining the maximum working pressure, resulting in poor sprayer performance.

NEVER try to increase the sprayer's maximum working pressure of 207 bar by performing these adjustments in any other way. Normal operation of the sprayer at higher pressures may result in component rupture, fire or explosion. To perform this adjustment, however, the sprayer pressure must be *temporarily* increased above the normal working pressure.

Use a *new* 15.2 m spray hose rated for at least 207 bar MAXIMUM WORKING PRESSURE. A used, under-rated hose could develop a high pressure leak or rupture.

NOTE: The following tools and equipment are required for this procedure.

3/8 in. nut driver or 3/8 in. socket wrench
1/4 in. open end wrench
7/16 in. open end wrench
0 – 345 bar, oil-filled test gauge, Part No. 102-814
Pail of clean water
Mineral spirits NEW high pressure spray hose, Part No. 214-915

1. Follow the **Pressure Relief Procedure Warning** on page 21.
2. Refer to the above list of tools and equipment needed. Remove the plug (A) from the top of the fluid filter and install the fluid-filled pressure gauge. Refer to Fig. 25. Connect the gun to the **new** test hose and connect the hose to the sprayer outlet.
3. Remove the pressure control cover.
4. Place the pump suction tube in a pail of clean water.
5. Be sure the gun safety latch is engaged.

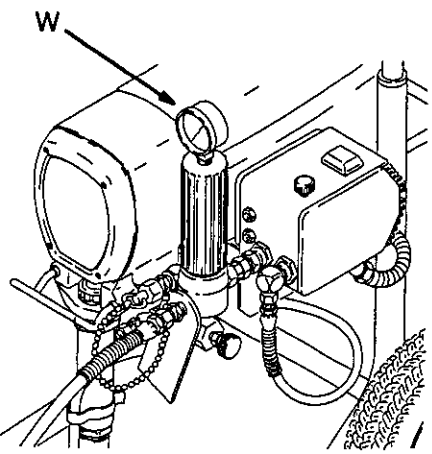


Fig. 25 03748

NOTE: For Steps 7 through 18, refer to Fig. 26.

6. Plug in the sprayer.
7. Turn the pressure control knob (B) to the *minimum* setting (fully counterclockwise), and turn the sprayer ON. **THE DISPLACEMENT PUMP SHOULD NOT CYCLE**

   If it does cycle, remove the plug (345) from the bottom of the pressure control. Insert a 3/8 in. nut driver through the opening, and unscrew the pressure adjustment nut (T) just until the sprayer stops running.

Adjust the Overpressurization Switch

8. With the spray gun triggered, ***slowly*** turn the pressure control knob clockwise just until the sprayer starts. Prime the pump and hose.
9. Slowly turn the pressure control knob to the maximum setting. While watching the red light on the circuit board and the pressure gauge, turn the nut (T) ***slowly*** to increase pressure until the red light goes out **and** the gauge reads between 238 – 266 bar.

   If the red light does not go out by 266 bar, loosen the nut (P) and adjust the stud (Q) until the light goes out.

   If the red light goes out before 238 bar, loosen the nut (P) and adjust the stud (Q) until the light goes out between 238 – 266 bar.
10. Tighten the nut (P) if it was loosened in Step 9.
11. Trigger the gun to relieve pressure. Release the trigger and engage the safety latch. Repeat Step 9 to verify your results.
12. Install the pressure control cover.

Pressure Control Adjustment

Maximum Working Pressure Adjustment

13. Turn the sprayer OFF. Disengage the gun safety latch. Trigger the gun into a grounded waste container until pressure is relieved. Engage the gun safety latch.

14. Use the 3/8 in. nut driver to turn the pressure adjustment nut (T) counterclockwise one full turn.

15. With the pressure control knob at the *minimum* setting, turn the sprayer ON.

16. ***Slowly*** turn the pressure control knob (B) clockwise to the maximum setting and hold it there. Use a 3/8 in. nut driver or socket wrench to slowly turn the pressure adjustment nut (T) clockwise until the gauge reads EXACTLY 207 bar.

17. Turn the pressure control knob to the minimum setting. Release the gun safety latch and trigger the gun into a grounded waste container until pressure is relieved. Engage the gun safety latch. Slowly increase the pressure to verify that the maximum working pressure is set at 207 bar.

CAUTION

To prevent pump corrosion, flush the water out of the pump, hose and gun with mineral spirits. Be sure to close the drain valve, first. Use the lowest pressure necessary to flush. Follow the **Pressure Relief Procedure Warning** on page 21. Leave the mineral spirits in the pump to protect it until you are ready to spray again.

18. Install the plug (345) in the bottom of the pressure control. Remove the gauge assembly and reinstall the plug. Flush out the water with mineral spirits.

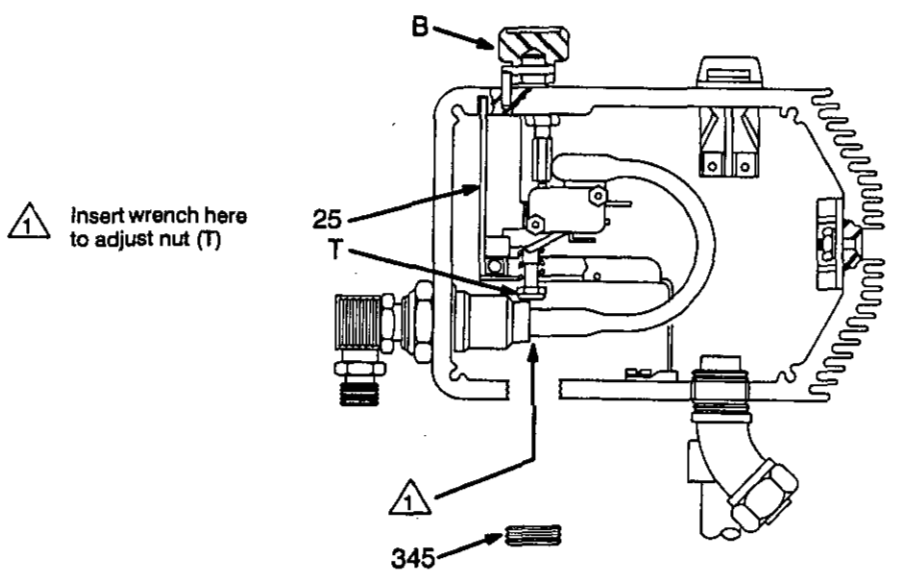


Fig. 26 02362

Displacement Pump

WARNING

Before doing this procedure, follow the **Pressure Relief Procedure Warning** on page 21 to reduce the risk of a serious injury.

Removing the pump

See Fig. 27.

1. Flush the pump. Relieve pressure.
2. Hold the intake valve (223) with a wrench and unscrew the suction. Remove the hose (47).
3. Push the retaining spring (35) up. Push the pin (20) out the rear.
4. Loosen the locknut (38). Unscrew the pump. See **Disassembling the pump**, below.

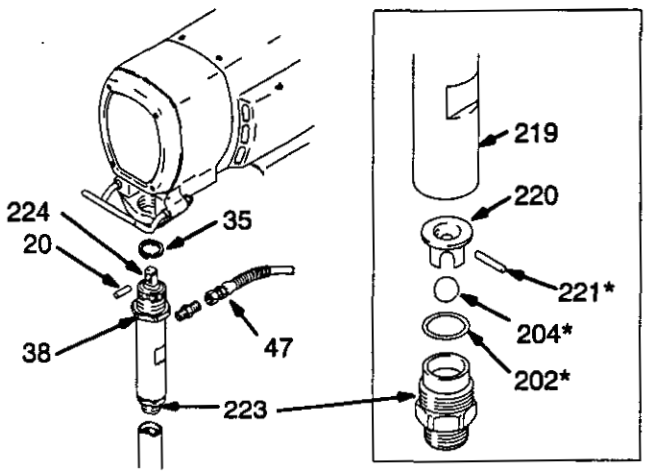


Fig. 27 03749

Disassembling the pump

1. Unscrew the intake valve (223) and remove all parts. See Fig. 27.
2. Remove the plug (205). Unscrew the packing nut (221). See Fig. 28.
3. Tap the piston rod (224) down and then pull it out the bottom of the cylinder (219). See Fig. 28.
4. Remove the throat packings. See Fig. 28.

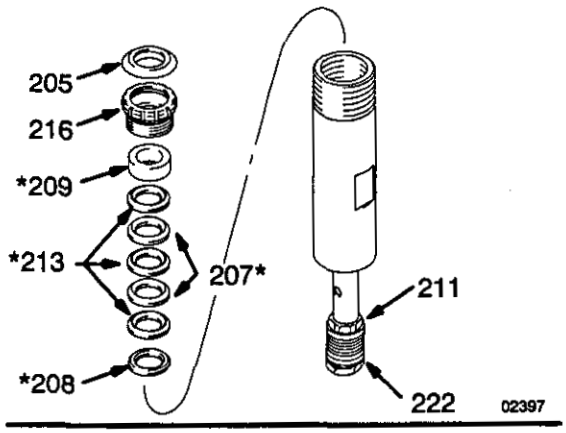


Fig. 28 02397

5. Clamp the piston rod (224) in a vise. Loosen the nut (211). Unscrew the piston valve (222). Remove the piston packings. See Fig. 28.

