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When Performance Matters.™

AR-522,722 T4F™ Rotary Mower Technical/Repair Manual 68132-68133



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.

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Foreword

General

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

Jacobsen AR-522 rotary 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 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 with in 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.

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Chapter 1

Safety

1

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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.

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.

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.

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 ignition sources. 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 Safety

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 1-6.)

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 1-6.)

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.

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Chapter 2

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Specifications

Test and Adjustment Specifications

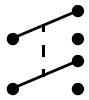
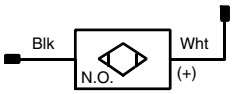
Specifications		
Resistance Across Solenoid Coil—Lift Solenoid Coil at 68° F (20° C)	ohms	7.0 ± 10%
Resistance Across Solenoid Coil—Lower Solenoid Coil at 68° F (20° C)	ohms	6.0 ± 10%
Resistance Across Solenoid Coil—Mow Solenoid Coil at 68° F (20° C)	ohms	9.8 ± 10%
Fuel Level Sender Resistance Between Terminals at Full Position	ohms	Between 26 and 35
Fuel Level Sender Resistance Between Terminals at Empty Position	ohms	Between 211 and 286

Theory and Diagnostic Information

Electrical Component Symbols

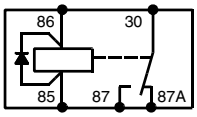
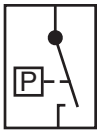
The following symbols are used in the electrical schematics to represent various electrical components.

Switches[1]

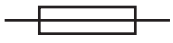
Single Pole, Single Throw (SPST) 	Double Pole, Single Throw (DPST) 
Single Pole, Double Throw (SPDT) 	Double Pole, Double Throw (DPDT) 
Proximity Switch 	

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

Relay 	Pressure Switch 

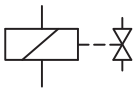
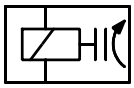
Circuit Protection Devices

Fuse 	Circuit Breaker 

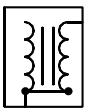
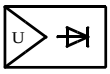
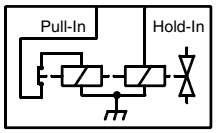
Motors and Generating Devices

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

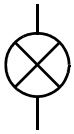
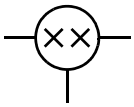
Actuating Devices

Solenoid Valve 	PTO Clutch 

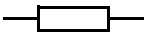
Engine-Related Devices

Ignition Coil 	Spark Plug 
Regulator 	Fuel Shutoff Solenoid 

Lights

Single-Element Light 	Dual-Element Light 

Miscellaneous Symbols

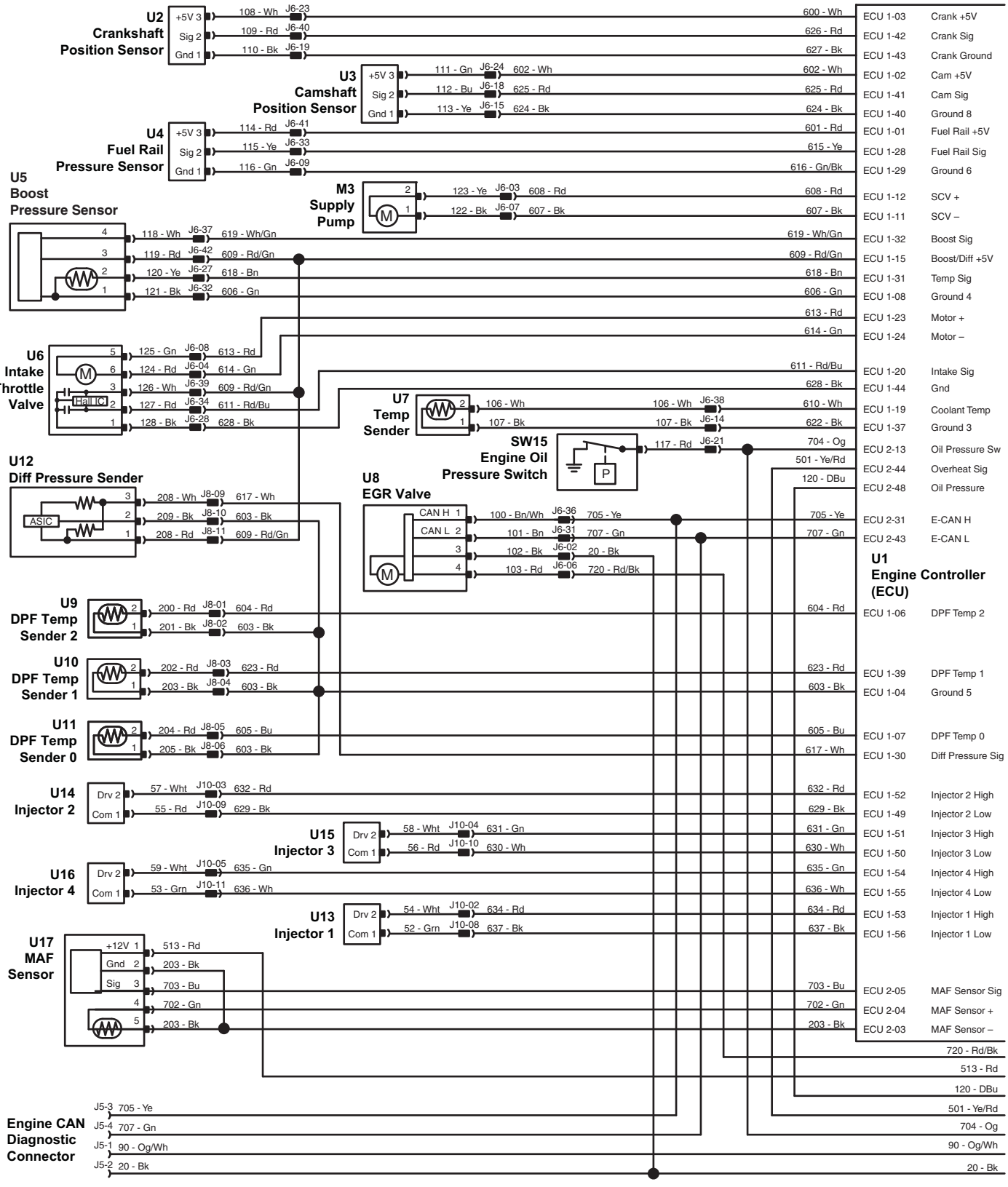
Enclosure (cabinet, housing, etc.) 	Wires (crossing but not connected) 
Ground (to earth) 	Wiring Connections 
Ground (to chassis) 	Coil
Direct Current (DC) (as shown on an oscilloscope)	Battery 
Alternating Current (AC) (as shown on an oscilloscope) 	Diode 
Resistor 	Pin and Socket Connector 

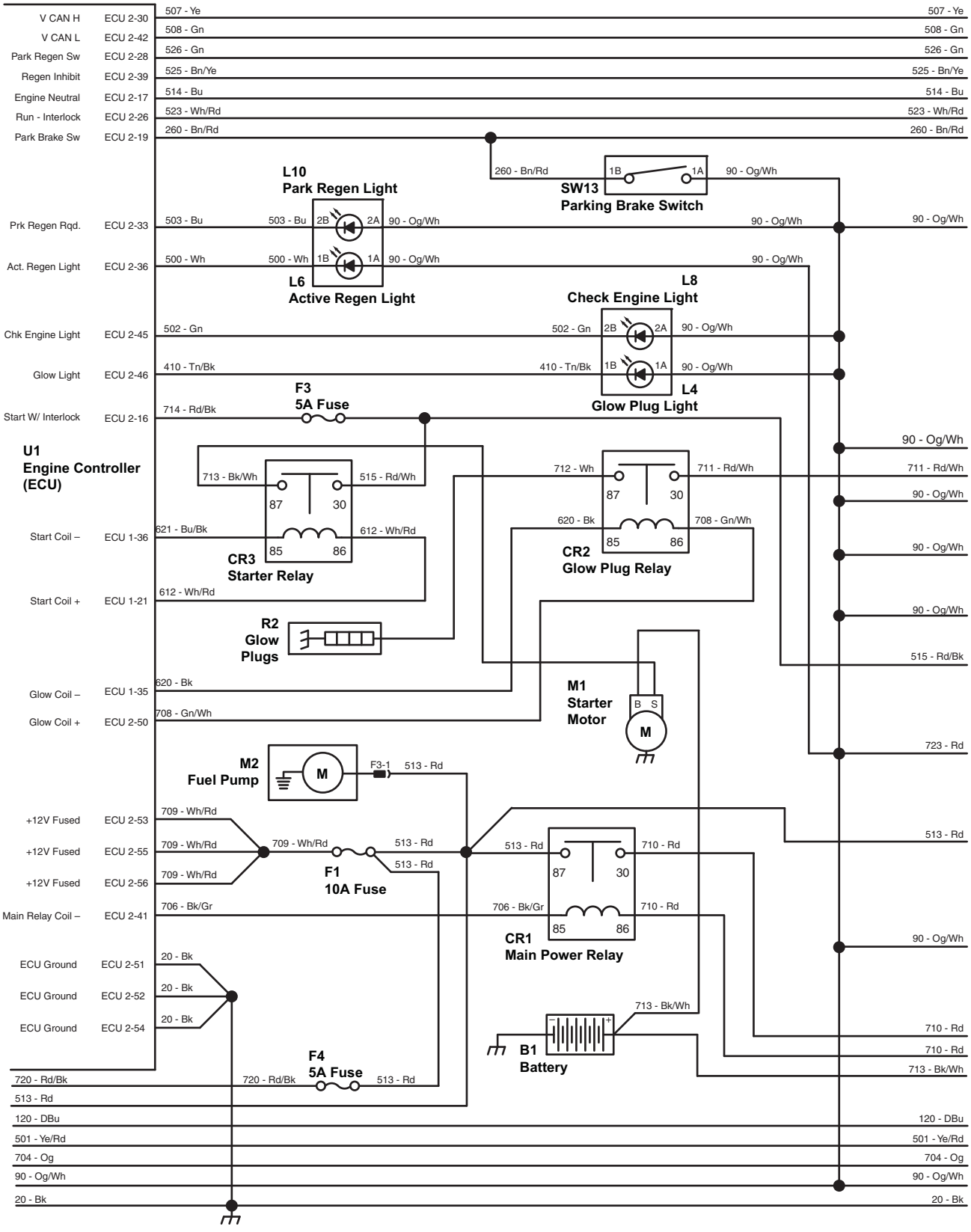
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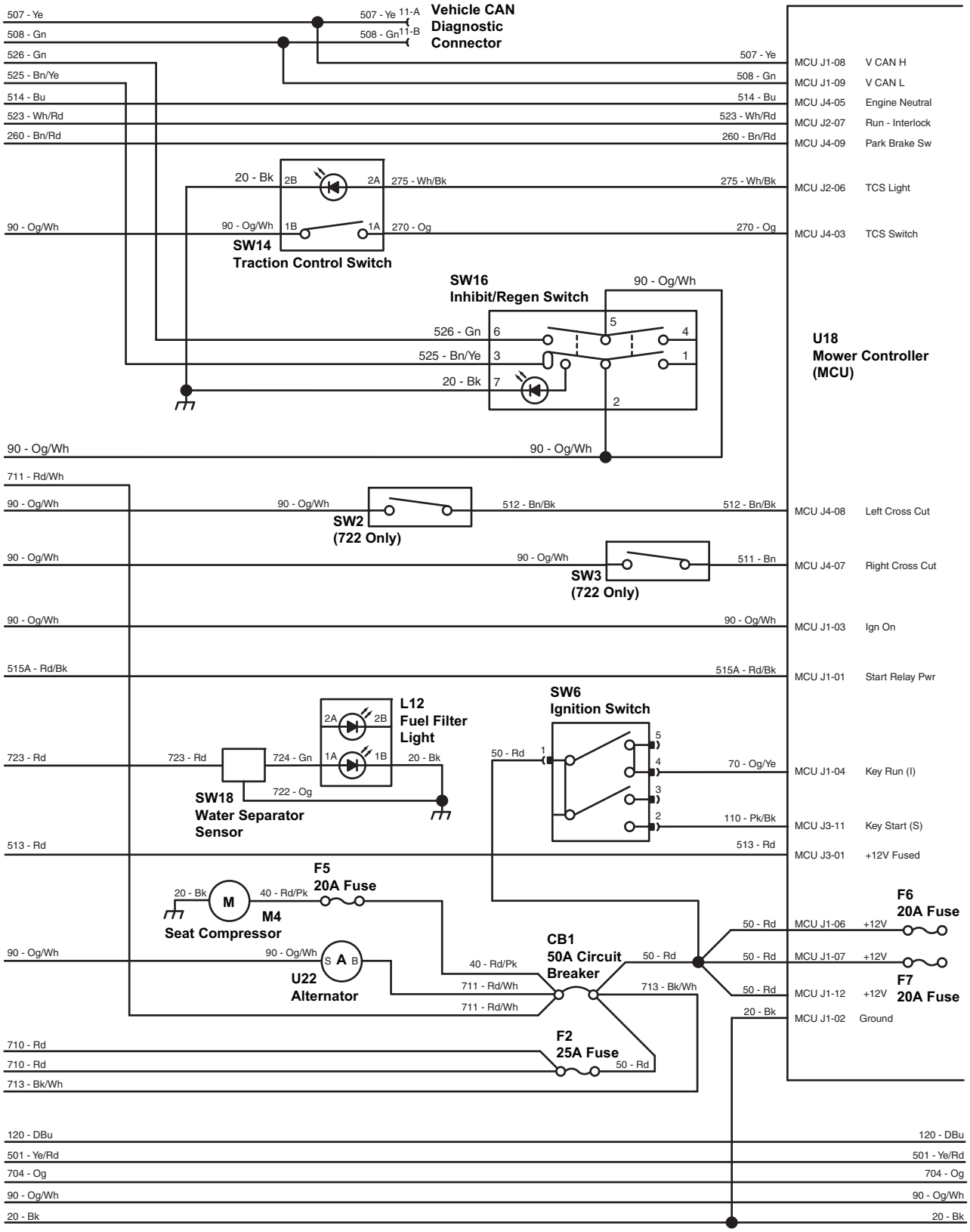
Electrical Schematic Component Identification

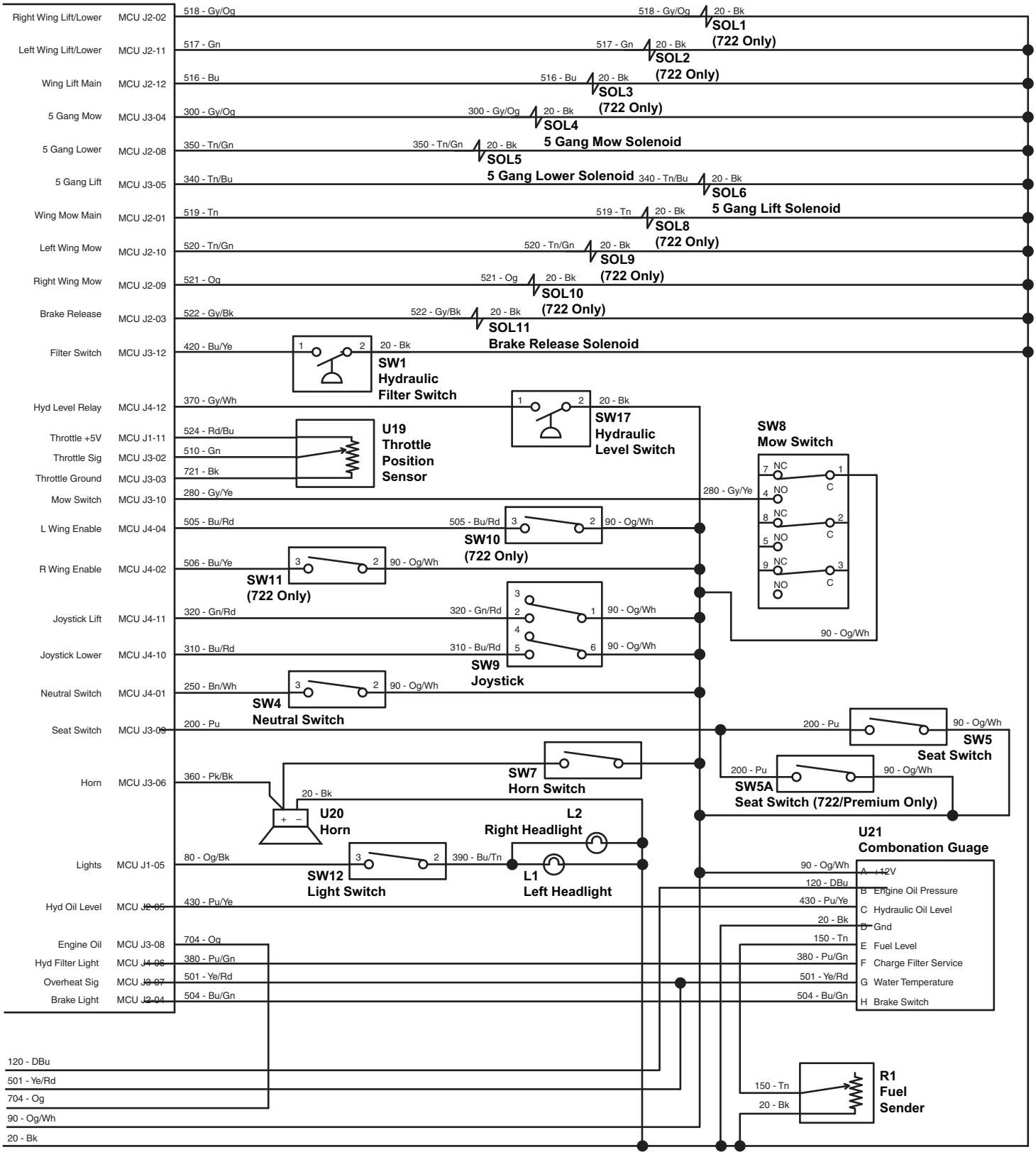
Electrical components shown in the main schematic are identified with an alpha-numeric callout. All electrical components shown in the electrical schematic are listed below.

- B1—Battery (See Figure 4-1)
- CB1—50A Circuit Breaker (See Figure 4-2)
- CR1—Main Power Relay (See Figure 4-1)
- CR2—Glow Plug Relay (See Figure 4-1)
- CR3—Starter Relay (See Figure 4-1)
- F1—10 Amp Fuse (See Figure 4-1)
- F2—25 Amp Fuse (See Figure 4-2)
- F3—5 Amp Fuse (See Figure 4-1)
- F4—5 Amp Fuse (See Figure 4-1)
- F5—20 Amp Fuse (See Figure 4-2)
- F6—20 Amp Fuse (See Figure 4-1)
- F7—20 Amp Fuse (See Figure 4-1)
- L1—Left Head Light (See Figure 4-2)
- L2—Right Head Light (See Figure 4-2)
- L4—Glow Plug Light (See Figure 4-1)
- L6—Active Regen Light (See Figure 4-1)
- L8—Check Engine Light (See Figure 4-1)
- L10—Park Regen Light (See Figure 4-1)
- L12—Fuel Filter Light (See Figure 4-2)
- F6—20A Fuse (See Figure 4-2)
- F7—20A Fuse (See Figure 4-2)
- M1—Starter Motor (See Figure 4-1)
- M2—Fuel Pump (See Figure 4-1)
- M4—Seat Compressor (See Figure 4-2)
- R1—Fuel Sender (See Figure 4-2)
- R2—Glow Plugs (See Figure 4-1)
- SOL1—Right Wing Lift/Lower (722 Only)
- SOL2—Left Wing Lift/Lower (722 Only)
- SOL3—Wing Lift Main (722 Only)
- SOL4—5 Gang Mow Solenoid (See Figure 4-2)
- SOL5—5 Gang Lower Solenoid (See Figure 4-2)
- SOL6—5 Gang Lift Solenoid (See Figure 4-2)
- SOL8—Wing Mow Main (722 Only)
- SOL9—Left Wing Mow (722 Only)
- SOL10—Right Wing Mow (722 Only)
- SOL11—Brake Release Solenoid (See Figure 4-2)
- SW1—Hydraulic Filter Switch (See Figure 4-2)
- SW2—Left Wing Mow (722 Only)
- SW3—Right Wing Mow (722 Only)
- SW4—Neutral Switch (See Figure 4-2)
- SW5—Seat Switch (See Figure 4-2)
- SW5A—Seat Switch (See Figure 4-2)
- SW6—Ignition Switch (See Figure 4-2)
- SW7—Horn Switch (See Figure 4-2)
- SW8—Mow Switch (See Figure 4-2)
- SW9—Joystick (See Figure 4-2)
- SW10—Left Wing Lower (722 Only)
- SW11—Right Wing Lower (722 Only)
- SW12—Light Switch (See Figure 4-2)
- SW13—Parking Brake Switch (See Figure 4-1)
- SW14—Traction Control Switch (See Figure 4-2)
- SW15—Engine Oil Pressure Switch (See Figure 4-1)
- SW16—Inhibit/Regen Switch (See Figure 4-2)
- SW17—Hydraulic Level Switch (See Figure 4-2)
- U1—Engine Controller (ECU) (See Figure 4-1)
- U2—Crankshaft Position Sensor (See Figure 4-1)
- U3—Camshaft Position Sensor (See Figure 4-1)
- U4—Fuel Rail Pressure Sensor (See Figure 4-1)
- U5—Boost Pressure Sensor (See Figure 4-1)
- U6—Intake Throttle Valve (See Figure 4-1)
- U7—Temperature Sender (See Figure 4-1)
- U8—EGR Valve (See Figure 4-1)
- U9—DPF Exhaust Temperature Sender 2 (See Figure 4-1)
- U10—DPF Exhaust Temperature Sender 1 (See Figure 4-1)
- U11—DPF Exhaust Temperature Sender 0 (See Figure 4-1)
- U12—Diff. Pressure Sender (See Figure 4-1)
- U13—Injector, Cylinder 1 (See Figure 4-1)
- U14—Injector, Cylinder 2 (See Figure 4-1)
- U15—Injector, Cylinder 3 (See Figure 4-1)
- U16—Injector, Cylinder 4 (See Figure 4-1)
- U17—MAF Sensor (Mass Air Flow) (See Figure 4-1)
- U18—Mower Controller (MCU) (See Figure 4-2)
- U19—Throttle Position Sensor (See Figure 4-2)
- U20—Horn (See Figure 4-2)
- U21—Combination Gauge (See Figure 4-2)
- U22—Alternator (See Figure 4-2)


U2
Crankshaft
Position Sensor
+5V 3
Sig 2
Gnd 1
108 - Wh J6-23
109 - Rd J6-40
110 - Bk J6-19
U3
Camshaft
Position Sensor
111 - Gn J6-24 602 - Wh
112 - Bu J6-18 625 - Rd
113 - Ye J6-15 624 - Bk
U4
Fuel Rail
Pressure Sensor
114 - Rd J6-41
115 - Ye J6-33
116 - Gn J6-09
U5
Boost
Pressure Sensor
118 - Wh J6-37 619 - Wh/Gn
119 - Rd J6-42 609 - Rd/Gn
120 - Ye J6-27 618 - Bn
121 - Bk J6-32 606 - Gn
M3
Supply
Pump
123 - Ye J6-03 608 - Rd
122 - Bk J6-07 607 - Bk
U6
Intake
Throttle
Valve
Hall IC
125 - Gn J6-08 613 - Rd
124 - Rd J6-04 614 - Gn
126 - Wh J6-39 609 - Rd/Gn
127 - Rd J6-34 611 - Rd/Bu
128 - Bk J6-28 628 - Bk
U7
Temp
Sender
106 - Wh
107 - Bk
106 - Wh J6-38
107 - Bk J6-14
SW15
Engine Oil
Pressure Switch
117 - Rd J6-21
U12
Diff Pressure Sender
ASIC
208 - Wh J8-09 617 - Wh
209 - Bk J8-10 603 - Bk
208 - Rd J8-11 609 - Rd/Gn
U8
EGR Valve
CAN H 1
CAN L 2
100 - Bn/Wh J6-36 705 - Ye
101 - Bn J6-31 707 - Gn
102 - Bk J6-02 20 - Bk
103 - Rd J6-06 720 - Rd/Bk
U9
DPF Temp
Sender 2
200 - Rd J8-01 604 - Rd
201 - Bk J8-02 603 - Bk
U10
DPF Temp
Sender 1
202 - Rd J8-03 623 - Rd
203 - Bk J8-04 603 - Bk
U11
DPF Temp
Sender 0
204 - Rd J8-05 605 - Bu
205 - Bk J8-06 603 - Bk
U14
Injector 2
Drv 2
Com 1
57 - Wht J10-03 632 - Rd
55 - Rd J10-09 629 - Bk
U15
Injector 3
58 - Wht J10-04 631 - Gn
56 - Rd J10-10 630 - Wh
U16
Injector 4
59 - Wht J10-05 635 - Gn
53 - Grn J10-11 636 - Wh
U13
Injector 1
54 - Wht J10-02 634 - Rd
52 - Grn J10-08 637 - Bk
U17
MAF
Sensor
+12V 1
Gnd 2
Sig 3
4
5
513 - Rd
203 - Bk
703 - Bu
702 - Gn
203 - Bk
Engine CAN
Diagnostic
Connector
J5-3 705 - Ye
J5-4 707 - Gn
J5-1 90 - Og/Wh
J5-2 20 - Bk
600 - Wh
626 - Rd
627 - Bk
602 - Wh
625 - Rd
624 - Bk
601 - Rd
615 - Ye
616 - Gn/Bk
608 - Rd
607 - Bk
619 - Wh/Gn
609 - Rd/Gn
618 - Bn
606 - Gn
613 - Rd
614 - Gn
611 - Rd/Bu
628 - Bk
610 - Wh
622 - Bk
704 - Og
501 - Ye/Rd
120 - DBu
705 - Ye
707 - Gn
604 - Rd
623 - Rd
603 - Bk
605 - Bu
617 - Wh
632 - Rd
629 - Bk
631 - Gn
630 - Wh
635 - Gn
636 - Wh
634 - Rd
637 - Bk
703 - Bu
702 - Gn
203 - Bk
720 - Rd/Bk
513 - Rd
120 - DBu
501 - Ye/Rd
704 - Og
90 - Og/Wh
20 - Bk
ECU 1-03 Crank +5V
ECU 1-42 Crank Sig
ECU 1-43 Crank Ground
ECU 1-02 Cam +5V
ECU 1-41 Cam Sig
ECU 1-40 Ground 8
ECU 1-01 Fuel Rail +5V
ECU 1-28 Fuel Rail Sig
ECU 1-29 Ground 6
ECU 1-12 SCV +
ECU 1-11 SCV –
ECU 1-32 Boost Sig
ECU 1-15 Boost/Diff +5V
ECU 1-31 Temp Sig
ECU 1-08 Ground 4
ECU 1-23 Motor +
ECU 1-24 Motor –
ECU 1-20 Intake Sig
ECU 1-44 Gnd
ECU 1-19 Coolant Temp
ECU 1-37 Ground 3
ECU 2-13 Oil Pressure Sw
ECU 2-44 Overheat Sig
ECU 2-48 Oil Pressure
ECU 2-31 E-CAN H
ECU 2-43 E-CAN L
U1
Engine Controller
(ECU)
ECU 1-06 DPF Temp 2
ECU 1-39 DPF Temp 1
ECU 1-04 Ground 5
ECU 1-07 DPF Temp 0
ECU 1-30 Diff Pressure Sig
ECU 1-52 Injector 2 High
ECU 1-49 Injector 2 Low
ECU 1-51 Injector 3 High
ECU 1-50 Injector 3 Low
ECU 1-54 Injector 4 High
ECU 1-55 Injector 4 Low
ECU 1-53 Injector 1 High
ECU 1-56 Injector 1 Low
ECU 2-05 MAF Sensor Sig
ECU 2-04 MAF Sensor +
ECU 2-03 MAF Sensor –


V CAN H ECU 2-30
V CAN L ECU 2-42
Park Regen Sw ECU 2-28
Regen Inhibit ECU 2-39
Engine Neutral ECU 2-17
Run - Interlock ECU 2-26
Park Brake Sw ECU 2-19
507 - Ye
508 - Gn
526 - Gn
525 - Bn/Ye
514 - Bu
523 - Wh/Rd
260 - Bn/Rd
L10
Park Regen Light
SW13
Parking Brake Switch
Prk Regen Rqd. ECU 2-33
Act. Regen Light ECU 2-36
503 - Bu
500 - Wh
90 - Og/Wh
L6
Active Regen Light
L8
Check Engine Light
Chk Engine Light ECU 2-45
Glow Light ECU 2-46
502 - Gn
410 - Tn/Bk
L4
Glow Plug Light
F3
5A Fuse
Start W/ Interlock ECU 2-16
714 - Rd/Bk
U1
Engine Controller
(ECU)
713 - Bk/Wh
515 - Rd/Wh
712 - Wh
711 - Rd/Wh
87
30
85
86
Start Coil – ECU 1-36
621 - Bu/Bk
612 - Wh/Rd
620 - Bk
708 - Gn/Wh
CR3
Starter Relay
CR2
Glow Plug Relay
Start Coil + ECU 1-21
R2
Glow
Plugs
Glow Coil – ECU 1-35
Glow Coil + ECU 2-50
M1
Starter
Motor
B S
M
M2
Fuel Pump
F3-1
513 - Rd
+12V Fused ECU 2-53
+12V Fused ECU 2-55
+12V Fused ECU 2-56
709 - Wh/Rd
F1
10A Fuse
710 - Rd
Main Relay Coil – ECU 2-41
706 - Bk/Gr
CR1
Main Power Relay
ECU Ground ECU 2-51
ECU Ground ECU 2-52
ECU Ground ECU 2-54
20 - Bk
713 - Bk/Wh
B1
Battery
F4
5A Fuse
720 - Rd/Bk
513 - Rd
120 - DBu
501 - Ye/Rd
704 - Og
90 - Og/Wh
20 - Bk


507 - Ye
508 - Gn
526 - Gn
525 - Bn/Ye
514 - Bu
523 - Wh/Rd
260 - Bn/Rd
507 - Ye 11-A
508 - Gn 11-B
Vehicle CAN Diagnostic Connector
20 - Bk
2B
2A
275 - Wh/Bk
90 - Og/Wh
1B
1A
270 - Og
SW14
Traction Control Switch
SW16
Inhibit/Regen Switch
90 - Og/Wh
526 - Gn
525 - Bn/Ye
20 - Bk
6
3
7
5
4
1
2
U18
Mower Controller
(MCU)
MCU J1-08 V CAN H
MCU J1-09 V CAN L
MCU J4-05 Engine Neutral
MCU J2-07 Run - Interlock
MCU J4-09 Park Brake Sw
MCU J2-06 TCS Light
MCU J4-03 TCS Switch
711 - Rd/Wh
512 - Bn/Bk
SW2
(722 Only)
MCU J4-08 Left Cross Cut
511 - Bn
SW3
(722 Only)
MCU J4-07 Right Cross Cut
MCU J1-03 Ign On
515A - Rd/Bk
MCU J1-01 Start Relay Pwr
L12
Fuel Filter
Light
723 - Rd
724 - Gn
722 - Og
SW18
Water Separator
Sensor
SW6
Ignition Switch
50 - Rd
70 - Og/Ye
MCU J1-04 Key Run (I)
110 - Pk/Bk
MCU J3-11 Key Start (S)
513 - Rd
MCU J3-01 +12V Fused
F5
20A Fuse
M
M4
Seat Compressor
40 - Rd/Pk
S A B
U22
Alternator
CB1
50A Circuit
Breaker
713 - Bk/Wh
F6
20A Fuse
MCU J1-06 +12V
MCU J1-07 +12V
F7
20A Fuse
MCU J1-12 +12V
MCU J1-02 Ground
F2
25A Fuse
710 - Rd
710 - Rd
713 - Bk/Wh
120 - DBu
501 - Ye/Rd
704 - Og


Right Wing Lift/Lower MCU J2-02
Left Wing Lift/Lower MCU J2-11
Wing Lift Main MCU J2-12
5 Gang Mow MCU J3-04
5 Gang Lower MCU J2-08
5 Gang Lift MCU J3-05
Wing Mow Main MCU J2-01
Left Wing Mow MCU J2-10
Right Wing Mow MCU J2-09
Brake Release MCU J2-03
Filter Switch MCU J3-12
Hyd Level Relay MCU J4-12
Throttle +5V MCU J1-11
Throttle Sig MCU J3-02
Throttle Ground MCU J3-03
Mow Switch MCU J3-10
L Wing Enable MCU J4-04
R Wing Enable MCU J4-02
Joystick Lift MCU J4-11
Joystick Lower MCU J4-10
Neutral Switch MCU J4-01
Seat Switch MCU J3-09
Horn MCU J3-06
Lights MCU J1-05
Hyd Oil Level MCU J2-05
Engine Oil MCU J3-08
Hyd Filter Light MCU J4-06
Overheat Sig MCU J3-07
Brake Light MCU J2-04
518 - Gy/Og
517 - Gn
516 - Bu
300 - Gy/Og
350 - Tn/Gn
340 - Tn/Bu
519 - Tn
520 - Tn/Gn
521 - Og
522 - Gy/Bk
420 - Bu/Ye
370 - Gy/Wh
524 - Rd/Bu
510 - Gn
721 - Bk
280 - Gy/Ye
505 - Bu/Rd
506 - Bu/Ye
320 - Gn/Rd
310 - Bu/Rd
250 - Bn/Wh
200 - Pu
360 - Pk/Bk
80 - Og/Bk
430 - Pu/Ye
704 - Og
380 - Pu/Gn
501 - Ye/Rd
504 - Bu/Gn
20 - Bk
SOL1 (722 Only)
SOL2 (722 Only)
SOL3 (722 Only)
SOL4 5 Gang Mow Solenoid
SOL5 5 Gang Lower Solenoid
SOL6 5 Gang Lift Solenoid
SOL8 (722 Only)
SOL9 (722 Only)
SOL10 (722 Only)
SOL11 Brake Release Solenoid
SW1 Hydraulic Filter Switch
SW17 Hydraulic Level Switch
U19 Throttle Position Sensor
SW8 Mow Switch
SW10 (722 Only)
SW11 (722 Only)
SW9 Joystick
SW4 Neutral Switch
SW5 Seat Switch
SW5A Seat Switch (722/Premium Only)
SW7 Horn Switch
U20 Horn
L2 Right Headlight
SW12 Light Switch
L1 Left Headlight
U21 Combonation Guage
A +12V
B Engine Oil Pressure
C Hydraulic Oil Level
D Gnd
E Fuel Level
F Charge Filter Service
G Water Temperature
H Brake Switch
R1 Fuel Sender
150 - Tn
90 - Og/Wh
90 - Og/Bk
120 - DBu

Theory of Operation and Sub Circuit Schematics

Power Circuit—Theory of Operation

Unswitched Power Circuit

Unswitched power is supplied from the battery (B1) positive terminal to the starting motor (M1) battery terminal, and to the battery terminal of the 50A circuit breaker (CB1).

From the battery terminal of the 50A circuit breaker (CB1) unswitched power is also supplied to the following components:

- Ignition Switch (SW6) terminal 1
- MCU (U18) terminals J1-06, J1-07, and J1-12
- 20A Fuse (F6) (internal to MCU)
- 20A Fuse (F7) (internal to MCU)
- 25A Fuse (F2)
- Main Power Relay (CR1) terminals 30, and 86

Current flows through the 50A circuit breaker (CB1) to the following components:

- 20A Fuse (F5)
- Seat Compressor (M4)
- Alternator (U22)
- Glow Plug Relay(CR2) relay terminal 30

Switched Power Circuit

When the ignition switch (SW6) is turned to the run position, current flows from ignition switch terminal (4) to the MCU (U18) terminal (J1-4), powering up the MCU.

With MCU (U18) energized, switched power is available from the MCU terminal (J1-3) to the following components:

- Hydraulic Level Switch (SW17)
- Left Wing Enable Switch (SW10) (722 only)
- Right Wing Enable Switch (SW11) (722 only)
- Mow Switch (SW8)
- Joystick (SW9) terminals (1) and (6)
- Neutral Switch (SW4)
- Horn Switch (SW7)
- Seat Switch (SW5)
- Seat Switch (SW5A)
- Combination Gauge (U21) terminal (A)
- Alternator (U22) terminal (S)
- Water Separator Sensor (SW18)
- Active Regen Light (L6)
- Right Cross Cut Switch (SW3) (722 only)
- Left Cross Cut Switch (SW2) (722 only)
- Inhibit/Regen Switch (SW16) terminals (2) and (5)
- Glow Plug Light (L4)
- Check Engine Light (L8)
- Park Regen Light (L4)
- Traction Control Switch (SW14)
- Parking Brake Switch (SW13)
- Engine CAN Diagnostic Connector terminal (J5-1)

Current flows through the inhibit/regen switch (SW16) terminal (3) to ECU (U1) terminal (2-39)

Main Relay Circuit

When interlock conditions are met, (See “Start Circuit-Theory of Operation” and/or “Run Circuit-Theory of Operation” on pages ?&?) current flows from MCU (U18) terminal (J2-07) to ECU (U1) terminal (2-26) powering up the ECU.

The ECU provides a ground at terminal (2-41) activating the main power relay (CR1) which supplies switched power to the following components from main power relay terminal (87):

- Fuel Pump (M2)
- MCU (U18) terminal (J3-01)
- 10A Fuse (F1)
- ECU (U1) terminal (2-53), (2-55), and (2-56)
- 5A Fuse (F4)
- EGR Valve (U8) terminal (4)
- MAF Sensor (U17) terminal (1)

CAN Diagnostic Circuit

With MCU (U18) energized, current flows from terminals (J1-08) and (J1-09) to vehicle CAN diagnostic connector terminals (11-A) and (11-B) and ECU (U1) terminals (2-30) and (2-42).

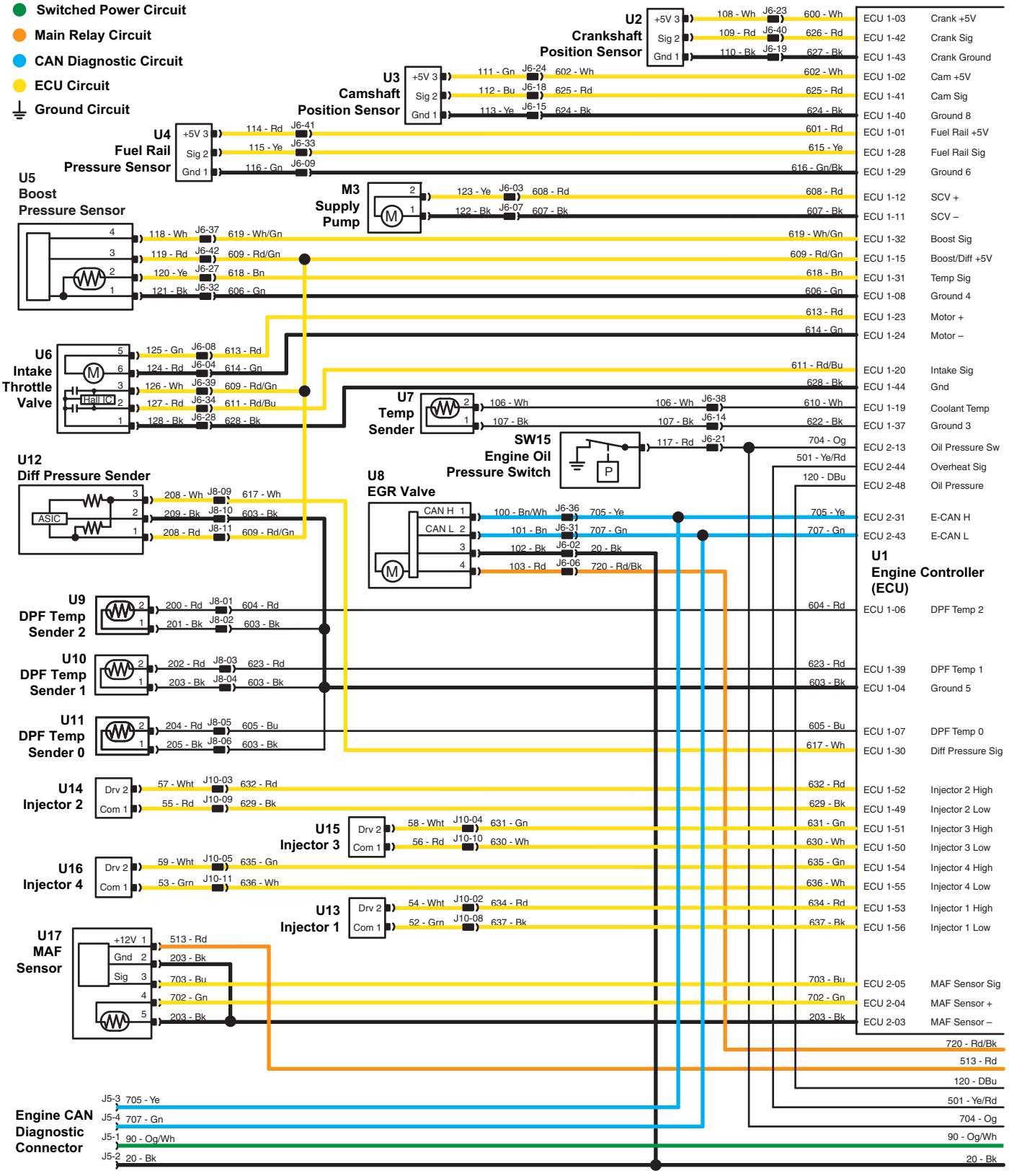
Power is supplied from ECU (U1) terminal (2-31) and (2-43) to EGR valve (U8) terminal (1), (2) and engine CAN diagnostic connector terminal (J5-3) and (J5-4)

ECU Circuit

Refer to Kubota service manual (?) for it’s theory of operation.

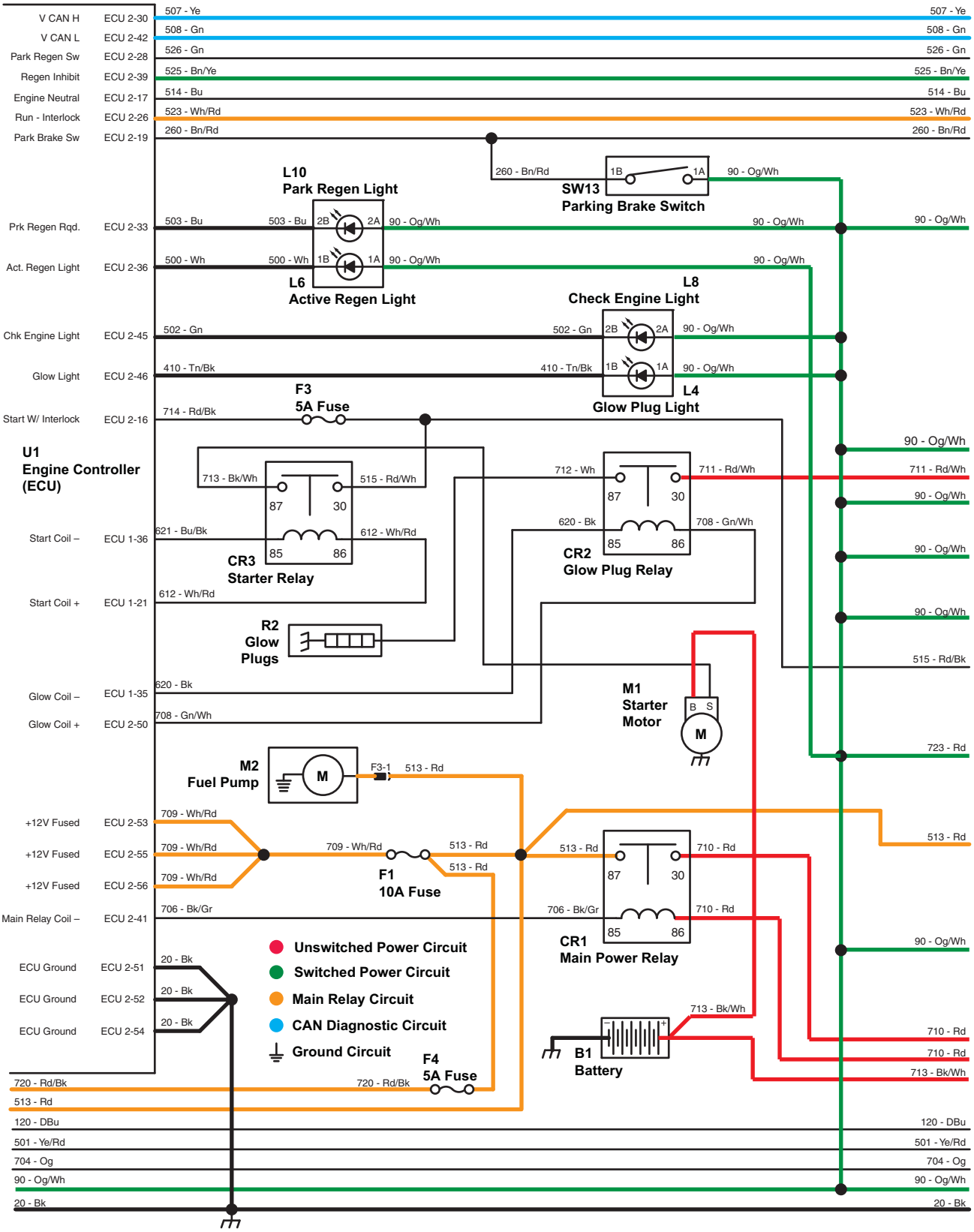
Power Circuit Schematic

See figures 4-3 and 4-4.



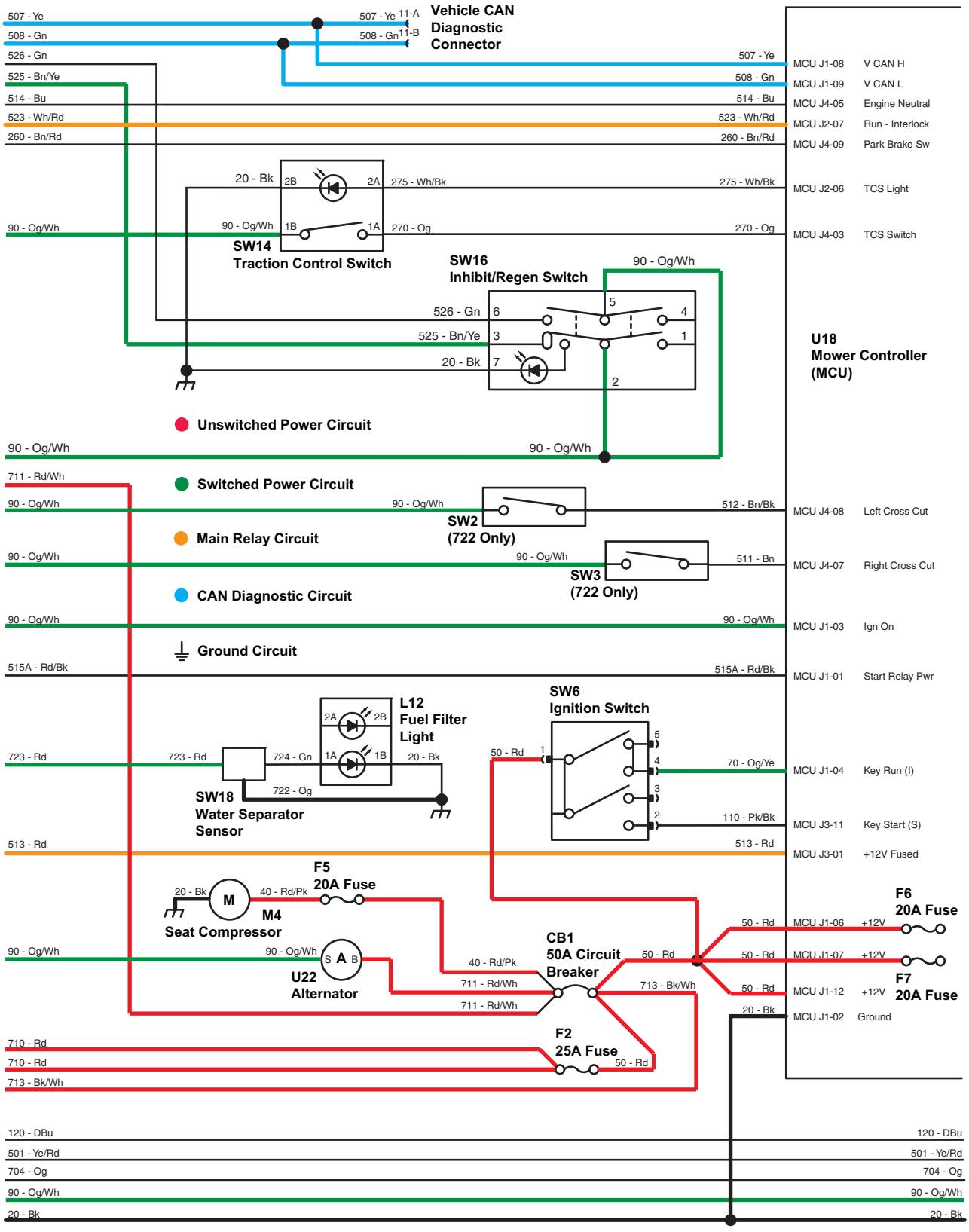
Power Circuit Schematic

(Continued)



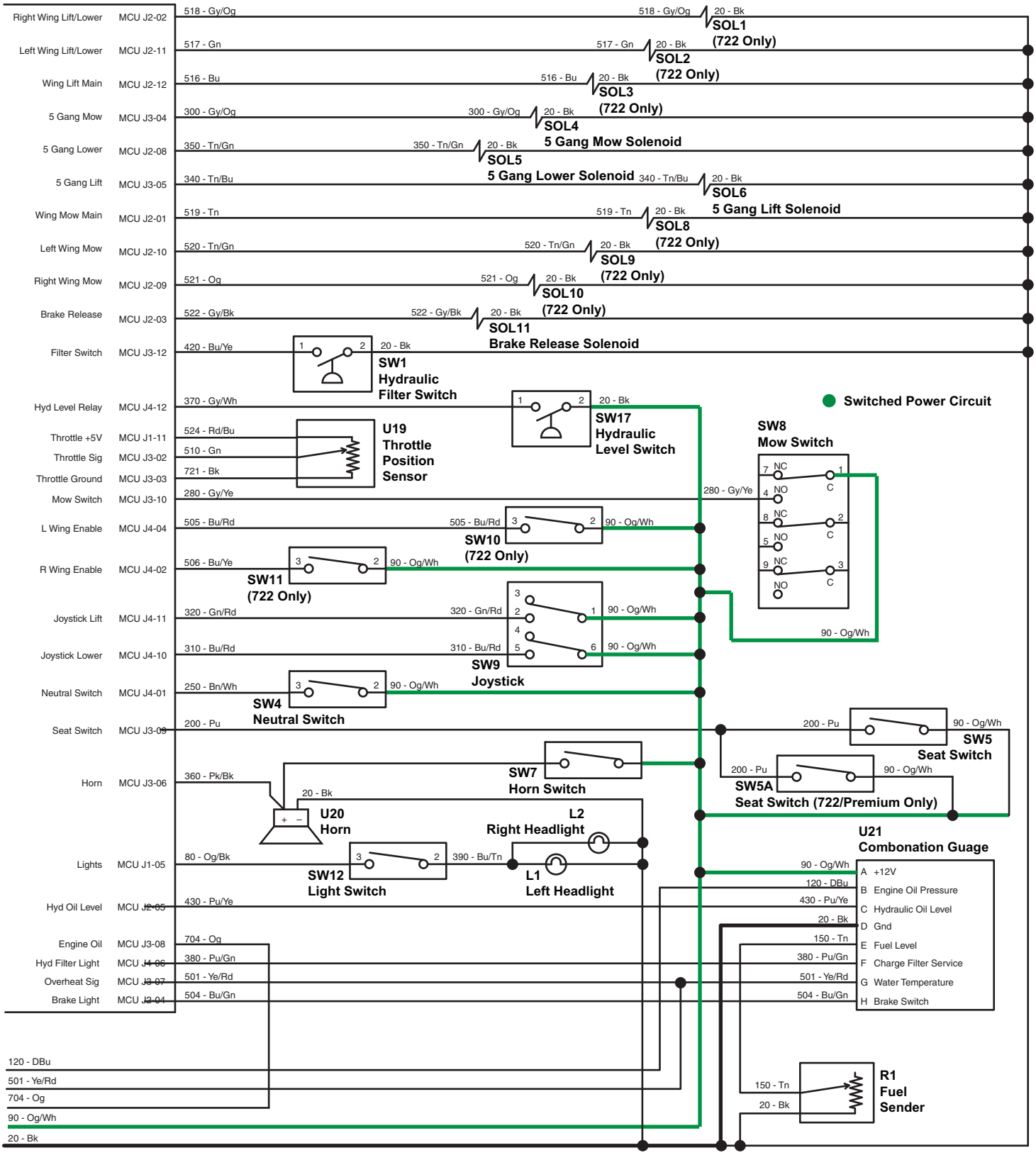
Power Circuit Schematic

(Continued)



Power Circuit Schematic

(Continued)



Charging Circuit—Theory of Operation

Power Circuit

(See “Power Circuit—Theory of Operation” on page 2-16.)

Charging Circuit

With the engine running and the ignition switch (SW6) in the run position, voltage at the alternator (U22) terminal (S) excites the alternator. With the alternator (S) terminal excited, the alternator produces three-phase alternating current (AC). The AC current is rectified by internal diodes, and direct current (DC) is available to the internal voltage regulator.

When the battery (B1) voltage is low, current flows from the voltage regulator trough the 50A circuit breaker (CB1) to the battery, charging the battery. When the battery is fully charged, the regulator stops providing current to the battery.

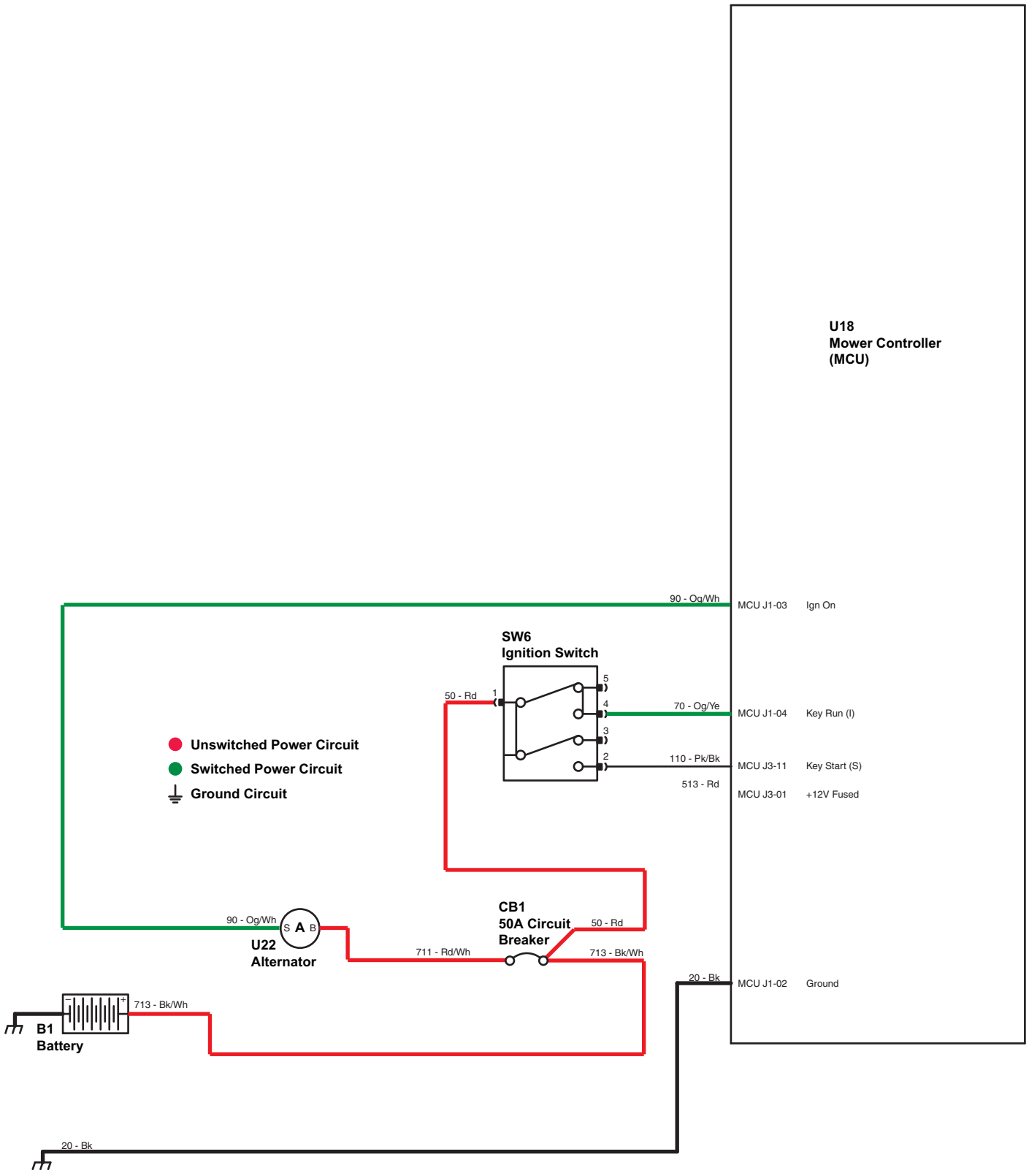
When battery (B1) voltage has dropped bellow 11.5 volts after a minute or longer, the combination gauge (U21) battery light illuminates red.

Charging Circuit Schematic

See Figure 4-5

Start and Glow Plug Circuit—Theory of Operation

Unswitched power is supplied from the battery (B1) positive terminal to the starting motor (M1) battery terminal, and to the battery terminal of the 50A circuit breaker (CB1).



Unswitched Power Circuit

From the battery terminal of the 50A circuit breaker (CB1) unswitched power is also supplied to the following components:

- Ignition Switch (SW6) terminal (1)
- MCU (U18) terminals (J1-06), (J1-07), and (J1-12)
- 20A Fuse (F6) (internal to MCU)
- 20A Fuse (F7) (internal to MCU)
- 25A Fuse (F2)
- Main Power Relay (CR1) terminals (30), and (86)

Current flows through the 50A circuit breaker (CB1) to the glow plug relay(CR2) relay terminal (30)

(See “Power Circuit—Theory of Operation” on page 2-16.)

Switched Power Circuit

When the ignition switch (SW6) is turned to the run position, current flows from ignition switch terminal (4) to the MCU (U18) key run terminal (J1-4), powering up the MCU.

With MCU (U18) energized, switched power is available from the MCU terminal (J1-3) to the following components:

- Mow Switch (SW8)
- Neutral Switch (SW4)
- Horn Switch (SW7)
- Glow Plug Light (L4)
- Check Engine Light (L8)
- Parking Brake Switch (SW13)

With the ignition switch (SW6) in the run position, the MCU (U18) performs a control panel lamp check for approximately 4 seconds. At the same time, the MCU performs a horn test, causing the horn (U20) to chirp three times.

Main Relay Circuit

When “Start and Glow Plug Circuit” interlock conditions are met, current flows from MCU terminal (J2-07) to ECU (U1) terminal (2-26) powering up the ECU.

The ECU then provides a ground through terminal (2-41) to activating the main power relay (CR1) terminal (85) which supplies switched power to the following components from main power relay terminal (87):

- Fuel Pump (M2)
- MCU (U18) terminal (J3-01)
- 10A Fuse (F1)
- ECU (U1) terminal (2-53), (2-55), and (2-56)

(See “Power Circuit—Theory of Operation” on page 2-16.)

Start and Glow Plug Circuits

To start and operate the engine with the operator on or off the seat, the mow switch (SW8) must be in the off position and the following interlock switches must be activated:

- Parking Brake Switch (SW13)
- Neutral Switch (SW4)

With the parking brake switch (SW13) in the on position, current flows from the parking brake switch to the MCU (U18) terminal (J4-09) and ECU (U1) terminal (2-19), activating the inputs.

With the traction pedal in the neutral position, the pedal linkage is brought near the magnetic target zone of the neutral switch (SW4), activating the switch, allowing current to flow from the switch to the MCU (U18) terminal (J4-01), activating the input.

With the interlock switch inputs satisfied and ignition switch (SW6) momentarily turned to the start position, the glow plug and start circuits are activated.

The ignition switch (SW6) can be held in the start position and the MCU (U18) will activate the start circuit after the glow circuit times out.

To activate the glow plug circuit, the ECU (U1) terminal (2-50) current flows to the glow plug relay terminal (86) and from glow plug relay terminal (85) to ground through ECU Terminal 1-35. With the relay energized, current flows from glow plug relay terminal (87) to the glow plugs (R2), heating the glow plugs. The ECU terminal (2-46) then grounds the glow plug light (L4), turning on the light.

The glow plug circuit remains activated for 1–6 seconds, depending on the coolant temperature. The ECU will not allow engine cranking until the glow plug circuit has timed out.

To activate the start circuit, the ECU (U1) terminal (1-21) current flows to the starter relay (CR3) terminal (86) and from starter relay terminal (85) to ground through ECU Terminal 1-21. Starter relay terminal (87) current flows to starter motor (M1) solenoid, energizing the solenoid and engaging the motor.

The MCU will only allow the start circuit to operate for a maximum of 10 seconds.

Start and Glow Plug Circuit Schematic

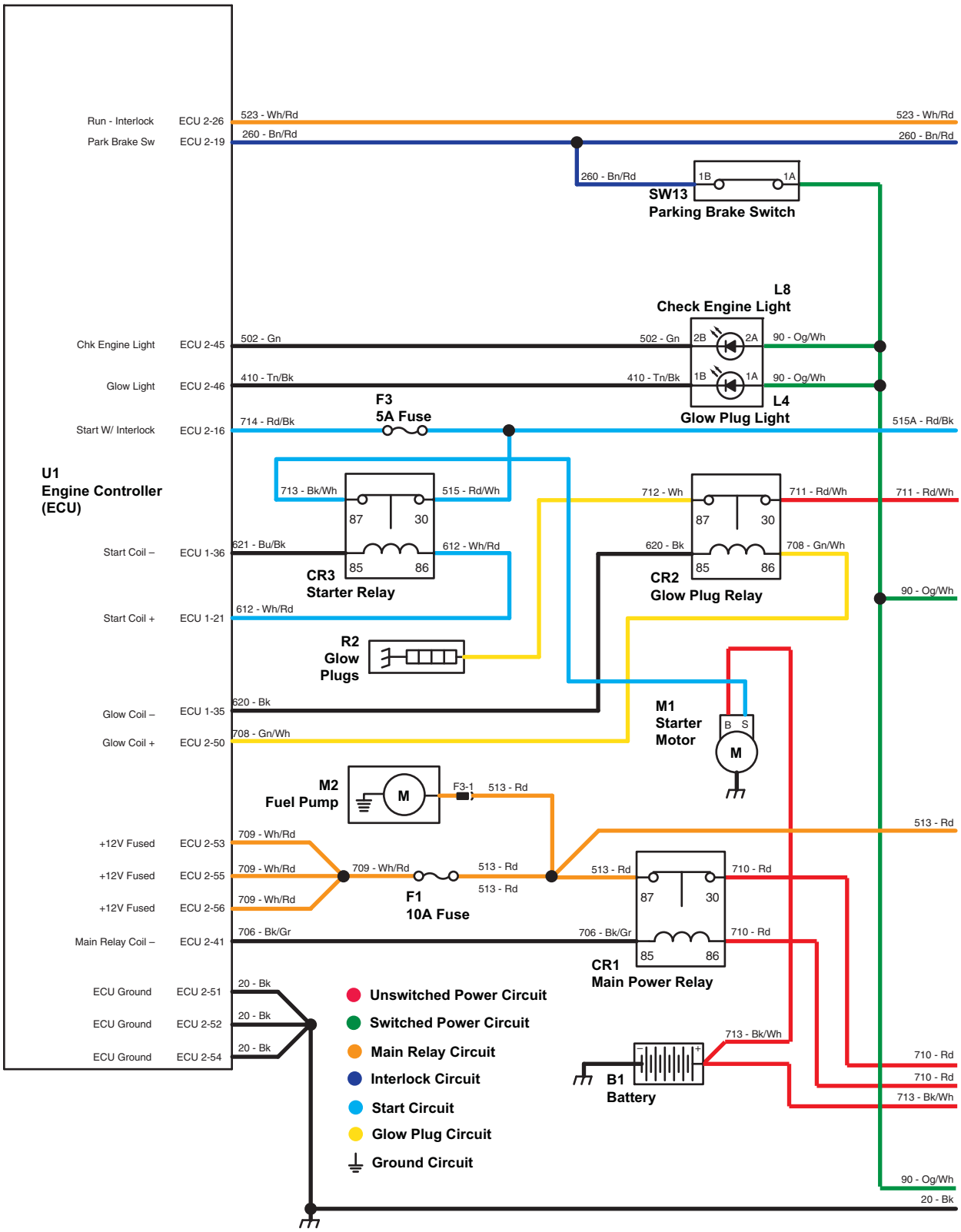
See Figure 4-6

Start and Glow Plug Circuit Schematic

See Figure 4-6

Run Circuit—Theory of Operation

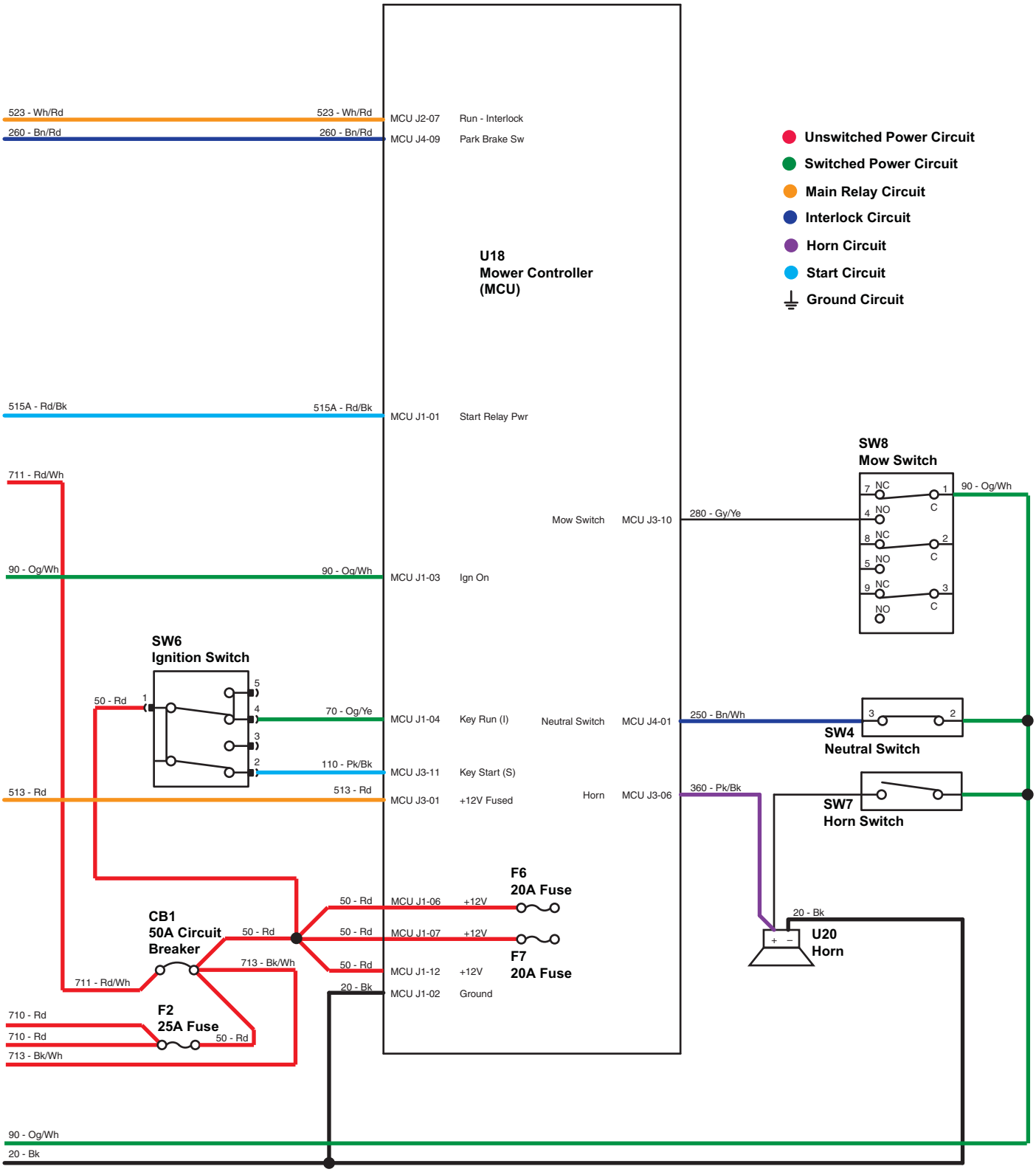
Unswitched Power Circuit



Unswitched power is supplied from the battery (B1) positive terminal to the starting motor (M1) battery terminal, and to the battery terminal of the 50A circuit breaker (CB1).

From the battery terminal of the 50A circuit breaker (CB1) unswitched power is also supplied to the following components:

- 20A Fuse (F6) (internal to MCU)
- 20A Fuse (F7) (internal to MCU)
- 25A Fuse (F2)



- Ignition Switch (SW6) terminal 1
- MCU (U18) terminals J1-06, J1-07, and J1-12
- Main Power Relay (CR1) terminals 30, and 86

Switched Power Circuit

When the ignition switch (SW6) is turned to the run position, current flows from ignition switch terminal (4) to the MCU (U18) key run input terminal (J1-4), powering up the MCU.

With MCU (U18) energized, switched power is available from the MCU terminal (J1-3) to the following components:

- Neutral Switch (SW4)
- Horn Switch (SW7)
- Seat Switch (SW5)
- Seat Switch (SW5A) (722/Premium Only)
- Parking Brake Switch (SW13)

With the ignition switch (SW6) in the run position, the MCU (U18) performs a control panel lamp check for approximately 4 seconds. At the same time, the MCU (U18) performs a horn test. During the test, the horn (U20) will chirp three times.

Main Relay Circuit

When “Run Circuit-On Seat” or “Run Circuit-Off Seat” interlock conditions are met, current flows from MCU (U18) terminal (J2-07) to ECU (U1) terminal (2-26) powering up the ECU.

The ECU provides a ground at terminal (2-41) activating the main power relay (CR1) which supplies switched power to the following components from main power relay terminal (87):

- Fuel Pump (M2)
- MCU (U18) terminal (J3-01)
- 10A Fuse (F1)
- ECU (U1) terminal (2-53), (2-55), and (2-56)

Run Circuit—On Seat

When the operator is on the seat, the seat switch (SW5) or (SW5A) contacts close providing to the MCU (U18) terminal (J3-09) with voltage, activating the input. With the input activated, the ECU allows the engine to continue to operate when the park brake (SW13) is released.

With the seat switch (SW5) input activated, the ECU (U1) keeps the main power relay (CR1) activated allowing current to flow to fuel pump (M2), and the pump continues to operate supplying the engine with fuel.

The ECU (U1) will un-ground the main power relay (CR1) if the following should occur:

- After starting the machine, if the operator should depress the traction pedal with the park brake on.
- If the operator should leave the seat with the park brake in the off position.

The ECU (U18) will un-ground the main circuit relay approximately 1 second after the seat switch (SW5) contacts open. The time delay is to compensate for seat bounce when operating the machine over rough terrain.

When the operator stops moving the machine and engages the park brake, the MCU (U18) will sound the horn (U20) to alert the operator that the park brake is set when the traction pedal is cycled. There is a 2-second delay before the MCU activates the horn.

Run Circuit—Off Seat

Before leaving the seat, the mow switch (SW8) must be in the off position and the following interlock switches must be activated:

- Parking Brake Switch (SW13)
- Neutral Switch (SW4)

With the parking brake switch (SW13) in the on position, voltage is provided from the switch to the MCU (U18) terminal (J4-09) and ECU (U1) terminal (2-19) activating the inputs.

With the traction pedal in the neutral position, the traction pedal linkage is brought near the magnetic target zone of the neutral switch, activating the switch. With the switch activated, voltage is provided from the switch to the MCU (U18) terminal (J4-01), activating the input.

NOTE

The switch is a solid state switch and will have approximately 2–3 volt drop across the switch when activated.

With the interlock switch inputs satisfied, the ECU (U1) continues to ground the main circuit relay at terminal (2-41) allowing the fuel pump (M2) and engine, to continue to operate.

Run Circuit Schematic—On Seat

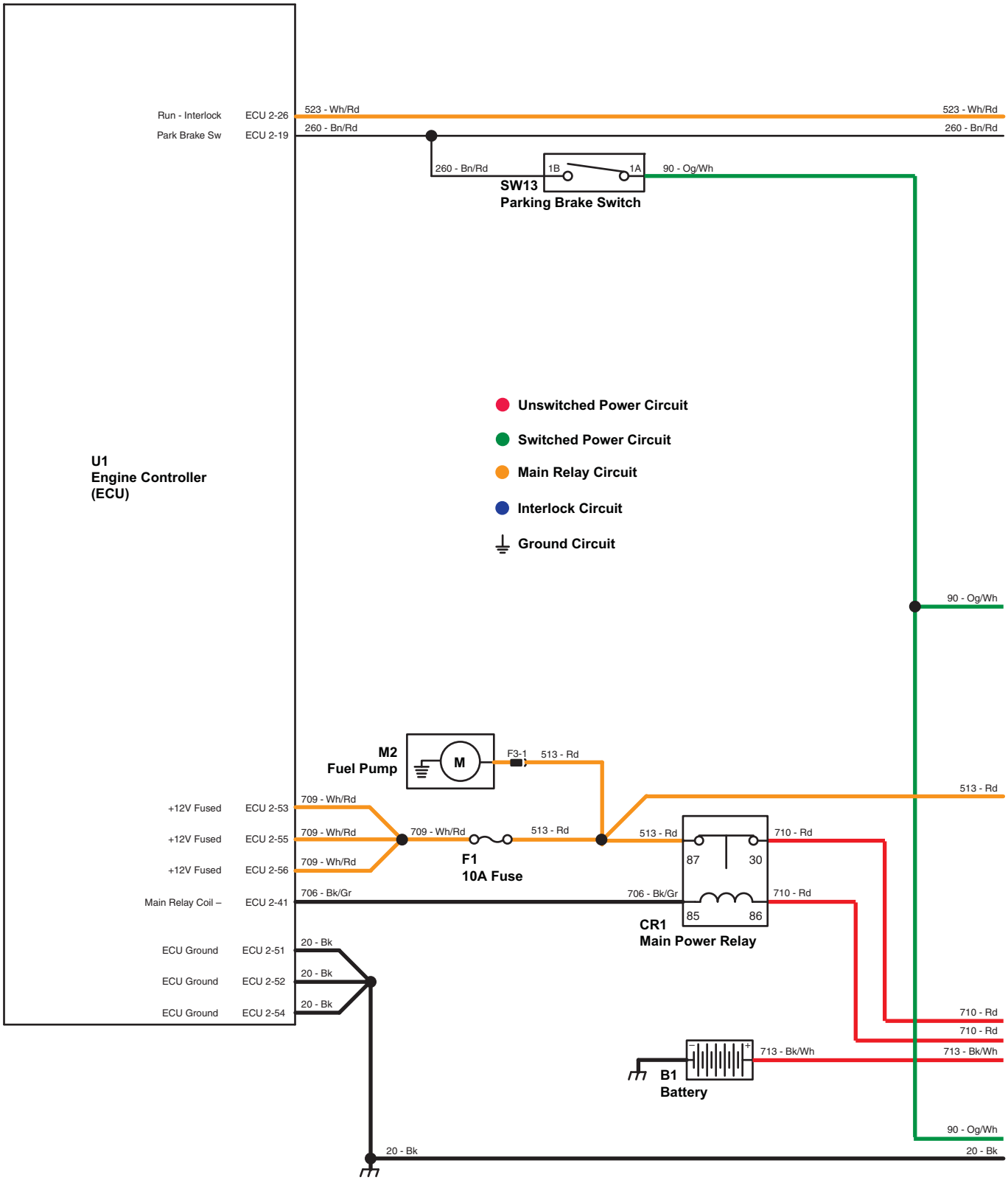
See Figure 4-7.

Run Circuit Schematic—On Seat

See Figure 4-7.

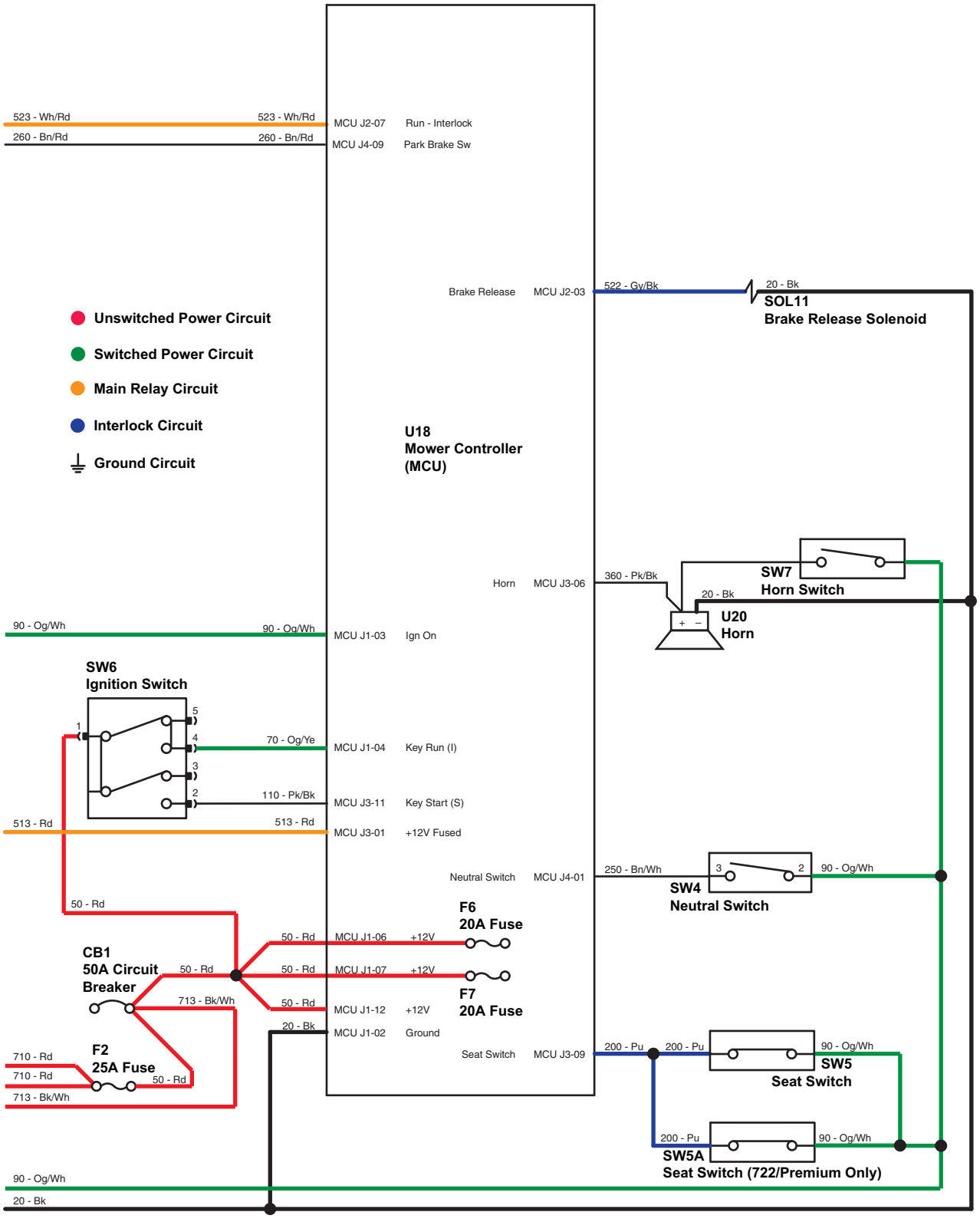
Run Circuit Schematic—Off Seat

See Figure 4-8.



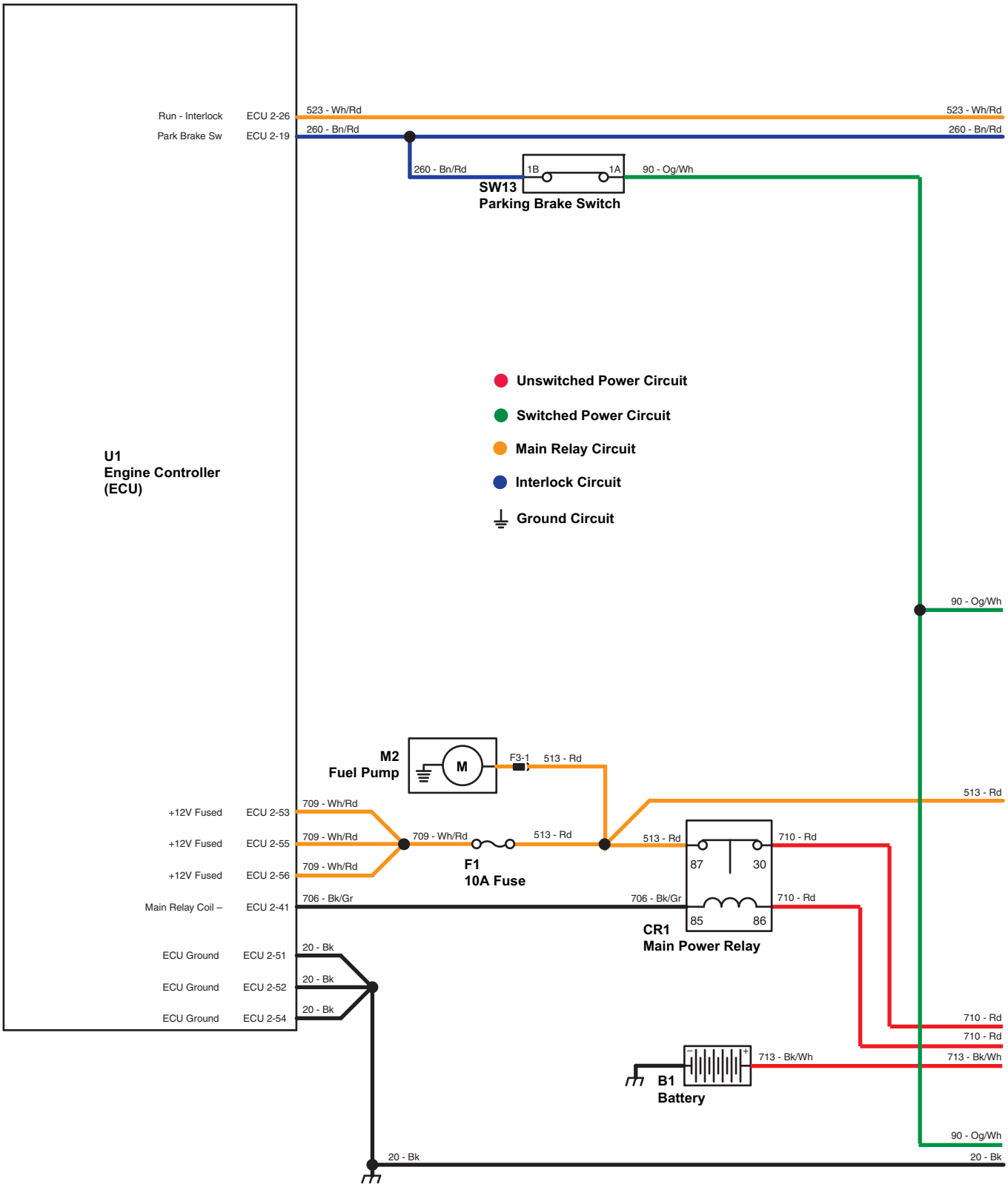
Run Circuit Schematic—Off Seat

See Figure 4-8.



Lift/Lower Circuit—Theory of Operation

page 2-16.)

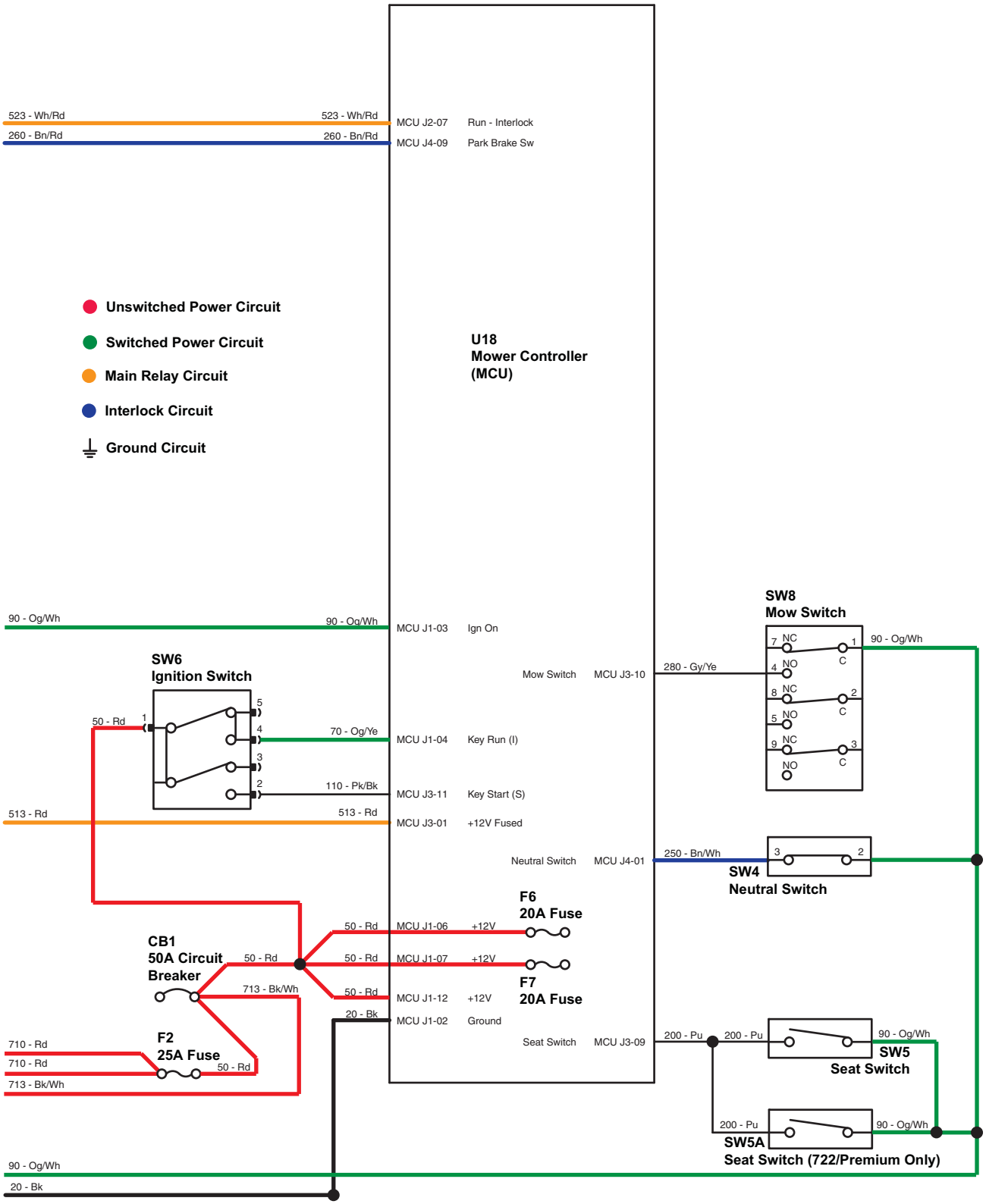


Power Circuit

(See “Power Circuit—Theory of Operation” on

Lift Circuit

When the joystick (SW9) is placed in the lift position, voltage is provided from the lift switch contacts to the MCU (U18) terminal (J4-11), activating the input. With the input activated, current flows from MCU terminal (J3-05) to the 5 gang lift solenoid (SOL6), energizing the solenoid.** With the solenoid energized, the cutting units will continue to rise until the joystick is released or until the cutting units reach their end of travel.



**In addition, on AR-722 models, current also flows from MCU terminal (J2-12) to the wing lift main solenoid (SOL3), energizing the solenoid. With the solenoid energized, the cutting units will rise until they reach their end of travel.

Right Wing Lift Circuit (722 Only)

When the right wing enable switch (SW11) is placed in the off position, voltage is cut off from the lift switch contacts to the MCU (U18) terminal (J4-02), deactivating the input. With the input deactivated, current flows from MCU terminal (J2-02) to the right wing lift/lower solenoid (SOL1), energizing the solenoid. With the solenoid energized, the cutting units will rise until they reach their end of travel.

Left Wing Lift Circuit (722 Only)

When the left wing enable switch (SW10) is placed in the off position, voltage is cut off from the lift switch contacts to the MCU (U18) terminal (J4-04), deactivating the input. With the input deactivated, current flows from MCU terminal (J2-11) to the left wing lift/lower solenoid (SOL2), energizing the solenoid. With the solenoid energized, the cutting units will rise until they reach their end of travel.

Lower Circuit

When the joystick (SW9) is placed in the lower position, voltage is provided from the lower switch contacts to the MCU (U18) terminal (J4-10), activating the input. With the input activated, current flows from MCU terminal (J2-08) to the 5 gang lower solenoid (SOL5), energizing the solenoid. With the solenoid energized, the cutting units are lowered. The MCU (U18) continues to energize the lower solenoid until the lift switch is activated.

Right Wing Lower/Float Circuit (722 Only)

When the right wing enable switch (SW11) is placed in the on position, voltage is provided from the lift switch contacts to the MCU (U18) terminal (J4-02), activating the input. With the input activated, current flows from MCU terminal (J2-02) to the right wing lift/lower solenoid (SOL1), opening the solenoid. With the solenoid open, the cutting units will lower until they reach their end of travel and float as necessary over uneven terrain.

Left Wing Lower/Float Circuit (722 Only)

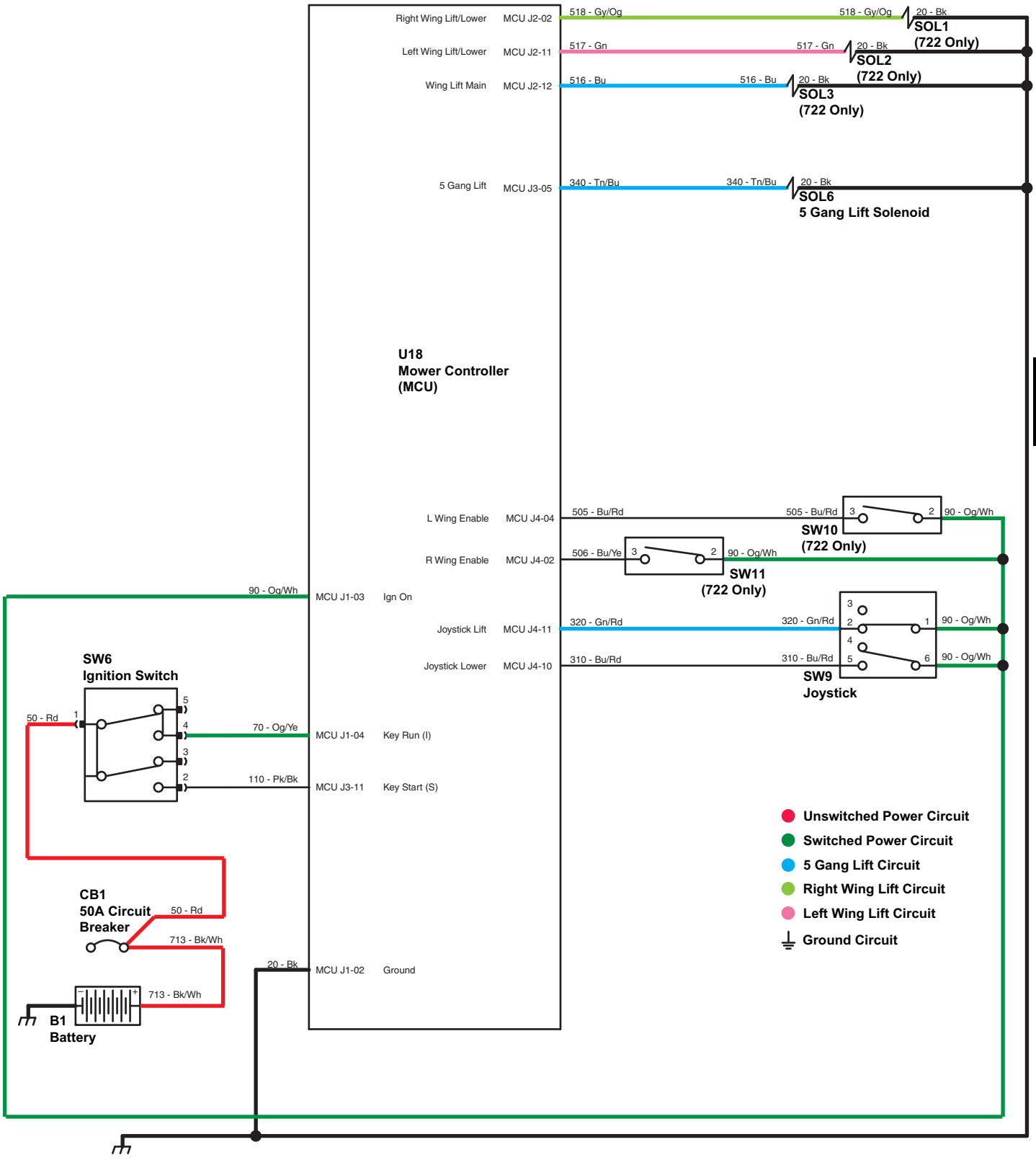
When the left wing enable switch (SW10) is placed in the on position, voltage is provided from the lift switch contacts to the MCU (U18) terminal (J4-04), activating the input. With the input activated, current flows from MCU terminal (J2-11) to the left wing lift/lower solenoid (SOL2), opening the solenoid. With the solenoid open, the cutting units will lower until they reach their end of travel and float as necessary over uneven terrain.

NOTE

While mowing, the lift/lower function will be in “one-touch crosscut” mode, meaning the joystick (SW9) only needs to be tapped to move the cutting units to a predetermined position. When not mowing, the joystick must be held until the cutting units reach the desired position.

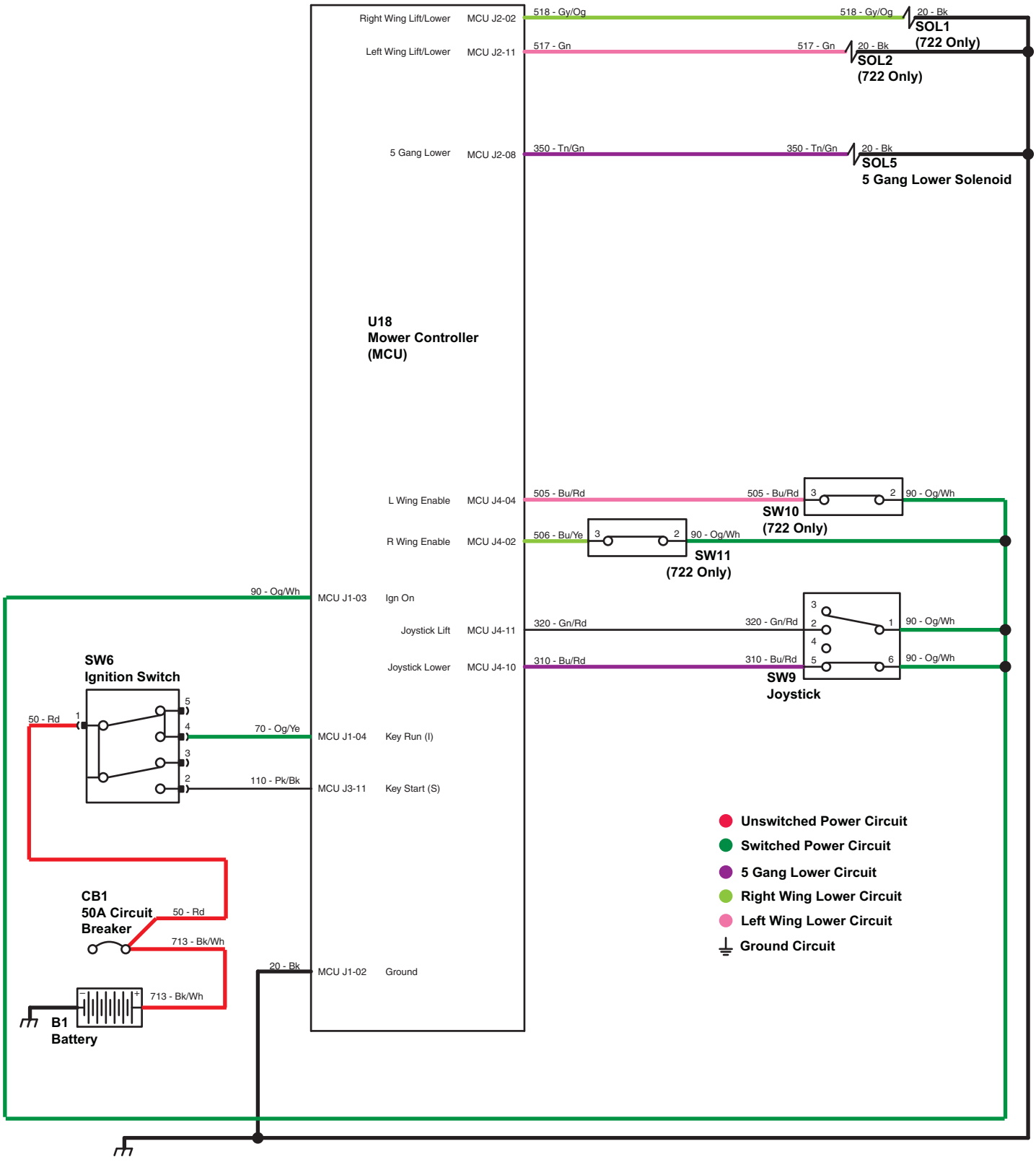
Lift Circuit Schematic

See Figure 4-9.



Lower Circuit Schematic

See Figure 4-10.



Mow Circuit—Theory of Operation

Power Circuit

(See “Power Circuit—Theory of Operation” on page 2-16.)

Mow Circuit(s)

Before the MCU (U18) allows activation of the mow circuit, the following must occur:

- Park brake must be in the released position.
- MCU seat switch input must be activated.

To activate the MCU (U18) seat switch input, the operator must be on the seat. With the operator is on the seat, the seat switch (SW5) or (SW5A) contacts close. With the seat switch contacts closed, current flows from the switch to MCU terminal (J3-09), activating the input.

When the mow switch (SW8) is in the mow position, current flows to MCU (U18) terminal (J3-10), activating the input. When the joystick (SW9) is momentarily placed in the lower position, voltage is provided to the MCU terminal (J1-10), activating the input. (See “Lift/Lower Circuit—Theory of Operation” on page 4-18.)

With the Mow switch (SW8) input activated and the lower switch input momentarily activated, current flows from VCU terminal (J3-11) to the 5 gang mow solenoid (SOL4), energizing the solenoid.**

**In addition, on AR-722 models, current also flows from MCU terminal (J2-01) to the wing mow main solenoid (SOL8), energizing the solenoid.

Right Wing Cross Cut Circuit (722 Only)

When the right cross cut switch (SW3) is in the mow position, current flows to MCU (U18) terminal (J4-07), activating the input. When the right wing lift/lower switch (SW11) is placed in the enable position, voltage is provided to the MCU terminal (J4-02), activating the input. (See “Lift/Lower Circuit—Theory of Operation” on page 4-18.)

With the right cross cut switch (SW3) input activated and the right wing lift/lower switch (SW11) input activated, current flows from VCU terminal (J2-09) to the right wing mow solenoid (SOL10), energizing the solenoid.

Left Wing Cross Cut Circuit (722 Only)

When the left cross cut switch (SW2) is in the mow position, current flows to MCU (U18) terminal (J4-08), activating the input. When the left wing lift/lower switch (SW10) is placed in the enable position, voltage is provided to the MCU terminal (J4-04), activating the input. (See “Lift/Lower Circuit—Theory of Operation” on page 4-18.)

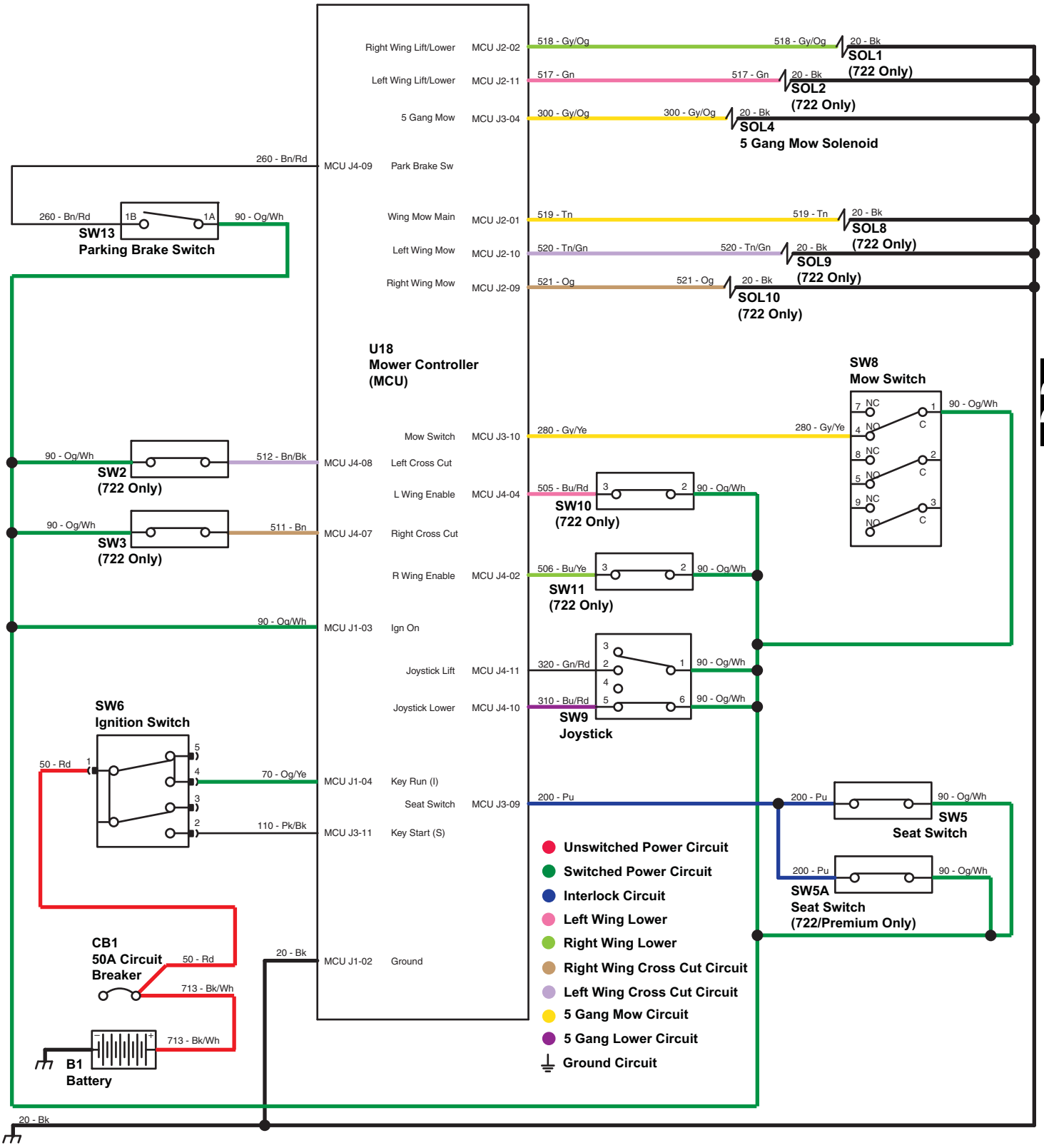
With the left cross cut switch (SW2) input activated and the right wing lift/lower switch (SW10) input activated, current flows from VCU terminal (J2-10) to the right wing mow solenoid (SOL9), energizing the solenoid.

Mow Circuit Schematic

See Figure 4-11.

Float/Traction Control Circuit—Theory of Operation

(See “Power Circuit—Theory of Operation” on page 2-16.)



Power Circuit

Float/Traction Control Circuit

When the mow 5 gang mow switch (SW8) is in the mow position, the traction control circuit operates automatically. (See “Mow Circuit—Theory of Operation” on page 4-20.)

When the mow switch (SW8) is in the mow position, current flows to MCU (U18) terminal (J3-10), activating the input.

With the Mow switch (SW8) input activated and the traction control switch input activated, current flows from MCU terminal (J3-05) to the lift solenoid (SOL6), energizing the solenoid. At the same time the MCU terminal (J2-08) provides a pulsing current to the lower solenoid (SOL5).

With a pulsing current applied to the lower solenoid (SOL5) and lift solenoid (SOL6) energized, the cutting units are slightly raised, shifting the weight of the mower decks back to the tires and allowing the cutting units to float over uneven terrain.

The MCU (U18) terminal (J2-06) also provides voltage to the traction control switch light, turning on the light.

The traction control circuit is deactivated when the traction control switch (SW14) is momentarily placed in the off position while the 5 gang mow switch (SW8) is in the mow position.

Right Wing Float Circuit (722 Only)

(See “Lift/Lower Circuit-Theory of Operation” page ?)

