

INSTRUCTIONS—PARTS LIST



308-084

Rev. H
Supersedes G

This manual contains **IMPORTANT
WARNINGS AND INSTRUCTIONS**
READ AND RETAIN FOR REFERENCE

Model PRO 4600SC™

AUTOMATIC ELECTROSTATIC AIR SPRAY GUN

100 psi (7 bar) MAXIMUM WORKING PRESSURE

U.S. Patent No. 4,290,091; 4,219,865; 4,497,447; 4,462,061; 4,660,774;
5,063,350; 5,073,709; 5,080,289; 5,093,625

Patented 1986, 1987 Canada

Brevete 1986, 1987

U.K. Patent No. 2,147,158; 2,142,559B; 2,140,327B; 2,245,197B

French Patent No. 91 14488

Other Foreign Patents Pending

Part No. 224-224, Series A

Air Spray Gun, without shroud
(0.059 in. (1.5 mm) spray nozzle)

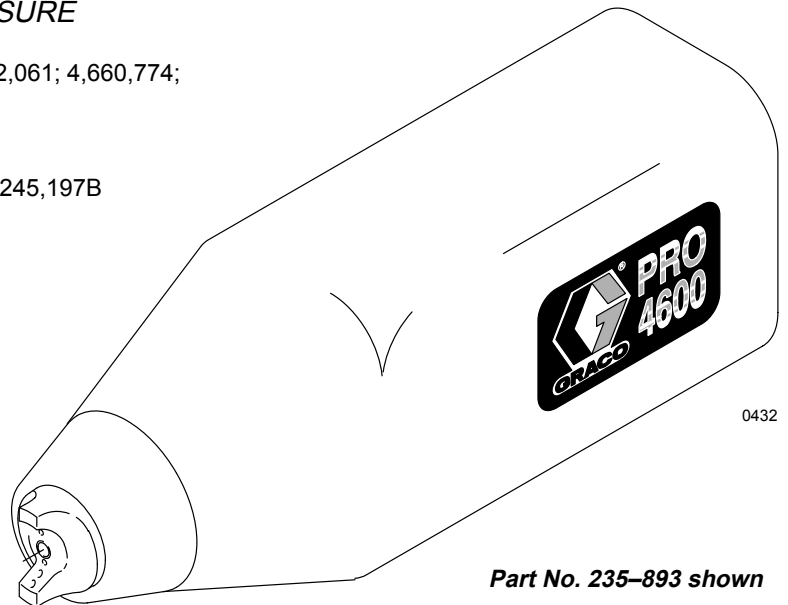
Part No. 235-893, Series A

Air Spray Gun, with standard shroud

Part No. 235-894, Series A

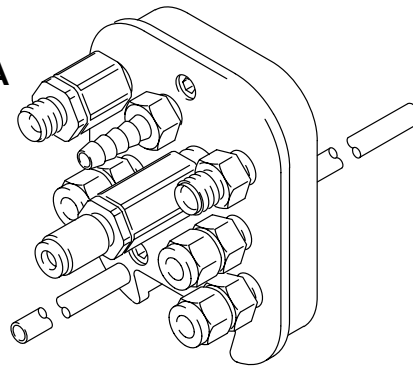
Air Spray Gun, with slotted shroud

For use when the gun is mounted in
the front position; see Fig 3 , page 6



Part No. 224-094 Series A Gun Manifold

Must order separately.



**Factory
Mutual
System**

Approved

For use with Class I, Group D paint spray materials

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WARNINGS

SERIOUS BODILY INJURY, EXPLOSION, FIRE, OR ELECTROSTATIC SHOCK CAN OCCUR IF THE PRECAUTIONS BELOW ARE NOT FOLLOWED.

READ AND UNDERSTAND ALL INSTRUCTION MANUALS, TAGS, AND WARNING LABELS BEFORE OPERATING EQUIPMENT.

ELECTROSTATIC EQUIPMENT SHALL ONLY BE USED BY TRAINED, QUALIFIED PERSONNEL WHO SHALL BE FULLY CONVERSANT WITH THE REQUIREMENTS STATED WITHIN THIS INSTRUCTION MANUAL.

EQUIPMENT MISUSE HAZARD

General Safety

Any misuse of the spray equipment or accessories, such as over pressurizing, modifying parts, using incompatible chemicals and fluids, or using worn or damaged parts, can cause them to rupture and result in serious bodily injury, fire, explosion or property damage.

NEVER point the spray gun at anyone or at any part of the body.

NEVER put hand or fingers over the spray nozzle.

ALWAYS follow the **Pressure Relief Procedure**, at right, before cleaning or removing the fluid nozzle or servicing any system equipment.

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

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.

System Pressure

This gun has a maximum working air and fluid pressure of 100 psi (7 bar). Never exceed the maximum working pressure of the gun or any other component or accessory used in the system.

Fluid Compatibility

BE SURE all fluids and solvents used are chemically compatible with the "Wetted Parts" shown in the **TECHNICAL DATA**. Always read and follow the fluid and solvent manufacturer's literature before using the fluid or solvent in this gun.

Pressure Relief Procedure

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

1. Turn off all the air to the control module except the manifold air. If the air pilot fluid regulator is used, air pressure is needed at the regulator air inlet to relieve pressure in the fluid line.
2. Turn off the fluid supply to the gun.
3. Trigger the gun into a *grounded* metal waste container to relieve fluid pressure.
4. Open the pump drain valve, having a waste container ready to catch the drainage.
5. Leave the pump drain valve open until you are ready to spray again.

HAZARDOUS FLUID HAZARD

Improper handling of hazardous fluids or inhaling vapors can cause extremely serious bodily injury, even death, due to splashing in the eyes, ingestion, inhalation, or bodily contamination. Be sure you know what fluid you are pumping and its specific hazards. Observe all precautions when handling known or potentially hazardous fluids, including, but not limited to, the following precautions.

1. Store hazardous fluids in approved containers.
2. Dispose of any waste fluid according to all Local, State and Federal regulations pertaining to the disposal of hazardous wastes.

3. Read and follow the fluid and solvent manufacturer's literature regarding the use of protective clothing and equipment, such as eye protection, respiratory protection, and gloves.
4. Provide for the safe piping and disposal of all exhaust air.
5. Provide proper ventilation in accordance with accepted industry standards and governmental regulations. Refer to **Ventilate the Spray Booth**, on page 6.

HOSE SAFETY

TIGHTEN all fluid connections securely before each use.

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.

HANDLE AND ROUTE HOSES CAREFULLY. Do not pull on hoses to move equipment. Do not use fluids or solvents which are not compatible with the inner tube and cover of the hose.

FIRE, EXPLOSION, OR ELECTROSTATIC SHOCK HAZARD

To reduce the risk of fire, explosion, or electrostatic shock, which may result from electrical discharge, it is essential that:

- All parts of the electrostatic system are properly grounded.
- All personnel in or close to the spray area are properly grounded.
- All electrically conductive objects or devices in the spray area, including paint containers, wash cans and tools, are properly grounded.

When operating the electrostatic device, any ungrounded objects in the spray area (such as people, containers, tools, etc.) can become electrically charged. Arcing may occur if these objects then come in contact or close to ground. Arcing of sufficient energy levels can ignite the fluid being sprayed, fumes from solvents, dust particles, and other flammable substances. This can cause a fire, explosion, or electrostatic shock and result in serious bodily injury and property damage.

Static electricity can also be generated by the flow of fluid through the pump, hose, gun, and nozzle, but it is dissipated through proper grounding as described in **Grounding** below.

If you experience any arcing or feel even a slight shock, **STOP SPRAYING IMMEDIATELY**. Check for proper grounding of the entire system. Be sure you have corrected the problem before starting to spray again.

Grounding

The following are minimum requirements for grounding a basic electrostatic system. Your system may include other equipment or objects which must also be grounded. Always check your local electrical code for detailed grounding instructions. Be sure your system is connected to a true earth ground.

1. *Pump*: ground by using a ground wire and clamp as described in your separate pump instruction manual.
2. *Air compressors and hydraulic power supplies*: ground according to the manufacturer's recommendations.
3. *Electrostatic Air Spray Gun*: obtain grounding through connection to a properly grounded air supply hose. Use only the Graco Electrically Conductive Air Supply Hose; see **ACCESSORIES** section to order. Connect the air hose ground wire to a true earth ground.
4. *Object being sprayed*: keep the work piece hangers clean and grounded at all times. Contact points must be sharp points or knife edges.
5. *All electrically conductive objects or devices* in the spray area, including paint containers and wash cans, must be properly grounded.

6. *All persons entering the spray area*: shoes must have conductive soles, such as leather, or personal grounding straps must be worn. Rubber or plastic soles are not conductive.
7. *The floor of the spray area* must be electrically conductive and grounded. Do not cover the floor with cardboard or any non-conductive material which would interrupt grounding continuity.
8. *Flammable liquids* in the spray area must be kept in approved, grounded containers. Do not store more than the quantity needed for one shift.
9. *All solvent pails*: use only grounded metal pails, which are conductive. Do not place the pail on any non-conductive surface, such as cardboard or paper, which would interrupt grounding continuity.
10. *All air and fluid lines and electric cables* must be properly grounded.

Flushing and Cleaning Safety

To reduce the risk of static sparking or splashing, always follow the **Pressure Relief Procedure** on page 2 before flushing.

Be sure the turbine air (electrostatics) is OFF before flushing or cleaning any part of the spray system.

Use the lowest possible pressure to flush. Trigger the gun into a grounded metal waste container.

To flush or purge equipment, ALWAYS use solvents with a flash point equal to or greater than that of the fluid being sprayed.

To clean the exterior of the equipment, ALWAYS use solvents with a flash point of higher than 100° F (38° C).

ALWAYS remove all solvent from the system before reactivating the spray gun.

Use only non-sparking tools to clean residue from the booth and hangers.

Ventilate the Spray Booth

To prevent hazardous concentrations of toxic and/or flammable vapors, spray only in a properly ventilated spray booth.

Check and follow all National, State and Local codes regarding air exhaust velocity requirements. Check and follow all local safety and fire codes and OSHA standard 1910.107.

NEVER operate the spray gun unless the ventilating fans are operating.

IMPORTANT

United States Government safety standards have been adopted under the Occupational Safety and Health Act. These standards—particularly the General Standards, Part 1910.107 and any other appropriate regulations—should be consulted in connection with the installation, operation, and maintenance of electrostatic spray painting equipment.

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TERMS

WARNING: Alerts user to avoid or correct conditions that could cause bodily harm.

CAUTION: Alerts user to avoid or correct conditions that could cause damage to or destruction of equipment.

NOTE: Identifies essential procedures or helpful information.

BASIC SYSTEM

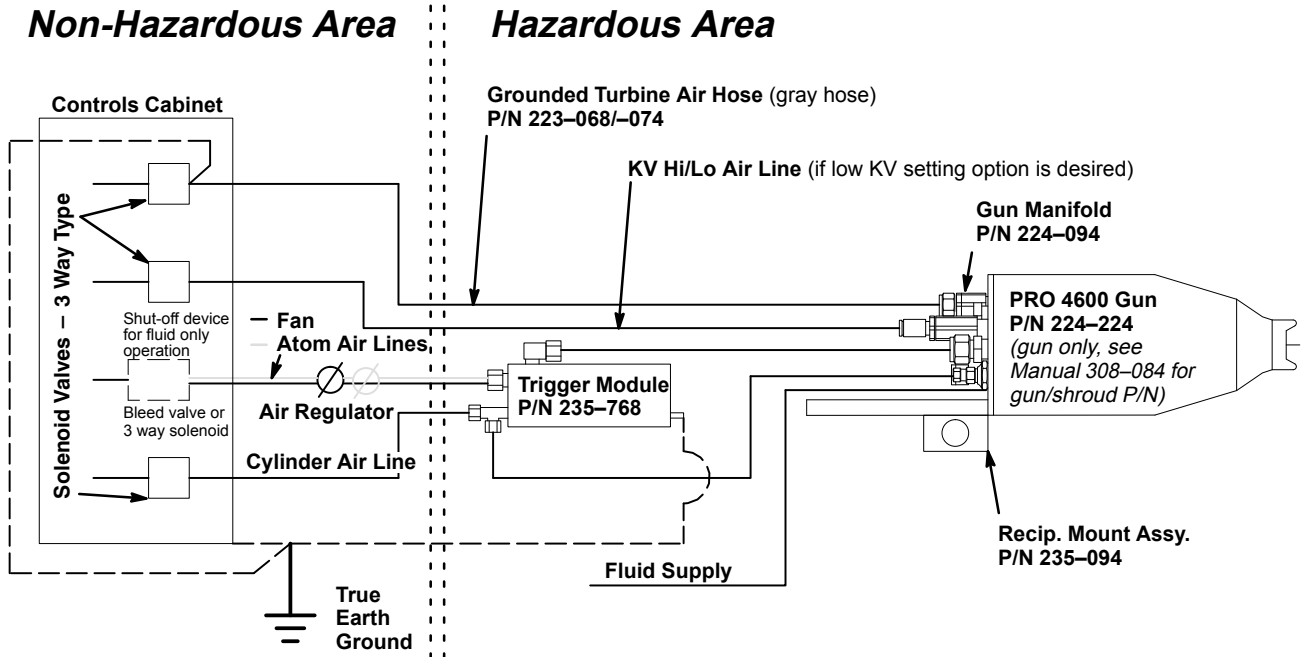


Fig 1

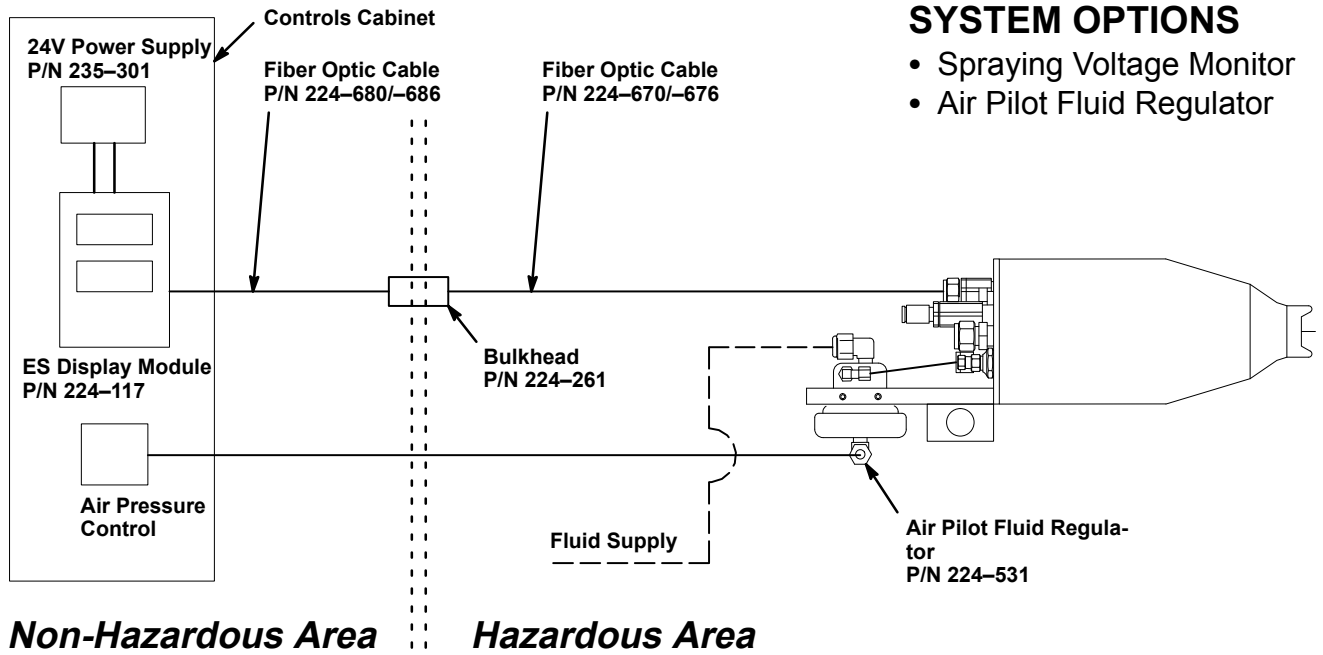


Fig 2

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Installing the System

Fig 1 , above, shows a typical Model 4600 system. Fig 2 shows some possible system options. For assistance in designing a system that is customized for your application, contact your Graco representative.

