JACOBSEN

TEXTRON

SERVICE & REPAIR INSTRUCTIONS

LF-3400 & LF-3800

LF-3400 2 Wheel Drive
Product No. 67839
Product No. 67869

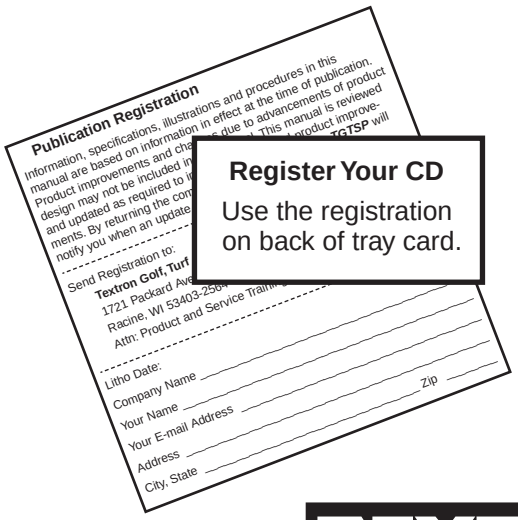
LF-3800 2 Wheel Drive
Product No. 67837
Product No. 67866

LF-3400 4 Wheel Drive
Product No. 67840
Product No. 67869

LF-3800 4 Wheel Drive
Product No. 67838
Product No. 67867

LF-3400 4 Wheel Drive Turbo Engine
Product No. 67889

Includes Attachments and Product Options



TEXTRON
GOLF, TURF & SPECIALTY PRODUCTS

Litho in U.S.A. 5/01

WARNING: If incorrectly used this machine can cause severe injury. Those who use and maintain the machine should be trained in its proper use, warned of its dangers and should read the entire manual before attempting to set up, operate, adjust or service the machine.

CD-SRI-3400/3800

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SECTION 1
INTRODUCTION

SECTION 1A. GENERAL INFORMATION

CONTENTS

This manual contains repair instructions for major tractor components, attachments and options. The Table of Contents at the start of each section lists contents of that section. Sections are identified by tabs in the right hand margin.

This manual is to be used in conjunction with the Operator's Manual and Parts Catalog.

Normal maintenance, adjustment, and operating procedures are also covered in the user Operator's Manual and are only included where appropriate in this Service and Repair Manual.

Engine repair is not covered in this manual. Refer to the appropriate engine manufacturer's instructions for engine service and repair.

This manual includes all removal, disassembly, inspection, repair, reassembly, installation, adjustment, and testing procedures. If you, as user of this machine, do not consider yourself or your repair facilities capable of a given procedure, please consult your dealer or distributor.

Information, specifications, illustrations, and procedures in this manual are based on information in effect at the time this manual was published. Improvements and product changes due to continual advancements of the product design may cause changes to your product that may not be included in this manual. Each manual is reviewed and updated as required to include changes and product improvements.

Read each section completely before proceeding with specific repairs in that section. You will minimize errors by understanding what you will be doing and how the component relates to others in its system. Lists of repair tools and materials for each section of the manual are given at the start of that section.

The designations L.H. (left hand) and R.H. (right hand) used throughout this manual refer to the operator's left or right when sitting in the normal operating position.

REGISTRATION

A registration card is provided in the back of this manual (bottom portion of page). Fill out the card, remove and mail immediately upon opening the manual for the first time.

The registration entitles you to receive manual updates for a period of two years. Updates are sent free of charge.

NOTE

Only the original registration card will be accepted. Photo copies, cards from other manuals, suggestion cards, or any facsimile are not acceptable and will not constitute a registration.

INDEX NUMBERS

Illustrations showing removal, disassembly, reassembly and installation may have index numbers to call out the sequence of procedure.

Where the sequence of procedure is not important or self-evident (eg. linkages, hoses, clamps, etc.) index numbers are not included.

Repair procedures for items not subject to wear (eg. panels, brackets, frames) are not included in this manual except for the general procedures given below.

Exercise common sense during disassembly or reassembly; remove only the items required to accomplish necessary repair or service.

REPLACEMENT PARTS

Use the appropriate Parts Catalog when ordering replacement parts. Follow installation instructions shipped with service parts or kits. When ordering parts, always give the serial number and product number of your machine as well as quantity, part number and description of the parts needed.

To eliminate error and speed delivery:

1. Write your NAME and ADDRESS on your order plainly.
2. Explain WHERE and HOW to make shipment.
3. Give PRODUCT NUMBER, NAME and SERIAL NUMBER that is stamped on the NAME and SERIAL PLATE of your product.
4. Order by QUANTITY DESIRED, the PART NUMBER and the DESCRIPTION OF PART.
5. Send your order to or visit your nearest dealer or distributor.
6. INSPECT ALL SHIPMENTS ON RECEIPT. If any parts are damaged or missing, file a claim with the carrier before accepting.
7. Do not return material to your dealer or distributor without a letter of explanation. Make a list of all returned parts, show your name and address, and include it with the shipment. TRANSPORTATION CHARGES MUST BE PREPAID.

SECTION 1A. GENERAL INFORMATION

SERIAL NUMBERS

See Figure 1A-1 for location of tractor assembly serial number.

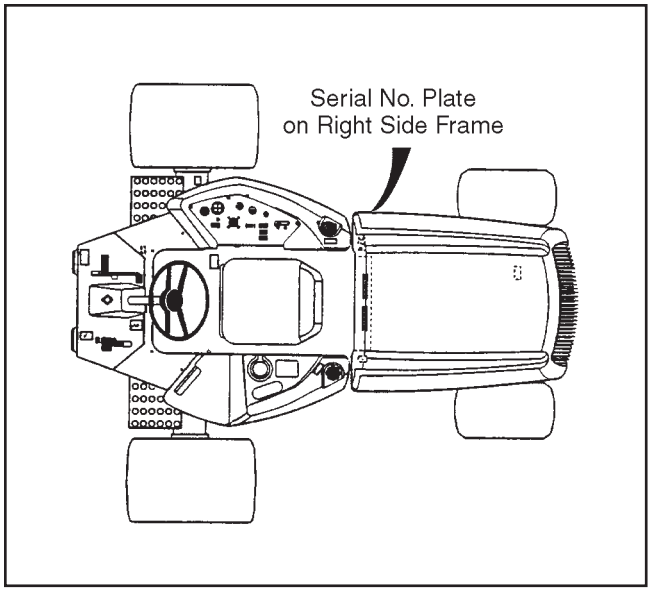

Figure 1A-1. Serial Number Location

GENERAL CLEANING

Improper cleaning and lubrication of your machine results in many equipment failures. Before any repairs are undertaken, thoroughly clean the exterior of the component to be removed.

Use a clean surface to lay out parts being removed. Keep lubricants clean and cover containers not being used. Plug or cap all hydraulic lines and ports to hydraulic components immediately after disconnecting.

SAFETY

Safety should always be the rule when working on or with machinery. Always use safe practices and common sense when using hand or power tools. Use the suggested procedures in this manual when working with the tractor.

Throughout this manual signal words will be used to highlight special procedures. The signal words and their meaning are as follows:

NOTE

Any procedure needing special care when performing a procedure.

⚠ CAUTION

Hazards or unsafe practices which *could* result in personal injury or product or property damage.

⚠ WARNING

Hazards or unsafe practices which *could* result in *severe* personal injury or death.

⚠ DANGER

Imminent hazards which *will* result in *severe* personal injury or death if precautions are not taken.

Decals on the machine denote cautions, warnings and dangers. These cautions, warnings and danger decals must be on the machine at all times. If they become worn, torn or painted over, new decals should be installed as shown in Section 14 of this manual.

⚠ CAUTION

Disconnect leads at alternator before electric welding is done on components in common ground with engine.

⚠ DANGER

This machine is equipped with an interlock system which is intended to protect the operator and others from injury, by preventing the engine from starting, unless the reel switch is in the “Off” position, traction pedal is in the “Neutral” position and the brake set. The system also shuts off the engine if the operator leaves the seat with the reel switch in “Cut” position. In the interest of safe operating conditions, this machine must never be operated with the interlock relays or interlock system disconnected or malfunctioning.

TORQUE VALUES

Torque values are given in the following “Torque Specification Chart”. Special torque values are called out on illustrations and text throughout this manual.

SECTION 1A. GENERAL INFORMATION

TORQUE SPECIFICATIONS

STANDARD SAE GRADE #5 SCREWS

Size	Torque Values	Size	Torque Values
8-32	27-33 in-lbs. (3-4 N.m)	½-13	67-83 ft-lbs. (90-113 N.m)
8-36	28-34 in-lbs. (3-4 N.m)	½-20	81-99 ft-lbs.(110-134 N.m)
10-24	39-47 in-lbs. (4-5 N.m)	9/16-12	99-121 ft-lbs. (134-164 N.m)
10-32	44-54 in-lbs. (5-6 N.m)	9/16-18	108-132 ft-lbs. (146-179 N.m)
¼-20	7-9 ft-lbs. (9-12 N.m)	⅝-11	135-165 ft-lbs. (183-223 N.m)
¼-28	9-11 ft-lbs. (12-15 N.m)	⅝-18	162-198 ft-lbs. (220-268 N.m)
5/16-18	15-18 ft-lbs. (20-24 N.m)	¾-10	234-286 ft-lbs. (317-388 N.m)
5/16-24	17-21 ft-lbs. (23-28 N.m)	¾-16	270-330 ft-lbs. (366-447 N.m)
⅜-16	27-33 ft-lbs. (37-45 N.m)	⅞-9	360-440 ft-lbs. (488-597 N.m)
⅜-24	31-39 ft-lbs. (42-53 N.m)	⅞-14	396-484 ft-lbs. (537-656 N.m)
7/16-14	45-55 ft-lbs. (61-75 N.m)	1-8	522-638 ft-lbs. (708-865 N.m)
7/16-20	49-61 ft-lbs. (66-83 N.m)	1-12	576-704 ft-lbs. (780-954 N.m)

NOTE: These torque values are to be used for all hardware excluding: locknuts, self-tapping screws, thread forming screws, sheet metal screws and socket head setscrews.

METRIC

Diameter — Coarse Thread	Metric Grade							
	5.6		8.8		10.9		12.9	
	N.m	ft-lbs.	N.m	ft-lbs.	N.m	ft-lbs.	N.m	ft-lbs.
M6	4.6	3.3	10.5	7.7	15	11	18	13
M7	7.8	5.6	17.5	12.9	26	18.4	29	21.3
M8	11	8.1	26	19	36	26	43	31
M10	22	16	51	37	72	53	87	64
M12	39	28	89	66	125	92	150	110
M14	62	45	141	103	198	146	240	177
M16	95	70	215	158	305	224	365	269
M18	130	95	295	217	420	309	500	368
M20	184	135	470	309	590	435	710	623

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SECTION 2
CONTROLS

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SECTION 2A. REPAIR AND SERVICE TOOLS AND MATERIALS

Tools required:	Standard automotive hand tools.
Cleaning materials:	Stoddard or equivalent solvent. Detergent and water.
Lubricants:	Refer to Section 11.

SECTION 2B. FAILURE ANALYSIS

GENERAL

The following table gives common problems, probable causes and suggested remedies with page references to detailed description of remedial procedures.

PROBLEM	PROBABLE CAUSE	REMEDY
1. Engine turns over but will not start.	a. Glow plug defective.	a. Test and replace (if necessary) glow plug (Section 10L).
	b. Fuel supply.	b. Check fuel supply.
	c. Fuel filter.	c. Change.
	d. Fuel solenoid inoperative.	d. Test solenoid (Section 10K).
2. Engine does not turn over.	a. Traction pedal not in “neutral”.	a. Adjust traction pedal (Section 2C).
	b. Brake pedal not latched.	b. Set brake.
	c. Mower switch in ON position.	c. Move switch to OFF.
	d. One of several switches damaged or loose.	d. Test switches and adjust if required (Section 10G).
	e. Neutral start switch out of adjustment or defective.	e. Adjust switch (Section 2C). Test switch (Section 10G).
	f. Battery defective or bad ground.	f. Test battery (Section 10D).
3. Engine speed does not increase when throttle control is moved.	a. Throttle control is not properly adjusted.	a. Adjust (Section 2C).
	b. Throttle control is broken.	b. Repair or replace (Section 2C).
	c. Fuel shutoff solenoid linkage is not properly adjusted.	c. Adjust linkage (Section 2C).
	d. Fuel shutoff solenoid is not functioning properly.	d. Perform test (Section 10K).
4. The unit “creeps” in either direction when the traction pedal is not depressed.	a. Traction pedal linkage out of adjustment.	a. Adjust traction (Section 2C).
5. Parking brake fails.	a. Brake not adjusted.	a. Adjust brake (Section 2C).
	b. Worn brake disks or linings.	b. Replace disks or linings (Section 5B).
6. Mowers do not lift or lower properly as lift/lower pedal is activated.	a. Lift/lower lever switches faulty.	a. Test, replace if necessary (Section 10G).
	b. Control valve leaking or defective.	b. Test valve (Section 8O). Repair valve (Section 8M), depending on serial number.
	c. Faulty lift limit switch adjustment.	c. Adjust (Section 2C).
	d. Faulty lift cylinder.	d. Test and repair cylinder (Section 8M).

SECTION 2C. CONTROL ADJUSTMENTS

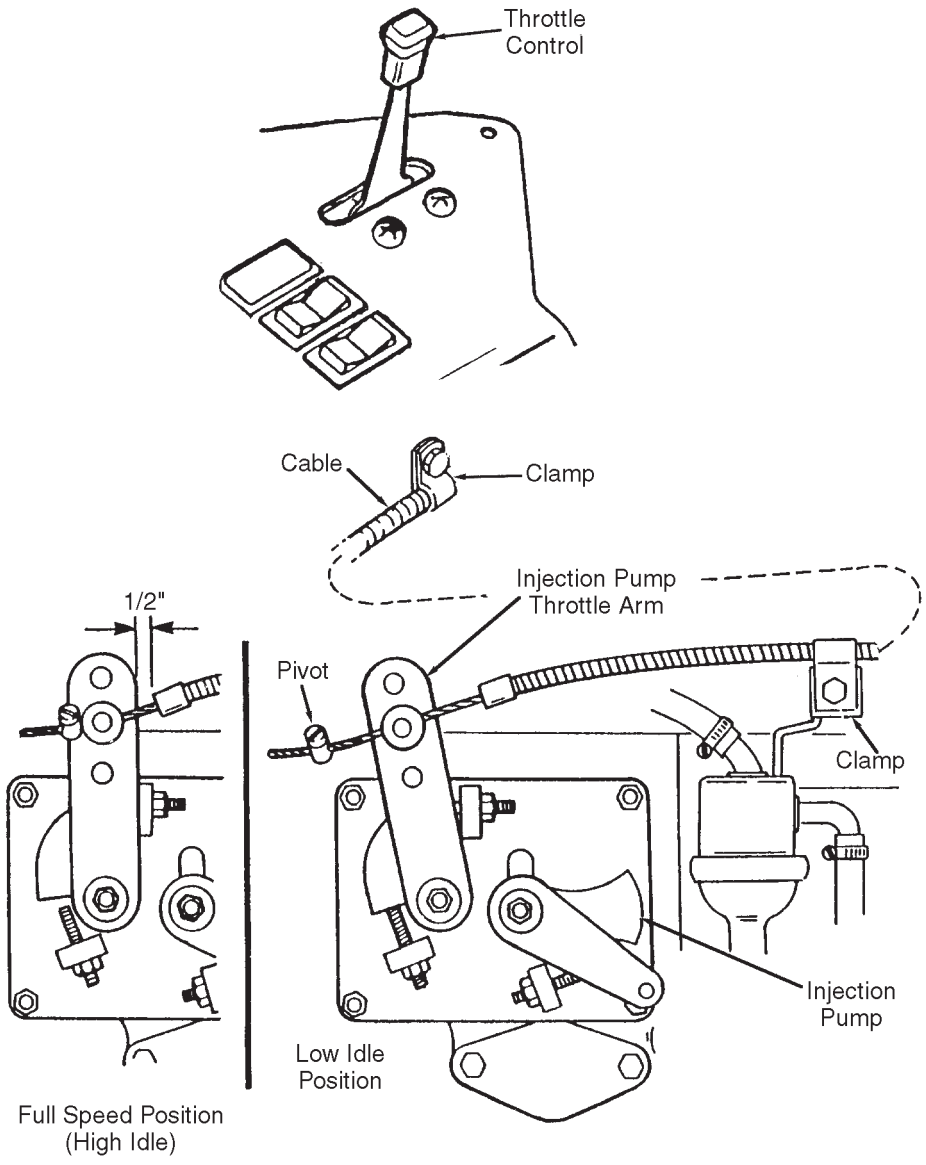
GENERAL

The repair of controls is limited to adjustment of linkages, straightening of bent rods or replacement of defective parts and hardware.

Control functions are monitored by an electronic controller at the front of the engine compartment. See Section 10 for electronic controller tests/repairs.

THROTTLE ADJUSTMENT (See Figure 2C-1)

Located on the control panel to the right of the operators seat, the throttle control is used to regulate engine speed. Adjust the throttle as shown in Figure 2C-1.



STEP 1

Push throttle to high idle position. Push injector pump throttle arm to the high idle (speed position.

STEP 2

Slide outer cable housing in clamp until housing is 1/2 inch from injector pump throttle lever. Tighten clamp.

STEP 3

Install wire stop against injector pump throttle pivot and tighten.

STEP 4

Start engine and check low and high idle speeds of engine. Low idle should be 1330 RPM and high is 3150 RPM. Make fine adjustments using the injector pump throttle arm stop screws.

Figure 2C-1. Throttle Control Adjustment

SECTION 2C. CONTROL ADJUSTMENTS

TRACTION SPEED ADJUSTMENT (See Figure 2C-2)

Forward and reverse speeds are adjusted at the traction pedal. Set forward speed before adjusting reverse.

To adjust forward speed:

1. Make sure traction pedal has been set to neutral and engine throttle is adjusted correctly.
2. Start engine and check forward travel speed with engine at full throttle and tractor in two wheel drive (2WD). Forward transport speed should measure 12 mph (19 kph).
3. Stop engine. To adjust speed, disconnect eye bolt from pedal and loosen jam nut. Turn eye bolt in to reduce speed, out to increase speed. Tighten jam nut to hold adjustment in place and connect eye bolt.
4. With traction pedal in neutral, check position of neutral switch. Adjust switch up or down so pointer on traction pedal bracket is centered over it. When adjusted correctly, lamp 5 on electronic controller will light when ignition switch is turned to ON.
5. Start engine and check speed. Repeat procedure until 12 mph (19 kph) forward transport speed is attained.

To adjust reverse speed:

1. Set forward speed.
2. Start engine and check reverse travel speed with engine at full throttle. Reverse speed should measure 4 to 5 mph (6 to 8 kph).
3. Stop engine. To adjust speed, loosen nut on reverse travel stop bolt. Slide bolt forward in slotted hole to increase speed, back to reduce speed. Tighten nut to hold adjustment in place.

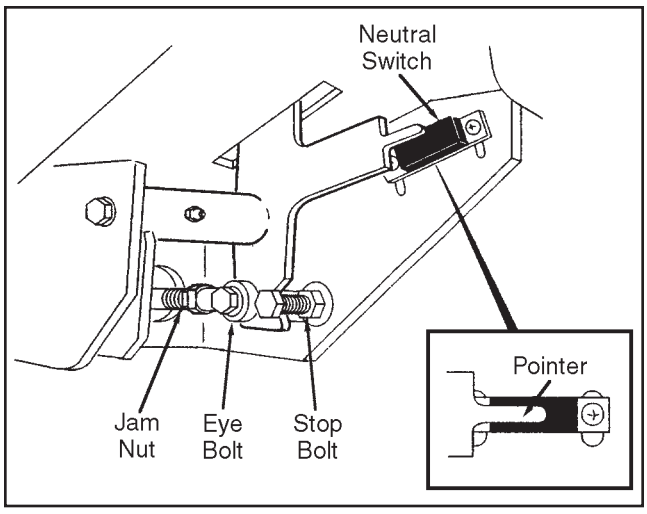


Figure 2C-2. Traction Speed Adjustment

4. Start engine and check speed. Repeat procedure until 4 to 5 mph (6 to 8 kph) reverse speed is attained.

TRACTION NEUTRAL ADJUSTMENT

Neutral adjustment can only be made at the traction pump.

The neutral adjustment is preset at the factory on all new tractors and replacement pumps. Further adjustment is not required unless the pump has been disassembled for repair or service.

1. Disconnect traction pedal linkage from pump.
2. Place tractor securely on jack stands so **all** wheels are raised off ground.
3. Check that tow valve is closed (see Figure 2C-3).
4. Engage parking brake and set mow switch to neutral. Make sure neutral switch at traction pedal is closed (see Figure 2C-2).
5. See Figure 2C-3. Loosen adjusting screws just enough to move the pump lever. Start engine and observe wheels. Adjust pump bracket in slotted holes until wheels do not turn. Turn off engine and tighten adjusting screws.
6. Connect traction linkage. When connecting linkage at traction pedal make sure pointer on traction pedal bracket is centered over neutral switch (see Figure 2C-2).
7. Start engine and check operation of traction pedal. Wheels must not turn when pedal returns to neutral and lamp 5 on electronic controller should light.

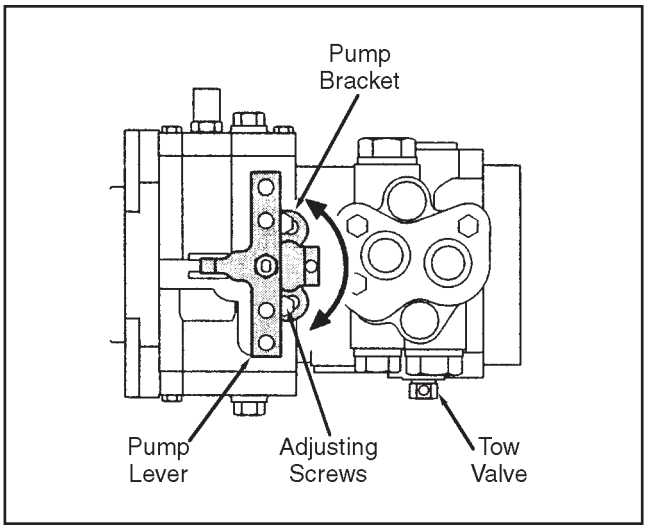


Figure 2C-3. Traction Neutral Adjustment

SECTION 2C. CONTROL ADJUSTMENTS

MOW SPEED ADJUSTMENT (See Figure 2C-4)

To set mow speed, loosen jam nut and turn mow speed stop upward to reduce speed and downward to increase speed. Tighten jam nut after desired speed is obtained.

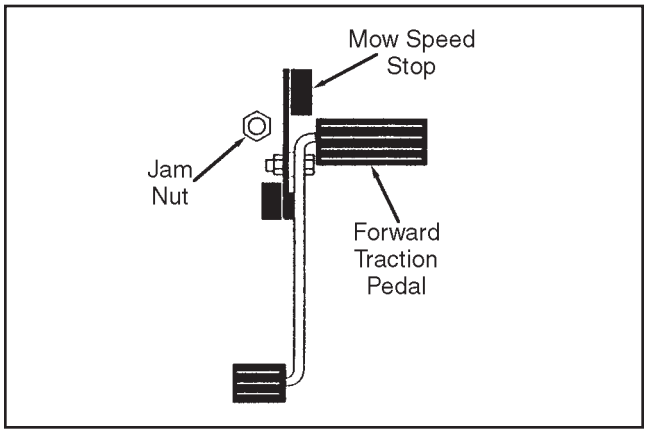


Figure 2C-4. Mow Speed Adjustment

BRAKE ADJUSTMENT (See Figure 2C-5)

The brake pedal free travel should be 1 inch (25 mm) before the brake pads engage the brake disk. To adjust pedal free travel, proceed as follows:

1. Loosen adjusting nuts.
2. Tighten brake cables to obtain 1 inch (25 mm) free travel, then tighten adjusting nuts.
3. If brakes wear beyond point where they can be adjusted by the cable, move brake bracket into second set of holes provided and complete adjustment procedure.

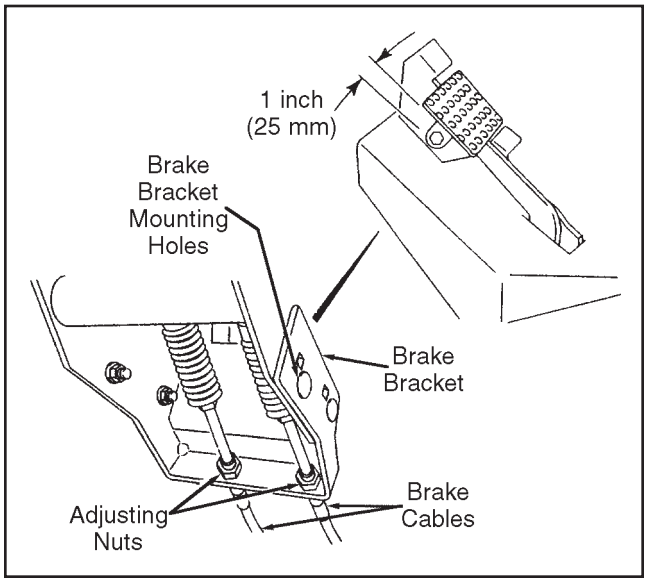


Figure 2C-5. Brake Adjustment

4. Start tractor and check operation of brakes. Park tractor on an incline (approximately 16.7° slope) and engage parking brake. Brake must prevent tractor from rolling.

REEL LIMIT SWITCH ADJUSTMENT (See Figure 2C-6)

The front left and right lift arms are equipped with proximity limit switches which signal the controller to turn off the reels. The switches are mounted to the tractor frame directly behind the lift arms. If reels continue to run when lifted, or do not run when lowered inspect switch. Adjust or replace switch as needed.

1. Park tractor on a flat, level surface.
2. Remove reel from lift arm.
3. Turn ignition key to the RUN position to activate controller. Do not run reels or start engine.
4. Lift arm manually until it is at an angle of 17°.
5. With lift arm at 17°, adjust limit switch up or down, until corresponding lamp on controller goes out. Secure switch in this position.
6. Repeat procedure for lift arm on opposite side.
7. Start engine and check that reels turn off when raised.

NOTE

The reel switches set the point where the reels turn off, not how high they will raise. The reels will actually raise to a position slightly above 17°.

8. Start tractor and test operation of lift arms.

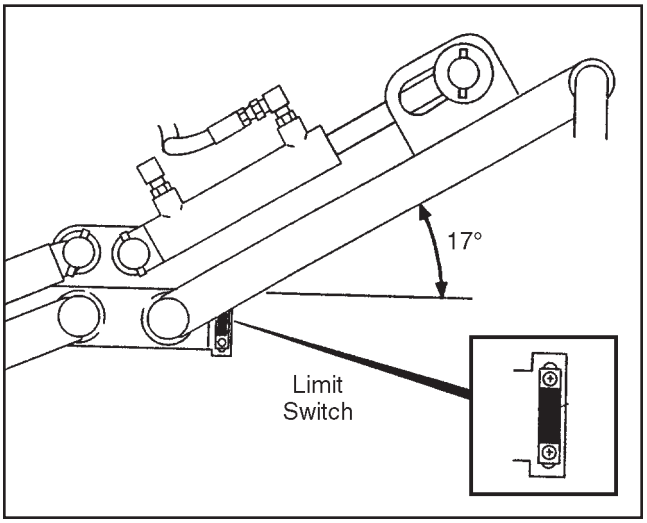


Figure 2C-6. Reel Limit Switch Adjustment

SECTION 2C. CONTROL ADJUSTMENTS

CRUISE CONTROL

There are no adjustments to the optional cruise control system. If your tractor is equipped with cruise control, and the control does not operate, test the cruise control magnet (located on the traction pedal bracket) and the cruise control rocker switch (on the operator control panel) as described in Section 10.

SECTION 2D. GAUGES AND INSTRUMENTS

REPAIR (See Figure 2D-1)

NOTE

Refer to Section 10 for test/repair of switches.

Repair of gauges and instruments is limited to replacement of defective components. See Figure 2D-1 and replace defective component as follows:

1. Disconnect battery ground (black) cable.
2. Label wires for proper identification and disconnect wiring.
3. Remove attaching hardware and replace defective instrument.
4. Connect wiring.
5. Connect battery ground cable.

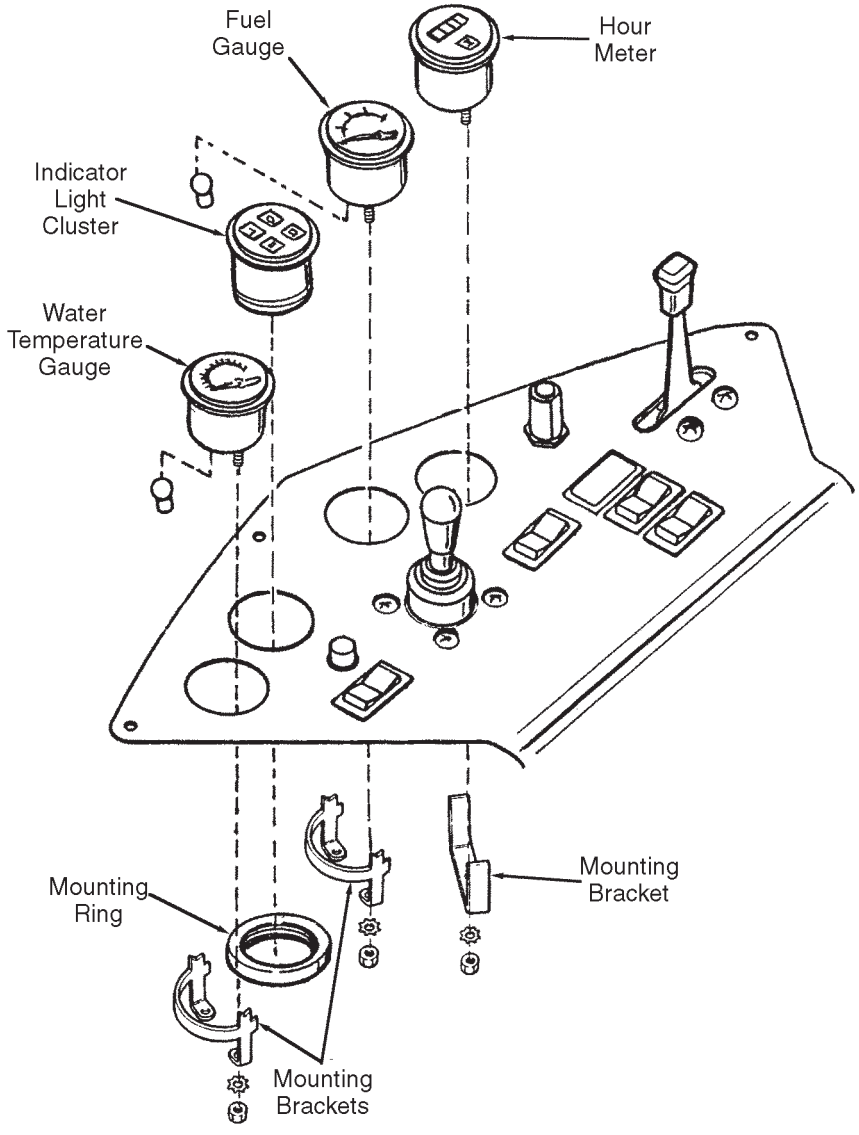


Figure 2D-1. Gauges and Instruments Removal and Replacement

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SECTION 3
ENGINE

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SECTION 3A. REPAIR AND SERVICE TOOLS AND MATERIALS

Tools required:	Standard automotive hand tools.
Cleaning materials:	Stoddard or equivalent solvent. Detergent and water. Anti-rust Never-Seize, Textron P/N 2810297.
Lubricants:	Refer to Section 11.
Other service items:	Compressed air source. Engine hoist.

SECTION 3B. FAILURE ANALYSIS

PROBLEM	PROBABLE CAUSE	REMEDY
1. Engine will not start.	a. Parking brake disengaged or mow switch on.	a. Engage brake, turn off mow switch.
	b. Glow plug has not timed out.	b. Reset ignition switch and allow glow plug to time out before cranking engine.
	c. Battery low on charge or defective.	c. Inspect condition of battery and battery connections.
	d. Fuel tank empty or dirty.	d. Fill with fresh fuel. Change fuel filter. Bleed fuel lines (Section 3D).
	e. Fuse blown.	e. Replace fuse.
	f. Relay defective.	f. Test and replace relay (Section 10).
	g. Traction pedal not in neutral.	g. Check position of pedal.
	h. Neutral switch on traction pedal out of adjustment or defective.	h. Adjust or replace switch (Sections 2 and 10).
2. Engine hard to start or runs poorly.	a. Fuel level low, fuel or fuel filter dirty.	a. Fill with fresh fuel. Change fuel filter. Bleed fuel lines (Section 3D).
	b. Air cleaner dirty.	b. Inspect and replace air filter (Section 3D).
	c. Injectors, fuel pump faulty.	c. Consult engine manufacturer's manual.
	d. Engine problem.	d. Consult engine manufacturer's manual.
3. Engine stops.	a. Fuel tank empty.	a. Fill with fresh fuel and bleed fuel lines (Section 3D).
	b. Interlocks not set before leaving operator's seat.	b. Engage parking brake and set mow switch to OFF.
4. Engine overheating.	a. Coolant level low.	a. Inspect and add coolant.
	b. Air intake restricted.	b. Clean air intake or radiator.
	c. Water pump belt broken or loose.	c. Tighten or replace belt.

SECTION 3C. GENERAL INSTRUCTIONS

CONTENTS

This section covers repairs to the engine associated components (eg. exhaust system, air cleaners, radiators). Removal and installation of the engine is also covered but engine repair is not included in this manual. Refer to the engine manufacturer's instructions for engine service and repair. The engine manual is available from your Golf, Turf & Specialty Products Dealer/Distributor.

NOTE

Tests for alternators, starters, and electronic controller are included in Section 10 of this manual. If these components are found faulty, refer to the engine manufacturer's manual for repair instructions.

The engine used on the LF-3400 is a Kubota liquid cooled V1305E 33.5 HP (25 kW) diesel or a Kubota V1505TE 44.2 HP (33 kW) turbocharged diesel.

The engine used on the LF-3800 is a Kubota V1505E 37.5 HP (28 kW) liquid cooled diesel.

CLEANING AND LUBRICATION

Thoroughly clean each component after removal from the machine. Follow engine manufacturer's instructions for lubrication of engine.

SECTION 3D. ENGINE

GENERAL

A separate engine operator's manual, prepared by the engine manufacturer is supplied with your tractor. Study the manual carefully until you are familiar with the maintenance, operation and adjustment of your equipment. Proper attention to the engine manufacturer's directions will assure maximum service life of the engine and highest operating efficiency.

AIR CLEANER SERVICE (See Figure 3D-1)

1. There is a filter minder indicator located on the air inlet tube. If the indicator shows an air restriction and has locked in the RED position proceed with Step 1. Loosen the retaining clamp and slide cover off of the air cleaner assembly. Empty dust from cover. Wipe clean with a clean damp cloth.
2. Grasp and slide element out of assembly.
3. Install a new element. Push in completely to seat seal against housing.
4. Secure cover with retaining clamp.
5. Push the button resetting the filter minder.

INSPECTION

1. Inspect the hose for cracks and wear, replace if damaged.
2. Inspect the element and air inlet housing for cleanliness and/or damage.

WARNING

DO NOT USE STARTING ASSIST FLUIDS. Use of starting assist fluids in the air intake system may be potentially explosive or cause a "RUN-AWAY" engine condition. This could result in serious engine damage and/or personal injury.

RADIATOR SERVICE (See Figure 3D-2)

CAUTION

Never open radiator cap while engine is running or soon after it stops. Hot water sometimes shoots out if the radiator cap is opened while the engine is hot.

CHANGING COOLANT

1. Open the drain cock and radiator cap, drain coolant into a clean container.
2. Flush the inside of the radiator with clean water.

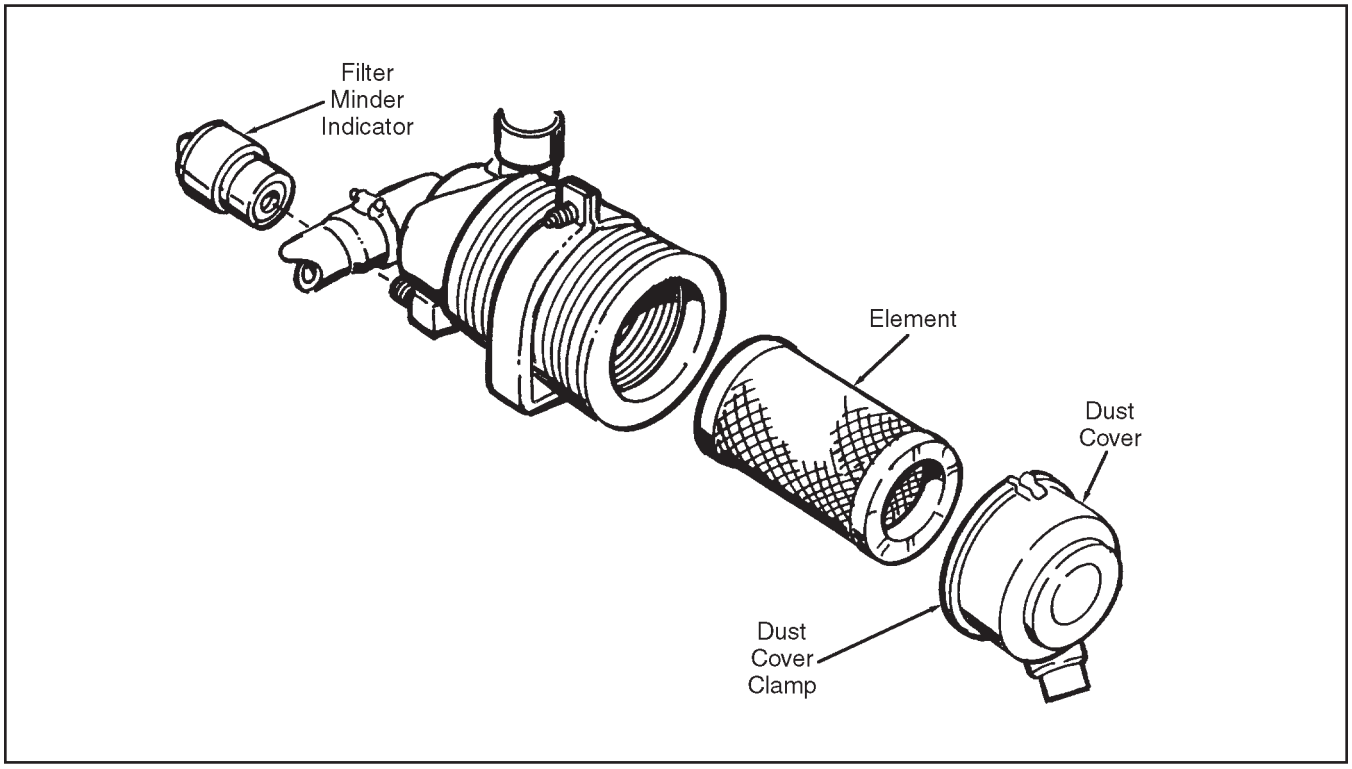

Figure 3D-1. Air Cleaner Service

SECTION 3D. ENGINE

NOTE

Always mix antifreeze with the cooling water. Mixture ratios differ with the antifreeze manufacturer and temperature. Follow the instructions of each manufacturer. However, do not exceed a 50/50 mixture of antifreeze to water.

CLEANING RADIATOR CORE

When dust enters between fins and tubes, blow out with air, then wash out with tap water.

NOTE

Never use a screwdriver or other pointed tool for cleaning. It may damage the special tubes or cause the radiator to lose its function.

RADIATOR REMOVAL (See Figure 3D-2)

1. Loosen wing nuts holding oil cooler in place and tilt oil cooler forward out of the way.
2. Open drain cock and remove radiator cap and drain the coolant.
3. Remove hardware securing fan shroud to radiator and move shroud back over fan.
4. Disconnect the inlet and outlet hoses by loosening the hose clamps.
5. Disconnect overflow tube at radiator.
6. Remove attaching hardware.
7. Inspect mounting bars. Replace if damaged.

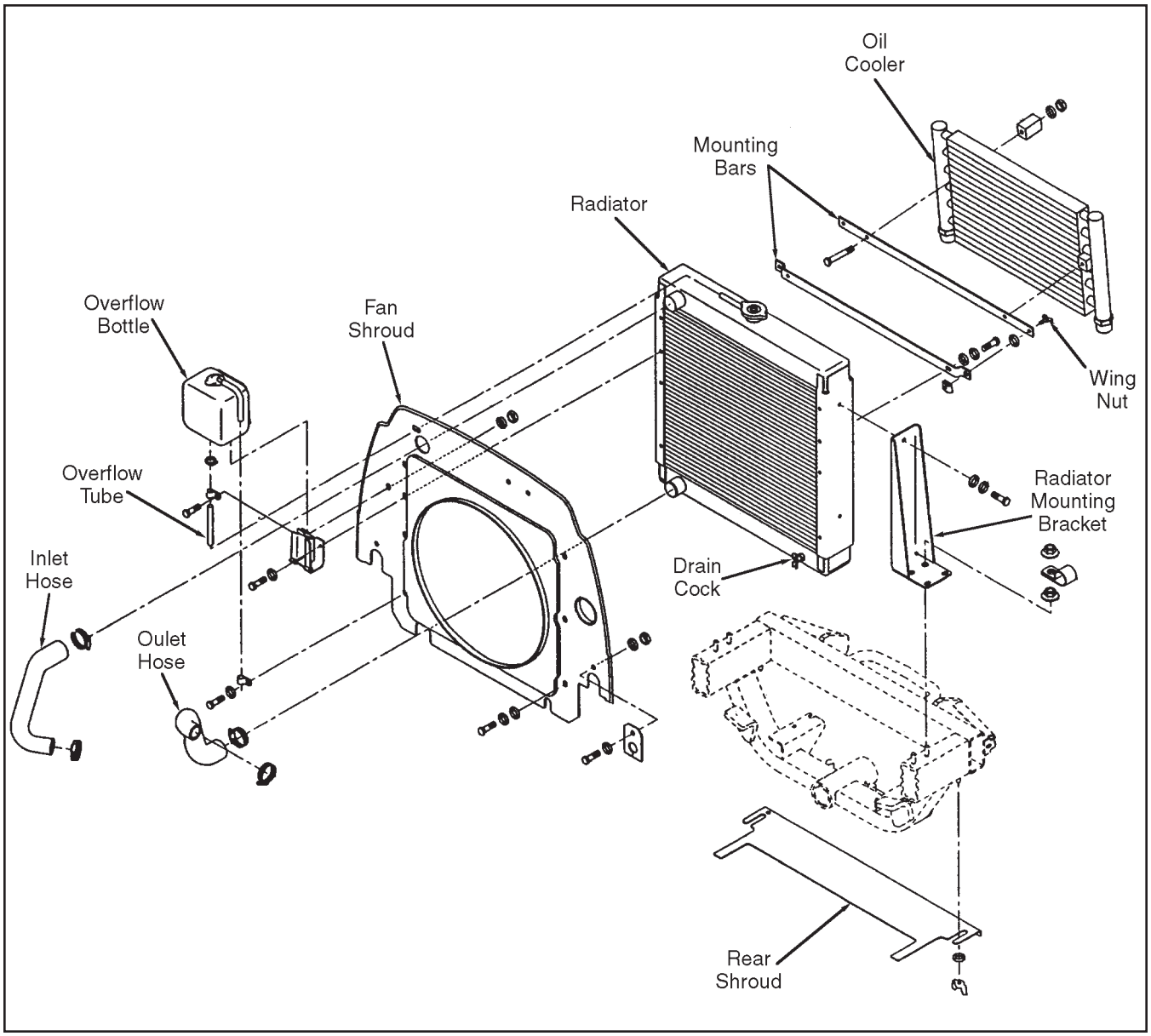

Figure 3D-2. Radiator Service

RADIATOR INSTALLATION (See Figure 3D-2)

1. Install insulation strip at base of radiator frame.
2. Place the radiator on mounting bar and secure with the attaching hardware.
3. Connect overflow coolant tube.
4. Connect the inlet and outlet hoses; tighten hose clamps.
5. Close the drain cock and fill the radiator with clean distilled water/antifreeze mixture.

NOTE

Always mix antifreeze with the cooling water. Mixture ratios differ with the antifreeze manufacturer and temperature. Follow the instructions of each manufacturer. However, do not exceed a 50/50 mixture of antifreeze to water.

6. Secure fan shroud to radiator with attaching hardware.
7. Secure oil cooler in place with wing nuts.

MUFFLER REMOVAL AND INSTALLATION

Remove and install the muffler as shown on Figure 3D-3.

CAUTION

Do not attempt to service muffler while engine is hot from operation.

EXHAUST SYSTEM INSPECTION

1. Clean all sections of the exhaust system of dirt, dust or other foreign material.
2. Inspect exhaust system for cracks, holes, distortion or deformation.

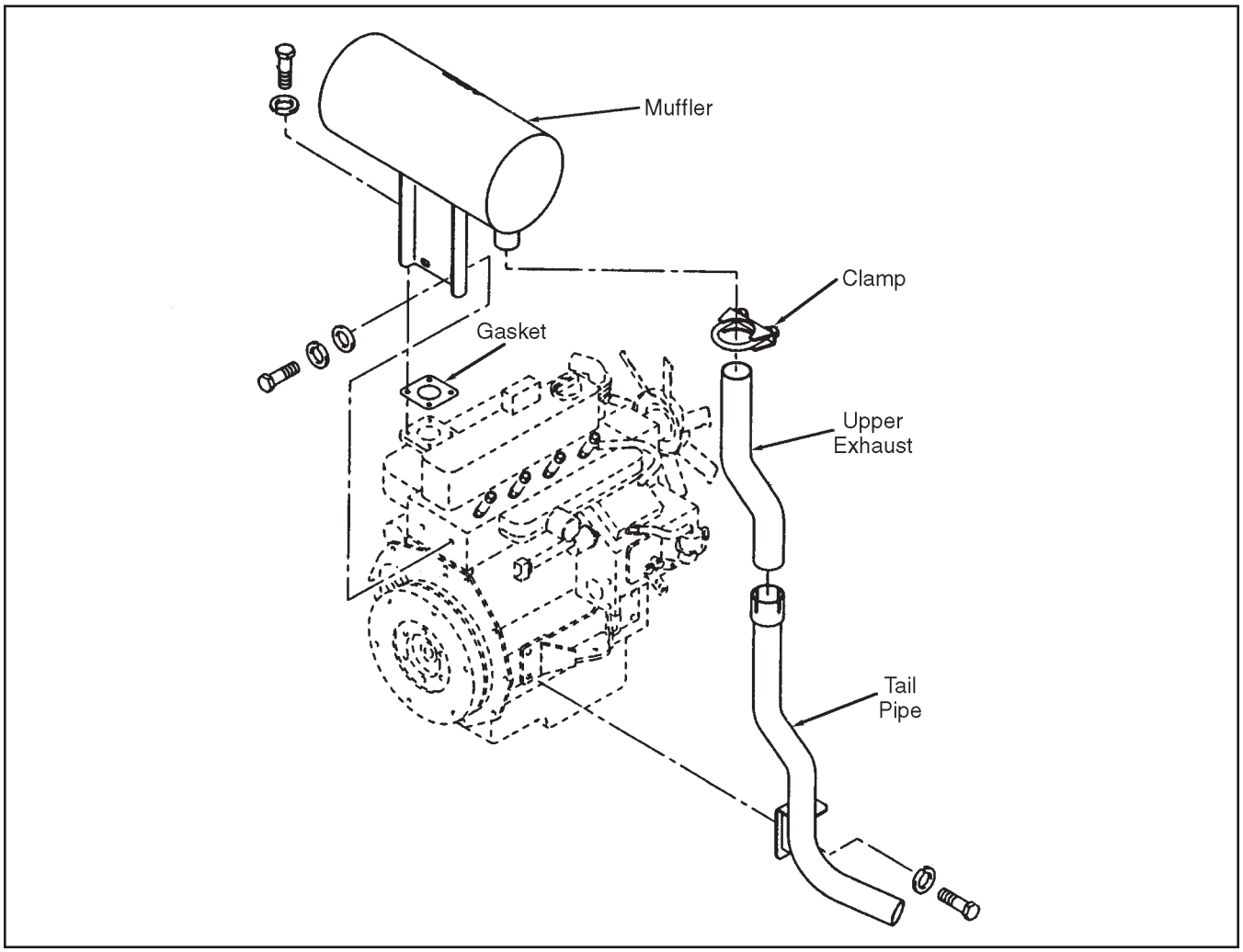

Figure 3D-3. Muffler Removal and Installation

FUEL FILTER SERVICE (See Figure 3D-4)

The fuel filter is mounted on the battery box. Moisture and other foreign matter accumulate in the fuel filter. Clean and replace the filter element (refer to Section 11).

Purge air from the fuel system after new filter has been installed.

PURGING THE FUEL SYSTEM (See Figures 3D-4 and 3D-5)

CAUTION

Do not perform purging when the engine is hot.

Whenever the fuel filter or fuel piping are removed, the fuel tank is completely emptied, or the engine has not been used for an extended time, vent the system of air as follows:

1. Fill the fuel tank with fuel.
2. Loosen the air vent screw at the top of the filter by turning it counterclockwise two turns. Use a suitable container to catch fuel which will flow from screw hole.
3. When bubbles disappear from fuel coming out of the air vent screw hole, turn the screw back in.
4. Open the air vent plug on the fuel injection pump.
5. Using the hand pump located on the fuel pump, prime until fuel comes out the vent screw hole.
6. Close the air vent plug when air bubbles disappear.

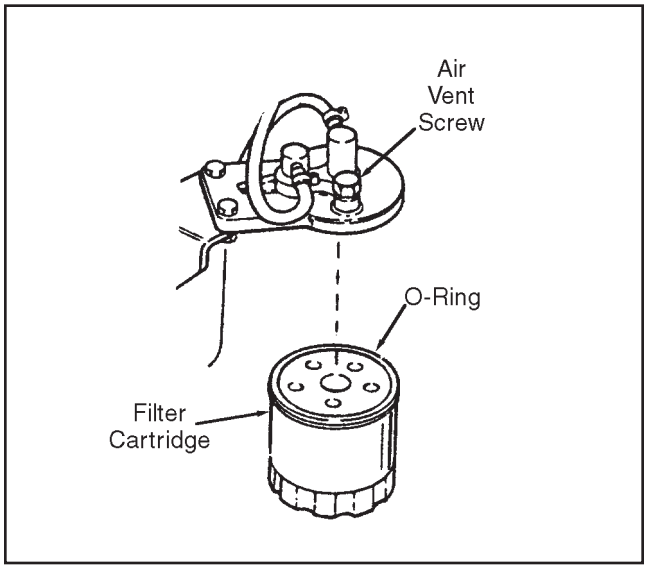

Figure 3D-4. Fuel Filter Service

WARNING

The engine may start during this process. Be careful of injury due to moving components. If the engine starts, continue purging the remaining fuel injector lines.

7. One at a time, loosen the high pressure fuel injector line nuts at the injector while cranking the engine.
8. When bubbles disappear, tighten the fuel line nuts. Repeat Step 7 for the remaining fuel injection lines.
9. When all the lines have been purged and the engine is running, listen to the engine. If it sounds like its missing, repeat Step 7 for all the injector lines.

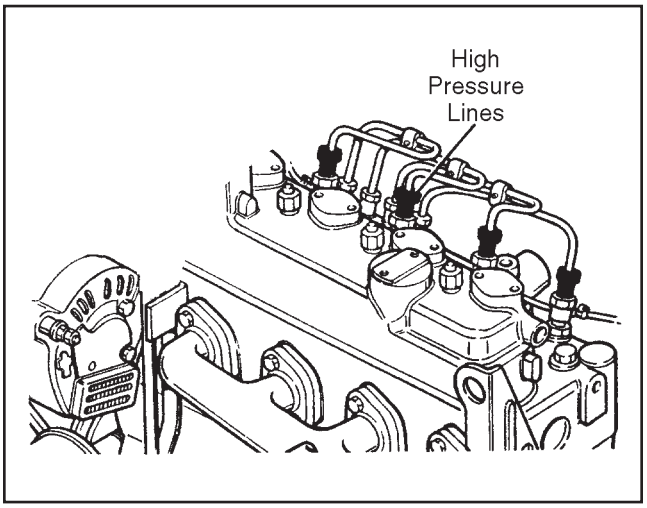

Figure 3D-5. Fuel Injector High Pressure Lines

ENGINE REMOVAL (See Figure 3D-6)

1. Disconnect and tag all electrical connections at the engine.
2. Shut off fuel at the tank. Remove fuel lines.
3. Disconnect air cleaner hose at intake manifold.
4. Disconnect the throttle cable at the fuel injection pump.
5. Remove the muffler and radiator described in preceding paragraphs (see Figures 3D-2 and 3D-3).

SECTION 3D. ENGINE

NOTE

When removing the engine, it is advisable to remove all components (radiator brackets and supports, engine mount bolts, etc.) and lift the engine out of the machine with a hoist attached to the eye bolts.

6. Remove the drive shaft.
7. Attach a chain hoist to the engine (the engine weighs over 200 lbs. [91 kgs]).
8. Remove all bolts and lockwashers that hold the engine to the frame.
9 Carefully lift the engine out of the machine.

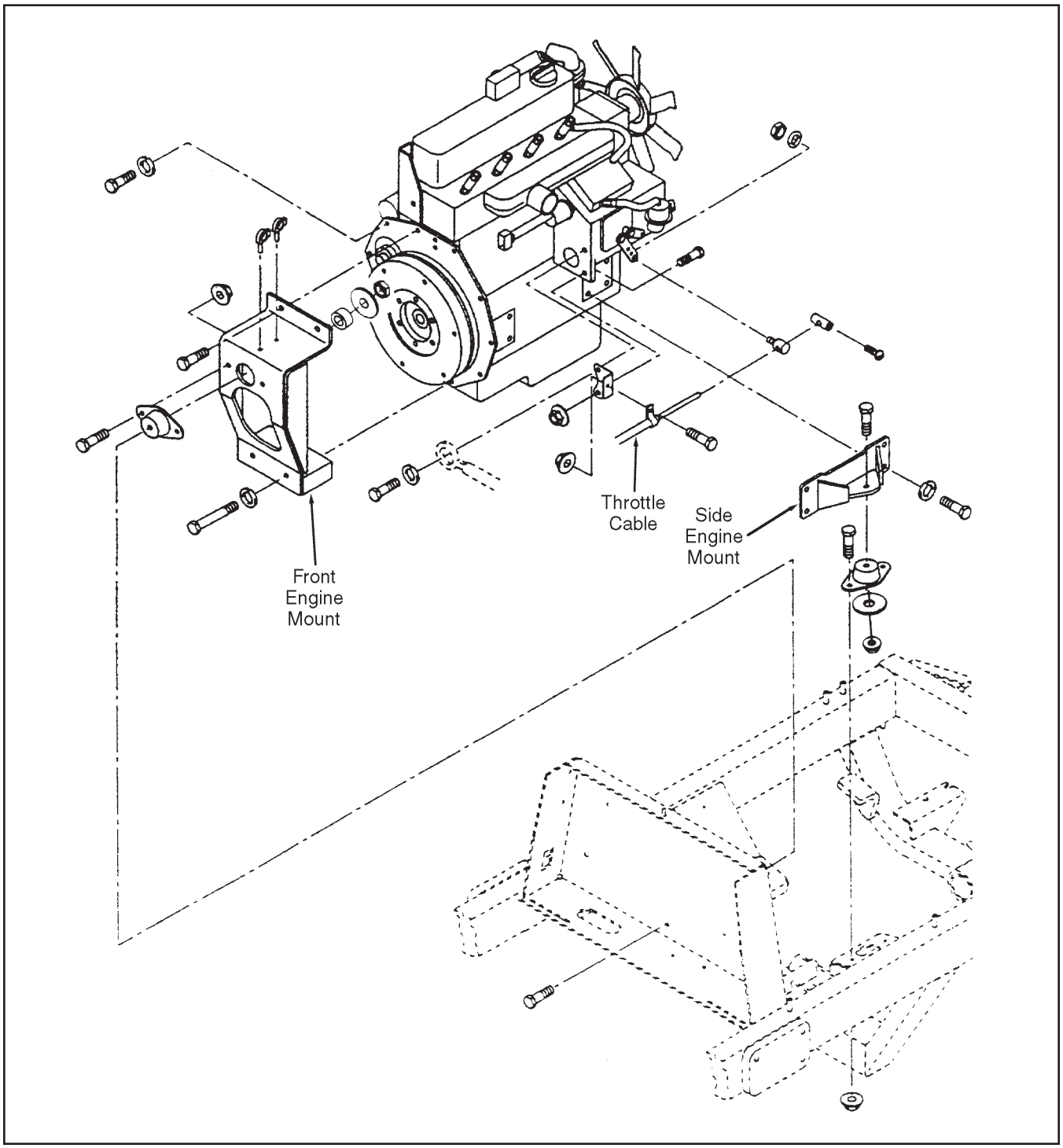

Figure 3D-6. Engine Removal and Installation

ENGINE INSTALLATION (See Figure 3D-6)

1. Move the engine into its approximate mounting position using a chain hoist.
2. Align and loosely attach all bolts and lockwashers that secure the engine to the frame. Tighten mounting bolts after all have been installed. Torque to 27 to 33 ft-lbs. (37 to 45 N.m).
3. Install the radiator and muffler as described in preceding paragraphs of this section.
4. Install drive shaft.
5. Connect and adjust the throttle control (see Section 2 of this manual).
6. Connect all electrical connections to the engine (see Section 10 for location and testing).
7. Connect air cleaner hose at intake manifold.
8. Connect fuel line.
9. Open the fuel valve.
10. Purge air from the fuel system as described in this section.

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SECTION 4
DRIVE TRAIN

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SECTION 4A. REPAIR AND SERVICE TOOLS AND MATERIALS

Tools required:	Standard automotive hand tools.
Cleaning materials:	Stoddard or equivalent solvent.
Lubricants:	Refer to Section 11.
Other service items:	Drive shaft repair kit.

SECTION 4B. DRIVE SHAFT

GENERAL

The traction pump is driven by a universal joint type drive shaft connected directly between the traction pump and engine.

REPAIR

Repairs are limited to renewing the cross and bearings.

If the drive shaft becomes damaged it must be replaced.

SERVICE

DISASSEMBLY (See Figure 4B-1)

1. Position the joint in a vise as shown.
2. With a soft face hammer, strike the top ear of the yoke. This will drive the top bushing outward 3/8 inch (9.525 mm).
3. Grip the loose bushing in the vise and drive the yoke off the bushing.
4. Repeat Steps 3 and 4 for the remaining bushings.

ASSEMBLY (See Figure 4B-1)

NOTE

During reassembly be sure all the parts are clean and free of dirt.

1. Start one bearing in yoke ear and position center cross through yoke.
2. Drive the first bearing flush with outside surface of ear.

NOTE

Do not bend ear of yoke.

3. Support the ear and using a socket or mandrel the same diameter as the bearing.
4. Repeat Steps 2 and 3 for the other bushings.
5. After assembly, ensure proper seating by striking the forged surfaces of the yoke ear one sharp blow with a soft mallet.
6. Lubricate the joint as described in Section 11.

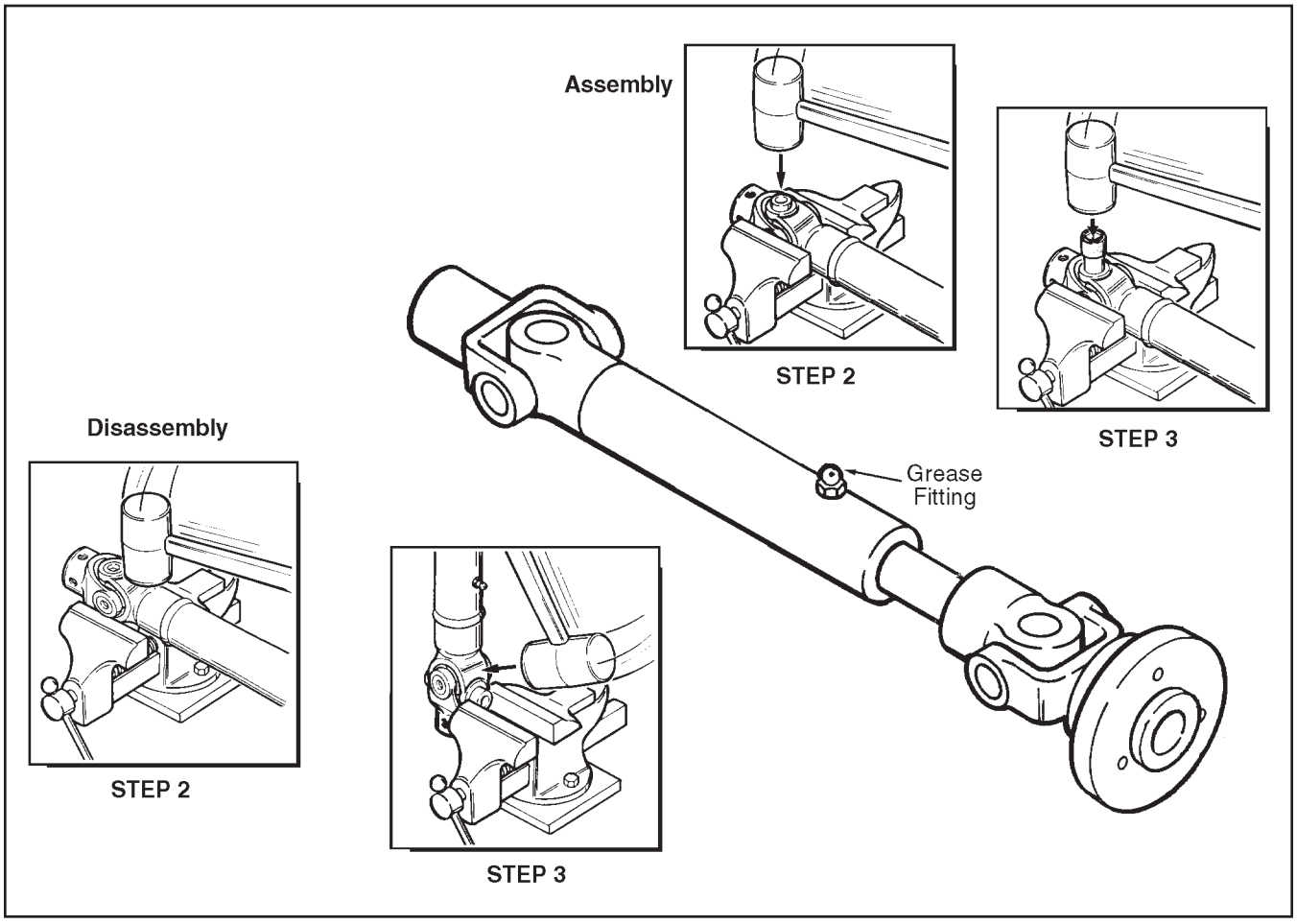

Figure 4B-1. Drive Shaft

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SECTION 5
BRAKE SYSTEM

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SECTION 5A. REPAIR AND SERVICE TOOLS AND MATERIALS

Tools required:	Standard automotive hand tools.
Cleaning materials:	Stoddard solvent or equivalent.
Lubricants:	See Section 11.
Other service items:	Brake discs. Brake stud linings.

SECTION 5B. FAILURE ANALYSIS

PROBLEM	PROBABLE CAUSE	REMEDY
1. Parking brake does not hold tractor in position when engine is off.	a. Brake is misadjusted. b. Worn brake discs. c. Broken or worn brake cable.	a. Adjust brake (Section 5C). b. Replace linings/discs (Section 5C). c. Replace cable (Section 5C).
2. Tractor creeps with engine running and parking brake applied.	a. Brake is misadjusted. b. Worn brake discs. c. Traction control needs adjusting.	a. Adjust brake (Section 5C). b. Replace linings/discs (Section 5C). c. Adjust (Section 2).

SECTION 5C. PARKING BRAKE

GENERAL

Releasing the traction pedal will cause the tractor to stop. There are no brakes applied when stopping the tractor during normal operation. If the tractor “creeps” when the traction pedal is not engaged, the traction pedal linkage must be adjusted as shown in Figure 5C-3.

Standard automotive type service brakes are mounted on the front wheels and operated by mechanical linkage to the parking brake pedal.

The parking brake pedal and control linkage are shown in Figure 5C-1.

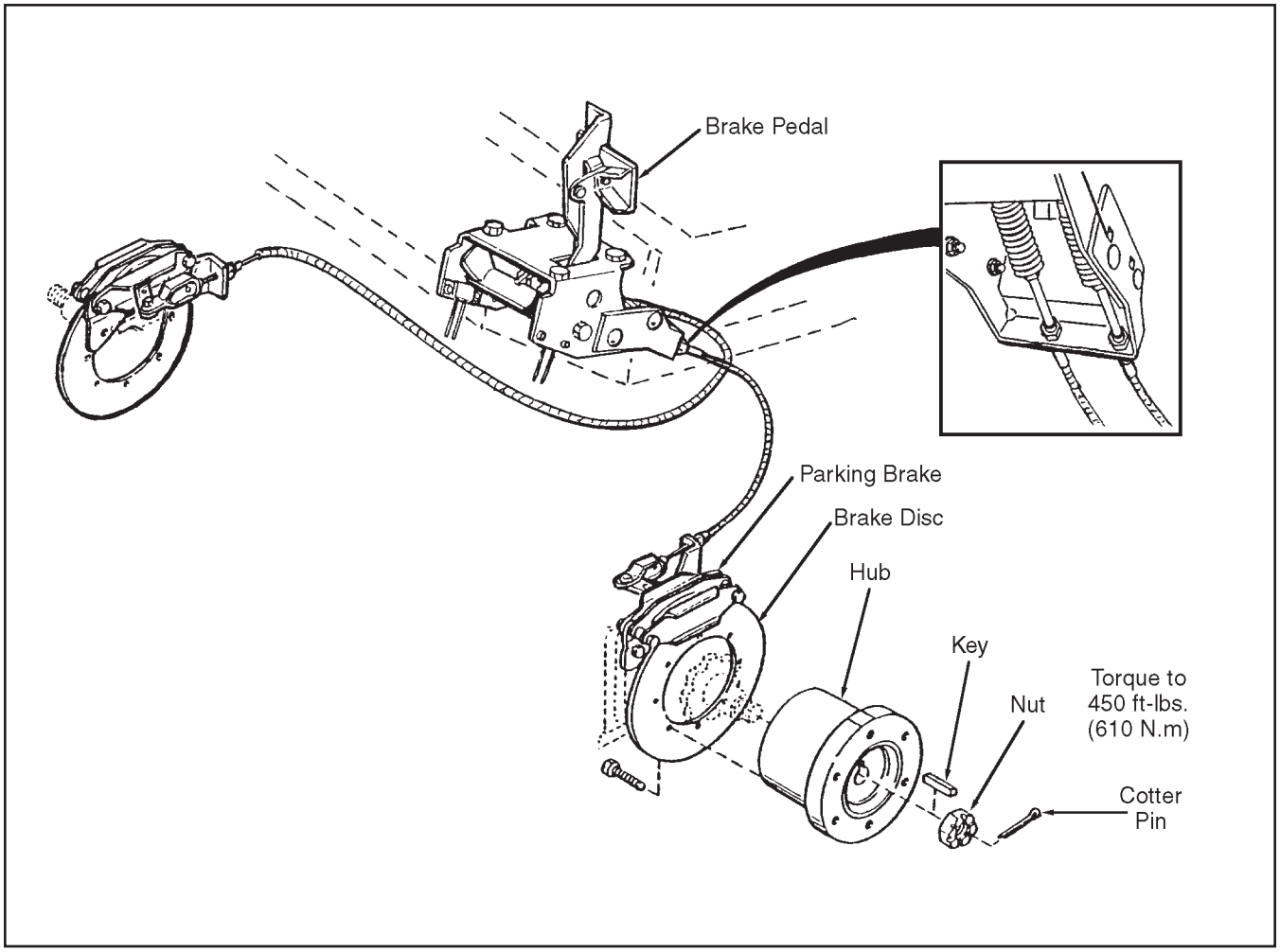

Figure 5C-1. Parking Brake Controls and Linkage

SECTION 5C. PARKING BRAKE

REPAIR (See Figure 5C-2)

Remove the tire and wheel hub to gain access to the parking brake and brake disc.

Repairs to the parking brake are limited to changing worn brake linings and renewing worn or damaged parts.

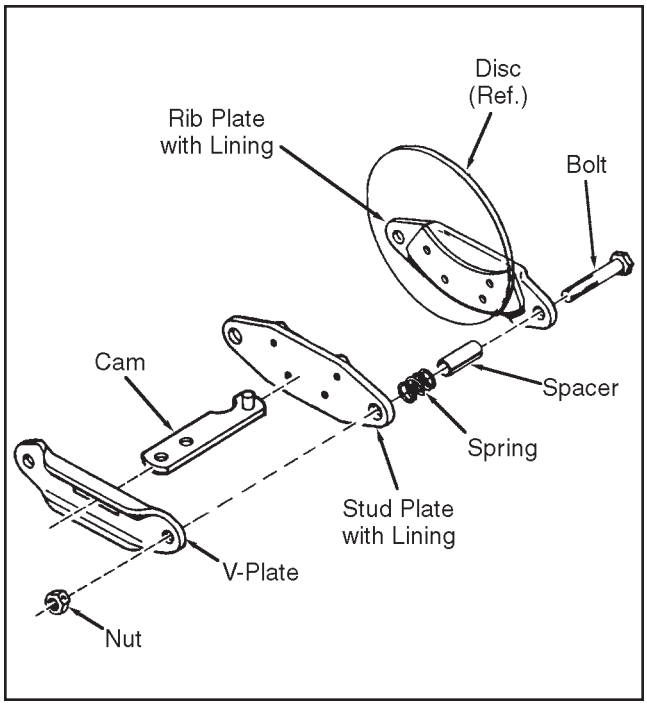

Figure 5C-2. Parking Brake Repair

BRAKE ADJUSTMENT (See Figure 5C-3)

The brake pedal free travel should be 1 inch (25 mm) before the brake pads engage the brake disk. To adjust pedal free travel, proceed as follows:

1. Loosen adjusting nuts.
2. Tighten brake cables to obtain 1 inch (25 mm) free travel, then tighten adjusting nuts.
3. If brakes wear beyond point where they can be adjusted by the cable, move brake bracket into second set of holes provided and complete adjustment procedure.
4. Start tractor and check operation of brakes. Park tractor on an incline (approximately 16.7° slope) and engage parking brake. Brake must prevent tractor from rolling.

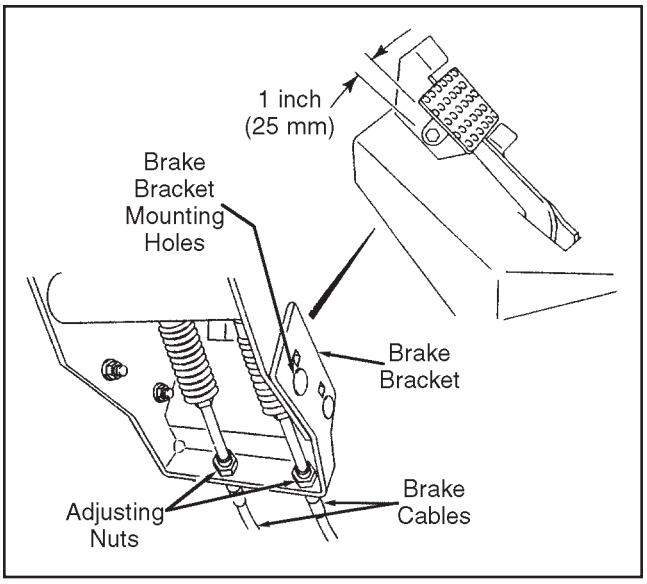

Table 5C-3. Brake Adjustment

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SECTION 6
STEERING

SECTION 6A. REPAIR AND SERVICE TOOLS AND MATERIALS

Tools required:	Standard automotive hand tools.
Cleaning materials:	Stoddard solvent or equivalent.
Lubricants:	See Section 11.
Other service items:	6 pieces 0.007 inch (0.18 mm) shim stock 0.5 inch (13 mm) wide and 1.5 inch (38 mm) long.
	Service fixture for Power Steering Unit (see Figure 6A-1).

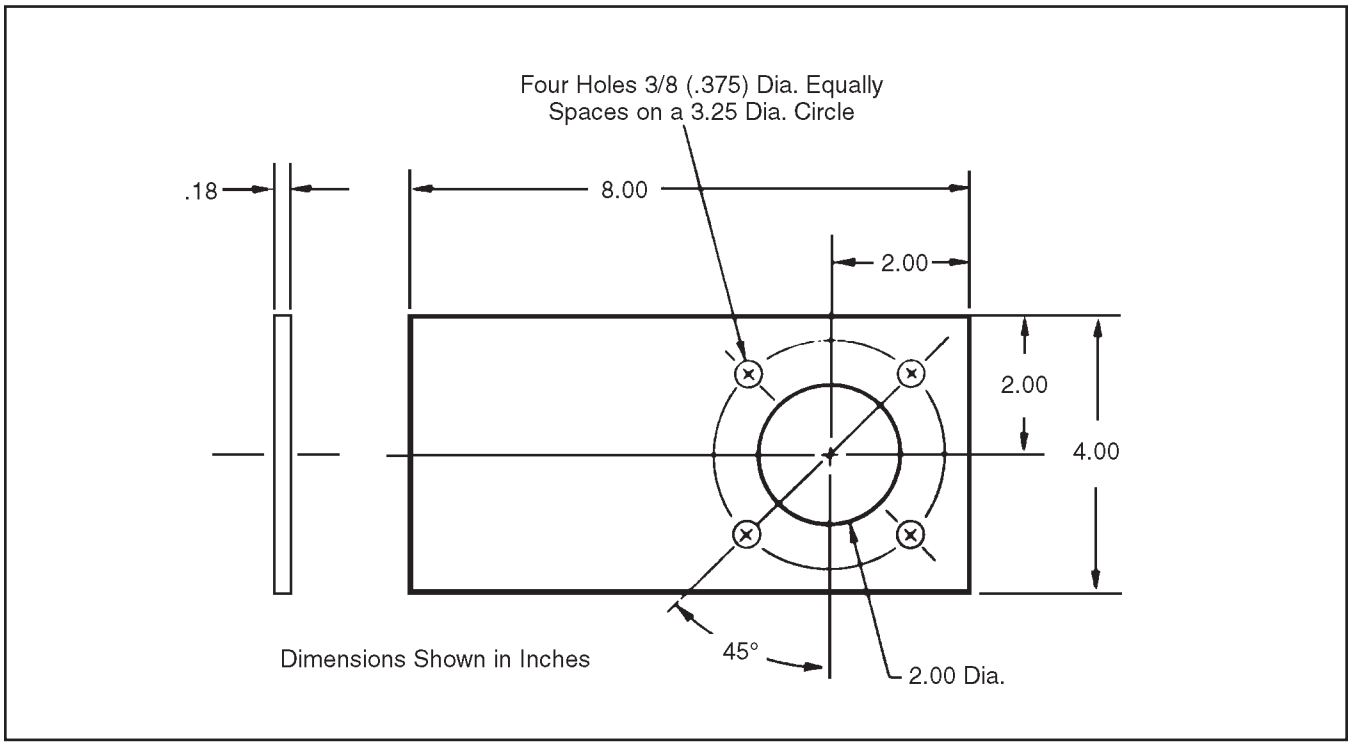

Figure 6A-1. Service Fixture

SECTION 6B. FAILURE ANALYSIS

PROBLEM	PROBABLE CAUSE	REMEDY
1. Noisy when steering wheel is turned.	a. Low hissing sound. b. Relief valve squeals when steering to maximum turn.	a. Normal. b. Normal.
2. Steering wanders.	a. Tire pressure incorrect. b. Loose or worn steering cylinder. c. Steering cylinder internal leakage. d. Steer wheels out of adjustment.	a. Properly inflate tires (Section 7C). b. Tighten or repair (Section 6E). c. Repair (Section 6E). d. Adjust (Section 6D).
3. Shimmy.	a. Tire mounting nuts loose. b. Loose or worn steering linkage. c. Wheel bearings worn. d. Steer wheels out of adjustment.	a. Tighten (Section 7C). b. Tighten or repair (Section 6E). c. Repair (Section 7C). d. Adjust (Section 6D).
4. Hard steering in one direction.	a. Internal failure of steering unit. b. Loose or worn steering linkage.	a. Repair (Section 6C). b. Tighten or repair (Section 6E).
5. Hard steering in both directions.	a. Tires under inflated. b. Low hydraulic oil level. c. Low oil pressure. d. Steering unit failure.	a. Inflate tires (Section 7C). b. Check level (Section 11) and oil if required. c. Check traction pump relief (Section 8O). d. Test steering unit (Section 8O).
6. Lost motion at steering wheel.	a. Steering wheel loose. b. Loose or worn steering linkage. c. Steering cylinder internal leakage. d. Steering unit internal leakage. e. Excessive heat. Hot oil.	a. Tighten (Section 6C). b. Tighten or repair (Section 6E). c. Repair (Section 6E). d. Repair (Section 6C). e. Check oil cooler and clean if necessary.

SECTION 6C. STEERING UNIT

GENERAL

Power steering is provided as long as the engine is running. If an engine failure occurs, the steering unit provides manual steering.

REMOVAL (See Figure 6C-1)

1. Remove the steering tower cover.
2. With the steering tower in the extreme rear position (toward operator) disconnect the pneumatic tilt actuator.
3. Remove steering wheel cap, nut and lockwasher.
4. Remove steering wheel.
5. Remove the steering unit bracket.
6. Tag, mark and remove hoses from steering unit.
7. Remove the steering unit.

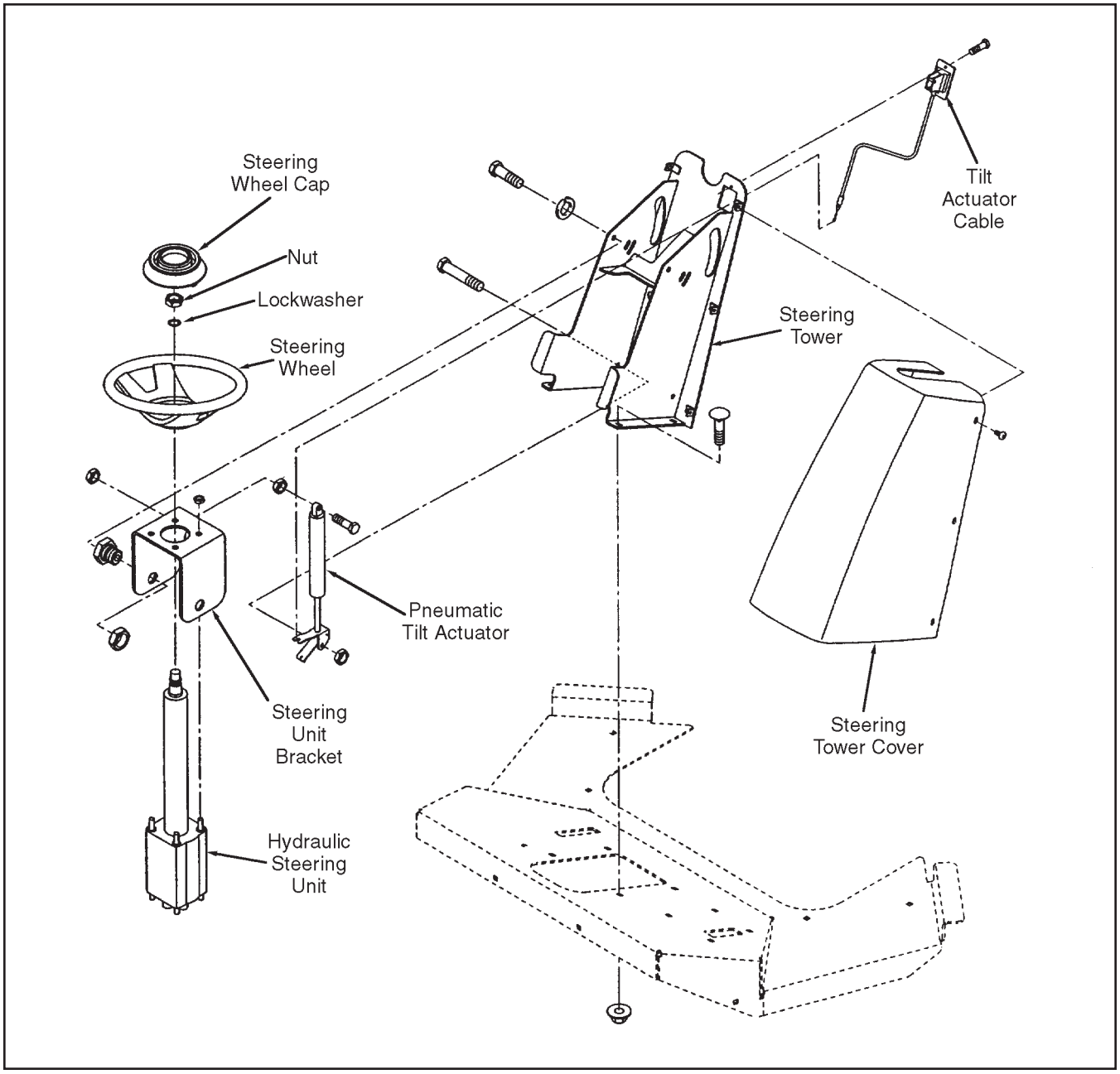

Figure 6C-1. Steering Unit Removal and Installation

SECTION 6C. STEERING UNIT

DISASSEMBLY (See Figure 6C-2)

NOTE

Before disassembly, scribe a line from top to bottom of valve assembly. Use this for future reference to determine proper orientation of sections (see Figure 6C-7).

1. Securely place the power steering service fixture in a vise (see Figure 6A-1).
2. Remove port cover nuts (1) and port cover (2). Note position of relief valve assembly (5).
3. Carefully remove port manifold (6). Be prepared to catch three springs (7). Remove springs.
4. Remove valve ring (8), valve plate springs (10) and valve plate (9).
5. Remove hex drive (11) and isolation manifold (13).

NOTE

DO NOT LOSE ALIGNMENT PINS (12).

6. Remove drive link (14) and metering ring (15).
7. Remove metering package (17) and commutator seal (16). The metering package (17) is serviced as an assembly kit. Refer to your parts manual (proceed with Step 11).

   Disassembly of metering package should be for inspection ONLY. To disassemble metering package, proceed with Step 8.

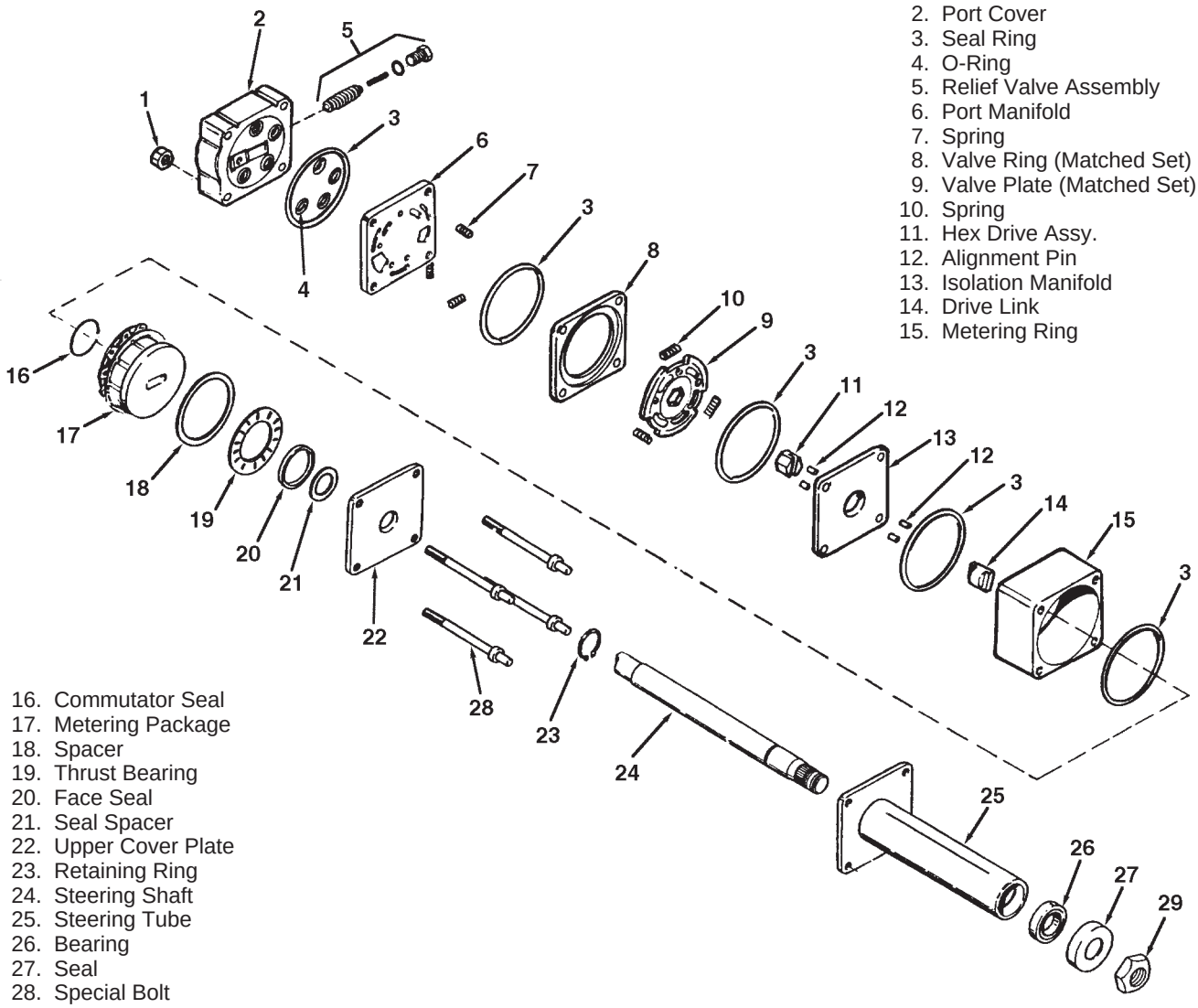

Figure 6C-2. Steering Unit Disassembly

SECTION 6C. STEERING UNIT

(See Figure 6C-3)

8. Remove socket capscrews (1), commutator cover (2), commutator ring (3) and commutator (4).
9. Remove five alignment pins (5).
10. Remove drive link spacer (6), rotor (7) and stator (8) from drive plate (9).

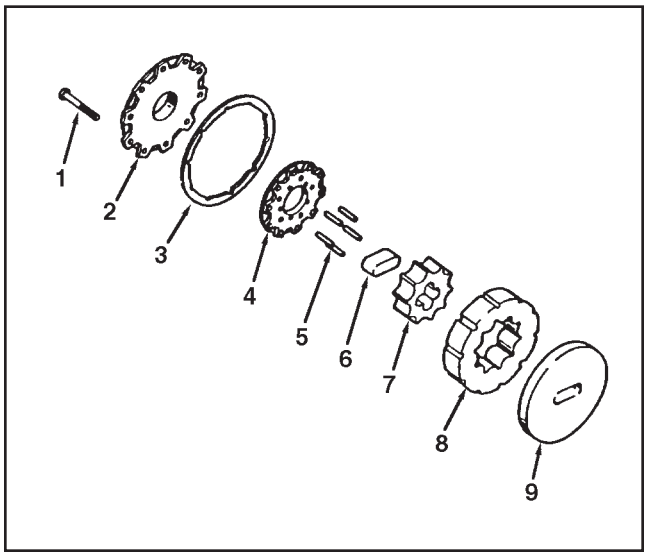

Figure 6C-3. Metering Package Disassembly

(See Figure 6C-2)

11. Remove face seal (20) and seal spacer (21).
12. Remove thrust bearing (19) and spacer (18).
13. Remove upper cover plate (22).
14. Remove shaft nut (29) and pull steering shaft (24) up out of tube (25).
15. Remove seal (27) and bearing (26).

INSPECTION

- Inspect springs (7) and (10) for bent, broken or distorted coils.

NOTE

Always replace springs as a set.

- Inspect finished ground surfaces of all components.
- Inspect the slot edges and surface for nicks or scoring and rounding edges.

NOTE

Valve ring (8) and valve plate (9) are a matched set and are not serviceable.

- Inspect hex drive (11) for wear.

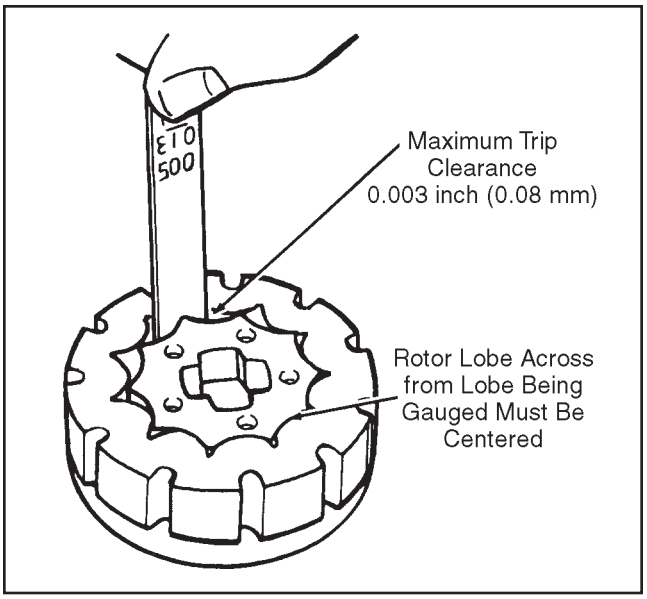

Figure 6C-4. Rotor and Stator Inspection

- Inspect isolation manifold (13). A normal polished pattern due to valve plate rotation will occur. Also, look for nicks, scratches or scoring.
- Inspect drive link (14).
- Inspect thrust bearing (19) for brinelling, spalling or missing rollers.
- Discard all seals and seal rings.

(See Figure 6C-3)

- Inspect commutator cover (2) and drive plate (9). A normal polished pattern will occur.
- Inspect the rotor (7) and stator (8) fit.

REASSEMBLY (See Figure 6C-5)

1. Install a new bearing (26) and seal (27) in tube (25).
2. Place tube (25) and special bolts (28) in the service fixture.
3. Place retainer plate (23) in tube (25) with flat side down.
4. Install a new retaining ring (23) to shaft (24) and install into tube (25). Secure with nut (29).

⚠ CAUTION

In the following assembly steps, it is important to align components for proper operation of steering unit. The correct alignment is illustrated in Figure 6C-7.

SECTION 6C. STEERING UNIT

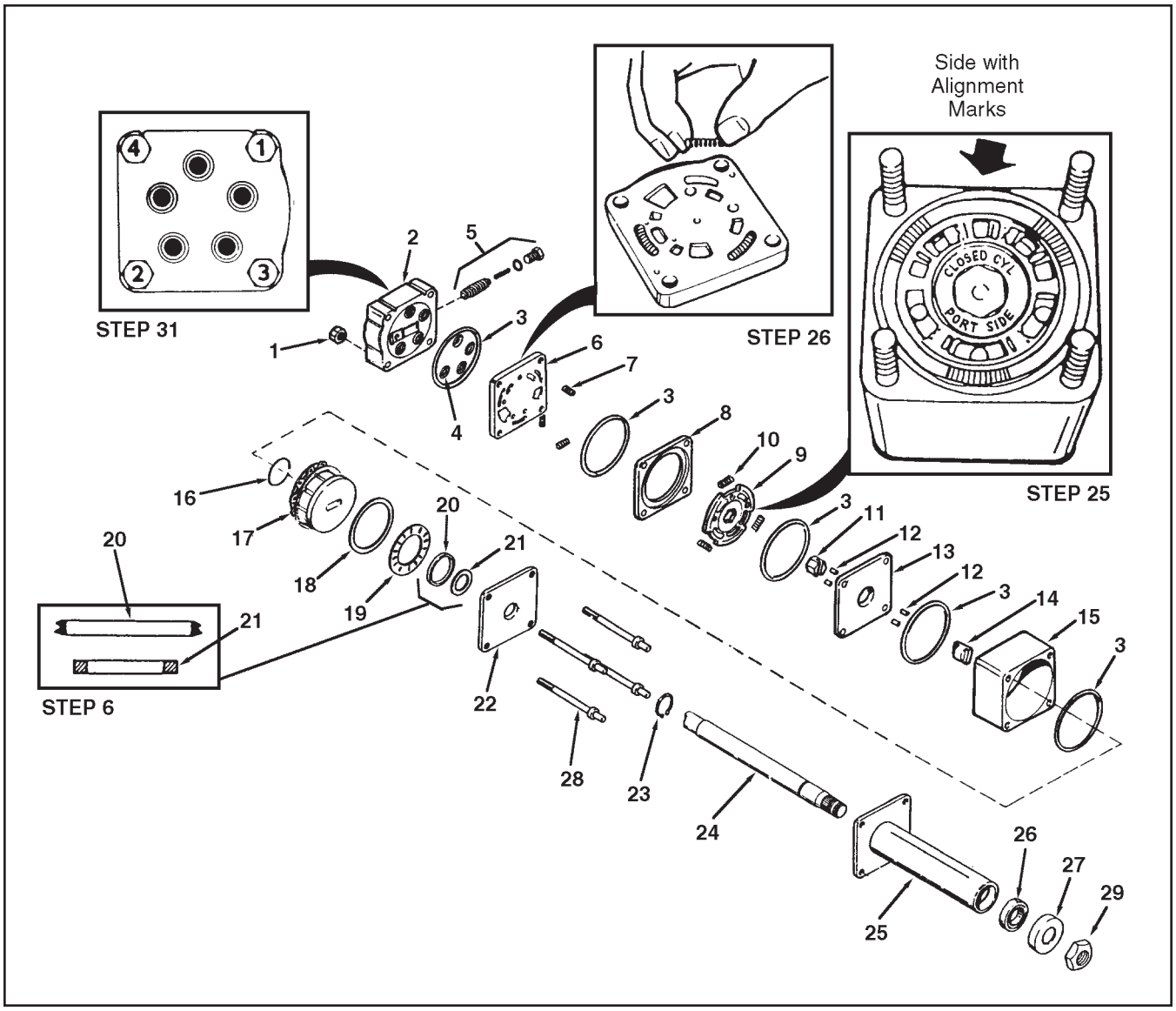

Figure 6C-5. Steering Unit Assembly

5. Install upper cover plate (22).
6. Assemble seal spacer (21) and seal (20) as shown.
7. Grease upper cover plate (22) and install assembled seal.

   If the metering package was disassembled, proceed with Step 8.

   If the metering package was not disassembled or a new one is being installed, proceed with Step 19.

(See Figure 6C-6)

8. Place drive plate (9) on a flat lint free surface.
9. Place stator (8) on drive plate (9) and insert rotor (7) into stator.
10. Apply a small amount of grease to drive link spacer (6) and install in rotor (7).
11. Place commutator (4) on top of rotor (7) with aligning pin holes up and place a few drops of oil in each recess of commutator.
12. Align the five holes of commutator (4) with holes in rotor (7) and install 5 pins (5).
13. Install commutator ring (3) and commutator cover (2) and eleven socket capscrews (1).

NOTE

DO NOT TIGHTEN CAPSCREWS.

SECTION 6C. STEERING UNIT

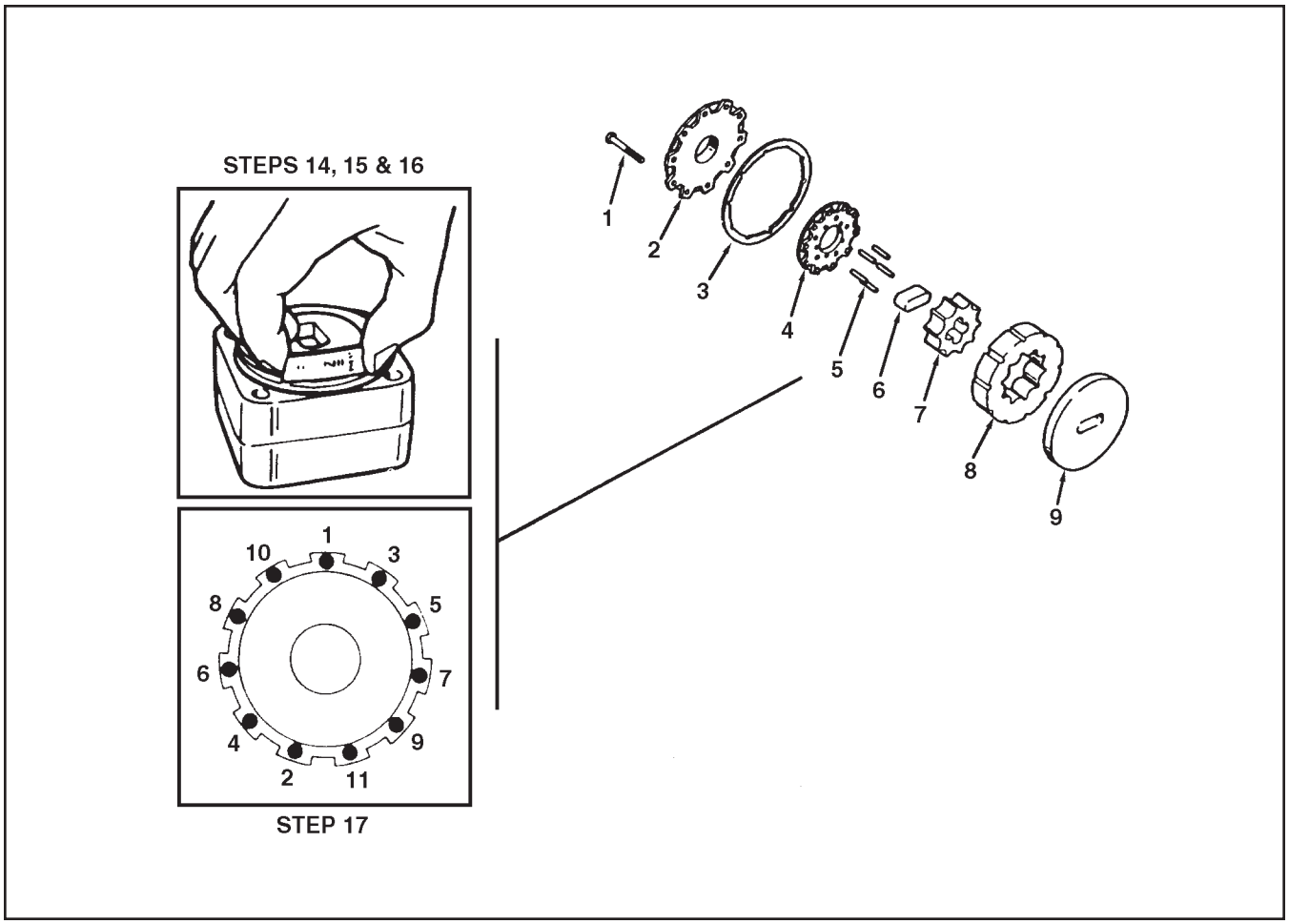

Figure 6C-6. Metering Package Assembly

(See Figure 6C-2)

14. Place metering ring (15) on a hard flat surface.
15. Place the now assembled metering package in the center of metering ring (15) with commutator cover down.
16. Place shim stock 0.007 inch (0.18 mm) thick, 1/2 inch (13 mm) wide by 1-1/2 inch (38 mm) long in three places between the metering ring and metering package as shown.
17. Tighten socket capscrews twice in sequence as shown to a final torque of 11 to 13 in-lbs. (1.2 to 1.5 N.m).
18. Remove the metering package and shims. Place drive link (14) in rotor and turn by hand to make sure there is no binding.

(See Figures 6C-5 and 6C-6)

19. Place metering ring (15) on top of upper cover plate (22) with aligning pin holes up.
20. Lubricate and install thrust bearing spacer (18) and thrust bearing (19) into metering ring (15).
21. Place metering package (17) into metering ring (15) engaging the drive slot with the steering shaft.
22. Install commutator ring (16) and seal ring (3). Install drive link (14).
23. Place isolation manifold (13) on metering ring (15) with aligning pin holes up. Install aligning pins (12).
24. Install three 1/2 inch springs (10) in isolation manifold (13) and install valve ring (8).
25. Install valve plate (9) as shown (closed cylinder up) in valve ring (8) aligning spring slots with springs. Install seal ring (3).
26. Place three 3/4 inch springs (7) in port manifold (6) as shown.
27. Carefully place port manifold (6) springs down onto valve ring (8).

SECTION 6C. STEERING UNIT

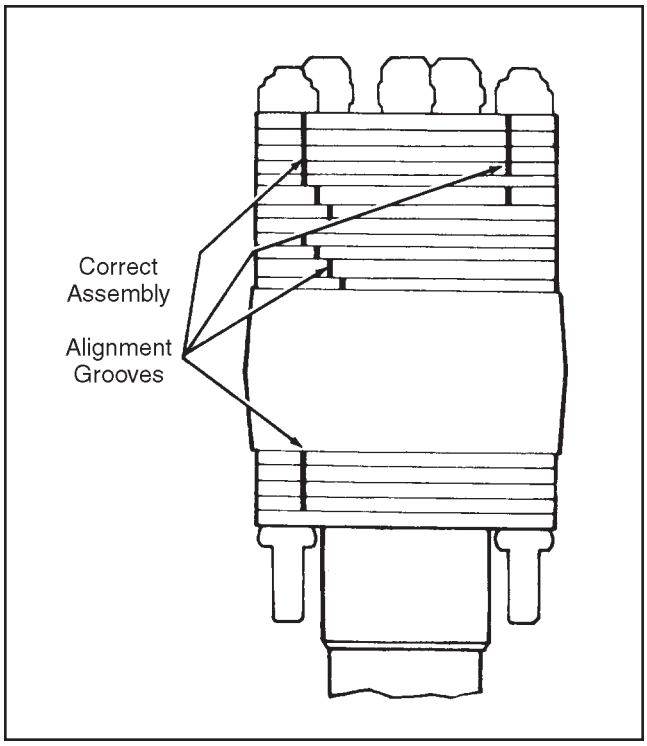

Figure 6C-7. Alignment Grooves

28. Install O-rings (4) and seal ring (3) to port cover (2).
29. Install check ball (5) in inlet port of port manifold (6).

NOTE

Install relief valve and plug if removed (5).

30. Install port manifold (6).
31. Install self-locking nuts (1) and tighten in sequence shown gradually until a final torque of 20 to 24 ft-lbs. (27 to 33 N.m) is obtained.

INSTALLATION (See Figure 6C-1)

1. Connect hoses to steering unit (12). Tighten hose connections. See Section 8C.
2. Position steering unit bracket (10) over steering unit and fasten in place with nuts.
3. Position steering unit and bracket in tower. Fasten with hardware shown.
4. Install the pneumatic tilt actuator.
5. Install steering wheel, lockwasher and nut, torque nut to 25 to 30 ft-lbs. (34 to 41 N.m).
6. Install steering wheel cap.

SECTION 6D. STEER WHEEL ADJUSTMENTS

2 WHEEL DRIVE TOE-IN (See Figure 6D-1)

1. Turn steer wheels to straight ahead position.
2. Loosen tie rod jam nuts.
3. Turn tie rod so wheels toe-in 1/16 inch (1.6 mm).

NOTE

After making adjustment, check the turn stop and adjust if necessary.

TURN STOP (See Figure 6D-1)

NOTE

Toe-in should be adjusted before adjusting turn stop.

1. Turn the steering wheel to the left until the cylinder is in its completely extended position.
2. Adjust cylinder ball joint so the spindle arm clears the stop by 1/32 to 3/32 inch (0.79 to 2.38 mm).

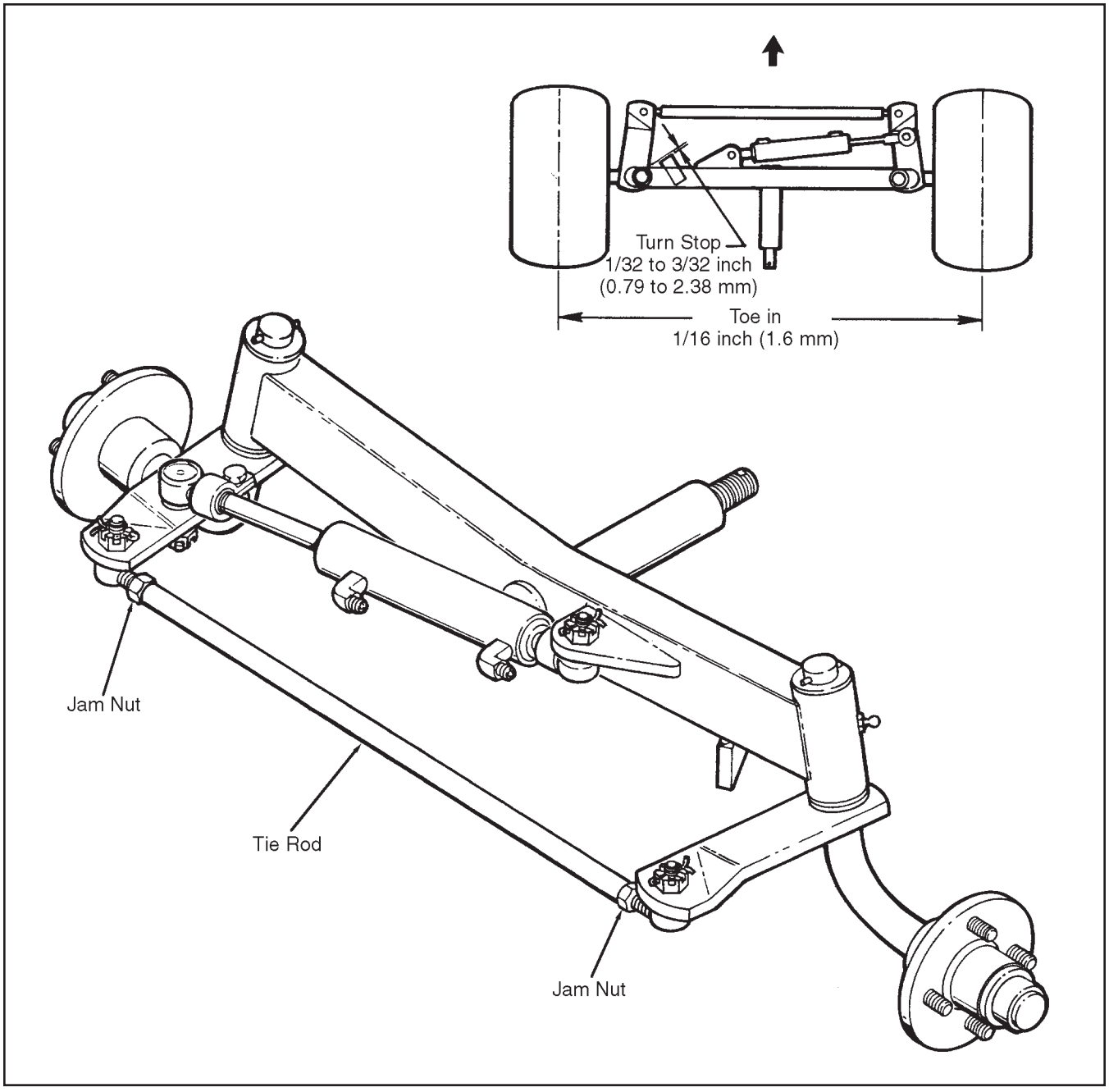

Figure 6D-1. 2 Wheel Drive Steer Wheel Adjustments

SECTION 6D. STEER WHEEL ADJUSTMENTS

4 WHEEL DRIVE TOE-IN (See Figure 6D-2)

1. Turn steer wheels to straight ahead position.
2. Loosen tie rod jam nuts.
3. Turn tie rod so wheels toe-in 3/8 inch (9.5 mm).

NOTE

After making adjustment, check the turn stop and adjust if necessary.

TURN STOP (See Figure 6D-2)

1. Turn the steering wheel to the right until the cylinder is in its completely retracted position.
2. Loosen jam nuts.
3. Adjust stop bolt so head of bolt is .030 to .060 inch (0.76 to 1.52 mm) from steering axle frame.
4. Tighten jam nuts to lock the adjustment.

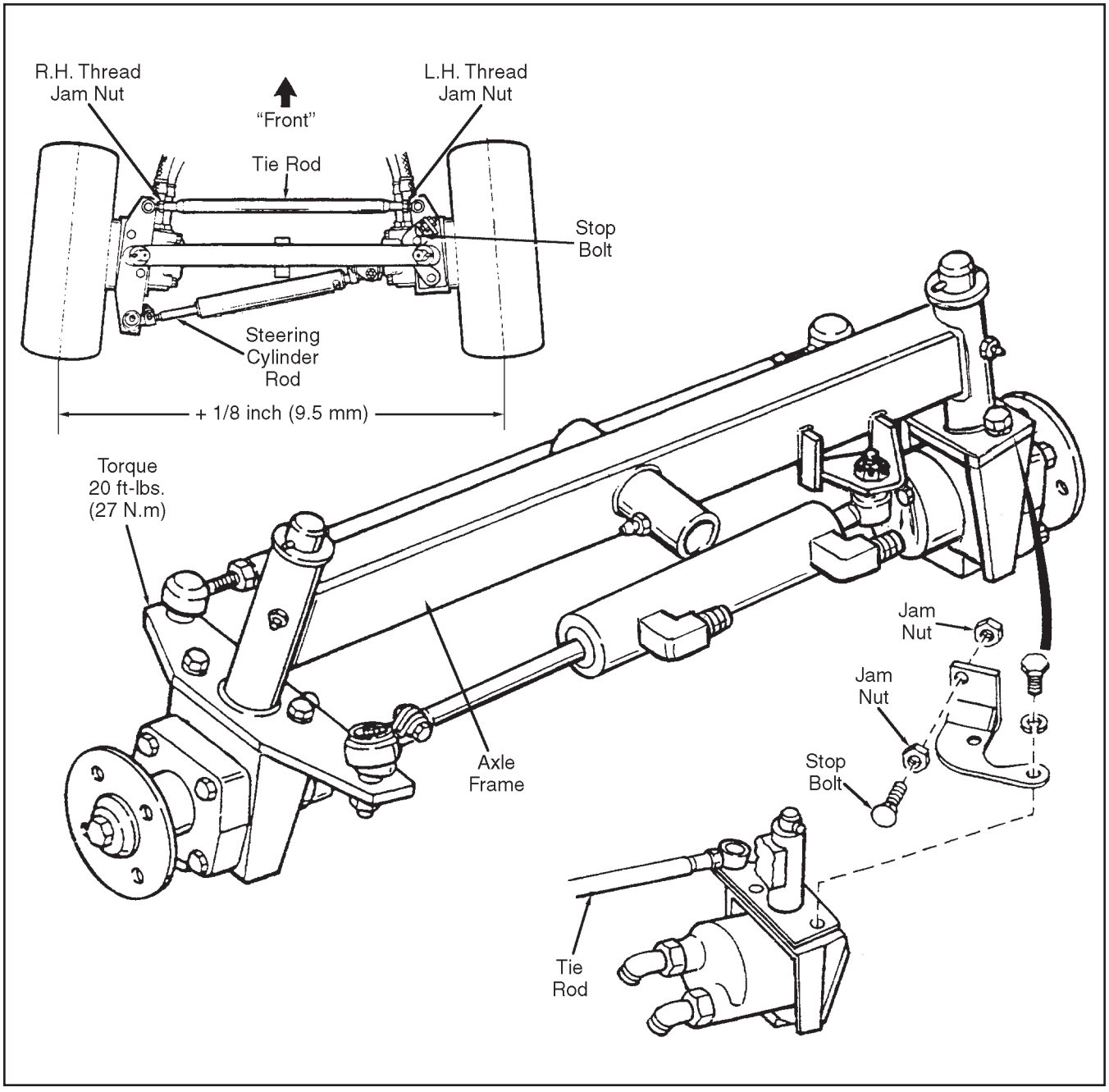

Figure 6D-2. 4 Wheel Drive Steer Wheel Adjustment

SECTION 6E. STEERING CYLINDER

2 WHEEL DRIVE REMOVAL
(See Figure 6E-1)

1. Block the wheel and set the parking brake.
2. Tag and remove hydraulic lines. Cap the cylinder ports and plug the lines.
3. Remove attaching hardware and remove cylinder.

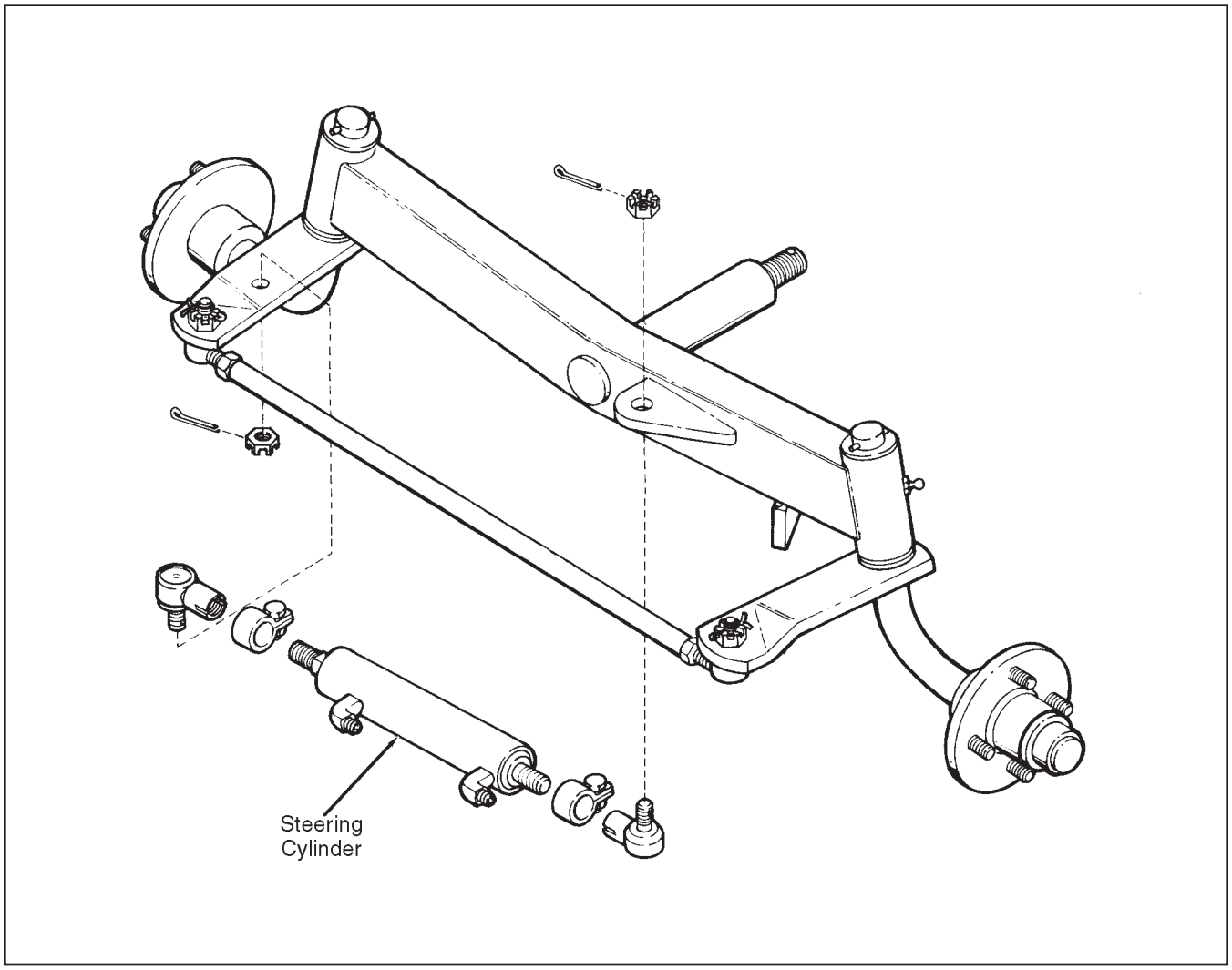

Figure 6E-1. 2 Wheel Drive Steering Cylinder Removal/Installation

SECTION 6E. STEERING CYLINDER

4 WHEEL DRIVE REMOVAL
(See Figure 6E-2)

1. Block the wheel and set the parking brake.
2. Tag and remove hydraulic lines. Cap the cylinder ports and plug the lines.
3. Remove attaching hardware and remove cylinder.

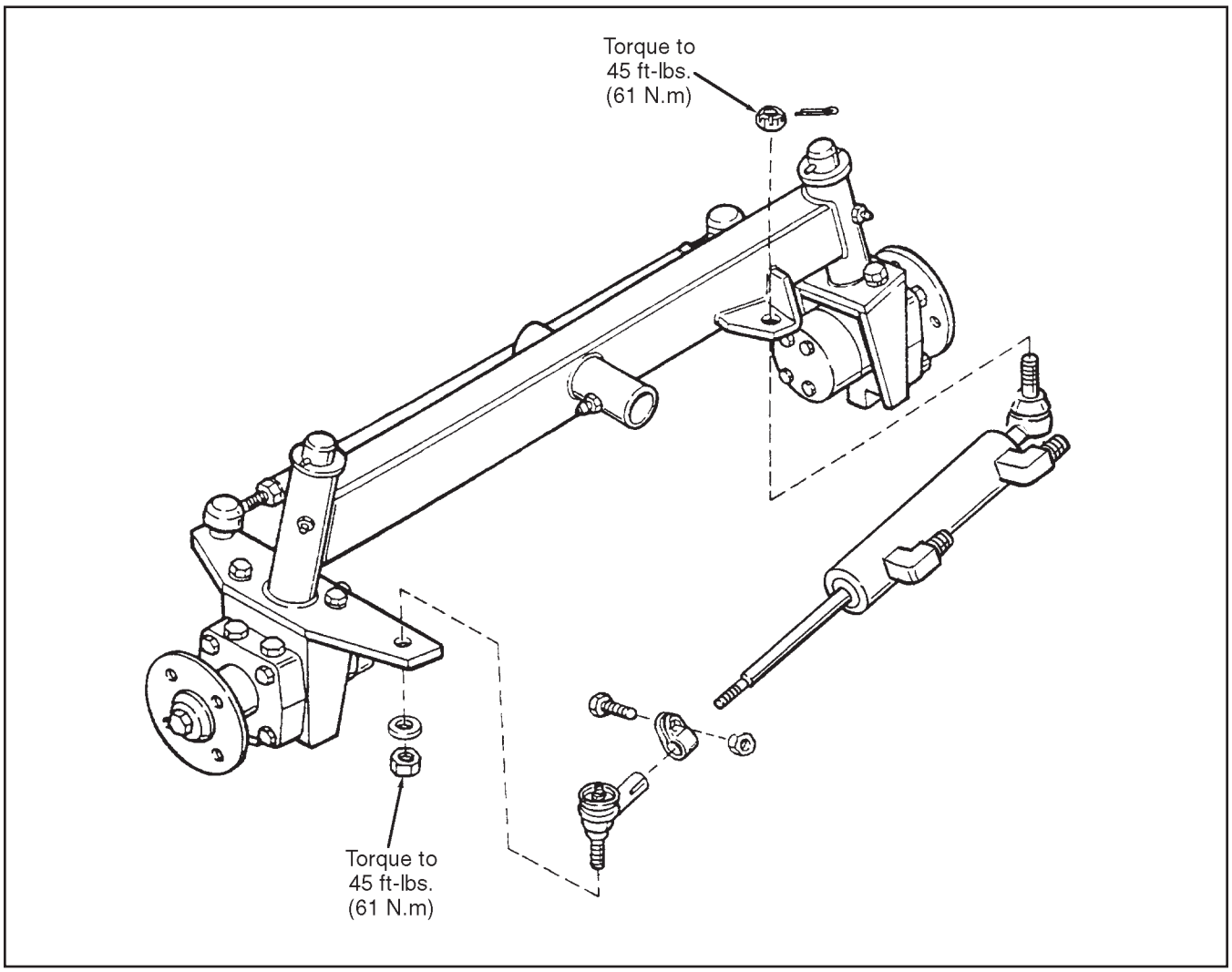

Figure 6E-2. 4 Wheel Drive Steering Cylinder Removal/Installation

SECTION 6E. STEERING CYLINDER

DISASSEMBLY (See Figure 6E-3)

Clean and and air dry exterior of cylinder. Drain all the oil from the cylinder. Disassemble as illustrated.

