Chapter 4

Electrical

4

JACOBSEN
A Textron Company

Specifications

Test and Adjustment Specifications

Specifications		
Resistance Across Solenoid Coil—12-Volt Solenoid Coils at 68°F	ohms	10.43 ±10%
Resistance Across Solenoid Coil—24-Volt Solenoid Coils at 68°F	ohms	41.74 ±10%
Fuel Shutoff Solenoid Resistance Between Terminal 1 and Ground	ohms	15.58
Fuel Shutoff Solenoid Resistance Between Terminal 3 and Ground	ohms	0.375
Fuel Level Sender Resistance Between Terminals at empty position	ohms	180
Fuel Level Sender Resistance Between Terminals at empty position	ohms	4.0

Repair Specifications

Specifications		
Solenoid Coil Retaining Nut Torque	lb-in. (N·m)	36 (4.1)

Fuse Identification

See Figure 4-1.

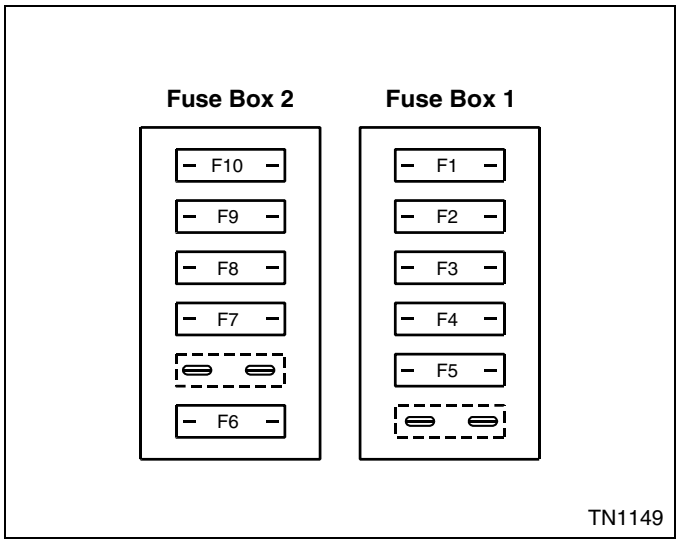


Figure 4-1

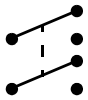
- F1— 5A Fuse, Accessory Socket 2
- F2—15A Fuse, Accessory Socket 1
- F3—10A Fuse, Work Lights
- F4—5A Fuse, Park Brake solenoid
- F5—2A Fuse, Multi-Function Gauge
- F6—15A Fuse, Start Circuit
- F7—7.5A Fuse, Alternator
- F8—5A Fuse, Mow Switch Light, Alternator Light, Multi-Function Gauge and Setup Switch
- F9—5A Fuse, Engine Oil Pressure Light, Hydraulic Filter Light
- F10—10A Fuse, Control Module

Theory and Diagnostic Information

Electrical Component Symbols

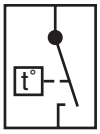
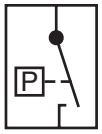
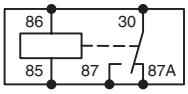
The following symbols are used in the electrical schematics to represent various electrical components.

Switches[1]

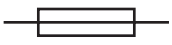
Single Pole, Single Throw (SPST) 	Double Pole, Single Throw (DPST) 
Single Pole, Double Throw (SPDT) 	Double Pole, Double Throw (DPDT) 

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

Switching Devices

Temperature Switch 	Pressure Switch 
Relay 	

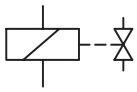
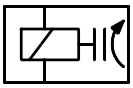
Circuit Protection Devices

Fuse 	Circuit Breaker 

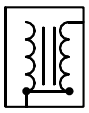
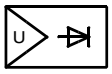
Motors and Generating Devices

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

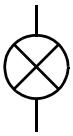
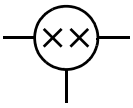
Actuating Devices

Solenoid Valve 	PTO Clutch 

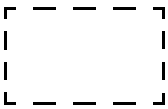
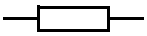
Engine-Related Devices

Ignition Coil 	Spark Plug 
Regulator 	

Lights

Single-Element Light 	Dual-Element Light 

Miscellaneous Symbols

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

Electrical Schematic Component Identification

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

- A1—Control Module (See Figure 4-4.)
- A2—Glow Plug Timer (See Figure 4-2.)
- A3—Multi-Function Gauge (See Figure 4-6.)
- B1—Engine Temperature Switch (See Figure 4-6.)
- B2—Engine Oil Pressure Switch (See Figure 4-6.)
- B3—Hydraulic Filter Switch (See Figure 4-6.)
- B4—Fuel Level Sensor (See Figure 4-6.)
- E1—Work Light (See Figure 4-7.)
- E2—Work Light (See Figure 4-7.)
- F1—15A Fuse (See Figure 4-7.)
- F2—15A Fuse (See Figure 4-7.)
- F3—10A Fuse (See Figure 4-7.)
- F4—5A Fuse (See Figure 4-4.)
- F5—2A Fuse (See Figure 4-2.)
- F6—15A Fuse (See Figure 4-2.)
- F7—7.5A Fuse (See Figure 4-2.)
- F8—5A Fuse (See Figure 4-3.)
- F9—5A Fuse (See Figure 4-4.)
- F10—10A Fuse (See Figure 4-4.)
- F11—40A Fuse (See Figure 4-2.)
- F12—40A Fuse (See Figure 4-2.)
- G1—Battery (See Figure 4-2.)
- G2—Alternator (See Figure 4-2.)
- H1—Glow Plug Wait Light (See Figure 4-2.)
- H2—Engine Oil Pressure Light (See Figure 4-6.)
- H3—Hydraulic Filter Light (See Figure 4-6.)
- H4—Over-Temperature Light (See Figure 4-6.)
- H5—Module Fault Light (See Figure 4-6.)
- H6—Alternator Light (See Figure 4-6.)
- H7—Alarm (See Figure 4-6.)
- K1—Start Relay (See Figure 4-2.)
- K2—Glow Plug Relay (See Figure 4-2.)
- M1—Starter Motor (See Figure 4-2.)
- M2—Fuel Pump (See Figure 4-2.)
- R1—Glow Plugs (See Figure 4-2.)
- S1—Key Switch (See Figure 4-2.)
- S2—Brake Release Safety Switch (See Figure 4-3.)
- S3—Backlap Switch (Model TR-3) (See Figure 4-3.)
- S4—Seat Switch (See Figure 4-3.)
- S5—Mow Switch (See Figure 4-3.)
- S6—Park Brake Switch (See Figure 4-4.)
- S7—Weight Transfer Switch (See Figure 4-5.)
- S8—Raise/Lower Switch (See Figure 4-5.)
- S9—Setup Switch (See Figure 4-6.)
- S10—Work Lights Switch (See Figure 4-7.)
- S11—Neutral Switch (See Figure 4-4.)
- V1—Diode Module (See Figures 4-2 and 4-3.)
- X1—Console Harness to Machine Harness
- X2—Console Harness to Machine Harness
- X3—Console Harness to Machine Harness
- X4—Diode Module Connector (See Figures 4-2 and 4-3.)
- X5—Cab Power Connector (See Figure 4-2.)
- X6—Accessory Socket 1 (See Figure 4-7.)
- X7—Accessory Socket 2 (See Figure 4-7.)
- X8—Jump Start Adaptor (See Figure 4-2.)
- Y1—Fuel Shutoff Solenoid (See Figure 4-3.)
- Y2—Brake Solenoid (See Figure 4-4.)
- Y3—Mow Solenoid (See Figure 4-5.)
- Y4—Raise Solenoid (See Figure 4-5.)
- Y5—Lower Solenoid (See Figure 4-5.)
- Y6—Weight Transfer Solenoid (See Figure 4-5.)
- Y7—Weight Transfer Solenoid (See Figure 4-5.)

Electrical Schematic

See Figures 4-2 through 4-7.

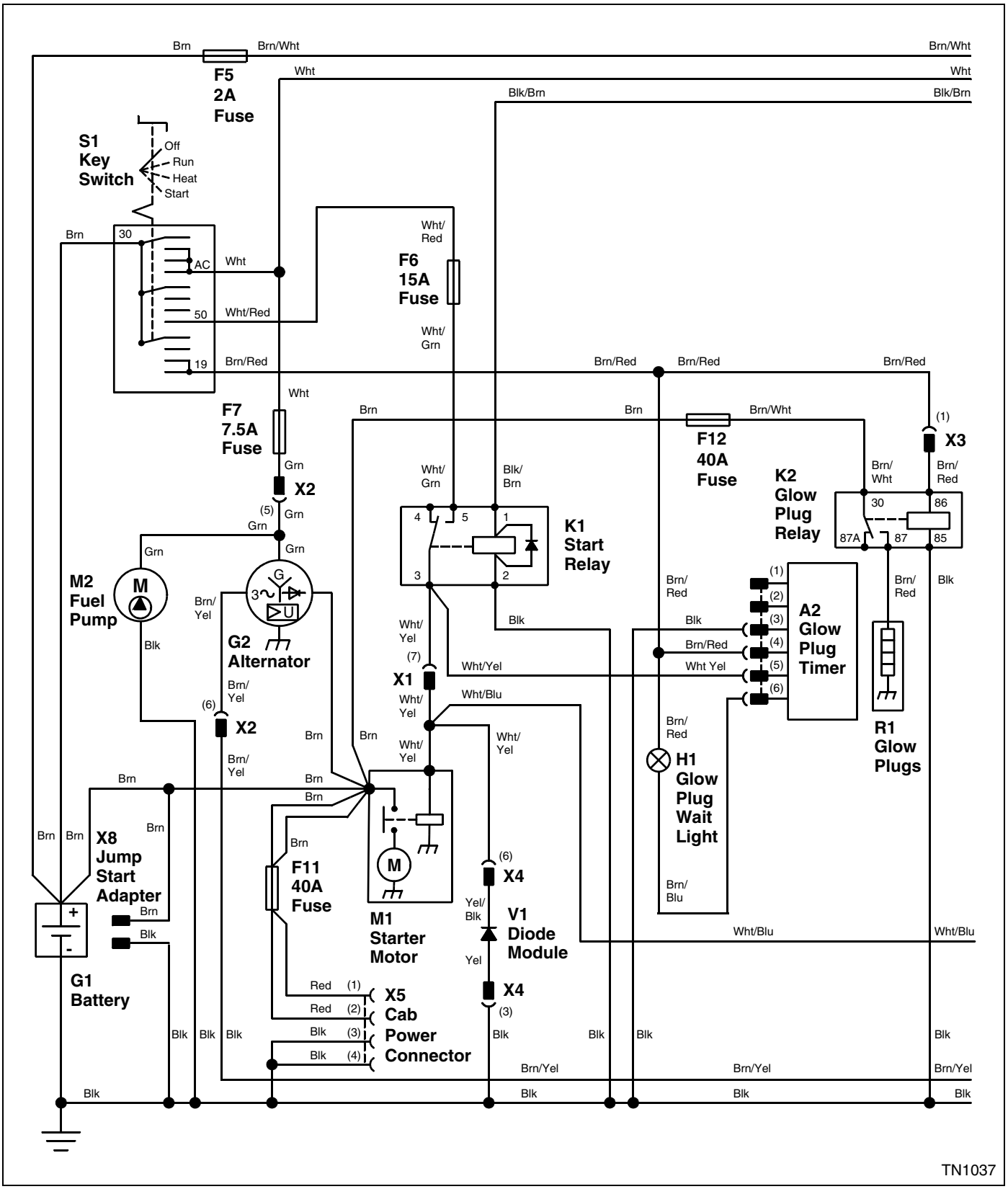


Figure 4-2

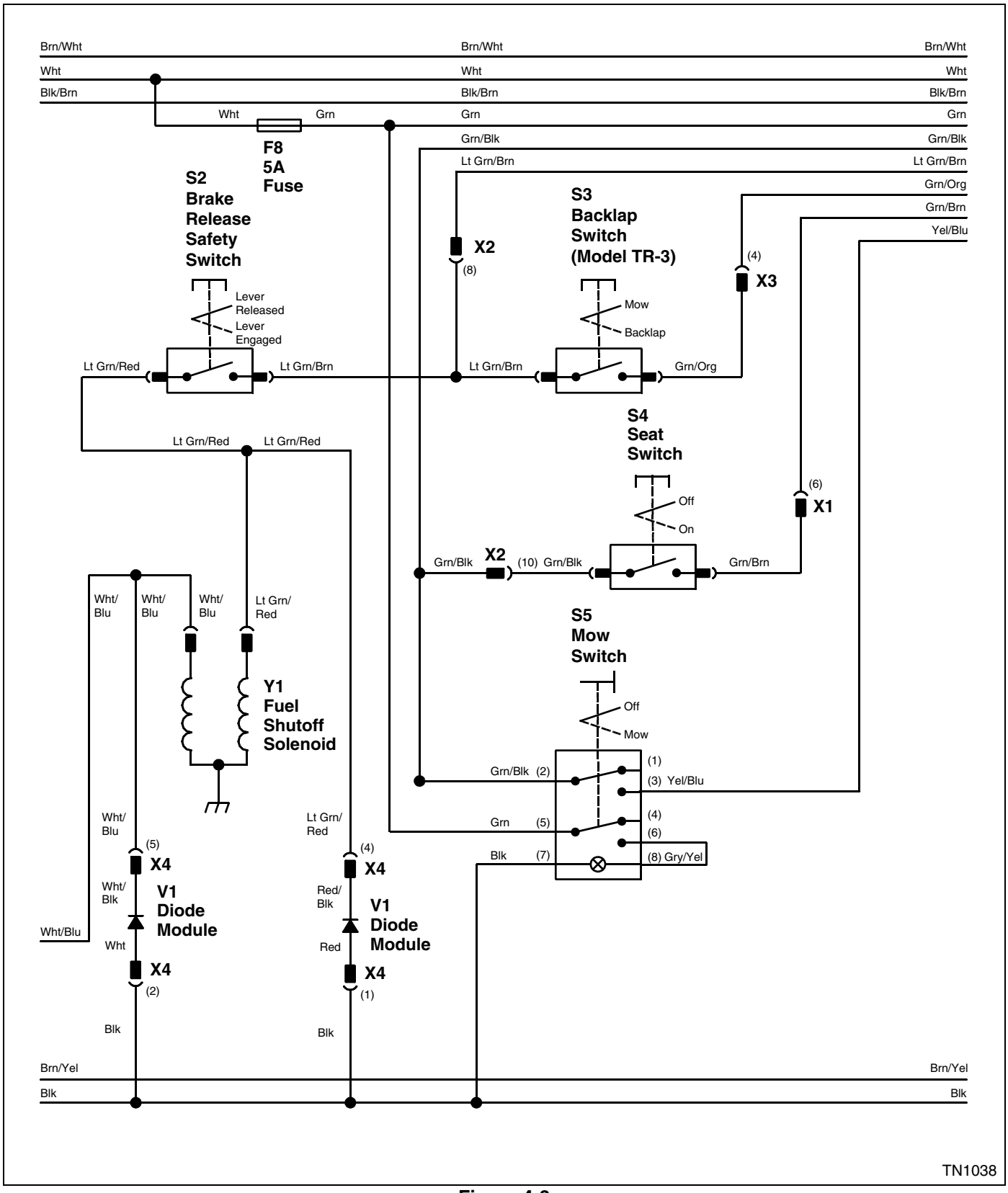

Brn/Wht
Wht
Blk/Brn
Wht
Grn
F8
5A
Fuse
S2
Brake
Release
Safety
Switch
Lever
Released
Lever
Engaged
Lt Grn/Red
Lt Grn/Brn
X2
(8)
S3
Backlap
Switch
(Model TR-3)
Mow
Backlap
(4)
X3
Grn/Org
Grn/Brn
Yel/Blu
Grn/Blk
Lt Grn/Brn
S4
Seat
Switch
Off
On
(6)
X1
(10) Grn/Blk
Wht/
Blu
Lt Grn/
Red
Y1
Fuel
Shutoff
Solenoid
S5
Mow
Switch
Off
Mow
(1)
(2)
(3) Yel/Blu
(4)
(5)
(6)
(7)
(8) Gry/Yel
X4
V1
Diode
Module
Wht/Blu
Wht/
Blk
Red/
Blk
Red
(5)
(4)
(2)
(1)
Blk
Brn/Yel
TN1038

Figure 4-3

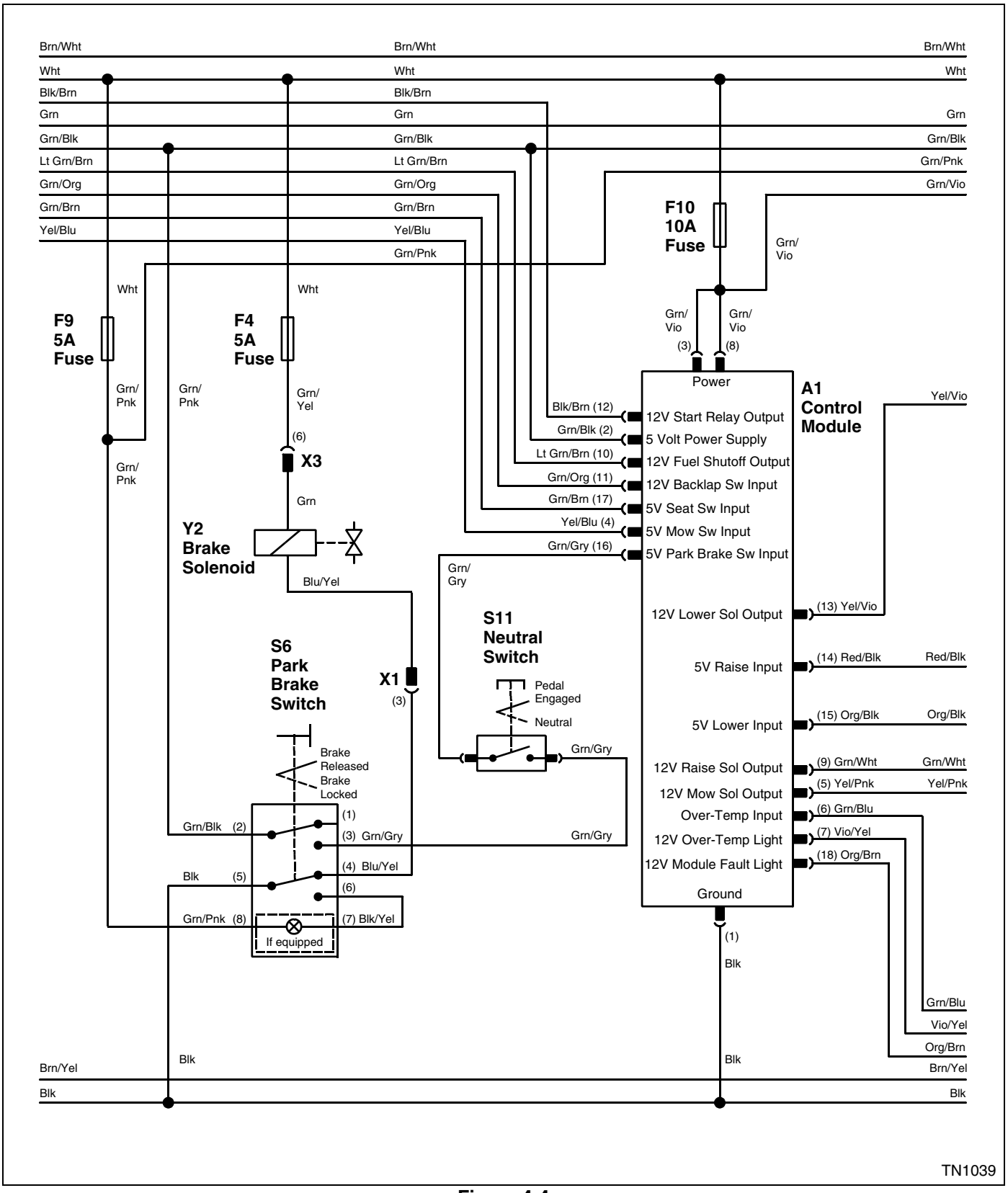

Brn/Wht
Wht
Blk/Brn
Grn
Grn/Blk
Lt Grn/Brn
Grn/Org
Grn/Brn
Yel/Blu
Grn/Pnk
Grn/Vio
F10
10A
Fuse
F9
5A
Fuse
F4
5A
Fuse
Grn/
Pnk
Grn/
Yel
Grn/
Vio
(3)
(8)
Power
A1
Control
Module
Blk/Brn (12)
12V Start Relay Output
Grn/Blk (2)
5 Volt Power Supply
Lt Grn/Brn (10)
12V Fuel Shutoff Output
Grn/Org (11)
12V Backlap Sw Input
Grn/Brn (17)
5V Seat Sw Input
Yel/Blu (4)
5V Mow Sw Input
Grn/Gry (16)
5V Park Brake Sw Input
Yel/Vio
(6)
X3
Y2
Brake
Solenoid
Blu/Yel
Grn/
Gry
S11
Neutral
Switch
Pedal
Engaged
Neutral
Grn/Gry
12V Lower Sol Output
(13) Yel/Vio
S6
Park
Brake
Switch
X1
(3)
Brake
Released
Brake
Locked
5V Raise Input
(14) Red/Blk
Red/Blk
5V Lower Input
(15) Org/Blk
Org/Blk
12V Raise Sol Output
(9) Grn/Wht
Grn/Wht
12V Mow Sol Output
(5) Yel/Pnk
Yel/Pnk
Over-Temp Input
(6) Grn/Blu
12V Over-Temp Light
(7) Vio/Yel
12V Module Fault Light
(18) Org/Brn
Ground
(1)
Blk
Grn/Blk (2)
(1)
(3) Grn/Gry
(4) Blu/Yel
Blk (5)
(6)
Grn/Pnk (8)
(7) Blk/Yel
If equipped
Grn/Blu
Vio/Yel
Org/Brn
Brn/Yel
Blk
TN1039

Figure 4-4

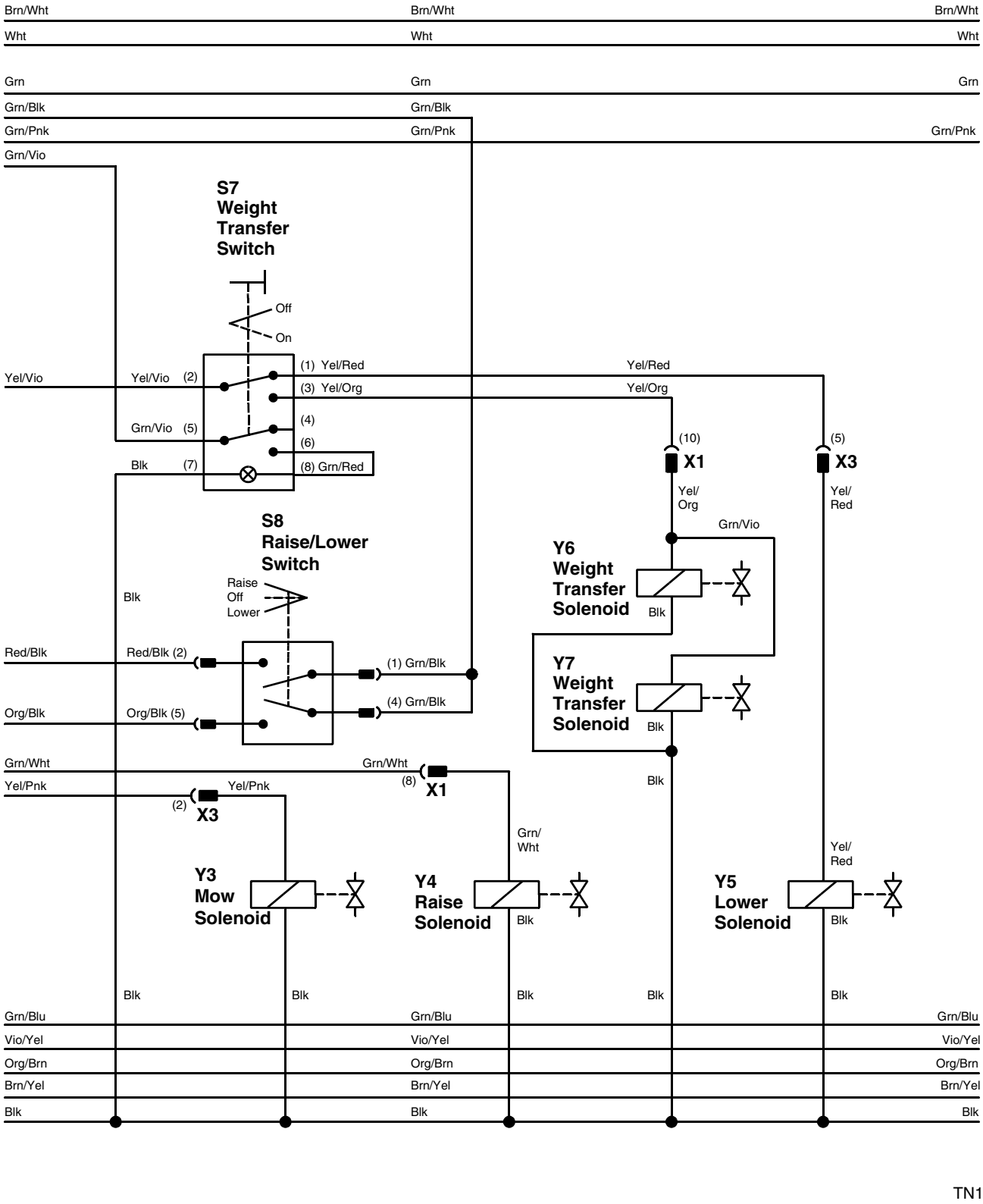

Brn/Wht
Wht
Grn
Grn/Blk
Grn/Pnk
Grn/Vio
S7
Weight
Transfer
Switch
Off
On
Yel/Vio
(1) Yel/Red
(3) Yel/Org
(4)
(6)
Grn/Vio (5)
Blk (7)
(8) Grn/Red
S8
Raise/Lower
Switch
Raise
Off
Lower
Red/Blk
Red/Blk (2)
(1) Grn/Blk
Org/Blk
Org/Blk (5)
(4) Grn/Blk
Grn/Wht
Yel/Pnk
(2)
X3
(8)
X1
(10)
X1
(5)
X3
Yel/Org
Yel/Red
Grn/Vio
Y6
Weight
Transfer
Solenoid
Y7
Weight
Transfer
Solenoid
Blk
Y3
Mow
Solenoid
Y4
Raise
Solenoid
Y5
Lower
Solenoid
Grn/Wht
Yel/Red
Grn/Blu
Vio/Yel
Org/Brn
Brn/Yel
TN1040

Figure 4-5

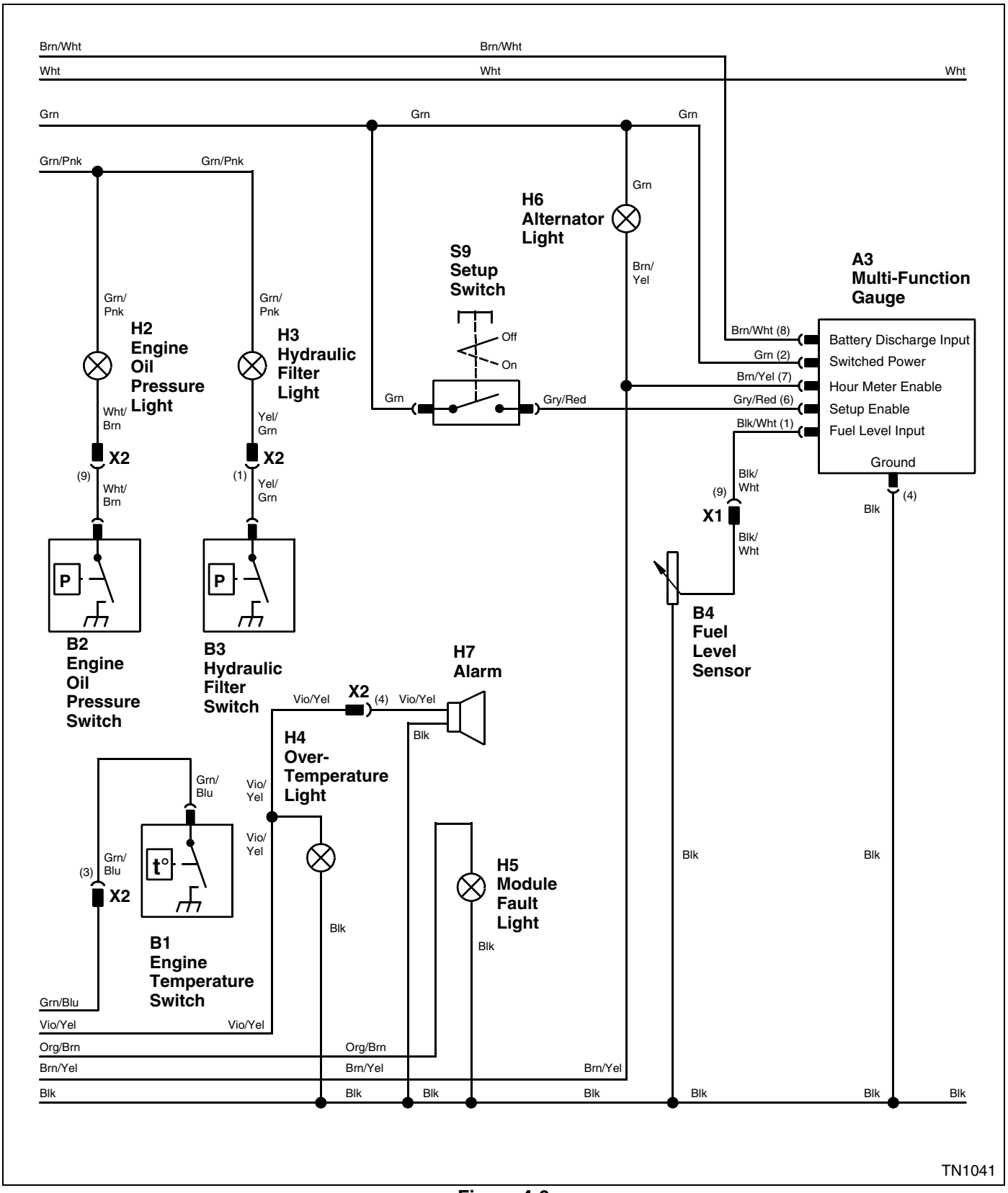

Brn/Wht
Brn/Wht
Wht
Wht
Wht
Grn
Grn
Grn
Grn/Pnk
Grn/Pnk
Grn
H6
Alternator
Light
S9
Setup
Switch
Brn/
Yel
A3
Multi-Function
Gauge
Grn/
Pnk
Grn/
Pnk
H2
Engine
Oil
Pressure
Light
H3
Hydraulic
Filter
Light
Off
On
Brn/Wht (8)
Battery Discharge Input
Grn (2)
Switched Power
Brn/Yel (7)
Hour Meter Enable
Grn
Gry/Red
Gry/Red (6)
Setup Enable
Blk/Wht (1)
Fuel Level Input
Ground
Wht/
Brn
Yel/
Grn
X2
X2
(9)
(1)
Wht/
Brn
Yel/
Grn
Blk/
Wht
(9)
X1
Blk/
Wht
(4)
Blk
P
P
B2
Engine
Oil
Pressure
Switch
B3
Hydraulic
Filter
Switch
B4
Fuel
Level
Sensor
H7
Alarm
Vio/Yel
X2
(4)
Vio/Yel
Blk
H4
Over-
Temperature
Light
Grn/
Blu
Vio/
Yel
Vio/
Yel
(3)
Grn/
Blu
X2
t°
Blk
H5
Module
Fault
Light
Blk
Blk
Blk
B1
Engine
Temperature
Switch
Grn/Blu
Vio/Yel
Vio/Yel
Org/Brn
Org/Brn
Brn/Yel
Brn/Yel
Brn/Yel
Blk
Blk
Blk
Blk
Blk
Blk
Blk
TN1041

Figure 4-6

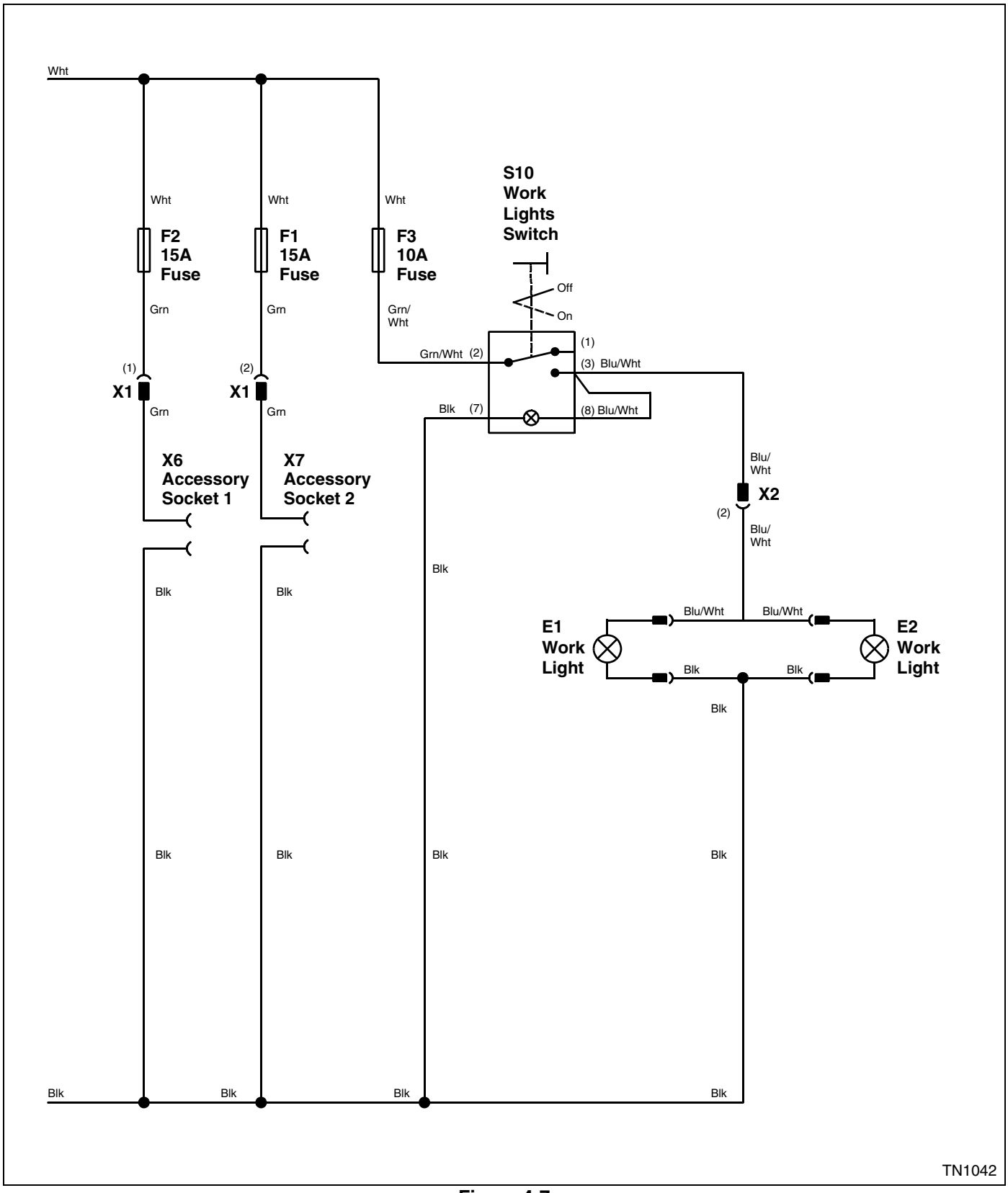

Wht
Wht
Wht
Wht
F2
15A
Fuse
F1
15A
Fuse
F3
10A
Fuse
S10
Work
Lights
Switch
Off
On
Grn
Grn
Grn/
Wht
Grn/Wht (2)
(1)
(3) Blu/Wht
(1)
X1
(2)
X1
Grn
Grn
Blk (7)
(8) Blu/Wht
X6
Accessory
Socket 1
X7
Accessory
Socket 2
Blu/
Wht
X2
(2)
Blu/
Wht
Blk
Blk
Blk
Blu/Wht
Blu/Wht
E1
Work
Light
E2
Work
Light
Blk
Blk
Blk
Blk
Blk
Blk
Blk
Blk
Blk
Blk
Blk
TN1042

Figure 4-7

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Theory of Operation and Sub Circuit Schematics

Power Circuit—Theory of Operation

Unswitched Power Circuit

Unswitched power is available from the battery positive terminal to the following components:

- 40A fuse F11
- Cab power connector X5, terminals 1 and 2
- Starter motor battery terminal
- 40A fuse F12
- Glow plug relay terminal 30
- 2A fuse F5
- Multi-function gauge terminal 8
- Key switch terminal 30
- Jump start terminal X8

The jump start terminal provides a more accessible place to charge the battery or to jump start the machine.

Switched Power Circuit

When the key switch is turned to the run position, voltage is available from key switch terminal AC to the following components:

- 15A fuse F1
- 15A fuse F2
- 10A fuse F3
- 5A fuse F4
- 2A fuse F5
- 7.5A fuse F7
- 5A fuse F8
- 5A fuse F9
- 10A fuse F10
- Alternator excitation terminal
- Fuel pump
- Mow switch terminal 5
- Park brake switch terminal 8
- Brake solenoid
- Weight transfer switch terminal 5
- Engine oil pressure light
- Hydraulic filter light
- Setup switch
- Alternator light

With the key switch in the run position, current flows through 10 amp fuse F10 to control module terminals 3 and 8, powering up the module. Current also flows to multi-function gauge terminal 2, powering up the gauge.

5-Volt Power Circuit

With the control module powered up, the control module now provides 5 volts to the following components:

- Seat switch
- Mow switch
- Park brake switch
- Raise/lower switch

The 5-volt power circuit is used to activate the control module switch inputs when a switch contact is closed.

Power Circuit Schematic

See Figures 4-8 through 4-13.

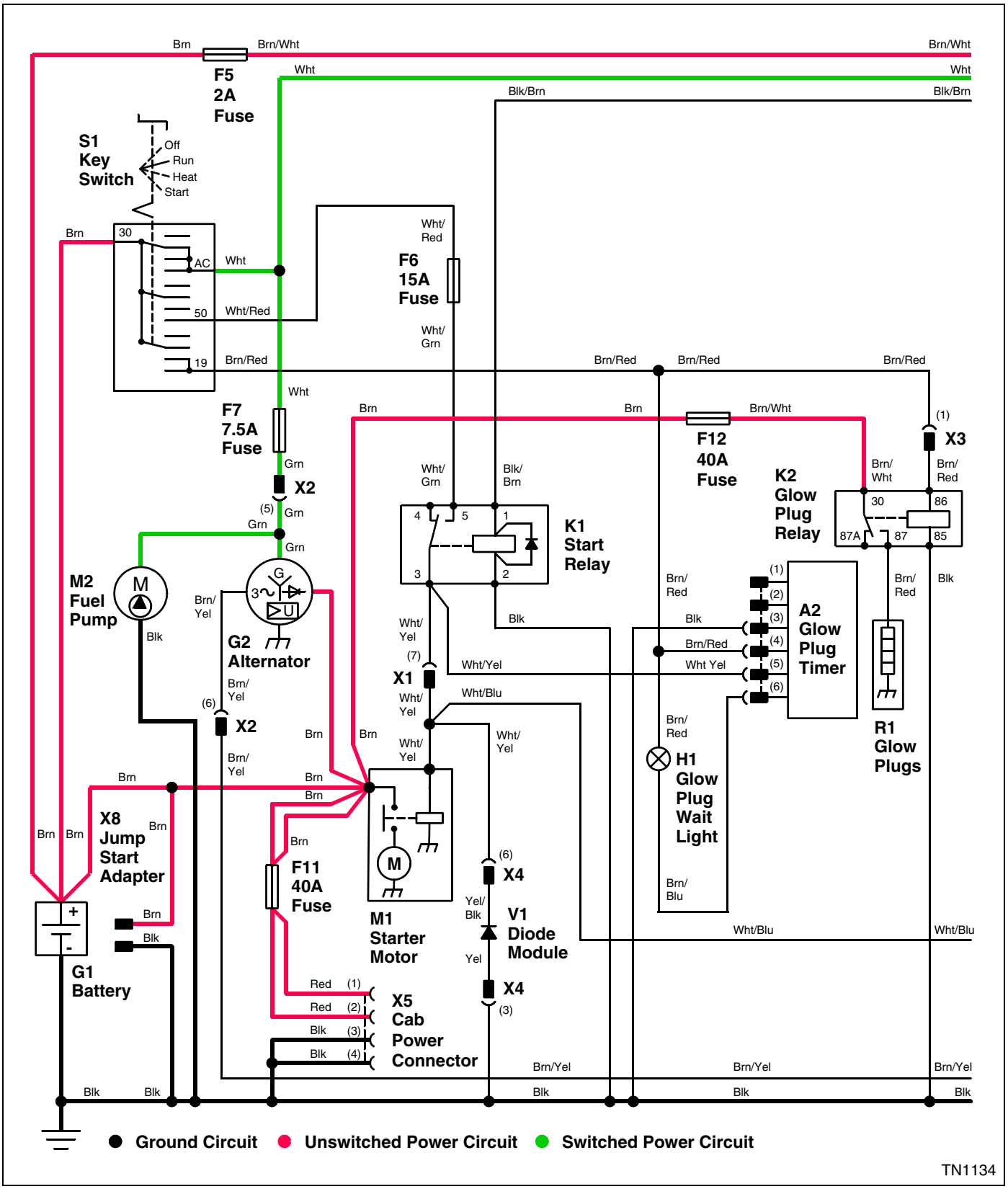

Figure 4-8

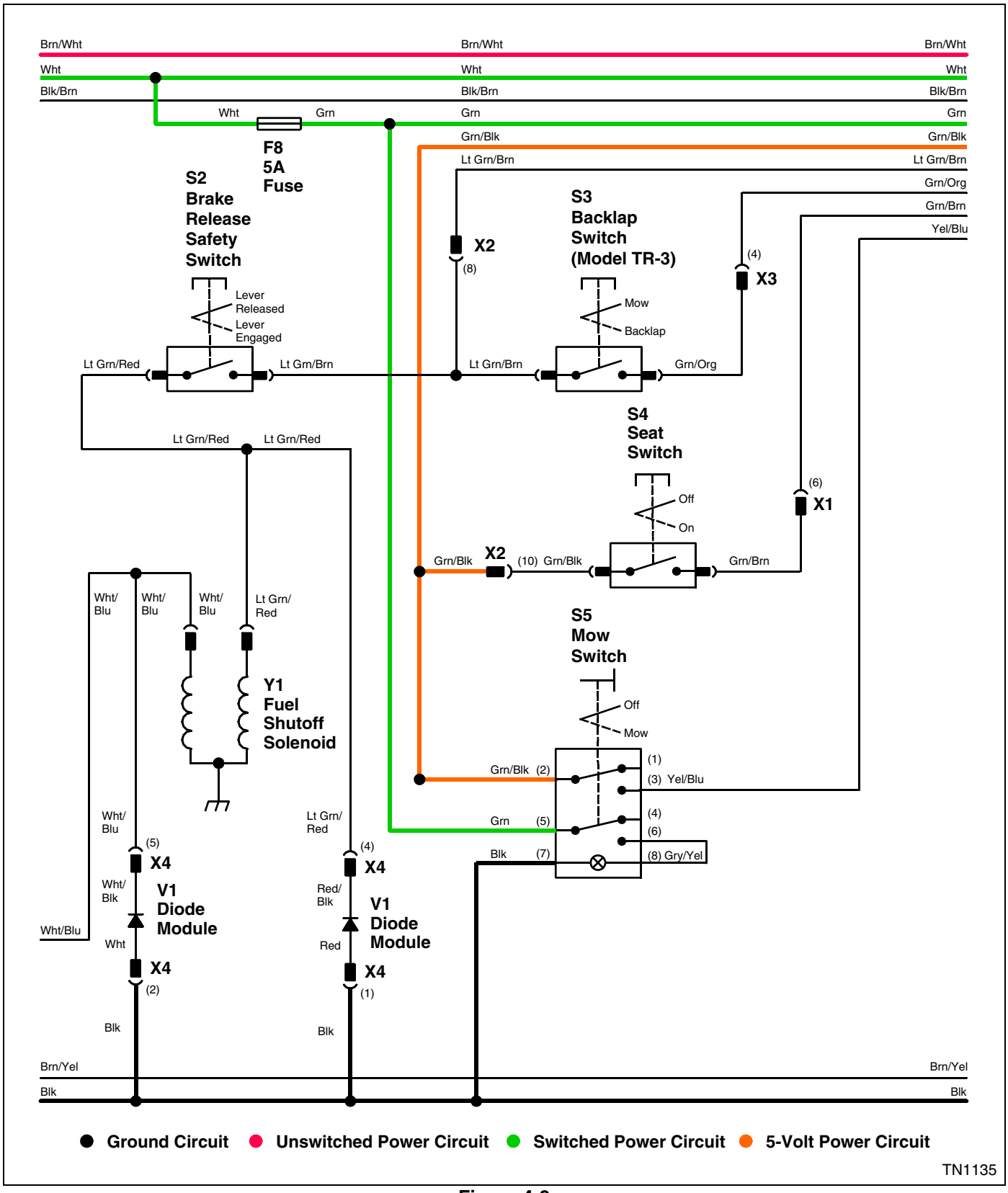
Brn/Wht
Wht
Blk/Brn
Grn
Grn/Blk
Lt Grn/Brn
Grn/Org
Grn/Brn
Yel/Blu
F8
5A
Fuse
S2
Brake
Release
Safety
Switch
Lever
Released
Lever
Engaged
Lt Grn/Red
X2
(8)
S3
Backlap
Switch
(Model TR-3)
Mow
Backlap
(4)
X3
Grn/Org
S4
Seat
Switch
Off
On
(6)
X1
(10) Grn/Blk
S5
Mow
Switch
Off
Mow
(1)
(3) Yel/Blu
(4)
(6)
(8) Gry/Yel
Wht/
Blu
Lt Grn/
Red
Y1
Fuel
Shutoff
Solenoid
(5)
X4
V1
Diode
Module
Wht/Blu
Red/
Blk
Red
(2)
(1)
Blk
Brn/Yel
Ground Circuit
Unswitched Power Circuit
Switched Power Circuit
5-Volt Power Circuit
TN1135

Figure 4-9

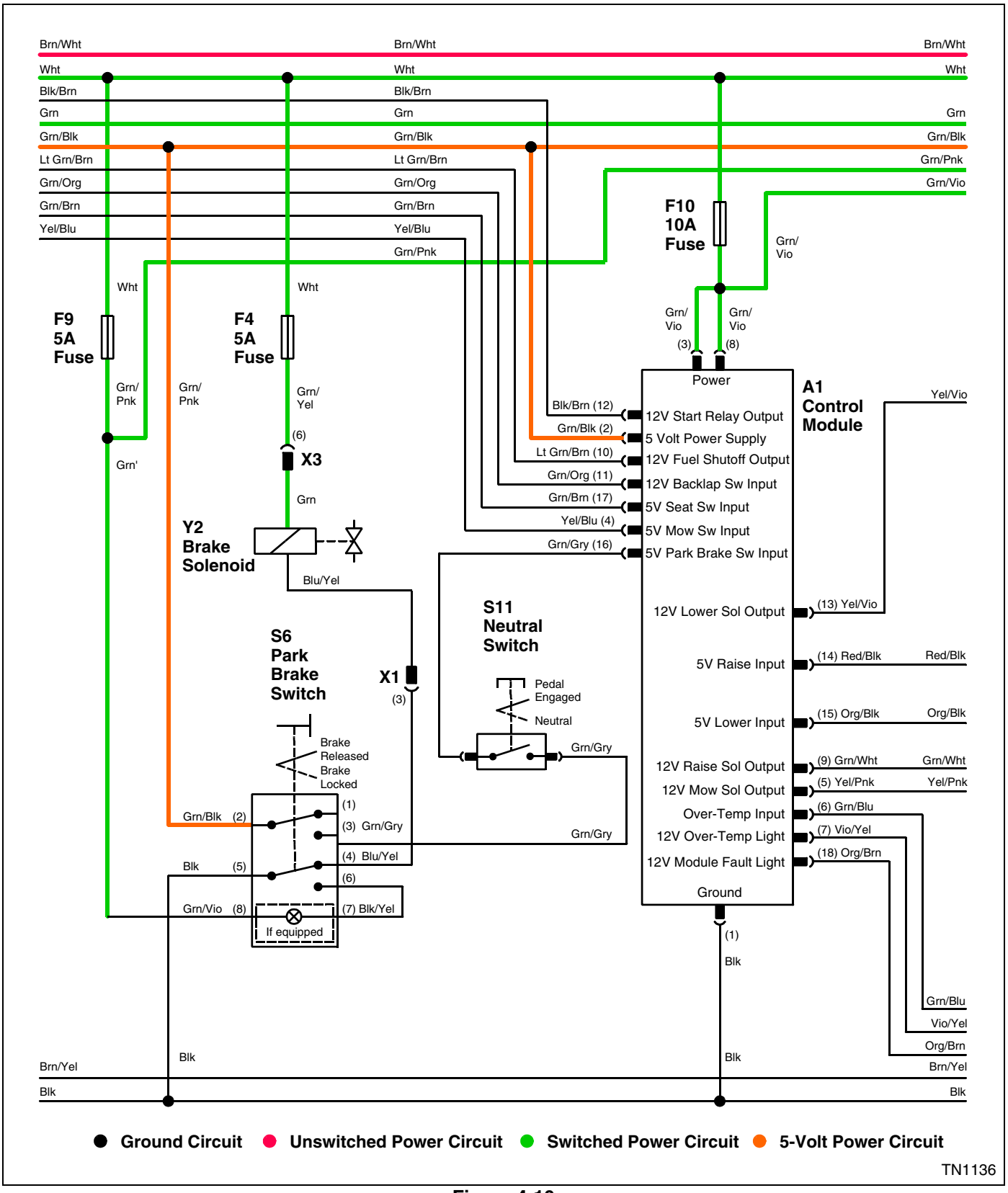
Brn/Wht
Wht
Blk/Brn
Grn
Grn/Blk
Lt Grn/Brn
Grn/Org
Grn/Brn
Yel/Blu
Grn/Pnk
Grn/Vio
F10
10A
Fuse
F9
5A
Fuse
F4
5A
Fuse
Grn/
Pnk
Grn/
Yel
Grn'
(6)
X3
Y2
Brake
Solenoid
Blu/Yel
S6
Park
Brake
Switch
X1
(3)
Brake
Released
Brake
Locked
Grn/Blk (2)
(1)
(3) Grn/Gry
(4) Blu/Yel
Blk (5)
(6)
Grn/Vio (8)
(7) Blk/Yel
If equipped
S11
Neutral
Switch
Pedal
Engaged
Neutral
Grn/Gry
Power
A1
Control
Module
Blk/Brn (12)
12V Start Relay Output
Grn/Blk (2)
5 Volt Power Supply
Lt Grn/Brn (10)
12V Fuel Shutoff Output
Grn/Org (11)
12V Backlap Sw Input
Grn/Brn (17)
5V Seat Sw Input
Yel/Blu (4)
5V Mow Sw Input
Grn/Gry (16)
5V Park Brake Sw Input
12V Lower Sol Output
(13) Yel/Vio
5V Raise Input
(14) Red/Blk
Red/Blk
5V Lower Input
(15) Org/Blk
Org/Blk
12V Raise Sol Output
(9) Grn/Wht
Grn/Wht
12V Mow Sol Output
(5) Yel/Pnk
Yel/Pnk
Over-Temp Input
(6) Grn/Blu
12V Over-Temp Light
(7) Vio/Yel
12V Module Fault Light
(18) Org/Brn
Ground
(1)
Blk
Grn/Blu
Vio/Yel
Org/Brn
Brn/Yel
Blk
Ground Circuit
Unswitched Power Circuit
Switched Power Circuit
5-Volt Power Circuit
TN1136

Figure 4-10

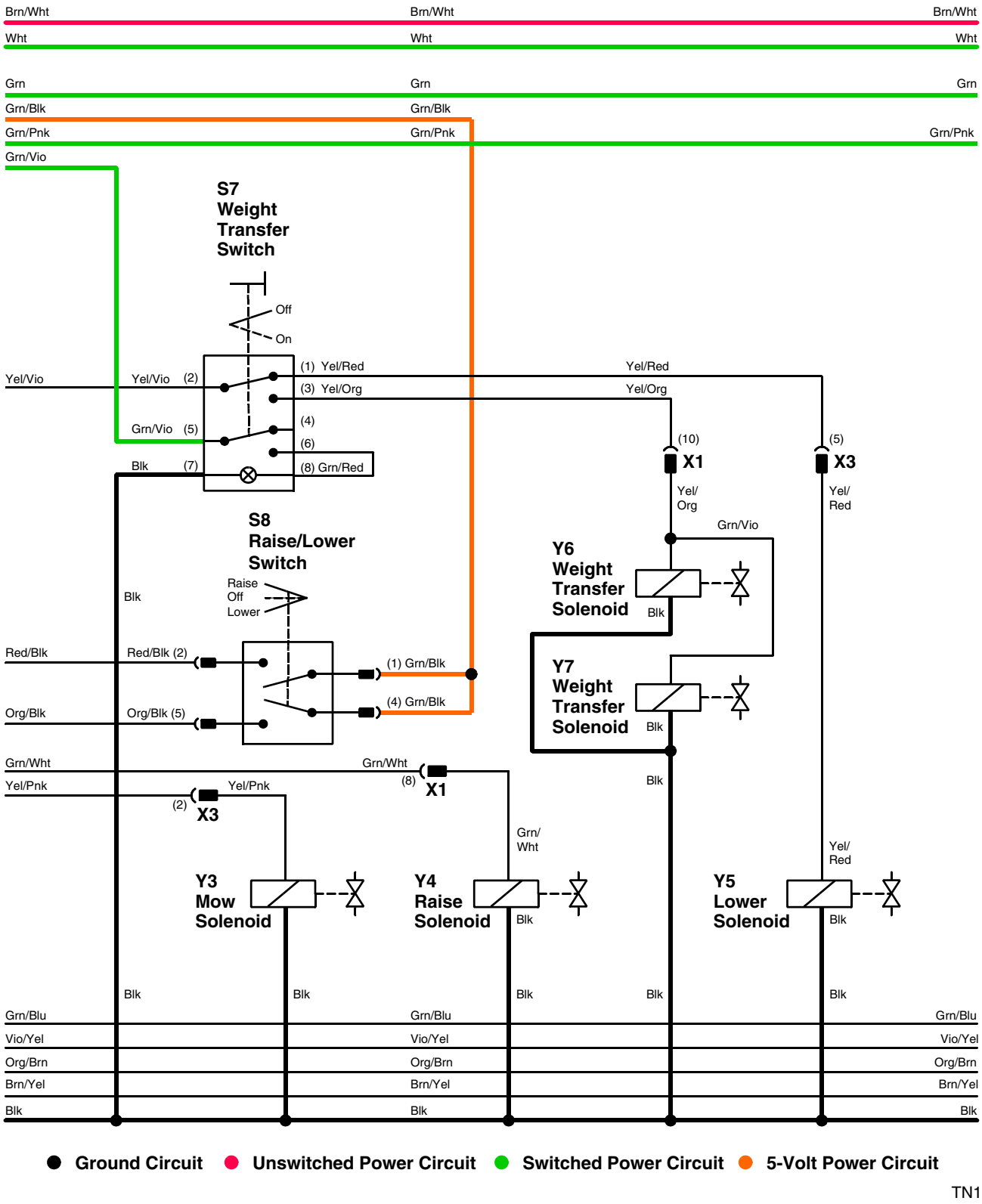
Brn/Wht
Wht
Grn
Grn/Blk
Grn/Pnk
Grn/Vio
S7
Weight
Transfer
Switch
Off
On
Yel/Vio
(1) Yel/Red
(3) Yel/Org
Grn/Vio (5)
(4)
(6)
Blk (7)
(8) Grn/Red
S8
Raise/Lower
Switch
Raise
Off
Lower
Red/Blk
Red/Blk (2)
(1) Grn/Blk
Org/Blk
Org/Blk (5)
(4) Grn/Blk
Grn/Wht
Yel/Pnk
(2)
X3
(8)
X1
(10)
X1
(5)
X3
Yel/
Org
Yel/
Red
Grn/Vio
Y6
Weight
Transfer
Solenoid
Y7
Weight
Transfer
Solenoid
Blk
Grn/
Wht
Y3
Mow
Solenoid
Y4
Raise
Solenoid
Y5
Lower
Solenoid
Grn/Blu
Vio/Yel
Org/Brn
Brn/Yel
Ground Circuit
Unswitched Power Circuit
Switched Power Circuit
5-Volt Power Circuit
TN1137

Figure 4-11

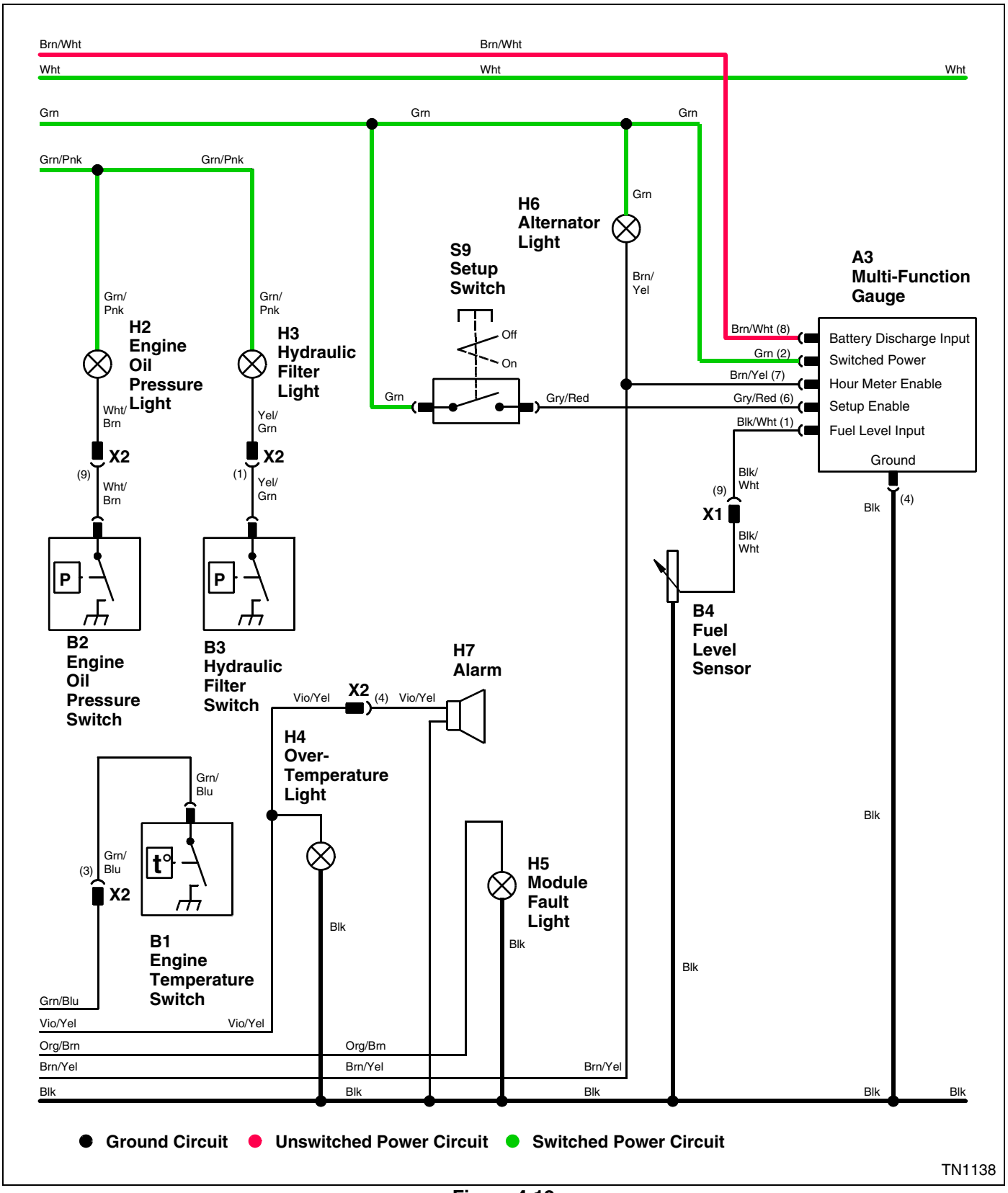
Brn/Wht
Brn/Wht
Wht
Wht
Wht
Grn
Grn
Grn
Grn/Pnk
Grn/Pnk
Grn
H6
Alternator
Light
S9
Setup
Switch
Brn/
Yel
A3
Multi-Function
Gauge
Grn/
Pnk
Grn/
Pnk
H2
Engine
Oil
Pressure
Light
H3
Hydraulic
Filter
Light
Off
On
Brn/Wht (8)
Battery Discharge Input
Grn (2)
Switched Power
Brn/Yel (7)
Hour Meter Enable
Grn
Gry/Red
Gry/Red (6)
Setup Enable
Blk/Wht (1)
Fuel Level Input
Ground
Wht/
Brn
X2
(9)
Wht/
Brn
Yel/
Grn
X2
(1)
Yel/
Grn
Blk/
Wht
(9)
X1
Blk/
Wht
Blk
(4)
P
P
B2
Engine
Oil
Pressure
Switch
B3
Hydraulic
Filter
Switch
B4
Fuel
Level
Sensor
H7
Alarm
Vio/Yel
X2
(4)
Vio/Yel
H4
Over-
Temperature
Light
Grn/
Blu
Grn/
Blu
(3)
X2
t°
B1
Engine
Temperature
Switch
Blk
H5
Module
Fault
Light
Blk
Blk
Blk
Grn/Blu
Vio/Yel
Vio/Yel
Org/Brn
Org/Brn
Brn/Yel
Brn/Yel
Brn/Yel
Blk
Blk
Blk
Blk
Blk
Ground Circuit
Unswitched Power Circuit
Switched Power Circuit
TN1138

Figure 4-12

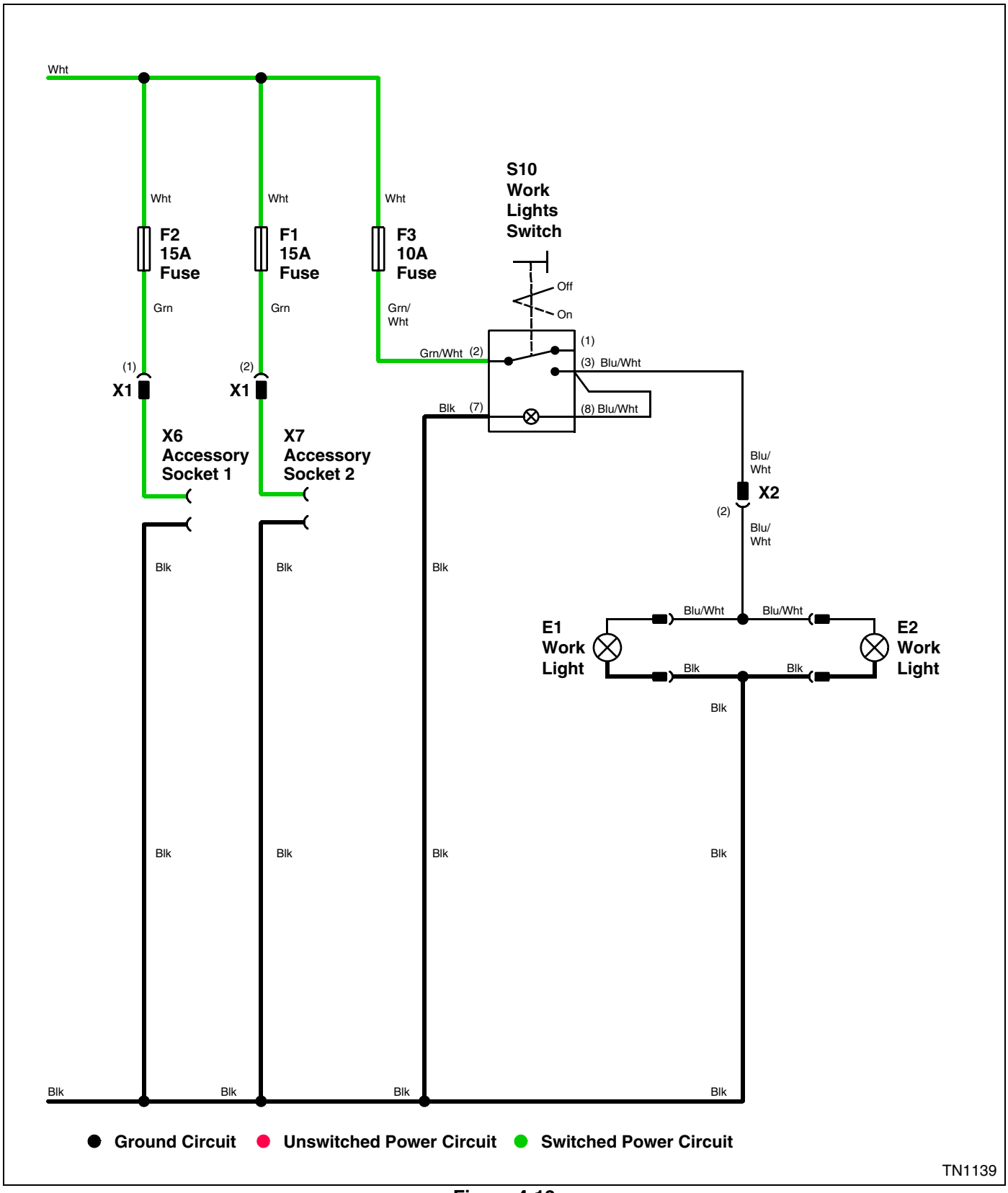
Wht
Wht
Wht
Wht
F2
15A
Fuse
F1
15A
Fuse
F3
10A
Fuse
S10
Work
Lights
Switch
Off
On
Grn
Grn
Grn/
Wht
Grn/Wht
(2)
(1)
(3) Blu/Wht
(8) Blu/Wht
Blk
(7)
(1)
X1
(2)
X1
X6
Accessory
Socket 1
X7
Accessory
Socket 2
Blu/
Wht
X2
(2)
Blu/
Wht
Blk
Blk
Blk
Blu/Wht
Blu/Wht
E1
Work
Light
E2
Work
Light
Blk
Blk
Blk
Blk
Blk
Blk
Blk
Blk
Blk
Blk
Ground Circuit
Unswitched Power Circuit
Switched Power Circuit
TN1139

Figure 4-13

Charging Circuit—Theory of Operation

With the engine running and the key switch in the run position, current flows from key switch terminal AC through 7.5-amp fuse F7 to the alternator field terminal, exciting the alternator. With the alternator field 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 voltage is low, current flows from the voltage regulator to the battery, charging the battery. When the battery is fully charged, the regulator stops providing current to the battery.