Warning Signs

Mount warning signs in the spray area where they can easily be seen and read by all operators. An English Warning Sign is provided with the gun. Additional English, French, German, and Spanish signs are available at no charge. See the **ACCESSORIES** section to order them.

INSTALLATION

WARNING

Installing and servicing this equipment requires access to parts which may cause electrostatic shock or other serious bodily injury if work is not performed properly.

- Do not install or service this equipment unless you are trained and qualified.
- Be sure your installation complies with National, State and Local codes for the installation of electrical apparatus in a Class I, Group D Hazardous Location.
- Check and follow all local safety and fire codes, NFPA 33, NEC 504 and 516, and OSHA standard 1910.107.

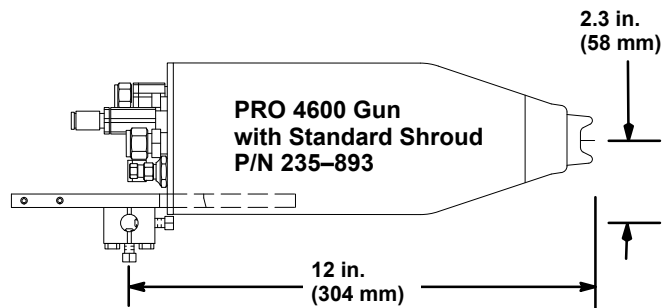


Fig 4 **BACK MOUNTING POSITION** 01876

Install the Gun and Manifold (See Fig 5)

1. Remove the air cap nut/air cap assembly and slide the shroud off the gun.
2. Connect the gun to the manifold by tightening the three socket head cap screws; use the ball end wrench (46), supplied. Make sure the o-ring is in place on the manifold.
3. Slide the gun and manifold along the dovetail until the button head screw bottoms against the mounting bracket.
4. Secure the gun to the mounting bracket with the button head screw, using the ball end wrench (46). Tighten the two mounting bracket setscrews.
5. Slide the shroud onto the gun and secure it by tightening the air cap nut onto the gun barrel. Tighten the nut just enough so that the air cap is snug but can still be turned.

Connect the Air, Fluid, and Optional Fiber Optic Lines (See Fig 6)

WARNING

To reduce the risk of electrostatic shock or other serious injury, the turbine air supply hose must be electrically connected to a true earth ground. **Use Only Graco Electrically Conductive Air Supply Hose** and connect the hose ground wire to a true earth ground.

See the **ACCESSORIES** section to order Graco Electrically Conductive Air Supply Hose. This hose and the gun have special left-hand threads to prevent connecting another type of air supply hose to the gun turbine air inlet.

Connect the air, fluid, and optional fiber optic lines to the gun manifold as shown in Fig 6 . Before connecting the fluid line, blow it out with air and flush it with solvent. Use solvent that is compatible with the fluid being sprayed.

Ventilate the Spray Booth

WARNING

To prevent hazardous concentrations of toxic and/or flammable vapors, spray only in a properly ventilated spray booth. Never operate the spray gun unless ventilation fans are operating.

Electrically interlock the gun air supply with the ventilators to prevent gun operation without ventilating fans operating. Check and follow all National, State, and Local codes regarding air exhaust velocity requirements.

High velocity air exhaust will decrease the operating efficiency of the electrostatic system. The minimum allowable air exhaust velocity is 60 feet/minute (19 linear meters/minute).

Install the Gun Mounting Bracket

Attach the mounting bracket to the robot or reciprocator. See the **ACCESSORIES** section for the mounting bracket and mount extension options and refer to Fig 3 and Fig 4 for mounting positions.

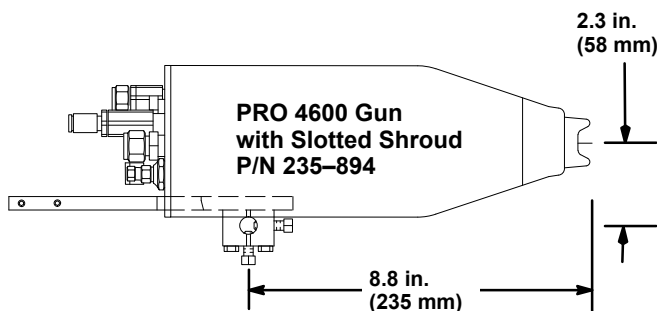


Fig 3 **FRONT MOUNTING POSITION** 01876

INSTALLATION

To ensure a dry, clean air supply to the gun, install an air line filter and an air and water separator on the air lines. Dirt and moisture can ruin the appearance of your fin-

ished workpiece and can cause the gun to malfunction. A combination air filter/moisture separator is shown in the **ACCESSORIES** section.

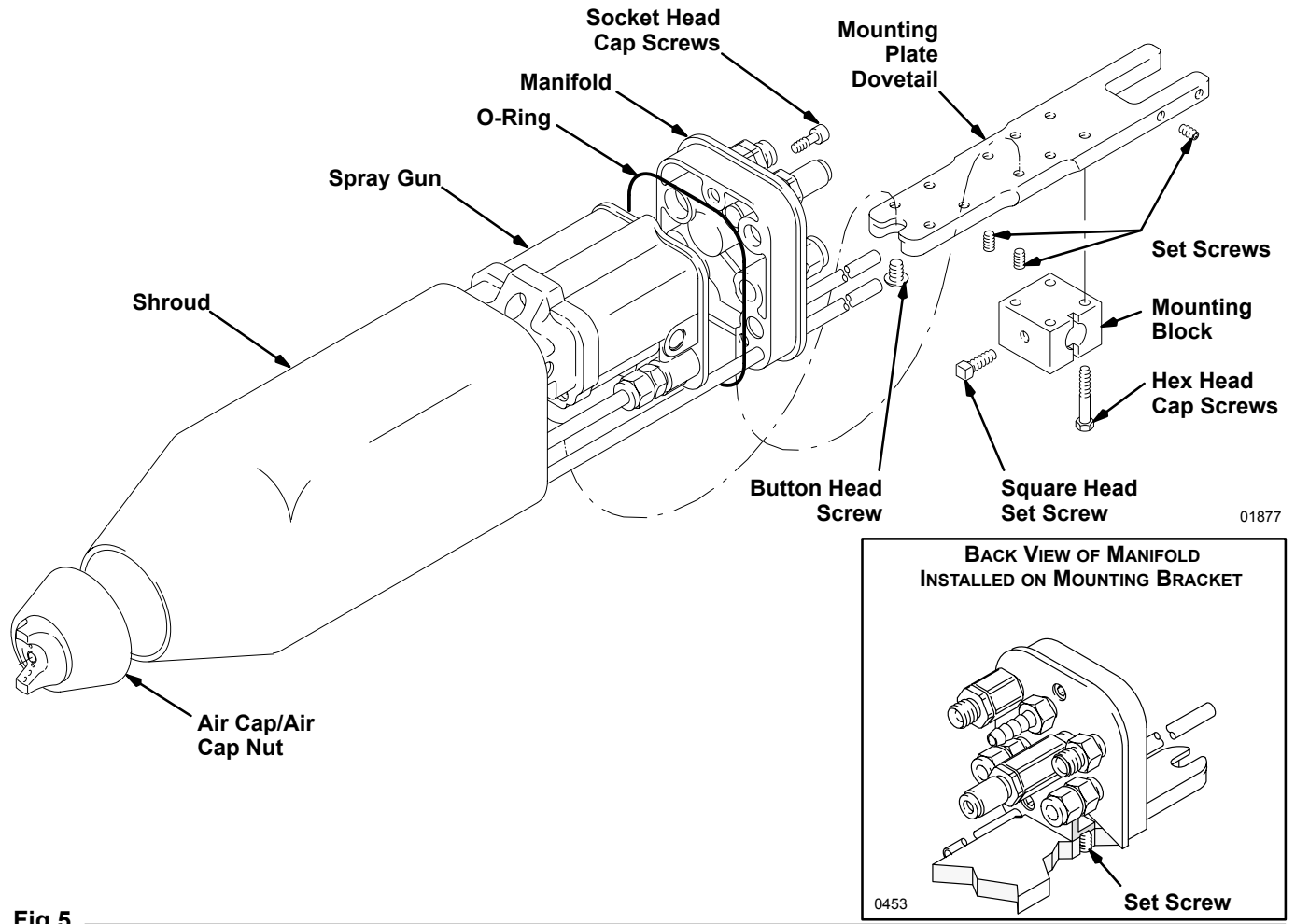


Fig 5

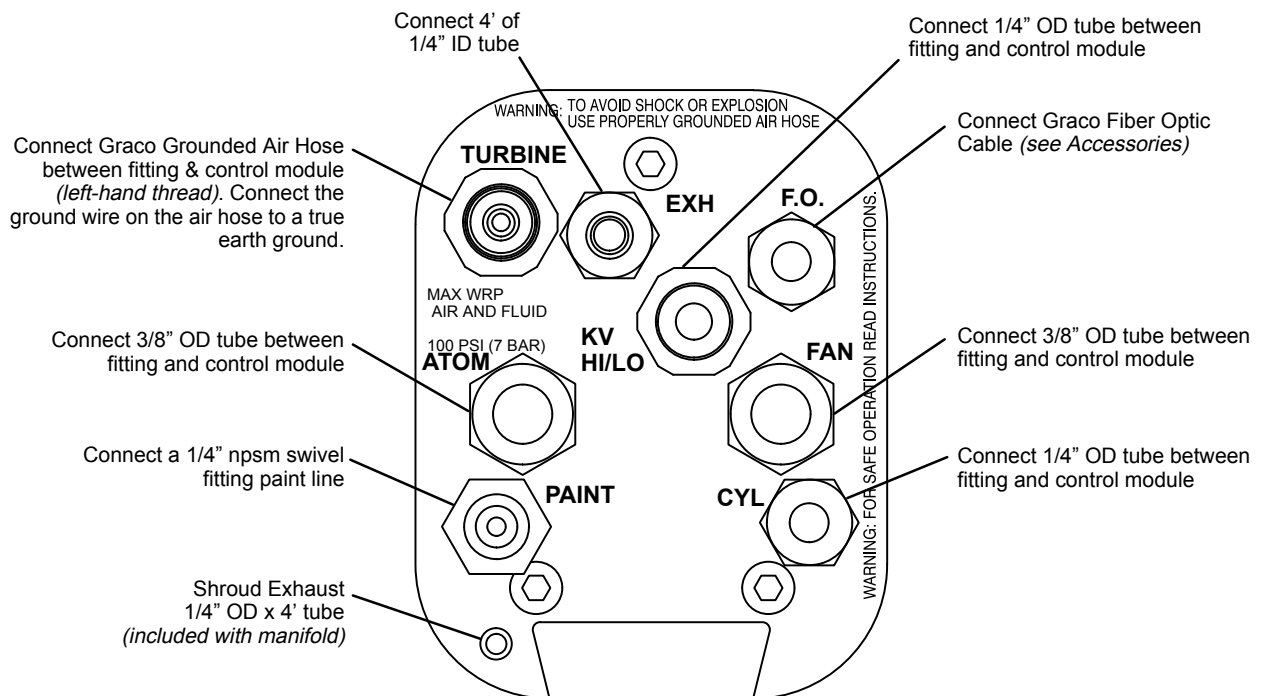


Fig 6

INSTALLATION

Check the Electrical Grounding (See Fig 7)

WARNING

Proper electrical grounding of every part of your system is essential. For your safety, read the warning section, **FIRE, EXPLOSION, OR ELECTROSTATIC SHOCK HAZARD**, on page 3. Ground the system as explained there. Then check your system as explained below.

1. Completely turn off the air and fluid supplies to the gun.
2. Have a qualified electrician check the electrical grounding continuity of the spray gun and air hose.
 - a. With the electrically conductive air hose connected and properly grounded, use a megohmmeter to measure the resistance between the gun manifold and a true earth ground. Use an applied voltage of 500 minimum to 1000 volts maximum.
 - b. If the resistance is greater than 2 megohms*, check the tightness of the ground connections, and be sure the air supply hose ground wire is connected to a true earth ground. If the resistance is still greater than 2 megohms*, replace the air supply hose.

* If you are using the red colored hose, resistance should not exceed 100 ohms.

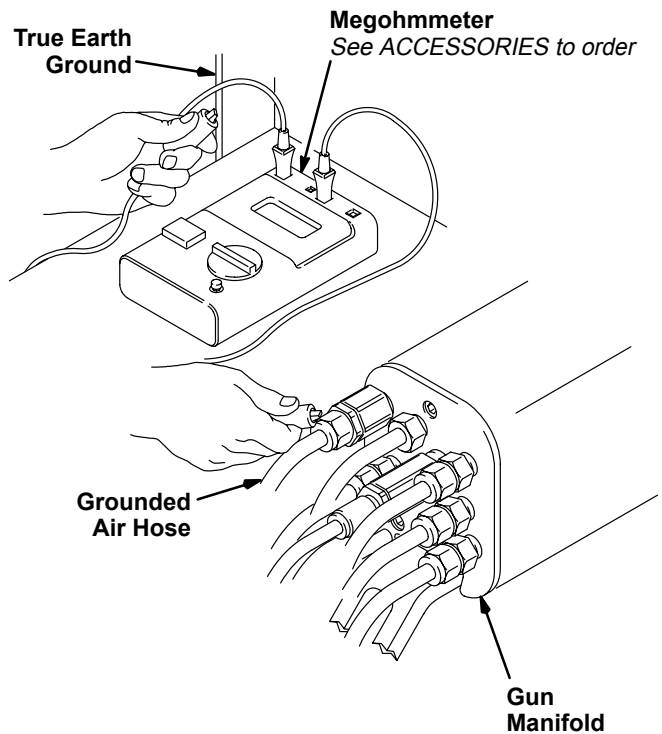


Fig 7

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Install the Fabric Cover (See Fig 8)

1. Install a fabric cover over the front of the gun and slide it back to cover the exposed tubing and hoses at the back of the manifold. See **ACCESSORIES** section.

2. Cut a small slit in the cover and route the two exhaust tubes outside the robot arm or reciprocator. This enables you to monitor the exhaust tubes for the presence of any paint or solvent. See **Check for Fluid Leakage** on page 12. Strap down the exhaust tubes to prevent them from moving around.

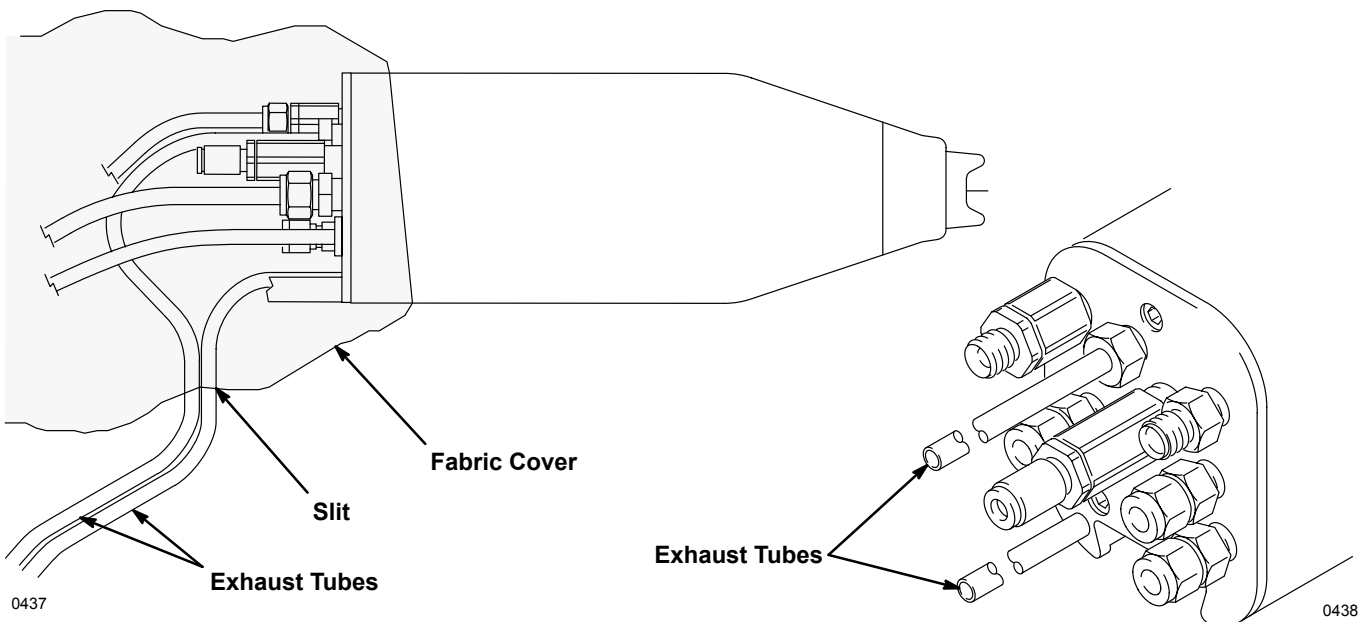


Fig 8

WARNING

Pressure Relief Procedure

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

1. Turn off the air to the control module, except for the manifold air. If the air pilot fluid regulator is used, air pressure is needed at the regulator air inlet to relieve pressure in the fluid line.
2. Turn off the fluid supply to the gun.
3. Trigger the gun into a grounded metal waste container to relieve fluid pressure.
4. Open the pump drain valve, having a waste container ready to catch the drainage.
5. Leave the pump drain valve open until you are ready to spray again.

