


REPAIR



309063F



Important Safety Instructions
Read all warnings and instructions in this manual. Save these instructions.

First choice when quality counts.™

- For portable spray applications of architectural paints and coatings -

190ES™ Airless Paint Sprayers

3000 psi (207 bar, 20.7 MPa) Maximum Working Pressure

120 VAC

- 232900, A, B, C, D, E, F
- 232901, A, B, C, D, E
- 233797, A, B, C, D, E
- 233815, A, B, C, D, E

100-120 VAC

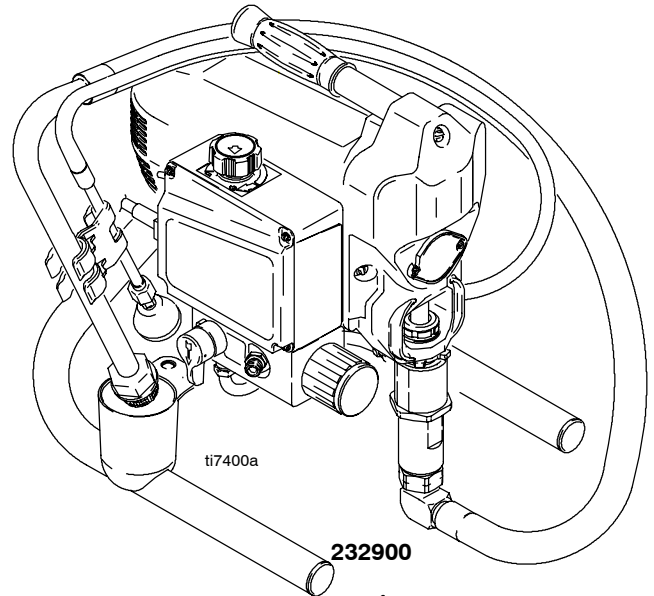


- 232903, A, B

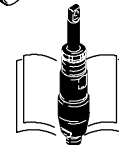
220-240 VAC



- 232906, A, B



..... 309365



..... 309060



..... 309045



..... 309065



..... 309064

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Specifications

This equipment is not intended for use with flammable or combustible materials used in places such as cabinet shops or other “factory” or fixed locations. If you intend to use this equipment in this type of application, you must comply with NFPA 33 and OSHA requirements for the use of flammable and combustible materials.

Warnings

Warning Symbol



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




Caution Symbol









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

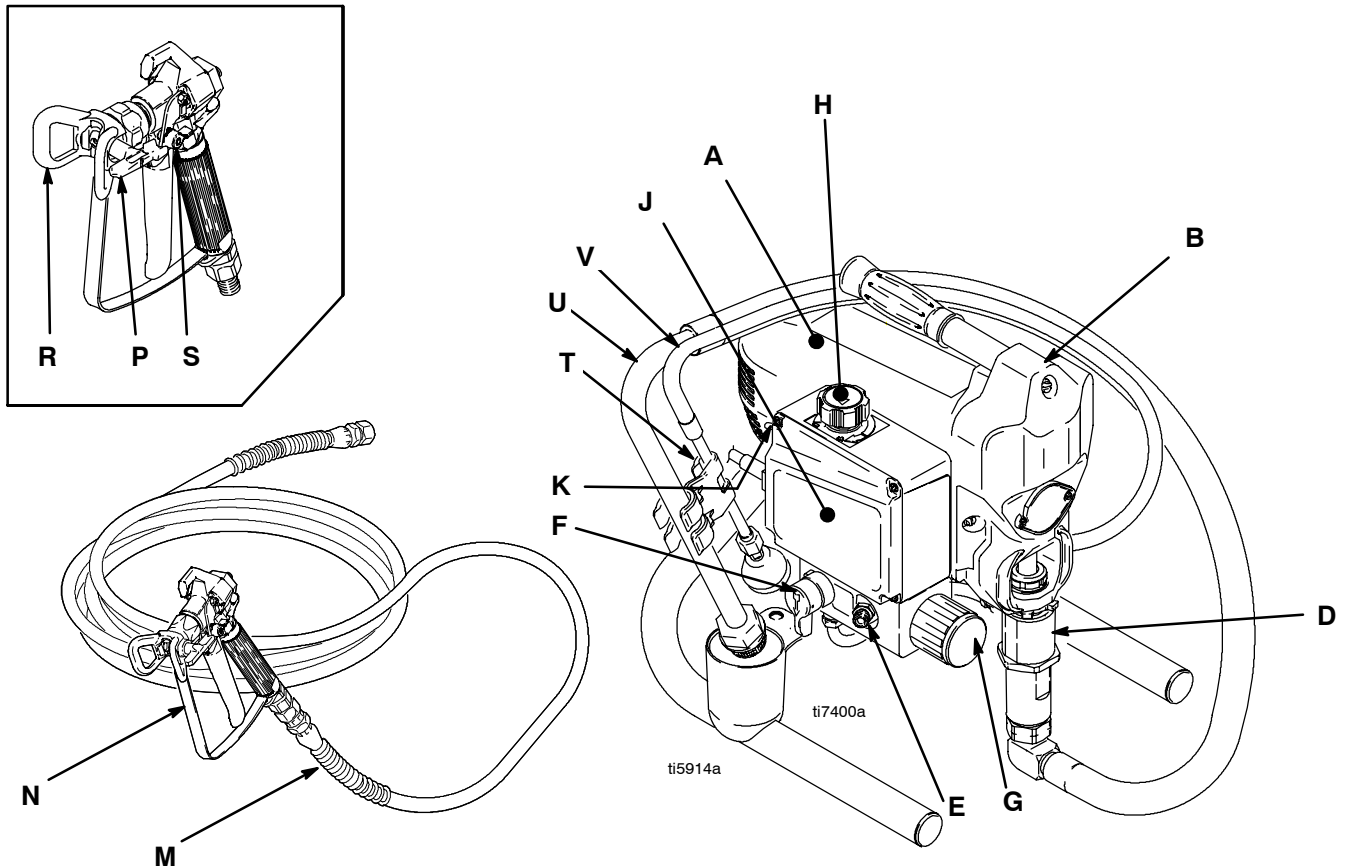
The following are general Warnings related to the safe setup, use, maintenance and repair of this equipment. Additional, more specific warnings may be found throughout the text of this manual where applicable.

! WARNING

	<p>FIRE AND EXPLOSION HAZARD</p> <p>Flammable fumes, such as solvent and paint fumes, in work area can ignite or explode. To help prevent fire and explosion:</p> <ul style="list-style-type: none"> ● Use equipment only in well ventilated area. ● When flammable liquid is used in or near sprayer or for flushing or cleaning, keep sprayer at least 20 feet (6 m) away from explosive vapors. ● Eliminate all ignition sources; such as pilot lights, cigarettes, portable electric lamps, and plastic drop clothes (potential static arc). ● Keep work area free of debris, including solvent, rags and gasoline. ● Do not plug or unplug power cords, or turn lights on or off when flammable fumes are present. ● Ground equipment and conductive objects in work area. See Grounding instructions. ● Use only grounded hoses. ● Hold gun firmly to side of grounded pail when triggering into pail. ● If there is static sparking or you feel a shock, stop operating immediately. Do not use equipment until you identify and correct the problem. ● Keep a fire extinguisher in the work area.
	<p>ELECTRIC SHOCK HAZARD</p> <p>Improper grounding, setup, or usage of the system can cause electric shock.</p> <ul style="list-style-type: none"> ● Turn off and disconnect power cord before servicing equipment. ● Use only grounded electrical outlets ● Use only 3-wire extension cords. ● Ensure ground prongs are intact on sprayer and extension cords.
	<p>SKIN INJECTION HAZARD</p> <p>High pressure fluid from gun, hose leaks, or ruptured components will pierce skin. This may look like just a cut, but it is a serious injury that can result in amputation. Get immediate surgical treatment.</p> <ul style="list-style-type: none"> ● Do not point gun at anyone or any part of the body. ● Do not put your hand over the spray tip. ● Do not stop or deflect leaks with your hand, body, glove, or rag. ● Do not spray without tip guard and trigger guard installed. ● Engage trigger lock when not spraying. ● Follow Pressure Relief Procedure in this manual, when you stop spraying and before cleaning, checking or servicing equipment.

 <p>INSTRUCTIONS</p>	<p>EQUIPMENT MISUSE HAZARD</p> <p>Misuse can cause death or serious injury.</p> <ul style="list-style-type: none"> • Do not exceed the maximum working pressure or temperature rating of the lowest rated system component. Read Technical Data in all equipment manuals. • Use fluids and solvents that are compatible with equipment wetted parts. Read Technical Data in all equipment manuals. Read fluid and solvent manufacturer's warnings. • Check equipment daily. Repair or replace worn or damaged parts immediately. • Do not alter or modify equipment. • Use equipment only for its intended purpose. Call your Graco distributor for information. • Route hoses and cables away from traffic areas, sharp edges, moving parts and hot surfaces. • Do not kink or overbend hoses or use hoses to pull equipment. • Keep children and animals away from work area. • Comply with all applicable safety regulations.
	<p>PRESSURIZED ALUMINUM PARTS HAZARD</p> <p>Do not use 1,1,1-trichloroethane, methylene chloride, other halogenated hydrocarbon solvents or fluids containing such solvents in pressurized aluminum equipment. Such use can cause serious chemical reaction and equipment rupture, and result in death, serious injury, and property damage.</p>
	<p>BURN HAZARD</p> <p>Equipment surfaces can become very hot during operation. To avoid sever burns, do not touch hot equipment. Wait until equipment has cooled completely.</p>
	<p>TOXIC FLUID HAZARD</p> <p>Toxic fluid or fumes can cause serious injury or death if splashed in the eyes or on skin, inhaled, or swallowed.</p> <ul style="list-style-type: none"> • Read MSDS's to know the specific hazards of the fluids you are using. • Store hazardous fluid in approved containers and dispose of it according to all applicable guidelines.
	<p>PERSONAL PROTECTIVE EQUIPMENT</p> <p>You must wear appropriate protective equipment when operating, servicing, or when in the operating area of the equipment to help protect you from serious injury, including eye injury, inhalation of toxic fumes, burns, and hearing loss. This equipment includes, but is not limited to:</p> <ul style="list-style-type: none"> • Protective eye wear. • Clothing and respirator as recommended by the fluid and solvent manufacturer. • Gloves. • Hearing protection.
	<p>MOVING PARTS HAZARD</p> <p>Moving parts can pinch or amputate fingers and other body parts.</p> <ul style="list-style-type: none"> • Keep clear of moving parts. • Do not operate equipment with protective guards or covers removed. • Pressurized equipment can start without warning. Before checking, moving, or servicing equipment, follow the Pressure Relief Procedure in this manual. Disconnect power or air supply.