INSPECTION

- Inspect all parts for excessive wear, cracks and broken parts.
- Discard all O-rings, seals and backup rings.

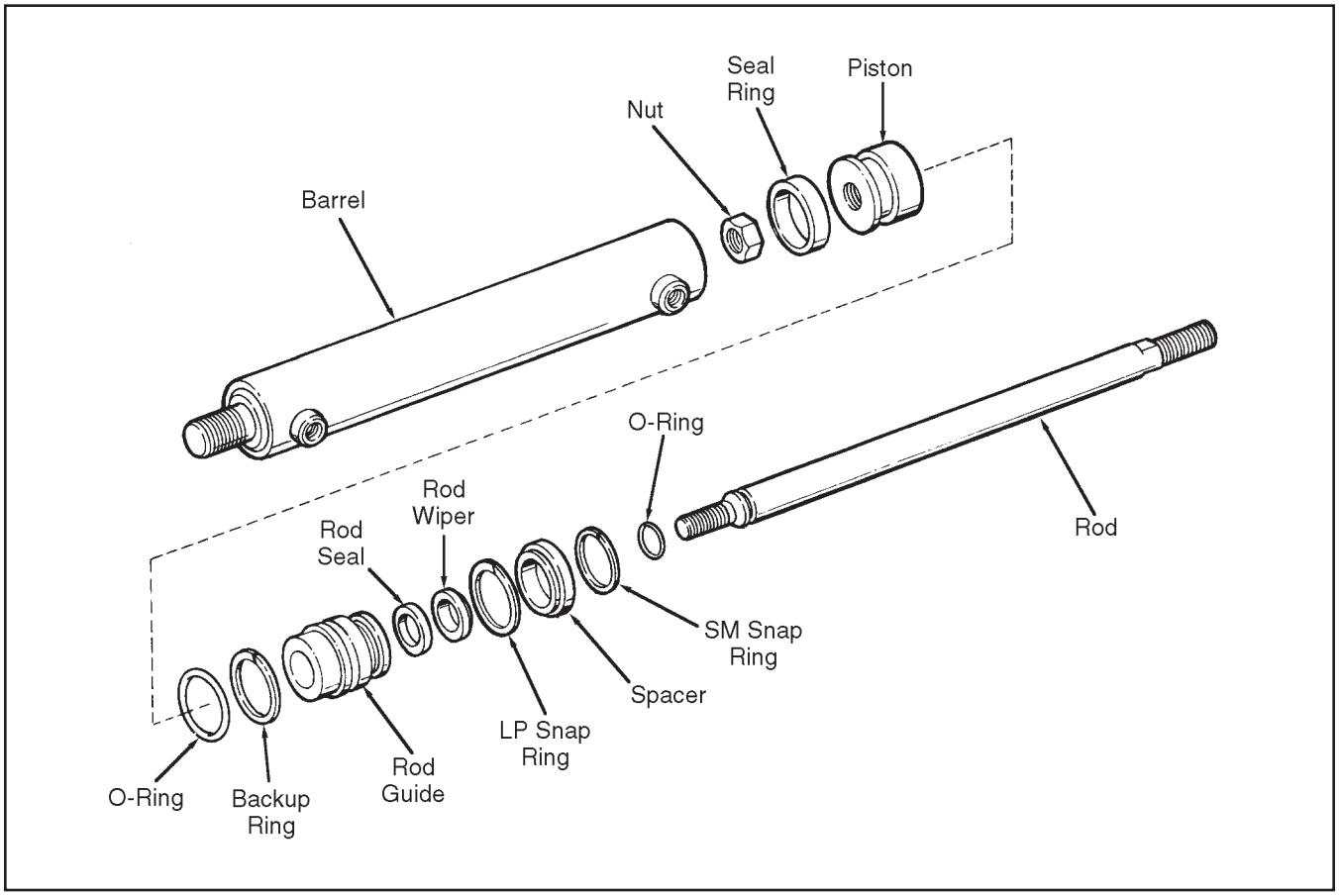

Figure 6E-3. Steering Cylinder Disassembly

SECTION 6E. STEERING CYLINDER

REASSEMBLY

1. Lightly lubricate O-rings, backup rings and seals.
2. Install seal kit as shown in Figure 6E-4.
3. Lubricate all parts before assembly.
4. Follow the steps as illustrated in Figure 6E-5 for reassembly.
5. Thread both ball joints on equally.

INSTALLATION (See Figures 6E-1 and 6E-2)

1. Install cylinder and secure with attaching hardware.
2. Connect hydraulic hoses.
3. Start tractor and check for leaks. Repair as necessary.
4. Adjust turn stop, see Pages 6D-1 and 6D-2.

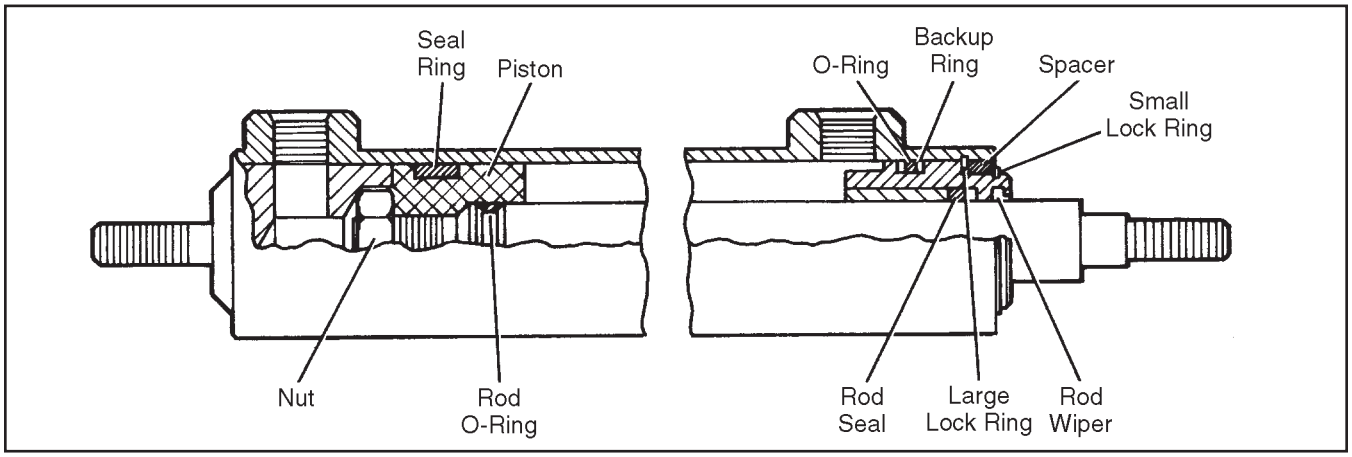

Figure 6E-4. Seal Kit Installation

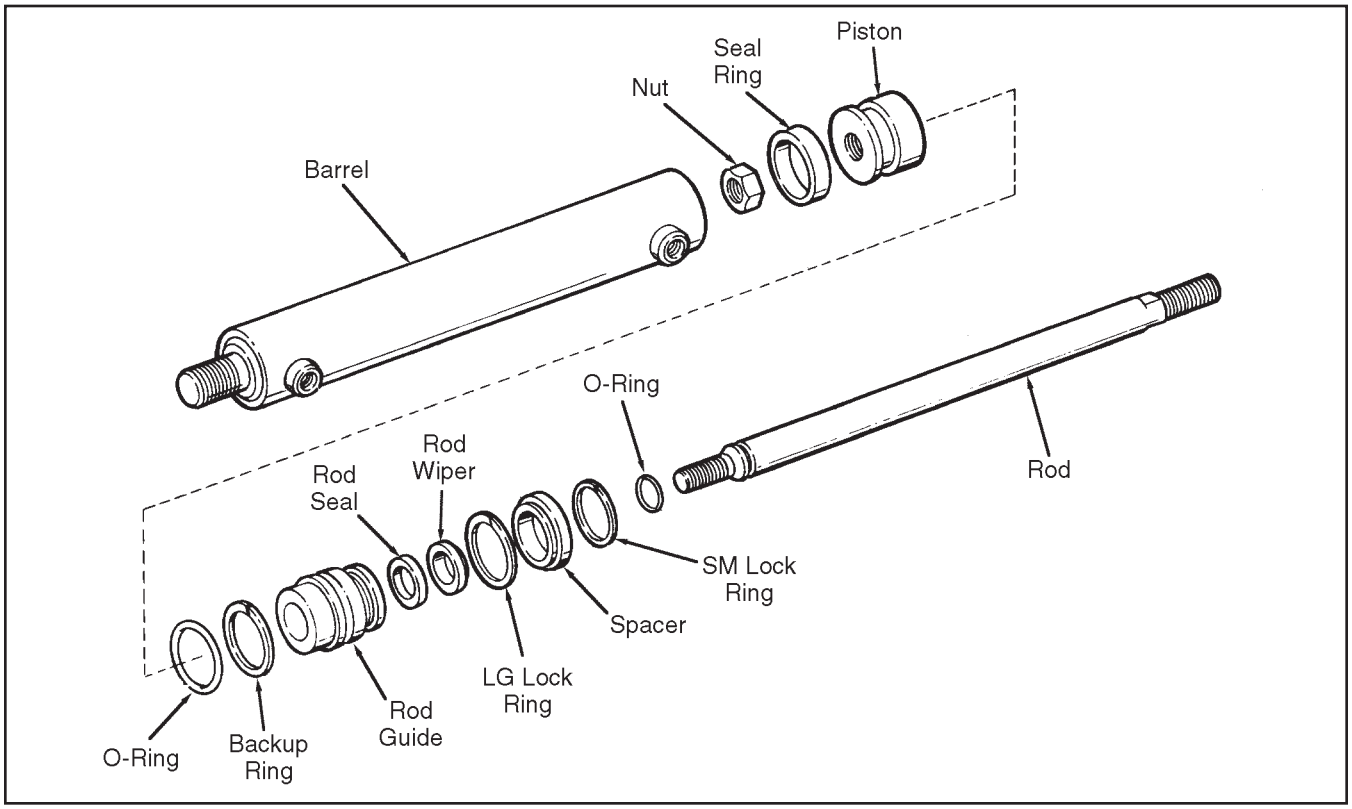

Figure 6E-5. Steering Cylinder Assembly

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SECTION 7
WHEELS AND TIRES

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SECTION 7A. REPAIR AND SERVICE TOOLS AND MATERIALS

Tools required:	Standard automotive hand tools.
Cleaning materials:	Stoddard or equivalent solvent.
Lubricants:	See Section 11.
Other service items:	Commercially available tire sealant.
	Tire pressure gauge.
	Compressed air with tire valve fitting.

SECTION 7B. FAILURE ANALYSIS

PROBLEM	PROBABLE CAUSE	REMEDY
1. Tractor rides hard.	a. Over inflated tires.	a. Reduce tire pressure to 10 to 12 psi (69 to 83 kPa).
2. Tractor wanders.	a. Under inflated tires.	a. Inflate tires to 10 to 12 psi (69 to 83 kPa).
	b. Malfunctioning traction motor.	b. Repair traction motor. Refer to Sections 8E and 8F.
	c. Steering malfunctioning.	c. Steering test. Refer to Section 8O.
	d. Wheel nuts loose.	d. Tighten wheel bolts to 88 to 95 ft-lbs. (115 to 128 N.m).
	e. Steer wheels out of adjustment.	e. Adjust. Refer to Section 6D.
3. Poor traction.	a. Over inflated tires.	a. Reduce tire pressure to 10 to 12 psi (69 to 83 kPa).

SECTION 7C. TIRE SERVICE

GENERAL

The tires are subject to damage from sharp objects. If large punctures or tears occur, it is advisable to take the tire (installed on the wheel) to a qualified tire repair shop.

The front (drive) and rear (steering) wheels on 2WD machines are bolted directly to the wheel hub. Torque front wheel bolts to 85 to 95 ft-lbs. (115 to 128 N.m).

On 4WD machines, the rear (steering) wheels are attached to the wheel drive motors. Torque rear wheel bolts to 88 to 95 ft-lbs. (115 to 128 N.m).

SERVICE

Tires are inflated to 10 to 12 psi (69 to 83 kPa) pressure. This pressure gives the best results for average use. Tire pressure should be equal in all tires.

If a tire is removed from the rim it should be inflated to approximately 22 psi (152 kPa) when it is replaced. This assures proper seating of the tire bead to the rim. Then reduce the pressure to the desired level before using.

NOTE

Never use grease or oil on the rim when mounting a tire.

Bead sealing of the tires may be repaired by using tire sealants available from tire repair shops. To apply sealant:

1. Break one bead from seal on rim and pull out past rim flange at bottom or install through valve stem.
2. Pour sealant into tire cavity.
3. Reseat bead on rim by inflating the tire to 22 psi (152 kPa).
4. Rotate tire slowly to spread compound.
5. Reduce tire pressure to 10 to 12 psi (69 to 83 kPa).

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SECTION 8
HYDRAULICS

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SECTION 8A. REPAIR AND SERVICE TOOLS AND MATERIALS

Tools required:	Standard automotive hand tools, including torque wrench, seal drivers, snap ring pliers, bearing driver.
	Tachometer.
	Hydra sleuth or in-line tester equipped with load valve.
	Wheel restraint (See Figure 8A-3).
Cleaning materials:	Stoddard or equivalent solvent. Detergent and water. Loctite “Locquic” Primer “T”.
Lubricants:	See Section 11.
Other service items:	Seal and Repair Kits (available from Textron Dealer/Distributors)
	Liquid Gasket (Textron P/N 2810298)
	Traction Motor Seal Installation Tool Front Traction Motor Repair JAC 5052 Rear Traction Motor Repair JAC 5053
	Blind Hole Puller (Traction Motors)
	Hydraulic Fitting Kit (available from Textron Dealer/Distributors)
	Hydraulic Pump Aligning Tool JAC 5088
	Loctite® 243 Blue (Textron P/N 2810300)
	Flow Lock Tool JAC 5000
	Traction Pump Seal Kit
	Traction Pump Shaft Seal Installation Tool (See Figure 8A-5)

SECTION 8A. REPAIR AND SERVICE TOOLS AND MATERIALS

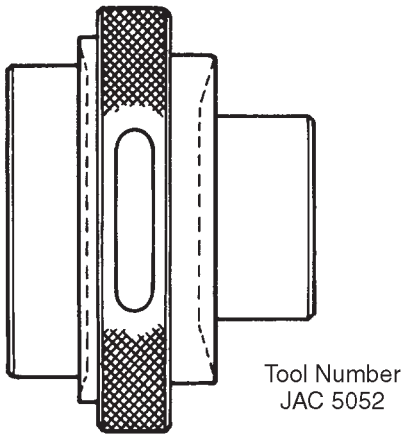


Figure 8A-1. Seal Installation Tool (Front Traction Motors)

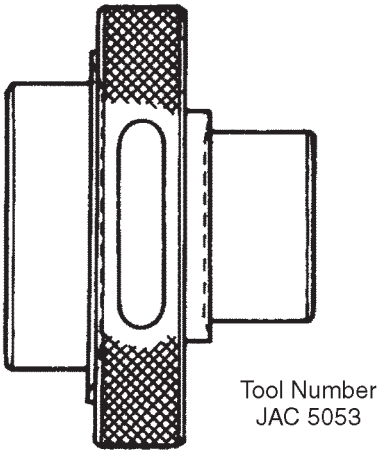
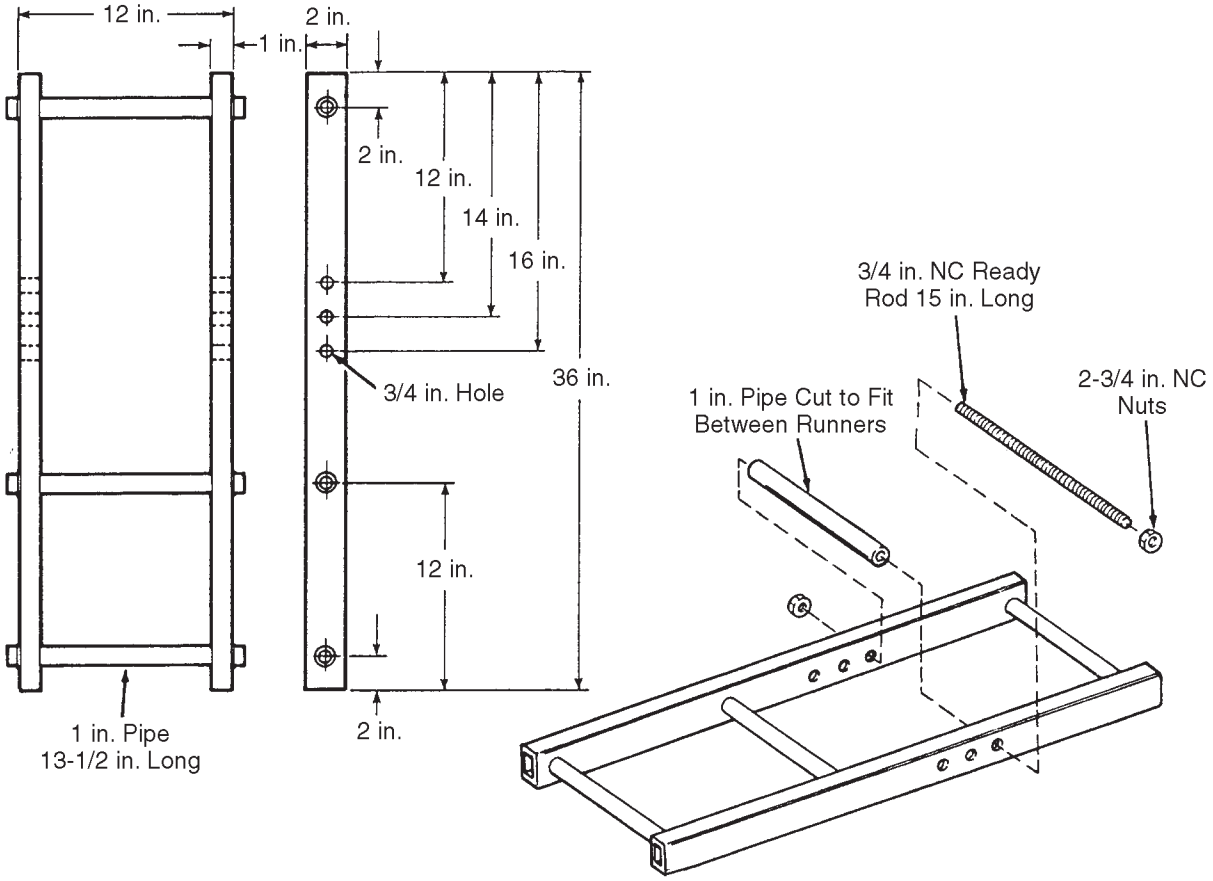


Figure 8A-2. Seal Installation Tool (Rear Traction Motors)

SECTION 8A. REPAIR AND SERVICE TOOLS AND MATERIALS



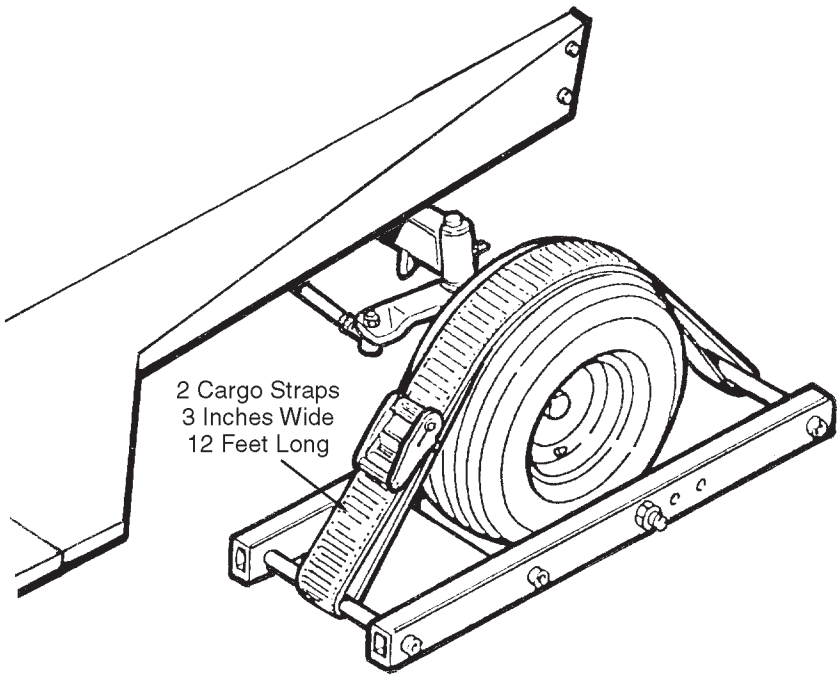
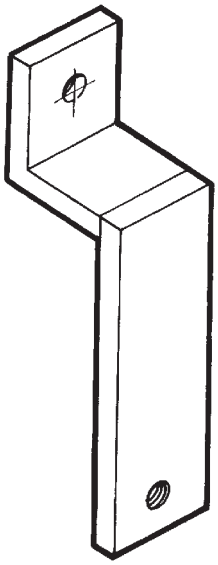


Figure 8A-3. Wheel Restraint

SECTION 8A. REPAIR AND SERVICE TOOLS AND MATERIALS



Tool Number
JAC 5088

Figure 8A-4. Alignment Tool

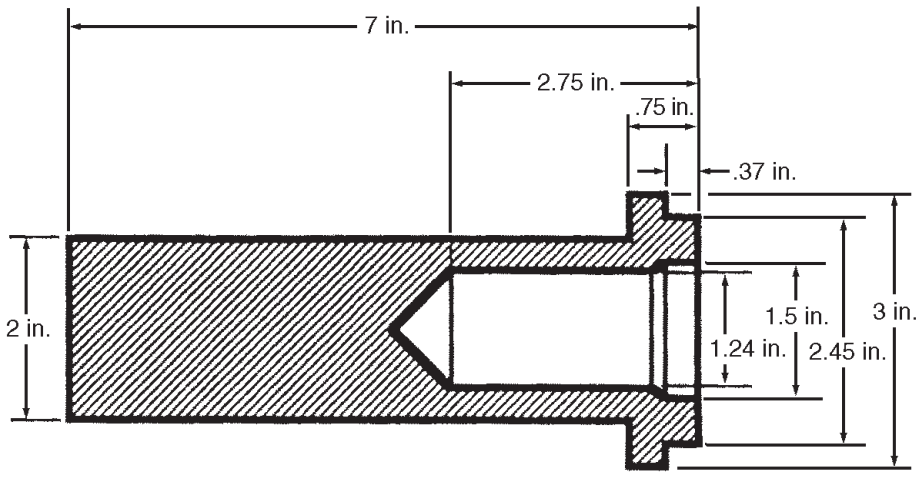


Figure 8A-5. Traction Pump Shaft Seal Installation Tool

SECTION 8B. FAILURE ANALYSIS

PROBLEM	PROBABLE CAUSE	REMEDY
1. Forward and reverse traction problem(s).	a. Engine RPM not correct.	a. Advance throttle and/or adjust (Section 2C).
	b. Parking brake applied.	b. Release brake.
	c. Low oil level.	c. Fill (Section 11).
	d. Tow valve not closed.	d. Close valve
	e. Traction pedal linkage out of adjustment or damaged.	e. Adjust or repair (Section 2C).
	f. No or little charge pressure.	f. Test/repair (Section 8O).
	g. Faulty traction pump.	g. Test (Section 8O). Repair (Section 8D).
	h. Faulty traction motor(s).	h. Test (Section 8O). Repair (Sections 8E and 8F).
2. Steering problems.	a. See Section 6B.	
3. Reels do not come on.	a. Mower switch not on.	a. Push ON.
	b. Electrical system faulty.	b. Check (Section 10B).
	c. Reel pump faulty.	c. Test (Section 8O). Repair (Section 8H).
	d. Reel valve faulty.	d. Test (Section 8O). Repair (Section 8K).
4. Reels come on but run slow (all reels).	a. Engine RPM not high enough.	a. Advance throttle. Adjust throttle (Section 2C).
	b. Improper reel-to-bedknife adjustment.	b. Adjust (Section 12G).
5. Reel(s) run slow.	a. Improper reel-to-bedknife adjustment.	a. Adjust (Section 12O).
	b. Reel motor faulty.	b. Test (Section 8O). Repair (Section 8I or 8J).
	c. Reel unit faulty.	c. Repair (Section 12F or 12G).
6. Mowers will not lower.	a. Reel lift lever in wrong position.	a. Move to correct mow position.
	b. Reel pump faulty.	b. Test (Section 8O). Repair (Section 8H).
	c. Lift valve faulty.	c. Test (Section 8O). Repair (Section 8L).
	d. Mechanical binding in lift system.	d. Repair (Section 9F).
7. Mowers lower too slow.	a. Engine RPM not high enough.	a. Advance throttle. Adjust throttle (Section 2C).
	b. Mechanical binding in lift system.	b. Repair (Section 9F).
	c. Lift valve faulty.	c. Test (Section 8O). Repair (Section 8L).
	d. Cylinder faulty.	d. Test (Section 8O). Repair (Section 8M).

SECTION 8B. FAILURE ANALYSIS

PROBLEM	PROBABLE CAUSE	REMEDY
8. Mowers do not lift.	a. Reel pump faulty.	a. Test (Section 8O). Repair (Section 8H).
	b. Lift valve faulty.	b. Test (Section 8O). Repair (Section 8L).
	c. Mechanical binding in lift system.	c. Repair (Section 9F).
	d. Cylinder faulty.	d. Test (Section 8O). Repair (Section 8M).
9. No backlap.	a. Backlap switch not in backlap.	a. Push switch into backlap.
	b. Backlap (reel) valve faulty.	b. Test (Section 8O). Repair (Section 8K).
	c. Backlap (reel) valve solenoid faulty.	c. Test (Section 10K).
10. Backlap reel speed too fast.	a. Flow control not adjusted.	a. Adjust reel valve flow control handle.
	b. Engine RPM too high.	b. Adjust throttle lever (Section 2C).
	c. Backlap (reel) valve faulty.	c. Test (Section 8O). Repair (Section 8K).

SECTION 8C. GENERAL INSTRUCTIONS

GENERAL

NOTE

Component location illustrations and hydraulic system diagrams are located at the end of this section.

The following general instructions apply to all hydraulic system service procedures. Carefully read and adhere to each precaution.

- Dirt in the hydraulic system will cause damage to system components and reduce the life of the machine. Clean all dirt from around fittings and components before disconnecting any hydraulic lines or removing components.
- Relieve system pressure at components or hydraulic lines by slightly loosening the line fitting before removing.
- Immediately after disconnecting a hydraulic line, cap the line fitting and plug the port of the removed component from the machine. This not only prevents the entry of dirt into the system but also eliminates the loss of hydraulic fluid.
- Identify and label all linkages, hydraulic lines and component parts. Mark the pump and motor sections before removal and disassembly. This will ensure the correct order of parts during reassembly and installation.
- Drain hydraulic fluid from components before disassembly.
- Discard all seals and O-rings as they are removed. Install new seals and O-rings during reassembly. Most seals are available in component kit form from your Textron Distributor.

CAUTION

Do not use steam or high pressure washers to clean hydraulic components.

- All parts should be thoroughly cleaned in a suitable non-flammable solvent and air blown dried before beginning repair or reassembly.
- Perform repair procedures in a clean work area using clean tools.
- Do not force or pry components apart or together. Light tapping with a plastic mallet is recommended unless otherwise specified in the repair instruction.
- Unless otherwise indicated, apply a light coat of clean hydraulic fluid to parts as each is reassembled. Apply clean grease to O-rings, if necessary, to hold them in position during reassembly.
- Hydraulic hose and tube lines should be inspected daily to check for loose connections, kinks, worn or cut hoses, etc. Be sure tubes and hoses do not contact other frame parts which could cause abrasive wear. Always replace worn hose or tube assemblies before operating machine.

CAUTION

If, during the disassembly of any hydraulic component, metal chips or damage is found the hydraulic system must be drained, thoroughly flushed with clean oil and then refilled.

WARNING

Always check hydraulic tank level after removing and installing a hydraulic component or line. Severe damage to system components can result if they are allowed to run dry.

HYDRAULIC TUBE AND HOSE FITTINGS

WARNING

To avoid serious bodily injury, always lower mowers fully, place all controls in neutral and shut off engine before inspecting hydraulic lines or hoses. Never run hands across tubes, hoses or fittings to check for leaks. Hydraulic fluid escaping under pressure can have sufficient force to penetrate skin and may cause infection in a minor cut or opening in the skin.

37° FLARE FITTINGS

TORQUE RECOMMENDATIONS

1. Assemble tube nut adapter to fitting with minimum torque (fingertight) until flare contacts seat on fitting body.
2. For tightening reference, mark a line lengthwise on the flats of both the nut and adapter fitting with a marker as shown in Figure 8C-1.

SECTION 8C. GENERAL INSTRUCTIONS

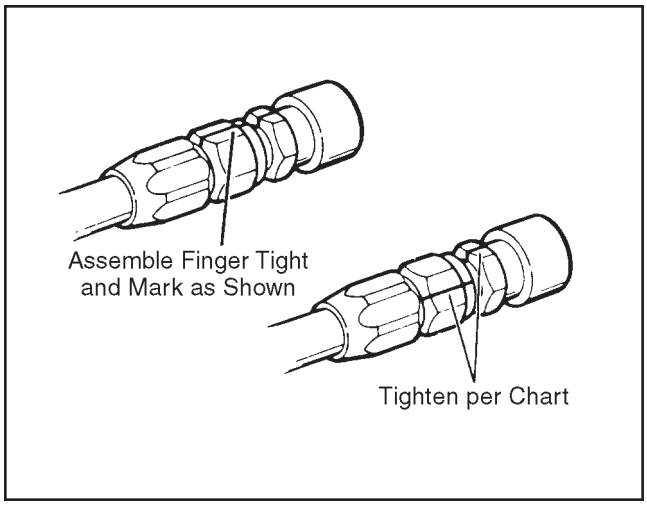


FIgure 8C-1. Reference Marking

3. Using a wrench, tighten the nut the amount shown in the chart below. The line will show which fittings have been tightened correctly and also indicates if a fitting is becoming loose.

37° Flare Torque Recommendations

SAE Dash Size	Thread Size	Tube O.D.	Torque In-Lbs.	# of Flat Rotations
3	3/8-24	0.188	95-105	1½:1¾
4	7/16-20	0.250	135-145	2¼:2¾
5	½-20	0.312	170-190	3¼:3¾
6	9/16-18	0.375	215-245	2¼:2¾
8	¾-16	0.500	430-470	2¼:2¾
10	⅞-14	0.625	680-750	2:2½
12	1 1/16-12	0.750	950-1050	2:2½
14	1 3/8-12	0.875	1000-1100	1:1½
16	1 5/16-12	1.000	1300-1360	2¼:2¾
20	1 5/8-12	1.250	1520-1600	1¼:1¾
24	1 7/8-12	1.500	1900-2000	¾:1¼

Tube O.D. or Hose I.D.	Rotate No. of Hex Flats
3/8"	2
1/2"	2
5/8"	1½-2
1"	¾-1

HOSE INSTALLATION INSTRUCTIONS

1. Hold the fixed portion of the hose coupling with one wrench; use a second wrench to tighten or loosen the hose nut. This will avoid damaging the fitting seal. When tightening a hose, do not permit it to twist; hold it in a normal straight position.
2. When installing mower hoses, place fittings at angles to avoid contact with fixed parts when turning. Make sure hoses are assembled to proper “A” and “B” ports on components.

O-RING BOSS FITTINGS

On hoses with O-ring fittings, make sure O-rings are clean and hose fittings are properly seated before tightening. Always install new O-rings. See Figure 8C-2.

REPLACEMENT O-RINGS FOR O-RING BOSS FITTINGS

A	B	O-Ring
Tubing O.D. or Hose I.D.	Thread Size	Jacobsen Part No.
1/8	5/16-24	459290
3/16	3/8-24	459291
1/4	7/16-20	339896
5/16	½-20	459293
3/8	9/16-18	339897
½	¾-16	339898
5/8	⅞-14	339899
¾	1 1/16-12	339900
⅞	1 3/16-12	459296
1	1 5/16-12	339901
1¼	1 5/8-12	339902
1½	1 7/8-12	339903
2	2½-12	459300

NOTE

O-rings should be lubricated with the fluid to be used in the system prior to assembly.

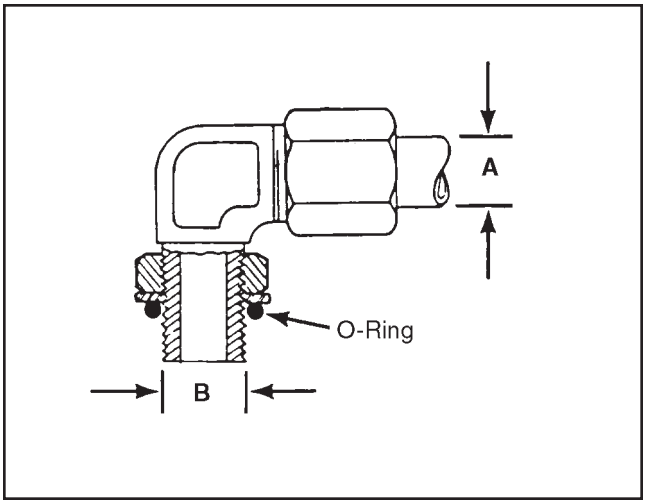


Figure 8C-2. Boss Fitting O-Ring Installation

SECTION 8C. GENERAL INSTRUCTIONS

O-RING BOSS TORQUE RECOMMENDATIONS

SAE Dash Size	Thread Size	Tube O.D.	Torque In-Lbs.
3	3/8-24	0.188	96-120
4	7/16-20	0.250	168-192
5	1/2-20	0.312	216-240
6	9/16-18	0.375	288-312
8	3/4-16	0.500	600-720
10	7/8-14	0.625	864-960
12	1 1/16-12	0.750	1500-1620
14	1 3/8-12	0.875	1920-2160
16	1 5/16-12	1.000	2400-2640
20	1 5/8-12	1.250	2520-3360
24	1 7/8-12	1.500	3240-4320

ORS (Face Seal) FITTINGS (See Figure 8C-3)

Face seal fittings have O-ring grooves machined into the flat male face. This O-ring and flat surface mate against the mating fittings machined face.

The swivel nut can be retracted to inspect the O-ring and fitting face without removal of tubes or components.

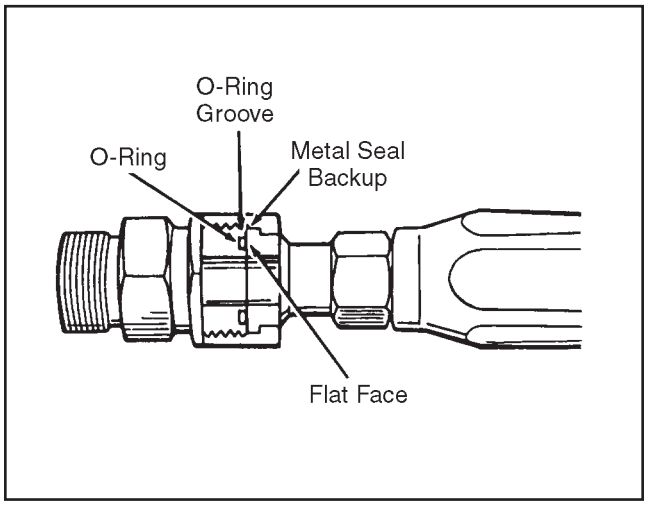


Figure 8C-3. ORS (Face Seal) Fitting

REPLACEMENT O-RING FOR ORS (FACE SEAL) FITTINGS

ORS (Face Seal) Tube Size	ORS (Face Seal) O-Ring Size	Jacobsen Part No.
4	11	339908
6	12	339909
8	14	339910
10	16	339911
12	18	339912
16	21	339913
20	25	339914
24	29	339915

O-RING FACE SEAL TORQUE RECOMMENDATIONS

SAE Dash Size	Thread Size	Tube O.D.	Torque In-Lbs.
3		N/A	N/A
4	9/16-18	0.250	120-144
5		N/A	N/A
6	11/16-16	0.375	216-240
8	13/16-16	0.500	384-420
10	1-14	0.625	552-600
12	1 3/16-12	0.750	780-840
16	1 7/16-12	1.000	1104-1200
20	1 11/16-12	1.250	1500-1680
24	2-12	1.500	1800-3960

SECTION 8D. HYDROSTATIC TRANSMISSION

GENERAL

The hydrostatic transmission (hydro) supplies oil to the traction system of the tractor. The hydro is engine driven through a drive shaft. It is a variable output pump.

When disassembling the hydro, ONLY disassemble the necessary components for repair. The disassembly procedure is broken down into segments. In some cases it is not necessary to remove the pump.

⚠ CAUTION

The servo regulator section of the traction pump is repairable at the factory level only. Do not attempt to disassemble the servo regulator.

REMOVAL (See Figure 8D-1)

NOTE

Do not attempt to remove or disassemble for repair until a traction pump test described in Section 8N and/or 8O is performed.

1. Disconnect NEG (–) battery cable from battery.
2. Tag and disconnect hydraulic lines from the reel pump and traction pump.
3. Remove the auxiliary pump bracket and pump.
4. Remove the traction pedal linkage from the hydro.
5. Remove hydro mounting bolts.
6. Slide hydro out from mounting bracket on the frame.

INSTALLATION (See Figure 8D-1)

1. Position hydro, aligning the pump shaft with the drive shaft.
2. Install hydro mounting bolts. Torque to 36 to 40 ft-lbs. (48 to 54 N.m).
3. Install auxiliary pump, making sure O-ring is properly positioned in groove of hydro. Torque mounting bolts to 27 to 37 ft-lbs. (37 to 50 N.m).
4. Reconnect hydraulic lines.
5. Reconnect NEG (–) battery cable.
6. Check hydraulic fluid level. Fill if necessary.
7. Reconnect traction pedal linkage to the hydro lever. Adjust forward and reverse speed (see Section 2C).

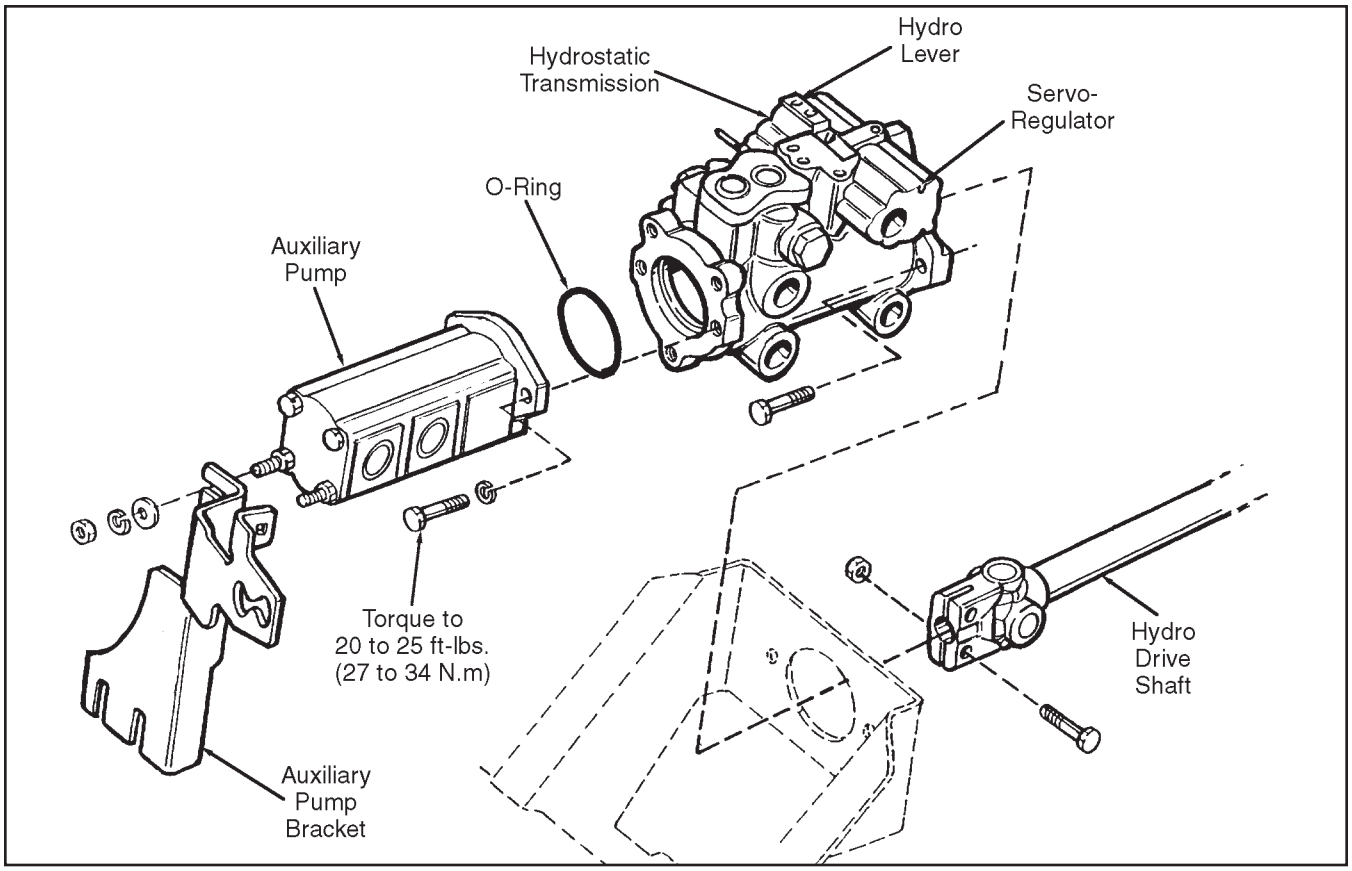


Figure 8D-1. Hydrostatic Transmission and Auxiliary Pump Removal and Installation

SECTION 8D. HYDROSTATIC TRANSMISSION

SHAFT SEAL REPAIR (See Figure 8D-2)

NOTE

The shaft seal is non-repairable. Once removed, the shaft seal must be replaced.

1. Remove the retaining ring from the housing.
2. Carefully remove the shaft seal from the housing bore. The face of the seal may be punctured with a sharp instrument (such as a screwdriver) to aid in prying the seal out, or a slide hammer type puller may be used to remove the seal. Care must be taken so as not to damage the housing bore or shaft.
3. Prior to installing the new seal, inspect the sealing area on the shaft for rust, wear or contamination. Polish the sealing area on the shaft if necessary.
4. Wrap the spline or key end of shaft with thin plastic to prevent damage to the seal lip during installation. Lubricate the inside diameter of the new seal with petroleum jelly.

NOTE

The outside diameter of the seal may be lightly coated with sealant prior to installation. This will aid in preventing leaks caused by damage to the housing seal bore.

5. Slide the new seal over the shaft and press it into the housing bore. Be careful not to damage seal. A seal installer tool can be made to aid in installing the seal. Dimensions for this tool are shown in Section 8A.
6. Reinstall the seal retaining ring.

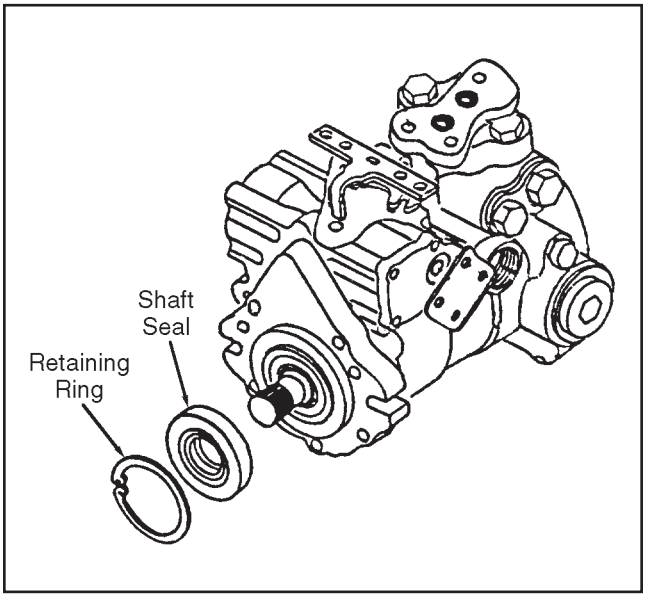


Figure 8D-2. Shaft Seal Repair

SECTION 8D. HYDROSTATIC TRANSMISSION

PUMP PAD, TEMPER LOAD RING AND GEROTOR COVER REPAIR (See Figure 8D-3)

NOTE

Whenever the temper load ring is removed it must be replaced with a new temper load ring.

NOTE

When removing the gerotor cover, mark the orientation of the pin in the gerotor cover. The position of this pin determines rotation of the pump. This pump's input rotation must be clockwise (CW), therefore, the pin should be oriented as shown in Figure 8D-3.

1. Remove the pump pad, temper load ring, gerotor cover and O-rings as shown in Figure 8D-3.
2. Replace the temper load ring and O-rings.
3. Make certain the gerotor cover is properly aligned for CW rotation.
4. Install pump pad and torque mounting bolts to 27 to 37 ft-lbs. (37 to 50 N.m).

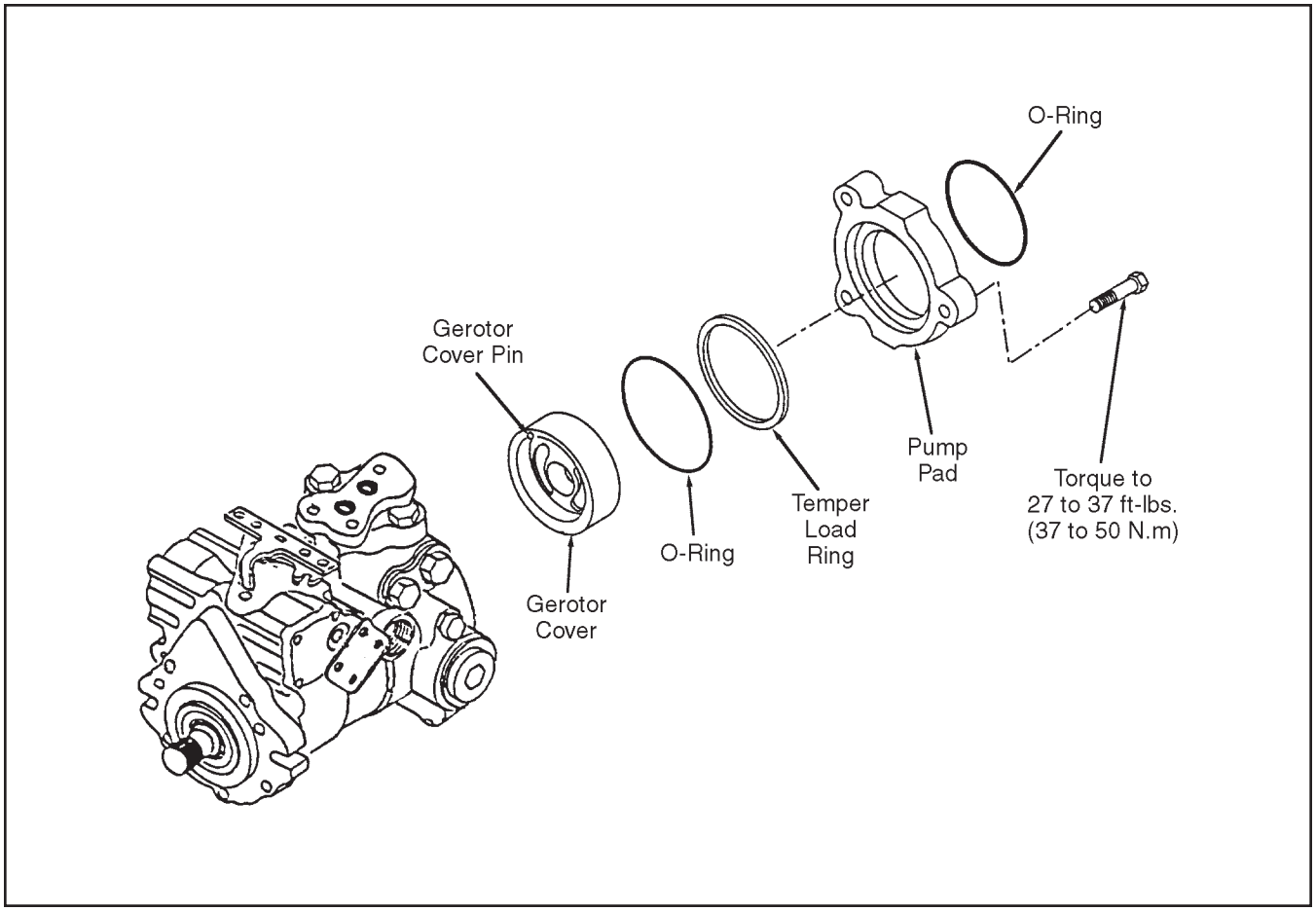


Figure 8D-3. Pump Pad, Temper Load Ring and Gerotor Cover Repair

FILTER ADAPTER REPAIR (See Figure 8D-4)

If the filter adapter seal requires replacement, replace as shown in Figure 8D-4. Torque the three mounting screws to 16 to 21 ft-lbs. (22 to 28 N.m).

HYDRO CONTROL REPAIR (See Figure 8D-4)

NOTE

Before disassembly of the hydro control mechanism, mark the position of the hydro control lever and neutral return bracket so that the mechanism is re-installed correctly.

1. The hydro control lever, neutral return bracket, spring, spool, sleeve and sleeve washer can be removed as an assembly by removing the two flange head screws.
2. If further disassembly is required, remove the spool nut and lockwasher, disengage the spring and replace parts as required. Replace O-rings and backup rings.
3. Inspect the control drain orifice, which is incorporated into the control valve sleeve.
4. Install the spool cap, spring and neutral bracket onto the spool. Install the lever onto the spool, aligning the marks made at disassembly. Engage the neutral spring with the control lever and neutral bracket. Install the lockwasher and nut onto the spool and torque spool nut to 10 to 12 ft-lbs. (13.6 to 16.3 N.m).
5. Align the control sleeve so its slot will engage the swashplate feedback pin (slot positioned toward the pump cover) and insert the sleeve into the housing. Install the sleeve washer onto the control sleeve.
6. Install the control spool assembly into the control sleeve, being certain that the control lever is oriented as noted during disassembly.

⚠ CAUTION

The slot in the lever end of the spool must be oriented toward the front hydro cover.

7. Align the marks made at disassembly and fasten the neutral bracket to the housing with the flange head screws.

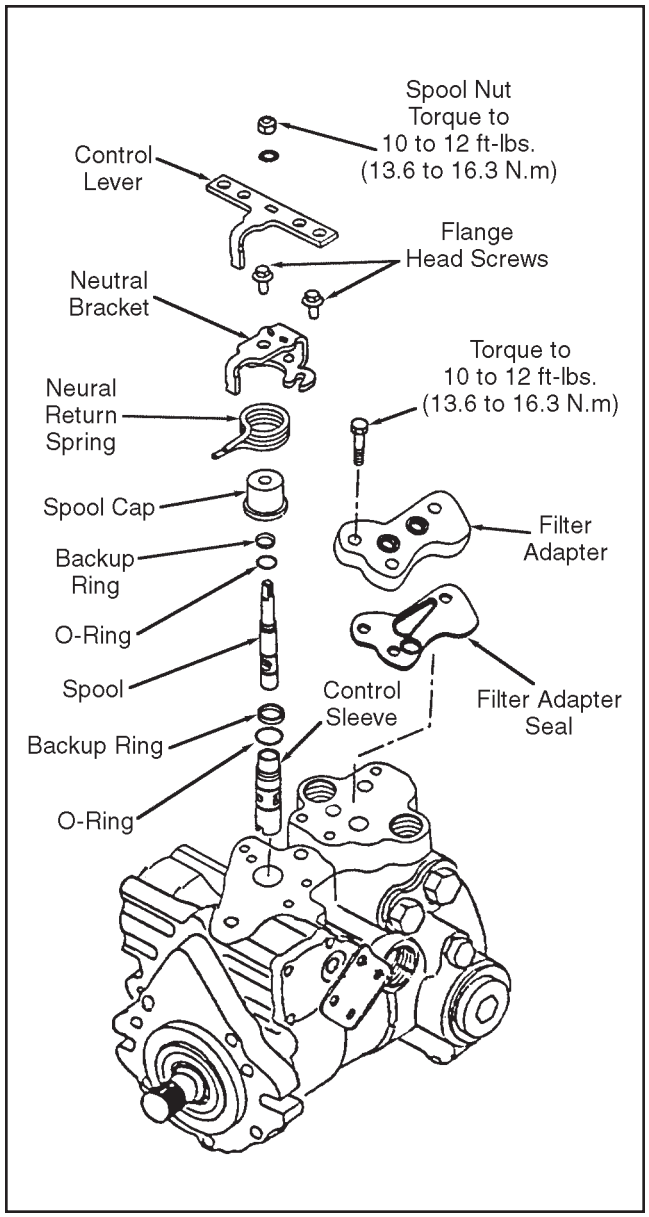


Figure 8D-4. Filter Adapter and Pump Control Repair

TOW VALVE, RELIEF VALVE AND INLET ORIFICE REPAIR (See Figure 8D-5)

GENERAL

If valves do not pass tests in Sections 8O and 8P, they should be disassembled, cleaned, inspected and (if necessary) replaced as described below.

1. Unscrew the tow valve from the housing. Inspect the valve and mating seat for damage or foreign material. Replace the O-ring and backup ring.
2. Reinstall the tow valve into the housing. Torque to 7 to 10 ft-lbs. (9.5 to 13.6 N.m).

SECTION 8D. HYDROSTATIC TRANSMISSION

CHARGE RELIEF VALVE

1. If charge relief pressure test (Section 8O) indicates that charge pressure is less than 220 psi (1517 kPa) above case pressure, the charge relief valve should be removed and inspected.
2. Remove as shown in Figure 8D-5.
3. Replace O-ring.
4. Adjust charge pressure by changing the thickness of the shim

TRACTION CIRCUIT RELIEF VALVES

CAUTION

The high pressure relief valves are factory set and should not be tampered with except for replacing the entire cartridge. Disassembly may change the setting and cause erratic unit operation or premature failure.

1. The traction circuit relief valves have the dual purpose of providing make-up oil during by-directional rotation and providing protection from system over-pressure.
2. When the problem occurs in one direction only, interchange the pressure relief valves to see if the problem changes to the other direction. If so, one pressure relief valve cartridge is either malfunctioning or does not have the proper setting and should be replaced.
3. After reinstalling the valve cartridge, O-ring, poppet and plug, torque the plug to 30 to 70 ft-lbs. (41 to 95 N.m).

CONTROL INLET ORIFICE

1. Remove the plug and control inlet orifice.
2. Clean the control inlet orifice in recommended solvent. Inspect the orifice screen for plugging or damage. Replace the orifice if necessary.
3. Install the control inlet orifice/screen plug and torque to 20 to 30 ft-lbs. (2.2 to 3.4 N.m). Install the external plug. Apply a thread sealant to the external plug.

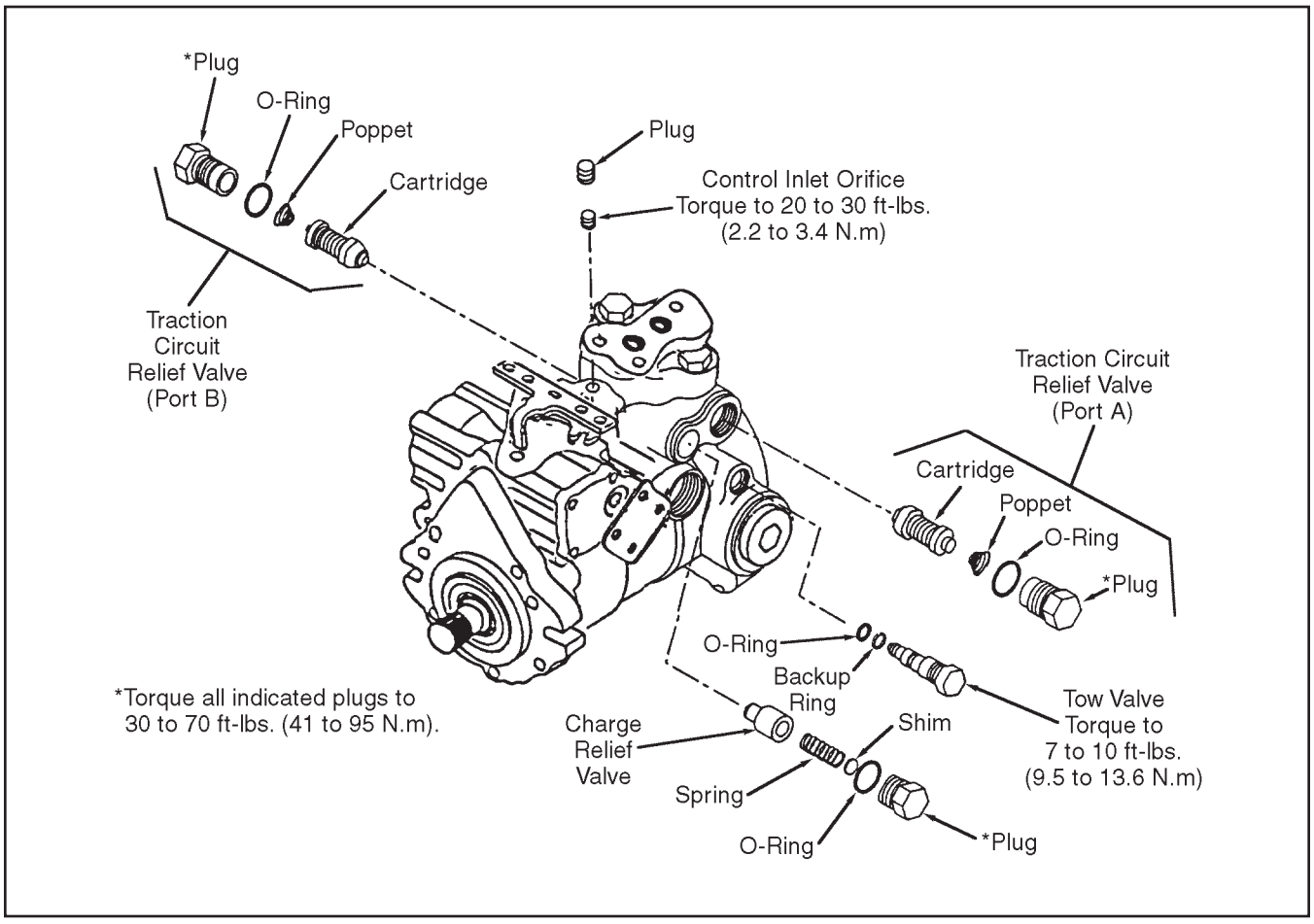


Figure 8D-5. Valve and Control Inlet Orifice Repair

SECTION 8E. FRONT TRACTION MOTORS

REMOVAL (See Figure 8E-1)

1. Block the rear wheels and support the tractor so that the front tire is off the ground.
2. Disconnect the brake cable and spring.
3. Disconnect hydraulic lines at the traction motor. Cap and plug fittings.
4. Remove the tire, wheel hub, disk brake and parking brake.
5. Remove the motor mounting bolts and washers and remove the traction motor from the frame.

INSTALLATION (See Figure 8E-1)

1. Position the traction motor on the frame and secure with bolts and washers.
2. Install the parking brake, disk brake, wheel hub and tire.
3. Reconnect the hydraulic lines to the traction motor.
4. Attach the brake spring and cable.
5. Lower the tire to the ground and adjust the brakes as described in Section 5C.

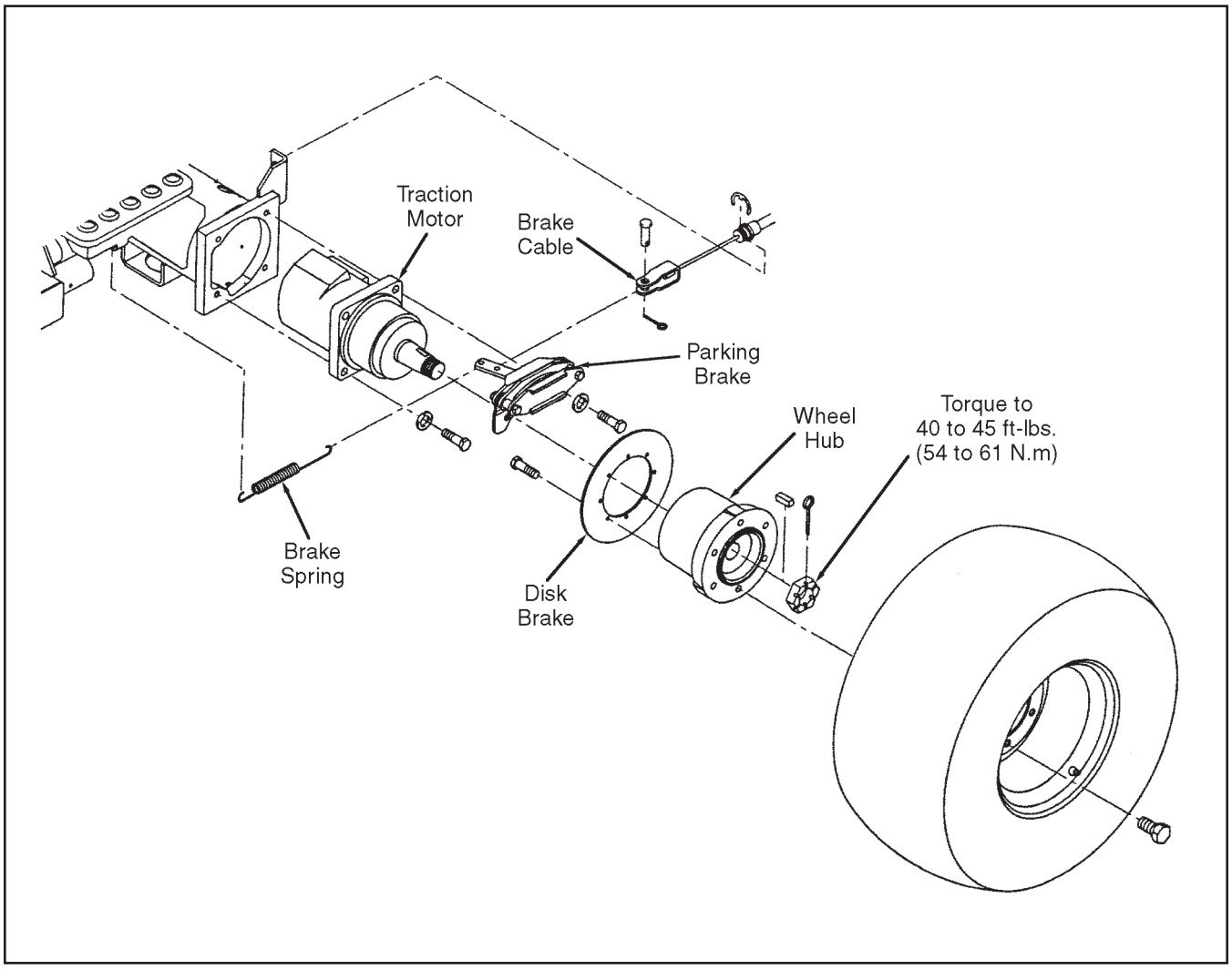


Fig. 8E-1. Front Traction Motor Removal and Installation

SECTION 8E. FRONT TRACTION MOTORS

DISASSEMBLY
(See Figures 8E-2 thru 8E-8)

1. Remove four bolts from valve housing.
2. Lift housing straight up. Be careful not to lose the two springs.
3. If necessary, remove the two check valve assemblies from valve housing.

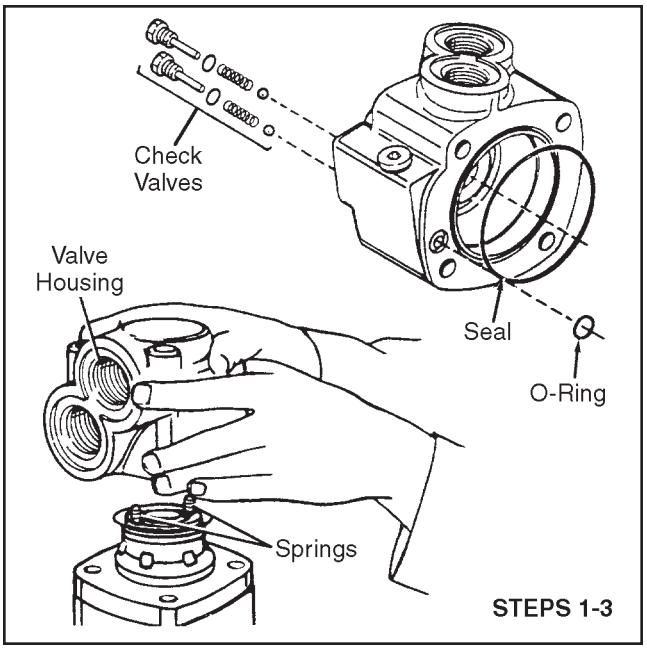


Figure 8E-3. Housing and Check Valves

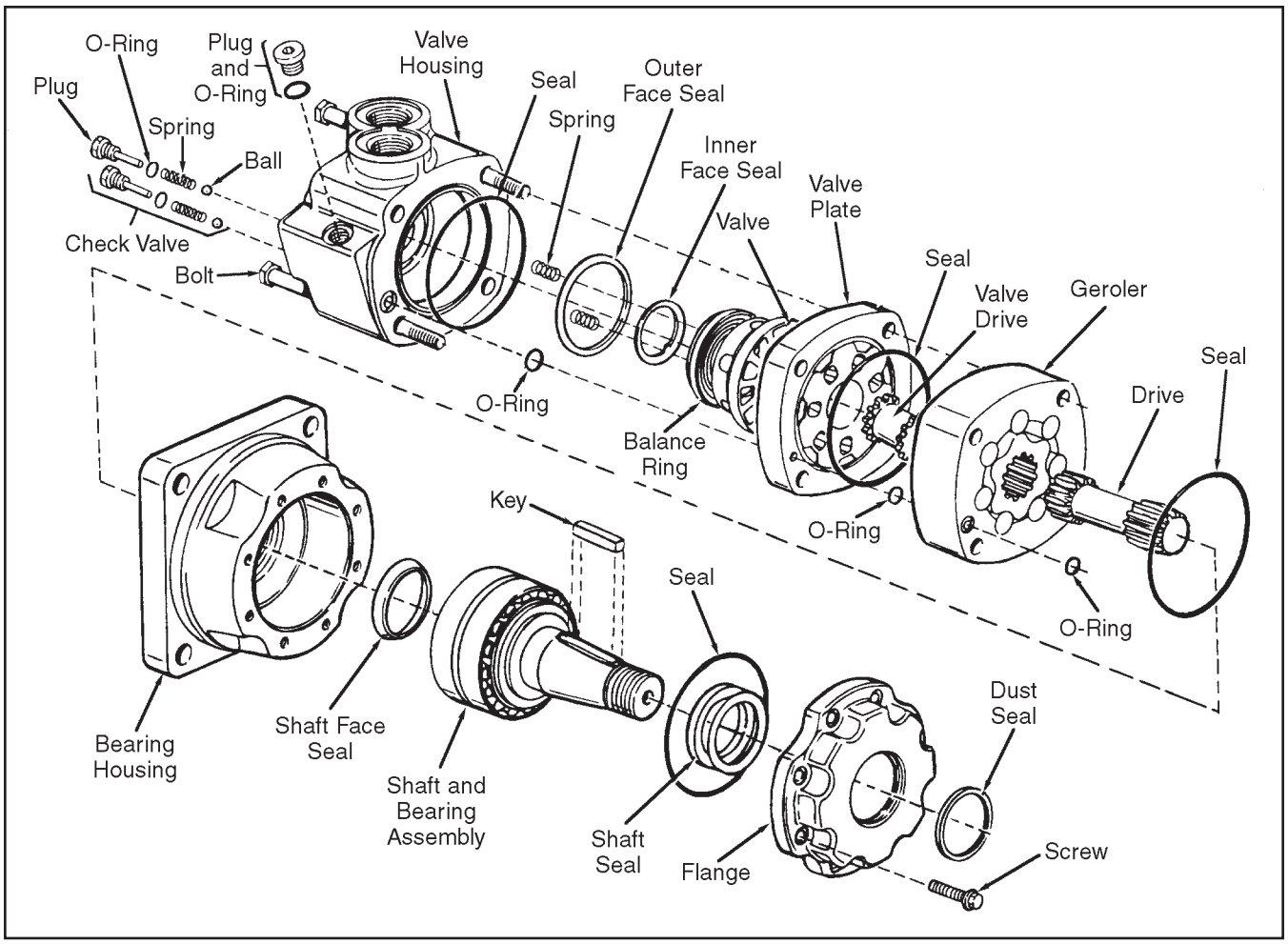


Figure 8E-2. Front Traction Motor

SECTION 8E. FRONT TRACTION MOTORS

4. Remove the two springs, balance ring and valve.
5. The inner and outer face seals can now be removed from the balance ring.

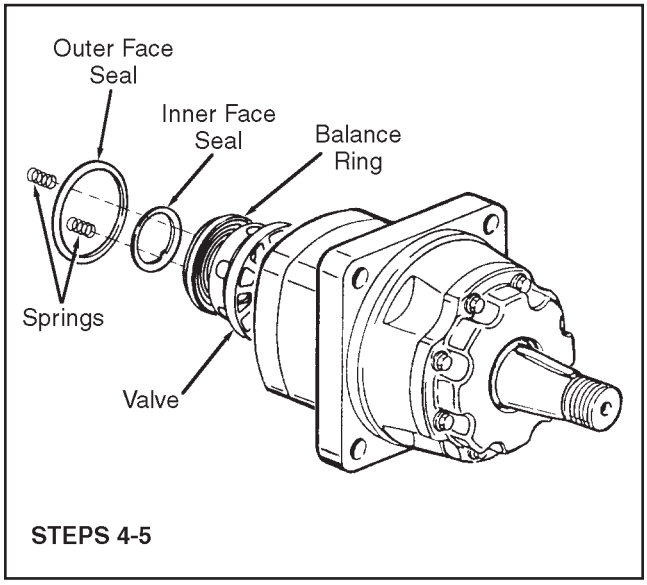


Figure 8E-4. Balance Ring

6. Remove the valve plate and seal ring.
7. Remove the valve drive.
8. Remove the Geroler.

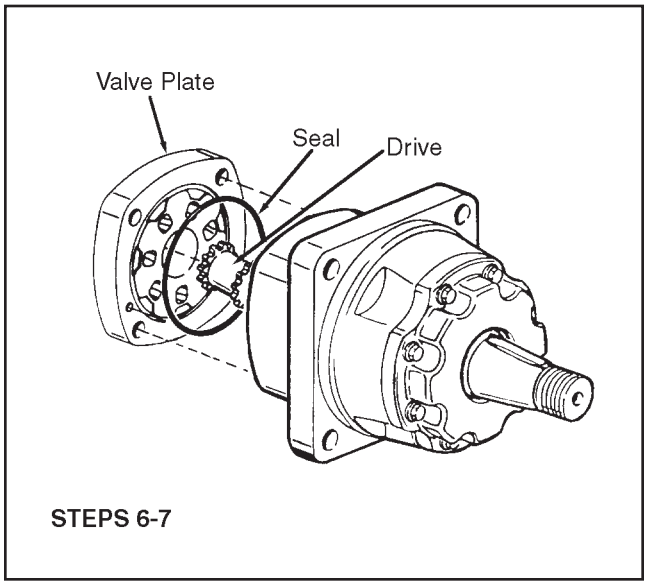


Figure 8E-5. Valve Plate

NOTE

Rollers and Geroler ring may be loose, retain them in position.

9. Remove seal rings, O-rings and drive.
10. Remove the flange.

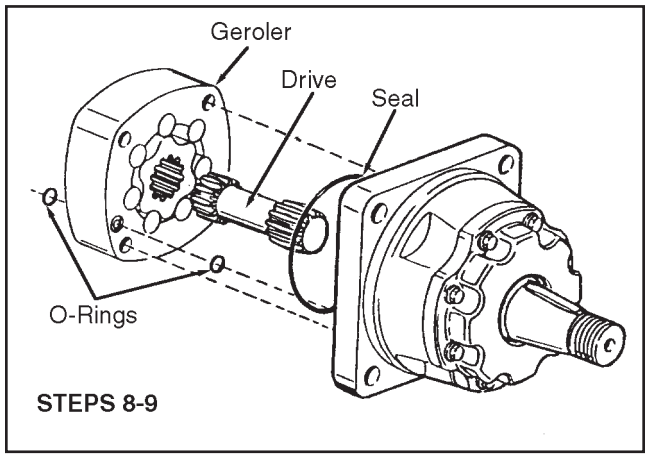


Figure 8E-6. Geroler

NOTE

If washers are used under the capscrews, discard. They are not used for reassembly.

11. Remove dust seal, shaft seal and backup ring.

NOTE

Be careful not to damage bore of flange.

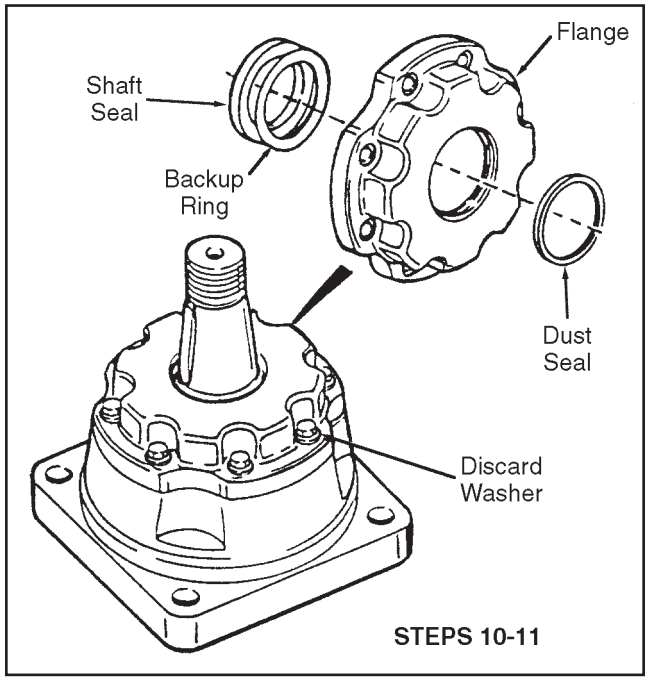


Figure 8E-7. Flange

8E

SECTION 8E. FRONT TRACTION MOTORS

12. Remove shaft and bearing assembly from bearing housing. Remove shaft face seal.

NOTE

It is not recommended to disassemble shaft and bearing assembly. It is serviced as a complete component.

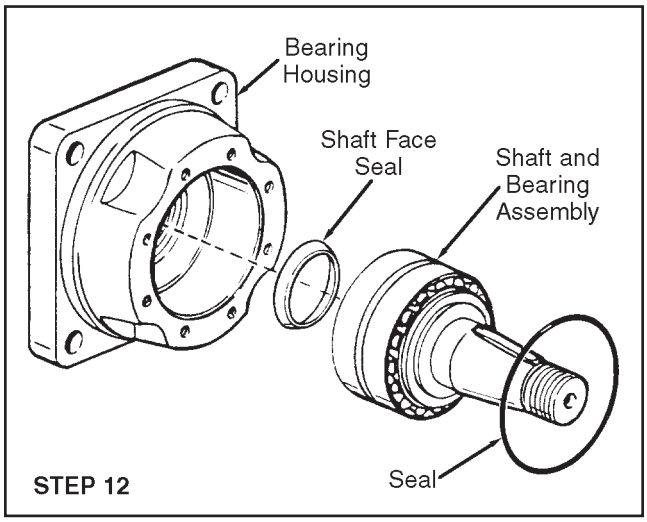


Figure 8E-8. Shaft and Bearing Assembly

INSPECTION

1. Inspect all mating surfaces for corrosion or damage.
2. Clean parts in a suitable solvent. Do not wipe with cloth or paper towels.
3. Do not file or grind any surfaces.
4. Inspect all parts for wear or damage. Replace if necessary.
5. Coat all parts with hydraulic oil.

REASSEMBLY
(See Figures 8E-9 thru 8E-12)

NOTE

When reassembling the motor be very careful to position seals, seal rings, and backup washers properly as shown.

1. Install face seal with chamfer up in bearing housing as shown.
2. Install shaft and bearing assembly into bearing housing.
3. Install backup ring and shaft seal in flange as shown.
4. Press in dust seal.

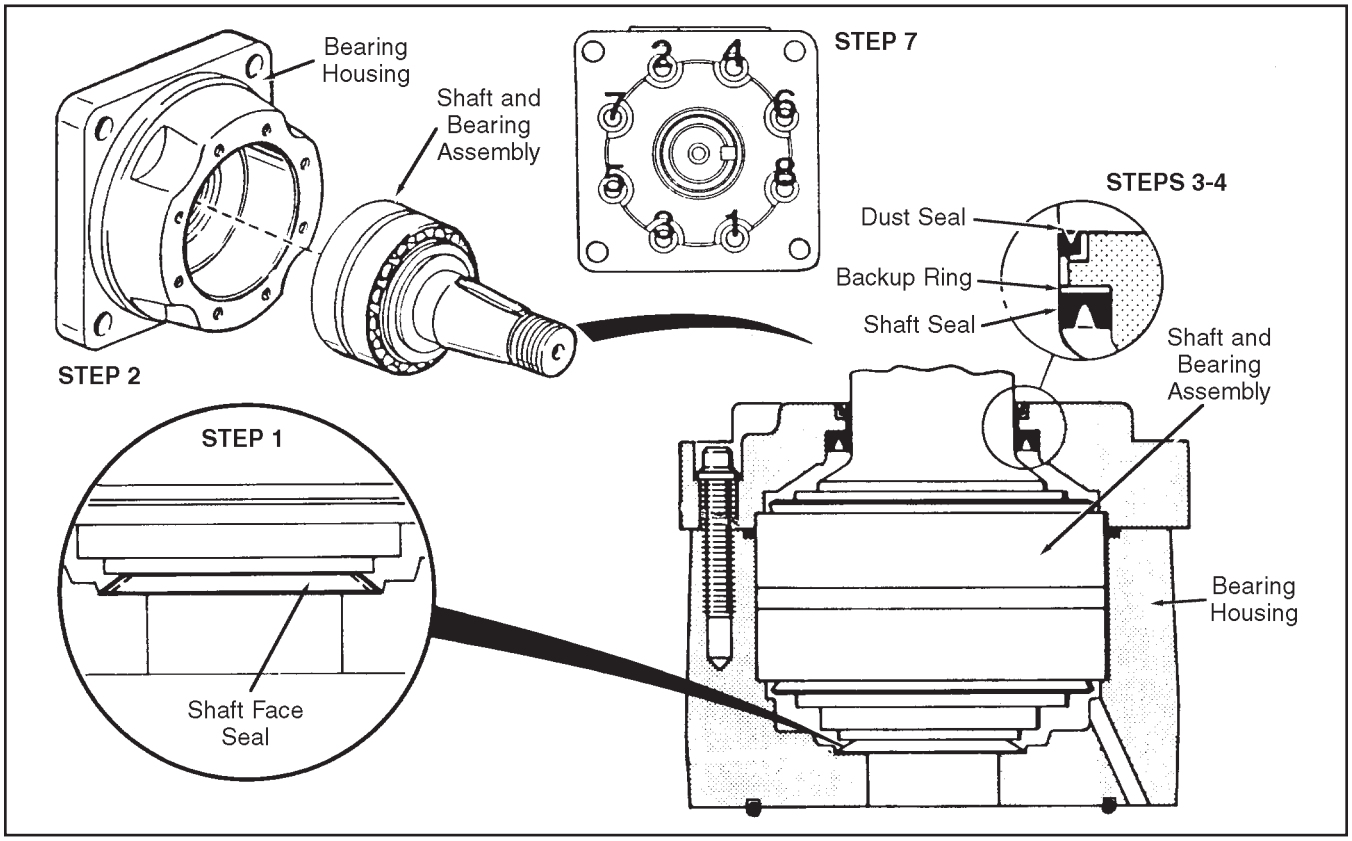


Figure 8E-9. Seal Installation

SECTION 8E. FRONT TRACTION MOTORS

5. Wrap the output shaft with a plastic bag and lubricate. Carefully install flange on bearing housing.
6. Lubricate threads of capscrews and install finger-tight.
7. Torque capscrews to 250 in-lbs. (28 N.m) in sequence as shown.
8. Pour a small amount of light oil into the bearing and shaft assembly.
9. Using petroleum jelly, install seal in groove of bearing housing.
10. Install long spline of drive in shaft and bearing assembly.
11. Using petroleum jelly, install two O-rings in case drain holes, one on each side of Geroler.

NOTE

The following steps involve timing of the motor. Timing determines the direction of rotation. The timing parts include:

1. Geroler
2. Valve Drive
3. Valve Plate
4. Valve

12. Locate largest open pocket in Geroler. Mark location of pocket on outside.
13. Align case drain hole in Geroler with case drain and pressure relief hole in the bearing housing. Retain rollers in outer Geroler ring and bearing housing while installing on bearing housing.
14. Install valve drain.
15. Using petroleum jelly, install seal in groove of valve plate.
16. Align case drain hole in valve plate with case drain hole in Geroler. Install valve plate.

NOTE

Case drain holes MUST be aligned.

17. Locate slot opening in valve plate which is in line with the largest open pocket of the Geroler.
18. Locate any one of the side openings of the valve that goes through to the face of the valve.
19. Line up this side opening with open slot of valve plate that is in line with largest open pocket of Geroler.
20. Rotate valve clockwise (CW) 1/2 spline tooth to engage spline of valve drive.

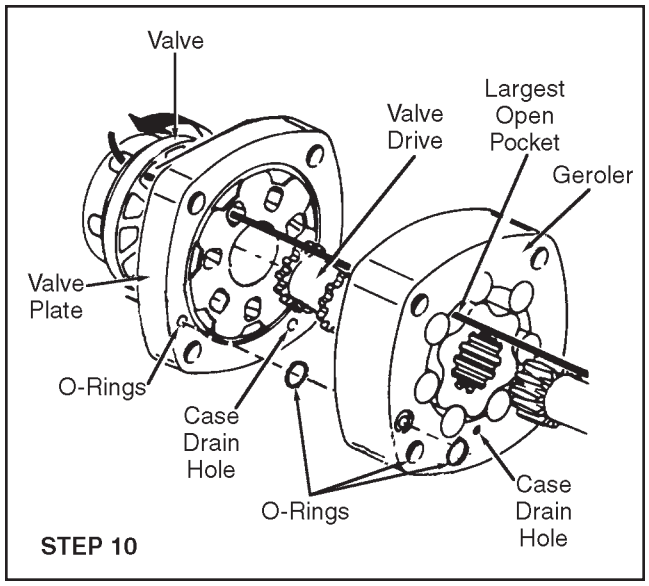


Figure 8E-10. Geroler and Valve Plate Alignment

NOTE

This will provide shaft rotation when oil is supplied to ports as shown in Figure 8E-11.

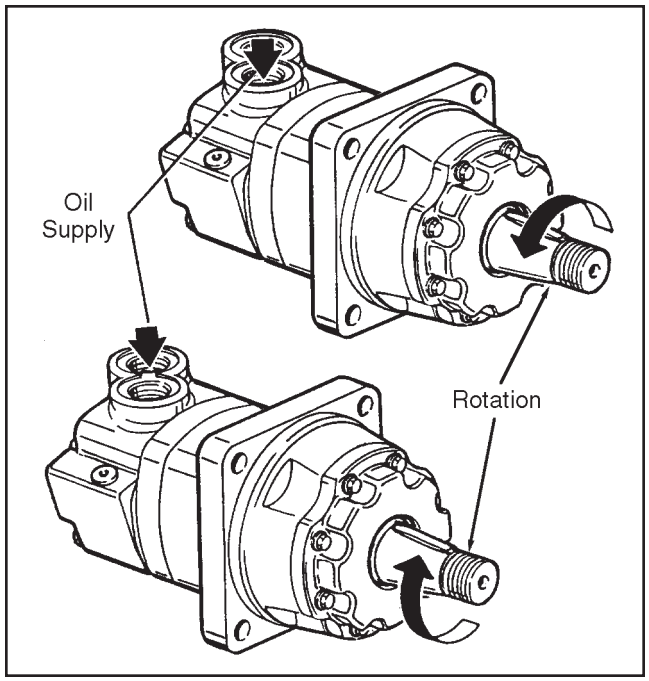


Figure 8E-11. Rotation

8E

SECTION 8E. FRONT TRACTION MOTORS

21. Apply grease to the two springs and install them into the holes of the valve housing.
22. Using petroleum jelly, install seals in groove of valve housing.
23. Using petroleum jelly, install inner and outer face seals in balance ring as shown.

NOTE

DO NOT force or bend face seals. Damage will affect motor operation.

24. Insert the balance ring into the valve aligning the balance ring pins with the springs.
25. The balance ring can be held in place by inserting a finger through the port opening in the valve housing.
26. While holding the balance ring, align the case drain hole in valve housing with case drain hole in valve plate, set valve housing on valve plate.
27. Install 4 bolts and torque in proper sequence shown to 600 in-lbs. (67.2 N.m).

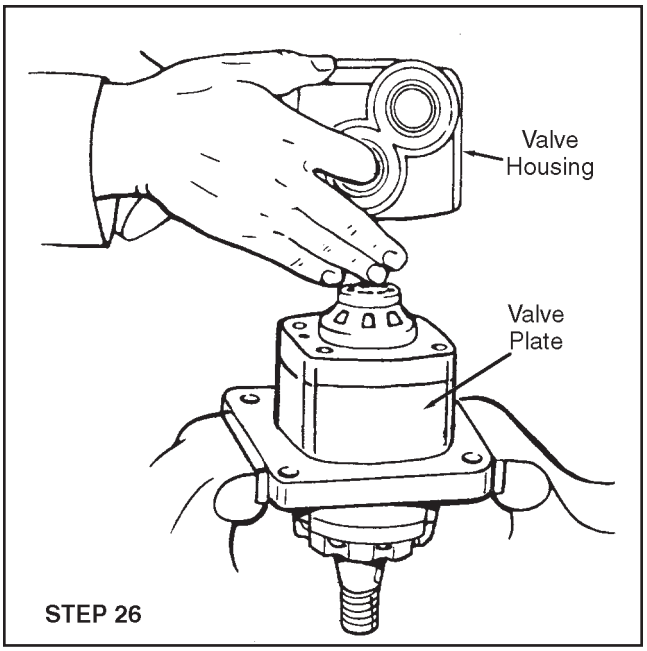


Figure 8E-13. Valve Housing Installation

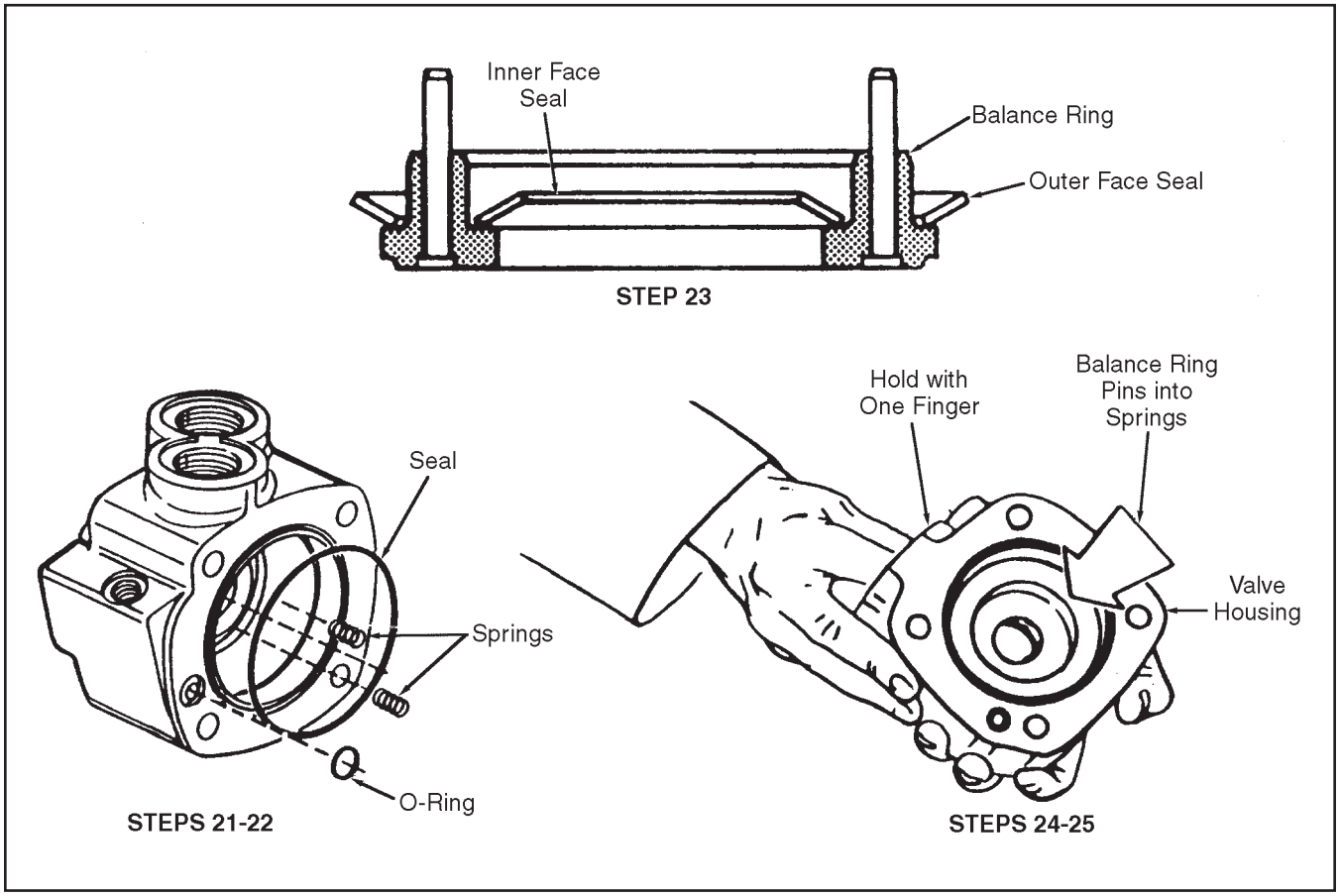


Figure 8E-14. Face Seal Installation

SECTION 8F. REAR (4 WHEEL DRIVE) TRACTION MOTORS

REMOVAL (See Figure 8F-1)

1. Block the front wheels and support the tractor so that the rear tires are off the ground.
2. Disconnect hydraulic lines from the traction motor. Cap and plug fittings.
3. Remove the tire and wheel hub.
4. Remove the four bolts and washers and remove the traction motor from the spindle.

INSTALLATION (See Figure 8F-1)

1. Attach the traction motor to the spindle with bolts and washers.
2. Connect the hydraulic lines to the traction motor.
3. Install the wheel hub and tire.
4. Lower the tire to the ground. Check toe-in and other steering adjustments (see Section 6D).

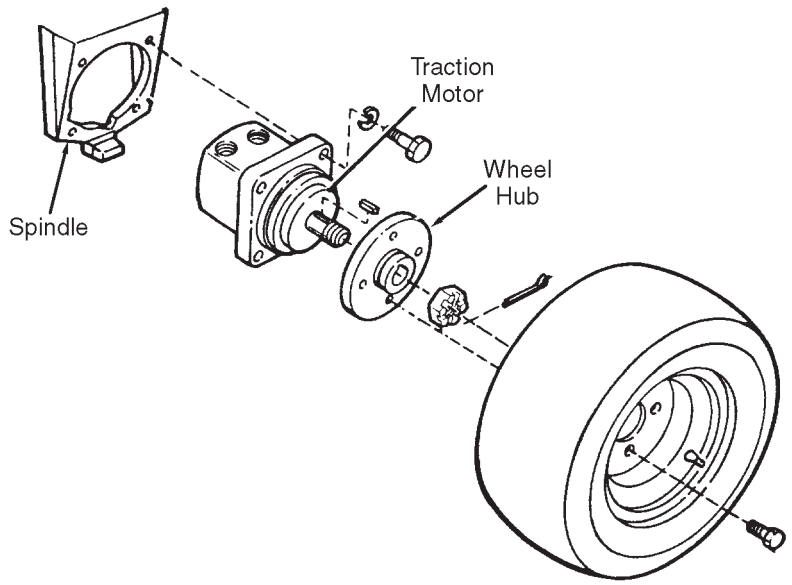
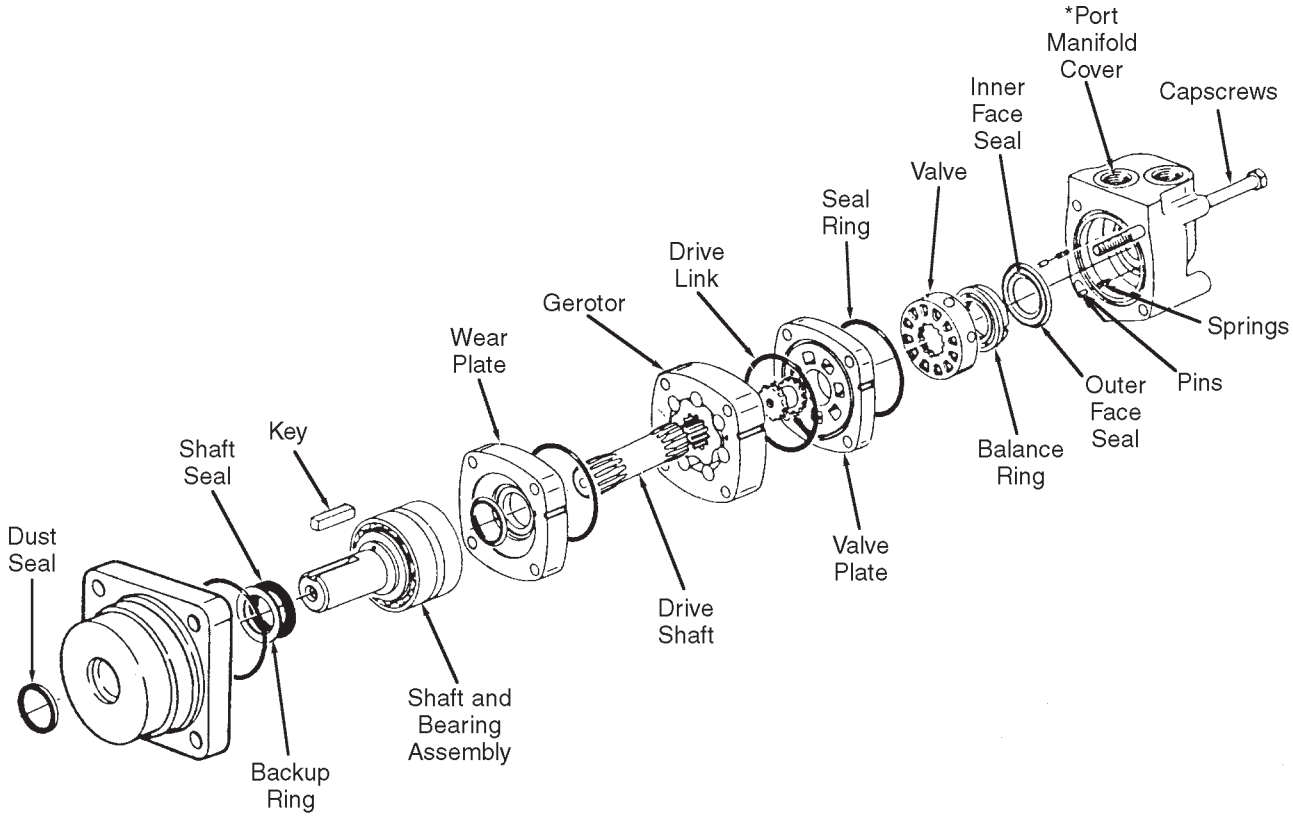


Figure 8F-1. Rear Traction Motor Removal and Installation (4 Wheel Drive)

SECTION 8F. REAR (4 WHEEL DRIVE) TRACTION MOTORS

REPAIR (See Figures 8F-2 thru 8F-4)



STEP 1

Disassemble motor as shown in this illustration.

***NOTE**

When removing the port manifold cover, be careful not to lose the two pins and springs between balance ring and cover.

STEP 2

Press the shaft and bearing assembly from the mounting flange end.

STEP 3

Remove and discard all seals, backup ring and seal rings.

STEP 4

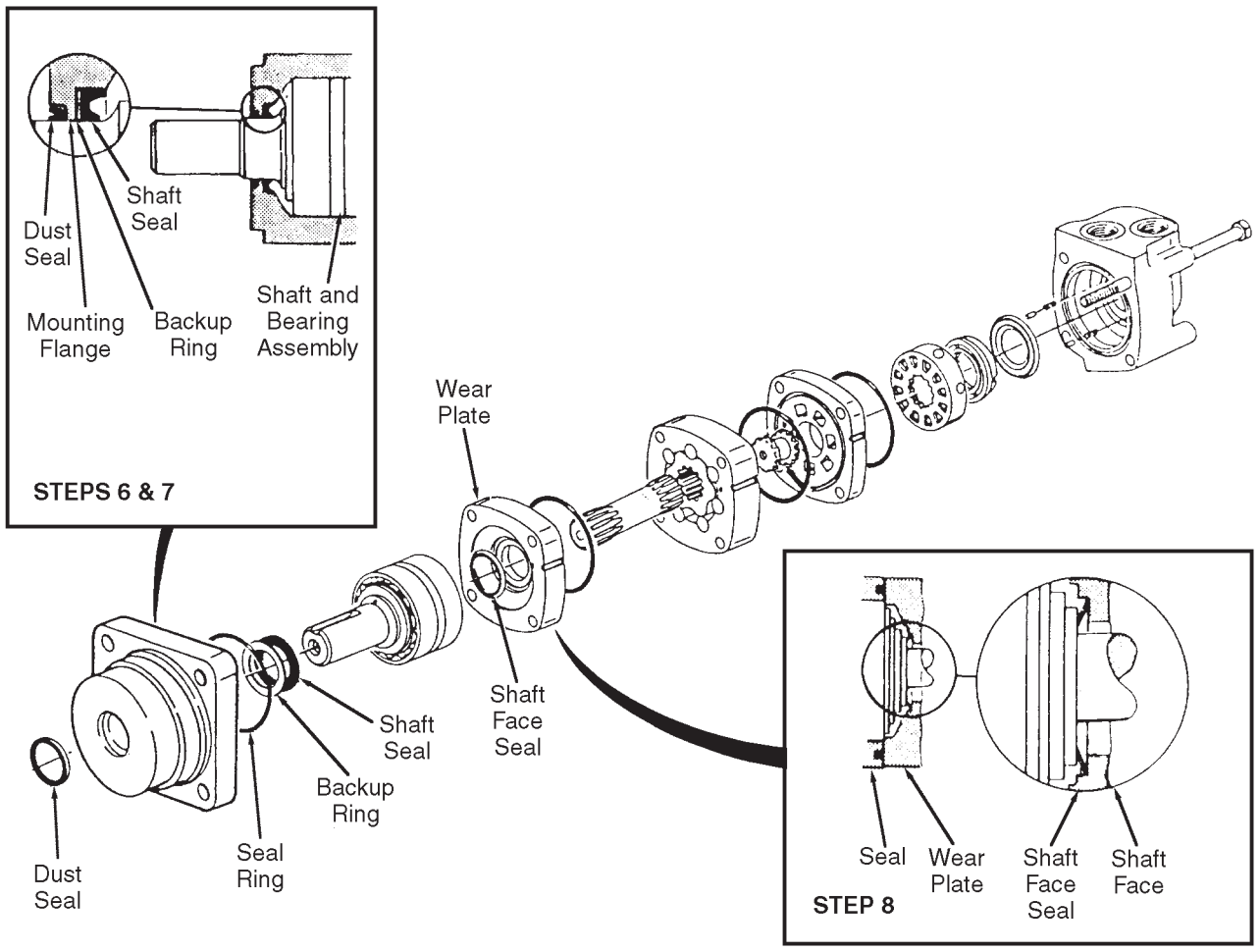
Clean all parts in a suitable solvent.

STEP 5

Inspect parts for wear or damage. The only serviceable items are the shaft and bearing assembly, shaft nut, key, bolts and a seal kit.

Figure 8F-2. Rear Traction Motor (4 Wheel Drive)

SECTION 8F. REAR (4 WHEEL DRIVE) TRACTION MOTORS



NOTE

When reassembling the motor, be very careful to position seals, seal rings and backup properly.

STEP 6

Install seals and backup ring in flange end as shown.

STEP 7

Press bearing and shaft assembly into flange end of motor.

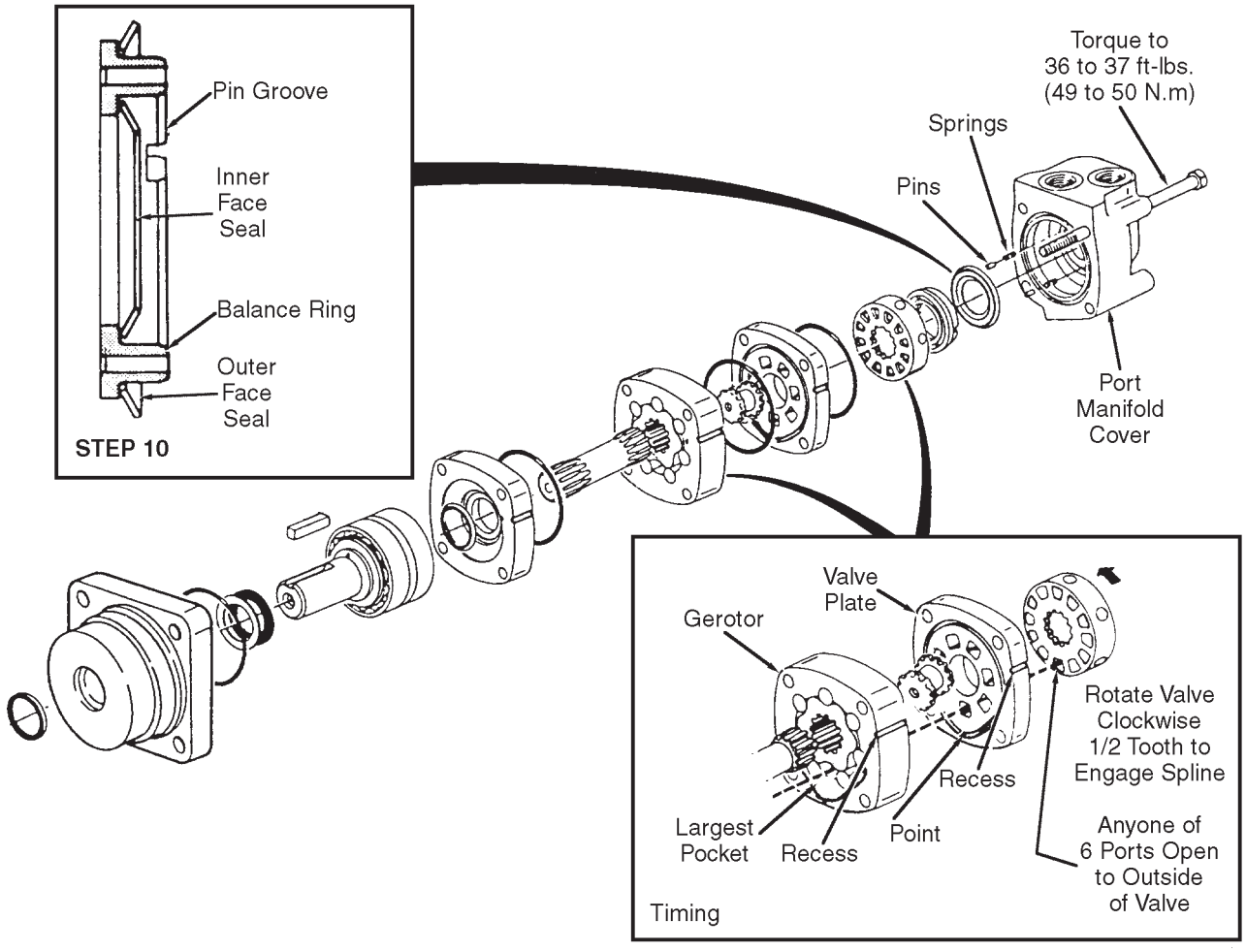
STEP 8

Install shaft face seal as shown. Place wear plate on flange end.

Figure 8F-3. Seal Assembly

8F

SECTION 8F. REAR (4 WHEEL DRIVE) TRACTION MOTORS



STEP 9

Continue to assemble as shown.

NOTE

Be sure the gerotor, valve plate and valve are timed, see inset.

STEP 10

Install inner and outer face seal, as shown, to balance ring.

STEP 11

Install balance ring on valve with pin groove facing up.

STEP 12

Coat springs and pins with petroleum jelly. Install both springs and pins in holes of manifold cover.

STEP 13

Carefully install manifold cover onto valve plate.

Center manifold cover and balance ring. When they are centered and aligned you should be able to push down on cover until it contacts the valve plate.

NOTE

The mounting cover will have a slight spring load to it, this is normal.

STEP 14

Install four capscrews and torque to 36 to 37 ft-lbs. (49 to 50 N.m).

Figure 8F-4. O-Rings and Seals

SECTION 8G. 4 WHEEL DRIVE CONTROL VALVE

REPAIR (See Figure 8G-1)

Repairs are limited to replacing the solenoid valve coils, cartridges, pilot operated 2-way valve, check valve and relief valve. Replace all O-rings and backup rings on components which are reinstalled.

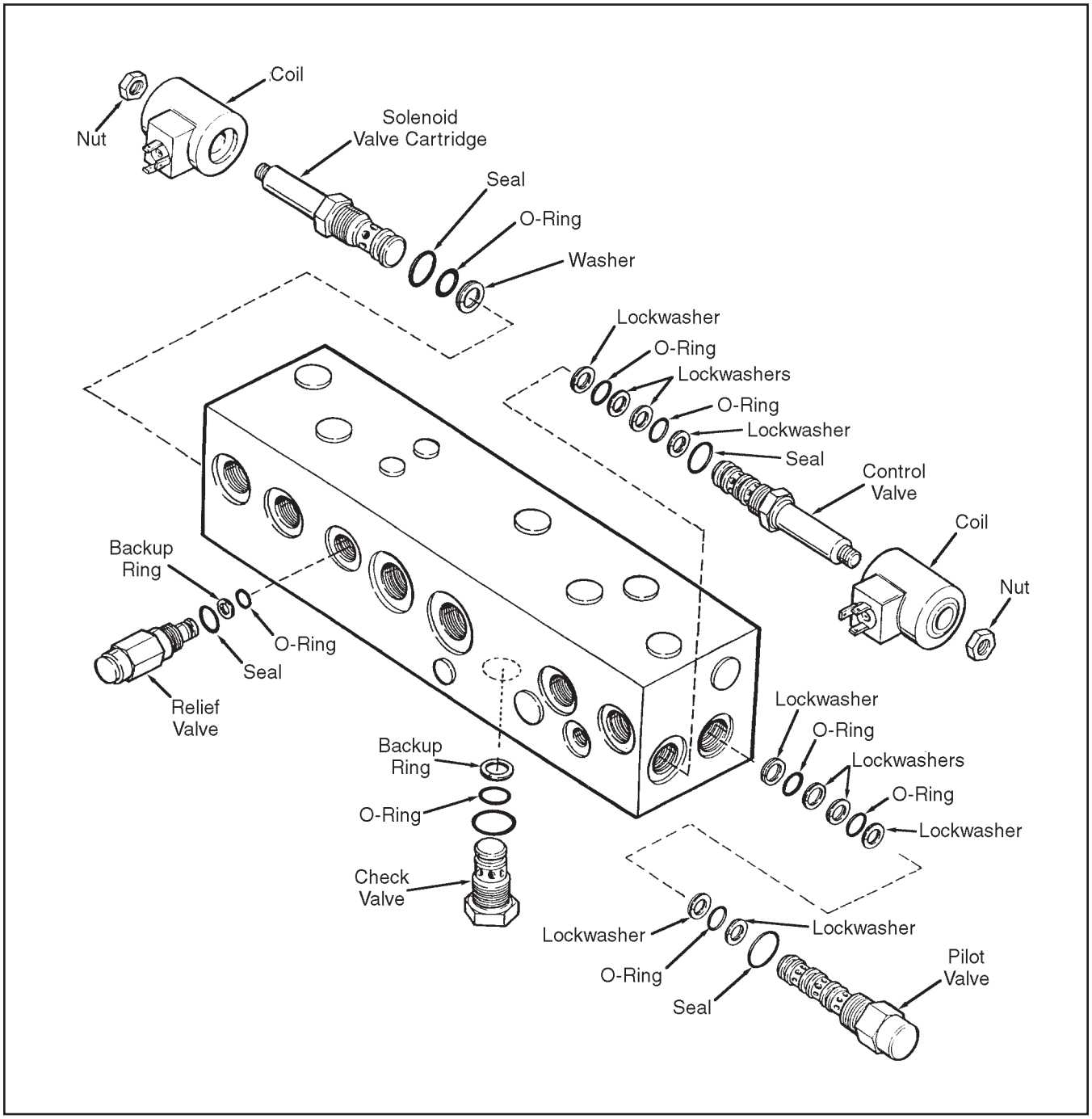


Figure 8G-1. 4 Wheel Drive Control Valve

SECTION 8H. AUXILIARY PUMP

REMOVAL AND INSTALLATION

Remove and install the auxiliary pump as described in Section 8D-1.

NOTE

Do not disassemble pump for repair unless test procedures (Sections 8N and/or 8O) indicate internal leakage.

DISASSEMBLY (See Figure 8H-1)

1. Clean exterior of pump with suitable solvent before removing bolts and studs.
2. Before disassembly mark pump sections, starting at drive shaft end, to ensure correct order and position of parts when reassembling. Recommended method of marking body sections is to use a fine point metal punch, making one indentation for section #1, two indentations for section #2, etc.

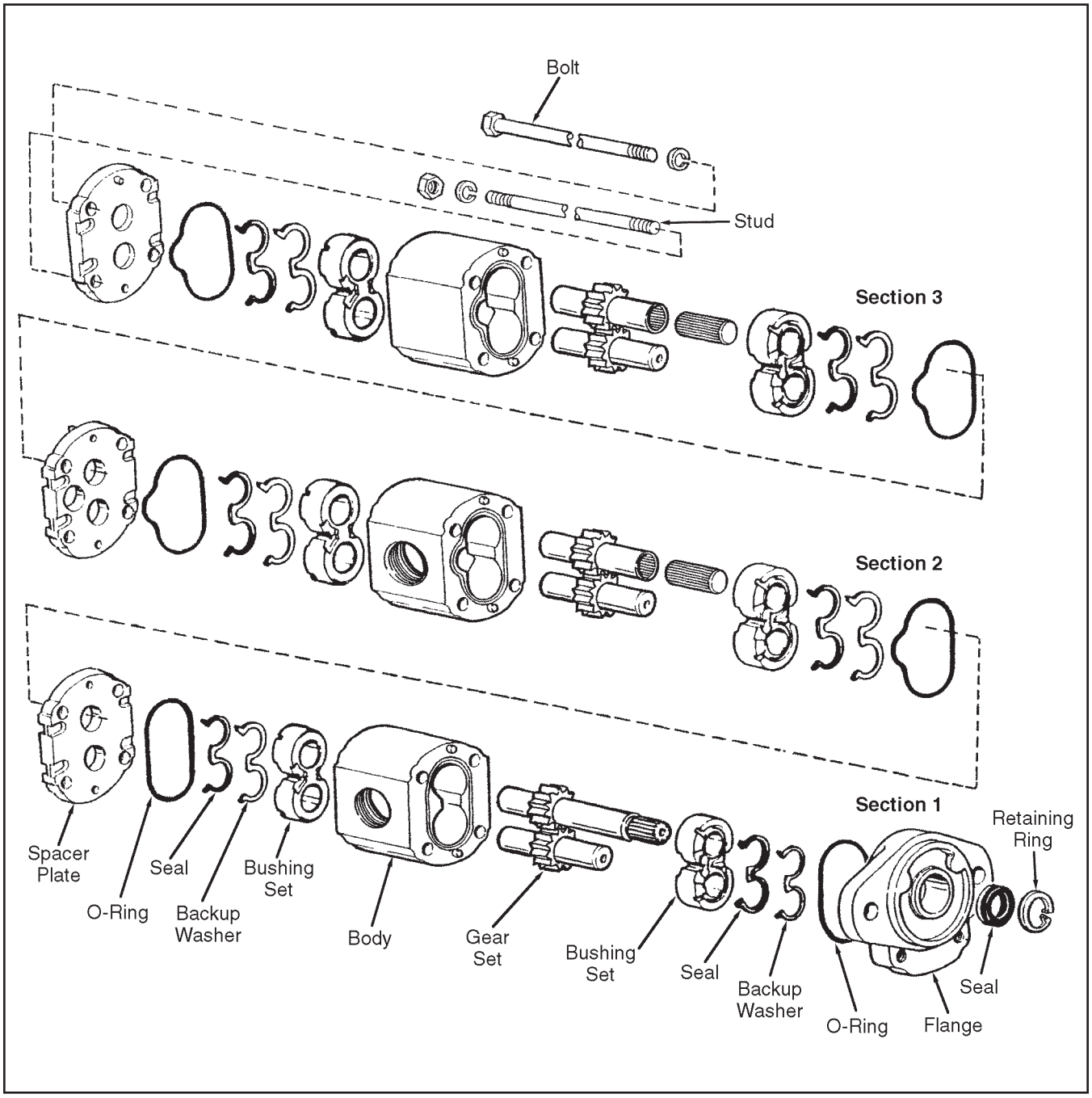


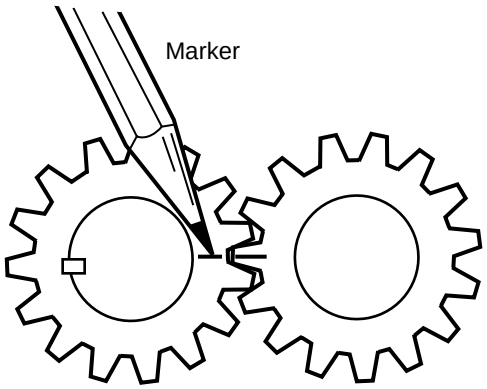
Figure 8H-1. Auxiliary Pump

SECTION 8H. AUXILIARY PUMP

CAUTION

Never pry pump sections apart as damage to sealing areas can result. Use of a soft face hammer to tap sections apart is recommended.

3. After removing studs and bolts, disassemble pump one section at a time. Before removing gear set, mark a line across meshing teeth to ensure that gears are reassembled in the same position (see Figure 8H-2).
4. Place parts in assembly order, on a clean work area as they are removed.
5. Discard seals as they are removed.



Mark alignment mark across meshing teeth before disassembly.

Figure 8H-2. Marking Gear Teeth

INSPECTION

1. Keeping parts in assembly order, clean and air dry each for inspection. Look for metal chips or slivers during cleaning (an indication of damage to pump or other hydraulic component).
2. Inspect all parts for cracks, nicks, burrs and excessive wear. Replace pump sections if found damaged or worn.

REASSEMBLY (See Figure 8H-1)

1. Apply a coat of clean hydraulic oil to all parts to ease assembly.
2. Assemble pump one section at a time, building up from flange section.
3. Use a new seal kit during assembly. Use clean grease to keep seals in position.
4. Remove alignment mark from gear sets after they have been installed with teeth in mesh.
5. Rotate drive shaft after assembling each section to make sure there is no binding between parts.
6. Use extreme care when installing shaft seal. It must seat squarely in seal bore. Wrap shaft and keyway with a plastic bag, grease plastic to avoid cutting seal during assembly.
7. Install the studs, bolts and nuts fingertight and rotate drive shaft to make sure it turns freely. Tighten tie bolts evenly and in steps to a final torque of 32 to 36 ft-lbs. (43 to 49 N.m).
8. Install pump and tighten attaching hardware.
9. Connect inlet and outlet hydraulic lines.
10. Start engine. Check for leaks and hydraulic oil level.

SECTION 8I. REEL MOTORS (LF-3800)

REMOVAL AND INSTALLATION (See Figure 8I-1)

1. Lower mowers to the ground and remove ignition key.
2. Clean the area around the hydraulic hose connections. Label and disconnect hydraulic hoses from the reel motor. Cap motor ports and plug hose fittings.
3. Turn the key on the reel unit bearing until the reel motor is free of the bearing housing. Pull the reel motor straight off the bearing housing.
4. When installing the motor, carefully align the motor with the coupler, push the motor straight in and lock in position by tightening the key.