WARNING

If any fluid leakage from the gun is detected, stop spraying IMMEDIATELY! Fluid leakage into the gun shroud could cause fire or explosion and result in serious bodily injury and property damage. See **Check for Fluid Leakage**, page 12.

Operating Checklist

Check the following list daily, before starting to operate the system, to help ensure you of safe, efficient operation.

- 1. Be sure all operators are properly trained to safely operate an automatic electrostatic air spray system.
- 2. Be sure all operators are trained how to properly and completely relieve system pressure.
- 3. Be sure the system is thoroughly grounded. See **FIRE, EXPLOSION OR ELECTROSTATIC SHOCK HAZARD** on page 3, and **Check the Electrical Grounding** on page 8.
- 4. Be sure the operator and all persons entering the spray area are properly grounded by wearing shoes with conductive soles or personal grounding straps.
- 5. Be sure ventilation fans are operating properly.
- 6. Be sure the workpiece hangers are clean and grounded. Contact points must be sharp points or knife edges.

- 7. Be sure all refuse is removed from the spray booth.
- 8. Be sure all flammable liquids in the spray booth are in approved, grounded containers.
- 9. Be sure all conductive objects in the spray area are electrically grounded and the floor of the spray area is electrically conductive and grounded.
- 10. Be sure to check the manifold exhaust tubes for the presence of any fluid as instructed in **Check for Fluid Leakage**, page 12.

Selecting a Fluid Nozzle and Air Cap

This gun is supplied with fluid nozzle 185–158 (1.5 mm) and air cap 177–033. If your application requires a different nozzle and air cap combination, use instruction manual 307–803 to select the appropriate fluid nozzle and air cap.

Gun Functions

The gun functions include the following:

- *Fluid Trigger* (only)
- *Spray* (properly timed on/off sequence of fan air, atom air, and paint)
- *Turbine Air*
- *Voltage Select*

Activating the Fluid Trigger Only

To activate the fluid trigger alone, first relieve the air pressure to the trigger module, then shut off the air supply to the ATOM and FAN air lines. Apply 50 psi (3.5 bar) minimum air pressure to the CYL air supply line to activate the gun's fluid trigger.

Adjusting the Spray Pattern

Follow the steps below to establish the correct fluid flow and air flow. **DO NOT** turn the turbine air (electrostatics) on yet.

1. Adjust the fluid flow with the fluid line's pressure regulator.
2. Rotate the air cap for the desired spray pattern.
3. Use an air pressure regulator to adjust the degree of atomization and pattern width. For the most efficiency, always use the lowest air pressure possible.

NOTE: See the **Spray Pattern Troubleshooting Chart** on page 13 to correct spray pattern problems.

OPERATION continued on next page

OPERATION

Adjusting the Turbine Air Pressure

WARNING

The fan and atomizing air **MUST** be on before turning on the turbine air. Actuating the turbine air without fan and atomizing air flow could damage the gun and may create hazardous operating conditions and result in serious injury and property damage.

1. Complete all the checks under the **Operating Checklist** on page 9.
2. Make sure the fan and atomizing air are on, then turn the turbine air (electrostatics) on.
3. The turbine air pressure should be adjusted to 40 psi (2.8 bar) at the gun manifold inlet when air is flowing. The gun may be operated at a lower air pressure, but some voltage loss could occur. Do not exceed 50 psi (3.5 bar) air pressure as there is no added benefit and turbine life could be reduced.

4. Check the gun electrostatics display module, if used, to see the voltage and current output levels.

NOTE: The gun's normal high voltage output is 60 to 70 kV. If a ball end high voltage measurement probe is used, the gun voltage will rise to about 85 kV. This will happen with all resistive electrostatic guns.

See the **Electrical Troubleshooting Chart** on page 15 to correct voltage problems.

Activating the Voltage Select (KV HI/LO)

To change the voltage to the lower setting, activate the voltage select function (KV HI/LO). The lower voltage setting is factory set to 60 kilovolts at zero microamperes. To change this setting, see page 25.

The valve used to activate the KV HI/LO switch must bleed the air out of the line for the switch to draw back to the high setting.

MAINTENANCE

WARNING

To reduce the risk of serious bodily injury, including splashing in the eyes or on the skin or electrostatic shock, always follow the **Pressure Relief Procedure Warning** on page 9 when shutting off the system, when you stop spraying and before checking, servicing, installing, cleaning or changing any part in the system.

CAUTION

Clean all parts with a non-conductive solvent, compatible with the fluid being sprayed. Conductive solvents can cause the gun to malfunction.

Methylene chloride is not recommended as a flushing or cleaning solvent with this gun as it will damage nylon components.

Immersing the gun in solvent is not recommended as a cleaning method. Solvent left in gun passages could result in a poor quality paint finish and may draw current and reduce the electrostatic effect. Solvent in the power supply cavity can reduce the alternator life.

Daily Care and Cleaning

1. Clean the fluid and air line filters daily.
2. Clean the outside of the gun daily with a soft cloth dampened in a compatible solvent.
3. Clean the air cap and fluid nozzle daily, minimum. Some applications require more frequent cleaning. Replace the fluid nozzle and air cap if they are damaged. See **Clean the Air Cap and Fluid Nozzle**.
4. Check the electrode wire. Straighten if bent, and replace if broken or damaged. See **Replacing the Electrode Needle**.
5. Check for any fluid leakage from the gun and fluid hoses. See **Check for Fluid Leaks**.
6. Check all of the work hangers for material build-up; clean them if necessary.

WARNING

To reduce the risk of fire, explosion, or electrostatic shock, **BE SURE** the turbine air (electrostatics) is off before flushing the gun or any part of the system.

7. Flush the fluid passages by alternating solvent and air. Flush before changing colors and whenever you are done operating the gun.

Clean the Air Cap and Fluid Nozzle

Equipment needed:

- Soft bristle brush (supplied)
- Solvent compatible with fluid being sprayed

Procedure:

1. Follow the **Pressure Relief Procedure Warning** on page 9.
2. Remove the air cap assembly and gun shroud.
3. Clean the air cap, fluid nozzle, and front of the gun, using the soft bristle brush and solvent. Point the gun down while cleaning to prevent dirty solvent from running back into the air passages. See Fig 9 .

Do not use metal tools to clean the air cap holes as this may scratch them, and make sure the electrode wire is not damaged. Scratches in the air cap holes or a damaged electrode wire can distort the spray pattern.

4. Carefully reinstall the air cap assembly. Avoid bending the electrode. Tighten the retaining nut until it is snug, allowing the air cap to turn with resistance.

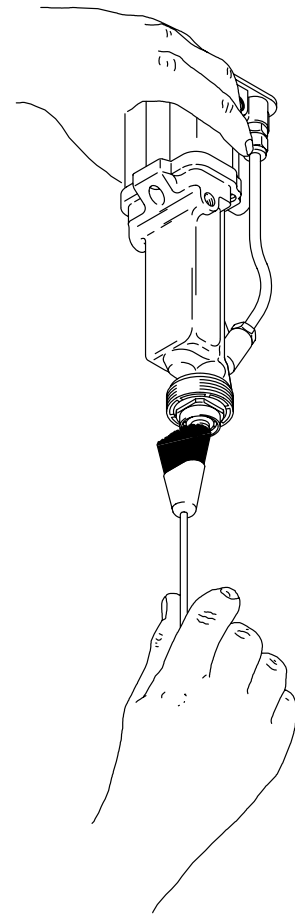


Fig 9

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MAINTENANCE continued on next page

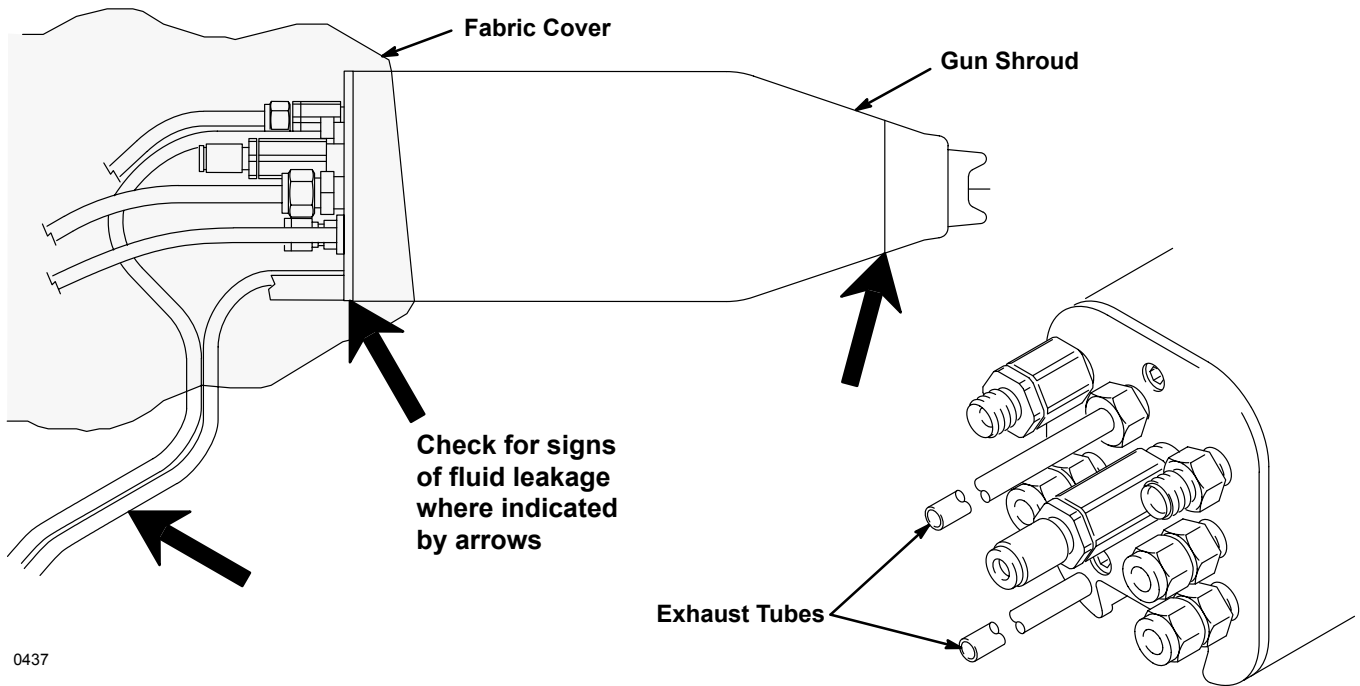
Check for Fluid Leakage (See Fig 10)

WARNING

If any fluid leakage from the gun is detected, stop spraying *IMMEDIATELY!* Fluid leakage into the gun shroud could cause fire or explosion and result in serious bodily injury and property damage.

During operation, periodically check the two manifold exhaust tubes and both ends of the gun shroud for the presence of fluid. Fluid in these areas would indicate fluid leakage into the shroud.

If fluid is seen in any of these areas, stop spraying immediately! Follow the **Pressure Relief Procedure** on page 9, then remove the gun for repair.



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Fig 10

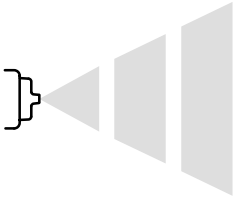



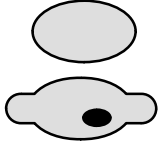

SPRAY PATTERN TROUBLESHOOTING CHART

WARNING

Installing and servicing this equipment requires access to parts which may cause electrostatic shock or other serious bodily injury if the work is not performed properly. Do not install or service this equipment unless you are trained and qualified.

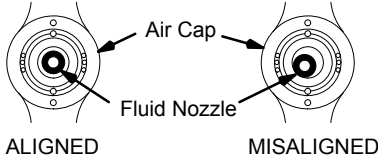
To reduce the risk of serious bodily injury, including splashing fluid or solvent in the eyes or on the skin, always follow the **Pressure Relief Procedure** on page 9 before checking, adjusting, cleaning or repairing the gun or any part of the system.

NOTE: Check all possible remedies in the Troubleshooting Charts before disassembling the gun.

PROBLEM: IMPROPER SPRAY PATTERN	CAUSE	SOLUTION
<p>Fluttering or spitting spray</p> 	<p>Insufficient fluid supply.</p> <p>Loose fluid nozzle or damaged fluid nozzle taper seat.</p> <p>Dirt between fluid nozzle, taper seat and body.</p> <p>Loose or cracked coupler at fluid inlet.</p> <p>Loose fluid tube in tank.</p>	<p>Adjust fluid regulator or fill fluid tank.</p> <p>Tighten or replace fluid nozzle. See page 19.</p> <p>Clean. See page 11.</p> <p>Tighten or repair.</p> <p>Tighten.</p>
	<p>Fluid build-up on air cap; partially clogged horn holes. Full air pressure from clean horn hole forces fan pattern toward clogged end.</p> <p>Bent electrode.</p> <p>Damaged fluid nozzle or air cap holes.</p>	<p>Clean with soft implement or submerge in suitable solvent and wipe clean. See page 11.</p> <p>Straighten electrode</p> <p>Replace damaged part. See page 19.</p>
	<p>Fluid build-up on the perimeter of fluid nozzle orifice, or partially clogged fluid nozzle orifice</p> <p>Bent electrode.</p>	<p>Remove obstruction. Never use wire or hard instruments. See page 11.</p> <p>Straighten electrode</p>
	<p>Too high fan air pressure.</p> <p>Fluid too thin.</p> <p>Not enough fluid pressure</p>	<p>Reduce air pressure or adjust fan air adjusting valve.</p> <p>Regulate fluid viscosity.</p> <p>Increase fluid pressure.</p>
	<p>Low fan air pressure</p> <p>Fluid too thick</p> <p>Too much fluid.</p>	<p>Increase air pressure.</p> <p>Regulate fluid viscosity.</p> <p>Reduce fluid flow.</p>
<p>Streaks</p> 	<p>Last coat of fluid applied too wet.</p> <p>Too much air pressure.</p> <p>Insufficient air pressure.</p> <p>Non-uniform spray pattern.</p>	<p>Apply drier finish with multiple strokes.</p> <p>Use least air pressure necessary.</p> <p>Increase air pressure.</p> <p>Clean or replace air cap. See page 11.</p>

NOTE: Some improper patterns are caused by the improper balance between air and fluid.

GUN OPERATION TROUBLESHOOTING CHART

PROBLEM	CAUSE	SOLUTION
Leakage from fluid packing area	Worn fluid rod packings or fluid rod	Replace fluid rod packings or rod. See page 23.
Fluid leakage from front of gun	Fluid rod worn or damaged Worn fluid seat Piston seal or o-ring damaged Loose resistor stud Loose fluid nozzle Damaged resistor stud o-ring	Replace fluid rod. See page 23. Replace fluid nozzle and/or electrode. See page 19 and 20. Replace seal and/or o-ring and lubricate. Tighten resistor stud. See page 19. Tighten fluid nozzle. See page 19. Replace o-ring. See page 19.
"Orange Peel" finish	Insufficient air pressure Fluid poorly mixed or filtered Improper thinner being used	Increase air pressure, use least air pressure needed for good results. Remix or refilter fluid. Use proper thinner.
Excessive spray fog	Too much air pressure Fluid thinned too much	Reduce air pressure, use least air pressure needed for good results. Properly thin fluid.
No fluid sprays from gun	Fluid low Damaged air cap Dirty or clogged fluid nozzle Damaged fluid nozzle Piston not actuating Actuator arm out of position	Check, add fluid if necessary. Replace air cap. Clean fluid nozzle. See page 11. Replace fluid nozzle. See page 19. Check cylinder (CYL) air. Check actuator arm (29) and nuts (25, 7). See page 21.
Equipment covered with fluid	Exhaust air flow insufficient or not directed properly Improper distance between gun and workpiece	Check for proper CFM; check baffles and direction of air flow. Adjust spraying distance to 8 to 12 inches (203 to 305 mm).
Dirty air cap	Misalignment between air cap and fluid nozzle 	Remove and clean air cap and fluid nozzle. See page 11. Then reinstall them. Or replace fluid nozzle and air cap. See page 19.