Left Wing Float Circuit (722 Only)

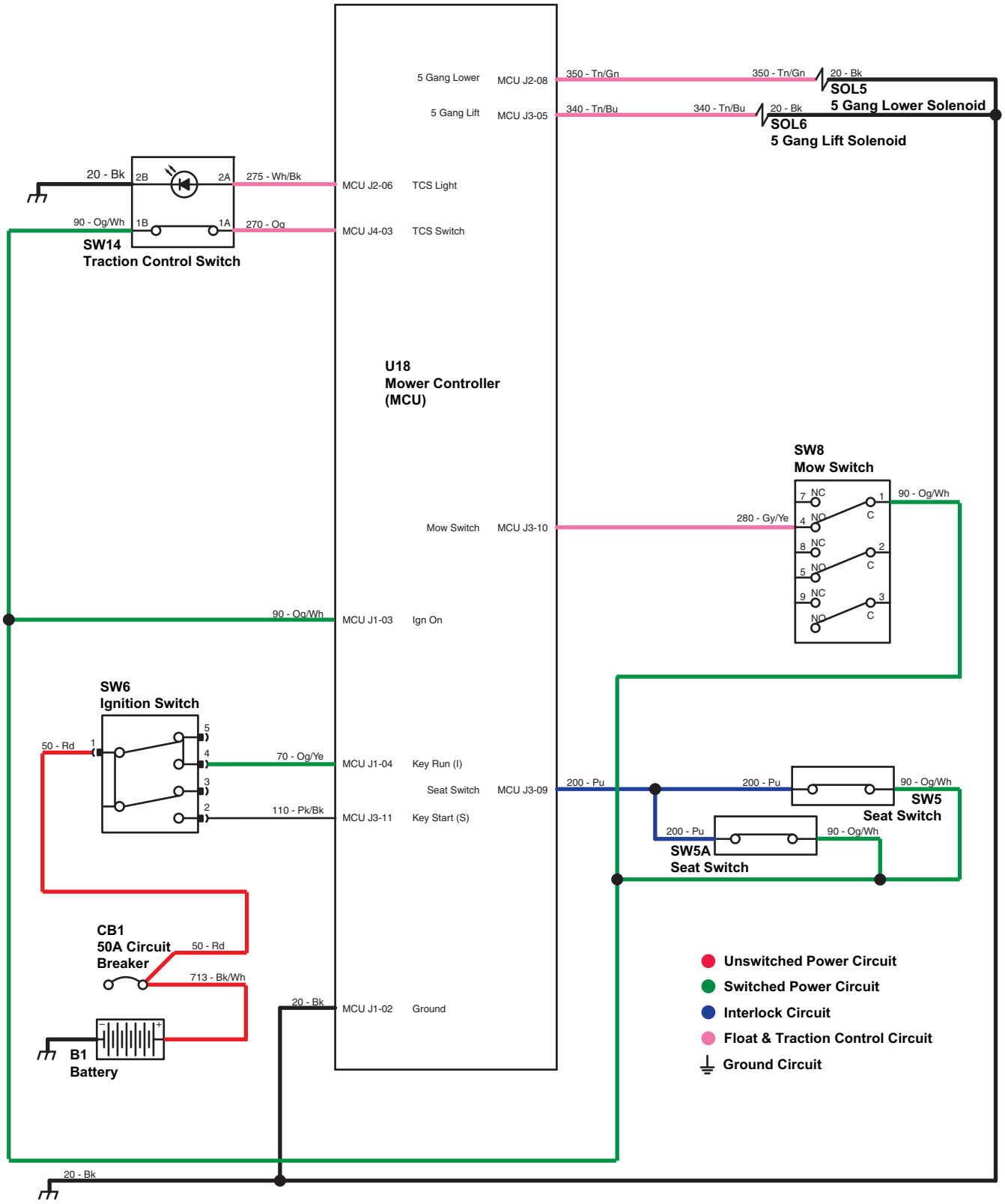
(See “Lift/Lower Circuit-Theory of Operation” page ?)

NOTE

The height of the cutting units can be calibrated. Calibration is required after hydraulic components are replaced or when the MCU (U18) is replaced.

Float and Traction Control Circuit Schematic

See Figure 4-12.



Instrumentation Circuit—Theory of Operation

Power Circuit

(See “Power Circuit—Theory of Operation” on page 2-16.)

Combination Gauge

The combination gauge (U21) displays operating hours and fuel level. The combination gauge (U21) also includes the following indicator lights:

- Battery Light
- Engine Oil Pressure Light
- Hydraulic Oil Level Light
- Hydraulic Oil Filter Light
- Coolant Temperature Light
- Parking Brake Light

Hourmeter

When the ignition switch (SW6) is in the run position, current flows to the combination gauge (U21) 12V input terminal. Hours begin to log with the supplied power and are displayed within the combination gauge.

Battery Light

Switched power from the MCU (U18) terminal J3-3 is supplied to the combination gauge (U21) 12V terminal. When the supplied voltage drops below 11.5 volts, the indicator light within the combination gauge (U21) illuminates, indicating the drop in voltage.

Engine Oil Pressure Light

When the engine oil pressure is below 7 psi (0.483 bar), the engine oil pressure switch (SW15) contacts close. With the switch contacts closed, a path to ground is provided to the combination gauge (U21) terminal (B), turning on the light.

With the engine oil pressure switch (SW15) closed, a path to ground is also provided from the switch to the MCU (U18) terminal (J3-08), activating the input. With the input activated and after a 30-second delay, the MCU does not allow the mow circuit to operate. At the same time, MCU terminal (J3-06) provides current to the horn (U20), turning on the horn. The horn sounds for 5 seconds and then chirps every 3 seconds.

Hydraulic Oil Level Light

When the hydraulic level switch (SW17) closes, current flows to the MCU (U18) terminal (J4-12). Current then flows from MCU terminal (J2-05) to the combination gauge (U21) terminal (C) turning on the indicator light within the combination gauge. Current at the MCU terminal (J4-12) activates the input. After a 5–second delay, the MCU does not allow the mow circuit to operate. The horn (U20) sounds for 5 seconds and then chirps every 3 seconds.

Fuel Gauge

The float attached to the fuel sender (R1) moves as the fuel level changes. The resistance of the fuel level sender changes in relationship to the position of the float. As the resistance changes, the amount of current flowing through the circuit to combination gauge terminal (E) changes. The amount of current flowing is indicated by the combination gauge (U21).

Hydraulic Filter Pressure Light

The hydraulic filter pressure switch (SW1) is a differential pressure switch. The switch closes when there is a 25 psi (1.723 bar) drop between the inlet and outlet pressures of the filter.

When the hydraulic filter pressure switch (SW1) closes, a path to ground is provided from the switch to the MCU (U18) terminal (J3-12), activating the input. With the input activated and after a 5-second delay, the MCU terminal (J4-06) provides a path to ground for the hydraulic filter pressure light within the combination gauge (U21), turning on the light. At the same time, the MCU (J3-06) provides current to the horn (U20), turning on the horn. The horn sounds for 5 seconds and then chirps every 3 seconds. The MCU does not allow the mow circuit to operate when the hydraulic filter pressure switch input is activated.

Engine Temperature Light

The temperature sender (U7) resistance changes in relationship to the engine coolant temperature. As the temperature sender is heated, the resistance of the sensor changes from a high resistance to a low resistance. The voltage drop across the temperature sender is provided to the ECU (U1) terminal (1-19). The amount of voltage across the sensor also has a relationship to temperature.

The temperature sender (U7) contacts close when the engine temperature reaches 230° F (110° C). When the contacts close, ground is supplied to the combination gauge (U21) terminal (G) turning on the water temperature light.

When the engine temperature reaches 230° F (110° C), the voltage across the temperature sender (U7) signals the ECU (U1) and the ECU signals the MCU (U18) to not allow the mow circuit to operate and to sound the horn (U20). The horn sounds for 5 seconds and then chirps every 3 seconds. There is a 30-second delay before the MCU activates the horn circuit.

Park Brake Light

Switch voltage to the parking brake switch (SW13) is used to indicate the state of the park brake within the combination gauge (U21). When the park brake is in the on position, current flows to ECU (U1) terminal (2-26) and MCU (U18) terminal (J4-09), activating the inputs. Current flows from MCU terminal (J2-04) to combination gauge terminal (H) turning on the park brake indicator light.

Fuel Filter Light

The water separator sensor (SW18) filters water from fuel collecting it in a separate reservoir that when full provides current to fuel filter light (L12) terminal (1A) turning in the fuel filter light until the reservoir is emptied.

Throttle Position Sensor

The throttle position sender (U19) resistance changes in relation to the throttle lever position. As the throttle is increased the resistance changes from a high resistance to a low resistance. Current flows from MCU (U18) terminal (J1-11) to the throttle position sender (U19) which in turn sends its signal back to the MCU terminal (J3-02).

Instrumentation Circuit Schematic

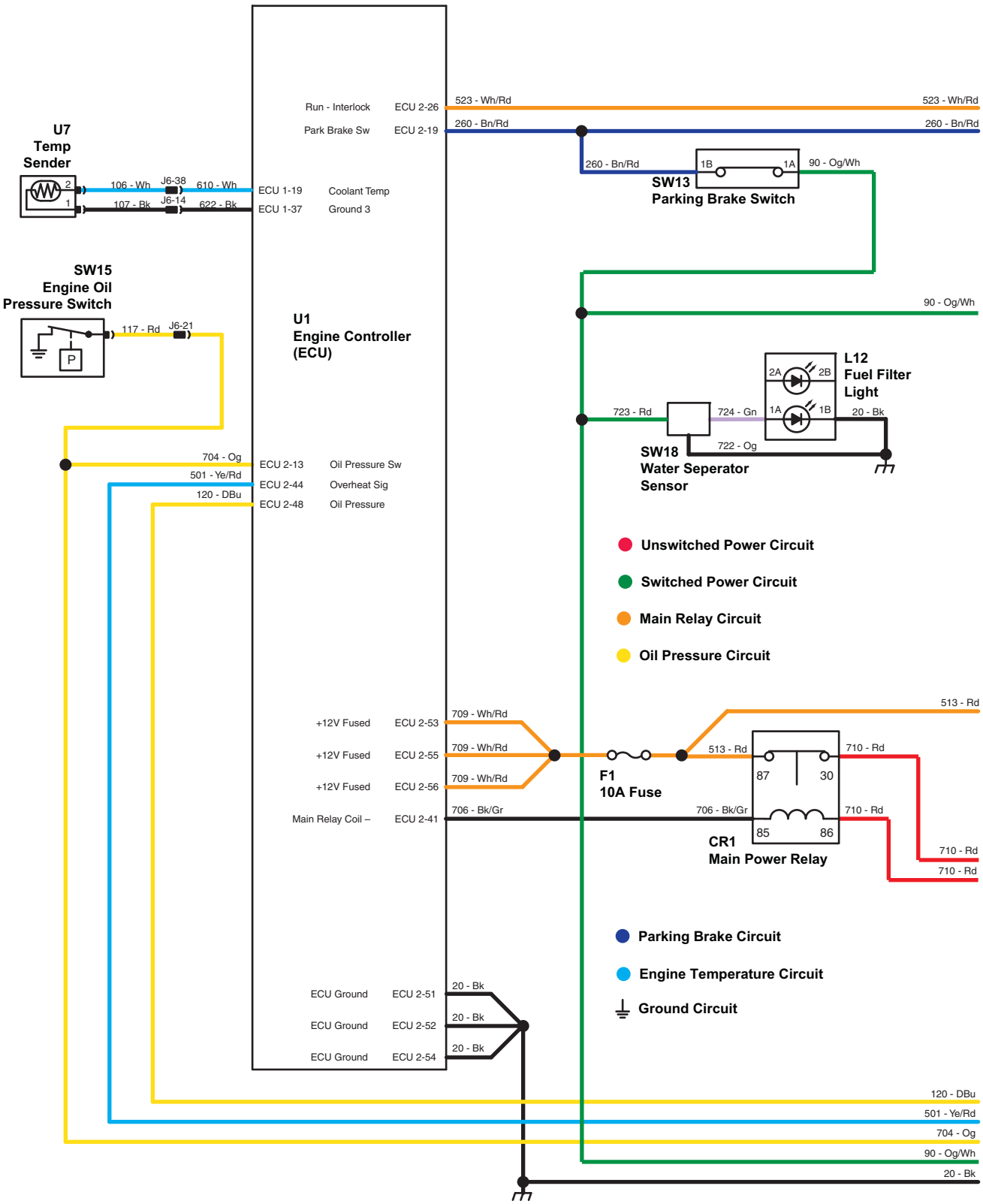
See Figures 4-14

Instrumentation Circuit Schematic

See Figures 4-14

Horn and Light Circuit—Theory of Operation

page 2-16.)



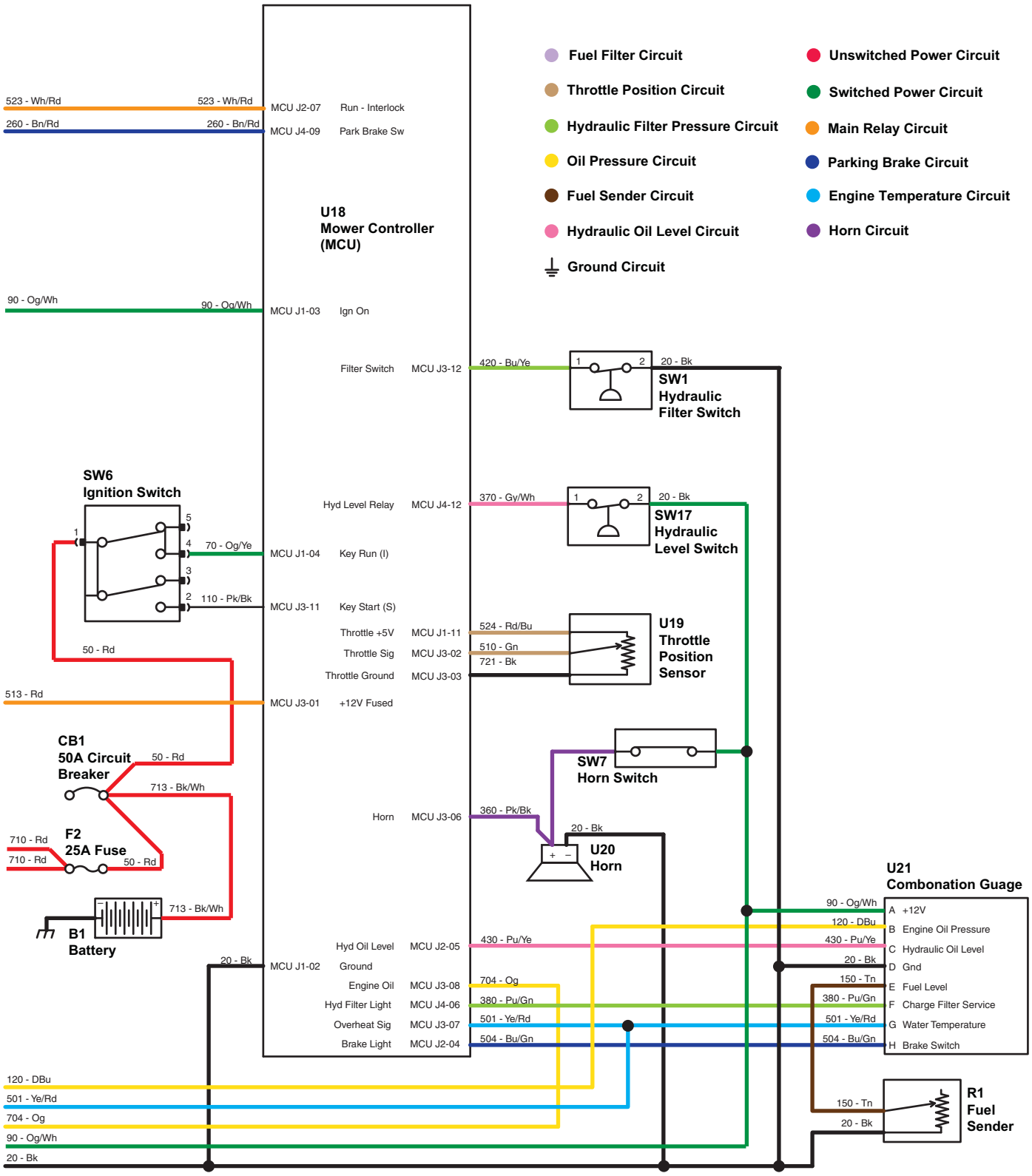
Power Circuit

(See “Power Circuit—Theory of Operation” on

Horn Circuit

When the horn switch (SW7) is placed in the on position, voltage is provided to the horn (U20), turning on the horn.

The MCU can also activate the horn as a test or signal for various issues. See “Start and Glow Plug Circuit-Theory of Operation”, “Run Circuit-Theory of Operation”, and/or “Instrumentation Circuit - Theory of operation” on pages ?,?,&?)



Light Circuit

Current flows from the MCU (U18) to the light switch (SW12) When the light switch is in the on position, voltage is provided to the right (L1) and left (L2) head lights, turning on the lights.

Horn and Headlight Circuit Schematic

See Figures 4-15

Active Regen and Park Regen Circuits—Theory of Operation

Power Circuit

(See “Power Circuit—Theory of Operation” on page 2-16.)

Park Regen Circuit

With the traction pedal in the neutral position, the traction pedal linkage is brought near the magnetic target zone of the neutral switch, activating the switch. With the switch activated, voltage is provided from the switch to the MCU (U18) terminal (J4-01), activating the input.

When the inhibit/regen switch (SW16) is placed in the enable position, current flows from switch terminals (6) and (3) to ECU (U1) terminals (2-28) and (2-39) activating the inputs.

When the park brake is in the on position, current flows to ECU (U1) terminal (2-26) and MCU (U18) terminal (J4-09), activating the inputs.

With the neutral switch (SW4), inhibit/regen switch (SW16), and parking brake switch (SW13) in the enable position, and mow switch (SW8) on the off position, the park regen circuit is activated. Current flows from ECU (U1) terminals (1-07), (1-39), and (1-06) to DPF temp sender 0 (U11), DPF temp sender 1 (U10), and DPF temp sender 2 (U9). The ECU also (U1) provides a ground at terminal (2-33) for the park regen light (L10) terminal (2B) turning on the light.

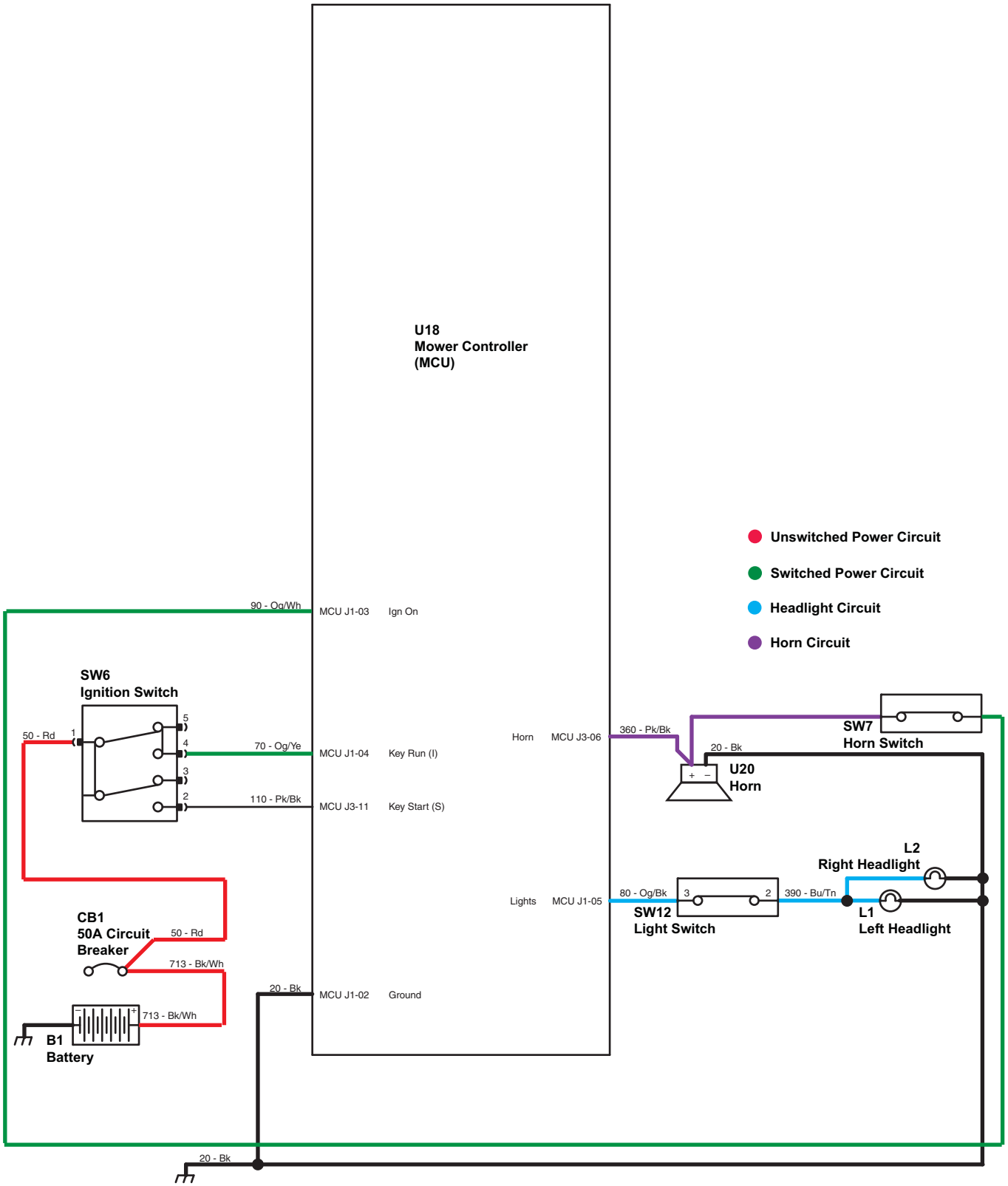
Active Regen Circuit

When the inhibit/regen switch (SW16) is placed in the enable position, current flows from switch terminals (6) and (3) to ECU (U1) terminals (2-28) and (2-39) activating the inputs.

With just the inhibit/regen switch (SW16) in the enable position, the active regen circuit becomes active. Current flows from ECU (U1) terminals (1-07), (1-39), and (1-06) to DPF temp sender 0 (U11), DPF temp sender 1 (U10), and DPF temp sender 2 (U9). The ECU also (U1) provides a ground at terminal (2-36) for the active regen light (L6) terminal (1B) turning on the light.

Park Regen Circuit Schematic

See Figure 4-7



Park Regen Circuit Schematic

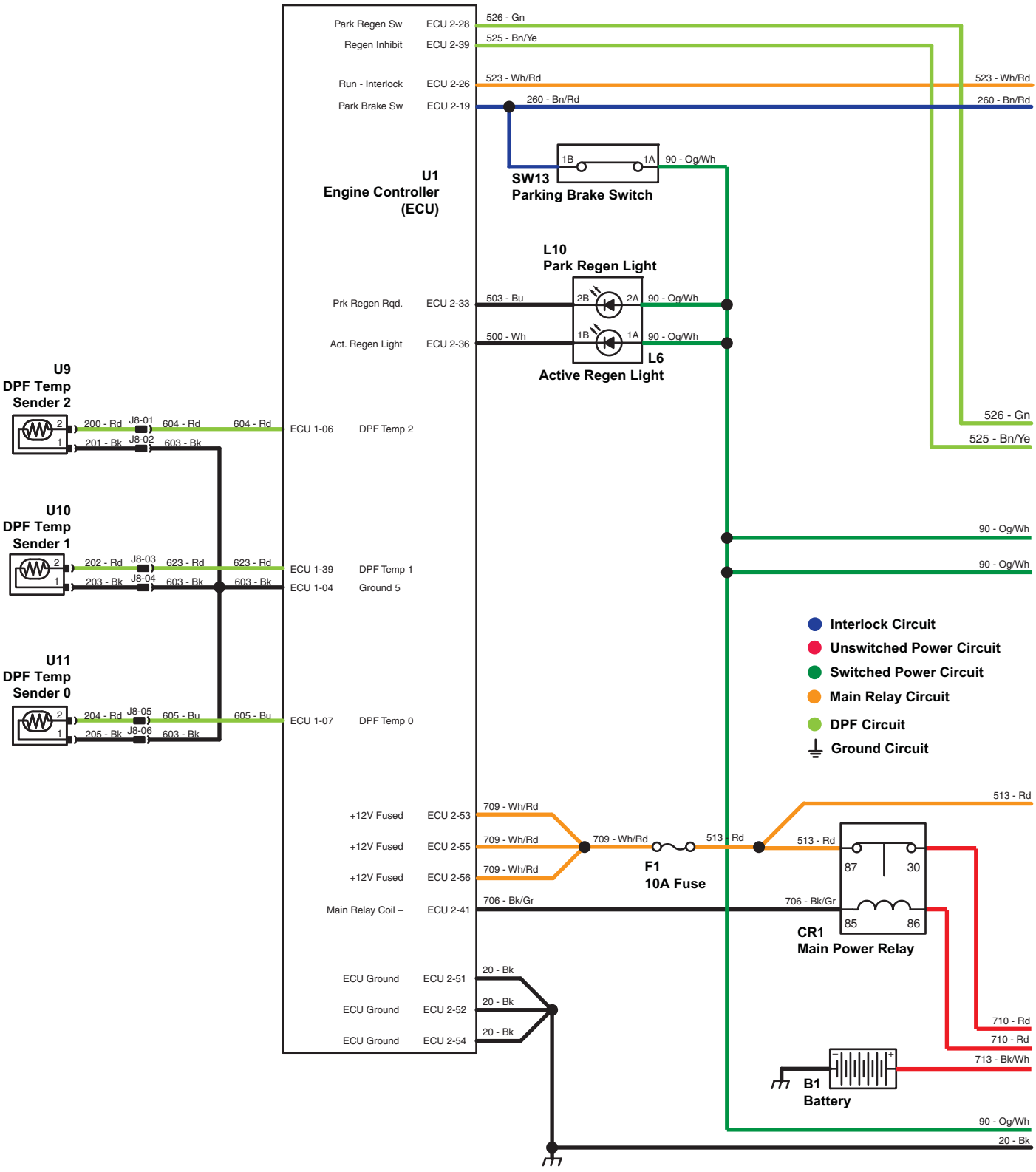
See Figure 4-7

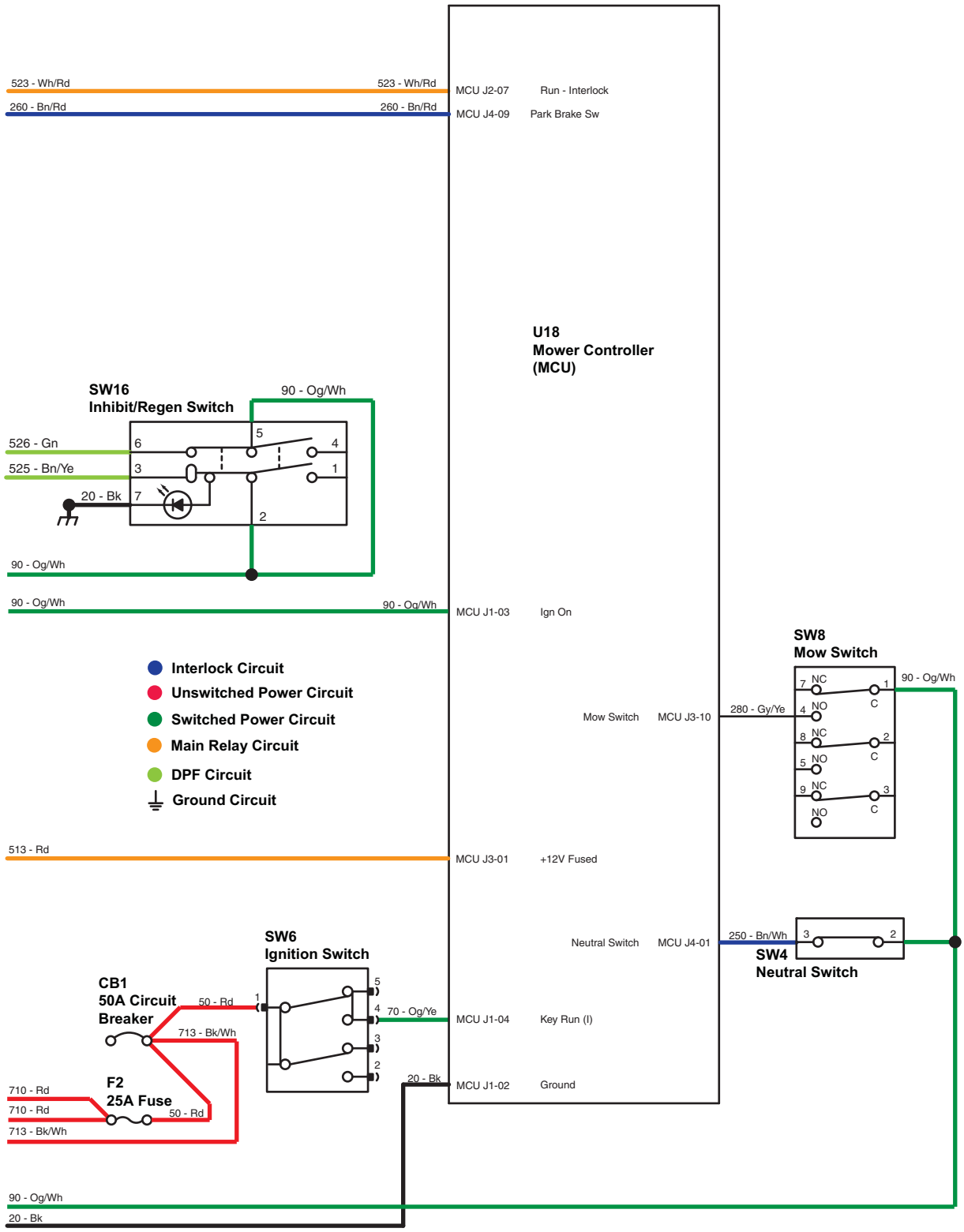
Active Regen Circuit Schematic

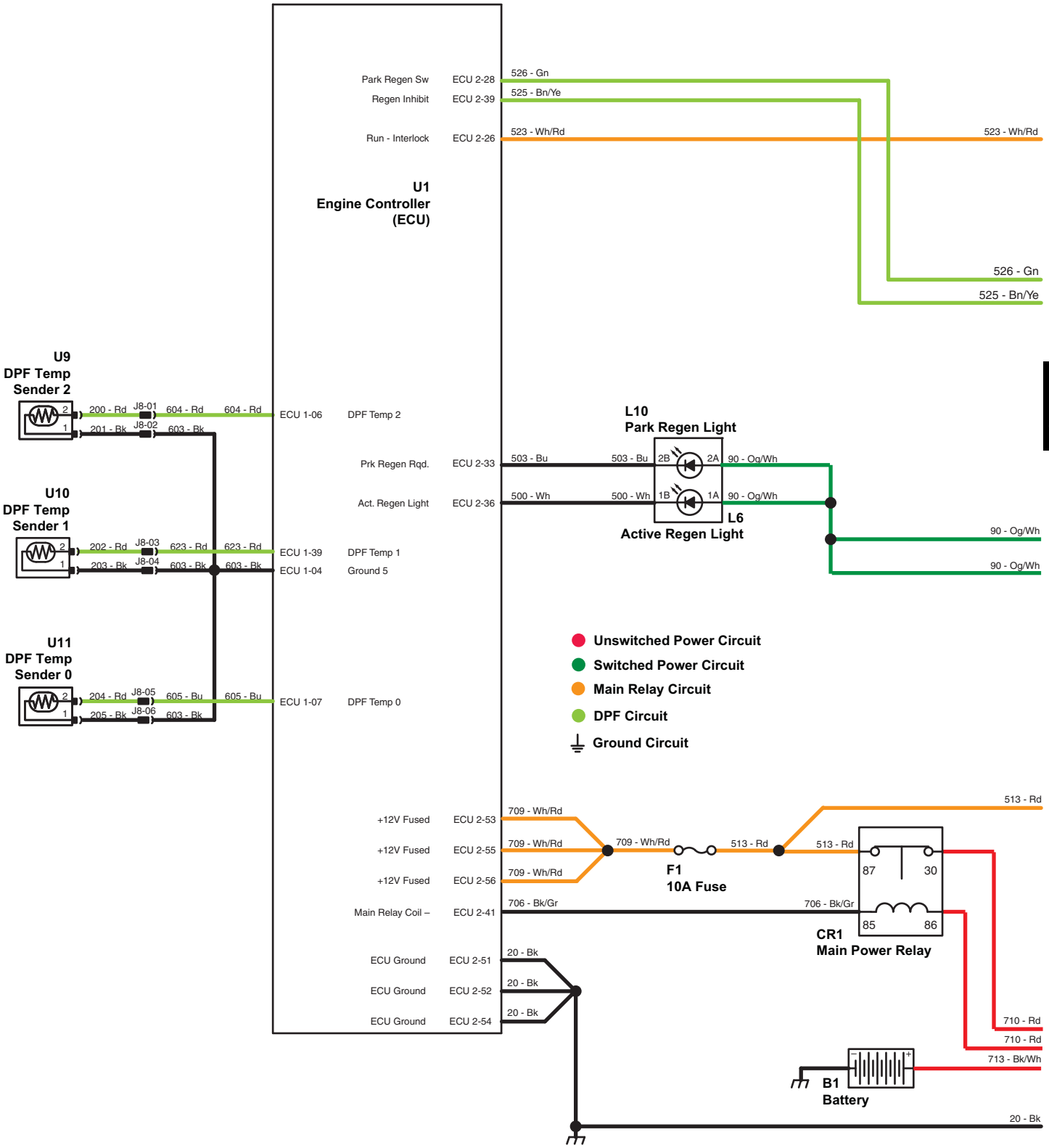
See Figures 4-

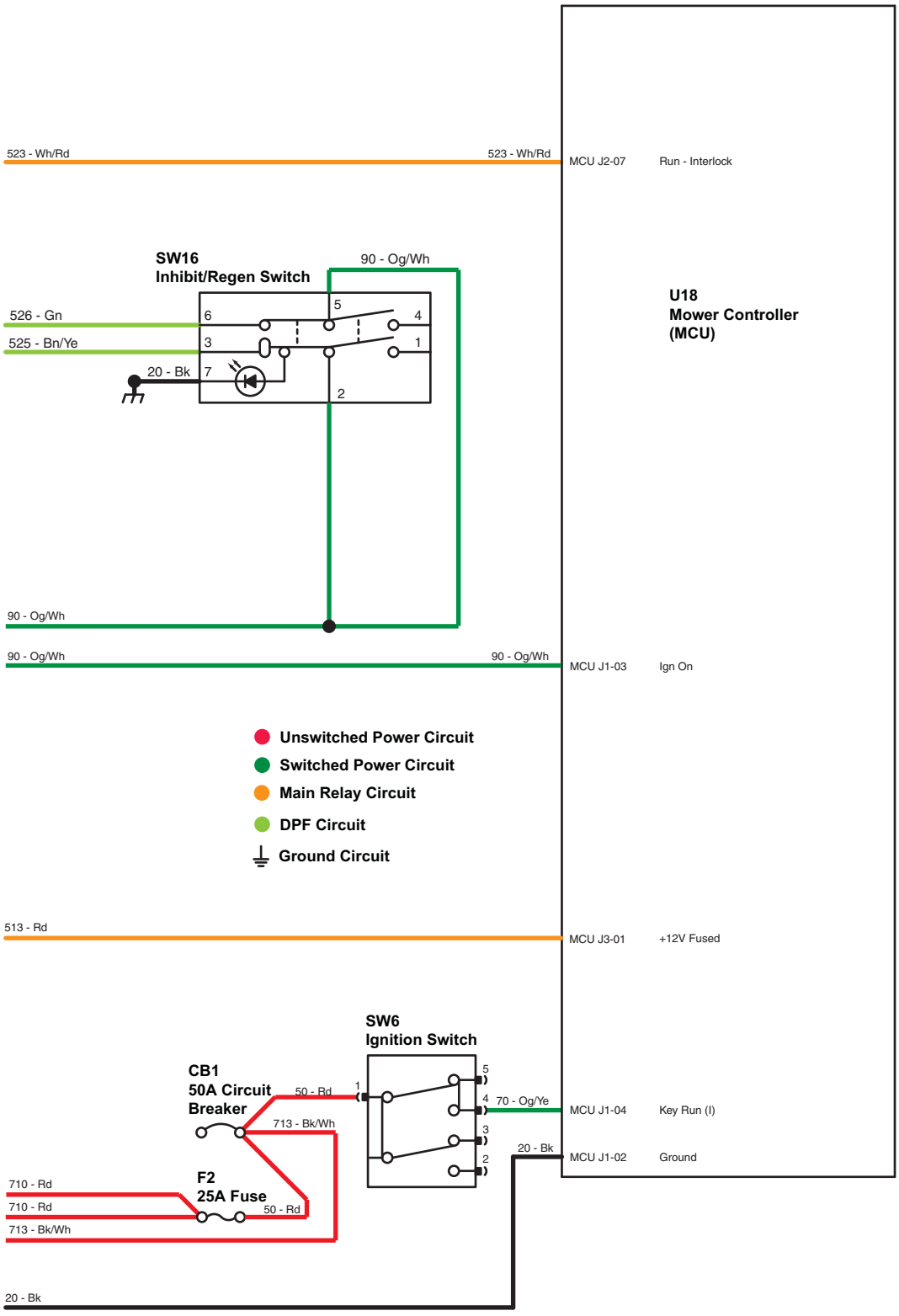
Active Regen Circuit Schematic

See Figures 4-


U1
Engine Controller
(ECU)
Park Regen Sw ECU 2-28
Regen Inhibit ECU 2-39
Run - Interlock ECU 2-26
Park Brake Sw ECU 2-19
526 - Gn
525 - Bn/Ye
523 - Wh/Rd
260 - Bn/Rd
SW13
Parking Brake Switch
1B
1A
90 - Og/Wh
L10
Park Regen Light
Prk Regen Rqd. ECU 2-33
Act. Regen Light ECU 2-36
503 - Bu
500 - Wh
2B
2A
L6
Active Regen Light
U9
DPF Temp
Sender 2
200 - Rd
201 - Bk
J8-01
J8-02
604 - Rd
603 - Bk
ECU 1-06 DPF Temp 2
U10
DPF Temp
Sender 1
202 - Rd
203 - Bk
J8-03
J8-04
623 - Rd
603 - Bk
ECU 1-39 DPF Temp 1
ECU 1-04 Ground 5
U11
DPF Temp
Sender 0
204 - Rd
205 - Bk
J8-05
J8-06
605 - Bu
603 - Bk
ECU 1-07 DPF Temp 0
Interlock Circuit
Unswitched Power Circuit
Switched Power Circuit
Main Relay Circuit
DPF Circuit
Ground Circuit
+12V Fused ECU 2-53
+12V Fused ECU 2-55
+12V Fused ECU 2-56
Main Relay Coil – ECU 2-41
709 - Wh/Rd
706 - Bk/Gr
513 - Rd
F1
10A Fuse
CR1
Main Power Relay
87
30
85
86
ECU Ground ECU 2-51
ECU Ground ECU 2-52
ECU Ground ECU 2-54
20 - Bk
710 - Rd
713 - Bk/Wh
B1
Battery


523 - Wh/Rd
523 - Wh/Rd
MCU J2-07
Run - Interlock
260 - Bn/Rd
260 - Bn/Rd
MCU J4-09
Park Brake Sw
U18
Mower Controller
(MCU)
SW16
Inhibit/Regen Switch
90 - Og/Wh
526 - Gn
525 - Bn/Ye
20 - Bk
90 - Og/Wh
90 - Og/Wh
90 - Og/Wh
MCU J1-03
Ign On
SW8
Mow Switch
Interlock Circuit
Unswitched Power Circuit
Switched Power Circuit
Main Relay Circuit
DPF Circuit
Ground Circuit
Mow Switch
MCU J3-10
280 - Gy/Ye
90 - Og/Wh
513 - Rd
MCU J3-01
+12V Fused
Neutral Switch
MCU J4-01
250 - Bn/Wh
SW4
Neutral Switch
SW6
Ignition Switch
CB1
50A Circuit
Breaker
50 - Rd
713 - Bk/Wh
70 - Og/Ye
MCU J1-04
Key Run (I)
F2
25A Fuse
710 - Rd
710 - Rd
50 - Rd
713 - Bk/Wh
20 - Bk
MCU J1-02
Ground
90 - Og/Wh
20 - Bk


U1
Engine Controller
(ECU)
Park Regen Sw
ECU 2-28
526 - Gn
Regen Inhibit
ECU 2-39
525 - Bn/Ye
Run - Interlock
ECU 2-26
523 - Wh/Rd
523 - Wh/Rd
526 - Gn
525 - Bn/Ye
U9
DPF Temp
Sender 2
200 - Rd
J8-01
604 - Rd
604 - Rd
ECU 1-06
DPF Temp 2
201 - Bk
J8-02
603 - Bk
U10
DPF Temp
Sender 1
202 - Rd
J8-03
623 - Rd
623 - Rd
ECU 1-39
DPF Temp 1
203 - Bk
J8-04
603 - Bk
603 - Bk
ECU 1-04
Ground 5
U11
DPF Temp
Sender 0
204 - Rd
J8-05
605 - Bu
605 - Bu
ECU 1-07
DPF Temp 0
205 - Bk
J8-06
603 - Bk
L10
Park Regen Light
Prk Regen Rqd.
ECU 2-33
503 - Bu
503 - Bu
2B
2A
90 - Og/Wh
Act. Regen Light
ECU 2-36
500 - Wh
500 - Wh
1B
1A
90 - Og/Wh
L6
Active Regen Light
90 - Og/Wh
90 - Og/Wh
Unswitched Power Circuit
Switched Power Circuit
Main Relay Circuit
DPF Circuit
Ground Circuit
+12V Fused
ECU 2-53
709 - Wh/Rd
+12V Fused
ECU 2-55
709 - Wh/Rd
709 - Wh/Rd
513 - Rd
513 - Rd
+12V Fused
ECU 2-56
709 - Wh/Rd
F1
10A Fuse
513 - Rd
87
30
Main Relay Coil –
ECU 2-41
706 - Bk/Gr
706 - Bk/Gr
85
86
CR1
Main Power Relay
ECU Ground
ECU 2-51
20 - Bk
ECU Ground
ECU 2-52
20 - Bk
ECU Ground
ECU 2-54
20 - Bk
710 - Rd
710 - Rd
713 - Bk/Wh
B1
Battery
20 - Bk


523 - Wh/Rd
523 - Wh/Rd
MCU J2-07
Run - Interlock
SW16
Inhibit/Regen Switch
90 - Og/Wh
U18
Mower Controller
(MCU)
526 - Gn
525 - Bn/Ye
20 - Bk
6
3
7
5
4
1
2
90 - Og/Wh
90 - Og/Wh
90 - Og/Wh
MCU J1-03
Ign On
Unswitched Power Circuit
Switched Power Circuit
Main Relay Circuit
DPF Circuit
Ground Circuit
513 - Rd
MCU J3-01
+12V Fused
SW6
Ignition Switch
CB1
50A Circuit
Breaker
50 - Rd
713 - Bk/Wh
1
5
4
3
2
70 - Og/Ye
MCU J1-04
Key Run (I)
20 - Bk
MCU J1-02
Ground
710 - Rd
710 - Rd
713 - Bk/Wh
F2
25A Fuse
50 - Rd
20 - Bk

Troubleshooting

MCU

Symptom: MCU does not power up.

Probable Cause	Remedy
Open fuse 20A fuse F6.	Test fuse. (See “Fuse Test” on page 2-54.)
Faulty MCU (U18) unswitched power circuit.	Measure voltage between MCU (U18) terminal (J3-6) and ground. Voltage must be approximately 12 VDC.
Faulty MCU (U18) switched power circuit.	With the ignition switch (SW6) in the run position, measure voltage between MCU (U18) terminal (J3-2) and ground. Voltage must be approximately 12 VDC.
Open MCU (U18) ground circuit.	Check continuity between MCU (U18) terminal (J3-8) and ground. Continuity must be indicated.
Faulty ignition switch (SW6).	Test ignition switch (SW6).
Faulty MCU (U18).	Substitute the MCU (U18) with a known good MCU.

Park Brake Circuit

Symptom: MCU brake sw LED does not turn on.

Probable Cause	Remedy
Faulty wiring harness or parking brake switch (SW13).	Disconnect parking brake switch (SW13) connector from wiring harness. With a jumper wire, connect the parking brake switch connector Org/Wht and Brn/Red wire terminals together. With the ignition switch (SW6) in the run position, check the MCU (U18) brake switch LED. If the LED turns on, substitute the parking brake switch with a known good switch. If the LED does not turn on, measure voltage between parking brake switch Org/Wht wire terminal and ground. Voltage must be approximately 12 VDC. If the LED does not turn on, check continuity between parking brake switch Brn/Red wire terminal and MCU terminal (J1-7). Continuity must be indicated.

Neutral Circuit

Symptom: MCU brake sw LED does not turn on.

Probable Cause	Remedy
Faulty wiring harness or neutral switch (SW4).	Disconnect neutral switch (SW4) connector from wiring harness. With a jumper wire, connect the neutral switch (SW4) connector Org/Pnk and Brn/Wht wire terminals together. With the ignition switch in the run position, check the MCU (U18) brake switch LED. If the LED turns on, substitute the neutral switch with a known good switch. If the LED does not turn on, measure voltage between neutral switch Org/Pnk wire terminal and ground. Voltage must be approximately 12 VDC. If the LED does not turn on, check continuity between neutral switch Brn/Wht wire terminal and MCU (U18) terminal (J1-7). Continuity must be indicated.

Charging Circuit

Symptom: Battery not charging.

Probable Cause	Remedy
Faulty alternator (U22) output circuit.	Make sure alternator (U22) output cable and battery positive (+) cable terminals are clean and tight. Check continuity between starter battery terminal and battery positive (+) terminal. Continuity must be indicated.
Faulty battery (B1) ground circuit.	Make sure battery negative (–) cable terminals are clean and tight. Check continuity between battery negative (–) terminal and ground. Continuity must be indicated.
Faulty battery (B1U20).	Check specific gravity of the individual battery cells.

Symptom: Alternator light stays on.

Probable Cause	Remedy
Missing excitation voltage.	With the ignition switch (SW6) in the run position, measure voltage between alternator ignition terminal (Org/Wht wire). Voltage must be approximately 12 VDC.
Faulty alternator (U22).	With the engine running, measure system voltage. Voltage must be approximately 14 VDC. If the voltage is below 12 volts, replace the alternator (U22).

Glow Plug Circuit

Symptom: Glow plugs do not get hot.

Probable Cause	Remedy
Faulty MCU (U18) output circuit.	Cycle ignition switch between the run and start positions and check MCU (U18) glow plug relay output LED. If the LED does not come on, substitute the MCU (U18) with a known good MCU.
Faulty power circuit.	Check continuity between 50A circuit breaker (CB1) and glow plug relay terminal 30. Continuity must be indicated.
Faulty glow plug relay (CR2).	Test relay. (See “Relay Tests” on page 2-54.)
Open glow plug relay (CR2) ground circuit.	Check continuity between glow plug relay (CR2) terminal 85 and ground. Continuity must be indicated.
Faulty glow plug relay (CR2) output circuit.	Measure voltage between glow plug terminal strip and ground. Voltage must be approximately 12 VDC.
Faulty connection at glow plug terminal strip.	Clean and tighten ring terminal connector.

Start Circuit

Symptom: Starter motor solenoid does not engage.

Probable Cause	Remedy
Parking brake switch (SW13) is in the off position.	Place the parking brake switch (SW13) in the on position.
Traction pedal not in the neutral position.	Move the traction pedal to the neutral position.
Mow switch (SW8) is in the mow position.	Place the mow switch (SW8) in the off position.
Faulty parking brake switch (SW13).	Test switch. (See “Park Brake Circuit” on page 2-44.)
Faulty neutral switch (SW4).	Test switch. (See “Neutral Circuit” on page 2-44.)
Faulty ignition switch (SW6).	With the ignition switch (SW6) in the start position, check MCU (U18) start switch input LED. If the LED does not light, test switch. (See “Ignition Switch Test” on page 2-55.)
Faulty MCU (U18) output.	With the ignition switch (SW6) in the start position, check MCU (U18) starter relay output LED. If the LED does not come on, substitute the MCU (U18) with a known good MCU. Note: The glow plug circuit must time out before the starter relay (CR3) output becomes active.
Faulty Starter relay (CR3).	Test relay. (See “Relay Tests” on page 2-54.)
Faulty power circuit.	Measure voltage between starter relay (CR3) terminal 30 and ground. Voltage must be approximately 12 VDC.
Faulty starter relay ground circuit.	Measure continuity between starter relay terminal 85 and ground. Continuity must be indicated.

Run Circuit

Symptom: Engine stops running when the park brake is released.

Probable Cause	Remedy
Faulty seat switch(SW5).	With the seat cushion depressed, check MCU seat switch input LED. If the LED does not light test the seat switch (SW5).
Faulty switched power circuit.	Measure voltage between seat switch (SW5) Org/Pnk wire terminal and ground. Voltage must be approximately 12 VDC.
Faulty 12V fuel solenoid (Y1) output circuit.	With the ignition switch (SW6) in the start position, measure voltage between the MCU (U18) fuel solenoid output terminal and ground. Voltage must be approximately 12 VDC.
Faulty MCU (U18).	Substitute the MCU (U18) with a known good MCU.

Lift/Lower Circuit

Symptom: Lower solenoid does not energize.

Probable Cause	Remedy
Faulty joystick (SW9).	With the joystick (SW9) in the lower position, check MCU (U18) joystick lower switch LED. If the LED does not light, test the switch. (See “Joystick Test” on page 2-55.)
Faulty switched power circuit.	Measure voltage between joystick (SW9) Org/Pnk terminals and ground. Voltage must be approximately 12 VDC.
Faulty lower switch input circuit.	With the joystick (SW9) in the lower position, measure voltage between MCU (U18) joystick lower switch input terminal and ground. Voltage must be approximately 12 VDC.
Faulty MCU (U18) output circuit	With the joystick (SW9) in the lower position, check MCU (U18) lower solenoid output LED. If the LED does not light, substitute the MCU (U18) with a known good MCU.
Faulty lower solenoid (SOL5) output circuit.	Momentarily place the joystick (SW9) in the lower position. Measure voltage between MCU (U18) lower solenoid output terminal and ground. Measure voltage between lower solenoid Tan/Grn wire terminal and ground. Voltage must be approximately 12 VDC.
Open lower solenoid (SOL5) ground circuit.	Check continuity between lower solenoid (SOL5) Blk wire terminal and ground. Continuity must be indicated.
Faulty lower solenoid (SOL5).	Test solenoid. (See “Solenoid Test” on page 2-60.)

Symptom: Lift solenoid does not energize.

Probable Cause	Remedy
Faulty joystick (SW9).	With the joystick (SW9) in the lower position, check MCU (U18) joystick lift switch LED. If the LED does not light, test the switch. (See “Joystick Test” on page 2-55.)
Faulty switched power circuit.	Measure voltage between joystick (SW9) Org/Pnk terminals and ground. Voltage must be approximately 12 VDC.
Faulty joystick(SW9) input circuit.	With the joystick (SW9) in the lift position, measure voltage between MCU (U18) joystick lift switch input terminal and ground. Voltage must be approximately 12 VDC.
Faulty MCU (U18) output circuit	With the joystick (SW9) in the lift position, check MCU (U18) lift solenoid output LED. If the LED does not light, substitute the MCU (U18) with a known good MCU.
Faulty lift solenoid (SOL6) output circuit.	Momentarily place the joystick (SW9) in the lift position. Measure voltage between MCU lift solenoid (SOL6) output terminal and ground. Measure voltage between lift solenoid (SOL6) Tan/Blu wire terminal and ground. Voltage must be approximately 12 VDC.
Open lift solenoid (SOL6) ground circuit.	Check continuity between lower solenoid (SOL6) Blk wire terminal and ground. Continuity must be indicated.
Faulty lift solenoid (SOL6).	Test solenoid. (See “Solenoid Test” on page 2-60.)

Mow Circuit

Symptom: Mow solenoid does not energize.

Probable Cause	Remedy
Joystick (SW9) was not momentarily placed in the lower position.	Momentarily place the joystick (SW9) in the lower position to activate the cutting units.
Faulty Mow switch(SW8).	With the mow switch (SW8) in the on position, check MCU (U18) mow switch input LED. If the LED does not light, test switch. (See “Mow Switch” on page 2-59.)
Faulty switched power circuit.	Measure voltage between mow switch (SW8) Org/Pnk terminal and ground. Voltage must be approximately 12 VDC.
Faulty MCU (U18) input circuit.	With the mow switch (SW8) in the mow position, measure voltage between MCU (U18) mow switch input terminal and ground. Voltage must be approximately 12 VDC.
Faulty MCU (U18) output circuit	With the joystick (SW9) in the lift position, check MCU (U18) lift solenoid output LED. If the LED does not light, substitute the MCU (U18) with a known good MCU.
Faulty mow solenoid (SOL4) output circuit.	With the mow switch (SW8) in the on position and the joystick (SW9) in the lower position, measure voltage between MCU (U18) mow solenoid output terminal and ground. Measure voltage between mow solenoid (SOL4) Gry/Org wire terminal and ground. Voltage must be approximately 12 VDC.
Open mow solenoid (SOL4) ground circuit.	Check continuity between mow solenoid (SOL4) Blk wire terminal and ground. Continuity must be indicated.
Faulty mow solenoid (SOL4).	Test solenoid. (See “Solenoid Test” on page 2-60.)

Traction Control Circuit

Symptom: Traction control circuit will not operate.

Probable Cause	Remedy
Faulty traction control switch (SW14).	With the traction control switch (SW14) in the on position, check MCU (U18) lift switch input LED. If the LED does not come on, test the switch. (See “Traction Control Switch Test” on page 2-56.)
Faulty switched power circuit.	With the ignition switch (SW6) in the run position, measure voltage between the traction control switch (SW14) Org/Wht wire terminals. Voltage must be approximately 12 VDC.
Faulty MCU (U18) input circuit.	Check continuity between MCU (U18) traction control input terminal (J1-9) and traction control switch (SW14) Org wire terminal. Continuity must be indicated.
Faulty traction control switch (SW14) light.	Test switch. (See “Traction Control Switch Test” on page 2-56.)
Faulty MCU (U18) output circuit.	Momentarily place the traction control switch (SW14) in the on position, check MCU (U18) 6-7 enable output LED. If the LED does not light, substitute the MCU with a known good MCU.
Faulty traction control output circuit.	Check continuity between MCU (U18) traction control light output terminal (J2-10) and traction control switch (SW14) Wht/Blk wire terminal. Continuity must be indicated.

Instrumentation Circuit

Lamp and Audible Alarm Check Circuit

The MCU provides a lamp and audible alarm check circuit. When the ignition switch is turned to the run position the MCU turns on the following for approximately 3 seconds:

- Glow Plug Light
- Hydraulic Filter Pressure Light
- Hydraulic Oil Level Light
- Horn (chirping)

After the lamp and audible alarm check circuit times out, the alternator and oil pressure light remains on because the engine is not operating. If any of the lights fail to turn on check the light bulbs.

Symptom: Engine oil pressure light does not turn on.

Probable Cause	Remedy
Faulty engine oil pressure switch (SW15).	With the ignition switch (SW6) in the off position, check continuity between engine oil pressure switch (SW15) and ground. Continuity must be indicated. If continuity is not indicated, replace engine oil pressure switch (SW15).
Faulty engine oil pressure light switched power circuit.	With the ignition switch (SW6) in the run position (engine off), measure voltage between engine oil pressure light terminal (C) at the combination gauge and ground. Voltage must be approximately 12 VDC.
Faulty engine oil pressure switch (SW15) circuit.	Check continuity between engine oil pressure switch (SW15) terminal and engine oil pressure light terminal (C) at the combination gauge. Continuity must be indicated.
Faulty LED.	Substitute the LED with a known good LED.

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

Probable Cause	Remedy
Low engine oil pressure.	Check engine oil pressure.
Faulty engine oil pressure switch (SW15).	If engine oil pressure tests good, replace engine oil pressure switch (SW15).

Symptom: Glow plug wait light does not come on.

Probable Cause	Remedy
Faulty MCU (U18) output circuit.	With ignition switch (SW6) in the run position, check MCU (U18) glow plug lamp output LED. If the LED turns on for approximately 3 seconds, check continuity between MCU (U18) glow plug lamp output terminal (J2-11) and glow plug lamp input terminal. Continuity must be indicated. If the LED does not turn on, substitute the MCU (U18) with a known good MCU.
Faulty switched power circuit.	Measure voltage between glow plug lamp Org/Wht terminal and ground. Voltage must be approximately 12 VDC.

Symptom: Hydraulic filter pressure light does not turn on with a blocked filter.

Probable Cause	Remedy
Faulty MCU (U18) output circuit.	With the ignition switch (SW6) in the run position, check MCU (U18) hydraulic filter lamp output LED. If the LED turns on for approximately 3 seconds, check for continuity between hydraulic filter pressure light Pur/Grn wire terminal at combination gauge (U21) and MCU (U18) hydraulic filter pressure light output terminal (J2-8). If the LED does not turn on, substitute the MCU (U18) with a known good MCU.
Faulty hydraulic filter pressure light switched power circuit.	With the ignition switch (SW6) in the run position (engine off), measure voltage between hydraulic filter pressure light Org/Wht terminal and ground. Voltage must be approximately 12 VDC.
Faulty MCU (U18) input circuit.	Connect a jumper wire to hydraulic filter switch (SW1) DB/Yel wire terminal and ground. With the ignition switch (SW6) in the run position, check MCU (U18) hydraulic filter sw input LED. If the LED does not turn on, check continuity between hydraulic filter pressure switch (SW1) DB/Yel wire terminal and MCU (U18) hydraulic filter pressure switch input terminal (J2-2). Continuity must be indicated. If the wiring checks good, substitute the MCU (U18) with a known good MCU.
Faulty hydraulic filter pressure switch (SW1).	Replace hydraulic filter switch (SW1).

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

Probable Cause	Remedy
Faulty hydraulic filter pressure switch (SW1).	Replace hydraulic filter switch (SW1).

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

Probable Cause	Remedy
Blocked hydraulic filter.	Replace hydraulic filter.
Faulty hydraulic filter pressure switch (SW1).	Replace hydraulic filter pressure switch (SW1).

Symptom: Engine temperature light on when the engine is cold.

Probable Cause	Remedy
Faulty temperature sender (U7).	Replace temperature sender (U7).
Faulty ground circuit.	Check continuity between the combination gauge (U21) water temperature terminal and ground. Continuity must be indicated.

Symptom: Engine temperature light does not light during lamp and audible alarm check.

Probable Cause	Remedy
Faulty temperature sender (U7).	With a jumper wire, connect the temperature sender (U7) to ground. With the ignition switch (SW6) in the run position, check the light. If the light is on, replace the temperature sender.
Faulty engine temperature circuit.	Check continuity between engine temperature light DG wire terminal and the temperature sender (U7) terminal. Continuity must be indicated.
Faulty switched power circuit.	With the ignition switch in the on position, measure voltage between combination gauge (U21) Org/Wht terminal and ground. Voltage must be approximately 12 VDC.
Faulty ground circuit.	Check continuity between combination gauge (U21) Blk wire terminal and ground. Continuity must be indicated.
Faulty engine temperature light.	Replace the engine temperature light.

Horn and Audible Alert Circuit

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

Probable Cause	Remedy
Faulty horn switch (SW7).	With the ignition switch (SW6) in the run position, pressed the horn switch (SW7). If the horn (U20) does not sound, test horn switch (SW7).
Faulty horn (U20).	Connect a test light between horn (U20) terminals (Pnk/Blk and Blk wires). With the ignition switch (SW6) in the run position, pressed the horn switch (SW7). If the test light turns on and the horn does not sound, replace the horn (U20).
Faulty switched power circuit.	Place ignition switch (SW6) into run position. Measure voltage between horn switch (SW7) Org/Wht terminal and ground. Voltage must be approximately 12 VDC.
Faulty horn switch (SW7) circuit.	Check continuity between horn switch (SW7) Pnk/Blk wire terminal and horn (U20) Pnk/Blk wire terminal. Continuity must be indicated.
Faulty ground circuit.	Check continuity between horn (U20) Blk wire terminal and ground. Continuity must be indicated.

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

Probable Cause	Remedy
Faulty horn (U20).	With the ignition switch (SW6) in the run position, pressed the horn switch (SW7). If the horn (U20) does not sound, see “Symptom: horn does not sound”.
Faulty horn (U20) output circuit.	With the ignition switch (SW6) in the run position, check MCU (U18) audible alarm output LED. If the LED flashes at 0.5 second rate for approximately 3 seconds and the horn (U20) does not sound, check continuity between horn (U20) Pnk/Blk wire terminal and MCU (U18) horn output terminal (J3-10). Continuity must be indicated If the LED does not turn on, substitute the MCU (U18) with a known good MCU.

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

Probable Cause	Remedy
Faulty engine oil pressure switch (SW15) input circuit.	With the ignition switch (SW6) in the run position and engine off, check MCU (U18) engine oil pressure switch input LED. If the LED does not come on, check continuity between engine oil pressure switch (SW15) terminal and MCU (U18) engine oil pressure switch input terminal (J2-1). Continuity must be indicated.

Symptom: Horn does not sound with engine temperatures over 230° F (110°C).

Probable Cause	Remedy
Faulty temperature sender (U7) input circuit.	Check continuity between temperature sender (U7) DG wire terminal and MCU (U18) temperature sender input terminal J2-12. Continuity must be indicated.

Light Circuit

Symptom: Head lights do not turn on.

Probable Cause	Remedy
Open fuse 20A fuse F6.	Test fuse. (See “Fuse Test” on page 2-54.)
Faulty light switch (SW12).	Test switch. (See “Light Switch Test” on page 2-57.)
Open light bulb circuit.	Check for continuity between lamp terminals and replace as required.

Component Testing

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 0.5 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.*

Fuse Test

Plug-In Fuses

See Figure 2-1.

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove fuse from fuse holder. (See “Plug-In Fuses” on page 2-66.)

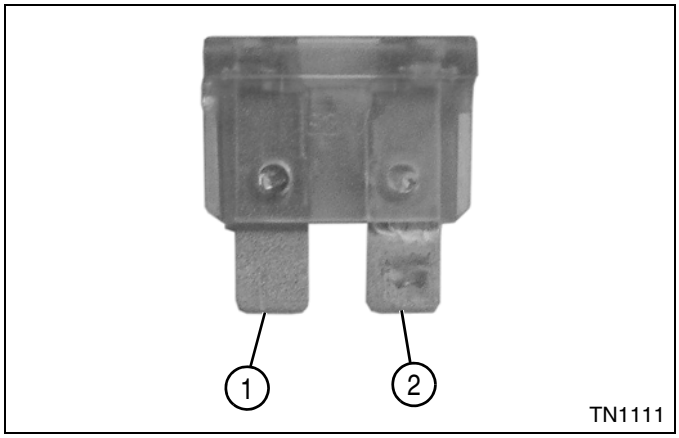


Figure 2-1

3. Connect one test lead to terminal (1).
4. Connect the other test lead to the other terminal (2) and check for continuity.

   Is continuity indicated?

   YES *The fuse is good.*

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

Relay Tests

See Figure 2-2.

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove relay. (See “Starter Relay” on page 2-67.)

   SPDT Relays (Jacobsen P/N 4193880)

- CR3 - Starter Relay
- CR2 - Glow Plug Relay
- K3 - Brake Release Relay

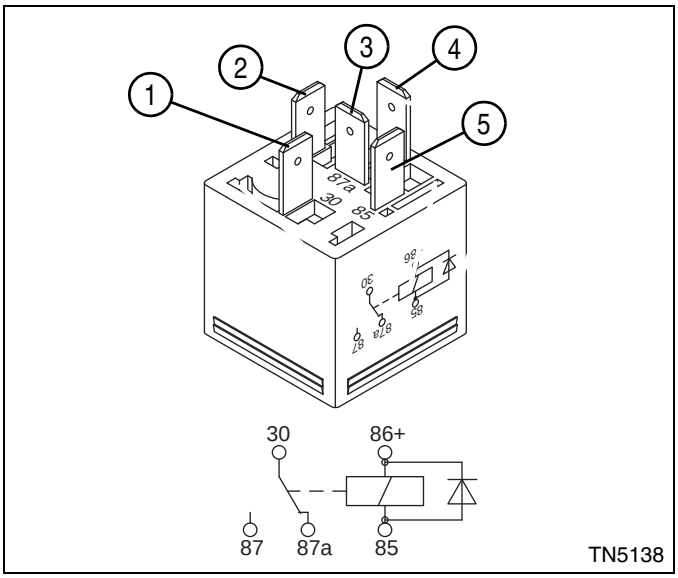


Figure 2-2

3. Connect one test lead to terminal 30 (1).
4. Connect the other test lead to terminal 87 (4) and check for continuity.

   Is continuity indicated?

   YES *The relay is faulty; replace the relay.*

   NO *Proceed to step 5.*
5. Connect one test lead to terminal 30 (1).
6. Connect the other test lead to terminal 87a (3) and check for continuity.

   Is continuity indicated?

   YES *Proceed to step 7.*

   NO *Check relay type. The relay is faulty; replace the relay.*
7. Connect one test lead to terminal 30 (1).
8. Connect the other test lead to terminal 87 (4).
9. Connect positive wire of 12 volt power source to terminal 86 (2) and negative wire to terminal 85 (5).
10. Check for continuity across terminals 30 and 87 (1 and 4).

    Is continuity indicated?

    YES *Proceed to step 11.*

    NO *The relay is faulty; replace the relay.*
11. Check for continuity across terminals 30 and 87a (1 and 3).

    Is continuity indicated?

    YES *The relay is faulty; replace the relay.*

    NO *The relay is good.*

Ignition Switch Test

See Figure 2-3.

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove the ignition switch from the instrument panel. (See “Ignition Switch” on page 2-69.)

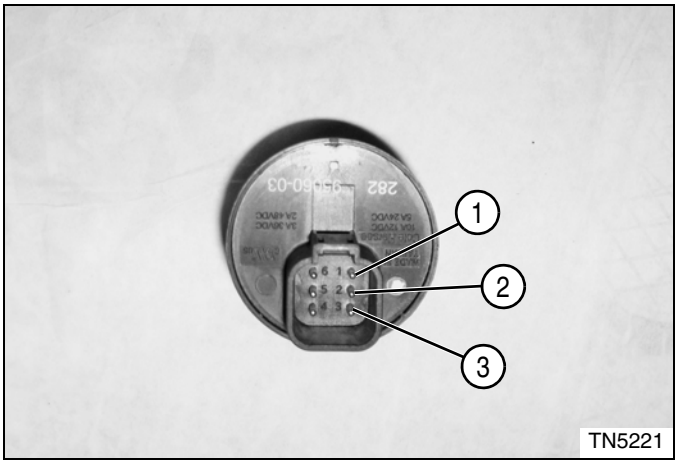


Figure 2-3

3. Move ignition switch to the on position.
4. Check continuity between terminals (2 and 3).

   Is continuity indicated?

   YES *Proceed to step 5.*

   NO *The ignition switch is faulty.*
5. Move the ignition switch to the start position. Check continuity between terminals (1, 2, and 3).

   Is continuity indicated?

   YES *The ignition switch is good.*

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

Joystick Test

See Figure 2-4.

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove the lift-lower switch from the instrument panel. (See “Joystick” on page 2-71.)

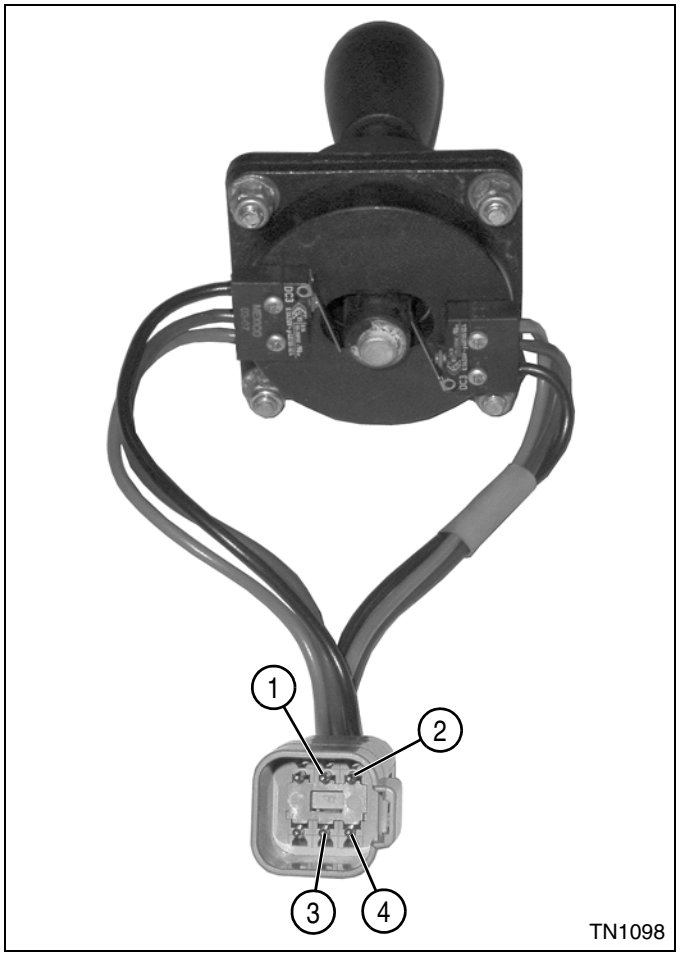


Figure 2-4

3. Connect test leads to terminals (1 and 2) and check for continuity.

   Is continuity indicated?

   YES *The switch is faulty; replace the lift-lower switch assembly.*

   NO *Proceed to step 4.*
4. With the test leads connected as described in step 3, move and hold the lift-lower lever in the lower position.

5. Check for continuity.

   Is continuity indicated?

   YES *Proceed to step 6.*

   NO *The switch is faulty; replace the lift-lower switch assembly.*

6. Return the lift-lower lever to the center (neutral) position.
7. Connect test leads to terminals (3 and 4) and check for continuity.

   Is continuity indicated?

   YES *The switch is faulty; replace the lift-lower switch assembly.*

   NO *Proceed to step 8.*

8. With the test leads connected as described in step 7, move and hold the lift-lower lever in the lift position.

   Is continuity indicated?

   YES *The lift-lower switch assembly is good.*

   NO *The switch is faulty; replace the lift-lower switch assembly.*

Traction Control Switch Test

See Figure 2-5.

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove the traction control switch from the machine. (See “Rocker Switches” on page 2-70.)

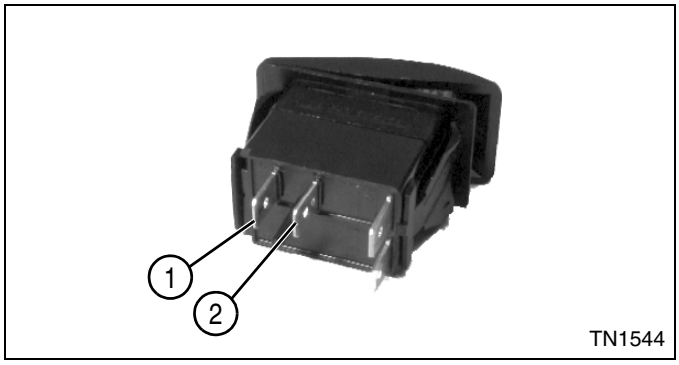


Figure 2-5

3. Connect test leads to the switch terminals (1 and 2).
4. Check for continuity.

   Is continuity indicated?

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

   NO *Proceed to step 5.*

5. With the test leads still connected, press the traction control switch.

   Is continuity indicated?

   YES *The switch is good.*

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

Light Switch Test

See Figure 2-6.

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove the head light switch from the control panel. (See “Rocker Switches” on page 2-70.)

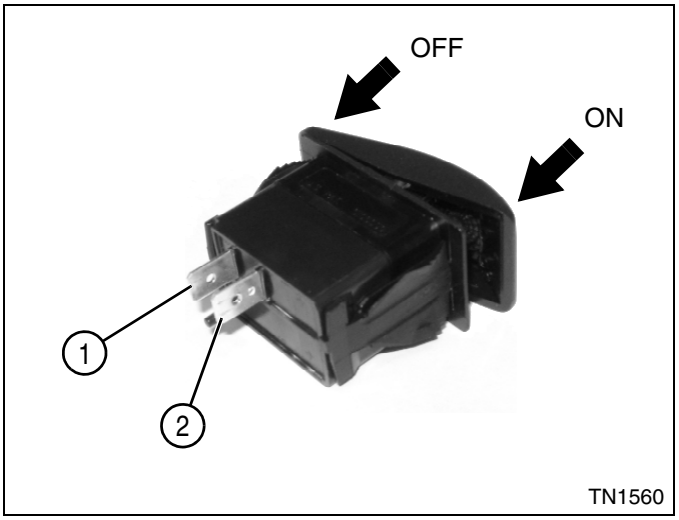


Figure 2-6

3. Place the switch in the off position.
4. Connect test leads to the switch terminals (1 and 2).
5. Check for continuity.

Is continuity indicated?

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

NO *Proceed to step 6.*

6. Place the switch in the on position.

Is continuity indicated?

YES *The switch is good.*

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

Horn Switch

See Figure 2-7.

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove the horn switch from the control panel. (See “Rocker Switches” on page 2-70.)

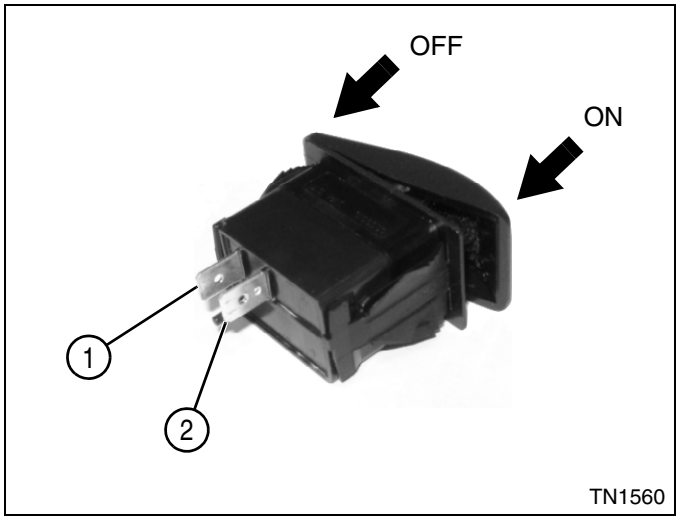


Figure 2-7

3. The switch is normally in the off position.
4. Connect test leads to the switch terminals (1 and 2).
5. Check for continuity.

Is continuity indicated?

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

NO *Proceed to step 6.*

6. Depress and hold the switch in the on position.

Is continuity indicated?

YES *The switch is good.*

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

Parking Brake Switch

See Figure 2-8.

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove the parking brake switch from the control panel. (See “Rocker Switches” on page 2-70.)

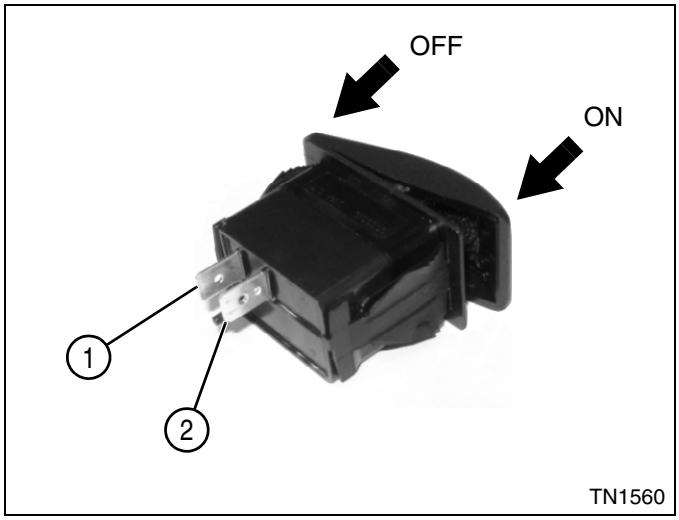


Figure 2-8

3. The switch is normally in the off position.
4. Connect test leads to the switch terminals (1 and 2).
5. Check for continuity.

   Is continuity indicated?

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

   NO *Proceed to step 6.*
6. Depress and hold the switch in the on position.

   Is continuity indicated?

   YES *The switch is good.*

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

Seat Switch Test

See Figure 2-9.

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)

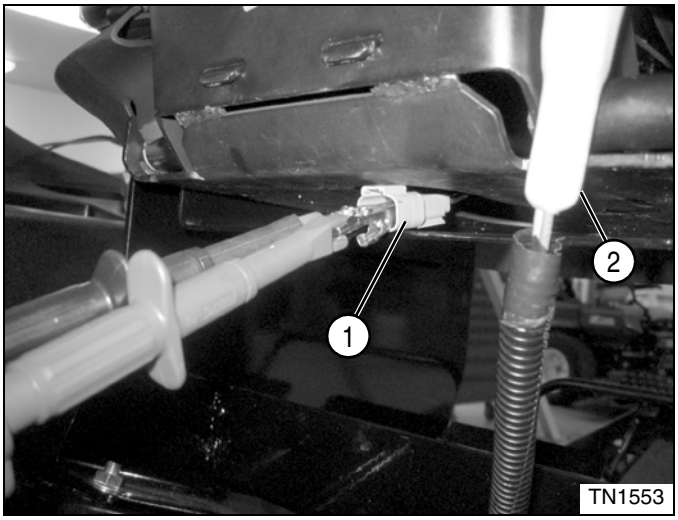


Figure 2-9

2. Unplug the seat switch (1) from the harness (2).
3. Connect test leads to the switch terminals.
4. Check for continuity.

   Is continuity indicated?

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

   NO *Proceed to step 5.*
5. Depress the seat switch or have a assistant sit in the seat.

   Is continuity indicated?

   YES *The switch is good.*

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

Hydraulic Level Switch Test

See Figures 2-10 and 2-11.

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Check to make sure hydraulic oil is at the correct level.
3. Remove the cover from the top of the hydraulic oil tank.
4. Remove the hydraulic level switch from the hydraulic oil tank.

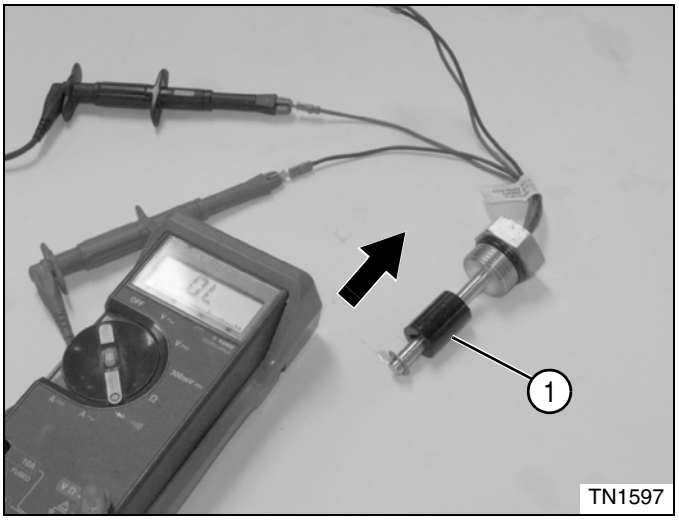


Figure 2-10

5. Connect test leads to the red and black switch terminals.
6. Push the float (1) to the full position.
7. Check for continuity.

Is continuity indicated?

YES *The hydraulic level switch is faulty; replace the switch.*

NO *Proceed to step 8.*

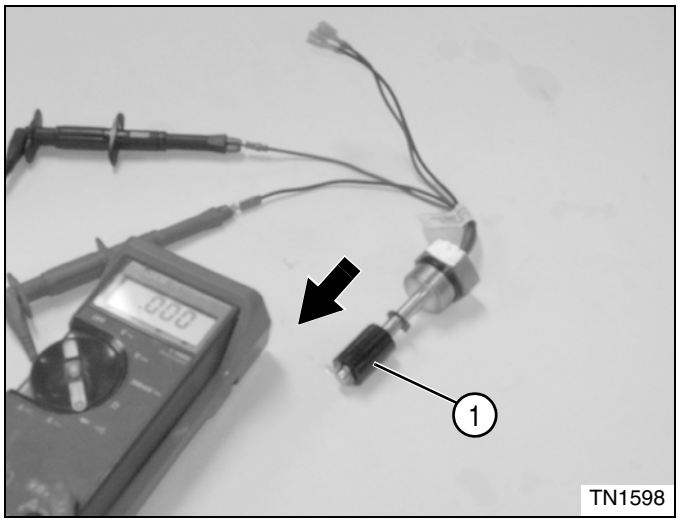


Figure 2-11

8. Push the float (1) to the empty position.
9. Check for continuity.

Is continuity indicated?

YES *The hydraulic level switch is good.*

NO *The hydraulic level switch is faulty; replace the switch.*

Mow Switch

See Figures 2-12 and 2-13.

Required Tools or Equipment
Digital Multimeter or Ohmmeter

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove the instrument panel. (See “Instrument Panel” on page 2-68.)

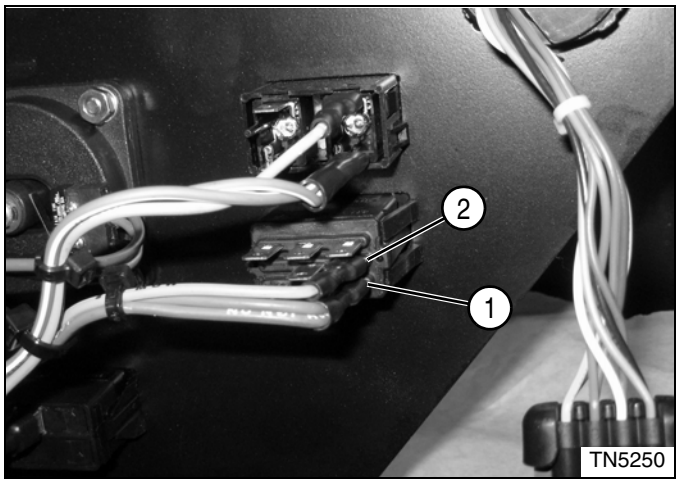


Figure 2-12

3. With the ignition key turned to the on position, use a multimeter to check for battery voltage at the orange/pink wire (1).
4. Battery voltage should be available at terminal (1). If not, check the wiring harness for loose, broken, or dirty connections.
5. Remove the wire connectors from the switch terminals.
6. Remove the mow switch from the control panel.

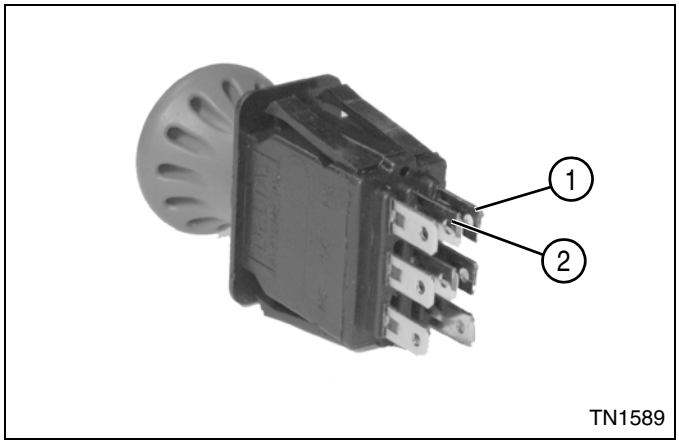


Figure 2-13

7. Place test leads on switch terminals (1 and 2).
8. Place the switch in the on (pulled up) position.
9. Check for continuity.

Is continuity indicated?

YES *The switch is good.*

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

10. Place the switch in the off (push down) position.

Is continuity indicated?

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

NO *The switch is good.*

Solenoid Test

See Figure 2-14.

Required Tools or Equipment
Digital Multimeter or Ohmmeter

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)

NOTE

This procedure applies to the following solenoid coils:

- *Mow Solenoid*
- *Lift Solenoid*
- *Lower Solenoid*
- *Brake Release Solenoid*

2. Locate the component solenoid to be tested. Remove the solenoid coil from the machine. (See “Solenoid Coils” on page 2-73.)

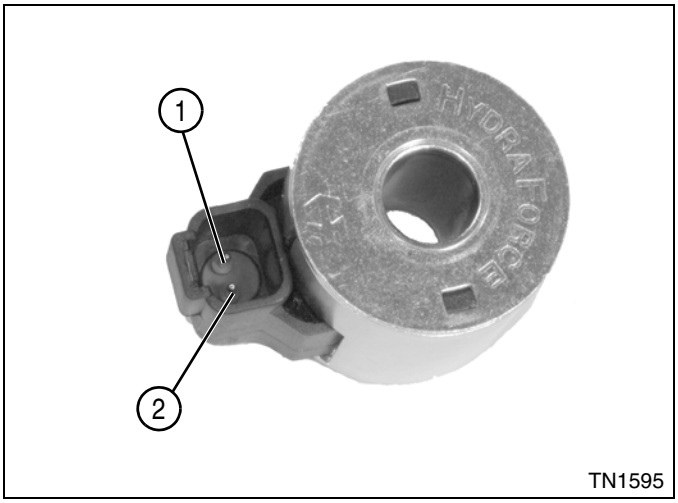


Figure 2-14

NOTE

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

3. Using a multimeter or ohmmeter, measure the ohms resistance between terminals (1 and 2). Refer to the specifications listed for the specific solenoid voltage.

- Lift Solenoid Coil—7.0 ohms ± 10% at 68°F/20°C
- Lower Solenoid Coil—6.0 ohms ± 10% at 68°F/20°C
- Mow Solenoid Coil—9.8 ohms ± 10% at 68°F/20°C

Does the resistance through the component match the specified value listed?

YES *The solenoid is good.*

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

Hydraulic Filter Pressure Switch Test

See Figure 2-15.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Shut down the engine and remove the key.
3. Set the multimeter to the continuity setting.

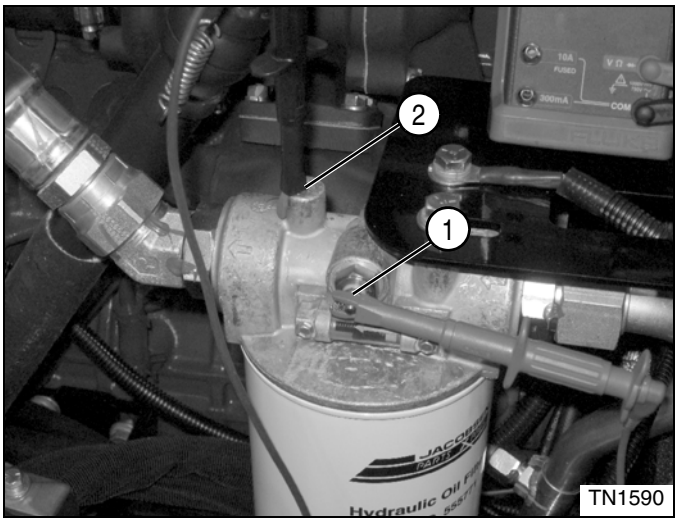


Figure 2-15

4. Remove the sender wire from the switch.
5. Place one test lead on the switch stud (1).
6. Place the other test lead on the filter head (2).

Is continuity indicated?

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

NO *The switch is good.*

Engine Oil Pressure Switch Test

See Figure 2-16.

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Check the engine oil level. Add oil as needed. (Refer to “Safety, Operation and Maintenance Manual” for oil specification.)

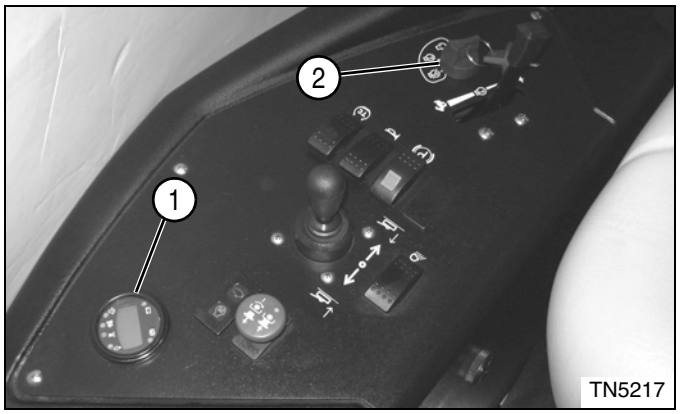


Figure 2-16

3. Turn the ignition switch (2) to the run position.

Does the engine oil pressure warning light (1) come on?

YES *Proceed to step 4.*

NO *Check the instrumentation Circuit. (See “Instrumentation Circuit Schematic” on page 4-31.)*

4. Start the engine. (Refer to “Safety, Operation and Maintenance Manual”.)

Does the engine oil pressure warning light (1) go out when the engine is running?

YES *The warning light is good.*

NO *Stop the engine immediately and check the engine. (Refer to the engine manufacturer’s manual.)*

Fuel Sender Test

See Figure 2-17.

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove the fuel sender from the fuel tank. (See “Fuel Tank” on page 9-5.)

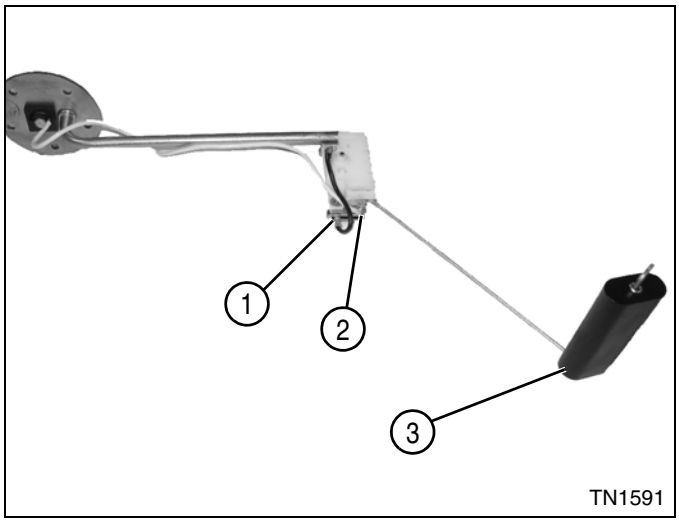


Figure 2-17

NOTE

Float shown in the empty position.

3. Connect the test leads to terminals (1 and 2).
4. Set the meter to read ohms.
5. Move the float (3) to the empty position and read the resistance value.

   Is the resistance value between 211–286 ohms?

   YES *Proceed to step 6.*

   NO *The sensor is faulty; replace fuel sender.*
6. Move the float (3) to the full position and read the resistance value.

   Is the resistance value between 26–35 ohms?

   YES *The sensor is good.*

   NO *The sensor is faulty; replace fuel sender.*

Circuit Breaker Test

See Figure 2-18.

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Allow engine to cool completely.
3. Set the multimeter to 20 volts DC.
4. Connect the black test lead to the negative (–) battery terminal.

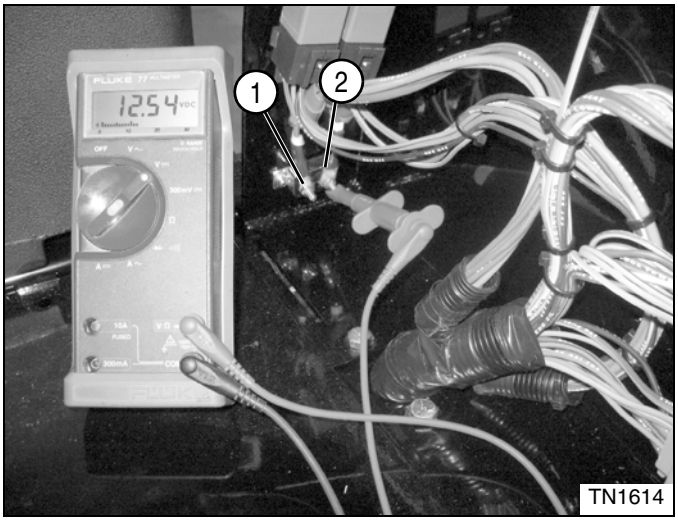


Figure 2-18

5. Connect the red test lead to each of the circuit breaker terminals (1 and 2).

   Is battery voltage indicated?

   YES *Circuit breaker is good.*

   NO *Circuit breaker is faulty; replace circuit breaker.*

Fuel Pump Test

See Figures 2-19 and 2-20

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Allow engine to cool completely.

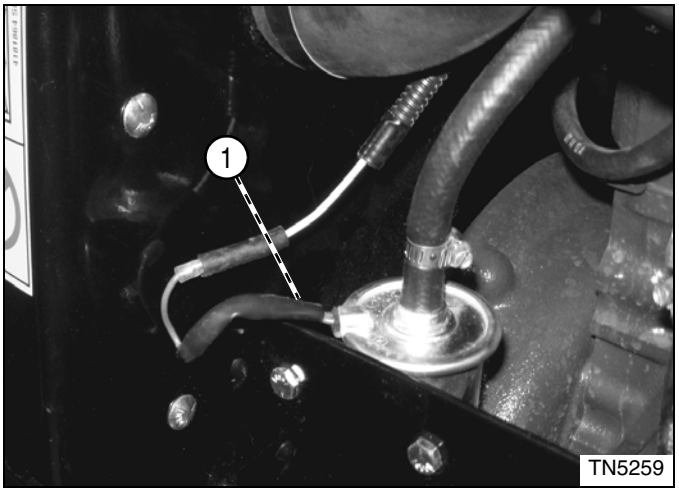


Figure 2-19

3. Connect the red test lead to fuel pump black ground wire (1).
4. Connect the black test lead to the negative (–) battery terminal.
5. Check for continuity.

Is continuity indicated?

YES *Proceed to step 6.*

NO *Check for proper ground at the pump.*

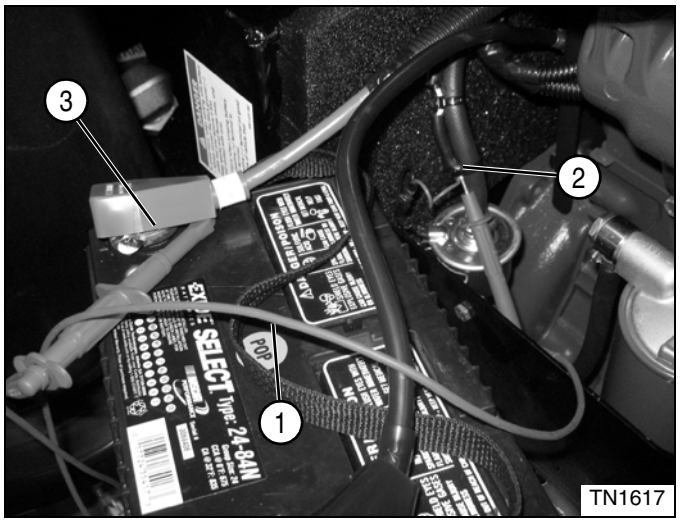


Figure 2-20

6. Using a jumper wire (1), connect one end to the power wire (2) pump side.
7. Touch the other end of the jumper to the positive (+) battery terminal (3).

Does the fuel pump start?

YES *The pump is good.*

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

Repair

Battery and Battery Tray

Removal and Installation

See Figures 2-21 and 2-22.

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 1-5.)
2. Raise the hood.

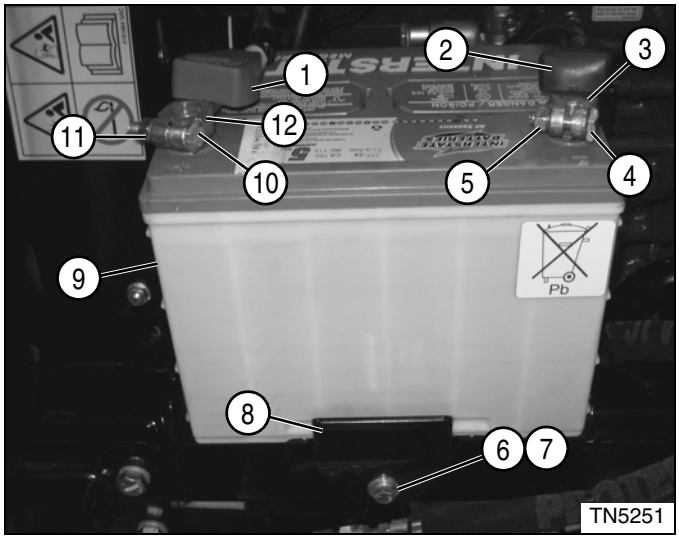


Figure 2-21

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 (5) and screw (4), and disconnect the negative (–) battery cable (3).
4. Remove nut (11) and screw (10), and disconnect the positive (+) battery cable (12).
5. Remove bolt (6), washer (7), and retainer bracket (8) from the battery tray.

NOTICE

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

6. Remove battery (9).

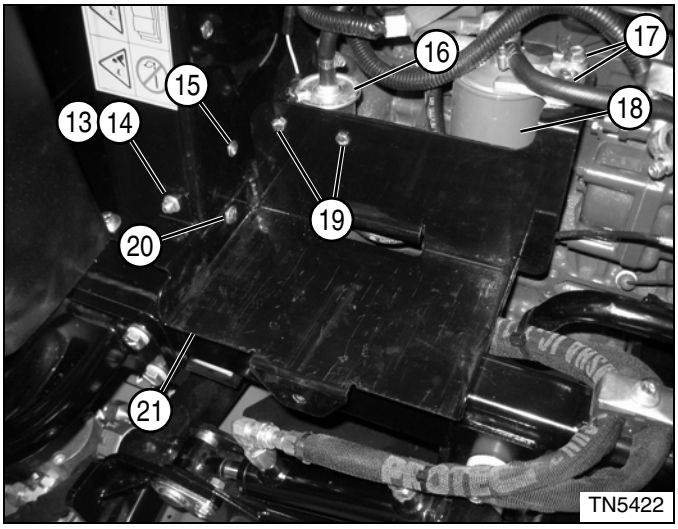


Figure 2-22

7. Support the battery tray (21).

NOTE

Perform steps 8 through 13 if the battery tray is to be removed.

8. Remove nut (13) and screw (14) from the controller support (15) and battery tray (21).
9. Remove screw (20) and nut (not shown) from the controller support (15) and battery tray (21).
10. Support the fuel solenoid (16). Remove screws (19) and nuts (not shown) from the battery tray (21) and fuel solenoid (16).
11. Support the fuel filter assembly (18). Remove nuts (17) and screws (not shown) from the fuel filter assembly (18) and battery tray (21).
12. Remove battery tray (21).

Installation Note

Install battery tray and battery by reversing the order of removal.

Alternator

Removal and Installation

See Figures 2-23 and 2-24.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Raise the hood.
3. Disconnect the negative (–) battery cable at the battery.

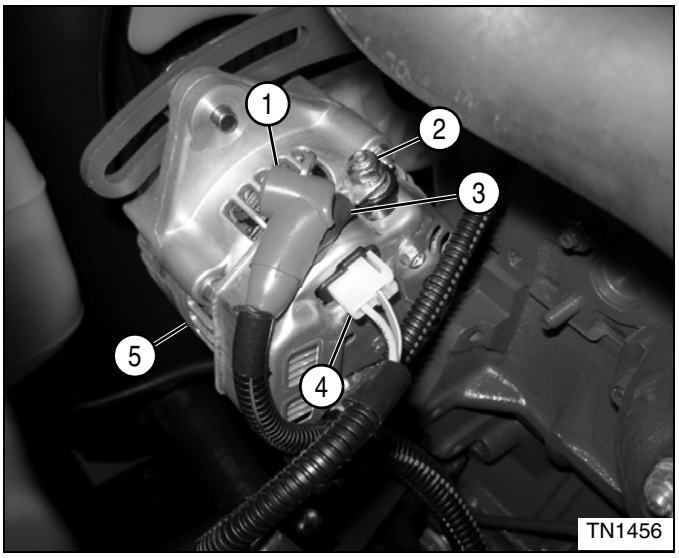


Figure 2-23

4. Remove boot (1) from terminal, and slide it down the wire.

NOTE

Label all wires before disconnecting to ensure correct installation.

5. Remove lock nut (2) and disconnect wire (3) from terminal.
6. Disconnect wiring connector block (4) from alternator (5).

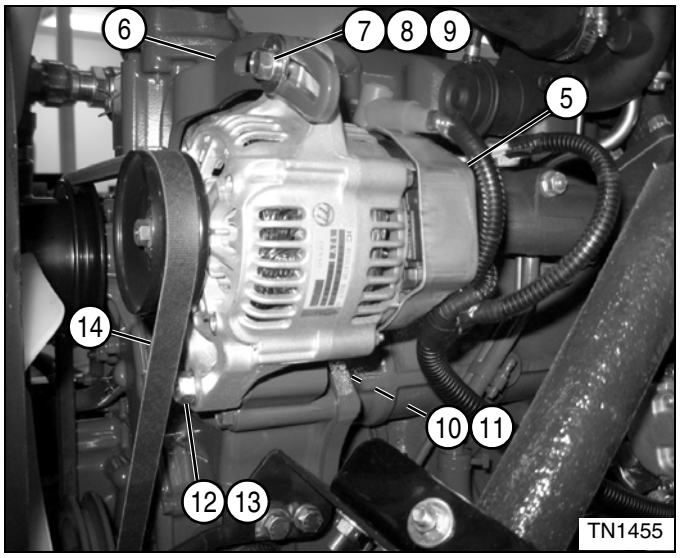


Figure 2-24

7. Loosen screw (7) and push the alternator (5) toward the engine.
8. Remove fan drive belt (14).
9. Support the alternator (5).
10. Remove screw (7), lock washer (8), and flat washer (9) from the upper bracket (6) and alternator (5).
11. Remove nut (10), lock washer (11), screw (12), and flat washer (13), and remove alternator (5).

Installation Notes

- *Install alternator by reversing the order of removal.*
- *Adjust fan belt tension. (Refer to “Safety, Operation, and Maintenance Manual.”)*

Starter Motor

Removal and Installation

See Figures 2-25 and 2-26.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Raise the hood.
3. Disconnect the negative (–) battery cable at the battery.

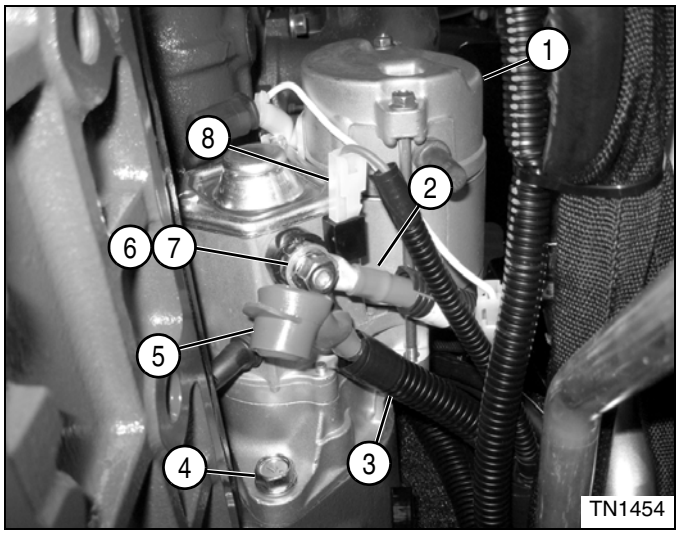


Figure 2-25

4. Remove boot (5) from terminal, and slide it down the wire (3).

NOTE

Label all wires before disconnecting to ensure correct installation.

5. Remove nut (6) and lock washer (7), and disconnect wires (2 and 3) from terminal.
6. Disconnect wiring connector (8) from the starter motor (1).
7. Support the starter motor (1).
8. Remove bolt (4).

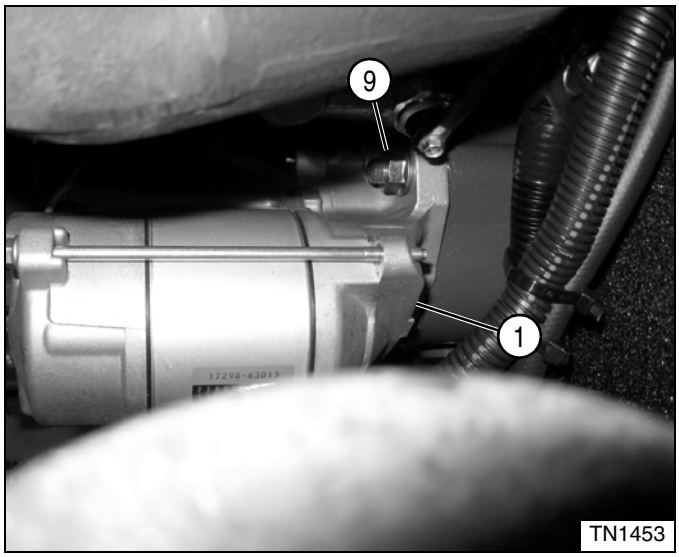


Figure 2-26

9. Remove socket-head screw (9) and remove starter motor (1).

Installation Note

Install starter motor by reversing the order of removal.

Plug-In Fuses

Removal and Installation

See Figures 2-27 and 2-28.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Raise the hood.
3. Disconnect the negative (–) battery cable at the battery.

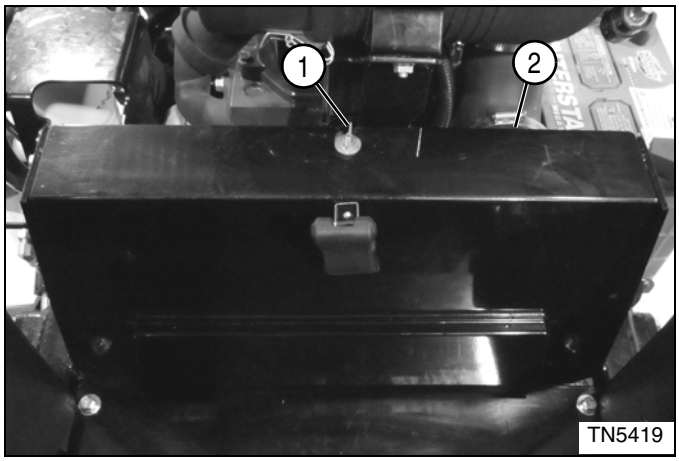


Figure 2-27

4. Move seat forward, loosen wing nut (1), and remove MCU cover (2).

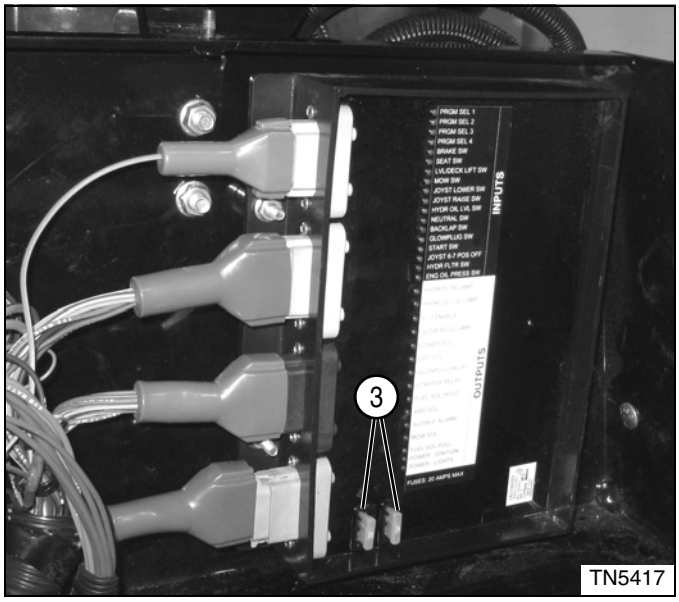


Figure 2-28

5. Remove fuse(s) (3) by pulling fuse(s) straight out of the fuse holder.

Installation Note

Apply dielectric grease (Jacobsen PN 365422) to connection.

Circuit Breaker

Removal and Installation

See Figures 2-29 and 2-30.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Raise the hood.
3. Disconnect the negative (–) battery cable at the battery.

