JACOBSEN®
A Textron Company

When Performance Matters.™

GP400
Riding Greens Mower
Technical/Repair Manual
USAG004, USAD004

CUSTOMERCARE

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Riding Greens Mower
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WARNING: If incorrectly used, this machine can cause severe injury. Those who use and maintain this 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.

Foreword

General

This manual provides detailed information and procedures to safely repair and maintain the following:

Jacobsen GP400 riding greens mower and associated accessory attachments

This manual is intended to introduce and guide the user through the latest factory-approved troubleshooting and repair techniques and practices.

Before you attempt to troubleshoot or make repairs, you must be familiar with the operation of this machine. Refer to the operator's manual and parts manual for specific information on these topics.

THE INFORMATION CONTAINED IN THIS MANUAL IS BASED ON MACHINES MANUFACTURED UP TO THE TIME OF PUBLICATION. JACOBSEN RESERVES THE RIGHT TO CHANGE ANY OF THIS INFORMATION WITHOUT NOTICE.

California Proposition 65 Warning

WARNING

Certain vehicle components contain or emit chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

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How to Use This Manual

This manual is designed to provide multiple ways to locate and access repair information.

Read each section in its entirety before beginning a procedure. Proper understanding of machine operation and components is the key to successful diagnostics and repair.

Make use of special information features within this manual in order to be better prepared to perform repairs. Always follow manual procedures and safety guidelines. Never take shortcuts.

Table of Contents

Major machine components or topics of interest are separated into specific chapters. Each manual lists these chapters in a main Table of Contents.

Chapter Table of Contents

Each chapter begins with a detailed table of contents related to the specific machine component or system.

Use the chapter table of contents to find specific component or procedural information.

Index

An alphabetical Index is located at the back of the manual.

Use the Index to find specific components and related procedures.

Required Tools and Materials

Some procedures will require the use of specific tools and/or materials. These tools and/or materials will be listed for reference, prior to beginning a procedure.

Specifications

Near the beginning of each chapter is a specifications listing. This listing contains any specifications contained within the chapter.

Quick Reference Specifications

A list of all machine specifications can be found in Chapter 2 Specifications and General Information. This is a list of all specifications from each chapter, combined and listed in one place for easy reference.

Warnings and Cautions

Warning and Caution indicators are located throughout the manual at specific points of interest. These notices are given to prevent personal injury, death, and/or equipment damage. Always heed these notices, and practice common sense when performing any maintenance or repair procedure.

Notes

Special notes are given in order to draw attention to detailed instructions. These notes are intended to give further important information regarding the machine and/or a step in a procedure.

Troubleshooting

Troubleshooting charts are provided in each chapter to aid in the diagnostic process. Use these suggestions to aid in identifying a potential mechanical or machine adjustment problem.

Table of Contents

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Chapter 1

Safety

1

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1

Introduction

Safety is the most important element of any repair procedure. Knowledge of the procedure to be performed and safe work habits are essential to preventing death, personal injury, or property damage. Use the following statements as a common-sense guide to proper work and tool-use habits.

Prepare for the Job

Preparation is essential to complete a procedure in a safe and efficient manner.

- Wear proper clothing. Loose or baggy clothing could become tangled in moving parts.
- Use eye/face protection. Always use proper eye/face protection to protect your eyes from flying debris or chemical splatters.
- Wear protective footwear. Wear safety shoes (steel-toe) to protect your feet from falling objects.
- Use gloves when handling parts. Parts may have sharp edges or may be hot.
- Remove jewelry prior to servicing electrical systems.
- Prepare proper tools and equipment. Always use the correct tool for the job. Improper or homemade tools can cause injury or machine damage.
- Prepare needed parts and materials. Gather the needed parts and materials before beginning the procedure.
- Allow machine to cool. Many components can get hot during operation. Be sure to allow enough time for components to cool before beginning service.
- Prepare proper work-space lighting. A well-lit work area can make the job easier.
- Follow procedures and safety warnings. Service procedures are written to be as safe and efficient as possible. Never take shortcuts.
- Be prepared for emergencies. Accidents can happen, even under the best conditions. Fire extinguishers and first aid kits should be well maintained and easily accessible.

Safety Notices

Throughout this manual, the following key safety words will be used to alert the reader of potential hazards. Become familiar with these words and their meaning. Take all precautions to avoid the hazards described.

This safety alert symbol is used to alert you to potential hazards.

DANGER

Indicates an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.

WARNING

Indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury and property damage. It may also be used to alert against unsafe practices.

NOTICE

Indicates a potentially hazardous situation which, if not avoided, MAY result in property damage. It may also be used to alert against unsafe practices.

Safety Label Locations

Become familiar with machine safety labels and locations. The following illustrations show safety label locations on the machine.

See Figure 1-1.

Figure 1-1

1

7

6

11

8

5

4

2

3

9

10

Inspect Safety Labels

Safety decals are critical to the safe operation of the mower. Inspect the mower for any damaged, missing, or unreadable decals. Replace decals as needed before placing the mower back in service.

1

Keep Work Area Clean

A clean, organized, well-lit work area is important to promote safe working conditions.

- Keep floor clean of debris and clear of parts and tools.
- Clean up any spilled fuel, oil, and/or chemicals immediately.
- Store all air hoses and electrical cords properly when not in use.

Keep Work Area Well Ventilated

WARNING

Never operate the engine without proper ventilation; exhaust fumes can be fatal if inhaled.

Certain test and adjustment procedures require the engine to be running. Be sure work area is well ventilated; never run the engine in an enclosed area.

Use Proper Eye and Face Protection

WARNING

Always use approved personal protection equipment. Avoid workplace hazards by wearing properly maintained, approved eye and face protection. Failure to use appropriate protection equipment may result in death or serious injury.

Always wear eye protection while in a shop environment.

- Safety Glasses: Safety glasses offer a minimum level of protection from flying debris.
- Face Shields: Face shields are often used along with safety glasses to offer a higher level of protection when sparks and flying debris are present.
- Vented Goggles: Goggles offer side protection not offered by safety glasses alone.
- Unvented Goggles: Unvented goggles offer protection from chemical splashes and vapors.

Park Mower Safely

See Figure 1-2.

WARNING

Before cleaning, adjusting, or repairing this equipment, disengage all drives, engage park brake, and stop engine to prevent injuries.

When performing maintenance other than adjustments that require the engine to be running, disconnect the battery negative cables to prevent accidental starting and bodily injury.

1. Park the mower on a solid, level surface.

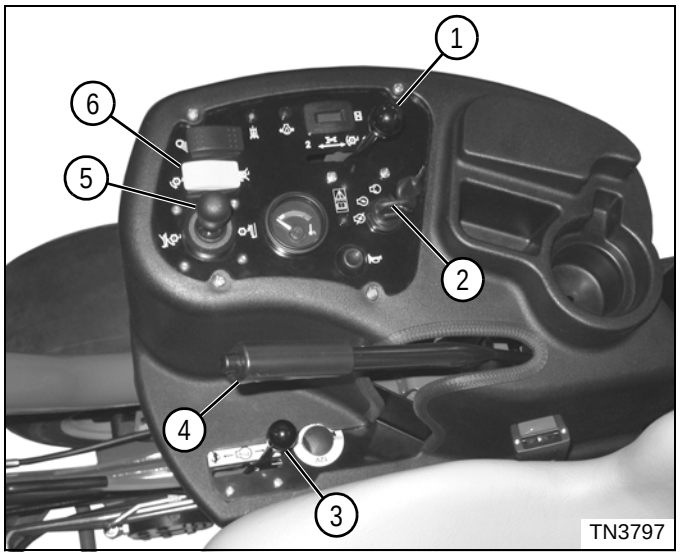

Figure 1-2

2. Disengage the cutting units by moving the mow switch (6) to the off position.
3. Lower the cutting units by moving the raise/lower switch (5) forward.
4. Move throttle lever (3) to the slow position.
5. Move traction lever (1) to the mow position.
6. Engage park brake lever (4) and rotate key switch (2) fully counterclockwise to off position.
7. Remove key from key switch.

Use Lifting Equipment Safely

WARNING

Always check the lifting capacity and condition of hoists, slings, cables, or chains before use. Using underrated or worn lifting components can result in death or serious injury.

- Always use a lifting device with a lifting capacity greater than the weight of the item being lifted.
- Secure the load to the lifting device using cables, chains, or slings rated to handle the load being lifted. Fasteners being used to connect lifting devices must be strong enough to handle the load. Also be sure the mounting point of load is strong enough to handle the load.
- When using a lifting device, always connect the load so it is balanced.
- Always use a lifting device on a hard, level surface.
- Lower the lifting device to the lowest point before moving. Move the load slowly.
- Always support the load as soon as possible; never leave a load suspended in mid-air.

Support Machine Securely

WARNING

- **Support the machine using properly rated jackstands. Never work under a machine supported only by a jack.**
- **Do not use wood or concrete blocks to support the machine. Failure to properly support the machine may result in death or serious injury.**

Use Compressed Air and Air Tools Safely

WARNING

Always wear approved eye and ear protection while using compressed air. Misuse of compressed air could result in death or serious injury.

- **When using air nozzles, air pressure should not exceed 30 psi (206.8 kPa).**
- **Never direct air nozzles or tools at a person.**
- **Never point air nozzles directly at skin.**

- Compressed air is a useful tool when used in a safe manner.
- Always use eye and ear protection while using compressed air and air tools.
- When using air tools, do not exceed the air pressure rating for the tool.
- When using an impact wrench, always use approved impact sockets. Never use standard sockets on an impact wrench.
- Disconnect the air supply before changing air tool attachments.
- Never point air nozzles or air tools at another person.
- Always maintain air tools properly.

Service Tires Safely

WARNING

An inflated tire contains explosive force. Use care when handling wheels and tires.

- Always wear safety glasses or goggles.
- Use proper lifting methods when working with wheels and tires.
- When working on an inflated tire, never position yourself directly over the work area.
- When dismounting or mounting tires, use a wheel holder or tire machine. Use proper tire mounting tools and equipment. Never use screwdrivers or makeshift tools to force a tire on or off a wheel.
- Be sure tire irons and mounting tools are free of grease and oil. Grip them firmly.
- Inspect wheel parts for rust, damage, or distortion. Never use wheels that are out-of-round, rusted, or cracked.
- Never hammer on wheels with a steel hammer. Use rubber-covered hammers.
- When inflating tires, always use an inflation cage. Always stand away from the valve stem.
- Use accurate, tested inflation gauges to set air pressures.

Handle Fuel Safely

Handle fuel with care—it is highly flammable.

WARNING

- **Never remove the fuel cap from the fuel tank, or add fuel, when the engine is running or while the engine is hot.**
- **Do not smoke when handling fuel. Never fill or drain the fuel tank indoors.**
- **Do not spill fuel. Clean spilled fuel immediately.**
- **Never handle or store fuel containers near an open flame or any device that may create sparks and ignite the fuel or fuel vapors.**
- **Be sure to reinstall and tighten fuel cap securely.**
- **Use an approved container; the spout must fit inside the fuel filler neck. Avoid using cans and funnels to transfer fuel.**

Store fuel according to local, state, or federal ordinances and recommendations from your fuel supplier.

Never overfill or allow the tank to become empty.

Use clean, fresh fuel.

Do not fill above the fuel filler neck.

Store Volatile and Hazardous Materials Safely

Store volatile materials (gasoline, diesel fuel, oil, etc.) in approved containers that are clearly marked. Containers should be stored in an approved safety cabinet away from possible sources of ignition. Storage areas and cabinets should be well ventilated to prevent the possible build-up of fumes.

Handle Chemical Products Safely

WARNING

Exposure to chemical products could result in serious injury. Handle chemical products with care. Refer to the chemical manufacturer's Material Safety Data Sheet (MSDS) for information regarding health hazards, safe handling, and emergency response procedures.

Routine service often requires the use of various chemical products, including lubricants and cleaning solutions. Many of these chemicals are flammable and can pose health risks if not handled properly.

- Never mix chemicals. Mixing chemicals can produce toxic or explosive results.
- Follow the manufacture's recommendations for safe usage and handling of the product.
- Various materials may pose a health hazard if used incorrectly. A Material Safety Data Sheet (MSDS) contains important information regarding proper handling and health hazards, as well as emergency response procedures. Contact the chemical manufacturer to obtain an MSDS for the chemical product.

Service Hydraulic System Safely

WARNING

The hydraulic system is under pressure, and the oil may be hot!

- **Always allow the machine to cool completely before performing service.**
- **Always relieve pressure in the hydraulic system before performing service.**
- **Always use appropriate safety equipment and clothing to protect exposed skin and eyes from high-pressure oil.**
- **Tighten all connections to proper specifications before applying pressure.**
- **Never use bare hands to check for leaks! Oil under pressure can penetrate the skin, and can cause gangrene within a few hours if not properly removed. Use a piece of cardboard to check for leaks.**

Failure to follow appropriate safety precautions may result in death or serious injury.

Always dispose of used hydraulic oil properly. (See "Dispose of Waste Materials Safely" on page 1-10.)

Service Cooling System Safely

WARNING

Engine coolant is hot and under pressure! Allow the cooling system to cool completely before performing service.

Rotate the filler cap 1/2-turn counterclockwise and allow pressure to vent before removing filler cap.

Failure to follow appropriate safety precautions may result in death or serious injury.

WARNING

Contact with anti-freeze can damage your skin. Use gloves when working with anti-freeze. If you come in contact with anti-freeze, wash it off immediately.

Always dispose of used engine coolant properly. (See "Dispose of Waste Materials Safely" on page 1-10.)

Service Electrical Components Safely

WARNING

Always disconnect the negative terminal first and positive terminal last. Connect positive terminal first and negative terminal last. Use care when testing live circuits to prevent arcing. Arcing could result in death or serious injury.

- Disconnect the battery negative (–) cable before removing or installing electrical components. Always connect the battery negative (–) cable last.
- Certain test and adjustment procedures must be performed with the battery connected. Use care to prevent arcing when working on live circuits or components. Arcing can cause component damage and could ignite flammable materials.

Dispose of Waste Materials Safely

Routine service can produce waste products such as used oil, coolant, grease, and used batteries.

If not handled properly, these materials can pose a threat to the environment.

Collect fluids in well-marked, approved storage containers. Some waste fluids can react with certain types of plastics. Make sure the fluid to be stored is compatible with the storage container. Never use food or beverage containers to store waste fluids.

IMPORTANT

Never dispose of waste fluids by pouring on the ground, down sewer drains, or into any body of water.

- Dispose of waste fluids properly at approved local recycling centers. If recycling facilities are not available, contact your local community for the correct disposal procedure for waste fluids.
- Dispose of old batteries properly. Battery electrolyte contains sulfuric acid and other hazardous materials. Never place an old battery in the trash. Batteries must be disposed of in a manner consistent with EPA and/or local regulations.

Chapter 2

Specifications and General Information

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Machine Identification

Machine Serial Number

See Figures 2-1 and 2-2.

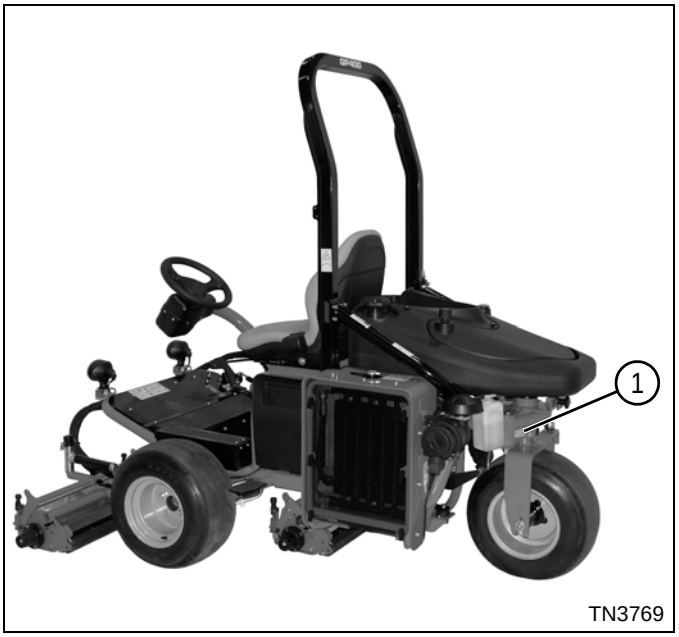


Figure 2-1

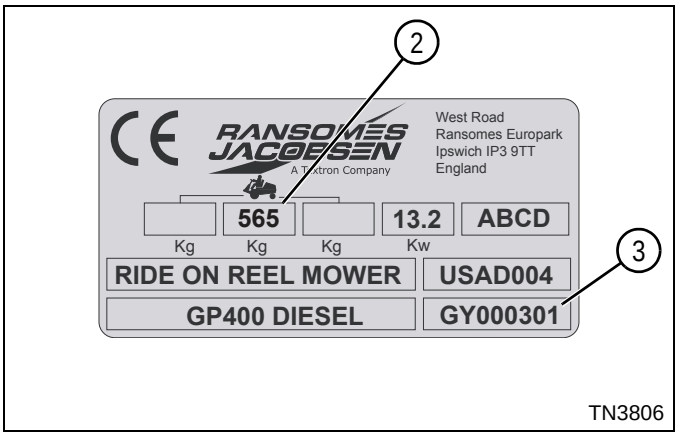


Figure 2-2

A machine identification plate (1) listing the serial number (3) and the machine weight (2) is attached to the rear frame of the mower near the steering yoke. Always provide the serial number of the machine when ordering replacement parts or requesting service information.

Engine Serial Number

See Figure 2-3.

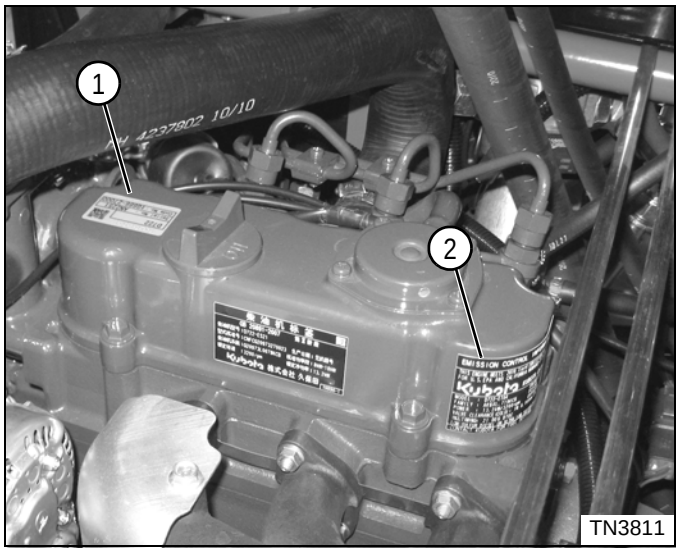


Figure 2-3

The engine serial number plate (1) is attached to the top of the rocker arm cover. The plate also includes the engine model number and the engine code number. An engine data tag (2) is attached to the side of the rocker arm cover. The tag includes information on valve adjustment specifications, injector timing, engine idle speed, and engine displacement.

Optional Machine Accessories

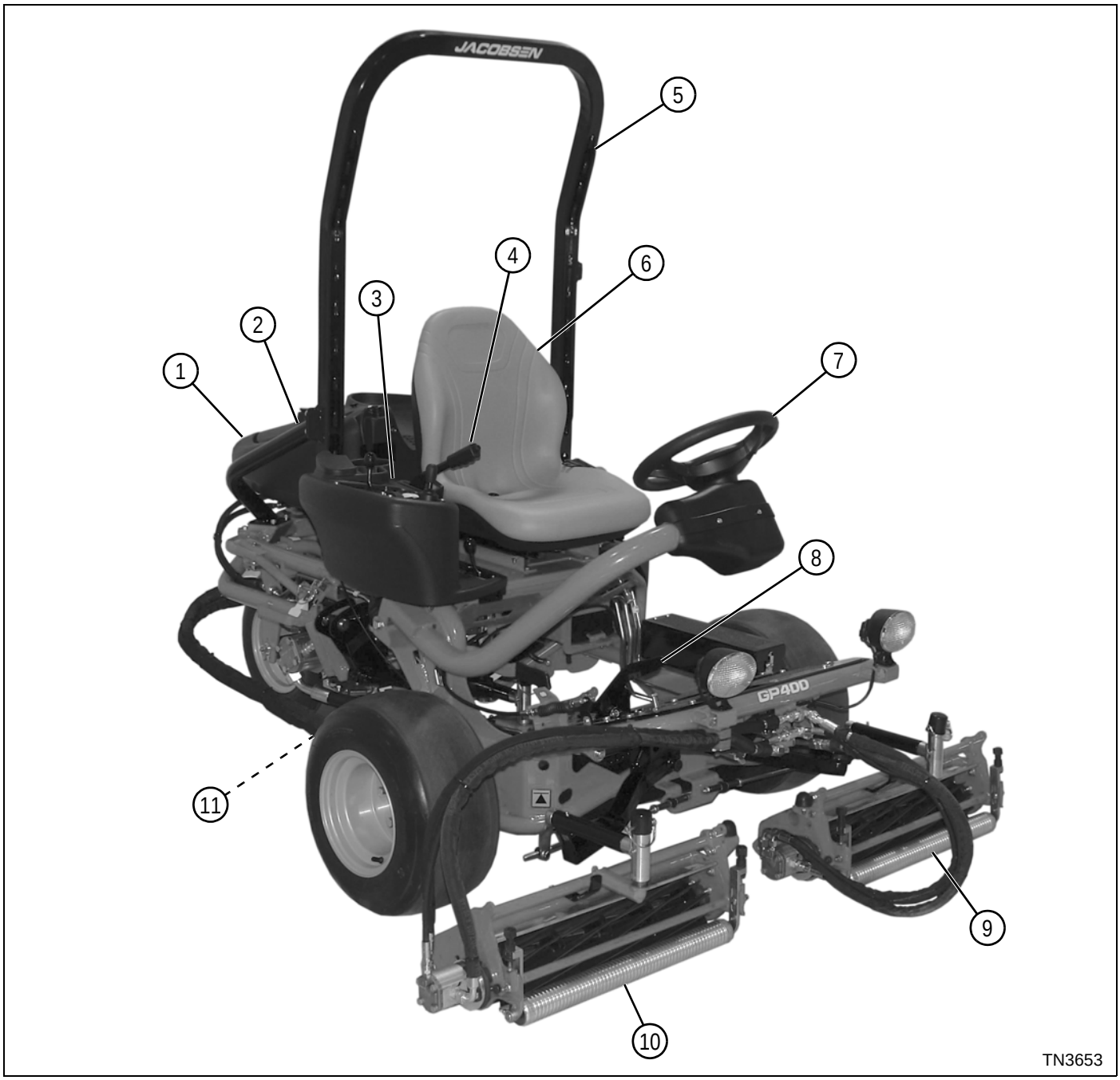
This manual is structured to cover all basic machine components and repair. The addition of accessories can affect certain troubleshooting, adjustment, and repair procedures.

Component Location

See Figure 2-4.

CAUTION

Become familiar with operator controls, machine components, and correct operating procedures before beginning repair procedures.



1	Fuel Tank	4	Park Brake Lever	7	Steering Wheel	10	Right Cutting Unit
2	Hydraulic Tank	5	OPS	8	Traction Pedal	11	Center Cutting Unit
3	Instrument Panel	6	Seat	9	Left Cutting Unit		

Figure 2-4: Component Location

Specifications

Quick Reference Specifications

Fuel System Capacity

Fuel System		
Capacity	gal (L)	14.2 (54)

General Engine Specifications

Diesel Models		
Manufacturer/Model		Kubota/D722-E3B-RUNK-1
Engine Type		Vertical 4-Cycle Diesel
Fuel Requirement		No. 2 Low or Ultra Low Sulfur Diesel (Minimum Cetane Rating 45)
Number of Cylinders/Configuration		3/In-Line
Displacement	cu in. (cc)	43.88 (719)
Bore x Stroke	in. (mm)	2.64 x 2.68 (67 x 68)
Power Output	hp (kW)	17.7 (13.2)@3200 rpm
Cooling System		Liquid Cooled
Cooling System Capacity	qt (L)	4 (3.8) 50/50 Water Ethylene Glycol Mix
Maximum Speed (No Load)	rpm	3400 ± 50
Oil Sump Capacity	qt (L)	3.4 (3.2)
Alternator		12 volt, 150W
Dry Weight	lb (kg)	139 (63)

Gasoline Models		
Manufacturer/Model		Briggs & Stratton/Vanguard V-Twin OHV
Engine Type		Gasoline
Fuel Requirement		Unleaded Gasoline (Minimum Octane Rating 87)
Number of Cylinders		2
Power Output	hp (kW)	17.7 (13.2)@3400 rpm
Cooling System		Air Cooled
Idle Speed	rpm	1700 ± 100
Maximum Speed (No Load)	rpm	3400
Oil Sump Capacity	qt (L)	1.5 (1.4)

Engine

Repair Specifications		
Engine Mounting Screw Torque (Diesel)	lb-ft (N·m)	44 (60)
Engine Isolation Mount Screw Torque (Gasoline)	lb-ft (N·m)	44 (60)

Electrical

Test and Adjustment Specifications		
Resistance Across Solenoid Coil—Mow Solenoid Coil	ohms	9 ± 10%
Resistance Across Solenoid Coil—Raise Solenoid Coil at 72° F (22° C)	ohms	5.6 ± 10%
Resistance Across Solenoid Coil—Lower Solenoid Coil at 72° F (22° C)	ohms	5.6 ± 10%
Resistance Across Fuel Shutoff Pull-In Coil	ohm	1.0 ± 10%
Resistance Across Carb Solenoid Coil at 68° F (20° C)	ohms	40 ± 10%
Mow/Transport Switch to Slide Mount Plate Air Gap	in. (mm)	0.157 (4)

Repair Specification		
Raise/Lower Solenoid Nut Torque	lb-ft (N·m)	7 (10)
Mow Solenoid Nut Torque	lb-in. (N·m)	65–75 (7–8)
Backlap Switch Torque	lb-ft (N·m)	3–5 (4–7)

Hydrostatic Power Train

Test Specifications		
Traction Pump Flow	gpm (lpm)	13.5 (51) @ 3400 rpm
Charge Pump Flow	gpm (lpm)	5 (19) @ 3400 rpm
Gear Pump Flow	gpm (lpm)	5.8 (22) @ 3400 rpm
Implement Relief Pressure	psi (bar)	800 ± 10% (55 ± 10%) @ 3400 rpm
Charge Pressure	psi (bar)	150–210 (10–14) @ 3400 rpm
Hydrostatic Leakage Percentage Ranges		0–10% = Good 11–20% = Marginal 21% and Beyond = Bad

Repair Specifications		
Traction Pump—Port “V1” Fitting Torque	lb-ft (N·m)	27 (37)
Traction Pump—Port “S” Fitting Torque	lb-ft (N·m)	77 (105)
Traction Pump—Port “L1” Fitting Torque	lb-ft (N·m)	55 (74)
Traction Pump—Ports “A” and “B” Fitting Torque	lb-ft (N·m)	55 (74)
Flushing Valve— Relief Valve Torque	lb-ft (N·m)	44 (60)
Flushing Valve—Check Valve Torque	lb-ft (N·m)	44 (60)
Flushing Valve—Port “RW1” Fitting Torque	lb-ft (N·m)	77 (105)
Flushing Valve—Port “RW2” Fitting Torque	lb-ft (N·m)	77 (105)
Flushing Valve—Port “PP” Fitting Torque	lb-ft (N·m)	27 (37)
Flushing Valve—Port “DR” Fitting Torque	lb-ft (N·m)	27 (37)
Front Wheel Motor—Mounting Screw Torque	lb-ft (N·m)	59–66 (80–90)
Front Wheel Motor—Inlet Port Fitting Torque	lb-ft (N·m)	77 (105)
Front Wheel Motor—Outlet Port Fitting Torque	lb-ft (N·m)	77 (105)
Front Wheel Motor—Case Drain Port Fitting Torque	lb-ft (N·m)	27 (37)
Front Wheel Motor—End Cover Screw Torque	lb-ft (N·m)	50–55 (68–75)
Rear Wheel Motor—Mounting Screw Torque	lb-ft (N·m)	59–66 (80–90)
Rear Wheel Motor—Inlet Port Fitting Torque	lb-ft (N·m)	77 (105)
Rear Wheel Motor—Outlet Port Fitting Torque	lb-ft (N·m)	77 (105)
Rear Wheel Motor—End Cover Screw Torque	lb-ft (N·m)	50–55 (68–75)

Hydraulics

Test Specifications		
Charge Relief Valve Pressure Setting	psi (bar)	150–210 (10–15)
Implement Relief Valve Pressure Setting	psi (bar)	800 ± 10% (55 ± 10%)
Lift Relief Valve Pressure Setting	psi (bar)	1250 ± 10% (86 ± 10%)
Reel Relief Valve Pressure Setting	psi (bar)	3020 ± 10% (208 ± 10%)
Reel Motor Case Drain Rate		Less than 1 Pint (0.47 L) per Minute
Hydraulic Leakage Percentage Ranges		0–10% = Good 11–20% = Marginal 21% and Beyond = Bad

Repair Specifications		
Hydraulic Oil Tank Capacity	gal (L)	5.3 (20)
Gear Pump—Retaining Screw Torque	lb-ft (N·m)	88 (120)
Gear Pump—Outlet Port Fitting Torque	lb-ft (N·m)	77 (105)
Gear Pump—Inlet Port Fitting Torque	lb-ft (N·m)	133 (180)
Lift Valve—Coil Nut Torque	lb-in. (N·m)	35–53 (4–6)
Lift Valve—Relief Valve Torque	lb-ft (N·m)	20–25 (27–34)
Lift Valve—Check Valve Torque	lb-ft (N·m)	30–35 (41–47)
Lift Valve—Solenoid Valve Torque	lb-ft (N·m)	25–30 (34–40)
Lift Valve—Port “P” Fitting Torque	lb-ft (N·m)	55 (74)
Lift Valve—Front Side Port “T” Fitting Torque	lb-ft (N·m)	55 (74)
Lift Valve—Port “A” Fitting Torque	lb-ft (N·m)	17 (23)
Lift Valve—Port “B” Fitting Torque	lb-ft (N·m)	17 (23)
Reel Valve Unit—Coil Nut Torque	lb-in. (N·m)	65–75 (7–8)
Reel Valve Unit—Check Valve Torque	lb-ft (N·m)	1.1–1.5 (1.5–2.0)
Reel Valve Unit—Orifice Torque	lb-ft (N·m)	1.1–1.5 (1.5–2.0)
Reel Valve Unit—Reel (Backlap) Valve Torque	lb-ft (N·m)	80–100 (108–136)
Reel Valve Unit—Mow/Relief Valve Torque	lb-ft (N·m)	20–25 (27–34)
Reel Valve Unit—Reel Speed Control Valve Torque	lb-ft (N·m)	30–35 (41–47)
Reel Valve Unit—Port “A” Fitting Torque	lb-ft (N·m)	77 (105)
Reel Valve Unit—Port “B” Fitting Torque	lb-ft (N·m)	77 (105)
Reel Valve Unit—Port “P” Fitting Torque	lb-ft (N·m)	77 (105)
Reel Valve Unit—Port “T” Fitting Torque	lb-ft (N·m)	133 (180)

Steering

Repair Specifications		
Steering Wheel Nut Torque	lb-ft (N·m)	28–30 (38–41)
Steering Unit End Cover-to-Housing Screw Torque	lb-ft (N·m)	20–24 (27–33)

Cutting Units

Checks and Adjustments		
Bedknife Front Face Height	in. (mm)	0.040 (1.0)
Bedknife Front Face Angle	degrees	5
Bedknife Top Face Angle (Rear Relief)	degrees	8–10
Reel Blade Relief Angle	degrees	45
Bedknife-to-Reel Gap	in. (mm)	0.001–0.003 (0.025–0.076)
Reel Bearing Pre-Load	in. (mm)	0.040 (1.0)
Right/Left Reel Leveling Rod—Rod End-to-Rod Connecting Pin Face Measurement (Non-Spring Side)	in. (mm)	1.5 (38.1)
Reel Leveling Rod—Rod End-to-Collar Face Measurement (Spring Side)	in. (mm)	4.606 (117)
Reel Leveling Rod—Rod End-to-Nut Face Measurement (Spring Side)	in. (mm)	0.094 (2.4)

Repair Specifications		
Reel Motor Mounting Nut Torque	lb-ft (N·m)	18 (24)
Reel Motor—Rear Cover-to-Body Retaining Screw Torque	lb-ft (N·m)	18.5 (25)
Reel Motor—Case Drain Fitting Torque	lb-ft (N·m)	15.5 (21)
Reel Motor—IN Port Fitting Torque	lb-ft (N·m)	54.6 (74)
Reel Motor—OUT Port Fitting Torque	lb-ft (N·m)	54.6 (74)
Reel Bearing Housing Assembly Mounting Screw Torque	lb-ft (N·m)	18–22 (24.4–29.8)
Bedknife Backing Mounting Screw Torque	lb-ft (N·m)	25–37 (33.9–50.2)
Bedknife Mounting Screw Torque	lb-in. (N·m)	90–120 (10.2–13.6)
Rear Roller Mounting Screw Torque	lb-ft (N·m)	16–24 (21.7–32.5)

Accessories and Miscellaneous

OPS		
Mounting Bolt Torque	lb-ft (N·m)	37 (50)
Bracket Screw Torque	lb-ft (N·m)	52 (71)

Fuel System		
Capacity	gal (L)	14.2 (54)

Front Tires		
Size		20 x 10-10
Type		2-Ply OTR Smooth
Air Pressure	psi (bar)	10 (0.70)
Mounting Bolt Torque	lb-ft (N·m)	55 (75)

Rear Tire		
Size		20 x 10-10
Type		2-Ply OTR Smooth
Air Pressure	psi (bar)	10 (0.70)
2WD Lug Nut Torque	lb-ft (N·m)	48–63 (65–85)
2WD Mounting Bolt Torque	lb-ft (N·m)	48–63 (65–85)
3WD Lug Nut Torque	lb-ft (N·m)	55–63 (75–85)

Front Wheel Hub		
Castle Nut Torque	lb-ft (N·m)	162 (220)

Rear Wheel Hub		
3WD Castle Nut Torque	lb-ft (N·m)	162 (220)

Mower Speed		
Transport	mph (km/h)	0–7.5 (0–12)
Mow	mph (km/h)	0–3.7 (0–6)
Reverse	mph (km/h)	0–1.9 (0–3)

Weights and Dimensions		
Overall Weight	lb (kg)	GY Series (Diesel): 1413.2 (641) GZ Series (Gasoline): 1254.4 (569.2)
Overall Cutting Width	in. (mm)	63 (160)
Overall Width	in. (mm)	Mow: 74 (188) Transport: 73.25 (186)
Overall Height with OPS	in. (mm)	77.4 (196.5)
Overall Length (with Grass Catchers)	in. (mm)	98.4 (250)

Standard Torque Values

NOTICE

All torque values included in these charts are approximate and are for reference only. Use of these torque values is at your sole risk. Jacobsen is not responsible for any loss, claim, or damage arising from the use of these charts.

Extreme caution should always be used when using any torque value.

NOTE

Jacobsen uses Grade 5 plated bolts as standard, unless otherwise noted. When tightening plated bolts, use the value given for lubricated.

Inch Fastener Torque Values

AMERICAN NATIONAL STANDARD FASTENERS											
SIZE	UNITS	GRADE 5		GRADE 8		SIZE	UNITS	GRADE 5		GRADE 8	
		Lubricated	Dry	Lubricated	Dry			Lubricated	Dry	Lubricated	Dry
#6-32	in-lb (Nm)	–	20 (2.3)	–	–	7/16-14	ft-lb (Nm)	37 (50.1)	50 (67.8)	53 (71.8)	70 (94.9)
#8-32	in-lb (Nm)	–	24 (2.7)	–	30 (3.4)	7/16-20	ft-lb (Nm)	42 (56.9)	55 (74.6)	59 (80.0)	78 (105)
#10-24	in-lb (Nm)	–	35 (4.0)	–	45 (5.1)	1/2-13	ft-lb (Nm)	57 (77.2)	75 (101)	80 (108)	107 (145)
#10-32	in-lb (Nm)	–	40 (4.5)	–	50 (5.7)	1/2-20	ft-lb (Nm)	64 (86.7)	85 (115)	90 (122)	120 (162)
#12-24	in-lb (Nm)	–	50 (5.7)	–	65 (7.3)	9/16-12	ft-lb (Nm)	82 (111)	109 (148)	115 (156)	154 (209)
1/4-20	in-lb (Nm)	75 (8.4)	100 (11.3)	107 (12.1)	143 (16.1)	9/16-18	ft-lb (Nm)	92 (124)	122 (165)	129 (174)	172 (233)
1/4-28	in-lb (Nm)	85 (9.6)	115 (13.0)	120 (13.5)	163 (18.4)	5/8-11	ft-lb (Nm)	113 (153)	151 (204)	159 (215)	211 (286)
5/16-18	in-lb (Nm)	157 (17.7)	210 (23.7)	220 (24.8)	305 (34.4)	5/8-18	ft-lb (Nm)	128 (173)	170 (230)	180 (244)	240 (325)
5/16-24	in-lb (Nm)	173 (19.5)	230 (26.0)	245 (27.6)	325 (36.7)	3/4-10	ft-lb (Nm)	200 (271)	266 (360)	282 (382)	376 (509)
3/8-16	ft-lb (Nm)	23 (31.1)	31 (42.0)	32 (43.3)	44 (59.6)	3/4-16	ft-lb (Nm)	223 (302)	298 (404)	15 (427)	420 (569)
3/8-24	ft-lb (Nm)	26 (35.2)	35 (47.4)	37 (50.1)	50 (67.8)	7/8-14	ft-lb (Nm)	355 (481)	473 (641)	500 (678)	668 (905)

Metric Fastener Torque Values

METRIC FASTENERS										
SIZE	UNITS	4.6		8.8		10.9		12.9		Non-Critical Fasteners into Aluminum
		Lubricated	Dry	Lubricated	Dry	Lubricated	Dry	Lubricated	Dry	
M4	Nm (in-lb)	–	–	–	–	–	–	3.83 (34)	5.11 (45)	2.0 (18)
M5	Nm (in-lb)	1.80 (16)	2.40 (21)	4.63 (41)	6.18 (54)	6.63 (59)	8.84 (78)	7.75 (68)	10.3 (91)	4.0 (35)
M6	Nm (in-lb)	3.05 (27)	4.07 (36)	7.87 (69)	10.5 (93)	11.3 (102)	15.0 (133)	13.2 (117)	17.6 (156)	6.8 (60)
M8	Nm (in-lb)	7.41 (65)	9.98 (88)	19.1 (69)	25.5 (226)	27.3 (241)	36.5 (323)	32.0 (283)	42.6 (377)	17.0 (150)
M10	Nm (ft-lb)	14.7 (11)	19.6 (14)	37.8 (29)	50.5 (37)	54.1 (40)	72.2 (53)	63.3 (46)	84.4 (62)	33.9 (25)
M12	Nm (ft-lb)	25.6 (19)	34.1 (25)	66.0 (48)	88.0 (65)	94.5 (70)	125 (92)	110 (81)	147 (108)	61.0 (45)
M14	Nm (ft-lb)	40.8 (30)	54.3 (40)	105 (77)	140 (103)	150 (110)	200 (147)	175 (129)	234 (172)	94.9 (70)

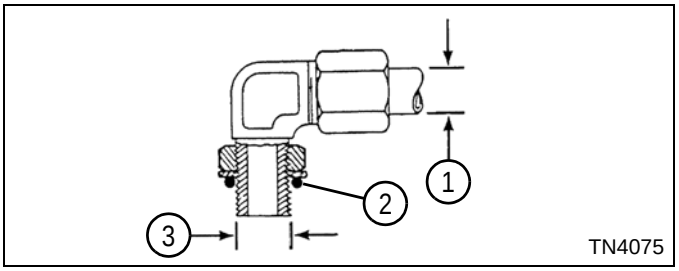
Hydraulic Hose, Tube, and Fitting General Instructions

O-Ring Installation

- Always install new O-rings.
- On hoses with O-ring fittings, make sure O-rings are properly seated before tightening.
- O-rings should be lubricated with the fluid to be used in the system prior to assembly.

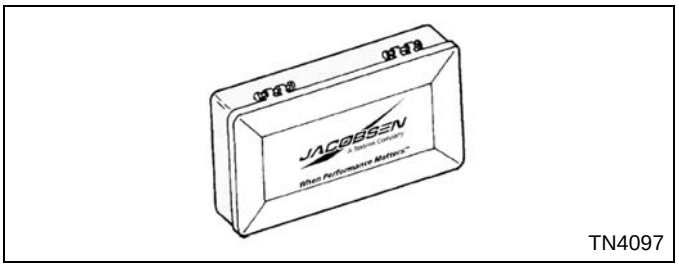
2

Boss Fitting O-Ring Installation



1 Tubing O.D. or Hose I.D. 2 O-Ring 3 Thread Size

O-Ring Seal Kits



- SAE Boss O-Ring Kit Jacobsen PN 5002452
- O-Ring Face Seal (ORS) O-Ring Kit PN 5002454
- Common O-Ring Sizes Kit PN 5002453

Replacement O-Rings for ORS (Face Seal) Fittings

ORS (Face Seal) Tube Size	ORS (Face Seal) O-Ring Size	Jacobsen Part Number
4	11	339908
6	12	339909
8	14	339910
10	16	339911
12	18	339912
16	21	339913
20	25	339914
24	29	339915

Replacement O-Rings for O-Ring Boss Fittings

Tubing O.D. or Hose I.D.	Thread Size	Jacobsen Part Number
1/8	5/16-24	459290
3/16	3/8-24	459291
1/4	7/16-20	339896
5/16	1/2-20	459293
3/8	9/16-18	339897
1/2	3/4-16	339898
5/8	7/8-14	339899
3/4	1-1/16-12	339900
7/8	1-3/16-12	459296
1	1-5/16-12	339901
1-1/4	1-5/8-12	339902
1-1/2	1-7/8-12	339903
2	2-1/2-12	459300

Hydraulic Hose Installation

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 the hose to twist; hold the hose in a normal straight position.

When installing 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.

Hydraulic Hose and Tube Torque Values

Size		lb-ft		N·m	
Dash	Fractional	Min	Max	Min	Max
-4	1/4	10	12	14	16
-6	3/8	18	20	24	27
-8	1/2	32	40	43	54
-10	5/8	46	56	60	75
-12	3/4	65	80	90	110
-16	1	92	105	125	240
-20	1-1/4	125	140	170	190
-24	1-1/2	150	180	200	246

Chapter 3

Engine

JACOBSEN
A Textron Company

Specifications

Fuel System Capacity

Fuel System		
Capacity	gal (L)	14.2 (54)

General Engine Specifications

Diesel Models		
Manufacturer/Model		Kubota/D722-E3B-RUNK-1
Engine Type		Vertical 4-Cycle Diesel
Fuel Requirement		No. 2 Low or Ultra Low Sulfur Diesel (Minimum Cetane Rating 45)
Number of Cylinders/Configuration		3/In-Line
Displacement	cu in. (cc)	43.88 (719)
Bore x Stroke	in. (mm)	2.64 x 2.68 (67 x 68)
Power Output	hp (kW)	17.7 (13.2)@3200 rpm
Cooling System		Liquid Cooled
Cooling System Capacity	qt (L)	4 (3.8) 50/50 Water Ethylene Glycol Mix
Maximum Speed (No Load)	rpm	3400 ± 50
Oil Sump Capacity	qt (L)	3.4 (3.2)
Alternator		12 volt, 150W
Dry Weight	lb (kg)	139 (63)

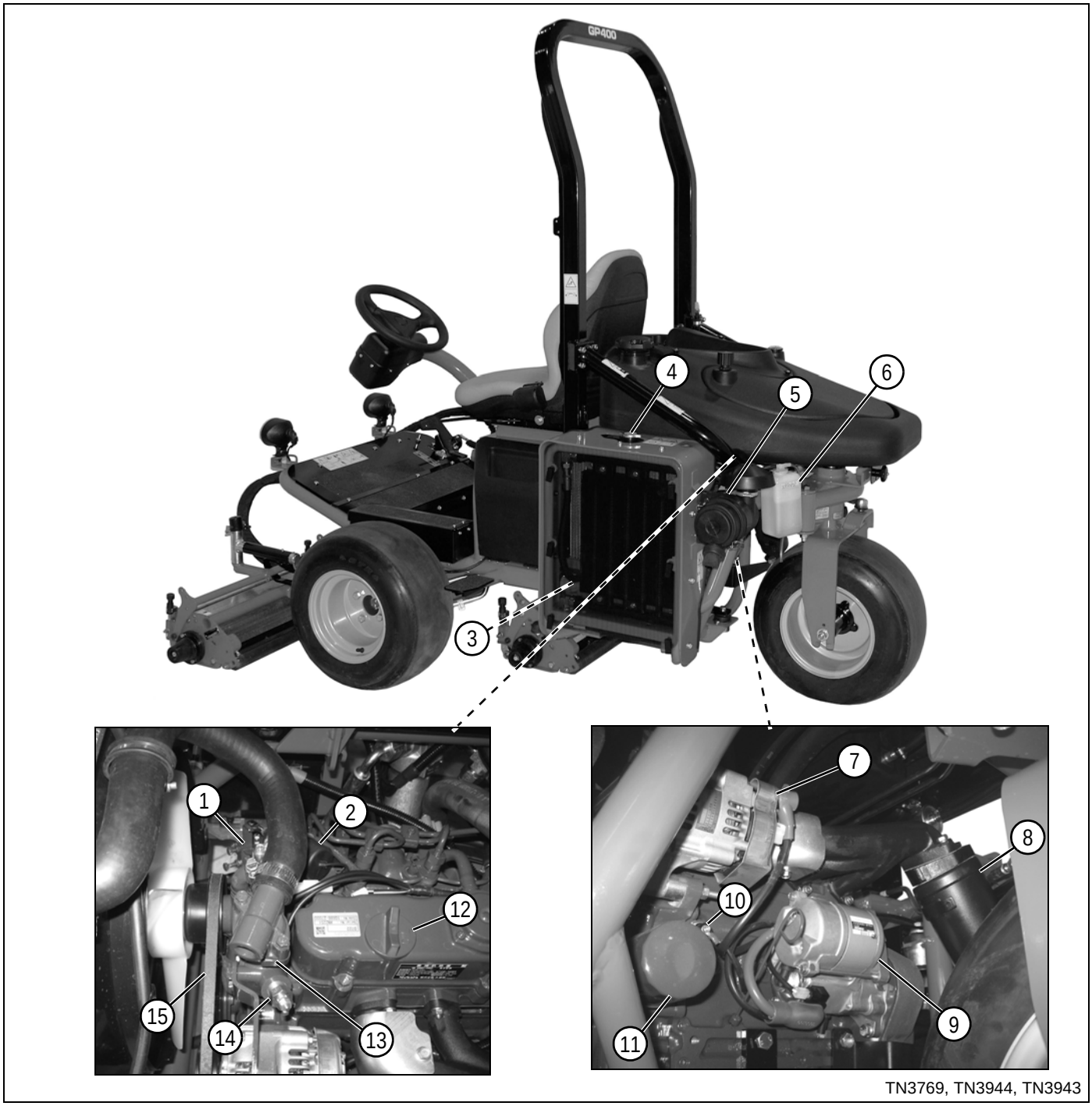
Gasoline Models		
Manufacturer/Model		Briggs & Stratton/Vanguard V-Twin OHV
Engine Type		Gasoline
Fuel Requirement		Unleaded Gasoline (Minimum Octane Rating 87)
Number of Cylinders		2
Power Output	hp (kW)	17.7 (13.2)@3400 rpm
Cooling System		Air Cooled
Idle Speed	rpm	1700 ± 100
Maximum Speed (No Load)	rpm	3400
Oil Sump Capacity	qt (L)	1.5 (1.4)

Repair Specifications		
Engine Mounting Screw Torque (Diesel)	lb-ft (N·m)	44 (60)
Engine Isolation Mount Screw Torque (Gasoline)	lb-ft (N·m)	44 (60)

Component Location

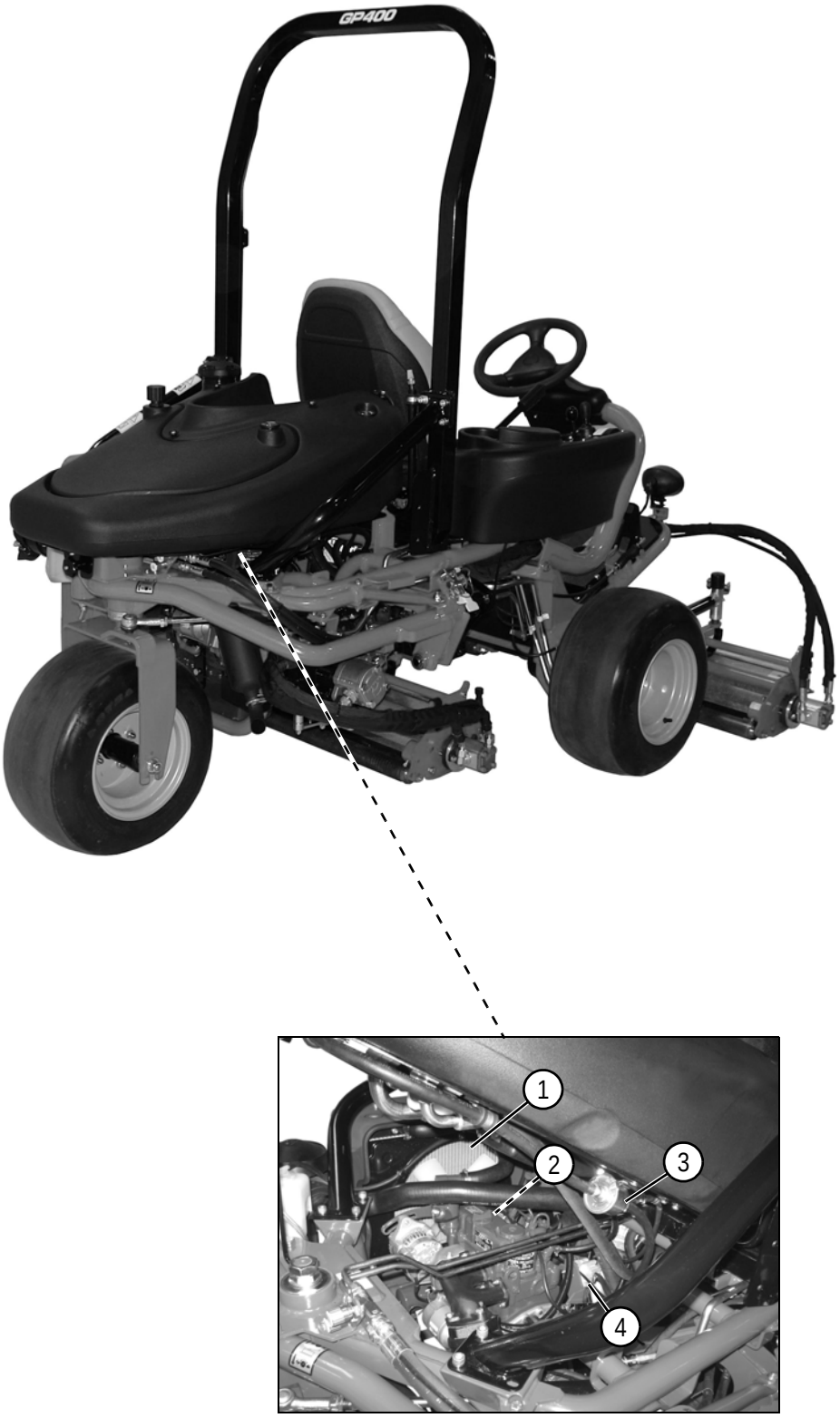
Diesel Models

See Figures 3-1 and 3-2.



1	Speed Control Plate	5	Air Cleaner Assembly	9	Starter	13	Thermostat
2	Fuel Shutoff Solenoid	6	Coolant Recovery Bottle	10	Engine Oil Pressure Switch	14	Engine Temperature Sensor
3	Radiator Drain Plug	7	Alternator	11	Engine Oil Filter	15	Fan Belt
4	Radiator Fill Cap	8	Muffler	12	Engine Oil Fill Cap		

Figure 3-1: Component Location—Left Side



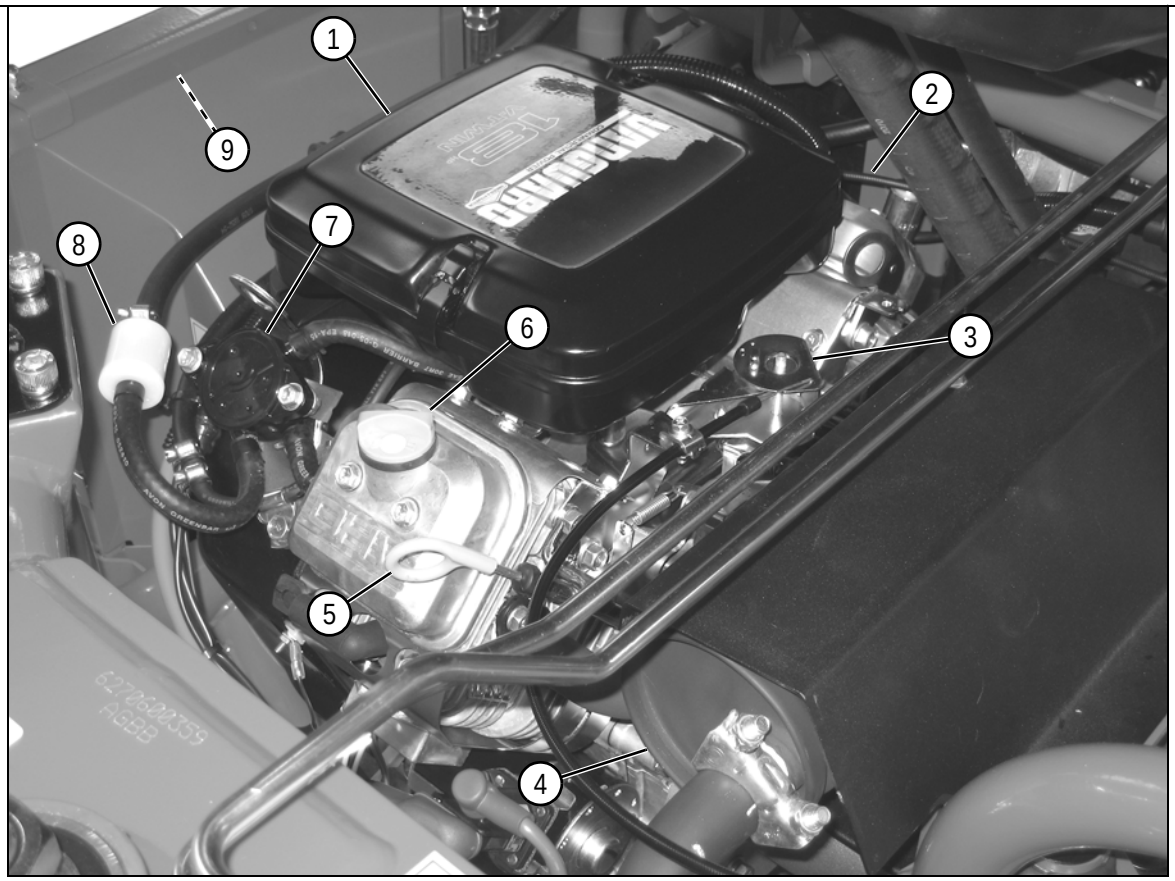
TN3767, TN3948

1 Radiator 2 Glow Plug 3 Fuel Pump 4 Fuel Filter

Figure 3-2: Component Location—Right Side

Gasoline Models

See Figure 3-33.



1	Air Filter Assembly	4	Muffler	7	Fuel Pump
2	Throttle Cable	5	Engine Oil Dipstick	8	Fuel Filter
3	Choke	6	Engine Oil Fill Cap	9	Engine Oil Cooler

Figure 3-3: Component Location

Checks and Adjustments—Diesel Models

Purging the Fuel System (Diesel)

See Figures 3-4 and 3-5.

CAUTION

Do not purge fuel system when engine is hot.

NOTE

The fuel system will need to be purged of air whenever the fuel filter or fuel lines are removed, the fuel tank is completely emptied, or the engine has not been used for an extended time.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Raise the hydraulic oil/fuel tank. (See “Raise Hydraulic Oil/Fuel Tank” on page 9-4.)

NOTE

Be sure the fuel tank is filled with clean, fresh diesel fuel before performing a purge of the fuel system.

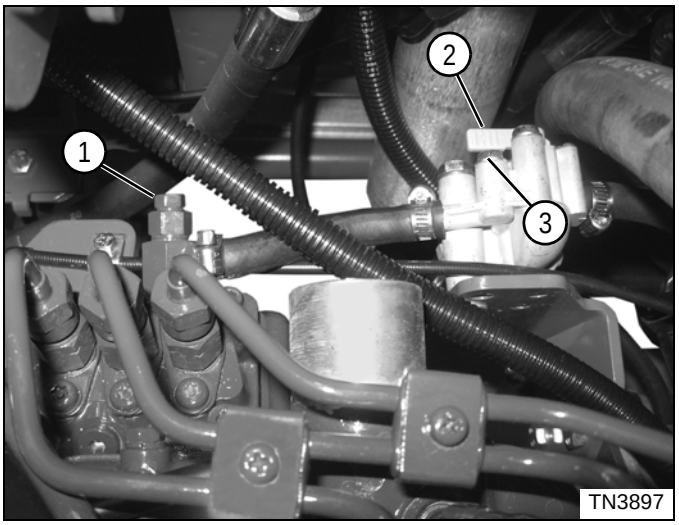


Figure 3-4

3. Turn fuel shutoff lever (2) to the vertical (on) position.
4. Loosen air vent screw (3) at the top of the filter by turning it counterclockwise two turns. Place a suitable container under the filter to catch fuel that will flow from the screw hole.
5. When bubbles no longer appear in fuel coming out of the air vent screw hole, tighten the air vent screw.
6. Open air vent plug (1) at the top of the fuel injection pump.

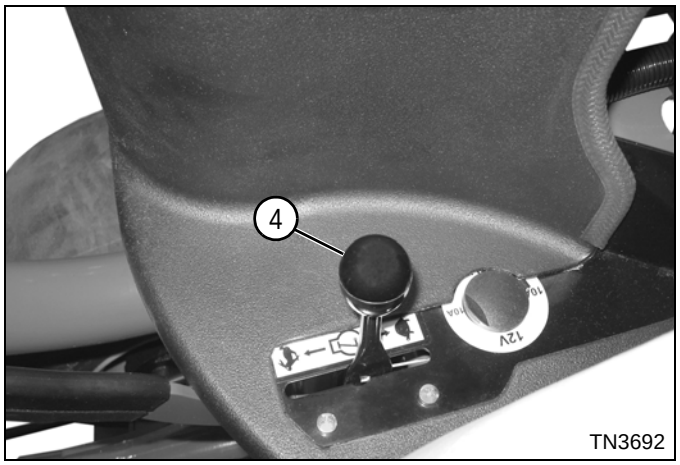


Figure 3-5

WARNING

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

7. Place throttle control lever (4) in the slowest position, and crank engine over for approximately 10 seconds.
8. Close air vent plug when bubbles no longer appear in the fuel flow and turn the ignition switch to the off position.
9. When the fuel system has been purged and the engine is running, listen to the engine. If the engine is misfiring, repeat steps 6 through 8.

Repair—Diesel Models

Fan Belt (Diesel)

Removal

See Figures 3-6 and 3-7.

CAUTION

Use extreme care when working near the muffler. Do not attempt to service when the engine is hot. Serious personal injury can occur.

NOTE

Inspect and adjust the new engine belt after the first 50 hours of operation. Check and adjust annually thereafter.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Raise the hydraulic oil/fuel tank. (See “Raise Hydraulic Oil/Fuel Tank” on page 9-4.)

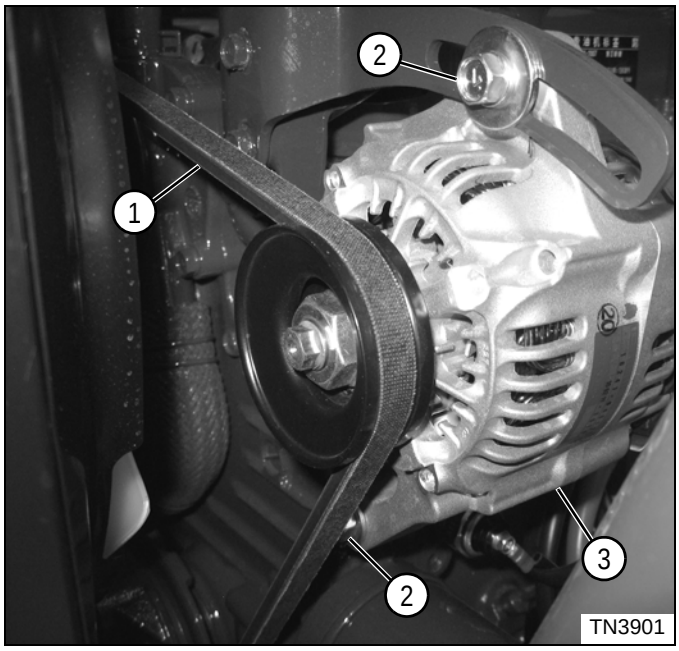


Figure 3-6

3. Loosen screws (2) and push the alternator (3) toward the engine to loosen the fan belt (1).

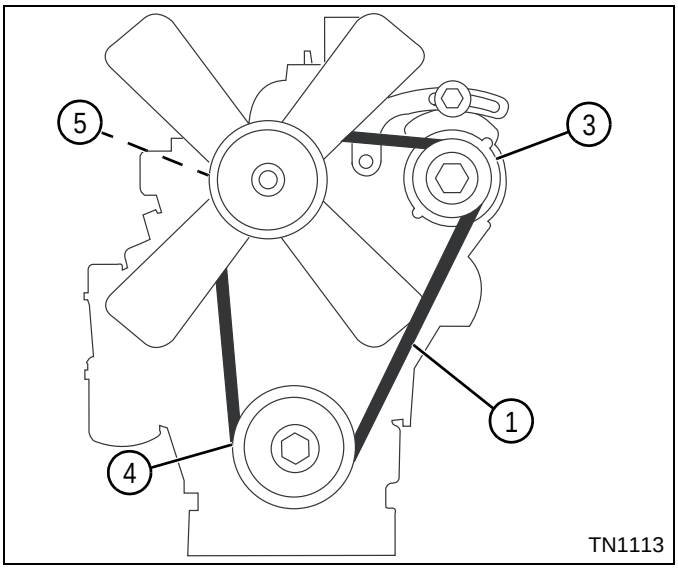


Figure 3-7

4. Remove fan belt (1) from the alternator (3), coolant pump (5), and crankshaft pulley (4).

Installation

1. Install fan belt by reversing the order of removal.
2. Adjust belt tension by loosening alternator mounting screws (2) and pulling the alternator (3) against the belt (1) until proper tension is achieved.
3. Measure belt tension at the midpoint between pulleys. Adjust fan belt to 0.28–0.35 in. (7–9 mm) deflection with a tension of 22 lb (98 N).

NOTE

See the engine manufacturer’s manual for further information.

Air Filter Assembly (Diesel)

Removal and Installation

See Figures 3-8 through 3-11.

CAUTION

- **Do not open the air filter assembly for inspection or cleaning. Unnecessary removal of the air filter increases the risk of injecting dust and other impurities into the engine.**
- **Do not remove air filter with engine running.**

NOTES

- *The air filter on this engine is a dry type; never apply oil to it.*
- *The dust cap should be removed and cleaned daily in dusty conditions.*

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

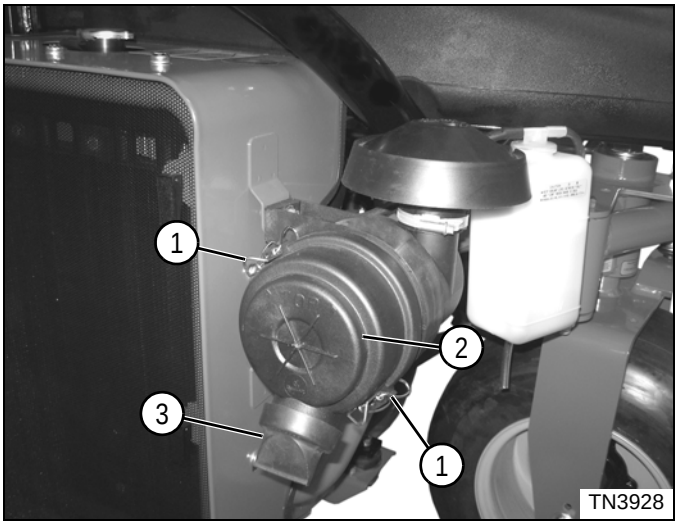


Figure 3-8

NOTE

Note orientation of air inlet (3) before removing air filter dust cap (2) to ensure correct installation.

2. Release retaining clips (1) and remove air filter dust cap (2).
3. Using damp, lint-free cloth, thoroughly clean the inside of the dust cap.

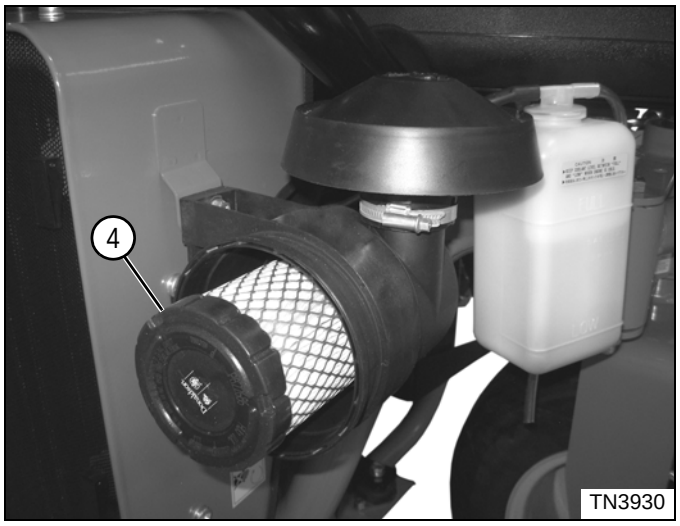


Figure 3-9

4. Slide air filter (4) out of the assembly.
5. Raise the hydraulic oil/fuel tank. (See “Raise Hydraulic Oil/Fuel Tank” on page 9-4.)

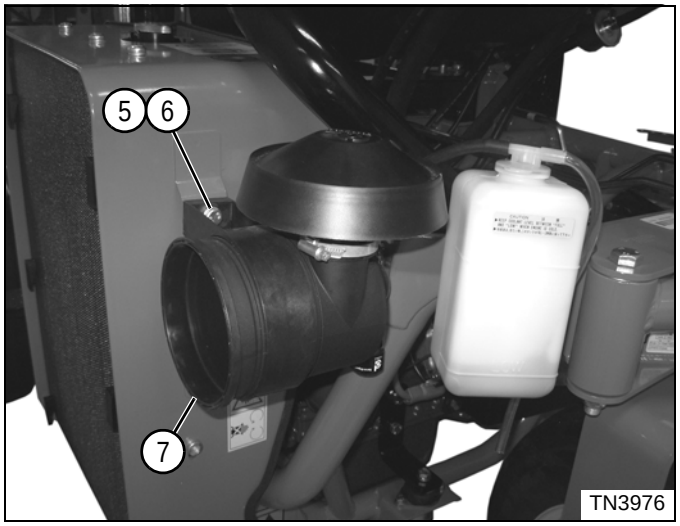


Figure 3-10

6. Remove two screws (5) and flat washers (6), and disconnect air filter assembly (7).

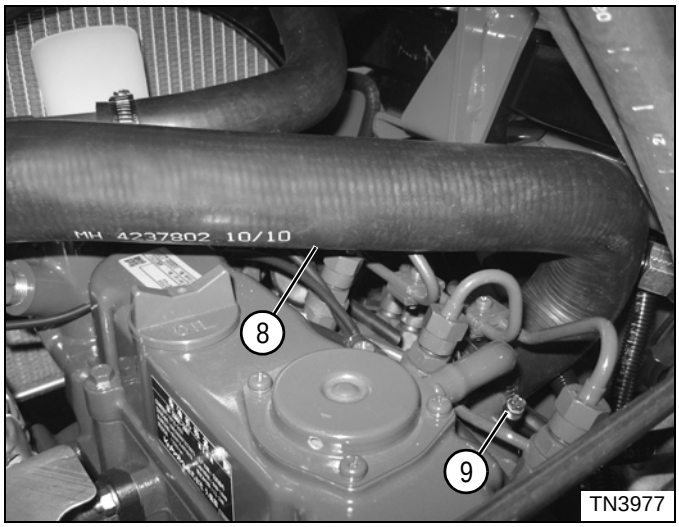


Figure 3-11

7. Loosen hose clamp (9) and remove air filter assembly and hose (8).

Installation Note

Install air filter assembly by reversing the order of removal.

Throttle Cable (Diesel)

Removal and Installation

See Figure 3-12.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Raise the hydraulic oil/fuel tank. (See “Raise Hydraulic Oil/Fuel Tank” on page 9-4.)
3. Remove throttle lever. (See “Throttle Lever” on page 9-14.)

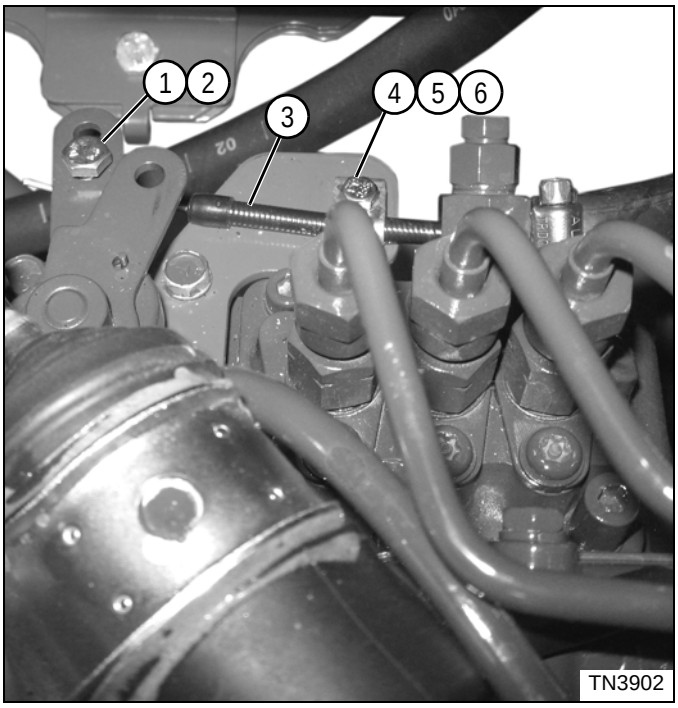


Figure 3-12

4. Loosen screw (1) and cable clamp (2).
5. Remove screw (4), nut (5), and clamp (6).

NOTE

Note routing of throttle cable (3) before removing to ensure correct installation.

6. Remove throttle cable (3).

Installation Note

Install throttle cable by reversing the order of removal.

Muffler (Diesel)

Removal and Installation

See Figure 3-13.

CAUTION

Do not attempt to service the exhaust system when the engine is hot. Serious personal injury can occur.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Raise the hydraulic oil/fuel tank. (See “Raise Hydraulic Oil/Fuel Tank” on page 9-4.)
3. Allow the engine to cool completely.

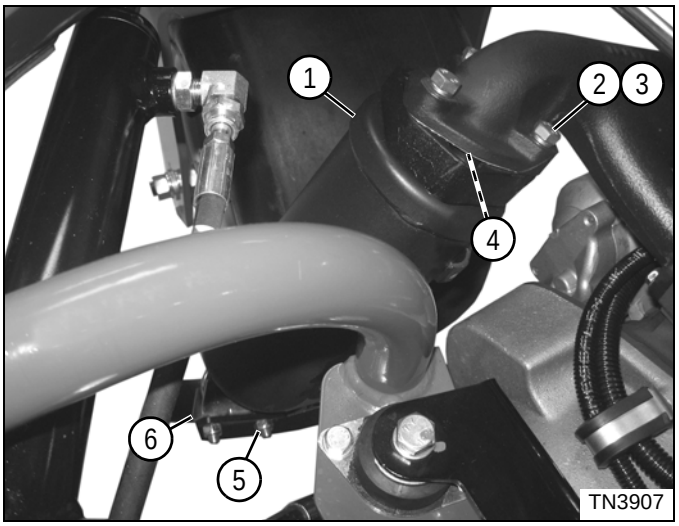


Figure 3-13

4. Remove two nuts (5) and muffler clamp (6).
5. Remove three screws (2) and washers (3), gasket (4), and muffler (1).
6. Inspect the exhaust system for cracks, holes, and distortion. Replace exhaust gasket.

Installation Notes

- *Install muffler by reversing the order of removal.*
- *Install new gasket (4) during installation.*

Coolant Recovery Bottle (Diesel)

Removal and Installation

See Figure 3-14.

CAUTION

Do not attempt to service any part of the coolant system when the engine is hot. Serious personal injury can occur.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

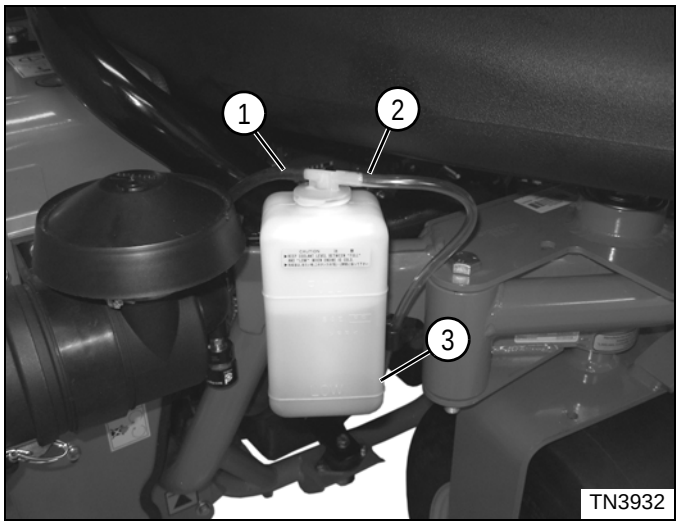


Figure 3-14

2. Disconnect hoses (1 and 2) from coolant recovery bottle (3).
3. Slide coolant recovery bottle (3) up and remove from machine.

Installation Note

Install coolant recovery bottle by reversing the order of removal.

Thermostat (Diesel)

Removal and Installation

See Figures 3-15 and 3-16.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Raise the hydraulic oil/fuel tank. (See “Raise Hydraulic Oil/Fuel Tank” on page 9-4.)
3. Allow the engine to cool completely.

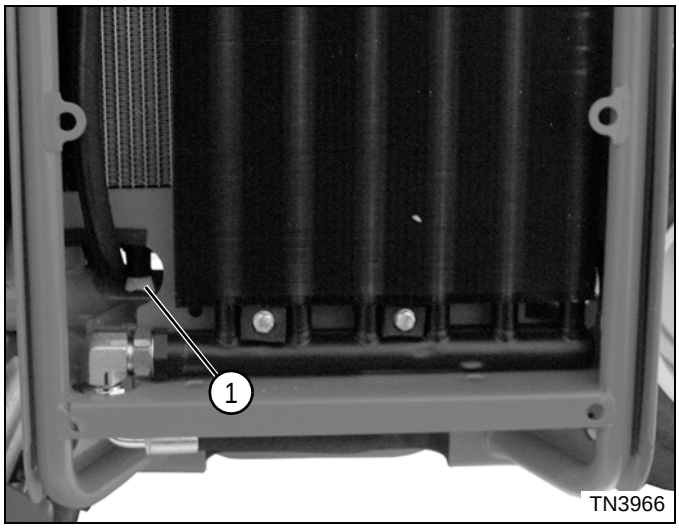


Figure 3-15

WARNING

Never remove the radiator cap when the coolant is hot. The engine must be shut down and cooled before the radiator cap is removed. Very hot coolant will be sprayed from the radiator if the cap is loosened before the engine has cooled. Serious personal injury can occur.

4. Place a suitable clean container, at least 1 gal (3.8 L) capacity, under the radiator.
5. Remove radiator cap to provide a vent for draining coolant.
6. Remove plug (1) located on bottom of radiator and drain approximately 0.5 qt (0.5 L) of coolant from engine cooling system.

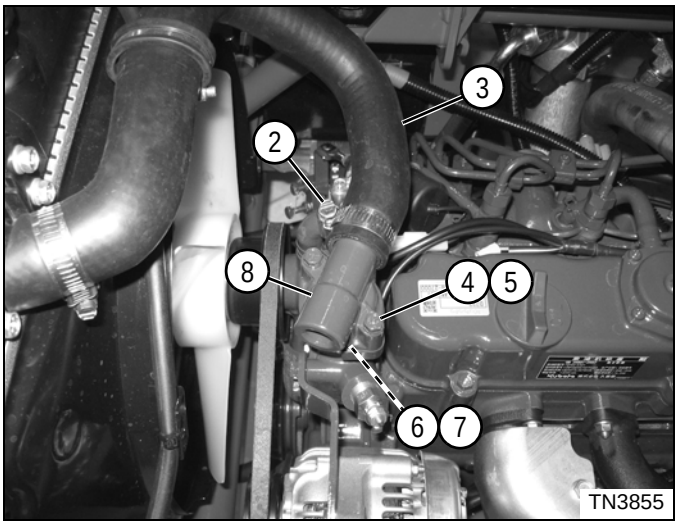


Figure 3-16

7. Loosen hose clamp (2) and disconnect hose (3).
8. Remove two screws (4) and lock washers (5).
9. Remove thermostat housing (8), gasket (6), and thermostat (7).

Installation Notes

- *Install thermostat by reversing the order of removal.*
- *Clean the gasket surface prior to installation.*
- *Use a new gasket during installation.*
- *Fill the radiator with clean water and ethylene glycol based antifreeze mixed for the coldest ambient temperature.*

Radiator (Diesel)

Removal

See Figures 3-17 through 3-22.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Allow the engine to cool completely.
3. Remove hydraulic oil cooler. (See “Hydraulic Oil Cooler (Diesel)” on page 6-60.)
4. Raise the hydraulic oil/fuel tank. (See “Raise Hydraulic Oil/Fuel Tank” on page 9-4.)

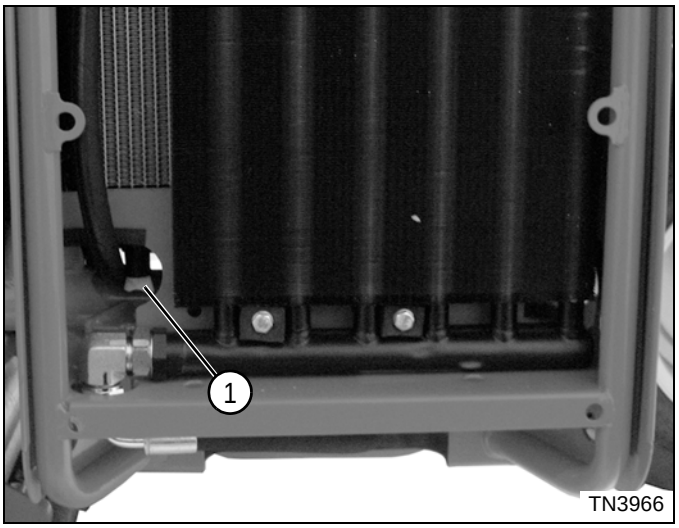


Figure 3-17

WARNING

Never remove the radiator cap when the coolant is hot. The engine must be shut down and cooled before the radiator cap is removed. Very hot coolant will be sprayed from the radiator if the cap is loosened before the engine has cooled. Serious personal injury can occur.

5. Place a suitable clean container, at least 1 gal (3.8 L) capacity, under the radiator.
6. Remove plug (1) located on bottom of radiator, remove radiator cap, and drain coolant.

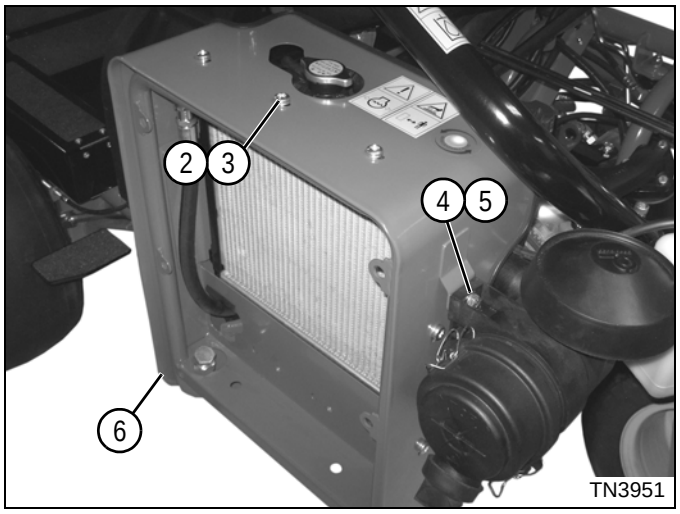


Figure 3-18

7. Remove two screws (4) and flat washers (5).
8. Remove nine screws (2) and flat washers (3), and remove radiator cover (6).

NOTE

Label all hoses before removing to ensure correct installation.

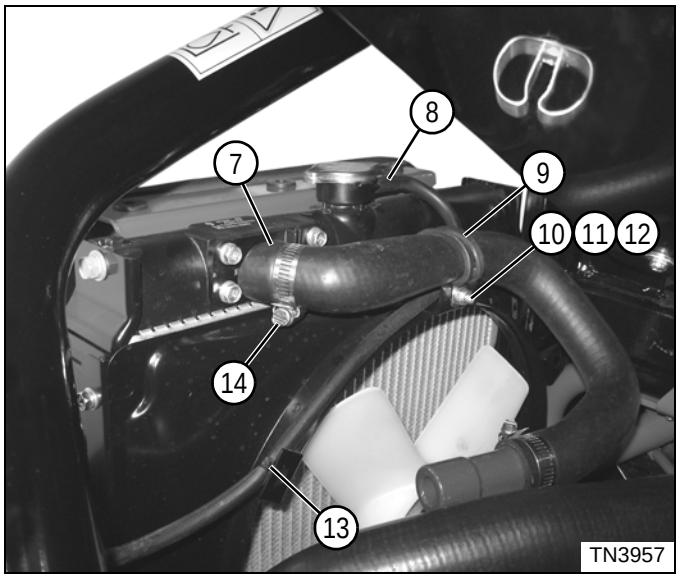


Figure 3-19

9. Disconnect hose (8).
10. Remove screw (10), flat washer (11), nut (12), and hose clamp (9).
11. Remove cable tie (13).
12. Loosen hose clamp (14) and disconnect upper radiator hose (7).

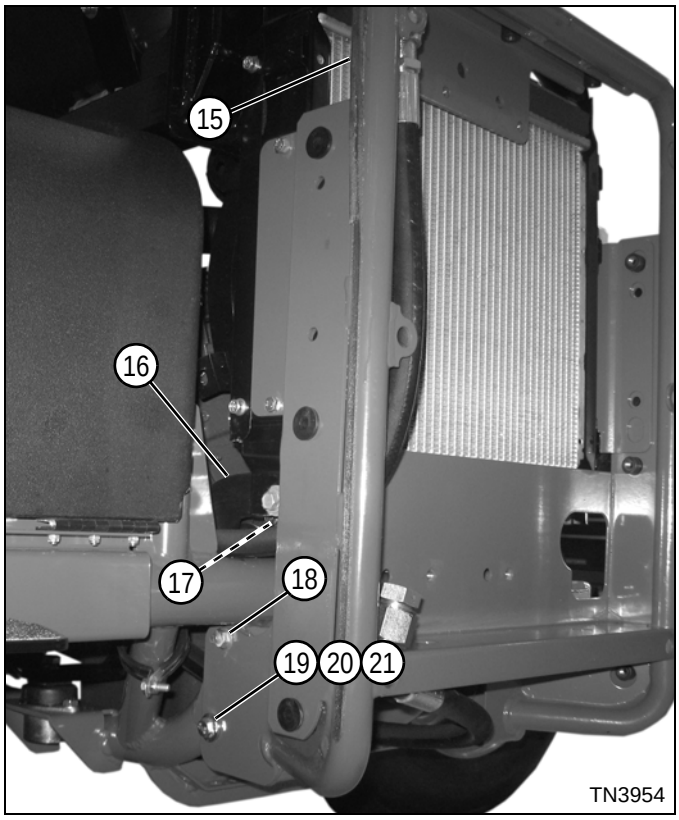


Figure 3-20

13. Support radiator and mounting frame (15) using a suitable lifting device.
14. Loosen hose clamp (17) and disconnect lower radiator hose (16).
15. Loosen two nuts (18).
16. Remove two screws (19), lock washers (20), and flat washers (21).
17. Remove radiator and mounting frame (15) from machine.

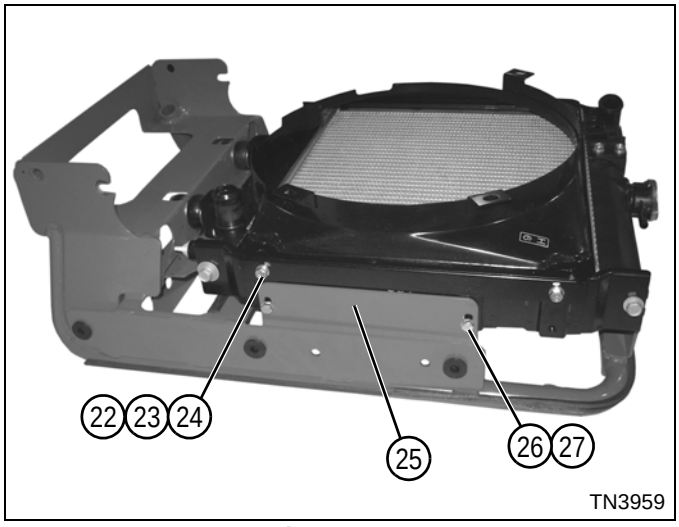


Figure 3-21

18. Remove four screws (22), lock washers (23), and flat washers (24).
19. Remove four screws (26), four flat washers (27), and two radiator brackets (25).

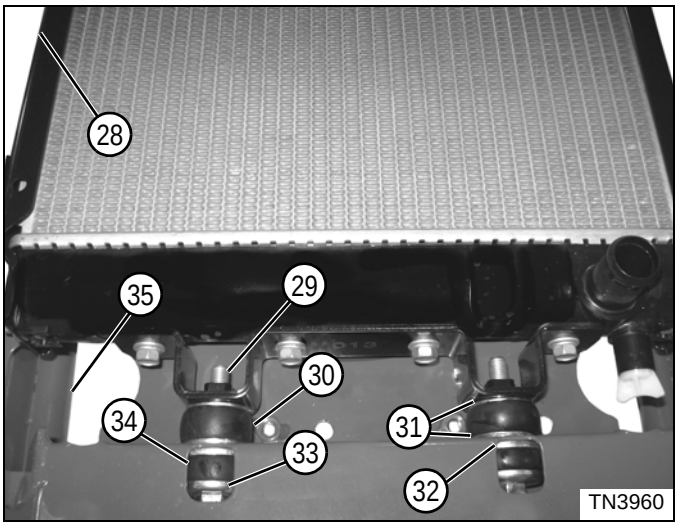


Figure 3-22

20. Remove two screws (29), two washers (33), two rubber bushings (34), two flat washers (32), four flat washers (31), and two rubber bushings (30).
21. Remove radiator (28) from mounting frame (35).

Installation

1. Flush the inside of the radiator with fresh water.
2. Install radiator by reversing the order of removal.
3. Use new cable tie to secure hose (8).
4. Fill the radiator with clean water and ethylene glycol based antifreeze mixed for the coldest ambient temperature.
5. Install radiator cap and start the engine, following the instructions in the “Safety and Operation Manual.”

⚠ CAUTION

Allow the engine coolant to cool completely before removing the radiator cap. Hot coolant sprayed from the cap can cause serious personal injury.

6. When the engine reaches normal operating temperature, check and fill the coolant reservoir to the hot full level.

Fuel Filter (Diesel)

Removal and Installation

See Figure 3-23.

CAUTION

Diesel fuel is highly flammable—handle with care. Use an approved container with a spout that will fit inside the fuel filler neck. Avoid using unapproved containers to transport fuel. Keep all fuel containers clean and closed when not in use.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Raise the hydraulic oil/fuel tank. (See “Raise Hydraulic Oil/Fuel Tank” on page 9-4.)
3. Allow the engine to cool completely.

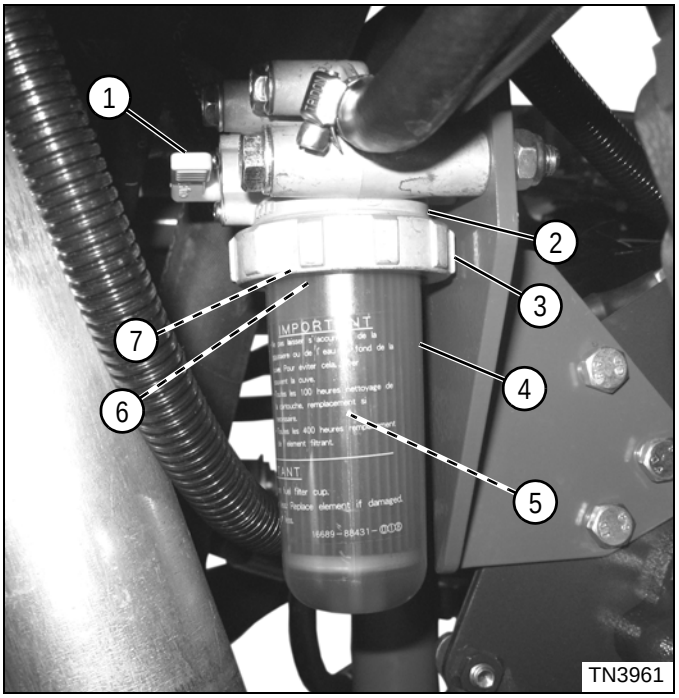


Figure 3-23

4. Turn the fuel shutoff lever (1) to the horizontal (off) position.
5. Thoroughly clean cup (4) and area surrounding the fuel filter.
6. Remove retaining nut (3) by turning counterclockwise.
7. Remove cup (4) and filter element (5). Drain excess fuel into an appropriate container.
8. Remove O-rings (6 and 7).

CAUTION

Dispose of fuel properly. Contact the local environmental department for instructions on disposing of unwanted fuel products.

Installation Notes

- *Clean the inside and outside of filter head (2).*
- *Lightly lubricate O-rings (6 and 7) with clean oil.*
- *Install fuel filter by reversing the order of removal.*
- *Tighten cup retaining nut (3) hand tight.*
- *Open fuel shutoff valve (1).*
- *Purge air from the fuel system after installing the new filter. (See “Purging the Fuel System (Diesel)” on page 3-6.) See the engine manufacturer’s manual for further instructions.*

Fuel Pump (Diesel)

Removal and Installation

See Figure 3-24.

CAUTION

Diesel fuel is highly flammable—handle with care. Use an approved container with a spout that will fit inside the fuel filler neck. Avoid using unapproved containers to transport fuel. Keep all fuel containers clean and closed when not in use.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Allow the engine to cool completely.
3. Disconnect the negative (–) battery cable from the battery.
4. Turn the fuel shutoff valve clockwise until valve bottoms lightly. Valve is located on the fuel filter.

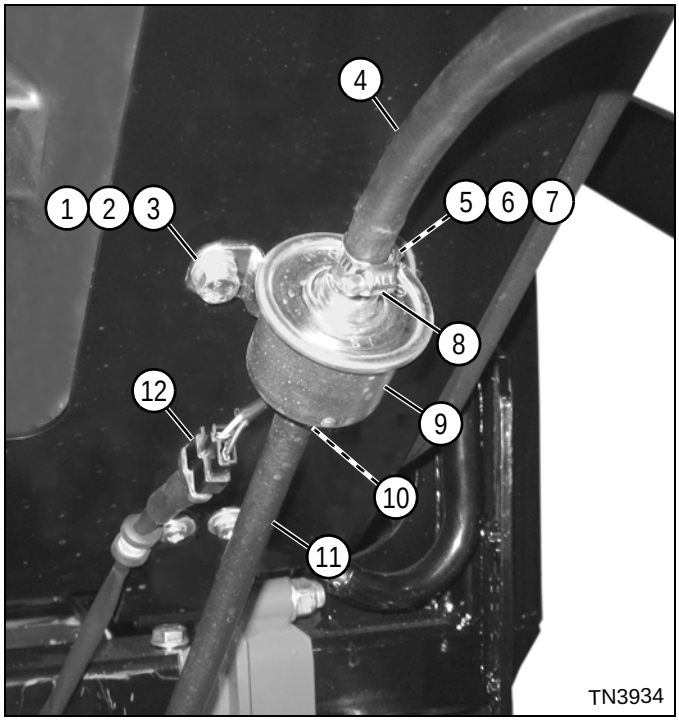


Figure 3-24

NOTE

Label all wires before disconnecting to ensure correct installation.

5. Disconnect fuel pump wire connector (12).
6. Loosen fuel hose clamps (8 and 10).
7. Disconnect fuel hoses (4 and 11) from fuel pump (9). Use a suitable container to catch the fuel that will flow from the fuel hoses. Cap the hoses.
8. Remove screw (1), lock washer (2), and flat washer (3).
9. Remove screw (5), lock washer (6), and flat washer (7), and remove fuel pump (9).

Installation Notes

Required Materials
Anti-Seize Compound

- *Install fuel pump by reversing the order of removal.*
- *Apply anti-seize compound to screws (1 and 5) prior to installation. Do not overtighten these screws or tank may crack and cause a leak.*
- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*

Engine (Diesel)

Removal and Installation

See Figures 3-25 through 3-30.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Allow the engine to cool completely.
3. Disconnect the positive (+) and negative (–) battery cables from the battery.
4. Remove fuel tank. (See “Fuel Tank (Diesel)” on page 9-7.)
5. Remove fuel tank support pan. (See “Fuel Tank Support Pan” on page 9-10.)
6. Remove hydraulic oil cooler. (See “Hydraulic Oil Cooler (Diesel)” on page 6-60.)
7. Remove radiator. (See “Radiator (Diesel)” on page 3-12.)
8. Remove air filter assembly. (See “Air Filter Assembly (Diesel)” on page 3-8.)
9. Remove traction pump. (See “Traction Pump and Control” on page 5-50.)

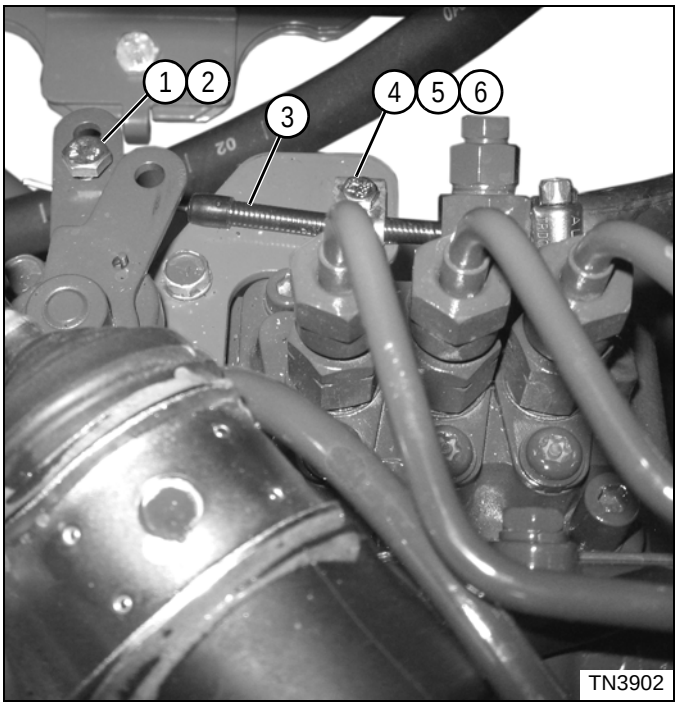


Figure 3-25

10. Loosen screw (1) and cable clamp (2).
11. Remove screw (4), nut (5), and clamp (6).
12. Disconnect throttle cable from engine.

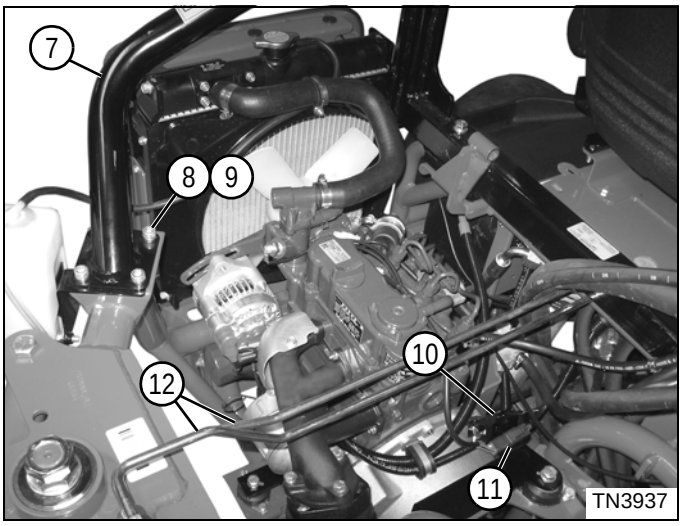


Figure 3-26

NOTE

Label all wires before disconnecting to ensure correct installation.

13. Disconnect wire connectors (10 and 11).
14. Remove hydraulic lines (12).
15. Remove seven screws (8) and lock washers (9), and remove OPS bracket (7).

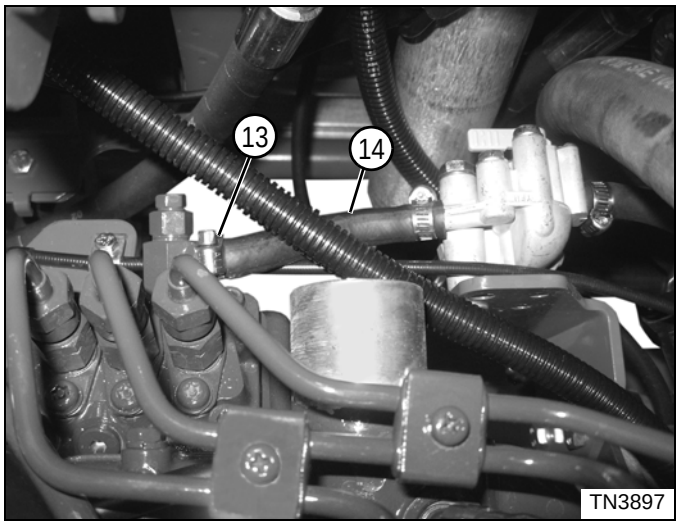


Figure 3-27

16. Loosen hose clamp (13) and disconnect fuel hose (14).

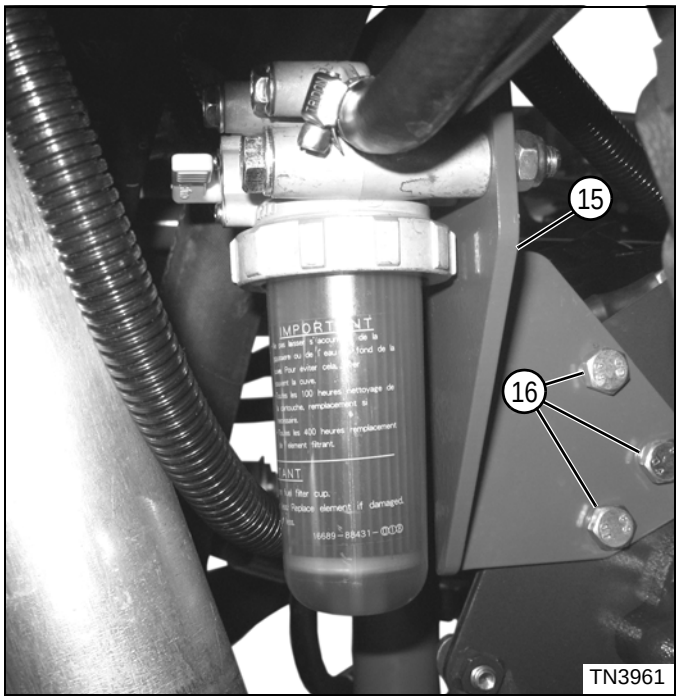


Figure 3-28

17. Remove screws (16), and disconnect fuel filter and bracket (15) from engine.

WARNING

Prevent personal injury. Use a properly rated lifting device. Always be sure the load is balanced before lifting.

18. Using a suitable engine hoist, support the engine.

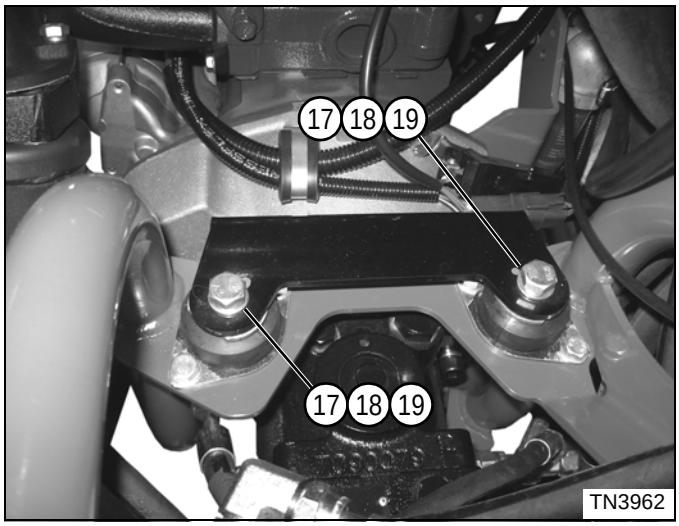


Figure 3-29

19. Remove engine mounting screws (17), lock washers (18), and flat washers (19).

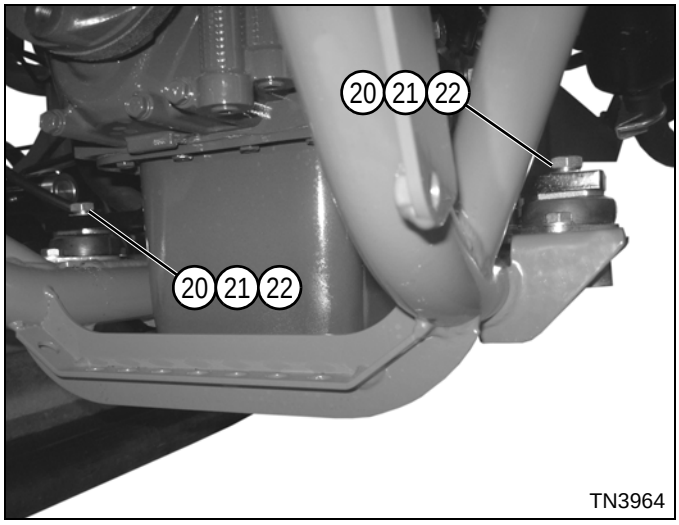


Figure 3-30

20. Remove engine mounting screws (20), lock washers (21), and flat washers (22).
21. Check for any connected wires and components, and carefully remove the engine and engine mounts from the machine.
22. Place the engine on a suitable stand or workbench that will support the full weight in a safe manner while preventing damage to the engine.

NOTE

If the engine is being replaced, some components must be removed and installed on the new engine. Refer to "Parts and Maintenance Manual" for additional information and illustrations.

Installation Notes

- *Inspect engine isolation mounts and replace if necessary.*
- *Install the engine by reversing the order of removal.*
- *Tighten engine mounting screws (17 and 20) to 44 lb-ft (60 N·m).*
- *If necessary, remove components from the engine and install the components on the new engine.*
- *Use new gaskets when installing the exhaust system.*
- *Use new cable ties to secure wire connectors and wire harnesses.*
- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*
- *Fill the radiator with clean water and ethylene glycol based antifreeze mixed for the coldest ambient temperature.*
- *Replace the engine oil filter and fill engine with oil.*
- *Purge air from the fuel system. (See "Purging the Fuel System (Diesel)" on page 3-6.)*

Engine Service (Diesel)

A separate engine manual, prepared by the engine manufacturer, is supplied with this machine. Refer to the engine manufacturer's manual for all engine-related service.

Proper attention to the engine manufacturer's manual directions will ensure maximum service life of the engine.

Repair—Gasoline Models

Air Filter Assembly (Gasoline)

Removal and Installation

See Figure 3-31.

CAUTION

Do not remove air filter with engine running.

NOTE

The air filter cartridge on this engine is a dry type; never apply oil to it.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Raise the hydraulic oil/fuel tank. (See “Raise Hydraulic Oil/Fuel Tank” on page 9-4.)
3. Allow the engine to cool completely.

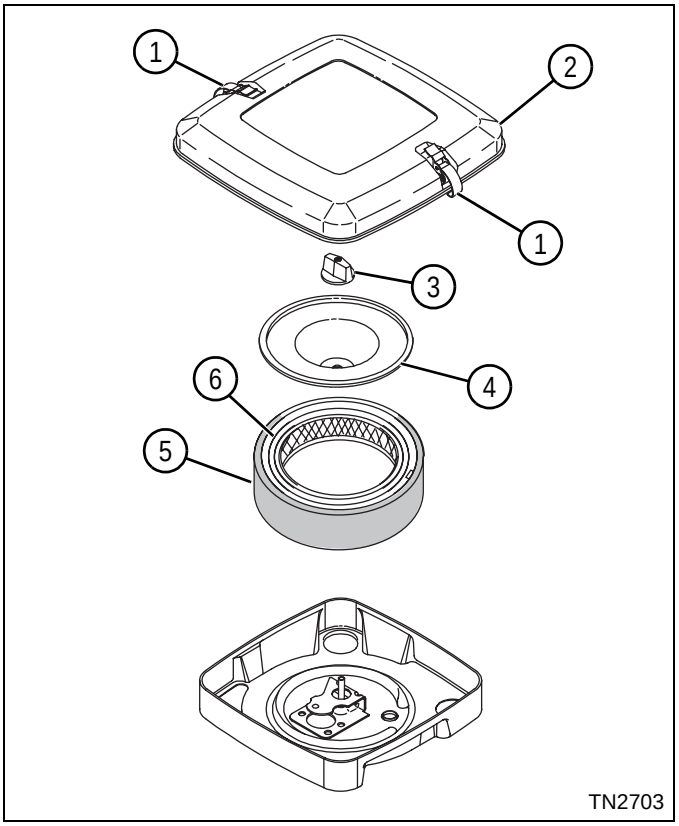


Figure 3-31

4. Disengage retaining clips (1) and remove cover (2).
5. Remove knob (3) and air filter retainer (4).
6. Remove air filter pre-cleaner (5) and air filter cartridge (6).

Installation Notes

- *Wash air filter pre-cleaner in liquid detergent and water. Squeeze dry in a clean cloth. Saturate in clean engine oil and squeeze out excess oil in a clean, absorbent cloth. Replace air filter pre-cleaner if it remains dirty or is damaged.*
- *Do not use petroleum solvents such as kerosene to clean air filter cartridge.*
- *Do not use pressurized air to clean air filter cartridge.*
- *Install air filter assembly by reversing the order of removal.*

Canister (Gasoline)

Removal and Installation

See Figure 3-32.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Raise the hydraulic oil/fuel tank. (See “Raise Hydraulic Oil/Fuel Tank” on page 9-4.)

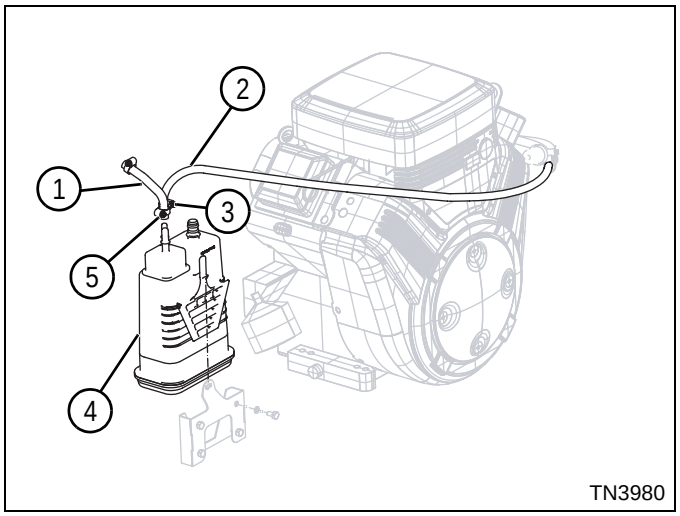


Figure 3-32

3. Loosen hose clamps (3 and 5) and disconnect hoses (1 and 2).
4. Slide canister (4) up and remove from machine.

Installation Note

Install canister by reversing the order of removal.

Muffler Assembly (Gasoline)

Removal and Installation

See Figure 3-33.

CAUTION

Do not attempt to service the exhaust system when the engine is hot. Serious personal injury can occur.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Raise the hydraulic oil/fuel tank. (See “Raise Hydraulic Oil/Fuel Tank” on page 9-4.)
3. Allow the engine to cool completely.

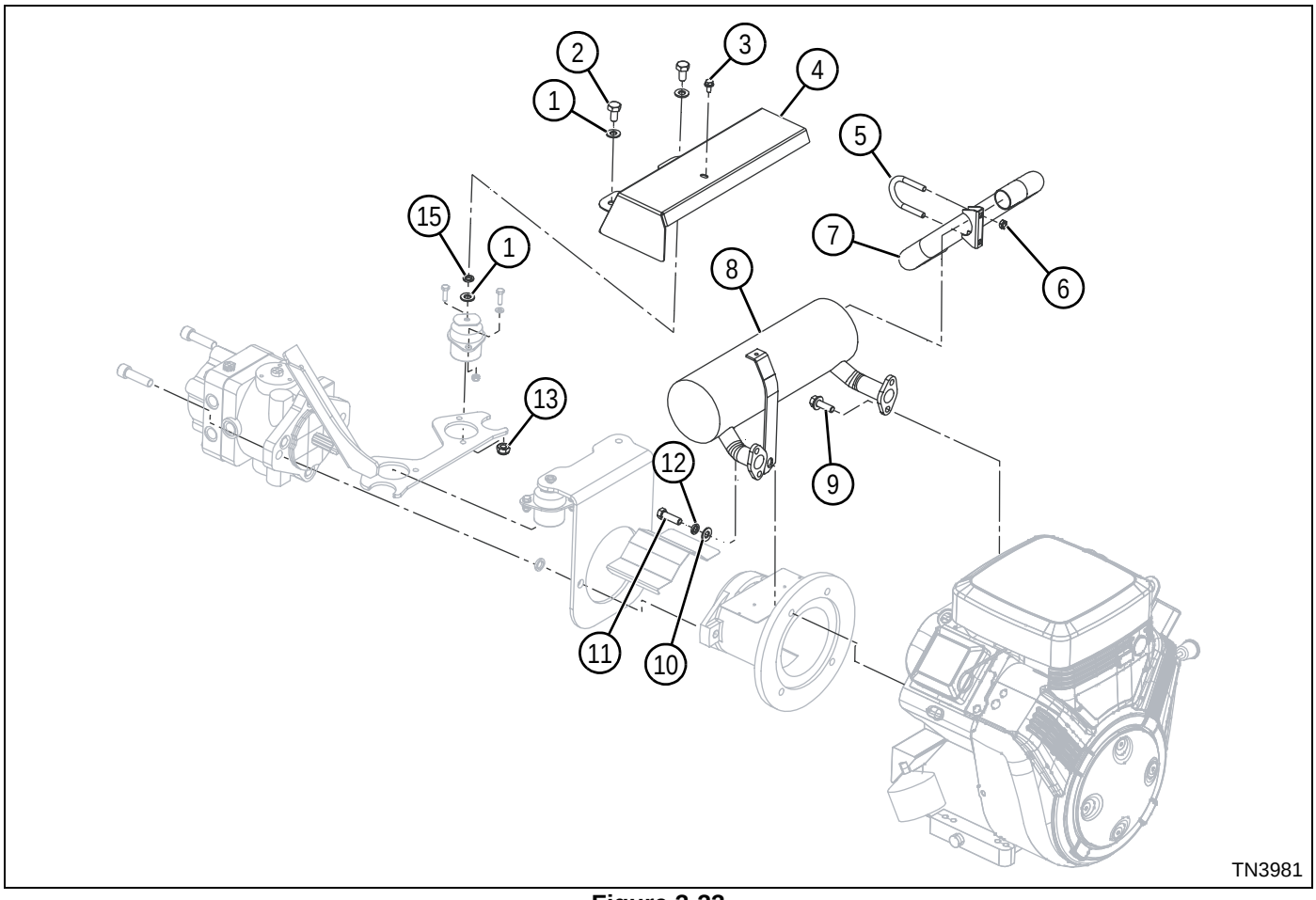


Figure 3-33

4. Remove screw (3).
5. Remove two nuts (13), four flat washers (1), two lock washers (15), and exhaust cover (4).
6. Remove two nuts (6) and clamp (5), and disconnect exhaust pipe (7) from muffler (8).
7. Remove screw (11), lock washer (12), and flat washer (10).
8. Remove four screws (9) and muffler (8).

Installation Note

Install muffler by reversing the order of removal.

Throttle Cable (Gasoline)

Removal and Installation

See Figure 3-34.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Allow the engine to cool completely.
3. Remove throttle lever. (See “Throttle Lever” on page 9-14.)

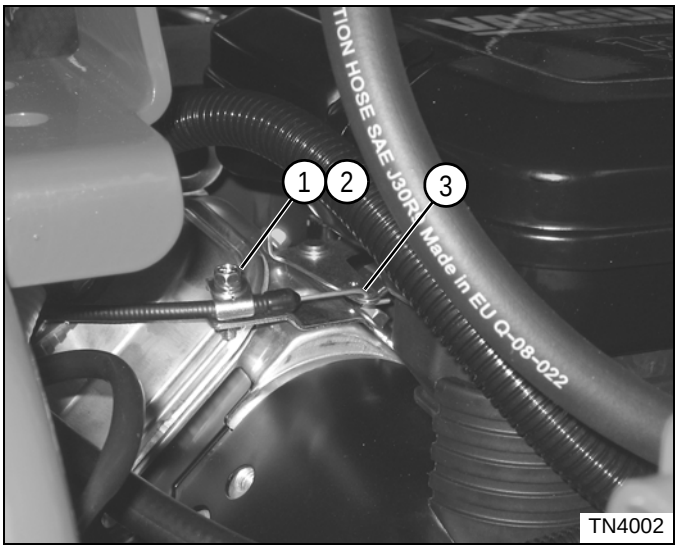


Figure 3-34

4. Remove screw (1) and clamp (2), and disengage throttle cable (2) at the engine.

NOTE

Note routing of throttle cable (2) before removing to ensure correct installation.

5. Remove throttle cable (2).

Installation Note

Install throttle cable by reversing the order of removal.

Choke Cable (Gasoline)

Removal and Installation

See Figures 3-35 and 3-36.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Allow the engine to cool completely.

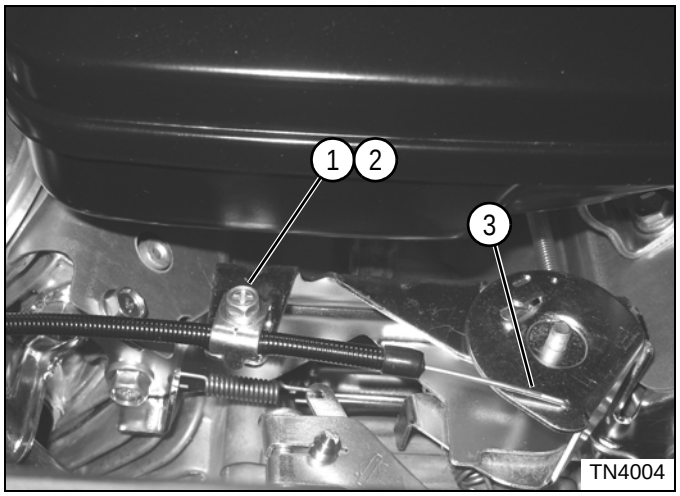


Figure 3-35

3. Remove screw (1) and clamp (2), and disengage choke cable (3) at the engine.

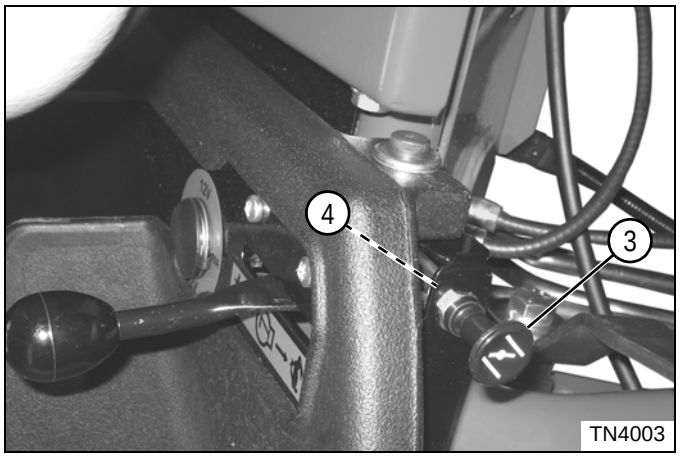


Figure 3-36

4. Loosen jam nut (4) and disengage jam nut from choke cable (3).

NOTE

Note routing of choke cable (3) before removing to ensure correct installation.

5. Remove choke cable (3).

Installation Note

Install choke cable by reversing the order of removal.

Fuel Filter (Gasoline)

Removal and Installation

See Figure 3-37.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Allow the engine to cool completely.

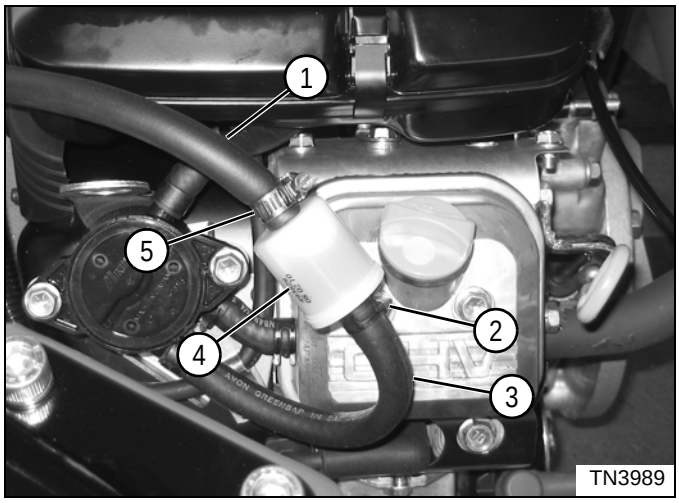


Figure 3-37

3. Loosen hose clamps (2 and 5).
4. Tag and disconnect fuel tank-to-fuel filter hose (1) from the fuel filter (4). Cap fitting and plug hose to prevent leakage and contamination.
5. Tag and disconnect fuel filter-to-fuel pump hose (3) from the fuel filter (4). Cap fitting and plug hose to prevent leakage and contamination.

Installation Notes

- *Install fuel filter by reversing the order of removal.*
- *Make sure the flow arrow on the side of the fuel filter is aligned with the fuel tank-to-fuel pump flow direction.*

Engine (Gasoline)

Removal and Installation

See Figure 3-38.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Allow the engine to cool completely.
3. Tag and disconnect the negative (–) battery cable.
4. Remove fuel tank. (See “Fuel Tank (Gasoline)” on page 9-9.)
5. Remove fuel tank support pan. (See “Fuel Tank Support Pan” on page 9-10.)
6. Remove muffler assembly. (See “Muffler Assembly (Gasoline)” on page 3-19.)
7. Remove traction pump. (See “Traction Pump and Control” on page 5-50.)
8. Disconnect the throttle cable at the engine. (See “Throttle Cable (Gasoline)” on page 3-20.)
9. Disconnect the choke cable at the engine. (See “Choke Cable (Gasoline)” on page 3-20.)

NOTE

Label all wires and hoses before disconnecting to ensure correct installation.

10. Tag and disconnect the wiring harnesses at the engine, ignition modules, carb solenoid, starter motor, starter solenoid, and engine oil pressure switch.
11. Tag and disconnect fuel lines at the engine. Plug lines and cap fittings to prevent leakage and contamination.

WARNING

Prevent personal injury. Use a properly rated lifting device. Always be sure the load is balanced before lifting.

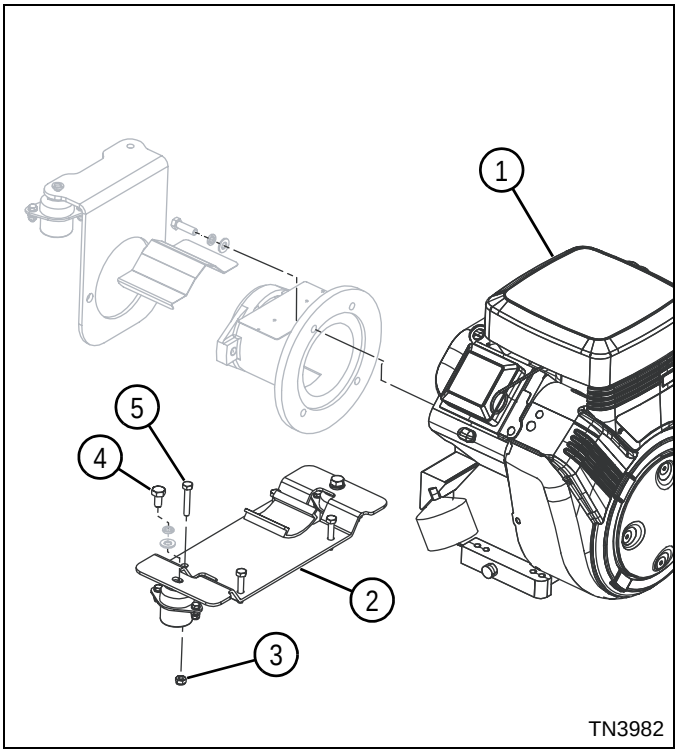


Figure 3-38

12. Using the proper engine hoist, support the engine (1) and remove four nuts (3) and screws (5) securing the engine (1) to the engine mount plate (2).
13. Move wiring harnesses and fuel lines aside.
14. Check for any connected wires and components, and carefully remove the engine from the machine.
15. Place the engine on a suitable stand or workbench that will support the full weight in a safe manner while preventing damage to the engine.

NOTE

If the engine is being replaced, some components must be removed and installed on the new engine. Refer to "Parts and Maintenance Manual" for additional information and illustrations.

Installation Notes

- *Inspect engine isolation mounts and replace if necessary. Tighten engine isolation mount screws (4) to 44 lb-ft (60 N·m).*
- *Install the engine by reversing the order of removal.*
- *If necessary, remove components from the engine and install the components on the new engine.*
- *Use new cable ties to secure wire connectors and wire harnesses.*
- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*
- *Replace the engine oil filter and fill engine with oil.*

Engine Service (Gasoline)

A separate engine manual, prepared by the engine manufacturer, is supplied with this machine. Refer to the engine manufacturer's manual for all engine-related service.

Proper attention to the engine manufacturer's manual directions will ensure maximum service life of the engine.

Chapter 4

Electrical

JACOBSEN
A Textron Company

Specifications

Test and Adjustment Specifications

Specification		
Resistance Across Solenoid Coil—Mow Solenoid Coil	ohms	9 ± 10%
Resistance Across Solenoid Coil—Raise Solenoid Coil at 72° F (22° C)	ohms	5.6 ± 10%
Resistance Across Solenoid Coil—Lower Solenoid Coil at 72° F (22° C)	ohms	5.6 ± 10%
Resistance Across Fuel Shutoff Pull-In Coil	ohm	1.0 ± 10%
Resistance Across Carb Solenoid Coil at 68° F (20° C)	ohms	40 ± 10%
Mow/Transport Switch to Slide Mount Plate Air Gap	in. (mm)	0.157 (4)

Repair Specifications

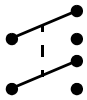
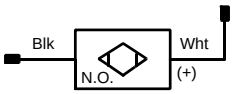
Specification		
Raise/Lower Solenoid Nut Torque	lb-ft (N·m)	7 (10)
Mow Solenoid Nut Torque	lb-in. (N·m)	65–75 (7–8)
Backlap Switch Torque	lb-ft (N·m)	3–5 (4–7)

Theory and Diagnostic Information

Electrical Component Symbols

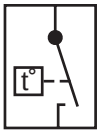
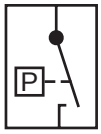
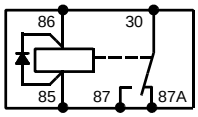
The following symbols are used in the electrical schematics to represent various electrical components.

Switches[1]

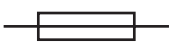
Single Pole, Single Throw (SPST) 	Double Pole, Single Throw (DPST) 
Single Pole, Double Throw (SPDT) 	Double Pole, Double Throw (DPDT) 
Proximity Switch 	

1 The sample switch symbols shown are just a few of the many switch configurations. Switches are designated by the number of "poles" (circuits controlled) and "throws" (actuator positions). Unless otherwise specified, switches are shown in the "Normally Open" (N.O.) position.

Switching Devices

Temperature Switch 	Pressure Switch 
Relay 	

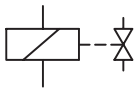
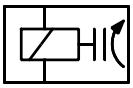
Circuit Protection Devices

Fuse 	Circuit Breaker 

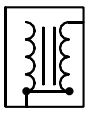
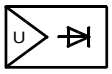
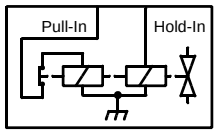
Motors and Generating Devices

Electric Motors (may also include “AC” or “DC”) 	Stator 
Alternator 	

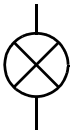
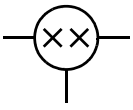
Actuating Devices

Solenoid Valve 	PTO Clutch 

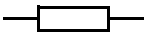
Engine-Related Devices

Ignition Coil 	Spark Plug 
Regulator 	Fuel Shutoff Solenoid 

Lights

Single-Element Light 	Dual-Element Light 

Miscellaneous Symbols

 Enclosure (cabinet, housing, etc.)	 Wires (crossing but not connected)
 Ground (to earth)	 Wiring Connections
 Ground (to chassis)	Coil
Direct Current (DC) (as shown on an oscilloscope)	 Battery
 Alternating Current (AC) (as shown on an oscilloscope)	 Diode
 Resistor	 Pin and Socket Connector

Electrical Schematic Component Identification

Electrical components shown in the main schematic are identified with an alphanumeric callout. All electrical components shown in the electrical schematic are listed below.

- A1—Control Module (See Figure 4-2.)
- A2—Fuel Shutoff Timer (See Figure 4-1.)
- B1—Engine Oil Pressure Switch (See Figure 4-4.)
- B2—Hydraulic Filter Pressure Switch (See Figure 4-4.)
- B3—Engine Temperature Sensor (See Figure 4-5.)
- E1—Work Light (See Figure 4-5.)
- E2—Work Light (See Figure 4-5.)
- F2—10A Fuse (See Figure 4-5.)
- F3—20A Fuse (See Figure 4-2.)
- F4—10A Fuse (See Figure 4-1.)
- F5—10A Fuse (See Figure 4-5.)
- F6—15A Fuse (See Figure 4-5.)
- F7—40A Fuse (See Figure 4-1.)
- G1—12V Battery (See Figure 4-1.)
- G2—Alternator (See Figure 4-1.)
- G3—Stator (See Figure 4-1.)
- H1—Hour Meter (See Figure 4-1.)
- H2—Alarm Light (See Figure 4-2.)
- H3—Horn (See Figure 4-3.)
- H4—Engine Oil Pressure Light (See Figure 4-4.)
- H5—Hydraulic Filter Pressure Light (See Figure 4-4.)
- H6—Engine Temperature Gauge (See Figure 4-4.)
- J1—Control Module Connector (See Figure 4-2.)
- J2—Control Module Connector (See Figure 4-2.)
- J3—Program Connector (See Figure 4-2.)
- J4—3-Pin Connector (See Figure 4-3.)
- J5—12V Accessory Socket (See Figure 4-5.)
- J6—Air Seat Connector (See Figure 4-5.)
- J7—Paddle Option Connector (See Figure 4-5.)
- K1—Start Relay (See Figure 4-1.)
- K2—Glow Plug Relay (See Figure 4-1.)
- K3—Engine Stop Relay (See Figure 4-1.)
- M1—Starter Motor (See Figure 4-1.)
- M2—Fuel Pump (See Figure 4-2.)
- N1—Voltage Regulator (See Figure 4-1.)
- R1—Glow Plugs (See Figure 4-1.)
- S1—Key Switch (See Figure 4-1.)
- S2—Backlap Switch (See Figure 4-2.)
- S3—Raise/Lower Switch (See Figure 4-3.)
- S4—Seat Switch (See Figure 4-3.)
- S5—Horn Switch (See Figure 4-3.)
- S6—Park Brake Switch (See Figure 4-3.)
- S7—Mow Switch (See Figure 4-4.)
- S8—Mow/Transport Switch (See Figure 4-4.)
- S9—Light Switch (See Figure 4-5.)
- Y1—Fuel Shutoff Solenoid (See Figure 4-1.)
- Y2—Carb Solenoid (See Figure 4-1.)
- Y3—Mow Solenoid (See Figure 4-3.)
- Y4—Raise Solenoid (See Figure 4-3.)
- Y5—Lower Solenoid (See Figure 4-3.)

Electrical Schematic

See Figures 4-1 through 4-5.