Component Identification and Function



A	Motor	DC motor, permanent magnet, fan cooled
B	Drive Assembly	Transfers power from DC motor to displacement pump
D	Displacement Pump	Transfers fluid to be sprayed from source through spray gun
E	Fluid Outlet	Spray gun is connected here
F	Prime Valve	Used to prime and drain sprayer (also relieves fluid outlet pressure) when open
G	Fluid Filter (optional)	Final filter of fluid to spray gun
H	Pressure Adjusting Knob	Controls fluid outlet pressure
J	Pressure Control	Controls motor speed to maintain fluid outlet pressure at displacement pump outlet. Works with pressure adjusting knob.
K	ON/OFF Switch	Power switch that controls main power to sprayer
M	50 ft (15 m) Main Hose	1/4 in. ID, grounded, nylon hose with spring guards on both ends
N	Spray Gun	High pressure spray gun with gun safety latch
P	RAC IV Switch Tip	Uses high pressure fluid to clear tip clogs without removing tip from spray gun
R	Tip Guard	Tip guard reduces risk of injection injury
S	Thumb Lock Safety	Gun safety latch inhibits accidental triggering of spray gun
T	Power Cord Rack	Holds wrapped power cord for storage
U	Suction Hose	Transfers fluid to be sprayed from source to pump
V	Drain Tube	Fluid outlet used to drain and prime the sprayer

Pressure Relief Procedure

⚠ WARNING



SKIN INJECTION HAZARD

Follow this Pressure Relief Procedure whenever you are instructed to relieve pressure, stop spraying, check or service equipment, or install or clean spray tip. read Injection Hazard Warning.

1. Turn OFF power and turn pressure control to lowest pressure setting.
2. Hold gun against side of grounded metal flushing pail. Trigger gun to relieve pressure.

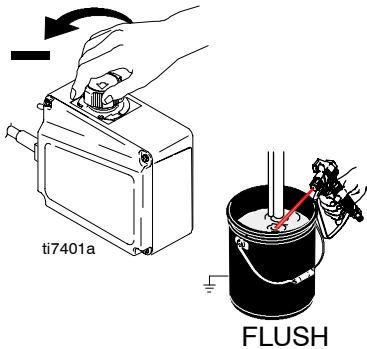


Fig. 1

3. Turn prime valve down

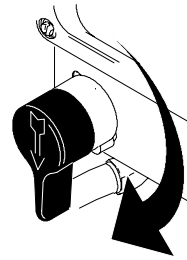


Fig. 2

If suspected that spray tip or hose is clogged or that pressure has not been fully relieved after following steps above , VERY SLOWLY loosen tip guard retaining nut or hose end coupling to relieve pressure gradually, then loosen completely. Clear tip or hose obstruction.

4. Engage trigger safety lock on gun if unit is being shut down or left unattended.

⚠ CAUTION

To reduce risk of pressure control malfunction:

- Use needle nose pliers to disconnect wire. Never pull on wire, pull on connector.
- Mate wire connectors properly. Center flat blade of insulated male connector in female connector.
- Route wires carefully to avoid interference with other connections of pressure control. Do not pinch wires between cover and control box.

General Repair Information

WARNING



Read **Electric Shock Warning** and **Burn Hazard Warning**.

WARNING



Flammable materials spilled on hot, bare, motor could cause fire or explosion. To reduce risk of burns, fire or explosion, do not operate sprayer with cover removed.

- Keep all screws, nuts, washers, gaskets, and electrical fittings removed during repair procedures. These parts usually are not provided with replacement kits.
- test repairs after problems are corrected.
- If sprayer does not operate properly, review repair procedure to verify you did it correctly. See Troubleshooting, page 9.
- Overspray may build up in the air passages. Remove any overspray and residue from air passages and openings in the enclosures whenever you service sprayer.
- Do not operate the sprayer without the motor shroud in place. replace if damaged. Motor shroud directs cooling air around motor to prevent overheating and insulate the control board from accidental electric shock.

WARNING



To reduce risk of serious injury, including electric shock:

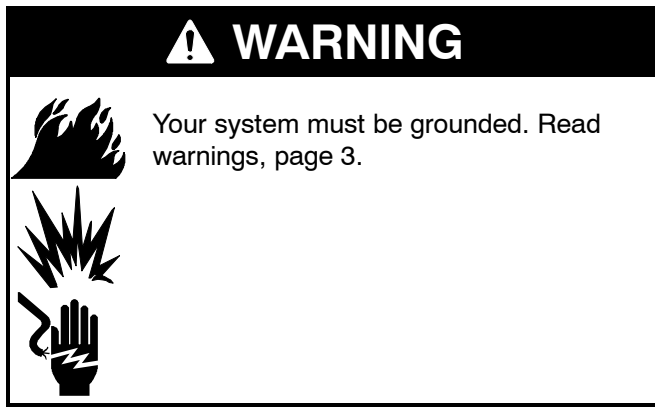
- Do not touch moving or electric parts with fingers or tools while testing repair
- Unplug sprayer when power is not required for testing
- Install all covers, gaskets, screws and washers before you operate sprayer



CAUTION

- Do not run sprayer dry for more than 30 seconds. Doing so could damage pump packings.
- Protect the internal drive parts of this sprayer from water. openings in the cover allow for air cooling of the mechanical parts and electronics inside. If water gets in these openings, sprayer could malfunction or be permanently damaged.
- Prevent pump corrosion and damage from freezing. Never leave water or water-base paint in sprayer when it is not in use in cold weather. Freezing fluids can seriously damage sprayer. Store sprayer with Pump armour to protect sprayer during storage.
- Do not operate the sprayer without the motor shroud or control box cover in place. Replace if damaged. Motor shroud directs cooling air around motor to prevent overheating and the control box cover insulates the control board from accidental electric shock.

Grounding and Electric Requirements



The sprayer cord includes: a grounding wire with an appropriate grounding contact.

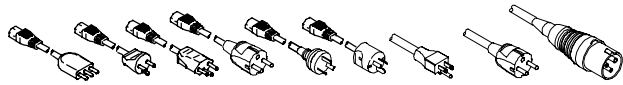


Fig. 3 ti7480a

The sprayer requires:

110–120V units: 100–130 VAC, 50/60 Hz, 15A, 1 phase, circuit with a grounding receptacle.

240V Units: 210–255 VAC, 50/60 Hz, 7.5A, 1 phase, circuit with a grounding receptacle.

Never use an outlet that is not grounded or an adapter.

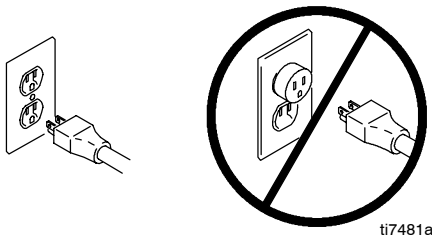


Fig. 4 ti7481a

Do not use the sprayer if the electrical cord has a damaged ground contact. Only use an extension cord with an undamaged ground contact.

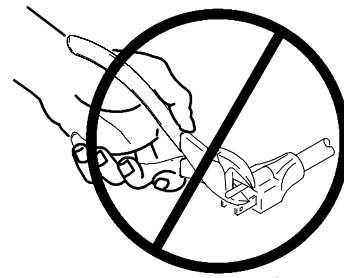


Fig. 5 ti7482a

Recommended extension cords for use with this sprayer:

- 110–120V: 3-wire, 12 AWG (2.5 mm²) minimum, 300 ft. (90 m) maximum length.
- 240V: 3-wire, 16 AWG (1.0 mm²) minimum, 300 ft. (90 m) maximum length.
Smaller gauge or longer extension cords may reduce sprayer performance.

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

Fluid supply container: follow local code.

Solvent and Oil-based fluids: follow local code. Use only conductive metal pails placed on a grounded surface such as concrete. Do not place the pail on a nonconductive surface such as paper or cardboard, which interrupts grounding continuity.

Grounding the metal pail: connect a ground wire to the pail by clamping one end to pail and other end to ground such as a water pipe.

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

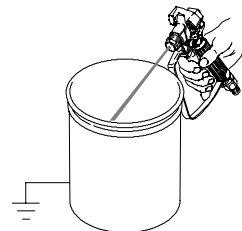


Fig. 6 ti7483a

Troubleshooting



Relieve pressure; page 6.