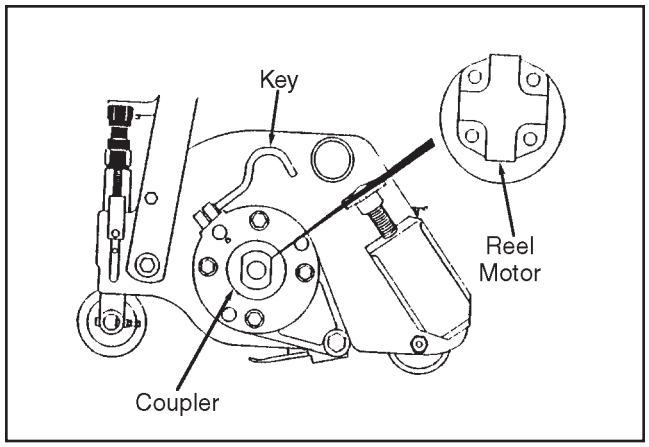


Figure 8I-1. LF-3800 Reel Motor Removal and Installation

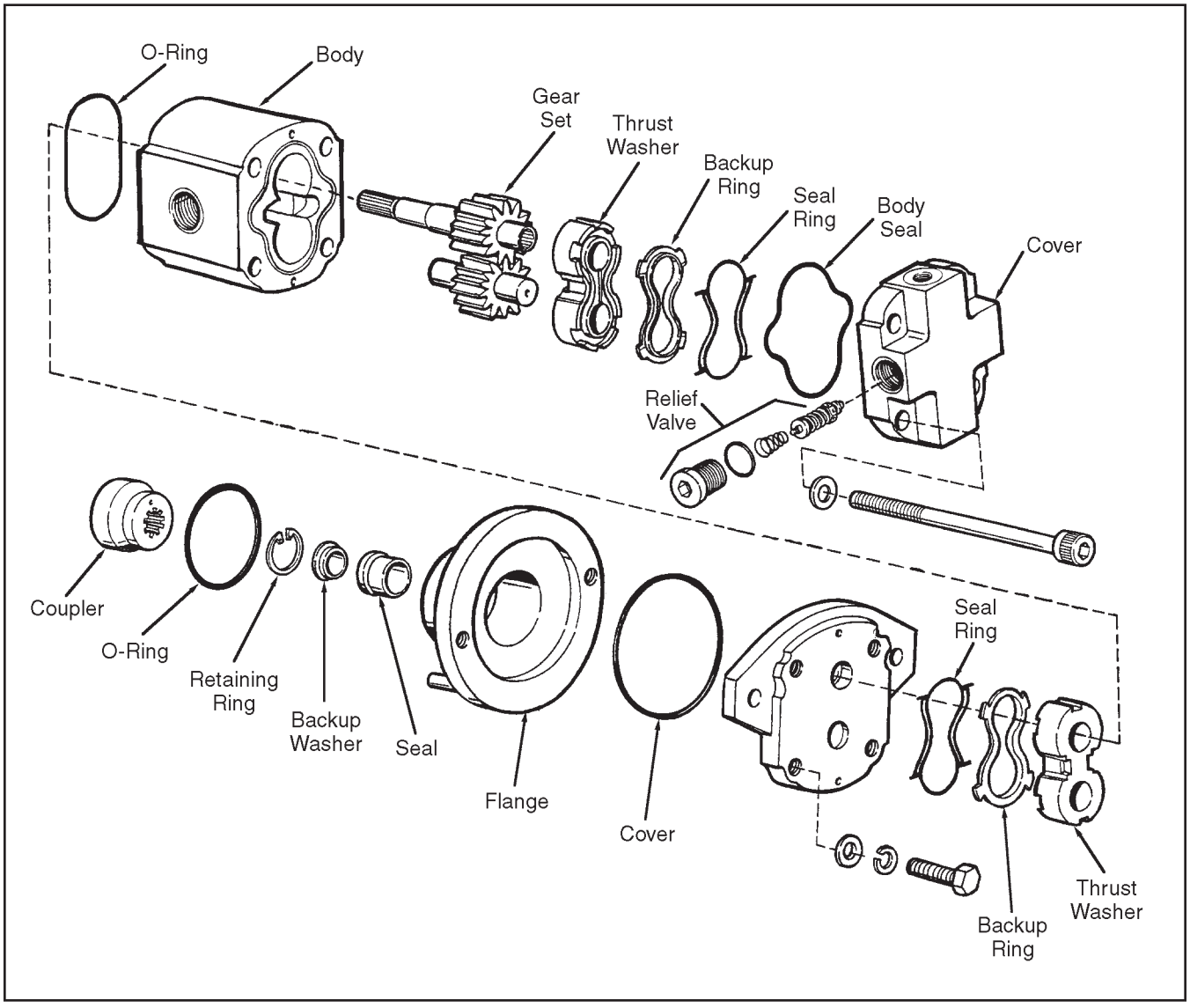


Figure 8I-2. LF-3800 Reel Motor Repair

8I

SECTION 8I. REEL MOTORS (LF-3800)

REPAIR (See Figure 8I-2)

Repair is limited to replacing seals and O-rings. If wear or damage to the motor body and/or gear set is found, it will be necessary to replace the motor. Disassemble and reassemble the motor as shown in Figure 8I-2.

NOTE

Before removing the gear set, mark the mating teeth to retain timing for reassembly (see Figure 8I-3).

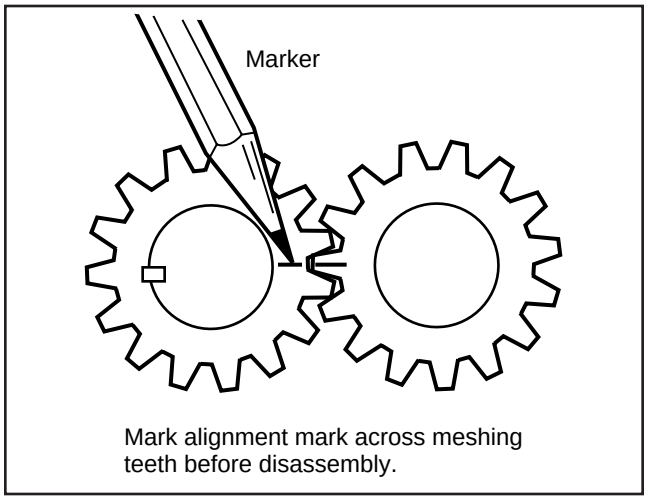


Fig. 8I-3. Marking Gear Teeth

SECTION 8J. REEL MOTORS (LF-3400)

REMOVAL AND INSTALLATION (See Figure 8J-1)

1. Lower mowers to the ground and remove ignition key.
2. Clean the area around the hydraulic hose connections. Label and disconnect hydraulic hoses from the reel motor. Cap motor ports and plug hose fittings.
3. Turn the quick release pin forward on the reel unit bearing until the reel motor is free of the bearing housing. Pull the reel motor straight off the bearing housing.
4. When installing the motor, carefully align the motor with the coupler, push the motor straight in and lock in position by lifting and rotating the quick release pin to its extreme clockwise (forward) position.

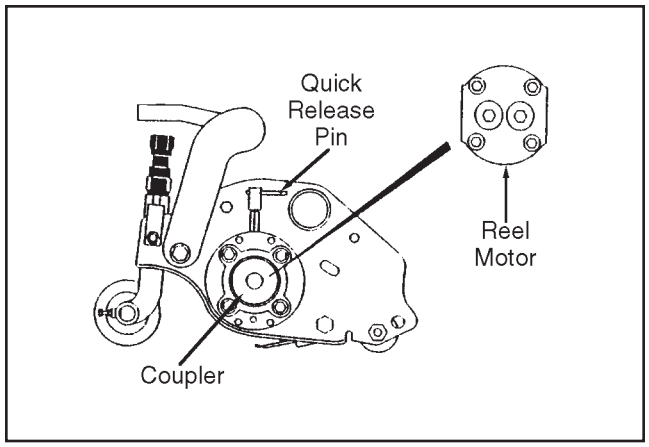


Figure 8J-1. LF-3400 Reel Removal and Installation

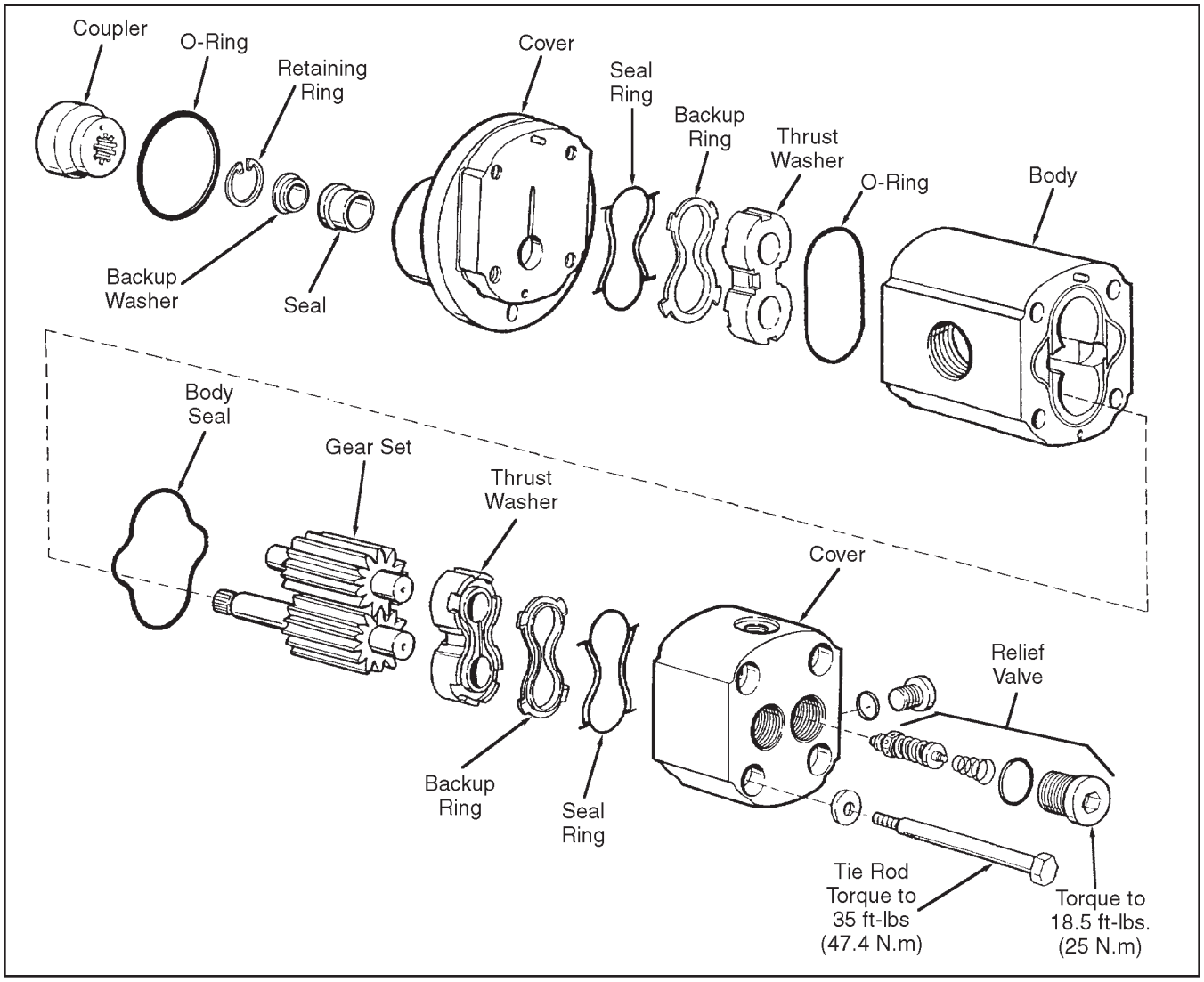


Figure 8J-2. LF-3400 Reel Motor Repair

8J

SECTION 8J. REEL MOTORS (LF-3400)

REPAIR (See Figure 8J-2)

Repair is limited to replacing seals and O-rings. If wear or damage to the motor body and/or gear set is found, it will be necessary to replace the motor. Disassemble and reassemble the motor as shown in Figure 8J-2.

NOTE

Before removing the gear set, mark the mating teeth to retain timing for reassembly (see Figure 8J-3).

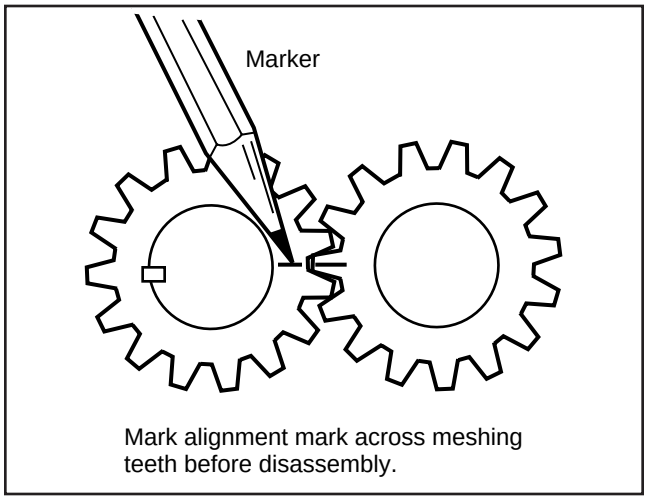


Fig. 8J-3. Marking Gear Teeth

SECTION 8K. MOWER MOTOR CONTROL VALVES

REPAIR (See Figure 8K-1)

Repairs are limited to replacing the solenoid valve coils, cartridges and flow control valve. Replace all O-rings and backup rings for parts which are reinstalled rather than replaced.

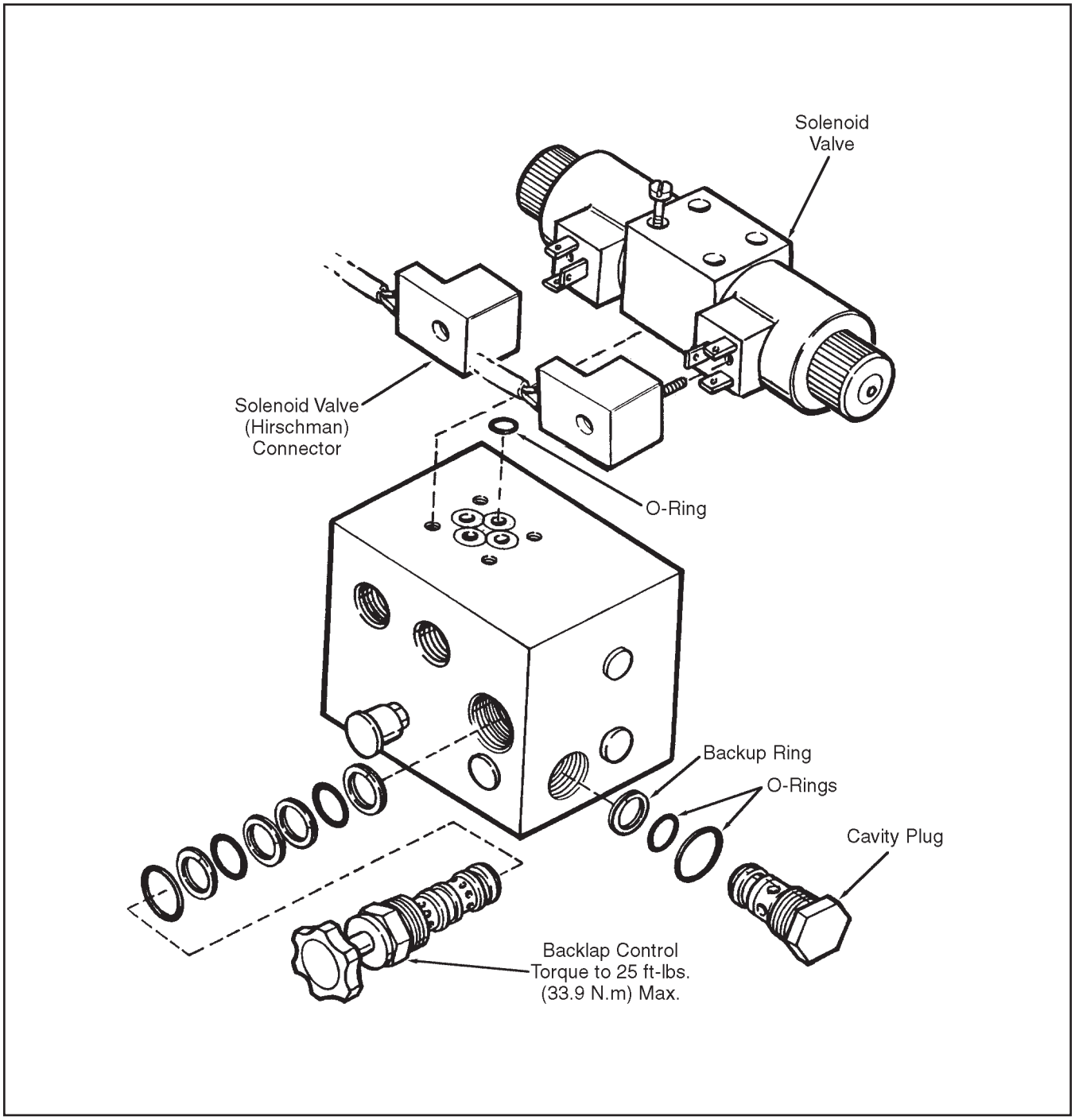


Figure 8K-1. Mower Motor Control Valve

SECTION 8L. LIFT/LOWER CONTROL VALVE

REPAIR (See Figure 8L-1)

Repairs are limited to replacing the solenoid valve coils, solenoid valve cartridge, relief valve and check valves. Replace all O-rings and backup rings for parts which are reinstalled rather than replaced.

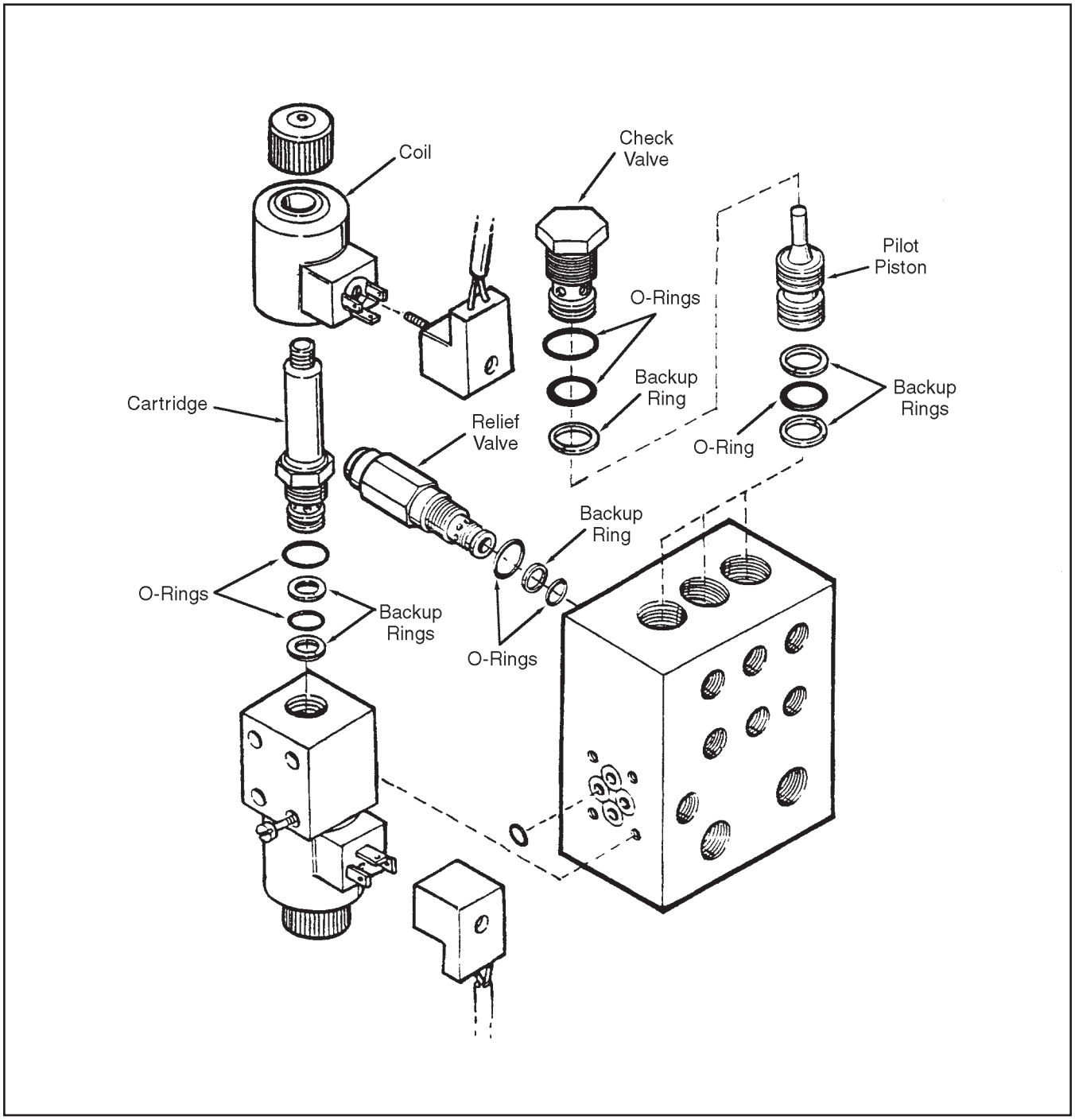


Figure 8L-1. Lift/Lower Control Valve

SECTION 8M. LIFT CYLINDERS

GENERAL

The tractor uses five hydraulic lift cylinders. The center, left and right rear cylinders are the same, the left and right front (wings) are the same. Internally all the cylinders are the same.

CAUTION

During repair of cylinder, use extreme care not to damage the body, rod or sealing surfaces of the cylinder.

DISASSEMBLY (See Figure 8M-1 or 8M-2)

1. Clean and air dry exterior of cylinder.
2. Drain all the oil from the cylinder.
3. Disassemble following the steps in Figure 8M-1 or 8M-2.

INSPECTION

1. Inspect all parts for excessive wear, cracks and broken parts.
2. Discard all O-rings, seals and backup rings.

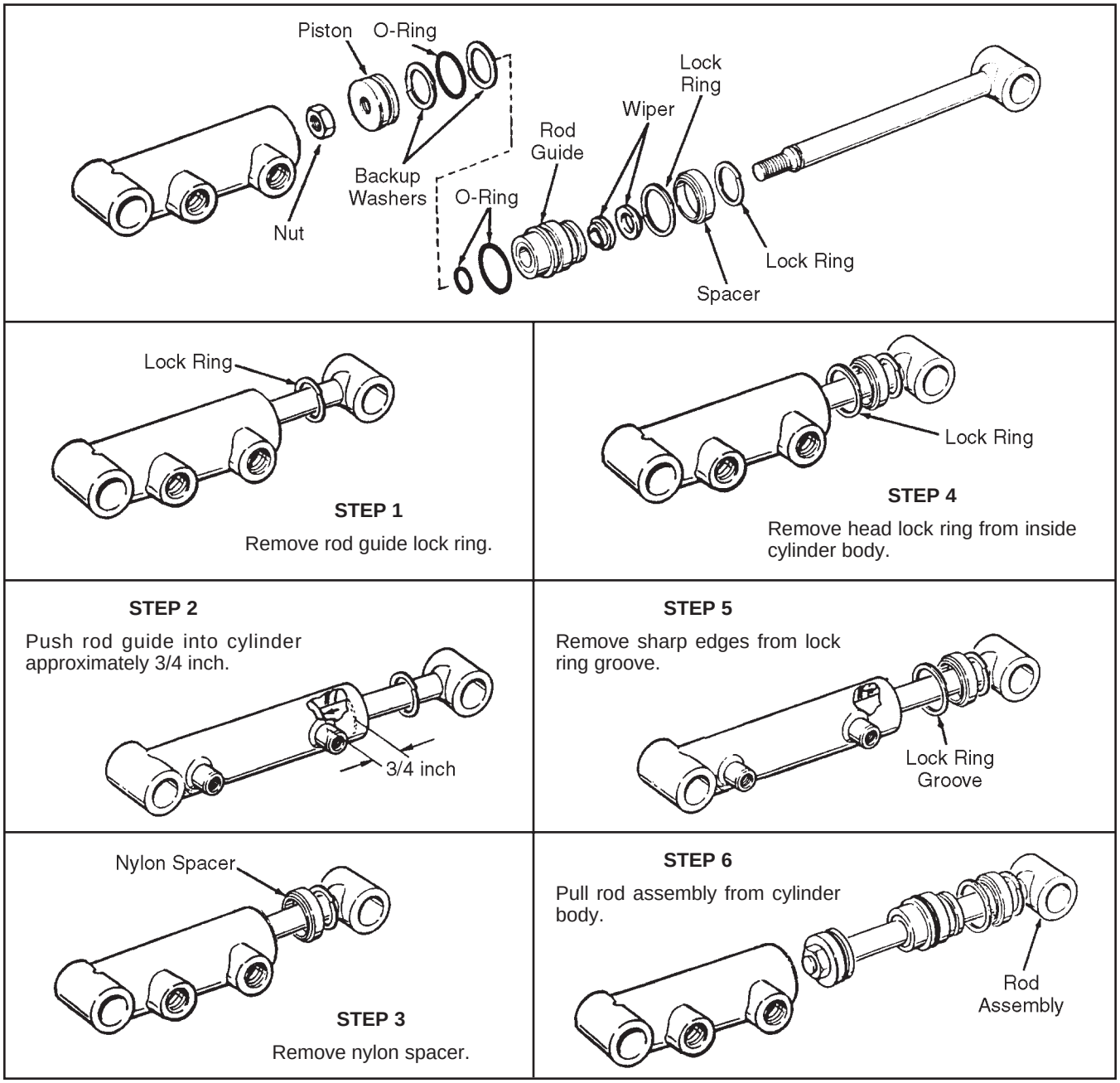


Figure 8M-1. Center, Right and Left Rear Lift Cylinder Disassembly

8M

SECTION 8M. LIFT CYLINDERS

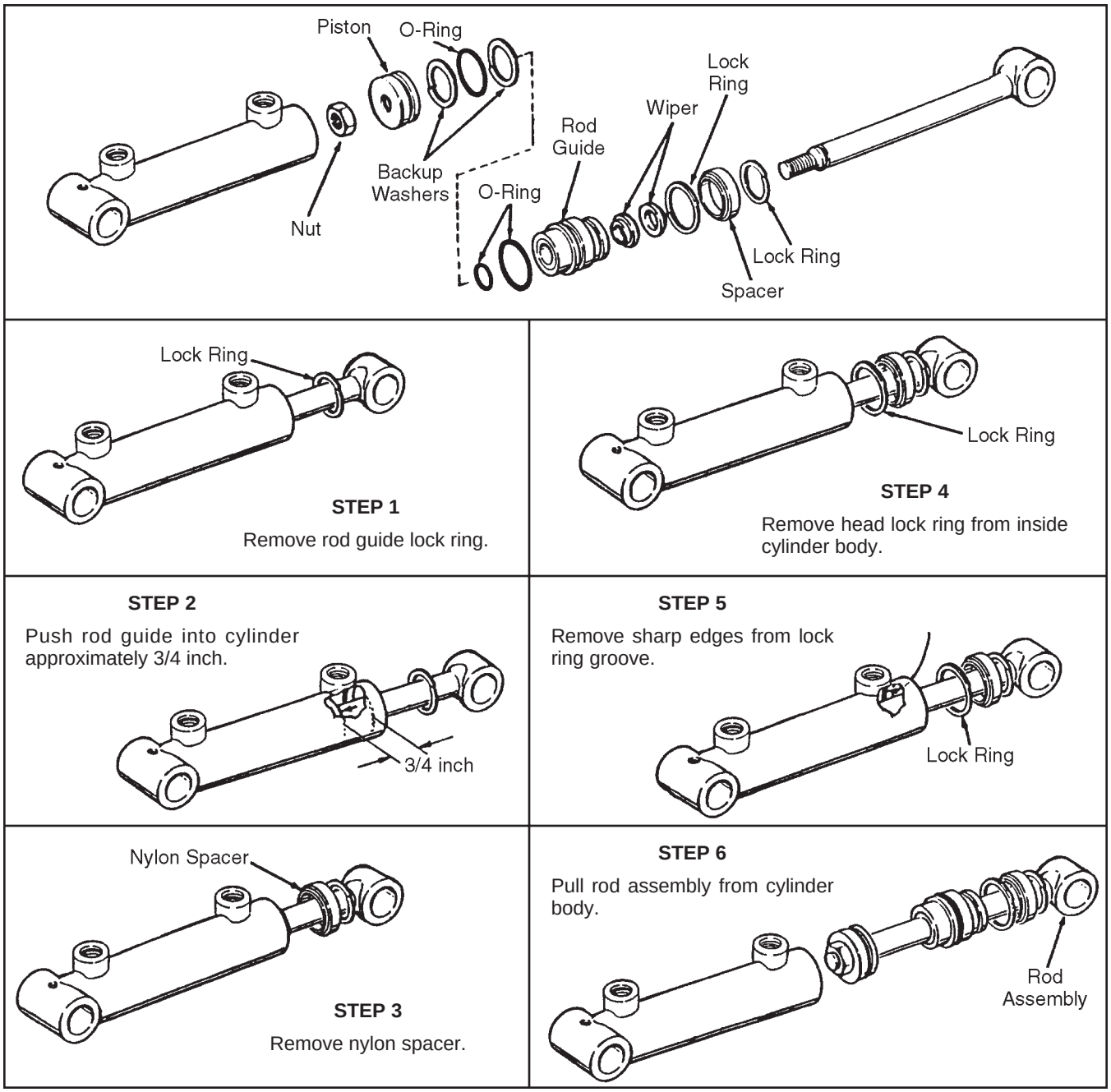


Figure 8M-2. Right and Left Front (Wing) Lift Cylinder Disassembly

SECTION 8M. LIFT CYLINDERS

REASSEMBLY

1. Lightly lubricate O-rings, backup rings and seals.
2. Install seal kit as shown in Figure 8M-3.

NOTE

Do not install rod O-ring at this time.

3. Lubricate all parts before assembly.
4. Follow the steps as illustrated in Figure 8M-4 or 8M-5 for reassembly.

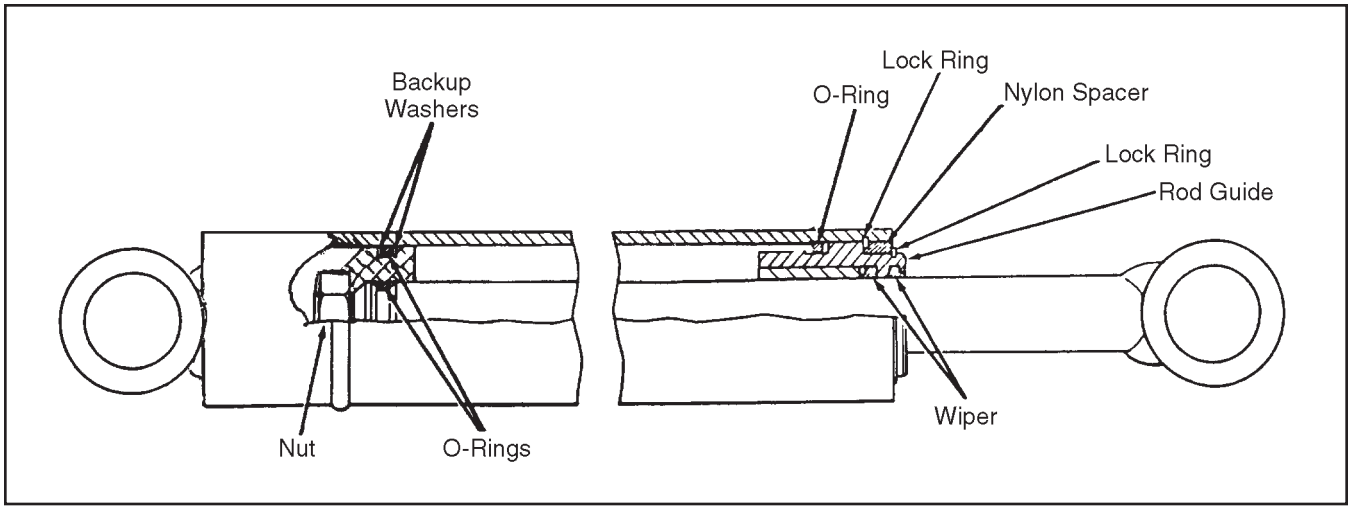
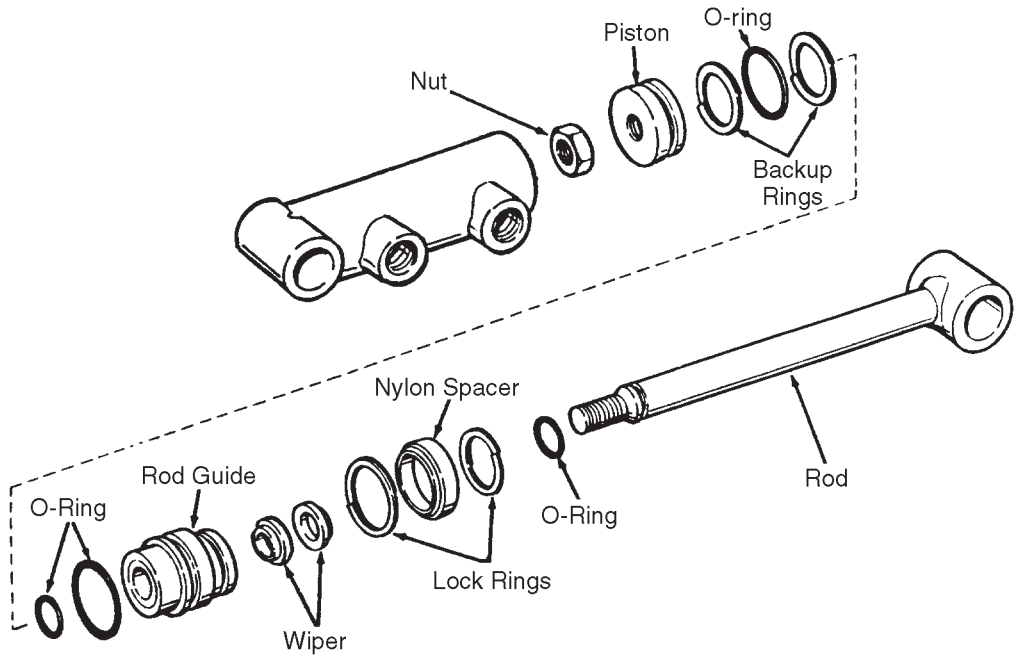
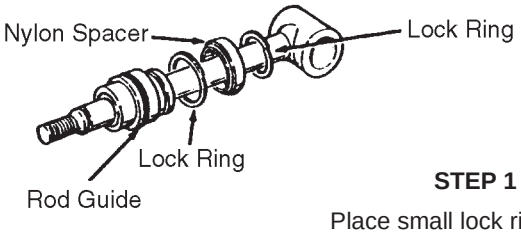


Figure 8M-3. Seal Kit Installation

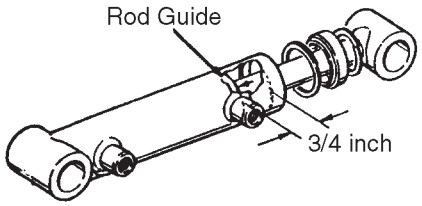
SECTION 8M. LIFT CYLINDERS





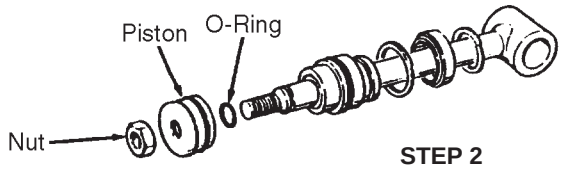
STEP 1

Place small lock ring, nylon spacer, large lock ring and rod guide onto rod.



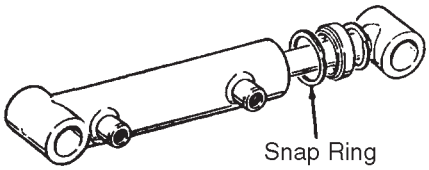
STEP 4

Push rod guide into cylinder approximately 3/4 inch.



STEP 2

Install rod O-ring. Screw piston onto rod and torque nut to 50 ft-lbs. (67.8 N.m).

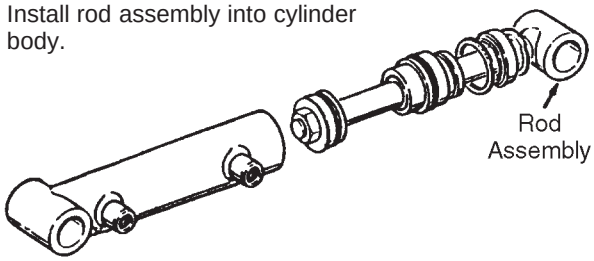


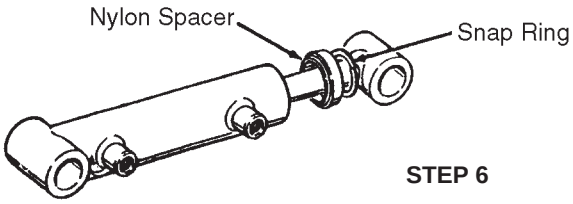
STEP 5

Install the large snap ring.

STEP 3

Install rod assembly into cylinder body.



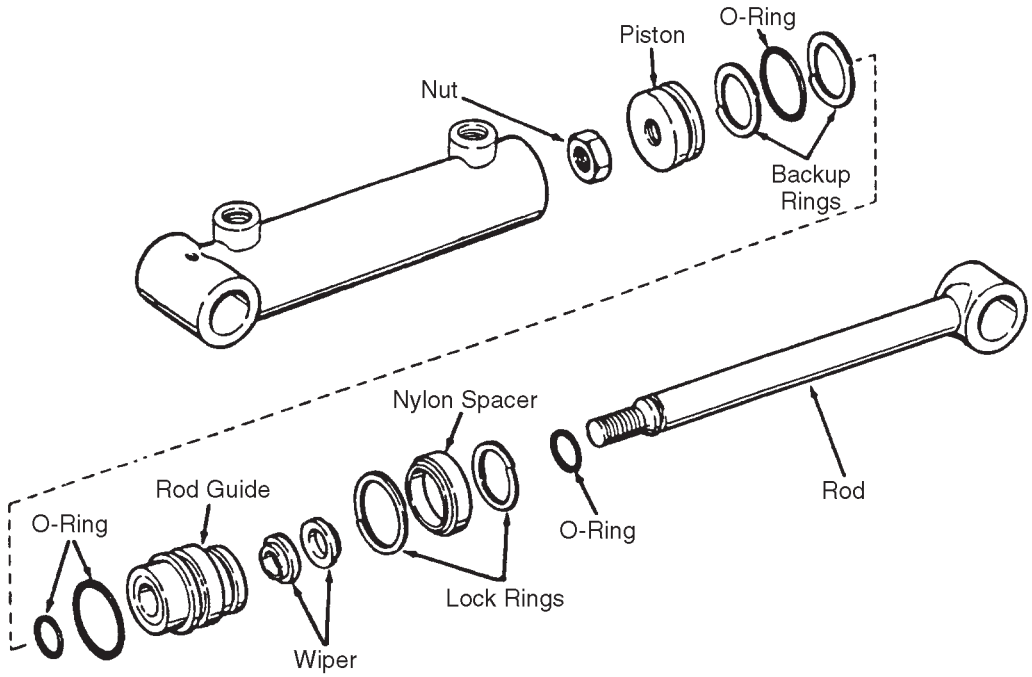


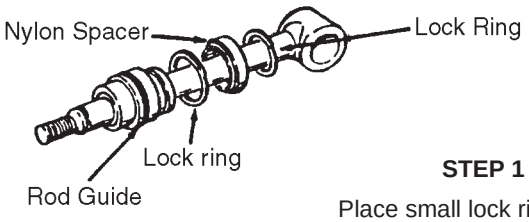
STEP 6

Pull rod and guide out. Install spacer and small snap ring.

Figure 8M-4. Center, Right and Left Rear Lift Cylinder Reassembly

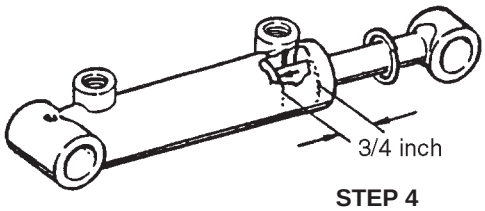
SECTION 8M. LIFT CYLINDERS





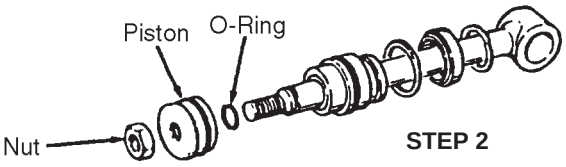
STEP 1

Place small lock ring, nylon spacer, large lock ring and rod guide onto rod.



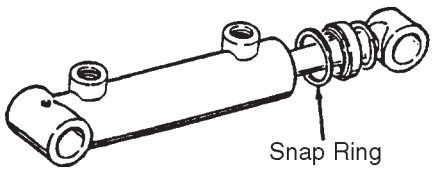
STEP 4

Push rod guide into cylinder approximately 3/4 inch.



STEP 2

Install rod O-ring. Screw piston onto rod and torque nut to 50 ft-lbs. (67.8 N.m).

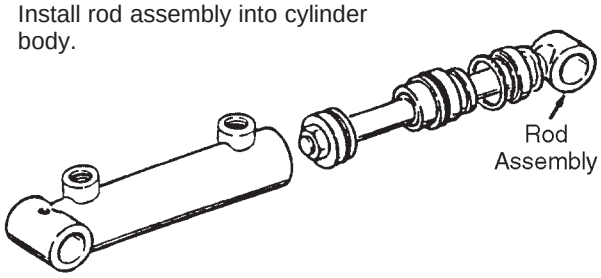


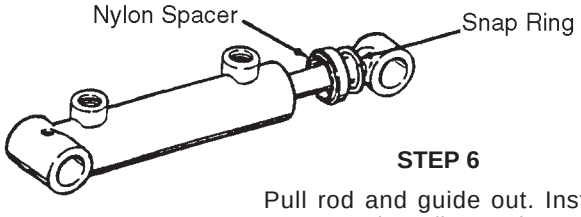
STEP 5

Install the large snap ring.

STEP 3

Install rod assembly into cylinder body.





STEP 6

Pull rod and guide out. Install spacer and small snap ring.

Figure 8M-5. Right and Left Front (Wing) Lift Cylinder Assembly

SECTION 8N. HYDRAULIC FIELD TEST PROCEDURES

GENERAL

The purpose of this section is to provide a guide for field testing the hydraulic system. More extensive test procedures, using test instruments, are presented in Section 8O. Component location illustrations, hydraulic schematics and diagrams are presented in Section 8P. Before performing any tests see “Preliminary Checks” below.

AS A SAFETY REMINDER

- Follow the procedures one step at a time.
- Observe all NOTES, CAUTIONS and WARNINGS.
- Pay attention to what you are doing. Work with a safety conscious attitude.
- Use care working with HOT oil.
- Wear safety glasses at all times.
- Keep hands and feet away from the moving parts.
- Engine must be shut off and attachments lowered to ground when making adjustments or hydraulic connections unless otherwise specified in the test instructions.

PRELIMINARY CHECKS

The following preliminary checks should be made before performing any tests.

1. The reservoir should be checked for proper level, the presence of water (noted by a cloudy or milky appearance), air (noted by a foaming appearance), or a rancid odor indicating excessive heat.

   If any of the above symptoms appear, or if the hydraulic oil becomes contaminated, or after a major component failure, the oil should be changed and system flushed.

   NOTE

   Use only the recommended hydraulic oil (see Section 11 — Preventive Maintenance). Always change the filter when changing the oil.

   The filter should be changed after the initial 250 hours of operation. Thereafter, the filter should be changed approximately every 250 hours.

2. Check all lines and fittings for leakage and tighten as necessary (see Section 8C).
3. Eliminate all possible mechanical problems first before starting the hydraulic tests.

FIELD TESTS

⚠ CAUTION

Before performing hydraulic tests, back off the bedknife from the reel. This will eliminate damage to the reel and/or bedknife when in operation.

When a hydraulic failure occurs, some simple, effective tests can be performed prior to using test instruments. The results of these tests may lead you to the suspected component failure. If further testing is necessary, proceed to INSTRUMENT TESTS (Section 8O).

AUXILIARY PUMP

The three section auxiliary pump supplies oil for the power steering unit, lift and lower, and for charging the traction hydrostatic transmission (hydro).

If a fault affects an entire system, proceed with an instrument test for the auxiliary pump.

TRACTION CIRCUIT

NOTE

Before performing any tests, be sure tow valve located on top of the hydro is closed (see Figure 8N-1).

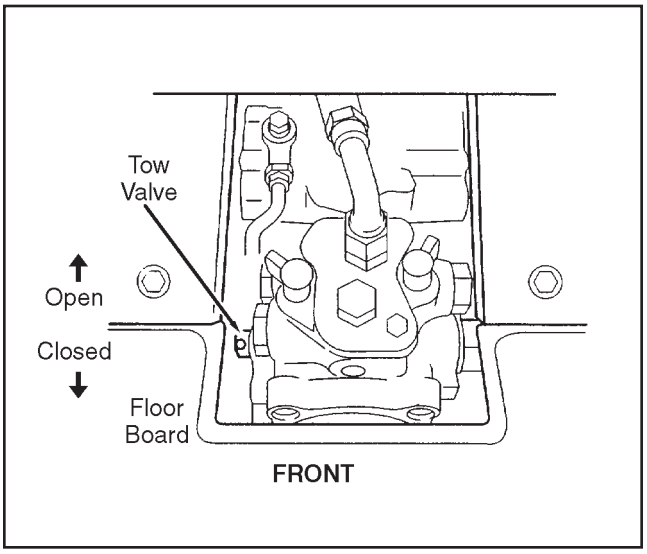


Figure 8N-1. Tow Valve

SECTION 8N. HYDRAULIC FIELD TEST PROCEDURES

TRACTION PUMP (4 WHEEL DRIVE)

See Figure 8N-2

1. At the main line cross tees remove motor line from each tee. Plug lines and cap ports.
2. At each rear traction motor, remove both hydraulic lines. Plug line cap motor ports.
3. Set the brake, start the engine and advance the throttle to full engine idle RPM (3150 RPM).
4. Very slowly step on the forward traction pedal.
   - Engine labors or stalls, proceed with Step 5.
   - Engine does not labor or stall, proceed with Step 6.
5. Push traction pedal in REVERSE.
   - Engine labors or stalls, traction pump is okay, proceed with Step 9.
   - Engine does not labor or stall, proceed with Step 6.
6. At the traction pump remove both cross port reliefs. Take right cross port relief and install on the left and the left on the right.
7. Set the brake, start the engine and advance the throttle to full engine idle RPM (3150 RPM).
8. Very slowly step on the forward traction pedal.
   - Engine labors or stalls, cross port relief cartridge was faulty, replace.
   - Engine does not labor or stall, hydro or cross relief faulty.
9. Push the 4 wheel drive switch to ON.
10. Very slowly step on the forward traction pedal.
    - Engine labors or stalls, proceed with Step 11.
    - Engine does not labor or stall, 4 wheel drive valve faulty.
11. Push traction pedal in REVERSE.
    - Engine labors or stalls, 4 wheel drive valve okay, proceed with Step 12.
    - Engine does not labor or stall, 4 wheel drive valve faulty.

See Figure 8N-3

12. At the right rear traction motor, connect the hydraulic lines.
13. Install a restraint to the right rear tire.
14. Set the brake, start the engine and advance the throttle to full engine idle RPM (3150 RPM).
15. Push the 4 wheel drive switch to ON.
16. Very slowly step on the forward traction pedal.
    - Engine labors or stalls, proceed with Step 16.
    - Engine does not labor or stall, right rear motor has excessive internal leakage, repair or replace.
17. Push traction pedal in REVERSE.
    - Engine labors or stalls, proceed with Step 18.
    - Engine does not labor or stall, right rear traction motor has excessive internal leakage, repair or replace.
18. At the left rear motor, reconnect hydraulic lines.
19. Install a wheel restraint to the left wheel.
20. Set the brake, start the engine and advance the throttle to full engine RPM (3150 RPM).
21. Push the 4 wheel drive switch to ON.
22. Very slowly step on the forward traction pedal.
    - Engine labors or stalls, proceed with Step 23.
    - Engine does not labor or stall, left rear motor has excessive internal leakage, repair or replace.
23. Push traction pedal in REVERSE.
    - Engine labors or stalls, proceed with Step 24.
    - Engine does not labor or stall, left rear traction motor has excessive internal leakage, repair or replace.

SECTION 8N. HYDRAULIC FIELD TEST PROCEDURES

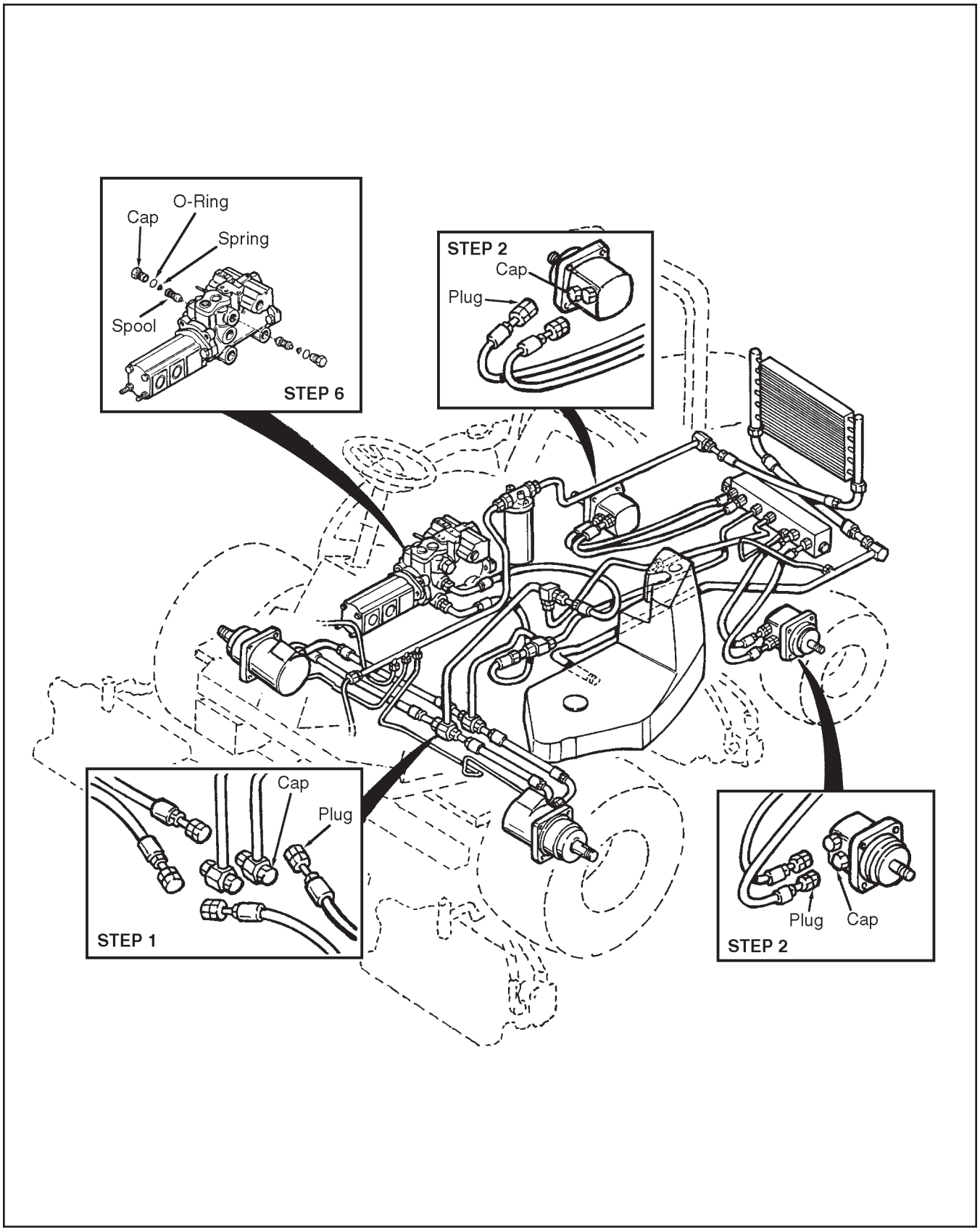


Figure 8N-2. Traction Circuit (4 Wheel Drive) Field Test

SECTION 8N. HYDRAULIC FIELD TEST PROCEDURES

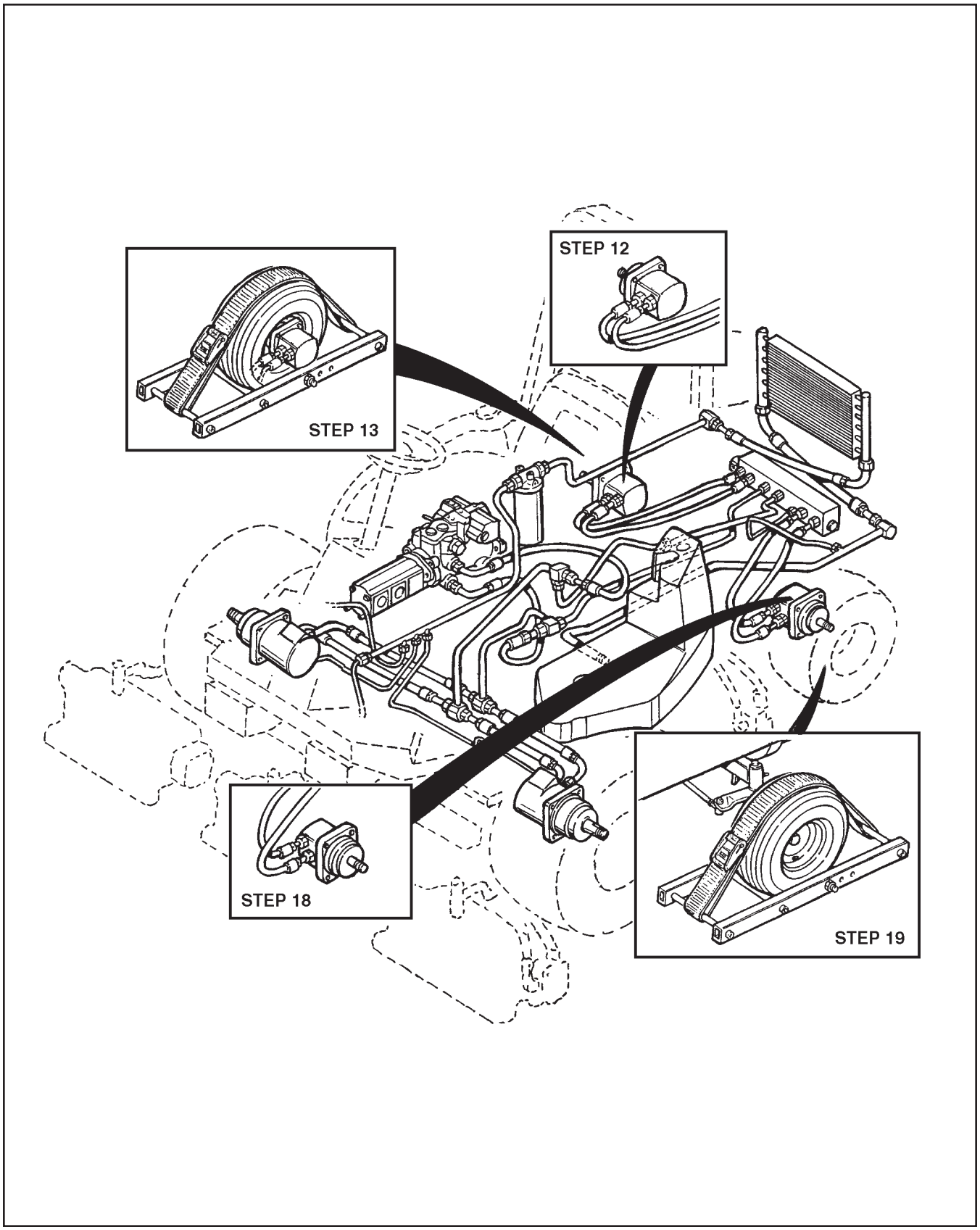


Figure 8N-3. Traction Circuit (4 Wheel Drive) Field Test

SECTION 8N. HYDRAULIC FIELD TEST PROCEDURES

See Figure 8N-4

24. At the 4 wheel drive supply line tee, install a size 16 blocking disc, with O-ring side facing tube nut, on the 4 wheel drive supply line.
25. Reconnect hydraulic lines to right front traction motor.
26. Install a wheel restraint to the right wheel.
27. Set the brake, start the engine and advance the throttle to full engine idle RPM (3150 RPM).
28. Very slowly step on the forward traction pedal.
    - Engine labors or stalls, proceed with Step 29.
    - Engine does not labor or stall, right front traction motor has excessive internal leakage, repair or replace.
29. Push traction pedal in REVERSE.
    - Engine labors or stalls, proceed with Step 30.
    - Engine does not labor or stall, right front traction motor has excessive internal leakage, repair or replace.
30. At the left front traction motor, reconnect hydraulic lines.
31. Install another wheel restraint to the left wheel.
32. Set the brake, start the engine and advance the throttle to full engine idle RPM (3150 RPM).
33. Very slowly step on the forward traction pedal.
    - Engine labors or stalls, proceed with Step 34.
    - Engine does not labor or stall, left traction motor has excessive internal leakage, repair or replace.
34. Push traction pedal in REVERSE.
    - Engine labors or stalls, traction system is okay.
    - Engine does not labor or stall, left traction motor has excessive internal leakage, repair or replace.

SECTION 8N. HYDRAULIC FIELD TEST PROCEDURES

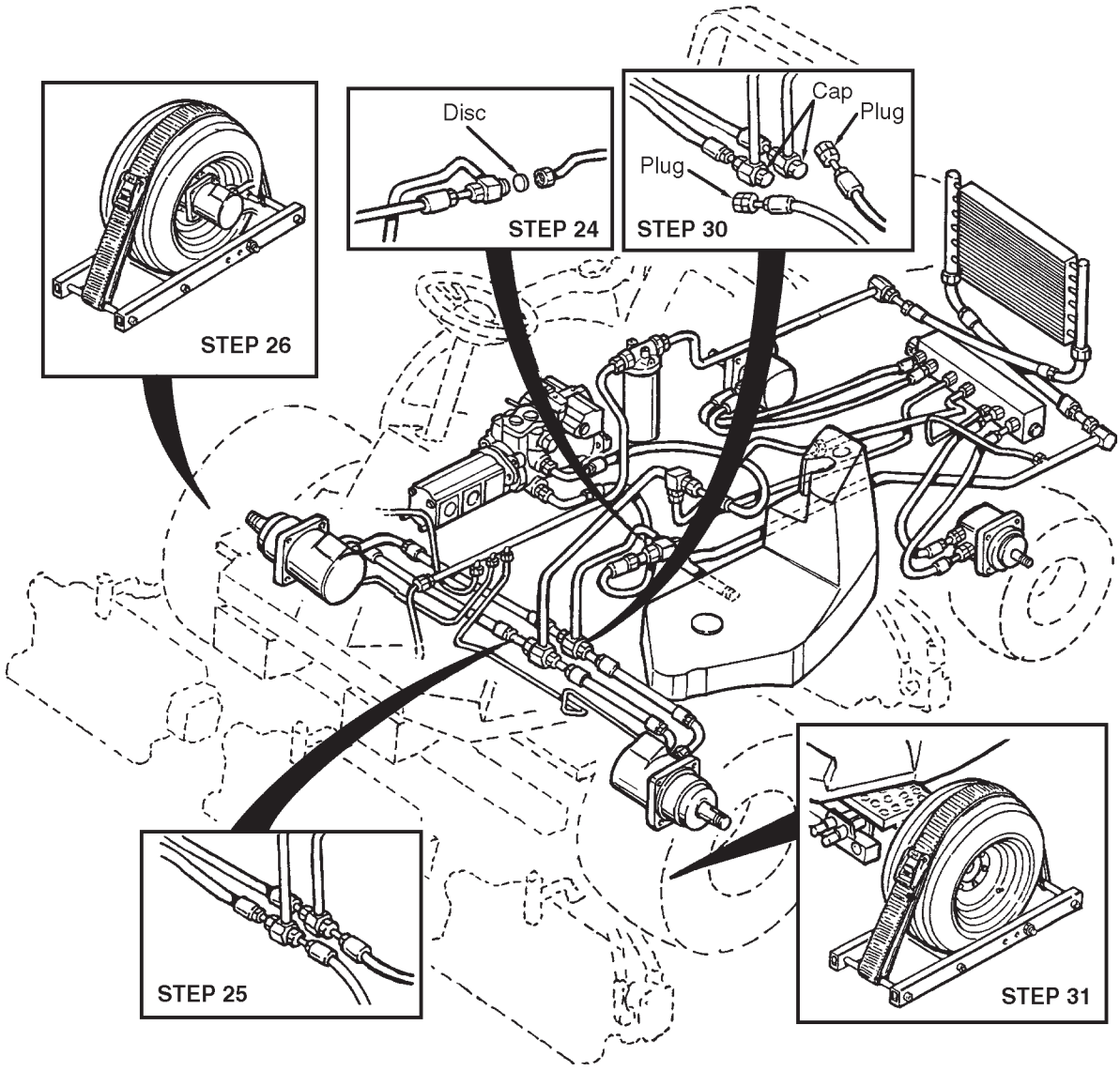


Figure 8N-4. Traction Circuit (4 Wheel Drive) Field Test

SECTION 8N. HYDRAULIC FIELD TEST PROCEDURES

POWER STEERING CIRCUIT (See Figure 8N-5)

NOTE

Before performing the following test, check the steering system for mechanical binding and/or damage that may affect the steering effort.

1. Turn the steering wheel completely to the right, then to the left.
   - If the steering wheel stops or becomes hard to turn and a hissing sound is heard after steering the maximum right and/or left, the steering unit is okay.
   - If the steering wheel continues to turn with little or no resistance, proceed to Step 2.
2. Remove both hydraulic lines from the steering cylinder, plug the lines, cap the cylinder ports.
3. Turn the steering wheel to the right, then to the left.
   - If the steering wheel stops or becomes hard to turn the cylinder is at fault and should be rebuilt, see Section 6E.
   - If the steering wheel continues to turn with little or no resistance, proceed with an instrument test, see Section 8O.
4. Reconnect lines to the steering cylinder.

LIFT/LOWER CIRCUIT

The lift/lower circuit's oil is supplied by auxiliary pump section 3. Oil from the steering unit is supplied to the lift valve. From the valve oil is directed to the lift/lower cylinders. The cylinders are connected in parallel with the valve.

See Figure 8N-6

1. Start the tractor, push the lift/lower lever forward and hold.
2. Check controller LEDs 22 and 13, they should be on (lit).
   - If both LEDs are on and the mowers lower, the lift/lower valve is okay, proceed with Step 5.
   - If both LEDs are on but the mowers do not lower, proceed with Step a below.
     a. Using a 1/8 inch pin punch, push the manual override on the right side of the lift/lower valve.
        - If mowers lower, proceed with Step 3.
        - If mowers still do not lower, the lift/lower valve may be faulty.
   - If one or both LEDs are not on, an electrical problem exists, see Section 10 for tests/repairs.
3. Remove the solenoid coil from the left side of the valve and put it on the right side, put the right solenoid on the left side.
4. Start the tractor push lift/lower lever forward, then release.
   - If mowers lower, solenoid was faulty.
   - If mowers still do not lower, valve may be faulty.
5. Pull lift/lower lever rearward to raise mowers.
6. Check controller LEDs 22 and 44, they should be on (lit).
   - If both LEDs are on and the mowers raise, the lift/lower valve is okay, proceed with Step 10.
   - If both LEDs are on but the mowers do not lower, proceed with Step a below.
     a. Using a 1/8 inch pin punch, push the manual override on the left side of the lift/lower valve.
        - If mowers raise, proceed with Step 7.
        - If mowers still do not raise, the lift/lower valve may be faulty.
   - If one or both LEDs are not on, an electrical problem exists, see Section 10 for tests/repairs.
7. Remove solenoid coil from left side of valve and put it on the right side, put right solenoid on the left side.
8. Start the tractor, push lift/lower lever forward and hold.
   - If mowers lower, solenoid was faulty.
   - If mowers still do not lower, valve may be faulty.
9. Start the machine, lower the mowers.

See Figure 8N-7

10. At the rear left cylinder disconnect lines from cylinder tees as shown. Plug the lines and cap tee ports.
11. Start the tractor, pull lift/lower lever rearward, then release.
    - If mowers do not float down, proceed with Step 12.
    - If front mowers float down, proceed with Step 16.
12. Start the machine, lower the mowers.
13. Reconnect cylinder lines to tees of left rear cylinder.
14. Disconnect right cylinder lines from tees on left cylinder. Plug lines, cap tee ports.

SECTION 8N. HYDRAULIC FIELD TEST PROCEDURES

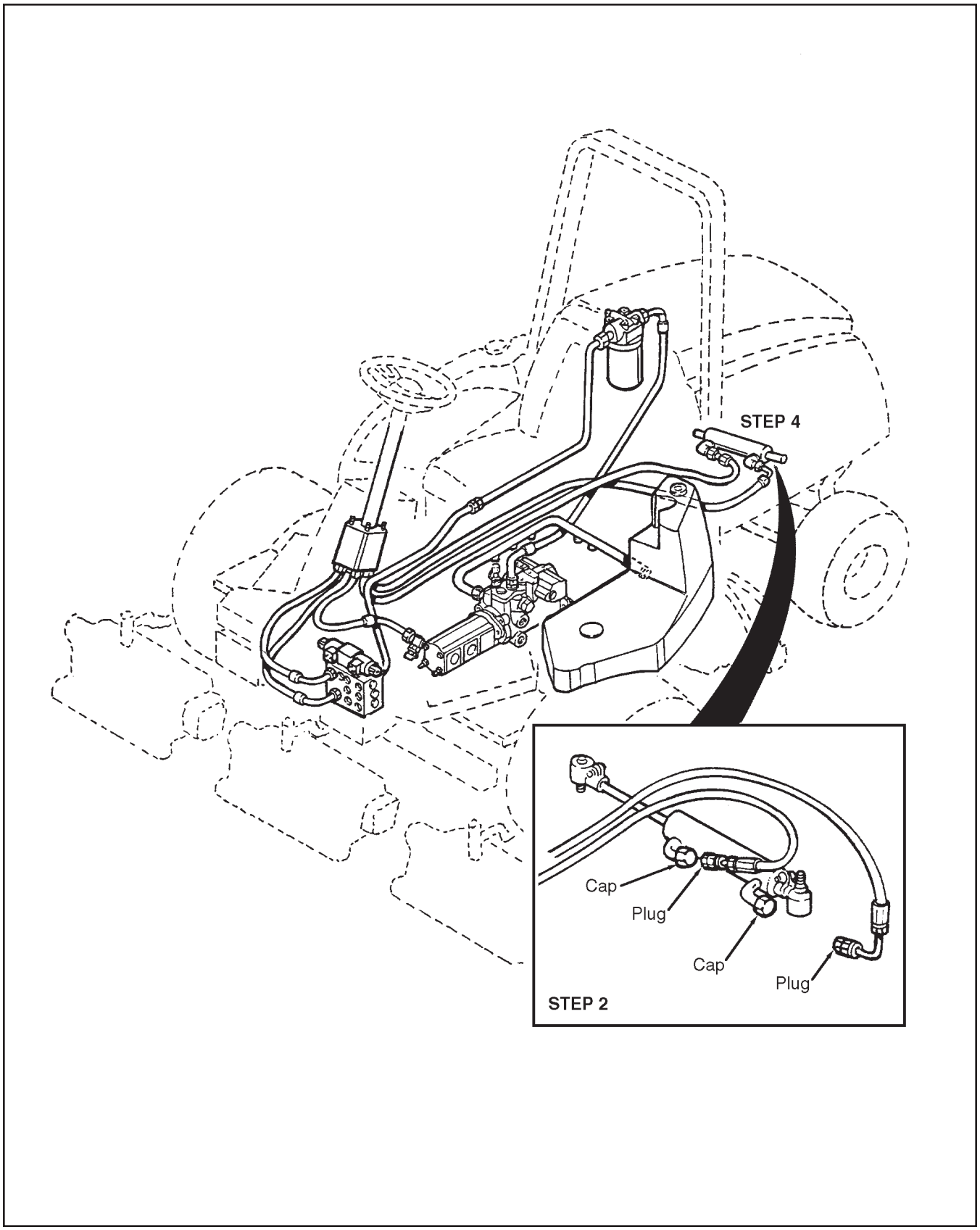


Figure 8N-5. Power Steering Circuit

SECTION 8N. HYDRAULIC FIELD TEST PROCEDURES

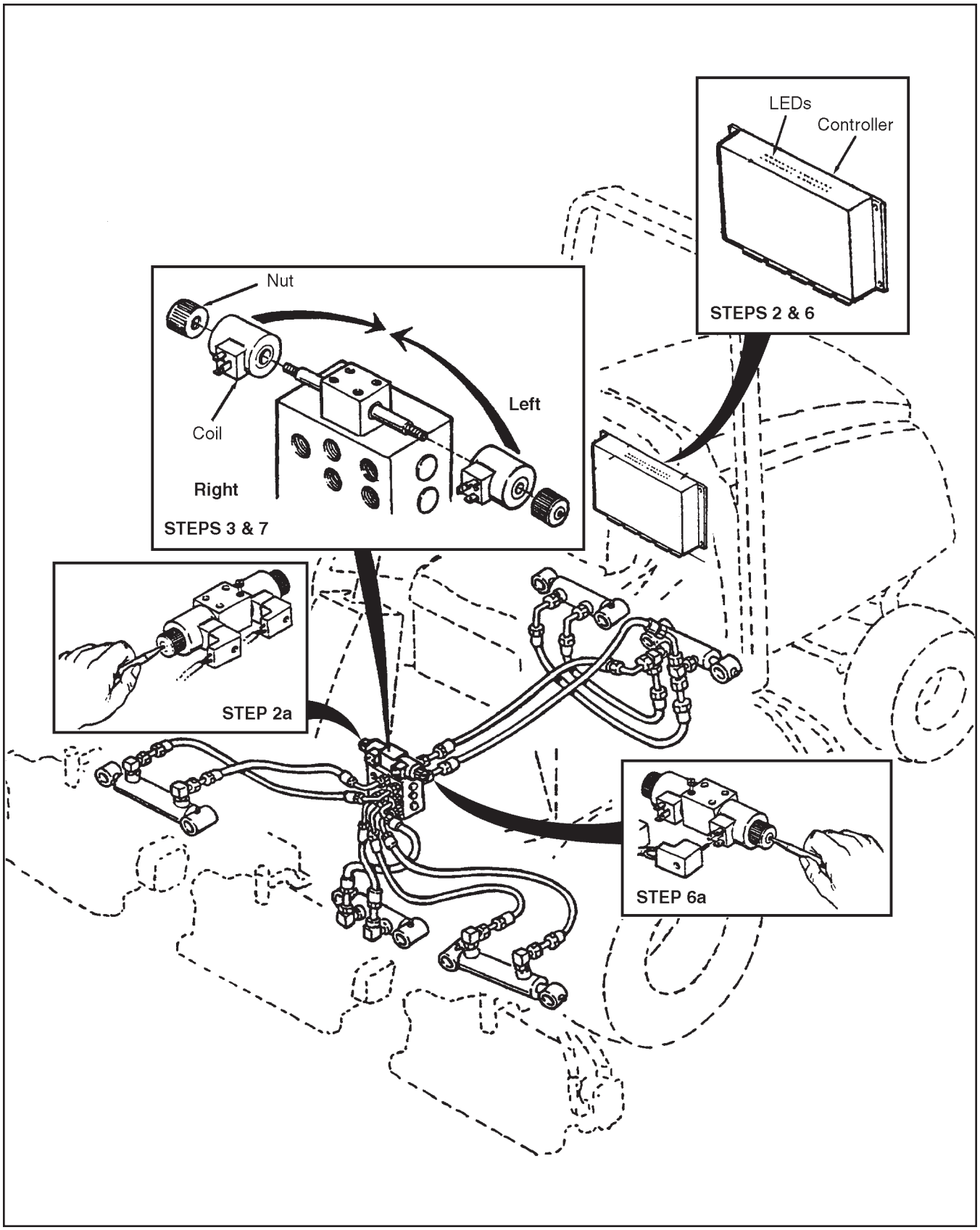


Figure 8N-6. Solenoid Coil

SECTION 8N. HYDRAULIC FIELD TEST PROCEDURES

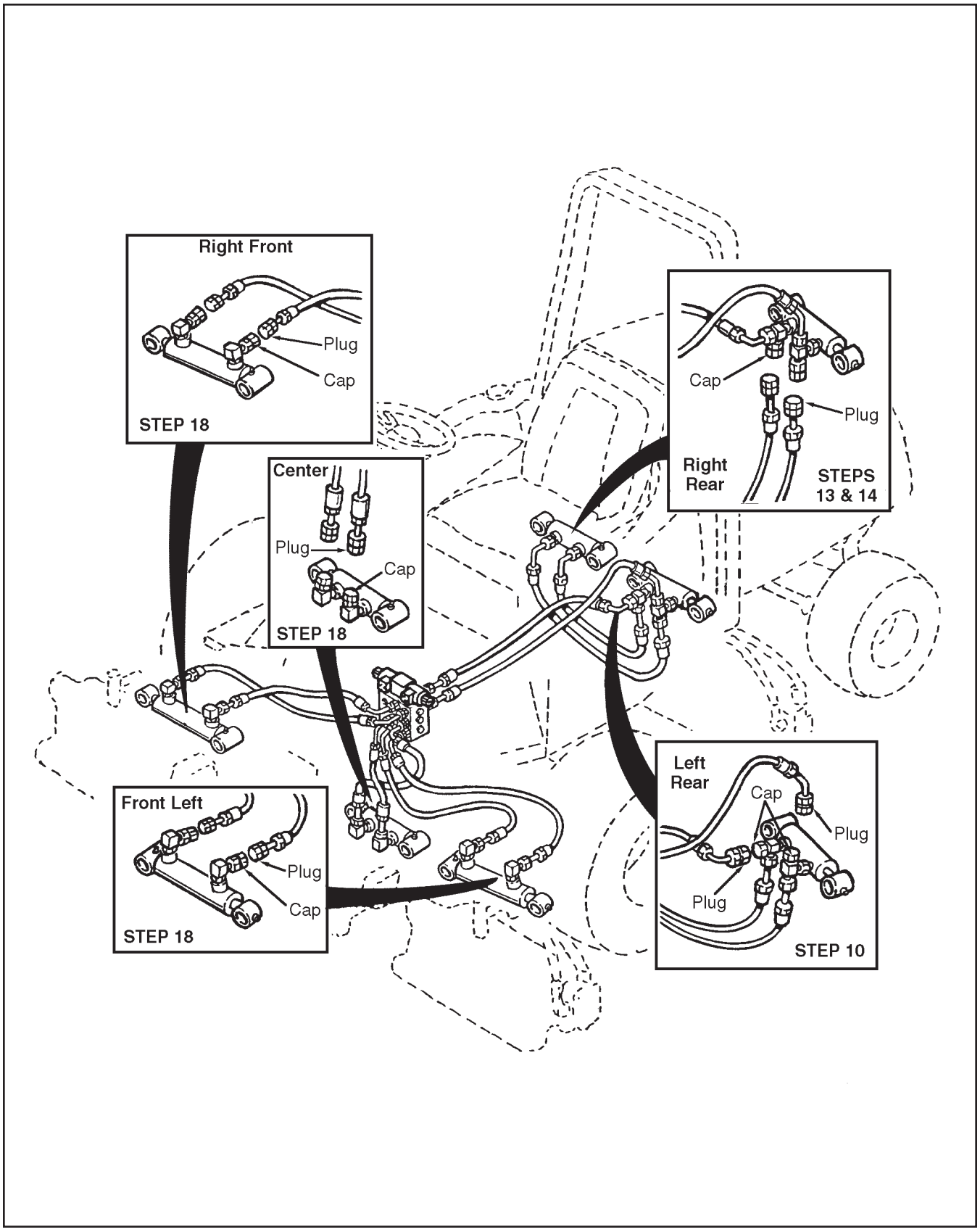


Figure 8N-7. Lift/Lower Circuit Field Test

SECTION 8N. HYDRAULIC FIELD TEST PROCEDURES

15. Start the tractor, pull lift/lower lever rearward, then release.
    - If mowers do not float down, right cylinder is at fault.
    - If mowers float down left cylinder is at fault.
16. Start the machine, lower the mowers.
17. Reconnect cylinder lines to tees of left rear cylinder.
18. At front left cylinder, remove hydraulic lines, plug lines and cap ports.
19. Start the tractor, pull lift/lower lever rearward, then release.
    - If mowers do not float down, right cylinder is at fault.
    - If mowers float down left cylinder is at fault.
20. Start the machine, lower the mowers.
21. Repeat Step 18 for remaining two front lift cylinders.

MOWER SYSTEM

See Figure 8N-8

The mower system can be divided into two separate circuits, front and rear. Pump section 2 for the rear circuit supplies oil to the right motor control valve, from the valve to the left rear, then to the right rear mower motors.

Pump section 3 for the front supplies oil to the front motor control valve, from the valve to the front left, then center, and finally to the right mower motors.

The motors in each circuit are connected in series and have their own relief valves.

DANGER

Keep clear of reels when performing tests.

1. Determine which mower circuit is experiencing a problem.
2. Start the tractor, lower the mowers, and push the master mow switch to CUT.
3. Check controller LEDs 17, 18 and 38, they should be on (lit).
    - If LEDs are on and the mowers run, mower circuit is okay.
    - If LEDs are on but the mowers do not come on, proceed with Step a below.
        a. Using a 1/8 inch pin punch, push the front left manual override button.
            - If mowers come one, proceed with Step 4.
            - If mowers still do not come on, hydraulic pump or mower motor control valve may be faulty, perform an instrument test.
    - If only one mower does not turn or turns slow and engine does not labor, proceed with Step 6.

See Figure 8N-9

4. Remove the solenoid coil from the left side of the valve and put it on the right side, put the right solenoid on the left side.
5. Start the tractor, push the master PTO switch to CUT.
    - If mowers come on, solenoid is faulty.
    - If mowers still do not come on, valve may be faulty.
6. Feel the drain lines on each motor in the circuit.
    - Feels moderately warm, this is normal.
    - Feels excessively warm or hot, motor may have excessive internal leakage, proceed with an instrument test.
7. All reel motors are the same, switch the faulty motor with a known good motor.
    - If fault goes with the switch, motor is faulty.
    - If fault stays with the mower, mower may be faulty.

SECTION 8N. HYDRAULIC FIELD TEST PROCEDURES

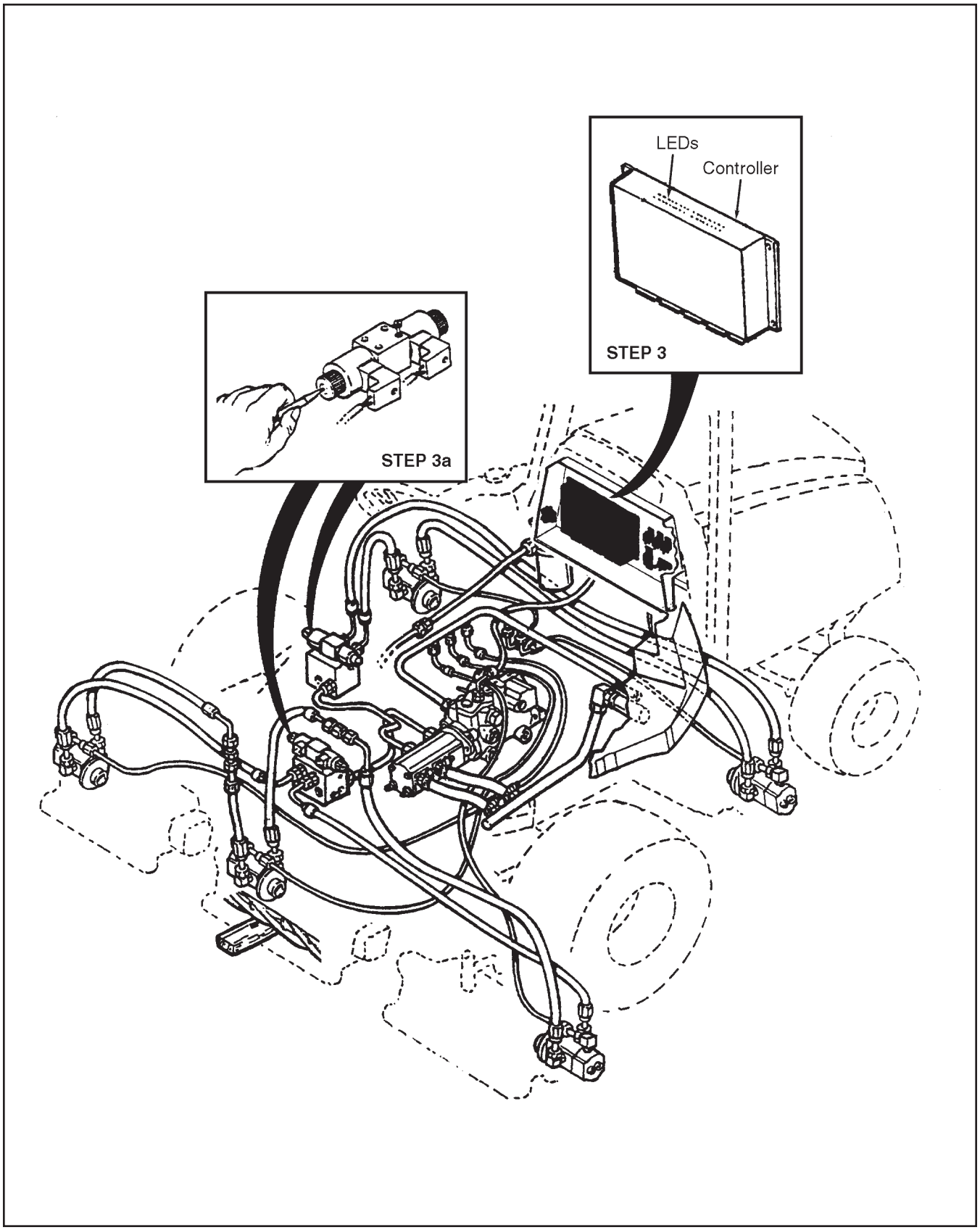


Figure 8N-8. Mower System Field Test

SECTION 8N. HYDRAULIC FIELD TEST PROCEDURES

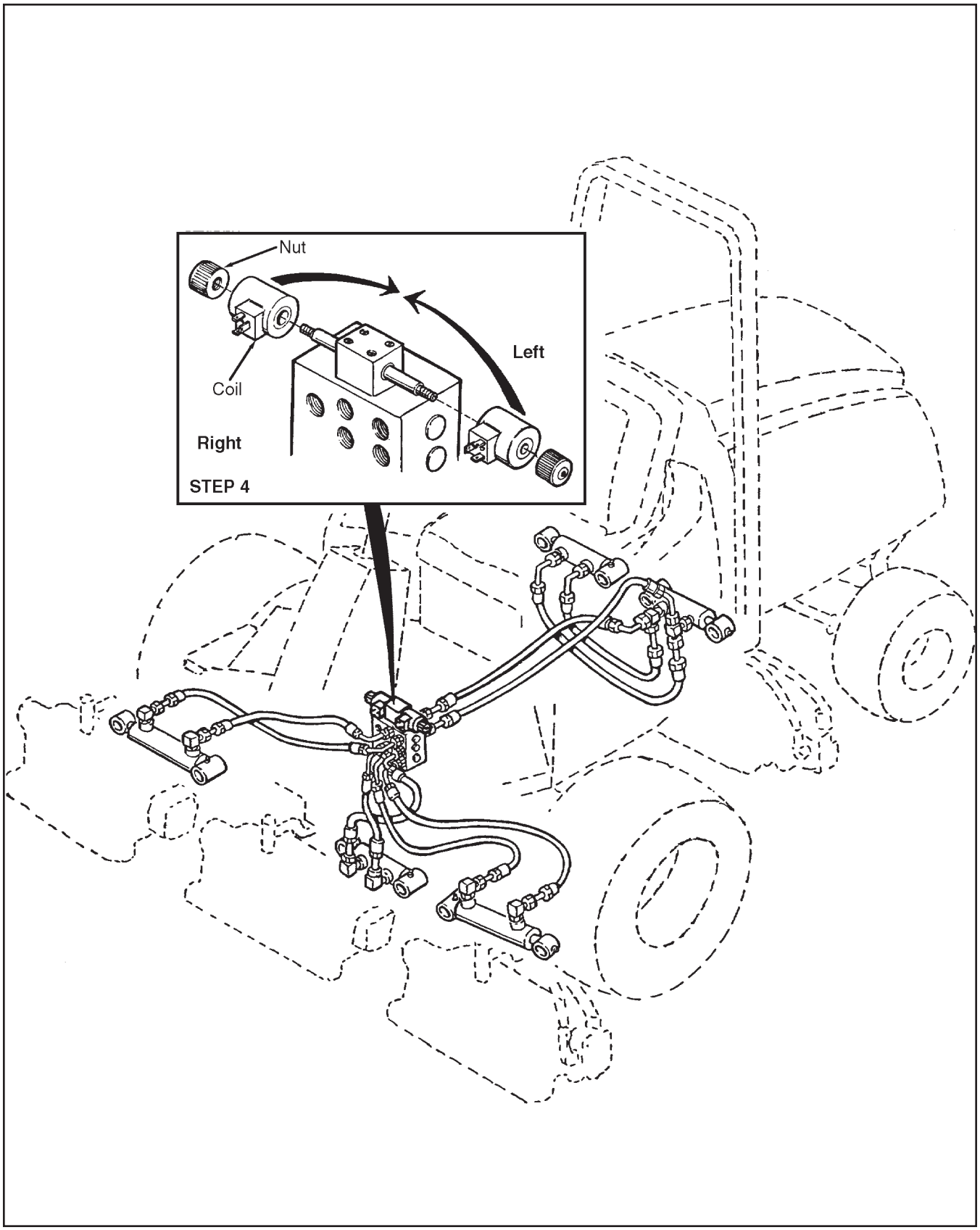


Figure 8N-9. Solenoid Coil

SECTION 8O. INSTRUMENT TEST

GENERAL

The tests in this section are provided as a means of isolating a problem in the hydraulic system.

This section consists of two test methods. The first; Relief Valve Tests, using pressure gauges only. Using this method results in some test conclusions not being final. Second; Starting with the Traction System Test, an in-line hydraulic flow/pressure instrument is used (see Figure 8O-1). This method is more complete and will result in a final conclusion of the failure.

Make sure the tractor is secured and cannot roll. If interlock systems are bypassed, exercise caution when performing each test — do so in a safe manner.

⚠ CAUTION

Make sure interlock system is reconnected after test has been completed.

It is important to follow the instructions accurately and completely. Make sure to plug lines and cap ports when so instructed. Also, read and follow the Preliminary Checks provided in Section 8N before proceeding with the instrument tests.

IMPORTANT

All of the tests in this section are shown using an in-line tester shown in Figure 8O-1. When using tester with variable gpm settings, make sure tester is set for the proper flow range to avoid damage to the test instrument. It is recommended that you record all readings obtained during these tests. It is important that you accurately run all tests at the same engine RPM and oil at operating temperature.

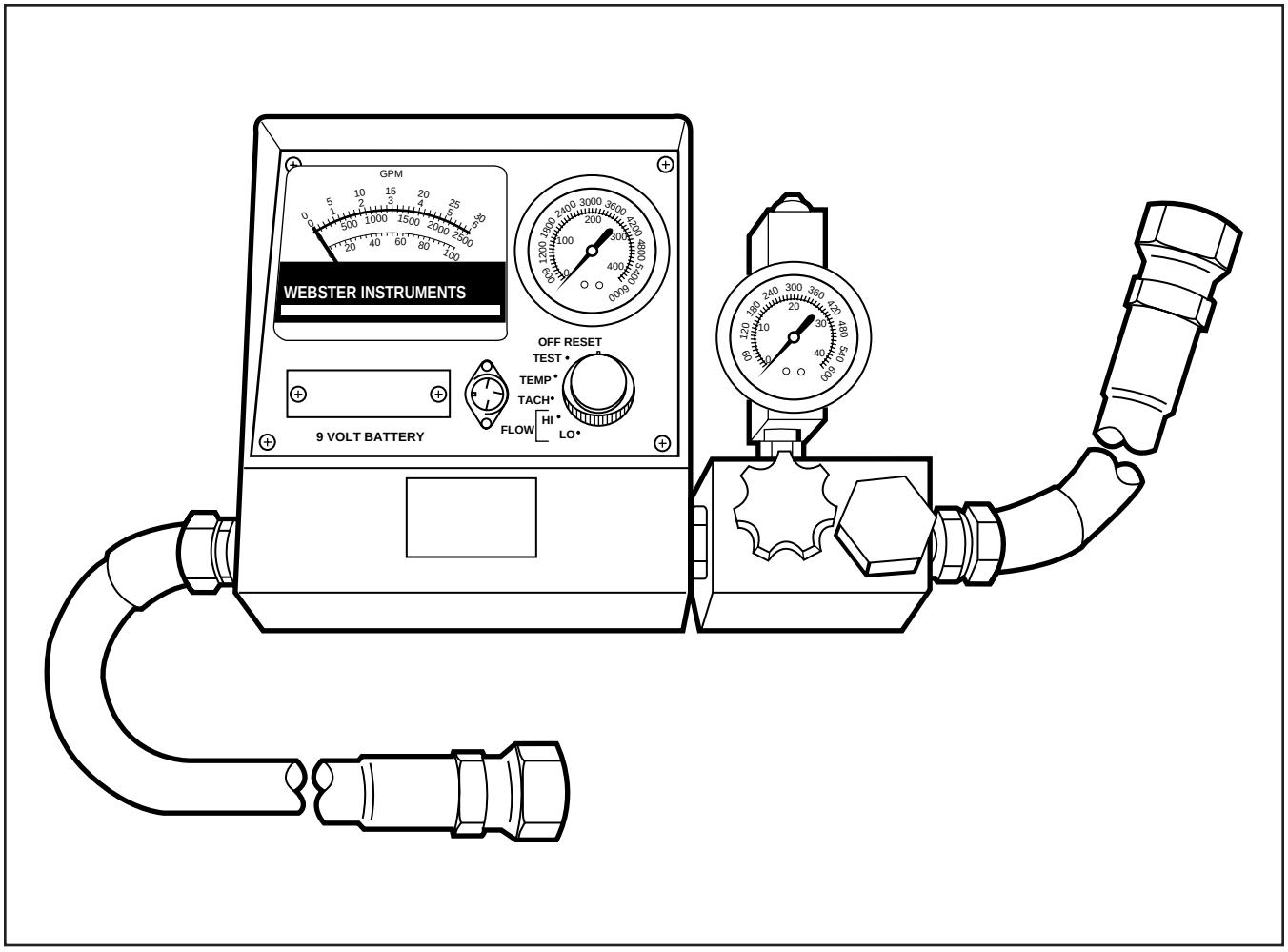


Figure 8O-1. In-Line Tester

SECTION 8O. INSTRUMENT TEST

STEERING, LIFT/LOWER CIRCUIT TESTS

GENERAL

Auxiliary pump section 3 supplies oil to the steering unit and lift/lower valve. In the steering unit there is a circuit relief valve for steering and the lift/lower valve.

If a fault occurs in the steering or raising the mowers proceed with Step 1 under Steering Circuit Test.

If both the steering and lift/lower circuits are faulty proceed with Pump Flow Test.

NOTE

Before performing any test be sure oil is at operating temperature 110 to 120°F (43 to 49°C) and the engine RPM is at 3125 to 3150.

STEERING CIRCUIT TEST (See Figure 8O-2)

1. Using adapter P/N 551433 and a 0 to 2000 psi (0 to 13790 kPa) gauge, connect the gauge to the test port in the outlet line of pump section 3.
2. Set the brake, start the engine and advance the throttle to full idle position.
3. Turn the steering wheel to the right, then to the left until it stops and hold at each position, read/record pressure reading.
   - Relief pressure is 1450 psi ± 10% (9000 to 10997 kPa), proceed with Step 7 (late machines) or 30 (early machines).
   - Relief pressure is not in specified range in one or both positions, proceed with Step 4.
4. At the steer cylinder, remove both hydraulic lines, plug the lines and cap the cylinder ports.
5. Set the brake, start the engine and advance the throttle to full idle position.
6. Turn the steering wheel to the right, then to the left until it stops and hold, read/record pressure reading.
   - Relief pressure is 1450 psi ± 10% (9000 to 10997 kPa) in both positions, steer cylinder faulty; repair (Section 6).
   - Relief pressure is not in specified range in one position only, steering unit is faulty; repair (Section 6).
   - Relief pressure is not in specified range in either direction, proceed with Pump Flow Test.

LIFT/LOWER CIRCUIT TEST (See Figure 8O-3)

7. Pull joystick rearward (RAISE) and hold, read/record pressure reading.
   - Relief pressure is 1450 psi ± 10% (9000 to 10997 kPa), proceed with Step 27.
   - Relief pressure is not in specified range, proceed with Step 8.
8. At the rear lift/lower cylinder line tees, mark and remove the two lines from the tees. Plug the lines and cap the tees.
9. Set the brake, start the engine and advance the throttle to full idle position.
10. Pull joystick rearward (RAISE) and hold, read/record pressure reading.
    - Relief pressure is 1450 psi ± 10% (9000 to 10997 kPa), proceed with Step 11.
    - Relief pressure is not in specified range, reconnect cylinder lines to tees, proceed with Step 15.
11. Reconnect cylinder lines to tees.
12. Remove the two right rear cylinder lines. Plug the lines and cap the cylinder ports.
13. Set the brake, start the engine and advance the throttle to full idle position.
14. Pull joystick rearward (RAISE) and hold, read/record pressure reading.
    - Relief pressure is 1450 psi ± 10% (9000 to 10997 kPa), right rear lift/lower cylinder is faulty (Section 8J).
    - Relief pressure is not in specified range, left rear lift/lower cylinder is faulty (Section 8J).
15. At the front left lift/lower cylinder, remove both lines. Plug the lines and cap the cylinder ports.
16. Set the brake, start the engine and advance the throttle to full idle position.
17. Pull joystick rearward (RAISE) and hold, read/record pressure reading.
    - Relief pressure is 1450 psi ± 10% (9000 to 10997 kPa), front left lift/lower cylinder is faulty (Section 8J).
    - Relief pressure is not in specified range, proceed with Step 18.
18. Reconnect lines to the front left lift/lower cylinder.
19. At the front center lift/lower cylinder, remove both lines. Plug the lines and cap the cylinder ports.
20. Set the brake, start the engine and advance the throttle to full idle position.

SECTION 8O. INSTRUMENT TEST

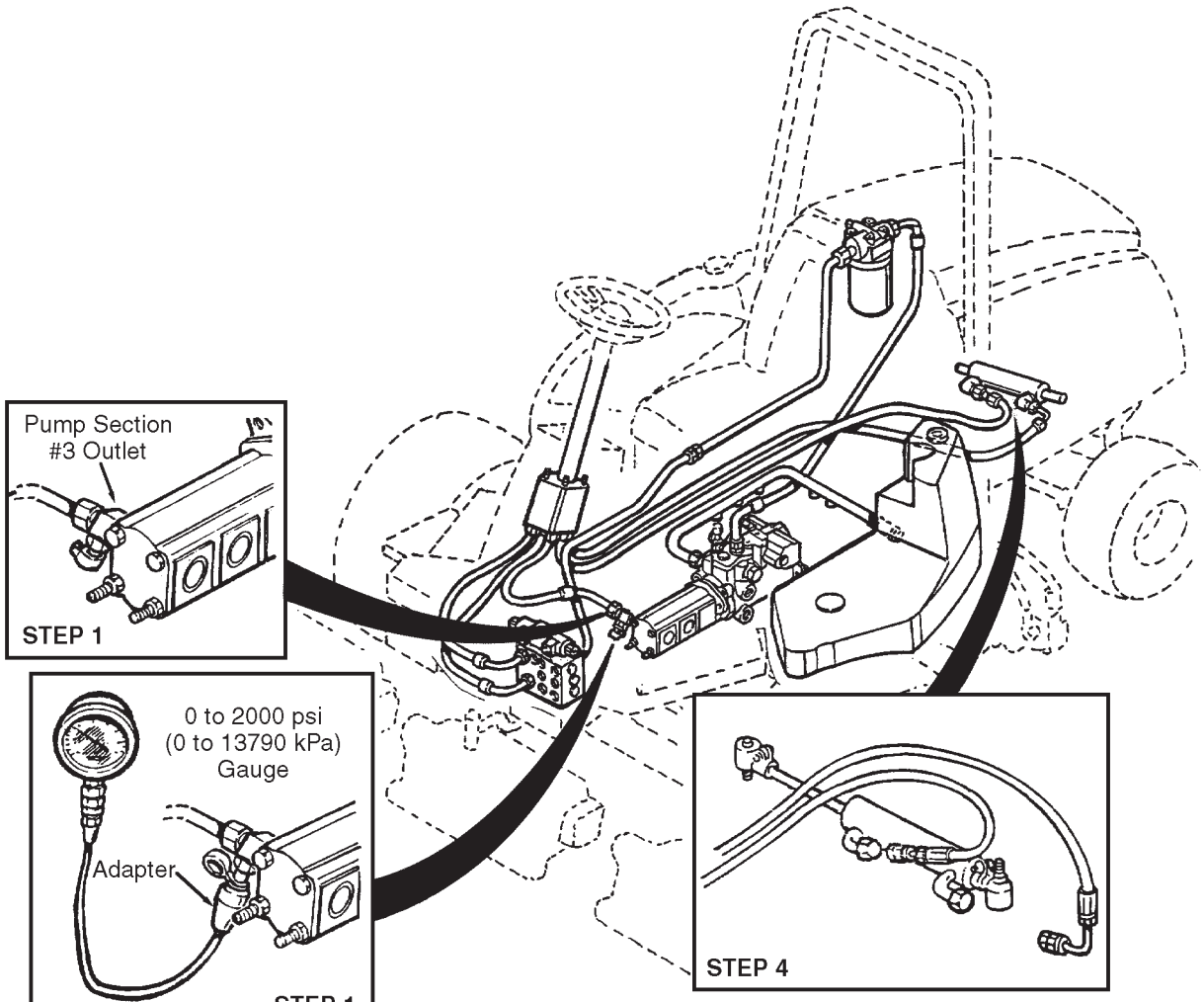


Figure 8O-2. Steering Circuit Test

SECTION 8O. INSTRUMENT TEST

21. Pull the joystick rearward (RAISE) and hold, read/record pressure reading.
    - Relief pressure is 1450 psi ± 10% (9000 to 10997 kPa), front center lift/lower cylinder is faulty (Section 8J).
    - Relief pressure is not in specified range, proceed with Step 22.
22. Reconnect the lines to center lift/lower cylinder.
23. At the front right lift/lower cylinder, remove both lines. Plug the lines and cap the cylinder ports.
24. Set the brake, start the engine and advance the throttle to full idle position.
25. Pull the joystick rearward (RAISE) and hold, read/record pressure reading.
    - Relief pressure is 1450 psi ± 10% (9000 to 10997 kPa), front right lift/lower cylinder is faulty (Section 8J).
    - Relief pressure is not in specified range, lift valve is faulty.
26. Reconnect lines to the right cylinder.
27. Lower the mowers.
28. Set the brake, start the engine and advance the throttle to full idle position.

CAUTION

DO NOT lift mowers. Damage to gauge connections will accrue.

29. Push the joystick forward (LOWER) and hold, read/record pressure reading.
    - Lower relief should open at 1450 psi ± 10% (9000 to 10997 kPa).
    - Relief pressure is not in specified range, lower relief cartridge is faulty.
30. At the rear lift/lower cylinder line tees, mark and remove the two lines from the tees. Plug the lines and cap the tees.
31. Set the brake, start the engine and advance the throttle to full idle position.
32. Push joystick forward (LOWER) and hold, read/record pressure reading.
    - Relief pressure is 1450 psi ± 10% (9000 to 10997 kPa), proceed with Step 33.
    - Relief pressure is not in specified range, reconnect cylinder lines to tees, proceed with Step 37.
33. Reconnect cylinder lines to tees.
34. Remove the two right rear cylinder lines. Plug the lines and cap the cylinder ports.
35. Set the brake, start the engine and advance the throttle to full idle position.
36. Push joystick forward (LOWER) and hold, read/record pressure reading.
    - Relief pressure is 1450 psi ± 10% (9000 to 10997 kPa), right rear lift/lower cylinder is faulty (Section 8J).
    - Relief pressure is not in specified range, left rear lift/lower cylinder is faulty (Section 8J).
37. At the front left lift/lower cylinder, remove both lines. Plug the lines and cap the cylinder ports.
38. Set the brake, start the engine and advance the throttle to full idle position.
39. Push joystick forward (LOWER) and hold, read/record pressure reading.
    - Relief pressure is 1450 psi ± 10% (9000 to 10997 kPa), front left lift/lower cylinder is faulty (Section 8J).
    - Relief pressure is not in specified range, proceed with Step 40.
40. Reconnect lines to the front left lift/lower cylinder.
41. At the front center lift/lower cylinder, remove both lines. Plug the lines and cap the cylinder ports.
42. Set the brake, start the engine and advance the throttle to full idle position.
43. Push the joystick forward (LOWER) and hold, read/record pressure reading.
    - Relief pressure is 1450 psi ± 10% (9000 to 10997 kPa), front center lift/lower cylinder is faulty (Section 8J).
    - Relief pressure is not in specified range, proceed with Step 44.
44. Reconnect the lines to center lift/lower cylinder.
45. At the front right lift/lower cylinder, remove both lines. Plug the lines and cap the cylinder ports.
46. Set the brake, start the engine and advance the throttle to full idle position.
47. Push the joystick forward (LOWER) and hold, read/record pressure reading.
    - Relief pressure is 1450 psi ± 10% (9000 to 10997 kPa), front right lift/lower cylinder is faulty (Section 8J).
    - Relief pressure is not in specified range, lift valve is faulty.
48. Reconnect lines to the right cylinder.

SECTION 8O. INSTRUMENT TEST

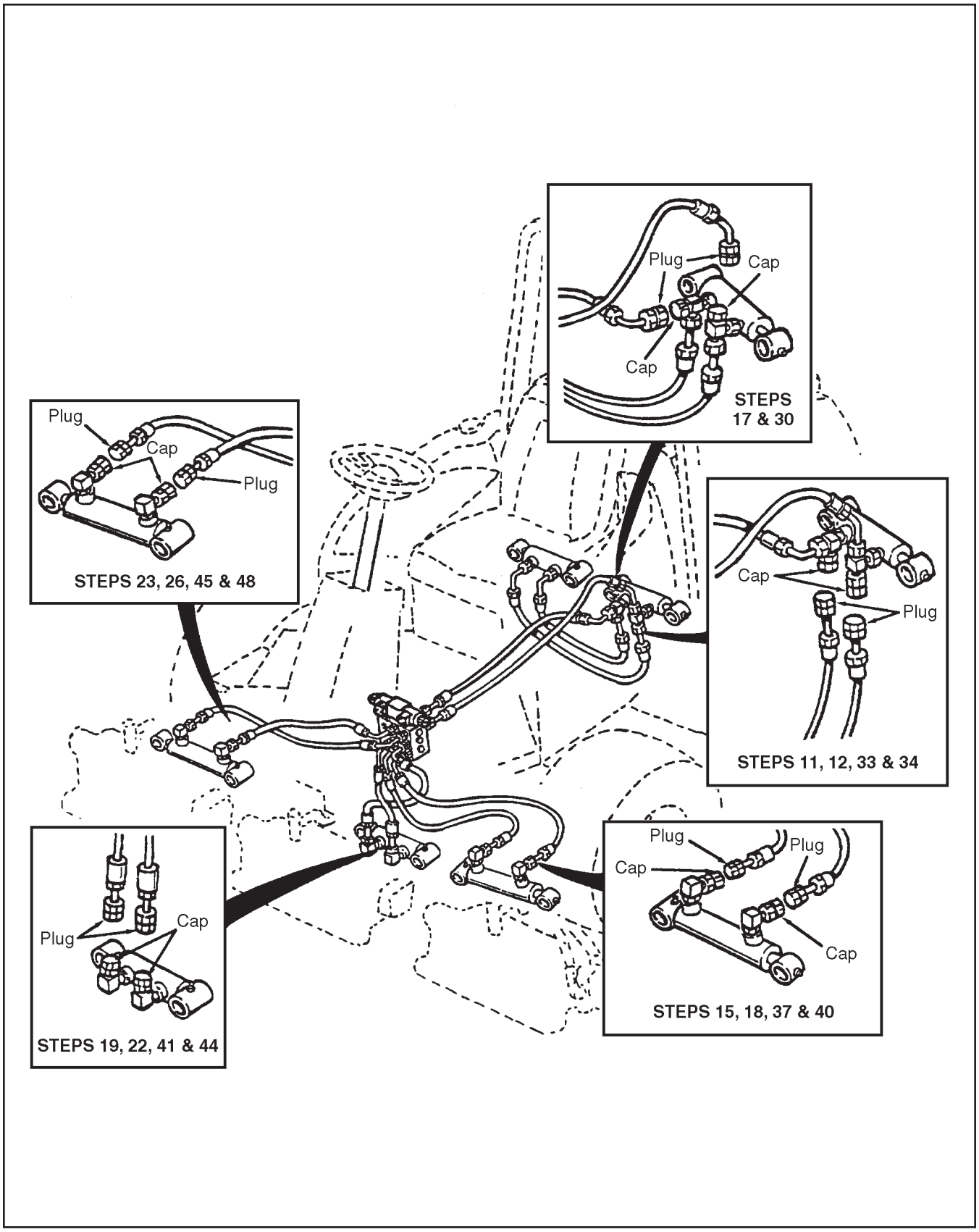


Figure 8O-3. Lift/Lower Circuit Test

SECTION 8O. INSTRUMENT TEST

PUMP FLOW TEST (See Figure 8O-4)

1. At auxiliary pump section 3, remove the outlet line from pump.
2. Connect flowmeter “IN” port line to the pump.
3. Connect the flowmeter “OUT” line to the line removed from the pump.
4. Completely open the flowmeter load valve.
5. Set the brake, start the engine and advance the throttle to full idle position.
6. Read/record no load flow. No load flow should be 7 gpm (26.495 lpm).
   - If flow is in specified range, proceed with Step 7.
   - If flow is lower than specified, engine RPM is not correct or pump is faulty.
7. Slowly close the flowmeter load valve until 1450 psi (9997 kPa) is obtained.
8. Subtract flow rate in Step 7 from flow in Step 6.

   Example:

   7.0 gpm (26.495 lpm), Step 6 @ 3150 engine RPM
   6.0 gpm (22.71 lpm), Step 13
   1.0 gpm (3.785 lpm) leakage
   - If leakage is 1/2 gpm (1.89 lpm), pump is okay, proceed with Step 15.
   - If leakage is 1/2 to 2 gpm (1.89 to 7.57 lpm), the pump is marginal.
   - More than 2 gpm (7.57 lpm) leakage will noticeably reduce performance. The pump may have to be repaired or replaced (Section 8H).
9. Open the flowmeter load valve.

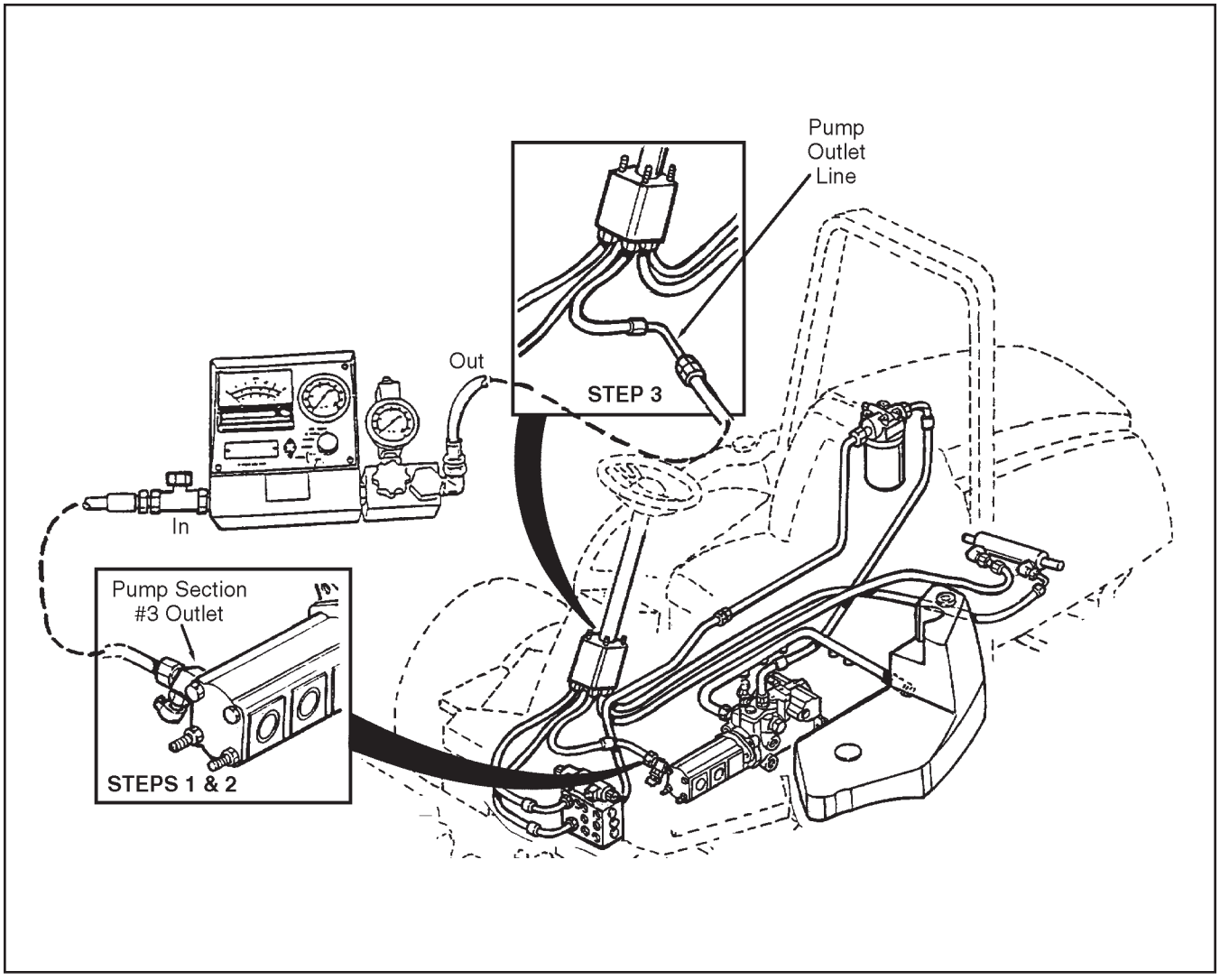


Figure 8O-4. Steering Circuit Pump Flow Test

SECTION 8O. INSTRUMENT TEST

CHARGE CIRCUIT TEST (See Figure 8O-5)

NOTE

Before performing any test be sure oil is at operating temperature 110 to 120°F (43 to 49°C) and the engine RPM is at 3125 to 3150.

1. At the hydro, remove the hydraulic line from the top of the hydro.
2. Install a tee and a 0 to 600 psi (0 to 4137 kPa) gauge to the tee.
3. Reconnect hydraulic line to tee.
4. Set the brake, start the engine and advance throttle full engine idle RPM.
   - Charge relief pressure is 285 psi ± 10% (1769 to 2161 kPa) charge relief is okay, proceed with Charge Pump Test.
   - Charge relief pressure is higher or lower than specified, proceed with Step a.
   a. At the hydro, remove the charge pressure relief valve.
   b. Inspect and replace any worn or broken parts.
   c. If the test results were higher than the pressure specified, remove a shim. If the test results were lower than the pressure specified, add a shim.
   d. Reinstall the charge relief assembly and proceed with Step 5.
5. Set the brake, start the engine and advance throttle full engine idle RPM.
   - Charge relief pressure is 255 to 300 psi ± 10% (1758 to 2068 kPa), charge relief is okay.
   - If after adjusting, the pressure changes but is still not in specified range, repeat Steps 4a and 4c above as necessary. When specified range is obtained remove tee fitting and reconnect lines.
   - If, after adjusting, the pressure reading does not change, proceed with Charge Pump Test.

SECTION 8O. INSTRUMENT TEST

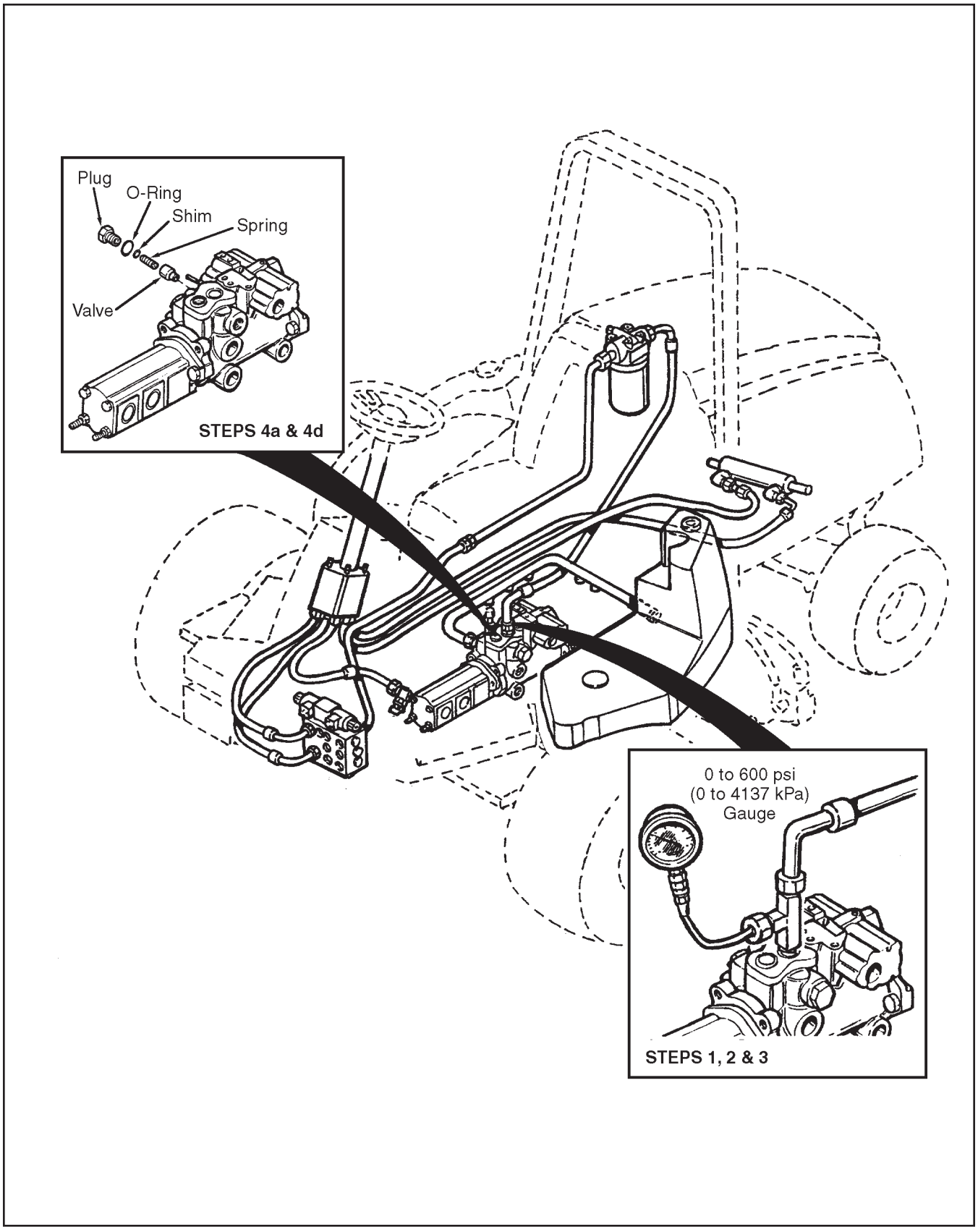


Figure 8O-5. Charge Circuit Test

SECTION 8O. INSTRUMENT TEST

CHARGE PUMP TEST

GENERAL

On the early machines, section 3 of the auxiliary pump is the charge pump. The pump supplies oil to the steering unit, lift/lower valve and then (through the charge filter) to the hydro.

On late machines, section 2 of the auxiliary pump acts as the charge pump. The pump supplies oil to the rear reel valve and (through the charge filter) to the hydro.

Before selecting which test to perform, first follow the hydraulic line routing from the port marked “T” on the rear reel valve. If the line goes to the charge filter, use the “Late” procedure; if the line goes to a tank line, use the “Early” procedure.

CHARGE PUMP TEST — LATE MACHINES (See Figure 8O-6)

1. At the auxiliary pump section 2, remove the metal hydraulic line between the pump and valve, cap valve port.
2. Install a tee to the pump outlet.
3. Connect “IN” port line of the flowmeter to the tee. Cap the open tee port.
4. Connect a return adapter to the fill port of the tank.
5. Connect the “OUT” port line of the flowmeter to the line removed from the pump.
6. Completely open flowmeter load valve.
7. Set parking brake, start engine, advance throttle to full engine idle position.
8. Read/record no load flow.
9. Slowly close flowmeter load valve until pressure reads 1100 psi (7585 kPa), read/record flow rate. Subtract flow in Step 8 from no load flow in Step 8.

NOTE

Monitor engine RPM as flow drops.

Example:

6.5 gpm (24.60 lpm) no load flow, Step 9
–6.0 gpm (22.71 lpm), Step 9 @ engine RPM
0.5 gpm (1.89 lpm) pump leakage

- If leakage is less than 1/2 gpm (1.89 lpm), pump is okay, proceed with Traction System Test.
- If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), pump is marginal.
- Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, the pump should be repaired or replaced.

CHARGE PUMP TEST — EARLY MACHINES (See Figure 8O-7)

1. At the auxiliary pump section 3, disconnect the hydraulic outlet line from the pump.
2. Connect the “IN” port line of the flowmeter to the pump.
3. Connect the “OUT” port line of the flowmeter to the line removed from the pump.
4. Completely open flowmeter load valve.
5. Set parking brake, start engine, advance throttle to full engine idle position.
6. Read/record no load flow.
7. Slowly close flowmeter load valve until pressure reads 1400 psi (9653 kPa), read/record flow rate. Subtract in Step 7 from no load flow in Step 6.

NOTE

Monitor engine RPM as flow drops.

Example:

6.5 gpm (24.60 lpm) no load flow, Step 6
–6.0 gpm (22.71 lpm), Step 7 @ engine RPM
0.5 gpm (1.89 lpm) pump leakage

- If leakage is less than 1/2 gpm (1.89 lpm), pump is okay, proceed with Traction System Test.
- If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), pump is marginal.
- Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, the pump should be repaired or replaced.