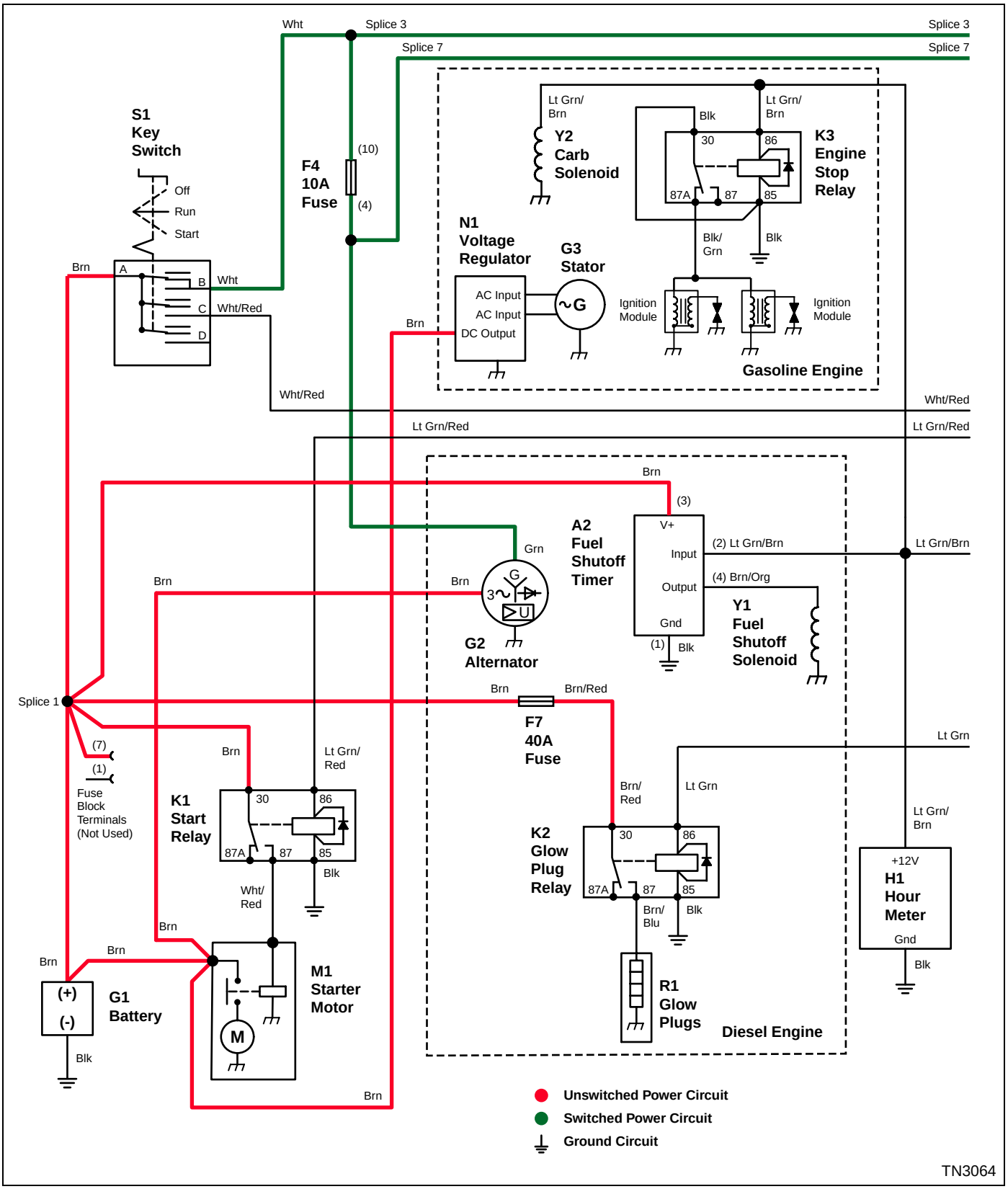


Figure 4-1

Electrical Schematic
Continued

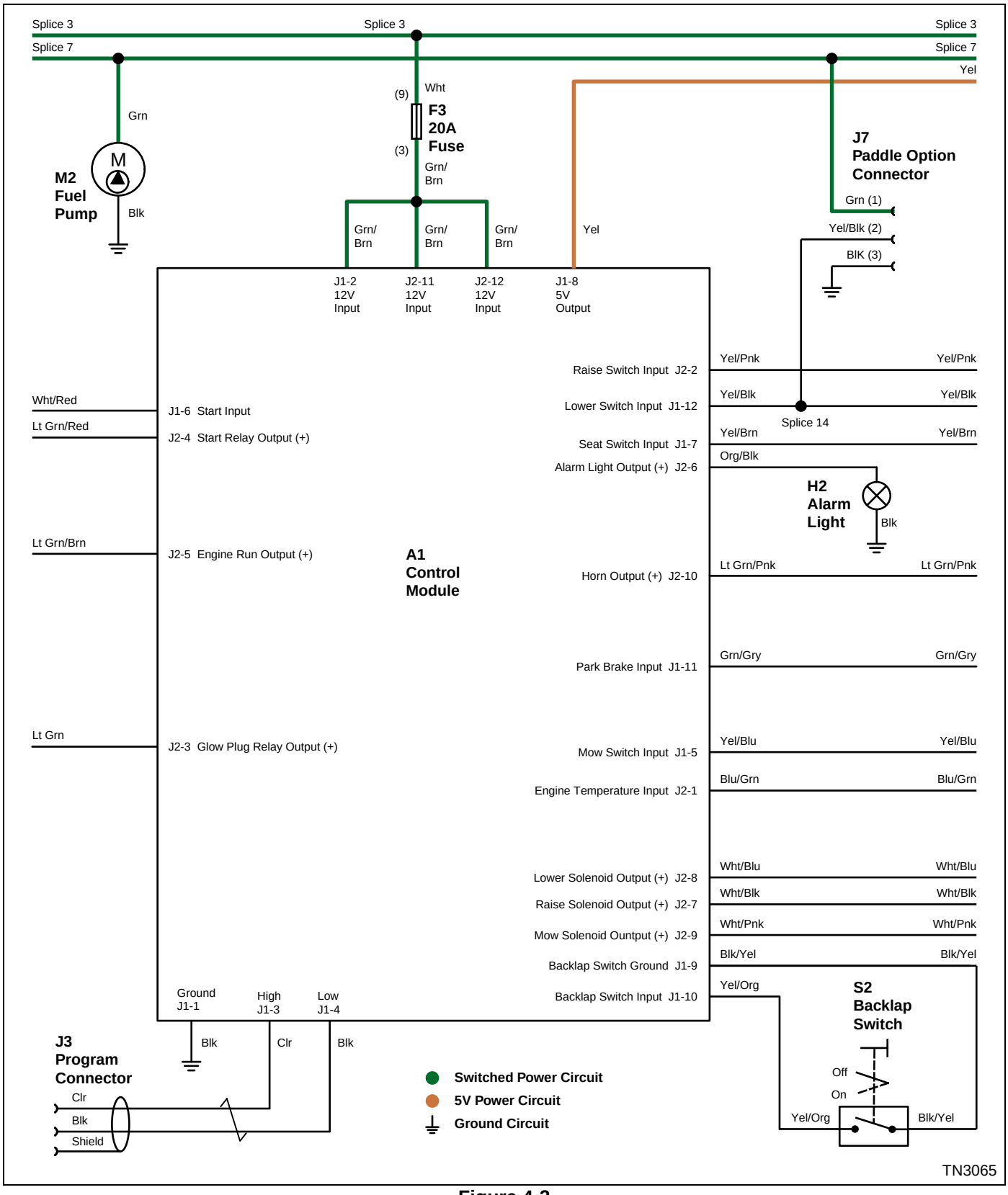


Figure 4-2

Electrical Schematic
Continued

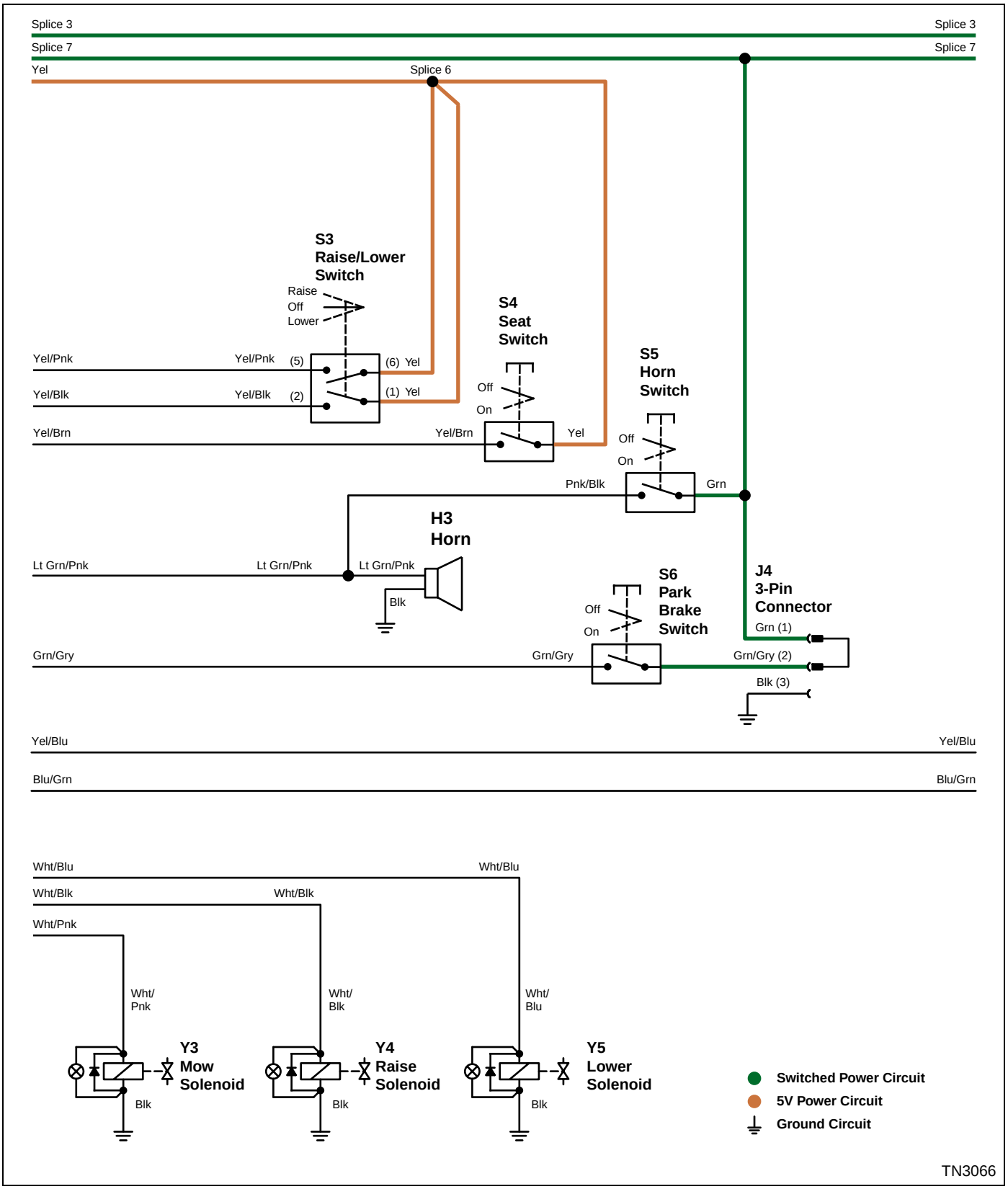


Figure 4-3

Electrical Schematic
Continued

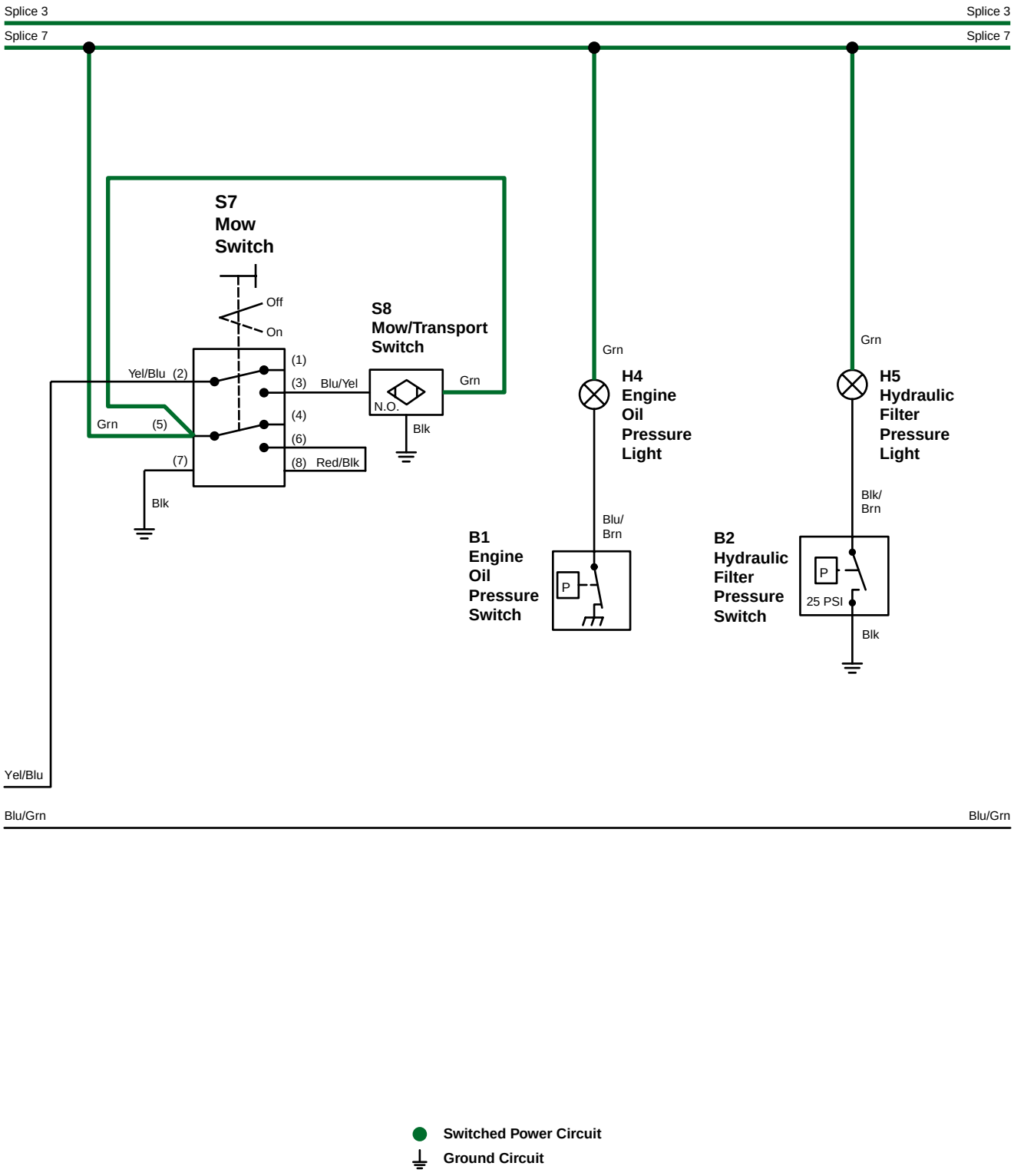


Figure 4-4

Electrical Schematic
Continued

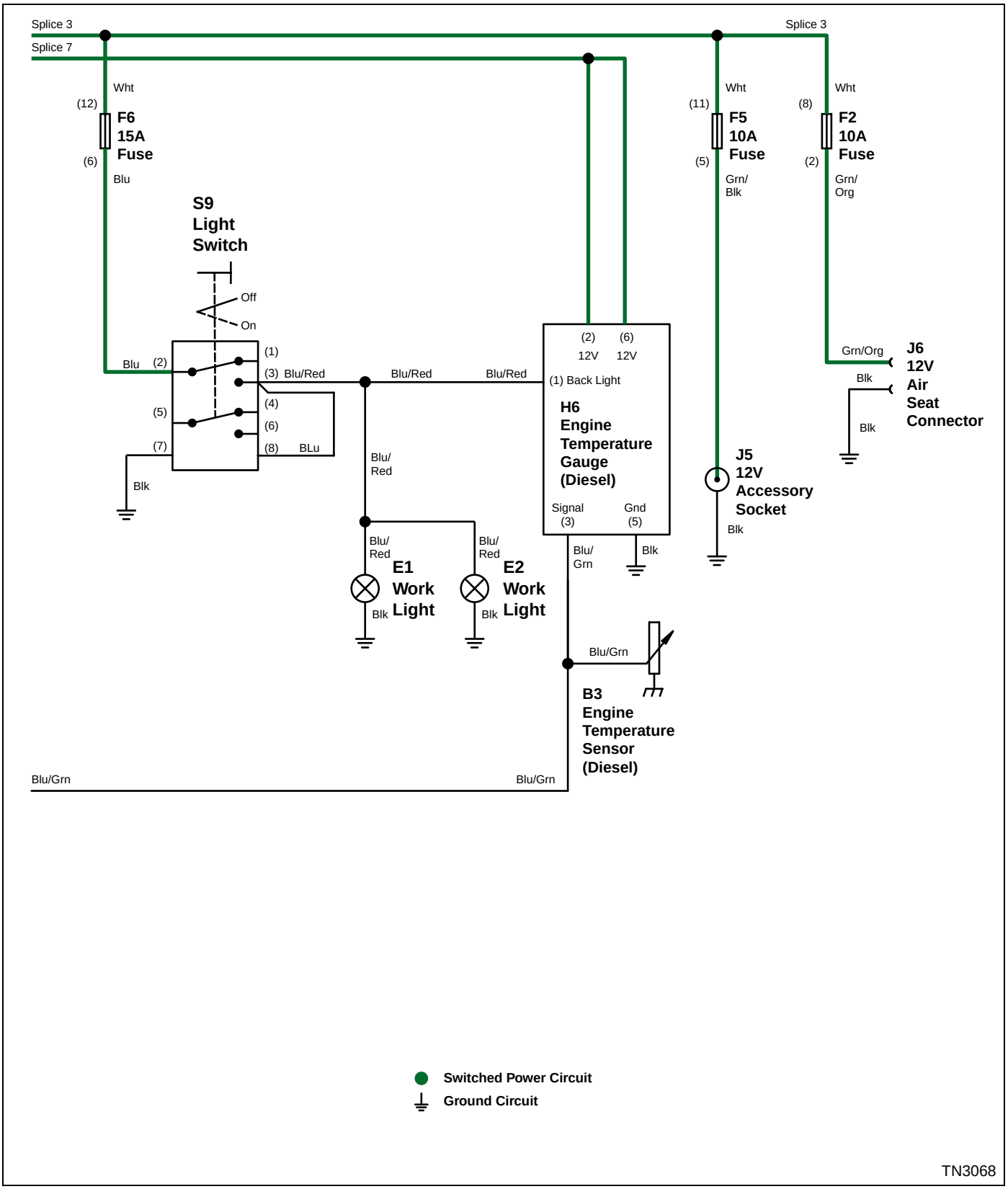


Figure 4-5

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Theory of Operation and Sub-Circuit Schematics

Power Circuit—Theory of Operation

Reference electrical schematic. See Figures 4-1 through 4-5.

Unswitched Power Circuit

Unswitched power is provided from the battery positive terminal to the starter motor battery terminal, and then from the starter motor battery terminal to the alternator battery terminal for diesel models or to the voltage regulator DC output terminal on gasoline models. Unswitched power is also available from the battery positive terminal to splice 1. Splice 1 provides voltage to glow plug relay terminal 30 through 40A fuse F7 for diesel models.

Splice 1 provides unswitched power to the following:

- Fuse block terminal 7 (not used)
- Key switch terminal A
- Start relay terminal 30
- Fuel shutoff timer terminal 3 (diesel)

Switched Power Circuit

When the key switch is turned to the run position, voltage is provided from key switch terminal B to splice 3. Splice 3 provides voltage to the following fuse block fuses:

- 10A fuse F2
- 20A fuse F3
- 10A fuse F4
- 10A fuse F5
- 15A fuse F6

The 10A fuse F2 provides voltage to the 12V air seat connector J6.

The 20A fuse F3 provides voltage to the control module terminals J1-2, J2-11 and J2-12, powering up the control module. With the control module powered up, 5 volts is provided from the control module 5V output terminal J1-8 to the following:

- Raise/lower switch terminals 1 and 6
- Seat switch

The 10A fuse F4 provides voltage to the following:

- Alternator field terminal (diesel)
- Fuel pump
- Paddle option connector J7-1
- Horn switch
- 3-Pin connector J4-1
- Mow switch
- Mow/transport switch
- Engine oil pressure light
- Hydraulic filter pressure light
- Engine temperature gauge (diesel)

The 10A fuse F5 provides voltage to the 12V accessory socket.

The 15A fuse F6 provides voltage to the light switch.

Diesel Engine Circuit—Theory of Operation

Power Circuit

When the key switch is turned to the run position, voltage is provided from key switch terminal B to control module terminals J1-2, J2-11, and J2-12, powering up the control module.

Switched power is also provided to the fuel pump. With switched power provided to the fuel pump, the fuel pump starts to operate. (See “Power Circuit—Theory of Operation” on page 4-14.)

Interlock Circuit

To start and operate the engine, the following must occur:

- Seat switch in the on position (operator on seat)
- Park brake switch in the on position
- Mow switch in the off position and/or mow/transport switch deactivated (lever in run position 2)

When the seat switch is in the on position, voltage is provided to the control module seat switch input terminal J1-7, activating the input.

When the park brake switch is in the on position, voltage is provided to the control module park brake switch input terminal J1-11, activating the input.

When the mow switch is placed in the off position, or the mow/transport lever is in run position 2, voltage is not provided from the switch to the control module mow switch input terminal J1-5, indicating the switch is in the off position.

Glow Plug Circuit

When the key switch is turned to the start position, voltage is provided from key switch terminal C to the control module start input terminal J1-6, activating the input. With the start input activated, voltage is provided from the control module glow plug relay output terminal J2-3 to glow plug relay terminal 86, energizing the relay. With the relay energized, voltage is switched between relay terminals 30 and 87 and is provided to the glow plugs, heating the glow plugs.

Glow plug activation is scaled between 1 and 8 seconds; the duration is determined by the engine temperature sensor. When the engine coolant temperature is 122° F (50° C), the engine temperature sensor provides 8.68 volts to the control module engine temperature input J2-1 and the glow plugs are activated for 1 second. When the engine coolant temperature is 32° F (0° C), the engine temperature sensor provides 10 volts to the control module engine temperature input J2-1 and the glow plugs are activated for 8 seconds (maximum).

The control module also flashes the alarm light at 1-second intervals while activating the glow plug circuit.

Start Circuit

With the key switch held in the start position, the control module start relay output terminal J2-4 provides voltage to start relay terminal 86, energizing the relay. With the start relay energized, voltage is switched between relay terminals 30 and 87 and provided to the starter motor solenoid, energizing the solenoid. With the starter solenoid energized, voltage is switched between the starter solenoid contacts to the starter motor, engaging the motor.

At the same time, the control module engine run output terminal J2-5 provides voltage to the fuel shutoff timer input terminal, activating the input. With the fuel shutoff timer input activated, the engine continues to operate.

The control module engine run output terminal also provides voltage to the hour meter, and the hour meter starts logging hours.

Run Circuit

When the operator is on the seat (seat switch in the on position), the control module allows the engine to continue to operate when the park brake switch is in the off position. The control module will deactivate the engine run output terminal if the operator leaves the seat with the park brake switch in the off position.

When the park brake is engaged (park brake switch in the on position), the control module allows the engine to continue to operate when the operator is off the seat. The control module will deactivate the engine run output terminal if the park brake is disengaged with the operator off the seat.

When the control module deactivates the engine run output terminal, voltage is no longer provided to the fuel shutoff timer input terminal, deactivating the input. With the input deactivated, the fuel shutoff timer output terminal provides voltage to the fuel shutoff solenoid for approximately 7 seconds. With the solenoid energized, fuel is prevented from flowing to the engine, and the engine stops operating. After approximately 7 seconds, the fuel shutoff timer de-energizes the solenoid.

Charging Circuit

With the engine running, switched power is provided to the alternator field terminal, exciting the alternator. With the alternator field terminal excited, the alternator produces three-phase alternating current (AC). The AC voltage is provided to the alternator’s internal voltage regulator.

When the battery voltage is low, the voltage regulator provides a regulated voltage to charge the battery. When the battery is fully charged, the regulator stops providing regulated voltage to the battery.

Diesel Engine Circuit Schematic

See Figures 4-6 and 4-7.

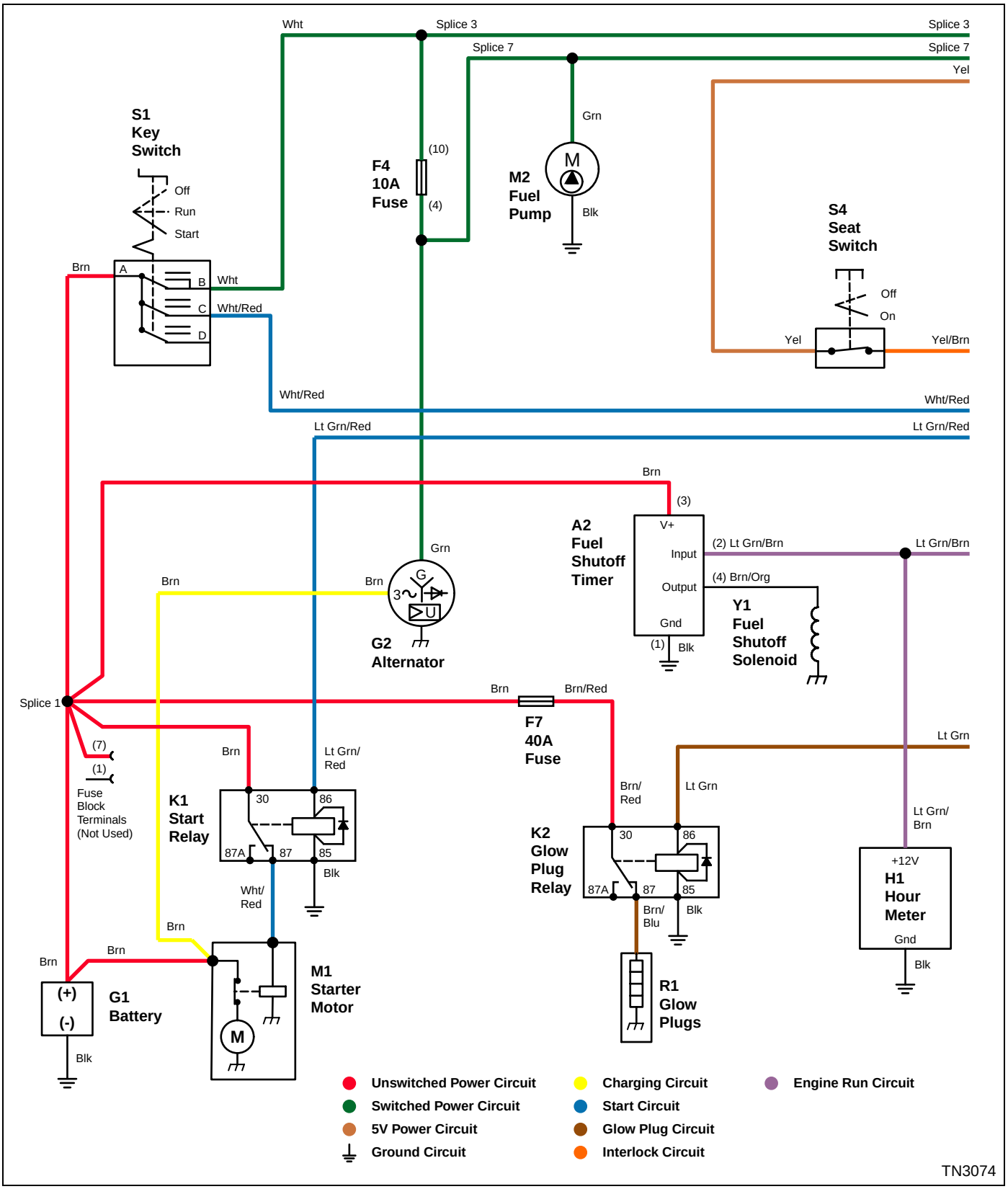

Figure 4-6

Diesel Engine Circuit Schematic Continued

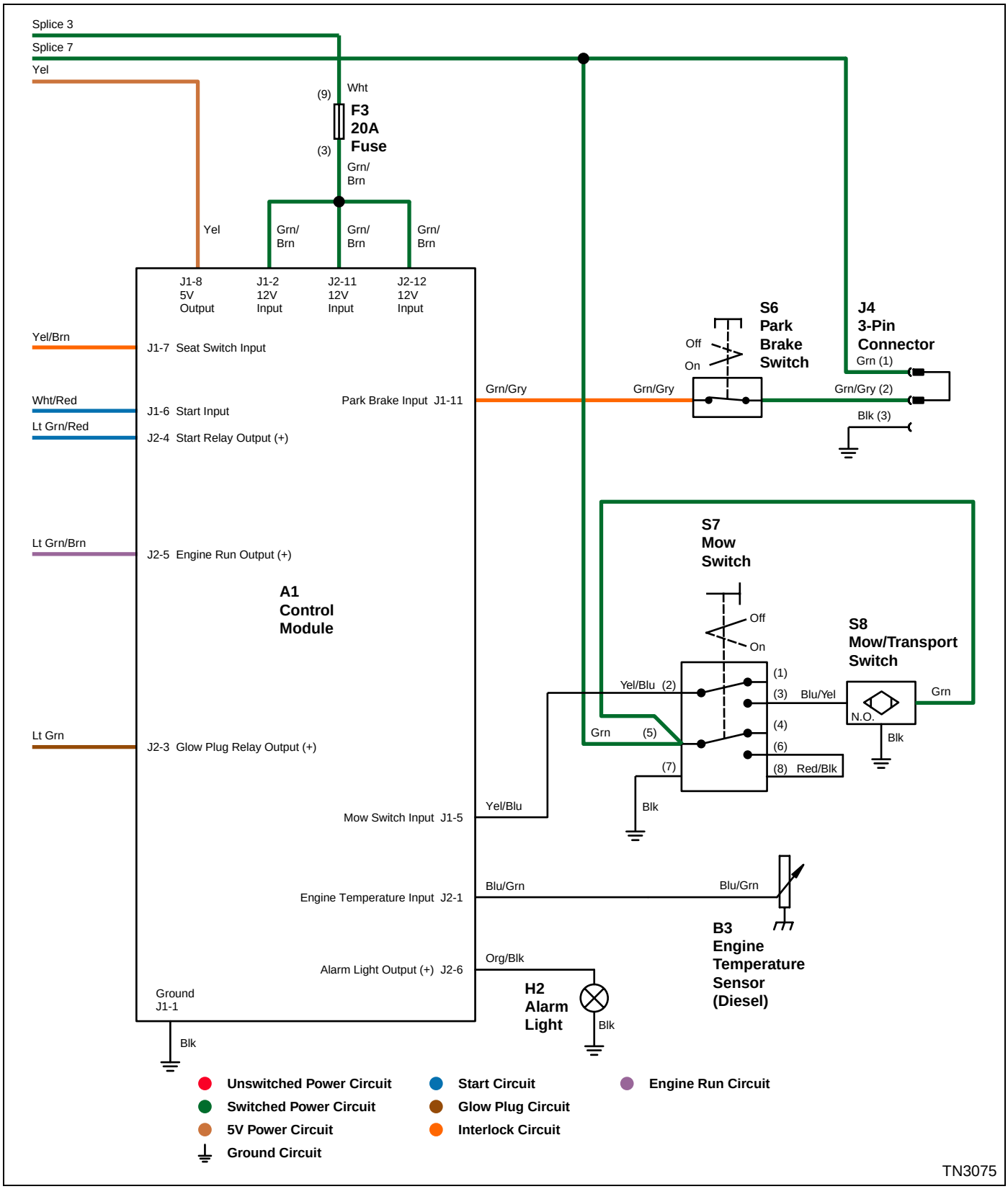

Figure 4-7

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Gasoline Engine Circuit—Theory of Operation

Power Circuit

When the key switch is turned to the run position, voltage is provided from key switch terminal B to control module terminals J1-2, J2-11, and J2-12, powering up the control module.

Switched power is also provided to the fuel pump. With switched power provided to the fuel pump, the fuel pump starts to operate. (See “Power Circuit—Theory of Operation” on page 4-14.)

Interlock Circuit

To start and operate the engine, the following must occur:

- Seat switch in the on position (operator on seat)
- Park brake switch in the on position
- Mow switch in the off position

When the seat switch is in the on position, voltage is provided to the control module seat switch input terminal J1-7, activating the input.

When the park brake switch is in the on position, voltage is provided to the control module park brake switch input terminal J1-11, activating the input.

When the mow switch is placed in the off position, voltage is not provided from the switch to the control module mow switch input terminal J1-5, indicating the switch is in the off position.

Start Circuit

When the key switch is turned to the start position, voltage is provided from key switch terminal C to the control module start input terminal J1-6, activating the input.

With the start input activated, the control module start relay output terminal J2-4 provides voltage to start relay terminal 86, energizing the relay. With the start relay energized, voltage is switched between relay terminals 30 and 87 and provided to the starter motor solenoid, energizing the solenoid. With the starter solenoid energized, voltage is switched between the starter solenoid contacts to the starter motor, engaging the motor.

At the same time, the control module engine run output terminal J2-5 provides voltage to the carb solenoid, energizing the solenoid. With the solenoid energized, the carb solenoid plunger retracts, allowing fuel to flow.

The control module engine run output terminal J2-5 also provides voltage to engine stop relay terminal 86, which energizes the relay. With the engine stop relay energized, the relay un-grounds the ignition modules, allowing the modules to produce spark when the engine is turning.

The control module engine run output terminal also provides voltage to the hour meter, and the hour meter starts logging hours.

Run Circuit

When the operator is on the seat (seat switch in the on position), the control module allows the engine to continue to operate when the park brake switch is in the off position. The control module will deactivate the engine run output terminal if the operator leaves the seat with the park brake switch in the off position.

When the park brake is engaged (park brake switch in the on position), the control module allows the engine to continue to operate when the operator is off the seat. The control module will deactivate the engine run output terminal if the park brake is disengaged with the operator off the seat.

When the control module deactivates the engine run output terminal, voltage is no longer provided to the carb solenoid and the carb solenoid plunger extends, stopping fuel flow.

At the same time, the engine stop relay de-energizes and relay terminal 87A provides a ground to the ignition modules, preventing the modules from producing spark.

Charging Circuit

The charging circuit is a permanent magnet and stator design. As the flywheel turns, the magnets pass the stator coils, producing AC voltage. The AC voltage is rectified by the voltage regulator, and DC voltage is produced. The DC voltage is used to charge the battery.

When the battery voltage is low, the voltage regulator supplies regulated voltage to charge the battery. When the battery is fully charged, the regulator stops providing voltage to the battery.

Gasoline Engine Circuit Schematic

See Figures 4-8 and 4-9.

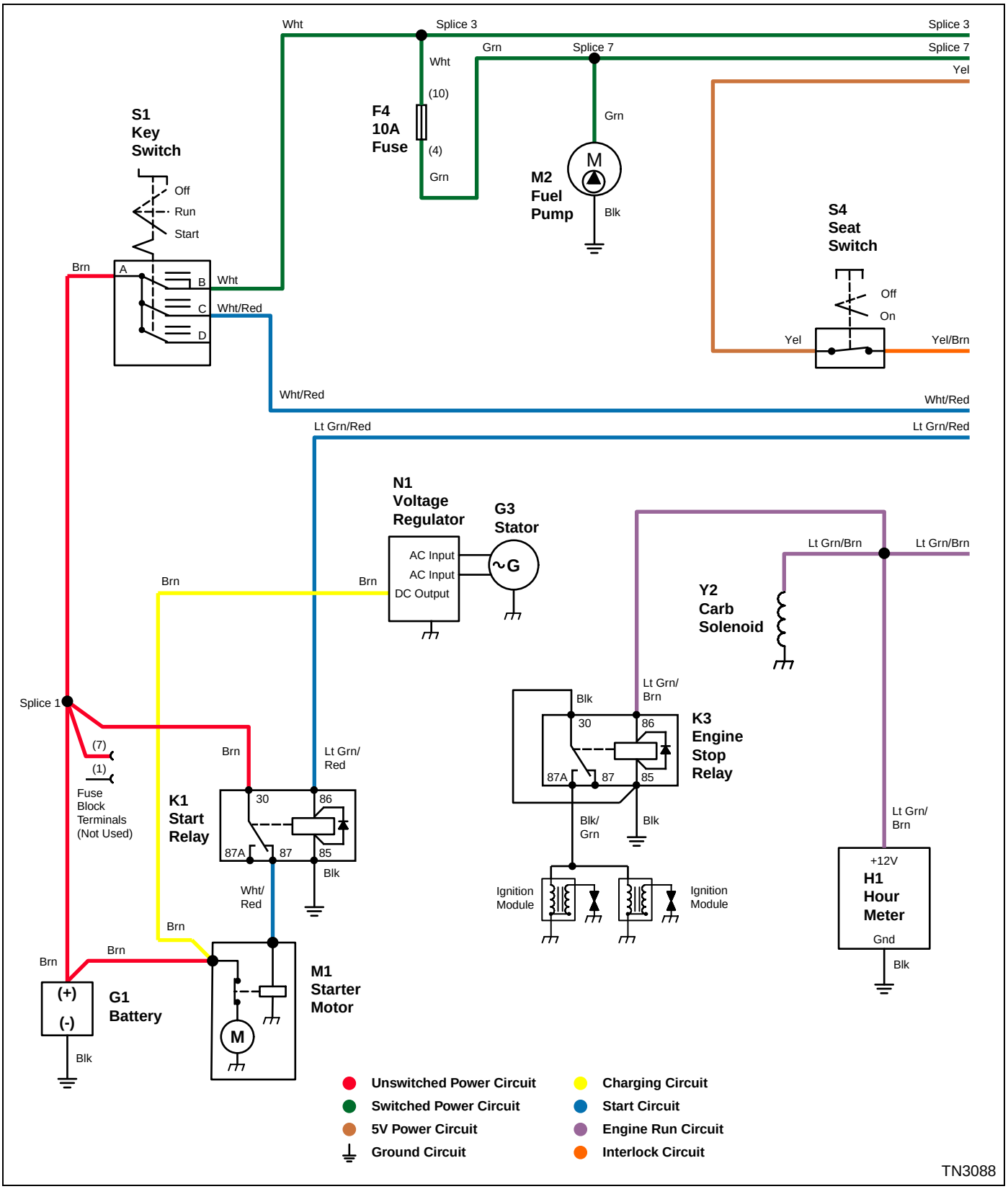

Figure 4-8

Gasoline Engine Circuit Schematic Continued

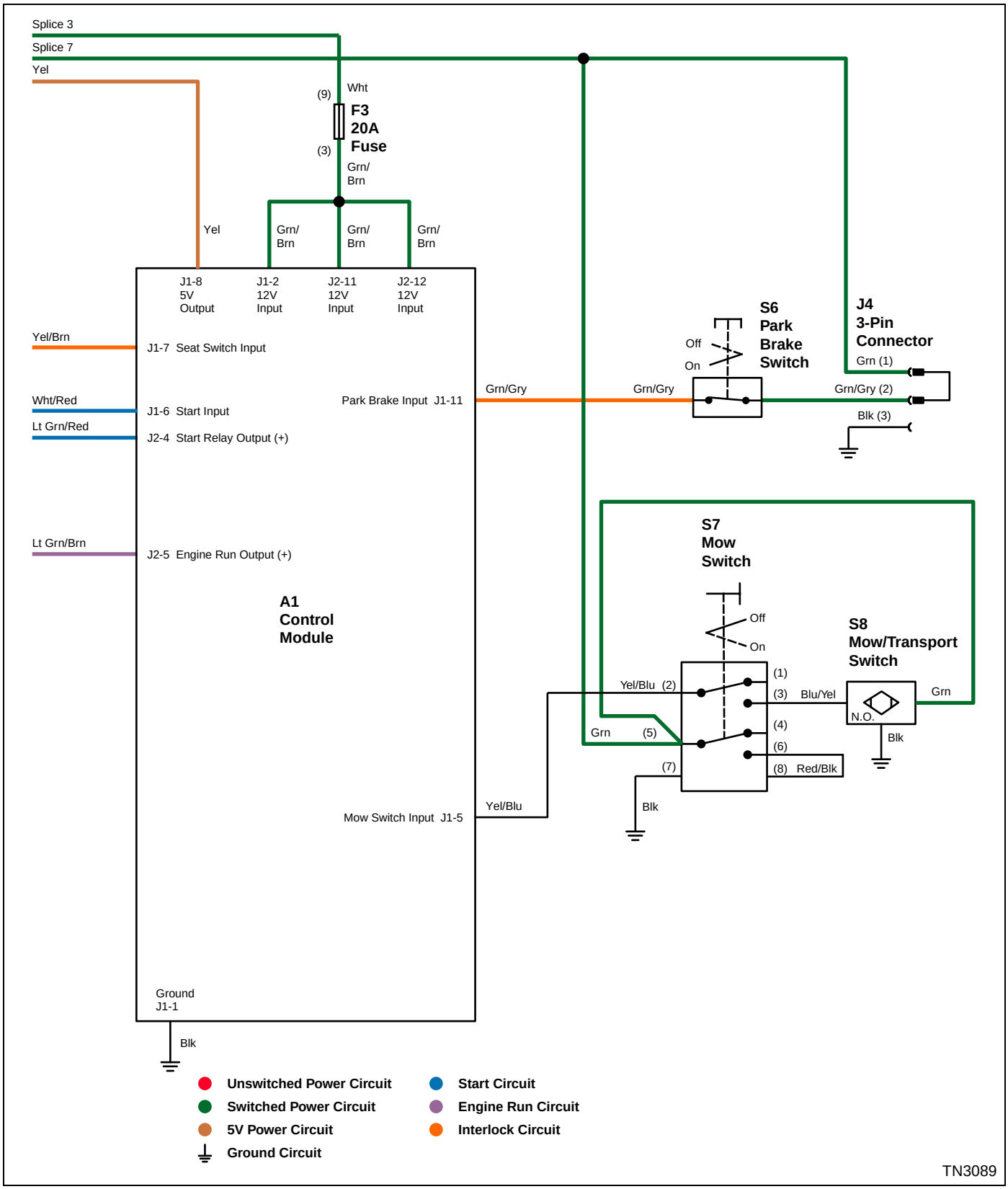

Figure 4-9

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Raise/Lower Circuit—Theory of Operation

Power Circuit

When the key switch is turned to the run position, voltage is provided from key switch terminal B to control module terminals J1-2, J2-11, and J2-12, powering up the control module. (See “Power Circuit—Theory of Operation” on page 4-14.)

Raise Circuit

When the raise/lower switch is placed in the raise position, voltage is provided from the raise switch to control module raise switch input terminal J2-2, activating the input. With the input activated, the control module raise solenoid output terminal J2-7 provides voltage to the raise solenoid, energizing the solenoid. With the solenoid energized, the cutting units will continue to rise until the raise/lower switch is released.

When the raise/lower switch is momentarily placed in the raise position, the control module energizes the raise solenoid for approximately 2 seconds.

Lower Circuit

When the raise/lower switch is placed in the lower position, voltage is provided from the lower switch to control module lower switch input terminal J1-12, activating the input. With the input activated, the control module lower solenoid output terminal J2-8 provides voltage to the lower solenoid, energizing the solenoid. With the solenoid energized, the cutting units will continue to lower until the raise/lower switch is released.

When the raise/lower switch is momentarily placed in the lower position, the control module energizes the lower solenoid for approximately 2 seconds.

Raise Circuit Schematic

See Figure 4-10.

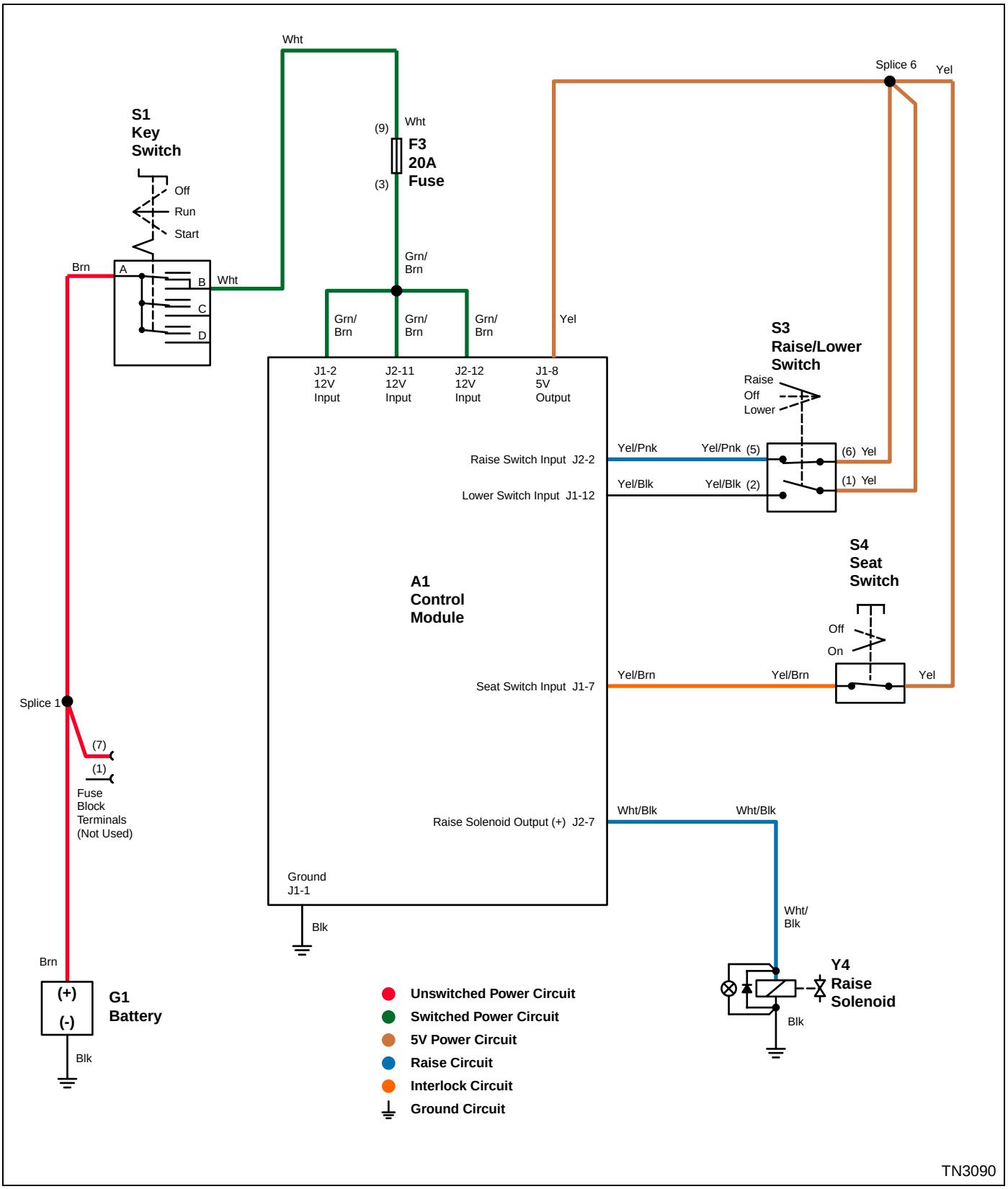

Figure 4-10

Lower Circuit Schematic

See Figure 4-11.

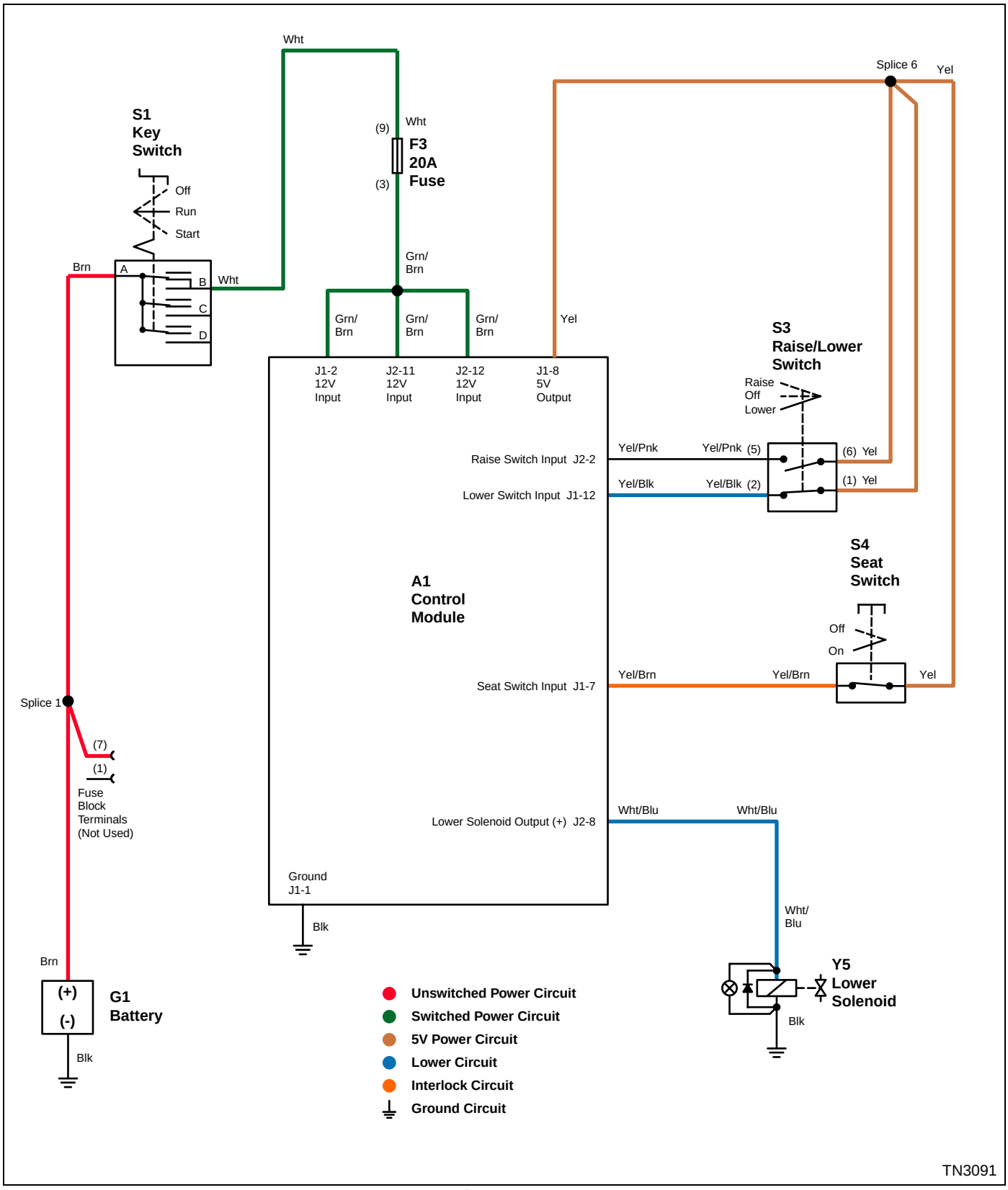

Figure 4-11

Mow Circuit—Theory of Operation

Power Circuit

When the key switch is turned to the run position, voltage is provided from key switch terminal B to control module terminals J1-2, J2-11, and J2-12, powering up the control module. (See “Power Circuit—Theory of Operation” on page 4-14.)

Interlock Circuit

Before the system allows activation of the mow circuit, the following must occur:

- Seat switch in the on position (operator on seat)
- Mow/transport lever in the mow position
- Park brake switch in the off position
- Cutting units in the lowered position

When the seat switch is in the on position, voltage is provided to the control module seat switch input terminal J1-7, activating the input.

When the mow/transport lever is in the 1 position (mow), the mow/transport linkage is brought near the mow/transport proximity switch, activating the switch. With the mow/transport switch activated, voltage is provided to terminal 3 on the mow switch.

When the park brake switch is in the off position, voltage is not provided from the switch to the control module park brake switch input terminal J1-11, indicating the switch is in the off position.

When the cutting units are placed in the lowered position, the control module allows activation of the mow circuit.

Mow Circuit

When the mow switch is in the on position, voltage is provided to the control module mow switch input terminal J1-5, activating the input. With the input activated, the control module mow solenoid output terminal J2-9 provides voltage to the mow solenoid, energizing the solenoid.

When the raise/lower switch is momentarily placed in the raise position, after a delay of 1.5 seconds the control module de-energizes the mow solenoid and energizes the raise solenoid for approximately 2 seconds, raising the cutting units.

When the raise/lower switch is momentarily placed in the lower position, the control module will lower the cutting units and energize the mow solenoid.

If the operator leaves the seat with the park brake engaged, the control module stops operation of the cutting units. When the operator returns to the seat, the mow switch must be placed in the off position to reset the control module. After resetting the control module, return the switch to the on position to resume operations.

Mow Circuit Schematic

See Figure 4-12.

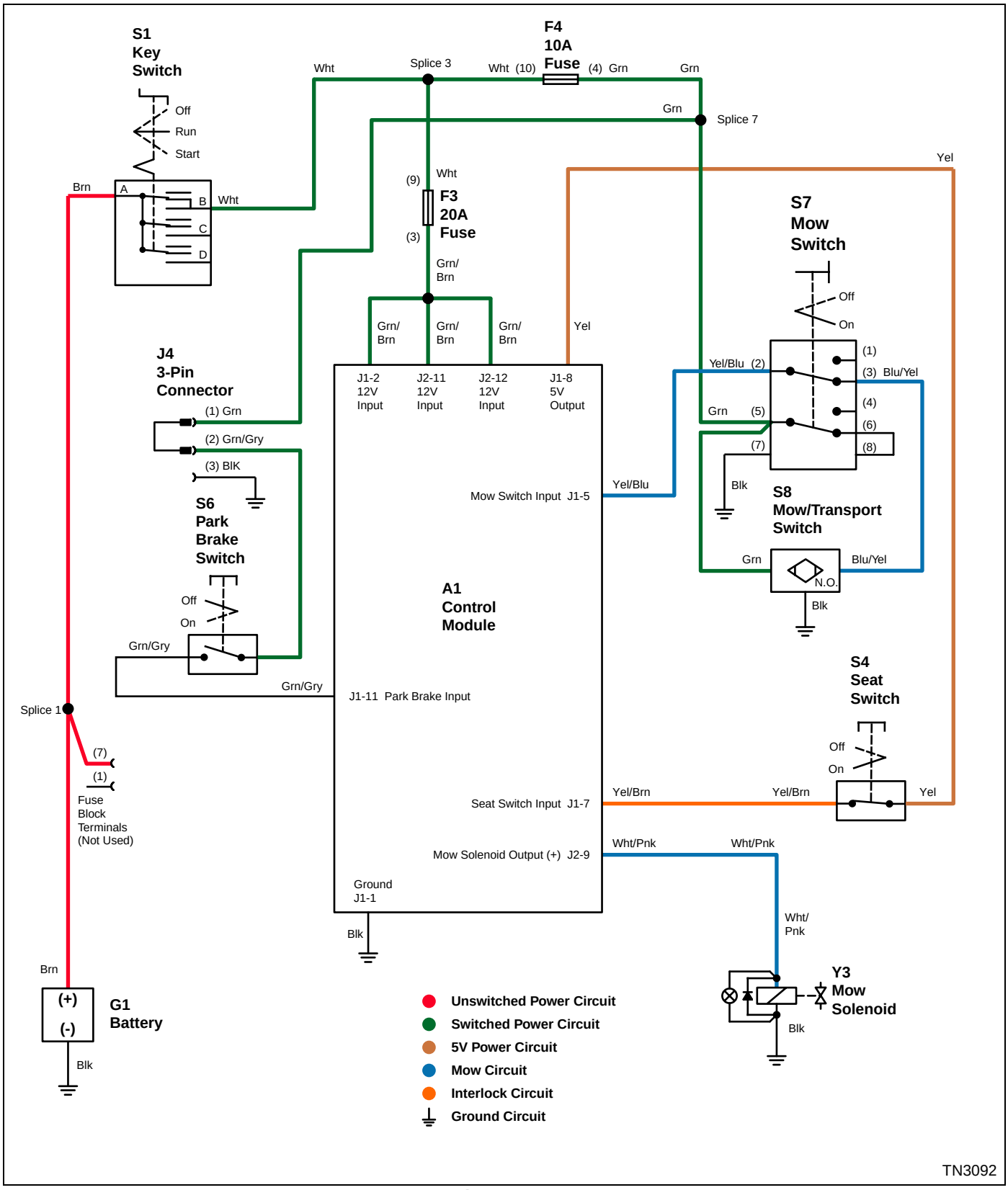

Figure 4-12

Backlap Circuit—Theory of Operation

Power Circuit

When the key switch is turned to the run position, voltage is provided from key switch terminal B to control module terminals J1-2, J2-11, and J2-12, powering up the control module. (See “Power Circuit—Theory of Operation” on page 4-14.)

Interlock Circuit

When backlapping, the following must occur:

- Seat switch in the on position (operator on seat)
- Mow/transport lever in the mow position
- Park brake switch in the on position
- Cutting units in the lowered position

When the seat switch is in the on position, voltage is provided to the control module seat switch input terminal J1-7, activating the input.

When the mow/transport lever is in the mow position, the mow/transport linkage is brought near the mow/transport proximity switch, activating the switch. With the mow/transport switch activated, voltage is provided to the mow switch.

When the park brake switch is in the on position, voltage is provided from the switch to the control module park brake switch input terminal J1-11, activating the input.

When the cutting units are placed in the lowered position, the control module allows activation of the mow circuit. The control module records the last position of the cutting units.

Backlap Circuit

When the reel valve is placed in the backlap position, the backlap switch is moved to the on position. With the switch in the on position, ground is provided from the switch to control module backlap switch input terminal J1-10, activating the input. With the input activated, the control module allows operation of the cutting units with the park brake engaged with the operator off the seat.

With the operator on the seat and when the mow switch is in the on position, voltage is provided to the control module mow switch input terminal J1-5, activating the input. With the input activated, the control module mow solenoid output terminal J2-9 provides voltage to the mow solenoid, energizing the solenoid. With the solenoid energized and the reel valve in the backlap position, the cutting units operate in the reverse direction. The operator can now leave the seat and the mow circuit continues to operate.

If the operator is off the seat for a period greater than 5 minutes, the control module deactivates the mow solenoid.

Backlap Circuit Schematic

See Figure 4-13.

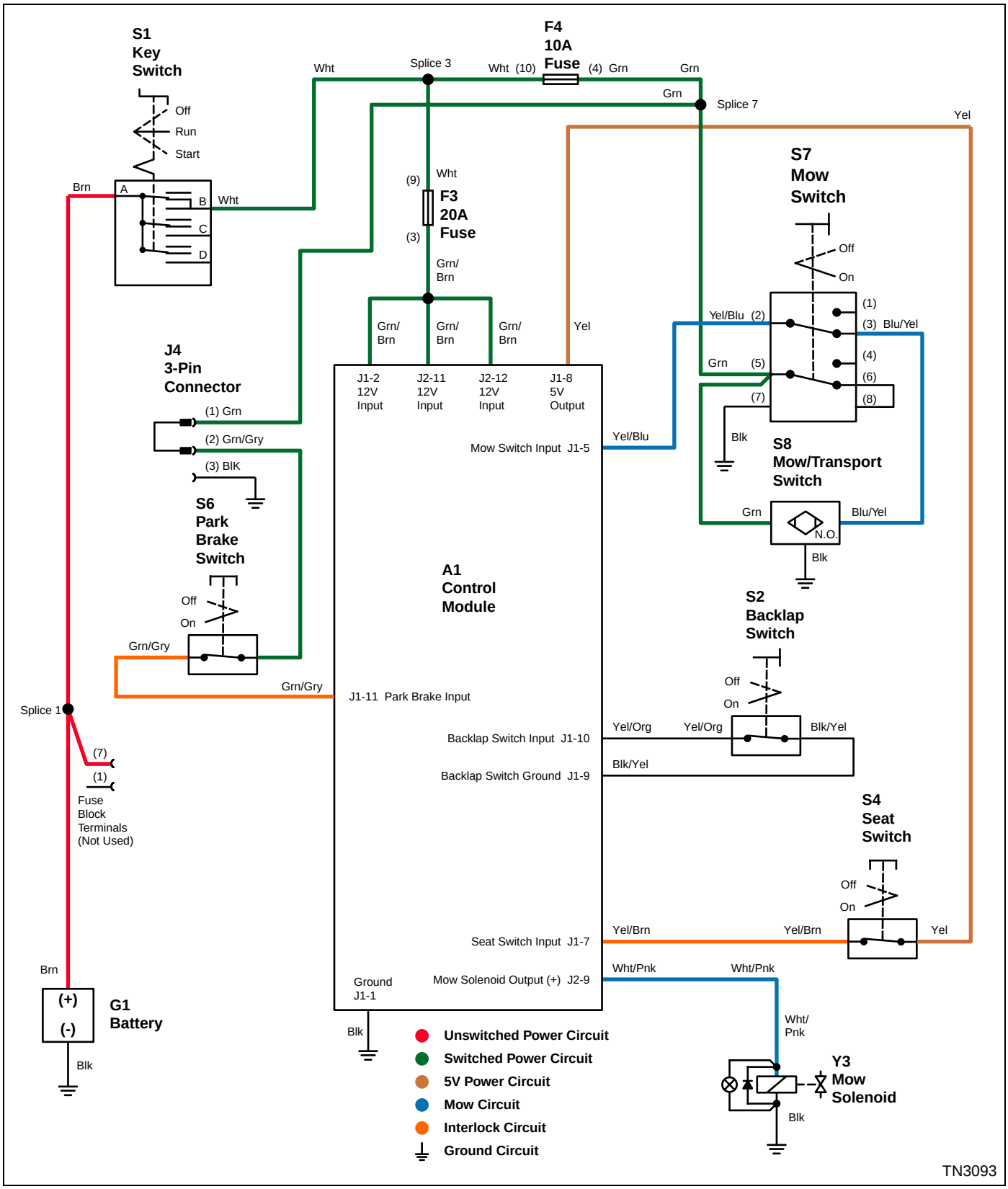

Figure 4-13

Work Light Circuit—Theory of Operation

Power Circuit

When the key switch is turned to the run position, voltage is provided from key switch terminal B to the light switch. (See “Power Circuit—Theory of Operation” on page 4-14.)

Work Light Circuit

When the light switch is placed in the on position, voltage is provided to the work lights, turning on the lights. Voltage is also provided from the light switch to the engine temperature gauge backlight terminal, illuminating the gauge.

Work Light Circuit Schematic

See Figure 4-14.

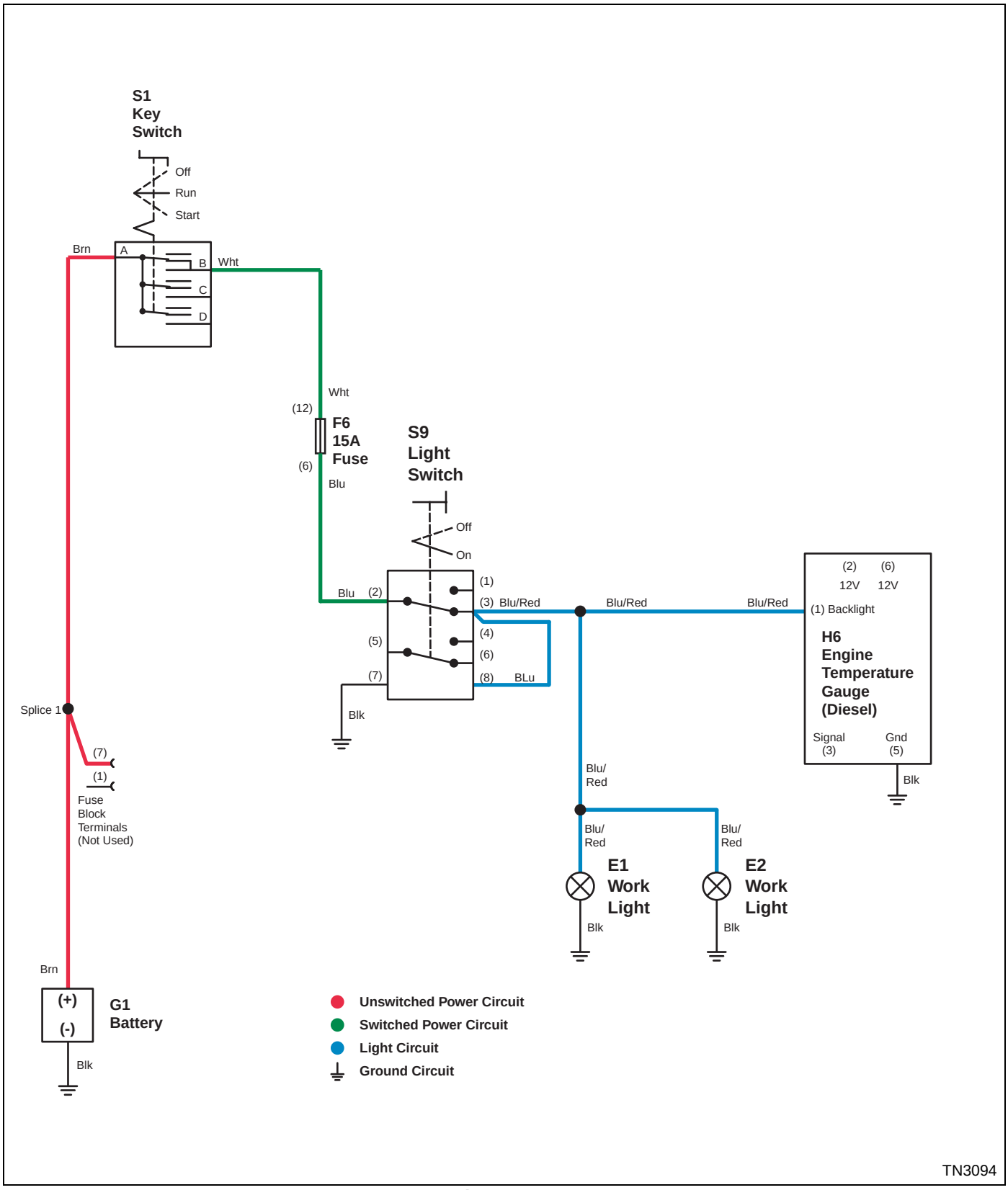

Figure 4-14

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Instrumentation Circuit—Theory of Operation

Power Circuit

When the key switch is turned to the run position, voltage is provided from key switch terminal B to control module terminals J1-2, J2-11, and J2-12, powering up the control module. (See “Power Circuit—Theory of Operation” on page 4-14.)

Hour Meter

When the key switch is turned to the start position, voltage is provided from key switch terminal C to the control module start input terminal J1-6, activating the input. With the start input activated, the control module engine run output terminal provides voltage to the hour meter, and the hour meter starts logging hours.

With the hour meter connected to the control module engine run output terminal, the hour meter only records hours when the engine is operating.

Hydraulic Filter Pressure Light

When the hydraulic filter pressure switch closes, a ground is provided from the switch to the hydraulic filter pressure light, turning on the light.

Engine Coolant Temp Light (Diesel)

The engine temperature sensor resistance changes in relationship to the engine coolant temperature. As the engine temperature sensor is heated, the resistance of the sensor changes from a high resistance to a low resistance. The control module engine temperature input terminal J2-1 measures the resistance of the temperature sensor.

When the engine coolant temperature reaches 221° F (105° C), the control module will deactivate the mow circuit and raises the cutting units. The control module then turns on the alarm light and activates the horn circuit; the horn chirps twice per second. The control module activates the alarm light and horn circuit for a period of 60 seconds.

Engine Oil Pressure Light

When the engine oil pressure is below 7 psi (0.483 bar), the engine oil pressure switch contacts close. With the switch contacts closed, a ground is provided to the engine oil pressure light, turning on the light.

Horn Circuit

When the horn switch is in the on position, voltage is provided from the switch to the horn, activating the horn. When the horn is activated by the control module, voltage is provided from terminal J2-10 of the control module to the horn.

Instrumentation Circuit Schematic

See Figures 4-15 and 4-16.

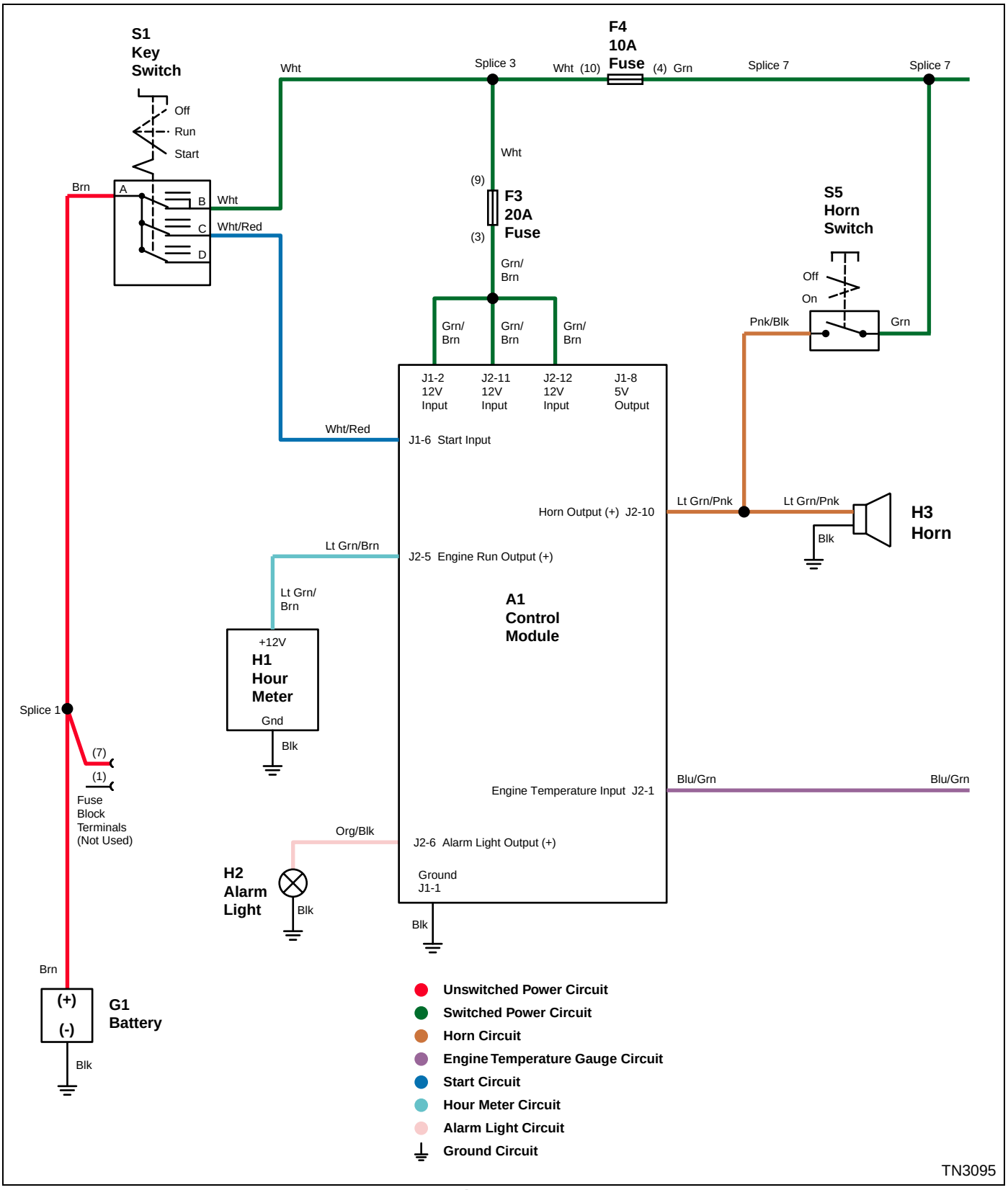


Figure 4-15

Instrumentation Circuit Schematic Continued

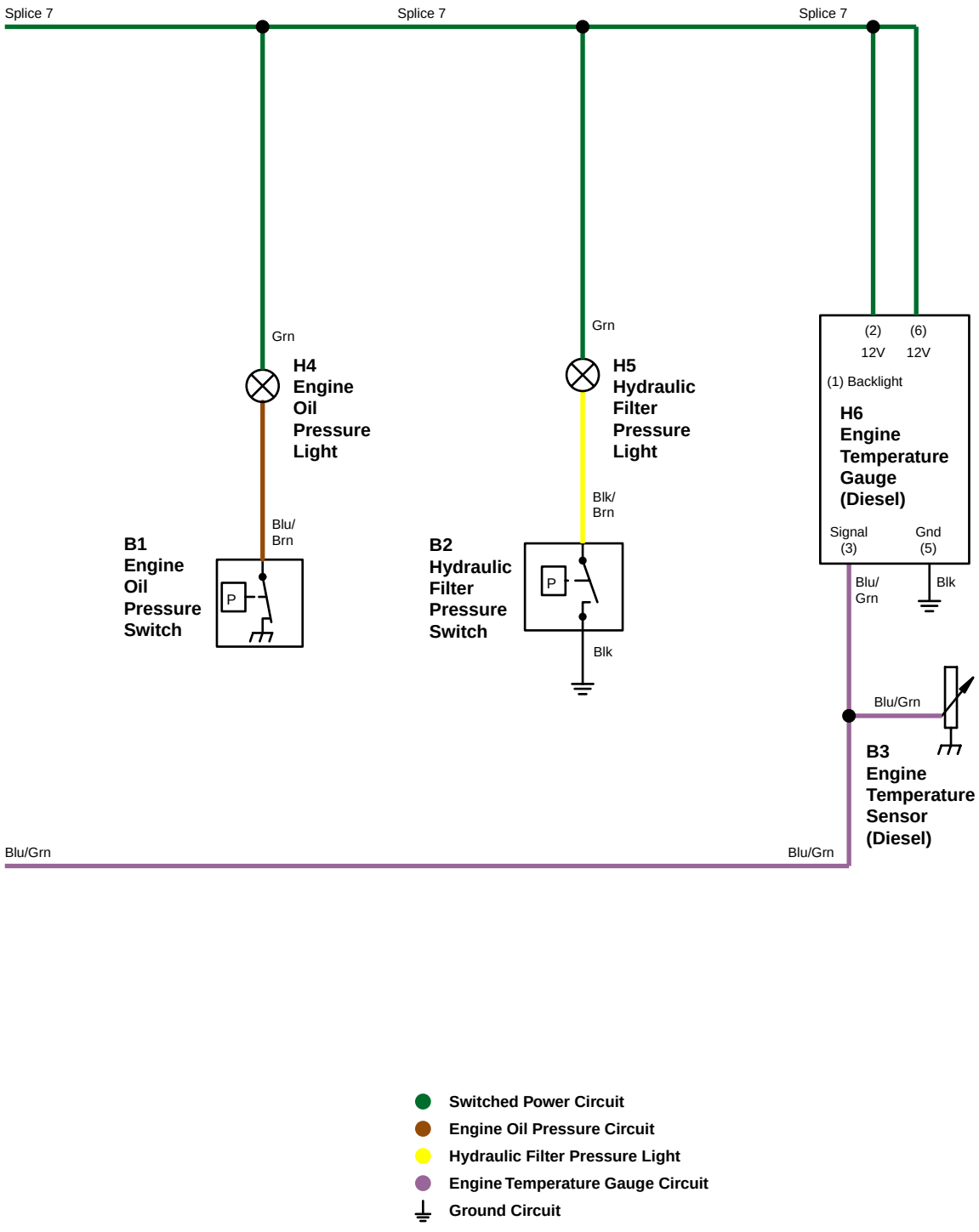


Figure 4-16

Troubleshooting

Power Circuit

Symptom: Machine does not power up.

Probable Cause	Remedy
Faulty wiring.	Check wiring and connections at the battery posts.
	Check wiring and connections between the battery negative (–) cable and ground.
Faulty battery.	Replace battery with a known good battery.
Insufficient circuit voltage.	Check for approximately 12 volts at key switch terminal A. If the voltage is not approximately 12 volts, diagnose the insufficient voltage issue.
Faulty key switch.	Turn the key switch to the run position; check for 12 volts at key switch terminal B. If the output is not approximately 12 volts, test the key switch. (See “Key Switch Test” on page 4-42.)

Glow Plug Circuit

Symptom: Glow plugs do not get hot.

Probable Cause	Remedy
Faulty 40A fuse.	Test the 40A glow plug fuse. (See “Fuses Test” on page 4-41.)
Insufficient circuit voltage.	Turn the key switch to the start position; check for approximately 12 volts at glow plug relay terminals 30 and 86. If the voltage is not approximately 12 volts, diagnose the insufficient voltage issue.
Faulty glow plug relay.	Test the glow plug relay. (See “Relays Test” on page 4-41.)
Faulty glow plugs.	Substitute the glow plugs with known good glow plugs.

Start Circuit

Symptom: Starter motor solenoid does not engage.

Probable Cause	Remedy
Faulty battery.	Replace battery with a known good battery.
Insufficient circuit voltage.	Turn the key switch to the start position; check for approximately 12 volts at the starter electrical connectors. If the voltage is not approximately 12 volts, diagnose the insufficient voltage issue.
	Turn the key switch to the start position; check for approximately 12 volts at starter relay terminals 30 and 86. If the voltage is not approximately 12 volts, diagnose the insufficient voltage issue.
Faulty start relay.	Test the start relay. (See “Relays Test” on page 4-41.)
Faulty seat switch.	Test the seat switch. (See “Seat Switch Test” on page 4-46.)
Faulty mow switch.	Test the mow switch. (See “Rocker Switches Test” on page 4-43.)
Faulty mow/transport switch	Ensure mow/transport switch is properly adjusted and verify LED on mow/transport switch illuminates when switch is activated. Adjust and/or replace switch as necessary. (See “Mow/Transport Switch Adjustment” on page 4-49.)
Faulty park brake switch.	Substitute the park brake switch with a known good park brake switch.
Faulty key switch.	Test the key switch. (See “Key Switch Test” on page 4-42.)
Faulty starter.	Substitute the starter with a known good starter.

Charging Circuit

Symptom: Battery not charging.

Probable Cause	Remedy
Faulty battery.	Replace battery with a known good battery.
Insufficient circuit voltage.	Turn the key switch to the run position; check for 12 volts at the alternator electrical connectors. If the voltage is not approximately 12 volts, diagnose the insufficient voltage issue.
Faulty 10A fuse (diesel models).	Test the 10A F4 fuse. (See “Fuses Test” on page 4-41.)
Faulty alternator output.	With the engine running, measure voltage between the positive (+) and negative (–) battery terminals. If output is not approximately 14 volts, substitute the alternator with a known good alternator.

No power at 12V accessory socket.

Probable Cause	Remedy
Open 10A fuse.	Test the 12V accessory socket fuse. (See “Fuses Test” on page 4-41.)
Faulty accessory socket.	Substitute the accessory socket with a known good accessory socket.

Raise/Lower Circuit

Symptom: Lower solenoid does not energize.

Probable Cause	Remedy
Faulty raise/lower switch.	Test the raise/lower switch. (See “Raise/Lower Switch Assembly Test” on page 4-45.)
Faulty lower solenoid.	Test the lower solenoid. (See “Raise/Lower Solenoid Test” on page 4-46.)

Symptom: Raise solenoid does not energize.

Probable Cause	Remedy
Faulty raise/lower switch.	Test the raise/lower switch. (See “Raise/Lower Switch Assembly Test” on page 4-45.)
Faulty raise solenoid.	Test the raise solenoid. (See “Raise/Lower Solenoid Test” on page 4-46.)

Mow Circuit

Symptom: Mow solenoid does not energize.

Probable Cause	Remedy
Faulty mow switch.	Test the mow switch. (See “Rocker Switches Test” on page 4-43.)
Faulty mow/transport switch.	Substitute the mow/transport switch with a known good mow/transport switch.
Faulty mow solenoid.	Test the mow solenoid. (See “Mow Solenoid Test” on page 4-47.)

Backlap Circuit

Symptom: Reels stop operating after 7 seconds when backlapping.

Probable Cause	Remedy
Faulty backlap switch.	Test the backlap switch. (See “Backlap Switch Test” on page 4-44.)

Work Light Circuit

Symptom: Work lights do not turn on.

Probable Cause	Remedy
Faulty work light(s).	Substitute the work light(s) with a known good work light(s).
Faulty 15A fuse.	Test the 15A light switch fuse. (See “Fuses Test” on page 4-41.)
Faulty work light switch.	Test the work light switch. (See “Rocker Switches Test” on page 4-43.)

Instrumentation Circuit

Lamp and Audible Alarm Check Circuit

The control module provides a lamp and audible alarm check circuit. When the key switch is turned to the run position, the control module turns on the following:

- Alarm light
- Horn (one chirp)

After the lamp and audible alarm check circuit, the oil pressure light remains on because the engine is not operating. If this light fails to turn on, check the LED.

Symptom: Engine oil pressure light stays on with engine running.

Probable Cause	Remedy
Low engine oil pressure.	Check engine oil level.
Faulty engine oil pressure switch.	Substitute the engine oil pressure switch with a known good engine oil pressure switch.

Symptom: Alarm light does not come on.

Probable Cause	Remedy
Faulty alarm light.	Substitute the alarm light with a known good alarm light.
Insufficient circuit voltage.	Turn the key switch to the run position; check for approximately 12 volts at control module terminal J2-6. If the voltage is not approximately 12 volts, diagnose the insufficient voltage issue.

Symptom: Hydraulic filter pressure light is on with the key switch in the run position (engine off).

Probable Cause	Remedy
Faulty hydraulic filter pressure switch.	Substitute the hydraulic filter pressure switch with a known good hydraulic filter pressure switch.

Symptom: Hydraulic filter pressure light is on with the key switch in the run position (engine on).

Probable Cause	Remedy
High hydraulic oil pressure.	Check hydraulic oil level.
Dirty hydraulic oil filter.	Replace hydraulic oil filter.
Faulty hydraulic filter pressure switch.	Substitute the hydraulic filter pressure switch with a known good hydraulic filter pressure switch.

Symptom: Engine temperature gauge indicates a temperature when the engine is cold.

Probable Cause	Remedy
Faulty engine temperature sensor.	Substitute the engine temperature sensor with a known good engine temperature sensor.
Faulty engine temperature sensor gauge.	Substitute the engine temperature gauge with a known good engine temperature gauge.

Symptom: Engine temperature gauge does not indicate a temperature.

Probable Cause	Remedy
Faulty engine temperature sensor.	Substitute the engine temperature sensor with a known good engine temperature sensor.
Faulty engine temperature sensor gauge.	Substitute the engine temperature gauge with a known good engine temperature gauge.

Symptom: Hour meter does not log hours.

Probable Cause	Remedy
Faulty hour meter.	Substitute the hour meter with a known good hour meter.

Horn and Audible Alert Circuit

Symptom: Horn does not sound when horn switch is pressed.

Probable Cause	Remedy
Faulty horn switch.	Test the horn switch. (See “Horn Switch Test” on page 4-44.)
Faulty horn.	Substitute the horn with a known good horn.

Symptom: Horn does not sound during lamp and audible alarm check.

Probable Cause	Remedy
Faulty horn.	Substitute the horn with a known good horn.
Insufficient circuit voltage.	Simultaneously turn the key switch in the run position and check for approximately 12 volts at control module terminal J2-10. If the voltage is not approximately 12 volts, diagnose the insufficient voltage issue.

Symptom: Horn does not sound with engine oil pressure light on.

Probable Cause	Remedy
Faulty horn.	Substitute the horn with a known good horn.
Insufficient circuit voltage.	Turn the key switch to the run position; check for approximately 12 volts at control module terminal J2-10. If the voltage is not approximately 12 volts, diagnose the insufficient voltage issue.

Symptom: Horn does not sound when engine temperature reaches overtemp.

Probable Cause	Remedy
Faulty horn.	Substitute the horn with a known good horn.
Insufficient circuit voltage.	Turn the key switch to the run position; check for approximately 12 volts at control module terminal J2-10. If the voltage is not approximately 12 volts, diagnose the insufficient voltage issue.

Component Tests and Adjustments

Electrical System and Component Testing

General Information

Repair of the electrical system, for the most part, is limited to the replacement of defective components or wiring. When replacing either electrical components or wiring, be sure to apply dielectric grease (Jacobsen PN 365422) to all connector terminals to prevent corrosion. Wiring diagrams are provided in this section for troubleshooting and/or testing the electrical system. Specific testing and replacement information, where applicable, is also provided 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 in the following tests.

NOTE

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

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

Continuity Test

Required Tools or Equipment
Digital Multimeter, Ohmmeter, or Continuity Tester

1. Identify and locate the wire or component to be checked using the electrical schematic.

NOTE

Some meters may have a continuity tester setting that uses a buzzer to indicate continuity. See the meter operator's manual for more information.

2. If using a multimeter, set to read ohms, or set meter to continuity setting.
3. Disconnect the ends of the wire being tested.
4. Touch meter leads to the ends of the wire or to the terminals of the component to be tested.

   Does meter read less than 0.02 ohm and/or does the buzzer sound?

   YES *The wire is good.*

   NO *Proceed to step 5.*

5. Use a known good jumper wire of the correct gauge to bypass the wire in question.
6. Test the function of the circuit.

   Does the circuit now operate properly?

   YES *Replace the wire.*

   NO *Continue testing other wires and components in the circuit.*

Resistance Test

Required Tools or Equipment
Digital Multimeter or Ohmmeter

1. Identify and locate the wire or component to be checked using the electrical schematic.

NOTE

On some meters it will be necessary to select an ohms scale. Select an appropriate range for the component being tested. Refer to the specifications listed in the component test procedure.

2. If using a multimeter, set to read ohms.
3. Isolate (disconnect) the component to be tested from the circuit to prevent a false reading through the circuit.
4. Connect the meter leads to the terminals of the component being tested. Check the component test procedure for specifications and additional test conditions.

   Does the resistance through the component match the specified value listed in the test procedure?

   YES *The component is good.*

   NO *Replace the component.*

Fuses Test

See Figure 4-17.

Required Tools or Equipment
Digital Multimeter or Ohmmeter

NOTE

This procedure applies to the following fuses:

- *10A fuse (x3)*
- *15A fuse*
- *20A fuse*
- *40A fuse*

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Set the meter to read ohms.
3. Touch meter leads to each other and confirm a resistance value of 0.0 ohms.
4. Remove fuse. (See “Fuses” on page 4-60.)

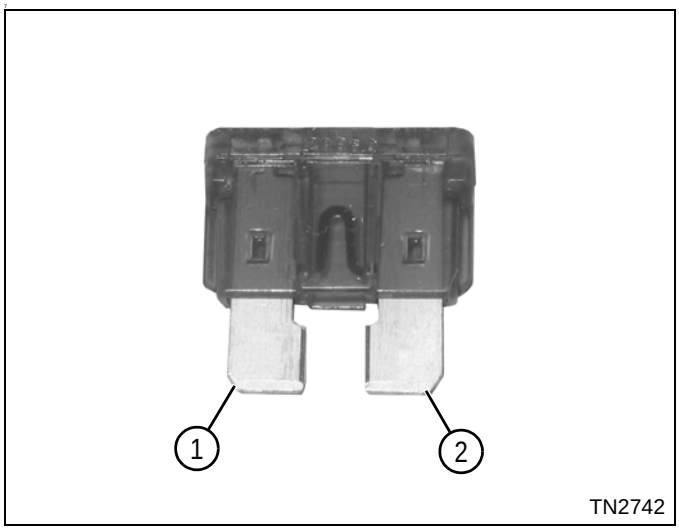


Figure 4-17

5. Measure the resistance between terminals (1 and 2).

   Is the resistance value 0.02 ohm or less?

   YES *The fuse is good.*

   NO *The fuse is faulty; replace the fuse.*

Relays Test

See Figure 4-18.

Required Tools or Equipment
• Digital Multimeter or Ohmmeter • 12-Volt DC Power Source

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove relay. (See “Relays” on page 4-60.)
3. Set the meter to read ohms.
4. Touch meter leads to each other and confirm a resistance value of 0.0 ohms.

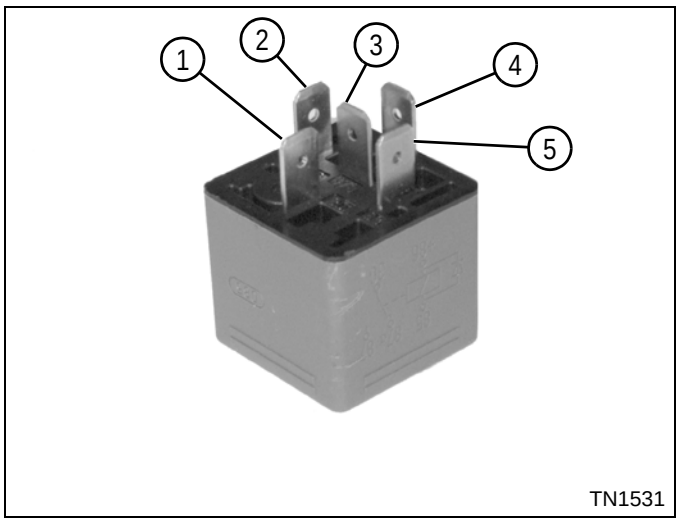


Figure 4-18

5. Measure the resistance between terminal 30 (1) and terminal 87a (3).

   Is the resistance value 0.02 ohm or less?

   YES *Proceed to step 6.*

   NO *The relay is faulty; replace the relay.*

6. Using a 12-volt DC power source, connect the positive output to terminal 86 (2) and connect the negative output to terminal 85 (5).
7. Measure the resistance between terminal 30 (1) and terminal 87 (4).

   Is the resistance value 0.02 ohm or less?

   YES *The relay is good.*

   NO *The relay is faulty; replace the relay.*

Engine Stop Relay (Gasoline)

See Figure 4-19.

Required Tools or Equipment
Digital Multimeter or Ohmmeter

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove the engine stop relay. (See “Relays” on page 4-60.)
3. Set the meter to read ohms.
4. Touch meter leads to each other and confirm a resistance value of 0.0 ohms.

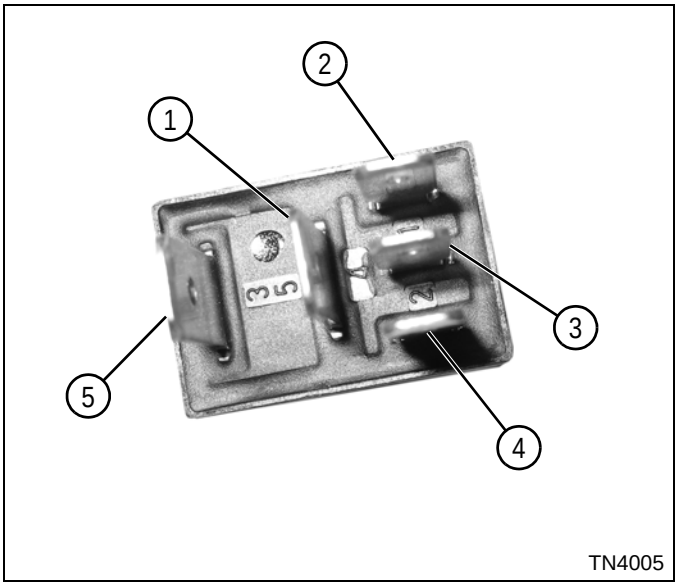


Figure 4-19

5. Measure the resistance between terminal 30 (5) and terminal 87a (3).

   Is the resistance value 0.02 ohm or less?

   YES *Proceed to step 6.*

   NO *The relay is faulty; replace the relay.*
6. Using a 12-volt DC power source, connect the positive output to terminal (2) and connect the negative output to terminal (4).
7. Measure the resistance between terminal 30 (5) and terminal 87 (1).

   Is the resistance value 0.02 ohm or less?

   YES *The relay is good.*

   NO *The relay is faulty; replace the relay.*

Key Switch Test

See Figure 4-20.

Required Tools or Equipment
Digital Multimeter or Ohmmeter

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove key switch. (See “Key Switch” on page 4-54.)
3. Set the meter to read ohms.
4. Touch meter leads to each other and confirm a resistance value of 0.0 ohms.

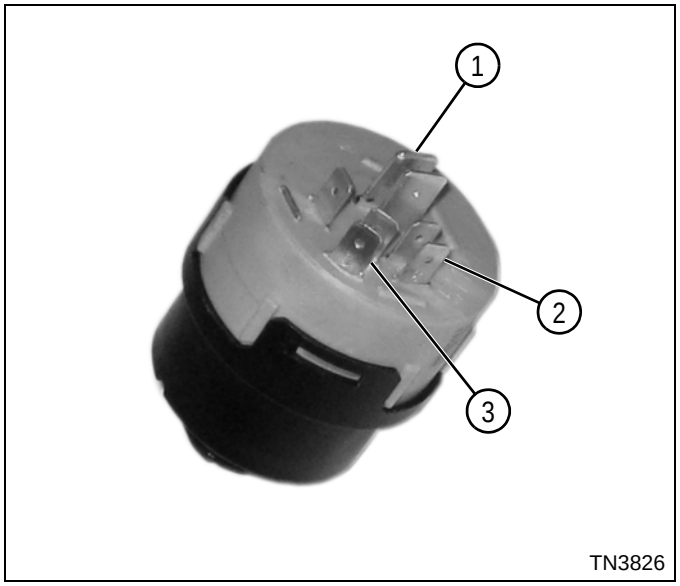


Figure 4-20

5. Move key switch to the on position.
6. Measure the resistance between terminals (1 and 2).

   Is the resistance value 0.02 ohm or less?

   YES *Proceed to step 7.*

   NO *The key switch is faulty; replace the key switch.*
7. Move key switch to the start position and measure the resistance between terminals (1 and 2, 1 and 3, and 2 and 3).

   Are the resistance values 0.02 ohm or less?

   YES *The key switch is good.*

   NO *The key switch is faulty; replace the key switch.*

Rocker Switches Test

See Figure 4-21.

Required Tools or Equipment
Digital Multimeter or Ohmmeter

NOTE

This procedure applies to the following switches:

- *Work light switch*
- *Mow switch*

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove rocker switch. (See “Rocker Switches” on page 4-53.)
3. Set the meter to read ohms.
4. Touch meter leads to each other and confirm a resistance value of 0.0 ohms.

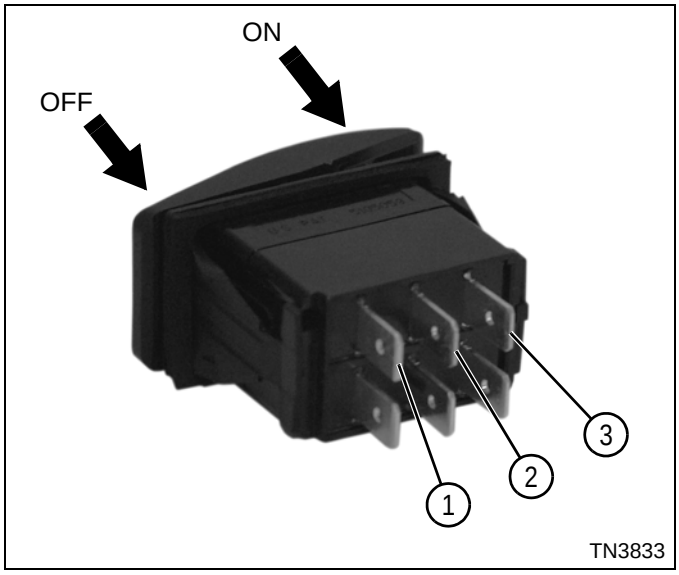


Figure 4-21

5. Place rocker switch in the on position.
6. Measure the resistance between terminals (1 and 2).

   Is the resistance value 0.02 ohm or less?

   YES *Proceed to step 7.*

   NO *The rocker switch is faulty; replace the rocker switch.*
7. Place rocker switch in the off position.
8. Measure the resistance between terminals (1 and 2).

   Is the resistance value 0.02 ohm or less?

   YES *The rocker switch is faulty; replace the rocker switch.*

   NO *Proceed to step 9.*
9. Measure the resistance between terminals (2 and 3).

   Is the resistance value 0.02 ohm or less?

   YES *Proceed to step 10.*

   NO *The rocker switch is faulty; replace the rocker switch.*
10. Place rocker switch in the on position.
11. Measure the resistance between terminals (2 and 3).

    Is the resistance value 0.02 ohm or less?

    YES *The rocker switch is faulty; replace the rocker switch.*

    NO *The rocker switch is good.*

Backlap Switch Test

See Figure 4-22.

Required Tools or Equipment
Digital Multimeter or Ohmmeter

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Rotate seat forward. (See “Rotate Seat Forward” on page 9-4.)
3. Remove backlap switch. (See “Backlap Switch” on page 4-56.)
4. Set the meter to read ohms.
5. Touch meter leads to each other and confirm a resistance value of 0.0 ohms.

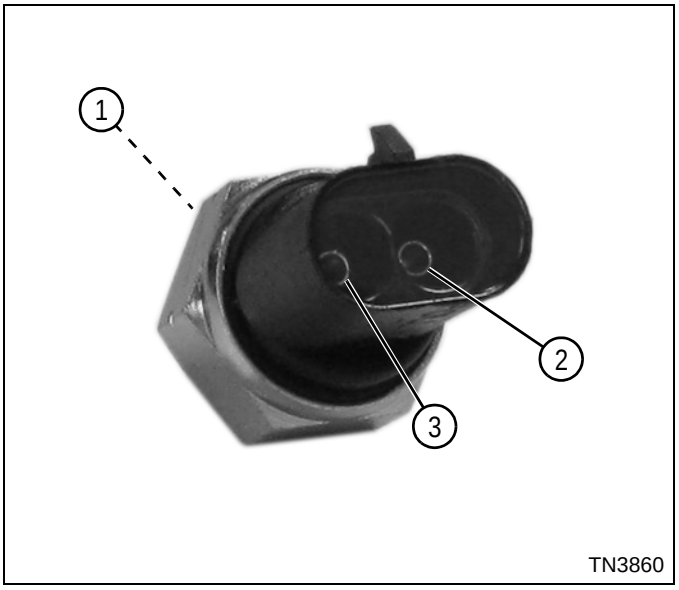


Figure 4-22

6. Measure the resistance between terminals (2 and 3).

   Is the resistance value 0.02 ohm or less?

   YES *Proceed to step 7.*

   NO *The backlap switch is faulty; replace the backlap switch.*

7. Depress and hold the plunger ball (1) on the backlap switch.
8. Measure the resistance between terminals (2 and 3).

   Is the resistance value 0.02 ohm or less?

   YES *The backlap switch is faulty; replace the backlap switch.*

   NO *The backlap switch is good.*

Horn Switch Test

See Figure 4-23.

Required Tools or Equipment
Digital Multimeter or Ohmmeter

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove horn switch. (See “Horn Switch” on page 4-54.)
3. Set the meter to read ohms.
4. Touch meter leads to each other and confirm a resistance value of 0.0 ohms.

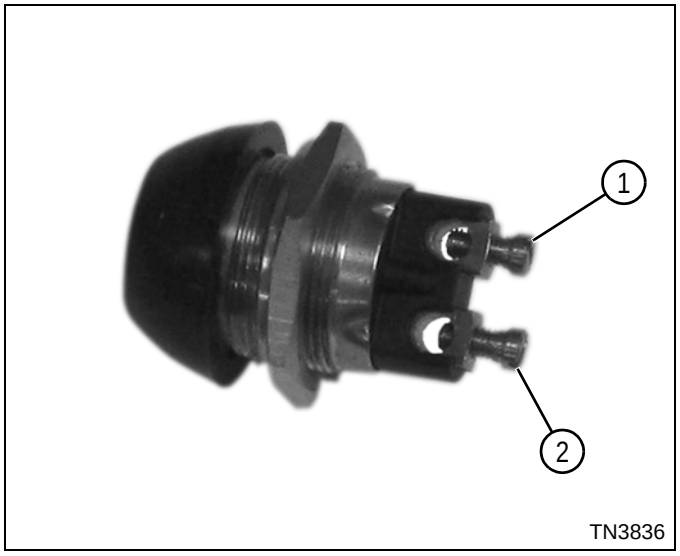


Figure 4-23

NOTE

The horn switch is normally in the off position.

5. Measure the resistance between terminals (1 and 2).

   Is the resistance value 0.02 ohm or less?

   YES *The horn switch is faulty; replace the horn switch.*

   NO *Proceed to step 7.*

6. Depress and hold horn switch in the on position.
7. Measure the resistance between terminals (1 and 2).

   Is the resistance value 0.02 ohm or less?

   YES *The horn switch is good.*

   NO *The horn switch is faulty; replace the horn switch.*

Raise/Lower Switch Assembly Test

See Figure 4-24.

Required Tools or Equipment
Digital Multimeter or Ohmmeter

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove raise/lower switch assembly. (See “Raise/Lower Switch Assembly” on page 4-55.)
3. Set the meter to read ohms.
4. Touch meter leads to each other and confirm a resistance value of 0.0 ohms.

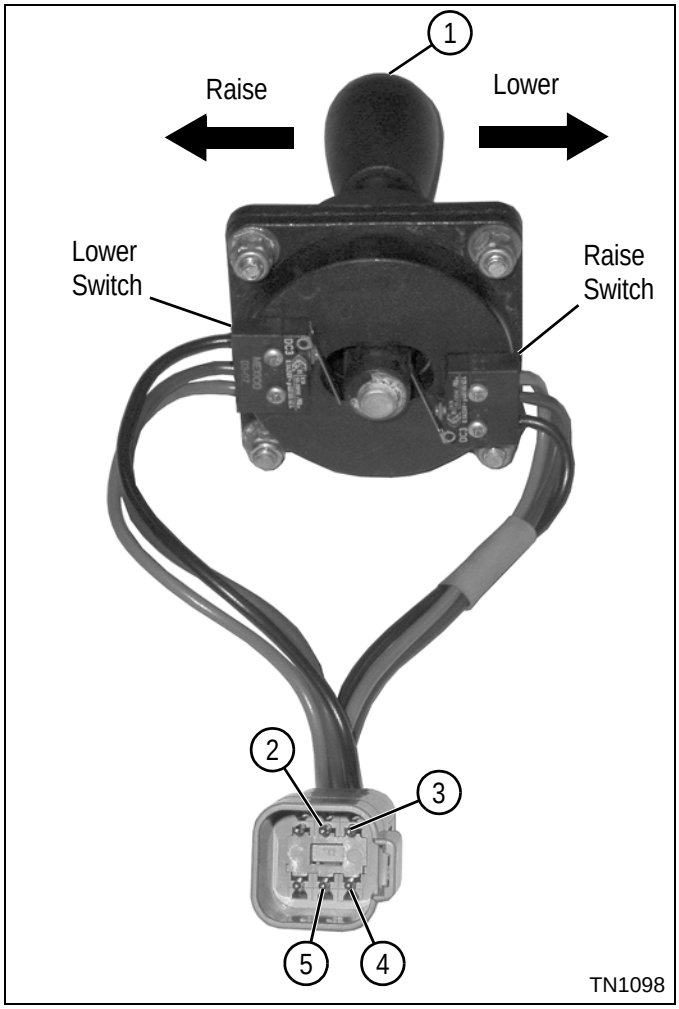


Figure 4-24

5. Measure the resistance between terminals (2 and 3).

   Is the resistance value 0.02 ohm or less?

   YES *The switch is faulty; replace the raise/lower switch assembly.*

   NO *Proceed to step 6.*

6. Move and hold the raise/lower switch assembly in the lower position and measure the resistance between terminals (2 and 3).

   Is the resistance value 0.02 ohm or less?

   YES *Proceed to step 7.*

   NO *The switch is faulty; replace the raise/lower switch assembly.*

7. Return the raise/lower switch assembly to the center (neutral) position.
8. Measure the resistance between terminals (4 and 5).

   Is the resistance value 0.02 ohm or less?

   YES *The switch is faulty; replace the raise/lower switch assembly.*

   NO *Proceed to step 9.*

9. Move and hold the raise/lower switch assembly in the raise position and measure the resistance between terminals (4 and 5).

   Is the resistance value 0.02 ohm or less?

   YES *The raise/lower switch assembly is good.*

   NO *The raise/lower switch assembly is faulty; replace the raise/lower switch assembly.*

Seat Switch Test

See Figure 4-25.

Required Tools or Equipment
Digital Multimeter or Ohmmeter

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Tag and disconnect the seat switch wire connectors.
3. Set the meter to read ohms.
4. Touch meter leads to each other and confirm a resistance value of 0.0 ohms.

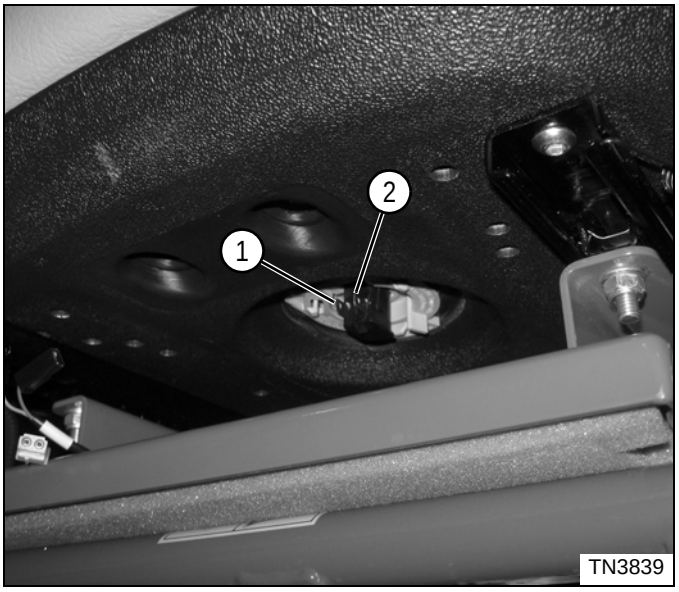


Figure 4-25

5. Measure the resistance between terminals (1 and 2).

   Is the resistance value 0.02 ohm or less?

   YES *The seat switch is faulty; replace the seat switch.*

   NO *Proceed to step 6.*

6. Depress the seat switch and measure the resistance between terminals (1 and 2).

   Is the resistance value 0.02 ohm or less?

   YES *The seat switch is good.*

   NO *The seat switch is faulty; replace the seat switch.*

Raise/Lower Solenoid Test

See Figure 4-26.

Required Tools or Equipment
Digital Multimeter or Ohmmeter

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove solenoid. (See “Lower Solenoid” on page 4-61 or “Raise Solenoid” on page 4-62.)
3. Set the meter to read ohms.
4. Touch meter leads to each other and confirm a resistance value of 0.0 ohms.

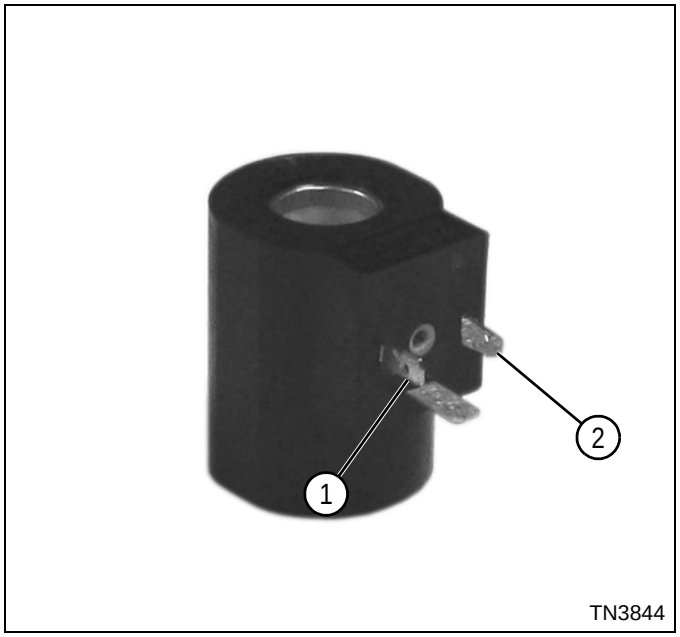


Figure 4-26

NOTE

On some meters it will be necessary to select a range for the solenoid being tested.

5. Measure the resistance between terminals (1 and 2). Refer to the specifications listed for the specific solenoid resistance.
   - Raise Solenoid Coil— 5.6 ohms ± 10% at 72° F (22° C)
   - Lower Solenoid Coil— 5.6 ohms ± 10% at 72° F (22° C)

   Does the resistance value match the specified value listed?

   YES *The solenoid is good.*

   NO *The solenoid is faulty; replace the solenoid.*

Mow Solenoid Test

See Figure 4-27.

Required Tools or Equipment
Digital Multimeter or Ohmmeter

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove mow solenoid. (See “Mow Solenoid” on page 4-62.)
3. Set the meter to read ohms.
4. Touch meter leads to each other and confirm a resistance value of 0.0 ohms.

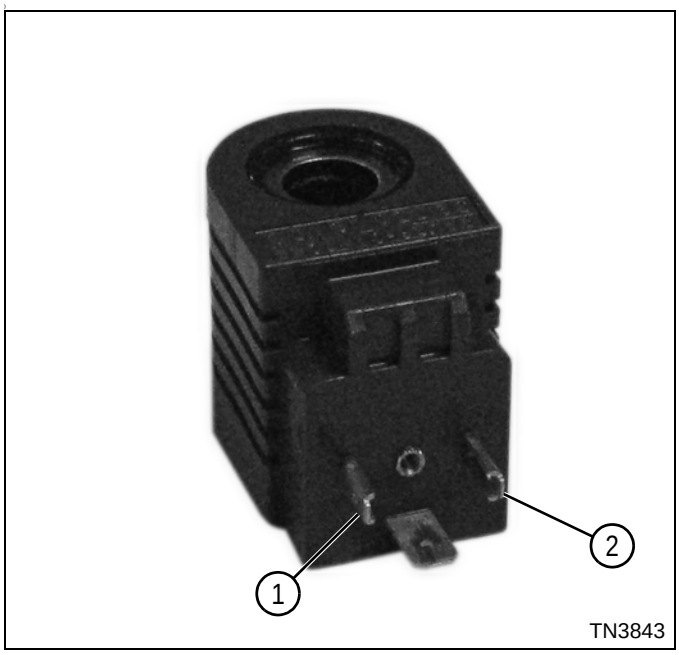


Figure 4-27

NOTE

On some meters it will be necessary to select a range for the solenoid being tested.

5. Measure the resistance between terminals (1 and 2).

   Is the resistance value approximately 9 ohms?

   YES *The solenoid is good.*

   NO *The solenoid is faulty; replace the solenoid.*

Fuel Shutoff Solenoid Test

See Figure 4-28.

Required Tools or Equipment
Digital Multimeter or Ohmmeter

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Set the meter to read ohms.
3. Touch meter leads to each other and confirm a resistance value of 0.0 ohms.

NOTE

Air intake removed for picture clarity.

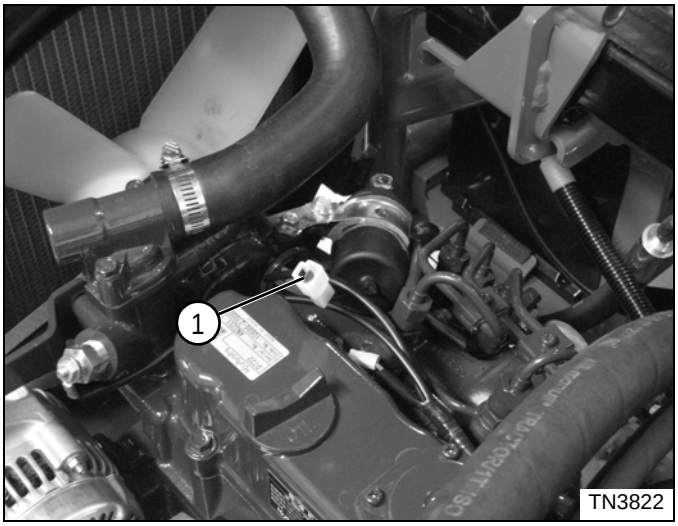


Figure 4-28

4. Tag and disconnect the fuel shutoff solenoid wire connector (1).
5. Measure the resistance between terminal (1) and ground.

   Is the resistance value approximately 1 ohm?

   YES *Fuel shutoff solenoid is good.*

   NO *The fuel shutoff solenoid is faulty; replace the fuel shutoff solenoid.*

Fuel Shutoff Timer Test

See Figure 4-29.

Required Tools or Equipment
• Digital Multimeter • 12-Volt DC Power Source

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove fuel shutoff timer. (See “Fuel Shutoff Timer” on page 4-64.)
3. Set the digital multimeter to read DC voltage.

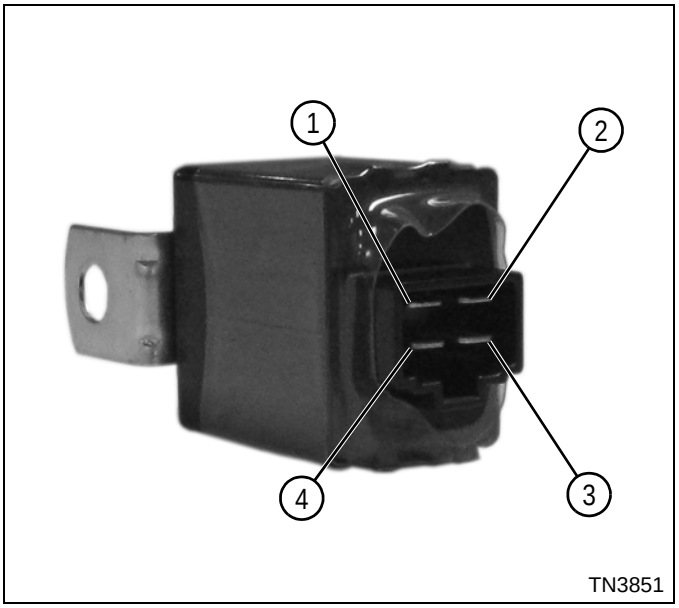


Figure 4-29

NOTE

The fuel shutoff timer must be positioned vertically with the connector end facing down to properly perform this test.

4. Using a 12-volt DC power source, connect the positive output terminal to terminals (1 and 2) and connect negative output to terminal (3).
5. Connect the red test lead to terminal (4).
6. Connect the black test lead to terminal (3).
7. Measure voltage between terminals (3 and 4).

   Is approximately 12 volts indicated?

   YES *The timer is faulty; replace the fuel shutoff timer.*

   NO *Proceed to step 8.*
8. Disconnect the positive output from terminal (1).
9. Measure the voltage between terminals (3 and 4).

   Is approximately 12 volts indicated?

   YES *Proceed to step 10.*

   NO *The fuel shutoff timer is faulty; replace the fuel shutoff timer.*
10. Wait approximately 7 seconds. Measure the voltage between terminals (3 and 4).

    Is 0 volts indicated?

    YES *The fuel shutoff timer is good.*

    NO *The fuel shutoff timer is faulty; replace the fuel shutoff timer.*

Carb Solenoid Test (Gasoline)

See Figure 4-30.

Required Tools or Equipment
Digital Multimeter or Ohmmeter

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.).
2. Set the meter to read ohms.
3. Touch meter leads to each other and confirm a resistance value of 0.0 ohms.

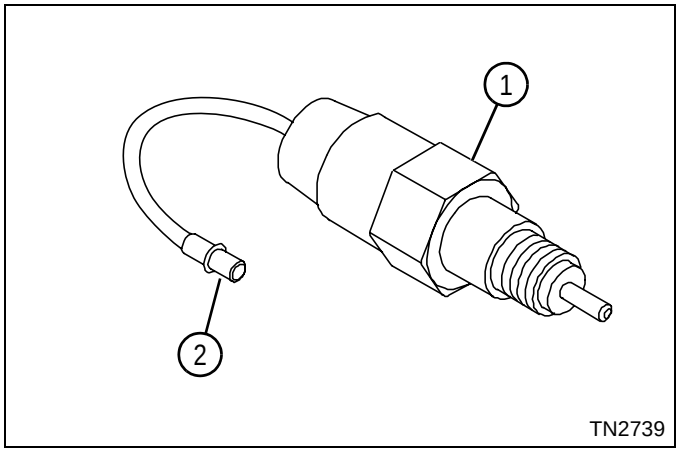


Figure 4-30

4. Tag and disconnect the carb solenoid wire connector (2).
5. Measure the resistance between terminal (2) and ground (1).

   Is the resistance value within 40 ohms ± 10% at 68° F (20° C)?

   YES *The carb solenoid is good.*

   NO *The carb solenoid is faulty; replace the carb solenoid.*

Mow/Transport Switch Adjustment

See Figures 4-31 through 4-33.

Required Tools or Equipment
Digital Multimeter or Ohmmeter

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.
3. Remove instrument panel cover. (See “Instrument Panel Cover” on page 9-13.)

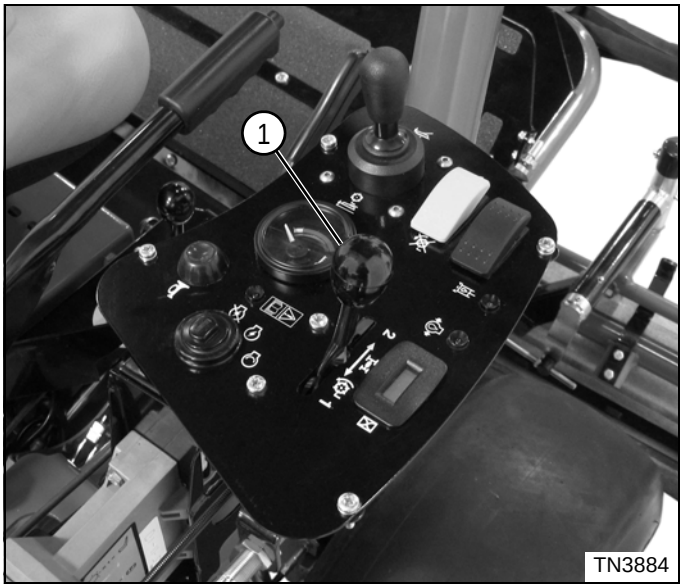


Figure 4-31

4. Position the traction lever (1) in the mow position.

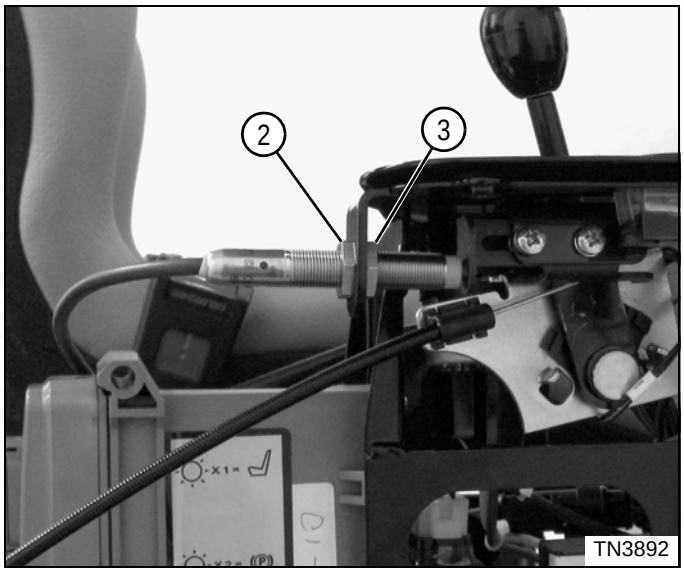


Figure 4-32

5. Loosen nuts (2 and 3).

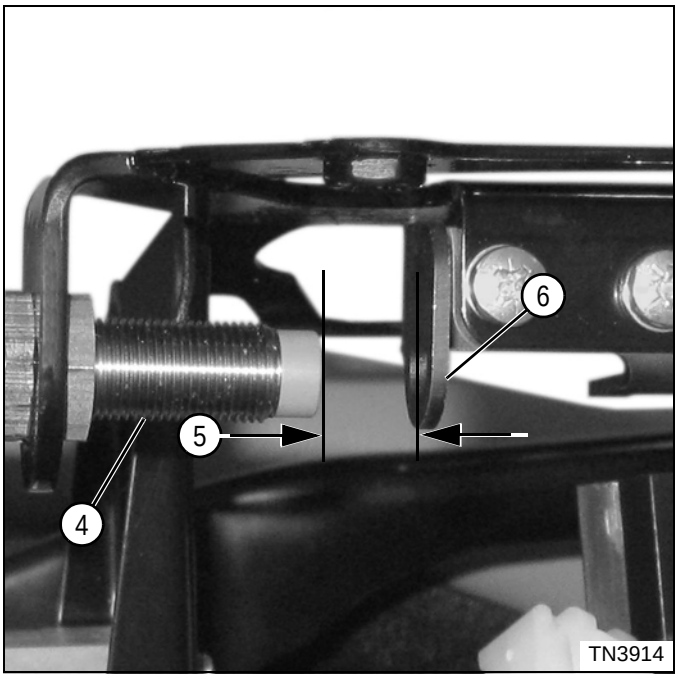


Figure 4-33

6. Adjust mow/transport switch (4) to obtain an air gap (5) of 0.157 in. (4 mm) between the mow/transport switch (4) and the mount slide plate (6).
7. Tighten nuts (2 and 3).

Repair

Control Module

Removal and Installation

See Figure 4-34.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.
3. Remove instrument panel cover. (See “Instrument Panel Cover” on page 9-13.)

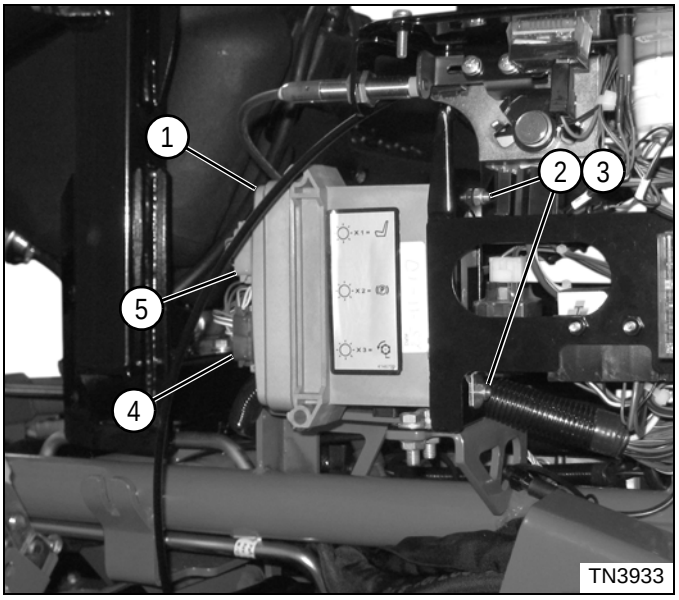


Figure 4-34

NOTE

Label all wires before disconnecting to ensure correct installation.

4. Disconnect control module wire connectors (4 and 5).
5. Remove screws (2) and nuts (3).
6. Remove control module (1).

Installation Notes

- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*
- *Install control module by reversing the order of removal.*

Battery Cover

Removal and Installation

See Figure 4-35.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

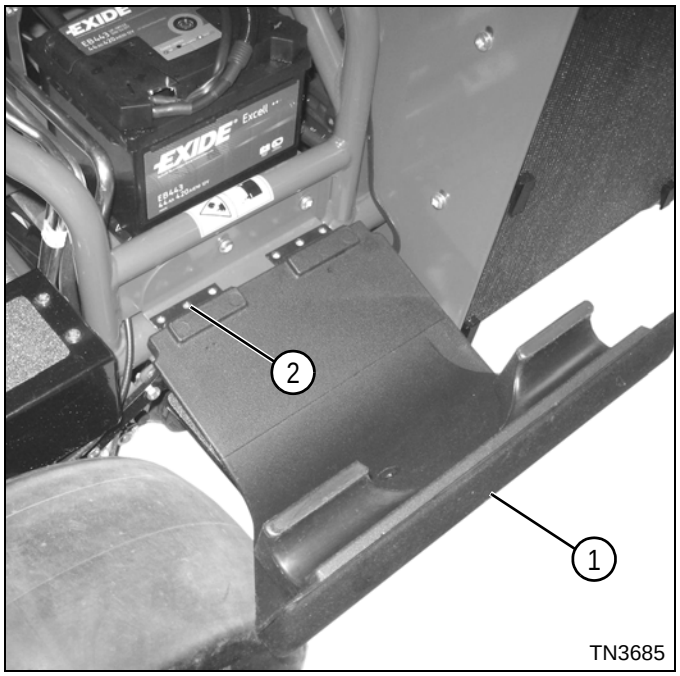


Figure 4-35

2. Fully open battery cover (1).
3. Remove six screws (2).
4. Remove battery cover.

Installation Note

Install battery cover by reversing the order of removal.

Battery

Removal and Installation

See Figure 4-36.

WARNING

- **Battery posts, terminals, and related accessories contain lead and lead compounds. Wash your hands after handling.**
- **Always wear eye protection when servicing battery.**

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Open battery cover.

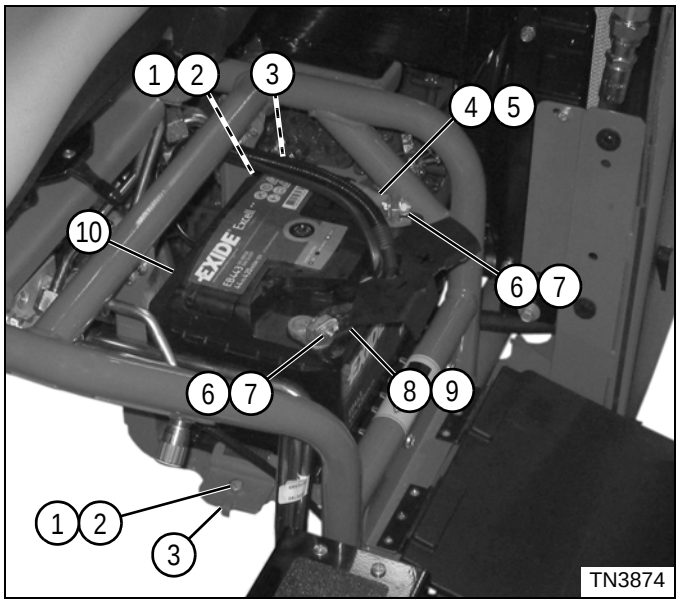


Figure 4-36

WARNING

Always disconnect the negative terminal first and positive terminal last. Connect positive terminal first and negative terminal last. Use care when testing live circuits to prevent arcing. Arcing could result in death or serious injury.

3. Remove nut (6) and screw (7), and disconnect negative (–) battery cables (4 and 5).
4. Remove nut (6) and screw (7), and disconnect positive (+) battery cables (8 and 9).
5. Remove nuts (1), screws (2), and retainer brackets (3) from battery tray.

NOTICE

Never place used batteries in the garbage. Dispose of used batteries in accordance with all applicable regulations.

6. Remove battery (10).

Installation Note

Install battery by reversing the order of removal.

Alternator

Removal and Installation

See Figure 4-37.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.
3. Raise hydraulic oil/fuel tank. (See “Raise Hydraulic Oil/Fuel Tank” on page 9-4.)

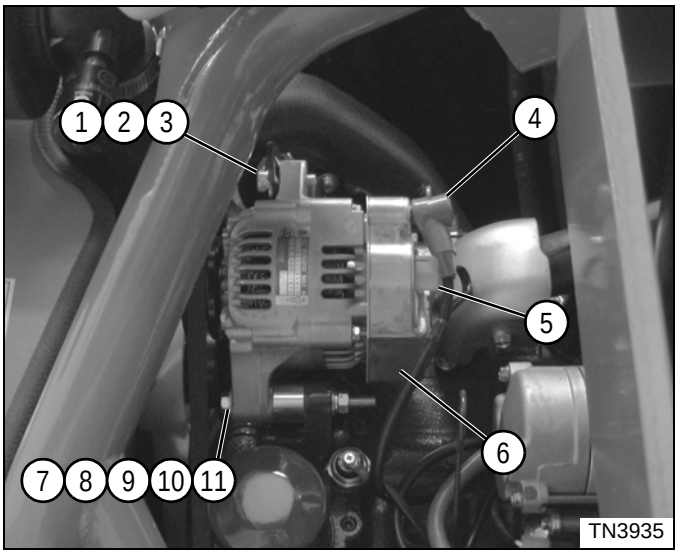


Figure 4-37

NOTE

Label all wires before disconnecting to ensure correct installation.

4. Disconnect wire connectors (4 and 5).
5. Support alternator (6).
6. Remove screw (1), lock washer (2), and flat washer (3).
7. Remove screw (7), flat washers (8 and 9), lock washer (10), and nut (11).
8. Remove alternator.

Installation Notes

- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*
- *Install alternator by reversing the order of removal.*
- *Adjust fan belt tension. (See "Fan Belt (Diesel)" on page 3-7.)*

Starter Motor

Removal and Installation

See Figure 4-38.

1. Park the mower safely. (See "Park Mower Safely" on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.

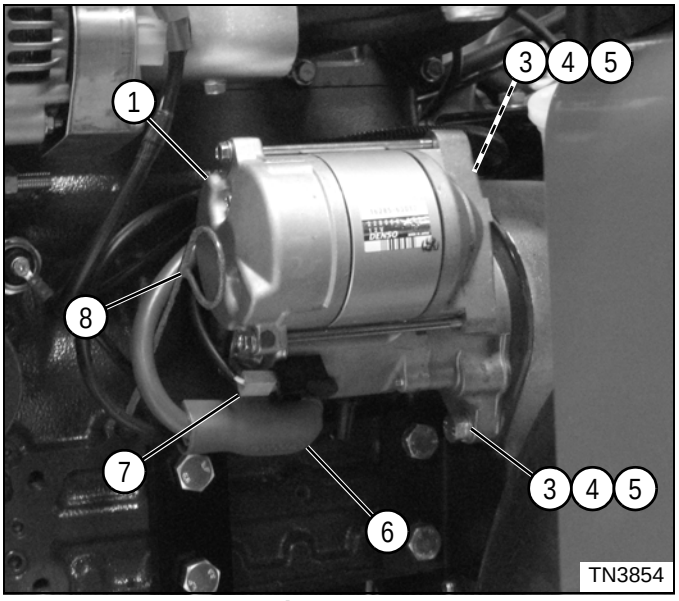


Figure 4-38

NOTE

Label all wires before disconnecting to ensure correct installation.

3. Disconnect wire connectors (6 and 7) from starter motor (1).
4. Remove engine oil dipstick (8).
5. Support starter motor.
6. Remove screws (3), lock washers (4), and flat washers (5).
7. Remove starter motor.

Installation Note

Install starter motor by reversing the order of removal.

Instrument Panel

Removal and Installation

See Figure 4-39.

NOTE

If servicing individual components, it is not always necessary to completely remove the instrument panel.

1. Park the mower safely. (See "Park Mower Safely" on page 1-6.)
2. Remove instrument panel cover. (See "Instrument Panel Cover" on page 9-13.)

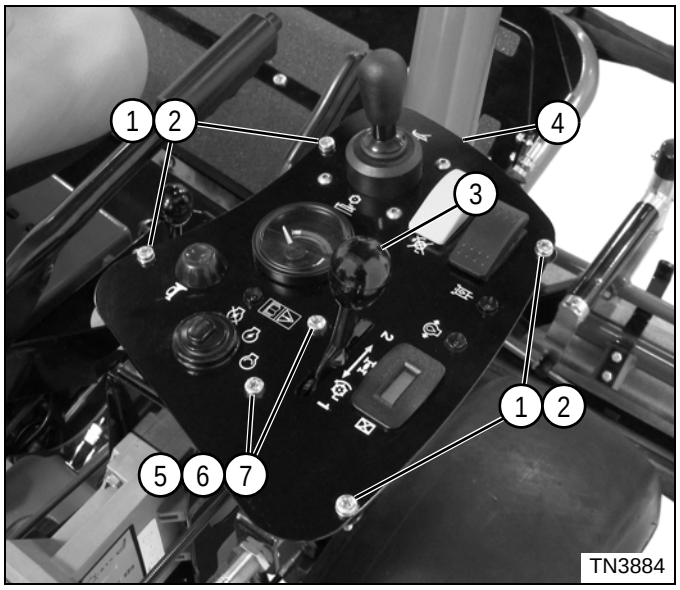


Figure 4-39

3. Remove mow/traction selector knob (3).
4. Remove screws (1) and washers (2).
5. Remove two screws (5), washers (6), and nuts (7).

NOTES

If moving the instrument panel aside, use caution to prevent stretching or pinching the wires.

6. Lift and move instrument panel (4) aside or service components as needed.

Installation Notes

- *Anti-seize compound must be applied to screw threads when installing instrument panel.*
- *Use new cable ties to secure wire connectors and wire harness.*
- *Install instrument panel by reversing the order of removal.*

Rocker Switches

Removal and Installation

See Figures 4-40 and 4-41.

NOTE

This procedure applies to the following switches:

- *Mow switch (1)*
- *Light switch (2)*

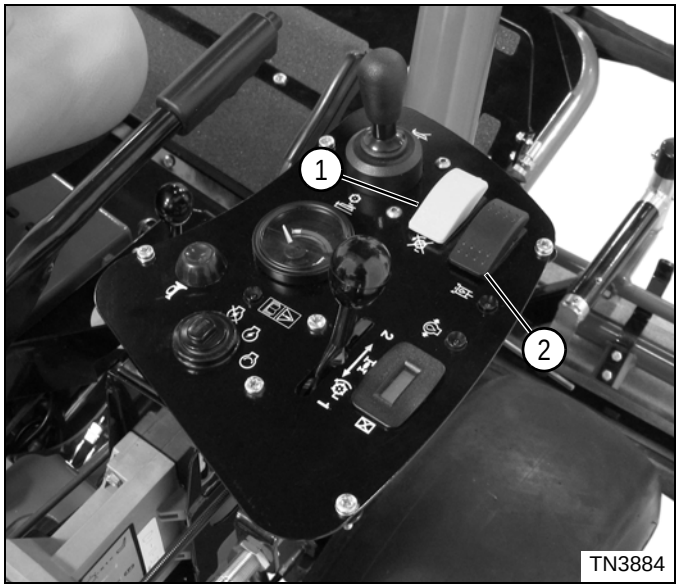


Figure 4-40

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.
3. Remove instrument panel cover. (See “Instrument Panel Cover” on page 9-13.)

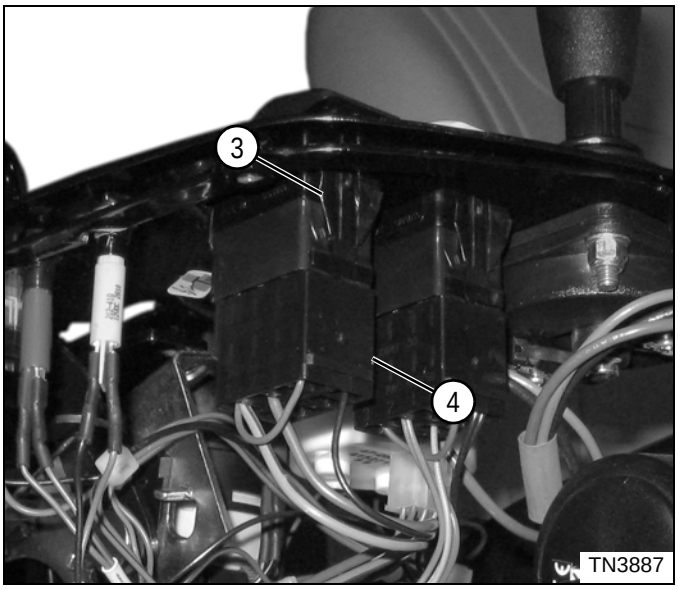


Figure 4-41

4. Disconnect wire connector (4).
5. Depress taps (3) on each side of rocker switch and remove rocker switch from instrument panel.