MOTOR WON'T OPERATE

TYPE OF PROBLEM	WHAT TO CHECK <i>If check is OK, go to next check</i>	WHAT TO DO <i>When check is not OK refer to this column</i>
Basic Fluid Pressure Problems	1. Pressure control knob setting. Motor will not run if at minimum setting (fully counterclockwise).	1. Slowly increase pressure setting to see if motor starts.
	2. Spray tip or fluid filter may be clogged.	2. Relieve pressure and clear clog or clean filter; refer to separate gun or tip instruction manual.
Basic Mechanical Problems	1. Pump (13) frozen or hardened paint.	1. Thaw sprayer if water or water-based paint has frozen in sprayer. Place sprayer in warm area to thaw. Do not start sprayer until thawed completely. If paint hardened (dried) in sprayer, replace pump packings. See page 26 (Displacement Pump Replacement).
	2. Displacement pump connecting rod pin (9a). Pin must be completely pushed into connecting rod (9) and retaining spring (9b) must be firmly in groove of pump pin. See Fig. 18.	2. Push pin into place and secure with spring retainer.
	3. Motor (1). Remove drive housing assembly (10). See page 24. Try to rotate fan by hand.	3. Replace motor (1) if fan won't turn. See page 25.
Basic Electrical Problems See Wiring Diagram, pages 15 to 18.	1. Motor control board. Board shuts down and displays error code on some models.	1. See Motor Control Board Diagnostics , page 19.
	2. Electrical supply. Meter must read 100-130 VAC for 110-120 VAC models and 210-255 VAC for 240 VAC models.	2. Reset building circuit breaker; replace building fuses. Try another outlet.
	3. Extension cord. Check extension cord continuity with volt meter.	3. Replace extension cord.
	4. Sprayer power supply cord. Inspect for damage such as broken insulation or wires.	4. Replace power supply cord.
	5. Fuse. Check replaceable fuse on control board.	5. Replace fuse after completing motor inspection.
	6. Motor leads are securely fastened and properly connected to control board.	6. Replace loose terminals; crimp to leads. Be sure terminals are firmly connected. Clean circuit board terminals. Securely reconnect leads.
	7. Motor thermal switch. Yellow motor leads must have continuity through thermal switch.	7. Replace motor. See page 25, Motor Replacement.
	8. Brush cap missing or loose brush lead connections.	8. Install brush cap or replace brushes if leads are damaged. See page 12, Motor Brush Replacement.
	9. Brush length which must be 1/4 in. (6 mm) minimum. NOTE: Brushes do not wear at the same rate on both sides of motor. Check both brushes.	9. Replace brushes. See page 12, Motor Brush Replacement.
	10. Motor armature commutator for burn spots, gouges and extreme roughness.	10. Remove motor and have motor shop resurface commutator if possible. See page 25, Motor Replacement.
	11. Motor armature for shorts using armature tester (growler) or perform spin test, page 12.	11. Replace motor. See page 25, Motor Replacement.
	12. Pressure control not plugged in to control board.	12. Insert pressure control connector into control board.

Troubleshooting

LOW OR FLUCTUATING OUTPUT

TYPE OF PROBLEM	WHAT TO CHECK <i>If check is OK, go to next check</i>	WHAT TO DO <i>When check is not OK refer to this column</i>
Low Output	1. For worn spray tip.	1. Follow Pressure Relief Procedure Warning , then replace tip. See your separate gun or tip manual.
	2. Verify pump does not continue to stroke when gun trigger is released.	2. Service pump. See page 26.
	3. Filter clogged (If optional filter is installed).	3. Relieve pressure. Check and clean filter.
	4. Prime valve leaking.	4. Relieve pressure. Repair prime valve.
	5. Suction hose connections.	5. Tighten any loose connections.
	6. Electrical supply with volt meter. Meter must read: 210–255 Vac for 220–240 Vac models. 85–130 Vac for 100–120 Vac models. Low volt-ages reduce sprayer performance.	6. Reset building circuit breaker; replace building fuse. Repair electrical outlet or try another outlet.
	7. Extension cord size and length; must be at least 12 gauge wire and no longer than 300 ft. Longer cord lengths reduce sprayer performance.	7. Replace with a correct, grounded extension cord.
	8. Leads from motor to pressure control circuit board (35) for damaged or loose wires or connectors. Inspect wiring insulation and terminals for signs of overheating.	8. Be sure male terminal blades are centered and firmly connected to female terminals. Replace any loose terminal or damaged wiring. Securely reconnect terminals.
	9. For loose motor brush leads and terminals. See page 12.	9. Tighten terminal screws. Replace brushes if leads are damaged. See page 12.
	10. For worn motor brushes which must be 1/4 in. (6 mm) minimum. See page 12.	10. Replace brushes. See page 12.
	11. For broken or missing motor brush caps.	11. Replace brushcap if broken. Realign spring with brush. See page 12.
	12. Motor brushes for binding in brush holders. See page 12.	12. Clean brush holders, remove carbon dust with small cleaning brush. Align brush lead with slot in brush holder to assure free vertical brush movement.
	13. Low stall pressure.	13. Do either or both: a. Turn pressure control knob fully clockwise. Make sure pressure control knob is properly installed to allow full clockwise position. b. Try a new transducer.
	14. Motor armature for shorts by using an armature tester (growler) or perform spin test. See page 12.	14. Replace motor. See page 25.

Troubleshooting

LOW OR FLUCTUATING OUTPUT

TYPE OF PROBLEM	WHAT TO CHECK <i>If check is OK, go to next check</i>	WHAT TO DO <i>When check is not OK refer to this column</i>
Motor runs and pump strokes	1. Paint supply.	1. Refill and reprime pump.
	2. Intake strainer clogged.	2. Remove and clean, then reinstall.
	3. Suction tube or fittings loose.	3. Tighten; use thread sealant or sealing tape on threads if necessary.
	4. To see if intake valve ball and piston ball are seating properly. See page 26.	4. Remove intake valve and clean. Check balls and seats for nicks; replace if necessary, page 26. Strain paint before using to remove particles that could clog pump.
	5. Leaking around throat packing nut which may indicate worn or damaged packings. See page 26.	5. Replace packings, page 26. Also check piston valve seat for hardened paint or nicks and replace if necessary. Tighten packing nut/wet-cup.
	6. Pump rod damage.	6. Repair pump, page 26.
	7. Capacitor failure. Visually inspect capacitor near terminals. Ensure that orange safety relief plug is intact.	7. Replace capacitor.
Motor runs but pump does not stroke	1. Displacement pump pin (9a) (damaged or missing), page 26.	1. Replace pump pin if missing. Be sure retainer spring (9b) is fully in groove all around connecting rod, page 26.
	2. Connecting rod assembly (9) for damage, page 24.	2. Replace connecting rod assembly, page 24.
	3. Gears or drive housing, page 24.	3. Inspect drive housing assembly and gears for damage and replace if necessary, page 24.
Motor is hot and runs intermittently	1. Be sure ambient temperature where sprayer is located is not more than 115 °F (46 °C) and sprayer is not located in direct sun.	1. Move sprayer to shaded, cooler area if possible.
	2. Motor has burned windings indicated by removing positive (red) brush and seeing burned adjacent commutator bars.	2. Replace motor. See page 25, Motor Replacement .
	3. Tightness of pump packing nut. Overtightening tightens packings on rod, restricts pump action and damages packings.	3. Loosen packing nut. Check for leaking around throat. Replace pump packings if necessary. See pump manual 309060.


Spin Test

Setup



Electric Shock Hazard; page 6.

To check armature, motor winding and brush electrical continuity:

1.  Relieve pressure; page 6.
2. Remove drive housing; page 24.
3. Fig. 7. Remove pressure control cover (39). Disconnect red and black motor leads from control board.
4. Fig. 8. Remove motor shroud (74).

Armature Short Circuit Test

Quickly turn motor fan by hand. If no electrical shorts, motor coasts two or three revolutions before complete stop. If motor does not spin freely, armature is shorted. Replace motor; page 25.

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

1. Connect red and black motor leads together with test lead. Turn motor fan by hand at about two revolutions per second.
2. If uneven or no resistance, check for: broken brush springs, brush leads, motor leads; loose brush terminal screws, motor lead terminals; worn brushes. Repair as needed; page 12.
3. If still uneven or no resistance, replace motor; page 25.

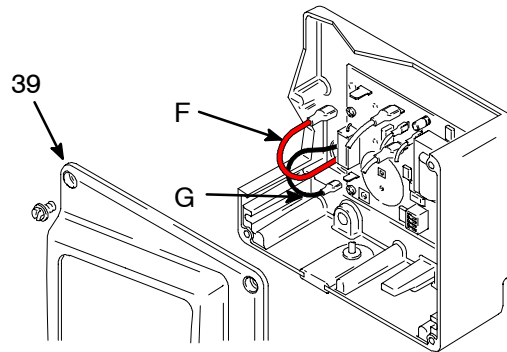



Fig. 7

9578A

Motor Brush Replacement

Motor Brush Removal

Replace brushes worn to less than 1/4 in. (6 mm). Check both sides. See Parts List 309064 for correct brush kit for your series of sprayer.

1. Read **General Repair Information;** page 7.
2.  Relieve pressure; page 6.
3. Fig. 8. Remove four screws (18) and motor shroud (74).
4. Pry off two brush caps (A). Tag locations of red (+) and black (-) motor leads. Cut tie wrap.
5. Fig. 5. Remove screw (C) and discard brush (B) for motor with capacitor attached. Remove brush leads from control box for motor without capacitor attached.

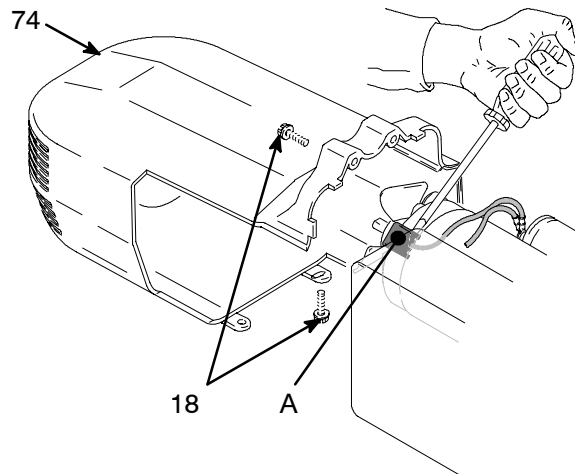


Fig. 8

T10053

(Continued on page 13)

Motor Brush Replacement

- Fig. 9. Insert brush (B). Push cap (A) into place over brush. Orient each cap with the 2 projections on either side of the brush lead. You will hear a "snap" when cap is securely in place.