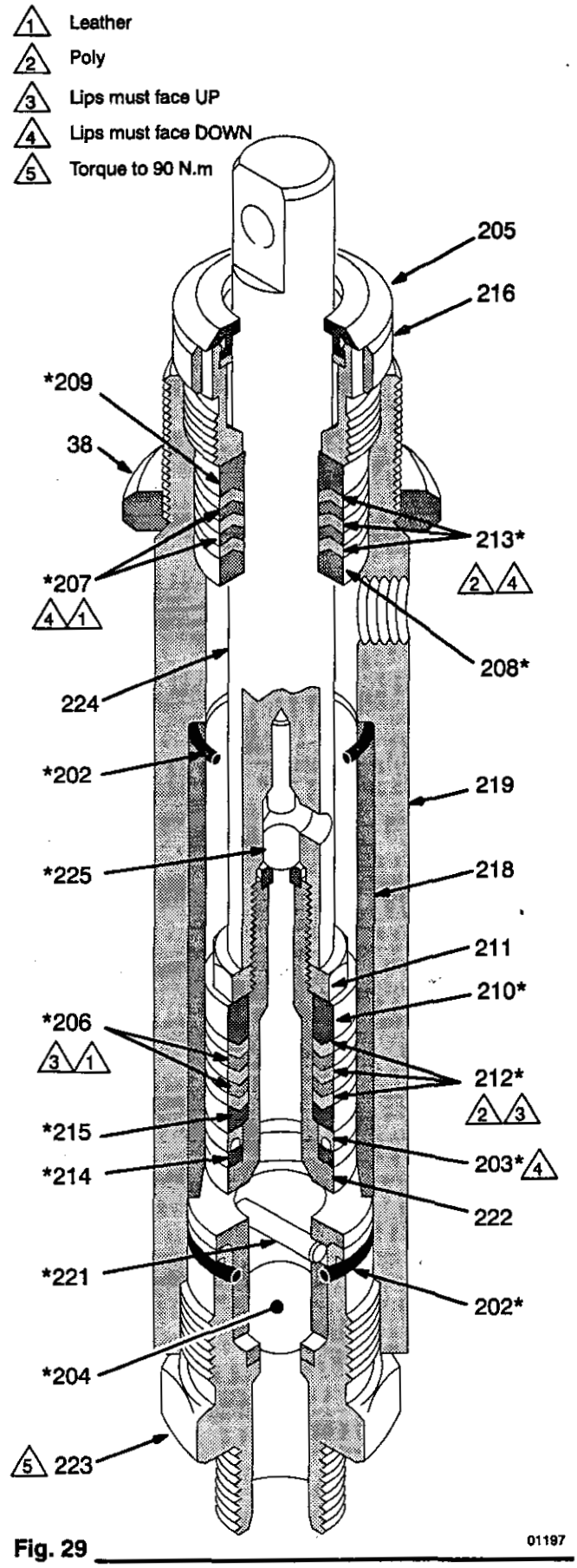


Fig. 29 01197

Displacement Pump

WARNING

To reduce the risk of serious bodily injury from pump rupture, use ***only*** tool 224–787 to remove the sleeve. If the sleeve is stuck, send the cylinder to your Graco distributor for removal.

6. Remove the sleeve whenever your service the pump. Use special tool, Part No. 224–787 only. Screw the nut (H) into the cylinder (219). Screw down the rod (J) to push the sleeve out. See Fig. 30.

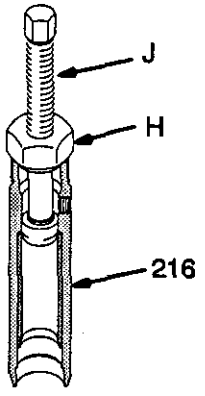


Fig. 30 0028

7. Clamp the piston rod (224) in a vise. Loosen the retaining nut (211). Unscrew the piston valve (222). Remove the piston packings. See Fig. 28.

Assembling the pump.

NOTE: For the best results, use repair kit 222–588, and use all the kit parts. Parts included in the kit are marked with an asterisk, (202*), in the text and drawings.

NOTE: Soak the packings in oil, and coat the rod and inside of the cylinder with oil.

NOTE: Alternate leather and plastic packings as shown in Fig. 29. Be sure the lips of the v–packings face the direction shown. Incorrect installation damages the packings and results in pump leakage.

1. Check the piston rod (224) and the inside of the sleeve (218) for scoring or scratches. If these parts are damaged, new packings will not seal properly.
2. Stack the piston packings onto the piston (222) as shown in Fig. 29.
3. Tighten the piston nut (211) onto the piston to 1.2 N.m to seat the packings, and then back off and tighten finger tight.

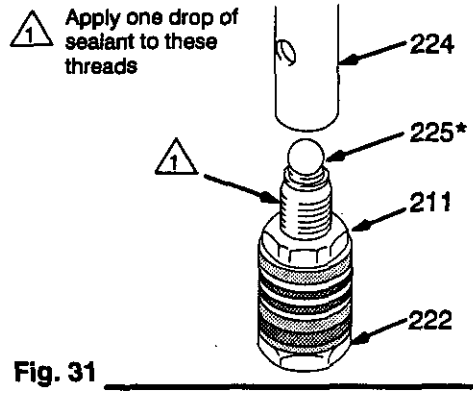


Fig. 31 0029

NOTE: Note the alignment of the piston (222) to the on nut (211) and maintain this alignment through Steps 4, 5 and 6.

4. Apply **ONE** drop of adhesive, supplied with the repair kit, to the piston threads. Place the ball (225*) on the piston. Hand tighten the piston into the rod (224) just until the nut (211) contacts the rod. Place the flats of the rod in a vise. See Fig. 31.
5. Tighten the nut (211) onto the rod (224) to 25 N.m. Use two wrenches to maintain the alignment as mentioned in the NOTE above.
6. Stack the throat packings into the top of the cylinder (219). Install the packing nut (216) loosely.
7. Install a new packing (202) on top of the sleeve. Insert the piston rod assembly into the **top of the sleeve.** Slide the sleeve assembly into the **bottom of the cylinder.** Note that the tapered end of the sleeve is the bottom. See Fig. 32.

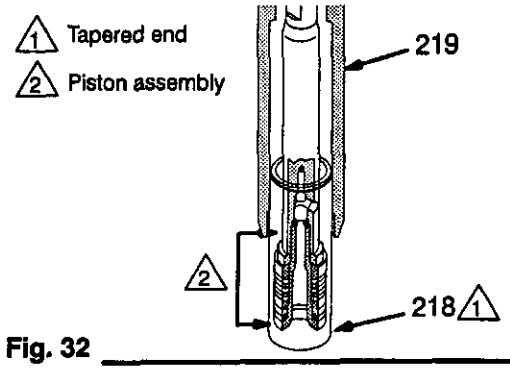


Fig. 32 0030

8. Assemble and install the intake valve. Use a **new** packing (202*). Tighten the valve to 90 N.m. See Fig. 27.

Displacement Pump

Installing the pump

See Fig. 33 and 34.

1. Screw the pump 3/4 of the way into the bearing housing (27). Hold the pin (20) up to the pin hole in the connecting rod (29) and continue screwing in the pump until the pin slides easily into the hole.

2. Align the top threads of the pump cylinder flush with the face of the bearing housing and so the outlet nipple (46) is straight back.

3. Push the retaining spring (35) into the groove of the connecting rod, all the way around. Tighten the locknut (38) very tight – 95 N.m, to prevent it loosening and damaging the threads of the bearing housing.

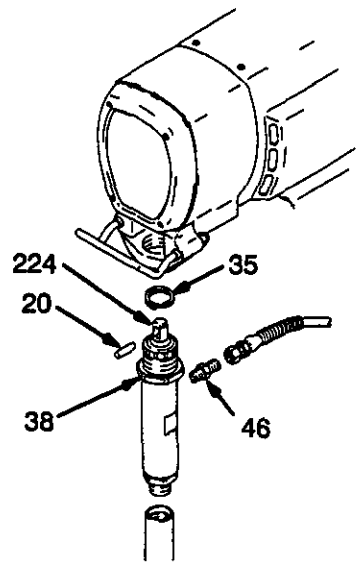


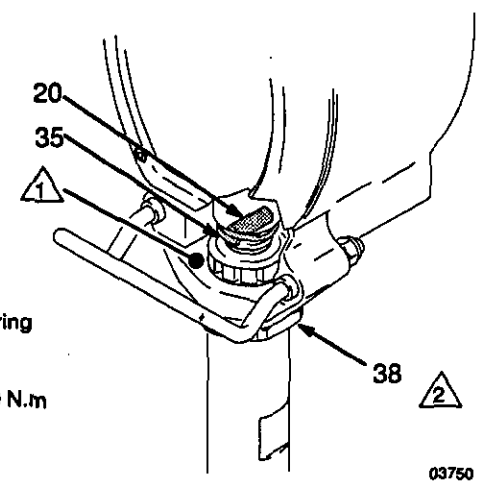
Fig. 33 03749

WARNING

Be sure the retaining spring (35) is firmly in the groove, all the way around, to prevent the pin (20) from working loose due to vibration.

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

4. Assemble the remaining parts.



1 Face of bearing housing

2 Torque to 90 N.m

Fig. 34 03750

Motor Capacitor Replacement

WARNING

Before doing this procedure, follow the **Pressure Relief Procedure Warning** on page 21 to reduce the risk of a serious injury.