Installation Notes

- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*
- *Use new cable ties to secure wire connectors and wire harness.*
- *Install rocker switches by reversing the order of removal.*

Horn Switch

Removal and Installation

See Figure 4-42.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.
3. Remove instrument panel cover. (See “Instrument Panel Cover” on page 9-13.)
4. Remove instrument panel. (See “Instrument Panel” on page 4-52.)

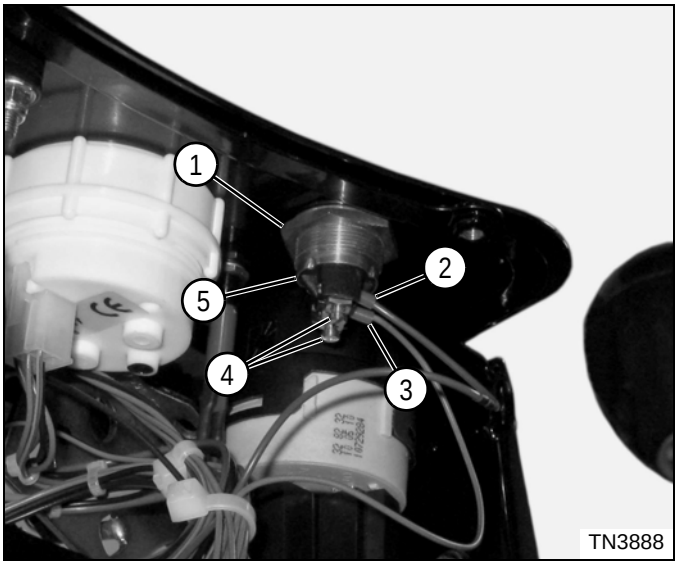


Figure 4-42

NOTES

- *Note orientation of horn switch to ensure correct installation.*
- *Label all wires before disconnecting to ensure correct installation.*

5. Loosen wire hold-down screws (4) on horn switch (5).
6. Disconnect wires (2 and 3).
7. Remove horn retainer nut (1), and remove horn from instrument panel.

Installation Note

Install horn switch by reversing the order of removal.

Key Switch

Removal and Installation

See Figures 4-43 and 4-44.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.
3. Remove instrument panel cover. (See “Instrument Panel Cover” on page 9-13.)
4. Remove instrument panel. (See “Instrument Panel” on page 4-52.)

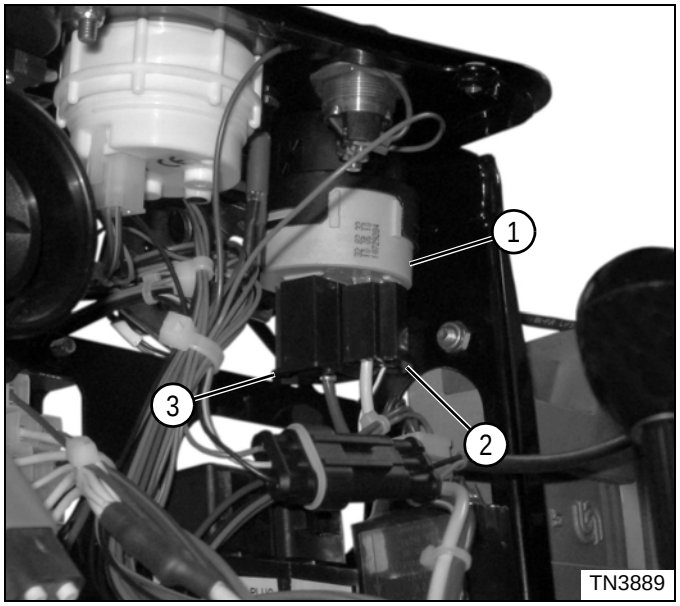


Figure 4-43

NOTES

- *Note orientation of the key switch to ensure correct installation.*
- *Label all wires before disconnecting to ensure correct installation.*

5. Remove key.
6. Disconnect wire connectors (2 and 3) from key switch (1).

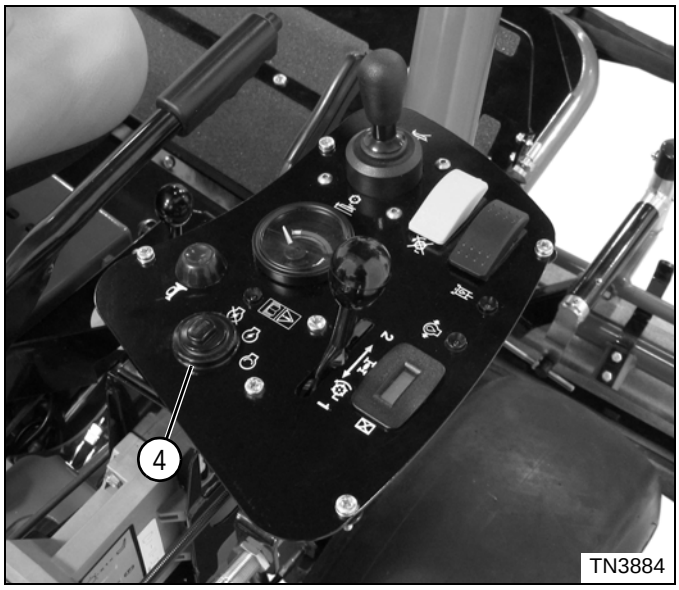


Figure 4-44

7. Remove retaining nut (4).
8. Remove key switch.

Installation Notes

- *Key switch has mounting tabs that fit into the instrument panel. When installing, make sure key switch is properly mounted.*
- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*
- *Use new cable ties to secure wire connectors and wire harness.*
- *Install key switch by reversing the order of removal.*

Raise/Lower Switch Assembly

Removal and Installation

See Figure 4-45.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.
3. Remove instrument panel cover. (See “Instrument Panel Cover” on page 9-13.)
4. Remove instrument panel. (See “Instrument Panel” on page 4-52.)

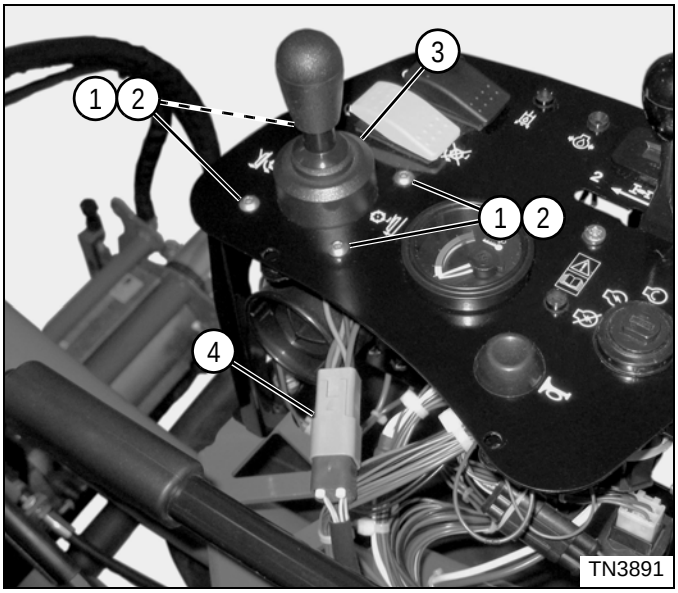


Figure 4-45

NOTES

- *Note orientation of the raise/lower switch assembly to ensure correct installation.*
- *Label all wires before disconnecting to ensure correct installation.*

5. Remove screws (1) and nuts (2).
6. Disconnect wire connector (4).
7. Remove raise/lower switch assembly (3).

Installation Notes

- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*
- *Use new cable ties to secure wire connectors and wire harness.*
- *Install raise/lower switch assembly by reversing the order of removal.*

Mow/Transport Switch

Removal and Installation

See Figures 4-46 and 4-47.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.
3. Remove instrument panel cover. (See “Instrument Panel Cover” on page 9-13.)

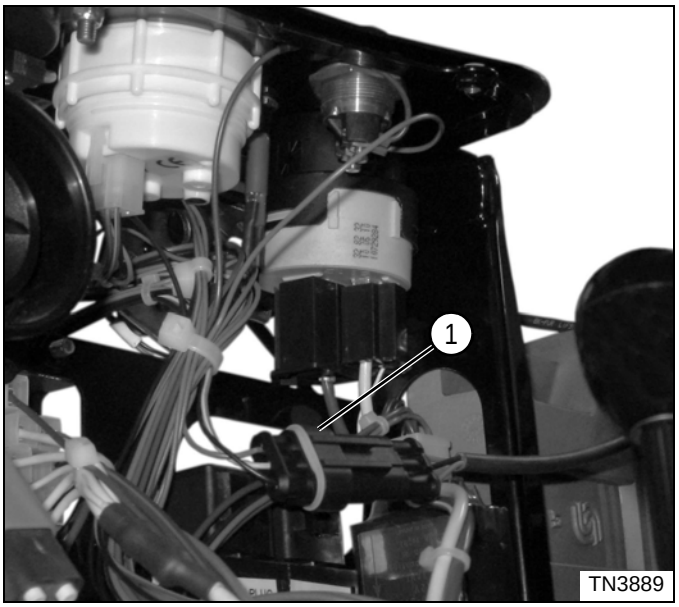


Figure 4-46

NOTE

Label all wires before disconnecting to ensure correct installation.

4. Disconnect wire connector (1).

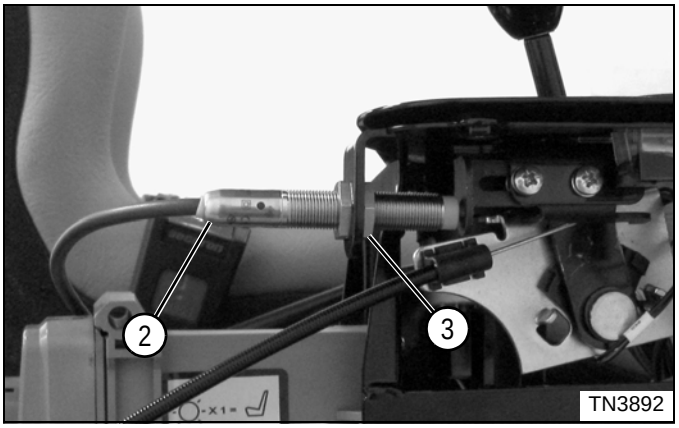


Figure 4-47

5. Remove nut (3).
6. Remove mow/transport switch (2).

Installation Notes

- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*
- *Use new cable ties to secure wire connectors and wire harness.*
- *Install mow/transport switch assembly by reversing the order of removal.*
- *Adjust the mow/transport switch. (See “Mow/Transport Switch Adjustment” on page 4-49.)*

Backlap Switch

Removal and Installation

See Figure 4-48.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.
3. Rotate seat forward. (See “Rotate Seat Forward” on page 9-4.)

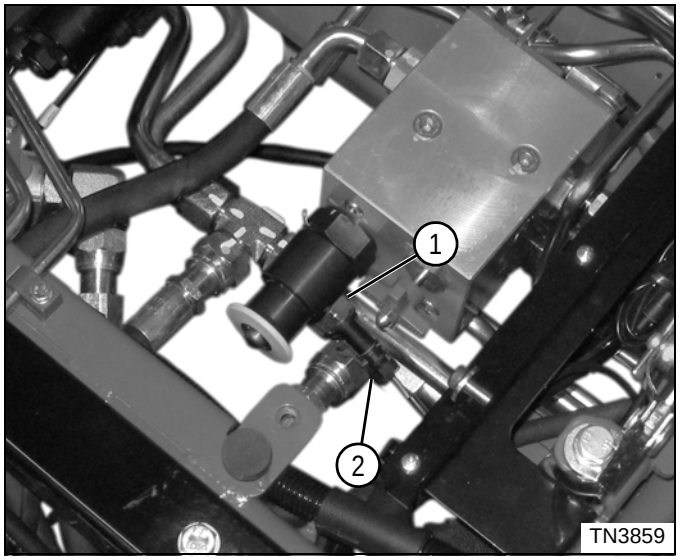


Figure 4-48

NOTE

Label all wires before disconnecting to ensure correct installation.

4. Disconnect wire connector (2).
5. Remove backlap switch (1).

Installation Notes

- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*
- *Tighten backlap switch to 3–5 lb-ft (4–7 N·m).*
- *Install backlap switch by reversing the order of removal.*

Engine Oil Pressure Switch (Diesel)

Removal and Installation

See Figure 4-49.

CAUTION

Engine components will become hot during operation. Allow engine components to cool before performing service.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.

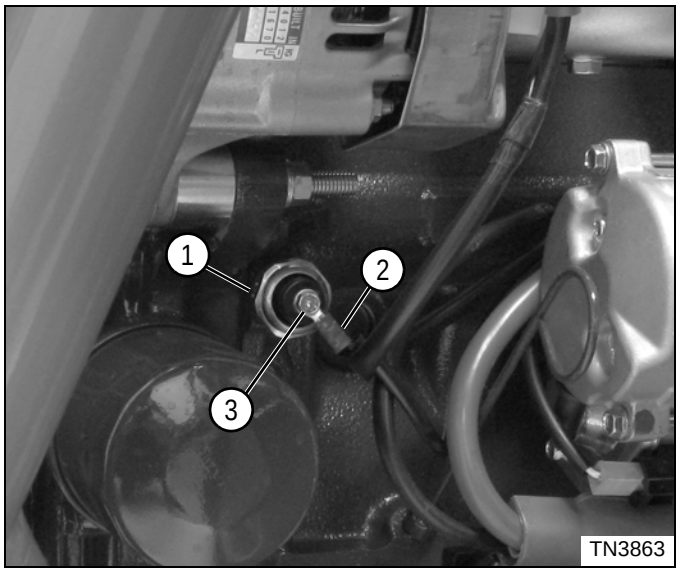


Figure 4-49

NOTE

Label all wires before disconnecting to ensure correct installation.

3. Remove screw (3) and disconnect wire (2) from engine oil pressure switch (1).
4. Remove engine oil pressure switch.

Installation Notes

Required Materials
Telfon® Tape

- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*
- *Apply Teflon tape to the threads of the oil pressure switch before installing.*
- *Install engine oil pressure switch by reversing the order of removal.*

Engine Oil Pressure Switch (Gasoline)

Removal and Installation

See Figure 4-50.

CAUTION

Engine components will become hot during operation. Allow engine components to cool before performing service.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.

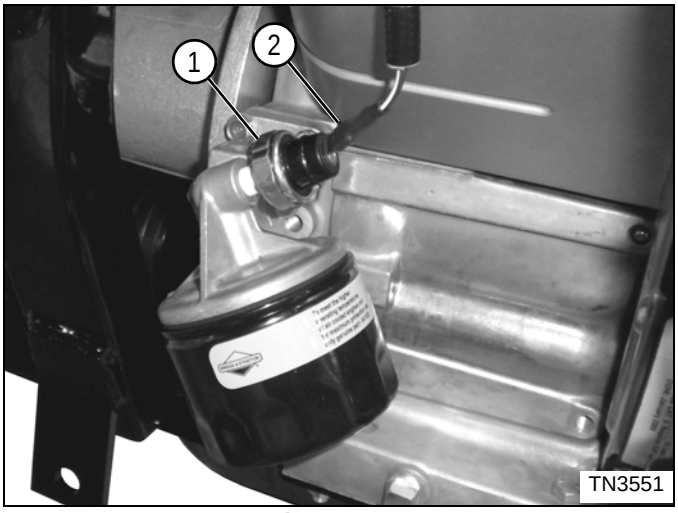


Figure 4-50

NOTE

Label all wires before disconnecting to ensure correct installation.

3. Disconnect wire (2) from the engine oil pressure switch (1).

4. Remove engine oil pressure switch.

Installation Notes

Required Materials
Telfon® Tape

- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*
- *Apply Teflon tape to the threads of the oil pressure switch before installing.*
- *Install engine oil pressure switch by reversing the order of removal.*

Hydraulic Oil Charge Filter Pressure Switch

Removal and Installation

See Figure 4-51.

WARNING

The hydraulic system is under pressure, and the oil may be hot!

- **Always allow the machine to cool completely before performing service.**
- **Always relieve pressure in the hydraulic system before performing service.**
- **Always use appropriate safety equipment and clothing to protect exposed skin and eyes from high-pressure oil.**
- **Tighten all connections to proper specifications before applying pressure.**
- **Never use bare hands to check for leaks! Oil under pressure can penetrate the skin and can cause gangrene within a few hours if not properly removed. Use a piece of cardboard to check for leaks.**

Failure to follow appropriate safety precautions may result in death or serious injury.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.
3. Rotate seat forward. (See “Rotate Seat Forward” on page 9-4.)
4. Disconnect hydraulic oil charge filter assembly. (See “Hydraulic Oil Charge Filter Assembly” on page 6-59.)

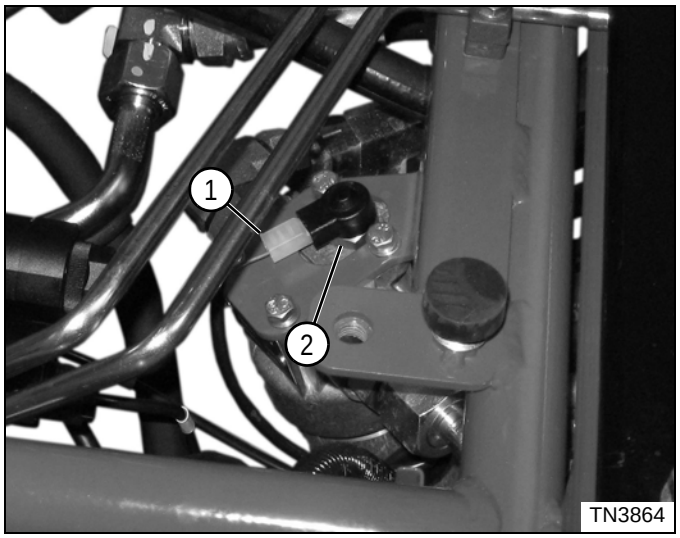


Figure 4-51

NOTE

Label all wires before disconnecting to ensure correct installation.

5. Disconnect wire connector (1).
6. Remove hydraulic oil charge filter pressure switch (2).

Installation Notes

Required Materials
Telfon® Tape

- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*
- *Apply Teflon® tape to the threads of the hydraulic oil charge filter pressure switch before installing.*
- *Install hydraulic filter pressure switch by reversing the order of removal.*

12V Accessory Socket

Removal and Installation

See Figures 4-52 through 4-55.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.
3. Remove instrument panel cover. (See “Instrument Panel Cover” on page 9-13.)

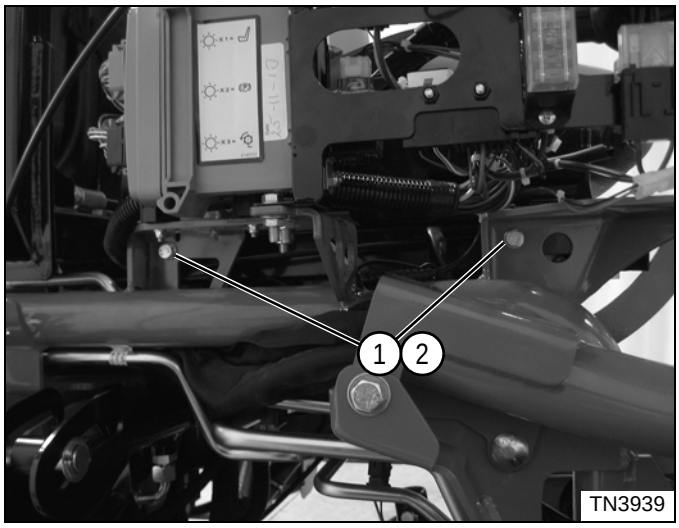


Figure 4-52

4. Remove screws (1) and flat washers (2).

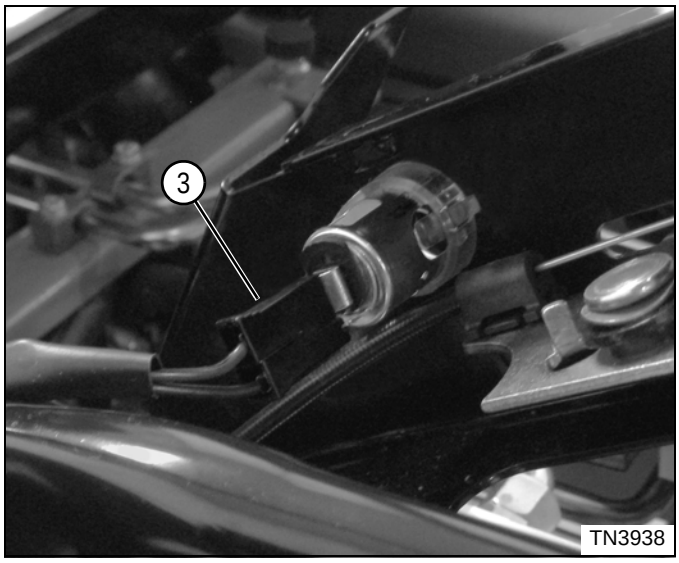


Figure 4-53

NOTE

Label all wires before disconnecting to ensure correct installation.

5. Disconnect wire connector (3).

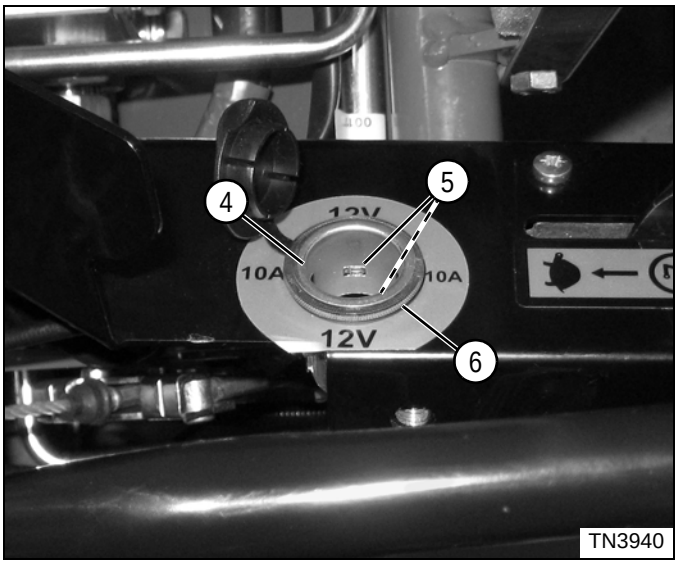


Figure 4-54

NOTE

Note orientation of the 12V accessory socket insert to ensure correct installation.

6. Press tabs (5) and pull up on 12V accessory socket insert (4), removing it from 12V accessory socket base (6).

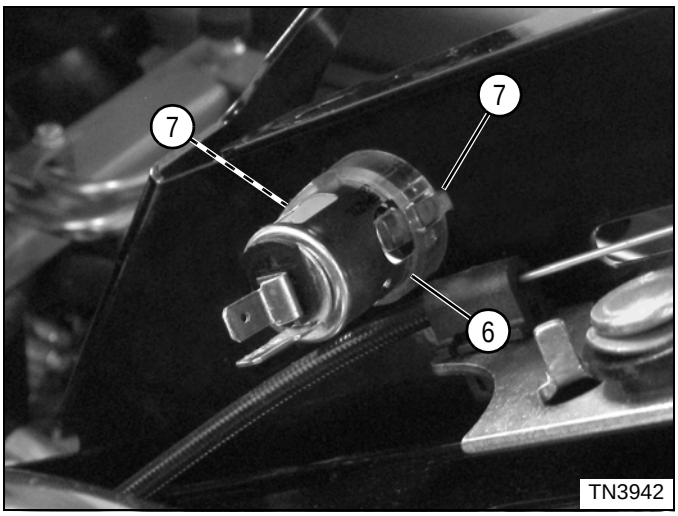


Figure 4-55

NOTE

Note orientation of the 12V accessory socket base to ensure correct installation.

7. Press tabs (7) and push 12V accessory socket base (6) through instrument panel.

Installation Notes

- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*
- *Use new cable ties to secure wire connectors and wire harness.*
- *Install the 12V accessory socket by reversing the order of removal.*

Fuses

Removal and Installation

See Figure 4-56.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.
3. Remove instrument panel cover. (See “Instrument Panel Cover” on page 9-13.)

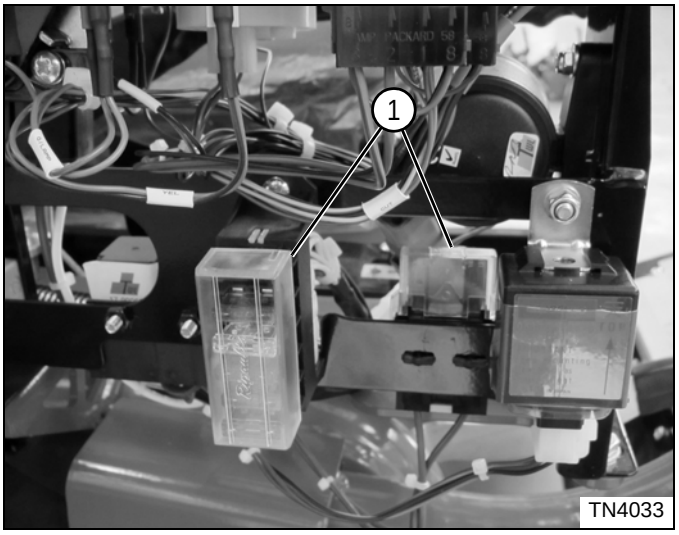


Figure 4-56

4. Remove fuse cover (1).
5. Locate correct fuse.
6. Remove fuse.

Installation Note

Install fuse(s) by reversing the order of removal.

Relays

Removal and Installation

See Figure 4-57.

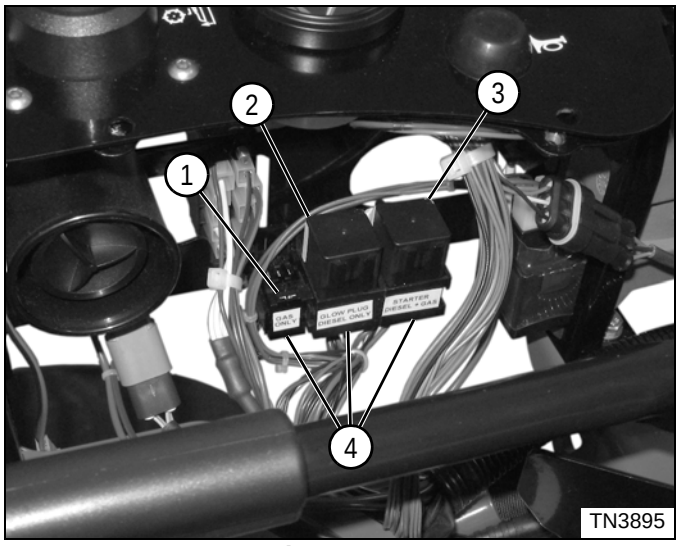


Figure 4-57

NOTES

Engine stop relay not shown.

This procedure applies to the following relays:

- *Engine stop relay (gasoline models) (1)*
- *Glow plug relay (2)*
- *Start relay (3)*

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.
3. Remove instrument panel cover. (See “Instrument Panel Cover” on page 9-13.)
4. Locate correct relay.
5. Pull relay straight up and out of relay base (4).

Installation Note

Install relay(s) by reversing the order of removal.

Engine Temperature Sensor

Removal and Installation

See Figure 4-58.

WARNING

Engine coolant is hot and under pressure! Allow the cooling system to cool completely before performing service.

Rotate the filler cap 1/2 turn counterclockwise and allow pressure to vent before removing filler cap.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.
3. Raise hydraulic oil/fuel tank. (See “Raise Hydraulic Oil/Fuel Tank” on page 9-4.)

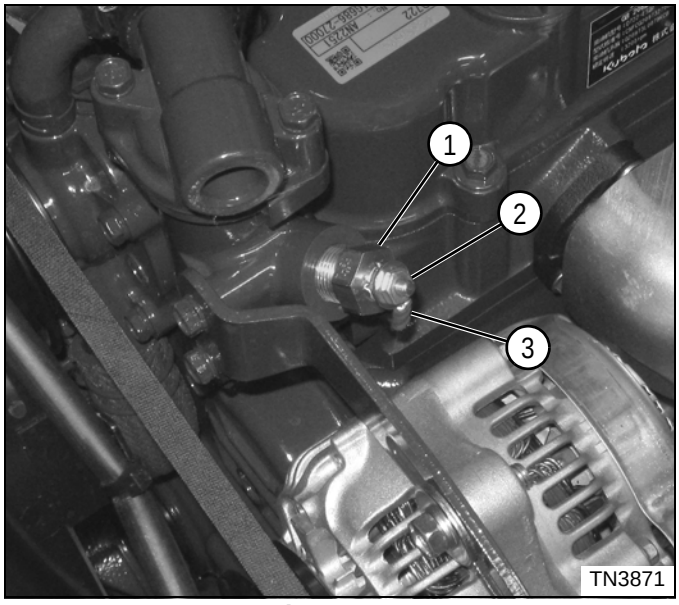


Figure 4-58

NOTE

Label all wires before disconnecting to ensure correct installation.

4. Remove nut (2) and disconnect wire (3) from engine temperature sensor (1).
5. Remove engine temperature sensor.

Installation Notes

Required Materials
Telfon® Tape

- *Apply Teflon tape to the threads of the engine temperature sensor before installing.*
- *Install engine temperature sensor by reversing the order of removal.*

Lower Solenoid

Removal and Installation

See Figure 4-59.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.
3. Rotate seat forward. (See “Rotate Seat Forward” on page 9-4.)
4. Remove lift valve. (See “Lift Valve” on page 6-46.)

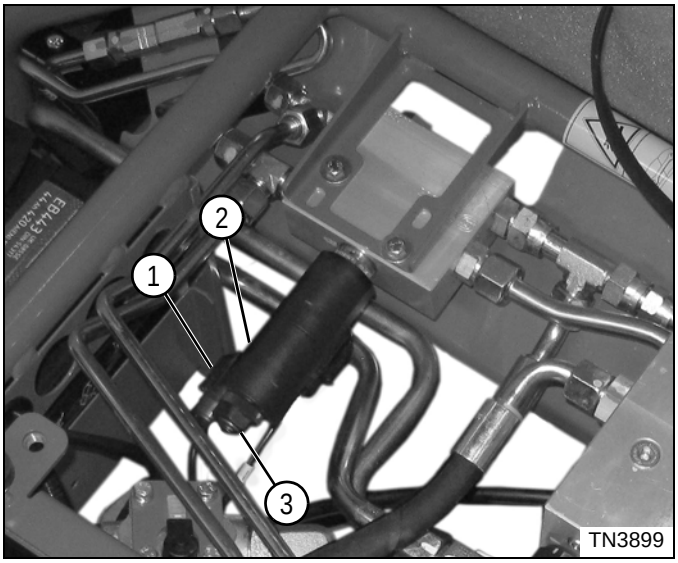


Figure 4-59

NOTE

Label all wires before disconnecting to ensure correct installation.

5. Remove nut (3).
6. Loosen connector hold-down screw and disconnect wire connector (1).
7. Remove lower solenoid (2).

Installation Notes

- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*
- *Use new cable ties to secure wire connectors and wire harness.*
- *Install lower solenoid by reversing the order of removal.*
- *Tighten nut (3) to 7 lb-ft. (10 N·m).*

Raise Solenoid

Removal and Installation

See Figure 4-60.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.
3. Remove lower solenoid. (See “Lower Solenoid” on page 4-61.)

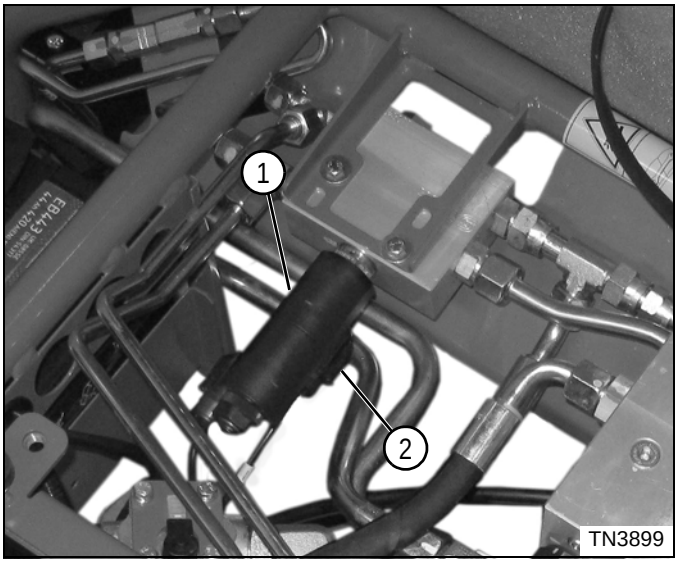


Figure 4-60

NOTE

Label all wires before disconnecting to ensure correct installation.

4. Loosen connector hold-down screw and disconnect wire connector (2).
5. Remove raise solenoid (1).

Installation Notes

- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*
- *Use new cable ties to secure wire connectors and wire harness.*
- *Install raise solenoid by reversing the order of removal.*

Mow Solenoid

Removal and Installation

See Figure 4-61.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.

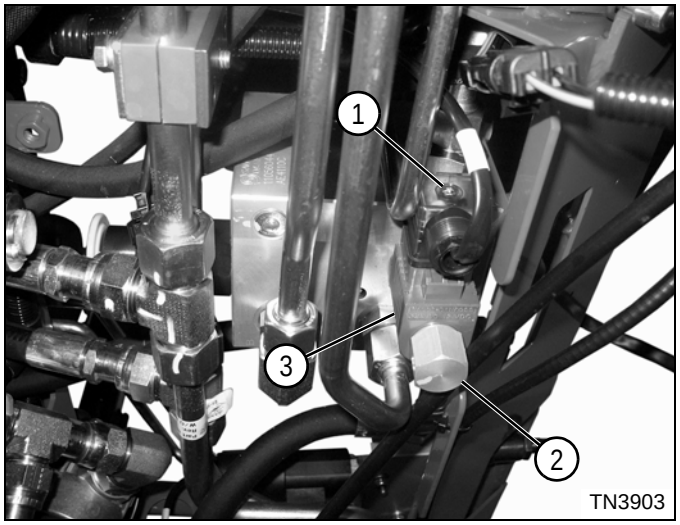


Figure 4-61

3. Loosen connector hold-down screw and disconnect wire connector (1).
4. Remove nut (2).
5. Remove mow solenoid (3).

Installation Notes

- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*
- *Use new cable ties to secure wire connectors and wire harness.*
- *Install mow solenoid by reversing the order of removal.*
- *Tighten nut (2) to 65–75 lb-in. (7–8 N·m).*

Fuel Shutoff Solenoid

Removal and Installation

See Figure 4-62.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.
3. Raise hydraulic oil/fuel tank. (See “Raise Hydraulic Oil/Fuel Tank” on page 9-4.)

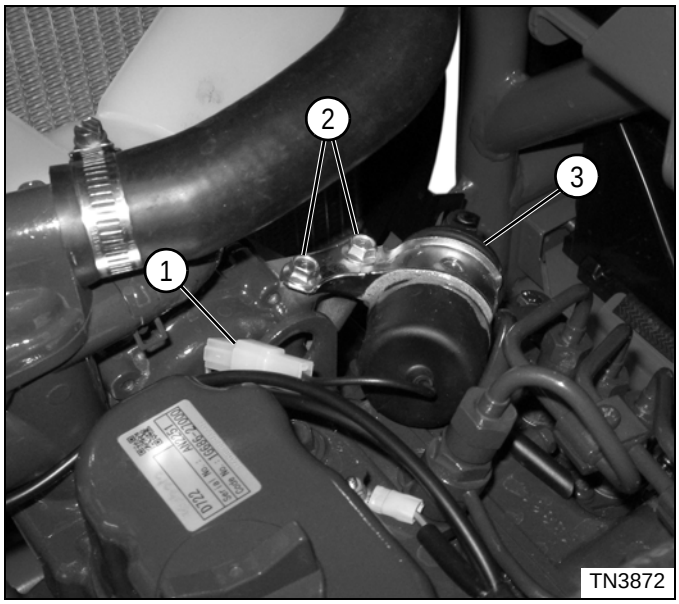


Figure 4-62

NOTE

Label all wires before disconnecting to ensure correct installation.

4. Disconnect wire connector (1).
5. Remove two screws (2).
6. Remove fuel shutoff solenoid (3).

Installation Notes

- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*
- *Use new cable ties to secure wire connectors and wire harness.*
- *Install fuel shutoff solenoid by reversing the order of removal.*

Warning Lights

Removal and Installation

See Figures 4-63 and 4-64.

NOTE

This procedure applies to the following warning lights:

- *Alarm light (1)*
- *Engine oil pressure light (3)*
- *Hydraulic oil pressure light (2)*

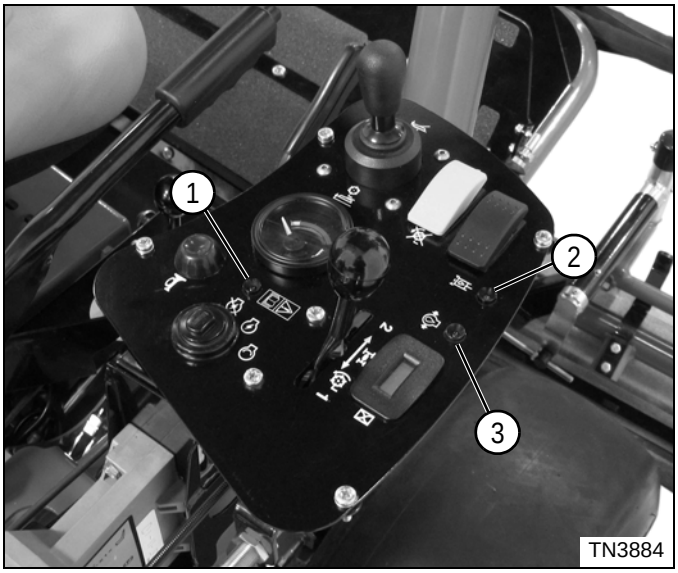


Figure 4-63

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.
3. Remove instrument panel cover. (See “Instrument Panel Cover” on page 9-13.)
4. Remove instrument panel. (See “Instrument Panel” on page 4-52.)

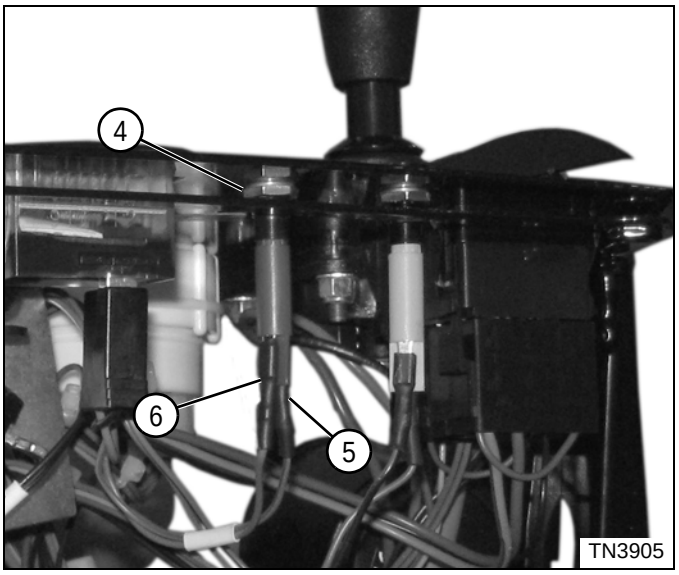


Figure 4-64

NOTE

Label all wires before disconnecting to ensure correct installation.

5. Locate correct warning light.
6. Disconnect wire connectors (5 and 6).
7. Remove nut (4).
8. Remove warning light.

Installation Note

Install warning lights by reversing the order of removal.

Fuel Shutoff Timer

Removal and Installation

See Figure 4-65.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.
3. Remove instrument panel cover. (See “Instrument Panel Cover” on page 9-13.)

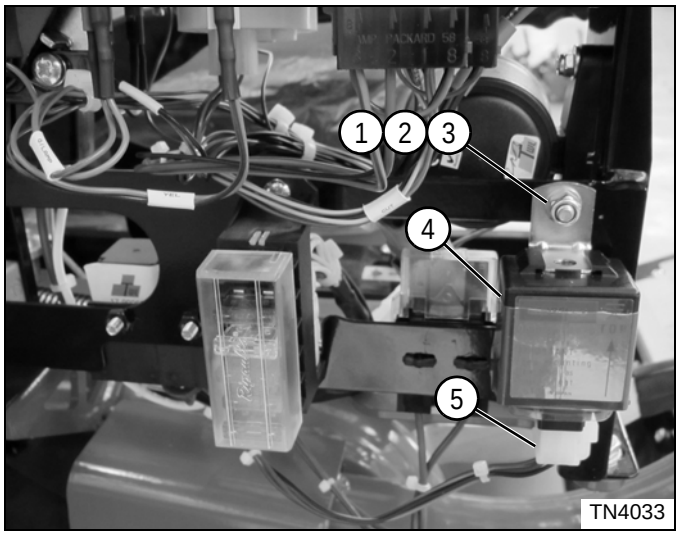


Figure 4-65

NOTE

Label all wires before disconnecting to ensure correct installation.

4. Disconnect wire connector (5).
5. Remove screw (1), nut (2), and two washers (3), and remove fuel shutoff timer (4).

Installation Notes

- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*
- *Use new cable ties to secure wire connectors and wire harness.*
- *Install fuel shutoff timer by reversing the order of removal.*

Hour Meter

Removal and Installation

See Figure 4-66.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.
3. Remove instrument panel cover. (See “Instrument Panel Cover” on page 9-13.)

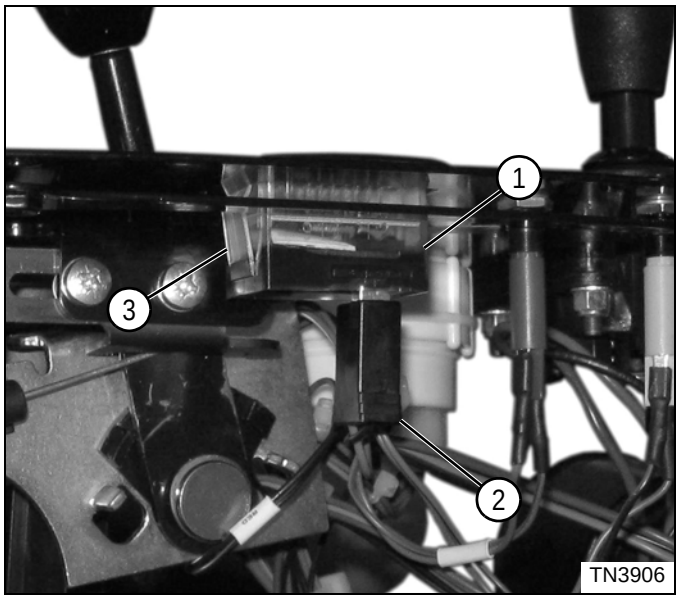


Figure 4-66

NOTE

Label all wires before disconnecting to ensure correct installation.

4. Disconnect wire connector (2).
5. Depress tabs (3) on each side of hour meter (1) and remove hour meter from instrument panel.

Installation Notes

- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*
- *Use new cable ties to secure wire connectors and wire harness.*
- *Install hour meter by reversing the order of removal.*

Horn

Removal and Installation

See Figure 4-67.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable at the battery.
3. Remove instrument panel cover. (See “Instrument Panel Cover” on page 9-13.)

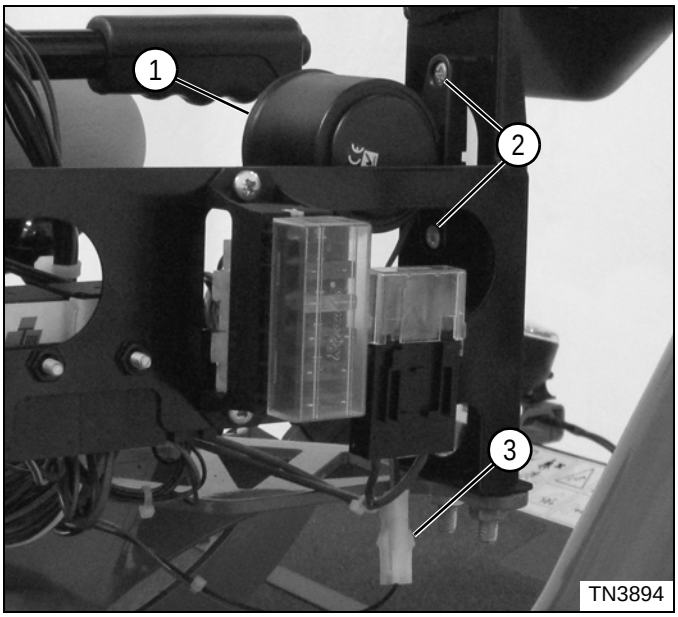


Figure 4-67

NOTE

Label all wires before disconnecting to ensure correct installation.

4. Disconnect wire connector (3).
5. Remove two screws (2) and remove horn (1).

Installation Notes

- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*
- *Install horn by reversing the order of removal.*

Chapter 5

Hydrostatic Power Train

5

JACOBSEN
A Textron Company

Specifications

Test Specifications

Specification		
Traction Pump Flow	gpm (lpm)	13.5 (51) @ 3400 rpm
Charge Pump Flow	gpm (lpm)	5 (19) @ 3400 rpm
Gear Pump Flow	gpm (lpm)	5.8 (22) @ 3400 rpm
Implement Relief Pressure	psi (bar)	800 ± 10% (55 ± 10%) @ 3400 rpm
Charge Pressure	psi (bar)	150–210 (10–14) @ 3400 rpm
Hydrostatic Leakage Percentage Ranges		0–10% = Good 11–20% = Marginal 21% and Beyond = Bad

Repair Specifications

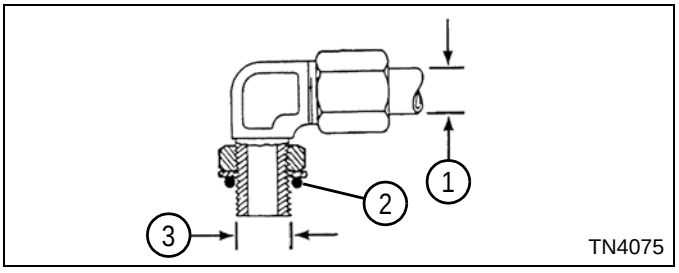
Specification		
Traction Pump—Port “V1” Fitting Torque	lb-ft (N·m)	27 (37)
Traction Pump—Port “S” Fitting Torque	lb-ft (N·m)	77 (105)
Traction Pump—Port “L1” Fitting Torque	lb-ft (N·m)	55 (74)
Traction Pump—Ports “A” and “B” Fitting Torque	lb-ft (N·m)	55 (74)
Flushing Valve—Relief Valve Torque	lb-ft (N·m)	44 (60)
Flushing Valve—Check Valve Torque	lb-ft (N·m)	44 (60)
Flushing Valve—Port “RW1” Fitting Torque	lb-ft (N·m)	77 (105)
Flushing Valve—Port “RW2” Fitting Torque	lb-ft (N·m)	77 (105)
Flushing Valve—Port “PP” Fitting Torque	lb-ft (N·m)	27 (37)
Flushing Valve—Port “DR” Fitting Torque	lb-ft (N·m)	27 (37)
Front Wheel Motor—Mounting Screw Torque	lb-ft (N·m)	59–66 (80–90)
Front Wheel Motor—Inlet Port Fitting Torque	lb-ft (N·m)	77 (105)
Front Wheel Motor—Outlet Port Fitting Torque	lb-ft (N·m)	77 (105)
Front Wheel Motor—Case Drain Port Fitting Torque	lb-ft (N·m)	27 (37)
Front Wheel Motor—End Cover Screw Torque	lb-ft (N·m)	50–55 (68–75)
Rear Wheel Motor—Mounting Screw Torque	lb-ft (N·m)	59–66 (80–90)
Rear Wheel Motor—Inlet Port Fitting Torque	lb-ft (N·m)	77 (105)
Rear Wheel Motor—Outlet Port Fitting Torque	lb-ft (N·m)	77 (105)
Rear Wheel Motor—End Cover Screw Torque	lb-ft (N·m)	50–55 (68–75)

Hydraulic Hose, Tube, and Fitting General Instructions

O-Ring Installation

- Always install new O-rings.
- On hoses with O-ring fittings, make sure O-rings are properly seated before tightening.
- O-rings should be lubricated with the fluid to be used in the system prior to assembly.

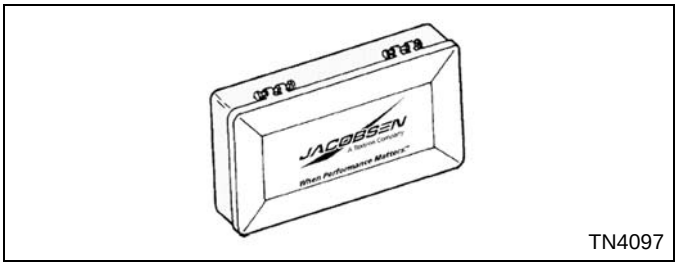
Boss Fitting O-Ring Installation



1 Tubing O.D. or Hose I.D. 2 O-Ring 3 Thread Size

5

O-Ring Seal Kits



- SAE Boss O-Ring Kit Jacobsen PN 5002452
- O-Ring Face Seal (ORS) O-Ring Kit PN 5002454
- Common O-Ring Sizes Kit PN 5002453

Replacement O-Rings for ORS (Face Seal) Fittings

ORS (Face Seal) Tube Size	ORS (Face Seal) O-Ring Size	Jacobsen Part Number
4	11	339908
6	12	339909
8	14	339910
10	16	339911
12	18	339912
16	21	339913
20	25	339914
24	29	339915

Replacement O-Rings for O-Ring Boss Fittings

Tubing O.D. or Hose I.D.	Thread Size	Jacobsen Part Number
1/8	5/16-24	459290
3/16	3/8-24	459291
1/4	7/16-20	339896
5/16	1/2-20	459293
3/8	9/16-18	339897
1/2	3/4-16	339898
5/8	7/8-14	339899
3/4	1-1/16-12	339900
7/8	1-3/16-12	459296
1	1-5/16-12	339901
1-1/4	1-5/8-12	339902
1-1/2	1-7/8-12	339903
2	2-1/2-12	459300

Hydraulic Hose Installation

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 the hose to twist; hold the hose in a normal straight position.

When installing 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.

Hydraulic Hose and Tube Torque Values

Size		lb-ft		N·m	
Dash	Fractional	Min	Max	Min	Max
-4	1/4	10	12	14	16
-6	3/8	18	20	24	27
-8	1/2	32	40	43	54
-10	5/8	46	56	60	75
-12	3/4	65	80	90	110
-16	1	92	105	125	240
-20	1-1/4	125	140	170	190
-24	1-1/2	150	180	200	246

Portable In-Line Filter

See Figure 5-1.

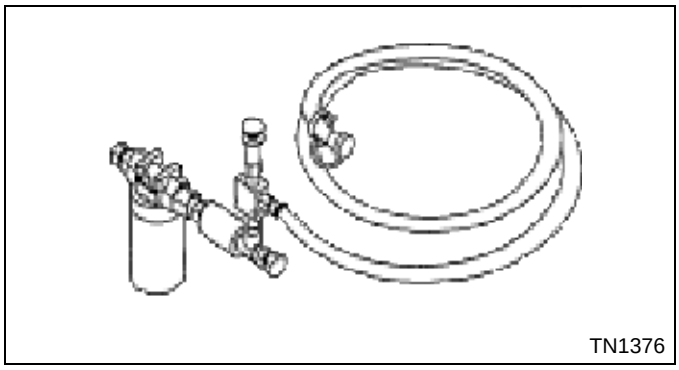


Figure 5-1

When hydraulic components fail internally, debris from the failed component can spread throughout the hydraulic system and cause additional damage.

This situation can be magnified when dealing with a closed-loop traction system, where oil is not filtered. In the event of a traction system component failure, it is recommended that all traction system components be disassembled and cleaned, or filtered using a portable in-line filter available through your Jacobsen Dealer. The portable in-line filter should also be used when testing hydraulic systems or after replacing a failed component.

IMPORTANT

Always install the in-line filter so oil flows through the filter before entering a component. Once filtering has begun, never reverse the flow of oil, or debris will re-enter the system.

Component Location

See Figure 5-2.

1 Traction Pump
2 Gear Pump
3 Front Wheel Motor (2)

Figure 5-2: Component Location

Theory of Operation and Sub-Circuit Schematics

Traction Circuit—Neutral Schematic and Theory of Operation (2WD Models)

System Conditions:

- Engine running
- Park brake released
- Traction pedal in the neutral position

Charge Pressure Circuit

The charge pump and traction pump are both driven by the engine. The charge pump is mounted between the rotating group and rear valve plate assembly in the traction pump housing. It supplies oil to the traction pump/circuit. Oil is drawn from the hydraulic tank through the charge filter and enters the charge pump.

The charge filter uses a 10-micron filter to remove debris from the oil. If the charge filter becomes plugged, a 29 psi (2.0 bar) pressure switch will activate the “Filter Blocked” LED on the instrument panel. The charge filter will be bypassed when the pressure exceeds 51 psi (3.5 bar).

Oil from the charge pump is routed to the 150–210 psi (10–15 bar) charge relief valve, the 800 psi (55 bar) implement relief valve, and the two check valves.

The charge relief valve regulates the charge pressure applied to the traction pump/circuit. When the incoming charge pressure oil reaches 150–210 psi (10–15 bar), the charge pressure relief valve will open, venting excess flow back to the hydraulic tank via the steering unit and oil cooler.

The excess charge pump supply is used to operate the steering circuit. The 800 psi (55 bar) implement relief valve is used to allow intermittent operation of the charge pump at 800 psi (55 bar).

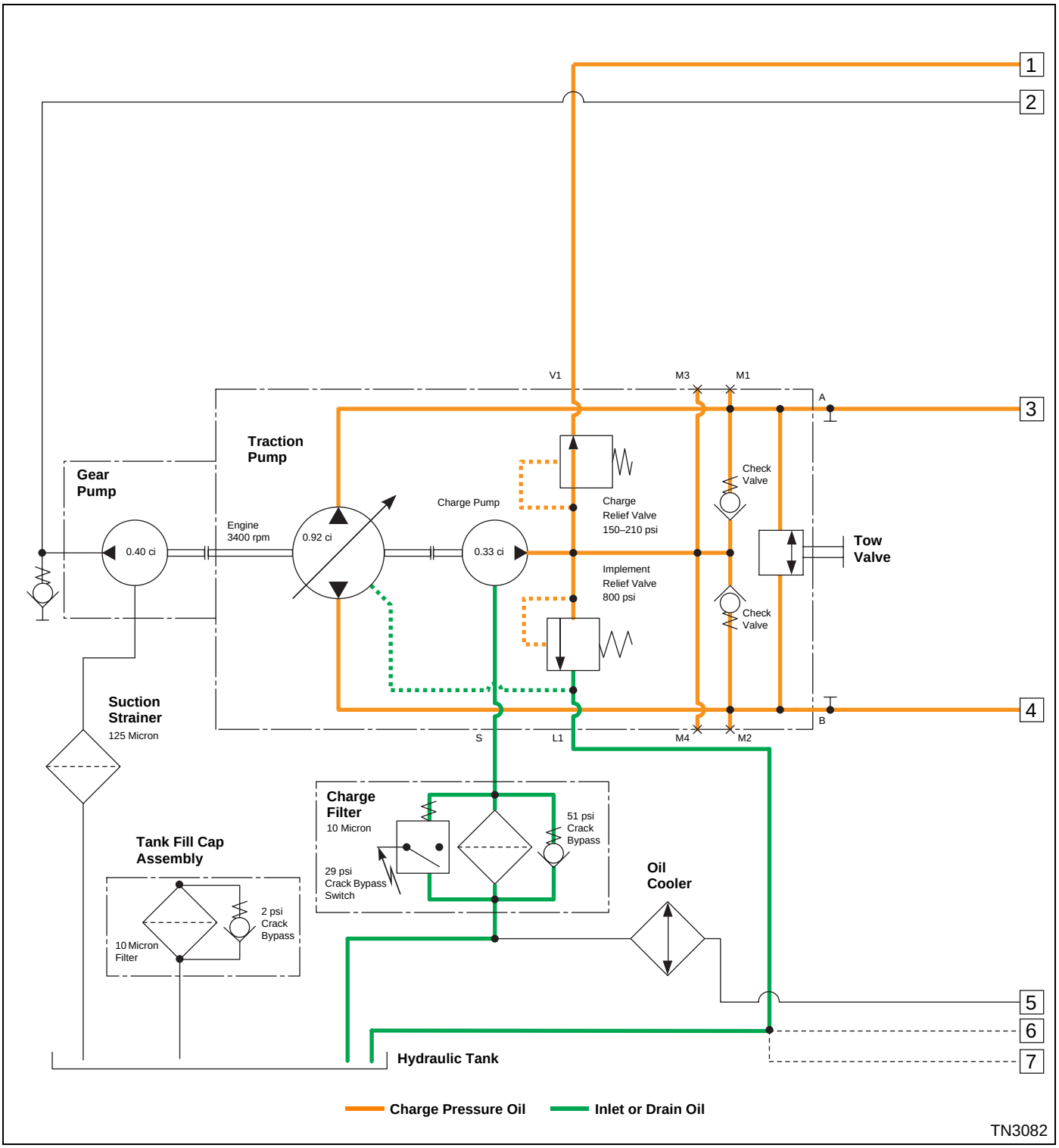
Traction Pump Circuit

The traction pedal is linked to the traction pump by cable. Movement of the traction pedal results directly in a corresponding movement of the traction pump swashplate. With the traction pedal in the neutral position, the swashplate is centered in the neutral position and there is no oil flow through the traction pump.

The charge oil is supplied to the closed-loop traction circuit via the check valves and exits the traction pump at ports “A” and “B.” Oil from port “A” is routed in parallel to the front wheel motors. Since pressure is equal on each side of the front wheel motors, no movement occurs. With the closed-loop circuit charged with oil, the 150–210 psi (10–15 bar) charge pressure relief valve opens and vents excess oil to the hydraulic tank via the steering unit and oil cooler.

Traction Circuit—Neutral Schematic (2WD Models)

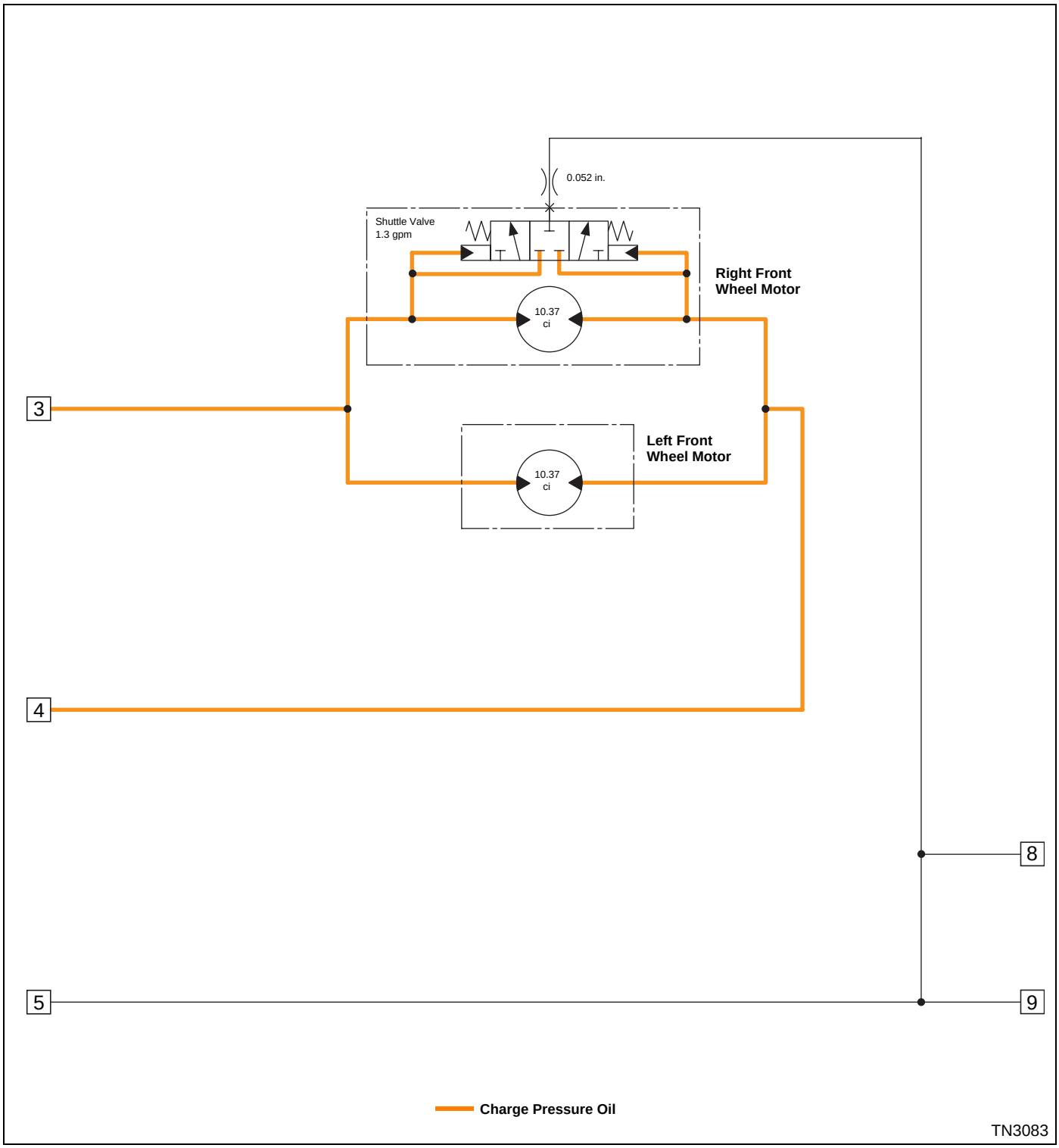
See Figures 5-3 and 5-4.



1	Return Oil to Steering Unit (Port P)	4	Charge Pressure Oil to Rear Wheel Motor	7	Return Oil from Center Reel Motor Case Drain
2	Return Oil to Reel Valve Unit (Port P)	5	Return Oil from Steering Unit (Port T) and Lift Valve (Port T)		
3	Charge Pressure Oil to Front Wheel Motors	6	Return Oil from Right and Left Reel Motor Case Drains		

Figure 5-3

Traction Circuit—Neutral Schematic (2WD Models), Continued



3 Charge Pressure Oil from Traction Pump (Port A)
4 Charge Pressure Oil from Traction Pump (Port B)
5 Return Oil to Oil Cooler
8 Return Oil from Steering Unit (Port T)
9 Return Oil from Lift Valve (Port T)

Figure 5-4

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Traction Circuit—Forward Schematic and Theory of Operation (2WD Models)

System Conditions:

- Engine running
- Park brake released
- Traction pedal in the forward position

Charge Pressure Circuit

The charge pump and traction pump are both driven by the engine. The charge pump is mounted between the rotating group and rear valve plate assembly in the traction pump housing. It supplies oil to the traction pump/circuit. Oil is drawn from the hydraulic tank through the charge filter and enters the charge pump.

The charge filter uses a 10-micron filter to remove debris from the oil. If the charge filter becomes plugged, a 29 psi (2.0 bar) pressure switch will activate the “Filter Blocked” LED on the instrument panel. The charge filter will be bypassed when the pressure exceeds 51 psi (3.5 bar).

Oil from the charge pump is routed to the 150–210 psi (10–15 bar) charge relief valve, the 800 psi (55 bar) implement relief valve, and the two check valves.

The charge relief valve regulates the charge pressure applied to the traction pump/circuit. When the incoming charge pressure oil reaches 150–210 psi (10–15 bar), the charge pressure relief valve will open, venting excess flow back to the hydraulic tank via the steering unit and oil cooler.

The excess charge pump supply is used to operate the steering circuit. The 800 psi (55 bar) implement relief valve is used to allow intermittent operation of the charge pump at 800 psi (55 bar).

Traction Drive Circuit

The traction pedal is linked to the traction pump by cable. Movement of the traction pedal results directly in a corresponding movement of the traction pump swashplate. When the traction pedal is moved to the forward position, the swashplate is moved to the forward position, stroking the traction pump and producing oil flow against the check valve and to port “A.” Operating pressure oil from port “A” of the traction pump is supplied in parallel to the front wheel motors, driving the motors in the forward direction.

Oil from the front wheel motors returns to the traction pump, entering port “B” and replenishing the intake side of the pump.

Shuttle Valve

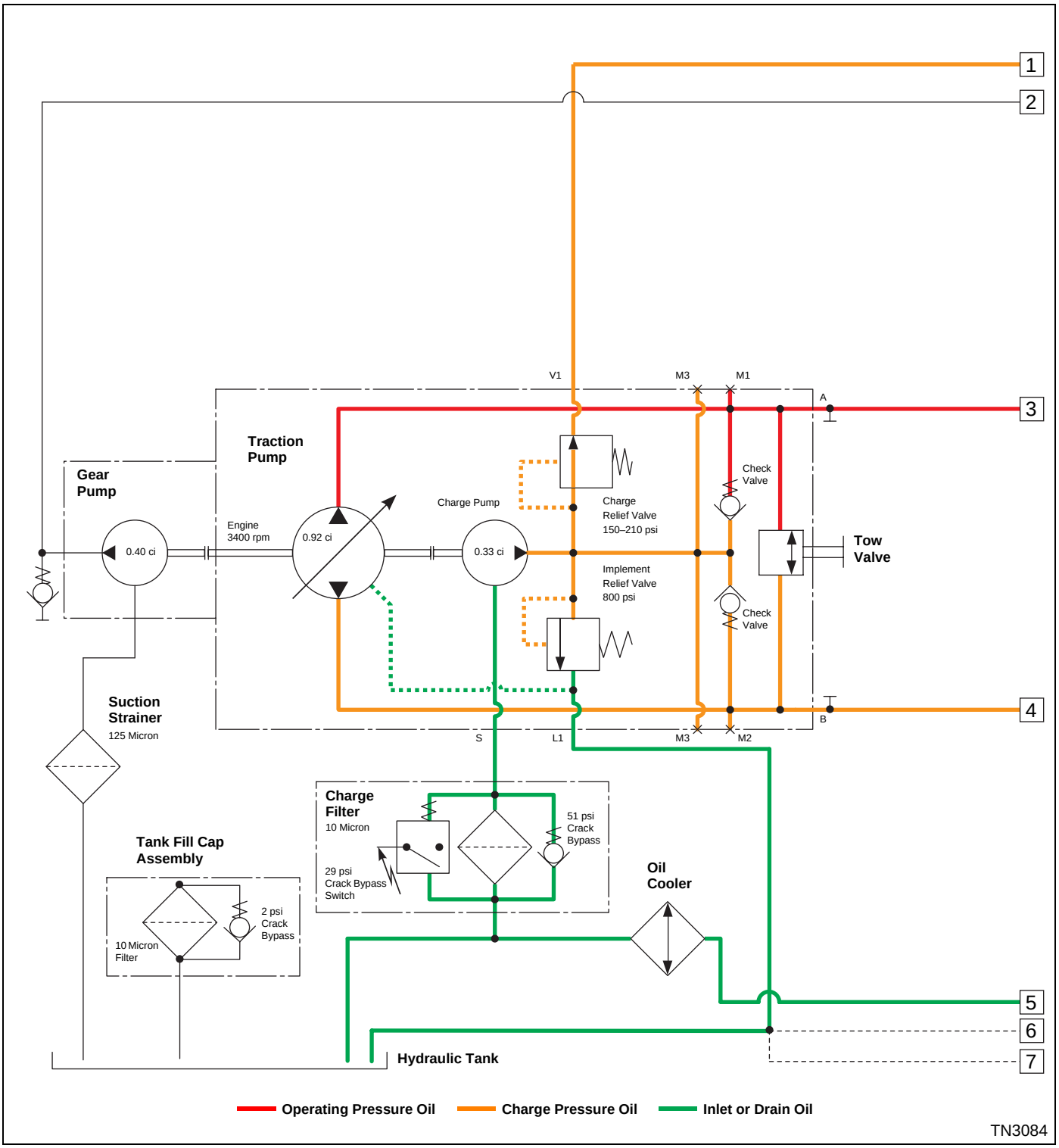
The shuttle valve located in the right front wheel motor is used to remove hot oil from the closed-loop traction drive circuit when moving in the forward or reverse direction. Oil lost due to venting through the shuttle valve is replaced within the traction pump by cooler, filtered oil from the charge pump. When driving forward, operating pressure oil is routed to the pilot line of the shuttle valve, opening the valve. Hot oil from traction pump port “A” flows through the shuttle valve, through the 0.052 in. (1.3 mm) orifice, and is routed back to the hydraulic tank via the oil cooler.

Circuit Relief

The traction circuit is not protected by any form of shock or relief valve. This is considered unnecessary, because overloading the system will result in spinning the slick tires.

Traction Circuit—Forward Schematic (2WD Models)

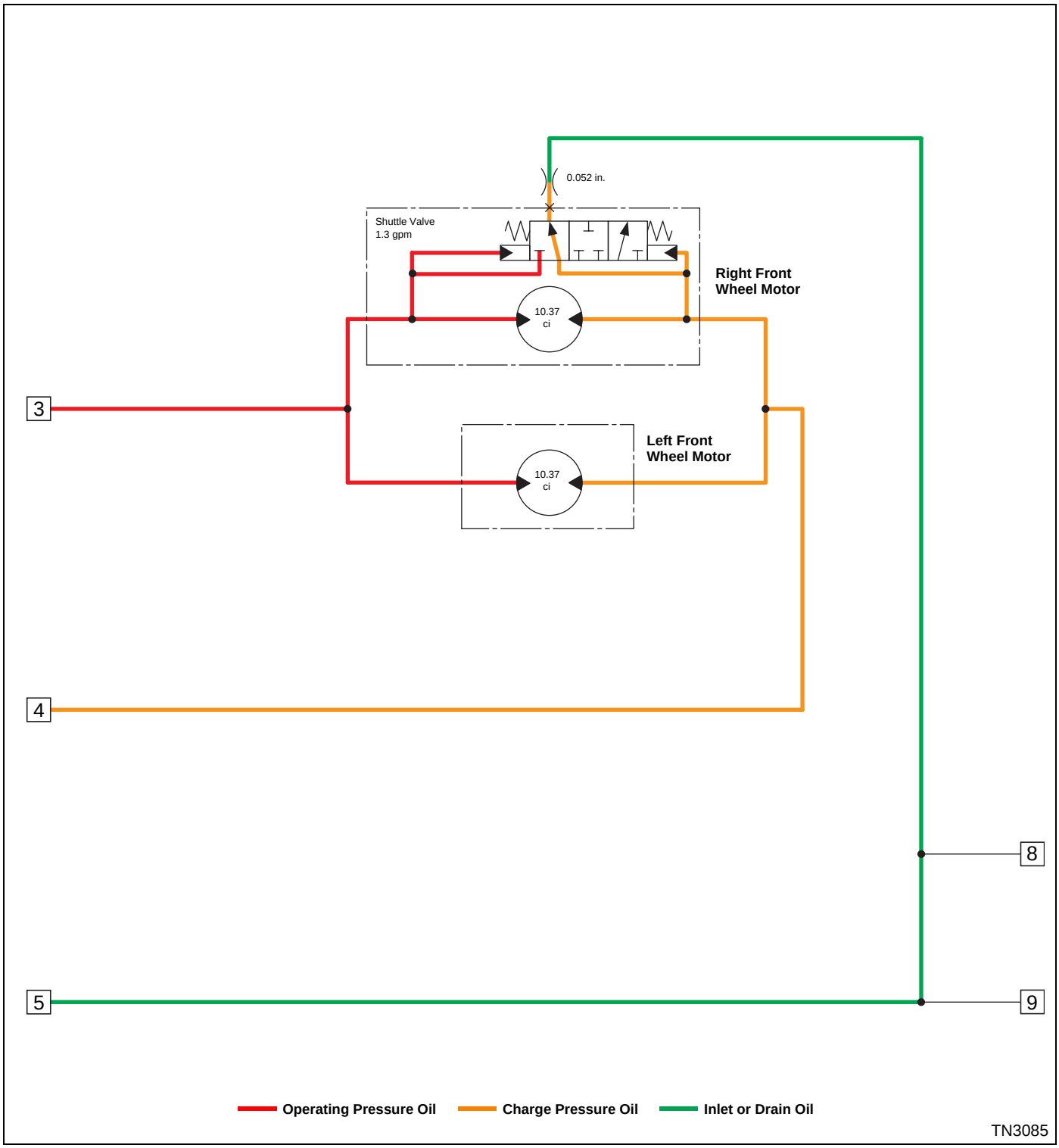
See Figures 5-5 and 5-6.



1	Return Oil to Steering Unit (Port P)	4	Charge Pressure Oil to Rear Wheel Motor	7	Return Oil from Center Reel Motor Case Drain
2	Return Oil to Reel Valve Unit (Port P)	5	Return Oil from Shuttle Valve, Steering Unit (Port T), and Lift Valve (Port T)		
3	Operating Pressure Oil to Front Wheel Motors	6	Return Oil from Right and Left Reel Motor Case Drains		

Figure 5-5

Traction Circuit—Forward Schematic (2WD Models), Continued



3 Operating Pressure Oil from Traction Pump (Port A)
4 Charge Pressure Oil from Traction Pump (Port B)
5 Return Oil to Oil Cooler
8 Return Oil from Steering Unit (Port T)
9 Return Oil from Lift Valve (Port T)

Figure 5-6

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Traction Circuit—Reverse Schematic and Theory of Operation (2WD Models)

System Conditions:

- Engine running
- Park brake released
- Traction pedal in the reverse position

Charge Pressure Circuit

The charge pump and traction pump are both driven by the engine. The charge pump is mounted between the rotating group and rear valve plate assembly in the traction pump housing. It supplies oil to the traction pump/circuit. Oil is drawn from the hydraulic tank through the charge filter and enters the charge pump.

The charge filter uses a 10-micron filter to remove debris from the oil. If the charge filter becomes plugged, a 29 psi (2.0 bar) pressure switch will activate the “Filter Blocked” LED on the instrument panel. The charge filter will be bypassed when the pressure exceeds 51 psi (3.5 bar).

Oil from the charge pump is routed to the 150–210 psi (10–15 bar) charge relief valve, the 800 psi (55 bar) implement relief valve, and the two check valves.

The charge relief valve regulates the charge pressure applied to the traction pump/circuit. When the incoming charge pressure oil reaches 150–210 psi (10–15 bar), the charge pressure relief valve will open, venting excess flow back to the hydraulic tank via the steering unit and oil cooler.

The excess charge pump supply is used to operate the steering circuit. The 800 psi (55 bar) implement relief valve is used to allow intermittent operation of the charge pump at 800 psi (55 bar).

Traction Drive Circuit

The traction pedal is linked to the traction pump by cable. Movement of the traction pedal results directly in a corresponding movement of the traction pump swashplate. When the traction pedal is moved to the reverse position, the swashplate is moved to the reverse position, stroking the traction pump and producing oil flow against the check valve and to port “B.” Operating pressure oil from port “B” of the traction pump is supplied in parallel to the front wheel motors, driving the motors in the reverse direction.

Oil from the front wheel motors returns to the traction pump, entering port “A” and replenishing the intake side of the pump.

Shuttle Valve

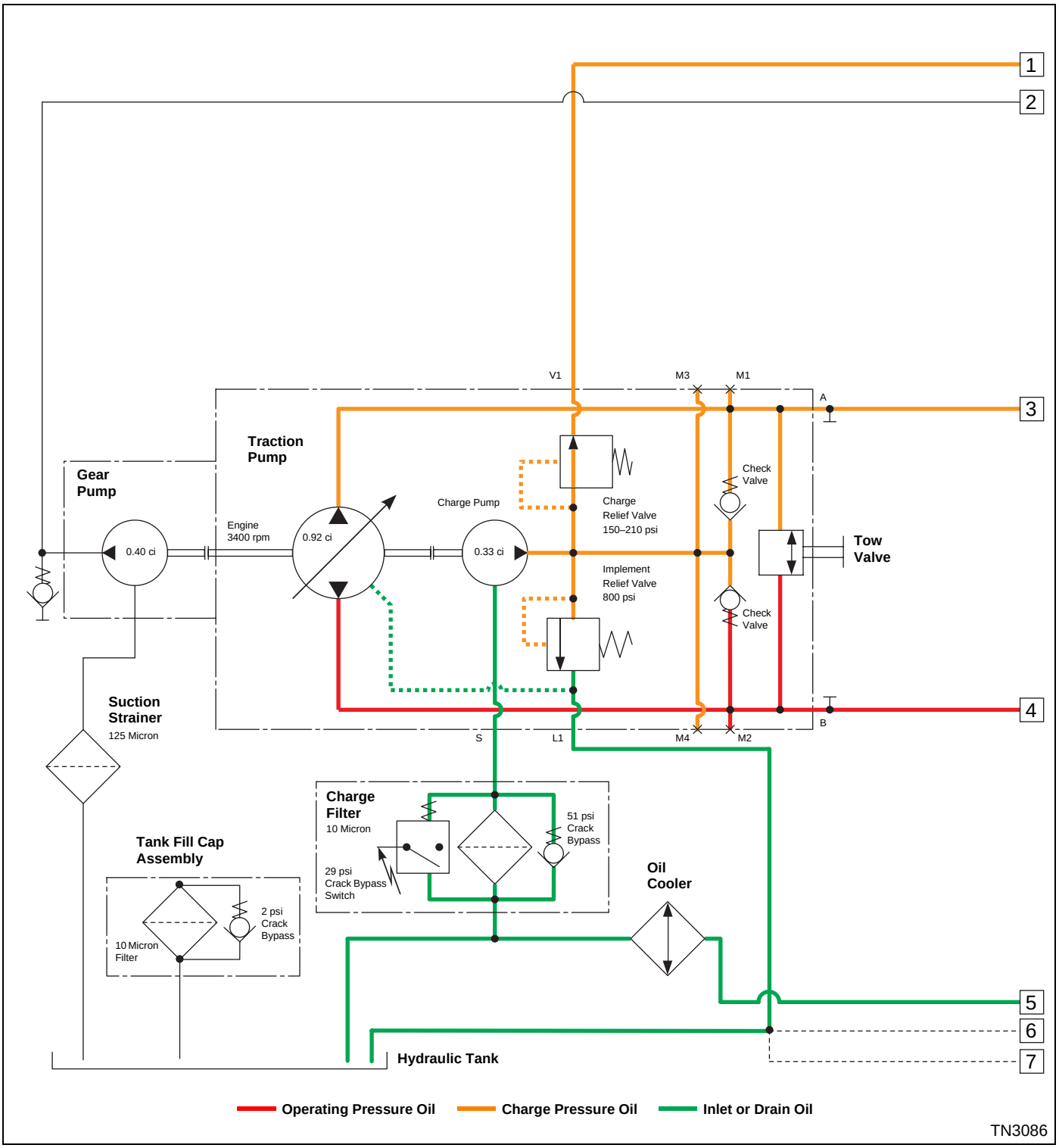
The shuttle valve located in the right front wheel motor is used to remove hot oil from the closed-loop traction drive circuit when moving in the forward or reverse direction. Oil lost due to venting through the shuttle valve is replaced within the traction pump by cooler, filtered oil from the charge pump. When driving in reverse, operating pressure oil is routed to the pilot line of the shuttle valve, opening the valve. Hot oil from traction pump port “B” flows through the shuttle valve, through the 0.052 in. (1.3 mm) orifice, and is routed back to the hydraulic tank via the oil cooler.

Circuit Relief

The traction circuit is not protected by any form of shock or relief valve. This is considered unnecessary, because overloading the system will result in spinning the slick tires.

Traction Circuit—Reverse Schematic (2WD Models)

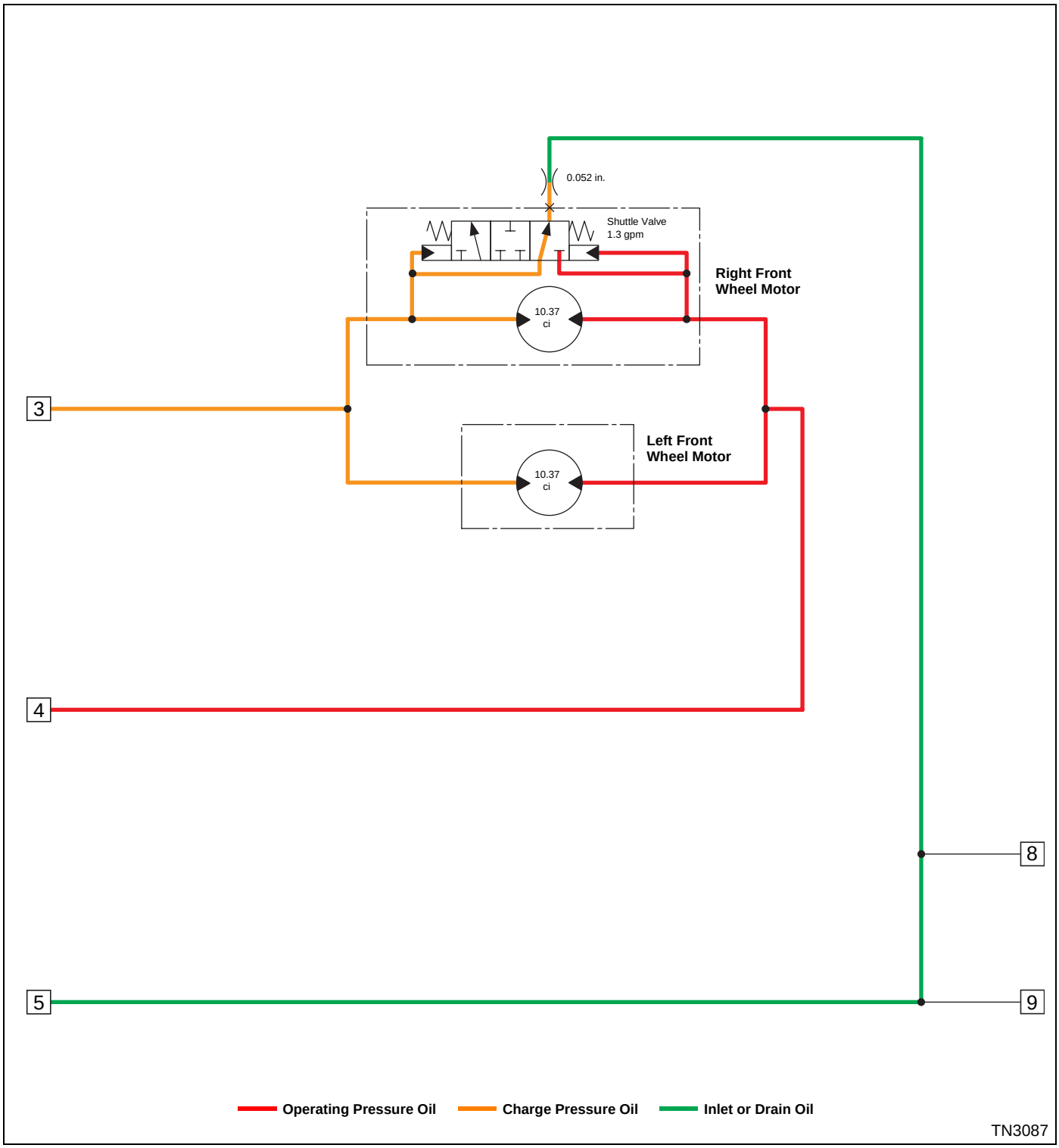
See Figures 5-7 and 5-8.



1	Return Oil to Steering Unit (Port P)	4	Operating Pressure Oil to Rear Wheel Motor	7	Return Oil from Center Reel Motor Case Drain
2	Return Oil to Reel Valve Unit (Port P)	5	Return Oil from Shuttle Valve, Steering Unit (Port T), and Lift Valve (Port T)		
3	Charge Pressure Oil to Front Wheel Motors	6	Return Oil from Right and Left Reel Motor Case Drains		

Figure 5-7

Traction Circuit—Reverse Schematic (2WD Models), Continued



3 Charge Pressure Oil from Traction Pump (Port A)
4 Operating Pressure Oil from Traction Pump (Port B)
5 Return Oil to Oil Cooler
8 Return Oil from Steering Unit (Port T)
9 Return Oil from Lift Valve (Port T)

Figure 5-8

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Traction Circuit—Neutral Schematic and Theory of Operation (3WD Models)

System Conditions:

- Engine running
- Park brake released
- Traction pedal in the neutral position

Charge Pressure Circuit

The charge pump and traction pump are both driven by the engine. The charge pump is mounted between the rotating group and rear valve plate assembly in the traction pump housing. It supplies oil to the traction pump/circuit. Oil is drawn from the hydraulic tank through the charge filter and enters the charge pump.

The charge filter uses a 10-micron filter to remove debris from the oil. If the charge filter becomes plugged, a 29 psi (2.0 bar) pressure switch will activate the “Filter Blocked” LED on the instrument panel. The charge filter will be bypassed when the pressure exceeds 51 psi (3.5 bar).

Oil from the charge pump is routed to the 150–210 psi (10–15 bar) charge relief valve, the 800 psi (55 bar) implement relief valve, and the two check valves.

The charge relief valve regulates the charge pressure applied to the traction pump/circuit. When the incoming charge pressure oil reaches 150–210 psi (10–15 bar), the charge pressure relief valve will open, venting excess flow back to the hydraulic tank via the steering unit and oil cooler.

The excess charge pump supply is used to operate the steering circuit. The 800 psi (55 bar) implement relief valve is used to allow intermittent operation of the charge pump at 800 psi (55 bar).

Traction Pump Circuit

The traction pedal is linked to the traction pump by cable. Movement of the traction pedal results directly in a corresponding movement of the traction pump swashplate. With the traction pedal in the neutral position, the swashplate is centered in the neutral position and there is no oil flow through the traction pump.

The charge oil is supplied to the closed-loop traction circuit via the check valves and exits the traction pump at ports “A” and “B.” Oil from port “A” is routed in parallel to the front wheel motors. Oil from port “B” is routed to the rear wheel motor and the “RW2” port of the flushing valve.

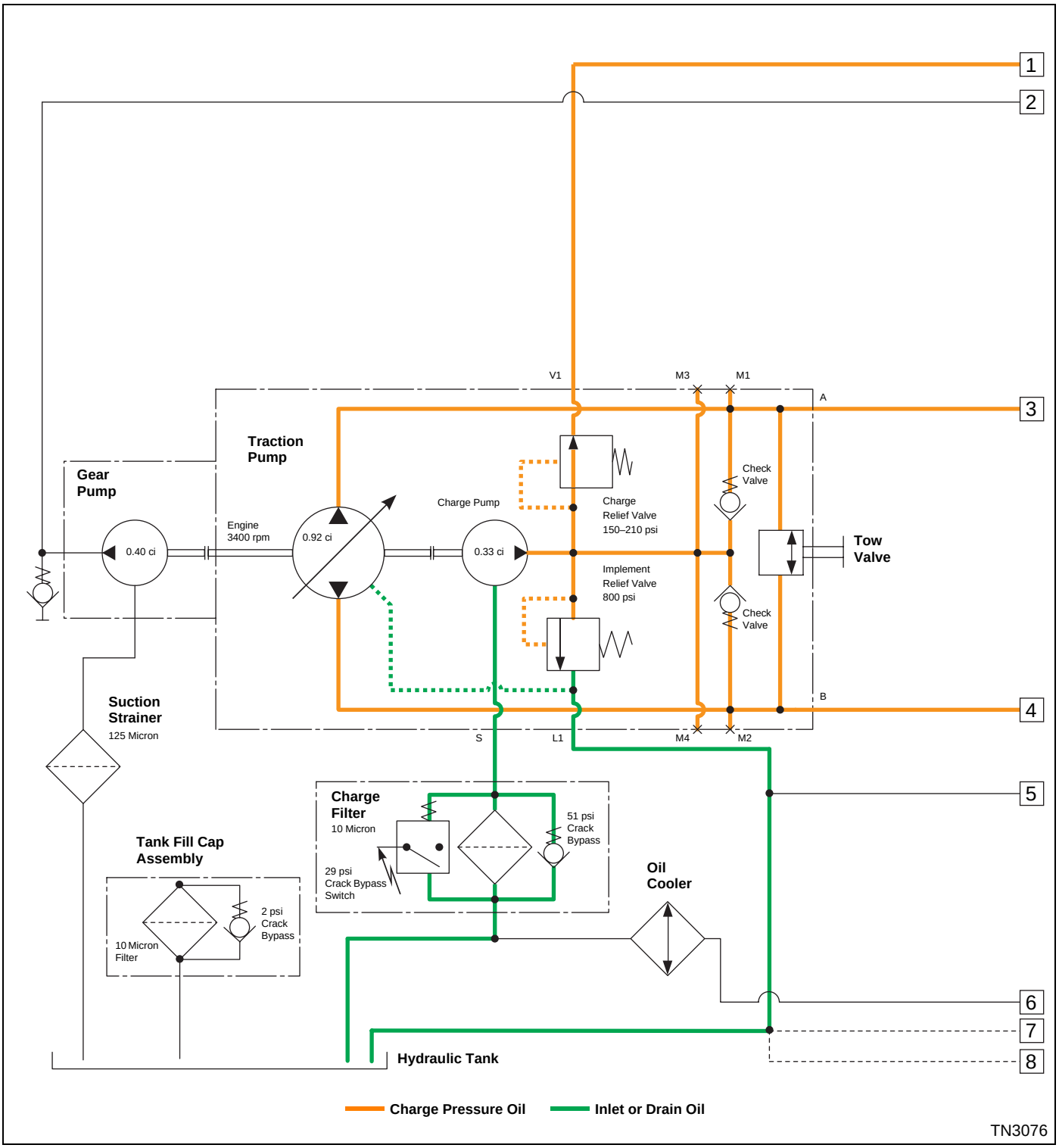
Oil exiting the rear motor is routed to the front wheel motors.

Oil from the “RW2” port of the flushing valve flows against the flushing valve, through the check valve, and exits the “RW1” port of the flushing valve. It is then routed in parallel to the front and rear wheel motors.

Since pressure is equal on each side of the front and rear wheel motors, no movement occurs. With the closed-loop circuit charged with oil, the 150–210 psi (10–15 bar) charge pressure relief valve opens and vents excess oil to the hydraulic tank via the steering unit and oil cooler.

Traction Circuit—Neutral Schematic (3WD Models)

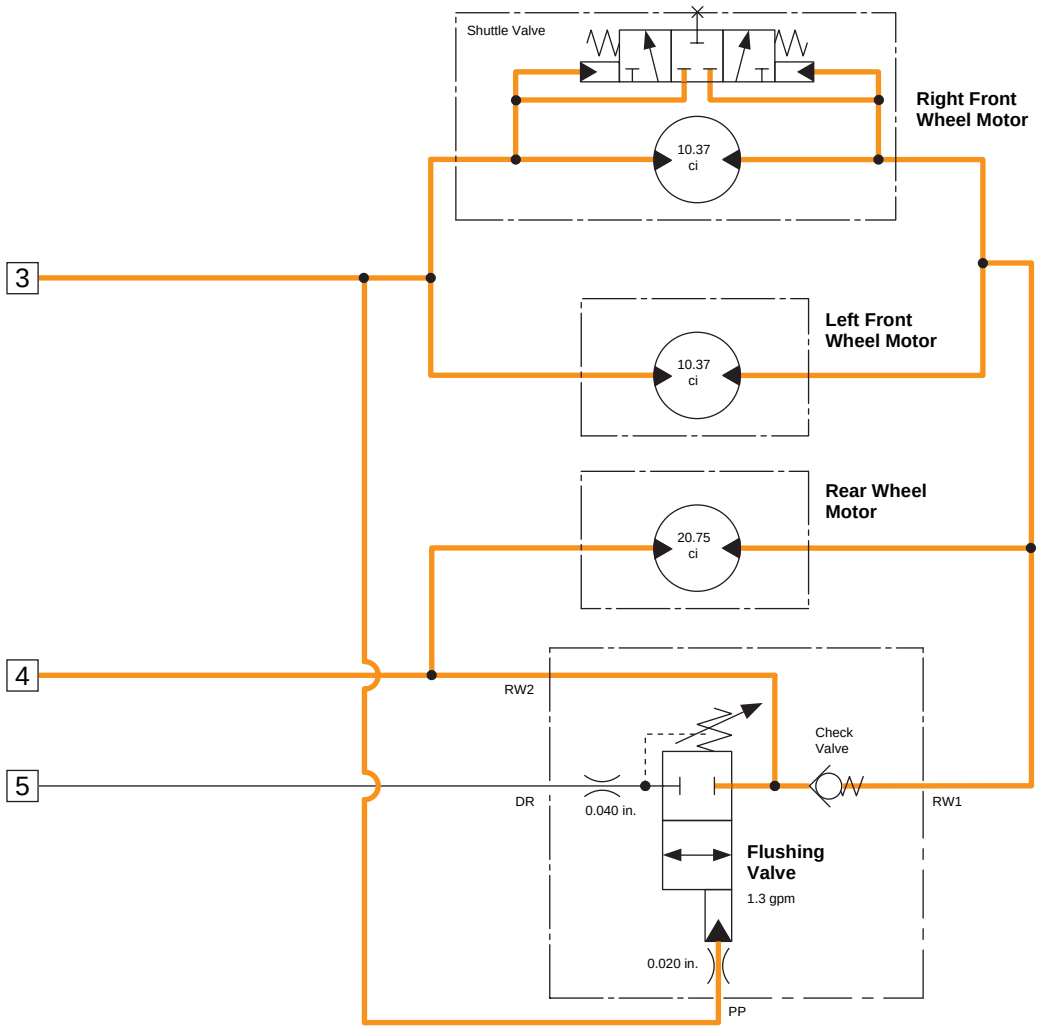
See Figures 5-9 and 5-10.



1	Return Oil to Steering Unit (Port P)	4	Charge Pressure Oil to Rear Wheel Motor	7	Return Oil from Right and Left Reel Motor Case Drains
2	Return Oil to Reel Valve Unit (Port P)	5	Return Oil from Flushing Valve	8	Return Oil from Center Reel Motor Case Drain
3	Charge Pressure Oil to Front Wheel Motors	6	Return Oil from Steering Unit (Port T) and Lift Valve (Port T)		

Figure 5-9

Traction Circuit—Neutral Schematic (3WD Models), Continued



3 Charge Pressure Oil from Traction Pump (Port A)

4 Charge Pressure Oil from Traction Pump (Port B)

5 Return Oil to Hydraulic Tank

Figure 5-10

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Traction Circuit—Forward Schematic and Theory of Operation (3WD Models)

System Conditions:

- Engine running
- Park brake released
- Traction pedal in the forward position

Charge Pressure Circuit

The charge pump and traction pump are both driven by the engine. The charge pump is mounted between the rotating group and rear valve plate assembly in the traction pump housing. It supplies oil to the traction pump/circuit. Oil is drawn from the hydraulic tank through the charge filter and enters the charge pump.

The charge filter uses a 10-micron filter to remove debris from the oil. If the charge filter becomes plugged, a 29 psi (2.0 bar) pressure switch will activate the “Filter Blocked” LED on the instrument panel. The charge filter will be bypassed when the pressure exceeds 51 psi (3.5 bar).

Oil from the charge pump is routed to the 150–210 psi (10–15 bar) charge relief valve, the 800 psi (55 bar) implement relief valve, and the two check valves.

The charge relief valve regulates the charge pressure applied to the traction pump/circuit. When the incoming charge pressure oil reaches 150–210 psi (10–15 bar), the charge pressure relief valve will open, venting excess flow back to the hydraulic tank via the steering unit and oil cooler.

The excess charge pump supply is used to operate the steering circuit. The 800 psi (55 bar) implement relief valve is used to allow intermittent operation of the charge pump at 800 psi (55 bar).

Traction Drive Circuit

The traction pedal is linked to the traction pump by cable. Movement of the traction pedal results directly in a corresponding movement of the traction pump swashplate. When the traction pedal is moved to the forward position, the swashplate is moved to the forward position, stroking the traction pump and producing oil flow against the check valve and to port “A.” Operating pressure oil from port “A” of the traction pump is supplied in parallel to the front wheel motors, then in series to the rear wheel motor, resulting in full-time three-wheel drive.

Oil from the rear wheel motor returns to the traction pump, entering port “B” and replenishing the intake side of the pump.

Flushing Valve

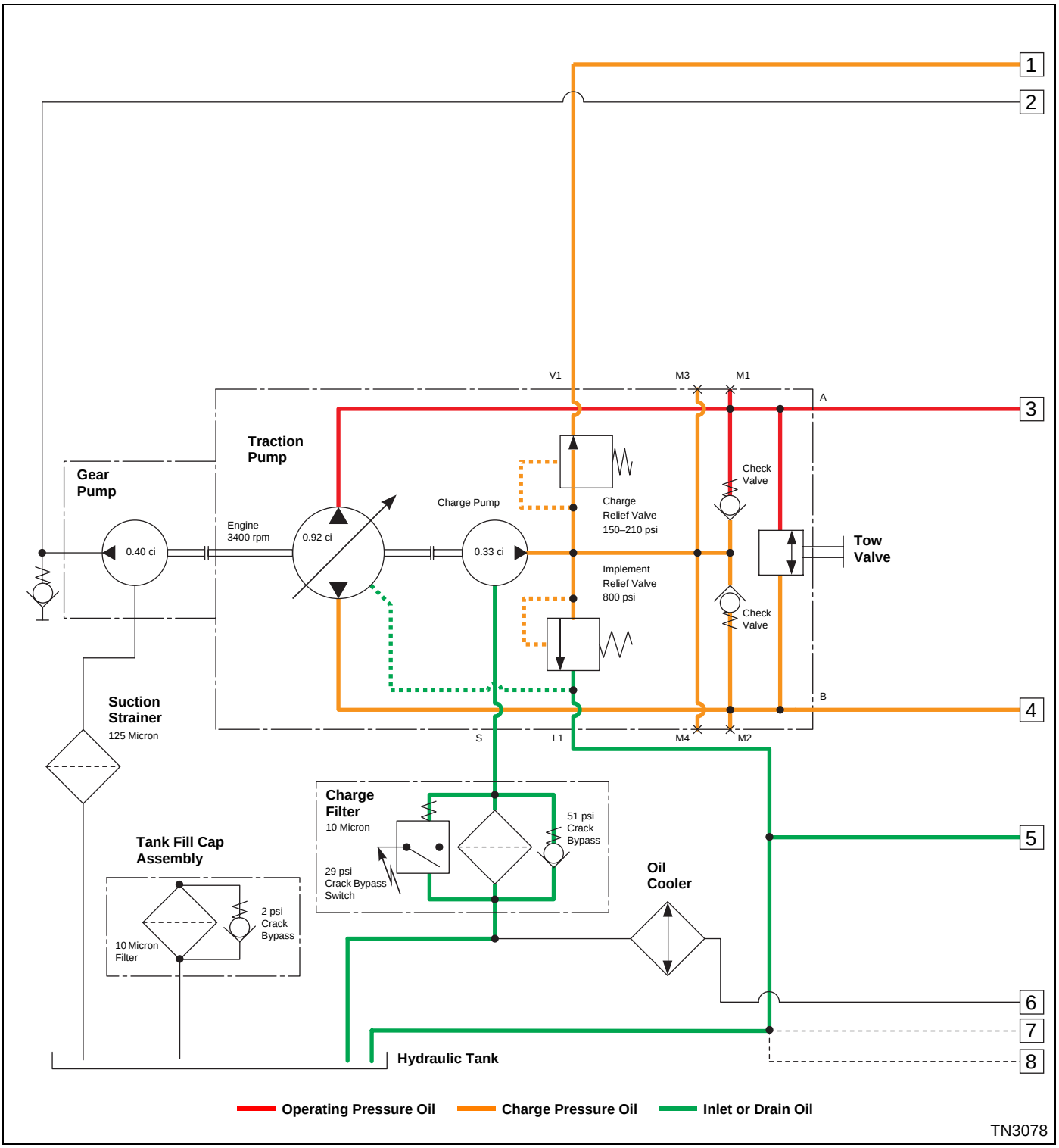
The flushing valve is used to remove hot oil from the closed-loop traction drive circuit when moving forward. Oil lost due to venting through the flushing valve is replaced within the traction pump by cooler, filtered oil from the charge pump. When driving forward, operating pressure oil is routed to the pilot line of the flushing valve, shifting the valve spool and opening the valve. Hot oil from the rear wheel motor flows through the flushing valve, through the 0.040 in. (1.0 mm) orifice, and is routed back to the hydraulic tank.

Circuit Relief

The traction circuit is not protected by any form of shock or relief valve. This is considered unnecessary, because overloading the system will result in spinning the slick tires.

Traction Circuit—Forward Schematic (3WD Models)

See Figures 5-11 and 5-12.



1 Return Oil to Steering Unit (Port P)

2 Return Oil to Reel Valve Unit (Port P)

3 Operating Pressure Oil to Front Wheel Motors

4 Charge Pressure Oil to Rear Wheel Motor

5 Return Oil from Flushing Valve

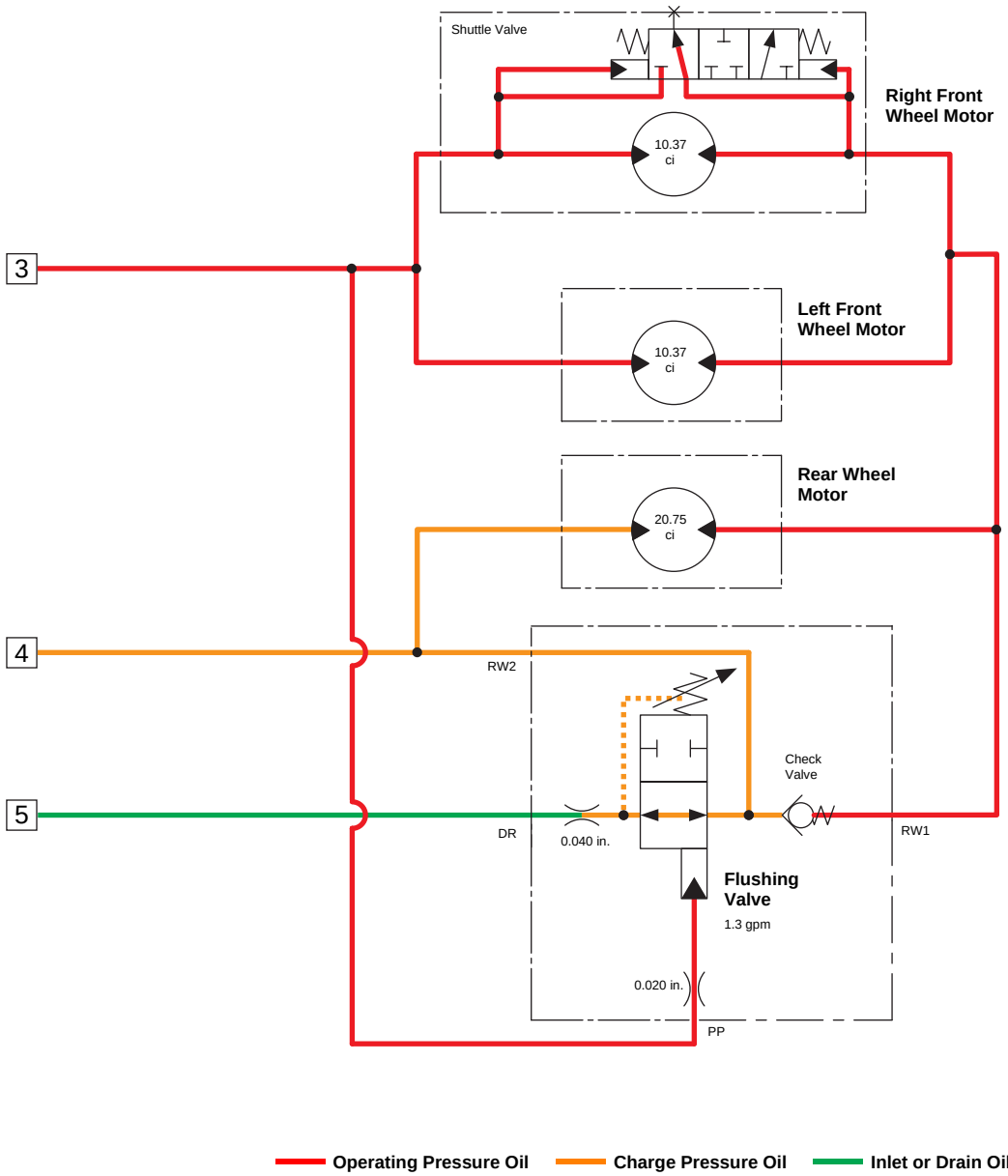
6 Return Oil from Steering Unit (Port T) and Lift Valve (Port T)

7 Return Oil from Right and Left Reel Motor Case Drains

8 Return Oil from Center Reel Motor Case Drain

Figure 5-11

Traction Circuit—Forward Schematic (3WD Models), Continued



3 Operating Pressure Oil from Traction Pump (Port A)
4 Charge Pressure Oil from Traction Pump (Port B)
5 Return Oil to Hydraulic Tank

Figure 5-12

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Traction Circuit—Reverse Schematic and Theory of Operation (3WD Models)

System Conditions:

- Engine running
- Park brake released
- Traction pedal in the reverse position

Charge Pressure Circuit

The charge pump and traction pump are both driven by the engine. The charge pump is mounted between the rotating group and rear valve plate assembly in the traction pump housing. It supplies oil to the traction pump/circuit. Oil is drawn from the hydraulic tank through the charge filter and enters the charge pump.

The charge filter uses a 10-micron filter to remove debris from the oil. If the charge filter becomes plugged, a 29 psi (2.0 bar) pressure switch will activate the “Filter Blocked” LED on the instrument panel. The charge filter will be bypassed when the pressure exceeds 51 psi (3.5 bar).

Oil from the charge pump is routed to the 150–210 psi (10–15 bar) charge relief valve, the 800 psi (55 bar) implement relief valve, and the two check valves.

The charge relief valve regulates the charge pressure applied to the traction pump/circuit. When the incoming charge pressure oil reaches 150–210 psi (10–15 bar), the charge pressure relief valve will open, venting excess flow back to the hydraulic tank via the steering unit and oil cooler.

The excess charge pump supply is used to operate the steering circuit. The 800 psi (55 bar) implement relief valve is used to allow intermittent operation of the charge pump at 800 psi (55 bar).

Traction Drive Circuit

The traction pedal is linked to the traction pump by cable. Movement of the traction pedal results directly in a corresponding movement of the traction pump swashplate. When the traction pedal is moved to the reverse position, the swashplate is moved to the reverse position, stroking the traction pump and producing oil flow against the check valve and to port “B.”

Operating pressure oil from port “B” of the traction pump is routed to the rear wheel motor and the “RW2” port of the flushing valve.

Oil exiting the rear motor is routed in parallel to the front wheel motors, driving the motors in the reverse direction.

Oil from the “RW2” port of the flushing valve flows against the flushing valve, through the check valve, and exits the “RW1” port of the flushing valve. It is then routed in parallel to the front and rear wheel motors. Since pressure is equal on each side of the rear wheel motor, the rear wheel motor does not drive in reverse and is effectively bypassed.

Oil from the front wheel motors returns to the traction pump, entering port “A” and replenishing the intake side of the pump.

Flushing Valve

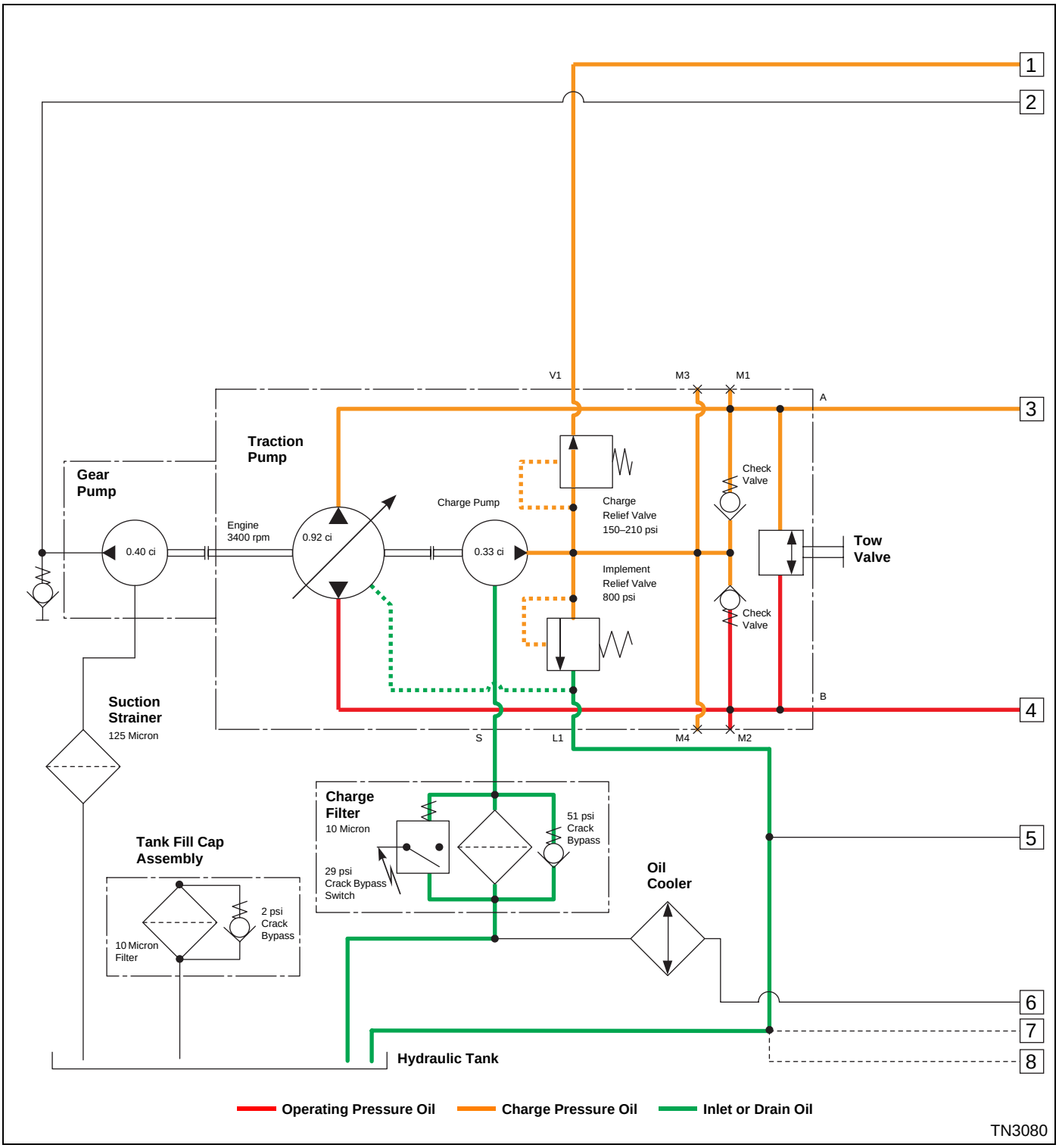
The flushing valve is held closed when there is operating pressure in the reverse position.

Circuit Relief

The traction circuit is not protected by any form of shock or relief valve. This is considered unnecessary, because overloading the system will result in spinning the slick tires.

Traction Circuit—Reverse Schematic (3WD Models)

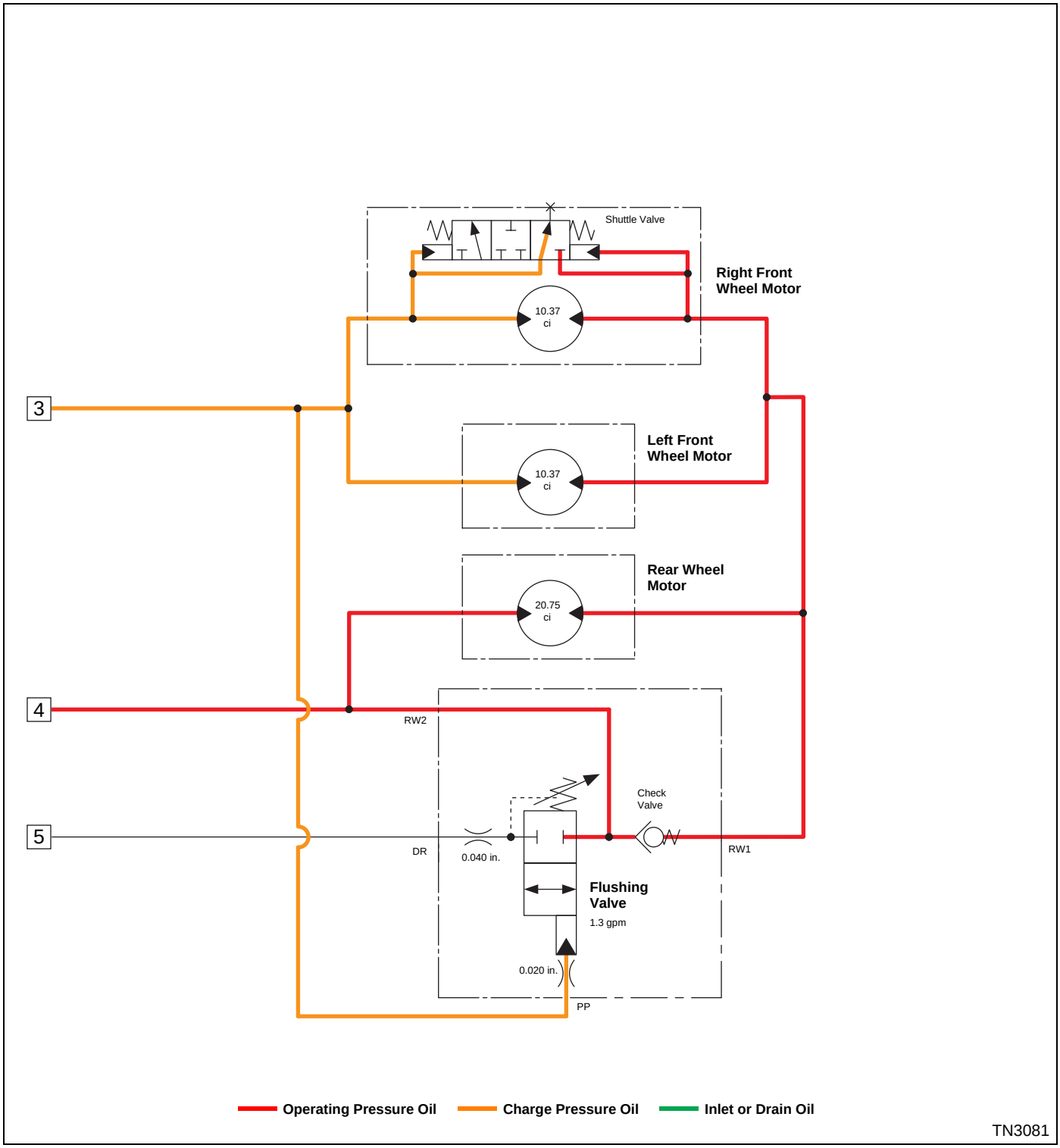
See Figures 5-13 and 5-14.



1	Return Oil to Steering Unit (Port P)	4	Operating Pressure Oil to Rear Wheel Motor	7	Return Oil from Right and Left Reel Motor Case Drains
2	Return Oil to Reel Valve Unit (Port P)	5	Return Oil from Flushing Valve	8	Return Oil from Center Reel Motor Case Drain
3	Charge Pressure Oil to Front Wheel Motors	6	Return Oil from Steering Unit (Port T) and Lift Valve (Port T)		

Figure 5-13

Traction Circuit—Reverse Schematic (3WD Models), Continued



3 Charge Pressure Oil from Traction Pump (Port A)
4 Operating Pressure Oil from Traction Pump (Port B)
5 Return Oil to Hydraulic Tank

Figure 5-14

Troubleshooting

Mower Will Not Move Forward or Reverse

Probable Cause	Remedy
Hydraulic oil not at correct level in reservoir.	Fill reservoir to correct level. (Refer to “Parts and Maintenance Manual” for correct oil specifications.)
Tow valve open.	Close tow valve. (Refer to “Safety and Operation Manual.”)
Low charge pressure.	Test charge pressure relief valve. (See “Charge Pressure Test” on page 5-36.) Repair or replace charge pressure relief valve as needed. (See “Traction Pump and Control” on page 5-50.)
Front wheel motor worn or damaged.	Test motor. (See “Wheel Motors Tests” on page 5-43.) Repair or replace motor as needed. (See “Wheel Motors” on page 5-57.)
Rear wheel motor worn or damaged.	Test motor. (See “Wheel Motors Tests” on page 5-43.) Repair or replace motor as needed. (See “Wheel Motors” on page 5-57.)
Traction pump worn or damaged.	Test pump. (See “Traction System Test” on page 5-37.) Repair or replace pump as needed. (See “Traction Pump and Control” on page 5-50.)

Mower Will Not Reach Full Speed

Probable Cause	Remedy
Hydraulic oil not at correct level in reservoir.	Fill reservoir to correct level. (Refer to “Parts and Maintenance Manual” for correct oil specifications.)
Tow valve open.	Close tow valve. (Refer to “Safety and Operation Manual.”)
Air in hydraulic system (air bubbles in hydraulic oil).	Check suction line for air leaks. Repair as needed. Operate various hydraulic systems until hydraulic system is free of air.
Low charge pressure.	Test charge pressure relief valve. (See “Charge Pressure Test” on page 5-36.) Repair or replace charge pressure relief valve as needed. (See “Traction Pump and Control” on page 5-50.)
Traction pump worn or damaged.	Test pump. (See “Traction System Test” on page 5-37.) Repair or replace pump as needed. (See “Traction Pump and Control” on page 5-50.)
Front wheel motor worn or damaged.	Test motor. (See “Wheel Motors Tests” on page 5-43.) Repair or replace motor as needed. (See “Wheel Motors” on page 5-57.)
Rear wheel motor worn or damaged.	Test motor. (See “Wheel Motors Tests” on page 5-43.) Repair or replace motor as needed. (See “Wheel Motors” on page 5-57.)
Engine RPM low.	Verify and adjust engine RPM. (See engine manufacturer’s manual for further instructions.)

Mower Moves When Traction Pedal Is in Neutral

Probable Cause	Remedy
Traction pump neutral not properly adjusted.	Adjust traction pump neutral. (See “Neutral Adjustment” on page 5-32.)

Hydrostatic System Operating Hot

Probable Cause	Remedy
Hydraulic oil not at correct level in reservoir.	Fill reservoir to correct level. (Refer to “Parts and Maintenance Manual” for correct oil specifications.)
Tow valve open.	Close tow valve. (Refer to “Safety and Operation Manual.”)
Oil cooler has dirt or debris in fins.	Clean oil cooler fins of dirt and debris.
Faulty flushing valve.	Inspect and repair. (See “Flushing Valve” on page 5-55.)
Slippage in pump or motor.	Perform instrument tests. (See “Instrument Test Overview” on page 5-35.)
Faulty charge pressure relief valve.	Test charge pressure relief valve. (See “Charge Pressure Test” on page 5-36.) Repair or replace charge pressure relief valve as needed. (See “Traction Pump and Control” on page 5-50.)

Excessive Traction Pump Noise

Probable Cause	Remedy
Hydraulic oil not at correct level in reservoir.	Fill reservoir to correct level. (Refer to “Parts and Maintenance Manual” for correct oil specifications.)
Hydraulic oil cold.	Warm hydraulic oil to operating temperature.
Air in hydraulic system (air bubbles in hydraulic oil).	Check suction line for air leaks. Repair as needed. Operate various hydraulic systems until hydraulic system is free of air.
Traction pump worn or damaged.	Test pump. (See “Traction System Test” on page 5-37.) Repair or replace pump as needed. (See “Traction Pump and Control” on page 5-50.)

Tests and Adjustments

Neutral Adjustment

See Figures 5-15 through 5-18.

WARNING

The hydraulic system is under pressure, and the oil will be hot.

- **Always relieve pressure in the hydraulic system before performing service.**
- **Failure to follow appropriate safety precautions may result in death or serious injury.**

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

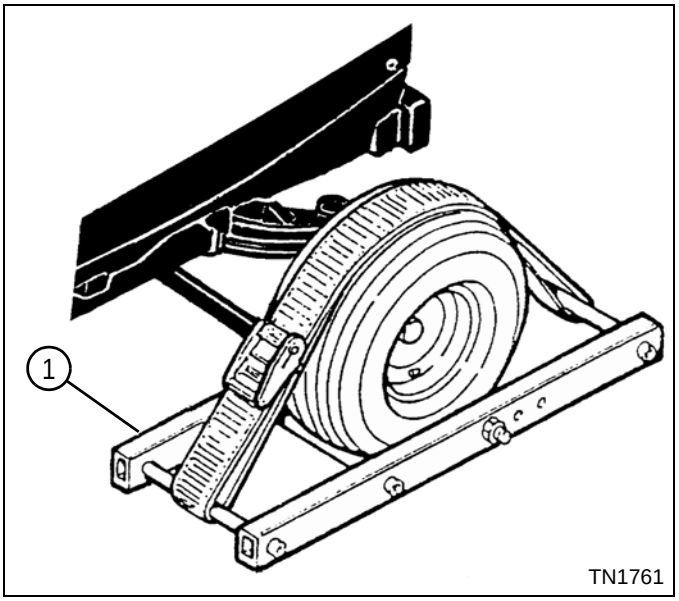


Figure 5-15

NOTE

Perform step 2 if the machine is a 2WD configuration.

2. Install wheel restraint (1) to rear wheel.

WARNING

Prevent personal injury. Use properly rated lifting devices. Always be sure load is balanced before lifting.

Support the machine properly using jackstands.

IMPORTANT

It is important to lift and support the front of the machine, or the machine will move.

3. Lift and support the machine so that the front wheels (2WD configuration) or all wheels (3WD configuration) are off the ground.
4. Close the tow valve completely by turning it clockwise.

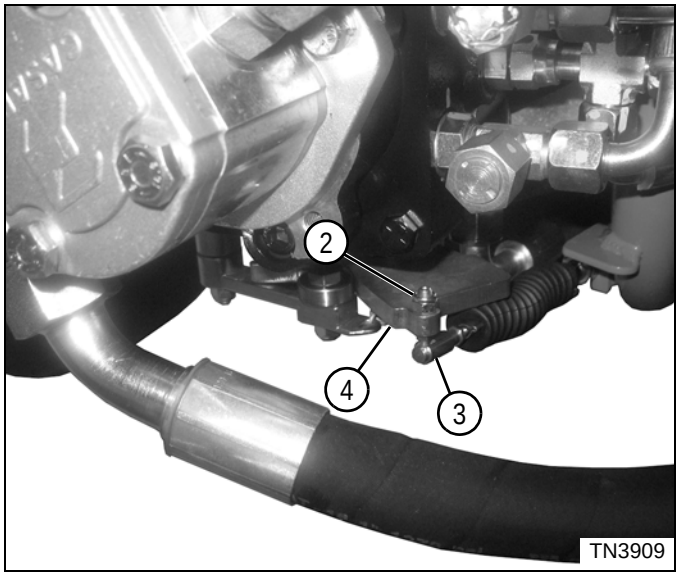


Figure 5-16

5. Remove nut (2), and disconnect traction control cable (3) from cam plate (4).
6. Release park brake.
7. Start engine and run at full throttle (3400 rpm ± 50).
8. Operate hydraulic system until oil temperature is 120–150° F (49–65° C).

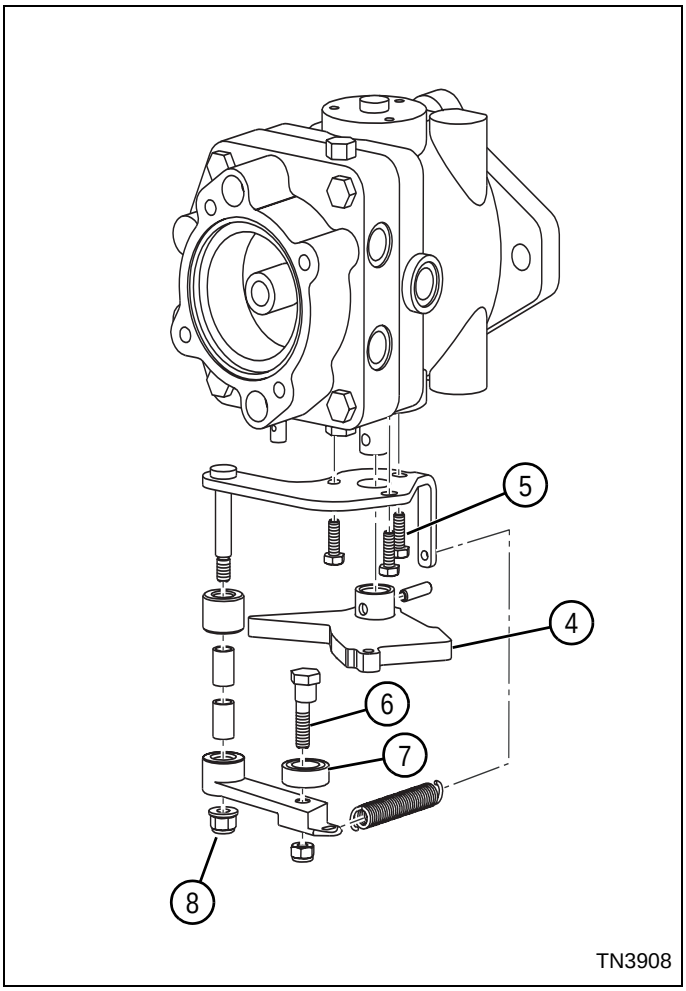


Figure 5-17

NOTE

The neutral adjustment has two stages: coarse and fine adjustment:

- *Use coarse adjustment procedure if the control mechanism has been removed from the pump, or if correct adjustment cannot be obtained using the fine adjustment.*
- *Use fine adjustment procedure for normal adjustment.*

Coarse Adjustment:

9. Loosen three screws (5) holding cam plate (4) to the pump.
10. Rotate cam plate (4) as needed until the bearing (7) is positioned in the V-shaped notch in the cam plate.
11. Tighten screws (5).
12. Proceed to “Fine Adjustment.”

Fine Adjustment:

13. Loosen lock nut (8) just enough to allow rotation of eccentric screw (6).
14. Rotate eccentric screw (6) until front wheels begin to rotate. Note position of screw.
15. Rotate eccentric screw (6) in the opposite direction until front wheels begin to rotate in the opposite direction. Note position of screw.
16. Hold eccentric screw (6) midway between the positions noted in steps 14 and 15 and tighten lock nut (8).
17. Stop engine and engage park brake.

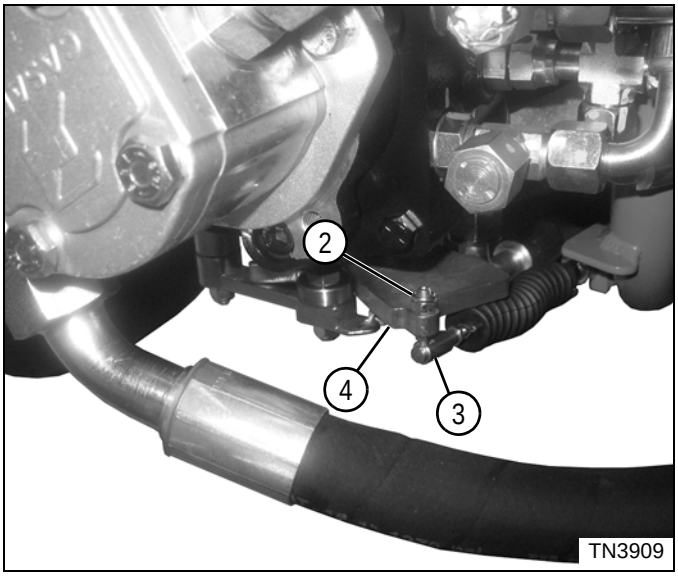


Figure 5-18

18. Connect traction control cable (3) to cam plate (4), using nut (2).

Field Test Procedures

When a hydraulic system failure occurs, some simple tests can be performed prior to using test instruments. The results of these tests can lead you to the suspected component failure. More extensive test procedures, using test instruments, are presented later in this section. (See “Instrument Test Procedures” on page 5-35.)

Preliminary Checks

Perform the following checks prior to beginning any tests.

1. Check the hydraulic oil reservoir for improper fluid level, the presence of air or water, and unusual odor.
2. Check all lines and fittings for leaks. Tighten as needed.
3. Eliminate all mechanical issues prior to starting hydraulic tests.

Charge Pump Test

The charge pump supplies oil for charging the traction circuit and traction pump.

If faults exist in the charge pump, proceed with an instrument test for the charge pump. (See “Charge Pressure Test” on page 5-36.)

Traction System Test

See Figure 5-19.

NOTE

Be sure tow valve is closed before beginning traction system test.

1. Operate hydraulic system until oil temperature is 120–150° F (49–65° C).

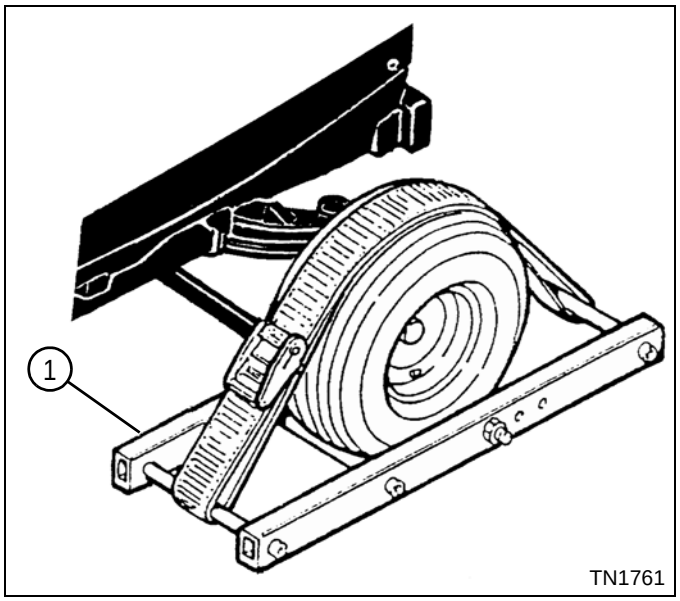


Figure 5-19

2. Install wheel restraints (1) to both front wheels.

IMPORTANT

For 3WD models, it is important to lift and support the rear of the machine, or the machine will move.

3. For 3WD models, lift the machine so that the rear wheel is off the ground. Support the machine with jackstands.
4. Release park brake, lower the cutting units, and move throttle lever to full throttle. Slowly push the traction pedal forward.

   Does the engine labor or stall?

   YES *The traction pump is not faulty.*

   NO *A fault exists in the hydrostatic drive circuit, which includes the traction pump and wheel motors. Proceed to instrument test. (See “Instrument Test Procedures” on page 5-35.)*

Instrument Test Procedures

Instrument Test Overview

The following tests are specifically designed to approach hydraulic testing on a system level. Each component within the system represents a portion of the total system leakage. An internal leakage percentage for each component will be calculated and recorded, enabling the technician to view the system performance issue more completely. The test results will help the technician to decide which repairs will best remedy the performance issue experienced by the operator.

The internal leakage percentage ranges are as follows:

0–10% = Good

11–20% = Marginal

21% and beyond = Bad

Example: Traction System Performance Complaint

The machine operator reports that the machine struggles to climb hills.

The traction system is tested as outlined, and the calculated system leakage is 31%, a result that requires the testing of individual components. This result can also be interpreted as system efficiency of 69%.

The components in question are as follows: traction pump, right front wheel motor, left front wheel motor, and rear wheel motor. Following the procedures as outlined, test each individual component, then calculate and record leakage percentages.

The results from this test reveal leakage of 5% in the traction pump, 20% in the right front wheel motor, 5.3% in the left front wheel motor, 4.1% in the rear wheel motor, and 2.9% in the flushing valve check valve. Although all the components lend to the overall system leakage, only the right front wheel motor, which is at the extreme end of the marginal range, would be considered for repair or replacement.