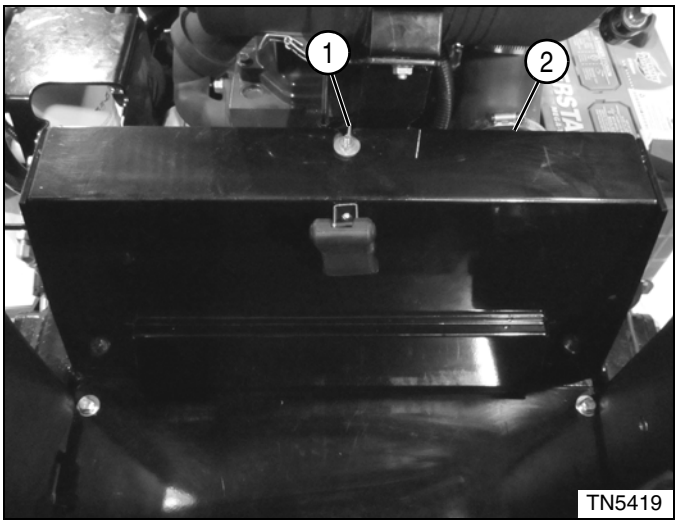


Figure 2-29

4. Move seat forward, loosen wing nut (1), and remove MCU cover (2).

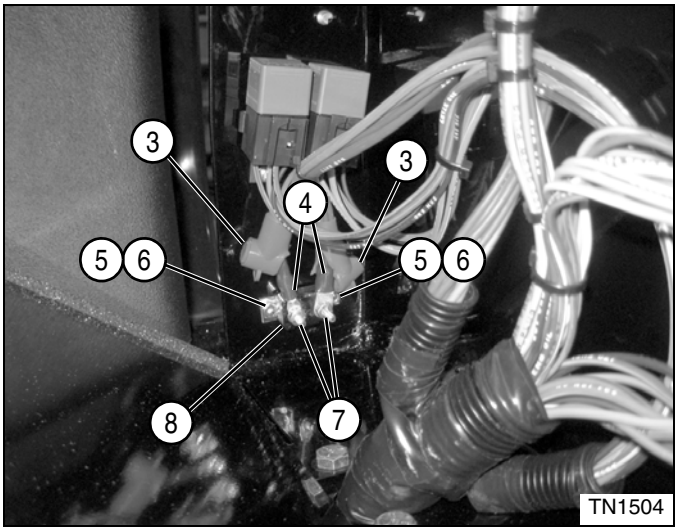


Figure 2-30

5. Remove boots (1 and 3) from terminals and slide them up the wires (2).

NOTE

Label all wires before disconnecting to ensure correct installation.

6. Remove nuts (7), and disconnect wires (2).
7. Remove two nuts (5) and screws (6).
8. Remove circuit breaker (8).

NOTE

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

Starter Relay

Removal and Installation

See Figures 2-31 and 2-32.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Raise the hood.
3. Disconnect the negative (–) battery cable at the battery.

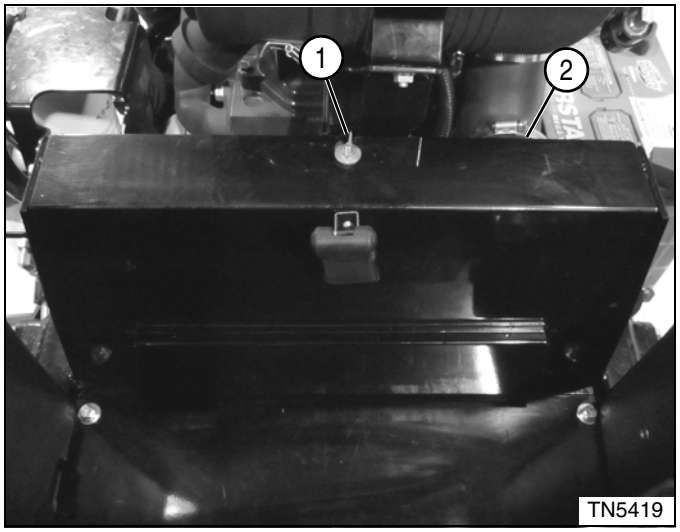


Figure 2-31

4. Move seat forward, loosen wing nut (1), and remove MCU cover (2).

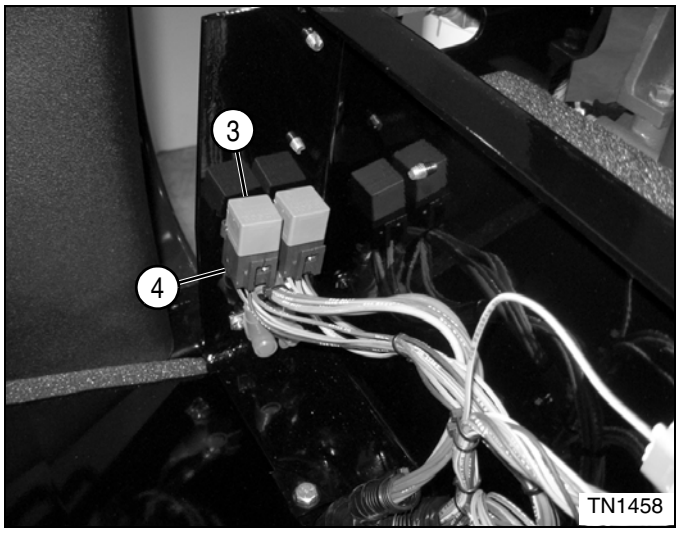


Figure 2-32

5. Pull the relay (3) straight up and out of the relay base (4).

Installation Note

Install the starter relay by reversing the order of removal.

Glow Plug Relay

Removal and Installation

See Figures 2-33 and 2-34.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Raise the hood.
3. Disconnect the negative (–) battery cable at the battery.

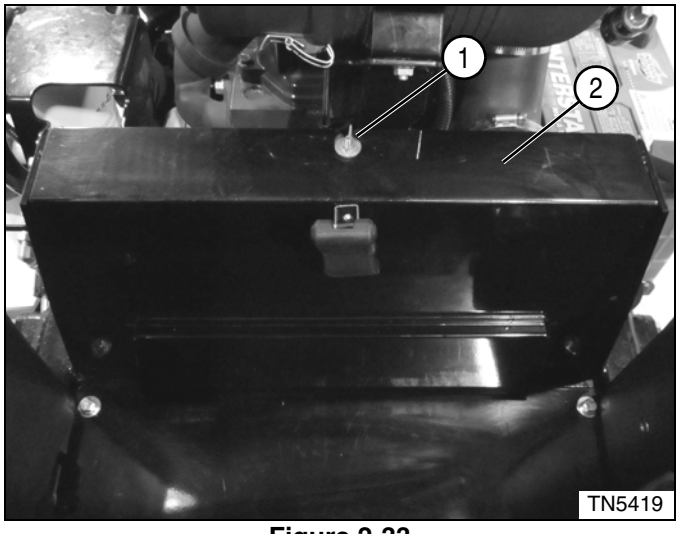


Figure 2-33

4. Move seat forward, loosen wing nut (1), and open the MCU cover (2).

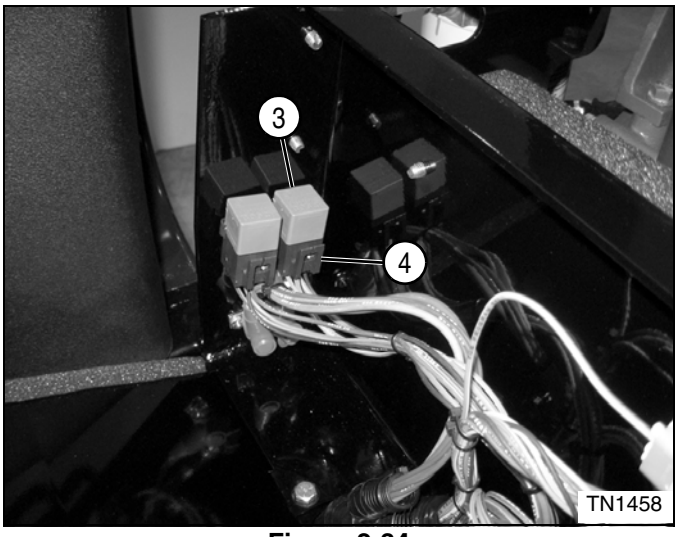


Figure 2-34

5. Pull the relay (3) straight up and out of the relay base (4).

Installation Note

Install the glow plug relay by reversing the order of removal.

Instrument Panel

Removal and Installation

See Figure 2-35.

NOTE

If servicing individual components, it is not necessary to completely remove the instrument panel. In these cases, the instrument panel can be moved aside for access to components.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)

NOTE

Label all wires before disconnecting to ensure correct installation.

2. Disconnect the negative (–) battery cable at the battery.
3. If removing the instrument panel, disconnect the positive (+) battery cables from the battery.

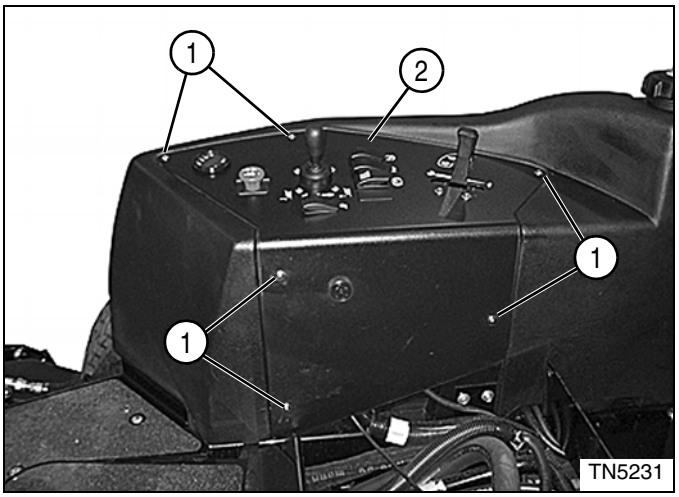


Figure 2-35

NOTES

- *Seat removed for photo clarity.*
- *If moving the instrument panel aside, use caution to prevent stretching or kinking the cables.*

4. Remove six screws (1) and move the panel (2) aside, to allow servicing of components as needed. If the instrument panel is to be removed, disconnect all wiring connectors and throttle cable.

Installation Notes

- *Anti-seize compound must be applied to screw threads when installing instrument panel.*
- *Install instrument panel by reversing the order of removal.*

Ignition Switch

Removal and Installation

See Figures 2-36 and 2-37.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Disconnect the negative (–) battery cable at the battery.
3. Remove instrument panel. (See “Instrument Panel” on page 2-68.)

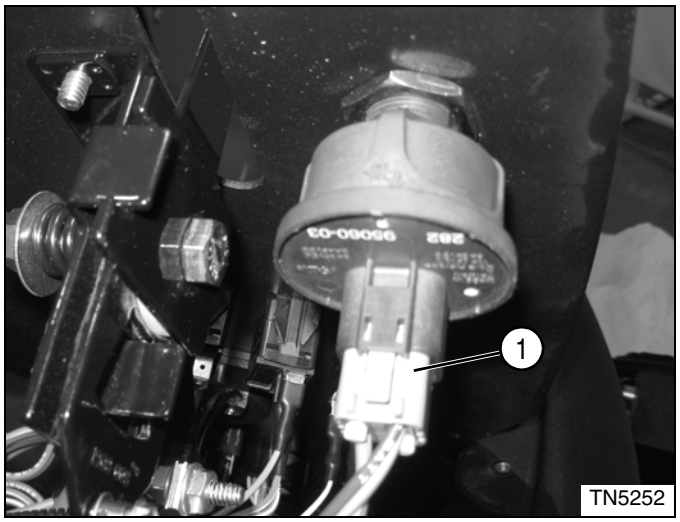


Figure 2-36

4. Disconnect wiring connector (1) from ignition switch.

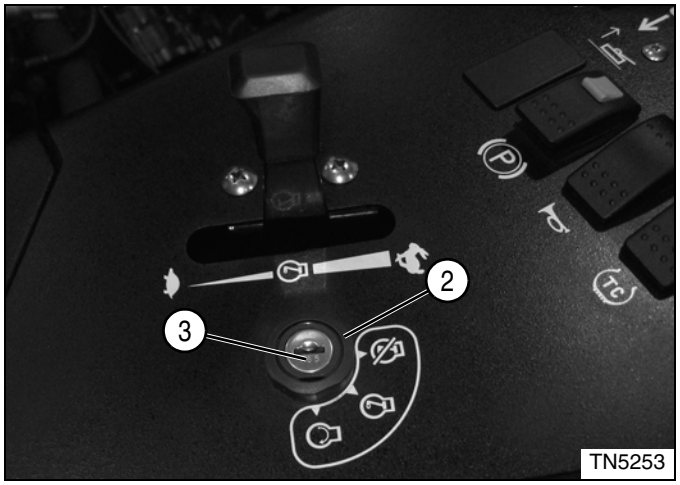


Figure 2-37

5. Remove retaining nut (2) from ignition switch (3).
6. Remove ignition switch (3) from bottom of instrument panel.

Installation Note

Install ignition switch by reversing the order of removal.

Rocker Switches

See Figure 2-38.

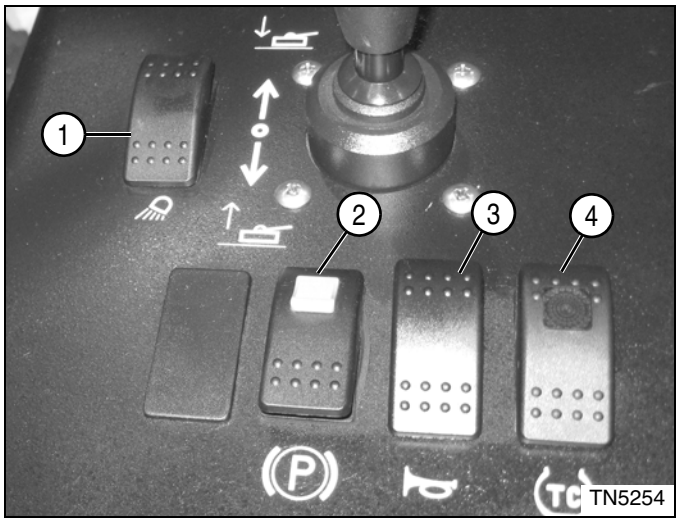


Figure 2-38

This procedure applies to the following switches:

- Traction Control Switch (4)
- Horn Switch (3)
- Parking Brake Switch (2)
- Light Switch (1)

Removal and Installation

See Figure 2-39.

NOTE

Horn switch shown.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Disconnect the negative (–) battery cable at the battery.
3. Remove instrument panel. (See “Instrument Panel” on page 2-68.)

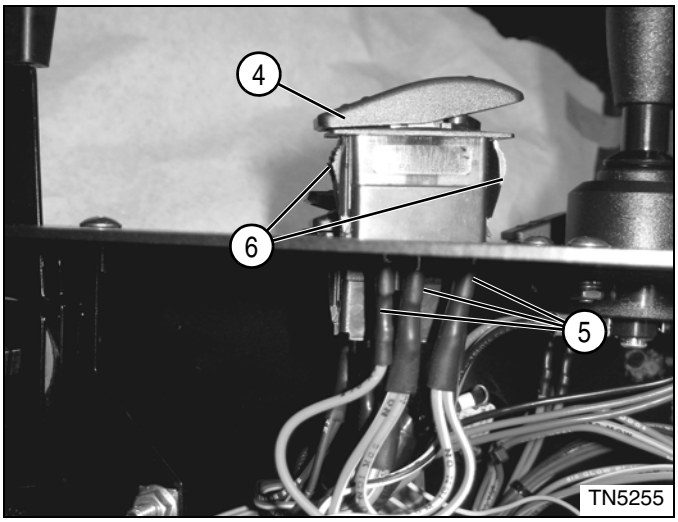


Figure 2-39

NOTE

Label all wires before disconnecting to ensure correct installation.

4. Disconnect wire connectors (5).
5. Depress tabs (6) on each side of the rocker switch and lift switch out of the instrument panel.

Installation Note

Install rocker switches by reversing the order of removal.

Indicator Lamps

See Figure 2-40.

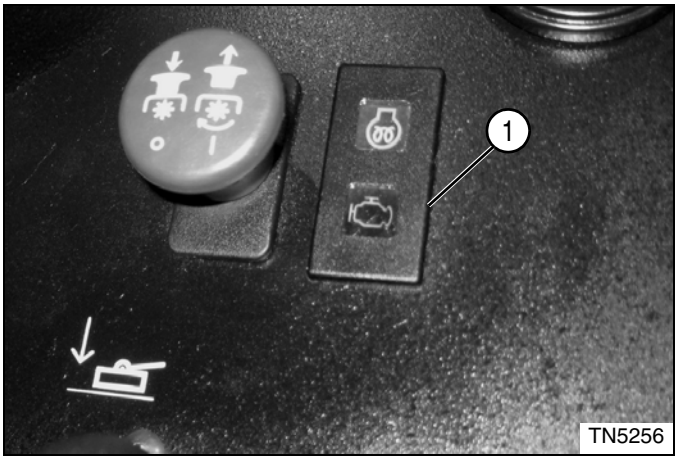


Figure 2-40

This procedure applies to the following indicator lamps:

- Engine Preheat/Charge Warning Lamps (1)

Removal and Installation

See Figures 2-41 and 2-42.

NOTE

Glow plug indicator lamp shown.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Disconnect the negative (–) battery cable at the battery.
3. Remove instrument panel. (See “Instrument Panel” on page 2-68.)

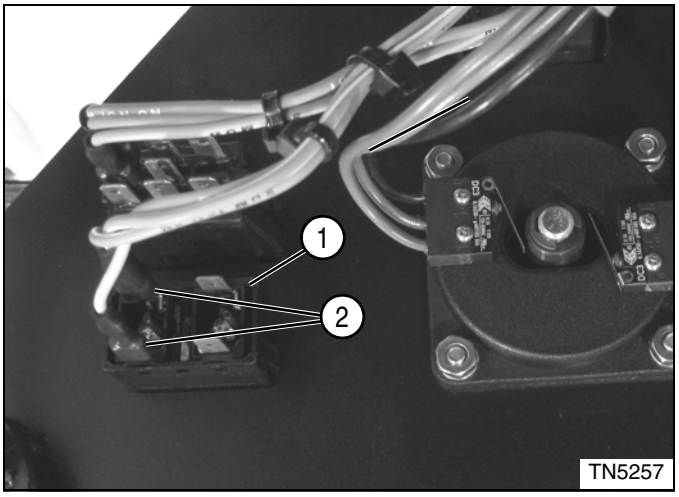


Figure 2-41

NOTE

Label all wiring connectors and note their location before removing to ensure correct installation.

4. Disconnect wiring connectors (2) from the indicator lamp module (1).

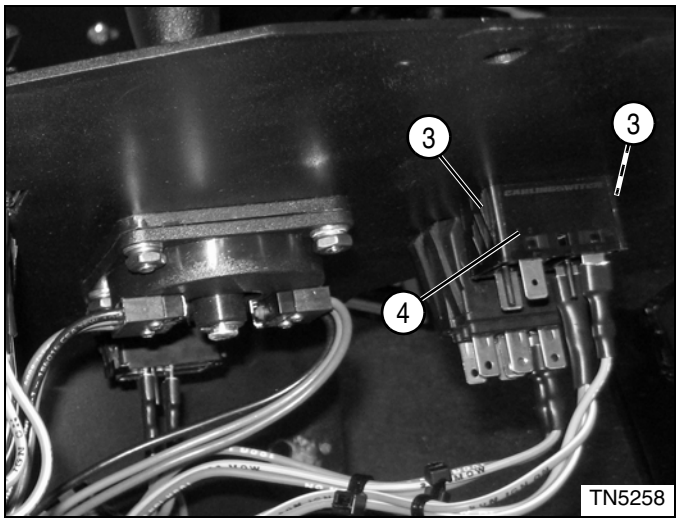


Figure 2-42

5. Depress tabs (3) on each side of the indicator lamp module (4), and push module up through the instrument panel.

Installation Note

Install indicator lamp module by reversing the order of removal.

Joystick

Removal and Installation

See Figures 2-43 and 2-44.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Disconnect the negative (–) battery cable at the battery.
3. Remove instrument panel. (See “Instrument Panel” on page 2-68.)

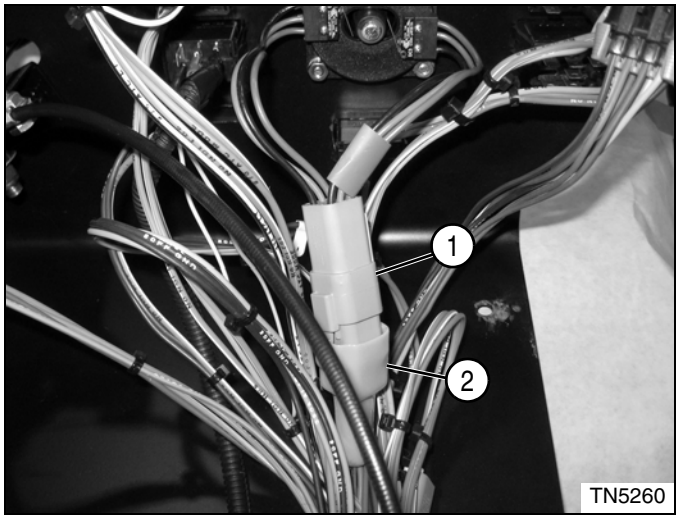


Figure 2-43

NOTE

Label all wiring connectors and note their orientation of the joystick before removing to ensure correct installation.

4. Disconnect the joystick wiring connector (1) from the wiring harness connector (2).

NOTE

When removed, the joystick may come out as two separate pieces. If the joystick is to be tested after removal, connect the two pieces using the mounting hardware.

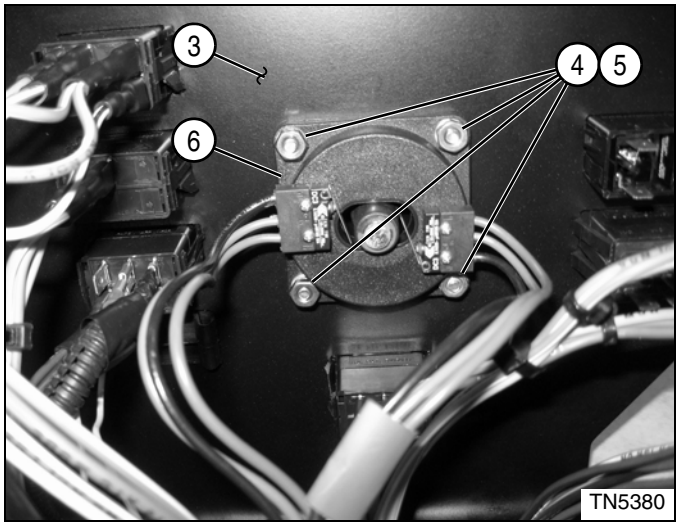


Figure 2-44

5. Remove four nuts (4) and screws (5), and remove joystick (6) from instrument panel (3).

Installation Note

Install joystick by reversing the order of removal.

Seat Switch

Removal and Installation

The seat switch removal and installation is included in the seat and mount plate removal and installation procedure. (See “Seat and Mount Plate” on page 9-9.)

Neutral Switch

Removal and Installation

See Figures 2-45 and 2-46.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Disconnect the negative (–) battery cable at the battery.

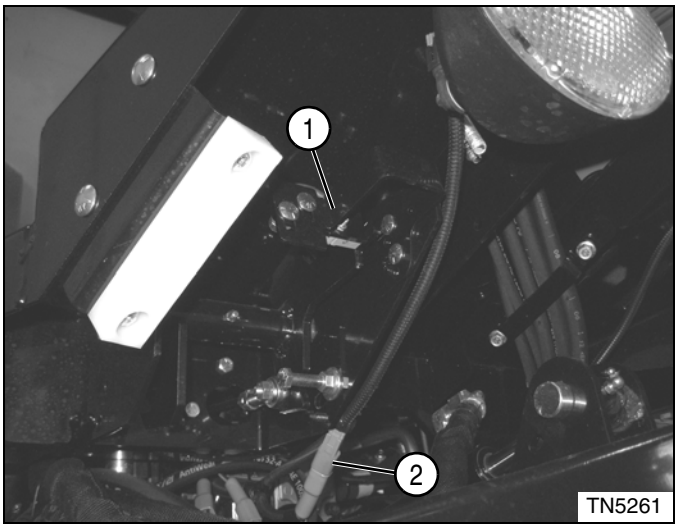


Figure 2-45

3. Disconnect the wiring connector (2) for the neutral switch (1).

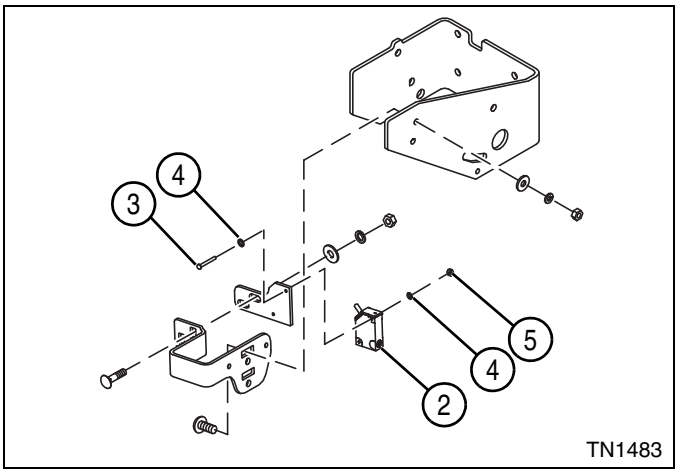


Figure 2-46

4. Remove two screws (3), four washers (4), and two nuts (5), and remove neutral switch (2).

Installation Note

Install neutral switch by reversing the order of removal.

Solenoid Coils

See Figures 2-47 through 2-49.

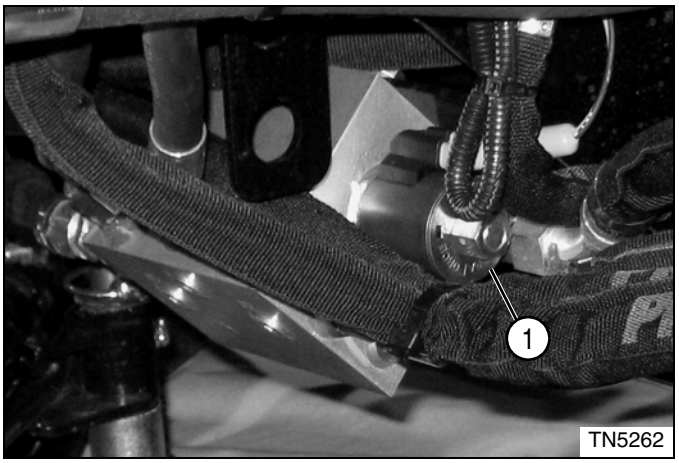


Figure 2-47: Mow Solenoid Coil

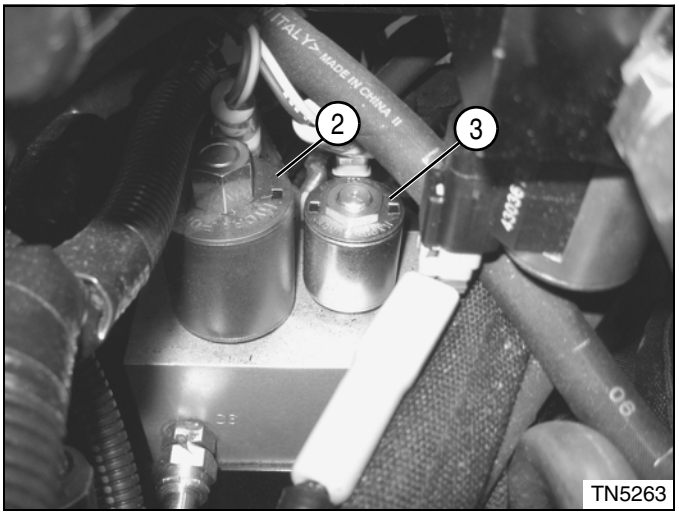


Figure 2-48: Lift and Lower Solenoid Coils

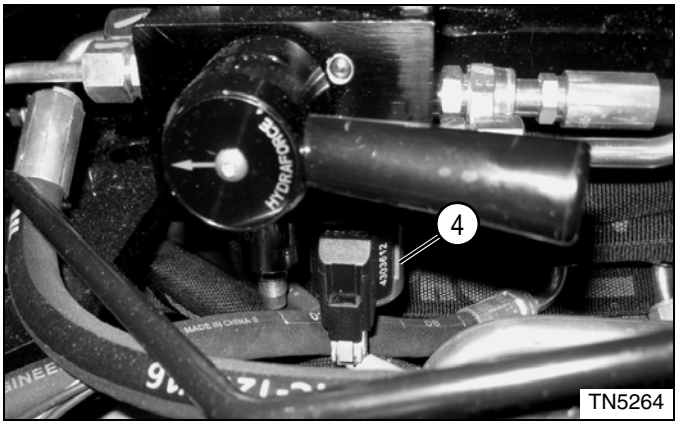


Figure 2-49: Brake Release Solenoid Coil

This procedure applies to the following solenoid coils:

- Mow Solenoid Coil (1)
- Lift Solenoid Coil (2)
- Lower Solenoid Coil (3)
- Park Brake Solenoid (4)

The mow solenoid coil is located under right center of machine.

The lift and lower solenoid coils are located under the center floorboard.

The park brake solenoid is located under the floor access panel, on the right side near the drive control pedal.

Removal and Installation

See Figure 2-50.

NOTE

The lift and lower solenoid coils are shown; all solenoids are removed and installed the same way.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Disconnect the negative (–) battery cable at the battery.
3. Remove the center floorboard (for lift and lower solenoid coils) or locate deck valve beneath front axle.

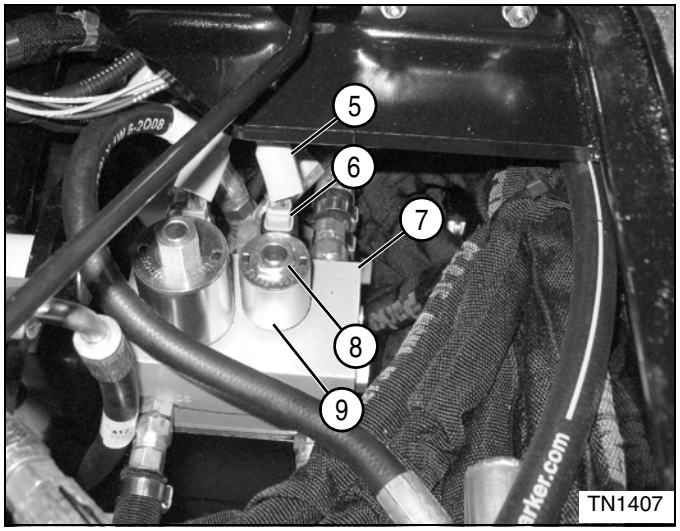


Figure 2-50

NOTE

Label connectors before disconnecting to ensure correct installation.

4. Remove boot (5), and slide it back over the wire, and disconnect connector (6) from solenoid coil.
5. Remove nut (8), and remove solenoid coil (9) from valve (7).

Installation Notes

- *Clean cartridge of any debris or surface rust and apply dielectric grease (Jacobsen PN 365422) to cartridge before installation.*
- *Install solenoid coils by reversing the order of removal.*
- *Tighten nut (8) to 7-10 lb-in. (0.7-0.10 N·m).*

Fuel Shutoff Solenoid

Removal and Installation

See Figure 2-51.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Raise the hood.
3. Disconnect the negative (–) battery cable at the battery.
4. Clean area around shutoff solenoid thoroughly.

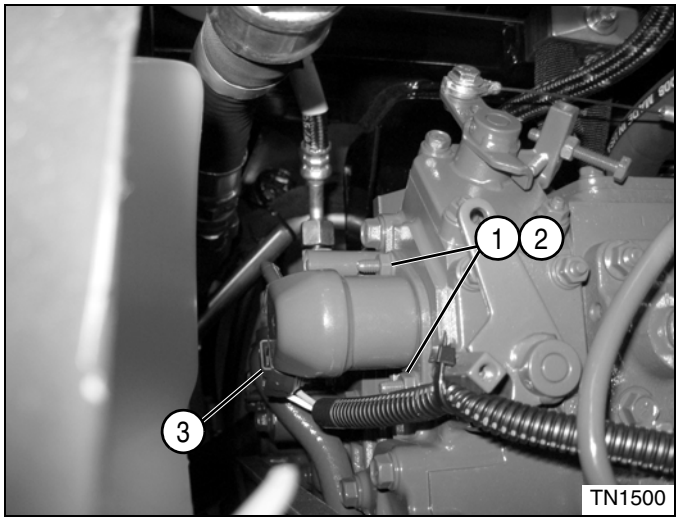


Figure 2-51

5. Disconnect solenoid electrical connector (3).
6. Remove two nuts (1) and washers (2).
7. Remove solenoid.

Installation Note

Install fuel shutoff solenoid by reversing the order of removal.

Hydraulic Oil Filter Switch

Removal and Installation

See Figure 2-52.

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 1-5.)
2. Raise the hood.
3. Disconnect the negative (–) battery cable at the battery.
4. Clean area around switch thoroughly.

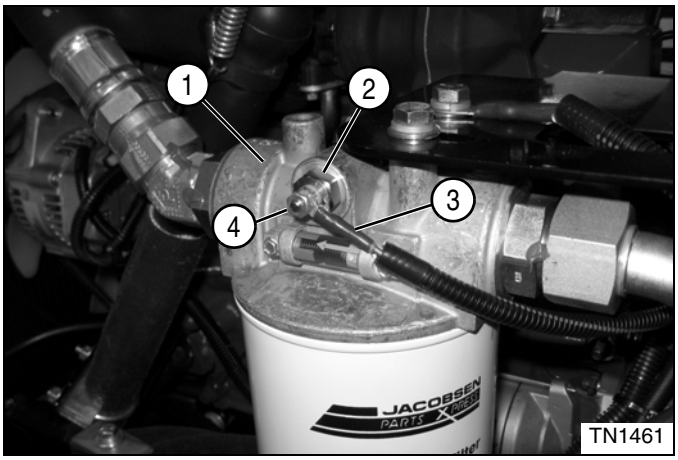


Figure 2-52

5. Remove nut (4), and disconnect wire (3) from the hydraulic filter switch (2).
6. Remove hydraulic filter switch (2) from the filter head (1).

Installation Notes

Required Materials
Telfon® Tape

- *Install hydraulic filter switch by reversing the order of removal.*
- *Apply Teflon® tape to the threads of the hydraulic filter switch before installing.*

Engine Oil Pressure Switch

Removal and Installation

See Figure 2-53.

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 1-5.)
2. Raise hood.
3. Disconnect the negative (–) battery cable at the battery.
4. Clean area around switch thoroughly.

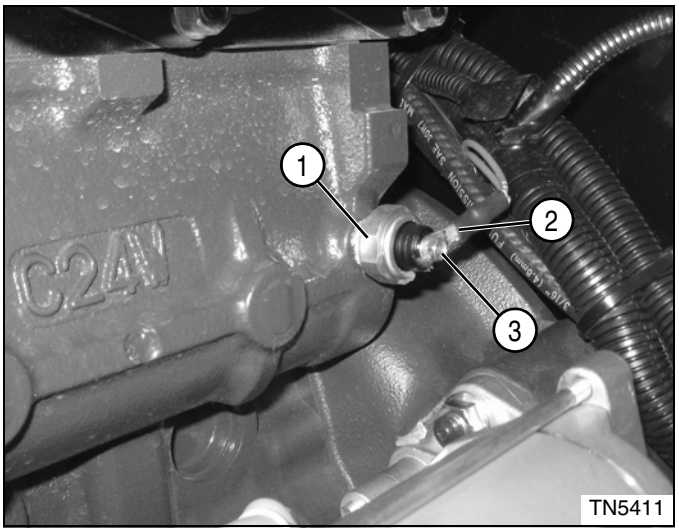


Figure 2-53

5. Remove screw (3), and disconnect wire (2) from the oil pressure switch (1).
6. Remove oil pressure switch (1) from the engine block.

Installation Notes

Required Materials
Telfon® Tape

- *Install engine oil pressure switch by reversing the order of removal.*
- *Apply Teflon® tape to the threads of the oil pressure switch before installing.*

Engine Temperature Switch

Removal and Installation

See Figure 2-54.

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 1-5.)
2. Raise the hood.
3. Disconnect the negative (–) battery cable at the battery.

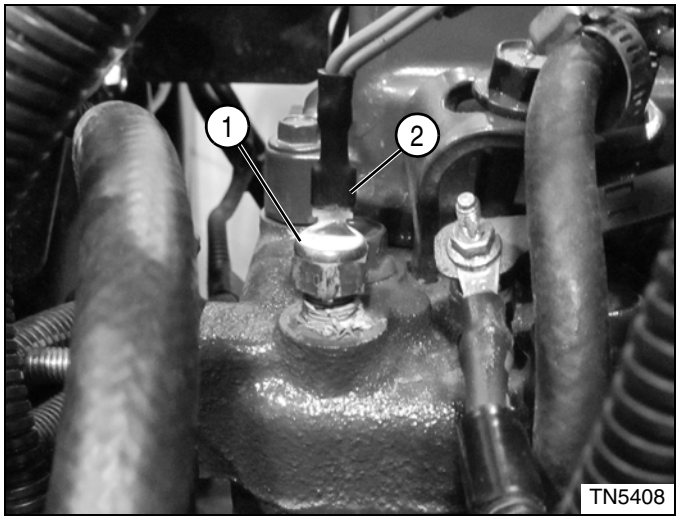


Figure 2-54

4. Disconnect the temperature sender connector (2).
5. Remove temperature sender (1) from the engine.

Installation Notes

Required Materials
Telfon® Tape

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

MCU

Removal and Installation

See Figures 2-55 through 2-57.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Raise the hood.
3. Disconnect the negative (–) battery cable at the battery.
4. Disconnect the positive (+) battery cable at the battery.

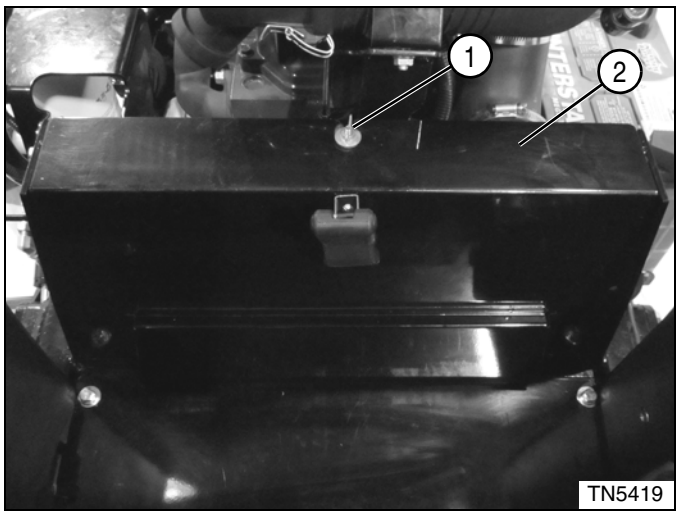


Figure 2-55

5. Move seat forward, loosen wing nut (1), and open the MCU cover (2).

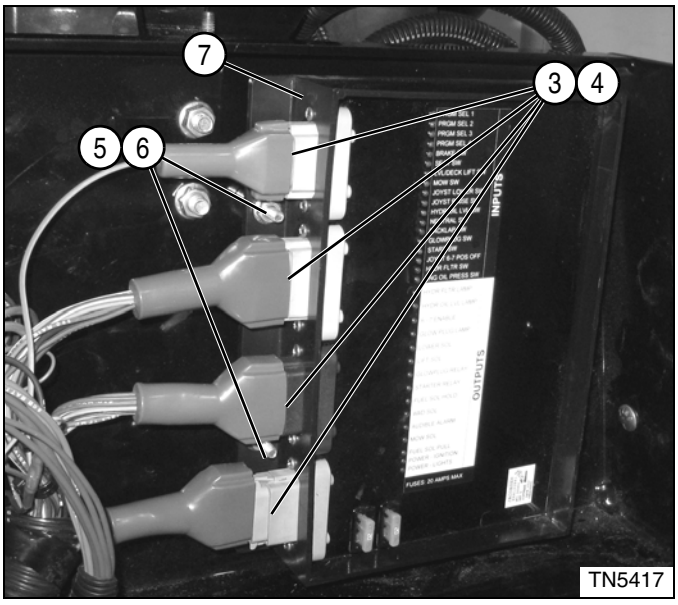


Figure 2-56

NOTE

Label all wires before disconnecting to ensure correct installation.

6. Disconnect wiring harness connectors (3) from MCU sockets (4).
7. Remove mounting screws (5) and nuts (6) from the MCU (7).

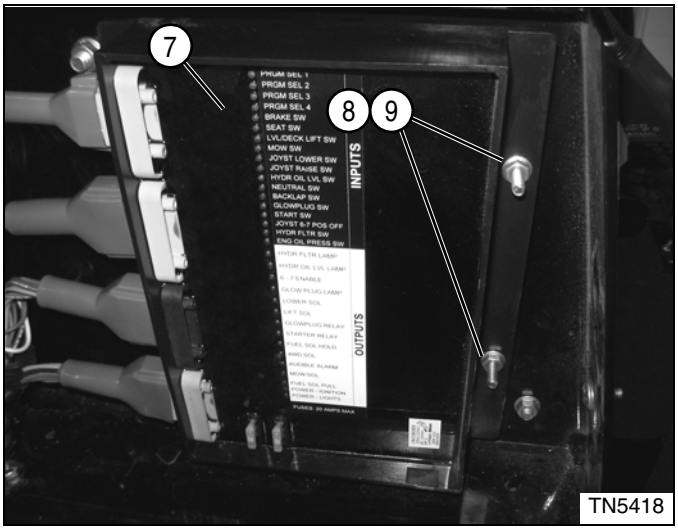


Figure 2-57

8. Remove mounting screws (8) and nuts (9) from the MCU (7).
9. Remove MCU (7).

Installation Notes

- *Harness connections to the MCU only fit one way. Do not force plug into the MCU.*
- *Install MCU by reversing the order of removal.*

Combination Gauge

Removal and Installation

See Figure 2-58.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Disconnect the negative (–) battery cable at the battery.
3. Remove the instrument panel. (See “Instrument Panel” on page 2-68.)

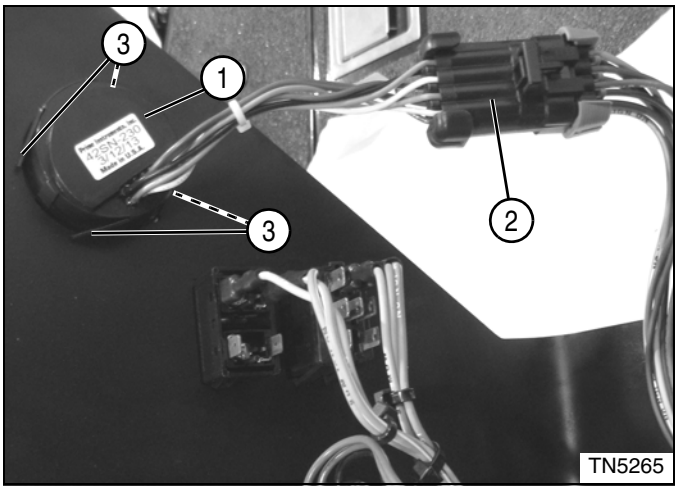


Figure 2-58

4. Disconnect the combination gauge electrical connector (2).
5. Depress locking tabs (3) on each side of the combination gauge and push gauge (1) through the instrument panel.

Installation Note

Install combination gauge by reversing the order of removal.

Fuel Level Sender

Removal and Installation

See Figure 2-59.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Disconnect the negative (–) battery cable at the battery.
3. Drain fuel until level is below the sender mount opening.
4. Remove instrument panel. (See “Instrument Panel” on page 2-68.)

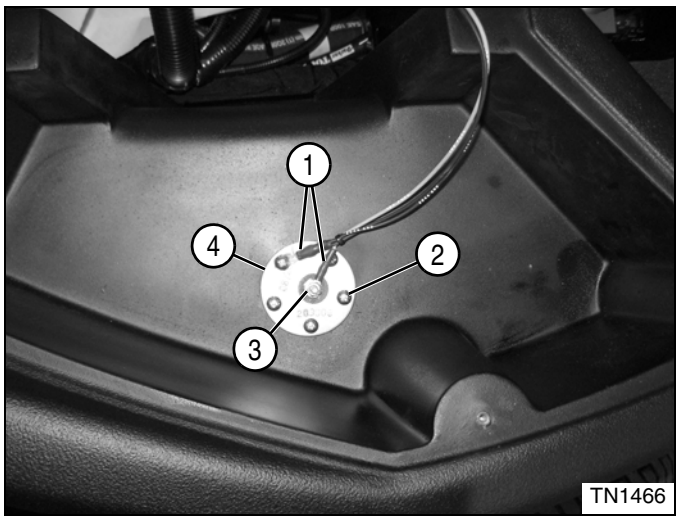


Figure 2-59

NOTE

Label all wires before disconnecting to ensure correct installation.

5. Remove nut (3), and disconnect wires (1) from the fuel level sender (4).
6. Remove five screws (2).
7. Remove fuel level sender (4).

Installation Note

- *Install fuel level sender by reversing the order of removal.*
- *Replace fuel sending unit gasket with new gasket.*

Horn

Removal and Installation

See Figure 2-60.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Disconnect the battery negative (–) cable at the battery.
3. Remove instrument panel. (See “Instrument Panel” on page 2-68.)

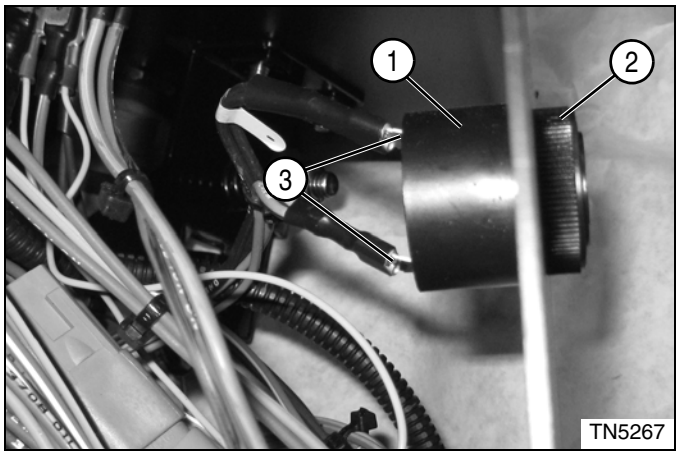


Figure 2-60

NOTE

Label all wires before disconnecting to ensure correct installation.

4. Disconnect wires (3) from horn (1).
5. Remove ring (2).
6. Remove horn (1).

Installation Note

Install horn by reversing the order of removal.

Chapter 3

Hydrostatic Power Train

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JACOBSEN
A Textron Company

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Specifications

Test and Adjustment Specification

Specification		
Traction Pump Flow	gpm (lpm)	35 (132) at 2920 rpm
Charge Pump Flow	gpm (lpm)	10.5 (40) at 2920 rpm
Forward System Relief Pressure	psi (bar)	4350 (300) at 2920 rpm
Reverse System Relief Pressure	psi (bar)	3625 (250) at 2920 rpm
Charge Pressure	psi (bar)	275—285 (19—20) @2920 rpm
Hydrostatic Leakage Percentage Ranges		0—10% = Good 11—20% = Marginal 21% and Beyond = Bad

Repair Specifications

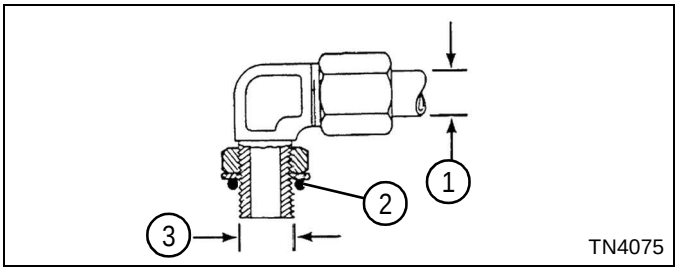
Specification		
Traction Pump—Servo Lock Nut Torque	lb-ft (N·m)	15 ± 3 (20 ± 4)
Traction Pump Weight	lb (kg)	131 (59)
Front Wheel Motor—Check Plug Torque	lb-ft (N·m)	8 ± 3 (10 ± 3)
Front Wheel Motor—Plug Torque	lb-ft (N·m)	13 (17)
Front Wheel Motor—Retainer Screw Torque	lb-ft (N·m)	25 (34)
Front Wheel Motor—Valve Housing Screw Torque	lb-ft (N·m)	63 (85)
Rear Wheel Motor—Valve Housing Screw Torque	lb-ft (N·m)	37 (50)
Rear Wheel Motor Hub Nut Torque	lb-ft (N·m)	200 ± 25 (271 ± 34)
Front Wheel Motor Hub Nut Torque	lb-ft (N·m)	400 ± 25 (542 ± 34)

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

Figure 5-1

3

O-Ring Seal Kits

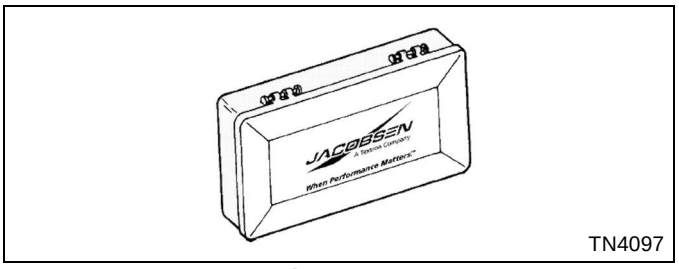


Figure 5-2

- 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

Hydraulic Service Tools

NOTE

The hydraulic service tools listed here can be obtained from K-Line Industries at http://klineind.com.

Portable In-Line Filter

PN JAC5097



TN4286

Figure 3-3

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.

Digital Hydraulic Tester

Part Number AT40031

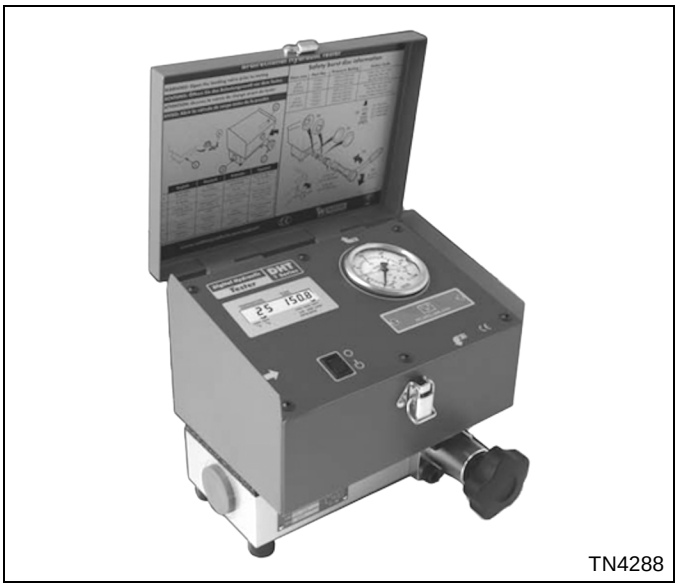


Figure 3-4

Features

- Flow up to 100 gpm (379 lpm)
- Pressure up to 6000 psi (414 bar)
- Temperature up to 250° F (120° C)
- Digital display for flow and temperature
- Analog display for pressure
- Flow accuracy 1% of full scale

Hydraulic Flow Meter

Part Number AT40002



Figure 3-5

Features

- Glycerin filled pressure gauge
- Precision needle-type load valve
- 4–40 gpm (15–15 lpm) flow range
- Pressure up to 5000 psi (345 bar)
- -12 port size

Digital Pressure Gauge Kit

Part Number JAC5106



Figure 3-6

Features

- Quick disconnect fittings
- Pressure up to 5000 psi (345 bar)
- Includes one 5 ft (152 cm) hose

Hydraulic Hose Kit

Part Number JAC5001H

NOTE

This hydraulic hose kit is intended to be used with the JAC5001A Hydraulic Test Fitting Kit.

Contents

- Two 8 ft (244 cm) 12 ORFS (F) x 10 ORFS (F) hoses
- Four 8 ft (244 cm) 10 ORFS (F) x 10 ORFS (F) hoses
- Two 8 ft (244 cm) 8 ORFS (F) x 10 ORFS (F) hoses

Hydraulic Test Fitting Kit

Part Number JAC5001A

NOTE

For detailed component descriptions and sizes, please see the K-Line Industries website at http://klineind.com.

Contents

- Twenty ORFS tee fittings in five sizes
- Eight ORFS 90° elbow fittings in four sizes
- Forty ORFS caps in five sizes
- Forty ORFS plugs in five sizes
- Six ORS reducer adapters in three sizes
- Sixteen ORS adapters in four sizes
- Eight blocking disks in four sizes
- Three JIC tee fittings in three sizes
- Three 4 in. (102 mm) jumper hoses in three sizes
- One ORS/male NPTF adapter
- One vented bushing
- One copper tube assembly

Blocking Disk Set

Part Number JAC5001-1

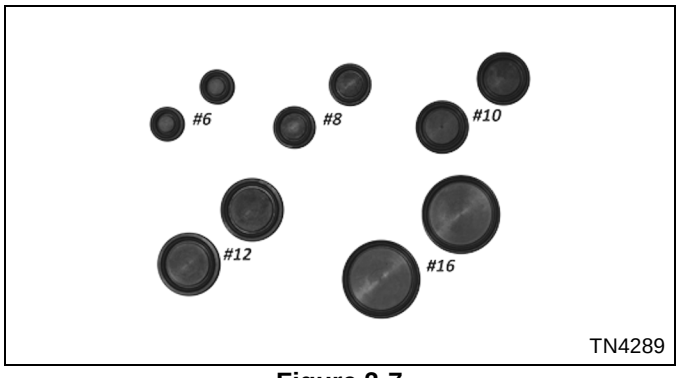


Figure 3-7

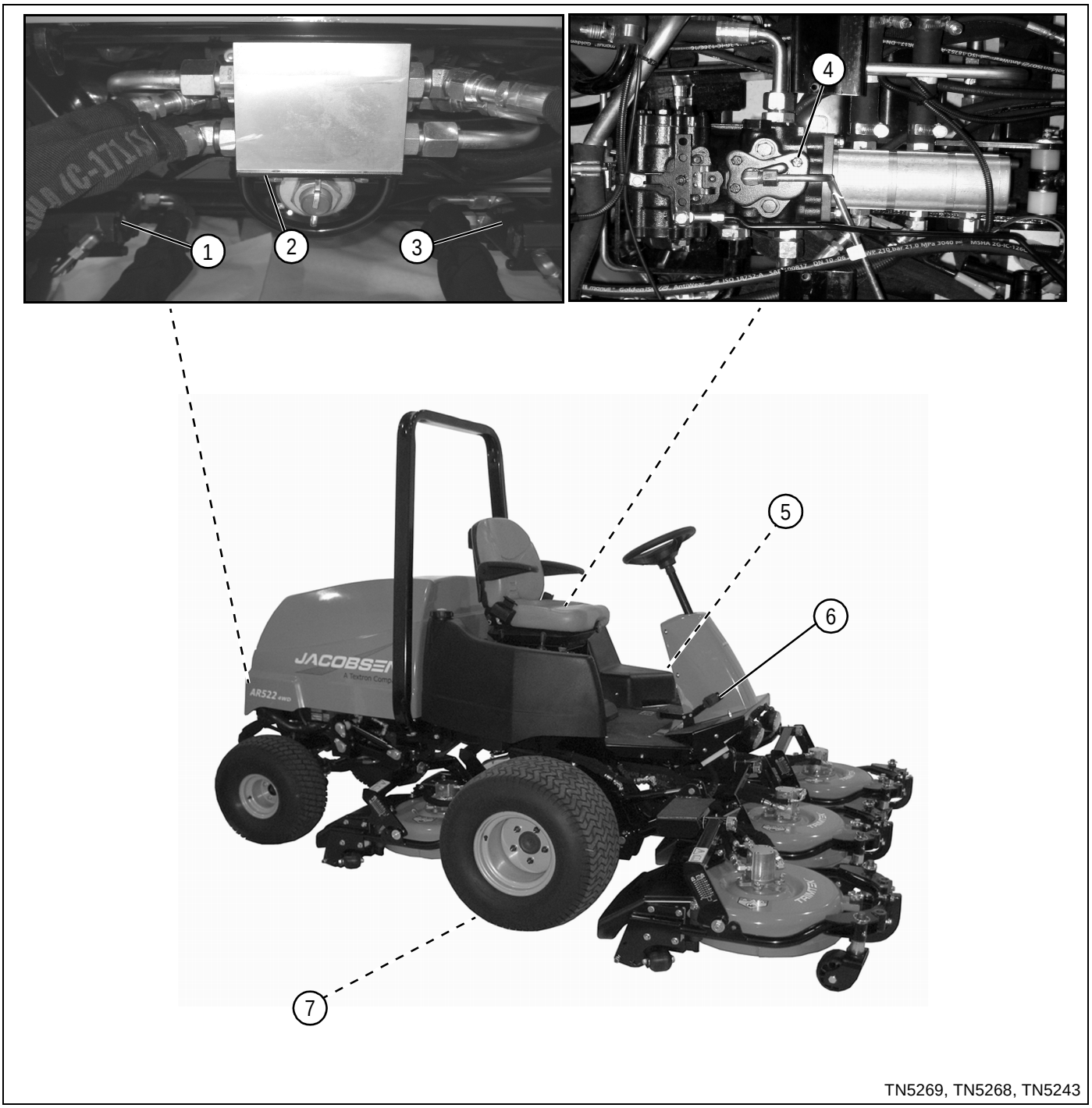
This blocking disk set is part of the JAC5001A Hydraulic Test Fitting Kit.

Contents

- Two -6 blocking disks
- Two -8 blocking disks
- Two -10 blocking disks
- Two -12 blocking disks
- Two -16 blocking disks

Component Location

See Figure 3-8.



TN5269, TN5268, TN5243

1 Left Rear Wheel Motor
2 4WD Valve
3 Right Rear Wheel Motor
4 Hydrostatic Pump
5 Left Front Wheel Motor
6 Traction Pedal
7 Right Front Wheel Motor

Figure 3-8: Power Train Component Location

Theory of Operation and Sub-Circuit Schematics

Traction Circuit Forward Schematic and Theory of Operation

System Conditions:

- Engine running
- Park brake released
- Traction pedal depressed (forward position)
- Tow valve in “Brake Engaged” 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 a 100 mesh screen, and enters the charge pump. Oil is then routed to the charge pressure relief valve and brake release valve, and is routed through the 0.28-inch supply orifice and displacement control valve to the traction pump.

The charge pressure relief valve regulates the charge pressure applied to the traction pump/circuit. When the incoming charge pressure oil reaches 285 psi (20 bar), the charge pressure relief valve will open, venting excess flow to the hydraulic tank.

With the park brake released, charge pressure oil flows through the brake release valve, and is applied to the brake cylinders on the front wheel motors, releasing the brakes.

Traction Pump Circuit

When the traction pedal is moved to the forward position, the displacement control valve is moved to the forward position. Charge oil is supplied through the 0.28-inch supply orifice, displacement control valve, and to the traction pump, moving the swash plate, stroking the pump, and producing operating pressure oil flow to port A.

The traction circuit is protected by a circuit relief valve. This valve will open, venting excess oil flow to the return side of the loop when the pressure rises above 4350 psi (300 bar).

Operating pressure oil from port A of the traction pump is supplied in parallel to the front wheel motors and in series to the rear wheel motors, resulting in full-time four-wheel drive.

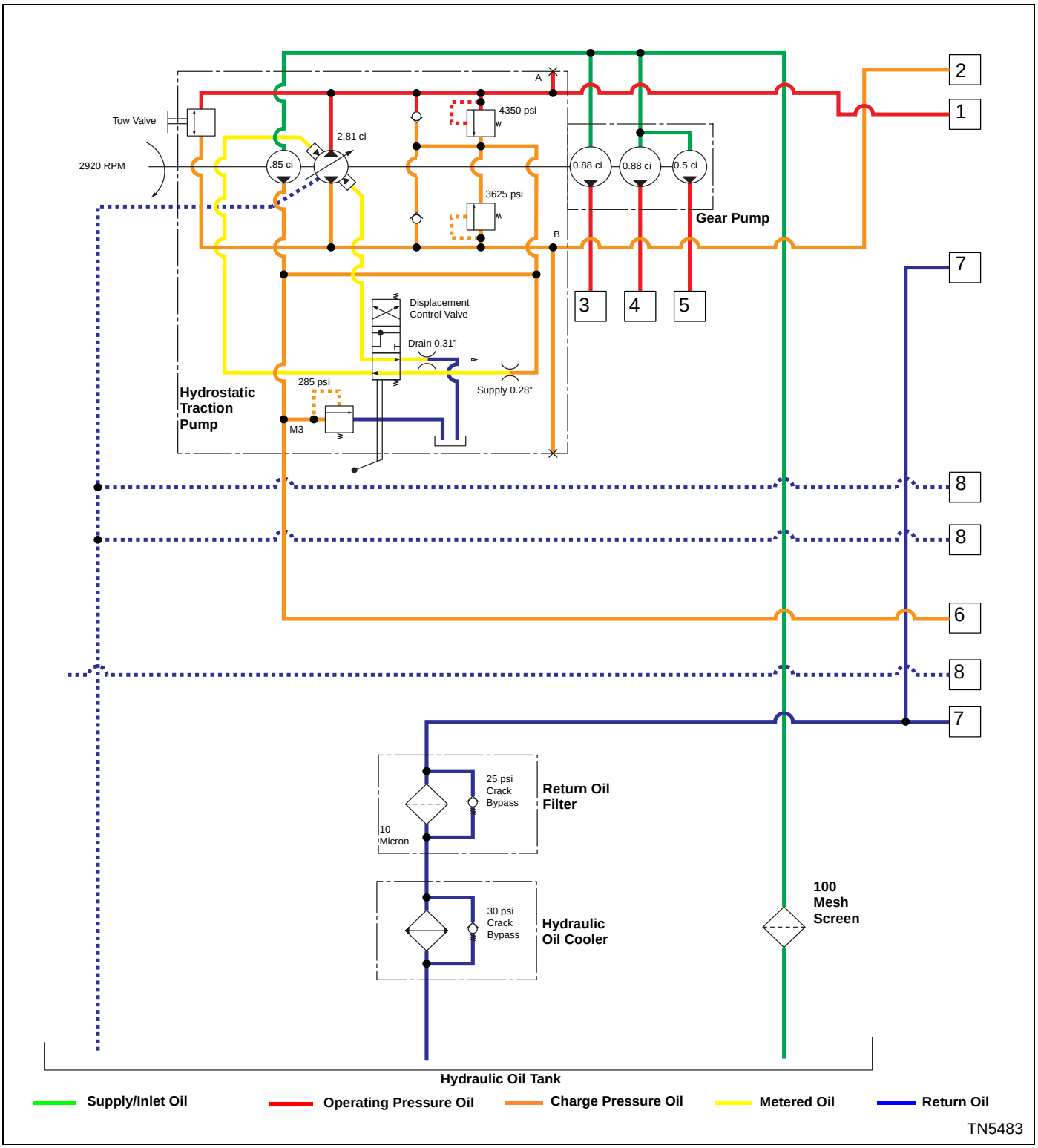
Oil from the rear wheel motors returns to the traction pump, entering through port B. Oil flows through the displacement control valve, and through the 0.31-inch drain office, dampening the flow of oil to tank.

Hot Oil Shuttle

The hot oil shuttle is located in the 4WD valve. The hot oil shuttle is held open when there is operating pressure oil in the forward direction. Charge pressure oil returning from the rear wheel motors flows through a 0.040-inch orifice and shuttle valve, returning to the return oil filter, hydraulic oil cooler, and hydraulic tank.

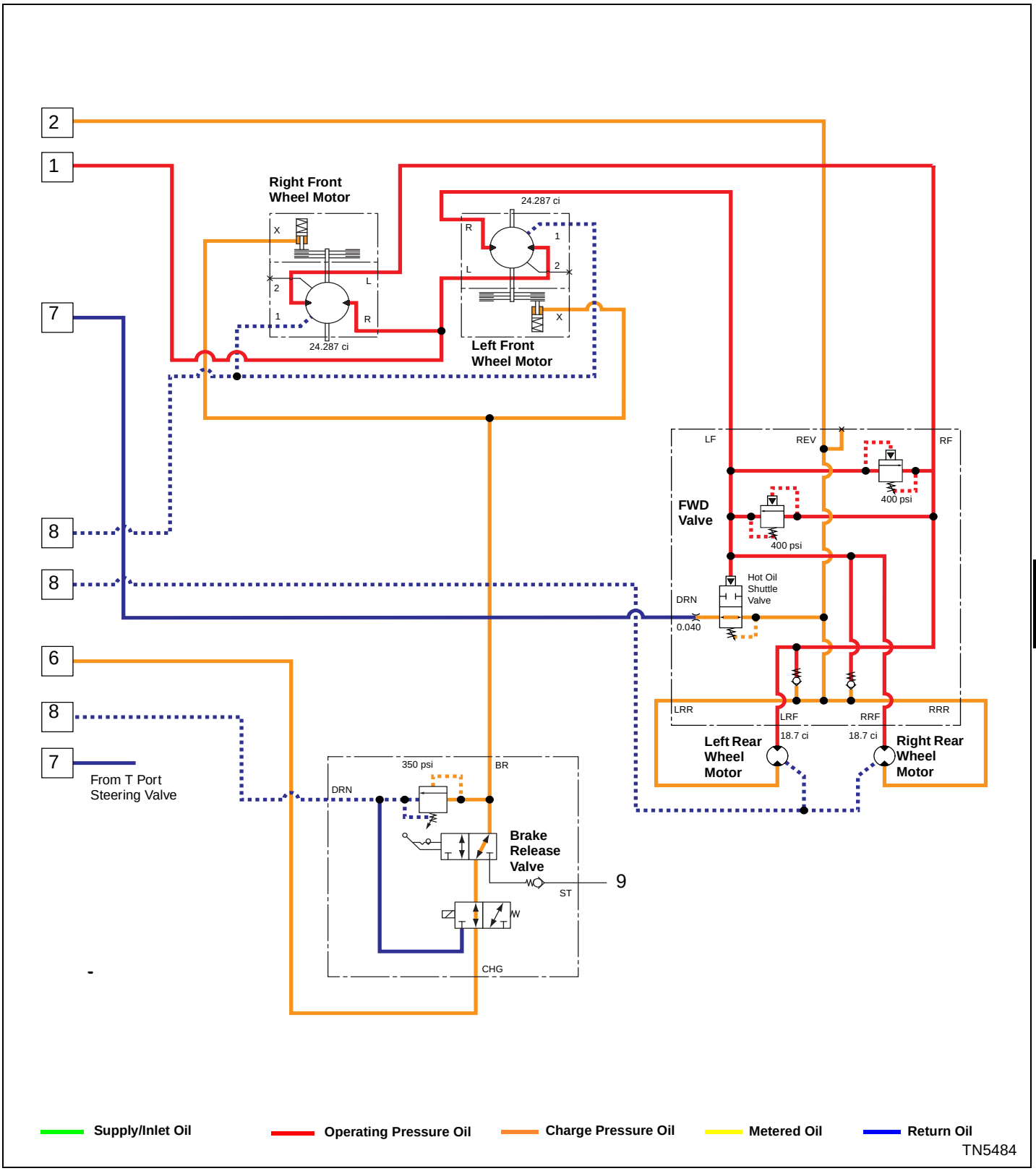
Traction Circuit—Forward Schematic

See Figures 3-9 and 3-10.



1	Operating Pressure Oil to Front Wheel Motors and 4WD Valve	4	Operating Pressure Oil to Deck Valve Port P1	7	Return Oil to Oil Filter, Oil Cooler, and Hydraulic Tank
2	Operating Pressure Oil to 4WD Valve Port REV	5	Operating Pressure Oil to Steering Valve Port P	8	Return Oil to Hydraulic Tank
3	Operating Pressure Oil to Deck Valve Port P2	6	Charge Pressure Oil to Brake Release Valve Port CHG		

Figure 3-9



1	Operating Pressure Oil to Front Wheel Motors and 4WD Valve	4	Operating Pressure Oil to Deck Valve Port P1	7	Return Oil to Oil Filter, Oil Cooler, and Hydraulic Tank
2	Operating Pressure Oil to 4WD Valve Port REV	5	Operating Pressure Oil to Steering Valve Port P	8	Return Oil to Hydraulic Tank
3	Operating Pressure Oil to Deck Valve Port P2	6	Charge Pressure Oil to Brake Release Valve Port CHG	9	To Steering Cylinder Port R

Figure 3-10

Traction Circuit Reverse Schematic and Theory of Operation

System Conditions:

- Engine running
- Park brake released
- Traction pedal depressed (reverse position)
- Tow valve in “Brake Engaged” 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 a 100 mesh screen, and enters the charge pump. Oil is then routed to the charge pressure relief valve and brake release valve, and is routed through the 0.28-inch supply orifice and the displacement control valve to the traction pump.

The charge pressure relief valve regulates the charge pressure applied to the traction pump/circuit. When the incoming charge pressure oil reaches 285 psi (20 bar), the charge pressure relief valve will open, venting excess flow to the hydraulic tank.

Traction Pump Circuit

When the traction pedal is moved to the reverse position, the displacement control valve is moved to the reverse position. Charge oil is supplied through a 0.28-inch supply orifice, displacement control valve, and to the traction pump, moving the swash plate, stroking the pump, and producing oil flow to port B.

The traction circuit is protected by a circuit relief valve. This valve will open, venting excess oil flow to the return side of the loop when the pressure rises above 3625 psi (250 bar).

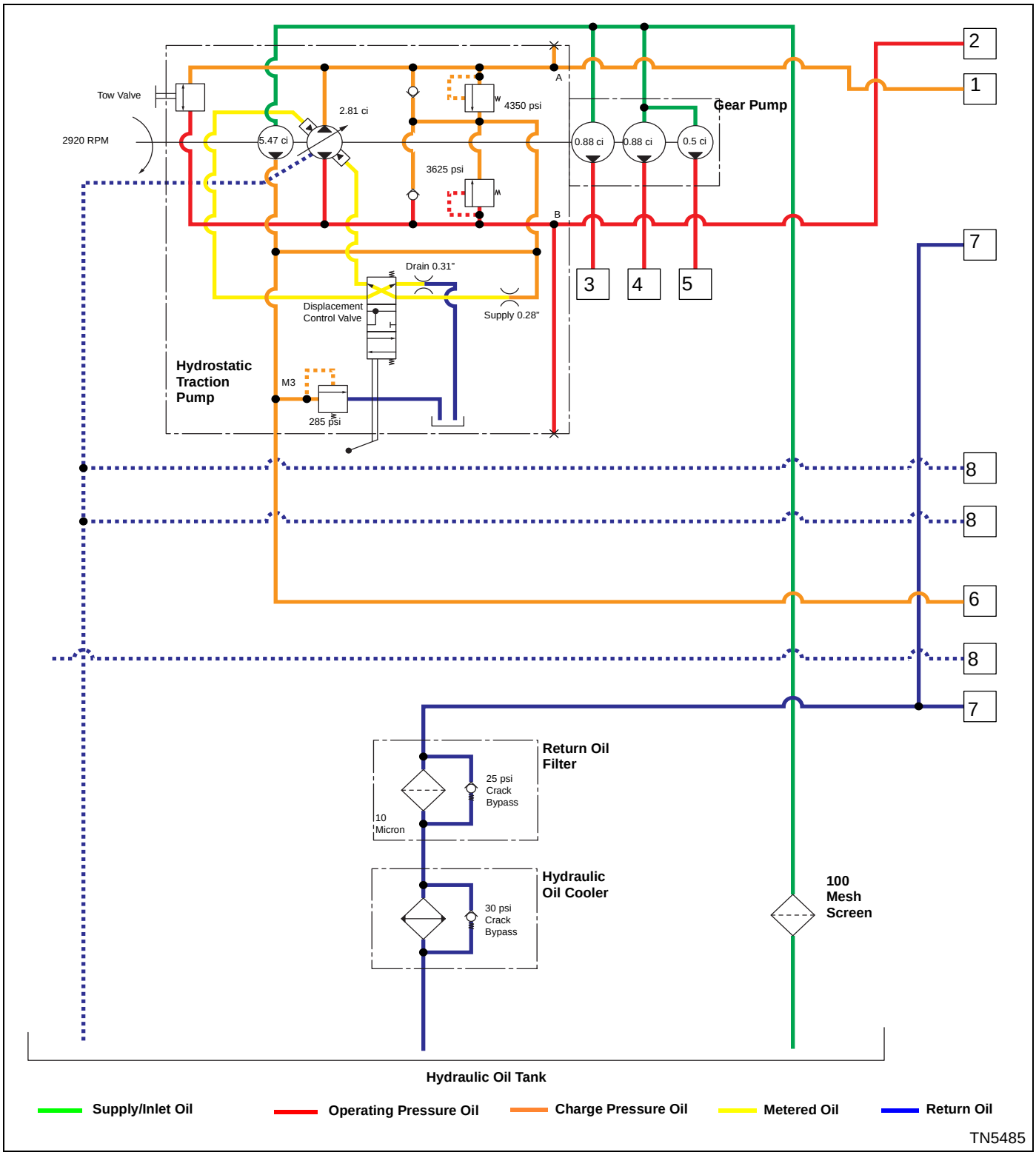
Operating pressure oil from port B of the traction pump is supplied in parallel to the rear wheel motors and in series to the front wheel motors. Oil from the front wheel motors returns to the traction pump, entering through port A.

Hot Oil Shuttle

The hot oil shuttle is located in the 4WD valve. The hot oil shuttle is held closed when there is operating pressure in the reverse direction.

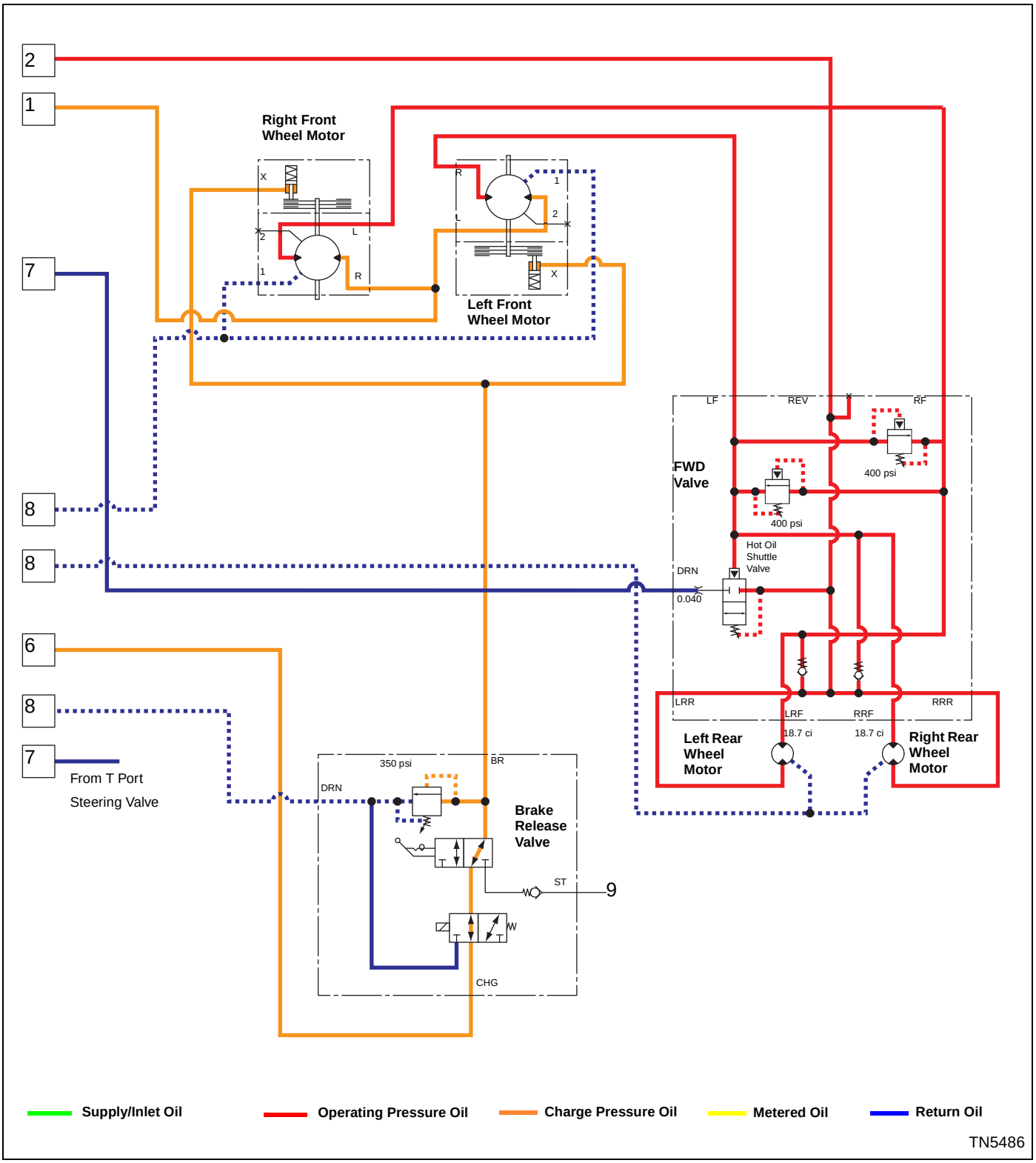
Traction Circuit—Reverse Schematic

See Figures 3-11 and 3-12.



1	Operating Pressure Oil to Front Wheel Motors and 4WD Valve	4	Operating Pressure Oil to Deck Valve Port P1	7	Return Oil to Oil Filter, Oil Cooler, and Hydraulic Tank
2	Operating Pressure Oil to 4WD Valve Port REV	5	Operating Pressure Oil to Steering Unit	8	Return Oil to Hydraulic Tank
3	Operating Pressure Oil to Deck Valve Port P2	6	Charge Pressure Oil to Brake Release Valve		

Figure 3-11



1	Operating Pressure Oil to Front Wheel Motors and 4WD Valve	4	Operating Pressure Oil to Deck Valve Port P1	7	Return Oil to Oil Filter, Oil Cooler, and Hydraulic Tank
2	Operating Pressure Oil to 4WD Valve Port REV	5	Operating Pressure Oil to Steering Unit	8	Return Oil to Hydraulic Tank
3	Operating Pressure Oil to Deck Valve Port P2	6	Charge Pressure Oil to Brake Release Valve	9	To Steering Cylinder Port RT

Figure 3-12

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. (See “Charge Pressure Test” on page 3-23.) Repair or replace charge pressure relief valve or rear cutting units circuit components as needed.
Front wheel motor worn or damaged.	Test motor. (See “Wheel Motors Test” on page 3-29.) Repair or replace motor as needed. (See “Front Wheel Motor” on page 3-47.)
Rear wheel motor worn or damaged.	Test motor. (See “Wheel Motors Test” on page 3-29.) Repair or replace motor as needed. (See “Rear Wheel Motor” on page 3-60.)
System relief valves worn or damaged.	Test pump. (See “Traction Pump Tests” on page 3-26.) Repair or replace system relief valves as needed. (See “Traction Pump” on page 3-39.)
Traction pump worn or damaged.	Test pump. (See “Traction System Test” on page 3-24.) Repair or replace pump as needed. (See “Traction Pump” on page 3-39.)

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.
Traction linkage not properly adjusted.	Adjust traction linkage. (See “Field Test Procedures” on page 3-20.)
Low charge pressure.	Test charge pressure. (See “Charge Pressure Test” on page 3-23.) Repair or replace charge pressure relief valve or rear cutting units circuit components as needed.
System relief valves worn or damaged.	Test pump. (See “Traction Pump Tests” on page 3-26.) Repair or replace system relief valves as needed. (See “Traction Pump” on page 3-39.)
Traction pump worn or damaged.	Test pump. (See “Traction System Test” on page 3-24.) Repair or replace pump as needed. (See “Traction Pump Tests” on page 3-26.)
Front wheel motor worn or damaged.	Test motor. (See “Wheel Motors Test” on page 3-29.) Repair or replace motor as needed. (See “Front Wheel Motor” on page 3-47.)
Rear wheel motor worn or damaged.	Test motor. (See “Wheel Motors Test” on page 3-29.) Repair or replace motor as needed. (See “Rear Wheel Motor” on page 3-60.)
Engine rpm low.	Verify and adjust engine rpm. (Refer to the 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 linkage. (See “Adjust Transmission Neutral (Creep)” on page 3-17.)

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 hot oil shuttle.	Inspect and repair. (See “4WD Valve” on page 3-45.)
Internal leakage in pump or motor.	Perform instrument tests. (See “Instrument Test Procedures” on page 3-22.)
Faulty charge pressure relief valve.	Test charge pressure. (See “Charge Pressure Test” on page 3-23.) Repair or replace charge pressure relief valve or rear cutting units circuit components as needed.

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 3-24.) Repair or replace pump as needed. (See “Traction Pump” on page 3-39.)

Tests and Adjustments

Transmission Neutral Adjustment

Adjust Transmission Neutral (Creep)

See Figures 3-13 and 3-14.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove center floorboard.
3. Confirm tow valve is closed.
4. Bypass the seat switch.

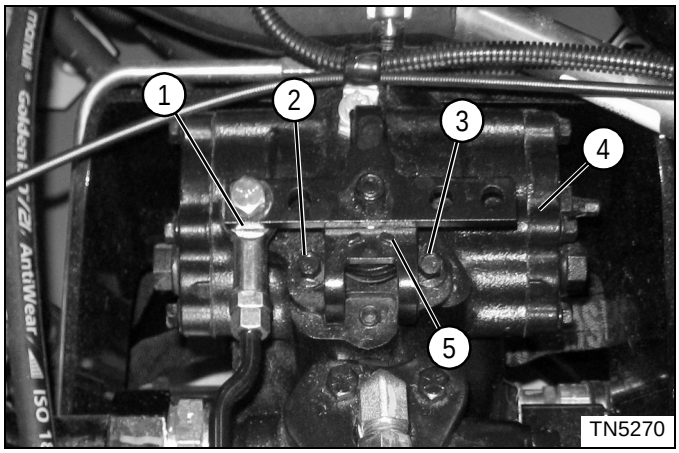


Figure 3-13

5. Disconnect traction pedal linkage (1) from traction pump (4).
6. Loosen screws (2 and 3).

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 machine or the machine will move.

7. Lift the machine so that front and rear wheels are off the ground and support with jackstands.

WARNING

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

CAUTION

Engine component will become hot during operation. Use caution when working near engine components while performing service. Failure to follow safety recommendations may result in injury.

8. Operate hydraulic system until oil temperature is at 120–150° F (49–65° C).
9. Start the engine, release brake, and observe the wheels.
10. Adjust bracket (5) until wheels do not turn.
11. Tighten screws (2 and 3), making sure wheels are not turning.
12. Stop the engine and apply brake.
13. Connect traction pedal linkage (1).
14. Adjust traction pedal neutral switch. (See “Adjust Traction Pedal Neutral Switch” on page 3-19.)
15. Start the engine and release brake.
16. Move the traction pedal to the forward and reverse positions and release the pedal. Pedal should return to the neutral position, and there should be no wheel movement.
17. Stop the engine and apply brake.
18. Repeat the procedure if any wheel movement is noted.

NOTE

If, after repeating the procedure, there is still wheel movement, the control sleeve may be sticking. Proceed to step 19.

19. Disconnect traction pedal linkage (1) from traction pump (4).
20. Remove screws (2 and 3).

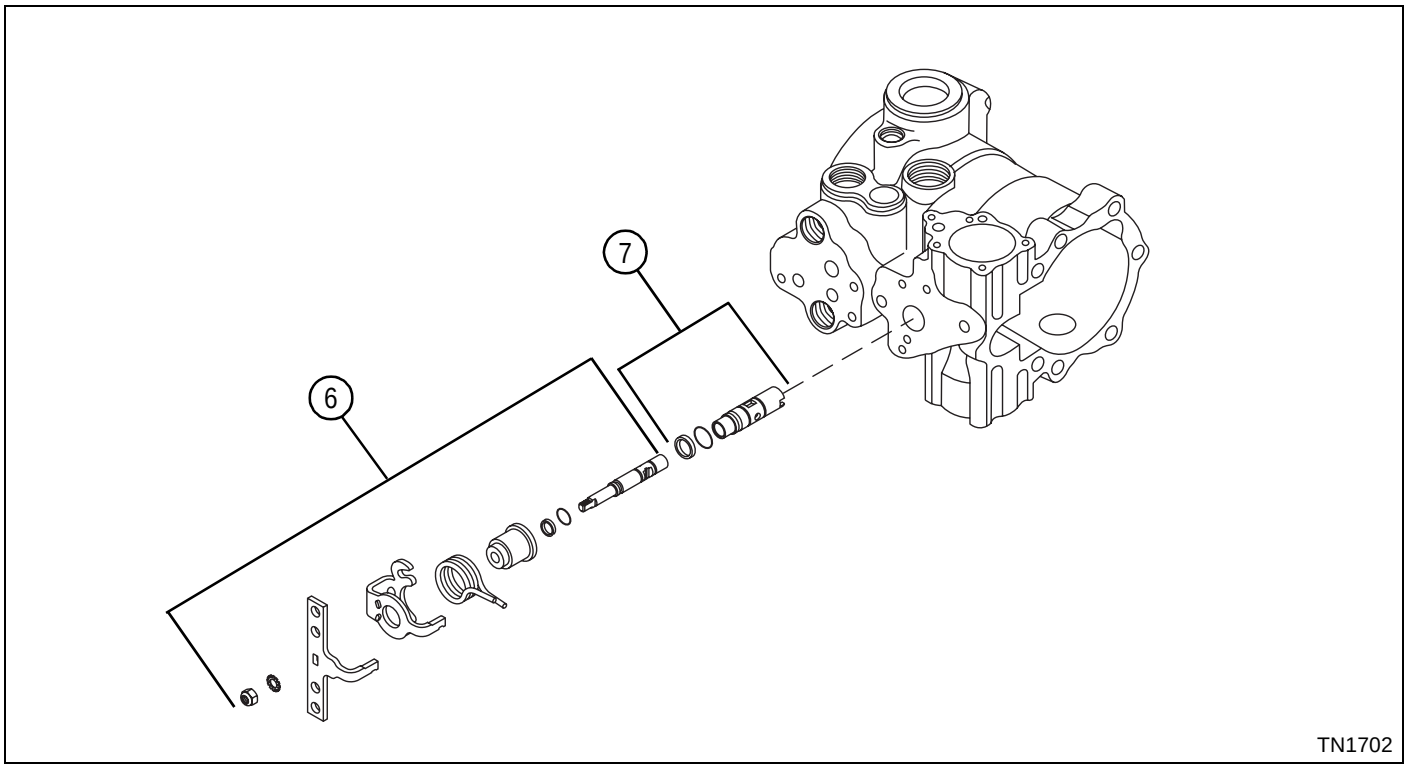


Figure 3-14

21. Remove control spool (6) as an assembly. Clean and inspect.

NOTE

Control sleeve (7) may be difficult to remove. If needed, use a blind race puller with a slide hammer to remove.

22. Remove control sleeve (7) as an assembly. Clean and inspect.
23. If needed, repair or replace control sleeve (7) and control spool (6).
24. Install control sleeve (7) as an assembly.
25. Install control spool (6) as an assembly.
26. Install screws (2 and 3), but do not tighten.

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 machine or the machine will move.

27. Lift the machine so that front and rear wheels are off the ground and support with jackstands.

WARNING

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

CAUTION

Engine component will become hot during operation. Use caution when working near engine components while performing service. Failure to follow safety recommendations may result in injury.

28. Start the engine, release brake, and observe the wheels.
29. Adjust bracket (5) until wheels do not turn.
30. Tighten screws (2 and 3), making sure wheels are not turning.
31. Stop the engine and apply brake.
32. Connect traction pedal linkage (1).
33. Adjust traction pedal neutral switch. (See “Adjust Traction Pedal Neutral Switch” on page 3-19.)
34. Start the engine and release brake.
35. Move the traction pedal to the forward and reverse positions and release the pedal. Pedal should return to the neutral position, and there should be no wheel movement.

36. Stop the engine and apply brake.
37. Repeat the procedure if any wheel movement is noted.
38. Install and connect all components as noted prior to adjustment.

Adjust Traction Pedal Neutral Switch

See Figure 3-15.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Allow the traction pedal to return to the neutral position.

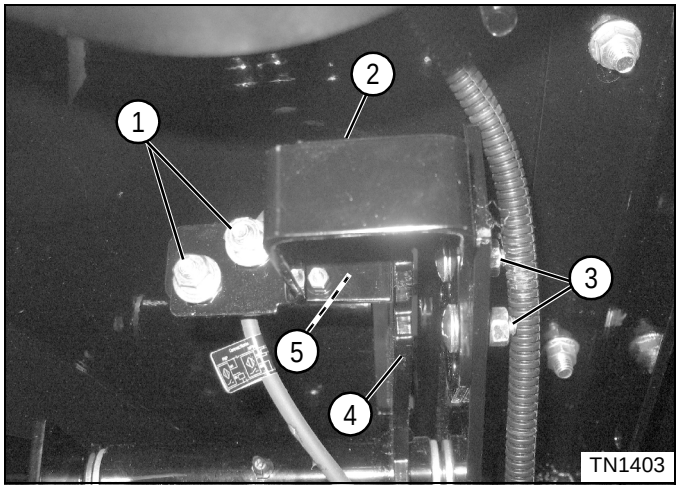


Figure 3-15

3. Align the proximity switch:

   To adjust the vertical alignment of the proximity switch: Loosen two screws (1) and center the proximity switch (5) with traction pedal pointer (4). Tighten the screws.

   To adjust the horizontal alignment of the proximity switch: Loosen two screws (3) and slide the proximity switch bracket (2) as needed, centering proximity switch (5) with traction pedal pointer (4). Tighten the screws.
4. Check the operation of the switch by depressing the traction pedal so that the proximity switch (5) is closed when the traction pedal is in neutral position and open when the traction pedal is moved out of neutral position. (See “Neutral Proximity Switch” on page 4-68.)

Field Test Procedures

When a hydraulic system failure occurs, some simple effective tests can be performed prior to using a test instrument. 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 3-22.)

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.

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 3-23.)

Traction System Test

See Figure 3-16.

NOTE

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

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

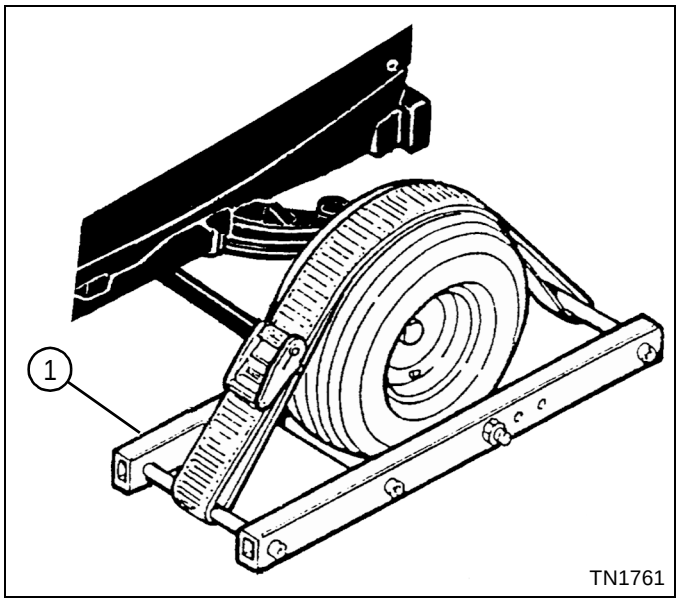


Figure 3-16

2. Install wheel restraints (1) to 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

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

3. Lift and support the machine so that rear wheels are off the ground.
4. Release park brake (park brake switch in the off position), 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 front wheel motors. Proceed to instrument test. (See “Instrument Test Procedures” on page 3-22.)*

Wheel Motor Test

The wheel motor case drain is used to return lubrication oil or bypassed hydraulic oil to the hydraulic tank.

1. Operate hydraulic system until oil temperature is at 120–150° F (49–65° C).
2. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
3. Remove the case drain hose from the wheel motor. Immediately plug the hose.
4. Position a drain pan with a minimum capacity of 1gallon (3.8 L) near the wheel motor.
5. Install a separate hose on the case drain fitting on the wheel motor, and place the free end in the container. Secure the hose to prevent spills.

NOTES

- *When testing rear wheel motor, put wheel restraints on the rear wheels, lift front of machine so that front wheels are off the ground, and support with jackstands.*
- *When testing front wheel motor, put wheel restraints on the front wheels, lift rear of machine so that rear wheels are off the ground, and support with jackstands.*

6. Install wheel restraints. (See Figure 3-16.)
7. Lift and support the rear or front of the machine, depending on wheel being tested.
8. Start the engine, release park brake (park brake switch in the off position), and place the traction pedal in the forward position for 15 seconds.
9. Stop the engine, engage park brake (park brake switch in the on position), and remove the ignition key.
10. Measure the amount of oil collected from the case drain. Amount x 4 = amount per minute.

    Is the oil measured less than 1 gallon per minute?

    YES *The motor is not faulty. Proceed to instrument test. (See “Instrument Test Procedures” on page 3-22.)*

    Is the oil measured more than 2 gallons per minute?

    YES *The motor is faulty. Repair or replace as needed. (See “Front Wheel Motor” on page 3-47 or see “Rear Wheel Motor” on page 3-60.)*

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 24%, a result that requires the testing of individual components. This result can also be interpreted as system efficiency of 76%.

The components in question are as follows: traction pump, right front wheel motor, left front wheel motor, 4WD valve, left rear wheel motor, and right 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 3.0% in the traction pump, 17.5% in the right front wheel motor, 5.0% in the left front wheel motor, 2.6% in the 4WD valve, 1.3% in the left rear wheel motor, and 5.4% in the right rear wheel motor. 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 Motor and 4WD Valve

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 = 10.0 gpm

Loaded Flow = 7.6 gpm

10.0 – 7.6 / 10.0 x 100 = Total System Leakage 24%

Traction Pump Test

No Load Flow = 10.0 gpm

Loaded Flow = 9.7 gpm

10.0 – 9.4 / 10.0 x 100 = Traction Pump Leakage 3.0%

Right Front Wheel Motor Test

Loaded Flow from traction pump test = 9.7 gpm

Loaded Flow from right front wheel motor test = 8.0 gpm

9.7 – 8.0 / 9.7 x 100 = Right Front Wheel Motor Leakage 17.5%

Left Front Wheel Motor Test

Loaded Flow from right front wheel motor test = 8.0 gpm

Loaded Flow from left front wheel test = 7.6 gpm

8.0 – 7.6 / 8.0 x 100 = Left Front Wheel Motor Leakage 5.0%

Charge Pressure Test

See Figures 3-17 through 3-20.

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)
• -6 ORB Adapter
• -6 ORFS Blocking Disk

1. Operate hydraulic system until oil temperature is at 120–150° F (49–65° C).
2. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
3. Remove center floorboard.

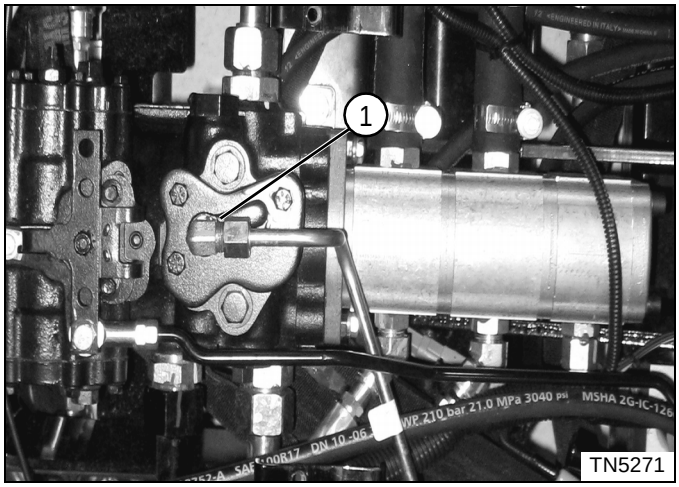


Figure 3-17

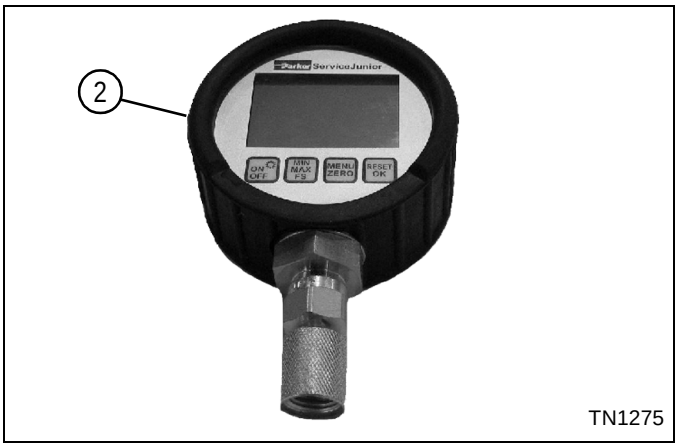


Figure 3-18

4. Connect adapter, test hose, and pressure gauge (2) to port (1).

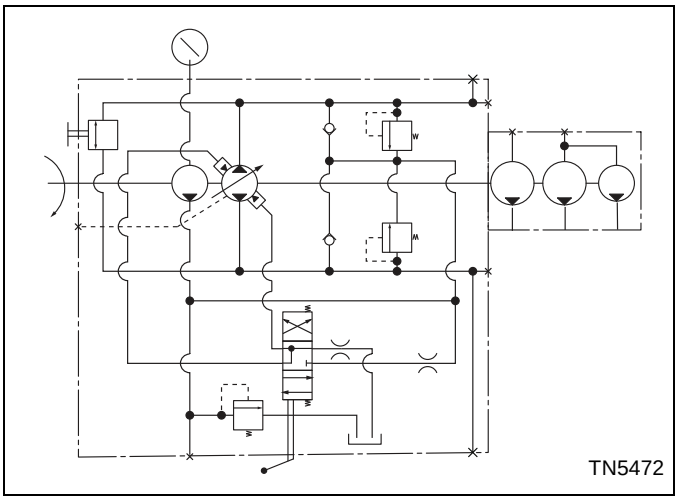


Figure 3-19: Charge Pressure Test—Connect Adaptor, Test Hose and Pressure Gauge (2) to Port (1)

NOTE

Verify engine rpm is within specification (2920 ± 50 rpm) to ensure accurate hydraulic test results.

5. Start engine and run at full throttle (2920 ± 50 rpm).
6. Record pressure reading.
7. Stop the engine.

Is charge pressure 275–285 psi (19–20 bar)?

YES *Charge pressure relief valve is good. Proceed to step 10.*

NO *Proceed to next step.*

3

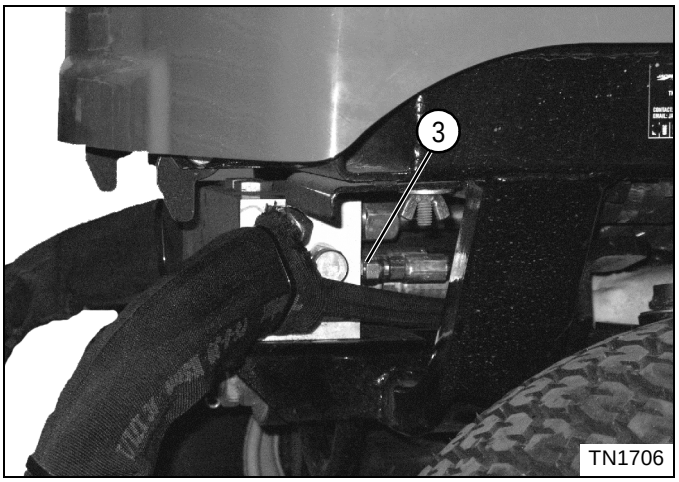


Figure 3-20

8. Insert blocking disk at the “H” port (3) of the 4WD valve and retest charge pressure.

   Is charge pressure 275–285 psi (19–20 bar)?

   YES *Inspect, repair, or replace hot oil shuttle. (See “4WD Valve” on page 3-45.)*

   NO *Inspect, repair, or replace charge relief valve.*

9. Retest charge pressure.

   Is charge pressure 275–285 psi (19–20 bar)?

   YES *Charge pump is good.*

   NO *Inspect, repair, or replace charge pump as needed. (See “Traction Pump” on page 3-39.)*

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 “Safety, Operation, and Maintenance Manual” for correct oil specifications.)

Traction System Test

See Figures 3-21 through 3-25.

IMPORTANT

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

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 • -12 ORFS Test Hose 5000 psi (345 bar) • Flow Lock Tool

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove center floorboard and seat.
3. Bypass the seat switch.

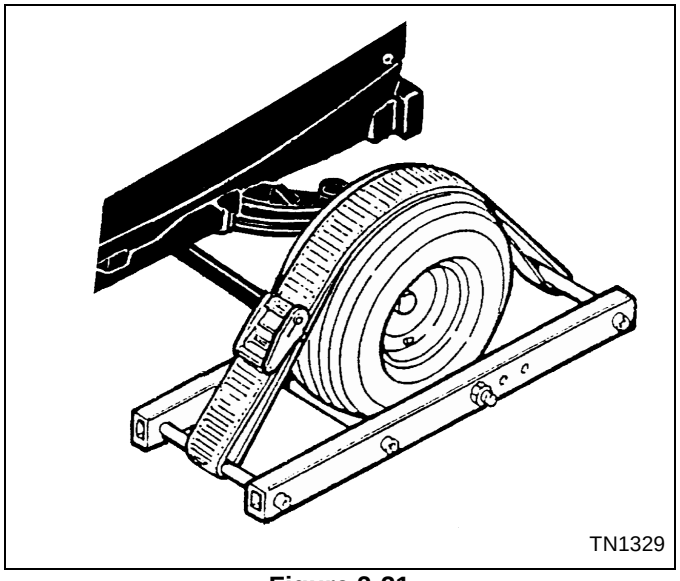


Figure 3-21

4. Install wheel restraints to front wheels.

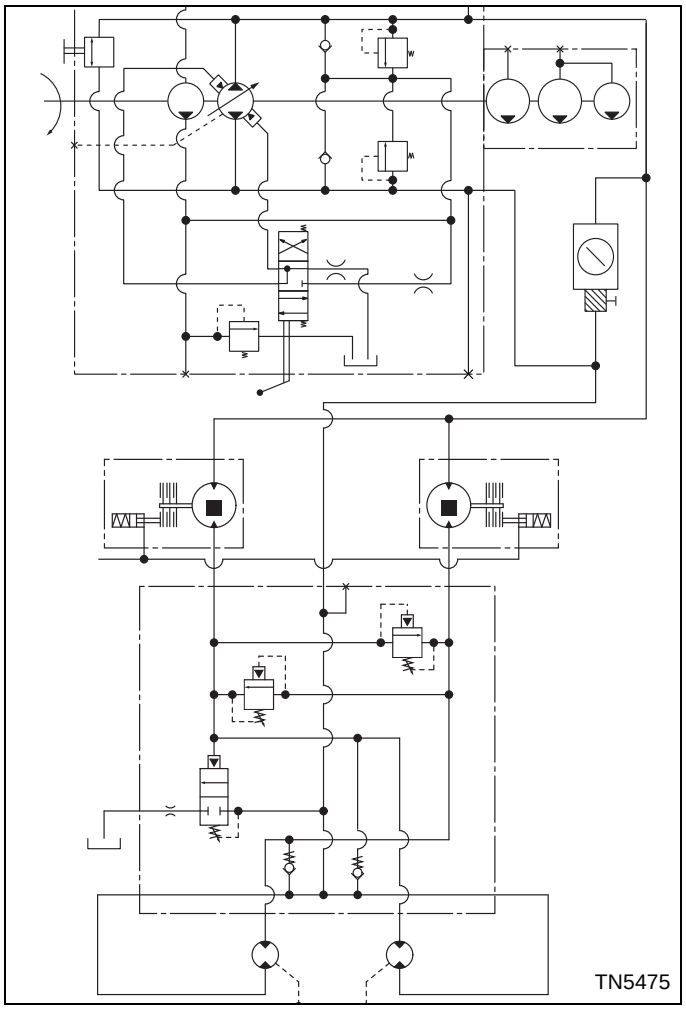


Figure 3-22: Traction System Test—Install Wheel Restraints to Front Wheels

WARNING

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

Support the machine properly using jackstands.

IMPORTANT

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

5. Lift and support the machine so that rear wheels are off the ground.
6. Disconnect traction pump control rod from pump control arm.

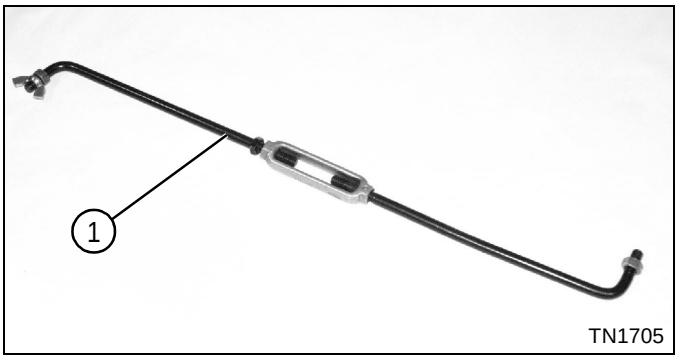


Figure 3-23

7. Install flow lock tool (1) and secure to pump control arm.
8. Close tow valve completely by turning clockwise.

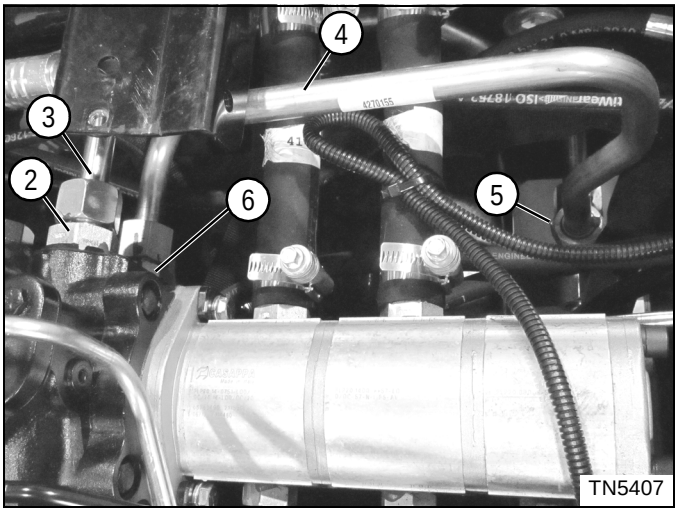


Figure 3-24

9. Remove drive tube (4).
10. Disconnect hose (3).

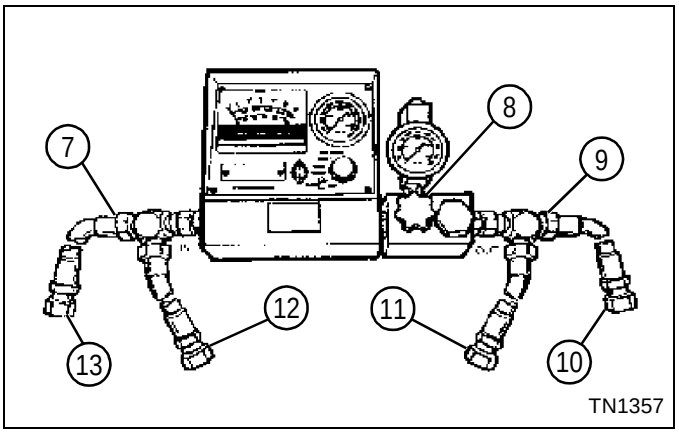


Figure 3-25

11. Connect test hose (13) of flow meter inlet to tee fitting (5).
12. Connect test hose (12) of flow meter inlet to tee fitting (6)on port A.
13. Connect hose (10) of flow meter outlet to hose (3).
14. Connect test hose (11) of flow meter outlet to fitting (2) on port B.
15. Open flow meter valve (8) completely before starting engine.