Unswitched power is available to multi-function gauge terminal 8 through 2-amp fuse F5.

With the key switch in the run position current flows through 5-amp fuse F8 to multi-function gauge terminal 2, powering up the gauge. Voltage is also available from fuse F8 to alternator light H6.

When the key switch is in the run position and with the engine off, the voltage regulator detects zero output voltage from the alternator and provides a ground to the alternator light circuit. With the alternator light circuit grounded, current flows through the alternator light, turning on the light. Ground is also provided from the voltage regulator to the multi-function gauge hour meter enable input terminal. With the input terminal grounded, the multi-function gauge is prevented from logging hours on the hour meter.

When the engine is running, and the alternator is operating correctly, the voltage regulator does not provide ground to the alternator light circuit and the alternator light is off. With the alternator light circuit not grounded, voltage is provided to the multi-function gauge hour meter enable input terminal through the filament of the alternator light, activating the input. With the input activated, the hour meter begins logging hours.

With the engine running, and when the voltage regulator detects low output voltage from the alternator, the voltage regulator provides a ground to the alternator light circuit. This turns on the alternator light and the hour meter stops logging hours.

Charging Circuit Schematic

See Figure 4-14.

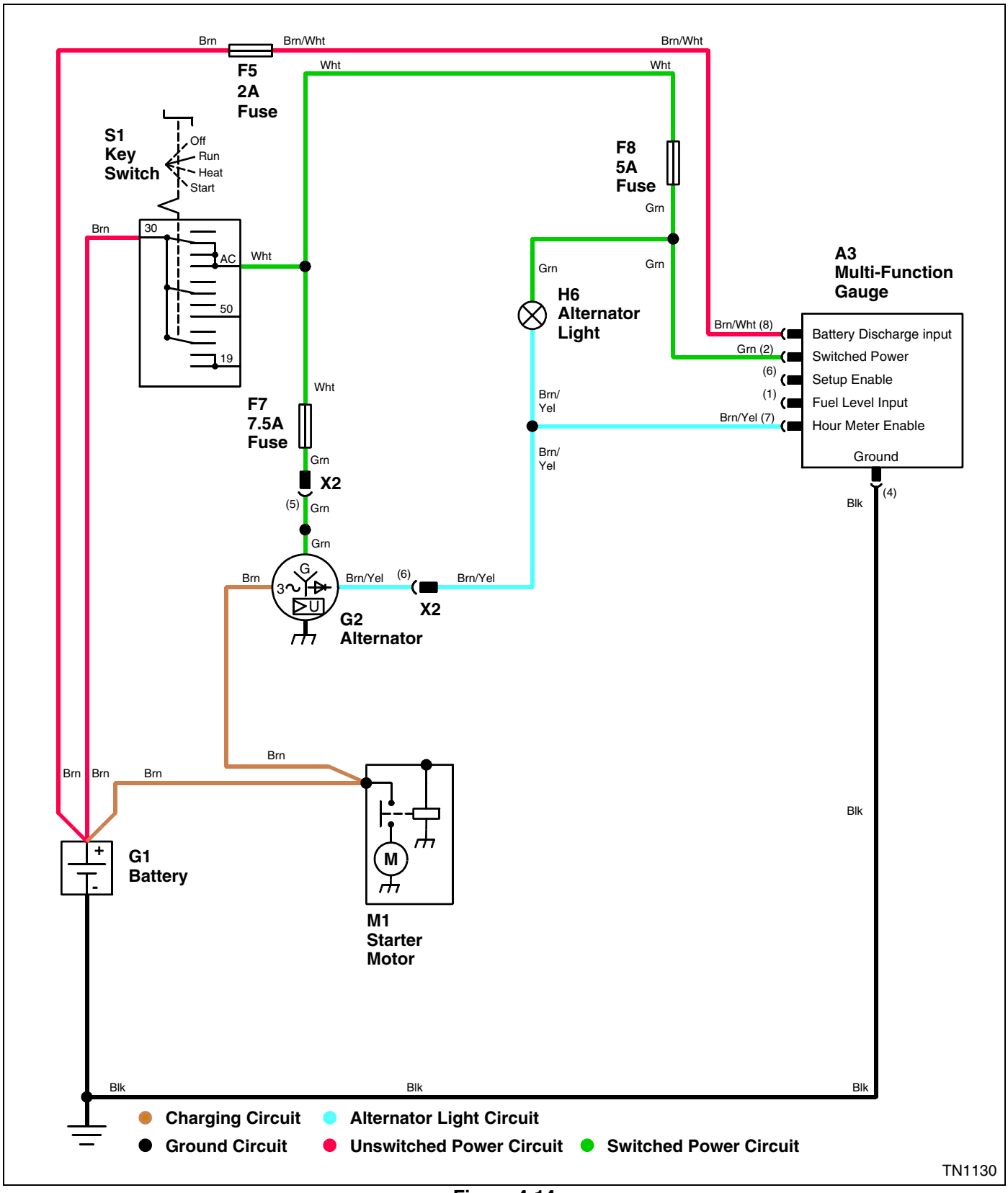

Figure 4-14

Glow Plug Circuit—Theory of Operation

When the key switch is turned and held in the glow position, voltage is available from key switch terminal 19 to glow plug wait light H1. Current also flows from key switch terminal 19 to glow plug timer terminal 4, turning on the timer.

With the glow plug timer on, a ground is provided from glow plug timer terminal 6 to the glow plug wait light, turning on the light for approximately 5 seconds.

Unswitched power is available to glow plug relay terminal 30 from 40-amp fuse F12. While the key switch is held in the glow position, current also flows from key switch terminal 19 to glow plug relay terminal 86, energizing the relay. With the relay energized, current flows between relay contacts 30 and 87 to the glow plugs, heating the glow plugs.

When the wait light goes off, the operator turns the key switch to the start position to crank the engine. With the key switch in the start, position current continues to flow from key switch terminal 19 to the glow plug circuit. The glow plugs continue to heat until the key switch is released to the run position.

If the key switch is turned to the start position before the glow plug wait light times out, the start circuit will cancel the wait light circuit. (See “Start Circuit—Theory of Operation” on page 4-29.)

Glow Plug Circuit Schematic

See Figure 4-15.

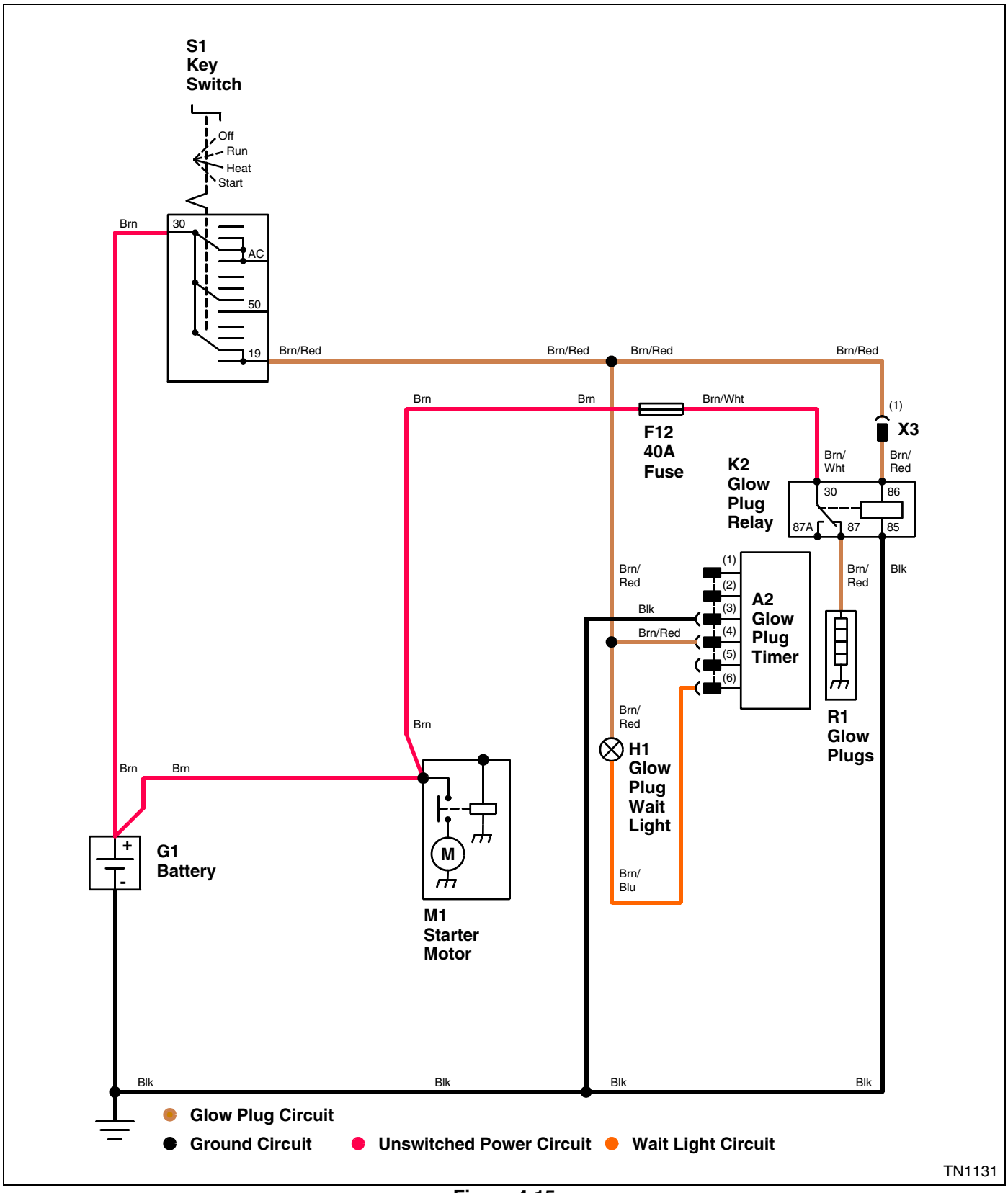

Figure 4-15

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Start Circuit—Theory of Operation

Power Circuit

Unswitched power is available to key switch terminal 30 and 40-amp fuse F12. When the key switch is turned to the run position, current flows from the AC terminal of the key switch through 10-amp fuse F10 to control module terminals 3 and 8, powering up the module. With the control module powered up, pin 2 of the control module now provides 5 volts to the seat switch and park brake switch.

Start Relay Circuit

Start relay K1 must be energized before current can flow from the key switch to the starter motor solenoid. To energize the start relay the following must occur:

- Operator on the seat
- Park brake switch in the locked position
- Drive pedal in the neutral position
- Mow switch in the off position

When the operator is on the seat, the seat switch contacts close. With the seat switch contacts closed, voltage is provided to control module 5V seat switch input, activating the input.

When park brake switch is in the locked position and the neutral switch is in the neutral position, voltage is provided to the control module 5V park brake switch input, activating the input.

When the mow switch is in the off position, the control module 5V mow switch input is de-activated. (See “Mow Circuit—Theory of Operation” on page 4-38.).

With the control module's 5V seat and 5V park brake switch inputs activated and the 5V mow switch input de-activated, the control module's 12V start relay output terminal provides voltage to start relay terminal 1, energizing the relay.

Start Circuit

With the start relay energized and when the key switch is turned to the start position, current flows from key switch terminal 50 to the starter motor solenoid, energizing the solenoid. To energize the starter solenoid, current flows from key switch terminal 50 to the following components:

- 15 amp fuse F6
- Start relay terminals 5 and 3
- Console connector X1, terminal 7
- Starter solenoid terminal

With the starter solenoid energized, current flows between the starter solenoid contacts to the starter motor, engaging the motor.

Diode module V1 conducts to ground the reverse voltage generated when the starter solenoid is de-energized.

Current also flows from the start circuit to glow plug timer terminal 4, activating the input. With the input activated and terminal 6 grounded, the glow plug timer cancels, interrupting the light circuit. Current also flows to the glow plug circuit. (See “Glow Plug Circuit—Theory of Operation” on page 4-26.)

With the key switch in the start position, current also flows to the fuel shutoff solenoid pull-in coil, energizing the coil. With the pull-in coil energized, the fuel shutoff solenoid plunger retracts. The pull-in coil is a high-current winding and is energized only when the key switch is in the start position.

When the key switch is released to the run position, the fuel shutoff solenoid hold-in coil keeps the plunger in the retracted position. (See “Run Circuit—Theory of Operation” on page 4-32.)

Start Circuit Schematic

See Figures 4-16 and 4-17.

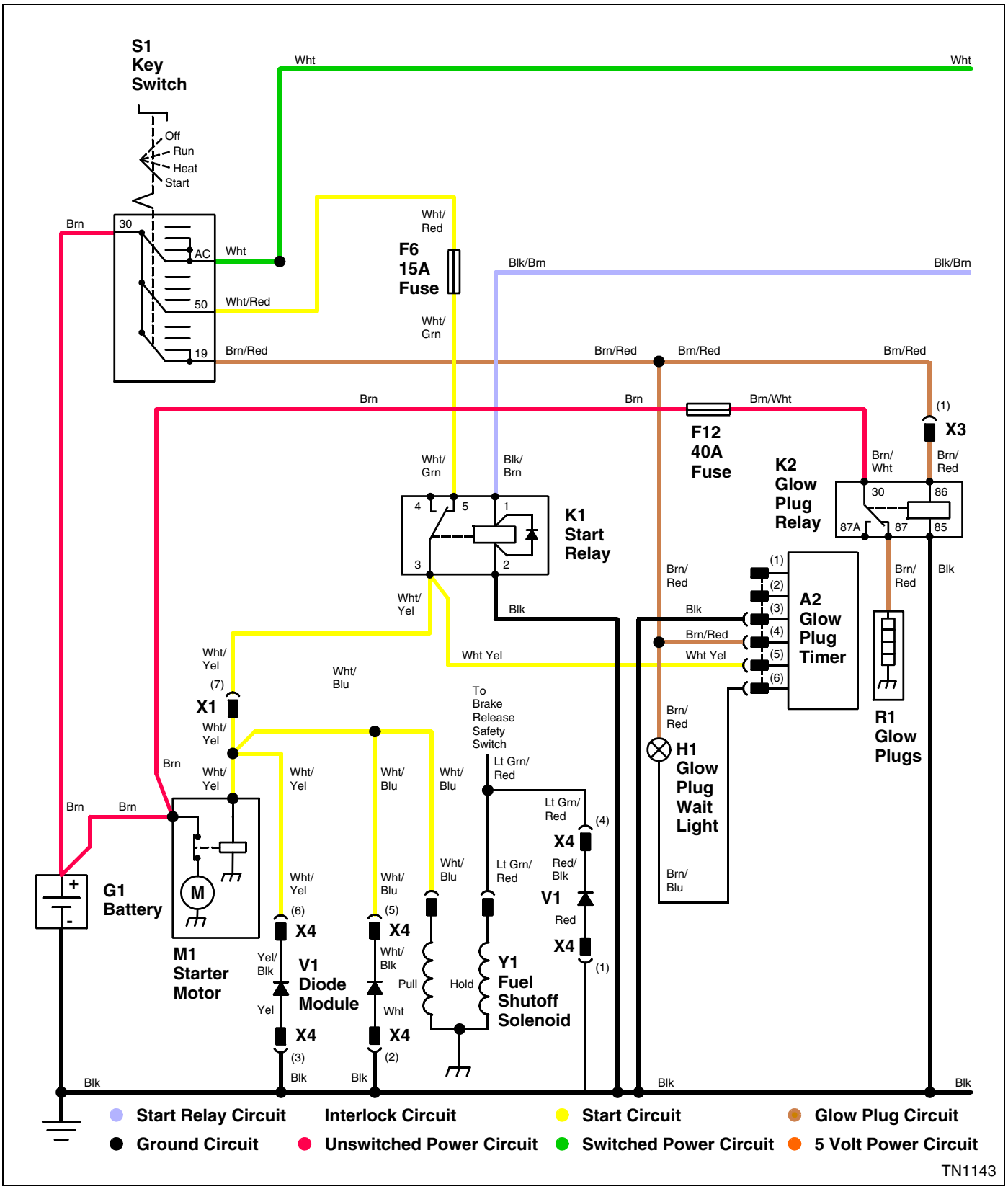

Figure 4-16

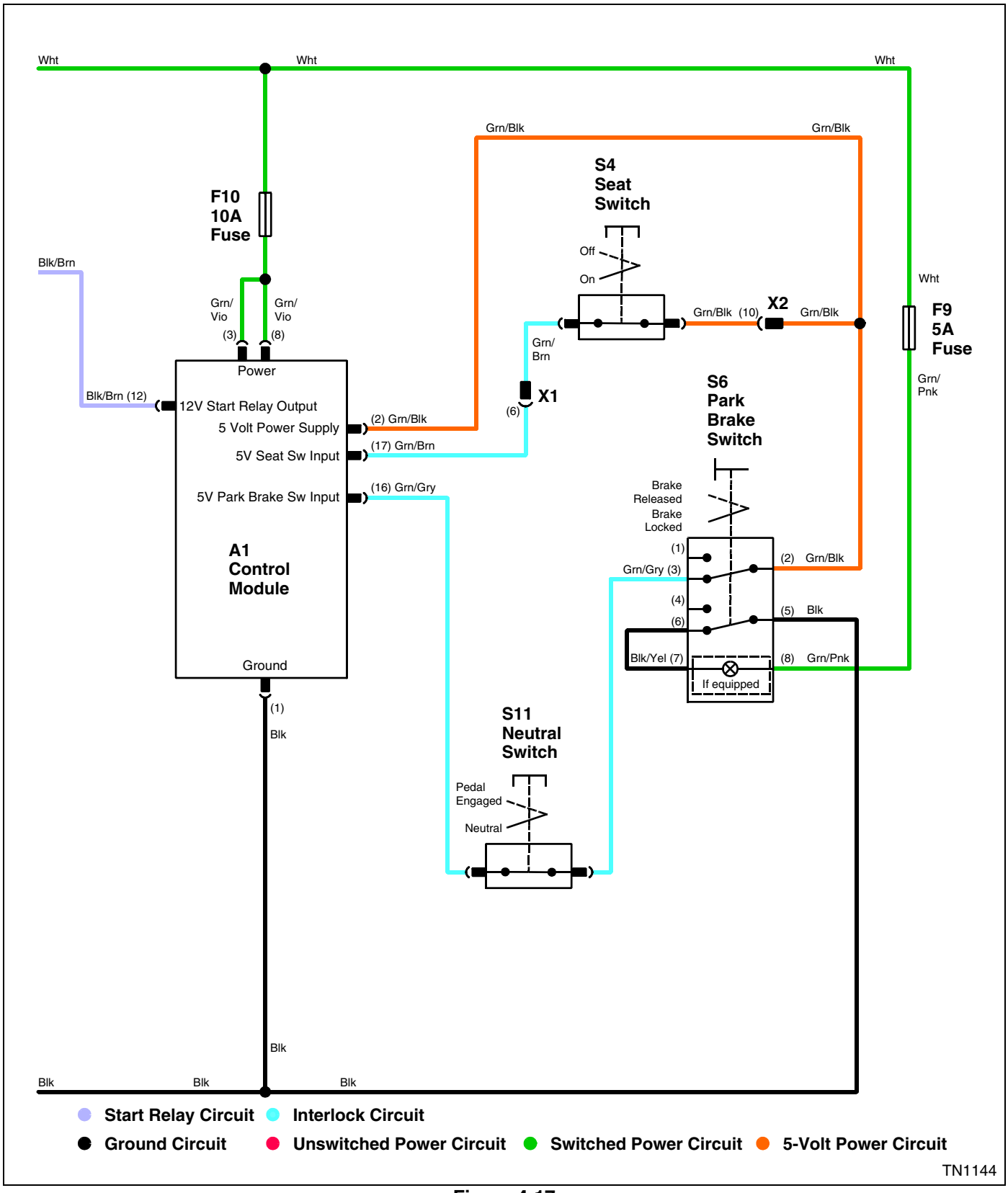
Wht
Wht
Wht
Grn/Blk
Grn/Blk
S4
Seat
Switch
F10
10A
Fuse
Off
On
Blk/Brn
Grn/
Vio
Grn/
Vio
(3)
(8)
Grn/Blk (10)
X2
Grn/Blk
Wht
F9
5A
Fuse
Grn/
Pnk
Grn/
Brn
X1
(6)
Power
Blk/Brn (12)
12V Start Relay Output
5 Volt Power Supply
5V Seat Sw Input
5V Park Brake Sw Input
(2) Grn/Blk
(17) Grn/Brn
(16) Grn/Gry
S6
Park
Brake
Switch
Brake
Released
Brake
Locked
(1)
(2) Grn/Blk
Grn/Gry (3)
(4)
(6)
(5) Blk
Blk/Yel (7)
(8) Grn/Pnk
If equipped
A1
Control
Module
Ground
(1)
Blk
S11
Neutral
Switch
Pedal
Engaged
Neutral
Blk
Blk
Blk
Blk
Start Relay Circuit
Interlock Circuit
Ground Circuit
Unswitched Power Circuit
Switched Power Circuit
5-Volt Power Circuit
TN1144

Figure 4-17

Run Circuit—Theory of Operation

Power Circuit

Unswitched power is available to key switch terminal 30. When the key switch is turned to the run position, current flows from the AC terminal of the key switch through 10-amp fuse F10 to control module terminals 3 and 8, powering up the module. With the control module powered up, the control module now provides 5 volts to the seat switch and park brake switch.

Run Circuit–On Seat

When the operator is on the seat, the seat switch contacts close. With the seat switch contacts closed, voltage is provided to control module 5V seat switch input, activating the input. With the input activated, current flows from control module 12V fuel shutoff output terminal 10 through the brake release safety switch to the hold-in side of the fuel shutoff solenoid, energizing the solenoid. With the solenoid energized, fuel is allowed to flow to the engine.

The control module will de-energize the fuel shutoff solenoid if the operator should leave the seat under the following conditions:

- The park brake switch is in the released position.
- The park brake switch is in the locked position and the drive pedal is not in the neutral position.

The control module will de-energize the fuel shutoff solenoid approximately 1.5 seconds after the seat switch contacts open. The time delay is to compensate for operating the machine over rough terrain.

Diode module V1 conducts to ground the reverse voltage generated when the fuel shutoff solenoid is de-energized.

Run Circuit–Off Seat

Before leaving the seat, the operator must place the park brake switch in the locked position and make sure the drive pedals are in their neutral positions.

With the park brake switch in the locked position and the neutral switch in the neutral position, voltage is provided to the control module 5V park brake switch input, activating the input. With the input activated, current continues to flow from control module 12V fuel shutoff solenoid output terminal to the hold-in side of the fuel shutoff solenoid, allowing the engine to continue to operate when the operator leaves the seat.

Brake Release Safety Switch

When the park brake release valve lever is placed in the released position, the brake release safety switch contacts open. With the switch contacts open, current is prevented from flowing to the hold-in side of the fuel shutoff solenoid, de-energizing the solenoid. This prevents the engine from running until the brake system is placed back into operation.

Run Circuit Schematic—On Seat

See Figure 4-18.

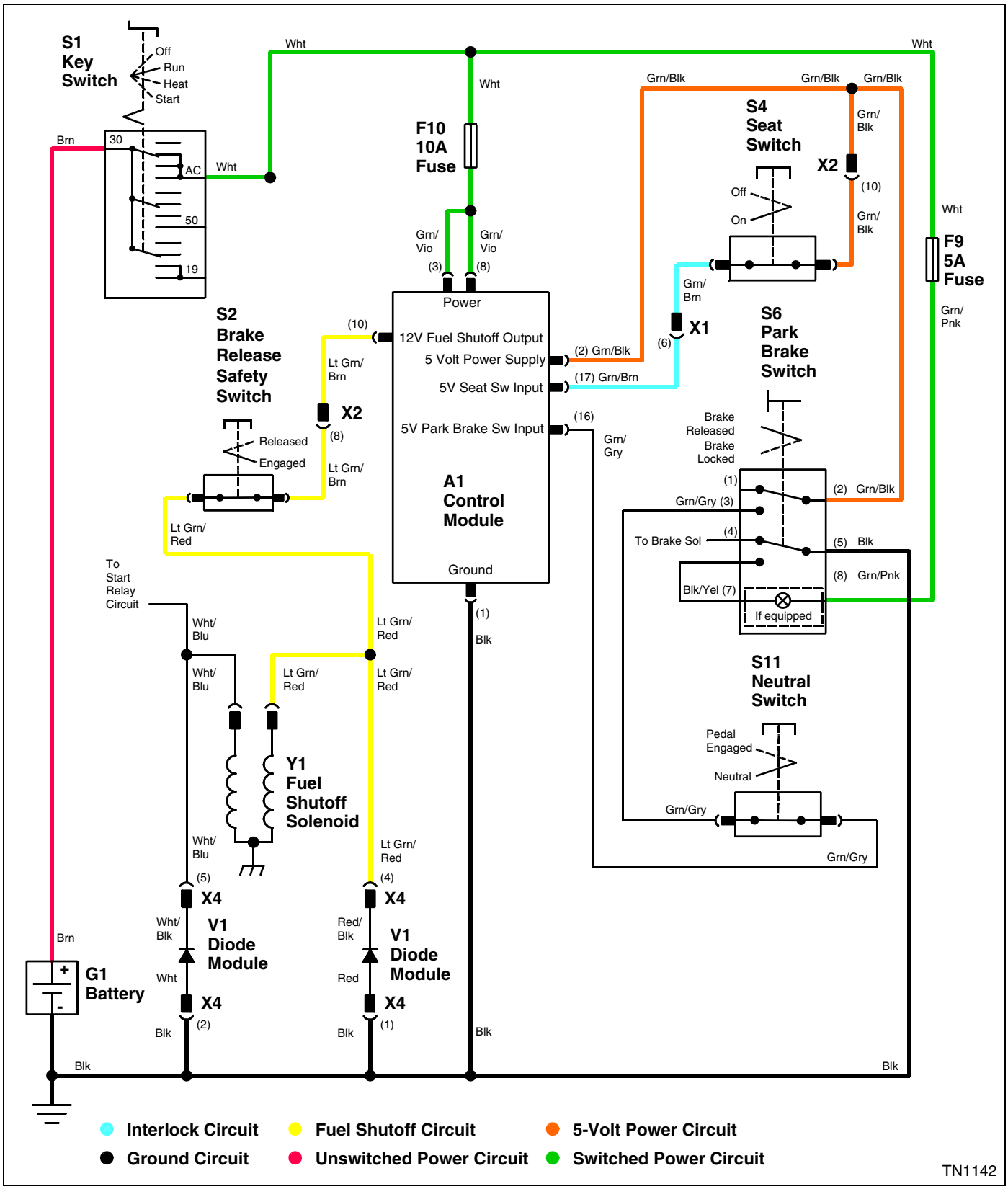

Figure 4-18

Run Circuit Schematic—Off Seat

See Figure 4-19.

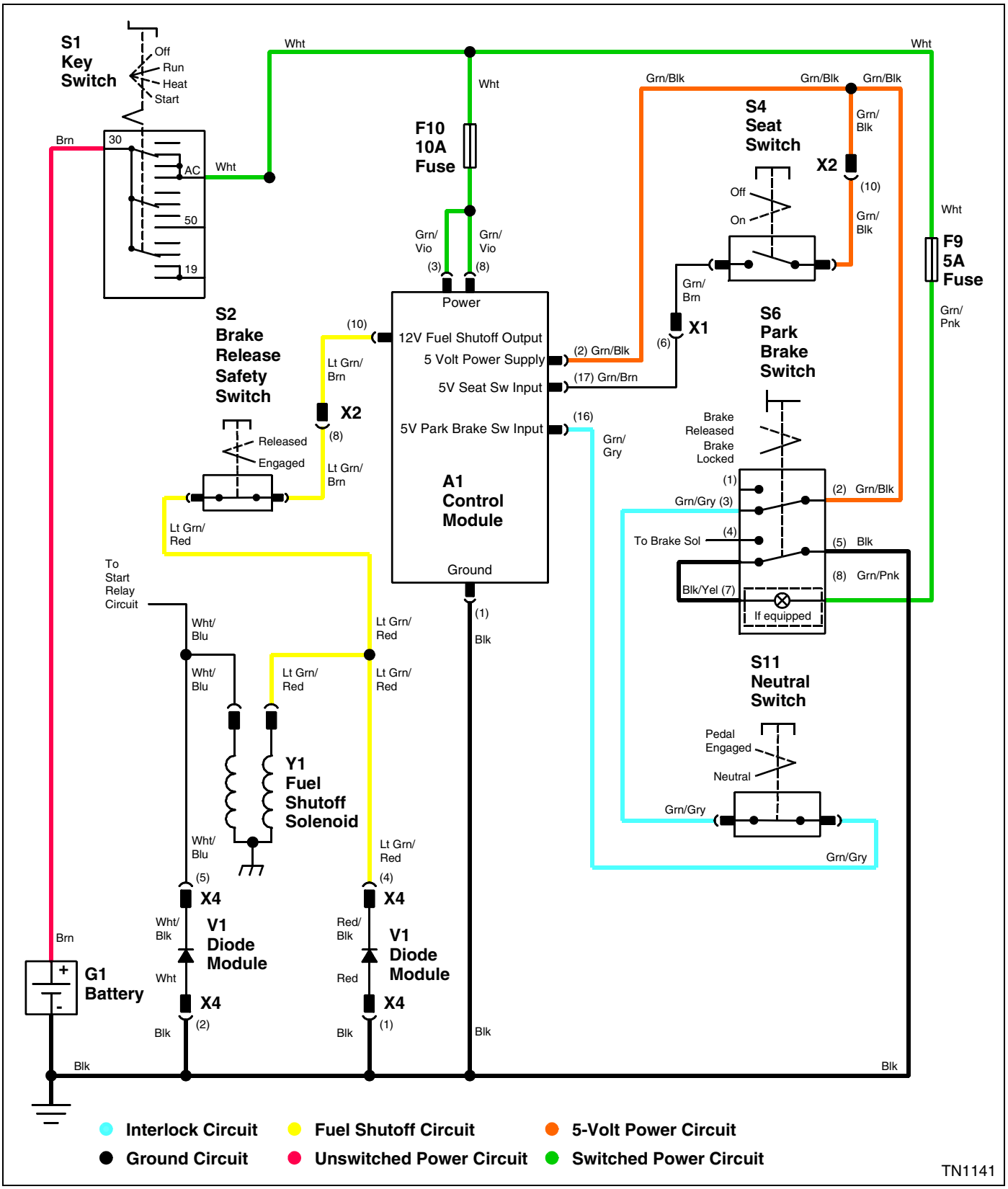

Figure 4-19

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Raise/Lower Circuit—Theory of Operation

Power Circuit

Unswitched power is available to key switch terminal 30. When the key switch is turned to the run position, current flows from the AC terminal of the key switch through 10-amp fuse F10 to control module terminals 3 and 8, powering up the module. With the control module powered up, the control module now provides 5 volts to the raise/lower switch.

Raise Circuit

When the raise/lower switch is placed in raise position, voltage is provided from the raise switch contacts to control module 5V raise switch input terminal 14, activating the input. With the input activated, current flows from control module 12V raise solenoid output terminal 9 to the raise solenoid, energizing the solenoid. With the solenoid energized, the cutting units will continue to rise until the raise/lower switch is released.

Lower Circuit

To energize the lower solenoid, the weight transfer switch must be in the off position.

When the raise/lower switch is momentarily placed in lower position, voltage is provided from the lower switch contacts to control module 5V lower switch input terminal 15, momentarily activating the input. With the input momentarily activated, current flows from control module 12V lower solenoid output terminal 13 through the weight transfer switch to the lower solenoid, energizing the solenoid. With the solenoid energized, the cutting units are lowered.

The control module output remains energized until the raise/lower switch is placed in the raise position.

Raise/Lower Circuit Schematic

See Figure 4-20.

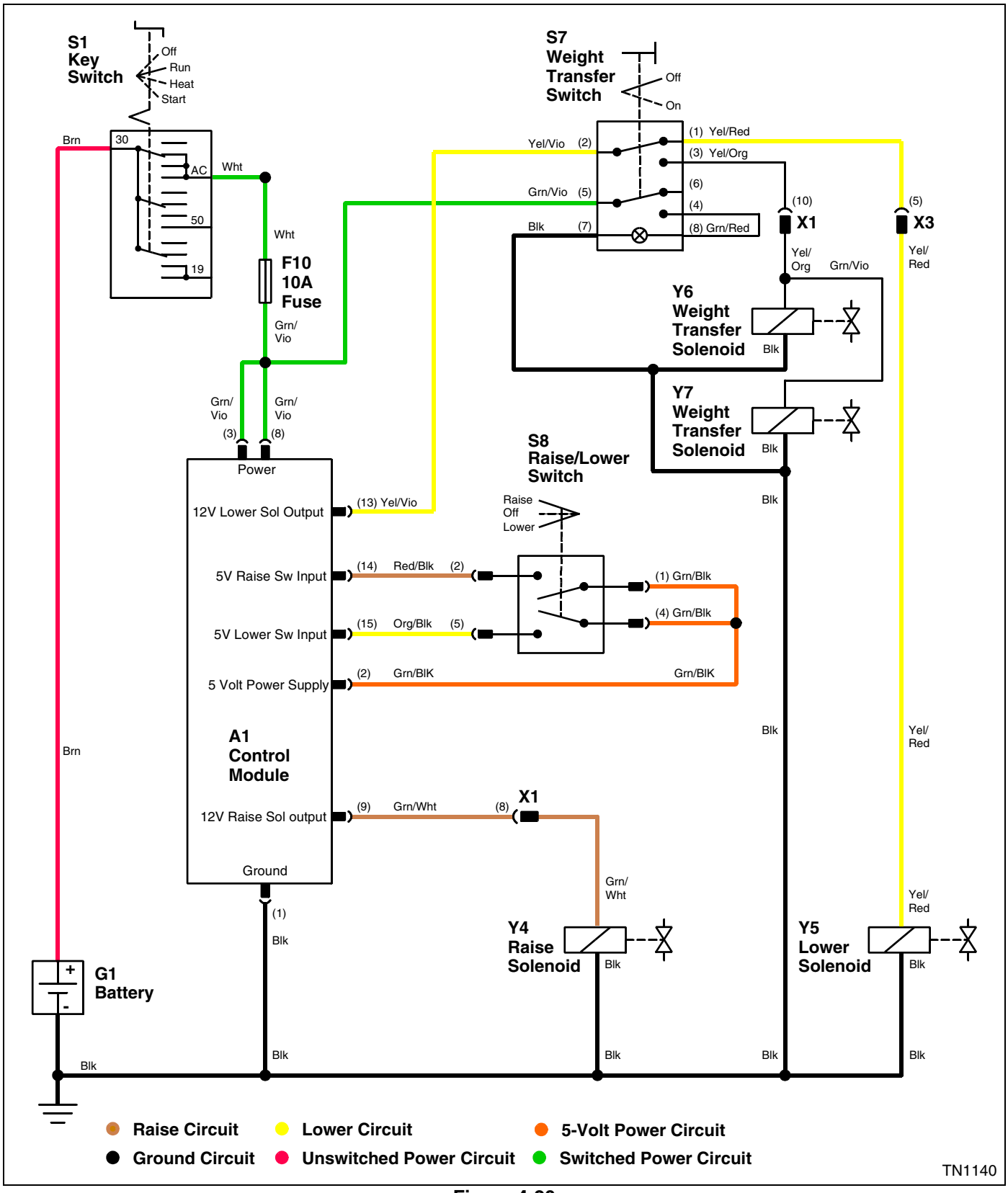

Figure 4-20

Mow Circuit—Theory of Operation

Power Circuit

Unswitched power is available to key switch terminal 30. When the key switch is turned to the run position, current flows from the AC terminal of the key switch through 10-amp fuse F10 to control module terminals 3 and 8, powering up the module. With the control module powered up, the control module now provides 5 volts to the mow switch.

Mow Circuit

When the mow switch is in the mow position, voltage is provided to the control module 5V mow switch input, activating the input. When the raise/lower switch is momentarily placed in the lower position, voltage is provided to the lower input, activating the input. (See “Raise/Lower Circuit—Theory of Operation” on page 4-36.)

With the 5V mow switch input activated and 5V lower switch input momentarily activated, current flows from 12V mow solenoid output terminal 5 to the mow solenoid, energizing the solenoid.

Mow Circuit Schematic

See Figure 4-21.

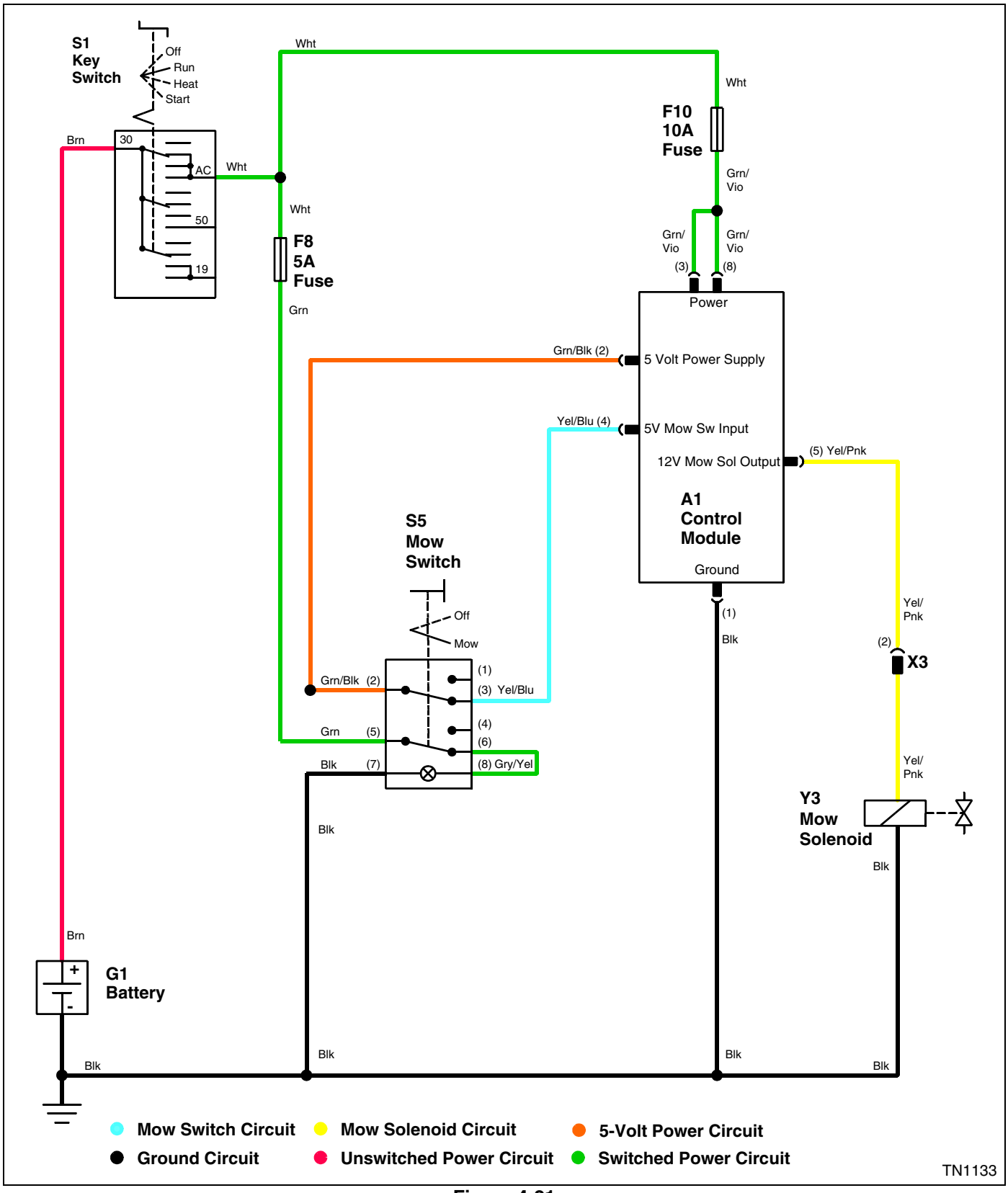

Figure 4-21

Park Brake Circuit—Theory of Operation

Power Circuit

Unswitched power is available to key switch terminal 30. When the key switch is turned to the run position, current flows from the AC terminal of the key switch through 10-amp fuse F10 to control module terminals 3 and 8, powering up the module and F4 5 amp fuse, providing power to the brake solenoid. With the control module powered up, the control module now provides 5 volts to the park brake switch.

Park Brake Circuit—Brake Released

When the park brake switch is in the brake released position, a ground is provided causing the brake solenoid to energize. With the solenoid energized, the park brake is released.

Park Brake Circuit—Brake Locked

When the park brake switch is in the brake lock position, ground is not provided to the park brake solenoid, de-energizing the solenoid. With the solenoid de-energized, the park brake is locked.

With the park brake switch is in the brake lock position, voltage is provided to the control module 5V park brake switch input, activating the input. (See “Run Circuit—Theory of Operation” on page 4-32.) and (See “Start Circuit—Theory of Operation” on page 4-29.)

Park Brake Circuit Schematic—Brake Released

See Figure 4-22.

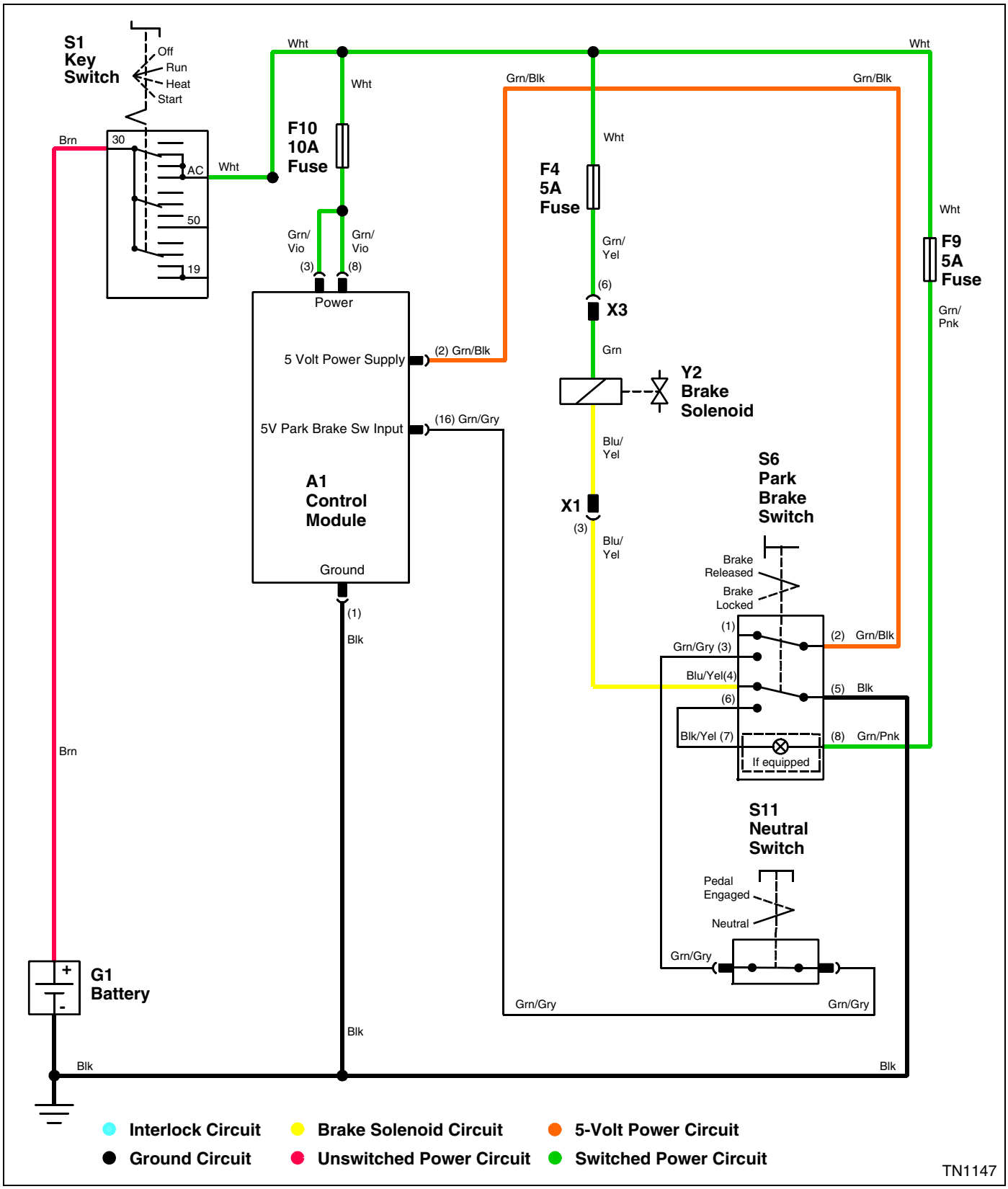

Figure 4-22

Park Brake Circuit Schematic—Brake Locked

See Figure 4-23.

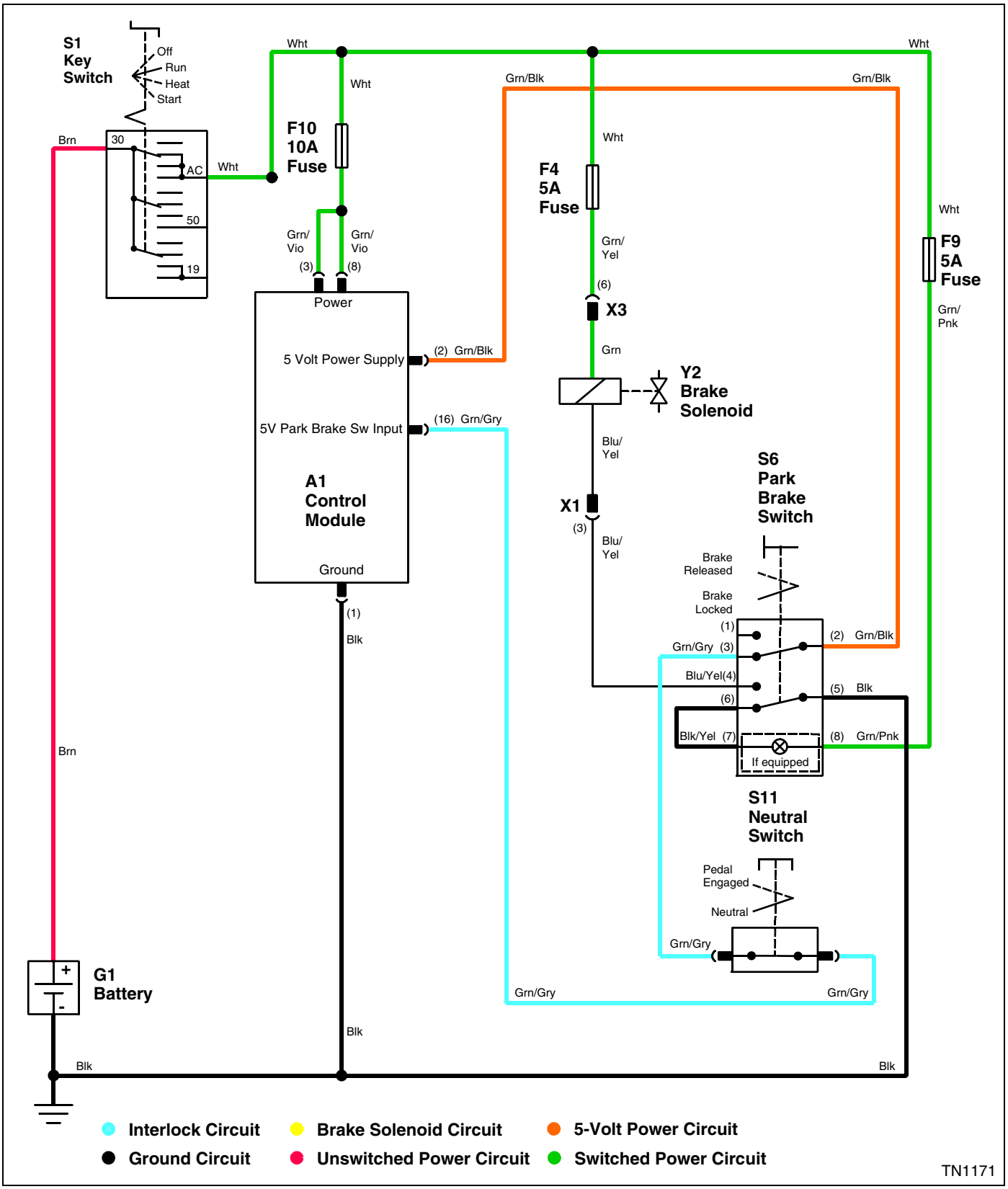

Figure 4-23

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Backlap Circuit Operation (Model TR-3)—Theory of Operation

Power Circuit

Unswitched power is available to key switch terminal 30. When the key switch is turned to the run position, current flows from the AC terminal of the key switch through 10-amp fuse F10 to control module terminals 3 and 8, powering up the module. With the control module powered up, the control module now provides 5 volts to the mow switch.

Backlap Circuit

Voltage is available from control module 12V fuel shutoff solenoid output terminal 10 to the backlap switch. (See “Run Circuit—Theory of Operation” on page 4-32.)

When the backlap switch is in the backlap position, voltage is provided to control module 12V backlap input, activating the input.

When the mow switch is in the mow position, voltage is provided to the control module 5V mow switch input, activating the input. When the raise/lower switch is momentarily placed in the lower position, voltage is provided to the lower input, activating the input. (See “Raise/Lower Circuit—Theory of Operation” on page 4-36.)

With the 5V mow switch input activated and 5V lower switch input momentarily activated, current flows from 12V mow solenoid output terminal 5 to the mow solenoid, energizing the solenoid.

Backlap Circuit Schematic (Model TR-3)

See Figure 4-24.

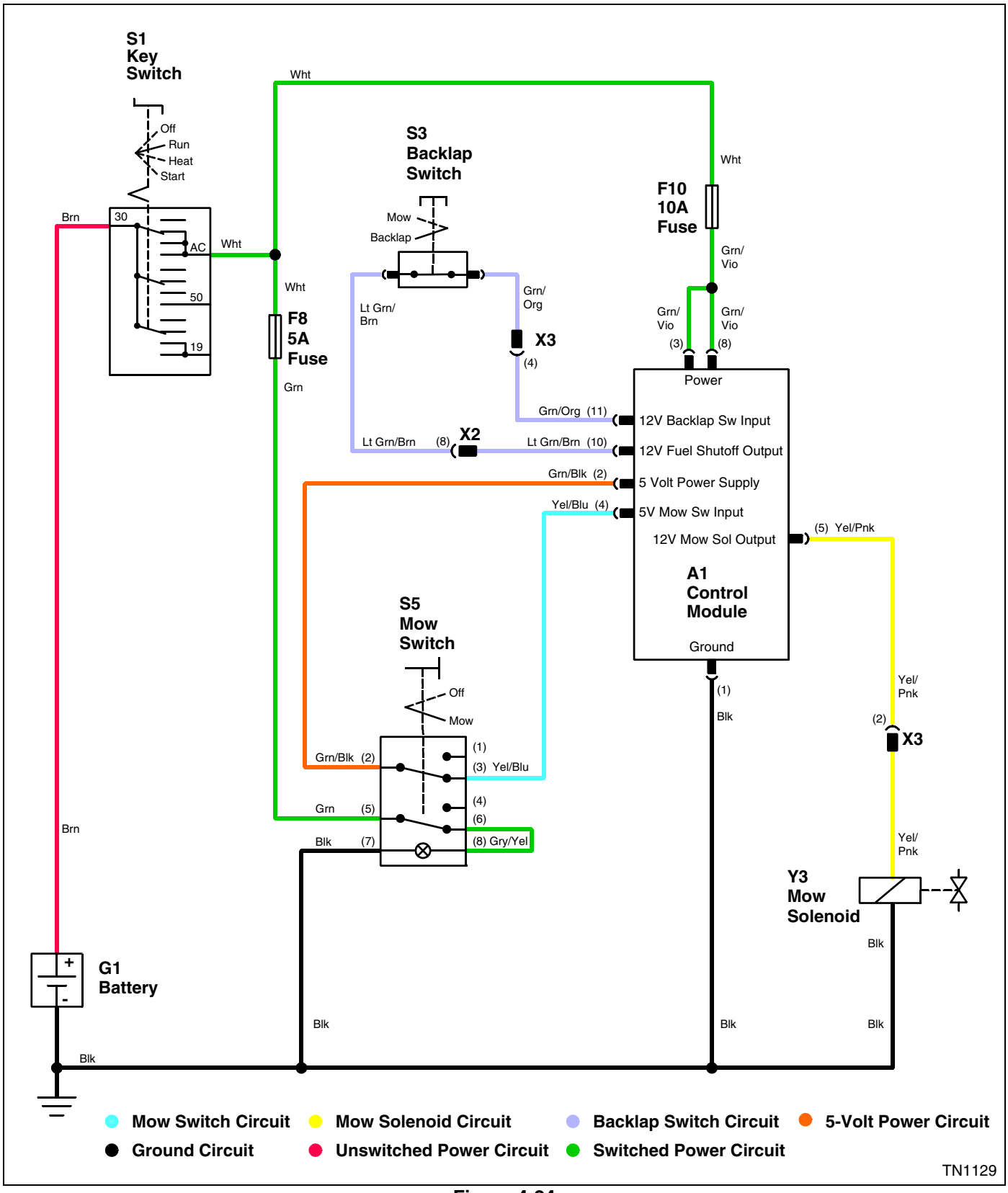

Figure 4-24

Weight Transfer Circuit—Theory of Operation

Power Circuit

Unswitched power is available to key switch terminal 30. When the key switch is turned to the run position, current flows from the AC terminal of the key switch through 10-amp fuse F10 to control module terminals 3 and 8, powering up the module. With the control module powered up, the control module now provides 5 volts to the raise/lower switch.

Weight Transfer Circuit

When the raise/lower switch is momentarily placed in the lower position control module 12V lower solenoid output provides voltage to the weight transfer switch. (See “Raise/Lower Circuit—Theory of Operation” on page 4-36.)

When the weight transfer switch is in the on position, current flows to the weight transfer solenoids, energizing the solenoids.

When the weight transfer switch is in the off position, current flows to the lower solenoid. (See “Raise/Lower Circuit—Theory of Operation” on page 4-36.)

Weight Transfer Circuit Schematic

See Figure 4-25.

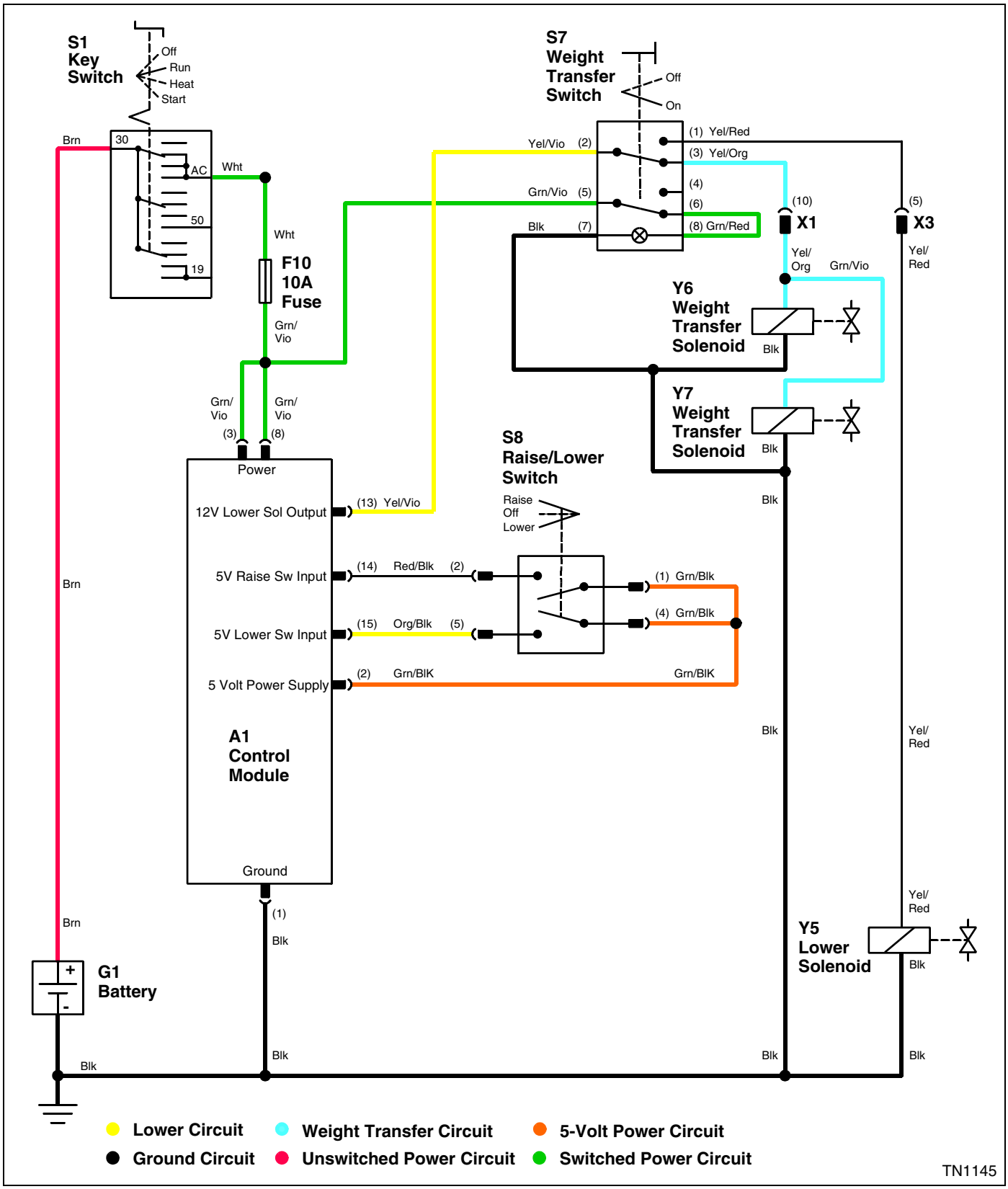

Figure 4-25

Instrumentation Circuit—Theory of Operation

Power Circuit

Unswitched power is available to key switch terminal 30 and to multi-function gauge terminal (8) through 2-amp fuse F5.

When the key switch is turned to the run position, current flows from the AC terminal of the key switch through 10-amp fuse F10 to control module terminals 3 and 8, powering up the module. Current also flows to multi-function gauge terminal 2 from 5-amp fuse F8, powering up the gauge.

Engine Oil Pressure Light

When the key switch is in the run position, voltage is available to engine oil pressure light from 5-amp fuse F9.

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

Hydraulic Filter Light

When the key switch is in the run position, voltage is available to hydraulic filter light from 5-amp fuse F9.

The hydraulic filter switch is a differential pressure switch. The switch closes when there is a 50 psi (3.447 bar) drop between the inlet and outlet pressures of the filter. When the switch closes, ground is provided through the switch to the hydraulic filter light, turning on the light.

Engine Over-Temperature Circuit

The engine coolant temperature switch closes when the coolant temperature reaches 230°F (110°C). When the switch closes, a ground is provided through the switch to the control module over-temp input terminal, activating the input. With the input activated, current flows from 12V over-temp light output to the over-temp light, turning on the light.

Current also flows from 12V over-temp light output to the alarm, activating the alarm.

Multi-Function Gauge

Fuel Level Sender Input

The float attached to the fuel level sender moves as the fuel level changes to various levels. The resistance of the fuel level sender changes in relationship to the position of the float. The resistance of the sender will vary between 4 and 180 ohms. When the fuel tank is full the sender resistance is 4 ohms and when the fuel tank is empty the sender resistance is 180 ohms. The multi-function gauge fuel level input terminal measures the resistance between the fuel level sender and ground. The multi-function gauge calculates the fuel level from the resistance reading and the result is displayed on the LCD display.

Setup Switch Input

When the setup switch is held in the depressed position, voltage is provided to the multi-gauge setup enable input terminal, activating the input. With the input activated, various gauge functions can be accessed. For more information, see “Safety, Operators & Maintenance Manual”.

Hour Meter Enable Input

The hour meter enable input provides control of when to allow the hour meter to start logging hours. The hour meter enable circuit is controlled by the alternator light circuit. (See “Charging Circuit—Theory of Operation” on page 4-24.)

Battery Discharge input

The battery discharge input monitors the battery voltage. When the battery voltage falls below a preset level, the battery icon blinks on the multi-function gauge.

Instrumentation Circuit Schematic

See Figure 4-26.

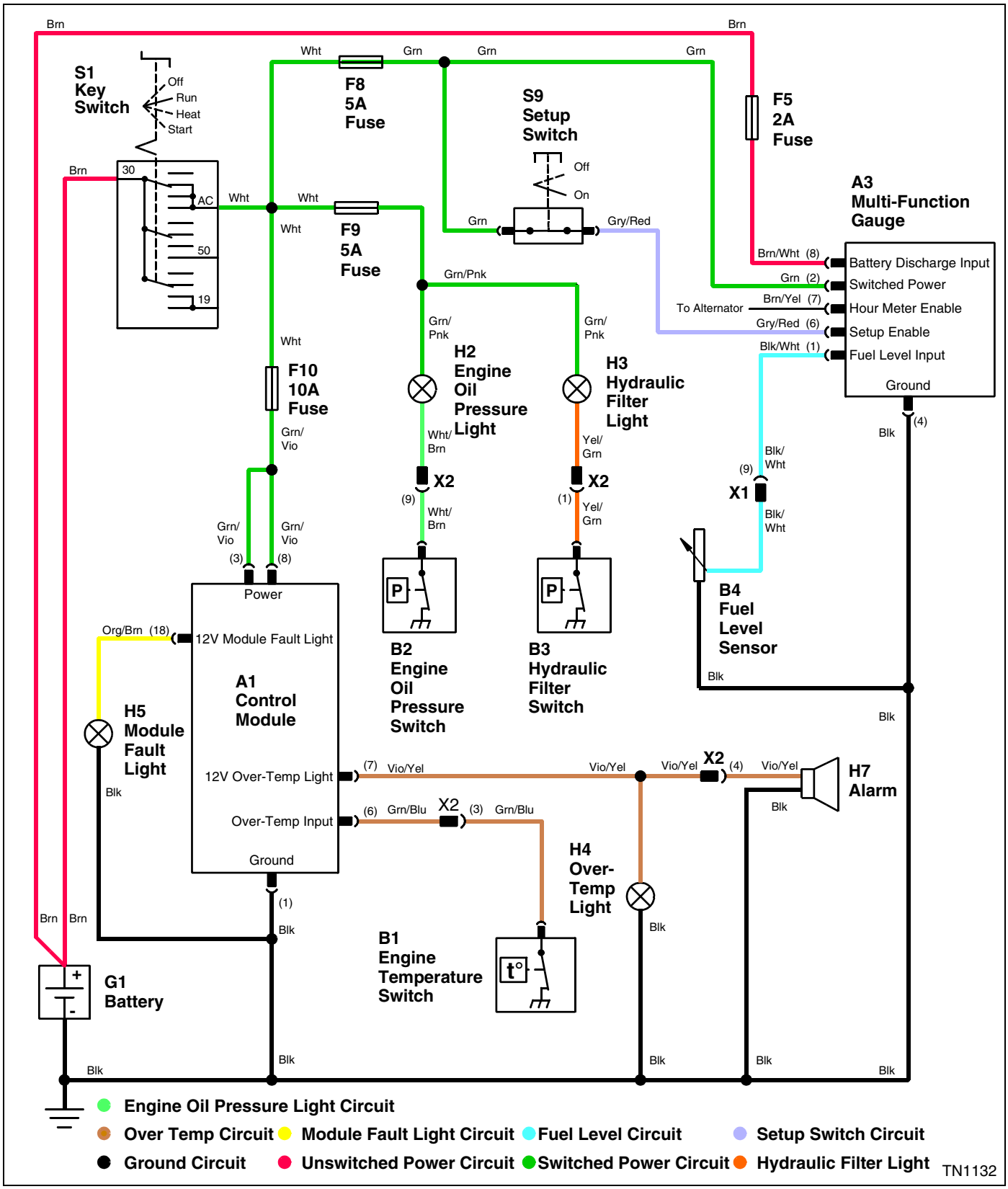

Figure 4-26

Work Lights Circuit—Theory of Operation

When the key switch is turned to the run position, voltage is available to work lights switch through 10-amp fuse F3.