Formulas:

System and Traction Pump

No Load Flow – Loaded Flow / No Load Flow x 100 = Leak Percentage

Wheel Motors

Loaded Flow from previous component – Loaded Flow from current component / Loaded Flow from previous component x 100 = Leak Percentage

Calculations:

System Test

No Load Flow = 10 gpm

Loaded Flow = 6.9 gpm

10 – 6.9 / 10 x 100 = Total System Leakage 31%

Traction Pump Test

No Load Flow = 10 gpm

Loaded Flow = 9.5 gpm

10 – 9.5 / 10 x 100 = Traction Pump Leakage 5%

Right Front Wheel Motor Test

Loaded Flow from traction pump test = 9.5 gpm

Loaded Flow from right front wheel motor test = 7.6 gpm

9.5 – 7.6 / 9.5 x 100 = Right Front Wheel Motor Leakage = 20%

Left Front Wheel Motor Test

Loaded Flow from right front wheel motor test = 7.6 gpm

Loaded Flow from left front wheel test = 7.2 gpm

7.6 – 7.2 / 7.6 x 100 = Left Front Wheel Motor Leakage = 5.3%

Rear Wheel Motor Test

Loaded Flow from left front wheel motor test = 7.2 gpm

Loaded Flow from rear wheel motor test = 6.9 gpm

7.2 – 6.9 / 7.2 x 100 = Rear Wheel Motor Leakage = 4.1%

Flushing Valve Check Valve Test

Loaded Flow from rear wheel motor test = 6.9 gpm

Loaded Flow from flushing valve check valve test = 6.7 gpm

6.9 – 6.7 / 6.9 x 100 = Rear Wheel Motor Leakage = 2.9%

Charge Pressure Test

See Figures 5-20 through 5-23.

WARNING

The hydraulic system is under pressure, and the oil will be hot.

- **Always relieve pressure in the hydraulic system before performing service.**
- **Failure to follow appropriate safety precautions may result in death or serious injury.**

Required Tools and Materials
• Pressure Gauge 500 psi (35 bar)
• Test Hose 500 psi (35 bar)

NOTE

Procedure is for 3WD models. Procedure for 2WD models is the same except where noted.

1. Operate hydraulic system until oil temperature is 120–150° F (49–65° C).
2. Park the mower safely.

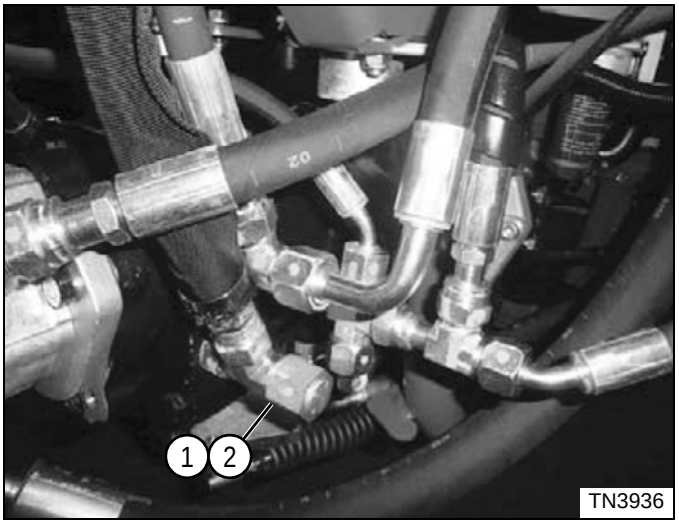


Figure 5-20: Traction Pump Fittings—3WD Models

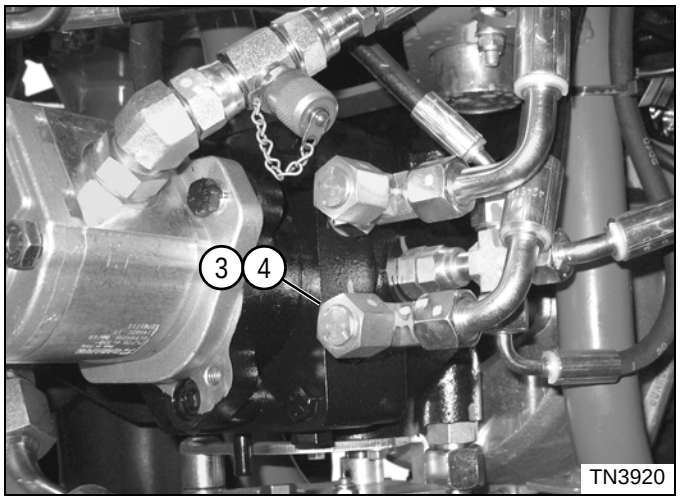


Figure 5-21: Traction Pump Fittings—2WD Models

Figure 5-22

3. For 3WD models, remove cap (1) and connect test hose and pressure gauge (5) to traction pump tee fitting (2) at port “B.”
4. For 2WD models, remove cap (3) and connect test hose and pressure gauge (5) to traction pump tee fitting (4) at port “B.”

NOTE

Verify engine rpm is within specification (3400 rpm ± 50) to ensure accurate hydraulic test results.

5. Start engine and run at full throttle (3400 rpm ± 50).
6. Record pressure reading.
7. Stop engine.

Is charge pressure 150–210 psi (10–15 bar)?

YES *Charge pressure relief valve is good. Proceed to step 11.*

NO *Inspect, repair, or replace charge pressure relief valve. Proceed to step 8.*

8. Retest charge pressure.

   Is charge pressure 150–210 psi (10–15 bar)?

   YES *Charge pressure relief valve is good. Proceed to step 11.*

   NO *For 3WD models, proceed to step 9. For 2WD models, inspect, repair, or replace charge relief valve. See "Traction Pump and Control" on page 5-50, then proceed to step 10.*

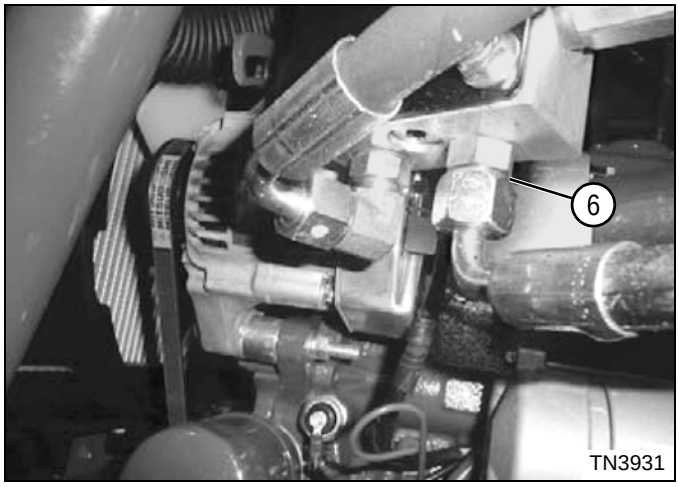


Figure 5-23

9. Insert blocking disk at port "DR" (6) of flushing valve and retest charge pressure.

   Is charge pressure 150–210 psi (10–15 bar)?

   YES *Inspect, repair, or replace flushing valve. See "Flushing Valve" on page 5-55, then proceed to step 11.*

   NO *Inspect, repair, or replace charge relief valve. See "Traction Pump and Control" on page 5-50, then proceed to step 10.*

10. Retest charge pressure.

    Is charge pressure 150–210 psi (10–15 bar)?

    YES *Charge pump is good. Proceed to step 11.*

    NO *Inspect, repair, or replace charge pump as needed. (See "Traction Pump and Control" on page 5-50.)*

11. Disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
12. Install and connect all components as noted prior to test.
13. Check hydraulic oil level. Add oil as needed. (Refer to "Parts and Maintenance Manual" for correct oil specifications.)

Traction System Test

See Figures 5-24 through 5-31.

IMPORTANT

- **Performing this test will isolate the traction pump and wheel motors from the rest of the hydrostatic system.**
- **This test works together with the traction pump tests, wheel motors tests, and flushing valve check valve test to isolate a problem within the hydrostatic power train.**

WARNING

The hydraulic system is under pressure, and the oil will be hot.

- **Always relieve pressure in the hydraulic system before performing service.**
- **Failure to follow appropriate safety precautions may result in death or serious injury.**

Required Tools and Materials

- Flow Meter
- -8 ORFS Test Hoses 4000 psi (276 bar)
- Flow Lock Tool
- Wheel Restraints

NOTE

Procedure is for 3WD models. Procedure for 2WD models is the same except where noted.

1. Park the mower safely. (See "Park Mower Safely" on page 1-6.)
2. Bypass seat switch.

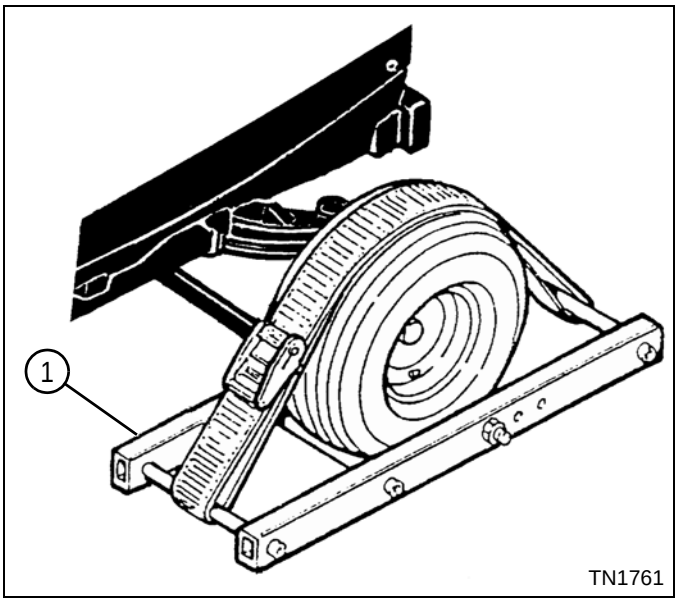


Figure 5-24

3. Install wheel restraints (1) to both front wheels.

WARNING

Prevent personal injury. Use properly rated lifting devices. Always be sure load is balanced before lifting.

Support the machine properly using jackstands.

IMPORTANT

For 3WD models, it is important to lift and support the rear of the machine, or the machine will move.

4. For 3WD models, lift the machine so that the rear wheel is off the ground. Support the machine with jackstands.
5. Disconnect traction pump control cable from pump control arm.

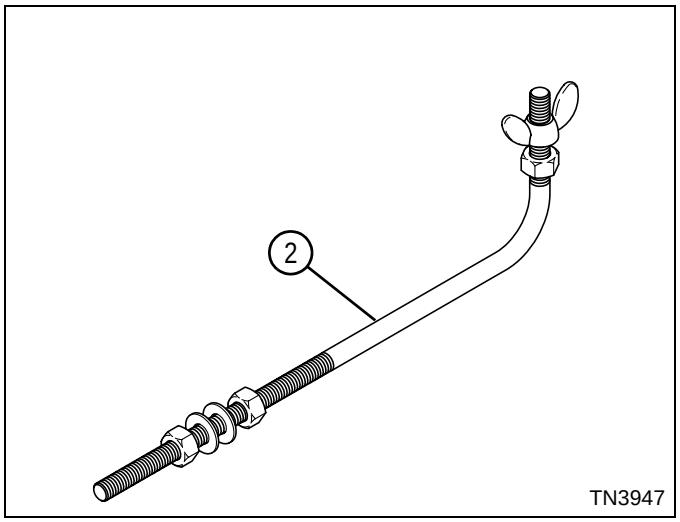


Figure 5-25

6. Install flow lock tool (2) and secure to pump control arm.
7. Close tow valve completely by turning clockwise.
8. For 3WD models, proceed to step 15.

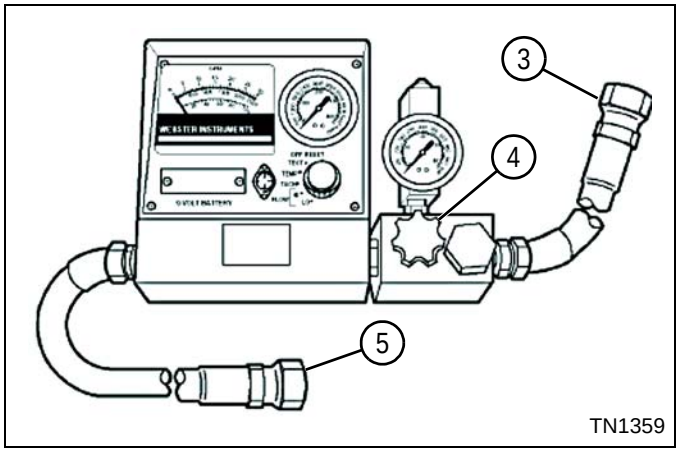


Figure 5-26

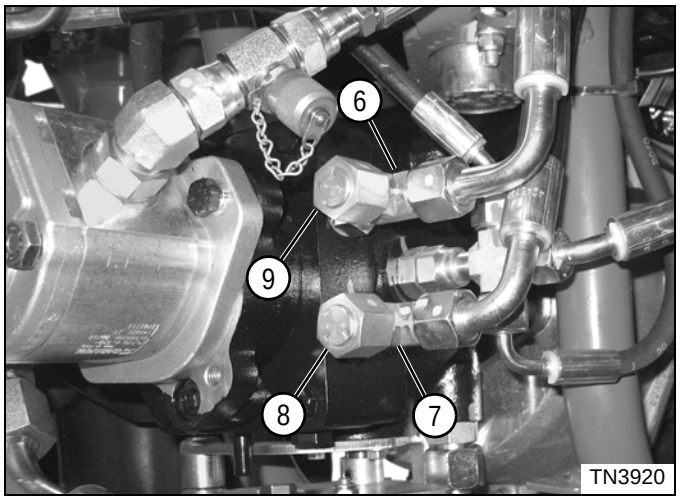


Figure 5-27: Traction Pump Fittings—2WD Models

9. Disconnect cap (9) from tee fitting (6).
10. Connect test hose (5) of flow meter inlet to tee fitting (6).
11. Disconnect cap (8) from tee fitting (7).
12. Connect test hose (3) of flow meter outlet to tee fitting (7).
13. Open flow meter valve (4) completely before starting engine.

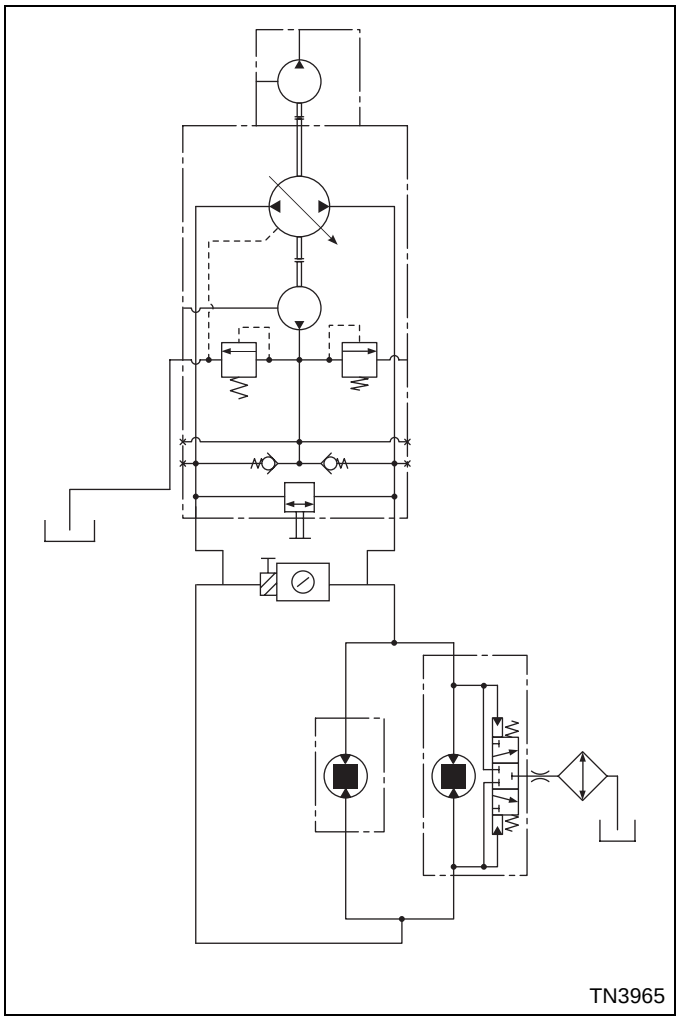


Figure 5-28: Traction System Test—2WD Models —Front Wheel Motors Restrained

14. Proceed to step 24.

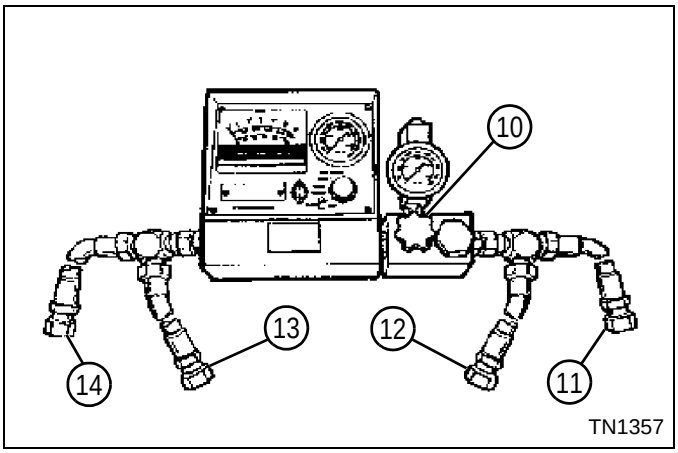


Figure 5-29

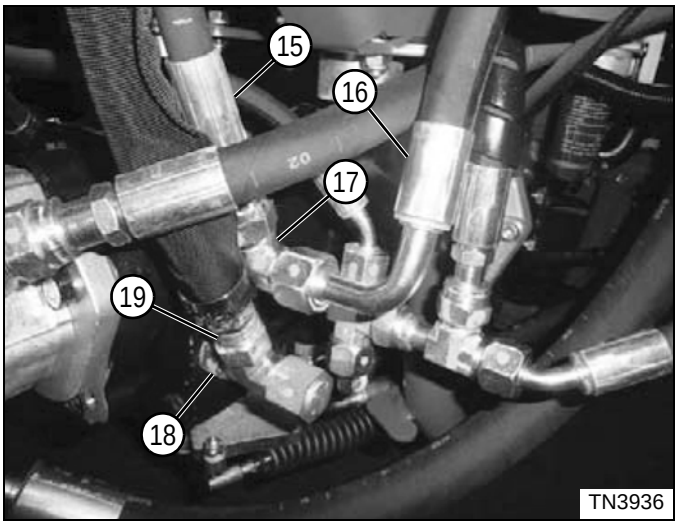


Figure 5-30: Traction Pump Fittings—3WD Models

15. Disconnect hoses (15 and 16) from tee fitting (17).
16. Remove tee fitting (17) from port “A” of traction pump.
17. Reconnect hoses (15 and 16) to tee fitting (17).
18. Connect test hose (14) of flow meter inlet to tee fitting (17).
19. Connect test hose (13) of flow meter inlet to port “A” of traction pump.
20. Disconnect hose (19) from tee fitting (18).
21. Connect test hose (12) of flow meter outlet to tee fitting (18).
22. Connect test hose (11) of flow meter outlet to hose (19).
23. Open flow meter valve (10) completely before starting engine.

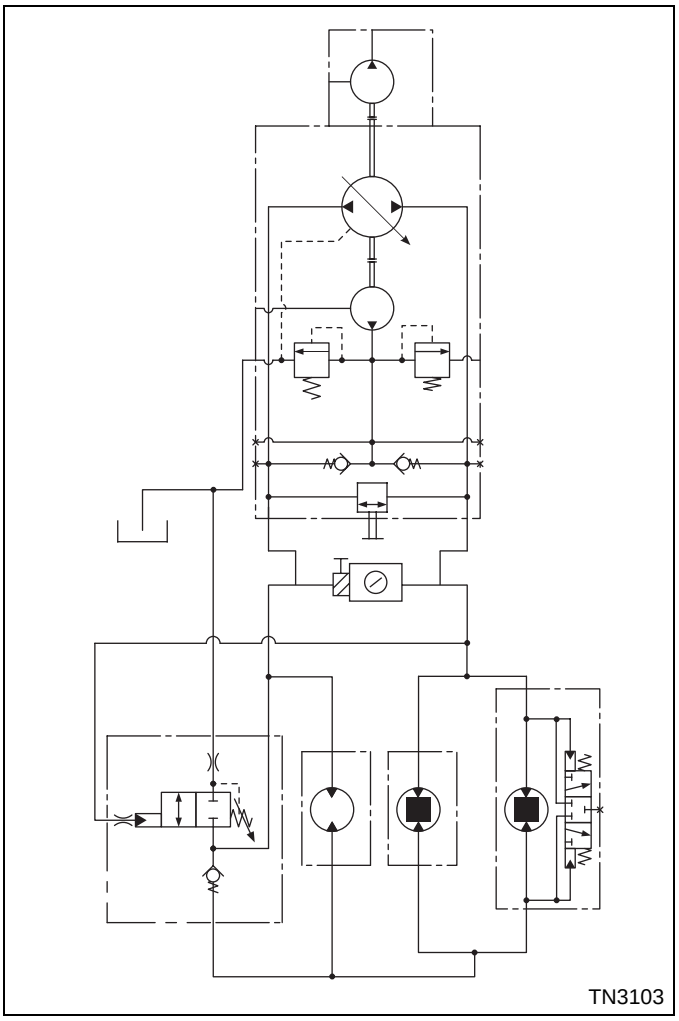


Figure 5-31: Traction System Test—3WD Models —Front Wheel Motors Restrained

NOTE

Verify engine rpm is within specification (3400 rpm ± 50) to ensure accurate hydraulic test results.

24. Start engine, release park brake, and run at full throttle (3400 rpm ± 50).
25. Adjust flow lock tool (2) to allow pump to produce 7 gpm (27 lpm) in the forward direction.
26. Use the flow meter to warm the hydraulic oil. Turn flow meter valve until a reading of 1000 psi (69 bar) is reached. Warm the oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
27. After warming the hydraulic oil, verify flow lock tool is adjusted to allow pump to produce 7 gpm (27 lpm) in the forward direction. Read and record no load flow.
28. Slowly close flow meter valve until a reading of 2500 psi (172 bar) is reached. Read and record loaded flow.
29. Stop engine, apply park brake, and return flow lock tool to the neutral position.
30. Calculate traction system leakage. (Step 27 – Step 28 / Step 27 x 100 = Leakage Percentage)

Is traction system leakage 10% or less?

YES *The traction system is good. Additional testing is required. Proceed to "Wheel Motors Tests" on page 5-43.*

NO *Proceed to next question.*

Is traction system leakage 11–20%?

YES *The traction system is marginal. Additional testing is required. Proceed to "Traction Pump Tests" on page 5-41.*

NO *Proceed to next question.*

Is traction system leakage 21% or more?

YES *Test individual components in traction system for leakage. Proceed to "Traction Pump Tests" on page 5-41.*

Traction Pump Tests

See Figures 5-32 through 5-37.

IMPORTANT

- **Performing this test will isolate the traction pump from the rest of the hydrostatic system.**
- **This test works together with the traction system test, wheel motors tests, and flushing valve check valve test to isolate a problem within the hydrostatic power train.**

WARNING

The hydraulic system is under pressure, and the oil will be hot.

- **Always relieve pressure in the hydraulic system before performing service.**
- **Failure to follow appropriate safety precautions may result in death or serious injury.**

Required Tools and Materials
• Flow Meter
• -8 ORFS Test Hoses 4000 psi (276 bar)
• -8 ORFS Blocking Disks
• Flow Lock Tool

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Before performing this test, perform traction system test, leaving rear of mower lifted and supported (3WD models), and flow meter and front wheel restraints connected as outlined. (See “Traction System Test” on page 5-37.)
3. For 3WD models, proceed to step 8.

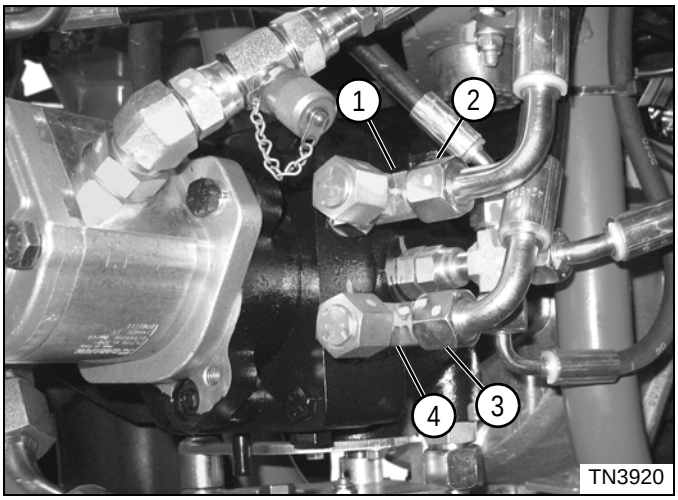


Figure 5-32: Traction Pump Fittings—2WD Models

4. Install blocking disk between tee fitting (1) and hose (2).
5. Install blocking disk between tee fitting (4) and hose (3).

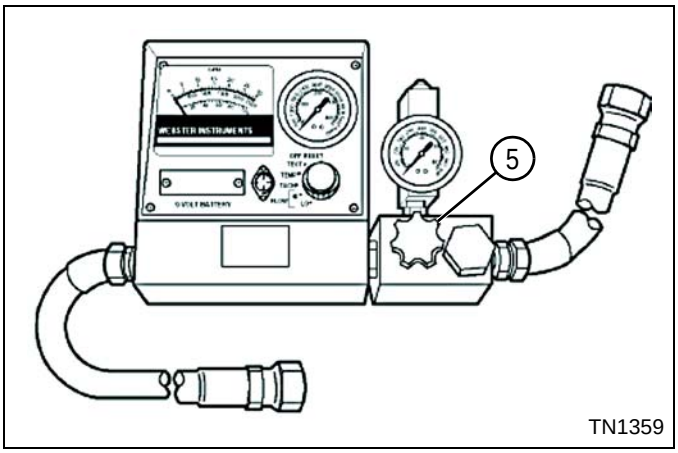


Figure 5-33

6. Open flow meter valve (5) completely before starting engine.
7. Proceed to step 10.

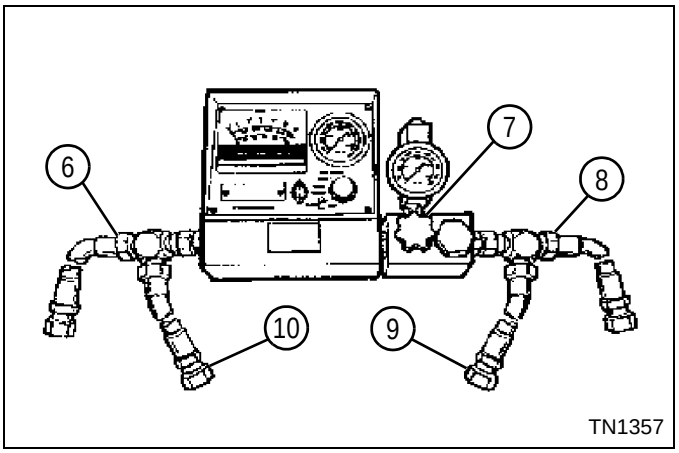


Figure 5-34

8. Install blocking disks at locations (6 and 8).
9. Open flow meter valve (7) completely before starting engine.

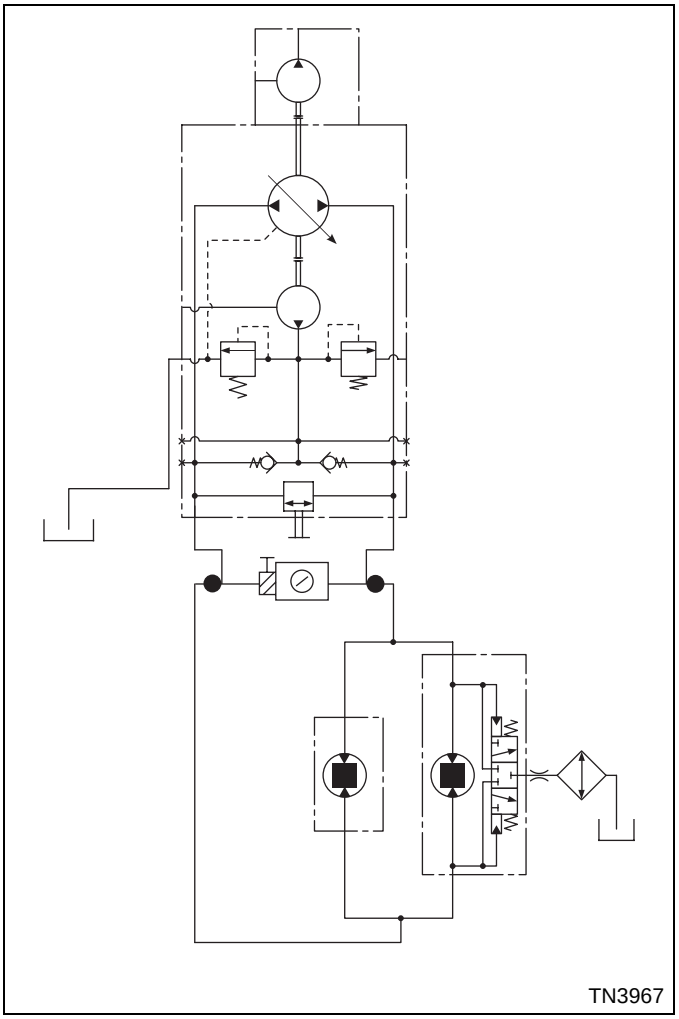


Figure 5-35: Traction Pump Test—2WD Models—Blocking Disks Blocking Oil to Wheel Motors

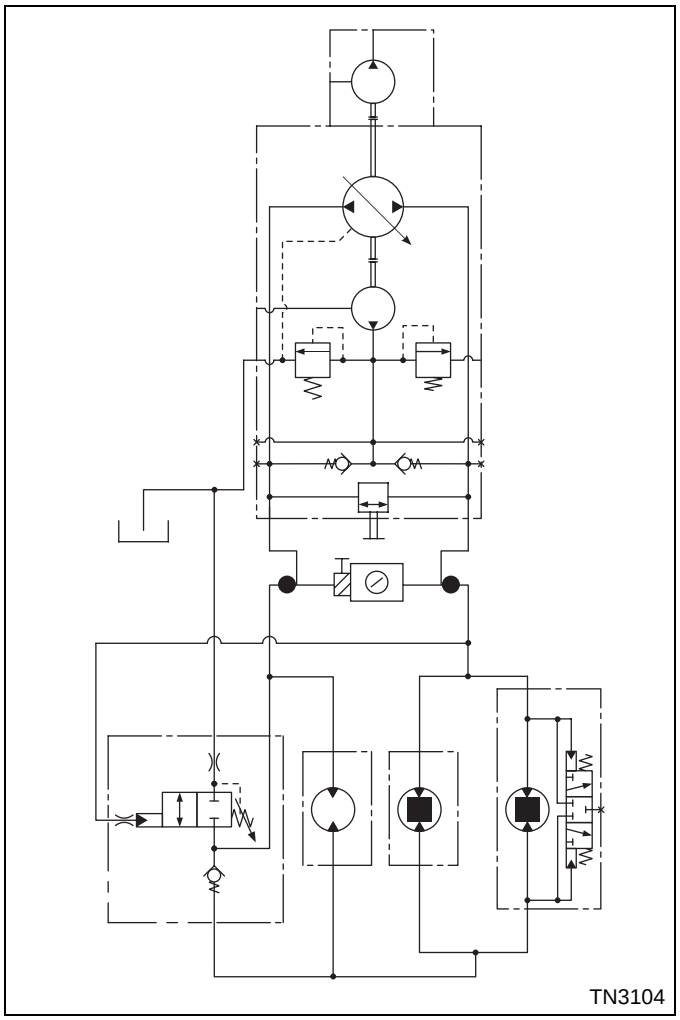


Figure 5-36: Traction Pump Test—3WD Models—Blocking Disks Blocking Oil to Wheel Motors

NOTE

Verify engine rpm is within specification (3400 rpm ± 50) to ensure accurate hydraulic test results.

10. Start engine, release park brake, and run at full throttle (3400 rpm ± 50).

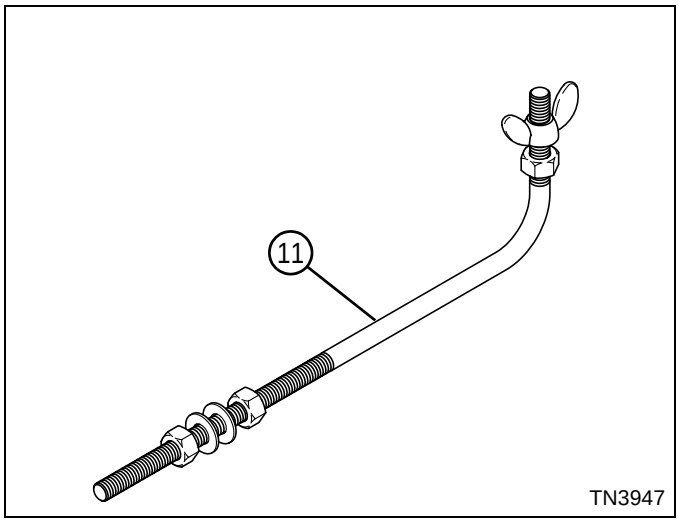


Figure 5-37

11. Adjust flow lock tool (11) to allow pump to produce 7 gpm (27 lpm) in the forward direction.
12. Use the flow meter to warm the hydraulic oil. Turn flow meter valve until a reading of 1000 psi (69 bar) is reached. Warm the oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
13. After warming the hydraulic oil, verify flow lock tool is adjusted to allow pump to produce 7 gpm (27 lpm) in the forward direction. Read and record no load flow.
14. Slowly close flow meter valve until a reading of 2500 psi (172 bar) is reached. Read and record loaded flow.
15. Stop engine, apply park brake, and return flow lock tool to the neutral position.
16. Calculate traction pump leakage. (Step 13 – Step 14 / Step 13 x 100 = Leak Percentage)

    Is traction pump leakage 10% or less?

    YES *The traction pump is good. Proceed to "Wheel Motors Tests" on page 5-43.*

    NO *Proceed to next question.*

    Is traction pump leakage 11–20%?

    YES *The traction pump is marginal. Additional testing is required. Proceed to "Wheel Motors Tests" on page 5-43.*

    NO *Proceed to next question.*

    Is traction pump leakage 21% or more?

    YES *Repair or replace traction pump. See "Traction Pump and Control" on page 5-50, then proceed to "Wheel Motors Tests" on page 5-43.*

Wheel Motors Tests

See Figures 5-38 through 5-45.

IMPORTANT

- **Performing this test will isolate the wheel motors from the rest of the hydrostatic system.**
- **This test works together with the traction system test, traction pump tests, and flushing valve check valve test to isolate a problem within the hydrostatic power train.**

⚠ WARNING

The hydraulic system is under pressure, and the oil will be hot.

- **Always relieve pressure in the hydraulic system before performing service.**
- **Failure to follow appropriate safety precautions may result in death or serious injury.**

Required Tools and Materials

- Flow Meter
- -8 ORFS Test Hoses 4000 psi (276 bar)
- -8 ORFS Blocking Disk
- -10 ORFS Blocking Disk
- Flow Lock Tool
- Wheel Restraints

NOTE

Procedure is for 3WD models. Procedure for 2WD models is the same except where noted.

1. Park the mower safely. (See "Park Mower Safely" on page 1-6.)
2. Before performing this test, perform traction pump tests, leaving rear of mower lifted and supported (3WD models), and flow meter and front wheel restraints connected as outlined. (See "Traction Pump Tests" on page 5-41.)
3. For 2WD models, remove blocking disks from between tee fitting (1) and hose (2), and between tee fitting (4) and hose (3) as identified in traction pump tests. (See "Traction Pump Tests" on page 5-41.)
4. For 3WD models, remove blocking disks from locations (6 and 8) as identified in traction pump tests. (See "Traction Pump Tests" on page 5-41.)
5. Connect hoses back to flow meter as outlined in traction system test. (See "Traction System Test" on page 5-37.)

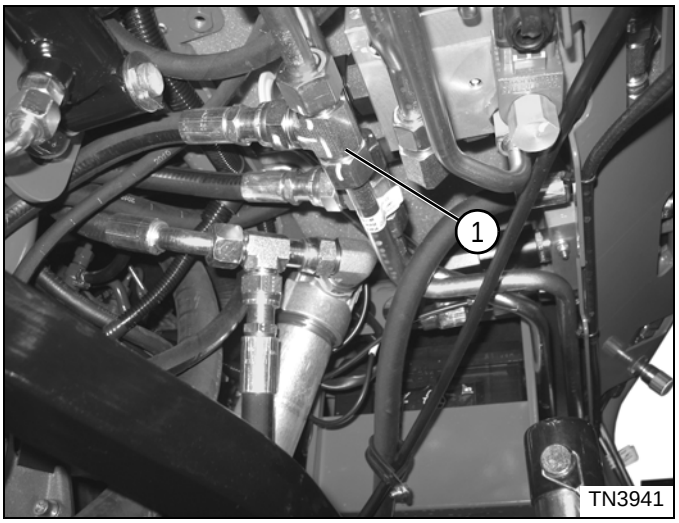


Figure 5-38

6. Install blocking disk at location (1) to block oil to left front wheel motor inlet.
7. Open flow meter valve completely before starting engine.

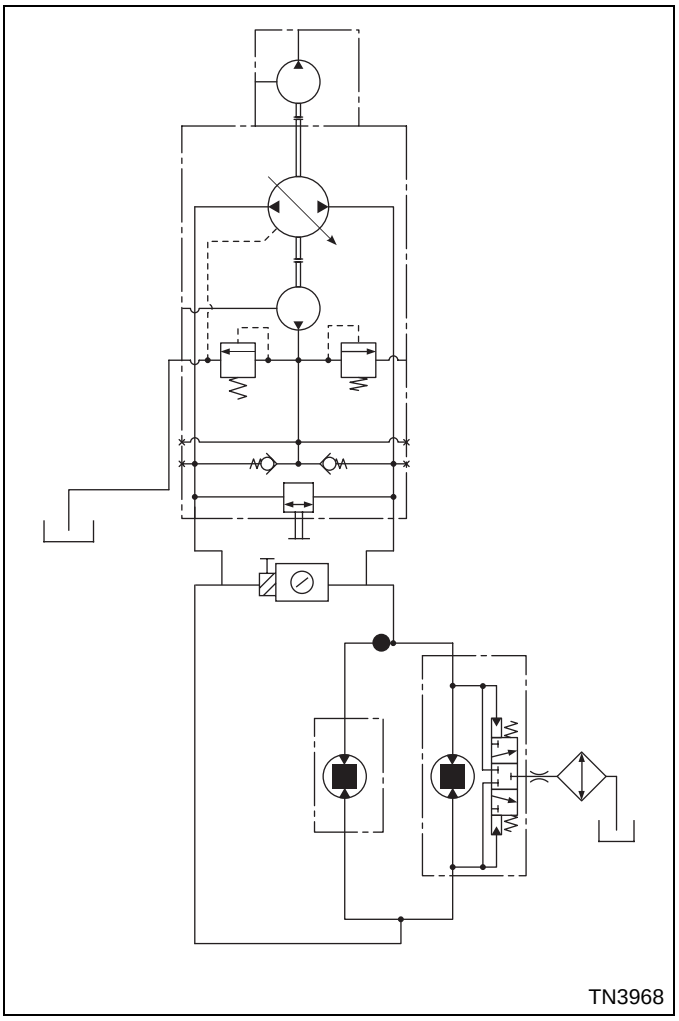


Figure 5-39: Right Front Wheel Motor Test—2WD Models—Blocking Disk Blocking Oil to Left Front Wheel Motor, Front Wheels Restrained

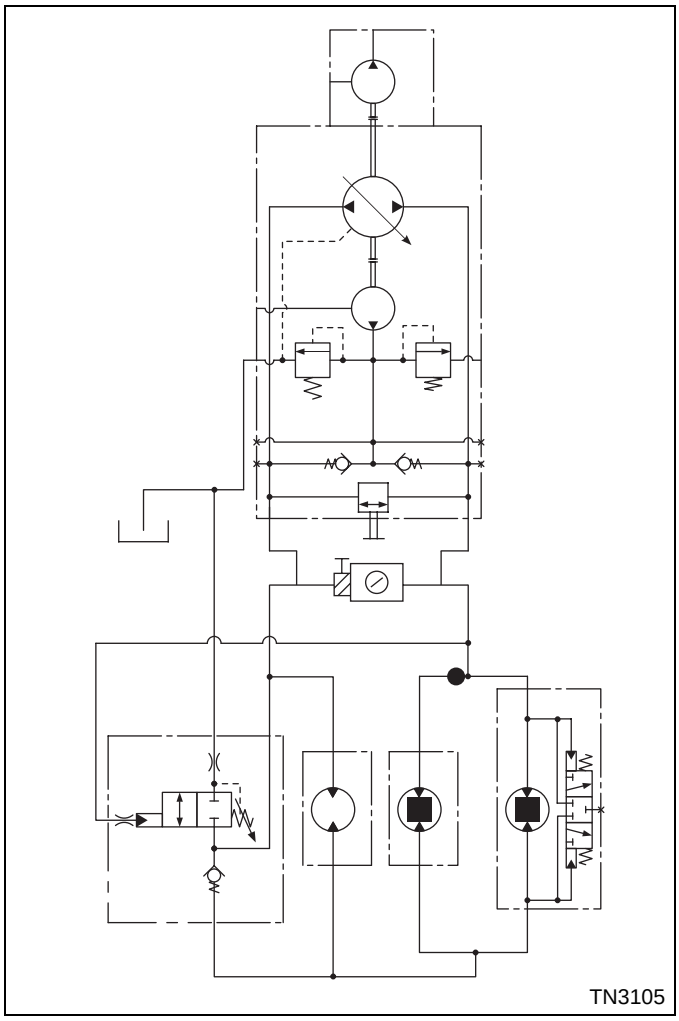


Figure 5-40: Right Front Wheel Motor Test—3WD Models—Blocking Disk Blocking Oil to Left Front Wheel Motor, Front Wheels Restrained

NOTE

Verify engine rpm is within specification (3400 rpm ± 50) to ensure accurate hydraulic test results.

8. Start engine, release park brake, and run at full throttle (3400 rpm ± 50).

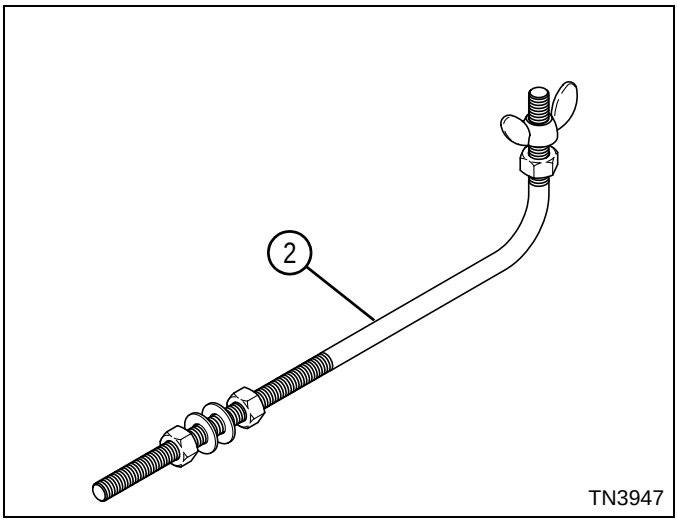


Figure 5-41

9. Adjust flow lock tool (2) to allow pump to produce 7 gpm (27 lpm) in the forward direction.
10. Use the flow meter to warm the hydraulic oil. Turn flow meter valve until a reading of 1000 psi (69 bar) is reached. Warm the oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
11. After warming the hydraulic oil, verify flow lock tool is adjusted to allow pump to produce 7 gpm (27 lpm) in the forward direction.
12. Slowly close flow meter valve until a reading of 2500 psi (172 bar) is reached. Read and record loaded flow.
13. Stop engine, apply park brake, and return flow lock tool to the neutral position.
14. Calculate right front wheel motor leakage. (Step 14 of previous test – Step 12 / Step 14 of previous test x 100 = Leak Percentage)

    Is right front wheel motor leakage 10% or less?

    YES *The right front wheel motor is good. Proceed to step 15.*

    NO *Proceed to next question.*

    Is right front wheel motor leakage 11–20%?

    YES *The right front wheel motor is marginal. Additional testing is required. Proceed to step 15.*

    NO *Proceed to next question.*

    Is right front wheel motor leakage 21% or more?

    YES *Repair or replace right front wheel motor. See "Wheel Motors" on page 5-57, then proceed to step 15.*

15. Remove blocking disk from location (1). See Figure 5-38. Connect hose back to tee fitting.

16. Open flow meter valve completely before starting engine.

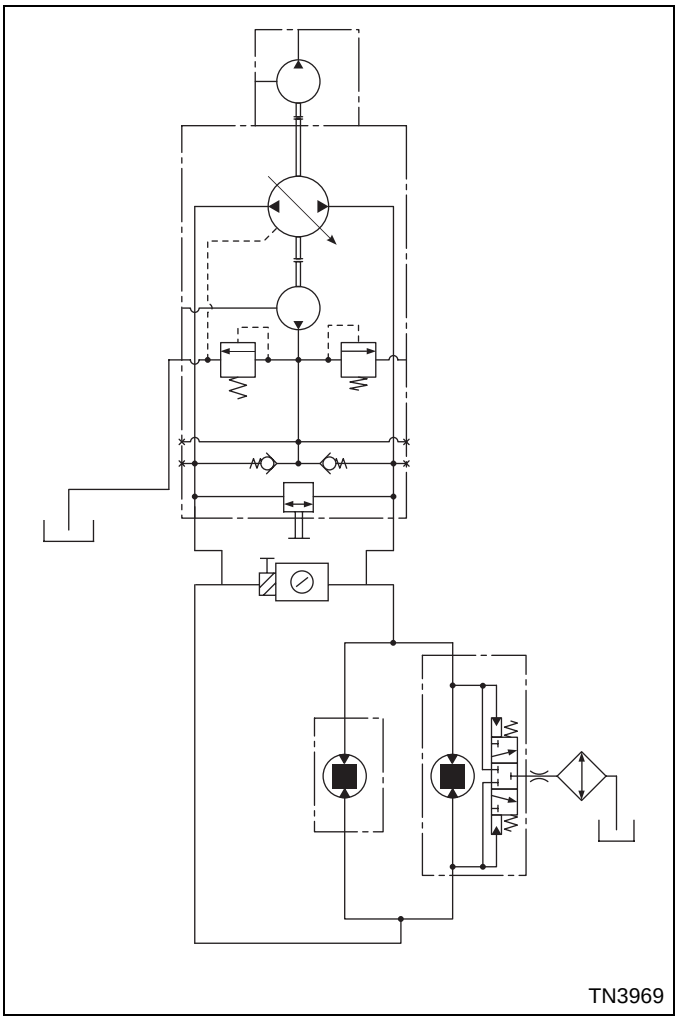


Figure 5-42: Left Front Wheel Motor Test—2WD Models—Front Wheels Restrained

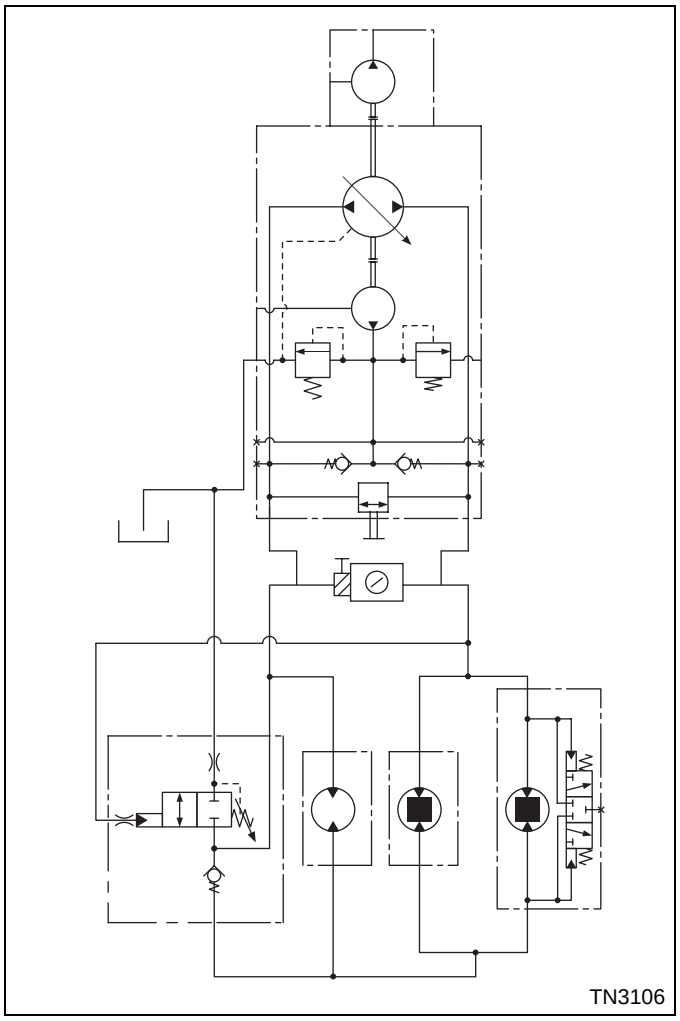


Figure 5-43: Left Front Wheel Motor Test—3WD Models—Front Wheels Restrained

NOTE

Verify engine rpm is within specification (3400 rpm ± 50) to ensure accurate hydraulic test results.

17. Start engine, release park brake, and run at full throttle (3400 rpm ± 50).
18. Adjust flow lock tool (1) to allow pump to produce 7 gpm (27 lpm) in the forward direction.
19. Use the flow meter to warm the hydraulic oil. Turn flow meter valve until a reading of 1000 psi (69 bar) is reached. Warm the oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
20. After warming the hydraulic oil, verify flow lock tool is adjusted to allow pump to produce 7 gpm (27 lpm) in the forward direction.
21. Slowly close flow meter valve until a reading of 2500 psi (172 bar) is reached. Read and record loaded flow.

22. Stop engine, apply park brake, and return flow lock tool to the neutral position.
23. Calculate left front wheel motor leakage. (Step 12– Step 21 / Step 12 x 100 = Leak Percentage)

    Is left front wheel motor leakage 10% or less?

    YES *The left front wheel motor is good. Proceed to step 24.*

    NO *Proceed to next question.*

    Is left front wheel motor leakage 11–20%?

    YES *The left front wheel motor is marginal. Proceed to step 24.*

    NO *Proceed to next question.*

    Is left front wheel motor leakage 21% or more?

    YES *Repair or replace left front wheel motor. See "Wheel Motors" on page 5-57, then proceed to step 24.*
24. Lower rear of machine to the ground.
25. Remove front wheel restraints.
26. For 3WD models, proceed to step 30.
27. For 2WD models, testing is complete. Disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
28. Check hydraulic oil level and add if necessary. (Refer to "Parts and Maintenance Manual" for correct oil specifications.).

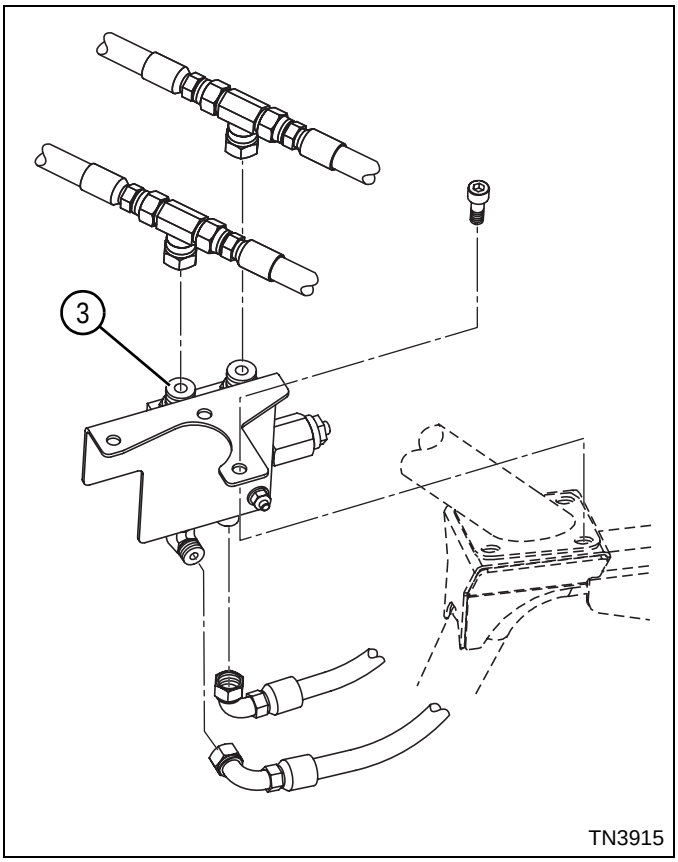


Figure 5-44

29. Install blocking disk at location (3) to block oil to port "RW1" of flushing valve.
30. Install wheel restraint to rear wheel.

WARNING

Prevent personal injury. Use properly rated lifting devices. Always be sure load is balanced before lifting.

Support the machine properly using jackstands.

31. Lift and support front of machine.
32. Open flow meter valve completely before starting engine.

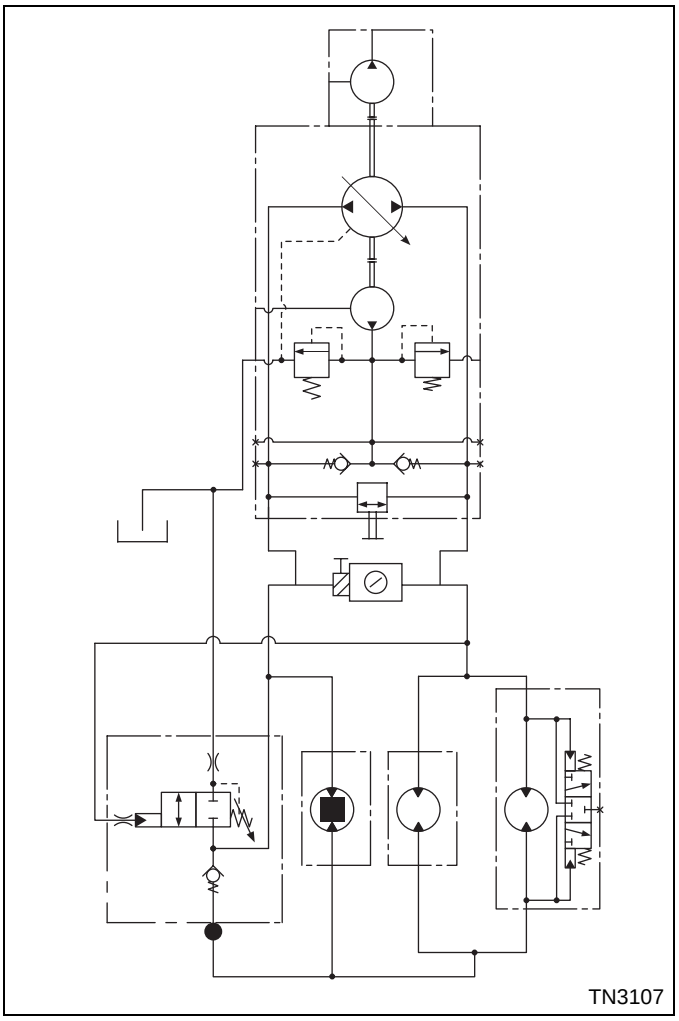


Figure 5-45: Rear Wheel Motor Test—3WD Models—Blocking Disk Blocking Oil to Flushing Valve Port "RW1," Rear Wheel Restrained

NOTE

Verify engine rpm is within specification (3400 rpm ± 50) to ensure accurate hydraulic test results.

33. Start engine, release park brake, and run at full throttle (3400 rpm ± 50).
34. Adjust flow lock tool (1) to allow pump to produce 7 gpm (27 lpm) in the forward direction.
35. Use the flow meter to warm the hydraulic oil. Turn flow meter valve until a reading of 1000 psi (69 bar) is reached. Warm the oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
36. After warming the hydraulic oil, verify flow lock tool is adjusted to allow pump to produce 7 gpm (27 lpm) in the forward direction.
37. Slowly close flow meter valve until a reading of 2500 psi (172 bar) is reached. Read and record loaded flow.
38. Stop engine, apply park brake, and return flow lock tool to the neutral position.
39. Calculate rear wheel motor leakage. (Step 21 – Step 37 / Step 21 x 100 = Leak Percentage)

    Is rear wheel motor leakage 10% or less?

    YES *The rear wheel motor is good. Proceed to "Flushing Valve Check Valve Test" on page 5-48.*

    NO *Proceed to next question.*

    Is rear wheel motor leakage 11–20%?

    YES *The rear wheel motor is marginal. Additional testing is required. Proceed to "Flushing Valve Check Valve Test" on page 5-48.*

    NO *Proceed to next question.*

    Is rear wheel motor leakage 21% or more?

    YES *Repair or replace rear wheel motor. See "Wheel Motors" on page 5-57, then proceed to "Flushing Valve Check Valve Test" on page 5-48.*

Flushing Valve Check Valve Test

See Figures 5-46 and 5-47.

IMPORTANT

- **Performing this test will isolate the flushing valve check valve from the rest of the hydrostatic system.**
- **This test works together with the traction system test, traction pump tests, and wheel motors tests to isolate a problem within the hydrostatic power train.**

WARNING

The hydraulic system is under pressure, and the oil will be hot.

- **Always relieve pressure in the hydraulic system before performing service.**
- **Failure to follow appropriate safety precautions may result in death or serious injury.**

Required Tools and Materials
• Flow Meter • -8 ORFS Test Hoses 4000 psi (276 bar) • Flow Lock Tool • Wheel Restraint

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Before performing this test, perform wheel motors tests leaving flow meter and rear wheel restraint connected as outlined. (See “Wheel Motors Tests” on page 5-43.)
3. Remove blocking disk at location (3). See Figure 5-44. Connect tee fitting back to flushing valve.
4. Open flow meter valve completely before starting engine.

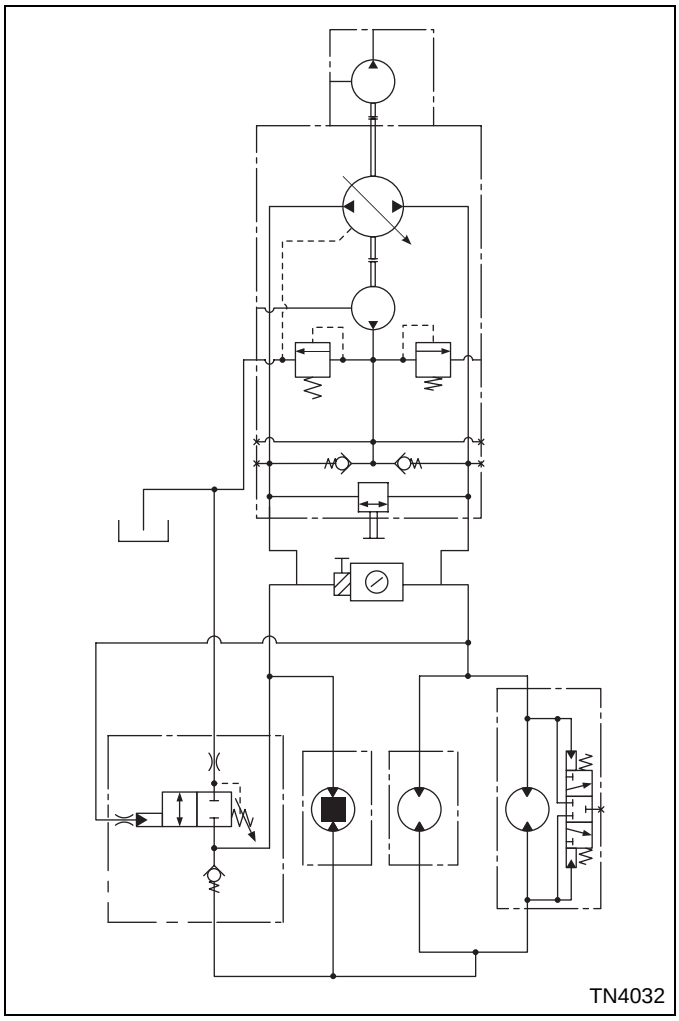


Figure 5-46: Flushing Valve Check Valve Test—3WD Models—Rear Wheel Restrained

NOTE

Verify engine rpm is within specification (3400 rpm ± 50) to ensure accurate hydraulic test results.

5. Start engine, release park brake, and run at full throttle (3400 rpm ± 50).

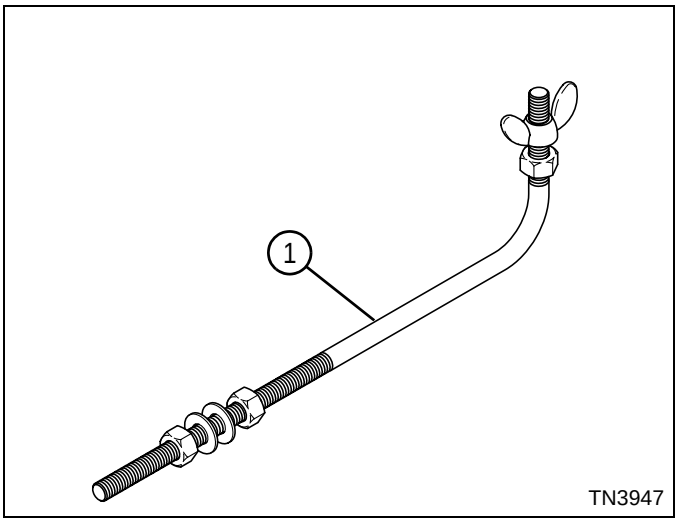


Figure 5-47

6. Adjust flow lock tool (1) to allow pump to produce 7 gpm (27 lpm) in the forward direction.
7. Use the flow meter to warm the hydraulic oil. Turn flow meter valve until a reading of 1000 psi (69 bar) is reached. Warm the oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
8. After warming the hydraulic oil, verify flow lock tool is adjusted to allow pump to produce 7 gpm (27 lpm) in the forward direction.
9. Slowly close flow meter valve until a reading of 2500 psi (172 bar) is reached. Read and record loaded flow.
10. Stop engine, apply park brake, and return flow lock tool to the neutral position.
11. Calculate check valve leakage.
(Step 37 of previous test – Step 9 / Step 37 of previous test x 100 = Leak Percentage)

    Is check valve leakage 10% or less?

    YES *The check valve is good. Proceed to step 12.*

    NO *Proceed to next question.*

    Is check valve leakage 11–20%?

    YES *The check valve is marginal. Additional testing is required. Proceed to step 12.*

    NO *Proceed to next question.*

    Is check valve leakage 21% or more?

    YES *Repair or replace check valve. See “Flushing Valve” on page 5-55, then proceed to step 12.*

12. Disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
13. Check hydraulic oil level and add if necessary. (Refer to “Parts and Maintenance Manual” for correct oil specifications.).

Repair

Traction Pump and Control

Removal and Installation

See Figures 5-48 through 5-51.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Drain hydraulic oil tank. (See “Hydraulic Oil Tank—Drain Procedure” on page 6-42.)
3. Remove gear pump. (See “Gear Pump” on page 6-43.)

NOTES

- *Label all hydraulic hoses and fittings before disconnecting to ensure correct installation.*
- *Close all openings with caps or plugs to prevent contamination.*

4. For 3WD models, proceed to step 8.

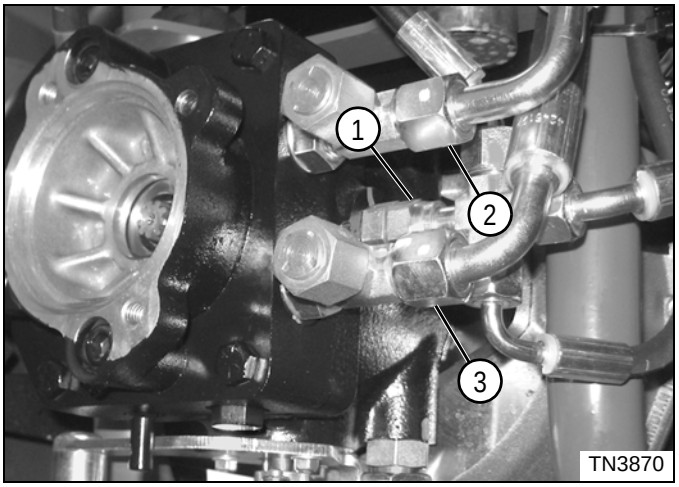


Figure 5-48

5. Disconnect hoses (2 and 3).
6. Disconnect cross fitting (1) at the traction pump.
7. Proceed to step 10.

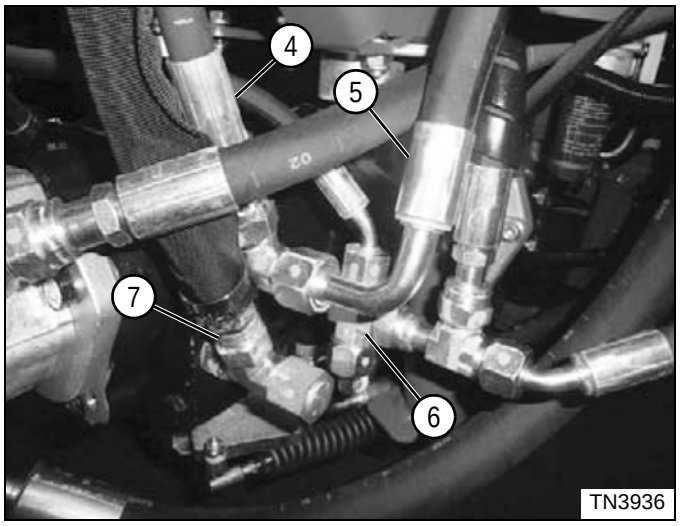


Figure 5-49

8. Disconnect hoses (4, 5, and 7).
9. Disconnect cross fitting (6) at the traction pump.

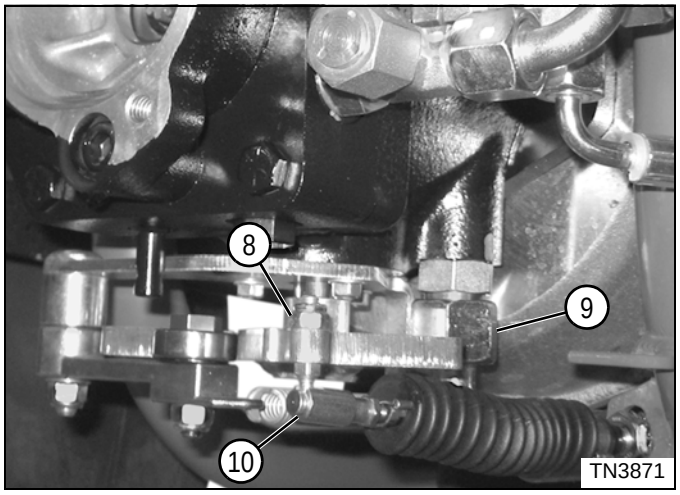


Figure 5-50

10. Remove nut (8) and disconnect control cable (10).

NOTES

- *Label all hydraulic hoses and fittings before disconnecting to ensure correct installation.*
- *Close all openings with caps or plugs to prevent contamination.*

11. Disconnect hose (9).

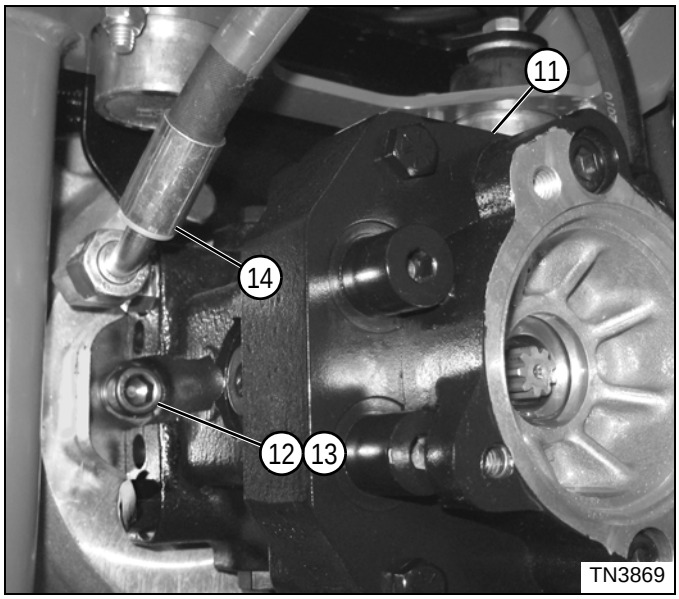


Figure 5-51

NOTES

- *Label all hydraulic hoses and fittings before disconnecting to ensure correct installation.*
- *Close all openings with caps or plugs to prevent contamination.*

12. Disconnect hose (14).
13. Support traction pump (11) with a suitable lifting device.
14. Remove mounting screw (12) and lock washer (13) on each side of traction pump (11).
15. Remove traction pump (11).

Installation Notes

- *Install traction pump by reversing the order of removal.*
- *Ensure new O-rings are in place before installing hoses on fittings.*
- *Pressure filter the traction system. (See "Portable In-Line Filter" on page 5-5.)*
- *Refill hydraulic oil tank. (Refer to "Parts and Maintenance Manual" for correct oil specifications.)*
- *Start engine. Check for leaks and repair as necessary.*
- *Perform neutral adjustment. (See "Neutral Adjustment" on page 5-32.)*

Disassembly, Inspection, and Assembly

See Figures 5-52 through 5-54.

NOTE

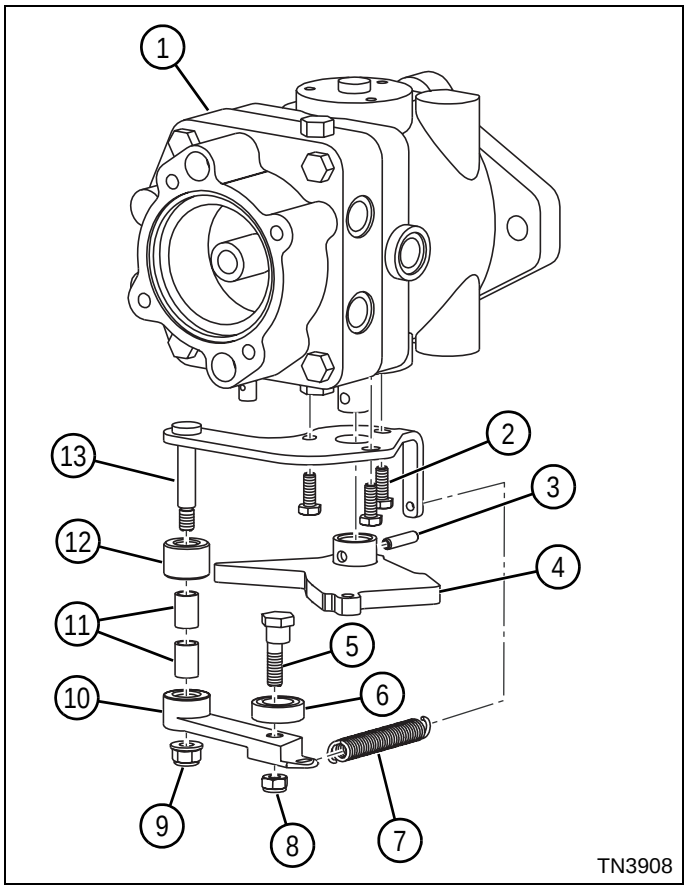
Service to the traction pump is limited to the following components:

- *Charge Pump*
- *Implement Relief Valve*
- *Charge Relief Valve*
- *Trunnion and Shaft Seals*

Damage or excessive wear to traction pump components other than service components requires traction pump replacement.

Control Linkage and Fittings

1. Thoroughly clean the exterior of the pump housing before disassembly.



1	Traction Pump	6	Bearing	10	Roller Arm
2	Screw (3)	7	Spring	11	Bushing (2)
3	Roll Pin	8	Lock Nut	12	Roller
4	Cam Plate	9	Lock Nut	13	Control Weldment
5	Eccentric Screw				

Figure 5-52

2. Disconnect spring (7) from control weldment (13).

3. Remove (drive out) roll pin (3), and remove cam plate (4) from traction pump (1).
4. Remove three screws (2), and remove control weldment assembly (13) from traction pump (1).

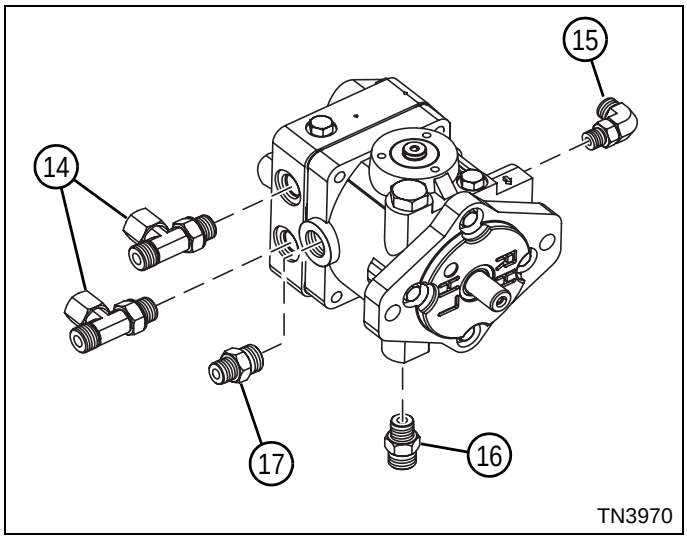


Figure 5-53

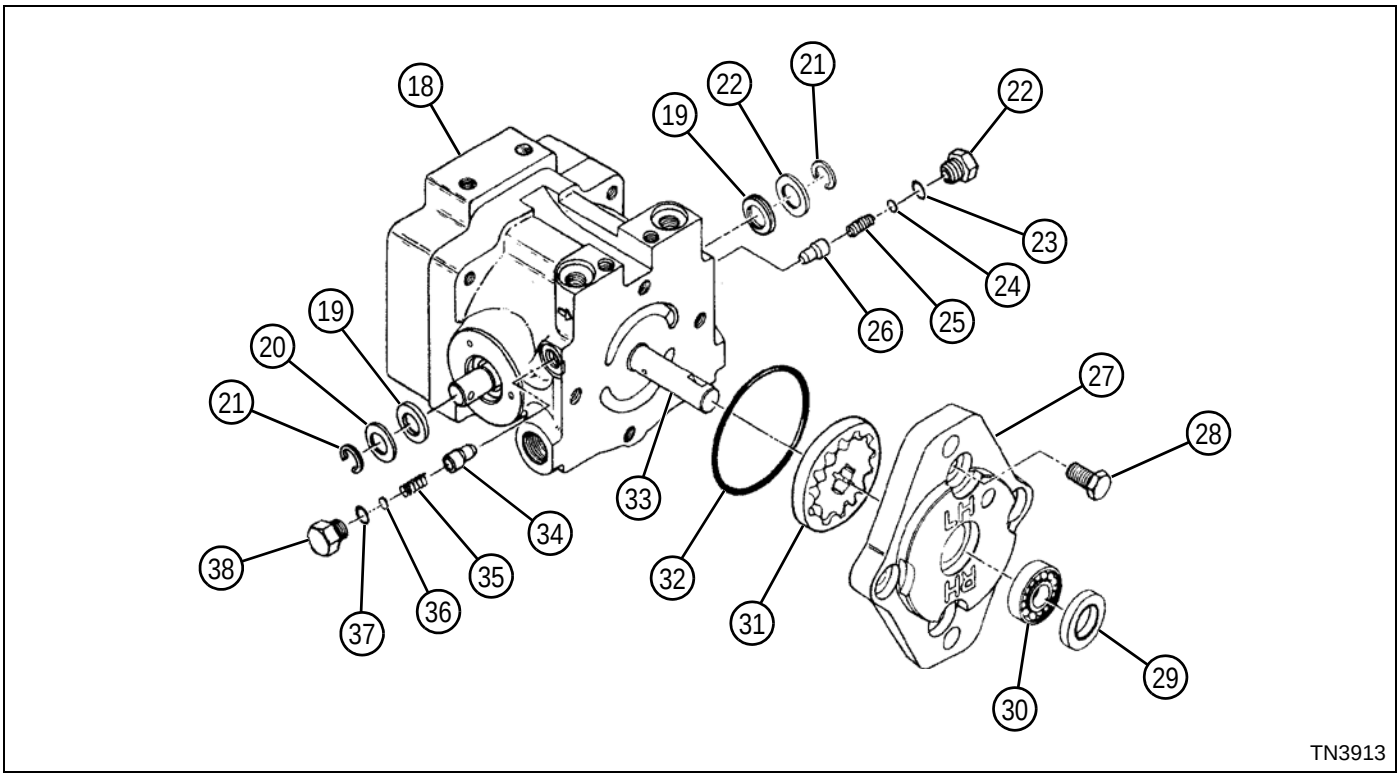
NOTE

Record the location of fittings before removing to ensure correct installation.

5. Remove, inspect, and replace fitting (15) for port “V1” as necessary.
6. Remove, inspect, and replace fitting (16) for port “S” as necessary.
7. Remove, inspect, and replace fitting (17) for port “L1” as necessary.
8. Remove, inspect, and replace fittings (14) for ports “A” and “B” as necessary.

Assembly Notes

- *Install new O-rings and seals.*
- *Tighten fitting (15) for port “V1” to 27 lb-ft (37 N·m).*
- *Tighten fitting (16) for port “S” to 77 lb-ft (105 N·m).*
- *Tighten fitting (17) for port “L1” to 55 lb-ft (74 N·m).*
- *Tighten fittings (14) for ports “A” and “B” to 55 lb-ft (74 N·m).*



18	Traction Pump Housing	24	Shim (A/R) (Implement Relief)	29	Seal	34	Poppet (Charge Relief)
19	Seal (2)	25	Spring (Implement Relief)	30	Bearing	35	Spring (Charge Relief)
20	Washer (2)	26	Poppet (Implement Relief)	31	Charge Pump (Gerotor)	36	Shim (A/R) (Charge Relief)
21	Retaining Ring (2)	27	Charge Pump Housing	32	O-Ring	37	O-Ring (Charge Relief)
22	Plug (Implement Relief)	28	Screw (4)	33	Shaft Extension	38	Plug (Charge Relief)
23	O-Ring (Implement Relief)						

Figure 5-54

5

Charge Pump

1. Note the orientation of charge pump housing (27), and mark the housing and adjacent portions of traction pump housing (18) to ensure correct installation.
2. Clean traction pump shaft extension (33), and remove any sharp edges and abrasive residue.
3. Remove four hex-head screws (28), and remove charge pump housing (27), charge pump (31), and O-ring (32).
4. Inspect seal (29) and bearing (30). Remove bearing and seal only if replacement is required.
5. Inspect the wear surfaces of charge pump (31) for excessive scratching or heavy wear patterns. If replacement is required, replace entire charge pump as a unit.

⚠ WARNING

Use appropriate eye protection when using compressed air for cleaning or drying purposes. Compressed air can cause serious personal injury. Use safety reduction valves to reduce the air pressure to a safe level before use.

NOTICE

It is important that all pump parts are absolutely clean, as contamination can result in serious damage and/or improper operation.

Never use shop towels or rags to dry parts after cleaning, as lint may clog passages. Dry parts using compressed air only.

6. Clean all parts using clean solvent, and dry using compressed air.

Inspection Notes

- *Keeping parts in assembly order, clean and air dry each item for inspection.*
- *Inspect for worn or defective parts.*
- *Look for metal chips or slivers during cleaning (an indication of damage to pump or other hydraulic component).*

Assembly Notes

- *Assemble charge pump by reversing the order of disassembly.*
- *Cover the end of the traction pump shaft extension (33) with tape before installing the charge pump housing to prevent damaging the seal (29).*
- *Apply a thin film of clean hydraulic oil to charge pump components (31), and charge pump housing (27) surface, and seal lip (29) before assembly.*

Charge Relief Valve

1. Remove plug (38), spring (35), and poppet (34) from traction pump housing (18). Note the number of shims (36).
2. Inspect poppet (34) and the seat in housing (18) for damage, and remove any foreign material. Replace components as needed.

WARNING

Use appropriate eye protection when using compressed air for cleaning or drying purposes. Compressed air can cause serious personal injury. Use safety reduction valves to reduce the air pressure to a safe level before use.

NOTICE

It is important that all pump parts are absolutely clean, as contamination can result in serious damage and/or improper operation.

Never use shop towels or rags to dry parts after cleaning, as lint may clog passages. Dry parts using compressed air only.

3. Clean all parts using clean solvent, and dry using compressed air.

Inspection Notes

- *Keeping parts in assembly order, clean and air dry each item for inspection.*
- *Inspect for worn or defective parts.*
- *Look for metal chips or slivers during cleaning (an indication of damage to pump or other hydraulic component).*

Assembly Note

Assemble charge relief valve by reversing the order of disassembly.

Implement Relief Valve

1. Remove plug (22), spring (25), and poppet (26) from traction pump housing (18). Note the number of shims (24).
2. Inspect poppet (26) and the seat in housing (18) for damage, and remove any foreign material. Replace components as needed.

WARNING

Use appropriate eye protection when using compressed air for cleaning or drying purposes. Compressed air can cause serious personal injury. Use safety reduction valves to reduce the air pressure to a safe level before use.

NOTICE

It is important that all pump parts are absolutely clean, as contamination can result in serious damage and/or improper operation.

Never use shop towels or rags to dry parts after cleaning, as lint may clog passages. Dry parts using compressed air only.

3. Clean all parts using clean solvent, and dry using compressed air.

Inspection Notes

- *Keeping parts in assembly order, clean and air dry each item for inspection.*
- *Inspect for worn or defective parts.*
- *Look for metal chips or slivers during cleaning (an indication of damage to pump or other hydraulic component).*

Assembly Note

Assemble implement relief valve by reversing the order of disassembly.

Trunnion and Shaft Seals

1. Remove retaining rings (21) and washers (20).

NOTICE

When removing seals, use caution to prevent damaging the housing bore or shaft surfaces.

2. Carefully pry seals (19) out of housing bore.
3. Clean and inspect the shaft, remove any sharp edges.

Inspection Notes

- *Keeping parts in assembly order, clean and air dry each item for inspection.*
- *Inspect for worn or defective parts.*
- *Look for metal chips or slivers during cleaning (an indication of damage to pump or other hydraulic component).*

Assembly Notes

- *Install seals by reversing the order of removal.*
- *The outside diameter of the seals may be coated with a sealant (such as Loctite® High Performance Sealant #5923) prior to installation. This will aid in preventing leaks caused by seal bore damage.*
- *Cover the end of the shaft with tape before installing the charge pump housing to prevent damaging the seals (19).*
- *Apply a thin film of clean hydraulic oil to seals (19) before assembly.*

Flushing Valve

Removal and Installation

See Figure 5-55.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Drain hydraulic oil tank. (See “Hydraulic Oil Tank—Drain Procedure” on page 6-42.)
3. Raise fuel/hydraulic tank. (See “Raise Hydraulic Oil/Fuel Tank” on page 9-4.)

NOTE

The flushing valve is located at the rear of the machine, on the left side, at the base of the left OPS strut.

4. Thoroughly clean the valve, especially the area surrounding hydraulic hoses, tubes, and fittings.

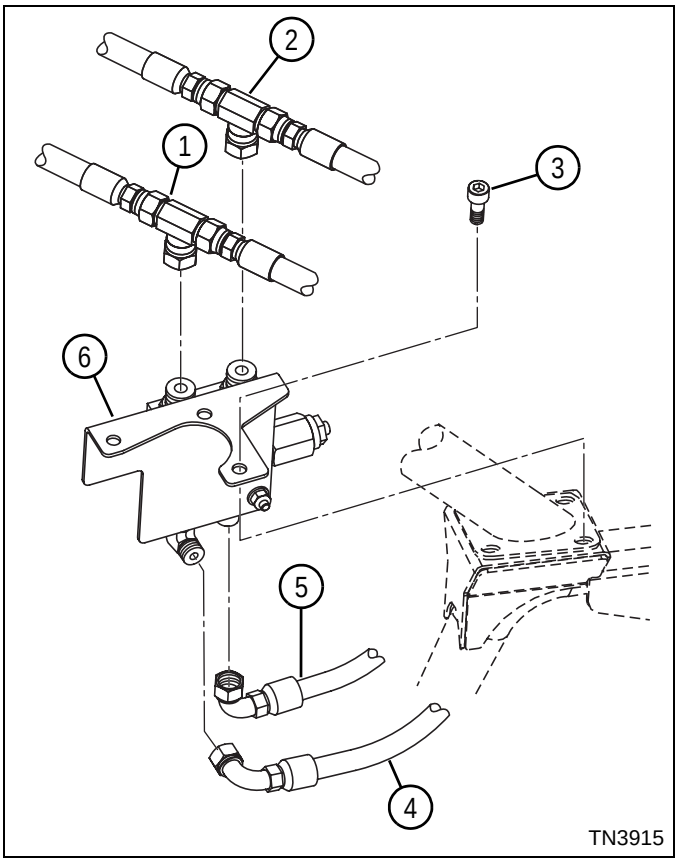


Figure 5-55

NOTES

- *Label all hydraulic hoses and tubes before disconnecting to ensure correct installation.*
- *Close all openings with caps or plugs to prevent contamination.*

5. Disconnect tee fittings (1 and 2) from flushing valve assembly (6).

6. Disconnect hoses (4 and 5) from flushing valve assembly (6).
7. Support flushing valve assembly (6).
8. Remove three mounting screws (3).
9. Remove flushing valve assembly (6).

Installation Notes

- *Install flushing valve by reversing the order of removal.*
- *Lubricate all O-rings prior to assembly.*
- *Make sure new O-rings are in place before installing hoses on fittings.*
- *Replace hydraulic oil charge filter. (See "Hydraulic Oil Charge Filter Assembly" on page 6-59.)*
- *Refill hydraulic oil tank. (Refer to "Parts and Maintenance Manual" for correct oil specifications.)*
- *Start engine. Check hydraulic system for leaks. Repair as necessary.*
- *Check hydraulic oil level and add if necessary.*

Disassembly, Inspection, and Assembly

See Figure 5-56.

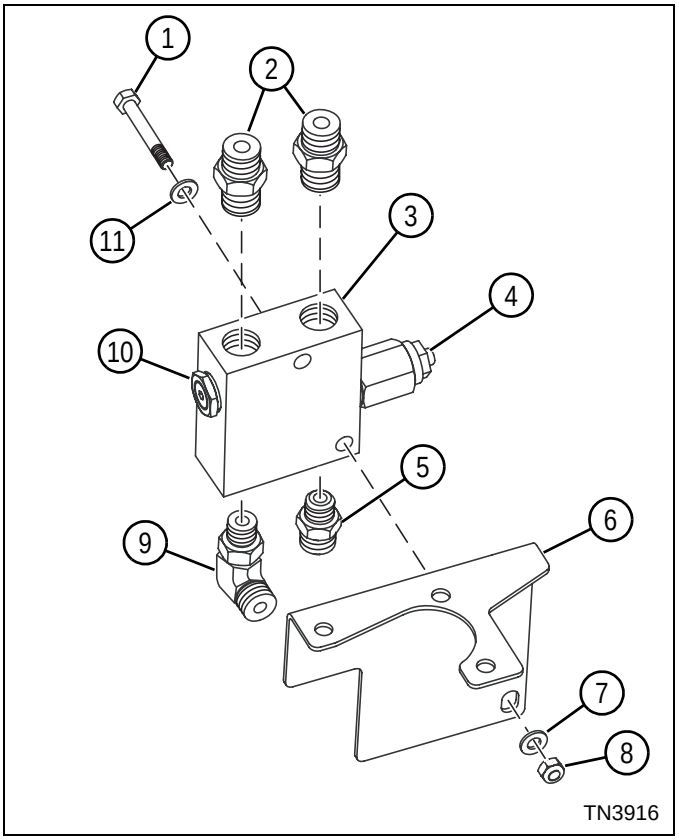


Figure 5-56

1. Remove two nuts (8), washers (7), washers (11), and screws (1), and remove flushing valve (3).

NOTE

Record the location of fittings before removing to ensure correct installation.

2. Remove, inspect, and replace fittings (2) for ports "RW1" and "RW2" as necessary.
3. Remove, inspect, and replace fitting (5) for port "DR" as necessary.
4. Remove, inspect, and replace fitting (9) for port "PP" as necessary
5. Clean all parts using clean solvent, and dry using compressed air.
6. Inspect all parts for wear or damage. Replace as necessary.

Assembly Notes

NOTICE

It is important that all component parts are absolutely clean, as contamination can result in serious damage and/or improper operation.

Never use shop towels or rags to dry parts after cleaning, as lint may clog passages. Dry parts using compressed air.

Required Materials
• Seal Kit

- *Assemble the flushing valve by reversing the order of disassembly.*
- *Use a new seal kit during assembly.*
- *Lubricate all O-rings prior to assembly.*
- *Tighten relief valve (4) to 44 lb-ft (60 N·m).*
- *Tighten check valve (10) to 44 lb-ft (60 N·m).*
- *Tighten fittings (2) for ports "RW1" and "RW2" to 77 lb-ft (105 N·m).*
- *Tighten fitting (5) for port "DR" to 27 lb-ft (37 N·m).*
- *Tighten fitting (9) for port "PP" to 27 lb-ft (37 N·m).*

Wheel Motors

Removal and Installation

Front Wheel Motor

See Figures 5-57 through 5-60.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove front wheel. (See “Front Wheel” on page 9-19.)
3. Remove front wheel hub. (See “Front Wheel Hub” on page 9-22.)

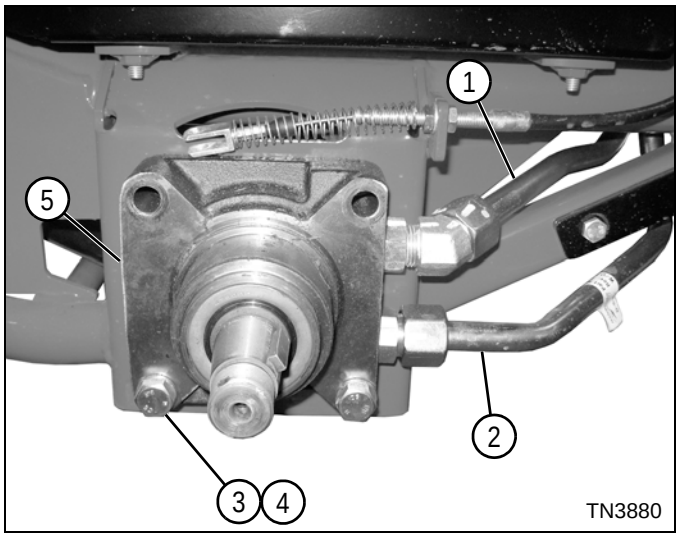


Figure 5-57

NOTES

- *Label all hydraulic tubes before disconnecting to ensure correct installation.*
- *Close all openings with caps or plugs to prevent contamination.*

4. Disconnect tubes (1 and 2).
5. Support front wheel motor (5) and remove four mounting screws (3) and lock washers (4).

NOTE

Perform step 6 only if removing the right side motor, otherwise proceed to step 8.

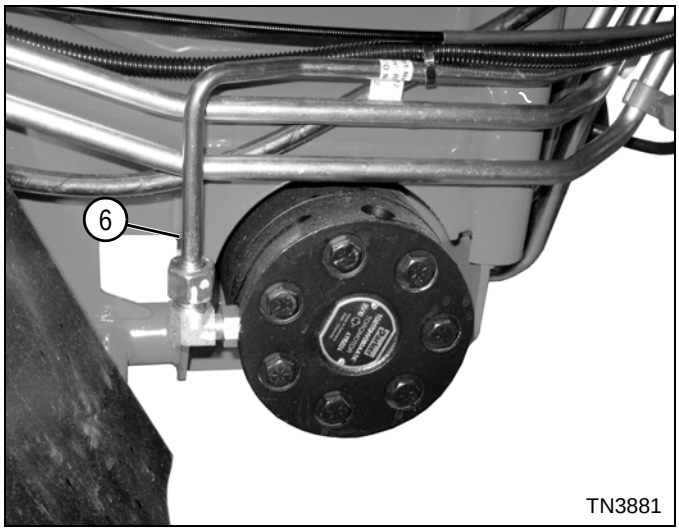


Figure 5-58

6. For 2WD models, disconnect tube (6).
7. Remove front wheel motor (5).

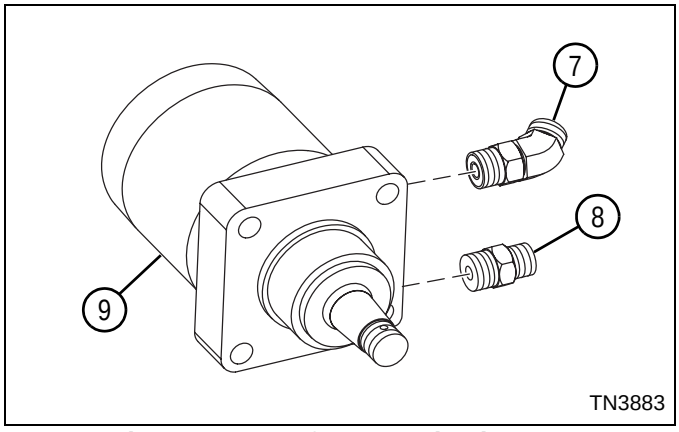


Figure 5-59: Left Front Wheel Motor

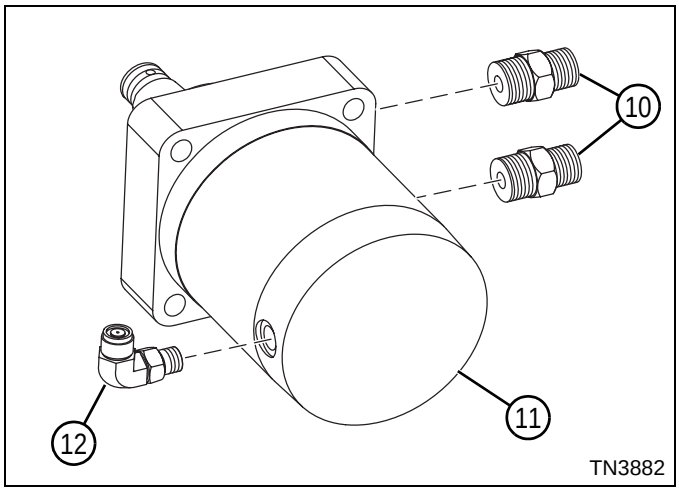


Figure 5-60: Right Front Wheel Motor

NOTE

Record the location of fittings before removing to ensure correct installation.

8. Remove, inspect, and replace fittings (7 and 8) from left wheel motor (9) as necessary.
9. Remove, inspect, and replace fittings (10 and 12) from right wheel motor (11) as necessary.

Installation Notes

- *Install front wheel motor by reversing the order of removal.*
- *Tighten front wheel motor mounting screws (3) to 59–66 lb-ft (80–90 N·m).*
- *Tighten case drain port fitting (12) to 27 lb-ft (37 N·m).*
- *Tighten inlet and outlet port fittings (7, 8, and 10) to 77 lb-ft (105 N·m).*
- *Pressure filter the traction system upon start-up if metal debris is found in system oil or motor. (See "Portable In-Line Filter" on page 5-5.)*
- *Check hydraulic oil level. Add oil as needed. (Refer to "Parts and Maintenance Manual" for correct oil specifications.)*

5

Rear Wheel Motor

See Figures 5-61 and 5-62.

1. Park the mower safely. (See "Park Mower Safely" on page 1-6.)
2. Remove rear wheel. (See "Rear Wheel—3WD Units" on page 9-25.)
3. Remove rear wheel hub. (See "Rear Wheel Hub—3WD Units" on page 9-26.)

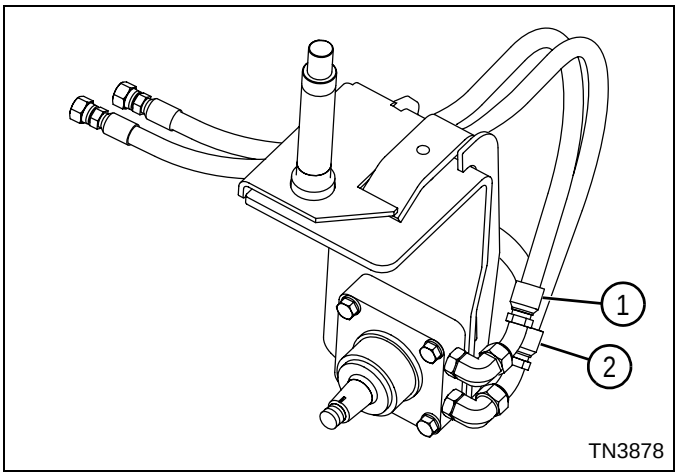


Figure 5-61

NOTES

- *Label all hydraulic hoses and tubes before disconnecting to ensure correct installation.*
- *Close all openings with caps or plugs to prevent contamination.*

4. Disconnect hoses (1 and 2).

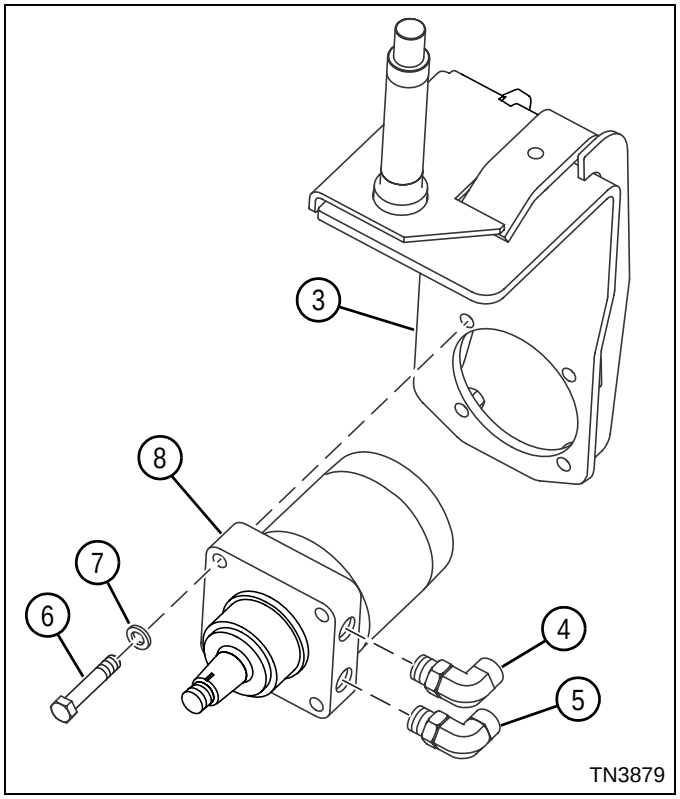


Figure 5-62

5. Support rear wheel motor (8) and remove four mounting screws (6) and lock washers (7).
6. Remove rear wheel motor (8) from fork weldment (3).

NOTE

Record the location of fittings before removing to ensure correct installation.

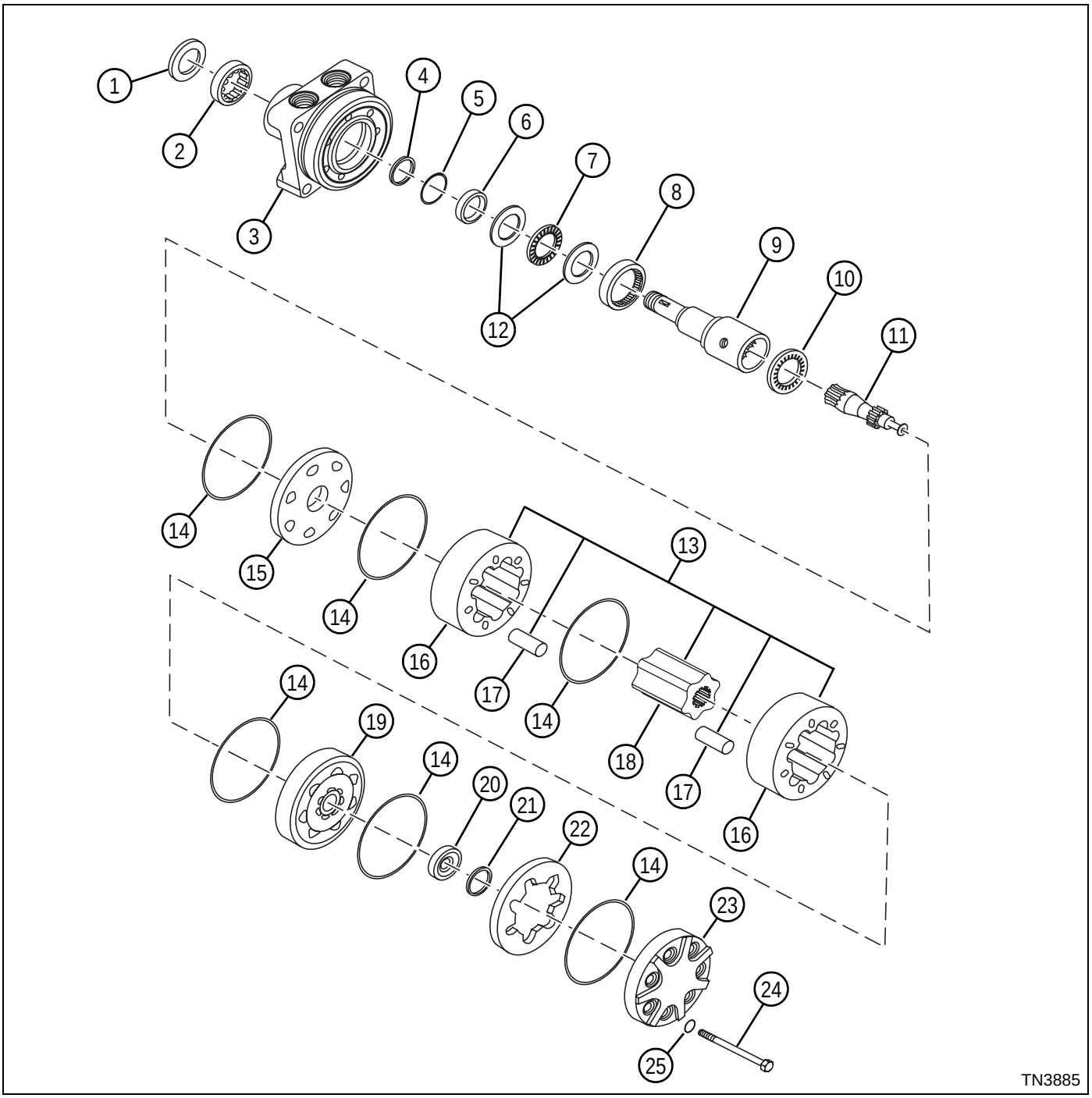
7. Remove, inspect, and replace fittings (4 and 5) as necessary.

Installation Notes

- *Install rear wheel motor by reversing the order of removal.*
- *Tighten rear wheel motor mounting screws (6) to 59–66 lb-ft (80–90 N·m).*
- *Tighten inlet and outlet port fittings (4 and 5) to 77 lb-ft (105 N·m).*
- *Pressure filter the traction system upon start-up if metal debris is found in system oil or motor. (See “Portable In-Line Filter” on page 5-5.)*
- *Check hydraulic oil level. Add oil as needed. (Refer to “Parts and Maintenance Manual” for correct oil specifications.)*

Disassembly and Inspection—Left Front and Rear (3WD) Wheel Motors

See Figures 5-63 through 5-66.



1	Seal	6	Seal	11	Drive Link	16	Stator Half (2)[1]	21	Seal Ring, Commutator
2	Bearing, Outer	7	Thrust Bearing	12	Thrust Washer (2)	17	Vane (14)[2]	22	Commutator Ring
3	Housing	8	Bearing, Inner	13	Rotor Set	18	Rotor	23	End Cover
4	Backup Ring	9	Coupling Shaft	14	Seal Ring (6)	19	Manifold	24	Screw (7)
5	Backup Washer	10	Thrust Bearing	15	Wear Plate	20	Commutator	25	Seal Ring (7)

1 Some motors may have a one-piece stator housing.

2 In motors with one-piece stator housings, seven vanes are used.

Figure 5-63

NOTE

The disassembly procedure for the left front and rear (3WD) wheel motors is the same. The motors differ in size, with the rear (3WD) motor being slightly larger.

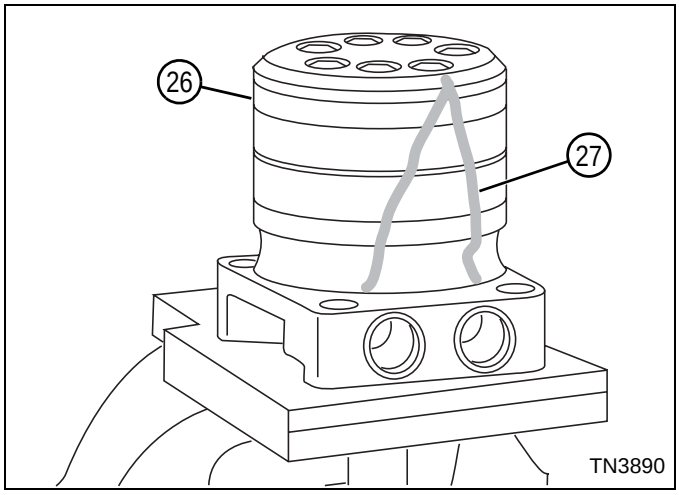


Figure 5-64

1. Place wheel motor (26) in a soft-jawed vice, with the coupling shaft pointed down and the vise jaws firmly clamping each side of the housing mounting flange.
2. Scribe or mark lines (27) across the side of wheel motor sections to mark the position and orientation of motor segments before disassembly.

NOTE

Use caution when removing screws, as motor segments will be free to move.

3. Remove seven screws (24) from end cover (23).
4. Inspect screws (24) and seal rings (25) for damage. Replace as needed.
5. Remove end cover (23) and seal ring (14) from commutator (20) and commutator ring (22).
6. Inspect the surface of the end cover that makes contact with commutator and commutator ring. A polished pattern (not scratches) from the commutator is normal. Discoloration indicates excess fluid temperature, thermal shock, or excess speed and requires inspection of the end cover, commutator, manifold, and rotor set. Replace as needed.
7. Remove commutator ring (22) and commutator (20).
8. Remove seal ring (21) from commutator (20) using compressed air to blow air into the ring groove until the seal ring is lifted out of the groove.

NOTE

If any damage or wear is noticed in the commutator or commutator ring, both must be replaced as a matched set.

9. Inspect commutator ring (22) for cracks or burrs.
10. Inspect commutator (20) for cracks, burrs, wear, scoring, spalling, or brinelling.

NOTES

- *The manifold is constructed of plates bonded together to form an integral component and must not be disassembled.*
- *Compare the configuration of each side of the manifold and note which side of the manifold is positioned against the rotor set to ensure correct installation.*

11. Remove manifold (19).
12. Remove and discard seal rings (14) from each side of the manifold (19).
13. Inspect the surface of the manifold that makes contact with commutator and commutator ring. A polished pattern (not scratches) from the commutator is normal. Inspect the manifold for cracks, burrs, wear, scoring, spalling, or brinelling. Replace as needed.

NOTES

- *The rotor set components are loose and can fall apart when removed. When removing, use caution and remove rotor set (13) as a unit.*
- *Do not disassemble the rotor set. If replacement is necessary, replace the entire assembly.*
- *The drive link (11) may come away from the coupling shaft (9) when removing the rotor set (13) and wear plate (15). Move the drive link as needed to loosen the drive link from the rotor set and wear plate.*

14. Remove rotor set (13) and wear plate (15) as a unit.
15. Inspect rotor set (13) for nicks, scoring, or spalling on any surface and for broken or worn splines. If any damage or wear is noted, replace the entire rotor set as an assembly.
16. Remove and discard seal rings (14) from each side of wear plate (15).
17. Inspect wear plate (15) for cracks, scoring, or brinelling. Replace as needed.

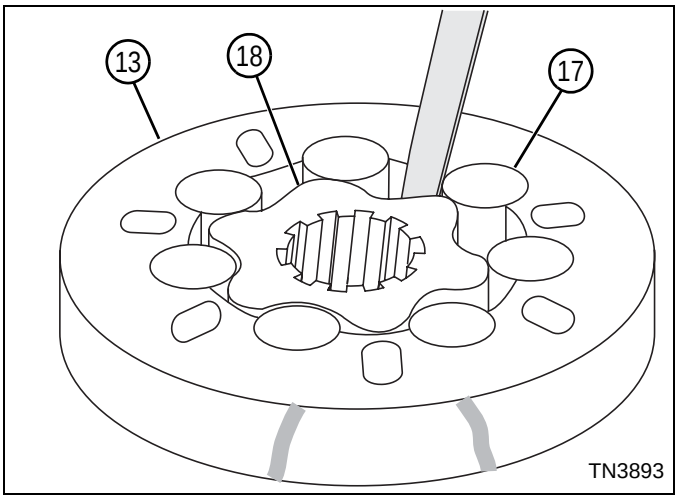


Figure 5-65

NOTE

For motors with two-piece stator housings, check the rotor clearance on each side of the rotor assembly.

18. Place rotor set (13) and wear plate (15) on a flat surface, with the rotor (18) positioned in the stator so that two rotor lobes (180° apart) and the rotor vane (17) center line are on the same stator center line. Check the rotor lobe-to-roller vane clearance with a feeler gauge. If clearance is greater than 0.005 in. (0.13 mm), replace the entire rotor set.
19. Check for lash (play) between drive link (11) and splined surfaces of coupling shaft (9). No play should be perceived.
20. Remove drive link (11) from coupling shaft (9).
21. Inspect drive link (11) for cracks, wear, or damaged splines. Replace as needed.
22. Remove thrust bearing (10) from coupling shaft (9).
23. Inspect bearing (10) for wear, brinelling, corrosion, and for any damaged or missing rollers. Replace as needed.
24. Inspect the exposed portion of the coupling shaft (9) for signs of corrosion. Clean shaft as needed.
25. Remove coupling shaft (9) from housing (3).

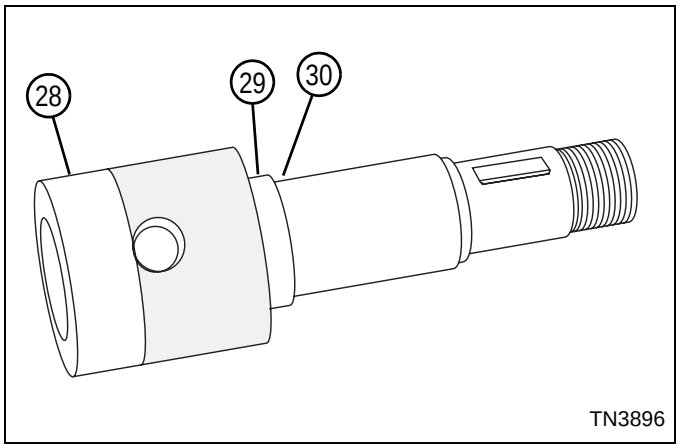


Figure 5-66

NOTES

- *Minor shaft wear in the seal area (30) is allowed. If wear exceeds 0.020 in. (0.51 mm), replace the coupling shaft.*
- *A slight "polish" is allowed in the bearing surfaces (28 and 29).*

26. Inspect coupling shaft bearing and seal surfaces for spalling, nicks, grooves, severe wear, corrosion, or discoloration. Inspect internal splines and keyways for damage. Replace as needed.

NOTE

The thrust bearing (7) is positioned between two thrust washers (12). If replacement is required, the inner bearing (8) must also be removed and replaced.

27. Inspect thrust bearing (7) for signs of wear, brinelling, corrosion, and for any damaged or missing rollers. Replace as needed.
28. Remove seal (6), backup ring (5), and backup washer (4) from housing (3) by working them around the unseated thrust washers (12) and thrust bearing (7).
29. Remove housing (3) from vise, invert it, and remove and discard seal (1).
30. Inspect housing (3) for cracks, and inspect the machined surfaces for nicks, burrs, brinelling, or corrosion. Remove burrs that can be removed without changing the dimensional characteristics. Replace housing as needed.

CAUTION

Remove the bearing only if replacement is required. The bearing must not be reused once removed.

NOTE

If inner bearing (8) requires replacement, measure and record the depth of the inner bearing in relation to the housing wear surface before removing the bearing. If outer bearing (2) requires replacement, measure and record the depth of the outer bearing in relation to the beginning of the bearing counterbore before removing the bearing.

31. Inspect inner bearing (8) and outer bearing (2). All roller elements must be firmly retained in the bearing cages and orbit freely. All rollers must be free of brinelling and corrosion.

WARNING

Use appropriate eye protection when using compressed air for cleaning or drying purposes. Compressed air can cause serious personal injury. Use safety reduction valves to reduce the air pressure to a safe level before use.

NOTICE

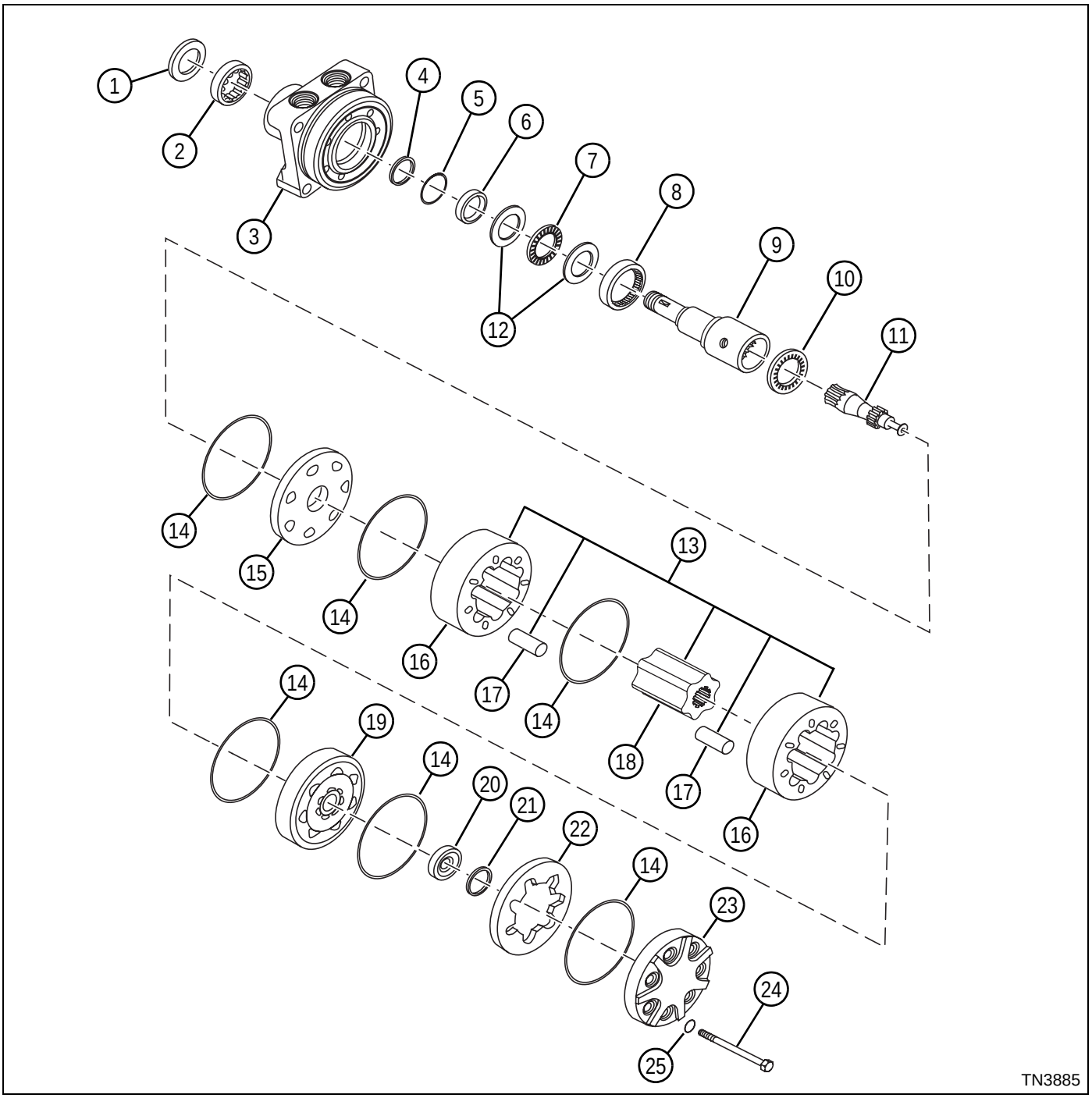
It is important that all motor parts are absolutely clean, as contamination can result in serious damage and/or improper operation.

Never use shop towels or rags to dry parts after cleaning, as lint may clog passages. Dry parts using compressed air only.

32. Clean all parts using clean solvent, and dry using compressed air.
33. Inspect all parts for wear or damage. Replace parts as needed.
34. Apply a thin film of clean hydraulic oil to all parts to prevent corrosion. Keep parts covered or stored in a clean environment until assembly.

Assembly—Left Front and Rear (3WD) Wheel Motors

See Figures 5-67 through 5-69.



1	Seal	6	Seal	11	Drive Link	16	Stator Half (2)[1]	21	Seal Ring, Commutator
2	Bearing, Outer	7	Thrust Bearing	12	Thrust Washer (2)	17	Vane (14)[2]	22	Commutator Ring
3	Housing	8	Bearing, Inner	13	Rotor Set	18	Rotor	23	End Cover
4	Backup Ring	9	Coupling Shaft	14	Seal Ring (6)	19	Manifold	24	Screw (7)
5	Backup Washer	10	Thrust Bearing	15	Wear Plate	20	Commutator	25	Seal Ring (7)

1 Some motors may have a one-piece stator housing.

2 In motors with one-piece stator housings, seven vanes are used.

Figure 5-67

NOTICE

It is important that all motor parts are absolutely clean, as contamination can result in serious damage and/or improper operation.

Never use shop towels or rags to dry parts after cleaning, as lint may clog passages. Dry parts using compressed air only.

Required Materials
Seal Kit (Jacobsen PN 891910)

NOTES

- *Always install new seals and O-rings for assembly. Used parts may leak.*
- *If the housing or bearings are being replaced, perform steps 1 through 6. If housing or bearings were not replaced, proceed to step 7.*

CAUTION

The outer bearing (2) is not lubricated by the system's hydraulic fluid. Thoroughly pack and coat the bearing with grease before installing.

1. Pack outer bearing (2) with grease that meets or exceeds NLGI Grade 2 LB specifications.

CAUTION

When installing bearings, the bearing must be positioned so that the bearing installer tool is applying force against the lettered side of the bearing shell.

NOTE

Install bearings and seals using a seal and driver set and press.

2. Install (press) outer bearing (2) into housing (3) to a depth of 0.290–0.310 in. (7.37–7.87 mm) from the outside end of the bearing counterbore.
3. Place a new outer seal (1) into housing (3), with the lip facing out, and press the seal into the housing until the seal is flush to 0.020 in. (0.51 mm) below the end of the bearing counterbore.
4. Install a new backup ring (4), backup washer (5), and seal (6) into housing (3). Position the seal so that the lip is facing toward the inside of the motor.
5. Install a new thrust bearing (7) and two thrust washers (12) into the housing. The thrust bearing must be positioned between the two thrust washers.
6. Install (press) inner bearing (8) into housing (3) to a depth of 0.105–0.125 in. (2.67–3.18 mm) below the housing wear plate contact surface.
7. Place housing (3) in a soft-jawed vice, with the coupling shaft bore pointed down and the vise jaws firmly clamping each side of the housing mounting flange.

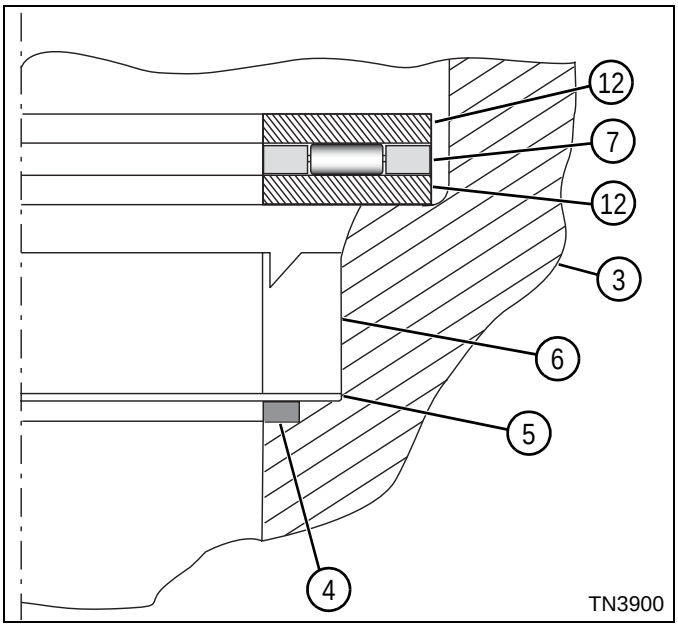


Figure 5-68

8. Install a new backup ring (4), backup washer (5), and seal (6) into housing (3), working the ring, washer, and seal around the thrust bearing (7) and thrust washers (12). Position the seal so that the lip is facing toward the inside of the motor. Make sure the components are properly seated into their respective counterbores.
9. Make sure thrust bearing (7) and thrust washers (12) are properly seated.
10. Apply masking tape around the threads on the coupling shaft (9) to prevent damage to seals during installation.
11. Install coupling shaft (9) into housing (3), making sure that coupling shaft is seated against thrust washer (12). When properly seated, the end of the coupling shaft will be approximately 0.10 in. (2.54 mm) below the housing wear plate surface.
12. Install thrust bearing (10) on the end of coupling shaft (9).

NOTE

Two alignment studs, installed finger-tight into two of the screw holes, 180° apart, may be used to aid in assembly. These studs can be made by cutting the heads from 5/16-24 UNF 2A bolts that are 0.50 in. (12.7 mm) longer than the screws (24) used to hold the motor together.

13. Install drive link (11) in coupling shaft (9), engaging the splines with splines on the coupling shaft.
14. Apply a thin film of petroleum jelly to seal ring (14), and install seal ring in the groove on the housing (3).
15. Apply a thin film of petroleum jelly to seal ring (14), and install seal ring in the groove in the wear plate side of the stator half (16).

NOTE

It may be necessary to remove one of the alignment studs temporarily to install the rotor set/wear plate.

16. Install rotor set (13) on the wear plate (15), with the counterbore and seal ring side toward the wear plate.
17. Install the rotor set and wear plate assembly over drive link (11). Make sure that drive link splines engage with rotor splines.
18. Apply a thin film of petroleum jelly to seal ring (14), and install seal ring in the groove on the side of the manifold (19) facing the rotor set.

NOTE

The manifold surface that must make contact with the rotor set has a series of irregular shaped cavities on the outside diameter. The surface may also have a polished impression left by contact with the rotor set.

19. Install manifold (19) on rotor set (13).
20. Apply a thin film of petroleum jelly to seal ring (14), and install seal ring in the groove in the manifold (19).
21. Install commutator ring (22) on manifold (19).
22. Install a new seal ring (21), with the flat side up, in the commutator (20).
23. Install commutator (20) over the drive link (11), with the seal ring side away from the manifold.
24. Apply a thin film of petroleum jelly to seal ring (14), and install seal ring in the groove in the end cover (23).
25. Install screws (24) in the motor, and tighten fingertight.
26. Remove the alignment studs, and install the remaining screws (24).

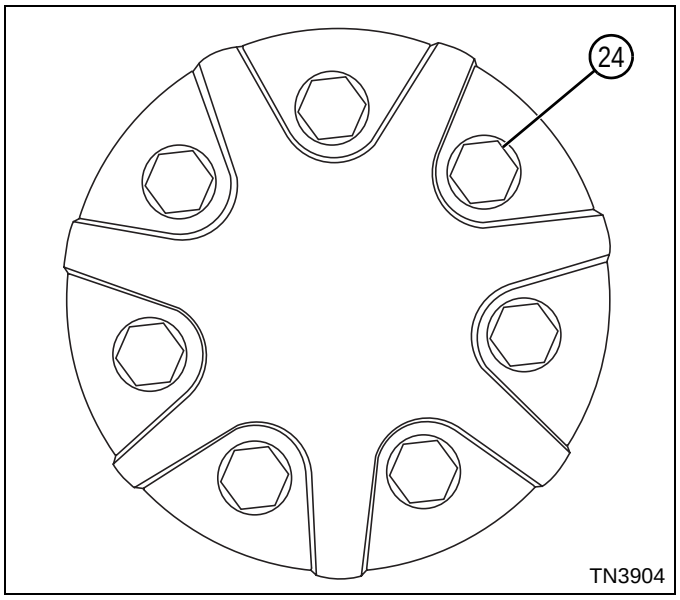
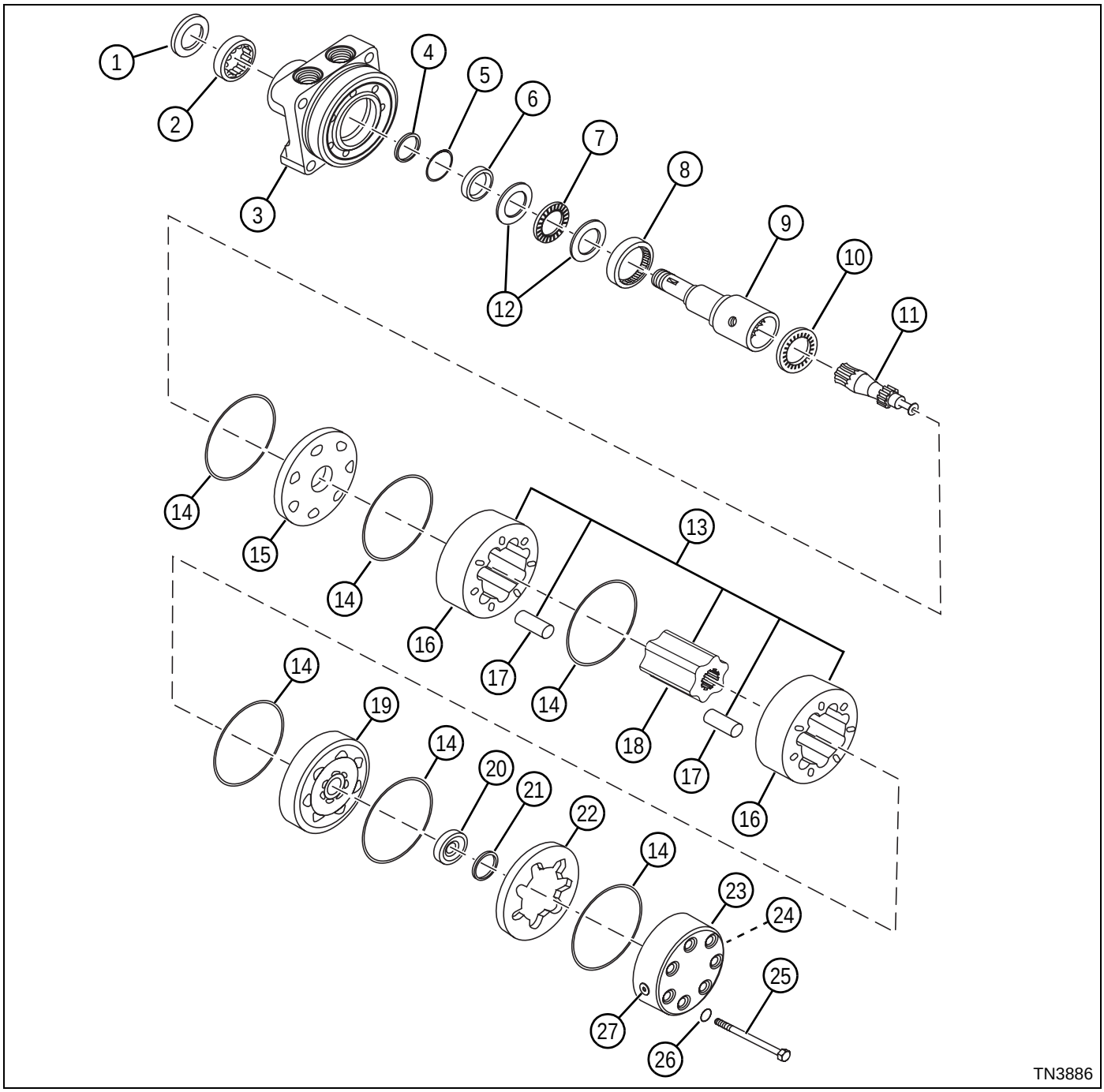


Figure 5-69

27. Tighten seven screws (24) in stages, using an alternating pattern, to a final torque of 50–55 lb-ft (68–75 N·m).

Disassembly and Inspection—Right Front Wheel Motor

See Figures 5-70 through 5-74.



1	Seal	8	Bearing, Inner	15	Wear Plate	22	Commutator Ring
2	Bearing, Outer	9	Coupling Shaft	16	Stator Half (2)[1]	23	End Cover Assembly
3	Housing	10	Thrust Bearing	17	Vane (14)[2]	24	Plug, Shuttle Valve
4	Backup Ring	11	Drive Link	18	Rotor	25	Screw (7)
5	Backup Washer	12	Thrust Washer (2)	19	Manifold	26	Seal Ring (7)
6	Seal	13	Rotor Set	20	Commutator	27	Plug, Shuttle Valve
7	Thrust Bearing	14	Seal Ring (6)	21	Seal Ring, Commutator		

1 Some motors may have a one-piece stator housing.

2 In motors with one-piece stator housings, seven vanes are used.

Figure 5-70

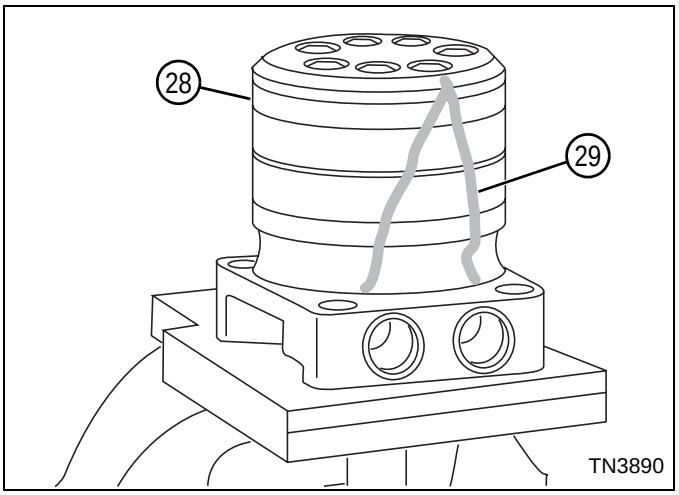


Figure 5-71

1. Place wheel motor (28) in a soft-jawed vice, with the coupling shaft pointed down and the vise jaws firmly clamping each side of the housing mounting flange.
2. Scribe or mark lines (29) across the side of wheel motor sections to mark the position and orientation of motor segments before disassembly.
3. Loosen, but do not remove, the two shuttle valve plugs (24 and 27).

NOTE

Use caution when removing screws, as motor segments will be free to move.

4. Remove seven screws (25) from end cover (23).
5. Inspect screws (25) and seal rings (26) for damage. Replace as needed.
6. Remove end cover (23) and seal ring (14) from commutator (20) and commutator ring (22).
7. Inspect the surface of the end cover that makes contact with commutator and commutator ring. A polished pattern (not scratches) from the commutator is normal. Discoloration indicates excess fluid temperature, thermal shock, or excess speed and requires inspection of the end cover, commutator, manifold, and rotor set. Replace as needed.

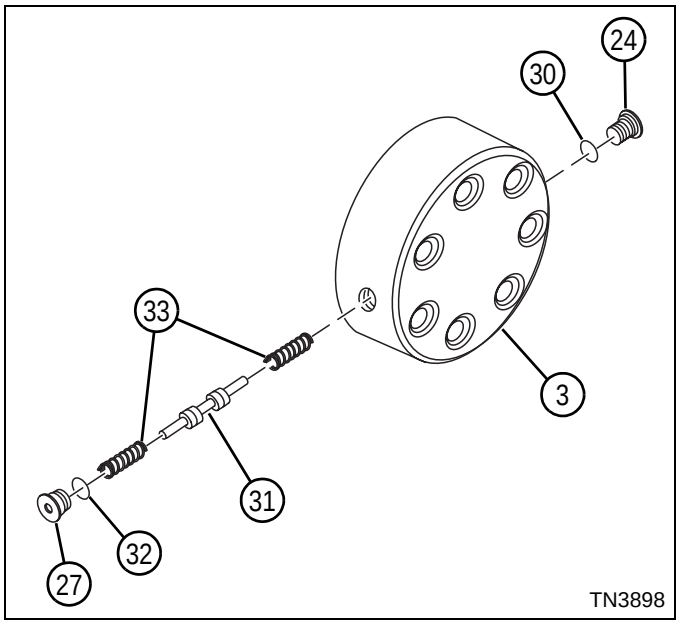


Figure 5-72

NOTICE

Shuttle valve components are spring-loaded and will fall out as the plugs are removed. Remove plugs slowly, and be ready to catch components.