 CAUTION
When installing brushes, follow all steps carefully to avoid damaging parts.

- Fig. 9. Install red (+) and black (-) motor leads according to tags. Install brush lead end with screw (C) to motor-mounted capacitor or route lead into control box and connect to board.

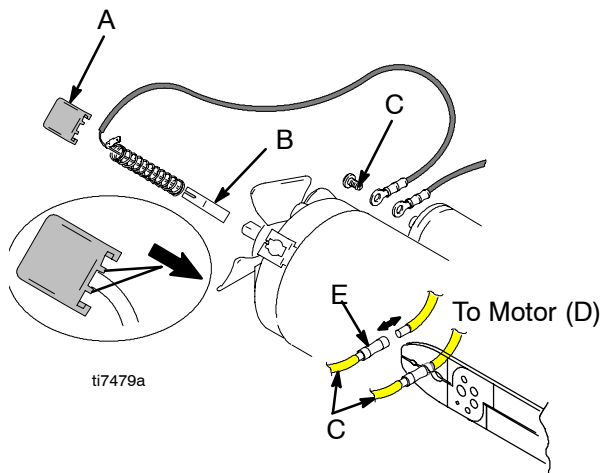


Fig. 9


T10053

- If replacement brush harness has 2 yellow wires (C), cut, strip, and crimp the 2 yellow wires (D) from the motor and butt splice (E) on the replacement harness.
- Inspect commutator for excessive pitting, burning or gouging. A black color on commutator is normal. Have commutator resurfaced by a motor repair shop if brushes wear too fast.
- Test brushes.
 - Remove pump (13); **Displacement Pump Replacement**, page 26.
 - With sprayer OFF, turn pressure control knob fully counterclockwise to minimum pressure. Plug in sprayer.
 - Turn sprayer ON. Slowly increase pressure until motor is at full speed.
- Break in brushes.
 - Operate sprayer 1 hour with no load.
 - Install pump (13); **Displacement Pump Replacement**, page 26.

On/Off Switch Replacement

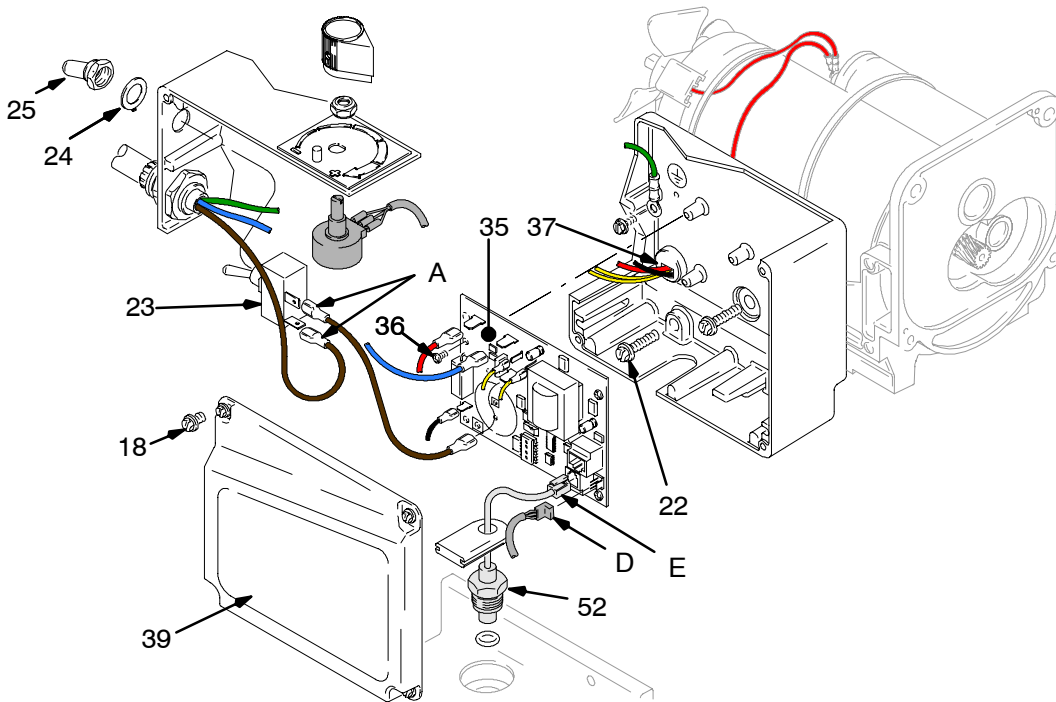
120 Vac

Removal

1.  Relieve pressure; page 6.
2. Fig. 10 and 11. Remove four screws (18) and pressure control cover (39).
3. Disconnect two wires (A) from ON/OFF switch (23).
4. Remove toggle boot (25) and locking ring (24). Remove ON/OFF switch (23).

Installation

1. Install new ON/OFF switch (23). Install locking ring (24) and toggle boot (25).
2. Connect two wires (A) to ON/OFF switch.
3. Install pressure control cover (39) with four screws (18).



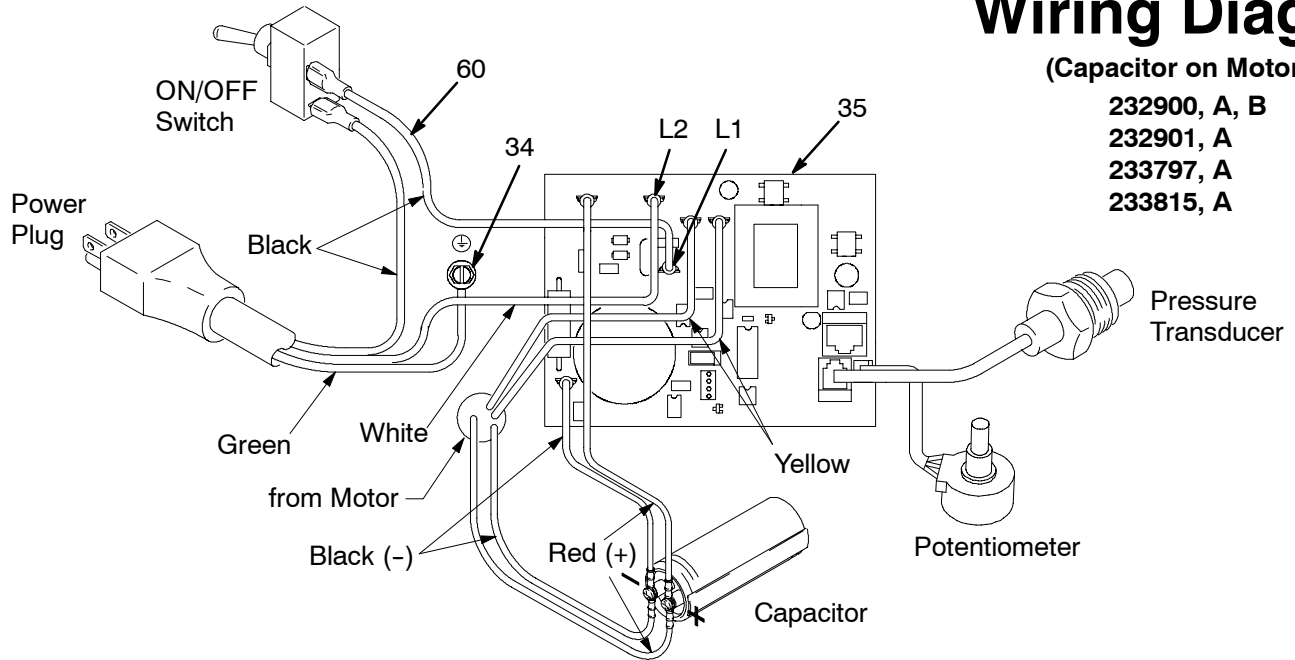
ti0057b

Fig. 10

On/Off Switch Replacement

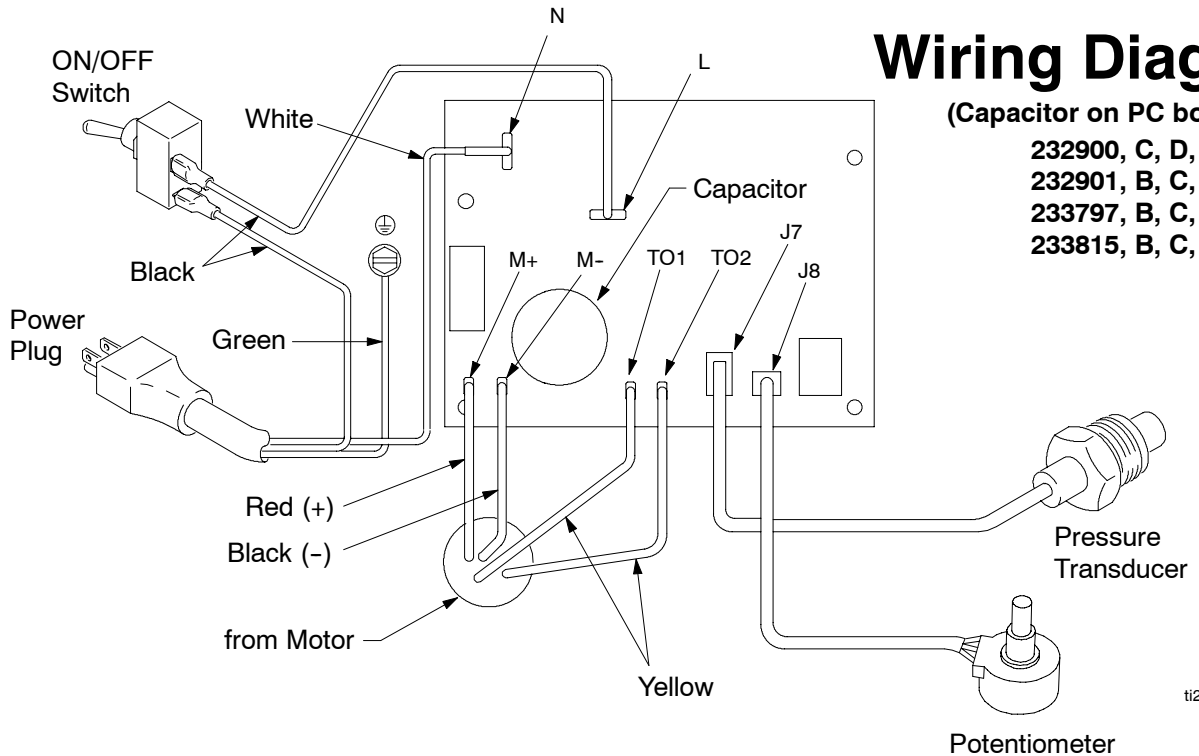
120 Vac

Wiring Diagram



T10060

Wiring Diagram



ti2159a

Fig. 11

Wiring Diagram

(Capacitor on PC board)