SECTION 8O. INSTRUMENT TEST

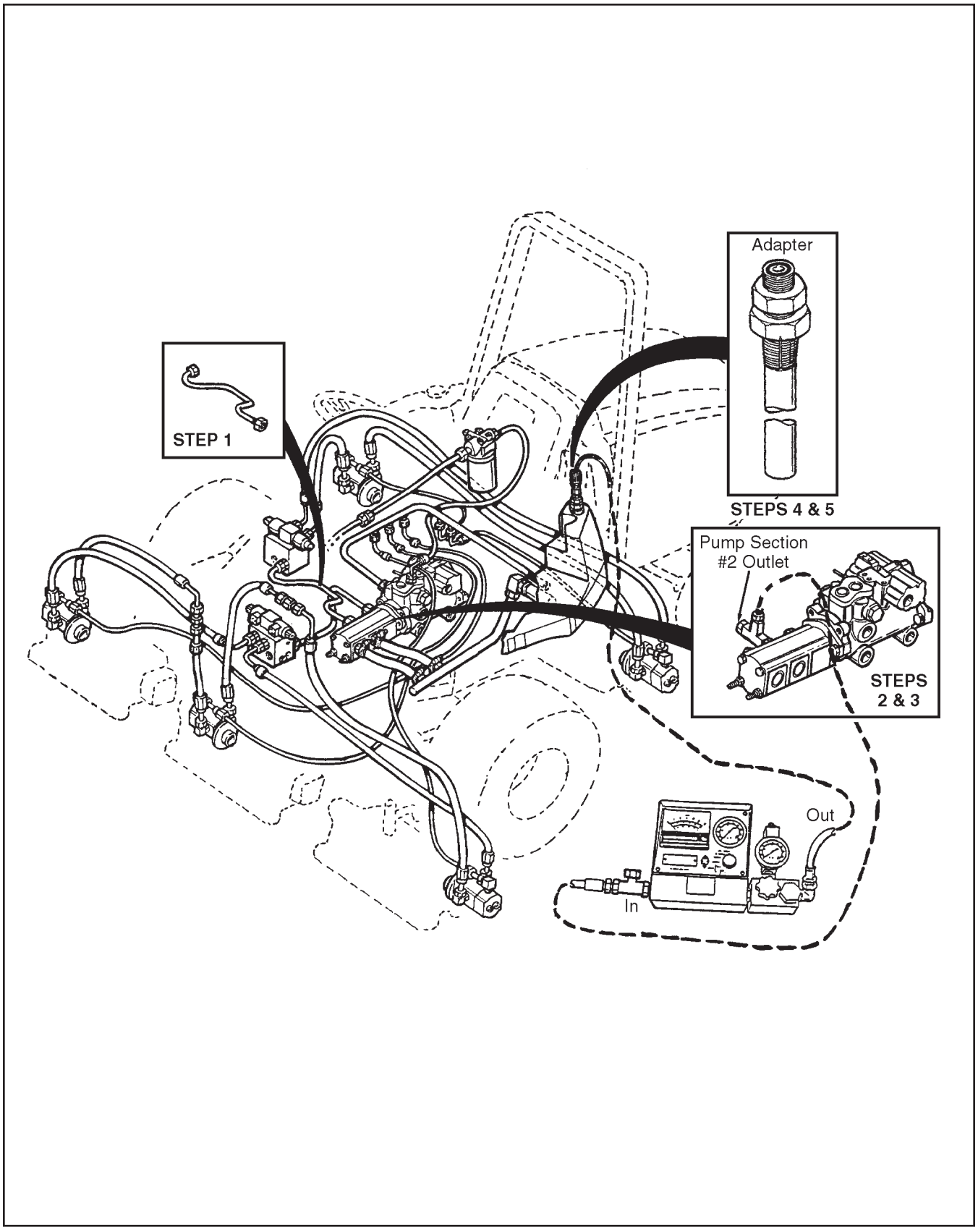


Figure 8O-6. Charge Pump Test — Late Machines

SECTION 8O. INSTRUMENT TEST

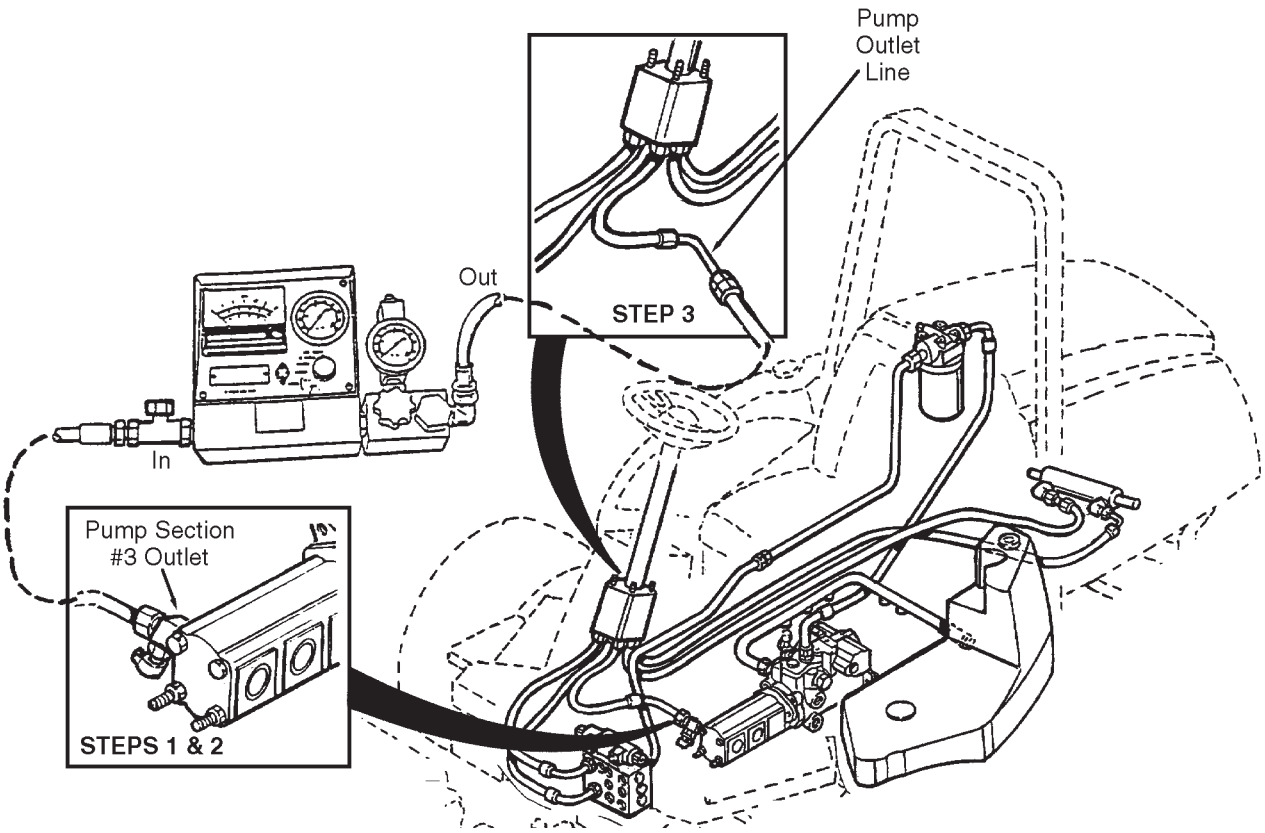


Figure 8O-7. Charge Pump Test — Early Machines

SECTION 8O. INSTRUMENT TEST

TRACTION SYSTEM TEST

TRACTION RELIEF TEST (See Figure 8O-8)

1. Tag and mark, then remove both forward and reverse hydraulic lines from crossover line tees as shown. Plug the motor lines.
2. Install another tee fitting to each crossover tee.
3. Connect “IN” port line of flowmeter to the top crossover tee and the “OUT” port line to the bottom tee. Cap remaining ports of the tees.
4. At the 4 wheel drive pipe tee on the left (4 wheel drive only), install a blocking disc in the 4 wheel drive pipe line.
5. Completely open flowmeter load valve.

NOTE

Be sure tow valve on hydro is closed.

6. Set parking brake, start engine, advance throttle to full engine idle RPM.
7. Read/record charge relief pressure.
   - Relief pressure is 285 ± 10% (1769 to 2161 kPa), charge relief is okay, proceed with a Traction Pump Test.
   - Relief pressure is not in specified range, a charge pressure circuit test should be performed.

TRACTION PUMP TEST (See Figure 8O-9)

NOTE

Before performing this test a Charge Relief Test should be performed.

1. Install a flow lock to the traction pump control arm.
2. On the right, under the floorboard, install a jumper wire in plug for the neutral start switch.

CAUTION

The jumper wire is used only during testing. Remember to remove the jumper when finished with the tests.

3. Open the flowmeter load valve, set parking brake, start engine, advance throttle to full engine idle RPM.
4. Adjust the flow lock to obtain 10 gpm (37.85 lpm) on the flow meter, lock it in place.
5. Slowly close flowmeter load valve until pressure reads 3000 psi (20685 kPa), read/record gpm flow.

NOTE

Monitor engine RPM as flow drops.

6. Continue to close the flowmeter load valve until flow drops off and pressure stays constant, read/record pressure. This is the forward cross port relief setting.

CAUTION

DO NOT exceed 3900 psi (20685 kPa) during this test.

   - Cross port relief is 3625 psi –0, +200 psi (24994 to 26373 kPa), relief is okay, proceed with Step 10.
   - Relief is not in specified range, proceed with Step 7.
7. At hydro remove both cross port reliefs. Take right cross port relief and install on the left and the left on the right.
8. Open flowmeter load valve, set parking brake, start engine, advance throttle to full engine idle RPM.
9. Slowly close the flowmeter load valve until flow drops off and pressure stays constant, read/record pressure.
   - Cross port relief is 3625 psi ± 10% (22496 to 27493 kPa), relief was faulty, replace with a new relief cartridge.
   - Relief is not in specified range. Hydro has excessive internal leakage.
10. Subtract flow rate obtained in Step 5 from 10 gpm (37.95 lpm).

    Example:

    10.0 gpm (37.85 lpm), Step 4
    –9.5 gpm (35.96 lpm), Step 5 @ engine RPM
    0.5 gpm (1.89 lpm) traction pump leakage

    - If leakage is less than 1/2 gpm (1.89 lpm), pump is okay, proceed with Step 11 for 4 wheel drive machines and Step 28 for 2 wheel drive machines.
    - If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), pump is marginal.
    - Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, the hydro may have to be repaired or replaced.

SECTION 8O. INSTRUMENT TEST

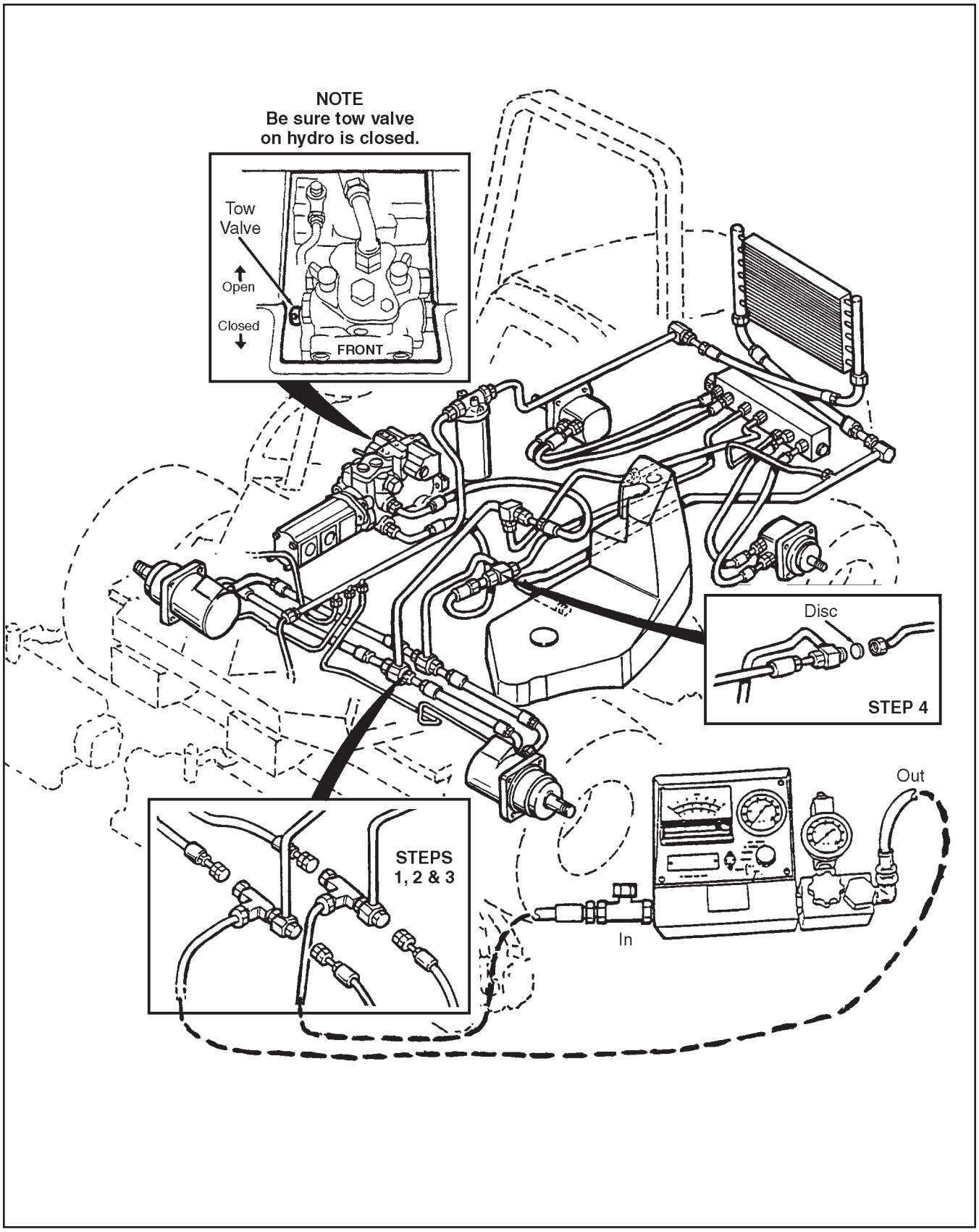


Figure 8O-8. Traction Relief Test

SECTION 8O. INSTRUMENT TEST

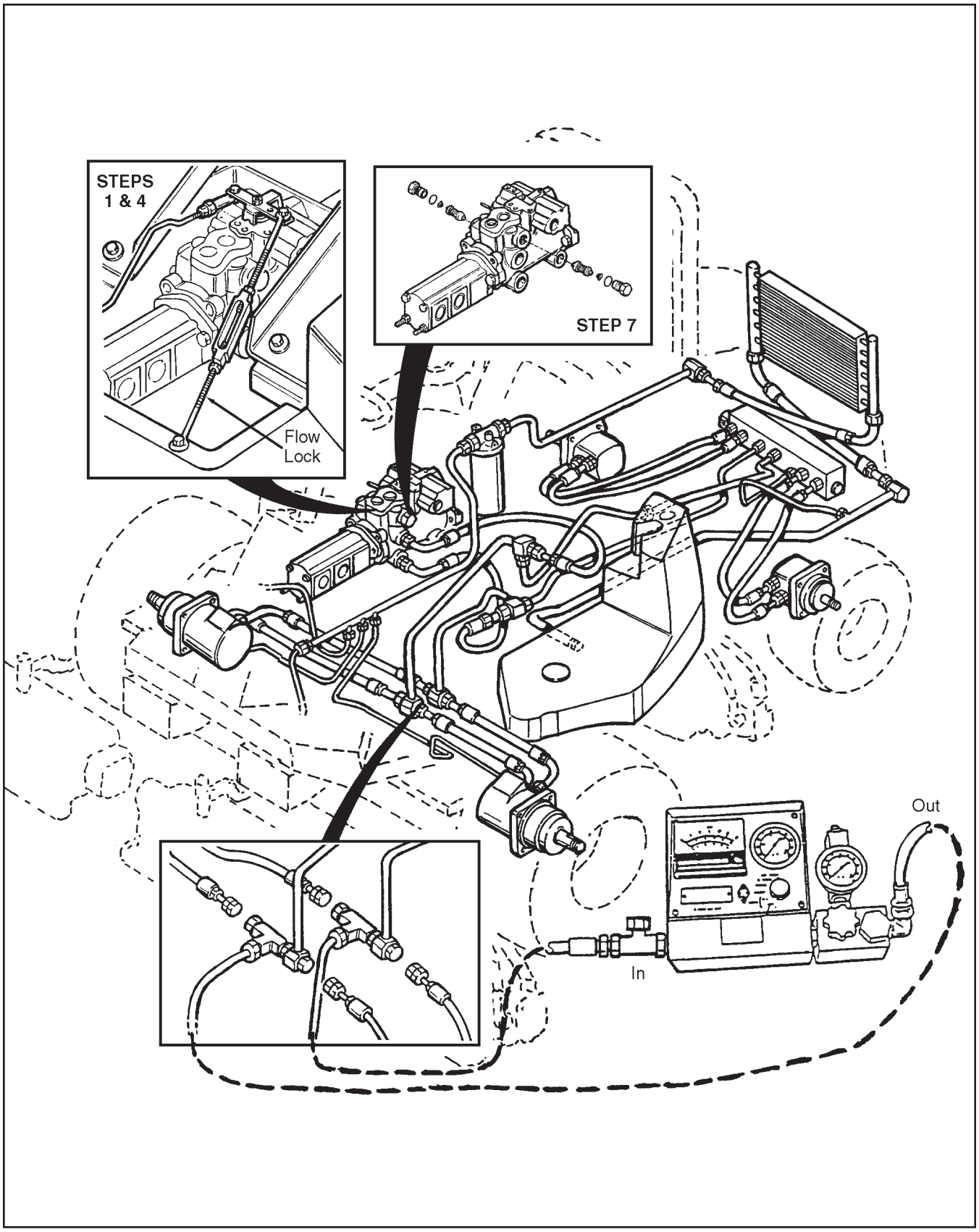


Figure 8O-9. Traction Pump Test

SECTION 8O. INSTRUMENT TEST

4 WHEEL DRIVE VALVE TEST (See Figure 8O-10)

11. Remove blocking disc from 4 wheel drive line at tee. Reconnect line.
12. At each of the rear traction motors, mark and remove both hydraulic lines. Plug the lines and cap motor ports.
13. Open flowmeter load valve, set parking brake, start engine and advance throttle to full engine idle RPM.
14. Slowly close the flowmeter load valve until pressure reads 3000 psi (20685 kPa), read/record flow rate. Subtract flow from flow in Step 5.

    Example:

    9.5 gpm (35.96 lpm), Step 5
    –9.0 gpm (34.07 lpm), Step 14
    0.5 gpm (1.89 lpm) 4 wheel drive valve leakage

    - If leakage is less than 1/2 gpm (1.89 lpm), valve is okay, proceed with Step 15.
    - If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), valve is marginal.
    - Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, cross port valve or cross port relief cartridges have excessive internal leakage or the valve block is cracked.

4 WHEEL DRIVE REAR TRACTION MOTOR TEST

15. Reconnect hydraulic lines to the left rear motor.
16. Install a wheel restraint to the left rear tire.
17. Open flowmeter load valve, set parking brake, start engine and advance throttle to full engine idle RPM.
18. Slowly close the flowmeter load valve until pressure reads 3000 psi (20685 kPa), read/record flow rate. Subtract flow from flow in Step 14.

    Example:

    9.0 gpm (34.07 lpm), Step 14
    –9.0 gpm (34.07 lpm), Step 18
    0.0 gpm (0.0 lpm) left rear traction motor leakage

    - If leakage is less than 1/2 gpm (1.89 lpm), motor is okay, proceed with Step 19.
    - If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), motor is marginal.
    - Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, motor should be repaired or replaced.
19. Reconnect hydraulic lines to the right rear motor.
20. Install a wheel restraint to the right rear tire.
21. Open flowmeter load valve, set parking brake, start engine and advance throttle to full engine idle RPM.
22. Slowly close the flowmeter load valve until pressure reads 3000 psi (20685 kPa), read/record flow rate. Subtract gpm flow from flow in Step 5.

    Example:

    9.0 gpm (34.07 lpm), Step 18
    –8.5 gpm (32.18 lpm), Step 22
    0.5 gpm (1.89 lpm) right rear traction motor leakage

    - If leakage is less than 1/2 gpm (1.89 lpm), motor is okay, proceed with Step 23.
    - If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), motor is marginal.
    - Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, motor should be repaired or replaced.

SECTION 8O. INSTRUMENT TEST

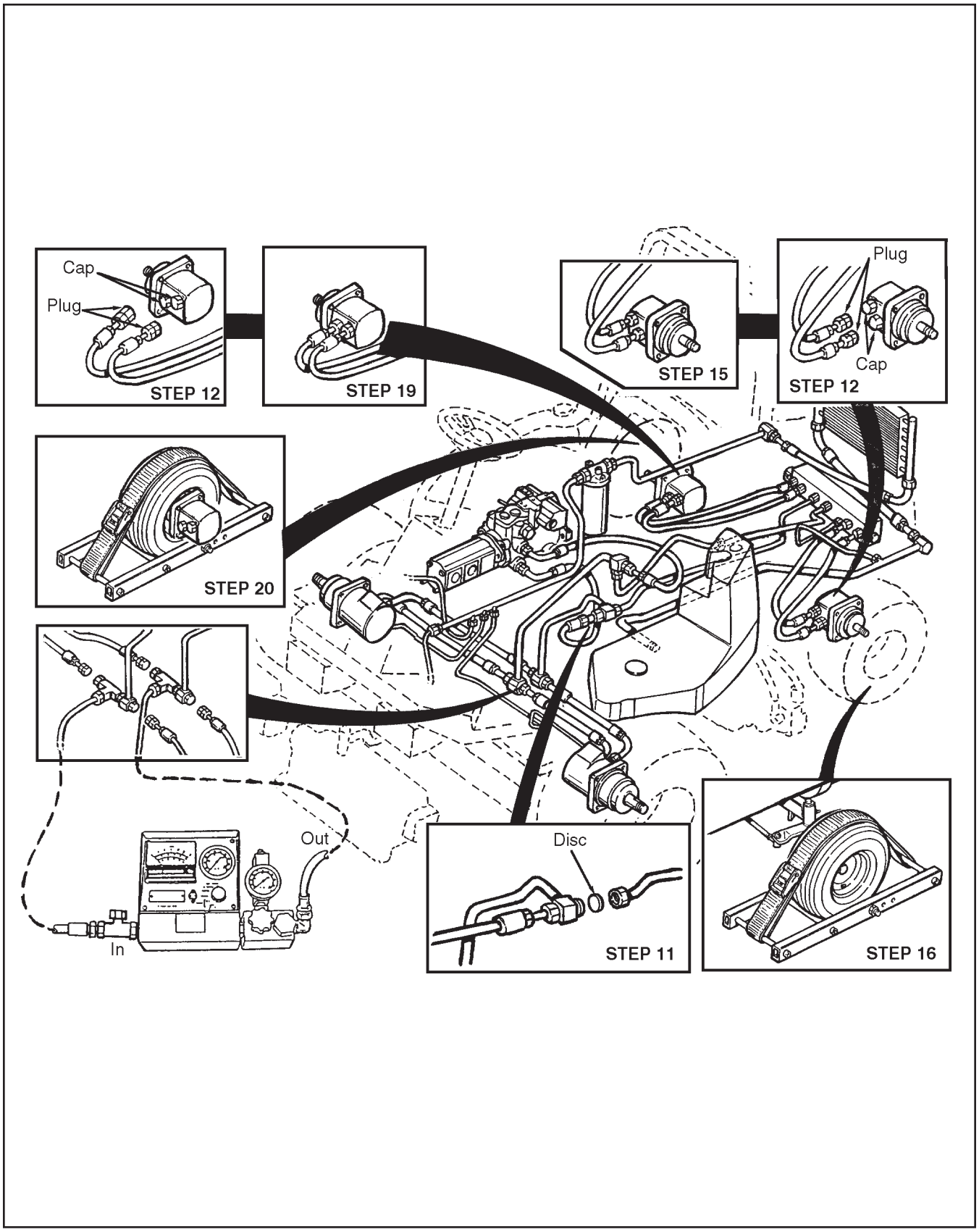


Figure 8O-10. 4 Wheel Drive Valve Test

SECTION 8O. INSTRUMENT TEST

FRONT TRACTION MOTOR TEST
(See Figure 8O-11)

27. At the 4 wheel drive pipe tee on the left, install a blocking disc on the 4 wheel drive pipe line.
28. Reconnect the hydraulic line for the front left motor.
29. Install a wheel restraint to the left front tire.
30. Open flowmeter load valve, set parking brake, start engine and advance throttle to full engine idle RPM.
31. Slowly close the flowmeter load valve until pressure reads 3000 psi (20685 kPa), read/record flow rate. Subtract flow from flow in Step 5.

    Example:

    9.5 gpm (35.96 lpm), Step 5
    –9.5 gpm (34.07 lpm), Step 31
    0.5 gpm (1.89 lpm) left rear traction motor leakage

    - If leakage is less than 1/2 gpm (1.89 lpm), motor is okay, proceed with Step 32.
    - If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), motor is marginal.
    - Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, motor should be repaired or replaced.
32. Reconnect the hydraulic line for the front right motor.
33. Install a wheel restraint to the right front tire.
34. Open flowmeter load valve, set parking brake, start engine and advance throttle to full engine idle RPM.
35. Slowly close the flowmeter load valve until pressure reads 3000 psi (20685 kPa), read/record flow rate. Subtract flow from flow in Step 5.

    Example:

    9.0 gpm (34.07 lpm), Step 31
    –8.5 gpm (32.18 lpm), Step 35
    0.5 gpm (1.89 lpm) left rear traction motor leakage

    - If leakage is less than 1/2 gpm (1.89 lpm), motor is okay, traction system is okay.
    - If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), motor is marginal.
    - Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, motor should be repaired or replaced.
36. Remove wheel restraints.
37. Remove flowmeter and reconnect all hydraulic lines.
38. Remove jumper wire from neutral start switch and reconnect switch to tractor harness.

MOWER SYSTEM TEST

GENERAL

The mower system consists of two hydraulic pumps, two solenoid operated motor control valves with manual hydraulic overrides and 5 bi-directional mower motors each having two relief valves. The front circuit has 3 motors, the rear circuit has 2 motors, both are series circuits.

Auxiliary pump section 1 supplies oil to the front motor control valve. The valve directs oil to the front right mower motor, then the center, then the front left. From the front left motor oil returns to the front motor control valve and back to tank.

Auxiliary pump section 2 supplies oil to the motor control valve located on the right in back of the wheel. The valve directs oil to the right rear mower motor, then to the left rear. From the left rear motor oil returns to the control valve and back to tank.

Before proceeding with the tests make sure the oil is at operating temperature, 110 to 130°F (43.3 to 54.4°C) and the engine full idle speed is 3150 RPM.

IMPORTANT

At the conclusion of each test and before removing lines and components always open the flowmeter load valve and shut down the engine.

SECTION 8O. INSTRUMENT TEST

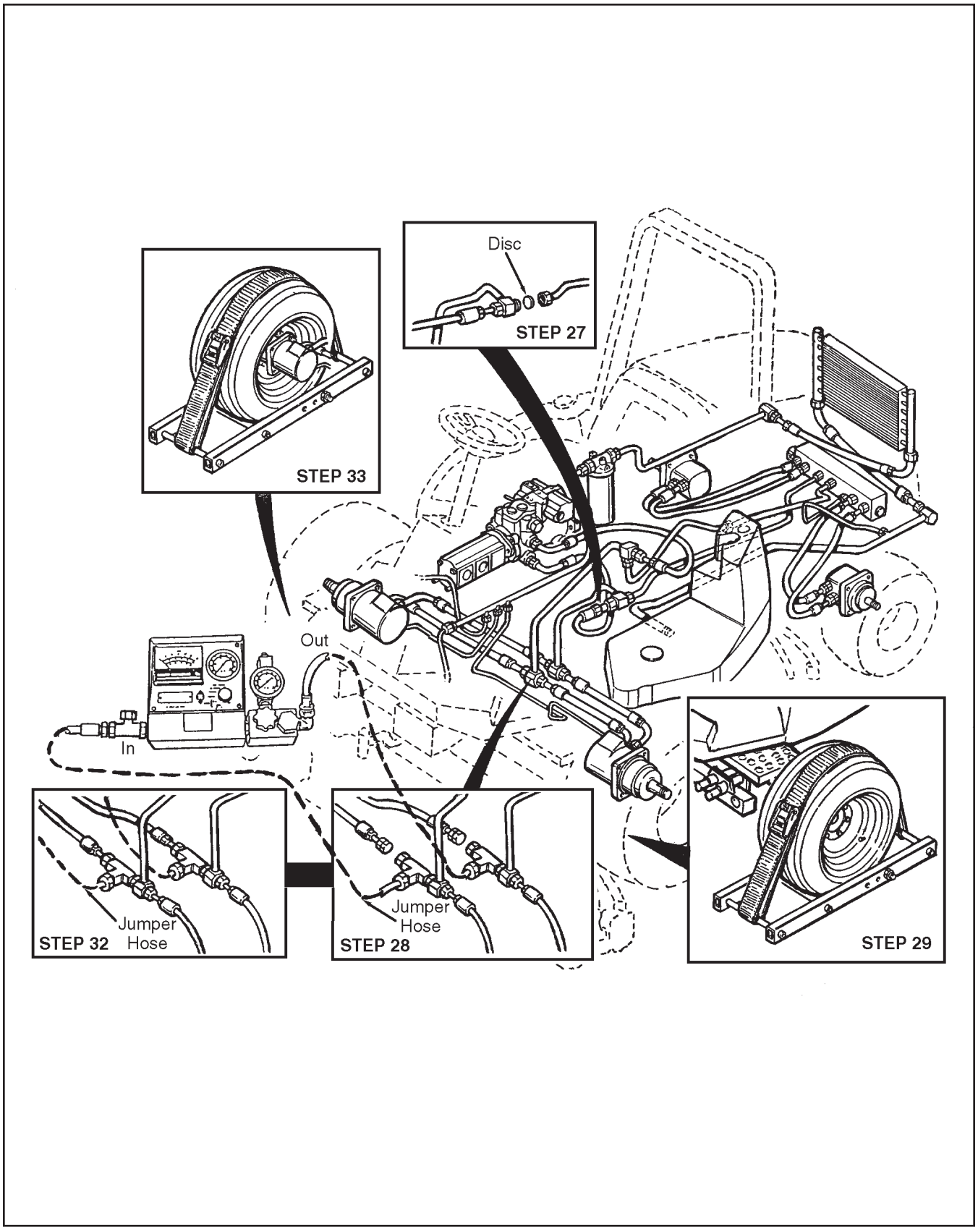


Figure 8O-11. Front Traction Motor Test

SECTION 8O. INSTRUMENT TEST

FRONT MOWER CIRCUIT TESTS

Pump Test (See Figure 8O-12)

1. At the auxiliary pump section 1, remove the metal hydraulic line between the pump and valve, cap valve port.
2. Install a tee to the pump outlet.
3. Connect “IN” port line of flowmeter to the tee. Cap the open tee port.
4. Connect a return adapter to the fill port of the tank.
5. Connect the “OUT” port line of the flowmeter to tank adapter.
6. Completely open flowmeter load valve.
7. Set parking brake, start engine, advance throttle to full engine idle RPM.
8. Read/record no load flow.
9. Slowly close flowmeter load valve until pressure reads 1100 psi (7585 kPa), read/record flow rate. Subtract flow in Step 9 from no load flow in Step 8.

NOTE

Monitor engine RPM as flow drops.

Example:

6.5 gpm (24.60 lpm) no load flow, Step 8
–6.0 gpm (22.71 lpm), Step 9 @ engine RPM
0.5 gpm (1.89 lpm) pump leakage

- If leakage is less than 1/2 gpm (1.89 lpm), pump is okay, proceed with Step 10.
- If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), pump is marginal.
- Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, the pump should be repaired or replaced.

Motor Control Valve Test (See Figure 8O-13)

10. Using a jumper hose with size 12 ORS male connections, connect the hose between the tee of the pump and valve.
11. At the front of valve remove two motor lines, plug the lines and cap valve ports.
12. Open flowmeter load valve, set parking brake, start engine, advance throttle to full engine idle RPM.
13. Slowly close flowmeter load valve until pressure reads 1100 psi (7585 kPa) read/record flow rate. Subtract flow from flow in Step 9.

    Example:

    6.0 gpm (22.71 lpm) flow, Step 9
    –5.5 gpm (20.82 lpm) flow, Step 13 @ engine RPM
    0.5 gpm (1.89 lpm) valve leakage

    - If leakage is less than 1/2 gpm (1.89 lpm), valve is okay, proceed with Step 14.
    - If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), valve is marginal.
    - Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, the valve should be repaired or replaced.
14. Under the seat, using a jumper wire, bypass the seat switch.

CAUTION

The jumper wire is used only during testing. Remember to remove the jumper when finished with the tests.

15. Open flowmeter load valve, set parking brake, start engine, advance throttle to full engine idle RPM.
16. Push the mow switch to “CUT” position.
17. Slowly close flowmeter load valve until pressure reads 1100 psi (7585 kPa) read/record flow rate. Subtract flow from flow in Step 13.

    Example:

    6.0 gpm (22.71 lpm) flow, Step 13
    –5.5 gpm (20.82 lpm) flow, Step 17 @ engine RPM
    0.5 gpm (1.89 lpm) valve leakage

    - If leakage is less than 1/2 gpm (1.89 lpm), valve is okay, proceed with Step 18.
    - If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), valve is marginal.
    - Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, the valve should be repaired or replaced.
18. Open flowmeter load valve.
19. Push the mow switch to “REVERSE” position.
20. Slowly close flowmeter load valve until pressure reads 1100 psi (7585 kPa), read/record flow rate. Subtract flow from flow in Step 13.

Example:

6.0 gpm (22.71 lpm) flow, Step 13
–5.5 gpm (20.82 lpm) flow, Step 17 @ engine RPM
0.5 gpm (1.89 lpm) valve leakage

- If leakage is less than 1/2 gpm (1.89 lpm), valve is okay, proceed with Step 18.
- If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), valve is marginal.
- Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, the valve should be repaired or replaced.

SECTION 8O. INSTRUMENT TEST

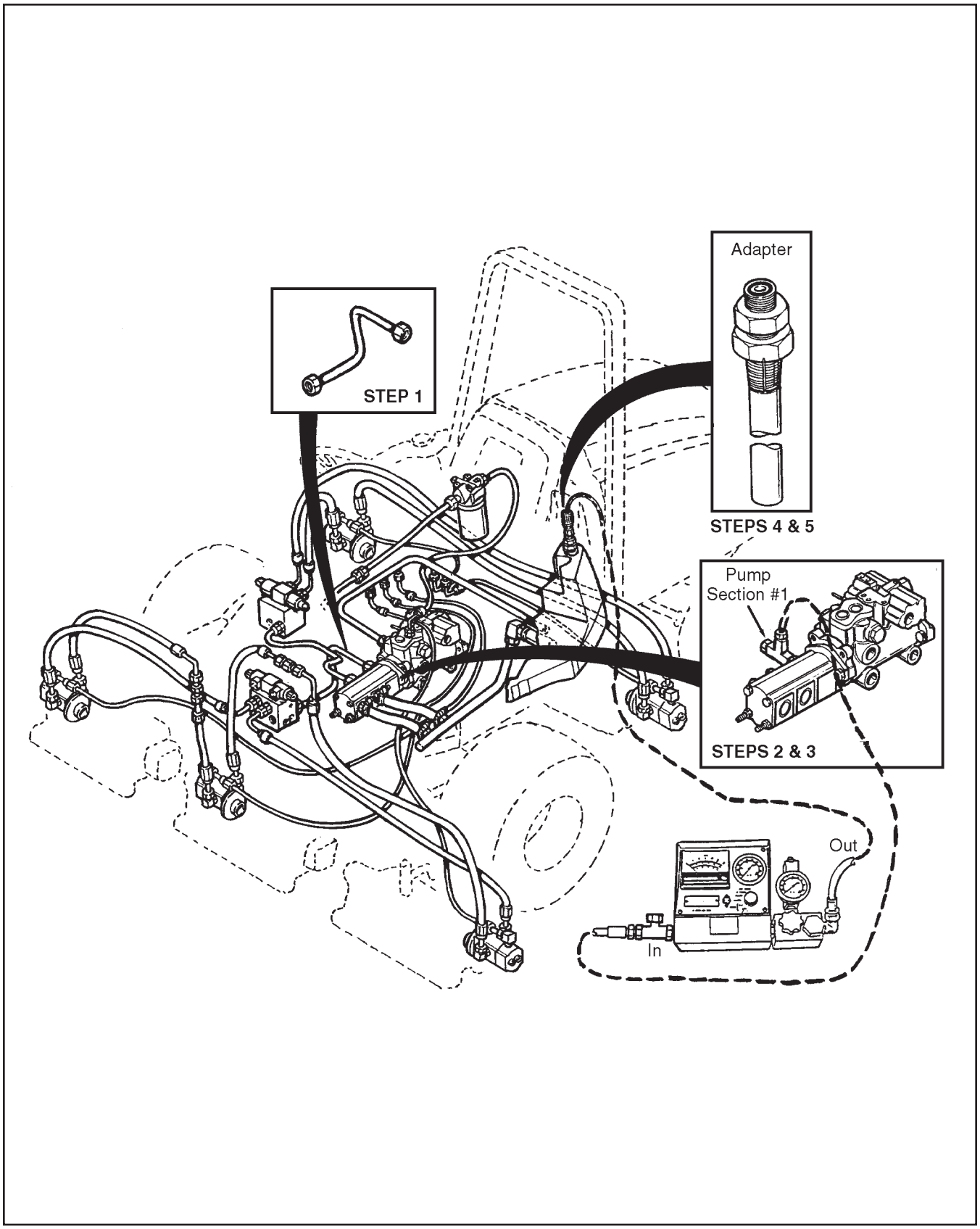


Figure 8O-12. Pump Test

SECTION 8O. INSTRUMENT TEST

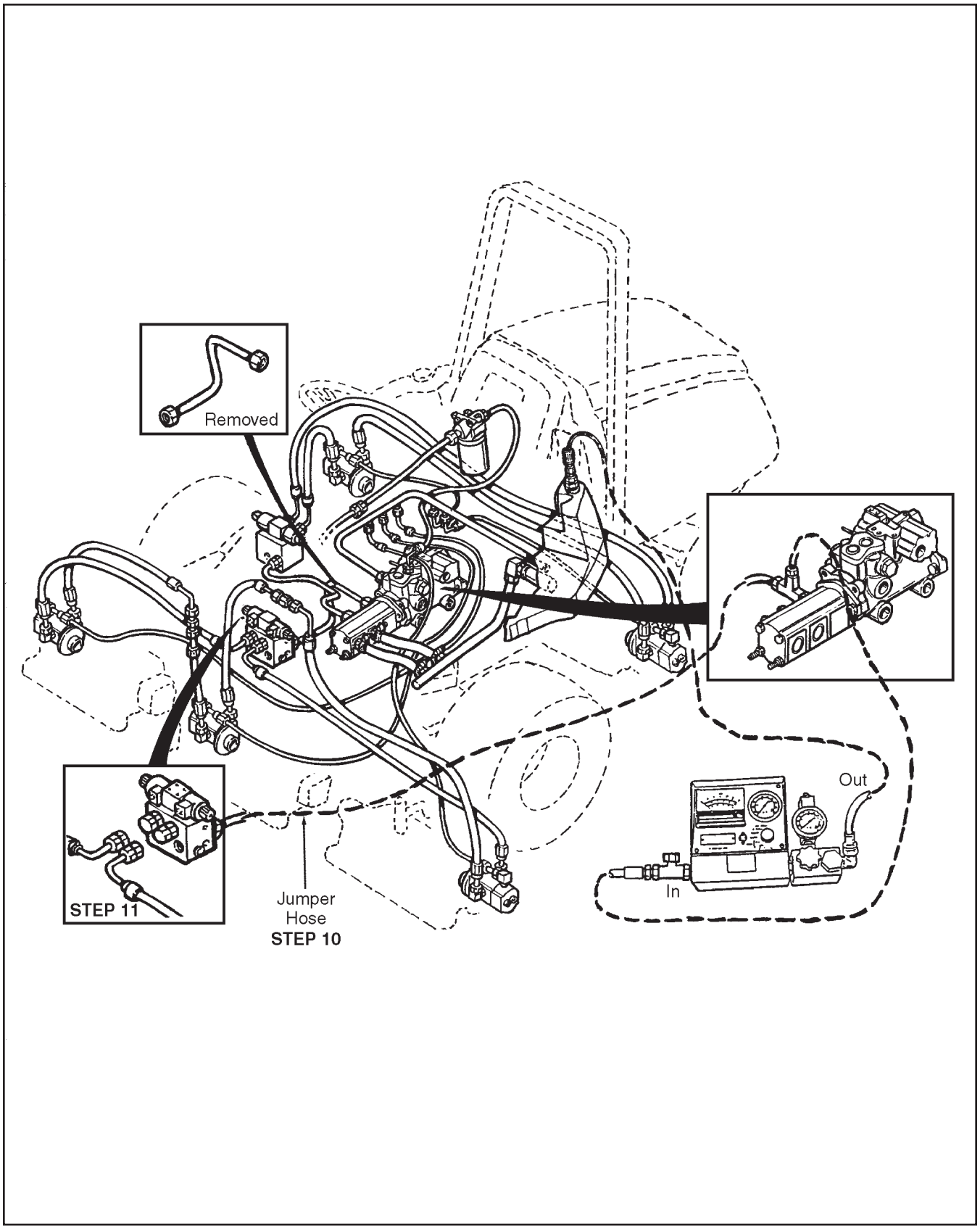


Figure 8O-13. Motor Control Valve Test

SECTION 8O. INSTRUMENT TEST

Front Right Motor Test (See Figure 8O-14)

21. Reconnect the two motor lines to valve.
22. At the front right mower, using a piece of wood, jam the reel so it can not turn.
23. Open flowmeter load valve, set parking brake, start engine, advance throttle to full engine idle RPM.
24. Push the reel switch to “CUT.”
25. Slowly close flowmeter load valve until pressure reads 1100 psi (7585 kPa) read/record flow rate. Subtract flow from flow in Step 17.

    Example:

    5.5 gpm (20.82 lpm) flow, Step 17
    –0.0 gpm (20.82 lpm) flow, Step 25 @ engine RPM
    0.0 gpm (0.0 lpm) pump leakage

    - If leakage is less than 1/2 gpm (1.89 lpm), right mower motor is okay, proceed with Step 26.
    - If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), right mower motor is marginal.
    - Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, the right mower motor should be repaired or replaced.
26. Continue to close flowmeter load valve until flow drops off and pressure stays constant. This is the forward (CUT) relief valve setting.

CAUTION

DO NOT exceed 1250 psi (8619 kPa) during this test.

- Cross port relief is 1165 ± 50 psi (7983 to 8083 kPa), relief is okay, proceed with Step 31.
- Relief is not in specified range, proceed with Step 27.

27. At motor, remove both relief valve cartridges. Take front cross port relief and install in the back and the back in the front.
28. Open flowmeter load valve, set parking brake, start engine, advance throttle to full engine idle RPM.
29. Push the mow switch to “CUT” position.
30. Slowly close the flowmeter load valve until flow drops off and pressure stays constant, read/record pressure.
    - Relief opens at 1165 psi ± 50 psi (7983 to 8083 kPa), relief was faulty, replace with a new relief cartridge.
    - Relief is not in specified range. Motor has excessive internal leakage, repair or replace.
31. Open flowmeter load valve.
32. Remove both hydraulic lines from both the center motor and left motor.
33. Using an ORS nipple, connect both hoses together.
34. Push the mow switch to “REVERSE” position.
35. Slowly close flowmeter load valve until pressure reads 1100 psi (7585 kPa) read/record flow rate. Subtract flow from flow in Step 17.

    Example:

    6.0 gpm (22.71 lpm) flow, Step 17
    –5.5 gpm (20.82 lpm) flow, Step 35 @ engine RPM
    0.5 gpm (1.89 lpm) right mower motor leakage

    - If leakage is less than 1/2 gpm (1.89 lpm), right mower motor is okay, proceed with Step 36.
    - If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), right mower motor is marginal.
    - Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, the right mower motor should be repaired or replaced.
36. Continue to close flowmeter load valve until flow drops off and pressure stays constant. This is the reverse (backlap) relief valve setting.

CAUTION

DO NOT exceed 1250 psi (8619 kPa) during this test.

- Cross port relief is 1165 ± 50 psi (7983 to 8083 kPa), relief is okay, proceed with Step 42.
- Relief is not in specified range, proceed with Step 37.

37. At right motor, remove both relief valve cartridges. Take front cross port relief and install in the back and the back in the front.
38. Open flowmeter load valve, set parking brake, start engine, advance throttle to full engine idle RPM.
39. Push the mow switch to “REVERSE” position.
40. Slowly close the flowmeter load valve until flow drops off and pressure stays constant, read/record pressure.
    - Relief opens at 1165 psi ± 50 psi (7983 to 8083 kPa), relief was faulty, replace with a new relief cartridge.
    - Relief is not in specified range. Motor has excessive internal leakage, repair or replace.

SECTION 8O. INSTRUMENT TEST

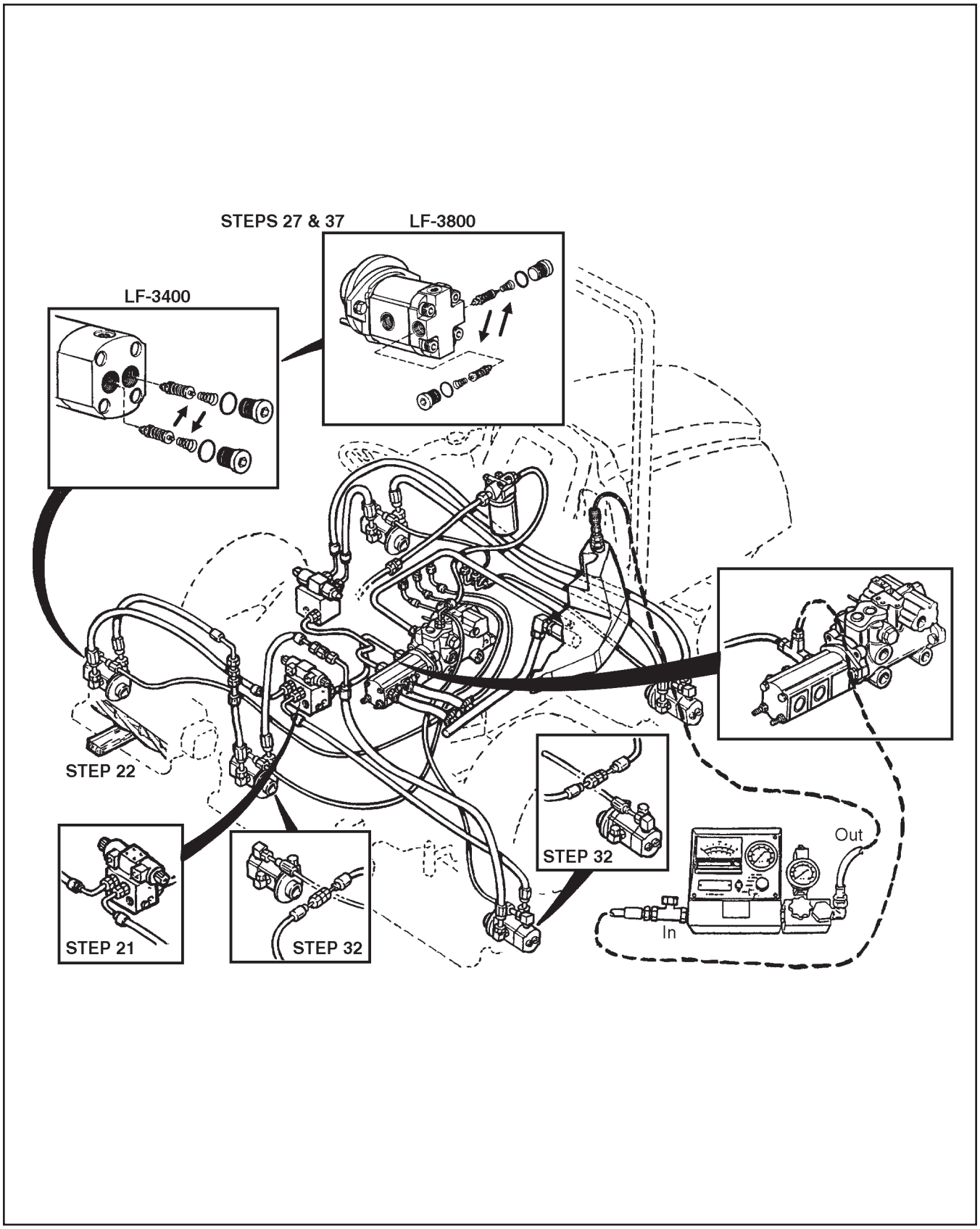


Figure 8O-14. Front Right Motor Test

SECTION 8O. INSTRUMENT TEST

Center Mower Motor Test (See Figure 8O-15)

41. Reconnect hydraulic lines to center motor.
42. Remove both hydraulic lines from the right motor.
43. Using the ORS nipple, connect both hoses together.
44. Move the wood stick from the right mower to center mower.
45. Open flowmeter load valve, set parking brake, start engine, advance throttle to full engine idle RPM.
46. Push the mow switch to “CUT” position.
47. Slowly close flowmeter load valve until pressure reads 1100 psi (7585 kPa) read/record flow rate. Subtract flow from flow in Step 25.

    Example:

    5.5 gpm (20.82 lpm) flow, Step 25
    –5.0 gpm (18.93 lpm) flow, Step 47 @ engine RPM
    0.5 gpm (1.89 lpm) pump leakage

    - If leakage is less than 1/2 gpm (1.89 lpm), left mower motor is okay, proceed with Step 48.
    - If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), left mower motor is marginal.
    - Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, the left mower motor should be repaired or replaced.
48. Continue to close flowmeter load valve until flow drops off and pressure stays constant. This is the forward (CUT) relief valve setting.

CAUTION

DO NOT exceed 1250 psi (8619 kPa) during this test.

- Relief is 1165 ± 50 psi (7983 to 8083 kPa), relief is okay, proceed with Step 51.
- Relief is not in specified range, proceed with Step 49.

49. At center motor, remove both relief valve cartridges. Take front cross port relief and install in the back and the back in the front.
50. Open flowmeter load valve, set parking brake, start engine, advance throttle to full engine idle RPM.
51. Push the mow switch to “CUT” position.
52. Slowly close the flowmeter load valve until flow drops off and pressure stays constant, read/record pressure.

CAUTION

DO NOT exceed 1250 psi (8619 kPa) during this test.

- Relief opens at 1165 psi ± 50 psi (7983 to 8083 kPa), relief was faulty, replace with a new relief cartridge.
- Relief is not in specified range. Motor has excessive internal leakage, repair or replace.

53. Open flowmeter load valve.
54. Push the mow switch to “REVERSE” position.
55. Slowly close flowmeter load valve until pressure reads 1100 psi (7585 kPa), read/record flow rate. Subtract flow from flow in Step 35.

    Example:

    6.0 gpm (22.71 lpm) flow, Step 35
    –5.5 gpm (20.82 lpm) flow, Step 55
    0.5 gpm (1.89 lpm) center mower motor leakage

    - If leakage is less than 1/2 gpm (1.89 lpm), center mower motor is okay, proceed with Step 56.
    - If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), center mower motor is marginal.
    - Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, the center mower motor should be repaired or replaced.
56. Continue to close flowmeter load valve until flow drops off and pressure stays constant. This is the forward (CUT) relief valve setting.

CAUTION

DO NOT exceed 1250 psi (8619 kPa) during this test.

- Relief is 1165 ± 50 psi (7983 to 8083 kPa), relief is okay, proceed with Step 61.
- Relief is not in specified range, proceed with Step 57.

57. At center motor, remove both relief valve cartridges. Take front cross port relief and install in the back and the back in the front.
58. Open flowmeter load valve, set parking brake, start engine, advance throttle to full engine idle RPM.
59. Push the mow switch to “REVERSE” position.

SECTION 8O. INSTRUMENT TEST

60. Slowly close the flowmeter load valve until flow drops off and pressure stays constant, read/record pressure.

⚠ CAUTION

DO NOT exceed 1250 psi (8619 kPa) during this test.

- Relief opens at 1165 psi ± 50 psi (7983 to 8083 kPa), relief was faulty, replace with a new relief cartridge.
- If relief is not in specified range, mower motor has excessive internal leakage, repair or replace.

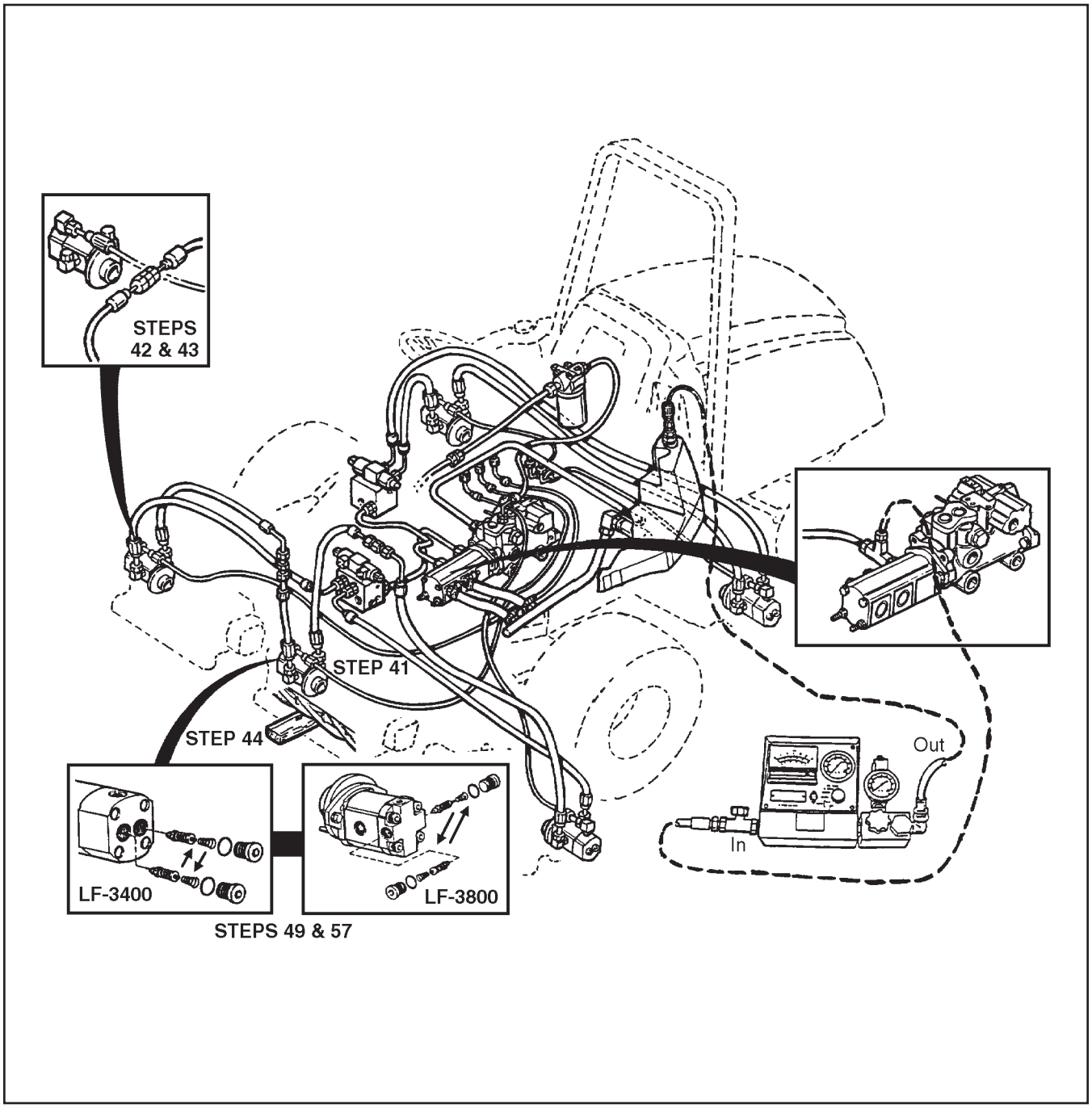


Figure 8O-15. Center Mower Motor Test

SECTION 8O. INSTRUMENT TEST

Front Left Mower Motor Test (See Figure 8O-16)

61. Reconnect hydraulic lines to left motor.
62. Remove both hydraulic lines from the center motor.
63. Using the ORS nipple, connect both hoses together.
64. Move the wood stick from the center mower to the front left mower.
65. Open flowmeter load valve, set parking brake, start engine, advance throttle to full engine idle RPM.
66. Push the mow switch to “CUT” position.
67. Slowly close flowmeter load valve until pressure reads 1100 psi (7585 kPa) read/record flow rate. Subtract flow from flow in Step 47.

    Example:

    5.0 gpm (20.82 lpm) flow, Step 47
    –5.0 gpm (20.82 lpm) flow, Step 67 @ engine RPM
    0.0 gpm (0.0 lpm) left mower motor leakage

    - If leakage is less than 1/2 gpm (1.89 lpm), left mower motor is okay, proceed with Step 68.
    - If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), left mower motor is marginal.
    - Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, the left mower motor should be repaired or replaced.
68. Continue to close flowmeter load valve until flow drops off and pressure stays constant. This is the forward (CUT) relief valve setting.

CAUTION

DO NOT exceed 1250 psi (8619 kPa) during this test.

- Relief opens at 1165 psi ± 50 psi (7983 to 8083 kPa), relief is okay, proceed with Step 71.
- Relief is not in specified range, proceed with Step 69.

69. At left motor, remove both relief valve cartridges. Take front cross port relief and install in the back and the back in the front.
70. Open flowmeter load valve, set parking brake, start engine, advance throttle to full engine idle RPM.
71. Push the mower switch to “CUT” position.
72. Slowly close the flowmeter load valve until flow drops off and pressure stays constant, read/record pressure.

CAUTION

DO NOT exceed 1250 psi (8619 kPa) during this test.

- Relief opens at 1165 psi ± 50 psi (7983 to 8083 kPa), relief was faulty, replace with a new relief cartridge.
- Relief is not in specified range. Motor has excessive internal leakage, repair or replace.

73. Open flowmeter load valve.
74. Push the mow switch to “REVERSE” position.
75. Slowly close flowmeter load valve until pressure reads 1100 psi (7585 kPa) read/record flow rate. Subtract flow from flow in Step 55.

    Example:

    6.0 gpm (22.71 lpm) flow, Step 55
    –5.5 gpm (20.82 lpm) flow, Step 75 @ engine RPM
    0.5 gpm (1.89 lpm) right mower motor leakage

    - If leakage is less than 1/2 gpm (1.89 lpm), right mower motor is okay, proceed with Step 76.
    - If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), right mower motor is marginal.
    - Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, the right mower motor should be repaired or replaced.
76. Continue to close flowmeter load valve until flow drops off and pressure stays constant. This is the reverse (backlap) relief valve setting.

CAUTION

DO NOT exceed 1250 psi (8619 kPa) during this test.

- Relief is 1165 ± 50 psi (7983 to 8083 kPa), relief is okay, proceed with Step 79.
- Relief is not in specified range, proceed with Step 77.

77. At left motor, remove both relief valve cartridges. Take front cross port relief and install in the back and the back in the front.
78. Open flowmeter load valve, set parking brake, start engine, advance throttle to full engine idle RPM.
79. Push the mow switch to “REVERSE” position.

SECTION 8O. INSTRUMENT TEST

80. Slowly close the flowmeter load valve until flow drops off and pressure stays constant, read/record pressure.

⚠ CAUTION

DO NOT exceed 1250 psi (86.2 bars) during this test.

- Relief opens at 1165 psi ± 50 psi (7983 to 8083 kPa), relief was faulty, replace with a new relief cartridge.
- Relief is not in specified range. Motor has excessive internal leakage, repair or replace.

81. Remove ORS nipples and reconnect lines to motors.
82. Remove flowmeter and reinstall the metal hydraulic line.

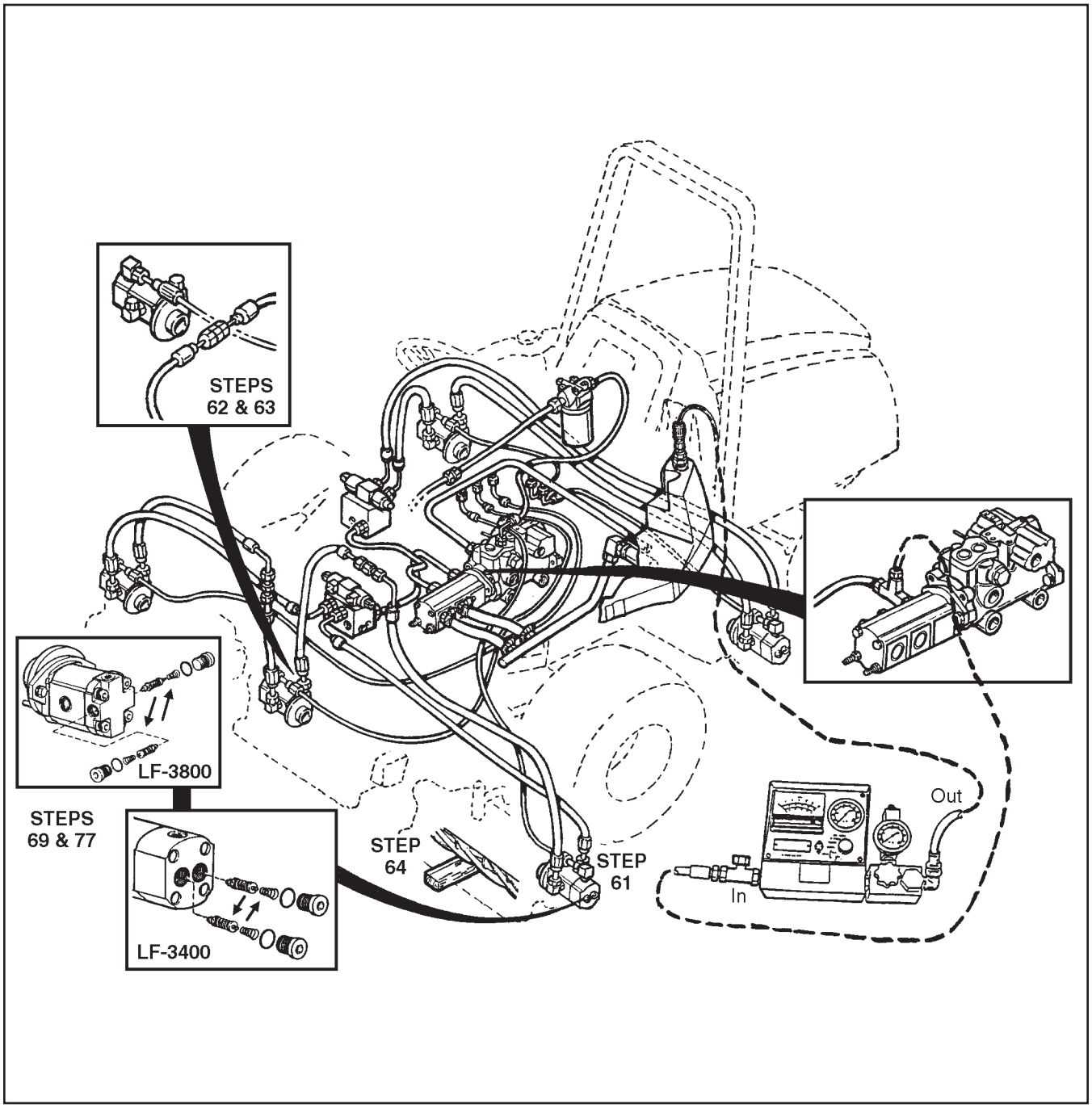


Figure 8O-16. Left Mower Motor Test

SECTION 8O. INSTRUMENT TEST

REAR MOWER CIRCUIT TESTS

Pump Test (See Figure 8O-17)

1. At the auxiliary pump section 1, remove the metal hydraulic line between the pump and valve, cap valve port.
2. Install a tee to the pump outlet.
3. Connect “IN” port line of flowmeter to the tee. Cap the open tee port.
4. Connect a return adapter to the fill port of the tank.
5. Connect the “OUT” port line of the flowmeter to tank adapter.
6. Completely open flowmeter load valve.
7. Set parking brake, start engine, advance throttle to full engine idle RPM.
8. Read/record no load flow.
9. Slowly close flowmeter load valve until pressure reads 1100 psi (7585 kPa), read/record flow rate. Subtract flow in Step 9 from no load flow in Step 8.

NOTE

Monitor engine RPM as flow drops.

Example:

6.5 gpm (24.60 lpm) no load flow, Step 8
–6.0 gpm (22.71 lpm) flow, Step 9 @ engine RPM
0.5 gpm (1.89 lpm) valve leakage

- If leakage is less than 1/2 gpm (1.89 lpm), pump is okay, proceed with Step 10.
- If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), pump is marginal.
- Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, the valve should be repaired or replaced.

Motor Control Valve Test (See Figure 8O-17)

10. Using a jumper hose with size 12 ORS male connections, connect the hose between the tee of the pump and valve.
11. At the front of valve remove two motor lines, plug the lines and cap valve ports.
12. Open flowmeter load valve, set parking brake, start engine, advance throttle to full engine idle RPM.
13. Slowly close flowmeter load valve until pressure reads 1100 psi (7585 kPa) read/record flow rate. Subtract flow from flow in Step 9.

    Example:

    6.0 gpm (22.71 lpm) flow, Step 9
    –5.5 gpm (20.82 lpm) flow, Step 13 @ engine RPM
    0.5 gpm (1.89 lpm) valve leakage

    - If leakage is less than 1/2 gpm (1.89 lpm), valve is okay, proceed with Step 14.
    - If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), valve is marginal.
    - Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, the valve should be repaired or replaced.
14. Under the seat, using a jumper wire, bypass the seat switch.

CAUTION

The jumper wire is used only during testing. Remember to remove the jumper when finished with the tests.

15. Open flowmeter load valve, set parking brake, start engine, advance throttle to full engine idle RPM.
16. Push the mow switch to “CUT” position.
17. Slowly close flowmeter load valve until pressure reads 1100 psi (7585 kPa) read/record flow rate. Subtract flow from flow in Step 13.

    Example:

    6.0 gpm (22.71 lpm) flow, Step 13
    –5.5 gpm (20.82 lpm) flow, Step 17 @ engine RPM
    0.5 gpm (1.89 lpm) valve leakage

    - If leakage is less than 1/2 gpm (1.89 lpm), valve is okay, proceed with Step 18.
    - If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), valve is marginal.
    - Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, the valve should be repaired or replaced.
18. Open flowmeter load valve.
19. Push the mow switch to “REVERSE” position.
20. Slowly close flowmeter load valve until pressure reads 1100 psi (7585 kPa), read/record flow rate. Subtract flow from flow in Step 13.

Example:

6.0 gpm (22.71 lpm) flow, Step 13
–5.5 gpm (20.82 lpm) flow, Step 17 @ engine RPM
0.5 gpm (1.89 lpm) valve leakage

- If leakage is less than 1/2 gpm (1.89 lpm), valve is okay, proceed with Step 18.
- If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), valve is marginal.
- Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, the valve should be repaired or replaced.

SECTION 8O. INSTRUMENT TEST

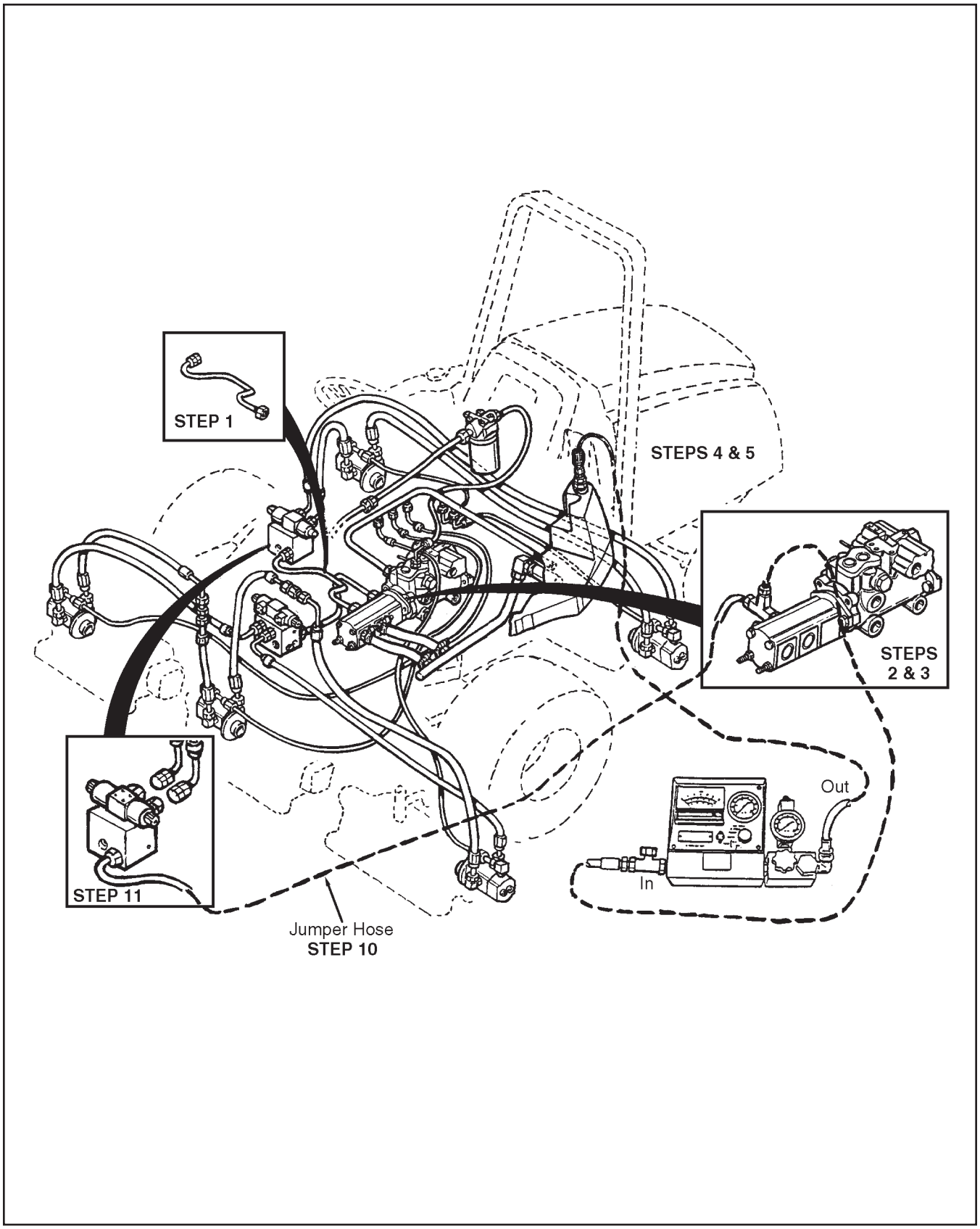


Figure 8O-17. Rear Mower Pump and Control Valve Tests

SECTION 8O. INSTRUMENT TEST

Rear Right Motor Test (See Figure 8O-18)

21. Reconnect the two motor lines to valve.
22. At the right rear mower, using a piece of wood, jam the reel so it can not turn.
23. Open flowmeter load valve, set parking brake, start engine, advance throttle to full engine idle RPM.
24. Push the reel switch to “CUT.”
25. Slowly close flowmeter load valve until pressure reads 1100 psi (7585 kPa) read/record flow rate. Subtract flow from flow in Step 17.

    Example:

    5.5 gpm (20.82 lpm) flow, Step 17
    –0.0 gpm (20.82 lpm) flow, Step 25 @ engine RPM
    0.0 gpm (0.0 lpm) pump leakage

    - If leakage is less than 1/2 gpm (1.89 lpm), right mower motor is okay, proceed with Step 26.
    - If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), right mower motor is marginal.
    - Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, the right mower motor should be repaired or replaced.
26. Continue to close flowmeter load valve until flow drops off and pressure stays constant. This is the forward (CUT) relief valve setting.

CAUTION

DO NOT exceed 1250 psi (8619 kPa) during this test.

- Cross port relief is 1165 ± 50 psi (7983 to 8083 kPa), relief is okay, proceed with Step 31.
- Relief is not in specified range, proceed with Step 27.

27. At motor, remove both relief valve cartridges. Take front cross port relief and install in the back and the back in the front.
28. Open flowmeter load valve, set parking brake, start engine, advance throttle to full engine idle RPM.
29. Push the mow switch to “CUT” position.
30. Slowly close the flowmeter load valve until flow drops off and pressure stays constant, read/record pressure.
    - Relief opens at 1165 psi ± 50 psi (7983 to 8083 kPa), relief was faulty, replace with a new relief cartridge.
    - Relief is not in specified range. Motor has excessive internal leakage, repair or replace.
31. Open flowmeter load valve.
32. Remove both hydraulic lines from both the center motor and left motor.
33. Using an ORS nipple, connect both hoses together.
34. Push the mow switch to “REVERSE” position.
35. Slowly close flowmeter load valve until pressure reads 1100 psi (7585 kPa) read/record flow rate. Subtract flow from flow in Step 17.

    Example:

    6.0 gpm (22.71 lpm) flow, Step 17
    –5.5 gpm (20.82 lpm) flow, Step 35 @ engine RPM
    0.5 gpm (1.89 lpm) right mower motor leakage

    - If leakage is less than 1/2 gpm (1.89 lpm), right mower motor is okay, proceed with Step 36.
    - If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), right mower motor is marginal.
    - Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, the right mower motor should be repaired or replaced.
36. Continue to close flowmeter load valve until flow drops off and pressure stays constant. This is the reverse (backlap) relief valve setting.

CAUTION

DO NOT exceed 1250 psi (8619 kPa) during this test.

- Cross port relief is 1165 ± 50 psi (7983 to 8083 kPa), relief is okay, proceed with Step 42.
- Relief is not in specified range, proceed with Step 37.

37. At right motor, remove both relief valve cartridges. Take front cross port relief and install in the back and the back in the front.
38. Open flowmeter load valve, set parking brake, start engine, advance throttle to full engine idle RPM.
39. Push the mow switch to “REVERSE” position.
40. Slowly close the flowmeter load valve until flow drops off and pressure stays constant, read/record pressure.
    - Relief opens at 1165 psi ± 50 psi (7983 to 8083 kPa), relief was faulty, replace with a new relief cartridge.
    - Relief is not in specified range. Motor has excessive internal leakage, repair or replace.

SECTION 8O. INSTRUMENT TEST

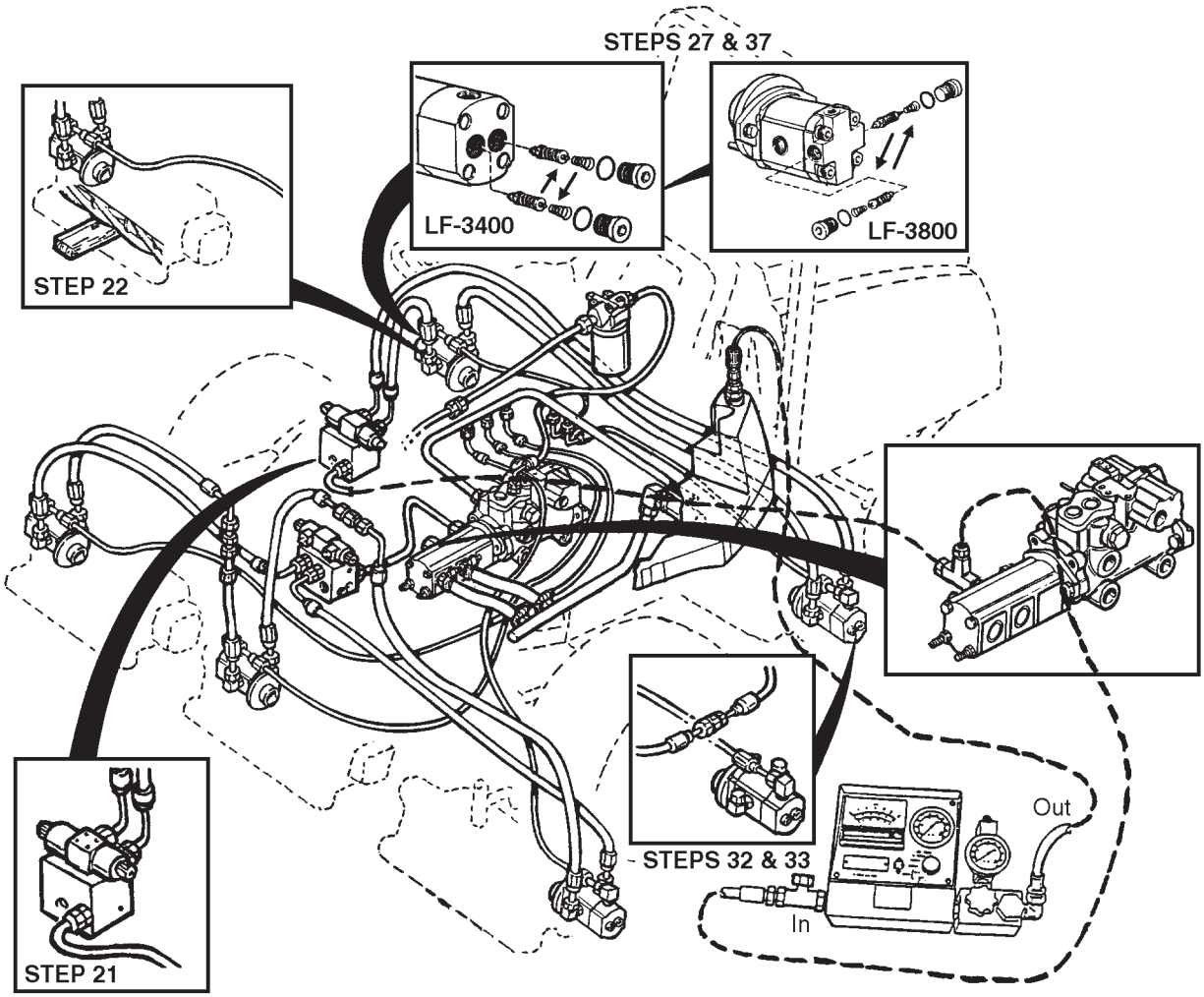


Figure 8O-18. Rear Right Motor Test

SECTION 8O. INSTRUMENT TEST

Left Rear Mower Motor Test (See Figure 8O-19)

41. Reconnect hydraulic lines to center motor.
42. Remove both hydraulic lines from the right motor.
43. Using the ORS nipple, connect both hoses together.
44. Move the wood stick from the right mower to center mower.
45. Open flowmeter load valve, set parking brake, start engine, advance throttle to full engine idle RPM.
46. Push the mow switch to “CUT” position.
47. Slowly close flowmeter load valve until pressure reads 1100 psi (7585 kPa) read/record flow rate. Subtract flow from flow in Step 25.

    Example:

    5.5 gpm (20.82 lpm) flow, Step 25
    –5.0 gpm (18.93 lpm) flow, Step 47 @ engine RPM
    0.5 gpm (1.89 lpm) pump leakage

    - If leakage is less than 1/2 gpm (1.89 lpm), left mower motor is okay, proceed with Step 48.
    - If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), left mower motor is marginal.
    - Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, the left mower motor should be repaired or replaced.
48. Continue to close flowmeter load valve until flow drops off and pressure stays constant. This is the forward (CUT) relief valve setting.

CAUTION

DO NOT exceed 1250 psi (8619 kPa) during this test.

- Relief is 1165 ± 50 psi (7983 to 8083 kPa), relief is okay, proceed with Step 51.
- Relief is not in specified range, proceed with Step 49.

49. At center motor, remove both relief valve cartridges. Take front cross port relief and install in the back and the back in the front.
50. Open flowmeter load valve, set parking brake, start engine, advance throttle to full engine idle RPM.
51. Push the mow switch to “CUT” position.
52. Slowly close the flowmeter load valve until flow drops off and pressure stays constant, read/record pressure.

CAUTION

DO NOT exceed 1250 psi (8619 kPa) during this test.

- Relief opens at 1165 psi ± 50 psi (7983 to 8083 kPa), relief was faulty, replace with a new relief cartridge.
- Relief is not in specified range. Motor has excessive internal leakage, repair or replace.

53. Open flowmeter load valve.
54. Push the mow switch to “REVERSE” position.
55. Slowly close flowmeter load valve until pressure reads 1100 psi (7585 kPa), read/record flow rate. Subtract flow from flow in Step 35.

    Example:

    6.0 gpm (22.71 lpm) flow, Step 35
    –5.5 gpm (20.82 lpm) flow, Step 55
    0.5 gpm (1.89 lpm) center mower motor leakage

    - If leakage is less than 1/2 gpm (1.89 lpm), center mower motor is okay, proceed with Step 56.
    - If leakage is 1-1/2 to 2 gpm (5.677 to 7.57 lpm), center mower motor is marginal.
    - Leakage more than 2 gpm (7.57 lpm) will noticeably reduce performance, the center mower motor should be repaired or replaced.
56. Continue to close flowmeter load valve until flow drops off and pressure stays constant. This is the forward (CUT) relief valve setting.

CAUTION

DO NOT exceed 1250 psi (8619 kPa) during this test.

- Relief is 1165 ± 50 psi (7983 to 8083 kPa), relief is okay, proceed with Step 61.
- Relief is not in specified range, proceed with Step 57.

57. At center motor, remove both relief valve cartridges. Take front cross port relief and install in the back and the back in the front.
58. Open flowmeter load valve, set parking brake, start engine, advance throttle to full engine idle RPM.
59. Push the mow switch to “REVERSE” position.

SECTION 8O. INSTRUMENT TEST

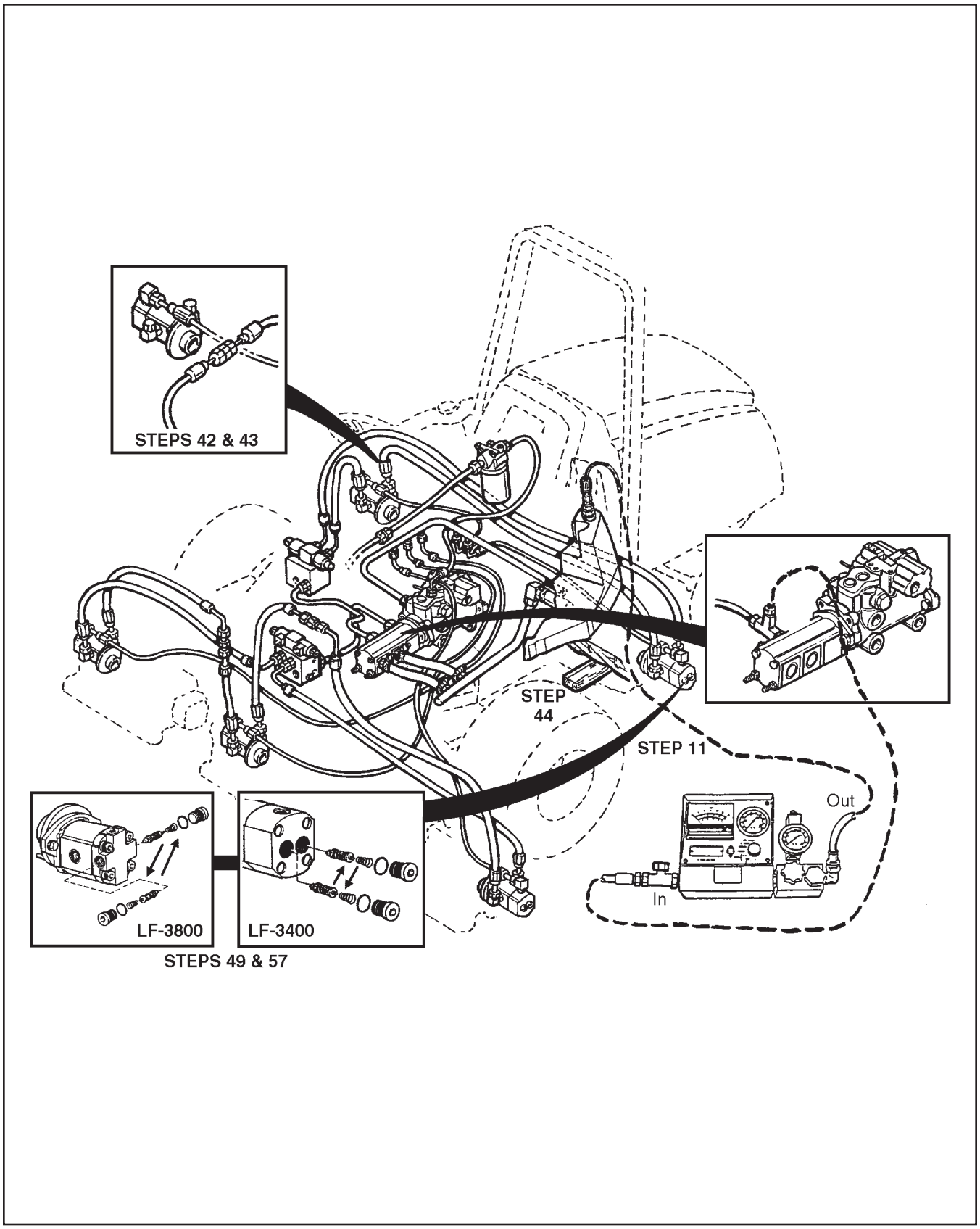


Figure 8O-19. Left Rear Mower Motor Test

60. Slowly close the flowmeter load valve until flow drops off and pressure stays constant, read/record pressure.

CAUTION

DO NOT exceed 1250 psi (8619 kPa) during this test.

- Relief opens at 1165 psi ± 50 psi (7983 to 8083 kPa), if relief was faulty, replace with a new relief cartridge.
- If relief is not in specified range, mower motor has excessive internal leakage, repair or replace.

61. Remove ORS nipples and reconnect lines to motors.
62. Remove flowmeter and reinstall the metal hydraulic line.

SECTION 8P. HYDRAULIC DIAGRAMS, SCHEMATICS AND COMPONENT LOCATIONS

HYDRAULIC GRAPHIC SYMBOLS

These are hydraulic graphic symbols commonly used in Textron Golf, Turf & Specialty Products diagrams and schematics.

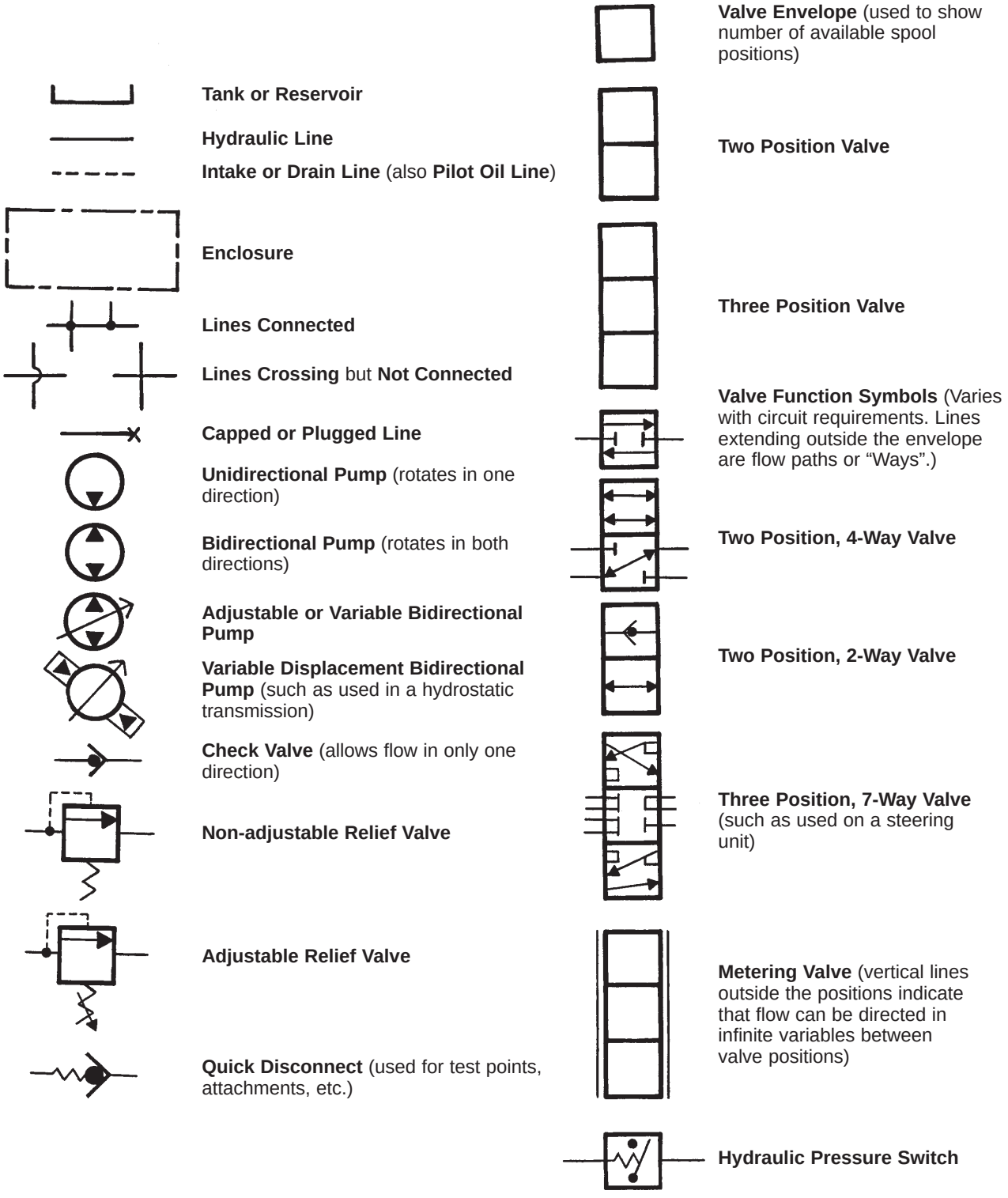


Figure 8P-1. Hydraulic Schematic Symbols (Sheet 1 of 2)

SECTION 8P. HYDRAULIC DIAGRAMS, SCHEMATICS AND COMPONENT LOCATIONS

HYDRAULIC GRAPHIC SYMBOLS

These are hydraulic graphic symbols commonly used in Textron Golf, Turf & Specialty Products diagrams and schematics.

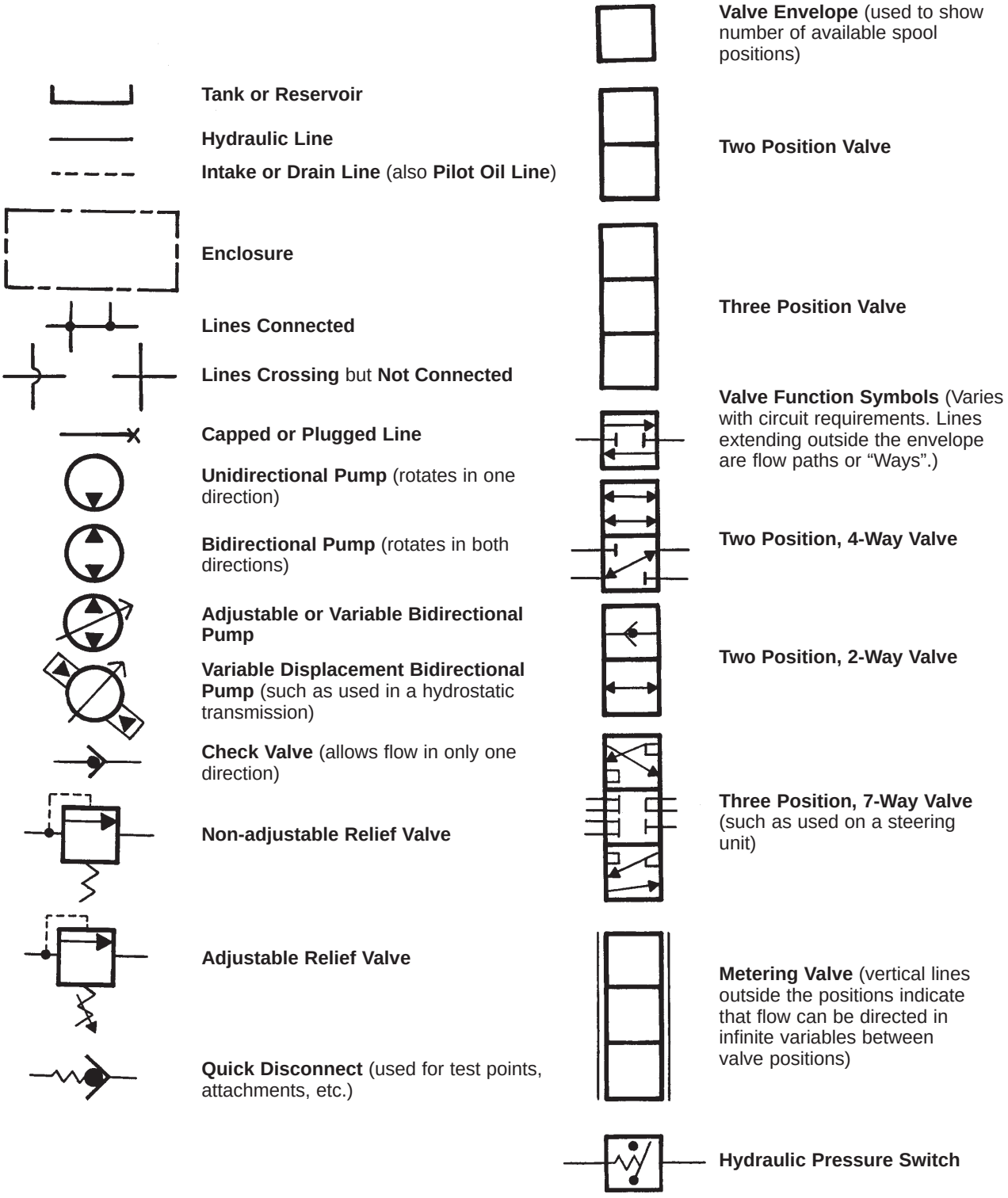


Figure 8P-1. Hydraulic Schematic Symbols (Sheet 2 of 2)