8. Remove two shuttle valve plugs (24 and 27) and O-rings (30 and 32).
9. Remove shuttle valve (31) and two springs (33).
10. Remove commutator ring (22) and commutator (20).
11. Remove seal ring (21) from commutator (20) using compressed air to blow air into the ring groove until the seal ring is lifted out of the groove.

NOTE

If any damage or wear is noticed in the commutator or commutator ring, both must be replaced as a matched set.

12. Inspect commutator ring (22) for cracks or burrs.
13. Inspect commutator (20) for cracks, burrs, wear, scoring, spalling, or brinelling.

NOTES

- *The manifold is constructed of plates bonded together to form an integral component and must not be disassembled.*
- *Compare the configuration of each side of the manifold and note which side of the manifold is positioned against the rotor set to ensure correct installation.*

14. Remove manifold (19).

15. Remove and discard seal rings (14) from each side of the manifold (19).
16. Inspect the surface of the manifold that makes contact with commutator and commutator ring. A polished pattern (not scratches) from the commutator is normal. Inspect the manifold for cracks, burrs, wear, scoring, spalling, or brinelling. Replace as needed.

NOTES

- *The rotor set components are loose and can fall apart when removed. When removing, use caution and remove rotor set (13) as a unit.*
- *Do not disassemble the rotor set. If replacement is necessary, replace the entire assembly.*
- *The drive link (11) may come away from the coupling shaft (9) when removing the rotor set (13) and wear plate (15). Move the drive link as needed to loosen the drive link from the rotor set and wear plate.*

17. Remove rotor set (13) and wear plate (15) as a unit.
18. Inspect rotor set (13) for nicks, scoring, or spalling on any surface and for broken or worn splines. If any damage or wear is noted, replace the entire rotor set as an assembly.
19. Remove and discard seal rings (14) from each side of wear plate (15).
20. Inspect wear plate (15) for cracks, scoring, or brinelling. Replace as needed.

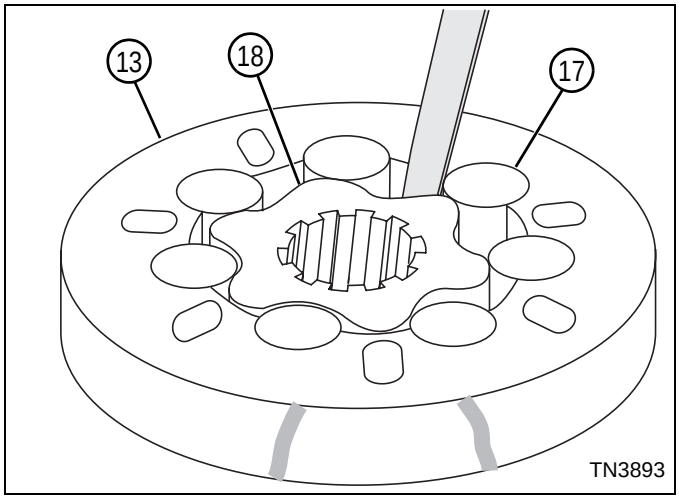


Figure 5-73

NOTE

For motors with two-piece stator housings, check the rotor clearance on each side of the rotor assembly.

21. Place rotor set (13) and wear plate (15) on a flat surface, with the rotor (18) positioned in the stator so that two rotor lobes (180° apart) and the rotor vane (17) center line are on the same stator center line. Check the rotor lobe-to-roller vane clearance with a feeler gauge. If clearance is greater than 0.005 in. (0.13 mm), replace the entire rotor set.
22. Check for lash (play) between drive link (11) and splined surfaces of coupling shaft (9). No play should be perceived.
23. Remove drive link (11) from coupling shaft (9).
24. Inspect drive link (11) for cracks, wear, or damaged splines. Replace as needed.
25. Remove thrust bearing (10) from coupling shaft (9).
26. Inspect bearing (10) for wear, brinelling, corrosion, and for any damaged or missing rollers. Replace as needed.
27. Inspect the exposed portion of the coupling shaft (9) for signs of corrosion. Clean shaft as needed.
28. Remove coupling shaft (9) from housing (3).

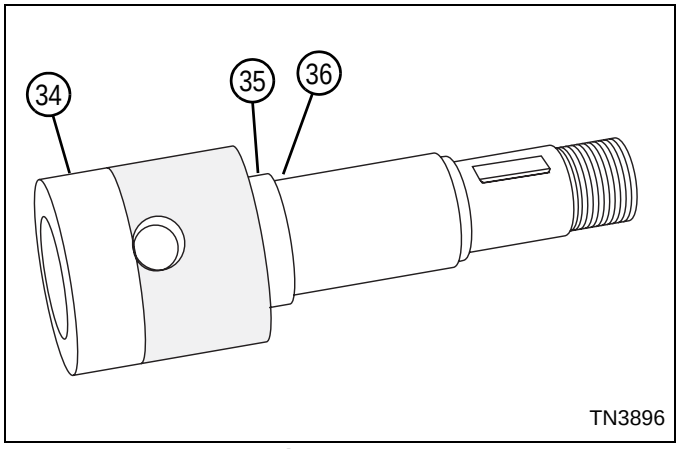


Figure 5-74

NOTES

- *Minor shaft wear in the seal area (36) is allowed. If wear exceeds 0.020 in. (0.51 mm), replace the coupling shaft.*
- *A slight "polish" is allowed in the bearing surfaces (34 and 35).*

29. Inspect coupling shaft bearing and seal surfaces for spalling, nicks, grooves, severe wear, corrosion, or discoloration. Inspect internal splines and keyways for damage. Replace as needed.

NOTE

The thrust bearing (7) is positioned between two thrust washers (12). If replacement is required, the inner bearing (8) also must be removed and replaced.

30. Inspect thrust bearing (7) for signs of wear, brinelling, corrosion, and for any damaged or missing rollers. Replace as needed.
31. Remove seal (6), backup ring (5), and backup washer (4) from housing (3), by working them around the unseated thrust washers (12) and thrust bearing (7).
32. Remove housing (3) from vise, invert it, and remove and discard seal (1).
33. Inspect housing (3) for cracks, and inspect machined surfaces for nicks, burrs, brinelling, or corrosion. Remove burrs that can be removed without changing the dimensional characteristics. Replace the housing as needed.

CAUTION

Remove the bearing only if replacement is required. The bearing must not be reused once removed.

NOTE

If inner bearing (8) requires replacement, measure and record the depth of the inner bearing in relation to the housing wear surface before removing the bearing. If outer bearing (2) requires replacement, measure and record the depth of the outer bearing in relation to the beginning of the bearing counterbore before removing the bearing.

34. Inspect inner bearing (8) and outer bearing (2). All roller elements must be firmly retained in the bearing cages and orbit freely. All rollers must be free of brinelling and corrosion.

WARNING

Use appropriate eye protection when using compressed air for cleaning or drying purposes. Compressed air can cause serious personal injury. Use safety reduction valves to reduce the air pressure to a safe level before use.

NOTICE

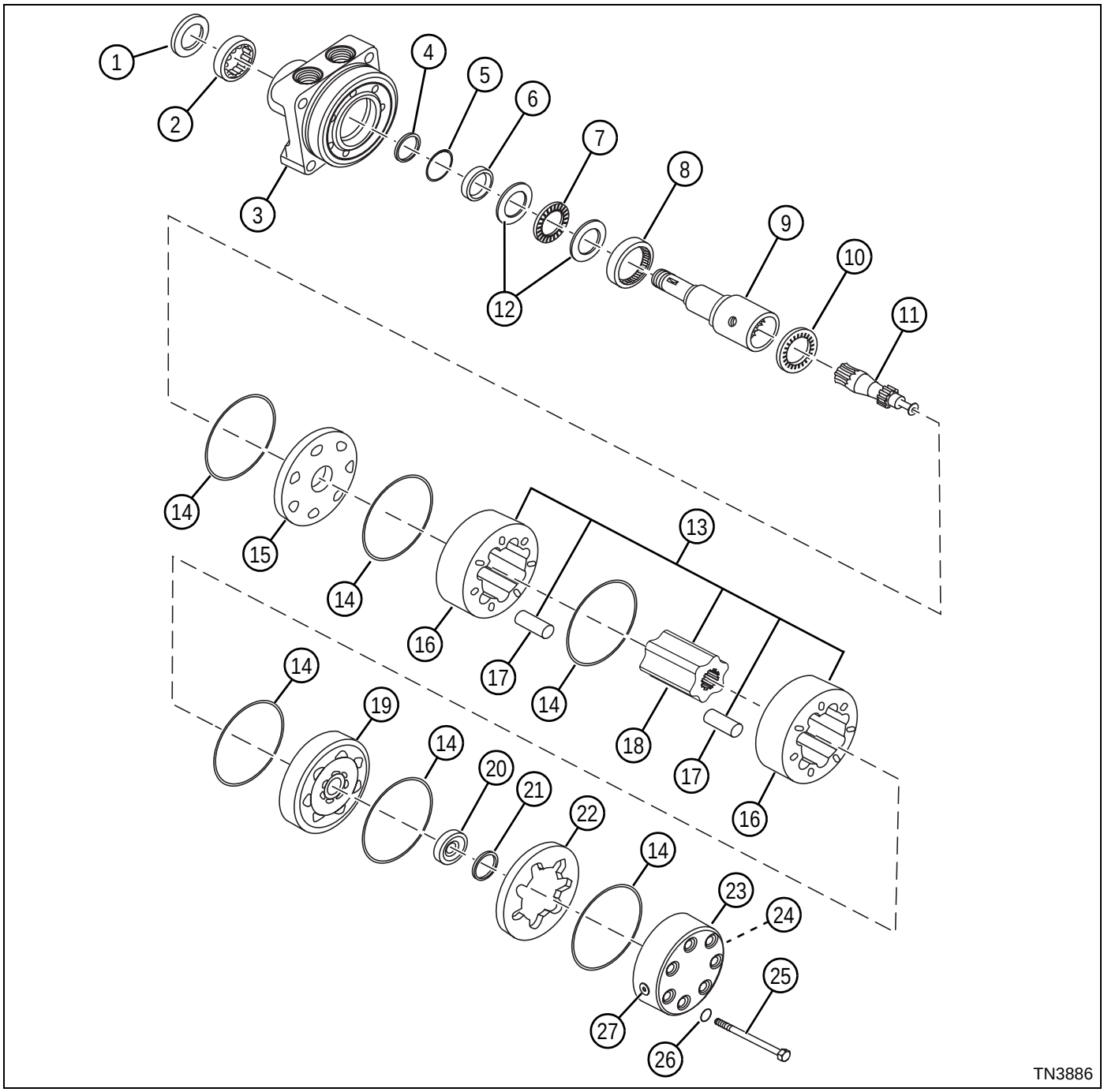
It is important that all motor parts are absolutely clean, as contamination can result in serious damage and/or improper operation.

Never use shop towels or rags to dry parts after cleaning, as lint may clog passages. Dry parts using compressed air only.

35. Clean all parts using clean solvent, and dry using compressed air.
36. Inspect all parts for wear or damage. Replace parts as needed.
37. Apply a thin film of clean hydraulic oil to all parts to prevent corrosion. Keep parts covered or stored in a clean environment until assembly.

Assembly—Right Front Wheel Motor

See Figures 5-75 through 5-78.



1	Seal	8	Bearing, Inner	15	Wear Plate	22	Commutator Ring
2	Bearing, Outer	9	Coupling Shaft	16	Stator Half (2)[1]	23	End Cover Assembly
3	Housing	10	Thrust Bearing	17	Vane (14)[2]	24	Plug, Shuttle Valve
4	Backup Ring	11	Drive Link	18	Rotor	25	Screw (7)
5	Backup Washer	12	Thrust Washer (2)	19	Manifold	26	Seal Ring (7)
6	Seal	13	Rotor Set	20	Commutator	27	Plug, Shuttle Valve
7	Thrust Bearing	14	Seal Ring (6)	21	Seal Ring, Commutator		

1 Some motors may have a one-piece stator housing.

2 In motors with one-piece stator housings, seven vanes are used.

Figure 5-75

NOTICE

It is important that all motor parts are absolutely clean, as contamination can result in serious damage and/or improper operation.

Never use shop towels or rags to dry parts after cleaning, as lint may clog passages. Dry parts using compressed air only.

Required Materials
Seal Kit (Jacobsen PN 891910)

NOTES

- *Always install new seals and O-rings for assembly. Used parts may leak.*
- *If the housing or bearings are being replaced, perform step 1 through 6. If housing or bearings were not replaced, proceed to step 7.*

CAUTION

The outer bearing (2) is not lubricated by the system's hydraulic fluid. Thoroughly pack and coat the bearing with grease before installing.

1. Pack outer bearing (2) with grease that meets or exceeds NLGI Grade 2 LB specifications.

CAUTION

When installing bearings, the bearing must be positioned so that the bearing installer tool is applying force against the lettered side of the bearing shell.

NOTE

Install bearings and seals using a seal and driver set and press.

2. Install (press) outer bearing (2) into housing (3) to a depth of 0.290–0.310 in. (7.37–7.87 mm) from the outside end of the bearing counterbore.
3. Place a new outer seal (1) into housing (3), with the lip facing out, and press the seal into the housing until the seal is flush to 0.020 in. (0.51 mm) below the end of the bearing counterbore.
4. Install a new backup ring (4), backup washer (5), and seal (6) into housing (3). Position the seal so that the lip is facing toward the inside of the motor.
5. Install a new thrust bearing (7) and two thrust washers (12) into the housing. The thrust bearing must be positioned between the two thrust washers.
6. Install (press) inner bearing (8) into housing (3) to a depth of 0.105–0.125 in. (2.67–3.18 mm) below the housing wear plate contact surface.
7. Place the housing (3) in a soft-jawed vice, with the coupling shaft bore pointed down and the vise jaws firmly clamping each side of the housing mounting flange.

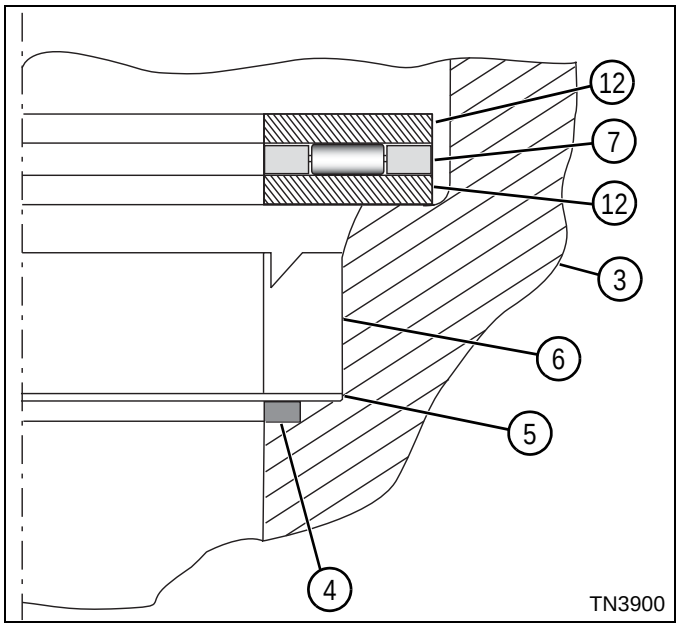


Figure 5-76

8. Install a new backup ring (4), backup washer (5), and seal (6) into housing (3), working the ring, washer, and seal around the thrust bearing (7) and thrust washers (12). Position the seal so that the lip is facing toward the inside of the motor. Make sure the components are properly seated into their respective counterbores.
9. Make sure thrust bearing (7) and thrust washers (12) are properly seated.
10. Apply masking tape around the threads on the coupling shaft (9), to prevent damage to seals during installation.
11. Install the coupling shaft (9) into housing (3), making sure that coupling shaft is seated against thrust washer (12). When properly seated, the end of the coupling shaft will be approximately 0.10 in. (2.54 mm) below the housing wear plate surface.
12. Install thrust bearing (10) on the end of coupling shaft (9).

NOTE

Two alignment studs, installed finger-tight into two of the screw holes, 180° apart, may be used to aid in assembly. These studs can be made by cutting the heads from 5/16-24 UNF 2A bolts, that are 0.50 in. (12.7 mm) longer than the screws (25) used to hold the motor together.

13. Install drive link (11) in coupling shaft (9), engaging the splines with splines on the coupling shaft.
14. Apply a thin film of petroleum jelly to seal ring (14), and install seal ring in the groove on housing (3).
15. Apply a thin film of petroleum jelly to seal ring (14), and install seal ring in the groove in the wear plate side of the stator half (16).

NOTE

It may be necessary to remove one of the alignment studs temporarily to install the rotor set/wear plate assembly.

16. Install rotor set (13) on the wear plate (15), with the counterbore and seal ring side toward the wear plate.
17. Install the rotor set and wear plate assembly over drive link (11). Make sure that drive link splines engage with rotor splines.
18. Apply a thin film of petroleum jelly to seal ring (14), and install seal ring in the groove on the side of the manifold (19) facing the rotor set.

NOTE

The manifold surface that must make contact with the rotor set has a series of irregular shaped cavities on the outside diameter. The surface may also have a polished impression left by contact with the rotor set.

19. Install manifold (19) on rotor set (13).
20. Apply a thin film of petroleum jelly to seal ring (14), and install seal ring in the groove in the manifold (19).
21. Install commutator ring (22) on manifold (19).
22. Install a new seal ring (21), with the flat side up, in the commutator (20).
23. Install commutator (20) over drive link (11), with the seal ring side away from the manifold.

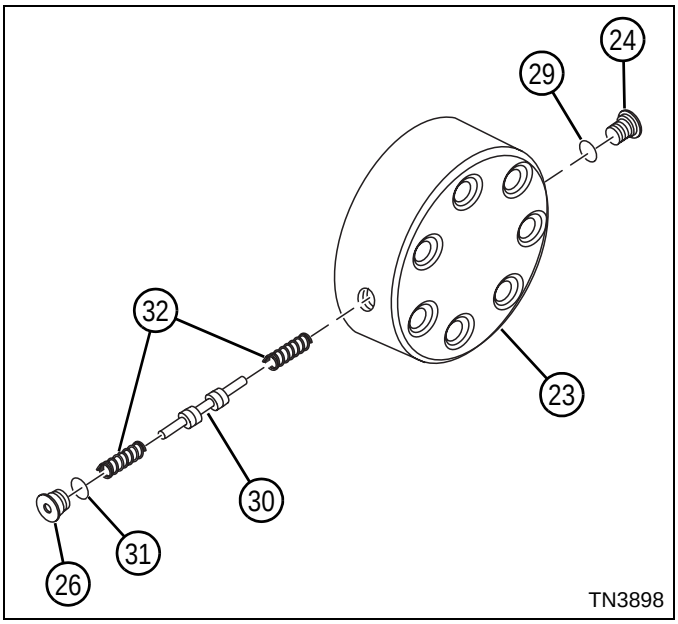


Figure 5-77

24. Install shuttle valve (30) and two springs (32).
25. Install two shuttle valve plugs (24 and 26) and O-rings (29 and 31).
26. Apply a thin film of petroleum jelly to seal ring (14), and install seal ring in the groove in the end cover (23).
27. Install screws (25) in the motor, and tighten fingertight.
28. Remove the alignment studs, and install the remaining screws (25).

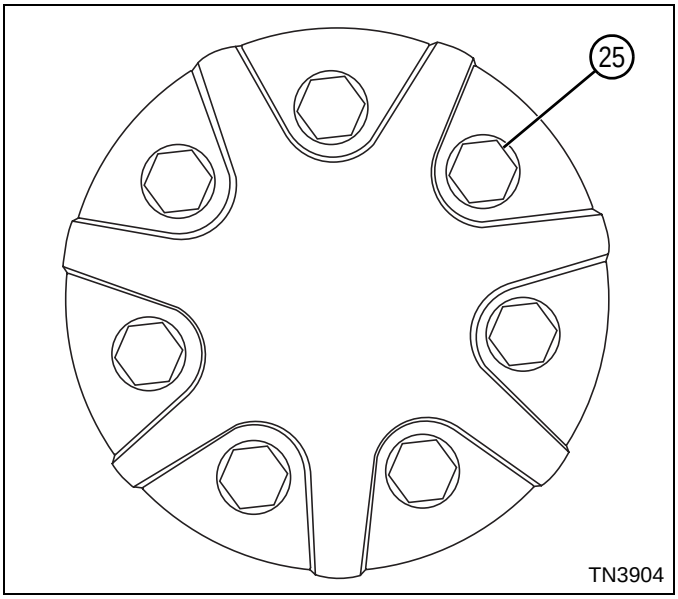


Figure 5-78

29. Tighten seven screws (25) in stages, using an alternating pattern, to a final torque of 50–55 lb-ft (68–75 N·m).

Chapter 6

Hydraulics

6

JACOBSEN
A Textron Company

Specifications

Test Specifications

Specifications		
Charge Relief Valve Pressure Setting	psi (bar)	150–210 (10–15)
Implement Relief Valve Pressure Setting	psi (bar)	800 ± 10% (55 ± 10%)
Lift Relief Valve Pressure Setting	psi (bar)	1250 ± 10% (86 ± 10%)
Reel Relief Valve Pressure Setting	psi (bar)	3020 ± 10% (208 ± 10%)
Reel Motor Case Drain Rate		Less than 1 Pint (0.47 L) per Minute
Hydraulic Leakage Percentage Ranges		0–10% = Good 11–20% = Marginal 21% and Beyond = Bad

Repair Specifications

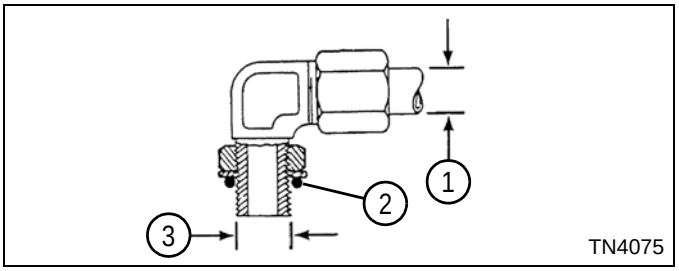
Specifications		
Hydraulic Oil Tank Capacity	gal (L)	5.3 (20)
Gear Pump—Retaining Screw Torque	lb-ft (N·m)	88 (120)
Gear Pump—Outlet Port Fitting Torque	lb-ft (N·m)	77 (105)
Gear Pump—Inlet Port Fitting Torque	lb-ft (N·m)	133 (180)
Lift Valve—Coil Nut Torque	lb-in. (N·m)	35–53 (4–6)
Lift Valve—Relief Valve Torque	lb-ft (N·m)	20–25 (27–34)
Lift Valve—Check Valve Torque	lb-ft (N·m)	30–35 (41–47)
Lift Valve—Solenoid Valve Torque	lb-ft (N·m)	25–30 (34–40)
Lift Valve—Port “P” Fitting Torque	lb-ft (N·m)	55 (74)
Lift Valve—Front Side Port “T” Fitting Torque	lb-ft (N·m)	55 (74)
Lift Valve—Port “A” Fitting Torque	lb-ft (N·m)	17 (23)
Lift Valve—Port “B” Fitting Torque	lb-ft (N·m)	17 (23)
Reel Valve Unit—Coil Nut Torque	lb-in. (N·m)	65–75 (7–8)
Reel Valve Unit—Check Valve Torque	lb-ft (N·m)	1.1–1.5 (1.5–2.0)
Reel Valve Unit—Orifice Torque	lb-ft (N·m)	1.1–1.5 (1.5–2.0)
Reel Valve Unit—Reel (Backlap) Valve Torque	lb-ft (N·m)	80–100 (108–136)
Reel Valve Unit—Mow/Relief Valve Torque	lb-ft (N·m)	20–25 (27–34)
Reel Valve Unit—Reel Speed Control Valve Torque	lb-ft (N·m)	30–35 (41–47)
Reel Valve Unit—Port “A” Fitting Torque	lb-ft (N·m)	77 (105)
Reel Valve Unit—Port “B” Fitting Torque	lb-ft (N·m)	77 (105)
Reel Valve Unit—Port “P” Fitting Torque	lb-ft (N·m)	77 (105)
Reel Valve Unit—Port “T” Fitting Torque	lb-ft (N·m)	133 (180)

Hydraulic Hose, Tube, and Fitting General Instructions

O-Ring Installation

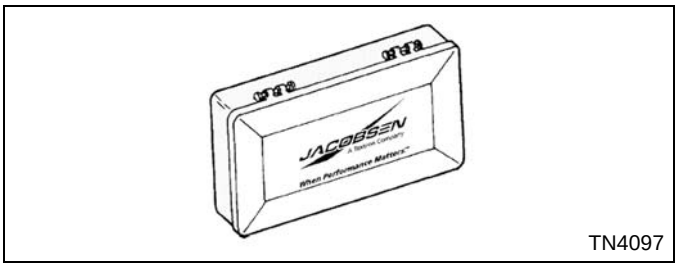
- Always install new O-rings.
- On hoses with O-ring fittings, make sure O-rings are properly seated before tightening.
- O-rings should be lubricated with the fluid to be used in the system prior to assembly.

Boss Fitting O-Ring Installation



1 Tubing O.D. or Hose I.D. 2 O-Ring 3 Thread Size

O-Ring Seal Kits



- SAE Boss O-Ring Kit Jacobsen PN 5002452
- O-Ring Face Seal (ORS) O-Ring Kit PN 5002454
- Common O-Ring Sizes Kit PN 5002453

Replacement O-Rings for ORS (Face Seal) Fittings

ORS (Face Seal) Tube Size	ORS (Face Seal) O-Ring Size	Jacobsen Part Number
4	11	339908
6	12	339909
8	14	339910
10	16	339911
12	18	339912
16	21	339913
20	25	339914
24	29	339915

Replacement O-Rings for O-Ring Boss Fittings

Tubing O.D. or Hose I.D.	Thread Size	Jacobsen Part Number
1/8	5/16-24	459290
3/16	3/8-24	459291
1/4	7/16-20	339896
5/16	1/2-20	459293
3/8	9/16-18	339897
1/2	3/4-16	339898
5/8	7/8-14	339899
3/4	1-1/16-12	339900
7/8	1-3/16-12	459296
1	1-5/16-12	339901
1-1/4	1-5/8-12	339902
1-1/2	1-7/8-12	339903
2	2-1/2-12	459300

Hydraulic Hose Installation

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 the hose to twist; hold the hose in a normal straight position.

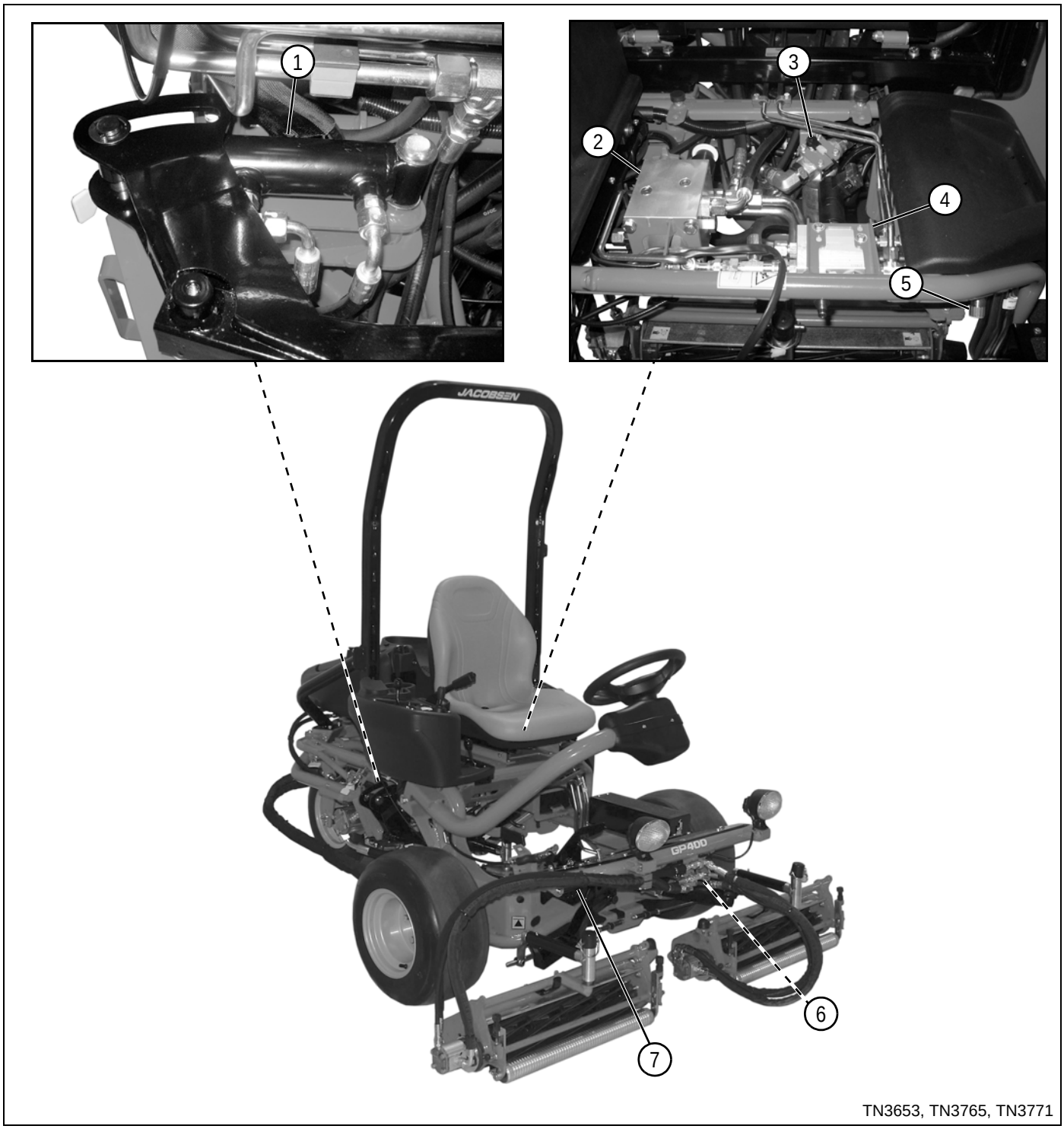
When installing hoses, place fittings at angles to avoid contact with fixed parts when turning. Make sure hoses are assembled to proper “A” and “B” ports on components.

Hydraulic Hose and Tube Torque Values

Size		lb-ft		N·m	
Dash	Fractional	Min	Max	Min	Max
-4	1/4	10	12	14	16
-6	3/8	18	20	24	27
-8	1/2	32	40	43	54
-10	5/8	46	56	60	75
-12	3/4	65	80	90	110
-16	1	92	105	125	240
-20	1-1/4	125	140	170	190
-24	1-1/2	150	180	200	246

Component Location

See Figures 6-1 and 6-2.



TN3653, TN3765, TN3771

1 Center Lift Cylinder
2 Reel Valve Unit
3 Hydraulic Oil Charge Filter Assembly
4 Lift Valve
5 Soft Drop Valve
6 Left Front Lift Cylinder
7 Right Front Lift Cylinder

Figure 6-1: Component Location—Front

TN3767, TN3769

1	Hydraulic Oil Cooler	3	Traction Pump	5	Top Sequence Valve
2	Gear Pump	4	Bottom Sequence Valve	6	Hydraulic Oil Tank

Figure 6-2: Component Location—Rear

Hydraulic Schematic (3WD)

See Figures 6-3 through 6-7.

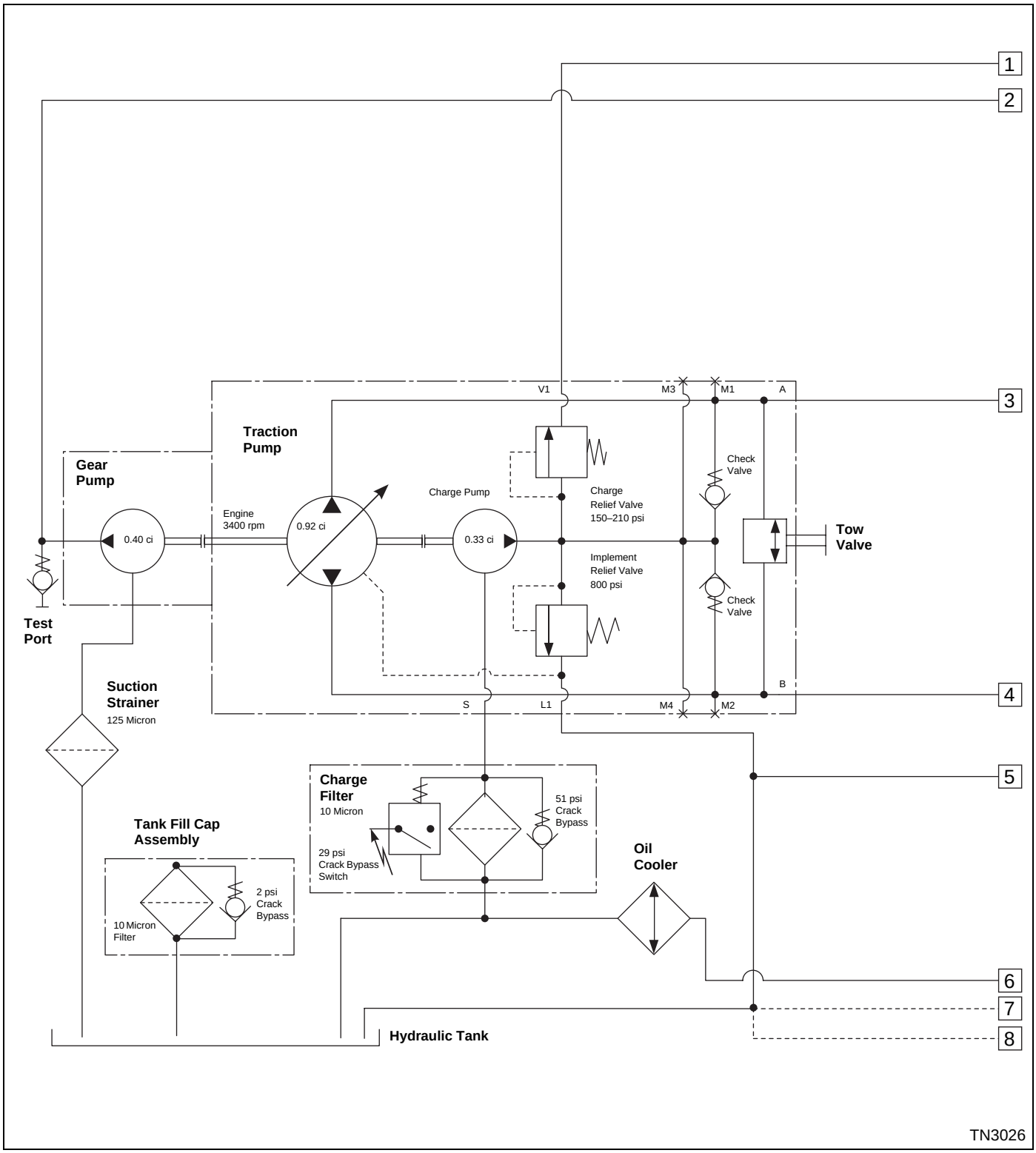


Figure 6-3

Hydraulic Schematic (3WD), Continued

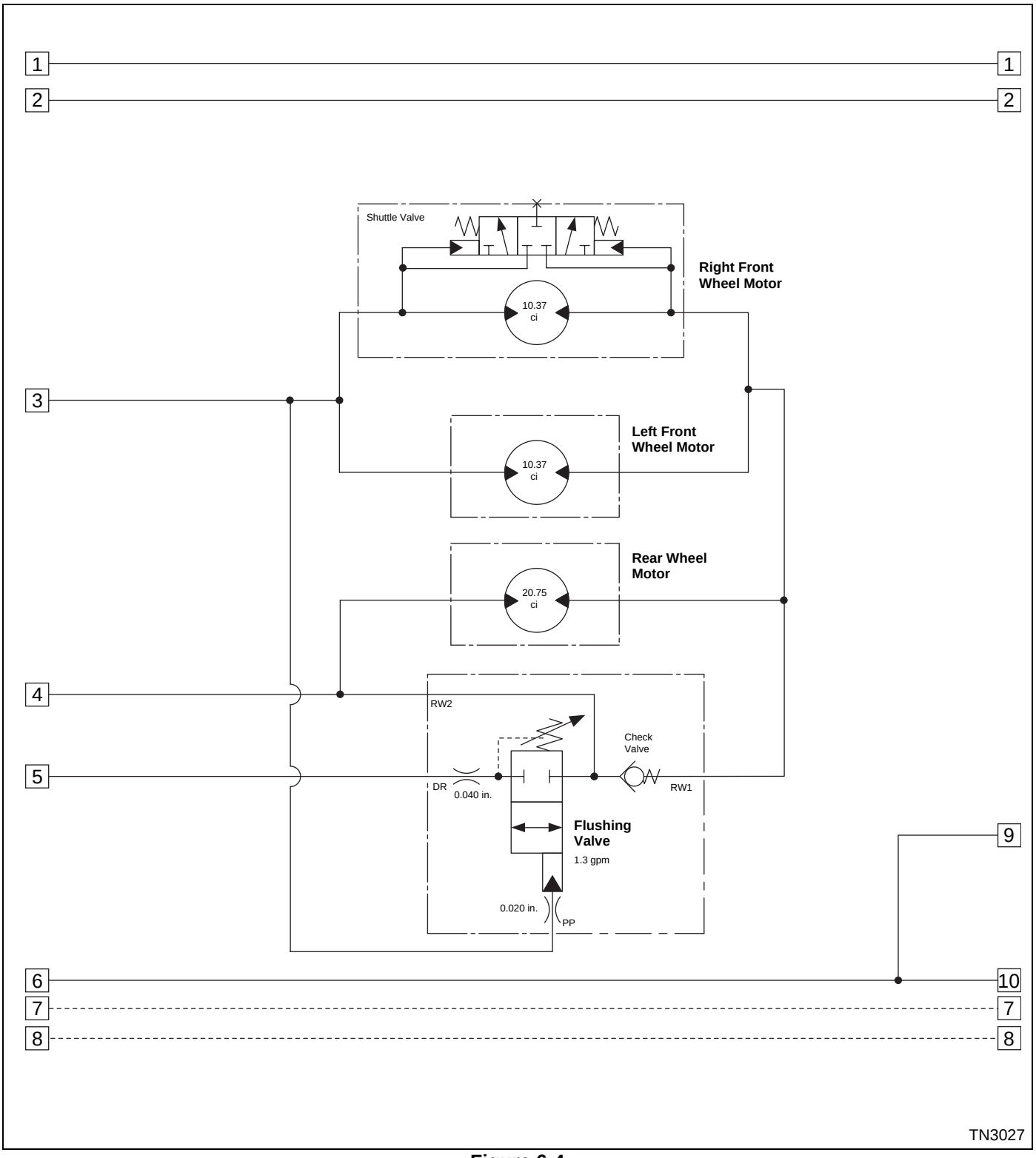


Figure 6-4

Hydraulic Schematic (3WD), Continued

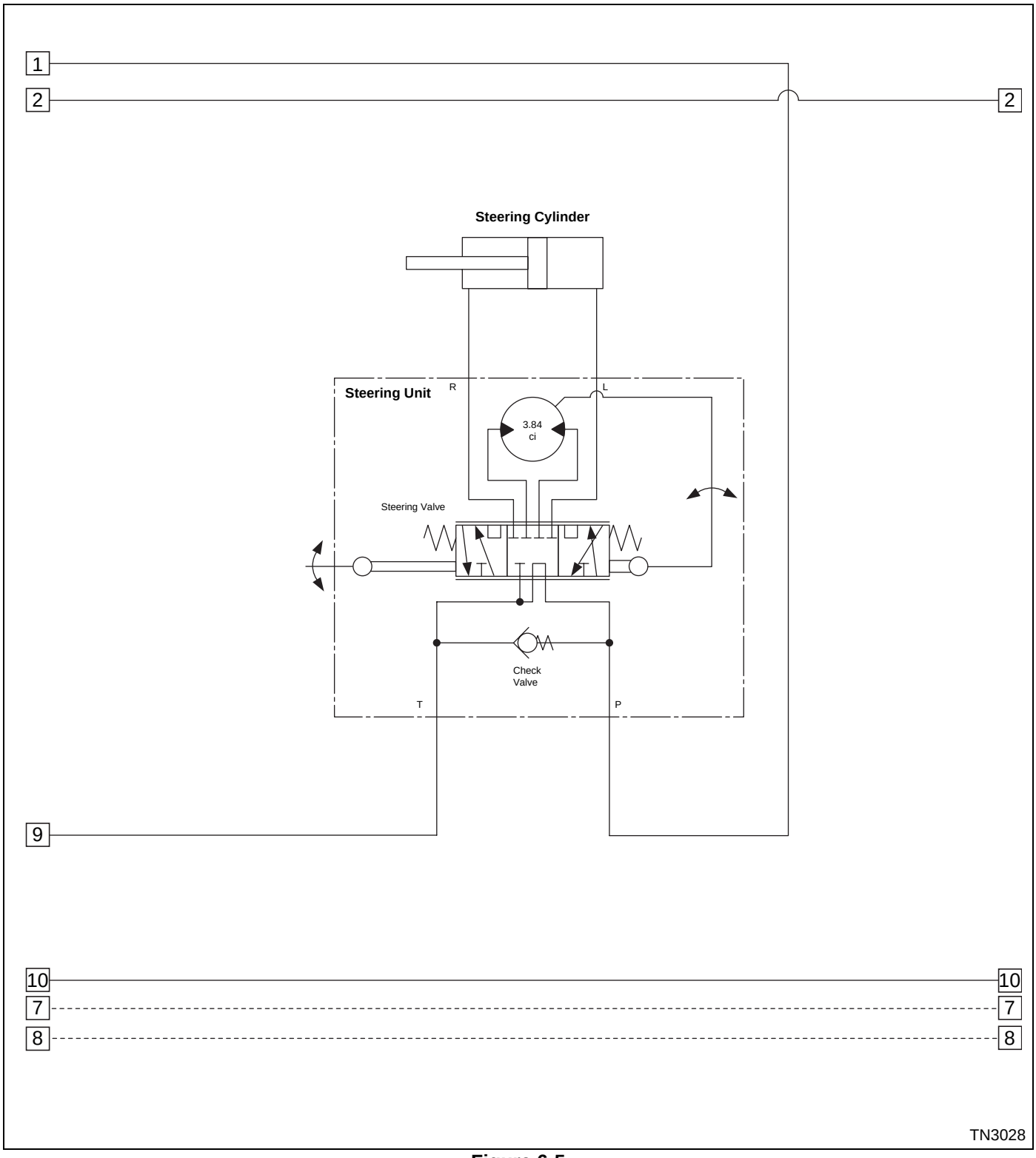


Figure 6-5

Hydraulic Schematic (3WD), Continued

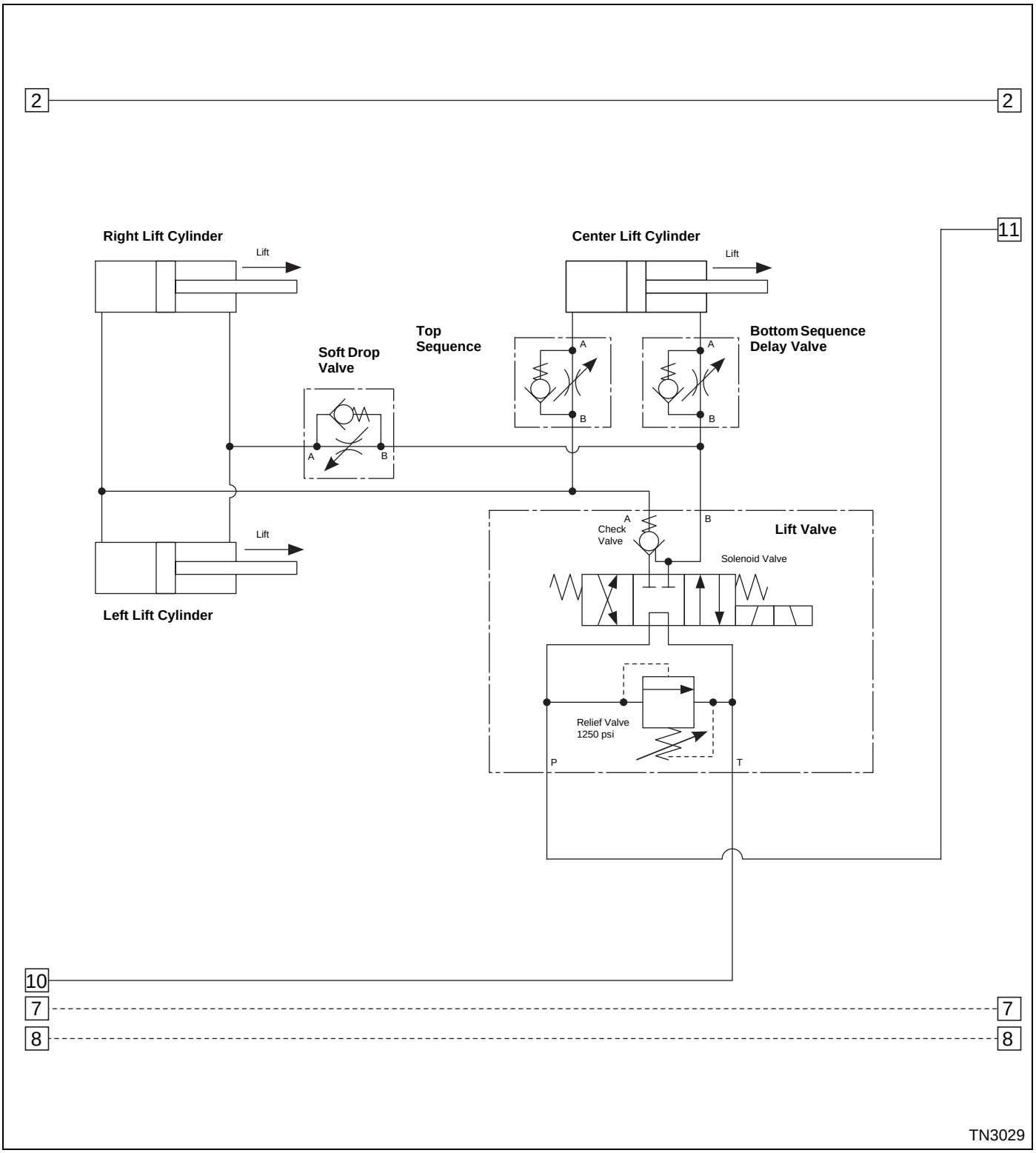


Figure 6-6

Hydraulic Schematic (3WD), Continued

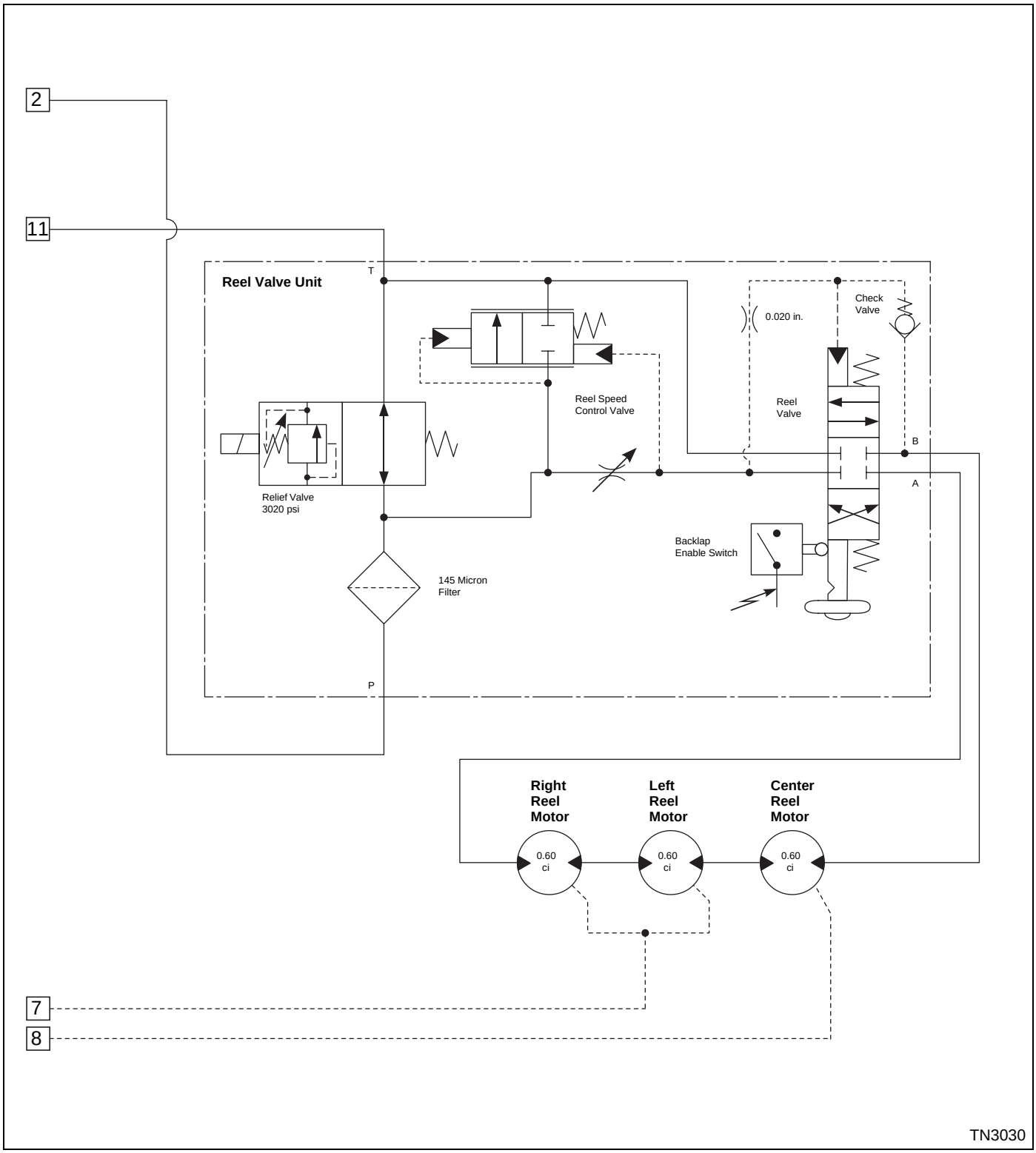


Figure 6-7

Hydraulic Schematic (2WD)

See Figures 6-8 through 6-12.

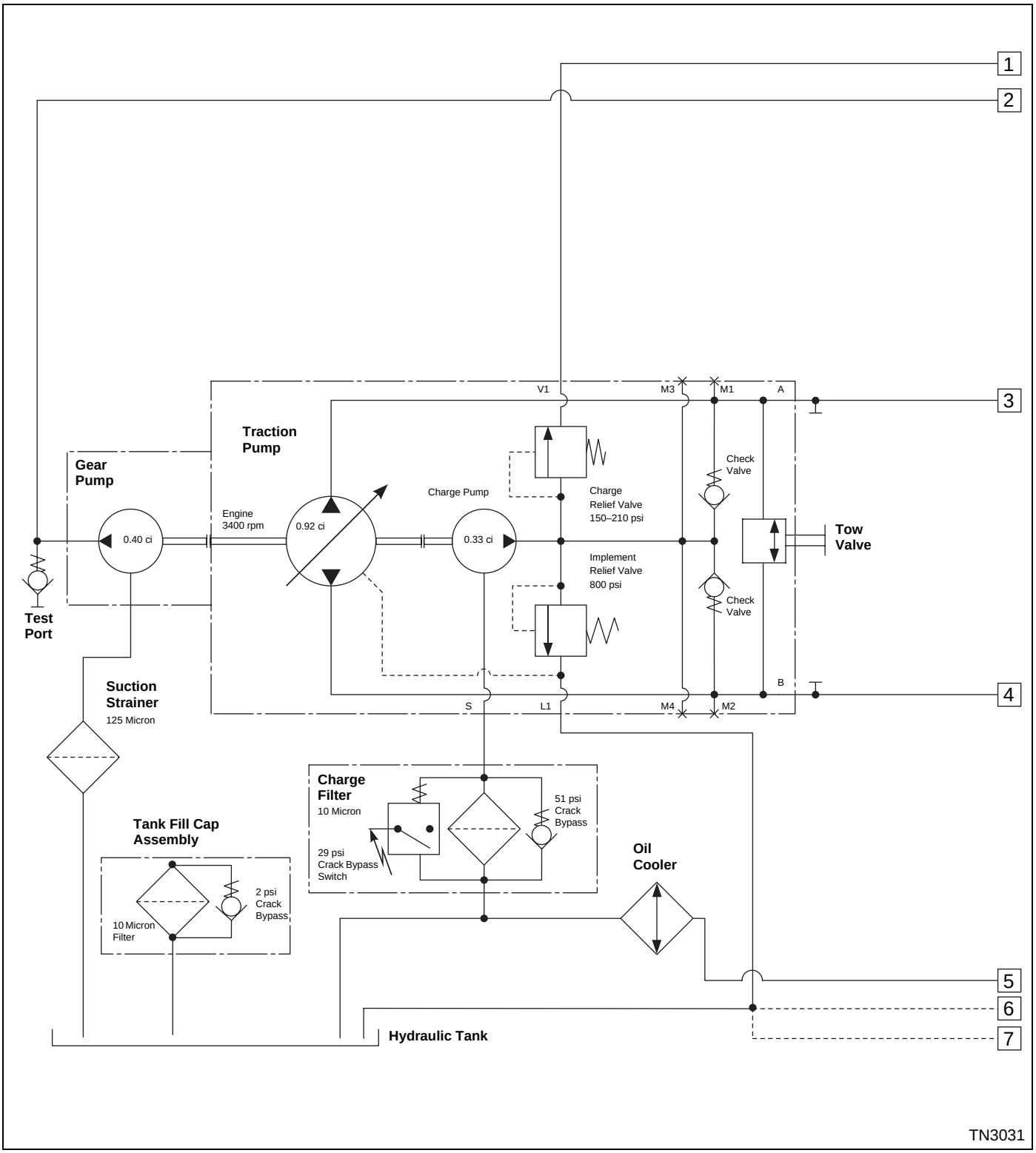


Figure 6-8

Hydraulic Schematic (2WD), Continued

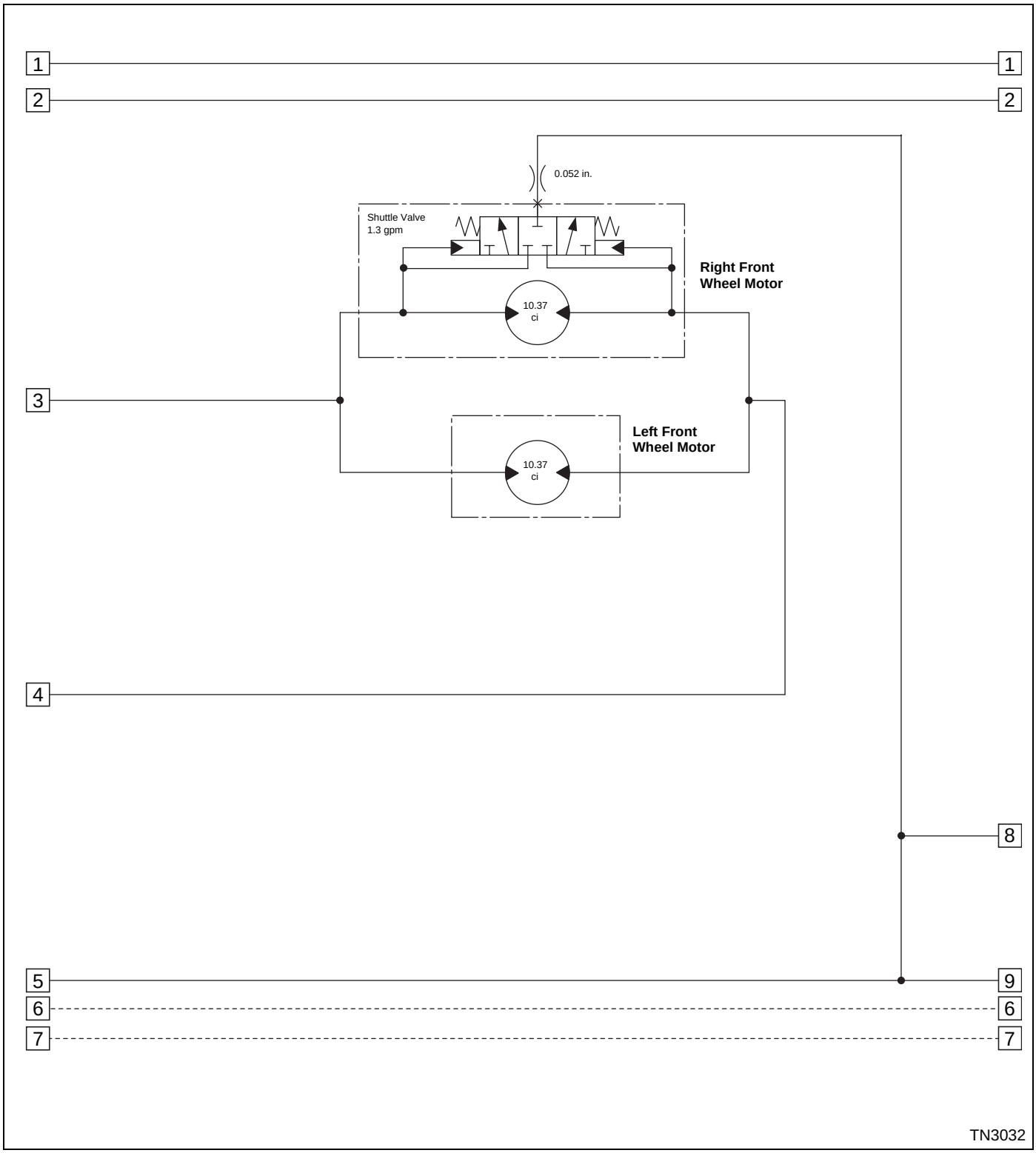


Figure 6-9

Hydraulic Schematic (2WD), Continued

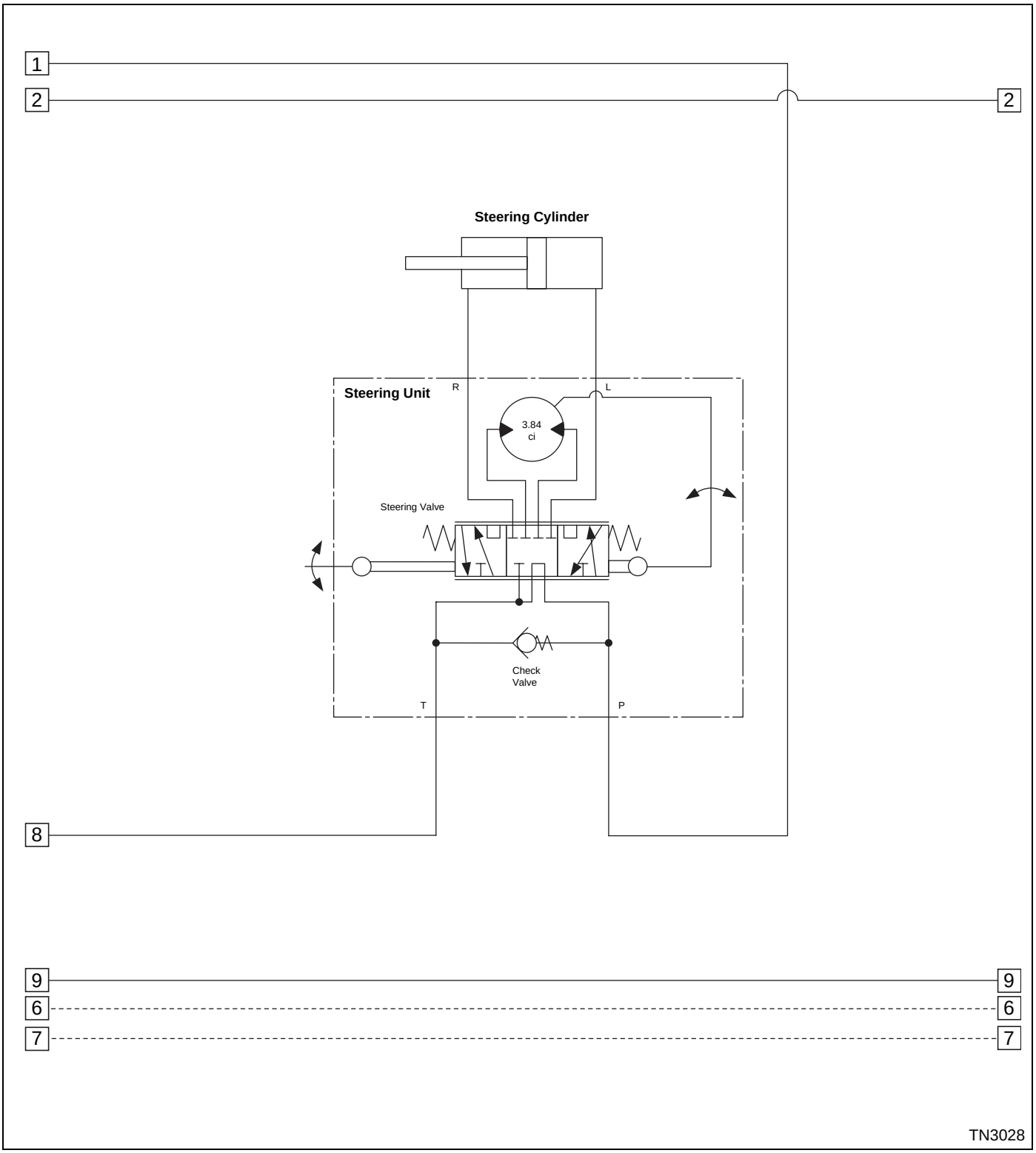


Figure 6-10

Hydraulic Schematic (2WD), Continued

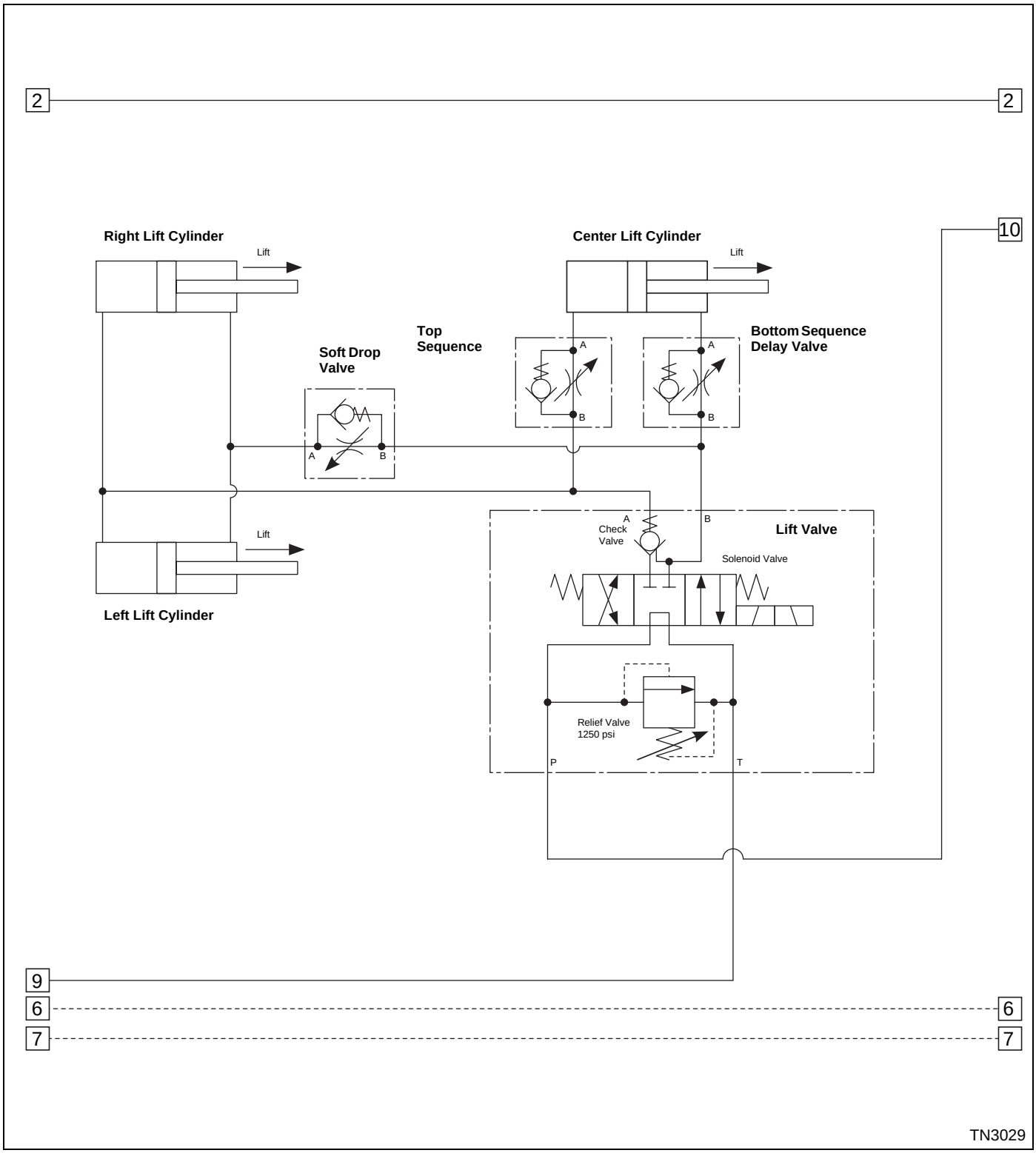


Figure 6-11

Hydraulic Schematic (2WD), Continued

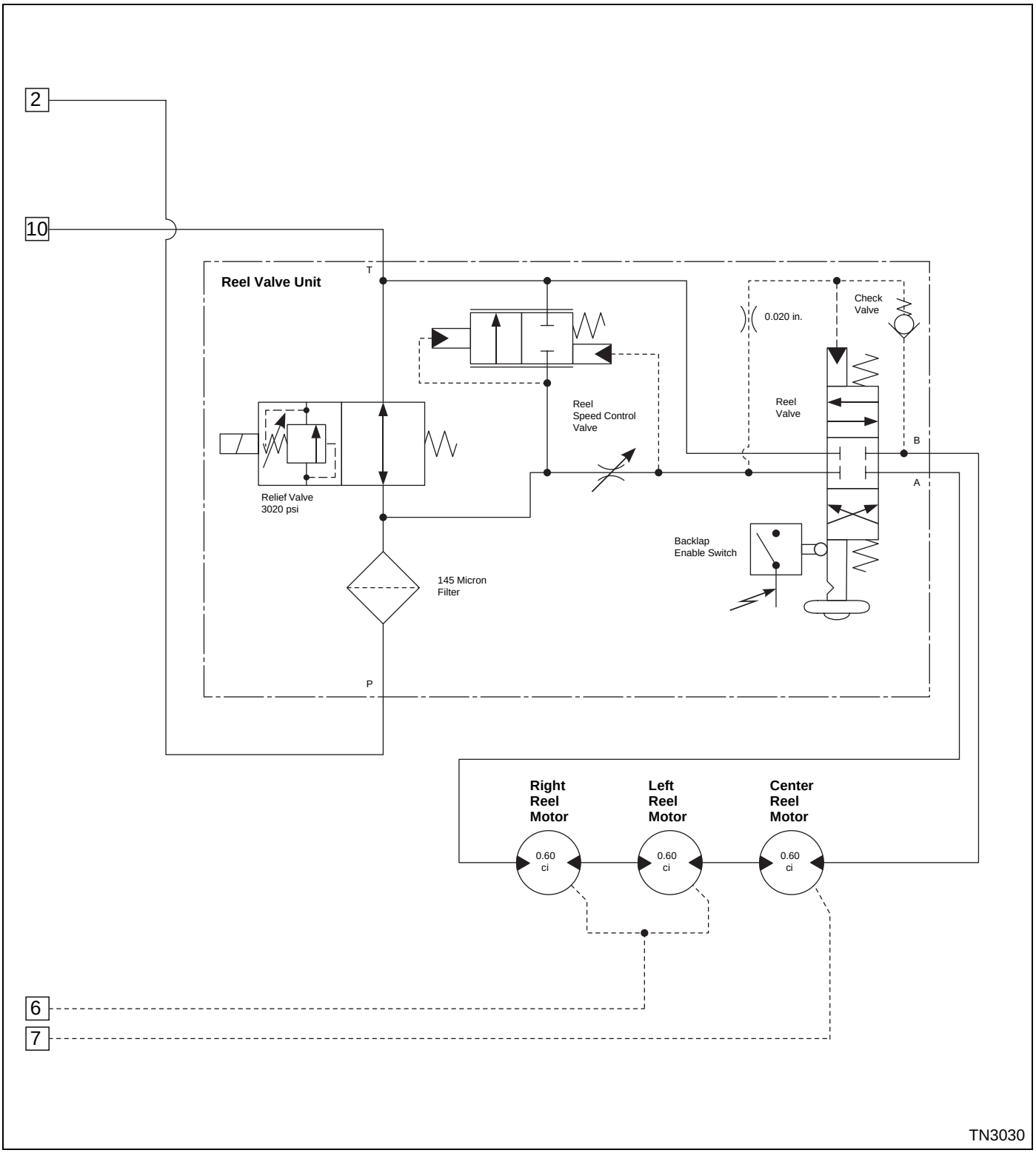


Figure 6-12

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Theory of Operation and Sub-Circuit Schematics

Steering Circuit Schematic and Theory of Operation

System Conditions:

- Engine running
- Steering wheel turned to the right or left (left turn shown)

Oil Supply to Steering Unit

Hydraulic oil is drawn from the hydraulic oil tank by the charge pump. Before entering the charge pump, the inlet oil is filtered by a 10 micron filter to remove any debris. Operating pressure oil from the charge pump is routed through the 150–210 psi (10–15 bar) charge relief valve, through port “V1” of the traction pump, and to port “P” of the steering unit.

Steering Circuit

Operating pressure oil enters the steering unit at port “P,” and is routed against the check valve and to the steering valve.

With the steering wheel in the neutral (straight ahead) position, the steering valve routes all of the operating pressure oil out of the steering unit through port “T,” to the oil cooler, and then to the hydraulic tank.

With the steering wheel turned to the left, the steering valve is moved, allowing oil to flow through the valve to the gerotor metering section. Oil is then routed through port “L” of the steering unit to the piston side of the steering cylinder, extending the rod and moving the rear wheels in the desired direction.

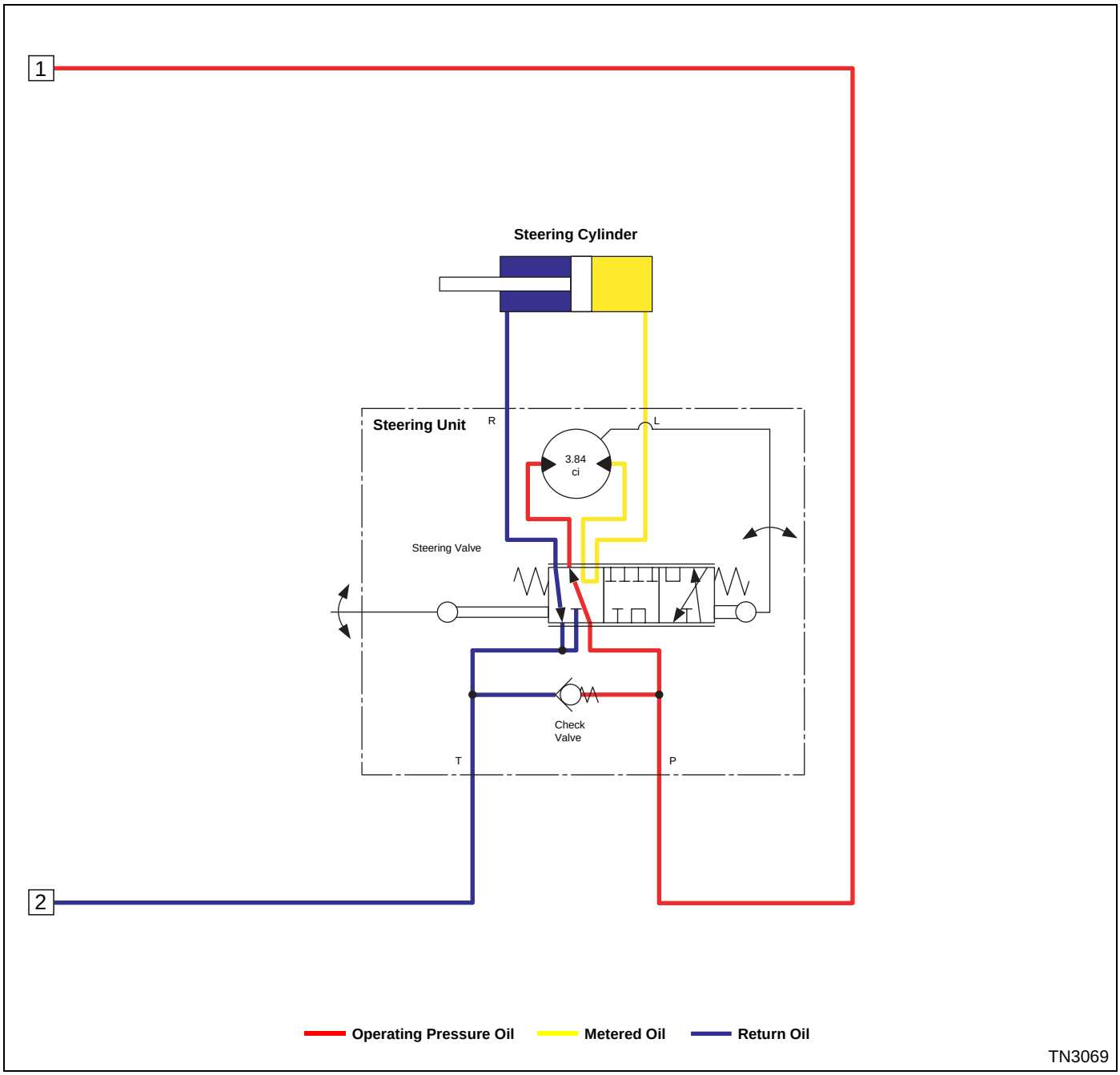
Oil from the rod end of the steering cylinder flows back into the steering unit through port “R,” through the steering valve, and through port “T.” Oil exiting the steering unit is routed to the oil cooler and then to the hydraulic tank.

Circuit Relief

The steering system is protected by the 800 psi (55 bar) implement relief valve. If the pressure on the pilot line of the relief valve reaches 800 psi (55 bar), the valve will open, dumping operating pressure oil through port “L1” of the traction pump to the hydraulic tank.

Steering Circuit Schematic

See Figure 6-13.



1 Operating Pressure Oil from Charge Pump (Traction Pump Port V1)

2 Return Oil to Oil Cooler and Hydraulic Tank

Figure 6-13

Raise Circuit Schematic and Theory of Operation

System Conditions:

- Engine running at fast idle
- Mower raise/lower switch in the raise position

NOTE

The cutting unit motors will automatically shut off as the cutting units are raised.

Oil Supply to Lift Valve

Hydraulic oil is drawn from the hydraulic oil tank by the gear pump. Before entering the gear pump, the inlet oil is filtered by a 125 micron suction strainer to remove any debris. Operating pressure oil from the gear pump is routed to port “P” of the reel valve unit, through the 3020 psi (207 bar) mowing relief valve, through port “T” of the reel valve unit, and to port “P” of the lift valve.

Raise Circuit

Operating pressure oil supplied from port “T” of the reel valve unit enters the lift valve at port “P.” The oil flows against the 1250 psi (80 bar) relief valve, through the solenoid valve, through the check valve, and then exits the lift valve at port “A.”

Oil from port “A” of the lift valve is routed to port “B” of the top sequence delay valve and to the piston side of the right and left lift cylinders. Oil flow to the piston side of the right and left lift cylinders raises the right and left cutting units.

Oil entering port “B” of the top sequence delay valve flows unrestricted through the check valve, exits port “A” of the top sequence delay valve, and flows to the piston side of the center lift cylinder. Oil flow to the piston side of the center lift cylinder raises the center cutting unit.

Oil from the rod end of the right and left lift cylinders flows through port “B” of the soft drop valve, flows unrestricted through the check valve, exits port “A” of the soft drop valve, and is then routed through the lift valve, back to the oil cooler, and then to the hydraulic tank.

Oil from the rod end of the center lift cylinder flows through port “A” of the bottom sequence delay valve, against the check valve, through the orifice, and exits port “B” of the bottom sequence delay valve. The orifice restricts the flow of oil, dampening the reaction of the center cylinder extension. Oil exiting port “B” of the bottom sequence delay valve is routed through the lift valve, back to the oil cooler, and then to the hydraulic tank.

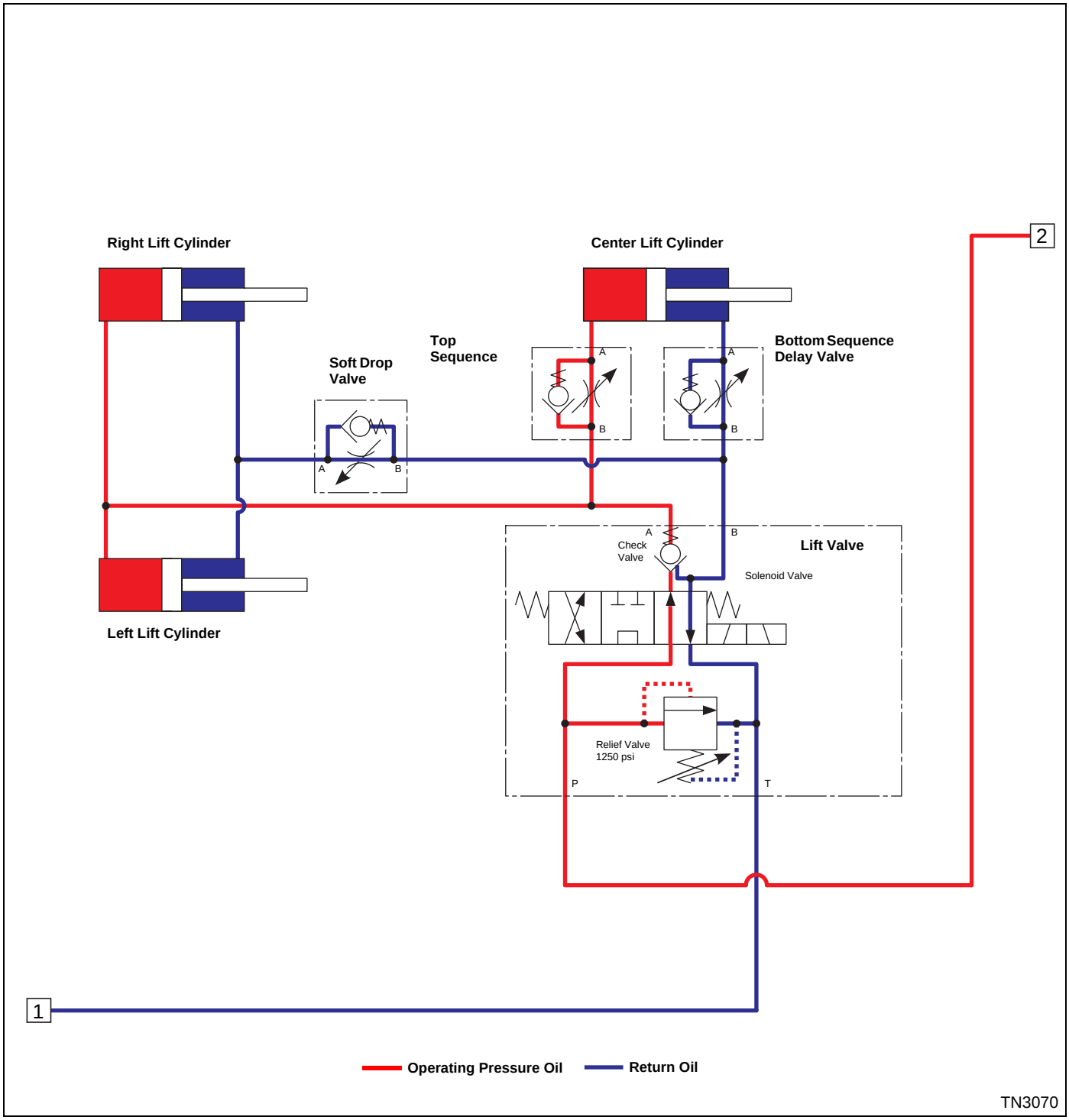
When the solenoid valve is returned to the center position, oil flow from the piston side of the cylinders is blocked by the check valve, ensuring the cutting units stay in the raised position.

Circuit Relief

The lift system is protected by the 1250 psi (86 bar) relief valve in the lift valve. If the pressure on the pilot line of the relief valve reaches 1250 ± 10% psi (86 ± 10% bar), the valve will open, dumping operating pressure oil through port “T” of the lift valve, to the oil cooler, and then to the hydraulic tank.

Raise Circuit Schematic

See Figure 6-14.



1 Return Oil to Oil Cooler and Hydraulic Tank

2 Operating Pressure Oil from Reel Valve Unit (Port T)

Figure 6-14

Lower Circuit Schematic and Theory of Operation

System Conditions:

- Engine running
- Mower raise/lower switch in the lower position

Oil Supply to Lift Valve

Hydraulic oil is drawn from the hydraulic oil tank by the gear pump. Before entering the gear pump, the inlet oil is filtered by a 125 micron suction strainer to remove any debris. Operating pressure oil from the gear pump is routed to port “P” of the reel valve unit, through the 3020 psi (207 bar) mowing relief valve, through port “T” of the reel valve unit, and to port “P” of the lift valve.

Lower Circuit

Operating pressure oil supplied from port “T” of the reel valve unit enters the lift valve at port “P.” The oil flows against the 1250 psi (80 bar) relief valve, through the solenoid valve, to the pilot of the check valve, opening the check valve, and then exits the lift valve at port “B.”

Oil from port “B” of the lift valve is routed to port “B” of the bottom sequence delay valve and to port “A” of the soft drop valve.

Oil entering port “B” of the bottom sequence delay valve flows unrestricted through the check valve, exits port “A” of the top sequence delay valve, and flows to the rod side of the center lift cylinder. Oil flow to the rod side of the center lift cylinder lowers the center cutting unit.

Oil entering port “A” of the soft drop valve flows against the check valve, through the orifice, and exits port “B” of the soft drop valve. Oil exiting port “B” of the drop valve flows to the rod side of the right and left lift cylinders. Oil flow to the rod side of the right and left lift cylinders lowers the right and left cutting units. The orifice restricts the flow of oil, dampening the reaction of the right and left cylinders’ retraction.

Oil from the piston end of the right and left lift cylinders flows through the lift valve, back to the oil cooler, and then to the hydraulic tank.

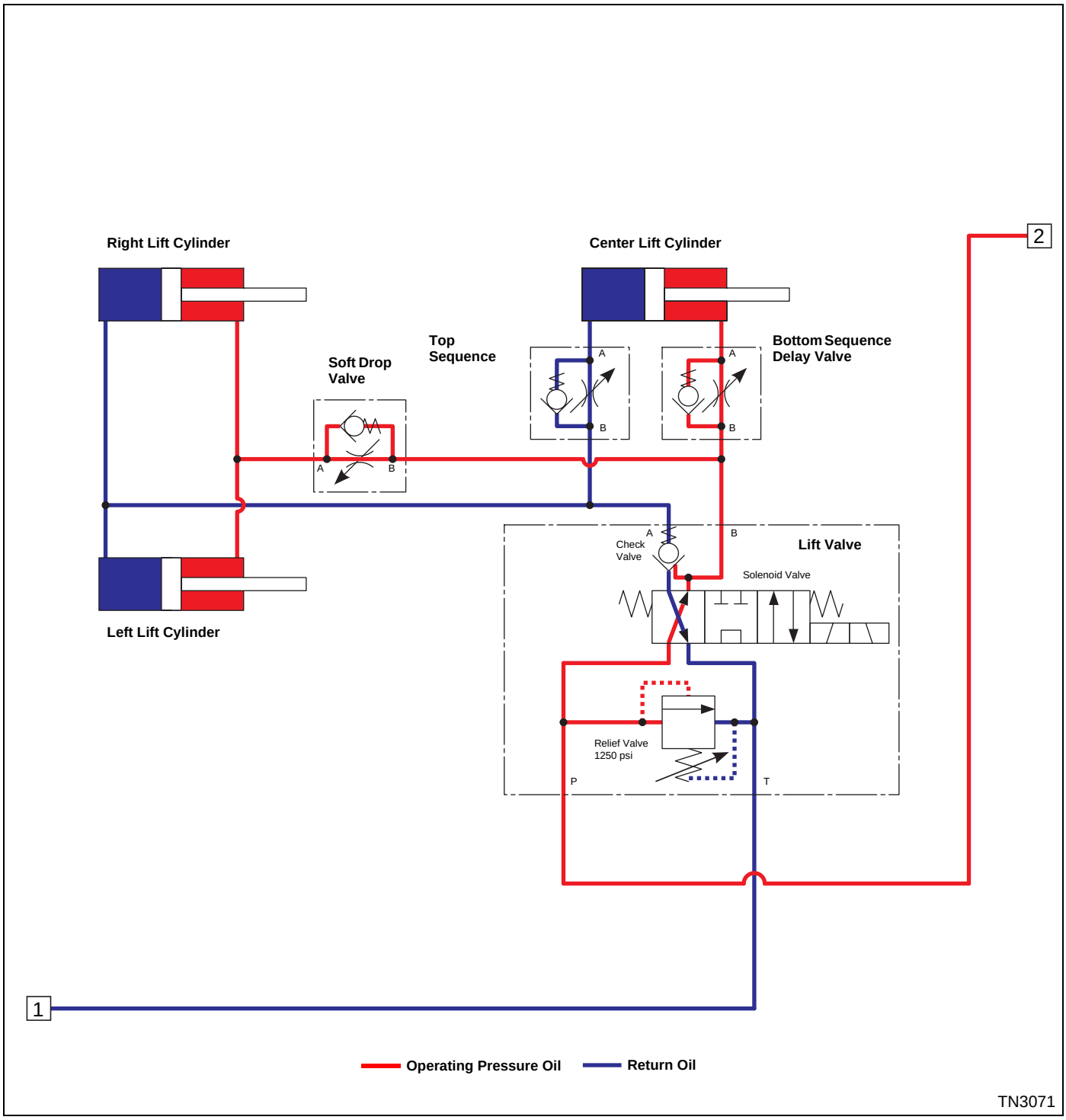
Oil from the piston end of the center lift cylinder flows through port “A” of the top sequence delay valve, against the check valve, through the orifice, and exits port “B” of the top sequence delay valve. The orifice restricts the flow of oil, dampening the reaction of the center cylinder retraction. Oil exiting port “B” of the top sequence delay valve is routed through the lift valve, back to the oil cooler, and then to the hydraulic tank.

Circuit Relief

The lift system is protected by the 1250 psi (86 bar) relief valve in the lift valve. If the pressure on the pilot line of the relief valve reaches 1250 ± 10% psi (86 ± 10% bar), the valve will open, dumping operating pressure oil through port “T” of the lift valve to the oil cooler, and then the hydraulic tank.

Lower Circuit Schematic

See Figure 6-15.



1 Return Oil to Oil Cooler and Hydraulic Tank

2 Operating Pressure Oil from Reel Valve Unit (Port T)

Figure 6-15

Mow Circuit Schematic and Theory of Operation

System Conditions:

- Engine running
- Cutting units lowered
- Park brake released
- Traction lever in the mow position
- Mow switch in the on position
- Reel valve in the mow position
- Seat switch in the on position (operator in seat)

NOTE

See "Mow Circuit—Theory of Operation" on page 4-26 for the electrical operation of this circuit.

Oil Supply to Reel Valve Unit

Hydraulic oil is drawn from the hydraulic oil tank by the gear pump. Before entering the gear pump, the inlet oil is filtered by a 125 micron suction strainer to remove any debris. Operating pressure oil from the gear pump is routed to port "P" of the reel valve unit.

Mow Circuit

Operating pressure oil supplied by the gear pump enters the reel valve unit body at port "P." It flows through the 145 micron filter and is routed against the relief valve and through the reel speed control valve. Oil is then routed to the 0.020 in. (0.5 mm) orifice and the reel valve. Oil from the 0.020 in. (0.5 mm) orifice is routed to the pilot of the reel valve and against the check valve. With oil pressure applied to the reel valve pilot, the reel valve shifts, routing operating pressure oil through port "A" to the reel motors. Operating pressure oil flows through the reel motors in series, driving the motors.

The oil flow to the reel motors is adjustable, with the reel speed control valve controlling the speed of the reels. The adjusted rate of oil flow regulates rotational speed and maintains motor speed as load is applied to the reel motors.

Oil returning from the motors enters the reel valve unit at port "B" and flows through the reel valve, exiting the valve at port "T." Oil exiting port "B" of the reel valve unit is routed through the lift valve and back to the oil cooler, then to the hydraulic tank.

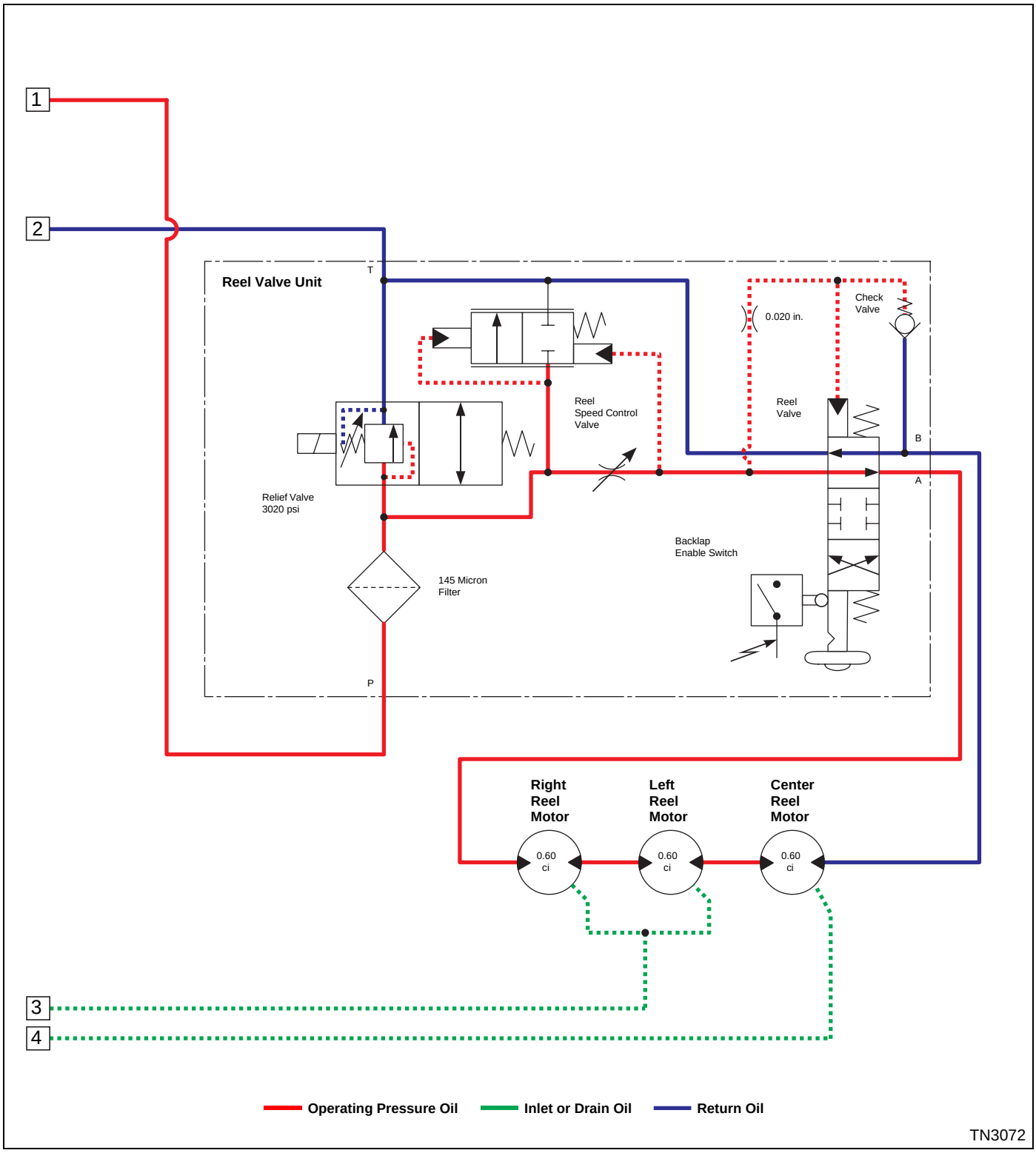
Hydraulic oil is used to lubricate the internal components of the reel motors. This oil is returned to the hydraulic tank via the case drain lines.

Circuit Relief

The mow circuit is protected by the 3020 psi (207 bar) relief valve. The relief valve will open if the oil pressure in the circuit reaches 3020 psi (207 bar), routing oil through port "T" of the reel valve unit, through the lift valve, and back to the oil cooler, then to the hydraulic tank.

Mow Circuit Schematic

See Figure 6-16.



1 Operating Pressure Oil from Gear Pump
2 Return Oil to Lift Valve (Port P)
3 Right and Left Reel Motor Case Drain Oil to Hydraulic Tank
4 Center Reel Motor Case Drain Oil to Hydraulic Tank

Figure 6-16

Backlap Circuit Schematic and Theory of Operation

System Conditions:

- Engine running
- Cutting units lowered
- Park brake engaged
- Traction lever in the mow position
- Mow switch in the on position
- Reel valve in the backlap position
- Seat switch in the on position (operator in seat)

NOTE

See "Mow Circuit—Theory of Operation" on page 4-26 for the electrical operation of this circuit.

Oil Supply to Reel Valve Unit

Hydraulic oil is drawn from the hydraulic oil tank by the gear pump. Before entering the gear pump, the inlet oil is filtered by a 125 micron suction strainer to remove any debris. Operating pressure oil from the gear pump is routed to port "P" of the reel valve unit.

Backlap Circuit

Operating pressure oil supplied by the gear pump enters the reel valve unit body at port "P." It flows through the 145 micron filter and is routed against the relief valve and through the reel speed control valve. Oil is then routed to the 0.020 in. (0.5 mm) orifice and the reel valve. Oil from the 0.020 in. (0.5 mm) orifice is routed to the pilot of the reel valve and against the check valve. With the reel valve in the backlap position, operating pressure oil is routed through port "B" to the reel motors in series, driving the reel motors in the reverse direction.

The oil flow to the reel motors is adjustable, with the reel speed control valve controlling the speed of the reels. The adjusted rate of oil flow regulates rotational speed and maintains motor speed as load is applied to the reel motors during backlapping.

Oil returning from the motors enters the reel valve unit at port "A" and flows through the reel valve, exiting the valve at port "T." Oil exiting port "B" of the reel valve unit is routed through the lift valve and back to the oil cooler, then to the hydraulic tank.

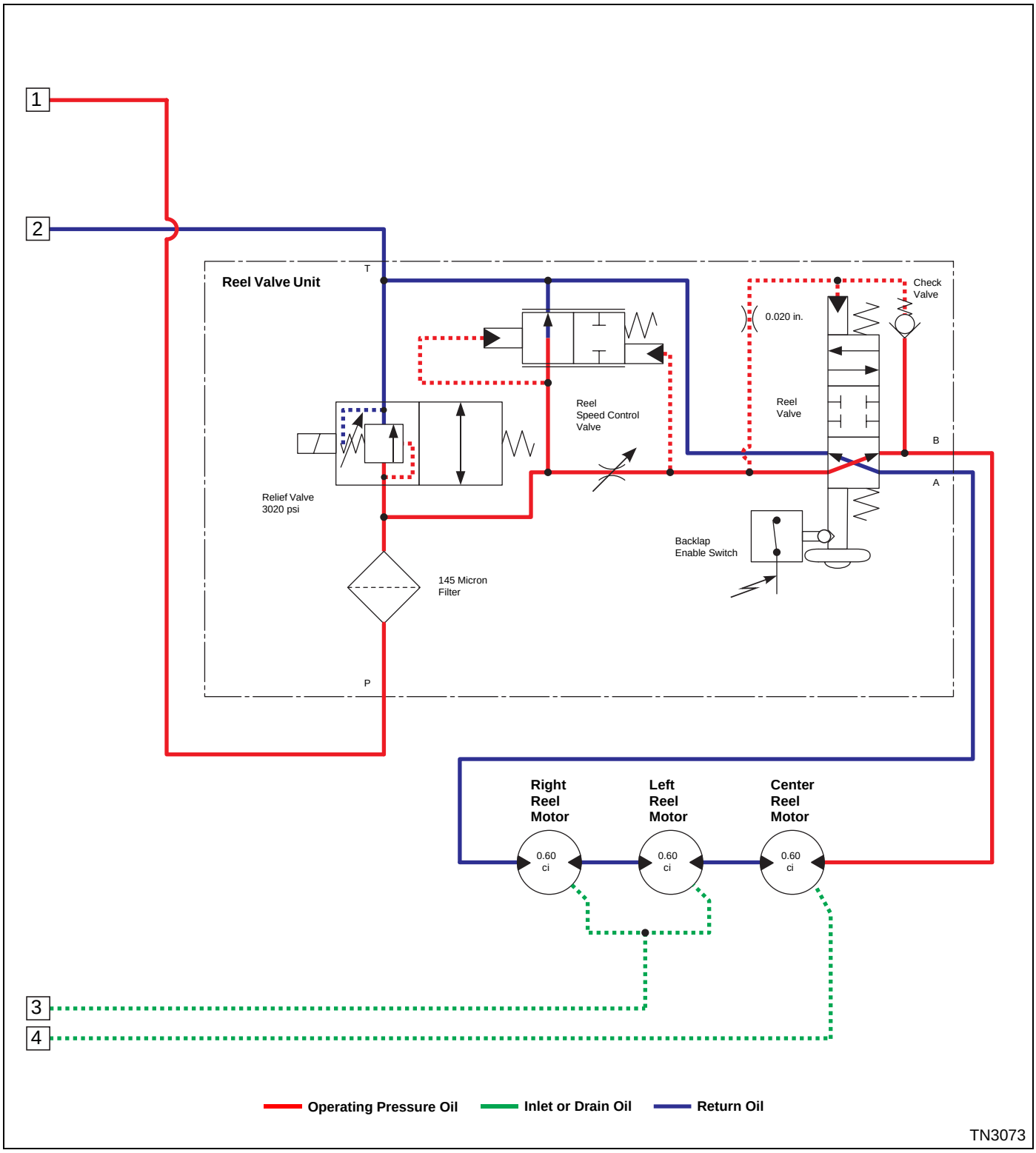
Hydraulic oil is used to lubricate the internal components of the reel motors. This oil is returned to the hydraulic tank via the case drain lines.

Circuit Relief

The backlap circuit is protected by the 3020 psi (207 bar) relief valve. The relief valve will open if the oil pressure in the circuit reaches 3020 psi (207 bar), routing oil through port "T" of the reel valve unit, through the lift valve, back to the oil cooler, and then to the hydraulic tank.

Backlap Circuit Schematic

See Figure 6-17.



1 Operating Pressure Oil from Gear Pump
2 Return Oil to Lift Valve (Port P)
3 Right and Left Reel Motor Case Drain Oil to Hydraulic Tank
4 Center Reel Motor Case Drain Oil to Hydraulic Tank

Figure 6-17

Field Test Procedures

When a hydraulic system failure occurs, some simple tests can be performed prior to using test instruments. The results of these tests can lead you to the suspected component failure. More extensive test procedures, using test instruments, are presented later in this section. (See “Instrument Test Procedures” on page 6-31.)

Preliminary Checks

Perform the following checks prior to beginning any tests.

1. Check the hydraulic oil reservoir for proper fluid level, the presence of air or water, and unusual odor.
2. Check all hoses, tubes, and fittings for leaks. Tighten as needed.
3. Eliminate all mechanical issues prior to starting hydraulic tests.

Lift Cylinder Leakage Test

See Figures 6-18 through 6-20.

NOTE

Front left lift cylinder is shown; procedure is similar for all lift cylinders.

WARNING

The hydraulic system is under pressure, and the oil will be hot.

- **Always relieve pressure in the hydraulic system before performing service.**
- **Failure to follow appropriate safety precautions may result in death or serious injury.**

1. Start engine. Operate hydraulic system until oil temperature is 120–150° F (49–65° C).
2. Raise cutting units.
3. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
4. Support all cutting unit lift arms.

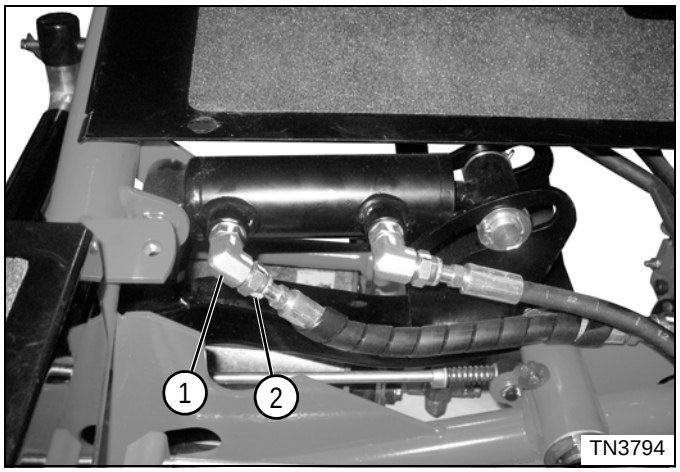


Figure 6-18

5. Disconnect hose (2) from lift cylinder piston end fitting (1).
6. Install plug in hose (2).
7. Install cap on lift cylinder fitting (1).
8. Remove support from cutting unit lift arm being tested.

   After 15 minutes, does cutting unit drift down?

   YES *Cylinder is bypassing oil. Repair or replace lift cylinder. (See “Center Lift Cylinder” on page 6-52 or “Left and Right Front Lift Cylinders” on page 6-54.)*

   NO *Repeat the test for all of the lift cylinders. If all cylinders pass test, the problem may be in the lift valve. Proceed to step 9.*
9. Support all cutting unit lift arms.
10. Connect hose (2) to lift cylinder fitting (1).
11. Start engine and lower the cutting units.
12. Stop engine.

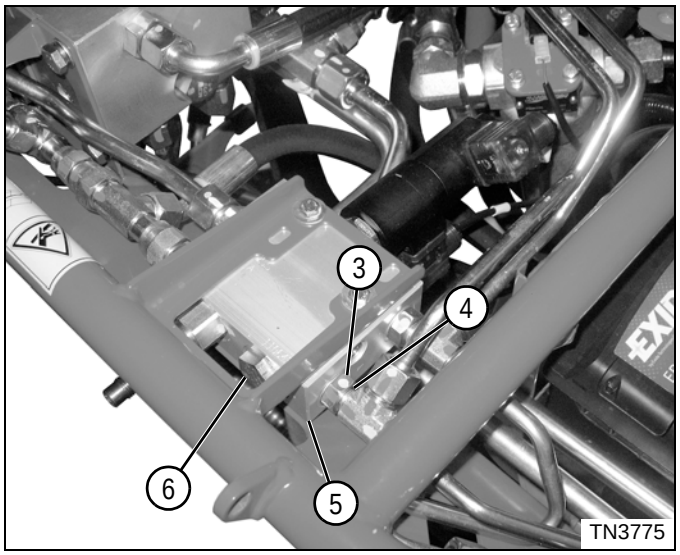


Figure 6-19

IMPORTANT

Cutting units must be lowered to the ground.

13. Disconnect tee fitting (4) from port “A” (3) of the lift valve (5). Cap tee fitting.

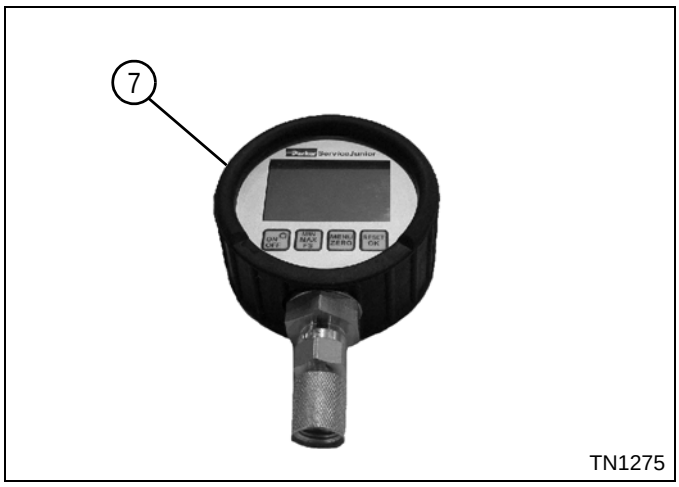


Figure 6-20

NOTE

The test hose to be used in step 14 must have a minimum length of 1 ft (304 mm) to provide sufficient oil volume to momentarily maintain pressure during testing.

14. Connect a 2000 psi (138 bar) pressure gauge (7) to one end of a test hose. Connect the other end of the test hose to port “A” of the lift valve.
15. Start engine.

NOTE

The pressure gauge will indicate the relief valve pressure setting, 1250 ± 10% psi (86 ± 10% bar), when the raise/lower switch is activated to the fully raised position and the relief valve opens.

16. Activate the raise/lower switch to the fully raised position just long enough to open the relief valve, then release the raise/lower switch and stop the engine.

    Does the pressure reading immediately begin to fall?

    YES *Check valve (6) is bypassing oil. Repair or replace check valve, then proceed to step 17.*

    NO *The check valve is not faulty. Proceed to step 17.*

17. Disconnect and remove test equipment. Install all hoses, fittings, and components as noted prior to removal.

Steering Leakage Test

See Figure 6-21.

1. Operate hydraulic system until oil temperature is 120–150° F (49–65° C).
2. Turn steering wheel fully left against stop.
3. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

WARNING

The hydraulic system is under pressure, and the oil will be hot.

- **Always relieve pressure in the hydraulic system before performing service.**
- **Failure to follow appropriate safety precautions may result in death or serious injury.**

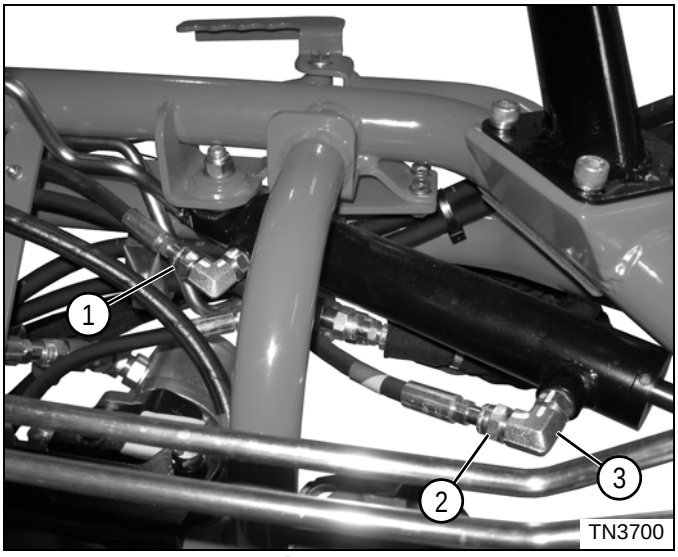


Figure 6-21

4. Disconnect hose (2) from steering cylinder fitting (3). Plug hose.
5. Place a suitable container under steering cylinder fitting (3).

WARNING

Do not turn steering wheel to the right.

Failure to follow appropriate safety precautions may result in death or serious injury.

6. With engine off, turn steering wheel fully left against stop.
7. Check for oil leakage in the drain pan.

Is steering cylinder leakage a nominal amount of oil or less?

YES *Go to step 8.*

NO *Repair or replace steering cylinder. (See "Steering Cylinder" on page 7-14.)*

8. Disconnect and plug hose (1).
9. Start engine and set engine speed to full throttle (3400 rpm ± 50).
10. Turn the steering wheel fully left, then fully right.

Does the steering wheel continue to turn past stop with little or no resistance?

YES *Steering unit is faulty. Replace steering unit. (See "Steering Unit" on page 7-6.)*

NO *Steering unit is good.*

Reel Motor Case Drain Test

The cutting units circuit consists of the gear pump, reel valve unit, right cutting unit, left cutting unit, and center cutting unit. This test helps to determine if one of the reel motors is faulty. An instrument test must be performed to isolate the performance of the gear pump and reel valve unit.

NOTES

- *Perform test on only one reel motor at a time.*
- *The case drain on a hydraulic motor is used to return lubrication or bypassed hydraulic oil to the hydraulic tank.*

1. Operate the machine until hydraulic oil reaches operating temperature, 120–150° F (49–65° C).
2. Stop the engine and remove the key.
3. Remove case drain hose from reel motor. Immediately plug the hose.
4. Place a drain pan with a minimum capacity of 1 gallon (3.8 L) near the reel motor.
5. Install a separate hose on the case drain fitting and place the free end in the container. Secure the hose to prevent spills.

WARNING

Safely block cutting unit from rotating using a suitable device or tool. Failure to follow appropriate safety precautions may result in death or serious injury.

6. Install suitable blocking device or tool in cutting unit being tested, preventing reel motor from turning.
7. Chock the wheels so the machine cannot roll.
8. Set park brake, start engine, release park brake, and place mow switch in the on position for 15 seconds.
9. Stop engine and remove ignition key.
10. Measure the amount of oil that flowed from the case drain. The amount x 4 = amount per minute.

Is the amount of oil captured from the case drain about a half pint per minute or less?

YES *The motor shaft and/or bearings are not faulty; proceed with an instrument test. (See "Instrument Test Procedures" on page 6-31.)*

Is the amount of oil captured from the case drain more than a pint per minute?

YES *The motor may be faulty; repair or replace as needed. (See "Reel Motor" on page 8-28.)*

NO Disconnect and remove test equipment. Install all hoses, fittings, and components as noted prior to removal.

Instrument Test Procedures

Instrument Test Overview

The following tests are specifically designed to approach hydraulic testing on a system level. Each component within the system represents a portion of the total system leakage. An internal leakage percentage for each component will be calculated and recorded, enabling the technician to view the system performance issue more completely. The test results will help the technician to determine which repairs will best remedy the performance issue experienced by the machine operator.

The internal leakage percentage ranges are as follows:

0–10% = Good

11–20% = Marginal

21% and Beyond = Bad

Example: Cutting Unit System Performance Complaint

The machine operator reports that the mower is not cutting correctly.

Troubleshooting must first be performed to rule out a cutting unit adjustment issue. Once the issue is known to be component related, the entire cutting unit system is tested as outlined. The calculated system leakage is 28%, a result that requires the testing of individual components. This result can also be interpreted as a system that is 72% efficient.

The remaining components in question are as follows: gear pump, reel valve unit, right reel motor, left reel motor, and center reel motor. Following the procedures as outlined, test each individual component, then calculate and record leakage percentages.

The results from this test reveal leakage of 5% in the gear pump, 5.3% in the reel valve unit, 20% in the right reel motor, 5.6% in the left reel motor, and 4.4% in the center reel motor. Although all the components lend to the overall circuit leakage, only the right reel motor, which is at the extreme end of the marginal range, would be considered for repair/replacement.

Formulas:

Cutting Units Circuit Test

No Load Flow – Loaded Flow / No Load Flow x 100 = Leak Percentage

Reel Valve Unit and Reel Motor

Loaded Flow from previous component – Loaded Flow from current component / Loaded Flow from previous component x 100 = Leak Percentage

Calculations:

Cutting Units Circuit Test

No Load Flow = 10 gpm

Loaded Flow = 7.2 gpm

10 – 7.2 / 10 x 100 = Total Circuit Leakage 28%

Gear Pump Test

No Load Flow = 10 gpm

Loaded Flow = 9.5 gpm

10 – 9.5 / 10 x 100 = Front Cutting Unit Pump Leakage 5%

Reel Valve Unit Test

Loaded Flow from front cutting units pump test = 9.5 gpm

Loaded Flow from front reel valve unit test = 9 gpm

9.5 – 9 / 9.5 x 100 = Reel Valve Unit Leakage 5.3%

Right Reel Motor Test

Loaded Flow from reel valve unit test = 9 gpm

Loaded Flow from right reel motor test = 7.2 gpm

9 – 7.2 / 9 x 100 = Right Reel Motor Leakage 20%

Left Reel Motor Test

Loaded Flow from right reel motor test = 7.2 gpm

Loaded Flow from left reel motor test = 6.8 gpm

7.2 – 6.8 / 7.2 x 100 = Left Reel Motor Leakage 5.6%

Center Reel Motor Test

Loaded Flow from left reel motor test = 6.8 gpm

Loaded Flow from center reel motor test = 6.5 gpm

6.8 – 6.5 / 6.8 x 100 = Center Reel Motor Leakage 4.4%

Cutting Units Circuit Test

See Figures 6-22 through 6-24.

IMPORTANT

- **Performing this test will isolate the gear pump, reel valve unit, and right reel motor from the rest of the cutting units circuit.**
- **This test works together with the gear pump test, reel valve unit test, and reel motors test to isolate a problem with the cutting units circuit.**

WARNING

The hydraulic system is under pressure, and the oil will be hot.

- **Always relieve pressure in the hydraulic system before performing service.**
- **Failure to follow appropriate safety precautions may result in death or serious injury.**

Required Tools and Materials
• Flow Meter • -8 ORFS Test Hose 4000 psi (276 bar) • -8 ORFS Tee Fitting • Blocking Device or Tool

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

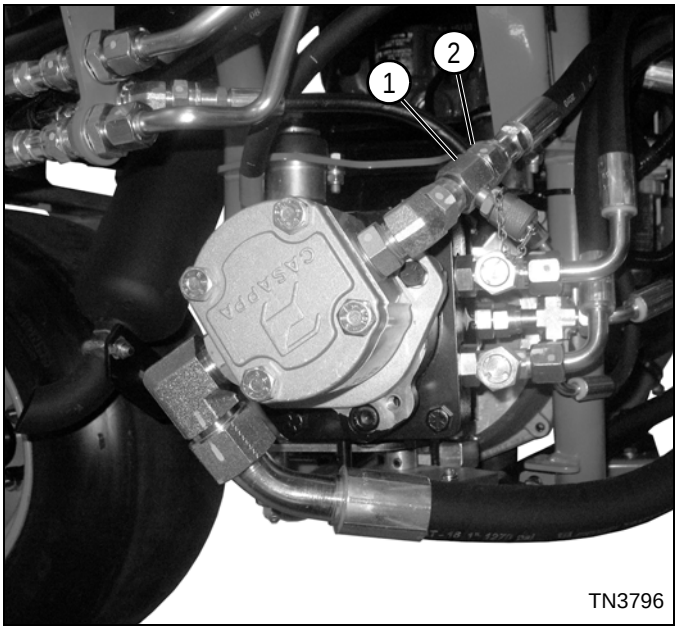


Figure 6-22

2. Disconnect hose (2) from fitting (1).

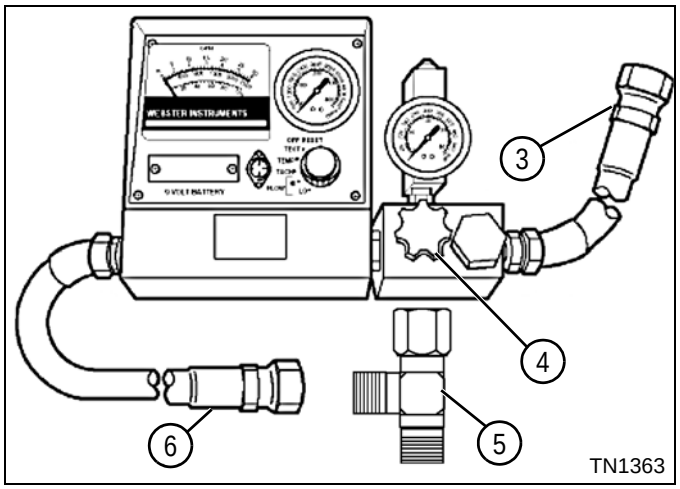


Figure 6-23

3. Install tee fitting (5) to fitting (1).
4. Connect flow meter inlet hose (6) and hose (2) to tee fitting (5).

NOTE

Make sure hose end is under oil level in hydraulic tank to prevent aeration of oil.

5. Secure flow meter outlet hose (3) to hydraulic tank fillneck.

WARNING

Safely block cutting unit from rotating using a suitable device or tool. Failure to follow appropriate safety precautions may result in death or serious injury.

6. Install suitable blocking device or tool in right cutting unit, preventing the reel motor from turning.
7. Open flow meter valve (4) completely.

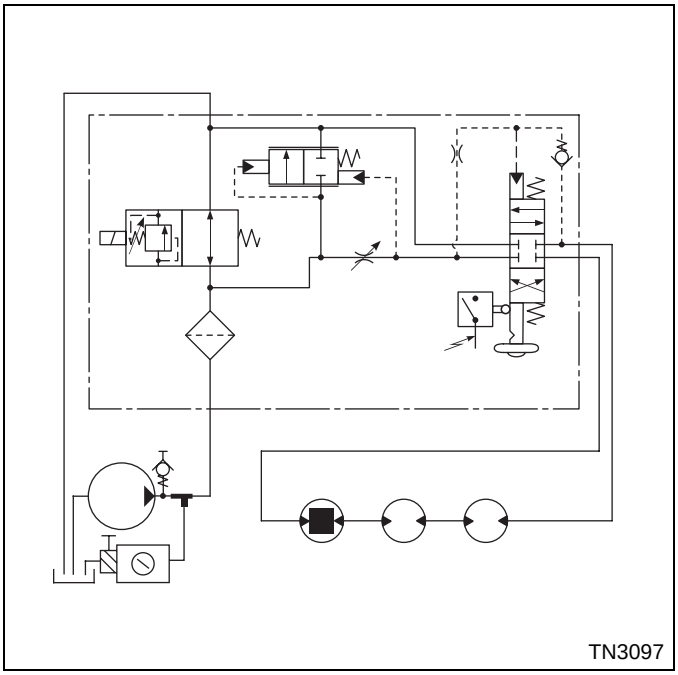


Figure 6-24: Cutting Units Circuit Test—Right Reel Motor Blocked

8. Block each side of rear wheels using suitable wheel blocks.
9. Bypass seat switch and release park brake.

NOTE

Verify engine rpm is within specification (3400 rpm ± 50) to ensure accurate hydraulic test results.

10. Start engine and run at full throttle (3400 rpm ± 50).
11. Use the flow meter to warm the hydraulic oil. Turn flow meter valve (4) until a reading of 1500 psi (103 bar) or 50% of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
12. Engage mow switch.
13. Read and record the cutting units circuit no load flow.
14. Slowly close flow meter valve (4) until pressure reaches 2200 psi (152 bar) or 75% of the relief valve rating is reached. Read and record the cutting units circuit loaded flow.
15. Open flow meter valve (4), disengage mow switch, and stop engine.
16. Calculate cutting units circuit leakage. (Step 13 – Step 14 / Step 13 x 100 = Leak Percentage)

Is cutting units circuit leakage 10% or less?

YES *The cutting units circuit is good. Proceed to "Reel Motors Test" on page 6-36.*

NO *Proceed to next question.*

Is cutting units circuit leakage 11–20%?

YES *The cutting units circuit is marginal. Additional testing is required. Proceed to "Gear Pump Test" on page 6-33.*

NO *Proceed to next question.*

Is cutting units circuit leakage 21% or more?

YES *Test individual components in cutting units circuit for leakage. Proceed to "Gear Pump Test" on page 6-33.*

Gear Pump Test

See Figures 6-25 through 6-27.

IMPORTANT

- **Performing this test will isolate the gear pump from the rest of the cutting units circuit.**
- **This test works together with the cutting units circuit test, reel valve unit test, and reel motors test to isolate a problem with the cutting units circuit.**

WARNING

The hydraulic system is under pressure, and the oil will be hot.

- **Always relieve pressure in the hydraulic system before performing service.**
- **Failure to follow appropriate safety precautions may result in death or serious injury.**

Required Tools and Materials
• Flow Meter • -8 ORFS Test Hose 4000 psi (276 bar) • -8 ORFS Tee Fitting • -8 ORFS Blocking Disk

1. Park the mower safely. (See "Park Mower Safely" on page 1-6.)
2. Before performing this test, perform cutting units circuit test, leaving flow meter connected as outlined.

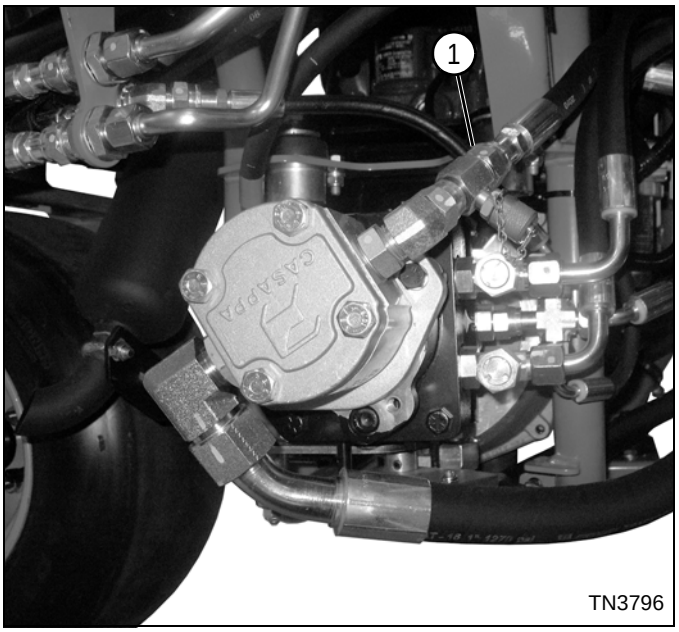


Figure 6-25

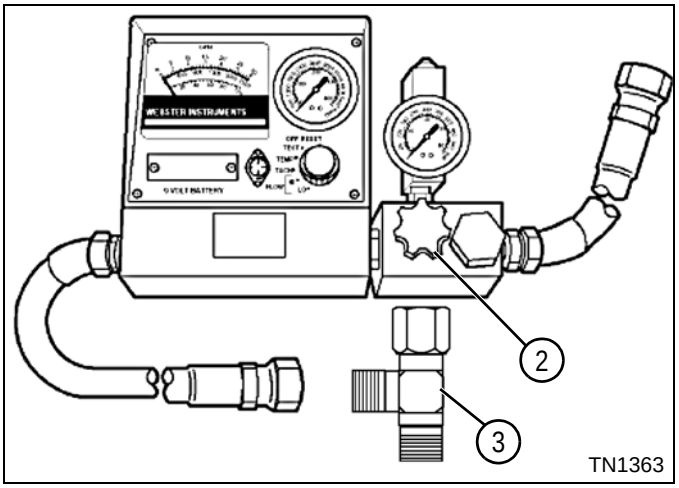


Figure 6-26

3. Install blocking disk between hydraulic hose (1) and tee fitting (3).
4. Open flow meter valve (2) completely.

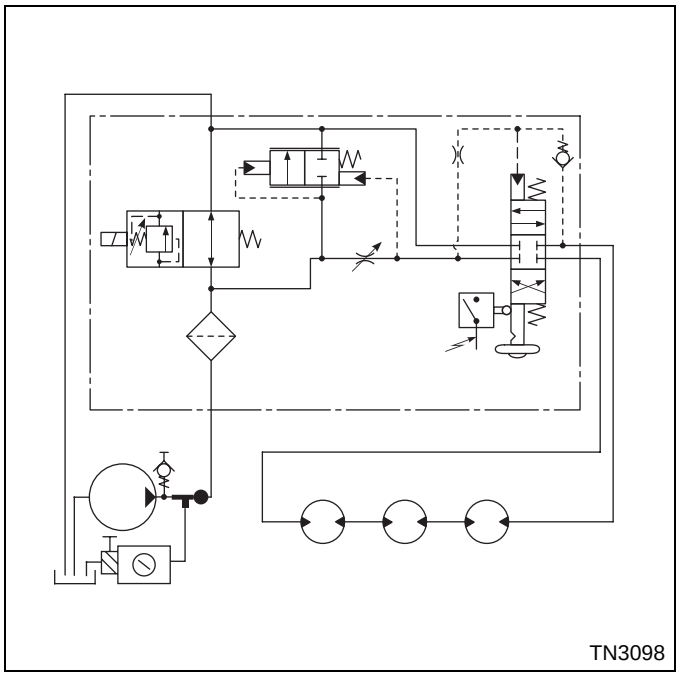


Figure 6-27: Gear Pump Test—Blocking Disk Between Pump and Reel Valve Unit

5. Block each side of rear wheels using suitable wheel blocks.
6. Bypass seat switch and release park brake.

NOTE

Verify engine rpm is within specification (3400 rpm ± 50) to ensure accurate hydraulic test results.

7. Start engine and run at full throttle (3400 rpm ± 50).

CAUTION

Do not exceed 3020 psi (208 bar) as this test does not utilize system relief and damage may occur to hydraulic system components.

8. Use the flow meter to warm the hydraulic oil. Turn flow meter valve until a reading of 1500 psi (103 bar) or 50% of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
9. Engage mow switch.
10. Slowly close flow meter valve until pressure reaches 2200 psi (152 bar) or 75% of the relief valve rating is reached. Read and record the gear pump loaded flow.
11. Open flow meter valve, disengage mow switch, and stop engine.

12. Calculate gear pump leakage.
(Step 13 of previous test – Step 10 / Step 13 of previous test x 100 = Leak Percentage)

Is gear pump leakage 10% or less?

YES *The gear pump is good. Proceed to step 13.*

NO *Proceed to next question.*

Is gear pump leakage 11–20%?

YES *The gear pump is marginal. Additional testing is required. Proceed to step 13.*

NO *Proceed to next question.*

Is gear pump leakage 21% or more?

YES *Repair or replace gear pump. See "Gear Pump" on page 6-43, then proceed to step 13.*

NO *Proceed to step 13.*

13. (See Figure 6-25.) Disconnect hydraulic hose (1) at tee fitting (3) and remove blocking disk. Reconnect hydraulic hose to tee fitting.
14. Proceed to "Reel Valve Unit Test" on page 6-35.

Reel Valve Unit Test

See Figures 6-28 through 6-30.

IMPORTANT

- **Performing this test will isolate the reel valve unit from the rest of the cutting units circuit.**
- **This test works together with the cutting units circuit test, gear pump test, and reel motors test to isolate a problem with the cutting units circuit.**

WARNING

The hydraulic system is under pressure, and the oil will be hot.

- **Always relieve pressure in the hydraulic system before performing service.**
- **Failure to follow appropriate safety precautions may result in death or serious injury.**

Required Tools and Materials
• Flow Meter • -8 ORFS Test Hose 4000 psi (276 bar) • -8 ORFS Tee Fitting • -8 ORFS Blocking Disk

1. Park the mower safely. (See "Park Mower Safely" on page 1-6.)
2. Before performing this test, perform cutting units circuit test, leaving flow meter connected as outlined.

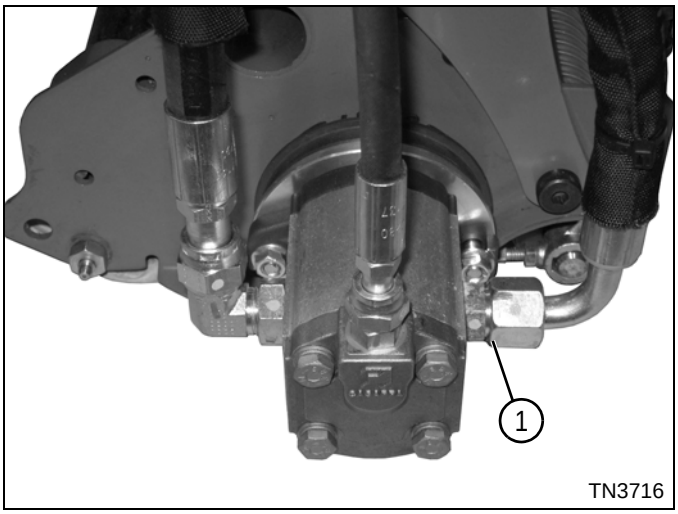


Figure 6-28

3. Install blocking disk at fitting (1) on right reel motor, blocking oil flow from entering right reel motor.

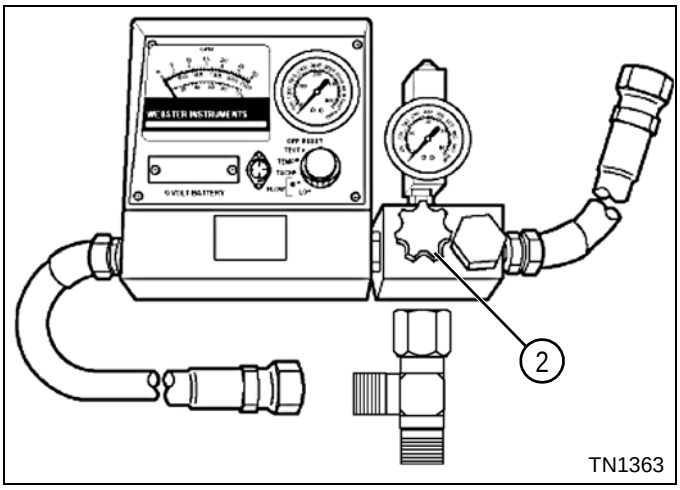


Figure 6-29

4. Open flow meter valve (2) completely.

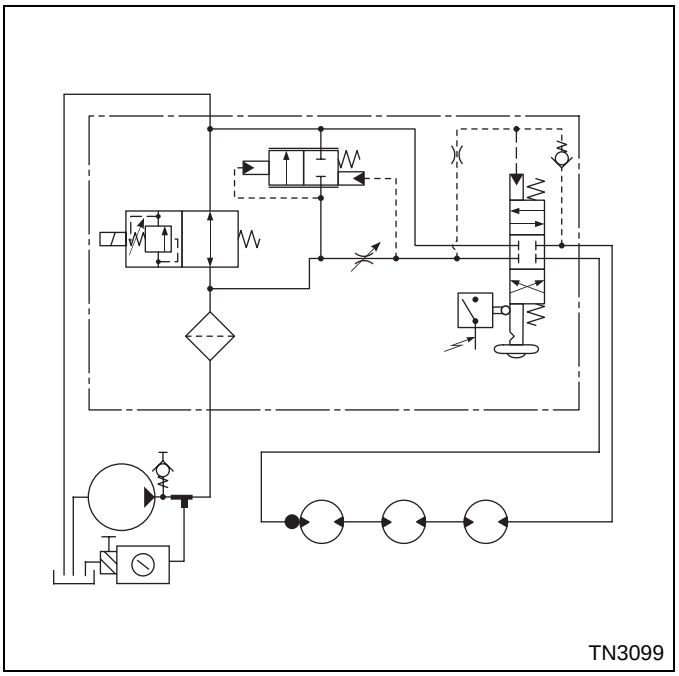


Figure 6-30: Reel Valve Unit Test—Blocking Disk at Right Reel Motor

5. Block each side of rear wheels using suitable wheel blocks.
6. Bypass seat switch and release park brake.

NOTE

Verify engine rpm is within specification (3400 rpm ± 50) to ensure accurate hydraulic test results.

7. Start engine and run at full throttle (3400 rpm ± 50).

CAUTION

Do not exceed 3020 psi (208 bar) as this test does not utilize system relief and damage may occur to hydraulic system components.

8. Use the flow meter to warm the hydraulic oil. Turn flow meter valve until a reading of 1500 psi (103 bar) or 50% of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
9. Engage mow switch.
10. Slowly close flow meter valve until pressure reaches 2200 psi (152 bar) or 75% of the relief valve rating is reached. Read and record the front reel valve unit loaded flow.
11. Open flow meter valve, disengage mow switch, and stop engine.
12. Calculate reel valve unit leakage.
    (Step 10 of previous test – Step 10 / Step 10 of previous test x 100 = Leak Percentage)

    Is reel valve unit leakage 10% or less?

    YES *The reel valve unit is good. Proceed to step 13.*

    NO *Proceed to next question.*

    Is reel valve unit leakage 11–20%?