When the work lights switch is placed in the on, position current flows from the switch to the work lights, turning on the lights.

Work Lights Circuit Schematic

See Figure 4-27.

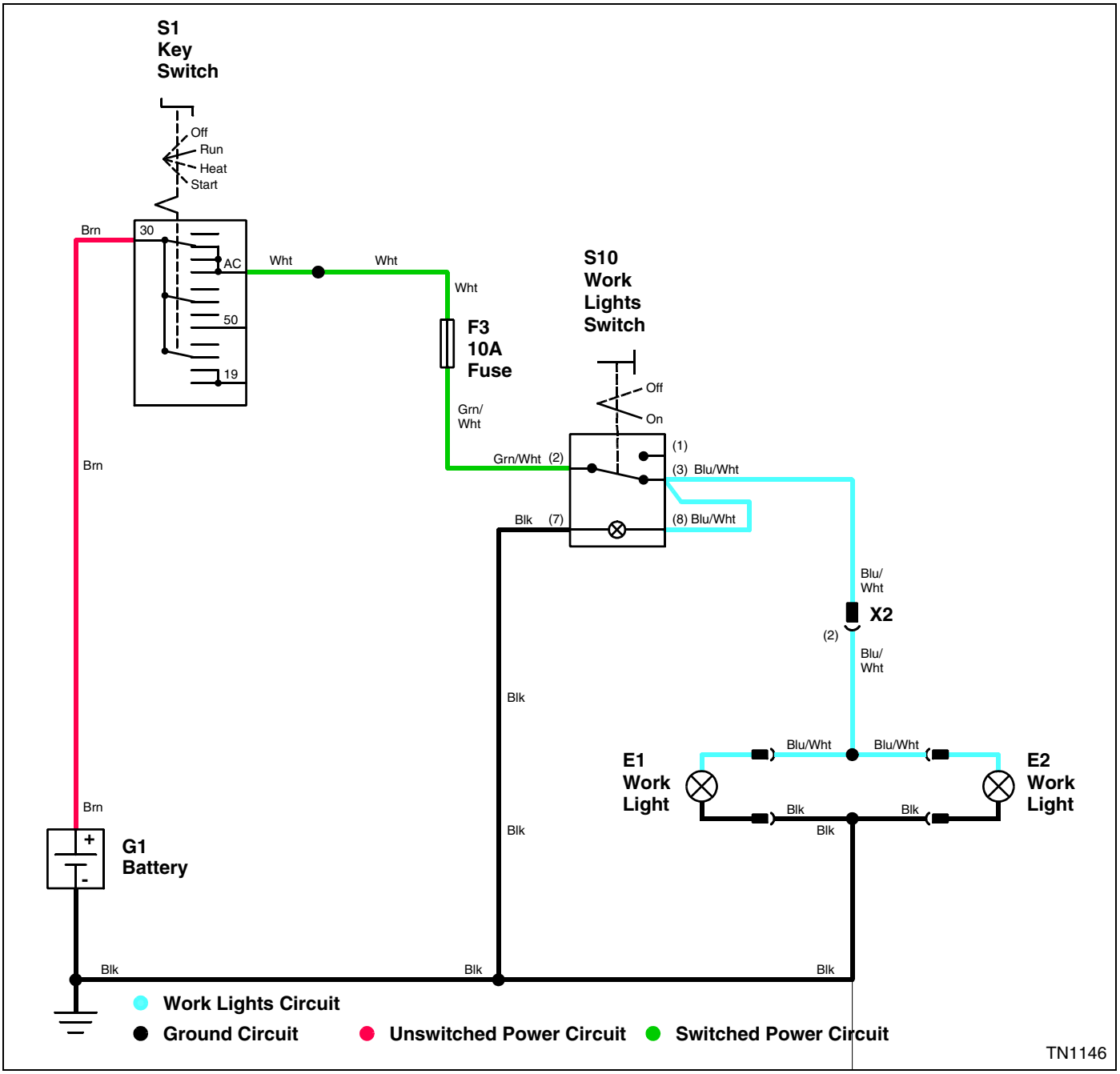

Figure 4-27

Troubleshooting

Power Circuit

Symptom: No power to cab connector.

Probable Cause	Remedy
Open fuse 40A fuse F11.	Test fuse. (See “Fuse Test” on page 4-62.)

Symptom: No power to accessory socket.

Probable Cause	Remedy
Open fuse 15A fuse F2.	Test fuse. (See “Fuse Test” on page 4-62.)

Symptom: Fuel pump does not operate.

Probable Cause	Remedy
Open fuse 7.5A fuse F7.	Test fuse. (See “Fuse Test” on page 4-62.)
Faulty fuel pump switched power circuit.	With the key switch in the run position, measure voltage between fuel pump grn wire terminal and ground. Voltage must be approximately 12 VDC.
Open fuel pump ground circuit.	Check continuity between fuel pump blk wire terminal and ground. Continuity must be indicated.
Faulty fuel pump.	Replace fuel pump.

Symptom: Control module does not power up.

Probable Cause	Remedy
Open fuse 10A fuse F10.	Test fuse. (See “Fuse Test” on page 4-62.)
Faulty control module switched power circuit.	With the key switch in the run position, measure voltage between control module terminal 3 and ground. Measure voltage between control module terminal 8 and ground. Voltage must be approximately 12 VDC.
Open control module ground circuit.	Check continuity between control module terminal 1 and ground. Continuity must be indicated.
Faulty control module.	Substitute the control module with a known good control module.

Charging Circuit

Symptom: Battery not charging.

Probable Cause	Remedy
Faulty alternator output circuit.	Make sure alternator 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 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.	Check specific gravity of the individual battery cells.

Symptom: Alternator light stays on.

Probable Cause	Remedy
Open fuse 7.5A fuse F7.	Test fuse. (See “Fuse Test” on page 4-62.)
Faulty control module switched power circuit.	With the key switch in the run position, measure voltage between control module terminal 3 and ground. Measure voltage between control module terminal 8 and ground. Voltage must be approximately 12 VDC.
Faulty alternator.	With the engine running, measure voltage between jump start connector terminals. Voltage must be approximately 14 VDC. If the voltage is below 12 volts, replace the alternator.

Glow Plug Circuit

Symptom: Glow plugs do not get hot.

Probable Cause	Remedy
Faulty power circuit.	Measure voltage between 40A fuse F12 brn wire terminal and ground. Voltage must be approximately 12 VDC.
Open 40A fuse F12.	Test fuse. (See “Fuse Test” on page 4-62.)
Faulty glow plug relay power circuit.	Measure voltage between 40A fuse F12 brn/wht wire terminal and ground. Voltage must be approximately 12 VDC.
Faulty glow plug relay.	Test relay. (See “Relay Tests” on page 4-63.)
Faulty key switch.	Test switch. (See “Key Switch Test” on page 4-64.)
Faulty key switch circuit.	Check continuity between key switch terminal 19 and glow plug relay terminal 86. Continuity must be indicated.
Open glow plug relay ground circuit.	Check continuity between glow plug relay terminal 85 and ground. Continuity must be indicated.
Faulty glow plug relay 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.

Symptom: Glow plug wait light does not come on.

Probable Cause	Remedy
Faulty glow plug wait light.	Check light bulb and connections.
Faulty glow plug timer.	Substitute the timer with a known good glow plug timer.
Faulty key switch.	Test switch. (See “Key Switch Test” on page 4-64.)
Faulty glow plug timer circuit.	With the key switch in the heat position, measure voltage between glow plug timer terminal 4 and ground. Voltage must be approximately 12 VDC.
Open glow plug timer ground circuit.	Check continuity between glow plug timer terminal 3 and ground. Continuity must be indicated.

Start Circuit

Symptom: Starter motor solenoid does not engage.

Probable Cause	Remedy
Park brake switch in the released position.	Place the park brake switch in the locked position.
Neutral switch is in the pedal engaged position.	Move drive pedals to the neutral position.
Seat switch is in the off position.	Operator must be in the seat.
Mow switch is in the mow position.	Place the mow switch in the off position.
Open 15A fuse F6.	Test fuse. (See “Fuse Test” on page 4-62.)
Faulty seat switch.	Test switch. (See “Seat Switch Test” on page 4-66.)
Faulty park brake switch.	Test switch. (See “Park Brake Switch Test” on page 4-68.)
Faulty neutral switch.	Test switch. (See “Traction Pedal Neutral Switch Test” on page 4-66.)
Faulty key switch.	Test switch. (See “Key Switch Test” on page 4-64.)
Faulty Start relay.	Test relay. (See “Relay Tests” on page 4-63.)
Faulty 5V power supply circuit.	With the key switch in the run position, measure voltage between control module 5V power supply terminal and ground. Voltage must be approximately 5 VDC.
Faulty 5V park brake switch input circuit.	With the key switch in the run position, measure voltage between control module 5V park brake input terminal and ground. Voltage must be approximately 5 VDC.
Faulty 5V seat switch input circuit.	With the key switch in the run position, measure voltage between control module 5V seat input terminal and ground. Voltage must be approximately 5 VDC.
Faulty 12V start relay output circuit.	With the key switch in the run position, measure voltage between control module 12V start relay output terminal and ground. With the key switch in the run position, measure voltage between start relay terminal 1 and ground. Voltage must be approximately 12 VDC.
Faulty start relay ground circuit.	Measure continuity between start relay terminal 2 and ground. Continuity must be indicated.
Faulty key switch start circuit.	With the key switch in the start position, measure voltage between start relay terminal 5 and ground. Voltage must be approximately 12 VDC.
Faulty start relay output circuit.	With the key switch in the start position, measure voltage between the starter motor solenoid terminal and ground. Voltage must be approximately 12 VDC.

Symptom: Fuel shutoff solenoid pull-in coil does not energize.

Probable Cause	Remedy
Faulty pull-in coil.	Test fuel shutoff solenoid. (See “Fuel Shutoff Solenoid Test” on page 4-70.)
Faulty pull-in coil circuit.	With the key switch in the start position, measure voltage at fuel shutoff solenoid wht/blu wire terminal. Voltage must be approximately 12 VDC.

Run Circuit

Symptom: Starter motor solenoid engages, but engine does not run.

Probable Cause	Remedy
Brake release safety lever is in the released position.	Place the brake release lever in the engaged position.
Faulty brake release safety switch.	Test switch. (See “Brake Safety Switch Test” on page 4-65.)
Faulty 12V fuel solenoid output circuit.	With the key switch in the start position, measure voltage between the control module fuel solenoid output terminal and ground. Voltage must be approximately 12 VDC.
Faulty control module.	Substitute the control module with a known good control module.

Symptom: Engine stops running when leaving the seat.

Probable Cause	Remedy
Park brake switch is in the released position and/or mow switch is in the mow position.	Place the park brake switch in the locked position and the mow switch in the off position.

Park Brake Circuit

Symptom: Park brake does not release.

Probable Cause	Remedy
Open 5A fuse F4.	Test fuse. (See “Fuse Test” on page 4-62.)
Faulty park brake switch.	Test switch. (See “Park Brake Switch Test” on page 4-68.)
Faulty brake solenoid.	Test solenoid. (See “Solenoid Test” on page 4-69.)
Open brake solenoid switched power circuit.	Measure voltage between brake solenoid grn wire terminal and ground. Voltage must be approximately 12 VDC.
Open park brake switch circuit.	Check continuity between brake solenoid blu/yel wire terminal and park brake switch terminal 4. Continuity must be indicated.
Open park brake switch ground circuit.	Check continuity between park brake switch terminal 5 and ground. Continuity must be indicated.

Raise/Lower Circuit

Symptom: Lower solenoid does not energize.

Probable Cause	Remedy
Faulty raise/lower switch.	Test switch. (See “Joystick Test” on page 4-65.)
Faulty weight transfer switch	Test switch. (See “Rocker Switch Test” on page 4-67.)
Faulty lower solenoid.	Test solenoid. (See “Solenoid Test” on page 4-69.)
Faulty raise/lower switch 5V power supply circuit.	Measure voltage between raise/lower switch terminal 4 and ground. Voltage must be approximately 5 VDC.
Faulty 5V lower switch input circuit.	With the raise/lower switch in the lower position, measure voltage between control module 5V lower switch input terminal and ground. Voltage must be approximately 5 VDC.
Faulty 12V lower solenoid output circuit.	Momentarily place the raise/lower switch in the lower position. Measure voltage between control module 12V lower solenoid output terminal and ground. Measure voltage between lower solenoid yel/red wire terminal and ground. Voltage must be approximately 12 VDC.
Open lower solenoid ground circuit.	Check continuity between lower solenoid blk wire terminal and ground. Continuity must be indicated.

Symptom: Raise solenoid does not energize.

Probable Cause	Remedy
Faulty raise/lower Switch.	Test switch. (See “Joystick Test” on page 4-65.)
Faulty raise solenoid.	Test solenoid. (See “Solenoid Test” on page 4-69.)
Faulty raise/lower switch 5V power supply circuit.	Measure voltage between raise/lower switch terminal 1 and ground. Voltage must be approximately 5 VDC.
Faulty 5V raise switch input circuit.	With the raise/lower switch in the raise position, measure voltage between control module 5V raise switch input terminal and ground. Voltage must be approximately 5 VDC.
Faulty 12V raise solenoid output circuit.	Place the raise/lower switch in the raise position. Measure voltage between control module 12V raise solenoid output terminal and ground. Measure voltage between raise solenoid grn/wht terminal and ground. Voltage must be approximately 12 VDC.
Open raise solenoid ground circuit.	Check continuity between raise solenoid blk wire terminal and ground. Continuity must be indicated.

Mow Circuit

Symptom: Mow solenoid does not energize.

Probable Cause	Remedy
Raise/lower switch was not momentarily placed in the lower position.	Momentarily place the raise/lower switch in the lower position to activate the cutting units.
Faulty mow switch.	Test switch. (See “Rocker Switch Test” on page 4-67.)
Faulty mow solenoid.	Test solenoid. (See “Solenoid Test” on page 4-69.)
Faulty mow switch 5V power supply circuit.	Measure voltage between mow switch terminal 2 and ground. Voltage must be approximately 5 VDC.
Faulty 5V mow switch input circuit.	With the mow switch in the mow position, measure voltage between control module 5V mow switch input terminal and ground. Voltage must be approximately 5 VDC.
Faulty 12V mow solenoid output circuit.	With the mow switch in the mow position, measure voltage between control module 12V mow solenoid output terminal and ground. Measure voltage between mow solenoid yel/pnk wire terminal and ground. Voltage must be approximately 12 VDC.
Open mow solenoid ground circuit.	Check continuity between mow solenoid blk wire terminal and ground. Continuity must be indicated.

Backlap Circuit–Model TR-3

Symptom: Mow solenoid does not energize.

Probable Cause	Remedy
Raise/lower switch was not momentarily placed in the lower position.	Momentarily place the raise/lower switch in the lower position to activate the cutting units.
Faulty mow switch.	Test switch. (See “Rocker Switch Test” on page 4-67.)
Faulty backlap switch.	Test switch. (See “Backlap Switch Test” on page 4-70.)
Faulty mow solenoid.	Test solenoid. (See “Solenoid Test” on page 4-69.)
Faulty mow switch 5V power supply circuit.	Measure voltage between mow switch terminal 2 and ground. Voltage must be approximately 5 VDC.
Faulty 5V mow switch input circuit.	With the mow switch in the mow position, measure voltage between control module 5V mow switch input terminal and ground. Voltage must be approximately 5 VDC.
Faulty 12V mow solenoid output circuit.	With the mow switch in the mow position, measure voltage between control module 12V mow solenoid output terminal and ground. Measure voltage between mow solenoid yel/pnk wire terminal and ground. Voltage must be approximately 12 VDC.
Open mow solenoid ground circuit.	Check continuity between mow solenoid blk wire terminal and ground. Continuity must be indicated.
Faulty 12V backlap switch input circuit.	With the backlap lever in the backlap position, measure voltage between control module 12V backlap input terminal and ground. Voltage must be approximately 12 VDC.

Weight Transfer Circuit

Symptom: Weight transfer solenoids do not energize.

Probable Cause	Remedy
Raise/lower switch was not momentarily placed in the lower position.	Momentarily place the raise/lower switch in the lower position.
Faulty weight transfer switch.	Test switch. (See “Rocker Switch Test” on page 4-67.)
Faulty weight transfer solenoids.	Test solenoids. (See “Solenoid Test” on page 4-69.)
Faulty 12V weight transfer solenoid output circuit.	Place the weight transfer switch in the on position. Momentarily place the raise/lower switch in the lower position. Measure voltage between control module 12V lower solenoid output terminal and ground. Measure voltage between weight transfer solenoid (Y6) yel/org wire terminal and ground. Measure voltage between weight transfer solenoid (Y7) grn/vio wire terminal and ground. Voltage must be approximately 12 VDC.
Open weight transfer solenoid ground circuit.	Check continuity between weight transfer solenoid (Y6) blk wire terminal and ground. Check continuity between weight transfer solenoid (Y7) blk wire terminal and ground. Continuity must be indicated.

4

Instrumentation Circuit

Symptom: Engine oil pressure light does not turn on.

Probable Cause	Remedy
Faulty engine oil pressure light.	Check light bulb.
Open 5A Fuse F9.	Test fuse. (See “Fuse Test” on page 4-62.)
Faulty engine oil pressure switch.	With the key switch in the off position, check continuity between engine oil pressure switch and ground. Continuity must be indicated. If continuity is not indicated, replace engine oil pressure switch.
Faulty engine oil pressure light switched power circuit.	With the key switch in the run position (engine off), measure voltage between engine oil pressure light grn/pnk terminal and ground. Voltage must be approximately 12 VDC.
Faulty engine oil pressure switch circuit.	Check continuity between engine oil pressure switch terminal and engine oil pressure light wht/brn terminal. Continuity must be indicated.

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.	If engine oil pressure tests good, replace engine oil pressure switch.

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

Probable Cause	Remedy
Faulty hydraulic filter light.	Check light bulb.
Open 5A fuse F9.	Test fuse. (See “Fuse Test” on page 4-62.)
Faulty hydraulic filter light switched power circuit.	With the key switch in the run position (engine off), measure voltage between hydraulic filter light grn/pnk terminal and ground. Voltage must be approximately 12 VDC.
Faulty hydraulic filter switch circuit.	Check continuity between hydraulic filter switch terminal and hydraulic filter light wht/brn terminal. Continuity must be indicated.
Faulty hydraulic filter switch.	Replace hydraulic filter switch.

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

Probable Cause	Remedy
Faulty hydraulic filter switch.	Replace hydraulic filter switch.

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

Probable Cause	Remedy
Blocked hydraulic filter.	Replace hydraulic filter.
Faulty hydraulic filter switch.	Replace hydraulic filter switch.

Symptom: Over temp light and alarm is on when the engine is cold.

Probable Cause	Remedy
Faulty engine temperature switch.	Check continuity between engine temperature switch terminal and ground. If continuity exists, replace engine temperature switch.

Symptom: Over temp-light and alarm do not turn on when the engine is over heated.

Probable Cause	Remedy
Faulty engine temperature switch.	Replace engine temperature switch.
Faulty over-temp light input circuit.	Check continuity between control module over-temp light input terminal and engine temperature switch connector. Continuity must be indicated.
Faulty 12V over-temp light output circuit.	Check continuity between control module 12V over-temp light output terminal and over temp light vio/yel wire terminal. Check continuity between control module 12V over-temp light output terminal and alarm vio/yel wire terminal. Continuity must be indicated.
Faulty control module.	Substitute the control module with a known good control module.

Symptom: Multi-function gauge does not power up.

Probable Cause	Remedy
Open 5A fuse F8.	Test fuse. (See “Fuse Test” on page 4-62.)
Faulty multi-function gauge switched power circuit.	With the key switch in the run position, measure voltage between multi-function gauge terminal 2 and ground. Voltage must be approximately 12 VDC.
Open multi-function gauge ground circuit.	Check continuity between multi-function gauge terminal 4 and ground. Continuity must be indicated.
Faulty multi-function gauge.	Substitute the multi-function gauge with a known good multi-function gauge.

Symptom: Multi-function gauge does not display fuel level.

Probable Cause	Remedy
Faulty fuel level sensor.	Disconnect the multi-function gauge connector. With the fuel level sensor still installed in the machine, measure the resistance between the fuel level sensor terminals. If the resistance measured is not in the range of 4 to 80 ohms, bench test the sensor. (See “Fuel Level Sender Test” on page 4-72.)
Faulty fuel level input circuit.	Check continuity between multi-function gauge terminal 1 and fuel level sensor blk/wht wire terminal. Continuity must be indicated.
Open fuel level sensor ground circuit.	Check continuity between fuel level sensor blk wire terminal and ground. Continuity must be indicated.
Faulty multi-function gauge	Substitute the multi-function gauge with a known good multi-function gauge

Symptom: Hour meter does not log hours.

Probable Cause	Remedy
Faulty alternator light.	Check light bulb. The multi-function gauge hour meter enable input is activated through the filament of the light bulb.
Faulty alternator light switched power circuit.	With the key switch in the run position, measure voltage between alternator light grn wire terminal and ground. Voltage must be approximately 12 VDC.
Faulty hour meter enable input circuit.	Check continuity between alternator light brn/yel wire terminal and multi-function gauge terminal 7. Continuity must be indicated.
Faulty multi-function gauge.	Substitute the multi-function gauge with a known good multi-function gauge.

Work Lights Circuit

Symptom: Hour meter does not log hours.

Probable Cause	Remedy
Open fuse 10A fuse F3.	Test fuse. (See “Fuse Test” on page 4-62.)
Faulty work lights switch.	Test switch. (See “Rocker Switch Test” on page 4-67.)
Faulty work lights.	Check light bulbs.
Faulty work lights switched power circuit.	With the key switch in the run position, measure voltage between work lights switch terminal 2 and ground. Voltage must be approximately 12 VDC.
Faulty work lights circuit.	Turn the key switch to the run position. With the light switch in the on position, measure voltage between the right work light blu/wht wire terminal and ground. Measure voltage between the left work light blu/wht wire terminal and ground. Voltage must be approximately 12 VDC.
Open work lights ground circuit.	Check continuity between right work light blk wire terminal and ground. Check continuity between left work light blk wire terminal and ground. Continuity must be indicated.

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 electrical components or wiring be sure to apply dielectric grease 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 ohms, 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 4-28.

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Remove fuse from fuse holder. (See “Plug-In Fuses” on page 4-78.)

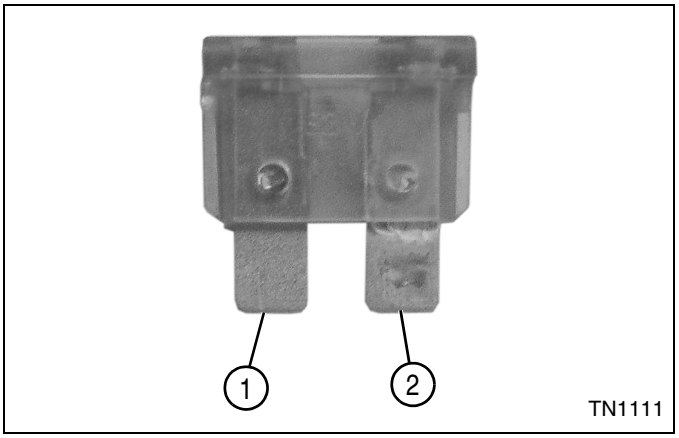

Figure 4-28

3. Connect one test lead a 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.*

Strip Fuses

See Figures 4-29 and 4-30.

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Disconnect the battery negative (–) cables at the battery.
3. Open the engine hood.

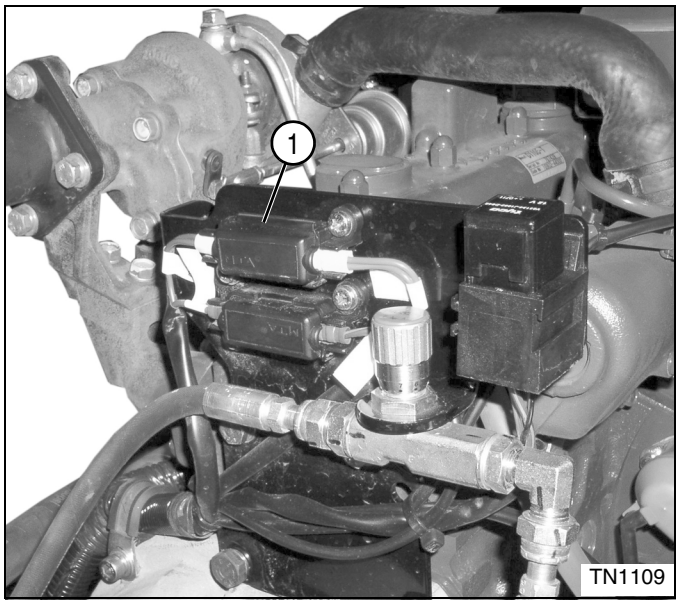

Figure 4-29

4. Open the fuse holder cover (1).

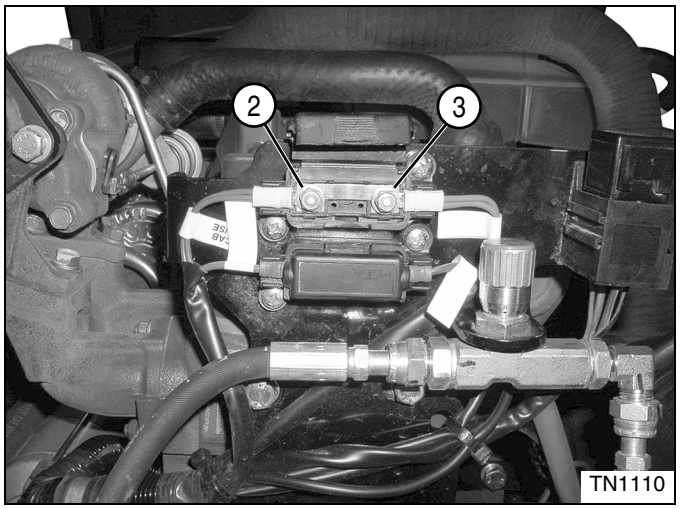

Figure 4-30

5. Connect one test lead to one side of the strip fuse (2).
6. Connect the other test lead to the other side of the strip fuse (3) and check for continuity.

Is continuity indicated?

YES *The fuse is good.*

NO *The fuse is faulty; replace the fuse. (See “Strip Fuses” on page 4-78.)*

Relay Tests

Start Relay

See Figure 4-31.

Required Tools or Equipment
Digital Multimeter, Ohmmeter, or Continuity Tester 12-Volt DC Power Source and Leads

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Remove the start relay. (See “Start Relay” on page 4-79.)

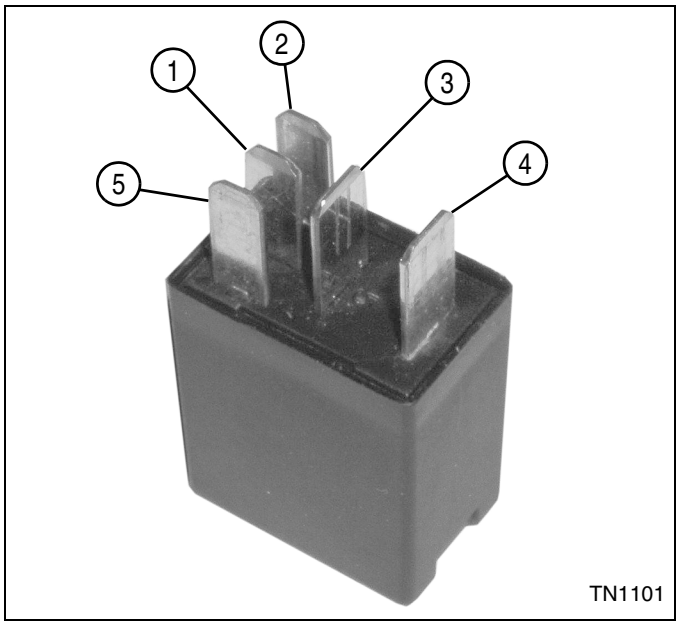

Figure 4-31

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

   Is continuity indicated?

   YES *Proceed to step 5.*

   NO *The relay is faulty; replace the relay.*
5. Connect one test lead to terminal (4).
6. Connect the other test lead to terminal (3).
7. Connect a 12-volt DC power source to terminals (5 and 2).
8. Check for continuity across terminals (4 and 3).

   Is continuity indicated?

   YES *The relay is good.*

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

Glow Plug Relay

See Figure 4-32.

Required Tools or Equipment
Digital Multimeter, Ohmmeter, or Continuity Tester 12-Volt DC Power Source and Leads

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Remove the glow plug relay. (See “Glow Plug Relay” on page 4-80.)

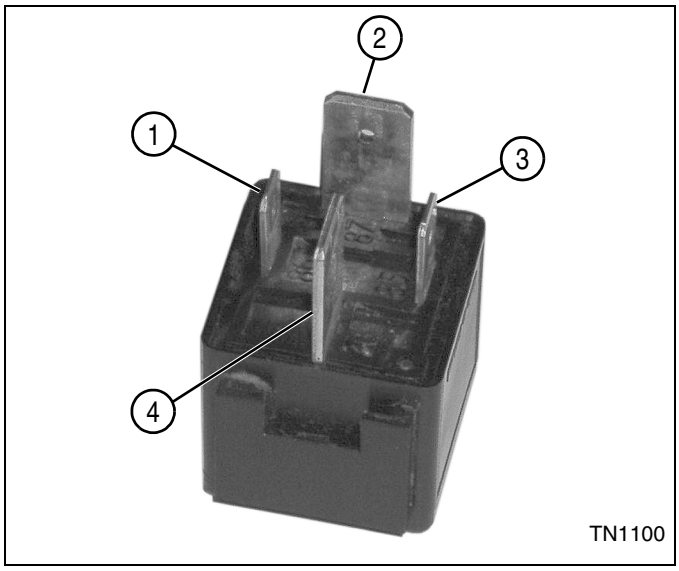

Figure 4-32

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

   Is continuity indicated?

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

   NO *Proceed to step 5.*
5. With the test leads connected, as described in step 4, connect a 12-volt DC power source to terminals (3) and (1).
6. Check for continuity across terminals (4 and 2).

   Is continuity indicated?

   YES *The relay is good.*

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

Key Switch Test

See Figure 4-33.

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Remove the key switch from the instrument panel. (See “Key Switch” on page 4-80.)

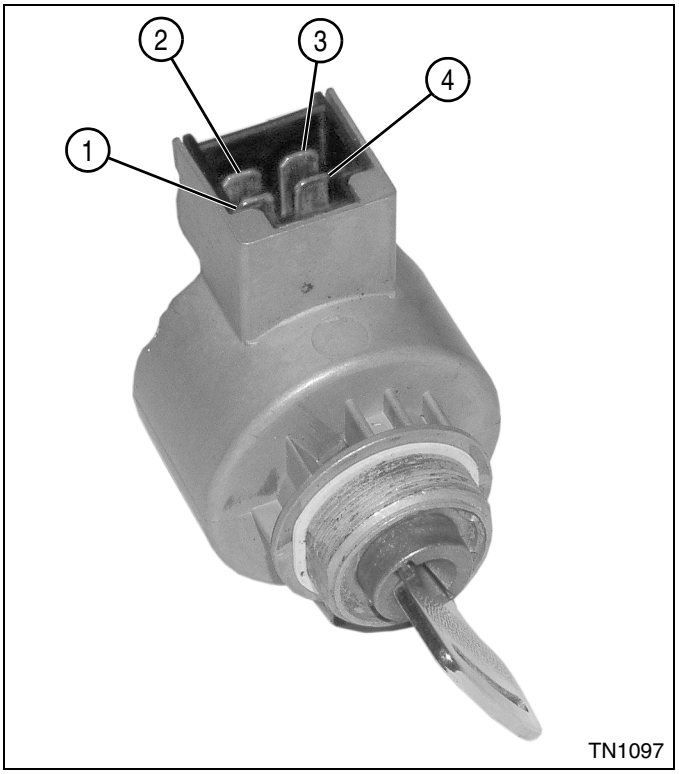

Figure 4-33

3. Place the key switch in the start position.
4. Connect one test lead to terminal (4).
5. Connect the other test lead to terminals (1, 2, and 3) as directed.

   Is continuity indicated at any of these terminals?

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

   NO *Proceed to step 6.*
6. Connect one test lead to terminal (4).
7. Place the key switch to the run position.
8. Connect the other test lead to terminal (3).

   Is continuity indicated?

   YES *Proceed to step 9.*

   NO *The switch is faulty; replace the switch.*
9. Move the test lead to terminal (1).

   Is continuity indicated?

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

   NO *Proceed to step 10.*
10. Move the test lead to terminal (2).

    Is continuity indicated?

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

    NO *Proceed to step 11.*
11. Connect one test lead to terminal (4).
12. Place and hold the key switch in the heat position.
13. Connect the other test lead to terminal (3).

    Is continuity indicated?

    YES *Proceed to step 14.*

    NO *The switch is faulty; replace the switch.*
14. Move the test lead to terminal (1).

    Is continuity indicated?

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

    NO *Proceed to step 15.*
15. Move the test lead to terminal (2).

    Is continuity indicated?

    YES *Proceed to step 16.*

    NO *The switch is faulty; replace the switch.*
16. Connect one test lead to terminal (4).
17. Place and hold the key switch in the start position.
18. Connect the other test lead to terminal (3).

    Is continuity indicated?

    YES *Proceed to step 19.*

    NO *The switch is faulty; replace the switch.*
19. Move the test lead to terminal (1).

    Is continuity indicated?

    YES *Proceed to step 20.*

    NO *The switch is faulty; replace the switch.*
20. Move the test lead to terminal (2).

    Is continuity indicated?

    YES *The switch is good.*

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

Brake Safety Switch Test

See Figure 4-34.

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Remove the brake safety switch from the machine. (See “Brake Safety Switch” on page 4-83.)

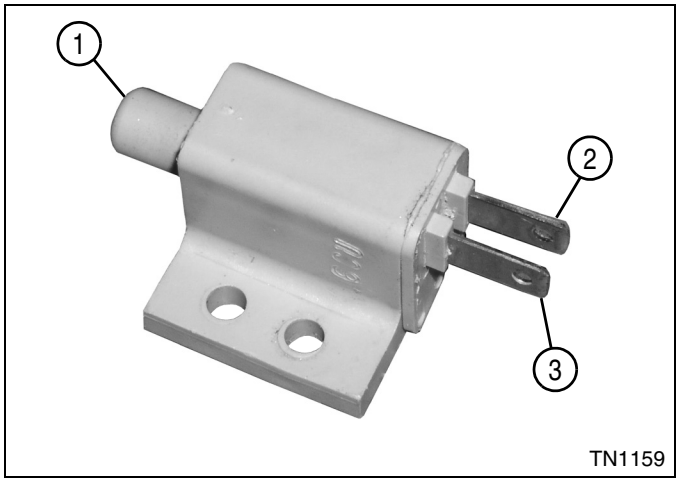

Figure 4-34

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

   Is continuity indicated?

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

   NO *Proceed to step 5.*
5. Press and hold the plunger (1) down and check for continuity.

   Is continuity indicated?

   YES *The switch is good.*

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

Joystick Test

See Figure 4-35.

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Remove the joystick from the instrument panel. (See “Joystick” on page 4-83.)

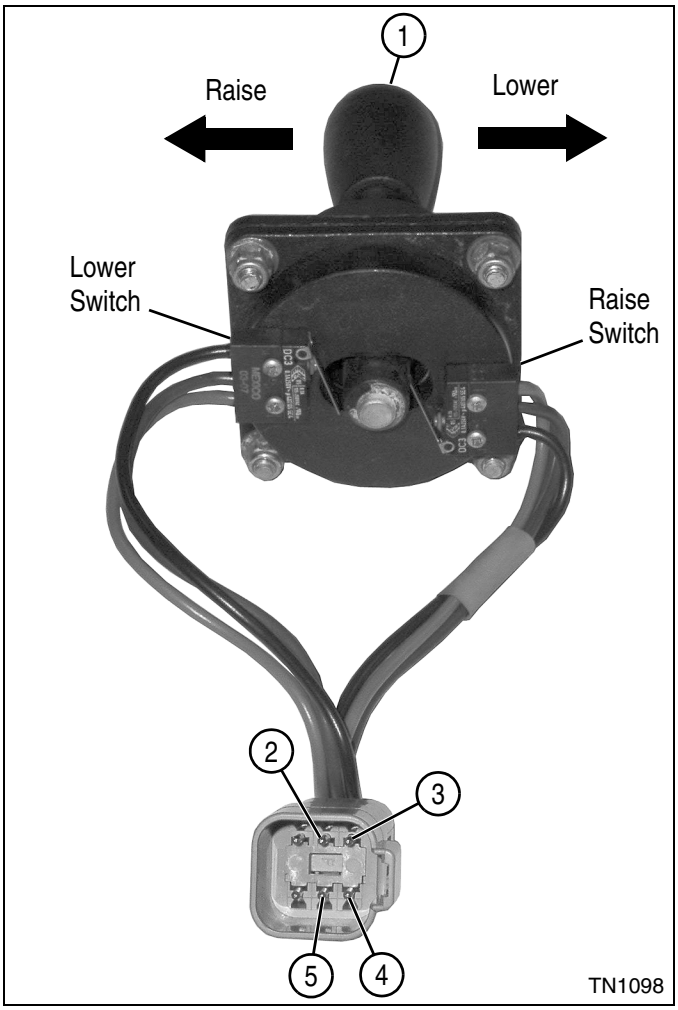

Figure 4-35

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

   Is continuity indicated?

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

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

   Is continuity indicated?

   YES *Proceed to step 5.*

   NO *The switch is faulty; replace the joystick assembly.*
5. Return the joystick to the center (neutral) position.
6. Connect test leads to terminals (4 and 5) and check continuity.

   Is continuity indicated?

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

   NO *Proceed to step 4.*

7. With the test leads connected as described in step 6, move and hold the joystick in the raise position.

   Is continuity indicated?

   YES *The switch/joystick assembly is good.*

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

Traction Pedal Neutral Switch Test

See Figure 4-36.

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)

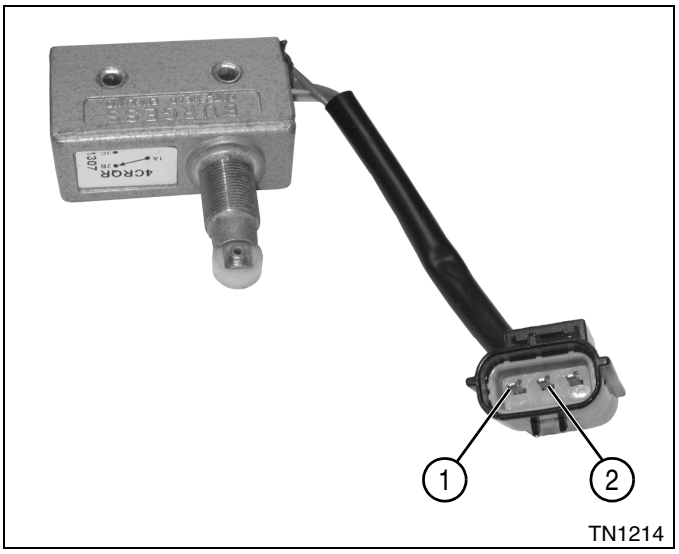

Figure 4-36

2. Remove traction pedal neutral switch from mower. (See “Traction Pedal Neutral Switch” on page 4-85.)
3. Connect test leads to the switch terminals (1 and 2).
4. Actuate traction pedal neutral switch.
5. Check for continuity.

   Is continuity indicated?

   YES *The switch is good.*

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

Seat Switch Test

See Figure 4-48.

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Remove the seat switch from the seat cushion. (See “Seat and Mounting Plate” on page 9-16.)

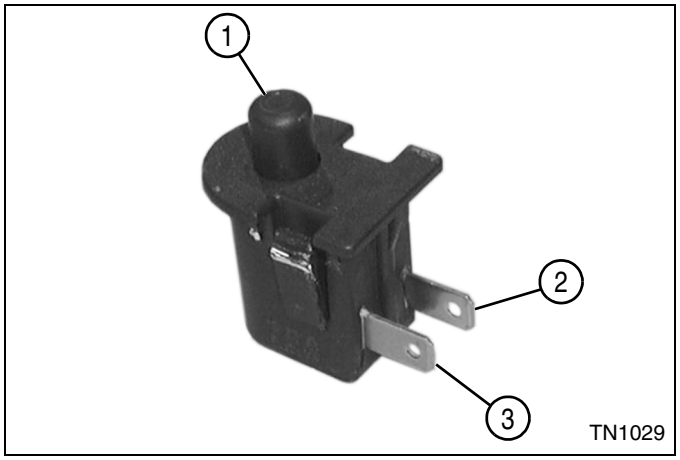

Figure 4-37

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

   Is continuity indicated?

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

   NO *Proceed to step 5.*

5. Press and hold the plunger (1) down and check for continuity.

   Is continuity indicated?

   YES *The switch is good.*

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

Rocker Switch Test

See Figures 4-38 and 4-39.

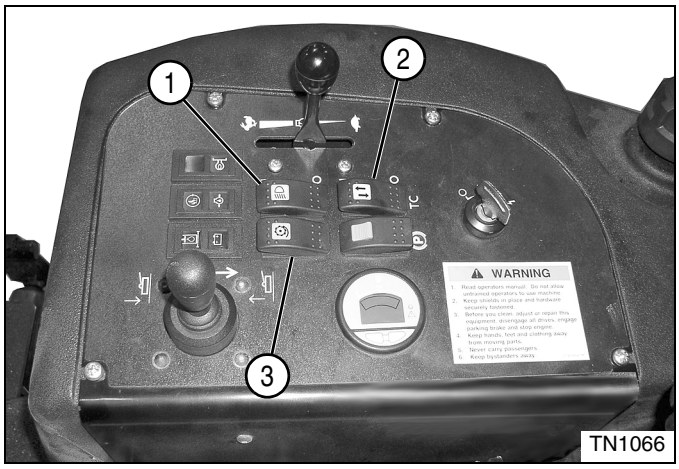

Figure 4-38

This procedure applies to the following switches:

- Work Light Switch (1)
- Weight Transfer Switch (2)
- Mow Switch (3)

Required Tools or Equipment
Digital Multimeter or Ohmmeter

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Remove the switch(es) from the instrument panel. (See “Rocker Switches” on page 4-81.)

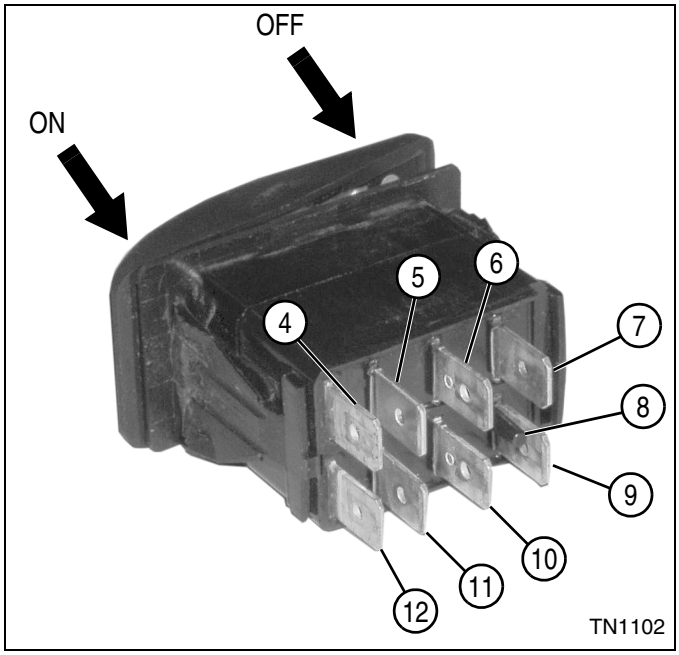

Figure 4-39

3. Place the switch in the off position.

NOTE

Use the alignment pin (8) as a reference point for correct orientation.

4. Connect one test lead to terminal (10).
5. Connect the other test lead to terminal (11) and check for continuity.

   Is continuity indicated?

   YES *Proceed to step 6.*

   NO *The switch is faulty; replace the switch.*
6. Place the switch in the on position.
7. Move the test lead from terminal (11) to terminal (9) and check for continuity.

   Is continuity indicated?

   YES *Proceed to step 8.*

   NO *The switch is faulty; replace the switch.*
8. Place the switch in the off position.
9. Connect one test lead to terminal (6).
10. Connect the other test lead to terminal (5) and check for continuity.

    Is continuity indicated?

    YES *Proceed to step 11.*

    NO *The switch is faulty; replace the switch.*
11. Place the switch in the on position.
12. Connect one test lead to terminal (6).
13. Connect the other test lead to terminal (7) and check for continuity.

    Is continuity indicated?

    YES *Proceed to step 14.*

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

NOTE

Terminals 4 and 12 are the connections for the LED used to illuminate the switch when the switch is turned on. The following test must be performed using a digital multimeter using a diode test setting.

14. Connect the test leads to terminals (4 and 12), and record the reading.
15. Reverse the test leads, and record the reading.

    Does the meter read approximately 1.76 volts in one direction, and an open circuit when the leads are reversed?

    YES *The switch is good.*

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

Park Brake Switch Test

See Figure 4-40.

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

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Remove the switch from the instrument panel. (See “Rocker Switches” on page 4-81.)

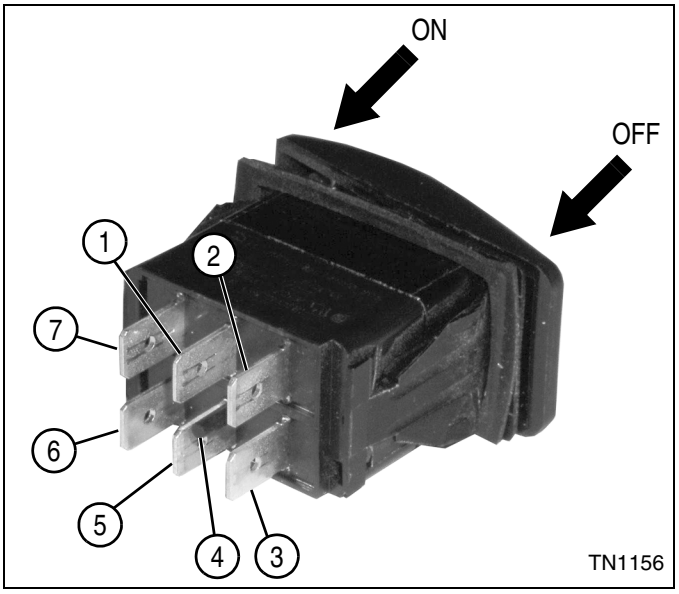

Figure 4-40

3. Place the switch in the off position.

NOTE

Use the alignment pin (4) as a reference point for correct orientation.

4. Connect one test lead to terminal (5).
5. Connect the other test lead to terminal (6) and check for continuity.

   Is continuity indicated?

   YES *Proceed to step 6.*

   NO *The switch is faulty; replace the switch.*
6. Place the switch in the on position.
7. Move the test lead from terminal (5) to terminal (3) and check for continuity.

   Is continuity indicated?

   YES *Proceed to step 8.*

   NO *The switch is faulty; replace the switch.*
8. Connect one test lead to terminal (1).
9. Connect the other test lead to terminal (2) and check for continuity.

   Is continuity indicated?

   YES *Proceed to step 10.*

   NO *The switch is faulty; replace the switch.*
10. Place the switch in the off position.
11. Move the test lead from terminal (2) to terminal (7) and check for continuity.

    Is continuity indicated?

    YES *The switch is good.*

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

Diode Module Test

See Figure 4-41.

Required Tools or Equipment
Digital Multimeter

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Remove the diode module. (See “Diode Module” on page 4-79.)

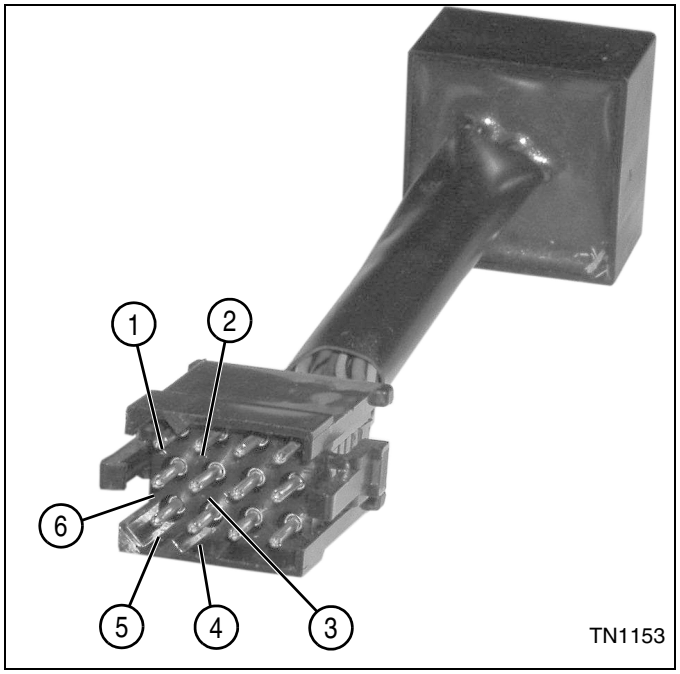

Figure 4-41

3. Set the digital multimeter to the diode check setting.
4. Connect the test leads to terminals (1 and 2), and record the reading.

5. Reverse the test leads, and record the reading.

   Does the meter read approximately 0.557 volts in one direction, and an open circuit when the leads are reversed?

   YES *The diode is good.*

   NO *The diode is faulty; replace the diode module.*

6. Repeat steps 4 and 5 for the remaining diodes, terminals (3 and 6) and terminals (4 and 5).

Solenoid Test

See Figure 4-42.

Required Tools
Digital Multimeter or Ohmmeter

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)

NOTE

This procedure applies to the following solenoid coils:

- *Brake Solenoid Coil*
- *Mow Solenoid Coil*
- *Weight Transfer Solenoid Coils*
- *Lower Solenoid Coil*
- *Lift Solenoid Coil*

2. Locate the component solenoid to be tested. Remove the solenoid coil from the machine. (See “Solenoid Coils” on page 4-86.) Identify the coil markings as either 12 or 24-volt.

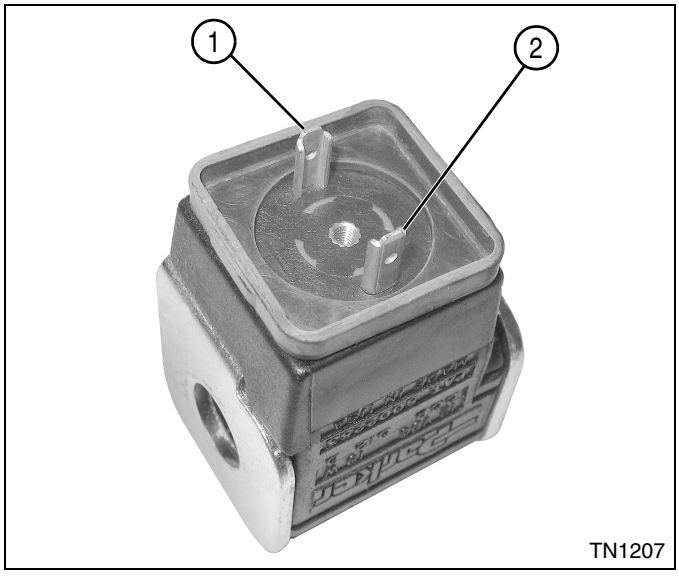

Figure 4-42

NOTE

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

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

12-Volt Solenoid Coil Equipped Machines

- Brake Solenoid Coil—10.43 ohms ±10% at 68°F
- Mow Solenoid Coil—10.43 ohms ±10% at 68°F
- Weight Transfer Solenoid Coils—10.43 ohms ±10% at 68°F
- Lower Solenoid Coil—10.43 ohms ±10% at 68°F
- Lift Solenoid Coil—10.43 ohms ±10% at 68°F

24-Volt Solenoid Coil Equipped Machines

- Brake Solenoid Coil—41.74 ohms ±10% at 68°F
- Mow Solenoid Coil—41.74 ohms ±10% at 68°F
- Weight Transfer Solenoid Coils—41.74 ohms ±10% at 68°F
- Lower Solenoid Coil—41.74 ohms ±10% at 68°F
- Lift Solenoid Coil—41.74 ohms ±0% at 68°F

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

YES *The solenoid is good.*

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

Fuel Shutoff Solenoid Test

See Figure 4-43.

Required Tools
Digital Multimeter or Ohmmeter

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Identify and locate the fuel shutoff solenoid and its connector on the engine block near the air cleaner.
3. Disconnect fuel shutoff solenoid electrical connector.

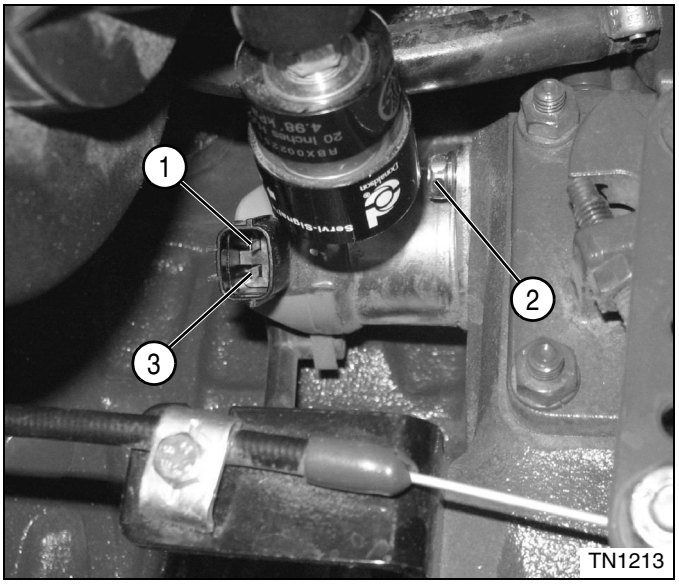

Figure 4-43

4. Measure resistance between terminal (1) and ground (2) (solenoid mounting bolt).

   Does the resistance through the solenoid read approximately 15.58 ohms?

   YES *Proceed to step 5.*

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

5. Measure ohms resistance between terminal (3) and ground (2) (solenoid mounting bolt).

   Does the resistance through the solenoid read approximately 0.375 ohms?

   YES *The solenoid is good.*

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

Backlap Switch Test

See Figure 4-44.

Required Tools
Digital Multimeter or Continuity Tester

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Identify and locate the switch and its connector beneath the operator's platform using electrical component location diagram.

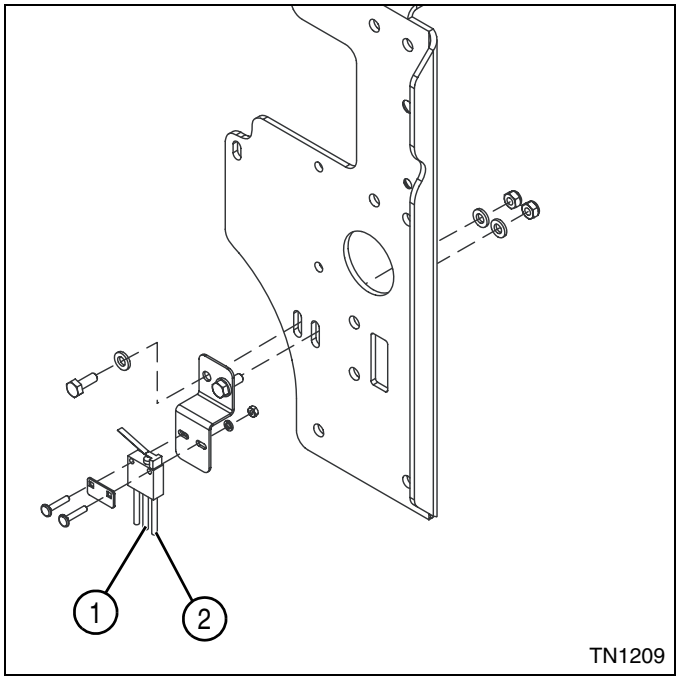

Figure 4-44

3. Disconnect the backlap switch electrical connector.
4. Remove two bolts holding switch to frame and remove the switch. Inspect switch for damage.
5. Using a multimeter set to test continuity or a continuity tester, measure the continuity between terminals (1 and 2) while operating the switch.

   Is continuity indicated?

   YES *The switch is good.*

   NO *The backlap switch is faulty; replace the switch. (See “Backlap Switch” on page 4-87.)*

Engine Oil Pressure Switch Test

See Figure 4-45.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Check the engine oil level. Add oil as needed. (Refer to “Safety, Operation & Maintenance Manual” for oil specification.)

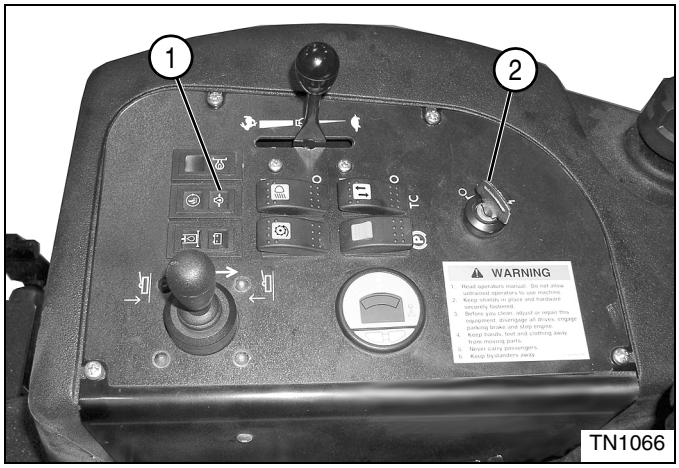

Figure 4-45

3. Turn the key 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 4-49.)*

4. Start the engine. (Refer to “Safety, Operation & 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 Level Sender Test

See Figures 4-46 and 4-47.

Required Tools or Equipment
Digital Multimeter or Ohmmeter

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Remove the fuel level sender from the fuel tank. (See “Fuel Tank” on page 9-6.)

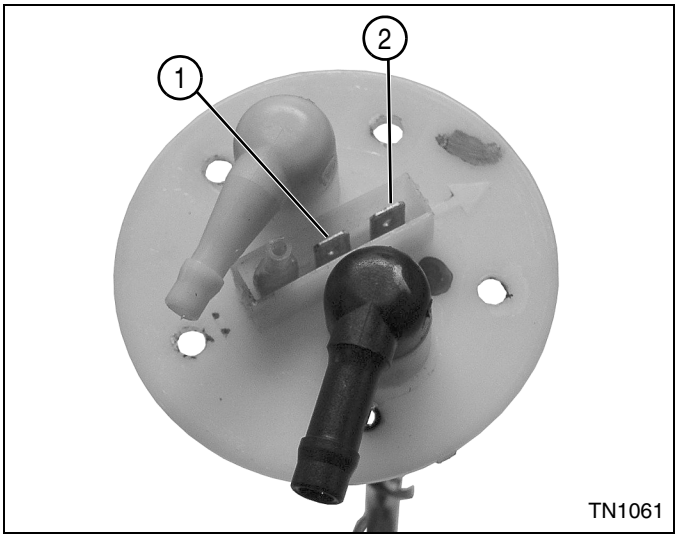

Figure 4-46

3. Connect the test leads to terminals (1 and 2).
4. Set the meter to read ohms.

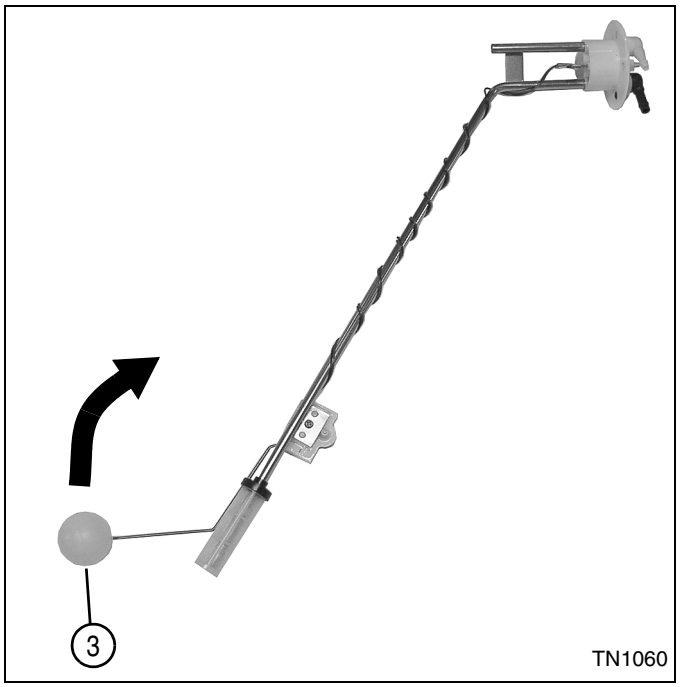

Figure 4-47

NOTE

Float shown in the empty position.

5. Move the float (3) in the empty position and read the resistance value.

   Is the resistance value approximately 180 ohms?

   YES *Proceed to step 6.*

   NO *The sender unit is faulty; replace the sender unit.*

6. Move the float (3) to the full position and read the resistance value.

   Is the resistance value approximately 4.0 ohms?

   YES *The sender unit is good.*

   NO *The sender unit is faulty; replace the sender unit.*

Engine Components

Refer to the engine manual for testing of engine-related electrical components.

Repair

Battery and Battery Tray

Removal and Installation

See Figures 4-48 through 4-50.

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 1-7.)
2. Raise and support the seat platform.
3. Remove OPS. (See “OPS” on page 9-4.)

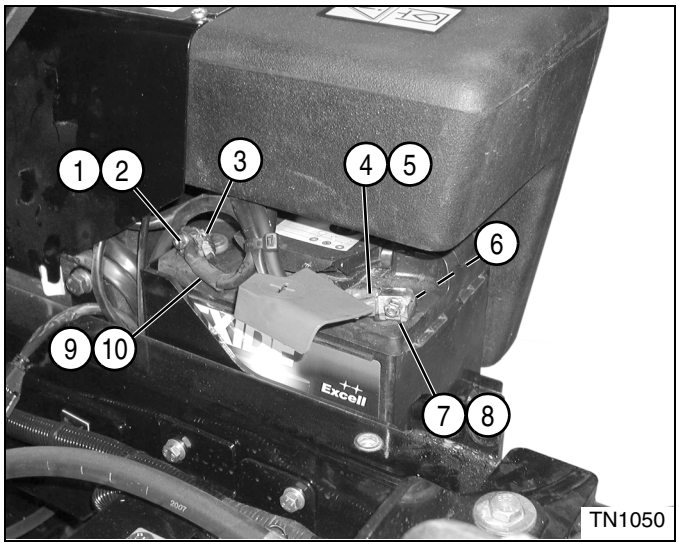

Figure 4-48

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.

4. Remove the nut (1), flat washer (2), and screw (3), and disconnect the negative (–) battery cables (9 and 10).
5. Remove the nut (7), flat washer (8), and screw (6), and disconnect the positive (+) battery cables (4 and 5).

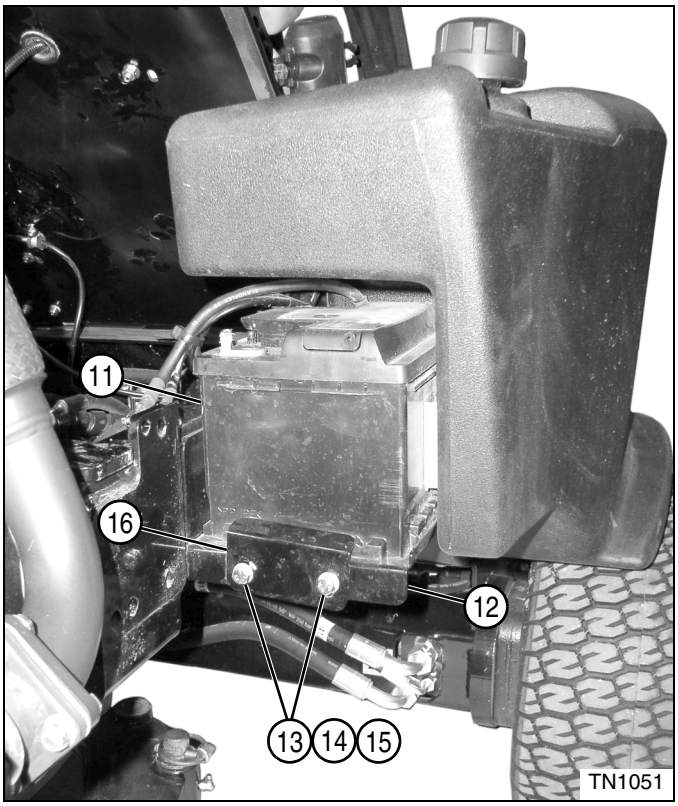

Figure 4-49

6. Remove two screws (13), lock washers (14) and flat washers (15) and retainer bracket (16) from the battery tray (12).

NOTICE

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

7. Remove the battery (11).

NOTE

Perform steps 8 through 11 if the battery tray is to be removed.