NOTE

Verify engine rpm is within specification (2920 ± 50 rpm) to ensure accurate hydraulic test results.

16. Start engine, release brake, and run at full throttle (2920 ± 50 rpm).
17. Adjust flow lock tool (1) to allow pump to produce 15 gpm (57 lpm) in the forward direction.
18. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (8) until a reading of 2000 psi (138 bar) or one-half of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
19. After warming the hydraulic oil, verify flow lock tool is adjusted to allow pump to produce 15 gpm (57 lpm) in the forward direction.
20. Read and record no load flow.
21. Slowly close flow meter valve (8) until pressure reaches 2700 psi (186 bar). Read and record loaded flow.
22. Stop engine, apply brake, and return flow lock tool to neutral position.
23. Calculate traction system leakage. (Step 20 – Step 21 / Step 20 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 Test" on page 3-29.*

    NO *Proceed to next question.*

    Is traction system leakage 11% to 20%?

    YES *The traction system is marginal. Additional testing is required. Proceed to step 24.*

    NO *Proceed to next question.*

    Is traction system leakage 21% or more?

    YES *Test individual components in traction system for leakage.*
24. Disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
25. Install and connect all components as noted prior to test.
26. Check hydraulic oil level. Add oil as needed. (Refer to "Safety, Operation, and Maintenance Manual" for oil specifications.)

Traction Pump Tests

See Figures 3-26 and 3-28.

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
• Flow Meter • -12 ORFS Test Hose 5000 psi (345 bar) • -12 ORFS Blocking Disks • Flow Lock Tool

1. Park the mower safely. (See "Park Mower Safely" on page 1-5.)
2. Before performing this test, perform traction system test leaving flow meter and flow lock tool connected as outlined. (See "Traction System Test" on page 3-24.)

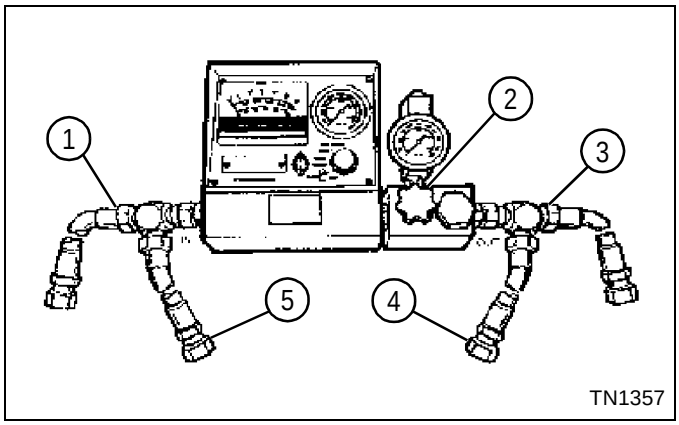


Figure 3-26

3. Install blocking disks at locations (1 and 3).

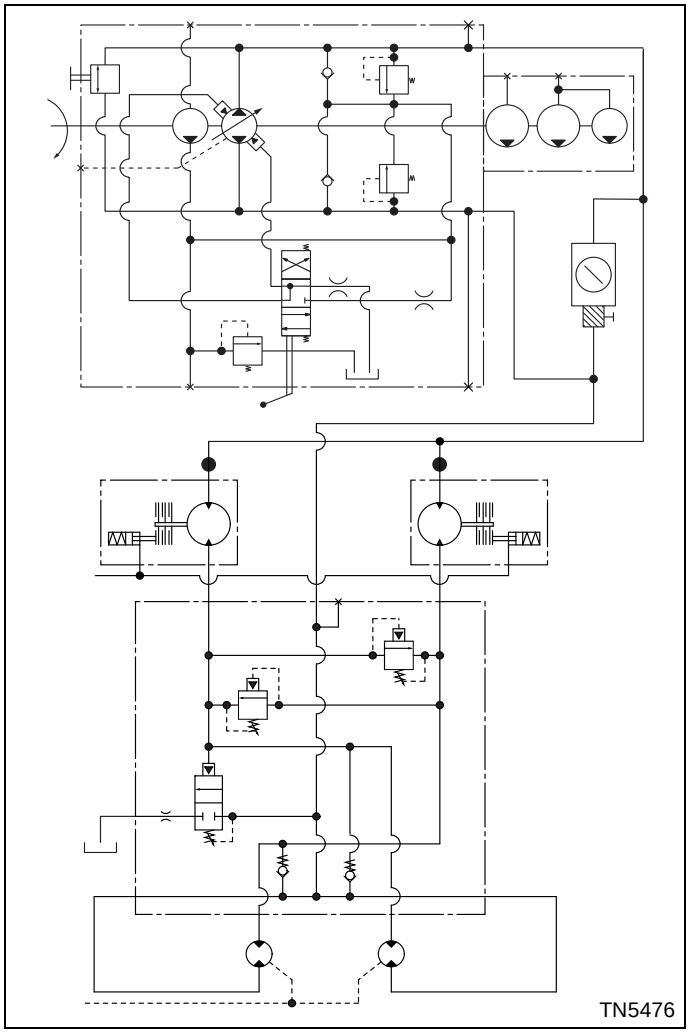


Figure 3-27: Traction Pump Tests Blocking Disk to Locations 1 and 3

4. Open flow meter valve (2) completely before starting engine.

NOTE

Verify engine rpm is within specification (2920 ± 50 rpm) to ensure accurate hydraulic test results.

5. Start engine, release brake, and run at full throttle (2920 ± 50 rpm).

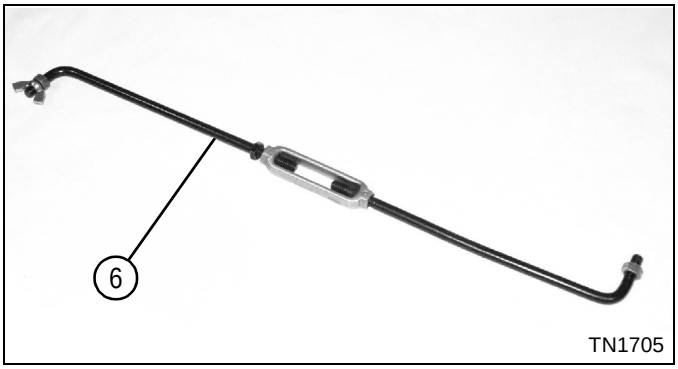


Figure 3-28

6. Adjust flow lock tool (6) to allow pump to produce 15 gpm (57 lpm) in the forward direction.
7. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (2) until a reading of 2000 psi (138 bar) or one-half of the relief valve rating is reached. Warm 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 15 gpm (57 lpm) in the forward direction.
9. Read and record no load flow.
10. Slowly close flow meter valve (2) until pressure reaches 2700 psi (186 bar). Read and record loaded flow.
11. Stop engine, apply brake, and return flow lock tool to neutral position.
12. Calculate traction pump leakage.
    (Step 9 – Step 10 / Step 9 x 100 = Leak Percentage)

    Is traction pump leakage 10% or less?

    YES *The traction pump is good. Proceed to step 17.*

    NO *Proceed to next question.*

    Is traction pump leakage 11% to 20%?

    YES *The traction pump is marginal. Additional testing is required. Proceed to step 13.*

    NO *Proceed to next question.*

    Is traction pump leakage 21% or more?

    YES *Repair or replace traction pump. (See “Traction Pump” on page 3-39.)*

CAUTION

Do not exceed 4350 psi (300 bar) when testing system relief valves or equipment damage may occur.

13. Open flow meter valve (2) completely before starting engine.

NOTE

Verify engine rpm is within specification (2920 ± 50 rpm) to ensure accurate hydraulic test results.

14. Start engine, release brake, and run at full throttle (2920 ± 50 rpm).
15. Adjust flow lock tool (6) to allow pump to produce 15 gpm (57 lpm) in the forward direction.
16. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (2) until a reading of 2000 psi (138 bar) or one-half of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C).
17. Continue to close flow meter valve (2) until zero flow is obtained. Record forward system relief valve pressure.
18. Stop engine, apply brake, and return flow lock tool to neutral position.

NOTE

Reverse system relief valve test is similar.

19. To test reverse system relief valve, swap hoses (4 and 5) at flow meter.
20. Open flow meter valve (2) completely before starting engine.

NOTE

Verify engine rpm is within specification (2920 ± 50 rpm) to ensure accurate hydraulic test results.

21. Start engine, release brake, and run at full throttle (2920 ± 50 rpm).
22. Adjust flow lock tool to 15 gpm (57 lpm) in the reverse direction.
23. Close flow meter valve (2) until zero flow is obtained and record reverse system relief valve pressure.
24. Stop engine, apply brake, and return flow lock tool to neutral position.

    Is forward system relief pressure 4350 psi (300 bar)?

    YES *Forward system relief valve is good. Proceed to step 25.*

    NO *Replace forward system relief valve. (See “Traction Pump” on page 3-39.)*

    Is reverse system relief pressure 3625 psi (250 bar)?

    YES *Reverse system relief valve is good. Proceed to step 25.*

    NO *Replace reverse system relief valve. (See “Traction Pump” on page 3-39.)*
25. If no further testing is required, disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
26. Install and connect all components as noted prior to test.
27. Check hydraulic oil level. Add oil as needed. (Refer to “Safety, Operation, and Maintenance Manual” for oil specifications.)

Wheel Motors Test

See Figures 3-29 through 3-40.

IMPORTANT

- **This test works together with the traction system test to isolate a problem within the hydrostatic power train.**
- **Performing this test will isolate the wheel motors and 4WD valve from the rest of the hydrostatic system. It will also isolate the system into right and left circuits.**

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
• -12 ORFS Test Hose 5000 psi (345 bar)
• -12 ORFS and -10 ORFS Blocking Disks
• Flow Lock Tool
• Wheel Restraints

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Before performing this test, perform traction system test, leaving flow meter and flow lock tool connected as outlined. (See “Traction System Test” on page 3-24.)
3. (See Figure 3-26.) Remove the blocking disks from locations (1 and 3).
4. Connect hoses to flow meter as outlined in traction system test. (See “Traction System Test” on page 3-24.)

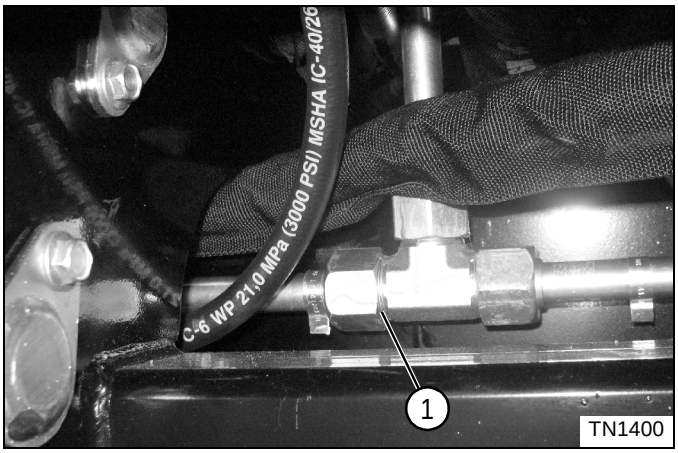


Figure 3-29

5. Install blocking disk at location (1), in front of front axle, to block oil from right wheel motor.

IMPORTANT

- **If performing this test after performing the traction system test, and the test results have proven the traction system to be good, proceed to step 16.**
- **If performing this test to determine which component in system is at fault (front wheel motor, check valve, or rear wheel motor) proceed to step 6.**

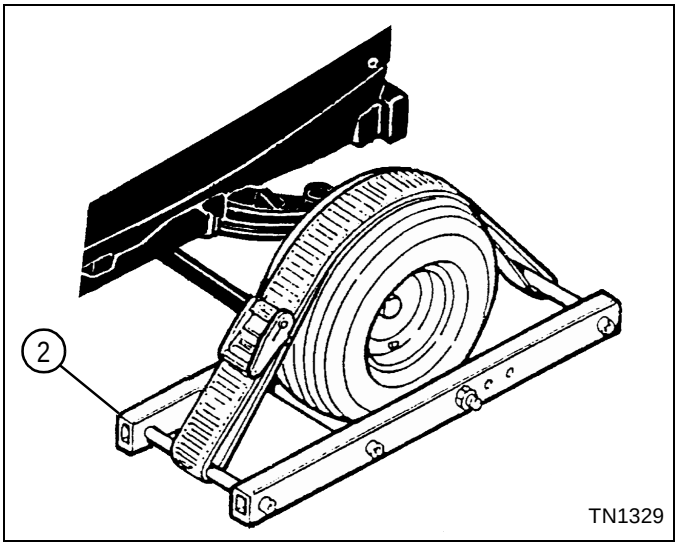


Figure 3-30

6. Install wheel restraint (2) to left front wheel.

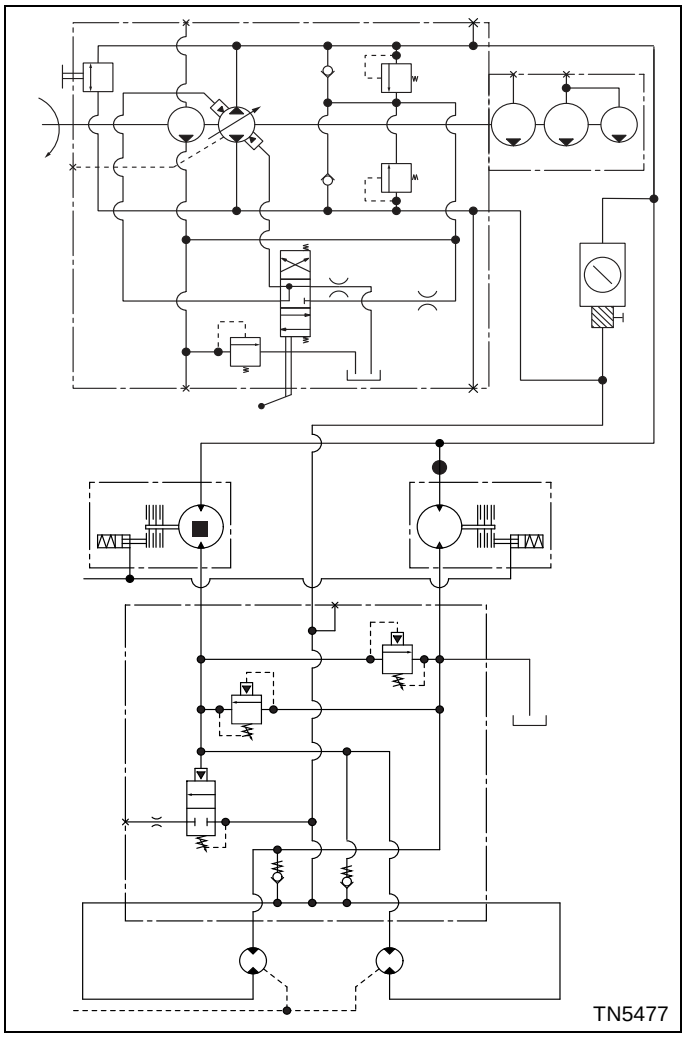


Figure 3-31: Wheel Motors Test—Install Blocking Disk to location (1) and Install Wheel Restraint to Left Front Wheel

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 rear of the machine because if there is any leakage in the front wheel motor the machine will move.

7. Lift rear of machine and support with jackstands.

NOTE

Verify engine rpm is within specification (2920 ± 50 rpm) to ensure accurate hydraulic test results.

8. Start engine, release brake, and run at full throttle (2920 ± 50 rpm).

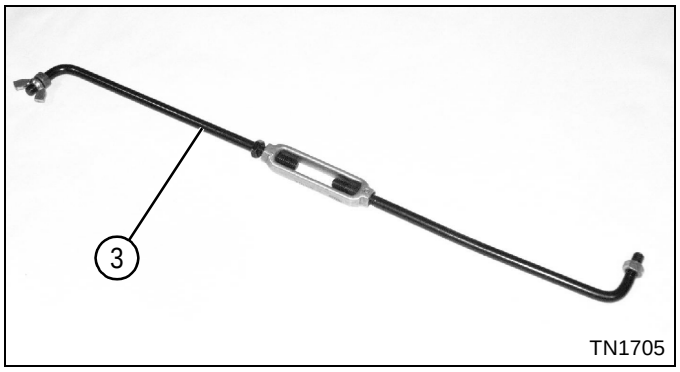


Figure 3-32

9. Adjust flow lock tool (3) to allow pump to produce 15 gpm (57 lpm) in the forward direction.
10. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve until a reading of 2000 psi (138 bar) or one-half of the relief valve rating is reached. Warm 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 15 gpm (57 lpm) in the forward direction.
12. Slowly close flow meter valve until pressure reaches 2700 psi (186 bar). Read and record loaded flow.
13. Stop engine, apply brake, and return flow lock tool to neutral position.
14. Calculate left front wheel motor leakage.
(Step 10 of previous test – Step 12 / Step 10 of previous test x 100 = Leak Percentage)

    Is left front wheel motor leakage 10% or less?

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

    NO *Proceed to next question.*

    Is left front wheel motor leakage 11% to 20%?

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

    NO *Proceed to next question.*

    Is left front wheel motor leakage 21% or more?

    YES *Repair or replace left front wheel motor. (See “Front Wheel Motor” on page 3-47.)*

15. Remove wheel restraint from left front 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 machine, or the machine will move.

16. Lift the front of machine and support with jackstands.

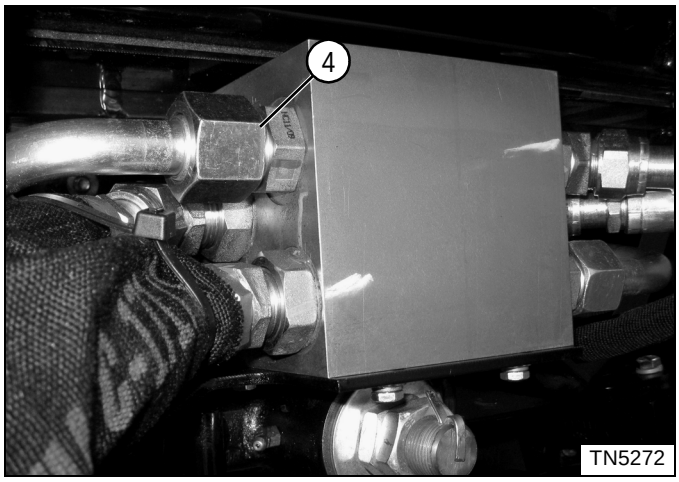


Figure 3-33

17. Install blocking disk at location (4) of 4WD valve.

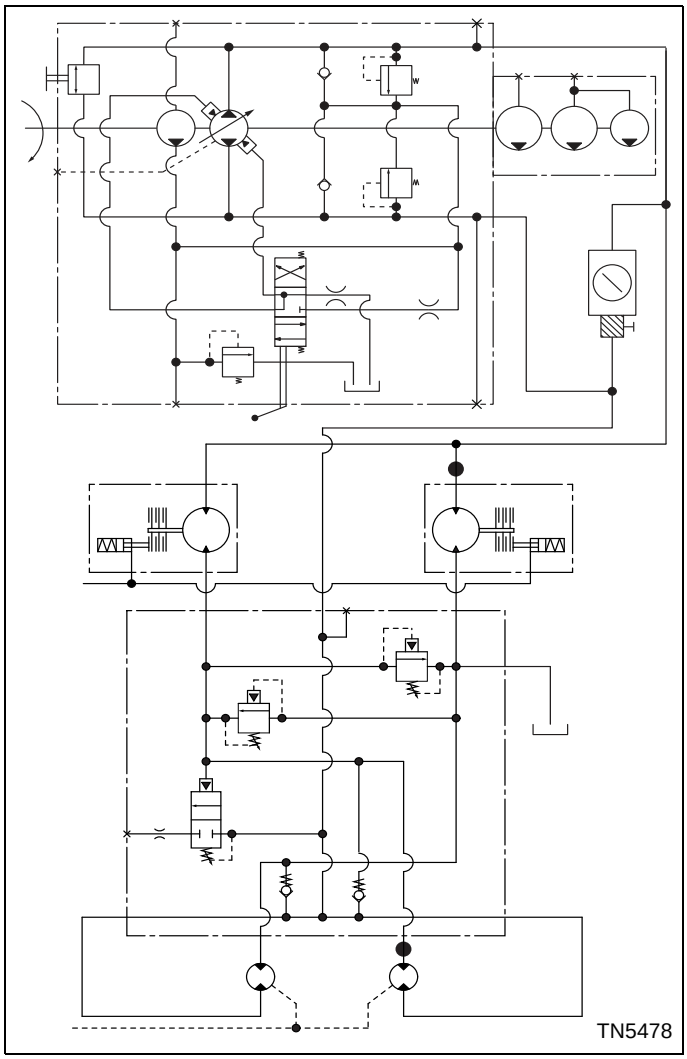


Figure 3-34: Wheel Motors Test—Install Blocking Disc to Location (4) of 4WD valve.

18. Open flow meter valve completely before starting engine.

NOTE

Verify engine rpm is within specification (2920 ± 50 rpm) to ensure accurate hydraulic test results.

19. Start engine, release brake, and run at full throttle (2920 ± 50 rpm).
20. Adjust flow lock tool (3) to allow pump to produce 15 gpm (57 lpm) in the forward direction.
21. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve until a reading of 2000 psi (138 bar) or one-half of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
22. After warming the hydraulic oil, verify flow lock tool is adjusted to allow pump to produce 15 gpm (57 lpm) in the forward direction.

23. Slowly close flow meter valve until pressure reaches 2700 psi (186 bar). Read and record loaded flow.
24. Stop engine, apply brake, and return flow lock tool to neutral position.
25. Calculate left check valve leakage. (Step 12 – Step 23 / Step 12 x 100 = Leak Percentage)

    Is left check valve leakage 10% or less?

    YES *The left check valve is good. Proceed to Step 26.*

    NO *Proceed to next question.*

    Is left check valve leakage 11% to 20%?

    YES *The left check valve is marginal. Additional testing is required. Proceed to step 26.*

    NO *Proceed to next question.*

    Is left check valve leakage 21% or more?

    YES *Repair or replace left check valve. (See "4WD Valve" on page 3-45.)*
26. Remove blocking disk from location (4) of 4WD valve.
27. Install wheel restraint to left rear wheel.

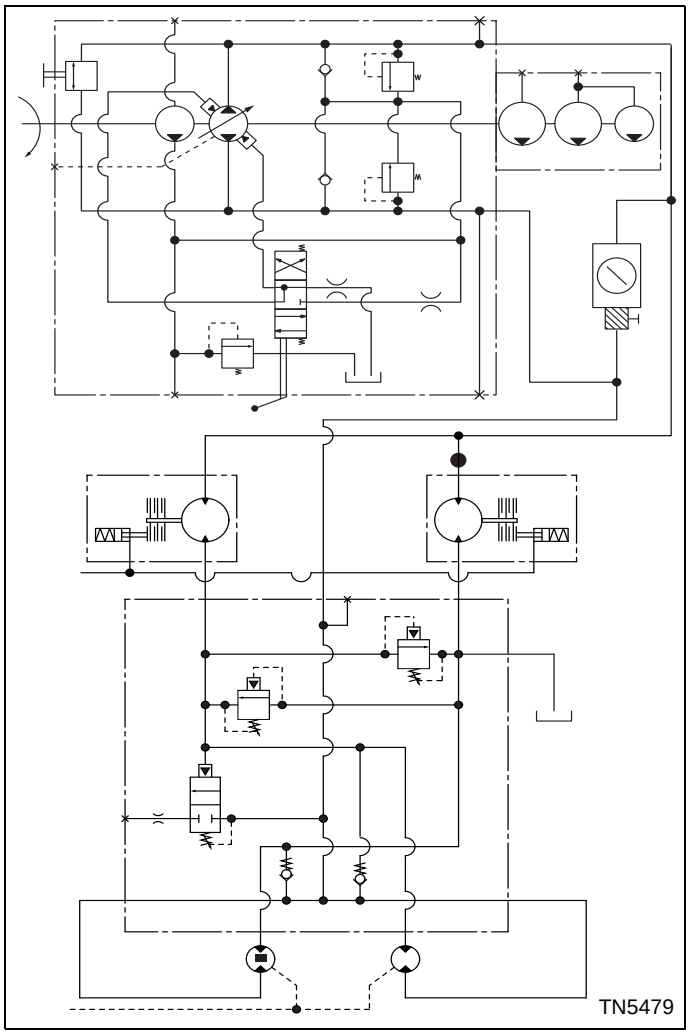


Figure 3-35: Wheel Motors Test—Install Wheel Restraint to Left Rear Wheel

28. Open flow meter valve completely before starting engine.

NOTE

Verify engine rpm is within specification (2920 ± 50 rpm) to ensure accurate hydraulic test results.

29. Start engine, release brake, and run at full throttle (2920 ± 50 rpm).
30. Adjust flow lock tool (3) to allow pump to produce 15 gpm (57 lpm) in the forward direction.
31. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve until a reading of 2000 psi (138 bar) or one-half of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
32. After warming the hydraulic oil, verify flow lock tool is adjusted to allow pump to produce 15 gpm (57 lpm) in the forward direction.
33. Slowly close flow meter valve until pressure reaches 2700 psi (186 bar). Read and record loaded flow.

34. Stop engine, apply brake, and return flow lock tool back to neutral position.
35. Calculate left rear wheel motor leakage. (Step 23 – Step 33 / Step 23 x 100 = Leak Percentage)

Is left rear wheel motor leakage 10% or less?

YES *The left rear wheel motor is good. Proceed to step 36.*

NO *Proceed to next question.*

Is left rear wheel motor leakage 11% to 20%?

YES *The left rear wheel motor is marginal. Additional testing is required. Proceed to step 36.*

NO *Proceed to next question.*

Is left rear wheel motor leakage 21% or more?

YES *Repair or replace left rear wheel motor. (See "Rear Wheel Motor" on page 3-60.)*

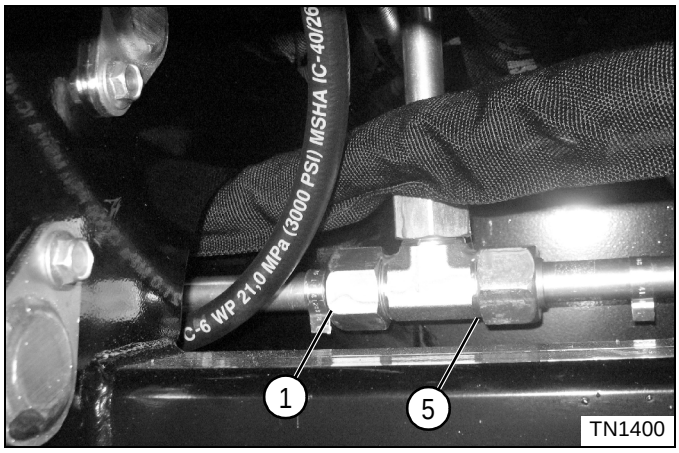


Figure 3-36

36. Remove blocking disk from location (1).
37. Install blocking disk at location (5), in front of front axle, to block oil from left wheel motor.

IMPORTANT

- **If performing this test after performing the traction system test, and the test results have proven the traction system to be good, proceed to step 49.**
- **If performing this test to determine which component in system is at fault (front wheel motor, check valve, or rear wheel motor) proceed to step 38.**

38. Install wheel restraint to right front wheel.

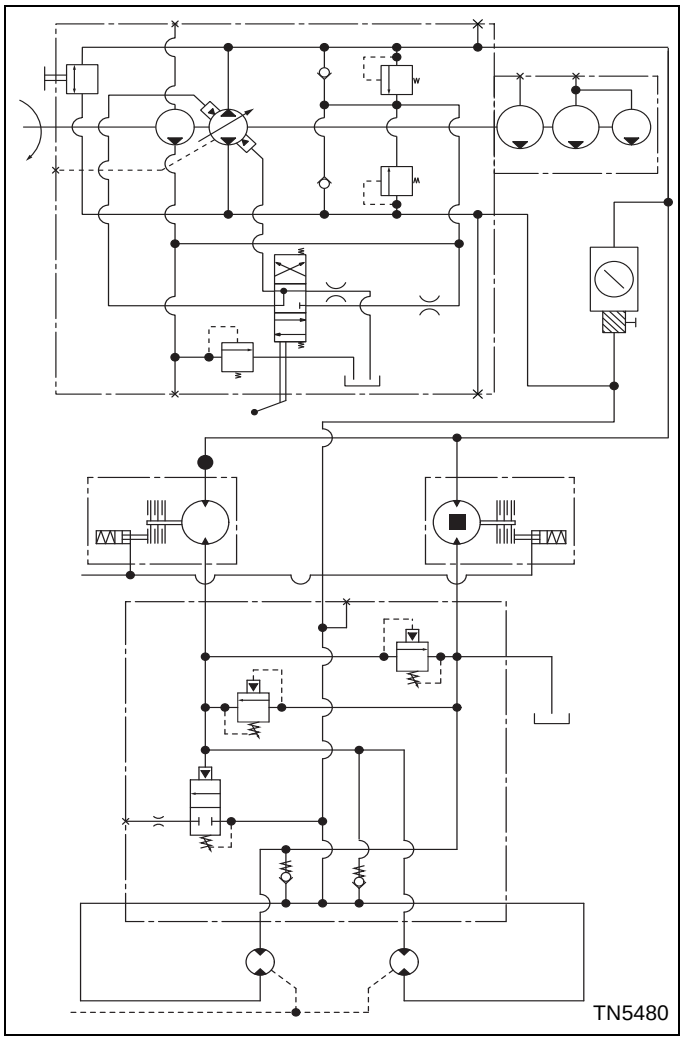


Figure 3-37: Wheel Motors Test—Install Blocking Disk to location (1) and Install Wheel Restraint to Right Front Wheel

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 the rear of machine and support with stands because if there is any leakage in the rear wheel motor, the machine will move.

39. Lift rear of machine and support with stands.
40. Open flow meter valve completely before starting engine.

NOTE

Verify engine rpm is within specification (2920 ± 50 rpm) to ensure accurate hydraulic test results.

41. Start engine, release brake, and run at full throttle (2920 ± 50 rpm).
42. Adjust flow lock tool (3) to allow pump to produce 15 gpm (57 lpm) in the forward direction.
43. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve until a reading of 2000 psi (138 bar) or one-half of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
44. After warming the hydraulic oil, verify flow lock tool is adjusted to allow pump to produce 15 gpm (57 lpm) in the forward direction.
45. Slowly close flow meter valve until pressure reaches 2700 psi (186 bar). Read and record loaded flow.
46. Stop engine, apply brake, and return flow lock tool to neutral position.
47. Calculate right front wheel motor leakage. (Step 10 of traction pump test on page 3-27 – Step 45 / Step 10 of traction pump test on page 3-27 x 100 = Leak Percentage)

    Is right front wheel motor leakage 10% or less?

    YES *The right front wheel motor is good. Proceed to step 48.*

    NO *Proceed to next question.*

    Is right front wheel motor leakage 11% to 20%?

    YES *The right front wheel motor is marginal. Additional testing is required. Proceed to step 48.*

    NO *Proceed to next question.*

    Is right front wheel motor leakage 21% or more?

    YES *Repair or replace right front wheel motor. (See "Front Wheel Motor" on page 3-47.)*

48. Remove wheel restraint from right front 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 machine, or the machine will move.

49. Lift front of machine and support with jackstands.

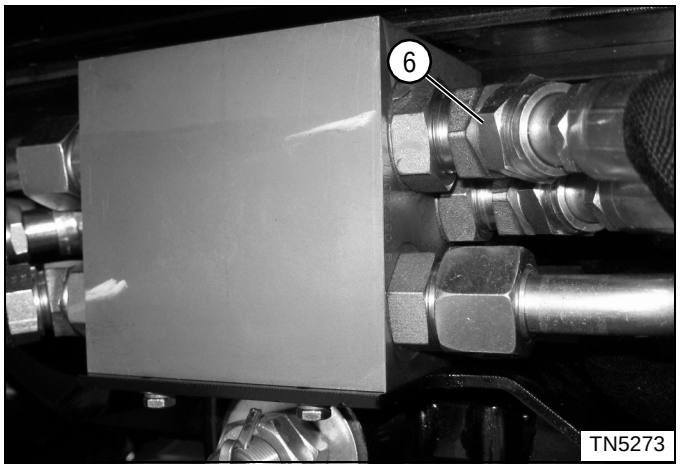


Figure 3-38

50. Install blocking disk at location (6) of 4WD valve.

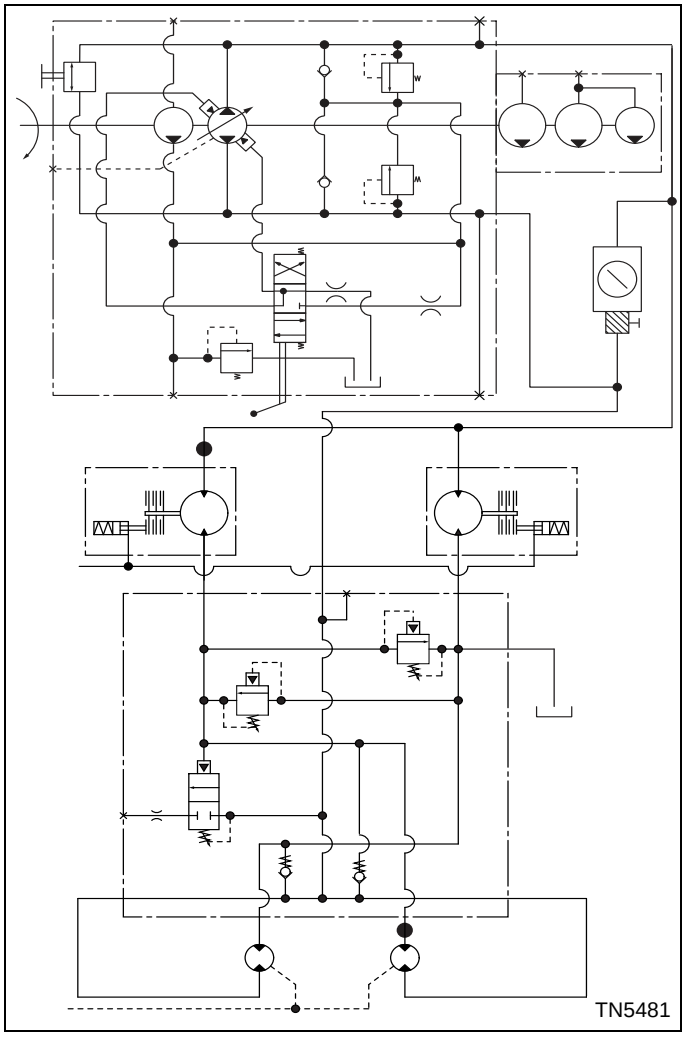


Figure 3-39: Wheel Motors Test—Install Blocking Disk to Location (6) of 4WD Valve

51. Open flow meter valve completely before starting engine.

NOTE

Verify engine rpm is within specification (2920 ± 50 rpm) to ensure accurate hydraulic test results.

52. Start engine, release brake, and run at full throttle (2920 ± 50 rpm).
53. Adjust flow lock tool (3) to allow pump to produce 15 gpm (57 lpm) in the forward direction.
54. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve until a reading of 2000 psi (138 bar) or one-half of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
55. After warming the hydraulic oil, verify flow lock tool is adjusted to allow pump to produce 15 gpm (57 lpm) in the forward direction.
56. Slowly close flow meter valve until pressure reaches 2700 psi (186 bar). Read and record loaded flow.
57. Stop engine, apply brake, and return flow lock tool to neutral position.
58. Calculate right check valve leakage. (Step 45 – Step 56 / Step 45 x 100 = Leak Percentage)

    Is right check valve leakage 10% or less?

    YES *The right check valve is good. Proceed to Step 59.*

    NO *Proceed to next question.*

    Is right check valve leakage 11% to 20%?

    YES *The right check valve is marginal. Additional testing is required. Continue to step 59.*

    NO *Proceed to next question.*

    Is right check valve leakage 21% or more?

    YES *Repair or replace right check valve. (See “4WD Valve” on page 3-45.)*

59. Remove blocking disk from location (6) of 4WD valve.
60. Install wheel restraint to right rear wheel.

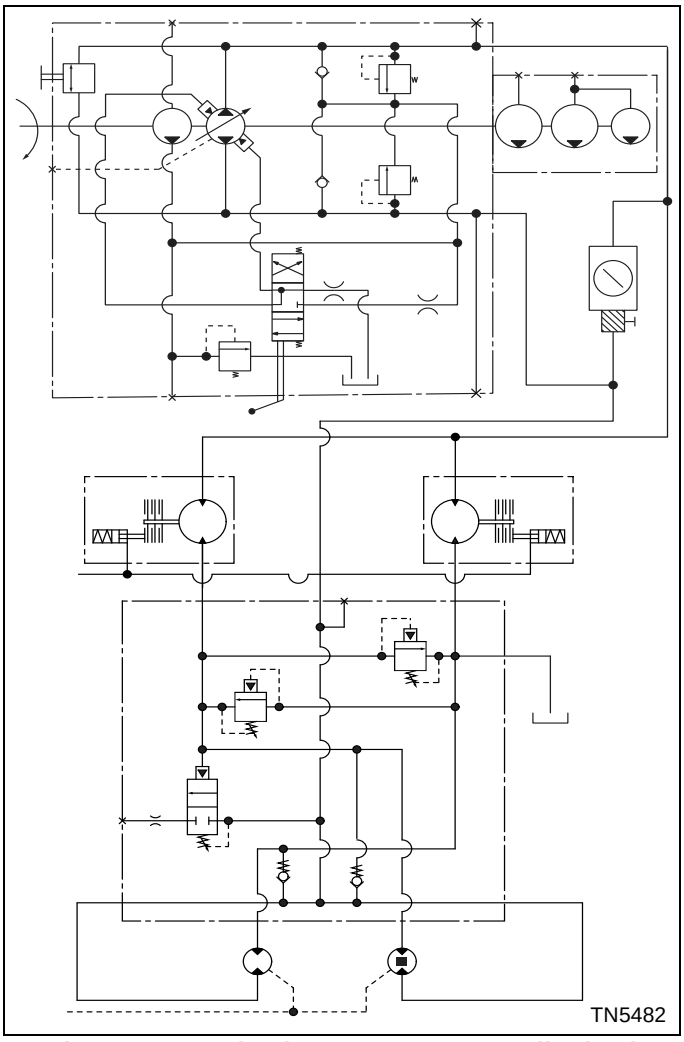


Figure 3-40: Wheel Motors Test—Install Wheel Restraint to Right Rear Wheel

61. Open flow meter valve completely before starting engine.

NOTE

Verify engine rpm is within specification (2920 ± 50 rpm) to ensure accurate hydraulic test results.

62. Start engine, release brake, and run at full throttle (2920 ± 50 rpm).
63. Adjust flow lock tool (3) to allow pump to produce 15 gpm (57 lpm) in the forward direction.
64. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve until a reading of 2000 psi (138 bar) or one half of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
65. After warming the hydraulic oil, verify flow lock tool is adjusted to allow pump to produce 15 gpm (57 lpm) in the forward direction.
66. Slowly close flow meter valve until pressure reaches 2700 psi (186 bar). Read and record loaded flow.

67. Stop engine, apply brake, and return flow lock tool to neutral position.
68. Calculate right rear wheel motor leakage. (Step 56 – Step 66 / Step 56 x 100 = Leak Percentage)

    Is right rear wheel motor leakage 10% or less?

    YES *The right rear wheel motor is good. Proceed to step 69.*

    NO *Proceed to next question.*

    Is right rear wheel motor leakage 11% to 20%?

    YES *The right rear wheel motor is marginal. Repair or replace as needed.*

    NO *Proceed to next question.*

    Is right rear wheel motor leakage 21% or more?

    YES *Repair or replace right rear wheel motor. (See "Rear Wheel Motor" on page 3-60.)*
69. Disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
70. Install and connect all components as noted prior to test.
71. Check hydraulic oil level. Add oil as needed. (Refer to "Safety, Operation, and Maintenance Manual" for correct oil specifications.)

Neutral Adjust—Servo

See Figures 3-41 through 3-43.

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
• -6 ORB Test Hose 5000 psi (345 bar)
• Pressure Gauge 5000 psi (345 bar)

1. Remove the center floorboard and the seat.
2. Bypass seat switch.

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 machine, or the machine will move.

3. Lift the machine so that front and rear wheels are off the ground and support with jackstands.

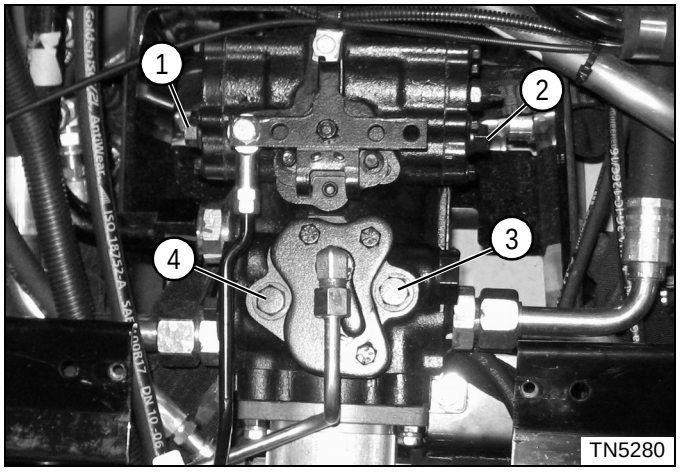


Figure 3-41

4. Install test hose between ports (1 and 2).
5. Install pressure gauges to the system pressure gauge ports (3 and 4).

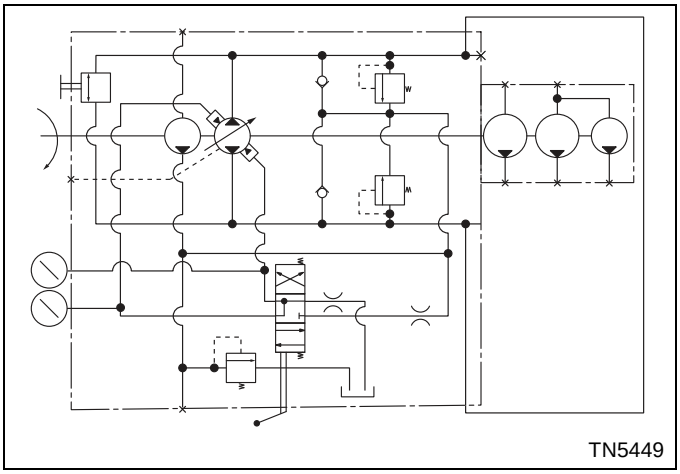


Figure 3-42: Neutral Adjust Servo—Pressure gauges at ports 3 and 4

NOTE

Verify engine rpm is within specification (2920 ± 50 rpm) to ensure accurate hydraulic test results.

6. Start engine, release brake, and run at full throttle (2920 ± 50 rpm).
7. Operate hydraulic system until oil temperature is at 120–150° F (49–65° C).

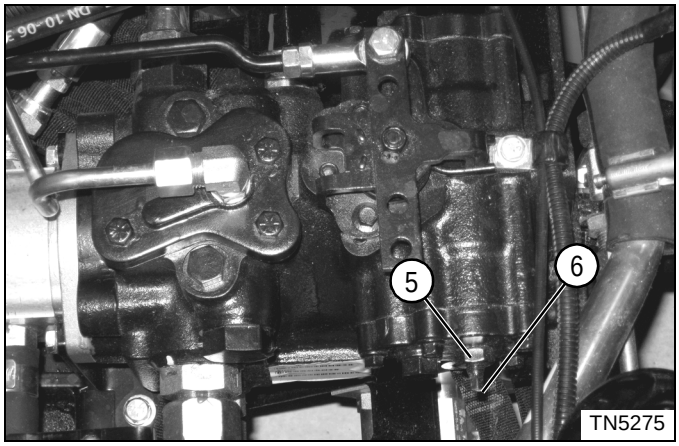


Figure 3-43

8. Loosen servo lock nut (5) while holding the servo adjustment screw (6) in position.
9. Turn servo adjustment screw (6) until the two system pressure gauge readings are equal.
10. Turn servo adjustment screw (6) clockwise until one of the system pressures starts to increase.
11. Noting the amount of rotation, turn servo adjustment screw (6) counterclockwise until the other system pressure starts to increase.
12. Turn servo adjustment screw (6) clockwise half the amount of rotation noted earlier.
13. While holding servo adjustment screw (6) from turning, tighten servo lock nut (5) to 15 ± 3 lb-ft (20 ± 4 N·m).
14. Stop the engine and apply brake.
15. Remove pressure gauges from ports (3 and 4) and remove hose between ports (1 and 2).
16. Adjust transmission neutral (creep). (See “Adjust Transmission Neutral (Creep)” on page 3-17.)

Repair

Drive Shaft

Removal and Installation

See Figure 3-44.

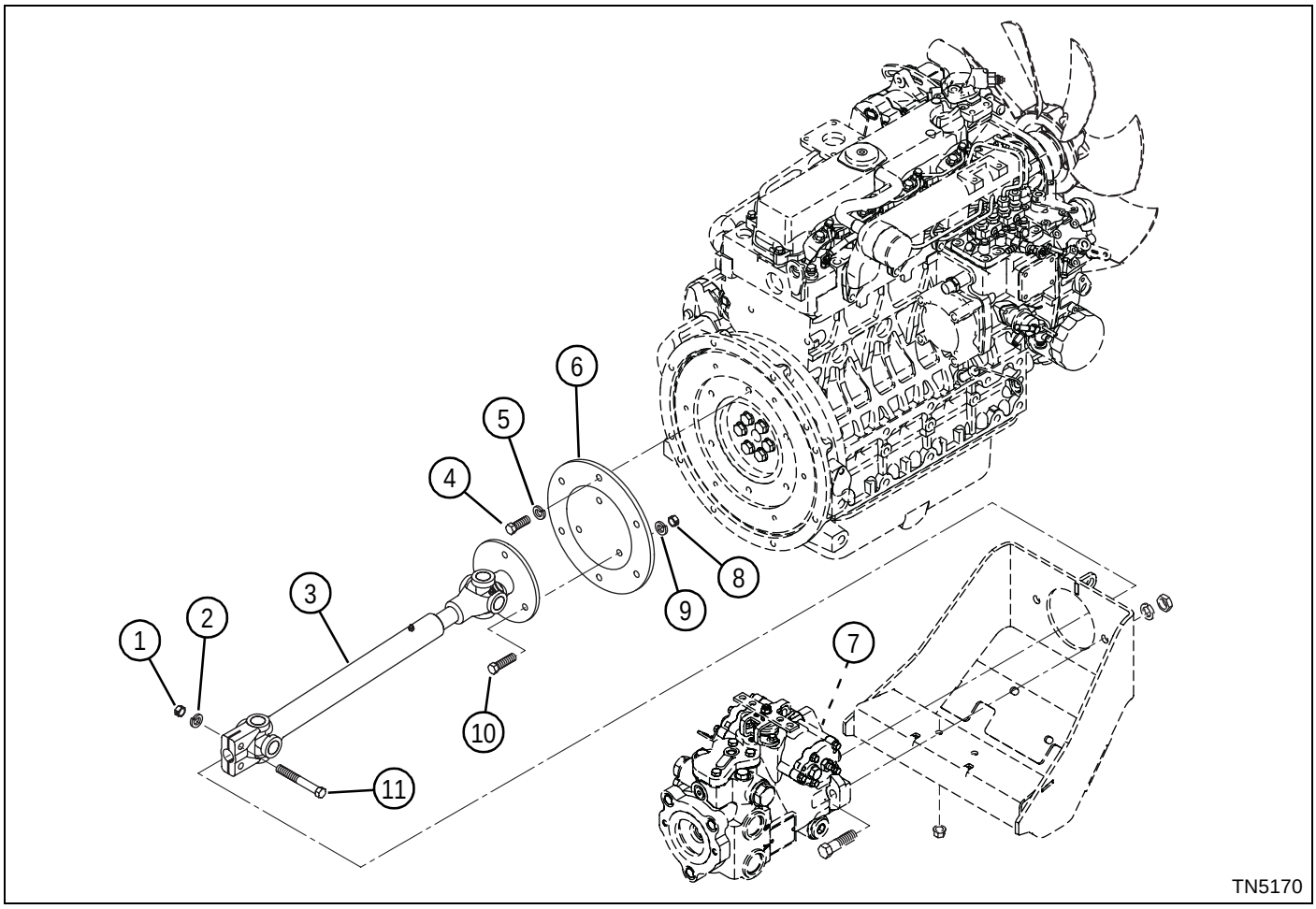


Figure 3-44

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove lock nut (1), lock washer (2), and screw (11).
3. Disconnect drive shaft (3) from traction pump input shaft (7).
4. Support the drive shaft (3) using a suitable lifting device.
5. Remove six screws (4) and lock washers (5), and remove the drive shaft flange (6) and drive shaft (3) as an assembly.
6. Remove three lock nuts (8), lock washers (9), and screws (10), and remove drive shaft flange (6) from drive shaft (3).

Installation Notes

- *Install drive shaft by reversing the order of removal.*
- *The tip of the pump shaft must be flush to within 0.125 inch (3 mm) of the inside of the yoke.*

Traction Pump

Removal and Installation

See Figures 3-45 through 3-50.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Drain hydraulic oil tank.
3. Remove seat. (See “Seat and Mount Plate” on page 9-9.)
4. Remove gear pump. (See “Gear Pump” on page 6-54.)

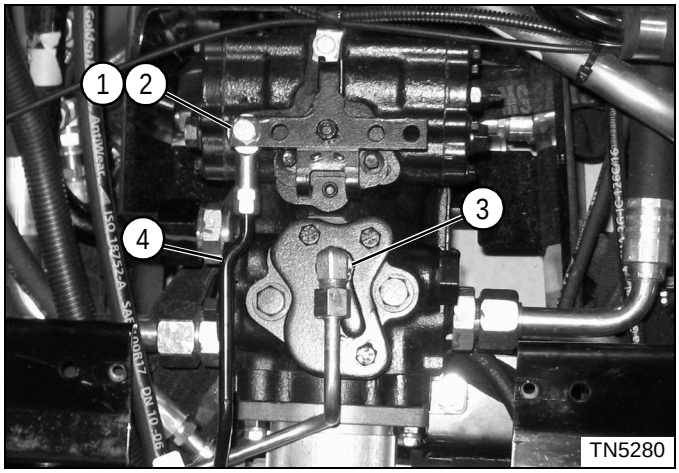


Figure 3-45

5. Remove nut (1) and screw (2), and disconnect control rod (4).

NOTES

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

6. Disconnect hose (3).

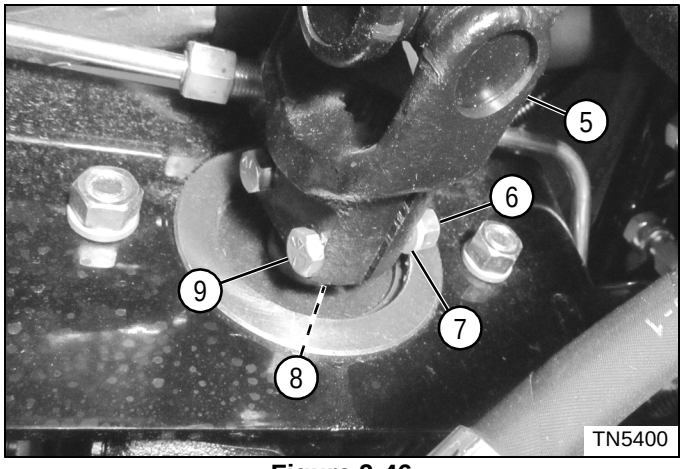


Figure 3-46

7. Remove lock nut (6), lock washer (7), and screw (9).
8. Disconnect drive shall (5) from traction pump input shaft (8).
9. Support the drive shaft (5) using a suitable lifting device.

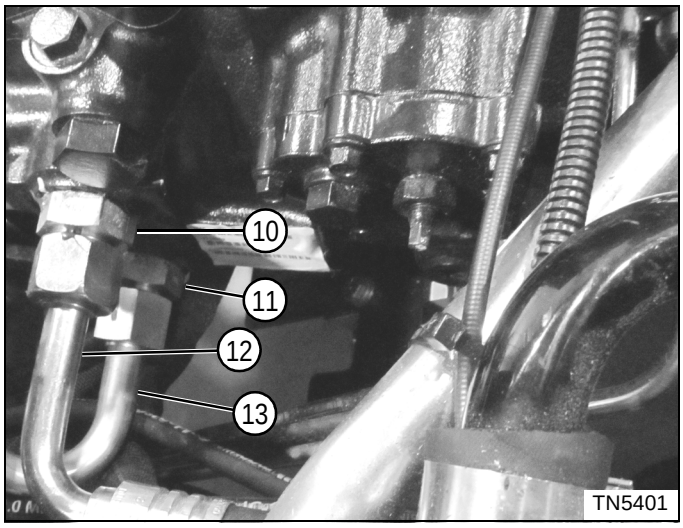


Figure 3-47

10. Disconnect hydraulic tube (12) from fitting (10).
11. Disconnect hydraulic tube (13) from fitting (10).

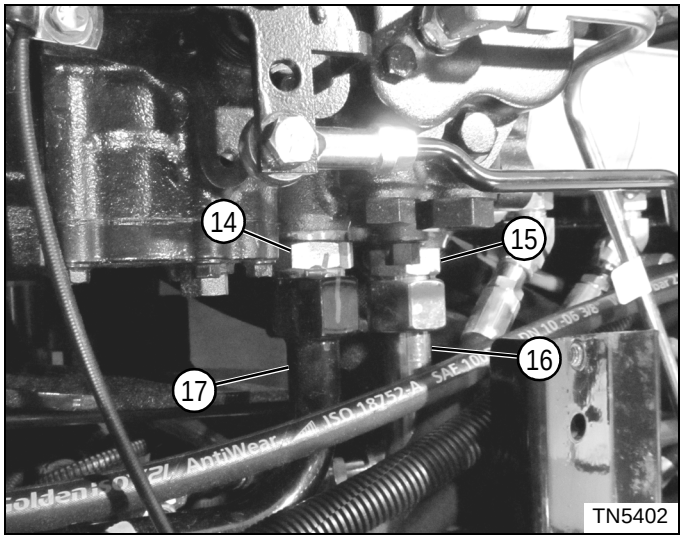


Figure 3-48

12. Disconnect hydraulic tube (17) from fitting (14).
13. Disconnect hydraulic tube (16) from fitting (15).

WARNING

The traction pump weighs approximately 131 lb (59 kg). Prevent personal injury. Use a properly rated lifting device. Always be sure the load is balanced before lifting.

14. Attach a suitable lifting device to the traction pump (21).

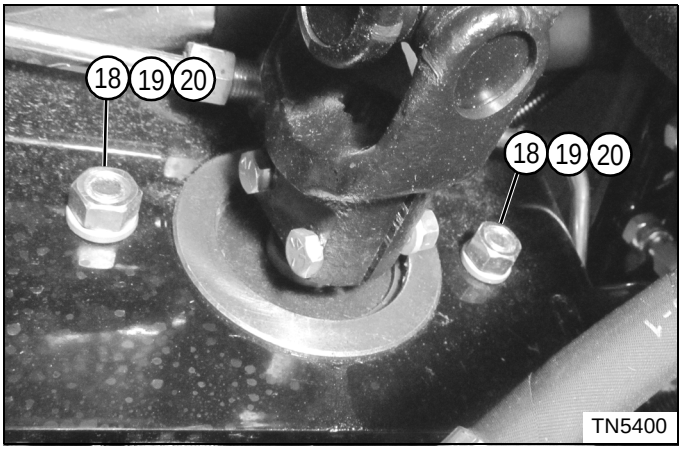


Figure 3-49

15. Remove nuts (18), lock washers (19), and screws (20).
16. Remove traction pump (21).

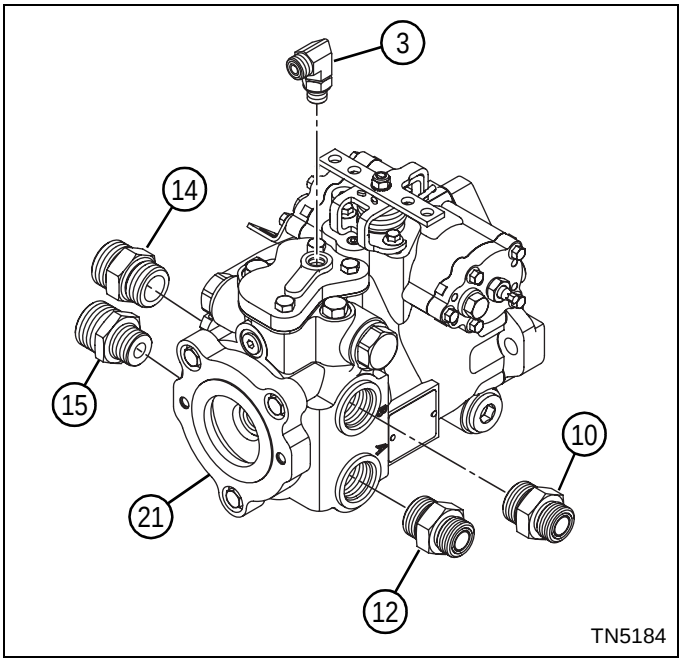


Figure 3-50

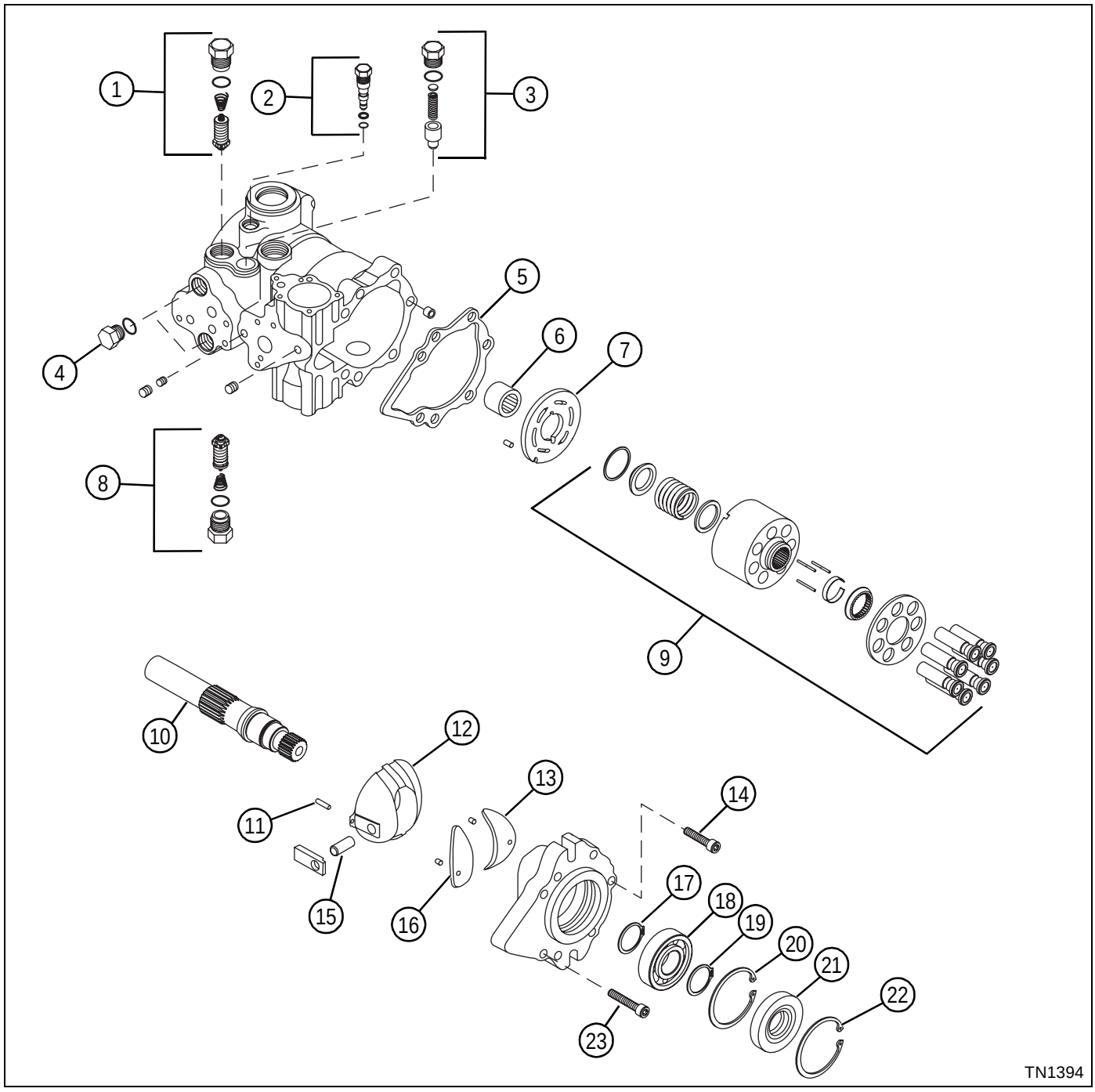
17. Remove fitting (3).
18. Remove fittings (14 and 15).
19. Remove fittings (12 and 10).

Installation Notes

- *Install the traction pump by reversing the order of removal.*
- *Ensure new O-rings are in place before installing hoses on fittings.*
- *Tighten fittings (14 and 15) to 160 lb-ft (217 N·m).*
- *Tighten fittings (12 and 10) to 160 lb-ft (217 N·m).*
- *Tighten fitting (3) to 110 lb-ft (149 N·m).*
- *If metal debris is found in system oil or motor, use a portable in-line filter to cleanse the system prior to start-up. (See “Portable In-Line Filter” on page 3-5.)*
- *Fill the hydraulic tank. (Refer to “Safety, Operation, and Maintenance Manual” for the correct oil specifications.)*
- *Start engine. Check for leaks and repair as necessary.*

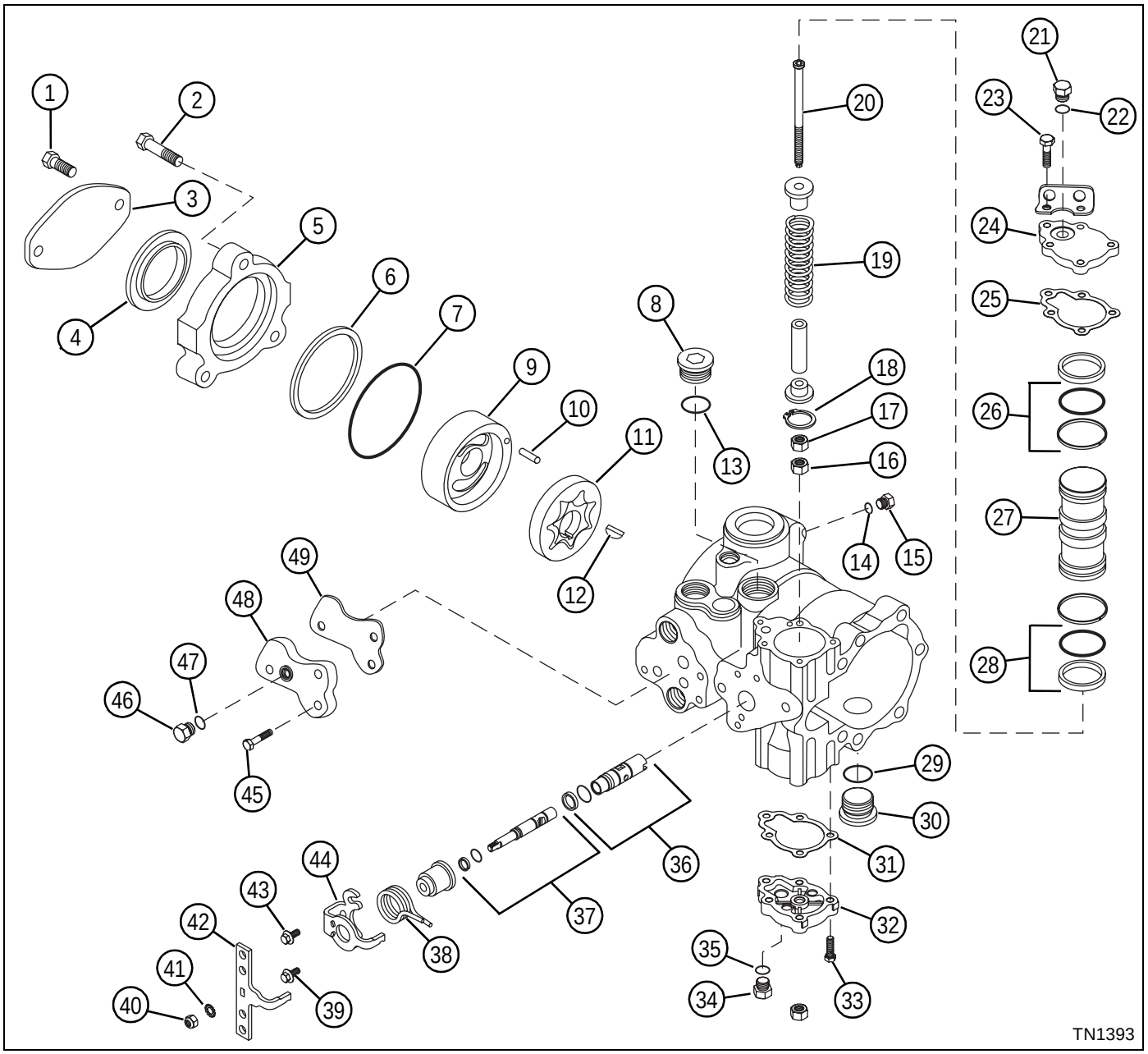
Disassembly, Inspection, and Assembly

See Figures 3-51 and 3-52.



1	Relief Valve	9	Cylinder Block Kit	17	Ring
2	Bypass Valve	10	Pump Shaft	18	Roller Bearing
3	Charge Pressure Relief Valve	11	Pin	19	Ring
4	Plug	12	Variable Swash Plate	20	Retaining Ring
5	Front Cover Gasket	13	Journal Bearing	21	Shaft Seal
6	Needle Bearing	14	Screw	22	Ring
7	Valve Plate	15	Pin	23	Screw
8	Relief Valve	16	Journal Bearing		

Figure 3-51



1	Screw	14	O-Ring	27	Piston	40	Nut
2	Screw	15	Plug	28	Piston Ring Kit	41	Washer
3	Flange Cover	16	Nut	29	O-Ring	42	Control Handle
4	Flange	17	Nut	30	Plug	43	Screw
5	Pad Adapter	18	Snap Ring	31	Servo Cover Gasket	44	Neutral Bracket
6	Temper Load Ring	19	Spring	32	Servo Cover	45	Screw
7	O-Ring	20	Screw	33	Screw (5)	46	Plug
8	Plug	21	Plug	34	Plug	47	O-Ring
9	Gerotor Cover	22	O-Ring	35	O-Ring	48	Suction Filter Adapter
10	Pin	23	Screw	36	Sleeve Assembly	49	Suction Filter Adapter Seal
11	Gerotor	24	Servo Cover	37	Spool Assembly		
12	Drive Key	25	Servo Cover Gasket	38	Neutral Return Spring		
13	O-Ring	26	Piston Ring Kit	39	Screw		

Figure 3-52

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove traction pump. (See “Traction Pump” on page 3-39.)
3. Disassemble traction pump as shown in Figure 35.
4. Place parts in assembly order on a clean work area as they are removed.

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.

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).*
- *Inspect all parts for cracks, nicks, burrs, and excessive wear. Inspect for scoring, galling, and scratches on surfaces. Replace parts as necessary.*

Assembly Notes

Required Materials
Overhaul Seal and Gasket Kit

- *Assemble the pump by reversing the order of disassembly.*
- *Install new O-rings and seals. Use clean grease to keep seals in position.*

Brake Release Valve

Removal and Installation

See Figures 3-53 and 3-54.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Drain hydraulic tank.
3. Remove center floorboard.

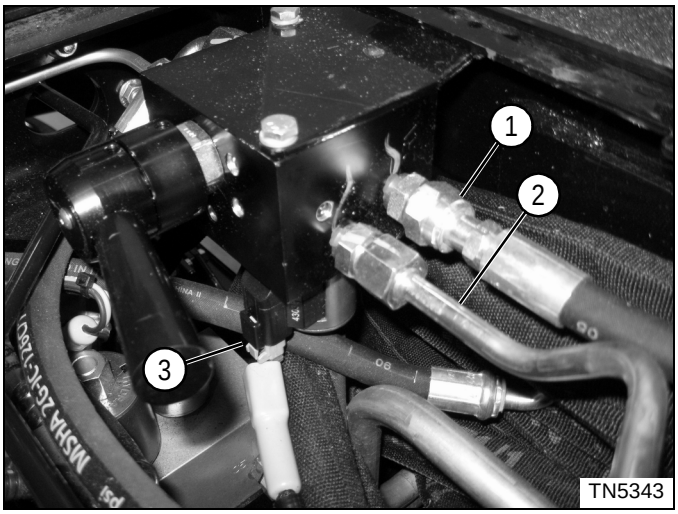


Figure 3-53

4. Disconnect wiring connector (3) from solenoid valve.

NOTES

- *Label all hydraulic hoses and tubes before disconnecting to ensure correct installation.*
- *Plug hydraulic hoses and tubes after disconnecting to prevent the loss of hydraulic oil.*

5. Disconnect tube (2) from fitting in “CHG” port.
6. Disconnect tube (1) from fitting in “DRN” port.

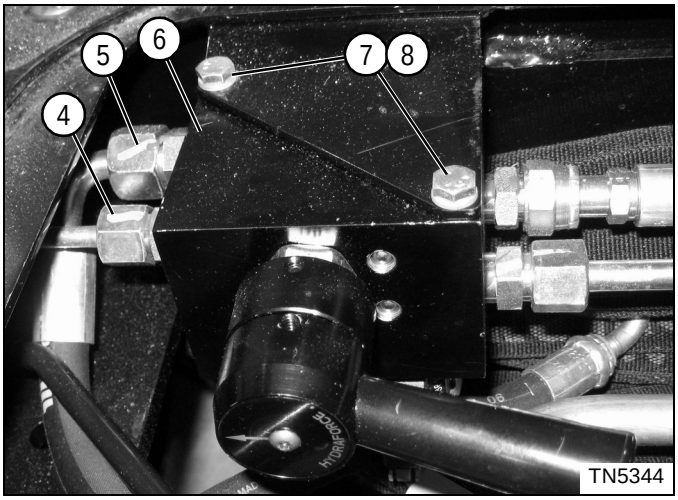


Figure 3-54

7. Disconnect hose (4) from fitting in “ST” port.
8. Disconnect hose (5) from fitting in “BR” port.
9. Support the brake release valve (6).
10. Remove two screws (7) and lock washers (8), and remove the brake release valve (6).

Disassembly, Inspection, and Assembly

See Figures 3-55 and 3-56.

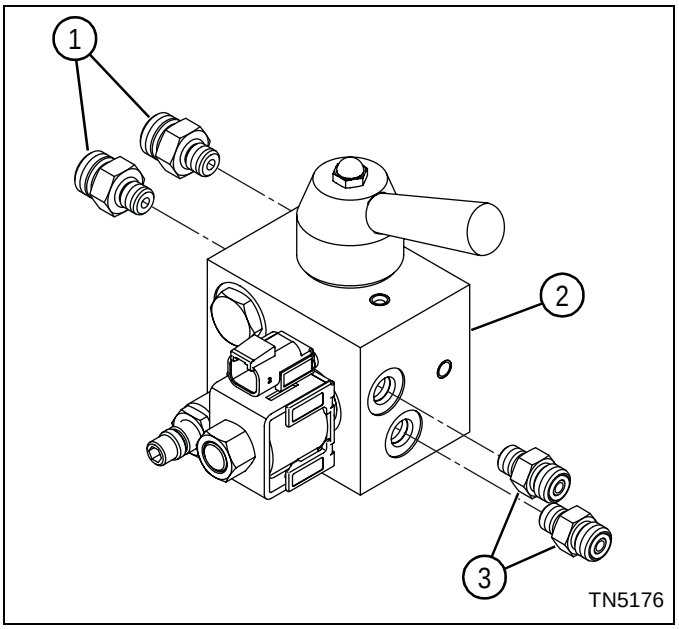
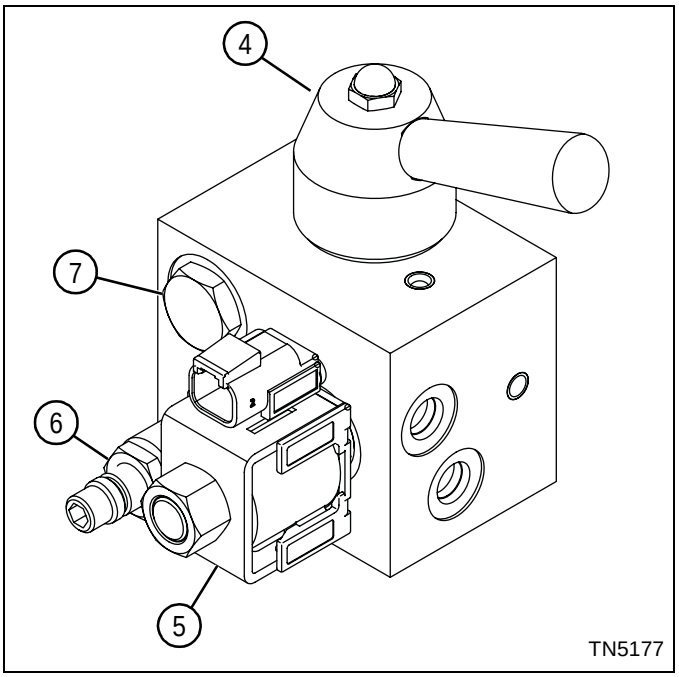


Figure 3-55

1. Remove fittings (1 and 3) from the brake release valve (2).



4 Direction Control Valve
5 Solenoid Valve
6 Relief Valve
7 Check Valve

Figure 3-56

2. Remove, inspect, and replace lift valve components as needed.

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.

3. Clean all parts using clean solvent, and dry using compressed air.
4. Inspect all parts for wear or damage. Replace parts as needed.

Assembly Notes

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.

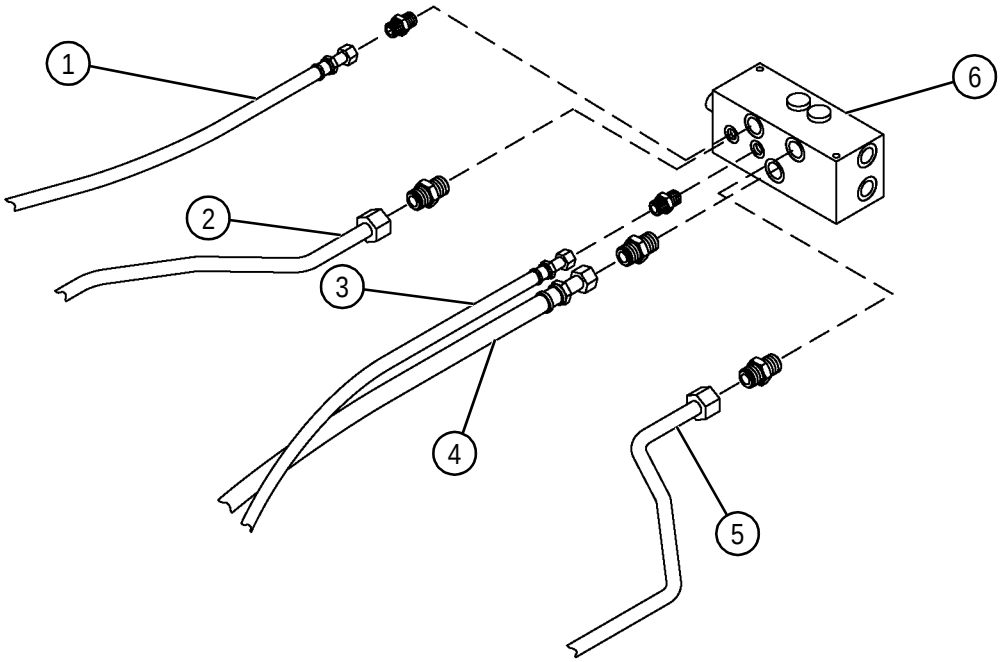
Required Materials
Seal Kit, Direction Control Valve (Jacobsen P/N 4219540)
Handle Kit (Jacobsen PN 4237106)
Seal Kit, Check Valve (Jacobsen PN 4219420)
Seal Kit, Relief Valve (Jacobsen PN 4219420)
Seal Kit, Solenoid Valve (Jacobsen PN 4235361)

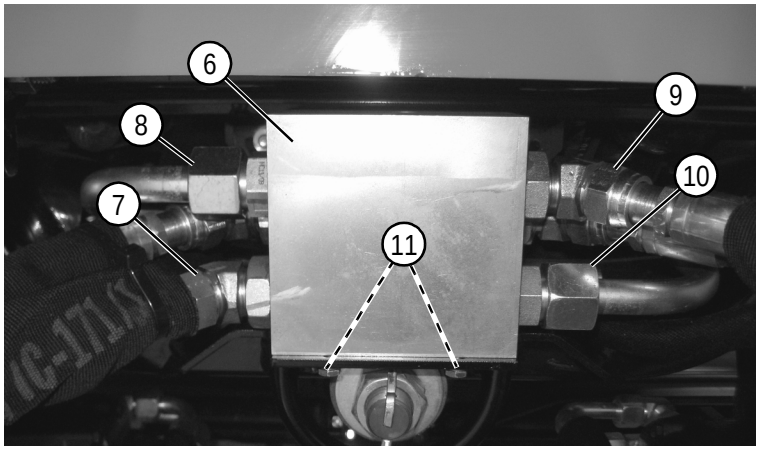
- *Assemble the lift valve by reversing the order of disassembly.*
- *Lubricate all O-rings prior to assembly.*
- *Tighten fittings (1 and 3) to 15 lb-ft (20 N·m).*

4WD Valve

Removal and Installation

See Figure 3-57.





TN1511, TN5409

Figure 3-57

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Drain hydraulic tank.

NOTES

- *Label all hydraulic hoses before disconnecting to ensure correct installation.*
- *Plug hydraulic hoses after disconnecting to prevent the loss of hydraulic oil.*

3. Disconnect hoses (1–5).
4. Disconnect hoses (7–10).
5. Remove mounting screws, flat washers, and lock washers (11).
6. Remove 4WD valve (6).

Installation Notes

- *Install 4WD valve by reversing the order of removal.*
- *Ensure new O-rings are in place before installing hoses on fittings.*
- *If metal debris is found in system oil or motor, use a portable in-line filter to cleanse the system prior to start-up. (See “Portable In-Line Filter” on page 3-5.)*
- *Fill the hydraulic tank. (Refer to “Safety, Operation, and Maintenance Manual” for the correct oil specifications.)*
- *Start engine. Check for leaks and repair as necessary.*

Disassembly, Inspection, and Assembly

See Figures 3-58 and 3-59.

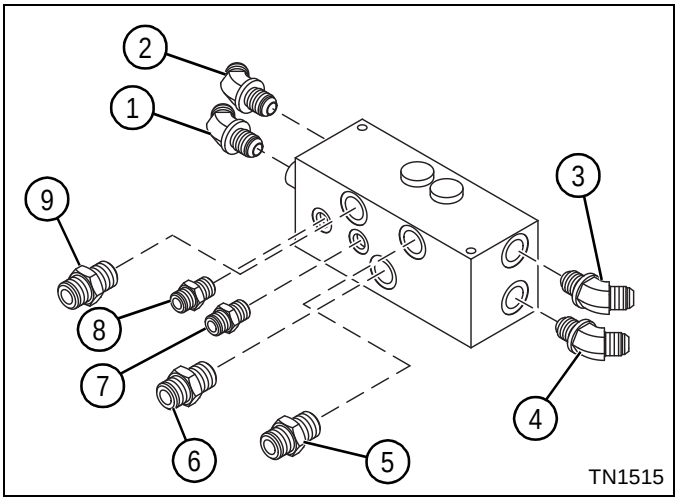


Figure 3-58

1. Remove fittings (1–9) from the 4WD valve.

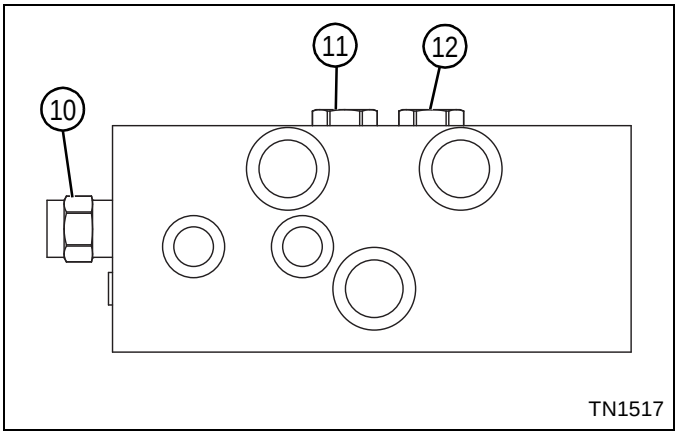


Figure 3-59

2. Remove hot oil shuttle (10).
3. Remove check valves (11 and 12).

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 wear or damage. Replace parts as needed.

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, Check Valve (Jacobsen PN 5003579) Seal Kit, Pilot Operated Internal Vent Valve (Jacobsen PN 5003579)

- *Assemble the 4WD valve by reversing the order of disassembly.*
- *Lubricate all O-rings prior to assembly.*

Front Wheel Motor

Removal and Installation

See Figures 3-60 and 3-61.

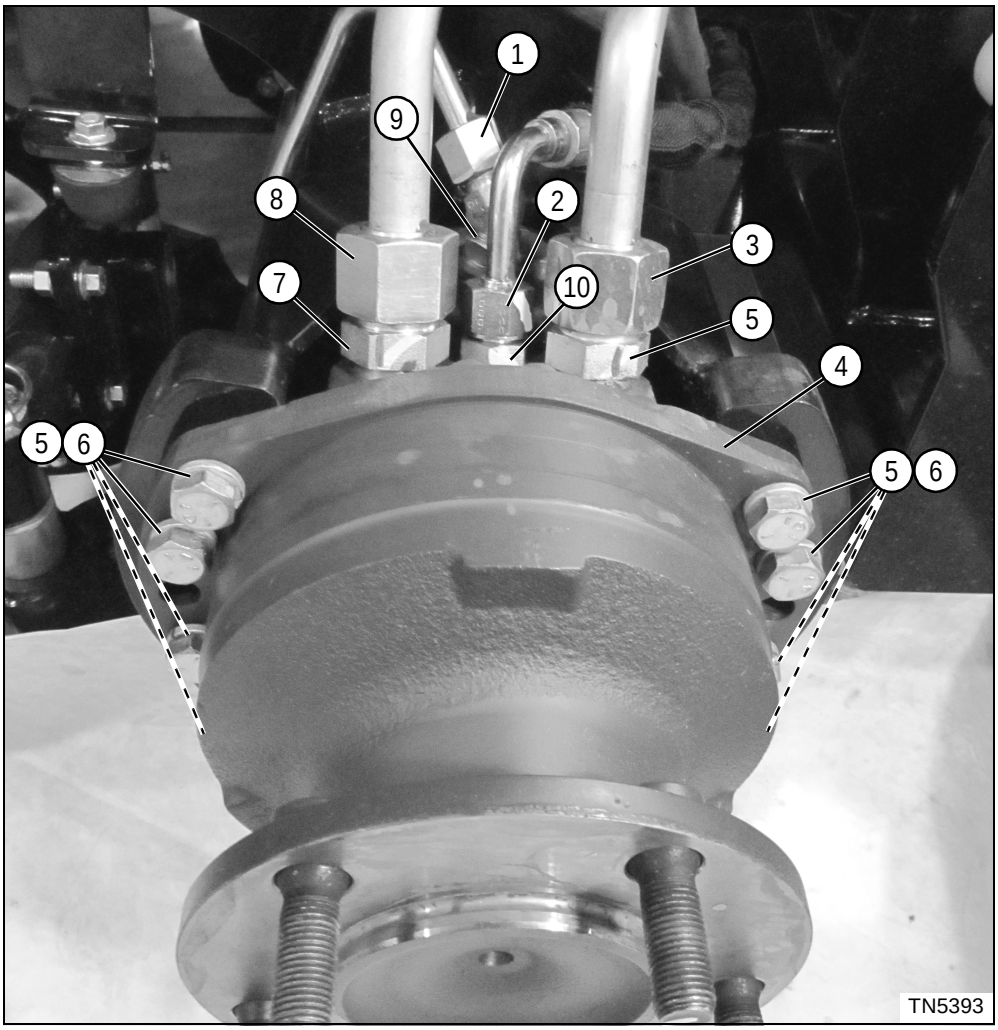


Figure 3-60

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove front wheel. (See “Front Wheels” on page 9-11.)

NOTES

- *Label all hydraulic hoses and tubes before disconnecting to ensure correct installation.*
- *Plug hydraulic hoses and tubes after disconnecting to prevent the loss of hydraulic oil.*

3. Disconnect brake hydraulic tube (1) from fitting (9) in port “X” on the wheel motor (4).
4. Disconnect drain hose (2) from fitting (10) in port “1” on the wheel motor (4).
5. Disconnect hydraulic tubes (8 and 3) from fittings (7 and 5) in ports “R” and “L” on the wheel motor (4).
6. Support the wheel motor using a suitable lifting device.
7. Remove eight screws (5) and lock washers (6), and remove wheel motor (4) from the axle.

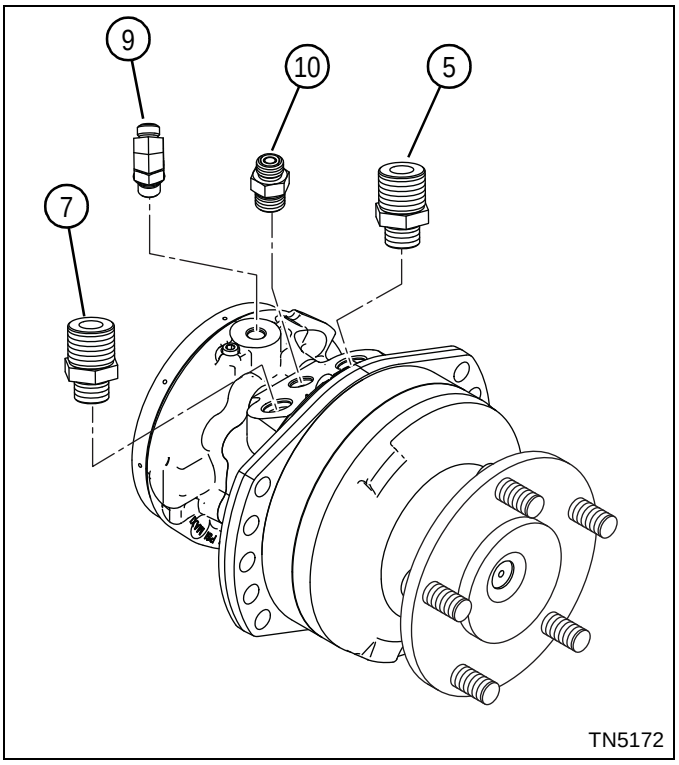


Figure 3-61

8. Remove fittings (7 and 5) from wheel motor ports “R” and “L.”
9. Remove fitting (10) from wheel motor port “1.”
10. Remove fitting (9) from wheel motor port “X.”

Installation Notes

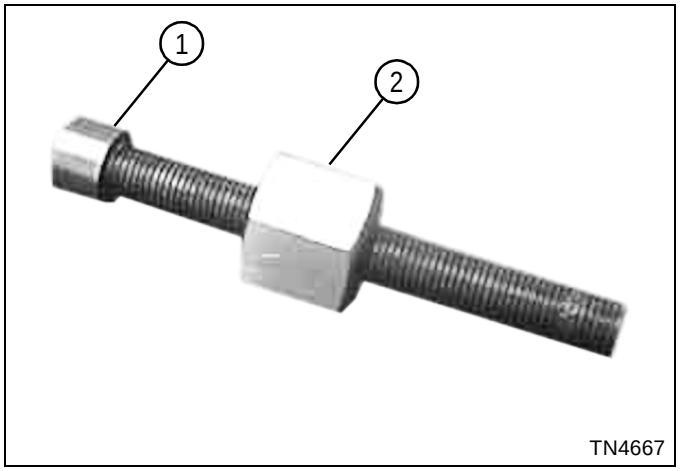
Required Materials
Anti-Seize Compound

- *Install the front wheel motor by reversing the order of removal.*
- *Tighten fittings (7 and 5) to 90 lb-ft (122 N·m).*
- *Tighten brake fitting (9) to 300 in-lb (34 N·m).*
- *Tighten drain fitting (10) to 132 in-lb (15 N·m).*
- *Tighten hydraulic tubes (8 and 3) to 65 lb-ft (88 N·m).*
- *Tighten drain hose (2) to 180 in-lb (20 N·m).*
- *Tighten brake tube (1) to 132 in-lb (15 N·m).*
- *If metal debris is found in system oil or motor, use a portable in-line filter to cleanse the system prior to start-up. (See “Portable In-Line Filter” on page 3-5.)*
- *Check hydraulic oil level. Add oil as needed. (Refer to “Safety, Operation, and Maintenance Manual” for the correct oil specifications.)*

Brake Mandrel Bolt and Nut

See Figure 3-62.

Required Tools or Equipment
Brake Mandrel Bolt and Nut



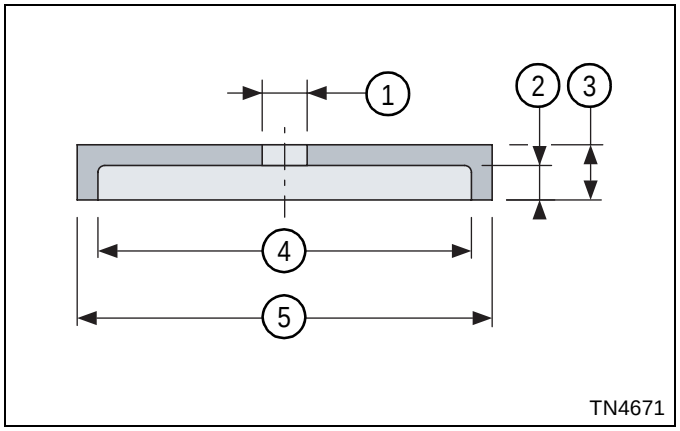
1 M12 x 150 mm Bolt Class 10.9 Threaded Full Length
2 Hh12 Nut

Figure 3-62: Brake Mandrel Bolt and Nut

Brake Spring Washer Compression Mandrel

See Figure 3-63.

Required Tools or Equipment
Brake Spring Washer Compression Mandrel



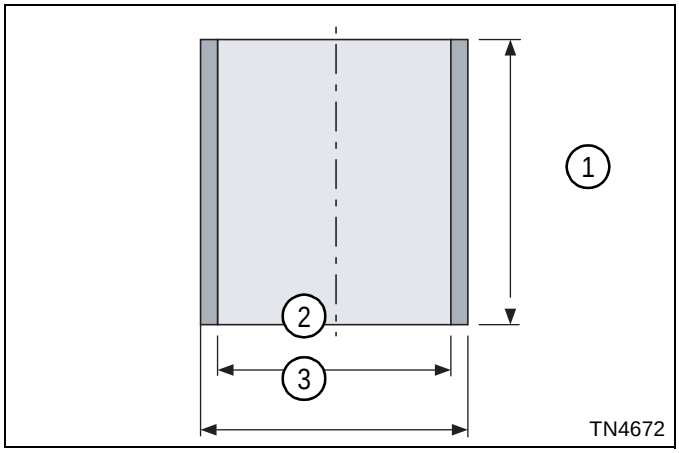
1 0.51 in. (13 mm) Ø Hole
2 0.39 in. (10 mm)
3 1.18 in. (30 mm)
4 3.94 in. (100 mm) Ø
5 4.33 in. (110 mm) Ø

Figure 3-63: Brake Spring Washer Compression Mandrel

Bearing Support and Sealing Ring Mandrel

See Figure 3-64.

Required Tools or Equipment
Bearing Support and Sealing Ring Mandrel



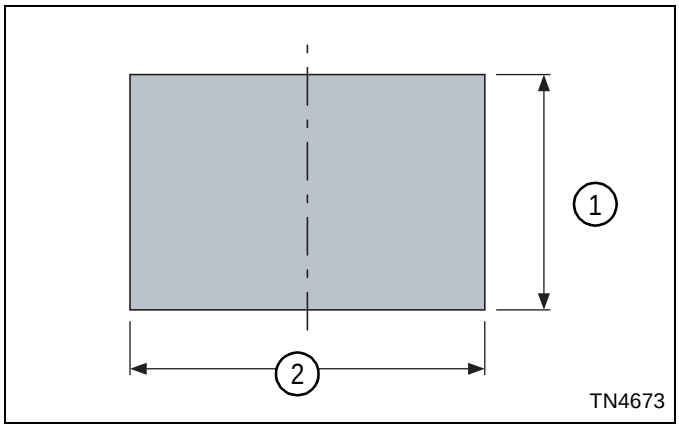
1 4.33 in. (110 mm)
2 1.78 in. (45 mm) Ø
3 2.16 in. (55 mm) Ø

Figure 3-64: Bearing Support and Sealing Ring Mandrel

Bearing Outer Race Mandrel

See Figure 3-65.

Required Tools or Equipment
Bearing Outer Race Mandrel



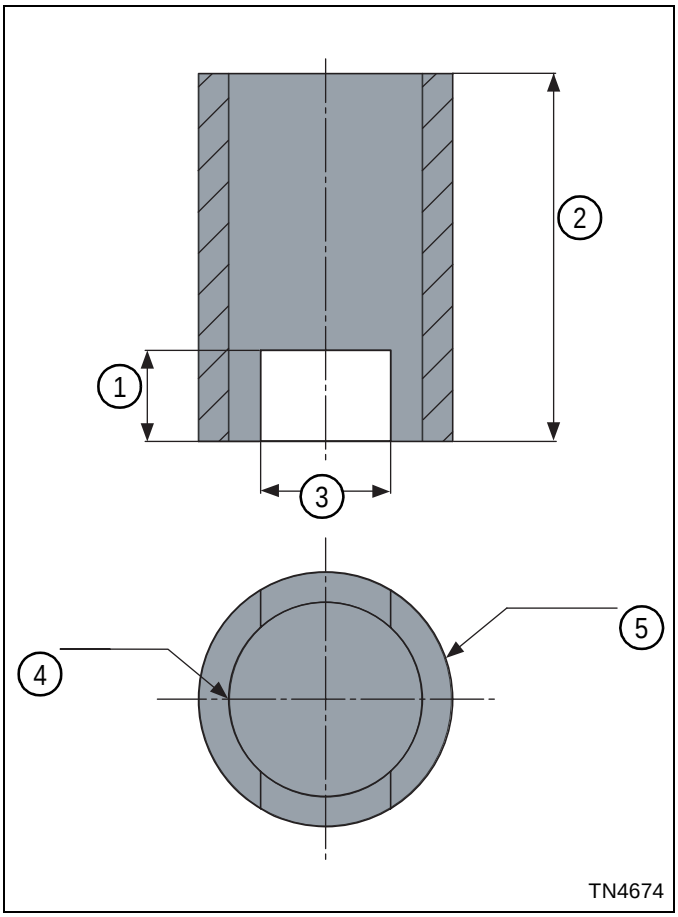
1 1.97 in. (50 mm)
2 3.50 in. (89 mm)

Figure 3-65: Bearing Outer Race Mandrel

Bearing Support Snap Ring Installation/Removal Tool

See Figure 3-66.

Required Tools or Equipment
Bearing Support Snap Ring Installation/Removal Tool

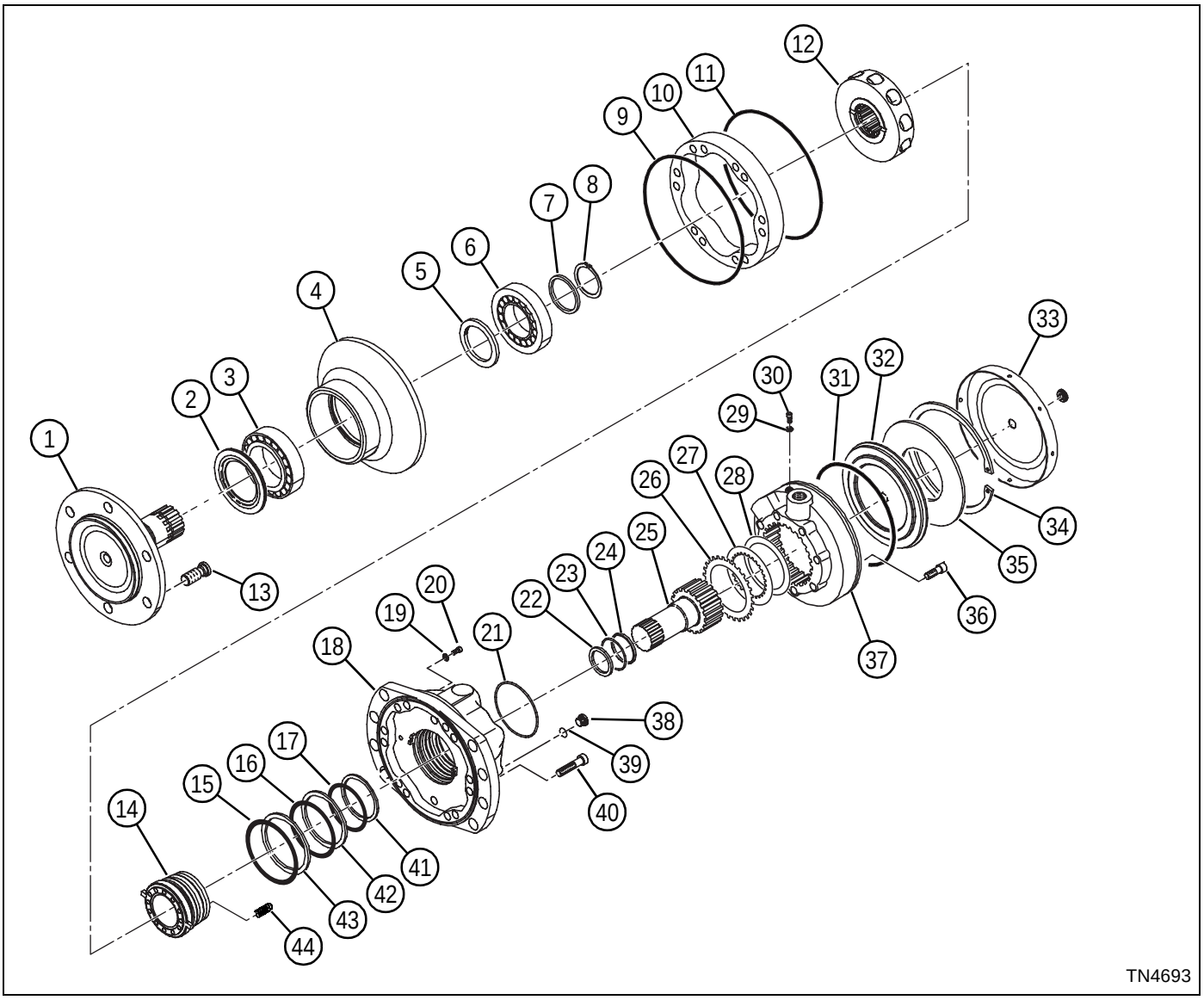


1 1.18 in. (30 mm)
2 3.94 in. (100 mm)
3 1.97 in. (50 mm)
4 2.16 in. (55 mm) Ø
5 2.75 in. (70 mm) Ø

Figure 3-66: Bearing Support Snap Ring Installation/Removal Tool

Disassembly and Inspection

See Figures 3-67 through 3-75.



1	Motor Shaft	12	Rotational Group	23	O-Ring	34	Snap Ring
2	Environmental Seal	13	Stud (5)	24	Backup Ring	35	Spring Washer
3	Roller Bearing	14	Valving	25	Brake Shaft	36	Screw (10)
4	Bearing Support	15	Seal Ring	26	External Brake Discs (21)	37	Brake Housing
5	Radial Lip Seal (with Spring)	16	Seal Ring	27	Internal Brake Discs (20)	38	Plug
6	Roller Bearing	17	Seal Ring	28	Shim(s)	39	Seal
7	Shim Spacer	18	Valving Cover	29	Sealing Washer	40	Screw (12)
8	Snap Ring	19	Sealing Washer	30	Screw	41	Backup Ring
9	Seal	20	Screw	31	O-Ring	42	Backup Ring
10	Cam Ring	21	O-Ring	32	Brake Piston	43	Backup Ring
11	Seal	22	Bushing	33	Brake Cover	44	Spring

Figure 3-67

Brake Disassembly

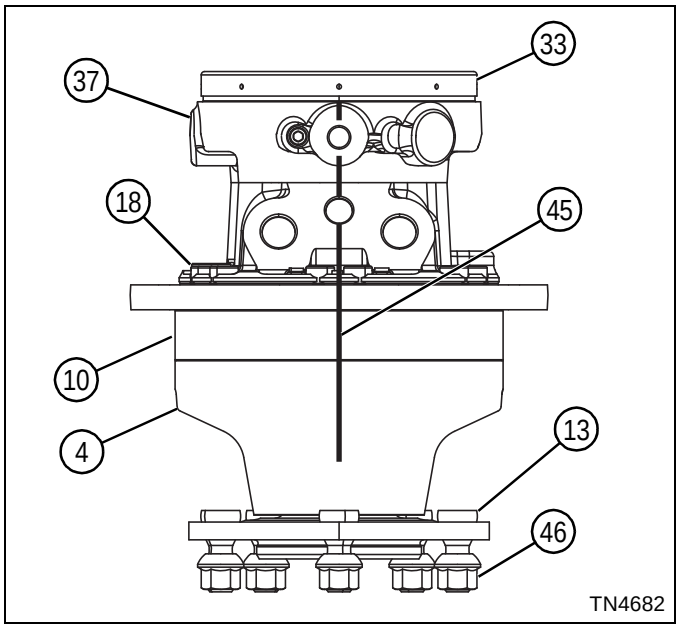


Figure 3-68

1. Install wheel lug nuts (46) on studs (13) to prevent damage to the stud threads, and place the wheel motor on the bearing support so that the brake end of the wheel motor is facing up.
2. Scribe an alignment mark (45) across the side of the brake housing (37), valving cover (18), cam ring (10), and bearing support (4) of the front wheel motor. This mark will be used for proper orientation of components for assembly.
3. Using a pry tool, remove and discard brake cover (33).
4. Compress spring washer (35) by one of the following two methods:

First Method with a Mandrel and Bolt

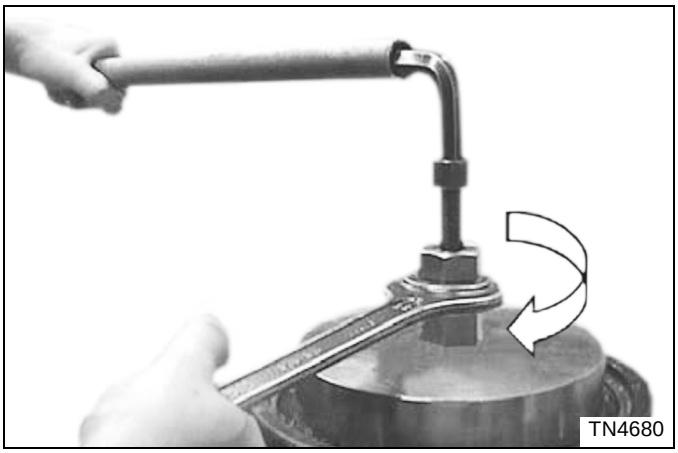


Figure 3-69

a. Install the brake spring washer compression mandrel onto spring washer (35). (See “Brake Mandrel Bolt and Nut” on page 3-48.)

b. Lubricate the brake mandrel bolt threads and nut faces and tighten the brake mandrel bolt into brake piston (32) down to the thread root.

c. Compress spring washer (35) by tightening the brake mandrel nut and locking the brake mandrel bolt until motor shaft (1) turns freely.

Second Method with a Mandrel and Press

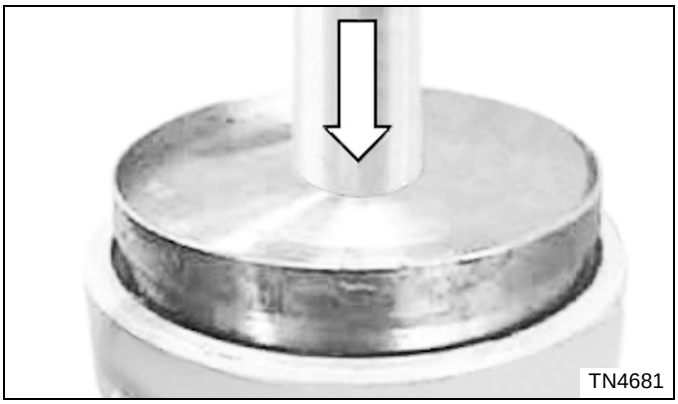


Figure 3-70

a. Install the brake spring washer compression mandrel onto spring washer (35). (See “Brake Spring Washer Compression Mandrel” on page 3-48.)

b. Position the bearing support under a press to avoid any force on the studs.

c. Compress spring washer (35) until motor shaft (1) turns freely.

NOTE

Mark the mounting direction of snap ring (34) prior to removal.

5. Remove snap ring (34), spring washer (35), and brake piston (32).
6. Remove and discard O-ring (31).
7. Remove and discard ten screws (36) and remove brake housing (37).

NOTE

When removing shims (28), mark the mounting order of the shims and note the quantity and total thickness of shims.

8. Remove shims (29) and brake discs (26 and 27).
9. Remove and discard O-ring (21).
10. Remove brake shaft (25).
11. Remove and discard backup ring (24) and O-ring (23).
12. Remove bushing (22).

Motor Disassembly

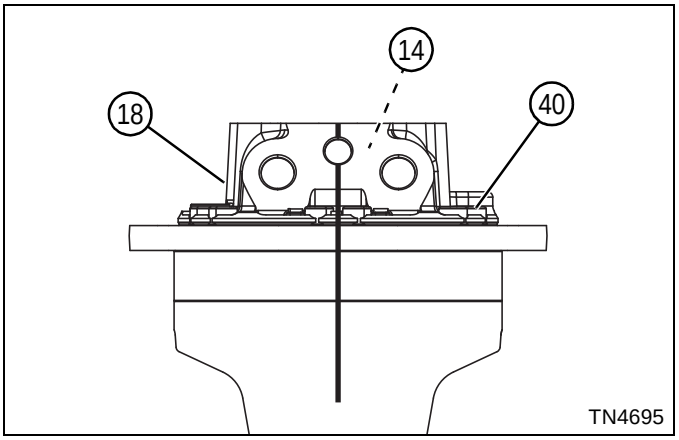


Figure 3-71

13. Remove twelve screws (40).

NOTE

During valving cover (18) removal, valving (14) may remain in valving cover. Hold valving during valving cover removal.