NOTE: Always replace both capacitors (one on each side of motor) at the same time.

1. Remove the motor cover (14) and both inspection covers (A). See Fig. 35.

2. Remove the screw and lockwasher (B) and the nut and lockwasher (D) which hold the capacitor (C) to the brush holder. See Fig. 36.

3. Check the new capacitor to be sure the ceramic case is not cracked.

4. Install the new capacitor, making sure to use a lockwasher with the nut and screw.

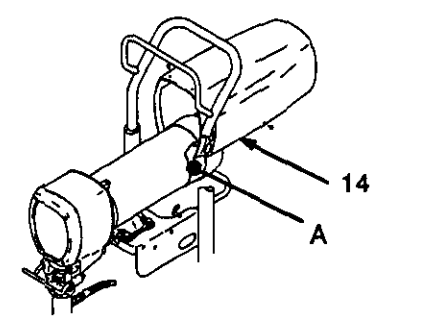


Fig. 35 03799

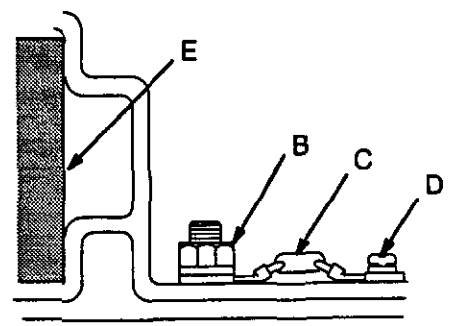


Fig. 36

Motor Brush

NOTE: Replace the brushes when worn to less than 10 mm. See Fig. 39. Always check both brushes. Brush Repair Kit 222–157 and spring clip 110–816 are available.

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

WARNING

Before doing this procedure, follow the **Pressure Relief Procedure Warning** on page 21 to reduce the risk of a serious injury.

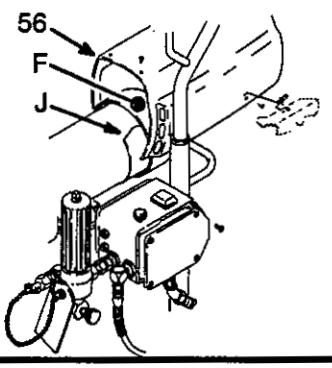


Fig. 37 03746

1. Remove the motor cover (14) and both inspection covers and gaskets (A). See Fig. 37.
2. Push in the spring clip to unhook it, and then pull it out. See Fig. 38.
3. Loosen the terminal screw. Pull the brush lead away, leaving the motor lead in place. Remove the brush and spring. See Fig. 39.
4. Inspect the commutator for excessive pitting, burning or gouging. A black color on the commutator is normal. Have the commutator resurfaced by a qualified motor repair shop if the brushes seem to wear too fast.
5. Install the new brush so its lead is in the long slot of the holder. Slide the terminal under the terminal screw washer. Make sure the motor lead is still connected the at the screw. Tighten the screw. See Fig. 40.
6. Place the spring on the brush as shown in Fig. 40.
7. Push in and hook the spring clip. See Fig. 40.
8. Repeat for the other side.
9. Test the brushes.
   d. Remove the connecting rod pin (20) only. Refer to Fig. 34 on page 32.
   e. With the sprayer off, turn the pressure control knob fully counterclockwise to minimum pressure. Plug in the sprayer.
   f. Turn the srpayer on. Slowly increase the pressure until the motor is at full speed.
   g. Inspect the brush and commutator contact area for excessive arcing. Arcs should not "trail" or circle around the 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 the brush inspection plates, gaskets and covers.
11. Break in the brushes. Operate the sprayer for at least one hour with no load. Then install the pump connecting rod pin.

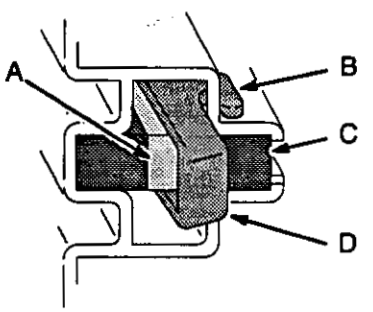
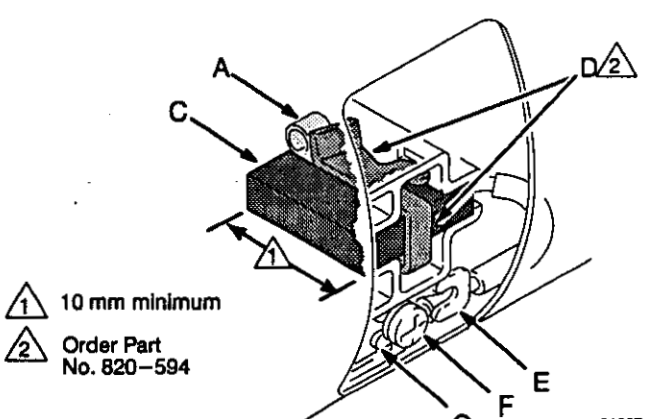
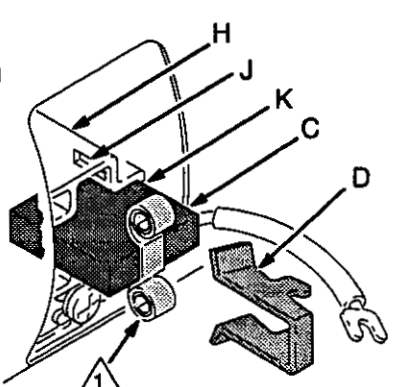


Fig. 38 01227



1 10 mm minimum
2 Order Part No. 820–594

Fig. 39 01227



1 Spring must coil in this direction

Fig. 40 01227

Bearing Housing & Connecting Rod

WARNING

Before doing this procedure, follow the **Pressure Relief Procedure Warning** on page 21 to reduce the risk of a serious injury.

See Fig. 41 for Steps 1 to 14.

NOTE: Stop the sprayer at the bottom of its stroke to get the crank (E) in its lowest position. If the crank must be lowered manually, carefully rotate the blades of the fan with a screwdriver.

1. Remove the front cover (31) and pail hanger (85).
2. If the crank (E) must be lowered manually, carefully rotate the blades of the fan with a screwdriver.
3. Unscrew the suction tube (42) from the pump, holding a wrench on the pump intake valve to keep the pump from loosening.
4. Disconnect the pump outlet hose (47) from the displacement pump outlet nipple (46).
5. Use a screwdriver to push aside the retaining spring (35) at the top of the pump. Push the pin (20) out the rear.
6. Loosen the jam nut (38) with an adjustable wrench. Unscrew and remove the displacement pump.
7. Remove the four screws (33) and lockwashers (49) from the bearing housing (27).
8. Lightly tap the lower rear of the bearing housing (27) with a plastic mallet to loosen it from the drive housing (18). Then pull the bearing housing and the connecting rod assembly (29) straight off the drive housing.
9. Inspect the crank (E) for excessive wear and replace parts as needed.
10. Evenly lubricate the inside of the bronze bearing in the bearing housing with high quality motor oil. Liberally pack the roller bearing in the connecting rod assembly (29) with bearing grease.
11. Assemble the connecting rod and bearing housing (27).
12. Clean the mating surfaces of the bearing and drive housings.
13. Align the connecting rod with the crank (E) and carefully align the locating pins in the drive housing with the holes in the bearing housing (27). Push the bearing housing onto the drive housing or tap it into place with a plastic mallet.

CAUTION

DO NOT use the bearing housing screws (33) to try to align or seat the bearing housing; the bearing and drive housing will not align properly and will result in premature bearing wear.

14. Install the screws (33) and lockwashers (49) on the bearing housing and tighten evenly to 13 to 16 N.m.
15. Install the displacement pump as instructed on page 32.
16. Reinstall the front cover and screws (31,32). Reconnect the suction tube (42) and pump outlet hose (47).

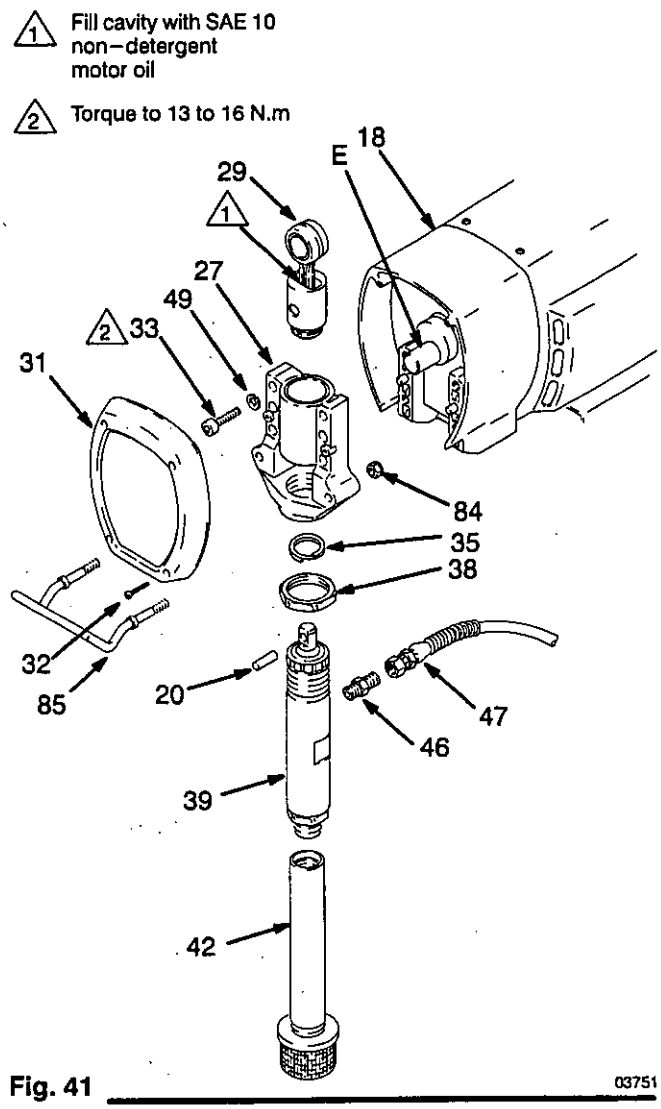


Fig. 41 03751

Drive Housing

WARNING

Before doing this procedure, follow the **Pressure Relief Procedure Warning** on page 21 to reduce the risk of a serious injury.