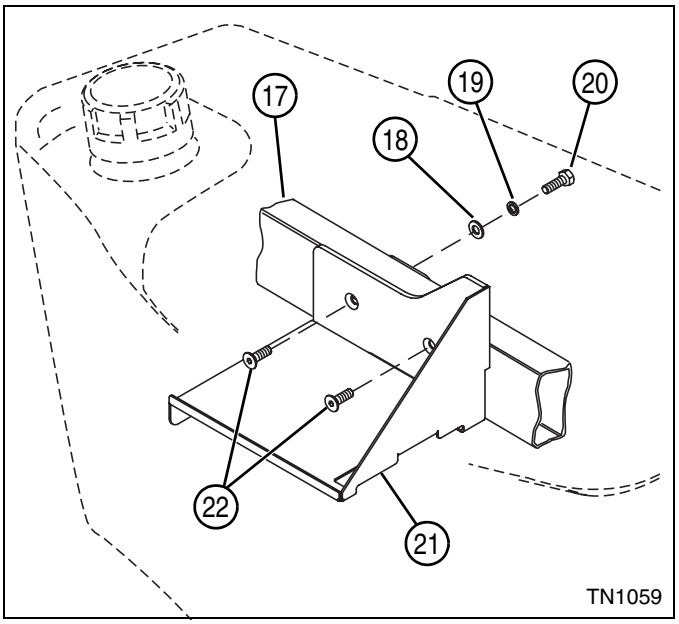

Figure 4-50

8. Support the battery tray (21).
9. Remove one screw (20), lock washer (19), and flat washer (18) from the inside of the frame rail (17) and battery tray (21).
10. Remove two countersunk, socket-head screws (22) from the battery tray (21) and the outside of the frame rail (17).
11. Remove the battery tray (21).

Installation Note

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

Alternator

Removal and Installation

See Figures 4-51 and 4-52.

NOTE

Turbocharged engine shown; naturally aspirated engine is similar.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Raise hood.
3. Disconnect the battery negative (–) cables at the battery.

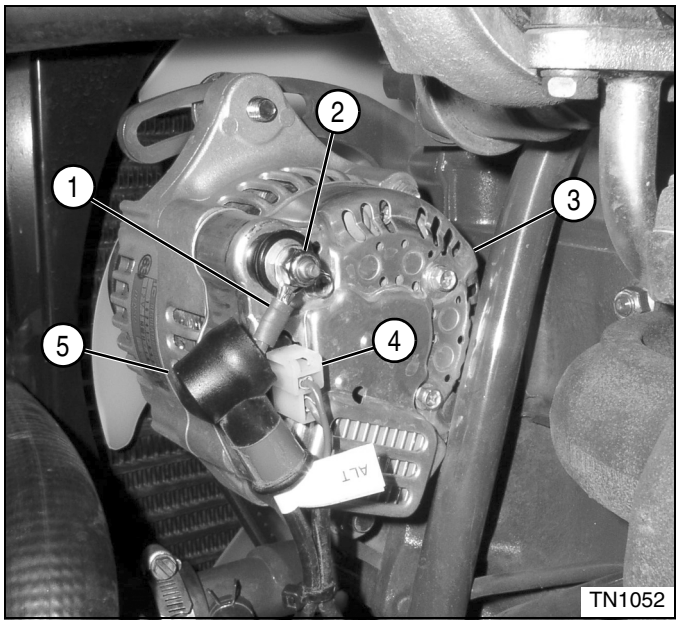

Figure 4-51

4. Remove the boot (5) from the 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 (1) from terminal.
6. Disconnect wiring connector block (4) from the alternator (3).

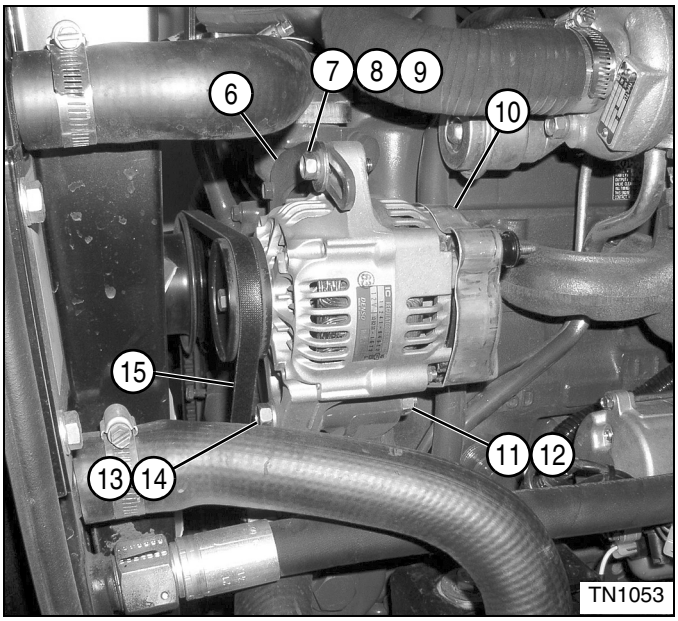

Figure 4-52

7. Loosen screw (7) and push the alternator (10) toward the engine.
8. Remove the fan drive belt (15).
9. Support the alternator (10).
10. Remove screw (7), lock washer (8), and flat washer (9) from the upper bracket (6) and alternator (10).
11. Remove nut (11), lock washer (12), screw (13), and flat washer (14), and remove alternator (10).

Installation Notes

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

Starter Motor

Removal and Installation

See Figures 4-53 through 4-55.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Raise hood.
3. Disconnect the battery negative (–) cables at the battery.

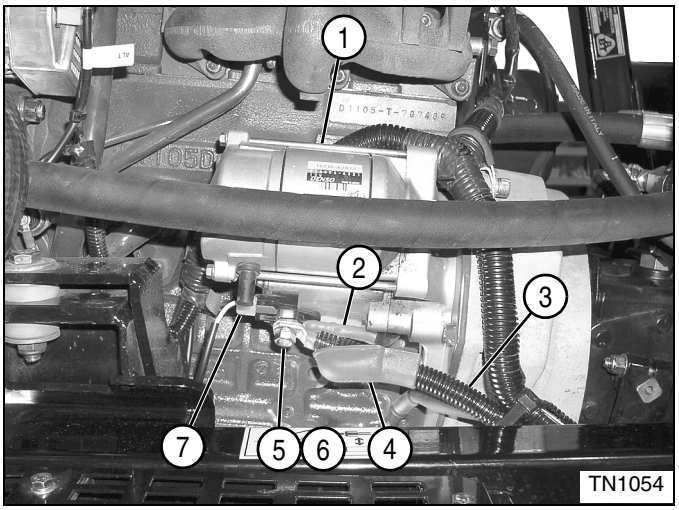

Figure 4-53

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

NOTE

Label all wires before disconnecting to ensure correct installation.

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

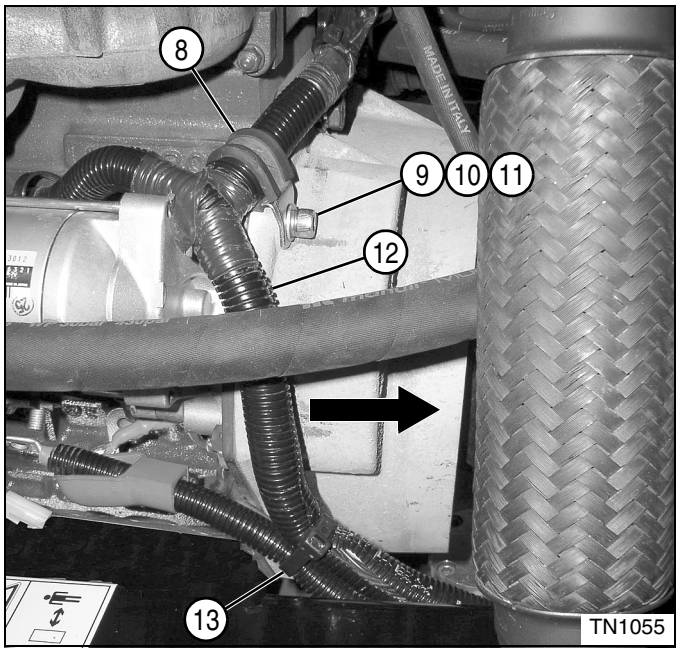

Figure 4-54

7. Remove socket-head screw (9), lock washer (10), and flat washer (11) from cushion clamp (8).
8. Remove cable tie (13).
9. Move the wiring harness (12) aside to allow access to the rear mounting screw.

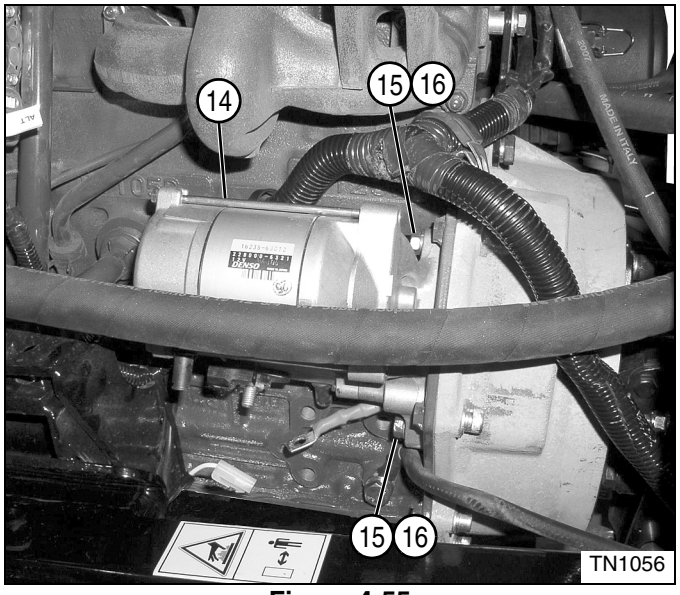

Figure 4-55

10. Support the starter motor (14).
11. Remove two screws (15) and lock washers (16), and remove the starter motor (14).

Installation Note

Install the starter motor by reversing the order of removal.

Instrument Panel

Removal and Installation

See Figures 4-56 through 4-58.

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 1-7.)

NOTE

Label all wires before disconnecting to ensure correct installation.

2. Disconnect the battery negative (–) cables at the battery.
3. If removing the instrument panel, disconnect the positive (+) cables from the battery.
4. Raise and support the seat platform.

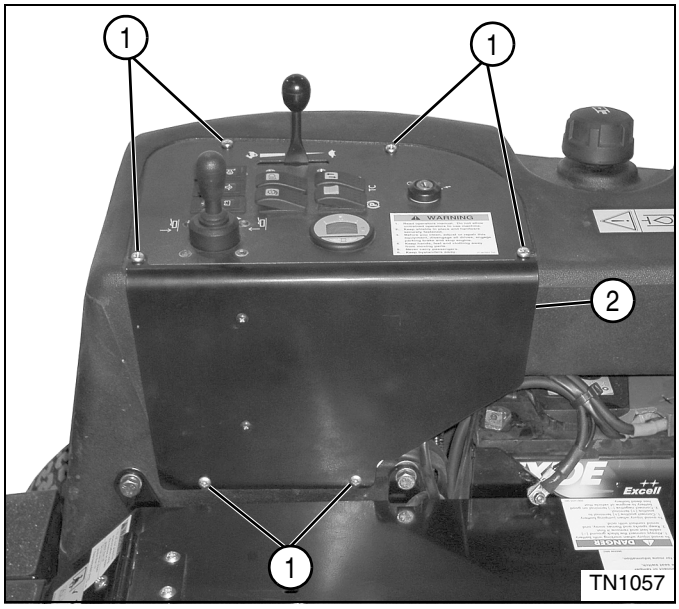

Figure 4-56

NOTES

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

5. Remove six screws (1) and move the panel (2) aside, or service components as needed.

NOTE

If removing the instrument panel, proceed to steps 6 through 9.

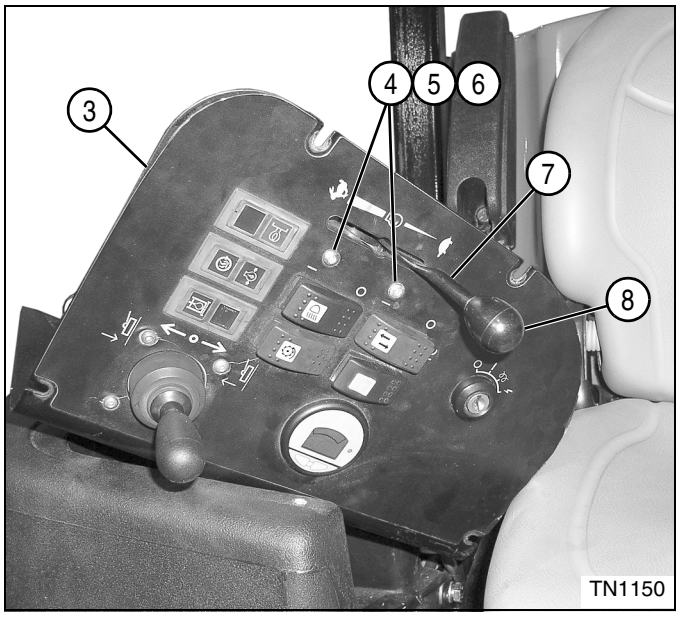

Figure 4-57

6. Remove (unscrew) the knob (8) from the throttle control lever assembly (7).
7. Remove two lock nuts (4), flat washers (5), and screws (6), and remove throttle control lever assembly (7) from instrument panel (3).

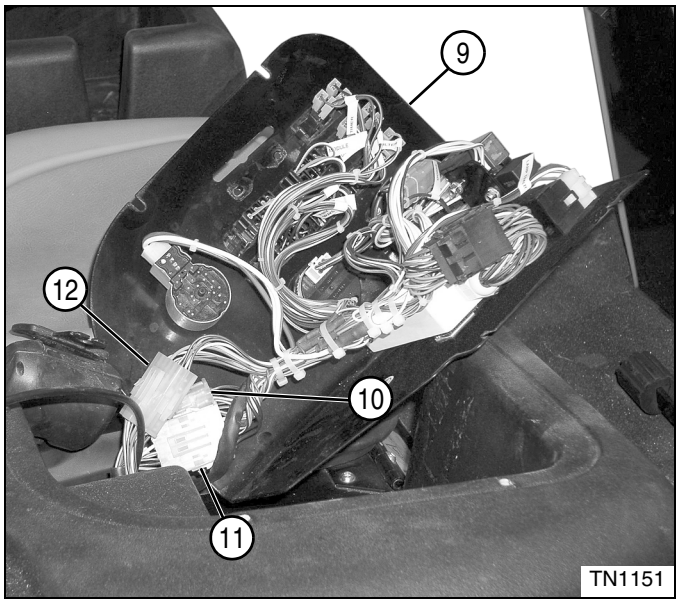

Figure 4-58

8. Disconnect three wiring connectors (10, 11 and 12) from the harness.
9. Remove the instrument panel (9).

Installation Note

Install the instrument panel by reversing the order of removal.

Fuses

Plug-In Fuses

Removal and Installation

See Figures 4-59 and 4-60.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Disconnect the battery negative (–) cables at the battery.
3. Remove instrument panel. (See “Instrument Panel” on page 4-77.)

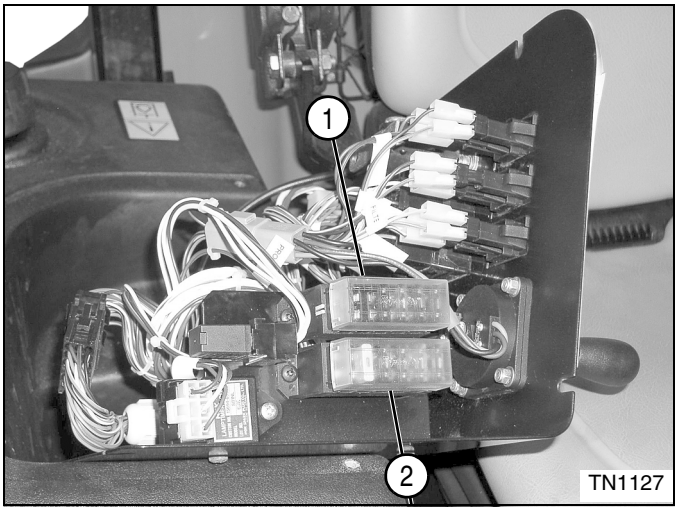

Figure 4-59

4. Remove the fuse holder cover(s) (1 or 2).

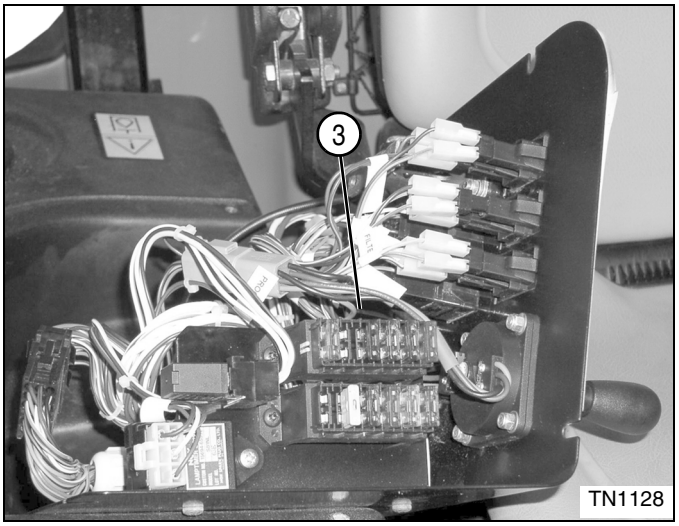

Figure 4-60

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

Installation Note

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

Strip Fuses

Removal and Installation

See Figures 4-61 and 4-62.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Disconnect the battery negative (–) cables at the battery.
3. Raise hood.

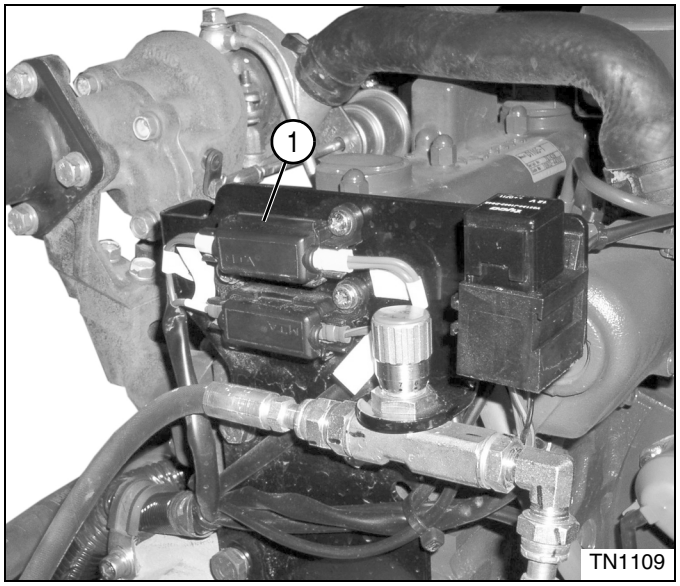

Figure 4-61

4. Open the fuse holder cover (1).

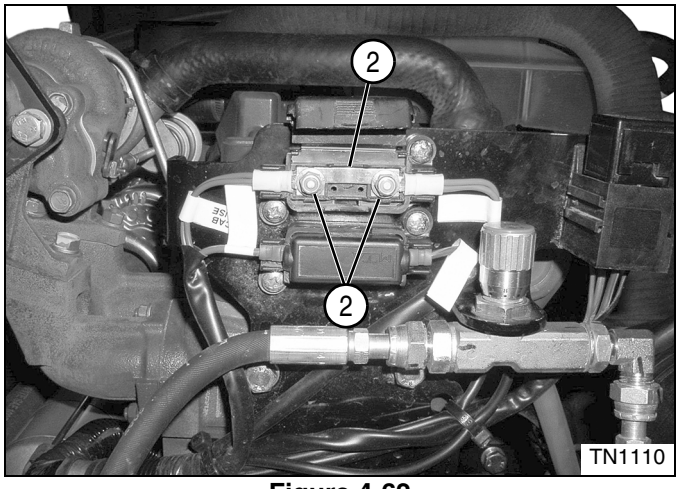

Figure 4-62

5. Remove two lock nuts (2), and remove strip fuse (2).

Installation Note

Install strip fuse by reversing the order of removal.

Diode Module

Removal and Installation

See Figure 4-63.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Disconnect the battery negative (–) cables at the battery.
3. Remove instrument panel. (See “Instrument Panel” on page 4-77.)

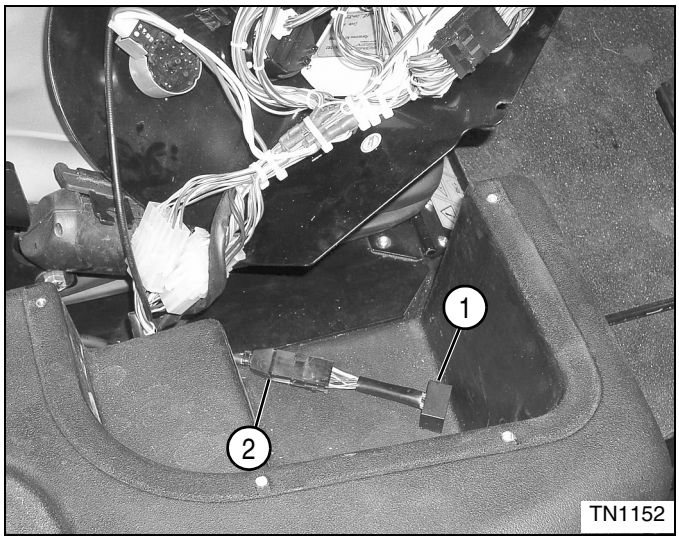

Figure 4-63

4. Disconnect the diode module (1) from the harness (2).

Installation Note

Install the diode module by reversing the order of removal.

Start Relay

Removal and Installation

See Figure 4-64.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Disconnect the battery negative (–) cables at the battery.
3. Remove instrument panel. (See “Instrument Panel” on page 4-77.)

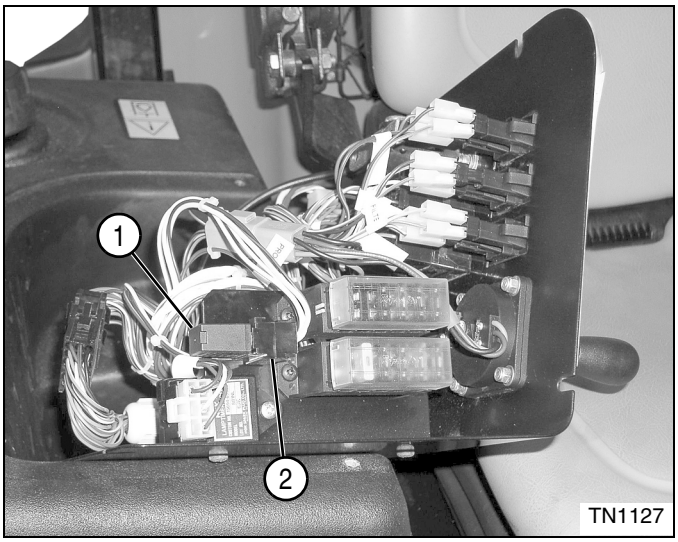

Figure 4-64

4. Pull the relay (1) straight up and out of the relay base (2).

Installation Note

Install the start relay by reversing the order of removal.

Glow Plug Relay

Removal and Installation

See Figure 4-65.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Disconnect the battery negative (–) cables at the battery.
3. Raise the engine hood.

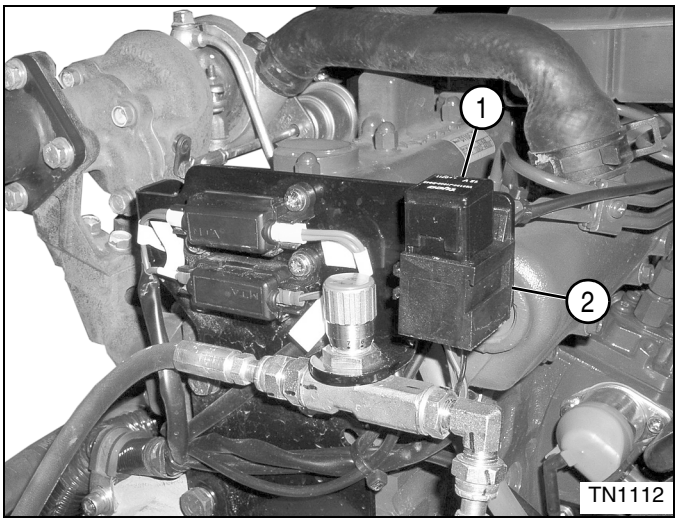

Figure 4-65

4. Pull the relay (1) straight up and out of the relay base (2).

Installation Note

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

Key Switch

Removal and Installation

See Figures 4-66 and 4-67.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Disconnect the battery negative (–) cables at the battery.
3. Remove instrument panel. (See “Instrument Panel” on page 4-77.)

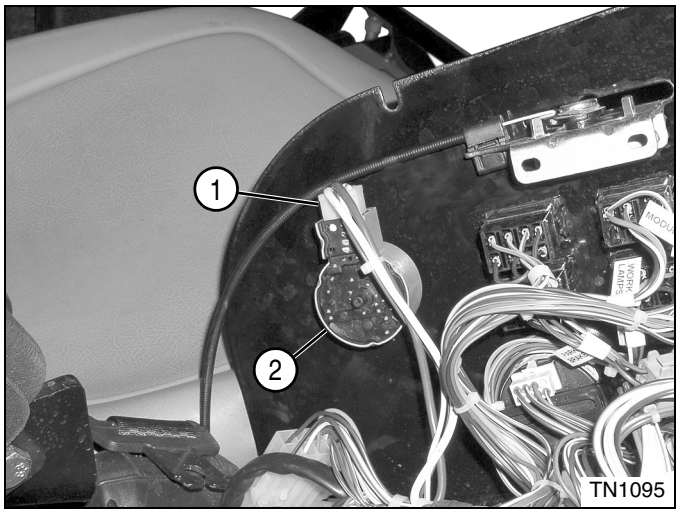

Figure 4-66

4. Disconnect the wiring connector (1) from the key switch (2).

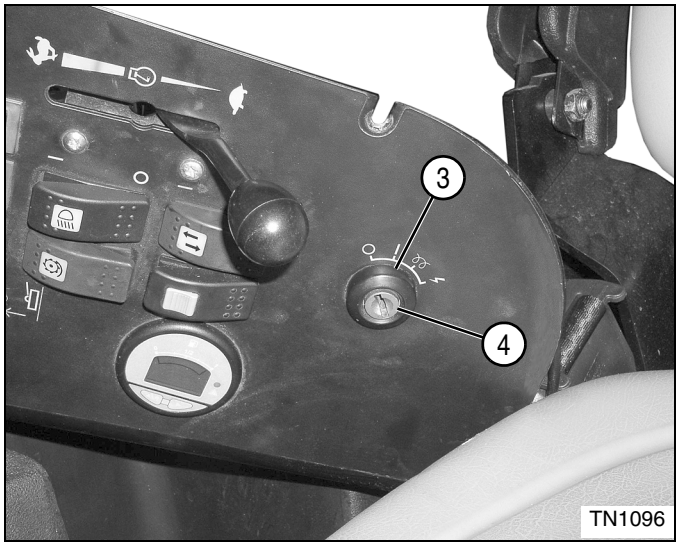

Figure 4-67

5. Remove (unscrew) the retainer ring (3), and remove the key switch (4).

Installation Note

Install the key switch by reversing the order of removal.

Rocker Switches

See Figure 4-68.

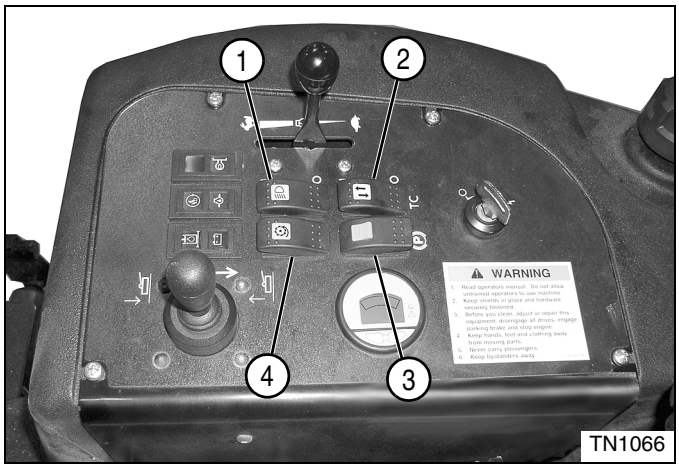

Figure 4-68

This procedure applies to the following switches:

- Work Light Switch (Optional) (1)
- Weight Transfer Switch (2)
- Park Brake Switch (3)
- Mow Switch (4)

Removal and Installation

See Figures 4-69 and 4-70.

NOTE

Weight transfer switch shown.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Disconnect the battery negative (–) cables at the battery.
3. Remove instrument panel. (See “Instrument Panel” on page 4-77.)

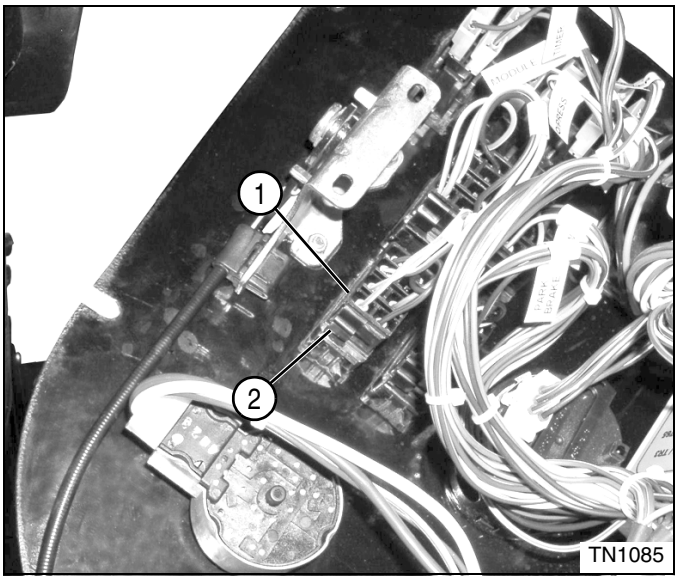

Figure 4-69

NOTE

Label all wiring connectors before removing to ensure correct installation.

4. Press in on the tab (2), and disconnect wiring connector (1) from switch.

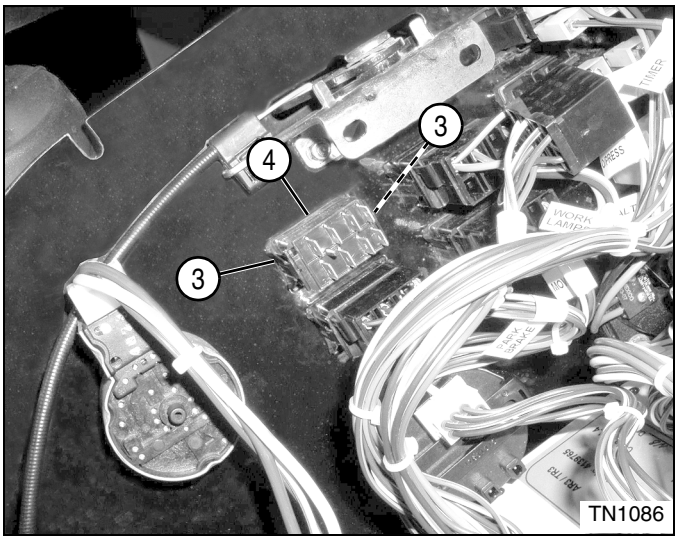

Figure 4-70

5. Press in on the tabs (3) on each side of the switch, and push the switch (4) through the panel.

Installation Note

Install switches by reversing the order of removal.

Indicator Lamps

See Figure 4-71.

Figure 4-71

This procedure applies to the following indicator lamps:

- Control Module Warning/Engine Preheat Lamps (1)
- Engine Temperature Warning/Engine Oil Pressure Warning Lamps (2)
- Block Hydraulic Filter Warning/Charge Warning Lamps (3)

Removal and Installation

See Figures 4-72 and 4-73.

NOTE

Control module warning/engine preheat lamp module shown.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Disconnect the battery negative (–) cables at the battery.
3. Remove instrument panel. (See “Instrument Panel” on page 4-77.)

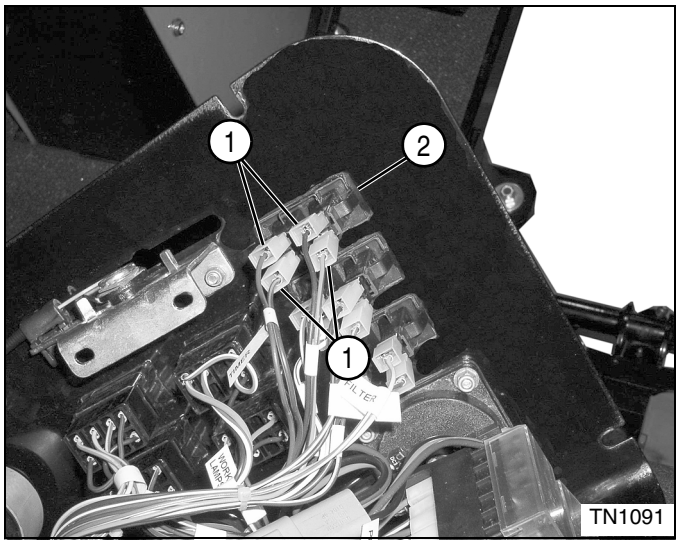

Figure 4-72

NOTE

Label all wiring connectors and record their locations before removing to ensure correct installation.

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

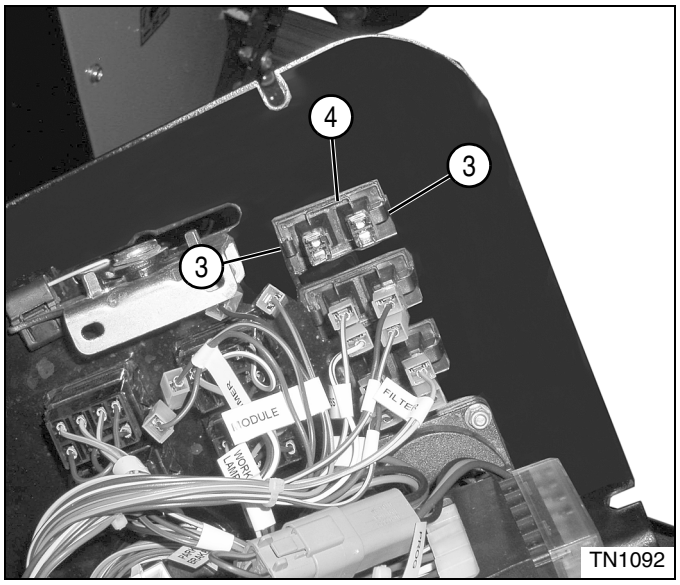

Figure 4-73

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

Installation Note

Install indicator lamp module(s) by reversing the order of removal.

Brake Safety Switch

Removal and Installation

See Figure 4-74.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Disconnect the battery negative (–) cables at the battery.

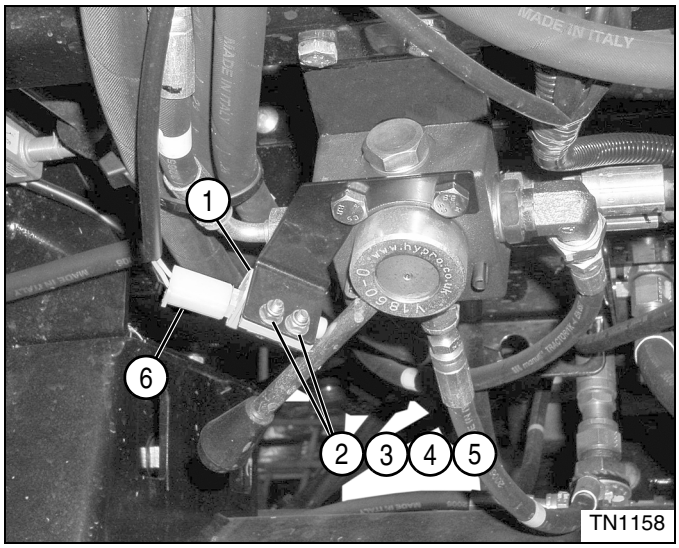

Figure 4-74

3. Disconnect the wiring connector (1) from the brake safety switch (6).
4. Remove two lock nuts (2), flat washers (3), and screws (4), and remove clamp plate (5) and brake safety switch (6).

Installation Note

Install the brake safety switch by reversing the order of removal.

Joystick

Removal and Installation

See Figures 4-75 and 4-76.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Disconnect the battery negative (–) cables at the battery.
3. Remove instrument panel. (See “Instrument Panel” on page 4-77.)

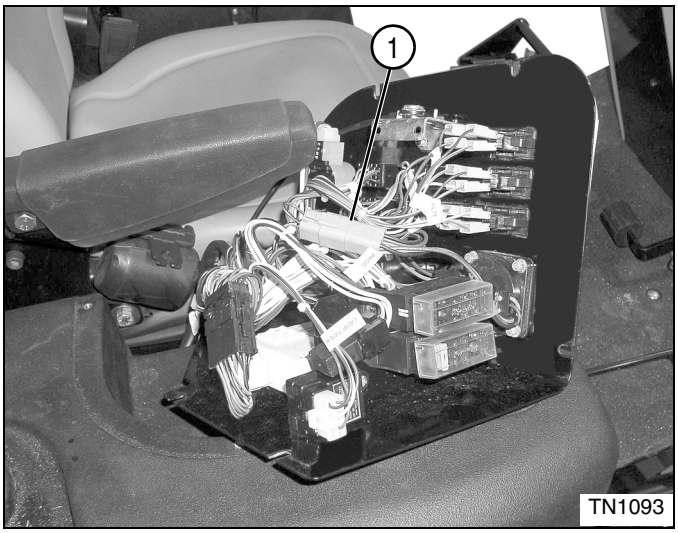

Figure 4-75

NOTE

Label all wiring connectors before removing to ensure correct installation.

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

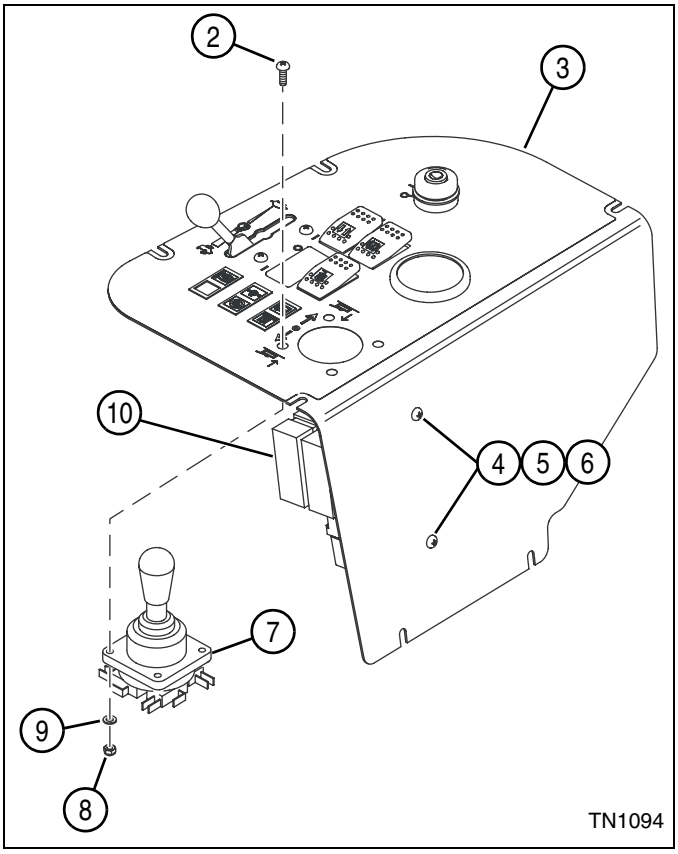

Figure 4-76

5. Remove two lock nuts (4), flat washers (5), and screws (6), and move the fuse block bracket assembly (10) aside.

NOTES

- Record the orientation of the joystick before removing to ensure correct installation.
- When removed, the joystick may come out as two separate pieces. If the joystick is to be tested after removal, connect the two pieces together using the mounting hardware.

6. Remove four lock nuts (8), flat washers (9), and screws (2), and remove joystick (7) from instrument panel (3).

Installation Note

Install the joystick by reversing the order of removal.

Control Module

Removal and Installation

See Figure 4-77.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Disconnect the battery negative (–) cables at the battery.
3. Remove instrument panel. (See “Instrument Panel” on page 4-77.)

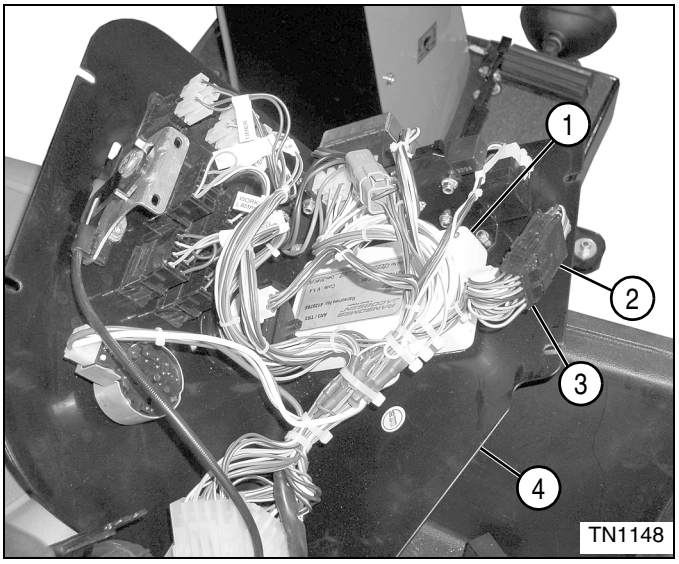

Figure 4-77

4. Disconnect the control module wiring connector (2) from the harness (3).
5. Remove the control module (1) from the instrument panel (4).

Installation Note

Install the control module by reversing the order of removal.

Multi-Function Gauge

Removal and Installation

See Figures 4-78 and 4-79.

NOTE

Remove the multi-function gauge only if replacement is required. Removal of the retainer bracket will result in damage to the bracket.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Disconnect the battery negative (–) cables at the battery.
3. Remove instrument panel. (See “Instrument Panel” on page 4-77.)

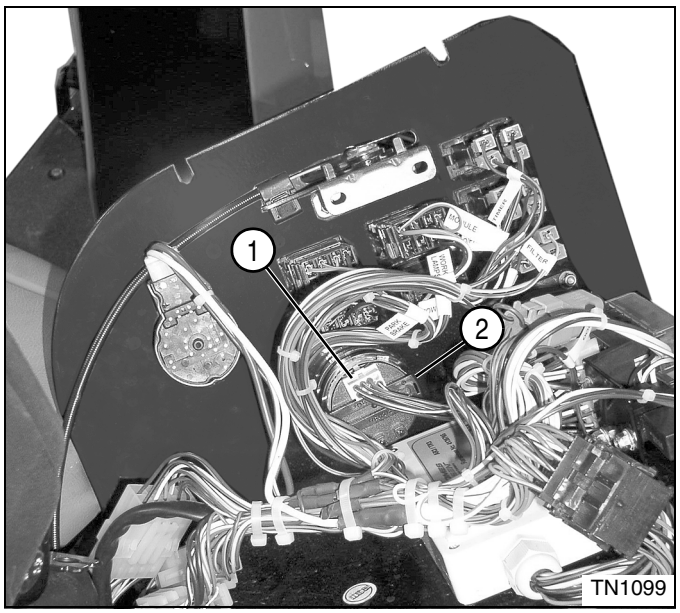

Figure 4-78

4. Disconnect the wiring connector (1) from the multi-function gauge (2).

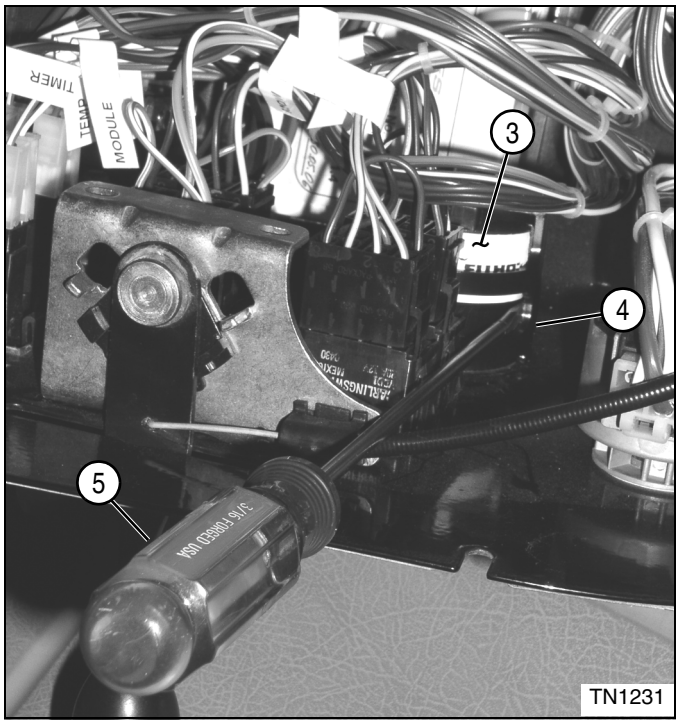

Figure 4-79

NOTE

The bracket must be removed in stages, working from side-to-side until the bracket is free of the gauge body.

5. Insert a thin flat-bladed screwdriver (5) between the mounting bracket (4) and gauge body (3), and carefully pry the bracket away from the gauge body while lifting the bracket.

   Repeat the procedure on the other side of the gauge/retainer bracket.

Installation Note

Install the multi-function gauge by reversing the order of removal.

Seat Switch

Removal and Installation

The seat switch removal and installation is included in the seat and mounting plate removal and installation procedure. (See “Seat and Mounting Plate” on page 9-16.)

Traction Pedal Neutral Switch

Removal and Installation

See Figure 4-80.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Remove the right front mower deck. (See “Rotary Cutting Unit” on page 8-25.)

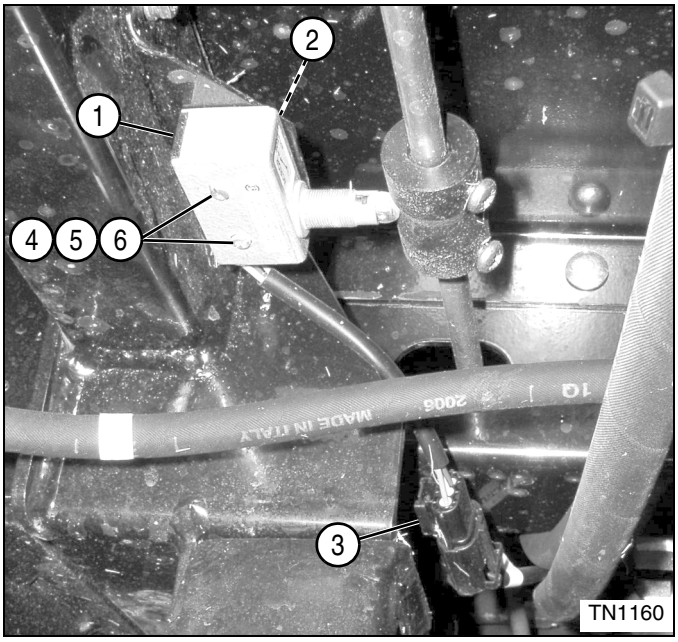

Figure 4-80

3. Disconnect the wiring connector (3) from the harness.
4. Remove two screws (4), lock washers (5), brass washers (6), and mounting plate (2), and remove neutral switch (1).

Installation Notes

- *Install the neutral switch by reversing the order of removal.*
- *Adjust the neutral switch. (See “TR-3 and Early Model 30001 AR-3 Traction Pedal Neutral Switch Adjustment” on page 5-21.)*

Solenoid Coils

See Figures 4-81 and 4-82.

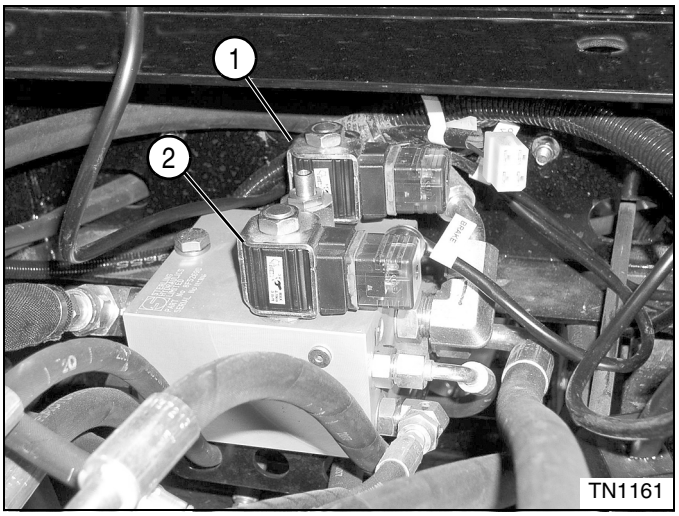

Figure 4-81: Mow and Brake Solenoid Coils

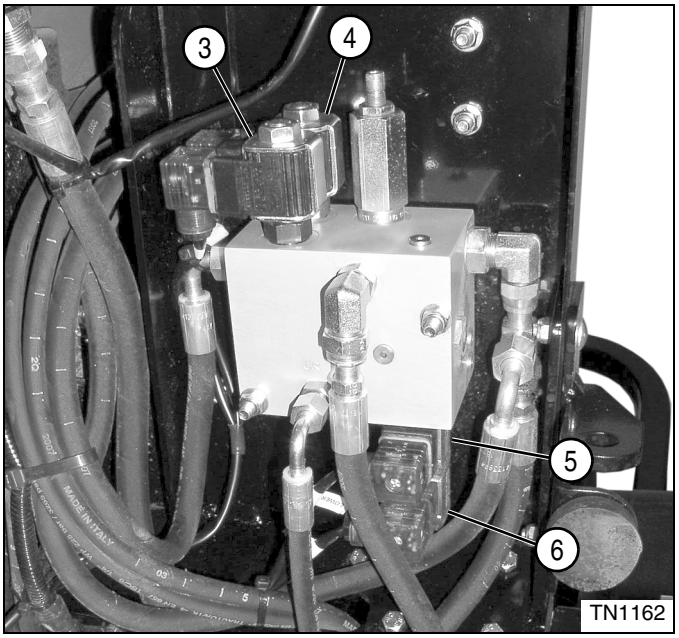

Figure 4-82

This procedure applies to the following solenoid coils:

- Brake Solenoid Coil (1)
- Mow Solenoid Coil (2)
- Weight Transfer Solenoid Coils (3 and 4)
- Lower Solenoid Coil (5)
- Lift Solenoid Coil (6)

The brake and mow solenoid coils are located under the seat platform.

The lift, lower, and weight transfer solenoid coils are located under the foot platform.

Removal and Installation

See Figure 4-83.

NOTE

The mow solenoid is shown; all solenoids are removed and installed the same way.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Raise and support the seat platform (mow and brake solenoids) or remove the left front mower deck (raise, lower, and weight transfer solenoids). (See “Rotary Cutting Unit” on page 8-25.)
3. Disconnect the battery negative (–) cables at the battery.

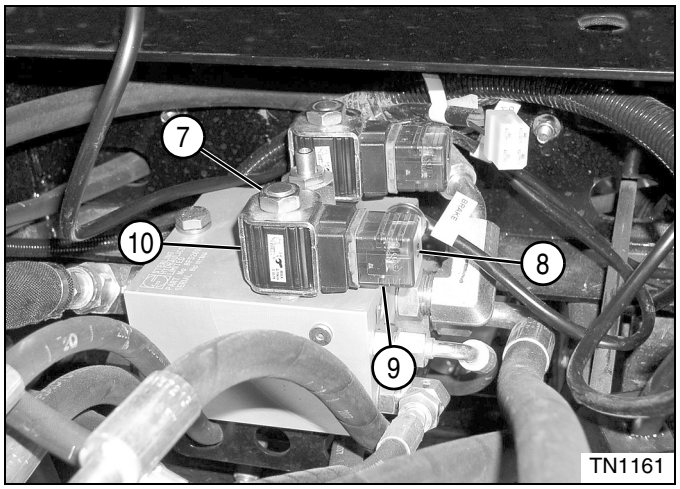

Figure 4-83

4. Remove screw (8), and disconnect connector block (9) from the solenoid coil (10).
5. Remove nut (7), and remove the solenoid coil (10) from the valve.

Installation Notes

- *Install the solenoid coils by reversing the order of removal.*
- *Tighten nut (7) to 36 lb-in. (4.1 N·m).*

Fuel Shutoff Solenoid

Removal and Installation

See Figure 4-84.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Disconnect the battery negative (–) cables at the battery.
3. Raise the hood.

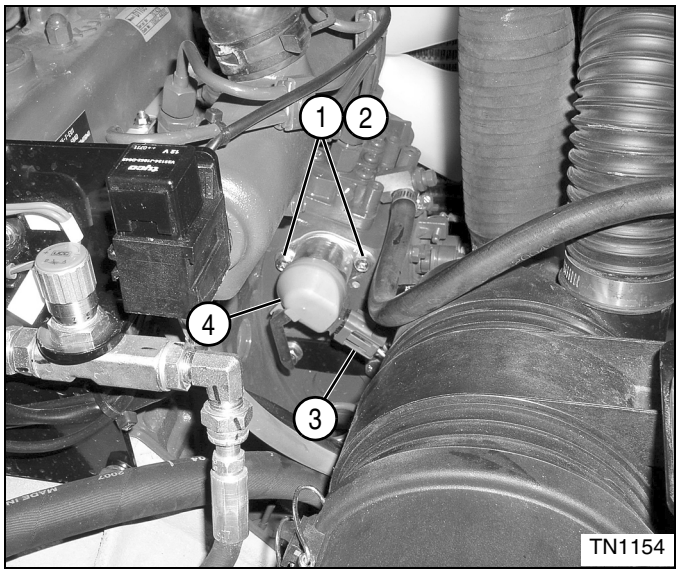

Figure 4-84

4. Disconnect the wiring connector (3) from the fuel shutoff solenoid (4).
5. Remove two screws (1) and washers (2).

Installation Note

Install the fuel shutoff solenoid by reversing order of removal.

Backlap Switch

Removal and Installation

See Figure 4-85.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)

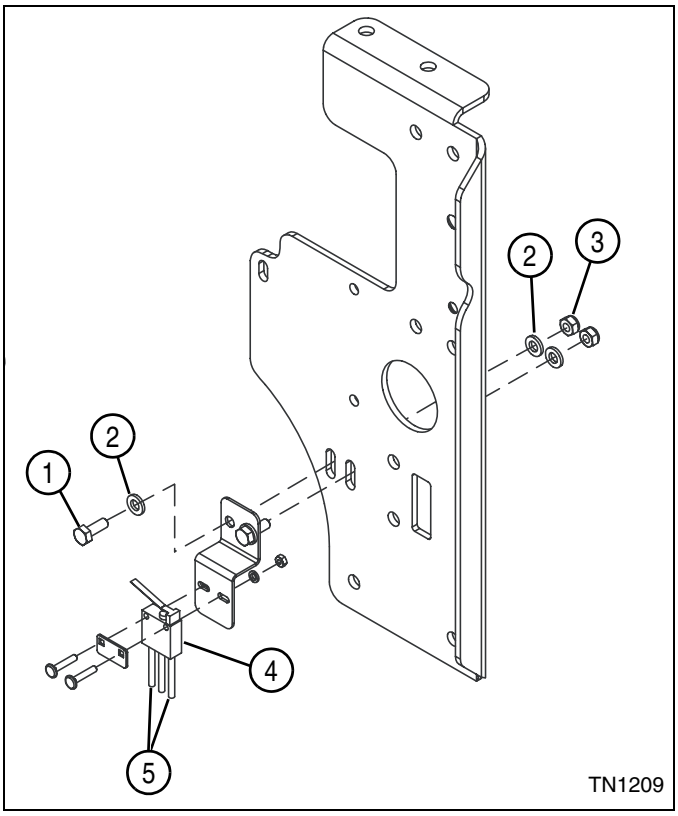

Figure 4-85

NOTE

Label all wires before disconnecting to ensure correct installation.

2. Disconnect wires (5) from switch terminals.
3. Remove two nuts (3) and screws (1), and four flat washers (2), and remove backlap switch (4).

Installation Note

Install backlap switch by reversing order of removal.

Hydraulic Oil Filter Switch

Removal and Installation

See Figure 4-86.

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 1-7.)
2. Raise and support the seat platform.

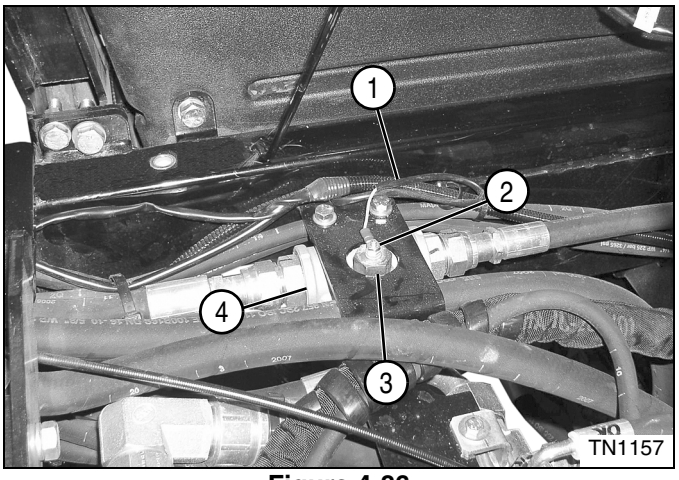

Figure 4-86

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

Installation Notes

Required Materials
Telfon® Tape

- *Install the 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 4-87.

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 1-7.)
2. Disconnect the battery negative (–) cables at the battery.
3. Open the engine hood.

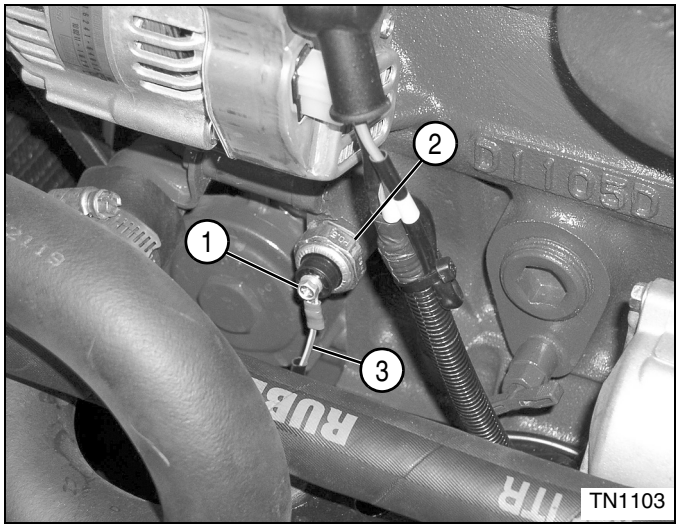

Figure 4-87

NOTE

Label all wires before disconnecting to ensure correct installation.

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

Installation Notes

Required Materials
Telfon® Tape

- *Install the 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 Figures 4-88 and 4-89.

NOTE

Naturally aspirated engine shown; turbocharged engine is similar.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Disconnect the battery negative (–) cables at the battery.
3. Open the engine hood.

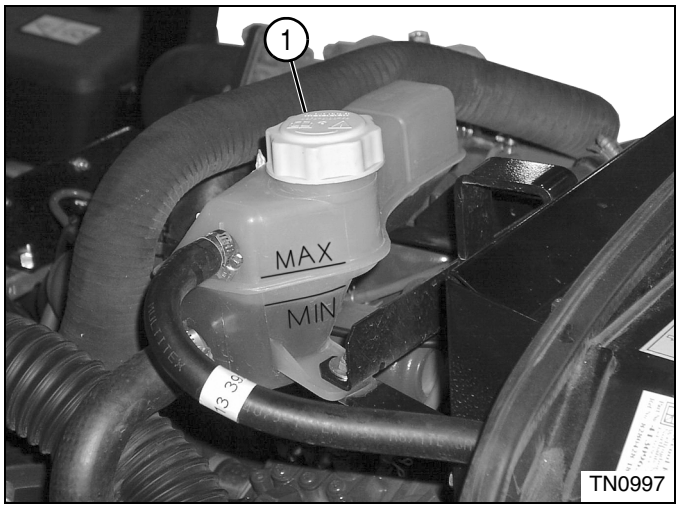

Figure 4-88

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.

4. Rotate pressure cap (1) 1/2-turn to relieve pressure in cooling system.

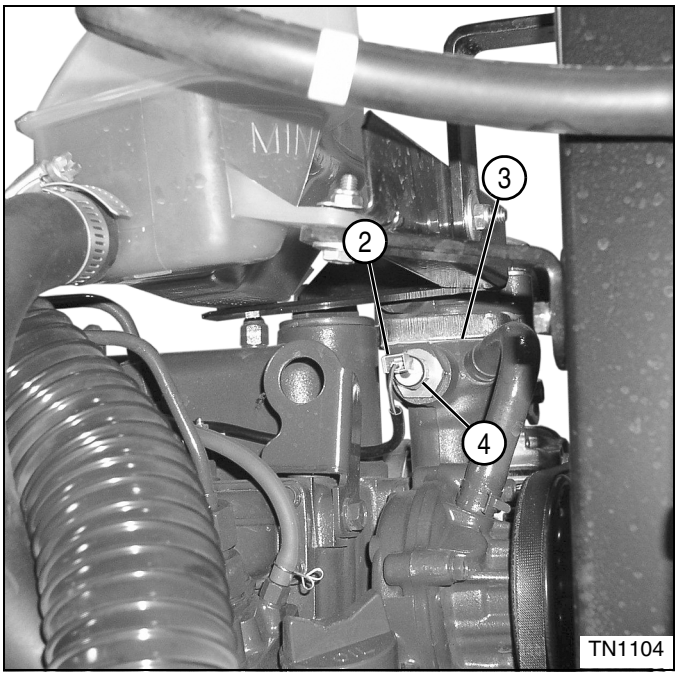

Figure 4-89

NOTE

Label all wires before disconnecting to ensure correct installation.

5. Disconnect wiring connector (2) from the engine temperature switch (4).
6. Remove the engine temperature switch (4) from the thermostat housing (3).

Installation Notes

Required Materials
Telfon® Tape

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

Fuel Level Sender

Removal and Installation

The fuel level sender removal and installation is included in the fuel tank disassembly and assembly procedure. (See “Fuel Tank” on page 9-6.)

Alarm

Removal and Installation

See Figure 4-90.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Raise and support the seat platform.

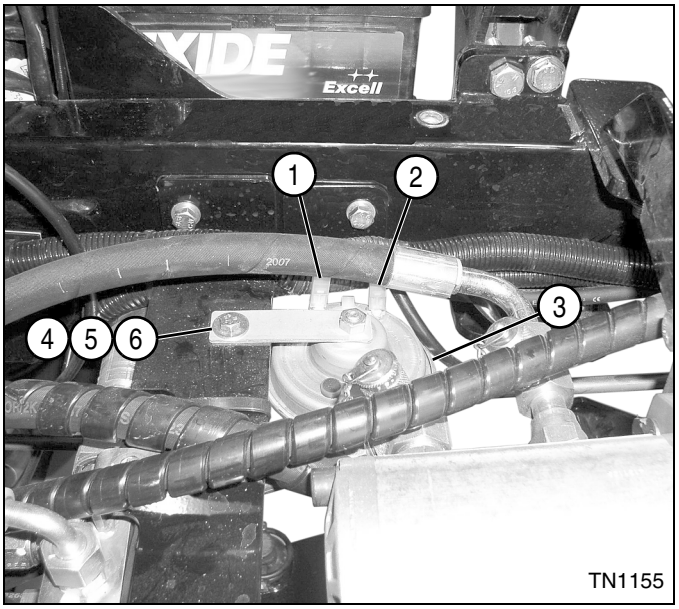

Figure 4-90

NOTE

Label all wires before disconnecting to ensure correct installation.

3. Disconnect wires (1 and 2) from alarm (3).
4. Remove lock nut (4), screw (5), and two flat washers (6), and remove the alarm (3).

Installation Note

Install the alarm by reversing the order of removal.

Glow Plug Timer

Removal and Installation

See Figure 4-91.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Disconnect the battery negative (–) cables at the battery.
3. Remove instrument panel. (See “Instrument Panel” on page 4-77.)