14. Remove valving cover (18).

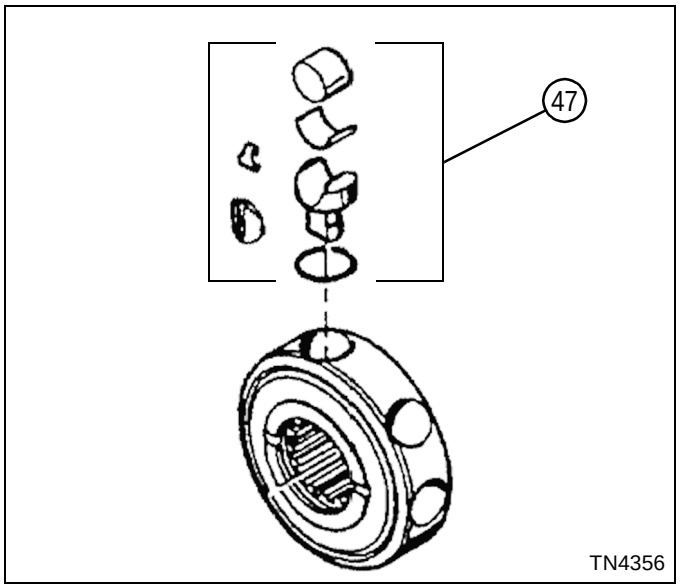


Figure 3-72

NOTE

Be careful not to lose rotational group sub-assembly components (47) during rotational group removal.

15. Remove cam ring (10) and rotational group (12).
16. Remove and discard O-ring (11).
17. Remove and discard O-ring (9).
18. Remove valving (14).
19. Remove spring (44) from valving (14).
20. Remove and discard seal rings (15–17) and backup rings (41–43).
21. Position the bearing support under a press on the motor shaft (1) or on a support to avoid any force on the studs.

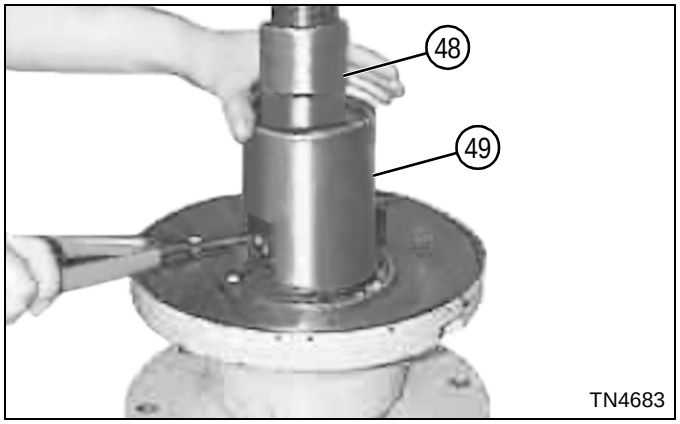


Figure 3-73

22. Using the bearing support snap ring installation/removal tool (49) and press (48), apply a force on roller bearings (3 and 6) just enough to provide clearance for snap ring (8) removal.
23. Remove snap ring (8).

24. Release press force and remove mandrel.

NOTE

When removing shim spacer (7), measure and note the thickness of the shim spacer.

25. Remove shim spacer (7).

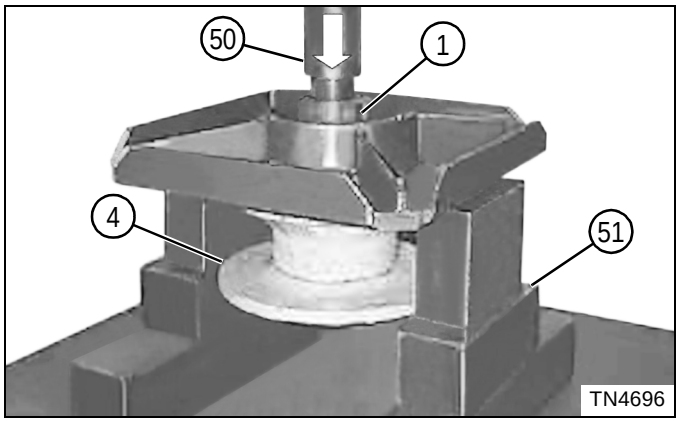


Figure 3-74

26. Place bearing support (4) on blocks (51) under a press (50) with enough clearance to remove motor shaft (1).
27. Remove motor shaft (1).
28. Remove roller bearing (6) and radial lip seal (5).

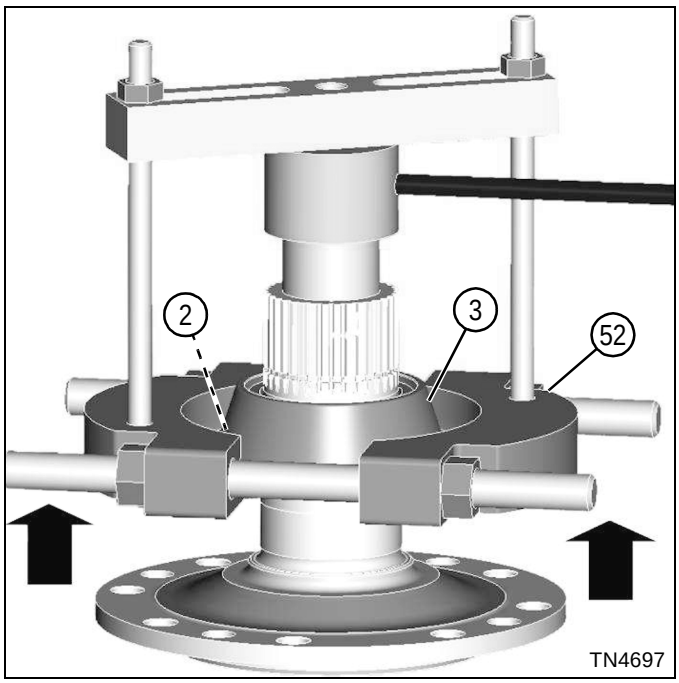
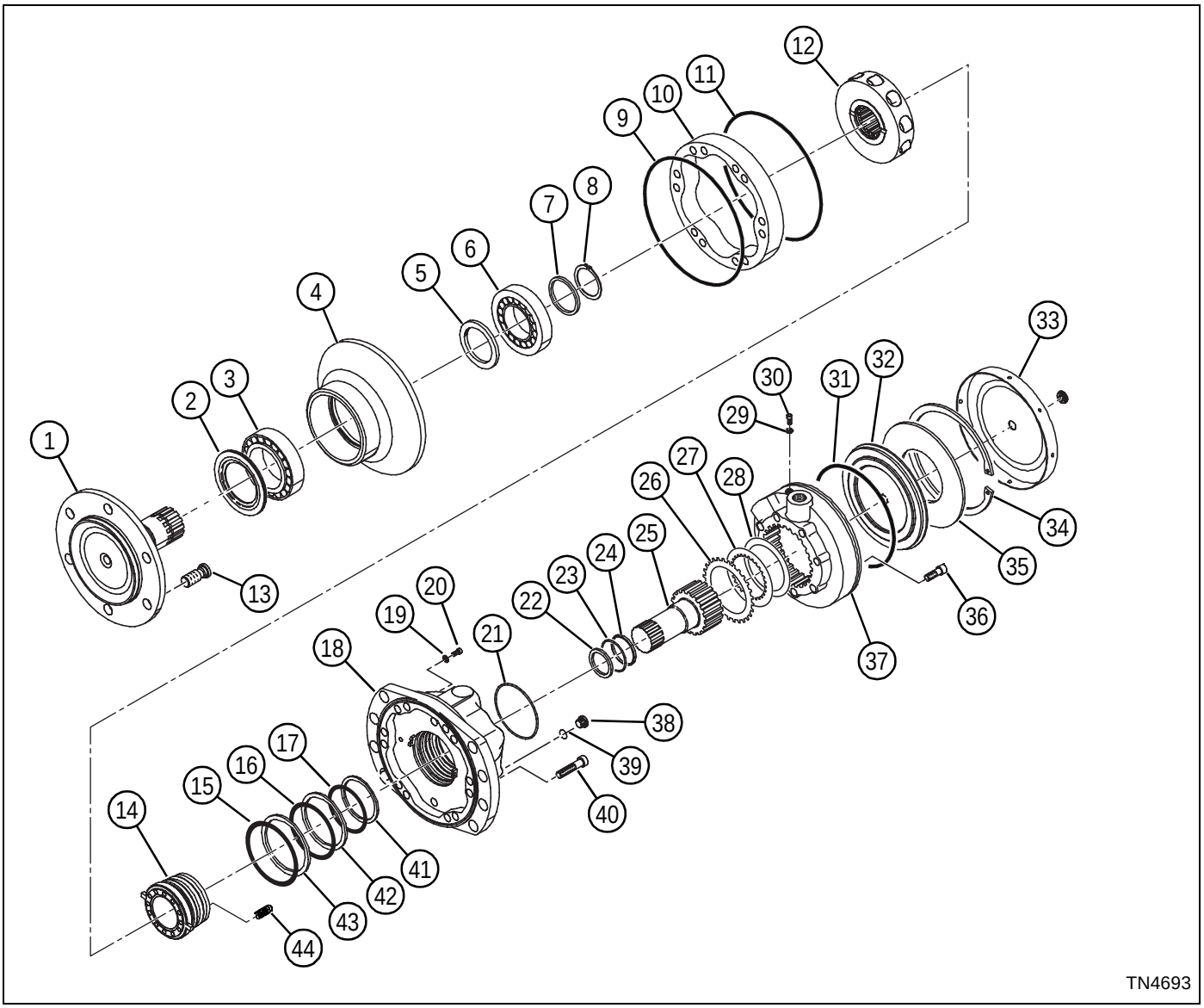


Figure 3-75

29. Install bearing puller (52) under environmental seal (2).
30. Remove environmental seal (2) and roller bearing (3). Discard environmental seal.

Front Wheel Motor Assembly

See Figures 3-76 through 3-85.



1	Motor Shaft	12	Rotational Group	23	O-Ring	34	Snap Ring
2	Environmental Seal	13	Stud (5)	24	Backup Ring	35	Spring Washer
3	Roller Bearing	14	Valving	25	Brake Shaft	36	Screw (10)
4	Bearing Support	15	Seal Ring	26	External Brake Discs (21)	37	Brake Housing
5	Radial Lip Seal (with Spring)	16	Seal Ring	27	Internal Brake Discs (20)	38	Plug
6	Roller Bearing	17	Seal Ring	28	Shim(s)	39	Seal
7	Shim Spacer	18	Valving Cover	29	Sealing Washer	40	Screw (12)
8	Snap Ring	19	Sealing Washer	30	Screw	41	Backup Ring
9	Seal	20	Screw	31	O-Ring	42	Backup Ring
10	Cam Ring	21	O-Ring	32	Brake Piston	43	Backup Ring
11	Seal	22	Bushing	33	Brake Cover	44	Spring

Figure 3-76

Motor Assembly

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

- Front Motor Seal Kit (Jacobsen PN 4274170)
- Brake Seal Kit (Jacobsen PN 4274171)
- Brake Kit (Jacobsen PN 4274172)
- Brake Disc Kit (Jacobsen PN 4274173)
- Bearing Support Seal Kit (Jacobsen PN 4274176)
- Taper-In Bearing (Jacobsen PN 4274174)
- Taper-Out Bearing (Jacobsen PN 4274175)
- Cam Ring (Jacobsen PN 4274177)
- Loctite® 638 Retaining Compound
- Loctite® 7471 Activator
- Mobilux EP2 Grease

1. Inspect the seal contact areas and splines of the motor shaft (1) for wear or damage and replace motor shaft as necessary.
2. Inspect the seal contact surfaces of the bearing support (4) for wear or damage and replace the bearing support as necessary.
3. Remove the spring from new radial lip seal (5).
4. Using the bearing support and sealing ring mandrel and a soft-faced hammer, install new radial lip seal (5) in bearing support (4). (See “Bearing Support and Sealing Ring Mandrel” on page 3-49.)
5. Using the bearing outer race mandrel and a soft-faced hammer, install the outer race of roller bearing (6) in bearing support (4) up to the stop. (See “Bearing Outer Race Mandrel” on page 3-49.)
6. Using the bearing outer race mandrel and a soft-faced hammer, install the outer race of roller bearing (3) in bearing support (4) up to the stop.
7. Reinstall the radial lip seal spring.
8. Lubricate the outer race of roller bearing (3) and the lips of radial lip seal (5) with Mobilux EP2 grease.
9. Lubricate roller bearing (3) with Mobilux EP2 grease and install roller bearing into its outer race.
10. Install environmental seal (2) with lips facing out.
11. Lubricate lips of environmental seal (2) with Mobilux EP2 grease.
12. Position motor shaft (1) under a press to avoid any force on the studs.
13. Using a press, install bearing support (4) on motor shaft (1).
14. Using the bearing support snap ring installation/removal tool and press, install roller bearing (6) in its outer race. Do not exceed 12,364 lb (55,000 N) force. (See “Bearing Support Snap Ring Installation/Removal Tool” on page 3-49.)
15. Install shim spacer (7) of correct thickness as noted during removal.
16. Install snap ring (8).

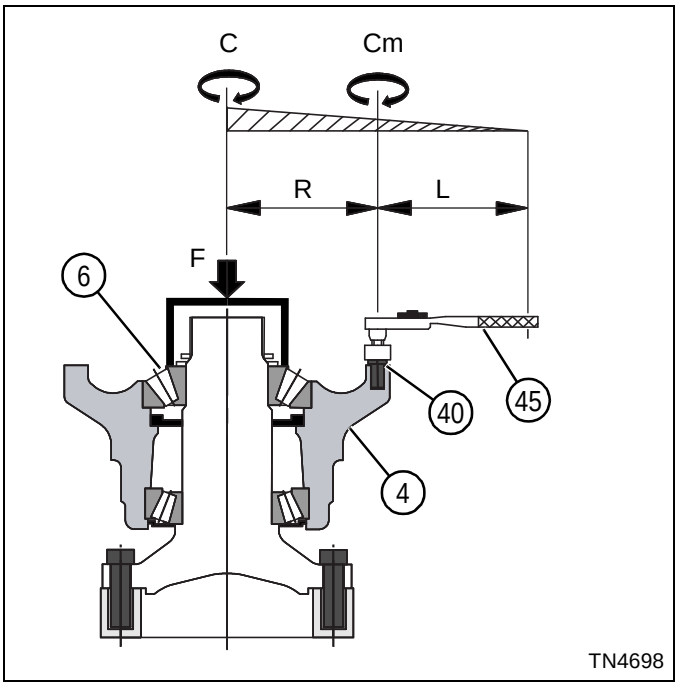


Figure 3-77

17. Check bearing support rotation torque as follows:
    a. Install and tighten one screw (40) in bearing support (4) mounting hole.
    b. Position bearing support assembly under a press to avoid any force on the studs.
    c. Install a dial torque wrench (45) on screw (40).
    d. Measure and record distance (R) from center of motor shaft to center of screw (40).
    e. Measure and record distance (L) from center of screw (40) to point on torque wrench handle where hand force is applied.
    f. Using the press and bearing support snap ring installation/removal tool, apply 12,364 lb (55,000 N) force (F) to bearing (6) for five seconds, then reduce force to 618 lb (2750 N).
    g. Measure and record the torque (Cm) necessary to rotate bearing support (4).
    h. Determine the bearing support revolving torque: C = Cm x (R+L)/L
    i. If bearing support revolving torque is not within 8.85 ± 10% lb-ft (12 ± 10% N·m), remove snap ring (8) and replace shim spacer (7) with a thinner shim spacer (to decrease torque) or thicker shim spacer (to increase torque).
    j. Repeat steps a through i as necessary to meet bearing support revolving torque specification.
    k. Remove screw (40).
18. Lubricate seal (9) with Mobilux EP2 grease and install O-ring in bearing support (4).
19. Lubricate O-ring (11) with Mobilux EP2 grease and install O-ring in valving cover (18).

NOTE

There are three different size seal rings and backup rings. Install the smallest seal ring to the deepest groove first.

20. Install seal rings (15–17) in valving cover (18), smallest first.
21. Install backup rings (41–43) in valving cover (18), smallest first.

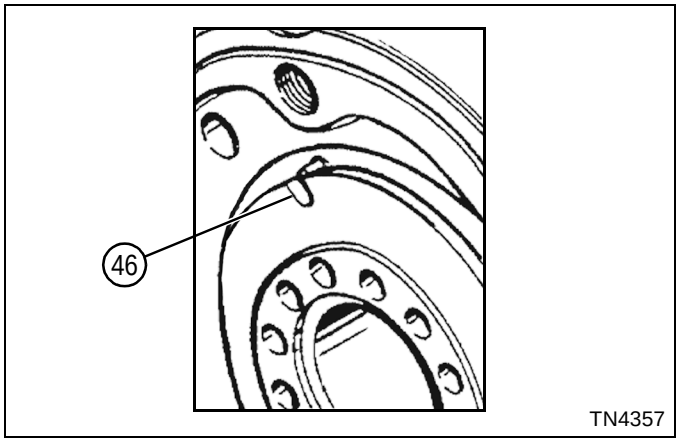


Figure 3-78

22. Using grease, insert spring (44) into hole (46) of valving cover (18).

IMPORTANT

Make sure timing notch in valving (14) aligns with locating pin in valving cover (18) when installing valving in valving cover.

23. Install valving (14) in valving cover (18).
24. Install rotational group (12).

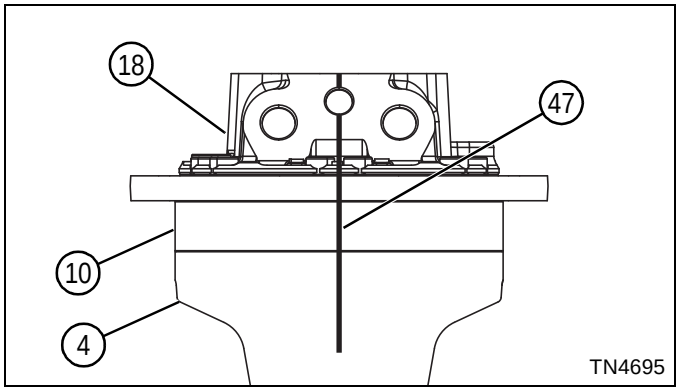


Figure 3-79

25. Using alignment mark (47) previously scribed on the wheel motor, install cam ring (10) on bearing support (4).

NOTE

Make sure alignment of timing notch in valving (14) and locating pin in valving cover (18) is maintained when installing valving cover.

26. Install valving cover (18) in line with the marks made during disassembly.
27. Center the cam by installing two screws (40) 180° apart.
28. Install screws (40) and tighten to 61 lb-ft ± 10% (83 N·m ± 10%) using an alternating pattern.

Brake Assembly

IMPORTANT

When removing retaining compound residue from valving cover (18), do not scratch the surface. The original surface finish must be maintained.

29. Ensure any dried retaining compound on the bushing mating surfaces of valving cover (18) is removed. Scrape off all retaining compound residue with a blade or fine (1200 grit) sandpaper.
30. Clean/degrease a new bushing (22), and the bushing mating surfaces of valving cover (18) with isopropyl alcohol.
31. Apply Loctite® 638 retaining compound to the external diameter of bushing (22) and position bushing on valving cover (18) with the chamfer of the bushing facing toward the valving cover.
32. Using the large diameter end of brake shaft (25) and a soft-faced hammer, install bushing (22) into valving cover flush to 0.004 in. (0.1 mm) below surface.
33. Remove excess retaining compound from each side of bushing.
34. Install new O-ring (23) and new backup ring (24).
35. Install brake shaft (25).
36. Apply Mobilux EP2 to the brake housing (37) brake shaft grooves and brake O-ring contact surface, and to the top of the brake piston (32), spring washer (35), and snap ring (34).

IMPORTANT

When removing retaining compound residue from valving cover (18) or brake housing (37), do not file or use emery cloth on the surface. The original surface finish must be maintained.

37. Ensure any dried retaining compound on the brake housing mating surfaces of valving cover (18) and brake housing (37) is removed. Scrape off all retaining compound residue with a blade.

IMPORTANT

After degreasing with isopropyl alcohol, do not touch the mating surfaces of the valving cover and brake housing with hands or fingers.

38. Clean/degrease the brake housing mating surfaces of valving cover (18) and brake housing (37) with isopropyl alcohol.

IMPORTANT

- **After applying activator, do not touch the brake housing mating surface of the valving cover.**
- **Do not apply any activator on the brake shaft.**

39. Apply a film of Loctite® 7471 activator on the brake housing mating surface of the valving cover (18), and wait 2 minutes before continuing procedure. Do not apply any activator on brake shaft (25).
40. Install new O-ring (21) in valving cover.

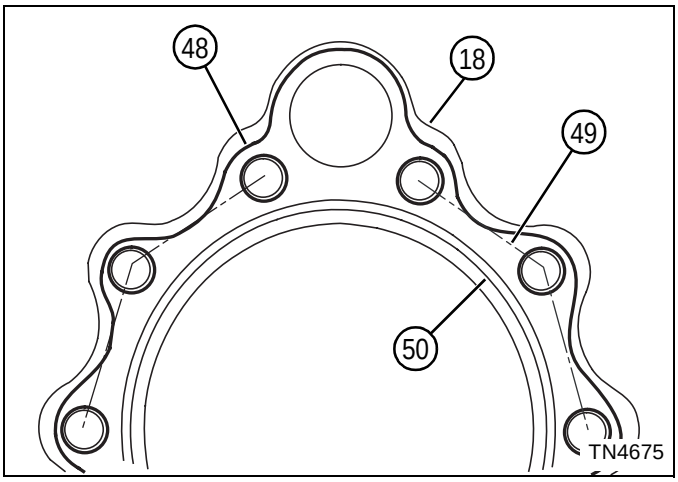


Figure 3-80

IMPORTANT

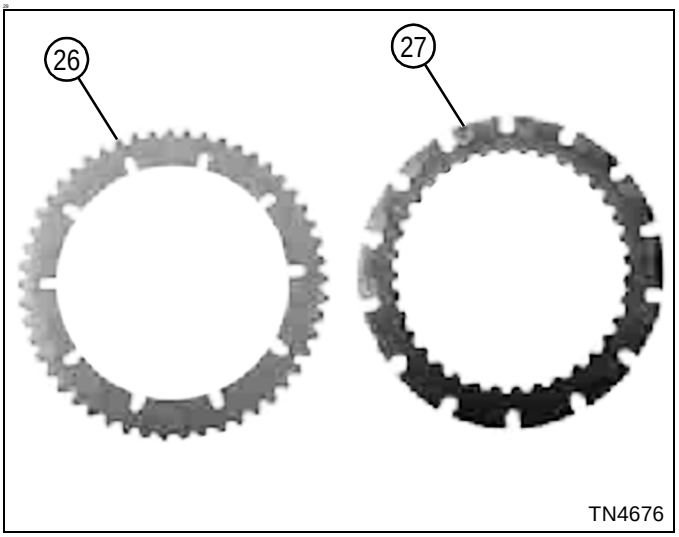
- **When placing bead of Loctite® 638 retaining compound on valving cover, make sure no retaining compound is placed on the O-ring groove (50).**
- **Step 42 must be completed within 10 minutes of applying Loctite® 638 retaining compound in step 41.**

41. Place a 0.2–0.4 in. (5–10 mm) wide continuous bead (no gaps) of Loctite® 638 retaining compound (48) on valving cover (18) following the median line (49) of the mounting screw hole centers.

IMPORTANT

The glued connection remains fragile up to six hours after being glued. During this time, avoid any shock to the glued parts; do not use or test the brake or the wheel motor.

42. Place brake housing onto valving cover and install ten new screws (36). Tighten screws to 107 lb-ft ± 10% (145 N·m ± 10%) in an alternating pattern.



26 External Brake Disc 27 Internal Brake Disc

Figure 3-81

43. Lubricate twenty-one new external brake discs (26) and twenty internal brake discs (27) with hydraulic fluid.
44. Install one external brake disc (26), then one internal brake disc (27). Continue alternately installing external and internal brake discs. The last brake disc installed must be an external disc (26).
45. Determine the shimming thickness as follows:
    a. Install brake piston (32) without O-ring (31).

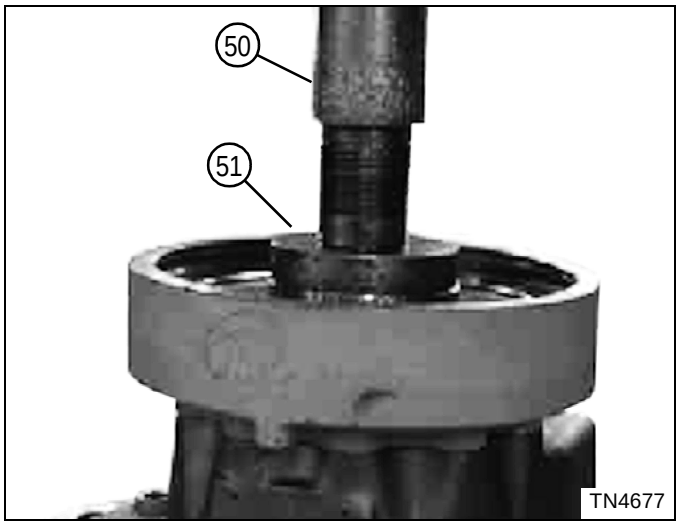


Figure 5-82

b. Using a mandrel (51) and press (50), apply a 11,240 lb force (50,000 N) to the brake piston.

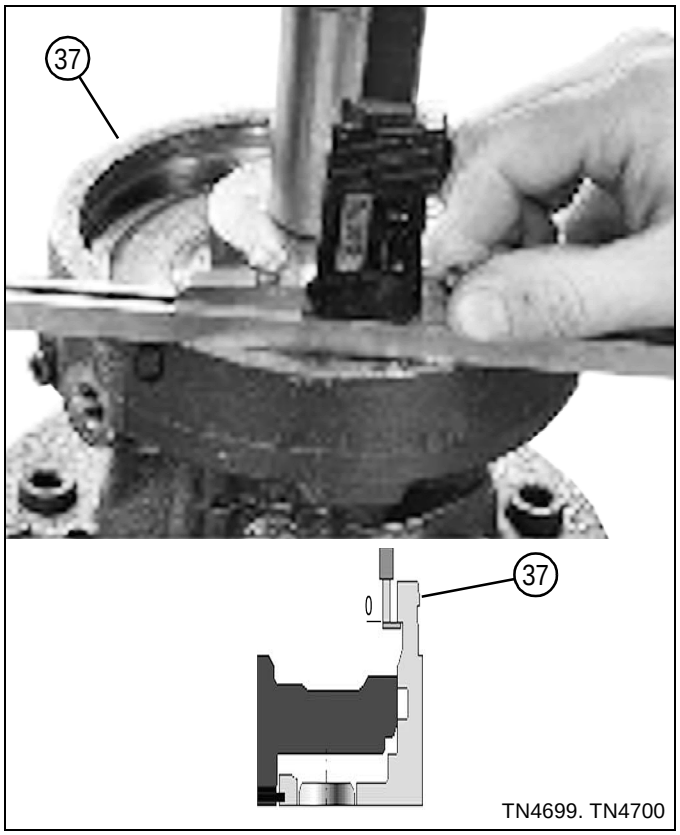


Figure 3-83

c. Using a depth gauge, establish a zero base measurement by positioning the heel of the depth gauge in the top of the snap ring groove on the brake housing (37).

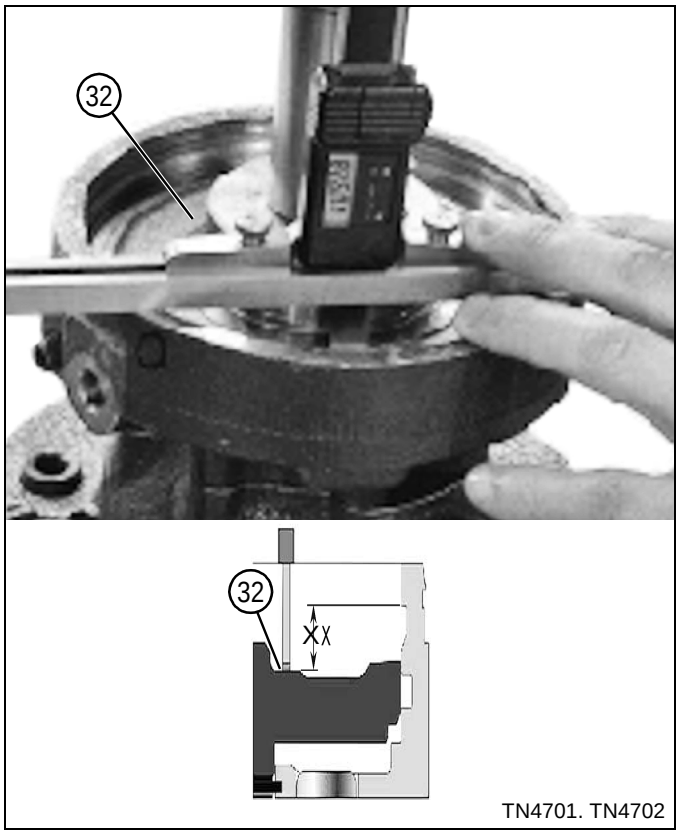


Figure 3-84

d. Measure at four different points (at every 90°) to determine the average distance (X) between the top of the snap ring groove and the spring washer contact surface on the brake piston (32).

e. Subtract 0.4 in. (10 mm) from the average distance (X) to obtain the shimming thickness:

Shimming Thickness = X – 0.4 in. (10.0 mm)

46. Remove brake piston (32).

NOTES

- *When installing shims, install the thickest shim toward the brake piston.*
- *Minimize the number of shims of thickness 0.008 in. (0.2 mm).*

47. Install the proper shims (28), as determined in step 45, on the last brake disc.
48. Lubricate the piston seal contact surface in the brake housing with Mobilux EP2 grease.
49. Install new O-ring (31) on brake piston (32). Make sure O-ring is not twisted after installation.

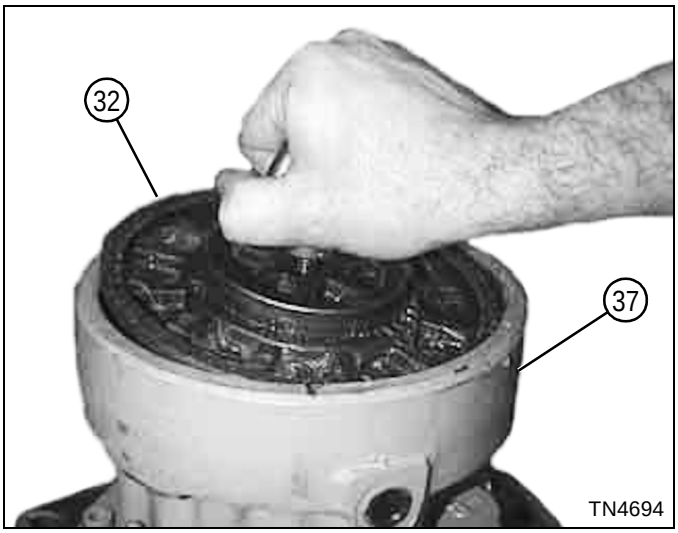


Figure 3-85

50. Install brake piston (32) in brake housing (37).
51. Lubricate spring washer (35) with Mobilux EP2 grease and install spring washer on brake piston (32).
52. Compress spring washer (35) by one of the two methods described in Front Wheel Motor “Disassembly and Inspection” on page 3-50.
53. Install snap ring (34) in line with the mark made prior to removal.
54. Lubricate seal in brake cover (33) with Mobilux EP2 grease.

NOTE

When installing the brake cover, make sure that the outer edge of the brake cover is engaged in the groove.

55. Place new brake cover (33) on brake housing chamfer and click into place using a soft-faced hammer.
56. Install front wheel motor. (See “Front Wheel Motor” on page 3-47.)
57. 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 3-5.)
58. Check brake effectiveness and repair or replace front wheel motor as necessary.

Rear Wheel Motor

Removal and Installation

See Figures 3-86 through 3-89.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove rear wheel. (See “Rear Wheels” on page 9-10.)

NOTES

- *Label all hydraulic hoses before disconnecting to ensure correct installation.*
- *Plug hydraulic hoses after disconnecting to prevent the loss of hydraulic oil.*

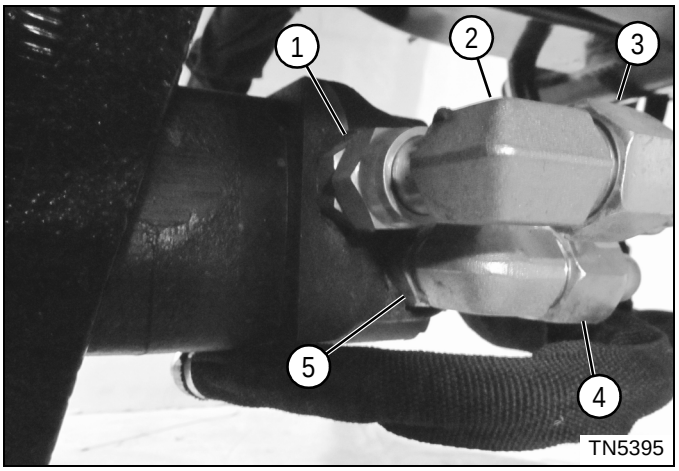


Figure 3-86

3. Disconnect hose (4) from fitting (5) in port “A.”
4. Disconnect hose (3) from fitting (2) in port “B.”
5. Remove fitting (5) from port “A.”
6. Remove fittings (1 and 2) from port “B.”

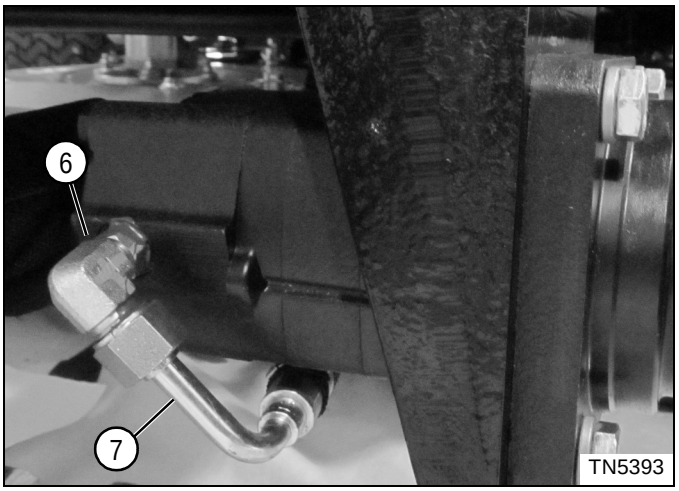


Figure 3-87

7. Disconnect hose (7) from fitting (6) in drain port.

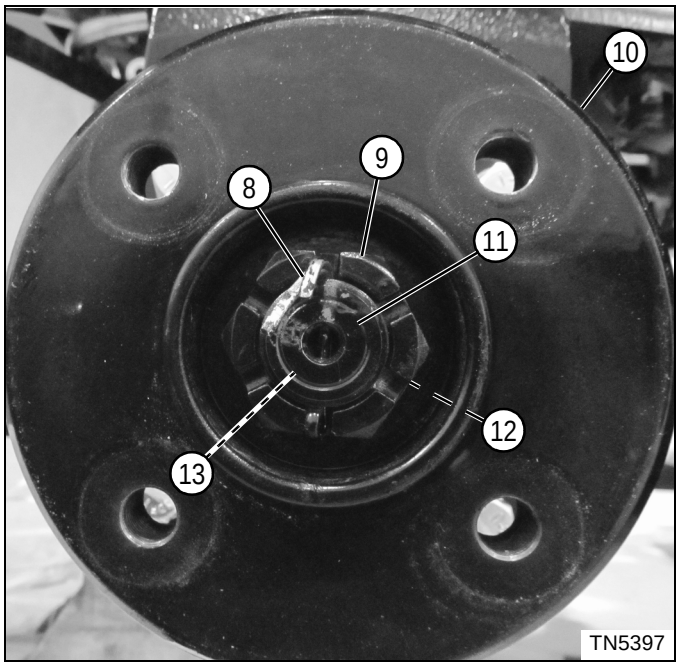


Figure 3-88

8. Remove cotter pin (8).

CAUTION

The wheel hub may move unexpectedly when using a puller. To prevent injury and/or property damage, do not remove the castle nut until the wheel hub has been loosened from the wheel motor shaft.

9. Loosen, but do not remove, the castle nut (9).
10. Loosen the wheel hub (10) from the motor shaft (11) using a puller.
11. Remove castle nut (9), washer (12), and wheel hub (10) from motor shaft (11).
12. Remove key (13) from motor shaft (12).

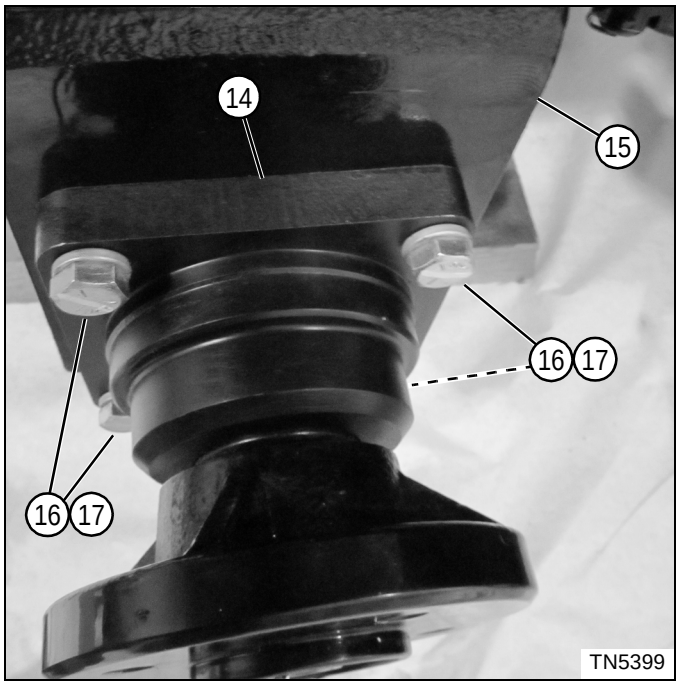


Figure 3-89

13. Remove four screws (16) and lock washers (17).
14. Remove motor (14) from motor mount (15).

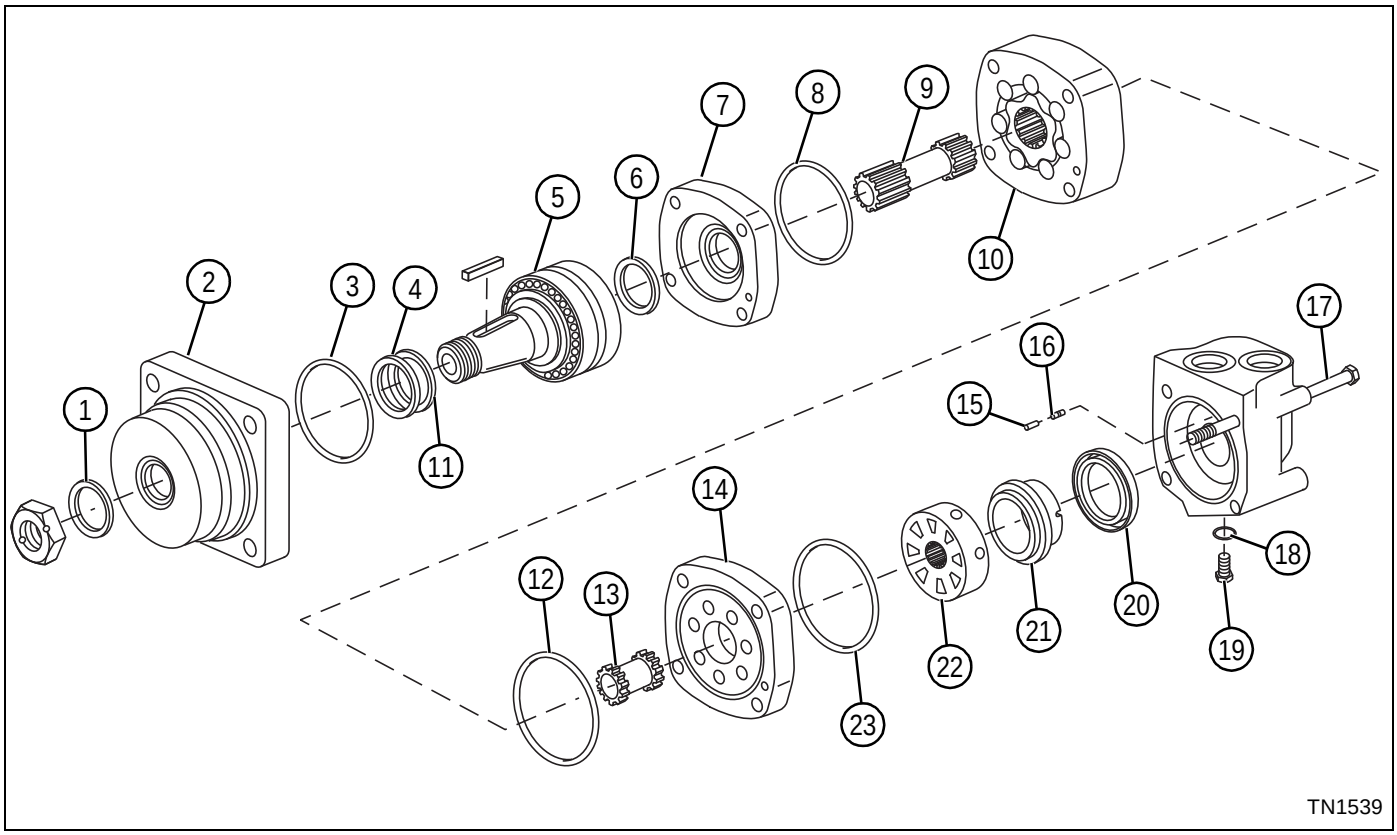
Installation Notes

Required Materials
Anti-Seize Compound

- *Install rear wheel motor by reversing the order of removal.*
- *Apply anti-seize compound to threads of motor shaft (11). Be careful not to apply anti-seize compound to the motor shaft.*
- *Install a new cotter pin (8) in castle nut (9) and motor shaft (11).*
- *Tighten fitting (1) to 90 lb-ft (122 N·m).*
- *Tighten fitting (2) to 48 lb-ft (65 N·m).*
- *Tighten fitting (5) to 48 lb-ft (65 N·m).*
- *Tighten fitting (6) to 180 in-lb (20 N·m).*
- *Tighten hydraulic hoses (3 and 4) to 48 lb-ft (65 N·m).*
- *If metal debris is found in system oil or motor, use a portable in-line filter to cleanse the system prior to start-up. (See “Portable In-Line Filter” on page 3-5.)*
- *Check hydraulic oil level. Add oil as needed. (Refer to “Safety, Operation, and Maintenance Manual” for the correct oil specifications.)*

Disassembly, Inspection, and Assembly

See Figures 3-90 and 3-91.



1	Dust Seal	7	Wear Plate	13	Valve Drive	19	Plug
2	Bearing Housing	8	Seal	14	Valve Plate	20	Outer Face Seal
3	Seal Ring	9	Drive	15	Pin	21	Balance Ring
4	Backup Ring	10	Geroler	16	Spring	22	Valve
5	Shaft Seal	11	Shaft Seal	17	Valve Housing Screw (4)	23	Seal
6	Shaft and Bearing Kit	12	Seal	18	Seal		

Figure 3-90

1. Disassemble rear wheel motor as shown.
2. Place parts in assembly order on a clean work area as they are removed.

NOTICE

It is important that motor parts are marked and placed in assembly order to aid in assembly.

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.

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).*
- *Inspect all parts for cracks, nicks, burrs, and excessive wear. Inspect for scoring, galling, and scratches on surfaces. 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 (Jacobsen PN 4134527)

- *Assemble the rear wheel motor by reversing the order of disassembly.*
- *Lubricate all O-rings prior to assembly.*
- *Time the motor correctly.*
- *Tighten valve housing screws (17) to 36–37 lb-ft (49–50 N·m).*
- *If metal debris is found in system oil or motor, use a portable in-line filter to cleanse the system prior to start-up. (See “Portable In-Line Filter” on page 3-5.)*

Rear Wheel Motor Timing

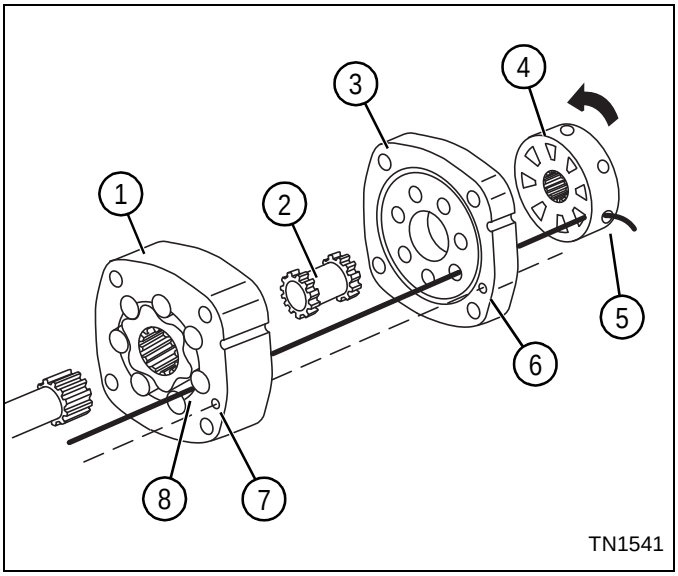


Figure 3-91: Correct Motor Timing

1. Locate the largest open pocket (6) in geroler (1). Mark the location of the pocket on the outside edge of geroler.
2. Align the case drain hole (7) in the geroler with the case drain hole in the bearing housing. Install the geroler on the bearing housing. Retain the rollers in the outer geroler ring if they are loose.
3. Install the valve drive (2) in geroler (1).
4. Lubricate the seal and install it in the valve plate (3).
5. Align the case drain hole (6) in the valve plate (3) with the case drain hole (7) in the geroler (1). Install the valve plate (3) with the seal side toward the geroler.
6. Locate the slot in the valve plate (3) that is in line with the largest open pocket (8) of geroler.
7. Locate any side valve opening (5) through to the face of the valve. Line up the opening with the open slot of the valve plate that is in line with the largest open pocket of geroler. Rotate valve (4) clockwise 1/2 spline tooth to engage with the valve drive.

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Chapter 4

Hydraulics

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A Textron Company

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Specifications

Test and Adjustment Specifications

Specifications		
Front Cutting Unit Pump Flow	gpm (lpm)	10.8 (40.8) at 2850 rpm
Rear Cutting Unit Pump Flow	gpm (lpm)	10.8 (40.8) at 2850 rpm
Lift/Steer Pump Flow	gpm (lpm)	6.1 (23) at 2850 rpm
Hydraulic Leakage Percentage Ranges		0—10% = Good 11—20% = Marginal 21% and Beyond = Bad
Lift/Steer System Relief Valve Pressure Setting	psi (bar)	1740 (120)
Cutting Unit System Relief Valve Pressure Setting	psi (bar)	2600 (180)
Cutting Unit Motor Case Drain Rate		Less than 1 pint (0.47 L) per minute at 2000 psi (138 bar)

Repair Specifications

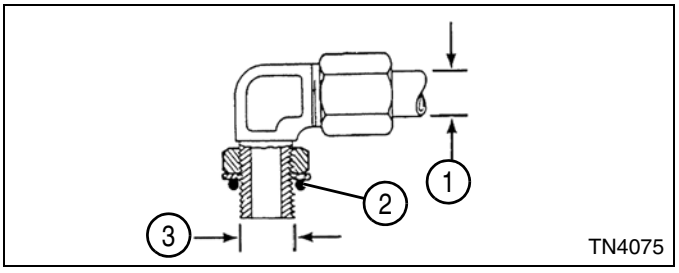
Specifications		
Gear Pump—Rear Cover-to-Pump Body Bolt Torque	lb-ft (N·m)	33 (45)
Cutting Unit Circuit Relief Valve Torque	lb-ft (N·m)	25 (34)
Hydraulic Oil Tank Capacity	gal (L)	14 (53)

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

Figure 4-1

O-Ring Seal Kits

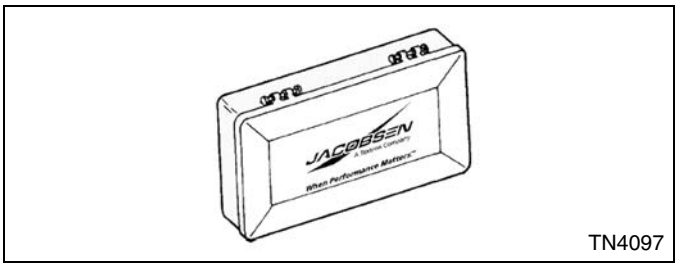


Figure 4-2

- 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

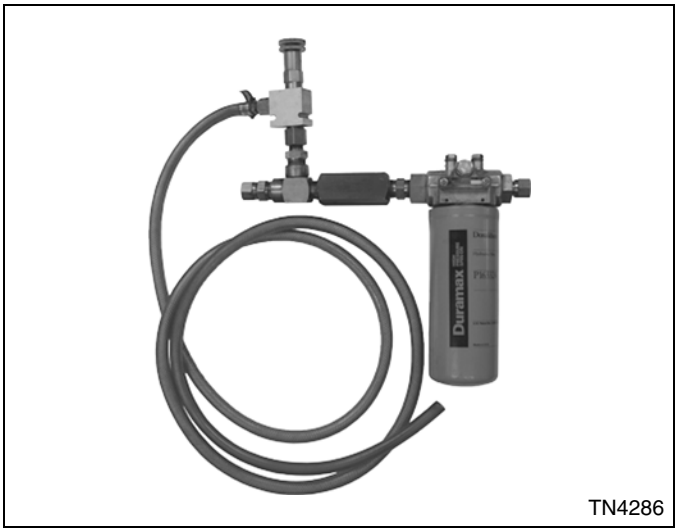
Hydraulic Service Tools

NOTE

The hydraulic service tools listed here can be obtained from K-Line Industries at http://klineind.com.

Portable In-Line Filter

Part Number JAC5097



TN4286

Figure 4-3

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.

Digital Hydraulic Tester

Part Number AT40031



TN4288

Figure 4-4

Features

- Flow up to 100 gpm (379 lpm)
- Pressure up to 6000 psi (414 bar)
- Temperature up to 250° F (120° C)
- Digital display for flow and temperature
- Analog display for pressure
- Flow accuracy 1% of full scale

Hydraulic Flow Meter

Part Number AT40002



TN4287

Figure 4-5

Features

- Glycerin filled pressure gauge
- Precision needle-type load valve
- 4–40 gpm (15–15 lpm) flow range
- Pressure up to 5000 psi (345 bar)
- -12 port size

Digital Pressure Gauge Kit

Part Number JAC5106



Figure 4-6

Features

- Quick disconnect fittings
- Pressure up to 5000 psi (345 bar)
- Includes one 5 ft (152 cm) hose

Hydraulic Hose Kit

Part Number JAC5001H

NOTE

This hydraulic hose kit is intended to be used with the JAC5001A Hydraulic Test Fitting Kit.

Contents

- Two 8 ft (244 cm) 12 ORFS (F) x 10 ORFS (F) hoses
- Four 8 ft (244 cm) 10 ORFS (F) x 10 ORFS (F) hoses
- Two 8 ft (244 cm) 8 ORFS (F) x 10 ORFS (F) hoses

Hydraulic Test Fitting Kit

Part Number JAC5001A

NOTE

For detailed component descriptions and sizes, please see the K-Line Industries website at http://klineind.com.

Contents

- Twenty ORFS tee fittings in five sizes
- Eight ORFS 90° elbow fittings in four sizes
- Forty ORFS caps in five sizes
- Forty ORFS plugs in five sizes
- Six ORS reducer adapters in three sizes
- Sixteen ORS adapters in four sizes
- Eight blocking disks in four sizes
- Three JIC tee fittings in three sizes
- Three 4 in. (102 mm) jumper hoses in three sizes
- One ORS/male NPTF adapter
- One vented bushing
- One copper tube assembly

Blocking Disk Set

Part Number JAC5001-1

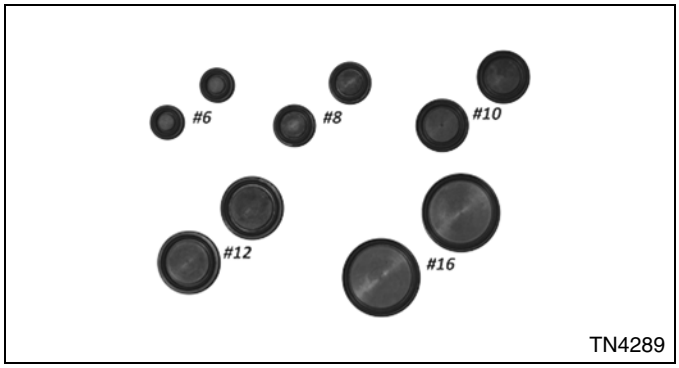


Figure 4-7

NOTE

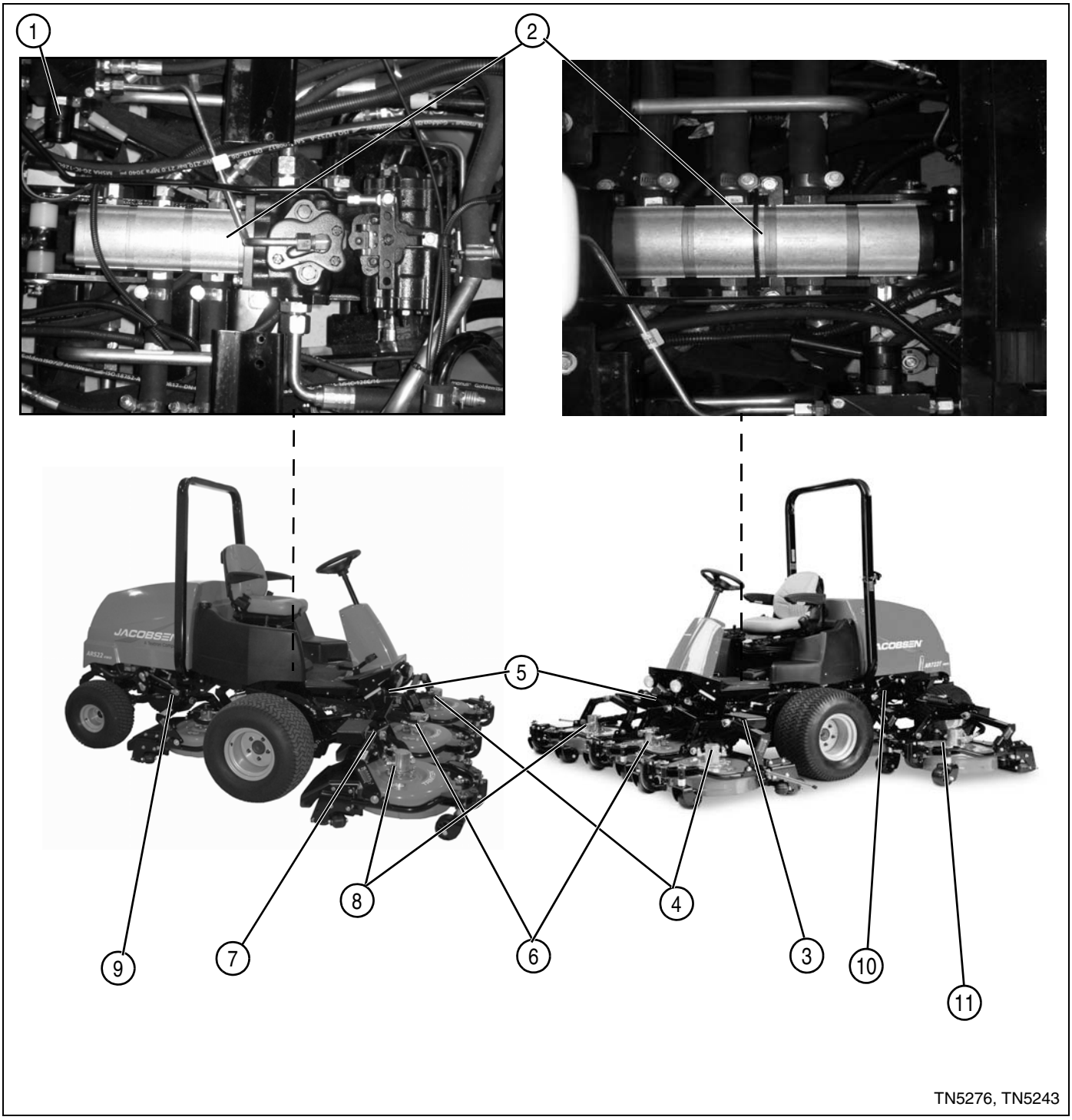
This blocking disk set is part of the JAC5001A Hydraulic Test Fitting Kit.

Contents

- Two -6 blocking disks
- Two -8 blocking disks
- Two -10 blocking disks
- Two -12 blocking disks
- Two -16 blocking disks

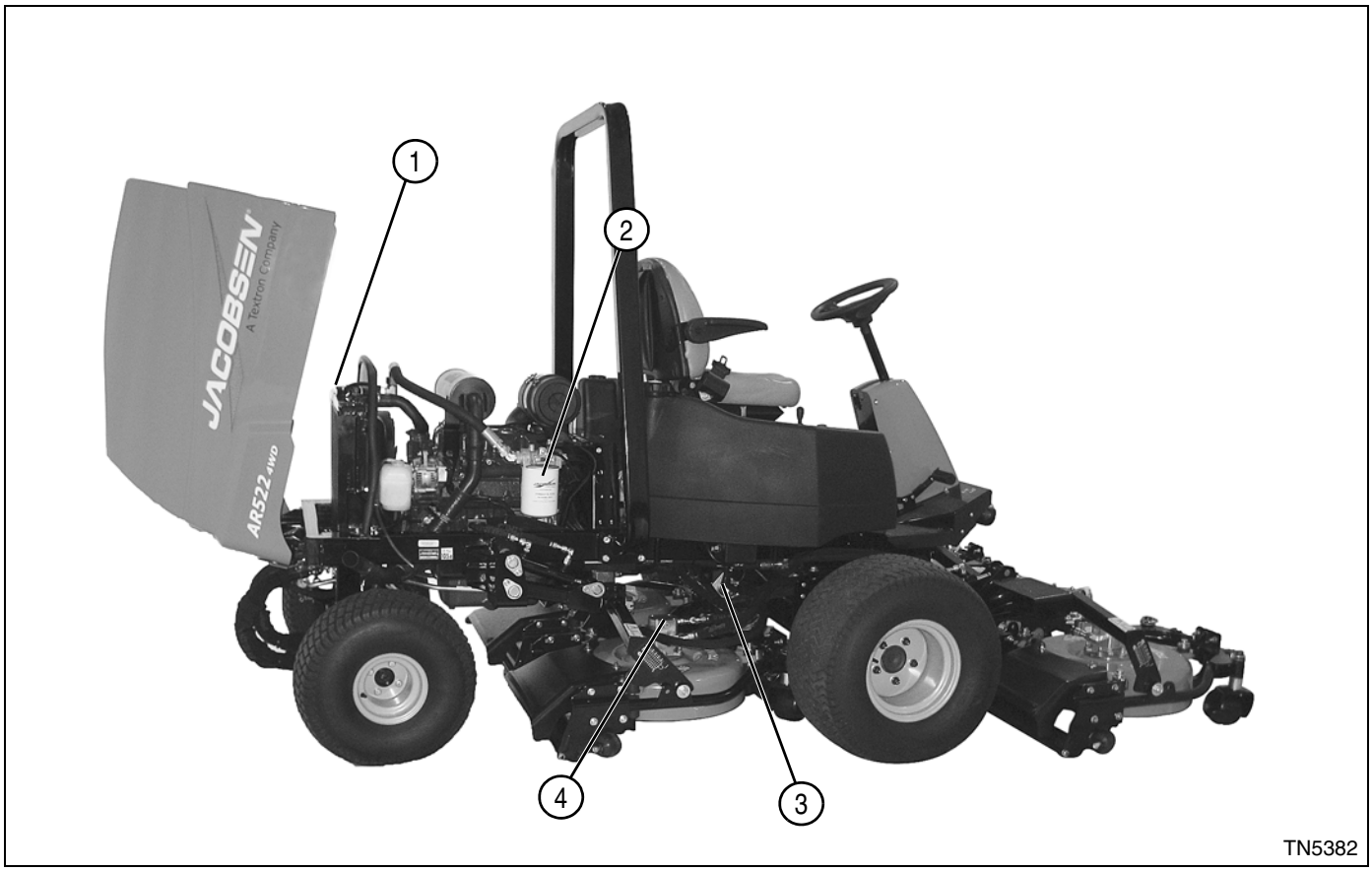
Component Location

See Figures 4-8 and 4-9.



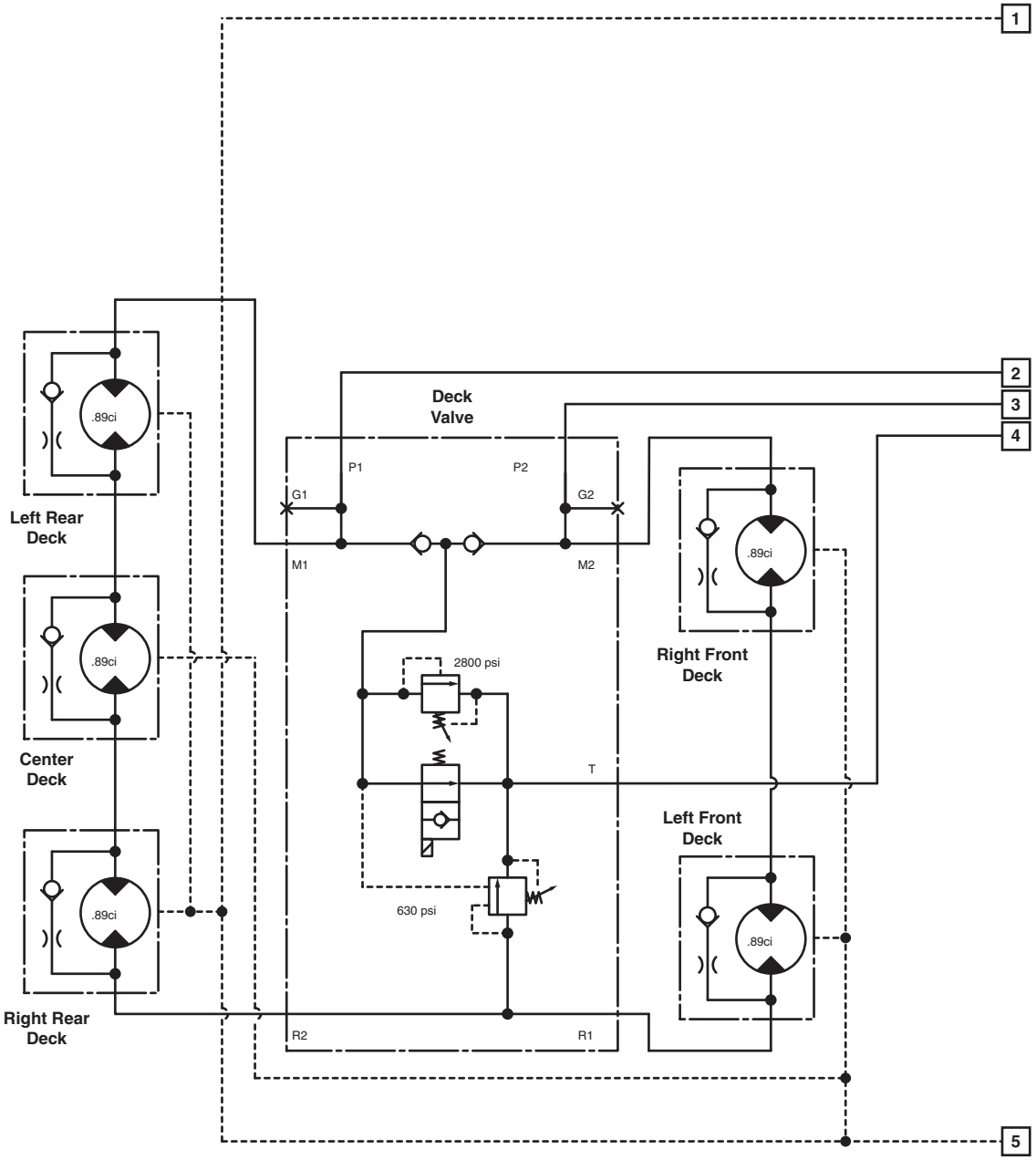
1	Brake Valve	6	Center Cutting Unit Motor
2	Gear Pump	7	Right Front Lift Cylinder
3	Left Front Lift Cylinder	8	Right Front Cutting Unit Motor
4	Left Front Cutting Unit Motor	9	Right Rear Lift Cylinder
5	Center Lift Cylinder	10	Left Wing Lift Cylinder
		11	Left Wing Cutting Unit Motor

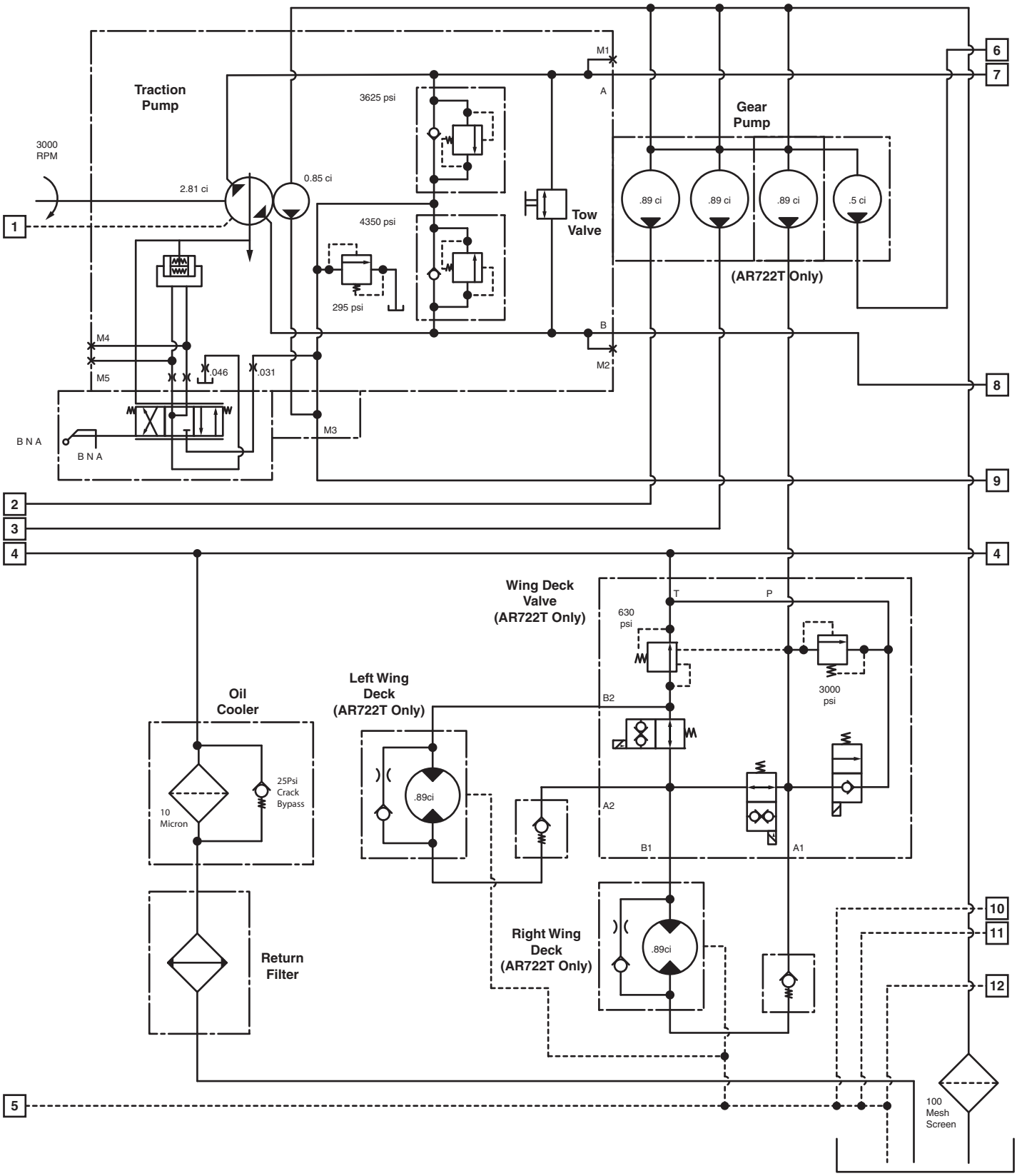
Figure 4-8: Component Location

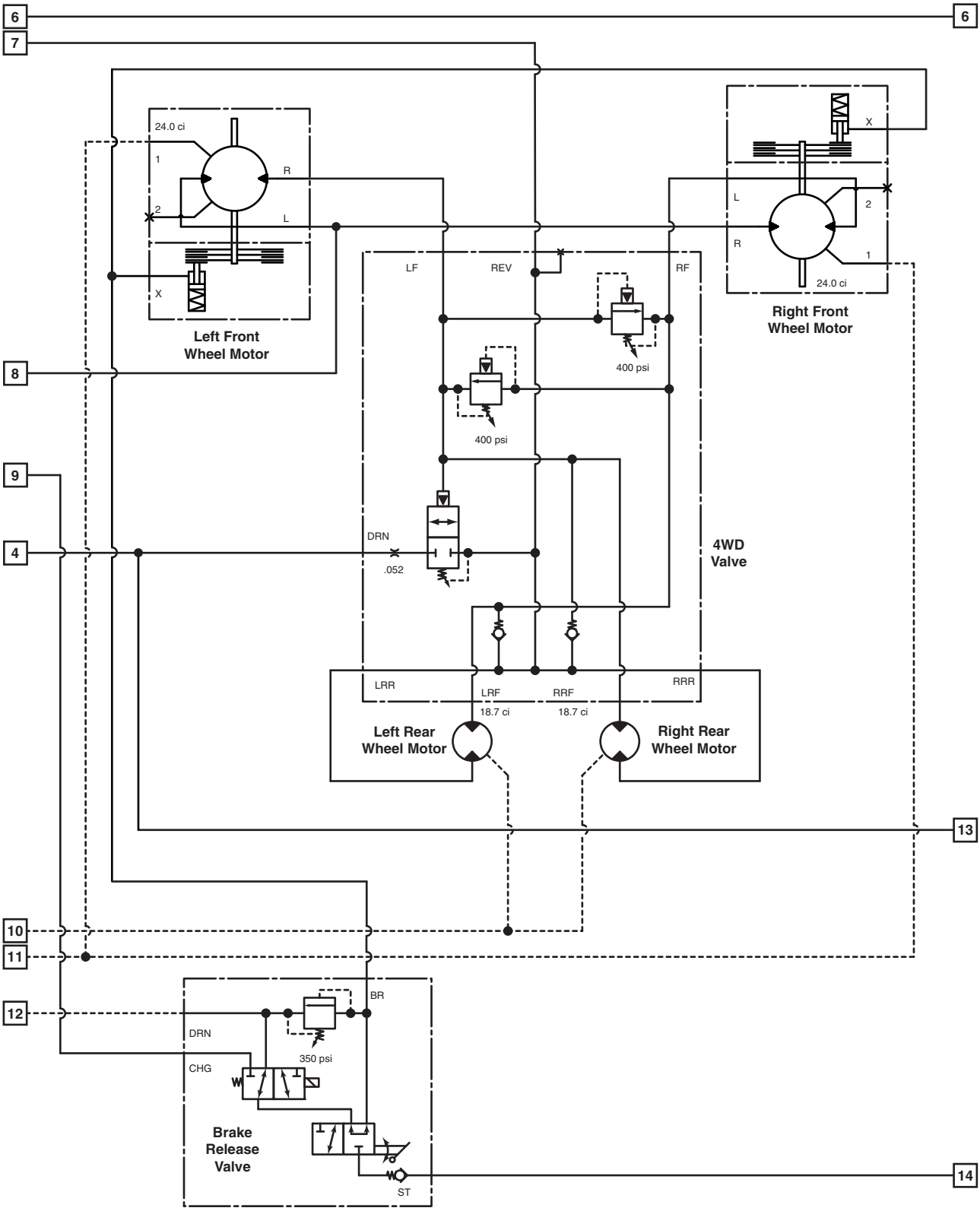


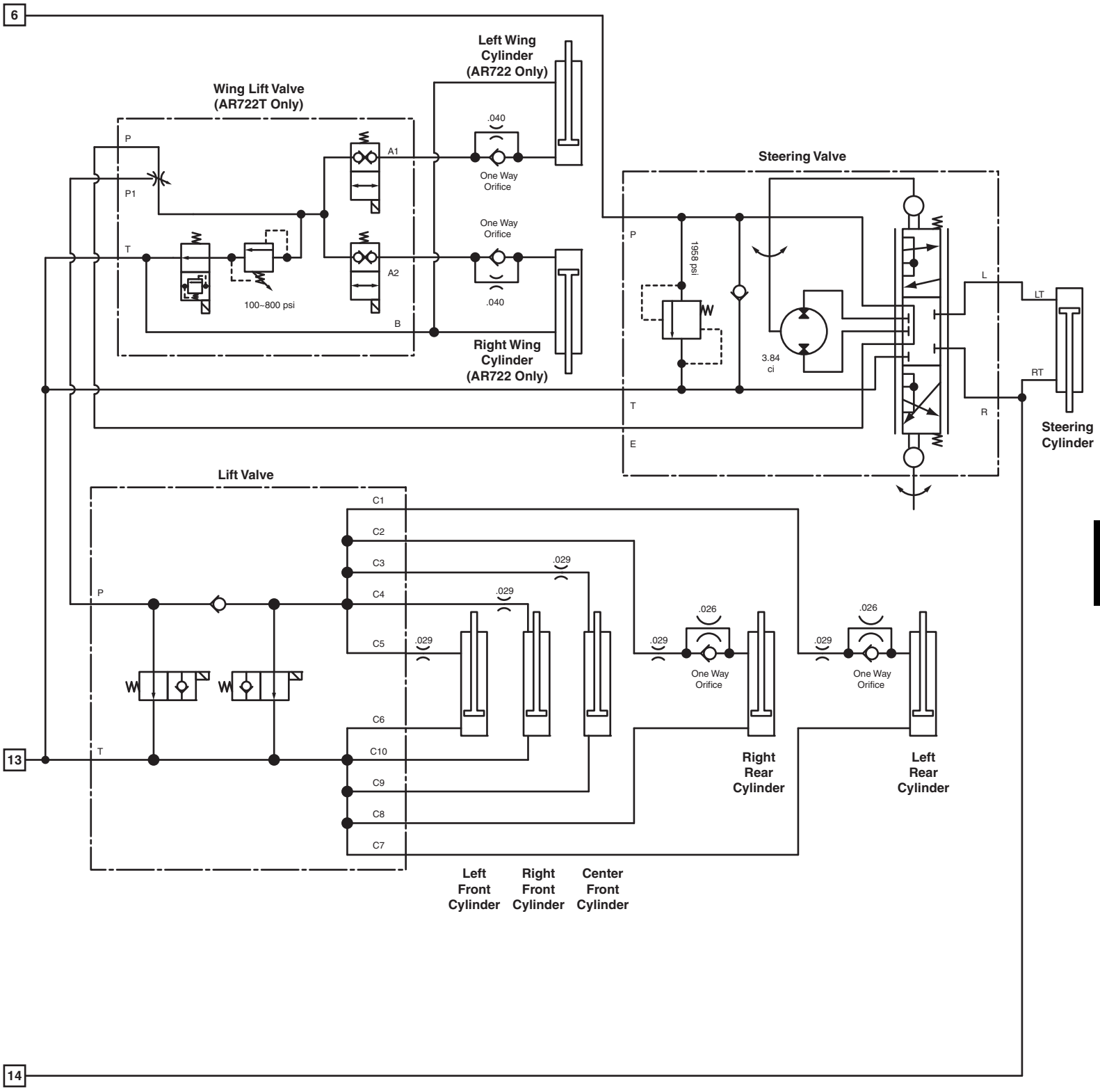
1 Radiator/Hydraulic Oil Cooler
2 Hydraulic Oil Filter
3 Deck Valve
4 Right Rear Cutting Unit Motor

Figure 4-9: Component Location


1
2
3
4
5
Deck
Valve
P1
P2
G1
G2
M1
M2
.89ci
Left Rear
Deck
Center
Deck
Right Rear
Deck
Right Front
Deck
Left Front
Deck
2800 psi
630 psi
T
R2
R1


Traction Pump
3000 RPM
2.81 ci
0.85 ci
3625 psi
4350 psi
295 psi
Tow Valve
Gear Pump
.89 ci
.89 ci
.89 ci
.5 ci
(AR722T Only)
M1
A
B
M2
M3
M4
M5
.046
.031
B N A
B N A
1
2
3
4
5
6
7
8
9
Wing Deck Valve (AR722T Only)
T
P
630 psi
3000 psi
B2
A2
B1
A1
Left Wing Deck (AR722T Only)
.89ci
Right Wing Deck (AR722T Only)
.89ci
Oil Cooler
10 Micron
25Psi Crack Bypass
Return Filter
100 Mesh Screen
10
11
12


6
7
6
24.0 ci
1
2
R
L
X
Left Front
Wheel Motor
X
L
R
2
1
24.0 ci
Right Front
Wheel Motor
LF
REV
RF
400 psi
400 psi
8
9
4
DRN
.052
4WD
Valve
LRR
LRF
RRF
RRR
18.7 ci
18.7 ci
Left Rear
Wheel Motor
Right Rear
Wheel Motor
13
10
11
12
BR
DRN
350 psi
CHG
Brake
Release
Valve
ST
14


6
Left Wing Cylinder (AR722 Only)
Wing Lift Valve (AR722T Only)
.040
P
A1
P1
One Way Orifice
Steering Valve
One Way Orifice
T
100~800 psi
A2
.040
P
1958 psi
L
LT
3.84 ci
B
Right Wing Cylinder (AR722 Only)
RT
T
R
Steering Cylinder
E
Lift Valve
C1
C2
C3
.029
P
C4
.029
.026
.026
C5
.029
.029
.029
One Way Orifice
One Way Orifice
C6
13
T
C10
Right Rear Cylinder
Left Rear Cylinder
C9
C8
C7
Left Front Cylinder
Right Front Cylinder
Center Front Cylinder
14

Theory of Operation and Diagnostic Information

Steering Circuit Schematic and Theory of Operation

System Conditions:

- Engine running
- Steering wheel turned to the right or left (right turn shown)

NOTE

Right turn shown.

Hydraulic oil is drawn from the hydraulic oil tank by the steering section of the gear pump assembly. Before entering the gear pump assembly, the inlet oil is filtered by a 100-mesh screen to remove any debris. Operating-pressure oil is then routed to port “P” of the steering valve assembly, and oil is applied to the relief valve, check valve, and steering direction valve.

With the steering wheel in the neutral (straight ahead) position, the steering direction valve routes all of the operating-pressure oil out of the steering valve assembly through port “E,” supplying operating-pressure oil to the lift valve assembly. If pressure within the lift system reaches 1740 psi (120 bar), the relief valve will open, dumping oil flow back to the hydraulic oil tank through the return filter and oil cooler. The relief valve will close once the lift system pressure drops below the relief valve setting.

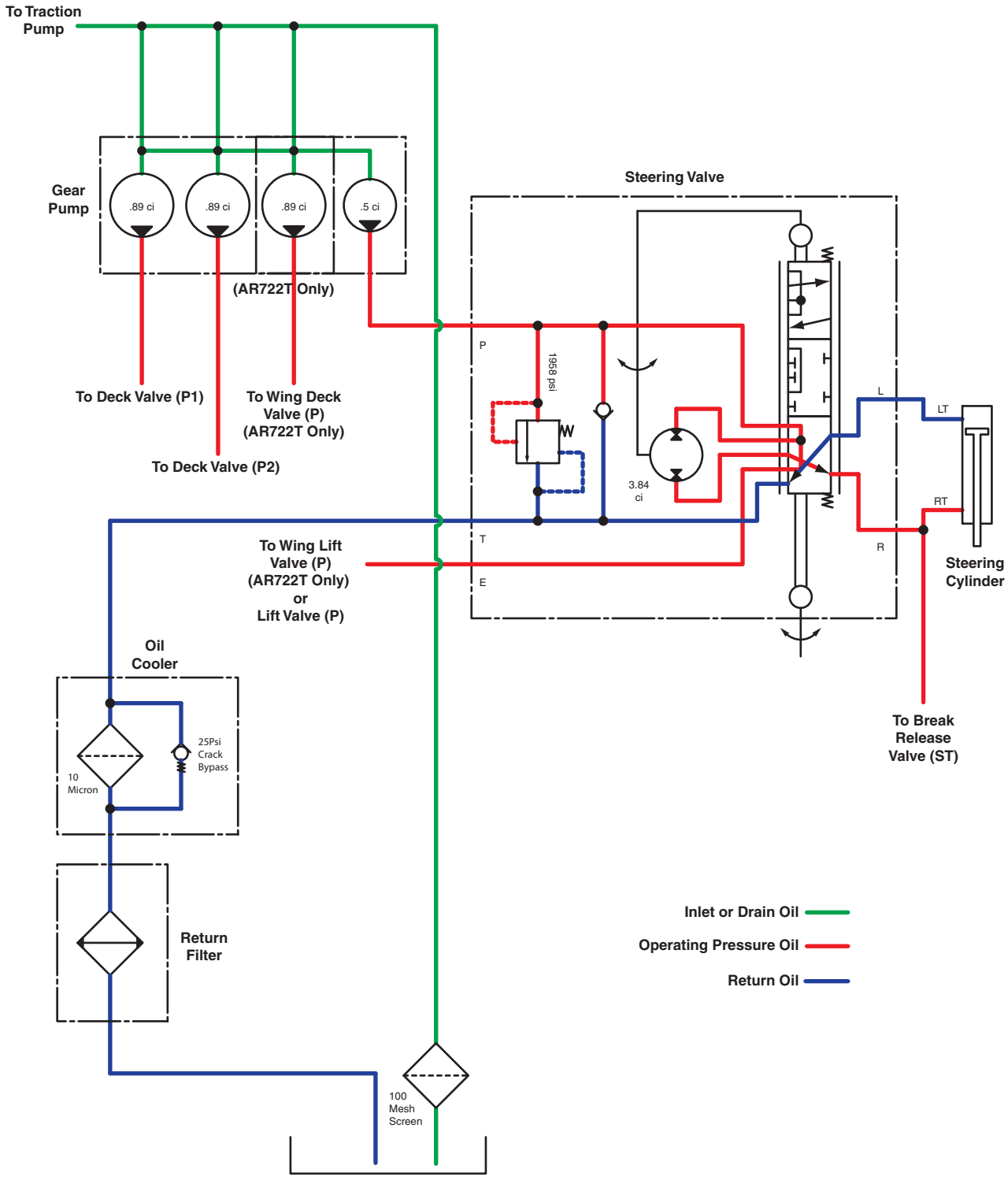
When the steering wheel is turned, the steering direction valve directs operating-pressure oil to one side of the steering cylinder, moving the piston and steering arms, turning the rear wheels.

Low-pressure (return) oil from the other side of the steering cylinder flows through the steering direction valve and exits the steering valve assembly at port “T.” It then flows back to the hydraulic oil tank through the return filter and oil cooler. The return filter and oil cooler are equipped with crack bypass valves. If either the return filter or oil cooler becomes clogged and restricts oil flow, the valve(s) will open to allow oil to flow directly to the hydraulic oil tank.

A portion of the operating-pressure oil flowing through the steering direction valve is directed to the wing lift valve (AR722T Only) or lift valve to supply oil to the lift/lower circuit. (See Lift Circuit Schematic and Theory of Operation) (See Lower Circuit Schematic and Theory of Operation) The amount of oil directed to the lift/lower circuit will depend on the position of the steering wheel, as the steering circuit has priority. The most oil will flow to the lift/lower circuit when the steering wheel is in the neutral (straight ahead) position.

Steering Circuit Schematic

Figure 6-13



Lift Circuit Schematic and Theory of Operation

System Conditions:

- Engine running
- Traction control switch in the off position
- Lift/lower joystick in the lift position

NOTES

See "Lift/Lower Circuit" for theory of operation" for the electrical operation of this circuit.

AR522

Operating-pressure oil is supplied to port "P" of the lift valve by the steering circuit. With the lift solenoid valve energized, and the lowering/proportional valve de-energized, oil flows against the check valves of each valve, and exits the lift valve assembly through ports "C1" through "C5" in parallel to the rod end of each lift cylinder.

NOTE

Rear cylinders include a one-way orifice and a 0.026-inch (0.660 mm) orifice on the rod side of the cylinder.

Oil passes through a 0.029 inch (0.736 mm) orifice at the rod end of each lift cylinder, and oil is applied to the back of the piston, causing the cylinder to retract, raising the cutting units.

Oil from the piston end of the lift cylinders flows back to the lift valve assembly through ports "C6" through "C10" in parallel. Oil exits the lift valve assembly through port "T," and flows to the return filter and oil cooler, and then back to the hydraulic oil tank.

If there is resistance to flow at the lift cylinders, causing oil pressure to rise above the steering relief valve setting of 1740 psi (120 bar), the steering relief valve will open. Oil flow will then be dumped back to the hydraulic oil tank through the return filter and oil cooler.

AR722T

Operating-pressure oil is supplied to port "P" of the wing lift valve by the steering circuit. The internal flow divider diverts metered flow between valve assembly and port "P1".

NOTES

Wing lift valve port "P1" supplies port "P" of the lift valve with metered operating oil in AR722T models. Lift valve operates the same in both models.

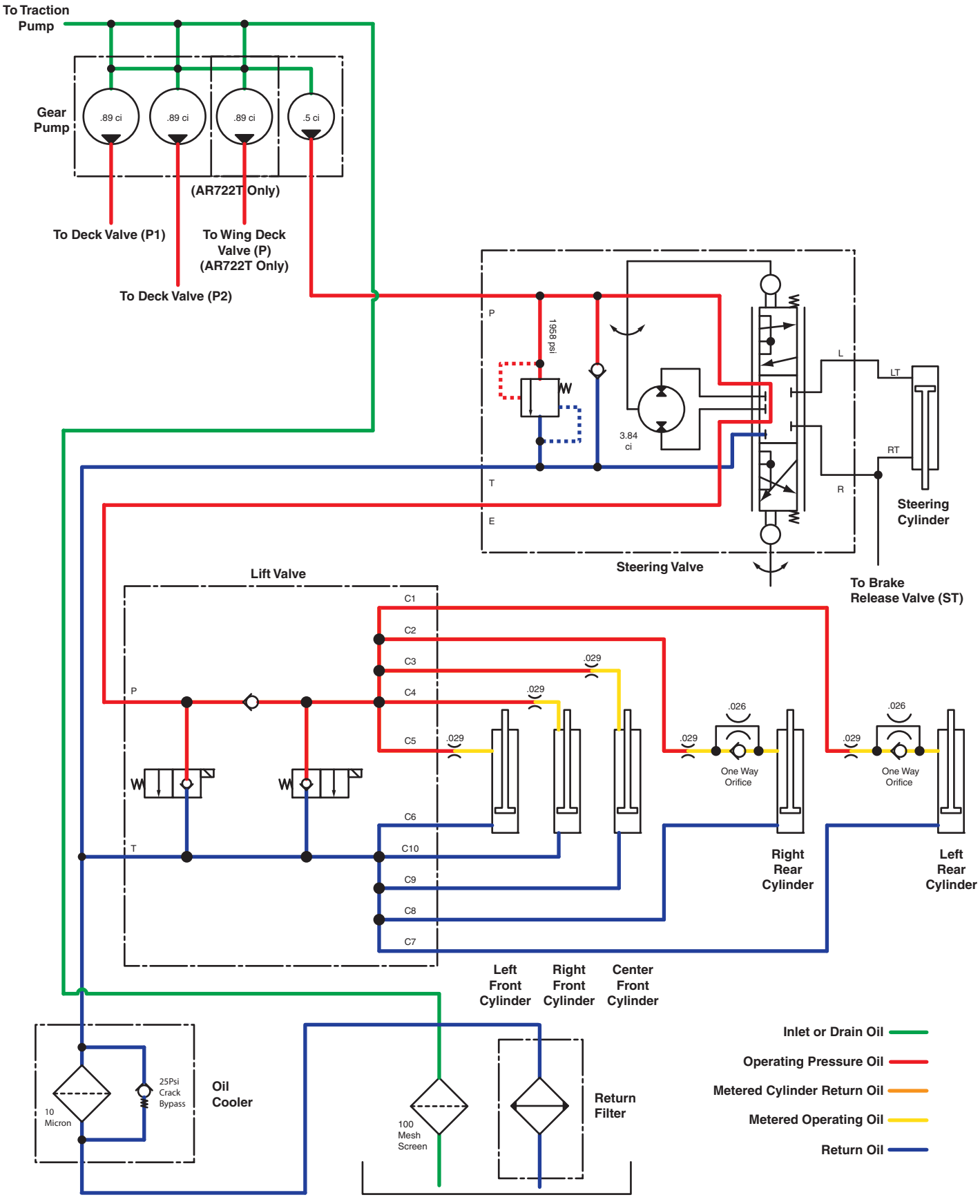
With the wing lift/lower valves energized, and the wing lowering solenoid valve de-energized, oil flows against the lowering check valve, and exits the wing lift/lower valve assembly through ports "A1" and "A2" in parallel to the piston end of each lift cylinder.

Oil is applied to the front of the piston, causing the cylinder to expand, raising the cutting units.

Oil from the rod end of the lift cylinders flows back to the wing lift valve assembly through port "B". Oil exits the wing lift valve assembly through port "T," and flows to the return filter and oil cooler, and then back to the hydraulic oil tank.

Lift Circuit (AR522) Schematic

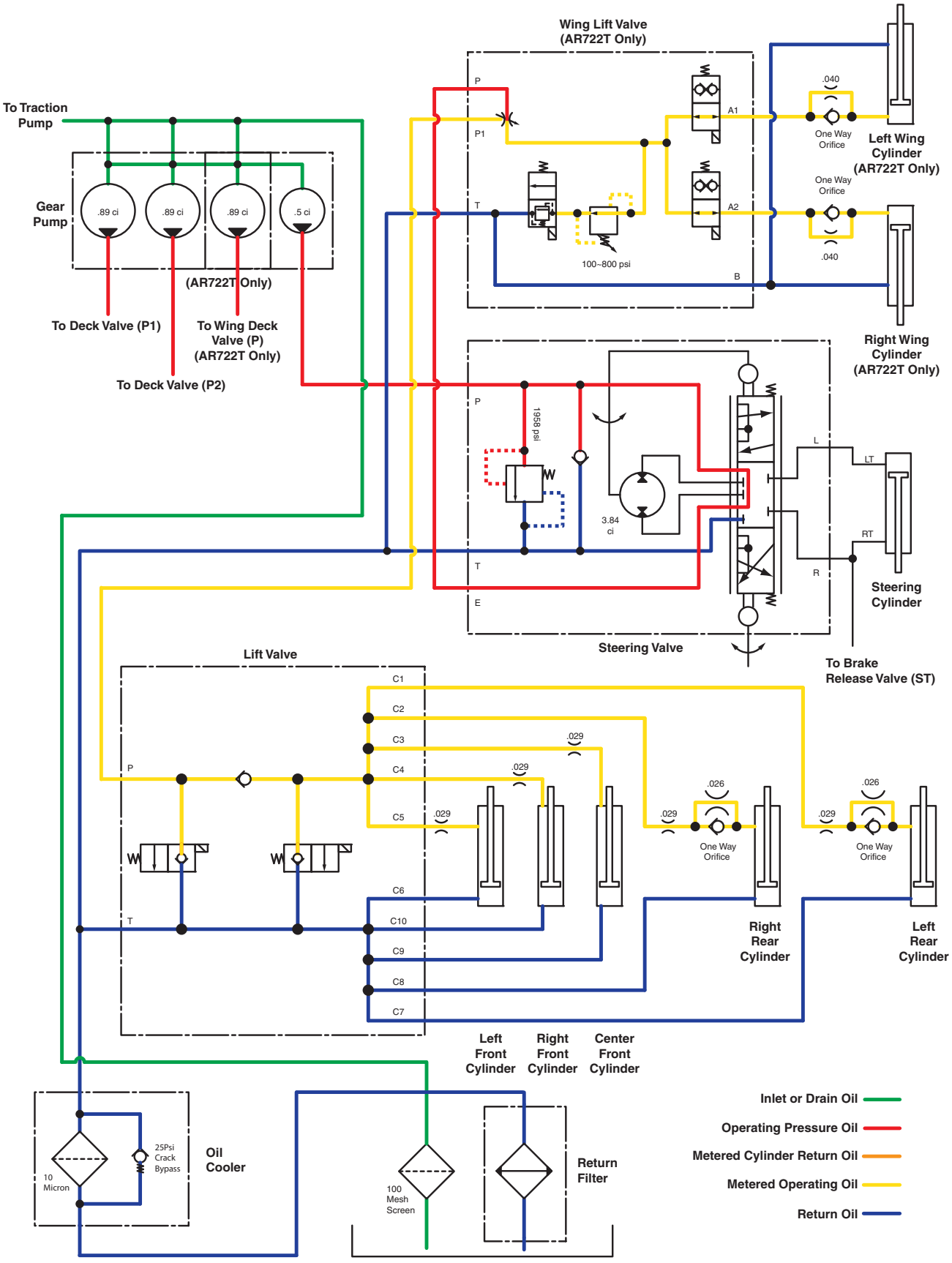
Figure 6-15



4

Lift Circuit (AR722T) Schematic

Figures 6-16



Lower Circuit Schematic and Theory of Operation

System Conditions:

- Engine running
- Traction control switch in the off position
- Lift/lower joystick in the lower position

NOTES

See "Lift/Lower Circuit theory of operation" for the electrical operation of this circuit.

AR522

Operating-pressure oil is supplied to port "P" of the lift valve assembly by the steering circuit. With the lift solenoid valve de-energized, the operating-pressure oil flows through the valve, back to the return filter and oil cooler, and then back to the hydraulic oil tank.

NOTE

Rear cylinders include a one-way orifice and a 0.026-inch (0.660 mm) orifice on the rod side of the cylinder.

Gravity pulls the cutting units down, pulling against the lift cylinders.

In the rear lift cylinders, oil flowing from the rod end of the cylinders flows against the one-way check valve, closing the valve and forcing oil to flow through the 0.026-inch (0.660 mm) orifice, slowing the flow of oil. This causes the rear cylinders to drop slower than the front cylinders.

Metered cylinder return oil from the rod end of the lift cylinders flows through the 0.029-inch (0.736 mm) orifices in each cylinder, and back into the lift valve through ports "C1" through "C5" in parallel. The oil is applied against the check valve, closing the valve. Oil then flows through the energized lowering/proportional solenoid valve and back to the return filter, oil cooler, and hydraulic tank.

NOTE

The lower proportional solenoid valve will remain energized until the raise/lower joystick is moved to the raise position.

AR722T

Operating-pressure oil is supplied to port "P" of the wing lift valve by the steering circuit. The internal flow divider diverts metered flow between valves assembly and port "P1".

NOTES

Wing lift valve port "P1" supplies port "P" of the lift valve with metered operating oil in AR722T models. Lift valve operates the same in both models.

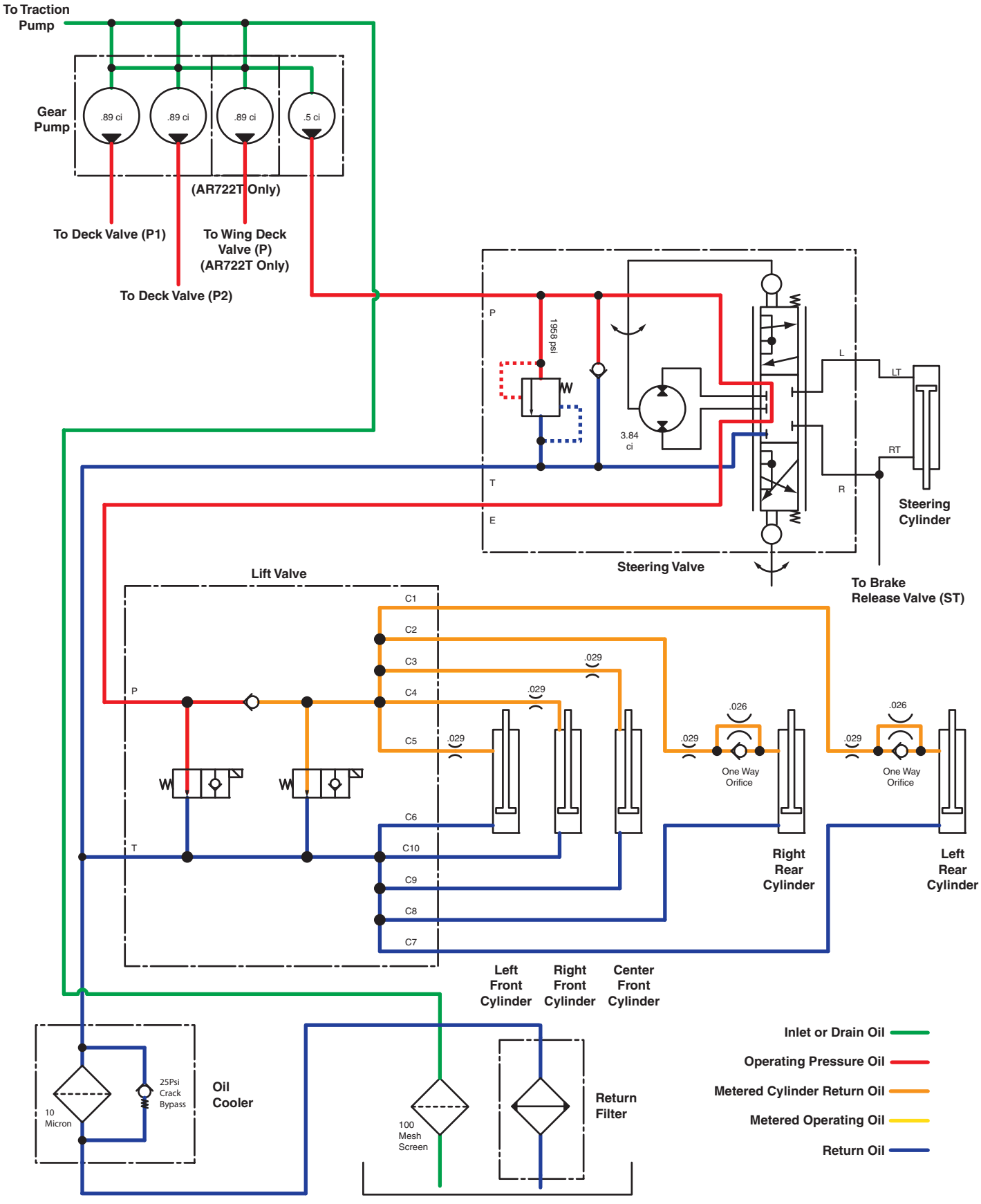
With the wing lowering solenoid valve energized, oil flows through, exits the wing lift valve assembly through port "T", and flows to the return filter and oil cooler, and then back to the hydraulic oil tank.

Gravity pulls the cutting units down, pushing against the lift cylinders.

Oil flowing from the piston end of the cylinders flows against the one-way check valve, closing the valve and forcing oil to flow through the 0.040-inch (1.016 mm) orifice, slowing the flow of oil. Metered cylinder return oil then flows back to the wing lift valve through ports "A1" and "A2", through the energized lift/lower valve, and back to the return filter, oil cooler, and hydraulic tank.

Lower Circuit (AR522) Schematic

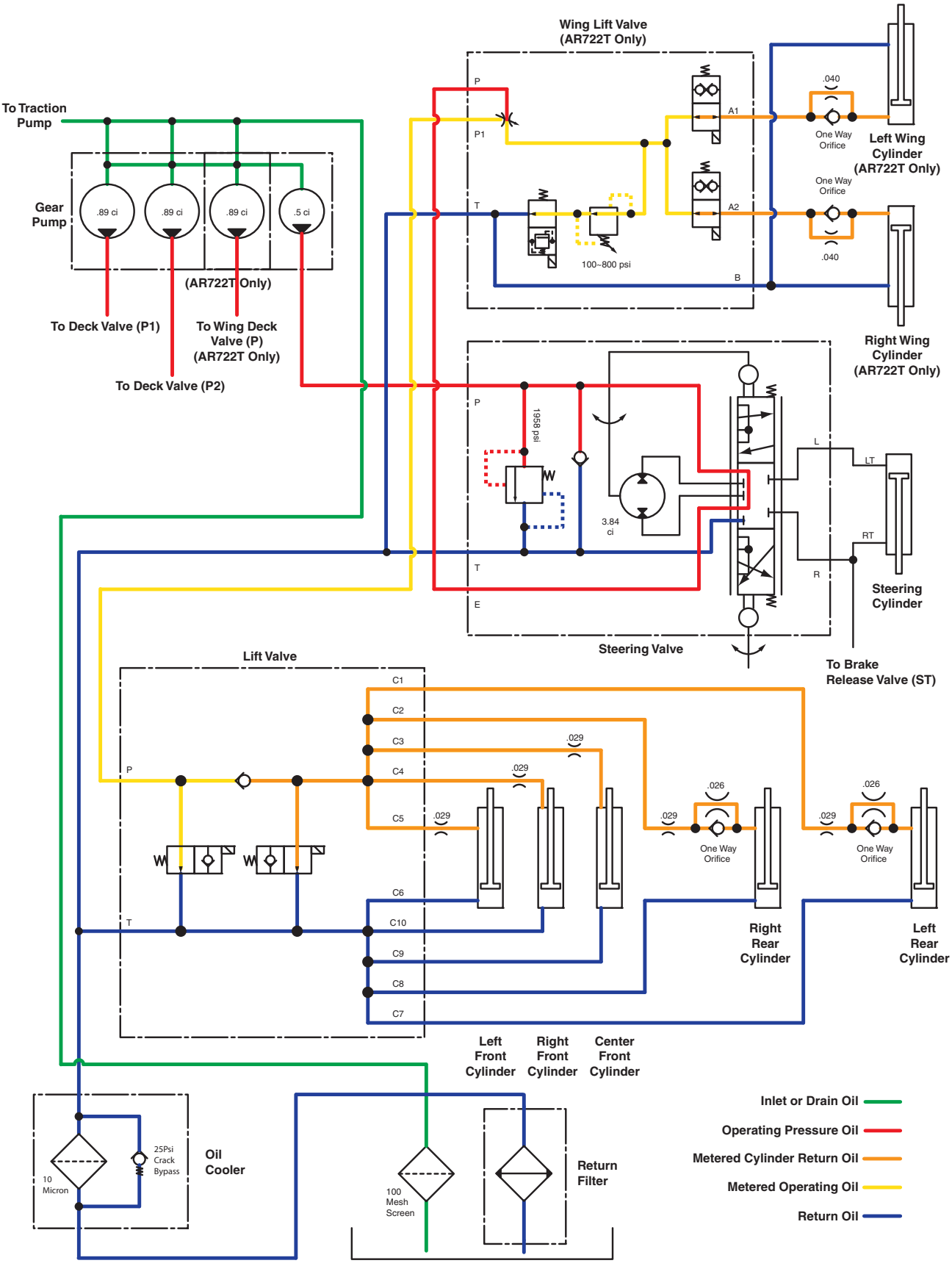
Figure 6-19



4

Lower Circuit (AR722T) Schematic

Figure 6-20



Float and Traction Control Circuit Schematic and Theory of Operation

System Conditions:

- Engine running
- Traction control switch in the on position

NOTES

See "Float and Traction control - Theory of Operation" for the electrical operation of this circuit.

AR522

The purpose of the traction control circuit is to allow the transfer of weight from the cutting units to the wheels to improve traction. This is done by applying slight upward pressure on the cutting units.

Operating-pressure oil is supplied to port "P" of the lift valve by the steering circuit. When the traction control is activated (on), the controller activates the raise solenoid valve (on) and the lower/ proportional solenoid valve (on). The controller pulses the electrical signal to the lowering proportional solenoid valve to meter the amount of oil pressure in ports "C1" through "C5." The metered oil pressure is approximately 400 psi (27 bar) and is adjustable through the traction control calibration. If the traction control is improperly calibrated, it can raise the decks off the ground. The oil pressure allowed to build up in the circuit allows the cutting units to transfer weight to the wheels, improving traction.

AR722T

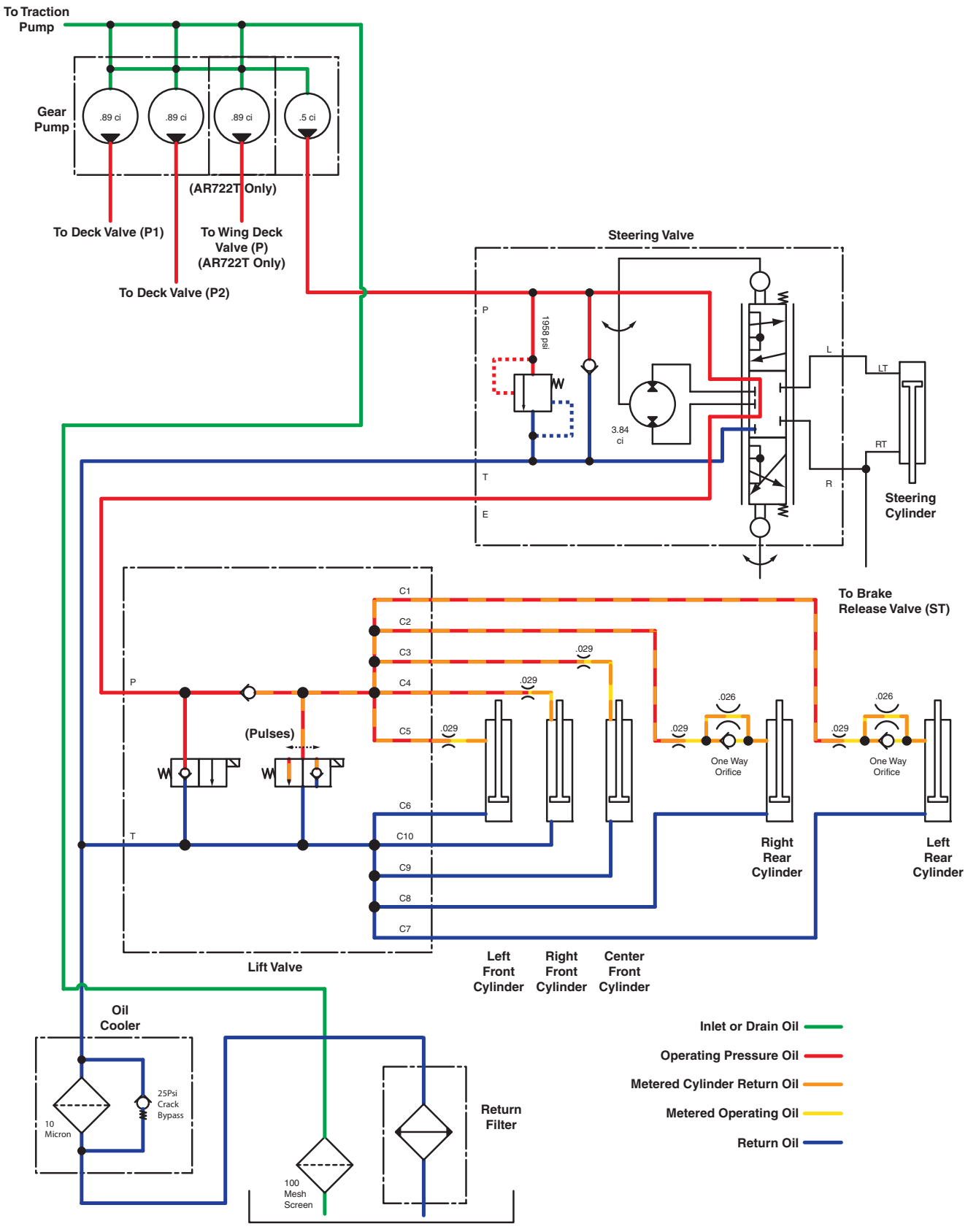
Metered operating pressure is supplied to port "P" of the lift valve by the wing lift valve in AR722T models.