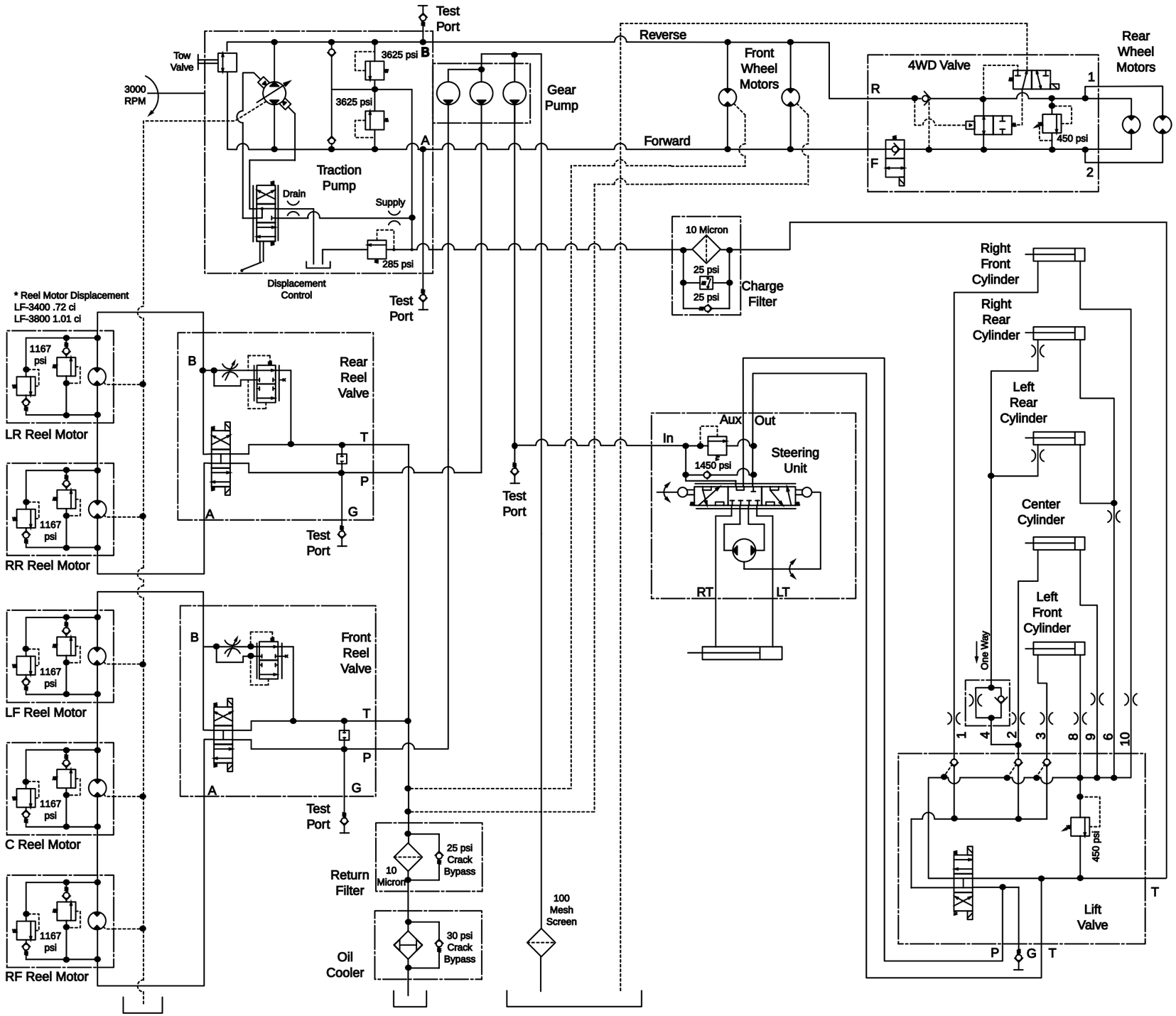


Figure 8P-2. Hydraulic Schematic — Early

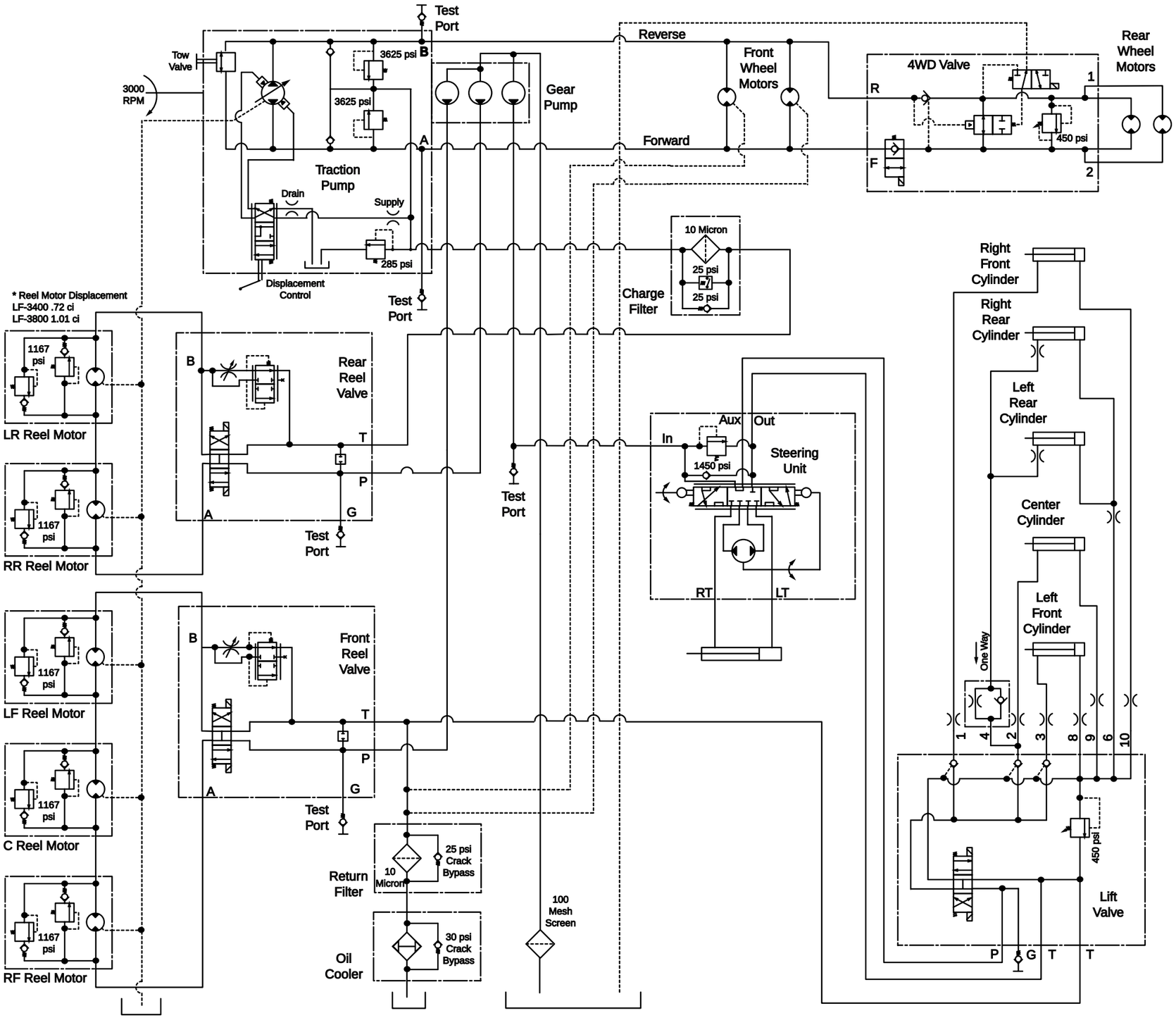


Figure 8P-3. Hydraulic Schematic — Late

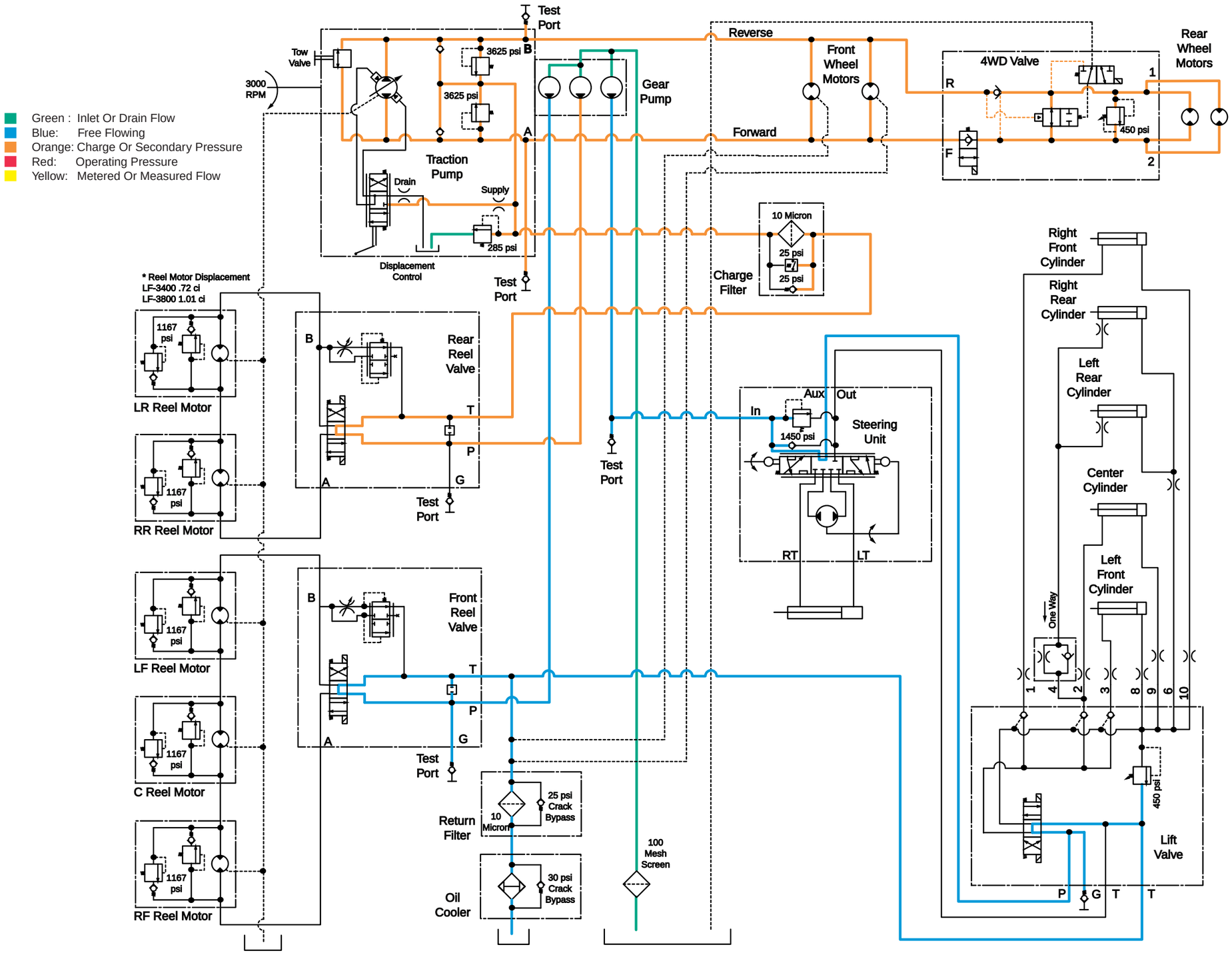


Figure 8P-4. Neutral

SECTION 8P. HYDRAULIC DIAGRAMS, SCHEMATICS AND COMPONENT LOCATIONS

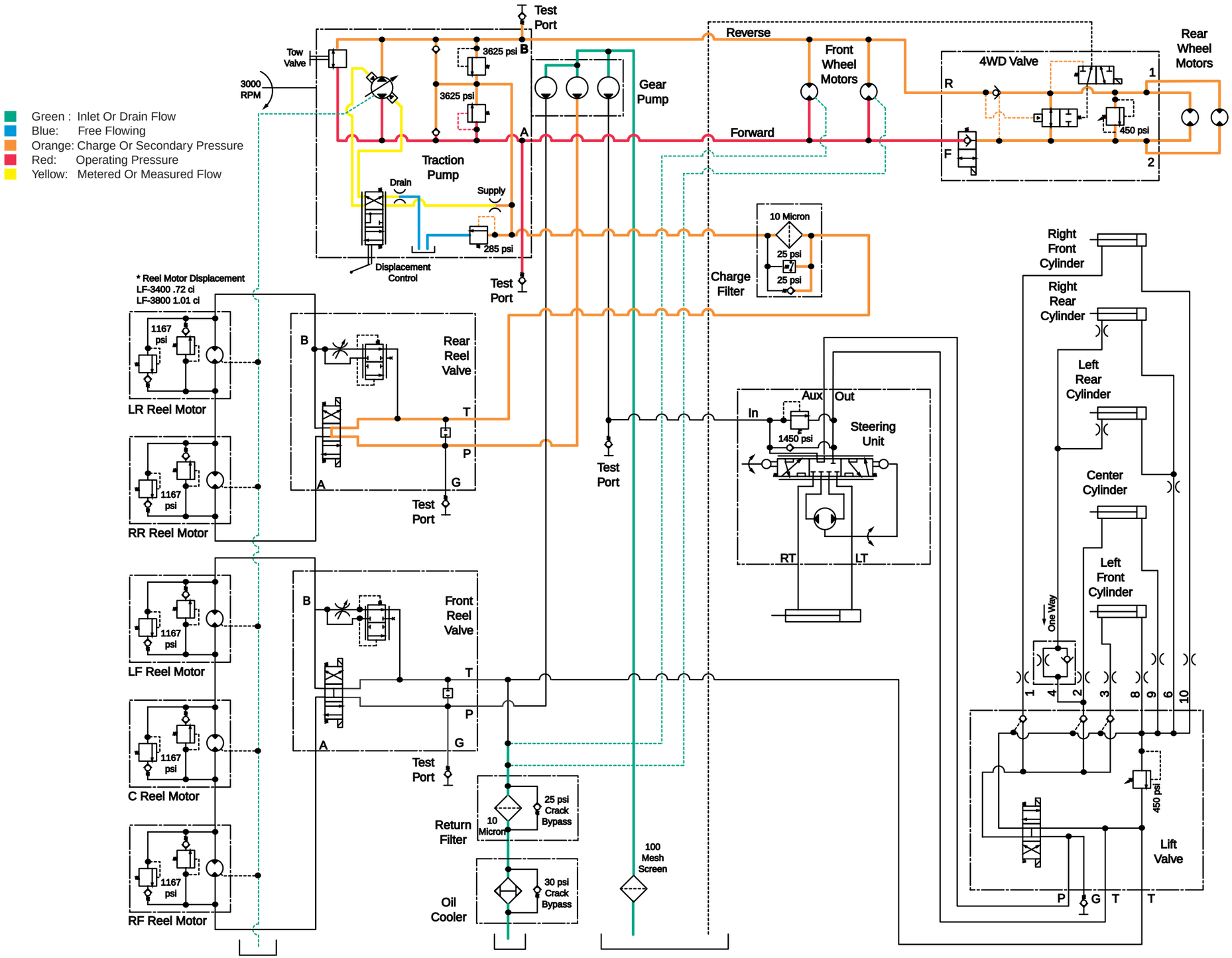


Figure 8P-5. Traction Forward

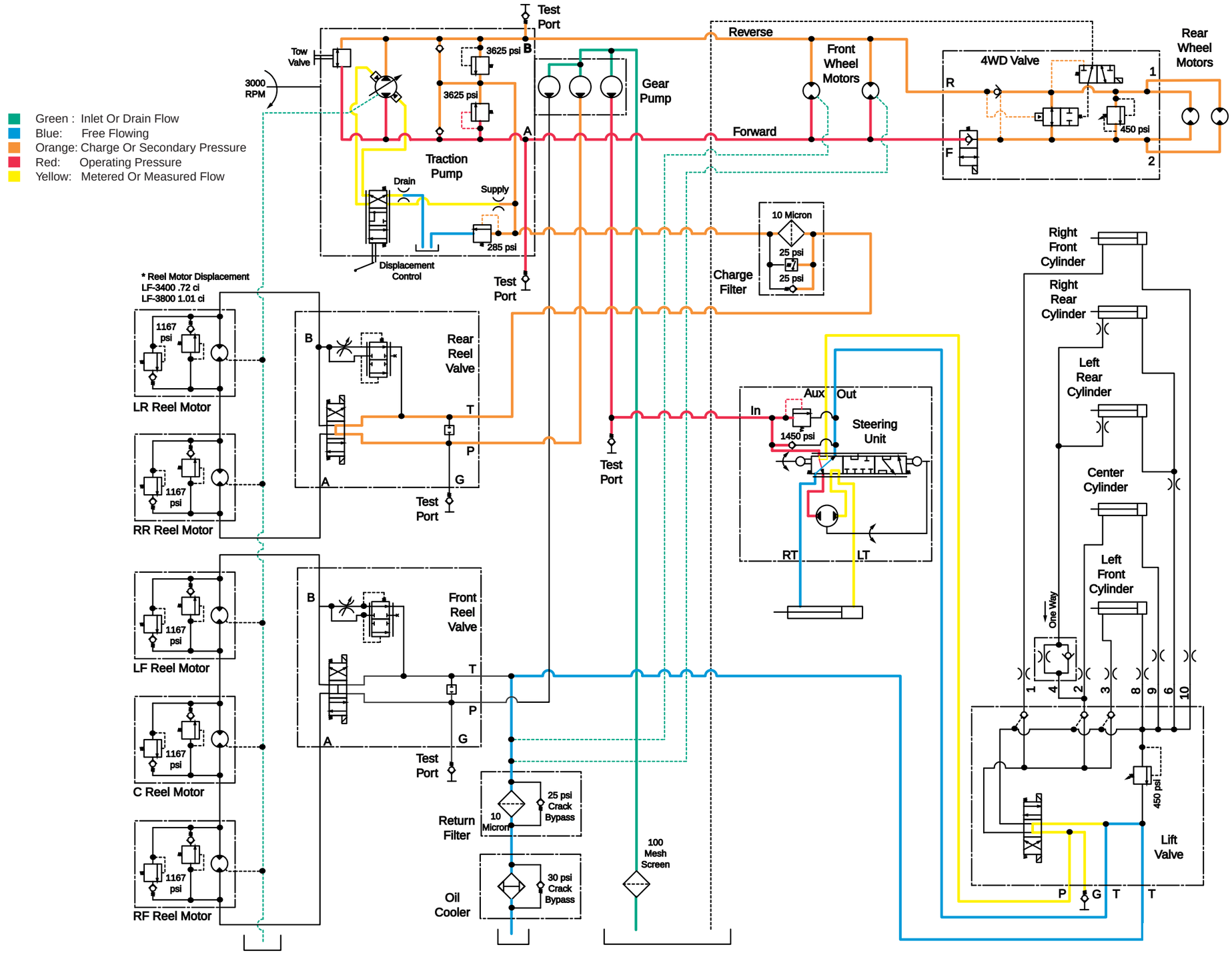


Figure 8P-6. Traction Forward, Left Turn

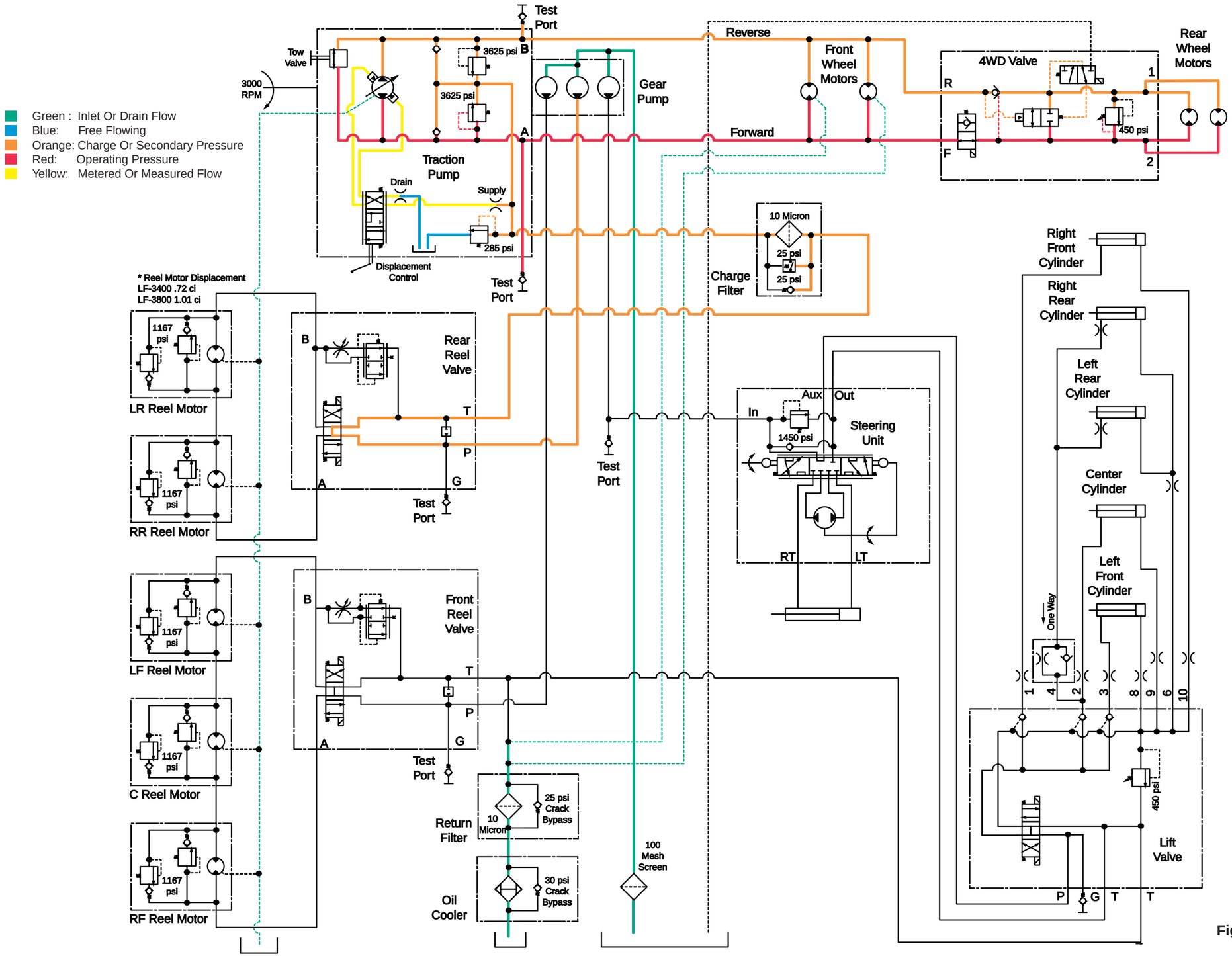


Figure 8P-7. Traction Forward, 4 Wheel Drive

SECTION 8P. HYDRAULIC DIAGRAMS, SCHEMATICS AND COMPONENT LOCATIONS

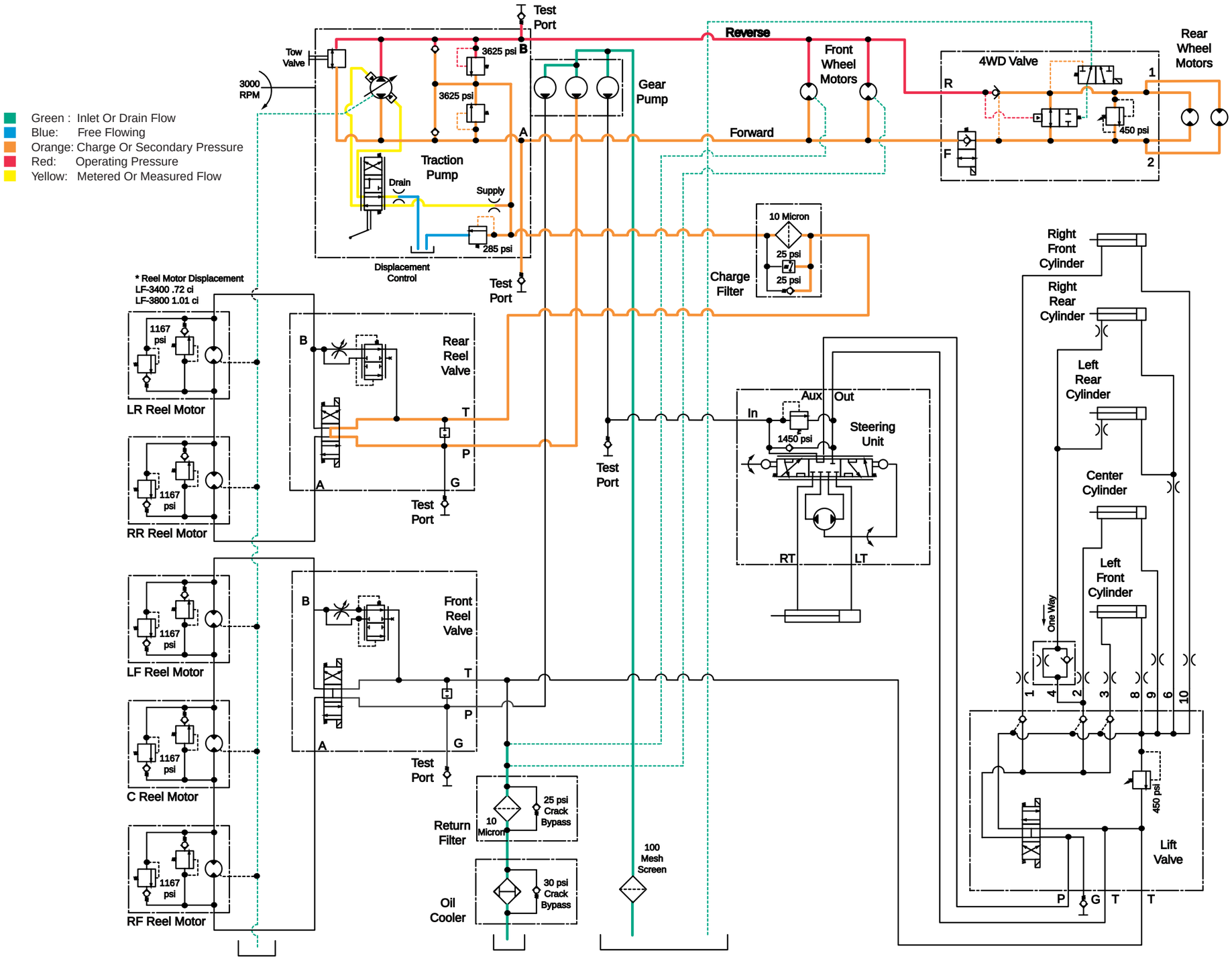


Figure 8P-8. Traction Reverse

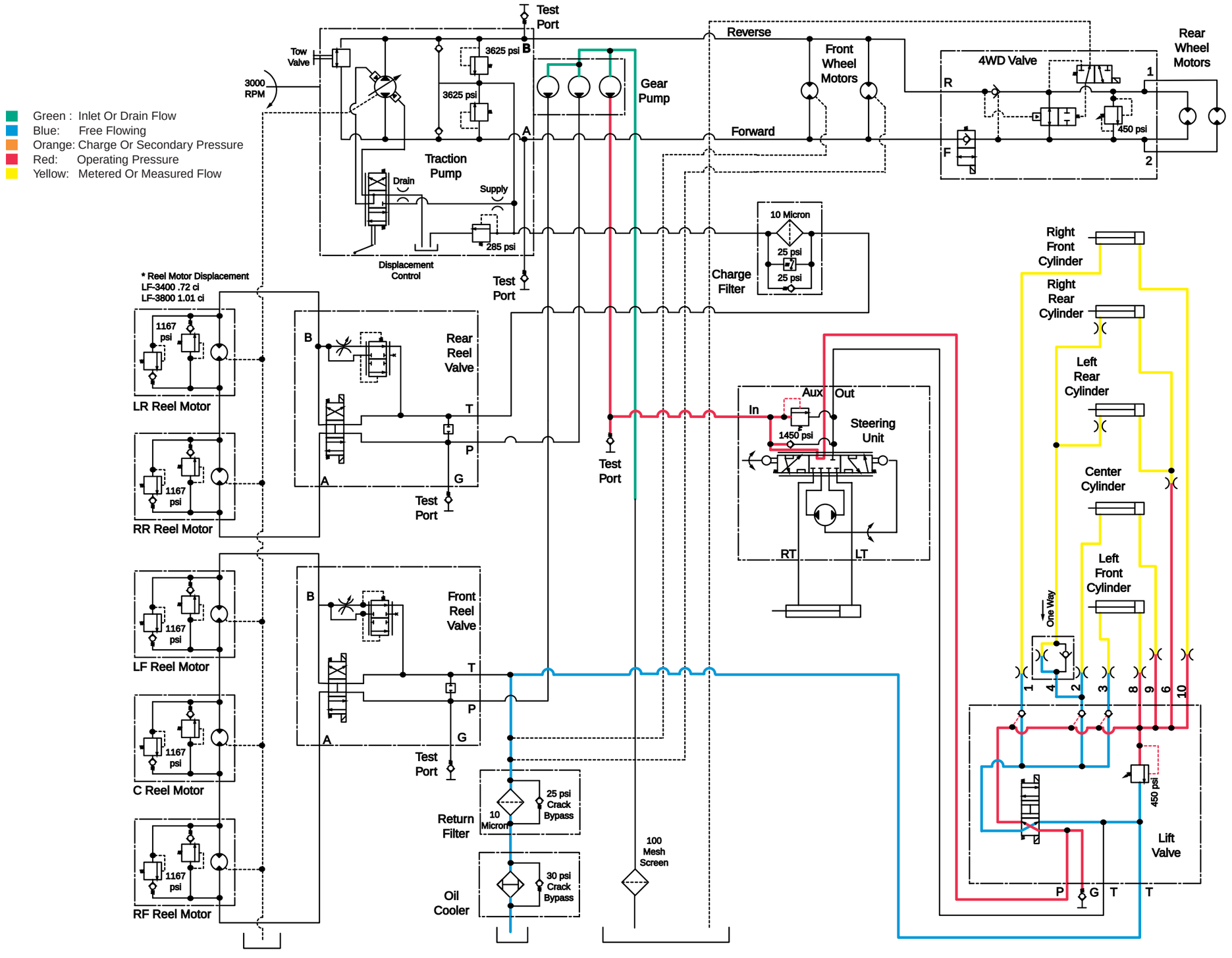


Figure 8P-9. Lowering

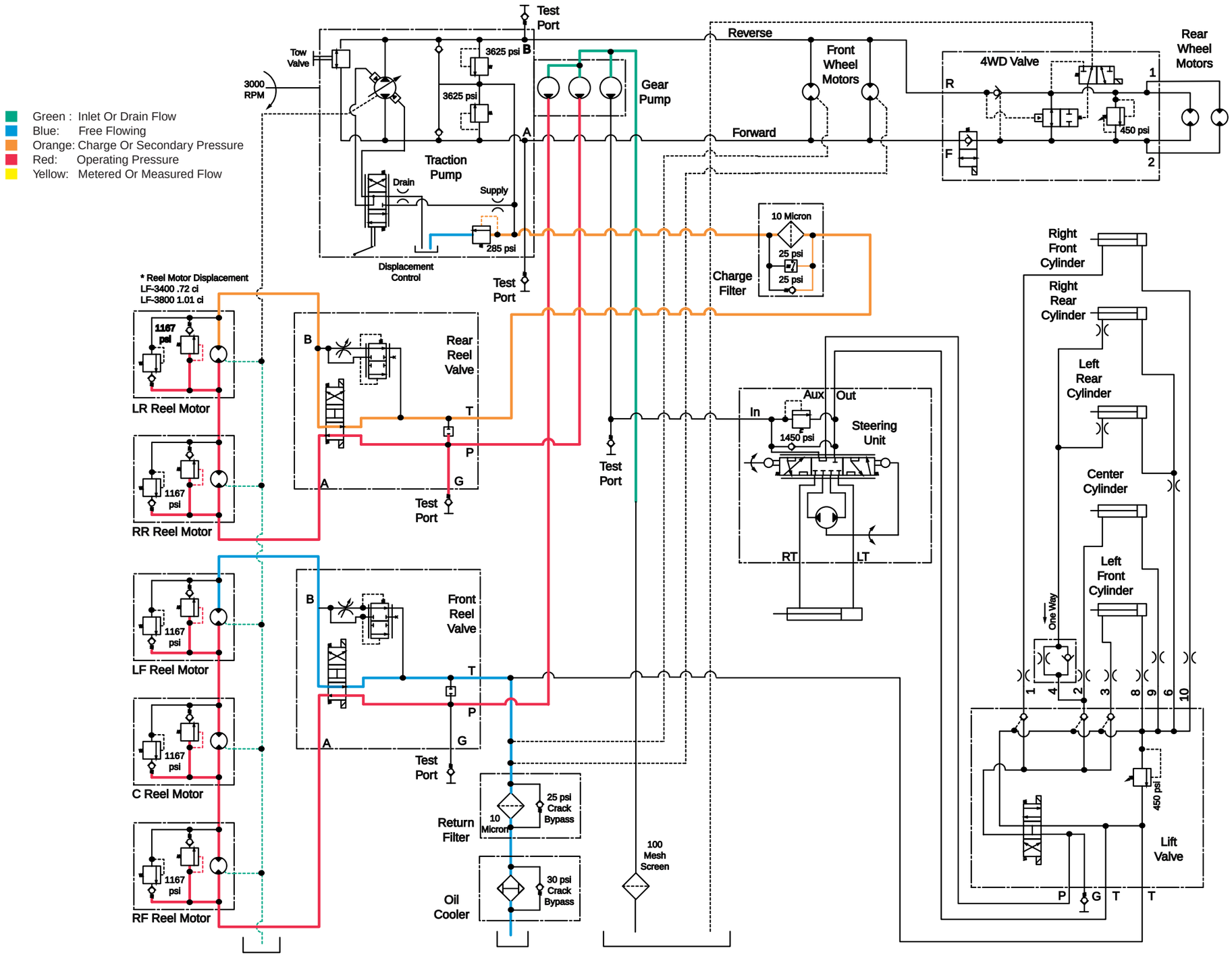


Figure 8P-10. Reels On

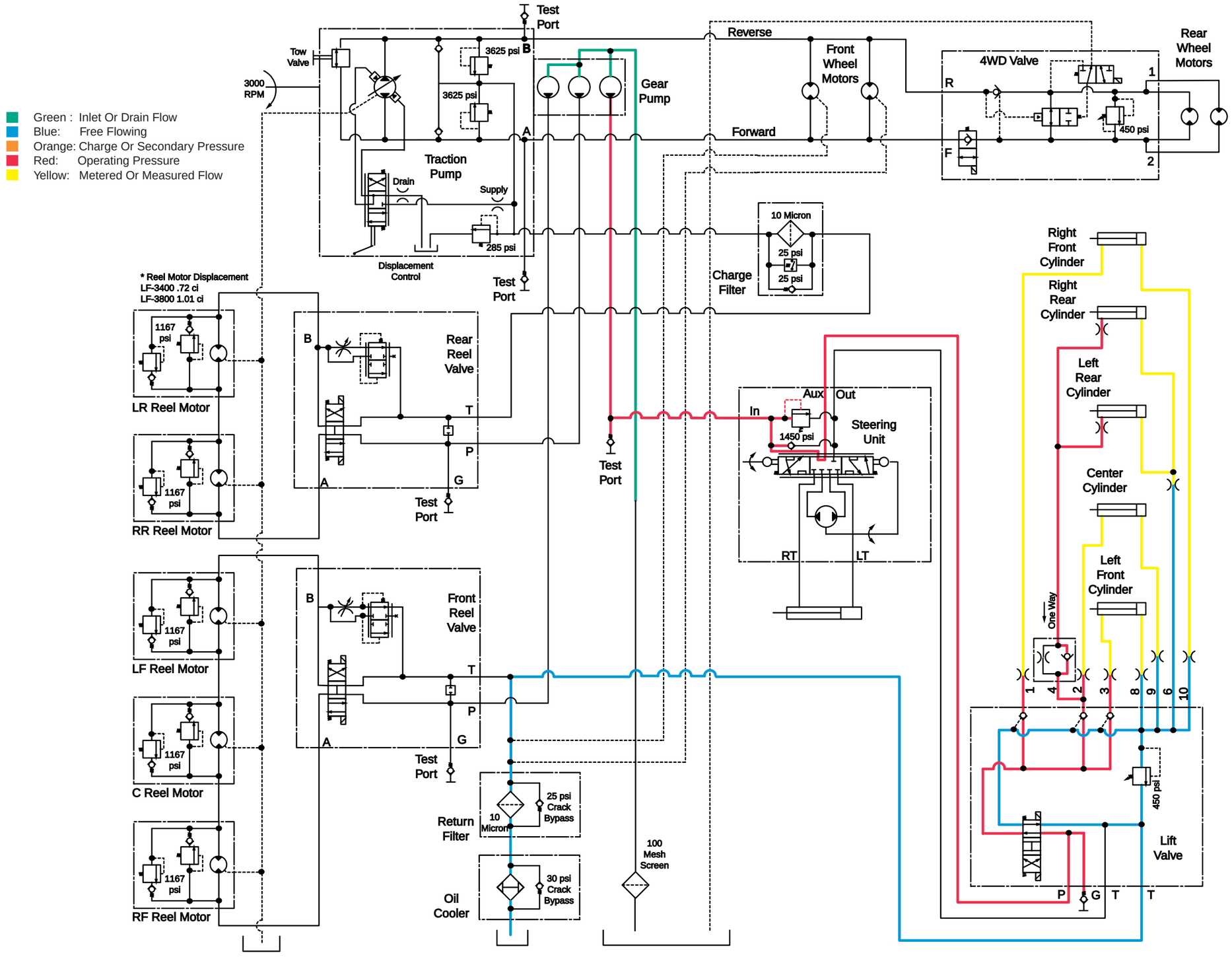


Figure 8P-11. Raising

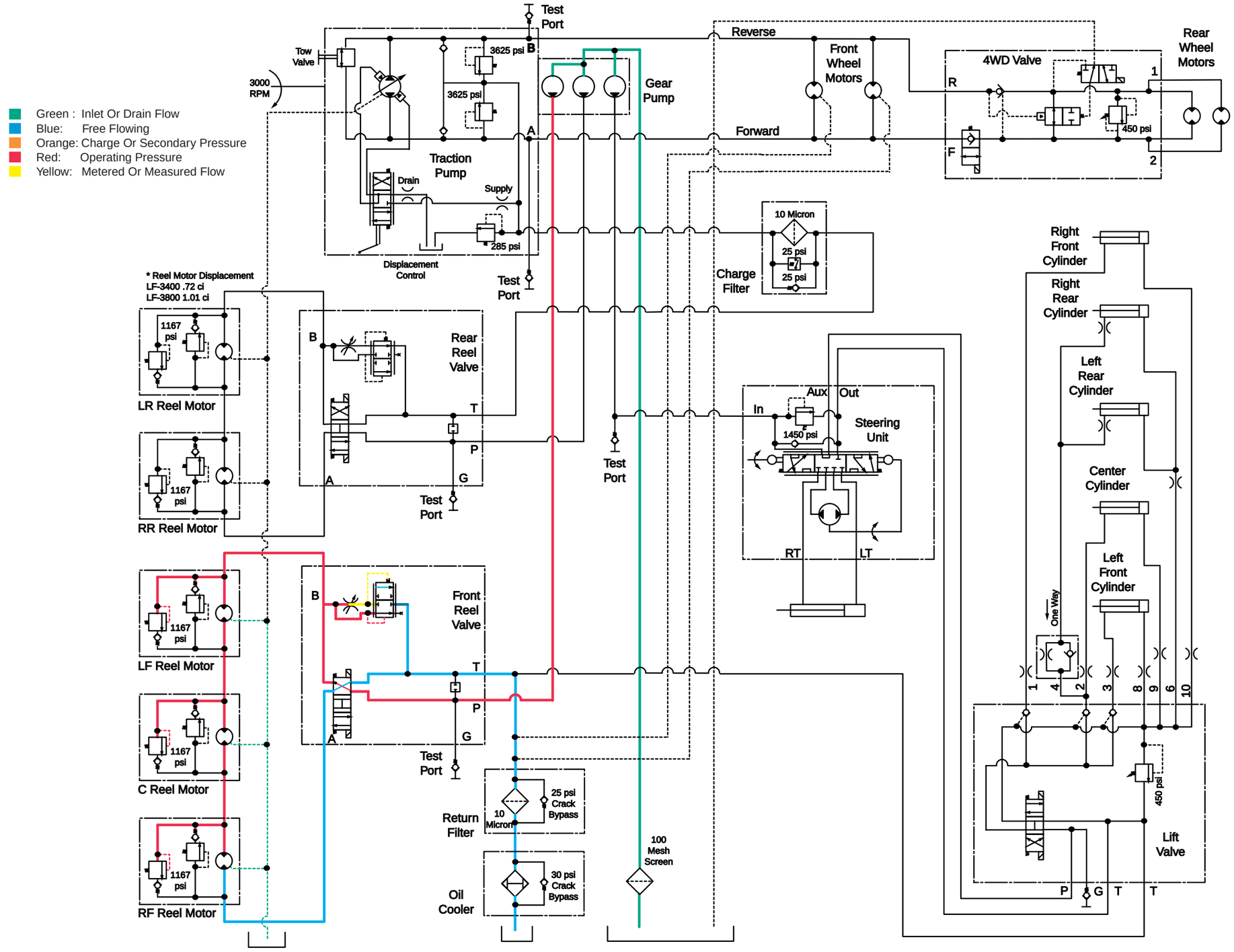


Figure 8P-12. Backlap

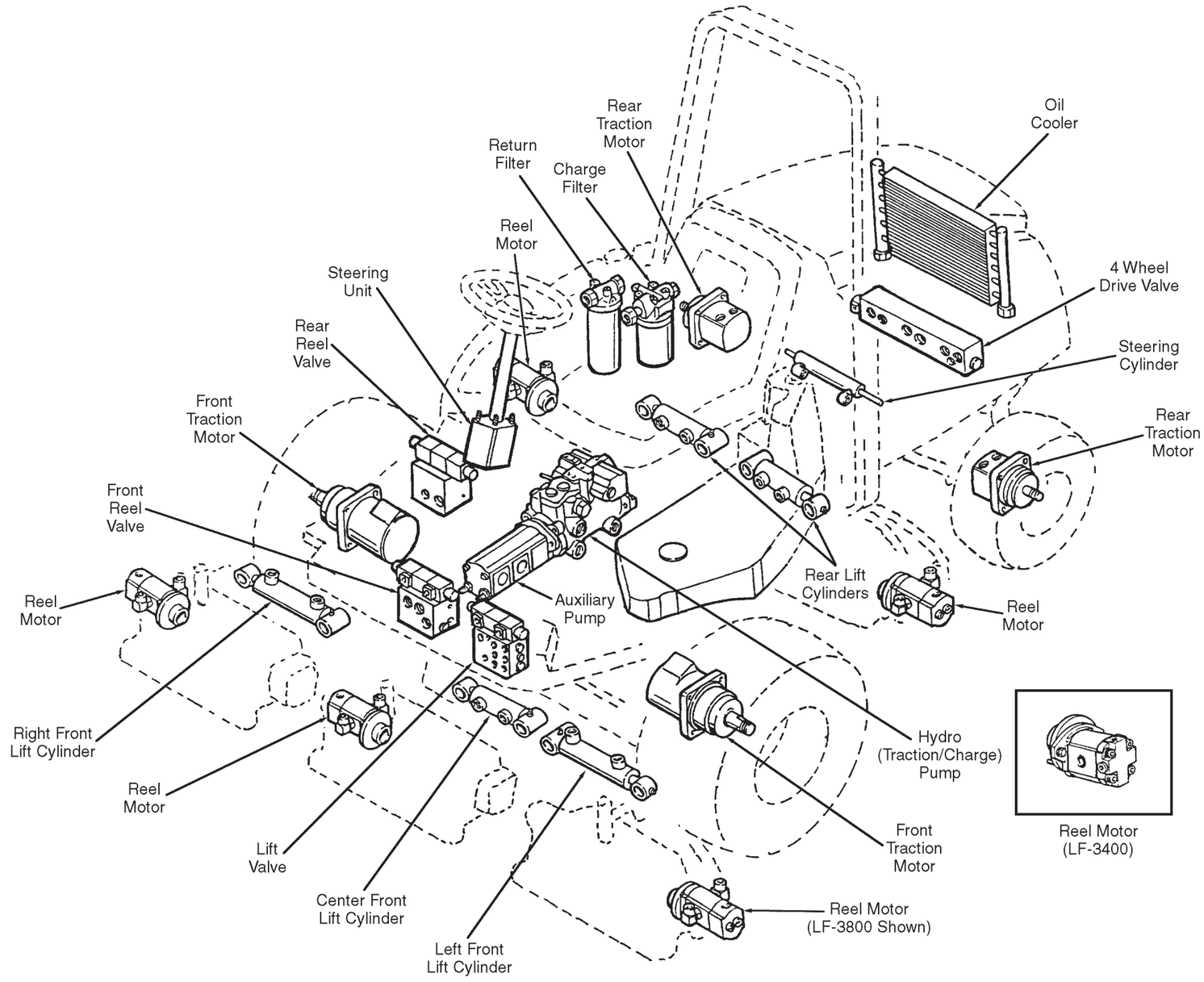


Figure 8P-13. Component Location 4 Wheel Drive

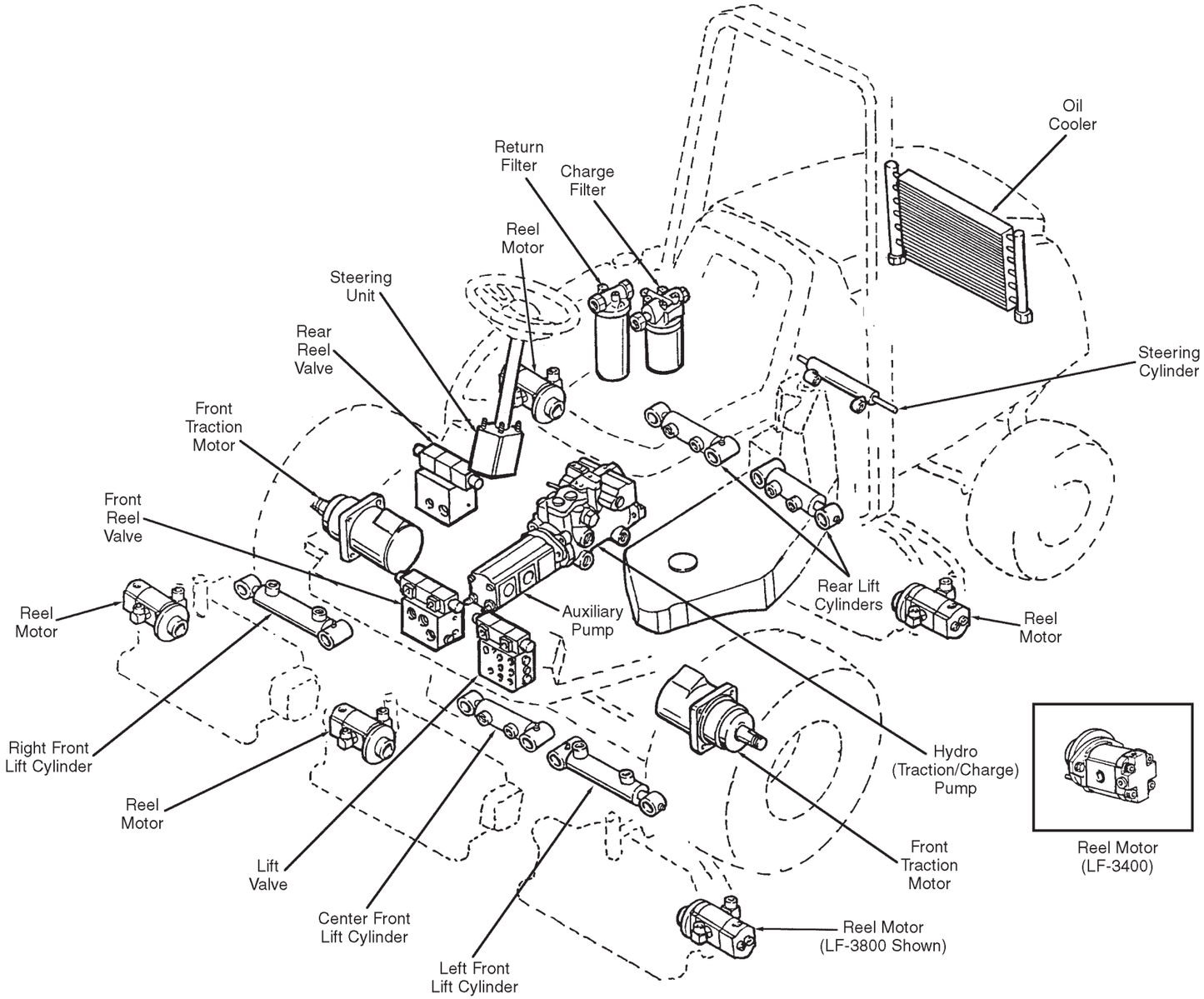


Figure 8P-14. Component Location 2 Wheel Drive

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SECTION 9
CHASSIS

SECTION 9A. REPAIR AND SERVICE TOOLS AND MATERIALS

Tools required:	Standard automotive hand tools including bearing pullers.
Cleaning and refinishing materials:	Stoddard or equivalent solvent.
	Detergent and water.
	Paint, orange — 6 twelve oz. aerosol cans (P/N 554598), 12 one qt. cans (P/N 546408) or 2 one gal. cans (P/N 546409).
	Paint, grey — 16 oz. aerosol can (P/N 5003469).
	Cleaning and maintenance products per Textron publication PL-109 (available thru Textron Dealers/Distributors).
	Anti-rust, Never-Seize (P/N 2810297).
Lubricants:	Refer to Section 11.

SECTION 9B. FAILURE ANALYSIS

PROBLEM	PROBABLE CAUSE	REMEDY
1. Lift/lower functions do not occur when pedal is actuated.	a. Pedal linkage is out of adjustment.	a. Adjust linkage (Section 2D).
	b. Hydraulic lines are kinked, worn or broken.	b. Adjust or replace lines (Section 8C).
	c. Reel pump faulty.	c. Test pump (Section 8O).
	d. Mower lift cylinder is not functioning.	d. Test cylinder (Section 8O).
	e. Lift valve is malfunctioning.	e. Test valve (Section 8O).
2. Slow or noisy drive or lift/lower operation.	a. Low fluid level in hydraulic tank.	a. Fill tank, check for hydraulic leaks.
	b. Faulty hydraulic component.	b. Test and repair (Section 8).
	c. Loose connections on hoses and to components.	c. Repair connections (Section 8C).
	d. Worn seals.	d. Replace seals (Section 8).
	e. Air in system.	e. Bleed system.
	f. Valves or motor malfunctioning.	f. Test motor valve or motors (Section 8).
	g. Reel pump relief too low.	g. See adjustment (Section 8O)
3. Interlock function does not operate.	a. Disconnected or inoperative seat switch.	a. Check connections. Test and repair or replace switch or cables (Section 10G).
	b. Seat switch faulty.	b. Test (Section 10G).
	c. Traction neutral limit switch not adjusted or faulty.	c. Adjust (Section 2C). Test (Section 10G).
4. Mower cuts lower on one side.	a. Improper height adjustment.	a. Check height adjustment (Section 12D).
	b. Bushings need to be lubricated.	b. See lubrication (Section 11).

SECTION 9C. FUEL TANK

GENERAL

The fuel tank is a single piece tank which should require no servicing unless punctured or otherwise accidentally damaged. The fuel tank should be drained whenever the machine is to be stored.

NOTE

The cap used on the tank is a vented cap.

REMOVAL AND INSTALLATION (See Figure 9C-1)

1. Close input and output valves at base of fuel tank.
2. Position a suitable container below the tank, disconnect input and output fuel lines, install drain lines, open input and output valves and drain the tank.
3. Remove attaching hardware, fuel tank and tank mounting plate.
4. Test fuel sender as described in Section 10E. If necessary, replace fuel sender.
5. Replace damaged or leaking tank and install as shown in Figure 9C-1.
6. Reconnect fuel lines.
7. Fill the tank with 17 gals. (64.3 liters) No. 2 diesel fuel and purge the fuel system as described in Section 3D.

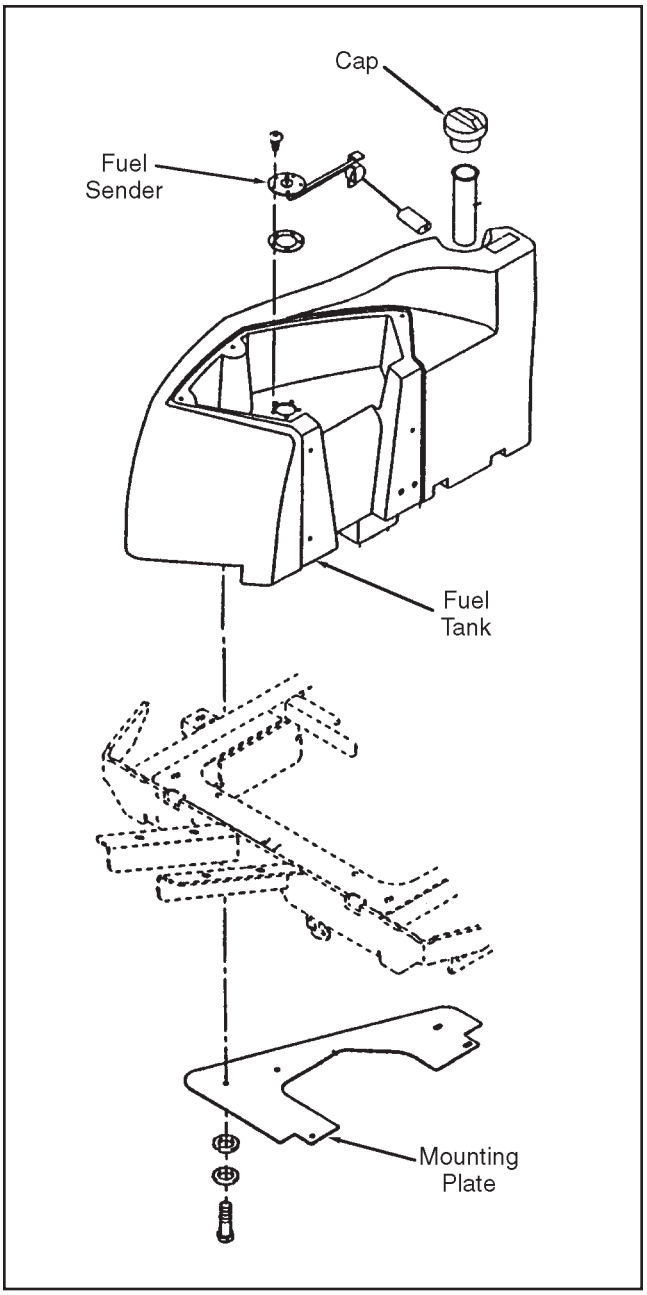

Figure 9C-1. Fuel Tank Removal and Installation

SECTION 9D. HYDRAULIC TANK

GENERAL

The hydraulic tank requires little or no service other than removing and cleaning outlet strainer and adding hydraulic oil when indicated by checking the dipstick. The hydraulic oil level should be checked daily for proper level. Use extreme care when checking oil level to prevent the entry of contaminates.

Do not check oil level when oil is hot.

Oil level should never be below the low level mark or more than 1/4 inch (6.35 mm) above the high level mark.

Overfilling tank could result in oil coming out cap (breather).

If you notice the presence of water (noted by a cloudy or milky appearance), or air (noted by a foamy appearance) or other contaminants, a rancid odor (indicating excessive heat), or after a major component failure, the hydraulic fluid should be changed.

NOTE

The cap on the hydraulic tank is a vented cap.

If water, air or contamination is indicated, locate the source of the problem and take corrective action.

REMOVAL AND INSTALLATION (See Figure 9D-1)

If it is necessary to remove the hydraulic tank, remove the drain plug, drain the fluid into a suitable container and disconnect all hoses at the tank.

Test the float switch as described in Section 10E; replace if required.

When installing the hydraulic tank, install the drain plug and secure the tank with mounting hardware, connect hydraulic hoses to the tank and fill with approximately 10 gals. (37.85 liters) of 10W30 hydraulic fluid.

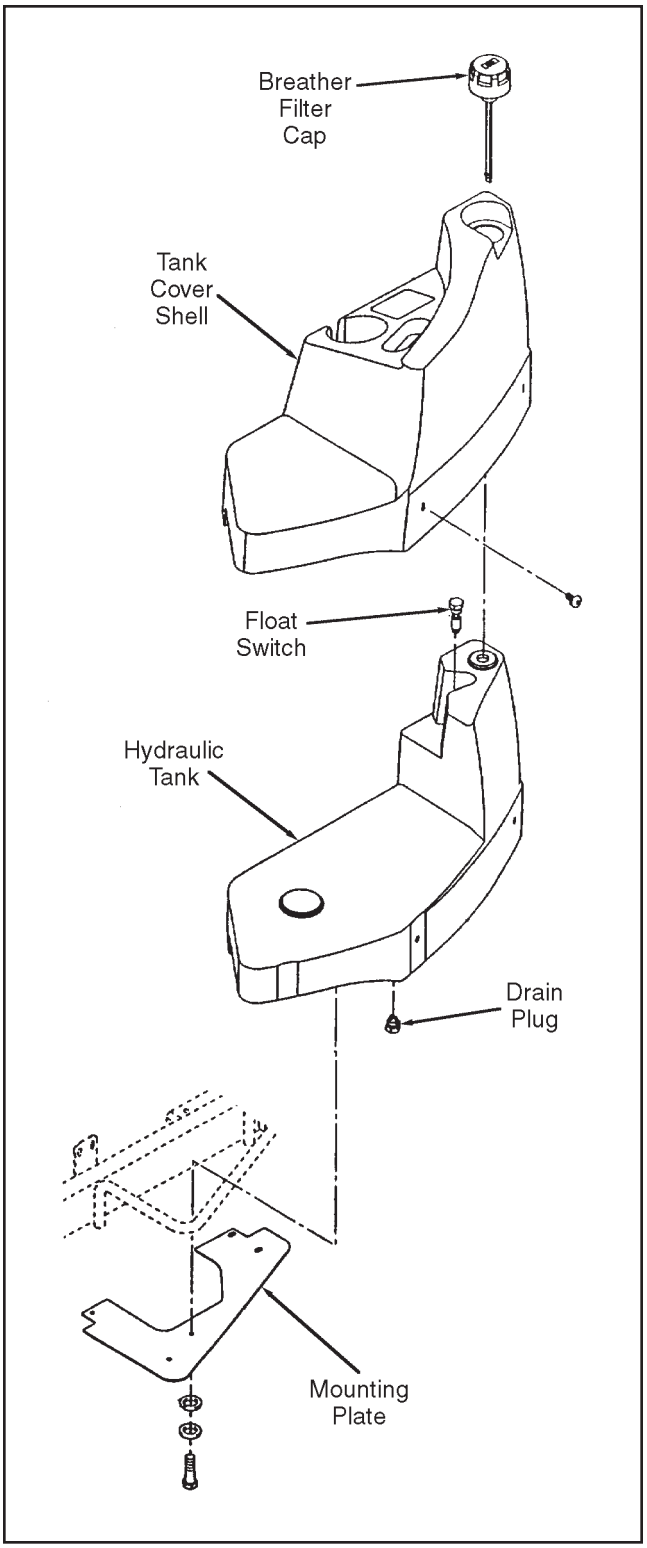

Figure 9D-1. Hydraulic Tank Removal and Installation

9D

SECTION 9E. LIFT CYLINDERS, ARMS, YOKES AND SUPPORTS

GENERAL (See Figure 9E-1)

The components used for the front lift mechanism are similar. However, the lift arms and lift yokes are different for the LF-3400 and LF-3800.

All five lift yokes for the LF-3800 are identical. The center and right side lift yokes for the LF-3400 are different from the left side lift yokes.

Mark parts to facilitate installation.

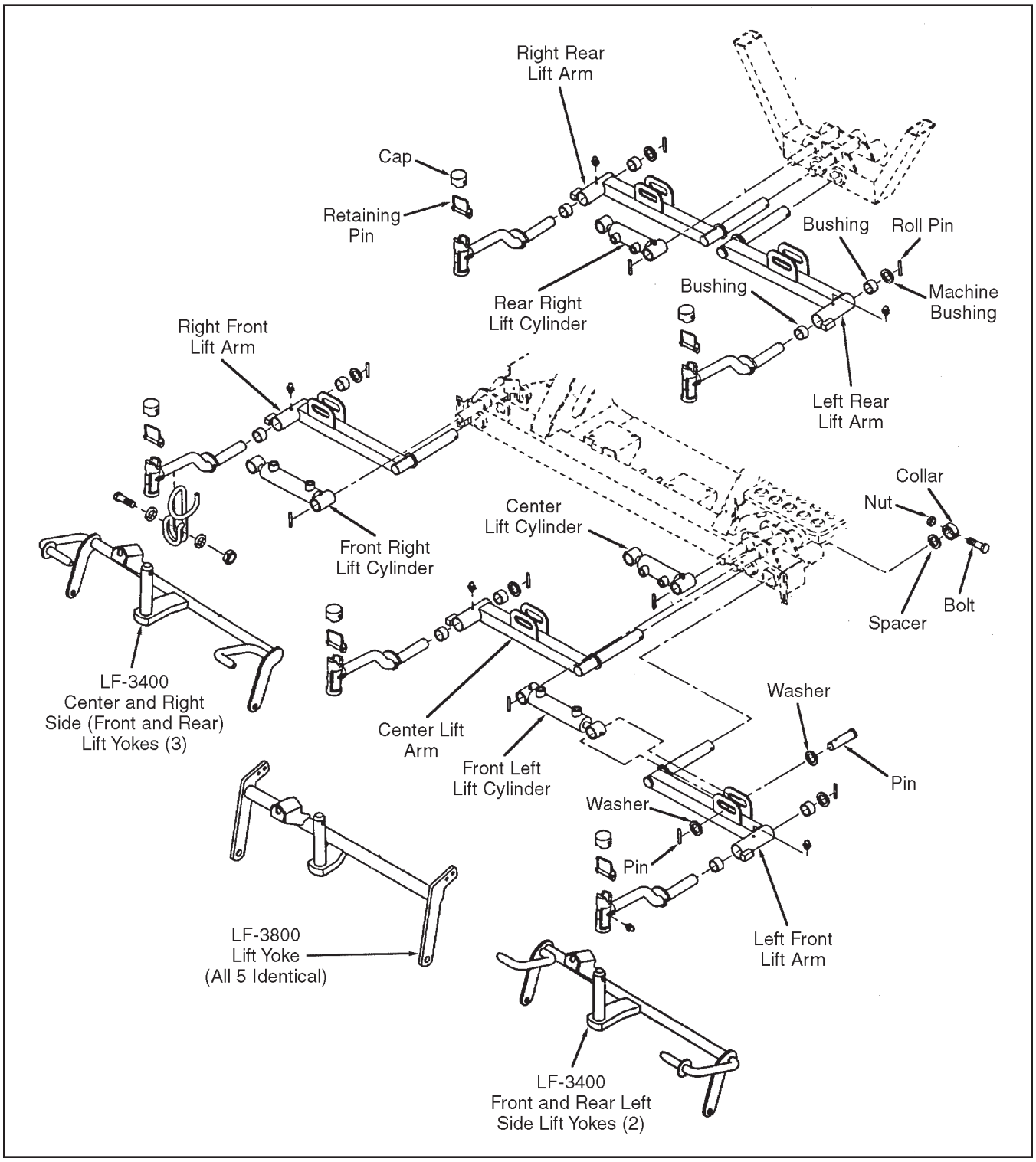

Figure 9E-1. Lift Arms, Cylinders, Stops and Supports Repair

SECTION 9E. LIFT CYLINDERS, ARMS, YOKES AND SUPPORTS

LIFT CYLINDER REMOVAL AND INSTALLATION (See Figure 9E-1)

1. Lower mowers to ground.
2. Disconnect hoses at cylinders; plug and cap all parts.

CAUTION

Care must be taken to avoid damaging the surface of the cylinder rod.

3. Remove cotter pins and pivot pins attaching cylinder to tractor and lift arms. Remove cylinder.

NOTE

See Section 8M for cylinder repair.

4. Install cylinder and secure with attaching hardware.
5. Connect hoses to cylinder.
6. Operate unit and lift and lower mowers.
7. Check hydraulic oil level.
8. Adjust lift limit switches (Section 2C).

LIFT ARMS, YOKES, STOPS AND SUPPORTS (See Figure 9E-1)

1. Replace worn parts as necessary.
2. After installation adjust lift limit switches (Section 2C).

SECTION 9F. REAR SPINDLE

GENERAL

Repair of the rear axle is limited to replacement of broken parts and servicing wheel bearings (see Section 6E, Steer Cylinder Service and Section 6D, Adjustments).

REMOVAL AND INSTALLATION (See Figure 9F-1)

1. Block front wheels to prevent tractor movement.
2. Raise the rear of the tractor. Do not attach lifting device to axle or any component connected to axle assembly.
3. Disconnect hydraulic lines to steering cylinder. Cap or plug all fittings.
4. Remove cotter pin, nuts and washer.
5. Making sure tractor and axle are well supported, remove axle from tractor frame.
6. Inspect all parts for damage or excessive wear. Replace as necessary.
7. Reassemble axle.
8. Position axle under tractor frame.
9. Install washer and nut, leave a 0.010 to 0.060 inch (0.25 to 1.52 mm) gap between washer and frame tube.
10. Install jam nut and torque against first nut 50 to 100 ft-lbs. (68 to 135 N.m).
11. Install cotter pins.

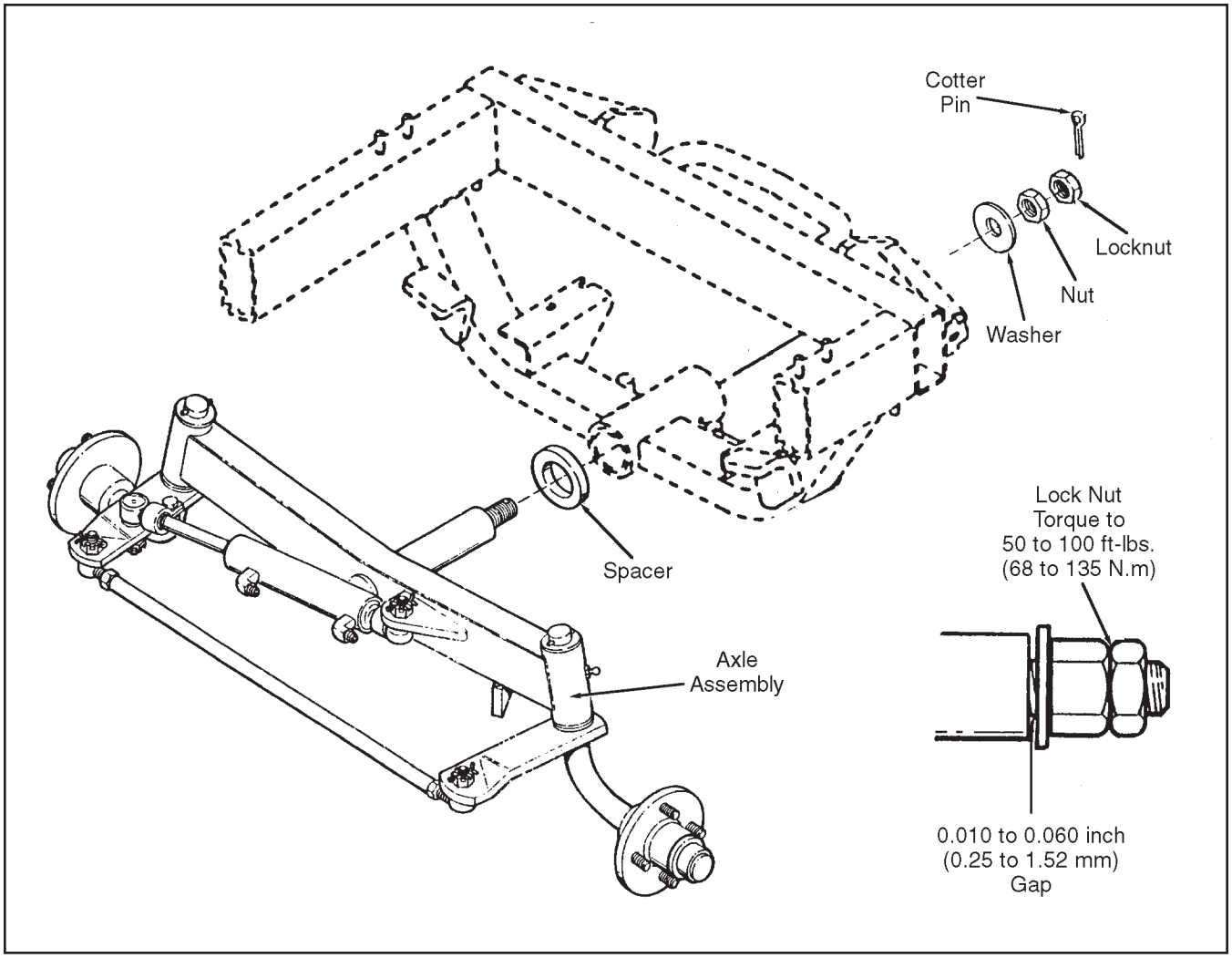

Figure 9F-1. Steering Spindle Removal and Installation

SECTION 9F. REAR SPINDLE

2 WHEEL DRIVE SPINDLE REPAIR (See Figure 9F-2)

1. Disconnect tie rod and rod end of the steering cylinder from the R.H. and L.H. steering assembly.
2. Remove the groove pin from the top of the steering assemblies and remove the steering assemblies.
3. Inspect steering assembly shafts for signs of wear and replace as necessary.
4. Replace lower thrust bearing and thrust washers and spindle bushings as needed.
5. Install thrust bearings and thrust washers on steering assembly.
6. Install steering assembly in to axle and lock in place by installing flat washer and new groove pin.
7. Reconnect tie rods and steering cylinder.
8. Perform toe-in adjustments as described in Section 6D.

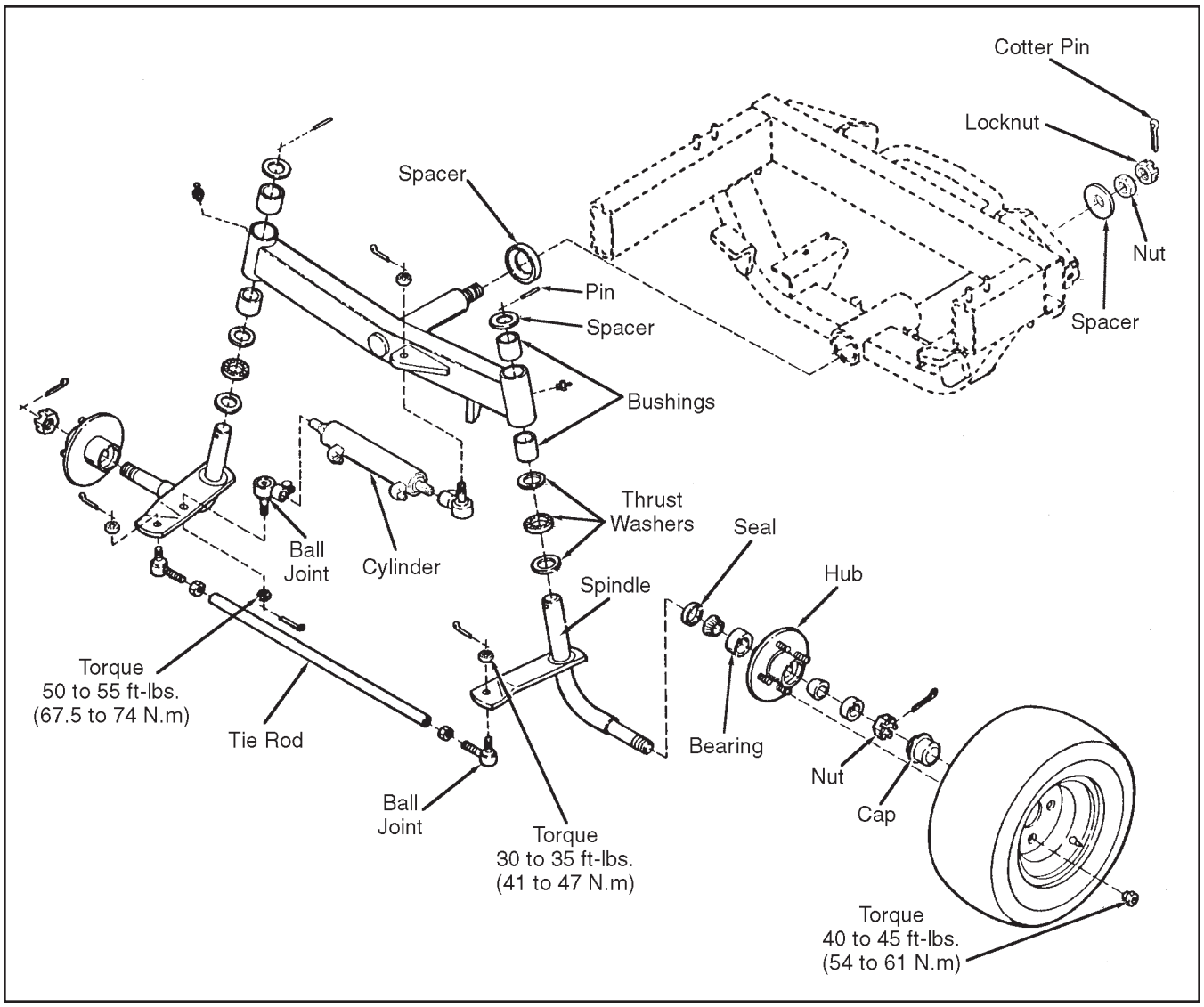

Figure 9F-2. Spindle Removal/Installation (2 Wheel Drive)

SECTION 9F. REAR SPINDLE

4 WHEEL DRIVE SPINDLE REPAIR (See Figure 9F-3)

1. Disconnect tie rod and rod end of the steering cylinder from the R.H. and L.H. steering assembly.
2. Remove the hydraulic lines from motor. Cap and plug all fittings.
3. Remove hydraulic motors.
4. Remove the groove pin from the top of the steering assemblies and remove the steering assemblies.
5. Inspect steering assembly shafts for signs of wear and replace as necessary.
6. Replace lower thrust bearing and thrust washers and spindle bushings as needed.
7. Install thrust bearings and thrust washers on steering assembly.
8. Install steering assembly into axle and lock in place by installing flat washer and new groove pin.
9. Reconnect tie rods and steering cylinder.
10. Perform cylinder and toe-in adjustments as described in Section 6D.

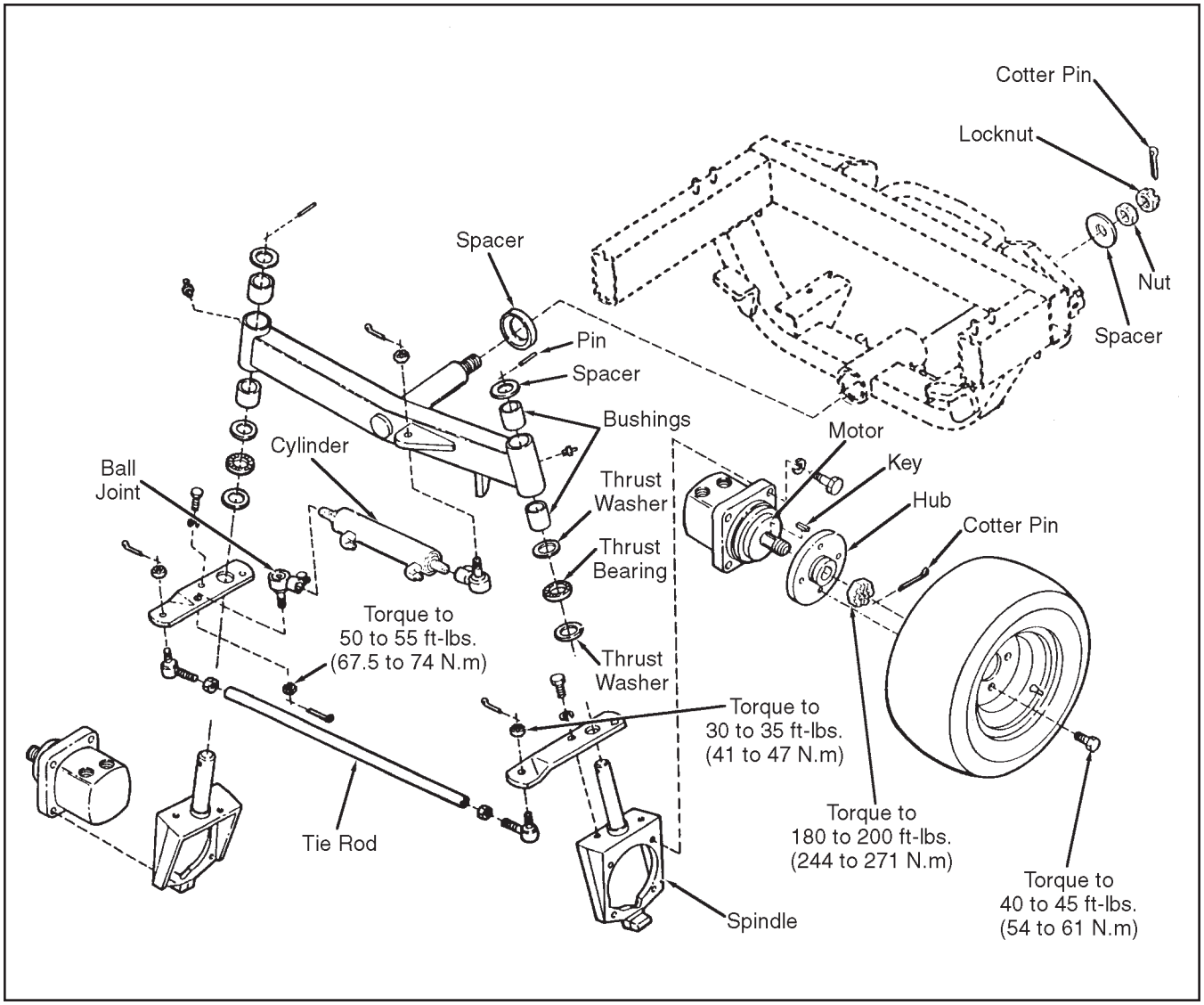

Figure 9F-3. 4 Wheel Drive Spindle Removal/Installation (4 Wheel Drive)

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SECTION 10
ELECTRICAL SYSTEM

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SECTION 10A. REPAIR AND SERVICE TOOLS AND MATERIALS

Tools required:	Multimeter. Jumper wires. 60 amp ammeter.
Cleaning materials:	Baking soda and water.
Other service items:	Electrical insulation compound P/N 365422.

SECTION 10B. FAILURE ANALYSIS

PROBLEM	PROBABLE CAUSE	REMEDY
1. Battery charge is low.	a. Buildup of corrosive acid across top of battery.	a. Clean and recharge battery (Section 10D).
	b. Terminals are loose.	b. Tighten terminals and recharge battery (Section 10D).
	c. Battery cables are frayed.	c. Replace cables and recharge battery (Section 10D).
	d. Faulty battery.	d. Replace battery (Section 10D).
	e. Alternator belt not adjusted.	e. Adjust belt (Section 3D).
	f. Voltage regulator defective.	f. Test regulator (Section 10E).
	g. Ignition switch damaged or corroded.	g. Test ignition switch (Section 10G).
	h. Bad ground.	h. Check ground corrosion.
2. Battery is not charging.	a. The alternator belt is not properly adjusted.	a. Adjust belt (Section 3D).
	b. Faulty alternator.	b. Replace alternator (Section 10E).
	c. Faulty gauge.	c. Test/replace fuse (Section 10P, 10H).
	d. Ignition switch damaged or corroded.	d. Test ignition switch (Section 10G).
	e. Faulty battery.	e. Test battery (Section 10D).
3. Engine will not turn over when ignition switch is engaged.	a. Dead battery.	a. Charge or replace (Section 10D).
	b. Neutral start switch faulty or out of adjustment.	b. Test switch as described in Section 10G. See Section 2C for adjustment instructions.
	c. Mower switch on.	c. Turn off.
	d. Faulty mower switch.	d. Test switch (Section 10G).
	e. Brake not applied.	e. Apply brake.
	f. Neutral start switch not adjusted.	f. Adjust switch (Section 2C).
	g. Faulty starter solenoid.	g. Test solenoid (Section 10K).
	h. Faulty ignition switch.	h. Test ignition switch (Section 10G).
	i. Faulty starter.	i. See engine manual and Section 10F.
	j. Faulty wiring.	j. Test wiring (Section 10C).
	k. Faulty fuse or circuit breaker tripped.	k. Determine cause of overload and correct problem. Check fuse and or reset circuit breaker (Section 10H).
	l. Faulty mower switch.	l. Test mower switch (Section 10G).
	m. Faulty controller.	m. See Section 10O.
4. Engine turns over but will not start.	a. Battery low.	a. Charge battery (Section 10D).
	b. Faulty glow plug.	b. Test glow plug (Section 10M).
	c. Faulty fuel shut-off solenoid.	c. Test solenoid (Section 10L).
	d. Faulty controller.	d. See Section 10O.

SECTION 10B. FAILURE ANALYSIS

PROBLEM	PROBABLE CAUSE	REMEDY
5. Engine starts but shuts down when ignition switch is released.	a. Faulty solenoid. b. Faulty controller.	a. Test (Section 10L). b. See Section 10O.
6. Reels do not come on when mower switch is on.	a. Mower limit switch not closed or faulty. b. Mower switch faulty. c. Mower control valve solenoid not properly grounded. d. Motor control valve solenoid faulty. e. Faulty controller.	a. Lower cutting unit test switch (Section 10G). b. Test switch (Section 10G). c. Clean/check ground connections. d. Push manual override to verify. If mower turns on, change coil, Section 10H. If mower does not come on, check Hydraulic Failure analysis (Section 8). e. See Section 10O.
7. Reels do not come on in reverse when mower switch is in “REVERSE”.	a. Mower switch not in “REVERSE”. b. Brake not applied. c. Faulty mower switch. d. Motor control valve solenoid not properly ground. e. Motor control valve solenoid faulty. f. Neutral start switch not adjusted or faulty. g. Faulty controller.	a. Push switch to “REVERSE”. b. Apply brake. c. Test switch (Section 10G). d. Clean/check ground connections. e. Override to verify if mower turns on, change coil, Section 10H. If mower does not come on, check Hydraulic Failure analysis (Section 8). f. Adjust (Section 2C). Test (Section 10G). g. See Section 10O.
8. Engine shuts down when mower switch is pushed in “REVERSE”.	a. Brake not set. b. Faulty brake switch. c. Faulty controller.	a. Apply brake. b. Test (Section 10G). c. See Section 10O.
9. Engine does not shut down when operator leaves the seat with the mower switch on.	a. Faulty seat switch. b. Faulty controller.	a. Test seat switch (Section 10G). b. See Section 10O.
10. Voltmeter reads low.	a. High resistance at fuse. b. Voltmeter faulty.	a. Clean contacts and change fuse. b. Check alternator and battery (Sections 10D and 10E).

SECTION 10C. GENERAL INSTRUCTIONS

GENERAL

Repair of the electrical system, for the most part, is limited to the replacement of defective components or wiring. Wiring diagrams and Component Location illustrations are provided in Section 10P for trouble-shooting and/or testing the electrical system. Specific repair and replacement instructions, where applicable, are also provided in this section.

NOTE

The test instrument shown in the illustrations for this section is a digital multimeter (DMM). However, any test instrument capable of measuring the current resistance and continuity values specified for each test is acceptable.

NOTE

See engine manufacturer's service manual for information on engine electrical components not covered in this section.

In addition to testing a suspected faulty component it may be necessary to check for shorts or breaks in the wiring to the component. A common method of testing wires or circuits is to perform a continuity check as described below.

NOTE

Before performing any component or wiring test, check for corrosion and loose or missing connections.

If a component (switch, relay, etc.) is removed for test or replacement make sure to identify and label wires so that the component can be installed correctly.

WIRE CONTINUITY TEST (See Figure 10C-1)

1. Identify and locate the wire to be checked on the appropriate wiring diagram in Section 10P.
2. Set multimeter to ohms ♪ scale and touch leads to end of wire.
   - There should be a reading (continuity) on the multimeter. If not, proceed to Step 3.
3. Perform a second check by using a jumper wire to bypass the wiring being tested. If the component in question now functions normally, replace the original wire.

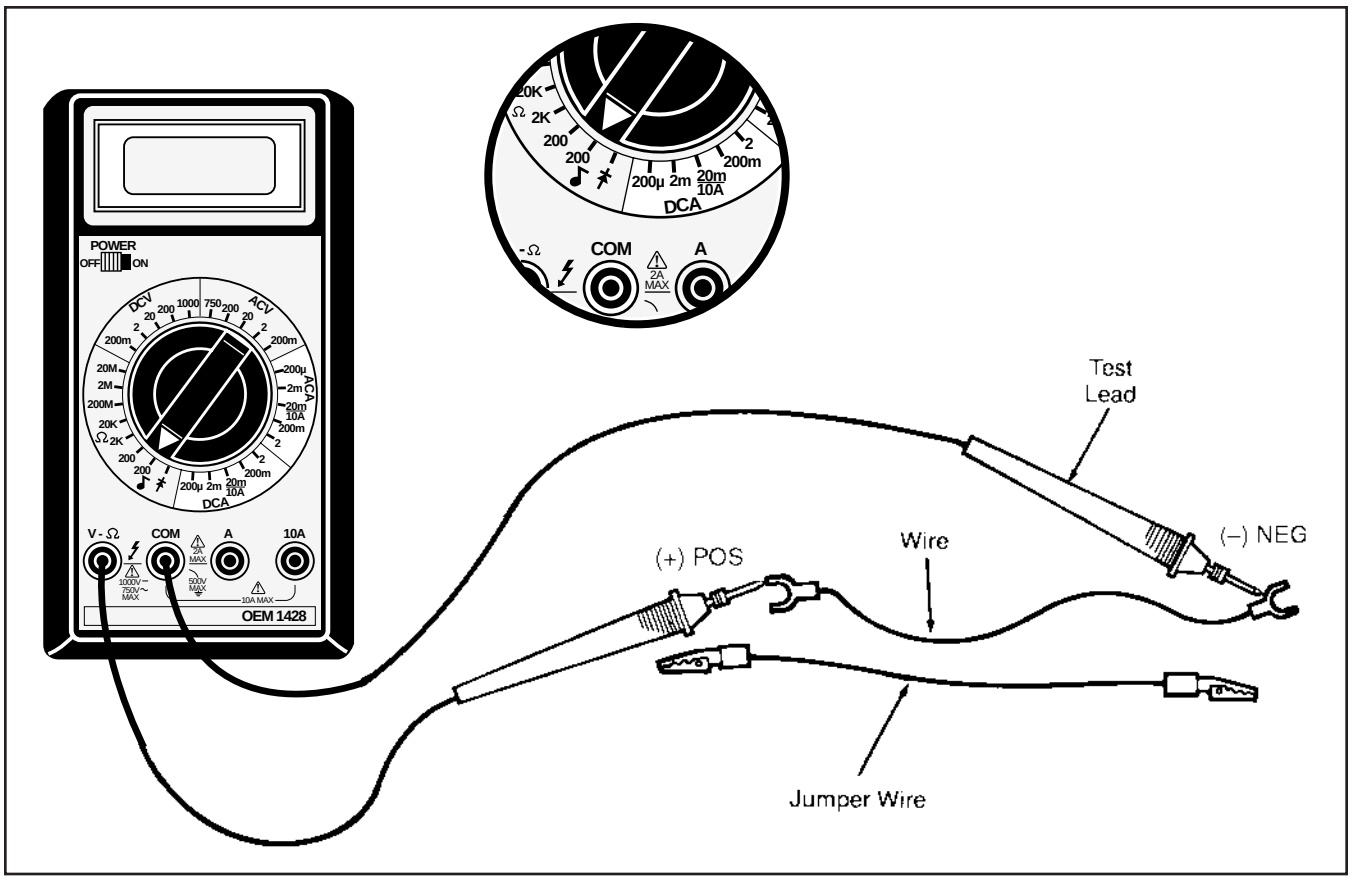


Figure 10C-1. Wire Continuity Test

10C

SECTION 10C. GENERAL INSTRUCTIONS

RESISTANCE TEST (See Figure 10C-2)

1. Set the multimeter to an Ω (ohms) scale.
2. Touch the leads to the terminals on the wire or switch.
3. Read the Ω (ohms) on the multimeter.
   - Contacts of a switch or a wire should have less than 0.5 Ω (ohms) reading.
   - If Ω (ohms) readings are above 0.5 the switch or wire is questionable.

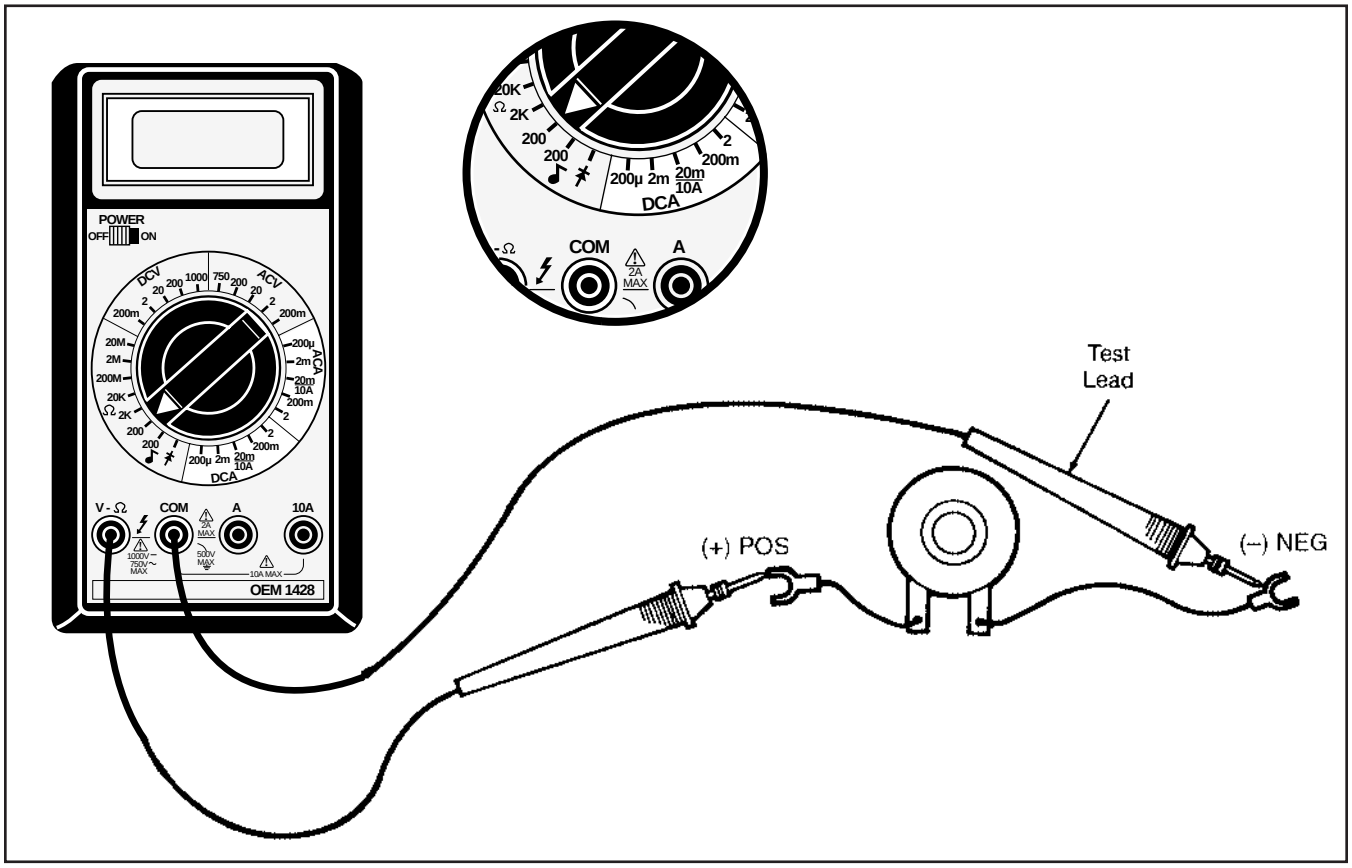


Figure 10C-2. Resistance Tests, Ohm Ω

SECTION 10D. BATTERY

GENERAL

For normal service, use a battery rated 12V, 600 cold cranking amps at 0°F (–18°C) Group BCI24. For continuous cold weather operation, use a battery with approximately 400 cold cranking amps at 0°F (–18°C) AABM group 22NF batteries meet this specification.

⚠ WARNING

Batteries contain sulfuric acid and generate explosive mixtures of hydrogen and oxygen gases. Keep any device which may cause sparks or flames away from the battery to prevent explosion.

⚠ WARNING

Always wear protective glasses or goggles and protective clothing when working with batteries.

You must follow the battery manufacturer's instructions on safety, maintenance and installation procedures.

⚠ CAUTION

Always connect the "ground" (black) cable last and remove it first whenever performing any battery maintenance. When the battery is being removed or reinstalled, make sure the positive and negative terminals do not contact metal tractor parts at the same time or arcing will result. Battery connections must be kept clean and tight at all times. Loose cables will cause arcing and pitting of the connections and cause eventual failure. Keep positive terminal cover in place.

CHARGING A MAINTENANCE FREE BATTERY

NOTE

Remove battery from tractor.

1. Be sure charger is "Off".
2. Connect charger leads to battery. Connect the positive (+) connector from the charger to the postive battery terminal. Connect the negative (–) connector of the charger to the negative battery terminal.

⚠ WARNING

To avoid possible injury, stand away from battery when the charger is turned on. A damaged battery or a battery with an internal short could explode.

3. Charge the battery using one of the methods shown below. Follow the manufacturer's instructions on the charger.

Slow Charge	Fast Charge
10 hours @ 5 amps 5 hours @ 10 amps	2½ hours @ 20 amps 1½ hours @ 30 amps 1 hour @ 45 amps

4. If, when charging the battery, violent gassing or spewing of electrolyte occurs, or the battery case feels hot — 125°F (52°C), reduce or temporarily halt charging to avoid damaging the battery.
5. Always turn charger to "Off" before removing a charger lead from the battery.

MAINTENANCE/CLEANING

A buildup of corrosive acid across the top of the battery can cause the battery to self-discharge. Even a light coating of this grayish-white substance can complete a circuit to drain and exhaust the energy in the battery. This is especially bad when moisture is present.

To maintain a battery in top condition, check and perform the following services at frequent intervals:

1. Regularly check level of electrolyte — add water as necessary to maintain level above plates — do not overfill as this can cause poor performance or early failure due to loss of electrolyte.
2. Keep terminals and top of battery clean. Wash with baking soda and rinse with clear water. Do not allow soda solution to enter cells as this will destroy the electrolyte.
3. Make sure battery terminals are tight and cables are in good condition.

SECTION 10D. BATTERY

TESTING (See Figure 10D-1)

Test battery voltage as follows:

1. Connect DC multimeter to battery terminals.
2. Set voltmeter to 20 VDC.
3. Crank the engine — if battery voltage falls below 9 volts while cranking, the battery is run-down or faulty. Charge and perform test again.

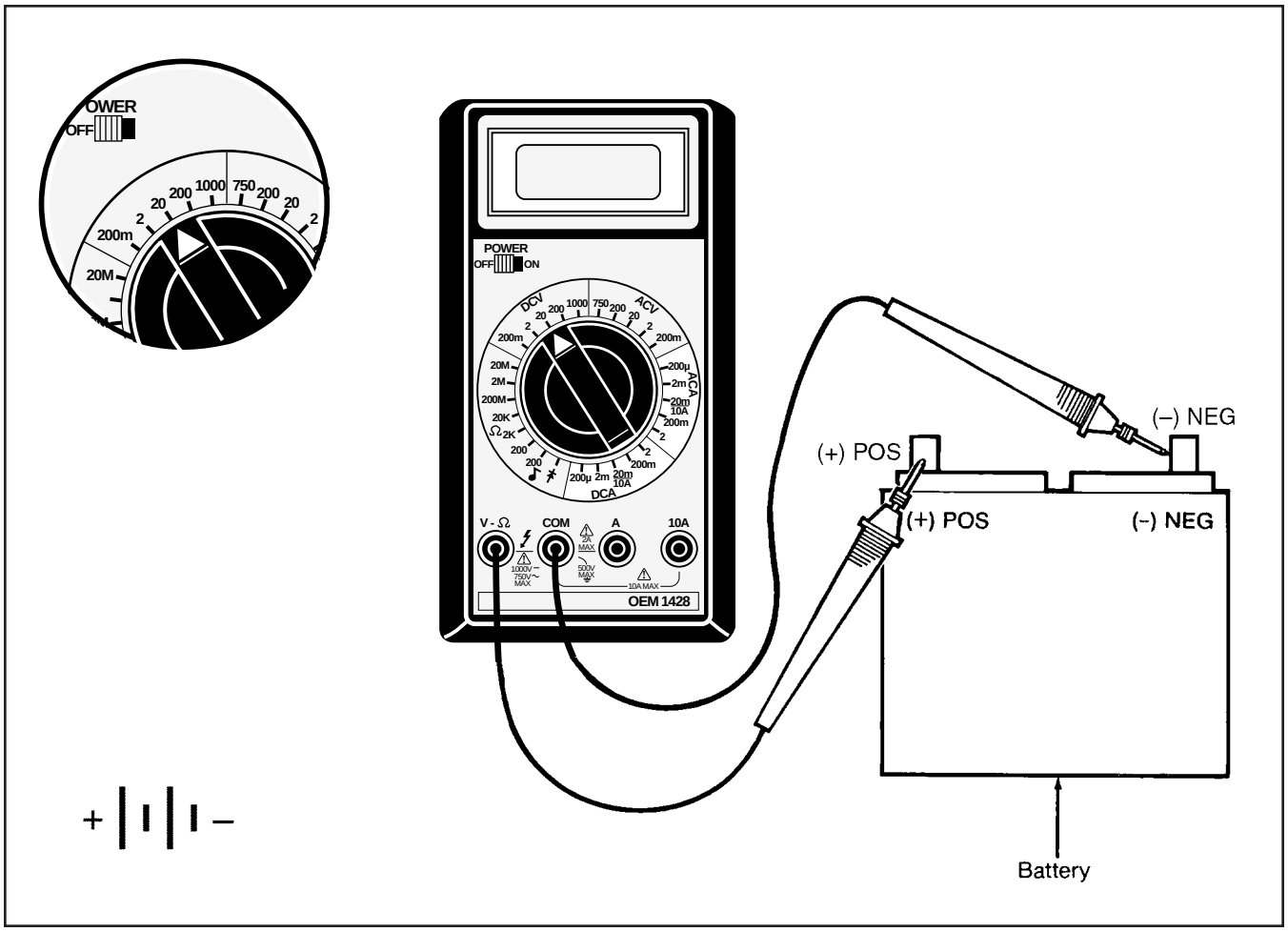


Figure 10D-1. Battery Test

SECTION 10E. CHARGING SYSTEM

GENERAL

The charging system consists of a 40 amp alternator with a built-in regulator/rectifier.

With a built-in regulator/rectifier, it is necessary to disassemble the alternator to electrically test the stator, rotor and rectifier. Refer to the engine manufacturer's service manual for detailed test and repair instructions.

Before attempting to disassemble the alternator, perform the following tests to confirm the alternator is at fault.

OUTPUT CURRENT TEST (See Figure 10E-1)

WARNING

Before installing test instruments, disconnect the NEG (–) battery cable from the battery.

1. Remove the RED wire from terminal B of the alternator.
2. Connect a 60 amp ammeter and multimeter as shown.
3. Set multimeter to 20 VDC range.
4. Reconnect battery NEG (–) cable.
5. Start the engine.
   - As engine RPM increases, voltage should increase to 14 to 14.5 volts. Current output should increase to a maximum of 40 amp.

NOTE

Charge condition of battery will affect current (amp) output.

- As the battery begins to charge, the current output will slowly decrease.
- If NO voltage and/or current is measured, proceed with Step 6.
- If voltage and current does not start coming down after a short running period, battery is faulty.

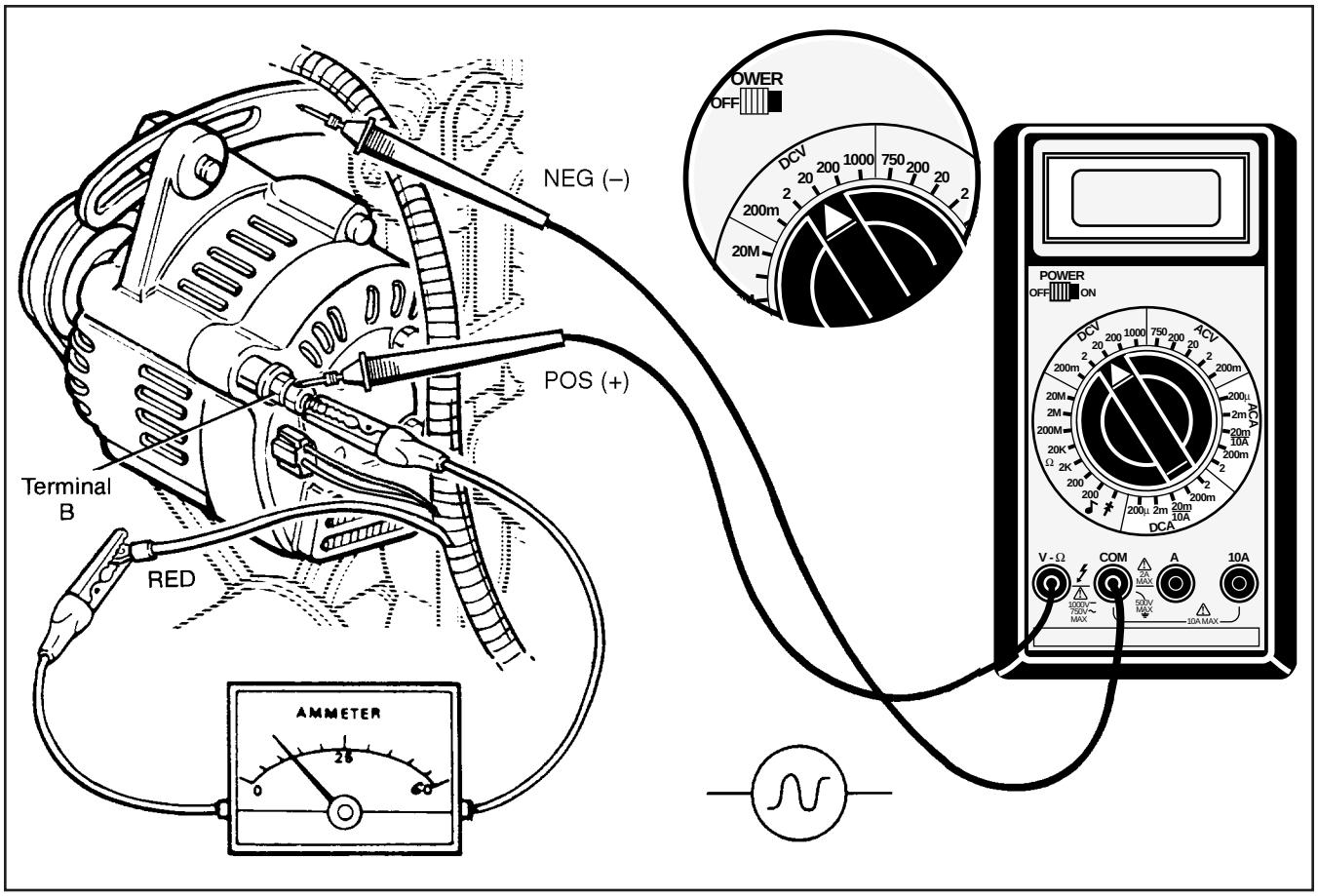


Figure 10E-1. Output Current Test

10E

SECTION 10E. CHARGING SYSTEM

6. Stop engine and replace battery with a known good battery.
7. Start the engine.
   - As engine RPM increases, voltage should increase to 14 to 14.5 volts. Current output should increase to a maximum of 40 amp.

NOTE

Charge condition of battery will affect current (amp) output.

- As the battery begins to charge, the current output will slowly decrease.
- If NO voltage and/or current is measured, alternator is faulty.

VOLTAGE TEST (See Figure 10E-2)

1. Set multimeter to 20 VDC range.
2. Connect NEG (–) lead of the multimeter to a good ground.
3. Touch the POS (+) lead of the multimeter to the “B” terminal of alternator.
   - Should read battery voltage, proceed with Step 4.
   - NO or low voltage, check battery, connections and wiring.
4. Remove plug from back of alternator.
5. Turn ignition key to the RUN position.
6. Touch POS (+) lead to plug terminal of the ORG wire.
   - Should read battery voltage.
   - NO voltage, 6 amp circuit breaker tripped.

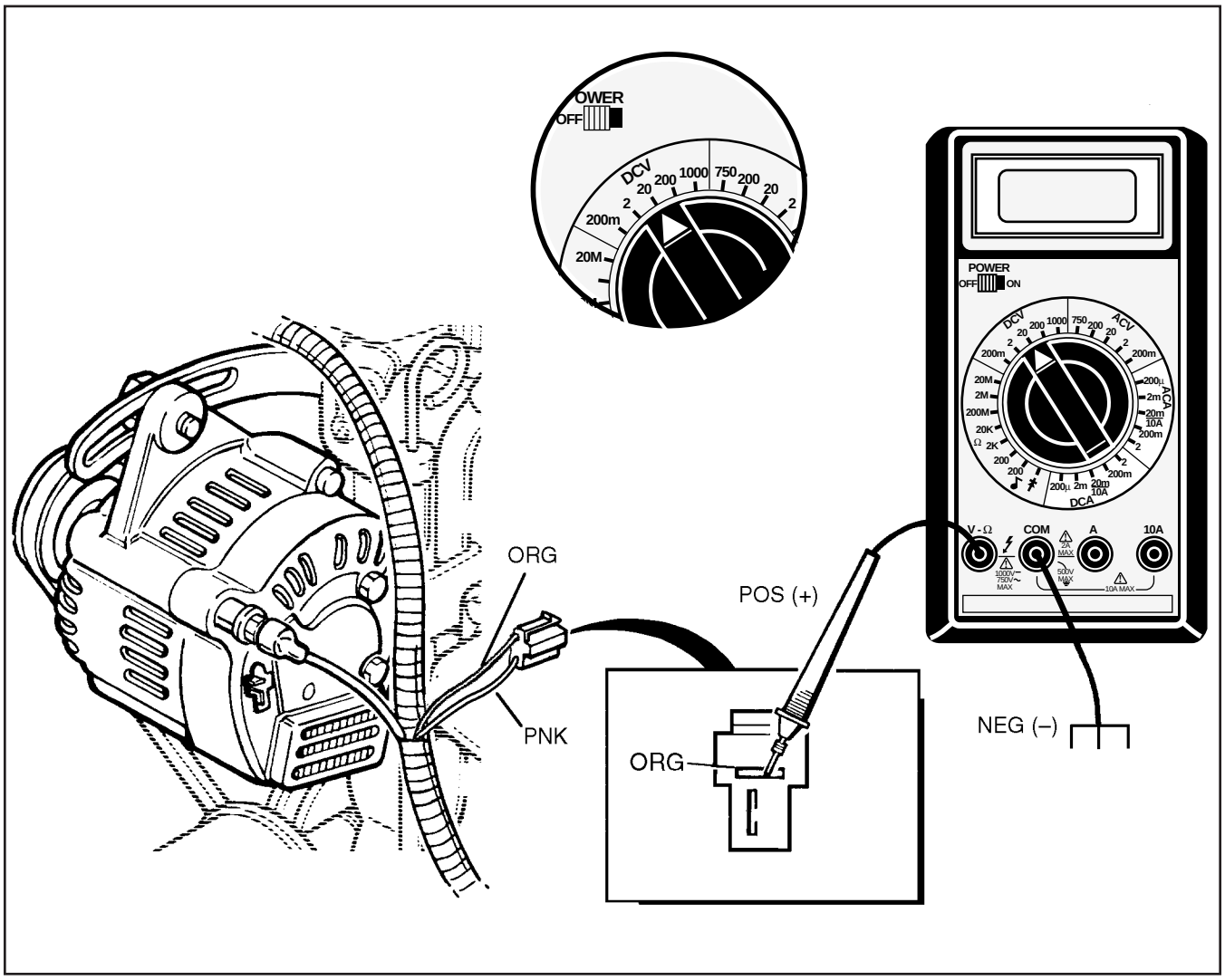


Figure 10E-2. Voltage Test

SECTION 10E. CHARGING SYSTEM

REGULATOR TEST (See Figure 10E-3)

1. Remove plug from back of alternator.
2. Set the multimeter to the continuity →⊢ test position.
3. Touch the multimeter leads to the two terminals of the alternator, then switch terminals.
   - Should have continuity in one direction ONLY.
   - If NO continuity or continuity in both directions, regulator may be faulty. Refer to the engine manufacturer's service manual for detailed test and repair instructions.

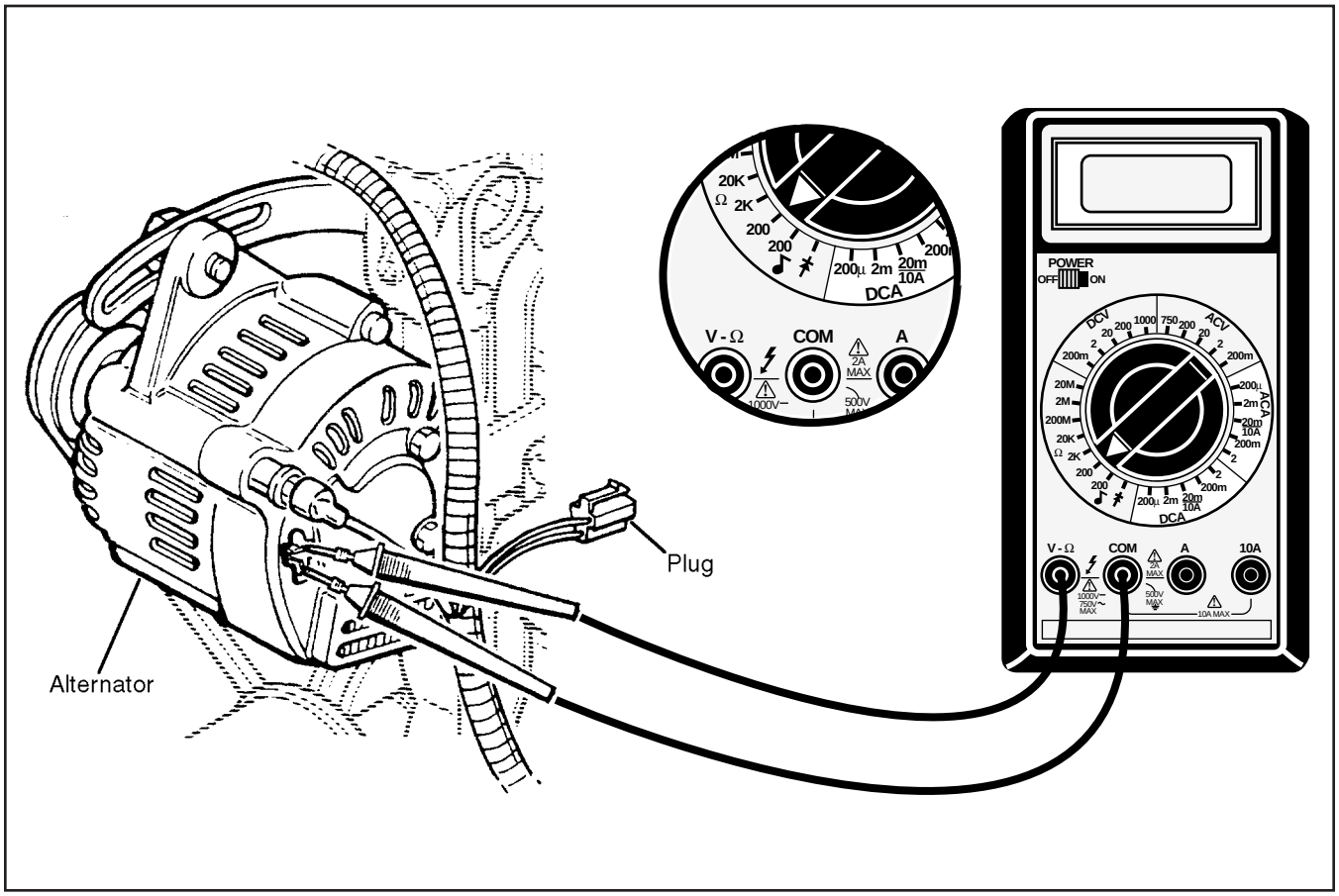


Figure 10E-3. Regulator Test

10E

SECTION 10F. STARTER

GENERAL

The repair of the starter is covered in the engine manufacturer's service manual which can be obtained through your local Textron Golf, Turf & Specialty Products Dealer/Distributor.

FIELD TEST

STARTER MOTOR SOLENOID (See Figure 10F-1)

1. Disconnect the NEG (–) battery cable.
2. Disconnect the RED lead from the coil and tape the end.
3. Connect the NEG (–) battery cable and turn the ignition switch to the START position.
   - Each time the ignition switch is turned to the start position, a "click" should be heard from the coil.
   - If no click is heard, the coil or electrical supply may be defective. Continue with the next step.
4. Remove the PUR/WHT solenoid wire.
5. Set the multimeter to 20 VDC and connect the POS (+) lead to the solenoid wire. Connect the NEG (–) lead to a good ground.
6. Turn and hold the ignition switch in the start position.
   - The multimeter should read battery voltage.
   - If no voltage is measured, an open seat switch (Section 10G), faulty wire (Section 10C) or ignition switch (Section 10G), could be at fault.

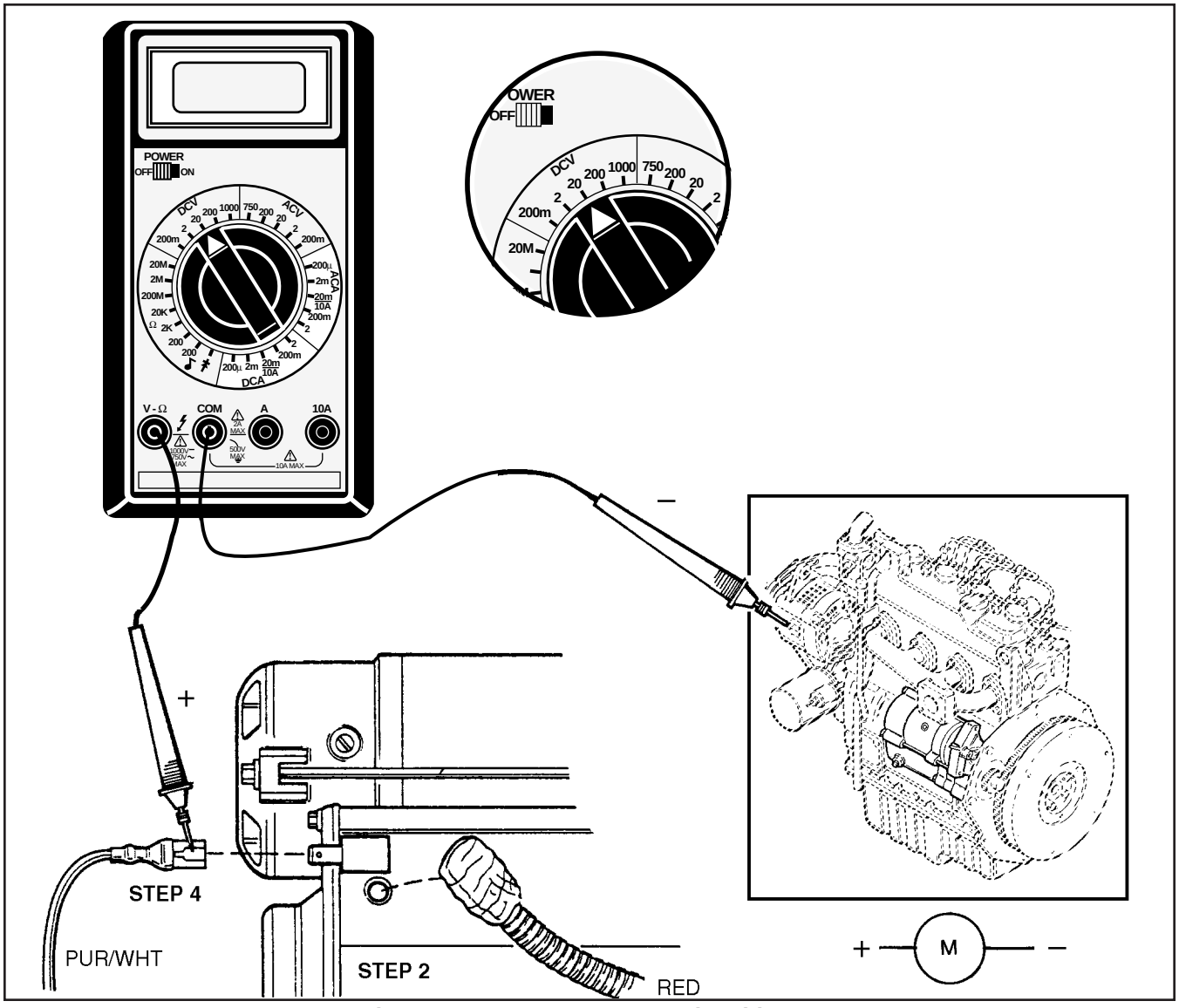


Figure 10F-1. Starter Motor Solenoid Test

10F

SECTION 10F. STARTER

STARTER MOTOR (See Figure 10F-2)

1. Disconnect the NEG (–) battery cable.
2. Disconnect the PUR/WHT solenoid wire from the starter solenoid.
3. Connect the POS (+) cable to starter as shown.
4. Connect cable to POS (+) terminal of battery.
5. Connect the NEG (–) cable to the NEG (–) terminal on the battery, touch NEG (–) cable to starter.
   - The starter motor should turn.
   - If the starter does not turn or turns slowly, connect a multimeter set at 20 VDC to the battery and repeat Step 4. Voltage should not drop below 10.5 volts.
   - If voltage is correct, starter may be faulty.

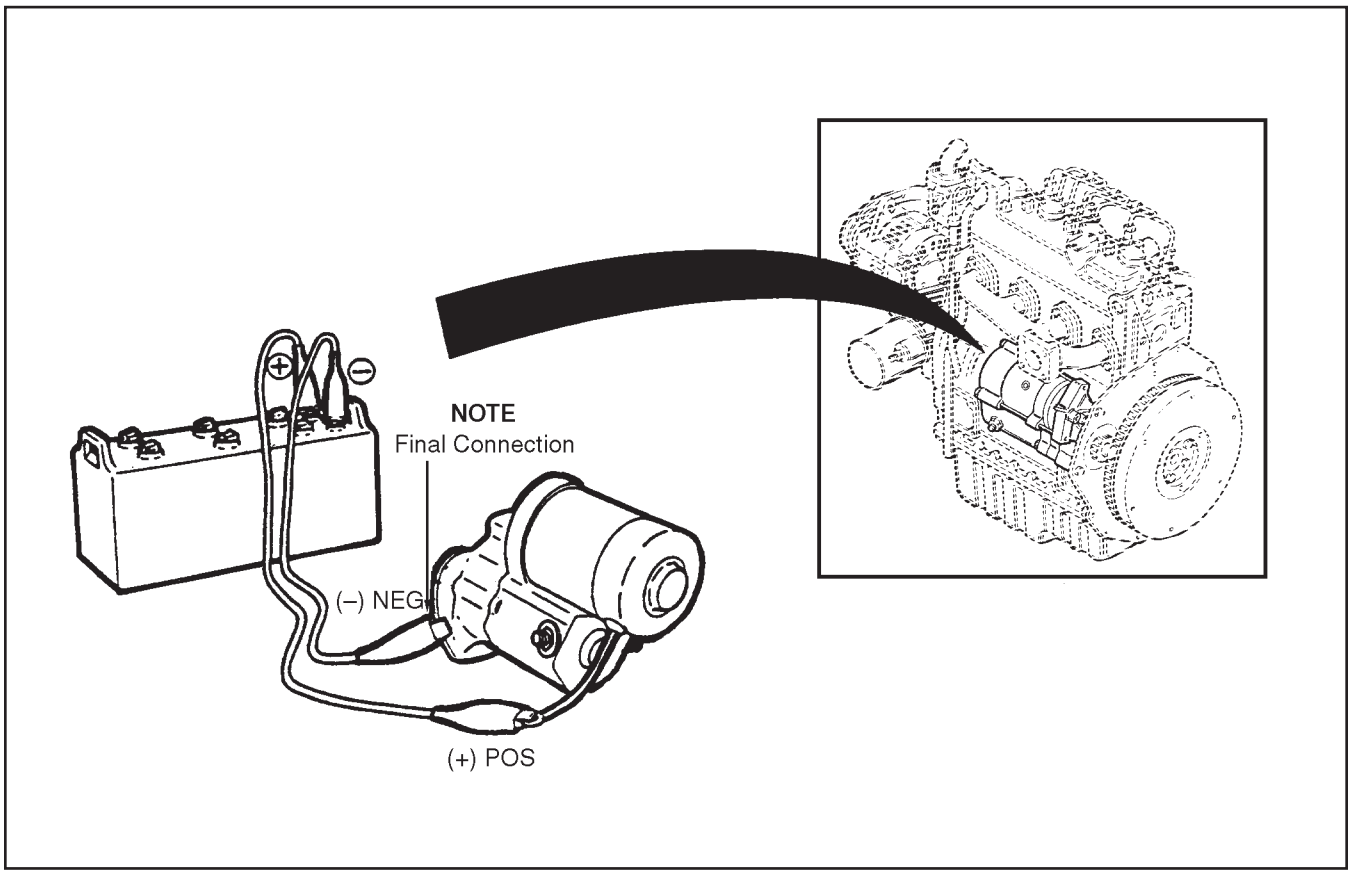


Figure 10F-2. Starter Motor Test

SECTION 10G. SWITCHES

SEAT SWITCH TEST (See Figure 10G-1)

1. Disconnect seat switch connector.
2. Set multimeter to 200 Ω (ohms).
3. Connect meter leads to connector terminals.
   - There should be no reading (no continuity) on the multimeter.
4. Depress seat switch.
   - There should be a reading (continuity) on the multimeter.

Replace a switch that does not meet all of the above tests.

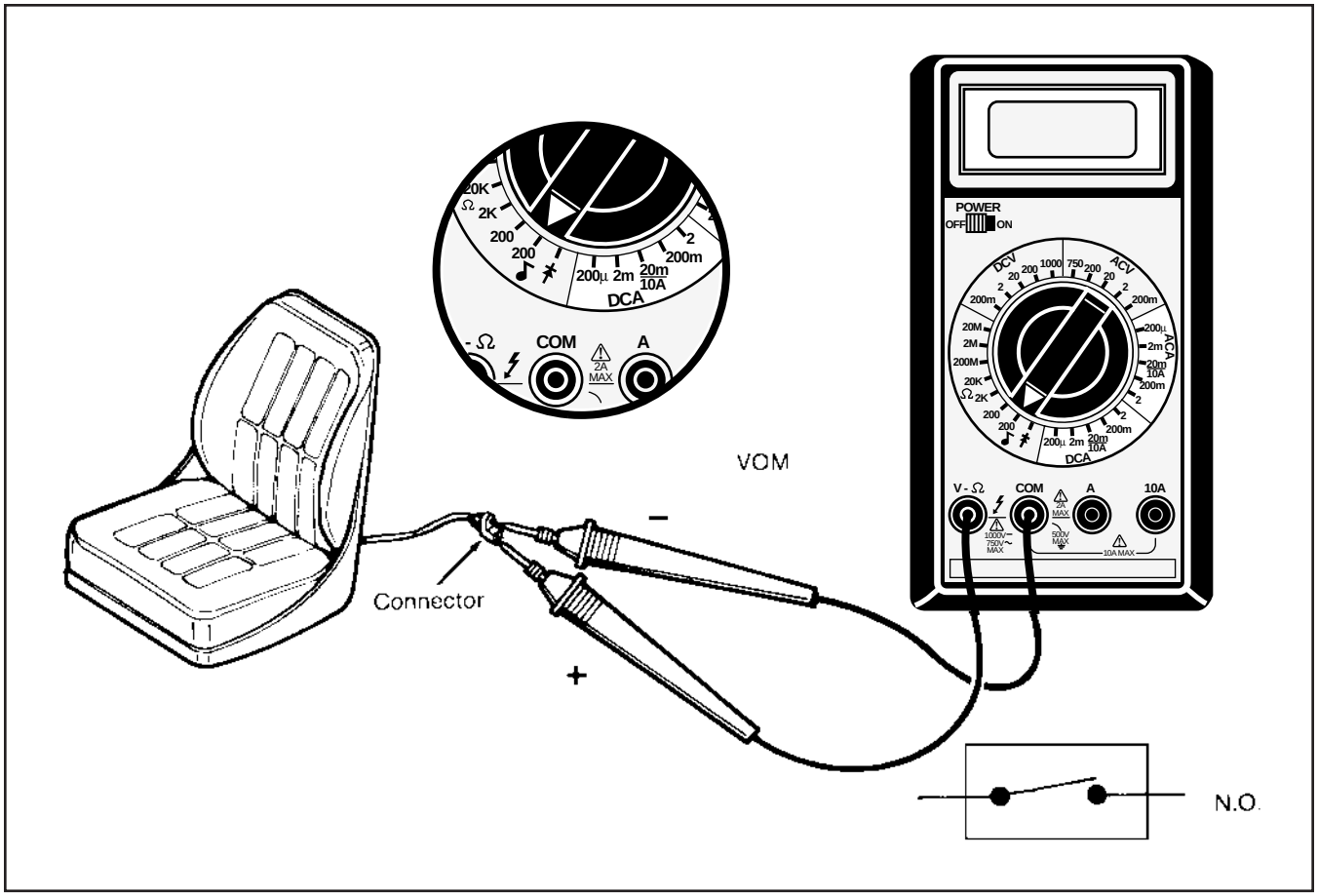


Figure 10G-1. Seat Switch Test

SECTION 10G. SWITCHES

IGNITION SWITCH TEST (See Figures 10G-1 and 10G-2)

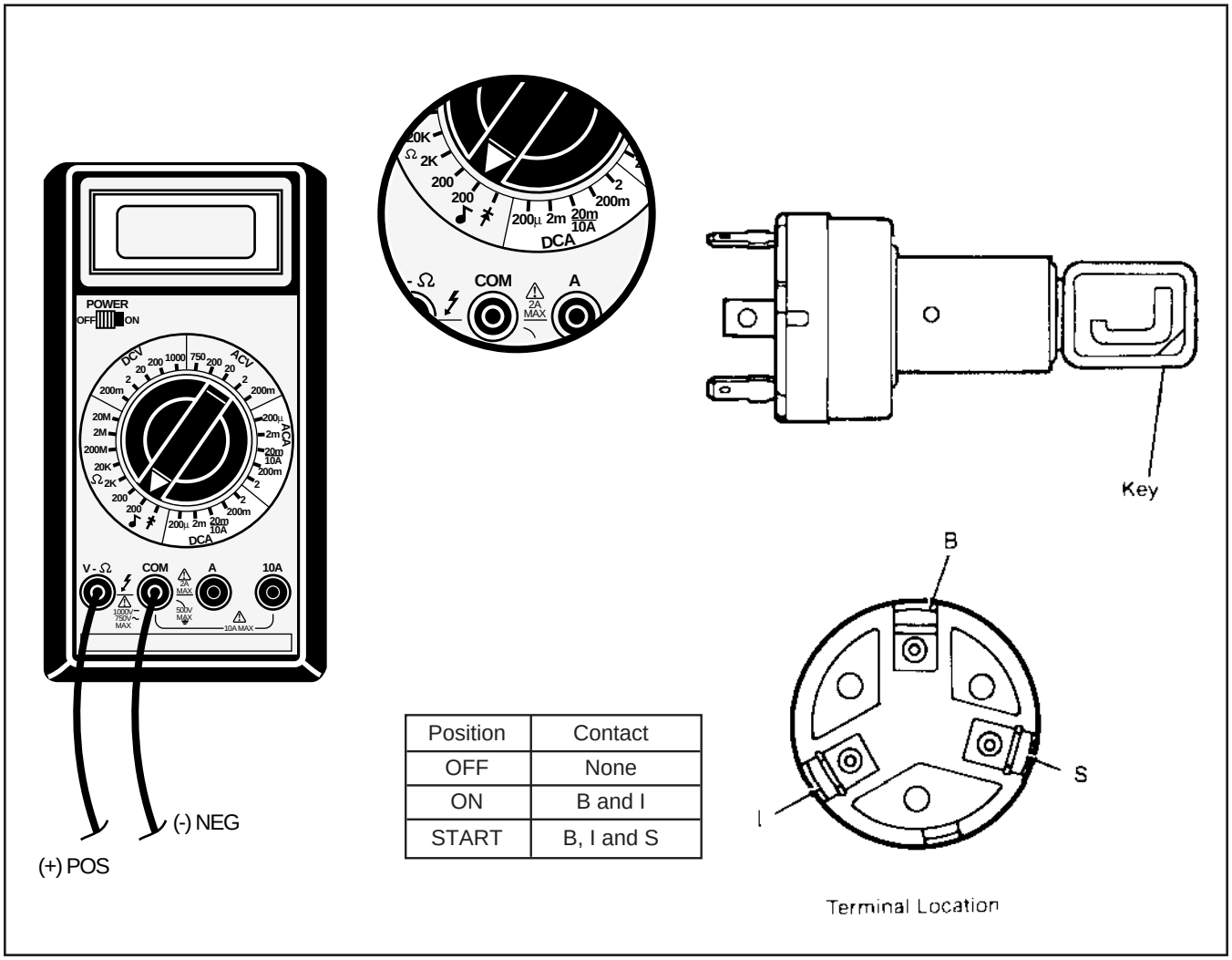
1. Disconnect the main battery connector plug.
2. Disconnect wires from the switch.
3. Set multimeter to 200 ♪ Ω (ohms).
4. See Figure 10G-3 and check all switch positions with key switch in OFF position. Connect test leads to any two terminals — check all three.
   - There should be no reading on multimeter.

NOTE

If there is a reading of more than 0.5 Ω (ohms) in any of the following tests, the switch is faulty and must be replaced.

5. With key switch in RUN position, connect black NEG (–) test lead to terminal B and red POS (+) lead to terminal I.
   - There should be a reading not to exceed 0.5 Ω (ohms) on the multimeter.
6. Hold switch in START position. Connect black NEG (–) lead to terminal B and red POS (+) lead to terminal I.
   - There should be a reading not to exceed 0.5 Ω (ohms) on multimeter.
7. Hold switch in START position. Connect black NEG (–) lead to terminal B and red POS (+) lead to terminal S.

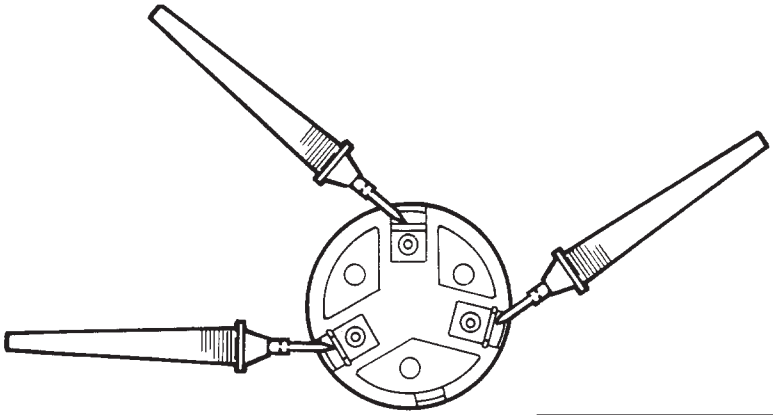
Replace a switch that does not meet all of the above tests.



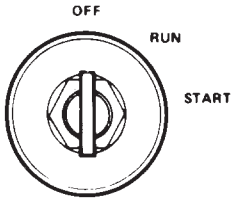
Position	Contact
OFF	None
ON	B and I
START	B, I and S

Figure 10G-2. Ignition Switch Test

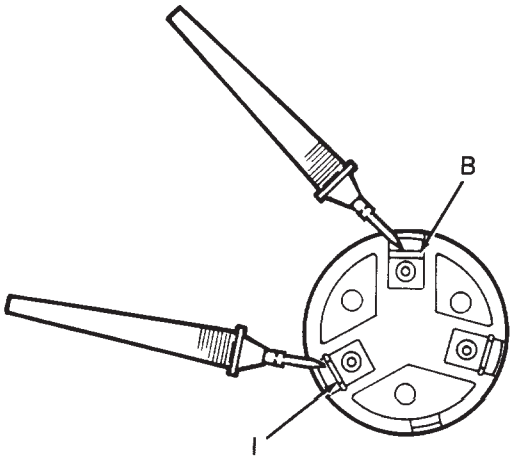
SECTION 10G. SWITCHES



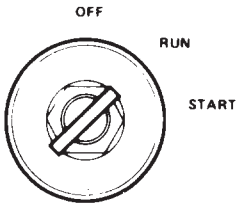
Contacts Open
No Continuity



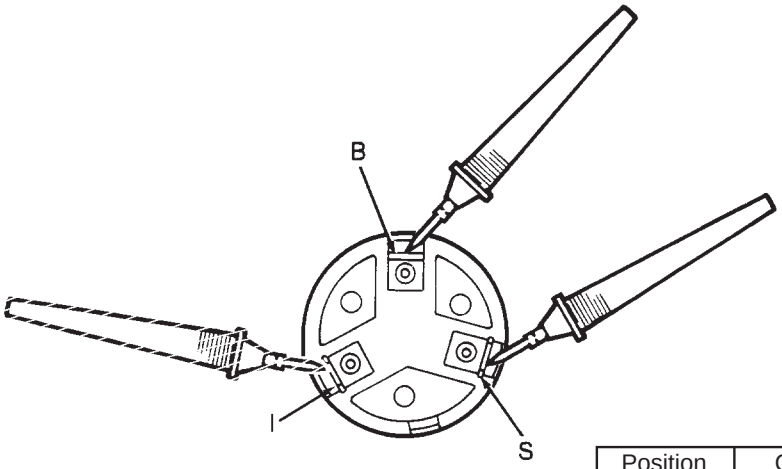
Position	Contacts
OFF	None



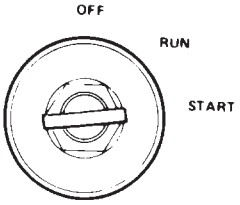
Contacts Closed
Continuity Max. 0.5 Ohms



Position	Contacts
Run	B and I



Contacts Closed
Continuity Max. 0.5 Ohms



Position	Contacts
Start	B, I and S

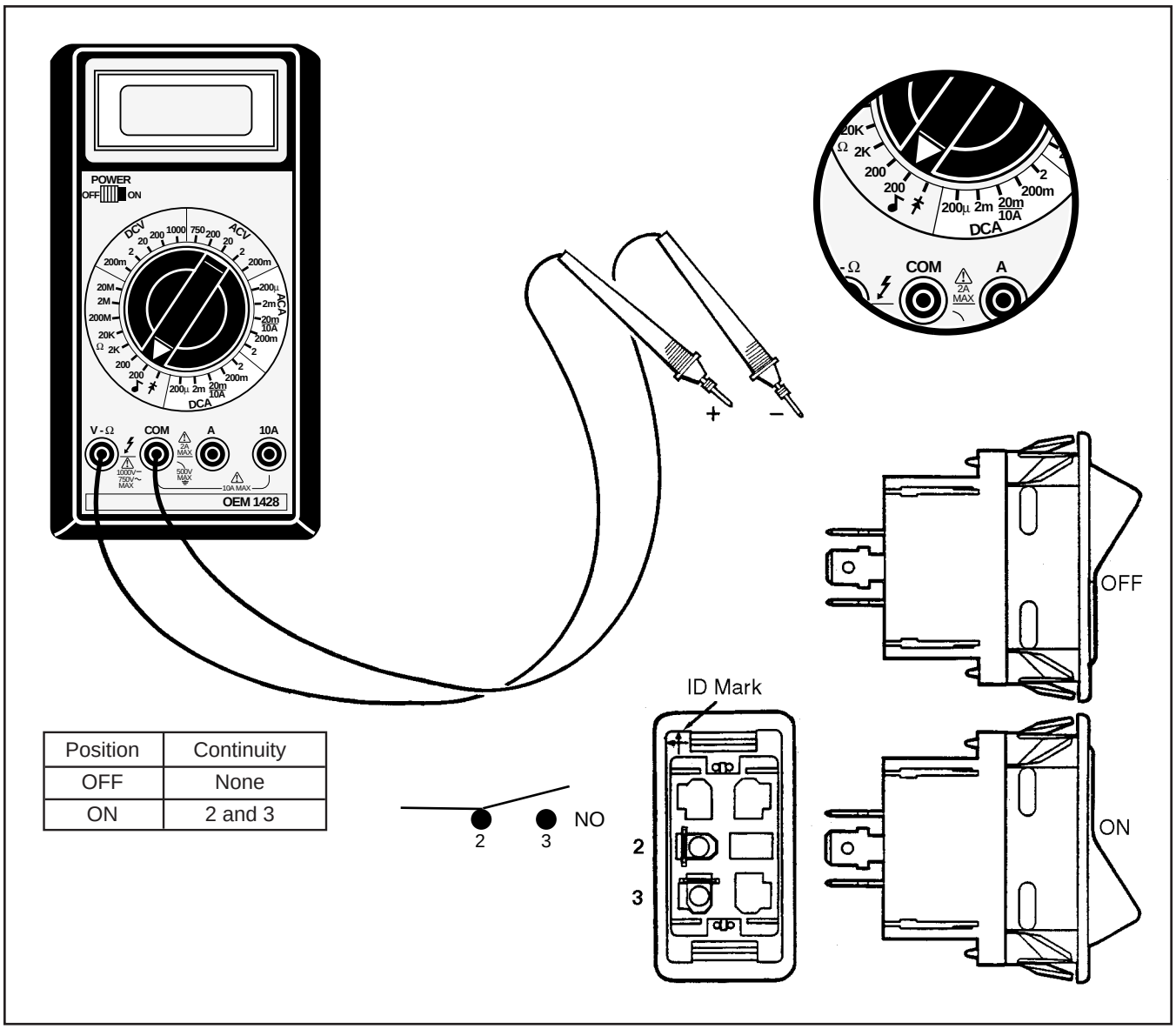
Figure 10G-3. Ignition Switch Test Step 4

SECTION 10G. SWITCHES

LIGHT, LOW HYDRAULIC LEVEL ALARM (HORN), BACKLAP AND 4WD SWITCH TESTS (See Figure 10G-4)

1. Mark and disconnect the switch connections.
2. Set multimeter to 200 ♪ Ω (ohms).
3. With switch in OFF position, check for continuity across all terminals (with switch in the OFF position).
   - There should be no reading on the multimeter.
4. Place switch in ON position and test as follows:
   a. Check for continuity by connecting one multimeter test lead to terminal 2 and the other to terminal 3.
      - There should be 0 to 0.5 Ω (ohms) on the multimeter.
   b. Check for continuity across remaining terminal (with switch in the ON position).
      - There should be no reading on the multimeter.

Replace a switch that does not meet all of the above tests.



Position	Continuity
OFF	None
ON	2 and 3

Figure 10G-4. Light, Low Hydraulic Level Alarm, Backlap and 4WD Switch Test

SECTION 10G. SWITCHES

MOW SWITCH TEST (See Figure 10G-5)

NOTE

This switch has a lock tab which must be pushed to move the rocker forward (CUT) or backward (REVERSE).

1. Mark and disconnect the switch connections.
2. Set multimeter to 200 ♪ Ω (ohms).
3. With switch in CUT position, test as follows:
   a. Connect one multimeter test lead to terminal 2 and the other lead to 1.
      - There should be 0 to 0.5 Ω (ohms) on the multimeter.
   b. Connect one multimeter test lead to terminal 5 and the other to terminal 4.
      - There should be 0 to 0.5 Ω (ohms) on the multimeter.
   c. Check for continuity across all remaining combinations of terminals (with switch in the center OFF position).
      - There should be no reading on the multimeter.
4. Place switch in REVERSE position and test as follows:
   a. Check for continuity by connecting one multimeter test lead to terminal 2 and the other to terminal 3.
      - There should be 0 to 0.5 Ω (ohms) on the multimeter.
   b. Connect one multimeter test lead to terminal 5 and the other to terminal 6.
      - Should be 0 to 0.5 Ω (ohms) on the multimeter.
   c. Check for continuity across all remaining combinations of terminals (with switch in the center OFF position).
      - There should be no reading on the multimeter.

Replace a switch that does not meet all of the above tests.