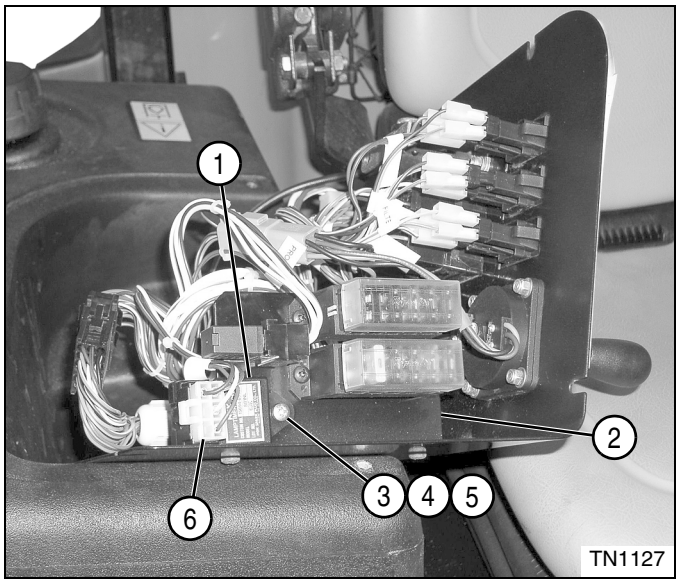

Figure 4-91

4. Disconnect wiring connector (6) from the glow plug timer (1).
5. Remove lock nut (3), flat washer (4), and screw (5), and remove the glow plug timer (1) from the fuse block bracket (2).

Installation Note

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

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Chapter 5

Hydrostatic Power Train

5

JACOBSEN
A Textron Company

Specifications

Test and Adjustment Specifications

Specification		
Hydrostatic Pump Flow	gpm (lpm)	20 (76)
Forward System Relief Pressure	psi (bar)	3046 (210)
Reverse System Relief Pressure	psi (bar)	3046 (210)
Charge Pressure	psi (bar)	160 (11)
Hydraulic Leakage Percentage Ranges		0–10% = Good 11–20% = Marginal 21% and Beyond = Bad

Repair Specifications

Specification		
Hydrostatic Pump—Hub Screw Torque	lb-ft (N·m)	37 (50)
Front Wheel Motor—Hub Nut Torque	lb-ft (N·m)	332 ± 7 (450 ± 10)
Front Wheel Motor—Mounting Flange-to-Bearing Housing Screw Torque	lb-ft (N·m)	27 (37)
Front Wheel Motor—End Cover Screw Torque	lb-ft (N·m)	52 (70)
Rear Wheel Motor—Hub Nut Torque	lb-ft (N·m)	148 ± 7 (200 ± 10)
Rear Wheel Motor—End Cover Screw Torque	lb-ft (N·m)	55—59 (75—80)

5

Portable In-Line Filter

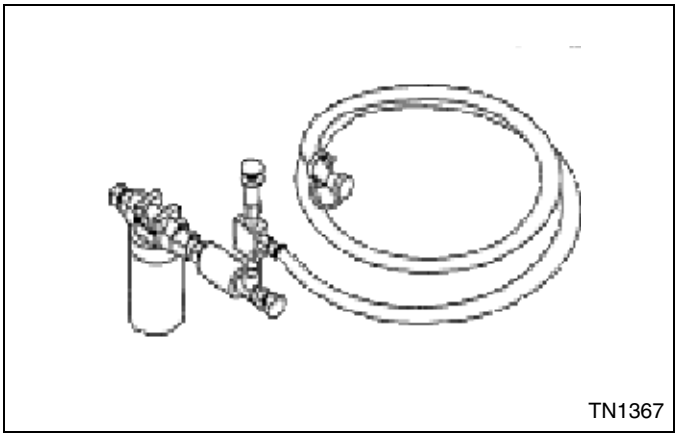
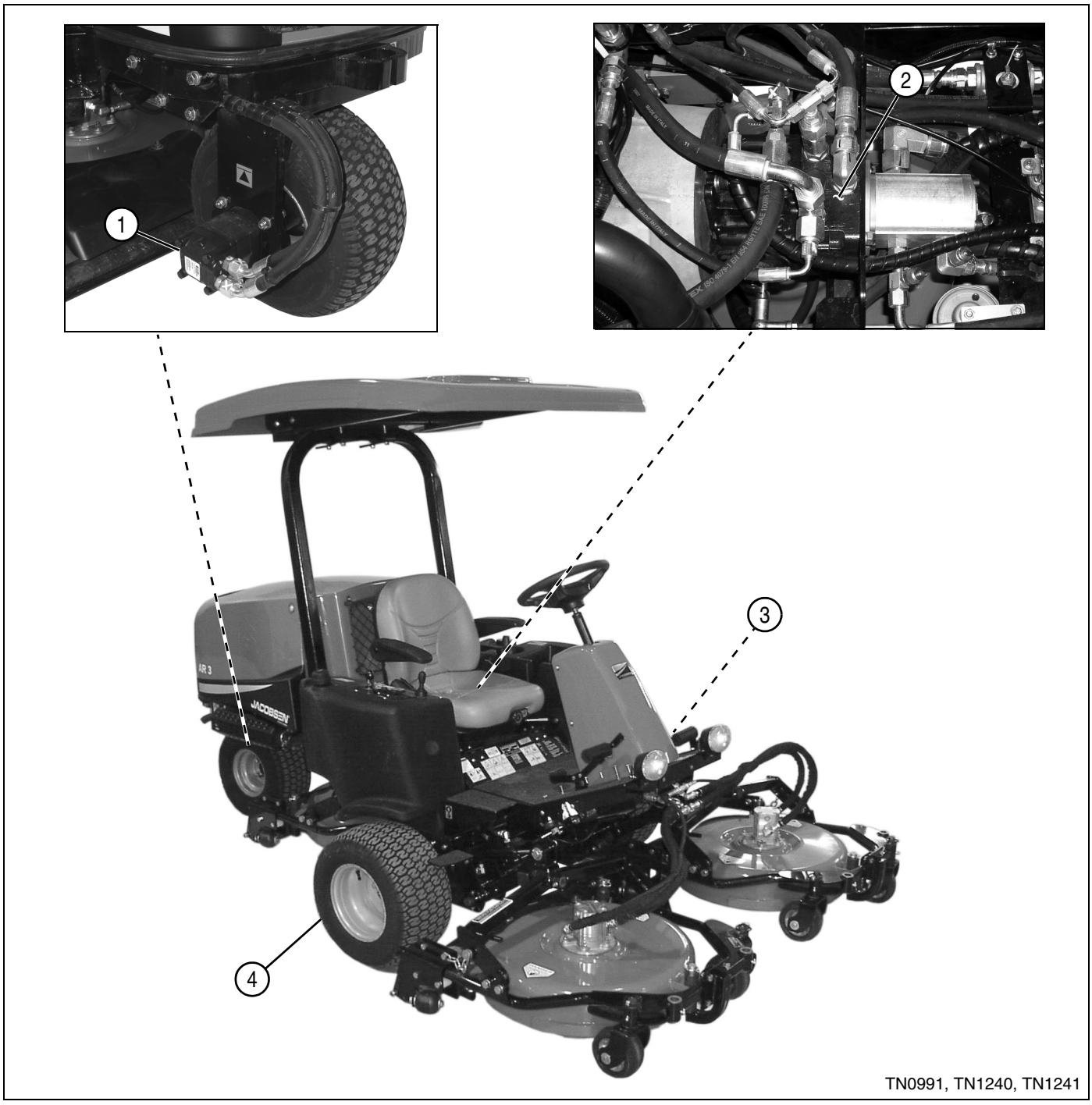


Figure 5-1

When hydraulic components fail internally, debris from the failed component can spread throughout the hydraulic system causing additional damage. Contaminated hydraulic systems should be filtered using a portable in-line filter available through your Jacobsen Dealer.

Component Location

See Figure 5-2.



1 Rear Wheel Motor
2 Hydrostatic Pump
3 Left Front Wheel Motor
4 Right Front Wheel Motor

Figure 5-2: Power Train Component Location

Theory of Operation and Sub-Circuit Schematics

Traction Circuit Forward Schematic and Theory of Operation

See Figure 5-3.

System Conditions:

- Engine running
- Mow valve off
- Park brake released
- Traction pedal depressed (forward position)

Charge Pressure Circuit

Operating pressure oil from the cutting unit pump enters the mow and brake valve at port “CP” and is directed to the pilot line circuits of the relief valve, mow solenoid valve, and the load control valve.

Operating pressure oil flows through the valve and exits the mow and brake valve at port “MP” and flows to the hydraulic oil filter. Oil flows through the oil filter, enters the traction drive pump at port “E,” and is routed to the pilot line of the charge pressure relief valve and to the traction drive circuit/pump. The charge pressure relief valve regulates the charge pressure applied to the traction drive circuit/pump. If the incoming charge pressure oil reaches 160 psi (11 bar), the charge pressure relief valve will open, releasing excess flow to the hydraulic tank.

Park Brake Circuit

The front wheel motors are equipped with multi-disk wet brakes. The brakes are spring-applied, and released with charge pressure oil controlled by the brake solenoid valve in the mow and brake valve.

The park brake circuit is equipped with a lever-operated park brake release valve to allow the release of the brakes with a dead engine for towing purposes. The park brake release valve is normally in the operating position, directing the charge oil from the mow and brake valve to the brake pistons in the front wheel motors to release the parking brakes.

When the park brake release lever is moved to the released position, the oil passage from the mow and brake valve is closed, and the passage is opened to the steering cylinder. This oil pathway provides a means to release the parking brakes with the engine off by turning the steering wheel, routing oil from the steering circuit to the parking brake to release the brakes.

Traction Pump Circuit

The traction drive pump receives a supply of filtered, charge pressure oil from the charge pressure circuit. When the traction pedal is moved to the forward position, the engine-driven traction pump supplies operating pressure oil in parallel to the front wheel motors, and in series to the rear wheel motor from port “B” of the traction drive pump, resulting in full time three-wheel drive. Oil from the rear wheel motor returns to the traction drive pump through port “A” and back into the closed-loop traction pump circuit. The traction drive circuit is protected by a circuit relief valve. This valve will open, venting excess oil flow to the return side of the loop if the pressure rises to 3046 psi (210 bar).

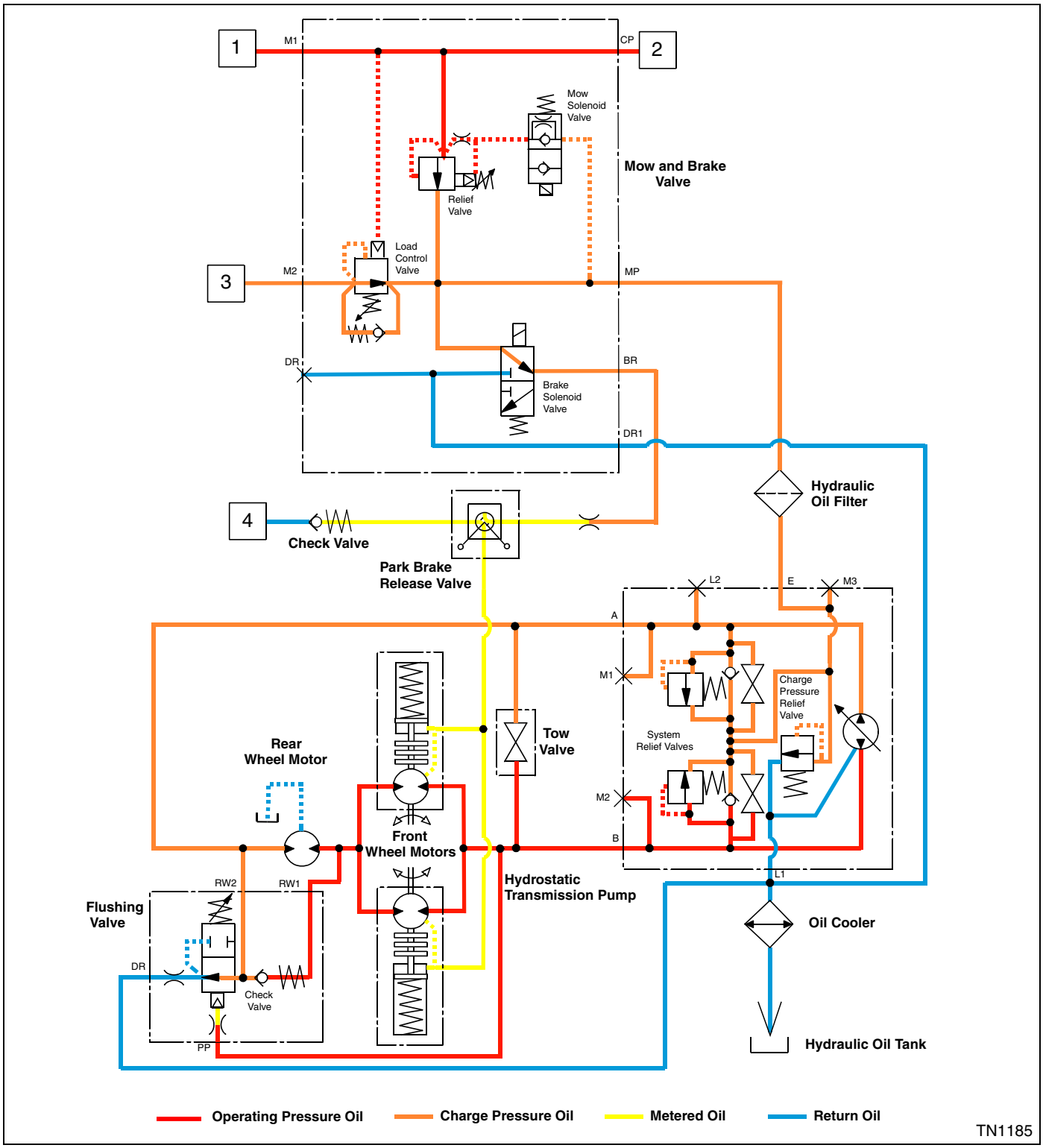
Flushing Valve

The flushing valve is used to remove hot oil from the closed-loop traction drive circuit when moving forward. Oil lost due to venting through the flushing valve is replenished by the incoming charge pressure oil at port “E” of the traction drive pump.

When driving forward, operating pressure oil is routed to the pilot line of the flushing valve, shifting the valve spool and opening the valve. Hot oil from traction drive pump port “A” and the wheel motors flows through the flushing valve, through the orifice, and is routed through the oil cooler and back to the hydraulic oil tank.

Traction Circuit—Forward Schematic

See Figure 5-3.



1 Operating Pressure Oil to Cutting Unit Drive Motors
2 Operating Pressure Oil from Mow Circuit
3 Charge Pressure Oil from Cutting Unit Drive Motors
4 Return Oil from Steering Circuit

Figure 5-3

Traction Circuit Reverse Schematic and Theory of Operation

See Figure 5-4.

System Conditions:

- Engine running
- Park brake released
- Traction pedal depressed (reverse position)

Charge Pressure Circuit

Operating pressure oil from the cutting unit pump enters the mow and brake valve at port “CP” and is directed to the pilot line circuits of the relief valve, mow solenoid valve, and the load control valve.

Operating pressure oil flows through the valve and exits the mow and brake valve at port “MP” and flows to the hydraulic oil filter. Oil flows through the oil filter, enters the traction drive pump at port “E,” and is routed to the pilot line of the charge pressure relief valve and to the traction drive circuit/pump. The charge pressure relief valve regulates the charge pressure applied to the traction drive circuit/pump. If the incoming charge pressure oil reaches 160 psi (11 bar), the charge pressure relief valve will open, venting excess oil flow to the hydraulic tank.

Park Brake Circuit

The front wheel motors are equipped with multi-disk wet brakes. The brakes are spring-applied and released with charge-pressure oil controlled by the brake solenoid valve in the mow and brake valve.

The park brake circuit is equipped with a lever-operated park brake release valve to allow the release of the brakes with a dead engine for towing purposes. The park brake release valve is normally in the operating position, directing the charge oil from the mow and brake valve to the brake pistons in the front wheel motors to release the parking brakes.

When the park brake release lever is moved to the released position, the oil passage from the mow and brake valve is closed, and the passage is opened to the steering cylinder. This oil pathway provides a means to release the parking brakes with the engine off by turning the steering wheel, routing oil from the steering circuit to the parking brake to release the brakes.

Traction Pump Circuit

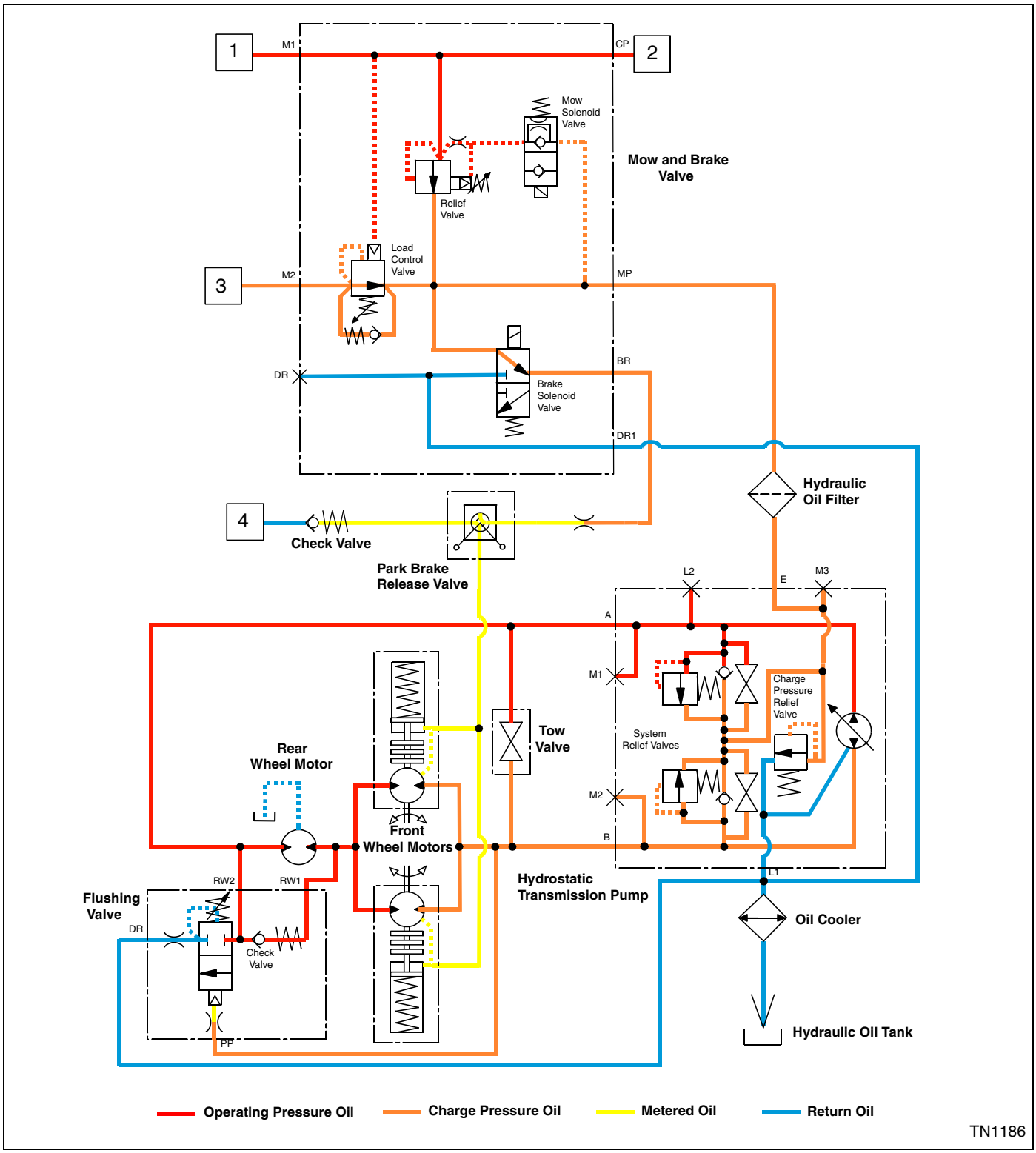
The traction drive pump receives a supply of filtered, charge pressure oil from the charge pressure circuit. When the traction pedal is moved to the reverse position, the engine-driven traction pump supplies high-pressure oil to the rear wheel motor and the check valve in the flushing valve through port “A” of the traction drive pump. The check valve in the flushing valve opens, and allows the high-pressure oil to bypass the rear wheel motor, resulting in two-wheel drive when in reverse. The oil flowing through the check valve is routed to the two front wheel motors, rotating them in the reverse direction. Oil then returns to the traction drive pump through port “B” and back into the closed-loop system. The traction drive circuit is protected by a circuit relief valve. This valve will open, venting excess oil flow to the return side of the loop if the pressure rises to 3046 psi (210 bar).

Flushing Valve

The flushing valve is used to remove hot oil from the closed-loop traction drive circuit when moving forward only. When driving in reverse, the oil pressure routed to the pilot line of the flushing valve drops, shifting the valve spool and closing the valve. Oil then flows through the check valve as described in “Traction Pump Circuit.”

Traction Circuit—Reverse Schematic

See Figure 5-4.



1 Operating Pressure Oil to Cutting Unit Drive Motors
2 Operating Pressure Oil from Mow Circuit
3 Charge Pressure Oil from Cutting Unit Drive Motors
4 Return Oil from Steering Circuit

Figure 5-4

Troubleshooting

Symptom: 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 “Safety, Operation, and Maintenance Manual” for the correct oil specifications.)
Tow valve open.	Close tow valve.
Incorrect charge pressure relief setting.	Test charge pressure relief valve setting. (See “Transmission Neutral Adjustment” on page 5-19.)
Faulty charge pump.	Test and repair. (See “Cutting Unit/Charge Pump Test” on page 6-32.)
Faulty wheel motor.	Test and repair. (See “Repair” on page 5-23.)
Faulty hydrostatic pump.	Test and repair. (See “Traction Pump Tests” on page 5-14.)

Symptom: Mower Will Not Reach Full Speed

Probable Cause	Remedy
Hydraulic oil not at correct level in reservoir.	Fill reservoir to correct level. (Refer to “Safety, Operation, and Maintenance Manual” for the correct oil specifications.)
Tow valve open.	Close tow valve.
Oil filter plugged.	Replace filter; find source of contamination.
Air bubbles in hydraulic oil.	Check suction line for air leaks.
Incorrect charge pressure relief setting.	Test charge pressure relief valve setting. (See “Transmission Neutral Adjustment” on page 5-19.)
Faulty charge pump.	Test and repair. (See “Cutting Unit/Charge Pump Test” on page 6-32.)
Faulty hydrostatic pump.	Test and repair. (See “Traction Pump Tests” on page 5-14.)
Faulty wheel motor.	Test and repair. (See “Repair” on page 5-23.)

Symptom: Poor Hydrostatic Transmission Response

Probable Cause	Remedy
Hydraulic oil not at correct level in reservoir.	Fill reservoir to correct level. (Refer to “Safety, Operation, and Maintenance Manual” for the correct oil specifications.)
Tow valve open.	Close tow valve.
Oil filter plugged.	Replace filter; find source of contamination.
Incorrect charge pressure relief setting.	Test charge pressure relief valve setting. (See “Transmission Neutral Adjustment” on page 5-19.)
Faulty charge pump.	Test and repair. (See “Cutting Unit/Charge Pump Test” on page 6-32.)
Faulty hydrostatic pump.	Test and repair. (See “Traction Pump Tests” on page 5-14.)

Symptom: Hydraulic System Operating Hot

Probable Cause	Remedy
Hydraulic oil not at correct level in reservoir.	Fill reservoir to correct level. (Refer to “Safety, Operation, and Maintenance Manual” for the correct oil specifications.)
Oil cooler has dirt or debris in fins.	Clean oil cooler fins of dirt and debris.
Incorrect charge pressure relief setting.	Test charge pressure relief valve setting. (See “Transmission Neutral Adjustment” on page 5-19.)
Faulty charge pump.	Test and repair. (See “Cutting Unit/Charge Pump Test” on page 6-32.)

Symptom: Excessive Pump Noise

Probable Cause	Remedy
Hydraulic oil not at correct level in reservoir.	Fill reservoir to correct level. (Refer to “Safety, Operation, and Maintenance Manual” for the correct oil specifications.)
Hydraulic oil cold.	Warm hydraulic oil to operating temperature.
Pump damage.	Repair pump as necessary. (See “Tandem Pump” on page 6-45.)

Wheel Restraint

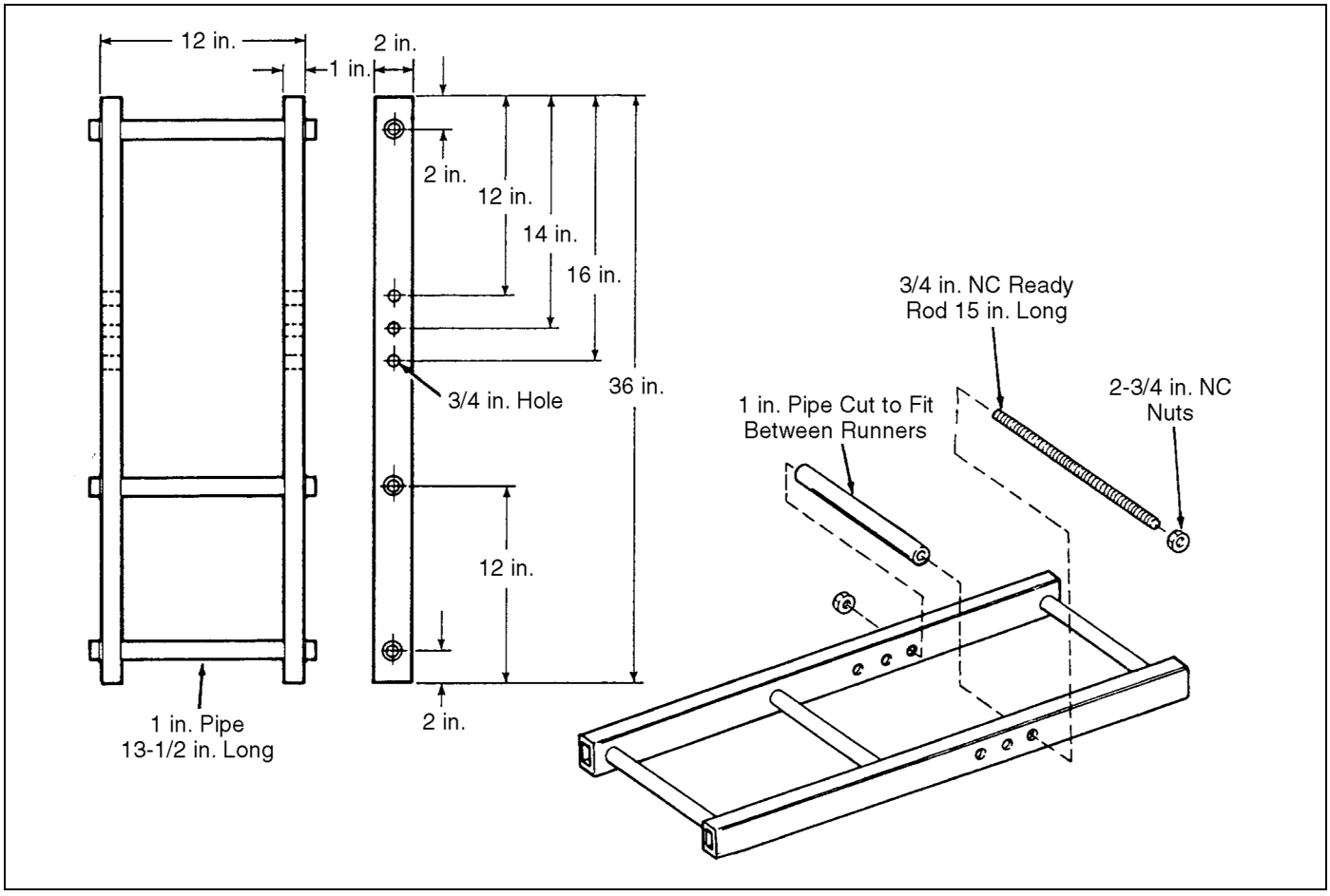


Figure 5-5: Wheel Restraint Fabrication Instructions

Field Test Procedures

When a hydraulic system failure occurs, some simple effective tests can be performed prior to performing an 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 5-11.)

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 lines and fittings for leaks. Tighten as needed.
3. Eliminate all mechanical issues prior to starting hydraulic tests.

Charge Pump Test

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

If faults exist in the charge pump, proceed with an instrument test for the charge pump. (See “Cutting Unit/Charge Pump Test” on page 6-32.)

Traction System Test

See Figure 5-6.

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).

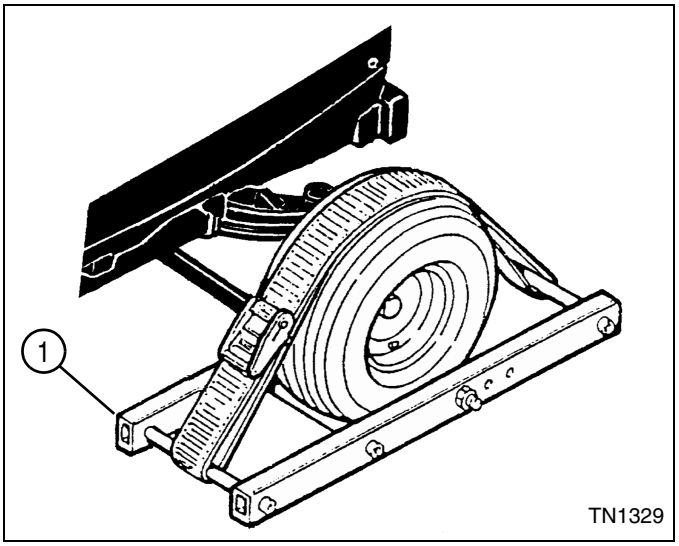


Figure 5-6

2. Install wheel restraints (1) to both front wheels. (See Figure 5-6.)
3. Raise rear of machine and place on jackstands.
4. 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, including the traction pump or wheel motors. Proceed to instrument test. (See “Instrument Test Procedures” on page 5-11.)*

Rear Wheel Motor Test

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

1. Operate hydraulic system until oil temperature is at 120—150°F (49—65°C).
2. Stop the engine and remove the ignition key.
3. Remove the case drain hose from the wheel motor. Immediately plug the hose.
4. Position a drain pan (minimum capacity 1 gallon (3.8 L) near the wheel motor.
5. Install a separate hose on the case drain fitting and place the free end in the container. Secure the hose to prevent spills.

NOTE

When testing rear wheel motor, put wheel restraints on the rear wheel, and raise the front of the machine with a chain hoist or floor crane so the wheels are off the ground.

6. Install wheel restraint. (See Figure 5-6.)
7. Start the engine and place the traction pedal in the forward position for 15 seconds.
8. Stop the engine and remove the ignition key.
9. 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 5-11.)*

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 5-26 or “Rear Wheel Motor” on page 5-37.)*

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 machine user.

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 the machine struggles to climb hills.

A charge pressure test must first be performed to rule out a charge pump issue. Next, the entire traction system is tested as outlined, and the calculated system leakage is 31%; a result which requires the testing of individual components. This result can also be interpreted as the system is 69% efficient.

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

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

Formulas:

Wheel Motor

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

System and Traction Pump

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

Calculations:

System Test

No Load Flow = 10 gpm

Loaded Flow = 6.9 gpm

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

Traction Pump Test

No Load Flow = 10 gpm

Loaded Flow = 9.5 gpm

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

Left Front Wheel Motor Test

Loaded Flow from traction pump test = 9.5 gpm

Loaded Flow from left front wheel motor test = 7.6 gpm

9.5 - 7.6 / 9.5 x 100 = Left Wheel Motor Leakage 20%

Right Front Wheel Motor Test

Loaded Flow from left front wheel motor test = 7.6 gpm

Loaded Flow from right front wheel motor test = 7.2 gpm

7.6 - 7.2 / 7.6 x 100 = Right Wheel Motor Leakage 5.3%

Rear Wheel Motor Test

Loaded Flow from right front wheel motor test = 7.2 gpm

Loaded Flow from rear wheel motor test = 6.9 gpm

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

Charge Pressure Test

See Figures 5-7 and 5-8.

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
• Pressure Gauge 500 psi (35 bar) • Test Hose 500 psi (35 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 1-7.)
3. Raise the hood and seat.

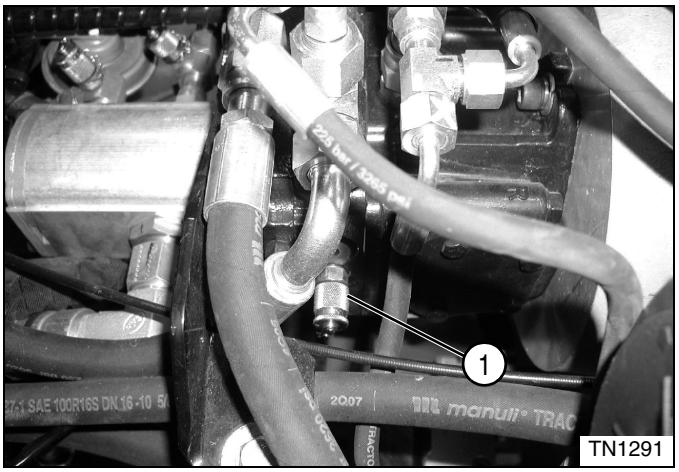


Figure 5-7

Figure 5-8

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

NOTE

Verify engine rpm is within specification (3150 rpm ± 50) to ensure accurate hydraulic test results.

5. Start engine and run at full throttle (3150 rpm ± 50).
6. Record pressure reading.

   Is charge pressure between 150–160 psi (10–11 bar)?

   YES *Charge pressure relief valve is good. Proceed to step 7.*

   NO *Inspect charge pressure relief valve and replace if needed (See “Traction Pump” on page 5-23.) Or proceed to traction system test (See “Traction System Test” on page 5-10.)*

7. Stop the engine, disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
8. Check hydraulic oil level. Add oil as needed. (Refer to “Safety, Operation, and Maintenance Manual” for correct oil specifications.)

Traction System Test

See Figures 5-10 through 5-12.

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 • Test Hose 4000 psi (276 bar) • Blocking Disks • Flow Lock Tool

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Raise seat platform.
3. 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 jack stands.

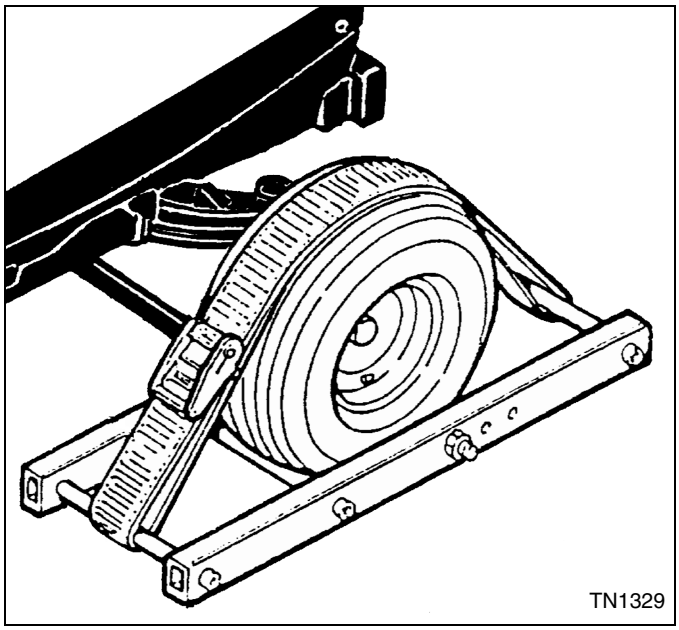


Figure 5-9

4. Install wheel restraint to front wheels.

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 the rear wheels are off the ground.
6. Disconnect traction pump control rod from pump control arm.

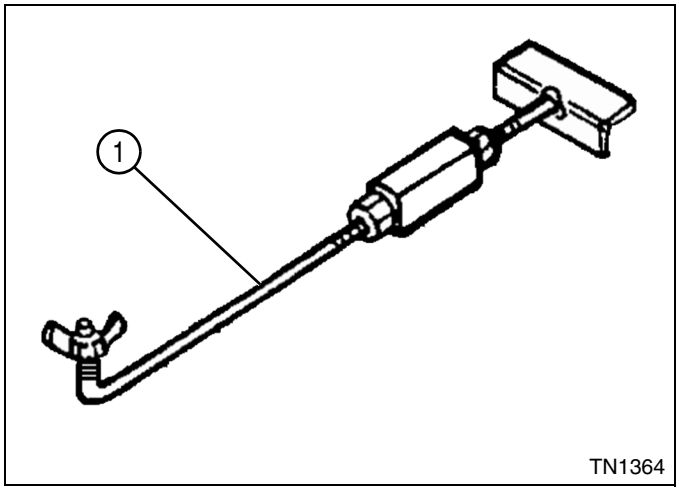


Figure 5-10

7. Install flow lock tool (1) and secure to pump control arm.

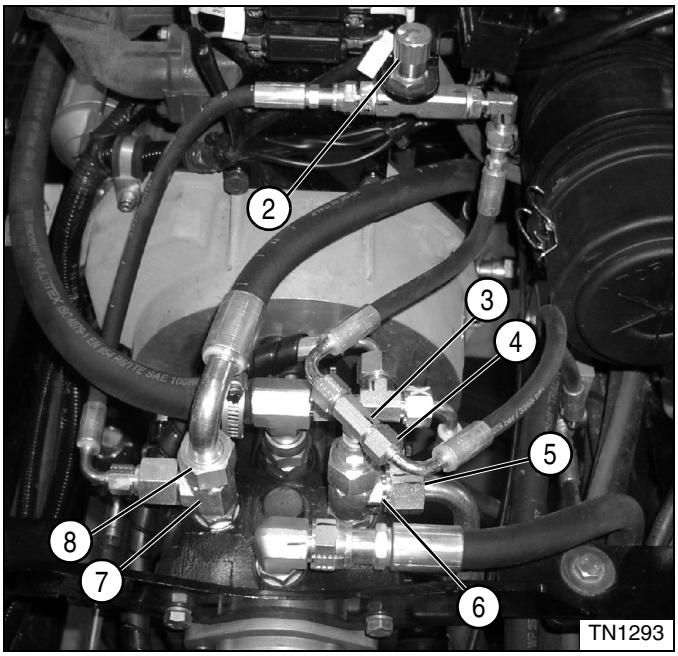


Figure 5-11

8. Close tow valve (2) completely by turning clockwise.
9. Disconnect and plug hose (4).
10. Install a cap to fitting (3).
11. Disconnect hoses (5 and 8).

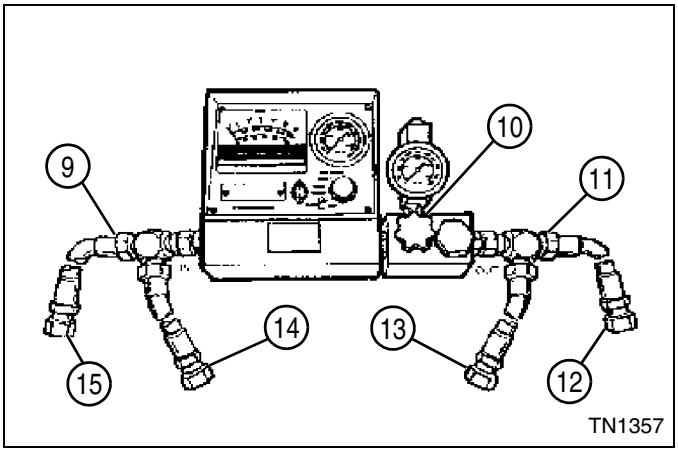


Figure 5-12

12. Connect test hose (14) of flow meter inlet to fitting (6).
13. Connect test hose (13) of flow meter outlet to fitting (7).
14. Connect hose (8) to flow meter outlet (12).
15. Connect hose (5) to flow meter inlet (15).
16. Open flow meter valve (10) completely before starting engine.

NOTE

Verify engine rpm is within specification (3150 rpm ± 50*) to ensure accurate hydraulic test results.*

17. Start engine and run at full throttle (3150 rpm ± 50).
18. Adjust flow lock tool (1) to allow pump to produce 10 gpm (37.8 lpm) in the forward direction.
19. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (10) until a reading of 1525 psi (105 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.
20. After warming the hydraulic oil, verify flow lock tool is adjusted to allow pump to produce 10 gpm (37.8 lpm) in the forward direction.
21. Read and record no load flow.
22. Slowly close flow meter valve (10) until pressure reaches 2300 psi (159 bar). Read and record loaded flow.
23. Stop engine and return flow lock tool back to neutral position.
24. Calculate traction system leakage. (Step 21 – Step 22 / Step 21 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 5-16.*

    NO *Proceed to next question.*

    Is traction system leakage 11% to 20%?

    YES *The traction system is marginal. Additional testing is required.*

    NO *Proceed to next question.*

    Is traction system leakage 21% or more?

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

Traction Pump Tests

See Figures 5-13 and 5-14.

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
- Test Hose 4000 psi (276 bar)
- Blocking Disks
- Flow Lock Tool

1. Park the mower safely. (See "Park Mower Safely" on page 1-7.)
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 5-12.)

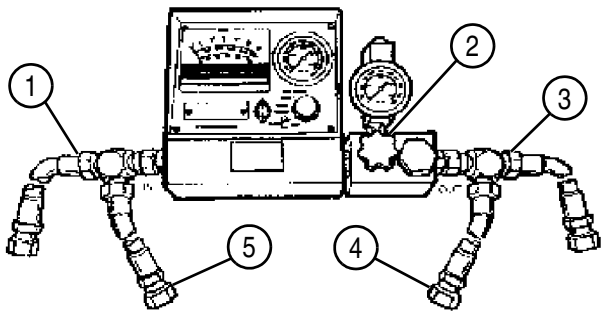


Figure 5-13

3. Install blocking disks at locations (1) and (3).
4. Open flow meter valve (2) completely before starting engine.

NOTE

Verify engine rpm is within specification (3150 rpm ± 50*) to ensure accurate hydraulic test results.*

5. Start engine and run at full throttle (3150 rpm ± 50).

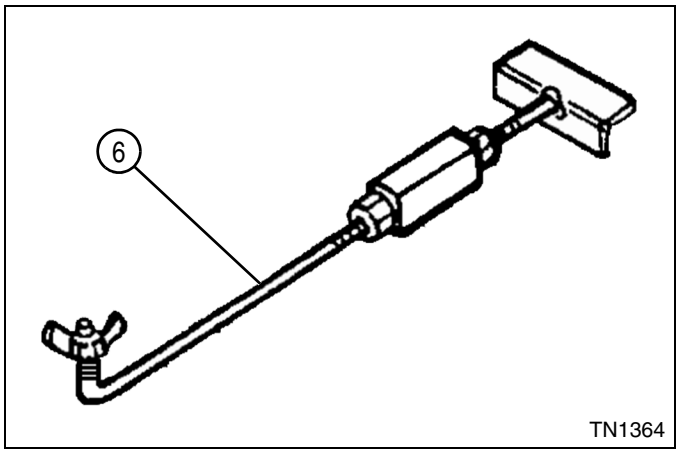


Figure 5-14

6. Adjust flow lock tool (6) to allow pump to produce 10 gpm (37.8 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 1525 psi (105 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 10 gpm (37.8 lpm) in the forward direction.
9. Read and record no load flow.
10. Slowly close flow meter valve (2) until pressure reaches 2300 psi (159 bar). Read and record loaded flow.
11. Stop engine and return flow lock tool back 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 13.*

    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 5-23.)*

⚠ CAUTION

Do not exceed 3100 psi (214 bar) when testing system relief valves or equipment damage may occur.

13. Continue to close flow meter valve (2) until zero flow is obtained. Record forward system relief valve pressure.
14. Stop engine and return flow lock tool back to neutral position.

NOTE

Reverse system relief valve test is similar.

15. To test reverse system relief valve, swap hoses (4) and (5) at flow meter and adjust flow lock tool to 10 gpm (37.8 lpm) in reverse direction.
16. Close flow meter valve (2) until zero flow is obtained and record reverse system relief valve pressure.
17. Stop engine and return flow lock tool back to neutral position.

    Is forward system relief pressure 3046 psi (210 bar)?

    YES *Forward system relief valve is good. Proceed to step 18.*

    NO *Replace forward system relief valve. (See "Traction Pump" on page 5-23.)*

    Is reverse system relief pressure 3046 psi (210 bar)?

    YES *Reverse system relief valve is good. Proceed to step 18.*

    NO *Replace reverse system relief valve. (See "Traction Pump" on page 5-23.)*

18. If no further testing is required, disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
19. Check hydraulic oil level. Add oil as needed. (Refer to "Safety, Operation, and Maintenance Manual" for oil specifications.)

Wheel Motors Test

See Figures 5-15 through 5-17.

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 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 • Test Hose 4000 psi (276 bar) • Blocking Disk • Flow Lock Tool • Wheel Restraints

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
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 5-12.)
3. (See Figure 5-13.) Remove the blocking disks from locations (1) and (3).
4. Connect hoses back to flow meter as outlined in traction system test. (See “Traction System Test” on page 5-12.)

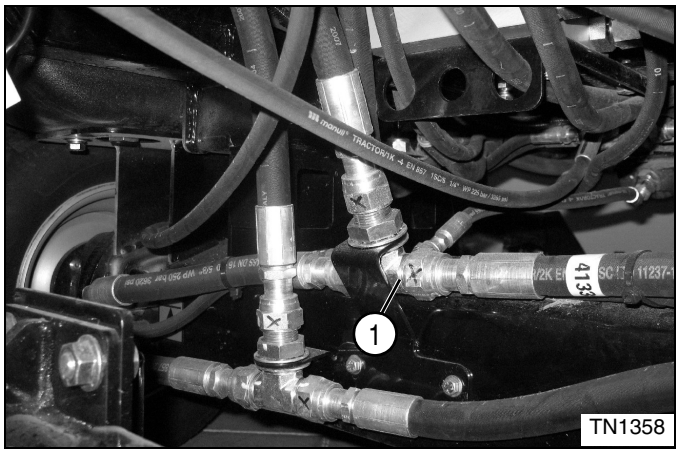


Figure 5-15

5. Install blocking disk at location (1) (backside of front axle housing) to block oil flow 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 27.**
- **If performing this test to determine which component in system is at fault (front wheel motors or rear wheel motor) continue to step 6.**

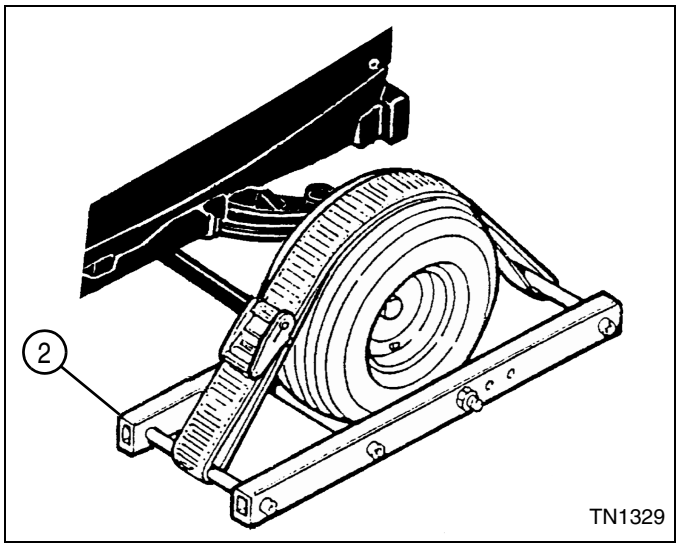


Figure 5-16

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

WARNING

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

Support the machine properly using jack stands.

7. Lift rear of machine and support with stand.
8. Open flow meter valve completely before starting engine.

NOTE

Verify engine rpm is within specification (3150 rpm ± 50) to ensure accurate hydraulic test results.

9. Start engine and run at full throttle (3150 rpm ± 50).

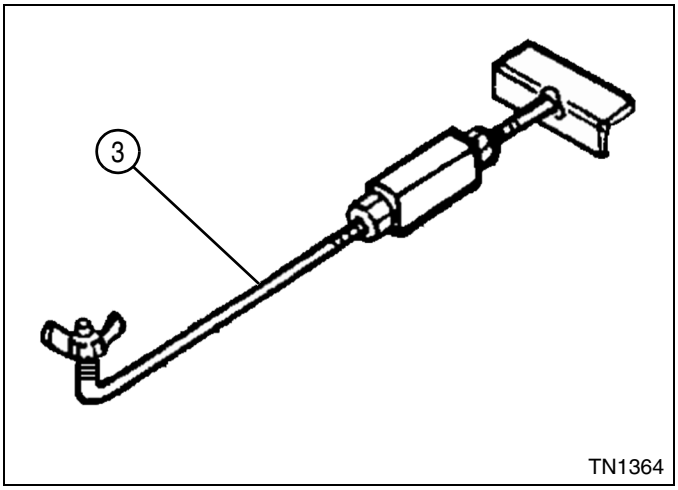


Figure 5-17

10. Adjust flow lock tool (3) to allow pump to produce 10 gpm (37.8 lpm) in the forward direction.
11. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve until a reading of 1525 psi (105 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.
12. After warming the hydraulic oil, verify flow lock tool is adjusted to allow pump to produce 10 gpm (37.8 lpm) in the forward direction.
13. Slowly close flow meter valve until pressure reaches 2300 psi (159 bar). Read and record loaded flow.
14. Stop engine and return flow lock tool back to neutral position.

15. Calculate left front wheel motor leakage. (Step 10 of previous test – Step 13 / 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 16.*

    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 16.*

    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 5-26.)*

16. Remove blocking disk from location (1). Connect hose back to T-fitting.
17. Return flow lock tool (3) back to neutral position.
18. Open flow meter valve completely before starting engine.

NOTE

Verify engine rpm is within specification (3150 rpm ± 50) to ensure accurate hydraulic test results.

19. Start engine and run at full throttle (3150 rpm ± 50).
20. Adjust flow lock tool (3) to allow pump to produce 10 gpm (37.8 lpm) in the forward direction.
21. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (2) until a reading of 1525 psi (105 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 10 gpm (37.8 lpm) in the forward direction.
23. Slowly close flow meter valve until pressure reaches 2300 psi (158 bar). Read and record loaded flow.
24. Stop engine and return flow lock tool back to neutral position.
25. Calculate right front wheel motor leakage. (Step 13 of previous test – Step 23 / Step 13 of previous test x 100 = Leak Percentage)

    Is right front wheel motor leakage 10% or less?

    YES *The right front wheel motor is good. Proceed to step 26.*

    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 26.*

    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 5-26.)*

26. Remove wheel restraints from both front wheels.
27. Install wheel restraint to rear wheel.

WARNING

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

Support the machine properly using jack stands.

IMPORTANT

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

28. Lift front of machine and support with stands.
29. Open flow meter valve (2) completely before starting engine.

NOTE

Verify engine rpm is within specification (3150 rpm ± 50) to ensure accurate hydraulic test results.

30. Start engine and run at full throttle (3150 rpm ± 50).
31. Adjust flow lock tool (3) to allow pump to produce 10 gpm (37.8 lpm) in the forward direction.
32. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve until a reading of 1525 psi (105 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.
33. After warming the hydraulic oil, verify flow lock tool is adjusted to allow pump to produce 10 gpm (37.8 lpm) in the forward direction.
34. Slowly close flow meter valve until pressure reaches 2300 psi (159 bar). Read and record loaded flow.

35. Stop engine and return flow lock tool back to neutral position.
36. Calculate rear wheel motor leakage.
(Step 23 of previous test – Step 34 /Step 23 of previous test x 100 = Leak Percentage)

Is rear wheel motor leakage 10% or less?

YES *The rear wheel motor is good. Proceed to step 37.*

NO *Proceed to next question.*

Is rear wheel motor leakage 11% to 20%?

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

NO *Proceed to next question.*

Is rear wheel motor leakage 21% or more?

YES *Repair or replace rear wheel motor. (See "Rear Wheel Motor" on page 5-37.)*

37. Disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
38. Check hydraulic oil level. Add oil as needed. (Refer to "Safety, Operation, and Maintenance Manual" for correct oil specifications.)

Transmission Neutral Adjustment

Adjust Transmission Neutral (Creep)

See Figures 5-18 through 5-21.

1. Park the mower safely. (See "Park Mower Safely" on page 1-7.)
2. Raise the hood.

WARNING

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

Support the machine properly using jack stands.

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

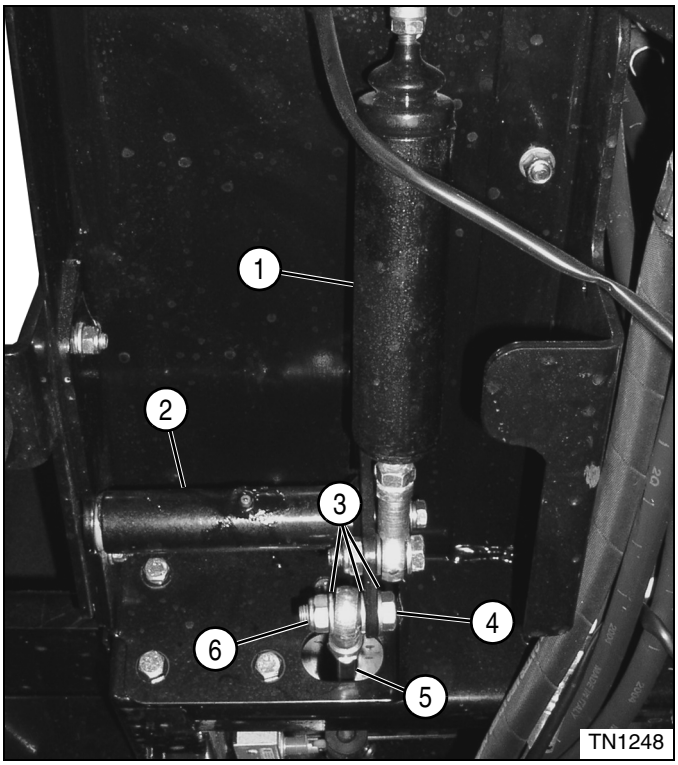


Figure 5-18

4. Remove lock nut (6), screw (4), and three flat washers (3), and disconnect rod end (5) from pedal weldment (2).
5. Allow the damper (1) to return the traction pedal to the neutral position.
6. Start the engine. (Refer to "Safety, Operation, and Maintenance Manual.")

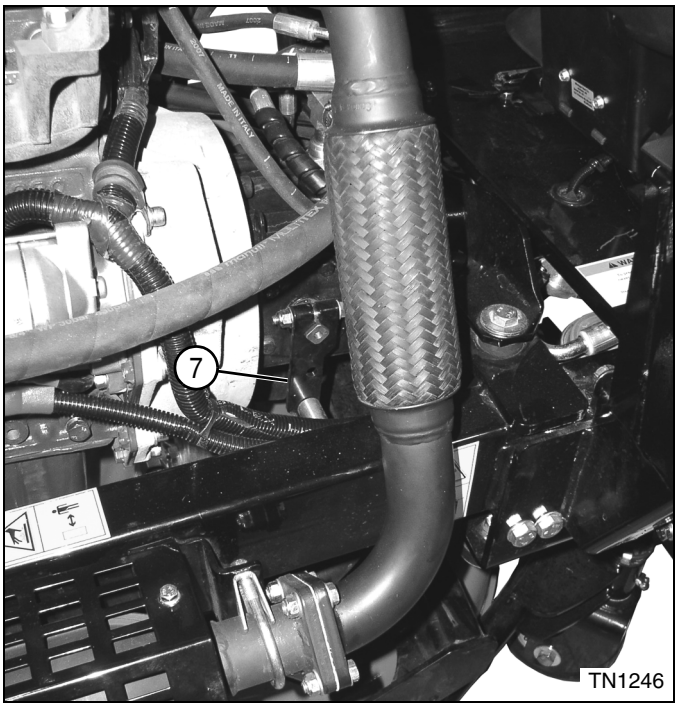


Figure 5-19

5

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.

7. Manually move the pump control lever (7) until the wheels stop rotating.
8. Stop the engine.

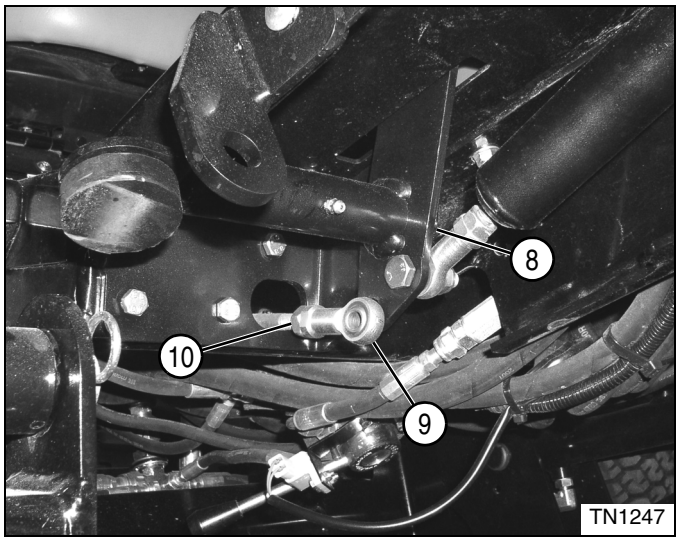


Figure 5-20

NOTE

Do not move the control arm out of the neutral position while adjusting the rod end.

9. Loosen the jam nut (10).
10. Adjust the rod end until the rod end (9) aligns with the hole in the pedal weldment (8).
11. Tighten the jam nut (10) against the rod end (9).

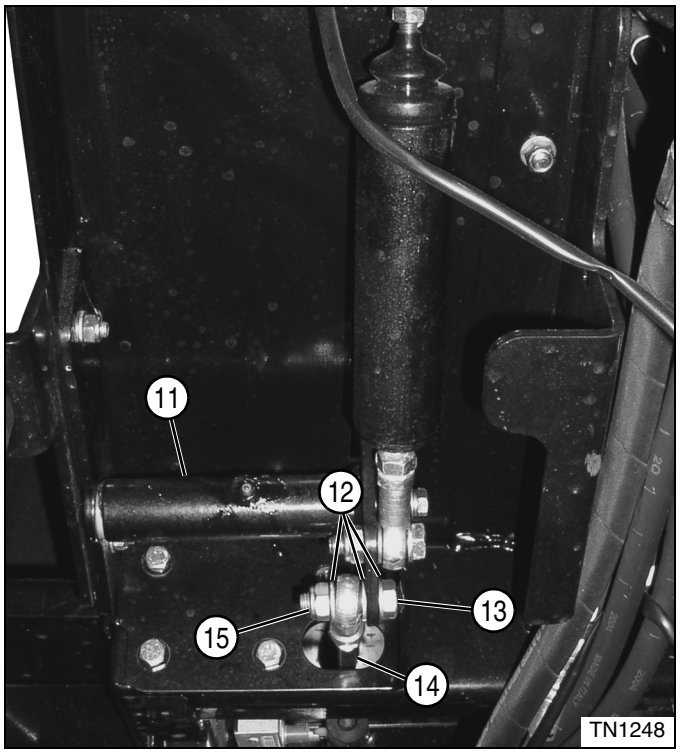


Figure 5-21

12. Install the rod end (14) from pedal weldment (11) using screw (13) and three flat washers (12) and lock nut (15).

13. Start the engine. (Refer to “Safety, Operation, and Maintenance Manual.”)
14. Move the traction pedal to the forward and reverse positions and release the pedal. Pedal should return to the neutral position.

    When in the neutral position, there should be no wheel movement. Repeat the procedure if any wheel movement is noted.
15. Stop the engine.
16. Adjust the neutral switch. (See “TR-3 and Early Model 30001 AR-3 Traction Pedal Neutral Switch Adjustment” on page 5-21.).

TR-3 and Early Model 30001 AR-3 Traction Pedal Neutral Switch Adjustment

See Figures 5-22 and 5-23.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Allow the traction pedal to return to the neutral position.

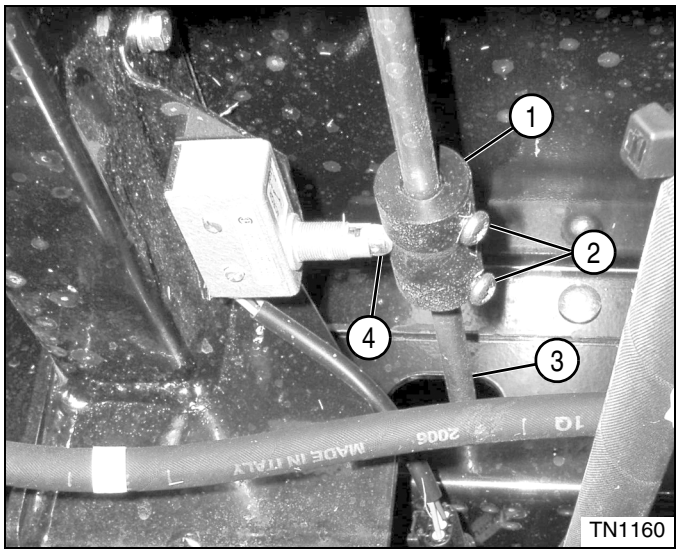


Figure 5-22

3. Loosen the screws (2), and slide the switch actuator (1) along the rod (3) until the switch button (4) is positioned in the opening in the switch actuator (switch in the OPEN position).
4. Tighten the screws (2).
5. Check the operation of the switch by depressing the traction pedal so that the switch actuator (1) engages the switch button (4). When engaged the switch should be closed. (See “Traction Pedal Neutral Switch Test” on page 4-66.)

   If the switch actuator cannot properly engage the switch button, proceed to step 6.

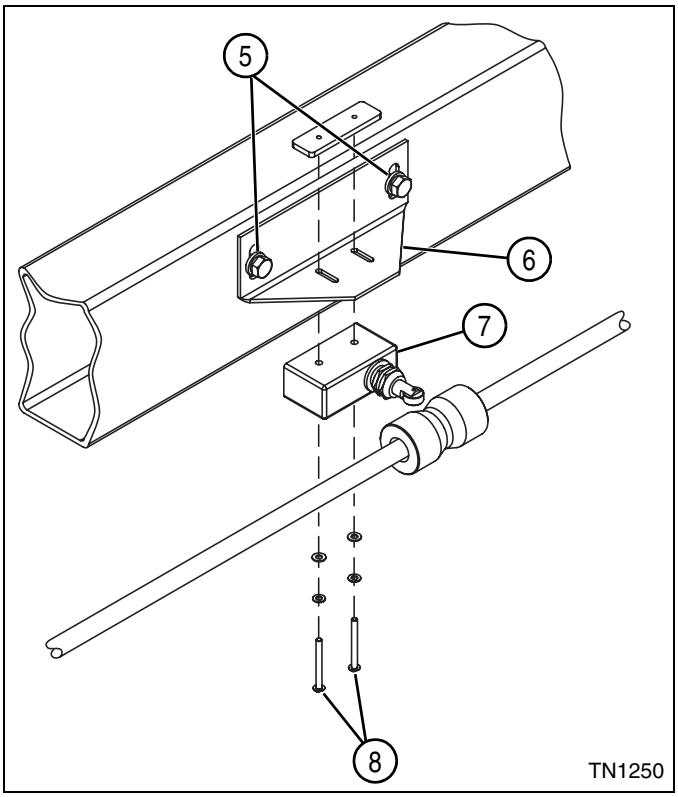


Figure 5-23

6. Adjust the switch as needed to properly align the switch button:

   To adjust the vertical alignment of the switch: Loosen two screws (5) and slide the switch bracket (6) up or down as needed to properly position the switch button. Tighten the screws.

   To adjust the horizontal alignment of the switch: Loosen two screws (8) and slide the switch (7) in or out as needed to properly position the switch button. Tighten the screws.
7. Check the operation of the switch by depressing the traction pedal so that the switch actuator (1) engages the switch button (4). When engaged the switch should be closed. (See “Traction Pedal Neutral Switch Test” on page 4-66.)

TR-3 and Late Model 30002 AR-3 Traction Pedal Neutral Switch Adjustment

See Figure 5-24.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Allow the traction pedal to return to the neutral position.

NOTE

Late Model 30002 AR3 traction pedal neutral switch is normally closed. (See “Traction Pedal Neutral Switch Test” on page 4-66.)

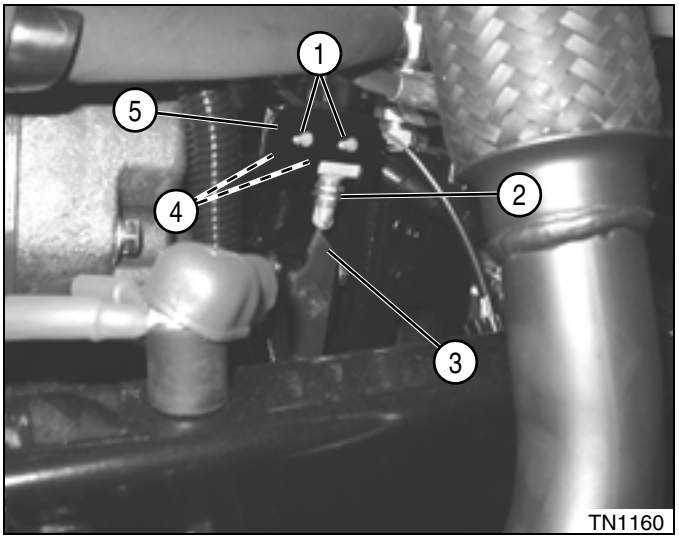


Figure 5-24

3. Check the operation of the switch. When in neutral position the switch actuator (3) should close the switch (2). (See “Traction Pedal Neutral Switch Test” on page 4-66.)