    YES *The reel valve unit is marginal. Additional testing is required. Proceed to step 13.*

    NO *Proceed to next question.*

    Is reel valve unit leakage 21% or more?

    YES *Repair or replace reel valve unit. See "Reel Valve Unit" on page 6-48, then proceed to step 13.*
13. (See Figure 6-28.) Disconnect hydraulic hose at fitting (1) on right reel motor and remove blocking disk.
14. Reconnect hydraulic hose to right reel motor.
15. Proceed to "Reel Motors Test" on page 6-36.

Reel Motors Test

See Figures 6-31 through 6-34.

IMPORTANT

- **Performing this test will isolate the reel motors from the rest of the cutting units circuit.**
- **This test works together with the cutting units circuit test, gear pump test, and reel valve unit test to isolate a problem with the cutting units circuit.**

WARNING

The hydraulic system is under pressure, and the oil will be hot.

- **Always relieve pressure in the hydraulic system before performing service.**
- **Failure to follow appropriate safety precautions may result in death or serious injury.**

Required Tools and Materials
• Flow Meter • -8 ORFS Test Hose 4000 psi (276 bar) • -8 ORFS Tee Fitting • Blocking Device or Tool

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Before performing this test, perform reel valve unit test, leaving flow meter connected as outlined.
3. Install suitable blocking device or tool in right cutting unit, preventing the reel motor from turning.
4. Block each side of rear wheels using suitable wheel blocks.
5. Bypass seat switch and release park brake.

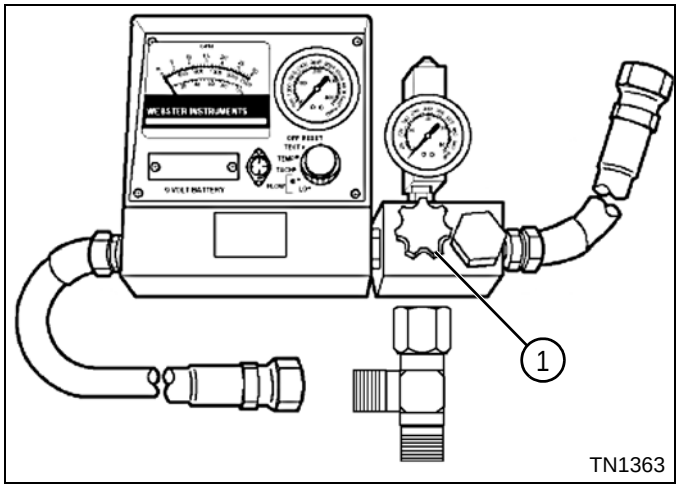


Figure 6-31

6. Open flow meter valve (1) completely.

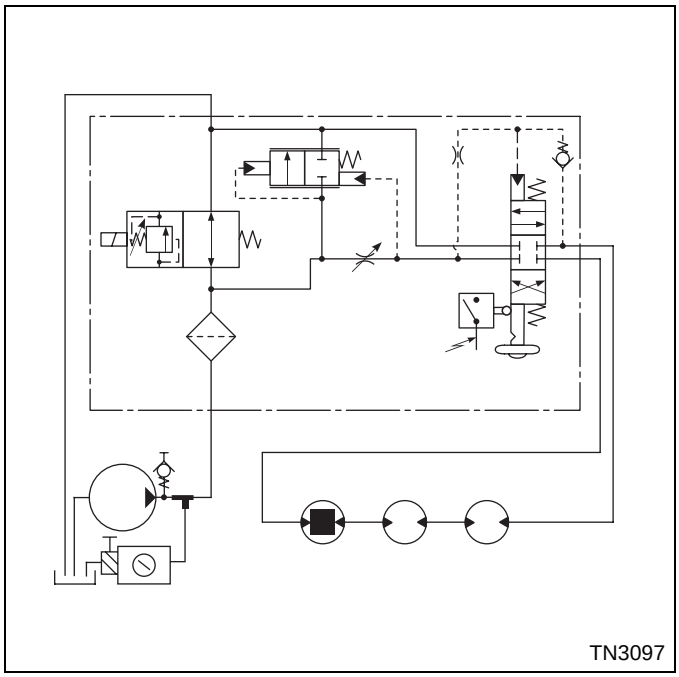


Figure 6-32: Reel Motors Test—Right Reel Motor Blocked

NOTE

Verify engine rpm is within specification (3400 rpm ± 50) to ensure accurate hydraulic test results.

7. Start engine and run at full throttle (3400 rpm ± 50).
8. Use the flow meter to warm the hydraulic oil. Turn flow meter valve until a reading of 1500 psi (103 bar) or 50% of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
9. Engage mow switch.
10. Slowly close flow meter valve until pressure reaches 2200 psi (152 bar) or 75% of the relief valve rating is reached. Read and record the right reel motor loaded flow.
11. Open flow meter valve, disengage mow switch, and stop engine.
12. Calculate right reel motor leakage.
    (Step 10 of reel valve unit test – Step 10 / Step 10 of reel valve unit test x 100 = Leak Percentage)

    Is right reel motor leakage 10% or less?

    YES *The right reel motor is good. Proceed to step 13.*

    NO *Proceed to next question.*

    Is right reel motor leakage 11–20%?

    YES *The right reel motor is marginal. Additional testing is required. Proceed to step 13.*

    NO *Proceed to next question.*

    Is right reel motor leakage 21% or more?

    YES *Repair or replace right reel motor. See “Reel Motor” on page 8-28, then proceed to step 13.*
13. Remove blocking device or tool from right reel motor.

WARNING

Safely block cutting unit from rotating using a suitable device or tool. Failure to follow appropriate safety precautions may result in death or serious injury.

14. Install suitable blocking device or tool in left cutting unit, preventing left reel motor from turning.
15. Open flow meter valve completely.

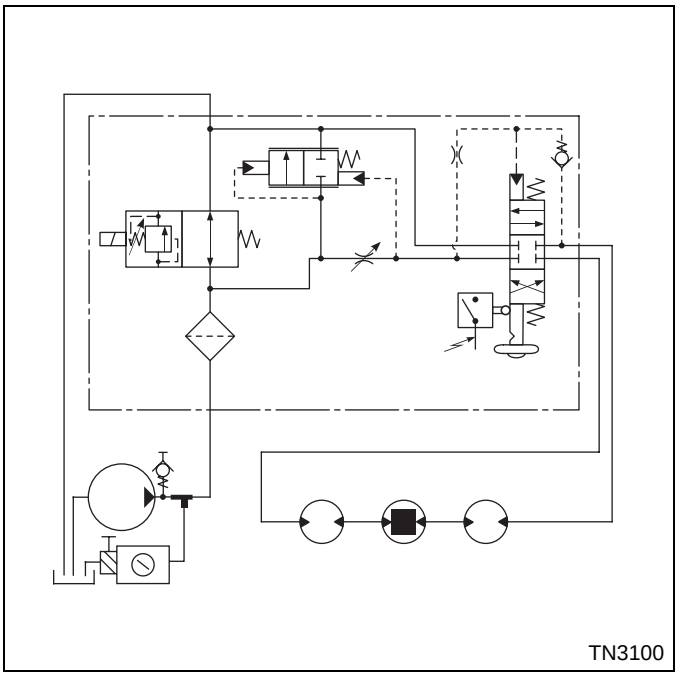


Figure 6-33: Reel Motors Test—Left Reel Motor Blocked

NOTE

Verify engine rpm is within specification (3400 rpm ± 50) to ensure accurate hydraulic test results.

16. Start engine and run at full throttle (3400 rpm ± 50).
17. Use the flow meter to warm the hydraulic oil. Turn flow meter valve until a reading of 1500 psi (103 bar) or 50% of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
18. Engage mow switch.
19. Slowly close flow meter valve until pressure reaches 2200 psi (152 bar) or 75% of the relief valve rating is reached. Read and record the left reel motor loaded flow.
20. Open flow meter valve, disengage mow switch, and stop engine.
21. Calculate left reel motor leakage. (Step 10 – Step 19 / Step 10 x 100 = Leak Percentage)

    Is left reel motor leakage 10% or less?

    YES *The left reel motor is good. Proceed to step 22.*

    NO *Proceed to next question.*

    Is left reel motor leakage 11–20%?

    YES *The left reel motor is marginal. Additional testing is required. Proceed to step 22.*

    NO *Proceed to next question.*

    Is left reel motor leakage 21% or more?

    YES *Repair or replace left reel motor. See "Reel Motors" on page 6-59, then proceed to step 22.*
22. Remove blocking device or tool from left cutting unit.

WARNING

Safely block cutting unit from rotating using a suitable device or tool. Failure to follow appropriate safety precautions may result in death or serious injury.

23. Install suitable blocking device or tool in center cutting unit, preventing center reel motor from turning.
24. Open flow meter valve completely.

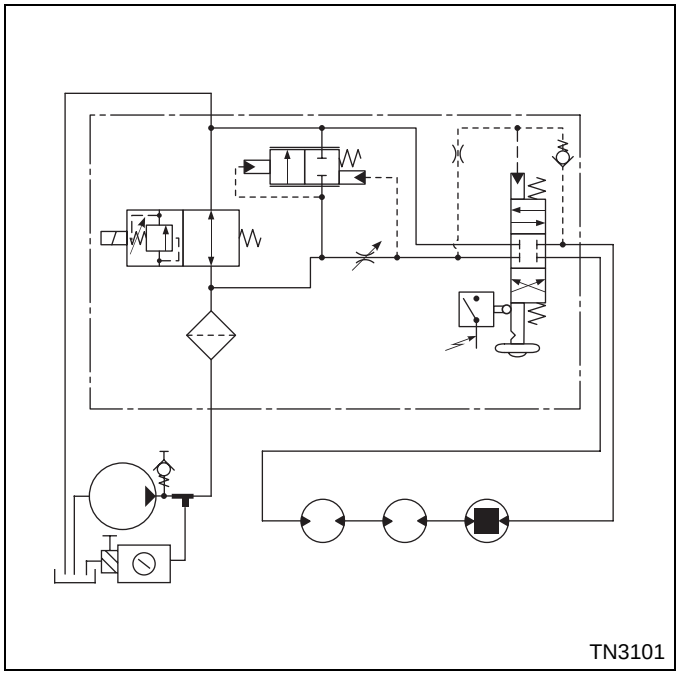


Figure 6-34: Reel Motors Test—Center Reel Motor Blocked

NOTE

Verify engine rpm is within specification (3400 rpm ± 50) to ensure accurate hydraulic test results.

25. Start engine and run at full throttle (3400 rpm ± 50).
26. Use the flow meter to warm the hydraulic oil. Turn flow meter valve until a reading of 1500 psi (103 bar) or 50% of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
27. Engage mow switch.
28. Slowly close flow meter valve until pressure reaches 2200 psi (152 bar) or 75% of the relief valve rating is reached. Read and record the center reel motor loaded flow.
29. Open flow meter valve, disengage mow switch, and stop engine.
30. Calculate center reel motor leakage. (Step 19 – Step 28 / Step 19 x 100 = Leak Percentage)

    Is center reel motor leakage 10% or less?

    YES *The center reel motor is good. Proceed to step 31.*

    NO *Proceed to next question.*

    Is center reel motor leakage 11–20%?

    YES *The center reel motor is marginal. Determine component(s) with greatest leakage and repair or replace as necessary, then proceed to step 31.*

    NO *Proceed to next question.*

    Is center reel motor leakage 21% or more?

    YES *Repair or replace center reel motor. See “Reel Motor” on page 8-28, then proceed to step 31.*
31. Remove blocking device or tool from center reel motor.
32. Disconnect and remove test equipment. Install all hoses, lines, and fittings as noted prior to removal.
33. Install and connect all components as noted prior to test.
34. Check hydraulic oil level. Add oil as needed. (Refer to “Parts and Maintenance Manual” for correct oil specifications.)

Implement Relief Valve Pressure Test

See Figures 6-35 through 6-37.

NOTE

Before performing this test, perform field test procedures. (See “Field Test Procedures” on page 6-28.)

WARNING

The hydraulic system is under pressure, and the oil will be hot.

- **Always relieve pressure in the hydraulic system before performing service.**
- **Failure to follow appropriate safety precautions may result in death or serious injury.**

Required Tools and Materials
• Pressure Gauge 2000 psi (138 bar) • Test Hose 2000 psi (138 bar) • -6 ORFS Tee Fitting

1. Operate hydraulic system until oil temperature is 120–150° F (49–65° C).
2. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

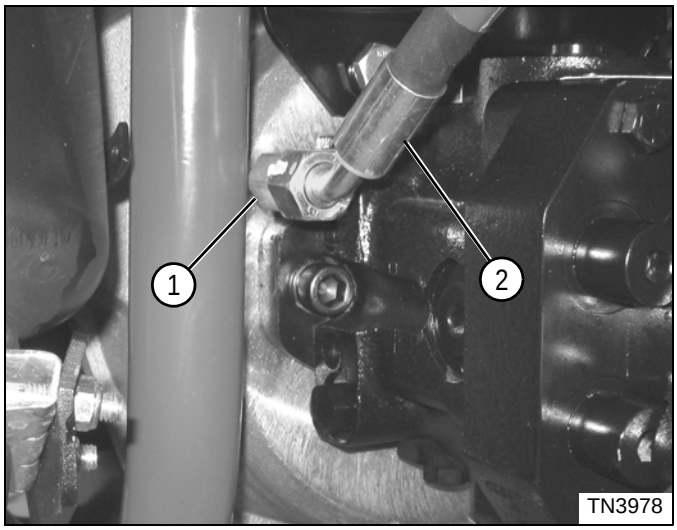


Figure 6-35

3. Disconnect hose (2) from traction pump port “V1” (1).

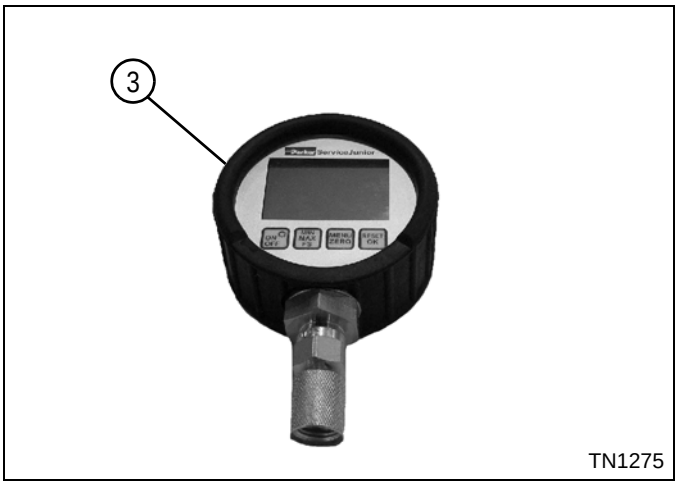


Figure 6-36

4. Connect tee fitting to traction pump port “V1” (1).
5. Connect hose (2) to tee fitting.
6. Connect test hose and pressure gauge (3) to tee fitting.
7. Bypass seat switch and apply park brake.

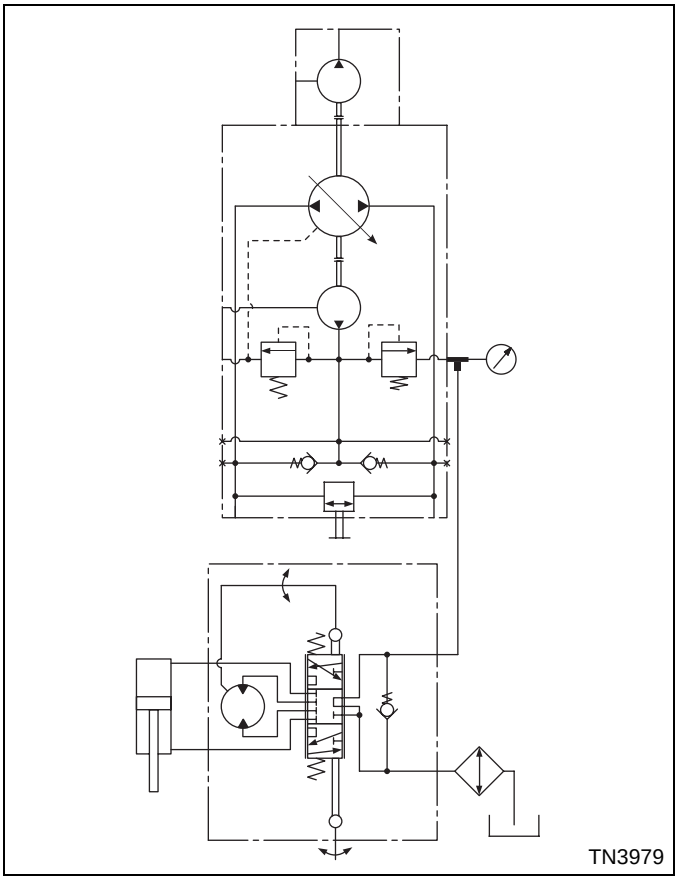


Figure 6-37: Implement Relief Valve Pressure Test

NOTE

Verify engine rpm is within specification (3400 rpm ± 50) to ensure accurate hydraulic test results.

8. Start engine and run at full throttle (3400 rpm ± 50).

CAUTION

Do not run implement relief valve over relief longer than 10 seconds or damage may occur to hydraulic system components.

9. Turn the steering wheel fully right against stop.
10. Record pressure reading.
11. Stop engine.

Is implement relief pressure 800 ± 10% psi (55 ± 10% bar)?

YES *Implement relief valve is good. Proceed to step 12.*

NO *Test charge pressure. (See “Charge Pressure Test” on page 5-36.) Test steer cylinder. (See “Steering Leakage Test” on page 6-29.) Repair or replace implement relief valve. (See “Steering Unit” on page 7-6.)*

12. Disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
13. Install and connect all components as noted prior to test.
14. Check hydraulic oil level. Add oil as needed. (Refer to “Parts and Maintenance Manual” for correct oil specifications.)

Lift Relief Valve Pressure Test

See Figures 6-38 through 6-40.

NOTE

Before performing this test, perform field test procedures. (See "Field Test Procedures" on page 6-28.)

⚠ WARNING

The hydraulic system is under pressure, and the oil will be hot.

- **Always relieve pressure in the hydraulic system before performing service.**
- **Failure to follow appropriate safety precautions may result in death or serious injury.**

Required Tools and Materials
• Pressure Gauge 2000 psi (138 bar) • Test Hose 2000 psi (138 bar)

1. Operate hydraulic system until oil temperature is 120–150° F (49–65° C).
2. Park the mower safely. (See "Park Mower Safely" on page 1-6.)

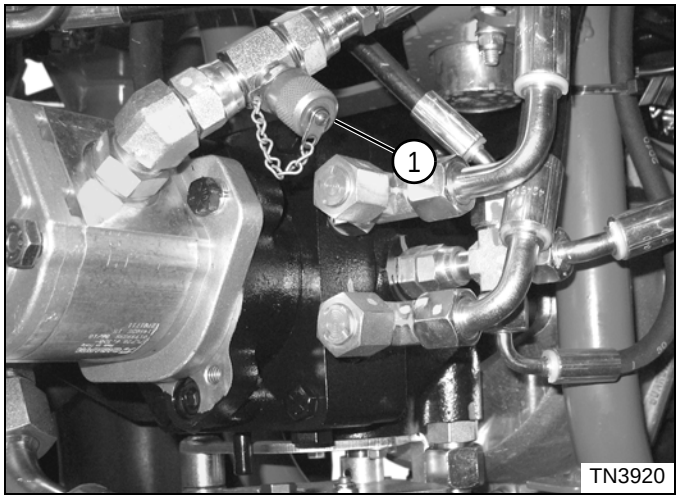


Figure 6-38

3. Remove cap from test port (1) at gear pump.

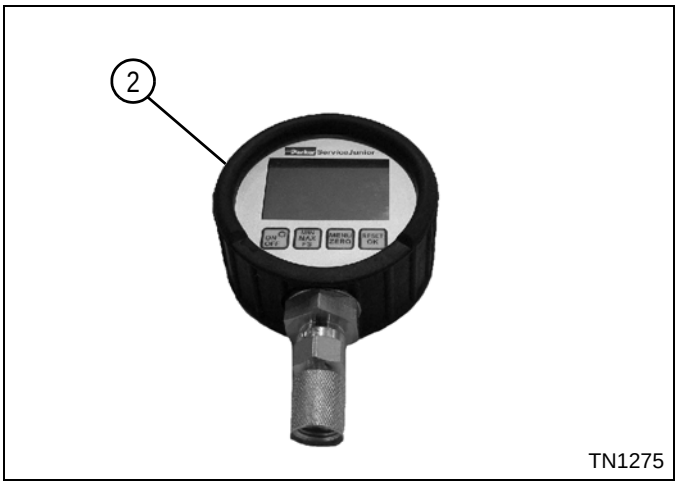


Figure 6-39

4. Connect test hose and pressure gauge (2) to test port (1).
5. Apply park brake.

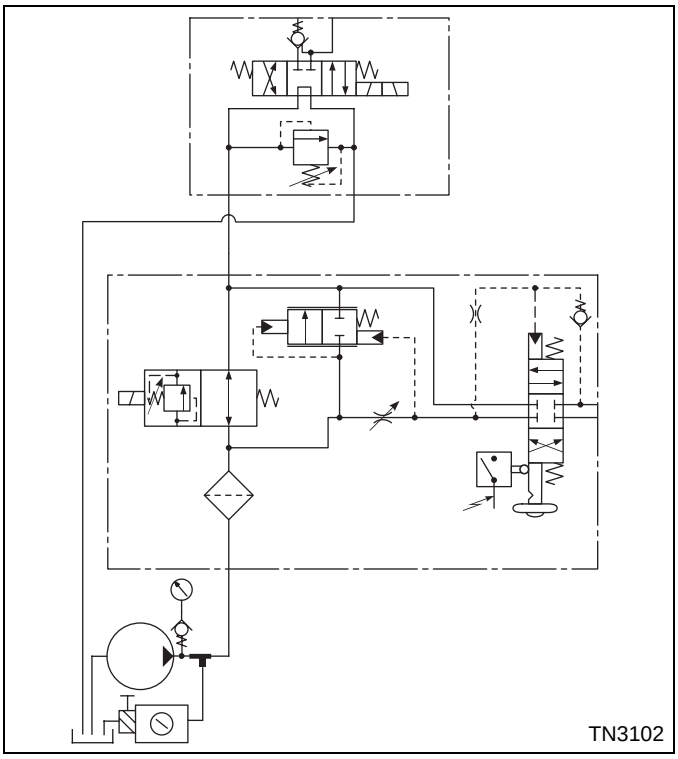


Figure 6-40: Lift Relief Valve Pressure Test

NOTE

Verify engine rpm is within specification (3400 rpm ± 50) to ensure accurate hydraulic test results.

6. Start engine and run at full throttle (3400 rpm ± 50).

CAUTION

Do not run mower lift system relief valve over relief longer than 10 seconds or damage may occur to hydraulic system components.

7. Lower the cutting units and hold the raise/lower lever in the lower position.
8. Record pressure reading.
9. Stop engine.

   Is relief pressure 1250 ± 10% psi (86 ± 10% bar)?

   YES *Lift relief valve is good. Proceed to step 10.*

   NO *Test gear pump. (See "Gear Pump" on page 6-43.) Test lift cylinders. (See "Lift Cylinder Leakage Test" on page 6-28.) Repair or replace relief valve. (See "Lift Valve" on page 6-46.)*
10. Disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
11. Install and connect all components as noted prior to test.
12. Check hydraulic oil level. Add oil as needed. (Refer to "Parts and Maintenance Manual" for correct oil specifications.)

6

Repair

Hydraulic Oil Tank—Drain Procedure

See Figure 6-41.

1. Park the mower safely. (See "Park Mower Safely" on page 1-6.)
2. Block each side of front wheels using suitable wheel blocks.

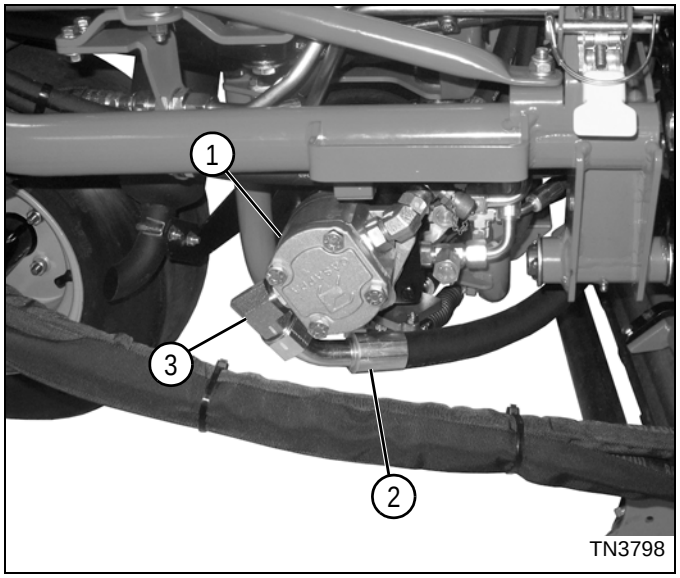


Figure 6-41

NOTES

- *Label all hydraulic hoses and tubes before disconnecting to ensure correct installation.*
- *Close all openings with caps or plugs to prevent contamination.*
- *Hydraulic system capacity is 5.3 gal (20 L). Have suitable container(s) available that can hold up to 10 gal (38 L) of hydraulic oil.*

3. Place a suitable container under the gear pump (1) and hose (2).
4. Disconnect hose (2), and plug the 90° gear pump fitting (3).
5. Loosen the hydraulic oil tank cap to provide a vent for draining oil.

Installation Notes

- *Ensure new O-ring is in place before installing hose on fitting.*
- *Connect hose (2).*
- *Replace hydraulic oil charge filter. (See "Hydraulic Oil Charge Filter Assembly" on page 6-59.)*
- *Refill hydraulic tank. (Refer to "Parts and Maintenance Manual" for correct oil specifications.)*
- *Start engine. Check hydraulic system for leaks. Repair as necessary.*
- *Check hydraulic oil level and add if necessary.*

Gear Pump

Removal and Installation

See Figures 6-42 and 6-43.

1. Park the mower safely. (See "Park Mower Safely" on page 1-6.)
2. Remove grass catchers (if equipped).

NOTE

Do not swing the arm out or in with cutting units in the lowered position.

3. Raise the cutting units.

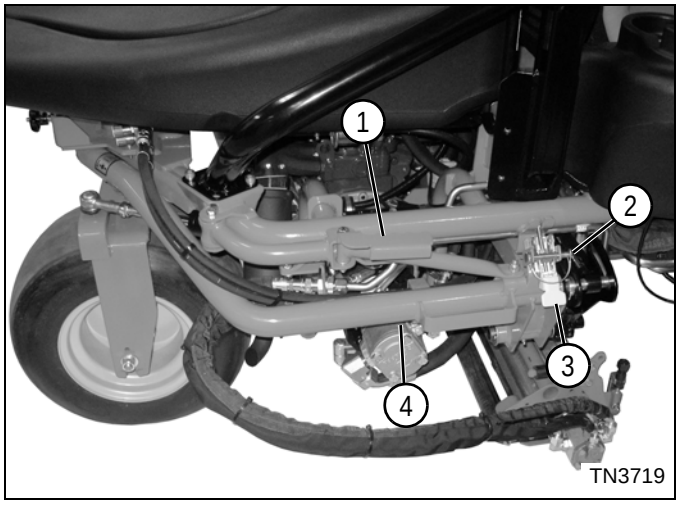


Figure 6-42

4. Remove lynch pin (2) and release latch (3).
5. Grasp handle (1), and swing the rear swing arm (4) and cutting unit out.
6. Lower the cutting units.
7. Drain hydraulic oil tank. (See "Hydraulic Oil Tank—Drain Procedure" on page 6-42.)

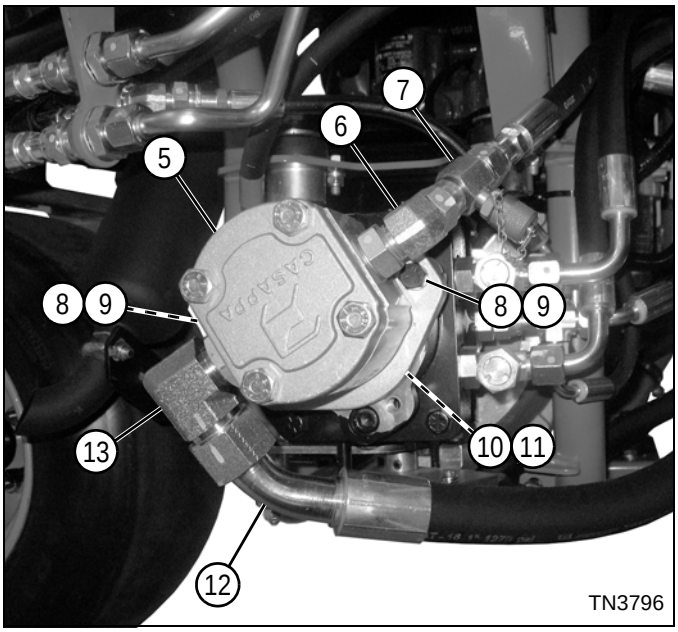


Figure 6-43

NOTES

- *Label all hydraulic hoses and tubes before disconnecting to ensure correct installation.*
- *Close all openings with caps or plugs to prevent contamination.*

8. Remove hose (12) from fitting (13).
9. Remove tee fitting (7) from fitting (6).
10. Support gear pump assembly (5).
11. Remove two screws (8) and lock washers (9).
12. Remove gear pump (5).
13. Remove O-ring (10) and coupler (11).

Installation Notes

- *Install gear pump by reversing the order of removal.*
- *Ensure new O-rings are in place before installing hoses on fittings.*
- *Replace hydraulic oil charge filter. (See "Hydraulic Oil Charge Filter Assembly" on page 6-59.)*
- *Refill hydraulic tank. (Refer to "Parts and Maintenance Manual" for correct oil specifications.)*
- *Start engine. Check hydraulic system for leaks. Repair as necessary.*
- *Check hydraulic oil level and add if necessary.*

Disassembly, Inspection, and Assembly

See Figures 6-44 through 6-46.

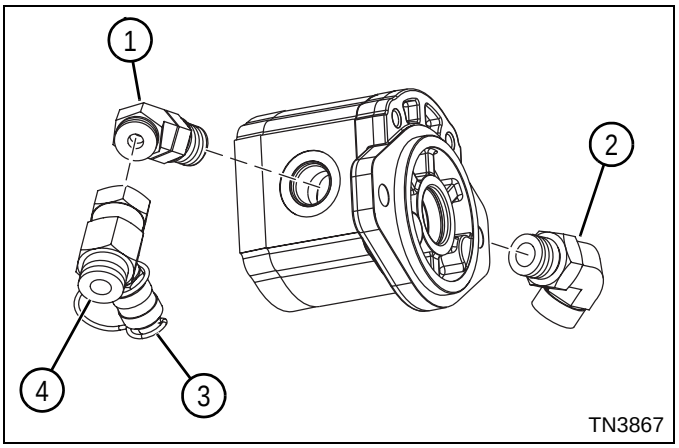
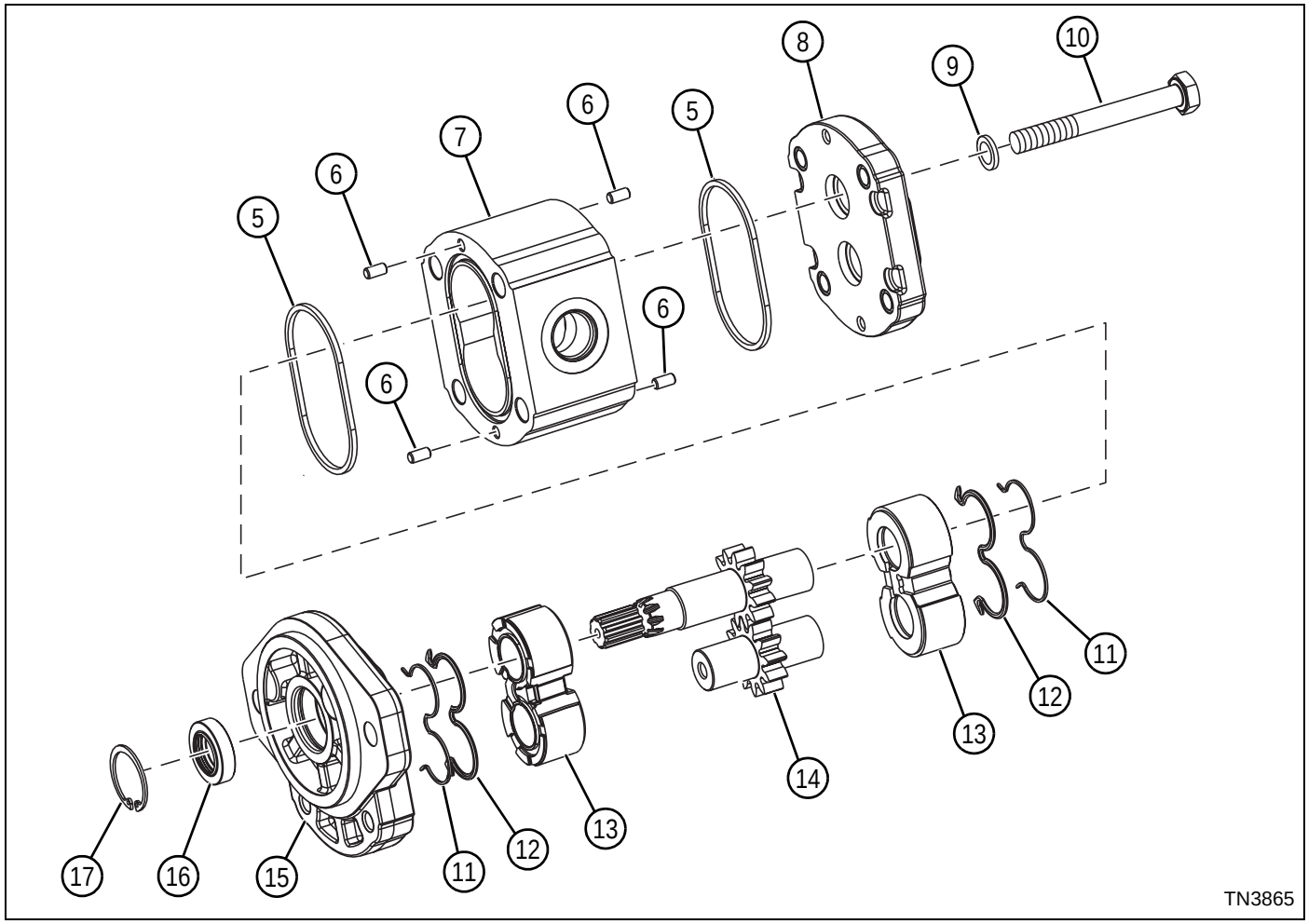


Figure 6-44

NOTE

Record the location of fittings before removing to ensure correct installation.

1. Remove, inspect, and replace dust cover (3) and tee fitting (4) as necessary.
2. Remove, inspect, and replace outlet port fitting (1) as necessary.
3. Remove, inspect, and replace inlet port fitting (2) as necessary.



5	Body Seal (2)	8	Rear Cover	11	Backup Ring (2)	14	Gear Set (Drive Shaft)	17	Retaining Ring
6	Dowel Pin (4)	9	Washer (4)	12	Seal (2)	15	Front Cover/Flange		
7	Body	10	Retaining Screw (4)	13	Thrust Plate (2)	16	Shaft Seal		

Figure 6-45

Disassembly Notes

- *Do not disassemble pump for repair unless test procedures indicate internal leakage.*
- *Never pry components apart. Use a soft-faced hammer, and gently tap housing and shaft to separate pump bodies.*
- *Scribe or mark the pump bodies and end covers before disassembly to aid in assembly. 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.*

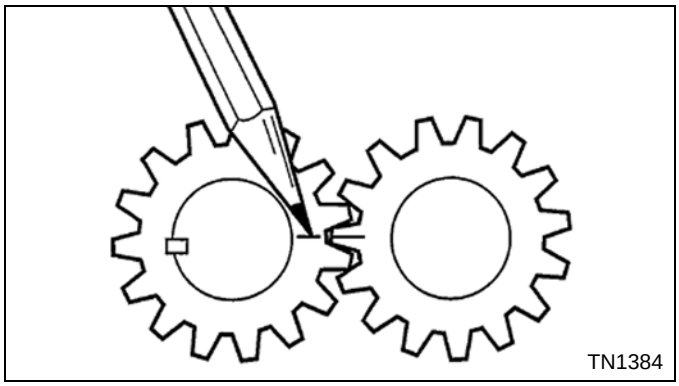


Figure 6-46

1. After removing bolts, disassemble pump. Before removing gear set, mark a line across meshing teeth to ensure that gears are reassembled in the same position.
2. Place parts, in assembly order, on a clean work area as they are removed.
3. Discard seals as they are removed.

WARNING

Use appropriate eye protection when using compressed air for cleaning or drying purposes. Compressed air can cause serious personal injury. Use safety reduction valves to reduce the air pressure to a safe level before use.

NOTICE

It is important that all component parts are absolutely clean, as contamination can result in serious damage and/or improper operation.

Never use shop towels or rags to dry parts after cleaning, as lint may clog passages. Dry parts using compressed air.

4. Clean all parts using clean solvent, and dry using compressed air.
5. Inspect all parts for cracks, nicks, burrs, and excessive wear. Inspect for scoring, galling, and scratches on surfaces. Damage or excessive wear to gear pump components other than seal kit components (5, 11, 12, and 16) requires gear pump replacement.
6. Inspect remaining gear pump components for excessive wear or damage. Replace gear pump if necessary.

Assembly Notes

NOTICE

It is important that all component parts are absolutely clean, as contamination can result in serious damage and/or improper operation.

Never use shop towels or rags to dry parts after cleaning, as lint may clog passages. Dry parts using compressed air.

Required Materials
Seal Kit

- *Assemble gear pump by reversing the order of disassembly.*
- *Use a new seal kit during assembly.*
- *Apply a coat of clean hydraulic oil to all parts to ease assembly.*
- *Remove alignment mark from gear sets after gears have been installed with teeth in proper mesh.*
- *Make sure that bushing sets are correctly installed to properly position the high-pressure seals.*
- *Rotate drive shaft by hand after assembling each section to make sure there is no binding between parts; do not force.*
- *Use extreme care when installing shaft seal. Seal must seat squarely in seal bore. Use caution not to damage seal when installing cover over pump shaft.*
- *Install retaining screws (10) finger-tight and rotate drive shaft to make sure it turns freely. Tighten retaining screws (10) evenly in steps to a final torque of 88 lb-ft (120 N·m) and check rotation of pump drive shaft.*
- *Tighten outlet port fitting (1) to 77 lb-ft (105 N·m).*
- *Tighten inlet port fitting (2) to 133 lb-ft (180 N·m).*
- *Lubricate pump through ports with clean hydraulic oil prior to installing.*

Lift Valve

Removal and Installation

See Figure 6-47.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

NOTE

The lift valve is located below the seat platform.

2. Remove seat and seat plate. (See “Seat and Seat Plate” on page 9-15.)

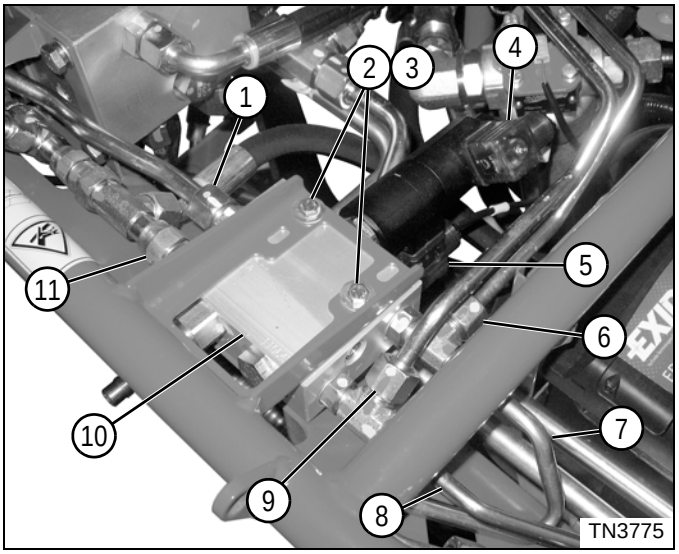


Figure 6-47

NOTE

Label wire connectors before disconnecting to ensure correct installation.

3. Disconnect wire connectors (4 and 5).

NOTES

- *Label all hydraulic hoses and tubes before disconnecting to ensure correct installation.*
- *Close all openings with caps or plugs to prevent contamination.*

4. Disconnect hydraulic tubes (7–9).
5. Disconnect hydraulic tubes (1 and 11).
6. Support lift valve (10).
7. Remove two mounting screws (2) and washers (3).
8. Remove lift valve (10).

Installation Notes

- *Install lift valve by reversing the order of removal.*
- *Ensure new O-rings are in place before installing hoses on fittings.*
- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*
- *Replace hydraulic oil charge filter. (See “Hydraulic Oil Charge Filter Assembly” on page 6-59.)*
- *Refill hydraulic tank. (Refer to “Parts and Maintenance Manual” for correct oil specifications.)*
- *Start engine. Check hydraulic system for leaks. Repair as necessary.*
- *Check hydraulic oil level and add if necessary.*

Disassembly, Inspection, and Assembly

See Figures 6-48 and 6-49.

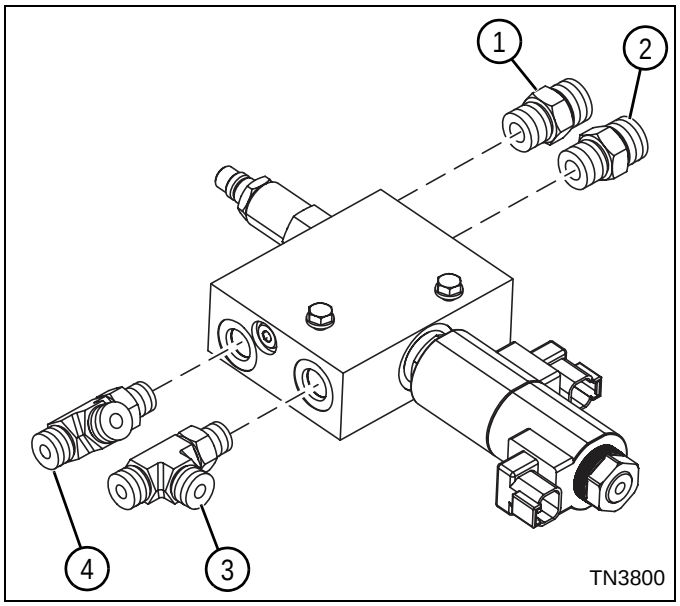
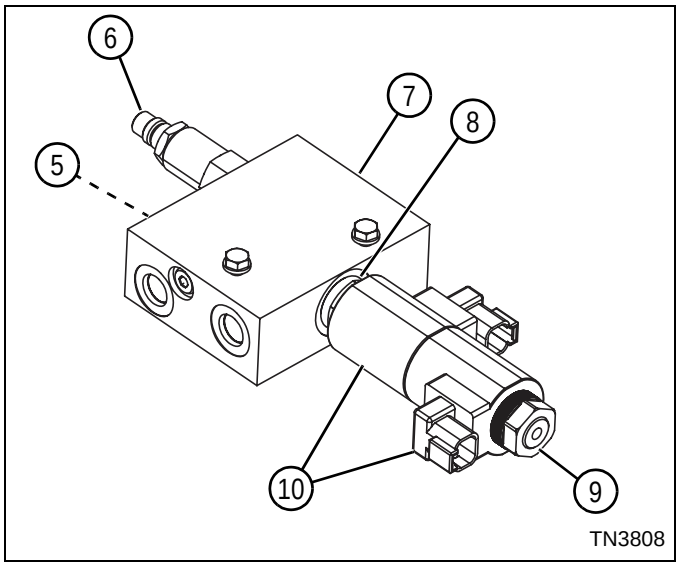


Figure 6-48: Lift Valve

NOTE

Record the location and orientation of fittings before removing to ensure correct installation.

1. Remove, inspect, and replace fitting (1) from port “T.”
2. Remove, inspect, and replace fitting (2) from port “P.”
3. Remove, inspect, and replace tee-fittings (3 and 4) from ports “A” and “B.”



5	Check Valve	8	Solenoid Valve
6	Relief Valve	9	Nut
7	Lift Valve Block	10	Coils

Figure 6-49

WARNING

Use appropriate eye protection when using compressed air for cleaning or drying purposes. Compressed air can cause serious personal injury. Use safety reduction valves to reduce the air pressure to a safe level before use.

4. Clean all parts using clean solvent, and dry using compressed air.
5. Inspect all parts for wear or damage. Replace parts as necessary.

Assembly Notes

NOTICE

It is important that all component parts are absolutely clean, as contamination can result in serious damage and/or improper operation.

Never use shop towels or rags to dry parts after cleaning, as lint may clog passages. Dry parts using compressed air.

Required Materials

- Seal Kit
- Solenoid Valve O-Ring

- *Assemble lift valve by reversing the order of disassembly.*
- *Use a new seal kit and solenoid valve O-ring during assembly.*
- *Lubricate all O-rings prior to assembly.*
- *Tighten coil nut (9) to 35–53 lb-in. (4–6 N·m).*
- *Tighten relief valve (6) to 20–25 lb-ft (27–34 N·m).*
- *Tighten solenoid valve (8) to 25–30 lb-ft (34–40 N·m).*
- *Tighten check valve (5) to 30–35 lb-ft (41–47 N·m).*
- *Tighten fittings for ports “P” (2) and “T” (1) to 55 lb-ft (74 N·m).*
- *Tighten fittings for ports “A” (4) and “B” (3) to 17 lb-ft (23 N·m).*

Reel Valve Unit

Removal and Installation

See Figures 6-50 and 6-51.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Drain hydraulic oil tank. (See “Hydraulic Oil Tank—Drain Procedure” on page 6-42.)

NOTE

The reel valve unit is located below the seat plate.

3. Remove seat and seat plate. (See “Seat and Seat Plate” on page 9-15.)
4. Thoroughly clean the valve, especially the area surrounding hydraulic hoses, tubes, and fittings.

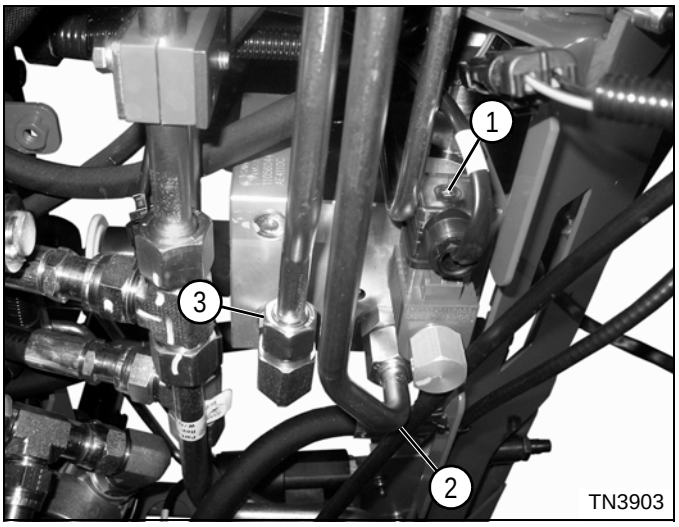


Figure 6-50

NOTE

Label wire connector before disconnecting to ensure correct installation.

5. Disconnect wire connector (1) from mow solenoid.

NOTES

- *Label all hydraulic hoses and tubes before disconnecting to ensure correct installation.*
- *Close all openings with caps or plugs to prevent contamination.*

6. Disconnect hydraulic tubes (2 and 3).

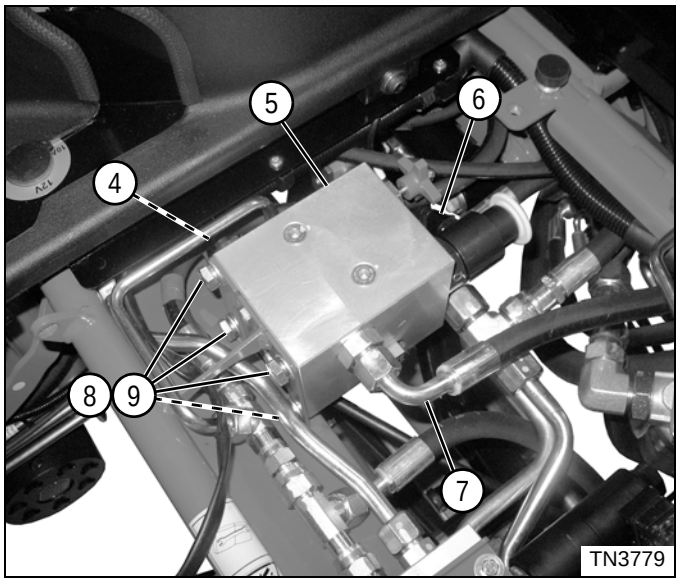


Figure 6-51

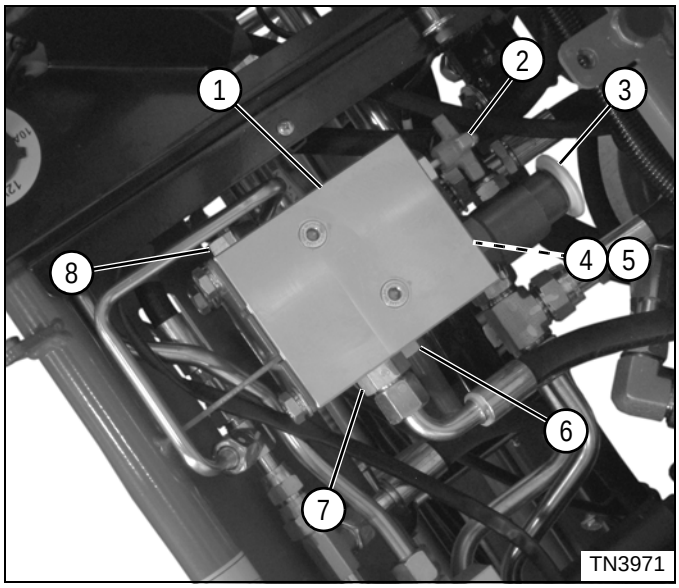
7. Disconnect backlap switch wire connector.
8. Support the reel valve unit (5).
9. Disconnect hydraulic tubes (4 and 7).
10. Remove four mounting screws (8) and washers (9).
11. Remove reel valve unit (5).

Installation Notes

- *Install reel valve unit by reversing the order of removal.*
- *Make sure new O-rings are in place before installing hoses on fittings.*
- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*
- *Replace hydraulic oil charge filter. (See “Hydraulic Oil Charge Filter Assembly” on page 6-59.)*
- *Refill hydraulic tank. (Refer to “Parts and Maintenance Manual” for correct oil specifications.)*
- *Start engine. Check hydraulic system for leaks. Repair as necessary.*
- *Check hydraulic oil level and add if necessary.*

Disassembly, Inspection, and Assembly

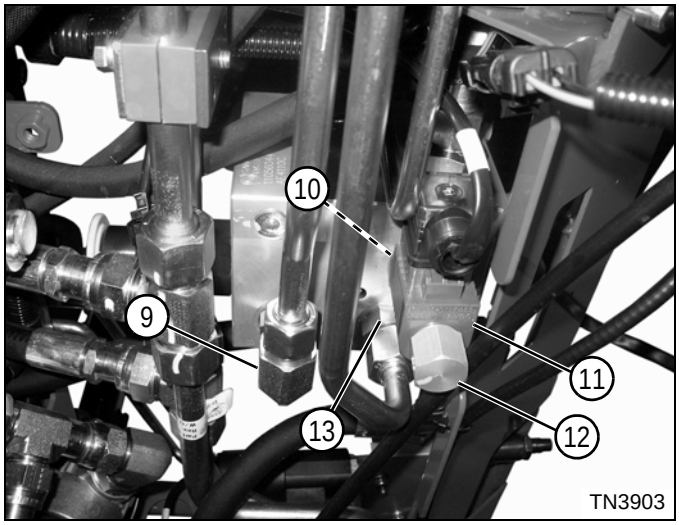
See Figures 6-52 and 6-53.



1	Reel Valve Unit Block	5	Check Valve
2	Speed Control Valve	6	Pressure Compensating Valve
3	Reel (Backlap) Valve	7	Port Fitting P
4	Orifice	8	Port Fitting T

Figure 6-52

12. Remove, inspect, and replace fitting (7) from port “P” as necessary.
13. Remove, inspect, and replace fitting (8) from port “T” as necessary.



9	Port B Fitting	12	Coil Nut
10	Mow/Relief Valve	13	Port A Fitting
11	Mow Solenoid		

Figure 6-53

14. Remove, inspect, and replace fitting (12) from port “A” as necessary.
15. Remove, inspect, and replace fitting (9) from port “B” as necessary.

WARNING

Use appropriate eye protection when using compressed air for cleaning or drying purposes. Compressed air can cause serious personal injury. Use safety reduction valves to reduce the air pressure to a safe level before use.

16. Clean all parts using clean solvent, and dry using compressed air.
17. Inspect all parts for wear or damage. Replace parts as necessary.

Assembly Notes

NOTICE

It is important that all component parts are absolutely clean, as contamination can result in serious damage and/or improper operation.

Never use shop towels or rags to dry parts after cleaning, as lint may clog passages. Dry parts using compressed air.

Required Materials
• Seal Kit • Reel Valve O-Ring

- *Assemble reel valve unit by reversing the order of disassembly.*
- *Use a new seal kit and reel valve O-ring during assembly.*
- *Lubricate all O-rings prior to assembly.*
- *Tighten check valve (5) to 1.1–1.5 lb-ft (1.5–2.0 N·m).*
- *Tighten coil nut (12) to 65–75 lb-in. (7–8 N·m).*
- *Tighten orifice (4) to 1.1–1.5 lb-ft (1.5–2 N·m).*
- *Tighten reel (backlap) valve (3) to 80–100 lb-ft (108–136 N·m).*
- *Tighten mow/relief valve (10) to 20–25 lb-ft (27–34 N·m).*
- *Tighten reel speed control valve (2) to 30–35 lb-ft (41–47 N·m).*
- *Tighten port “A” fitting (13) to 77 lb-ft (105 N·m).*
- *Tighten port “B” fitting (9) to 77 lb-ft (105 N·m).*
- *Tighten port “P” fitting (7) to 77 lb-ft (105 N·m).*
- *Tighten port “T” fitting (8) to 133 lb-ft (180 N·m).*
- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*

Soft Drop Valve

Removal and Installation

See Figures 6-54 through 6-56.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable from the battery.

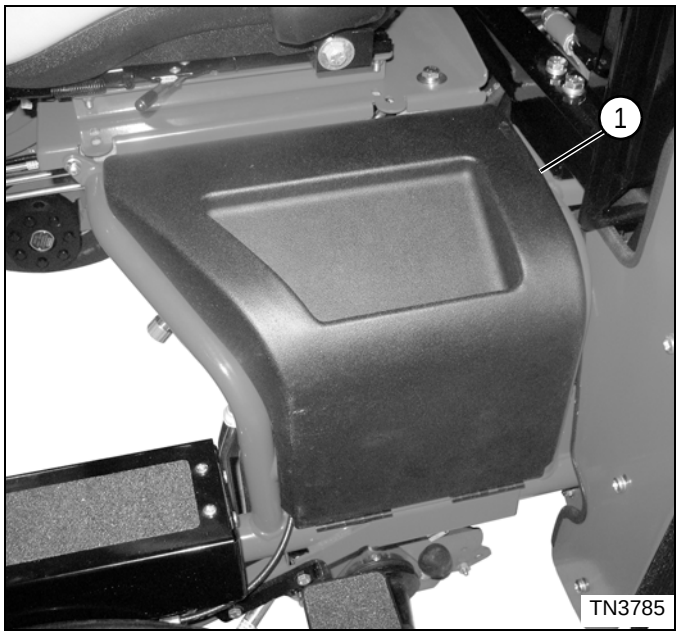


Figure 6-54

3. Unsnap and swing the battery cover (1) out.

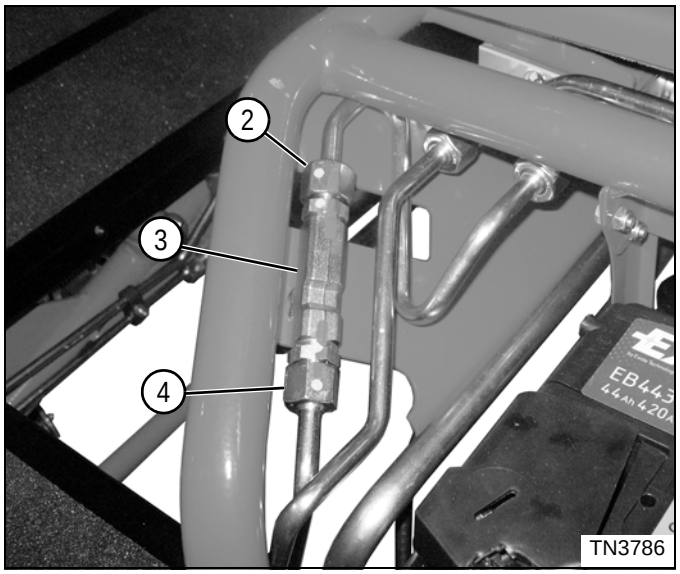


Figure 6-55

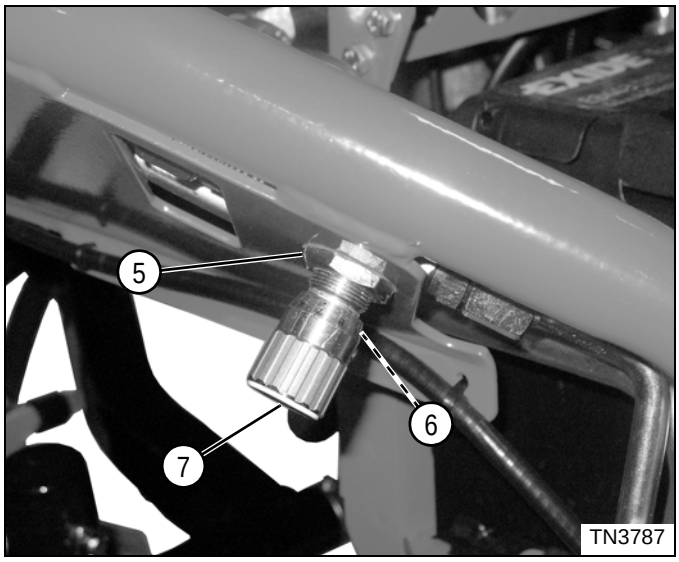


Figure 6-56

4. Thoroughly clean the valve, especially the area surrounding the hydraulic hoses, tubes, and fittings.

NOTES

- *Label all hydraulic hoses and tubes before disconnecting to ensure correct installation.*
- *Close all openings with caps or plugs to prevent contamination.*

5. Disconnect hydraulic tubes (2 and 4).
6. Loosen set screw (6), and remove knob (7).

NOTE

Record the orientation of the soft drop valve before removing to ensure correct installation.

7. Remove nut (5), and remove soft drop valve (3).

Installation Notes

- *Install soft drop valve by reversing the order of removal.*
- *Make sure new O-rings are in place before installing lines on fittings.*
- *Replace hydraulic oil charge filter. (See "Hydraulic Oil Charge Filter Assembly" on page 6-59.)*
- *Start engine. Check hydraulic system for leaks. Repair as necessary.*
- *Check hydraulic oil level and add if necessary.*

Top and Bottom Sequence Valves

Removal and Installation

See Figure 6-57.

NOTE

The top sequence valve is shown; the bottom sequence valve is similar.

1. Park the mower safely. (See "Park Mower Safely" on page 1-6.)
2. Disconnect the negative (–) battery cable from the battery.
3. Raise fuel/hydraulic tank. (See "Fuel Tank (Diesel)" on page 9-7.)

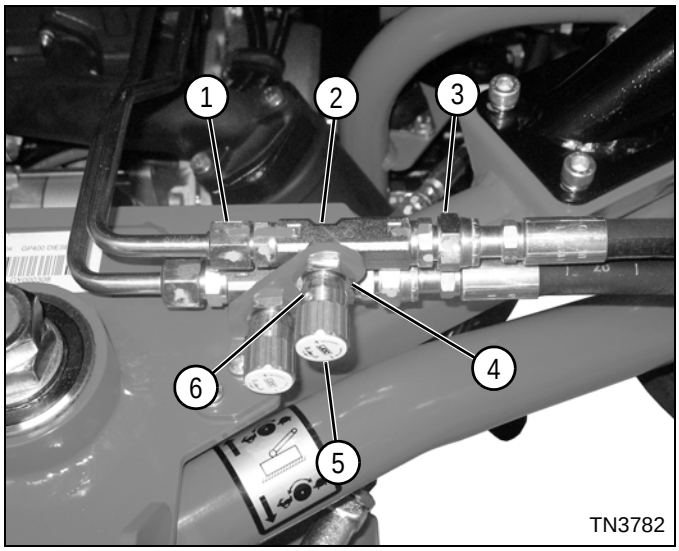


Figure 6-57

4. Thoroughly clean the valve, especially the area surrounding the hydraulic hoses, tubes, and fittings.

NOTES

- *Label all hydraulic hoses and tubes before disconnecting to ensure correct installation.*
- *Close all openings with caps or plugs to prevent contamination.*

5. Disconnect hydraulic tubes (1 and 3).
6. Loosen set screw (6) and remove knob (5).

NOTE

Record the orientation of the sequence valve before removing to ensure correct installation.

7. Remove nut (4), and remove sequence valve (2).

Installation Notes

- *Install sequence valve by reversing the order of removal.*
- *Make sure new O-rings are in place before installing hoses on fittings.*
- *Replace hydraulic oil charge filter. (See “Hydraulic Oil Charge Filter Assembly” on page 6-59.)*
- *Refill hydraulic tank. (Refer to “Parts and Maintenance Manual” for correct oil specifications.)*
- *Start engine. Check hydraulic system for leaks. Repair as necessary.*
- *Check hydraulic oil level and add if necessary.*

Center Lift Cylinder

Removal and Installation

See Figures 6-58 through 6-60.

CAUTION

Care must be taken to avoid damaging the surface of the cylinder rod during removal and installation.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove grass catchers (if equipped).

NOTE

Do not swing the arm out or in with cutting units in the lowered position.

3. Raise the cutting units.

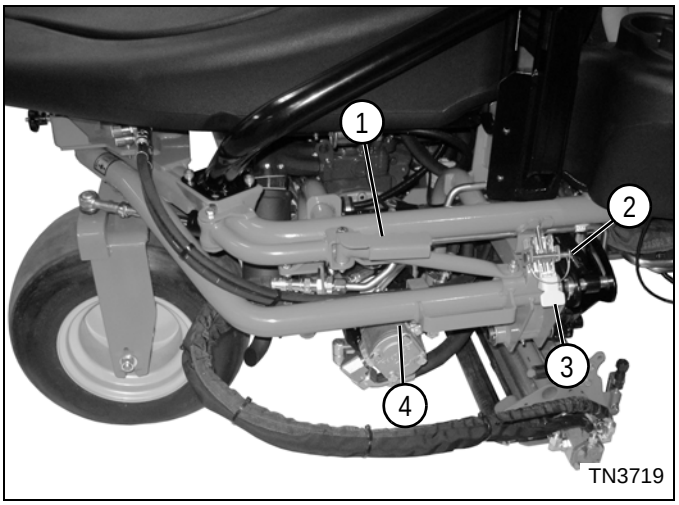


Figure 6-58

4. Remove lynch pin (2) and release latch (3).
5. Grasp handle (1), and swing the rear swing arm (4) and cutting unit out.
6. Lower the cutting units.

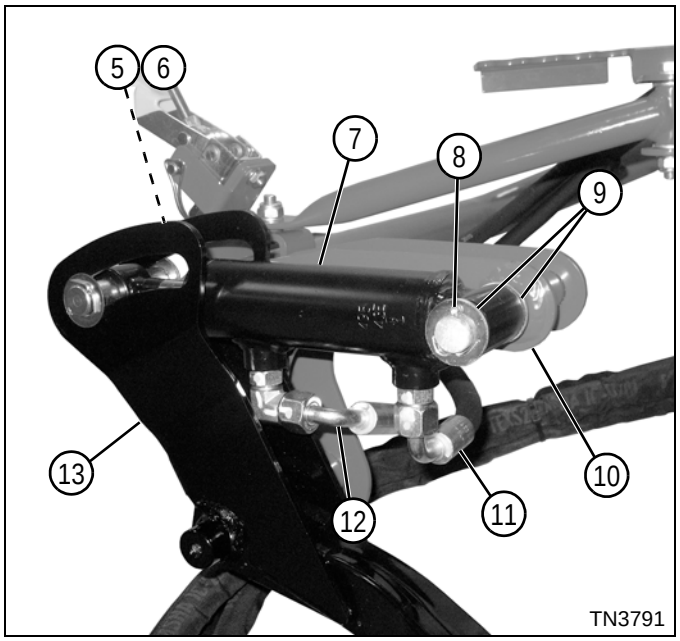


Figure 6-59

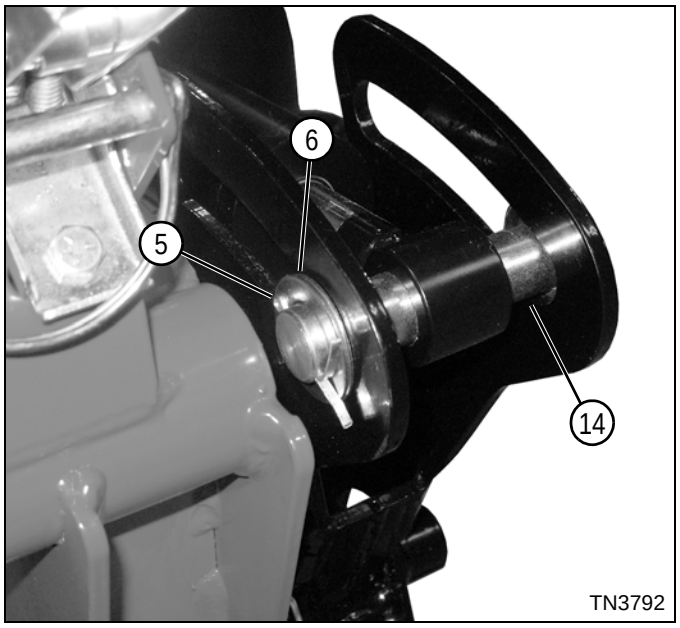


Figure 6-60

NOTES

- *Label all hydraulic hoses and tubes before disconnecting to ensure correct installation.*
- *Close all openings with caps or plugs to prevent contamination.*

7. Disconnect hydraulic hoses (11 and 12) from lift cylinder (7).

NOTE

Record the number of washers used and their locations to ensure correct installation.

8. Remove cotter pin (8) and washers (9).
9. Remove cotter pin (5) and washers (6), and remove pin (14) from lift cylinder (7) and lift arm (13).
10. Rotate the rod end of the lift cylinder (7) up, and remove lift cylinder from swing arm (10).

Installation Notes

- *Install lift cylinder by reversing the order of removal.*
- *Make sure new O-rings are in place before installing hoses on fittings.*
- *Replace hydraulic oil charge filter. (See "Hydraulic Oil Charge Filter Assembly" on page 6-59.)*
- *Refill hydraulic tank. (Refer to "Parts and Maintenance Manual" for correct oil specifications.)*
- *Start engine. Check hydraulic system for leaks. Repair as necessary.*
- *Check hydraulic oil level and add if necessary.*

Disassembly, Inspection, and Assembly

See Figures 6-61 through 6-64.

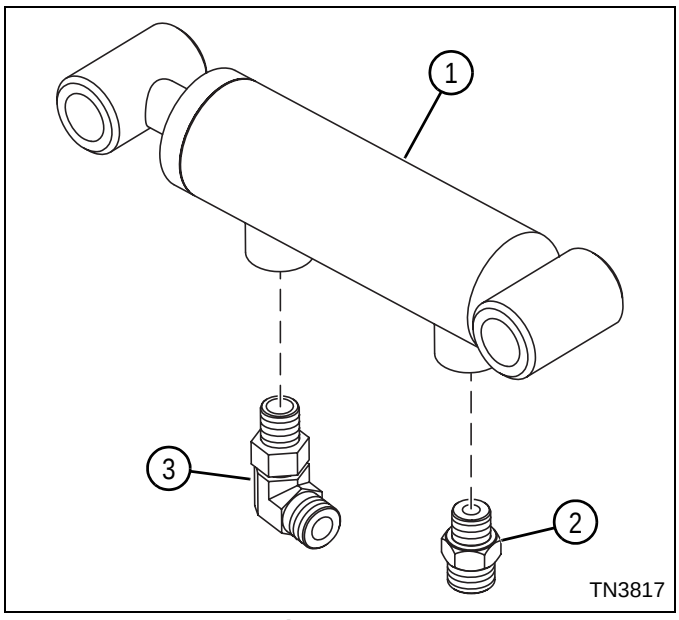


Figure 6-61

NOTE

Record the location and orientation of fittings before removing to ensure correct installation.

1. Remove fittings (2 and 3) from lift cylinder (1).

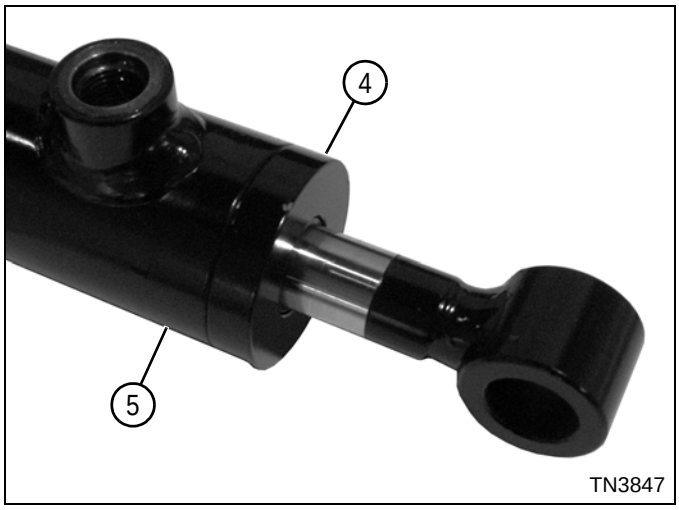


Figure 6-62

2. Use a spanner wrench to remove rod guide (4) from barrel (5).

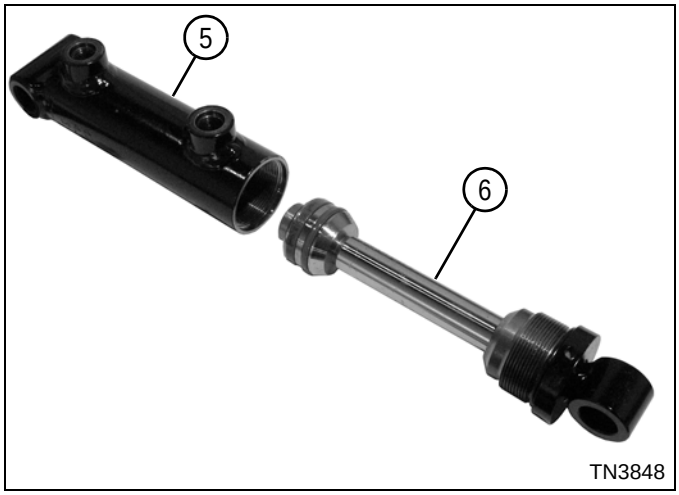


Figure 6-63

3. Remove piston rod assembly (6) from barrel (5).

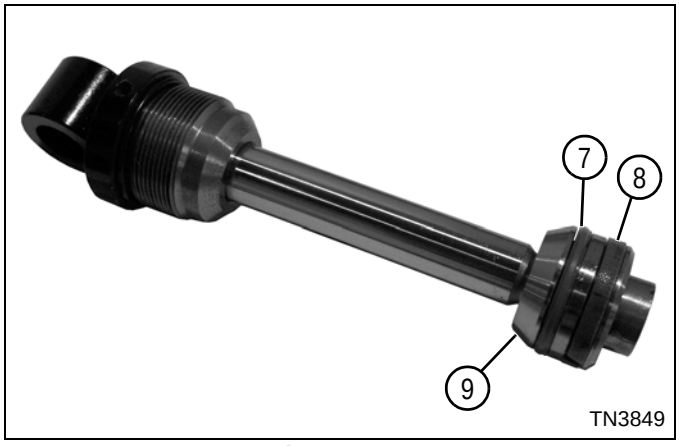


Figure 6-64

4. Remove seals (7 and 8) from piston (9).

WARNING

Use appropriate eye protection when using compressed air for cleaning or drying purposes. Compressed air can cause serious personal injury. Use safety reduction valves to reduce the air pressure to a safe level before use.

NOTICE

During repair of the cylinder, use extreme care not to damage the barrel, piston, rod, and sealing surfaces of the cylinder.

It is important that all component parts are absolutely clean, as contamination can result in serious damage and/or improper operation.

Never use shop towels or rags to dry parts after cleaning, as lint may clog passages. Dry parts using compressed air.

5. Clean all parts using clean solvent, and dry using compressed air.
6. Inspect all parts for excessive wear, cracks, broken parts, and scoring of the cylinder barrel, piston, and rod.

Assembly Notes

NOTICE

It is important that all component parts are absolutely clean, as contamination can result in serious damage and/or improper operation.

Never use shop towels or rags to dry parts after cleaning, as lint may clog passages. Dry parts using compressed air.

Required Materials
Seal Kit

- *Use a new seal kit during assembly.*
- *Lubricate O-rings, rod seal, and wiper with clean hydraulic oil before assembly.*
- *Assemble lift cylinder by reversing the order of disassembly.*

Left and Right Front Lift Cylinders

Removal and Installation

See Figures 6-65 and 6-66.

NOTE

The left lift cylinder is shown; the right lift cylinder is similar.

CAUTION

Care must be taken to avoid damaging the surface of the cylinder rod during removal and installation.

1. Lower the cutting units.
2. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
3. Remove lower floorboard panel. (See “Floorboard Assembly” on page 9-17.)

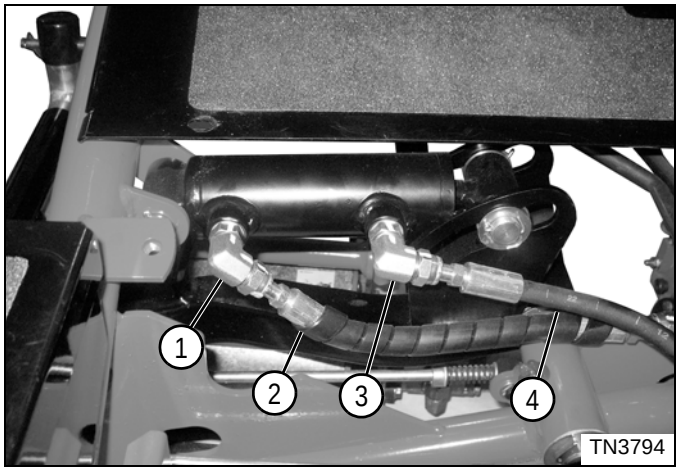


Figure 6-65

NOTES

- *Label all hydraulic hoses and tubes before disconnecting to ensure correct installation.*
- *Close all openings with caps or plugs to prevent contamination.*

4. Disconnect hydraulic hoses (2 and 4) from fittings (1 and 3).

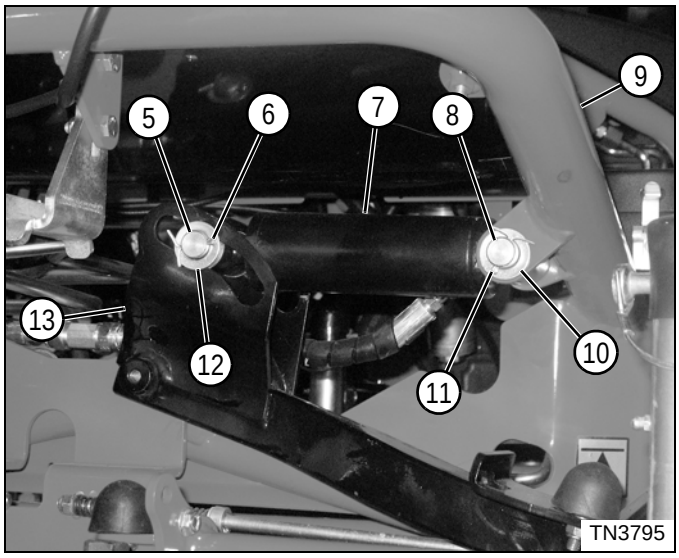


Figure 6-66

5. Remove cotter pin (6) and washer (12), and remove pin (5) from lift cylinder (7) and lift arm (13).
6. Remove cotter pin (11) and washer (10), and remove lift cylinder (7) from frame (9).

Installation Notes

- *Install lift cylinder by reversing the order of removal.*
- *Make sure new O-rings are in place before installing hoses on fittings.*
- *Replace hydraulic oil charge filter. (See "Hydraulic Oil Charge Filter Assembly" on page 6-59.)*
- *Refill hydraulic tank. (Refer to "Parts and Maintenance Manual" for correct oil specifications.)*
- *Start engine. Check hydraulic system for leaks. Repair as necessary.*
- *Check hydraulic oil level and add if necessary.*

Disassembly, Inspection, and Assembly

See Figures 6-67 through 6-70.

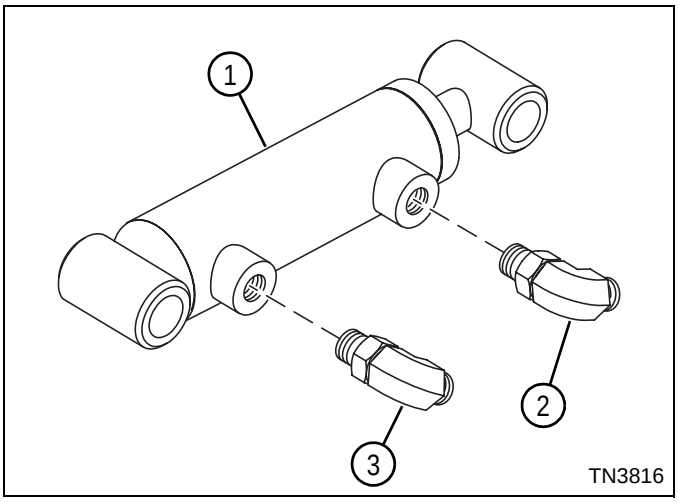


Figure 6-67

NOTE

Record the location and orientation of fittings before removing to ensure correct installation.

1. Remove fittings (2 and 3) from lift cylinder (1).

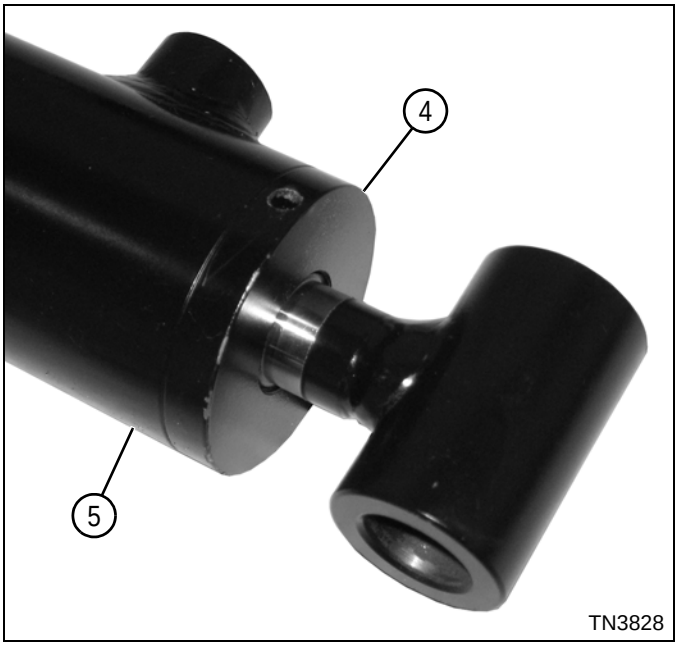


Figure 6-68

2. Use a spanner wrench to remove rod guide (4) from barrel (5).

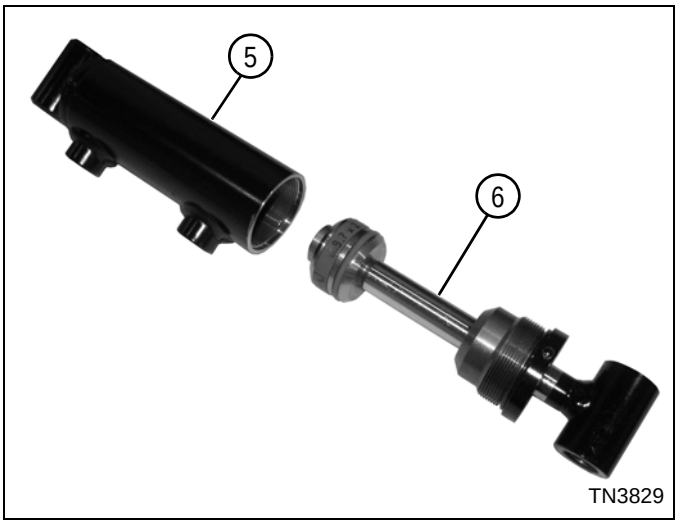


Figure 6-69

3. Remove piston rod assembly (6) from barrel (5).

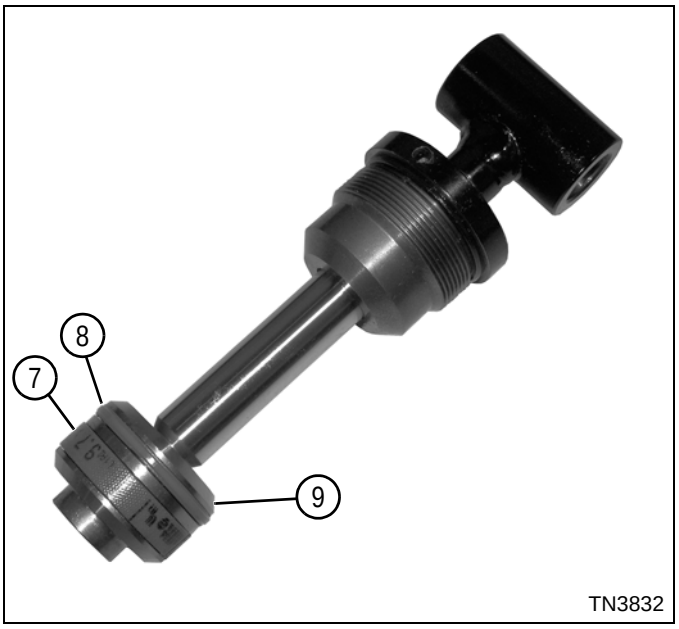


Figure 6-70

4. Remove seals (7 and 8) from piston (9).

WARNING

Use appropriate eye protection when using compressed air for cleaning or drying purposes. Compressed air can cause serious personal injury. Use safety reduction valves to reduce the air pressure to a safe level before use.

NOTICE

During repair of the cylinder, use extreme care not to damage the barrel, piston, rod, and sealing surfaces of the cylinder.

It is important that all component parts are absolutely clean, as contamination can result in serious damage and/or improper operation.

Never use shop towels or rags to dry parts after cleaning, as lint may clog passages. Dry parts using compressed air.

5. Clean all parts using clean solvent, and dry using compressed air.
6. Inspect all parts for excessive wear, cracks, broken parts, and scoring of the cylinder barrel, piston, and rod.
7. Inspect the barrel for dents, score lines, or grooves inside.
8. Inspect the fittings for wear and damage.

Assembly Notes

NOTICE

It is important that all component parts are absolutely clean, as contamination can result in serious damage and/or improper operation.

Never use shop towels or rags to dry parts after cleaning, as lint may clog passages. Dry parts using compressed air.

Required Materials
Seal Kit

- *Use a new seal kit during assembly.*
- *Lubricate O-rings, rod seal, and wiper with clean hydraulic oil before assembly.*
- *Assemble lift cylinder by reversing the order of disassembly.*

Hydraulic Oil Tank (Diesel)

Removal and Installation

See Figures 6-71 and 6-72.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable from the battery.
3. Drain hydraulic oil tank. (See “Hydraulic Oil Tank—Drain Procedure” on page 6-42.)
4. Raise hydraulic oil/fuel tank. (See “Raise Hydraulic Oil/Fuel Tank” on page 9-4.)

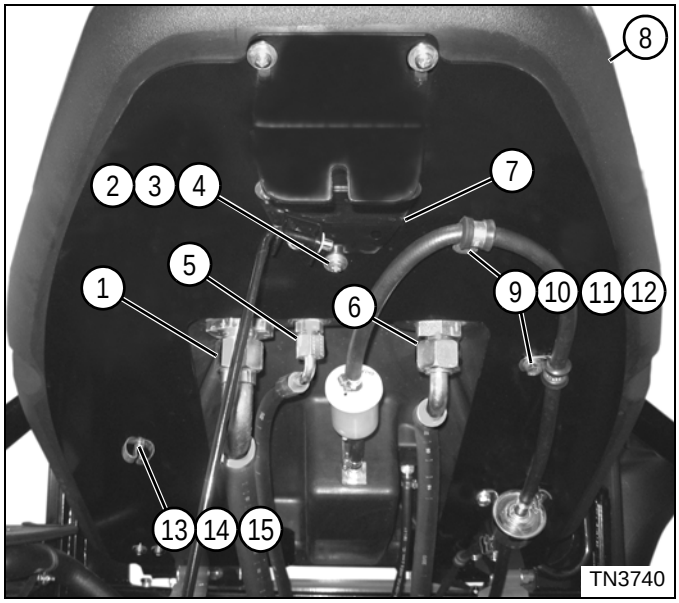


Figure 6-71

5. Remove screws (9), lock washers (10), flat washers (11), and clamps (12).
6. Remove screw (13), lock washer (14), and clip (15).

NOTES

- *Label all hydraulic hoses and tubes before disconnecting to ensure correct installation.*
- *Close all openings with caps or plugs to prevent contamination.*

7. Disconnect hoses (1, 5, and 6) from hydraulic oil tank.
8. Support hydraulic oil/fuel tank (8) using a suitable lifting device.
9. Remove three screws (2), lock washers (3), flat washers (4), and bracket assembly (7).
10. Lower hydraulic oil/fuel tank (8) to operating position.

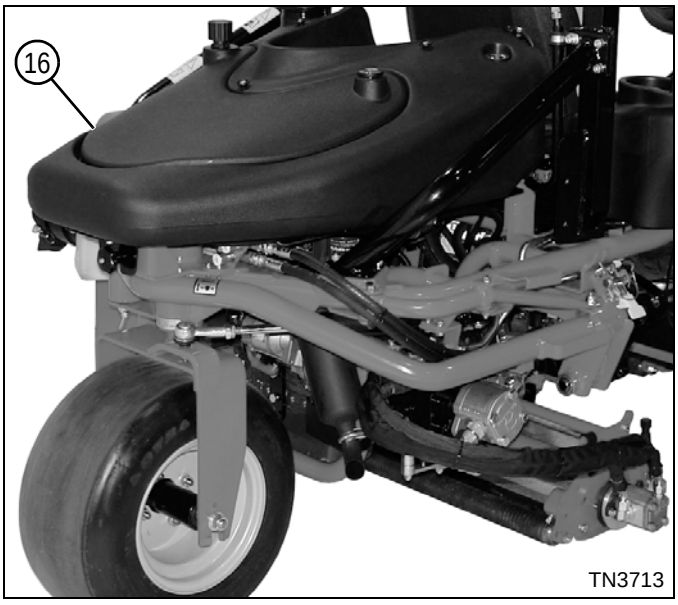


Figure 6-72

11. Remove hydraulic oil tank (16).

Installation Notes

Required Materials
Anti-Seize Compound

- *Install hydraulic oil tank by reversing the order of removal.*

CAUTION

- **When connecting fittings to the tank, be sure to hold the tank fitting with the proper wrench. If the proper wrench is not used, the fitting in the tank might break loose from the plastic and cause it to leak.**
- **Do not overtighten screws to tank or tank may crack and cause a leak.**

- *Apply anti-seize compound to screws (2, 9, and 13) prior to installation. Do not overtighten these screws or tank may crack and cause a leak.*
- *Ensure new O-rings are in place before installing hoses on fittings.*
- *Replace hydraulic oil charge filter. (See “Hydraulic Oil Charge Filter Assembly” on page 6-59.)*
- *Refill hydraulic oil tank. (Refer to “Parts and Maintenance Manual” for correct oil specifications.)*
- *Start engine. Check hydraulic oil tank for leaks and repair as necessary.*
- *Check hydraulic oil level and add if necessary.*

Hydraulic Oil Tank (Gasoline)

Removal and Installation

See Figures 6-73 and 6-74.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable from the battery.
3. Drain hydraulic oil tank. (See “Hydraulic Oil Tank—Drain Procedure” on page 6-42.)
4. Raise hydraulic oil/fuel tank. (See “Raise Hydraulic Oil/Fuel Tank” on page 9-4.)

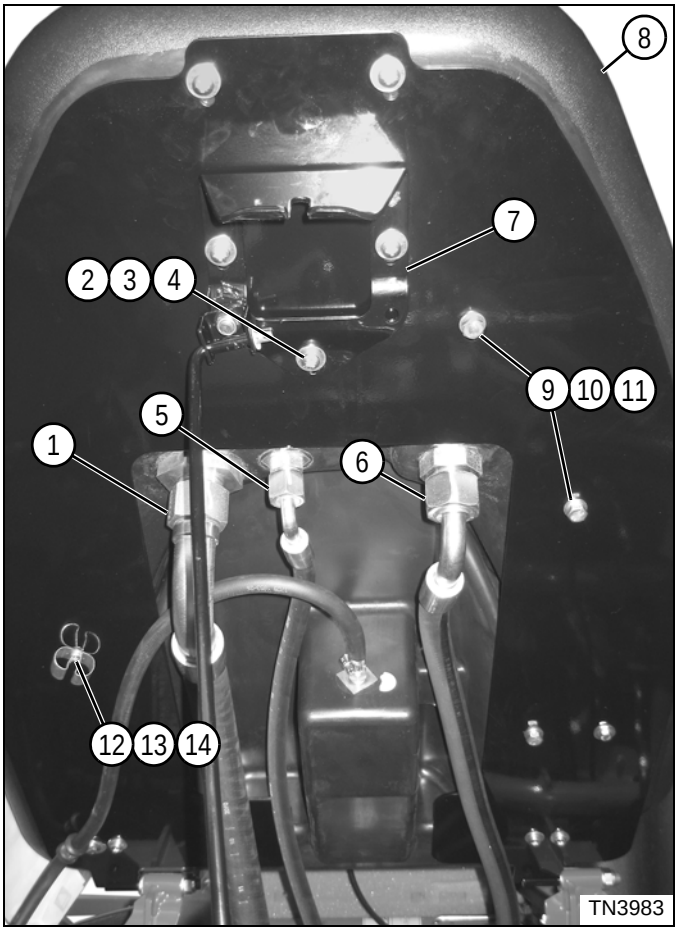


Figure 6-73

5. Remove screws (9), lock washers (10), and flat washers (11).
6. Remove screw (12), lock washer (13), and clip (14).

NOTES

- *Label all hydraulic hoses and tubes before disconnecting to ensure correct installation.*
- *Close all openings with caps or plugs to prevent contamination.*

7. Disconnect hoses (1, 5, and 6) from hydraulic oil tank.
8. Support hydraulic oil/fuel tank (8) using a suitable lifting device.
9. Remove three screws (2), lock washers (3), flat washers (4), and bracket assembly (7).
10. Lower hydraulic oil/fuel tank (8) to operating position.

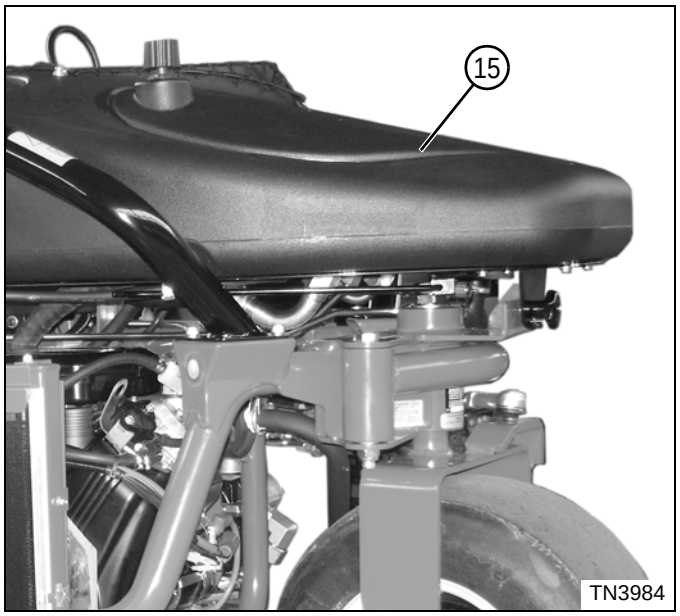


Figure 6-74

11. Remove hydraulic oil tank (15).

Installation Notes

Required Materials
Anti-Seize Compound

- *Install hydraulic oil tank by reversing the order of removal.*

CAUTION

- **When connecting fittings to the tank, be sure to hold the tank fitting with the proper wrench. If the proper wrench is not used, the fitting in the tank might break loose from the plastic and cause it to leak.**
- **Do not overtighten screws to tank or tank may crack and cause a leak.**

- *Apply anti-seize compound to screws (2, 9, and 12) prior to installation. Do not overtighten these screws or tank may crack and cause a leak.*
- *Ensure new O-rings are in place before installing hoses on fittings.*
- *Replace hydraulic oil charge filter. (See "Hydraulic Oil Charge Filter Assembly" on page 6-59.)*
- *Refill hydraulic oil tank. (Refer to "Parts and Maintenance Manual" for correct oil specifications.)*
- *Start engine. Check hydraulic oil tank for leaks and repair as necessary.*
- *Check hydraulic oil level and add if necessary.*

Hydraulic Oil Charge Filter Assembly

Removal and Installation

See Figure 6-75.

1. Park the mower safely. (See "Park Mower Safely" on page 1-6.)
2. Remove seat and seat plate. (See "Seat and Seat Plate" on page 9-15.)
3. Drain hydraulic oil tank. (See "Hydraulic Oil Tank—Drain Procedure" on page 6-42.)
4. Thoroughly clean the hydraulic oil charge filter assembly, especially the area surrounding the hydraulic hoses, tubes, and fittings.

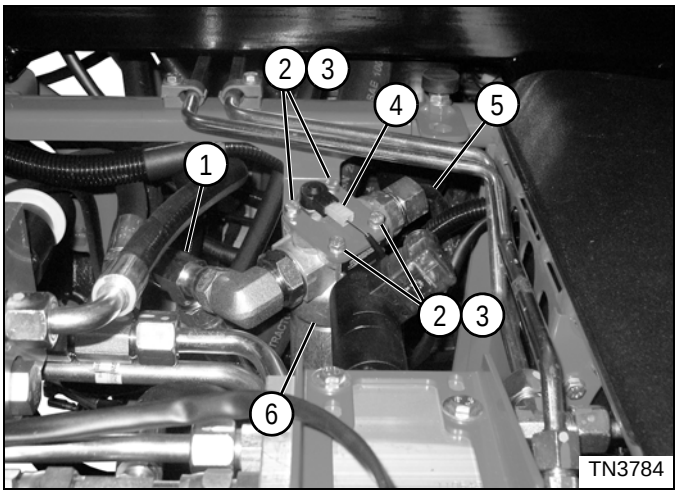


Figure 6-75

NOTE

Label wire connectors before disconnecting to ensure correct installation.

5. Disconnect wire connector (4).

NOTES

- *Label all hydraulic hoses and tubes before disconnecting to ensure correct installation.*
- *Close all openings with caps or plugs to prevent contamination.*

6. Disconnect hydraulic hose (5).
7. Disconnect tee fitting (1).
8. Support the hydraulic oil charge filter assembly (6).

NOTE

Note the orientation of the hydraulic oil charge filter head before removing to ensure correct installation.

9. Remove four screws (2) and lock washers (3).
10. Remove oil filter assembly (6).

Installation Notes

- *Install hydraulic oil charge filter assembly by reversing the order of removal.*
- *Refill hydraulic tank. (Refer to "Parts and Maintenance Manual" for correct oil specifications.)*
- *Start engine. Check hydraulic system for leaks. Repair as necessary.*
- *Check hydraulic oil level and add if necessary.*

Hydraulic Oil Cooler (Diesel)

Removal and Installation

See Figures 6-76 and 6-77.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable from the battery.
3. Drain hydraulic oil tank. (See “Hydraulic Oil Tank—Drain Procedure” on page 6-42.)

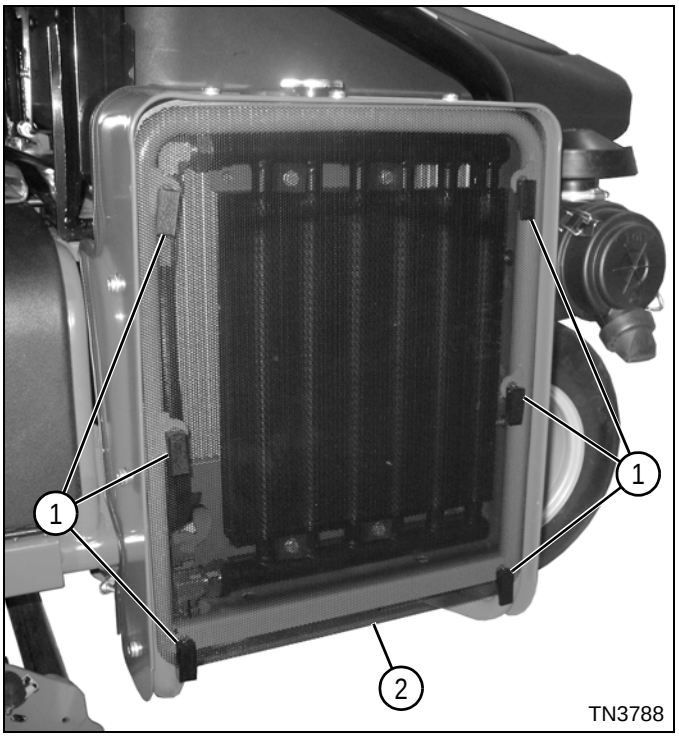


Figure 6-76

4. Open six latches (1) and remove bug screen panel (2).

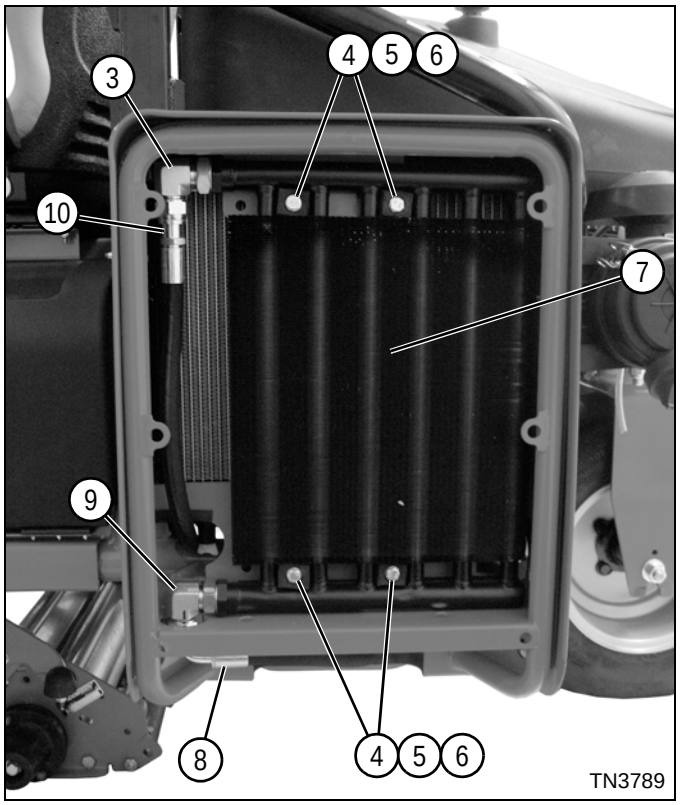


Figure 6-77

5. Thoroughly clean the hydraulic oil cooler, especially the area surrounding the hydraulic hoses, tubes, and fittings.

NOTES

- *Label all hydraulic hoses and tubes before disconnecting to ensure correct installation.*
- *Close all openings with caps or plugs to prevent contamination.*

6. Disconnect hydraulic hoses (8 and 10).
7. Remove four screws (4), washers (5), and mounting blocks (6).
8. Remove hydraulic fittings (3 and 9) and remove oil cooler (7).

Installation Notes

- *Install oil cooler by reversing the order of removal.*
- *Make sure new O-rings are in place before installing hoses and fittings.*
- *Replace hydraulic oil charge filter. (See “Hydraulic Oil Charge Filter Assembly” on page 6-59.)*
- *Refill hydraulic tank. (Refer to “Parts and Maintenance Manual” for correct oil specifications.)*
- *Start engine. Check hydraulic system for leaks. Repair as necessary.*
- *Check hydraulic oil level and add if necessary.*

Hydraulic Oil Cooler Assembly (Gasoline)

Removal and Installation

See Figures 6-78 through 6-81.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable from the battery.
3. Drain hydraulic oil tank. (See “Hydraulic Oil Tank—Drain Procedure” on page 6-42.)

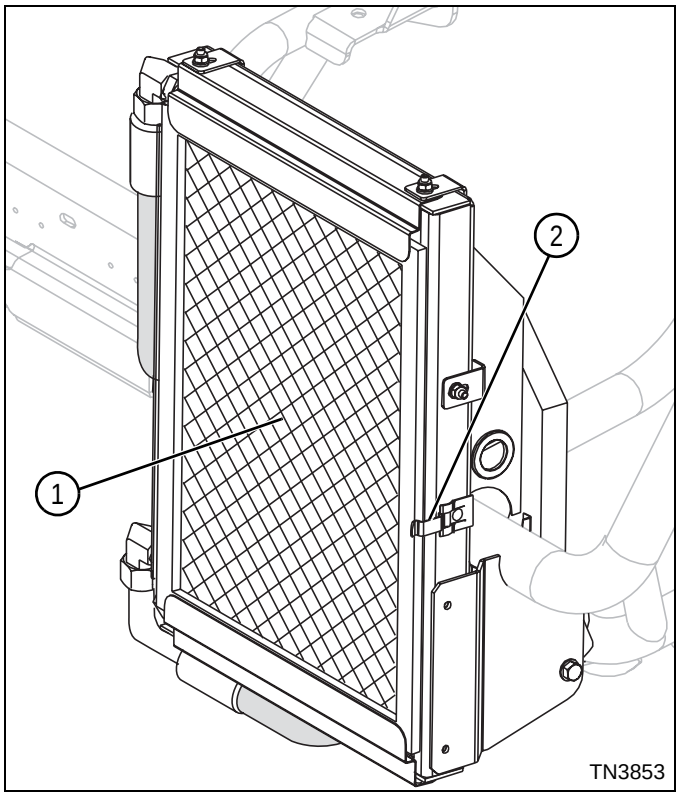


Figure 6-78

4. Release latch (2).
5. Slide screen (1) toward the rear of the machine, and remove the screen.

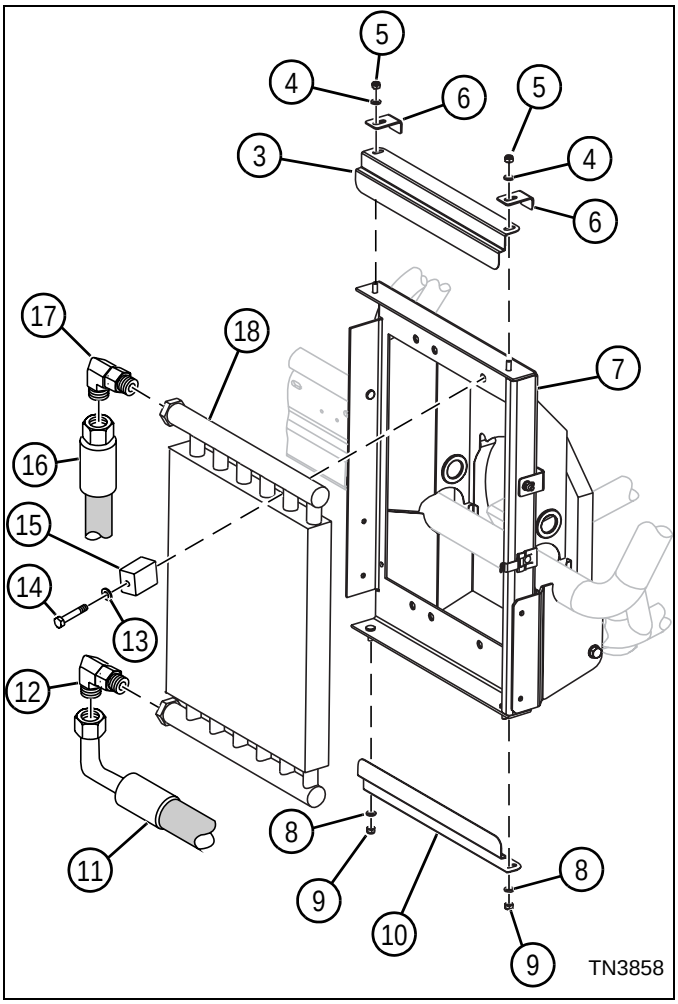


Figure 6-79

6. Remove two nuts (5), washers (4), and clips (6), and remove the top screen retainer bracket (3).
7. Remove two nuts (9) and washers (8), and remove the bottom screen retainer bracket (10).
8. Thoroughly clean the valve, especially the area surrounding the hydraulic hoses, tubes, and fittings.

NOTES

- *Label all hydraulic hoses and tubes before disconnecting to ensure correct installation.*
- *Close all openings with caps or plugs to prevent contamination.*

9. Disconnect hydraulic hoses (11 and 16).
10. Remove four screws (14) and washers (13), and remove oil cooler (18) and four mounting blocks (15).

NOTE

Record the location and orientation of fittings before removing to ensure correct installation.

11. Remove fittings (12 and 17) from oil cooler (18).

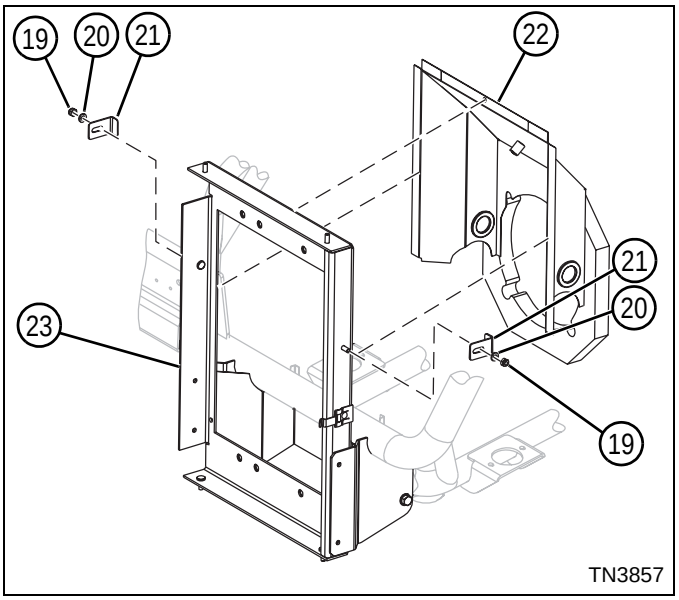


Figure 6-80

12. Remove two nuts (19), washers (20), and clamps (21), and remove air intake cover assembly (22) from cooler frame (23).

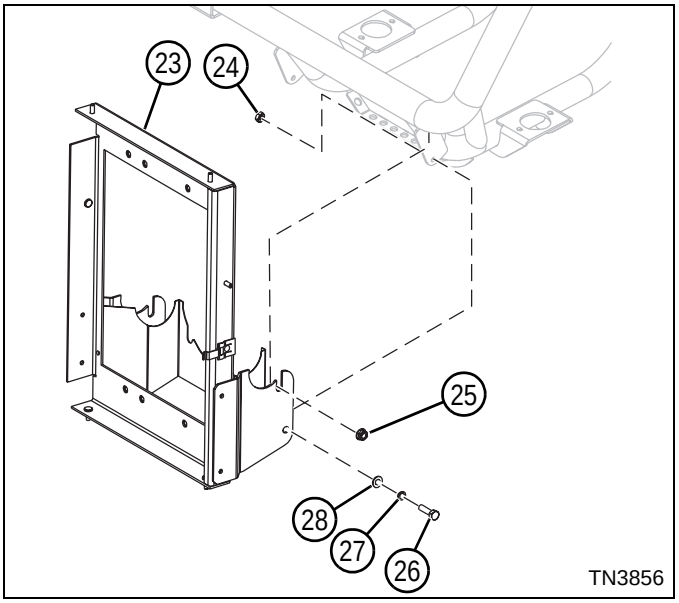


Figure 6-81

13. Support the cooler frame (23) using a suitable lifting device.
14. Remove two nuts (25).
15. Remove two nuts (24), screws (26), lock washers (27), and flat washers (28), and remove oil cooler frame (23) from the machine.

Installation Notes

- *Install oil cooler by reversing the order of removal.*
- *Make sure new O-rings are in place before installing hoses and fittings.*
- *Replace hydraulic oil charge filter. (See "Hydraulic Oil Charge Filter Assembly" on page 6-59.)*
- *Refill hydraulic tank. (Refer to "Parts and Maintenance Manual" for correct oil specifications.)*
- *Start engine. Check hydraulic system for leaks. Repair as necessary.*

16. *Check hydraulic oil level and add if necessary.*

Chapter 7

Steering

7

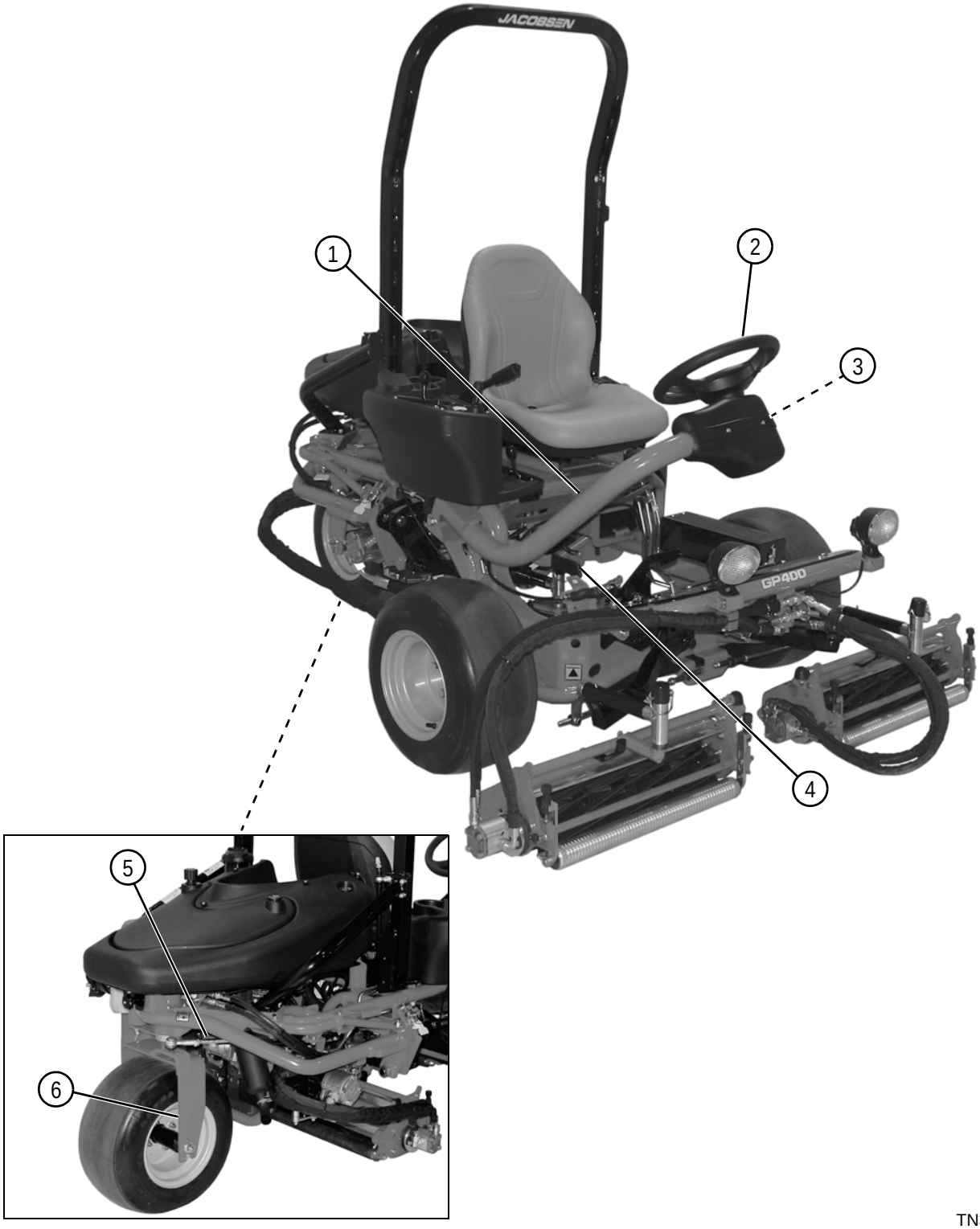
JACOBSEN
A Textron Company

Specifications

Repair Specifications		
Steering Wheel Nut Torque	lb-ft (N·m)	28–30 (38–41)
Steering Unit End Cover-to-Housing Screw Torque	lb-ft (N·m)	20–24 (27–33)

Component Location

See Figure 7-1.



TN3653, TN3713

1	Control Arm	4	Control Arm Lock Lever
2	Steering Wheel	5	Steering Cylinder
3	Steering Unit	6	Steering Yoke

Figure 7-1: Component Location

Repair

Steering Wheel

Removal and Installation

See Figures 7-2 and 7-3.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

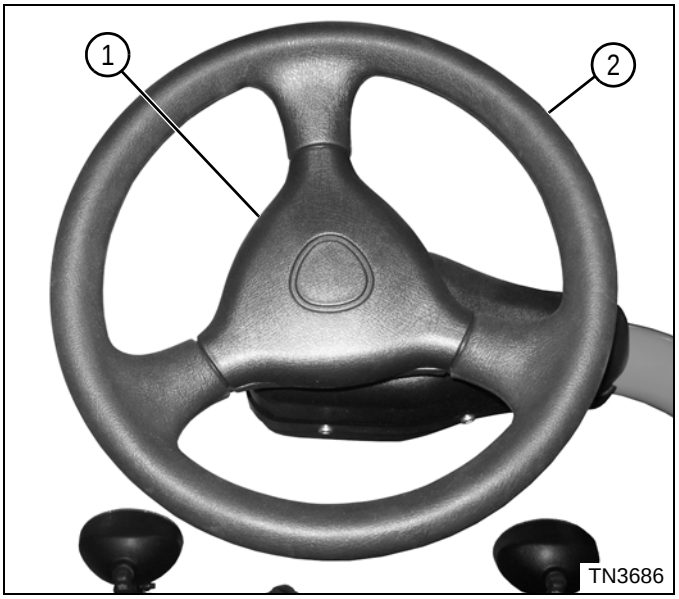


Figure 7-2

2. Remove (unsnap) cap (1) from steering wheel (2).

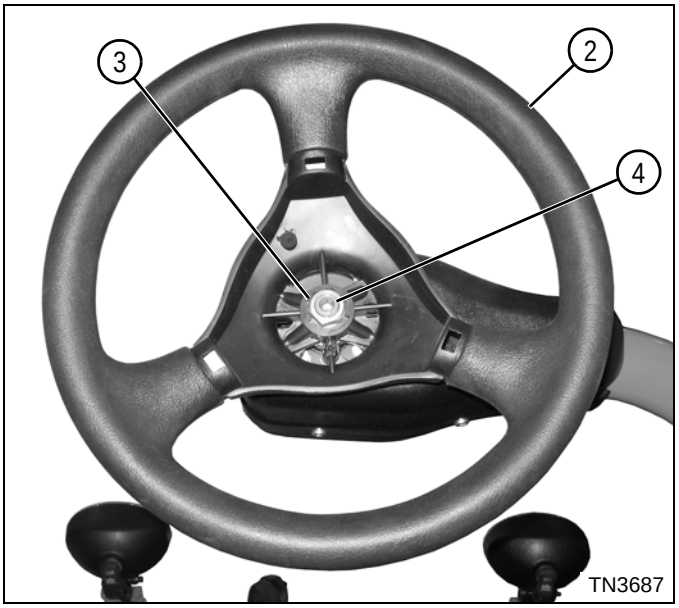


Figure 7-3

3. Remove nut (3).
4. Remove steering wheel (2) from steering column (4).

Installation Notes

- *Install steering wheel by reversing the order of removal.*
- *Tighten the steering wheel nut (3) to 28–30 lb-ft (38–41 N·m).*

Steering Column Covers

Removal and Installation

See Figures 7-4 and 7-5.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove steering wheel. (See “Steering Wheel” on page 7-4.)

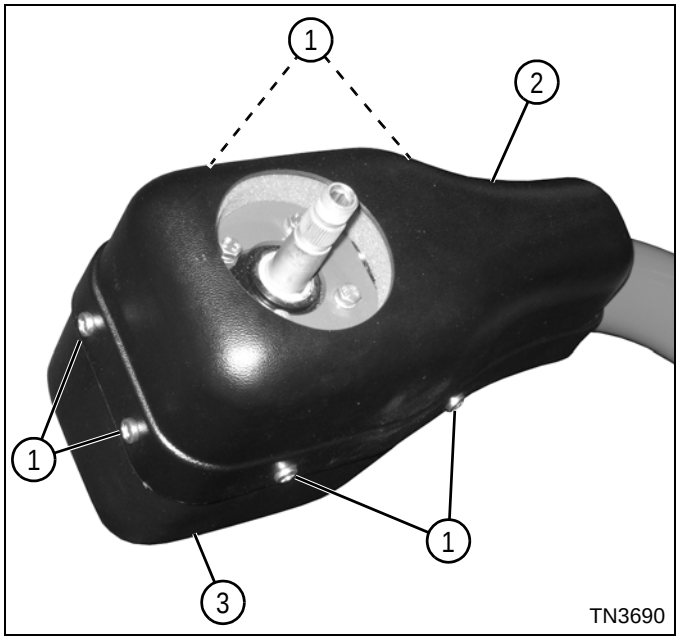


Figure 7-4

3. Remove six screws (1).
4. Remove the lower (3) and upper (2) steering column covers from machine.

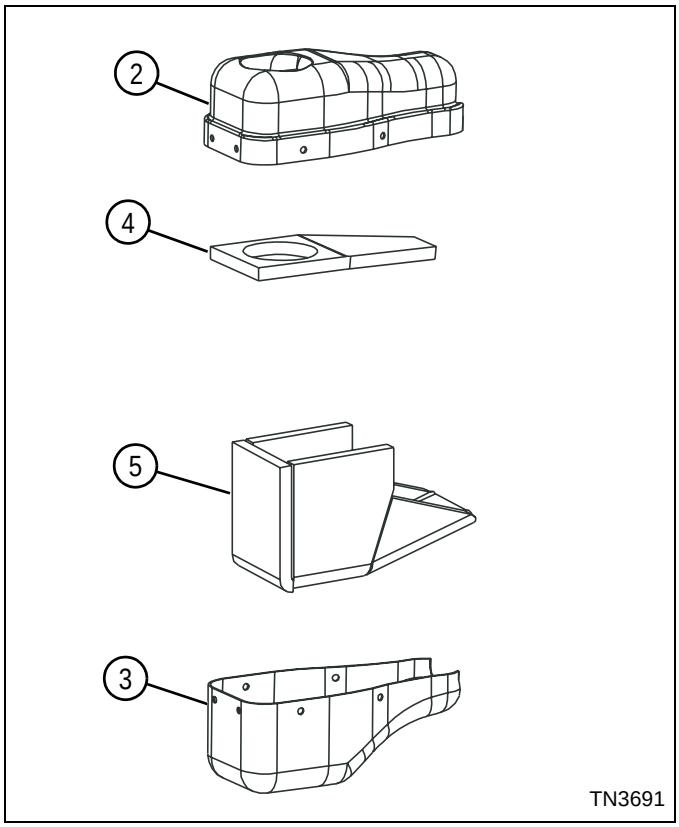


Figure 7-5

5. Inspect foam inserts (4 and 5) in the upper (2) and lower (3) steering column covers. Replace as needed.

Installation Note

Install steering column covers by reversing the order of removal.

Control Arm

Removal and Installation

See Figures 7-6 and 7-7.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove steering unit. (See “Steering Unit” on page 7-6.)

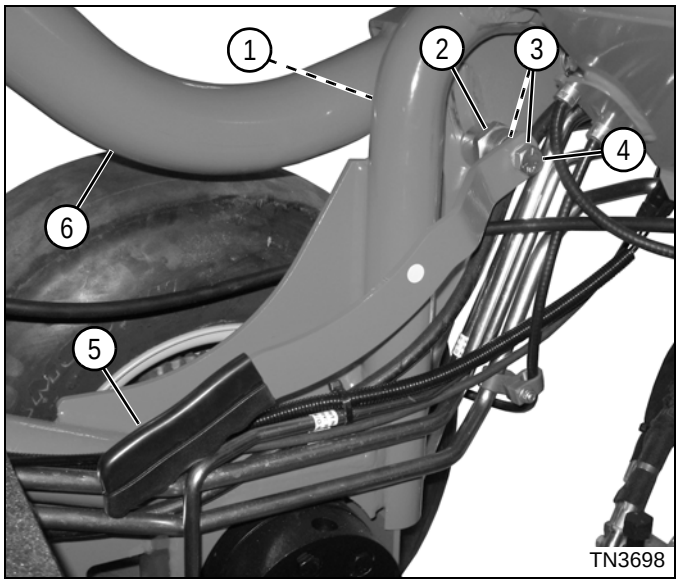


Figure 7-6

3. Lower the lift lever (5) and control arm (6) to the lowest position.
4. Support the control arm (6).

NOTE

Record the position of the left lever relative to the control arm before removing to ensure correct installation.

5. Remove screw (4), four (two per side) washers (3), and lift lever (5).
6. Remove lock collar (2) and carriage bolt (1).

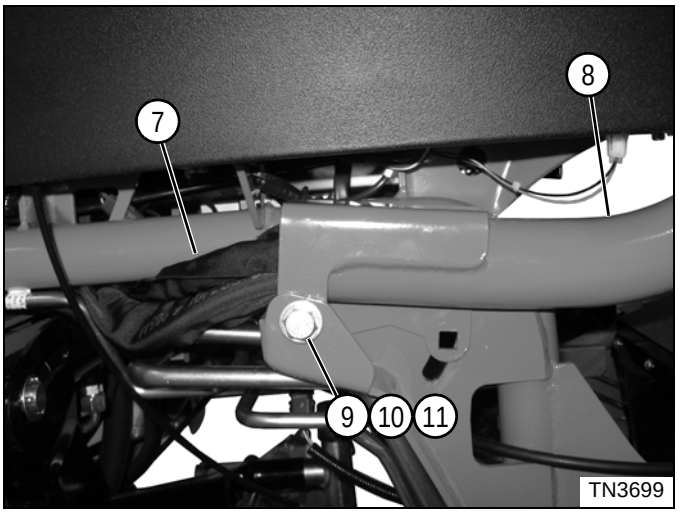


Figure 7-7

7. Support the control arm (8).
8. Remove nut (9), screw (10), and two flat washers (11).
9. Pull the control arm (8) forward, while guiding the steering unit hoses (7) out of the control arm.
10. Remove (pull) the steering unit hoses (7) from the control arm, as the control arm is removed.

Installation Note

Install control arm by reversing the order of removal.

Steering Unit

Removal and Installation

See Figures 7-8 and 7-9.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove steering wheel. (See “Steering Wheel” on page 7-4.)
3. Remove steering column covers. (See “Steering Column Covers” on page 7-4.)

NOTE

If available, use a portable hydraulic filtering unit to remove the hydraulic oil from the hydraulic tank. Place the filtering unit suction hose in the tank, and pump the oil into a clean, sealable container.

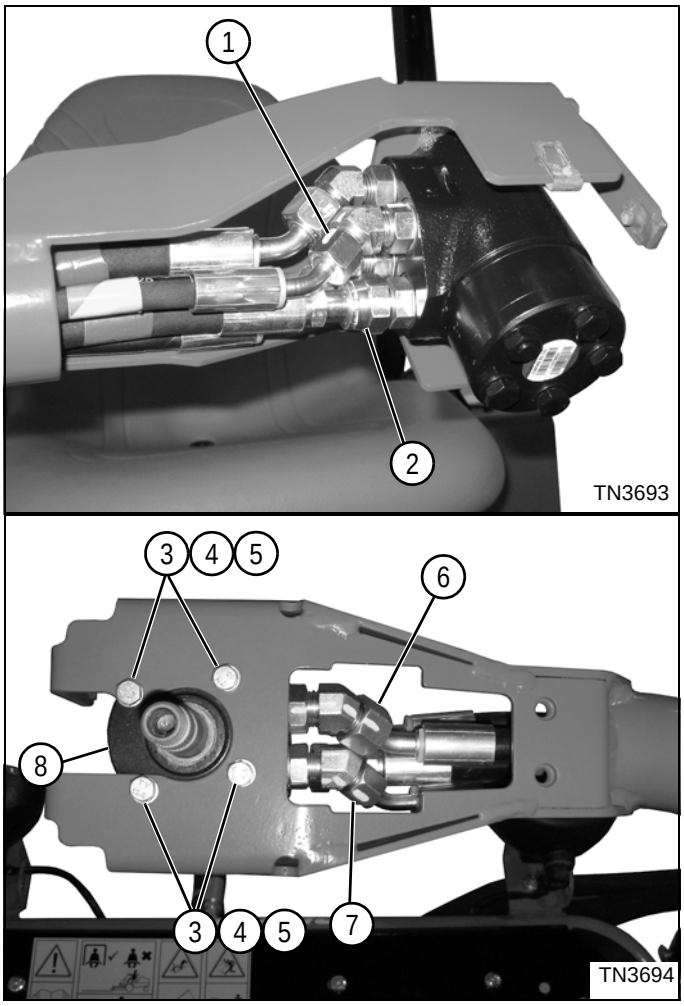


Figure 7-8

NOTES

- *Label all hydraulic hoses before disconnecting to ensure correct installation.*
- *Close all openings with caps or plugs to prevent contamination.*

4. Disconnect hydraulic hose (1) from steering unit port “R.”
5. Disconnect hydraulic hose (2) from steering unit port “P.”
6. Disconnect hydraulic hose (6) from steering unit port “T.”
7. Disconnect hydraulic hose (7) from steering unit port “E.”
8. Support steering unit (8).
9. Remove four screws (3), lock washers (4), flat washers (5), and remove steering unit (8).

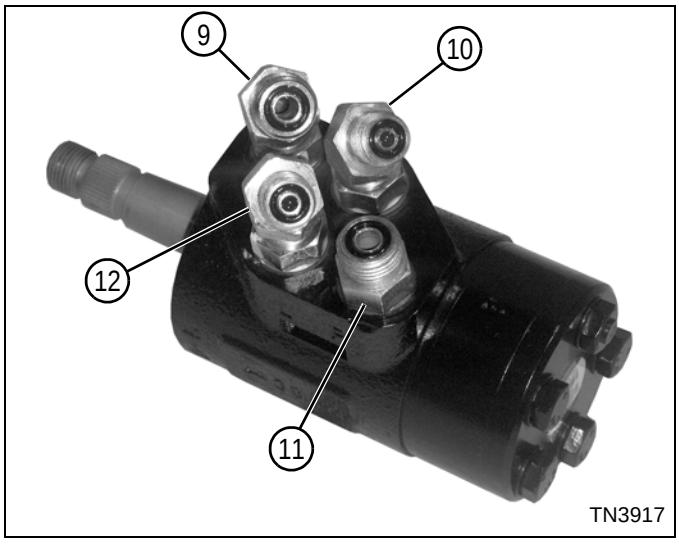


Figure 7-9

NOTE

Record the location and orientation of fittings before removing to ensure correct installation.

10. Remove, inspect, and replace fitting (9) from steering unit port “T” as necessary.
11. Remove, inspect, and replace fitting (10) from steering unit port “R” as necessary.
12. Remove, inspect, and replace fitting (11) from steering unit port “P” as necessary.
13. Remove, inspect, and replace fitting (12) from steering unit port “L” as necessary.

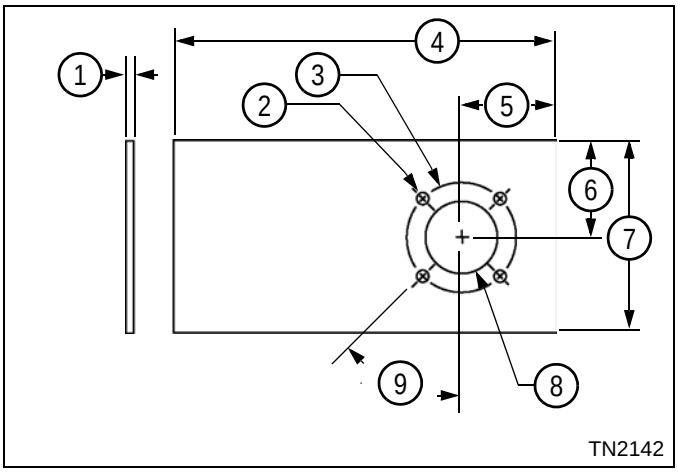
Installation Notes

- *Install steering unit by reversing the order of removal.*
- *Check hydraulic oil level. Add oil as needed.*
- *Start the machine and check cylinder operation. Check for hydraulic leaks. Repair as necessary.*

Steering Unit Service Fixture

See Figures 7-10 and 7-11.

Required Tools or Equipment
Steering Unit Service Fixture



1	0.165 in. (4.2 mm)	6	2.0 in. (50.8 mm)
2	0.250 in. (6.35 mm) Ø Hole (4)	7	4.0 in. (101.5 mm)
3	2.280 in. (58.0 mm) Ø	8	1.5 in. (38 mm) Ø Hole
4	8.0 in. (202 mm)	9	45° (4)
5	2.0 in. (50.8 mm)		

Figure 7-10

NOTICE

Do not clamp the steering unit directly into a vise. Clamping the steering unit directly into a vise may damage or distort the steering unit.

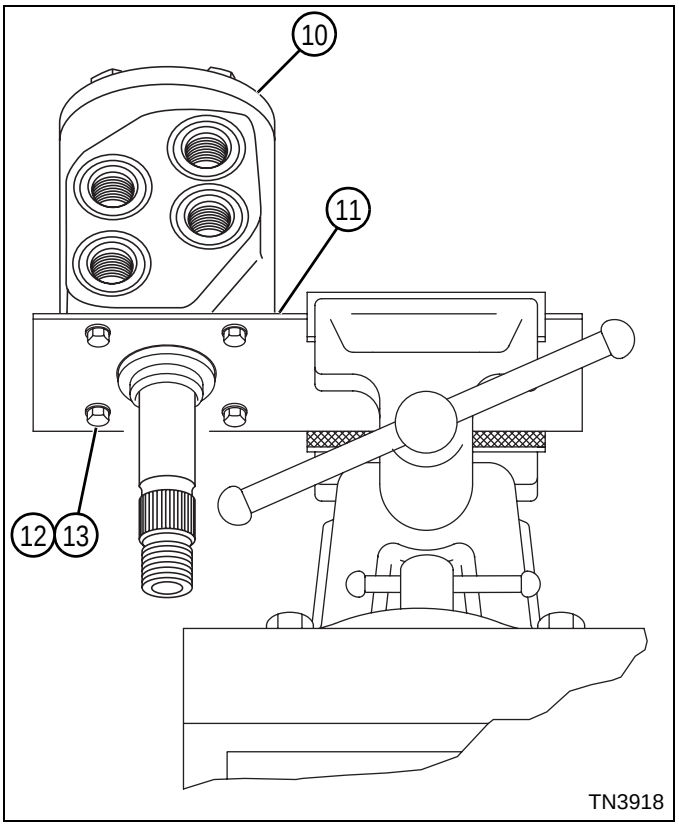


Figure 7-11

1. Place the steering unit service fixture (11) securely in a vise.
2. Place steering unit (10) into the service fixture (11), input shaft down.
3. Secure the steering unit to the service fixture using four M6 x 16 mm screws (12) and M6 lock washers (13).