Float and Traction Control Circuit (AR522) Schematic

Figure 6-23

Float and Traction Control Circuit (AR722) Schematic

Figure 6-24


To Traction Pump
Gear Pump
.89 ci
.89 ci
.89 ci
.5 ci
(AR722T Only)
To Deck Valve (P1)
To Wing Deck Valve (P) (AR722T Only)
To Deck Valve (P2)
Steering Valve
P
1956 psi
3.84 ci
L
LT
RT
R
T
E
Steering Cylinder
To Brake Release Valve (ST)
C1
C2
C3
C4
C5
C6
C10
C9
C8
C7
P
T
(Pulses)
.029
.026
One Way Orifice
Right Rear Cylinder
Left Rear Cylinder
Lift Valve
Left Front Cylinder
Right Front Cylinder
Center Front Cylinder
Oil Cooler
10 Micron
25Psi Crack Bypass
100 Mesh Screen
Return Filter
Inlet or Drain Oil
Operating Pressure Oil
Metered Cylinder Return Oil
Metered Operating Oil
Return Oil

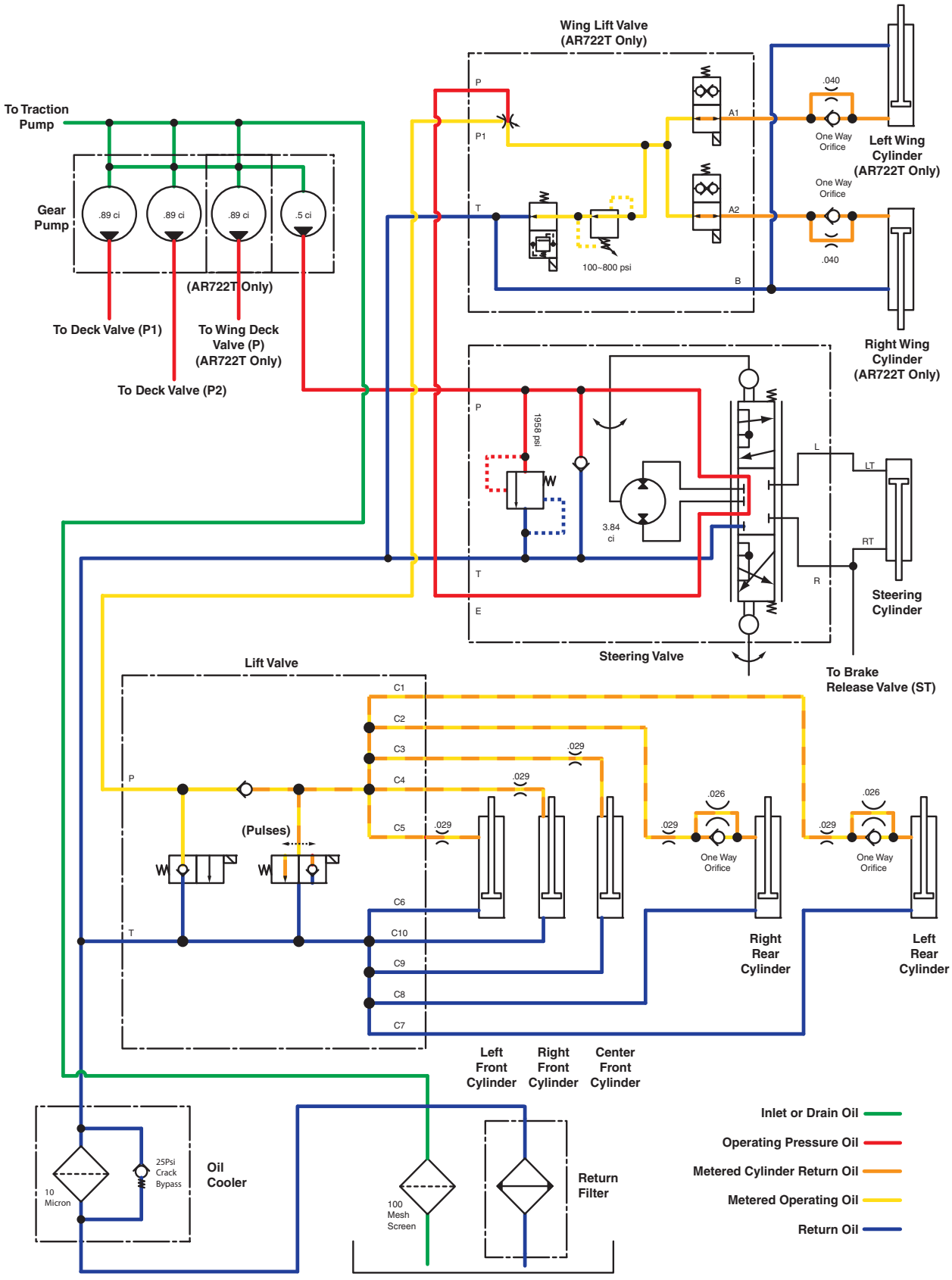
4

Mow Circuit Schematic and Theory of Operation

Mow Circuit (On) Theory of Operation

System Conditions:

- Engine running



- Cutting units lowered
- PTO switch in the on position
- Park brake released

NOTE

See "Mow Circuit Theory of Operation" for the electrical operation of this circuit.

Hydraulic oil is drawn from the hydraulic oil tank by the gear pump assembly, sections 1 and 2. Before entering the gear pump assembly, the inlet oil is filtered by a 100-mesh screen to remove any debris.

AR522

Oil Supply—Right and Left Rear and Center Front Cutting Unit Motors

Operating-pressure oil from the gear pump (pump section 1) is supplied to the deck valve at port "P1." Oil then flows through port "M1" to the left rear, center front, and right rear cutting unit motors in series.

Operating-pressure oil is also applied to check valve 1 in the deck valve. The three-motor system has a higher working pressure than the two-motor system; therefore check valve 1 opens and operating pressure oil is applied against check valve 2, keeping it closed. Oil also flows to the shuttle valve (pilot lines on both sides of the valve and supply to the valve). With oil pressure on the pilot lines on both sides of the valve, and spring bias on one side of the valve, the valve will remain closed, preventing oil flow. Oil is also supplied to the solenoid ON valve and logic check valve, seating the logic check valve against the return side of the system. With the solenoid ON valve energized, operating-pressure oil cannot flow through the valve. Oil pressure forces the logic check valve to open, allowing the flow of oil to the pilot line of the relief valve.

Oil Supply—Right and Left Front Cutting Unit Motors

Operating-pressure oil from the gear pump (pump section 2) is supplied to the deck valve at port "P2." Oil then flows through port "M2" to the left front and right front cutting unit motors. Operating-pressure oil is also applied to check valve 2 in the deck valve. The three-motor system produces greater pressure than the two-motor system. When check valve 2 opens, operating pressure is applied against check valve 1, keeping it closed. Oil also flows through an orifice to the shuttle valve (pilot lines on both sides of the valve and supply to the valve). With oil pressure on the pilot lines on both sides of the valve, and spring pressure on one side of the valve, the valve will remain closed, preventing oil flow. Oil is also supplied to the solenoid ON valve and logic check valve, seating the logic check valve against the return side of the system. With the solenoid ON valve energized, operating-pressure oil cannot flow through the valve. Oil pressure forces the logic check valve to open, allowing the flow of oil to the pilot line of the relief valve.

System Relief

If there is resistance to flow at the cutting unit motors, causing oil pressure to rise above the relief valve setting of 2800 psi (193 bar), the relief valve will open. When the relief valve opens, oil flows through the check valve, resulting in a pressure drop allowing check valve 1 to shift, permitting full pump flow back to the return filter, oil cooler, and hydraulic tank.

Oil Return

With the solenoid valve energized, oil pressure is applied to the check valve, preventing oil flow to the valve. Oil then flows through the pilot line of the relief valve, opening the valve.

Return oil from the cutting unit motors enters the deck valve through ports "R1" (right and left front cutting unit motors) and "R2" (right and left rear and center front cutting unit motors) and flows through the relief valve. It then flows back to the return filter, oil cooler, and hydraulic oil tank.

The return filter and oil cooler are equipped with crack bypass valves. If either the return filter or oil cooler becomes clogged and restricts oil flow, the valve(s) will open to allow oil to flow directly to the hydraulic oil tank.

Oil that leaks through the motors drains back to the hydraulic oil tank through the case drain hoses.

AR722

Oil Supply—Right and Left Wing Cutting Unit Motors

Operating-pressure oil from the gear pump (pump section 3) is supplied to the wing deck valve at port "P." Oil then flows through port "A1" to the right wing cutting unit motor, back in port "B1", and back out port "A2" to left wing cutting unit motor.

Operating-pressure oil flows to the solenoid ON valve and logic check valve, seating the logic check valve against the return side of the system. Oil also flows to the solenoid right and left wing valves. With the solenoid valves energized, operating-pressure oil cannot flow through either valve. Oil pressure forces the logic check valve to open, allowing the flow of oil to the pilot line of the relief valve.

System Relief

If there is resistance to flow at the cutting unit motors, causing oil pressure to rise above the relief valve setting of 3000 psi (207 bar), the relief valve will open. When the relief valve opens, oil flows to the return filter, oil cooler, and hydraulic tank.

Oil Return

With either solenoid valve energized, oil pressure is applied to the relief valve, allowing the flow of oil through it.

Return oil from the cutting unit motors enters the deck valve through port “B1” (right wing cutting unit motor) or “B2” (left wing or both cutting unit motors) and flows through the relief valve. It then flows back to the return filter, oil cooler, and hydraulic oil tank.

The return filter and oil cooler are equipped with crack bypass valves. If either the return filter or oil cooler becomes clogged and restricts oil flow, the valve(s) will open to allow oil to flow directly to the hydraulic oil tank.

Oil that leaks through the motors drains back to the hydraulic oil tank through the case drain hoses.

Mow Circuit (Off) Theory of Operation

AR522

System Conditions:

- Engine running
- Cutting units lowered
- PTO switch in the OFF position
- Park brake released

Operating-pressure oil from gear pump section 1 is supplied to the deck valve at port “P1,” and from gear pump section 2 to the deck valve at port “P2.” Operating-pressure oil then flows to, and opens, check valves 1 and 2. Oil also flows to all system deck motors, pressurizing the system. With system operating-oil pressure equal in the system, the spring biased shuttle valve shifts to the closed position. With the solenoid valve in the off position, oil is forced to drain to the hydraulic tank.

AR722

System Conditions:

- Engine running
- Wing cutting units lowered
- Both wing switches in the OFF position
- Park brake released

Operating-pressure oil from gear pump section 3 is supplied to the deck valve at port “P.” With both wing solenoid valves in the off position, operating-pressure oil flows through them to both sides of both deck motors, pressurizing the system. With system operating-oil pressure against the relief valve, the relief valve shifts to the open position allowing oil to drain to the hydraulic tank.

Mow Circuit (On) (right wing off) Theory of Operation

AR722

System Conditions:

- Engine running
- Cutting units lowered
- PTO switch in the on position
- Park brake released

Oil Supply—Right and Left Wing Cutting Unit Motors

Operating-pressure oil from the gear pump (pump section 3) is supplied to the wing deck valve at port “P.” Oil then bypasses right wing cutting unit motor, and flows out port “A2” to left wing cutting unit motor.

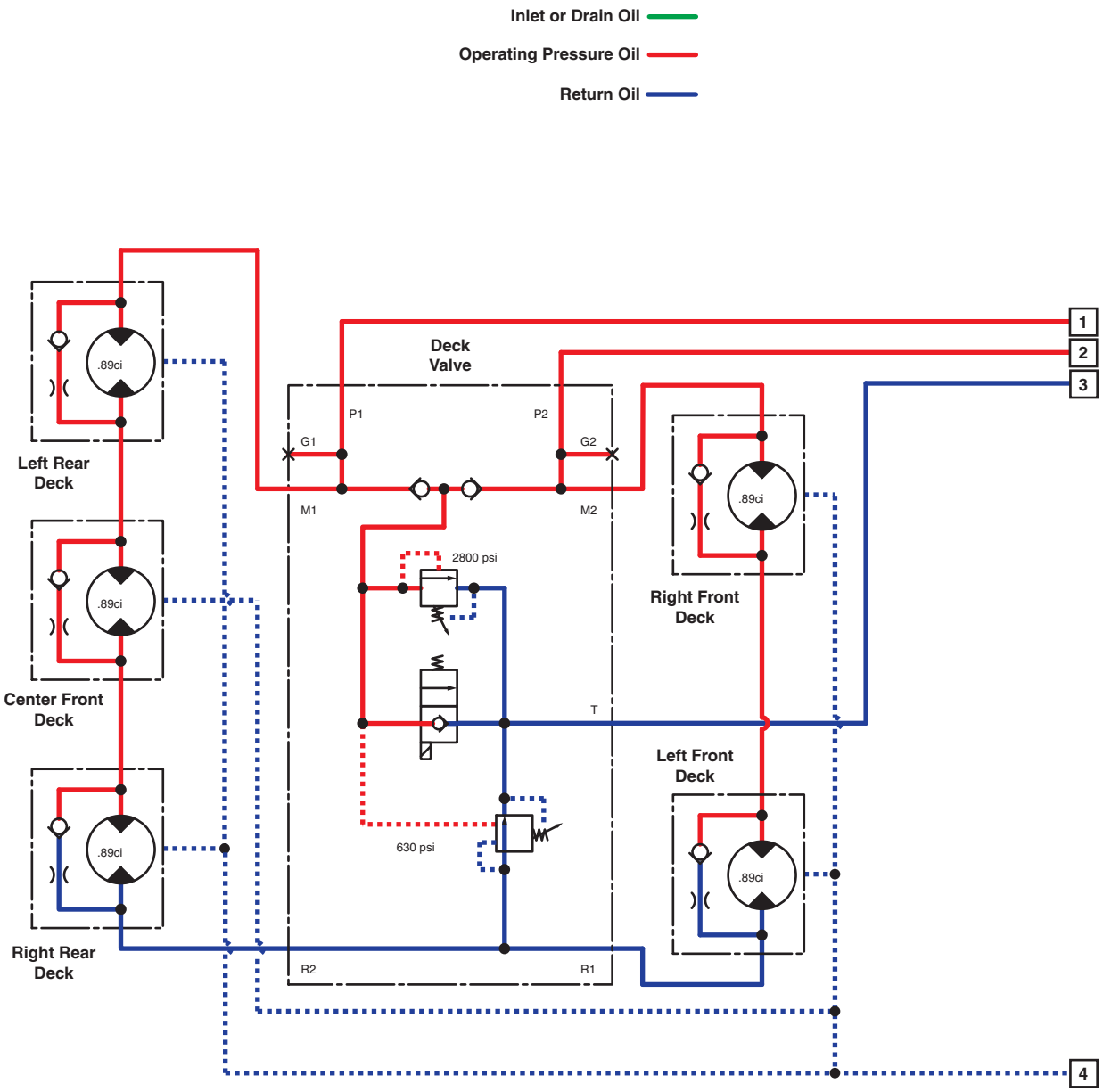
Operating-pressure oil flows to the solenoid ON valve and logic check valve, seating the logic check valve against the return side of the system. Oil also flows to the solenoid right and left wing valves. With the right wing solenoid valve de-energized and left wing solenoid valve energized, operating-pressure oil flows through the right wing solenoid valve, but cannot flow through the left. Oil pressure forces the logic check valve to open, allowing the flow of oil to the pilot line of the relief valve.

Mow On Circuit Schematic

See Figure 6-29

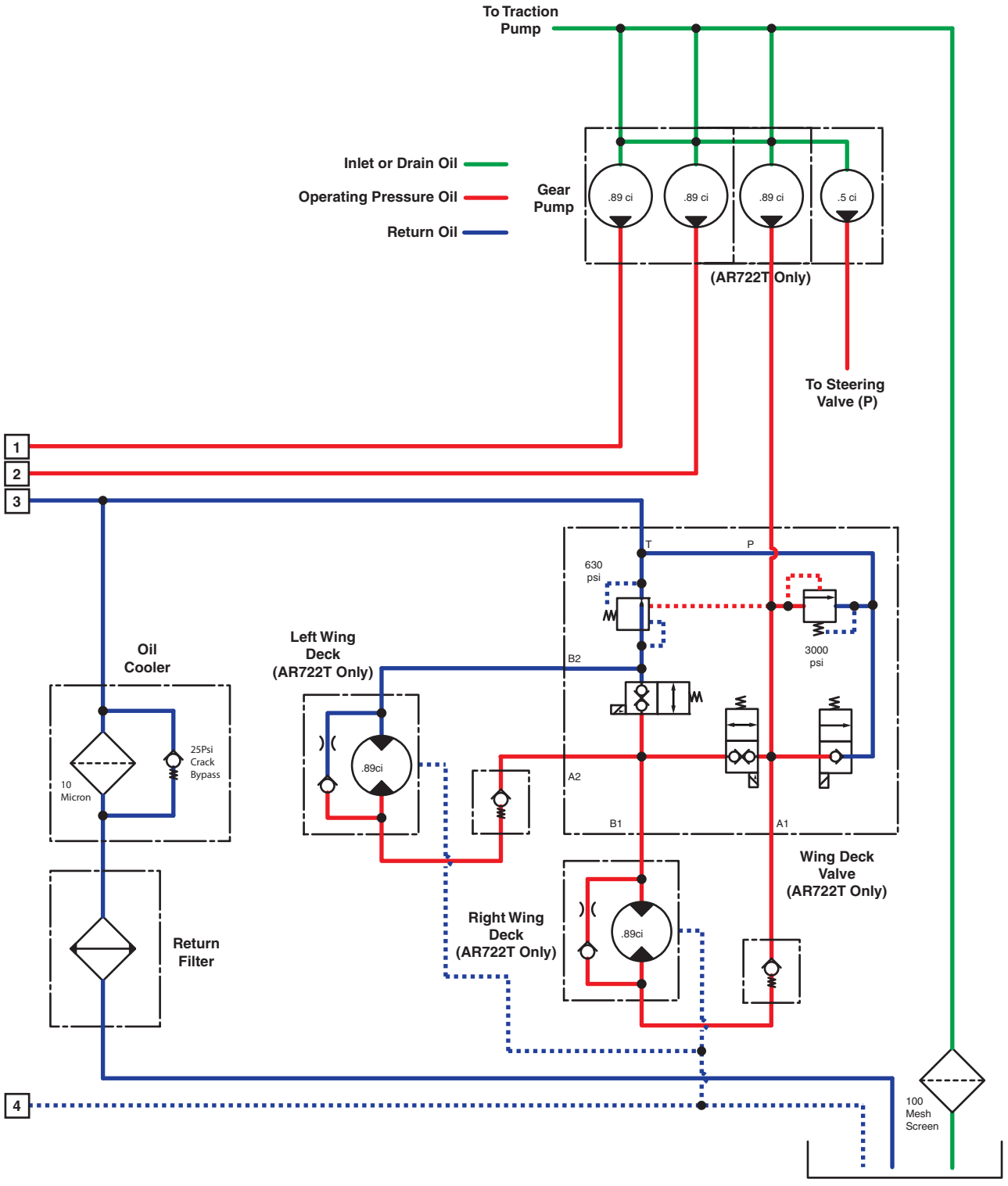
Mow On Circuit Schematic

(Continued)



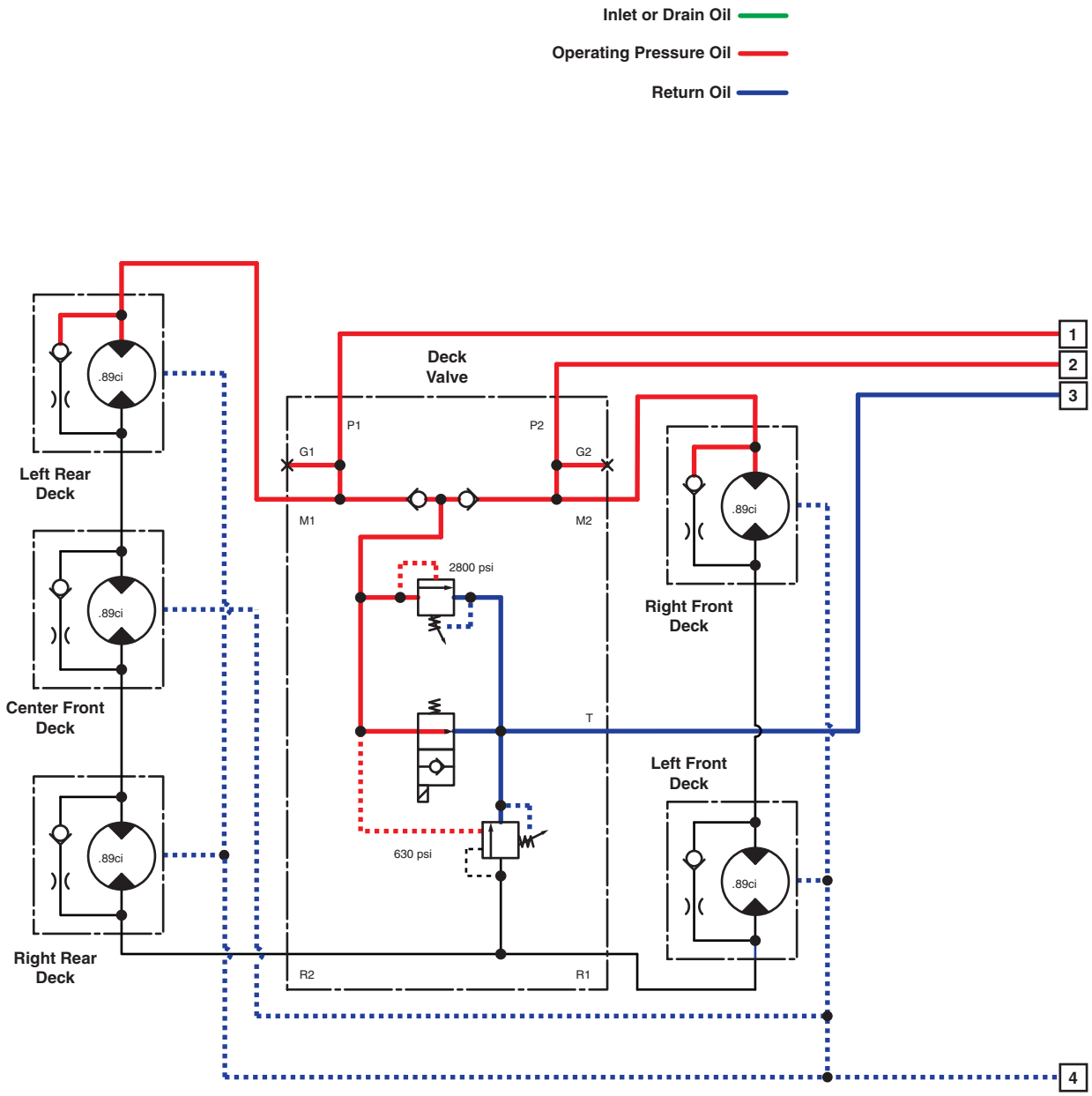
Mow Off Circuit Schematic

See Figure 6-30



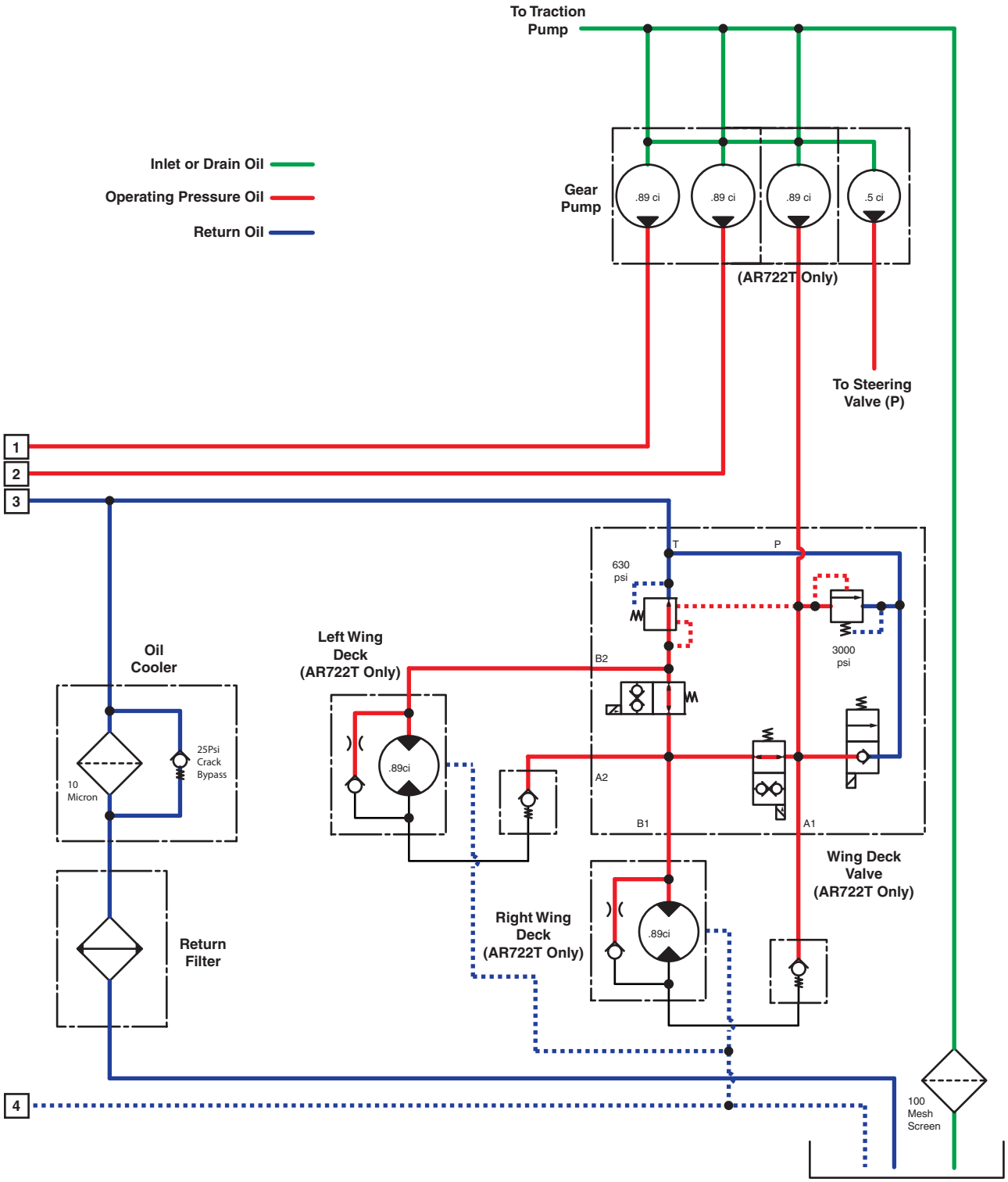
Mow Off Circuit Schematic

(Continued)



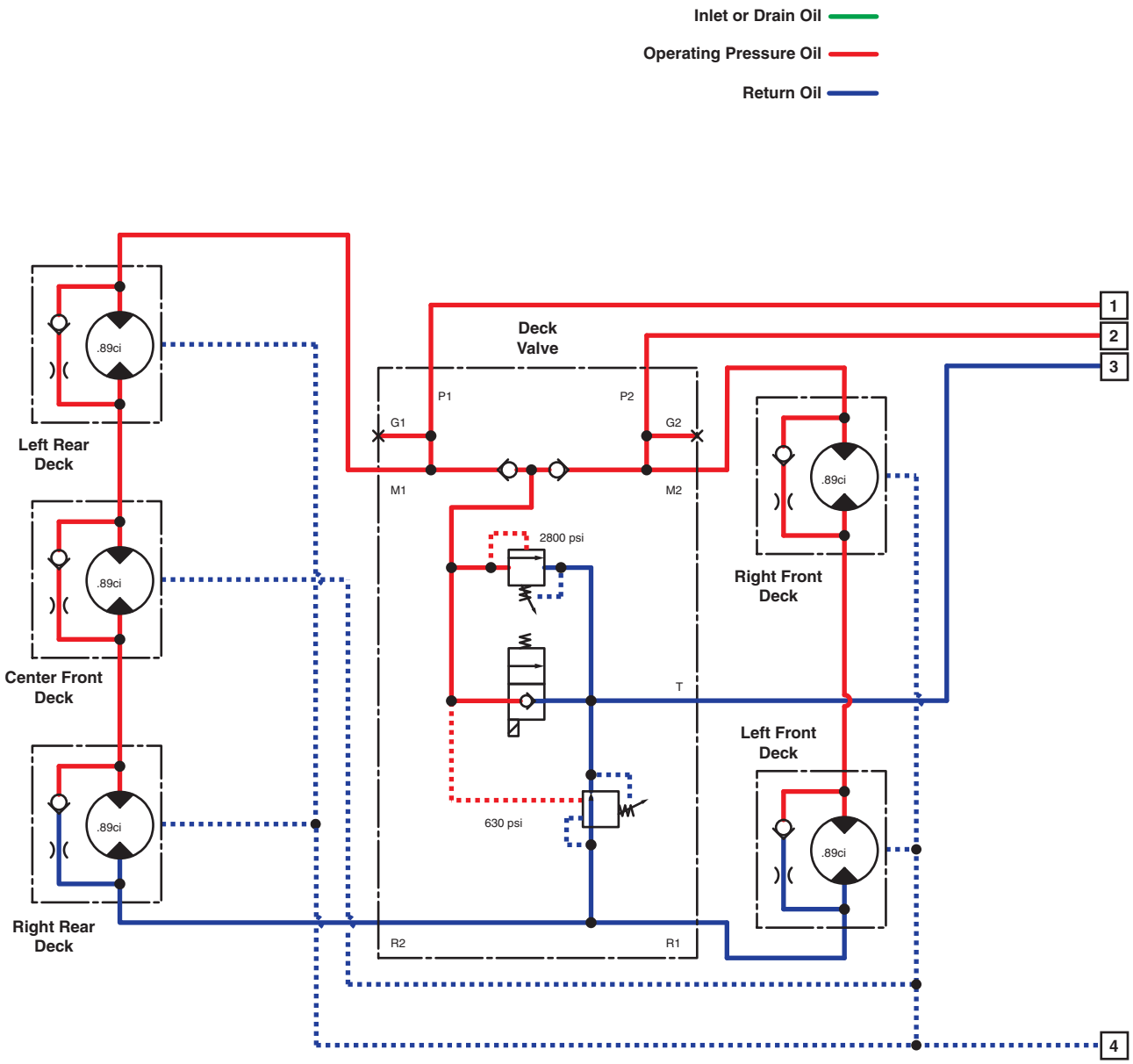
Mow ON (right wing off) Circuit Schematic

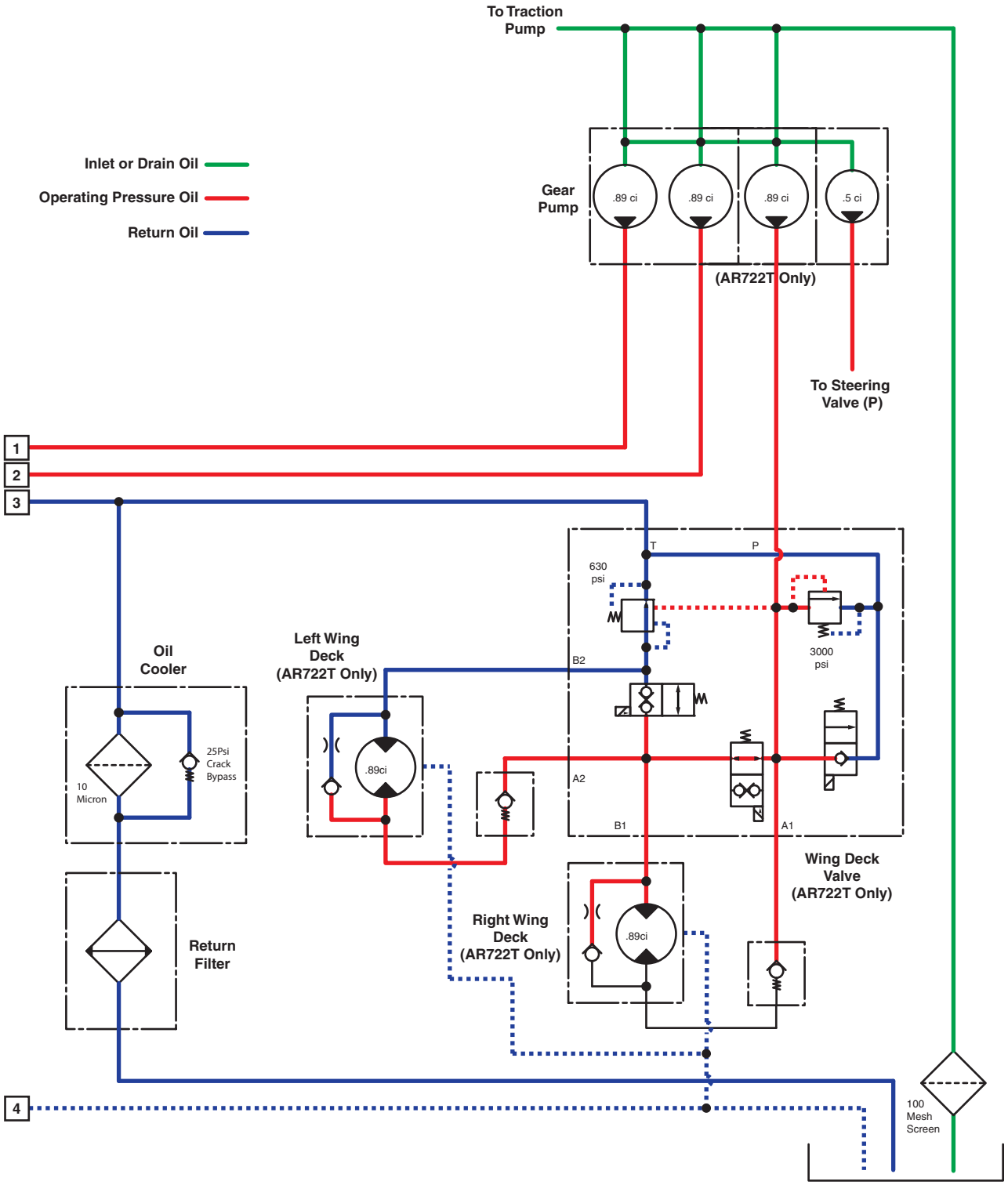
See Figure 6-31



Mow ON (right wing off) Circuit Schematic

(Continued)




To Traction Pump
Inlet or Drain Oil
Operating Pressure Oil
Return Oil
Gear Pump
.89 ci
.89 ci
.89 ci
.5 ci
(AR722T Only)
To Steering Valve (P)
1
2
3
T
P
630 psi
3000 psi
B2
A2
B1
A1
Oil Cooler
10 Micron
25Psi Crack Bypass
Left Wing Deck (AR722T Only)
.89ci
Wing Deck Valve (AR722T Only)
Right Wing Deck (AR722T Only)
.89ci
Return Filter
4
100 Mesh Screen

Field Test Procedures

When a hydraulic system failure occurs, some simple effective tests can be performed prior to using a test instrument. 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 Procedure” on page 6-33.)

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.

Eliminate all mechanical issues prior to starting hydraulic tests.

Lift Cylinder Leakage Test

See Figures 6-1 and 6-2.

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 at 120–150° F (49–65°C).
2. Raise cutting units.
3. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
4. Support all cutting unit lift arms.

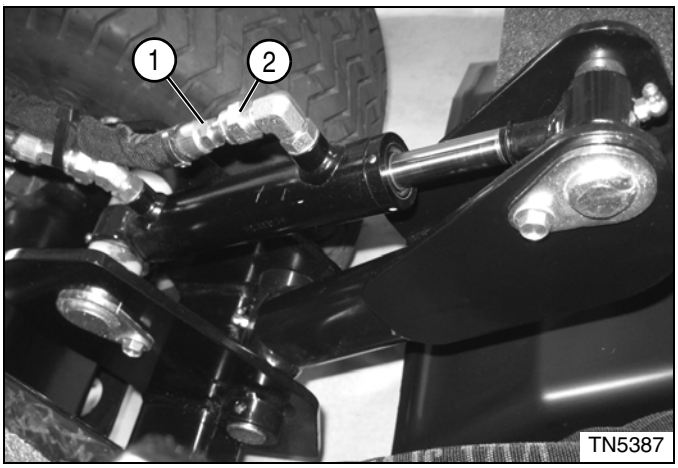


Figure 6-1

NOTE

Figure 6-123 shows left rear lift arm cylinder. Procedure is similar for right rear and front lift cylinders.

5. Disconnect hose (1) from lift cylinder rod end fitting (2).
6. Install plug in hose (1).
7. Install cap on lift cylinder fitting (2).
8. Remove support from cutting unit lift arm being tested.

   After 15 minutes, does cutting unit drift down?

   YES *Cylinder is bypassing oil. Replace lift cylinder. (See “Lift Cylinders” on page 6-68.)*

   NO *Repeat the test for all 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 (1) to lift cylinder fitting (2).
11. Start the engine and lower cutting units.
12. Stop the engine.

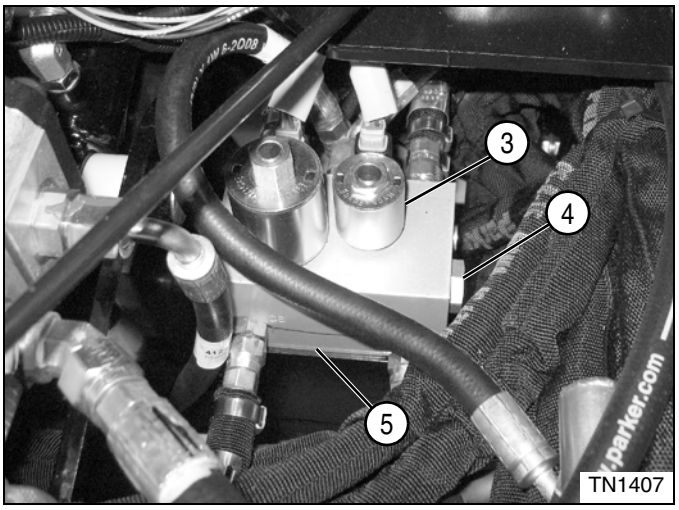


Figure 6-2

13. Remove center floorboard.

IMPORTANT

Cutting units must be lowered to the ground.

14. Remove check valve (4) from the lift valve body (5).
15. Clean and inspect check valve for damage. Replace as necessary.
16. Start the engine and raise the cutting units.
17. Stop the engine.
18. If lift cylinders continue to drift down, start the engine and lower the cutting units.
19. Stop the engine.

IMPORTANT

Cutting units must be lowered to the ground.

20. Remove lower/proportional solenoid valve (3) from the lift valve body (5).
21. Clean and inspect lower/proportional solenoid valve for damage. Replace as necessary. (See “Solenoid Test” on page 4-60.)

Power Steering Circuit Test

The purpose of this test is to determine if the steering cylinder and the steering valve are operating properly.

NOTE

Before performing this test, check the steering system for mechanical binding or damage that may affect the steering.

1. Operate the machine until hydraulic oil reaches operating temperature, 120–150° F (49–65° C).
2. With the engine running, turn the steering wheel all the way to the right, and then all the way to the left.

   Does the steering wheel continue to turn after full left or right movement of the steering cylinder?

   YES *Proceed to step 3.*

   NO *Steering system is not faulty.*
3. Stop the engine and remove both hydraulic hoses from the steering cylinder; plug the hoses and cap the cylinder ports.
4. Start the engine and turn the steering wheel all the way to the right and then all the way to the left. Only a little movement should be evident.

   Is the steering wheel hard to turn or does it not turn at all?

   YES *Steering cylinder is faulty; repair or replace as needed. (See “Steering Cylinder” on page 7-16.)*

   With steady pressure in one direction, does steering wheel make one complete revolution in 30 seconds?

   YES *Steering valve is faulty; repair or replace as needed. (See “Steering Valve” on page 7-7.)*

Cutting Unit System Test

The cutting unit system consists of two circuits: the front cutting unit circuit and the rear cutting unit circuit. The front cutting unit circuit consists of the front cutting unit pump, deck valve, right front cutting unit motor, and left front cutting unit motor. The rear cutting unit circuit consists of the rear cutting unit pump, deck valve, left rear cutting unit motor, center cutting unit motor, and right rear cutting unit motor. This test determines if one of the cutting unit motors is faulty. An instrument test must be performed to isolate the performance of the cutting unit pumps and deck valve.

NOTES

- *Perform test on only one cutting unit motor at a time.*
- *The case drain on a hydraulic motor is used to return lubrication or bypassed hydraulic oil back 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. Bypass the seat switch.
4. Remove the case drain hose from the cutting unit motor. Immediately plug the hose.
5. Position a drain pan with a minimum capacity of 1 gallon (3.8 L) near the cutting unit motor.

6. 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 precaution may result in death or serious injury.

7. Install a suitable blocking device or tool in cutting unit, preventing cutting unit from turning.
8. Set the park brake and start the engine.
9. Disconnect park brake switch. (See “Rocker Switches” on page 4-70.)
10. Place the PTO switch in the on position for 15 seconds.
11. Stop the engine and remove the key.
12. Measure the amount of oil that flowed from the case drain. The amount x 4 = amount per minute.

    Is the oil captured from the case drain within a half pint per minute?

    YES *The motor shaft and/or bearings are not faulty; proceed with an instrument test. (See “Instrument Test Procedure” on page 6-33.)*

    Is the oil captured from the case drain more than 1 pint per minute?

    YES *The motor may be faulty; repair or replace as needed. (See “Cutting Unit Motors” on page 6-62.)*
13. Disconnect and remove test equipment. Install all hoses, fittings, and components as noted prior to removal.

Instrument Test Procedure

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 user.

The internal leakage percentage ranges are as follows:

0% to 10% = Good

11% to 20% = Marginal

21% or more = Bad

Example: Cutting Unit System Performance Complaint

The machine operator reports 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 35%; a result which requires the testing of individual components. This result can also be interpreted as the system is 65% efficient.

The remaining components in question are as follows: rear cutting unit pump, deck valve, left rear cutting unit motor, center cutting unit motor, and right rear cutting unit 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 rear cutting unit pump, 10.5% in the deck valve, 20% in the left rear cutting unit motor, 5.6% in the center cutting unit motor, and 4.4% in the right rear cutting unit motor. Although all the components lend to the overall circuit leakage, only the left rear cutting unit motor, which is at the extreme end of the marginal range, would be considered for repair/replacement.

Formulas:

Cutting Unit Motor and Deck Valve

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

Circuit and Rear Cutting Unit Pump

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

Calculations:

Circuit Test

No Load Flow = 10 gpm

Loaded Flow = 6.5 gpm

10 – 6.5 / 10 x 100 = Total Circuit Leakage 35%

Rear Cutting Unit Pump Test

No Load Flow = 10 gpm

Loaded Flow = 9.5 gpm

10 – 9.5 / 10 x 100 = Rear Cutting Unit Pump Leakage 5%

Deck Valve Test

Loaded Flow from rear cutting unit pump test = 9.5 gpm

Loaded Flow from deck valve test = 9 gpm

10 – 9 / 9.5 x 100 = Deck Valve Leakage 10.5%

Left Rear Cutting Unit Motor Test

Loaded Flow from deck valve test = 9 gpm

Loaded Flow from left rear cutting unit motor test = 7.2 gpm

9 – 7.2 / 9 x 100 = Left Rear Cutting Unit Motor Leakage 20%

Center Cutting Unit Motor Test

Loaded Flow from left rear cutting unit motor test = 7.2 gpm

Loaded Flow from center cutting unit motor test = 6.8 gpm

7.2 – 6.8 / 7.2 x 100 = Center Cutting Unit Motor Leakage 5.6%

Right Rear Cutting Unit Motor Test

Loaded Flow from center cutting unit motor test = 6.8 gpm

Loaded Flow from right rear cutting unit motor test = 6.5 gpm

6.8 – 6.5 / 6.8 x 100 = Right Rear Cutting Unit Motor Leakage = 4.4%

Front Cutting Units Circuit

See Figures 6-3 through 6-5.

IMPORTANT

- **This test works together with the front cutting units motors test to isolate a problem with the front cutting unit circuit.**
- **Performing this test will isolate the front cutting units pump, deck valve, and right front cutting unit motor from the rest of the front 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 3000 psi (207 bar) • -8 ORFS Tee Fitting • Blocking Device or Tool

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove center floorboard.

IMPORTANT

Depending on the machine model number and production date, the possibility exists that the hoses connected to the center and rear sections of the gear pump could be reversed. This design change does not affect the operation of the mower, but will affect the outcome of this test as outlined. Please confirm that the hose connected to the center section of the gear pump is connected to deck valve port “P2.” Please see “Hydraulic Schematic” on page 6-10 for additional information.

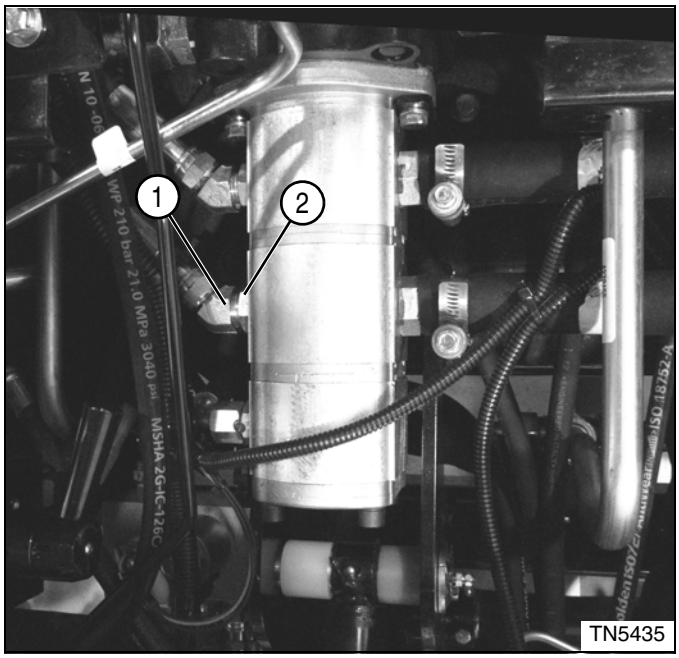


Figure 6-3

3. Disconnect hose (1) from fitting (2).

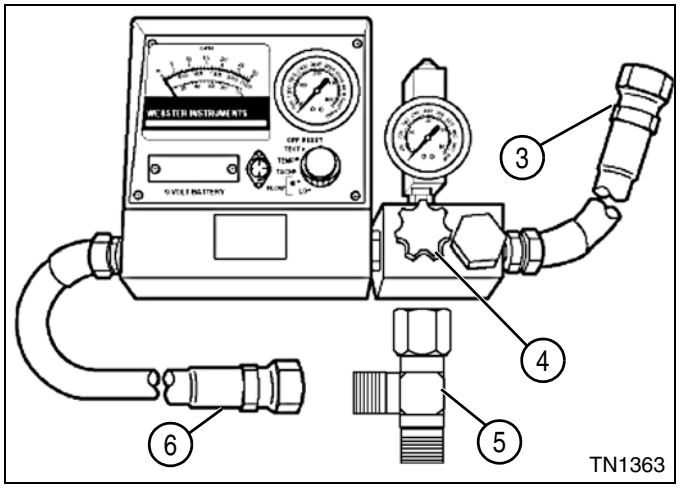


Figure 6-4

4. Install tee fitting (5) to fitting (2).
5. Connect test hose (6) of flow meter inlet and hose (1) to tee fitting (5).

NOTE

Make sure hose end is under oil level in hydraulic tank to prevent aeration of oil.

6. Connect flow meter outlet hose (3) to hydraulic tank.

WARNING

Safely block cutting unit from rotating using a suitable device or tool. Failure to follow appropriate safety precaution may result in death or serious injury.

7. Install a suitable blocking device or tool in right front cutting unit, preventing cutting unit from turning. Open flow meter valve (4) completely.

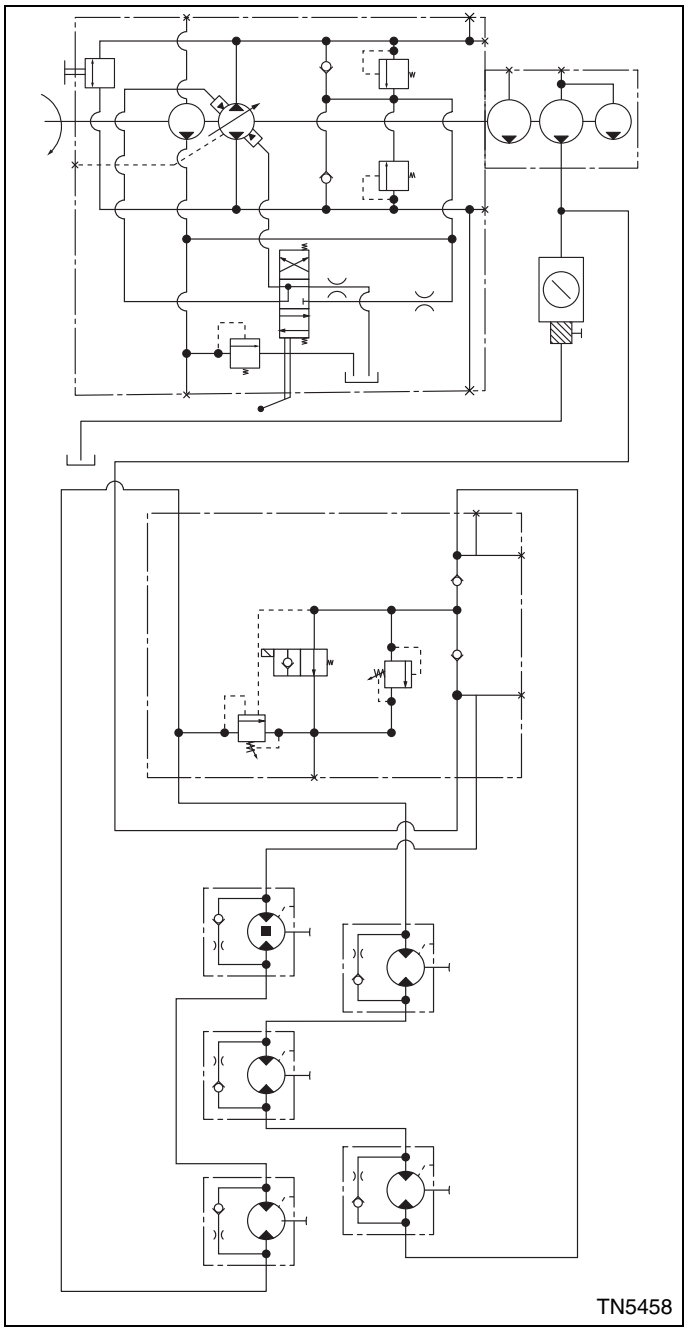


Figure 6-5: Front Cutting Unit Circuit—Install Suitable Blocking Device to Right Front Wheel

4

8. Bypass the seat switch.

NOTE

Verify engine rpm is within specification (2850 ± 50 rpm) to ensure accurate hydraulic test results.

9. Start engine and run at full throttle (2850 ± 50 rpm).
10. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (4) until a reading of 1300 psi (90 bar) or one-half of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
11. Disconnect park brake switch.
12. Engage PTO switch.
13. Read and record the front cutting units pump no load flow.
14. Slowly close flow meter valve (4) until pressure reaches 1950 psi (134 bar). Read and record the front cutting units pump loaded flow.
15. Open flow meter valve (4) and stop engine.
16. Calculate front cutting units circuit leakage. (Step 13 – Step 14 / Step 13 x 100 = Leak Percentage)

    Is front cutting units circuit leakage 10% or less?

    YES *The front cutting units circuit is good. Proceed to "Front Cutting Units Motors Test" on page 6-41.*

    NO *Proceed to next question.*

    Is front cutting units circuit leakage 11% to 20%?

    YES *The front cutting units circuit is marginal. Additional testing is required.*

    NO *Proceed to next question.*

    Is front cutting units circuit leakage 21% or more?

    YES *Test individual components in front cutting units circuit for leakage.*

17. Disconnect and remove test equipment. Remove blocking device or tool from cutting unit. Install all hoses and fittings as noted prior to removal.
18. Install and connect all components as noted prior to test.
19. Check hydraulic oil level. Add oil as needed. (Refer to "Safety, Operation, and Maintenance Manual" for correct oil specifications.)

Front Cutting Units Pump Test

See Figures 6-6 through 6-8.

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 3000 psi (207 bar) • -8 ORFS Tee Fitting • -8 ORFS Blocking Disk

1. Park the mower safely. (See "Park Mower Safely" on page 1-5.)
2. Before performing this test, perform front cutting units circuit test, leaving flow meter connected as outlined.

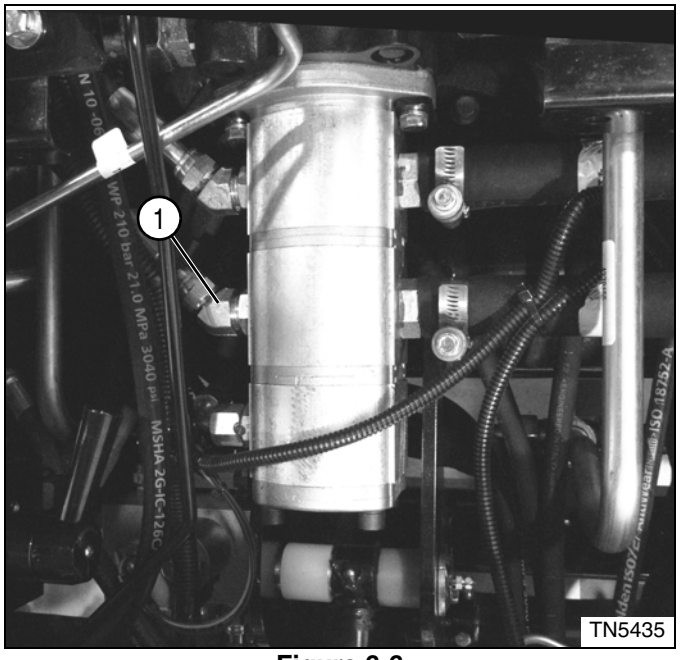


Figure 6-6

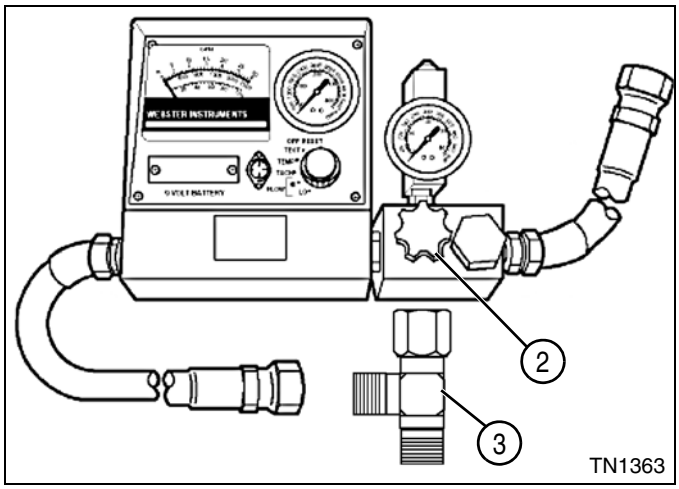


Figure 6-7

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

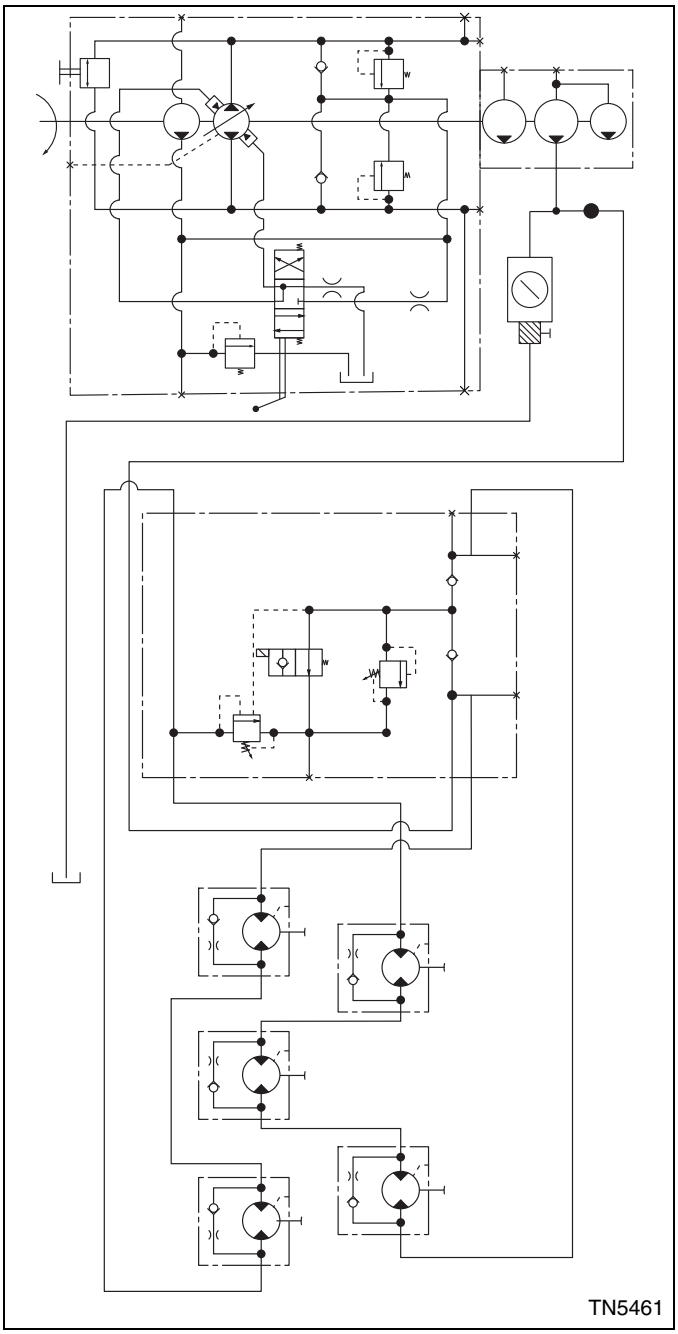


Figure 6-8: Front Cutting Units Pump Test—Install Blocking Disk between Hose (1) and Tee Fitting (3)

4. Open flow meter valve (2) completely.
5. Bypass the seat switch.

NOTE

Verify engine rpm is within specification (2850 ± 50 rpm) to ensure accurate hydraulic test results.

6. Start engine and run at full throttle (2850 ± 50 rpm).

7. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve until a reading of 1300 psi (90 bar) or one-half of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.

CAUTION

Do not exceed 1950 psi (134 bar) when testing pump, or equipment damage may occur.

8. Slowly close flow meter valve until pressure reaches 1950 psi (134 bar). Read and record the front cutting units pump loaded flow.
9. Stop engine.
10. Calculate front cutting units pump leakage. (Step 14 of previous test – Step 8 / Step 14 of previous test x 100 = Leak Percentage)

    Is front cutting units pump leakage 10% or less?

    YES *The front cutting units pump is good. Proceed to next test.*

    NO *Proceed to next question.*

    Is front cutting units pump leakage 11% to 20%?

    YES *The front cutting units pump is marginal. Additional testing is required.*

    NO *Proceed to next question.*

    Is front cutting units pump leakage 21% or more?

    YES *Repair or replace front cutting units pump. (See "Gear Pump" on page 6-60.)*
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 "Safety, Operation, and Maintenance Manual" for correct oil specifications.)

Front Cutting Units Circuit Valve Tests

See Figures 6-9 through 6-11.

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 3000 psi (207 bar)
• -8 ORFS Tee Fitting
• -10 ORFS Blocking Disk

1. Park the mower safely. (See "Park Mower Safely" on page 1-5.)
2. Before performing this test, perform front cutting units circuit test, leaving flow meter connected as outlined.

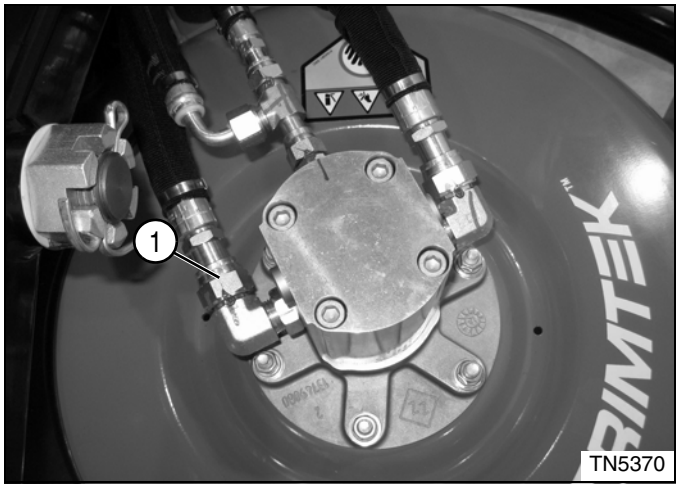


Figure 6-9

3. Install blocking disk at fitting (1) on right front cutting unit motor, blocking oil flow from entering right front cutting unit motor.

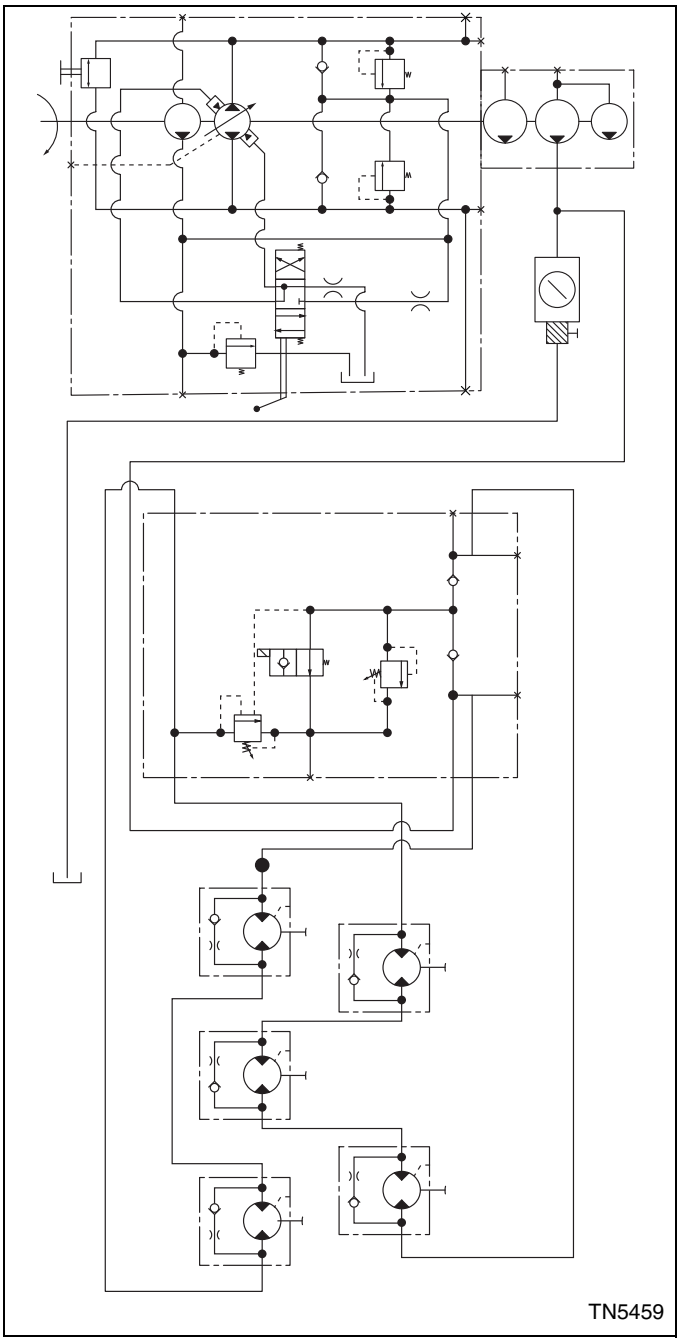


Figure 6-10: Front Cutting Units Circuit Valve Tests—Install Blocking Disk at Fitting on Right Front Cutting Unit Motor

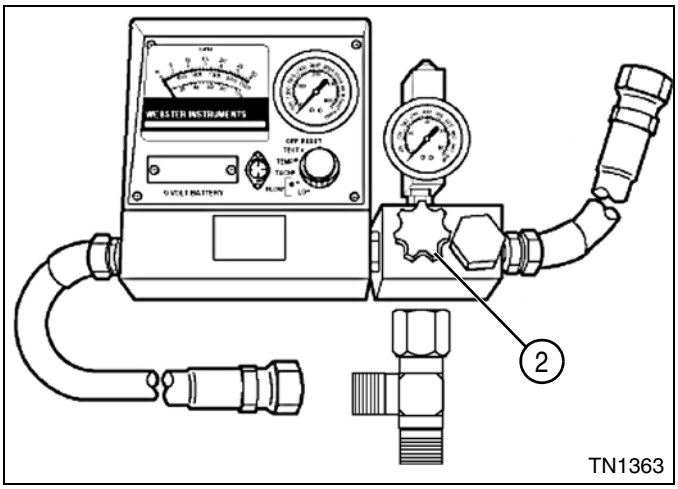


Figure 6-11

4. Open flow meter valve (2) completely.
5. Bypass the seat switch.

NOTE

Verify engine rpm is within specification (2850 ± 50 rpm) to ensure accurate hydraulic test results.

6. Start engine and run at full throttle (2850 ± 50 rpm).
7. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (2) until a reading of 1300 psi (90 bar) or one-half of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
8. Disconnect park brake switch.
9. Engage PTO switch.
10. Slowly close flow meter valve (2) until pressure reaches 1950 psi (134 bar). Read and record the front cutting units pump loaded flow.
11. Calculate front cutting units circuit valve leakage. (Step 8 of previous test – Step 10 / Step 8 of previous test x 100 = Leak Percentage)

    Is front cutting units circuit valve leakage 10% or less?

    YES *The front cutting units circuit valve is good. Proceed to step 12.*

    NO *Proceed to next question.*

    Is front cutting units circuit valve leakage 11% to 20%?

    YES *The front cutting units circuit valve is marginal. Additional testing is required.*

    NO *Proceed to next question.*

    Is front cutting units circuit valve leakage 21% or more?

    YES *Repair or replace deck valve. (See “Deck Valve” on page 6-65.)*

CAUTION

Do not exceed 2650 psi (183 bar) when testing system relief valve, or equipment damage may occur.

12. Continue to close flow meter valve (2) until zero flow is obtained. Record cutting unit system relief valve pressure.
13. Open flow meter valve (2) and stop engine.

    Is cutting unit system relief valve pressure 2600 psi (179 bar)?

    YES *Cutting unit system relief valve is good. Proceed to step 14.*

    NO *Adjust cutting unit system relief pressure. (See "Adjust Cutting Unit System Relief Valve Pressure" on page 6-40.)*
14. Disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
15. Install and connect all components as noted prior to test.
16. Check hydraulic oil level. Add oil as needed. (Refer to "Safety, Operation, and Maintenance Manual" for correct oil specifications.)

Adjust Cutting Unit System Relief Valve Pressure

See Figure 6-12.

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 3000 psi (207 bar) • -8 ORFS Tee Fitting • -10 ORFS Blocking Disk

NOTE

This adjustment should be done in conjunction with front cutting units circuit valve tests.

1. Park the mower safely. (See "Park Mower Safely" on page 1-5.)
2. Perform front cutting units circuit valve test. (See "Front Cutting Units Circuit Valve Tests" on page 6-38.)

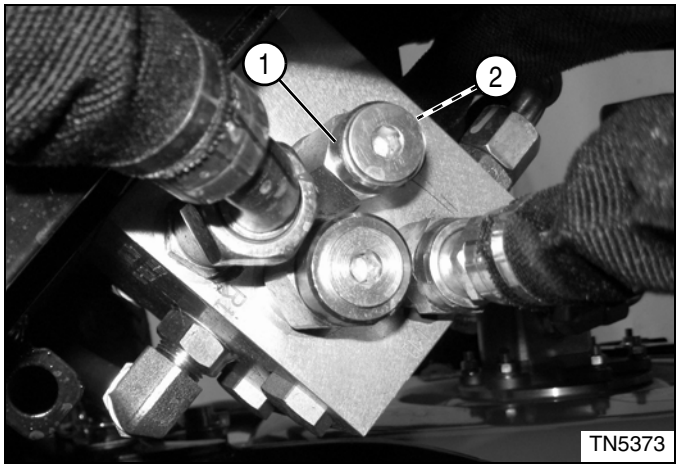


Figure 6-12

3. Remove cap (1).
4. Rotate screw (2) to adjust the relief valve pressure setting.
   - To increase the pressure setting: Turn the screw in (clockwise).
   - To decrease the pressure setting: Turn the screw out (counterclockwise).
5. Install cap (1).

   Could relief valve be adjusted to 2600 psi (179 bar)?

   YES *Cutting unit system relief valve is good. Proceed to step 6.*

   NO *Repair or replace cutting unit system relief valve. (See "Deck Valve" on page 6-65.)*
6. Disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
7. Install and connect all components as noted prior to adjustment.
8. Check hydraulic oil level. Add oil as needed. (Refer to "Safety, Operation, and Maintenance Manual" for correct oil specifications.)

Front Cutting Units Motors Test

See Figures 6-13 and 6-14.

IMPORTANT

- **This test works together with the front cutting units circuit test to isolate a problem with the front cutting units circuit.**
- **Performing this test will isolate the front cutting unit motors from the rest of the front 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 3000 psi (207 bar) • -8 ORFS Tee Fitting • Blocking Device or Tool

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Before performing this test, perform front cutting units circuit test, leaving flow meter connected as outlined.
3. Bypass the seat switch.

IMPORTANT

- **If performing this test after performing front cutting units circuit test, and test proved front cutting units pump, deck valve, and right front cutting unit motor good, proceed to step 14.**
- **If performing this test to determine which component in system is at fault (right front cutting unit motor or left front cutting unit motor), proceed to step 4.**

WARNING

Safely block cutting unit from rotating using a suitable device or tool. Failure to follow appropriate safety precaution may result in death or serious injury.

4. Install a suitable blocking device or tool in right front cutting unit, preventing cutting unit from turning.

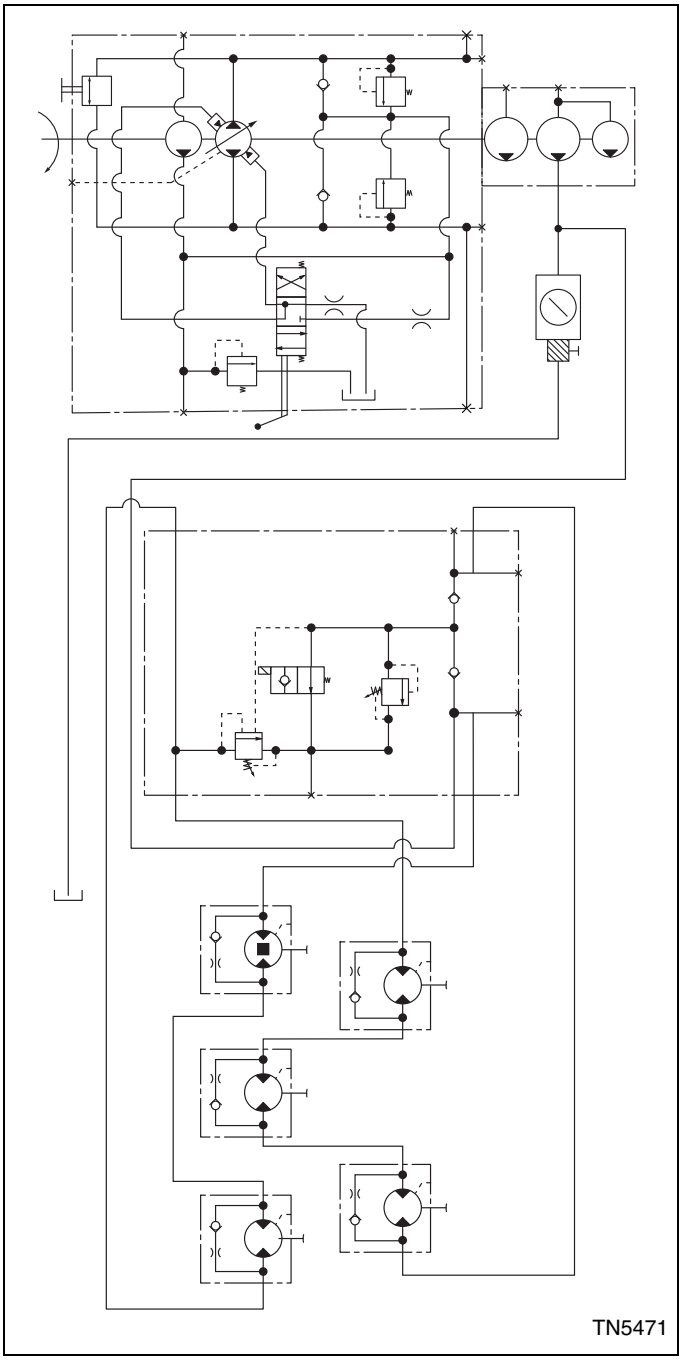


Figure 6-13: Front Cutting Units Motors Test—Install a Suitable Blocking Device to Right Front Cutting Unit

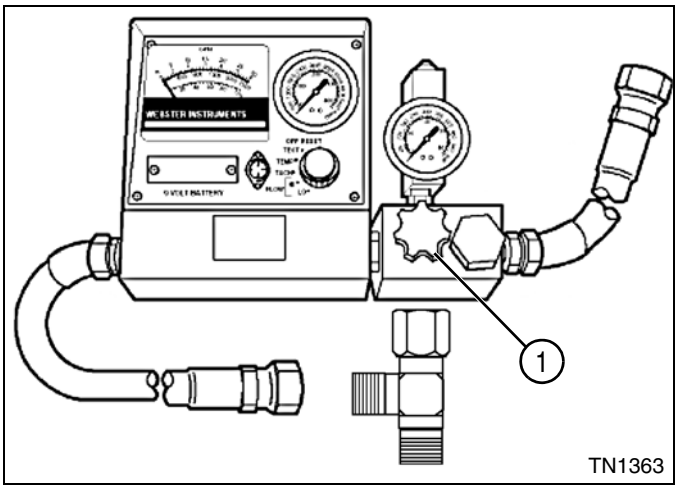


Figure 6-14

5. Open flow meter valve (1) completely.

NOTE

Verify engine rpm is within specification (2850 ± 50 rpm) to ensure accurate hydraulic test results.

6. Start engine and run at full throttle (2850 ± 50 rpm).
7. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (1) until a reading of 1300 psi (90 bar) or one-half of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
8. Disconnect park brake switch.
9. Engage PTO switch.
10. Slowly close flow meter valve (1) until pressure reaches 1950 psi (134 bar). Read and record the right front cutting unit motor loaded flow.
11. Open flow meter valve (1) and stop engine.
12. Calculate right front cutting unit motor leakage. (Step 10 of front cutting units circuit valve tests – Step 10 / Step 10 of front cutting units circuit valve tests x 100 = Leak Percentage)

    Is right front cutting unit motor leakage 10% or less?

    YES *The right front cutting unit motor is good. Proceed to step 13.*

    NO *Proceed to next question.*

    Is right front cutting unit motor leakage 11% to 20%?

    YES *The right front cutting unit motor is marginal. Additional testing is required.*

    NO *Proceed to next question.*

    Is right front cutting unit motor leakage 21% or more?

    YES *Repair or replace right front cutting unit motor. (See “Cutting Unit Motors” on page 6-62.)*
13. Remove device or tool from right front cutting unit.

WARNING

Safely block cutting unit from rotating using a suitable device or tool. Failure to follow appropriate safety precaution may result in death or serious injury.

14. Install a suitable blocking device or tool in left front cutting unit, preventing cutting unit from turning.
15. Open flow meter valve (3) completely.
16. Connect park brake switch.

NOTE

Verify engine rpm is within specification (2850 ± 50 rpm) to ensure accurate hydraulic test results.

17. Start engine and run at full throttle (2850 ± 50 rpm).
18. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (3) until a reading of 1300 psi (90 bar) or one-half of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
19. Disconnect park brake switch.
20. Engage PTO switch.
21. Slowly close flow meter valve (3) until pressure reaches 1950 psi (134 bar). Read and record the left cutting unit motor loaded flow.
22. Open flow meter valve (3) and stop engine.

23. Calculate left front cutting unit motor leakage. (Step 10 – Step 21 / Step 10 x 100 = Leak Percentage)

    Is left front cutting unit motor leakage 10% or less?

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

    NO *Proceed to next question.*

    Is left front cutting unit motor leakage 11% to 20%?

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

    NO *Proceed to next question.*

    Is left front cutting unit motor leakage 21% or more?

    YES *Repair or replace left front cutting unit motor. (See "Cutting Unit Motors" on page 6-62.)*

24. Remove device or tool from left front cutting unit.
25. Disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
26. Install and connect all components as noted prior to test.
27. Check hydraulic oil level. Add oil as needed. (Refer to "Safety, Operation, and Maintenance Manual" for correct oil specifications.)

Rear Cutting Units Circuit Test

See Figures 6-15 through 6-17.

IMPORTANT

- **This test works together with the rear cutting units motors test to isolate a problem with the rear cutting units circuit.**
- **Performing this test will isolate the rear cutting units pump, deck valve, and left rear cutting unit motor from the rest of the rear 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 3000 psi (207 bar) • -8 ORFS Tee Fitting • Blocking Device or Tool

1. Park the mower safely. (See "Park Mower Safely" on page 1-5.)
2. Remove center floorboard.

IMPORTANT

Depending on the machine model number and production date, the possibility exists that the hoses connected to the center and rear sections of the gear pump could be reversed. This design change does not affect the operation of the mower, but will affect the outcome of this test as outlined. Please confirm that the hose connected to the center section of the gear pump is connected to deck valve port "P2." Please see "Hydraulic Schematic" on page 6-10 for additional information.

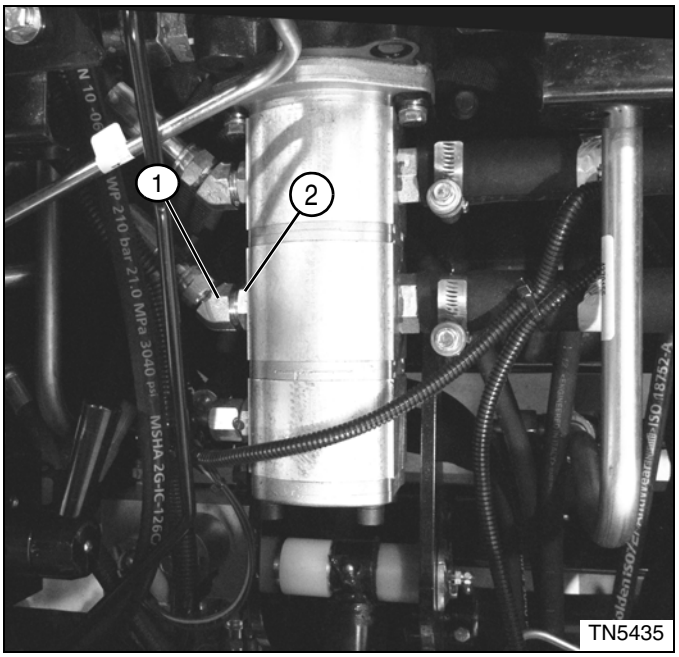


Figure 6-15

3. Disconnect hose (1) from fitting (2).

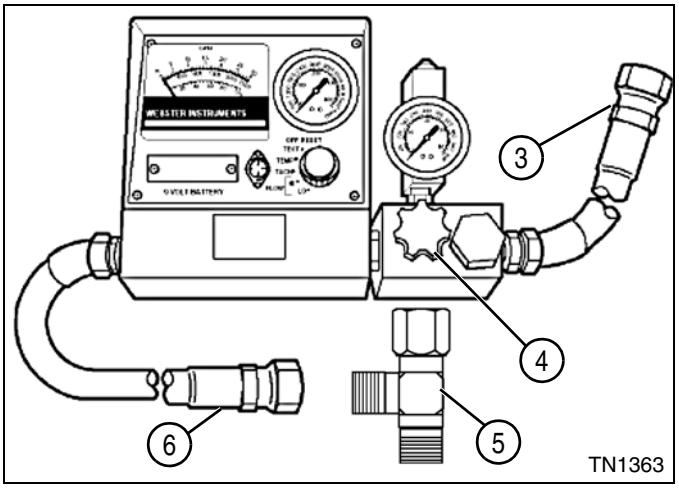


Figure 6-16

4. Install tee fitting (5) to fitting (2).
5. Connect test hose (6) of flow meter inlet and hose (1) to tee fitting (5).

NOTE

Make sure hose end is under oil level in hydraulic tank to prevent aeration of oil.

6. Connect flow meter outlet hose (3) to the hydraulic tank.

WARNING

Safely block cutting unit from rotating using a suitable device or tool. Failure to follow appropriate safety precaution may result in death or serious injury.

7. Install a suitable blocking device or tool in left rear cutting unit, preventing cutting unit from turning. Open flow meter valve (4) completely.

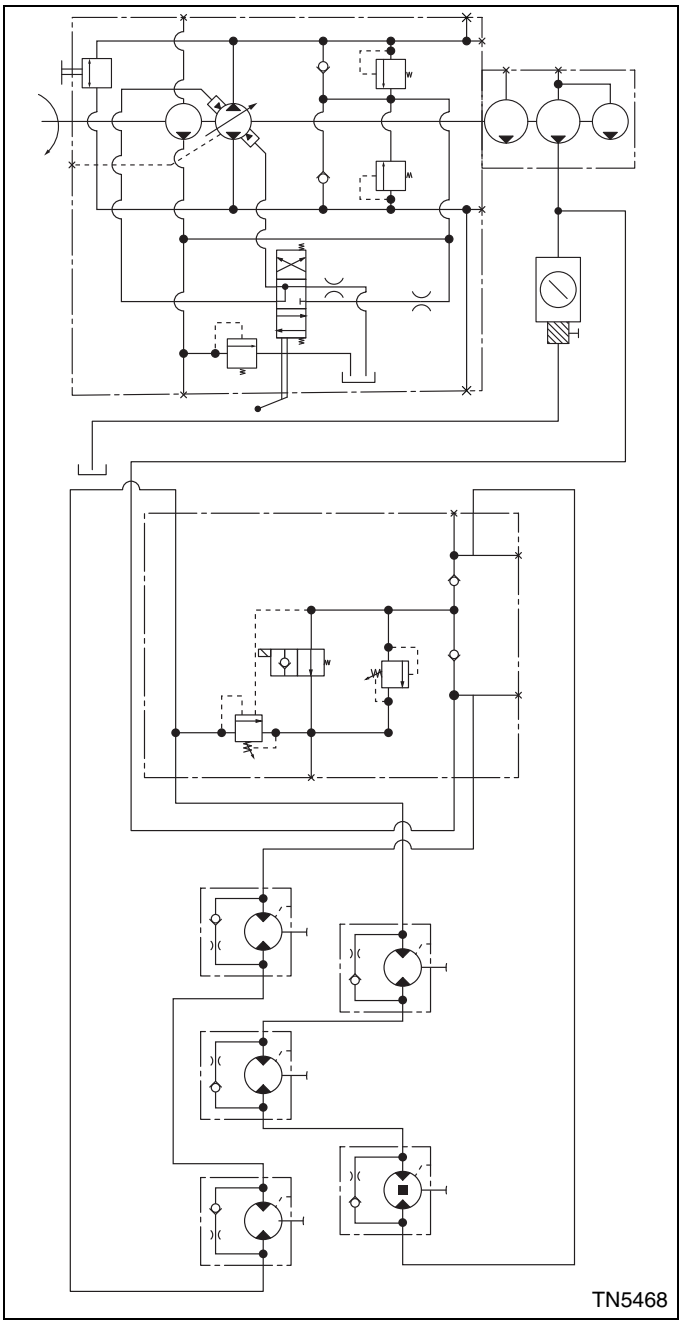


Figure 6-17: Rear Cutting Unit Circuit Test—Install Suitable Blocking Device to Left Rear Cutting Unit

8. Bypass the seat switch.

NOTE

Verify engine rpm is within specification (2850 ± 50 rpm) to ensure accurate hydraulic test results.

9. Start engine and run at full throttle (2850 ± 50 rpm).
10. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (4) until a reading of 1300 psi (90 bar) or one-half of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
11. Disconnect park brake switch.
12. Engage PTO switch.
13. Read and record the rear cutting units pump no load flow.
14. Slowly close flow meter valve (4) until pressure reaches 1950 psi (134 bar). Read and record the rear cutting units pump loaded flow.
15. Open flow meter valve (4) and stop engine.
16. Calculate rear cutting units circuit leakage. (Step 13 – Step 14 / Step 13 x 100 = Leak Percentage)

    Is rear cutting units circuit leakage 10% or less?

    YES *The rear cutting units circuit is good. Proceed to "Rear Cutting Units Motors Test" on page 6-49.*

    NO *Proceed to next question.*

    Is rear cutting units circuit leakage 11% to 20%?

    YES *The rear cutting units circuit is marginal. Additional testing is required.*

    NO *Proceed to next question.*

    Is rear cutting units circuit leakage 21% or more?

    YES *Test individual components in rear cutting units circuit for leakage.*

17. Disconnect and remove test equipment. Remove blocking device or tool from cutting unit. Install all hoses and fittings as noted prior to removal.
18. Install and connect all components as noted prior to test.
19. Check hydraulic oil level. Add oil as needed. (Refer to "Safety, Operation, and Maintenance Manual" for correct oil specifications.)

Rear Cutting Units Pump Test

See Figures 6-18 through 6-20.

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 3000 psi (207 bar)
• -8 ORFS Tee Fitting
• -8 ORFS Blocking Disk

1. Park the mower safely. (See "Park Mower Safely" on page 1-5.)
2. Before performing this test, perform rear cutting units circuit test, leaving flow meter connected as outlined.

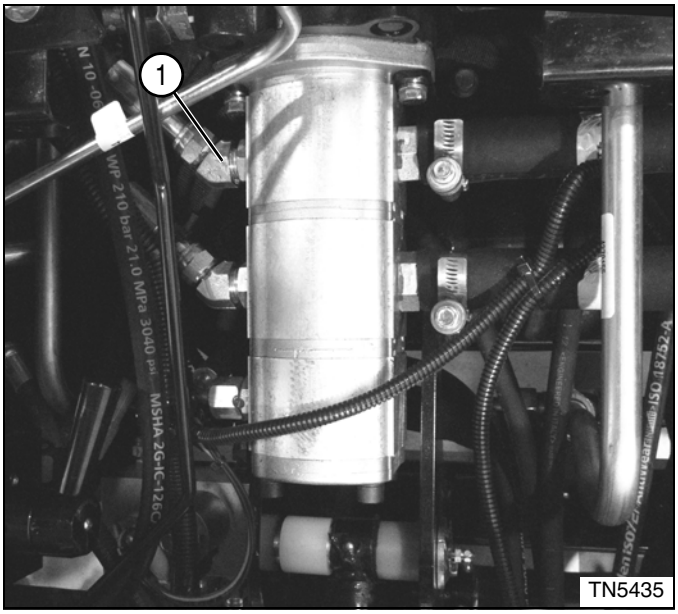


Figure 6-18

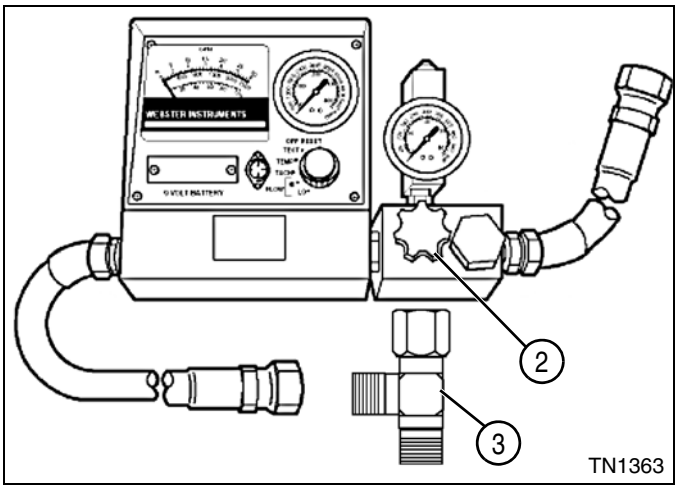


Figure 6-19

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

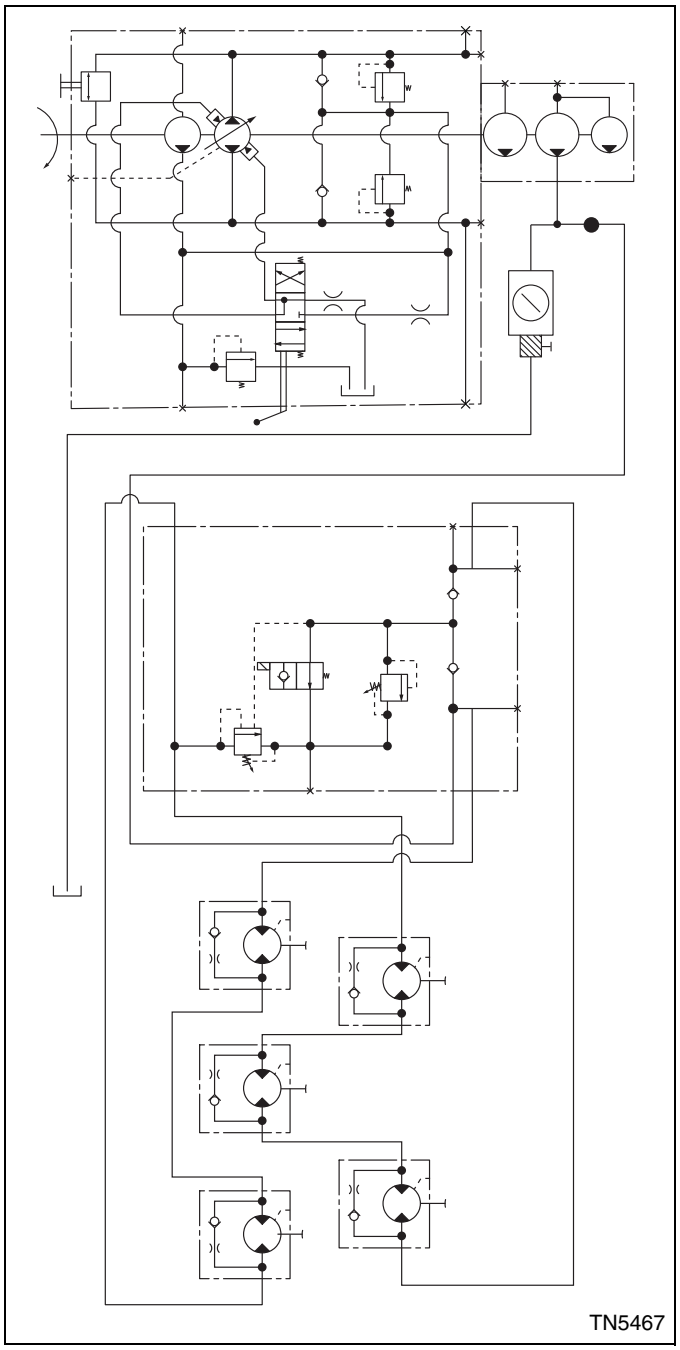


Figure 6-20: Rear Cutting Units Pump Test—Install Blocking Disk Between Hose (1) and Tee Fitting (3)

4. Open flow meter valve (2) completely.
5. Bypass the seat switch.

NOTE

Verify engine rpm is within specification (2850 ± 50 rpm) to ensure accurate hydraulic test results.

6. Start engine and run at full throttle (2850 ± 50 rpm).

7. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve until a reading of 1300 psi (90 bar) or one-half of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.

CAUTION

Do not exceed 1950 psi (134 bar) when testing pump, or equipment damage may occur.

8. Slowly close flow meter valve until pressure reaches 1950 psi (134 bar). Read and record the rear cutting units pump loaded flow.
9. Stop engine.
10. Calculate rear cutting units pump leakage. (Step 14 of previous test – Step 8 / Step 14 of previous test x 100 = Leak Percentage)

    Is rear cutting units pump leakage 10% or less?

    YES *The rear cutting units pump is good. Proceed to next test.*

    NO *Proceed to next question.*

    Is rear cutting units pump leakage 11% to 20%?

    YES *The rear cutting units pump is marginal. Additional testing is required.*

    NO *Proceed to next question.*

    Is rear cutting units pump leakage 21% or more?

    YES *Repair or replace rear cutting units pump. (See "Gear Pump" on page 6-60.)*
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 "Safety, Operation, and Maintenance Manual" for correct oil specifications.)

Rear Cutting Units Circuit Valve Tests

See Figures 6-21 through 6-23.

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
• Flow Meter
• -8 ORFS Test Hose 3000 psi (207 bar)
• -8 ORFS Tee Fitting
• -10 ORFS Blocking Disk

1. Park the mower safely. (See "Park Mower Safely" on page 1-5.)
2. Before performing this test, perform rear cutting units circuit test, leaving flow meter connected as outlined.

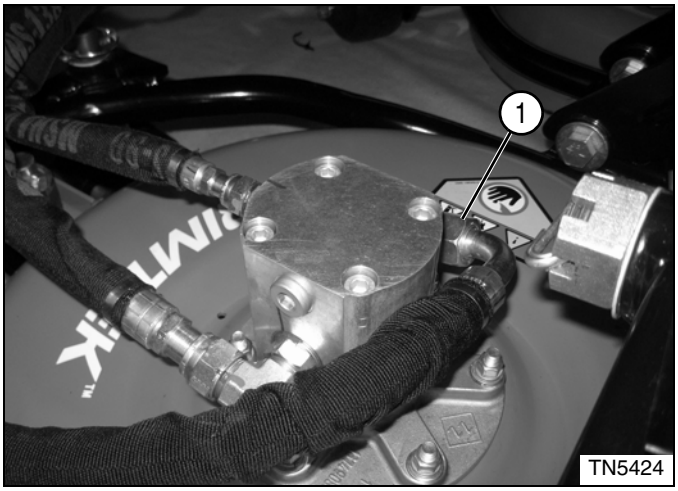


Figure 6-21

3. Install blocking disk at fitting (1) on left rear cutting unit motor, blocking oil flow from entering left rear cutting unit motor.

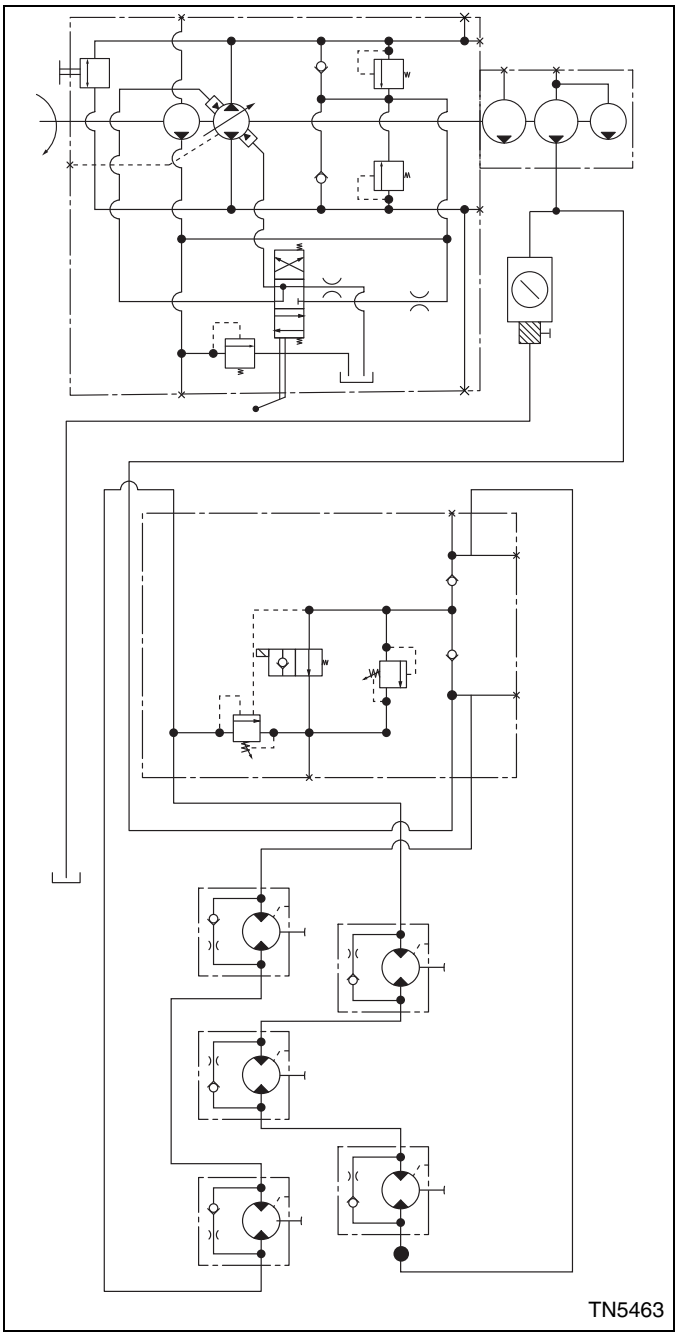


Figure 6-22: Rear Cutting Units Circuit Valve Tests—Install Blocking Disk at Fitting (1) on Left Rear Cutting Unit

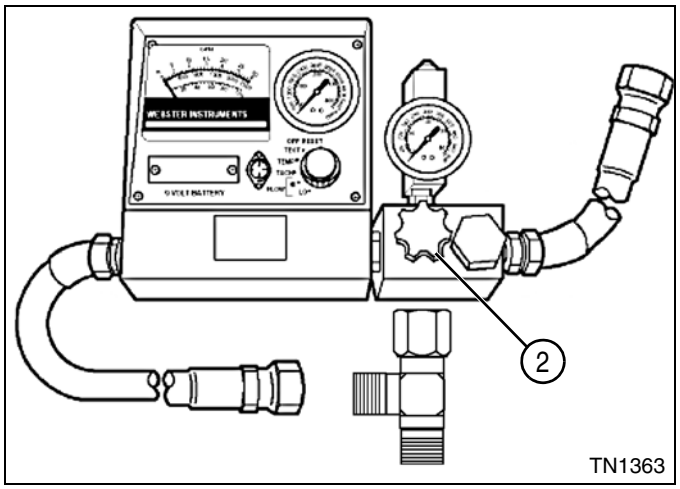


Figure 6-23

4. Open flow meter valve (2) completely.
5. Bypass the seat switch.

NOTE

Verify engine rpm is within specification (2850 ± 50 rpm) to ensure accurate hydraulic test results.

6. Start engine and run at full throttle (2850 ± 50 rpm).
7. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (2) until a reading of 1300 psi (90 bar) or one-half of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
8. Disconnect park brake switch.
9. Engage PTO switch.
10. Slowly close flow meter valve (2) until pressure reaches 1950 psi (134 bar). Read and record the rear cutting units pump loaded flow.
11. Calculate rear cutting units circuit valve leakage. (Step 8 of previous test – Step 10 / Step 8 of previous test x 100 = Leak Percentage)

    Is rear cutting units circuit valve leakage 10% or less?

    YES *The rear cutting units circuit valve is good. Proceed to step 12.*

    NO *Proceed to next question.*

    Is rear cutting units circuit valve leakage 11% to 20%?

    YES *The rear cutting units circuit valve is marginal. Additional testing is required.*

    NO *Proceed to next question.*

    Is rear cutting units circuit valve leakage 21% or more?

    YES *Repair or replace deck valve. (See “Deck Valve” on page 6-65.)*

CAUTION

Do not exceed 2650 psi (183 bar) when testing system relief valve, or equipment damage may occur.

12. Continue to close flow meter valve (2) until zero flow is obtained. Record cutting unit system relief valve pressure.
13. Open flow meter valve (2) and stop engine.

    Is cutting unit system relief valve pressure 2600 psi (179 bar)?

    YES *Cutting unit system relief valve is good. Proceed to step 14.*

    NO *Adjust cutting unit system relief pressure. (See "Adjust Cutting Unit System Relief Valve Pressure" on page 6-40.)*
14. Disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
15. Install and connect all components as noted prior to test.
16. Check hydraulic oil level. Add oil as needed. (Refer to "Safety, Operation, and Maintenance Manual" for correct oil specifications.)

Rear Cutting Units Motors Test

See Figures 6-24 through 6-27

IMPORTANT

- **This test works together with the rear cutting units circuit test to isolate a problem with the rear cutting units circuit.**
- **Performing this test will isolate the rear cutting unit motors from the rest of the rear 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 3000 psi (207 bar)
• -8 ORFS Tee Fitting
• Blocking Device or Tool

1. Park the mower safely. (See "Park Mower Safely" on page 1-5.)
2. Before performing this test, perform rear cutting units circuit test, leaving flow meter connected as outlined.
3. Bypass the seat switch.

IMPORTANT

- **If performing this test after performing rear cutting units circuit test, and test proved rear cutting units pump, deck valve, and left rear cutting unit motor good, proceed to step 14.**
- **If performing this test to determine which component in system is at fault (left rear cutting unit motor, center cutting unit motor, or right rear cutting unit motor), proceed to step 4.**

⚠ WARNING

Safely block cutting unit from rotating using a suitable device or tool. Failure to follow appropriate safety precaution may result in death or serious injury.

4. Install a suitable blocking device or tool in left rear cutting unit, preventing cutting unit from turning.

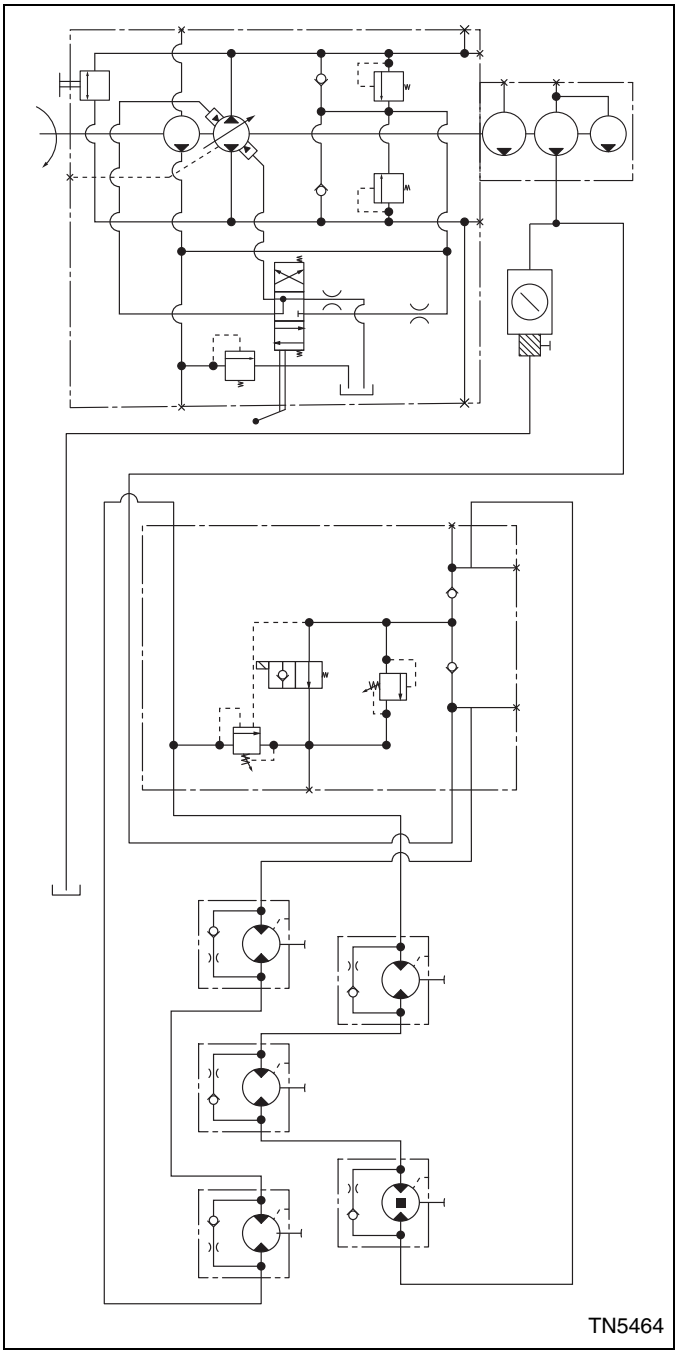


Figure 6-24: Rear Cutting Units Motors Test—Install Suitable Blocking Device to Left Rear Cutting Unit

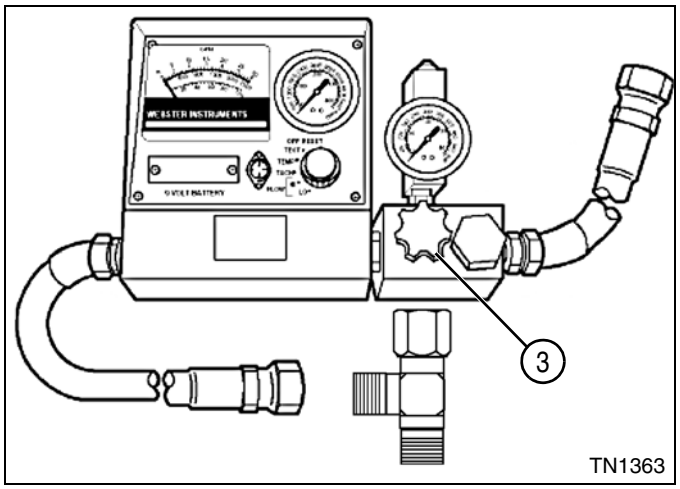


Figure 6-25

5. Open flow meter valve (3) completely.

NOTE

Verify engine rpm is within specification (2850 ± 50 rpm) to ensure accurate hydraulic test results.