   If the switch actuator cannot properly close the switch, proceed to step 4.

4. Adjust the switch as needed:

   Loosen two screws (4) and slide the switch bracket (5) to properly position the switch button. Tighten the screws.

   Loosen two screws (1) and slide the switch (2) to properly position the switch button. Tighten the screws.

5. Check the operation of the switch. When in neutral position the switch actuator (3) should close the switch (2). (See “Traction Pedal Neutral Switch Test” on page 4-66.)

Repair

Traction Pump

Removal and Installation

See Figure 5-25.

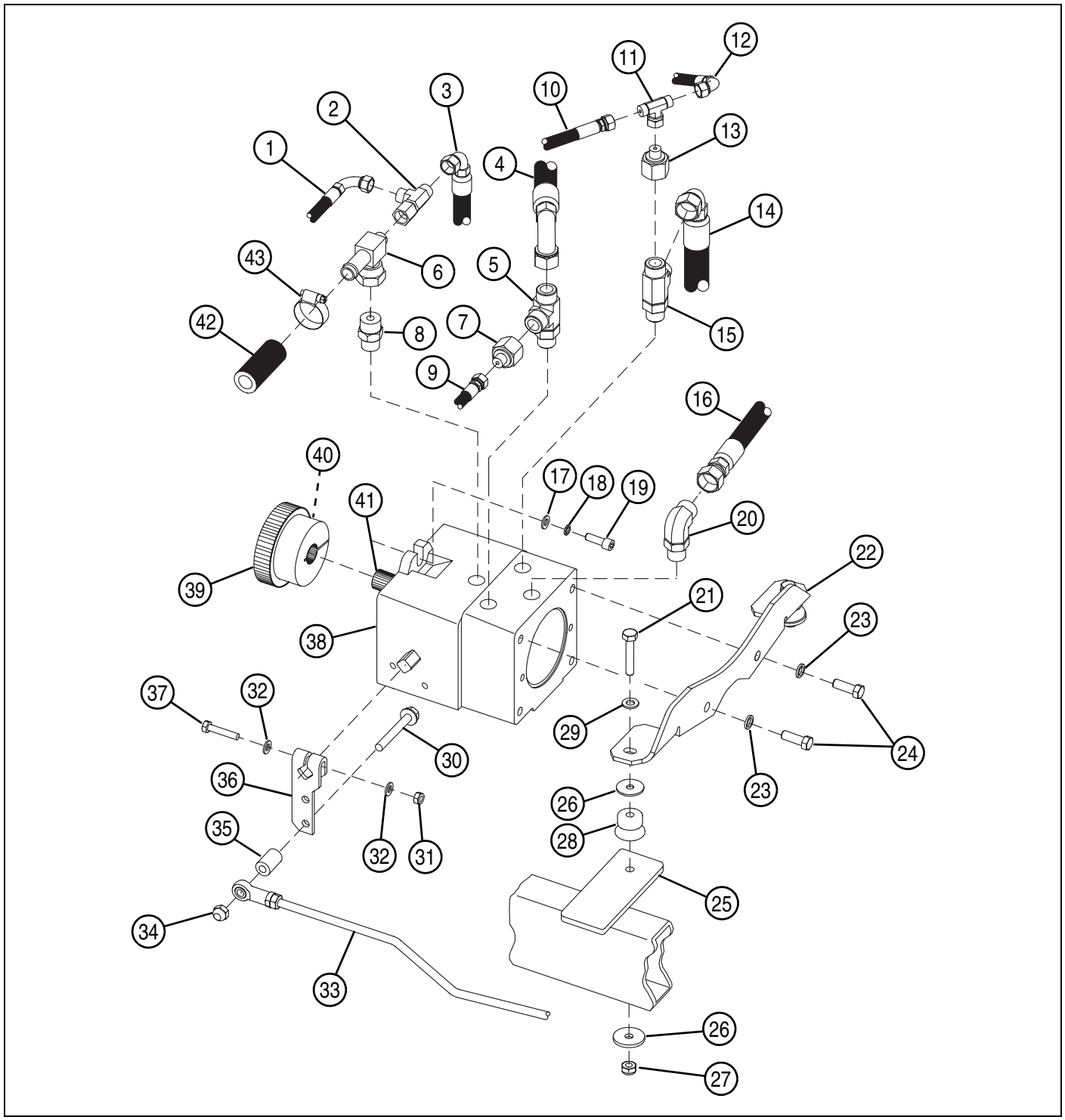


Figure 5-25

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Remove the seat and mounting plate. (See “Seat and Mounting Plate” on page 9-16.)
3. Drain hydraulic oil tank.
4. Remove pump drain plug and drain hydraulic oil from pump.
5. Remove tandem pump. (See “Tandem Pump” on page 6-45.)

NOTES

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

6. Loosen clamp (43) and disconnect hose (42) from fitting (6).
7. Disconnect hoses (1 and 3) from fitting (2).
8. Disconnect hose (4) from fitting (5).
9. Disconnect hose (9) from reducer fitting (7).
10. Disconnect hoses (10 and 12) from tee-fitting (11).
11. Disconnect hose (14) from tee-fitting (15).
12. Disconnect hose (16) from elbow fitting (20).
13. Remove nut (34), screw (30), and spacer (35), and disconnect control rod (33) from control arm (36).

WARNING

The engine weighs approximately 214 lb (97 kg). Prevent personal injury. Use a properly rated lift device. Always be sure the load is balanced before lifting.

14. Attach a suitable lifting device to the engine to support the engine weight.
15. Attach a suitable lifting device to the pump to support the pump weight.
16. Remove nut (27), screw (21), two flat washers (26), washer (29), and bushing (28) from both sides of bracket (22) and frame (25).
17. Remove two socket-head screws (19), lock washers (18), and flat washers (17) (top and bottom) from the hydrostatic pump (38) and bell housing.
18. Slide pump (38) away from engine to disengage pump hub (39) from engine.
19. Lift hydrostatic pump (38) with bracket (22) from mower frame (25).
20. Remove two screws (24) and washers (23), and remove bracket (22) from pump (38).
21. Loosen screw (40) and remove pump hub (39) from end of pump shaft (41).

NOTE

Note orientation of fittings on pump body to aid in assembly.

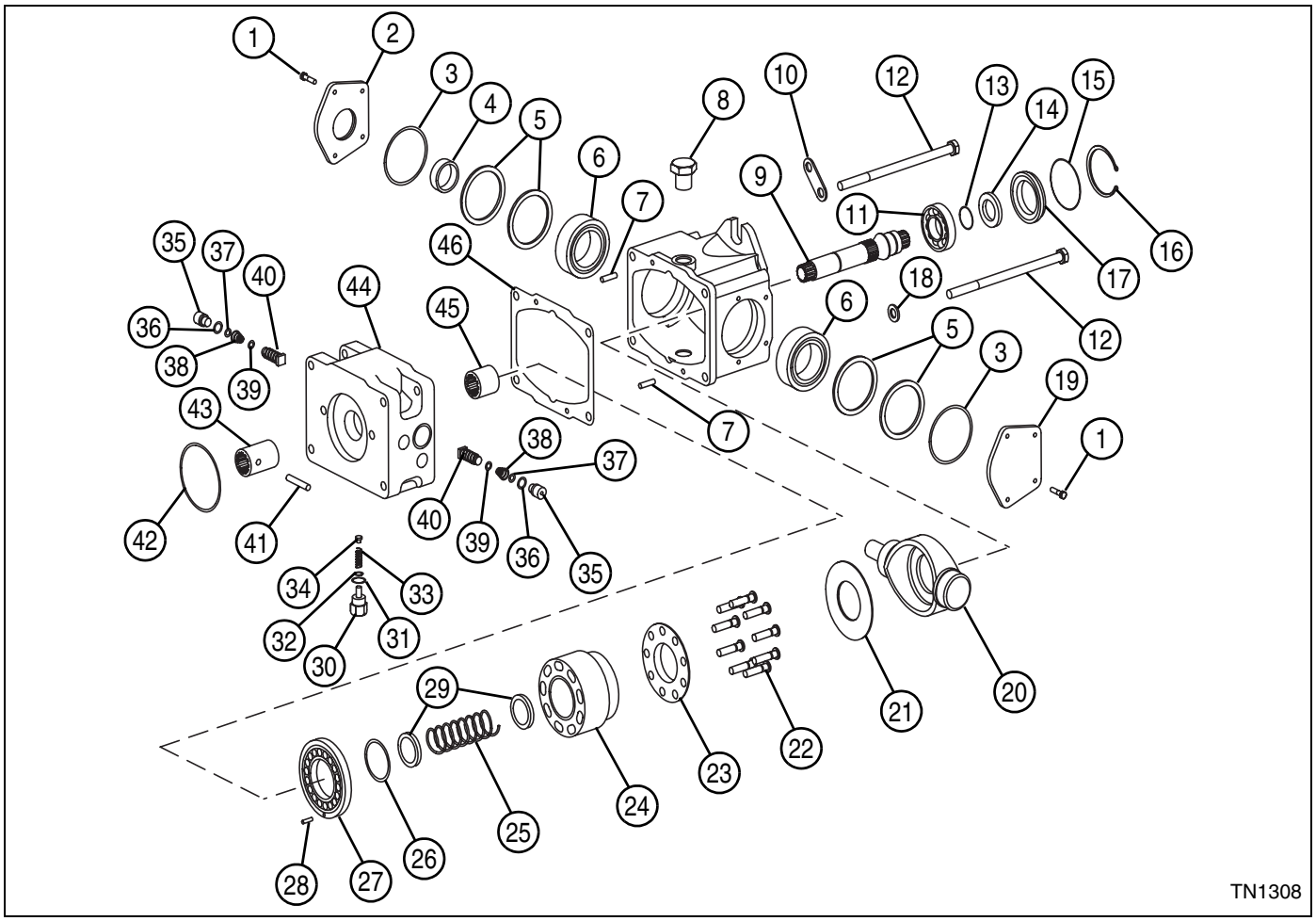
22. Remove fittings (2, 6, and 8) from pump (38).
23. Remove tee-fitting (5) and reducer fitting (7) from pump (38).
24. Remove tee-fitting (15) and reducer fitting (13) from pump (38).
25. Remove elbow fitting (20) from pump (38).
26. Remove nut (31), screw (37), and washers (32), and remove control arm (36) from pump (38).

Installation Notes

- *Install the hydrostatic pump by reversing the order of removal.*
- *Tighten pump hub screw (40) to 37 lb-ft (50 N·m).*
- *Ensure new O-rings are in place before installing hoses on fittings.*
- *Replace hydraulic filter.*
- *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 Figure 5-26.



1	Screw (8)	13	Retaining Ring	25	Cylinder Block Spring	37	O-Ring (2)
2	Trunnion Cover Assembly	14	Lip Seal	26	Retaining Ring	38	Hex Plug (2)
3	O-Ring (2)	15	O-Ring	27	Valve Plate	39	O-Ring (2)
4	Lip Seal	16	Internal Retaining Ring	28	Pin	40	SCR Valve
5	Shim (3)	17	Seal Carrier	29	Washer (2)	41	Spring Pin
6	Taper Roller Bearing (2)	18	Washer (3)	30	Plug Assembly	42	Pad Seal
7	Pin (2)	19	Trunnion Cover	31	O-Ring	43	Coupling
8	Hex Plug (3)	20	Swash Plate	32	Shim Kit	44	End Cap
9	Shaft	21	Thrust Plate	33	Spring	45	Needle Bearing
10	Lift Bracket	22	Piston Assembly	34	Charge Relief Poppet	46	End Cap Gasket
11	Ball Bearing	23	Slipper Retainer	35	Special Plug (2)		
12	Screw (4)	24	Cylinder Block	36	O-Ring (2)		

Figure 5-26

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Remove hydrostatic pump. (See “Traction Pump” on page 5-23.)
3. Scribe a line along the side of the pump to mark the position of the pump segments before disassembly.
4. Remove four screws (12) and washers (18) that hold the pump together.
5. Remove each section of the pump. Look for identifying marks for assembly.
6. Place parts in assembly order on a clean work area 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.

Inspection

- *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.*

Front Wheel Motor

Removal and Installation

See Figures 5-27 through 5-30.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Remove the front cutting unit on the side where the motor is being removed.
3. Remove front wheel. (See “Front Wheels” on page 9-19.)

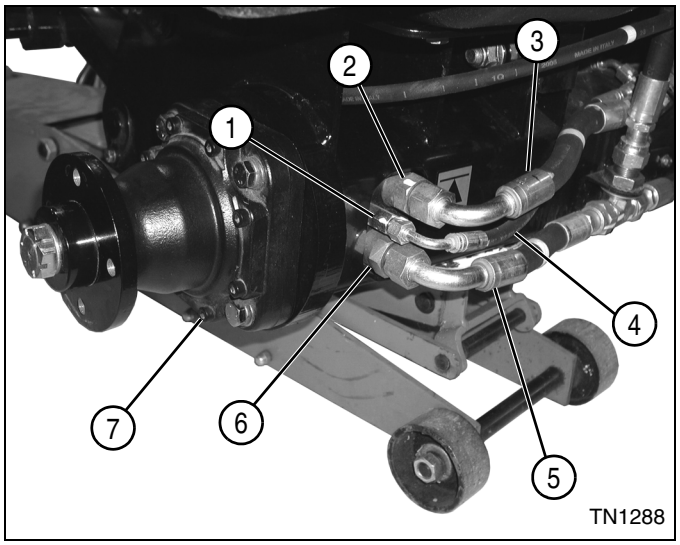


Figure 5-27

NOTES

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

4. Disconnect hoses (3, 4, and 5).
5. Remove hydraulic fittings (1, 2, and 6) from motor (7).

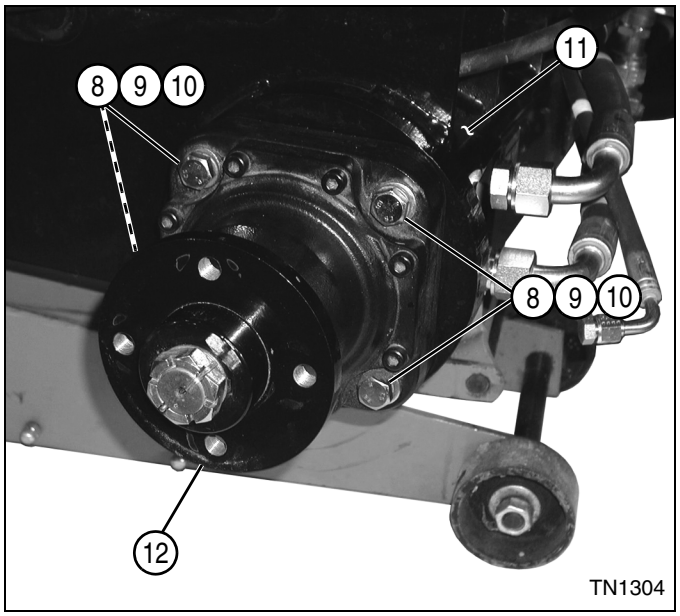


Figure 5-28

6. Remove four screws (8), lock washers (9), and flat washers (10).
7. Remove motor (12) from axle (11).

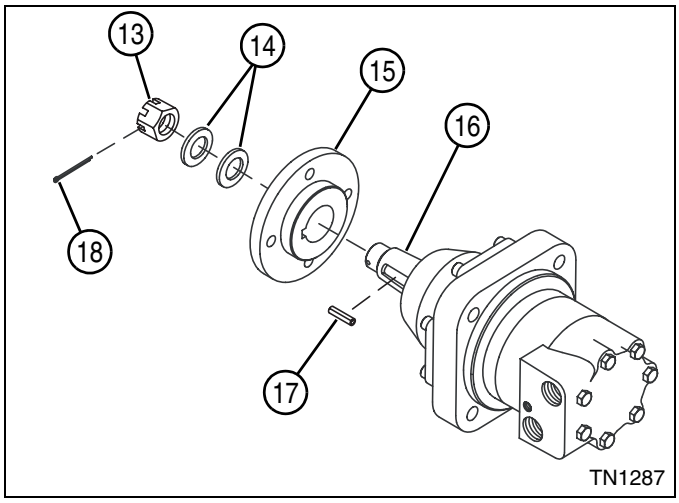


Figure 5-29

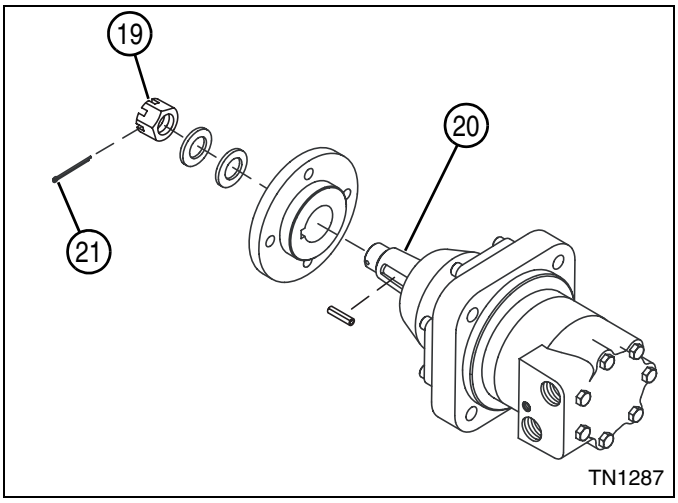


Figure 5-30

8. Remove cotter pin (18).

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 (13).
10. Loosen the wheel flange (15) from the motor shaft (16) using a puller.
11. Remove the castle nut (13), two flat washers (14), and wheel flange (15) from the motor shaft (16).
12. Remove key (17) from the motor shaft (16).

Installation Notes

Required Materials
Anti-Seize Compound

- *Install the front wheel motor by reversing the order of removal.*
- *Apply anti-seize compound to the motor shaft (20) before installing the wheel hub.*
- *Tighten castle nut (19) to 332 ± 7 lb-ft (450 ± 10 N·m).*
- *Install a new cotter pin (21) in the castle nut (19) and motor shaft (20).*
- *Check hydraulic oil level. Add oil as needed. (Refer to "Safety, Operation, and Maintenance Manual" for the correct oil specifications.)*

Disassembly and Inspection

See Figures 5-31 through 5-46.

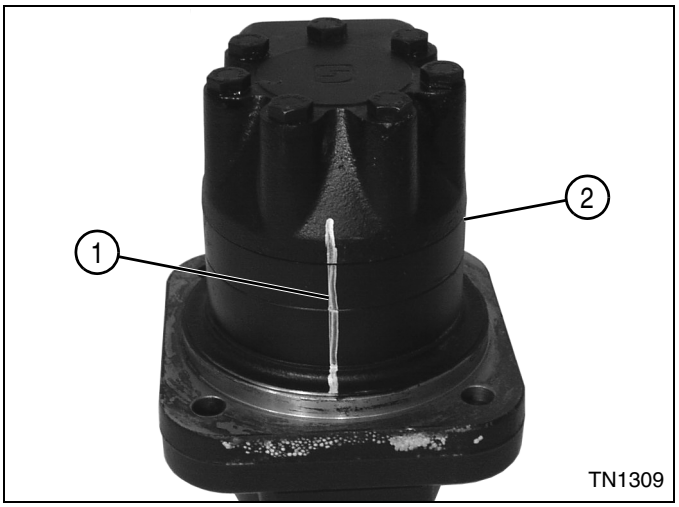


Figure 5-31

1. Scribe a line (1) along the side of hydraulic motor sections (2) to mark the position of motor segments before disassembly.

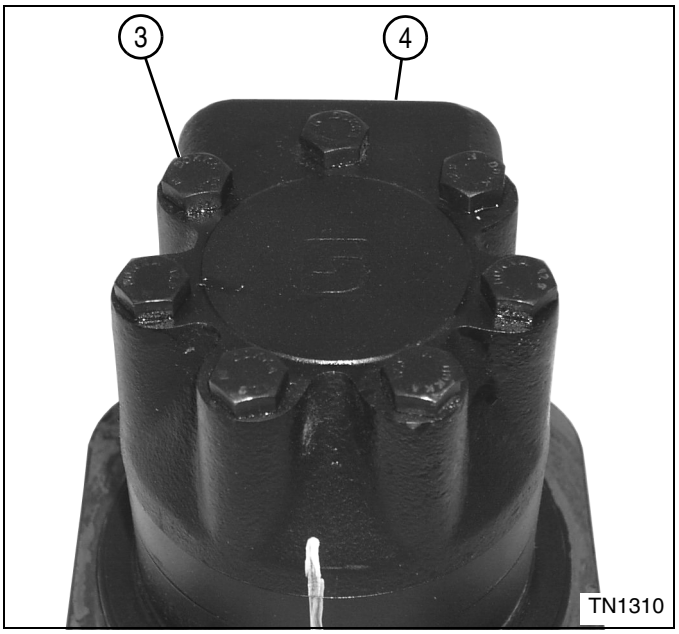


Figure 5-32

NOTE

Use caution when removing screws, as motor segments will be free to move.

2. Remove seven screws (3) from the end cover (4).

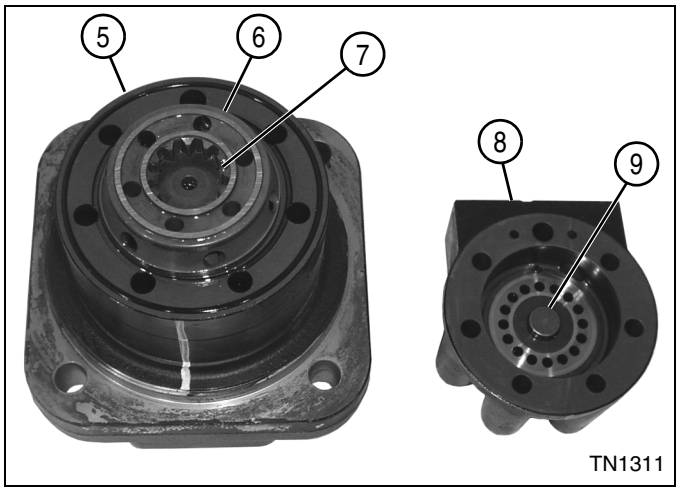


Figure 5-33

NOTE

The spacer (9) may remain with the disk valve (6) when the valve housing is removed.

3. Remove the end cover assembly (8) and spacer (9) from the disk valve (6) valve plate (5).
4. Remove the disk valve (6) from the valve drive (7) and valve plate (5).

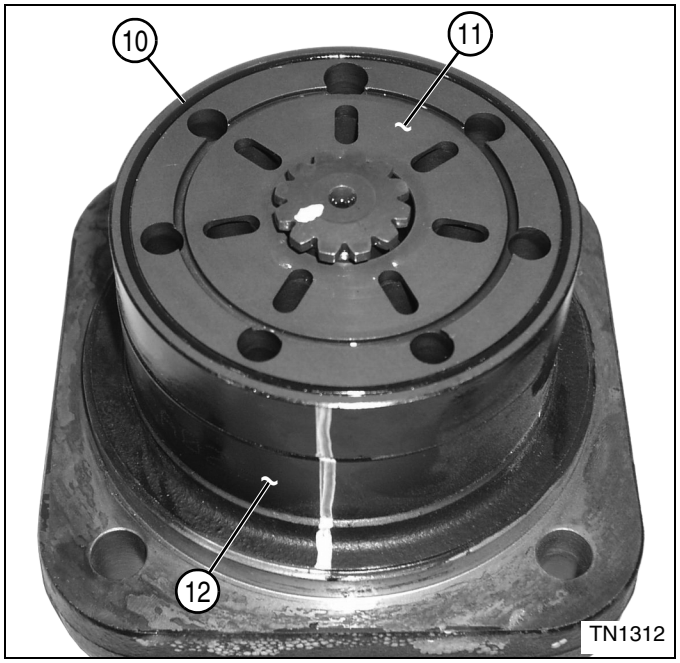


Figure 5-34

5. Remove the O-ring (10) from the valve plate (11).

NOTE

Record the orientation of the valve drive before removing to ensure correct installation.

6. Remove the valve plate (11) from the gear wheel set (12).

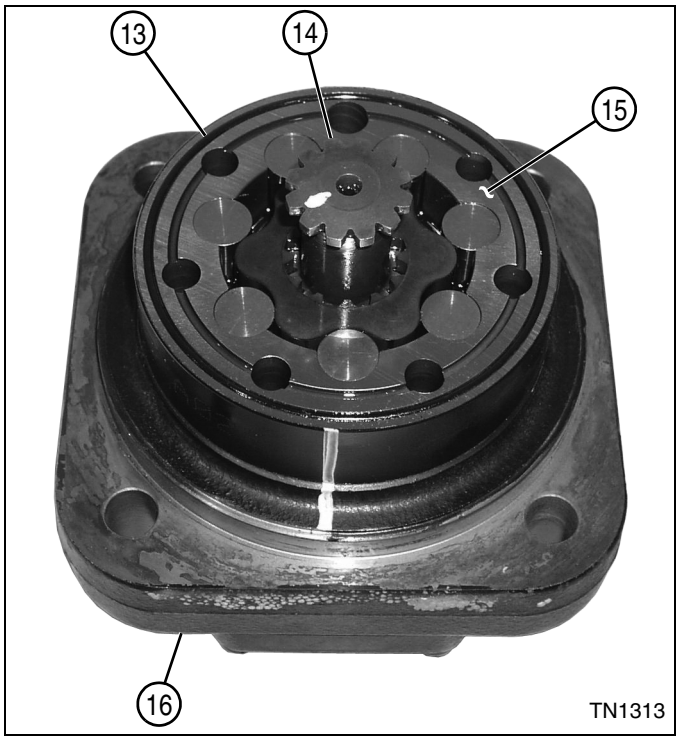


Figure 5-35

7. Remove the O-ring (13) from the gear wheel set (15).
8. Remove the valve drive (14) from the gear wheel set (15).

NOTES

- *The gear wheel set components are loose and can fall apart when removed. When removing use caution and remove the gear wheel set as a unit.*
- *Do not disassemble the gear wheel set. If replacement is necessary, replace the entire assembly.*

9. Remove the gear wheel set (15) from the mounting flange/bearing housing assembly (16).

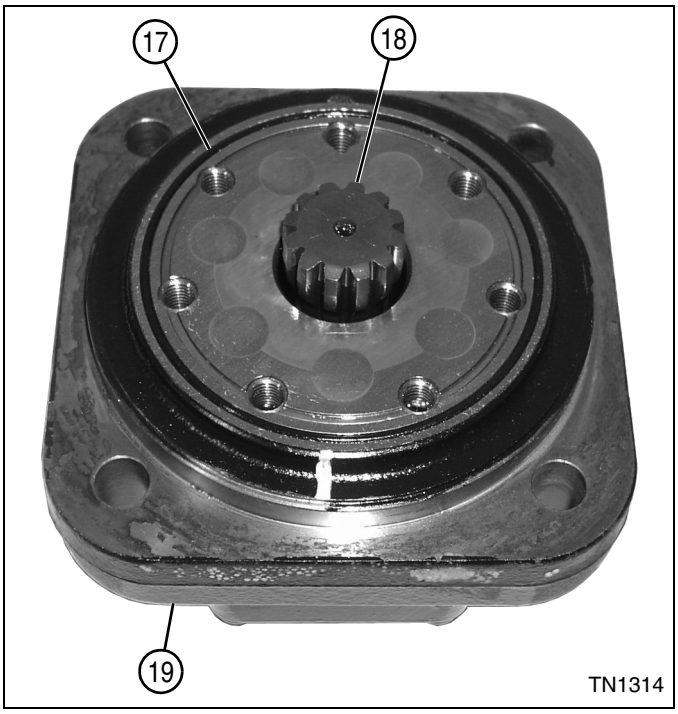


Figure 5-36

10. Remove the O-ring (17) from the mounting flange assembly (19).
11. Remove the drive shaft (18) from the mounting flange assembly (19).

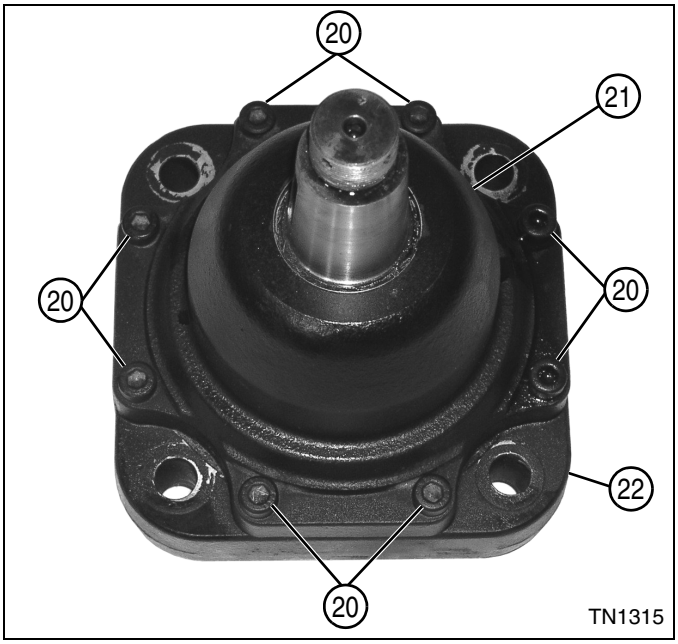


Figure 5-37

12. Remove eight socket-head screws (20) and remove the bearing housing assembly (21) from the mounting flange assembly (22).

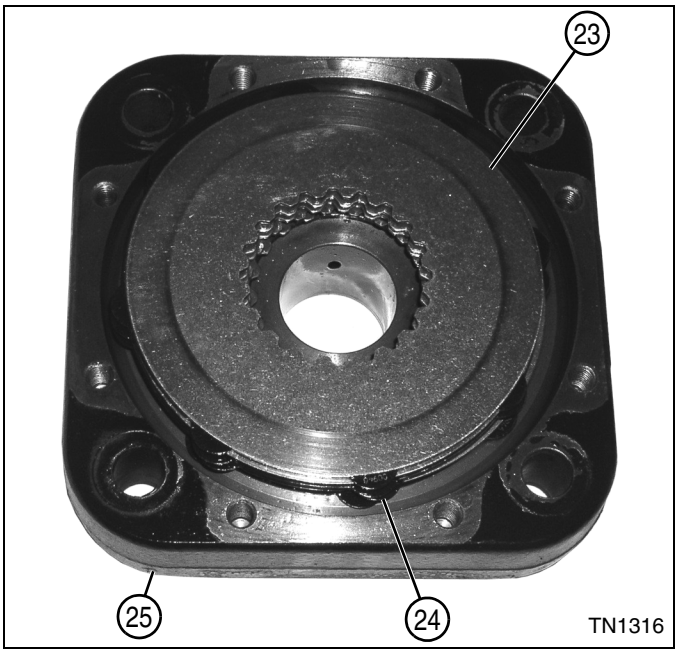


Figure 5-38

NOTE

Record the order of brake disks and stator rings to ensure correct assembly.

13. Remove five brake disks (23) and six stator rings (24) from the mounting flange assembly (25).

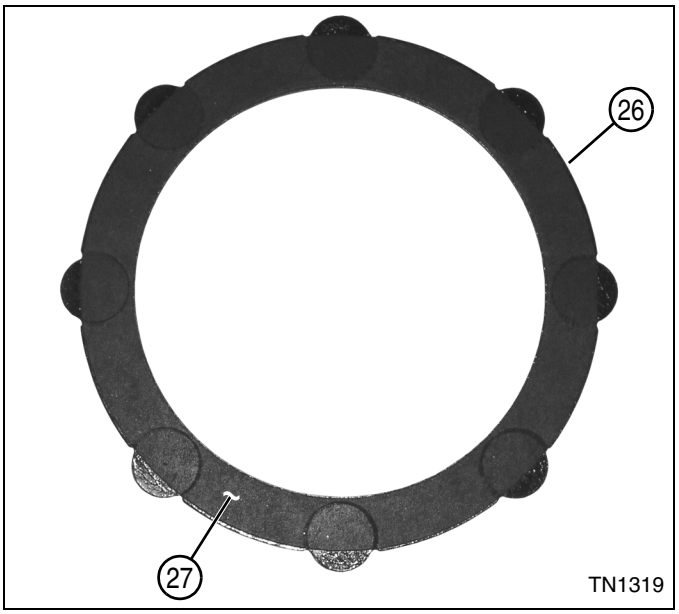


Figure 5-39

NOTE

Always replace the stator rings and brake discs as a set.

14. Inspect the friction surfaces (27) (front and rear). Replace the stator rings (26) if the surfaces are worn or damaged, or if any other damage is noted.

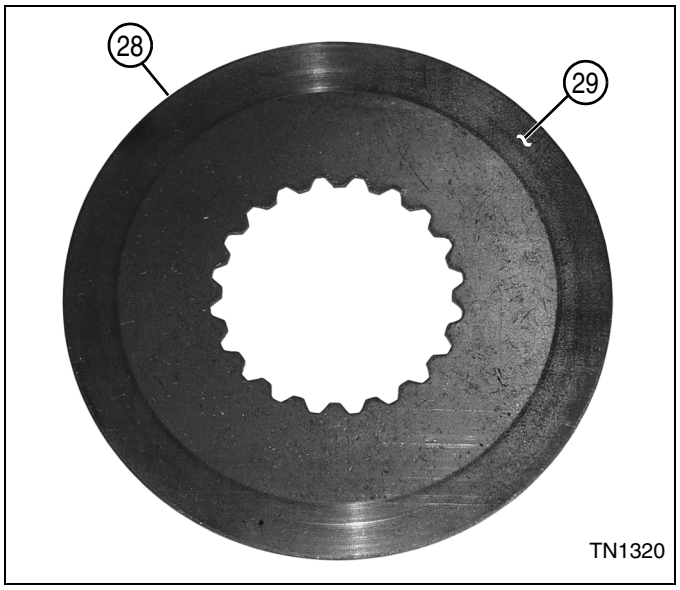


Figure 5-40

15. Inspect the disks for any scratches on the mating surfaces (29) (front and rear). Replace the disks (28) if any damage is noted.

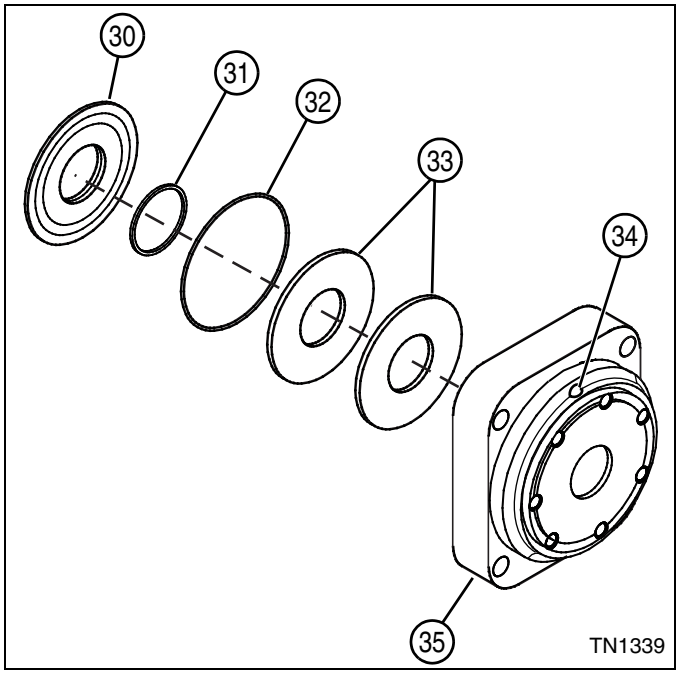


Figure 5-41

NOTE

Record the orientation of the brake piston (30) and spring discs (33) before removing to ensure correct installation.

16. Apply compressed air to vent (34), and remove the brake piston (30), O-rings (31 and 32), and two spring disks (33) from the mounting flange (35).

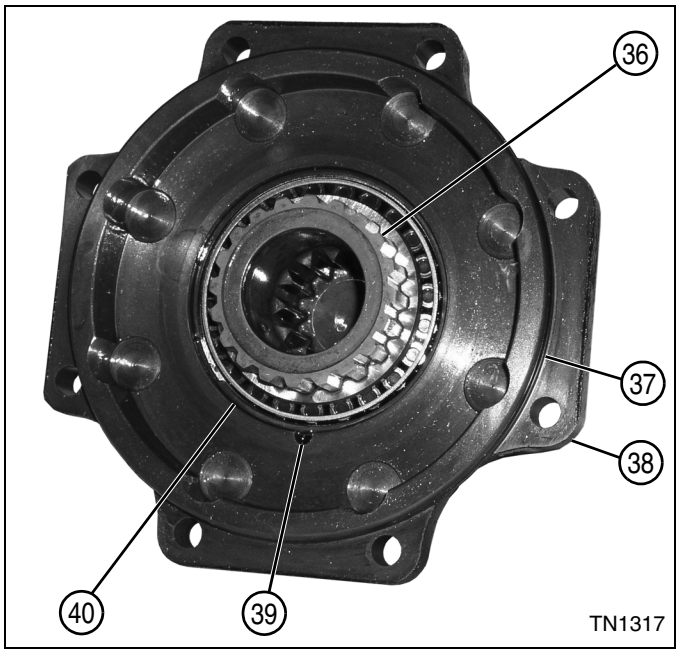


Figure 5-42

17. Remove O-ring (37) from the bearing housing (38).
18. Remove the retaining ring (40) from the bearing housing (38) by inserting a pick or small screwdriver in the opening (39) in the bearing housing and carefully prying the end of the retaining ring out of the groove.

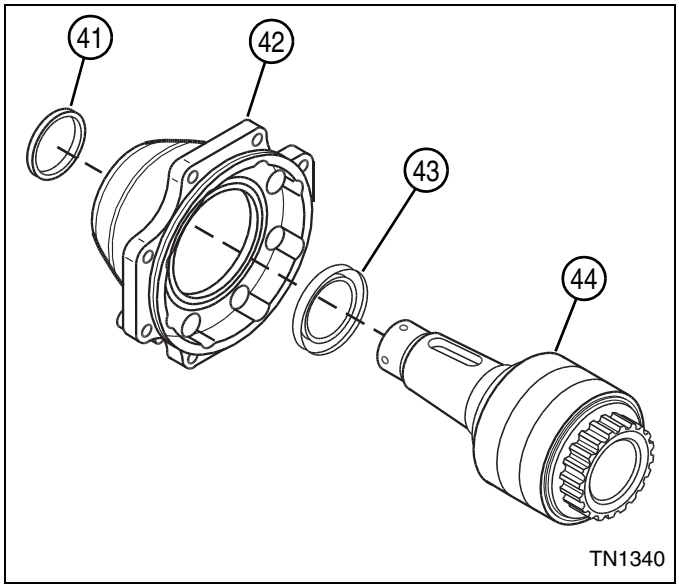


Figure 5-43

NOTE

Support the base of the bearing housing (42) and apply pressure to the end of the shaft assembly.

19. Remove the shaft assembly (44) from the bearing housing (42) using a press.

NOTE

Record the orientation of the dust (41) and shaft (43) seals before removing to ensure correct installation.

20. Remove dust seal (41) and shaft seal (43) from the bearing housing (42).

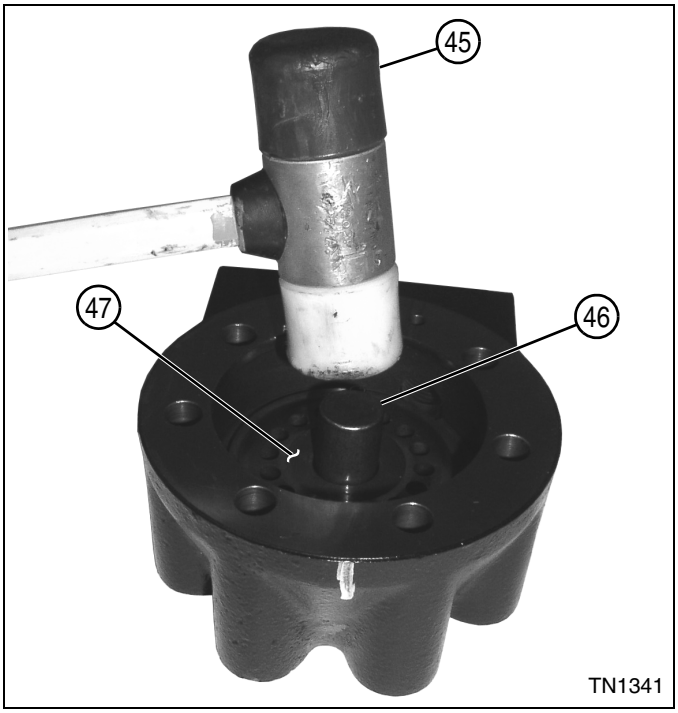


Figure 5-44

21. Fill the hole in the center of the balance plate (47) with oil, and install the spacer (46).
22. Tap the spacer (46) using a soft-faced hammer (45) to loosen the balance plate (47).

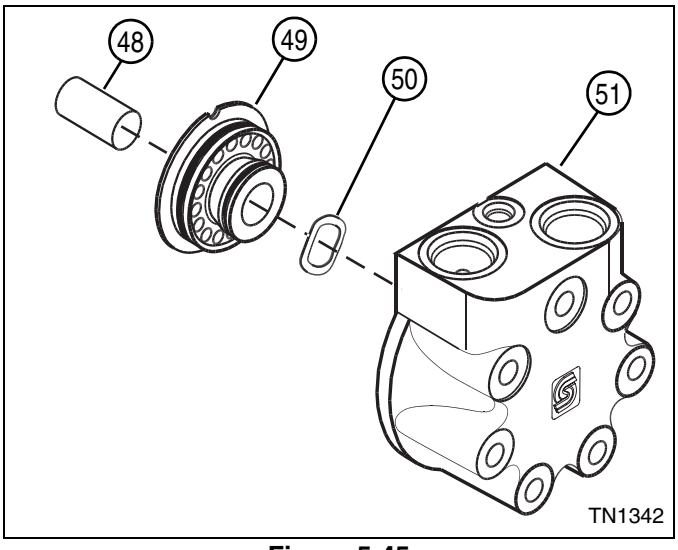


Figure 5-45

23. Remove the spacer (48), balance plate (49), and spring washers (50) from the end cover (51).

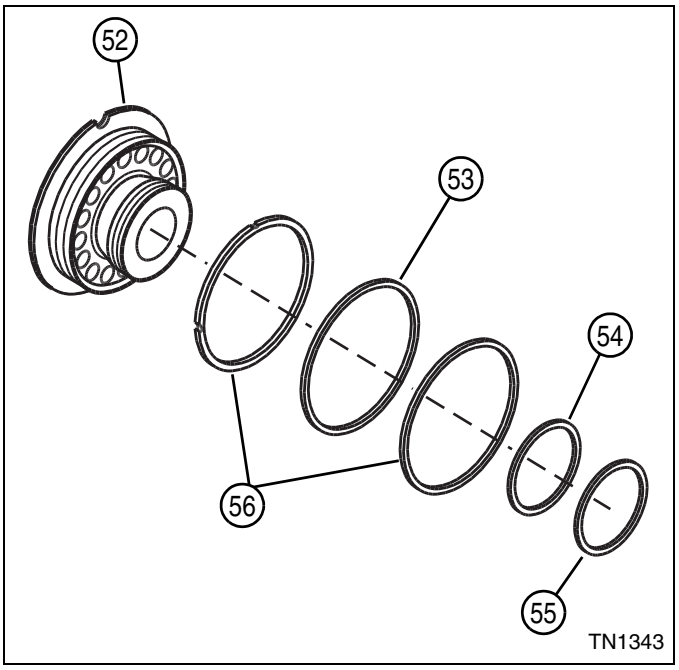


Figure 5-46

NOTE

Record the location of the backing rings before removing to ensure correct installation.

24. Remove O-ring (55) and backing ring (54) from the balance plate (52).
25. Remove O-ring (53) and two backing rings (56) from the balance plate (52).

NOTICE

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

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

26. Clean all parts using clean solvent, and dry using compressed air.
27. Inspect all parts for wear or damage. Replace parts as needed.
28. Apply a thin film of clean hydraulic oil to all parts to prevent corrosion. Keep parts covered or stored in a clean environment until assembly.

Assembly

See Figures 5-47 through 5-61.

NOTICE

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

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

Required Materials
Seal Kit (Jacobsen P/N 4134020)

NOTE

Always install new seals and O-rings for assembly. Used parts may leak.

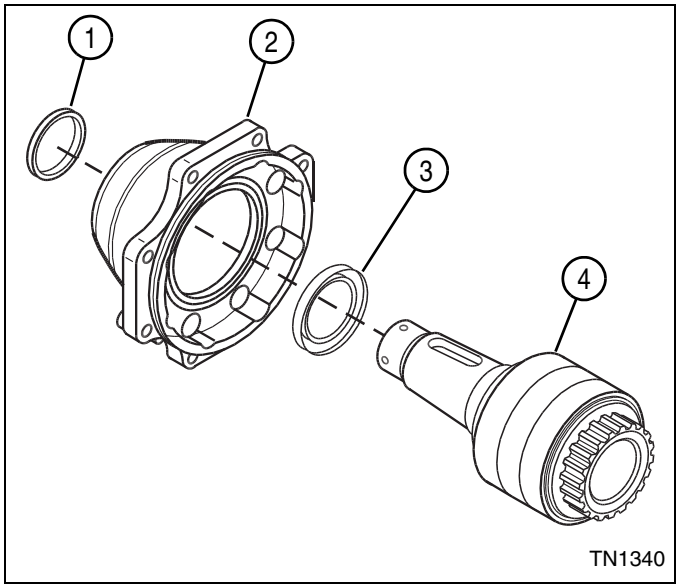


Figure 5-47

1. Apply a thin film of petroleum jelly to the inner and outer surfaces of the dust (1) and shaft (3) seals.

NOTE

Install the seals using a seal and driver set and press.

2. Install the shaft seal (3) in the bearing housing (2).
3. Install the dust seal (1) in the bearing housing (2).
4. Support the bearing housing (2), and place the shaft assembly (4) into the housing/seals. Install the shaft assembly into the housing using a press.

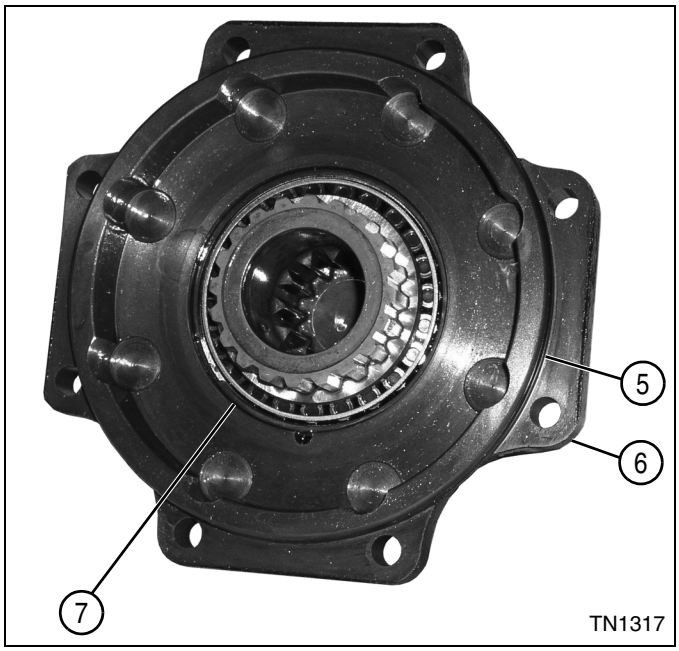


Figure 5-48

5. Install the retaining ring (7) into the groove in the bearing housing (6).
6. Apply a thin film of petroleum jelly to O-ring (5), and install O-ring on the bearing housing (6).

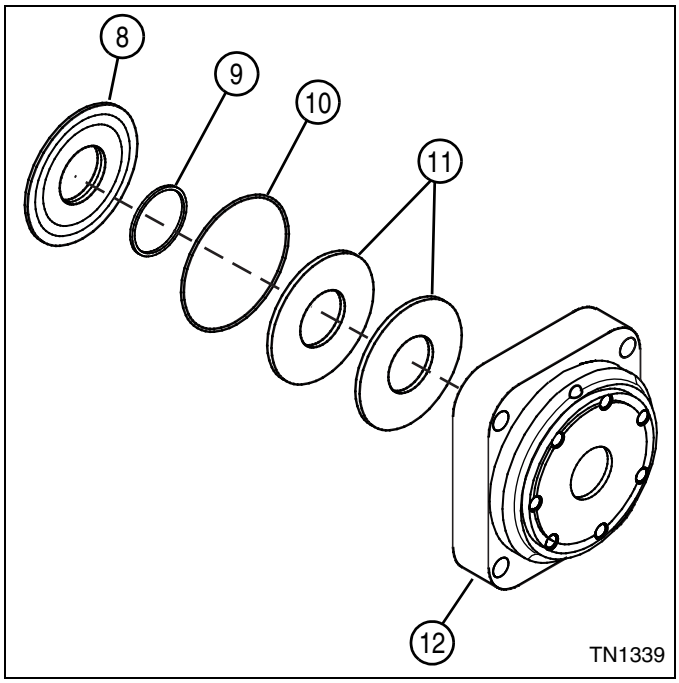


Figure 5-49

7. Install the spring discs (11) in the mounting flange (12) in the same orientation as recorded during removal.
8. Apply a thin film of petroleum jelly to O-rings (9 and 10), and install O-rings on the brake piston (8).
9. Install the brake piston (8) in the mounting flange (12) in the same orientation as recorded during removal.

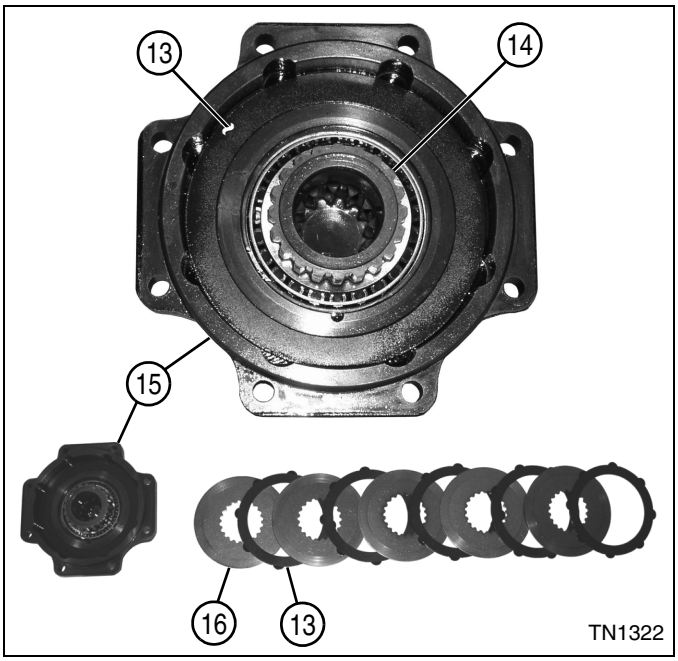


Figure 5-50

10. Install the brake disks (16) and stator rings (13) in the bearing housing (15) and output shaft (14).

    Install a stator ring (13) first, aligning the tabs with the detents in the bearing housing (15), followed by a brake disk (16), installed over the output shaft splines. Continue installation by alternating a stator ring and brake disk.

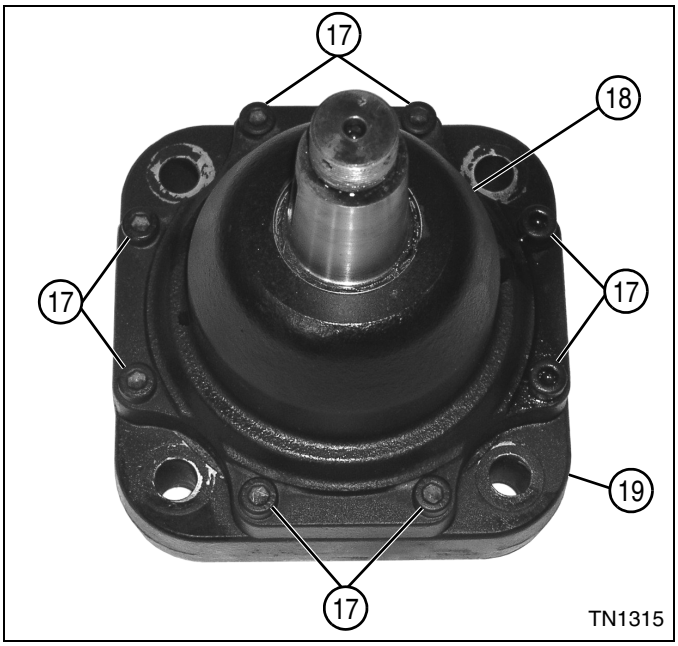


Figure 5-51

11. Install the mounting flange assembly (19) on the bearing housing assembly (18) using six socket-head screws (17). Tighten screws using an alternating pattern to 27 lb-ft (37 N·m).

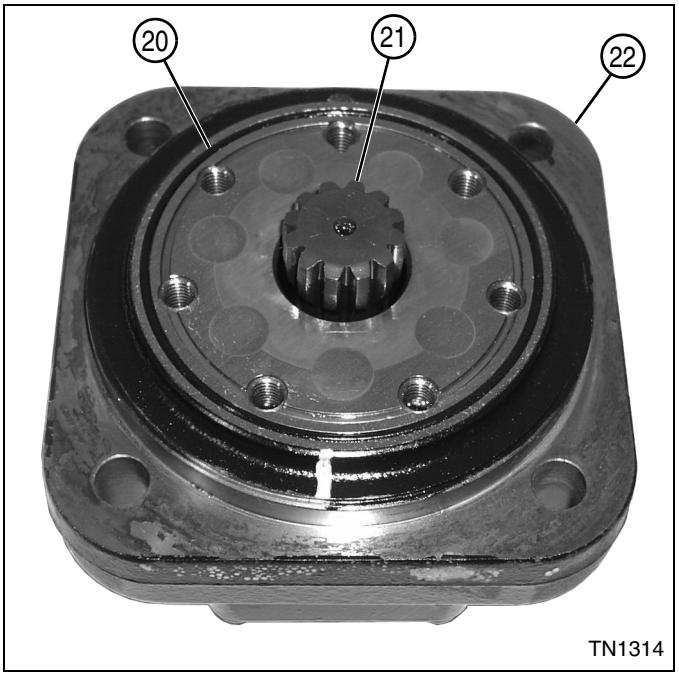


Figure 5-52

12. Install the drive shaft (21) in the mounting flange assembly (22).
13. Apply a thin film of petroleum jelly to O-ring (20), and install an O-ring in the mounting flange assembly (22).

IMPORTANT

The motor must be timed correctly.

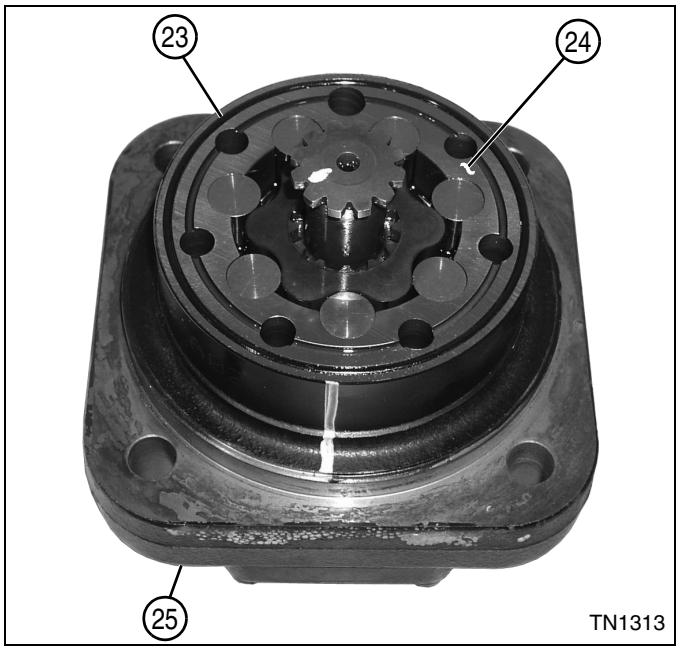


Figure 5-53

14. Install the gear wheel set (24) on the mounting flange/bearing housing assembly (25).
15. Apply a thin film of petroleum jelly to O-ring (23). Install O-ring on the gear wheel set (24).

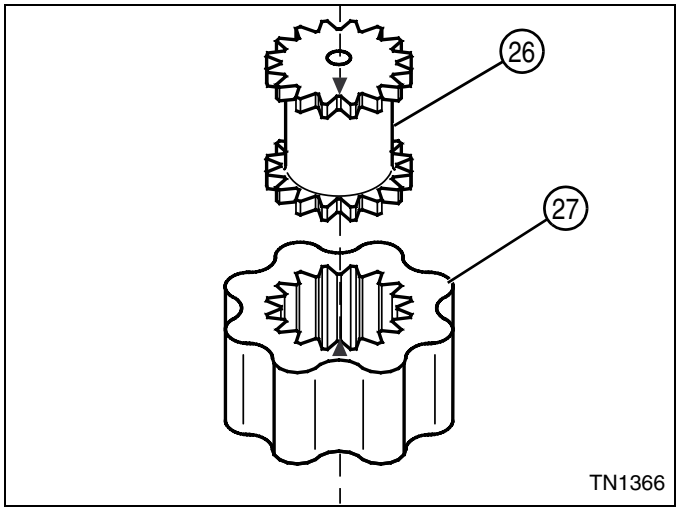


Figure 5-54: Correct Timing

16. The gerotor (27) should be marked at a point where the tip of an inner spline aligns with the root of the outer teeth.
17. Mark the root of a spline on both ends of the valve drive (26).
18. Line up mark on gerotor (27) with marks on valve drive (26).

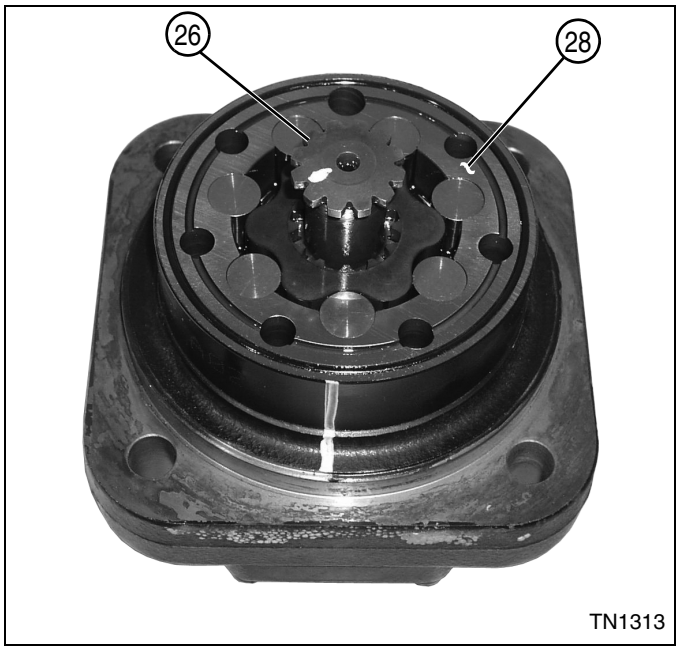


Figure 5-55

19. Install the valve drive (26) in the gear wheel set (28).

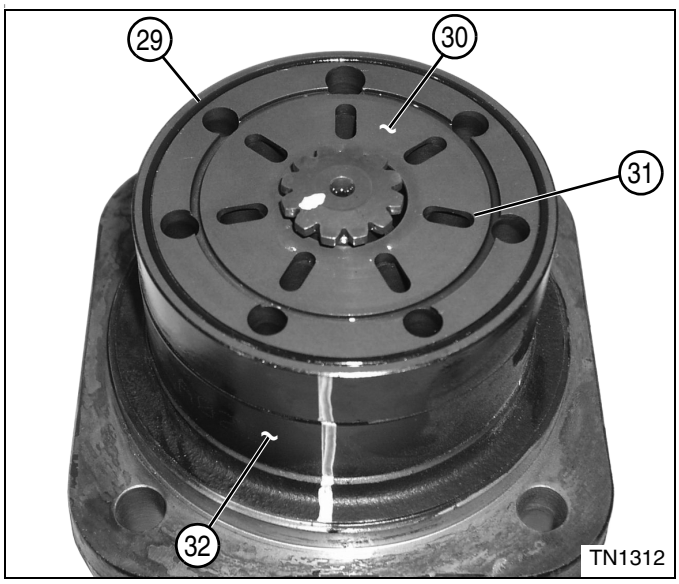


Figure 5-56

20. Install the valve plate (30) on the gear wheel set (32) with the oval ports (31) facing away from the gear wheel set.
21. Install an O-ring (29) on the valve plate (30).

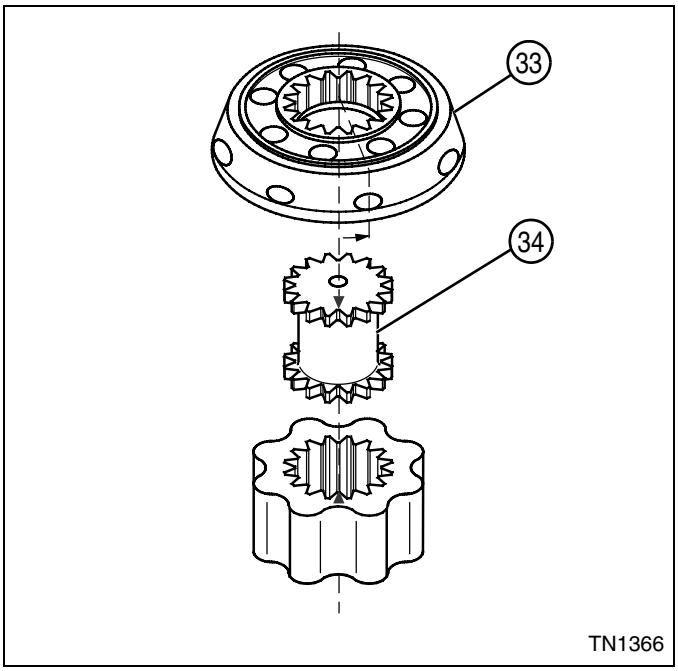


Figure 5-57: Correct Motor Timing

22. Align mark on valve drive (34) with a hole in the outer rim of disk valve (33).

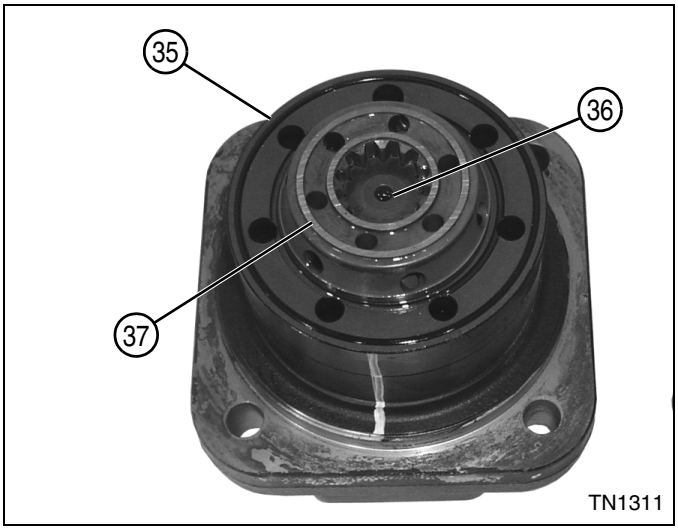


Figure 5-58

23. Install the disk valve (37) on the valve drive (36) and valve plate (35).

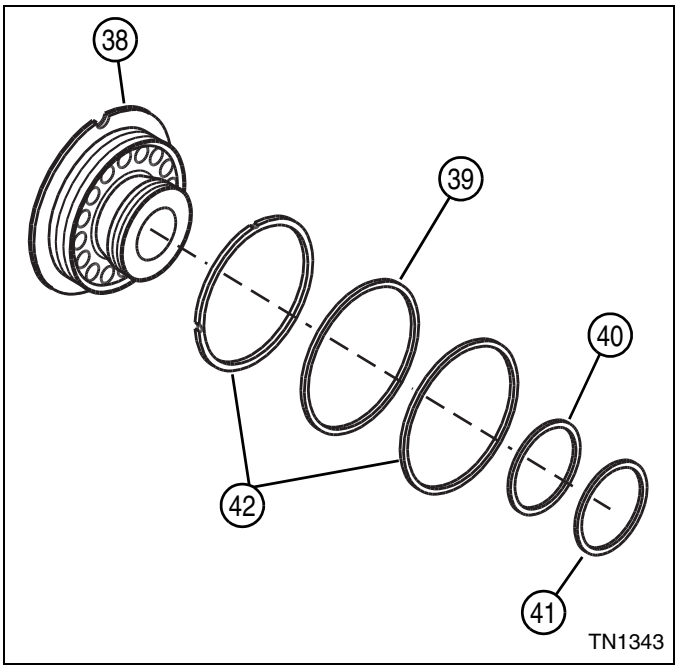


Figure 5-59

NOTE

Install the backing rings in the same locations as record during removal.

24. Install O-ring (39) and two backing rings (42) on the balance plate (38).
25. Install O-ring (40) and backing ring (41) on the balance plate (38).