ELECTRICAL TROUBLESHOOTING CHART

PROBLEM	CAUSE	SOLUTION
Poor wrap-around	<p>Improper distance between gun and workpiece</p> <p>Parts poorly grounded</p> <p>High booth exhaust velocity</p> <p>Atomizing air pressure too high</p> <p>Fluid pressure too high</p> <p>Improper fluid viscosity</p> <p>Fluid resistivity too low</p> <p>No or low voltage output</p> <p>Turbine alternator not operating</p> <p>Faulty gun resistance</p> <p>Fluid leaks from fluid rod packing and causes short</p> <p>Faulty turbine alternator</p> <p>KV HI-LO switch stuck on low</p>	<p>Adjust spraying distance to 8 to 12 inches (203 to 305 mm).</p> <p>Clean hangers, check for proper ground on conveyer or track.</p> <p>Reduce exhaust velocity within code limits.</p> <p>Reduce atomizing air pressure.</p> <p>Reduce fluid pressure.</p> <p>Check supplier for proper fluid for electrostatic spray.</p> <p>Check fluid resistivity with paint meter and probe.</p> <p>Check possible causes listed below.</p> <p>Check air supply to gun.</p> <p>Check gun resistance. See page 16.</p> <p>Clean fluid rod cavity, replace packing. See page 23.</p> <p>Be sure plug is in place on back of turbine alternator housing. Remove and test turbine alternator. See page 25.</p> <p>Check switch actuation; replace if needed.</p>
Operator gets shock	<p>Operator not properly grounded or is near an ungrounded object</p> <p>Gun not properly grounded</p>	<p>Be sure floor is properly grounded. Wear shoes with conductive soles or wear personal grounding straps. Be sure operator is not in contact with or carrying any metallic items which could build up electrical charge.</p> <p>See Check the Electrical Grounding.</p>
Operator gets shock when touching workpiece	Workpiece not properly grounded	Clean workpiece hangers. Check for proper ground on conveyer or track.
No or low voltage output reading on gun display module	Damaged fiber optic cable or connection	<p>Check cables and connections. Replace if damaged.</p> <p>See other causes under Problem – “Poor wrap-around”, above.</p>

ELECTRICAL TESTS

The performance of the spray gun is directly affected by the condition of the electrical components contained inside the gun. The electrical tests below can be used to determine the condition of the power supply (40) and the resistor stud (2) as well as the continuity of the electrical path between the components.

Use megohmmeter 218–979 (see **ACCESSORIES**) and an applied voltage of 500 volts to complete these electrical tests. Connect the leads as shown.

Remove the gun from the manifold and bracket, as instructed on page 18, before performing the electrical tests.

WARNING

To reduce the risk of sparking, which could cause fire, explosion, or electrostatic shock and result in serious bodily injury, do not use the megohmmeter in the hazardous area. Remove the gun from the hazardous area before testing it.

Test Gun Resistance (See Fig 11)

Measure the resistance between the end of the electrode (28) and the gun body (39). The resistance should be between 329 to 401 megohms. If the resistance is outside the specified range, go to the next test. If the resistance is correct, refer to the **Electrical Troubleshooting Chart** on page 15 for other possible causes of poor performance.

Test Power Supply Resistance (See Fig 12)

Remove the power supply (40) from the gun body (39). See page 25.

Measure the resistance from the power supply's ground contact point (EE) to the contact inside of the power supply seal (40d) [the conductive rubber contact may be slightly recessed into the seal]. See Fig 12 .

The resistance should be 297 to 363 megohms. If the resistance is outside the specified range, the power supply is defective and must be replaced. If the resistance of the power supply is correct, proceed to the next test.

If you still have problems, refer to the **Electrical Troubleshooting Chart** for other possible causes of poor performance, or contact the nearest authorized service agency.

KEY

- A Megohmmeter
- 28 Electrode
- 39 Gun Body

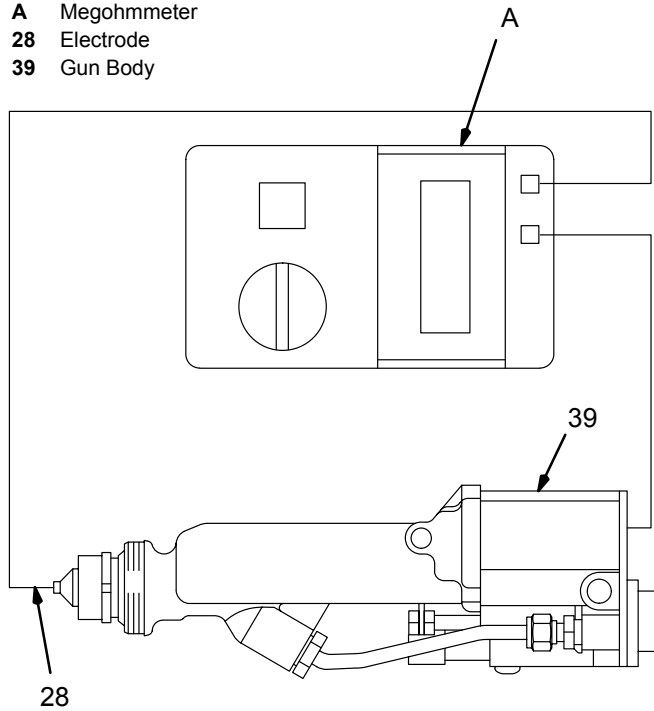


Fig 11

0440

KEY

- A Megohmmeter
- EE Ground Contact Point
- 40 Power Supply
- 40d Seal

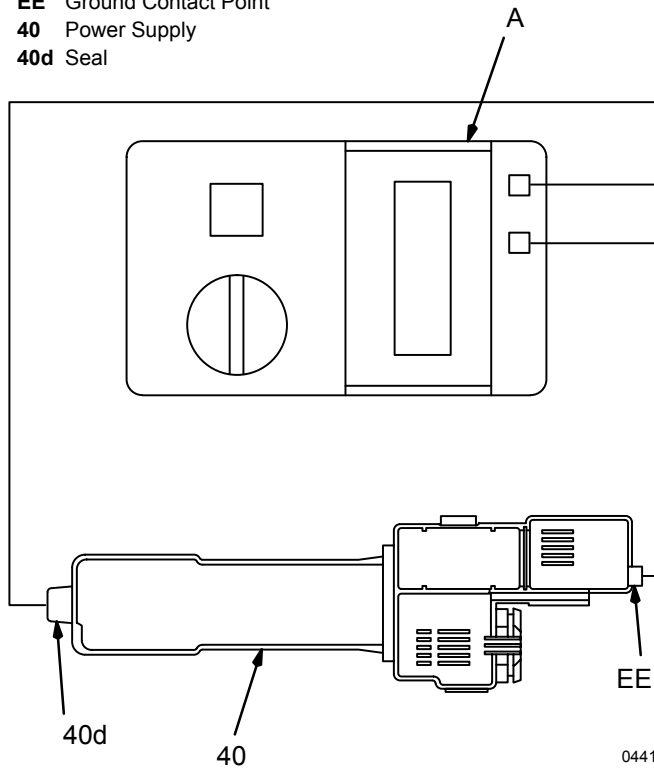


Fig 12

0441

Test Resistor Stud Resistance

(See Fig 13)

Remove the resistor stud. See **Air Cap/Nozzle/Resistor Stud Replacement**. Check the resistance between the black resistor stud ring contact (D) and the needle contact ring (E). You may have to press down on the contact ring (D) in several places to get a good reading.

The resistance should be 21 to 29 megohms. If the resistance is correct, make sure the metal contact in the gun barrel and the needle contact ring (E) are clean. If the resistance is outside the specified range, the resistor is defective and the resistor stud (2) must be replaced. See **Air Cap/Nozzle/Resistor Stud Replacement**.

WARNING

The resistor stud contact ring (D) is a conductive contact ring, NOT a sealing o-ring. To reduce the risk of sparking, which could cause fire, explosion, or electrostatic shock and result in serious injury , **DO NOT** remove the resistor stud contact ring (D) from the resistor stud or operate the gun without the contact ring in place. **DO NOT** replace the resistor stud with anything but a genuine Graco part.

KEY

- D Resistor Stud Contact Ring
- E Needle Contact Ring

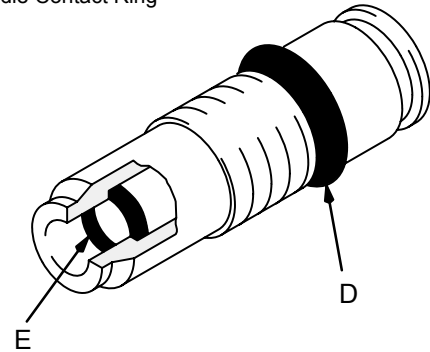


Fig 13

0442

SERVICE

WARNING

Installing and servicing this equipment requires access to parts which may cause electrostatic shock or other serious bodily injury if the work is not performed properly. Do not install or service this equipment unless you are trained and qualified.

NOTE: Check all possible remedies in the **Troubleshooting Charts** before disassembling the gun.

Flush the Gun and Relieve Pressure

WARNING

To reduce the risk of fire, explosion, or electrostatic shock, **BE SURE** the turbine air (electrostatics) is off before flushing the gun.

CAUTION

Methylene chloride is not recommended as a flushing or cleaning solvent with this gun as it will damage nylon components.

Before removing the gun for service, flush it by alternating solvent and air. Then follow the **Pressure Relief Procedure**, at right.

Service Notes:

- If the plastic parts of the gun must be held in a vise, **ONLY** use padded vise jaws to avoid damaging parts.
- **ALWAYS** remove the gun from the worksite for service or repair. The service or repair area must be clean.

WARNING

Pressure Relief Procedure

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

1. Turn off the air to the control module, except for the manifold air. If the air pilot fluid regulator is used, air pressure is needed at the regulator air inlet to relieve pressure in the fluid line.
2. Turn off the fluid supply to the gun.
3. Trigger the gun into a grounded metal waste container to relieve fluid pressure.
4. Open the pump drain valve, having a waste container ready to catch the drainage.
5. Leave the pump drain valve open until you are ready to spray again.

Remove the Gun from the Manifold and the Mounting Bracket (See Fig 14)

1. Remove the air cap/air cap nut assembly and the gun shroud.
2. Loosen the three socket head cap screws and the button head screw, using the ball end wrench (46) supplied.
3. Remove the gun from the manifold.

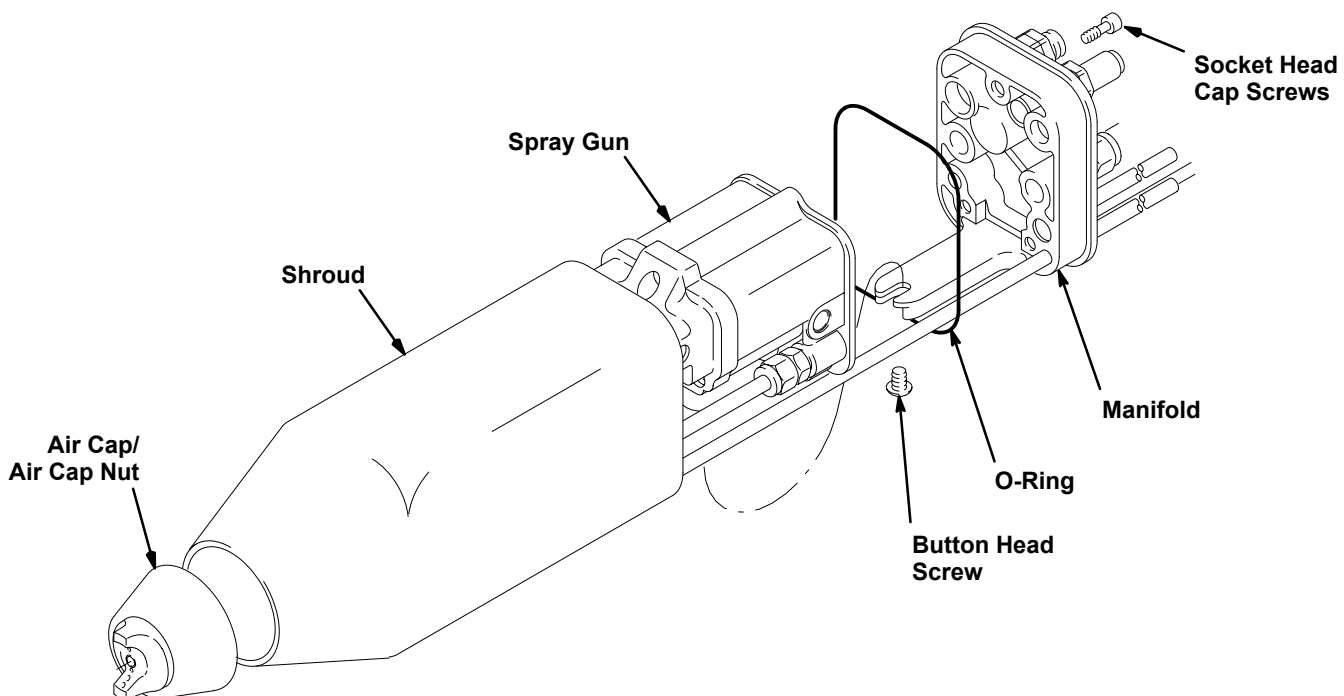


Fig 14

01179

Air Cap/Nozzle/Resistor Stud Replacement

CAUTION

BE SURE to hold the front end of the gun up while removing the nozzle and resistor stud. This helps drain the gun and prevent any paint or solvent left in the gun from entering the air passages.

1. Point the front end of the gun up while removing the fluid nozzle (14) and resistor stud (2) assembly with the nozzle wrench (48). This helps drain the gun and prevent any paint or solvent left in the gun from entering the air passages. See Fig 15 .

If the resistor stud remains in the gun when the fluid nozzle is removed, start the nozzle thread onto the stud and pull the stud out.

2. Using an 8 mm hex key (A), unscrew and remove the resistor stud (2). See Fig 16 .

WARNING

The resistor stud contact ring (D) is a conductive contact ring, NOT a sealing o-ring. To reduce the risk of sparking, which could cause fire, explosion, or electrostatic shock and result in serious injury, **DO NOT** remove the contact ring from the resistor stud or operate the gun without the contact ring in place. **DO NOT** replace the resistor stud with anything but a genuine Graco part.

To install the resistor stud:

3. Lightly lubricate the o-ring (31) with petroleum jelly and install it on the resistor stud (2).
4. Using an 8 mm hex key (A), install the resistor stud (2) in the fluid nozzle (14). Tighten to 10 in-lb (1.12 N•m).

Make sure the electrode (28) is tightened properly , as shown in Fig 17 , page 20.

5. Install the fluid nozzle (14) and resistor stud (2) assembly with the nozzle wrench (48). Tighten until the fluid nozzle seats in the gun barrel (1/8 to 1/4 turn past hand-tight).
6. Install the air cap assembly (6, 16, 43), o-ring (12), and retaining ring (9). Test gun resistance as instructed on page 16.