Disassembly

See Figures 7-12 through 7-20.

CAUTION

Wear eye protection when assembling and disassembling the steering unit. Springs and other objects may be propelled into the air, causing eye injury.

NOTES

- *Before attempting repairs or disassembly of any hydraulic components, thoroughly clean the components and work area. A clean work area is essential to satisfactory operation of hydraulic components.*
- *Utilize steering unit service fixture for disassembly. (See "Steering Unit Service Fixture" on page 7-7.)*

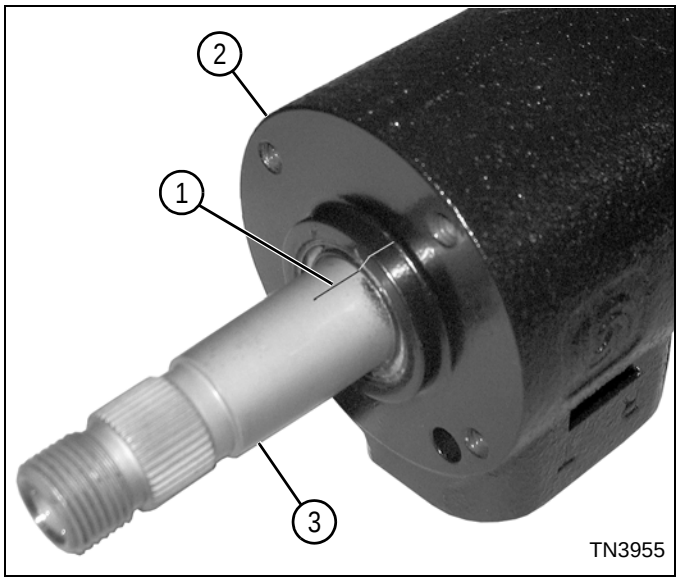


Figure 7-12

1. Scribe or mark a line (1) across the output shaft (3) and housing (2) before disassembly.

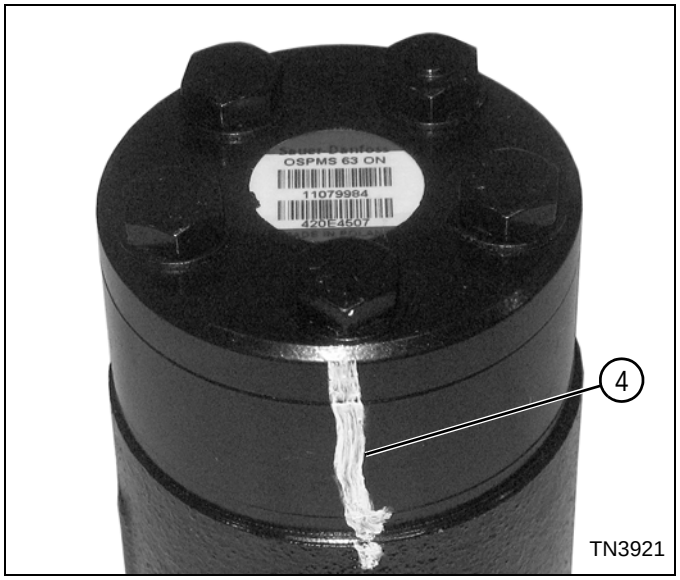


Figure 7-13

2. Scribe or mark a line (4) across the side of the steering unit to mark the position and orientation of valve segments before disassembly.

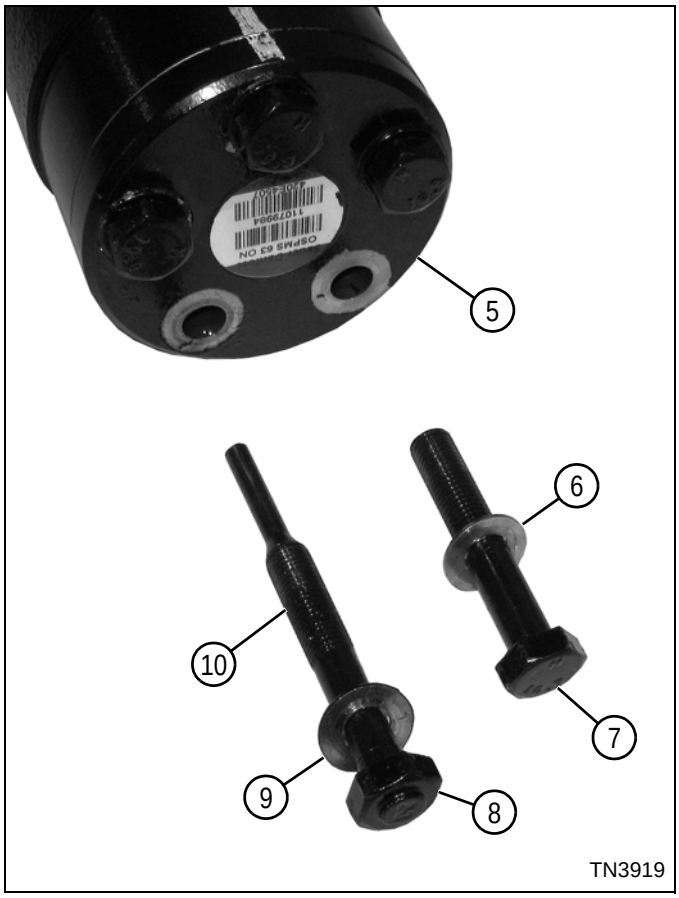


Figure 7-14

3. Remove four screws (7) and washers (6).

NOTE

Mark the location of the special screw before removing to ensure correct installation.

4. Remove special screw (10) with nut (8) and washer (9).
5. Remove end cover (5).

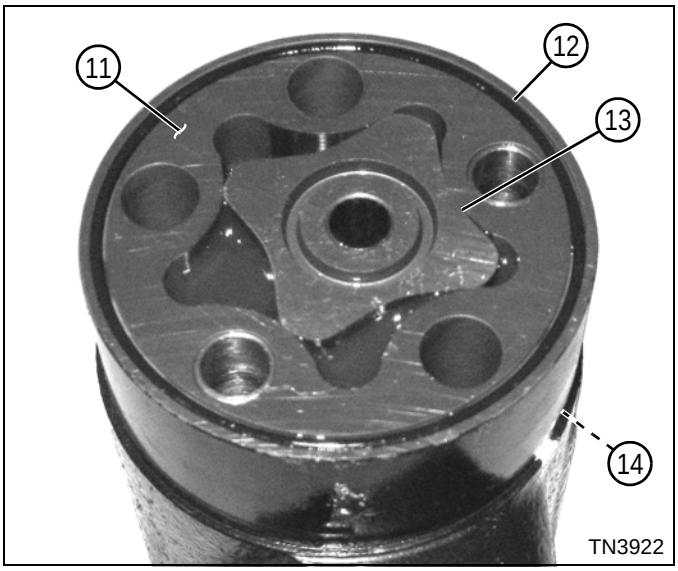


Figure 7-15

NOTE

The gearwheel to distributor plate is a tight fit. Tap the side of the gearwheel rim with a soft-faced hammer to loosen.

6. Remove the gearwheel rim (11), gearwheel (13), and two O-rings (12 and 14) as a unit, keeping the gearwheel and gearwheel rim in the same orientation to each other.

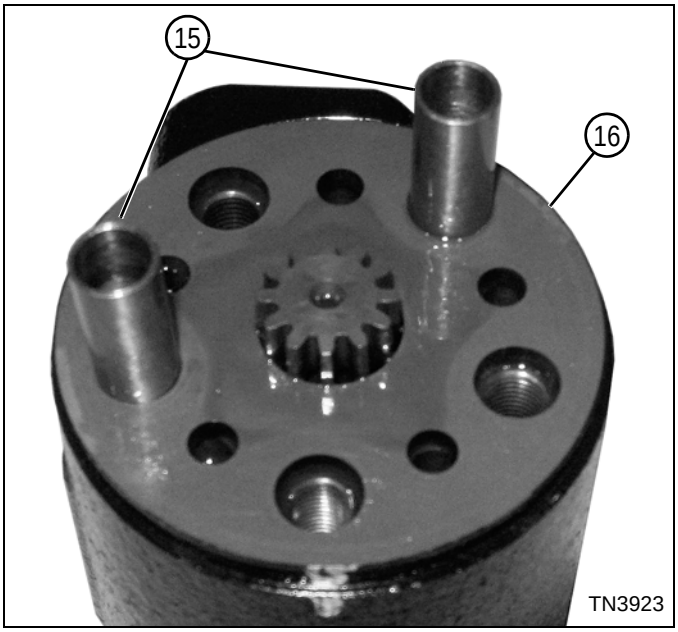


Figure 7-16

NOTE

The distributor plate to housing is a tight fit. Tap the side of the distributor plate with a soft-faced hammer to loosen.

7. Remove two sleeves (15).
8. Remove distributor plate (16).

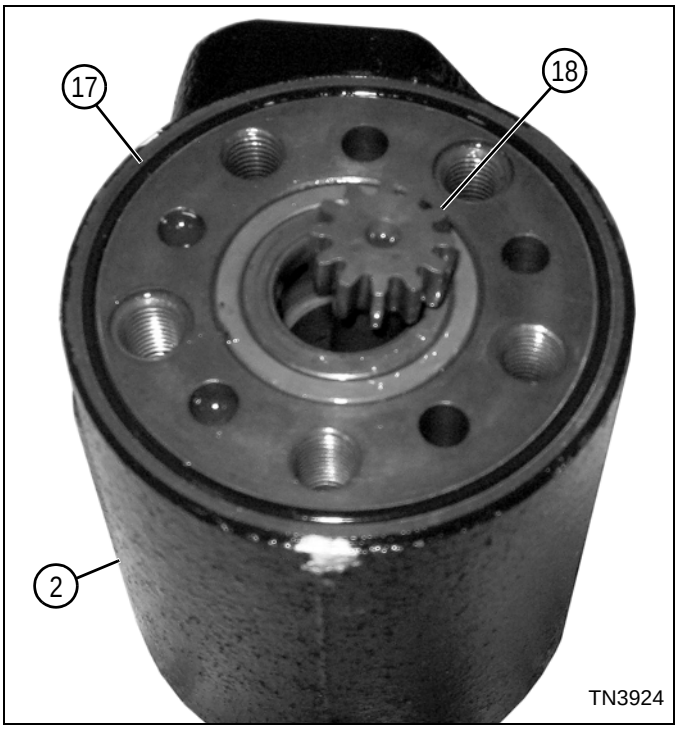


Figure 7-17

9. Remove O-ring (17) from housing (2).
10. Remove cardan shaft (18).

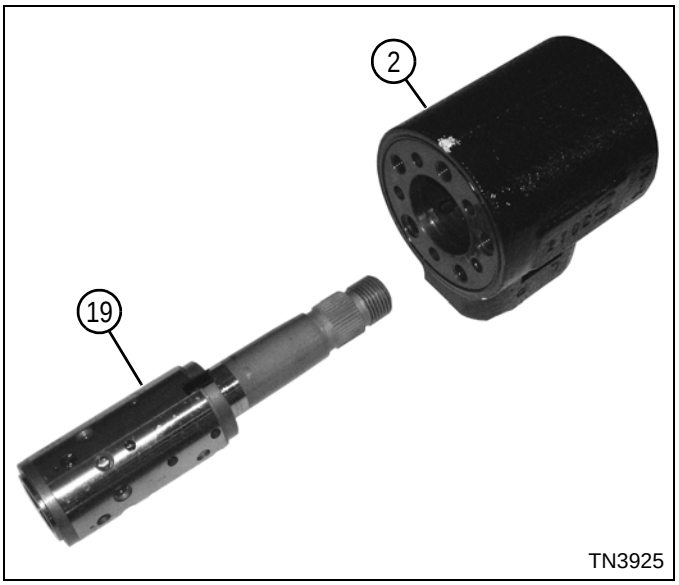


Figure 7-18

11. Remove spool and sleeve assembly (19) as a unit from the housing (2).

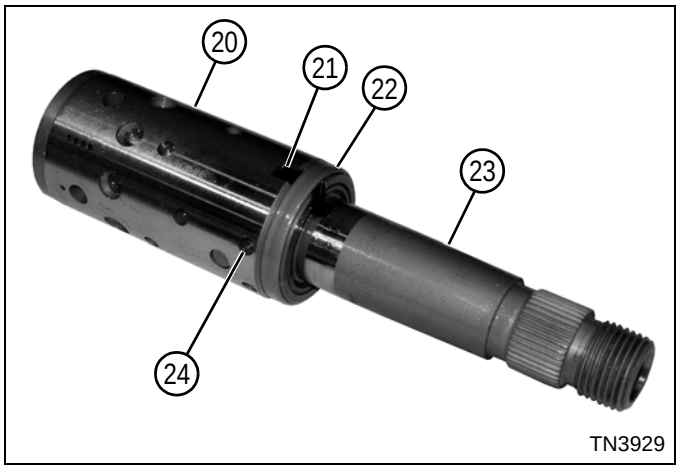


Figure 7-19

NOTE

The spring retaining ring may remain inside the housing when the spool and sleeve assembly is removed.

12. Remove spring retaining ring (22).
13. Remove spring set (21) from spool (20).
14. Remove cross pin (24) from spool (23) and sleeve (20), and remove spool from sleeve.

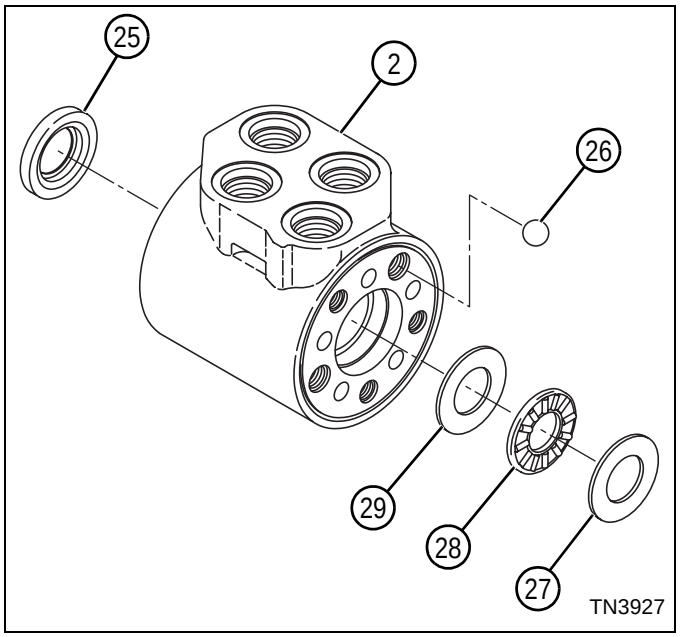


Figure 7-20

15. Remove thin washer (27), thrust bearing (28), and thick washer (29).

NOTE

Note the location of the check valve ball to ensure correct installation.

16. Remove fixture from vise and shake out check valve ball (26) from port “T.”

17. Re-secure service fixture in vise with input shaft down.
18. Remove housing (2) from service fixture.
19. Remove seal (25) from housing (2).

WARNING

Use appropriate eye protection when using compressed air for cleaning or drying purposes. Compressed air can cause serious personal injury. Use safety reduction valves to reduce the air pressure to a safe level before use.

NOTICE

It is important that all components are absolutely clean, as contamination can result in serious damage and/or improper operation.

Never use shop towels or rags to dry parts after cleaning, as lint may clog passages. Dry parts using compressed air.

20. Clean all parts using clean solvent, and dry using compressed air.
21. Inspect all parts for excessive wear, cracks, broken parts, and damaged threads.

Assembly

See Figures 7-21 through 7-28.

CAUTION

Wear eye protection when assembling and disassembling the steering unit. Springs and other objects may be propelled into the air, causing eye injury.

Required Materials
Seal Kit

NOTES

- *Inspect all parts for wear or damage and replace as necessary.*
- *Lubricate all parts with clean hydraulic oil before assembly.*
- *Always install new O-rings for assembly; used parts may leak.*
- *Utilize steering unit service fixture for assembly. (See “Steering Unit Service Fixture” on page 7-7.)*

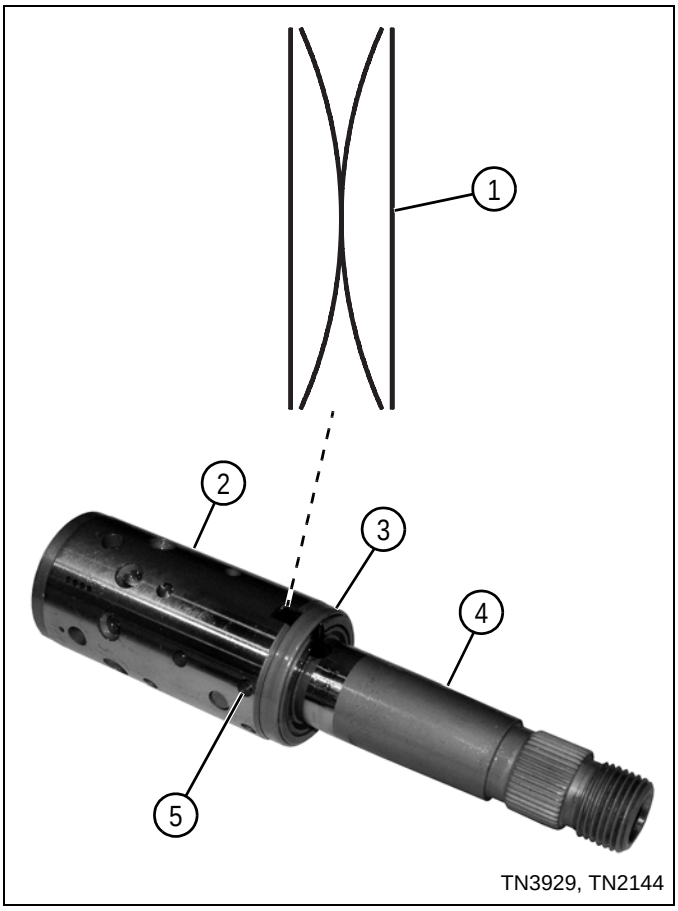


Figure 7-21

1. Assemble spool (4) into sleeve (2) and align so that cross pin slots are adjacent to each other.
2. Install cross pin (5) in the spool and sleeve assembly.

NOTES

- *See Figure 7-21. When installing spring set, insert the curved springs between the flat springs and push in place.*
- *Spring retaining ring must be able to rotate unimpeded by the springs.*

3. Center the spring set (1) in the spool and sleeve assembly, and install spring retaining ring (3).

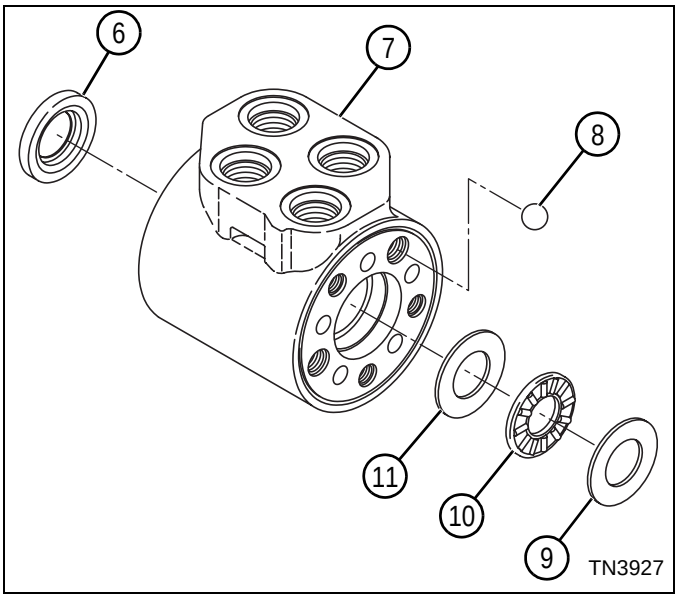


Figure 7-22

4. Install seal (6) in housing (7).
5. Lubricate the inside diameter of seal (6).
6. Place housing (7) into the service fixture, input shaft opening down. Secure the housing to the service fixture using four M6 x 16 mm screws and M6 lock washers.
7. Install thick washer (11), thrust bearing (10), and thin washer (9) in the housing (7).
8. Install check valve ball (8) into port “T.”

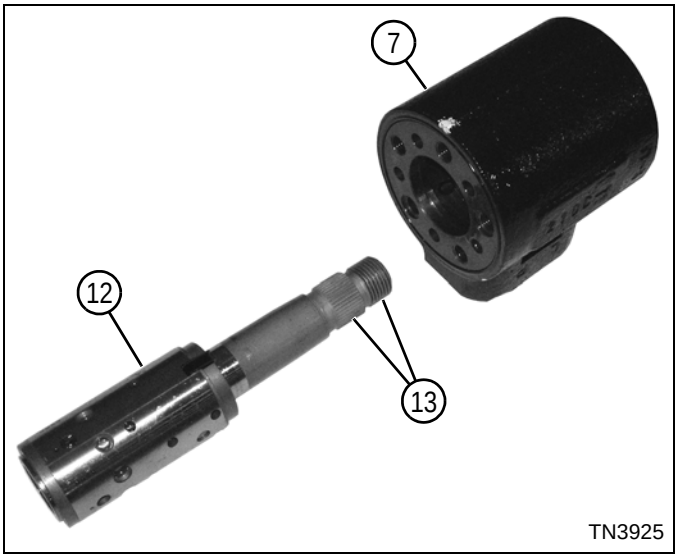


Figure 7-23

9. Wrap tape around the threaded and splined area (13) of the spool and sleeve assembly (12) to prevent damaging the seal during installation.
10. While holding the cross pin in place, guide the spool and sleeve assembly (12) into housing (7).

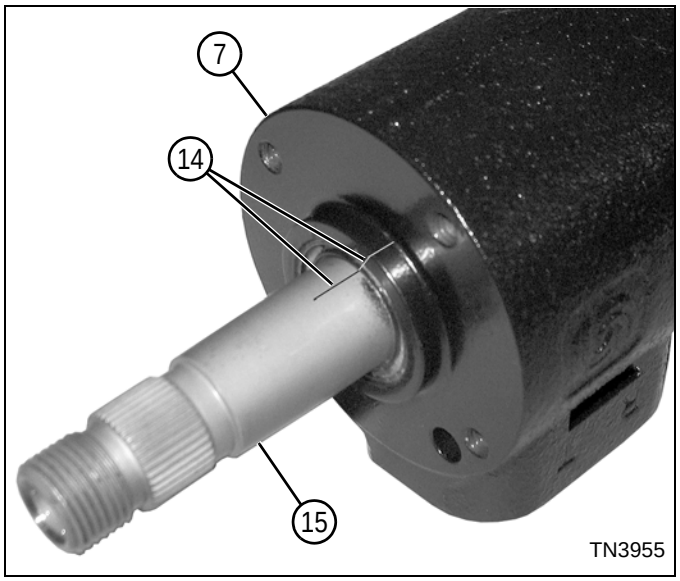


Figure 7-24

11. Align the lines (14) on the output shaft (15) and housing (7).

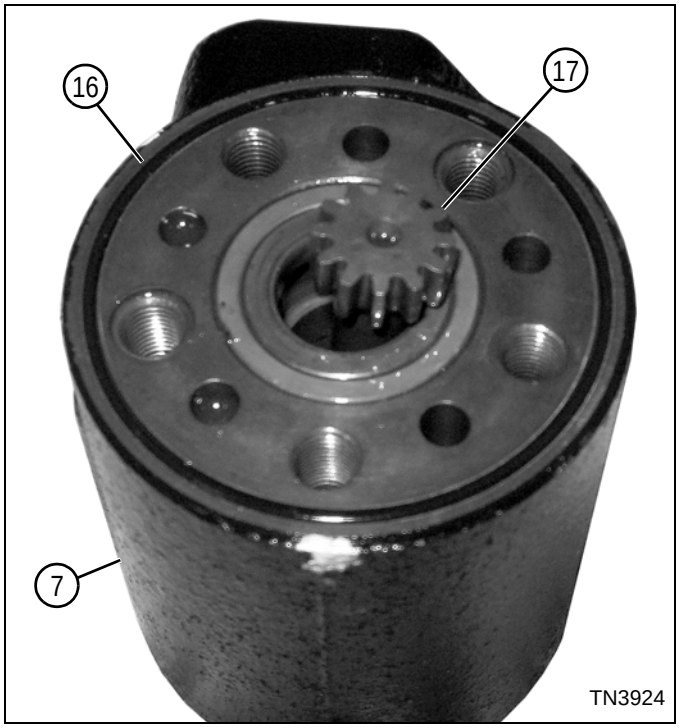


Figure 7-25

12. Install O-ring (16) in housing (7).
13. Install cardan shaft (17), making sure the slot in the shaft fits over the cross pin in the spool and sleeve assembly.

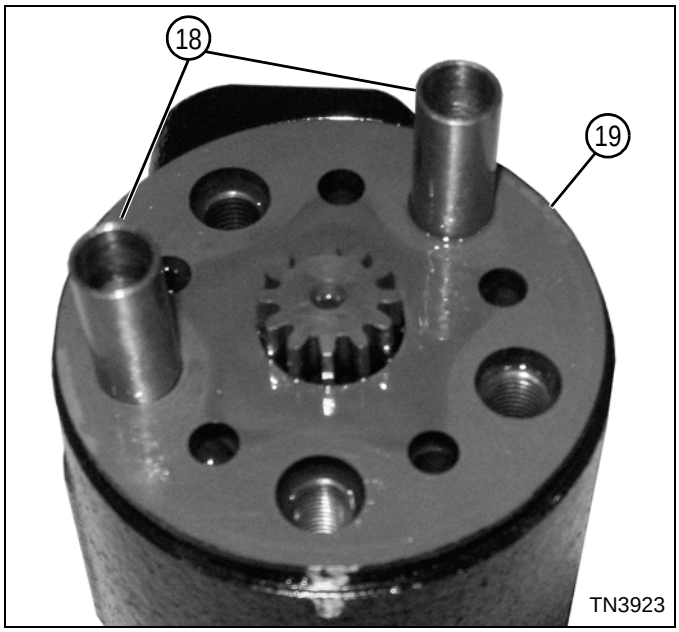


Figure 7-26

14. Install two sleeves (18).
15. Install distributor plate (19).

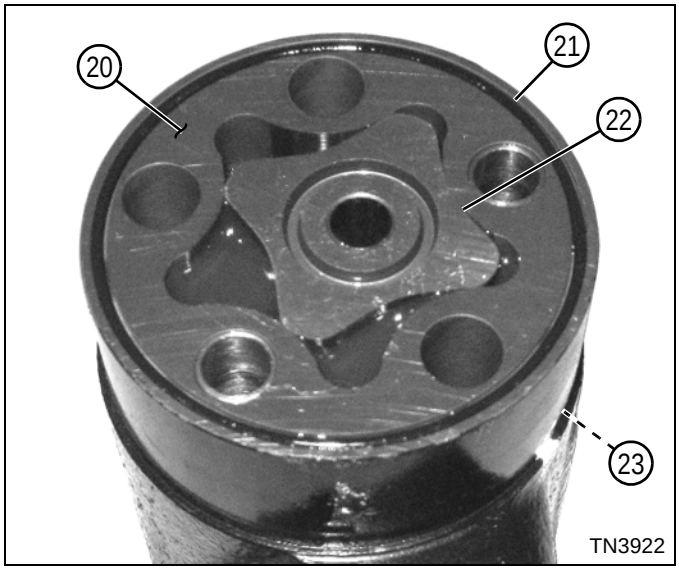


Figure 7-27

16. Install a new O-ring (23) in the distributor plate side of the gearwheel rim (20).

NOTE

When installing the gearwheel, the gearwheel must be correctly aligned so that it engages with the cardan shaft.

17. Install gearwheel rim (20) and gearwheel (22) onto the distributor plate, in the same orientation as noted during removal.
18. Install a new O-ring (21).

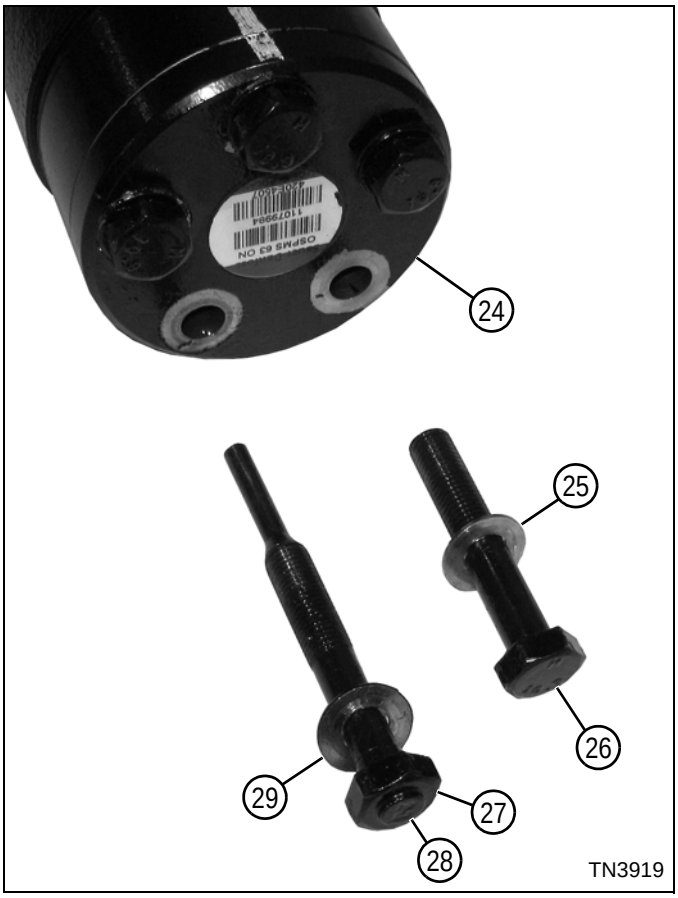


Figure 7-28

19. Align end cover (24) to housing and install special screw (28) with nut (27) and washer (29) into the same location in the end cover as noted during removal. Do not tighten at this time.
20. Install four special screws (26) and washers (25) into the end cover (24). Do not tighten at this time.
21. Tighten screws in an alternating pattern to 20–24 lb-ft (27–33 N·m).
22. Remove steering unit from the service fixture.

Steering Cylinder

Removal and Installation

See Figures 7-29 through 7-31.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Raise hydraulic oil/fuel tank. (See “Raise Hydraulic Oil/Fuel Tank” on page 9-4.)
3. Thoroughly clean the area surrounding the steering cylinder, especially the hydraulic hose fittings.

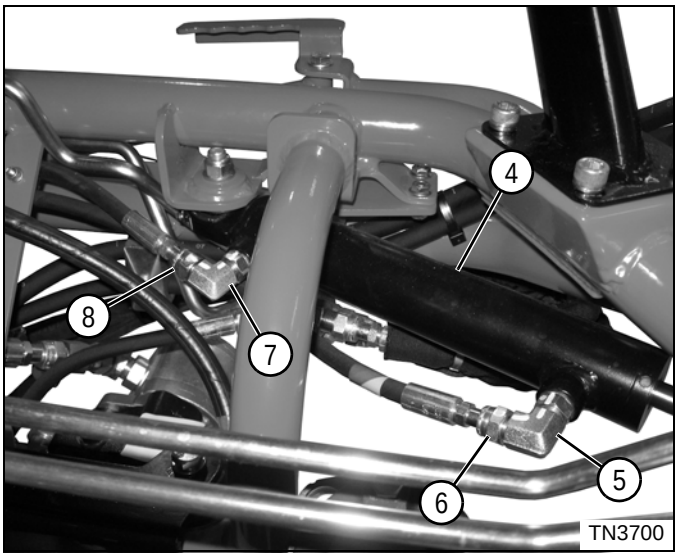


Figure 7-29

NOTES

- *Label all hydraulic hoses before disconnecting to ensure correct installation.*
- *Close all openings with caps or plugs to prevent contamination.*

4. Disconnect hydraulic hoses (5 and 6) from steering cylinder (4).
5. Swing the rear swing arm out to allow access to the steering cylinder.

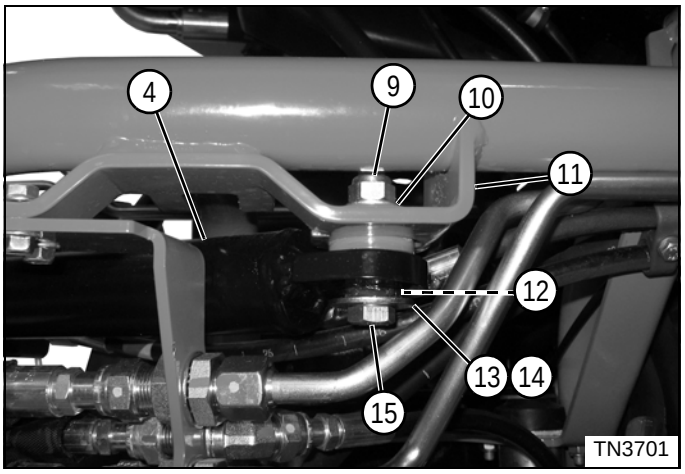


Figure 7-30

6. Support the steering cylinder (4).
7. Remove lock nut (9), washers (10, 13, and 14), and screw (15).
8. Remove steering cylinder (4) and sleeve (12) from bracket (11).

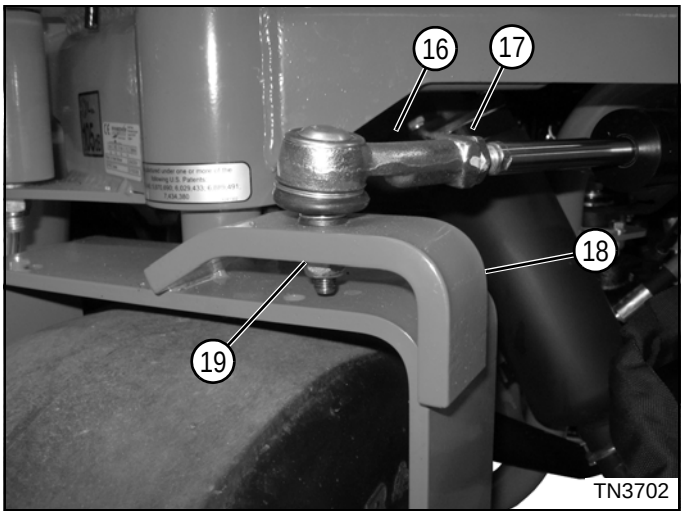


Figure 7-31

9. Remove lock nut (19) from ball joint (16).
10. Disconnect ball joint (16) from steering yoke (18).
11. Remove steering cylinder (4) from steering yoke (18).

NOTES

- *Record the location and orientation of the fittings (5 and 7) before removing to ensure correct installation.*
- *Record the orientation of the ball joint (16) before removing to ensure correct installation.*
- *Record the number of turns required to remove ball joint (16).*

12. Remove fittings (5 and 7) from steering cylinder (4).

13. Remove ball joint (16) and jam nut (17) from steering cylinder (4).
14. Inspect ball joint. Replace as needed.

Installation Notes

- *Install steering cylinder by reversing the order of removal.*
- *Lubricate grease fitting with grease that meets or exceeds NLGI Grade 2 LB specifications.*
- *Check hydraulic oil level. Add oil as needed.*
- *Start the machine and check cylinder operation. Check for hydraulic leaks. Repair as necessary.*

Disassembly, Inspection, and Assembly

See Figures 7-32 through 7-37.

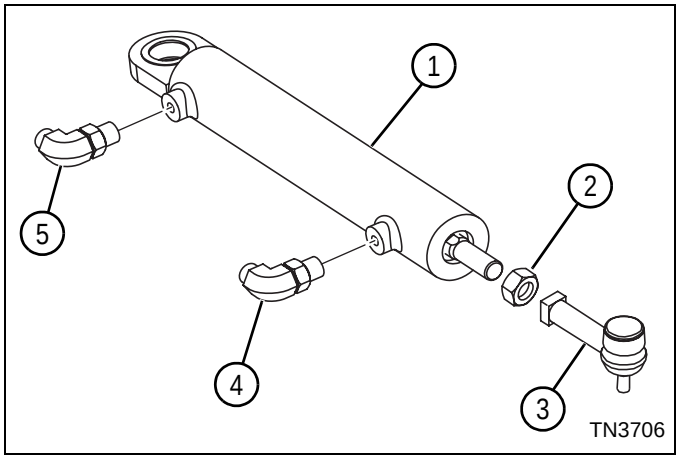


Figure 7-32

NOTES

- *Record the location and orientation of fittings before removing to ensure correct installation.*
- *Record the number of turns required to remove the ball joint to ensure correct installation.*

1. Remove, inspect, and replace fittings (4 and 5) from steering cylinder (1) as necessary.
2. Remove ball joint (3) and nut (2) from rod.

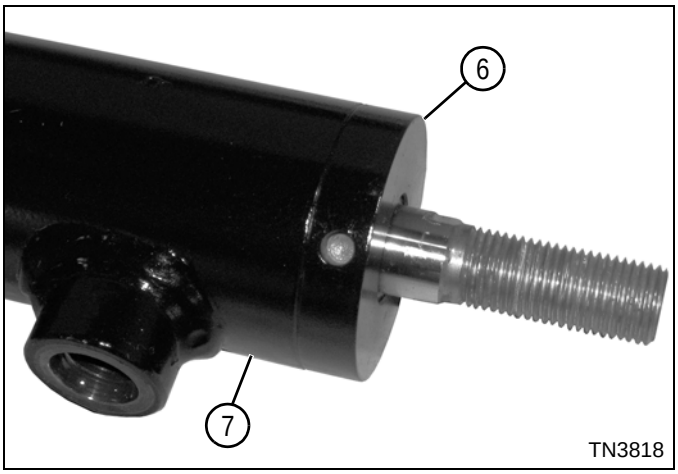


Figure 7-33

3. Use a spanner wrench to remove rod guide (6) from barrel (7).

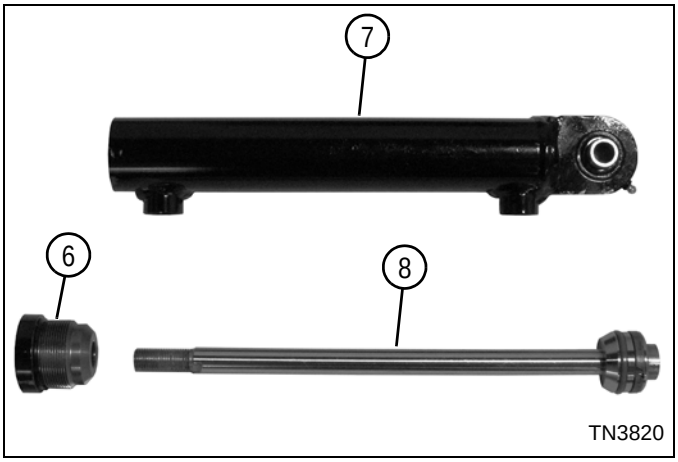


Figure 7-34

4. Remove rod guide (6) and rod (8) from barrel (7) as an assembly.
5. Remove rod guide (6) from rod (8).

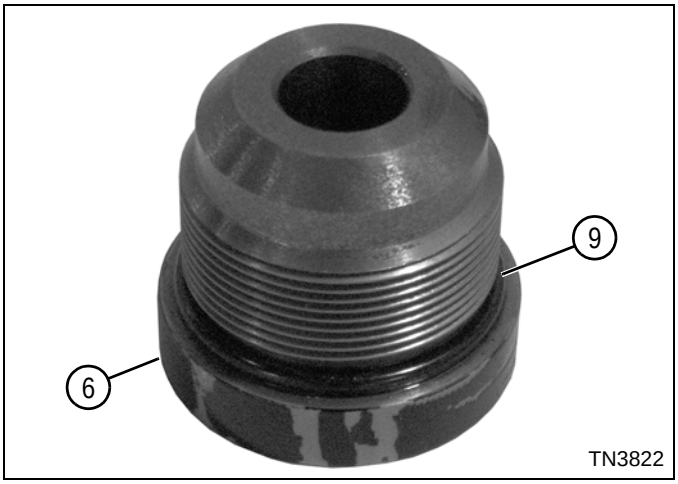


Figure 7-35

6. Remove O-ring (9) from rod guide (6).

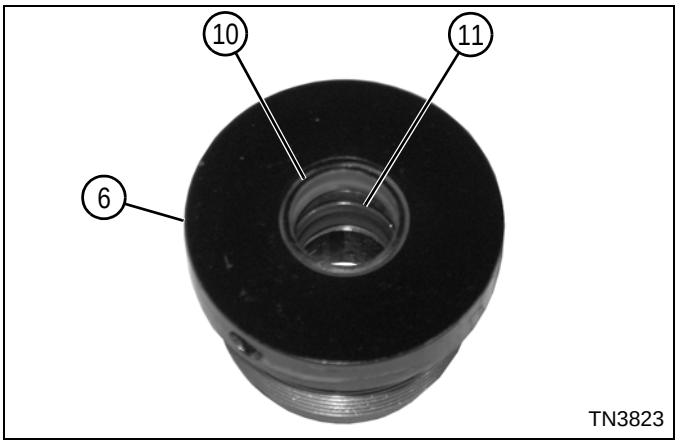


Figure 7-36

7. Remove seals (10 and 11) from rod guide (6).

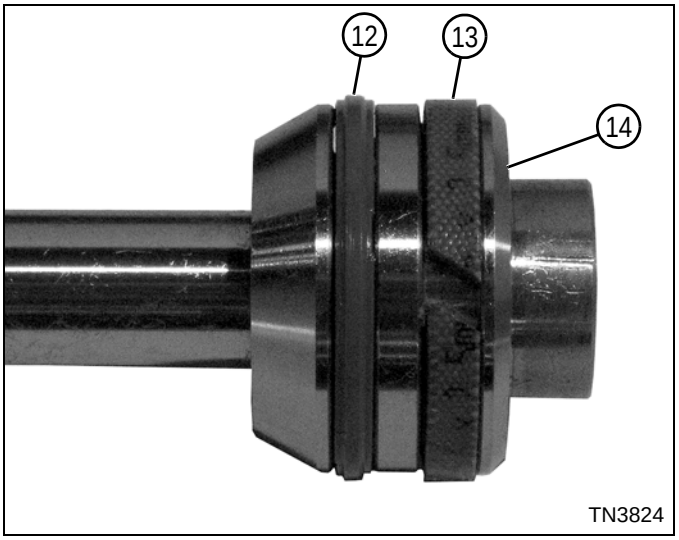


Figure 7-37

8. Remove seals (12 and 13) from piston (14).

WARNING

Use appropriate eye protection when using compressed air for cleaning or drying purposes. Compressed air can cause serious personal injury. Use safety reduction valves to reduce the air pressure to a safe level before use.

NOTICE

It is important that all components are absolutely clean, as contamination can result in serious damage and/or improper operation.

Never use shop towels or rags to dry parts after cleaning, as lint may clog passages. Dry parts using compressed air.

9. Clean all parts using clean solvent, and dry using compressed air.
10. Inspect all parts for excessive wear, cracks, broken parts, and damaged threads.
11. Inspect the barrel for dents, score lines, or grooves inside.

Assembly Notes

Required Materials
Seal Kit

- *Assemble steering cylinder by reversing the order of disassembly.*
- *Lubricate all parts with clean hydraulic oil before assembly.*
- *Install new seals and O-rings.*

Steering Yoke Assembly

Removal and Installation

See Figures 7-38 and 7-39.

NOTE

2WD steering assembly is shown; 3WD steering assembly is similar.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Raise hydraulic oil/fuel tank. (See “Raise Hydraulic Oil/Fuel Tank” on page 9-4.)
3. For 3WD models, remove rear wheel motor. (See “Wheel Motors” on page 5-57.) For 2WD models, remove rear wheel and steering axle. (See “Rear Wheel and Steering Axle—2WD Units (Diesel)” on page 9-22.)

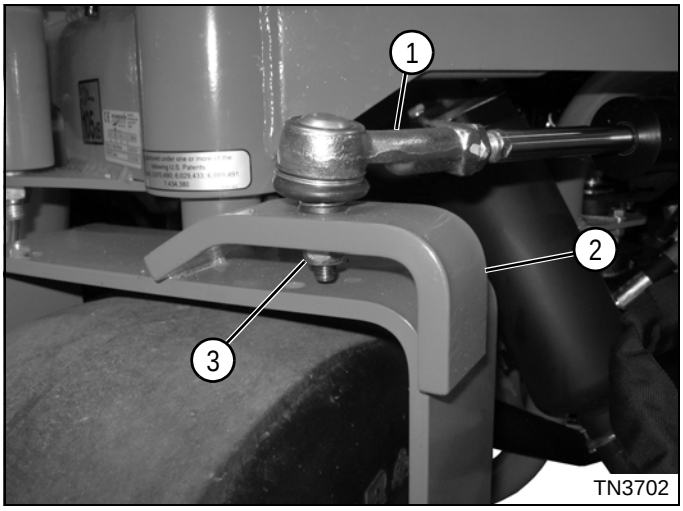


Figure 7-38

4. Remove lock nut (3) from ball joint (1).
5. Disconnect ball joint (1) from steering yoke (2).

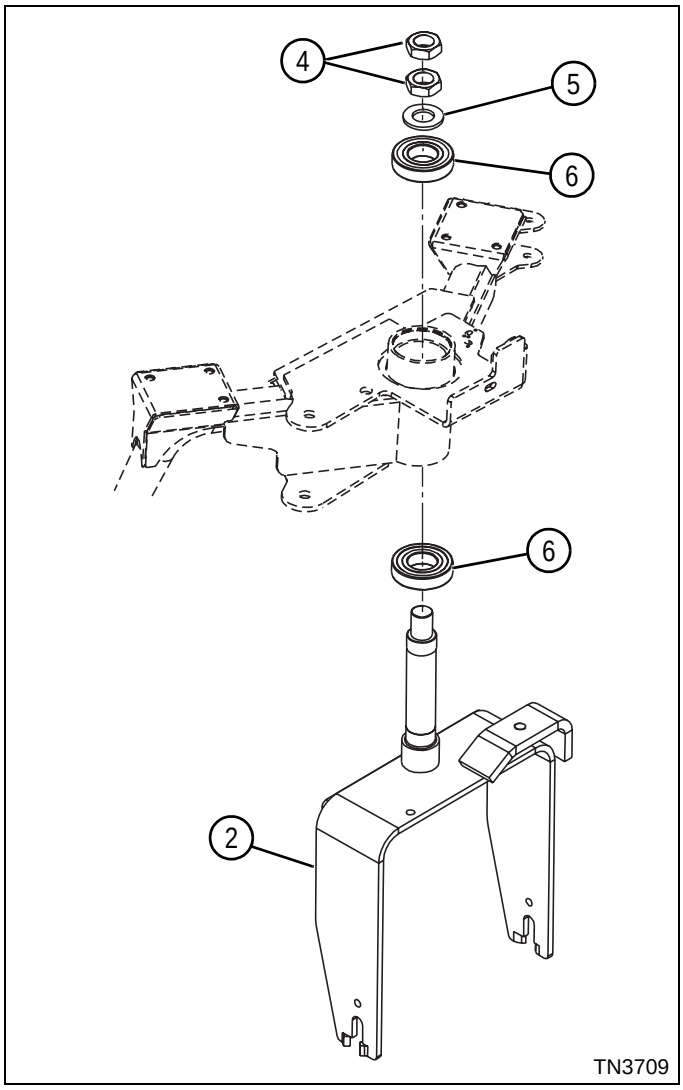


Figure 7-39

6. Support the steering yoke (2) using an appropriate lifting device.
7. Remove two nuts (4) and washer (5), and remove steering yoke (2) from frame.
8. Inspect upper and lower bearings (6). Replace as required.

Installation Note

Install steering yoke assembly by reversing the order of removal.

7

Chapter 8

Cutting Units

8

JACOBSEN
A Textron Company

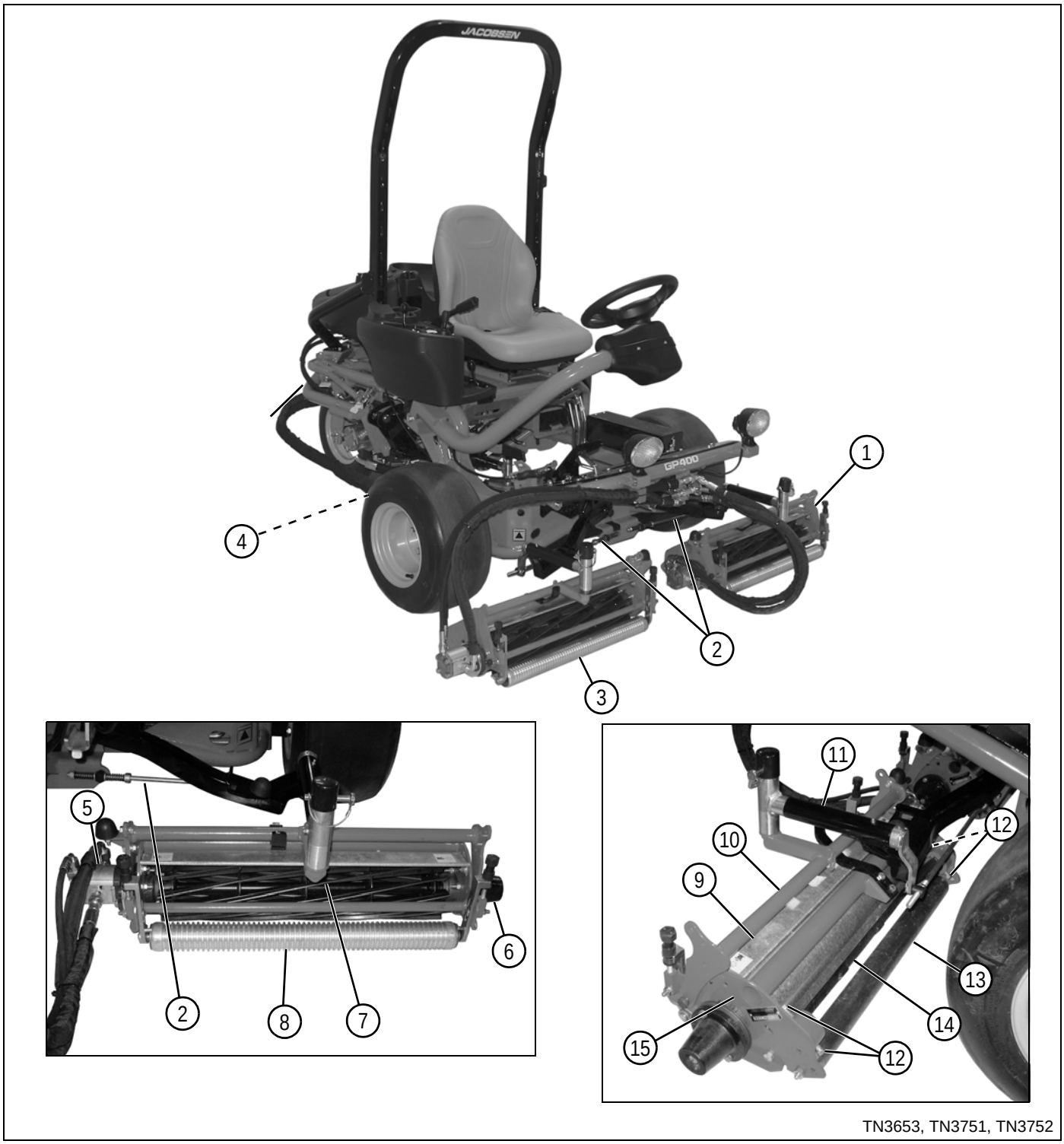
Specifications

Checks and Adjustments		
Bedknife Front Face Height	in. (mm)	0.040 (1.0)
Bedknife Front Face Angle	degrees	5
Bedknife Top Face Angle (Rear Relief)	degrees	8–10
Reel Blade Relief Angle	degrees	45
Bedknife-to-Reel Gap	in. (mm)	0.001–0.003 (0.025–0.076)
Reel Bearing Pre-Load	in. (mm)	0.040 (1.0)
Right/Left Reel Leveling Rod—Rod End-to-Rod Connecting Pin Face Measurement (Non-Spring Side)	in. (mm)	1.5 (38.1)
Reel Leveling Rod—Rod End-to-Collar Face Measurement (Spring Side)	in. (mm)	4.606 (117)
Reel Leveling Rod—Rod End-to-Nut Face Measurement (Spring Side)	in. (mm)	0.094 (2.4)

Repair		
Reel Motor Mounting Nut Torque	lb-ft (N·m)	18 (24)
Reel Motor—Rear Cover-to-Body Retaining Screw Torque	lb-ft (N·m)	18.5 (25)
Reel Motor—Case Drain Fitting Torque	lb-ft (N·m)	15.5 (21)
Reel Motor—IN Port Fitting Torque	lb-ft (N·m)	54.6 (74)
Reel Motor—OUT Port Fitting Torque	lb-ft (N·m)	54.6 (74)
Reel Bearing Housing Assembly Mounting Screw Torque	lb-ft (N·m)	18–22 (24.4–29.8)
Bedknife Backing Mounting Screw Torque	lb-ft (N·m)	25–37 (33.9–50.2)
Bedknife Mounting Screw Torque	lb-in. (N·m)	90–120 (10.2–13.6)
Rear Roller Mounting Screw Torque	lb-ft (N·m)	16–24 (21.7–32.5)

Component Location

See Figure 8-1.



TN3653, TN3751, TN3752

1	Left Cutting Unit	5	Reel Motor	9	Grass Shield	13	Cutting Unit Rear Roller
2	Lift Lerveling Rods	6	Counterweight	10	Yoke	14	Bedknife Backing Assembly
3	Right Cutting Unit	7	Reel Assembly	11	Lift Arm	15	Cutting Unit Frame
4	Center Cutting Unit	8	Cutting Unit Front Roller	12	Adjusters		

Figure 8-1: Component Location

Troubleshooting

Quality-of-Cut Troubleshooting

Factors That Affect Cut Appearance

Even though the cutting units are properly sharpened and adjusted, some mowing practices and turf conditions can cause poor cutting results. These include:

- Repetitious mowing patterns—tires running over the same path—may cause depressions and ruts. This is also known as compaction.
- Mowing with excessive moisture in the ground may result in varying cutting heights. The mower slides over the wet turf, leaving grass uncut and depressed.
- Repetitious cutting of grass in the same direction may cause the grass to take a permanent set in that direction. The reel and bedknife have difficulty “lifting” the grass into cutting position. This condition is called graining.
- Poor quality grass that is matted cannot be lifted and cut uniformly.
- Dry grass does not lubricate the blades and leads to early dulling of the blades.

In most cases, information provided by the user/customer will provide the basis for the repairs and adjustments that may be required. However, it is recommended that a “test cut” be performed to evaluate the mower’s performance before beginning repairs or adjustments.

An area should be available where “test cuts” can be made. This area should provide known and consistent turf conditions to allow accurate evaluation of the mower’s performance.

Before performing a “test cut” to diagnose cut appearance and mower performance, verify the following items to ensure an accurate “test cut”:

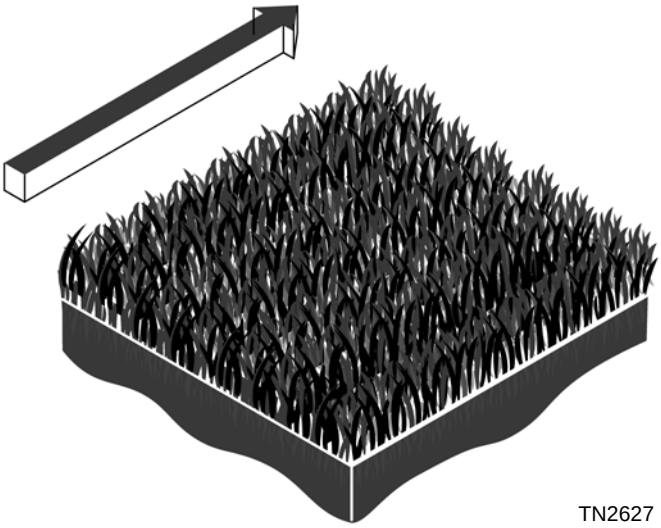
1. Mowing (Ground) Speed
2. Reel Bearing Condition and Pre-Load (End Play) Adjustment
3. Reel and Bedknife Sharpness
4. Bedknife Alignment to Reel
5. Bedknife-to-Reel Contact
6. Height-of-Cut (HOC)
7. Bedknife Application (Correct Bedknife)
8. Roller and Roller Bearing Condition
9. Reel Speed
10. Frequency-of-Clip (FOC)

Another “test cut” should be performed after the completion of the repairs and/or adjustments to verify the mower’s performance.

Definition of Terms

The following terms are used to describe various cut appearance symptoms.

Ragged Cut



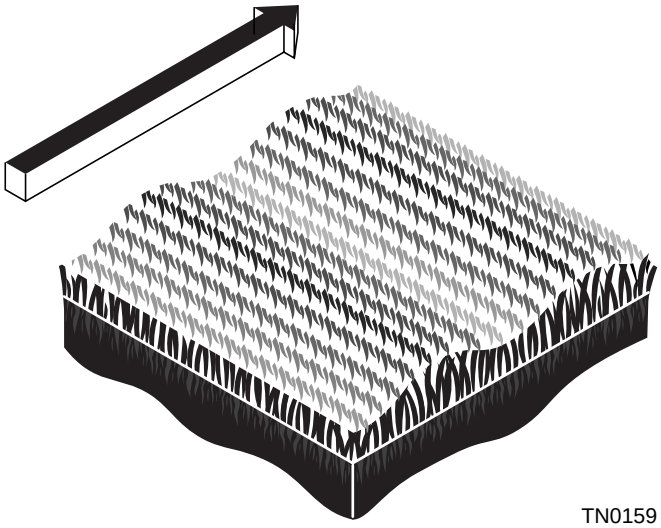
TN2627

NOTE: Arrow indicates direction of travel.

Ragged cutting occurs when blades of grass are torn or damaged rather than cut. This is usually caused by incorrect height-of-cut adjustment, incorrect bedknife-to-reel adjustment, or dull blades.

Probable Cause	Remedy
Incorrect cutting height adjustment.	Adjust to the proper height-of-cut. (See “Height-of-Cut (HOC) Adjustment” on page 8-18.)
Incorrect bedknife-to-reel clearance.	Adjust the bedknife-to-reel clearance. (See “Bedknife-to-Reel Clearance Adjustment” on page 8-17.)
Worn or damaged reel bearings.	Replace the reel bearings. (See “Reel Bearing Housing Assembly” on page 8-34.)
Incorrectly adjusted bearing pre-load.	Adjust the bearing pre-load. (See “Reel Bearing Pre-Load Adjustment” on page 8-19.)
Dull bedknife and/or reel blades.	Sharpen the bedknife and reel blades. (Refer to “Parts and Maintenance Manual.”)
Wavy or rifled bedknife.	Grind and adjust the reel and bedknife. (Refer to “Parts and Maintenance Manual” and see “Bedknife-to-Reel Clearance Adjustment” on page 8-17.)

Washboarding



TN0159

NOTE: Arrow indicates direction of travel.

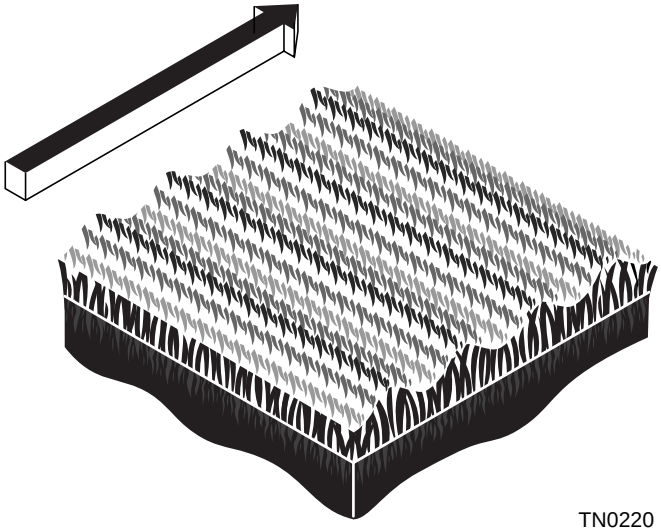
Washboarding is a cyclical pattern of varying cutting heights, resulting in a wave-like cut appearance. In most cases, the wave tip-to-tip distance is approximately 6–8 in. (15–20 cm). Color variation (light-to-dark) may also be noticed.

This condition is usually caused by a rocking motion in the cutting unit(s). This condition is found mostly on mowers with multiple (suspended) cutting units.

Washboarding may also be caused by variations in the turf.

Probable Cause	Remedy
Mowing (ground) speed is too fast.	Reduce mowing (ground) speed.
Grass buildup on roller.	Clean the roller and scraper.
Roller is out of round.	Replace roller. (See “Front Roller” on page 8-38 and “Rear Roller” on page 8-38.)
Mowing in the same direction all the time.	Change mowing direction regularly.
Use of a groomer on cleanup pass.	Use groomers only when cutting in a straight line.
Reel motor performance is reduced.	Check operation of reel motor(s) and repair/replace as necessary. (See “Reel Motor” on page 8-28.)

Marcelling



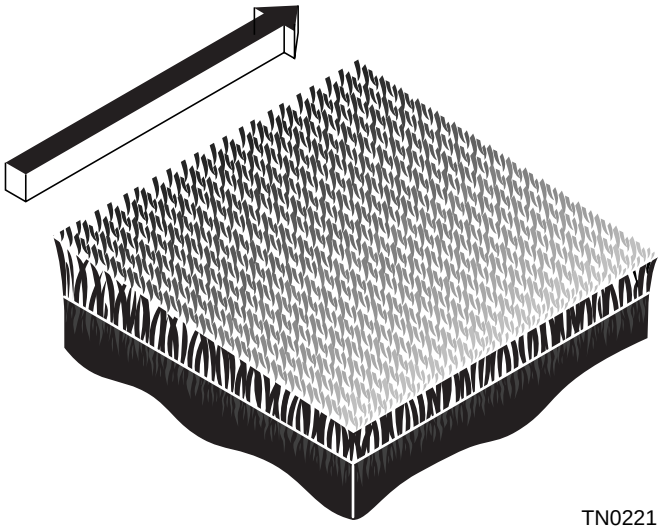
TN0220

NOTE: One cutting unit width shown. Arrow indicates direction of travel.

Marcelling is a wave-like cut appearance similar to washboarding but with a uniform cutting height and smaller wave tip-to-tip distance. In most cases, the wave tip-to-tip distance is 2 in. (5 cm) or less. Color variation (light-to-dark) may also be noticed. This condition is usually caused by an incorrect frequency-of-clip.

Probable Cause	Remedy
Incorrect frequency-of-clip.	Check and adjust frequency-of-clip. Frequency-of-clip must be equal to or less than height-of-cut. Verify proper reel is being used for the correct application and change if necessary. May need more blades.
Mowing (ground) speed is too fast.	Reduce mowing (ground) speed.
HOC (height-of-cut) setting is too low for the machine's capability.	Confirm proper HOC range for reel/bedknife combination.
Reel speed is too low.	Check operation of reel motor(s) and repair/replace as necessary. (See "Reel Motor" on page 8-28.)

Step Cutting



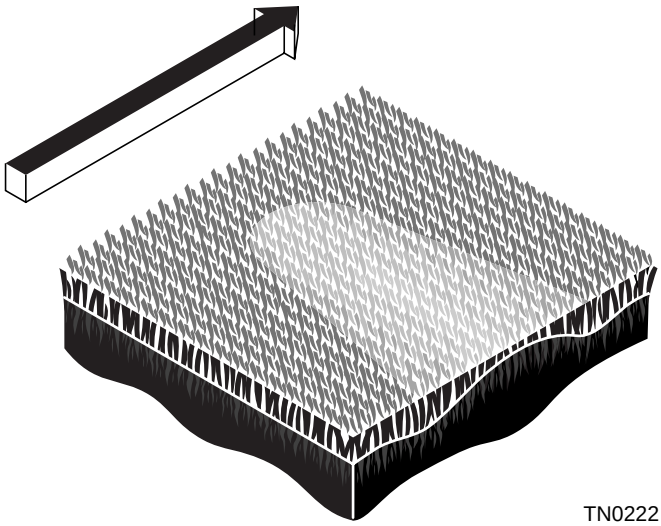
TN0221

NOTE: Arrow indicates direction of travel.

Step cutting occurs when grass is cut taller on one side of a cutting unit than on the other, or on one side of the mower than on the other. This is usually caused by mechanical wear or an incorrect roller or adjustment.

Probable Cause	Remedy
HOC (height-of-cut) settings are different from one side of a reel to the other, or from one cutting unit to another.	Check HOC adjustment of cutting units. (See “Height-of-Cut (HOC) Adjustment” on page 8-18.)
Worn roller bearings.	Check/replace roller bearings. (See “Roller Bearings” on page 8-39.)
Worn reel bearings.	Replace reel bearings. (See “Reel Bearing Housing Assembly” on page 8-34.)
Bedknife-to-reel contact is different from one side of the cutting unit to the other.	Check bedknife-to-reel clearance. (See “Bedknife-to-Reel Clearance Adjustment” on page 8-17.)
Cutting unit movement is restricted.	Check/remove cutting unit movement restriction.
Variations in turf density.	Change mowing direction.
Machine ride height is uneven from side to side.	Check/adjust tire inflation pressure. (Refer to “Parts and Maintenance Manual.”)
Mower frame is bent.	Repair or replace as needed.

Scalping



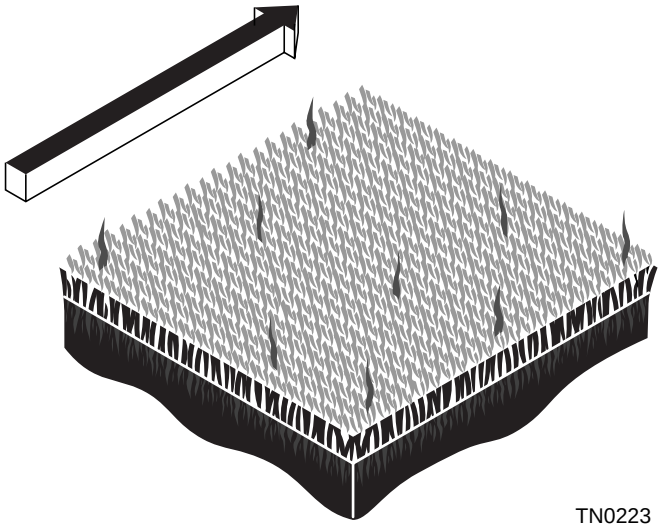
TN0222

NOTE: Arrow indicates direction of travel.

Scalping is a condition in which areas of grass are cut noticeably shorter than the surrounding areas, resulting in a light green or even brown patch. This is usually caused by an excessively low height-of-cut setting and/or uneven turf.

Probable Cause	Remedy
HOC (height-of-cut) settings are lower than normal.	Check and adjust the HOC settings. (See “Height-of-Cut (HOC) Adjustment” on page 8-18.)
Turf too uneven for the mower to follow.	Change mowing direction.
Incorrect bedknife for HOC.	Install correct bedknife for desired HOC.
Cutting too much grass at one time.	Mow more often.
Mowing (ground) speed is too fast.	Reduce mowing (ground) speed.

Stragglers



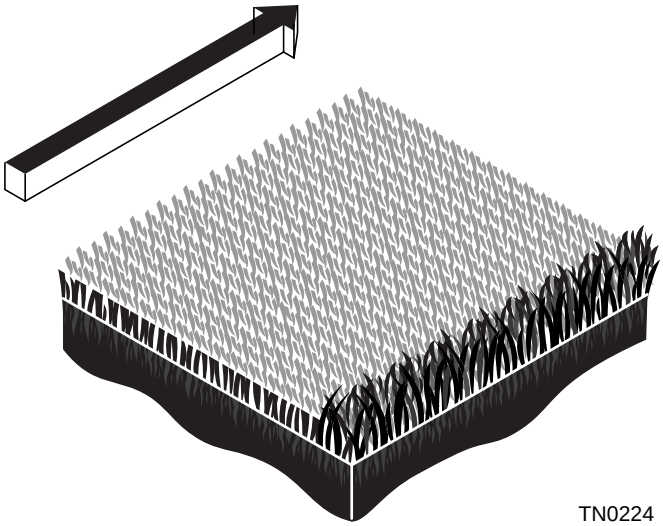
TN0223

Stragglers are scattered blades of uncut or poorly cut grass.

NOTE: Arrow indicates direction of travel.

Probable Cause	Remedy
Bedknife improperly adjusted.	Adjust bedknife. (See “Bedknife-to-Reel Clearance Adjustment” on page 8-17.)
Dull cutting edges.	Sharpen reel and bedknife. (Refer to “Parts and Maintenance Manual.”)
Mowing (ground) speed is too fast.	Reduce mowing (ground) speed.
Incorrect roller.	Install correct roller for application.
Grass is too tall.	Mow more often.
Mowing in the same direction all the time.	Change mowing direction regularly.

Streaks



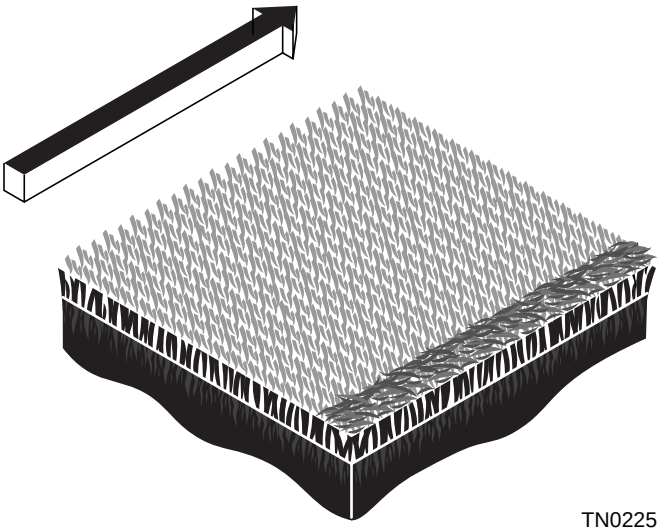
TN0224

A streak is a line of uncut grass. This is usually caused by a damaged bedknife or reel blade.

NOTE: Arrow indicates direction of travel.

Probable Cause	Remedy
Damaged bedknife.	Replace bedknife. (See “Bedknife” on page 8-33.)
Damaged or unevenly worn reel.	Inspect reel. Replace as needed. (See “Reel Assembly” on page 8-37 or “Front Roller” on page 8-38.)
Loose or missing bedknife fasteners.	Check bedknife screws. Tighten loose screws; replace missing screws. (See “Bedknife” on page 8-33.)
Incorrect roller.	Install correct roller for application. (See “Front Roller” on page 8-38 or “Rear Roller” on page 8-38.)
Bedknife is matting the grass down.	Install correct bedknife for application.
Turning too aggressively. Cutting units don’t overlap during turns or on side hills.	Turn less aggressively to allow cutting units to overlap. Change mowing direction or pattern on side hills.
Tire mats down grass before it is cut.	Check/adjust tire inflation pressure. (Refer to “Parts and Maintenance Manual.”)
Wet grass is matted down before it is cut.	Cut when grass is dry.

Windrowing



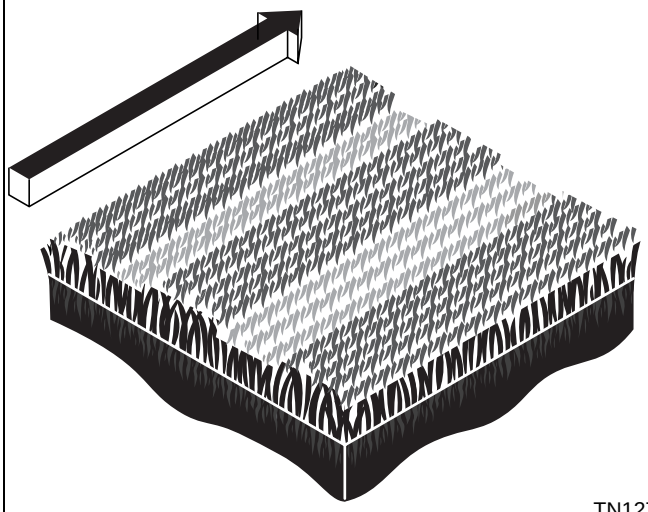
TN0225

Windrowing is the deposit of clippings concentrated at one end of cutting unit(s) or between cutting units, forming line(s) in the direction of travel.

NOTE: Arrow indicates direction of travel.

Probable Cause	Remedy
Grass is too tall.	Mow more often.
Mowing while grass is wet.	Mow when grass is dry.
Grass buildup on roller.	Clean rollers and scrapers.
Grass collecting on mower or cutting unit frame.	Clear cutting unit(s) grass shield.

Mismatched Cutting Units



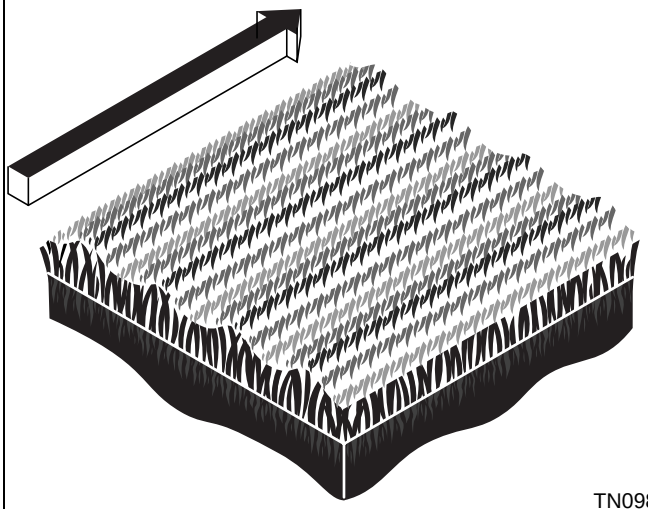
TN1278

Mismatched cutting units cause a pattern of varying cutting heights, resulting in a stepped cut appearance, usually due to a different HOC (height-of-cut) adjustment from one cutting unit to another.

NOTE: Arrow indicates direction of travel.

Probable Cause	Remedy
HOC inconsistent from one cutting unit to another.	Adjust HOC on cutting units to same height. (See “Height-of-Cut (HOC) Adjustment” on page 8-18.)
	Check condition of cutting unit frame and/or mower frame. Repair or replace as needed.
Difference in reel motor speeds.	Check operation of reel motor(s) and repair/replace as necessary. (See “Reel Motor” on page 8-28.)
Difference in mower ride height from side-to-side.	Check/adjust tire inflation pressure. (Refer to “Parts and Maintenance Manual.”)

Rifling or Tramlining



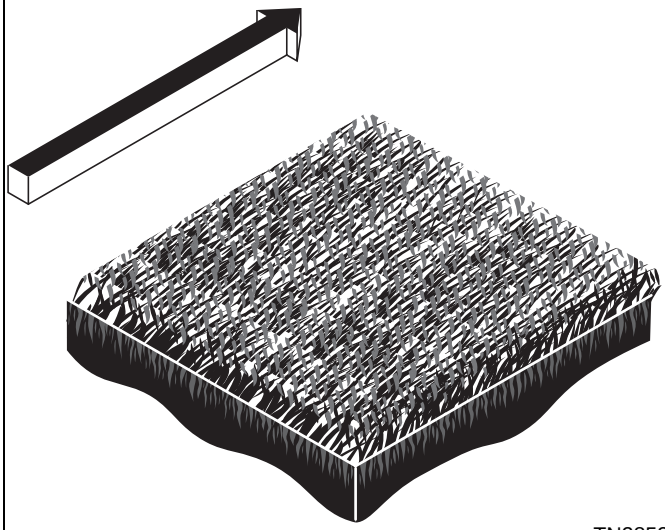
TN0987

NOTE: Arrow indicates direction of travel.

Rifling or tramlining is a pattern of varying cutting heights, resulting in a wave-like cut appearance, usually due to heavy contact points across the reel and/or bedknife.

Probable Cause	Remedy
Reel and/or bedknife unevenly worn.	Inspect bedknife and reel. Grind or replace as needed. (Refer to "Parts and Maintenance Manual" and see "Bedknife" on page 8-33.)

Grass Graining



TN2853

Grass graining is a directional orientation of grass blades and/or stems usually due to mowing in one direction or constant traffic in one direction.

NOTE: Arrow indicates direction of travel.

Probable Cause	Remedy
Mowing in the same direction all the time.	Mow against the grain or change the mowing pattern.
Constant traffic direction.	Use a brush attachment on the cutting unit.
Nature of grass growth influenced by water.	Use Turf Groomer® or vertical mower.

Mechanical Troubleshooting

Condition	Probable Cause	Remedy
Reel drive does not engage.	Traction lever and/or mow/transport switch not in the mow position.	Move traction lever and/or mow/transport switch to the mow position. (Refer to “Safety and Operation Manual.”)
	Reel motor faulty.	Repair or replace reel motor. (See “Reel Motor” on page 8-28.)
Reel drive does not reach full speed.	Reel motor faulty.	Repair or replace reel motor. (See “Reel Motor” on page 8-28.)
	Bedknife-to-reel contact too tight.	Check bedknife-to-reel clearance adjustment. (See “Bedknife-to-Reel Clearance Adjustment” on page 8-17.)
Cutting unit roller does not rotate.	Roller is out of round and restricted by scraper and/or scraper is bent.	Replace roller or scraper. (See “Front Roller” on page 8-38 or “Rear Roller” on page 8-38.)
	Roller bearing faulty.	Replace roller bearing. (See “Roller Bearings” on page 8-39.)

Checks and Adjustments

Bedknife-to-Reel Clearance Adjustment

See Figures 8-2 and 8-3.

CAUTION

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

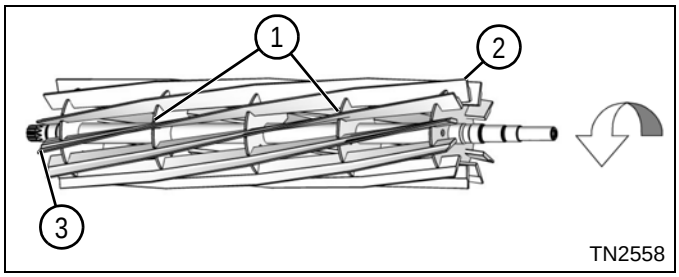


Figure 8-2

NOTES

- *Clearance between the bedknife and reel should be checked with a feeler gauge. Slide the feeler gauge between the bedknife and reel. There should be a slight drag on the feeler gauge. Do not turn the reel while making the check. Clearance should be checked at the outer ends of the reel, then at the inner set of spiders (1), and then in the middle.*
- *The bedknife-to-reel adjustment should be made by starting with the leading end of the reel (3) and following with the trailing end (2). The leading end of the reel blade is the end that passes over the bedknife first during normal reel rotation.*

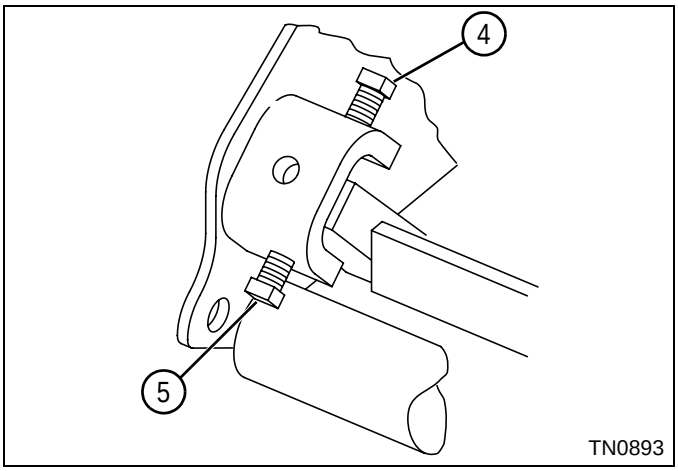


Figure 8-3

2. Adjust bedknife-to-reel gap to 0.001–0.003 in. (0.025–0.075 mm) between reel blade and bedknife using upper adjuster (4) and lower adjuster (5) on both leading and trailing edges of reel.

NOTES

- *Move the adjusting screws in very small increments when making bedknife-to-reel adjustments.*
- *Keep the adjusting screws tight against the bedknife backing for a positive clearance setting.*
- *Avoid aggressive tightening, or damage may occur to bedknife and reel blades.*
- *Poor bedknife-to-reel adjustment will occur if one screw is loosened too much and the other screw is brought in.*
- *Inconsistent bedknife-to-reel clearance settings will occur when opposing screws are at a low torque value. Final bedknife-to-reel adjustments may be done on the appropriate (single) opposing screw. During final adjustments, screws must be tightened, never loosened.*
- *When the reel and bedknife are properly adjusted, the reel will spin freely and will cut a piece of newspaper along the full length of the reel when the paper is held at a 90° angle to the bedknife.*

Height-of-Cut (HOC) Adjustment

See Figure 8-4.

CAUTION

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

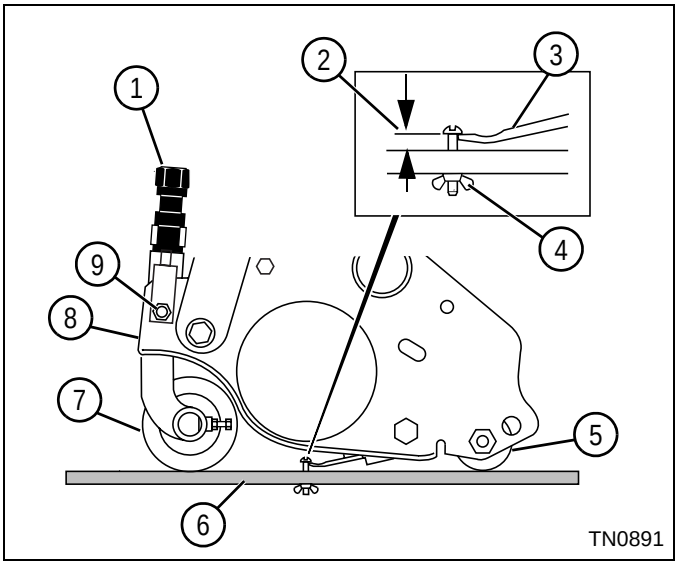


Figure 8-4

NOTE

The bedknife-to-reel clearance should be properly adjusted before adjusting the cutting height. (See “Bedknife-to-Reel Clearance Adjustment” on page 8-17.)

2. Loosen lock nut (9) on the side of front roller bracket (8) just enough to allow adjusting knob (1) to raise or lower the bracket.
3. Set height-of-cut bar (6) to desired height-of-cut (2) by measuring between underside of screw head and surface of height-of-cut bar and tightening the wing nut (4).
4. Place height-of-cut bar (6) across bottom of front roller (7) and rear roller (5), near one end.
5. Slide the head of the gauge screw over the bedknife (3).
6. Turn adjusting knob (1) to close the gap between the front roller (7) and rear roller (5) and the height-of-cut bar (6).
7. Tighten lock nut (9).
8. Repeat steps 2 through 7 on opposite end of front roller (7).
9. Recheck each end with height-of-cut bar and readjust as necessary.

NOTES

- *Check the position of each reel for desired height-of-cut.*
- *All reels must be accurately adjusted to exactly the same height for proper cutting.*

Grass Shield Adjustment

See Figure 8-5.

CAUTION

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

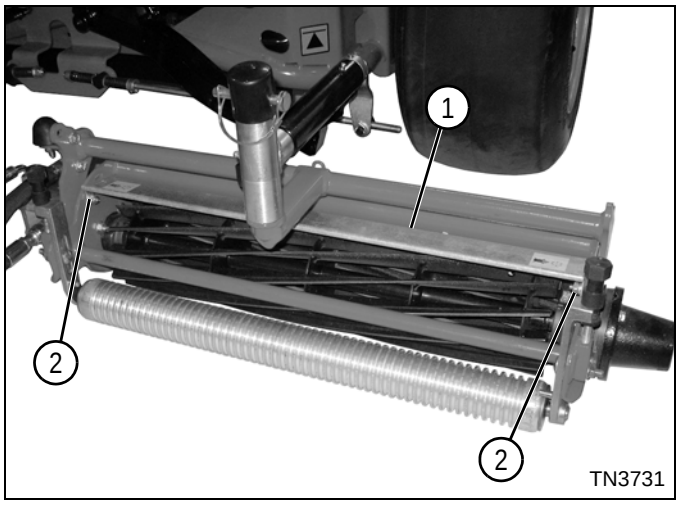


Figure 8-5

2. Loosen nut (2) on each end of grass shield (1) and adjust grass shield as close to reel blades as possible without making contact.
3. Tighten nut (2) on each end of grass shield.

Reel Bearing Pre-Load Adjustment

See Figures 8-6 through 8-10.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Back bedknife away from reel. (See “Bedknife-to-Reel Clearance Adjustment” on page 8-17.)

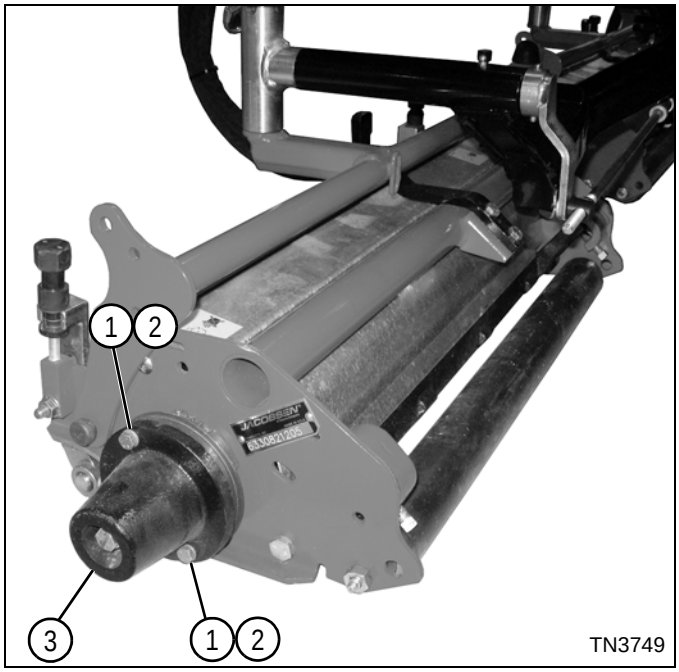


Figure 8-6

3. Remove two screws (1), two lock washers (2), and counterweight (3).

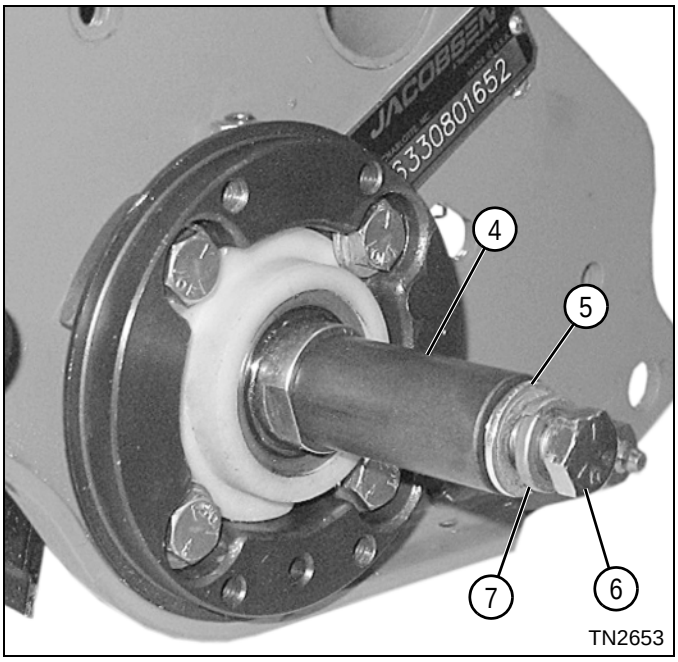


Figure 8-7

4. Remove screw (6), lock washer (7), washer (5), and spacer (4).

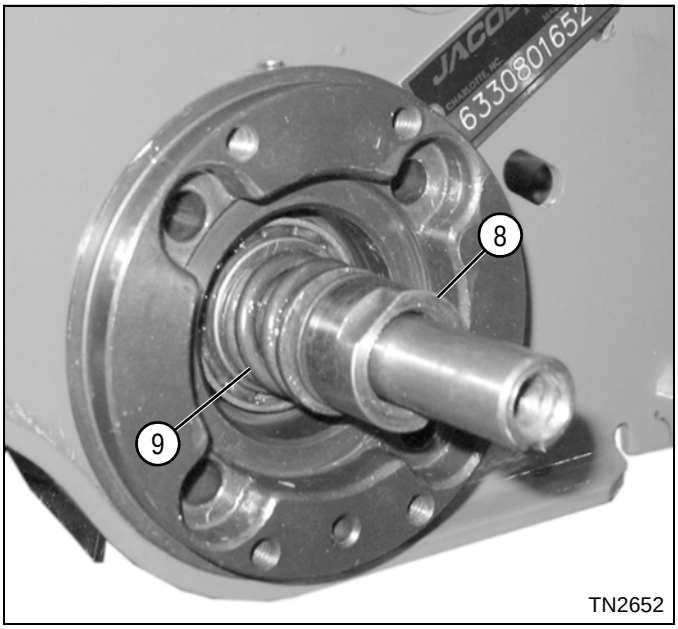


Figure 8-8

5. Tighten adjuster nut (8) until the spring (9) is completely collapsed, then back the nut out two or three turns, or until there is 0.040 in. (1.0 mm) side-to-side movement of the reel.

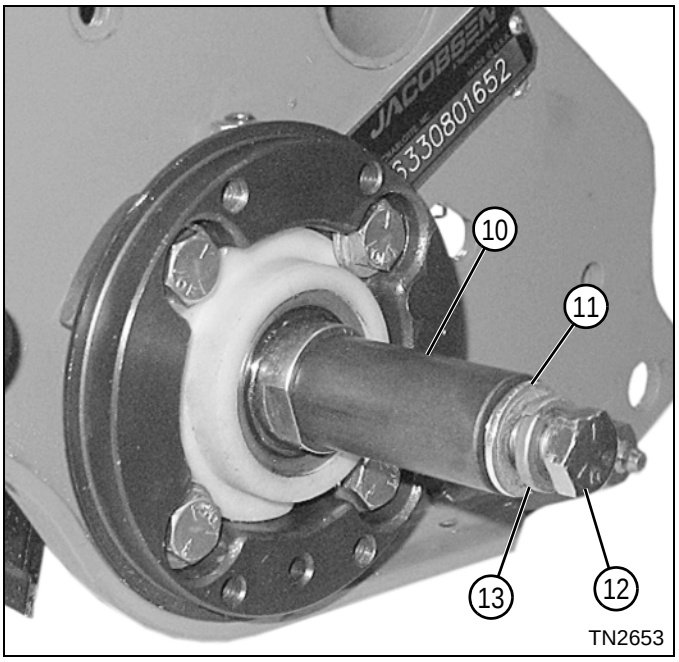


Figure 8-9

6. Install spacer (10), washer (11), lock washer (13), and screw (12).

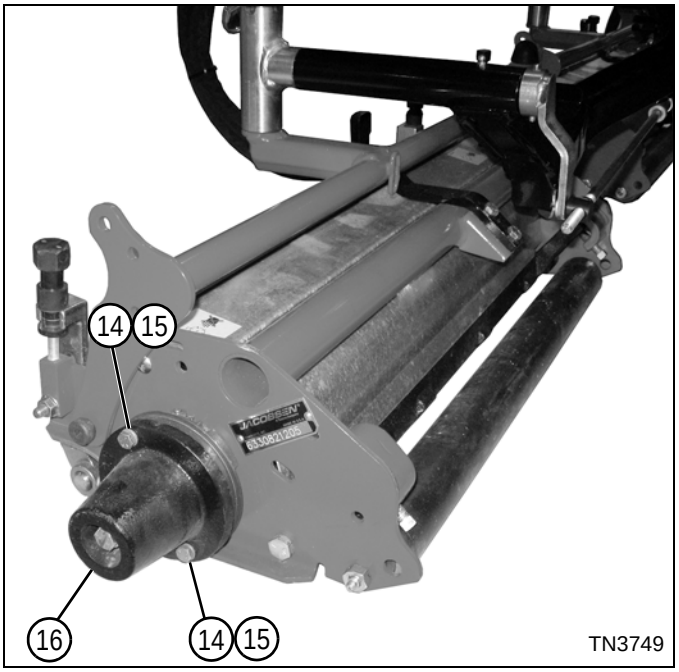


Figure 8-10

7. Install counterweight (16), two screws (14), and two lock washers (15).
8. Adjust bedknife-to-reel clearance. (See “Bedknife-to-Reel Clearance Adjustment” on page 8-17.)

Reel Leveling Rod Pre-Adjustment

See Figure 8-11.

Required Materials
Loctite® 242 (Blue)

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove reel leveling rod. (See “Reel Leveling Rod” on page 8-23.)

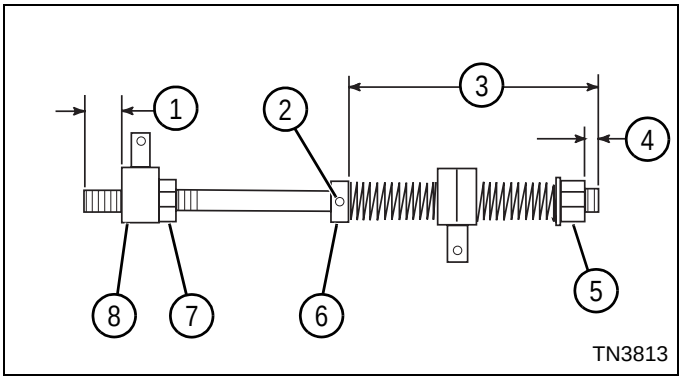


Figure 8-11

3. Measure distance (1) between end of leveling rod and face of rod connecting pin. The measurement should be 1.5 in. (38.1 mm). If the measurement does not meet specifications, adjust as follows:
   a. Loosen nut (7).
   b. Turn rod connecting pin (8) as needed to obtain proper distance (1).
   c. Tighten nut (7).
4. Measure distance (3) between end of leveling rod and face of collar. The measurement should be 4.606 in. (117 mm). If the measurement does not meet specifications, adjust as follows:
   a. Loosen the set screw (2) on collar (6).
   b. Slide collar (6) as needed to obtain proper distance (3).
5. Apply Loctite® 242 (Blue) to the threads of the set screw (2).
6. Tighten the set screw (2) on collar (6).
7. Measure distance (4) between end of leveling rod and face of nut. The measurement should be 0.094 in. (2.4 mm). If the measurement does not meet specifications, turn nut (5) as needed to obtain proper distance (4).
8. Install reel leveling rod. (See “Reel Leveling Rod” on page 8-23.)
9. Level cutting unit as necessary. (See “Cutting Unit Leveling Adjustment” on page 8-21.)

Cutting Unit Leveling Adjustment

See Figures 8-12 and 8-13.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Pre-adjust reel leveling rod, if necessary. (See “Reel Leveling Rod Pre-Adjustment” on page 8-20.)

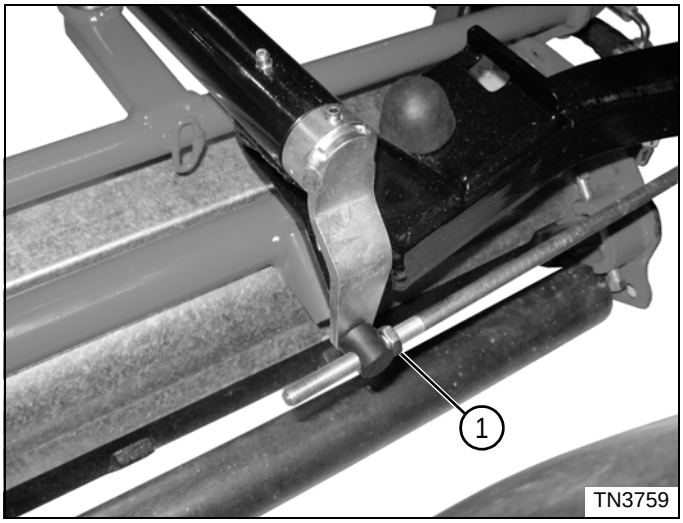


Figure 8-12

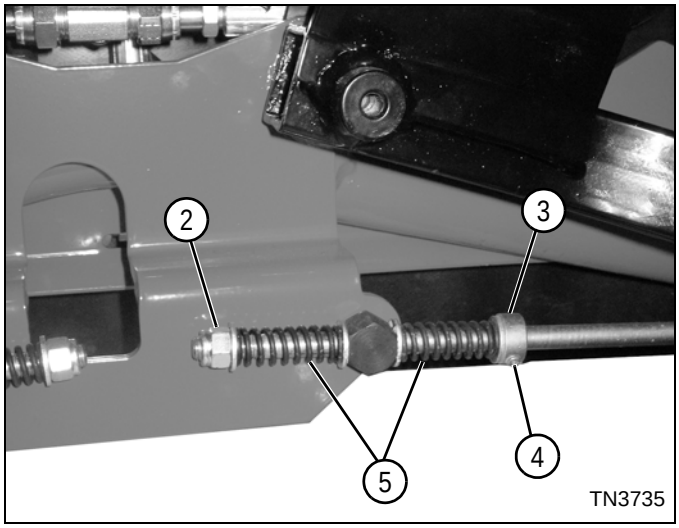


Figure 8-13

NOTE

Ensure grass catcher is installed (if equipped).

3. Fully lower cutting unit to a level, solid surface; then raise cutting unit until slightly above surface.
4. Loosen nut (1).
5. Loosen the set screw (4) on collar (3) and adjust collar and nut (2) until cutting unit is level and springs (5) are slightly compressed.
6. Tighten the set screw (4) on collar (3).
7. Tighten nut (1).

Repair

Cutting Unit

Removal and Installation

See Figures 8-14 through 8-17.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove grass catcher (if equipped).

NOTES

- *Perform steps 3 through 6 if removing the rear cutting unit.*
- *Do not swing the arm out or in with the cutting units in the lowered position.*

3. Raise the cutting units.

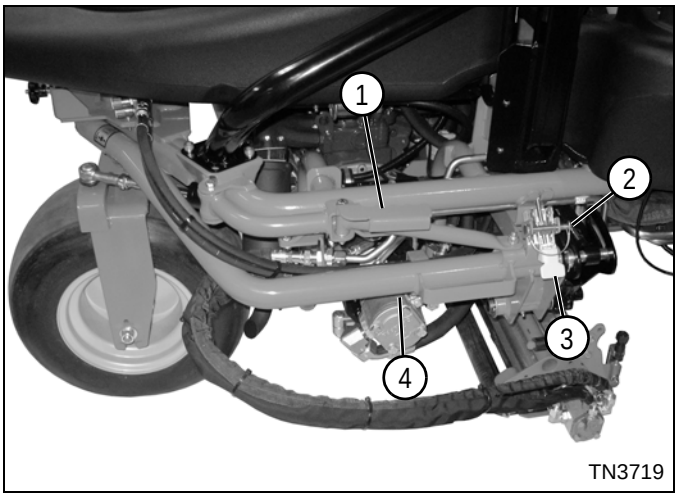


Figure 8-14

4. Remove pin (2), and release latch (3).
5. Grasp handle (1), and swing the rear swing arm (4) and cutting unit out.
6. Lower the cutting units.

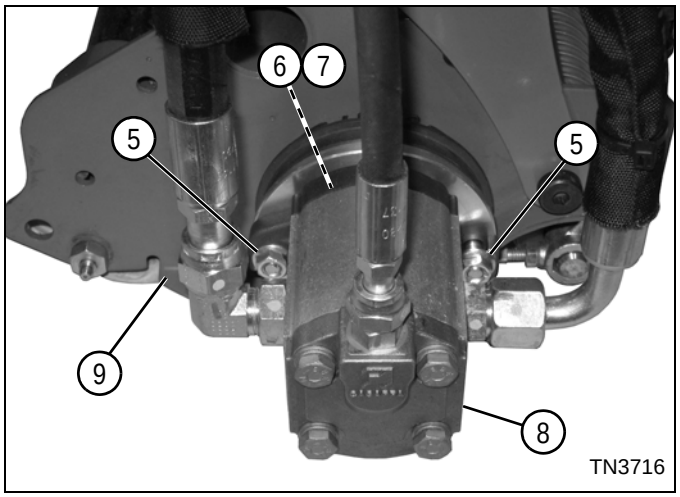


Figure 8-15

7. Loosen two nuts (5), and rotate reel motor (8) clockwise.

NOTE

In some cases, the coupler (6) may remain attached to the reel shaft.

8. Remove reel motor (8), coupler (6), and O-ring (7) from the cutting unit (9), and move the motor aside.

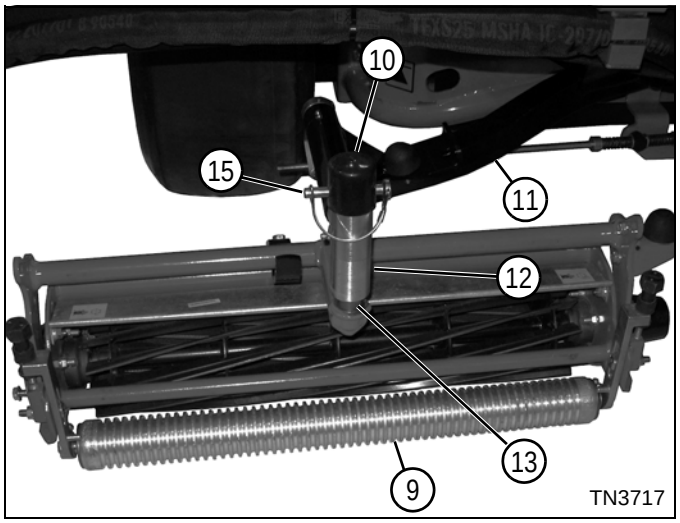


Figure 8-16

9. Remove pin (15) and cap (10) from yoke shaft (13).
10. Raise lift arm (11) until yoke shaft (13) clears the bottom of the shaft housing (12).
11. Move cutting unit (9) away from the machine.

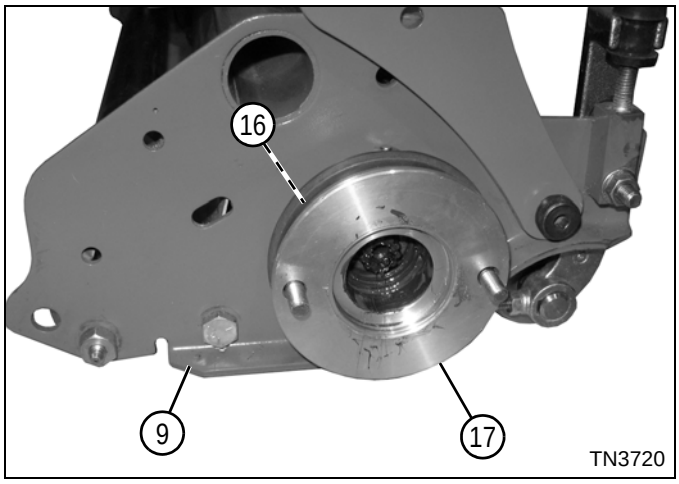


Figure 8-17

NOTE

Perform step 9 if the cutting unit is to be disassembled.

12. Remove adapter plate (17) and O-ring (16) from cutting unit.

Installation Notes

- *Install cutting unit by reversing the order of removal.*
- *Lubricate grease fittings with grease that meets or exceeds NLGI Grade 2 LB specifications. Clean grease fittings before lubricating and apply grease to the fittings with a hand grease gun only. Pump the gun slowly until a slight amount of pressure is felt, then stop—do not over-grease. Do not use compressed air gun.*

Lift Yoke

Removal and Installation

See Figure 8-18.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove the cutting unit. (See “Cutting Unit” on page 8-22.)

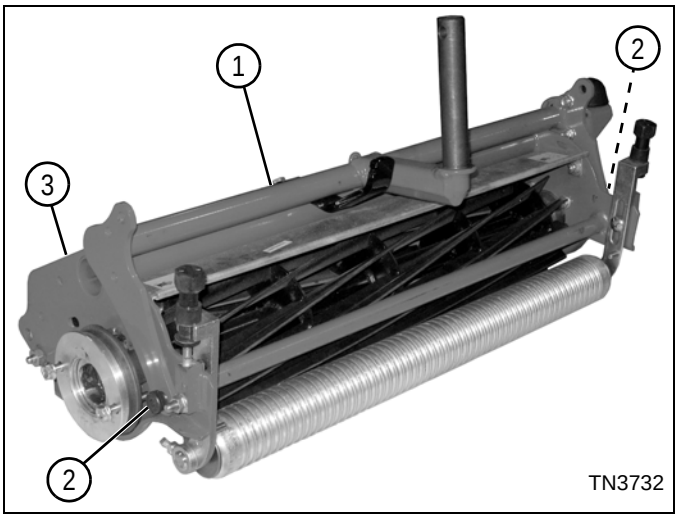


Figure 8-18

3. Remove two (one each side) shoulder bolts (2) from yoke assembly (1) and cutting unit frame (3).
4. Remove lift yoke assembly (1).

Installation Note

Install lift yoke assembly by reversing the order of removal.

Reel Leveling Rod

Removal and Installation

See Figures 8-19 and 8-20.

NOTE

The left reel leveling rod is shown; the right leveling rod is similar.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

NOTE

For removal purposes, do not place the lift actuator in the fully down position.

2. Lower the cutting unit to the ground.

8

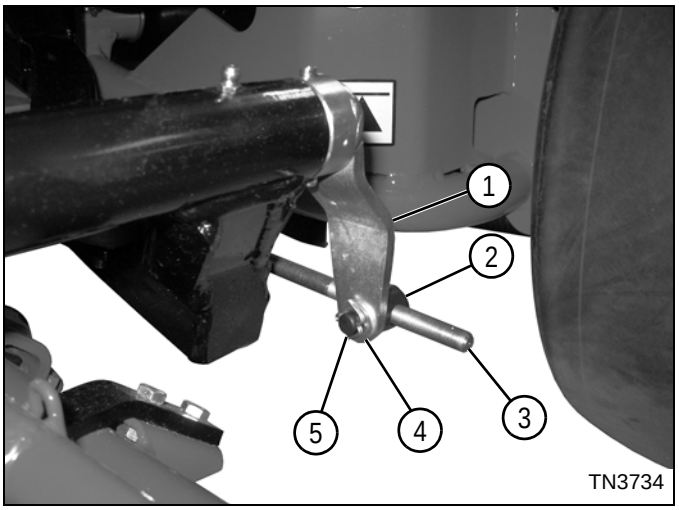


Figure 8-19

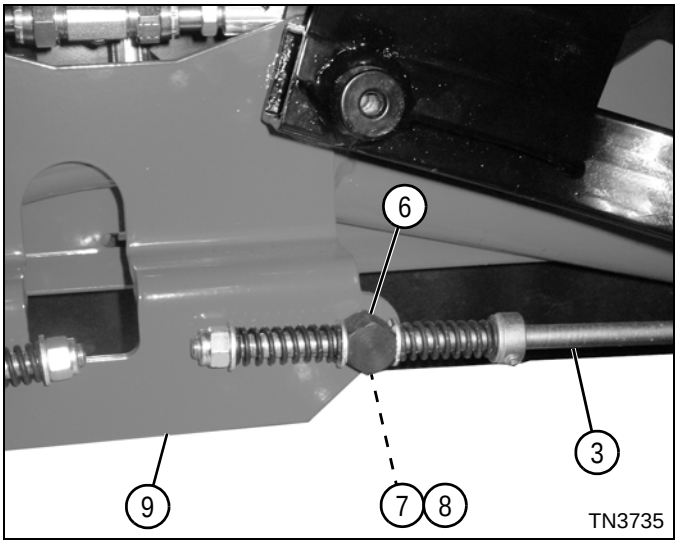


Figure 8-20

3. Remove cotter pin (4) and flat washer (5) from connecting pin (2).
4. Remove cotter pin (7) and flat washer (8) from connecting pin (6).
5. Remove leveling rod assembly (3) from link arm (1) and machine frame (9).

Installation Notes

- *Apply marine lubrication grease to I.D. of rod connecting pin (6) and reel leveling rod (3) at area beneath the springs.*
- *Install reel leveling rod by reversing the order of removal.*
- *Adjust leveling rod. (See "Cutting Unit Leveling Adjustment" on page 8-21.)*

Right and Left Lift Arms

Removal and Installation

See Figures 8-21 through 8-23.

NOTE

The left lift arm is shown; the right lift arm is similar.

1. Park the mower safely. (See "Park Mower Safely" on page 1-6.)
2. Remove cutting unit. (See "Cutting Unit" on page 8-22.)

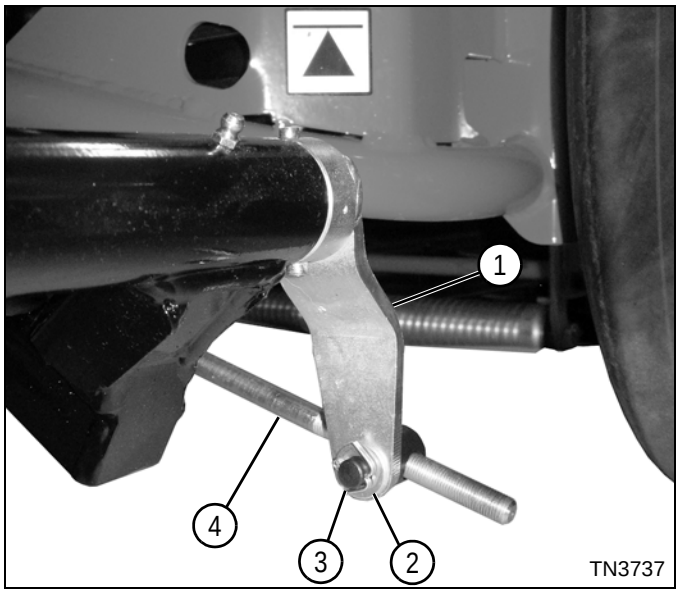


Figure 8-21

3. Remove cotter pin (3) and flat washer (2), and disconnect the leveling rod (4) from link arm (1).

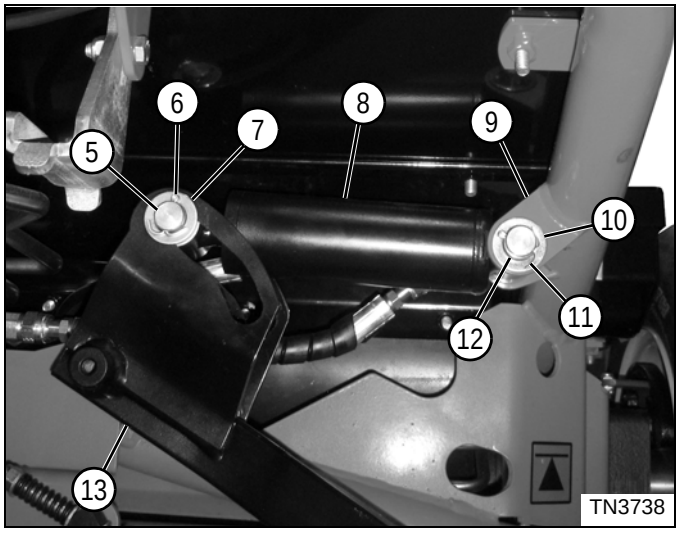


Figure 8-22

NOTE

Record the locations of flat washers (7) to ensure correct installation.

4. Remove cotter pin (6), pin (5), and six flat washers (7) from lift cylinder (8) and lift arm (13).
5. Remove cotter pin (11), pin (12), and two flat washers (10) from lift cylinder (8) and frame (9).
6. Move lift cylinder (8) aside.

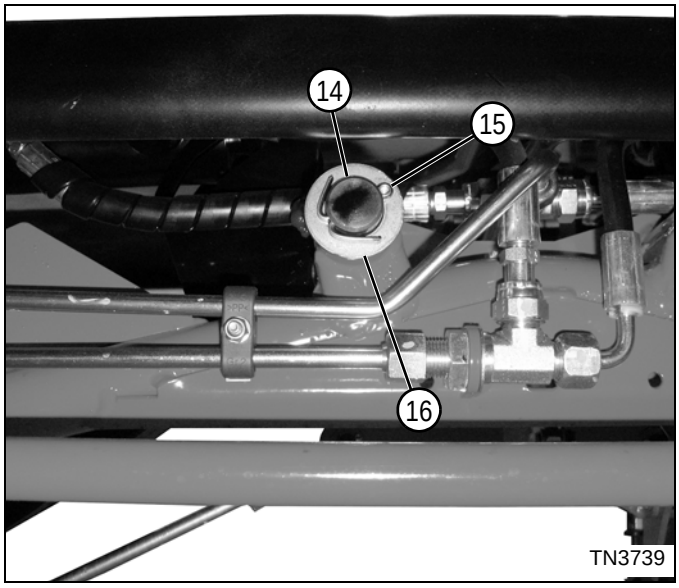
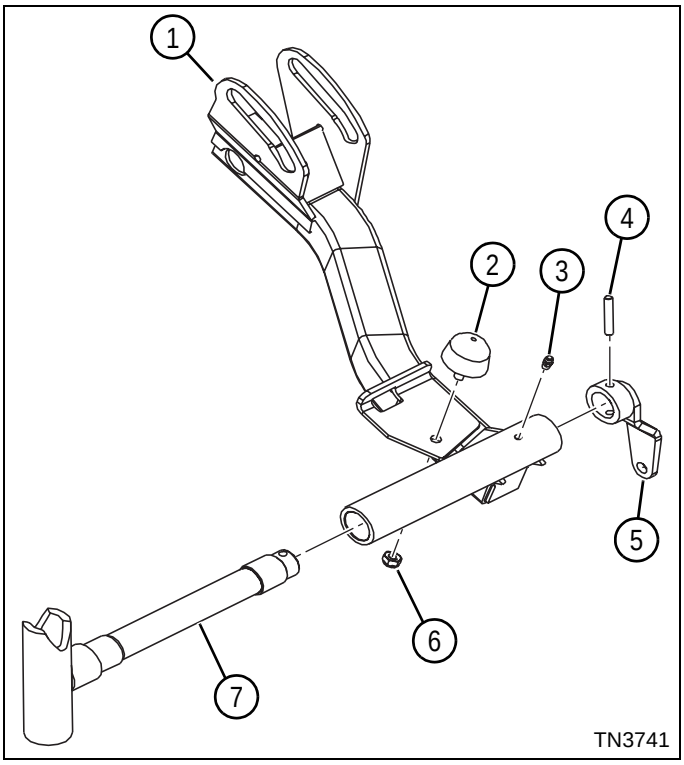


Figure 8-23

7. Remove cotter pin (15) and flat washer (16) from lift arm shaft (14).
8. Remove lift arm.

Disassembly and Assembly

See Figure 8-24.



1	Lift Arm	5	Link Arm
2	Rubber Bumper	6	Nut
3	Grease Fitting	7	Pivot Shaft

Figure 8-24

NOTE

Apply grease that meets or exceeds NLGI Grade 2 LB specifications to grease fitting (3).

8

Center Lift Arm

Removal and Installation

See Figures 8-25 and 8-26.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove cutting unit. (See “Cutting Unit” on page 8-22.)

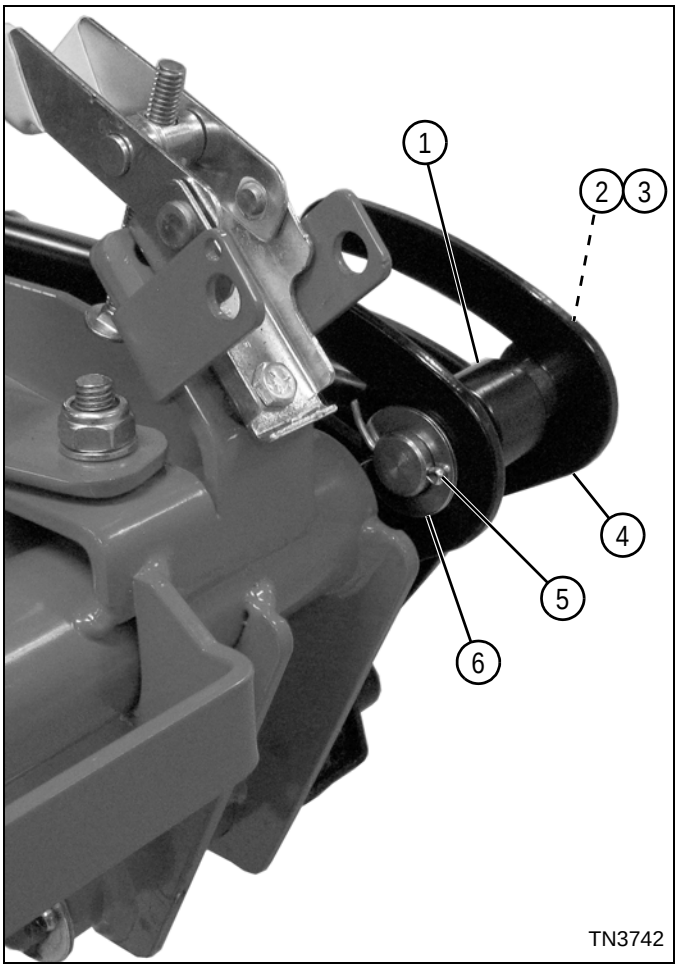


Figure 8-25

3. Remove cotter pin (5) and two flat washers (6).
4. Remove pin (2) and flat washer (3) from lift cylinder (1) and lift arm (4).

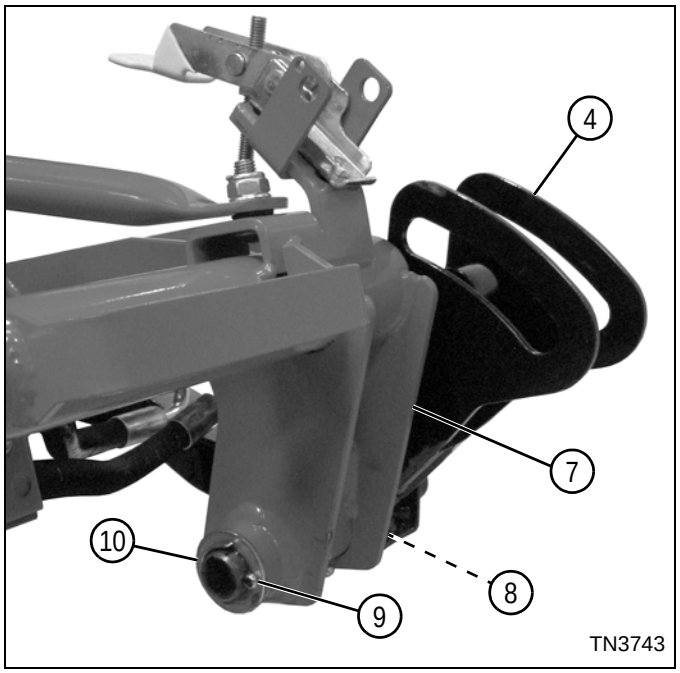


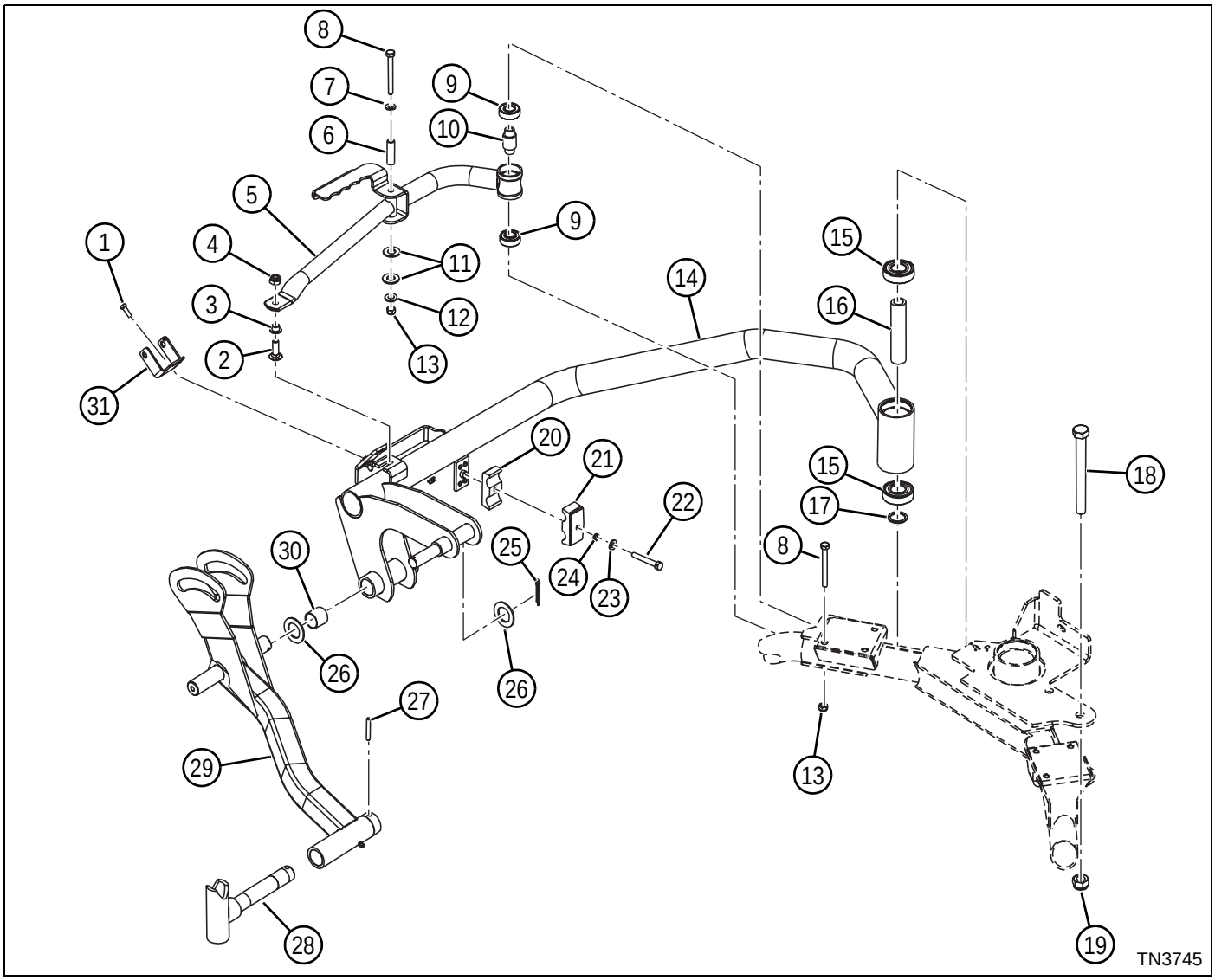
Figure 8-26

5. Remove cotter pin (9) and flat washer (10).
6. Remove lift arm (4) and washer (8) from rear swing arm (7).

Swing Arm

Disassembly and Assembly

See Figure 8-27.



1	Screw (2)	9	Ball Bearing (2)	17	Thrust Washer	25	Cotter Pin
2	Carriage Bolt	10	Spacer	18	Bolt	26	Washer (2)
3	Bushing	11	Flat Washer (2)	19	Nyloc Nut	27	Spring Pin
4	Nut	12	Flat Washer	20	Hose Clamp	28	Pivot Shaft
5	Link Arm Assembly	13	Nyloc Nut (2)	21	Tube Clamp Top Plate	29	Lift Arm
6	Pivot Bushing	14	Swing Arm	22	Bolt	30	Bushing (4)
7	Flat Washer	15	Ball Bearing (2)	23	Flat Washer	31	Latch Lock Bracket
8	Screw (2)	16	Spacer	24	Lock Washer		

Figure 8-27

Disassembly Notes

- *Before disassembly, clean the center lift arm and swing arm—removing all dirt and debris.*
- *Inspect link arm, center lift arm, swing arm, reel steering pivot, and all bushings for damage or wear. Remove bushings only if replacement is required.*

Assembly Notes

Required Materials
Anti-Seize Compound

- *Before assembly, verify that the bushings and mating surfaces are free of burrs, dirt, and debris.*
- *Repair or replace the link arm, center lift arm, swing arm, or reel steering pivot, if necessary.*
- *Replace any bushings that are damaged or have excessive wear.*

Reel Motor

Removal and Installation

See Figure 8-28.

NOTE

The right reel motor is shown; the left and center reel motors are similar.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

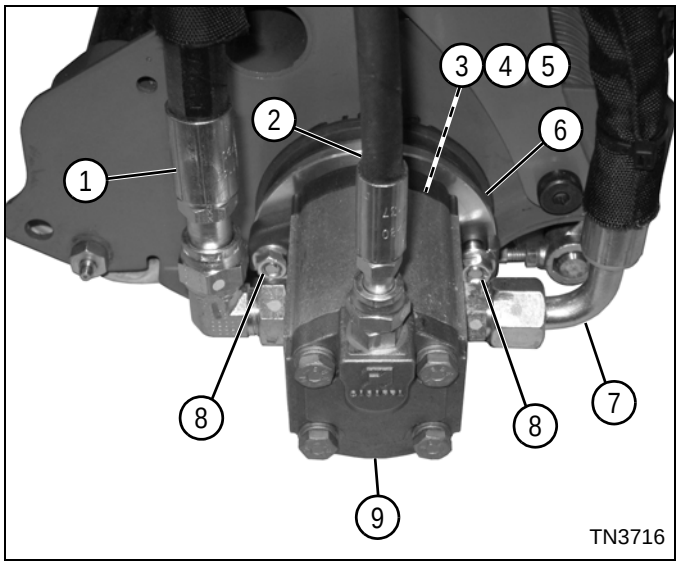


Figure 8-28

NOTES

- *Label all hydraulic hoses and tubes before disconnecting to ensure correct installation.*
- *Close all openings with caps or plugs to prevent contamination.*

2. Disconnect hydraulic hoses (1, 2, and 7).
3. Loosen nuts (8).

NOTE

In some cases, the coupler (3) may remain attached to the reel shaft.

4. Rotate reel motor (9) clockwise, and remove reel motor with O-ring (5) and coupler (3) from adapter plate (6).
5. Remove coupler (3) from reel motor shaft (4).

Installation Notes

- *Install the reel motor by reversing the order of removal.*
- *Coat the reel motor shaft (4) and coupler (3) with grease that meets or exceeds NLGI Grade 2 LB specifications before installing reel motor (8).*
- *Tighten nuts (8) to 18 lb-ft (24 N·m).*
- *Make sure new O-rings are in place before installing hoses on fittings.*
- *Replace hydraulic oil charge filter. (See “Hydraulic Oil Charge Filter Assembly” on page 6-59.)*
- *Refill hydraulic tank. (Refer to “Parts and Maintenance Manual” for correct oil specifications.)*
- *Start engine. Check hydraulic system for leaks. Repair as necessary.*
- *Check hydraulic oil level and add if necessary.*

Disassembly, Inspection, and Assembly

See Figures 8-29 through 8-31.

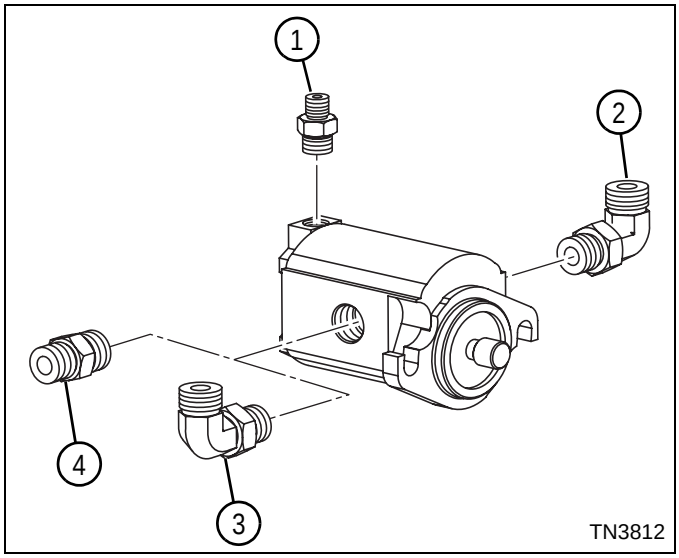
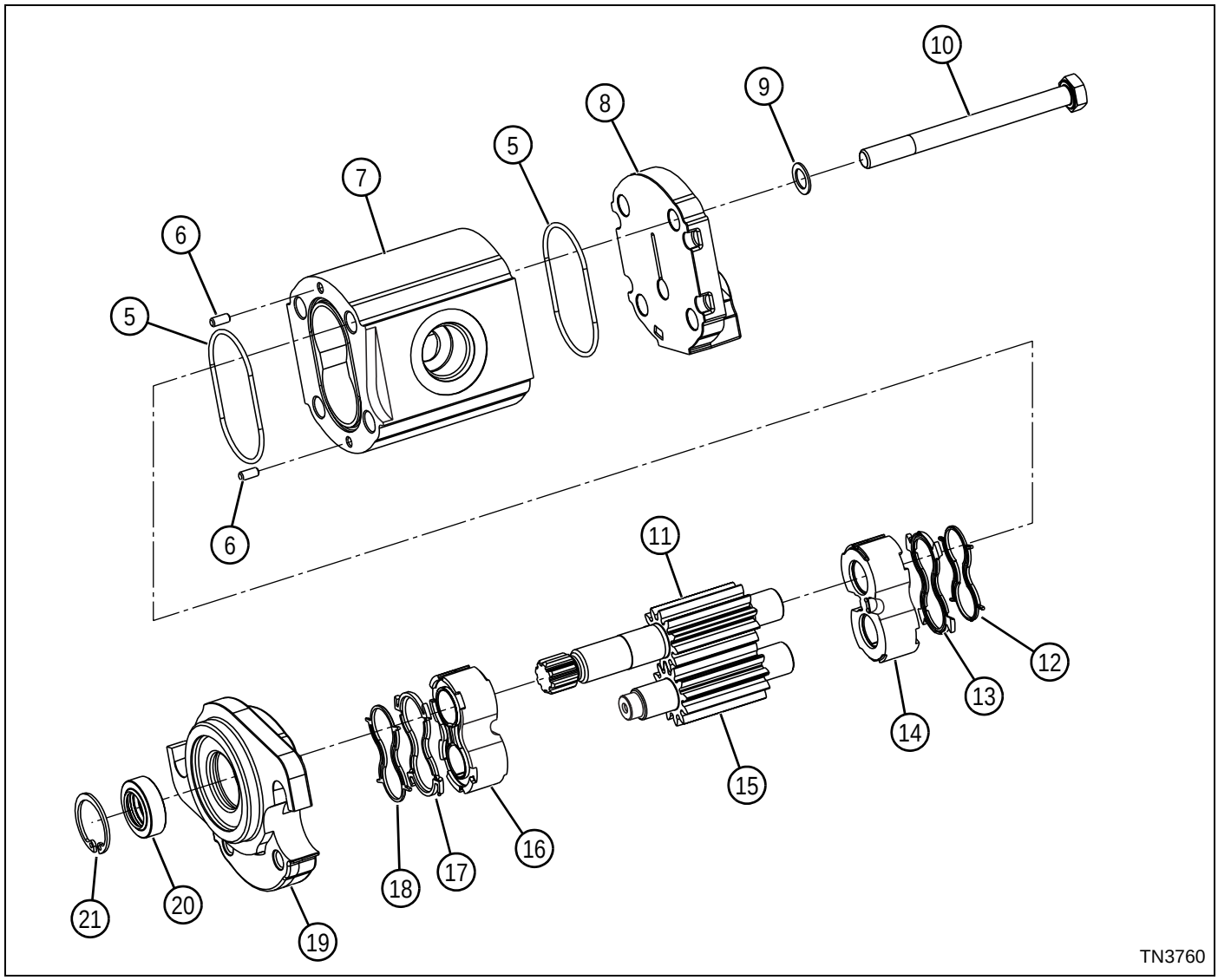


Figure 8-29

NOTE

Record the location and orientation of fittings before removing to ensure correct installation.

1. Remove, inspect, and replace fitting (1) from case drain port.
2. Remove, inspect, and replace fitting (2) from inlet port.
3. For center cutting unit, remove, inspect, and replace fitting (3) from outlet port. For front cutting units, remove, inspect, and replace fitting (4) from outlet port.