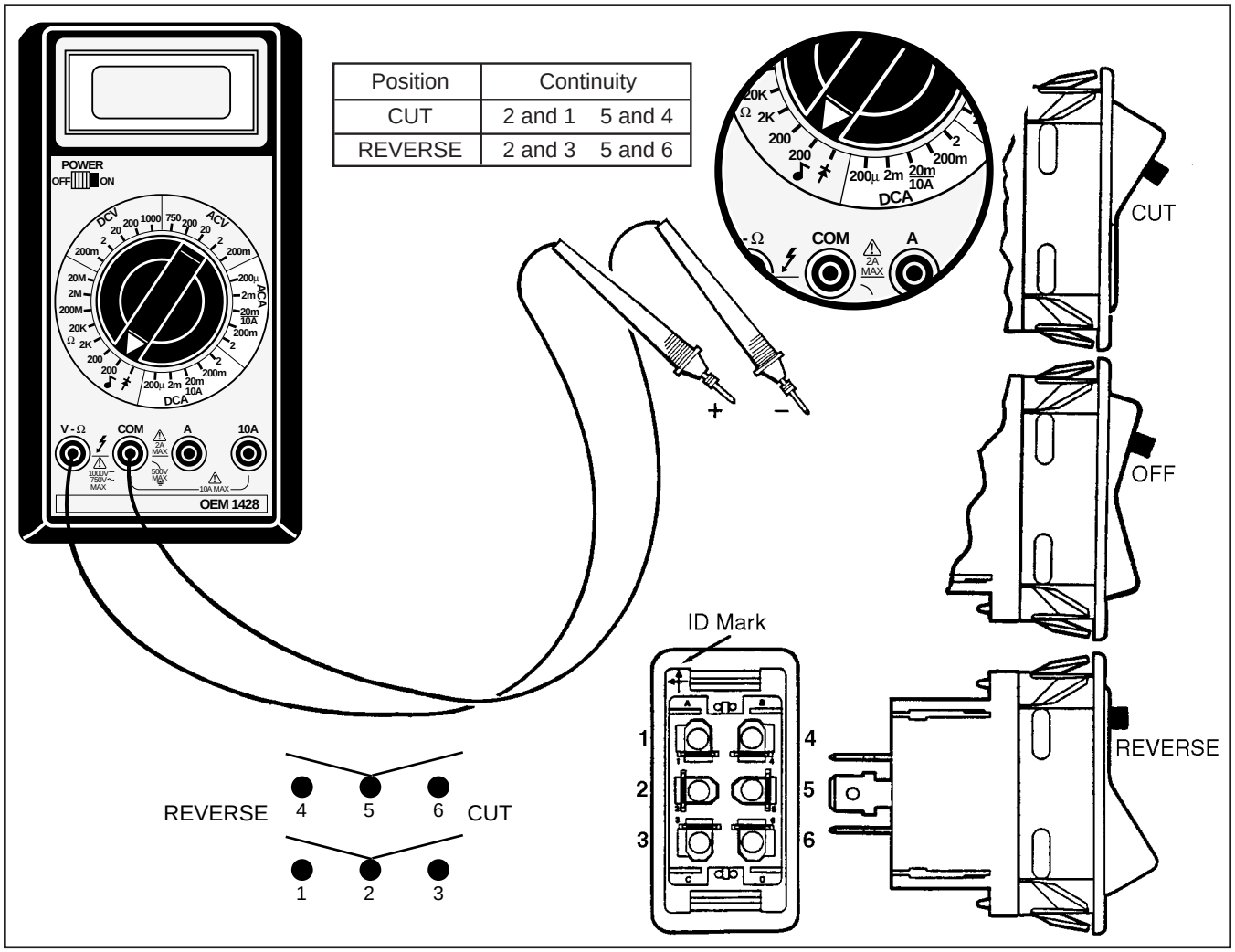


Figure 10G-5. Mow Switch Test

SECTION 10G. SWITCHES

CRUISE CONTROL SWITCH TEST (See Figure 10G-6)

1. Mark and disconnect the switch connections.
2. Set multimeter to 200 Ω (ohms).
3. With switch in ON 1 position, test as follows:
   a. Connect one multimeter test lead to terminal 2 and the other lead to 1.
      - There should be 0 to 0.5 Ω (ohms) on the multimeter.
   b. Connect one multimeter test lead to terminal 5 and the other to terminal 4.
      - There should be 0 to 0.5 Ω (ohms) on the multimeter.
   c. Check for continuity across all remaining combinations of terminals (with switch in the center OFF position).
      - There should be no reading on the multimeter.
4. Place switch in ON 2 position and test as follows:
   a. Check for continuity by connecting one multimeter test lead to terminal 2 and the other to terminal 3.
      - There should be 0 to 0.5 Ω (ohms) on the multimeter.
   b. Connect one multimeter test lead to terminal 5 and the other to terminal 6.
      - Should be 0 to 0.5 Ω (ohms) on the multimeter.
   c. Check for continuity across all remaining combinations of terminals (with switch in the center OFF position).
      - There should be no reading on the multimeter.

Replace a switch that does not meet all of the above tests.

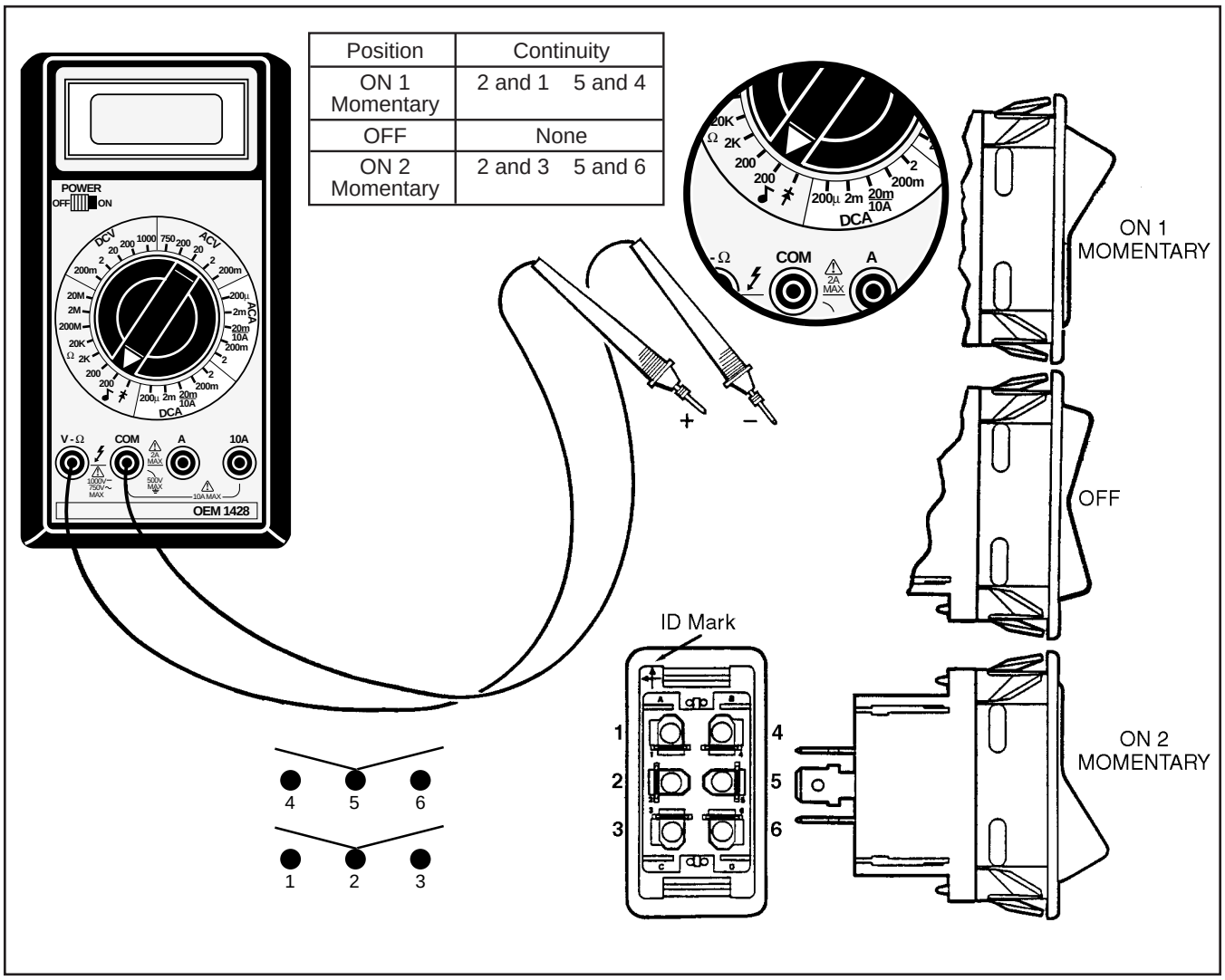


Figure 10G-6. Cruise Control Switch Test

SECTION 10G. SWITCHES

LIFT/LOWER JOYSTICK TEST (EARLY) (See Figure 10G-7)

GENERAL

The lift/lower joystick has three positions and actuates two built-in switches.

The joystick is inter-connected with the mow switch circuit. The function of the joystick changes depending on the mow switch position (off, cut, reverse).

The three positions are:

Joystick Position	Switch Function
• Centered (Neutral)	OFF
• Pushed Forward	Mow switch off — lowers mowers. Mow switch on — lowers mowers and mowers turn on.
• Pulled Back	Mow switch off — mowers raise until joystick is released. Mow switch on — mowers raise to cut position and mowers shut down.

1. Disconnect the joystick plug.
2. Set multimeter to 200 ♪ Ω (ohms).
3. Move the joystick to its center position.
4. Connect the NEG (–) test lead to pin #1.
5. Touch the POS (+) test lead to pin #2, then pin #3.
   - There should be no continuity.
   - If there is continuity, the switch or plug may be at fault.
6. Move the joystick to its forward position.
7. Touch the POS (+) test lead to pin #3.
   - There should be continuity. Resistance should not exceed 0.5 Ω (ohms).
   - If there is no continuity, the switch or plug may be at fault.
8. Move the joystick to its rear position.
9. Touch the POS (+) test lead to pin #2.
   - There should be continuity. Resistance should not exceed 0.5 Ω (ohms).
   - If there is no continuity, the switch or plug may be at faulty.

Replace a joystick that does not meet all of the above tests.

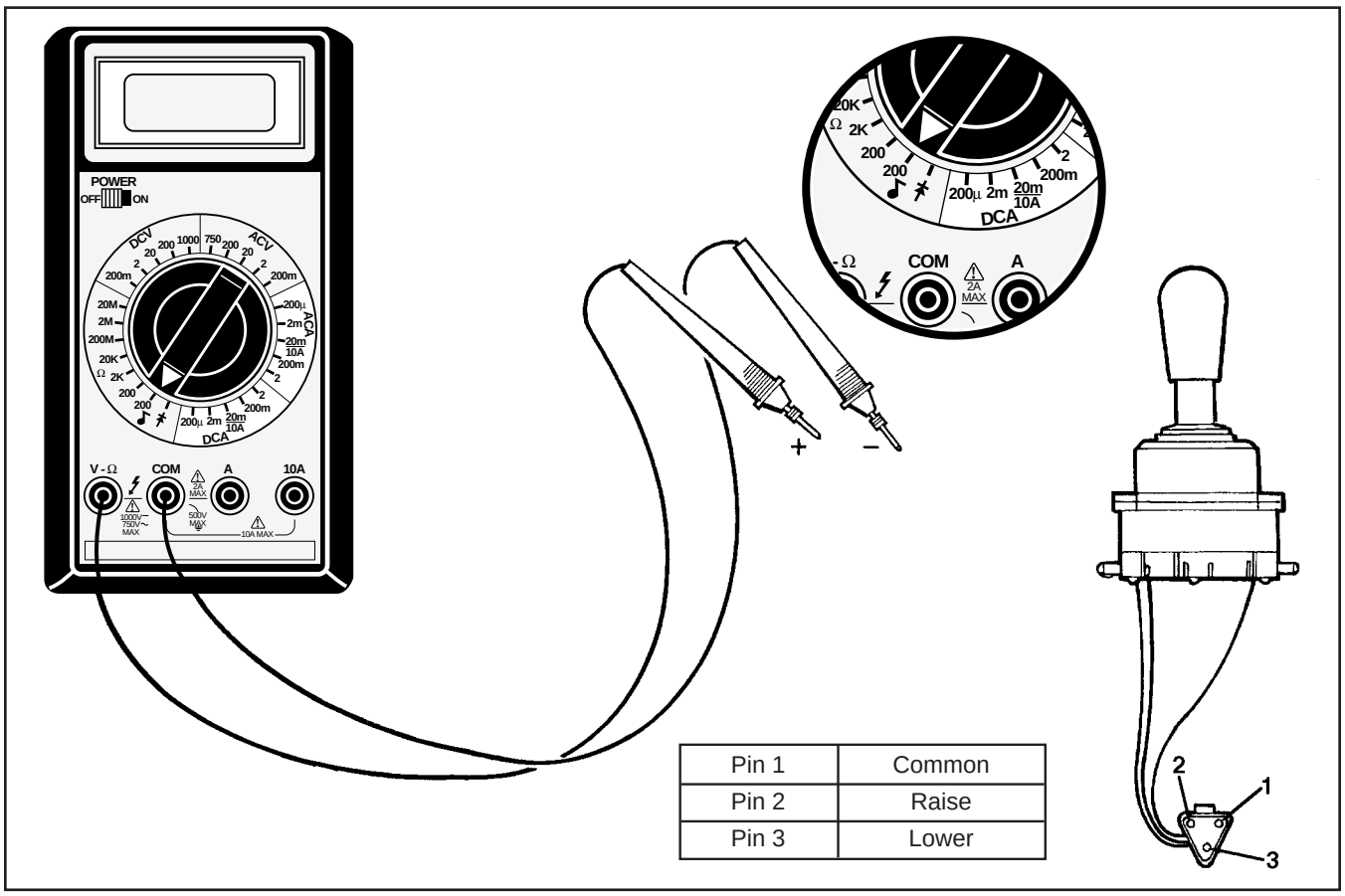


Figure 10G-7. Lift/Lower Joystick Test (Early)

10G

SECTION 10G. SWITCHES

LIFT/LOWER JOYSTICK TEST (LATE) (See Figure 10G-8)

GENERAL

The lift/lower joystick has three positions and actuates two built-in switches.

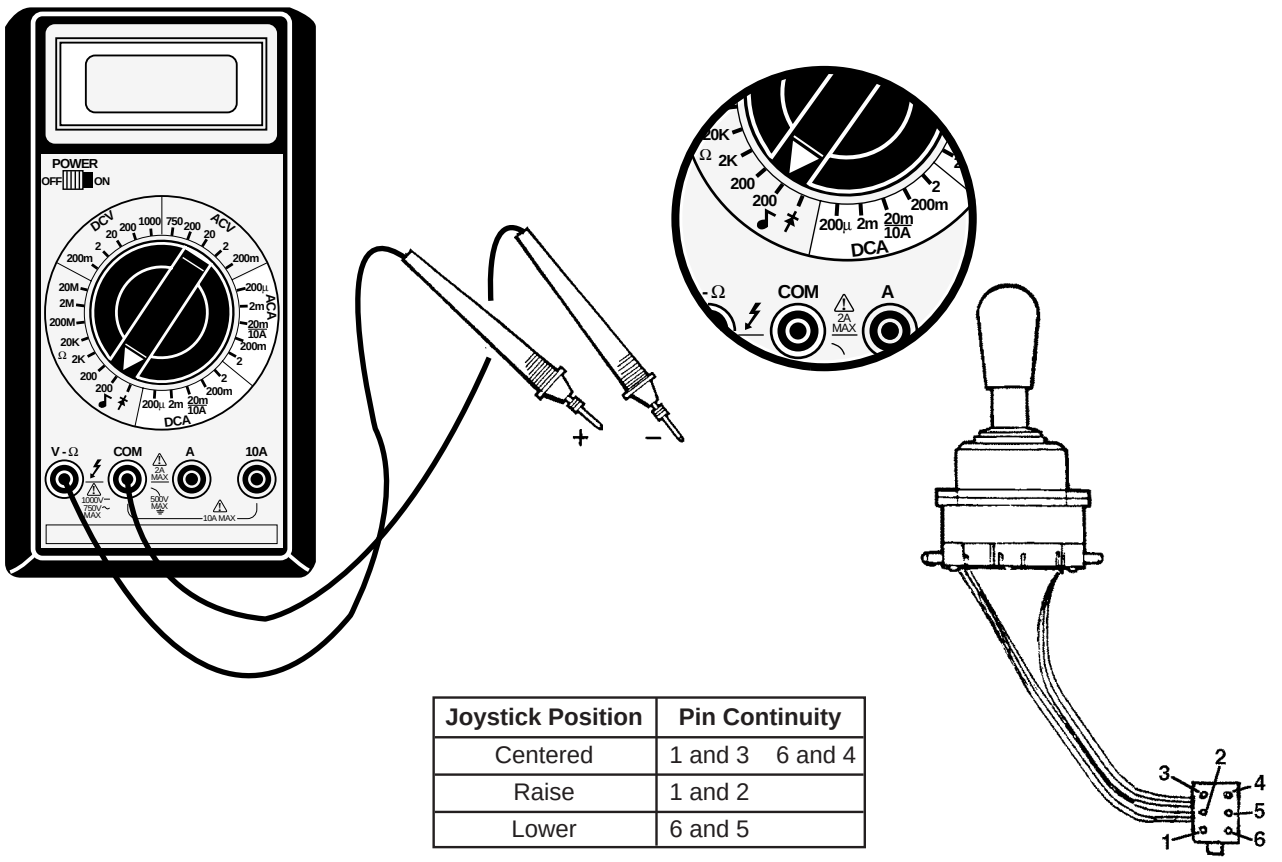
The joystick is inter-connected with the mow switch circuit. The function of the joystick changes depending on the mow switch position (off, cut, reverse).

The three positions are:

Joystick Position	Switch Function
• Centered (Neutral)	OFF
• Pushed Forward	Mow switch off — lowers mowers. Mow switch on — lowers mowers and mowers turn on.
• Pulled Back	Mow switch off — mowers raise until joystick is released. Mow switch on — mowers raise to cut position and mowers shut down.

1. Disconnect the joystick plug.
2. Set multimeter to 200 Ω (ohms).
3. Using the continuity table on Figure 10G-8, connect multimeter test leads to indicated pins.
4. Using the continuity table, determine continuity and resistance (ohms) for each position.
   - Resistance should be 0 to 0.5 Ω (ohms).

Replace a joystick that does not meet all of the above tests.



Joystick Position	Pin Continuity
Centered	1 and 3 6 and 4
Raise	1 and 2
Lower	6 and 5

Figure 10G-8. Lift/Lower Joystick Test (Late)

SECTION 10G. SWITCHES

PARKING BRAKE, LIFT ARM AND NEUTRAL START LIMIT SWITCH TESTS (See Figure 10G-9)

GENERAL

These limit switches are normally open proximity (reed) switch types. When a metallic target (screwdriver blade or other metallic object) is moved into the magnet's sensing area, the reeds change position moving — closing when the target is in the sensing area and opening when it is not.

CONTINUITY TEST

1. Disconnect the switch plug.
2. Set multimeter to 200 ♪ Ω (ohms).
3. Connect the multimeter POS (+) terminal to pin A and the NEG (–) terminal to pin B. With no target or magnet present there should be no continuity.
4. Pass a target across the sensing area of the switch. The switch contacts should close (continuity). Resistance should be 0 to 0.5 Ω (ohms).

SENSITIVITY TEST

The reed contacts should close within .050" minimum from alignment of the center line of the target and magnet. The sensor contacts must remain closed for a minimum travel of .180". Travel may be from either direction.

Replace a switch that does not meet all of the above tests.

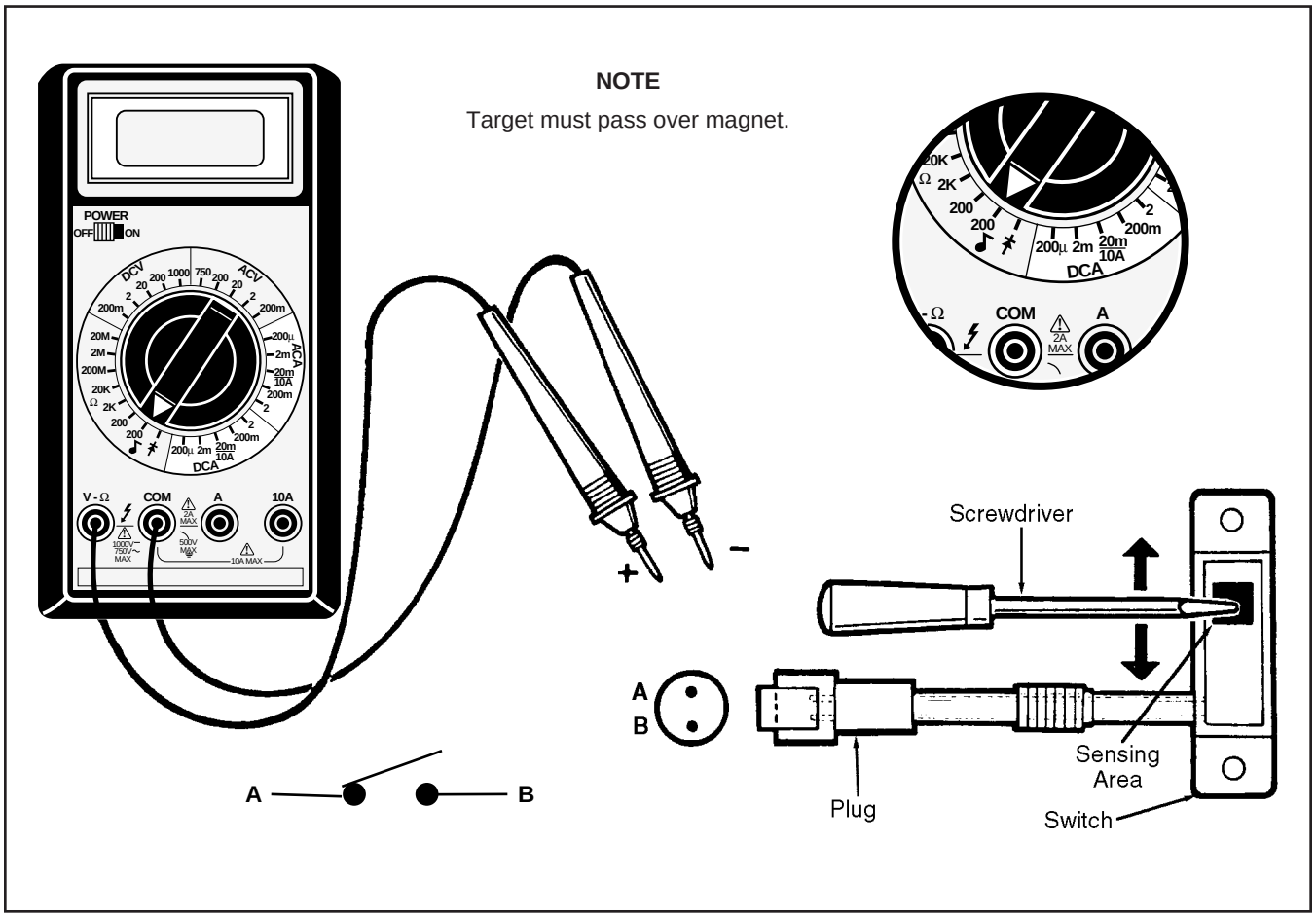


Figure 10G-9. Parking Brake, Lift Arm and Neutral Start Limit Switch Tests

10G

SECTION 10G. SWITCHES

HYDRAULIC OIL LEVEL FLOAT SWITCH TEST (See Figure 10G-10)

1. Disconnect both wires from switch.
2. Remove switch from tank.
3. Set multimeter to 200 ♪ (Ω) ohms.
4. Connect multimeter to leads of switch.
5. Raise float of switch.
   - Switch should OPEN (no continuity), switch is OK.
   - If multimeter shows continuity, switch may be faulty.
6. Lower float of switch.
   - Switch should CLOSE (continuity), multimeter should read 0 to 0.5 Ω (ohms) or less.

Replace a switch that does not meet all the above tests.

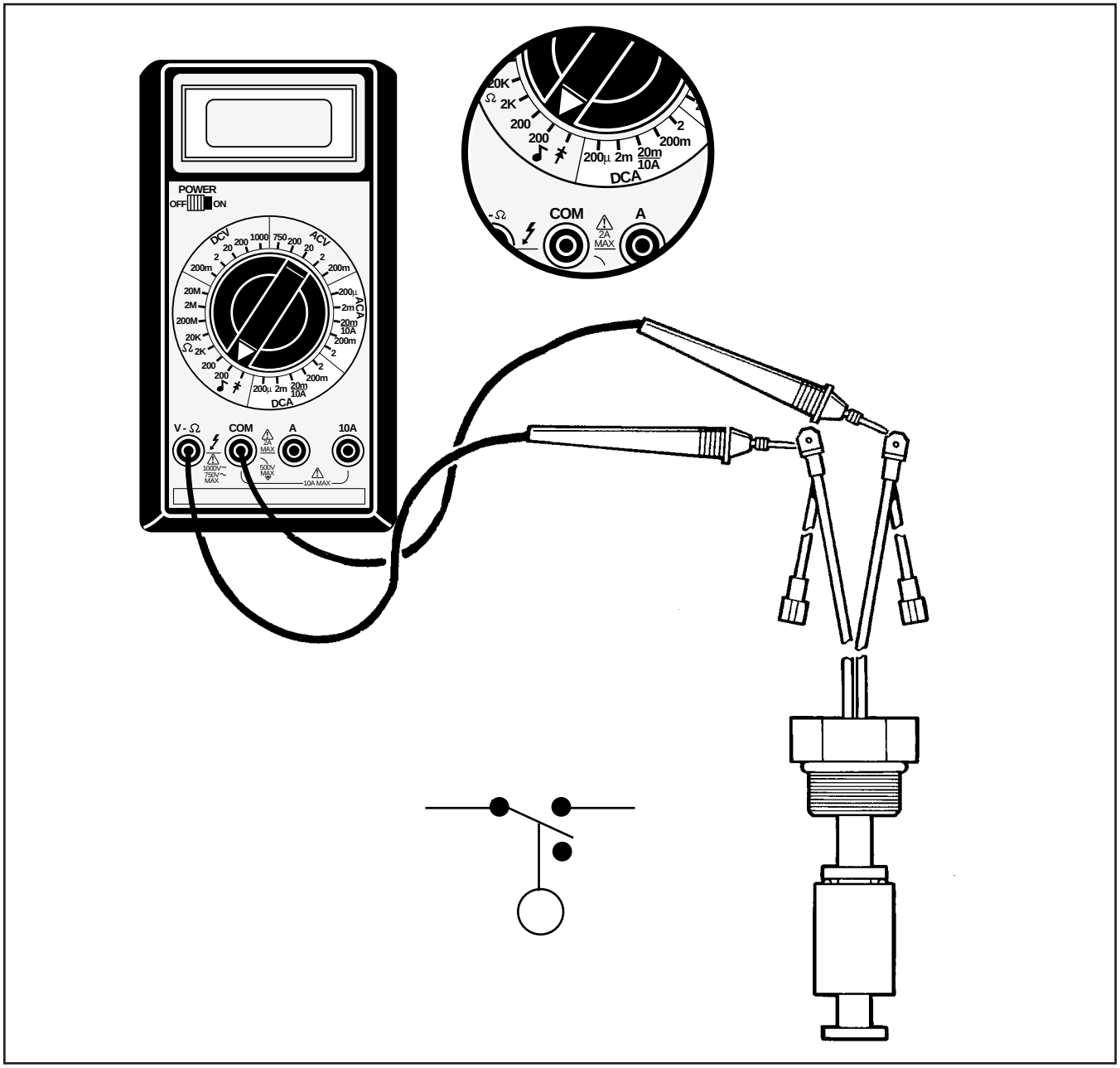


Figure 10G-10. Hydraulic Oil Level Float Switch Test

SECTION 10G. SWITCHES

ENGINE OIL PRESSURE SWITCH TEST (See Figure 10G-11)

The engine oil pressure switch is a normally CLOSED (NC) switch. When the ignition key is turned ON the engine oil pressure light comes on. When the engine is started and oil pressure increases above 10 psi, the switch OPENS and the engine oil pressure light goes OFF.

FIELD TEST

Engine oil pressure light does not come on when ignition switch is turned ON.

Using a jumper wire, ground the switch terminal.

- Light comes on, proceed with switch test, Step 1.
- Light does not come ON, check circuit wiring and/or bulb.

Engine oil pressure light does not go off when engine is started.

Remove DK BLU wire from switch terminal.

- Light goes OFF, proceed with switch test, Step 1.
- Light does not go OFF, check circuit wiring for ground.

SWITCH TEST

1. Set multimeter to 200 ♪ Ω (ohms) scale.
2. Connect test leads as shown.
   - There should be continuity and the meter should read 0 to 0.5 Ω (ohms).
3. Increase pressure above 10 psi.
   - Switch contacts should open.

NOTE

If switch tests OK and the engine oil pressure light still does not go out, engine oil pressure may be too low.

Replace a switch that does not meet all the above tests.

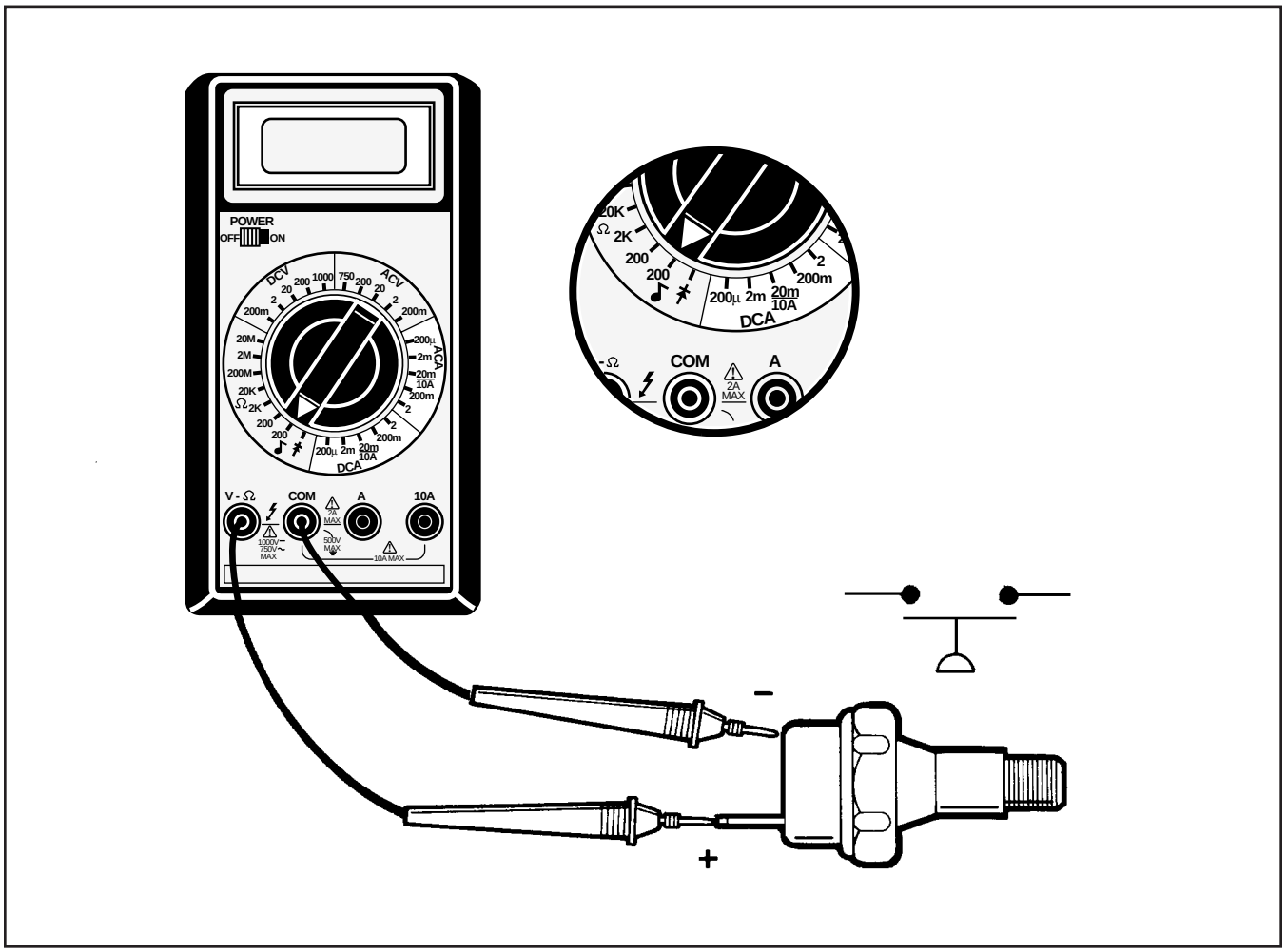


Figure 10G-11. Engine Oil Pressure Switch Test

10G

SECTION 10G. SWITCHES

HYDRAULIC CHARGE PRESSURE SWITCH TEST (See Figure 10G-12)

The charge pressure switch is a normally OPEN (NO) switch. When the engine is started and hydraulic charge pressure rises above 25 psi (172 kPa), the switch CLOSES.

FIELD TEST

Hydraulic charge filter light does not come on when ignition switch is turned ON.

At the switch, disconnect the wires.

- Light comes ON, proceed with switch test, Step 1.
- Light does not come ON, check circuit wiring and/or bulb.

SWITCH TEST

1. Set multimeter to 200 ♪ Ω (ohms) scale.
2. Connect test leads as shown.
   - Switch contacts should open.
3. Increase pressure above 18 psi.
   - There should be continuity and the meter should read 0 to 0.5 Ω (ohms).

Replace a switch that does not meet all the above tests.

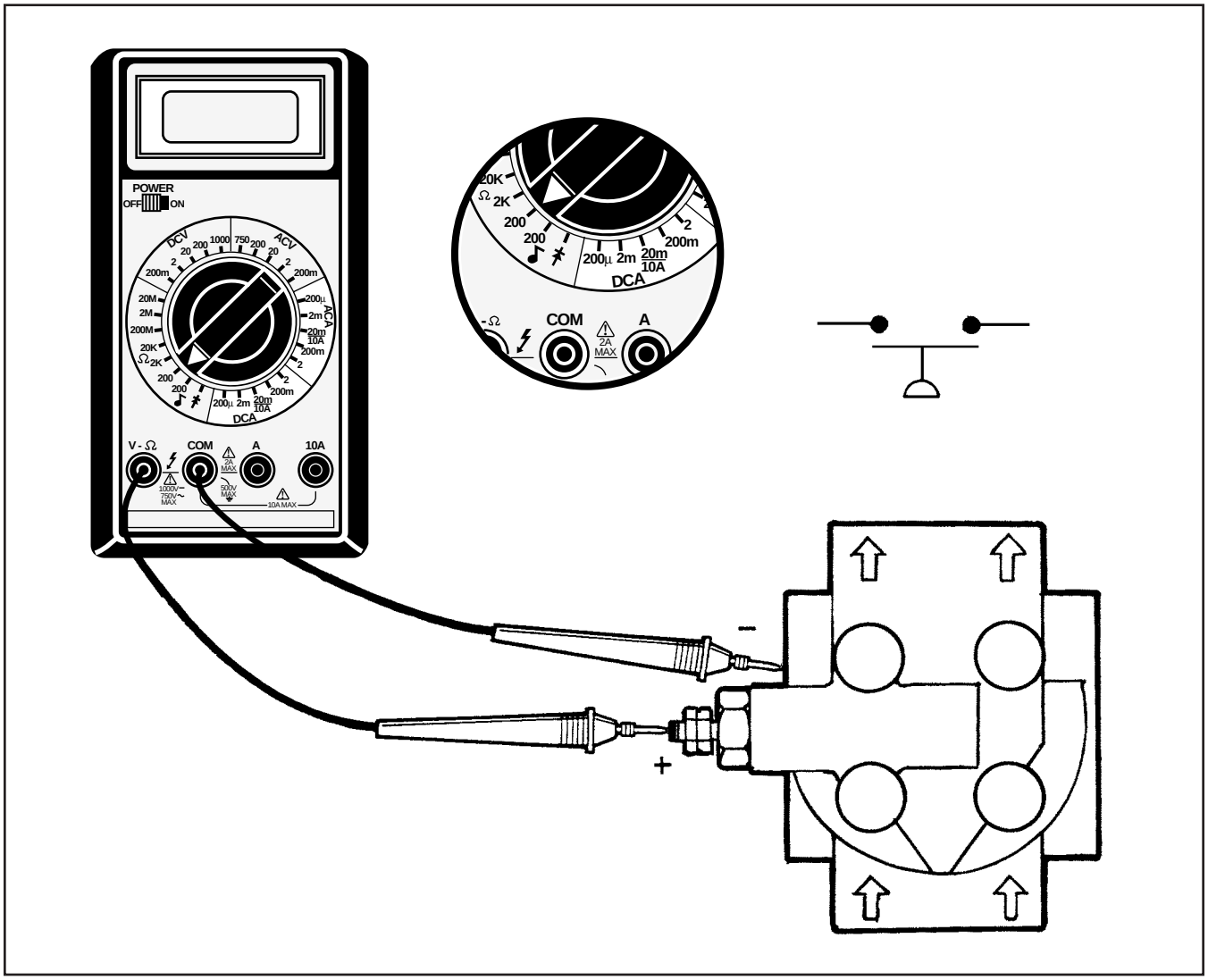


Figure 10G-12. Hydraulic Charge Pressure Switch Test

SECTION 10H. CIRCUIT BREAKERS

CIRCUIT BREAKER TEST (See Figure 10H-1)

1. Set motor to 200 ♪ Ω (ohms) scale.
2. Connect meter leads to terminals as shown.
   - With the circuit breaker open (tripped) there should be no continuity on the meter scale.
3. Depress button (close).
   - There should be a reading (continuity) on meter scale.

Replace a circuit breaker that does not meet the above tests.

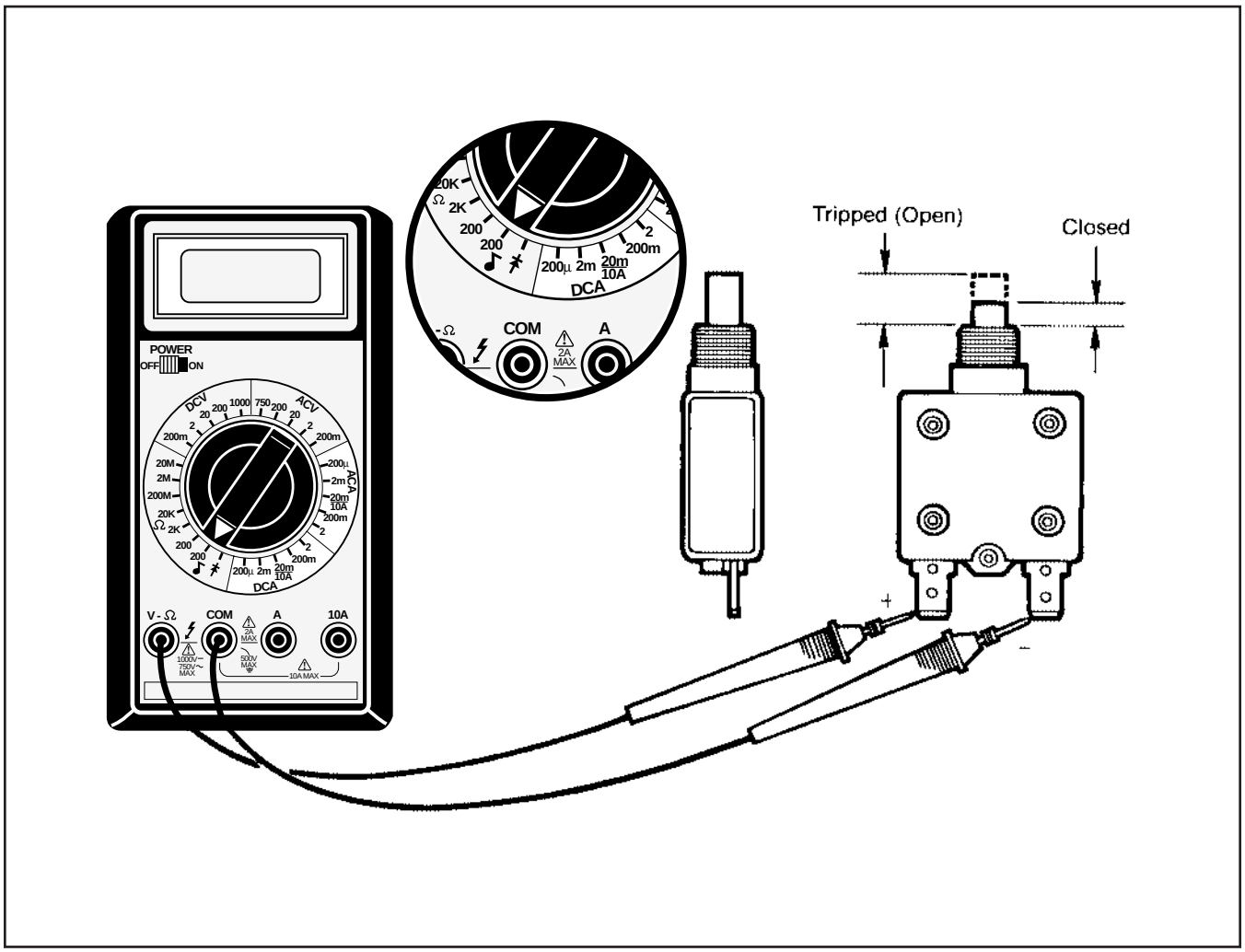


Figure 10H-1. Circuit Breaker Test

10H

SECTION 10I. SENDERS

ENGINE COOLING WATER TEMPERATURE SENDER TEST (See Figure 10I-1)

The temperature sender is a rheostat type.

As temperature rises, resistance Ω (ohms) decreases, causing the gauge to read higher.

FIELD TEST

1. Remove DK GRN wire from sender and ground.
   - If gauge jumps to its highest reading sender is faulty.
   - If gauge does not jump to its highest reading, gauge or wiring may be faulty.

Replace a sender or gauge that does not meet all the above tests.

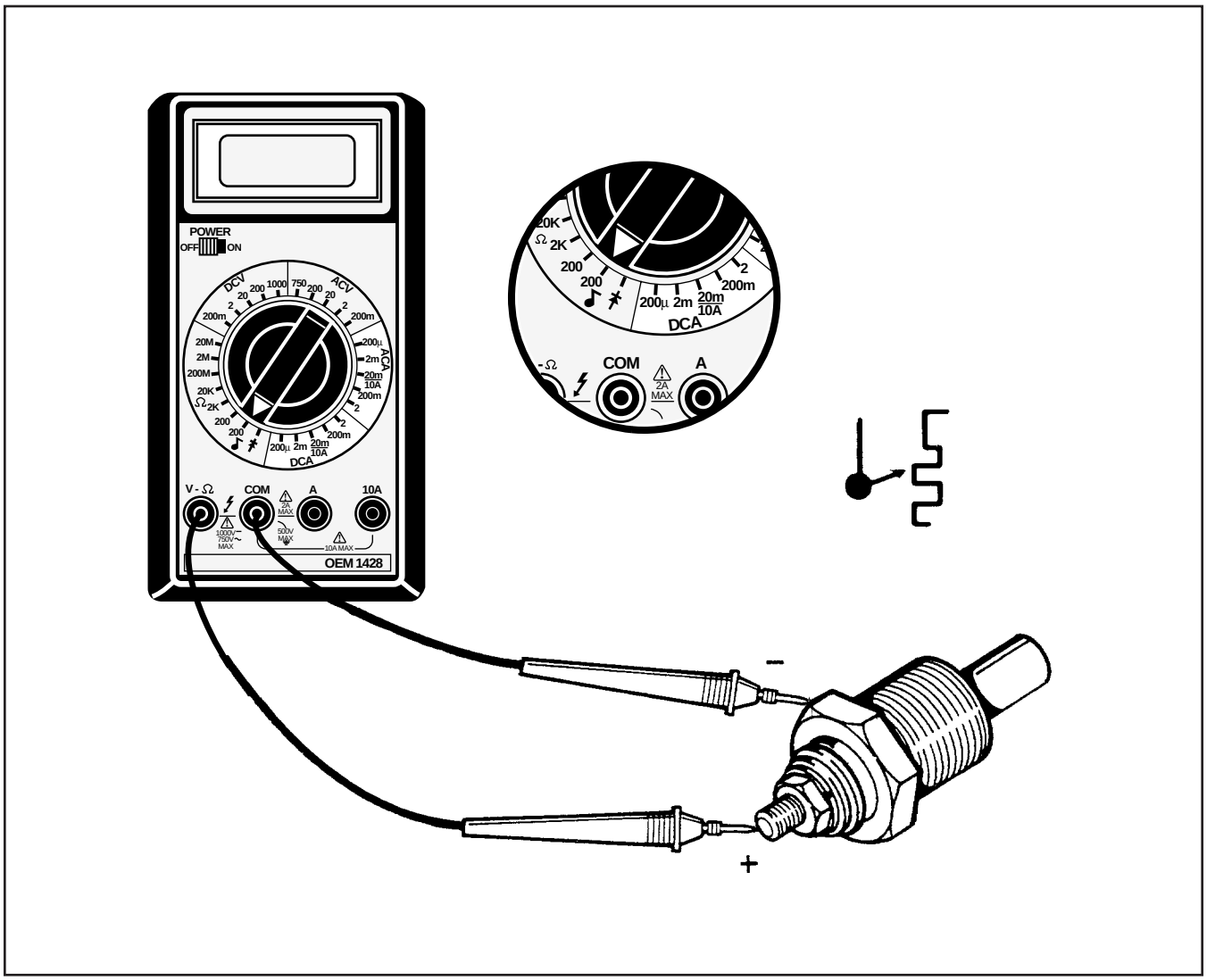


Figure 10I-1. Engine Cooling Water Temperature Sender

10I

SECTION 10J. RELAYS

RELAY TEST (See Figure 10J-1)

See Figure 10M-1 and test relay as follows:

1. Set multimeter to 200 Ω (ohms).
2. Connect black NEG (–) lead from multimeter to terminal 30.
3. Connect red POS (+) lead from multimeter to terminal 87a.
   - There should be continuity. If there is no continuity, replace relay.
4. Move the red lead to terminal 87.
   - There should be no reading on multimeter (no continuity). If there is a reading, replace relay.
5. Connect 12V across terminals 85 and 86. There should be an audible “click”.
6. Connect black NEG (–) lead from multimeter to terminal 30.
7. Connect red POS (+) lead from multimeter to terminal 87a.
   - Open when coil is energized.
8. Move red lead to terminal 87.
   - Closed when coil is energized.

Replace a relay that does not meet the above tests.

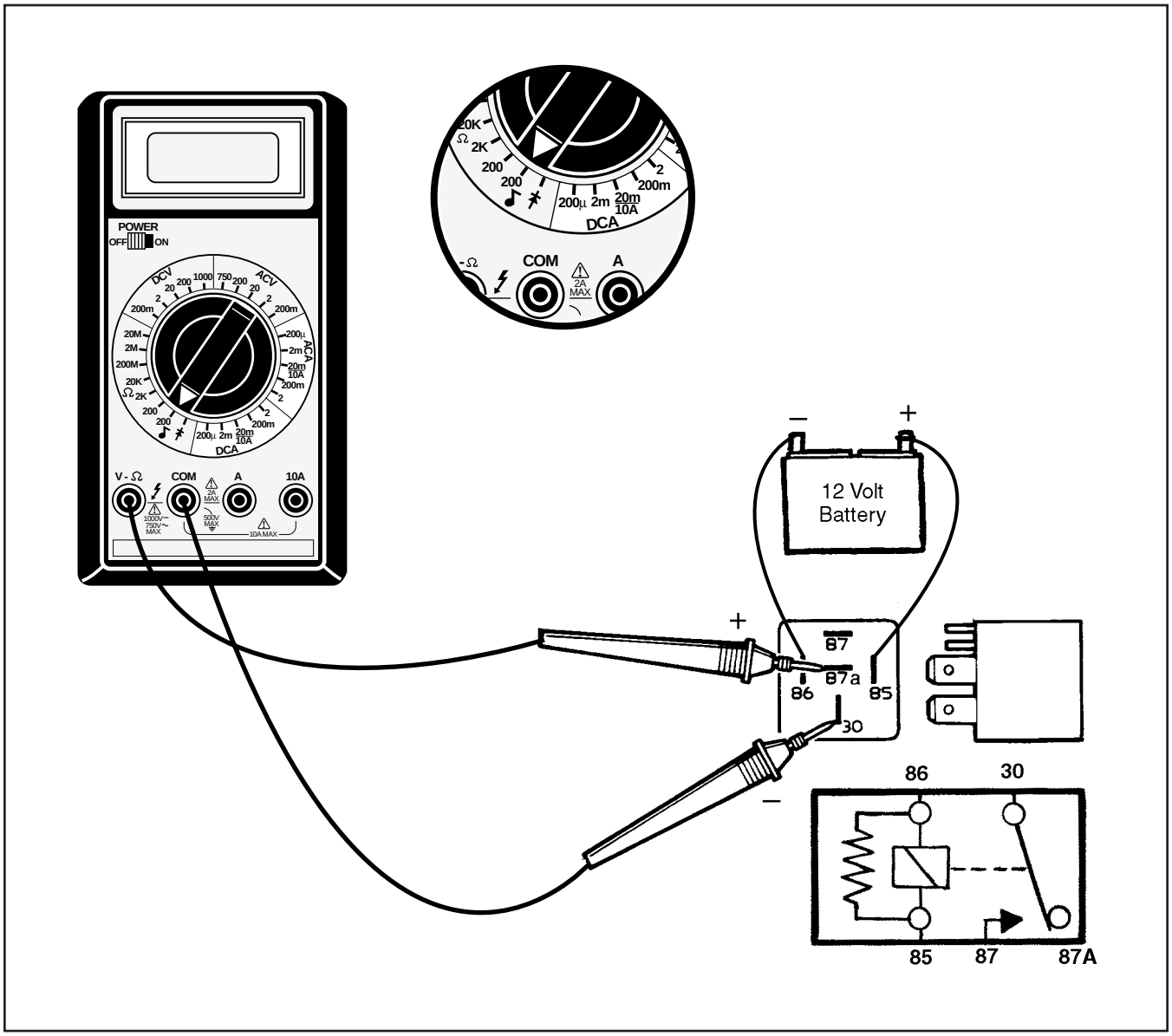


Figure 10J-1. Relay Test

SECTION 10K. DIODE TEST

DIODE TEST

See Figure 10K-1 and test diode as follows:

1. Set meter to →⊢ scale.
2. Connect meter leads to diode as shown.
   - There should be a reading (continuity) on the meter scale.
3. Reverse the POS (+) and NEG (–) test leads.
   - There should be no continuity.
   - If continuity registers in both positions, the diode is faulty.
   - If there is no continuity in either direction, diode is also faulty.

Replace a diode that does not meet the above tests.

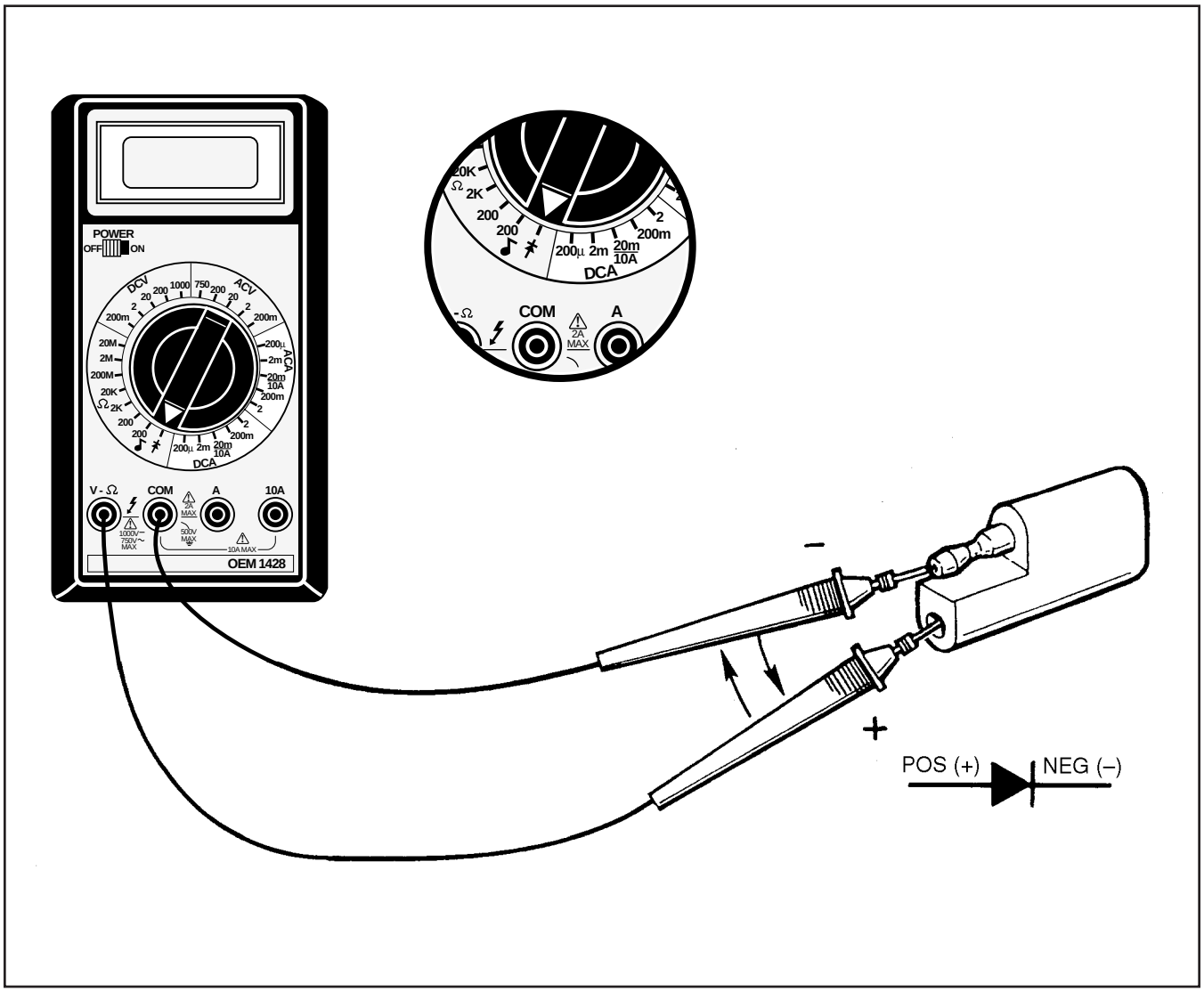


Figure 10K-1. Diode Test

10K

SECTION 10L. SOLENOIDS

FUEL SOLENOID TEST (See Figure 10L-1)

When the ignition switch is turned to the START position, the solenoid plunger retracts approximately 1 inch (25.4 mm). This opens the fuel system.

TEST

Solenoid does not PULL IN (open fuel system) when ignition switch is turned to start.

1. Disconnect solenoid plug.
2. Set multimeter to 20 VDC range.
3. Connect black NEG (–) lead of multimeter to terminal of BLK wire.
4. Connect red POS (+) lead of multimeter to terminal of WHT wire.
5. Turn and hold ignition switch in the START position.
   - Multimeter should read battery voltage if tests are OK, fuel solenoid may be faulty.
   - If low or no voltage registers, check for high resistance or opens.

Solenoid does not HOLD after starting engine and ignition switch returned to the RUN position.

1. Disconnect solenoid plug.
2. Set multimeter to 20 VDC range.
3. Connect black NEG (–) lead of multimeter to terminal of BLK wire.
4. Connect red POS (+) lead of multimeter to terminal of RED/YEL wire, turn ignition switch to RUN.
   - There should be no reading, proceed with Step 5.
   - If multimeter reads battery voltage, charge pressure relay or switch may be faulty.
5. Turn ignition switch to START and crank over engine.
   - Multimeter should read battery voltage.
   - If no voltage is present, proceed with Step 6.
6. Disconnect the charge pressure switch plug.
7. Using a suitable jumper wire, ground the PUR/GRN wire terminal of the socket.
8. Turn ignition switch to START and crank over engine.
   - Multimeter should read battery voltage. Tractor has no charge pressure.
   - If no voltage is present, charge pressure relay may be faulty, test. If relay test is satisfactory, fuel solenoid is faulty.

Replace a solenoid that does not meet the above tests.

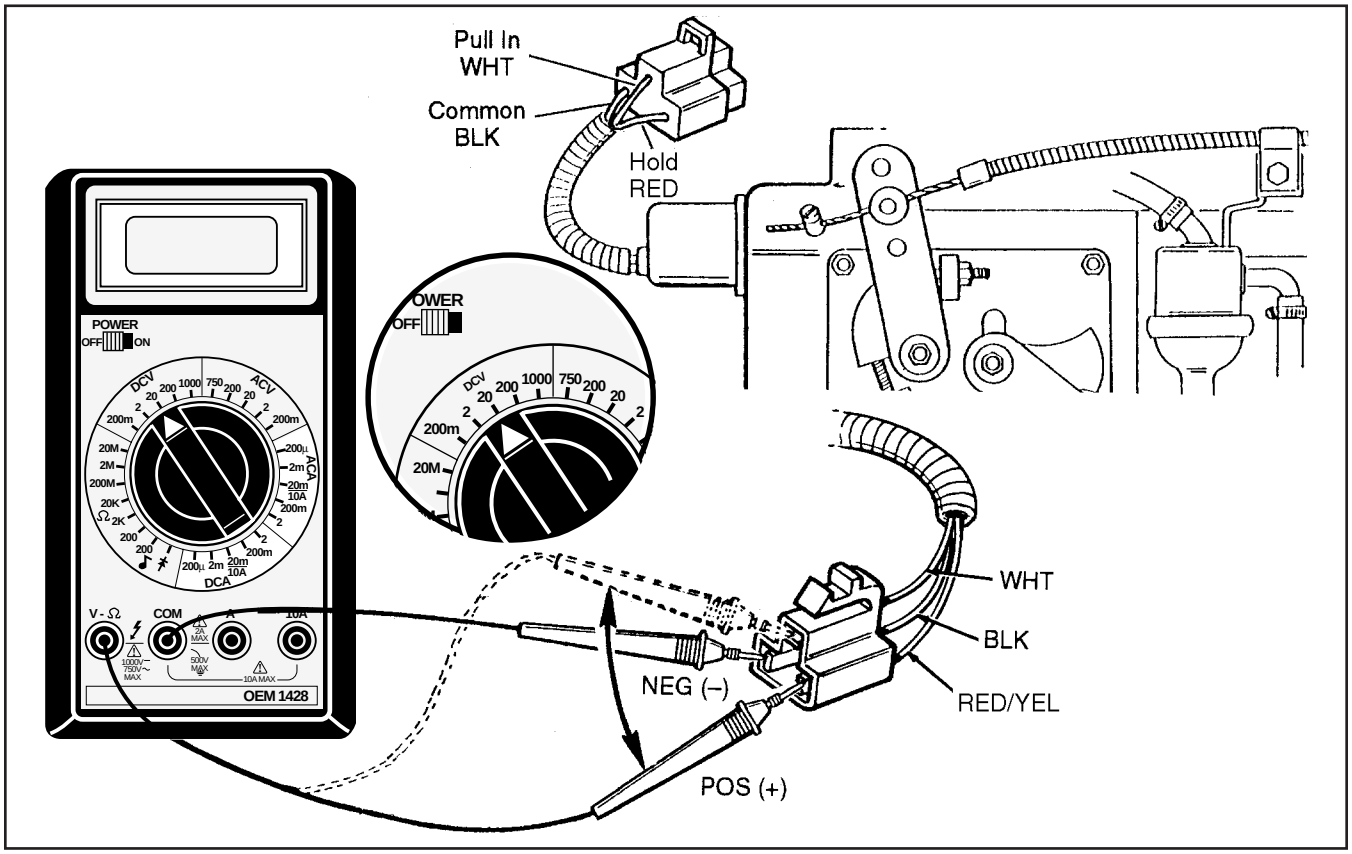


Figure 10L-1. Fuel Solenoid Test

SECTION 10L. SOLENOIDS

SOLENOID CONNECTOR (See Figure 10L-2)

GENERAL

The Hirschmann connector provides three functions. First, it is a means to connect the wiring system to the solenoid coil. Second, it acts as an electrical surge protector. High inductive voltage may occur when coils are energized and de-energized. The connector diode blocks this electrical surge. Third, it has a red Light Emitting Diode (LED). This is used as a troubleshooting aid.

Due to the design of an LED, it takes very little voltage to light. A voltage test should be taken at the connector.

If the LED is lit, this does not mean proper voltage is being supplied to the connector, nor does it mean the coil is okay. If the LED is lit, it means the electrical circuit is lined up to supply voltage. A voltage test should be performed to verify correct voltage.

If a new connector is being installed, it is important to connect the wire properly or a short will occur (see Figure 10L-2).

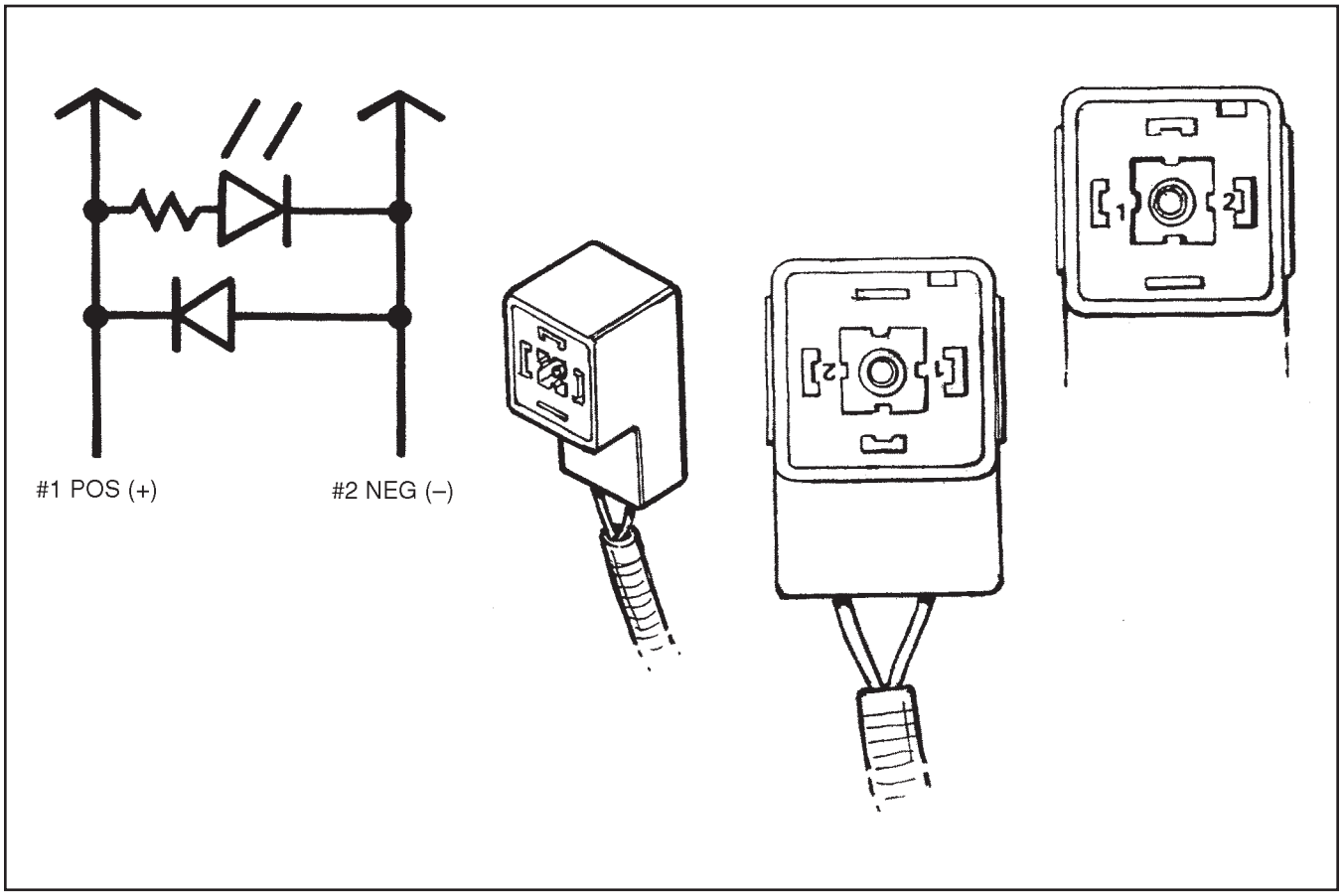


Figure 10L-2. Solenoid Valve Connectors

SECTION 10L. SOLENOIDS

TEST (See Figure 10L-3)

1. Energize the solenoid.
2. Notice if the LED (light emitting diode) is lit.
   - If LED is lit, proceed with Step 3.
   - If LED does not light, check interlock switches and wiring.
3. Remove the Hirschmann connector from solenoid.
4. Set multimeter to 20 VDC range.
5. Connect black NEG (–) multimeter lead to connector as shown.
6. Connect red POS (+) lead of multimeter to connector as shown.
   - Multimeter reads battery voltage, coil may be faulty, proceed with coil test.
   - Low or no voltage, check for high resistance or opens in wiring and/or seat switch.

Replace a connector that does not meet the above tests.

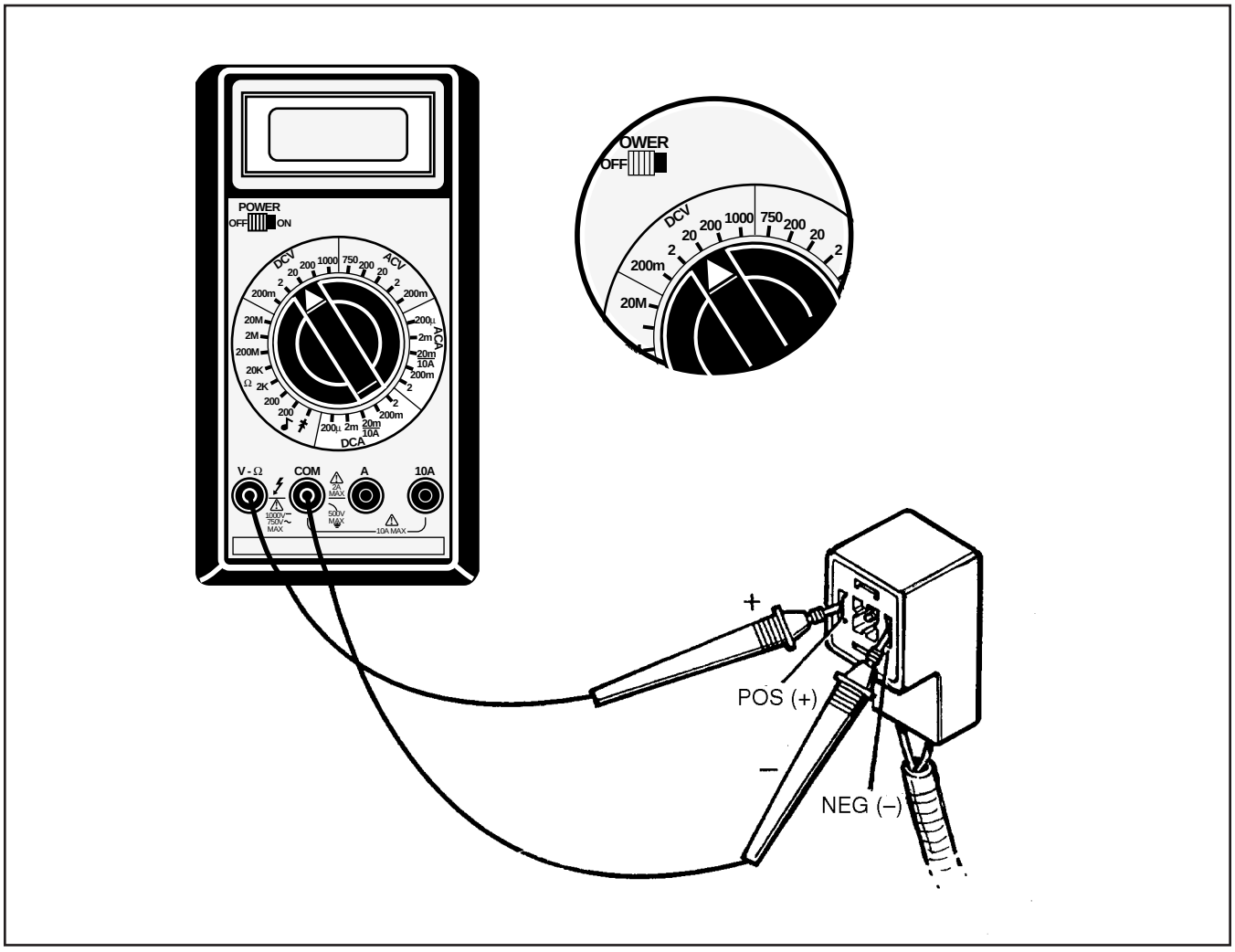


Figure 10L-3. Solenoid Valve Connector Test

SECTION 10L. SOLENOIDS

SOLENOID COIL TEST
(See Figure 10L-4)

1. Disconnect the connector from the coil.
2. Set multimeter to 200 Ω (ohms) range.
3. Connect multimeter leads to coil as shown.
   - Coil ohm reading should be approximately 9.5 to 10.5 Ω (ohms).

Replace a coil that does not meet the above tests.

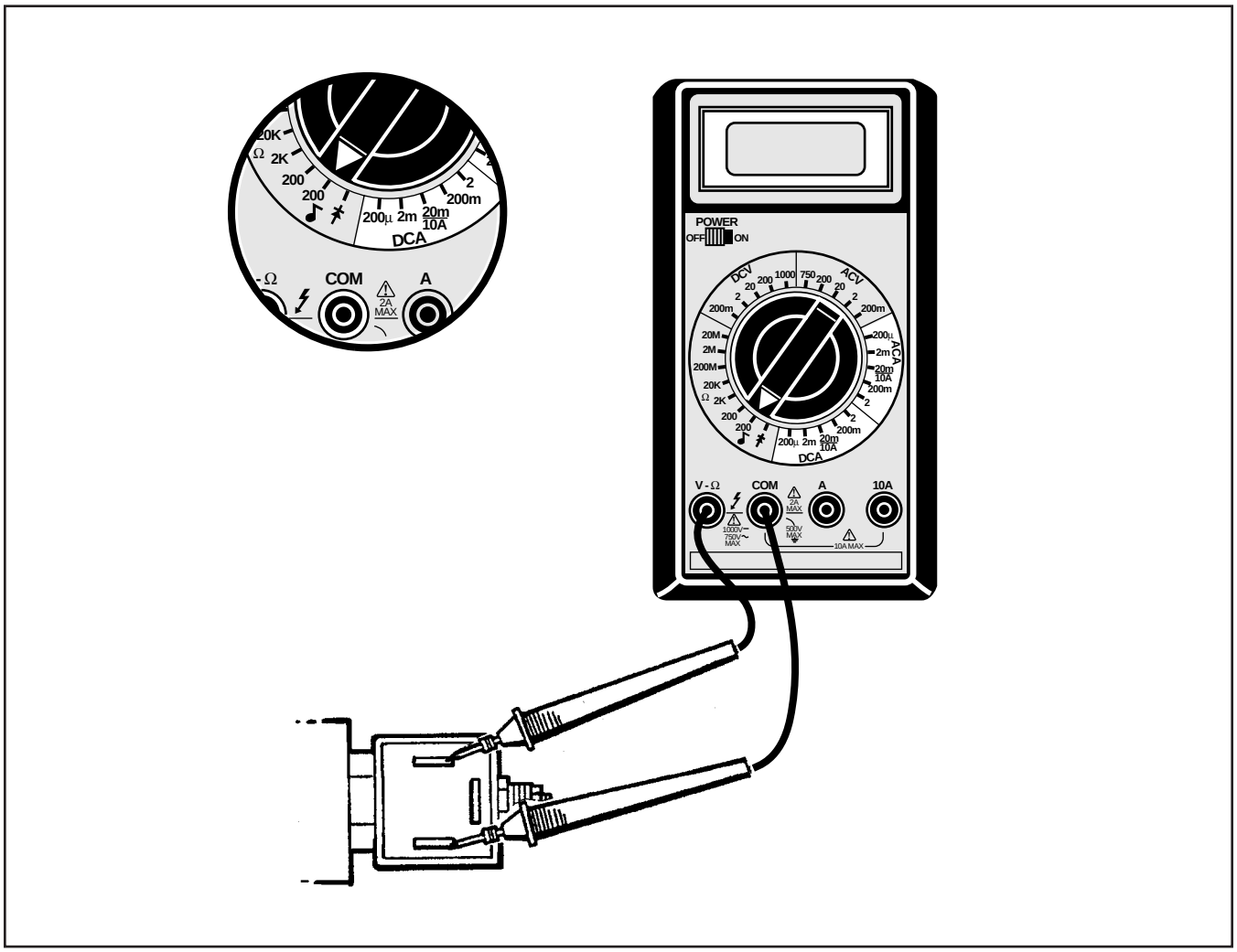


Figure 10L-4. Solenoid Coil Test

SECTION 10M. GLOW PLUGS

GLOW PLUG TEST (See Figure 10M-1)

Test a suspected faulty glow plug as follows:

1. Shut down and allow engine to cool.
2. Disconnect glow plug lead wire.
3. Set multimeter to 200 Ω (ohms).
4. Connect one multimeter test lead to glow plug terminal and the other to housing.
   - The multimeter reading should be approximately 1.4 Ω (ohms) (cold). If the reading is at infinity or 0 Ω (ohms) the glow plug is faulty and must be replaced.

Replace *a glow plug that does not meet the above* tests.

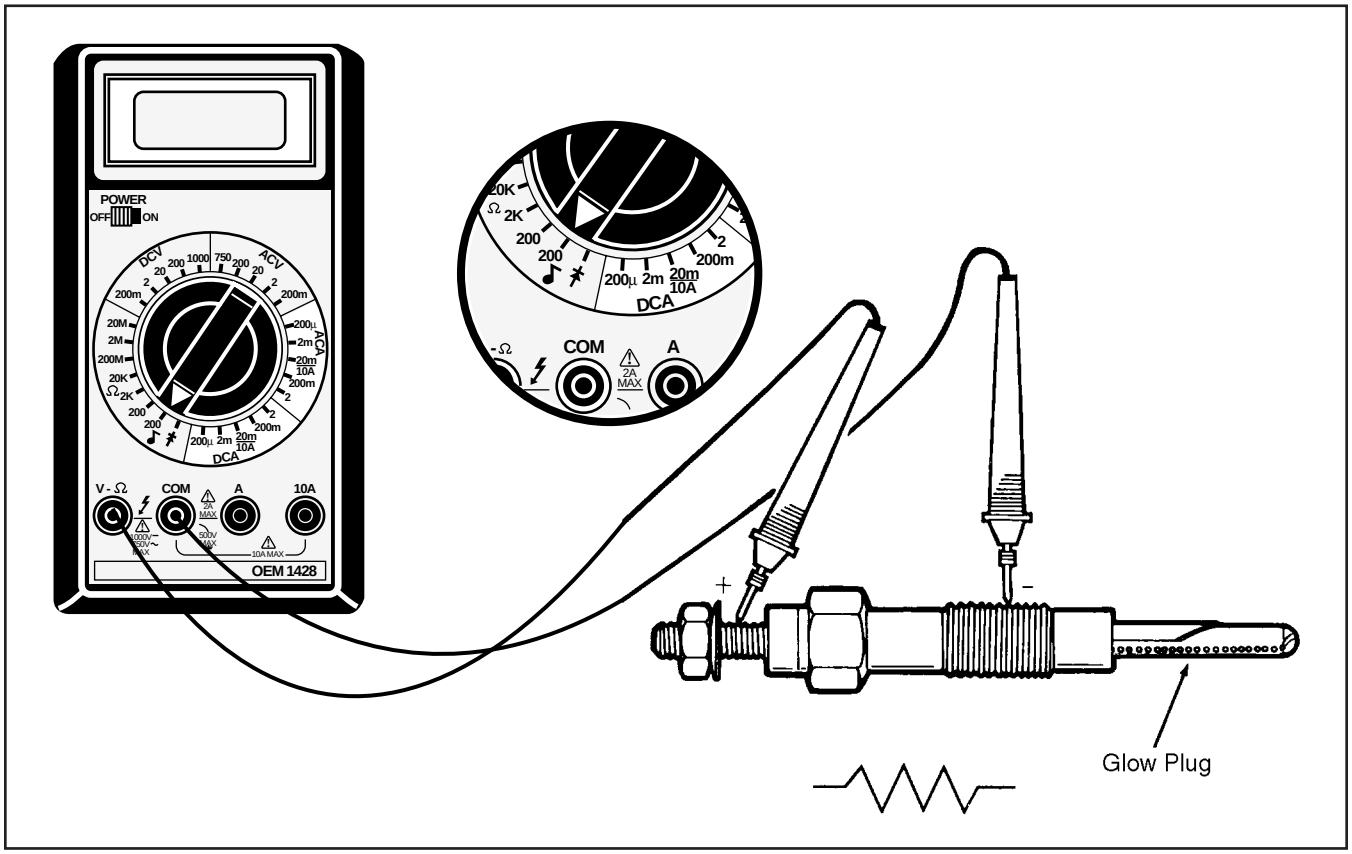


Figure 10M-1. Glow Plug Test

10M

SECTION 10N. GAUGES

GENERAL

Repair of gauges and sensing units are limited to the replacement of faulty components or wiring. Before replacing a gauge that is not working, make sure to check for proper ground connections and perform a voltage check at the gauge wire. If grounds and voltage checks okay, a gauge that does not work is faulty, except for a water temperature gauge which can be tested as described below.

NOTE

See Section 10P for the location of all instruments and gauges.

WATER TEMPERATURE GAUGE TEST (See Figure 10N-1)

Test the water temperature gauge as follows:

1. Turn ignition switch ON.
2. Disconnect lead wire to sending unit on engine and ground it.
   - The gauge indicator should go all the way up. If not, gauge or wiring is defective and must be replaced. If gauge needle does go to upper limit but does not work during operation, sending unit is faulty.

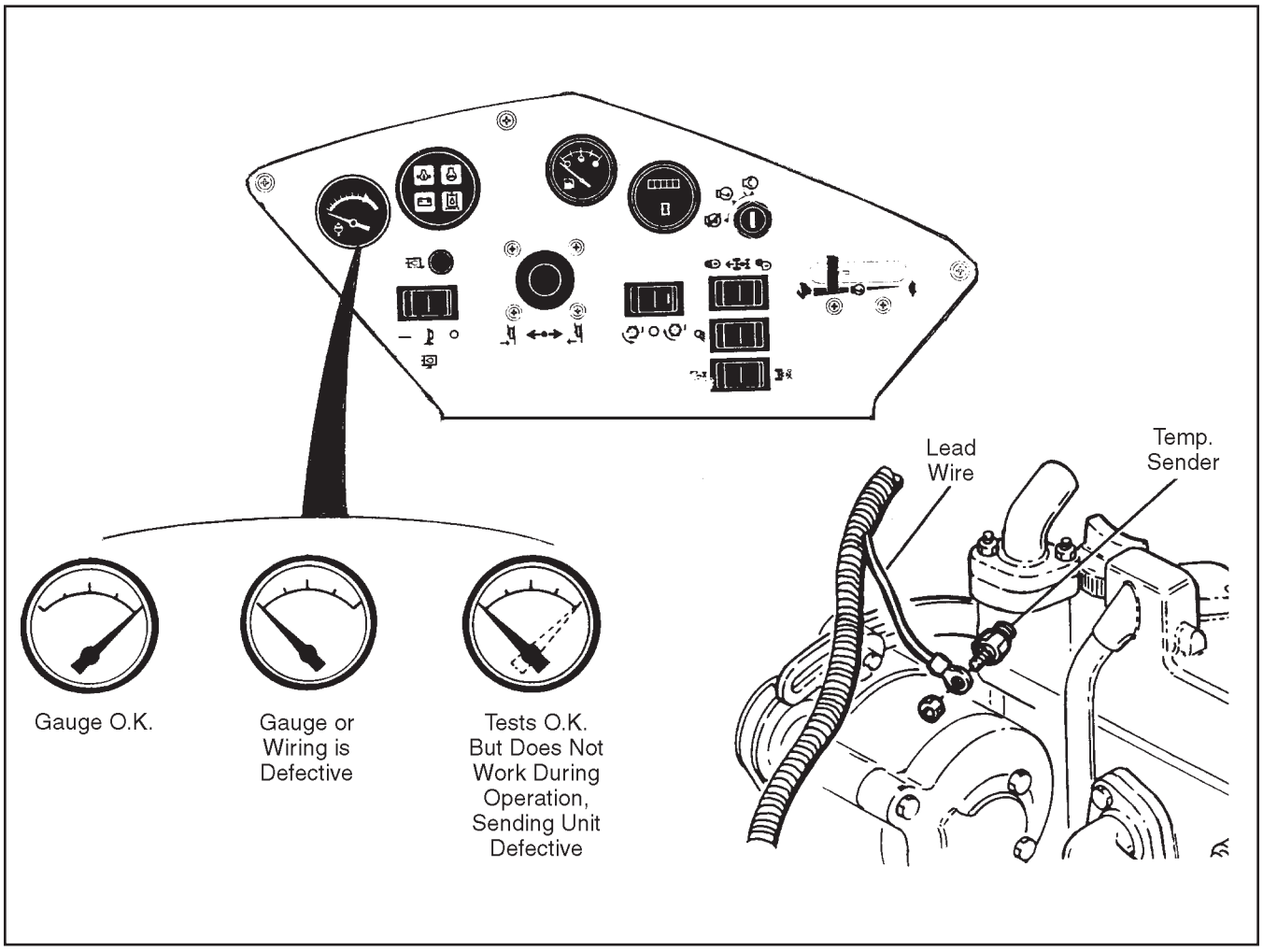


Figure 10N-1. Water Temperature Gauge Test

SECTION 10O. ELECTRONIC CONTROLLER

GENERAL

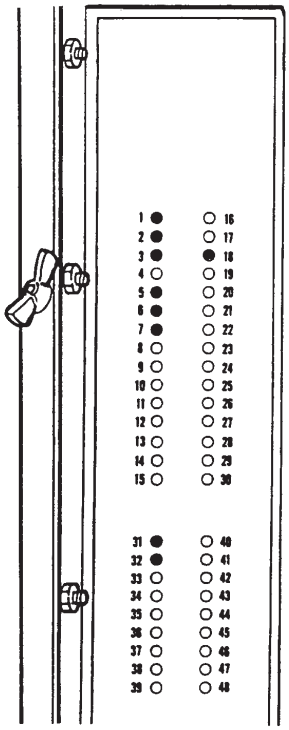
The controller is an electronic signal processor, receiving and sending electrical signals of various tractor circuits. The controller oversees most of the tractor functions such as the interlocks, time delays, starting, reels, and lift and lowering.

The controller is a sealed component and should not be opened. The controller panel has 48 LEDs (Light Emitting Diodes), of which nineteen are not used, numbers 14, 15, 16, 19, 20, 21, 24, 26, 27, 29, 30, 37, 39, 41, 42, 45, 46, 47 and 48.

There may be occasions when one or more of the unused LEDs will be on. This is due to the logic design of the controller. When troubleshooting disregard the above numbered LEDs. It is helpful when troubleshooting to place a piece of tape over the unused LEDs. This will not affect operation or control of the electrical circuits.

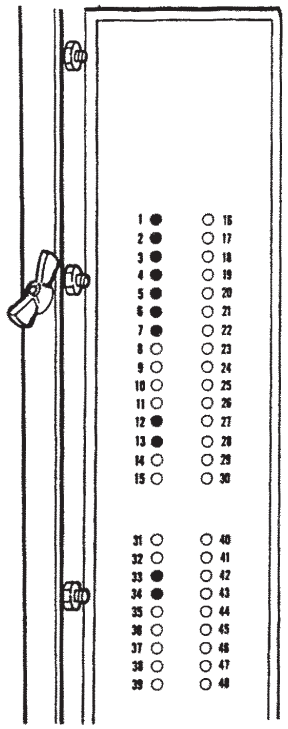
When diagnosing a failure use the charts on the following pages in conjunction with the electrical schematic in Section 10P. Knowing which circuits are being affected by the display of LEDs a technician can use the schematic to locate its related circuit and components. Once the circuit components are identified and located, proper testing as per each individual component instructions are listed in Section 10.

SECTION 10O. ELECTRONIC CONTROLLER



LED #	WIRE #	INPUT	WIRE #	OUTPUT	FUNCTION
1	6-1	Power			From ignition relay
2	6-2	Power			From ignition relay
3	6-3	Power			From ignition relay
5	3-4	Neutral Start			When traction pedal is in neutral
6	3-10	Brake			When brake is applied
7	3-3	Seat Switch			Only with operator in seat
12	4-8	Oil Level Horn Switch			On when oil level is low
13	3-6	Engine Oil			No engine oil pressure
18	2-4	Ls Fl			Front left reel lowered, limit switch closed
31			4-2	Glow Plugs	On approximately 7 seconds
32			4-11	Lamp Test	Power to yellow GP lamp on dash approximately 7 sec.

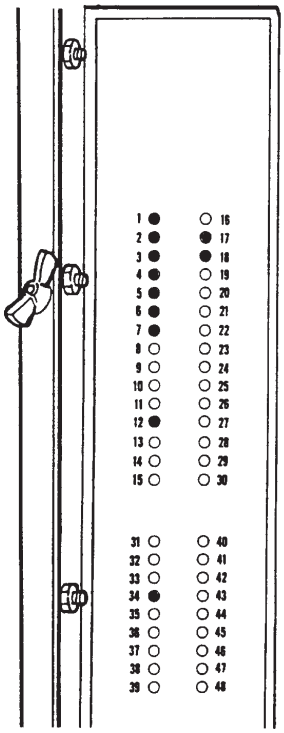
Figure 10O-1. Key On



LED #	WIRE #	INPUT	WIRE #	OUTPUT	FUNCTION
1	6-1	Power			From ignition relay
2	6-2	Power			From ignition relay
3	6-3	Power			From ignition relay
4	6-4	Power			From ignition relay, activates start circuit, goes out when key is released to run
5	3-4	Neutral Start			When traction pedal is in neutral
6	3-10	Brake			When brake is applied
7	3-3	Seat Switch			Only with operator in seat
12	4-8	Oil Level Horn Switch			On when oil level is low
13	3-6	Engine Oil			No engine oil pressure
33			4-1	Start	Key in start/starter relay, goes out when key is released to run
34			4-12	Fuel Hold	Power to hold in winding fuel solenoid

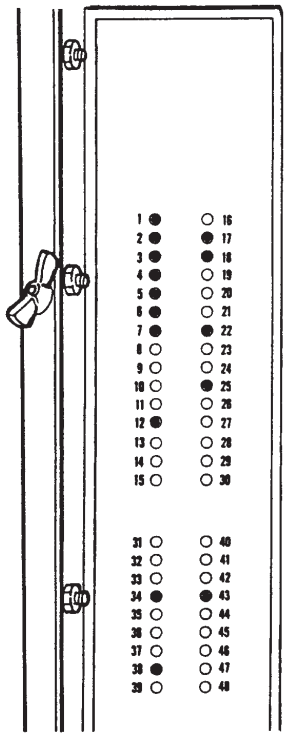
Figure 10O-2. Key in Start Position

SECTION 10O. ELECTRONIC CONTROLLER



LED #	WIRE #	INPUT	WIRE #	OUTPUT	FUNCTION
1	6-1	Power			From ignition relay
2	6-2	Power			From ignition relay
3	6-3	Power			From ignition relay
5	3-4	Neutral Start			When traction pedal is in neutral
6	3-10	Brake			When brake is applied
7	3-3	Seat Switch			Only with operator in seat
12	4-8	Oil Level Horn Switch			On when oil level is low
17	2-10	Ls Fr			Front right reel lowered, limit switch closed
18	2-4	Ls Fl			Front left reel lowered, limit switch closed
34			4-12	Fuel Hold	Power to hold in winding fuel solenoid

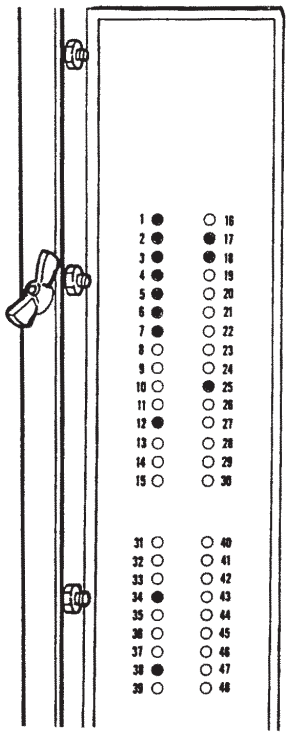
Figure 10O-3. Run After Start



LED #	WIRE #	INPUT	WIRE #	OUTPUT	FUNCTION
1	6-1	Power			From ignition relay
2	6-2	Power			From ignition relay
3	6-3	Power			From ignition relay
5	3-4	Neutral Start			When traction pedal is in neutral
6	3-10	Brake			When brake is applied
7	3-3	Seat Switch			Only with operator in seat
12	4-8	Oil Level Horn Switch			On when oil level is low
17	2-10	Ls Fr			Front right reel lowered, limit switch closed
18	2-4	Ls Fl			Front left reel lowered, limit switch closed
22	2-6	Lower			With joystick in the lowered position, Pin C
25	3-8	Mow G-F			With reel switch on in forward, Pin 1
34			4-12	Fuel Hold	Power to hold in winding fuel solenoid
38			5-3	Mow C-1	To mow switch, Pin 5
43			5-10	Lift Lower Solenoid	To lift valve solenoid lower coil, goes off after mowers are lowered

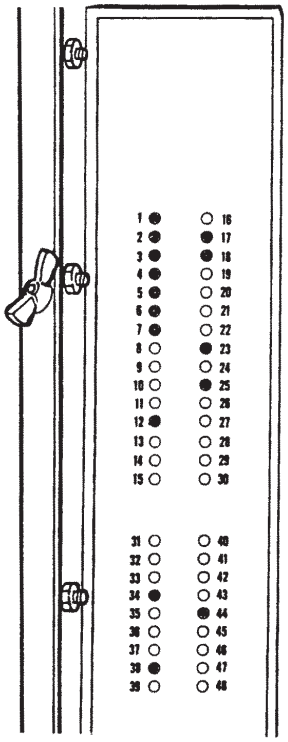
Figure 10O-4. Lower Reels, Reel Switch On

SECTION 10O. ELECTRONIC CONTROLLER



LED #	WIRE #	INPUT	WIRE #	OUTPUT	FUNCTION
1	6-1	Power			From ignition relay
2	6-2	Power			From ignition relay
3	6-3	Power			From ignition relay
5	3-4	Neutral Start			When traction pedal is in neutral
7	3-3	Seat Switch			Only with operator in seat
12	4-8	Oil Level Horn Switch			On when oil level is low
17	2-10	Ls Fr			Front right reel lowered, limit switch closed
18	2-4	Ls Fl			Front left reel lowered, limit switch closed
25	3-8	Mow G-F			With reel switch on in forward, Pin 1
34			4-12	Fuel Hold	Power to hold in winding fuel solenoid
38			5-3	Mow C-1	To mow switch, Pin 5

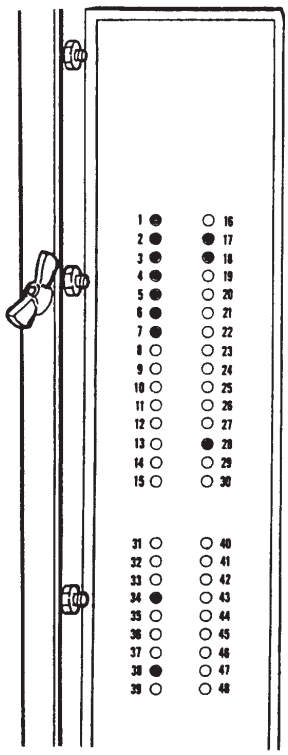
Figure 10O-5. Mow



LED #	WIRE #	INPUT	WIRE #	OUTPUT	FUNCTION
1	6-1	Power			From ignition relay
2	6-2	Power			From ignition relay
3	6-3	Power			From ignition relay
5	3-4	Neutral Start			When traction pedal is in neutral
6	3-10	Brake			When brake is applied
7	3-3	Seat Switch			Only with operator in seat
12	4-8	Oil Level Horn Switch			On when oil level is low
17	2-10	Ls Fr			Front right reel lowered, limit switch closed
18	2-4	Ls Fl			Front left reel lowered, limit switch closed
23	2-7	Raise			With joystick in the raised position, Pin B
25	3-8	Mow C-F			Mow switch forward, Pin 1
34			4-12	Fuel Hold	Power to hold in winding fuel solenoid
38			5-3	Mow C-L	To the reel switch, Pin 5
44			5-7	Lift Raise Solenoid	To lift valve solenoid raise coil, time delay goes off after mowers are raised

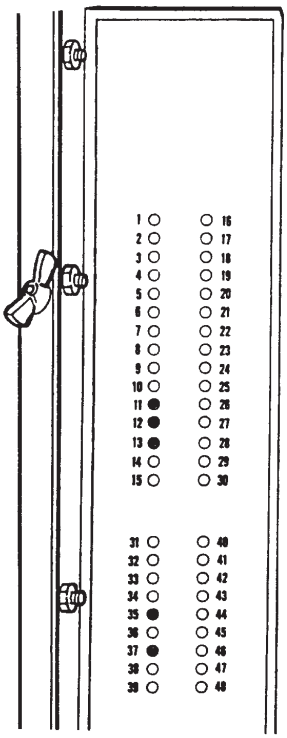
Figure 10O-6. Raise

SECTION 10O. ELECTRONIC CONTROLLER



LED #	WIRE #	INPUT	WIRE #	OUTPUT	FUNCTION
1	6-1	Power			From ignition relay
2	6-2	Power			From ignition relay
3	6-3	Power			From ignition relay
5	3-4	Neutral Start			When traction pedal is in neutral
6	3-10	Brake			When brake is applied
7	3-3	Seat Switch			Only with operator in seat
12	4-8	Oil Level Horn Switch			On when oil level is low
17	2-10	Ls Fr			Front right reel lowered, limit switch closed
18	2-4	Ls Fl			Front left reel lowered, limit switch closed
34			4-12	Fuel Hold	Power to hold in winding fuel solenoid

Figure 10O-7. Backlap



LED #	WIRE #	INPUT	WIRE #	OUTPUT	FUNCTION
1	6-1	Power			From ignition relay
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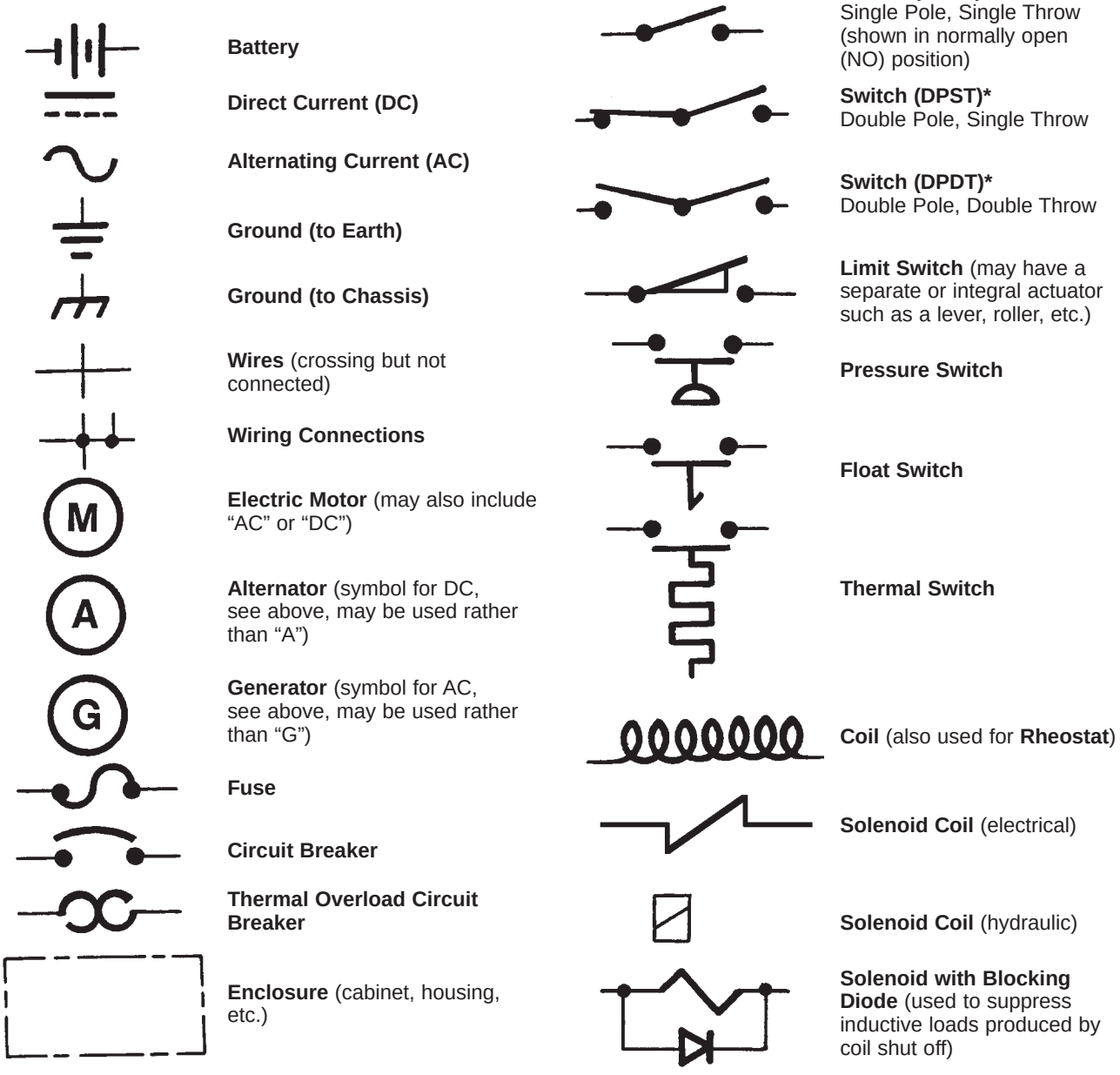
5	3-4	Neutral Start			When traction pedal is in neutral
6	3-10	Brake			When brake is applied
7	3-3	Seat Switch			Only with operator in seat
12	4-8	Oil Level Horn Switch			On when oil level is low
17	2-10	Ls Fr			Front right reel lowered, limit switch closed
18	2-4	Ls Fl			Front left reel lowered, limit switch closed
22	2-6	Lower			With joystick in the lowered position, Pin C
25	3-8	Mow G-F			With reel switch on in forward, Pin 1
34			4-12	Fuel Hold	Power to hold in winding fuel solenoid
38			5-3	Mow C-1	To mow switch, Pin 5
43			5-10	Lift Lower Solenoid	To lift valve solenoid lower coil, goes off after mowers are lowered

Figure 10O-8. Alarm

SECTION 10P. WIRING DIAGRAMS AND COMPONENT LOCATION ILLUSTRATIONS

ELECTRICAL GRAPHIC SYMBOLS

These are electrical graphic symbols commonly used in Textron Golf, Turf & Specialty Products diagrams and schematics.



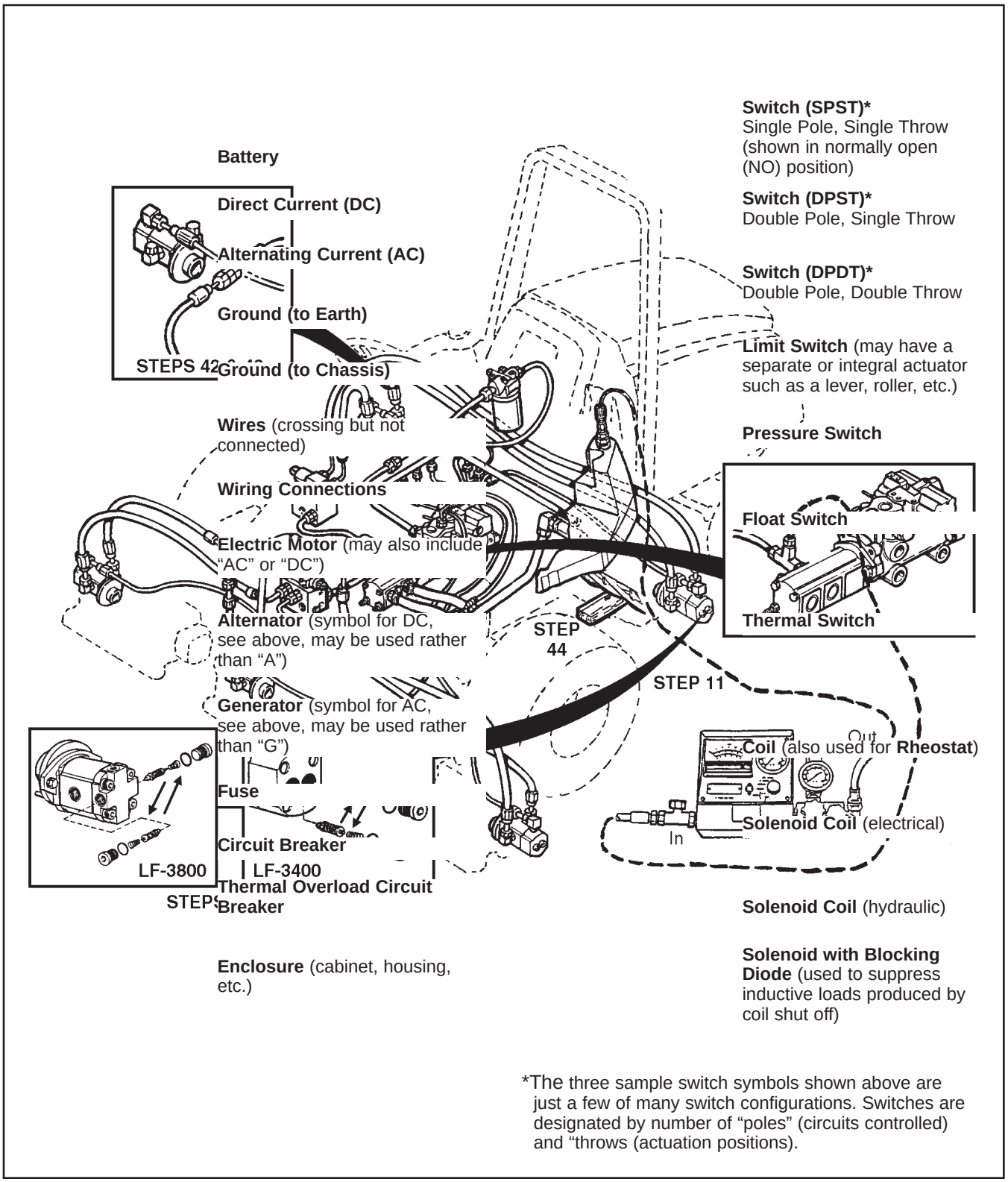
*The three sample switch symbols shown above are just a few of many switch configurations. Switches are designated by number of "poles" (circuits controlled) and "throws (actuation positions).

Figure 10P-1. Electrical Schematic Symbols (1 of 2)

SECTION 10P. WIRING DIAGRAMS AND COMPONENT LOCATION ILLUSTRATIONS

ELECTRICAL GRAPHIC SYMBOLS

These are electrical graphic symbols commonly used in Textron Golf, Turf & Specialty Products diagrams and schematics.



*The three sample switch symbols shown above are just a few of many switch configurations. Switches are designated by number of "poles" (circuits controlled) and "throws (actuation positions).