KEY

D Contact Ring
2 Resistor Stud

6, 16,

43 Air Cap Assembly

9 Retaining Ring

12 O-Ring

14 Fluid Nozzle

28 Electrode

31 O-Ring

48 Nozzle Wrench

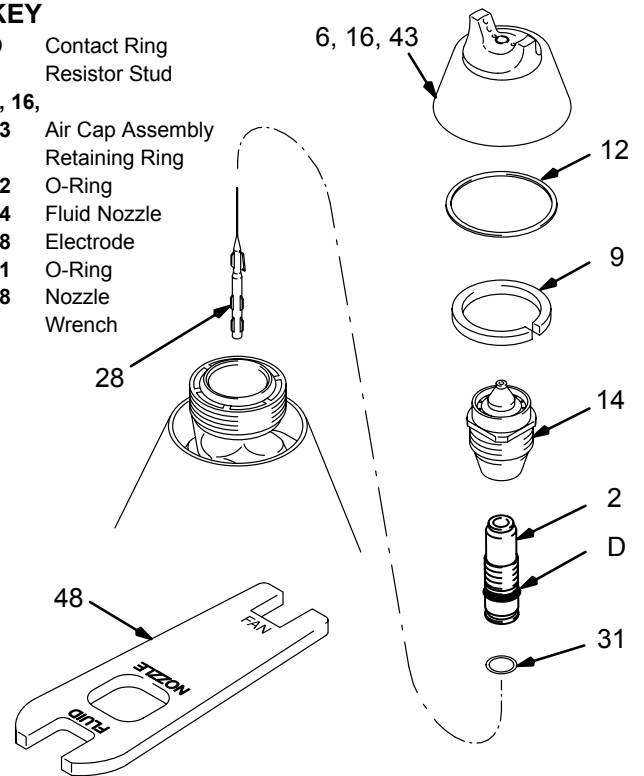


Fig 15

0443

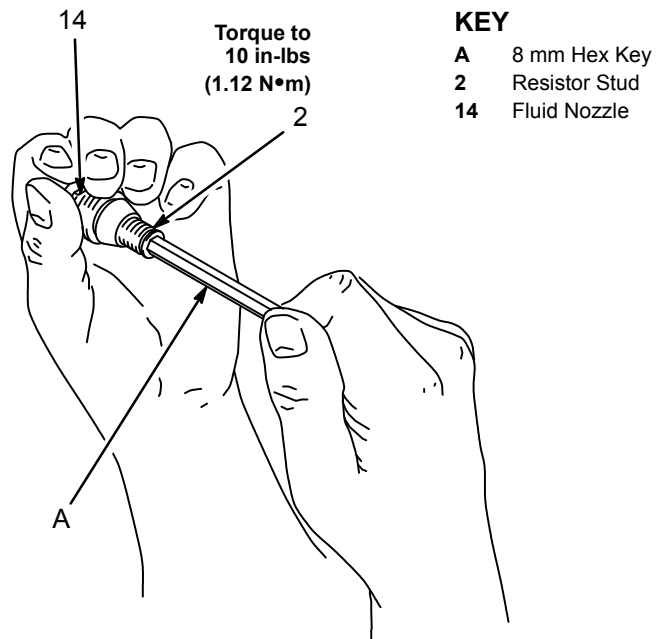


Fig 16

0444

Torque to
10 in-lbs
(1.12 N•m)

KEY

A 8 mm Hex Key

2 Resistor Stud

14 Fluid Nozzle

Electrode Replacement

1. Remove the air cap, nozzle and resistor stud as described in **Air Cap/Nozzle/Resistor Stud Replacement**.
2. Unscrew and remove the fluid needle/electrode (28) with the electrode tool (47) provided. Be careful not to damage the contact wire. See Fig 17 .

If the fluid rod turns, hold the back end of the fluid rod.

3. Apply low-strength (*purple*) Loctite[®] or equivalent thread sealant to the electrode and fluid rod threads. Refer to **SERVICE NOTES**, page 25.

Hold the back end of the fluid rod to prevent it from turning while installing the new electrode finger tight. **DO NOT** over tighten the electrode.

CAUTION

To avoid damaging the plastic threads or contact wire, be very careful when installing the electrode.

4. Install the fluid nozzle and resistor stud assembly . Install the air cap assembly. Test the gun resistance as instructed on page 16.

KEY

- 28 Electrode
- 47 Electrode Tool

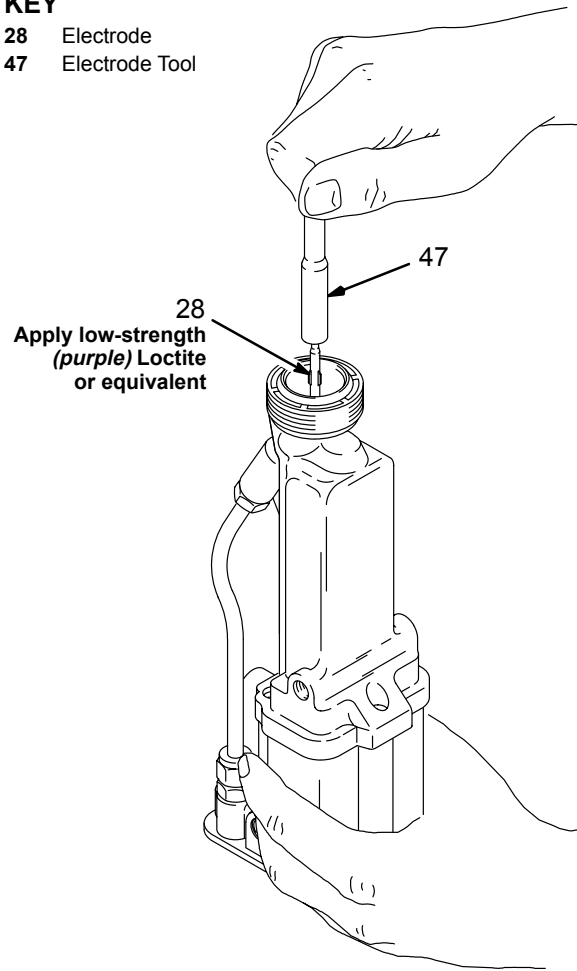


Fig 17

0445

Barrel Removal

1. Carefully loosen the fluid fitting nut (21). Pull the tube (19) out of the fitting. Make sure both ferrules and the nut stay with the tube. See Fig 19 .
2. Remove the jam nut (25) and actuator arm (29).

NOTE: The fluid nozzle must be in place when removing or installing the jam nut and actuator arm.

3. Using the ball end wrench (46), supplied, loosen the three socket head cap screws (15). See Fig 20 .
4. Hold the gun body (39) with one hand and pull the barrel (10) straight away from the body to remove it. See Fig 18 .

CAUTION

To avoid damaging the power supply, always pull the gun barrel straight away from the gun body. If necessary, gently move the barrel from side to side to free the power supply from the gun body.

KEY

- | | |
|-----------|--------------|
| 10 | Gun Barrel |
| 39 | Gun Body |
| 40 | Power Supply |

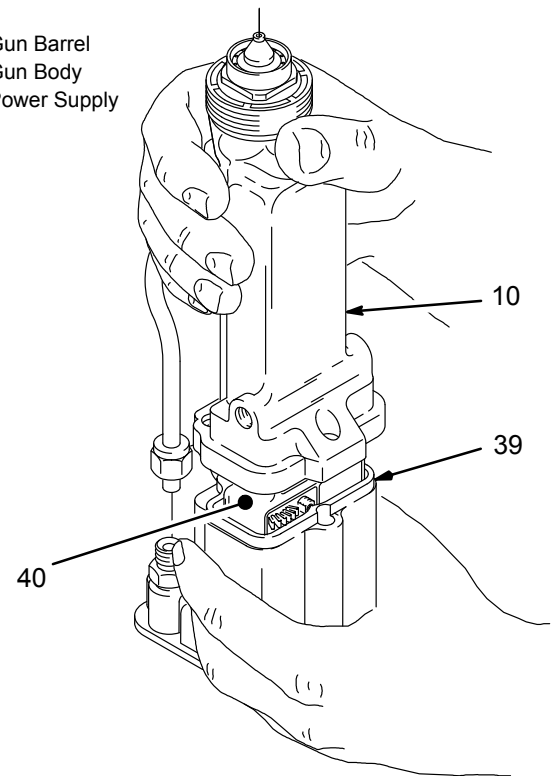


Fig 18

0447

KEY

- | | | | |
|-----------|-------------------|-----------|--------------|
| 7 | Jam Nut | 25 | Jam Nut |
| 10 | Gun Barrel | 29 | Actuator Arm |
| 19 | Fluid Tube | 39 | Gun Body |
| 21 | Fluid Fitting Nut | | |

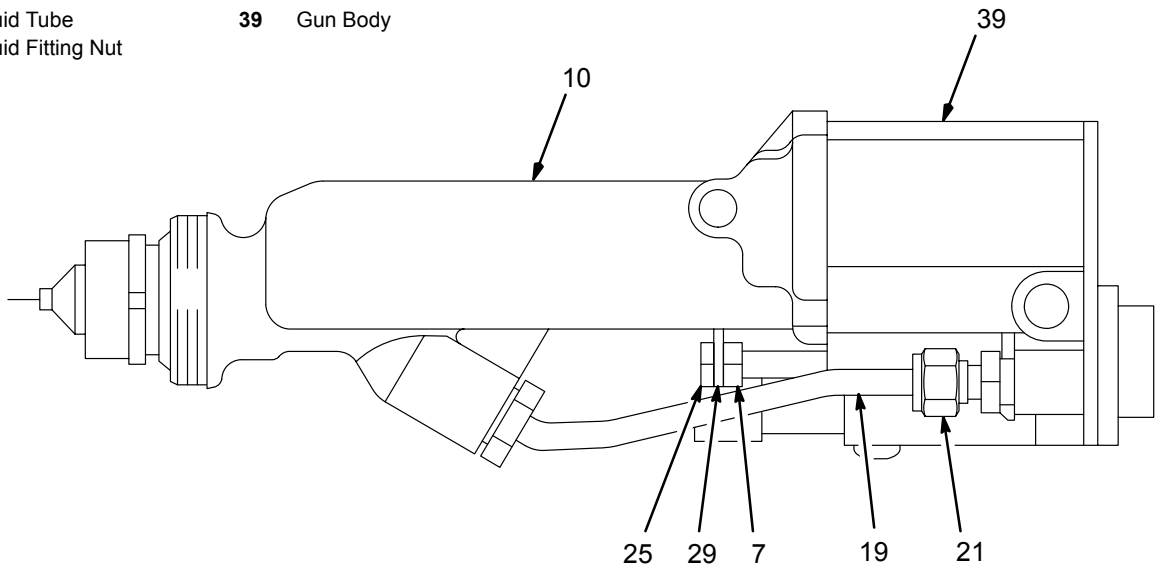


Fig 19

0446

Barrel Installation

1. Be sure the gaskets (23 & 40a) and spring (11) are in place. See Fig 20 . Replace if damaged.
2. Place the barrel (10) over the power supply (40) and onto the gun body (39). Make sure the fluid rod spring (11) is seated properly.
3. Tighten the three socket head cap screws (15) oppositely and evenly with the ball end wrench (46). Tighten the cap screws to 18 in-lbs (2 N •m) *MAXIMUM* (about a half turn past snug). *DO NOT* over tighten.

CAUTION

To avoid damaging the gun, *DO NOT* over tighten the cap screws (15). Tighten the screws to 18 in-lbs (2 N •m) *MAXIMUM* (about a half turn past snug), using the wrench (46) supplied only.

4. Install the fluid tube back into the fluid fitting (21).
5. Install the actuator arm (29) and jam nut (25), with the jam nut assembled flush to the end of the rod.

There should be about a 1/16 in. gap between the actuator arm (29) and the nut on the fluid shaft. When the gun is triggered, the electrode needle should draw back 3 to 4 mm. If necessary , adjust the jam nuts to obtain these dimensions.

The jam nut must be tightened securely to prevent it from loosening during operation.

6. Test the gun resistance as instructed on page 16.

KEY

- 10 Gun Barrel
- 11 Spring
- 15 Cap Screws
- 21 Fluid Tube Fitting
- 23 Gasket
- 25 Jam Nut
- 29 Actuator Arm
- 39 Gun body
- 40 Power Supply
- 40a Gasket

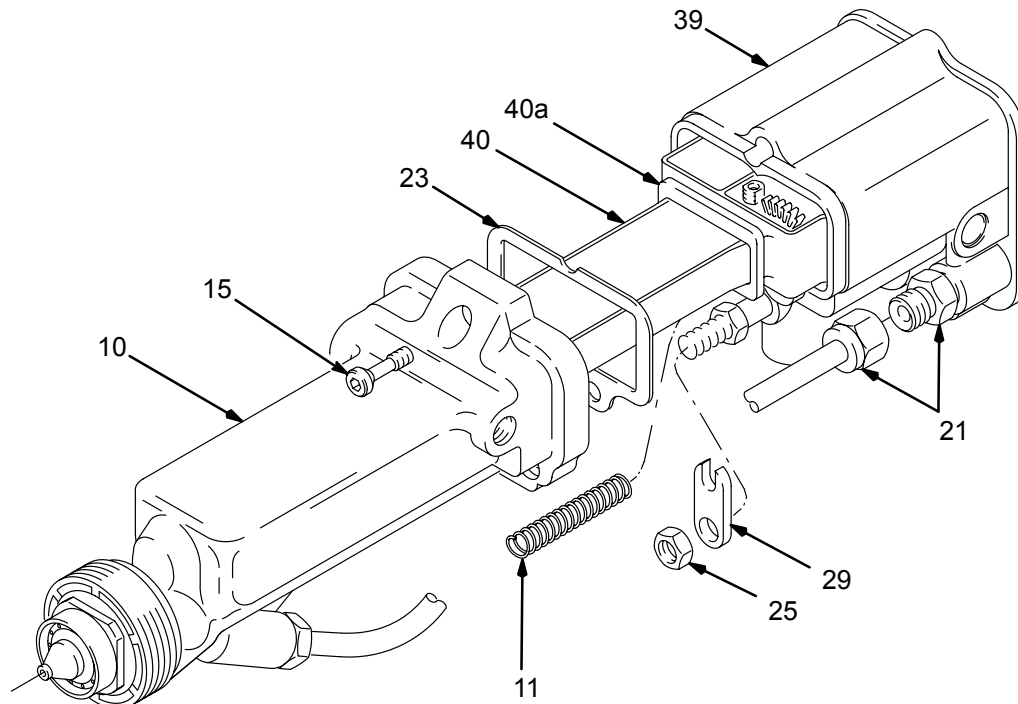


Fig 20

0457

Fluid Packing Rod Removal and Repair

NOTE: The fluid packing rod can be replaced as individual parts or as an assembly. If the assembly is purchased, it is pre-adjusted at the factory.

1. Remove the jam nut (25) and arm (29). See Fig 20.
2. Remove the air cap assembly, fluid nozzle and resistor stud and electrode as described in **Electrode Replacement**.
3. Remove the fluid packing rod assembly (3), using the 9 mm hex nut driver (45). See Fig 21.

CAUTION

Clean all parts in non-conductive solvent compatible with the fluid being used, such as xylol or mineral spirits. Use of conductive solvents can cause the gun to malfunction.

4. Check all the parts for wear or damage and replace if necessary.

Before installing the fluid packing rod assembly (3), clean the internal surfaces of the barrel with a soft brush or cloth. Check the inside of the barrel for marks from high voltage arcing. If the marks are present, replace the barrel.

5. *If the parts are purchased separately*, assemble them as instructed in steps 6 to 9 and as shown in Fig 22.

If installing the complete fluid rod assembly, go to step 10, on page 24.

KEY

- 3 Fluid Packing Rod Assembly
- 45 Hex Nut Driver

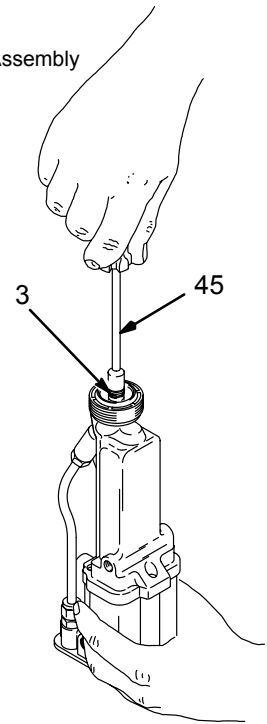


Fig 21

0448

6. Place the packing nut (3c) and o-ring (3g) on the fluid rod (3b). The flats on the packing nut must be facing toward the back of the fluid rod.
7. Fill the entire inner cavity of the spacer (3d) with the dielectric grease included with the gun. Place the spacer on the fluid rod (3b), in the direction shown in Fig 22. Generously apply the grease to the outside of the spacer.