232900, F,
232901, E
233797, E
233815, E

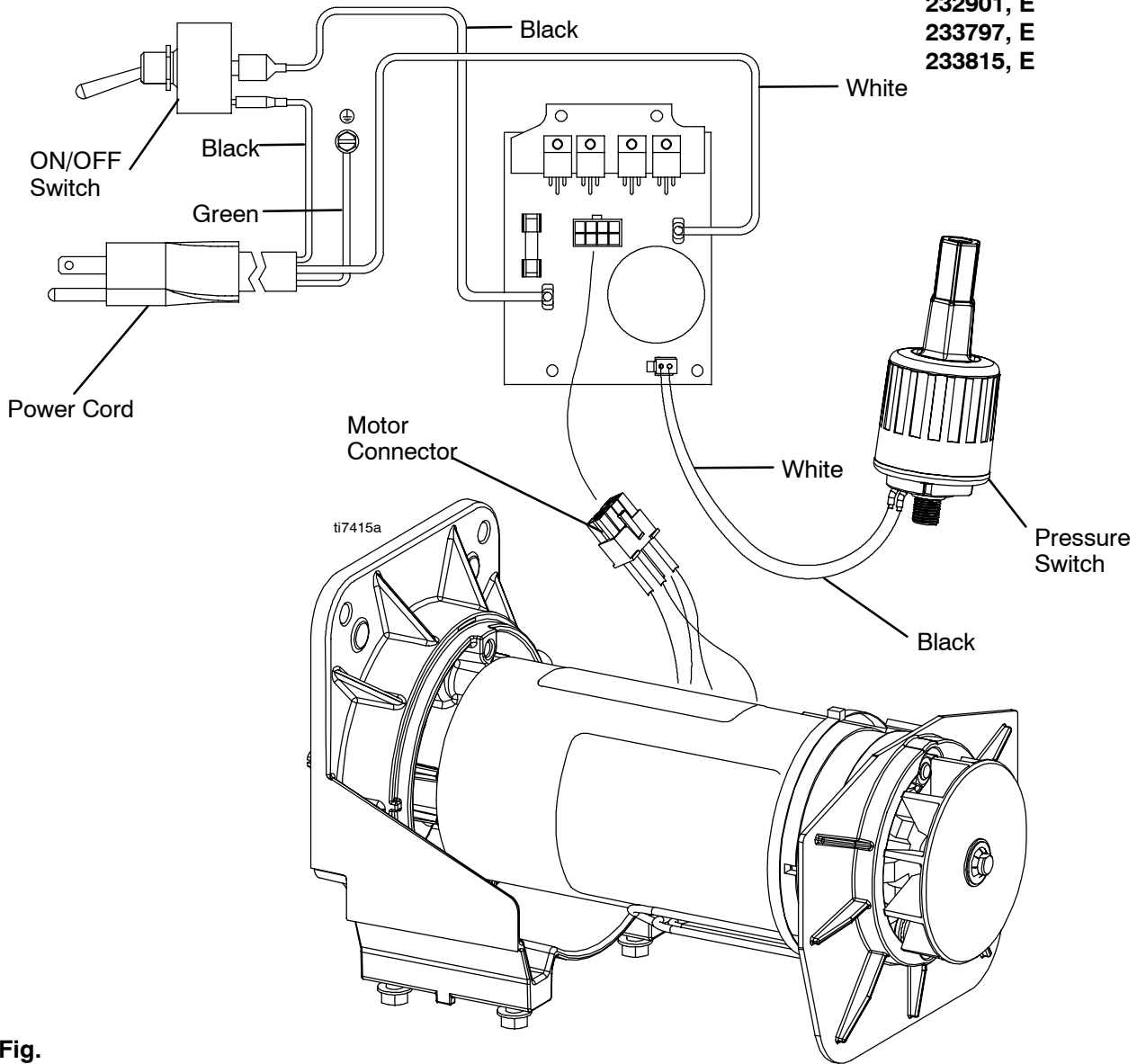



Fig.
12

On/Off Switch Replacement

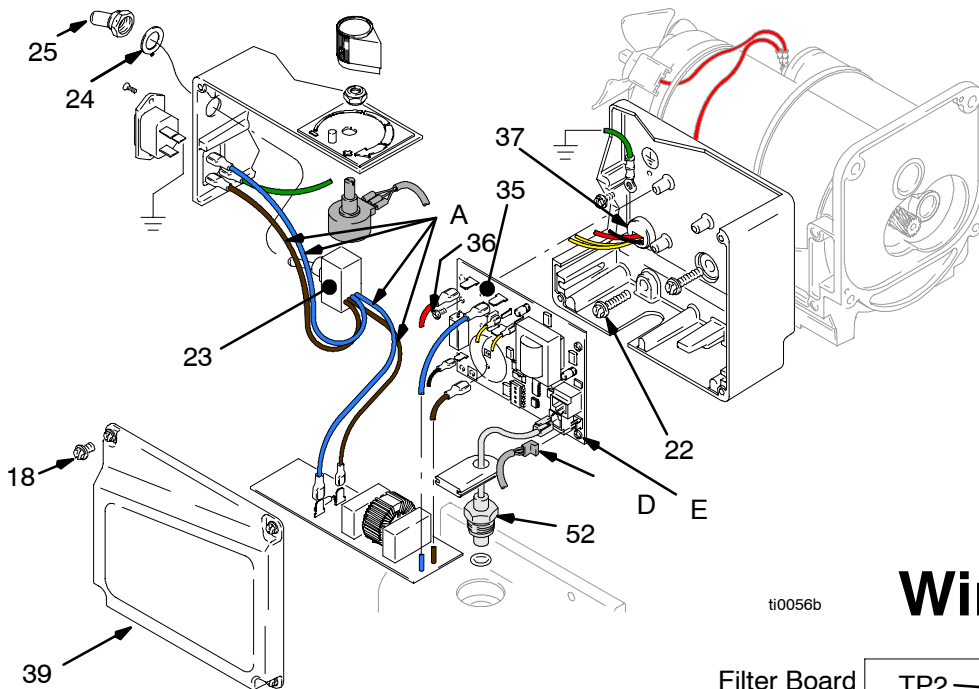
100 Vac (232903)

Removal

1.  Relieve pressure; page 6.
2. Fig. 13. Remove four screws (18) and pressure control cover (39).
3. Disconnect four wires (A) from ON/OFF switch (23).
4. Remove toggle boot (25) and locking ring (24). Remove ON/OFF switch (23).

Installation

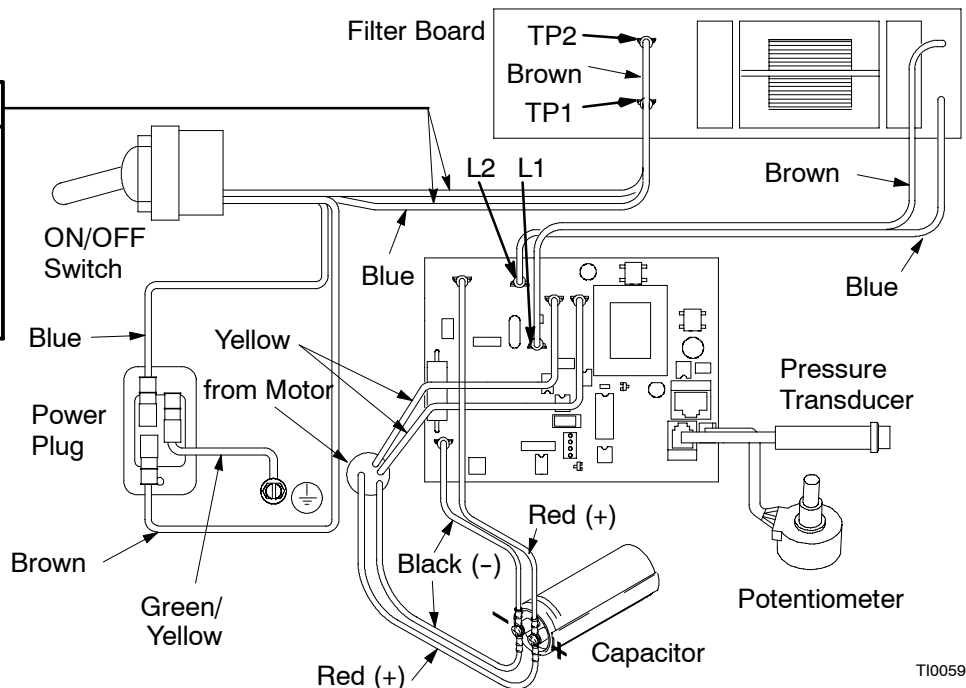
1. Install new ON/OFF switch (23). Install locking ring (24) and toggle boot (25).
2. Connect four wires (A) to ON/OFF switch (23).
3. Install pressure control cover (39) with four screws (18).



ti0056b

Wiring Diagram

Caution
Heat from inductor coil of filter board may destroy wire insulation that comes in contact with it. Exposed wires could cause shorts and component damage. Bundle and tie all loose wires so none lay in contact with inductor coil of filter board.