NOTE: See Fig. 42.

1. Remove the front cover (31), the pail hanger (85), and the motor cover (14).
2. Disconnect the pump outlet hose (47).
3. Remove the four screws (33) and lockwashers (49) from the bearing housing.
4. Lightly tap the lower rear of the bearing housing (27) with a plastic mallet to loosen it from the drive housing (18). Then pull the bearing housing and connecting rod assembly straight off the drive housing.
5. Remove the two screws (51) from the recess of the drive housing, the two screws (30) from the rear of the motor front end bell (1a) and the two screws (21) from the upper rear of the motor front end bell (1a).
6. Lightly tap the drive housing (18) with a plastic mallet to loosen it from the front end bell, then pull it straight off.

CAUTION

DO NOT allow the gear cluster (9) to fall when removing the drive housing (18). It is easily damaged if dropped. The gear may stay engaged in either the front end bell or the drive housing.

DO NOT lose the thrust balls (1d and 10) located at each end of the gear cluster (9) or allow them to fall between gears. The balls, which are heavily covered with grease, usually stay in the shaft recesses, but could be dislodged. If caught between gears and not removed, the balls will seriously damage the drive housing. If the balls are not in place, the bearings will wear prematurely.

7. Liberally apply bearing grease to the gear cluster (9). Use approximately 170 gr (6 oz) of the bearing grease supplied with the drive housing replacement kit. Be sure the thrust balls (1d and 10) are in place.
8. Place the bronze–colored washer (18c) THEN the silver–colored washer (18b) on the shaft protruding from the big gear in the drive housing (18). Align the gears and push the new drive housing straight onto the front end bell and locating pins.
9. Starting at Step 5 and working backwards, continue to reassemble the sprayer.

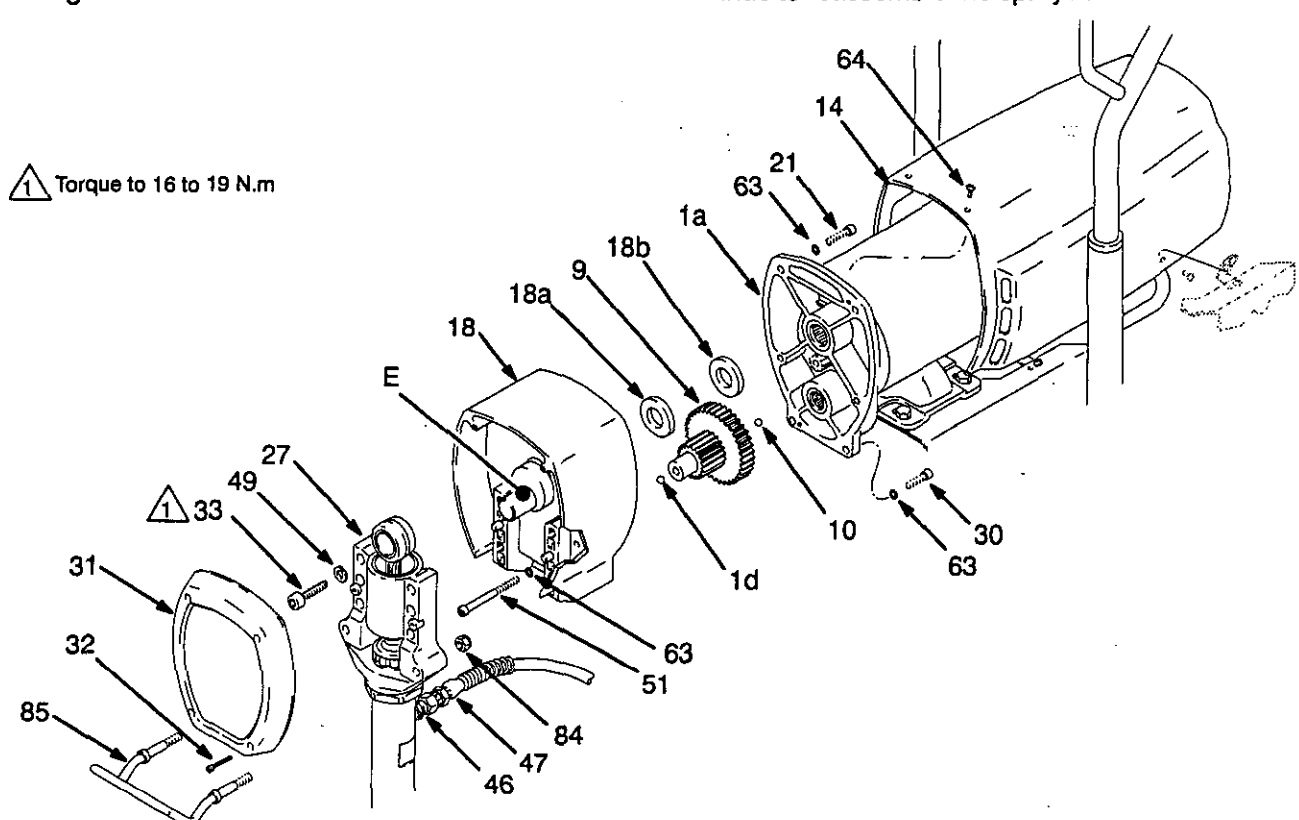


Fig. 42

03752

Motor Replacement

WARNING

Before doing this procedure, follow the **Pressure Relief Procedure Warning** on page 21 to reduce the risk of a serious injury.

NOTE: See Fig. 44 except where noted.

1. Disconnect the pump outlet hose (47) from the displacement pump outlet nipple (46).
2. Remove the pressure control cover and screws and disconnect the four motor leads. See Fig. 43. Remove the conduit seal from the conduit connector coming into the control box.
3. Use an adjustable wrench to loosen the conduit connector (346) at the pressure control assembly (43).
4. Swing the conduit (22) away from the pressure control conduit connector.
5. Pull the motor leads (A) through the conduit connector, one at a time.

CAUTION

Always pull the motor leads one at a time to avoid loosening the terminals.

6. Loosen the conduit connector (54) at the motor and pull the conduit (22) away from the motor, then pull the leads through the conduit, one at a time.
7. Unscrew the conduit connector from the motor.
8. Pull the wires through the conduit connector, one at a time.
9. Remove the front cover (31) and the pail hanger (85).
10. Remove the motor cover (14) and screws (64).
11. Use a hex key wrench to remove the following:
12. Remove the two screws (51) and washers (63) from the recess of the drive housing.
13. Remove the two screws (30) and washers (63) from the lower rear of the motor front end bell (1a).
14. Remove the two screws (21) and washers (63) from the upper rear of the motor front end bell (1a).

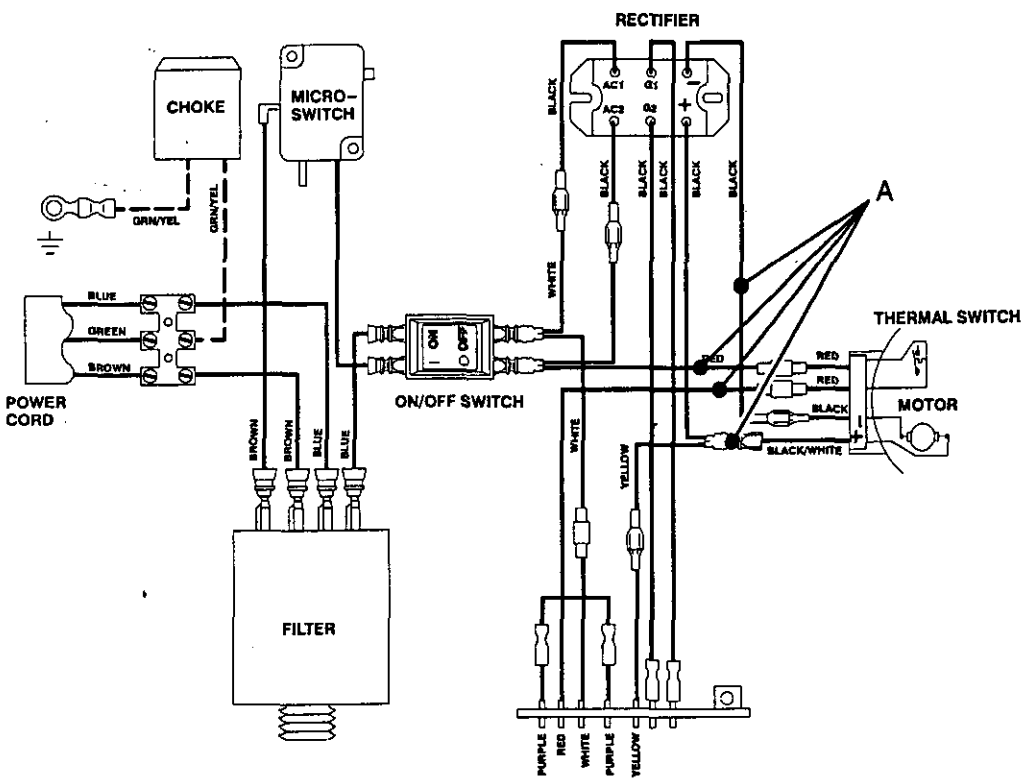


Fig. 43

03754

Motor

15. Use a plastic mallet to gently tap the displacement pump (39) from the rear to loosen the drive housing from the front end bell. Then pull the drive housing away from the end bell.