Figure 10P-1. Electrical Schematic Symbols (2 of 2)

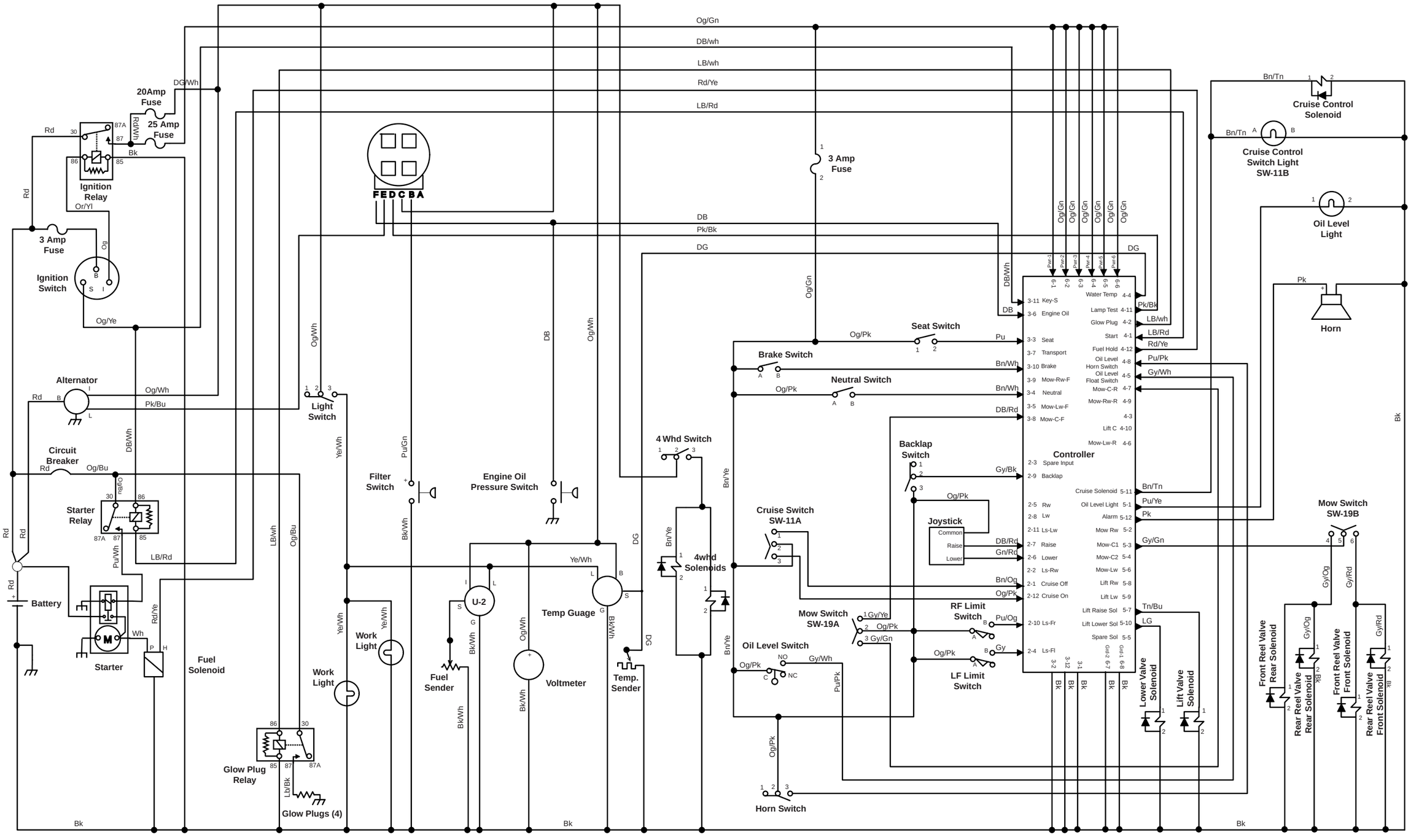


Figure 10P-2. Electrical Schematic (Early)

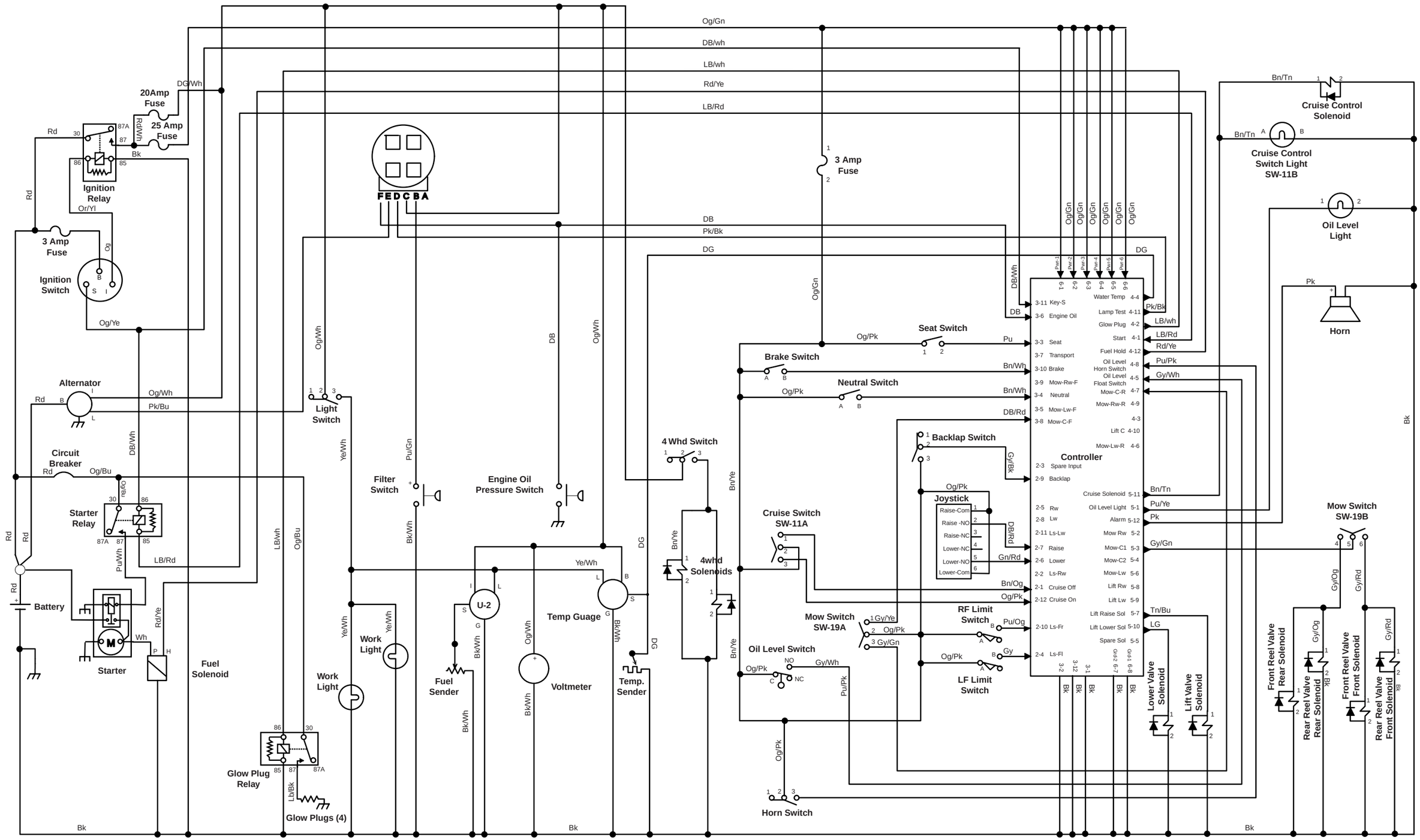


Figure 10P-3. Electrical Schematic (Late)

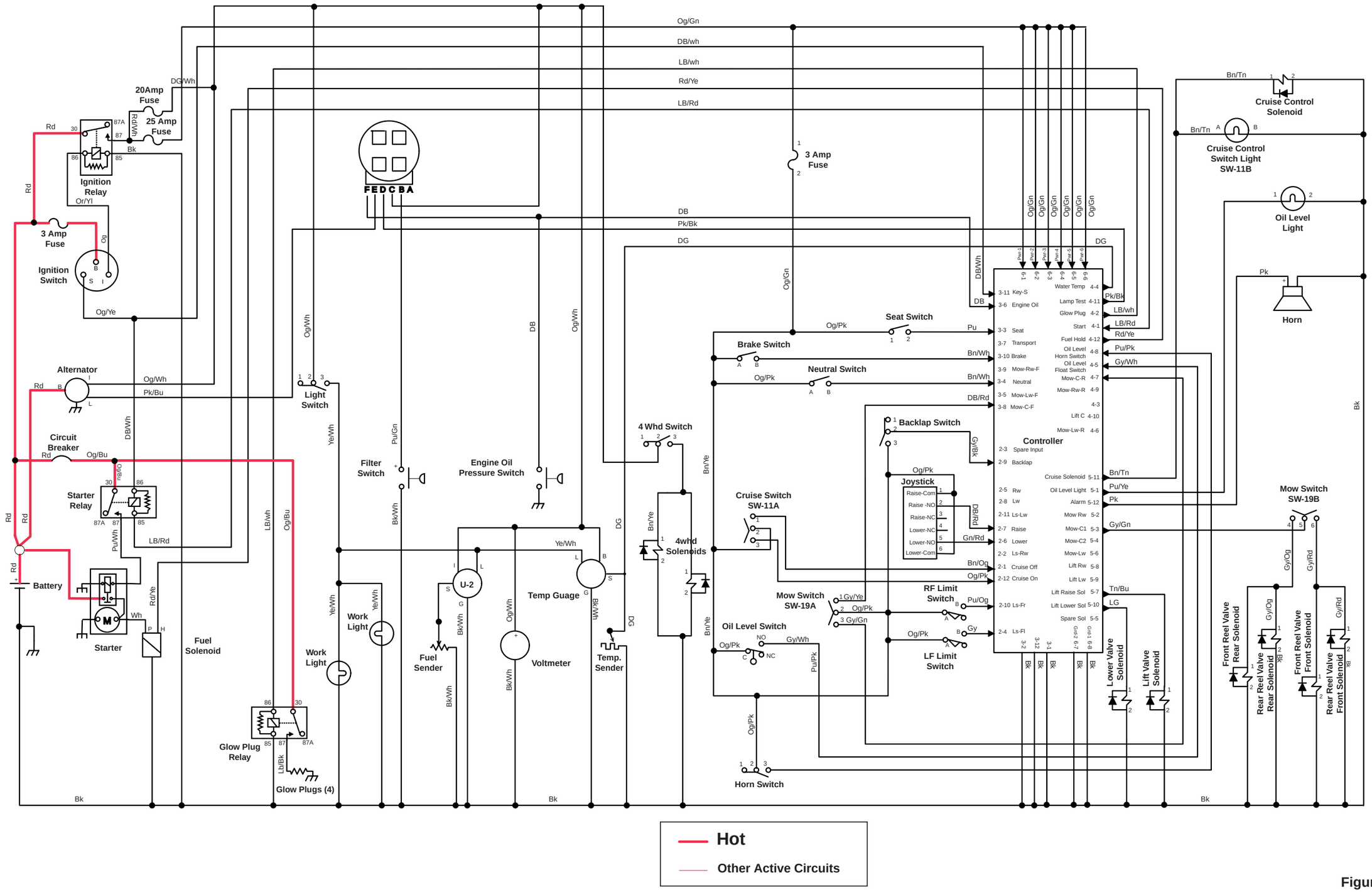


Figure 10P-4. Hot

10P

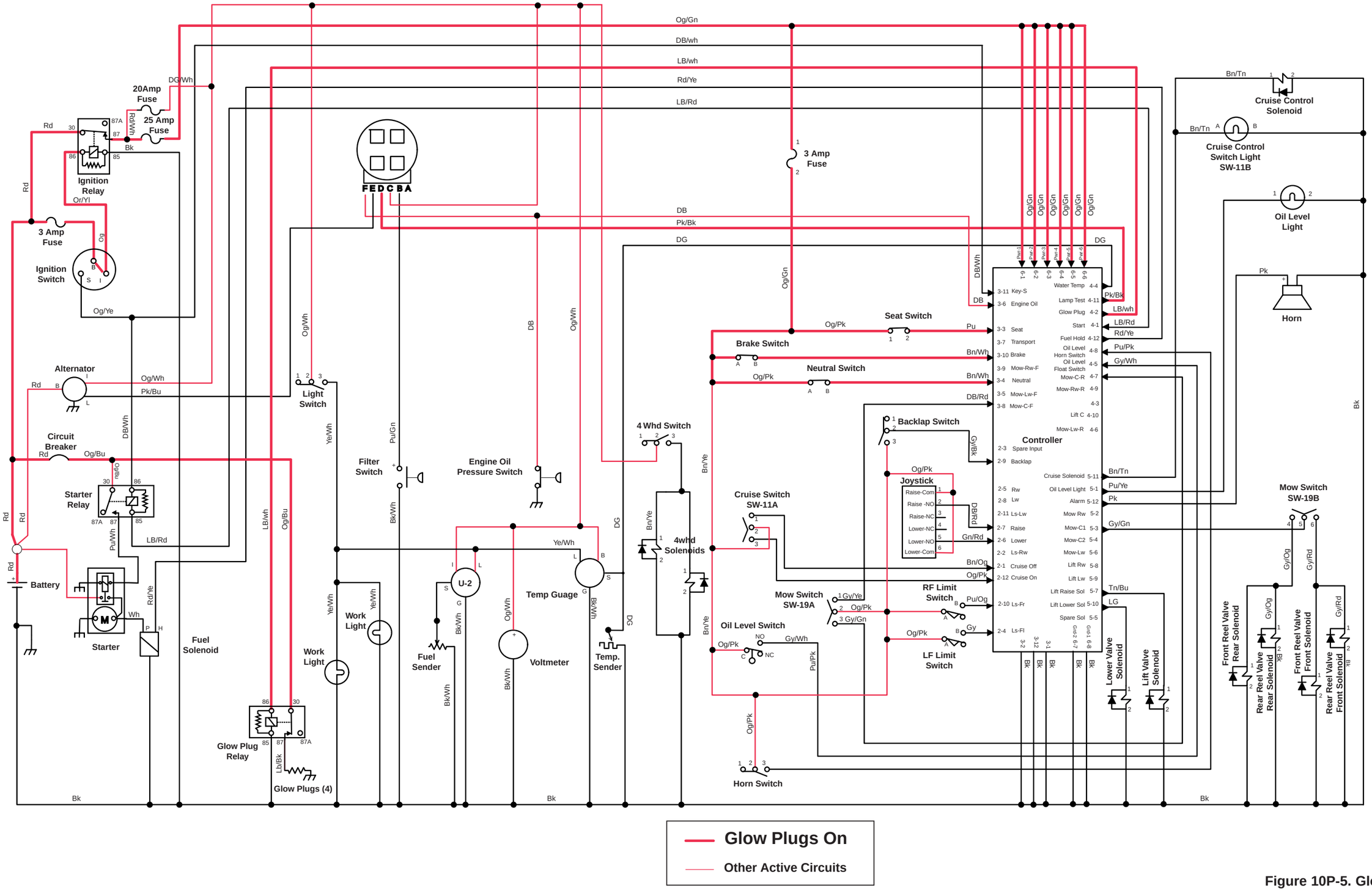


Figure 10P-5. Glow Plugs On

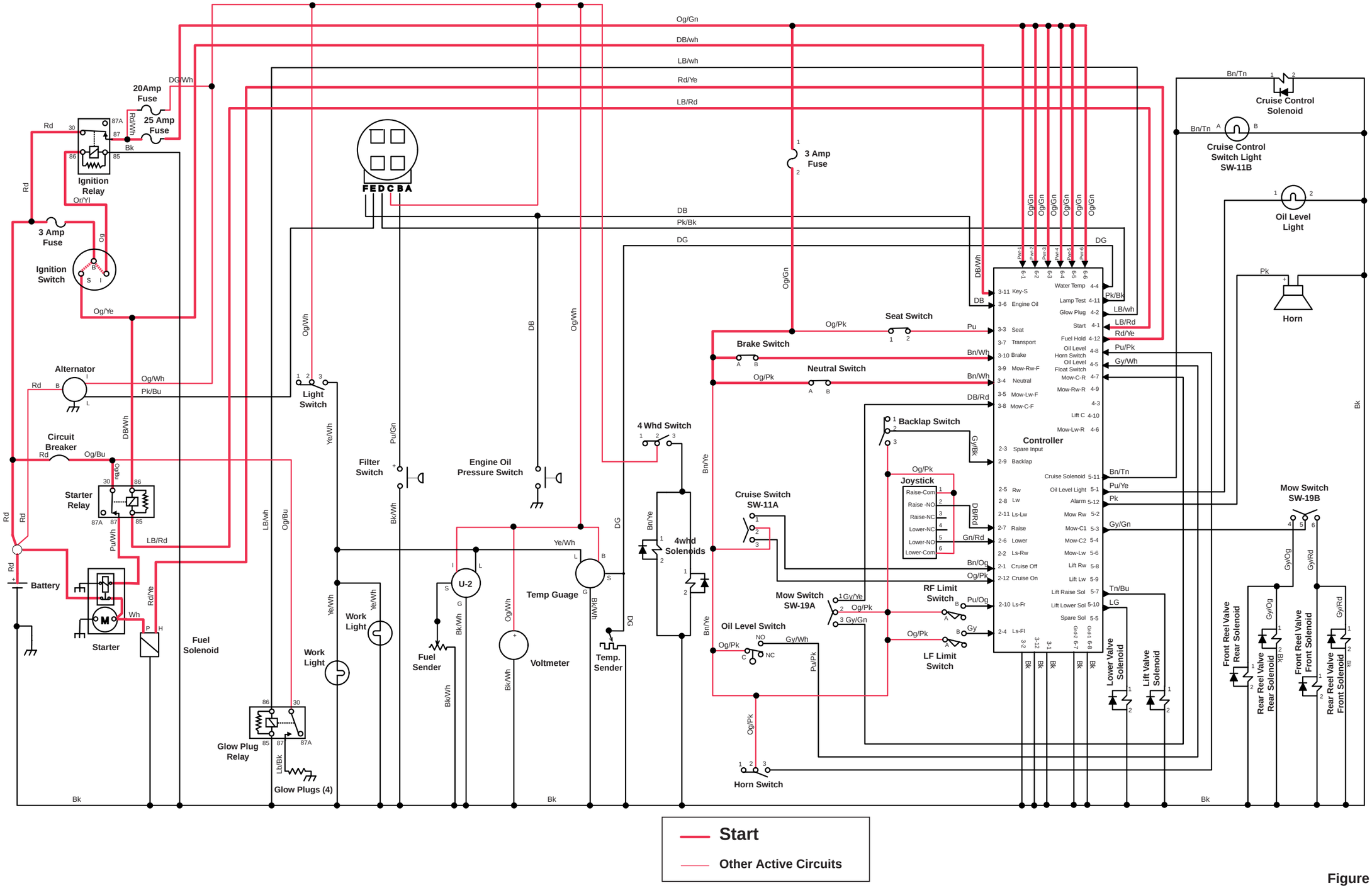


Figure 10P-6. Start

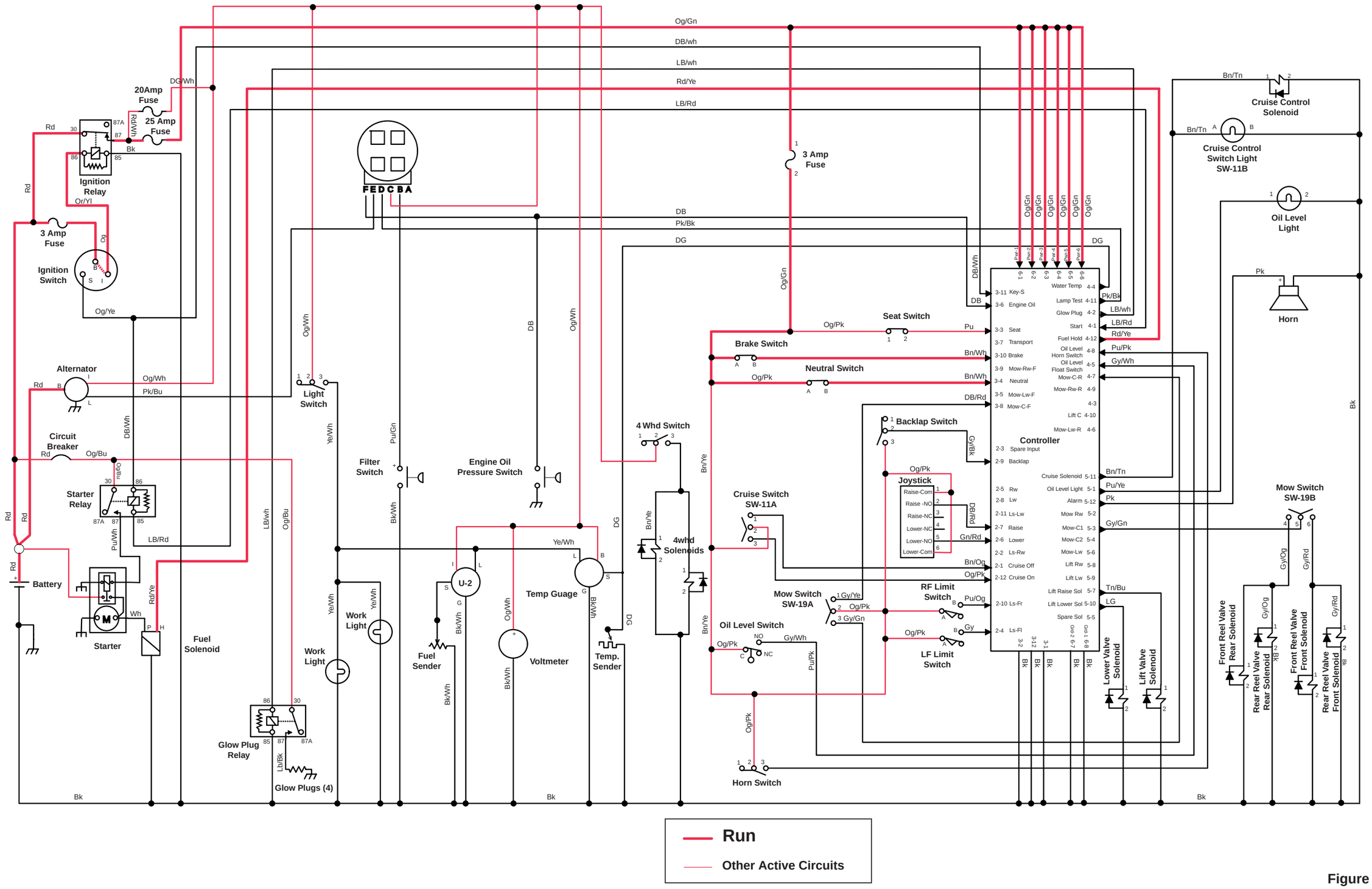


Figure 10P-7. Run

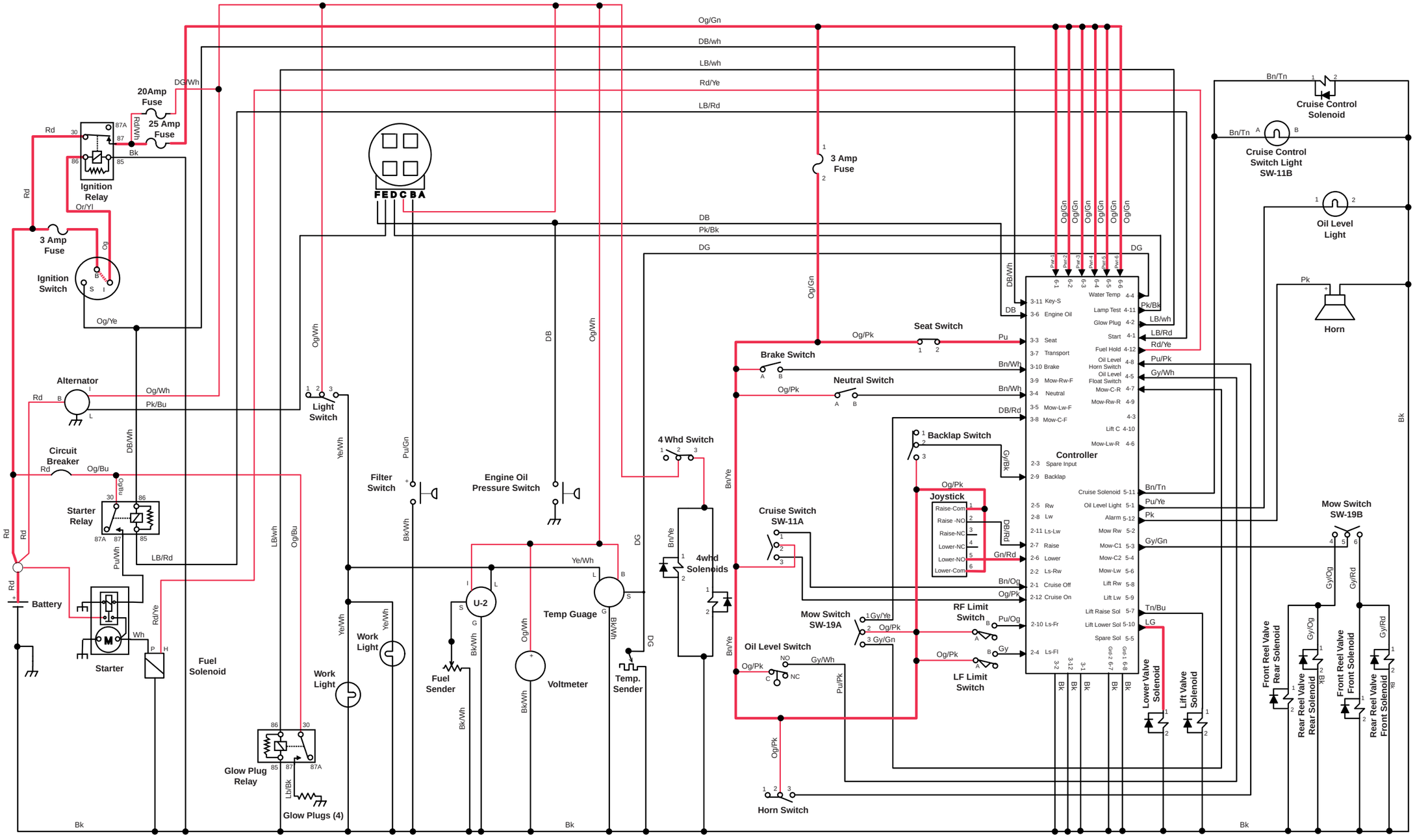


Figure 10P-8. Lower

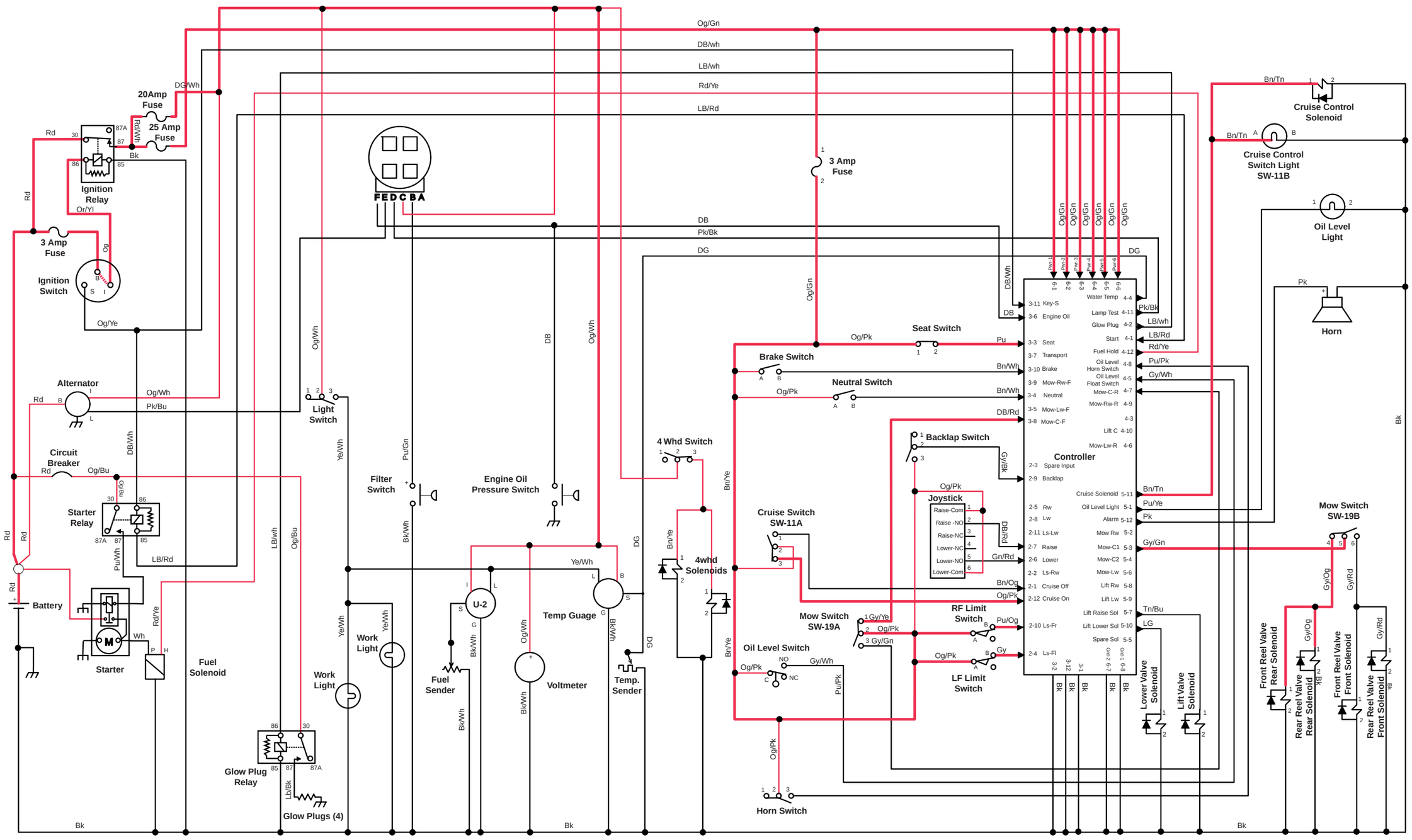


Figure 10P-9. Mowers On, Cruise On

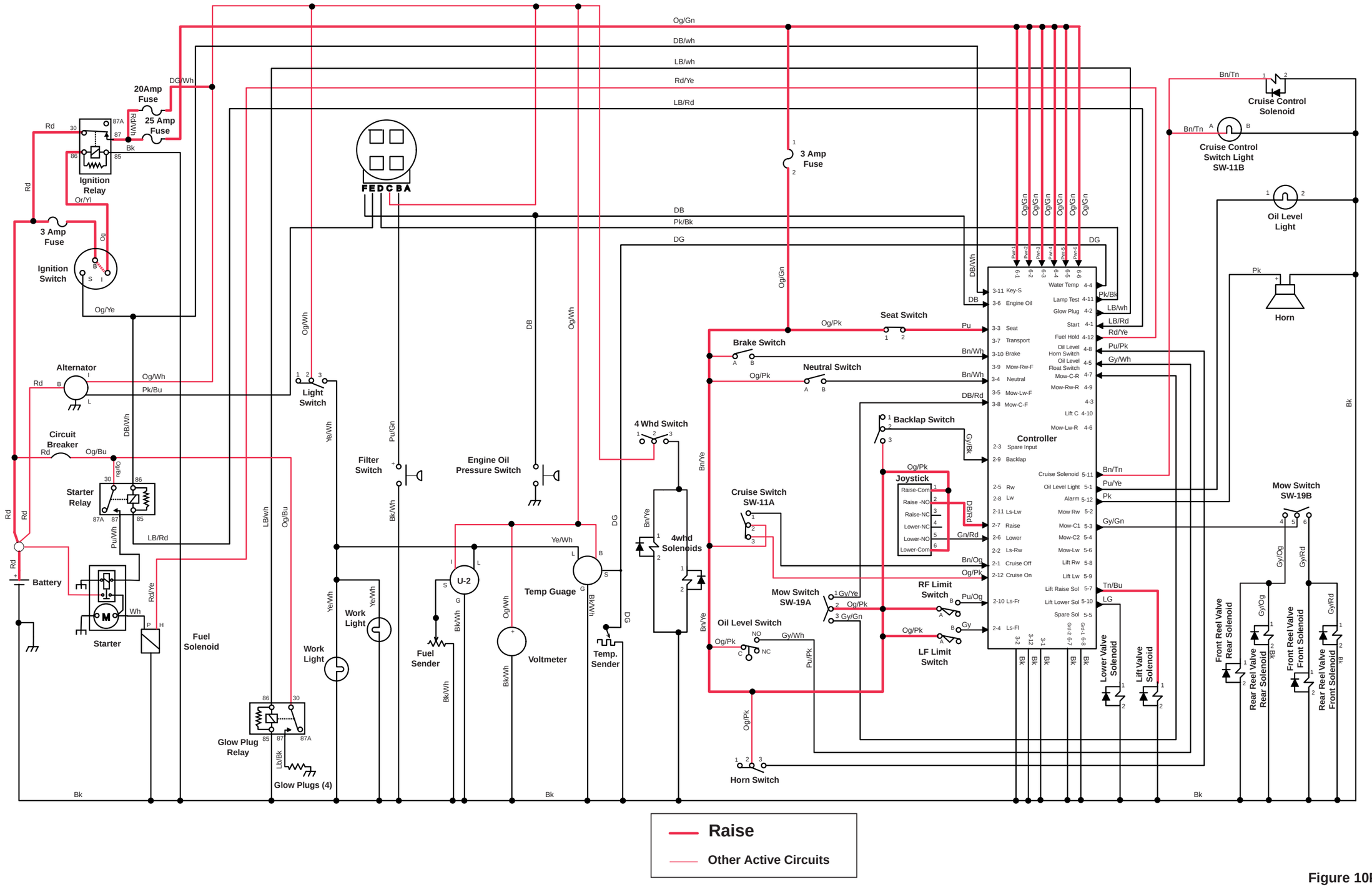


Figure 10P-10. Raise

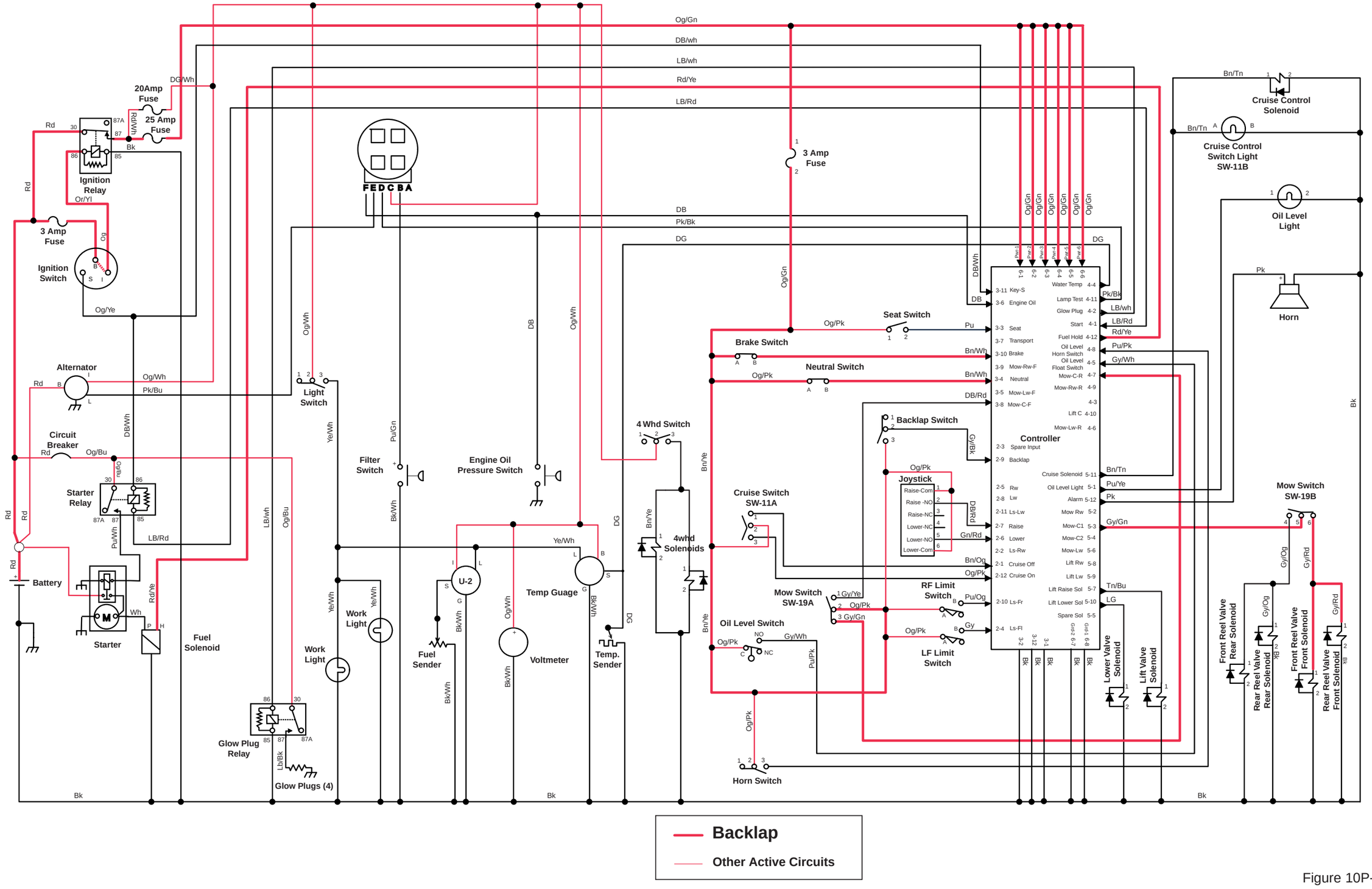


Figure 10P-11. Backlap

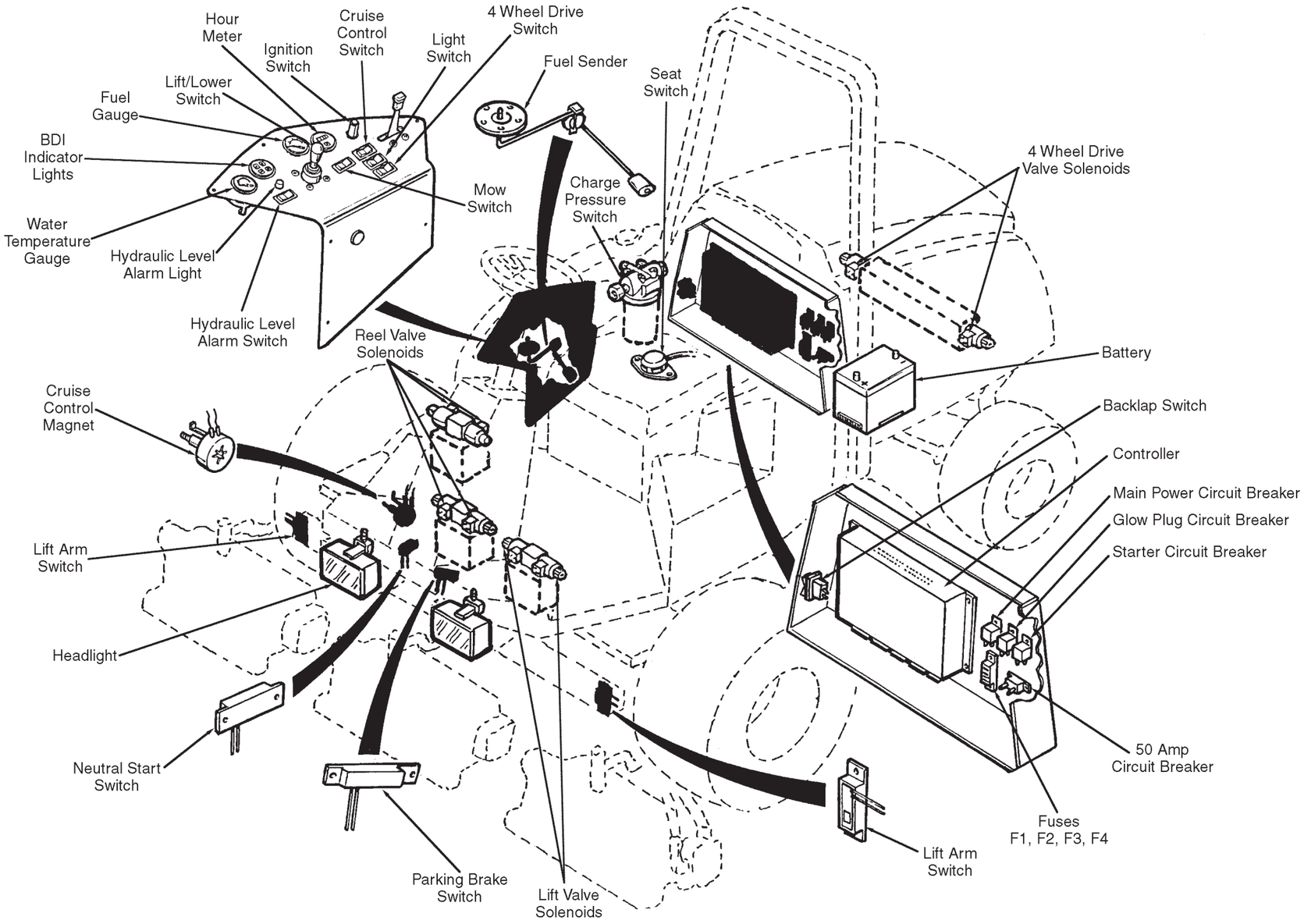


Figure 10P-12. Electrical Component Locations

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TABLE OF CONTENTS

SECTION 11
PREVENTIVE MAINTENANCE

SECTION 11A. GENERAL

PREVENTIVE MAINTENANCE

Preventive Maintenance (PM) is maintenance performed to prevent malfunctions and parts breakdowns by periodically and systematically checking equipment and its systems.

Preventive maintenance will cut back corrective maintenance.

SCHEDULING

Each machine should be scheduled for preventive maintenance according to the hours used, its severity of use, and the type of environment the machine is used in.

Use the manufacturer's recommendation of preventive maintenance. These recommendations can then be altered as experience is gained with the type of equipment and the type of environment in which it operates.

While performing preventive maintenance tasks the individual should always be alert to conditions that may seem abnormal. If an abnormal condition is detected a determination must be made to either correct the condition immediately or schedule the vehicle in the shop for necessary repairs.

ADMINISTRATION

Record keeping is an important and most often a forgotten part of preventive maintenance.

Textron has developed a PMMRS (Preventive Maintenance Management Record System).

PMMRS PROGRAM KITS

The PMMRS kits and replacement forms (see Figure 11A-1) are available directly from your local Textron Golf, Turf & Specialty Products Dealer/Distributor.

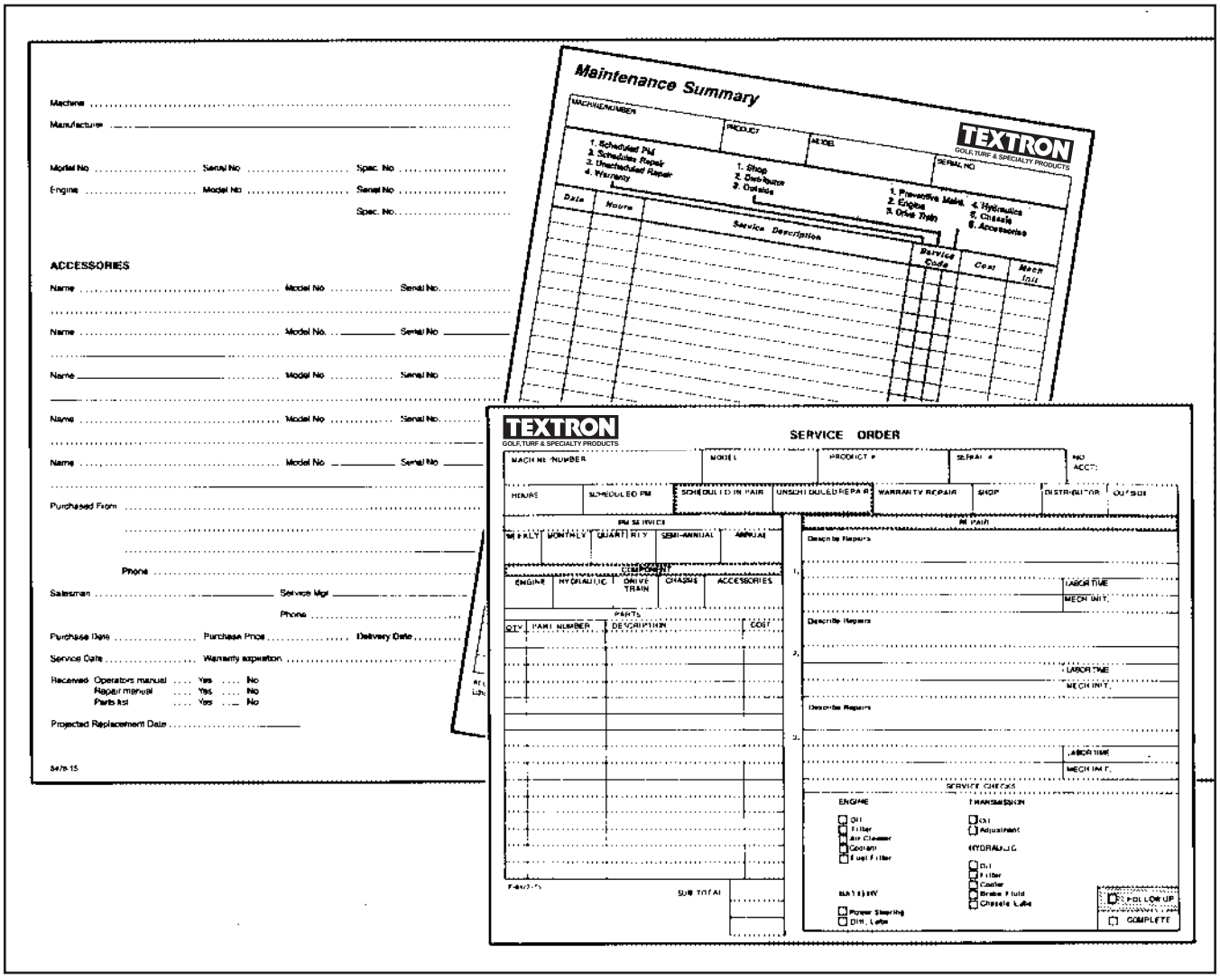

Figure 11A-1. PMMRS Kit Order Forms

11A

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PMMRS

PREVENTIVE MAINTENANCE MANAGEMENT RECORD SYSTEM

ORDER BLANK

NAME _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____

DISTRIBUTOR
P.O. NO. _____
CHECK NO. _____

CUSTOMER CHECK
MUST ACCOMPANY ORDER

PMMRS KIT @ $6.00 per kit QTY. KITS ORDERED _____

Kit consists of: 10 ea. 8476-TS Maintenance Summary Sheets
20 ea. 8477-TS Service Order Sheets
5 ea. 8478-TS Folders (check color desired)

____Orange	Turf Tractors
____Gray	Reel Mowers
____Lt. Blue	Aerators
____Red	Rotarys
____Dk. Blue	Seeders
____Yellow	Sweepers and Blowers
____White	Grooming Equipment
____Copper	Trucks
____Green	Greens Equipment

TO ORDER SEPARATELY	QTY.	PRICE
5 Folders $2.50 (state colors)	_____	_____
_____ _____		
_____ _____		
_____ _____		
10 Maintenance Summary Sheets @ $1.50	_____	_____
25 Service Order Sheets @ $2.00	_____	_____

TEXTRON
GOLF, TURF & SPECIALTY PRODUCTS

Textron, Inc.
1721 Packard Avenue
Racine, Wisconsin 53403-9988

_____
Authorized Signature

Price subject to change, contact your Textron Dealer.

PMMRS

PREVENTIVE MAINTENANCE MANAGEMENT RECORD SYSTEM

ORDER BLANK

NAME _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____

DISTRIBUTOR
P.O. NO. _____
CHECK NO. _____

CUSTOMER CHECK
MUST ACCOMPANY ORDER

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TO ORDER SEPARATELY	QTY.	PRICE
5 Folders $2.50 (state colors)	_____	_____
_____ _____		
_____ _____		
_____ _____		
10 Maintenance Summary Sheets @ $1.50	_____	_____
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TEXTRON
GOLF, TURF & SPECIALTY PRODUCTS

Textron, Inc.
1721 Packard Avenue
Racine, Wisconsin 53403-9988

_____
Authorized Signature

Price subject to change, contact your Textron Dealer.

SECTION 11B. LUBRICATION AND MAINTENANCE SCHEDULES

GENERAL

Intervals are based on operating hours. These are suggested intervals only. As experience is gained in operating this machine, the schedule can be tailored to your operating time.

LUBRICATION SCHEDULE (See Figure 11B-1)

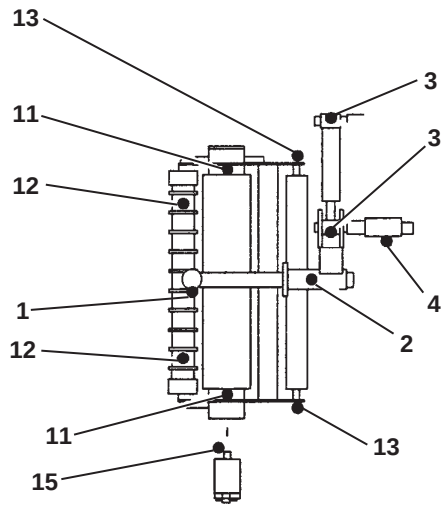
Clean grease fittings before greasing. Apply grease to fittings with hand grease gun only and fill slowly.

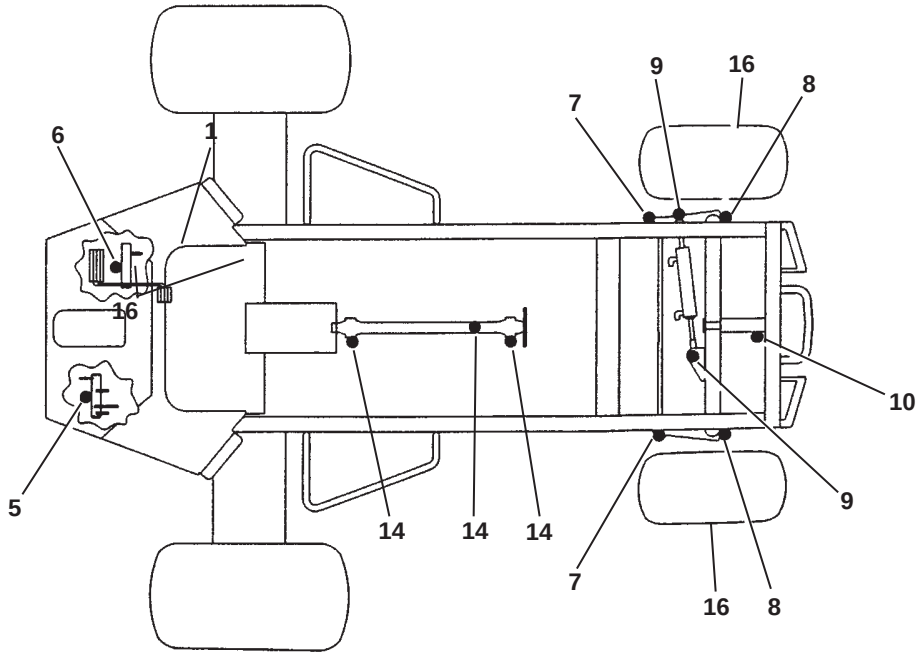
CAUTION

Do NOT use compressed air grease guns.

Over greasing will produce high loads on bearings and pivot points reducing performance of the machine.

MOWERS (Front Left Mower Shown)





LUBE CHART

50 HOURS (Every Week)

1	a	Swivel Housing
2	a	Lift Arm
3	a	Lift Cylinders
4	a	Lift Arm Pivot
5	a	Brake Pedal Pivot
6	a	Traction Pedal Pivot
7	a	Ball Joints
8	a	Steering Pivot
9	a	Steering Cylinder
10	a	Axle Pivot

100 HOURS

11	a	Reel Bearing Cavity
12	a	Front Roller
13	a	Rear Roller
14	a	U-Joint Driveshaft

250 HOURS

15	a	Reel Motor Spline

ANNUALLY

16	b	Rear Wheel Bearings (2WD only)

FOOTNOTES

a Use a good quality NLGI Grade 2 grease (use manual grease gun).

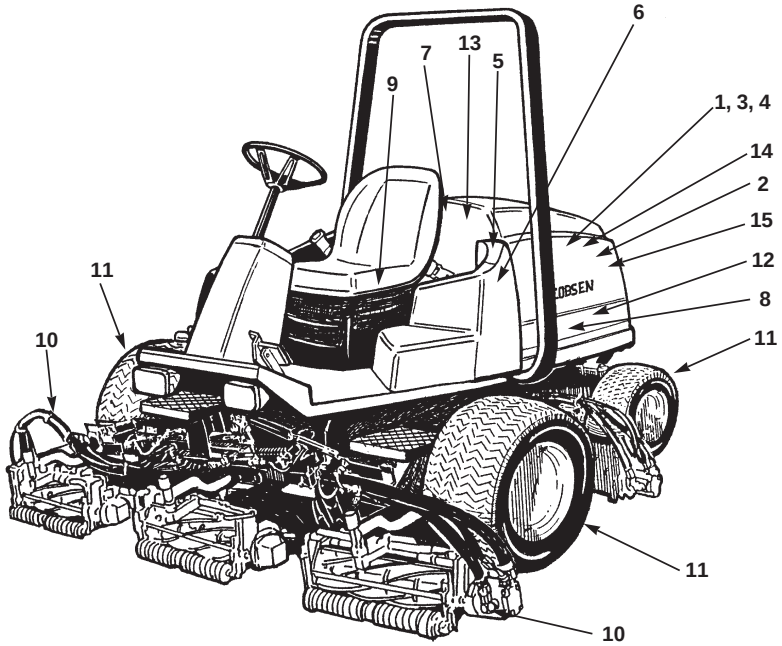
b Pack bearings with NLGI Grade 2 grease.

Figure 11B-1. Lubrication Schedule

11B

SECTION 11B. LUBRICATION AND MAINTENANCE SCHEDULES

MAINTENANCE SCHEDULE
(See Figure 11B-2)



FOOTNOTES

c Radiator should be full and recovery bottle full to "cold" mark.

d Use ISO VG68, available in cases of two 2.5 gal. (9.5 liter) bottles (P/N 5001405) or 5 gal. (19 liter) pails (P/N 5001404). Hydraulic capacity is 10 gal. (37.85 liters).

Or use Greens Care 46 biodegradable hydraulic fluid, available in 55 gal. (208 liter) drums (P/N 5003104) or 5 gal. (19 liter) pails (P/N 5003105).

NOTE

Biodegradable fluid uses this symbol.

e Inspect belt after first 10 hours of operation. Adjust alternator pulley so belt deflects 1/4 to 5/16 inch (6 to 8 mm) with a 20 lb. push midway between pulleys.

MAINTENANCE SCHEDULE CHART

Ref.	Description	Every 8-10 Hours	Every 50 Hours	Every 100 Hours	Every 200 Hours	Every 500 Hours	Annually	Remarks
1	Air cleaner	X						Clean dust cap.
1	Air cleaner element			X			X	As necessary. Replace annually.
1	Air cleaner filter minder indicator	X						Check daily; change element when red band is in window with engine shut down.
2	Radiator screen	X						Check, clean.
2	**c** Cooling system	X						Check, clean, fill.
							X	Change coolant annually.
3	Engine oil	X						Check.
				X				Change oil. Use 5.5 qts. (5.2 liters) SAE 10W-30 classification CD/CE.
4	Engine oil filter		X	X				Change. Replace filter after the first 50 hours of operation, thereafter, every two weeks.
5	**d** Hydraulic oil	X						Check level.
						X		Change oil.
6	Hydraulic oil filters	X				X		Replace filter after the first 50 hours of operation, thereafter, 500 hours or sooner if conditions warrant.
7	Fuel level	X						Check, refill with #2 fuel oil, cetane rating 45.
8	Fuel filter				X			Inspect. Clean, if necessary.
9	Electrical interlock system	X						Test. Do not operate vehicle if test fails.
10	Hydraulic hoses and fittings	X						Inspect.
11	Tires		X					Check. Inflate 10-12 psi (69-83 kPa)
12	Battery			X				Inspect, clean.
13	Muffler/exhaust				X			Inspect.
14	**e** Engine belts	X		X				Inspect. Adjust, if necessary.
15	Oil cooler	X						Inspect, clean.

Figure 11B-2. Maintenance Schedule

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SECTION 12
ATTACHMENTS

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SECTION 12A. REPAIR AND SERVICE TOOLS AND MATERIALS

Tools required:	Standard automotive hand tools, including driving tools, and seal spreaders; Reel Grinder; Bedknife Grinder; Lapping Machine; Bearing Puller.
Cleaning materials:	Stoddard or equivalent solvent. Detergent and water.
Lubricants:	Refer to Section 11.
Other service items:	Newspaper. Gauge bar for adjusting bedknife (P/N 158568). Lapping compound available as: • One 10 pound pail of 80 grit (P/N 5002488) • One 25 pound pail of 80 grit (P/N 5002490) • One 10 pound pail of 120 grit (P/N 5002489) • One 25 pound pail of 120 grit (P/N 5002491)

SECTION 12B. FAILURE ANALYSIS

PROBLEM	PROBABLE CAUSE	REMEDY
1. Mower does not turn.	a. Reel is jammed with grass.	a. Clean reels.
	b. Reel motor new (tight).	b. Turn in REVERSE to break in motors.
	c. Reel motor malfunctioning.	c. Repair or replace (Section 8I or 8J).
	d. Bedknife too tight.	d. Adjust (Section 12D).
	e. Mower switch malfunctioning.	e. Test (Section 10G).
	f. Mower switch not in FORWARD or REVERSE position.	f. Push switch into FORWARD or REVERSE position.
	g. Reel bearing failure.	g. Repair (Section 12D).
	h. Motor drive coupling failure.	h. Replace (Section 12D).
2. Reel turns only FORWARD, not in REVERSE when mower switch is pushed.	a. Mower switch malfunctioning.	a. Test (Section 10G).
	b. Reel valve solenoid failure.	b. Test (Section 10K).
3. Reels turn slow.	a. Reel motor malfunctioning.	a. Test/repair (Sections 8N and 8I or 8J).
	b. Solenoid valve malfunctioning.	b. Test/repair (Sections 8N and 10K).
	c. Reel pump malfunctioning.	c. Test/replace (Sections 8N and 8H).
4. Only one reel circuit affected.	a. Reel motor malfunctioning.	a. Test/repair (Sections 8N and 8I or 8J).
	b. Solenoid valve malfunctioning.	b. Test/repair (Sections 8N and 10K).
	c. One reel pump section malfunctioning.	c. Test/repair (Sections 8N and 8H).
	d. Reel motor malfunctioning.	d. Test/replace (Sections 8N and 8I or 8J).
5. Uneven cutting.	a. Reel has loose or broken blades.	a. Repair (Section 12F or 12G).
	b. Reel bearing or bearing housings are worn.	b. Repair (Section 12F or 12G).
	c. Roller or roller bearings defective.	c. Repair (Section 12H).
	d. Reel blade and/or bedknife damaged.	d. Repair (Section 12F or 12G).
6. Ragged cutting.	a. Bedknife has damaged edge and/or face.	a. Sharpen (Section 12E).
	b. Reel not sharp.	b. Sharpen (Section 12E).
	c. Poor reel to bedknife adjustment.	c. Adjust (Section 12D).

SECTION 12C. GENERAL INSTRUCTIONS

GENERAL

The mower units of the LF-3400 and LF-3800 differ greatly. Carefully read the following instructions to make certain they pertain to your machine.

BEDKNIFE VARIATIONS (See Figure 12C-1)

The standard bedknife for machines shipped from the factory is the “low profile.”

Optional “high profile” and “ultraknife” bedknives are also available for the LF-3400 and LF-3800.

Bedknife selection depends upon the desired cutting job to be done. Bedknives are designed for various heights.

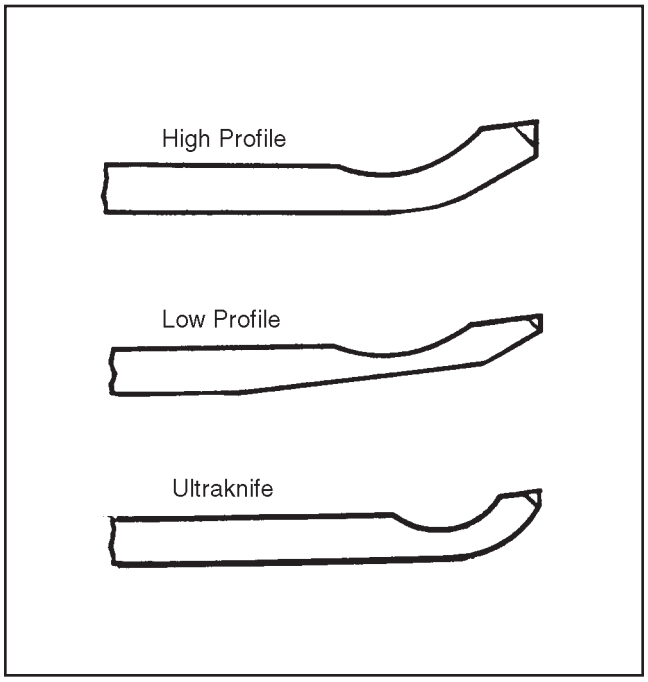


Figure 12C-1. Bedknife Configurations

PREPARATION FOR REPAIR

Thoroughly clean the mower and reel assemblies prior to disassembly and repair procedures. Coat bare metal parts with a light coat of oil.

The cutting and grooming attachments are exposed to water (used in daily washing), grass clippings, sand, corrosive fertilizers, and foreign objects such as tees. It may be necessary to use bearing pullers and/or wooden blocks and hammers to free up some parts such as bearings and spacers.

When such force is required to remove parts, those parts should be replaced rather than reinstalled on the machine.

WARNING

Before removing components, turn mower switch “OFF”, lower reels, stop engine, set parking brake and remove key from ignition switch.

DEFLECTOR AND THROW SHIELD (See Figure 12C-2)

Remove the deflector and throw shield, as shown in Figure 12C-2, to gain access to mower unit components.

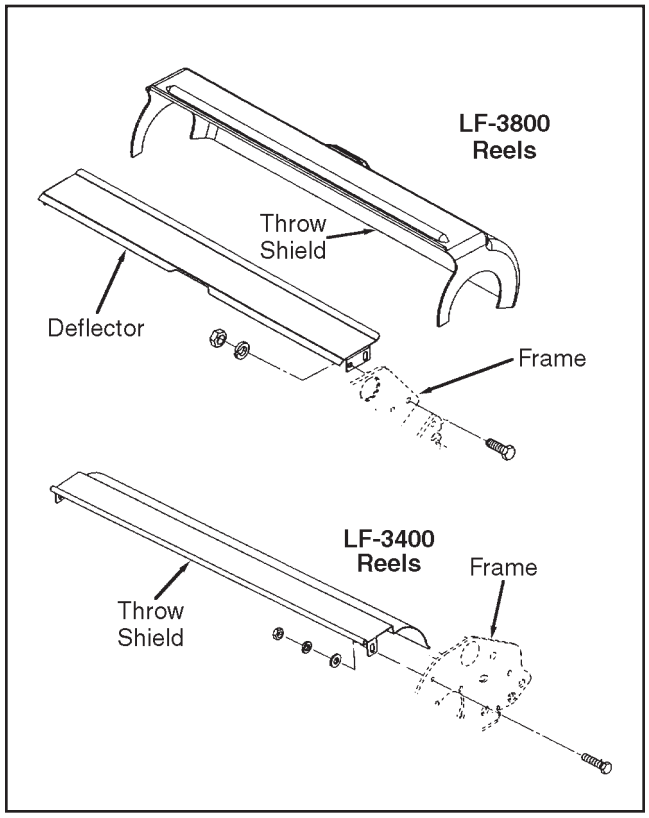


Figure 12C-2. Deflector and Throw Shield

12C

SECTION 12D. MOWER AND REEL ADJUSTMENTS

DOWN PRESSURE ADJUSTMENT

Each reel is equipped with a down pressure spring. Down pressure improves cutting quality by ensuring good contact between the reel and ground when cutting uneven surfaces. Check and adjust down pressure any time cutting height has been changed (see Figure 12D-1).

1. Lower reels to the ground. Engage parking brake, stop engine and remove key from ignition switch.

NOTE

Reels must be lowered when measuring down pressure.

2. Measure length of spring as shown. Adjust spring to 3.75 ± 0.06 inch (95 ± 1.5 mm).

   To make fine adjustments loosen jam nut and turn adjusting rod in or out of rod end. Tighten jam nut after adjustment is made. For adjustments greater than 1/4 inch (6 mm), relax spring tension by first raising reels, then adjust pin up or down in holes.

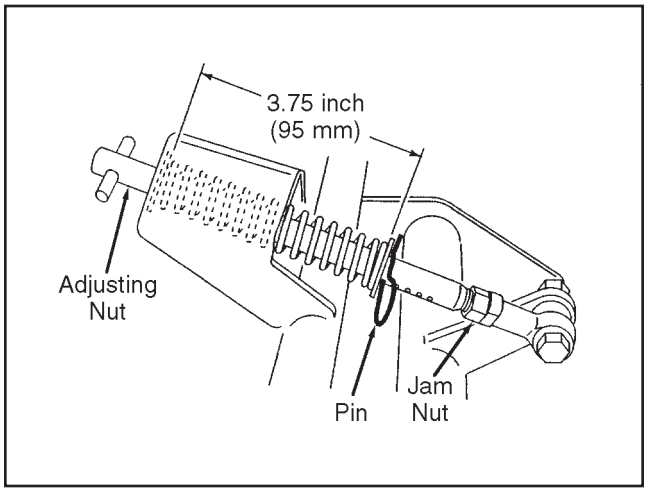


Figure 12D-1. Down Pressure Adjustment

If the down pressure springs require replacement, disassemble as shown in Figure 12D-2. Replace damaged components, reassemble as shown and adjust as described above.

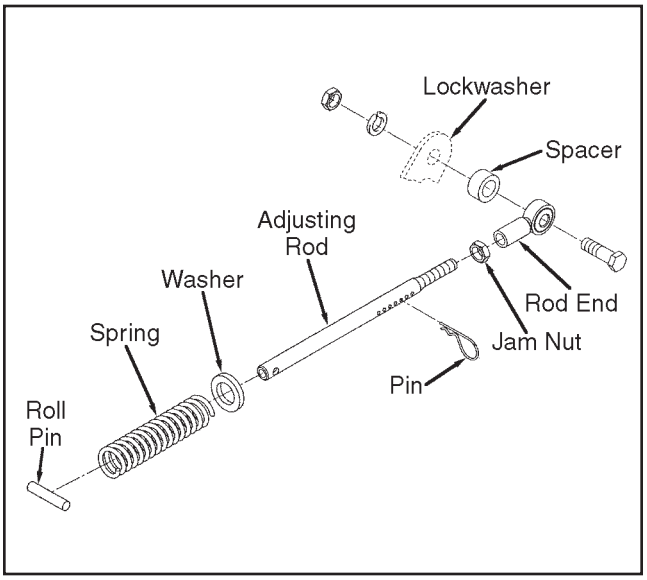


Figure 12D-2. Down Pressure Springs Repair

BEDKNIFE-TO-REEL ADJUSTMENT

WARNING

To prevent personal injury and damage to the cutting edges, handle the reel with extreme care.

1. Reel bearings are self-adjusting. Check the reel bearings for end play or radial play which would indicate worn bearings to be replaced as described in Sections 12F and 12G.
2. Inspect the reel blades and bedknife to insure good sharp edges without bends or nicks.
   a. The leading edge of the reel blades must be sharp, free of burrs and show no signs of rounding off.
   b. The bedknife and bedknife backing must be securely tightened. The bedknife must be straight and sharp.

SECTION 12D. MOWER AND REEL ADJUSTMENTS

c. For the standard low profile bedknife, a flat surface of at least 1/16 inch (1.5 mm) minimum must be maintained on the front face of the bedknife (see Figure 12D-3). Use a small disc grinder to dress the bedknife.

For the optional high profile bedknife, this front face should be 3/32 inch (2.38 mm). For the ultraknife, the front face should be 9/64 inch (0.138 mm).

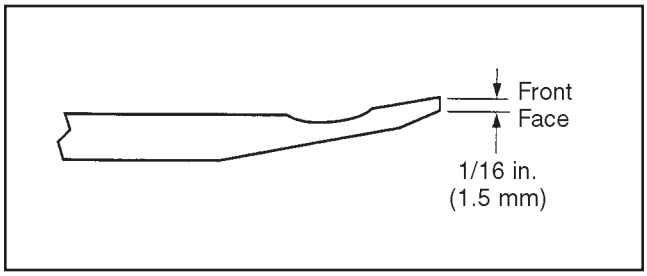


Figure 2D-3. Standard Bedknife Front FAce

3. If wear or damage is beyond the point where the reel or bedknife can be corrected by the lapping process, they must be ground (see Section 12E).
4. Proper reel-to-bedknife adjustment is critical. A gap of 0.001 to 0.003 inch (0.025 to 0.076 mm) must be maintained across the entire length of the reel and bedknife.
5. The reel must be parallel to the bedknife. An improperly adjusted reel will lose its sharp edges prematurely and may result in serious damage to the reel and bedknife.
6. Grass conditions will also affect the adjustment.
   a. Dry, sparse conditions will require a wider gap to prevent heat buildup and damage to the reel and bedknife.
   b. High quality grass with a good moisture content requires a closer gap (near zero).
7. Start adjustment at leading end of reel, followed by the trailing end. The leading end of the reel blade is that end which passes over the bedknife first during normal reel rotation (see Figure 12D-4).

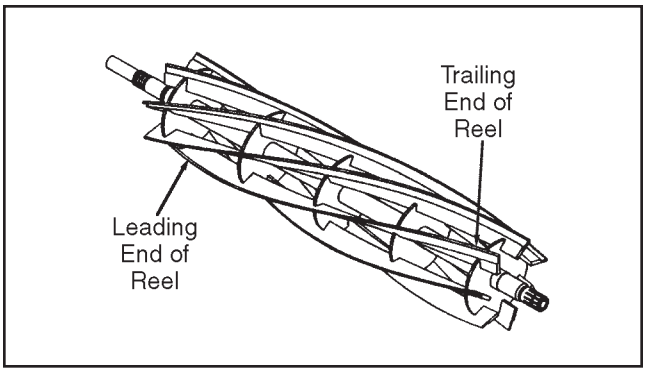


Figure 2D-4. Reel Leading End

8. Set leading edge of reel. On LF-3800 reels, use adjuster, to set the bedknife-to-reel gap. Screw adjuster knob down (clockwise) to reduce gap (see Figure 12D-5).

   On LF-3400 reels, use adjusting screws to adjust gap. Loosen bottom screw and turn top screw down to reduce gap.
9. Slide a feeler gauge or shim stock — 0.001 to 0.003 inch (0.025 to 0.076 mm) — between the reel blade and the bedknife. Do not turn the reel.
10. Adjust the trailing end of the reel in the same manner, then recheck the adjustment at the leading end.
11. When the reel is properly adjusted to the bedknife, the reel will spin freely and you should be able to cut a piece of newspaper, along the full length of the reel, when the paper is held at 90° to the the bedknife.

NOTE

Avoid excessive tightening or damage may occur to bedknife and reel blades. Reels must turn freely.

SECTION 12D. MOWER AND REEL ADJUSTMENTS

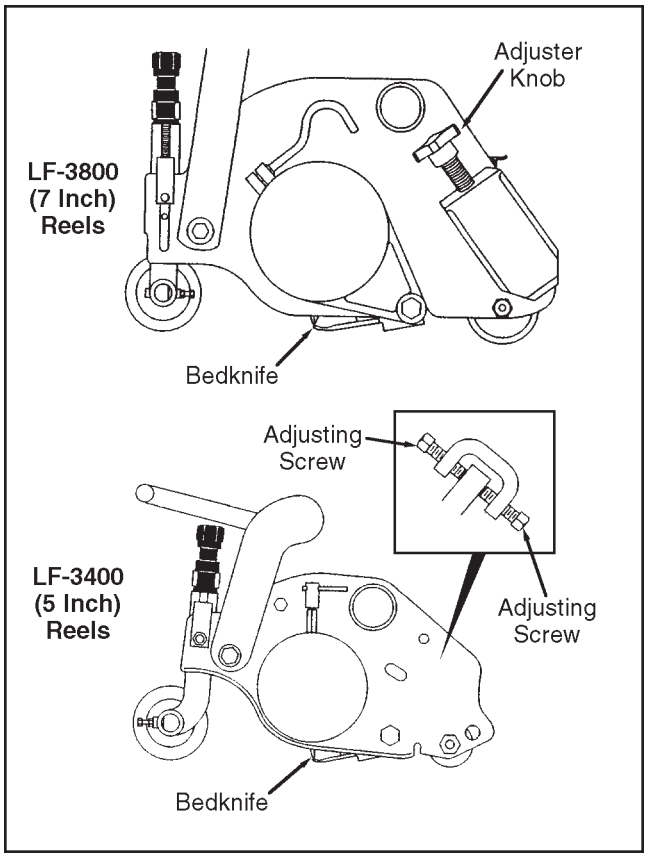


Figure 2D-5. Bedknife-to-Reel Adjustment

CUTTING HEIGHT ADJUSTMENT (See Figure 12D-6)

All reels must be accurately adjusted to exactly the same height for proper cutting.

It is best to use two gauge bars, one on each side of the reel, then adjust each end equally.

NOTE

See preceding paragraph for bedknife-to-reel adjustment.

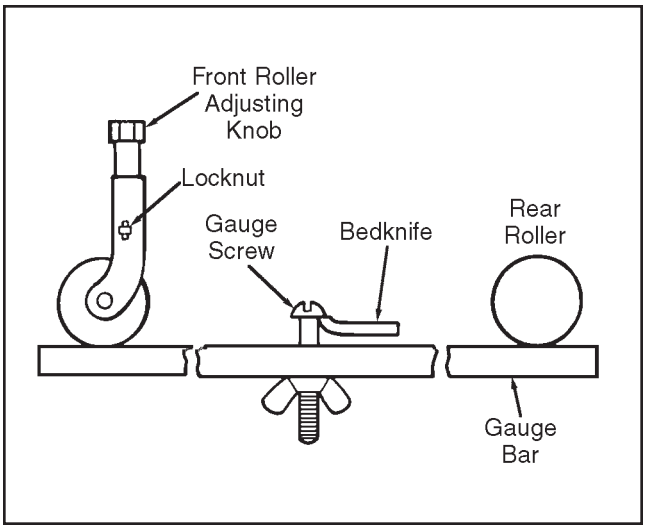


Figure 2D-6. Cutting Height Adjustment

1. Loosen the locknut on the side of the front roller brackets just enough to allow the adjusting nut to raise or lower the bracket.
2. Set cutting height gauge to desired height by measuring between the underside of screw head and gauge bar surface and tighten the wing nut.
3. Place gauge bar across bottom of front and rear rollers near one end.
4. Slide the head of gauge screw over the bedknife.
5. Adjust the hand adjusting knob of the front roller to close the gap between the roller and gauge bar. Then tighten locknut.
6. Repeat steps on opposite end.
7. After tightening locknuts, recheck each end with gauge for proper adjustment.

SECTION 12E. SHARPENING REELS AND BEDKNIVES

GENERAL

When a mower reel rotates, it cuts off the tops of grass blades which are lifted and held erect by a flat stationary bedknife. A properly sharpened and adjusted reel mower cuts grass cleanly and with minimum effort. A poorly sharpened reel mower may tear, shread, pull, or leave grass uncut and usually requires more effort than a properly sharpened reel mower.

If a mower cuts in streaks, strips or ragged areas, chances are the cutting edges are not properly adjusted or they need sharpening.

Inspect the blades and bedknife for nicks, gouges, high or low wear areas, or other signs of damage or uneven wear. However, consider these other factors that can contribute to poor cutting performance before grinding and lapping the cutting edges:

IMPROPER ADJUSTMENT

The perfect adjustment of blade and bedknife is a light contact without drag or resistance to rotation. Owing to the manufacturing clearances required in bearings and other mating components, the bedknife should be set close enough to the reel so the mower cuts a strip of newspaper clear across the blades without a metal-to-metal contact between the bedknife and reel blades.

DAMAGED MOWER PARTS

A gouged bedknife, nicked reel blade, or wavy bedknife and reel as well as a bent frame, bent bedknife ears, broken welds, worn bearings or loose attaching hardware can cause poor quality cutting. Solve such problems by making sure the bedknife mounting screws and other hardware are secure and by replacing parts if damage cannot be corrected by grinding and lapping.

BAD BEARINGS, END PLAY OR RADIAL PLAY

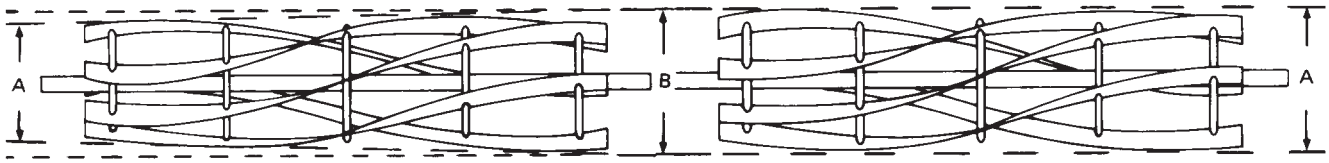
Check for play in the reel bearings. Mowers have self adjusting bearings. Excessive play indicates worn bearings or weak tensioning spring. Repair as described in Section 12F or 12G.

CAUTION

Never grind and lap a reel in the frame until all end play and radial play are eliminated. End or radial play will cause uneven grinding.

Reel blades and a bedknife that are slightly dull or have minor nicks or high spots can be honed quickly and easily by lapping. Both grinding and lapping are required when more severe wear or damage exists. If a wave has developed in the bedknife, lapping will not solve the problem and the mower reel and bedknife must be ground.

A reel worn or incorrectly ground to a conical shape instead of a cylindrical shape will cause a wavy bedknife (see Figure 12E-1).



If diameters A and B are not equal, the reel is conical.

If diameters A and B are equal, the reel is cylindrical.

NOTE

Always correct a conical shaped reel by grinding. A conical reel can cause a wavy bedknife.

Figure 12E-1. Reel Wear

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SECTION 12E. SHARPENING REELS AND BEDKNIVES

BEDKNIFE FRONT FACE ANGLE (See Figure 12E-2)

If grass is to be cut at the desired height, it must contact the front edge (front face) of the bedknife at the proper angle. This front face angle is called the “front face relief” angle.

Without a relief angle to the bedknife front face, the grass blades would contact the lower edge of the bedknife and simply fold over and not be lifted to an angle where they could be cut by the reel blades.

The proper bedknife front face relief angle for all Jacobsen reel mowers is 0 to 5°. The height thickness of the front face must be taken into consideration when grinding the relief angle. Regardless of the height of the front face, the relief angle is measured from the top of the bottom of the front face, not from the top to bottom of the front of the bedknife.

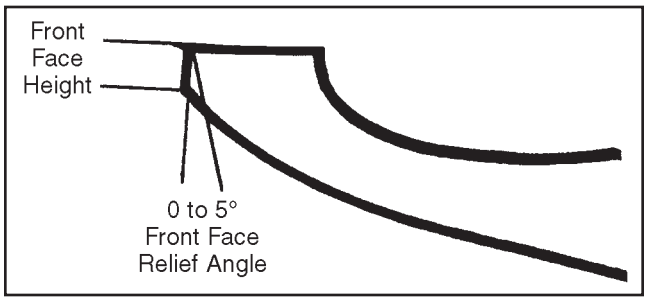

Figure 12E-2. Front Face Grinding Angle

BACKLAPPING

GENERAL (See Figure 12E-3)

Lapping is to be considered a honing process and should not be used to sharpen an extremely dull or damaged reel or bedknife.

Lapping is not a substitute for grinding. Lapping can maintain a sharp edge — it does not create a sharp edge.

Lapping (backlapping) is the method of removing nicks, burrs, and other minor obstructions to clean cutting.

During the lapping process, the reel-to-bedknife clearance is adjusted until the reel and bedknife are in contact. Lapping compound is applied to the relief area of the reel blades.

When the reel is turned in the backward direction shown, lapping compound is forced between the top of the bedknife and the “land” (or cutting edge) of the reel blade.

The grit in the lapping compound acts like sandpaper to hone the cutting edges of both the bedknife and reel blades. Only a small amount of metal (0.005 inch [0.127 mm]) or less should be removed by lapping. Beyond that point, the lapping process actually destroys the cutting surface. There is no clearance in lapping.

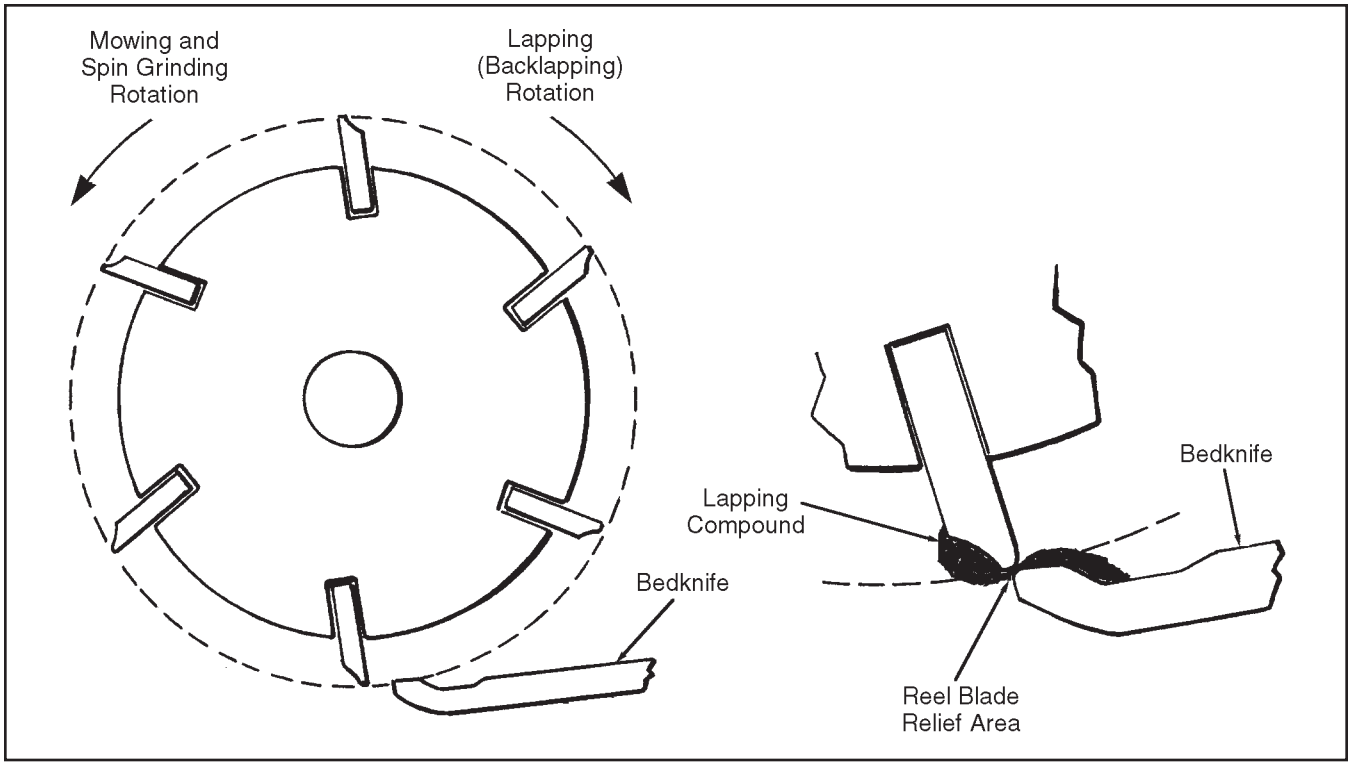

Figure 12E-3. Lapping Process

SECTION 12E. SHARPENING REELS AND BEDKNIVES

BACKLAPPING ON THE TRACTOR (See Figure 12E-4)

WARNING

Since the engine is operating during lapping on the machine, never backlap on the machine without proper ventilation. Carbon monoxide in exhaust fumes can be fatal.

1. Lower the reels to the ground, disengage all drives, engage parking brake and stop engine.
2. Loosen locknut at valve stem.
3. Open hood and place backlap control to REVERSE. Start the engine and set throttle to low idle speed.
4. Set mower switch on instrument panel to REVERSE. Reels will begin rotating.
5. Both the front and rear reel valves contain an adjustable control to control the speed of the reels. The front valve controls the front three reels. The back valve controls the two rear reels. Turn valve control counterclockwise to reduce reel speed. Repeat for both valves.
6. After the desired speed is set, disengage reels and stop engine. Tighten locknut to lock adjustment in place. Start engine and set mower switch to REVERSE to begin backlapping.
7. Apply lapping compound, with a long handled brush, along the entire length of the reel.
8. When the blades have been evenly honed, carefully and thoroughly wash off the remaining mixture.

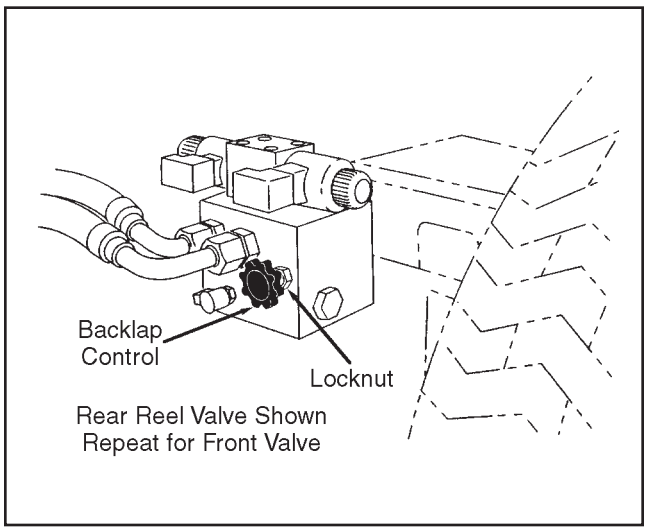

Figure 12E-4. Backlap Control

9. Repeat the entire process on the other reels.
10. After lapping, turn mow switch OFF (center position) and set backlap control for FORWARD rotation.

NOTE

The backlap control limits reverse speed only. Once the desired backlapping speed has been set, the valves can remain in this position for normal mowing. If full reverse speed is needed, for instance during operation of vertical mowers, the valve can be fully closed (turn clockwise).

BENCH LAPPING

Whenever a reel and bedknife have been ground or a new reel and/or bedknife are being installed, the assembled reel should be lapped using an electric powered bench lapper. Operate the bench lapper in accordance with the its manufacturer's instructions.

1. The lapper should be connected to the reel shaft at the end opposite the hydraulic reel motor.
2. Apply lapping compound to each reel blade.
3. Run the lapper and continue applying lapping compound, making slight reel-to-bedknife adjustments if necessary until there is uniform contact along the full length of the cutting edges.

WARNING

Do not rotate the reel by hand, use a piece of wood, plastic, or other rigid non-metallic material to rotate the reel by hand, when checking clearances.

4. Turn off the lapper.
5. Wash off compound before running the reel in the forward direction.
6. Carefully turn the reel backward slowly by using a wooden or other non-metallic probe. Make necessary reel-to-bedknife clearance adjustments (see Section 12D).
7. As a final check, place a strip of newspaper vertically between the reel and bedknife. Manually rotate the reel forward. The blades should cut the newspaper across entire edge of the bedknife.
8. If mower unit was removed, lubricate and install the mower unit on the machine as described in Section 12F or 12G.
9. Make reel-to-bedknife adjustments and cutting height adjustments for each reel after installation (see Figure 12D).

SECTION 12E. SHARPENING REELS AND BEDKNIVES

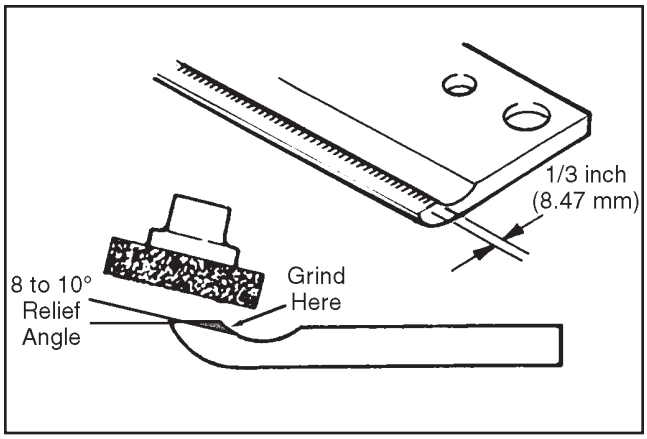

Figure 12E-5. Bedknife Grinding Angle

DANGER

Always wear eye protection when operating a grinding machine.

CAUTION

Handle and store grinding wheels carefully. Discard grinding wheels that are cracked, badly chipped, or have been dropped.

CAUTION

Always install blotter washers between the grinding wheel and the flanges. Do not overtighten the flange nut on the grinding wheel. Do not run a grinding wheel faster than specified on the wheel blotters.

DANGER

Do not stand in line with a grinding wheel the first three minutes it is run. Never jam a grinding wheel into the work piece, especially when the wheel is not rotating.

1. Before mounting the bedknife on the grinding machine, thoroughly remove all dried material, rust and scale from the bedknife.
2. Hand held grinders can be used to grind the bedknife while it is installed in the mower unit. Other grinding machines require the removal of the bedknife from the mower unit. Refer to the grinding machine manufacturer's instructions for mounting the bedknife and operating the grinders.
3. Tilt the grinding head so the stone contacts the bedknife at rear one third of top surface. This will give proper set up to grind bedknife correctly (see Figure 12E-5).
4. Grind the top face and front face as described in the preceding paragraphs.

NOTE

The bedknife end at which the reel first makes contact is called the leading end. A beveled corner (dub) is ground on this end. It is important that the dub be maintained throughout the life of the bedknife. The dub provides an entrance ramp for the reel blade on to the bedknife. If the dub is worn or ground away and not replaced, the reel blade could hook the corner of the bedknife as it begins contact.

5. After grinding the bedknife, examine the dub. If, through grinding, it has become smaller than 0.18 inch (1.6 mm) hand grind or file the surface to the specified dimensions.
6. Use a fine hone or block of wood to clean up ground material and any small burrs after grinding the bedknife.

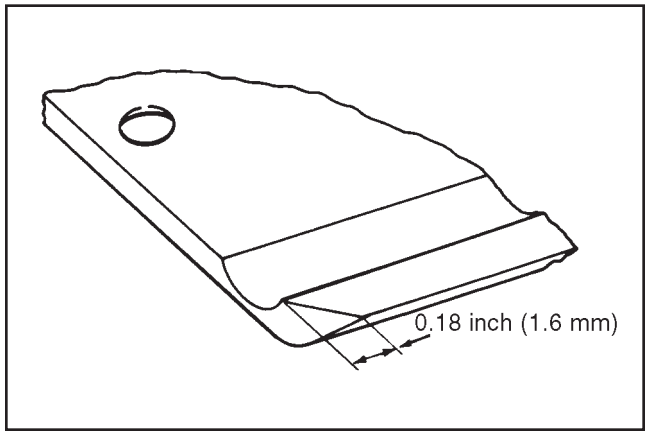

Figure 12E-6. Bedknife Dub

SECTION 12E. SHARPENING REELS AND BEDKNIVES

REEL REPAIR AND GRINDING (See Figure 12E-7)

Reel blades and a bedknife that are slightly dull or have minor nicks or high spots can be reconditioned quickly and easily by lapping. Grinding is required when more severe wear or damage exists. If a wave has developed in the bedknife, lapping will not solve the problem and the mower reel and bedknife must be ground or replaced.

NOTE

A reel worn or one incorrectly ground to a conical shape instead of a cylindrical shape will cause a wavy bedknife.

Prior to grinding the reel, clean, inspect, and repair the reel as follows:

- Steam clean or wash the reel.
- Clean the reel thoroughly by scraping off all dried material from the blades.
- Inspect the back of each reel blade for irregular surface which could cause the guide finger to hang up while grinding. Remove any irregularities.
- Inspect the welds at the spiders. If any have cracked or broken loose, reweld using a #7018 low hydrogen welding rod.
- Straighten any bent reel blades by hammering into shape with a block of steel and a hammer.

The method of grinding will depend upon the grinding equipment being used. Set up and operate the grinding machine in accordance with the manufacturer's instructions.

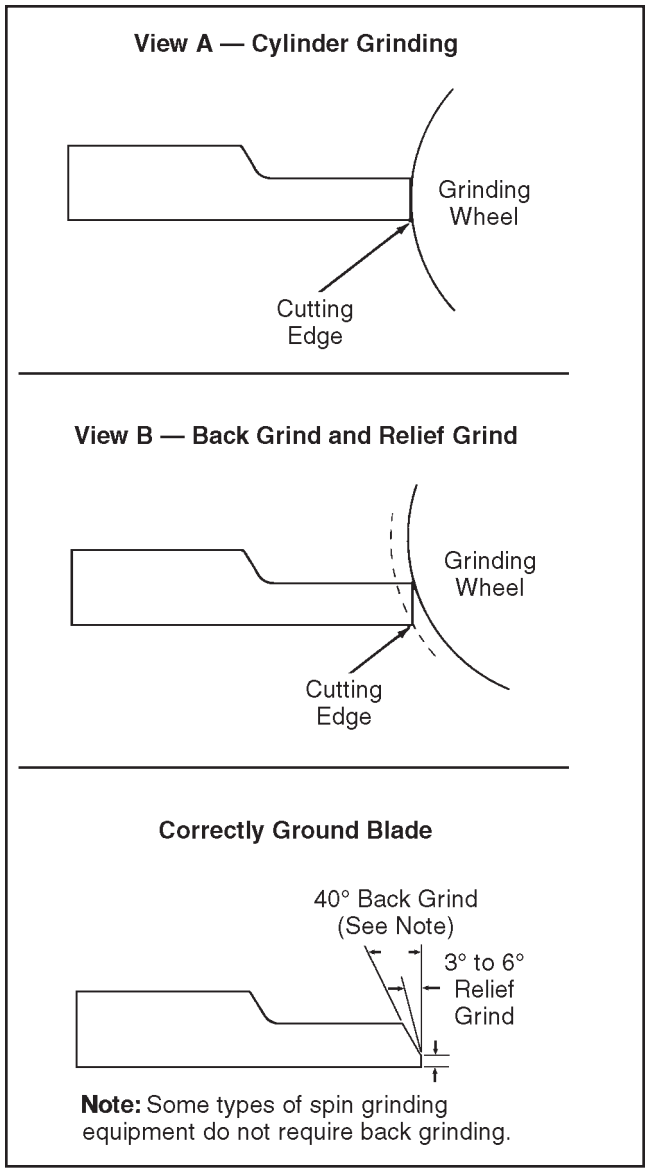

Figure 12E-7. Reel Grinding Procedure

12E

SECTION 12F. LF-3400 MOWER UNITS

REMOVAL
(See Figure 12F-1)

1. Lower the mower units to the ground. Mark or note the position of the down pressure adjustment pins (see Section 12D). Remove the down pressure adjustment pins.
2. Lift the quick release pin and turn it forward to release the reel motor.
3. Pull the reel motor straight out from the mower housing.
4. Carefully place the reel motor and its hoses away from the mower unit. Cap or cover the bearing housing cavity to prevent contamination and/or damage to internal mower components.
5. Remove the cap on the lift arm. Unfasten the pin retaining clip and remove the yoke pin.
6. Carefully raise the lift arm to clear the lift yoke and remove the mower unit.

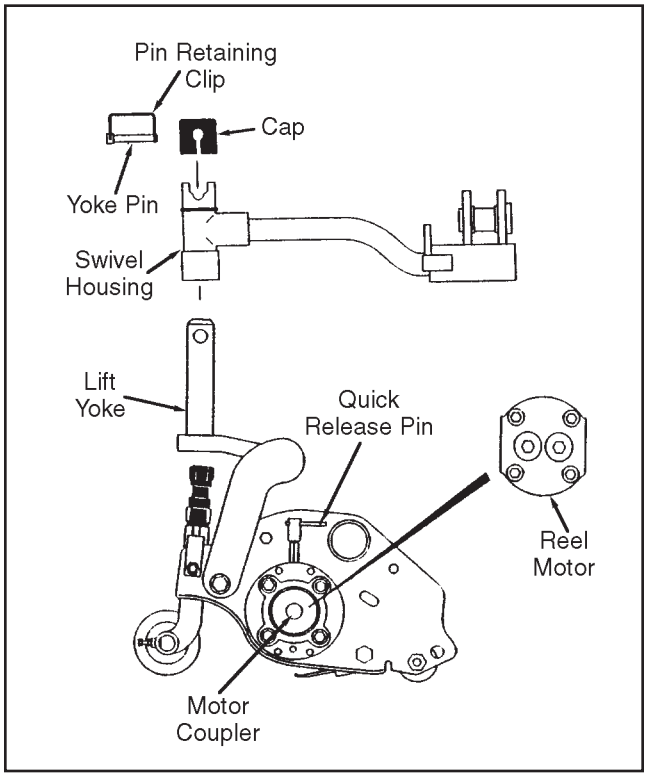

Figure 12F-1. Mower Unit Removal/Installation

BEDKNIFE REPLACEMENT
(See Figure 12F-2)

Bedknives that cannot be repaired by lapping or grinding should be replaced. The bedknife is held to the bedknife shoe by flat head screws. When replacing a bedknife the bedknife should be lightly ground to level the cutting edge.

When a bedknife is installed, clean the backing prior to installation.

Secure the installed bedknife by tightening the mounting screws, starting with those at the center and working out to the ends.

A new bedknife must be ground to assure straightness and parallelism with the reel cylinder (see Section 12D).

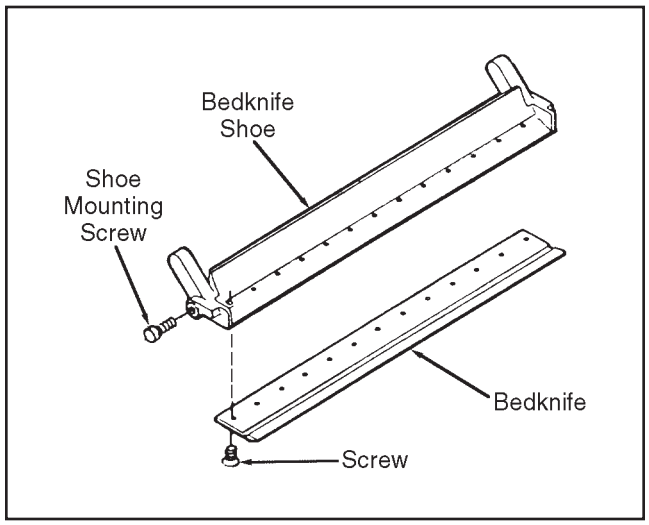

Figure 12F-2. Bedknife Removal and Replacement

DISASSEMBLY

1. Remove lift yoke attaching hardware and lift yoke.
2. Refer to Figure 12F-3 (Sheet 1 of 2). If not previously removed, remove the throw shield.
3. Remove the bedknife assembly from the mower frame (see Figure 12F-3, Sheet 2).
4. Using a block of wood, block the reel so it will not turn.
5. Using a suitable puller, remove the reel motor coupler.
6. Remove the remaining components as shown in Figure 12F-3, Sheets 1 and 2.

SECTION 12F. LF-3400 MOWER UNITS

INSPECTION

Inspect reel, if cracked or broken, repair using a #7018 low hydrogen welding rod.

Discard seals and bearings.

Check frame for cracks and/or bent frame members.

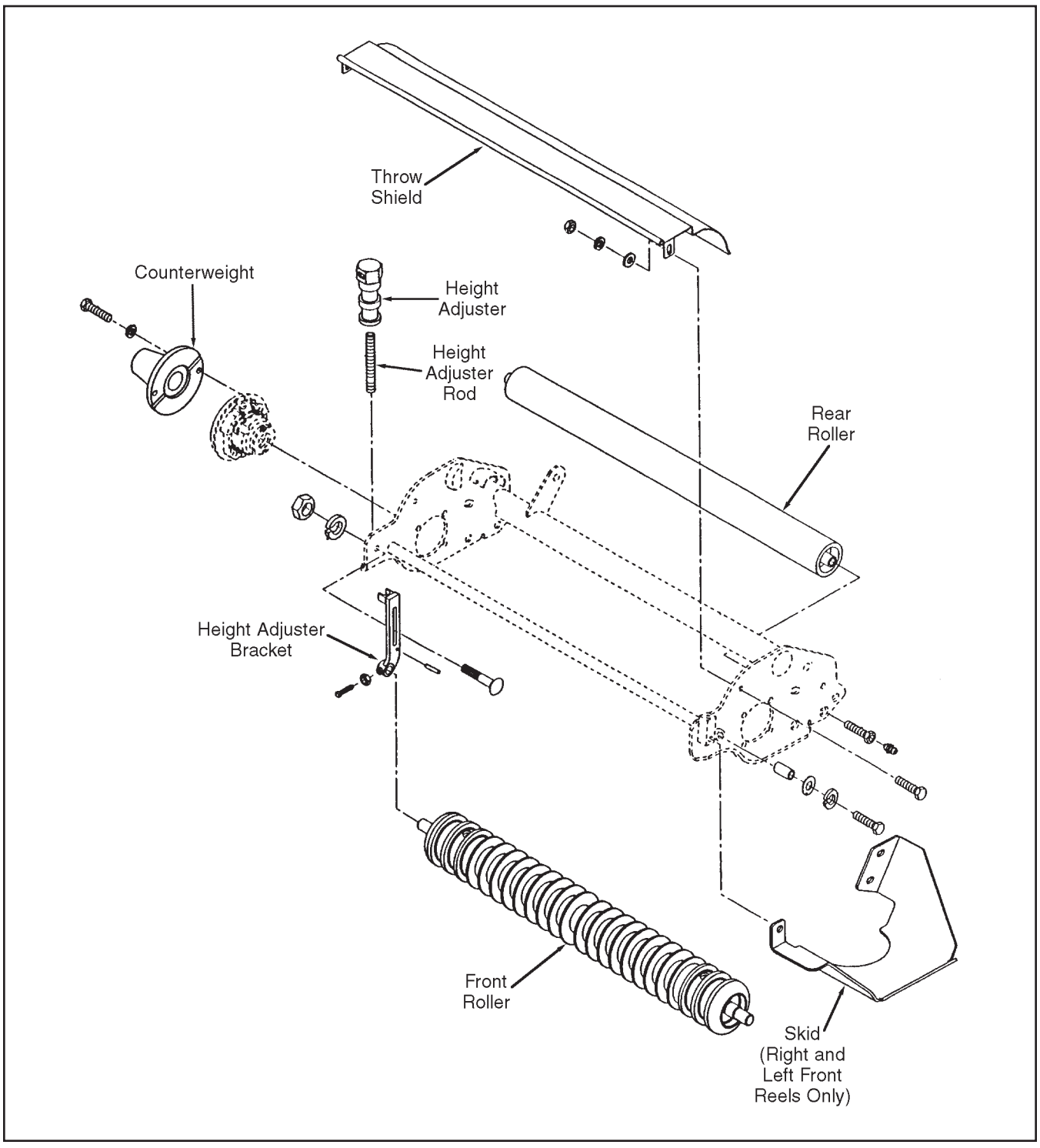

Figure 12F-3. Mower Unit Repair (Sheet 1 of 2)

SECTION 12F. LF-3400 MOWER UNITS

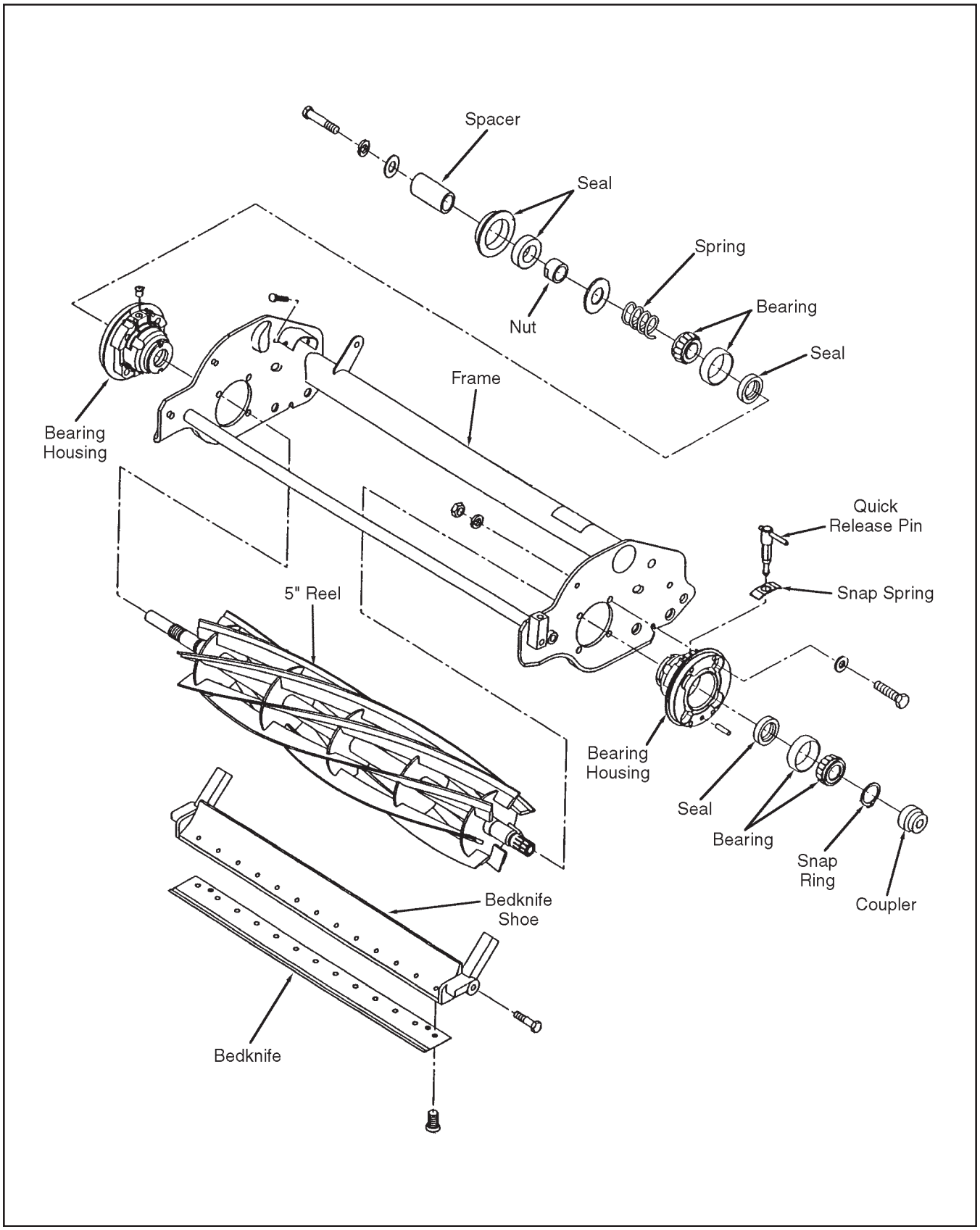

Figure 12F-3. Mower Unit Repair (Sheet 2 of 2)

SECTION 12F. LF-3400 MOWER UNITS

REASSEMBLY

1. Refer to Figure 12F-4. Using a suitable press, install new seals, lip to the outside, in the bearing housings.
2. Using a suitable press, install bearing cups, taper toward the inside of housing.

NOTE

Make sure bearing is seated squarely against shoulder of housing.

3. Wrap both ends of the reel shaft with a plastic bag or wrapping material. This will protect the shaft seal when installing the reel.
4. Install the reel, splined end on the left, into the frame.
5. Slide the bearing housing with the quick release pin over the splined end of the shaft against the frame. Fasten it with the mounting hardware.
6. Repeat Step 5 on the right side of the frame.
7. On the left, install the bearing cone and snap ring.
8. On the right install the bearing cone and spring.
9. Apply a small amount of Loctite® 243 (Textron P/N 2810300 [10 ml btl.] or 2811163 [50 ml btl.]) to the threads of the nut. Install nut so there is 1-27/32 inches (46.8 mm) from the nut to the end of the reel shaft.
10. Install seal assembly, counterweight, spacer, flat washer, lockwasher and screw.
11. Install reel motor coupler in bearing housing as shown in Figure 12F-3, Sheet 2.
12. Install the bedknife.
13. Refer to Figure 12F-3, Sheet 1. Install the rear roller, height adjusters, front roller, skids, and throw shield.
14. Install the left yoke and install the mower unit in the swivel housing (see Figure 12F-1).
15. Make adjustments described in Section 12D.

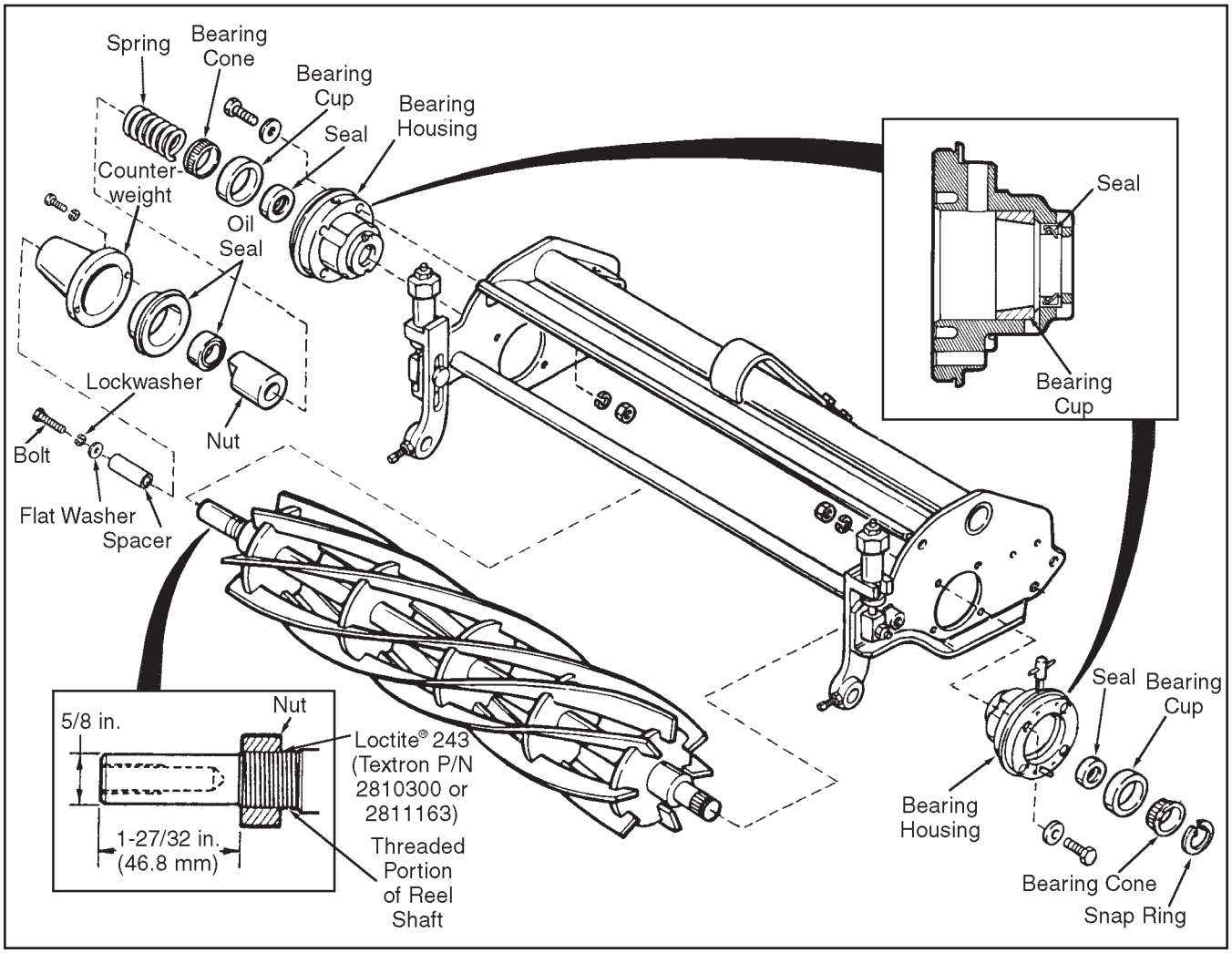

Figure 12F-4. Reel Reassembly

SECTION 12G. LF-3800 MOWER UNITS

REMOVAL
(See Figure 12G-1)

1. Lower the mower units to the ground. Mark or note the position of the down pressure adjustment pins (see Section 12D). Remove the down pressure adjustment pins.
2. Turn the key to loosen the clamp on the motor housing.
3. Pull the real motor straight out from the mower housing.
4. Carefully place the reel motor and its hoses away from the mower unit. Cap or cover the bearing housing cavity to prevent contamination and/or damage to internal mower components.
5. Remove the cap on the lift arm. Unfasten the pin retaining clip and remove the yoke pin.
6. Carefully raise the lift arm to clear the lift yoke and remove the mower unit.

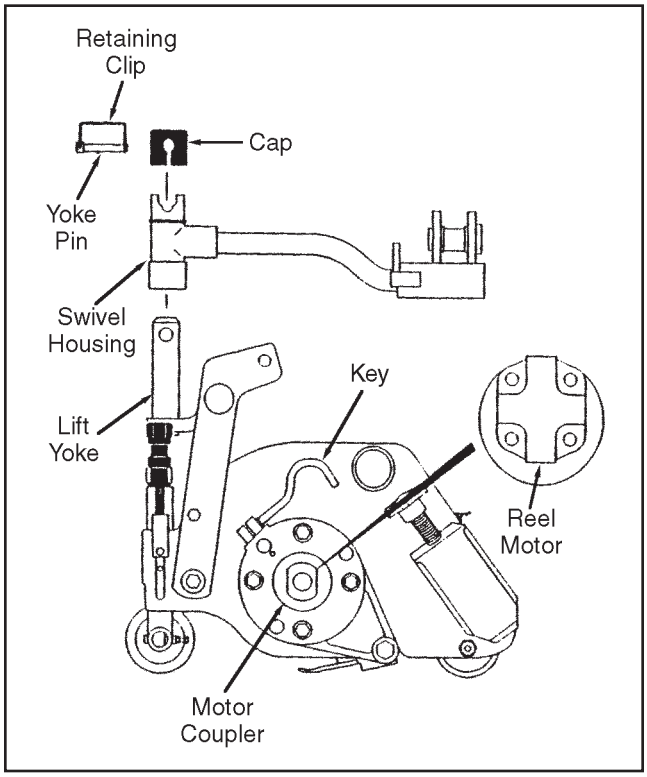

Figure 12G-1. Mower Unit Removal/Installation

BEDKNIFE REPLACEMENT
(See Figure 12G-2)

Bedknives that cannot be repaired by lapping or grinding should be replaced. The bedknife is held to the bedknife shoe by flat head screws. When replacing a bedknife the bedknife should be lightly ground to level the cutting edge.

When a bedknife is installed, clean the backing prior to installation.

Secure the installed bedknife by tightening the mounting screws, starting with those at the center and working out to the ends.

A new bedknife must be ground to assure straightness and parallelism with the reel cylinder (see Section 12D).

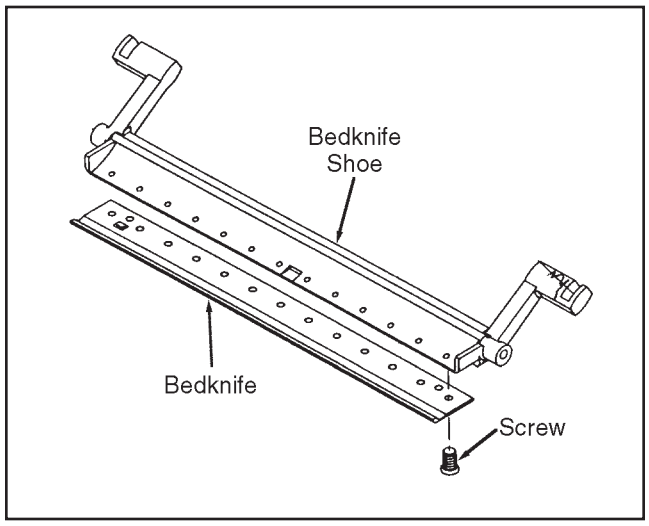

Figure 12G-2. Bedknife Removal and Replacement

12G

SECTION 12G. LF-3800 MOWER UNITS

BEDKNIFE ADJUSTER REPAIR

REMOVAL (See Figure 12G-3)

NOTE

The bedknife adjusters are held against the arms of the bedknife shoe by the compressed springs of the adjusters.

Fully loosen the adjuster to remove spring tension and pull the adjuster assembly straight off the bedknife shoe arm.

DISASSEMBLY (See Figure 12G-4, Sheet 2 of 2)

1. Remove the cotter pin and unscrew the knob and adjusting bolt.
2. Disassemble the adjuster as shown.

REASSEMBLY (See Figure 12G-3)

1. Screw the knob into the housing until it bottoms out.
2. Insert the rod into the knob. Insert spring and spacers as shown.
3. Make sure the rod is pushed into the handle all the way (so square end engages square socket in handle).
4. Screw the bolt into the housing so the rod end is flush with the bolt.
5. Align notch of bolt with hole in rod, install a cotter pin.
6. Bend the ends of the cotter pin over the end of the bolt as shown.

INSTALLATION (See Figure 12G-3)

1. Install the bedknife to the frame, torque mounting bolts to 30 ft-lbs. (41 N.m).
2. Using a channel lock pliers, compress the spring of the bedknife adjuster. Position the adjuster so that the arm of the bedknife goes between the spacers.
3. Fasten the adjuster to me side frame. Repeat this procedure for the opposite side.
4. Make adjustments as described in Section 12G.

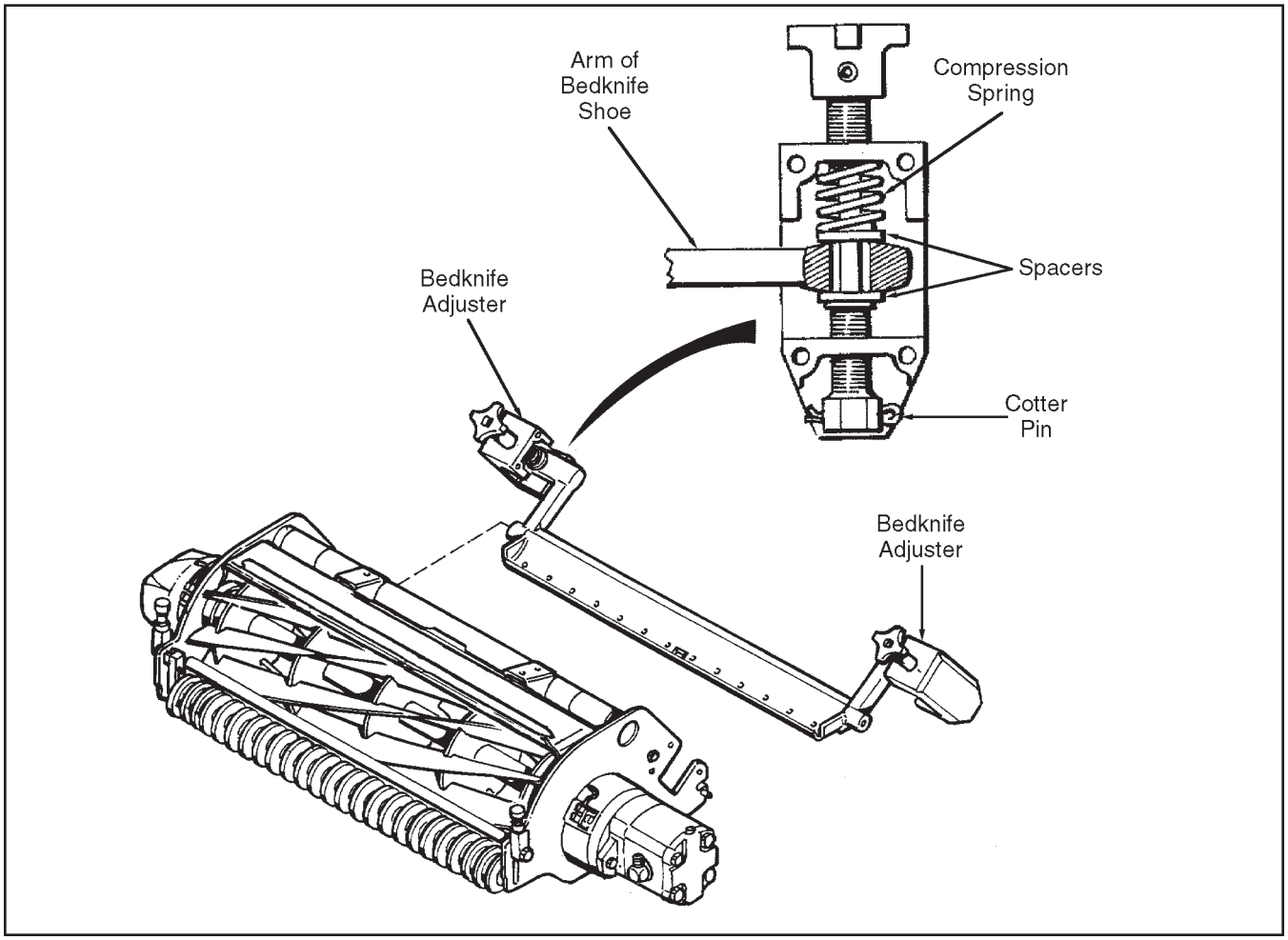

Figure 12G-3. Bedknife Adjuster Removal and Installation

SECTION 12G. LF-3800 MOWER UNITS

DISASSEMBLY

1. Remove lift yoke attaching hardware and lift yoke.
2. Refer to Figure 12G-4 (Sheet 1 of 2). If not previously removed, remove the throw shield and deflector.
3. Remove the rear roller scraper and both rear and front rollers.
4. Remove counterweight.
5. Remove the bedknife adjusters (see Figure 12G-4, Sheet 2).

NOTE

The bedknife adjusters are held against the arm of the bedknife by the compressed spring of the adjuster. Pull adjuster assembly straight off.

6. Remove the bedknife assembly from the mower frame (see Figure 12G-4, Sheet 2).

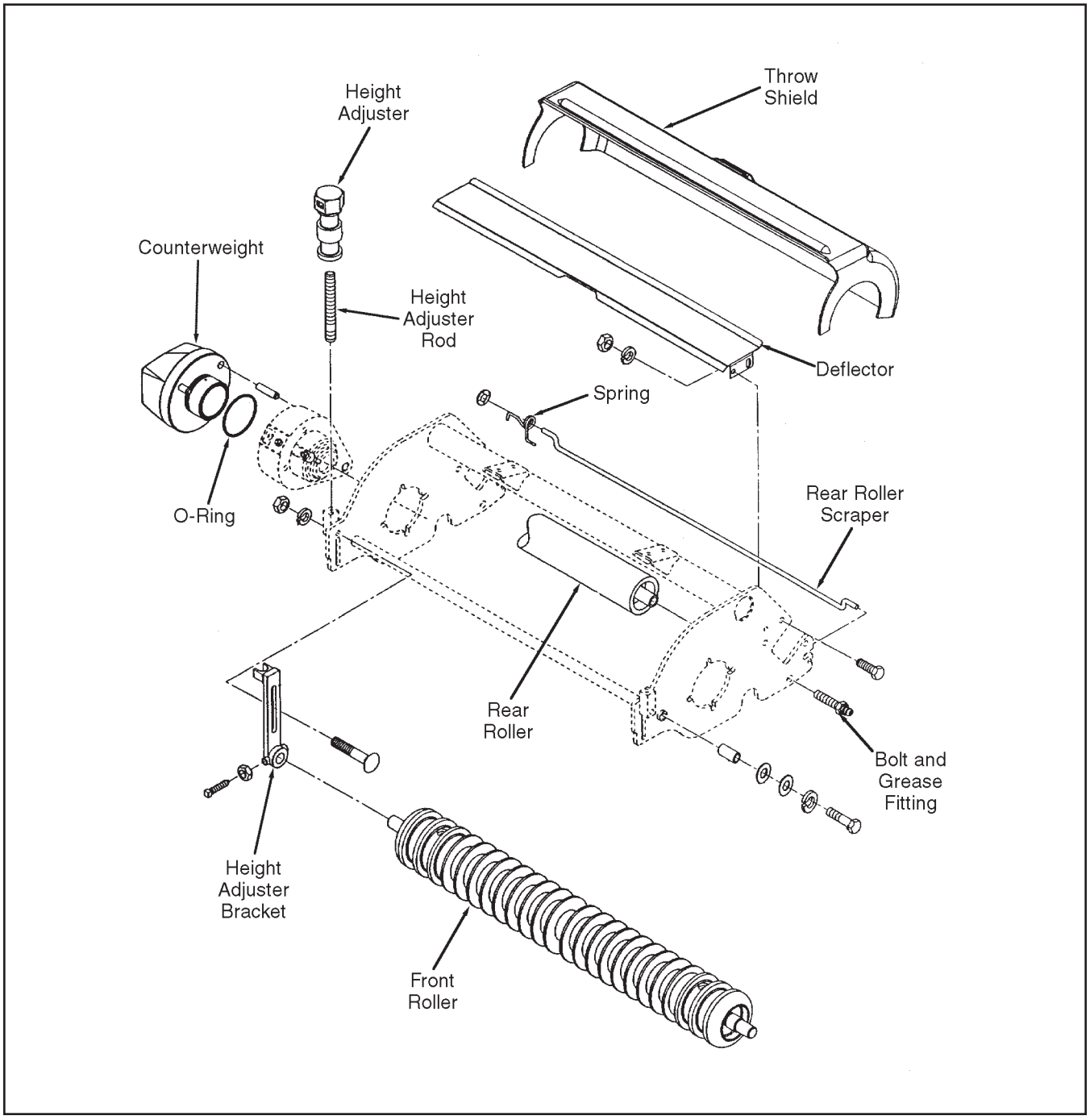

Figure 12F-4. Mower Unit Disassembly (Sheet 1 of 2)

SECTION 12G. LF-3800 MOWER UNITS

7. Using a piece of wood, block the reel so it will not turn.
8. Remove the socket head capscrew from the center of each of the couplers.
9. Using a suitable puller, pull couplers off reel shaft.

NOTE

The couplers are taper fitted to the reel shaft.

10. Remove remaining components as shown in Figure 12G-4, Sheets 1 and 2).

INSPECTION

Inspect reel, if cracked or broken, repair using a #7018 low hydrogen welding rod.

Discard seals and bearings.

Check frame for cracks and/or bent frame members.

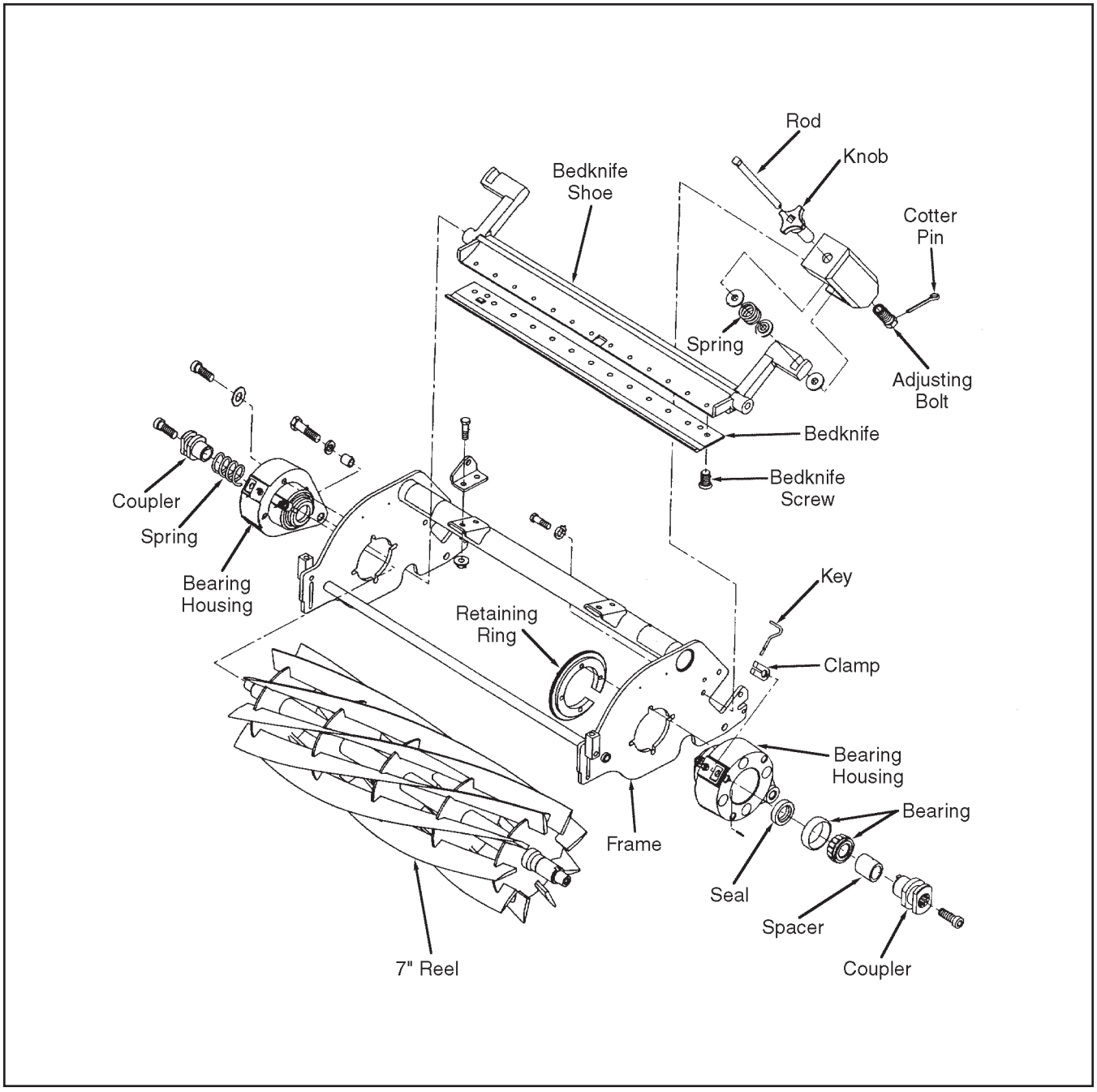

Figure 12G-4. Mower Unit Disassembly (Sheet 2 of 2)

SECTION 12G. LF-3800 MOWER UNITS

REASSEMBLY

1. Refer to Figure 12G-5. On both ends of the reel, position the retainer rings with the raised centers facing away from the reel.
2. Position the reel in the frame.
3. Install the seals (ring facing reel) into the bearing housings.
4. Using a suitable press, install bearing cups so the taper is facing inside the retainer.
5. On the left side of the mower frame, carefully position the bearing retainers over the reel shaft against the frame.

NOTE

Be careful not to damage the shaft seal.

6. Position the retaining ring against the frame aligning the notch with the grease fitting and the holes with the holes of the bearing housing. Install flat washer, lockwasher and bolts. Torque bolts to 17 ft-lbs. (23 N.m).
7. Install bearing cone (taper to the inside) over shaft into the bearing retainer.

NOTE

Do not prepack the bearing with grease before assembly.

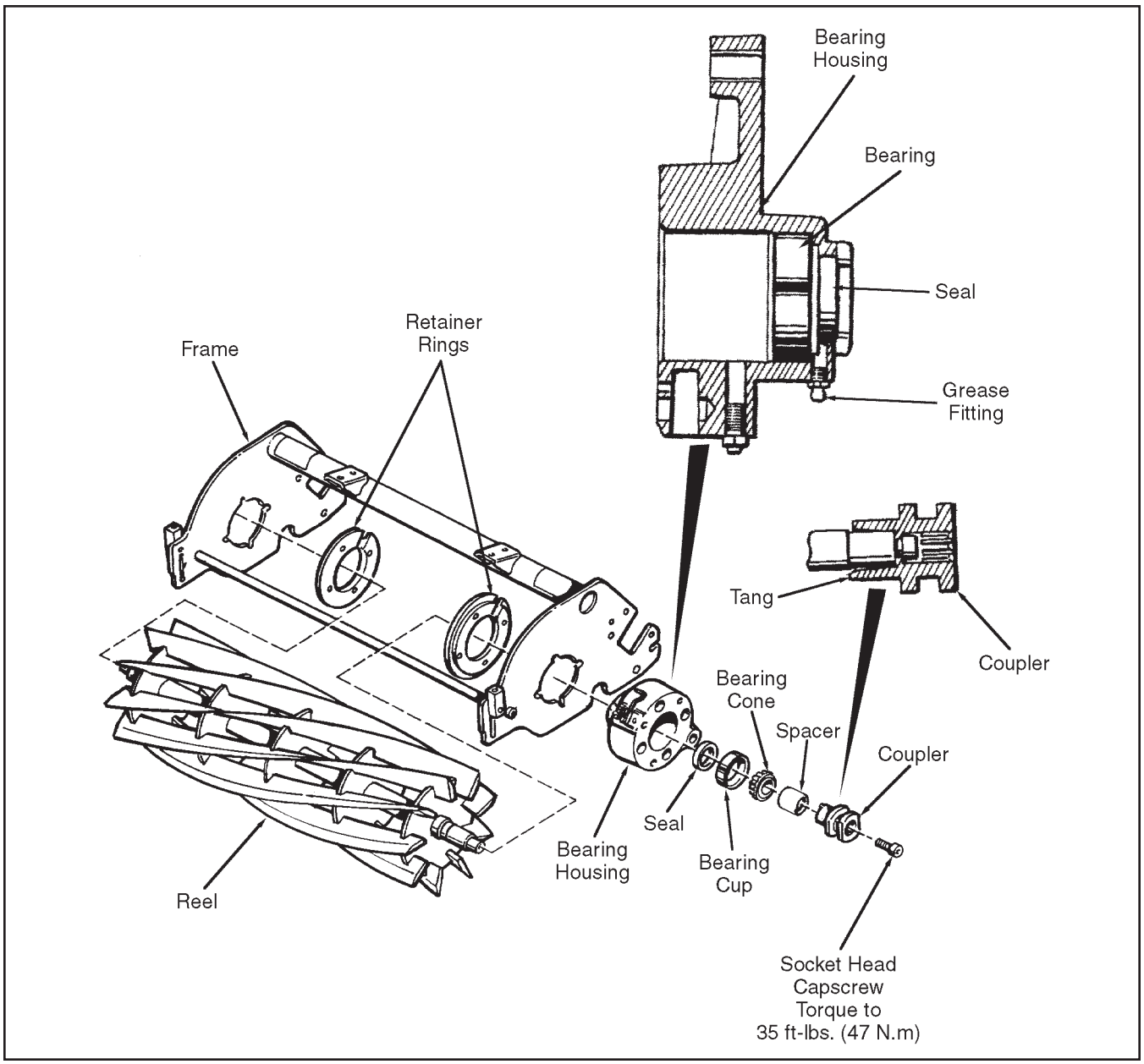

Figure 12G-5. Reel Reassembly (Steps 1 to 12)

SECTION 12G. LF-3800 MOWER UNITS

8. Install the spring and coupler.
9. Push the coupler against the spring, install the socket head capscrew in the center of the coupler just so the first few threads engage.
10. Slowly and carefully tighten the socket head capscrew just until it gets snug, then stop.