6. Start engine and run at full throttle (2850 ± 50 rpm).
7. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (3) until a reading of 1300 psi (90 bar) or one-half of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
8. Disconnect park brake switch.
9. Engage PTO switch.
10. Slowly close flow meter valve (3) until pressure reaches 1950 psi (134 bar). Read and record the left rear cutting unit motor loaded flow.
11. Open flow meter valve (3) and stop engine.
12. Calculate left rear cutting unit motor leakage. (Step 10 of rear cutting units circuit valve tests – Step 10 / Step 10 of rear cutting units circuit valve tests x 100 = Leak Percentage)

    Is left rear cutting unit motor leakage 10% or less?

    YES *The left rear cutting unit motor is good. Proceed to step 13.*

    NO *Proceed to next question.*

    Is left rear cutting unit motor leakage 11% to 20%?

    YES *The left rear cutting unit motor is marginal. Additional testing is required.*

    NO *Proceed to next question.*

    Is left rear cutting unit motor leakage 21% or more?

    YES *Repair or replace left rear cutting unit motor. (See “Cutting Unit Motors” on page 6-62.)*

13. Remove device or tool from left rear cutting unit.

WARNING

Safely block cutting unit from rotating using a suitable device or tool. Failure to follow appropriate safety precaution may result in death or serious injury.

14. Install a suitable blocking device or tool in center cutting unit, preventing cutting unit from turning.

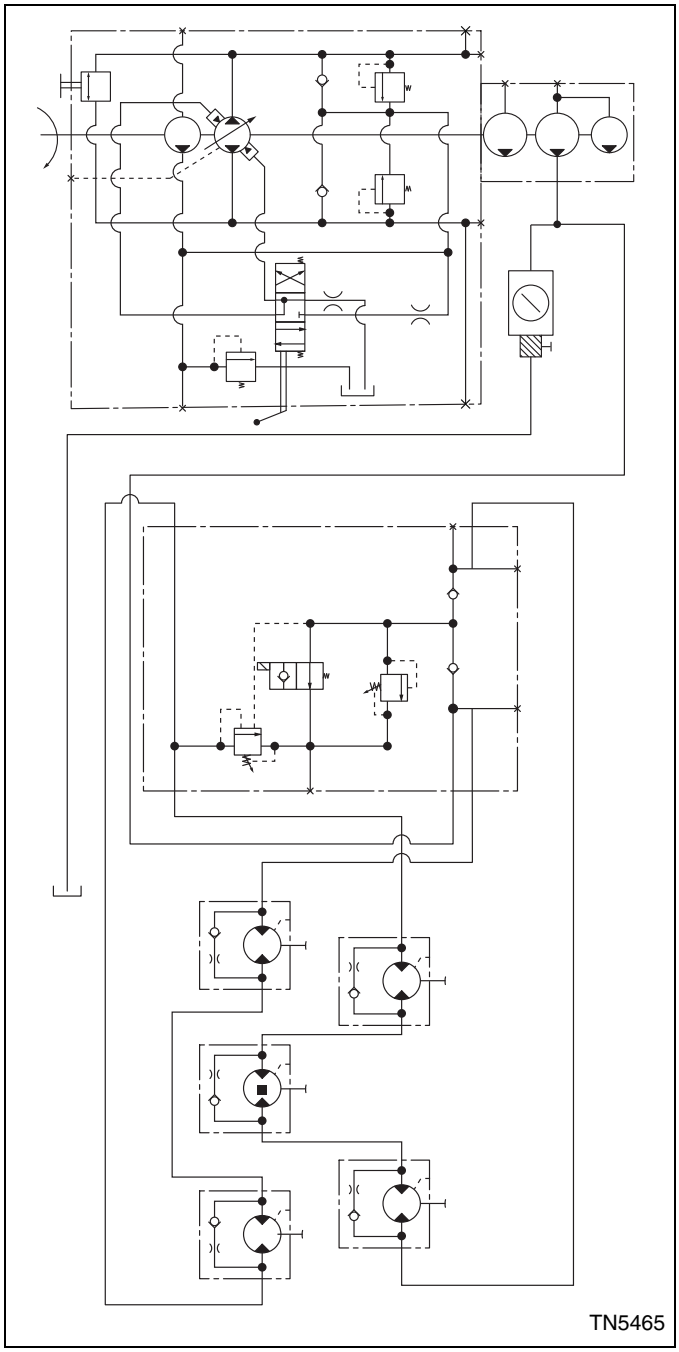


Figure 6-26: Rear Cutting Units Motors Test—Install Suitable Blocking Device to Center Cutting Unit

15. Open flow meter valve (3) completely.
16. Connect park brake switch.

NOTE

Verify engine rpm is within specification (2850 ± 50 rpm) to ensure accurate hydraulic test results.

17. Start engine and run at full throttle (2850 ± 50 rpm).
18. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (3) until a reading of 1300 psi (90 bar) or one-half of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
19. Disconnect park brake switch.
20. Engage PTO switch.
21. Slowly close flow meter valve (3) until pressure reaches 1950 psi (134 bar). Read and record the center cutting unit motor loaded flow.
22. Open flow meter valve (3) and stop engine.
23. Calculate center cutting unit motor leakage. (Step 10 – Step 21 / Step 10 x 100 = Leak Percentage)

    Is center cutting unit motor leakage 10% or less?

    YES *The center cutting unit motor is good. Proceed to step 24.*

    NO *Proceed to next question.*

    Is center cutting unit motor leakage 11% to 20%?

    YES *The center cutting unit motor is marginal. Additional testing required.*

    NO *Proceed to next question.*

    Is center cutting unit motor leakage 21% or more?

    YES *Repair or replace center cutting unit motor. (See “Cutting Unit Motors” on page 6-62.)*

24. Remove device or tool from center cutting unit.

WARNING

Safely block cutting unit from rotating using a suitable device or tool. Failure to follow appropriate safety precaution may result in death or serious injury.

25. Install a suitable blocking device or tool in right rear cutting unit, preventing cutting unit from turning.

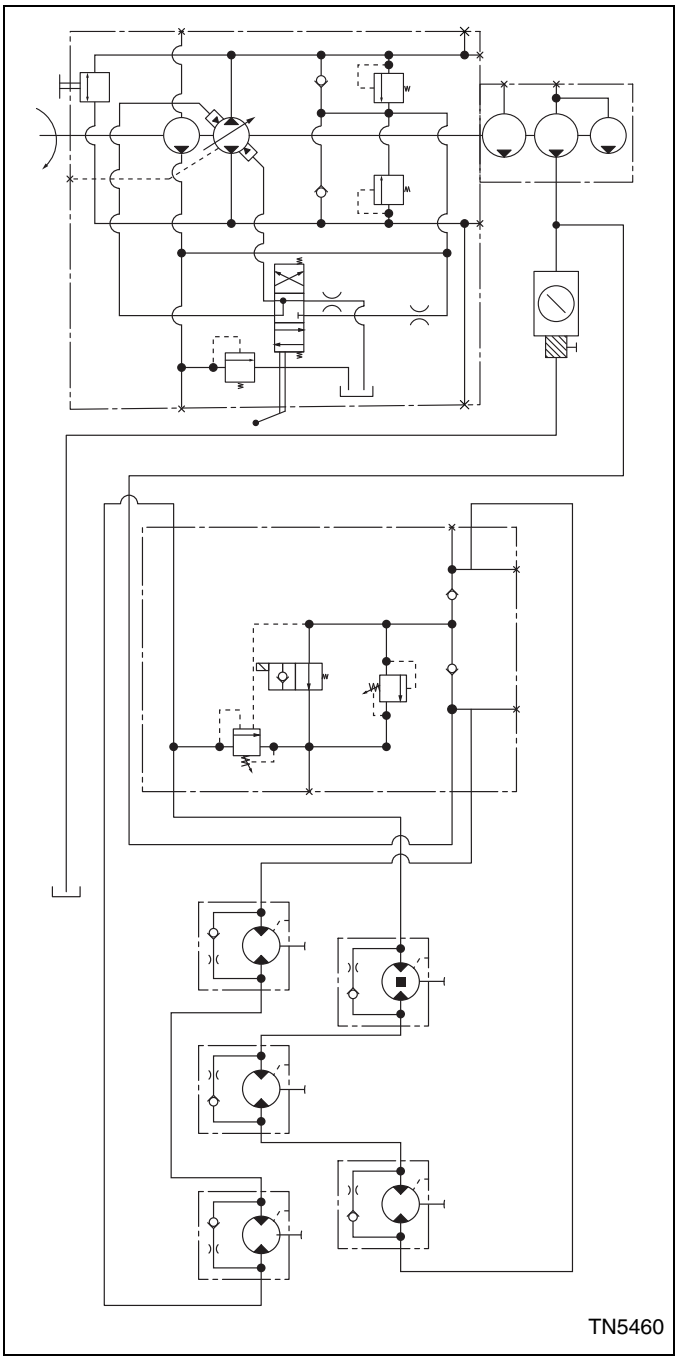


Figure 6-27: Rear Cutting Units Motors Test—Install a Suitable Blocking Device to Right Rear Cutting Unit

26. Open flow meter valve (3) completely.
27. Connect park brake switch.

NOTE

Verify engine rpm is within specification (2850 ± 50 rpm) to ensure accurate hydraulic test results.

28. Start engine and run at full throttle (2850 ± 50 rpm).
29. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (3) until a reading of 1300 psi (90 bar) or one-half of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
30. Disconnect park brake switch.
31. Engage PTO switch.
32. Slowly close flow meter valve (3) until pressure reaches 1950 psi (134 bar). Read and record the right rear cutting unit motor loaded flow.
33. Open flow meter valve (3) and stop engine.
34. Calculate right rear cutting unit motor leakage. (Step 21 – Step 32 / Step 21 x 100 = Leak Percentage)

    Is right rear cutting unit motor leakage 10% or less?

    YES *The right rear cutting unit motor is good. Proceed to step 35.*

    NO *Proceed to next question.*

    Is right rear cutting unit motor leakage 11% to 20%?

    YES *The right rear cutting unit motor is marginal. Proceed to step 35.*

    NO *Proceed to next question.*

    Is right rear cutting unit motor leakage 21% or more?

    YES *Repair or replace right rear cutting unit motor. (See “Cutting Unit Motors” on page 6-62.)*
35. Remove device or tool from right rear cutting unit.
36. Disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
37. Install and connect all components as noted prior to test.
38. Check hydraulic oil level. Add oil as needed. (Refer to “Safety, Operation, and Maintenance Manual” for correct oil specifications.)

Lift/Steer System Relief Valve Pressure Test

See Figures 6-28 through 6-30.

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 5000 psi (345 bar) • -8 ORFS Test Hose 5000 psi (345 bar)

1. Operate hydraulic system until oil temperature is at 120–150° F (49–65° C).
2. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
3. Remove center floorboard.

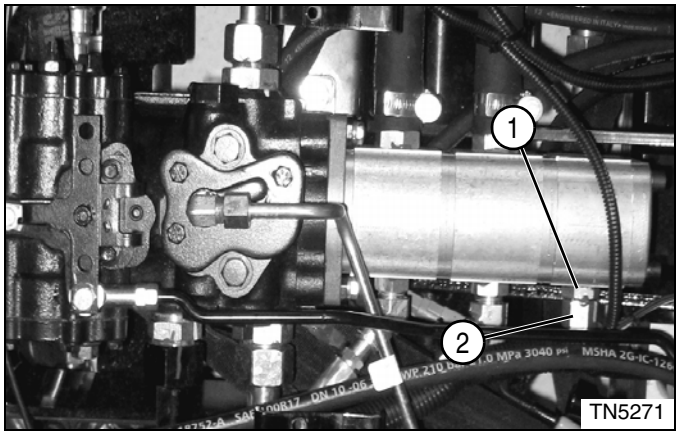


Figure 6-28



Figure 6-29

4. Install tee fitting between fitting (1) and hose (2).
5. Connect test hose from tee fitting to pressure gauge (3).

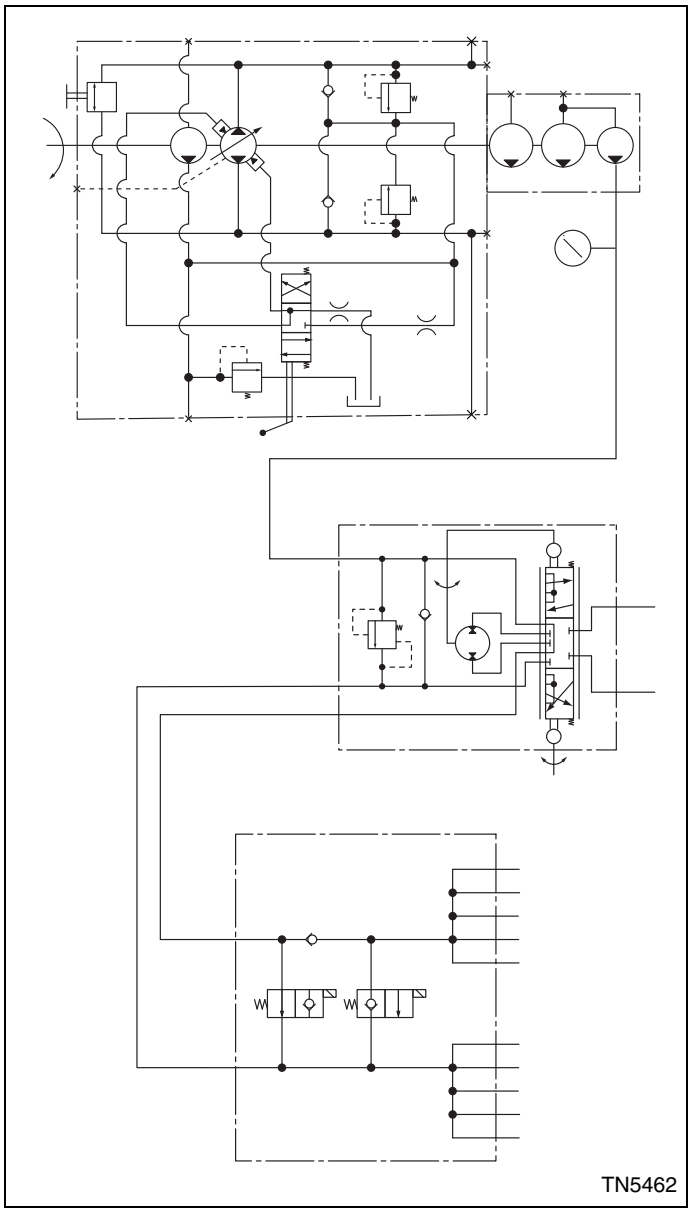


Figure 6-30: Lift Steer System Relief Valve Pressure Test—Install Tee Fitting (1) and Hose (2) and Connect Test Hose From Tee Fitting To Pressure Gauge

6. Bypass the seat switch.

CAUTION

Do not run mower lift/steer system relief valve over relief longer than 10 seconds, or damage may occur to hydraulic system.

7. Start engine and run at full throttle (3150 ± 50 rpm).
8. Turn steering wheel fully right against stop.
9. Record pressure reading.
10. Stop engine.

Is lift/steer system relief pressure 1595 psi (110 bar)?

YES *Lift/steer system relief valve is good. Proceed to step 11.*

NO *Test lift/steer pump. (See "Lift/Steer Pump Test" on page 6-56.) Test lift cylinder. (See "Lift Cylinder Leakage Test" on page 6-31.) Replace steering valve. (See "Steering Valve" on page 7-7.)*

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 "Safety, Operation, and Maintenance Manual" for correct oil specifications.)

Lift System Test

See Figures 6-31 through 6-33.

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 2000 psi (138 bar) • -8 ORFS Tee Fitting

1. Park the mower safely. (See "Park Mower Safely" on page 1-5.)
2. Remove center floorboard.

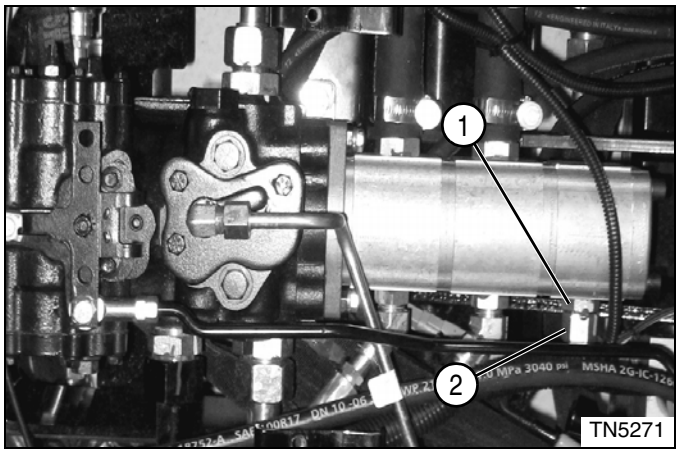


Figure 6-31

3. Disconnect hose (2) from fitting (1).

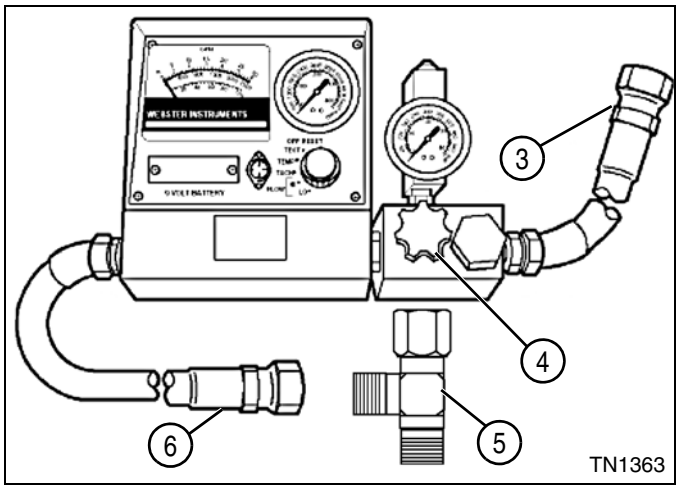


Figure 6-32

4. Install tee fitting (5) to fitting (1).
5. Connect flow meter inlet test hose (6) and hose (2) to tee fitting (5).

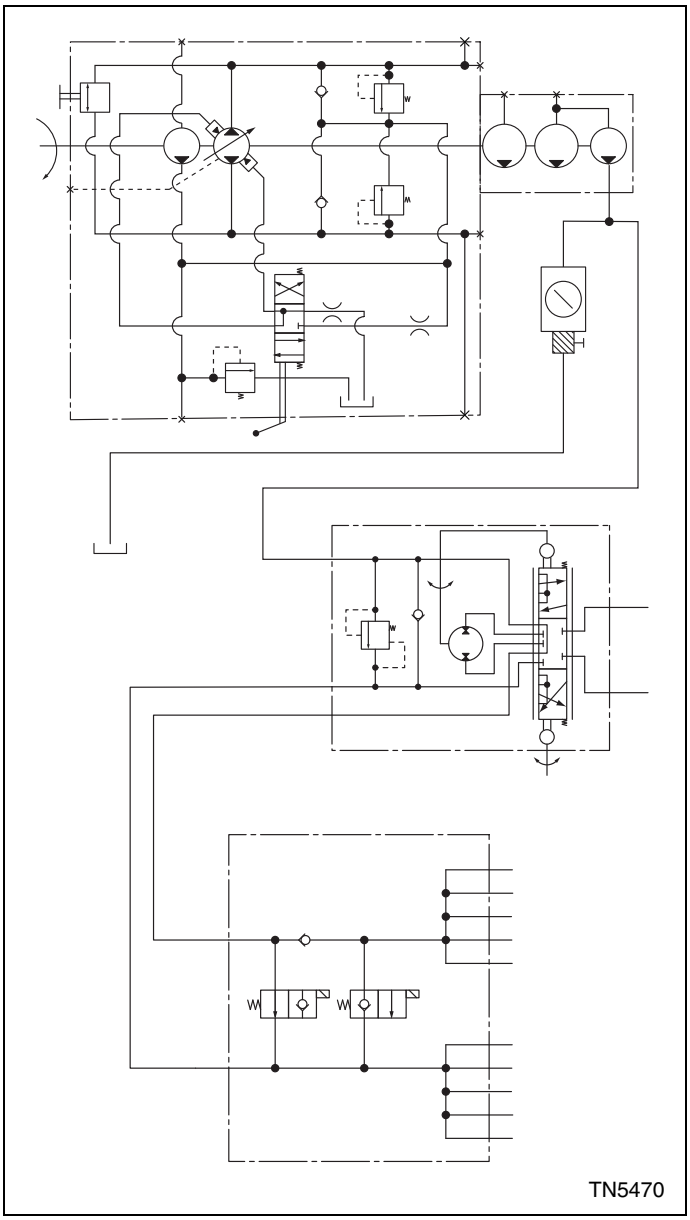


Figure 6-33: Lift System Test—Install Tee Fitting (5) to Fitting (1) and Connect Flow Meter Inlet Test Hose (6) and Hose (2) to Tee Fitting (5)

NOTE

Make sure hose end is under oil level in hydraulic tank to prevent aeration of oil.

6. Connect flow meter outlet test hose (3) to the hydraulic tank.
7. Open flow meter valve (4) completely.
8. Bypass the seat switch.

NOTE

Verify engine rpm is within specification (2850 ± 50 rpm) to ensure accurate hydraulic test results.

9. Start engine and run at full throttle (2850 ± 50 rpm).

4

⚠ CAUTION

Do not exceed 1800 psi (124 bar) as this test does not utilize system relief.

10. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (4) until a reading of 900 psi (62 bar) or one-half of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
11. Hold the lever in the raise position.
12. Read and record the lift/steer pump no load flow.
13. While holding the raise/lower lever in the raise position, slowly close flow meter valve (4) until pressure reaches 1300 psi (90 bar).
14. Hold the lever in the raise position.
15. Read and record the lift/steer pump loaded flow.
16. Open flow meter valve (4) and stop engine.
17. Calculate lift system leakage. (Step 12 – Step 15 / Step 12 x 100 = Leak Percentage)

    Is lift system leakage 10% or less?

    YES *The lift system is good. Proceed to step 18.*

    NO *Proceed to next question.*

    Is lift system leakage 11% to 20%?

    YES *The lift system is marginal. Additional testing is required.*

    NO *Proceed to next question.*

    Is lift system leakage 21% or more?

    YES *Test individual components in lift system for leakage.*
18. If no further testing is required, disconnect and remove test equipment.
19. Install and connect all components as noted prior to test.
20. Check hydraulic oil level. Add oil as needed. (Refer to “Safety, Operation, and Maintenance Manual” for correct oil specifications.)

Lift/Steer Pump Test

See Figures 6-34 and 6-35.

⚠ 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 2000 psi (138 bar) • -8 ORFS Tee Fitting • -8 ORFS Blocking Disk

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)

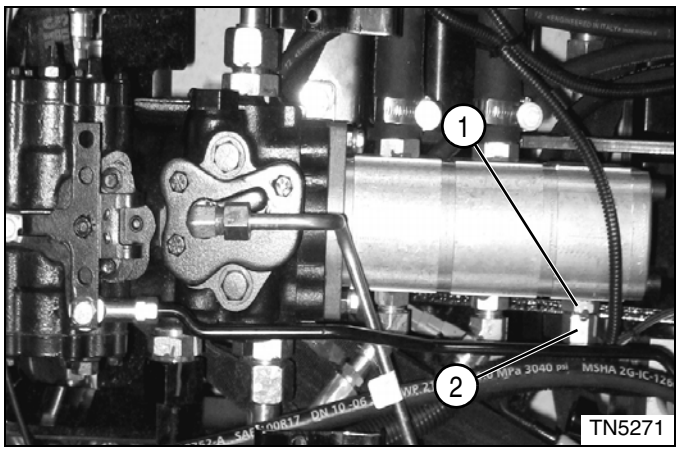


Figure 6-34

2. Before performing this test, perform lift system test. Leave flow meter connected as outlined in lift system test. Install blocking disk between hose (2) and tee fitting (5). (*See “Lift System Test” on page 6-54.)*

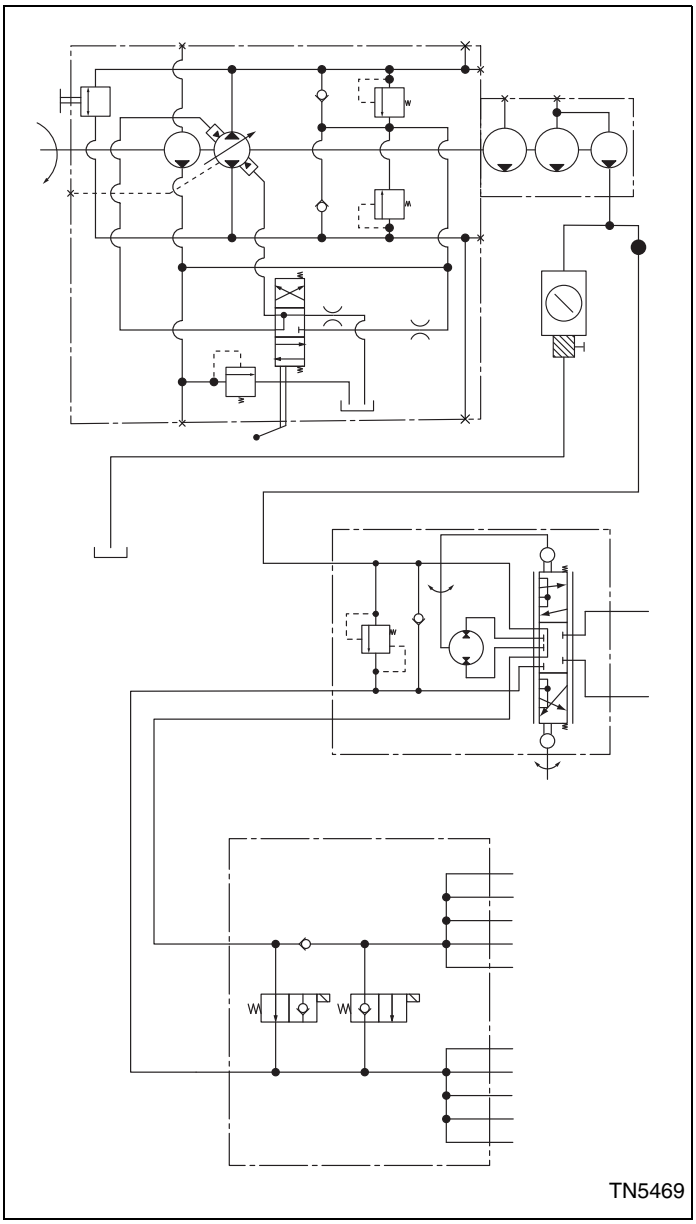


Figure 6-35: Lift Steer Pump Test—Install Blocking Disk Between Hose (2) and Tee Fitting (5)

3. Open flow meter valve (4) completely. (See Figure 6-32.)
4. Bypass the seat switch.

NOTE

Verify engine rpm is within specification (2850 ± 50 rpm) to ensure accurate hydraulic test results.

5. Start engine and run at full throttle (2850 ± 50 rpm).

⚠ CAUTION

Do not exceed 1800 psi (124 bar) as this test does not utilize system relief.

6. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (4) until a reading of 900 psi (62 bar) or one-half of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C).
7. Open flow meter valve (4) completely. Read and record the lift/steer pump no load flow.
8. Slowly close flow meter valve (4) until pressure reaches 1300 psi (90 bar). Read and record the lift/steer pump loaded flow.
9. Open flow meter valve (4) and stop engine.
10. Calculate lift/steer pump leakage.
    (Step 7 – Step 8 / Step 7 x 100 = Leak Percentage)

    Is lift/steer pump leakage 10% or less?

    YES *The lift/steer pump is good. Proceed to step 11.*

    NO *Proceed to next question.*

    Is lift/steer pump leakage 11% to 20%?

    YES *The lift/steer pump is marginal. Additional testing is required.*

    NO *Proceed to next question.*

    Is lift/steer pump leakage 21% or more?

    YES *Repair or replace lift/steer pump. (See "Gear Pump" on page 6-60.)*
11. If further testing is not required, disconnect and remove test equipment.
12. Install and connect all components as noted prior to test.
13. Check hydraulic oil level. Add oil as needed. (Refer to "Safety, Operation, and Maintenance Manual" for correct oil specifications.)

Lift Valve Test

See Figures 6-36 through 6-38.

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 2000 psi (138 bar) • -8 ORFS Tee Fitting • -6 ORFS Blocking Disk

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Before performing this test, perform lift system test. Leave flow meter connected as outlined in lift system test. *(See “Lift System Test” on page 6-54.)*

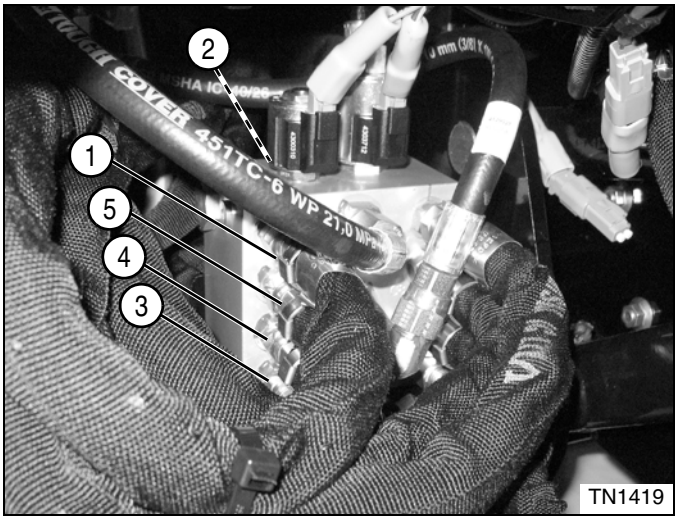


Figure 6-36

3. Install blocking disks at fittings (1–5) on lift valve, preventing oil flow from entering lift cylinders.

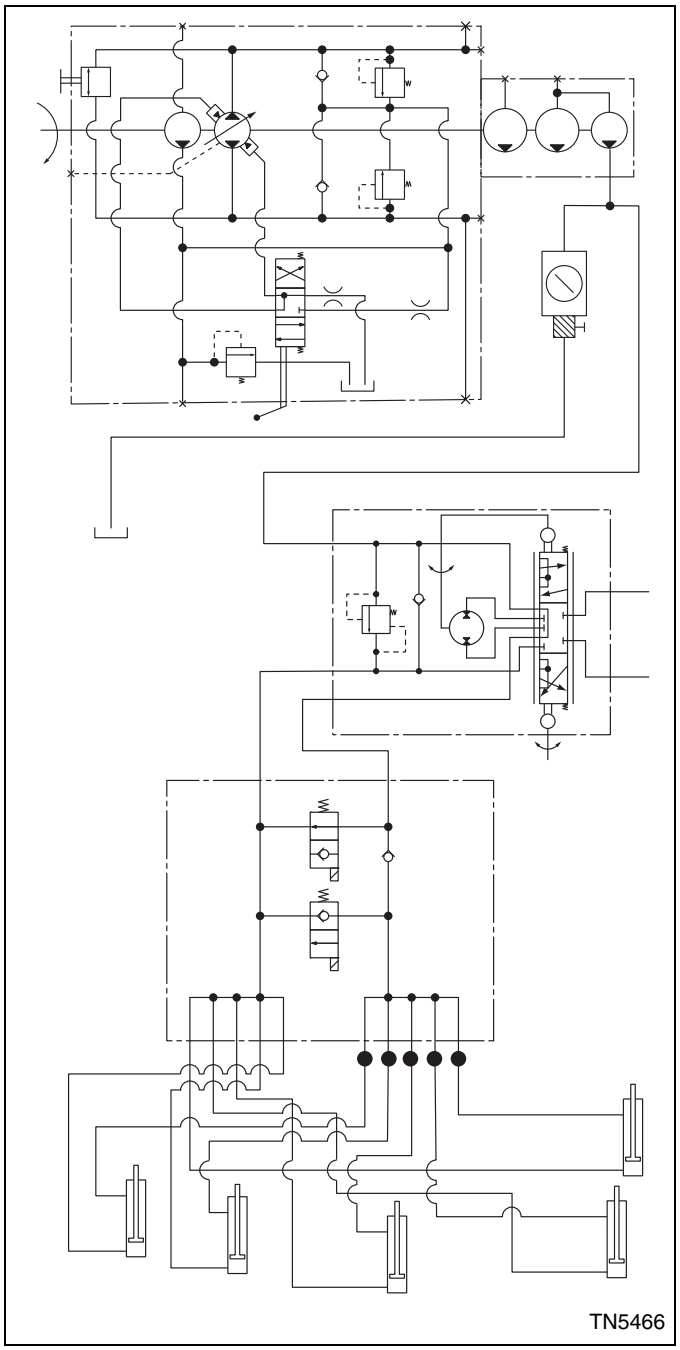


Figure 6-37: Lift Valve Test—Install Blocking Disks at Fittings (1—5) on Lift Valve

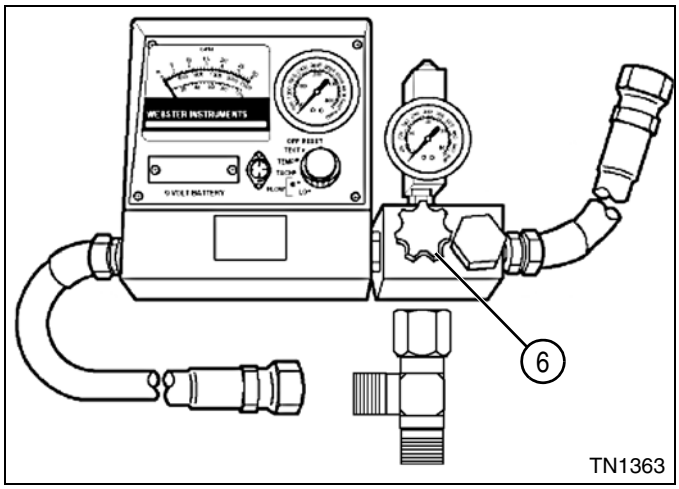


Figure 6-38

4. Open flow meter valve (6) completely.
5. Bypass seat switch.

NOTE

Verify engine rpm is within specification (2850 ± 50 rpm) to ensure accurate hydraulic test results.

6. Start engine and run at full throttle (2850 ± 50 rpm).
7. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (6) until a reading of 900 psi (62 bar) or one-half of the relief valve rating is reached. Warm oil to 120–150° F (49–65° C); open valve fully after operating temperature is reached.
8. Hold the lever in the raise position.
9. Slowly close flow meter valve (6) until pressure reaches 1300 psi (90 bar). Read and record the lift/steer pump loaded flow.
10. Open flow meter valve (6) and stop engine.
11. Calculate lift valve leakage.
    (Step 8 of previous test – Step 9 / Step 8 of previous test x 100 = Leak Percentage)

    Is lift valve leakage 10% or less?

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

    NO *Proceed to next question.*

    Is lift valve leakage 11% to 20%?

    YES *The lift valve is marginal. Repair or replace as needed.*

    NO *Proceed to next question.*

    Is lift valve leakage 21% or more?

    YES *Repair or replace lift valve. (See “Lift Valve” on page 6-63.)*
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 “Safety, Operation, and Maintenance Manual” for correct oil specifications.)

Repair

Gear Pump

Removal and Installation

See Figures 6-39 through 6-41.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove the seat and mount plate. (See “Seat and Mount Plate” on page 9-9.)
3. Drain hydraulic oil.

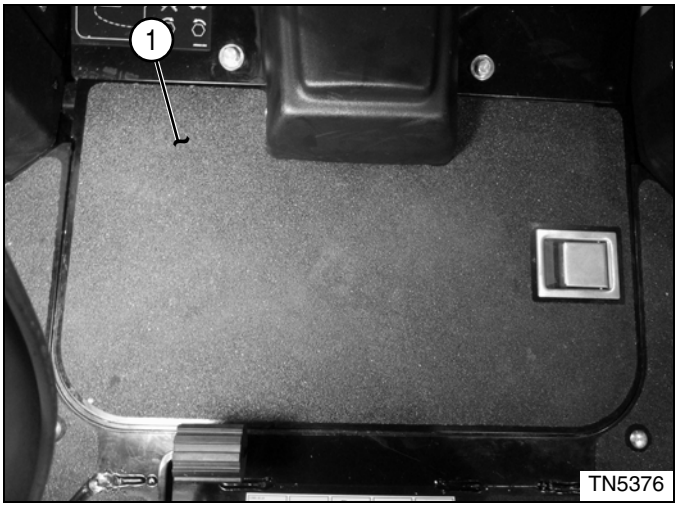


Figure 6-39

4. Remove center floorboard (1).

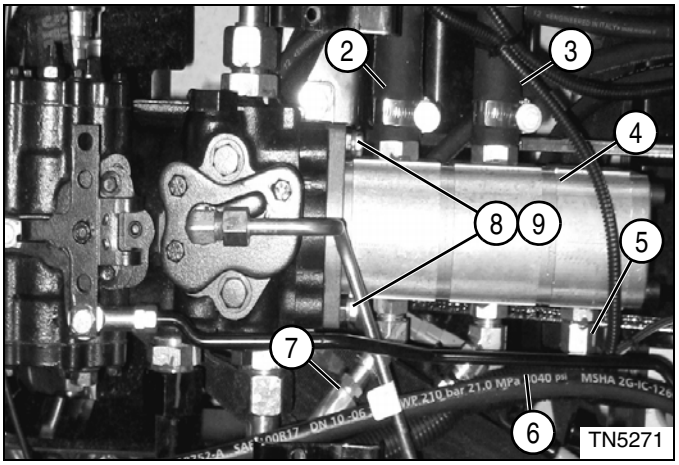


Figure 6-40

NOTES

- *Label all hydraulic hoses and tubes before disconnecting to aid in installation.*
- *Close all openings with caps or plugs to prevent contamination.*

5. Loosen hose clamps, and remove pump suction hoses (2 and 3).
6. Disconnect steering supply hose (5).
7. Disconnect deck hoses (6 and 7).
8. Support gear pump assembly (4).
9. Remove two screws (8) and lock washers (9).
10. Remove gear pump (4).

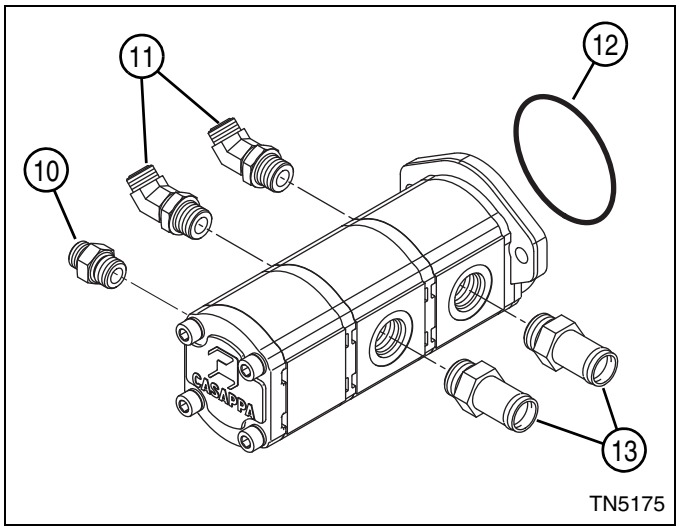


Figure 6-41

11. Remove O-ring (12).

NOTE

Note the position and orientation of the fittings before removing to ensure correct installation.

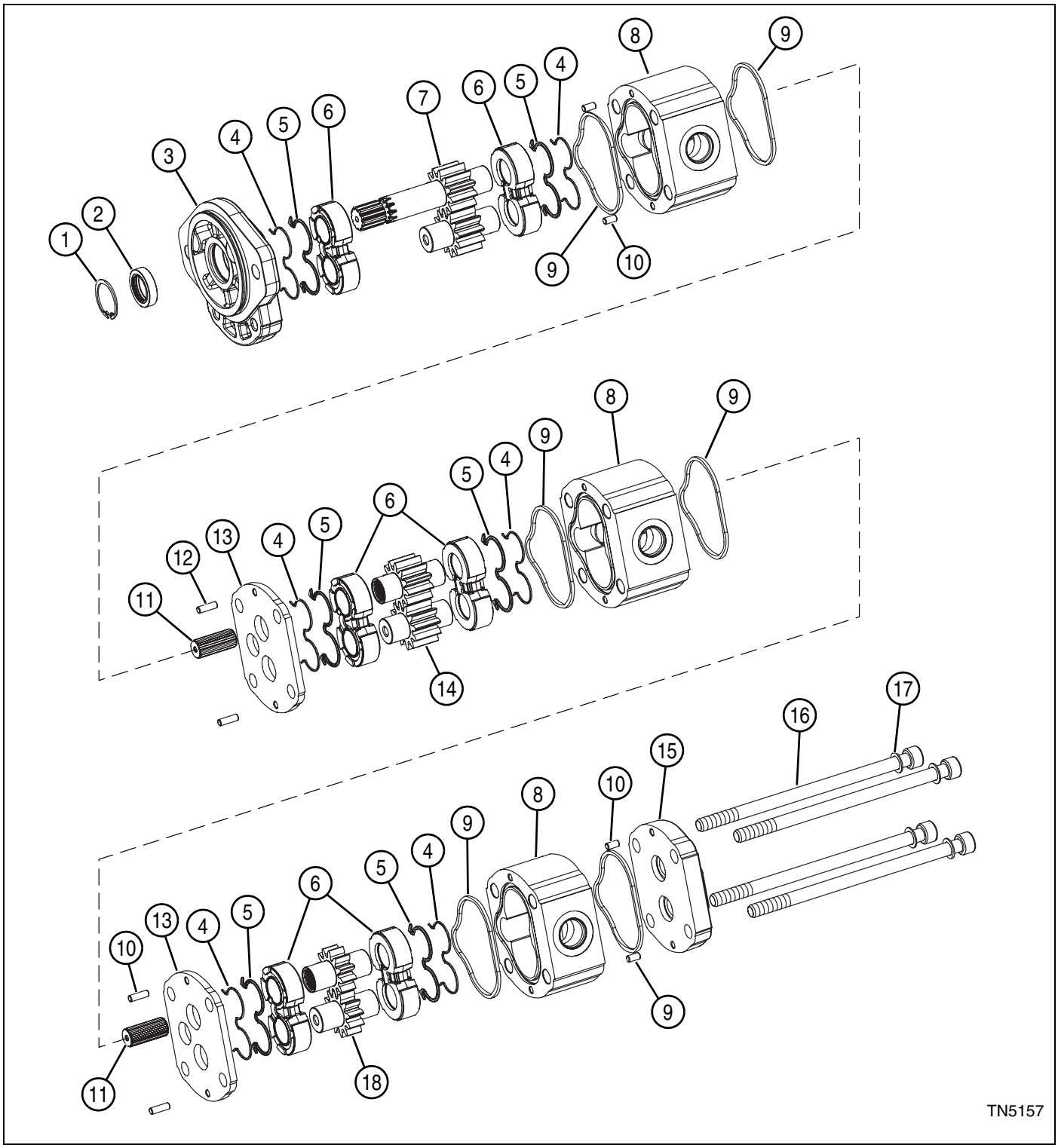
12. Remove fittings (11).
13. Remove pump suction fittings (13).
14. Remove fitting (10).

Installation Notes

- *Install gear pump by reversing the order of removal.*
- *Ensure new O-rings are in place before installing hoses on fittings.*
- *Tighten pump suction fittings (13) to 33 lb-ft (45 N·m).*
- *Tighten fittings (11) to 55 lb-ft (75 N·m).*
- *Tighten fitting (10) to 55 lb-ft (75 N·m).*
- *Replace hydraulic oil filter.*
- *Refill hydraulic tank. (Refer to “Safety, Operation, and Maintenance Manual” for oil specifications.)*
- *Install seat and mounting plate. (See “Seat and Mount Plate” on page 9-9.)*
- *Start engine. Check hydraulic system for leaks. Repair as necessary.*
- *Check hydraulic oil level and add if necessary.*

Disassembly, Inspection, and Assembly

See Figures 6-42 and 6-43



1	Retaining Ring	6	Thrust Plate (6)	11	Splined Connecting Shaft (2)	16	Bolt (4)
2	Seal	7	Gear Set (Drive Shaft)	12	Dowel Pin (4)	17	Washer (4)
3	Front Cover/Flange	8	Body (3)	13	Spacer (2)	18	Gear Set, End
4	Backup Washer (6)	9	Seal (6)	14	Gear Set, Intermediate		
5	Seal (6)	10	Dowel Pin (4)	15	Rear Cover		

Figure 6-42

Disassembly Notes

- *Do not disassemble pump for repair unless test procedures indicate internal leakage.*
- *Never pry components apart. Use a soft face 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.*

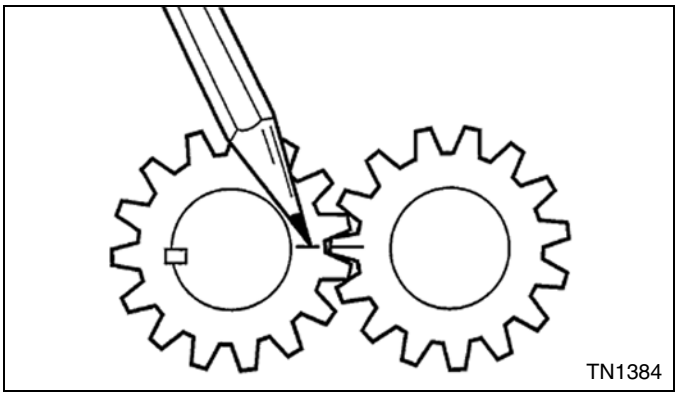


Figure 6-43

1. After removing bolts, disassemble pump, one section at a time. Before removing gear set, mark a line across meshing teeth to ensure that gears are reassembled in the same position.
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 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.

4. Clean all parts using clean solvent, and dry using compressed air.
5. Inspect all parts for wear or damage. Replace parts as needed.

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 P/N 4174881)

- *Assemble the 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.*
- *Assemble pump one, section at a time, building up from flange section.*
- *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 bolts finger-tight and rotate drive shaft to make sure it turns freely. Tighten bolts evenly in steps to a final torque of 33 lb-ft (45 N·m) and check rotation of pump drive shaft.*
- *Lubricate pump through ports with clean hydraulic oil prior to installing.*

Cutting Unit Motors

Removal and Installation

NOTE

See Chapter 8—Cutting Units for cutting unit motor service information. (See “Deck Motor” on page 8-12.)

Lift Valve

Removal and Installation

See Figures 6-44 through 6-46.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove center floorboard.

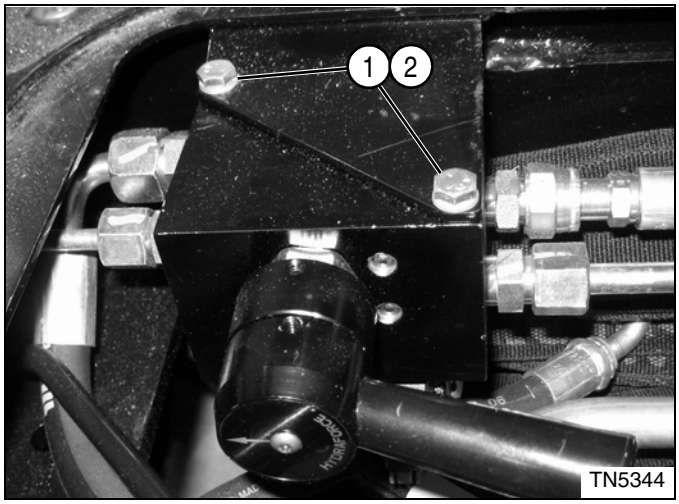


Figure 6-44

3. Remove two brake valve mounting screws (1) and lock washers (2) and reposition brake valve to provide access to lift valve.
4. Thoroughly clean the valve, especially the area surrounding the hydraulic hoses, tubes, and fittings.

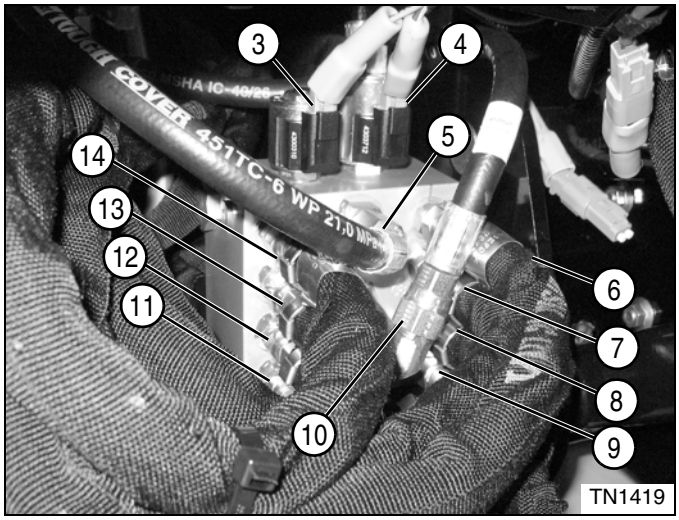


Figure 6-45

NOTE

Label connectors before disconnecting to ensure correct installation.

5. Disconnect electrical connectors (3 and 4).

NOTES

- *Label hydraulic hoses to aid in installation.*
- *Close all openings with caps or plugs to prevent contamination.*

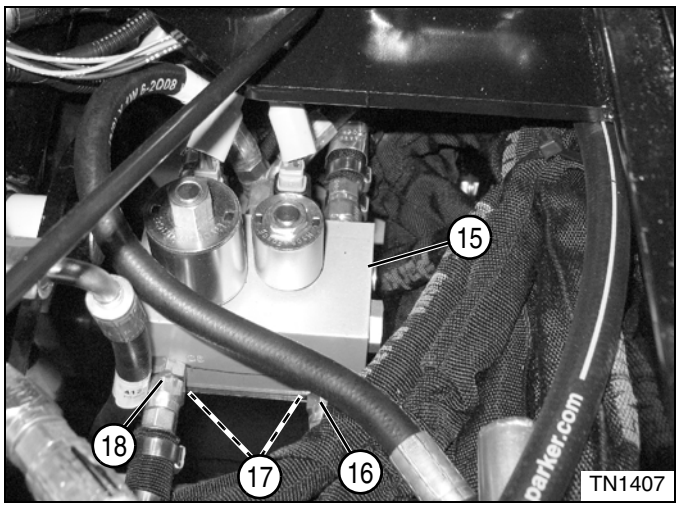


Figure 6-46

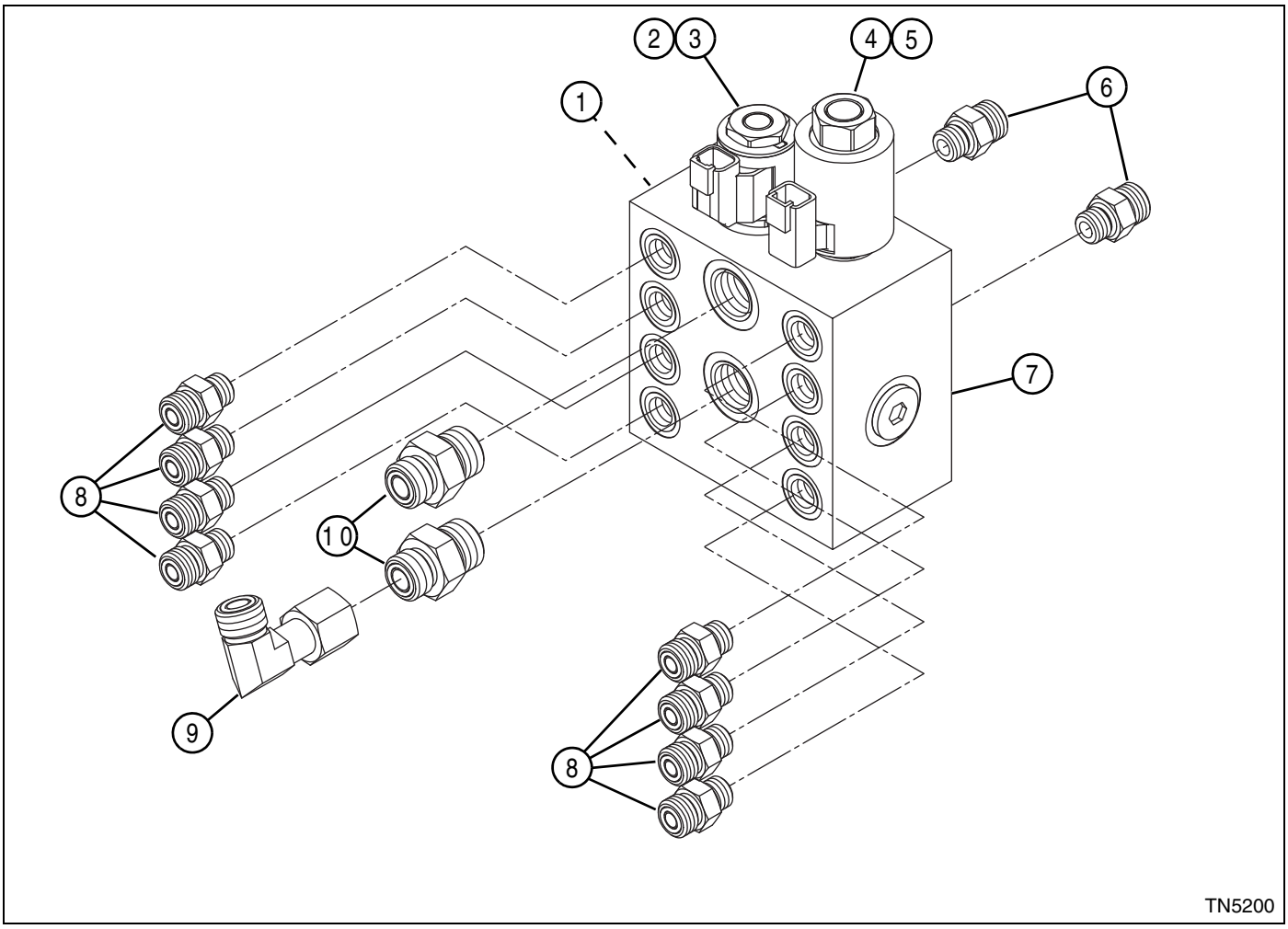
6. Disconnect hydraulic hoses (5–14).
7. Disconnect hydraulic hoses (16 and 18).
8. Support lift valve (15).
9. Remove the two mounting screws (17).
10. Remove lift valve (15).

Installation Notes

- *Install lift valve by reversing the order of removal.*
- *Ensure new O-rings are in place before installing hoses on fittings.*
- *Tighten hose (5) to 33 lb-ft (45 N·m).*
- *Replace hydraulic oil filter.*
- *Refill hydraulic tank. (Refer to “Safety, Operation, and Maintenance Manual” for 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 6-47.



1	Check Valve Cartridge	4	Raise Solenoid Coil	7	Lift Valve	10	Fitting (2)
2	Lower Solenoid Coil	5	Raise Solenoid Valve	8	Fitting (10)		
3	Lower/Proportional Solenoid Valve	6	Fitting (2)	9	90° Fitting		

Figure 6-47

NOTE

Note the position and orientation of the fittings before removing to ensure correct installation.

1. Remove 10 fittings (8) from the lift valve (7).
2. Remove two fittings (6) from the lift valve (7).
3. Remove 90° fitting (9) from the lift valve (7).
4. Remove two fittings (10) from the lift valve (7).
5. Remove, inspect, and replace lift valve components as needed.

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.

6. Clean all parts using clean solvent, and dry using compressed air.
7. Inspect all parts for wear or damage. Replace parts as needed.

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, Check Valve (Jacobsen PN 5003579) Seal Kit, Raise Solenoid Valve (Jacobsen PN 5003579) Seal Kit, Lowering/Proportional Solenoid Valve (Jacobsen PN 5003578)

- *Assemble the lift valve by reversing the order of disassembly.*
- *Lubricate all O-rings prior to assembly.*
- *Tighten fittings (8) to 33 lb-ft (44 N·m).*
- *Tighten fittings (10) to 60 lb-ft (81 N·m).*
- *Tighten fitting (9) to 48 lb-ft (65 N·m).*

Deck Valve

Removal and Installation

See Figure 6-48.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Drain hydraulic oil.
3. Thoroughly clean the valve, especially the area surrounding the hydraulic hoses, tubes, and fittings.

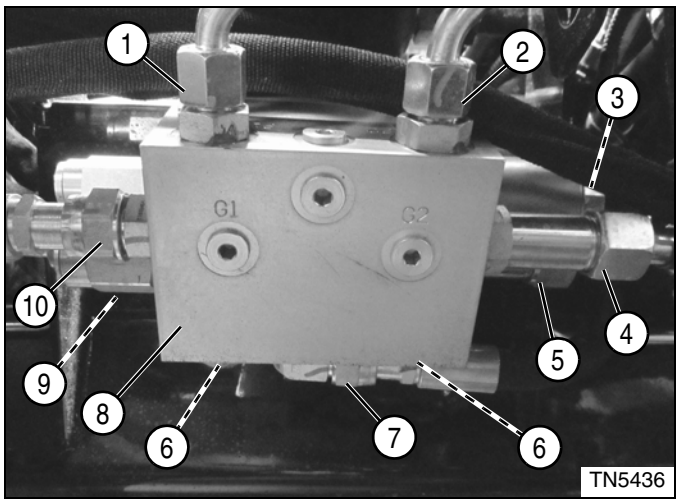


Figure 6-48

NOTE

Label connector before disconnecting to ensure correct installation.

4. Disconnect electrical connector (3) from solenoid.

NOTES

- *Label all hydraulic hoses and tubes before disconnecting to aid in installation.*
- *Close all openings with caps or plugs to prevent contamination.*

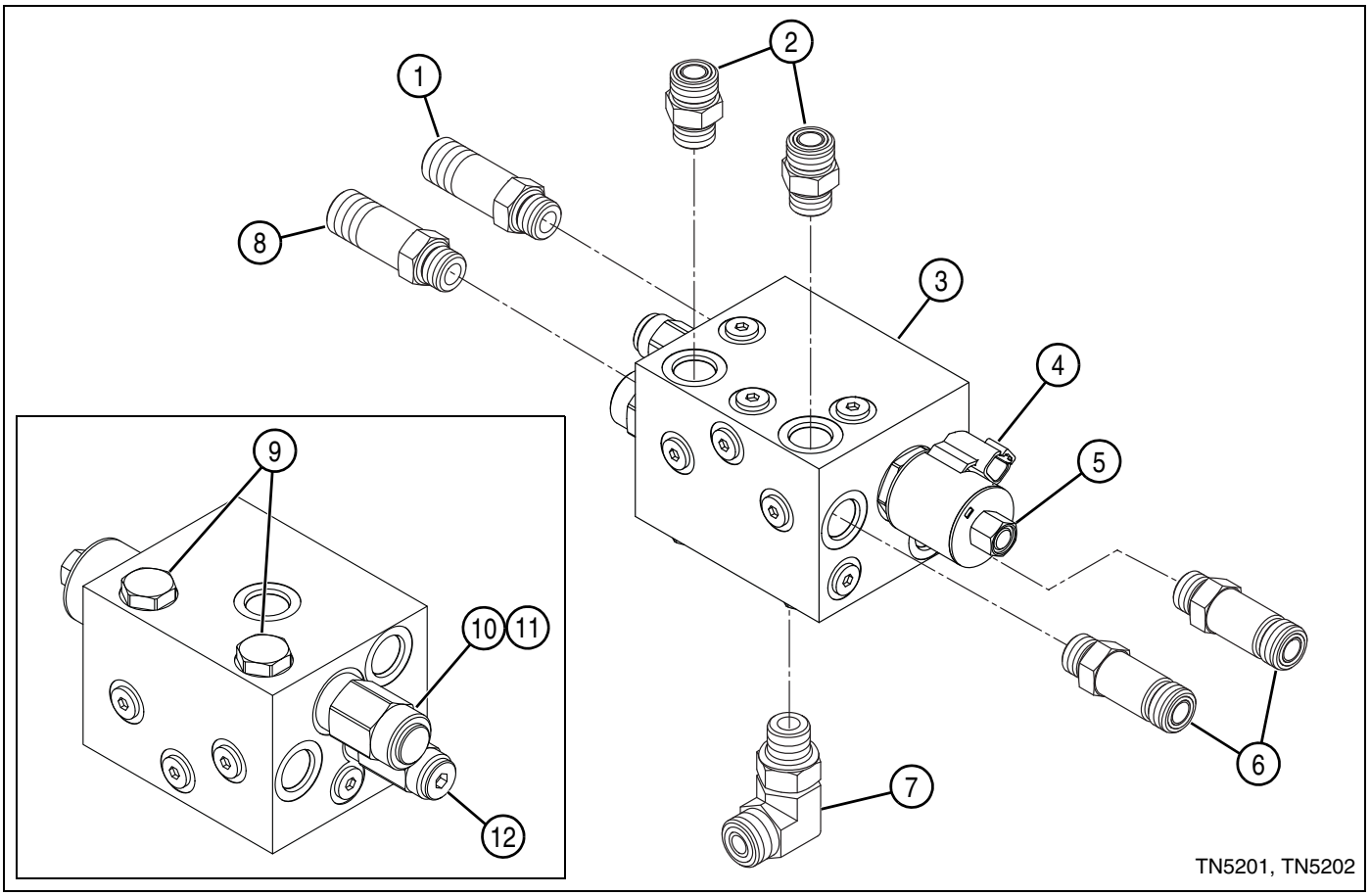
5. Disconnect hydraulic hoses (1, 2, and 4).
6. Disconnect hydraulic hoses (5 and 7).
7. Disconnect hydraulic hoses (9 and 10).
8. Support the deck valve (8).
9. Remove two mounting screws, lock washers, and washers (6) from the deck valve (8).
10. Remove deck valve (8).

Installation Notes

- *Install deck valve by reversing the order of removal.*
- *Ensure new O-rings are in place before installing hoses on fittings.*
- *Replace hydraulic oil filter.*
- *Refill hydraulic tank. (Refer to “Safety, Operation, and Maintenance Manual” for 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 6-49.



1	Fitting	4	Solenoid Valve Coil	7	90° Fitting	10	Relief Valve, 630 psi
2	Fitting (2)	5	Solenoid Valve	8	Fitting	11	Pilot Piston
3	Deck Valve	6	Fitting (2)	9	Check Valve (2)	12	Relief Valve, 2800 psi

Figure 6-49

NOTE

Note the position and orientation of the fittings before removing to ensure correct installation.

1. Remove fittings (1, 2, 6, and 7) from the lift valve.

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.

2. Clean all parts using clean solvent, and dry using compressed air.
3. Inspect all parts for wear or damage. Replace parts as needed.

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 (Jacobsen PN 4223640) Seal Kit, Relief Valve, 2800 psi (Jacobsen PN 5003579) Seal Kit, Relief Valve, 630 psi (Jacobsen PN 5003554) Seal Kit, Check Valve (Jacobsen PN 5003579)

- *Assemble the deck valve by reversing the order of disassembly.*
- *Lubricate all O-rings prior to assembly.*
- *Tighten cartridges and relief valve to 25 lb-ft (34 N·m).*
- *Tighten fittings (1, 2, 6, and 7) to 60 lb-ft (81 N·m).*

Hydraulic Filter

Removal and Installation

See Figures 6-50 and 6-51.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Raise engine hood.
3. Drain hydraulic tank.

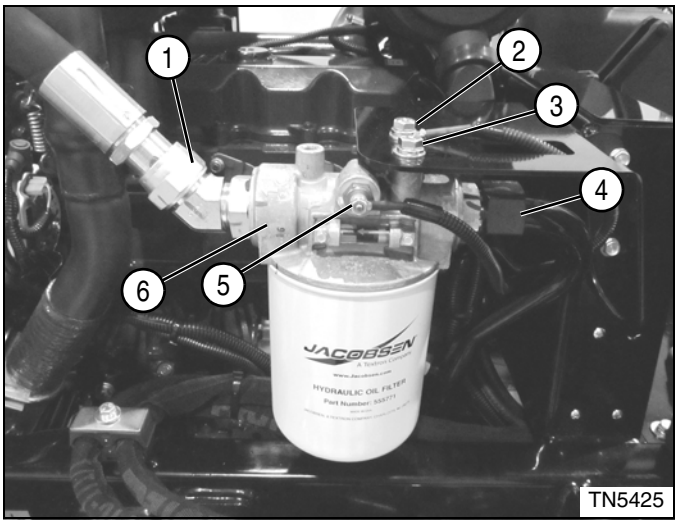


Figure 6-50

4. Disconnect electrical connectors (2 and 5).

NOTES

- *Label all hydraulic hoses and tubes to aid in installation.*
- *Close all openings with caps or plugs to prevent contamination.*

5. Disconnect hydraulic hose (1).
6. Disconnect hydraulic tube (4).
7. Support the oil filter assembly (6).
8. Remove screw, lock washer, and flat washer (3).
9. Remove oil filter assembly (6).

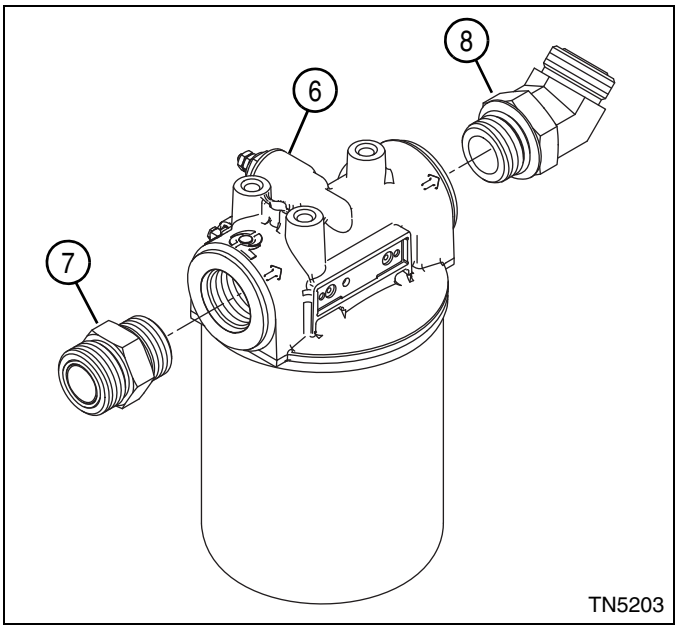


Figure 6-51

NOTE

Note the position and orientation of the fittings before removing to ensure correct installation.

10. Remove fittings (7 and 8) from oil filter assembly (6).

Installation Notes

- *Install oil filter assembly by reversing the order of removal.*
- *Replace hydraulic oil filter. (Refer to "Safety, Operation, and Maintenance Manual" for oil specifications.)*
- *Refill hydraulic tank. (Refer to "Safety, Operation, and Maintenance Manual" for oil specifications.)*
- *Start engine. Check hydraulic system for leaks. Repair as necessary.*
- *Check hydraulic oil level and add if necessary.*

Lift Cylinders

Removal and Installation

See Figure 6-52.

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 1-5.)

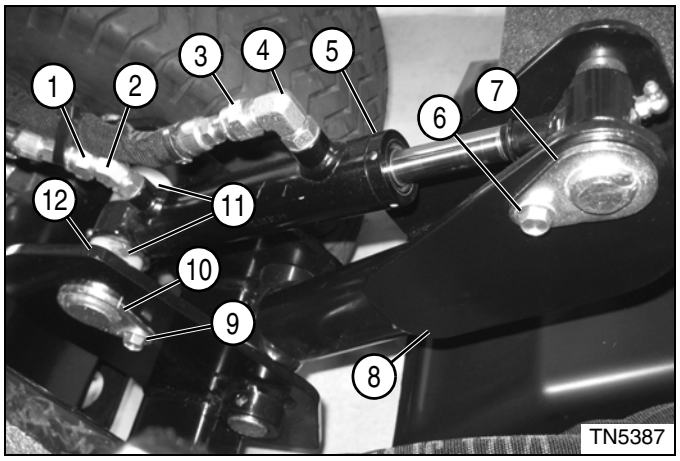


Figure 6-52

NOTES

- *Label all hydraulic hoses before disconnecting to ensure correct installation.*
- *All of the lift cylinders have an orifice installed between the hose and one of the cylinder fittings. Note the location of the orifice and recover the orifice when removing the hydraulic hoses.*
- *Close all openings with caps or plugs to prevent contamination.*

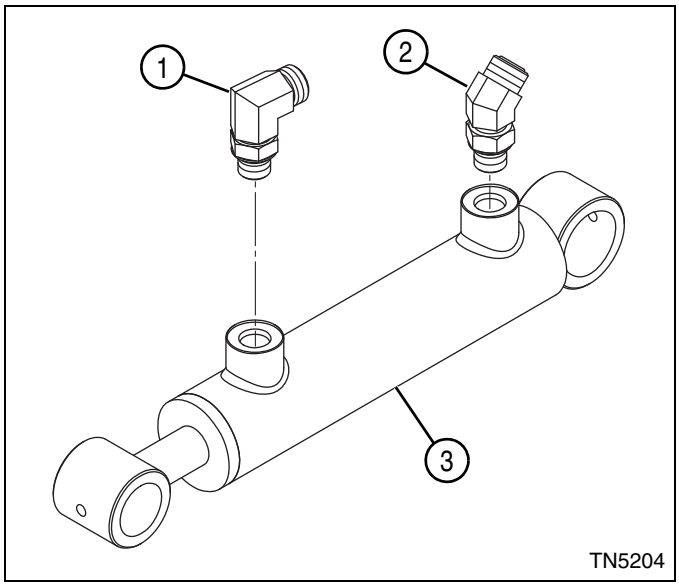
3. Disconnect hydraulic hoses (1 and 3) from fittings (2 and 4).
4. Remove screw (9), pin (10), and spacers (11) from lift cylinder (5) and bracket (12).
5. Remove screw (6) and pin (7) from lift cylinder (5) and lift arm (8).
6. Remove lift cylinder (5).

Installation Notes

- *Install lift cylinder by reversing the order of removal.*
- *Ensure new O-rings are in place before installing hoses on fittings.*
- *Replace hydraulic oil filter.*
- *Inspect hydraulic oil level within hydraulic tank. (Refer to "Safety, Operation, and Maintenance Manual" for 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 6-53 through 6-55.

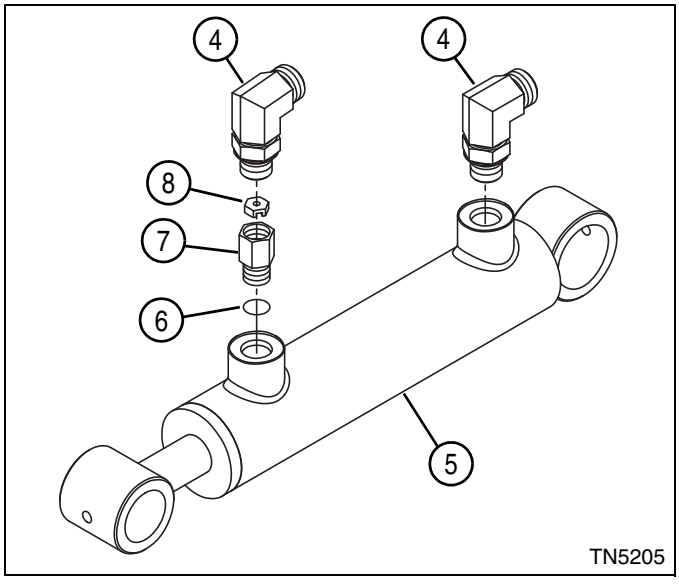


1 90° Fitting
2 45° Fitting
3 Lift Cylinder

Figure 6-53: Front Lift Cylinder

NOTE

Rear cylinders include a one-way orifice and a 0.026-inch (0.660 mm) orifice on the rod side of the cylinder.



4 90° Fitting (2)
5 Lift Cylinder
6 O-Ring
7 One-Way Orifice Adapter
8 One-Way Orifice Plate

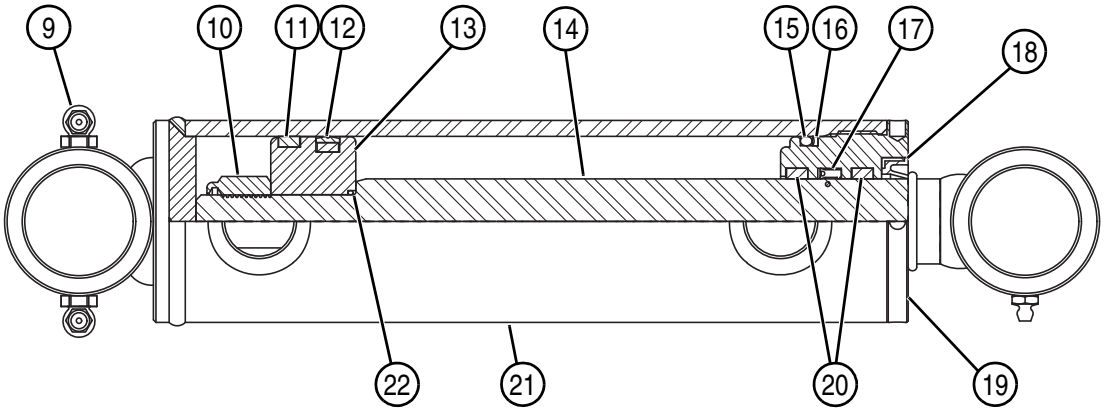
Figure 6-54: Rear Lift Cylinder

1. Drain oil from lift cylinder.

NOTES

- *Note the position and orientation of the fittings before removing to ensure correct installation.*
- *The front center lift cylinder has the ports located differently from the other lift cylinders, but is serviced in the same manner.*

2. Remove fittings from lift cylinder.



9	Grease Fitting	13	Piston	17	Rod Seal	21	Barrel
10	Nut	14	Rod	18	Rod Wiper	22	O-Ring
11	Wear Ring	15	O-Ring	19	Rod Guide		
12	Piston Seal	16	Backup Ring	20	Wear Ring (2)		

Figure 6-55

NOTE

During repair of the cylinder, use extreme care not to damage the barrel, piston, rod, and sealing surfaces of the cylinder.

3. Use a spanner wrench to remove the rod guide assembly (19) from the barrel (21).
4. Remove nut (10).
5. Remove piston assembly (13) and rod guide assembly (19) from the rod (14).
6. Remove wear ring (11) and O-ring (12) from the piston (13).
7. Remove O-ring (15), backup ring (16), rod wiper (18), and two wear rings (20) from the rod guide (19).

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.

8. Clean all parts using clean solvent, and dry using compressed air.
9. 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 (Jacobsen PN 4137138)

- *Lubricate O-rings, seals, and rod wiper with clean hydraulic oil before assembly.*
- *Assemble the lift cylinder by reversing the order of disassembly.*

Hydraulic Oil Cooler

Removal and Installation

The hydraulic oil cooler is combined with the radiator and uses the engine cooling fan to cool the hydraulic oil. Removal and installation of the radiator/hydraulic oil cooler is described in Chapter 3—Engine. (See “Radiator/Hydraulic Oil Cooler” on page 3-9.)

Hydraulic Oil Tank

Removal and Installation

See Figures 6-56 through 6-58.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Disconnect the negative (–) battery cable from the battery.
3. Place a suitable container beneath the hydraulic oil tank.
4. Drain hydraulic oil from hydraulic tank.

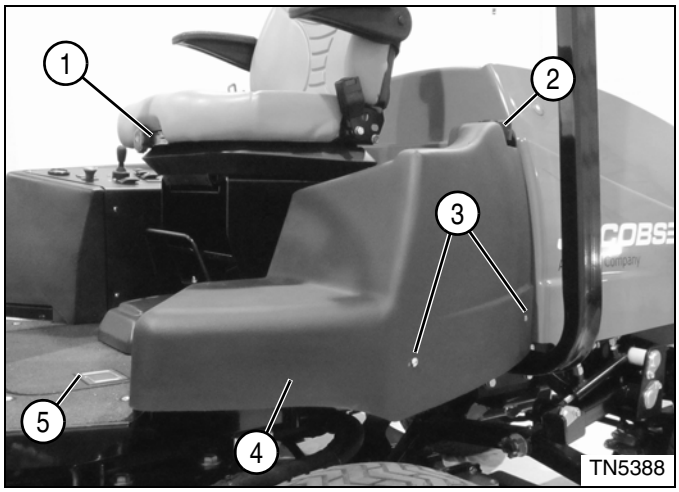


Figure 6-56

5. Remove center floorboard (5) and seat (1).
6. Remove filler cap (2), five screws (3), and tank cover (4).

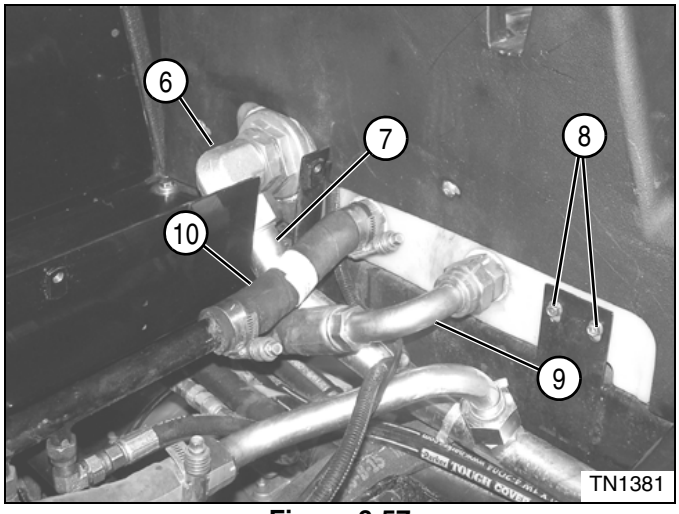


Figure 6-57

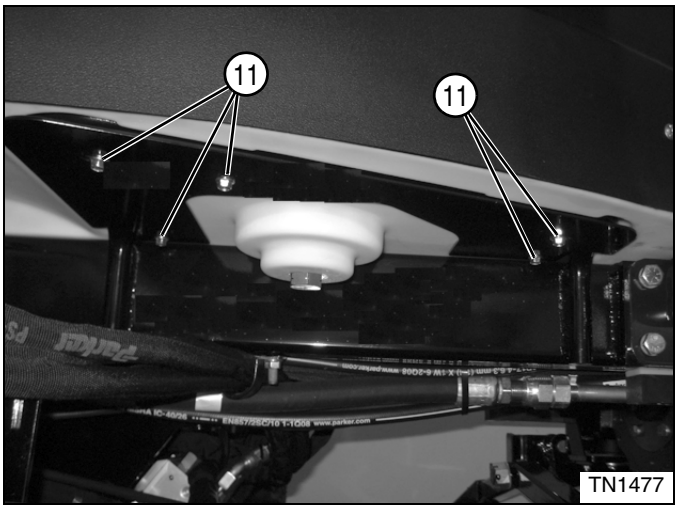


Figure 6-58

NOTES

- *Label all hydraulic hoses and tubes before disconnecting to aid in installation.*
- *Close all openings with caps or plugs to prevent contamination.*

7. Disconnect hose (7) from fitting (6).
8. Disconnect hoses (9 and 10) from hydraulic oil tank.
9. Support the hydraulic oil tank.
10. Remove two screws (8).
11. Remove five screws (11) from the bottom of the hydraulic oil tank.
12. Remove hydraulic oil tank.

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 over torque screws to tank or tank may crack and cause leak.**

- *Apply anti-seize compound to screws (11) and tighten to correct torque. Do not overtighten these screws, or tank may crack and leak.*
- *Ensure new O-rings are in place before installing hoses on fittings.*
- *Replace hydraulic oil filter.*
- *Refill hydraulic oil tank. (Refer to "Safety, Operation, and Maintenance Manual" for oil specifications.)*
- *Start engine. Check hydraulic oil tank for leaks and repair as necessary.*
- *Check hydraulic oil level and add if necessary.*

Chapter 5

Steering

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5

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A Textron Company

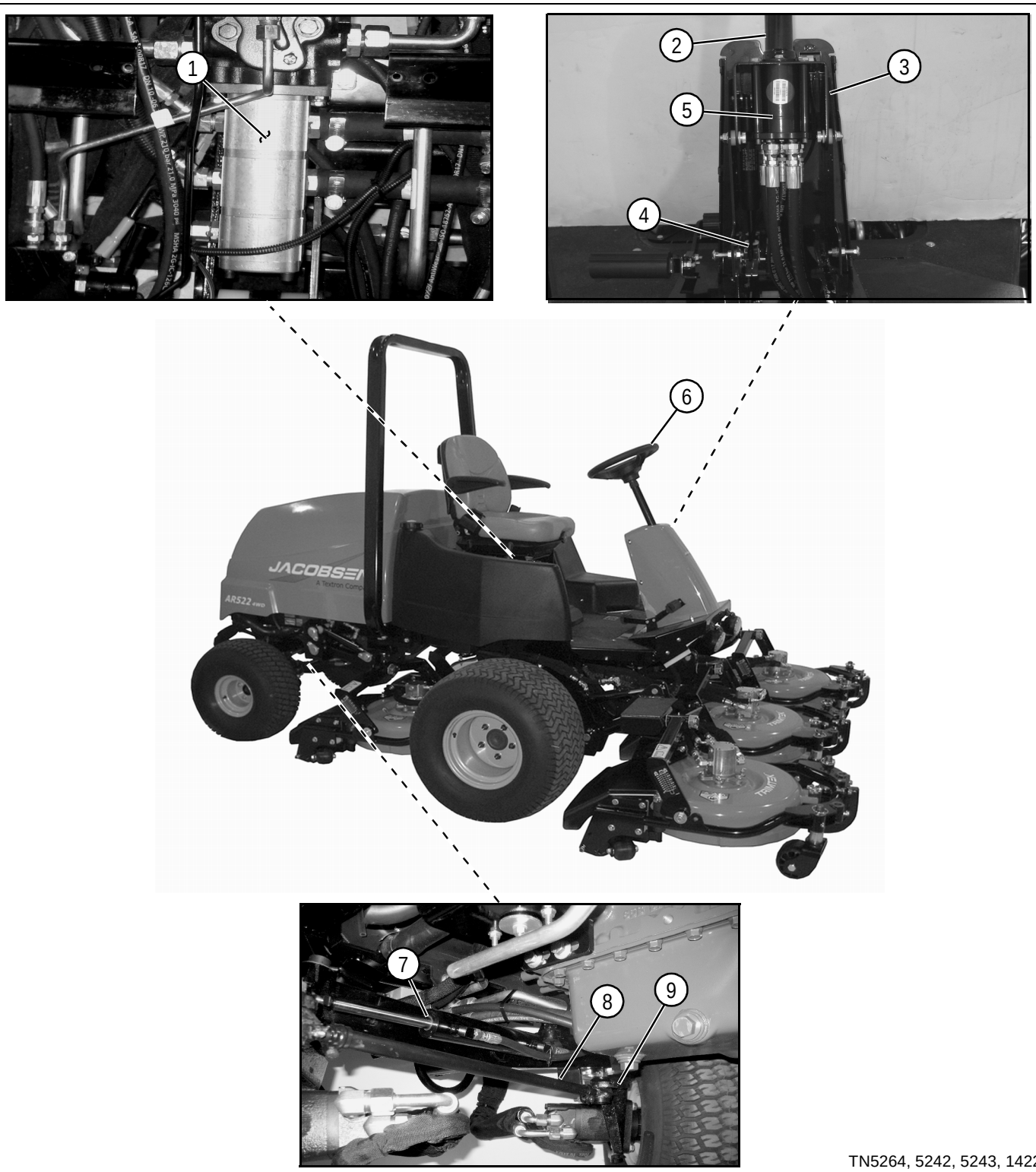
Specifications

Test Specifications		
Steering System Leakage Test—Cylinder Leakage	pt (L)	Zero—Nominal Amount

Repair Specifications		
Steering Wheel Nut	lb-ft (N·m)	25–30 (34–41)
Rear Axle End Play	in. (mm)	0.010–0060 inch (0.25–1.5 mm)
Steering Cylinder Ball Joint-to-Steering Arm Torque	lb-ft (N·m)	80–110 (108–149)
Tie Rod Ball Joint-to-Steering Arm Torque	lb-ft (N·m)	60 ± 5 (81 ± 7)
Rear Axle Alignment Toe-In Measurement	in. (mm)	0.0625 in (1.6)
Rear Axle Spindle Arm-to-Axle Stop Measurement	in. (mm)	0.50 (13)
Rear Axle Steering Arm-to-Motor Mount Bolt Torque	lb-ft (N·m)	95 ± 5 lb-ft (128 ± 7 N·m)
Steering Valve Port Cover-to-Port Manifold Nut Torque	lb-ft (N·m)	20–24 (27–33)
Steering Valve Rotor-to-Stator Clearance	in. (mm)	0.003 (0.08)

Component Location

See Figure 5-1.



1	Steering Unit Pump	4	Tilt Bracket	7	Steering Cylinder
2	Steering Column	5	Steering Valve	8	Tie Rod
3	Steering Tower	6	Steering Wheel	9	Steering Axle

Figure 5-1

Tests and Adjustments

Tie Rod Adjustment

See Figure 5-2.

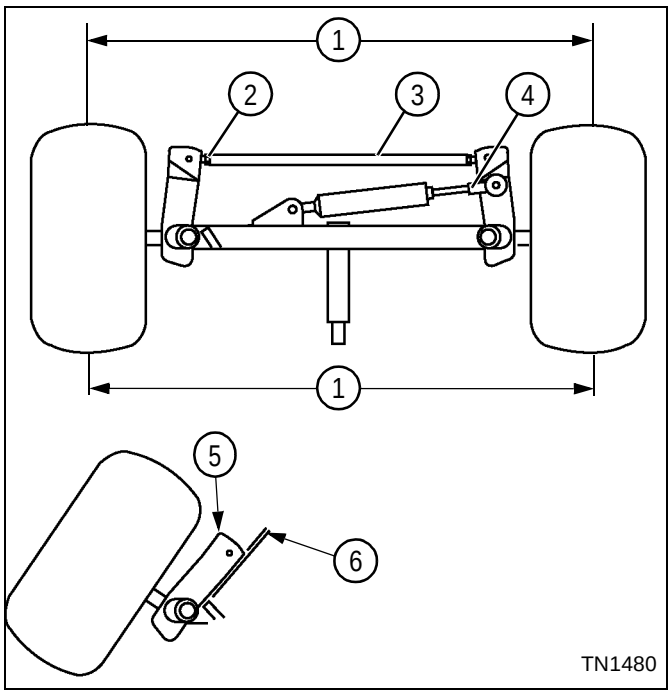


Figure 5-2

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Turn the wheels to the straight-ahead position.
3. Loosen jam nuts (2) on both sides of the tie rod (3).
4. Turn the tie rod (3) to provide proper toe-in (1). Toe-in must not exceed 0.0625 in. (1.6 mm). Retighten jam nuts.
5. After adjusting the tie rod, adjust the steering cylinder by threading the rod (4) in or out of the ball joint so the spindle arm (6) clears the stop on the axle (6) by 0.75 ± 0.0625 in. (19 ± 1.5 mm) when the cylinder is fully extended.

NOTE

Equal angle steering should be checked by driving the unit in a circle in both a hard right and left turn. Measure the diameter of the tire track circles and adjust the steering cylinder rod ball joint (described in step 4) until equal angles are achieved. Tighten the ball joint lock nut when finished.

Steering Relief Valve Pressure Test

See Figures 5-3 and 5-4.

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 0–5000 psi (0–345 bar)
• Test Hose
• Tee Fitting

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove seat and mount plate. (See “Seat and Mount Plate” on page 9-9.)

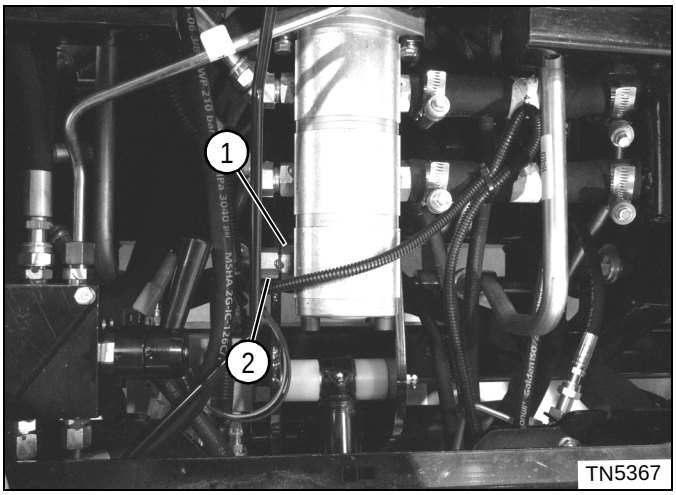


Figure 5-3

3. Disconnect line (2) from port (1).
4. Install tee fitting to port (1).
5. Connect line (2) to tee fitting.



Figure 5-4

6. Connect test hose from tee fitting to 5000 psi (345 bar) test gauge (3).
7. Disconnect and cap both steering cylinder hydraulic hoses.
8. Operate hydraulic system until oil temperature is at 120–150° F (49–65° C).

NOTICE

Do not run mower lift/steer system relief valve over relief longer than 10 seconds, or damage to hydraulic system may occur.

9. Start engine and run at full throttle (2850 ± 50 rpm).
10. Turn steering wheel fully right against stop.
11. Record pressure reading.

    Is lift/steer system relief pressure 1740 psi (120 bar)?

    YES *Lift/steer system relief valve is good. Proceed to step 14.*

    NO *Proceed to next step.*
12. Raise the decks and hold the joystick in the raise position.
13. Record pressure reading.

    Is lift/steer system relief pressure 1740 psi (120 bar) reached?

    YES *Relief valve is good. Replace steering valve. (See "Steering Valve" on page 5-7.)*

    NO *Relief valve is faulty. Repair or replace relief valve.*
14. Stop engine.
15. Disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
16. Check hydraulic oil level. Add oil as needed. (Refer to "Safety, Operation, and Maintenance Manual" for correct oil specifications.)

Steering Leakage Test

See Figure 5-5.

1. Operate hydraulic system until oil temperature is at 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 1-5.)

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.**

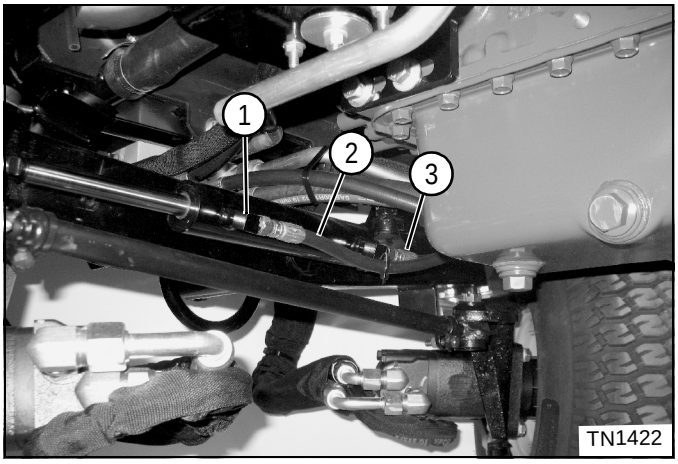


Figure 5-5

4. Disconnect hose (2) from steering cylinder fitting (1). Plug hose.
5. Position a suitable container under steering cylinder fitting (1).

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 *Proceed to step 10.*

   NO *Repair or replace steering cylinder. (See "Steering Cylinder" on page 5-16.)*
8. Disconnect and plug hose (3).
9. Start the engine and set engine speed to full throttle (2850 ± 50 rpm).
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 valve is faulty. Replace steering valve. (See "Steering Valve" on page 5-7.)*

    NO *Steering valve is good. Test complete.*

Repair

Steering Wheel

Removal and Installation

See Figure 5-6.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)

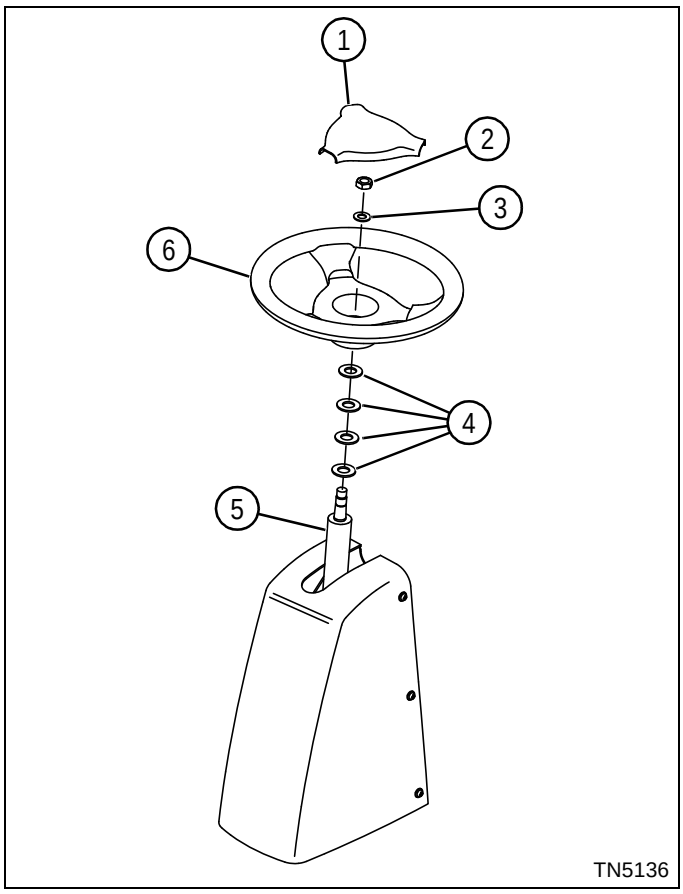


Figure 5-6

2. Remove (unsnap) the cap (1) from the steering wheel (6).
3. Remove nut (2) and lock washer (3).
4. Remove the steering wheel (6) and four washers (4) from the steering column (5).

Installation Notes

- Install steering wheel by reversing the order of removal.
- Tighten the steering wheel nut (2) to 25–30 lb-ft (34–41 N·m).

Steering Valve

Removal and Installation

See Figures 5-7 through 5-12.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove the steering wheel. (See “Steering Wheel” on page 5-7.)

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 and sealable container.

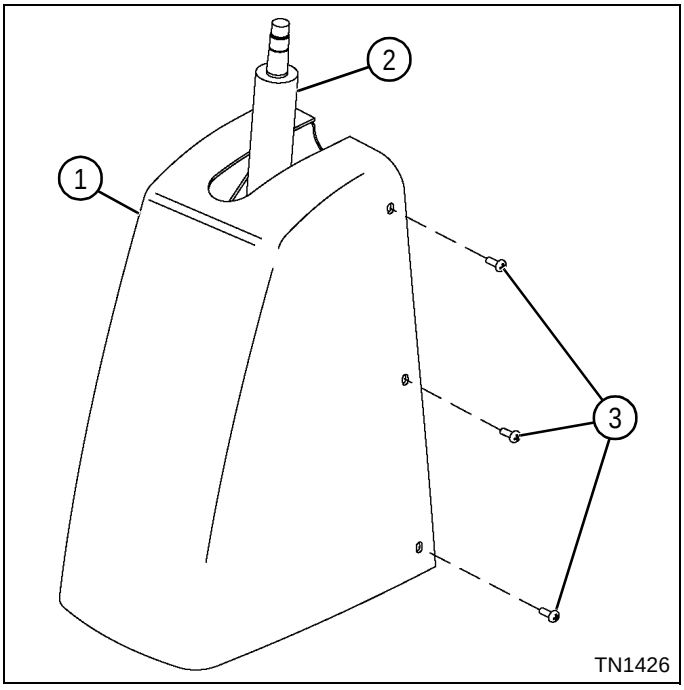


Figure 5-7

3. Remove six (three each side) screws (3).
4. Remove cover (1) from the steering column (2).
5. Using the steering tilt control, tilt the steering column toward the back of the mower. (Refer to “Safety, Operation, and Maintenance Manual.)



Figure 5-8

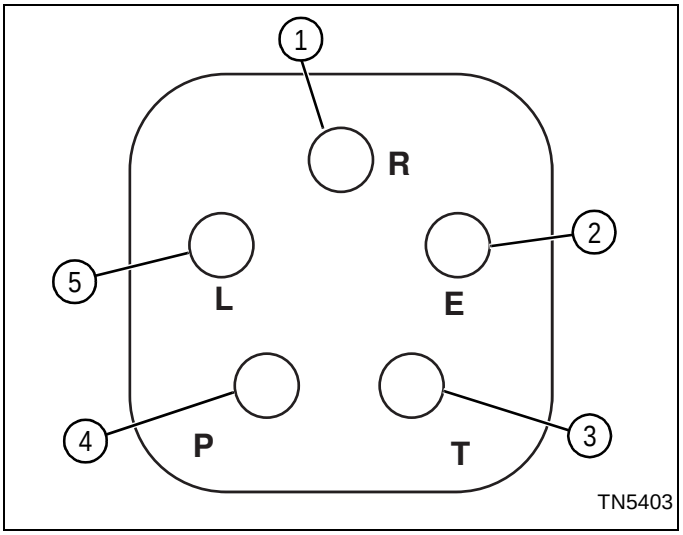


Figure 5-9

NOTES

- *Label all hydraulic hoses and record their locations to ensure correct installation.*
- *Plug hydraulic hoses after disconnecting to prevent loss of hydraulic oil.*

6. Disconnect hydraulic hose (1) from steering valve port R.
7. Disconnect hydraulic hose (2) from steering valve port E.
8. Disconnect hydraulic hose (3) from steering valve port T.
9. Disconnect hydraulic hose (4) from steering valve port P.
10. Disconnect hydraulic hose (5) from steering valve port L.
11. Using the tilt lever, tilt the steering column forward.

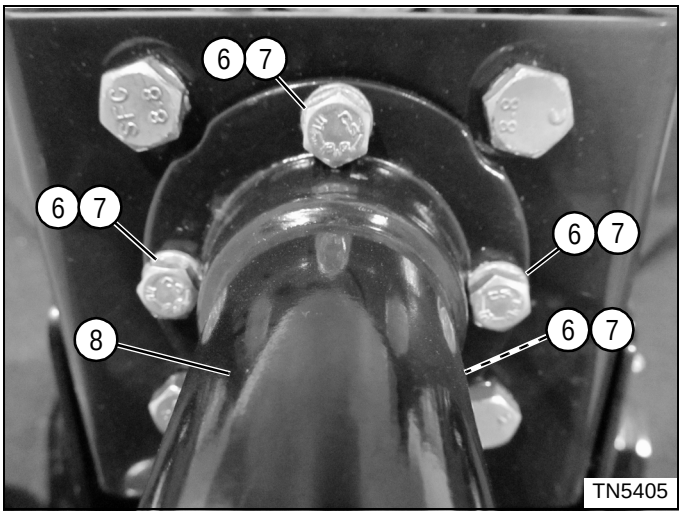


Figure 5-10

12. Remove four screws (6) and lock washers (7).

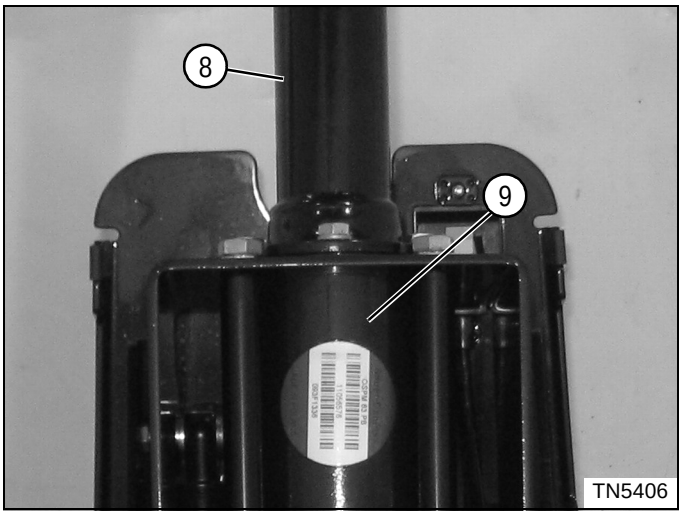


Figure 5-11

13. Remove steering column (8) from steering unit (9).
14. Support the steering unit (9).

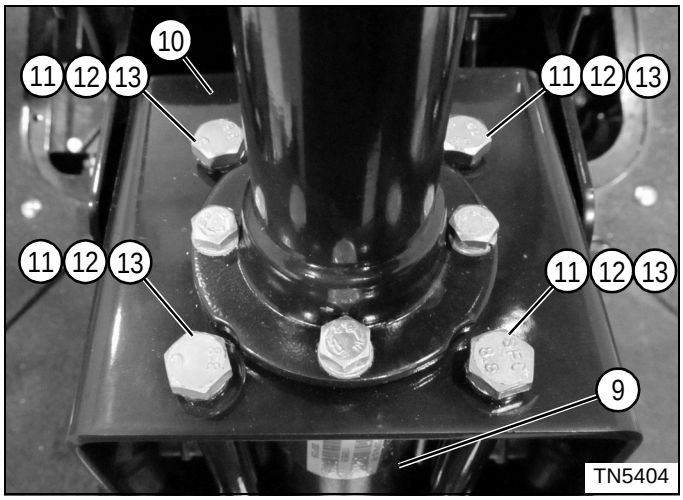


Figure 5-12

15. Remove four screws (11), lock washers (12), and spacers (13), and remove steering unit (9).
16. Remove steering valve (9) from bracket (10).

Installation Notes

- *Install steering valve by reversing the order of removal.*
- *Check hydraulic oil level. Add oil as needed.*
- *Start the machine and check for hydraulic leaks and cylinder operation. Repair as necessary.*

Steering Valve Service Fixture

See Figures 5-13 and 5-14.

Required Tools or Equipment
Steering Valve Service Fixture

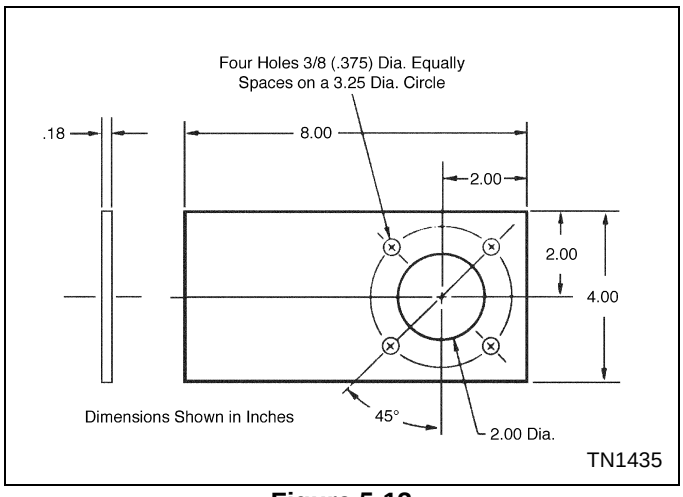


Figure 5-13

NOTICE

Do not clamp the steering valve assembly directly into a vise. Clamping the steering valve directly into a vise may damage or distort the steering valve.

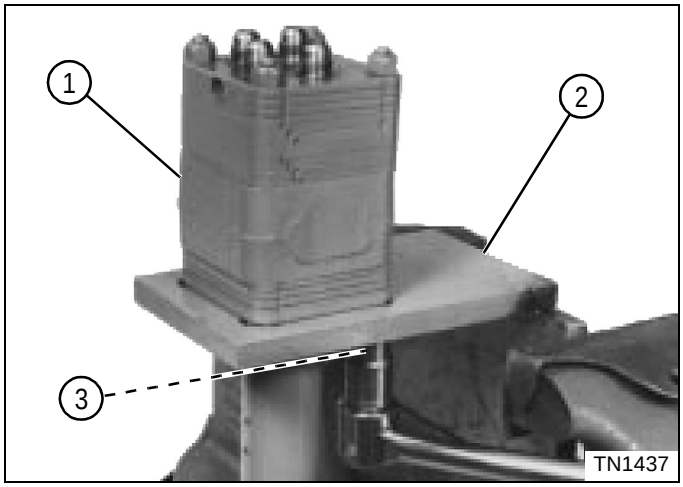


Figure 5-14

1. Place the steering valve service fixture (2) securely in a vise.
2. Place the steering valve (1) into the service fixture (2), input shaft down.
3. Secure the steering valve to the service fixture using four nuts (3).

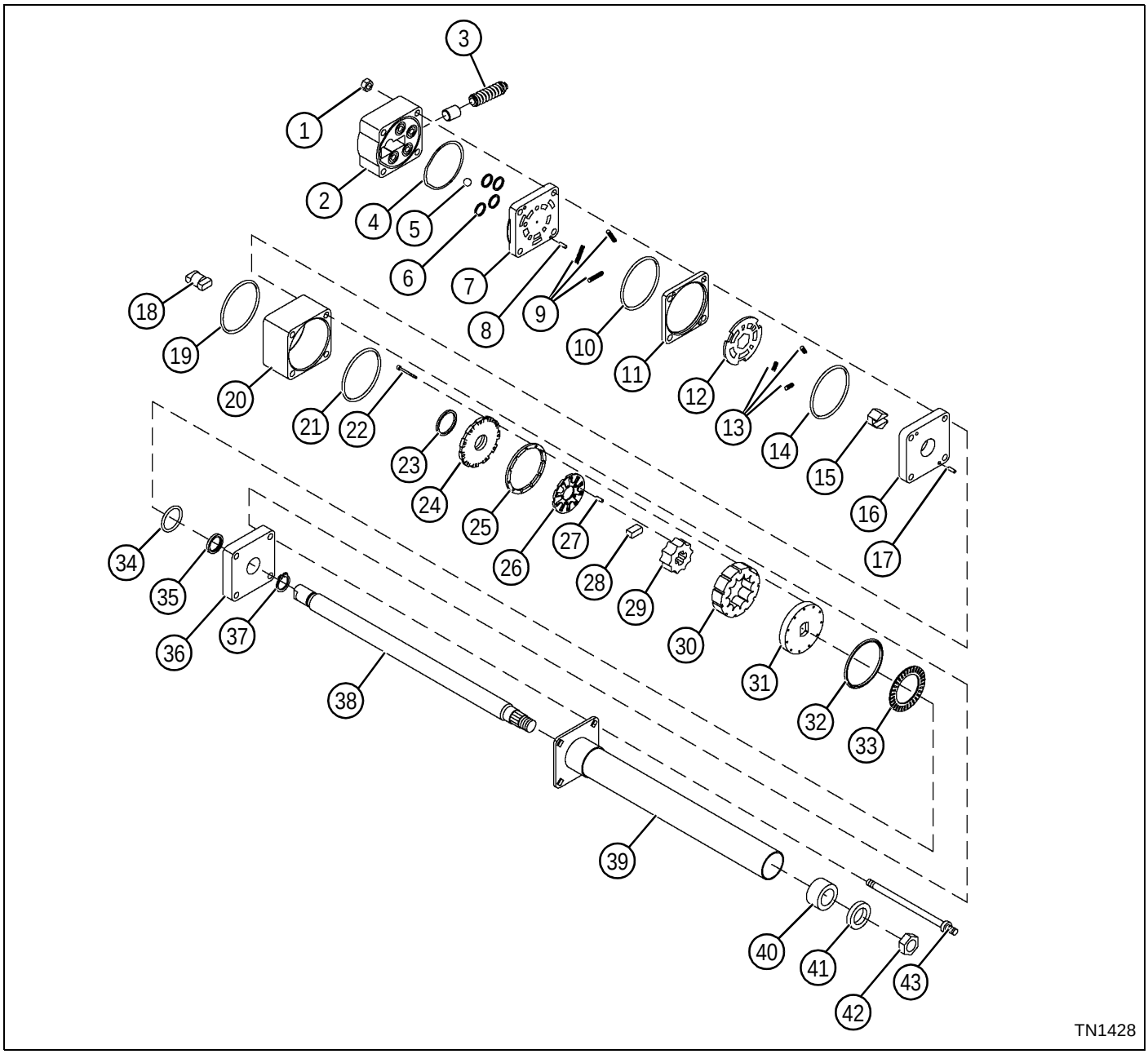
IMPORTANT

Scribe a line from the top to the bottom of the steering valve assembly, not including the steering tube. Use the scribed line for reference when assembling valve sections.