CAUTION

DO NOT allow the gear cluster (9) to fall when removing the drive housing (18). It is easily damaged if dropped. The cluster may stay engaged in either the front end bell or the drive housing.

DO NOT lose the thrust balls (1d and 10) located at each end of the gear cluster (9) or allow them to fall between gears. The balls, which are heavily covered with grease, usually stay in the gear recesses, but could be dislodged. If caught between gears and not removed, the balls will seriously damage the drive housing. If the balls are not in place, the bearings will wear prematurely.

16. Remove the four screws (44) from the motor bracket (A). Be sure to support the motor to keep the sprayer from tipping.

17. Lift the motor assembly off the frame.

18. Align the motor assembly with the frame mounting holes. Install the screws (44)and related hardware.

19. Liberally grease the gear cluster (9) and pinion gear (B) and pack all bearings in the motor front end bell. Check to be sure the thrust balls (1d and 10) are in place.

20. Place the bronze–colored washer (18c) and THEN the silver–colored washer (18b) on the shaft protruding from the big gear in the drive housing (18).

21. Align the gears and push the drive housing (18) straight onto the front end bell (1a) and locating pins.

22. Starting at Step 12 and working backwards, continue to reassemble the sprayer.

NOTE: Use a turning motion on the conduit (22) when feeding wires through it. Be sure to reinstall the conduit seal (5) around the wires of the conduit connector (346) to prevent motor contamination from entering the pressure control. See the **Detail** in Fig. 42.

23. Reinstall the motor cover and pressure control cover.

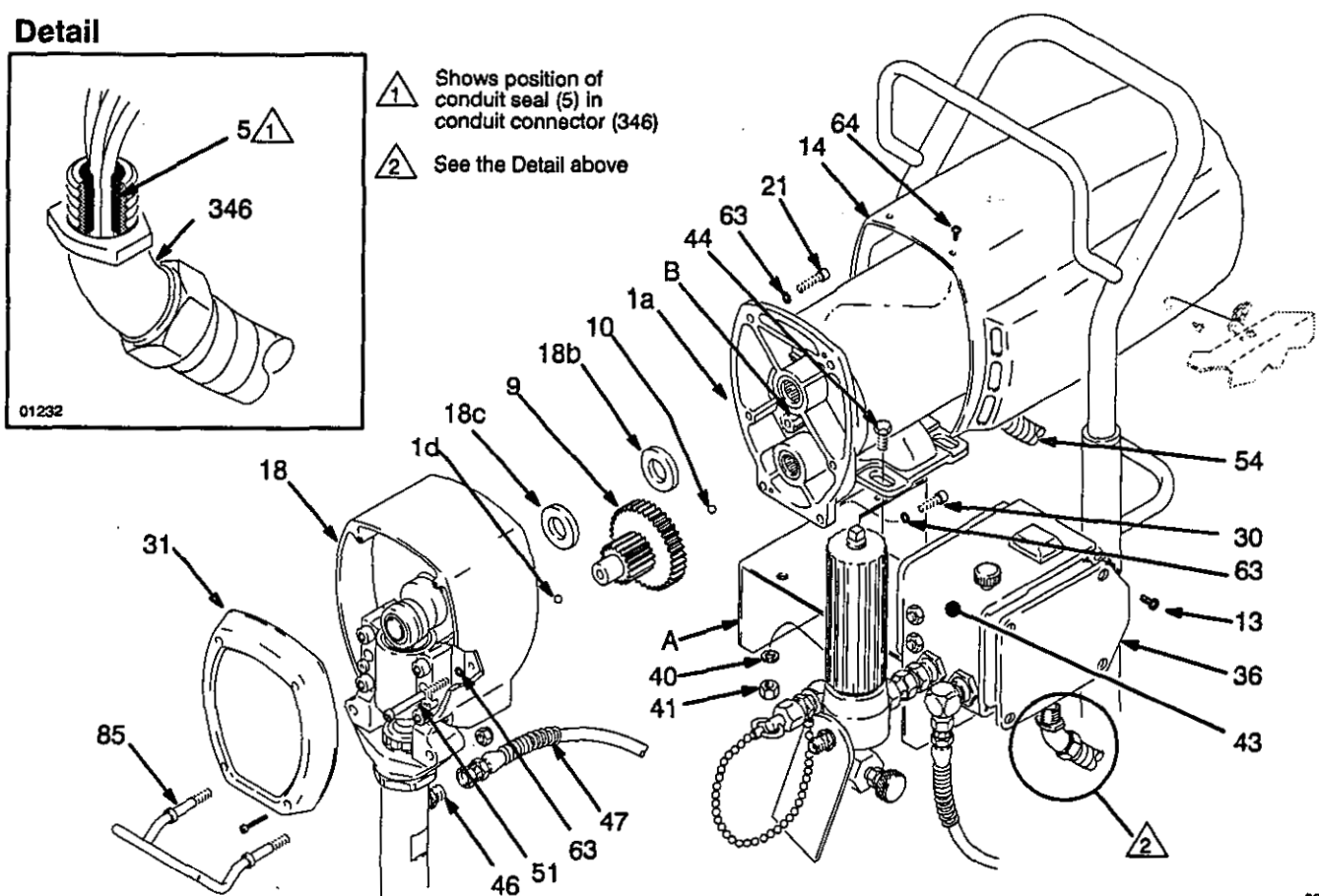
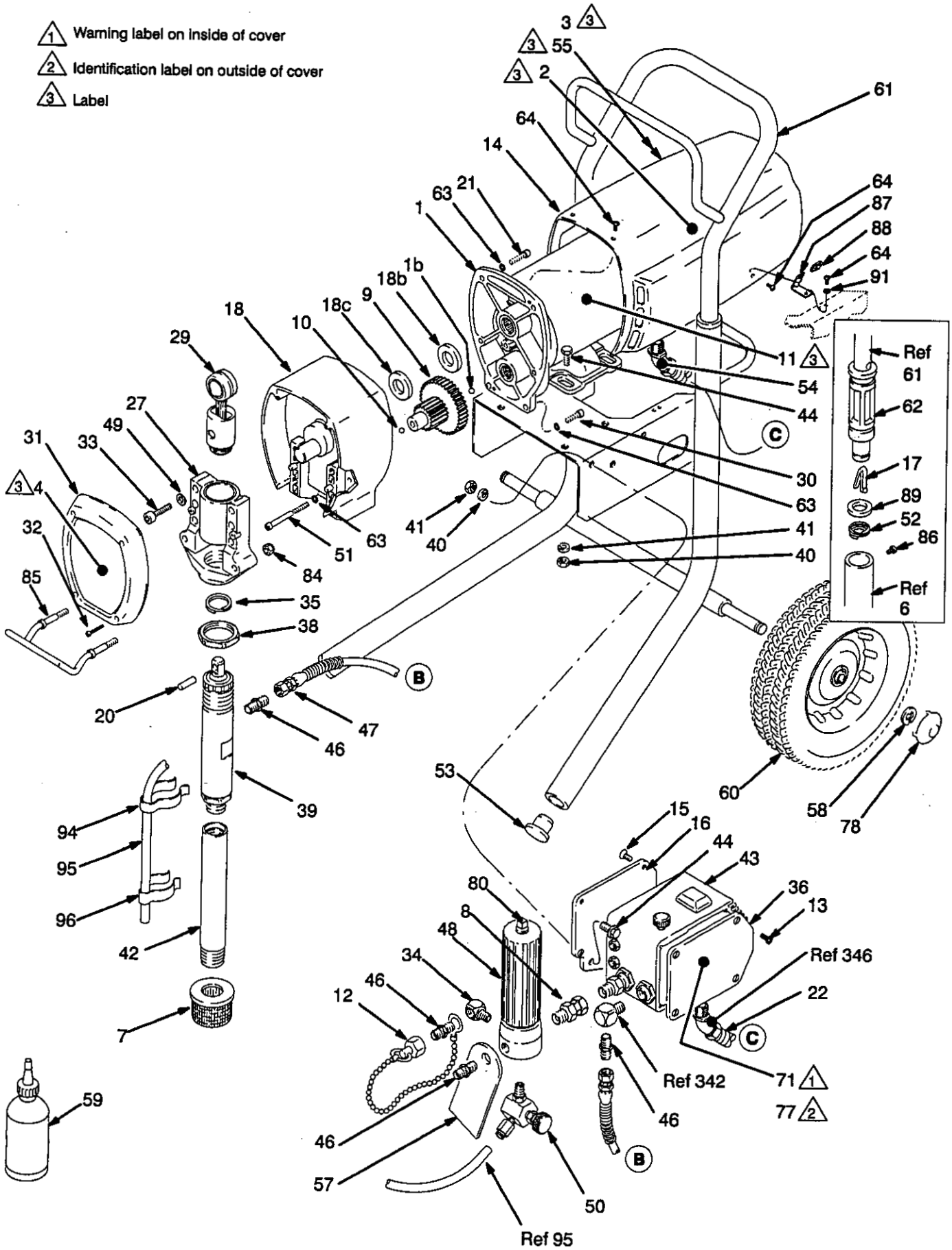