CAUTION

The tang on the coupler must be aligned with the notch in the reel shaft. Perform this step carefully as not to damage or bend the tang.

11. Slowly turn the coupler by hand until the coupler tang engages the notch of the reel shaft.
12. Once the coupler is aligned with the notch of the reel shaft, tighten the socket head capscrew, torquing it to 35 ft-lbs. (47 N.m).
13. Refer to Figure 12G-6. Stand the reel and frame up onto the spring side of the bearing housing. This will push the coupling in, compressing the spring and shifting the reel to the right.
14. On the other spacer side of the mower frame, carefully position the bearing housing over the reel shaft.

NOTE

Be careful not to damage the shaft seal.

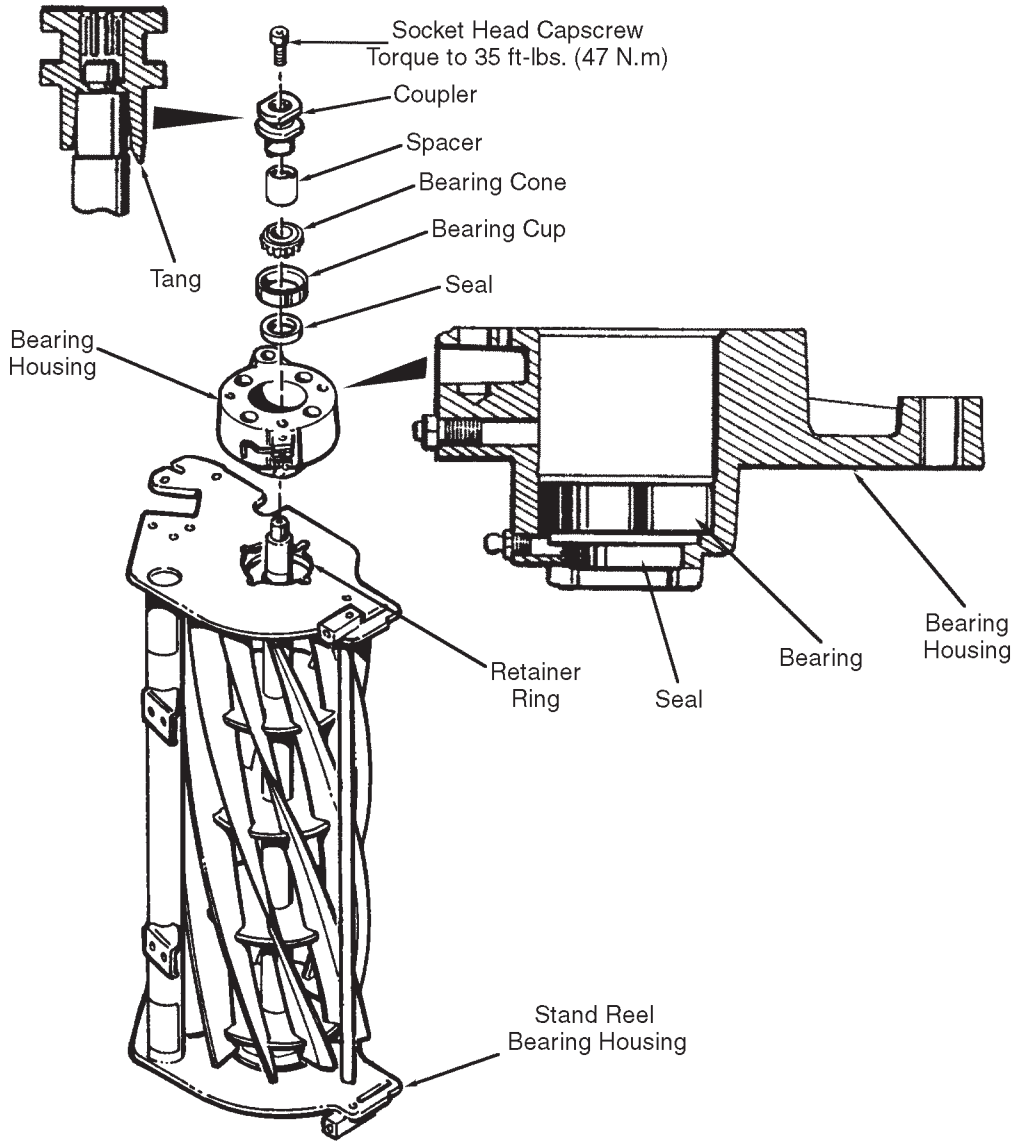

Figure 12G-5. Reel Reassembly (Steps 13 to 19)

SECTION 12G. LF-3800 MOWER UNITS

15. Position the retainer ring against the frame aligning the notch with the grease fitting and the holes with the holes of the bearing housing. Install flat washer, lockwasher and bolts. Torque bolts to 17 ft-lbs. (23 N.m).
16. Install bearing cone (taper to the inside) over shaft into the bearing assembly.

NOTE

Do not prepack the bearing with grease before assembly.

17. Install the spacer and coupler.
18. Slowly turn the coupler by hand until the coupler tang engages the notch of the reel shaft. Using a suitable hammer, lightly tap the coupling to set the taper between the coupler and reel shaft.
19. Once the coupler is in position, tighten the socket head capscrew, torquing it to 35 ft-lbs. (47 N.m).
20. Refer to Figure 12G-4 (Sheet 2). Install the bedknife to the frame, torque mounting bolts to 30 ft-lbs. (41 N.m).
21. Refer to Figure 12G-4 (Sheet 1). Install the deflector shield. Fasten it to the frame using only one flat washer, lockwasher and capscrew through the inside hole.
22. Refer to Figure 12G-3. Using a channel lock pliers, compress the spring of the bedknife adjuster. Position the adjuster so the ear of the bedknife goes between the spacers.
23. Fasten the adjuster to the side frame. Repeat this procedure for the opposite side.
24. Install the throw shield (see Figure 12G-4, Sheet 1).
25. Install the front and rear rollers and rear roller scraper (See Figure 12G-4, Sheet 1).
26. Install the lift yoke and install the mower unit in the swivel housing (see Figure 12G-1).
27. Make adjustments described in Section 12D.

SECTION 12H. FRONT ROLLER

DISASSEMBLY (See Figure 12H-1)

1. Remove lock nut, deflector cup and seal on each end of the roller.
2. Using a soft face hammer, tap one end of the shaft. Remove wear sleeves, bearing cone and shaft.
3. Use a blind hole puller to remove the bearing cup from the roller.

NOTE

When replacing the bearing cup and cone, the cup and cone should be replaced as a set.

4. Remove seal.

REASSEMBLY (See Figure 12H-1)

1. Install a new seal (lip to inside) in each end of roller.
2. Install bearing cup in each end of roller.
3. Insert shaft in roller.
4. To each end of roller, install bearing cone and wear sleeve.
5. Install oil seals (lip to inside), deflector cup and nuts.

ADJUSTMENT

1. Tighten locknuts to 10 ft-lbs. (13.6 N.m).
2. Continue to torque nuts until 5 to 10 in-lbs. (0.56 to 1.12 N.m) of rotational torque is achieved. DO NOT torque nuts more than 30 ft-lbs. (40.6 N.m).

LUBRICATION (Refer to Section 11)

1. If no grease fitting is installed, remove plug from the roller.
2. Insert the grease fitting (1/4-28UNF-2B). Slowly pump grease into roller until resistance is felt.
3. Remove the grease fitting and replace plug.

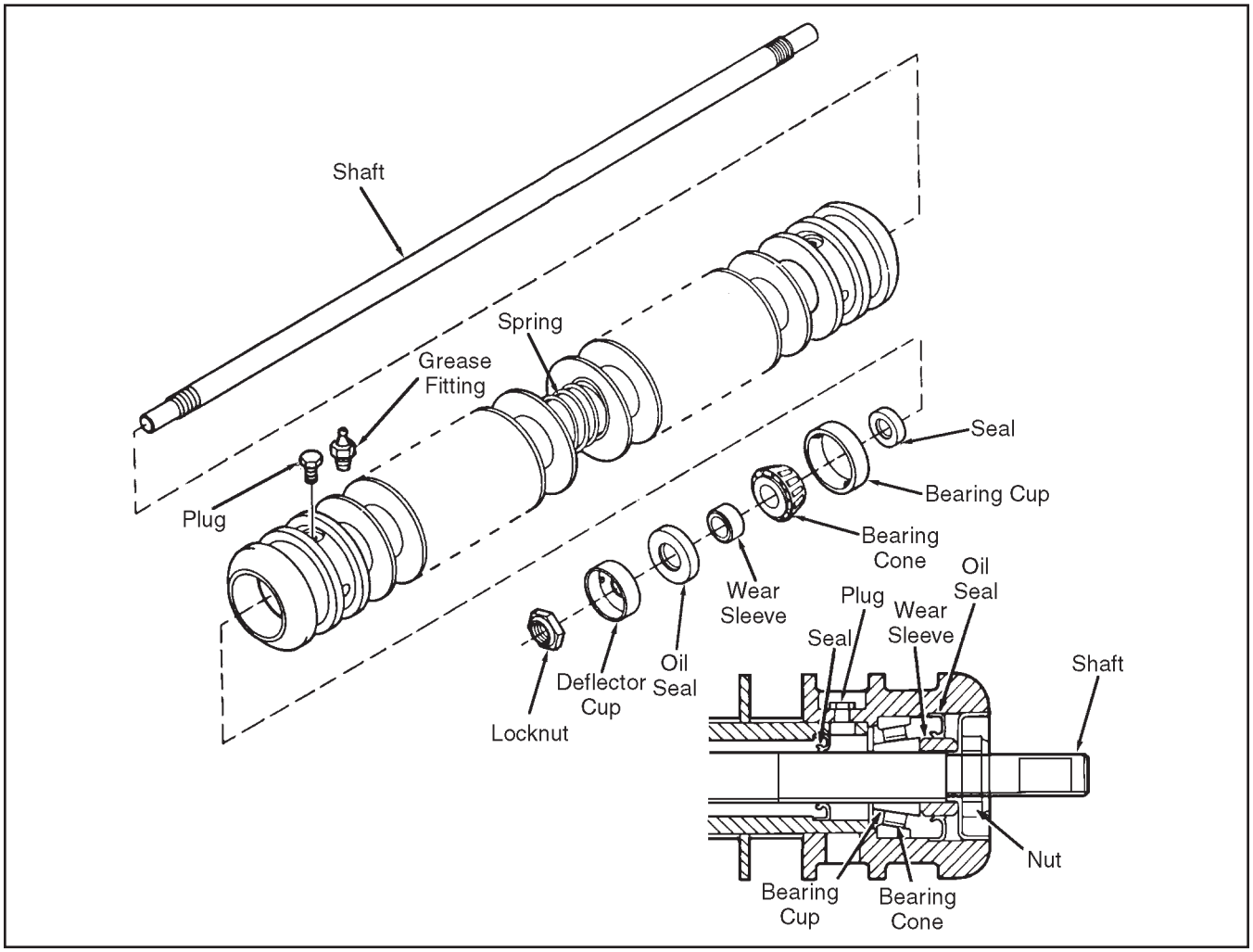

Figure 12H-1. Front Roller

SECTION 12I. REAR ROLLER

GENERAL (See Figure 12I-1)

The repair of the rear rollers of both the LF-3400 and LF-3800 mower units are identical except as noted in text and Figure 12I-1.

DISASSEMBLY (See Figure 12I-1)

1. Remove roller from the cutting unit (see Section 12F or 12G).
2. Remove locknuts from both ends of roller shaft.
3. Using a soft face hammer, tap one end of shaft driving washer (LF-3800 only), wear sleeve and outer seal out of roller tube.
4. Repeat Step 3 for the opposite end.
5. Remove bearings and, on LF-3800, the inner seals. Discard old seals.

INSPECTION

Clean and inspect bearings. Replace if necessary.

DANGER

Do NOT spin bearing using compressed air.

Clean outside diameter of the wear sleeve for grooves. If grooved, replace.

REASSEMBLY (See Figure 12I-1)

1. On the LF-3800 only, use a suitable tool to install an inner seal, lip to the inside, in one end of the roller tube.
2. On both the LF-3400 and LF-3800, use a suitable press to install a bearing cup, taper to the outside, in one end of the roller tube.
3. Pack the bearing with grease.
4. Using a suitable press, install a bearing cone, taper in, in one end of the roller shaft.
5. Careful not to damage inner seal, install roller shaft into roller tube.
6. Pack bearing cavity 3/4 full of grease.
7. Using a suitable tool install an outer seal, lip to the inside.
8. Install a wear sleeve, washer (LF-3800 only) and locknut. Do not tighten locknut.
9. Repeat Steps 1 through 8 for the other end of the roller.
10. Evenly tighten both locknuts 10 to 30 ft-lbs. (13.5 to 40.6 N.m). This will set in the bearings.
11. Back off one locknut. Retighten the same locknut to obtain a roller rotational torque of 3 to 7 in-lbs. (0.3 to 0.8 N.m).

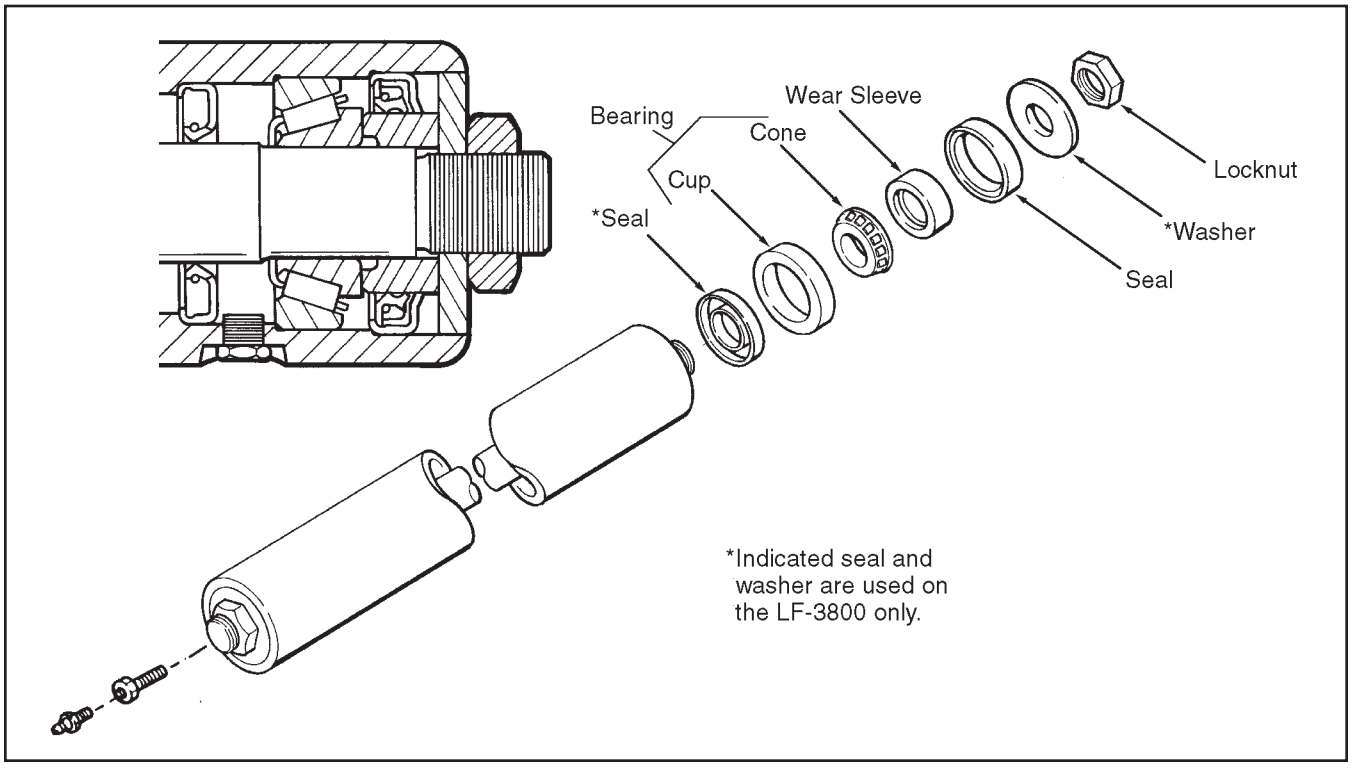

Figure 12I-1. Rear Roller Repair

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SECTION 13
OPTIONS

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SECTION 13A. REPAIR AND SERVICE TOOLS AND MATERIALS

Tools required:	Standard automotive hand tools, including driving tools, bearing pullers, and seal spreaders.
Cleaning materials:	Stoddard or equivalent solvent. Detergent and water.
Lubricants:	See Section 11.
Other service items:	Gauge bar for adjusting height of cut (Part No. 163694). Bearing Tool Part No. JAC 5084 Bearing Housing Tool Part No. JAC 5085 Blind Hole Puller Roller Tool Part No. JAC 5078

SECTION 13B. VERTICAL MOWER

GENERAL

Vertical mower attachments are normally used as replacements for standard reel mowers when thatch removal and grain control is the primary greens and fairway care objective.

The vertical mower uses the same lift yoke and reel motor as the standard reel mower.

There is no grinding or sharpening procedure for vertical blades. Bent blades can be straightened; broken or dull blades must be replaced.

The vertical mower assembly includes a front roller assembly and front roller grass shield assembly.

REPAIR AND SERVICE (See Figure 13B-1)

Normal repairs and servicing of vertical mowers consist of blade replacement and cleaning and lubricating or replacement of bearings.

Individual blades are readily removed without removing the reel from the frame. To replace blades, back off the blade clamp nut 1/4 to 3/8 inch (6.3 to 9.5 mm). Pull the spacer next to the blade to be removed toward the blade clamp nut to disengage it from the locking lugs on the spacer. Remove slotted blade from the shaft. Install replacement blade with the slot in blade in same position as blade that was removed and retighten the blade clamp nut 12 to 15 ft-lbs. (16 to 20 N.m). Retighten clamp nut lock screw and nut.

NOTE

When replacing all blades, starting from one end rotate each blade 90 degrees in the same direction.

1. Remove reel motor and disconnect the mower from the lift yoke.
2. Disassemble and reassemble the cutter assembly as shown in Figure 13B-1.

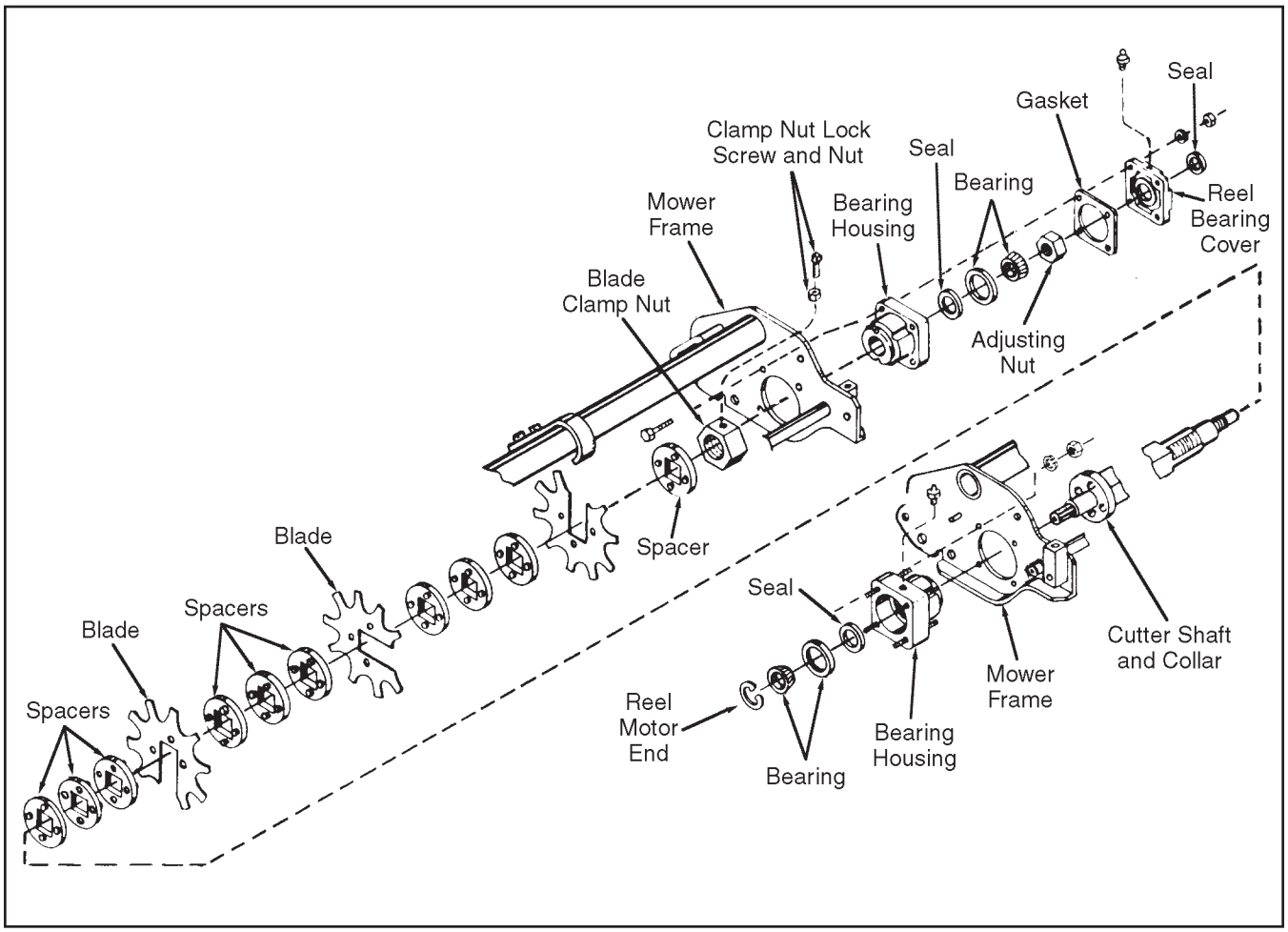

Figure 13B-1. Disassembly and Reassembly of Vertical Mower Assembly

13B

SECTION 13B. VERTICAL MOWER

3. Clean bearings in solvent and dry. Replace worn or badly pitted bearings. Pack bearing cups and cone with grease and reassemble. Grease all lube fittings after reassembly.
4. Turn the adjusting nut slowly in a clockwise direction until all end play is removed and slight resistance can be felt when turning the reel. Tap end of shaft with a soft hammer, if turning resistance is still present, back off the adjusting nut 1/8 turn and tap with hammer. Repeat if necessary. The adjustment is correct when the reel can be revolved freely and end play does not exceed 0.010 inch (.25 mm).
5. Install the mower on the machine as described in Section 12D.

CHANGING BLADE SPACING (See Figure 13B-2)

Blade spacing of 3/4 inch (19 mm) is standard on factory built mowers. Cutting widths can be reduced or increased between 1/2 and 1-1/2 inch (12.7 and 38 mm) in 1/4 inch (19 mm) increments by adding or removing individual blades. To do this, follow instructions on removal of individual blades.

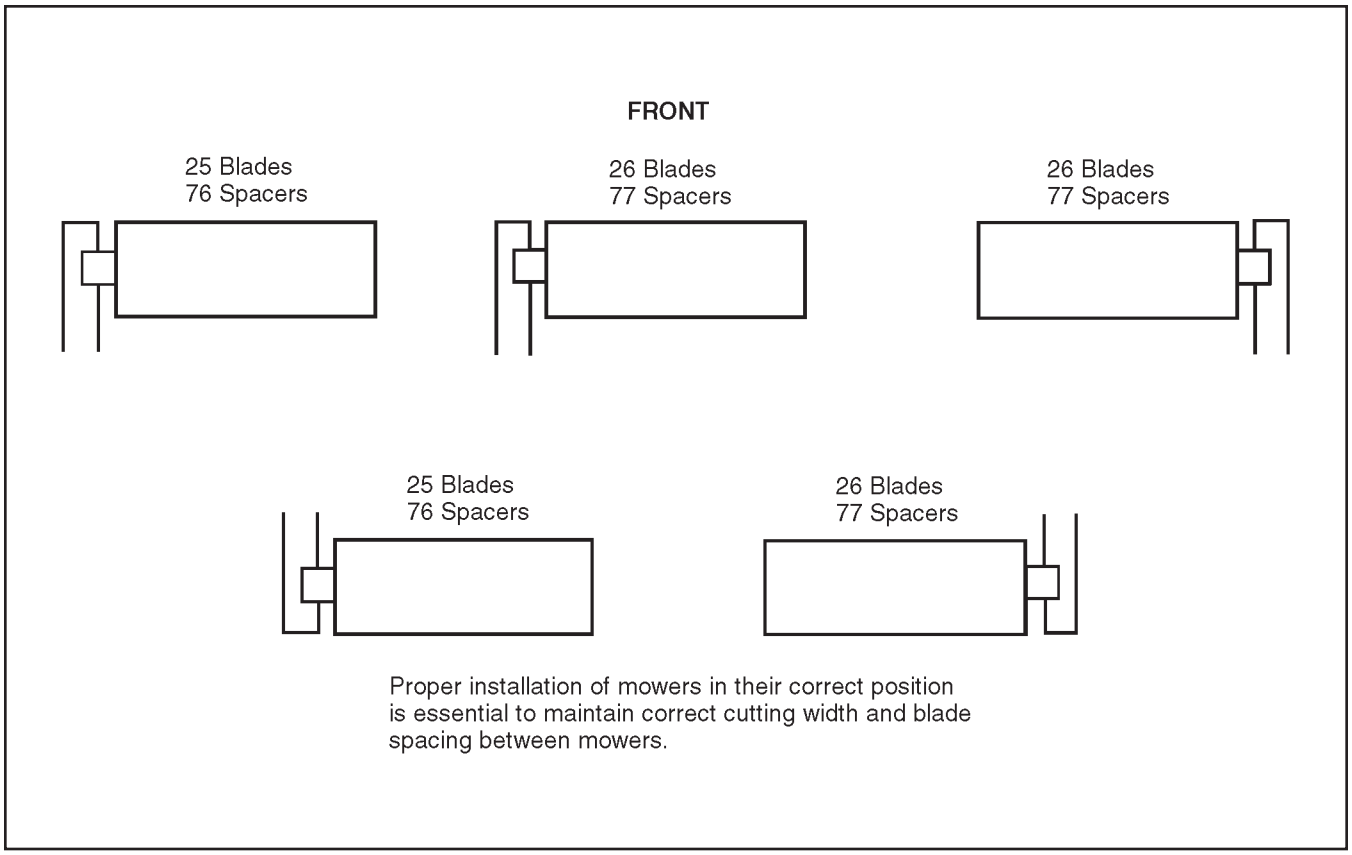

Figure 13B-2. Blade Spacing Adjustment

SECTION 13B. VERTICAL MOWER

REPAIR OF FRONT ROLLER, GRASS SHIELDS AND SCRAPERS (See Figure 13B-3)

If the front roller, grass shields and grass shield scrapers require repair or replacement, disassemble and reassemble as shown in Figure 13B-3. Replace worn or badly pitted bearings. Clean in solvent, dry and pack (with grease gun grease) bearings and bearing seals before installing. Fill lube fittings on the front roller after reassembling.

NOTE

When installing the front roller in a vertical reel mower, the roller brackets must be assembled with the roller in forward position as shown in Figure 13B-3.

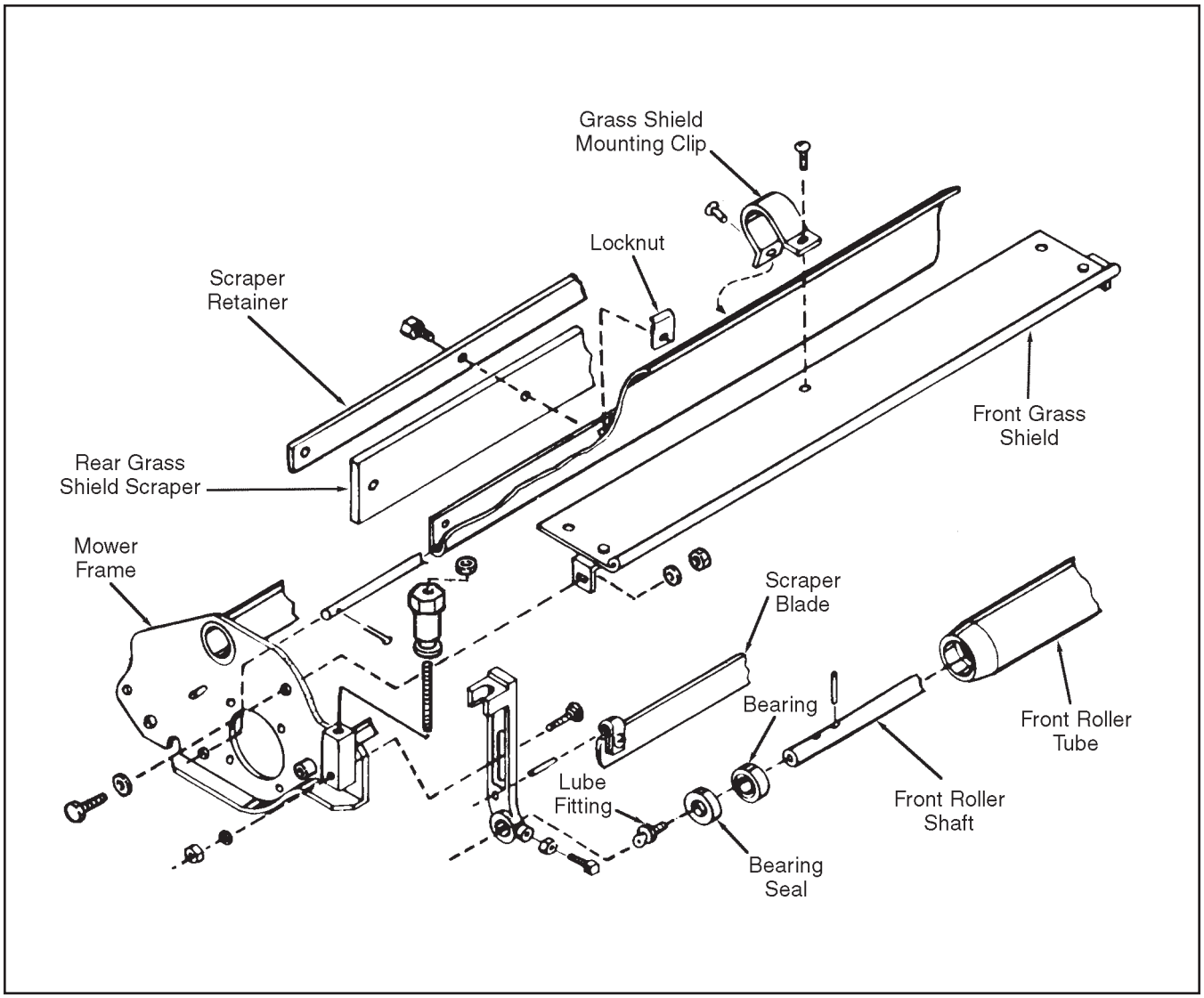

Figure 13B-3. Disassembly and Reassembly of Front Roller, Grass Shields and Scrapers

SECTION 13B. VERTICAL MOWER

CUTTING DEPTH ADJUSTMENT (See Figure 13B-4)

With engine stopped, reels raised, adjust reels to desired cutting depth before using mower. Optimum cutting depth is 1/8 to 3/16 inch (3.2 to 4.7 mm) for most turf conditions. A greater cutting depth may damage the root structure. If the mower slows down under load, it is an indication that the cut may be too deep. Teeth should not penetrate into the soil under any circumstances. To provide an even cut, reels should be adjusted to the same depth below the rollers within 1/64 inch (.39 mm) from end to end.

To make a cutting depth adjustment, loosen locknuts on both sides enough to allow the hand knobs to move the front roller brackets freely in the side frames. Place a height adjusting gauge across the two rollers outside the first blade on one end of the reel and turn the reel to place one tooth of the blade at 90° to the top of the gauge. Adjust reel visually to the approximate depth desired. Check and make final adjustment with a scale to measure the distance the tooth projects below the roller contacting edge of the gauge. Repeat the above on the opposite end of the reel and tighten locknuts.

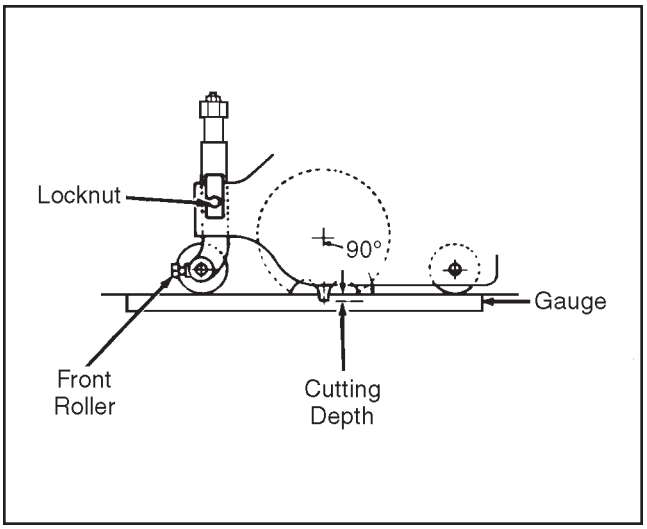

Figure 13B-4. Cutting Depth Adjustment

SECTION 13C. TURF GROOMER (LF-3400 ONLY)

GROOVED ROLLER

REMOVAL (See Figure 13C-1)

1. Loosen setscrews on outer roller shaft nuts.
2. Remove roller shaft nuts and spacer(s).
3. On the motor end, remove the groomer side plates.
4. Remove roller.

REPAIR (See Figure 13C-2)

1. Remove snap ring.
2. Using a puller, remove shaft assembly.
3. Bearing, nilos ring and seal can be removed by first removing nut and associated hardware.

NOTE

Grease fitting and shaft nuts should be removed before reassembly.

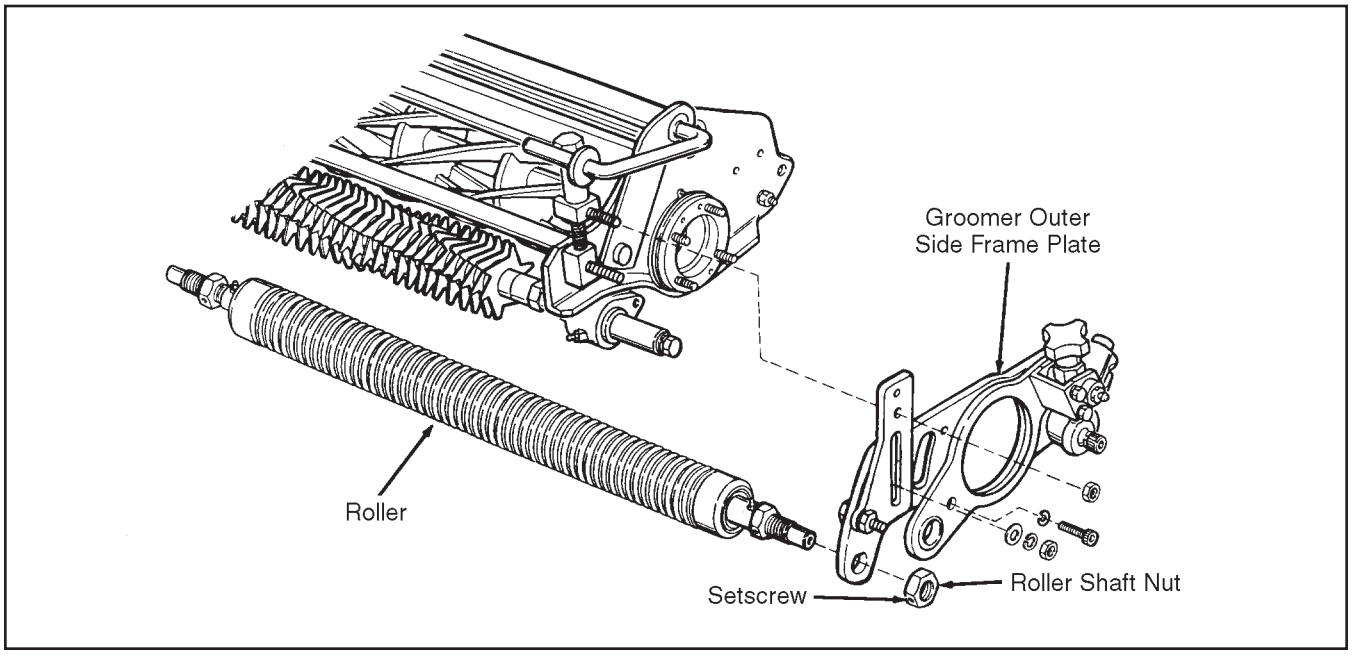

Figure 13C-1. Roller Removal

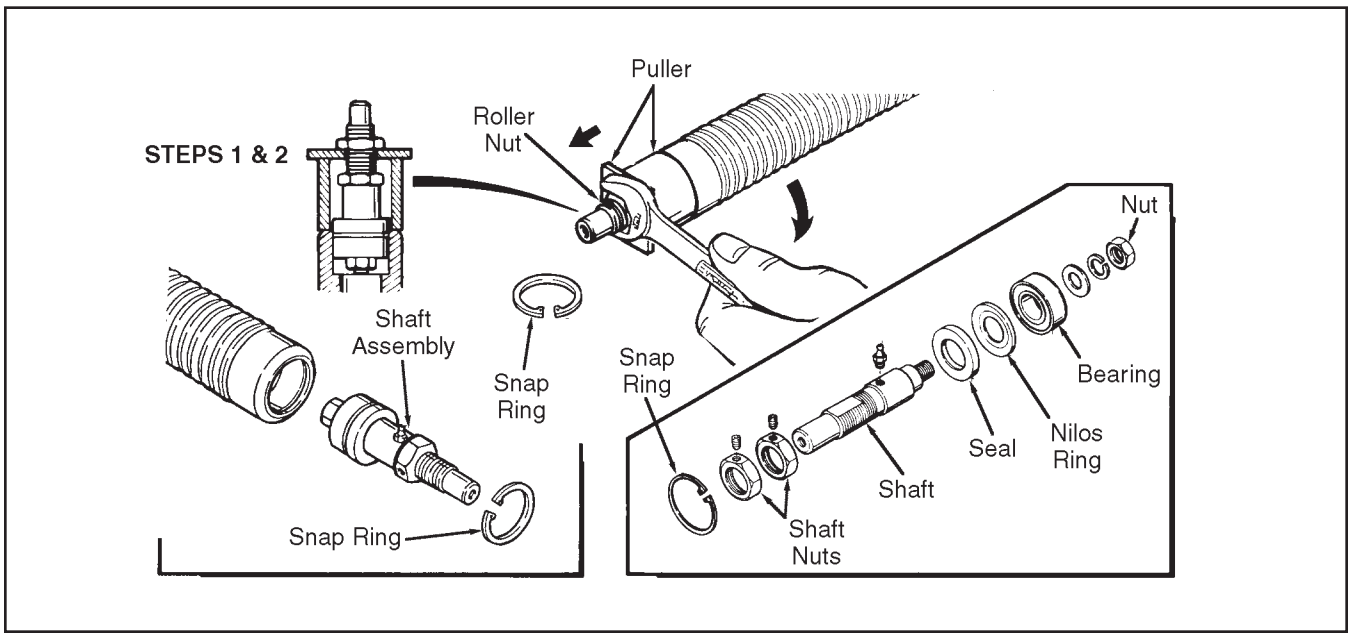

Figure 13C-2. Roller Repair

SECTION 13C. TURF GROOMER (LF-3400 ONLY)

4. Install nilos ring onto shaft.
5. Install bearing, seal side first, onto shaft.
6. Install flat washer, lockwasher and nut. Torque nut to 20 ft-lbs. (27 N.m).
7. Press shaft subassembly into the roller.

NOTE

Seal must be pressed so it just clears the snap ring groove in roller.

8. Press seal (seal lip to the inside) into roller.
9. Install snap ring.
10. Install grease fitting and one shaft nut).

INSTALLATION (See Figure 13C-3)

1. Loosen setscrews in roller nuts.
2. Position roller end in groomer side frame.
3. Install groomer side frame on motor end, tighten hardware as shown.
4. Using the two inside roller nuts, center groomer blades between roller discs.
5. Install shims and outer nuts.

NOTE

Install the required amount of shims necessary so that when the outer nut is tightened there are no threads exposed beyond the nut. Each shim is 0.60 inch (15.24 mm) thick.

6. Tighten roller shaft outer nuts, tighten nut set-screws.

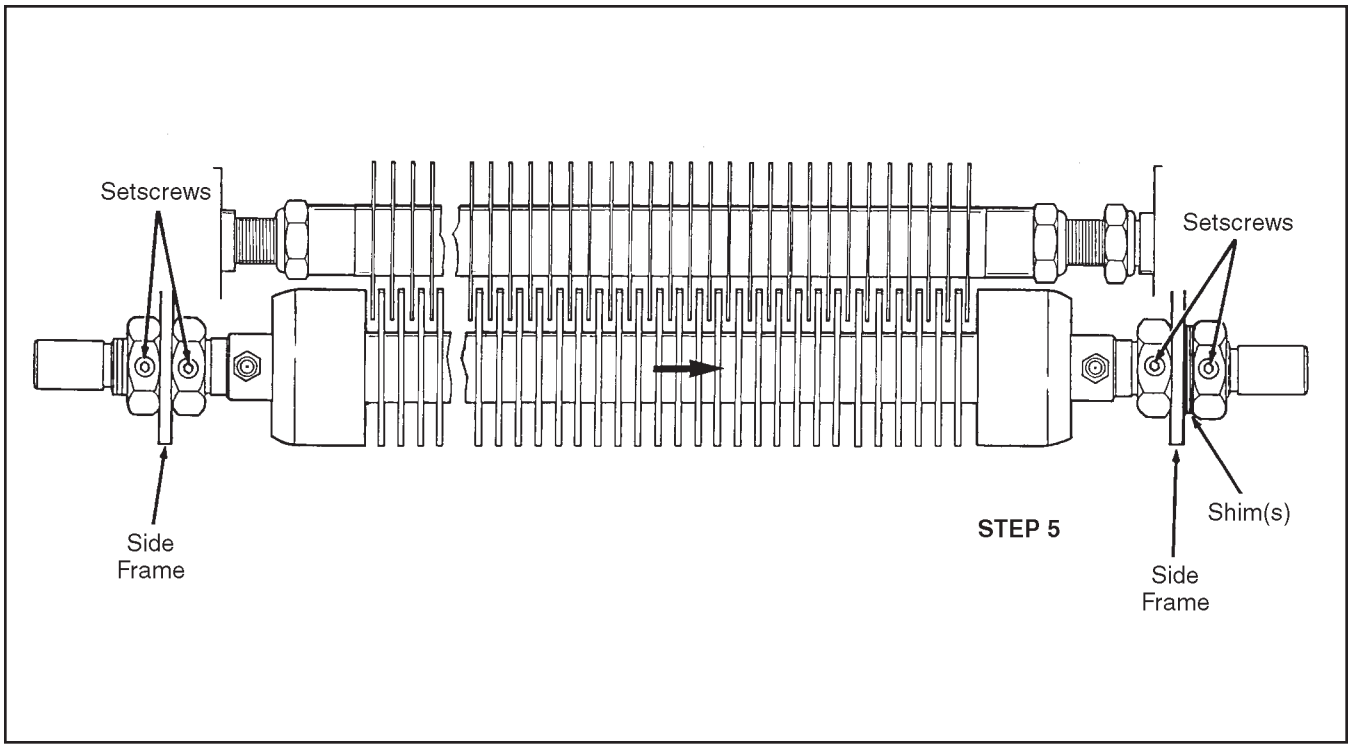

Figure 13C-3. Roller Installation Alignment

SECTION 13C. TURF GROOMER (LF-3400 ONLY)

GROOMER SHAFT ASSEMBLY

REMOVAL (See Figure 13C-4)

1. Remove belt case cover and loosen belt adjusting eccentric. Remove bearing retainer capscrew.
2. Remove clutch, drive key and spacer.
3. Remove drive gear and belt.

NOTE

Do not pry on pulley flange.

4. On motor end remove bearing retainer capscrew.
5. Remove quick height pivot screw and nylon clamp.
6. Remove groomer mounting bracket and groomer shaft.

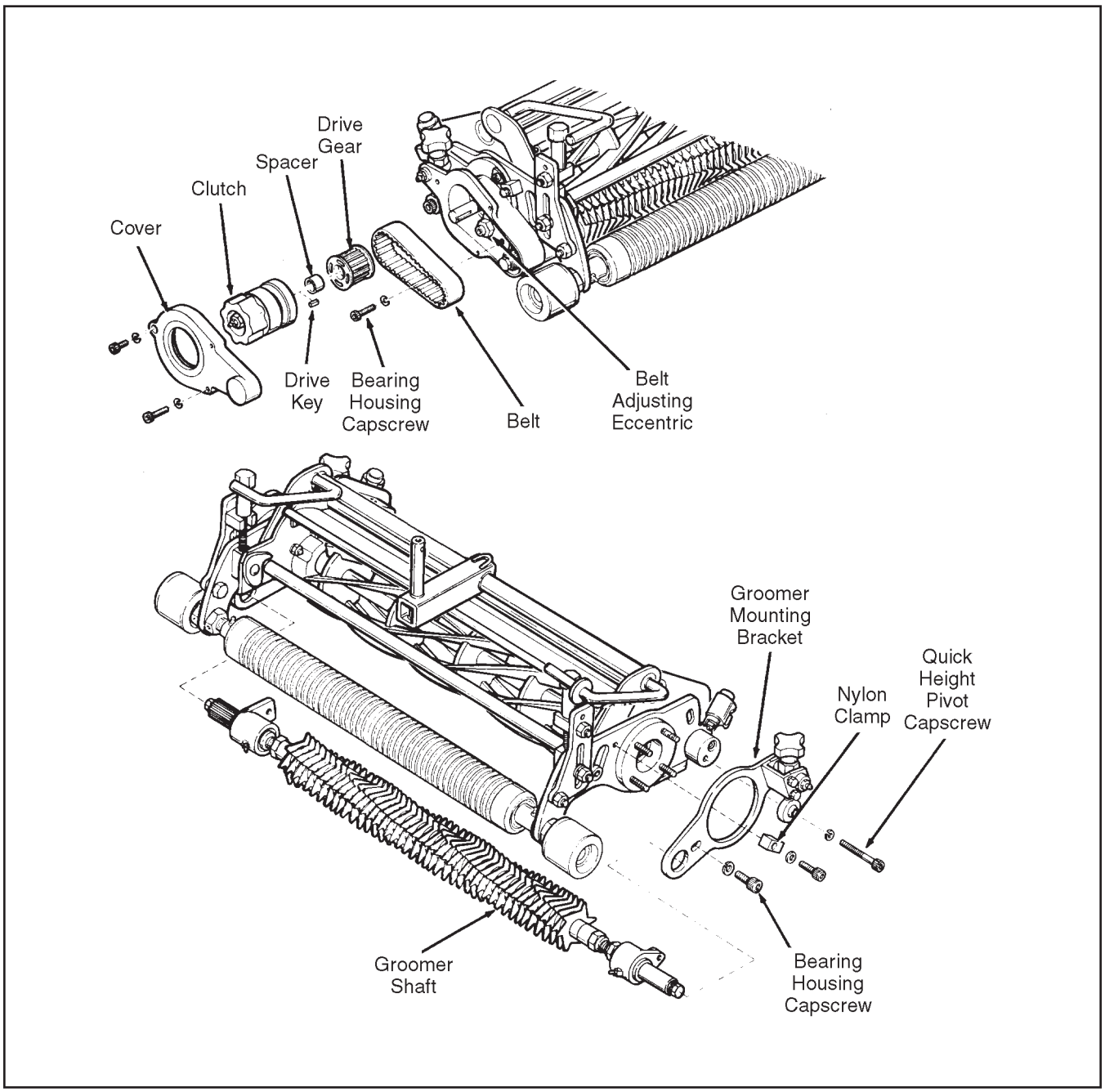

Figure 13C-4. Groomer Shaft Assembly

13C

SECTION 13C. TURF GROOMER (LF-3400 ONLY)

BEARING REPAIR (See Figure 13C-5)

Disassembly

1. Remove hardware as shown from ends of groomer shaft.
2. Remove bearing housing.
3. Remove outer snap ring from bearing housing.
4. Remove seal and inner snap ring.
5. Press bearing from bearing housing.

NOTE

Discard old seal and bearings.

Reassembly

CAUTION

Properly support retainer to prevent damage.

1. Press new bearing into housing.
2. Install inner snap ring and press in new seal (lip to the inside).
3. Install outer snap ring and spacer.
4. On drive end install spacer, square drive key and driven gear.
5. Install hardware on both ends, torque to 20 ft-lbs. (27 N.m).

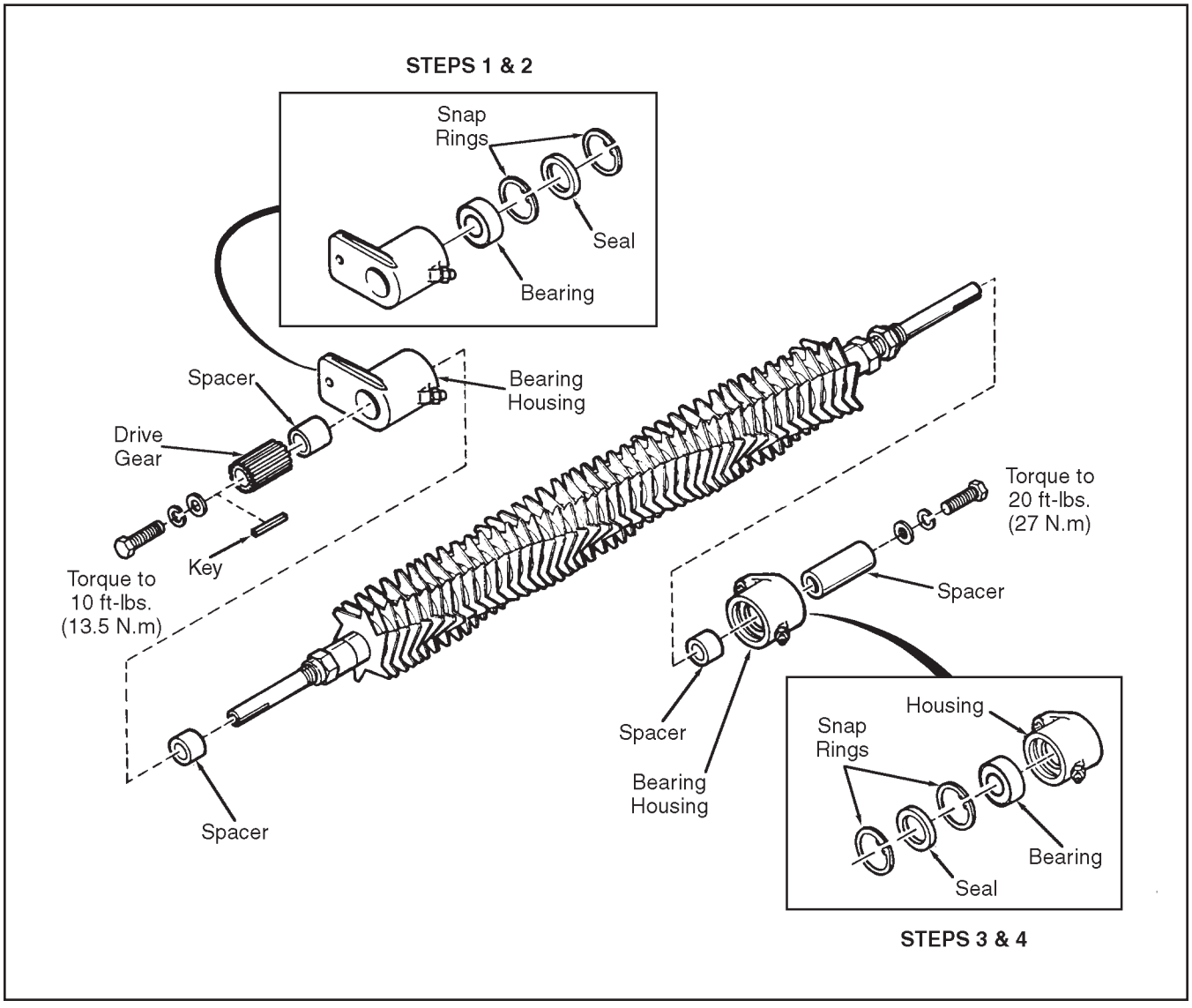

Figure 13C-5. Groomer Shaft Assembly

SECTION 13C. TURF GROOMER (LF-3400 ONLY)

BLADE REPAIR

Check condition of blades, straighten bent blades whenever practical. If blades must be replaced, proceed as described below.

Disassembly (See Figure 13C-6)

1. Remove groomer shaft assembly as described in Groomer Shaft Assembly, Removal.
2. On motor end of groomer shaft, remove capscrew, spacer, bearing housing and bearing adjustment nut.
3. Remove blade retaining nut and spacer.
4. Remove spacers and damaged blade(s) as necessary.

Reassembly

1. Install and set the blade retainer nut on drive end 1 inch from the shoulder of shaft to inside of nut (see Figure 13C-6 inset).
2. Install a 3/4 inch (19.05 mm) spacer, 15/32 inch (11.91 mm) spacer and a blade.

NOTE

Blade must be positioned so flat of blade rotates toward bedknife (see Figure 13C-6).

3. Alternately install a spacer and blade until 41 spacers and 40 blades have been installed.
4. Install blade retaining nut, torque to 10 to 15 ft-lbs. (13.5 to 20 N.m).

NOTE

It is necessary to align the blades with the grooves of the roller. This can be done after installing groomer shaft assembly.

5. Install groomer shaft assembly as described in Groomer Shaft Assembly, Installation.

INSTALLATION (See Figure 13C-1)

1. Install groomer shaft drive end into belt case aligning bearing housing flat in belt case groove.
2. Install bearing housing capscrew, do not tighten.
3. Install groomer mounting bracket and bearing housing capscrew, do not tighten.

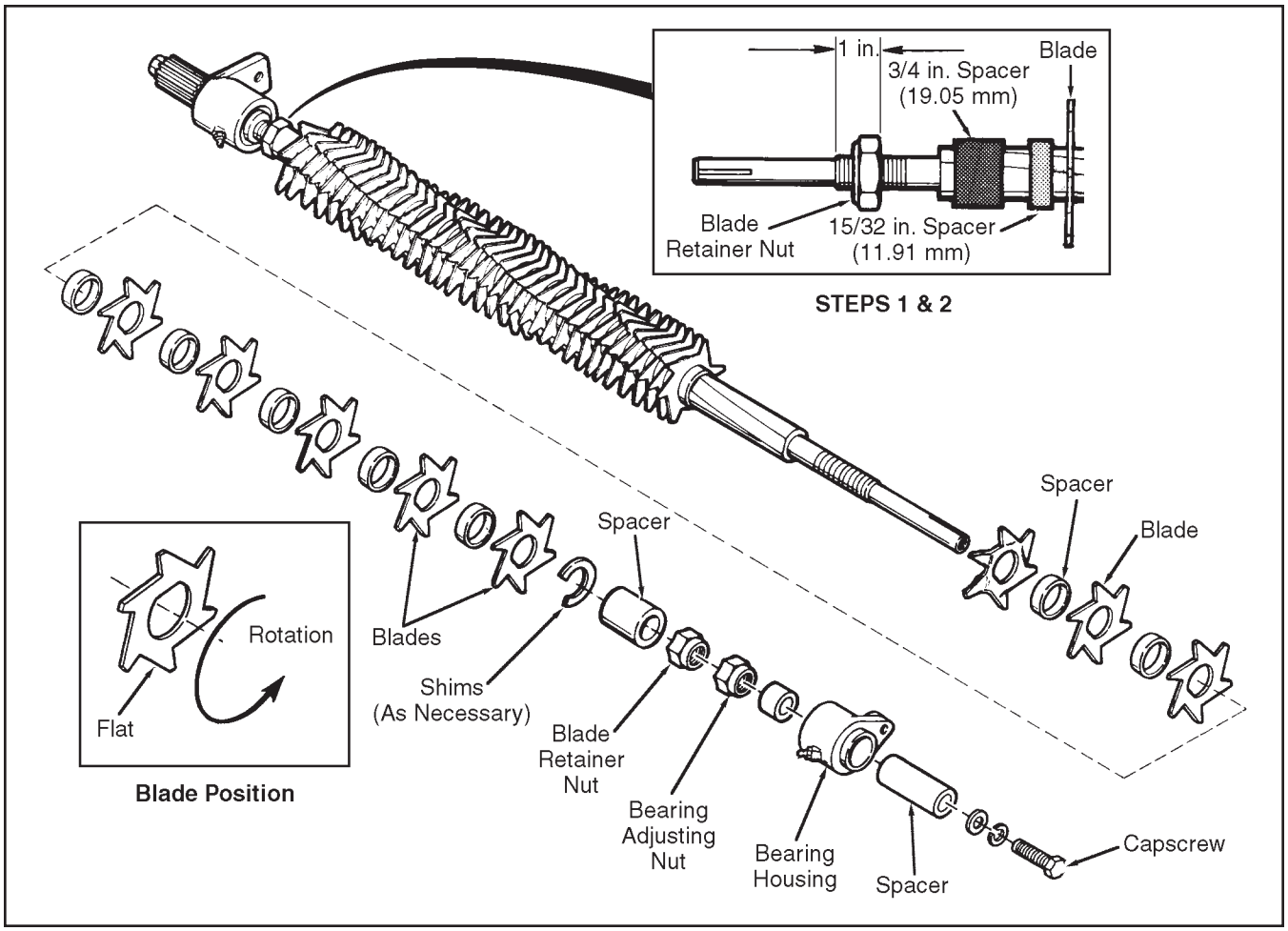

Figure 13C-6. Groomer Blade Repair

SECTION 13C. TURF GROOMER (LF-3400 ONLY)

4. Install quick height pivot screw, tighten then back off 1/8th turn.
5. Adjust groomer shaft bearing as described in Groomer Shaft Assembly, Bearing Adjustment.
6. Install drive gear and belt.
7. Install spacer, drive key and clutch, torque clutch bolt to 20 ft-lbs. (27 N.m).
8. Adjust belt as described in Drive, Belt Adjustment.
9. Install cover, torque capscrews to 6 to 8 ft-lbs. (8 to 10.8 N.m).
10. Align blades to roller as described in Blade to Roller Alignment.

BLADE TO ROLLER ALIGNMENT
(See Figure 13C-7)

1. The groomer shaft should be installed to properly align groomer cutter to roller.
2. Loosen front roller locknuts. Slide roller toward belt case end until cutters contact roller discs.
3. Starting on the drive end check that all blades touch roller disks. If there is a space, install 0.010 inch (0.25 mm) shim Part No. 364040 until all blades touch roller disks.
4. Torque blade retainer nut 10 to 15 ft-lbs. (13.5 to 20 N.m).
5. Slide roller toward motor end so blades are centered between each disc. Fasten roller retaining locknuts on each end.

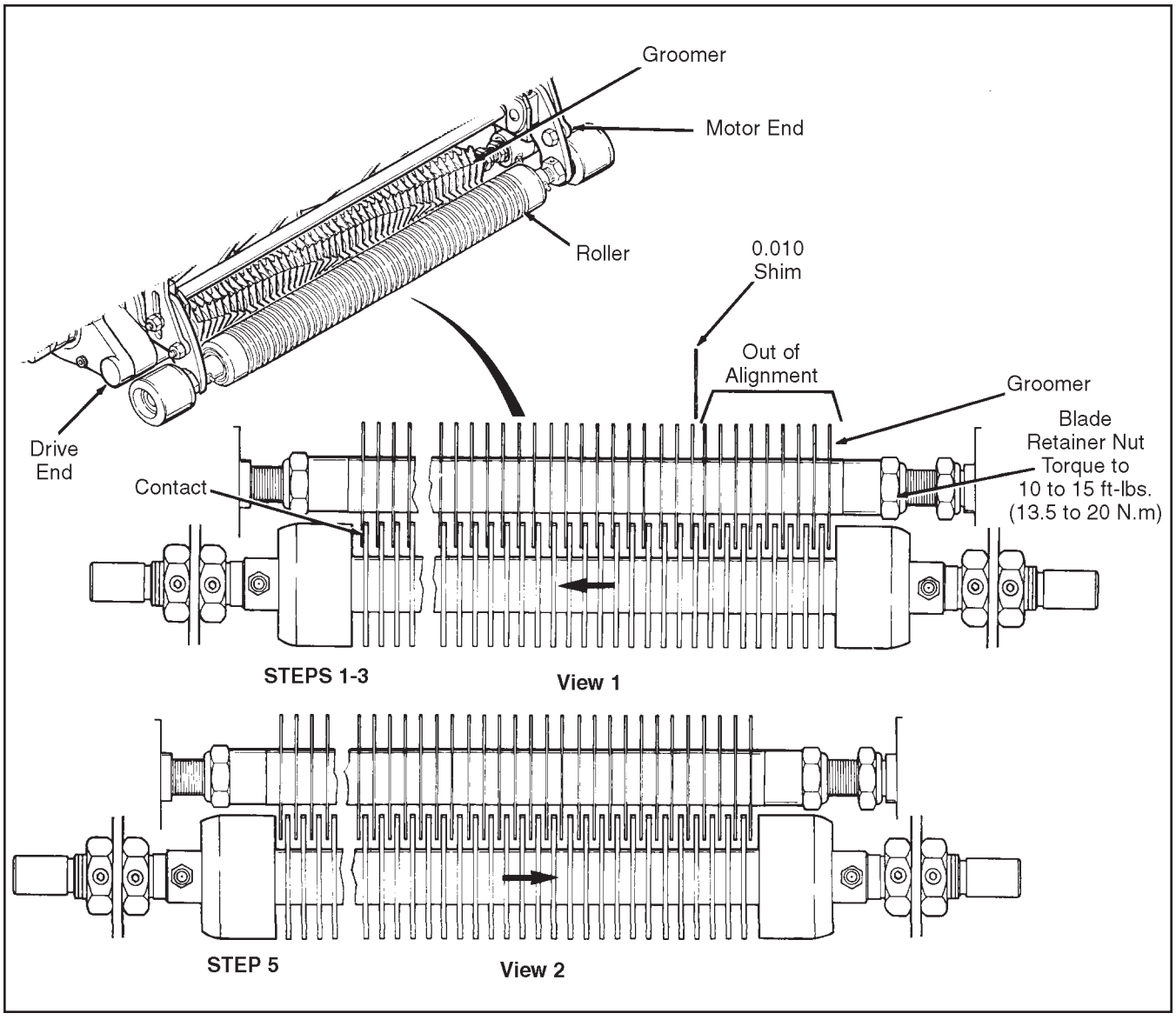

Figure 13C-7. Blade to Roller Alignment

SECTION 13C. TURF GROOMER (LF-3400 ONLY)

BEARING ADJUSTMENT (See Figure 13C-8)

1. Remove nylon clamp and loosen capscrew on end of groomer shaft.
2. Pull the groomer mounting bracket out, away from the cutting unit. You will see a gap between the inner and outer groomer brackets.
3. Slowly tighten capscrew (C) on end of groomer shaft until outer groomer bracket is pulled in against inner bracket and gap closes.
4. Using two wrenches, hold the cutter retaining nut (A) and slowly turn the bearing adjustment nut (B) until it just contacts the bearing spacer. As slight resistance will be felt.
5. Torque capscrew (C) on end of groomer shaft to 20 ft-lbs. (27 N.m).
6. Install nylon clamp, torque to 5 ft-lbs. (6.7 N.m).

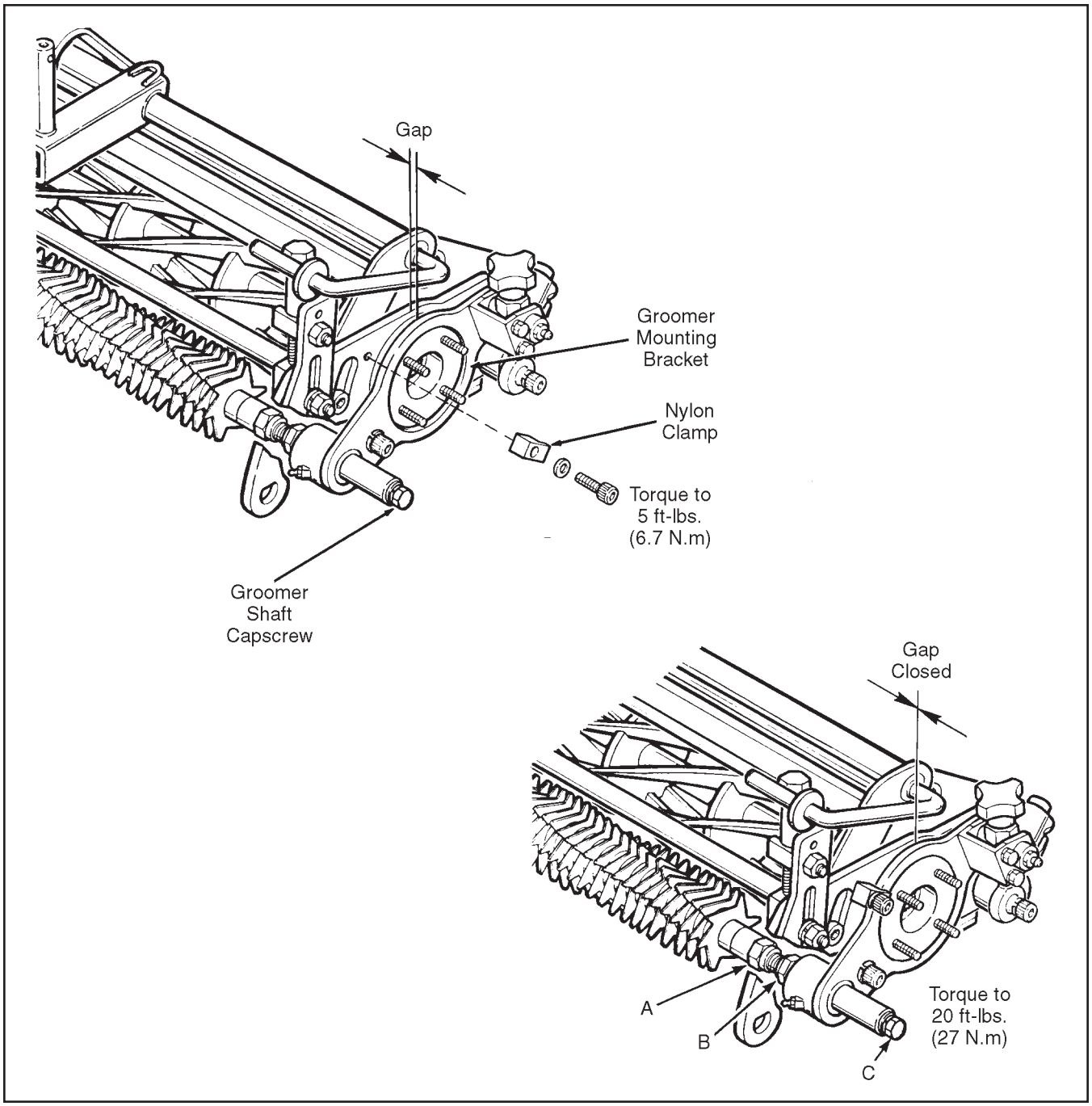

Figure 13C-8. Bearing Adjustment

SECTION 13C. TURF GROOMER (LF-3400 ONLY)

DRIVE

DRIVE PULLEY REPAIR (See Figure 13C-9)

1. Remove the belt case cover, clutch and drive key.
2. Loosen the drive belt.
3. Remove drive pulley, spacer and belt.

CAUTION

Do not support drive pulley on outer flange. Support on solid part of gear.

4. Using a drift punch, drive the outer bearing from drive gear (see Figure 13C-10).

NOTE

Spacer will be damaged during bearing removal, discard and install a new spacer.

5. Remove snap ring and press out inner bearing.
6. Press a new bearing seal side first into drive gear (see Figure 13C-11).

CAUTION

When pressing new bearings, always use a flat or round mandrel the diameter of the bearing outer race. Do not press on inner race only.

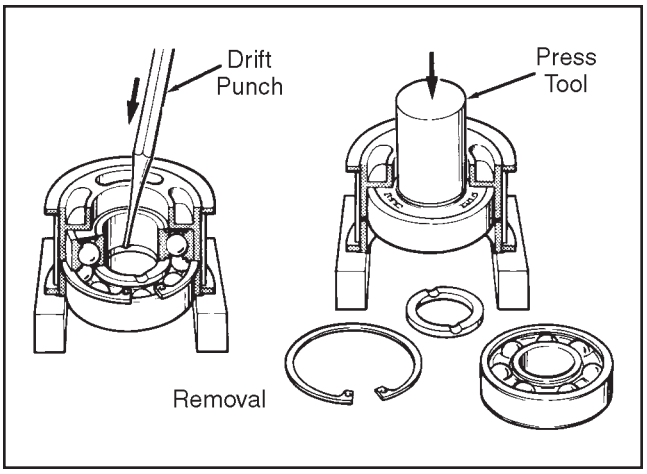

Figure 13C-10. Drift Punch

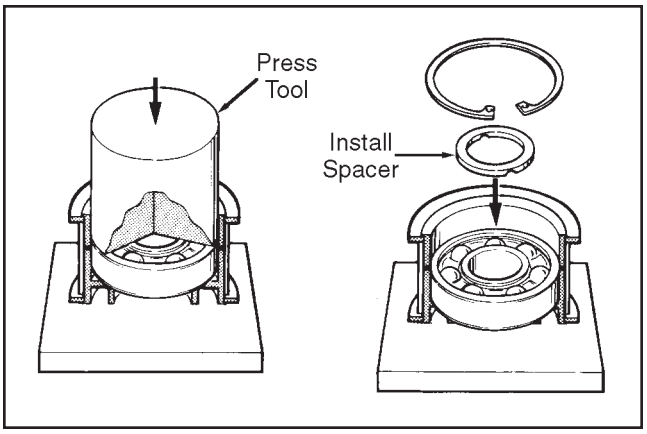

Figure 13C-11. Press Tool

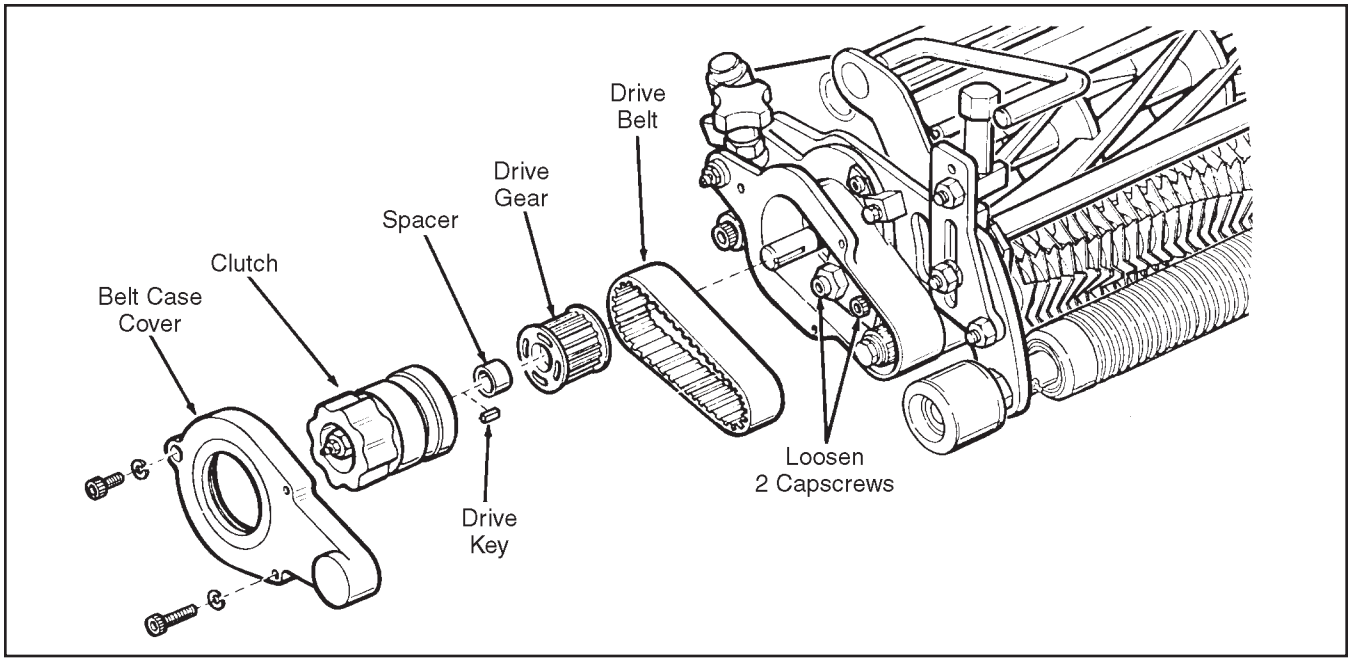

Figure 13C-9. Drive Pulley Repair

SECTION 13C. TURF GROOMER (LF-3400 ONLY)

7. Install snap ring and new spacer.

NOTE

Spacer does not have to be centered at this point.

8. Install outer bearing with seal side out (see Figure 13C-12).

NOTE

When installing outer bearing, use a flat plate across top of bearing.

9. When bearing has been pressed 3/4 of the way in drive gear, center spacer. Continue pressing bearing until it contacts center spacer.
10. Install drive gear and belt into belt case (see Figure 13C-8).
11. Install spacer, drive key and clutch, torque clutch bolt to 20 ft-lbs. (27 N.m).
12. Adjust drive belt as described in Belt Adjustment.
13. Install belt case cover, torque capscrews to 6 to 8 ft-lbs. (8 to 10.8 N.m).

BELT REPLACEMENT (See Figure 13C-13)

1. Remove belt case cover.
2. Remove clutch and drive key.
3. Loosen belt adjuster eccentric and bearing retainer capscrew.

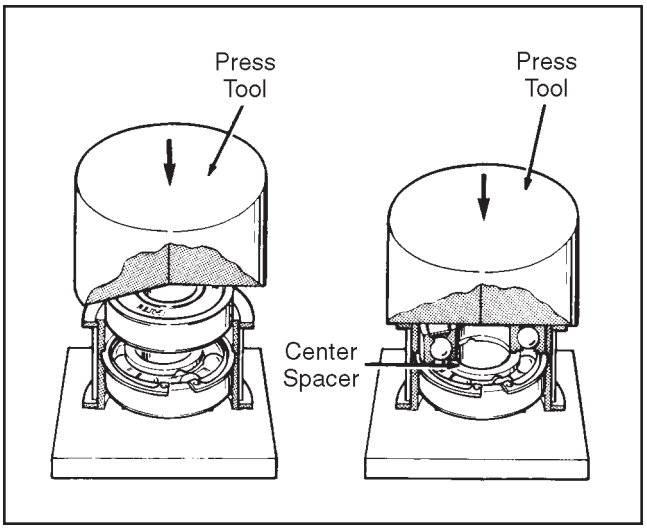

Figure 13C-12. Drive Groomer Installation

4. Remove spacer, drive pulley and belt.
5. Install drive gear, bearing toward the inside and belt over reel shaft. Work end of belt over groomer shaft drive gear.
6. Install spacer, drive key and clutch, torque clutch bolt to 20 ft-lbs. (27 N.m).
7. Proceed with Step 3 of Belt Adjustment.

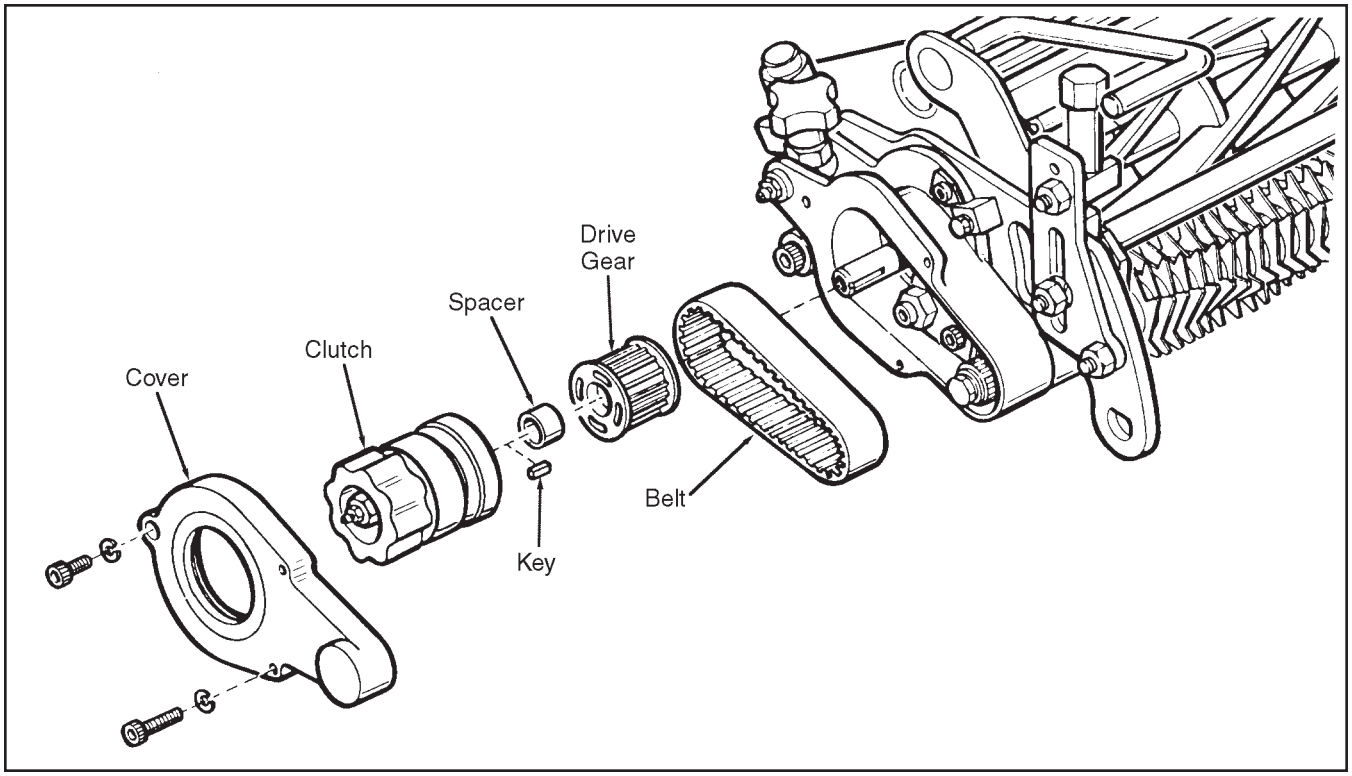

Figure 13C-13. Belt Replacement

SECTION 13C. TURF GROOMER (LF-3400 ONLY)

BELT ADJUSTMENT (See Figure 13C-14)

1. Remove belt case cover.
2. Slightly loosen tightener eccentric and bearing housing capscrews.
3. Using a deep socket, turn eccentric tightener by hand until belt just becomes tight.
4. Hold the adjustment and tighten bearing housing capscrew. Remove socket and tighten eccentric capscrew.

CAUTION

DO NOT OVERTIGHTEN BELT. Belt and/or bearing may be damaged.

5. Torque both capscrews to 10 ft-lbs. (13.5 N.m).
6. Install belt case cover, torque to 6 to 8 ft-lbs. (8 to 10.8 N.m).

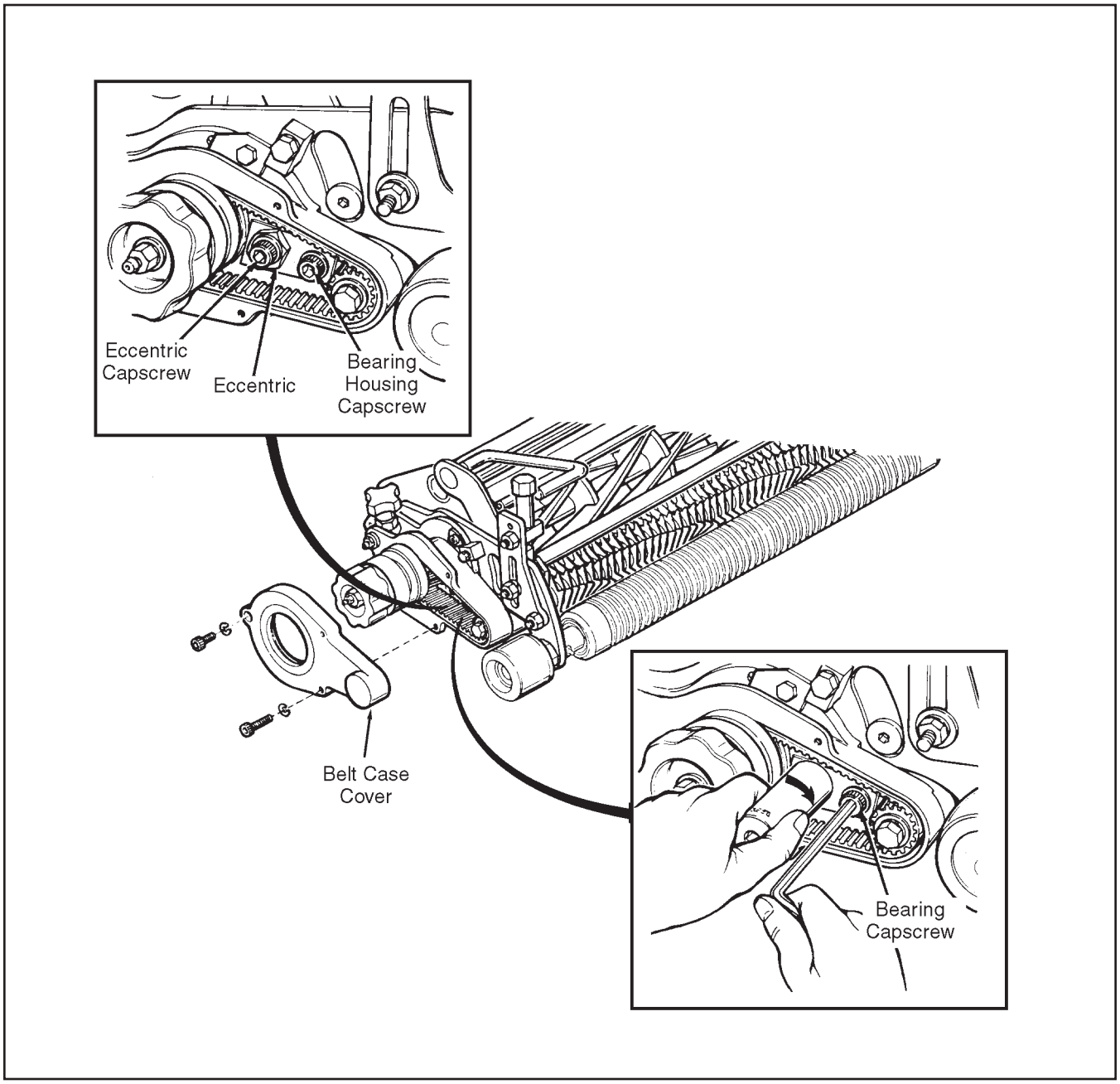

Figure 13C-14. Groomer Belt Adjustment

SECTION 13C. TURF GROOMER (LF-3400 ONLY)

CLUTCH ASSEMBLY (See Figure 13C-15)

Clutch repair is limited to replacing worn or broken springs and/or clutch pins.

When working on clutch, place it pulley side down on a work bench.

QUICK HEIGHT ADJUST ASSEMBLY

REPAIR (See Figure 13C-16)

Inspect, replace any parts that are questionable. Follow disassembly/reassembly as shown in Figure 13C-16).

ADJUSTMENT (See Figure 13C-16)

Each notch the quick height adjust is moved, changes the groomer shaft 1/8 inch (3.18 mm).

If the control is loose when locked in a notch, proceed as follows:

1. Remove knob by loosening setscrew.
2. Using an open end wrench hold bolt. Turn nut on top counterclockwise (CCW) until control is tight in notch.
3. Install knob and tighten setscrew.

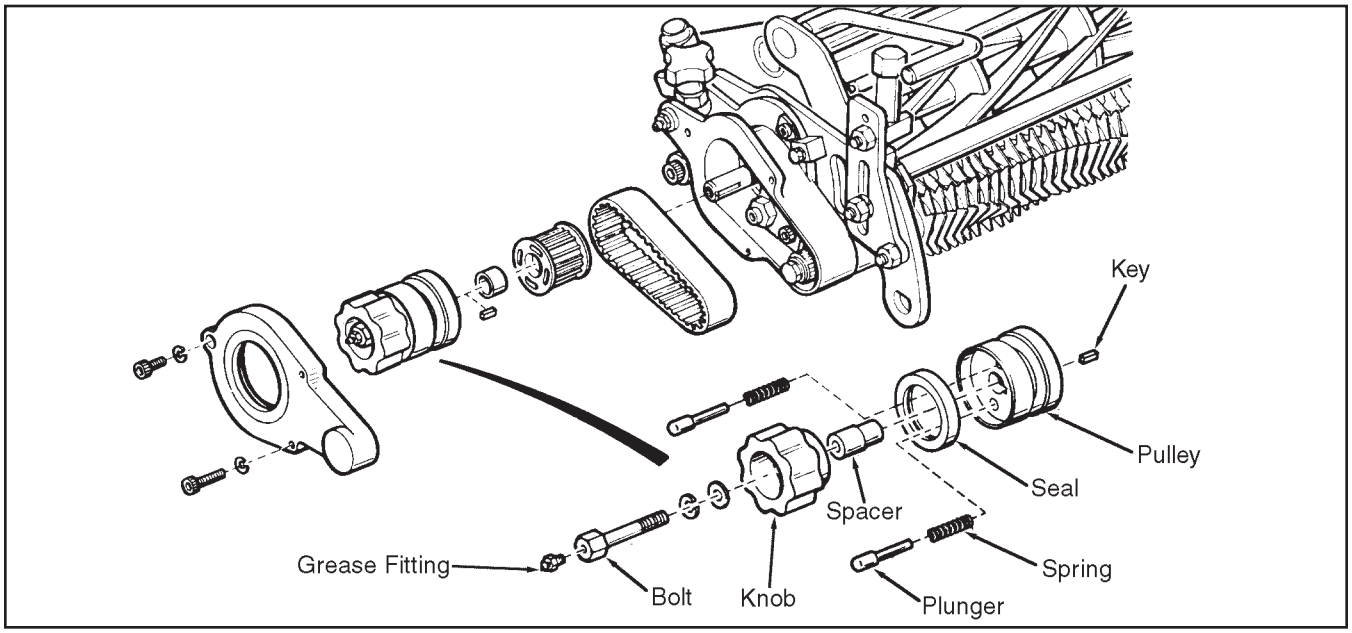

Figure 13C-15. Clutch Assembly

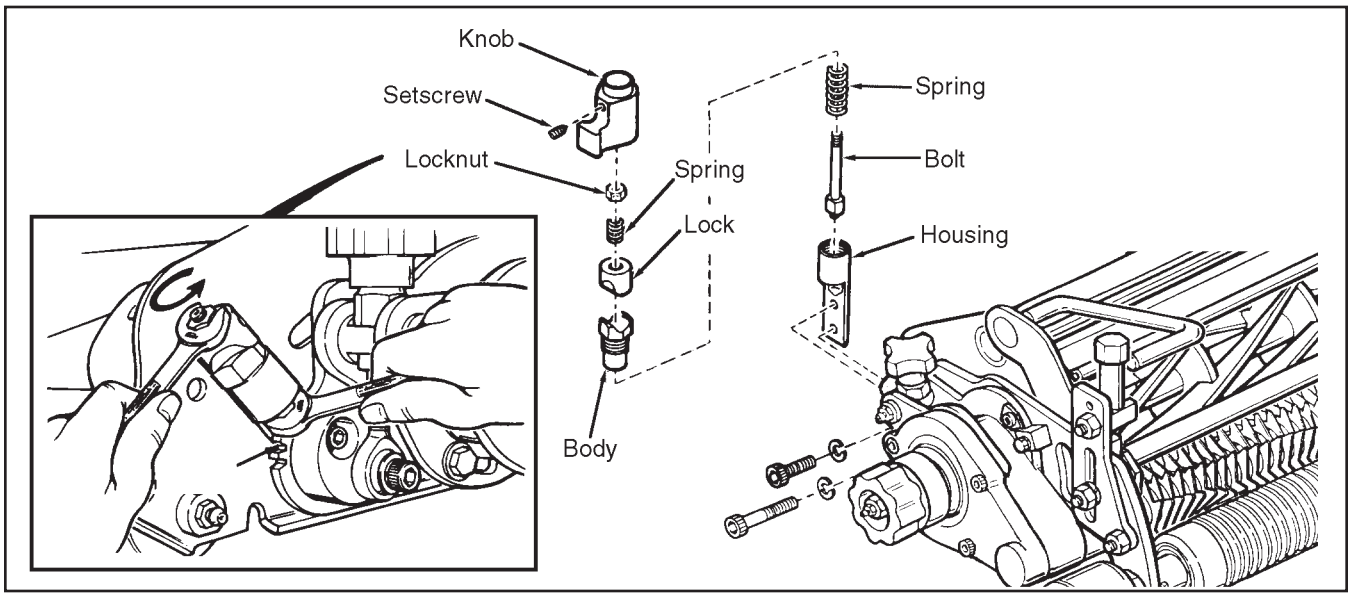

Figure 13C-16. Quick Height Adjustment

SECTION 13C. TURF GROOMER (LF-3400 ONLY)

MICRO HEIGHT ADJUST ASSEMBLY (See Figure 13C-17)

The micro height adjust can be disassembled for repairs as shown.

At time of assembly make sure roll pin in pin assembly is on BOTTOM when installing pin assembly in pivot block.

LUBRICATION (See Figure 13C-18)

Use a hand grease gun when lubricating Turf Groomer components.

Pump the gun slowly and carefully until a slight amount of pressure is felt, then stop — DO NOT over grease.

Lubricate groomer shaft bearings, roller shaft bearings and clutch monthly.

Lubricate micro adjusters monthly. Wipe off excess grease.

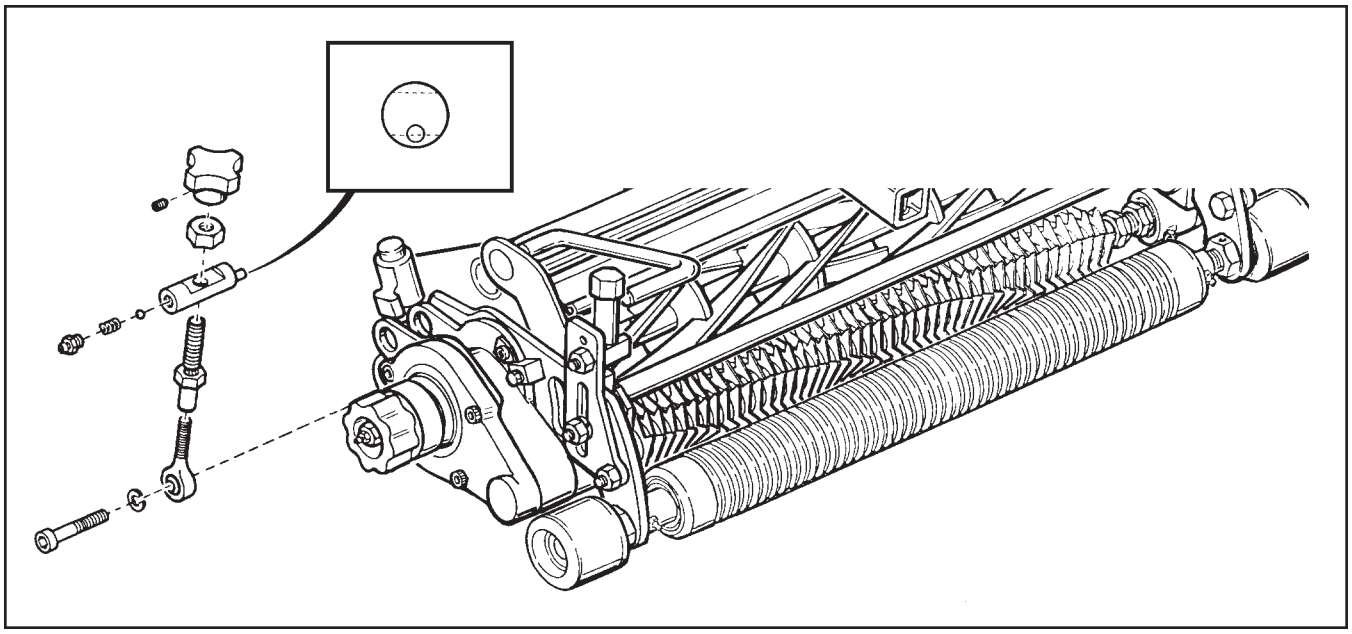

Figure 13C-17. Micro Height Adjustment

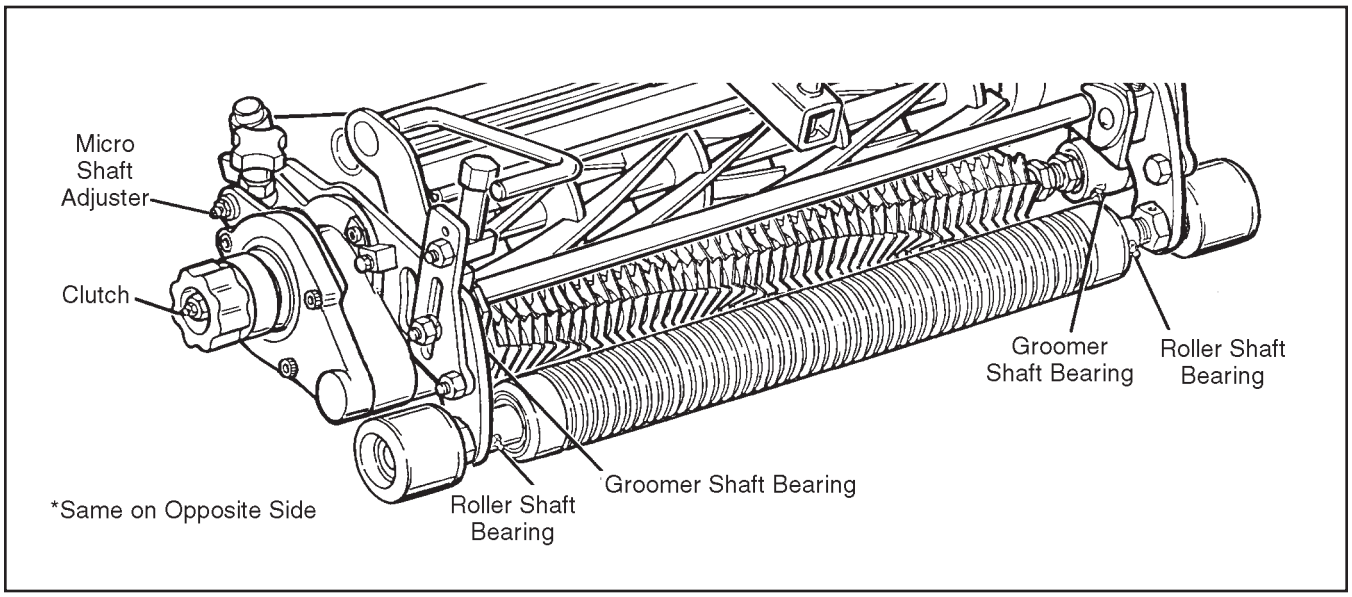

Figure 13C-18. Lubrication

SECTION 13D. POWER REAR ROLLER CLEANER (LF-3800 ONLY)

ASSEMBLY (See Figure 13D-1)

1. Remove and discard existing hardware holding the rear roller in place.
   a. Assemble grease fitting (2) to roller mounting bolt (16).
   b. Loosely assemble setscrew (17) to eccentric nut (15).
   c. Slip nut (15) over bolt (16), and fasten into the roller. Setscrew is to be positioned towards the outside of the reel on both ends.

   Repeat Steps a, b and c for other side.
2. Subassemble the right side bearing housing (1R) as illustrated. The seal (Item 5) and cup portion of the bearing (Item 4) is preassembled.
   a. Place the bearing (4) nilos ring (24) and spacer (14) into the housing.
   b. Assemble the short end of the roller shaft (13) into the housing and secure the two assemblies together with one 3/8 inch flat washer (6), 3/8 inch lockwasher (8) and one 3/8-16 x 3/4 inch screw (9) as shown.
   c. Assemble grease fitting (2) to the bearing housing, then fully tighten screw (9).
3. Slide the housing and brush over the right side eccentric adjuster and secure the housing to the frame with one 5/16-18 x 1 inch screw (19), 5/16 inch flat washers (3) on both sides, 5/16 inch lockwashers (35) and one 5/16-18 nut (20).
4. Assemble the left side bearing housing (1L) as illustrated. Again, the seal (5) and cup portion of the bearing (4) are preassembled.
   a. Insert the roller bearing (4) and nilos cup (24) into the housing.
   b. Slide the subassembly over the shaft and onto the eccentric adjuster. Make certain the set screw (17) is facing the outside of the frame.
5. Place one 5/16-18 x 3/4 inch screw (31) with one 5/16 inch flat washer (3) as shown, then add the remaining components.
   a. Spacer (34) is behind the bracket (28) when a Turf Groomer is used with the reel.
   b. Spacer (34) is assembled in front of the bracket (28) when the Turf Groomer is not used.
   c. Add one lockwasher (35) and nut (20) but do not tighten hardware.
6. Complete the brush assembly by adding one spacer (12), spring (7) and the key (11).

   Place spring on inside of pulley on 5/8 inch diameter shaft.

   Place spring on outside of pulley on 1/2 inch diameter shaft.
   a. Align the keyway in pulley (10) and slide the pulley over the key and shaft.
   b. Add one 7/16 inch flat washer (36), when using the brush with the Turf Groomer, one lockwasher and one 3/8-16 x 3/4 inch screw (8 and 9).
7. Loosely assemble the shield brace (27) to the mower's bearings housing as shown.
8. Slide the corresponding spacer (22) over the shaft (depending on the diameter of the shaft) then add one key (11) if required.
   a. Assemble setscrews (33) to the pulley if required.
   b. Place belt (23) onto the groove of pulley (10) and pulley (18).
   c. Slide pulley (18) onto reel shaft and add one 3/8 inch flat washer (6), 3/8 inch lockwasher (8) and 3/8-24 x 1 inch bolt (21).
   d. Align both pulleys with straight edge then tighten hardware (21 and 33).
9. Assemble belt shield (26) to braces (27 and 28) using 1/4 inch flat washer, lockwashers and 1/4-20 x 3/4 inch screw (32, 30 and 29) as shown. Add nut 40 if other using bracket is used.

   Slide bracket (26) in or out as necessary for proper lift and tighten all hardware.

FINAL ASSEMBLY

1. Make sure all components have been properly assembled and adjusted and that all hardware is securely fastened.
2. Clean the grease fitting before and after you apply grease. Use a grease gun with NLGI Grade 0 grease and fill the cavity in both housings (1).
3. Reassemble the cutting unit to the tractor.

SECTION 13D. POWER REAR ROLLER CLEANER (LF-3800 ONLY)

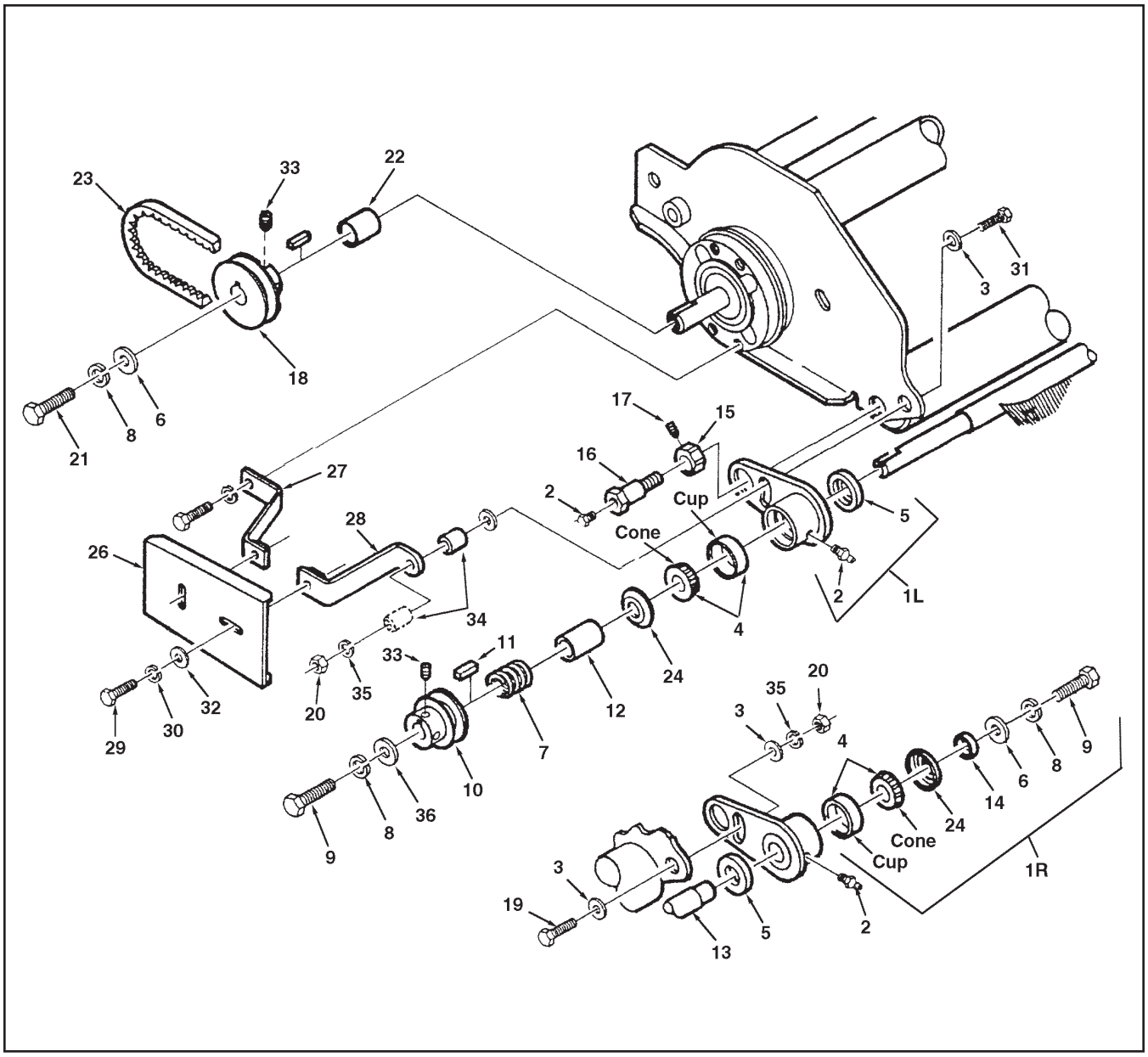

Figure 13D-1.

RETURN TO MAIN
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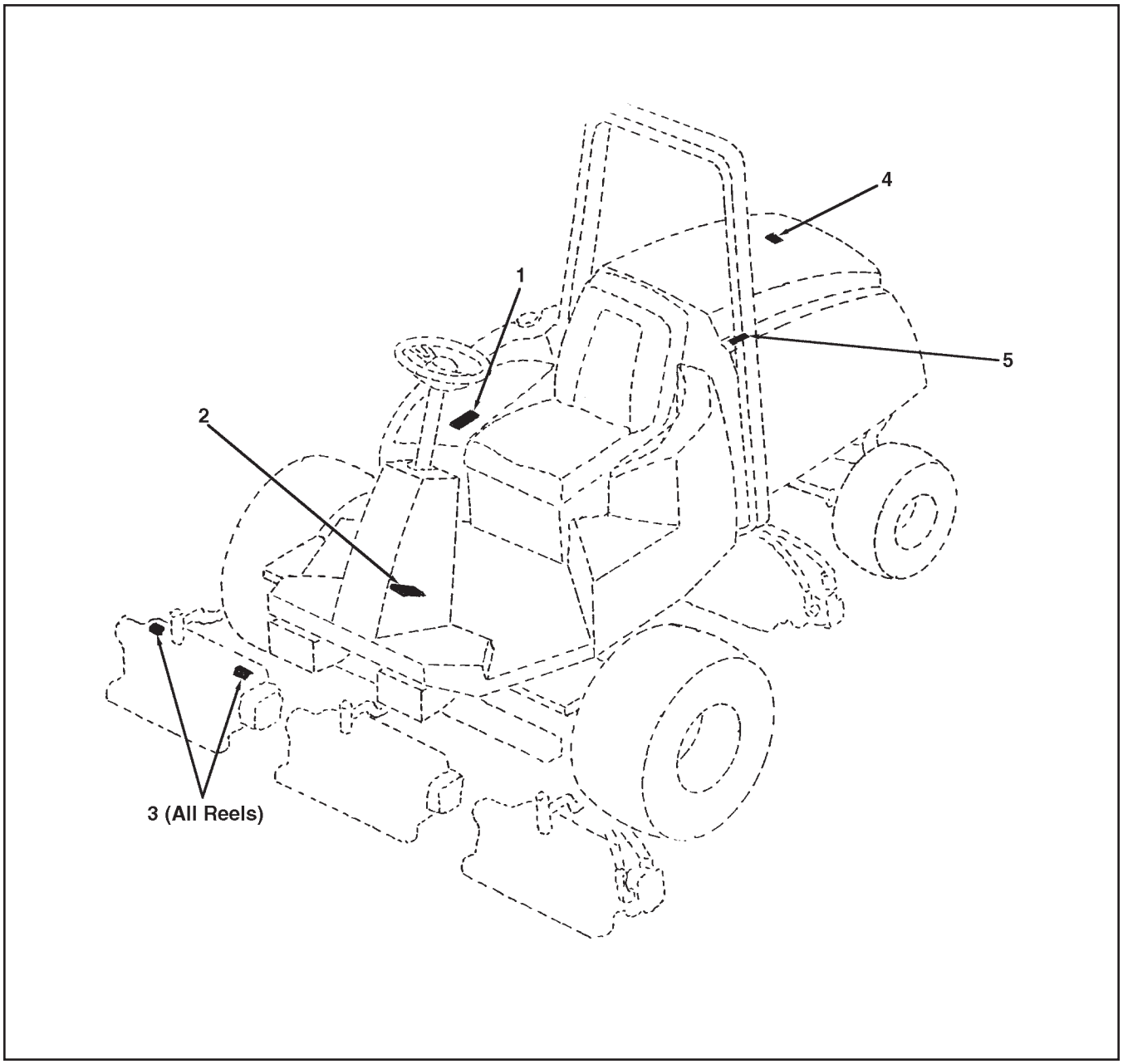
SECTION 14
MISCELLANEOUS

SECTION 14A. PRECAUTION DECAL LOCATIONS



SECTION 14A. PRECAUTION DECAL LOCATIONS

1

⚠ CAUTION

1. Read operator's manual before operating machine.
2. Keep shields in place and hardware securely fastened.
3. Before you clean, adjust or repair this equipment, disengage all drives, engage parking brake and stop engine.
4. Keep hands, feet and clothing away from moving parts.
5. Never carry passengers.
6. Keep bystanders away.
7. Do not use on slopes greater than 22°

Included on Instrument Panel Decal 3007236

2 Part No. 340830

⚠ ATENCION

1. No opere esta maquina sin previo entrenamiento, instruccion y sin haber leido el manual de operacion.
2. Tenga todas las guardas en su lugar y plezas bien aseguradas.
3. Neutralice todas las velocidades y apague el motor antes de vaciar los recolectores de pasto, darie servicio, limplar, ajustar y destrabar la maquina.
4. Mantenga las manos, los ples y ropa suelta lejos de plezas en movimiento.
5. No deberan transportar pasajeros si no existe un asiento para ellos.
6. Si no sabe leer ingles, pida que aiguien le lea las calcomanias de avisos y los manuales de instruccion y operacion.

3 Part No. 361877

⚠ DANGER

To prevent injury, disengage all drives, engage parking brake and stop engine before working on machine or emptying grass catchers.

361877

4 Part No. 365956

⚠ WARNING

Radiator is under pressure. Remove cap slowly to avoid personal injury.

5 Part No. 3001435

⚠ DANGER

To avoid injury when working with battery:

1. Always connect the black ground (-) cable last and remove it first.
2. Keep sparks and flames away, and avoid contact with acid.

To avoid injury when jumping battery:

1. Connect positive (+) terminal to positive (+) terminal.
2. Connect negative (-) terminal on good battery to frame of vehicle that has dead battery.

6 Part No. 1000997

⚠ WARNING

To prevent cuts use socket wrench or Turf Groomer® knob to turn reel.

1000997

Not Illustrated

SECTION 14B. CONVERSION CHARTS

MILLIMETERS TO DECIMALS

Starrett® Metric Tools

MILLIMETERS TO DECIMALS

mm	Decimal	mm	Decimal	mm	Decimal	mm	Decimal	mm	Decimal
0.01	.00039	0.41	.01614	0.81	.03189	21	.82677	61	2.40157
0.02	.00079	0.42	.01654	0.82	.03228	22	.86614	62	2.44094
0.03	.00118	0.43	.01693	0.83	.03268	23	.90551	63	2.48031
0.04	.00157	0.44	.01732	0.84	.03307	24	.94488	64	2.51969
0.05	.00197	0.45	.01772	0.85	.03346	25	.98425	65	2.55906
0.06	.00236	0.46	.01811	0.86	.03386	26	1.02362	66	2.59843
0.07	.00276	0.47	.01850	0.87	.03425	27	1.06299	67	2.63780
0.08	.00315	0.48	.01890	0.88	.03465	28	1.10236	68	2.67717
0.09	.00354	0.49	.01929	0.89	.03504	29	1.14173	69	2.71654
0.10	.00394	0.50	.01969	0.90	.03543	30	1.18110	70	2.75591
0.11	.00433	0.51	.02008	0.91	.03583	31	1.22047	71	2.79528
0.12	.00472	0.52	.02047	0.92	.03622	32	1.25984	72	2.83465
0.13	.00512	0.53	.02087	0.93	.03661	33	1.29921	73	2.87402
0.14	.00551	0.54	.02126	0.94	.03701	34	1.33858	74	2.91339
0.15	.00591	0.55	.02165	0.95	.03740	35	1.37795	75	2.95276
0.16	.00630	0.56	.02205	0.96	.03780	36	1.41732	76	2.99213
0.17	.00669	0.57	.02244	0.97	.03819	37	1.45669	77	3.03150
0.18	.00709	0.58	.02283	0.98	.03858	38	1.49606	78	3.07087
0.19	.00748	0.59	.02323	0.99	.03898	39	1.53543	79	3.11024
0.20	.00787	0.60	.02362	1.00	.03937	40	1.57480	80	3.14961
0.21	.00827	0.61	.02402	1	.03937	41	1.61417	81	3.18898
0.22	.00866	0.62	.02441	2	.07874	42	1.65354	82	3.22835
0.23	.00906	0.63	.02480	3	.11811	43	1.69291	83	3.26772
0.24	.00945	0.64	.02520	4	.15748	44	1.73228	84	3.30709
0.25	.00984	0.65	.02559	5	.19685	45	1.77165	85	3.34646
0.26	.01024	0.66	.02598	6	.23622	46	1.81102	86	3.38583
0.27	.01063	0.67	.02638	7	.27559	47	1.85039	87	3.42520
0.28	.01102	0.68	.02677	8	.31496	48	1.88976	88	3.46457
0.29	.01142	0.69	.02717	9	.35433	49	1.92913	89	3.50394
0.30	.01181	0.70	.02756	10	.39370	50	1.96850	90	3.54331
0.31	.01220	0.71	.02795	11	.43307	51	2.00787	91	3.58268
0.32	.01260	0.72	.02835	12	.47244	52	2.04724	92	3.62205
0.33	.01299	0.73	.02874	13	.51181	53	2.08661	93	3.66142
0.34	.01339	0.74	.02913	14	.55118	54	2.12598	94	3.70079
0.35	.01378	0.75	.02953	15	.59055	55	2.16535	95	3.74016
0.36	.01417	0.76	.02992	16	.62992	56	2.20472	96	3.77953
0.37	.01457	0.77	.03032	17	.66929	57	2.24409	97	3.81890
0.38	.01496	0.78	.03071	18	.70866	58	2.28346	98	3.85827
0.39	.01535	0.79	.03110	19	.74803	59	2.32283	99	3.89764
0.40	.01575	0.80	.03150	20	.78740	60	2.36220	100	3.93701

THE L. S. STARRETT COMPANY
Athol, Massachusetts 01331, U. S. A.

SECTION 14B. CONVERSION CHARTS

DECIMALS TO MILLIMETERS, FRACTIONS TO DECIMALS TO MILLIMETERS

Starrett® Metric Tools

DECIMALS TO MILLIMETERS

Decimal	mm	Decimal	mm
0.001	0.0254	0.500	12.7000
0.002	0.0508	0.510	12.9540
0.003	0.0762	0.520	13.2080
0.004	0.1016	0.530	13.4620
0.005	0.1270	0.540	13.7160
0.006	0.1524	0.550	13.9700
0.007	0.1778	0.560	14.2240
0.008	0.2032	0.570	14.4780
0.009	0.2286	0.580	14.7320
		0.590	14.9860
0.010	0.2540		
0.020	0.5080		
0.030	0.7620		
0.040	1.0160	0.600	15.2400
0.050	1.2700	0.610	15.4940
0.060	1.5240	0.620	15.7480
0.070	1.7780	0.630	16.0020
0.080	2.0320	0.640	16.2560
0.090	2.2860	0.650	16.5100
		0.660	16.7640
0.100	2.5400	0.670	17.0180
0.110	2.7940	0.680	17.2720
0.120	3.0480	0.690	17.5260
0.130	3.3020		
0.140	3.5560		
0.150	3.8100		
0.160	4.0640	0.700	17.7800
0.170	4.3180	0.710	18.0340
0.180	4.5720	0.720	18.2880
0.190	4.8260	0.730	18.5420
		0.740	18.7960
0.200	5.0800	0.750	19.0500
0.210	5.3340	0.760	19.3040
0.220	5.5880	0.770	19.5580
0.230	5.8420	0.780	19.8120
0.240	6.0960	0.790	20.0660
0.250	6.3500		
0.260	6.6040		
0.270	6.8580	0.800	20.3200
0.280	7.1120	0.810	20.5740
0.290	7.3660	0.820	20.8280
		0.830	21.0820
0.300	7.6200	0.840	21.3360
0.310	7.8740	0.850	21.5900
0.320	8.1280	0.860	21.8440
0.330	8.3820	0.870	22.0980
0.340	8.6360	0.880	22.3520
0.350	8.8900	0.890	22.6060
0.360	9.1440		
0.370	9.3980		
0.380	9.6520		
0.390	9.9060		
		0.900	22.8600
0.400	10.1600	0.910	23.1140
0.410	10.4140	0.920	23.3680
0.420	10.6680	0.930	23.6220
0.430	10.9220	0.940	23.8760
0.440	11.1760	0.950	24.1300
0.450	11.4300	0.960	24.3840
0.460	11.6840	0.970	24.6380
0.470	11.9380	0.980	24.8920
0.480	12.1920	0.990	25.1460
0.490	12.4460	1.000	25.4000

FRACTIONS TO DECIMALS TO MILLIMETERS

Fraction	Decimal	mm	Fraction	Decimal	mm
1/64	0.0156	0.3969	33/64	0.5156	13.0969
1/32	0.0312	0.7938	17/32	0.5312	13.4938
3/64	0.0469	1.1906	35/64	0.5469	13.8906
1/16	0.0625	1.5875	9/16	0.5625	14.2875
5/64	0.0781	1.9844	37/64	0.5781	14.6844
3/32	0.0938	2.3812	19/32	0.5938	15.0812
7/64	0.1094	2.7781	39/64	0.6094	15.4781
1/8	0.1250	3.1750	5/8	0.6250	15.8750
9/64	0.1406	3.5719	41/64	0.6406	16.2719
5/32	0.1562	3.9688	21/32	0.6562	16.6688
11/64	0.1719	4.3656	43/64	0.6719	17.0656
3/16	0.1875	4.7625	11/16	0.6875	17.4625
13/64	0.2031	5.1594	45/64	0.7031	17.8594
7/32	0.2188	5.5562	23/32	0.7188	18.2562
15/64	0.2344	5.9531	47/64	0.7344	18.6531
1/4	0.2500	6.3500	3/4	0.7500	19.0500
17/64	0.2656	6.7469	49/64	0.7656	19.4469
9/32	0.2812	7.1438	25/32	0.7812	19.8438
19/64	0.2969	7.5406	51/64	0.7969	20.2406
5/16	0.3125	7.9375	13/16	0.8125	20.6375
21/64	0.3281	8.3344	53/64	0.8281	21.0344
11/32	0.3438	8.7312	27/32	0.8438	21.4312
23/64	0.3594	9.1281	55/64	0.8594	21.8281
3/8	0.3750	9.5250	7/8	0.8750	22.2250
25/64	0.3906	9.9219	57/64	0.8906	22.6219
13/32	0.4062	10.3188	29/32	0.9062	23.0188
27/64	0.4219	10.7156	59/64	0.9219	23.4156
7/16	0.4375	11.1125	15/16	0.9375	23.8125
29/64	0.4531	11.5094	61/64	0.9531	24.2094
15/32	0.4688	11.9062	31/32	0.9688	24.6062
31/64	0.4844	12.3031	63/64	0.9844	25.0031
1/2	0.5000	12.7000	1	1.0000	25.4000

SECTION 14B. CONVERSION CHARTS

U.S. TO METRIC CONVERSIONS

	To Convert	Into	Multiply By
Linear Measurement	Miles	Kilometers	1.609
	Yards	Meters	0.9144
	Feet	Meters	0.3048
	Feet	Centimeters	30.48
	Inches	Meters	0.0254
	Inches	Centimeters	2.54
	Inches	Millimeters	25.4
Area	Square Miles	Square Kilometers	2.59
	Square Feet	Square Meters	0.0929
	Square Inches	Square Centimeters	6.452
	Acre	Hectare	0.4047
Volume	Cubic Yards	Cubic Meters	0.7646
	Cubic Feet	Cubic Meters	0.02832
	Cubic Inches	Cubic Centimeters	16.39
Weight	Tons (Short)	Metric Tons	0.9078
	Pounds	Kilograms	0.4536
	Ounces (Avdp.)	Grams	28.3495
Pressure	Pounds/Sq. In.	Kilopascal	6.895
		Bars	0.069
Work	Foot-pounds	Newton-Meters	1.356
	Foot-pounds	Kilogram-Meters	0.1383
	Inch-pounds	Kilogram-Centimeters	1.152144
Liquid Volume	Quarts	Liters	0.9463
	Gallons	Liters	3.785
Liquid Flow	Gallons/Minute	Liters/Minute	3.785
Temperature	Fahrenheit	Celsius	1. Subtract 32° 2. Multiply by 5/9