KEY

- E Nut
- 3 Fluid Packing Rod Assembly
- 3a Packing Housing
- 3b Fluid Rod
- 3c Packing Nut
- 3d Spacer
- 3e Rod Packing
- 3f Fluid Packing
- 3g O-Ring
- 11 Spring

(Item 11 not included with Fluid Packing Rod Assembly)

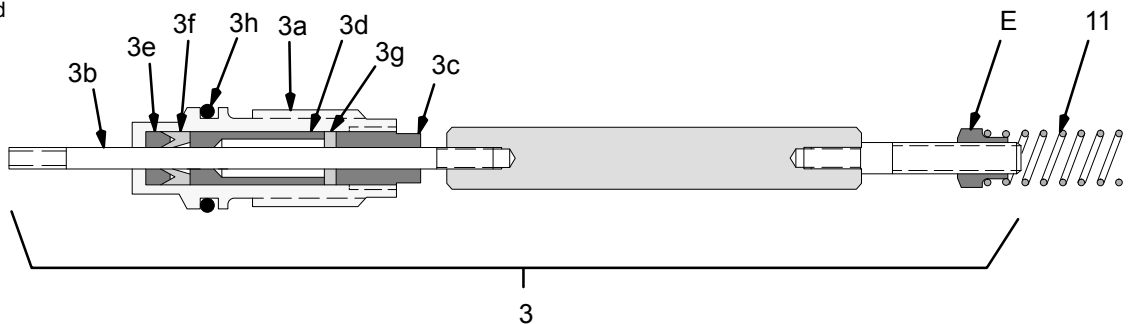


Fig 22

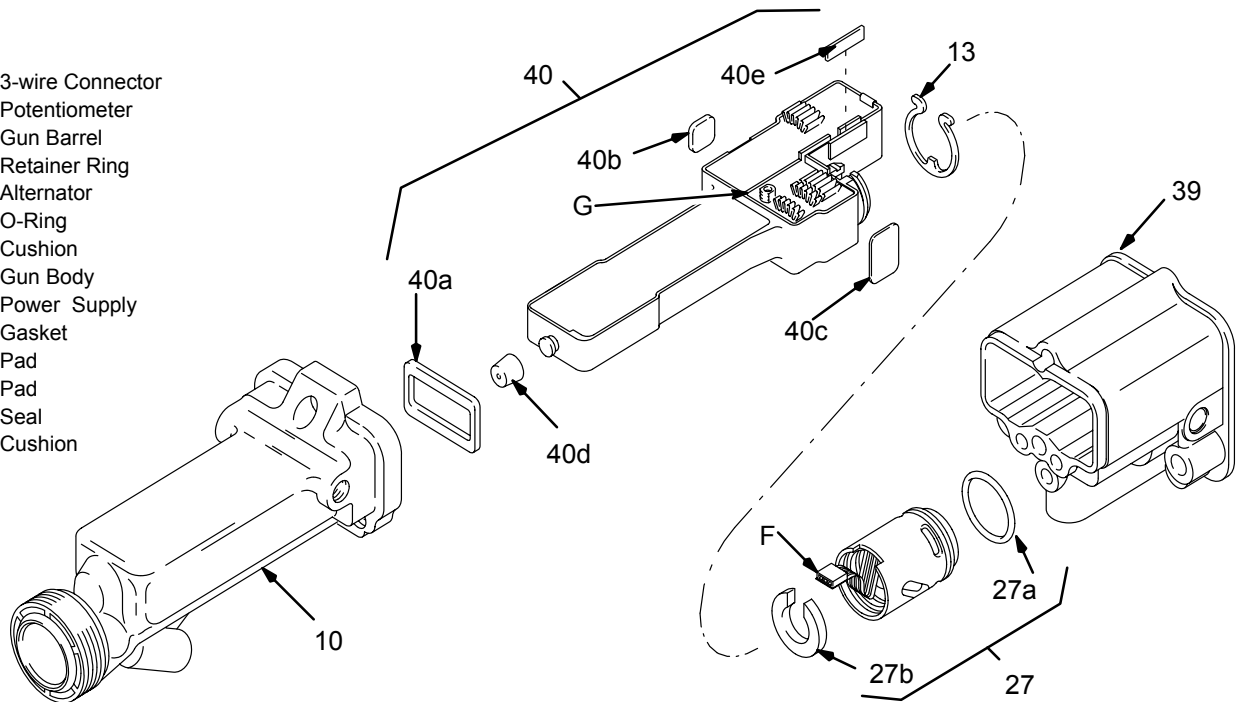
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Fluid Packing Rod Removal and Repair (continued)

8. Place the fluid packing (3f), rod packing (3e), and housing (3a) on the fluid rod (3b) as shown in Fig 22 .
9. Lightly tighten the packing nut (3c). The packing nut is properly tightened when there is 2 lbs. (9 N) of drag force when sliding the packing housing (3a) assembly along the shaft. Tighten or loosen the packing nut as needed.
10. Lubricate the o-ring (3h) on the outside of the packing housing (3a).
11. Install the fluid packing rod assembly (3) into the gun barrel. Using the 9 mm hex nut driver (45), tighten the assembly until just snug, then check the drag on the fluid rod.
12. Make sure the spring (11) is installed on the nut (E) as shown in Fig 22 .
7. Install the electrode, nozzle and resistor stud assembly and the air cap assembly as described in **Electrode Replacement**.
8. Install the arm (29) and jam nut (25), with the jam nut assembled flush to the end of the rod. See Fig 20 , page 22.

KEY

F	3-wire Connector
G	Potentiometer
10	Gun Barrel
13	Retainer Ring
27	Alternator
27a	O-Ring
27b	Cushion
39	Gun Body
40	Power Supply
40a	Gasket
40b	Pad
40c	Pad
40d	Seal
40e	Cushion



0450

Fig 23

Power Supply Removal and Replacement

REPAIR NOTES:

- a. To avoid a loss in electrostatic performance, inspect the gun handle's power supply cavity for dirt or moisture. Clean the cavity with a clean, dry rag.
- b. Do not expose the seal (40d) or o-ring (27a) to solvents as solvents will damage them.

1. Remove the barrel as described in **Barrel Removal**.
2. Grasp the power supply (40) with your hand. With a gentle side-to-side motion, being careful not to damage the power supply, pull the power supply free from the gun handle (39), then pull it straight out.
3. Inspect the power supply for any physical damage. Check the electrical resistance as instructed in **Test Power Supply Resistance**. If needed, replace the power supply.

Before installing the power supply, inspect the seal (40d) for any damage or swelling; replace if necessary. Also, make sure the gaskets/pads (40a–40e) are in place.

4. Lubricate the o-ring (27a) and insert the power supply in the gun handle.
5. Install the barrel on the handle as described in **Barrel Installation**.

Power Supply Adjustment

The KV HI/LO switch, on the back of the gun manifold, enables you to switch between full voltage and a lower voltage output. The lower voltage is factory set at 60 kV, but can be adjusted between 45 and 80 kV.

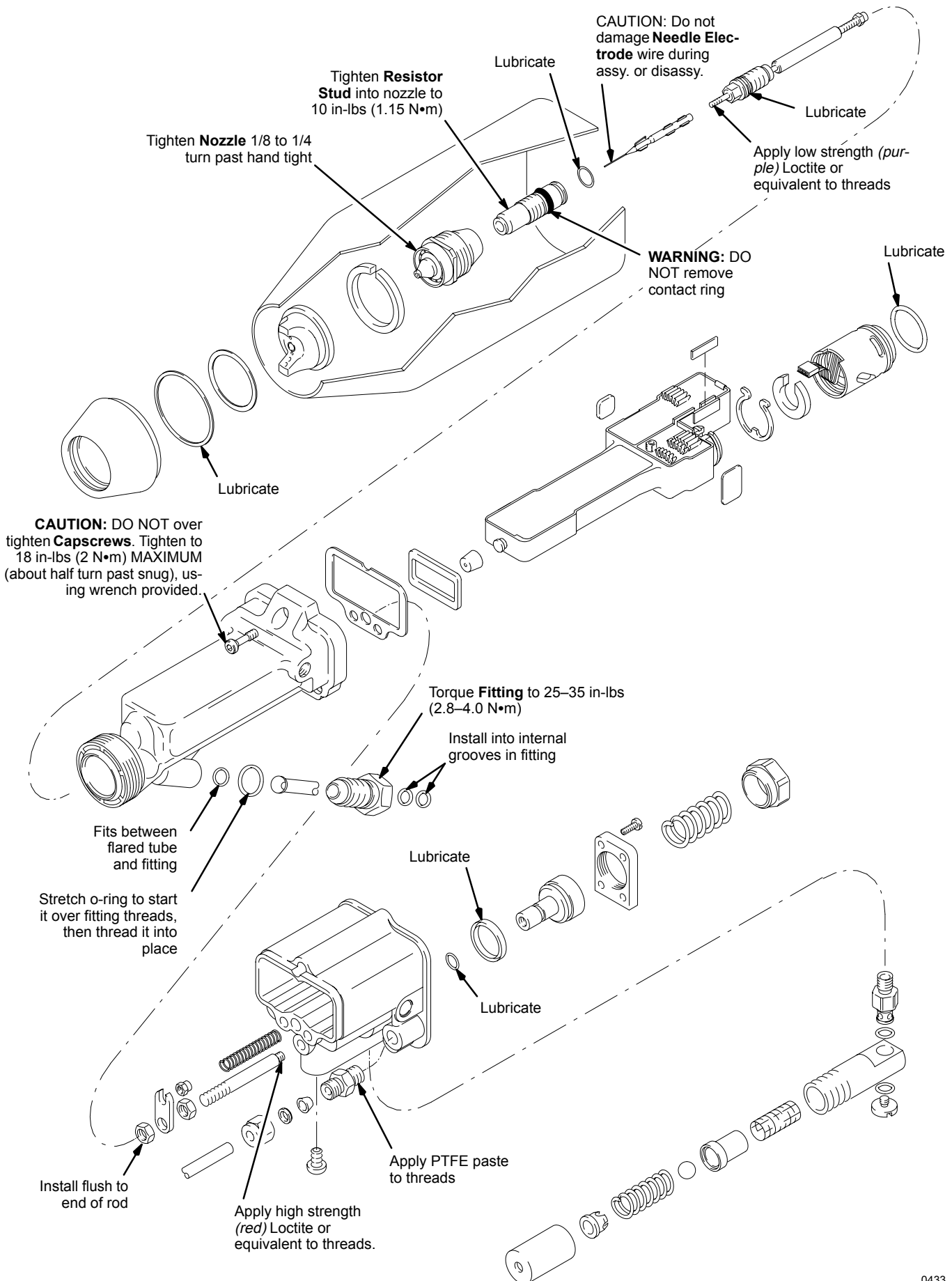
To adjust the low voltage setting, use a small blade end screw driver to turn the potentiometer (G), clockwise to increase the voltage or counterclockwise to decrease it; fully clockwise is 80 kV, fully counterclockwise is 45 kV.

Turbine Alternator Removal and Replacement

NOTE: Replace turbine bearings after 2,000 hours of operation. See your authorized Graco representative.

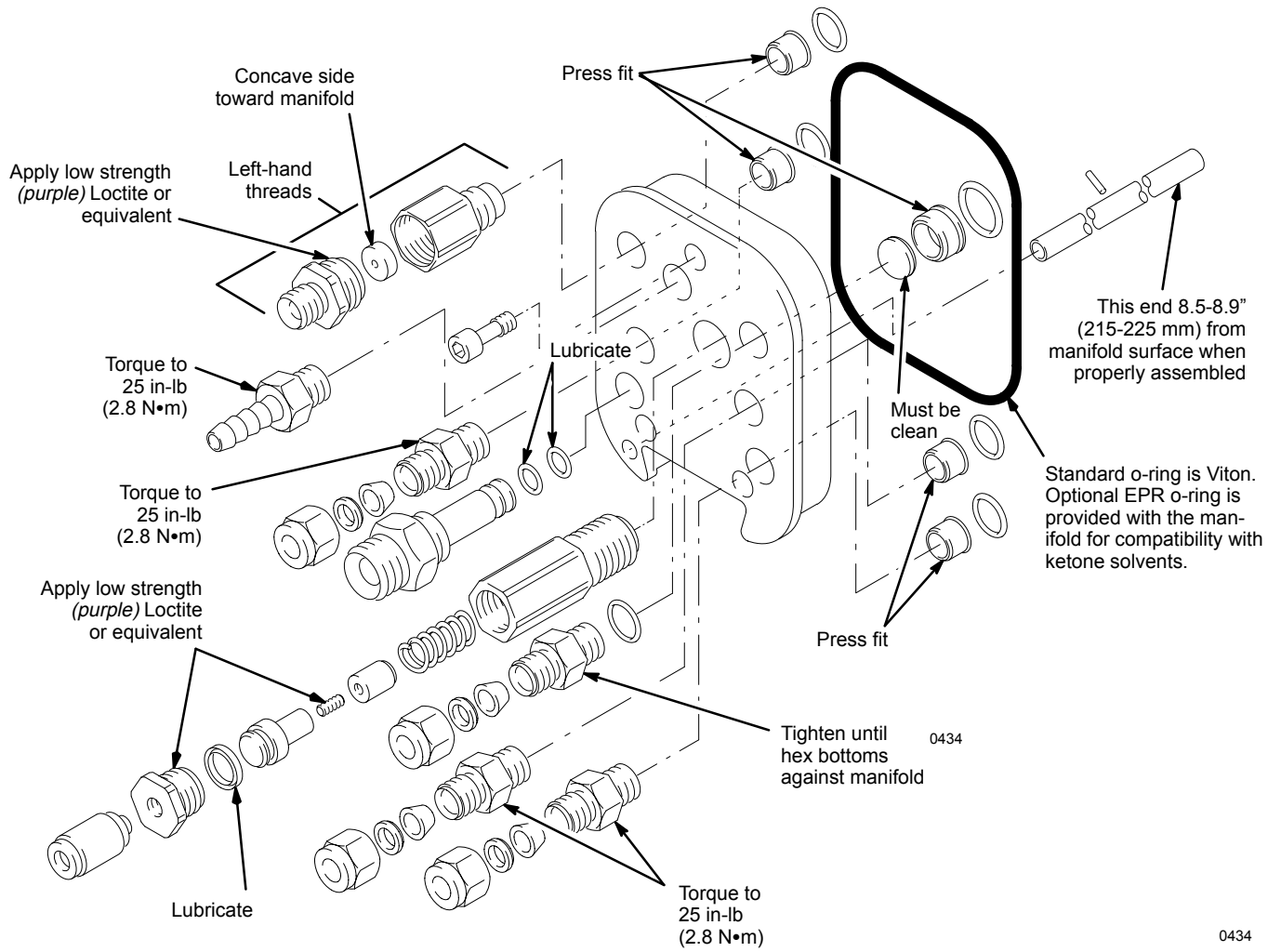
1. Remove the power supply from the gun handle as described at left.
2. Squeeze the two ends of the retaining ring (13) together and carefully pull the alternator (27) away from the power supply (40) until the wire connector (F) disengages. See Fig 23 .
3. Use an ohmmeter to test the turbine alternator coil. Measure the resistance between the two outer terminals of the 3-wire connector (F). Resistance should be 3 to 5 ohms. If the reading varies from this value, replace the alternator.
4. Connect the 3-wire connector to the 3 prongs in the power supply. Push the alternator (27) onto the power supply (40) until the retaining ring (13) engages with the alternator.
5. Install the power supply in the gun handle as described at left.