Fig. 42

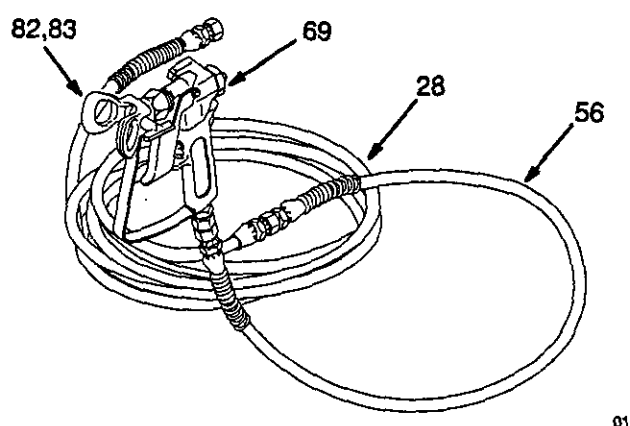
Parts – Sprayer



Parts – Sprayer

Ref. No.	Part No.	Description	Qty.
1	222–397	MOTOR, electric	1
		Includes replaceable items 1b – 1g	
1b	105–684	.BEARING	1
1c	107–088	.BEARING	1
1d	100–069	.BALL	1
1e▲	185–951	.LABEL, DANGER, English	1
1f	107–267	.TERMINAL	2
1g	107–264	.TERMINAL	2
2	181–639	LABEL, DESIGNATION	1
3	181–640	LABEL, DESIGNATION	1
4	181–641	LABEL, DESIGNATION	1
5	107–447	SEAL, conduit *SEE PAGE 40*	2
6	222–555	FRAME, sprayer	1
7	187–147	STRAINER	1
8	109–046	ORS FITTING; 3/8–18 npt x 11/16–16UN	1
9	179–961	GEAR CLUSTER	1
10	100–069	BALL, STEEL; 1/4" dia.	1
12	220–285	CAP, secondary outlet	1
13	110–037	SCREW, mach, panhd; 10–24, type C	4
14	185–430	MOTOR COVER ASSEMBLY	1
		without labels	
15	106–078	SCREW, mach, ovhd, thd frmg; no 6–24 x 1/2", type C	4
16	183–573	MOUNTING BRACKET	1
17	111–590	BUTTON, snap	2
18	218–032	DRIVE HOUSING ASSEMBLY	1
		Includes replaceable item 18a to 18c	
18a	110–293	.GREASE, gear, 6 oz. *(not shown)*	1
18b	178–967	.SPACER	1
18c	107–089	.WASHER, thrust	1
20	176–818	PIN, straight, hdls	1
21	100–644	CAPSCREW, socket head; 1/4 x 3/4" long	2
22	065–099	CONDUIT, electrical	241 mm
25	218–355	CIRCUIT BOARD	
		see page 40	1
27	218–035	HOUSING, bearing	1
28	223–541	HOSE, grounded, nylon; 1/4" ID ;50 ft (15 m) long; spring guard both ends	1
29	218–034	ROD, connecting	1
30	100–643	CAPSCREW, soc hd; 1/4 x 1"	2
31	188–154	COVER, front;	
		without labels	1
32	107–209	SCREW, mach, filh; no. 8–32 x 1"	4
33	107–210	CAPSCREW, sch; 3/8–16 unc–3a x 1–1/2"	4
34	100–840	ELBOW, street, 1/4 npt(m) x 1/4 npt(f)	1
35	176–817	SPRING, retaining	1
36	188–333	COVER, pressure control	1
		without label	
38	178–941	NUT, hex	1
39	222–580	DISPLACEMENT PUMP	1
		see parts on page 38	
40	100–214	LOCKWASHER, 5/16"	7
41	100–188	NUT, hex, 5/16–18	7
42	185–386	SUCTION TUBE	1
43	222–176	PRESSURE CONTROL ASSY.	1
		see separate parts list on page 40	
44	110–963	SCREW, serrated flange, hex hd, 5/16–18 x 3/4"	7
46	162–453	NIPPLE, hex; 1/4 npsm x 1/4 npt, 1–3/16" long	3
47	235–574	HOSE, grounded, nylon; 1/4" ID; 29" (736 m) long; spring guard both ends	1
48	214–570	FLUID FILTER	1
		Includes item 80 and one of 46	
		See 307–273 for remaining parts	
49	106–115	LOCKWASHER, spring; 3/8"	4
50	222–198	PRESSURE DRAIN VALVE	1
51	107–218	CAPSCREW, sch; 1/4–20 x 2.75"	2
52	110–243	RING, retaining	2
53	108–691	PLUG, tubing	2
54	108–460	CONNECTOR, conduit	1
55▲	185–952	LABEL, DANGER, English	1
56	214–701	HOSE, grounded, nylon; 3/16" ID; 3 ft (0.9 m) long; spring guards both ends	1
57▲	178–034	TAG, WARNING	1
58	101–242	RING, retaining	2
59	206–994	THROAT SEAL LIQUID 8 oz. (0.27 liter)	1
60	106–062	WHEEL	2
61	222–554	HANDLE, frame	1
62	187–603	SLEEVE, handle	2
63	105–510	LOCKWASHER, spring; 1/4"	6
64	108–865	SCREW, mach; panhead; no. 8–32 x 3/8" long	10
69	222–667	GUN, airless	1
		see 307–614 for parts	
71▲	177–762	LABEL, WARNING	1
77	181–608	LABEL, identification	1
78	104–811	HUBCAP	2
80	100–040	PLUG, pipe; 3/8–18 nptf	1
82	220–422	RAC IV DripLess Tip Guard	1
83	221–621	RAC IV SwitchTip	1
84	112–746	NUT, retainer	2
85	189–918	HANGER, pail	1
86	109–032	SCREW, mach, panhead, type F 10–24 x 1/4	4
87	185–384	BRACKET	2
88	110–240	NUT, self retaining, type U	2
89	183–350	WASHER, 0.9 x 1.25"	2
91	100–020	LOCKWASHER, spring, 0.194 x 0.334"	2
94	186–994	CLIP	1
95	186–495	DRAIN HOSE	1
96	181–102	CLIP	1

▲ Extra Danger and Warning labels and tags available free.