Ti0059

Fig. 13

On/Off Switch Replacement

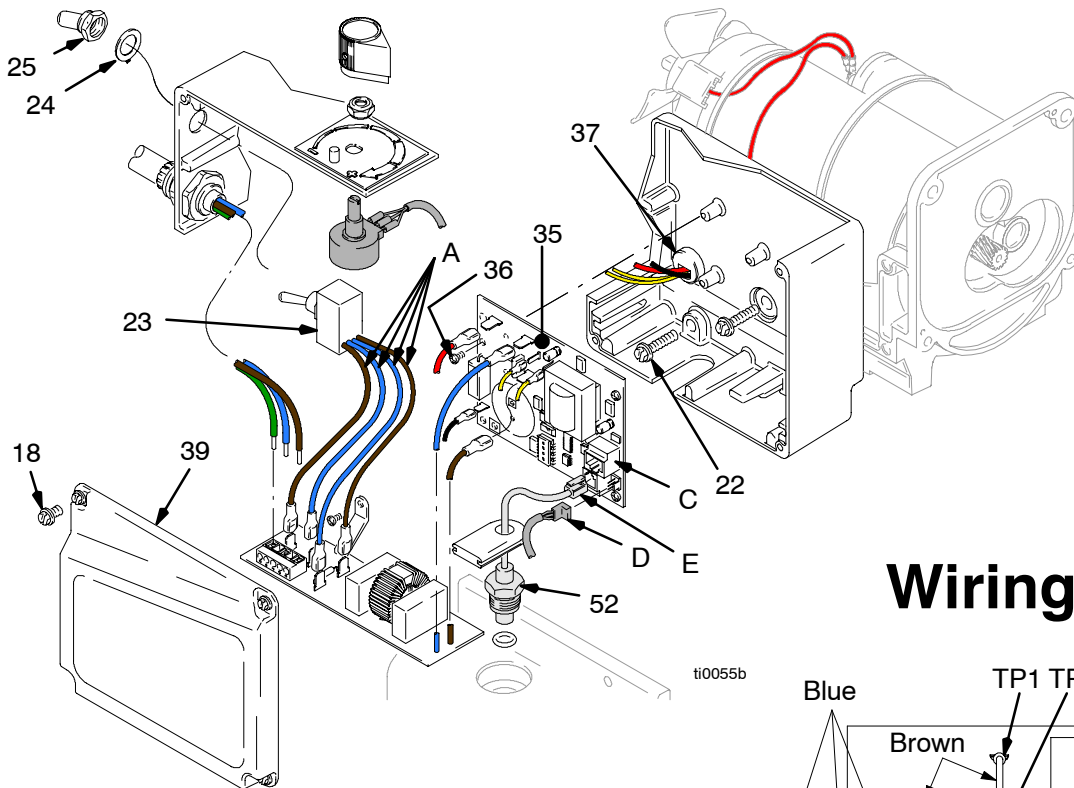
240 Vac (232906)

Removal

1.  Relieve pressure; page 6.
2. Fig. 14. Remove pressure control cover (39).
3. Disconnect four wires (A) at ON/OFF switch (23).
4. Remove toggle boot (25) and locking ring (24). Remove ON/OFF switch (23).

Installation

1. Install new ON/OFF switch (23). Install locking ring (24) and toggle boot (25).
2. Connect four wires (A) to ON/OFF switch.
3. Install pressure control cover (39).



Wiring Diagram

Caution

Heat from inductor coil of filter board may destroy wire insulation that comes in contact with it. Exposed wires could cause shorts and component damage. Bundle and tie all loose wires so none lay in contact with inductor coil of filter board.

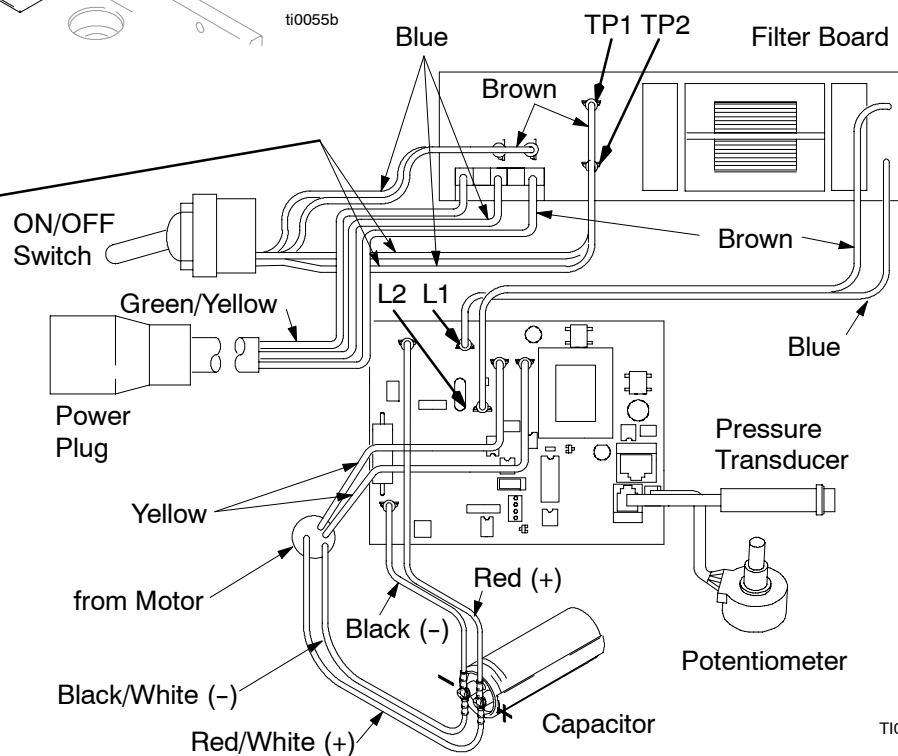


Fig. 14

Pressure Control Repair

Motor Control Board Diagnostics

For these models and series only:

232900 A, B, C, D, E

232901 A, B, C, D



233797 A, B, C, D

233815 A, B, C, D


232903 A, B

232906 A, B

1. Remove four screws (18) and cover (39).
2. Turn ON/OFF switch ON.
3. Observe LED operation and reference following table:

4.   Relieve pressure and unplug sprayer before servicing control board; page 6.

Note: Keep a new transducer on hand to use for test.

 CAUTION
Do not allow sprayer to develop fluid pressure without transducer installed. Leave drain valve open if test transducer is used.

LED BLINKS	SPRAYER OPERATION	INDICATES	WHAT TO DO
Once	Sprayer runs	Normal operation	Do nothing
Once and stays ON	Sprayer shuts down and LED stays ON	Motor open circuit or bad control board	Check motor brushes and armature. If OK, replace motor control board.
Two times repeatedly	Sprayer shuts down and LED continues to blink two times repeatedly	Run away pressure. Pressure greater than 4500 psi (310 bar, 31 MPa).	Replace motor control board. See following Motor Control Board procedure.
Three times repeatedly	Sprayer shuts down and LED continues to blink three times repeatedly	Pressure transducer is faulty or missing	Check transducer connection. Open drain valve. Substitute new transducer for transducer in sprayer. If sprayer runs, replace transducer.
Four times repeatedly	Sprayer shuts down and LED continues to blink four times repeatedly	Line voltage is too high	Check for voltage supply problems
Five times repeatedly	Sprayer shuts down and LED continues to blink five times repeatedly	Too much current	Check for locked rotor, shorted wiring or motor. Repair or replace failed parts.
Six times repeatedly	Sprayer shuts down and LED continues to blink six times repeatedly	Motor thermal switch open circuit	Check for binding in pump or drive. Check for bad motor.

Pressure Control Repair

Motor Control Board

For these models and series only:

232900 A, B, C, D, E

232901 A, B, C, D

233797 A, B, C, D


233815 A, B, C, D

232903 A, B

232906 A, B

Removal

Refer to Fig. 10 and 11, 13 or 14 depending on sprayer voltage.

-  1. Relieve pressure; page 6.
2. Remove four screws (18) and cover (39).
3. Disconnect at motor control board (35):
 - Filter board (X) (not 120 Vac sprayers).
 - Four motor leads: two yellow, black (-) and red (+).
 - Two line voltage leads.
 - Lead (D) from potentiometer.
 - Lead (E) from transducer.
4. Remove five screws (36) and circuit board (35).

Installation

1. Clean pad on rear of motor control board. Apply small amount of thermal compound 073019 to pad.
2. Fig. 10. Install motor control board (35) with five screws (36).
3. Connect to motor control board (35):
 - Lead (E) to transducer.
 - Lead (D) to potentiometer.
 - Two line voltage leads.
 - Four motor leads: two yellow, black (-) and red (+).
 - Filter board (X) (not 120 Vac sprayers).
4. Bundle and tie all loose wires so none lay in contact with inductor coil on filter board (not 120 Vac sprayers). See **Wiring Diagram CAUTION**, Fig. 13 or 14.
5. Install cover (39) with four screws (18).

Pressure Control Repair

For these models and series only:

232900 A, B, C, D, E

232901 A, B, C, D

233797 A, B, C, D

233815 A, B, C, D



232903 A, B

232906 A, B

Pressure Control Transducer

Removal

Refer to Fig. 10 and 11, 13 or 14 depending on sprayer voltage.