SPRAY GUN SERVICE NOTES

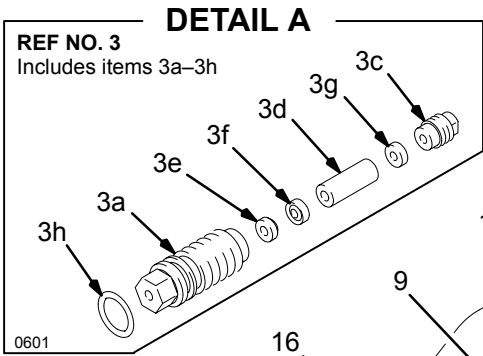


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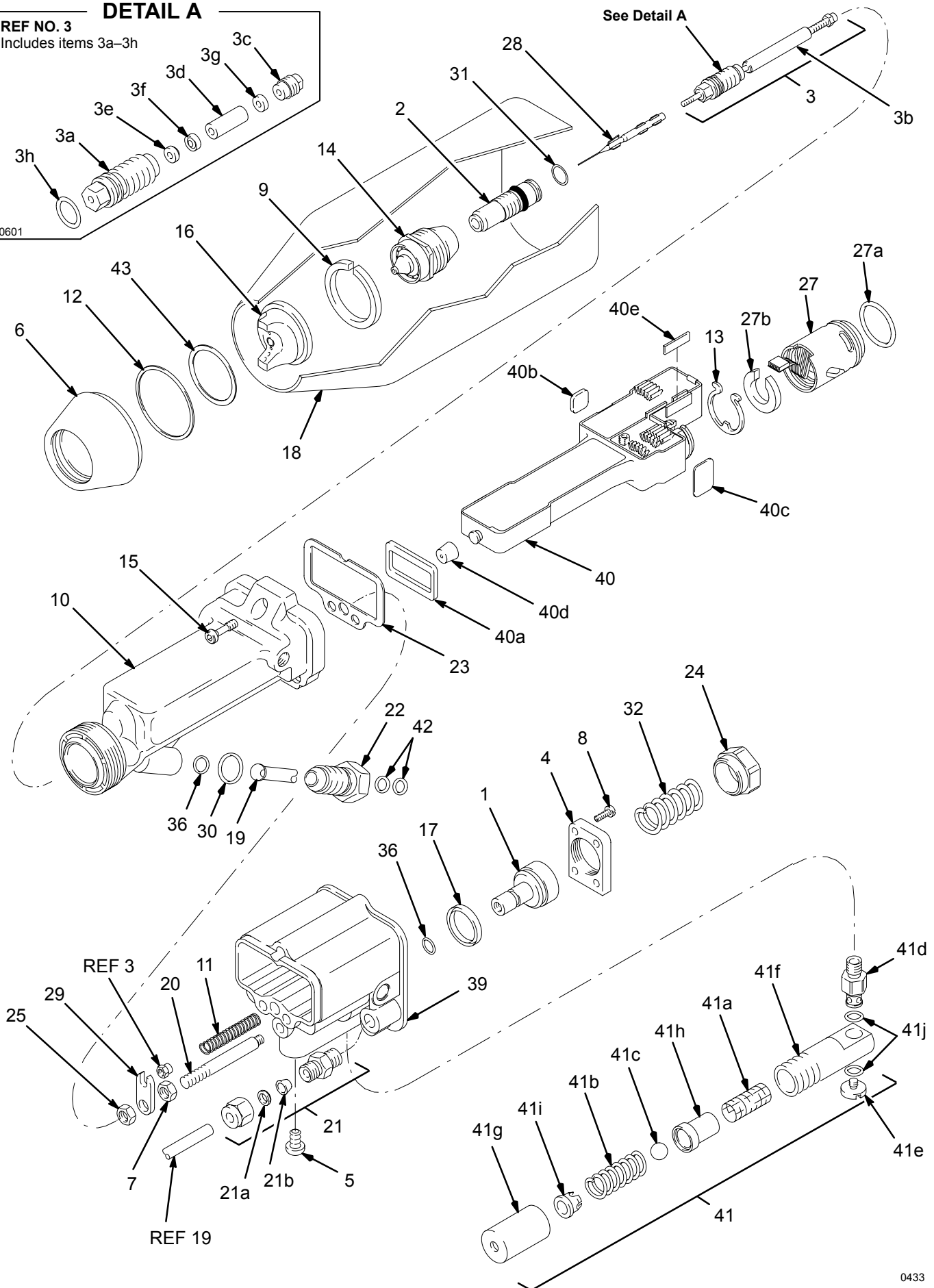
MANIFOLD SERVICE NOTES



SPRAY GUN PARTS DRAWING



See Detail A



SPRAY GUN PARTS LIST

**Part No. 224–224 Automatic
Electrostatic Air Spray Gun, without shroud**
Includes items 1–17, 19–52

**Part No. 235–894, Series A
Air Spray Gun, with slotted shroud**
Includes items 1–52

**Part No. 235–893, Series A
Air Spray Gun, with standard shroud**
Includes items 1–52

REF NO.	PART NO.	DESCRIPTION	QTY	REF NO.	PART NO.	DESCRIPTION	QTY
1	186-762	PISTON, valve	1	39	224-095	BODY, gun	1
2	223-977	STUD, resistor	1	40	224-093	POWER SUPPLY ASSY; 85 KV	
3	224-747	PACKING ROD ASSY				Includes items 40a–40e	1
		Includes items 3a–3h	1	40a†	186-840	•GASKET, power supply	1
3a	185-495	•HOUSING, packing	1	40b	185-099	•PAD	1
3b	223-981	•ROD, fluid	1	40c	185-145	•PAD	1
3c	185-488	•NUT, packing	1	40d†	186-637	•SEAL	1
3d*	186-069	•SPACER, packing	1	40e	185-141	•CUSHION	1
3e*	178-763	•PACKING, rod	1	41	224-340	CHECK VALVE ASSY	
3f*	178-409	•PACKING, fluid	1			Includes items 41a-41j	1
3g*	111-504	•O-RING, fluoroelastomer	1	41a	187-264	•MUFFLER/FLAME ARRESTOR	1
3h*	111-316	•O-RING, fluoroelastomer	1	41b	108-046	•BEARING, ball	1
4	186-763	COVER, piston	1	41c	101-435	•BEARING, ball	1
5	111-177	CAP SCREW, button hd; 1/4-20 x 0.5"	1	41d	186-980	•FITTING, check valve; 5/16-18	1
6	186-764	RING, air cap	1	41e	186-981	•SCREW, check valve; M4 x 0.7	1
7	102-025	NUT, hex; 1/4"-20	1	41f	186-982	•BODY, check valve; 3/4-16	1
8	100-518	SCREW, mach, pnh; 6-32 x 3/8"	4	41g	186-983	•NUT, check valve; 3/4-16	1
9	176-930	RING, retaining	1	41h	186-984	•SEAT, check valve	1
10	223-940	BARREL, gun	1	41i	186-985	•VALVE, check, body	1
11	185-111	SPRING, compression	1	41j	103-337	•O-RING; Viton	2
12†	110-492	O-RING, PTFE	1	42*	103-337	O-RING; Viton	2
13	185-114	RING, retainer, alternator	1	43†	186-848	GASKET, air cap nut	1
14	185-158	NOZZLE, fluid, See Manual 307-803 for available nozzles	1	44**	179-791	TAG, warning (<i>not shown</i>)	1
15	185-096	SCREW, cap, relieved; M5 x 0.8	3	45	110-087	DRIVER, hex nut; 9 mm (<i>not shown</i>)	1
16	177-033	AIR CAP; See Manual 307-803 for available air caps	1	46	107-460	WRENCH, barrel (<i>not shown</i>)	1
17†	181-039	PACKING, u-cup, UHMWPE	1	47	185-123	WRENCH, electrode (<i>not shown</i>)	1
18	186-770	SHROUD, standard; <i>included with Part No. 235-893 only</i>	1	48	187-421	WRENCH, nozzle (<i>not shown</i>)	1
	188-699	SHROUD, slotted; <i>included with Part No. 235-894 only</i>	1	49**	180-060	SIGN, warning, English (<i>not shown</i>)	1
19	186-958	TUBE, flared; PTFE	1	50	187-343	COVER, gun (<i>not shown</i>)	1
20	186-765	ROD, actuator	1	51	110-088	WRENCH, allen; 8 mm	1
21	187-319	CONNECTOR, male; 1/8 npt; for 1/4" OD tubing; Includes items 21a & 21b	1	52	105-749	BRUSH	1
21a*	111-285	•FERRULE	1				
21b*	111-286	•FERRULE	1				
22	186-818	FITTING, fluid; 5/8-20	1				
23†	185-113	GASKET, manifold; polyethylene	1				
24	181-178	CAP, retainer, spring	1				
25	101-324	NUT, hex, jam; 1/4"-20	1				
27	222-319	ALTERNATOR, turbine					
		Includes items 27a & 27b	1				
27a†	110-073	•O-RING, Viton®	1				
27b	185-124	•CUSHION	1				
28	185-107	NEEDLE, electrode	1				
29	186-766	ARM, actuator	1				
30*	102-982	O-RING; PTFE	1				
31*	111-507	O-RING; fluoroelastomer	1				
32	111-182	SPRING, compression	1				
36†*	111-450	O-RING; fluoroelastomer	2				

* The replacements for these parts are available in Fluid Seal Repair Kit 237-786. Purchase the kit separately.

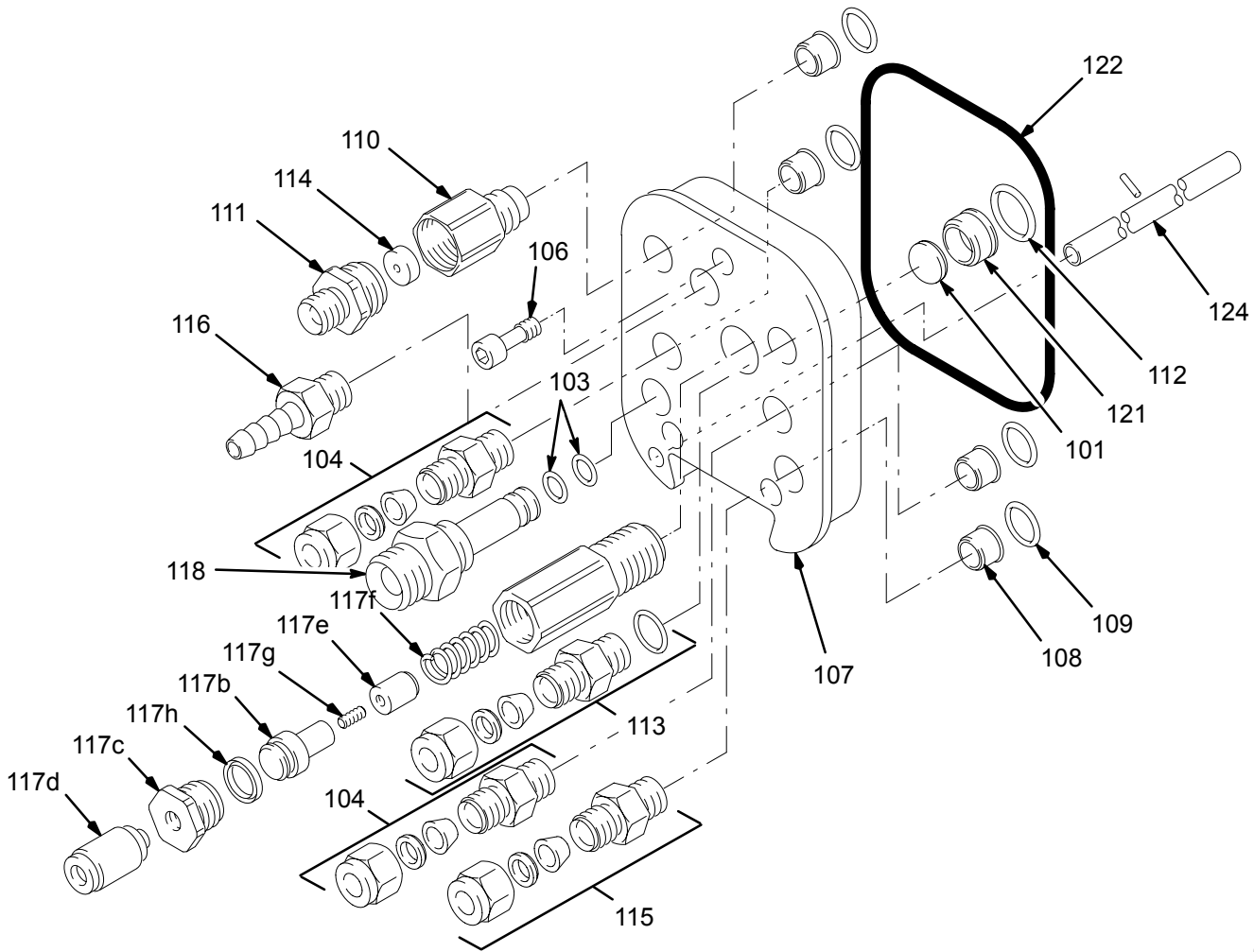
** Additional warning tags and signs available at no charge. French, German, and Spanish warning signs are also available. See ACCESSORIES section.

† The replacements for these parts are available in Air Seal Repair Kit 224-636. Purchase the kit separately.

WARNING

When servicing use only genuine Graco replacement parts. Use of other parts or any modification of the gun could alter the grounding continuity of the gun or cause parts to rupture and result in serious injury, fire, explosion, electrostatic shock or property damage.

MANIFOLD PARTS DRAWING



0434

MANIFOLD PARTS LIST

Part No. 224-094 Gun Manifold

Includes items 101-124

REF NO.	PART NO.	DESCRIPTION	QTY	REF NO.	PART NO.	DESCRIPTION	QTY
101	111-224	LENSE	1	117f	111-208	•SPRING, compression	1
103*	106-167	O-RING; perfluoroelastomer	2	117g	111-295	•SET SCREW, cup point; 4-40	1
104	110-078	FITTING, tube; for 3/8" OD tube	2	117h	111-294	•PACKING, u-cup; UHMWPE	1
106	186-846	BOLT, manifold; M5 x 0.8	3	118	185-819	FITTING, fluid; 1/4 npsm	1
107	186-820	MANIFOLD	1	121	186-847	SLEEVE, o-ring	1
108	183-822	SLEEVE, o-ring	4	122†	111-180	O-RING; Viton	1
109†	105-668	O-RING; Viton®	4	123	111-333	O-RING; EPR	1
110	186-844	FITTING, flow-washer; M16 x 1.5 LH	1	124	224-548	TUBE	1
111	186-845	FITTING, turbine; 1/4-18 npsm LH	1				
112†	105-796	O-RING, Viton	1				
113	186-779	FITTING, fiber optic cable; 7/16-20	1				
114	107-107	DISK, regulator	1				
115	111-157	FITTING, tube; for 1/4" OD tube	1				
116	111-237	FITTING, barb	1				
117	224-143	SWITCH, voltage	1				
		Includes items 17a-17h	1				
117a	186-809	•CYLINDER	1				
117b	186-808	•PISTON	1				
117c	186-810	•FITTING, plug	1				
117d	111-165	•FITTING, male	1				
117e	224-577	•MAGNET	1				

* The replacements for these parts are available in Fluid Seal Repair Kit 237-786. Purchase the kit separately.

† The replacements for these parts are available in Air Seal Repair Kit 224-636. Purchase the kit separately.

WARNING

When servicing use only genuine Graco replacement parts. Use of other parts or any modification of the gun could alter the grounding continuity of the gun or cause parts to rupture and result in serious injury, fire, explosion, electrostatic shock, or property damage.

PRO 4600HC CONVERSION KIT

Part No. 237-301

PRO 4600HC Conversion Kit; To convert the PRO 4600SC™ spray gun to the PRO 4600HC spray gun. The longer 20 in. (508 mm) fluid tube used by the HC gun provides increased spraying voltage when spraying highly conductive fluids. The kit must be ordered separately. It includes items 201 to 204.

Ref. No.	Part No.	Description	Qty.
201	237-299	COILED TUBE ASSY.	1
202	112-644	NUT; nylon; for 1/4" O.D. tube	1
203	111-285	FERRULE; nylon	1
204	111-286	FERRULE; nylon	1

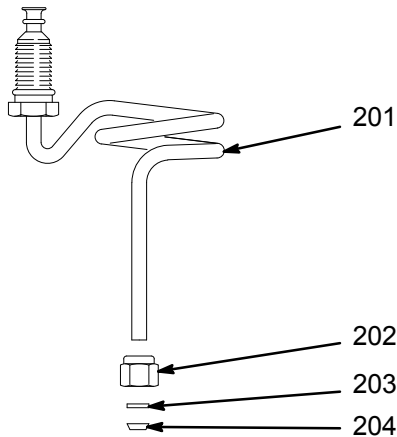


Fig. 24 3933A

Installing the PRO 4600HC Conversion Kit

1. Flush the gun with a compatible solvent.
2. Relieve system pressure as instructed in the **Pressure Relief Procedure** on page 18.
3. Remove the gun from the manifold as instructed on page 18. Remove the gun from the spray area.
4. Remove the PRO 4600SC gun's fluid tube, fittings, and o-rings (B). See Fig. 25 .
5. Clean the barrel fluid inlet (A) with compatible solvent. Inspect the barrel fluid inlet for damage and replace if needed.
6. Slide the coils of the tube assembly (201) over the front of the gun barrel, until it is past the barrel fluid inlet (A). See Fig. 26 and 27 .
7. Position the coiled tube assembly so its threaded inlet fitting (C) is aligned with the barrel fluid inlet (A), then tighten the fitting into the inlet as shown in Fig. 27 .