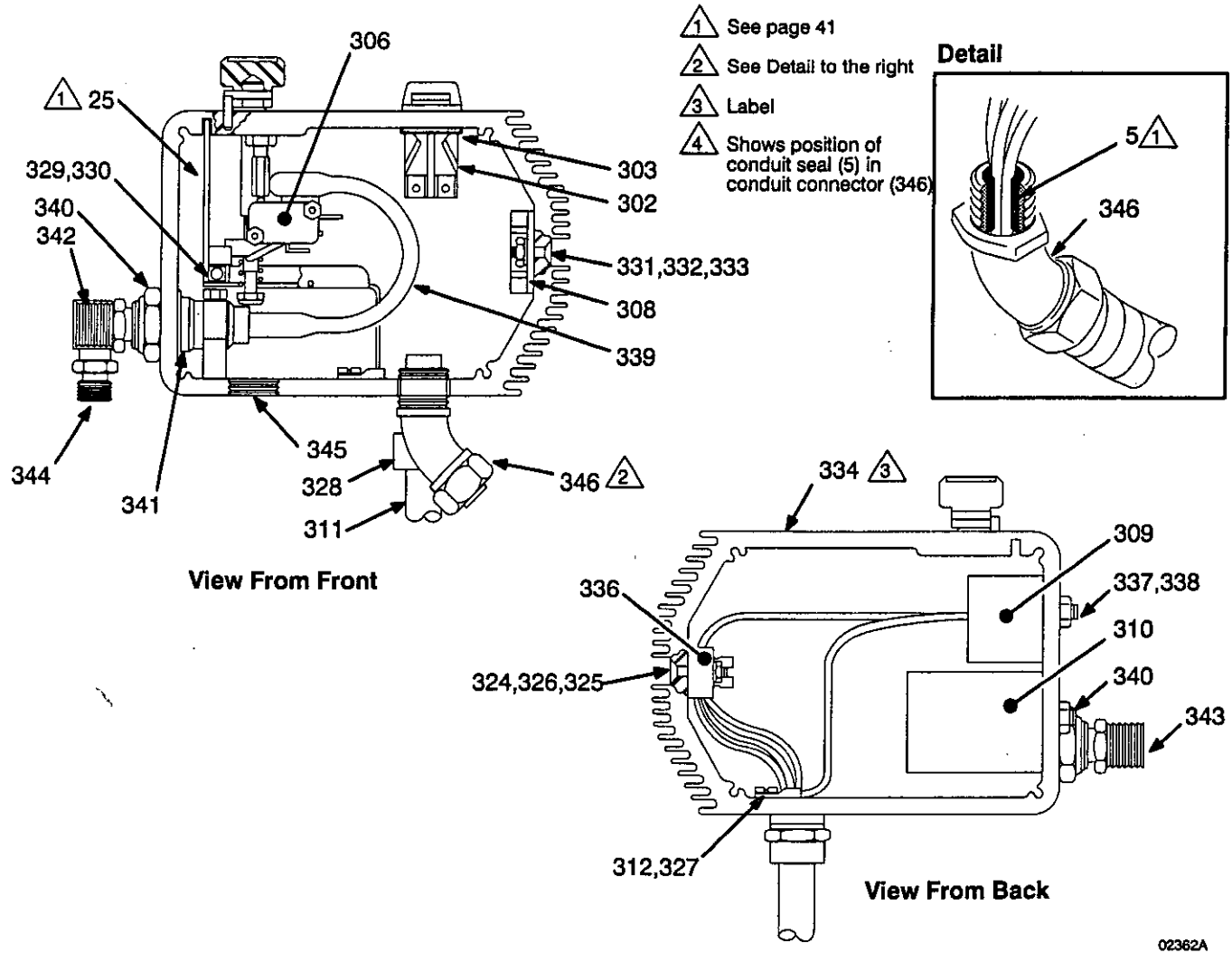
0160

Parts – Pressure Control

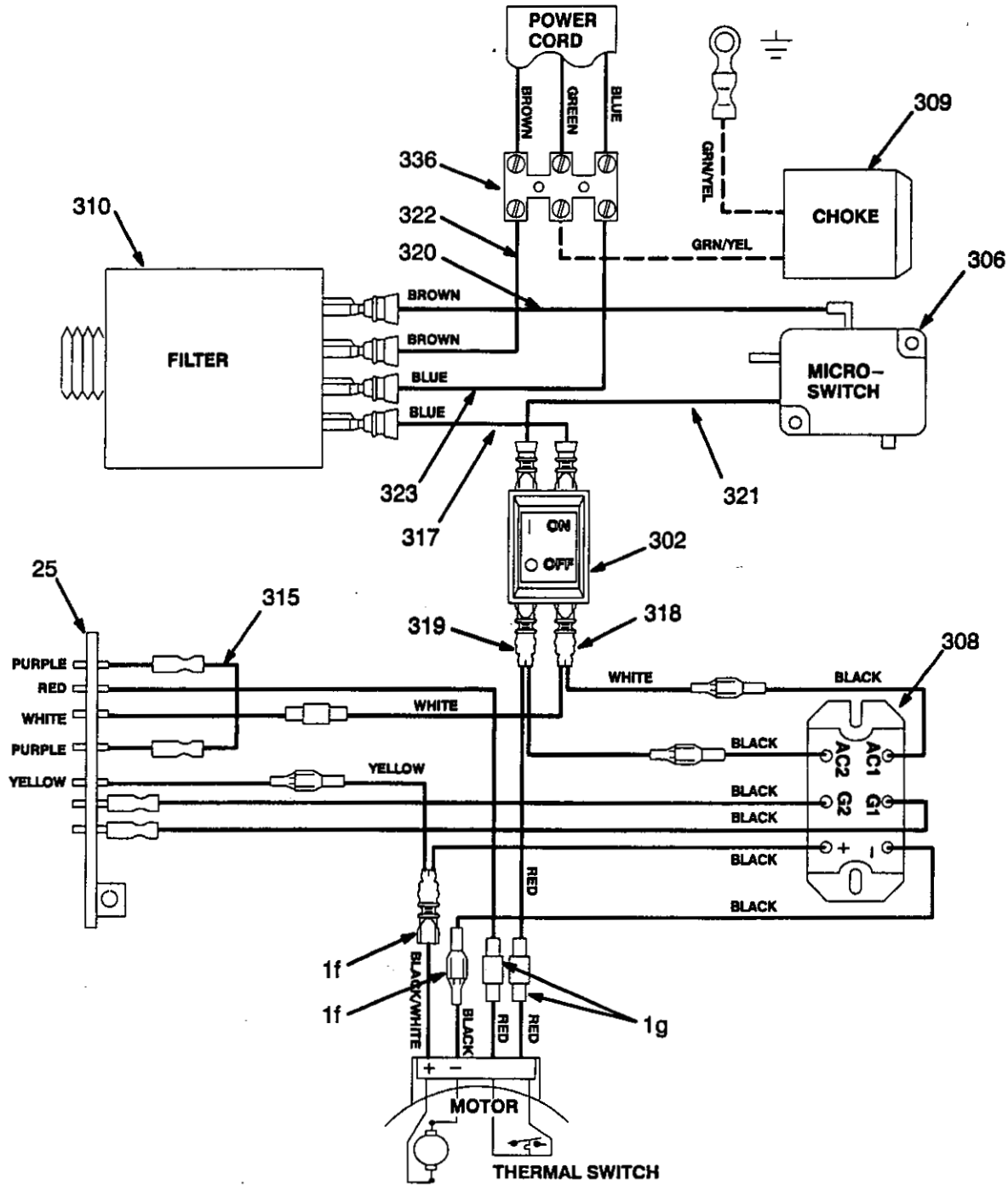
Pressure Control Assembly 222–176

Ref. No.	Part No.	Description	Qty.
300	223–419	PRESSURE CONTROL *includes 302 to 306*	1
302	109–191	.ON/OFF SWITCH	1
303	109–192	.CLIP, retaining	1
306	109–074	.MICROSWITCH	1
308	218–400	RECTIFIER, bridge	1
309	218–366	CHOKE	1
310	107–427	FILTER	1
311	185–314	CORD SET, power supply, no plug	1
312	100–035	SCREW, mach; slotted pan hd; no. 8 x 5/16"	1
315	222–099	JUMPER, wire	1
317	222–577	HARNESS, wire	1
318	222–386	HARNESS, wire	1
319	222–387	HARNESS, wire	1
320	222–578	HARNESS, wire	1
321	222–579	HARNESS, wire	1
322	222–353	HARNESS, wire	1
323	222–354	HARNESS, wire	1
324	107–438	SCREW, mach, flat, csk head; no. 5–40 x 5/8"	2
325	100–975	NUT, hex mach, no.5	2
326	101–792	LOCKWASHER, ext;shakeproof; no. 5	2
327	157–021	LOCKWASHER, no. 8 internal	1
328	105–746	BUSHING, strain relief	1
329	107–258	TIP, pin, black plastic	1
330	180–041	PIN	1
331	101–273	SCREW, mach; flat, soc hd; no. 10–24 x 5/8"	2
332	100–179	NUT, hex, mscr, no. 10–24 thd	2
333	100–718	LOCKWASHER, internal, shakeproof, no. 10	2
334▲	183–466	LABEL, warning	1
336	107–436	TERMINAL, strip	1
337	105–329	NUT, hex, M8 x 1.25	2
338	100–109	LOCKWASHER, external shakeproof; 5/16"	2
339	222–197	BOURDON TUBE	1
340	176–906	NUT	2
341	105–772	WASHER	2
342	100–840	ELBOW	1
343	109–047	ADAPTER	1
344	162–453	NIPPLE	1
345	101–754	PLUG, pipe, 3/8–18 npt	1
346	108–460	CONNECTOR, conduit, 45°	1

▲ Extra warning labels are available free of charge.