1.   Relieve pressure; page 6.
2. Remove four screws (18) and cover (39).
3. Disconnect lead (E) from motor control board (35).
4. Remove two screws (22) and filter housing (45).
5. Thread transducer lead plastic connector down through transducer grommet (28).
6. Remove pressure control transducer (52) and packing o-ring (51) from filter housing.



Installation

1. Install packing o-ring (51) and pressure control transducer (52) in filter housing (45). Torque to 30-35 ft-lb.
2. Thread transducer lead plastic connector up through transducer grommet (28).
3. Install filter housing (45) with two screws (22).
4. Connect lead (E) to motor control board (35).
5. Install cover (39) with four screws (18).

Pressure Adjust Potentiometer

Removal

Refer to Fig. 10 and 11, 13 or 14 depending on sprayer voltage.

1.   Relieve pressure; page 6.
2. Remove four screws (18) and cover (39).
3. Disconnect all leads from motor control board (35).
4. Remove five screws (36) and board (35)
5. Remove potentiometer knob (27), sealing shaft nut (33) and pressure adjust potentiometer (26).

Installation

1. Install pressure adjust potentiometer (26), sealing shaft nut (33) and potentiometer knob (27).
 - a. Turn potentiometer fully clockwise.
 - b. Install knob at full clockwise position.
2. Install board (35) with five screws (36).
3. Connect all leads to motor control board (35).
4. Install cover (39) with four screws (18).

Pressure Control Repair

For these models and series only:

232900 F


232901 E

233797 E

233815 E

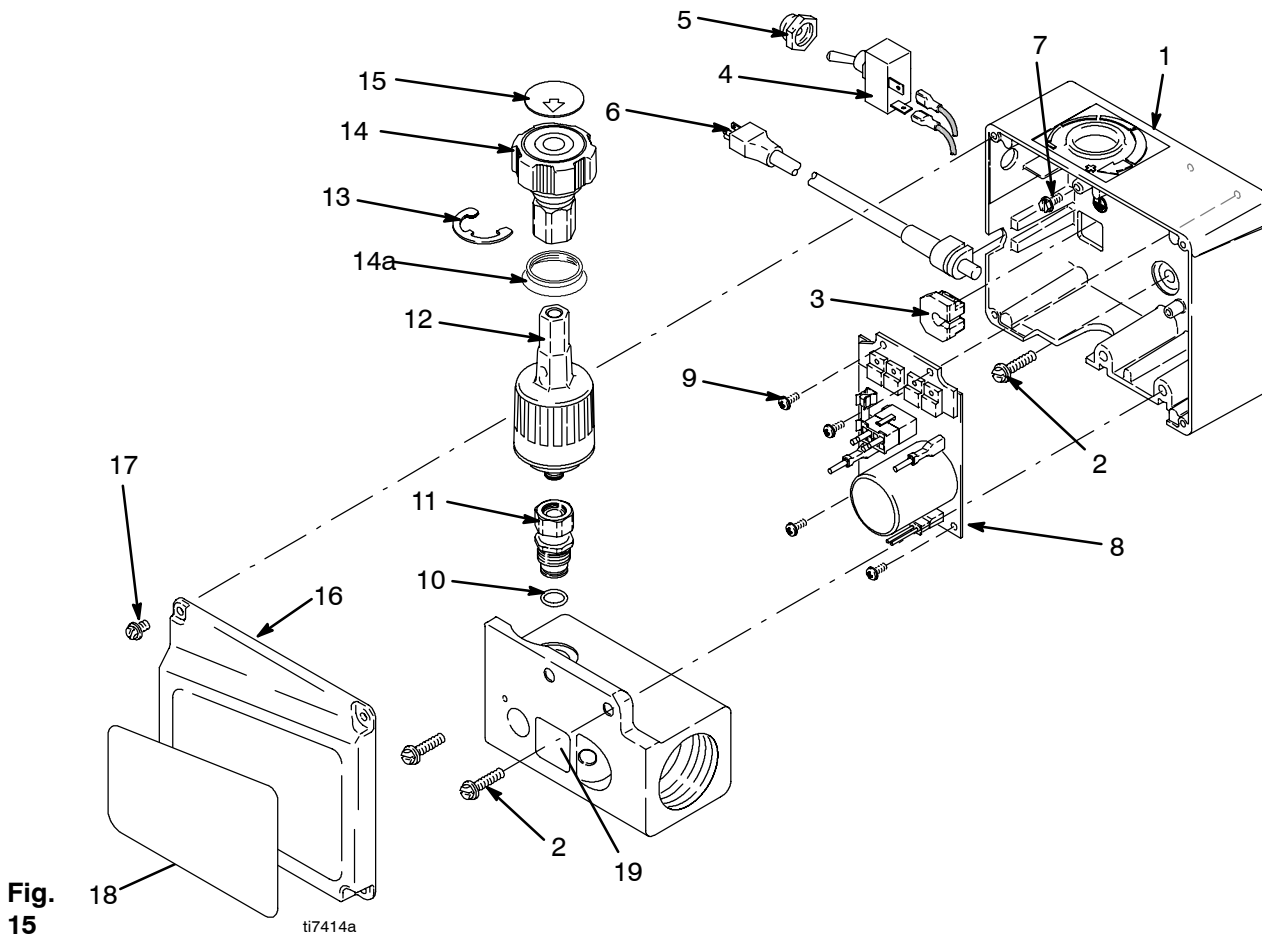
Motor Control Board

Removal

1.  Relieve pressure; page 6.
2. Remove 4 screws (17) and control cover (16).
3. Disconnect motor connector, pressure control connector white wire to control board (8) and black wire to switch (4).
4. Remove 4 screws (9) and control board (8).

Installation

1. Assemble control board (8) with 4 screws (9).
2. Connect motor connector, pressure control connector white wire to control board (8) and black wire to switch (4).
3. Install cover (16) with 4 screws (17).



Pressure Control Repair

For these models and series only:

232900 F


232901 E

233797 E

233815 E

Pressure Control

Removal (See Fig. 15)

1.  Relieve pressure; page 6.
2. Remove 4 screws (17) and control cover (16).
3. Disconnect pressure control connector from control board (8).
4. Remove clip (13) from control knob (14). Slide knob (14) off of pressure control (12) and remove knob (14) and baffle (14a) from control box (1).
5. Disconnect high pressure hose at pump.
6. Remove 2 screws (2) from fluid manifold and remove manifold from sprayer.
7. Remove pressure control (12) from fitting (11).

Installation (See Fig. 15)

NOTE: The pressure control has been preset at the factory to the design stall pressure.


1. Apply red thread locking adhesive (provided in kit) to the brass threads of the pressure control (12).
2. Assemble pressure control (12) into fitting (11) and torque to 140 in. lbs (12 ft. lbs). Do not pinch or damage the wires on the pressure control.
3. Assemble the fluid manifold to the control box with 2 screws (2).
4. Connect the high-pressure hose at pump.
5. Turn pressure control (12) fully clockwise to maximum pressure.
6. Slide knob (14) and baffle (14a) onto stem of pressure control (12). Install clip 13.
7. Install label (15) on knob (14) with indicator pointing at “+” on the control box (1).
8. Attach pressure control connector to control board (8).
9. Install cover (16) with 4 screws (17).

Drive Housing Replacement

⚠ CAUTION

Do not drop gear cluster (7) when removing drive housing (10). Gear cluster may stay engaged in motor front end bell or drive housing.

Disassembly

1.  Relieve pressure; page 6.
2. Remove pump (13); **Displacement Pump Replacement**, page 26.
3. Fig. 16. Remove two screws (18a). Tip sprayer up. Remove two screws (18b) and remove shroud (74).
4. Remove two front screws (22).

5. Remove two back screws (22).
6. Pull drive housing (10) off of motor (1).

Assembly

1. Push drive housing (10) onto motor (1).
2. Install two front screws (22).
3. Install two back screws (22).
4. Fig. 16. Install shroud (74) with two screw (18a). Tip sprayer up. Install two screws (18b).
5. Install pump (13); **Displacement Pump Replacement**, page 26.
6. Install new access cover (10a) with two screws (10b).