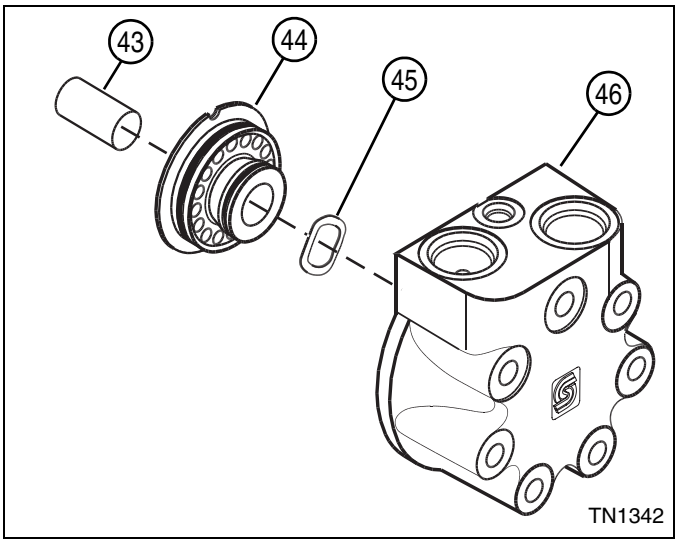


Figure 5-60

26. Install spring washer (45) and balance plate (44) in the end cover (46).
27. Apply a thin film of petroleum jelly to spacer (43), and install spacer in the end cover assembly (46).

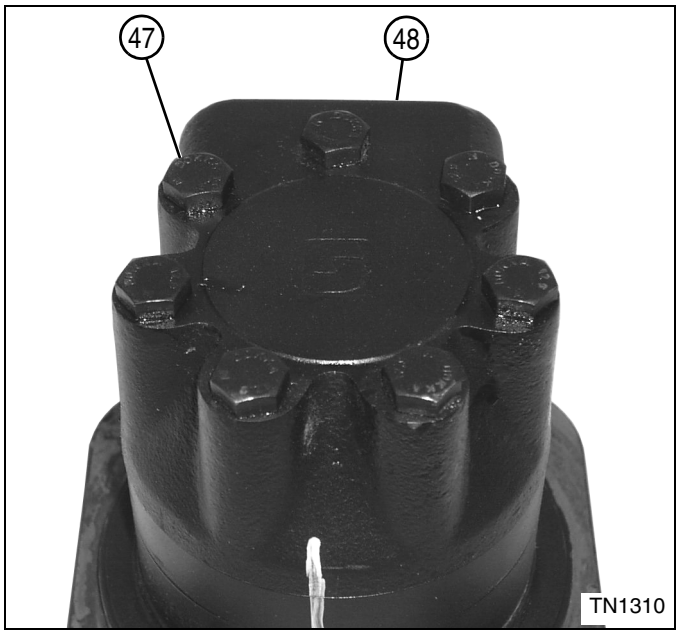


Figure 5-61

28. Install seven screws (47) in the end cover (48). Tighten screws using an alternating pattern to 52 lb-ft (70 N·m).

Rear Wheel Motor

Removal and Installation

See Figures 5-62 through 5-65.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Remove rear wheel. (See “Rear Wheel” on page 9-18.)

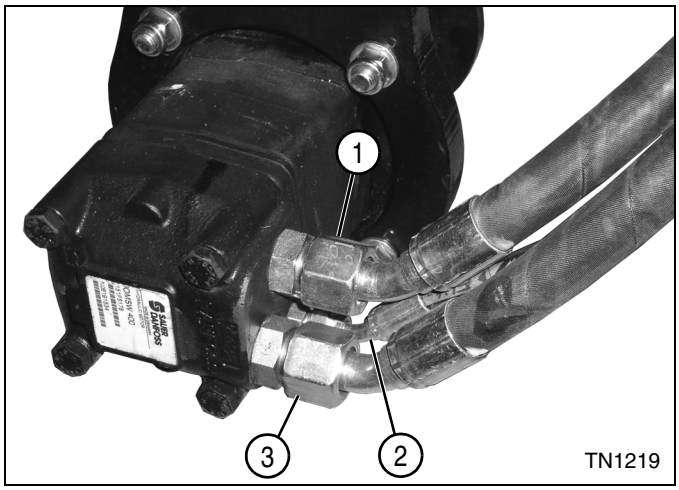


Figure 5-62

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 three hoses (1, 2, and 3).

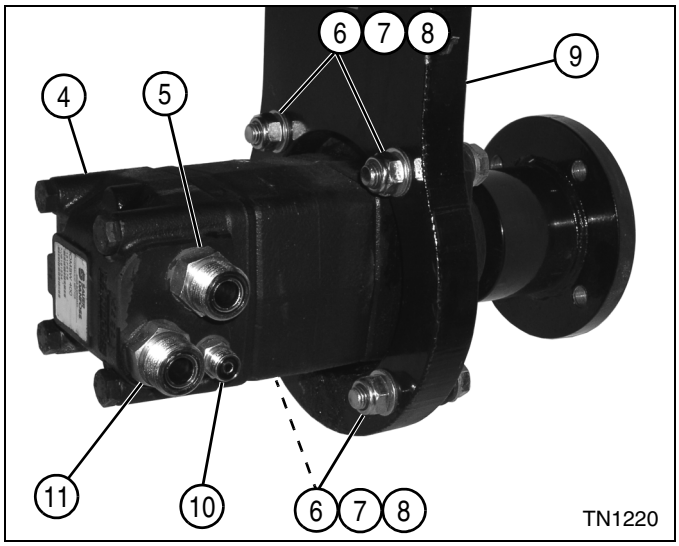


Figure 5-63

4. Remove hydraulic fittings (5, 10, and 11).
5. Remove four motor mounting nuts (6), bolts (7), and eight washers (8).
6. Remove hydraulic motor (4) from bracket (9).

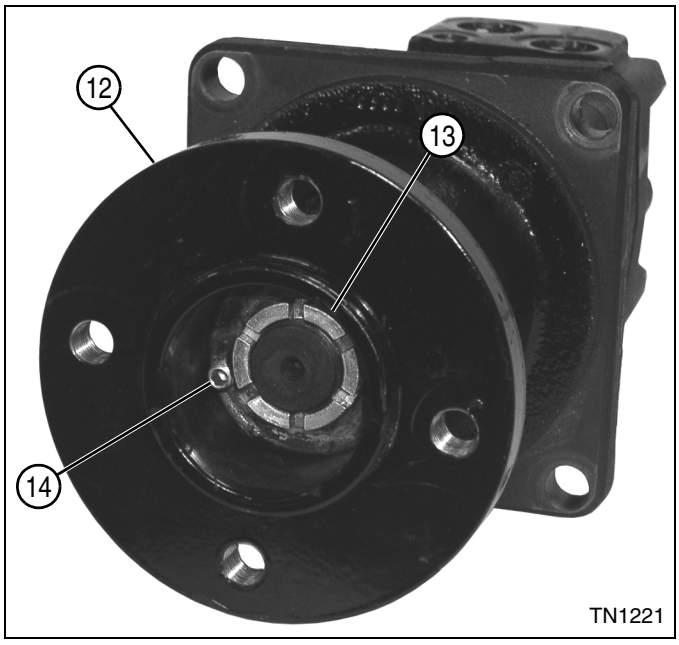


Figure 5-64

7. Remove set screw (14)

⚠ 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.

8. Loosen, but do not remove, the castle nut (13).
9. Remove the wheel hub (12) using a puller.

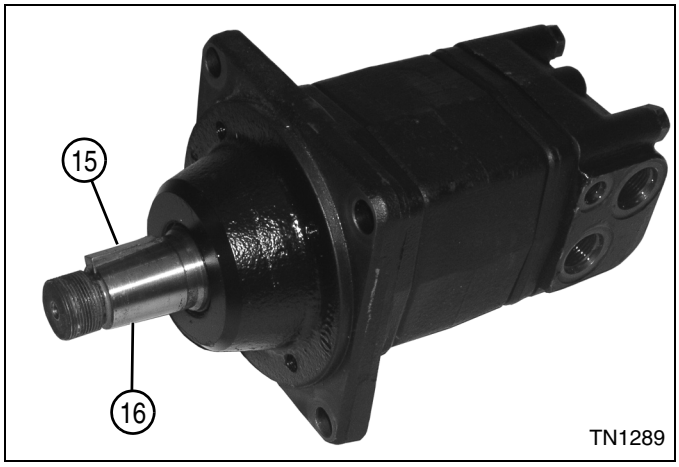


Figure 5-65

10. Remove key (15) from the motor shaft (16).

Installation Notes

Required Materials
Anti-Seize Compound Loctite® 242 (Blue) Thread Sealant

- *Install the rear wheel hydraulic motor by reversing the order of removal.*

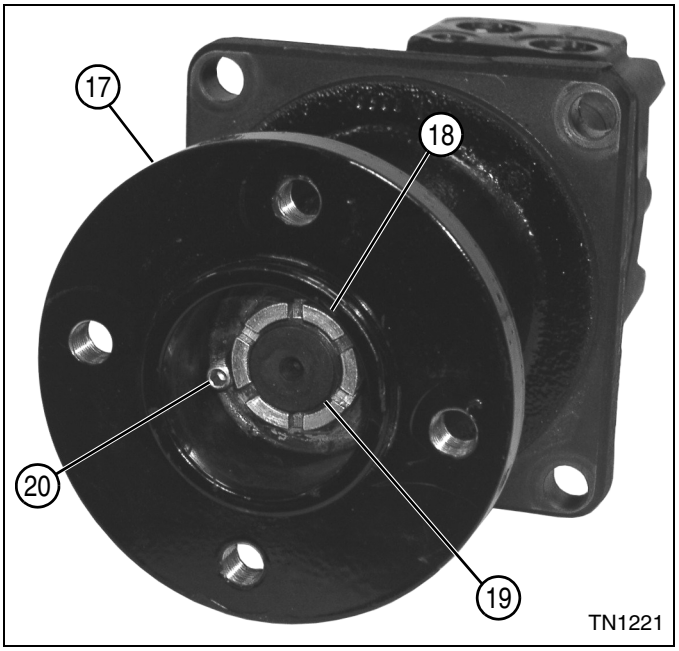


Figure 5-66

- *Apply anti-seize compound to the motor shaft (19) before installing the wheel hub (17).*
- *Tighten castle nut (18) to 148 ± 7 lb-ft (200 ± 10 N·m). Position the nut so the flats are not covering set screw (20) hole.*
- *Apply Locite® 242 (Blue) Thread Sealant to set screw threads (20) before installing set screw.*

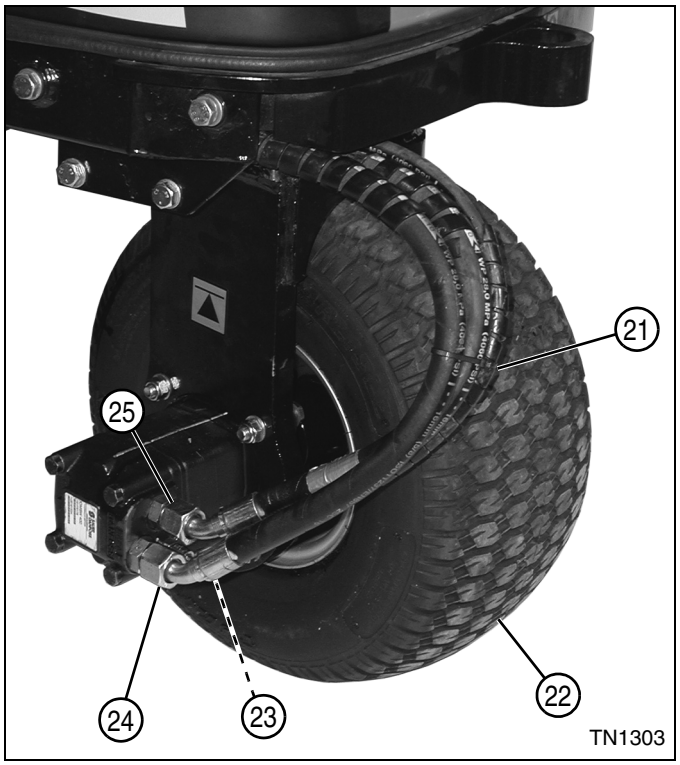


Figure 5-67

- *Before tightening the hose connections (23, 24, and 25) position hoses to allow clearance between hoses and rear wheel (22).*
- *Tie hoses together using a cable tie (21).*
- *Check hydraulic oil level. Add oil as needed. (Refer to "Safety, Operation, and Maintenance Manual" for the correct oil specifications.)*

Disassembly

See Figures 5-68 through 5-75.

Figure 5-68

1. Scribe or mark a line (1) along the side of hydraulic motor sections (2) to mark the alignment of motor segments before disassembly.

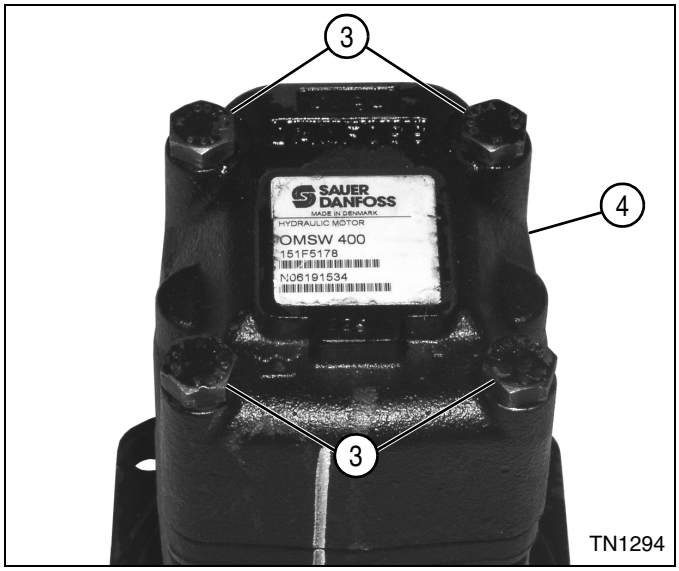


Figure 5-69

NOTE

Use caution when removing screws as motor segments will be free to move.

2. Remove four screws (3) from the valve housing (4).

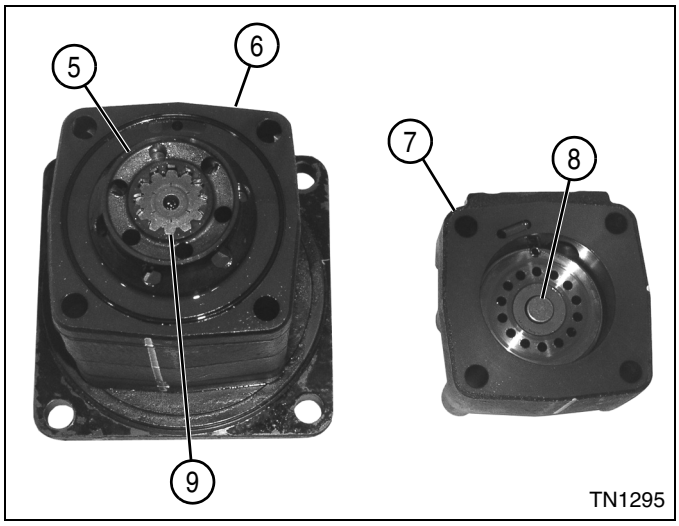


Figure 5-70

NOTE

The spacer (8) may remain with the disk valve (5) when the valve housing is removed.

3. Remove the valve housing assembly (7) and spacer (8) from the channel plate (6).
4. Remove the disk valve (5) from the valve drive (9) and channel plate (6).

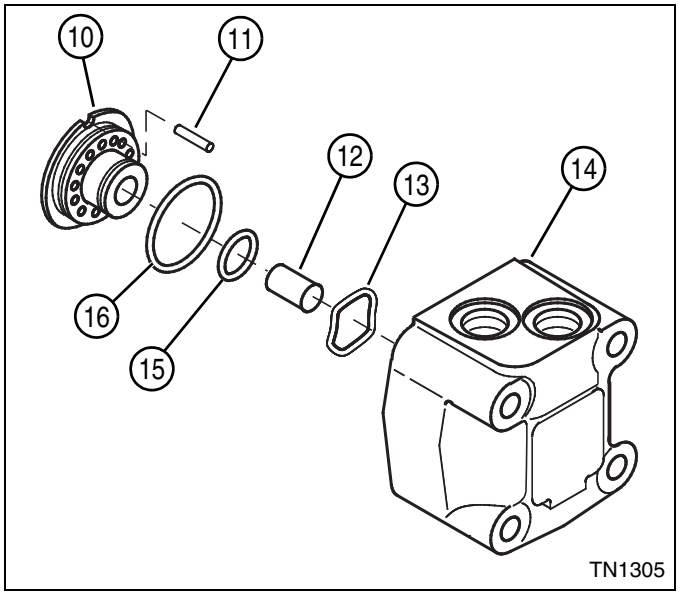


Figure 5-71

NOTE

Do not remove the alignment pin (11) unless replacement is required.

5. Remove the balance plate (10), spacer (12), and spring washer (13) from the valve housing (14).
6. Remove O-rings (15 and 16) from the balance plate (10).

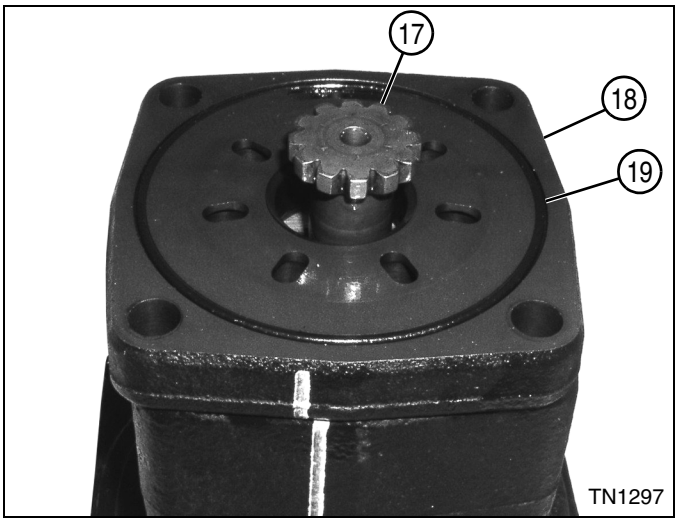


Figure 5-72

NOTE

Record the orientation of the valve drive before removing to ensure correct installation.

7. Remove the valve drive (17).

NOTE

Record the orientation of the channel plate before removing to ensure correct installation.

8. Remove the channel plate (18).
9. Remove the O-ring (19) from channel plate (18).

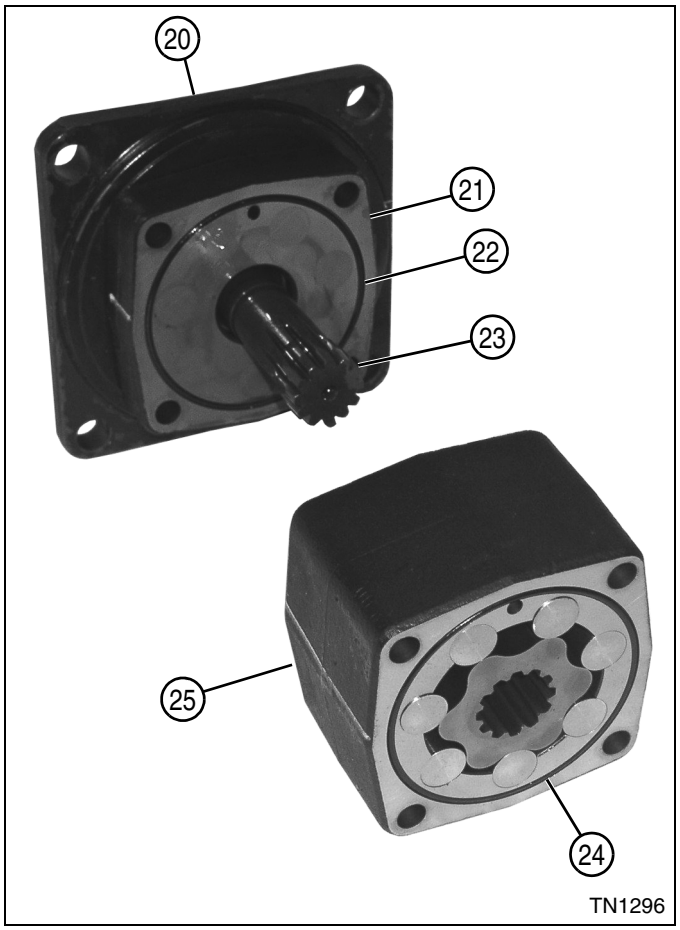


Figure 5-73

NOTES

- *Do not disassemble the gear wheel set. If replacement is necessary, replace the entire assembly.*
- *Record the orientation of all components before removing to ensure correct installation.*

10. Remove the gear wheel set (25) from the intermediate plate (21).
11. Remove the cardan shaft (23) from the intermediate plate (21).
12. Remove the intermediate plate (21) from the bearing housing (20).
13. Remove O-ring (22) from the intermediate plate (21).
14. Remove O-ring (24) from the gear wheel set (25).

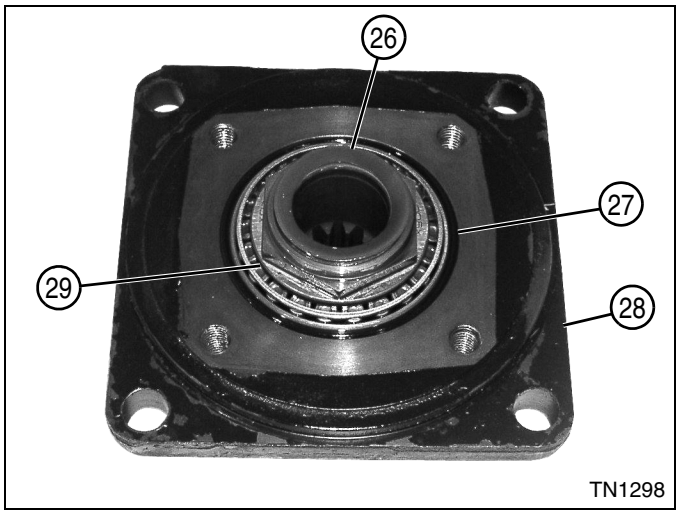


Figure 5-74

15. Remove the spring washer (26) from the motor output shaft (29).
16. Remove the O-ring (27) from the bearing housing (28).

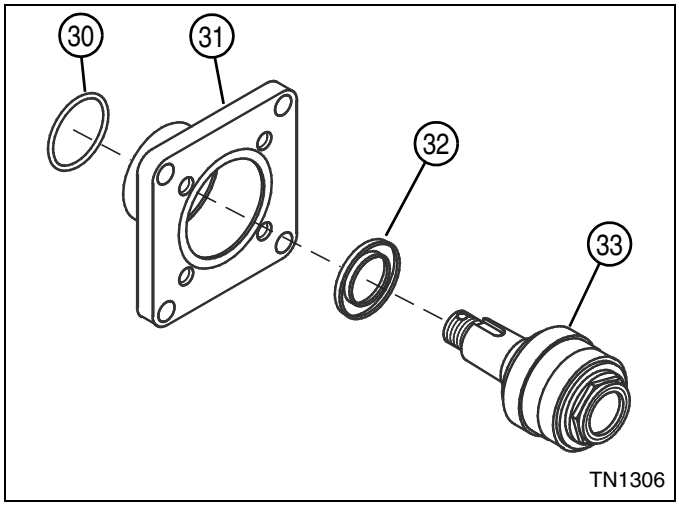


Figure 5-75

17. Remove the shaft assembly (33) from the bearing housing (31).
18. Remove the shaft seal (32) and O-ring (30) from the bearing housing (31).

NOTICE

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

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

19. Clean all parts using clean solvent, and dry using compressed air.
20. Inspect all parts for wear or damage. Replace parts as needed.
21. Apply a thin film of clean hydraulic oil to all parts to prevent corrosion. Keep parts covered or stored in a clean environment until assembly.

Assembly

See Figures 5-76 trough 5-86.

NOTICE

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

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

Required Materials
Seal Kit (Jacobsen P/N 002300620)

NOTE

Always install new seals and O-rings for assembly. Used parts may leak.

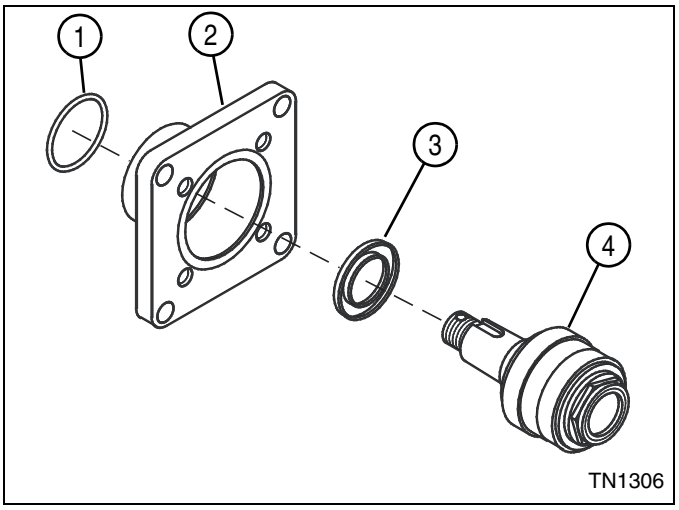


Figure 5-76

1. Install a new shaft seal (3) in bearing housing (2).
2. Install a new O-ring (1) in the bearing housing (2).
3. Install the shaft assembly (4) in the bearing housing (2).

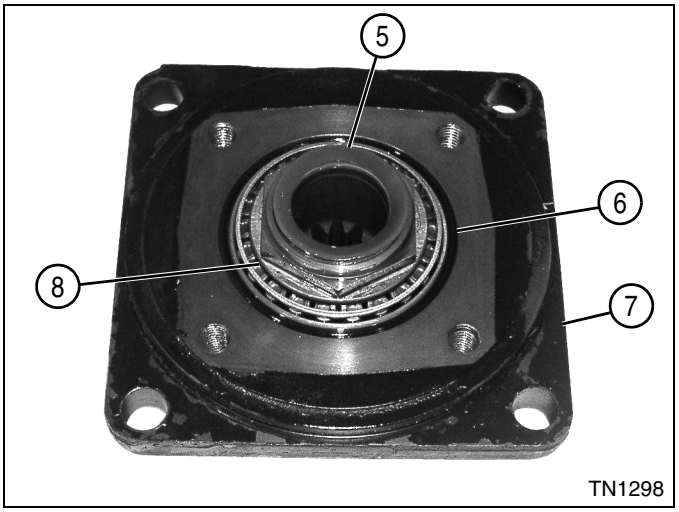


Figure 5-77

4. Place the spring washer (5) on the motor output shaft (8).
5. Install new O-ring (6) in the bearing housing (7).

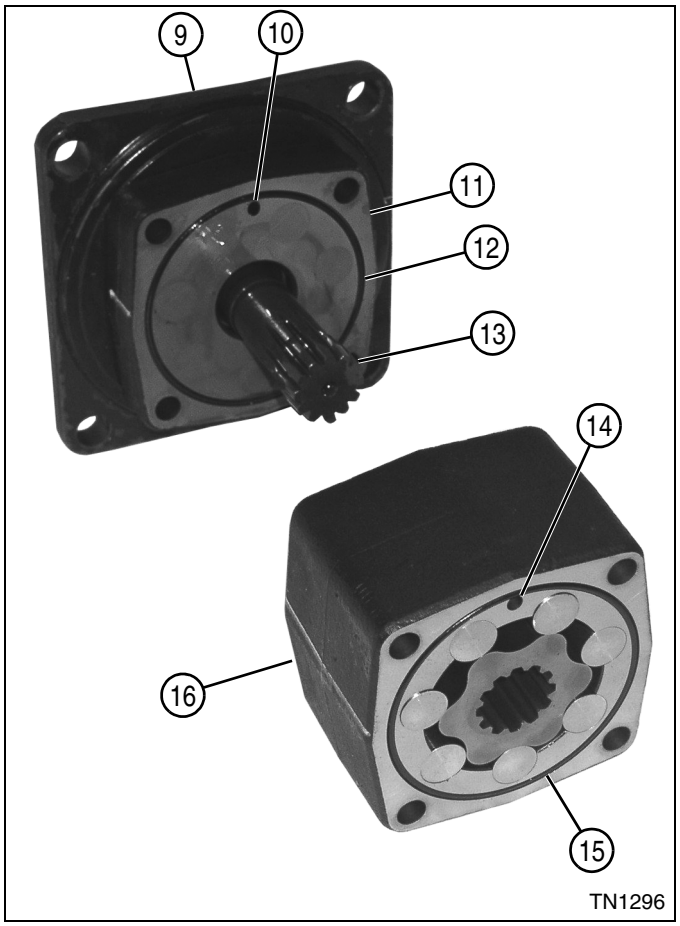


Figure 5-78

6. Install a new O-ring (12) in the intermediate plate (11).
7. Install the intermediate plate (11) on the bearing housing assembly (9).
8. Install cardan shaft (13) in the intermediate plate (11).
9. Install the gear wheel set (16) over the cardan shaft (13) and on the intermediate plate (11), aligning the port (14) on the gear wheel set with the port (10) on the intermediate plate.
10. Install a new O-ring (15) in the gear wheel set (16).

IMPORTANT

The motor must be timed correctly.

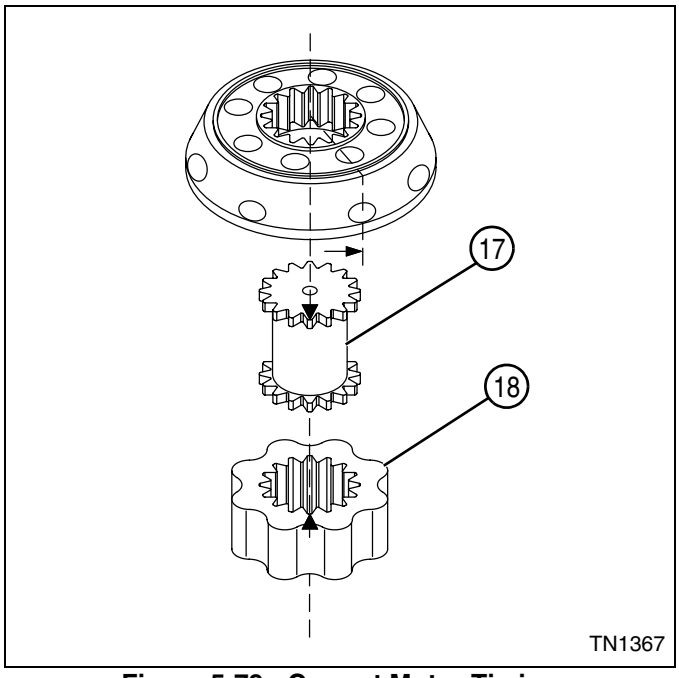


Figure 5-79: Correct Motor Timing

11. Mark the gear wheel set rotor (18) at the point where the bottom of a spline tooth is opposite to the bottom of a tooth in the external rotor teeth.
12. Mark the tip of a spline on both ends of the valve drive (17).
13. Line up mark on gear wheel set rotor (18) with mark on thinner gear face of valve drive (17).

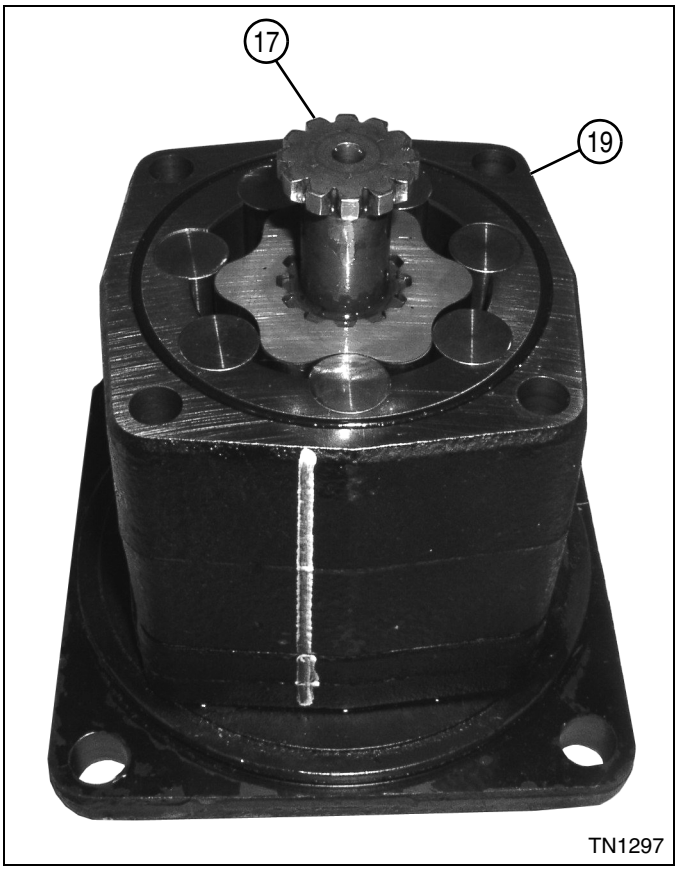


Figure 5-80

14. Install the valve drive (17) in the gear wheel set (19) positioning the thinner gear face toward the gear wheel set.

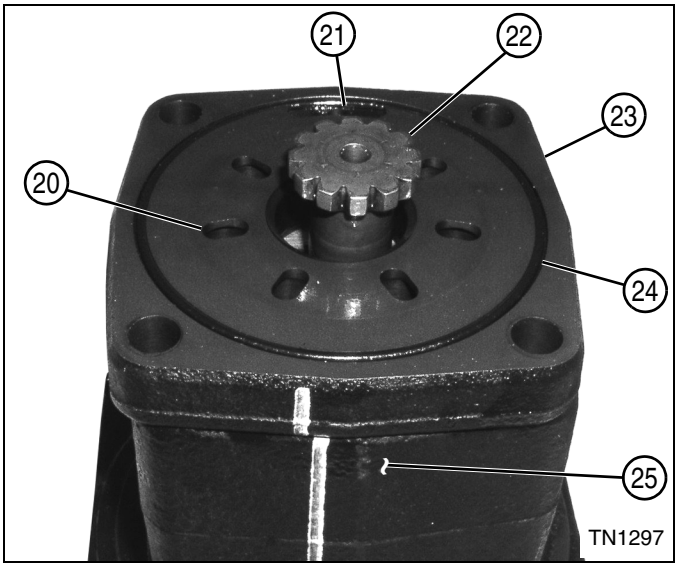


Figure 5-81

15. Install the channel plate (23) over the valve drive (22), positioning the oval ports (20) facing away from the gear wheel set (25), and aligning the port (21) on the channel plate with the port on the gear wheel set.

16. Install a new O-ring (24) on the channel plate (23).

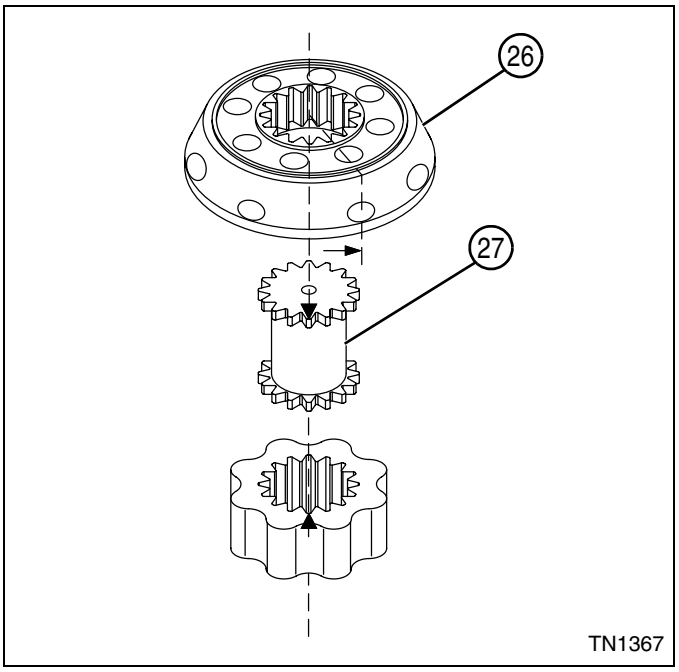


Figure 5-82: Correct Motor Timing

17. Align mark on valve drive (27) with a hole in the outer rim of disk valve (26).

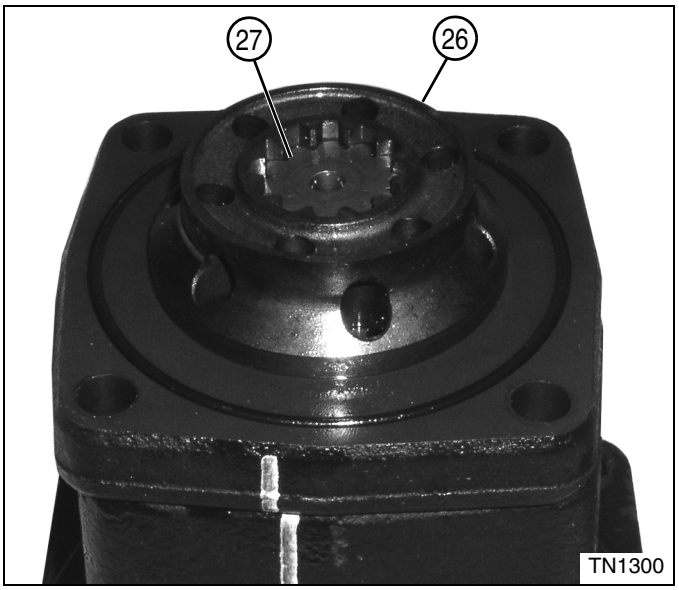


Figure 5-83

18. Install the disk valve (26) over the valve drive (27).

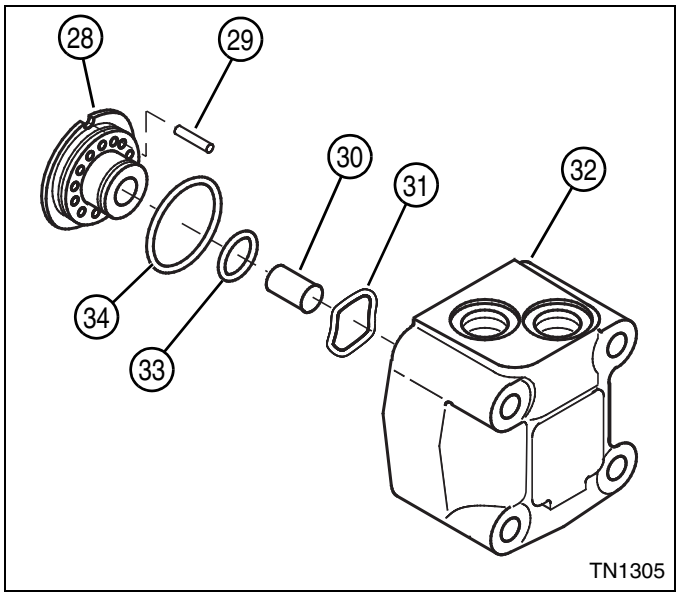


Figure 5-84

19. Install alignment pin (29) in valve housing (if removed).
20. Install new O-rings (33 and 34) on the balance plate (28).
21. Install balance plate (28), spacer (30), and spring washer (31) in the valve housing (32).

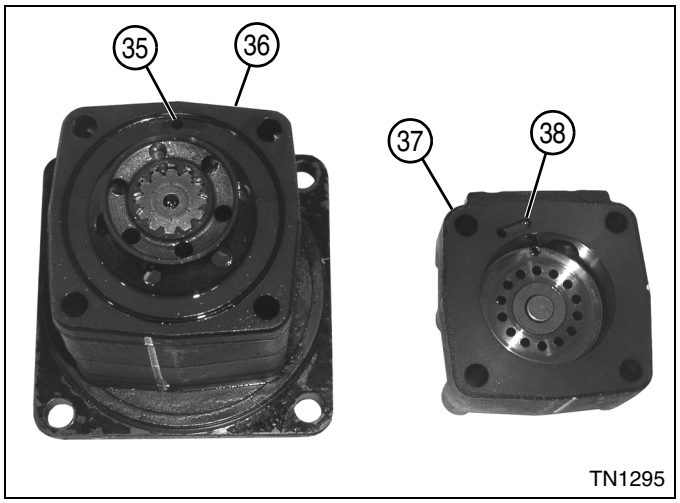


Figure 5-85

22. Install the valve housing assembly (37) on the channel plate (36) aligning the port (38) on the valve housing with the port (35) on the channel plate.

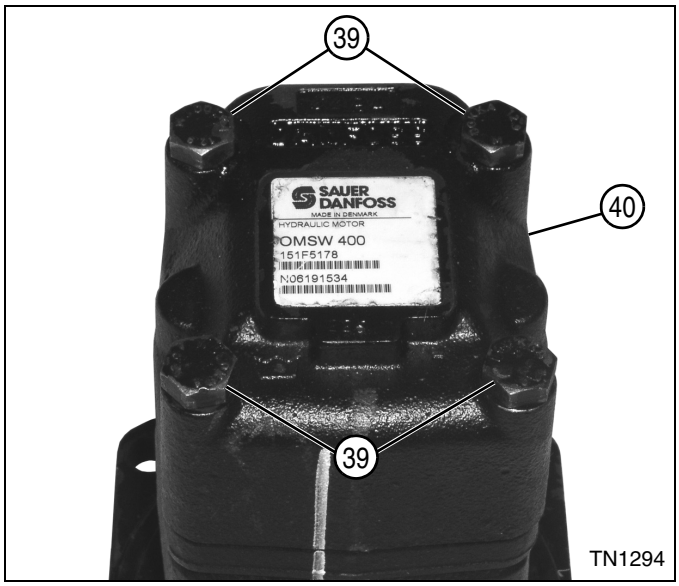


Figure 5-86

23. Install four screws (39) in the valve housing (40). Tighten screw using an alternating pattern to 55—59 lb-ft (75—80 N·m).

Chapter 6

Hydraulics

6

JACOBSEN
A Textron Company

Specifications

Test and Adjustment Specifications

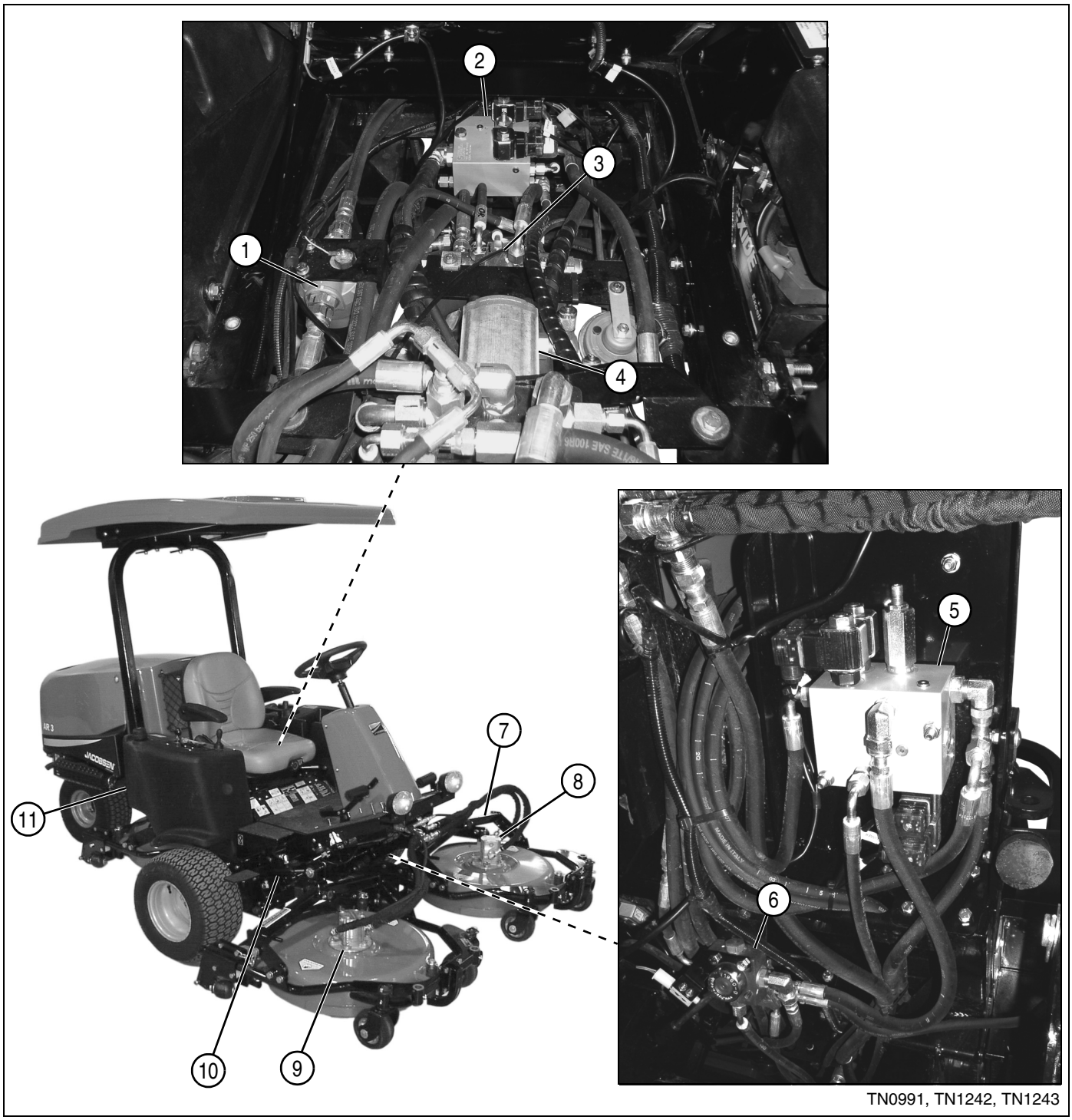
Specifications		
Hydrostatic Pump Flow	gpm (lpm)	20 (76) at 3150 rpm
Mow/Brake Relief Valve Pressure Setting—AR-3 Model 30001	psi (bar)	3046 (210)
Mow/Brake Relief Valve Pressure Setting—AR-3 Model 30002	psi (bar)	3626 (250)
Mow/Brake Relief Valve Pressure Setting—TR-3	psi (bar)	3046 (210)
Hydraulic Leakage Percentage Ranges		0–10% = Good 11–20% = Marginal 21% and Beyond = Bad
Lift/Steer Pump Relief Valve Pressure Setting	psi (bar)	1595 (110 bar)
Cutting Unit Motor Case Drain Rate—AR-3		Less than 1 pint (0.47 L) per minute at 2000 psi (138 bar)
Cutting Unit Motor Case Drain Rate—TR-3		Less than 1 pint (0.47 L) per minute at 2000 psi (138 bar)

Repair Specifications

Specifications		
Tandem Pump—End Cap-to-Pump Body Screw Torque	lb-ft (N·m)	32—36 (43—49)
Lift Valve—Solenoid Coil Torque	lb-ft (N·m)	3 (4)
Lift Valve—Relief Valve Torque	lb-ft (N·m)	37 (50)
Lift Valve—Check Valve Torque	lb-ft (N·m)	30 (40)
Lift Valve—Orifice Plug Torque	lb-ft (N·m)	2 (3)
Lift Valve—Hollow Hex Plug Torque	lb-ft (N·m)	5 (6.5)
Flushing Valve—Check Valve Torque	lb-ft (N·m)	37 (50)
Flushing Valve—Sequence Valve Torque	lb-ft (N·m)	37 (50)
Flushing Valve—M5 x 1.00 Diameter Orifice Plug Torque	lb-ft (N·m)	2 (3)
Flushing Valve—M5 x 0.50 Diameter Orifice Plug Torque	lb-ft (N·m)	1.7 (2.5)
Mow/Brake Valve—Mow Solenoid Valve Torque	lb-ft (N·m)	20 (27)
Mow/Brake Valve—Brake Solenoid Valve Torque	lb-ft (N·m)	22 (30)
Mow/Brake Valve—Load Control Valve Torques	lb-ft (N·m)	50 (68)
Mow/Brake Valve—Relief Valve Torque	lb-ft (N·m)	37 (50)
Mow/Brake Valve—Solenoid Coil Torque	lb-ft (N·m)	3 (4)
Mow/Brake Valve—Hollow Hex Plug Torque	lb-ft (N·m)	5 (6.5)
Mow/Brake Valve—Hollow Hex Plug Torque	lb-ft (N·m)	37 (50)
Hydraulic Oil Tank Capacity	gal (L)	6.6 (25)

Component Location—AR-3

See Figures 6-1 and 6-2.



TN0991, TN1242, TN1243

1 Hydraulic Oil Filter
2 Mow and Brake Valve
3 Hydraulic Oil Manifold
4 Tandem Pump Assembly
5 Lift Valve
6 Brake Release Valve
7 Left Front Lift Cylinder
8 Left Front Cutting Unit Drive Motor
9 Right Front Cutting Unit Drive Motor
10 Right Front Lift Cylinder
11 Hydraulic Oil Tank

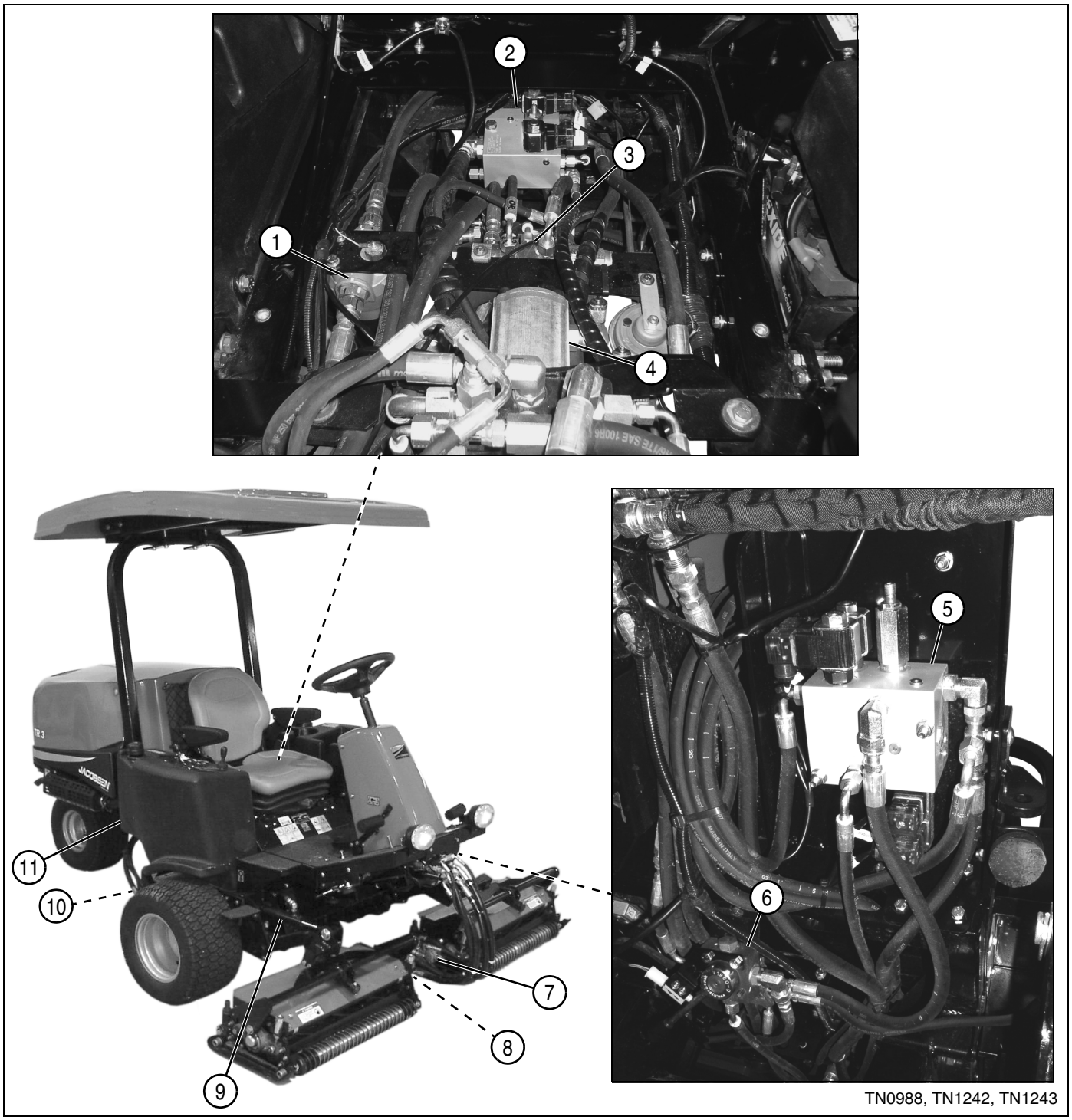
Figure 6-1: Component Location—Right Side

1	Flushing Valve	4	Rear (Center) Cutting Unit Lift Cylinder
2	Radiator/Hydraulic Oil Cooler	5	Hydraulic Oil Filter
3	Rear (Center) Cutting Unit Drive Motor		

Figure 6-2: Component Location—Left Side

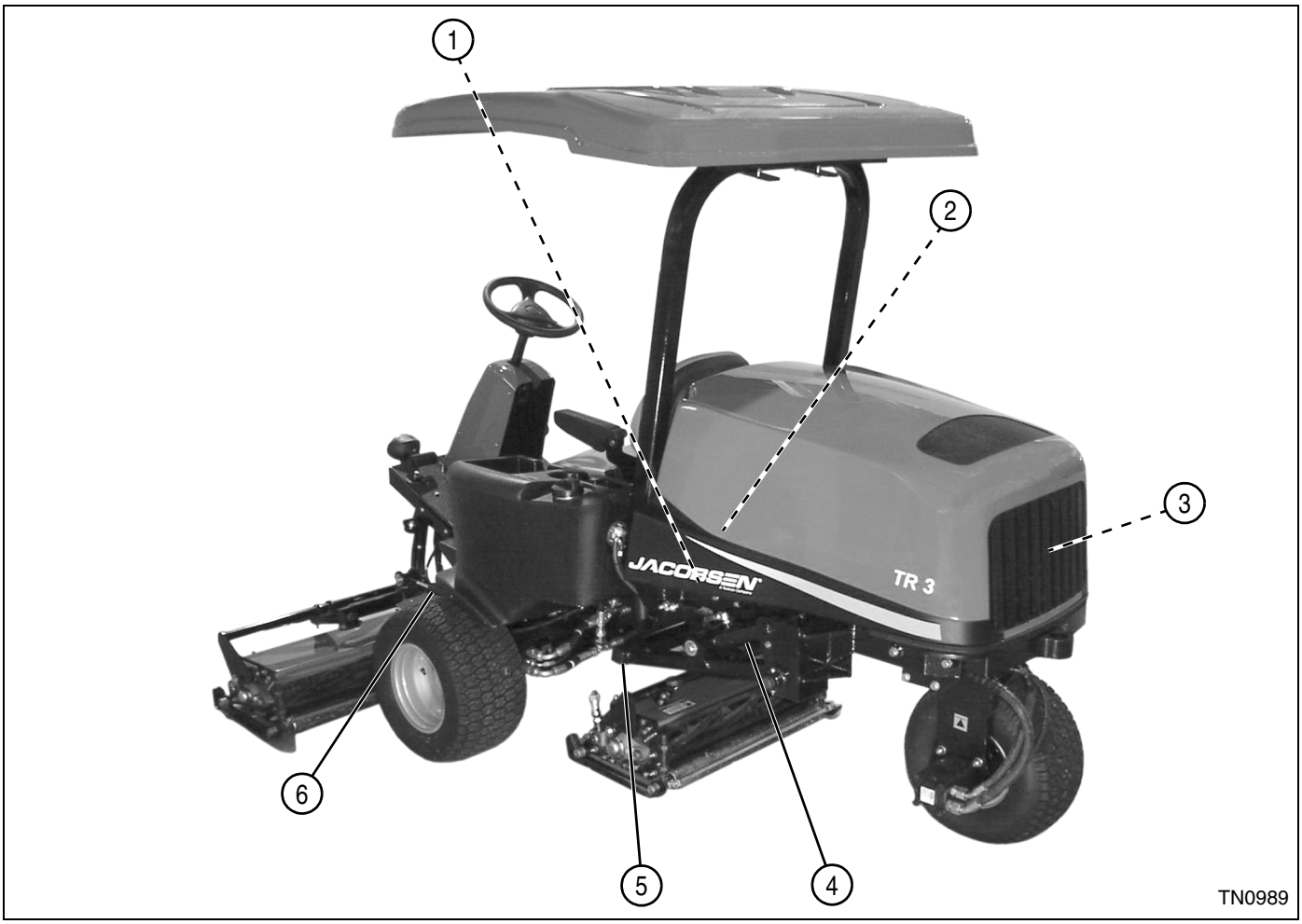
Component Location—TR-3

See Figures 6-3 and 6-4.



1	Hydraulic Oil Filter	7	Left Front Cutting Unit Drive Motor
2	Mow and Brake Valve	8	Right Front Cutting Unit Drive Motor
3	Hydraulic Oil Manifold	9	Right Front Lift Cylinder
4	Tandem Pump Assembly	10	Rear (Center) Cutting Unit Drive Motor
5	Lift Valve	11	Hydraulic Oil Tank
6	Brake Release Valve		

Figure 6-3: Component Location—Right Side



1 Flushing Valve
2 Backlap Valve (If Equipped)
3 Radiator/Hydraulic Oil Cooler
4 Rear (Center) Cutting Unit Lift Cylinder
5 Hydraulic Oil Filter
6 Left Front Lift Cylinder

Figure 6-4: Component Location—Left Side

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Hydraulic Schematic–AR-3 Model AR30001

See Figures 6-5 and 6-6.

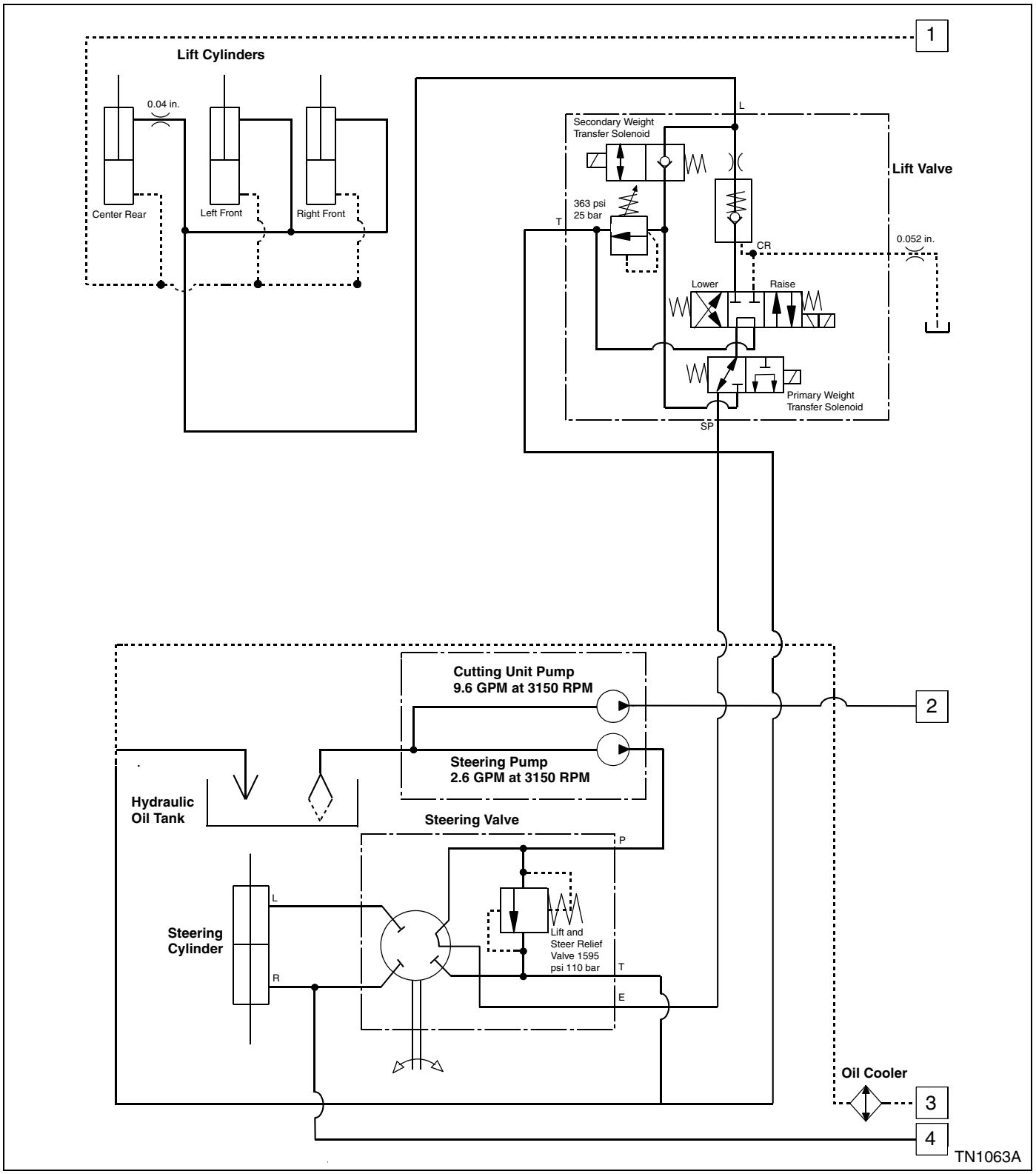


Figure 6-5

Hydraulic Schematic–AR-3 Model AR30001

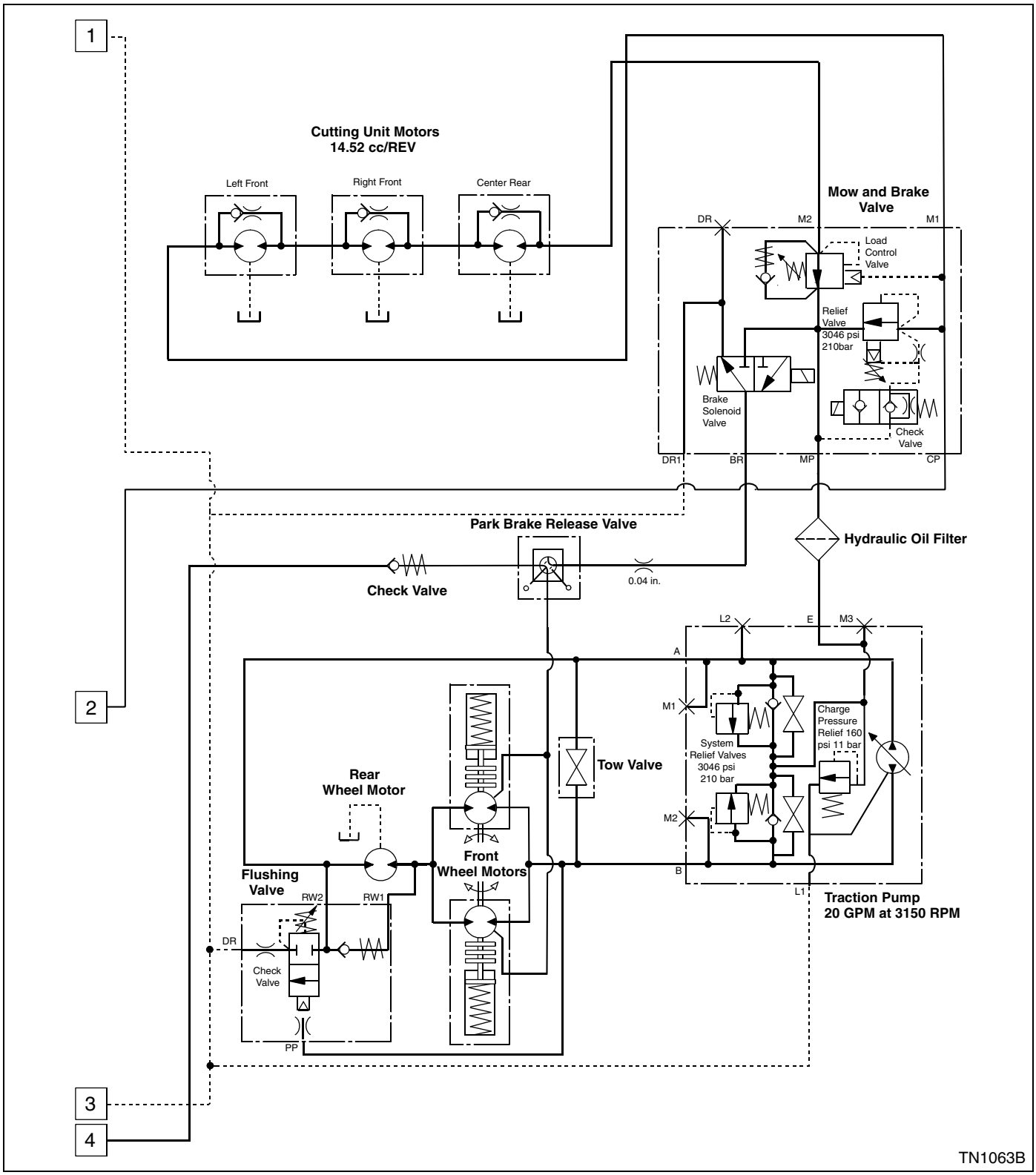


Figure 6-6

Hydraulic Schematic—AR-3 Model AR30002

See Figures 6-7 and 6-8.