5	O-Ring (2)	10	Retaining Screw (4)	15	Driven Gear	20	Shaft Seal
6	Dowel Pin (2)	11	Drive Shaft	16	Thrust Plate	21	Snap Ring
7	Pump Housing	12	Anti-Extrusion Ring	17	Upper Seal		
8	Rear Cover	13	Seal	18	Anti-Extrusion Ring		
9	Washer (4)	14	Thrust Plate	19	Front Cover		

Figure 8-30

8

Disassembly Notes

- *Do not disassemble reel motor for repair unless test procedures indicate internal leakage.*
- *Never pry components apart. Use a soft-faced hammer, and gently tap body and drive shaft to separate reel motor body.*

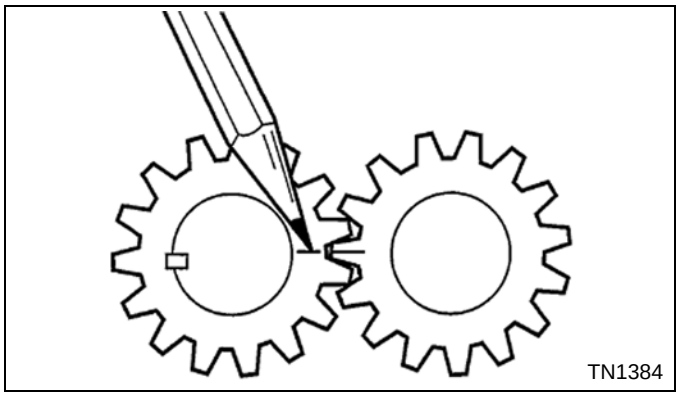


Figure 8-31

1. Before removing gear set, mark a line across meshing teeth to ensure that gears are reassembled in the same position.
2. Place parts, in assembly order, on a clean work area as they are removed.
3. Discard seals as they are removed.

NOTICE

It is important that all component parts are absolutely clean, as contamination can result in serious damage and/or improper operation.

Never use shop towels or rags to dry parts after cleaning, as lint may clog passages. Dry parts using compressed air.

4. Clean all parts using clean solvent, and dry using compressed air.
5. Inspect seal kit components (12, 13, 17, 18, and 20) for cracks, nicks, burrs, and excessive wear. Inspect surfaces for scoring, galling, and scratches. Replace as necessary.
6. Inspect remaining reel motor components for excessive wear or damage. Replace reel motor if necessary.

Assembly Notes

NOTICE

It is important that all component parts are absolutely clean, as contamination can result in serious damage and/or improper operation.

Never use shop towels or rags to dry parts after cleaning, as lint may clog passages. Dry parts using compressed air.

Required Materials
Seal Kit (Jacobsen PN 2702706)

- *Assemble the reel motor by reversing the order of disassembly.*
- *Use a new seal kit during assembly.*
- *Apply a coat of clean hydraulic oil to all parts to ease assembly.*
- *Remove alignment mark from gear set after gears have been installed with teeth in proper mesh.*
- *Rotate drive shaft by hand after assembling to make sure there is no binding between parts; do not force.*
- *Use extreme care when installing shaft seal. Seal must seat squarely in seal bore.*
- *Install retaining screws (10) finger tight and rotate drive shaft to make sure it turns freely. Tighten retaining screws (10) evenly in steps to a final torque of 18.5 lb-ft (25 N·m) and check rotation of drive shaft.*
- *Tighten case drain fitting (1) to 15.5 lb-ft (21 N·m).*
- *Tighten IN/OUT port fittings (2, 3, and 4) to 54.6 lb-ft (74 N·m).*
- *Lubricate reel motor through ports with clean hydraulic oil prior to installing.*

Grass Shield

Removal and Installation

See Figure 8-32.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove cutting unit. (See “Cutting Unit” on page 8-22.)
3. Remove front roller. (See “Front Roller” on page 8-38.)

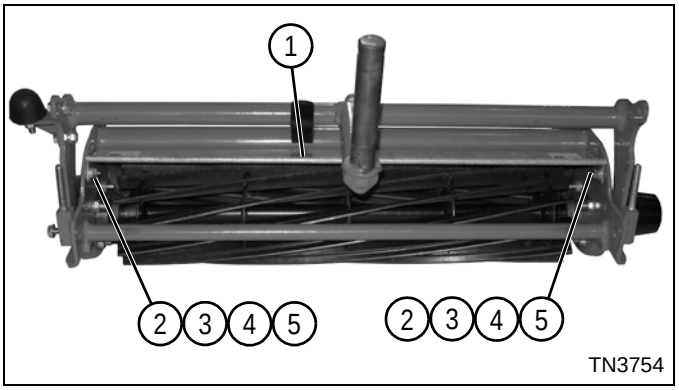


Figure 8-32

4. Remove nut (2), lock washer (3), flat washer (4), and screw (5) from each side of cutting unit.
5. Remove grass shield (1).

Installation Notes

- *Install grass shield by reversing the order of removal.*
- *Adjust the grass shield. (See “Grass Shield Adjustment” on page 8-18.)*

Bedknife Backing Assembly

Removal and Installation

See Figures 8-33 and 8-34.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove cutting unit from mower. (See “Cutting Unit” on page 8-22.)
3. Place cutting unit on a solid work surface.

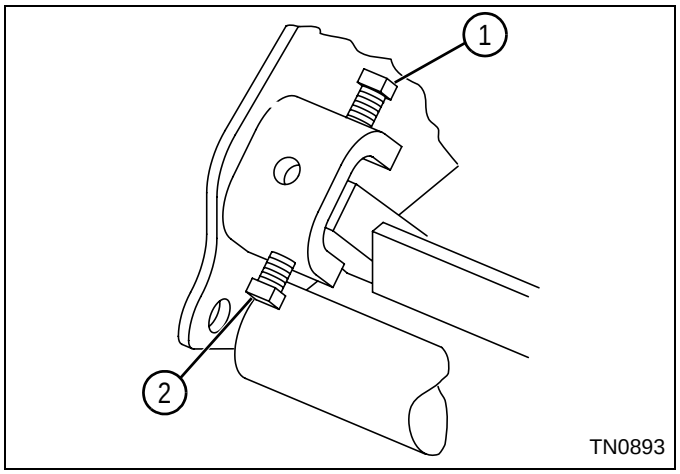


Figure 8-33

4. Loosen bedknife adjuster screws (1 and 2) on each side of cutting unit.

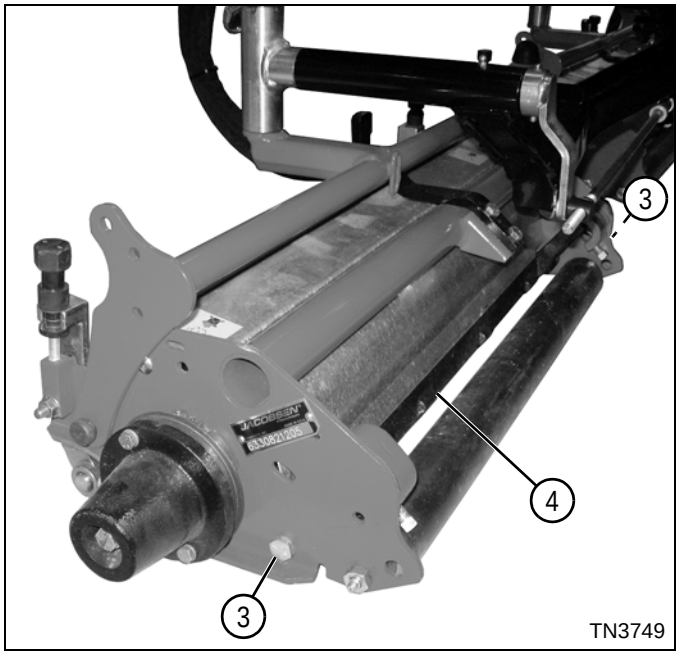


Figure 8-34

5. Support bedknife backing assembly (4).
6. Remove bedknife backing mounting screw (3) from each side of cutting unit.

7. Remove bedknife backing assembly (4).

Installation Notes

Required Materials
Anti-Seize Compound

- *Install bedknife backing assembly by reversing the order of removal.*
- *Apply anti-seize compound to the threads of the bedknife backing mounting screws before installing. Tighten bedknife backing mounting screws to 25–37 ft-lb (33.9–50.2 N·m).*
- *Adjust bedknife-to-reel clearance. (See "Bedknife-to-Reel Clearance Adjustment" on page 8-17.)*

Bedknife

Removal and Installation

See Figure 8-35.

1. Park the mower safely. (See "Park Mower Safely" on page 1-6.)
2. Remove bedknife backing assembly. (See "Bedknife Backing Assembly" on page 8-32.)

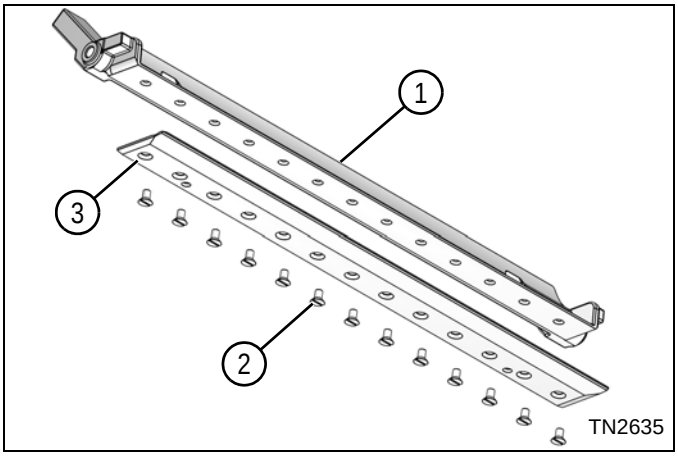


Figure 8-35

3. Remove screws (2) and bedknife (3) from bedknife backing (1).

Installation Notes

Required Materials
Anti-Seize Compound

- *Install bedknife by reversing the order of removal.*
- *Apply anti-seize compound to screws (2).*
- *Tighten screws (2) to 90–120 lb-in. (10.2–13.6 N·m), starting with screws in the center and working out to the ends of the bedknife.*
- *Grind bedknife after assembling to bedknife backing to achieve a 0.040 in. (1.0 mm) bedknife front face height, a 5° bedknife front face angle, and an 8–10° bedknife top face angle (rear relief).*
- *Adjust bedknife-to-reel clearance. (See "Bedknife-to-Reel Clearance Adjustment" on page 8-17.)*

Reel Bearing Housing Assembly

Removal and Installation—Drive Side

See Figure 8-36.

Required Tools or Equipment
• Bearing Assembly Tool (Jacobsen PN JAC5084) • Reel Bearing Housing Puller (Jacobsen PN JAC5085)

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove cutting unit from the mower. (See “Cutting Unit” on page 8-22.)
3. Remove grass shield. (See “Grass Shield” on page 8-32.)
4. Remove reel motor. (See “Reel Motor” on page 8-28.)

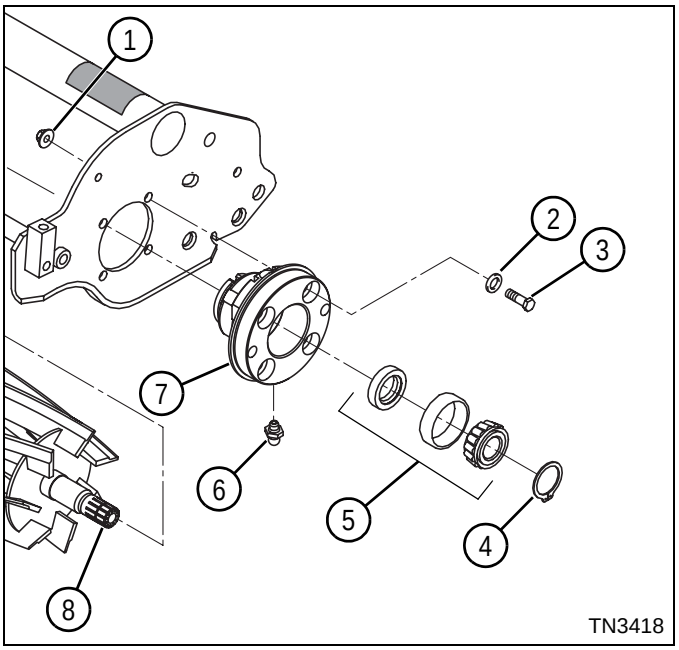


Figure 8-36

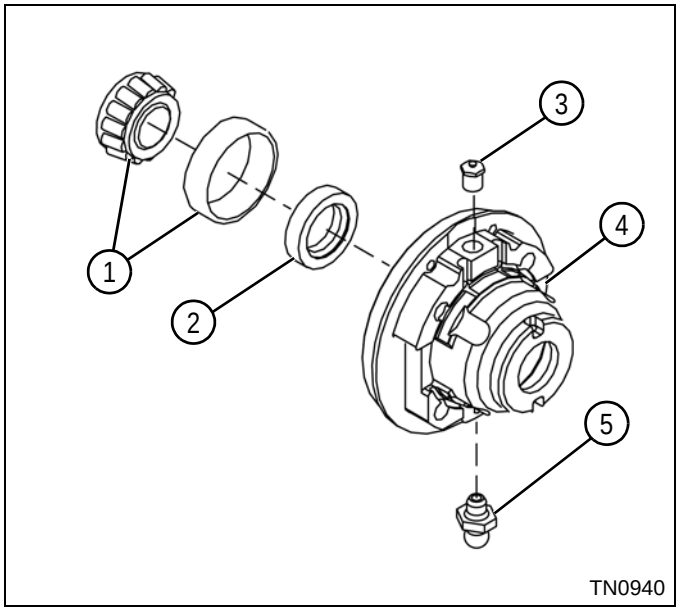
5. Remove grease fitting (6).
6. Remove snap ring (4).
7. Remove four mounting screws (3), lock washers (2), and nuts (1).
8. Remove reel bearing housing assembly (7) using reel bearing housing puller (Jacobsen PN JAC5085).
9. Inspect reel shaft (8) for wear or damage. Replace reel if needed. (See “Reel Assembly” on page 8-37.)

Installation Notes

- *Install reel bearing housing assembly by reversing the order of removal.*
- *Use bearing assembly tool (Jacobsen PN JAC5084) to install reel bearing housing assembly onto reel shaft.*
- *Inspect bearing (5) for wear or damage. Replace as needed.*
- *Pack bearing (5) with grease that meets or exceeds NLGI Grade 2 LB specifications before assembly.*
- *Tighten mounting screws (3) to 18–22 lb-ft (24.4–29.8 N·m).*
- *Lubricate grease fitting (6) with grease that meets or exceeds NLGI Grade 2 LB specifications. Clean grease fitting before lubricating and apply grease to the fitting with a hand grease gun only. Pump the gun slowly until a slight amount of pressure is felt, then stop—do not over-grease. Do not use compressed air gun.*
- *Adjust bedknife-to-reel clearance prior to installing cutting unit to mower. (See “Bedknife-to-Reel Clearance Adjustment” on page 8-17.)*

Disassembly and Assembly

See Figure 8-37.



1	Bearing Cup and Cone	4	Reel Bearing Housing
2	Grease Seal	5	Grease Fitting
3	Vent Fitting		

Figure 8-37

Assembly Notes

- *Install new grease seal (2).*
- *Inspect bearing cup and cone (1) for wear or damage. Replace as needed.*
- *Pack bearing (1) with grease that meets or exceeds NLGI Grade 2 LB specifications before assembly.*
- *Apply grease that meets or exceeds NLGI Grade 2 LB specifications to the lips of grease seal (2).*

Removal—Non-Drive Side

See Figures 8-38 and 8-39.

Required Tools or Equipment
Reel Bearing Housing Puller (Jacobsen PN JAC5085)

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove cutting unit from the mower. (See “Cutting Unit” on page 8-22.)
3. Remove grass shield. (See “Grass Shield” on page 8-32.)

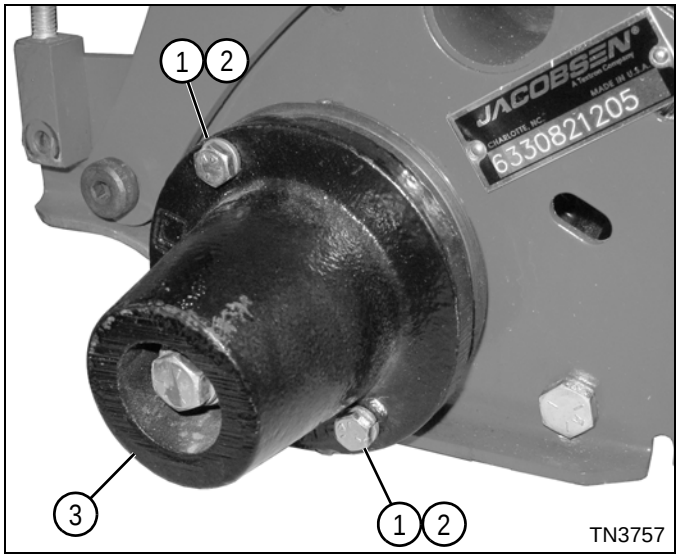


Figure 8-38

4. Remove two screws (1) and lock washers (2).
5. Remove counterweight (3).

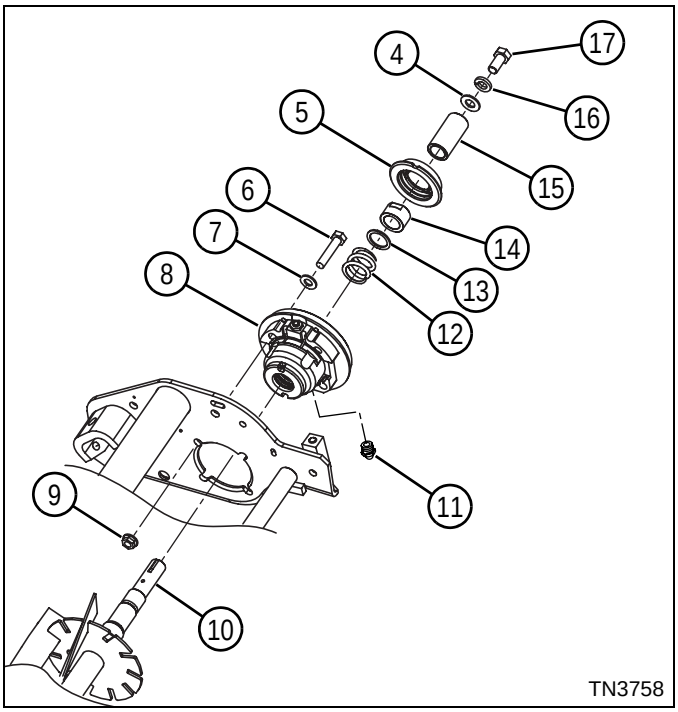
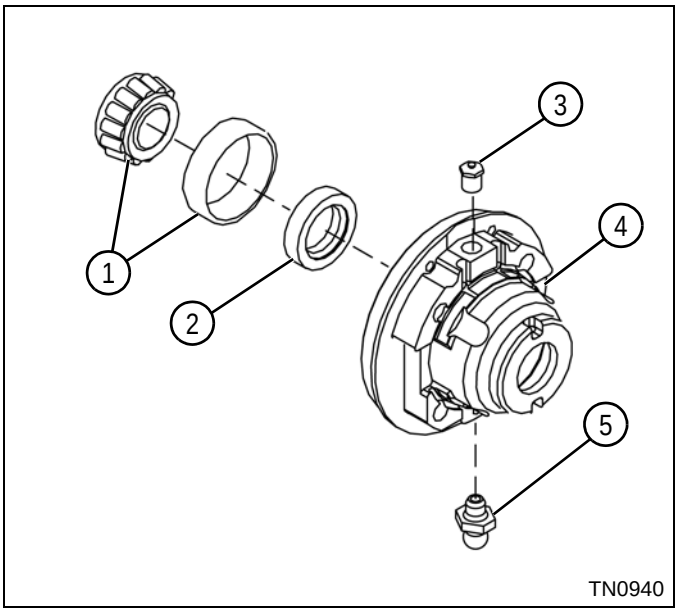


Figure 8-39

6. Remove grease fitting (11).
7. Remove screw (17), lock washer (16), flat washer (4), and spacer (15).
8. Remove four mounting screws (6), washers (7), and nuts (9).
9. Remove seal (5).
10. Remove nut (14).
11. Remove washer (13) and spring (12).
12. Remove reel bearing housing assembly (8) using reel bearing housing puller (Jacobsen PN JAC5085).
13. Inspect reel shaft (10) for wear or damage. Replace reel if needed. (See “Reel Assembly” on page 8-37.)

Disassembly and Assembly

See Figure 8-40.



1	Bearing Cup and Cone	4	Reel Bearing Housing
2	Grease Seal	5	Grease Fitting
3	Vent Fitting		

Figure 8-40

Assembly Notes

- *Install new grease seal (2).*
- *Apply grease that meets or exceeds NLGI Grade 2 LB specifications to the lips of grease seal (2).*
- *Inspect bearing cup and cone (1) for wear or damage. Replace as needed.*
- *Pack bearing (1) with grease that meets or exceeds NLGI Grade 2 LB specifications before assembly.*

Installation—Non-Drive Side

See Figures 8-41 and 8-42.

Required Tools or Equipment
Bearing Assembly Tool (Jacobsen PN JAC5084)

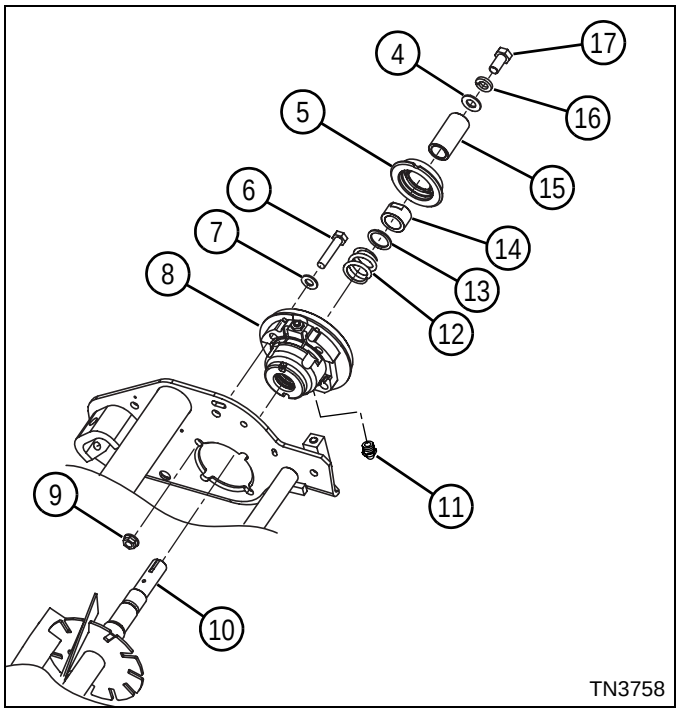


Figure 8-41

1. Install reel bearing housing assembly (8) using bearing assembly tool (Jacobsen PN JAC5084).
2. Install seal (5) using mounting screws (6), washers (7), and nuts (9).
3. Tighten mounting screws (6) to 18–22 lb-ft (24.4–29.8 N·m).
4. Install grease fitting (11).
5. Install spring (12), washer (13), and nut (14).
6. Adjust reel bearing pre-load. (See “Reel Bearing Pre-Load Adjustment” on page 8-19.)
7. Install spacer (15), flat washer (4), lock washer (16), and screw (17).

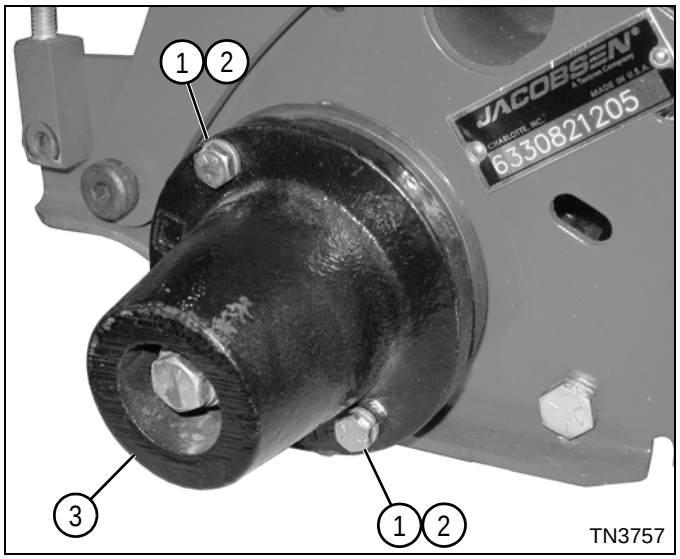


Figure 8-42

8. Install counterweight (3), two lock washers (2), and screws (1).
9. Lubricate grease fitting (11) with grease that meets or exceeds NLGI Grade 2 LB specifications. Clean grease fitting before lubricating and apply grease to the fitting with a hand grease gun only. Pump the gun slowly until a slight amount of pressure is felt, then stop—do not over-grease. Do not use compressed air gun.
10. Install grass shield. (See “Grass Shield” on page 8-32.)
11. Adjust bedknife-to-reel clearance. (See “Bedknife-to-Reel Clearance Adjustment” on page 8-17.)
12. Install cutting unit to mower. (See “Cutting Unit” on page 8-22.)

Reel Assembly

Removal and Installation

See Figure 8-43.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove cutting unit from mower. (See “Cutting Unit” on page 8-22.)
3. Remove bedknife backing assembly. (See “Bedknife Backing Assembly” on page 8-32.)
4. Remove front roller. (See “Front Roller” on page 8-38.)
5. Remove grass shield. (See “Grass Shield” on page 8-32.)
6. Remove drive side reel bearing housing assembly. (See “Reel Assembly” on page 8-37.)
7. Remove non-drive side reel bearing housing assembly. (See “Reel Assembly” on page 8-37.)

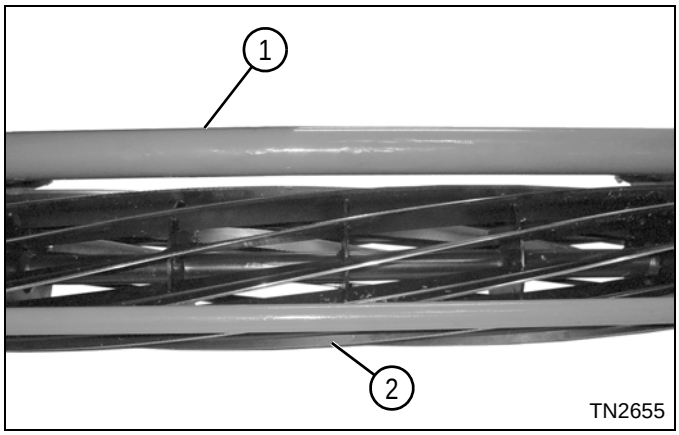


Figure 8-43

CAUTION

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

8. Remove reel (2) from frame (1).

Installation Notes

- *Install reel assembly by reversing the order of removal.*
- *Adjust reel bearing pre-load. (See “Reel Bearing Pre-Load Adjustment” on page 8-19.)*
- *Adjust grass shield. (See “Grass Shield Adjustment” on page 8-18.)*
- *Adjust bedknife-to-reel clearance. (See “Bedknife-to-Reel Clearance Adjustment” on page 8-17.)*
- *Check height-of-cut adjustment. (See “Height-of-Cut (HOC) Adjustment” on page 8-18.)*

8

Front Roller

Removal and Installation

See Figure 8-44.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Raise cutting unit assembly with a suitable lifting device and support the cutting unit frame to remove weight from roller.

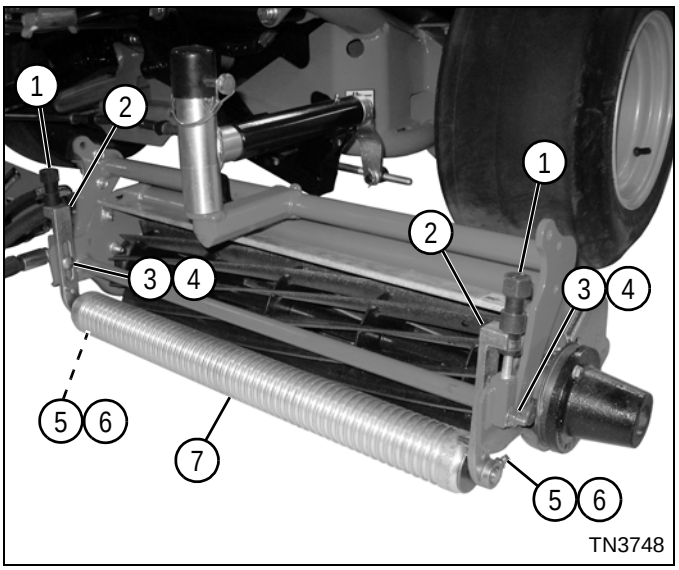


Figure 8-44

3. Remove nuts (3) and screws (4).
4. Remove adjuster knobs (1).
5. Remove adjuster brackets (2) and front roller (7) from cutting unit.
6. Loosen jam nut (5) and square head bolt (6) on each side of front roller (7).
7. Remove front roller (7) from adjuster brackets (2).

Installation Notes

- *Install front roller by reversing the order of removal.*
- *Center the roller between adjuster brackets before tightening jam nuts and square head bolts.*
- *Align roller shaft flat with square head bolts before tightening bolt on flat on each end of shaft.*
- *Lubricate grease fittings with grease that meets or exceeds NLGI Grade 2 LB specifications. Clean grease fittings before lubricating and apply grease to the fittings with a hand grease gun only. Pump the gun slowly until a slight amount of pressure is felt, then stop—do not over-grease. Do not use compressed air gun.*
- *Check height-of-cut adjustment. (See “Height-of-Cut (HOC) Adjustment” on page 8-18.)*

Rear Roller

Removal and Installation

See Figure 8-45.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Raise cutting unit assembly with a suitable lifting device and support the cutting unit frame to remove weight from roller.

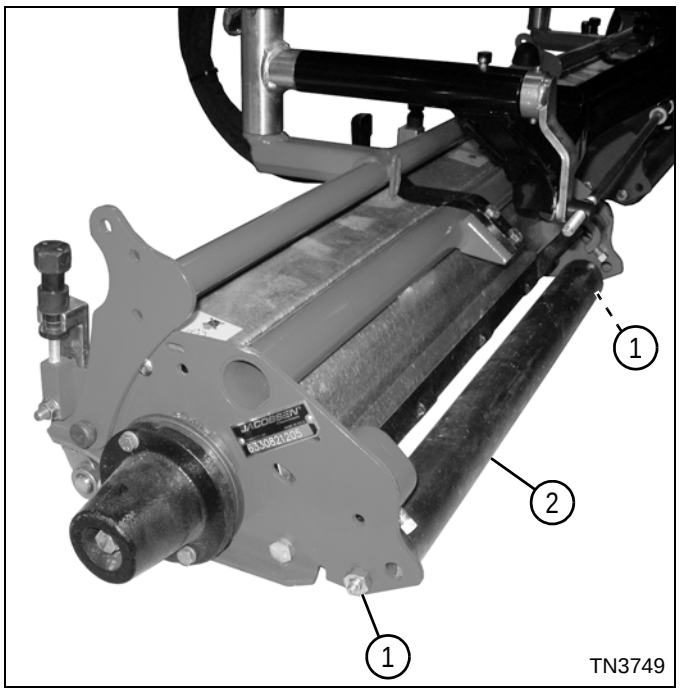


Figure 8-45

3. Remove screw with grease fitting (1) on each side of rear roller (2).
4. Remove rear roller (2).

Installation Notes

- *Install rear roller by reversing the order of removal.*
- *Tighten screws (1) to 16–24 ft-lb (21.7–32.5 N·m).*
- *Lubricate grease fittings with grease that meets or exceeds NLGI Grade 2 LB specifications. Clean grease fittings before lubricating and apply grease to the fittings with a hand grease gun only. Pump the gun slowly until a slight amount of pressure is felt, then stop—do not over-grease. Do not use compressed air gun.*

Roller Bearings

Removal

See Figure 8-46.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove roller. (See “Front Roller” on page 8-38 or “Rear Roller” on page 8-38.)

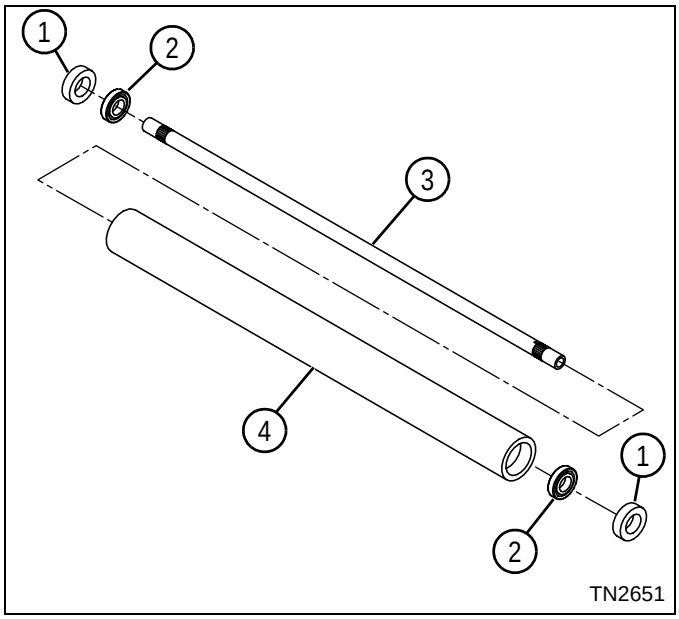


Figure 8-46

3. Support one end of roller tube (4), and use a suitable hammer to drive the bearing (2) and outer seal (1) out of roller tube by tapping opposite end of shaft (3).
4. Remove bearing (2) and seal (1) from shaft (3).
5. Repeat steps 3 and 4 for other end of roller.

Installation

NOTES

- *Clean and inspect bearings for wear or damage. Replace if necessary.*
- *Pack bearings (2) with grease that meets or exceeds NLGI Grade 2 LB specifications prior to installation.*

1. Press one bearing (2) onto end of shaft (3) until it contacts the shoulder of the shaft.
2. Install the shaft and bearing assembly to the roller (4) and press bearing into the roller.
3. Support the bearing end of the shaft and roller, and press the other bearing into roller (4).
4. Install seals (1).

Chapter 9

Accessories and Miscellaneous Repair

JACOBSEN
A Textron Company

Specifications

OPS		
Mounting Bolt Torque	lb-ft (N·m)	37 (50)
Bracket Screw Torque	lb-ft (N·m)	52 (71)

Fuel System		
Capacity	gal (L)	14.2 (54)

Front Tires		
Size		20 x 10-10
Type		2-Ply OTR Smooth
Air Pressure	psi (bar)	10 (0.70)
Mounting Bolt Torque	lb-ft (N·m)	55 (75)

Rear Tire		
Size		20 x 10-10
Type		2-Ply OTR Smooth
Air Pressure	psi (bar)	10 (0.70)
2WD Lug Nut Torque	lb-ft (N·m)	48–63 (65–85)
2WD Mounting Bolt Torque	lb-ft (N·m)	48–63 (65–85)
3WD Lug Nut Torque	lb-ft (N·m)	55–63 (75–85)

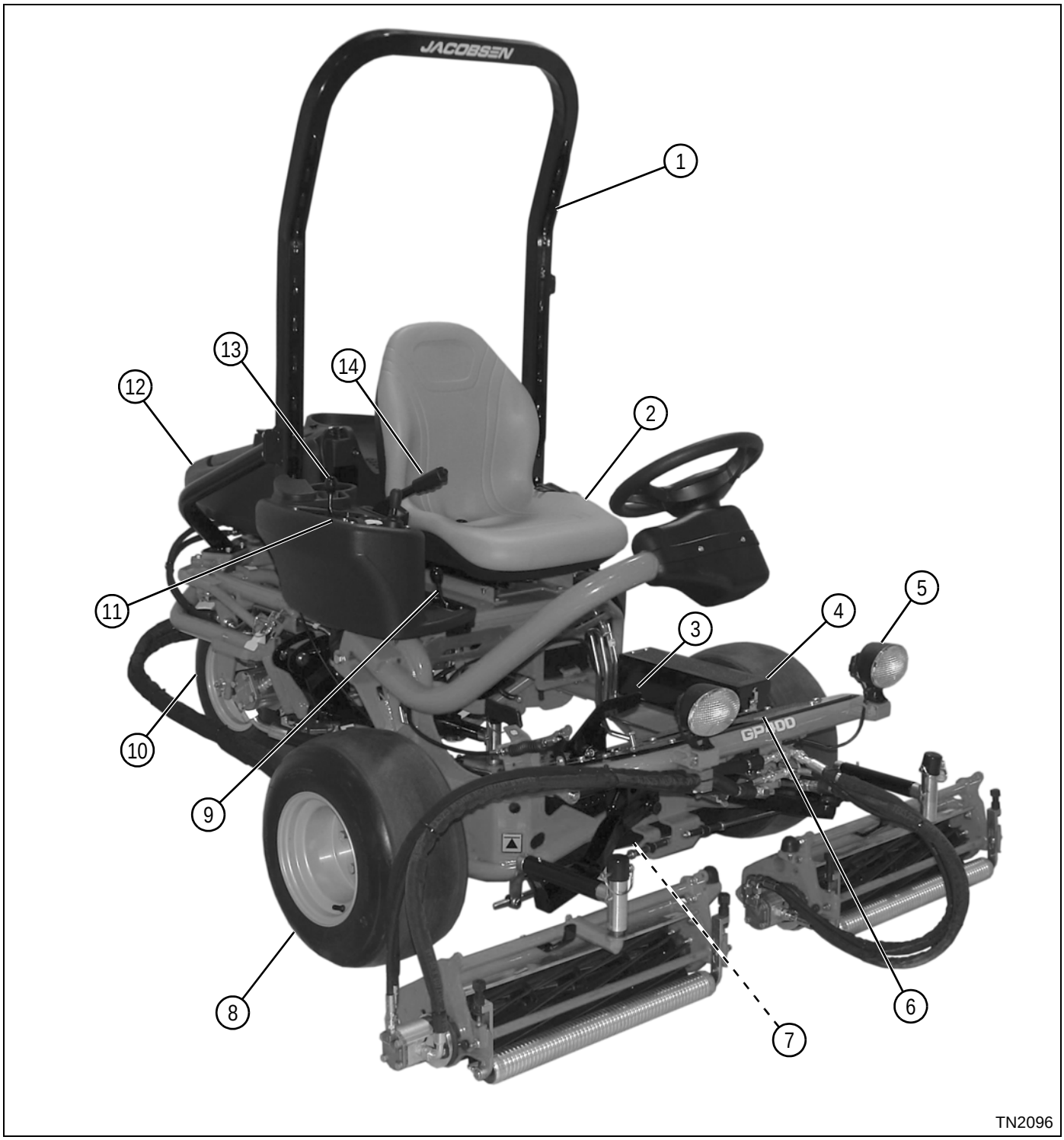
Front Wheel Hub		
Castle Nut Torque	lb-ft (N·m)	162 (220)

Rear Wheel Hub		
3WD Castle Nut Torque	lb-ft (N·m)	162 (220)

Mower Speed		
Transport	mph (km/h)	0–7.5 (0–12)
Mow	mph (km/h)	0–3.7 (0–6)
Reverse	mph (km/h)	0–3 (0–1.9)

Component Location

See Figure 9-1.



1	OPS (Operator Protective Structure)	6	Floorboard Assembly	11	Instrument Panel Cover
2	Seat and Seat Plate	7	Splash Shield	12	Fuel Tank
3	Traction Pedal	8	Front Wheel (2)	13	Traction Lever
4	Tool Box	9	Throttle Lever	14	Park Brake Lever
5	Work Light (2)	10	Rear Wheel		

Figure 9-1: Component Location

Checks and Adjustments

Rotate Seat Forward

See Figure 9-2.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

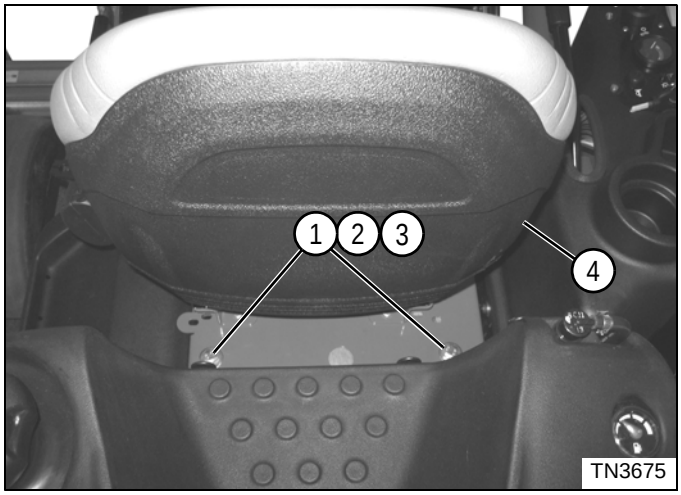


Figure 9-2

2. Remove screws (1), lock washers (2), and flat washers (3).
3. Rotate seat (4) forward.

Raise Hydraulic Oil/Fuel Tank

See Figures 9-3 and 9-4.

NOTE

Diesel model is shown; gasoline model is similar.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Rotate seat forward. (See “Rotate Seat Forward” on page 9-4.)

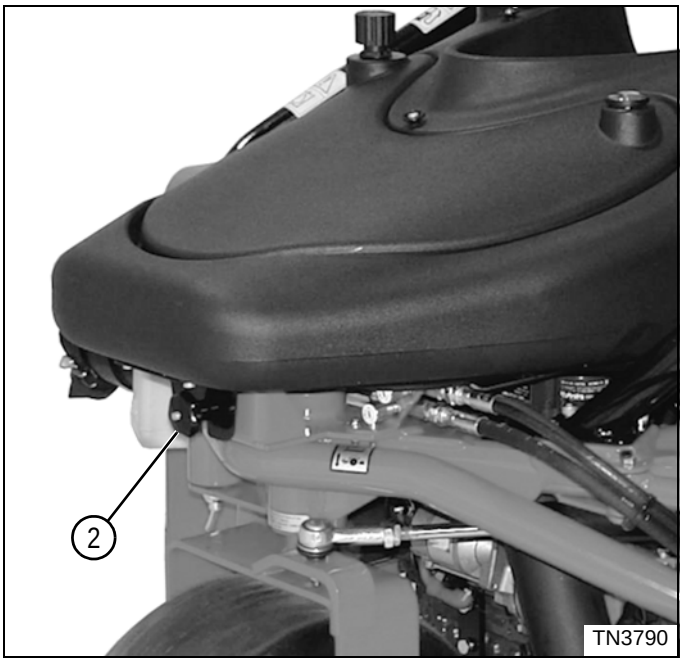


Figure 9-3

3. Loosen knob (2).

9

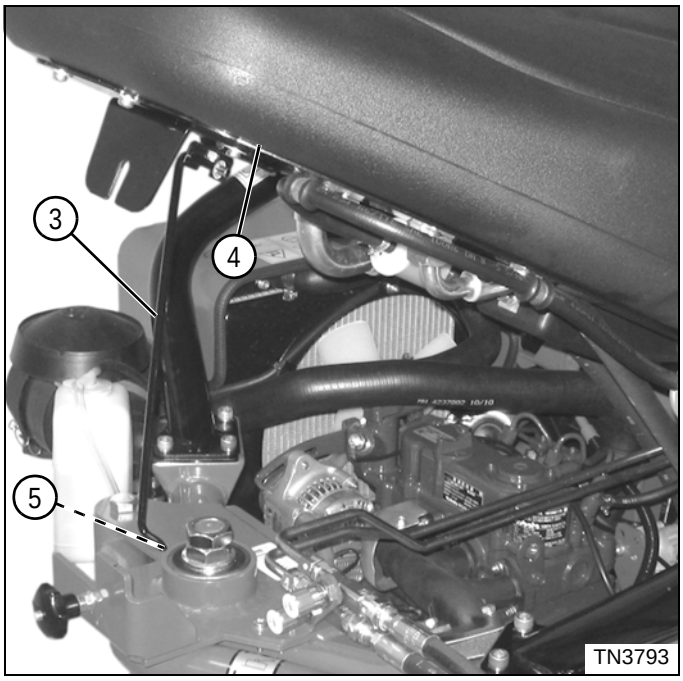


Figure 9-4

WARNING

DO NOT remove the fuel tank cap while the hydraulic oil/fuel tank is in the raised position. Removing fuel tank cap may cause diesel fuel to spill from tank.

4. Raise hydraulic oil/fuel tank (4).
5. Support hydraulic oil/fuel tank by pivoting support rod (3) under the hydraulic oil/fuel tank into support rod hole (5).

NOTE

Lower hydraulic oil/fuel tank by reversing the order of raising.

Transport Speed Stop Adjustment

See Figure 9-5.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

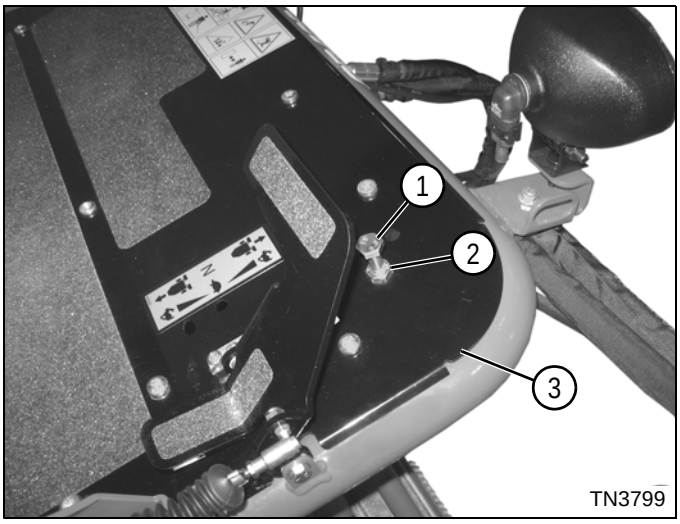


Figure 9-5

NOTE

Adjusting transport speed stop clockwise increases transport speed. Adjusting transport speed stop counterclockwise decreases transport speed.

2. Loosen lock nut (2) on each side of upper floorboard (3).
3. Adjust transport speed stop (1).
4. Tighten lock nut (2) on each side of upper floorboard (3).

Mow Speed Stop Adjustment

See Figure 9-6.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

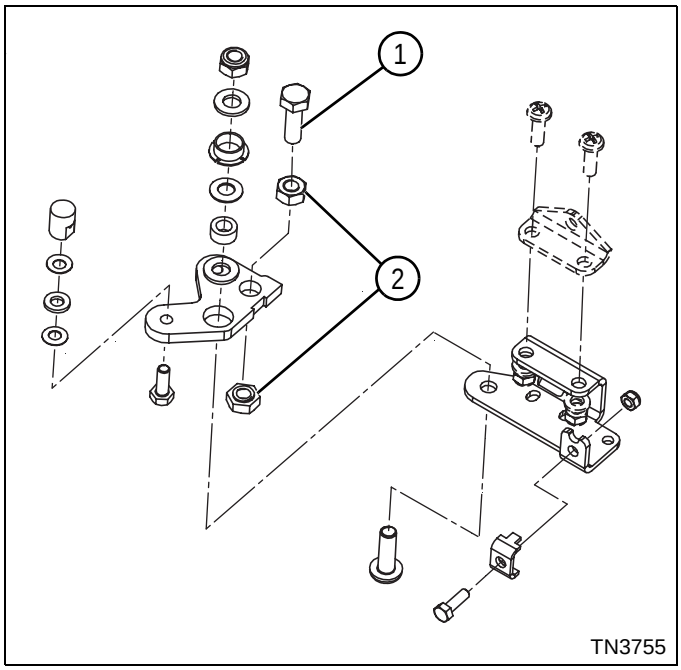


Figure 9-6

NOTE

Adjusting mow speed stop clockwise increases mow speed. Adjusting mow speed stop counterclockwise decreases mow speed.

1. Loosen lock nuts (2).
2. Adjust mow speed stop (1).
3. Tighten lock nuts (2).

Park Brake Adjustment

See Figure 9-7.

NOTE

Right park brake shown; left park brake is similar. To access left park brake, remove tool box. (See “Tool Box” on page 9-17.)

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Block each side of rear wheel using suitable wheel blocks.
3. Disengage park brake.

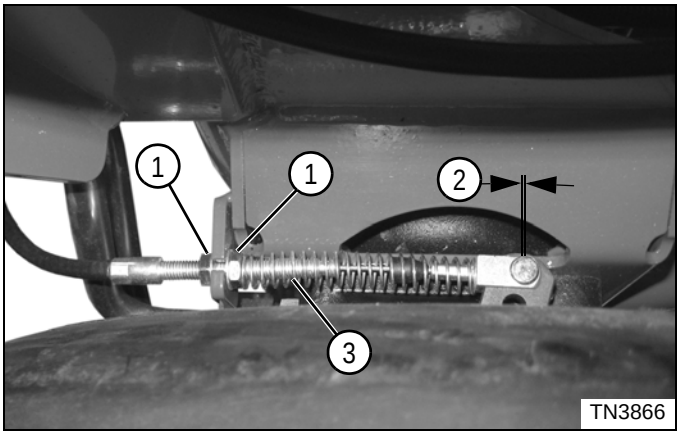


Figure 9-7

4. Loosen lock nuts (1).
5. Adjust park brake cable (3) until caliper lever movement (2) is 0.04 in. (1 mm).
6. Tighten lock nuts (1).
7. Repeat steps 1 through 4 for other park brake.

Repair

OPS

Removal and Installation

See Figures 9-8 and 9-9.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Raise the hydraulic oil/fuel tank. (See “Raise Hydraulic Oil/Fuel Tank” on page 9-4.)

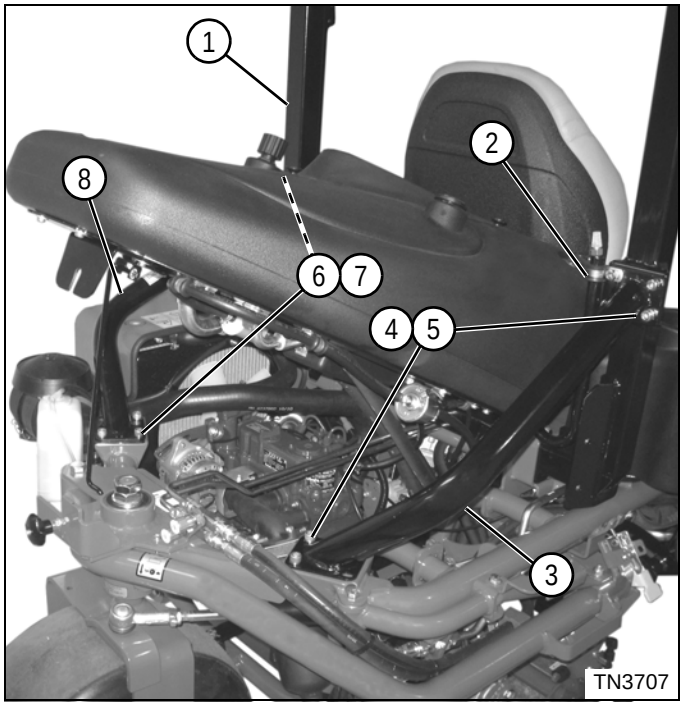


Figure 9-8

3. Disconnect fuel tank breather (2).
4. Remove six screws (4) and lock washers (5).
5. Remove OPS bracket (3).
6. Remove seven screws (6) and lock washers (7).
7. Remove OPS bracket (8).
8. Fully lower hydraulic oil/fuel tank to operating position.
9. Support OPS (1) using a suitable lifting device.

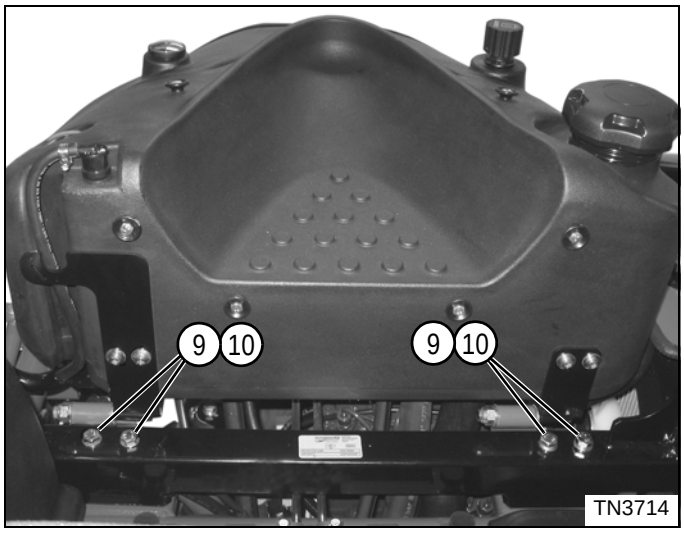


Figure 9-9

10. Remove four OPS mounting bolts (9) and flat washers (10).
11. Remove OPS.

Installation Notes

- *Install OPS by reversing the order of removal.*
- *Tighten OPS mounting bolts (9) to 37 lb-ft (50 N·m).*
- *Tighten OPS bracket screws (4) to 52 lb-ft (71 N·m).*
- *Tighten OPS bracket screws (6) to 52 lb-ft (71 N·m).*

Fuel Tank (Diesel)

Removal and Installation

See Figures 9-10 through 9-13.

CAUTION

Diesel fuel is highly flammable. Do not drain fuel indoors. Heaters can ignite fuel vapors. Use extreme caution when draining fuel.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable from the battery.
3. Remove hydraulic oil tank. (See “Hydraulic Oil Tank (Diesel)” on page 6-57.)

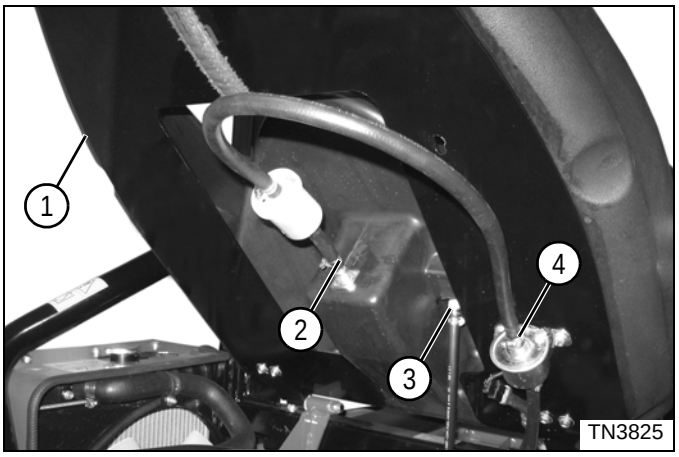


Figure 9-10

CAUTION

Contact with diesel fuel can damage your skin. Use gloves when working with diesel fuel. If you come in contact with diesel fuel, wash skin immediately.

4. Support fuel tank (1) using a suitable lifting device.

NOTE

Fuel system capacity is 14.2 gal (54 L). Have suitable container(s) available that can hold up to 15 gal (57 L) of fuel.

5. Place a suitable container under the fuel tank.
6. Disconnect fuel line (4) and drain fuel into container. Lower fuel tank (1) to operating position and loosen the fuel cap to aid in draining fuel.
7. After fuel tank is drained, raise fuel tank (1) and connect fuel line (4).
8. Disconnect fuel lines (2 and 3). Plug lines and cap fittings to prevent leakage and contamination.

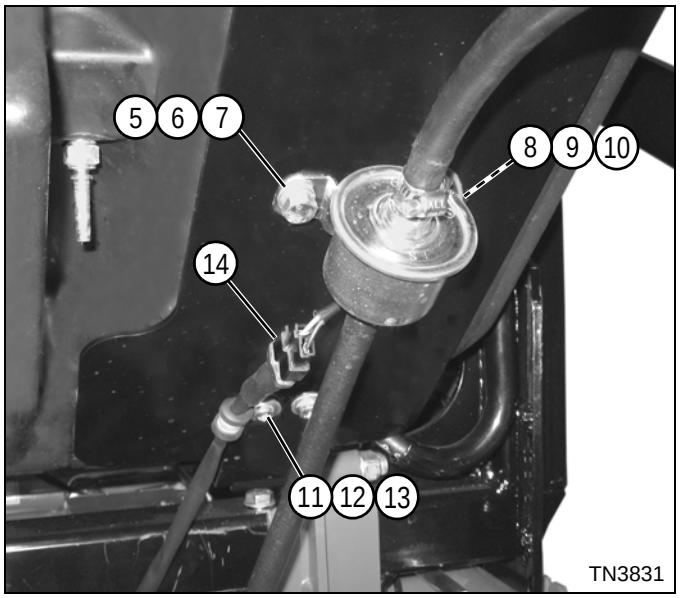


Figure 9-11

NOTE

Label all wires before disconnecting to ensure correct installation.

9. Disconnect fuel pump wire connector (14).
10. Remove screw (11), flat washer (12), and clamp (13).
11. Remove screw (5), lock washer (6), and flat washer (7).
12. Remove screw (8), lock washer (9), and flat washer (10).

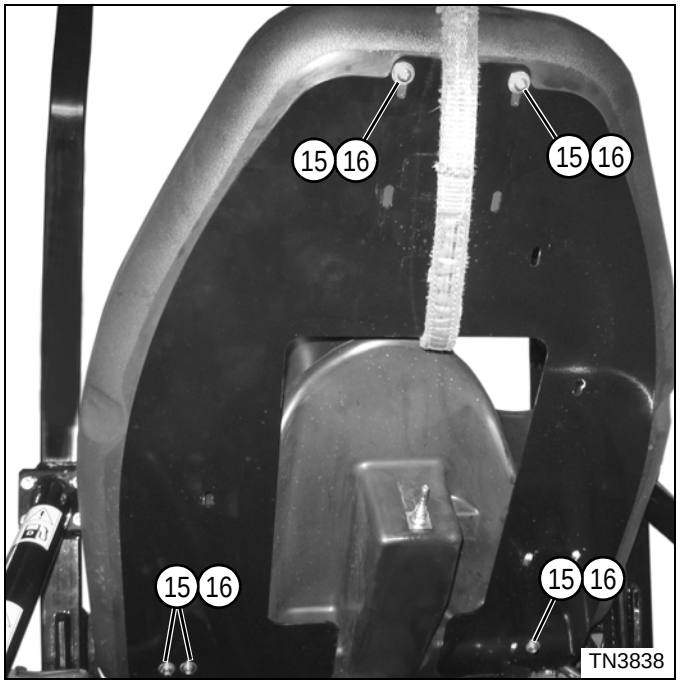


Figure 9-12

13. Remove screws (15) and flat washers (16).

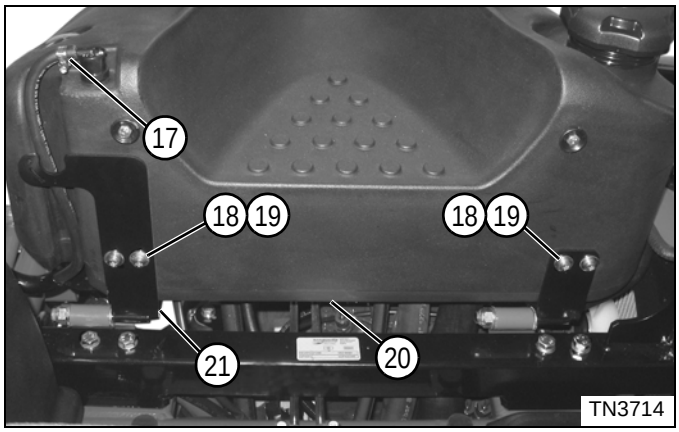


Figure 9-13

14. Lower fuel tank to operating position and disconnect fuel tank breather hose (17).
15. Remove four screws (18) and flat washers (19).
16. Remove fuel tank (20) from fuel tank pan (21).

Installation Notes

Required Materials
Anti-Seize Compound

- *Apply anti-seize compound to screws (5, 8, 11, 15, and 18) prior to installation. Do not overtighten these screws or tank may crack and cause a leak.*
- *Install fuel tank by reversing the order of removal.*
- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*

Fuel Tank (Gasoline)

Removal and Installation

See Figures 9-14 through 9-16.

CAUTION

Gasoline is highly flammable. Do not drain fuel indoors. Heaters can ignite fuel vapors. Use extreme caution when draining fuel.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable from the battery.
3. Remove hydraulic oil tank. (See “Hydraulic Oil Tank (Gasoline)” on page 6-58.)

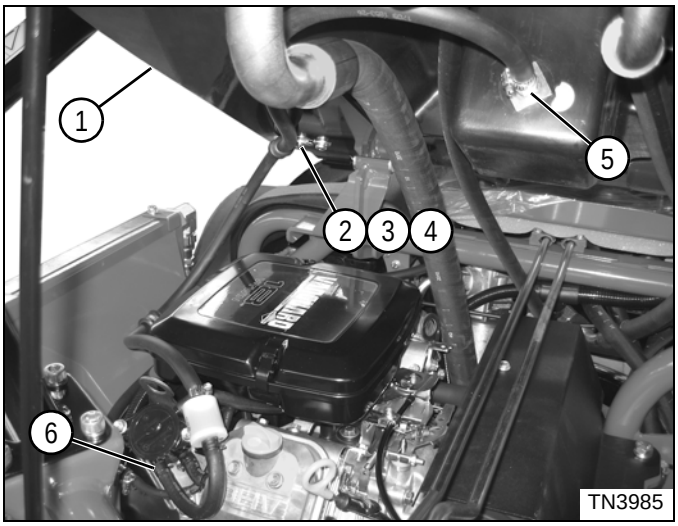


Figure 9-14

4. Support fuel tank (1) using a suitable lifting device.

NOTE

Fuel system capacity is 14.2 gal (54 L). Have suitable container(s) available that can hold up to 15 gal (57 L) of fuel.

5. Place a suitable container under the fuel tank.
6. Disconnect fuel line (6) and drain fuel into container. Lower fuel tank (1) to operating position and loosen the fuel cap to aid in draining fuel.
7. After fuel tank is drained, raise fuel tank (1) and connect fuel line (6).
8. Remove screw (2), flat washer (3), and clamp (4).
9. Disconnect fuel line (5). Plug line and cap fitting to prevent leakage and contamination.

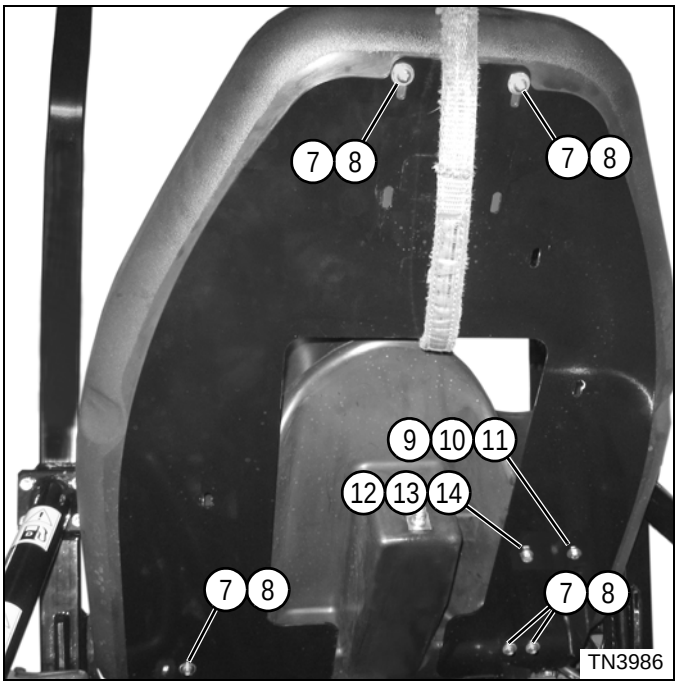


Figure 9-15

10. Remove screw (9), lock washer (10), and flat washer (11).
11. Remove screw (12), lock washer (13), and flat washer (14).
12. Remove screws (7) and flat washers (8).

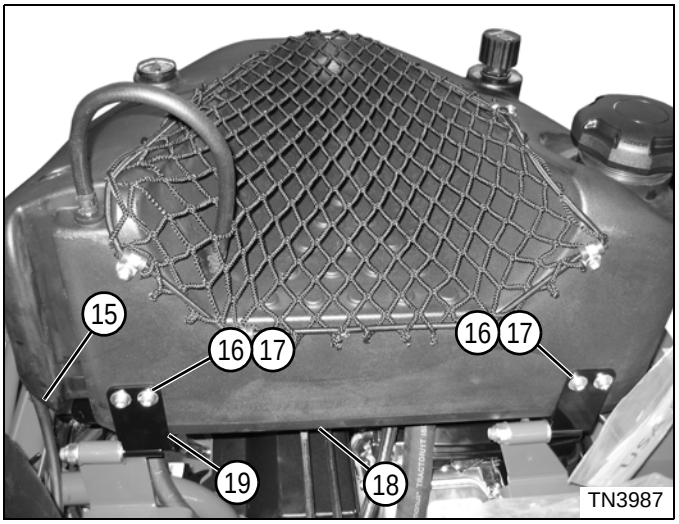


Figure 9-16

13. Lower fuel tank to operating position and disconnect hose (15).
14. Remove four screws (16) and flat washers (17).
15. Remove fuel tank (18) from fuel tank pan (19).

Installation Notes

Required Materials
Anti-Seize Compound

- *Apply anti-seize compound to screws (2, 7, 9, 12, and 16) prior to installation. Do not overtighten these screws or tank may crack and cause a leak.*
- *Install fuel tank by reversing the order of removal.*

Fuel Tank Support Pan

Removal and Installation

See Figures 9-17 and 9-18.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove hydraulic oil tank. (See “Hydraulic Oil Tank (Diesel)” on page 6-57 or “Hydraulic Oil Tank (Gasoline)” on page 6-58.)
3. Remove fuel tank. (See “Fuel Tank (Diesel)” on page 9-7 or “Fuel Tank (Gasoline)” on page 9-9.)

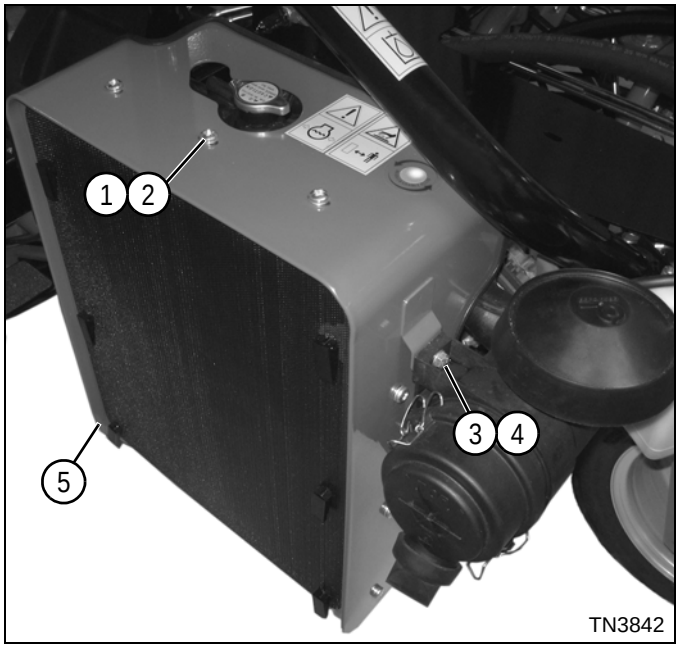


Figure 9-17

4. Remove two screws (3) and flat washers (4).
5. Remove nine screws (1) and flat washers (2), and remove radiator cover (5).

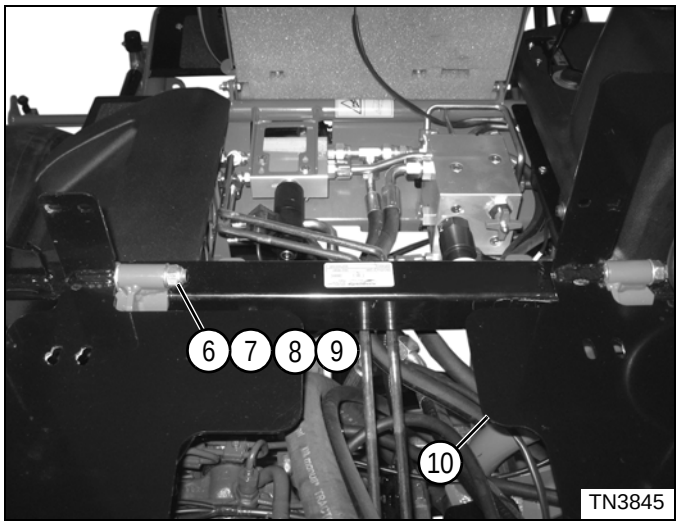


Figure 9-18

6. Remove two nuts (6), flat washers (7), flat washers (8) and nylon bearings (9), and remove fuel tank support pan (10).

Installation Note

Install fuel tank support pan by reversing the order of removal.

Traction Pedal Assembly

Removal and Installation

See Figures 9-19 through 9-22.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

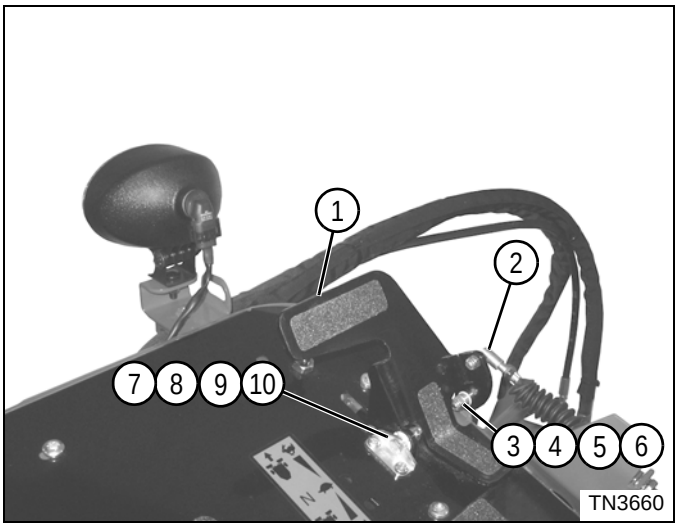


Figure 9-19

2. Disconnect rod (2).
3. Remove nut (3), steel bushing (4), nylon bearing (5), and screw (6).
4. Remove screw (7), nylon bearing (8), steel bushing (9), and nut (10).
5. Remove traction pedal (1).

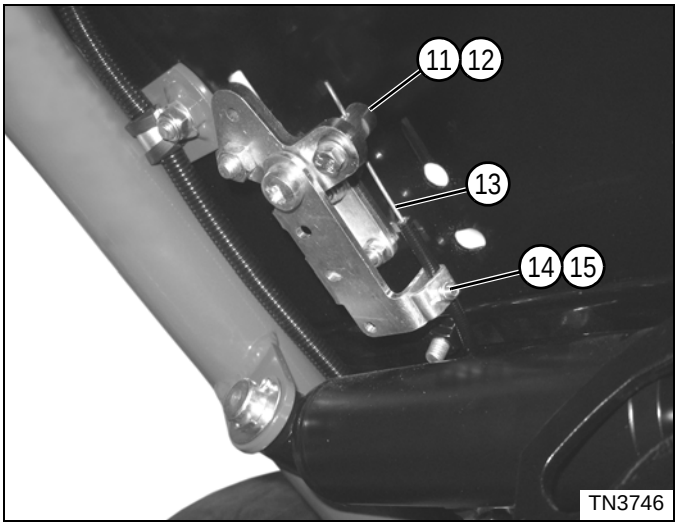


Figure 9-20

6. Loosen screw (11) and cable clamp (12).
7. Loosen screw (14) and nut (15).
8. Disconnect mow speed cable (13).

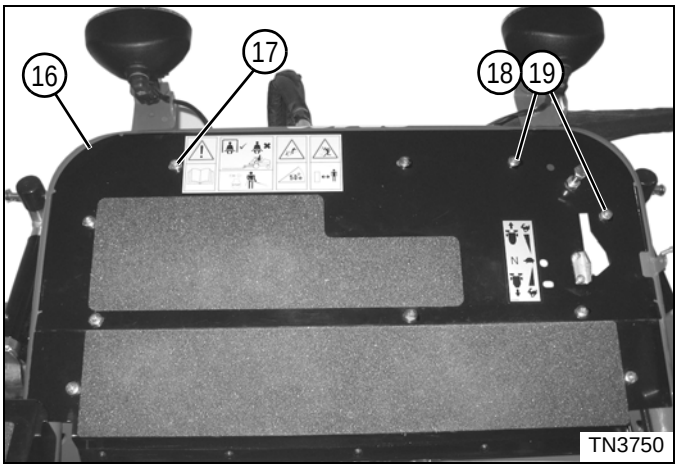


Figure 9-21

9. Remove screws (18) and nuts (19).
10. Remove six screws (17).
11. Remove upper floorboard (16).

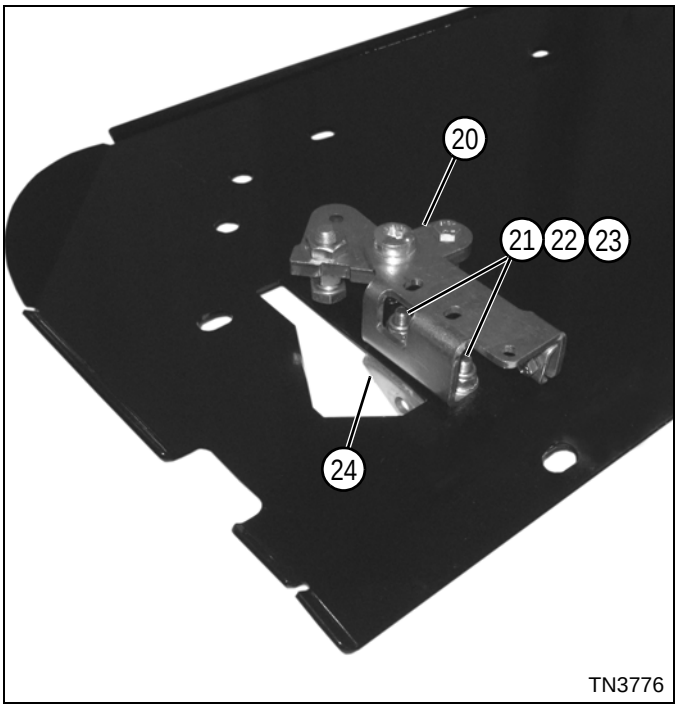


Figure 9-22

12. Remove nuts (21), flat washers (22), screws (23), mow speed stop bracket (20), and traction pedal bracket (24).

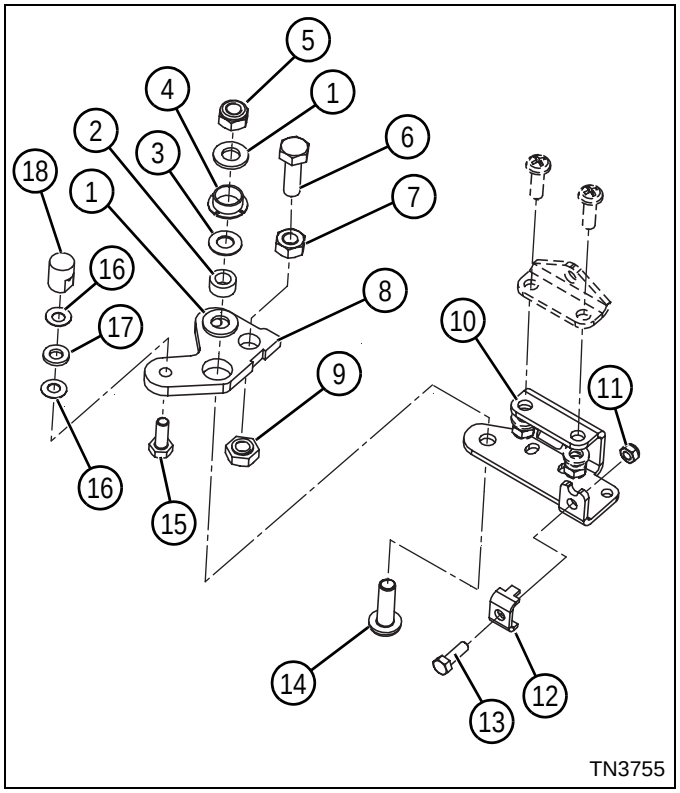
Installation Notes

- *Install traction pedal assembly by reversing the order of removal.*
- *Adjust transport speed stop. (See "Transport Speed Stop Adjustment" on page 9-5.)*
- *Adjust mow speed stop. (See "Mow Speed Stop Adjustment" on page 9-6.)*

Disassembly and Assembly

Mow Speed Stop Bracket Assembly

See Figure 9-23.



1	Flat Washer (2)	10	Mow Speed Bracket
2	Bushing	11	Lock Nut
3	Spring-Disc	12	Cable Clamp
4	Nylon Bearing	13	Screw
5	Lock Nut	14	Screw
6	Screw	15	Screw
7	Nut	16	Spring-Disc (2)
8	Mow Speed Lever	17	Flat Washer
9	Nut	18	Cable Clamp

Figure 9-23

Disassembly Note

Clean and inspect all moving parts, checking for wear, damage, and binding.

Assembly Notes

- *Assemble mow speed stop bracket in reverse order of disassembly.*
- *Adjust mow speed stop. (See "Mow Speed Stop Adjustment" on page 9-6.)*

Instrument Panel Cover

Removal and Installation

See Figure 9-24.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

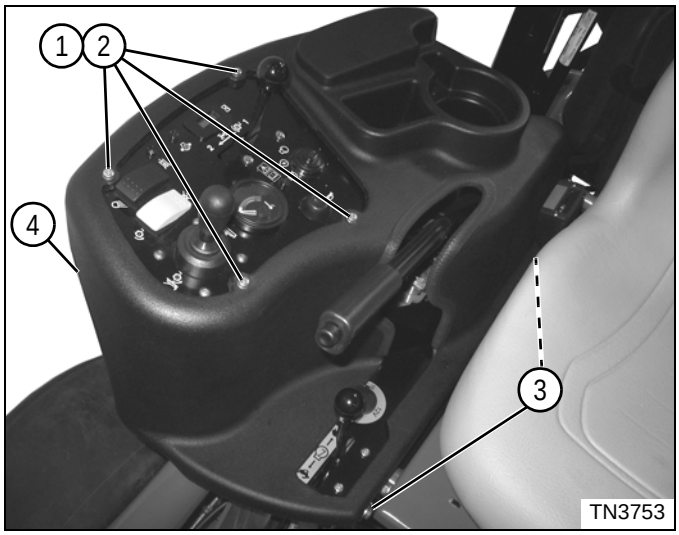


Figure 9-24

2. Loosen, but do not remove, screws (3).
3. Remove screws (1) and flat washers (2).
4. Remove instrument panel cover (4).

Installation Note

Install instrument panel cover by reversing the order of removal.

Traction Lever Assembly

Removal and Installation

See Figures 9-25 and 9-26.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove instrument panel cover. (See “Instrument Panel Cover” on page 9-13.)

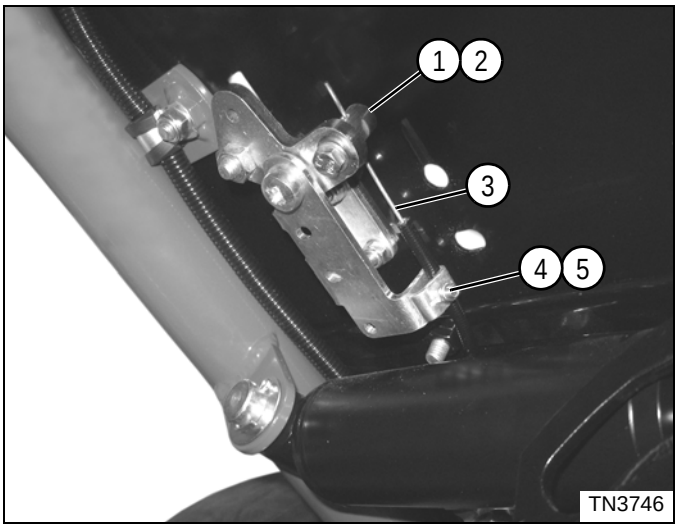


Figure 9-25

3. Loosen screw (1) and cable clamp (2).
4. Loosen screw (4) and nut (5).
5. Disconnect mow speed cable (3).

NOTE

Note mow speed cable routing to ensure correct installation.

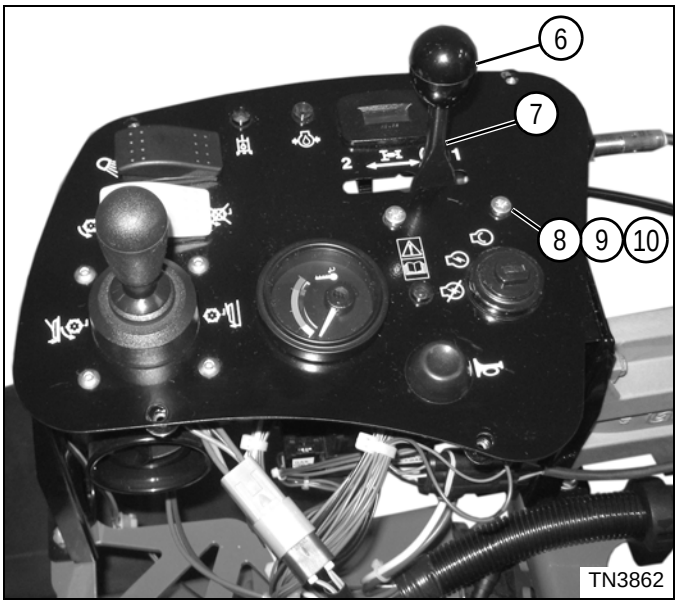


Figure 9-26

6. Remove threaded traction lever knob (6).
7. Remove two nuts (8), flat washers (9), and screws (10).
8. Remove traction lever assembly (7).

Installation Note

Install traction lever assembly by reversing the order of removal.

Throttle Lever

Removal and Installation

See Figure 9-27.

NOTE

Diesel model is shown; gasoline model is similar.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

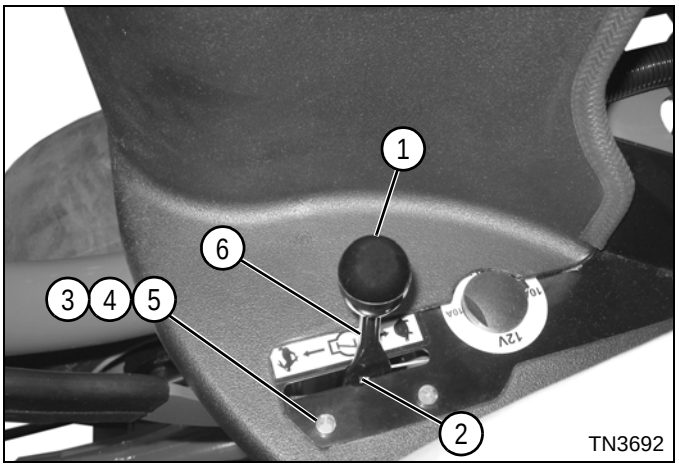


Figure 9-27

2. Remove threaded throttle lever knob (1).
3. Remove two nuts (3), flat washers (4), and screws (5).
4. Disconnect throttle cable (2).
5. Remove throttle lever (6).

Installation Note

Install throttle lever by reversing the order of removal.

Park Brake Lever

Removal and Installation

See Figure 9-28.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable from the battery.
3. Remove instrument panel cover. (See “Instrument Panel Cover” on page 9-13.)

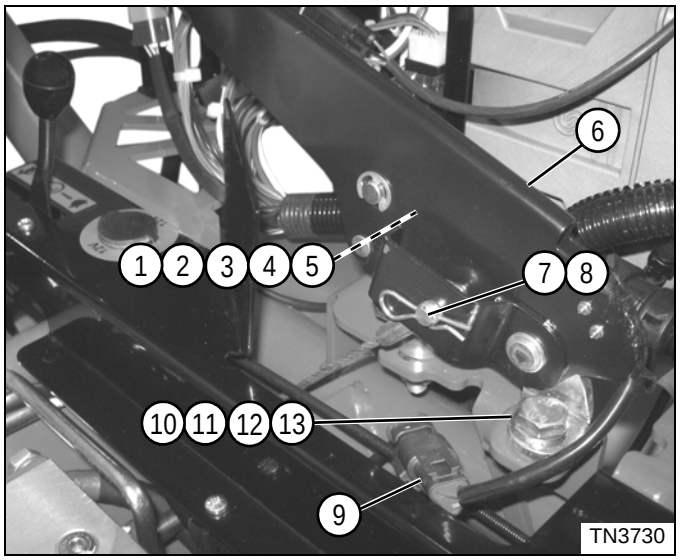


Figure 9-28

4. Disengage park brake lever (6).
5. Remove pin (7) and clip (8).

NOTE

Label all wires before disconnecting to ensure correct installation.

6. Disconnect wire connector (9).
7. Remove nut (1), flat washer (2), spacer (3), flat washer (4) and bolt (5).
8. Remove nut (10), flat washer (11), flat washer (12), and bolt (13).
9. Remove park brake lever (6).

Installation Notes

- *Install park brake lever by reversing the order of removal.*
- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*

Seat and Seat Plate

Removal and Installation

See Figures 9-29 and 9-30.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable from the battery.

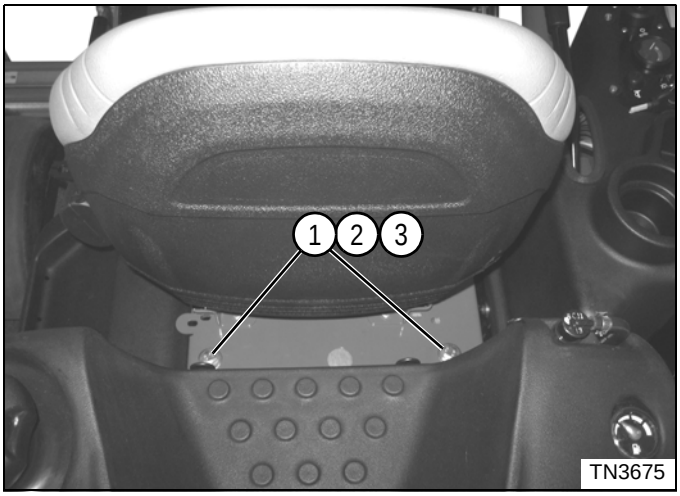


Figure 9-29

3. Remove screws (1), lock washers (2), and flat washers (3).

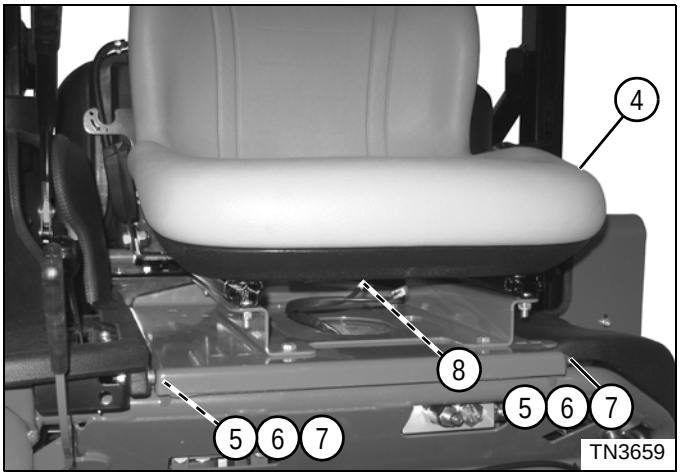


Figure 9-30

4. Support the seat and seat plate (4) with a suitable lifting device.

NOTE

Label all wires before disconnecting to ensure correct installation.

5. Disconnect the operator’s seat switch wire connector (8).
6. Remove nuts (5), flat washers (6), and screws (7).
7. Using a lifting device, remove seat and seat plate.

Installation Notes

- *Install seat and seat plate by reversing the order of removal.*
- *Carefully route seat switch wire harness to avoid damage from pinched wires.*
- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*

Disassembly and Assembly—Seat and Seat Plate

See Figures 9-31 through 9-33.

Figure 9-31

1. Remove four nuts (2) and four flat washers (3), and remove seat plate (4) from seat (1).

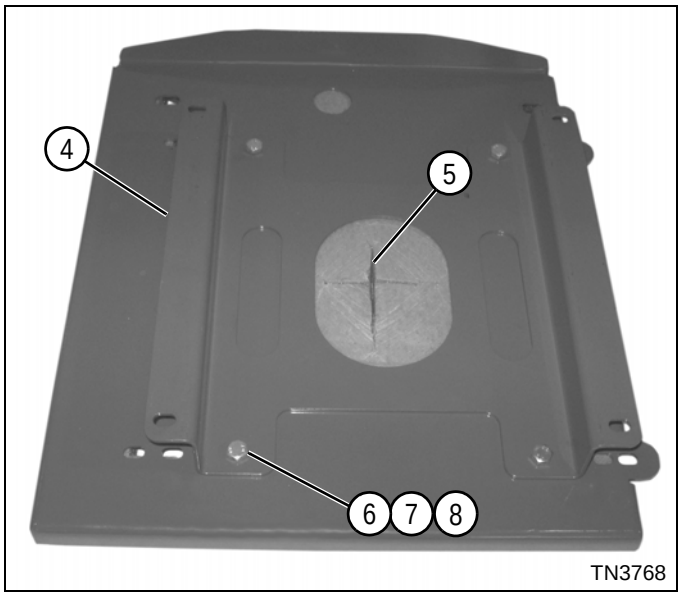


Figure 9-32

2. Remove four screws (6), flat washers (7), and nuts (8), and remove seat mount (4).
3. Remove acoustic foam (5).

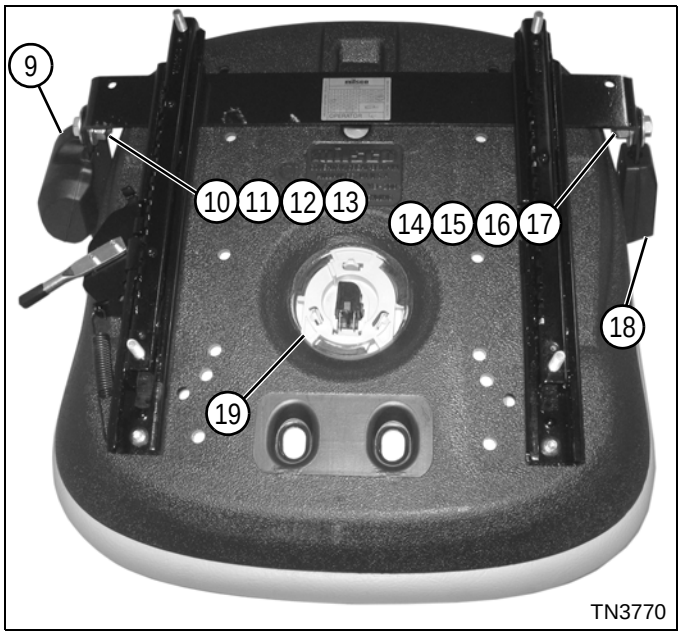


Figure 9-33

4. Remove nut (10), flat washers (11 and 12), screw (13), and seat belt (9).
5. Remove nut (14), flat washers (15 and 16), screw (17), and seat belt latch (18).
6. Remove seat switch (19) by turning counterclockwise.

Assembly Note

Assemble seat and seat plate by reversing the order of disassembly.

Seat Switch

Removal and Installation

Standard Seat

See Figure 9-34.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

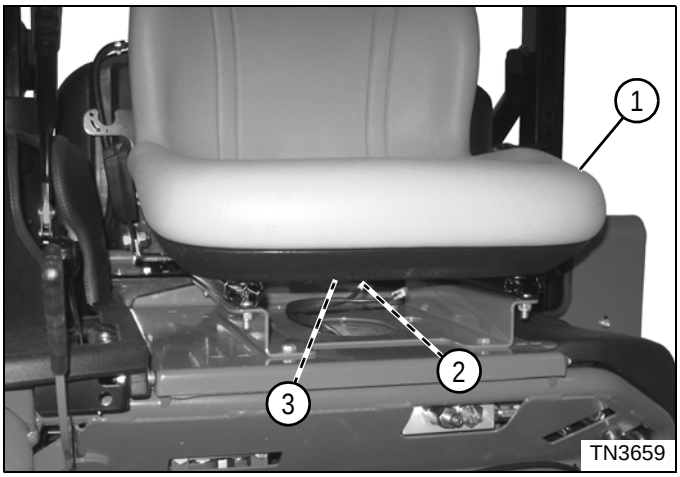


Figure 9-34

NOTE

Label all wires before disconnecting to ensure correct installation.

2. Disconnect the seat switch wire connector (2).
3. Remove seat switch (3) by turning counterclockwise.

Installation Notes

- *Install seat switch by reversing the order of removal.*
- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*

Tool Box

Removal and Installation

See Figure 9-35.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

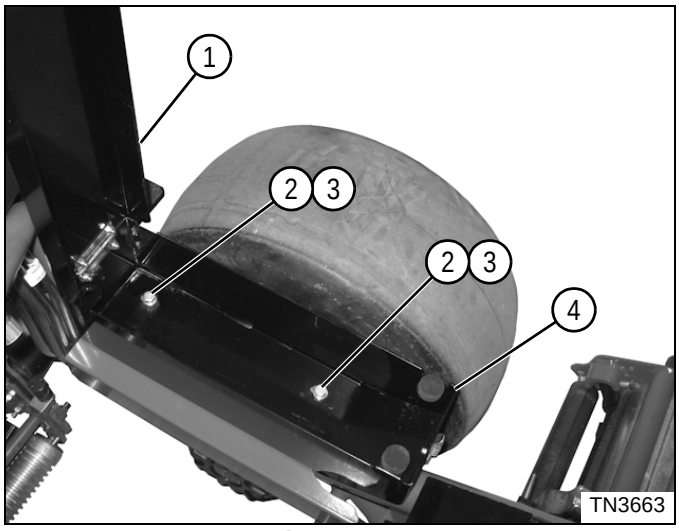


Figure 9-35

2. Raise tool box cover (1).
3. Remove screws (2) and flat washers (3).
4. Lower tool box cover (1) and remove tool box (4).

Installation Note

Install tool box by reversing the order of removal.

Floorboard Assembly

Removal and Installation

See Figures 9-36 through 9-39.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove splash shield. (See “Splash Shield” on page 9-18.)
3. Remove traction pedal. (See “Traction Pedal Assembly” on page 9-11.)

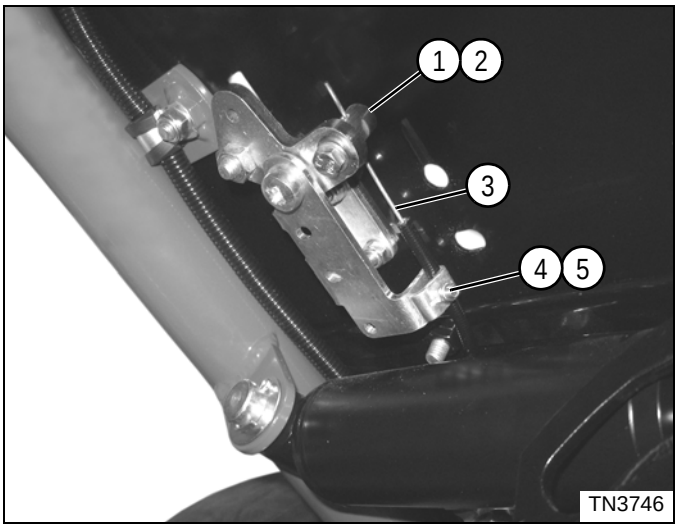


Figure 9-36

4. Loosen screw (1) and cable clamp (2).
5. Loosen screw (4) and nut (5).
6. Disconnect mow speed cable (3).

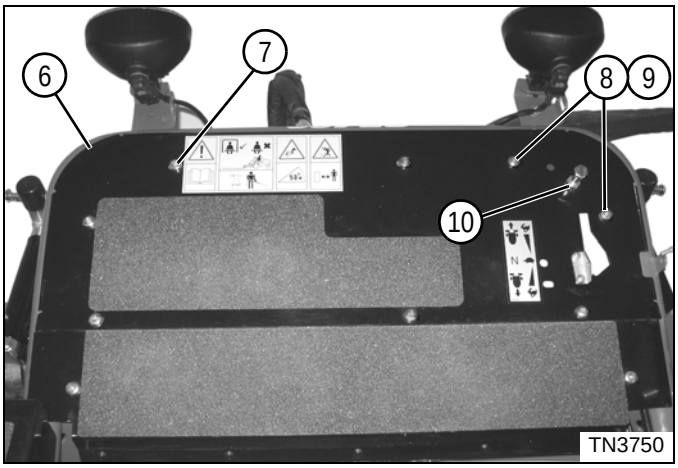


Figure 9-37

7. Remove transport speed stop (10).
8. Remove screws (8) and nuts (9).
9. Remove six screws (7).
10. Remove upper floorboard (6).

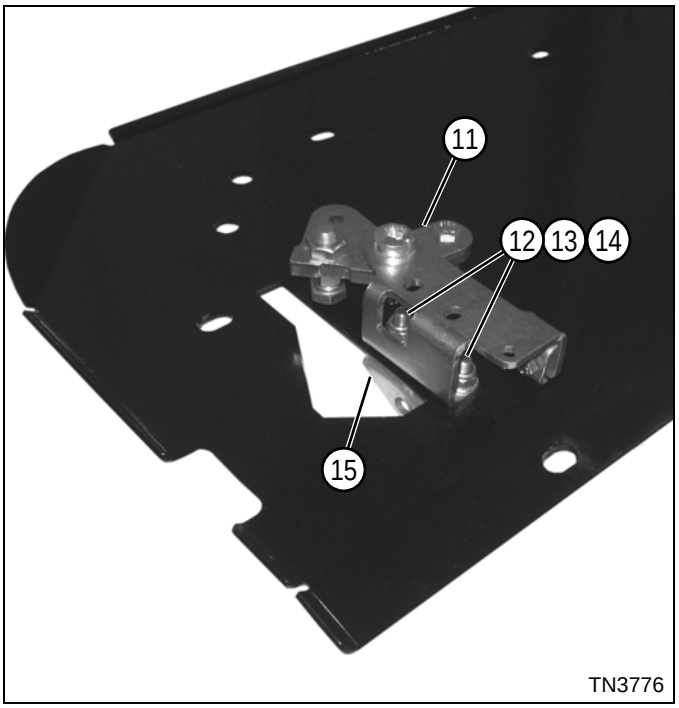


Figure 9-38

11. Remove nuts (12), flat washers (13), screws (14), mow speed stop bracket (11), and traction pedal bracket (15).

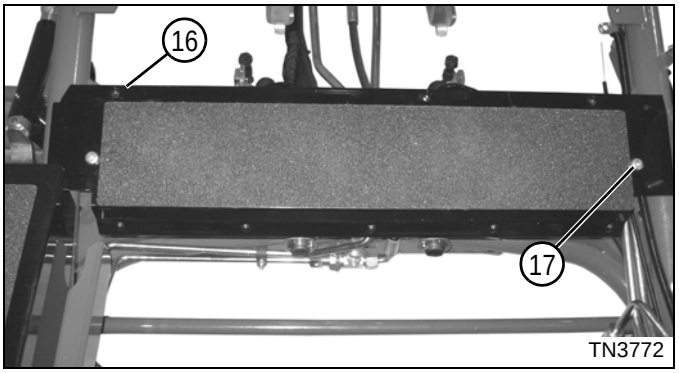


Figure 9-39

12. Remove two screws (17) and lower floorboard (16).

Installation Notes

- *Install floorboard assembly by reversing the order of removal.*
- *Adjust transport speed stop. (See "Transport Speed Stop Adjustment" on page 9-5.)*
- *Adjust mow speed stop. (See "Mow Speed Stop Adjustment" on page 9-6.)*

Splash Shield

Removal and Installation

See Figure 9-40.

1. Park the mower safely. (See "Park Mower Safely" on page 1-6.)

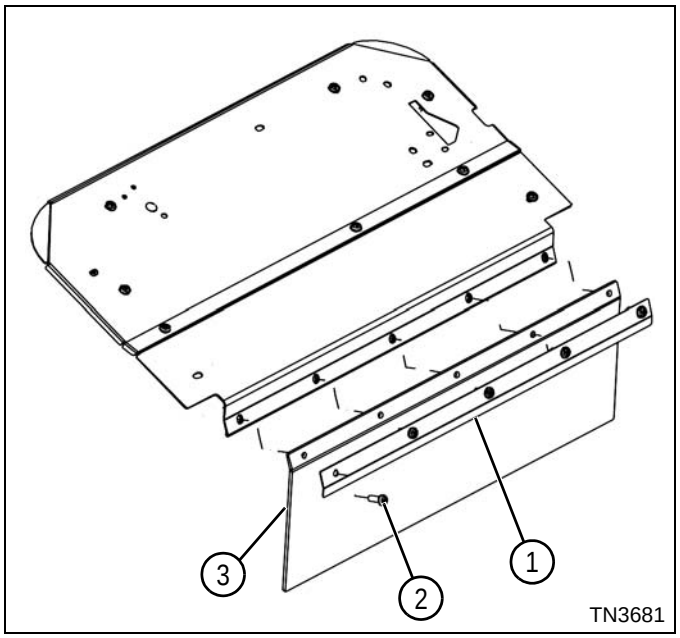


Figure 9-40

2. Remove five screws (2).
3. Remove plate (1) and splash shield (3).

Installation Note

Install splash shield by reversing the order of removal.

Work Light

Removal and Installation

See Figure 9-41.

NOTE

Right work light is shown; left work light is similar.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Disconnect the negative (–) battery cable from the battery.

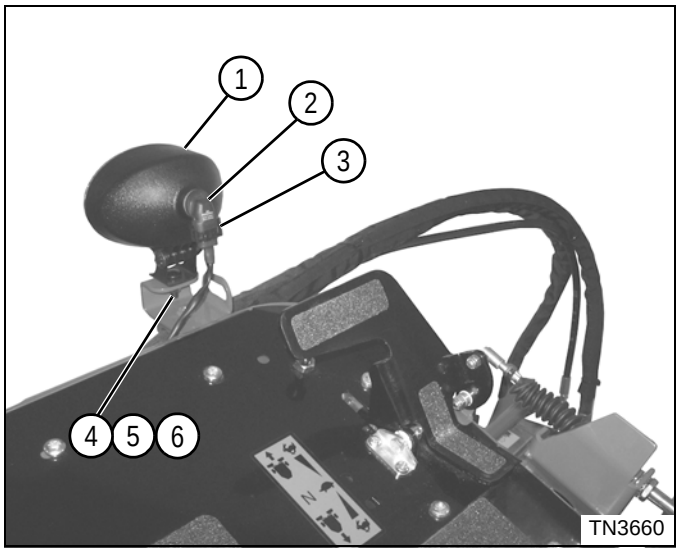


Figure 9-41

NOTE

Label all wires before disconnecting to ensure correct installation.

3. Disconnect wire connector (3).
4. Remove nut (4), lock washer (5), and screw (6).
5. Remove work light (1).
6. To replace bulb, rotate bulb (2) counterclockwise at wire connector end, until bulb stops. Pull bulb straight out to remove.

Installation Notes

- *Install work light bulb and work light by reversing the order of removal.*
- *Apply dielectric grease (Jacobsen PN 365422) to any wire connectors disconnected.*
- *Adjust work lights to project desired distance in front of the mower.*

Front Wheel

Removal and Installation

See Figure 9-42.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Block each side of rear wheel using suitable wheel blocks.

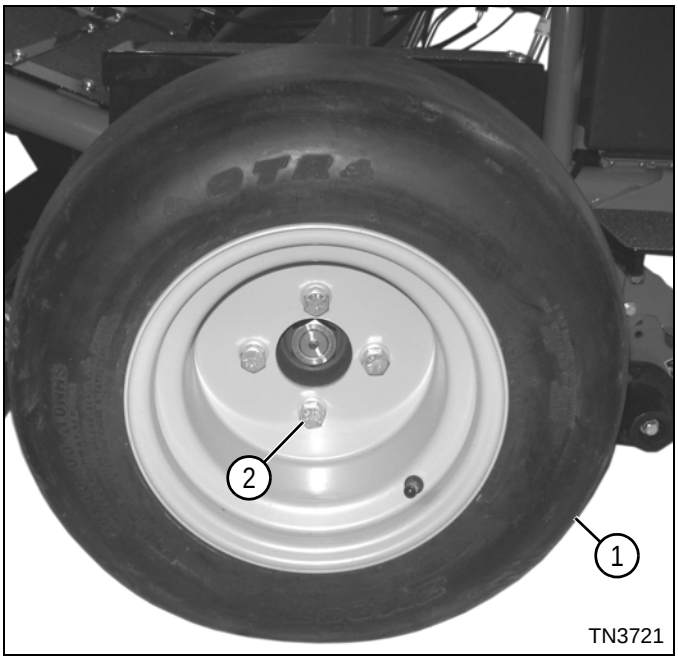


Figure 9-42

3. Loosen, but do not remove, four mounting bolts (2).

WARNING

- **Support the machine using properly rated jackstands. Never work under a machine supported only by a jack.**
- **Do not use wood or concrete blocks to support the machine. Failure to properly support the machine may result in death or serious injury.**

IMPORTANT

It is important to lift and support the machine, or the machine will move.

4. Raise and support front of machine with jackstands.
5. Remove four mounting bolts (2).
6. Remove wheel (1) and inspect tread area for tears or other damage.
7. Replace tire if damage is excessive.

Installation Notes

- *Inspect and clean any rust from hub or wheel mounting area.*
- *Install wheel by reversing the order of removal.*
- *Tighten mounting bolts to 55 lb-ft (75 N·m) using an alternating pattern.*
- *Set tire pressure to 10 psi (0.7 bar).*

Park Brake Caliper Assembly

Removal and Installation

See Figure 9-43.

NOTE

Right wheel park brake caliper assembly is shown; left wheel park brake caliper assembly is similar.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove front wheel. (See “Front Wheel” on page 9-19.)
3. Disengage park brake.

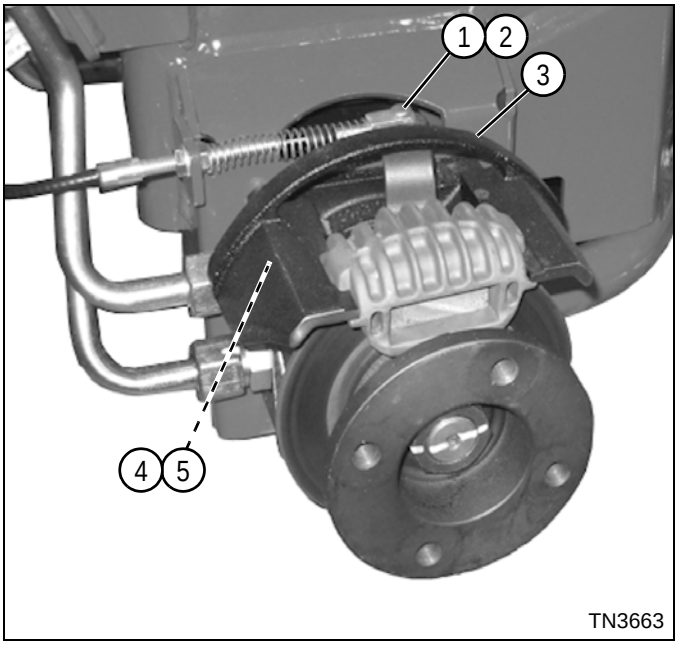


Figure 9-43

4. Remove pin (1) and clip (2).
5. Remove two screws (4) and flat washers (5).
6. Remove park brake caliper assembly (3).

Installation Note

Install park brake caliper assembly by reversing the order of removal.

Disassembly and Assembly

See Figure 9-44.

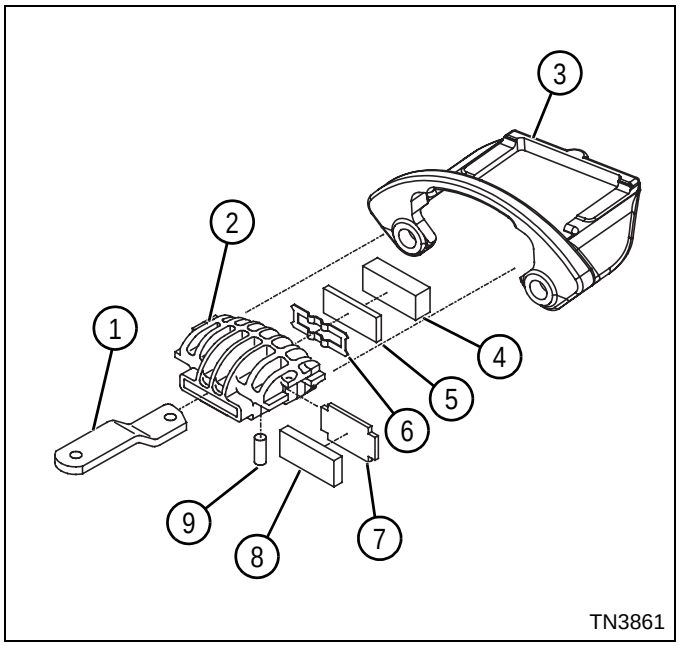


Figure 9-44

1. Remove caliper housing (2) from caliper bracket (3).
2. Remove pin (9) and cam (1).
3. Remove pad support (7) and brake pad (8).
4. Remove retainer (6), pad support (5), and brake pad (4).
5. Inspect brake pads for excessive or uneven wear. Replace as a set if necessary.

Assembly Note

Assemble park brake caliper in reverse order of disassembly.

Park Brake Cables

Removal and Installation

See Figures 9-45 through 9-48.

NOTE

Right park brake cable shown; left park brake cable is similar. To access left park brake cable, remove tool box. (See “Tool Box” on page 9-17.)

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove instrument panel cover. (See “Instrument Panel Cover” on page 9-13.)
3. Block each side of front wheels using suitable wheel blocks.
4. Disengage park brake.

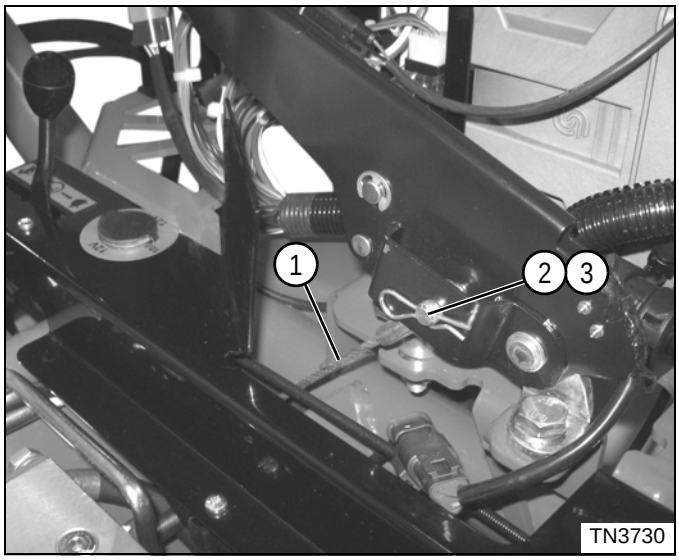


Figure 9-45

5. Remove pin (2), clip (3), and cable (1).

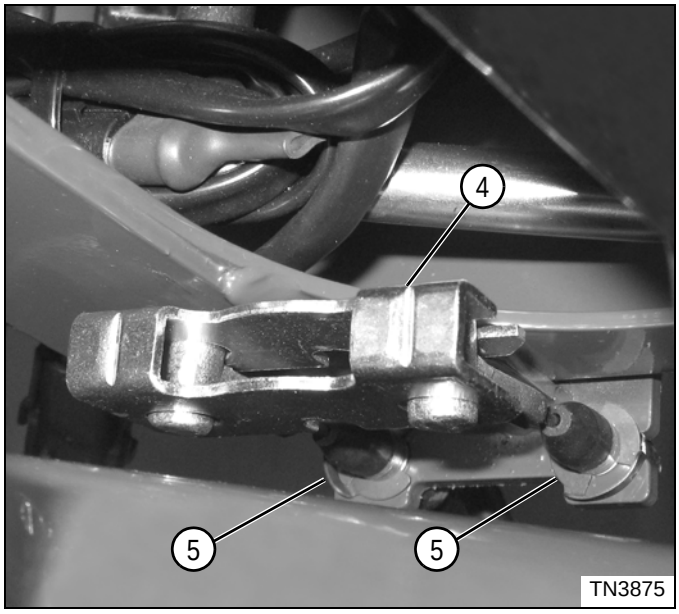


Figure 9-46

6. Remove two clips (5) and cable equalizer (4).

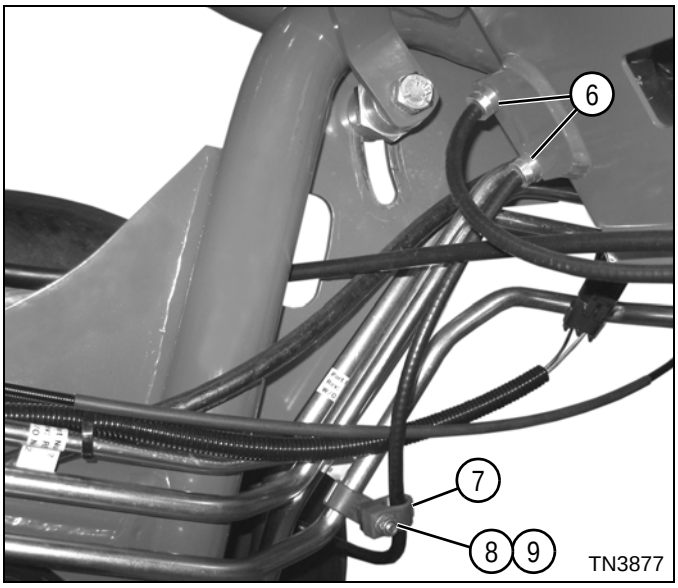


Figure 9-47

7. Remove nut (8), flat washer (9), and clamp (7).

NOTE

- *Note cable routing to ensure correct installation.*
- *Note placement of cable ties to ensure correct installation.*

8. Disconnect two cables (6) from machine frame.
9. Remove all cable ties from cables (6).

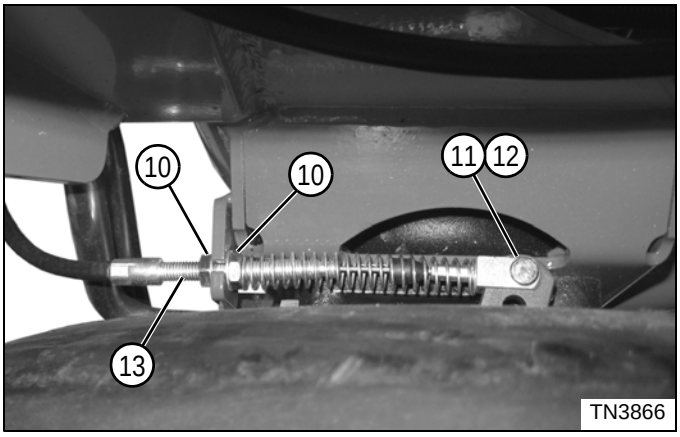


Figure 9-48

10. Remove clip (11) and pin (12).
11. Loosen two lock nuts (10).
12. Remove cable (13).
13. Repeat steps 10 through 12 for left park brake cable.

Installation Notes

- *Install park brake cables by reversing the order of removal.*
- *Adjust park brake. (See “Park Brake Adjustment” on page 9-6.)*

Front Wheel Hub

Removal and Installation

See Figure 9-49.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove front wheel. (See “Front Wheel” on page 9-19.)

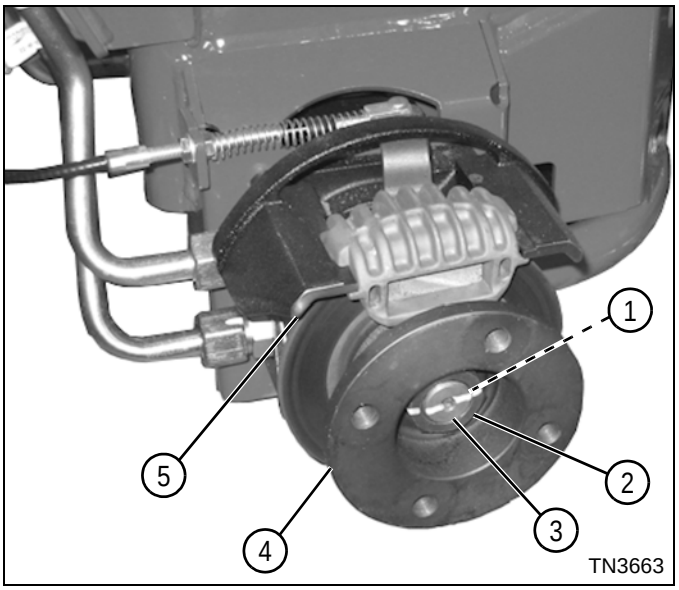


Figure 9-49

3. Remove park brake caliper assembly (5). (See “Park Brake Caliper Assembly” on page 9-20.)
4. Loosen, but do not remove, castle nut (2).
5. Loosen the wheel hub (4) from the motor shaft (3) using a suitable puller.
6. Remove castle nut (2) and wheel hub (4).
7. Remove key (1) from motor shaft (3).

Installation Notes

Required Materials
Anti-Seize Compound

- *Clean the motor shaft and hub tapers with brake cleaner, or similar cleaning solvent, to remove any oil or grease.*
- *Install the front wheel hub by reversing the order of removal.*
- *Apply anti-seize compound (Jacobsen PN 360652) to key. Key must be bottomed in slot.*
- *Do not lubricate or apply anti-seize on the tapers; hub must be installed dry.*
- *Tighten castle nut to 162 ft-lb (220 N·m).*

Rear Wheel and Steering Axle—2WD Units (Diesel)

Removal and Installation

See Figures 9-50 and 9-51.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

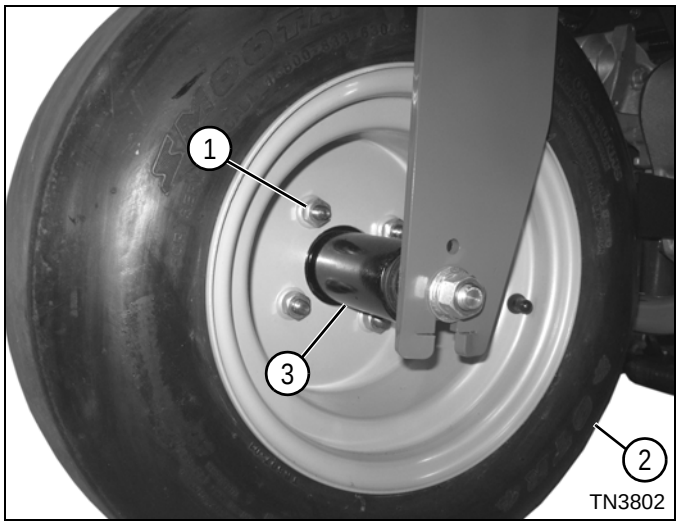


Figure 9-50

2. Loosen, but do not remove, four lug nuts (1).

WARNING

- **Support the machine using properly rated jackstands. Never work under a machine supported only by a jack.**
- **Do not use wood or concrete blocks to support the machine. Failure to properly support the machine may result in death or serious injury.**

IMPORTANT

It is important to lift and support the machine, or the machine will move.

3. Raise and support rear of machine with jackstands.

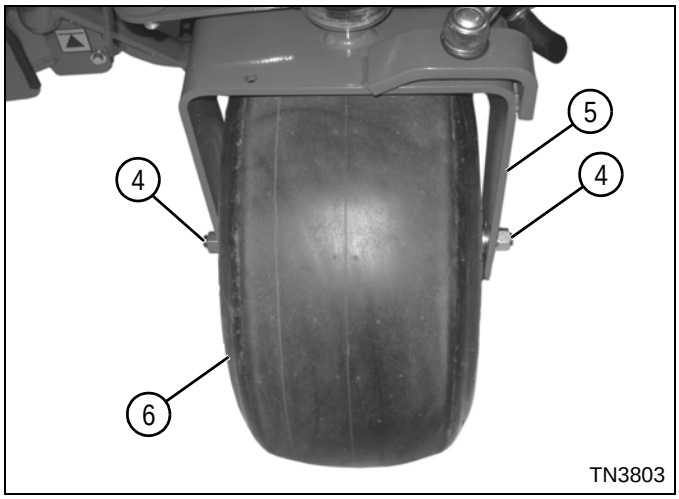


Figure 9-51

4. Loosen, but do not remove, axle nuts (4).
5. Remove wheel and axle assembly (6) from steering yoke (5).
6. Remove four lug nuts (1) and remove wheel (2) from axle (3).
7. Inspect tread area for tears or other damage.
8. Replace tire if damage is excessive.

Installation Notes

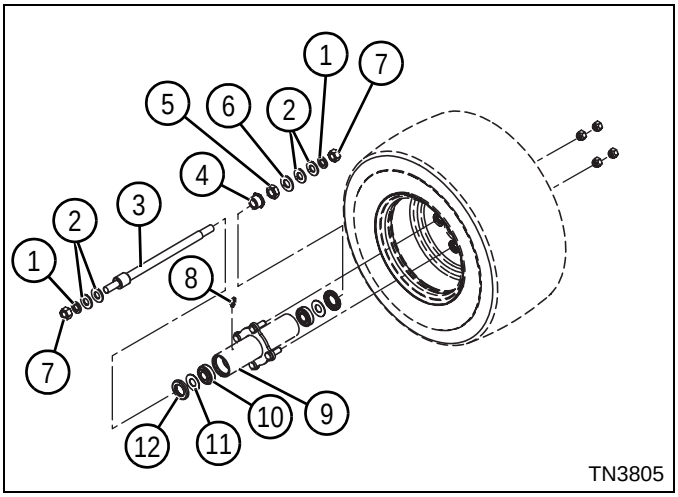
- *Inspect and clean any rust from wheel hub or wheel mounting area.*
- *Install wheel by reversing the order of removal.*
- *Tighten lug nuts (1) to* 55–63 *lb-ft (*75–85 *N·m) using an alternating pattern.*
- *Set tire pressure to 10 psi (0.70 bar).*

Steering Axle—2WD Units (Diesel)

Disassembly and Assembly

See Figure 9-52.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove rear wheel and steering axle. (See “Rear Wheel and Steering Axle—2WD Units (Diesel)” on page 9-22.)



1	Lock Washer (2)	7	Nut (2)
2	Flat Washer (4)	8	Grease Fitting
3	Axle Shaft	9	Hub Assembly
4	Nut	10	Bearing (2)
5	Nut	11	Flat Washer (2)
6	Flat Washer	12	Seal (2)

Figure 9-52

Assembly Notes

- *Assemble steering axle in reverse order of removal.*
- *Clean and inspect hub assembly, bearings, and seals for wear or damage. Replace as needed.*
- *Pack bearings with grease that meets or exceeds NLGI Grade 2 LB specifications prior to installation.*

Rear Wheel and Steering Axle—2WD Units (Gasoline)

Removal and Installation

See Figures 9-53 and 9-54.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

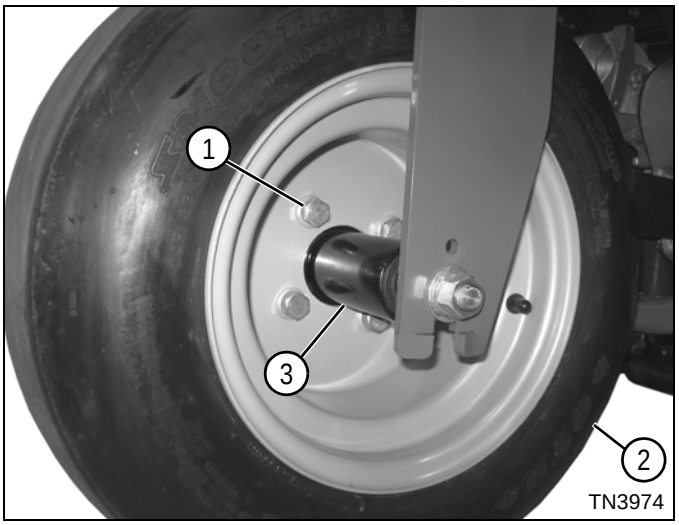


Figure 9-53

2. Loosen, but do not remove, four mounting bolts (1).

WARNING

- **Support the machine using properly rated jackstands. Never work under a machine supported only by a jack.**
- **Do not use wood or concrete blocks to support the machine. Failure to properly support the machine may result in death or serious injury.**

IMPORTANT

It is important to lift and support the machine, or the machine will move.

3. Raise and support rear of machine with jackstands.

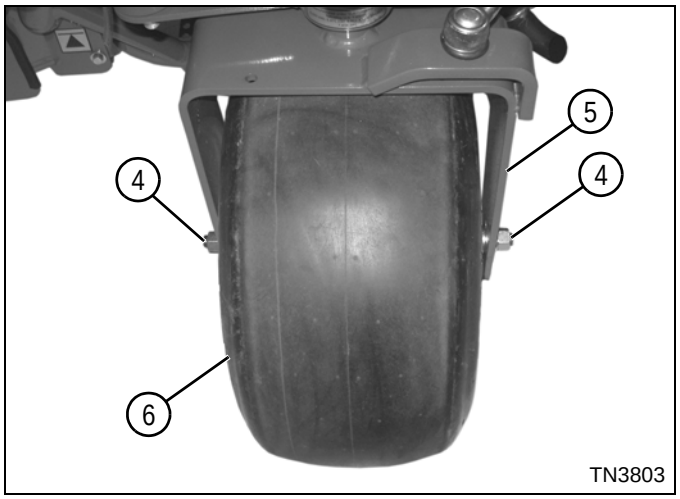


Figure 9-54

4. Loosen, but do not remove, axle nuts (4).
5. Remove wheel and axle assembly (6) from steering yoke (5).
6. Remove four mounting bolts (1) and remove wheel (2) from axle (3).
7. Inspect tread area for tears or other damage.
8. Replace tire if damage is excessive.

Installation Notes

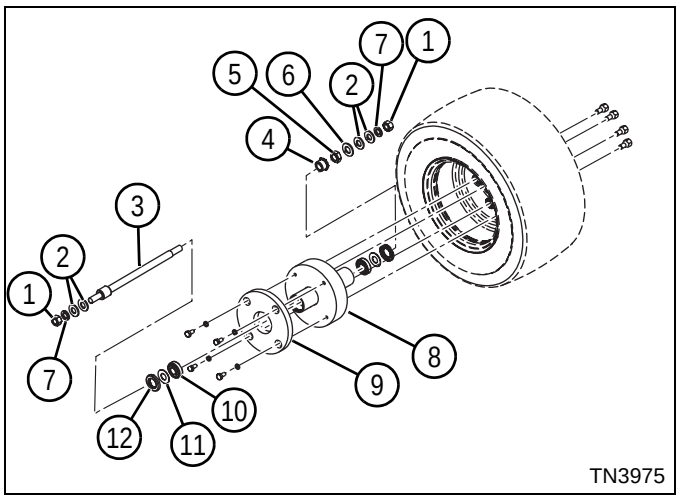
- *Inspect and clean any rust from wheel hub or wheel mounting area.*
- *Install wheel by reversing the order of removal.*
- *Tighten mounting bolts (1) to* 55–63 *lb-ft (*75–85 *N·m) using an alternating pattern.*
- *Set tire pressure to 10 psi (0.70 bar).*

Steering Axle—2WD Units (Gasoline)

Disassembly and Assembly

See Figure 9-55.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove rear wheel and steering axle. (See “Rear Wheel and Steering Axle—2WD Units (Gasoline)” on page 9-24.)



1	Nut (2)	7	Lock Washer (2)
2	Flat Washer (4)	8	Hub Assembly
3	Axle Shaft	9	Rear Wheel Weight
4	Nut	10	Bearing (2)
5	Nut	11	Flat Washer (2)
6	Flat Washer	12	Seal (2)

Figure 9-55

Assembly Notes

- *Assemble steering axle in reverse order of removal.*
- *Clean and inspect hub assembly, bearings, and seals for wear or damage. Replace as needed.*
- *Pack bearings with grease that meets or exceeds NLGI Grade 2 LB specifications prior to installation.*

Rear Wheel—3WD Units

Removal and Installation

See Figure 9-56.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)

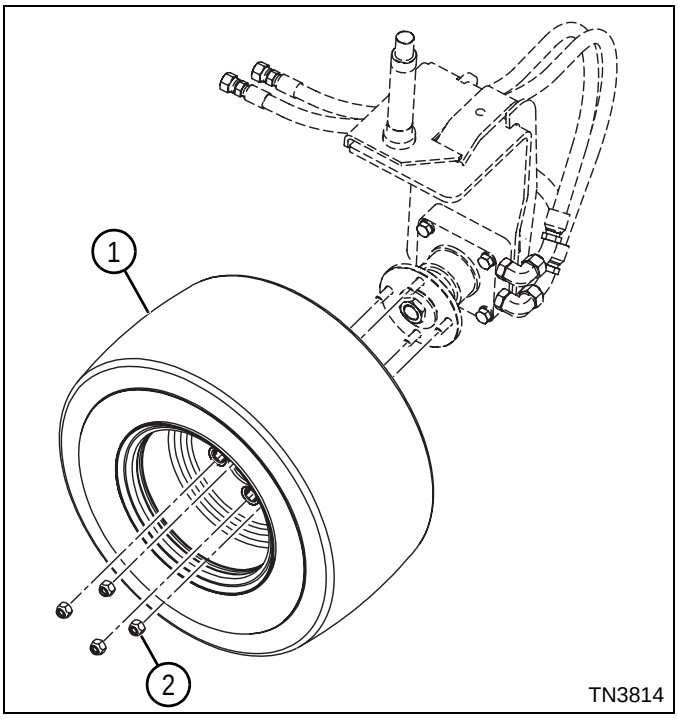


Figure 9-56

2. Loosen, but do not remove, four lug nuts (2).

WARNING

- **Support the machine using properly rated jackstands. Never work under a machine supported only by a jack.**
- **Do not use wood or concrete blocks to support the machine. Failure to properly support the machine may result in death or serious injury.**

IMPORTANT

It is important to lift and support the machine, or the machine will move.

3. Raise and support rear of machine with jackstands.
4. Remove four lug nuts (2).
5. Remove rear wheel (1) and inspect tread area for tears or other damage.
6. Replace tire if damage is excessive.

Installation Notes

- *Inspect and clean any rust from hub or wheel mounting area.*
- *Install wheel by reversing the order of removal.*
- *Tighten lug nuts to 55–63 lb-ft (75–85 N·m) using an alternating pattern.*
- *Set tire pressure to 10 psi (0.70 bar).*

Rear Wheel Hub—3WD Units

Removal and Installation

See Figure 9-57.

1. Park the mower safely. (See “Park Mower Safely” on page 1-6.)
2. Remove rear wheel. (See “Rear Wheel—3WD Units” on page 9-25.)

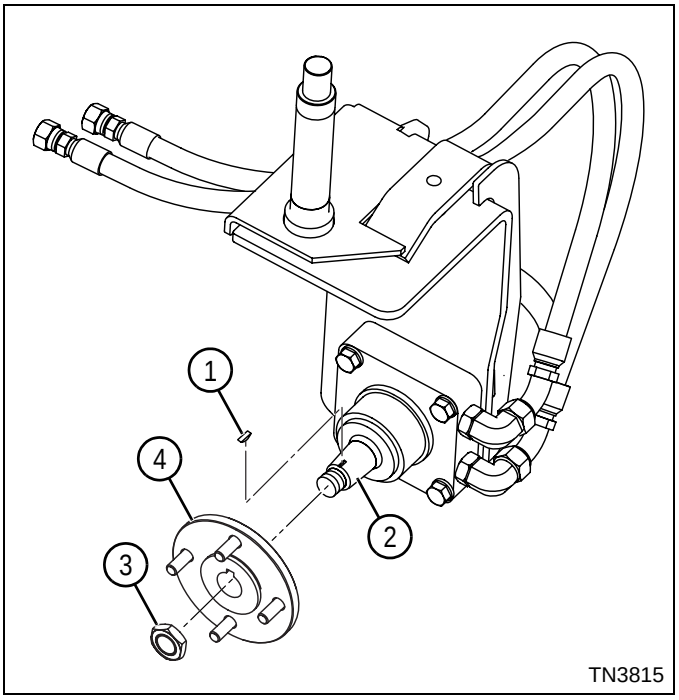


Figure 9-57

3. Loosen, but do not remove, castle nut (3).
4. Loosen the wheel hub (4) from the motor shaft (2) using a suitable puller.
5. Remove castle nut (3) and wheel hub (4).
6. Remove key (1) from motor shaft (2).

Installation Notes

Required Materials
Anti-Seize Compound

- *Clean the motor shaft and hub tapers with brake cleaner, or similar cleaning solvent, to remove any oil or grease.*
- *Install rear wheel hub in reverse order of removal.*
- *Apply anti-seize compound (Jacobsen PN 360652) to key. Key must be bottomed in slot.*
- *Do not lubricate or apply anti-seize on the tapers; hub must be installed dry.*
- *Tighten castle nut to 162 ft-lb (220 N·m).*

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