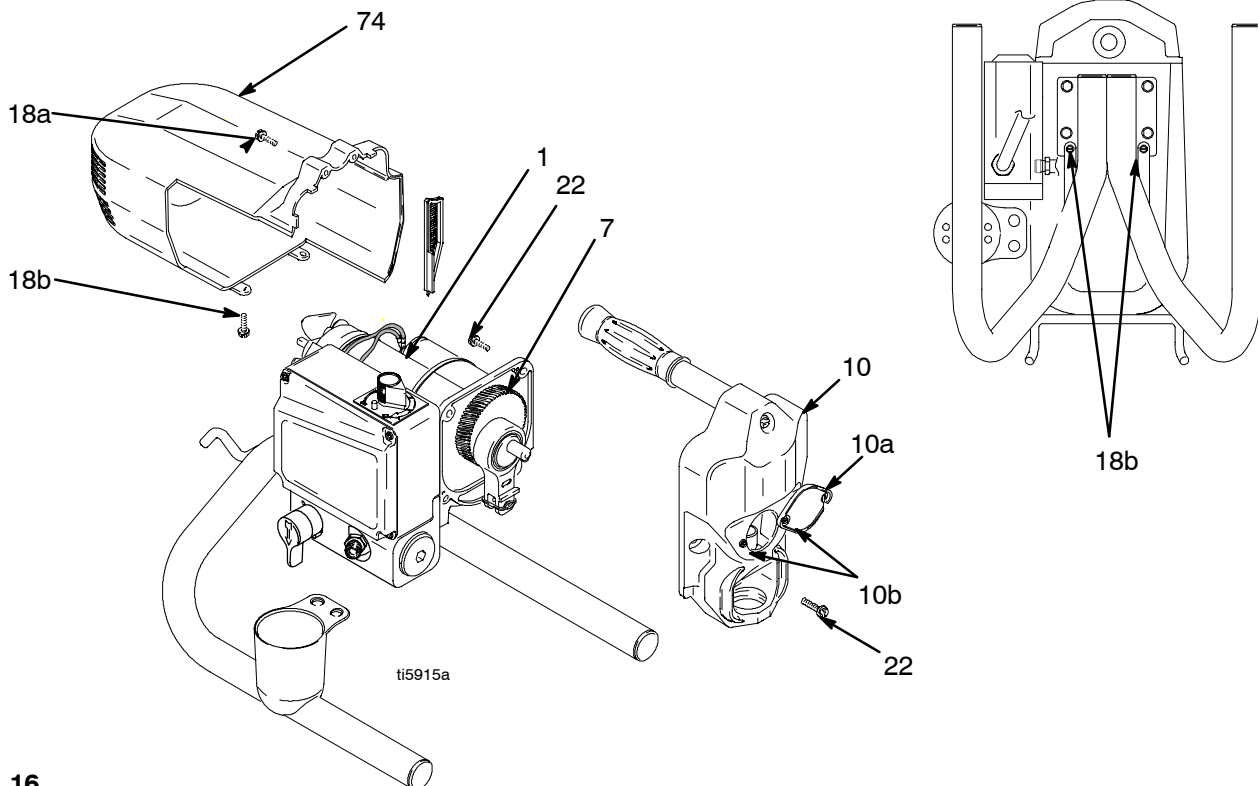



Fig. 16

Motor Replacement

Disassembly

1.  Relieve pressure; page 6.
2. Remove pump; **Displacement Pump Replacement**, page 26.

CAUTION

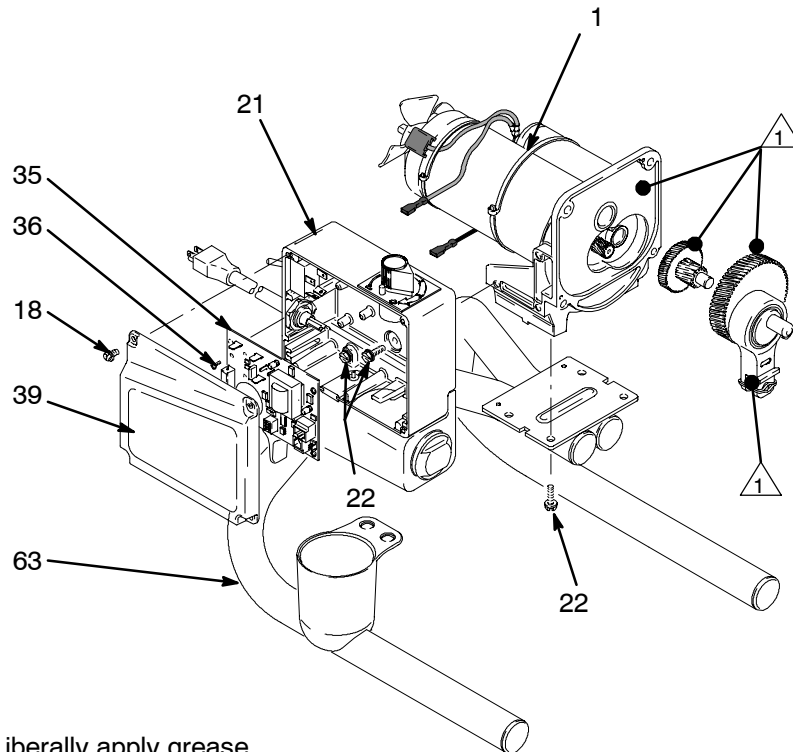
Do not drop gear cluster (7) when removing drive housing (10). Gear cluster may stay engaged in motor front end bell or drive housing.


3. Remove drive housing; **Drive Housing Replacement**, page 24.
4. Remove fluid manifold; **Pressure Control Replacement**, page 23.
5. Remove control board; **Control Board Replacement**, page 20 or 22.
6. Remove strain relief (37; Fig. 10, 13 or 14) and motor fan (2).

7. Remove three screws (22) behind board and remove control housing (21).
8. Remove four screws (22) and motor (1) from frame (63).

Assembly

1. Install new motor (1) on frame (63) with four screws (22).
2. Install control housing (21) with three screws (22).
3. Install strain relief (37; Fig. 10, 13 or 14) and motor fan (2).
4. Install fluid manifold; **Pressure Control Replacement**, page 23.
5. Install control board; **Control Board Replacement**, page 20 or 22.
6. Install drive housing (10); **Drive Housing Replacement**, page 24.
7. Install pump (13); **Displacement Pump Replacement**, page 26.



 Liberally apply grease

ti0054b


Fig. 17

Displacement Pump Replacement

See manual 309060 for pump repair instructions.

See manual 309064 or 309065 for sprayer part number references.

Removal

1. Flush pump (13).
2.  Relieve pressure; page 6.
3. Fig. 18. Loosen two screws (10b) and rotate cover (10a).

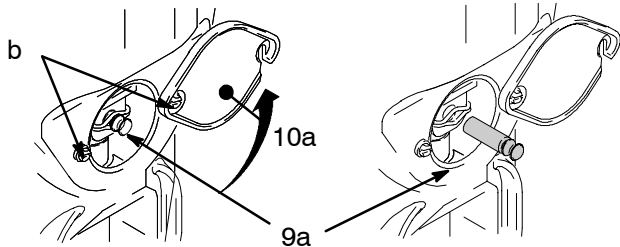


Fig. 18 9573A

4. Cycle pump until pump pin (9a) is in position to be removed. Remove pump pin (9a).

5. Fig. 19. Remove suction tube (78) and hose (19).
6. Loosen pump jam nut (12). Unscrew pump.

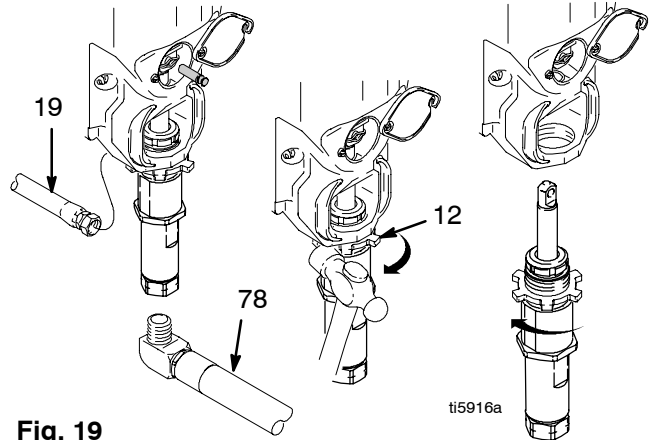


Fig. 19 ti5916a

Installation

⚠ WARNING

If pin works loose, parts could break off due to force of pumping action. Parts could project through the air and result in serious injury or property damage.

⚠ CAUTION

If the pump locknut loosens during operation, the threads of the drive housing will be damaged.

1. Fig. 20. Extend pump piston rod fully. Apply grease to top of pump rod at (A) or inside connecting rod.

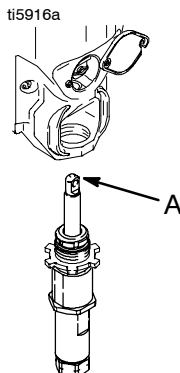


Fig. 20 TI0062

2. Fig. 18. Install pump pin (9a). Verify retainer spring (9b) is in groove of pump pin.

3. Push pump up until pump threads engage.
4. Screw in pump until threads are flush with drive housing opening. Align pump outlet to back.
5. Fig. 21. Install suction tube (78) and hose (19).
6. Fig. 21. Screw jam nut (12) up onto pump until nut stops. Tighten jam nut by hand, then tap 1/8 to 1/4 turn with a 20 oz (maximum) hammer to approximately 75 +/- 5 ft-lb (102 N·m).

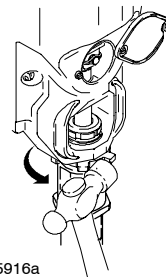


Fig. 21 ti5916a

7. Fig. 22. Fill packing nut with Graco TSL until fluid flows onto top of seal.

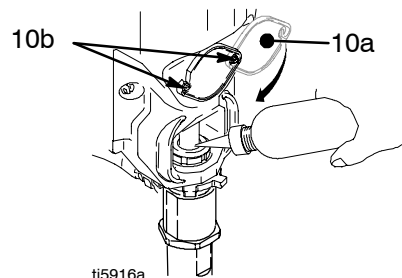


Fig. 22 ti5916a

8. Fig. 18. Rotate cover (10a); tighten screws (10b).

Technical Data

100-120V, Ø, A, Hz	220-240V, Ø, A, Hz	Generator Minimum W	Motor HP (W)	Cycles per gallon (liter)	Maximum Delivery gpm (lpm)	Maximum Tip size	Fluid Outlet npsm
1, 15, 50/60	1, 10, 50/60	3000	7/8 (653)	680 (180)	0.38 (1.25)	0.019	1/4 in.

Basic Sprayer Wetted Parts:
 zinc-plated carbon steel, polyurethane, polyethylene,
 stainless steel, PTFE, Delrin®, chrome plating, leather,
 V-Max™ UHMWPE, aluminum, stainless steel,
 tungsten carbide

NOTE: Delrin® is a registered trademarks of the DuPont Co.

Dimensions

Weight lb (kg)	Height in. (cm)	Length in. (cm)	Width in. (cm)
34.5 (15.7)	17.75 (45.1)	14.5 (36.8)	13.5 (34.3)

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MM 309063

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