5

Disassembly

See Figure 5-15.



1	Nut (4)	12	Valve Plate (Matched Set)	23	Commutator Seal	34	Face Seal
2	Port Cover	13	Spring	24	Commutator Cover	35	Seal Spacer
3	Relief Valve Assembly	14	Seal Ring	25	Commutator Ring	36	Upper Cover Plate
4	Seal Ring	15	Hex Drive Assembly	26	Commutator	37	Retaining Ring
5	Ball, 9/32 inch	16	Isolation Manifold	27	Alignment Pin (5)	38	Steering Shaft
6	O-Ring (4)	17	Alignment Pin	28	Drive Link Spacer	39	Steering Tube
7	Port Manifold	18	Drive Link	29	Rotor	40	Bearing
8	Alignment Pin	19	Seal Ring	30	Stator	41	Seal
9	Spring (3)	20	Metering Ring	31	Drive Plate	42	Shaft Nut
10	Seal Ring	21	Seal Ring	32	Spacer	43	Special Bolt (4)
11	Valve Ring (Matched Set)	22	Socket Head Cap Screw (11)	33	Thrust Bearing		

Figure 5-15

CAUTION

Wear eye protection when assembling and disassembling the steering valve. Springs and other objects may be propelled into the air, causing eye injury.

NOTE

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 repaired hydraulic components.

1. Remove nuts (1) and port cover (2).
2. Remove relief valve (3) from the port cover (2).
3. Carefully remove the port manifold (7). Be prepared to catch the three springs (9). Remove the springs.
4. Remove valve ring (11), valve plate springs (13), and valve plate (12).
5. Remove hex drive (15) and isolation manifold (16).

NOTE

Secure the alignments pins (17) to prevent loss.

6. Remove drive link (18) and metering ring (20).
7. Remove metering package (24–31) and commutator seal (23). The metering package is serviced as an assembly kit.

The metering package should be disassembled for inspection purposes only. Proceed to step 8 for disassembly and inspection procedures. If you are not disassembling the metering package, proceed to step 11.

8. Remove socket head cap screws (22), commutator cover (24), commutator ring (25), and commutator (26).
9. Remove five alignment pins (27).
10. Remove drive link spacer (28), rotor (29), and stator (30) from drive plate (31).
11. Remove face seal (34) and seal spacer (35).
12. Remove thrust bearing (33) and spacer (32).
13. Remove upper cover plate (36) and retaining ring (37).
14. Remove four special bolts (43).
15. Remove steering shaft (38) from tube (39).
16. Remove bearing (40) and seal (41).

Inspection

See Figure 5-16.

IMPORTANT

Always replace springs as a set.

1. Inspect springs (9 and 13) for bent, broken, or distorted coils.
2. Inspect the finished ground surfaces of all the components.
3. Inspect the slot edges and surface for nicks, scoring, and rounding edges.

NOTE

The valve ring (11) and valve plate (12) are a matched set and are not serviceable.

4. Inspect the hex drive (15) for wear.
5. Inspect the isolation manifold (16) for nicks, scratches, and scoring. A polished wear pattern due to valve plate rotation is normal.
6. Inspect the drive link (18) for wear and damage.
7. Inspect the thrust bearing (33) for dents, spalling, and missing rollers.
8. Discard all seals and seal rings.
9. Inspect the commutator cover (24) and drive plate (31) for wear and damage. A polished wear pattern is normal.

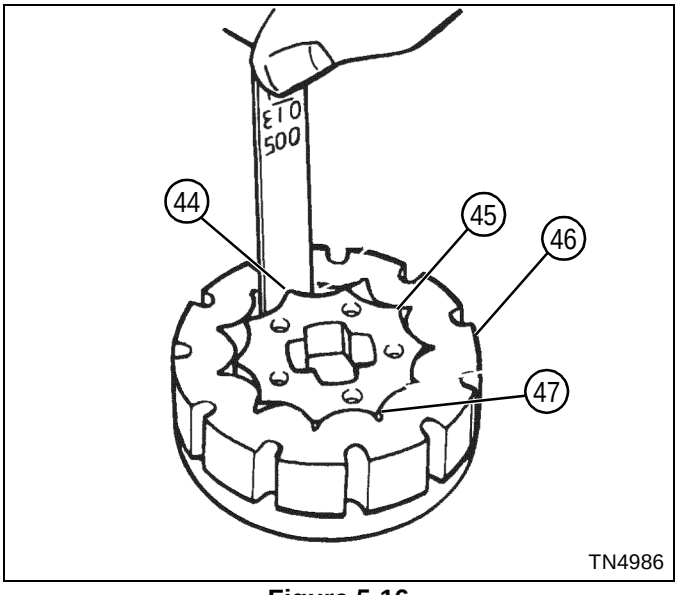
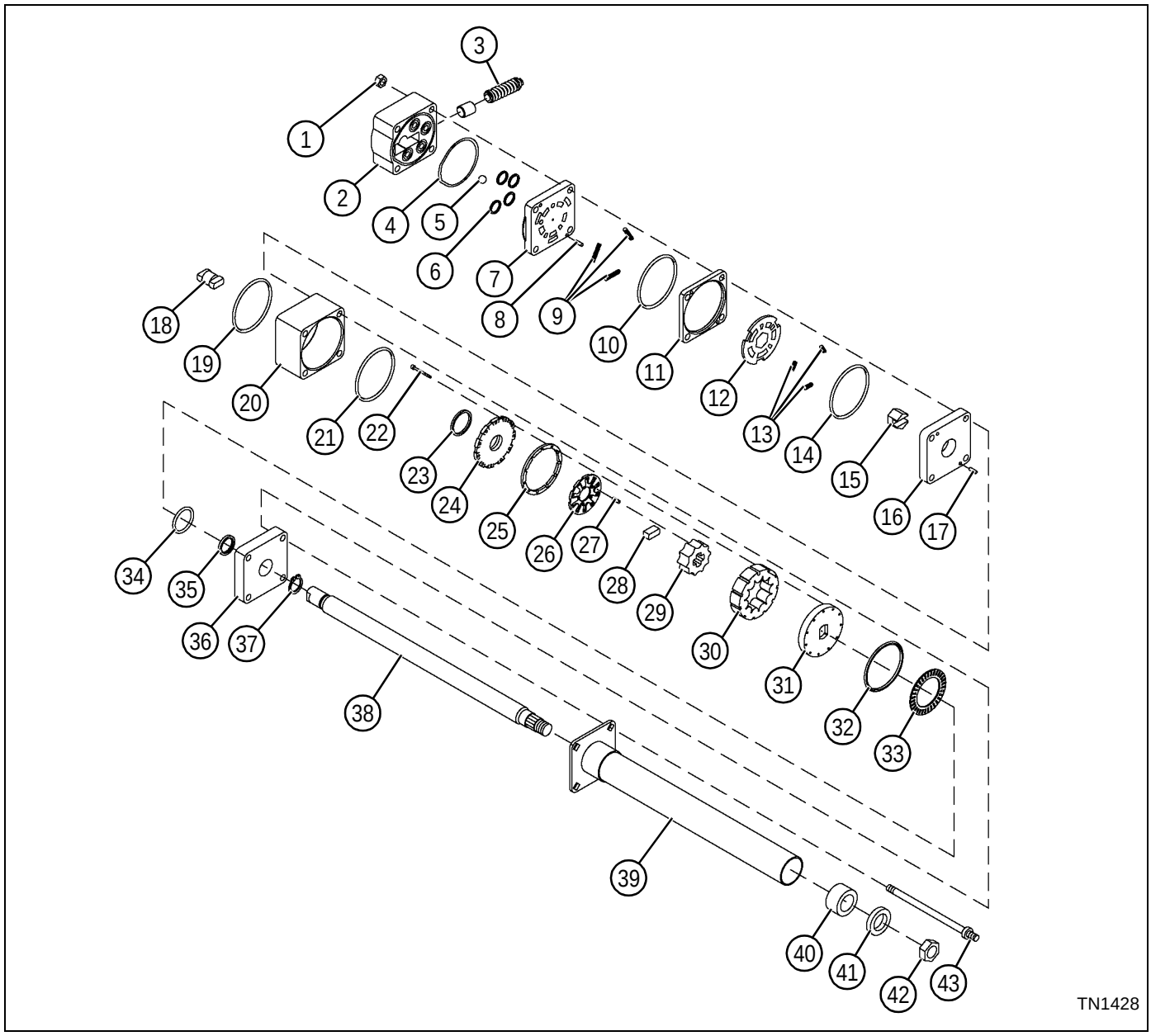


Figure 5-16

10. Inspect the rotor (45) and stator (46) for wear and damage.
11. Install rotor in stator and center the rotor lobe (47) across from a lobe to be measured (44). Measure rotor (45) and stator (46) for maximum tip clearance of 0.003 in. (0.08 mm).

Assembly

See Figures 5-17 through 5-20.



1	Nut	12	Valve Plate (Matched Set)	23	Commutator Seal	34	Face Seal
2	Port Cover	13	Spring (3)	24	Commutator Cover	35	Seal Spacer
3	Relief Valve Assembly	14	Seal Ring	25	Commutator Ring	36	Upper Cover Plate
4	Seal Ring	15	Hex Drive Assembly	26	Commutator	37	Retaining Ring
5	Ball, 9/32 inch	16	Isolation Manifold	27	Alignment Pin (5)	38	Steering Shaft
6	O-Ring (4)	17	Alignment Pin	28	Drive Link Spacer	39	Steering Tube
7	Port Manifold	18	Drive Link	29	Rotor	40	Bearing
8	Alignment Pin	19	Seal Ring	30	Stator	41	Seal
9	Spring (3)	20	Metering Ring	31	Drive Plate	42	Shaft Nut
10	Seal Ring	21	Seal Ring	32	Spacer	43	Special Bolt
11	Valve Ring (Matched Set)	22	Socket Head Cap Screw (11)	33	Thrust Bearing		

Figure 5-17

Service Part Kits
Seal Kit (Jacobsen PN 4197940) Metering Assembly Kit (Jacobsen PN 5003220) Spring Kit (Jacobsen PN 502924) Jacket Tube Kit (Jacobsen PN 5003219) Needle Roller Kit (Jacobsen PN 502925)

NOTE

In the following assembly steps, it is important to align the components for proper operation of the steering valve. Use the scribed line for reference when assembling the valve sections.

1. Install a new bearing (40) and seal (41) in the steering tube (39). Crimp the tube end in two places, 90° apart.
2. Place the steering tube (39) and special bolts (43) in the service fixture.
3. Install the retaining ring (37) on the steering shaft (38) and install into steering tube (39).
4. Install upper cover plate (36).
5. Assemble the seal spacer (35) and face seal (34).
6. Grease the upper cover plate (36) and install the assembled seal, backup ring, and seal spacer.

NOTE

If the metering package was disassembled, proceed to step 7. If the metering package was not disassembled or a new one is being installed, proceed to step 19.

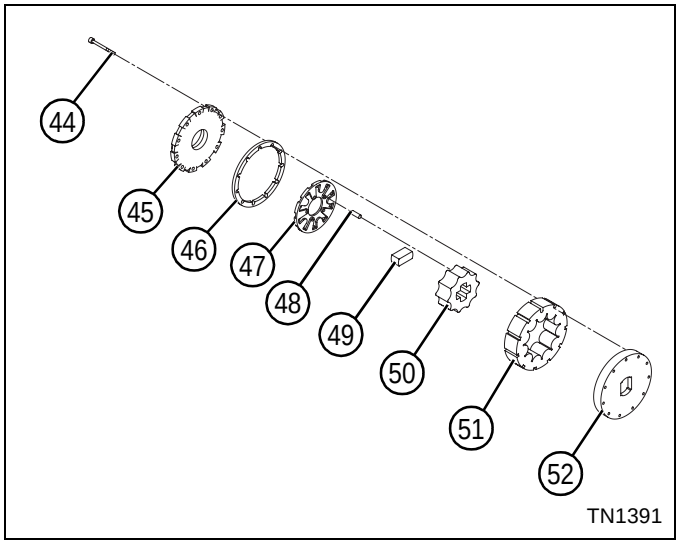


Figure 5-18

7. Place the drive plate (52) on a flat, lint-free surface.
8. Place the stator (51) on the drive plate (52) and insert the rotor (50) into the stator.
9. Apply a small amount of grease to the drive link spacer (49) and install in the rotor (50).
10. Place the commutator (47) on top of the rotor (50) with the aligning pin holes facing up. Place a few drops of oil in each recess of the commutator (47).

NOTE

Make sure the pins (48) are pressed below the surface of the commutator (47).

11. Align the five pin holes in the commutator (47) with the holes in the rotor (50) and install five pins (48).
12. Install commutator ring (46) and commutator cover (45), flat surface down with ring screw recesses, stator screw slots, and cover screw holes aligned. Install 11 socket-head cap screws (44).
13. Place the metering ring (20) on a hard, flat surface.
14. Place the assembled metering package in the center of the metering ring (20) with the commutator cover down.
15. Place a piece of 0.007-in. (0.18 mm) shim stock, 0.5 in. (13 mm) wide by 1.5 in. (38 mm) long, in three places, an equal distance apart, between the metering ring and metering package.

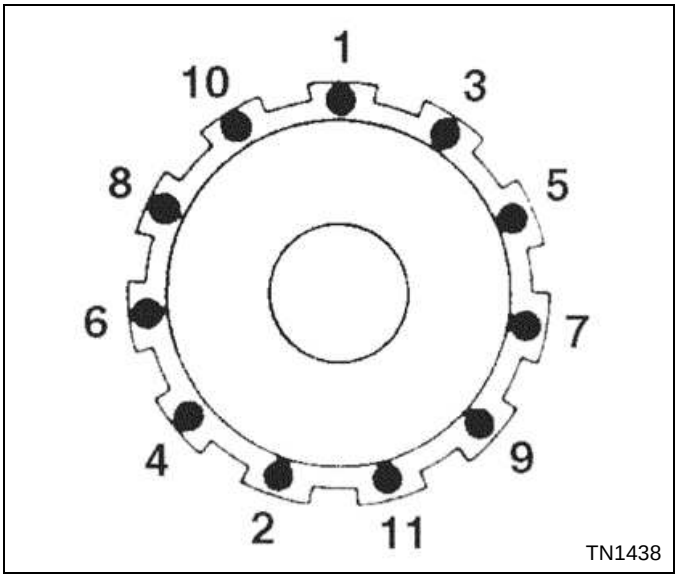


Figure 5-19: Metering Package Tightening Sequence

16. Tighten cap screws (44) twice, in the sequence shown to 11–13 lb-in. (1.2–1.5 N·m).
17. Remove the metering package and shims. Place the drive link (18) large tang into the rotor. Turn the metering package by hand to make sure there is no binding.

NOTE

The metering package should rotate inside the stator. If binding occurs, disassemble the metering package, correct the cause, and repeat the assembly process.

18. Place the metering ring (20) on top of the upper cover plate (36) with the alignment pin holes up.
19. Lubricate and install the thrust bearing spacer (32) and thrust bearing (33) into the metering ring (20).
20. Place the metering package into the metering ring (20), engaging the drive slot with the steering shaft.
21. Install commutator seal (23), seal ring (21), and drive link (18).
22. Place the isolation manifold (16) on the metering ring (20) with the alignment pin holes up. Install alignment pins (27) into the metering ring (20).
23. Install alignment pins (17) into the isolation manifold (16).
24. Install three springs (13) into the isolation manifold (16) and install valve ring (11).
25. Install valve plate (12) (closed cylinder up) in the valve ring (11), aligning the spring slots with the springs. Install seal ring (10).
26. Place three springs (9) in the port manifold (7).
27. Carefully place the port manifold (7), springs down, onto the valve ring (11).
28. Install four O-rings (6) and seal ring (4) on the port cover (2).
29. Install relief valve (3) in the port cover (2).
30. Install port manifold (7).

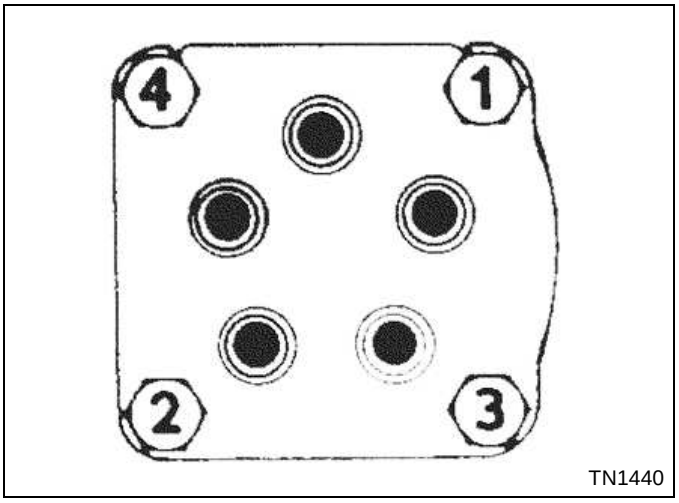


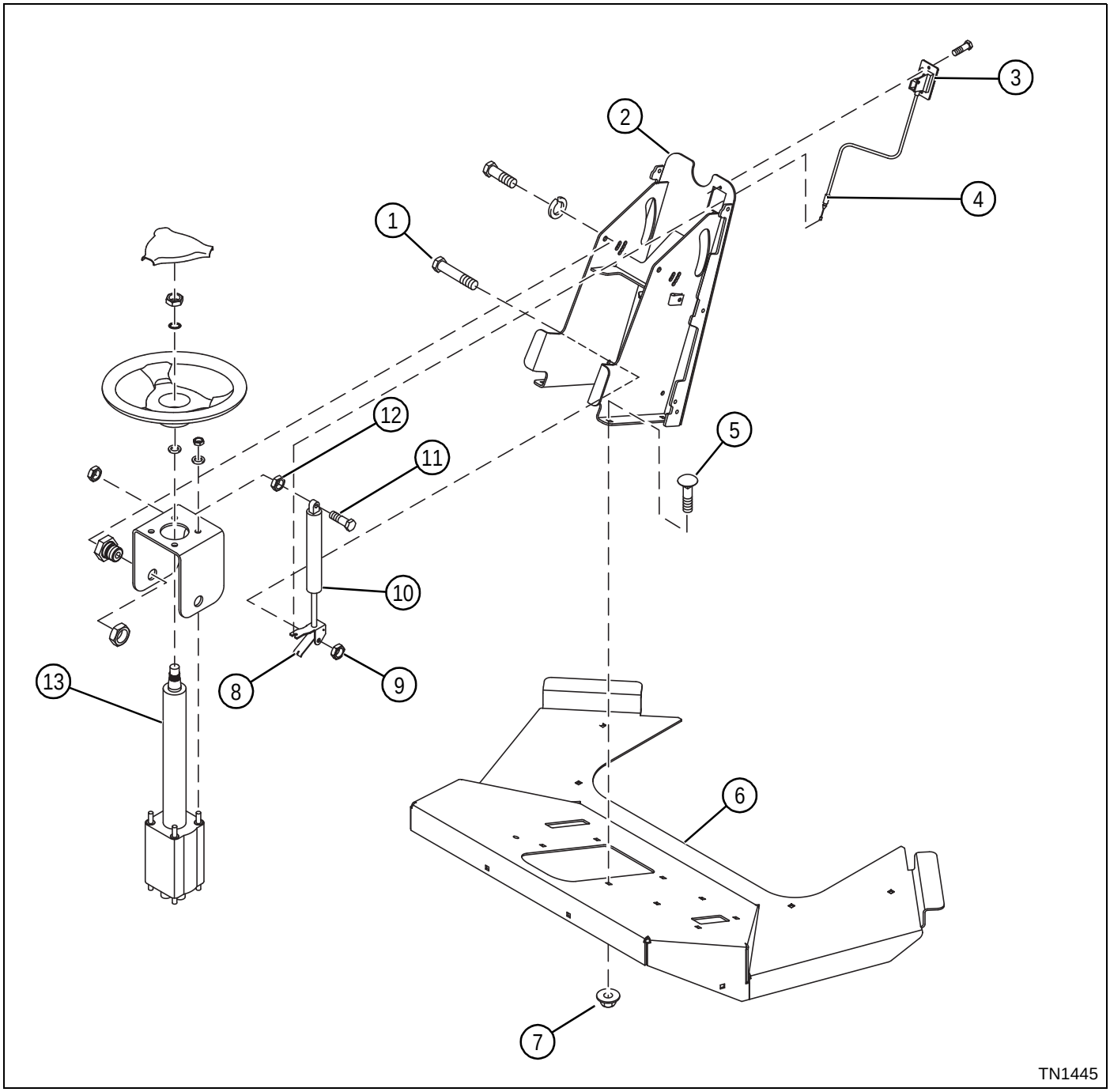
Figure 5-20

31. Install nuts (1). Tighten the nuts gradually, in the sequence shown to 20–24 lb-ft (27–33 N·m).

Steering Tower

Removal and Installation

See Figure 5-21.



1	Hex Bolt	5	Bolt	9	Lock Nut	13	Steering Column
2	Steering Tower	6	Platform	10	Tilt Gas Spring		
3	Steering Tilt Control	7	Flanged Lock Nut (4)	11	Hex Bolt		
4	Tilt Cable	8	Tilt Spring Release Bracket	12	Lock Nut		

Figure 5-21

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove steering valve. (See “Steering Valve” on page 5-7.)
3. Using the steering tilt control (3), tilt the steering column (13) toward the rear of the mower.
4. Remove tilt cable (4) from tilt spring release bracket (8).

CAUTION

Tilt column gas actuator spring is under high pressure; do not attempt to open for service.

5. Remove lock nuts (12), upper and lower hex bolts (1 and 11), and remove tilt gas spring (10).
6. Remove four flanged lock nuts (7), and lift steering tower (2) from platform (6).

Installation Note

Install the steering tower by reversing the order of removal.

Steering Cylinder

Removal and Installation

See Figures 5-22 through 5-24.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Thoroughly clean the area surrounding the steering cylinder, especially the hydraulic hose fittings.

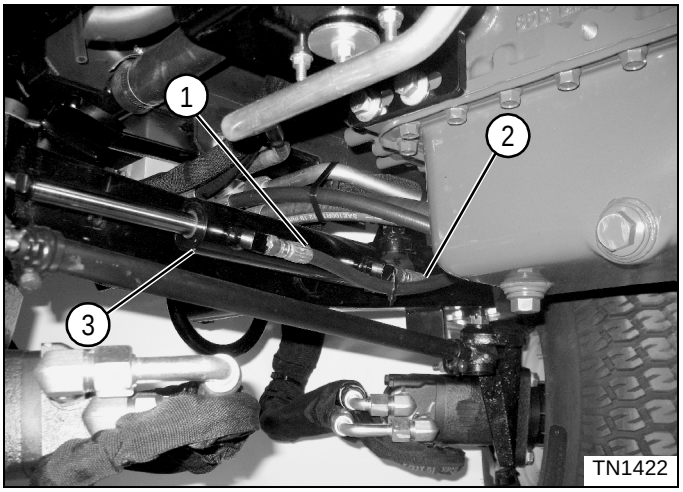


Figure 5-22

NOTES

- *Label all hydraulic hoses and record their locations to ensure correct installation.*
- *Plug hydraulic hoses after disconnecting to prevent loss of hydraulic oil.*

3. Disconnect hydraulic hoses (1 and 2) from steering cylinder (3).

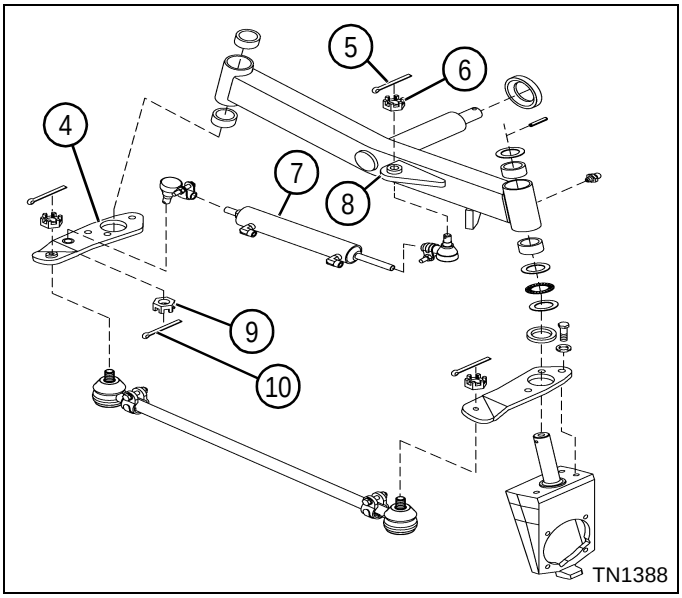


Figure 5-23

4. Support the steering cylinder (7).
5. Remove cotter pins (5 and 10) and castle nuts (6 and 9) from both ends of the steering cylinder (7).
6. Using a ball joint removal tool, remove ball joint from the steering arm. Remove steering cylinder (7) from the steering arm (4) and rear axle (8).

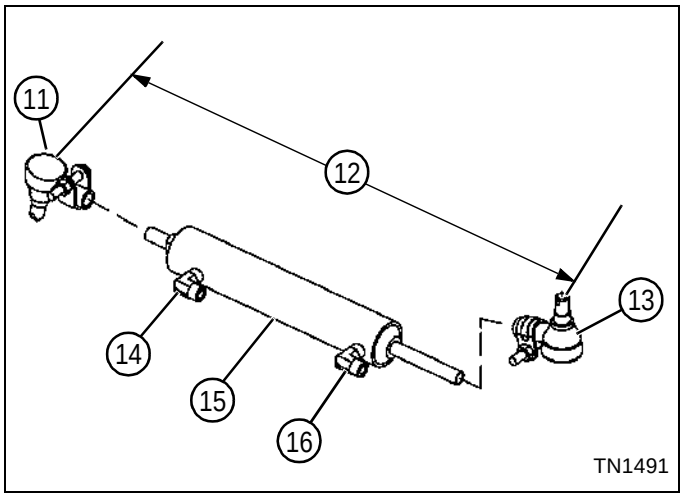


Figure 5-24

NOTES

- *Record the location and orientation of fittings (14 and 16) before removing to ensure correct installation.*
- *Record the orientation of the ball joints before removing to ensure correct installation.*
- *Record the number of turns required to remove each ball joint.*

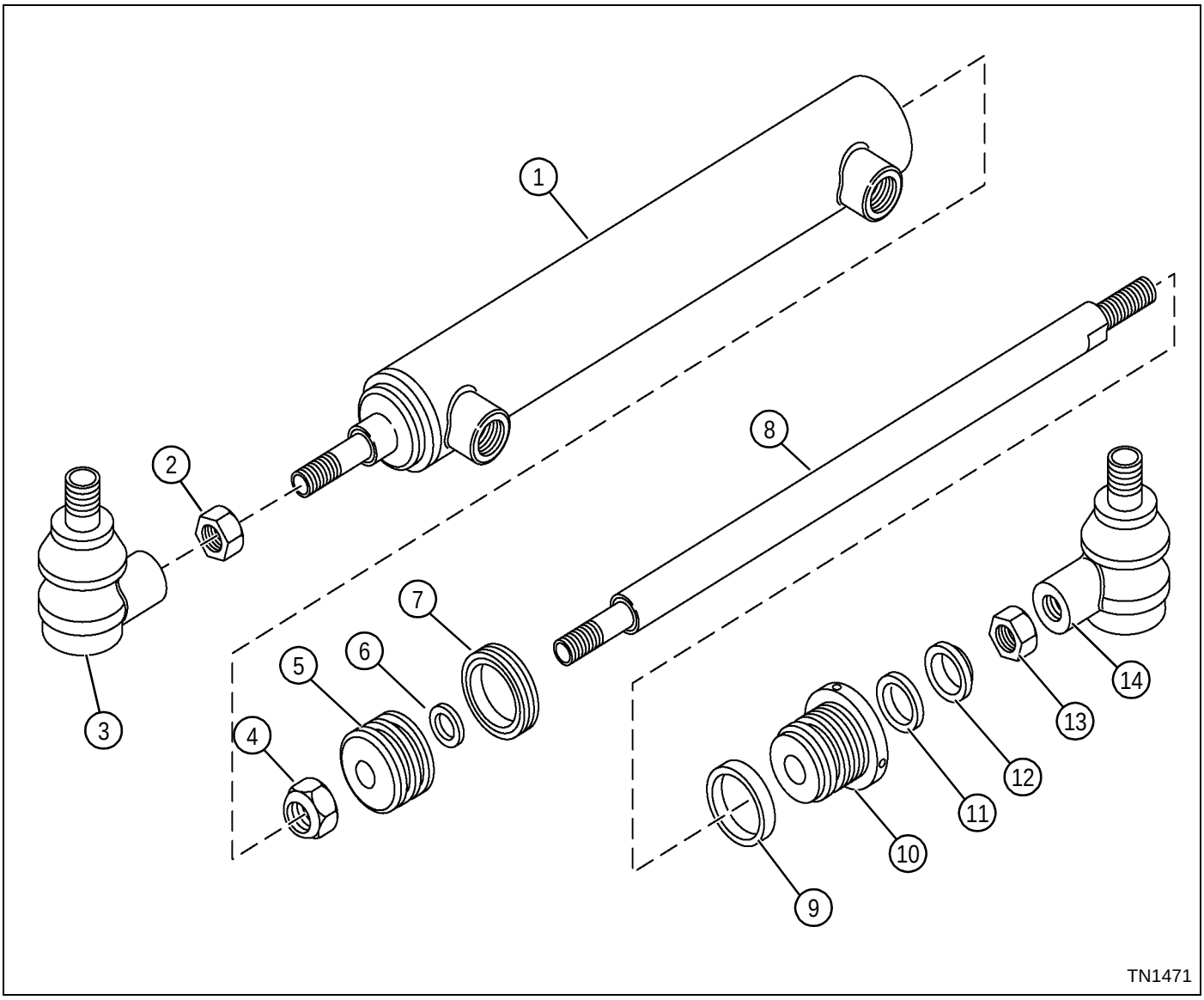
7. Remove fittings (14 and 16) from steering cylinder (15).
8. Record ball joint center-to-center distance.
9. Remove the ball joints (11 and 13) from the steering cylinder (15).
10. Inspect ball joints (11 and 13). Replace as needed.

Installation Notes

- *Install steering cylinder by reversing the order of removal.*
- *Tighten castle nuts (6 and 9) to 80–110 lb-ft (108–149 N·m). Adjust nuts as needed to align the slots with the hole in the rod ends.*
- *Install new cotter pins (5 and 10).*
- *Check hydraulic oil level. Add oil as needed.*
- *Start the machine and check for hydraulic leaks and cylinder operation. Repair as necessary.*
- *Check steering toe-in adjustment. (See “Tie Rod Adjustment” on page 5-4.)*

Disassembly, Inspection, and Assembly

See Figure 5-25.



1	Barrel	5	Pistion	9	Seal Ring	13	Nut
2	Nut	6	O-Ring	10	Rod Guide	14	Right Ball Joint
3	Left Ball Joint	7	Piston Ring	11	O-Ring		
4	Nut	8	Rod	12	Rod Wiper		

Figure 5-25

1. Use a spanner wrench to remove rod guide (10) from barrel (1).
2. Pull rod assembly (8) out of barrel (1).
3. Remove ball joint (14) and nut (13) from rod (8).
4. Remove nut (4), piston (5), O-ring (6), and piston ring (7) from rod.

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.

5. Clean all parts using clean solvent, and dry using compressed air.
6. Inspect all parts for excessive wear, cracks, broken parts, and damaged threads.
7. Inspect the inside of the barrel for dents, score lines, or grooves.
8. Inspect the fittings for wear and damage.

Assembly Notes

Required Materials
Seal Kit (Jacobsen PN 4137139)

- *Assemble the steering cylinder by reversing the order of disassembly.*
- *Lubricate all parts with clean hydraulic oil before assembly.*
- *Always install new seals and O-rings for assembly; used parts may leak.*

Tie Rod Assembly

Removal and Installation

See Figure 5-26.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)

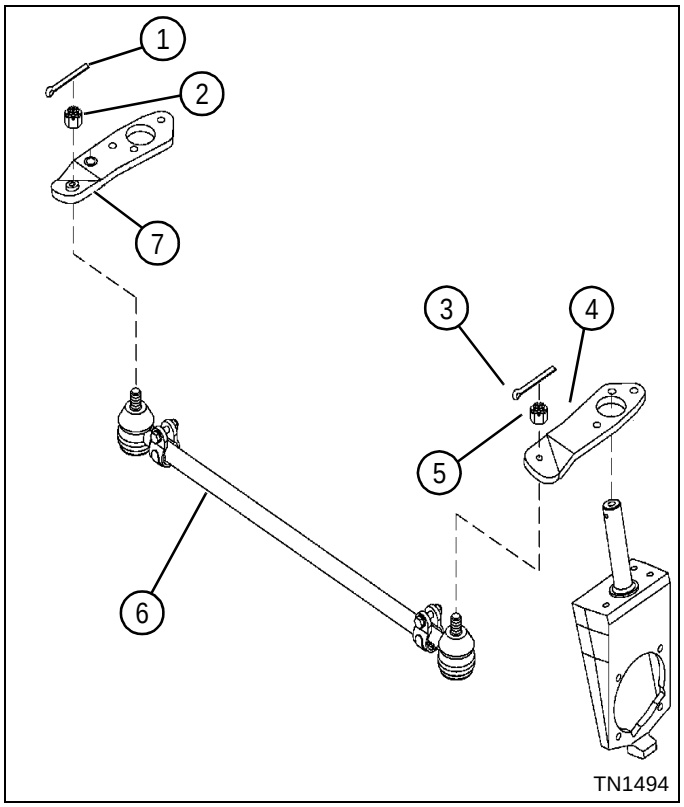


Figure 5-26

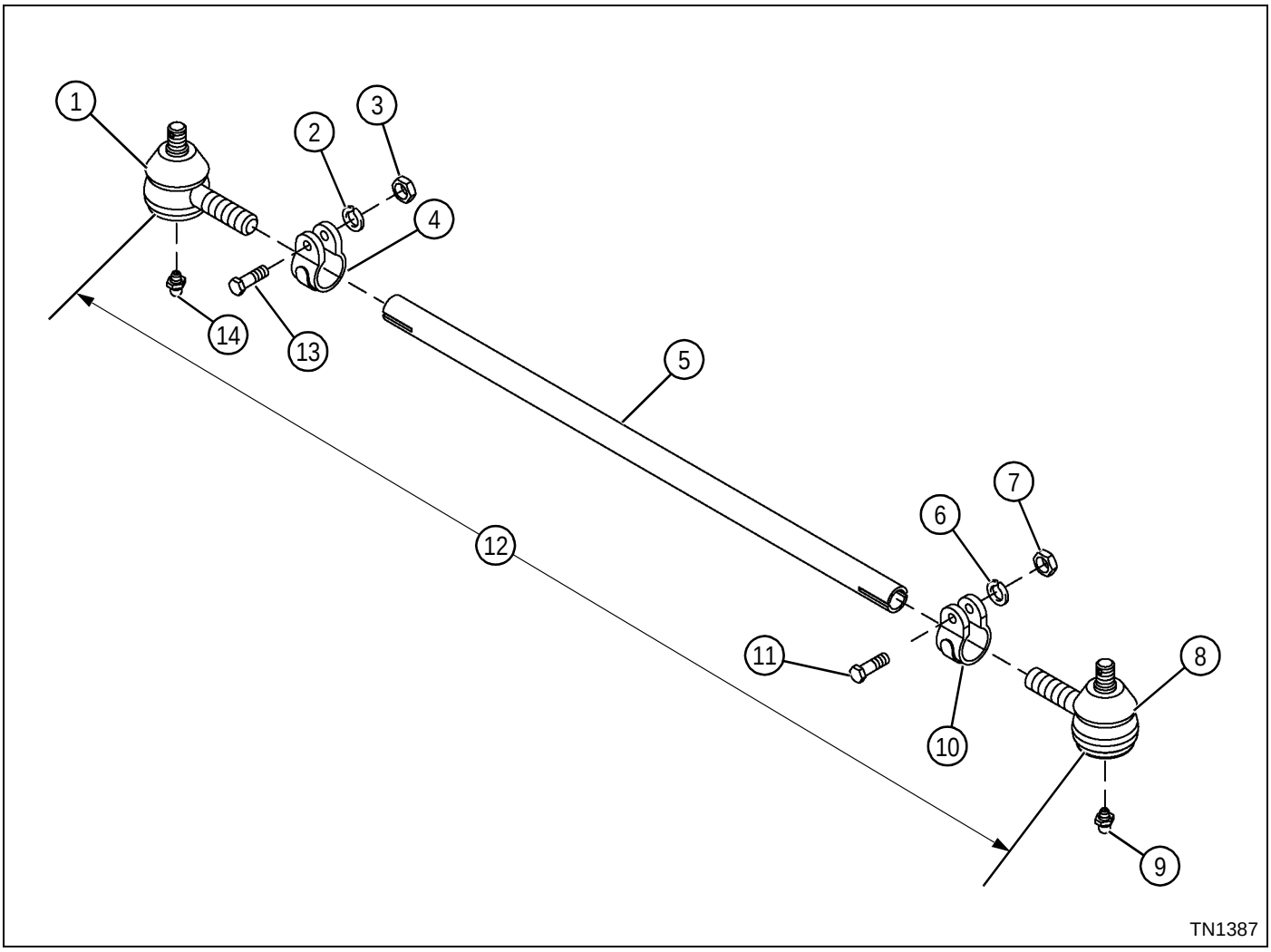
2. Support the tie rod assembly (6).
3. Remove cotter pins (1 and 3) and castle nuts (5 and 7) from both steering arms (2 and 4), and remove the tie rod assembly (6).

Installation Notes

- *Install the tie rod by reversing the order of removal.*
- *Tighten castle nuts (5 and 7) to 60 ± 5 lb-ft (81 ± 7 N·m). Adjust nuts as needed to align the slots with the hole in the tie rod ends.*
- *Always install new cotter pins (1 and 3).*
- *Adjust tie rod. (See “Tie Rod Adjustment” on page 5-4.)*

Disassembly, Inspection, and Assembly

See Figure 5-27.



1	Threaded Ball Joint Right	5	Tie Rod	9	Grease Fitting	13	Hex Head Bolt
2	Lock Washer	6	Lock Washer	10	Tie Rod Clamp	14	Grease Fitting
3	Nut	7	Nut	11	Hex Head Bolt		
4	Tie Rod Clamp	8	Threaded Ball Joint Left	12	Ball Joint Measurement		

Figure 5-27

Disassembly Notes

- *Before disassembling the tie rod assembly, measure and record the ball joint stud center-to-center distance (13).*
- *Record the number of turns required to remove ball joints from tie rod.*

Assembly Notes

- *Assemble the tie rod assembly by reversing the order of disassembly.*
- *Using information recorded during disassembly, install ball joints into tie rod with the correct number of turns.*
- *Verify the ball joint stud center-to-center distance; correct as needed.*

Rear Axle

Removal and Installation

See Figures 5-28 and 5-29.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove rear wheel motors. (See “Rear Wheel Motor” on page 5-60.)

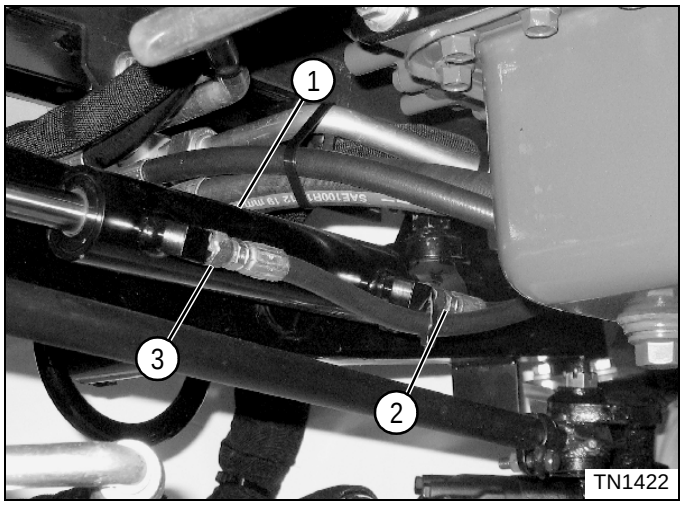


Figure 5-28

NOTE

- *Label all hydraulic hoses and record their locations to ensure correct installation.*
- *Plug hydraulic hoses after disconnecting to prevent loss of hydraulic oil.*

3. Disconnect hydraulic hoses (2 and 3) from steering cylinder (1).

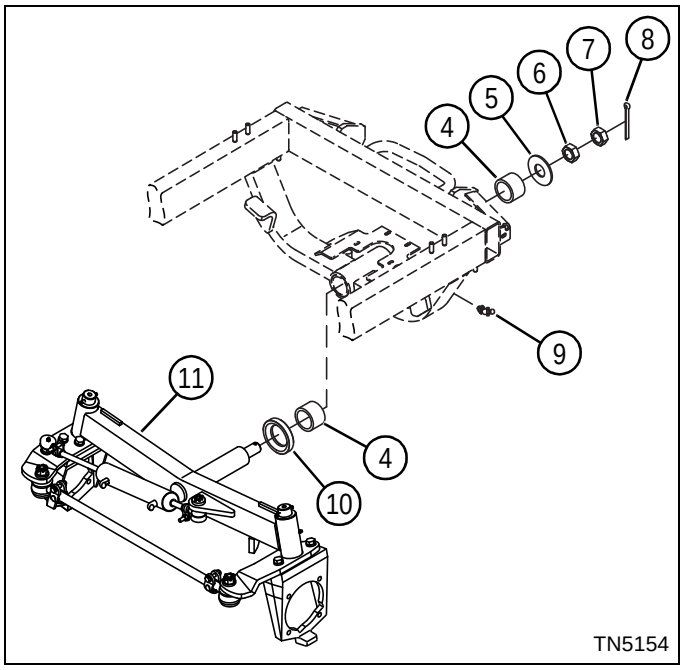


Figure 5-29

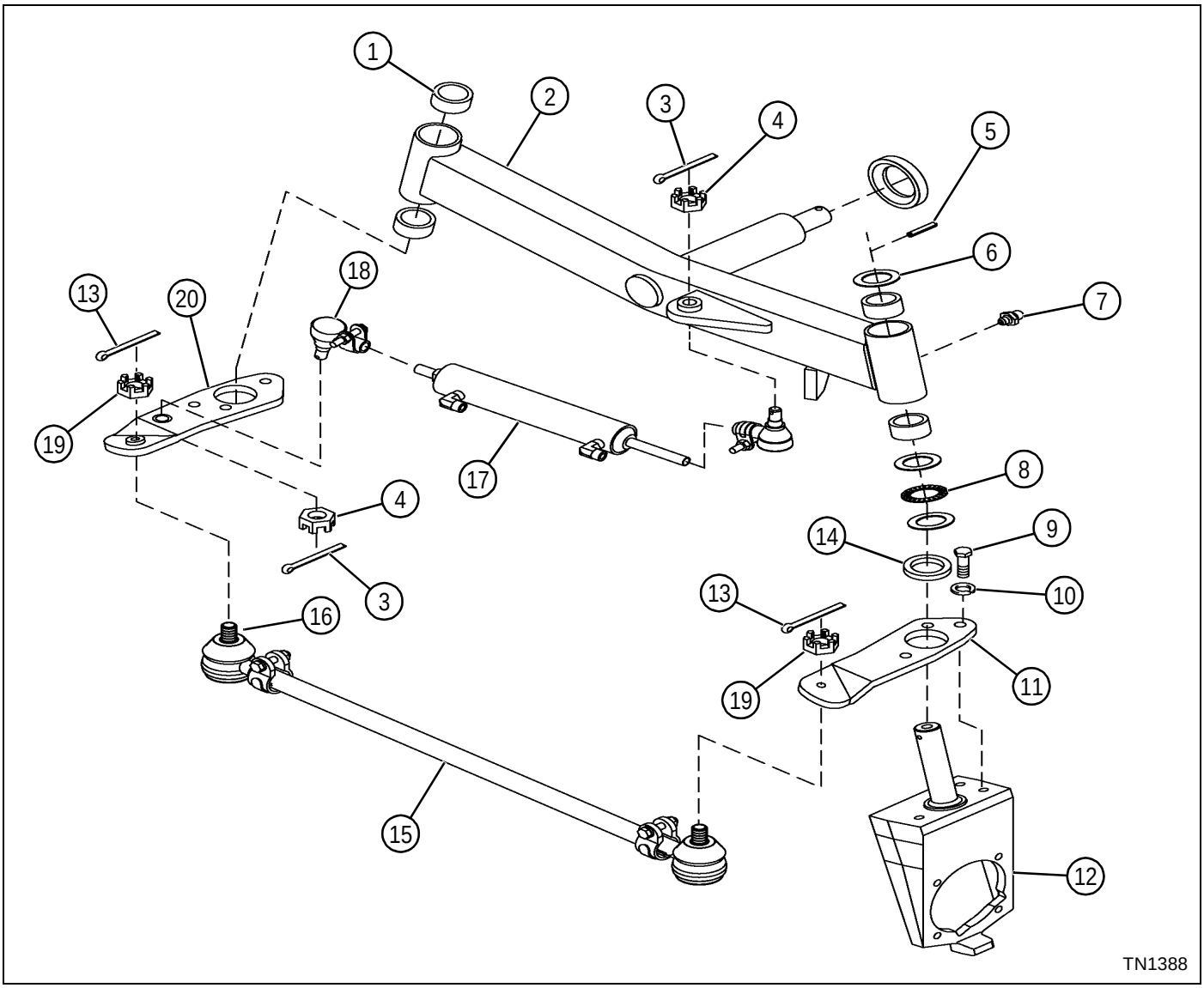
4. Support the rear axle assembly (11) using an appropriate lifting device.
5. Remove cotter pin (8), inner jam nut (6) outer jam nut (7), and flat washer (5), and remove axle assembly (11) and spacer (10) from the mower.
6. Inspect bushings (4); replace bushings if worn or damaged.

Installation Notes

- *Install the rear axle assembly by reversing the order of removal.*
- *Adjust rear axle end play to 0.010–0060 in. (0.25—1.5 mm) by tightening inner jam nut (6). Tighten outer jam nut (7) to 95 ± 20 lb-ft (128 ± 20 N·m).*
- *Always install new cotter pin (8).*
- *Apply grease to grease fitting (9).*
- *Check hydraulic oil level. Add oil as needed.*
- *Start the machine and check for hydraulic leaks and cylinder operation. Repair as necessary.*
- *Check steering toe-in adjustment. (See “Tie Rod Adjustment” on page 5-4.)*

Disassembly, Inspection, and Assembly

See Figure 5-30.



1	Bushing (4)	6	Thrust Washer (6)	11	Left Steering Arm	16	Castle Nut (2)
2	Axle	7	Grease Fitting (2)	12	Motor Mount (2)	17	Steering Cylinder
3	Cotter Pin (2)	8	Thrust Bearing (2)	13	Cotter Pin (2)	18	Ball Joint (2)
4	Castle Nut (2)	9	Hex Bolt (6)	14	Thrust Washer (2)	19	Castle Nut (2)
5	Spring Pin (2)	10	Lock Washer (6)	15	Tie Rod Assembly	20	Right Steering Arm

Figure 5-30

Disassembly Notes

- *Before disassembly, clean and remove all dirt and grass from rear axle assembly.*
- *Inspect all bushings, thrust washers, and bearings for damage or wear.*
- *Inspect steering cylinder for leaks or dents to the barrel and rod.*
- *Inspect all ball joints for wear or torn dust seals.*

Assembly Notes

- *Replace any bushings, bearings, and ball joints that were damaged or had excessive wear.*
- *Replace or repair steering cylinder if dented or leaking.*
- *Tighten tie rod castle nuts (16) to 60 ± 5 lb-ft (81 ± 7 N·m). Adjust nuts as needed to align the slots with the hole in the tie rod ends.*
- *Tighten steering cylinder castle nuts (13) to 80–110 lb-ft (108–149 N·m). Adjust nuts as needed to align the slots with the hole in the rod ends.*
- *Never reuse cotter pins; use new cotter pins of correct size.*
- Apply grease to grease fittings (7).

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Chapter 6

Cutting Units

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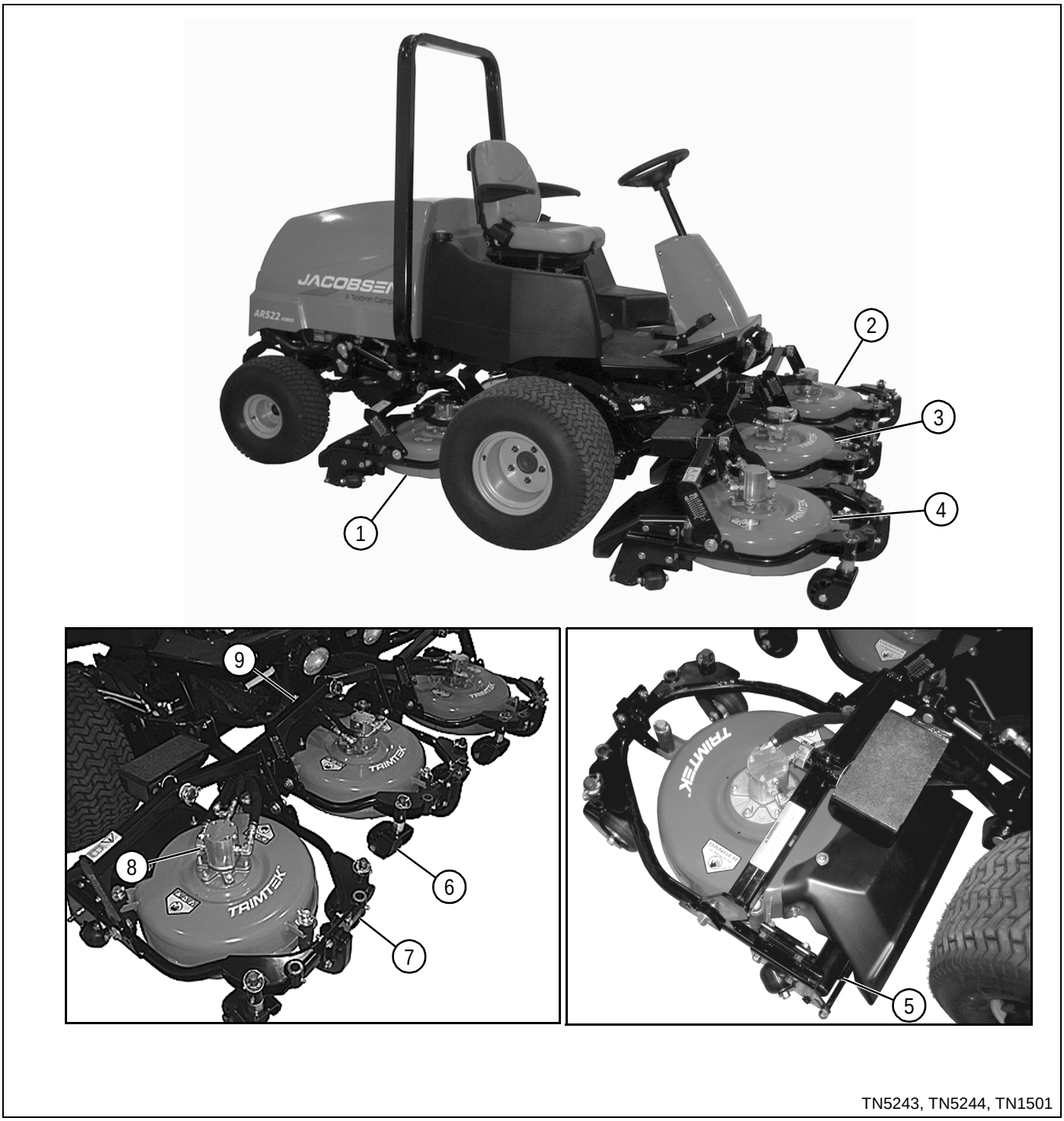
Mower Deck Housing 6-22

6

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Component Location

See Figure 6-1.



TN5243, TN5244, TN1501

1	Right Rear Cutting Unit	4	Right Front Cutting Unit	7	Deck Frame
2	Left Front Cutting Unit	5	Deck Roller	8	Drive Motor
3	Center Cutting Unit	6	Deck Caster Wheel	9	Deck Yoke

Figure 6-1: Component Location

Troubleshooting

Mechanical Troubleshooting

Condition	Probable Cause	Remedy
Drive motors do not reach full speed.	Engine speed is insufficient, not set to specification.	Check/adjust engine speed. (Refer to “Safety, Operation, and Maintenance Manual.”)
	Rotary drive motors and/or hydraulic system performance is reduced.	Check hydraulic system performance (pump output, motor operation, valve operation, relief valve settings, etc.). (See “Instrument Test Procedure” on page 6-27.)
Drive motors do not engage.	PTO switch is not engaged.	Engage PTO switch. (Refer to “Safety, Operation, and Maintenance Manual.”)
	Low hydraulic oil level.	Check hydraulic oil level.
	PTO switch is faulty.	Test PTO switch. (See “PTO Switch” on page 4-55.)
	Mow solenoid is faulty.	Test mow solenoid. (See “Solenoid Test” on page 4-56.) (See “Mow Circuit Schematic” on page 4-31.)
	Operator not in seat.	Operator must be in seat before engaging mower.
	Park brake is on or park brake switch is faulty.	Test park brake switch.
	Engine overheated.	Check engine cooling system and coolant level.
	Hydraulic oil filter restriction.	Test hydraulic oil pressure switch. (See “Hydraulic Filter Pressure Switch Test” on page 4-57.)
Cutting unit does not lower completely to ground.	Cutting unit movement is restricted.	Check/remove cutting unit restriction.
	Raise/lower circuit is faulty.	Test raise/lower circuit. (See “Raise/Lower Circuit—Theory of Operation” on page 4-26.)
Cutting unit does not rise off ground.	Faulty lift cylinder.	Test lift system. (See “Lift/Steer Pump Test” on page 6-50.)
	Hydraulic system performance is reduced.	Check hydraulic system performance (pump output, motor operation, valve operation, relief valve settings, etc.). (See “Instrument Test Procedure” on page 6-27.)
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 “Deck Roller” on page 6-19.)
	Roller bearing is faulty.	Replace roller bearing. (See “Deck Roller” on page 6-19.)

Quality of Cut Troubleshooting

Factors That Affect Cut Appearance

In most cases, information provided by the user/customer will provide the basis for the repairs and adjustments that are required. However, it is recommended that a “test cut” be performed to evaluate the mower’s performance before beginning repairs.

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.

Another “test cut” should be performed after the completion of the repairs and/or adjustments to verify the mower’s performance.

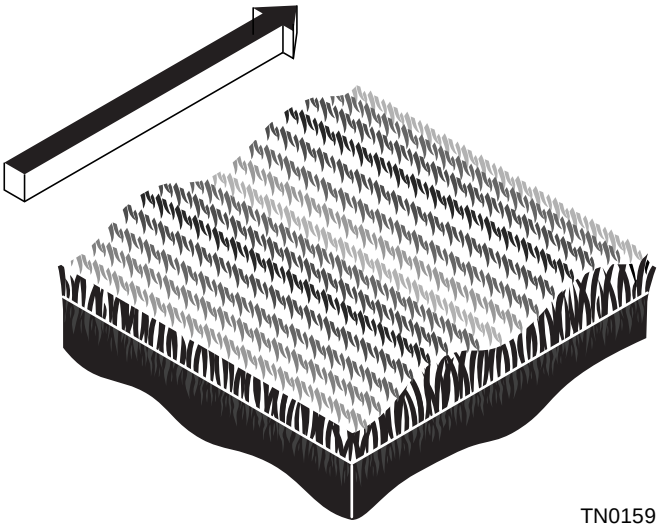
Before performing a “test cut” to diagnose cut appearance and mower performance, the following items should be verified to ensure an accurate “test cut.”

1. Mowing (Ground) Speed
2. Blade Sharpness
3. Height-of-Cut (HOC)
4. Roller and Roller Bearing Condition
5. Blade Speed

Definition of Terms

The following terms are used to describe various cut appearance symptoms.

Washboarding



TN0159

NOTE: Arrow indicates direction of travel.

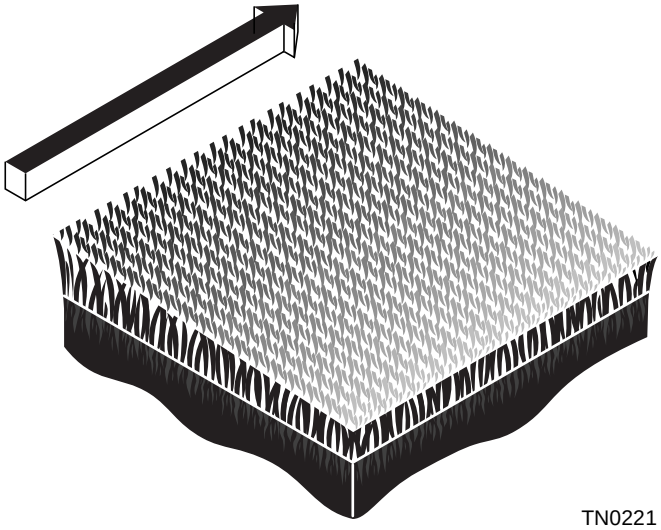
Washboarding is a cyclical pattern of varying cutting heights, resulting in a wave-like cut appearance. In most cases, the wave tip-to-tip distance is approximately 6—8 in. (15—20 cm). Color variation (light-to-dark) may also be noticed.

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 build-up on roller.	Clean the roller and scraper.
Roller is out of round.	Replace roller. (See “Deck Roller” on page 6-19.)
Mowing in the same direction.	Change mowing direction regularly.
Insufficient engine speed, not set to specification.	Check/adjust engine speed. (Refer to “Safety, Operation, and Maintenance Manual.”)
Hydraulic system and/or rotary drive motor performance is reduced.	Check hydraulic system performance (pump output, motor operation, valve operation, relief valve settings, etc.). (See “Instrument Test Procedure” on page 6-27.)

Step Cutting



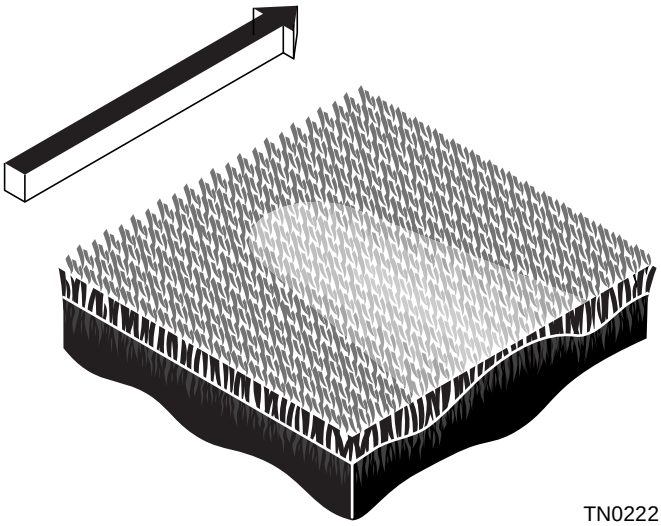
TN0221

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 deck caster adjustment.

NOTE: Arrow indicates direction of travel.

Probable Cause	Remedy
HOC (height-of-cut) settings are different from one side of a cutting unit to the other, or from one cutting unit to another.	Check HOC adjustment of cutting units. (Refer to “Safety, Operation, and Maintenance Manual.”)
Worn roller bearings or deck caster wheels.	Check/replace roller bearings. (See “Deck Roller” on page 6-19.) Check/replace deck caster wheels. (See “Deck Caster Wheels” on page 6-17.)
Cutting unit movement is restricted.	Check/remove cutting unit movement restriction.
Variations in turf density.	Change mowing direction.
Machine ride height is uneven side to side.	Check/adjust proper tire inflation pressure. (Refer to “Safety, Operation, and Maintenance Manual.”)
Cutting unit height is uneven side to side.	Check/adjust for even mower weight distribution. (See “Raise/Lower Circuit—Theory of Operation” on page 4-26.)
Mower frame is bent.	Repair or replace as needed.

Scalping



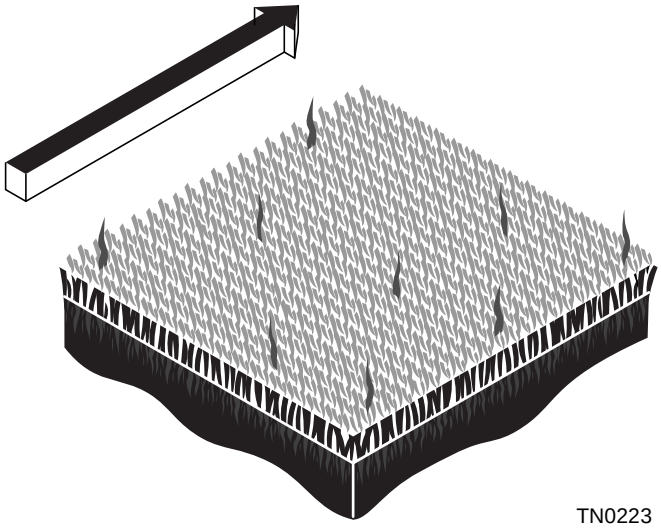
TN0222

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. (Refer to “Safety, Operation, and Maintenance Manual.”)
Turf too uneven for the mower to follow.	Change mowing direction.
Cutting too much grass at one time.	Mow more often.
Mowing (ground) speed is too fast.	Reduce mowing (ground) speed.

Stragglers



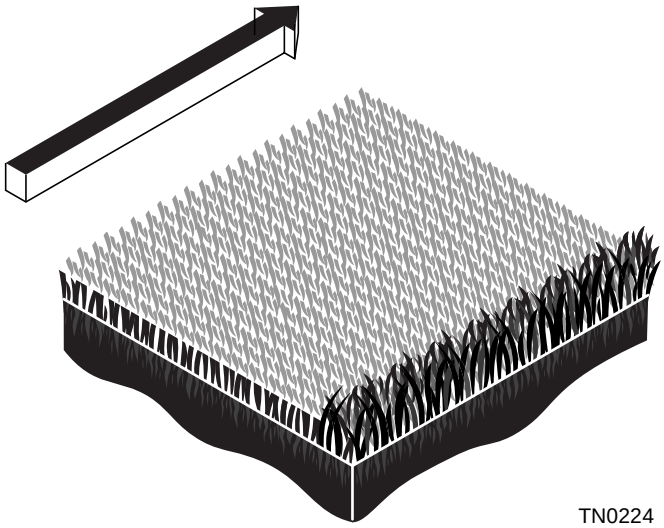
TN0223

Stragglers are scattered blades of uncut or poorly cut grass.

NOTE: Arrow indicates direction of travel.

Probable Cause	Remedy
Dull cutting blade(s).	Sharpen blade(s). (Refer to “Safety, Operation, and Maintenance Manual.”)
Mowing (ground) speed is too fast.	Reduce mowing (ground) speed.
Grass is too tall.	Mow more often.
Mowing in the same direction.	Change mowing direction regularly.

Streaks



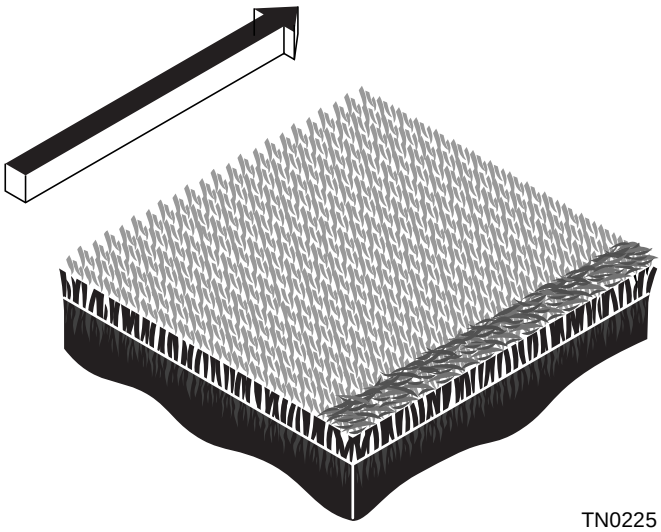
TN0224

A streak is a line of uncut grass. This is usually caused by a damaged blade.

NOTE: Arrow indicates direction of travel.

Probable Cause	Remedy
Damaged blade(s).	Replace blade(s). (See “Blade” on page 6-15.)
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 “Safety, Operation, and Maintenance Manual.”)
Wet grass is matted down before it is cut.	Cut when grass is dry.

Windrowing



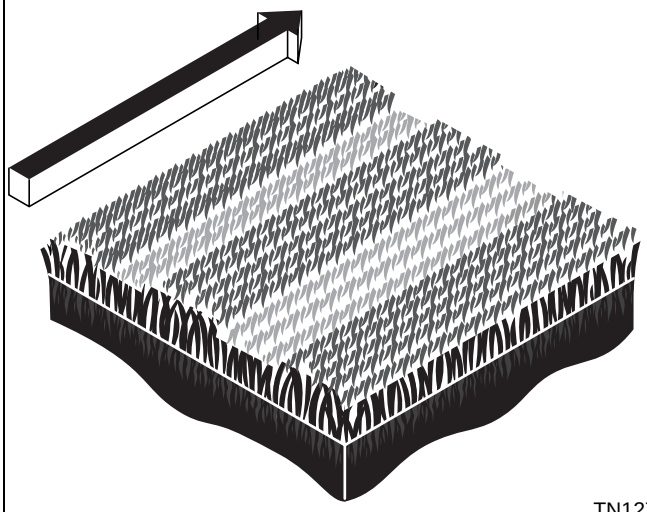
TN0225

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 built up on roller.	Clean rollers and scrapers.
Grass collecting on mower or deck frame.	Clear cutting unit(s) discharge deflector.

Mismatched Cutting Units



TN1278

NOTE: Arrow indicates direction of travel.

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.

Probable Cause	Remedy
HOC inconsistent from one cutting unit to another.	Check/adjust HOC on cutting units to same height. (Refer to "Safety, Operation, and Maintenance Manual.")
	Check condition of deck and/or frame. Repair or replace as needed.
Difference in rotary cutting unit speeds.	Check operation of rotary cutting motor(s) and repair/replace as necessary. (See "Cutting Unit System Test" on page 6-26.)
Difference in mower ride height, side to side.	Check/adjust tire inflation pressure. (Refer to "Safety, Operation, and Maintenance Manual.")
	Check/adjust for even mower weight distribution. (Refer to "Safety, Operation, and Maintenance Manual.")

Repair

Deck Motor

Removal and Installation

See Figure 6-2.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove cutter blade. (See “Blade” on page 6-15.)
3. Thoroughly clean the exterior of the motor, especially the area surrounding hydraulic hoses and fittings, with a suitable solvent.

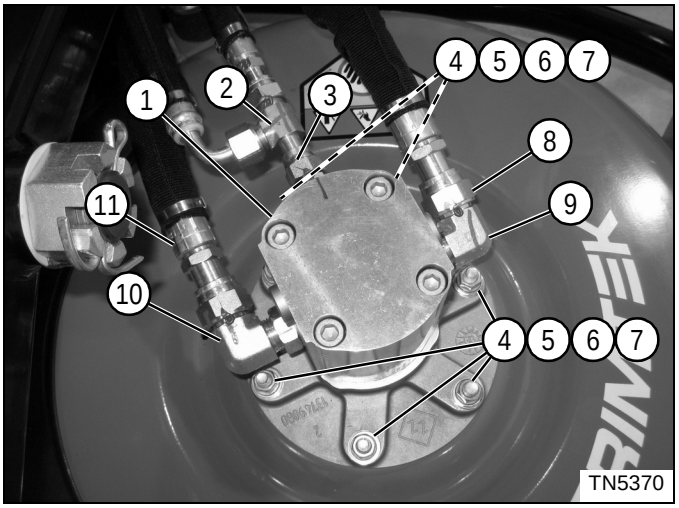


Figure 6-2

NOTES

- *Record the orientation of hydraulic hoses to motor and motor to deck to ensure correct installation.*
- *Close all openings with caps or plugs to prevent contamination.*

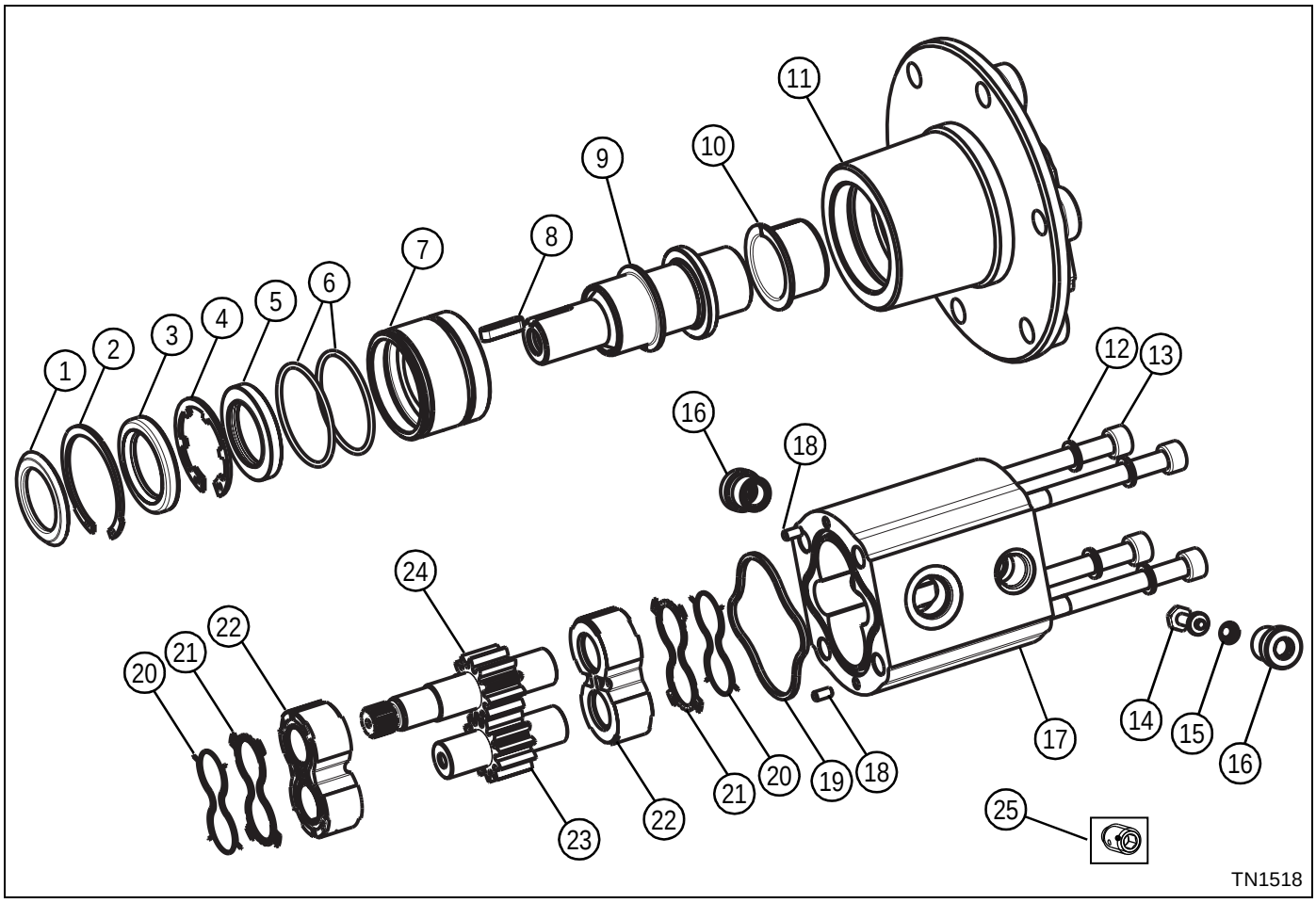
4. Remove hose (11) from elbow fitting (10).
5. Remove hose (8) from elbow fitting (9).
6. Remove tee fitting (2) from fitting (3).
7. Remove six nuts (4), flat washers (5), push-on nuts (6), and carriage bolts (7) from the deck motor (1).
8. Remove deck motor (1) from cutting unit.

Installation Notes

- *Install deck motor by reversing the order of removal.*
- *Install motor on the deck, making sure it is in proper orientation with the marks made on removal.*
- *Inspect O-rings on fittings before installation.*
- *Replace O-rings if damaged or missing.*
- *Replace hydraulic oil filter.*
- *Check hydraulic oil level. Add oil as needed. (Refer to “Safety, Operation, and Maintenance Manual” for oil specifications.)*
- *Start engine and check motor operation. Check for leaks and repair as necessary.*

Disassembly and Assembly

See Figure 6-3.



1	Shaft Seal	7	Sleeve Bearing Holder	13	Screw (4)	19	Gasket
2	Retaining Ring	8	Key	14	Check Valve	20	Backing Seal
3	Shaft Seal	9	Support Shaft	15	Spring	21	Seal
4	Retaining Ring	10	Sleeve Bearing	16	Plug	22	Thrust Plate
5	Shaft Seal	11	Front Cover	17	Pump Body	23	Driven Gear
6	Seal (2)	12	Washer (4)	18	Dowel Pin	24	Drive Shaft
						25	Check Valve Body (Old Style)

Figure 6-3

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Thoroughly clean the exterior of the motor, especially the area surrounding hydraulic hoses and fittings, with a suitable solvent.
3. Remove deck motor. (See “Deck Motor” on page 6-12.)

CAUTION

Never pry components apart. Use a soft-faced hammer, and gently tap housing and shaft to separate pump body.

4. After removing screws, disassemble motor.
5. Place parts in assembly order on a clean work area as they are removed.

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.

6. Clean all parts using clean solvent, and dry using compressed air.
7. Inspect all parts for wear or damage. Replace the motor as a unit if any parts other than seals require replacement.

   Inspect for metal chips or slivers during cleaning (an indication of damage to motor or other hydraulic component.)

Assembly Notes

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.

Required Materials
Seal Kit (Jacobsen PN 4136829)

- *Assemble the deck motor by reversing the order of disassembly.*
- *Apply a coat of clean hydraulic oil to all parts to aid assembly.*
- *Use extreme care when installing shaft seal; it must seat squarely in seal bore. Use clean grease on shaft and seal. Use caution when inserting shaft into seal to avoid cutting or damage to seal during assembly.*
- *Install screws finger tight and rotate drive shaft to make sure it turns freely. Tighten screws evenly in steps to a final torque of 30 lb-ft (40 N·m).*

Rotary Deck

Removal and Installation

See Figures 6-4 and 6-5.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Clean hydraulic motor, hydraulic lines, and working area of rotary deck.

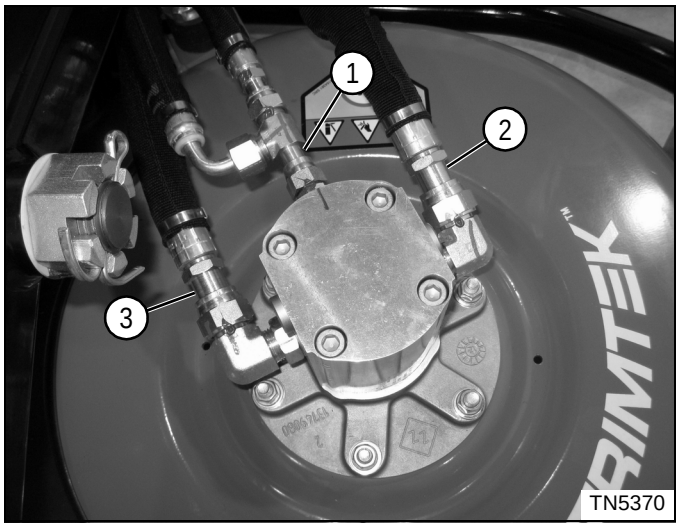


Figure 6-4

NOTE

Label all hydraulic hoses and note their locations before disconnecting to ensure correct installation.

3. Disconnect hydraulic hoses (1–3) from rotary motor.
4. Remove deck yoke. (See “Front Deck Yoke” on page 6-16.) (See “Rear Deck Yoke” on page 6-16.)

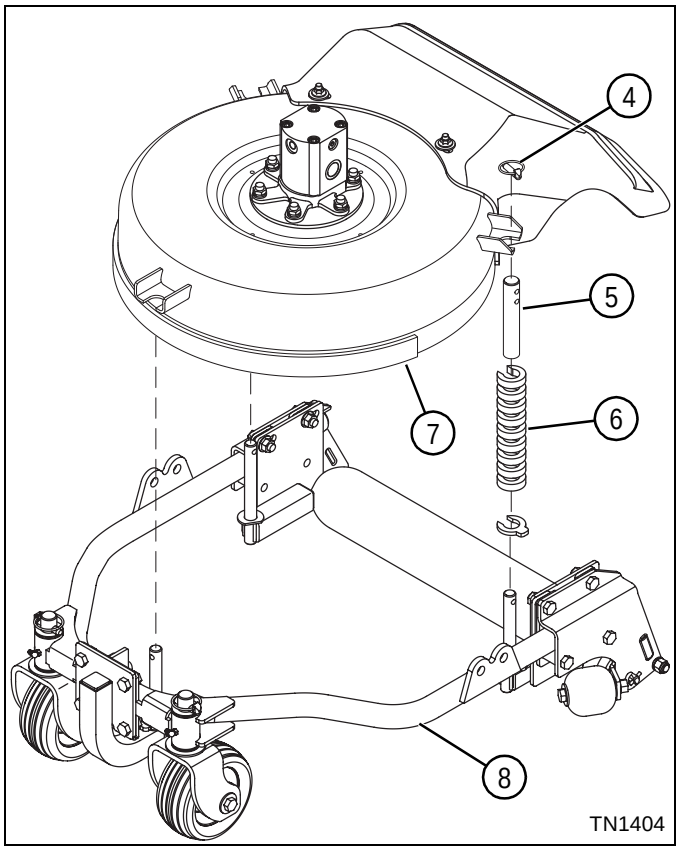


Figure 6-5

5. Remove three snap ring lock pins (4) and spacers (6) from cutting height sleeves (5).
6. Lift mower deck (7) up and away from deck frame (8).

Installation Note

Install mower deck by reversing the order of removal.

Blade

Removal and Installation

See Figure 6-6.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Raise and support the cutting units. (Refer to “Safety, Operation, and Maintenance Manual.”)
3. Disconnect the negative (–) battery cable at the battery.

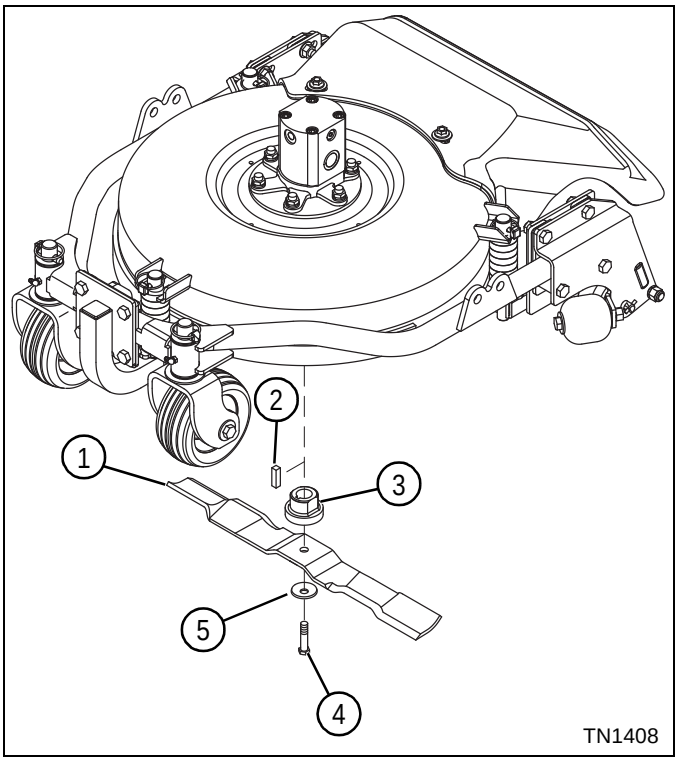


Figure 6-6

CAUTION

Blades are extremely sharp and can cause severe injury.

4. Remove blade screw (4), washer (5), blade (1), blade adapter (3), and key (2) from hydraulic motor spindle (not shown).

Installation Notes

- *Install blade by reversing the order of removal.*
- *Tighten blade screw (4) to 75–90 lb-ft (100–120 N·m).*

Front Deck Yoke

Removal and Installation

See Figure 6-7.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)

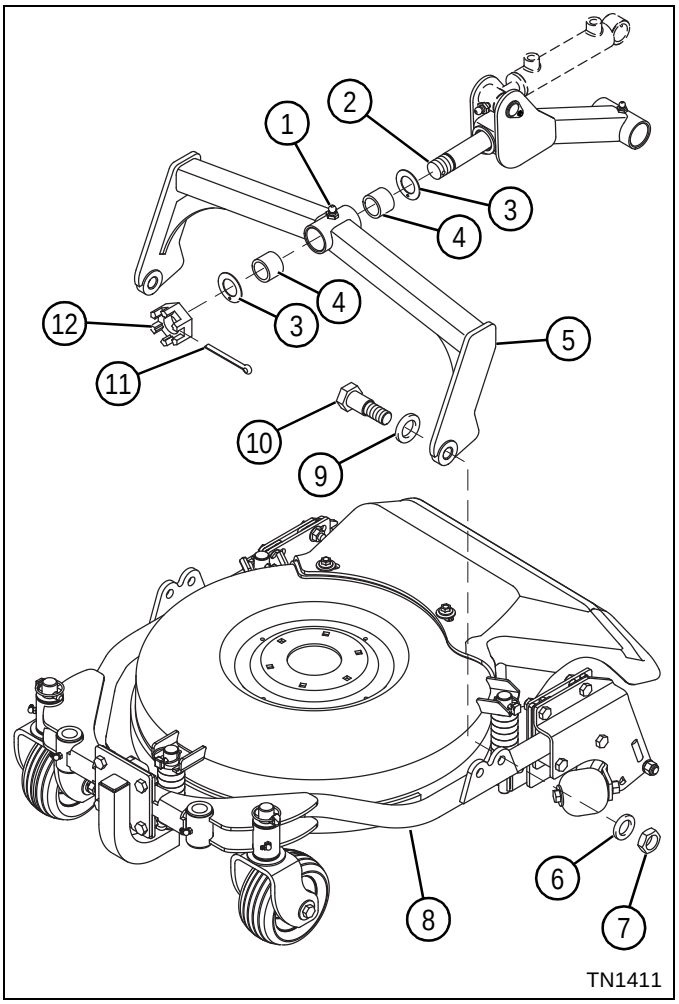


Figure 6-7

2. Remove cotter pin (11), slotted hex nut (12), and plastic washers (3) from lift arm pivot shaft (2).
3. Inspect lift arm shaft bushings (4). Remove only if replacement is required.
4. Roll the cutting unit forward until the deck yoke (5) clears the lift arm pivot shaft (2). Retain lift arm shaft bushings (4) inside deck yoke (5).
5. Remove lock nut (7), washers (6 and 9), and screw (10) from both sides of the deck frame (8) and deck yoke (5).
6. Remove yoke (5) from deck frame (8).

Installation Notes

- *Install front deck yoke by reversing the order of removal.*
- *Apply grease on lift arm pivot shaft bushings (4) and lift arm pivot shaft (2) before installation. (Refer to “Safety, Operation, and Maintenance Manual” for grease specifications.)*
- *After assembly, apply grease to grease fitting (1). (Refer to “Safety, Operation, and Maintenance Manual” for grease specifications.)*

Rear Deck Yoke

Removal and Installation

See Figure 6-8.

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)

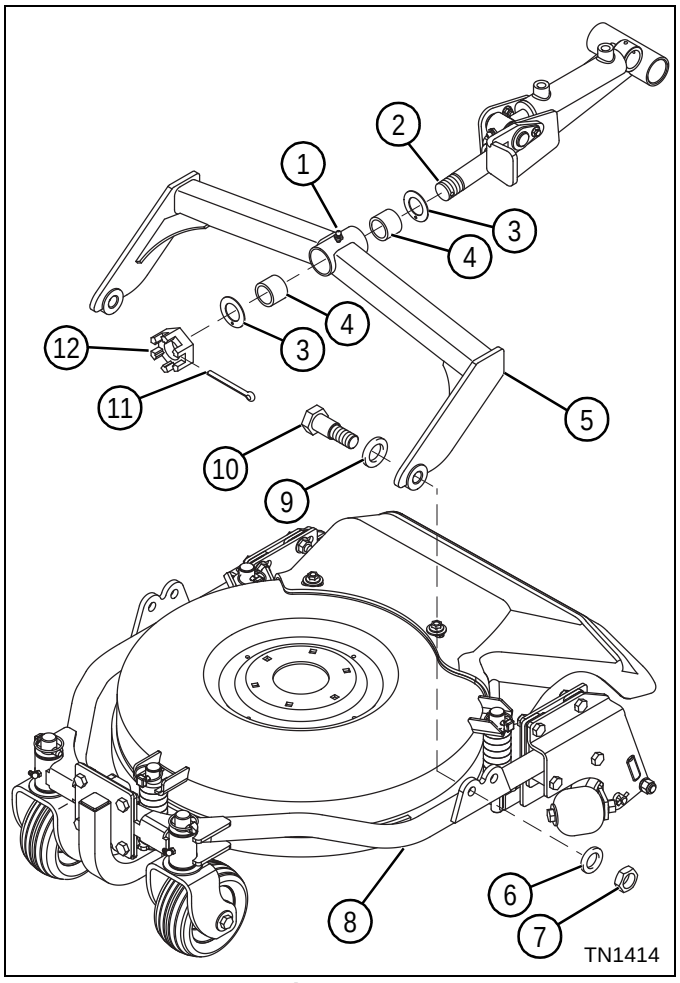


Figure 6-8

2. Remove cotter pin (11), slotted hex nut (12), and plastic washers (3) from lift arm pivot shaft (2).
3. Inspect lift arm shaft bushings (4). Remove only if replacement is required.

4. Roll the cutting unit forward until the deck yoke (5) clears the lift arm pivot shaft (2). Retain lift arm shaft bushings (4) inside deck yoke (5).
5. Remove lock nut (7), washers (6 and 9), and screw (10) from both sides of the deck frame (8) and deck yoke (5).
6. Remove yoke (5) from deck frame (8).

Installation Notes

- *Install rear deck yoke by reversing the order of removal.*
- *Apply grease on lift arm pivot shaft bushings (4) and lift arm pivot shaft (2) before installation. (Refer to "Safety, Operation, and Maintenance Manual" for grease specifications.)*
- *After assembly, apply grease to grease fitting (1). (Refer to "Safety, Operation, and Maintenance Manual" for grease specifications.)*

Deck Caster Wheels

Removal and Installation

See Figures 6-9 through 6-11.

1. Park the mower safely. (See "Park Mower Safely" on page 1-5.)
2. Raise and support cutting deck approximately 6 inches above ground to allow room to remove caster from deck frame.
3. Stop engine, set park brake, and remove key.

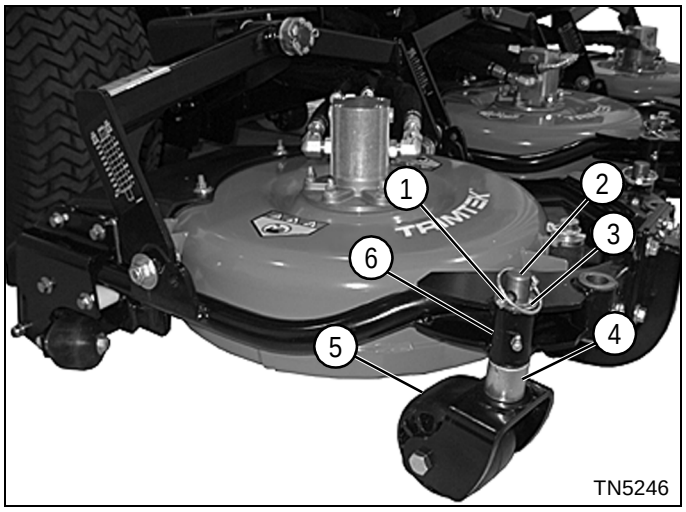


Figure 6-9

4. Support caster wheel assembly (5).
5. Remove lock pin (1) and flat washer (3) from caster yoke shaft (2).
6. Remove caster wheel assembly (5) and spacer (4) from bottom of deck frame (6).

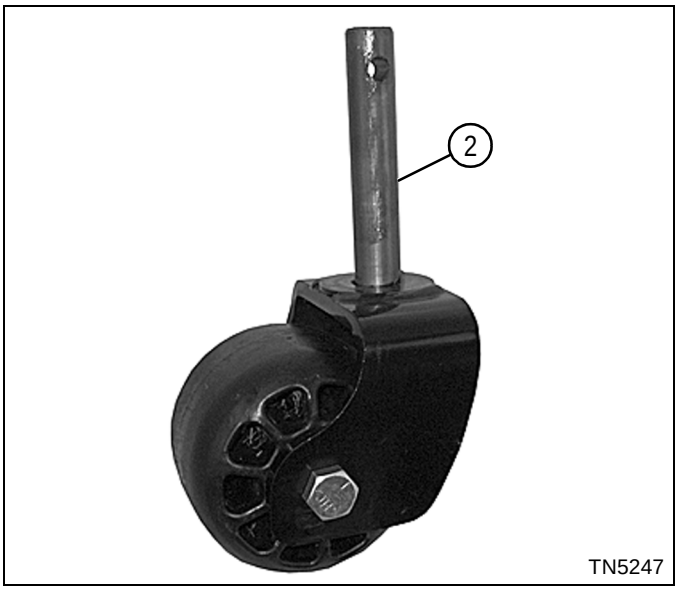


Figure 6-10

7. Inspect caster wheel yoke shaft (2) for wear and damage, and replace as necessary.

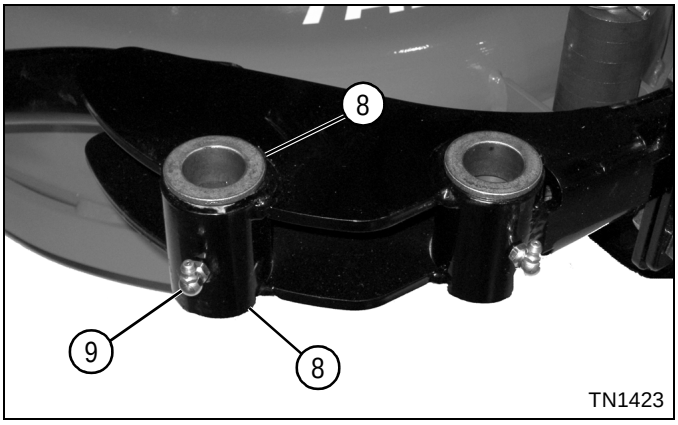


Figure 6-11

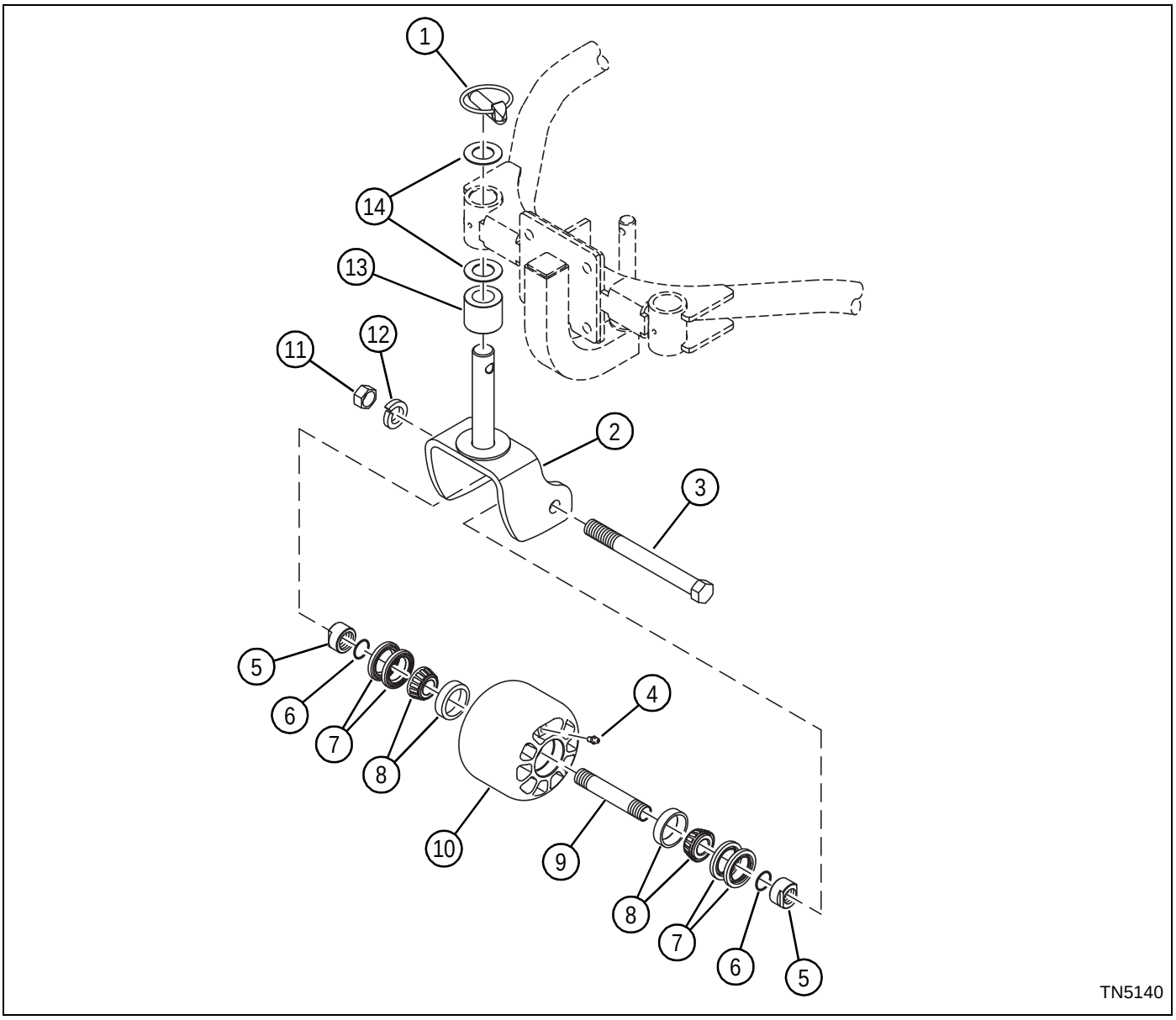
8. Inspect caster bushings (8) for wear and damage, and replace as necessary.

Installation Notes

- *Install deck caster wheel by reversing the order of removal.*
- *Apply grease to grease fitting (9). (Refer to "Safety, Operation, and Maintenance Manual" for grease specifications.)*

Disassembly and Assembly

See Figure 6-12.



1	Snap Ring	5	Spacer (2)	9	Yoke Spacer	13	Spacer
2	Caster Wheel Yoke	6	O-Ring (2)	10	Caster Wheel	14	Flat Washer (4)
3	Screw	7	Grease Seal (4)	11	Nut		
4	Grease Fitting	8	Bearing Cup and Cone (2)	12	Lock Washer		

Figure 6-12

Deck Roller

Removal and Installation

See Figures 6-13 and 6-14.

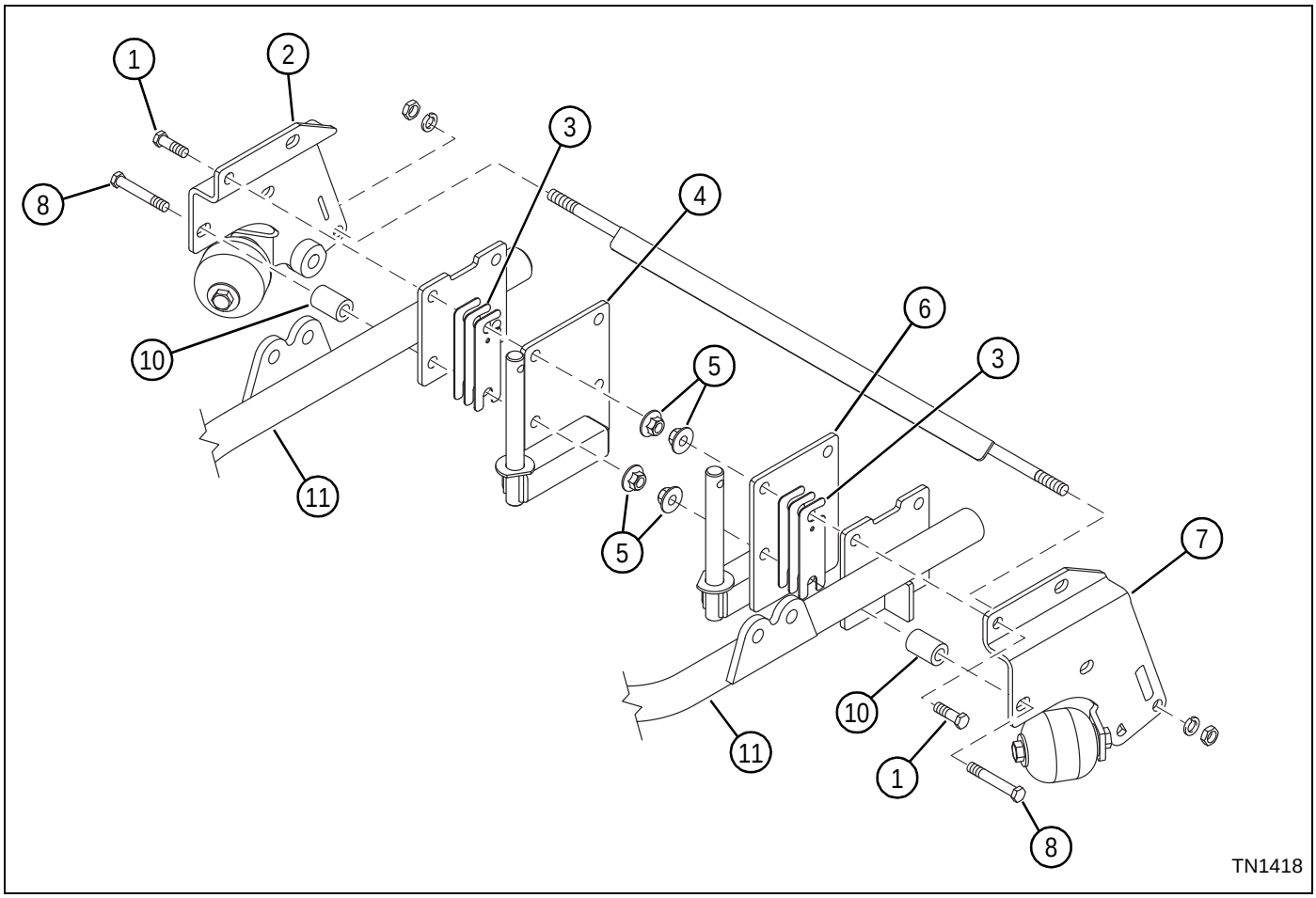


Figure 6-13

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove mower deck. (See “Rotary Deck” on page 6-14.)
3. Remove deck yoke. (See “Front Deck Yoke” on page 6-16.) (See “Rear Deck Yoke” on page 6-16.)

NOTE

Record the location and number of shims (3) prior to disassembly.

4. Remove four screws (1 and 8) and nuts (5), two spacers (10), six shims (3), right roller bracket (2), and left roller bracket (7), left cutting height bracket (6), and right cutting height bracket (4) from deck frame (11).

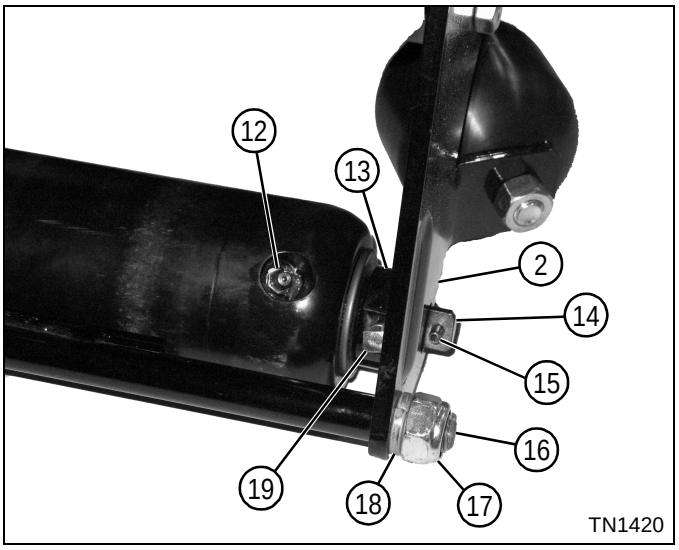


Figure 6-14

NOTE

Steps 5 through 8 apply to both sides of the roller assembly.

5. Loosen screw (19) from collar (13) on roller shaft (14).
6. Remove pin (15) from roller shaft (14).
7. Remove lock nut (17) and washer (18) from scraper shaft (16).
8. Remove roller bracket from roller shaft (14) and scraper shaft (16).

Installation Notes

- *Install roller by reversing the order of removal.*
- *Apply grease to grease fitting (12).*

Disassembly, Inspection, and Assembly

See Figure 6-15.

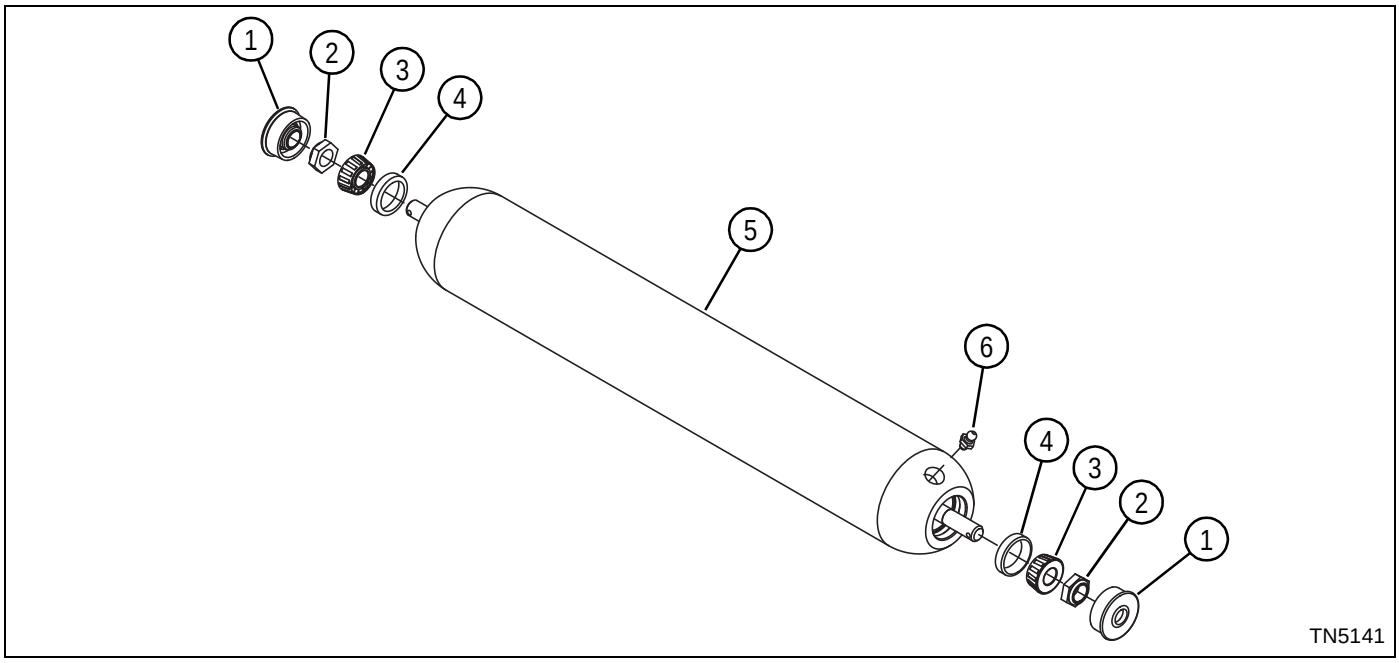


Figure 6-15

1. Park the mower safely. (See “Park Mower Safely” on page 1-5.)
2. Remove deck roller from cutting unit. (See “Deck Roller” on page 6-19.)

NOTE

Do not remove bearing cone (4) unless it is necessary to replace the bearing (3). Always replace the bearing and bearing cone as a set.

3. Remove seal (1), lock nut (2), bearing (3), and bearing cone (4) from both ends of roller (5).
4. Inspect roller, shaft, bearings, and bearing cones for wear or damage. Replace as necessary.

Assembly Notes

- *Assemble the deck roller by reversing the order of disassembly.*
- *Apply grease to grease fitting (6) at both ends of roller (5). (Refer to “Safety, Operation, and Maintenance Manual” for grease specifications.)*

Mower Deck Housing

Disassembly and Assembly

See Figure 6-16.

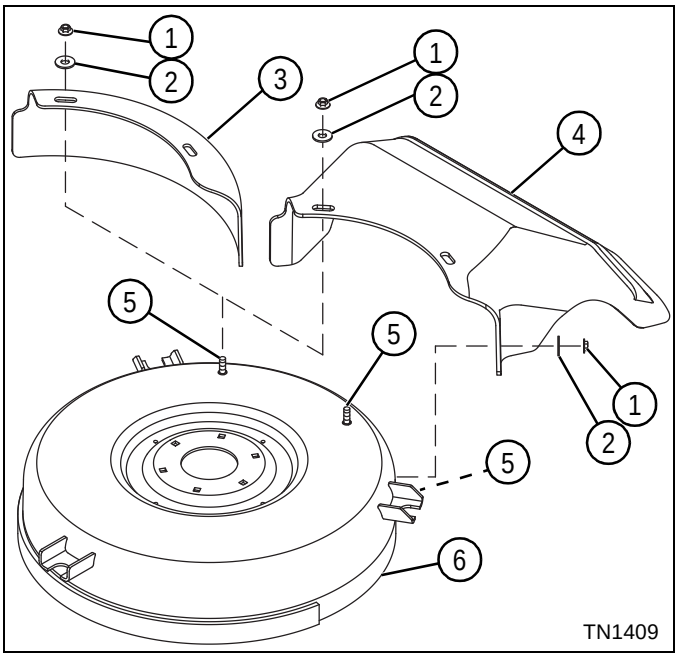


Figure 6-16

1. Remove nuts (1) and washers (2) from screws (5) (two for mulch cover, three for rear discharge deflector).
2. Remove mulch cover (3) or rear discharge deflector (4) from mower deck (6).

Assembly Note

Assemble mower deck by reversing the order of disassembly.

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