8. Slide the nylon nut (202) and ferrules (203 & 204) onto the coiled tube assembly (201). See Fig. 24 .
9. Install the coiled tube assembly (201) into the fluid fitting and tighten the nut (202). See Fig. 27 . Make sure the entire tube is clear of the actuator arm (D) to avoid having the tube rub against it during operation.
10. Install the gun onto the manifold. Refer to page 6.

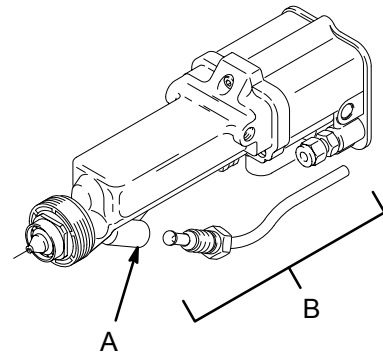


Fig. 25 04673

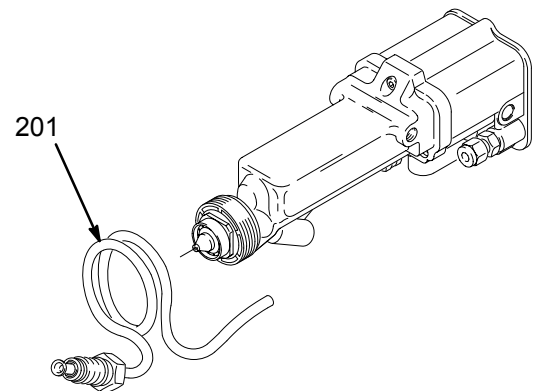


Fig. 26 04674

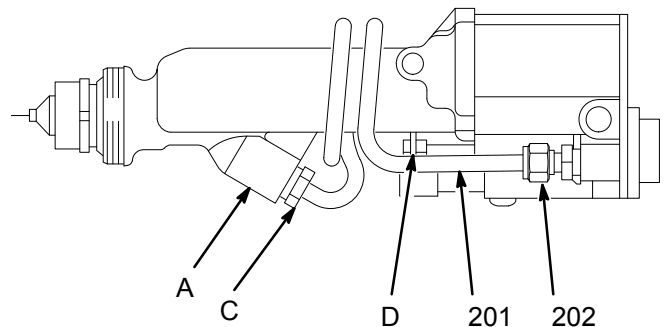


Fig. 27 04672

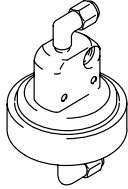
ACCESSORIES

Accessories must be purchased separately.
Use only GENUINE GRACO PARTS AND ACCESSORIES.

AIR AND FLUID LINE ACCESSORIES

Air Pilot Paint Regulator 224–531

For controlling paint flow through the spray gun.
Connects to mount assembly 235–094.



0331

Grounded Air Supply Hose

100 psi (7 bar) MAXIMUM WORKING PRESSURE
0.315 in. (8 mm) ID; 1/4 npsm(f) x 1/4 npsm(f) LH;
Color coded black

PART NO. LENGTH

220–444	6 ft (1.8 m)
218–100	15 ft (5 m)
218–101	25 ft (8 m)
218–102	36 ft (11 m)
218–103	50 ft (15 m)
220–119	75 ft (23 m)
220–120	100 ft (30.5 m)

Grounded Air Supply Hose

100 psi (7 bar) MAXIMUM WORKING PRESSURE
0.315 in. (8 mm) ID; 1/4 npsm(f) x 1/4 npsm(f) LH;
Color coded gray; More flexible than black hose

PART NO. LENGTH

223–068	6 ft (1.8 m)
223–069	15 ft (5 m)
223–070	25 ft (8 m)
223–071	36 ft (11 m)
223–072	50 ft (15 m)
223–073	75 ft (23 m)
223–074	100 ft (30.5 m)

Grounded Air Supply Hose

100 psi (7 bar) MAXIMUM WORKING PRESSURE
0.315 in. (8 mm) ID; 1/4 npsm(f) x 1/4 npsm(f) LH;
Color coded red; Stainless steel braid ground path

PART NO. LENGTH

235–068	6 ft (1.8 m)
235–069	15 ft (5 m)
235–070	25 ft (8 m)
235–071	36 ft (11 m)
235–072	50 ft (15 m)
235–073	75 ft (23 m)
235–074	100 ft (30.5 m)

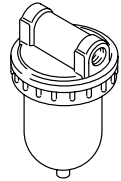
Air Adapter Nipple 185–493

For connecting two or more grounded gun air supply hoses. 1/4 npt x 1/4 npsm (left hand thread)

Air Filter & Moisture Separator 106–148

250 psi (17.5 bar) MAXIMUM WORKING PRESSURE

For cleaning and drying air in air spray system. 20 micron element, 5 oz. bowl capacity, 3/8 npt(f) inlet and outlet



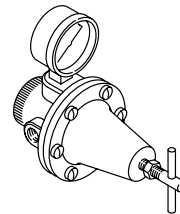
High Volume Air Regulator 206–199

0–125 psi (0–9 bar) Regulated Pressure

200 psi (14 bar) Steel Pressure Gauge

For regulating air to the gun.

1/2 npt(f) inlet and outlet

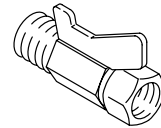


Air Shut-off Valve 224–754

150 psi (10 bar) MAXIMUM WORKING PRESSURE

For turning air to gun off or on.

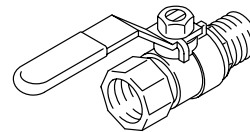
1/4 npsm(m) LH x 1/4 npsm(f) LH



Bleed-type Master Air Valve 107–141

300 psi (21 bar) MAXIMUM WORKING PRESSURE

Relieves air trapped in the air line between the paint pump air motor and this valve when closed. 3/4 npt

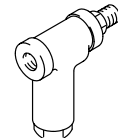


Filter (Air or Paint) 202–271

750 psi (52 bar) MAXIMUM WORKING PRESSURE

With 60 mesh (250 micron) element,

3/8 npt(f) inlet, 3/8 npt(m) outlet



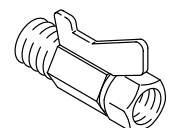
Fluid Drain Valve

500 psi (35 bar) MAXIMUM WORKING PRESSURE

For relieving fluid line pressure

208–630 1/2 npt(m) x 3/8 npt(f); carbon steel and PTFE; for non-corrosive fluids

210–071 3/8 npt(m) x 3/8 npt(f); stainless steel and PTFE; for corrosive fluids



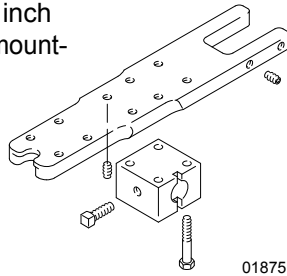
ACCESSORIES

Accessories must be purchased separately.
Use only GENUINE GRACO PARTS AND ACCESSORIES.

GUN MOUNTING ACCESSORIES

Gun Mount Assembly 235-094

Bracket for mounting to a 1/2 inch (12.7 mm) rod, with a slot for mounting the air pilot fluid regulator 224-531.



Gun Mount Assembly 224-118

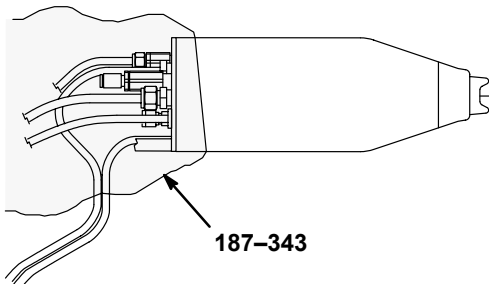
For mounting the PRO4600 gun to the GMF P150 robot.

Mount Extensions 224-255/259

For extending the mount length of Mount Assembly 224-118. Contact your Graco representative for available lengths.

Nylon Fabric Cover 187-343

Fabric cover to protect the manifold inlet tubing and fittings from paint buildup.

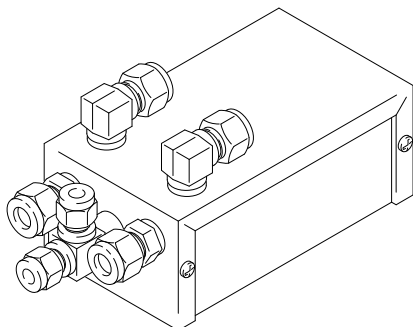


GUN CONTROL AND MONITORING ACCESSORIES

For more information about gun controls and monitoring accessories contact your Graco representative.

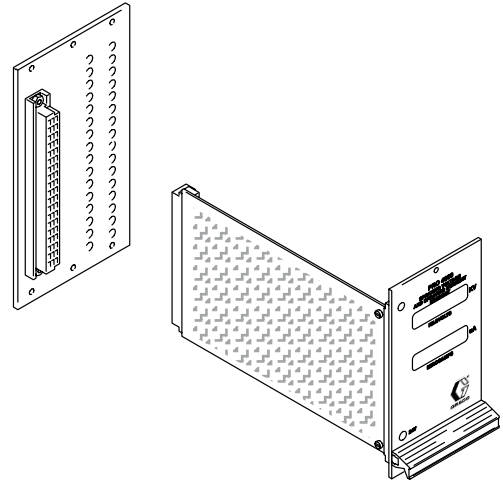
Pneumatic Trigger Module 235-768

Provides pilot air valve control for atomizing air, fan air and fluid trigger air gun functions. Refer to manual 308-264.



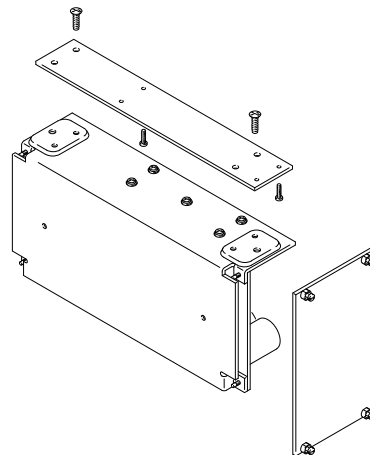
ES Display Module 224-117

Receives fiber optic transmission from the PRO 4600SC Gun and displays the gun's output voltage and current. Mounts in a standard 19" DIN Rack. Refer to manual 308-265.



24 Volt Power Supply 235-301

Provides 24 volt power for up to 23 ES Display Modules.



ACCESSORIES

Accessories must be purchased separately.
Use only GENUINE GRACO PARTS AND ACCESSORIES.

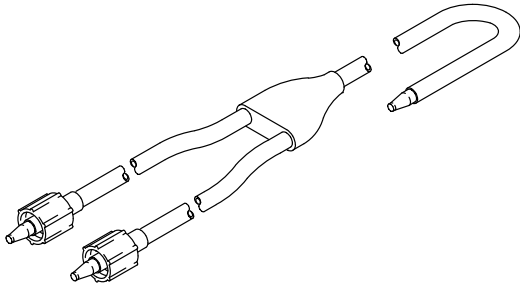
CABLE ACCESSORIES

Fiber Optic Cables

Fiber Optic Cable Assembly

For connection between gun manifold and display module or between bulkhead connector and display module.

<u>PART NO.</u>	<u>LENGTH</u>
224-680	6 ft (1.8 m)
224-681	15 ft (5 m)
224-682	25 ft (8 m)
224-683	36 ft (11 m)
224-684	50 ft (15 m)
224-685	75 ft (23 m)
224-686	100 ft (30.5 m)

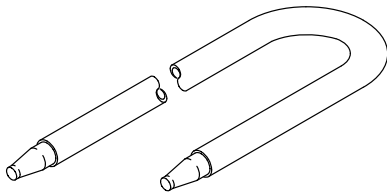


0330

Fiber Optic Cable Extender

For connection between gun manifold and bulkhead connector.

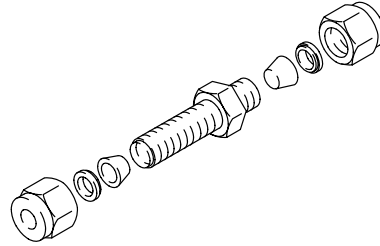
<u>PART NO.</u>	<u>LENGTH</u>
224-670	6 ft (1.8 m)
224-671	15 ft (5 m)
224-672	25 ft (8 m)
224-673	36 ft (11 m)
224-674	50 ft (15 m)
224-675	75 ft (23 m)
224-676	100 ft (30.5 m)



0184

Bulkhead Connector 224-261

For connection between two fiber optic cables.

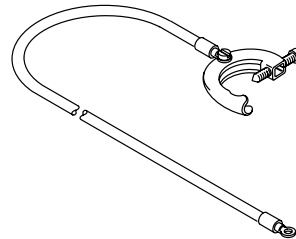


0185A

MISCELLANEOUS ACCESSORIES

Grounding Clamp and Wire 222-011

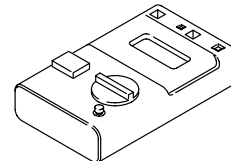
12 ga, 25 ft (7.6 m) wire



0189

Megohmmeter 218-979

500 Volt output; 0.01-2000 megohms.
Not for use in Hazardous areas.



Safety Warning Signs

Available at no charge from Graco.
Must be ordered separately.

<u>PART NO.</u>	<u>DESCRIPTION</u>
180-060	Warning Sign (English)
180-061	Warning Sign (French)
180-062	Warning Sign (German)
180-063	Warning Sign (Spanish)

Paint Resistance Meter 722-886

Used with 722-860 Paint Probe to measure resistance of paint. **Not for use in Hazardous areas.**

Paint Probe 722-860

Used with 722-886 Paint Resistance Meter to measure resistance of paint. **Not for use in Hazardous areas.**

Gun High Voltage Probe & Meter 217-452

For direct measurement of gun output voltage.

SYSTEMS

Gun, Manifold, and Mount System 235-303

Includes:

<u>PART NO.</u>	<u>DESCRIPTION</u>
224-224	PRO4600 Gun
224-094	Gun Manifold
235-094	Standard Gun Mount

TECHNICAL DATA

Weight (*gun & manifold*) 43 oz (1207 g)
Maximum Working Pressure 100 psi (7 bar)
Air Pressure Operating Range . . . 0-100 psi (0-7 bar)
Fluid Pressure Operating Range . . 0-100 psi (0-7 bar)
Voltage Output 0-85 kV
Paint Resistivity Range 3 megohm cm to infinity
Turbine Air Inlet 1/4 npsm(m) L.H.
Wetted Parts Stainless Steel, Nylon, Acetal,
PTFE[®], Kalrez[®], Ultra High
Molecular Weight Polyethylene,
Ceramic, Chemraz[®], Fluoro-
polymer

Viton[®] and Kalrez[®] are registered trademarks of the DuPont Co.

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Chemraz[®] is a registered trademark of the Green, Tweed, & Co.

MANUAL CHANGE SUMMARY

The following parts have been changed in this revision:

Assembly Changed	Part Status	Ref No.	Part No.	Name
224-635,	Old	3	223-980	Packing Rod
224-224,	New	3	224-747	Packing Rod
235-893 &	Added	51	110-088	Wrench
235-894	Added	52	105-749	Brush
Spray Gun				

Miscellaneous Changes:

1. Changed the Fluid Seal Repair Kit from part no. 224-635 to part no. 237-786.
2. Added the PRO 4600HC Conversion Kit, part no. 237-301 to the manual.

THE GRACO 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 or two thousand hours of operation from time of sale, repair or replace any part of the equipment proven defective. However, any deficiency in the barrel, handle, trigger, hook, internal power supply, and alternator (excluding turbine bearings) will be repaired or replaced for thirty-six months or six thousand hours of operation from time 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.

GRACO PHONE NUMBERS

TO PLACE AN ORDER, contact your Graco distributor, or call Graco: **1-800-367-4023 Toll Free**

FOR TECHNICAL ASSISTANCE, service repair information or answers about the application of Graco equipment, call: **1-800-543-0339 Toll Free**

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

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PRINTED IN U.S.A. 308-084 June 1991 Revised January 1995

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