Wiring Diagram



03754

Parts – Displacement Pump

Model 222–580, Series A

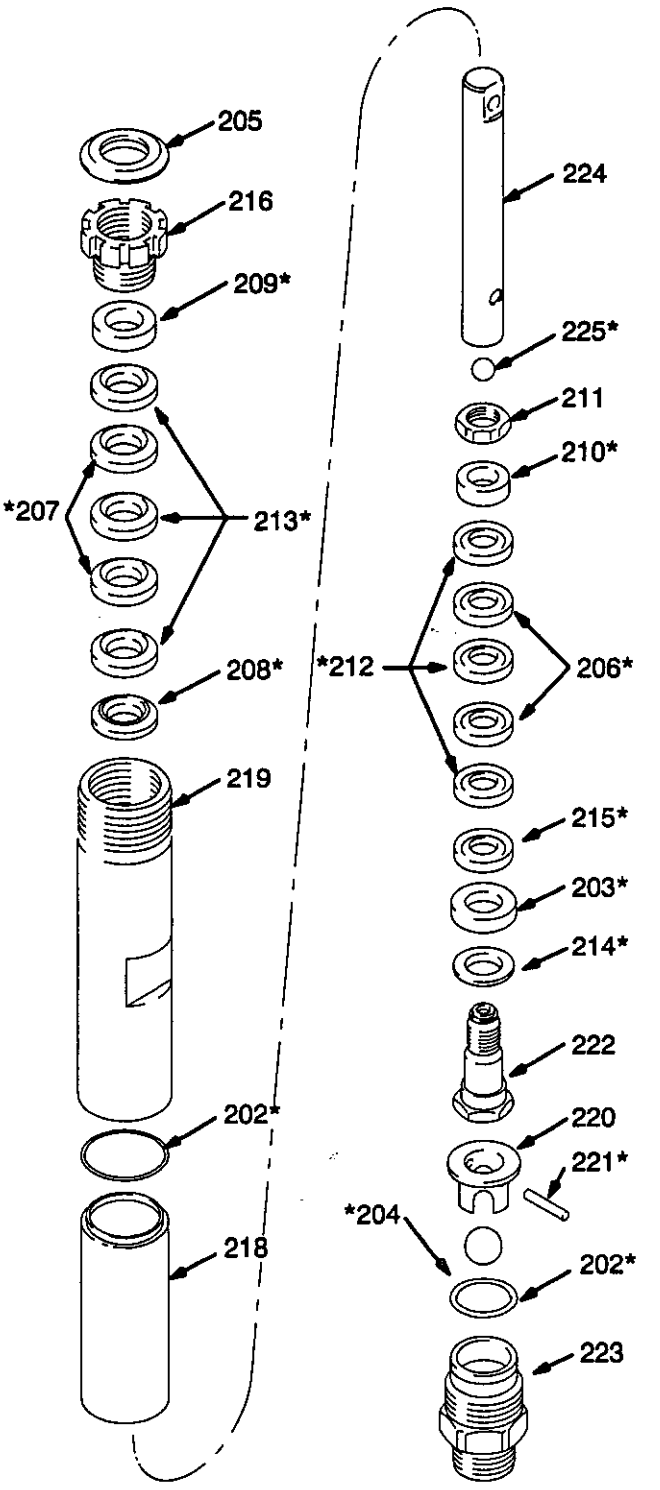
Sleeved Displacement Pump

Includes items 202 to 225

Ref No.	Part No.	Description	Qty
202*	108–526	PACKING, oPTFE Ilon®	2
203*	107–093	SEAL, u–cup, polyurethane	1
204*	105–445	BALL; sst	1
205	179–810	PLUG	1
206*	178–939	V–PACKING, leather	2
207*	178–940	V–PACKING, leather	2
208*	178–942	GLAND, male	1
209*	178–943	GLAND, female	1
210*	178–944	GLAND, male	1
211	178–945	NUT, hex, retaining	1
212*	178–964	V–PACKING, plastic	3
213*	178–965	V–PACKING, plastic	3
214*	181–338	WASHER, backup	1
215*	178–969	GLAND, female	1
216	179–809	NUT, packing	1
218	185–213	SLEEVE, cylinder	1
219	185–211	CYLINDER	1
220	185–214	GUIDE, ball	1
221*	178–938	PIN, ball stop	1
222	218–036	VALVE, piston	1
223	222–437	VALVE, intake	1
224	222–438	ROD, piston	1
225*	105–444	BALL	1

* *These parts are also included in* ***Repair Kit 222–588****, which may be purchased separately.*

NOTE: Use Sleeve Removal Tool 224–787.



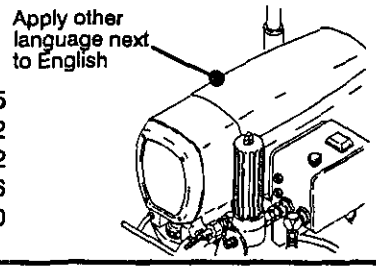
01198

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.

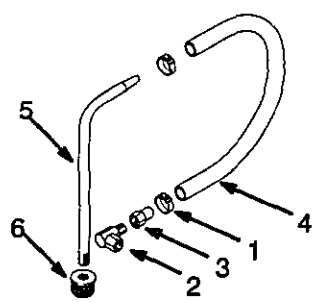
Order the labels directly from your Graco distributor, free of charge.



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

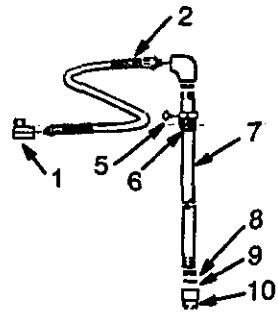
Suction Tube Kit 208–920 19 liter size

Ref No.	Part No.	Description	Qty
1	101–818	CLAMP, hose	1
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
5	170–957	TUBE, suction	1
6	181–072	STRAINER	1



Suction Tube Kit 208–259 200 liter size

Ref No.	Part No.	Description	Qty
1	156–589	UNION, 90°; 3/4 npt(f x sw)	1
2	214–961	HOSE, 3/4 npt(mbe);3/4" ID; nylon; 1.8 m; spring guard 1 end	1
3	156–591	ELBOW, 90°; 3/4 nptx 1–1/2 – 24 ns	1
4	156–593	PACKING, o–ring, nitrile	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



Displacement Pump Repair Kit 222–588
See parts on page 42.
Repair instructions included with kit.

Sleeve Removal Tool 224–787
Required for removing the displacement pump sleeve.

Motor Brush 222–157
Repair instructions included with kit.

Manual Change Summary

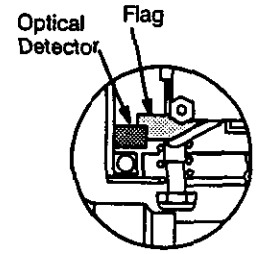
Model 231–082 has been advanced to Series C. The following part changes have been made. Old and new parts are interchangeable; added and deleted parts are not.

Part Status	Ref No.	Part No.	Name
Old	7	181–072	Strainer
New	7	187–147	Strainer
Old	17	179–777	Button
New	17	111–590	Button
Old	31	179–899	Front cover
new	31	188–154	Front cover
Old	36	183–995	PC Cover
new	36	188–333	PC Cover
Old	44	100–057	Capscrew
New	44	110–963	Capscrew
Old	47	218–083	Hose
new	47	235–674	Hose
Old	62	183–194	Sleeve
New	62	187–603	Sleeve
Delete	84	108–662	Nut
Add	84	110–814	Nut
Delete	85	183–037	Hanger
Add	85	186–227	Hanger

Part Status	Ref No.	Part No.	Name
Delete	90	107–194	Washer
Delete	92	183–035	Bracket
Add	94	186–994	Clip
Add	95	186–495	Drain Tube
Add	96	181–102	Clip

Additional changes:

- Corrected wiring diagram (pages 14, 26,36, 41).
- The bearing housing has changed, but the part number for it has not changed.
- The sleeve removal tool for the displacement pump was changed. The old number was 222–585, the new one is 224–787.
- The position of the circuit board optical detector has been changed. Now, the motor turns on as the bourdon tube flag **enters** the optical detector, as shown to the right. This is opposite of the old circuit board. The method of installing the board does not change.



- All illustrations have been updated.

Technical Data

Power Requirements	220/240 VAC, 50Hz, 1 phase, 7 amp minimum
Working Pressure Range	0 – 207 bar
Cycles/liter	53
Maximum Delivery	3.2 liter/min
Power Cord	No. 14 AWG, 3 wire, 2.6 m
Inlet Paint Strainer	1190 micron Stainless Steel Screen, reusable
Outlet Paint Filter	250 micron Stainless Steel Screen, reusable
Pump Inlet Size	3/4 npt(m) with 20° ID chamfer
Fluid Outlet Size	1/4 npsm from fluid filter
Wetted Parts:	
Displacement Pump	Carbon steel, Polyurethane, UHMW polyethylene, Delrin®, Leather
Filter	Aluminum, Carbon steel, Stainless steel,

NOTE: Delrin®

Dimensions

Weight (dry w/o packaging)	43 Kg (approx.)
Height	711 mm
Length	660 mm
Width	572 mm

The Graco Ultra® Warranty and Disclaimers

WARRANTY

Graco warrants all equipment manufactured by it and bearing its name to be free from defects in material and workmanship on the date of sale by an authorized Graco distributor to the original purchaser for use. As purchaser's sole remedy for breach of this warranty, Graco will, for a period of twelve months from the date of sale, repair or replace any part of the Ultra equipment proven defective, with the exception of defects in parts on the drive train/gear box, which will be repaired or replaced for forty-eight months from the date of sale and the electric motor (excluding brush replacement, which is routine maintenance) or pressure control assembly which will be repaired or replaced for twenty-four months from the date of sale. This warranty applies only when the equipment is installed, operated and maintained in accordance with Graco's written recommendations.

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

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

DISCLAIMERS AND LIMITATIONS

The terms of this warranty constitute purchaser's sole and exclusive remedy and are in lieu of any other warranties (express or implied), **including warranty of merchantability or warranty of fitness for a particular purpose,** and of any non–contractual liabilities, including product liabilities, based on negligence or strict liability. Every form of liability for direct, special or consequential damages or loss is expressly excluded and denied. In no case shall Graco's liability exceed the amount of the purchase price. Any action for breach of warranty must be brought within two (2) years of the date of sale.

EQUIPMENT NOT COVERED BY GRACO WARRANTY

Graco makes no warranty, and disclaims all implied **warranties of merchantability and fitness for a particular purpose,** with respect to accessories, equipment, materials, or components sold but not manufactured by Graco. These items sold, but not manufactured by Graco (such as electric motor, 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.

Sales Offices: Atlanta, Chicago, Dallas, Detroit, Los Angeles, Mt. Arlington (N.J.)
Foreign Offices: Canada; England; Korea; Switzerland; France; Germany; Hong Kong; Japan

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

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