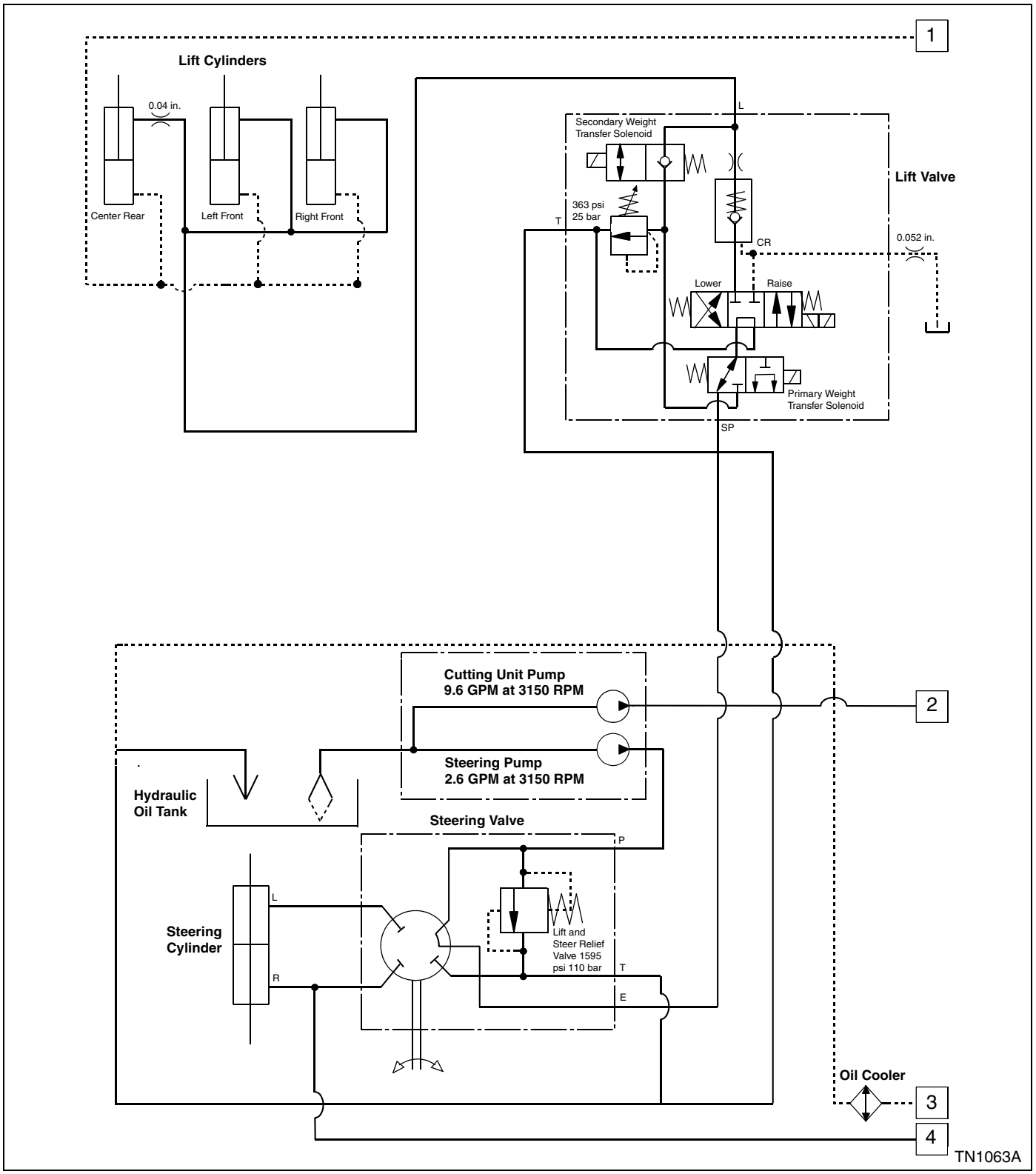


Figure 6-7

Hydraulic Schematic–AR-3 Model AR30002

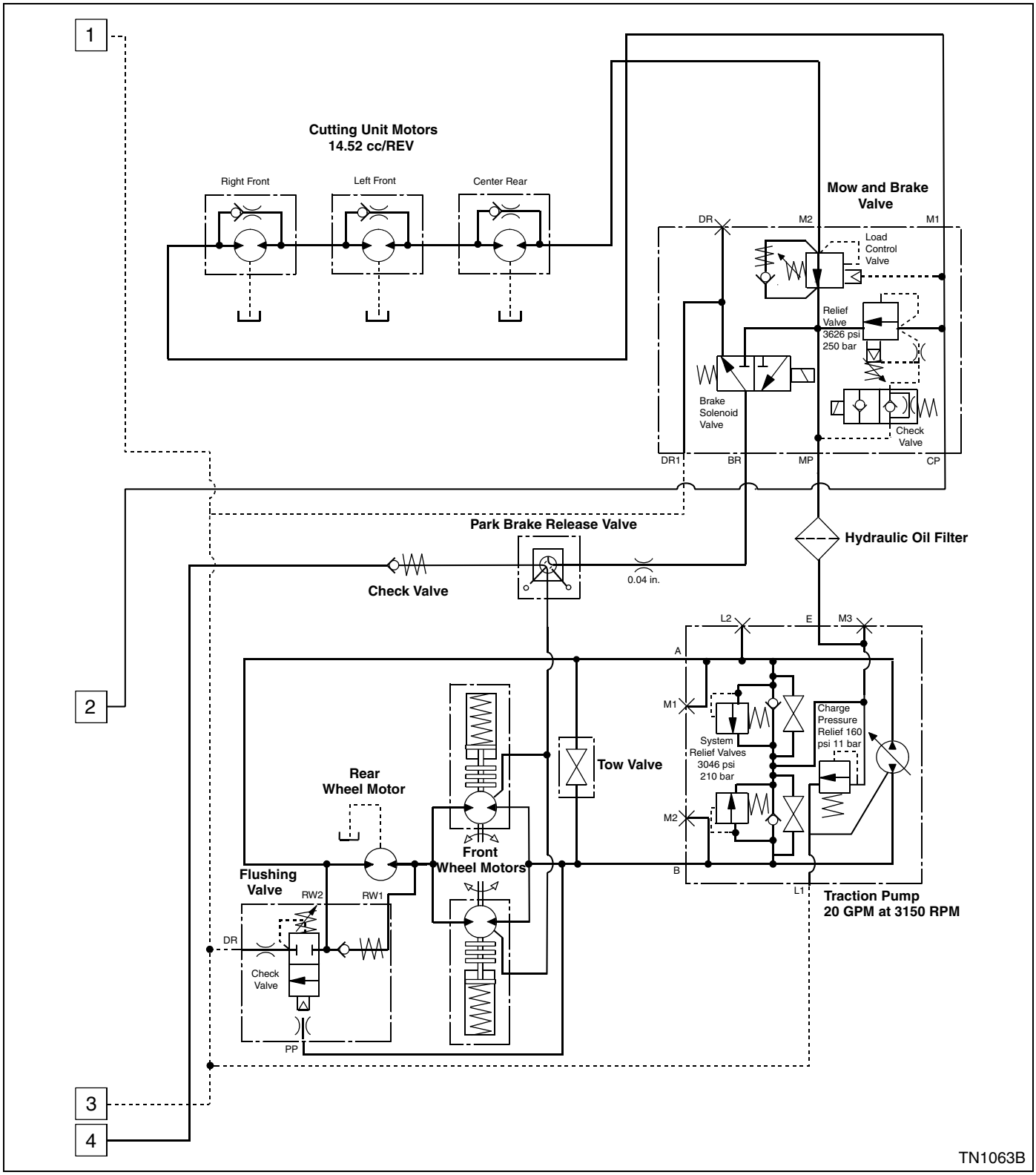


Figure 6-8

Hydraulic Schematic–TR-3

See Figures 6-9 and 6-10.

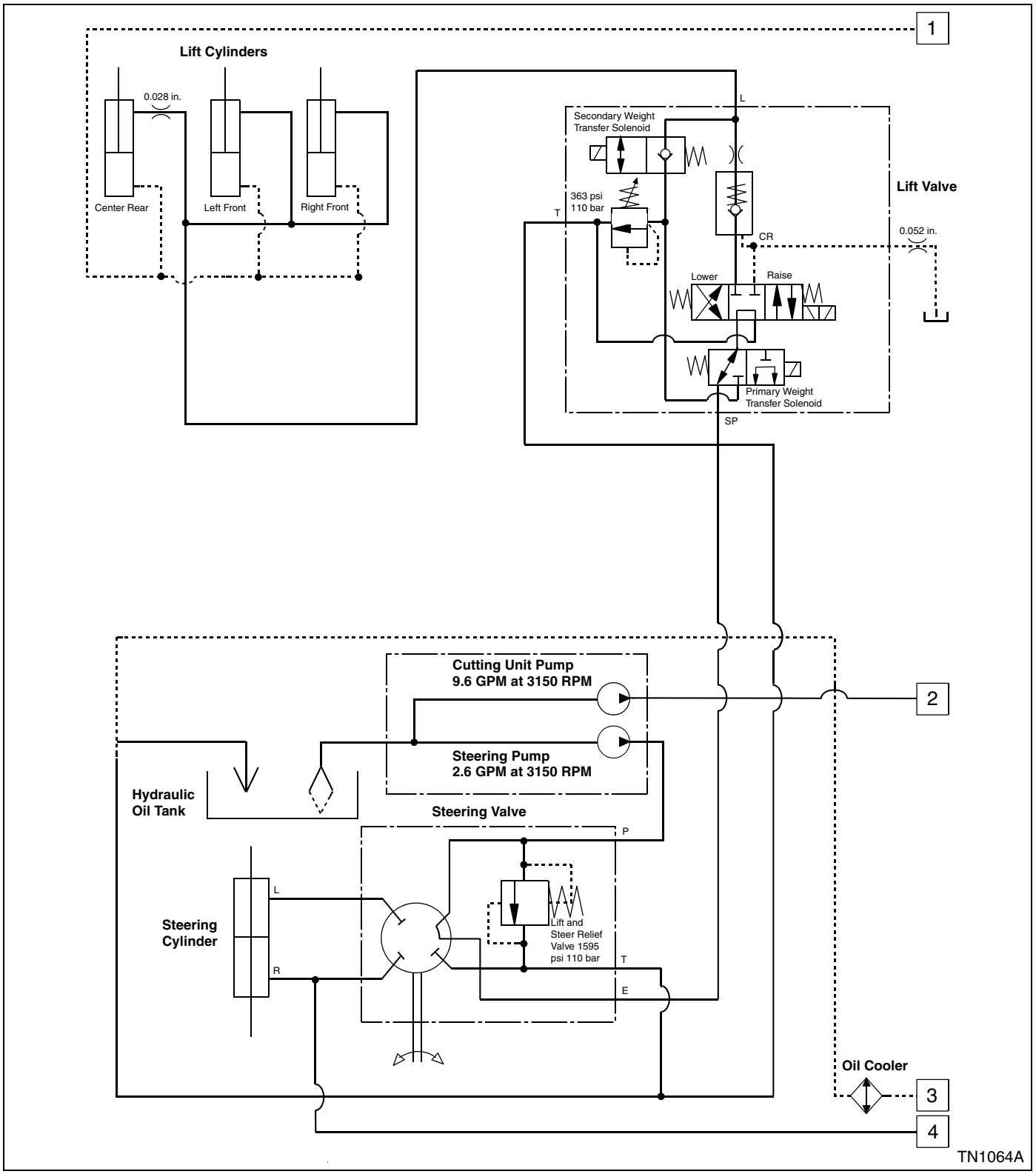


Figure 6-9

Hydraulic Schematic—TR-3

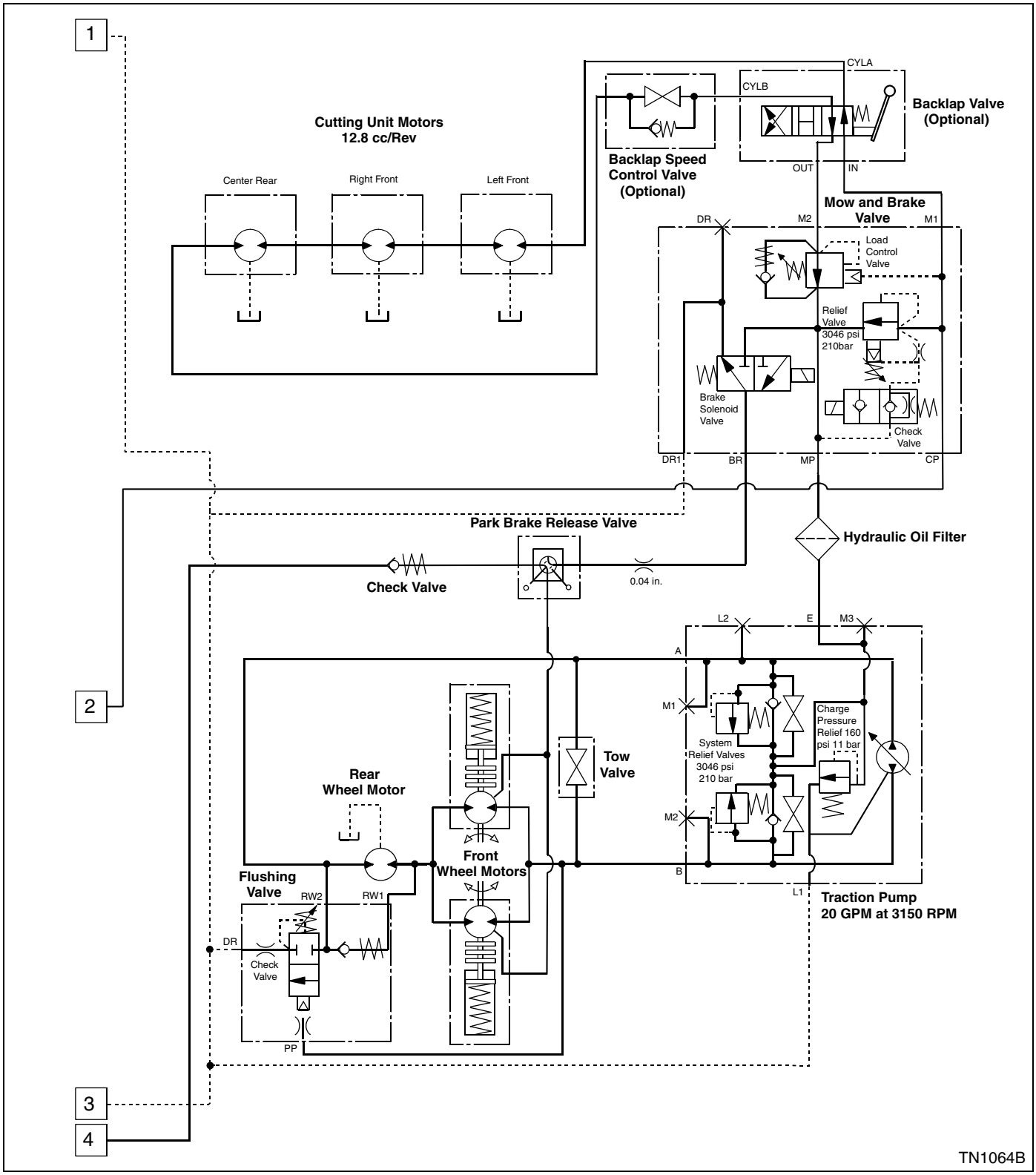


Figure 6-10

Theory of Operation and Diagnostic Information

Steering Circuit and Theory of Operation

See Figure 6-11.

Hydraulic oil is drawn from the hydraulic oil tank by the steering pump. Operating pressure oil flows from the steering pump to the steering valve where there is a relief valve set to reach a maximum pressure of 1595 psi (110 bar).

When the steering wheel is turned, oil is directed from steering valve to one side of the steering cylinder, moving the piston and rear wheel support and turning the rear wheel.

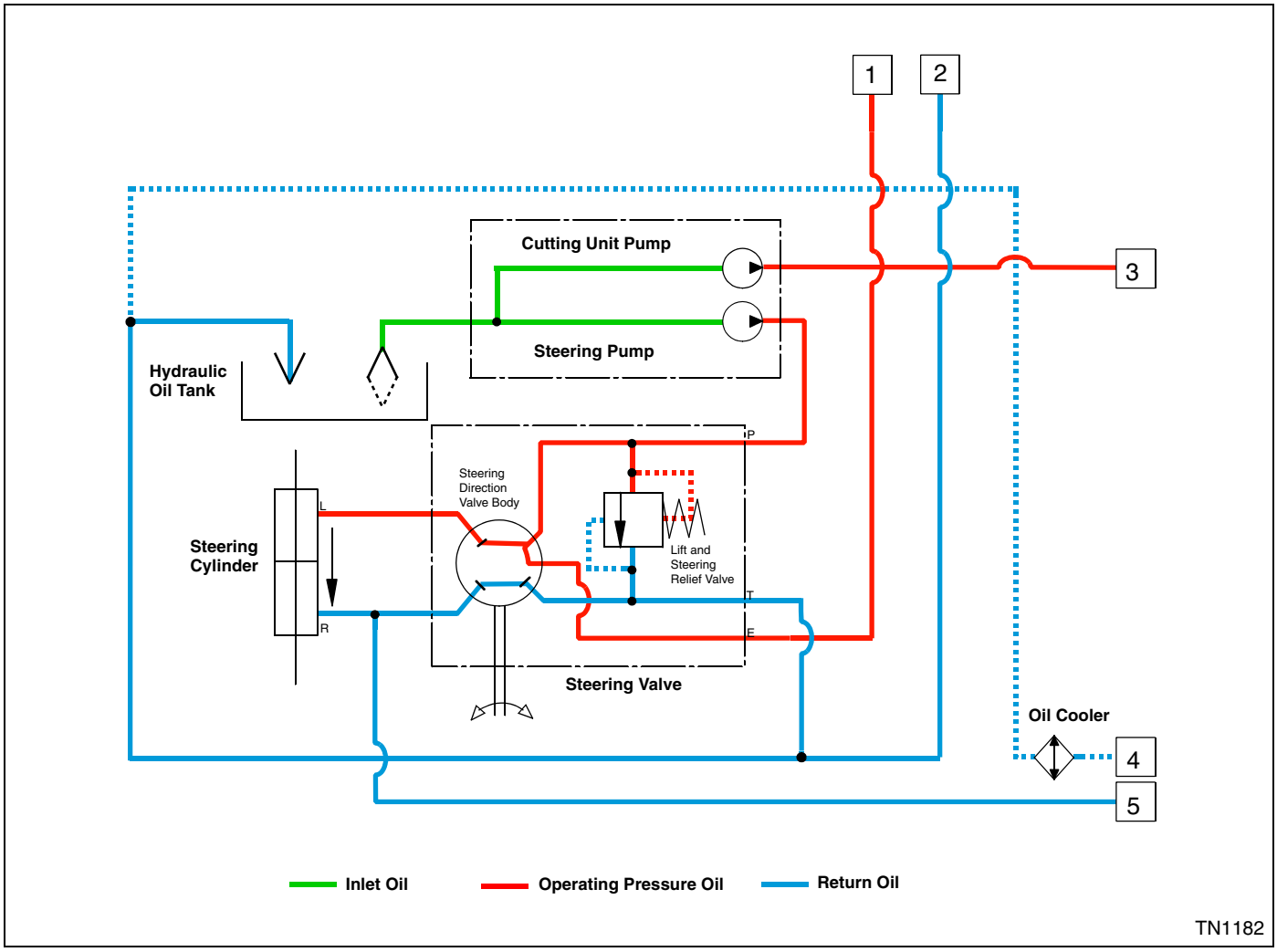
Low-pressure (return) oil from the other side of the steering cylinder flows through the steering direction valve body and returns to the hydraulic oil tank.

When the steering cylinder reaches the end of its travel, or if the steering mechanism movement is stopped with the steering wheel turned, pressure in the steering circuit will build. When pressure reaches maximum pressure the steering relief valve opens and releases excess oil flow to the hydraulic oil tank.

A portion of the operating pressure oil flowing through the steering direction valve body is directed to the lift valve to supply oil for the raise/lower circuit. (See “Raise Circuit Schematic and Theory of Operation” on page 6-18.) The amount of oil routed to the raise/lower circuit will depend on the position of the steering wheel/steering direction valve, as the steering system has priority. The most oil will flow to the raise/lower circuit when the steering wheel is in the center (neutral) position.

Steering Circuit Schematic

See Figure 6-11.



1 Operating Pressure Oil to Raise/Lower Circuit
2 Return Oil from Raise/Lower Circuit
3 Operating Pressure Oil to Mow Circuit
4 Return Oil from Traction Drive Circuit
5 Return Oil from Brake Release Valve

Figure 6-11

Raise Circuit Schematic and Theory of Operation

See Figure 6-12.

System Conditions:

- Engine running
- Weight transfer switch in the off position
- Raise/lower joystick in the raise position

NOTE

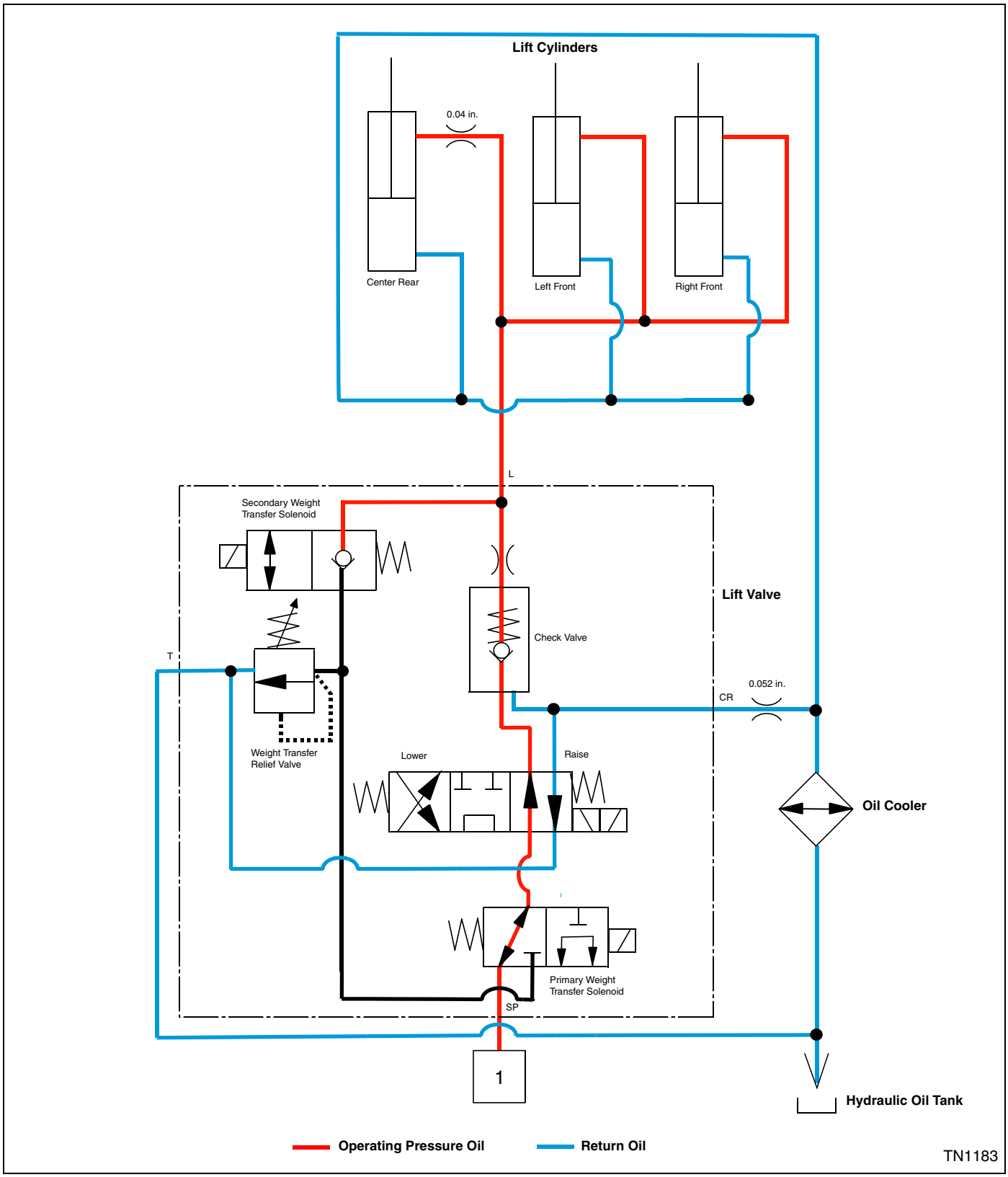
See “Raise/Lower Circuit—Theory of Operation” on page 4-36 for the electrical operation of this circuit.

Operating pressure oil is supplied to the lift valve by the steering circuit, and oil flows to the primary weight transfer valve in the lift valve. With the primary weight transfer valve de-energized, and the raise valve energized, high-pressure oil flows through the primary weight transfer valve and raise/lower valve. The oil then unseats the check valve and flows to the check valve in the secondary weight transfer valve. The check valve blocks the oil and forces it to the rod end of the lift cylinders, raising the cutting units.

Oil from the piston end of the lift cylinders flows through the oil cooler and back to the hydraulic tank.

Raise Circuit Schematic

See Figure 6-12.



1 Operating Pressure Oil from Steering Circuit

Figure 6-12

Lower Circuit Schematic and Theory of Operation

See Figure 6-13.

System Conditions:

- Engine running
- Weight transfer switch in the off position
- Raise/lower joystick in the lower position

NOTE

See “Raise/Lower Circuit—Theory of Operation” on page 4-36 for the electrical operation of this circuit.

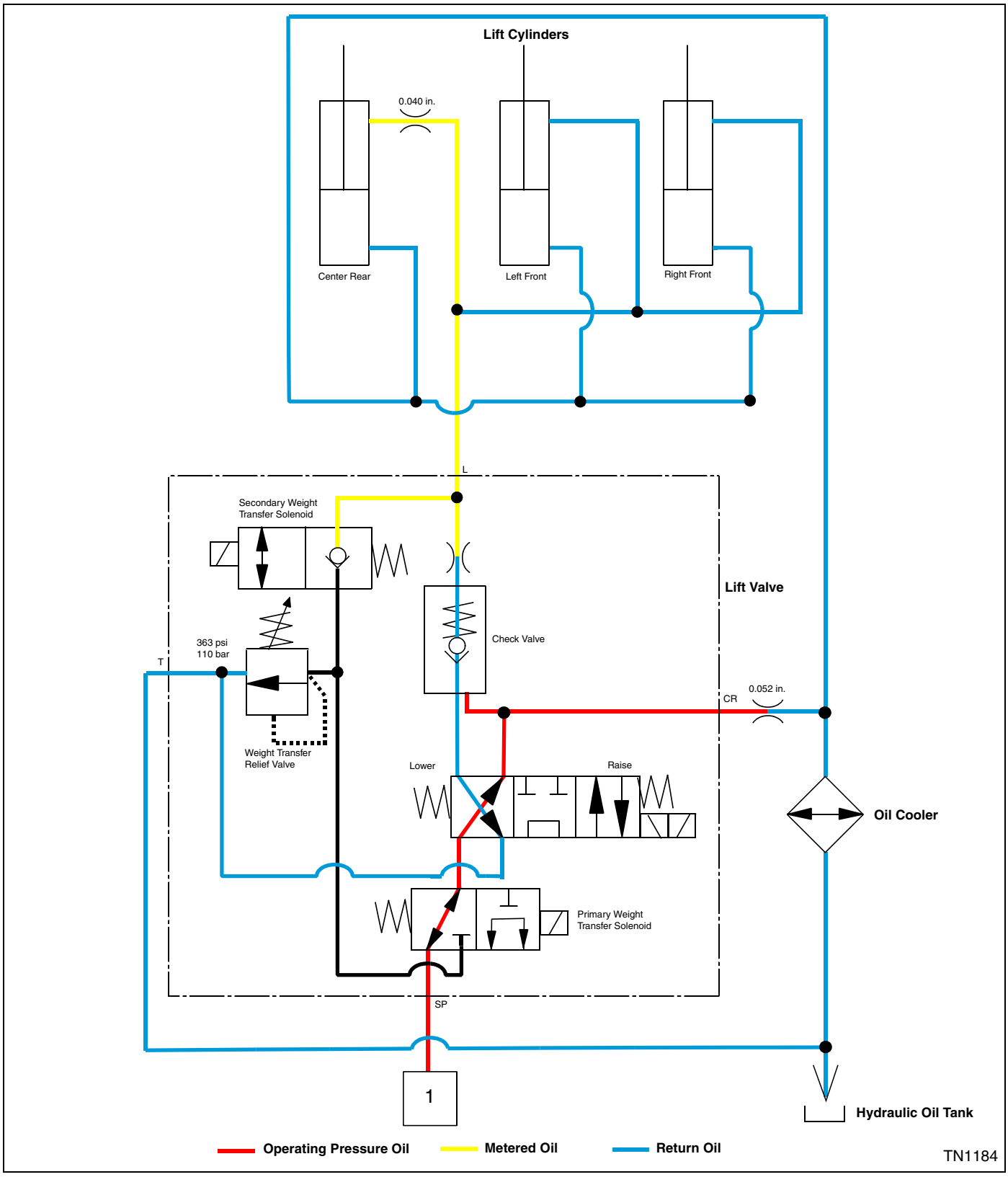
Operating pressure oil is supplied to the lift valve by the steering circuit, and oil flows to the primary weight transfer valve in the lift valve. With the primary weight transfer valve de-energized, and the lower valve energized, oil flows through the primary weight transfer valve and is directed to the raise/lower valve. With the raise/lower valve in the lower position, the pressurized oil unseats the check valve once oil pressure is built against the 0.052 inch (1.3 mm) orifice located in the raise/lower valve drain hose at the return manifold.

Gravity pulls the mower decks down, pulling against the lift cylinders. The rear deck has an orifice located in the rod end hose, which lowers the rear deck at a slower rate then the front decks. Oil from the rod side of the lift cylinders flows through the open check valve and through the raise/lower valve, returning to the hydraulic tank.

Some of the pressurized oil used to unseat the check valve is used as “make-up” oil to the piston end of the lift cylinders. Any extra oil is returned to the hydraulic tank.

Lower Circuit Schematic

See Figure 6-13.



1 Operating Pressure Oil from Steering Circuit

Figure 6-13

Weight Transfer Circuit Schematic and Theory of Operation

See Figure 6-14.

System Conditions:

- Engine running
- Weight transfer switch in the on position
- Cutting units lowered

NOTE

See “Weight Transfer Circuit—Theory of Operation” on page 4-46 for the electrical operation of this circuit.

The purpose of the weight transfer 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 lift cylinders.

Operating pressure oil supplied to the lift valve by the steering circuit, flows to the primary weight transfer valve. With the primary weight transfer valve energized, operating pressure oil flows to the weight transfer relief valve and through the secondary weight transfer valve. Operating pressure oil is then routed to the check valve, closing the valve. Operating pressure oil is also routed to the rod side of the lift cylinders, placing upward pressure to the lift cylinders.

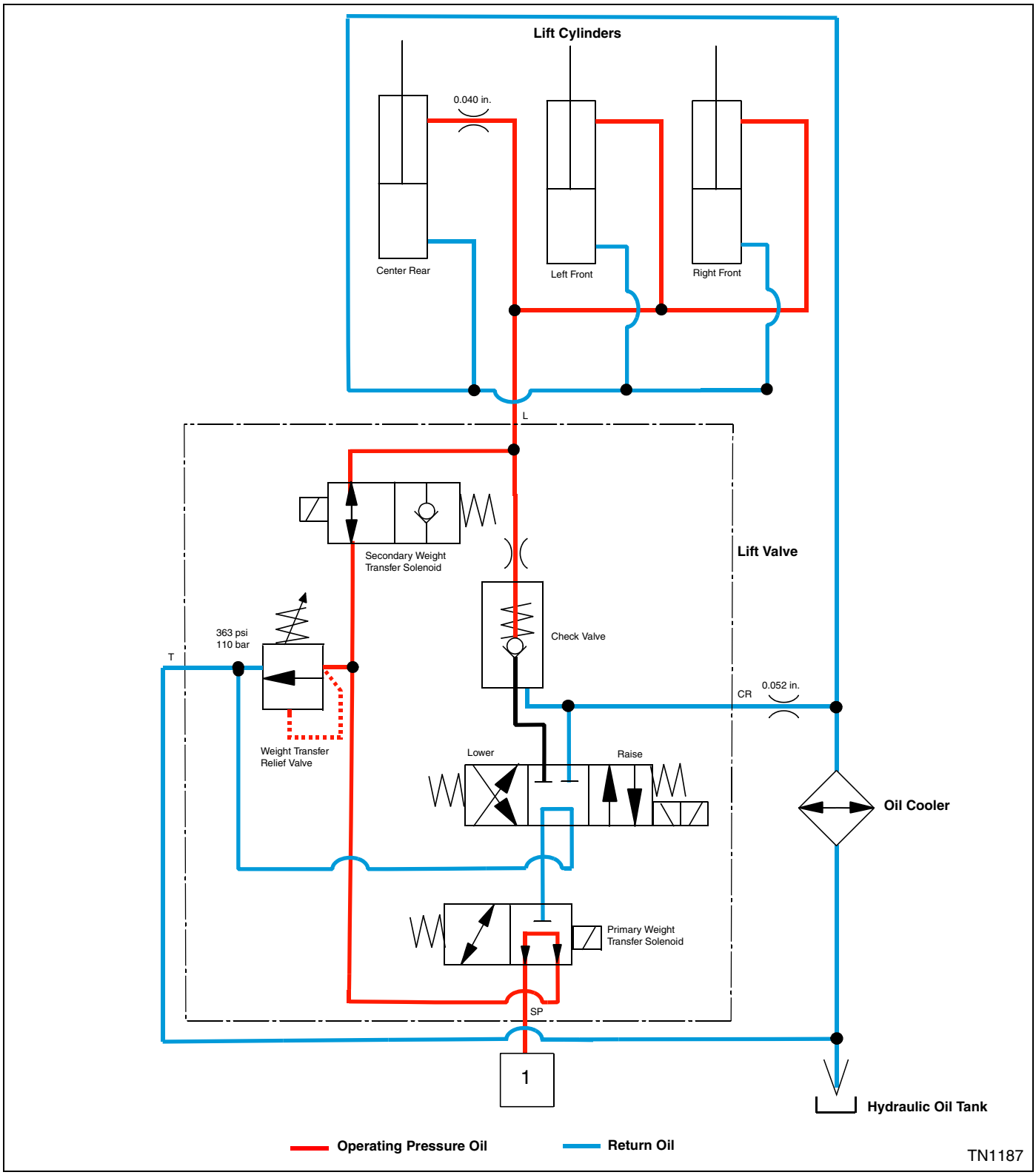
Gravity pulls the mower decks down, pulling against the lift cylinders. This applies back pressure through the secondary weight transfer valve and to the pilot line of the adjustable weight transfer relief valve. As the pressure increases, the relief valve will open to vent excess oil flow to the hydraulic tank. Once the oil pressure drops to a level lower than the relief valve setting, the relief valve will close. This regulates the upward pressure applied to the lift cylinders.

NOTE

The weight transfer relief valve should be adjusted to operating conditions. If the cutting units are lifting off the ground when going over undulations, the relief valve pressure is adjusted too high. If excessive wheel slippage occurs when traveling up a hill, the relief valve pressure is set too low.

Weight Transfer Circuit Schematic

See Figure 6-14.



1 Operating Pressure Oil from Steering Circuit

Figure 6-14

Mow Circuit Schematic and Theory of Operation

See Figure 6-15.

System Conditions:

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

NOTE

See "Mow Circuit—Theory of Operation" on page 4-38 for the electrical operation of this circuit.

Hydraulic oil is drawn from the hydraulic oil tank by the cutting unit pump and is protected by a relief valve set to a maximum pressure of 3046 psi (210 bar) on early models and 3626 psi (250 bar) on later models. Operating pressure oil flows to the pilot line of the cutting circuit relief valve, against the check valve in the mow valve, and to the pilot line end of the load control valve, opening the load valve.

Operating pressure oil then exits the mow and brake valve at port M1, and is routed to the cutting unit motors.

Oil flows through the cutting unit motors will vary as follows:

AR-3 (Early [Aluminum-Colored]) Motors and TR-3: Oil flows from mow and brake valve port M1 to the left front motor to the right front motor, and then to the rear (center) motor before returning to the mow and brake valve at port M2.

Each AR-3 cutting unit motor also has a check valve that is forced closed by the incoming oil from the mow and brake valve port M1. These valves will open, bypassing the cutting unit motors, when the cutting units are shut off to allow the blades to slow down before stopping.

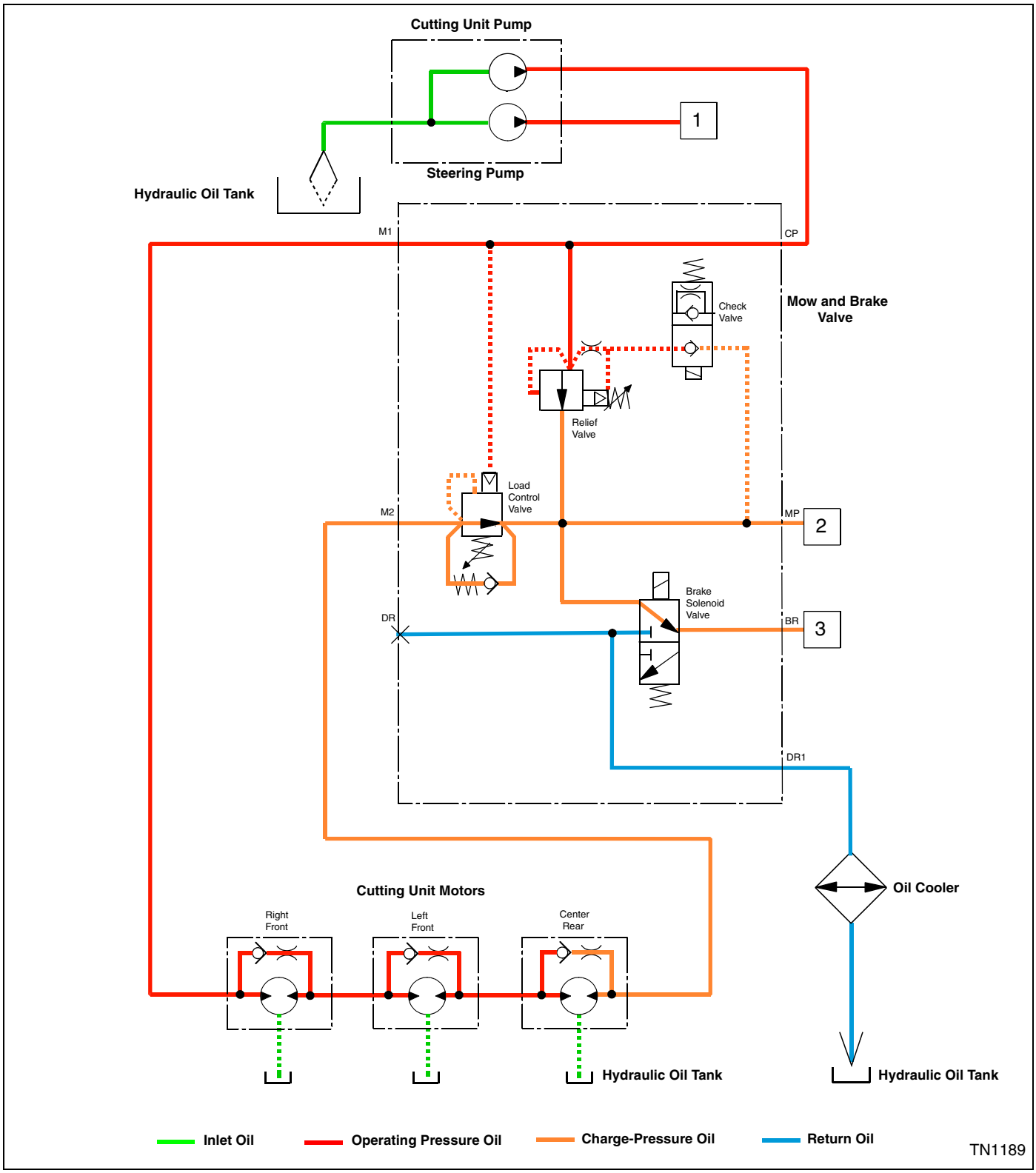
TR-3 cutting unit motors do not include check valves. This allows the motors to be driven in the reverse direction when the oil flow is reversed for backlapping.

AR-3 (Late [Black-Colored]) Motors: Oil flows from mow and brake valve port M1 to the right front motor, to the left front motor, and then to the rear (center) motor before returning to the mow and brake valve at port M2.

After driving the cutting unit motors, oil returns to the mow and brake valve. Oil then flows through the load control valve to supply charge-pressure oil to the traction drive circuit and then through the energized brake valve to supply charge-pressure oil to the park brake release valve. (See "Theory of Operation and Sub-Circuit Schematics" on page 5-4 or "Traction Circuit Reverse Schematic and Theory of Operation" on page 5-6 for further information.)

Mow Circuit Schematic

See Figure 6-15.



1 Operating Pressure Oil to Raise/Lower Circuit
2 Charge-Pressure Oil to Traction Drive Circuit
3 Charge-Pressure Oil to Park Brake Release Circuit

Figure 6-15

Backlap Circuit Schematic and Theory of Operation (TR-3 Only)

See Figure 6-16.

System Conditions:

- Engine running
- Cutting units lowered
- Mow switch in the on position
- Park brake set
- Backlap valve in backlap position
- Backlap speed control valve adjusted for the desired backlapping speed

NOTE

See “Backlap Circuit Operation (Model TR-3)—Theory of Operation” on page 4-44 for the electrical operation of this circuit.

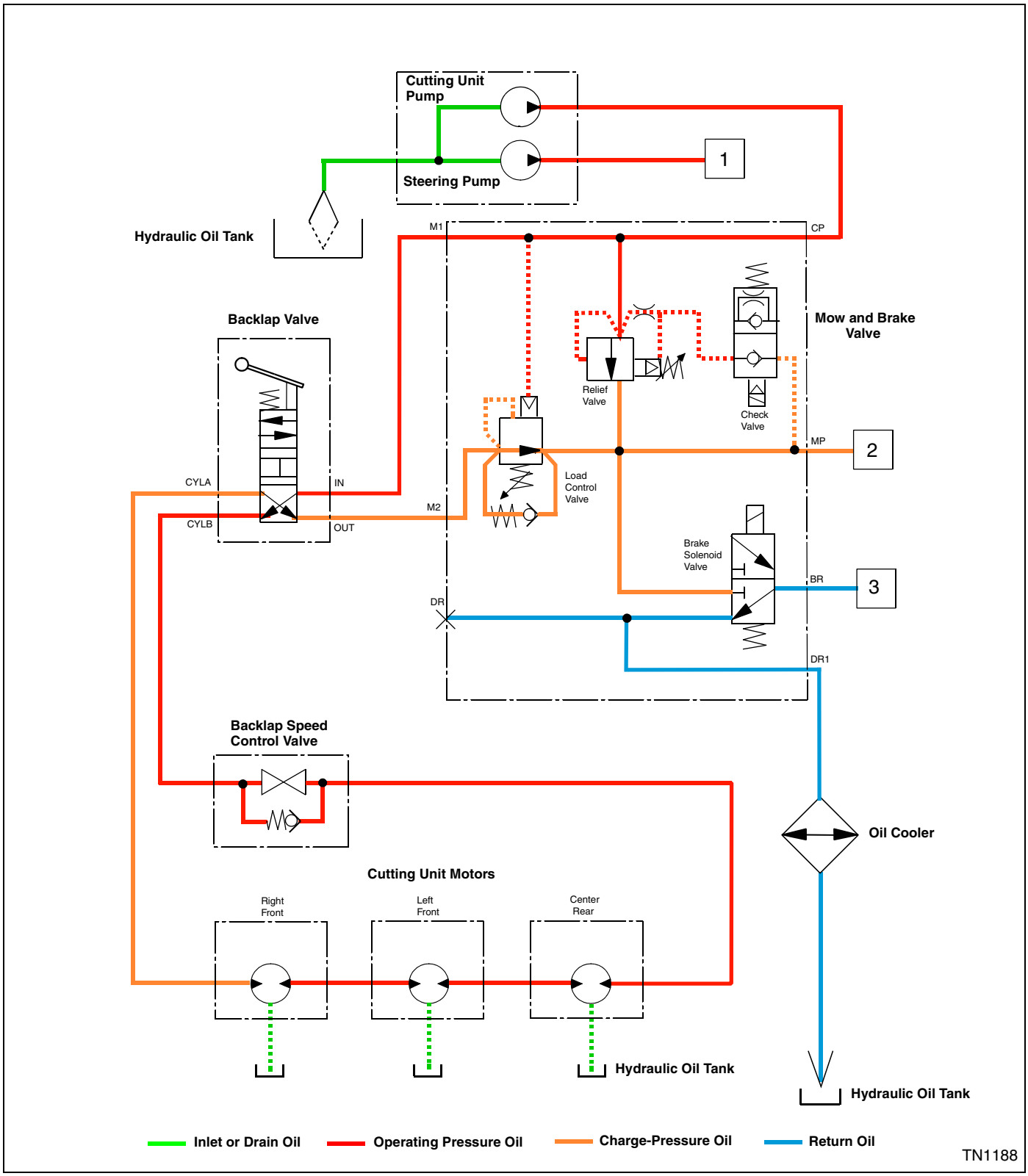
Hydraulic oil is drawn from the hydraulic oil tank by the cutting unit pump and is protected by a relief valve set to a maximum pressure of 3046 psi (210 bar) on early models and 3626 psi (250 bar) on later models. Operating pressure oil flows to the pilot line of the cutting circuit relief valve, against the check valve in the mow valve, closing the relief valve and to the pilot line end of the load control valve, opening the load valve.

Operating pressure oil flows through the backlap valve, reversing the direction of oil flow to the cutting unit motors. Before reaching the cutting unit motors, the oil flows through the backlap speed control valve. This valve can be adjusted to control the speed of the cutting unit drive motors.

Oil then flows through the cutting unit motors and flows through the backlap valve and mow and brake valve. Oil then flows through the load control valve to supply charge-pressure oil to the traction drive circuit and then through the energized brake valve to supply charge-pressure oil to the park brake release valve.

Backlap Circuit Schematic

See Figure 6-16.



1 Operating Pressure Oil to Raise/Lower Circuit
2 Charge-Pressure Oil to Traction Drive Circuit
3 Return Oil to Park Brake Release Circuit

Figure 6-16

Field Test Procedures

Lift Cylinder Leakage Test

See Figures 6-17 and 6-18.

WARNING

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

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

1. Start engine. 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 1-6.)
3. Raise cutting units and stop engine.
4. Support cutting unit lift arms.

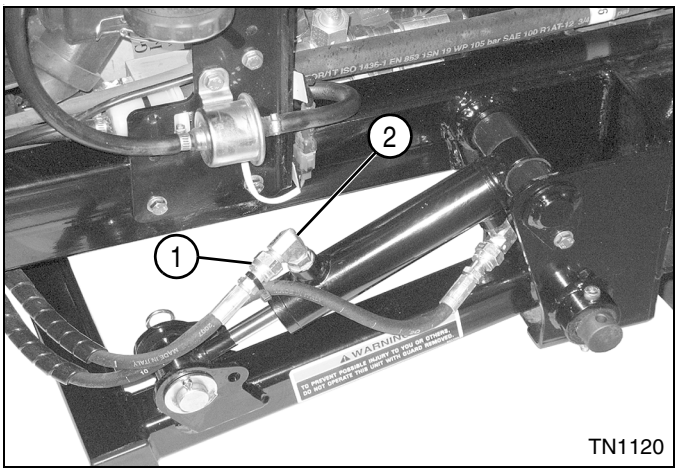


Figure 6-17

NOTE

Figure 6-24 shows rear lift arm cylinder. Procedure is similar for front lift cylinders.

5. Remove 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.

   After 15 minutes, does cutting unit drift down?

   YES *Cylinder is bypassing oil. Replace lift cylinder. (See “Lift Cylinder” on page 6-55.)*

   NO *Repeat the test for all of the lift cylinders. If all cylinders pass test, the problem may be in the lift valve. Proceed to step 9.*
9. Support cutting unit lift arm.
10. Connect hose (2) to lift cylinder fitting (1).
11. Start the engine and lower cutting units.
12. Stop the engine.

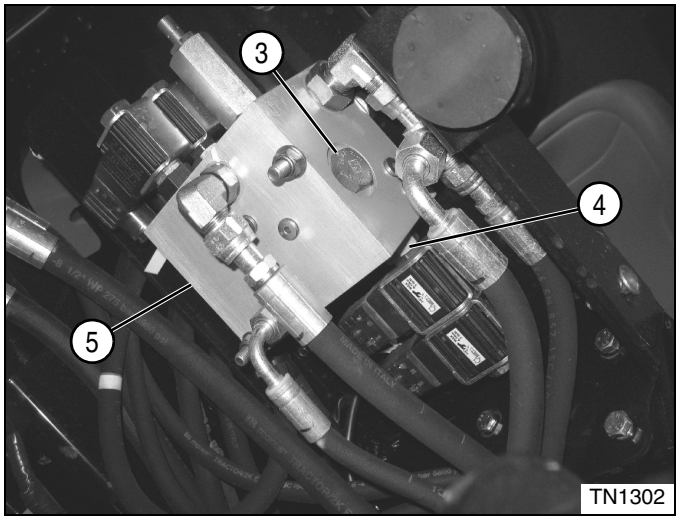


Figure 6-18

13. Remove check valve (3) from the lift valve body (5).
14. Clean and inspect check valve for damage. Replace as necessary.
15. Start the engine, raise the cutting units.
16. Stop the engine.
17. If lift cylinders continue to drift down, start the engine and lower the cutting units.
18. Stop the engine.
19. Remove lift solenoid valve (4) from lift valve body (5).
20. Clean and inspect lift solenoid valve for damage. Replace as necessary. (See “Solenoid Test” on page 4-69.)

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 the test, check the steering system for mechanical binding or damage that may effect 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 right, and then all the way 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 left, only a little movement should be evident.

   Is the steering wheel hard to turn or does not turn?

   YES *Steering cylinder is faulty, repair or replace as needed. (See "Steering Cylinder" on page 7-10.)*

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

   YES *Steering valve faulty, repair or replace as needed. (See "Steering Valve" on page 7-7.)*

Cutting Unit Motor Test

The deck motor circuit consists of the cutting unit/charge pump, mow valve, and cutting unit motors. This test determines if one of the cutting unit motors are faulty. An instrument test must be performed to isolate the performance of the charge pump and mow valve.

NOTES

- *Perform test on only one cutting unit motor at a time.*
- *The case drain on a hydraulic motor is used to return excess 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. Remove the case drain hose from the cutting unit motor. Immediately plug the hose.
4. Position a drain pan (minimum capacity 1 gallon (3.8 L) near the cutting unit motor.
5. Install a separate hose on the case drain fitting and place the free end in the container. Secure the hose to prevent spills.

⚠ WARNING

Safely block cutting unit from rotating using a suitable device or tool. Failure to follow appropriate safety precaution may result in death or serious injury.

6. Install suitable blocking device or tool in cutting unit, preventing cutting unit from turning.
7. Chock the wheels so the machine cannot roll.
8. Set the parking brake, start the engine, release the parking brake, and place the mow switch in the on position for 15 seconds.
9. Stop the engine and remove the ignition key.
10. 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 Procedures" on page 6-29.)*

    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 Motor" on page 6-47.)*
11. Remove the test hose and all caps and plugs. Reconnect hydraulic hose to motor.

Instrument Test Procedures

Instrument Test Overview

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

The internal leakage percentage ranges are as follows:

0—10% = Good

11—20% = Marginal

21% and beyond = Bad

Example: Cutting Unit System Performance Complaint

The machine operator reports 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: cutting unit/charge pump, mow/brake valve, left cutting unit motor, right cutting unit motor, and center 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 traction pump, 5.3% in the mow/brake valve, 20% in the left cutting unit motor, 5.6% in the right cutting unit motor, and 4.4% in the center rear cutting unit motor. Although all the components lend to the overall system leakage, only the left cutting unit motor, which is at the extreme end of the marginal range, would be considered for repair/replacement.

Formulas:

Cutting Unit Motor and Mow/Brake Valve

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

System and Cutting Unit/Charge Pump

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

Calculations:

System Test

No Load Flow = 10 gpm

Loaded Flow = 6.5 gpm

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

Cutting Unit/Charge Pump Test

No Load Flow = 10 gpm

Loaded Flow = 9.5 gpm

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

Mow/Brake Valve Test

Loaded Flow from cutting unit/charge pump test = 9.5 gpm

Loaded Flow from mow/brake valve test = 9 gpm

10 – 9 / 9.5 x 100 = Mow/Brake Valve Leakage 5%

Left Cutting Unit Motor Test

Loaded Flow from mow/brake valve test = 9 gpm

Loaded Flow from left cutting unit motor test = 7.2 gpm

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

Right Cutting Unit Motor Test

Loaded Flow from left cutting unit motor test = 7.2 gpm

Loaded Flow from right cutting unit motor test = 6.8 gpm

7.2 – 6.8 / 7.2 x 100 = Right Cutting Unit Motor Leakage 5.0%

Center Rear Cutting Unit Motor Test

Loaded Flow from right cutting unit motor test = 6.8 gpm

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

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

Cutting Unit/Charge Pump System Test

See Figures 6-19 and 6-20.

IMPORTANT

- **This test works together with the cutting units motors test to isolate a problem with the cutting unit system.**
- **Performing this test will isolate the cutting unit pump, the mow/brake valve, and the left or right front cutting unit motor (depending on model number).**

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 • Test Hose 3000 psi (207 bar) • Tee Fitting • Blocking Disk

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)

2. Raise seat platform.
3. Bypass seat switch.

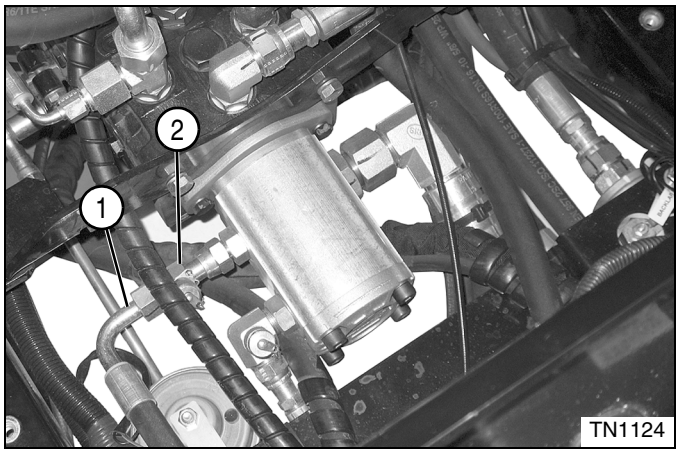


Figure 6-19

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

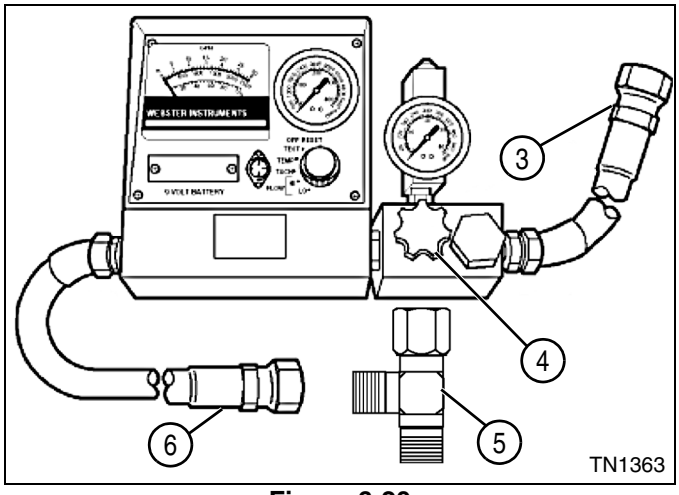


Figure 6-20

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

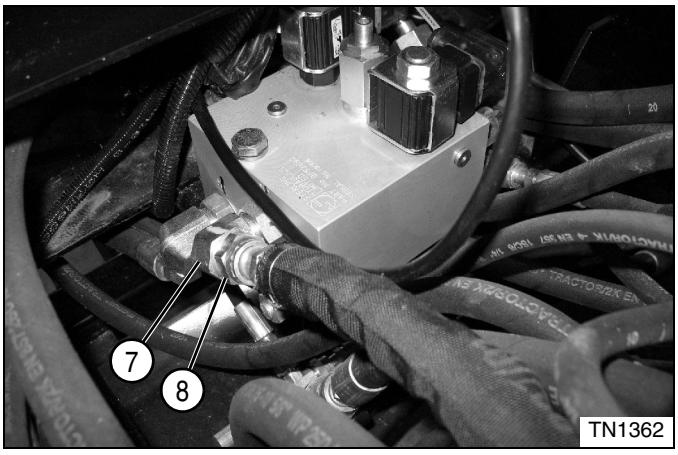


Figure 6-21

7. Disconnect hose (8) from fitting (7).
8. Connect tee fitting to fitting (7).
9. Connect test hose (3) and hose (8) to tee fitting.

IMPORTANT

- **If testing TR-3 or early model 30001 AR-3 install suitable blocking device or tool in left front cutting unit.**
- **If testing late model 30002 AR-3 install suitable blocking device or tool in right front cutting unit.**

10. Install suitable blocking device or tool in cutting unit, preventing cutting unit from turning. Open flow meter valve (4) completely.

NOTE

Verify engine rpm is within specification (3150 rpm ± 50*) to ensure accurate hydraulic test results.*

11. Start engine and run at full throttle (3150 rpm ± 50).
12. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (4) until a reading of 1525 psi (105 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.
13. Engage cutting unit switch.
14. Read and record the cutting unit/charge pump no load flow.
15. Slowly close flow meter valve (4) until pressure reaches 2300 psi (159 bar). Read and record the cutting unit/charge pump system test loaded flow.
16. Open flow meter valve (4) and stop engine.

17. Calculate cutting unit system leakage. (Step 14 – Step 15 / Step 14 x 100 = Leak Percentage)

    Is cutting unit system leakage 10% or less?

    YES *The cutting unit system is good. Proceed to "Cutting Unit Motor Test" on page 6-29.*

    NO *Proceed to next question.*

    Is cutting unit system leakage 11% to 20%?

    YES *The cutting unit system is marginal. Additional testing is required.*

    NO *Proceed to next question.*

    Is cutting unit system leakage 21% or more?

    YES *Test individual components in cutting unit system for leakage.*

18. Disconnect and remove test equipment. Remove blocking device or tool from cutting unit. Install all hoses and fittings as noted prior to removal.
19. Check hydraulic oil level. Add oil as needed. (Refer to "Safety, Operation, and Maintenance Manual" for correct oil specifications.)

Cutting Unit/Charge Pump Test

See Figures 6-22 through 6-24.

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
• Test Hose 3000 psi (207 bar)
• Tee Fitting
• Blocking Disk

1. Park the mower safely. (See "Park Mower Safely" on page 1-7.)
2. Before performing this test, perform cutting unit system test leaving flow meter connected as outlined.

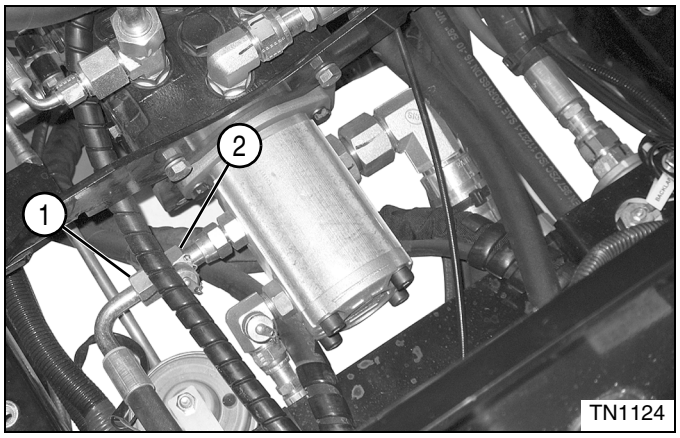


Figure 6-22

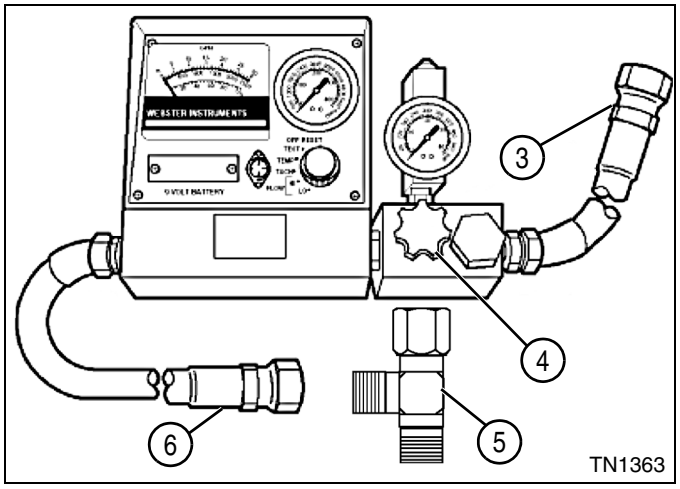


Figure 6-23

3. Disconnect hose (1) and install blocking disk to tee fitting (5).

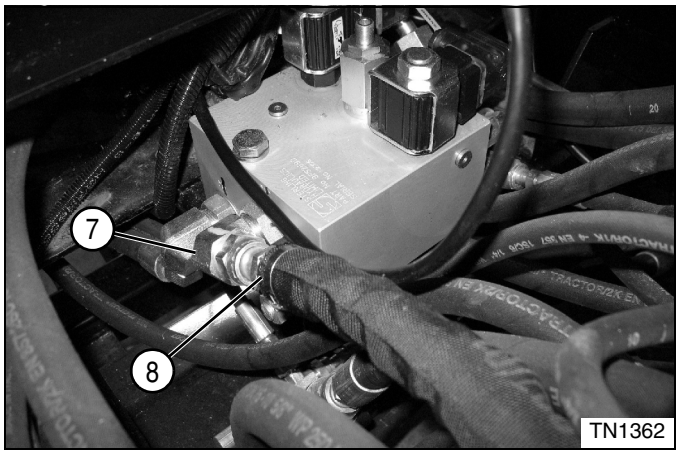


Figure 6-24

4. Open flow meter valve (4) completely.

NOTE

Verify engine rpm is within specification (3150 rpm ± 50) to ensure accurate hydraulic test results.

5. Start engine and run at full throttle (3150 rpm ± 50).
6. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve until a reading of 1525 psi (105 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.
7. Slowly close flow meter valve until pressure reaches 2300 psi (159 bar). Read and record the cutting unit/charge pump loaded flow.
8. Stop engine.
9. Calculate cutting unit/charge pump leakage. (Step 15 of previous test – Step 7 / Step 15 of previous test x 100 = Leak Percentage)

   Is cutting unit/charge pump leakage 10% or less?

   YES *The cutting unit/charge pump is good. Proceed to step 10.*

   NO *Proceed to next question.*

   Is cutting unit/charge pump leakage 11% to 20%?

   YES *The cutting unit/charge pump is marginal. Additional testing is required.*

   NO *Proceed to next question.*

   Is cutting unit/charge pump leakage 21% or more?

   YES *Replace cutting unit/charge pump. (See "Tandem Pump" on page 6-45.)*
10. Disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
11. Check hydraulic oil level. Add oil as needed. (Refer to "Safety, Operation, and Maintenance Manual" for correct oil specifications.)

Mow/Brake Valve Tests

See Figures 6-25 and 6-26.

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
- Test Hose 4000 psi (276 bar)
- Tee Fitting
- Blocking Disk

1. Park the mower safely. (See "Park Mower Safely" on page 1-7.)
2. Before performing this test, perform cutting unit system test leaving flow meter connected as outlined.
3. Raise seat platform.
4. Bypass seat switch.

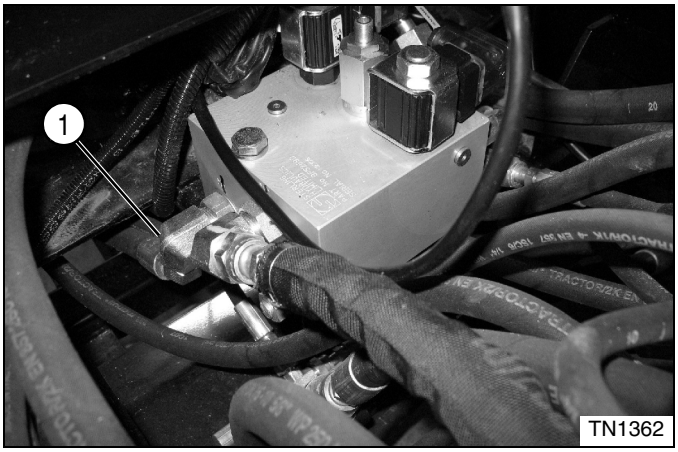


Figure 6-25

5. Install blocking disk at fitting (1) on mow/brake valve, blocking oil flow from entering left front cutting unit motor.

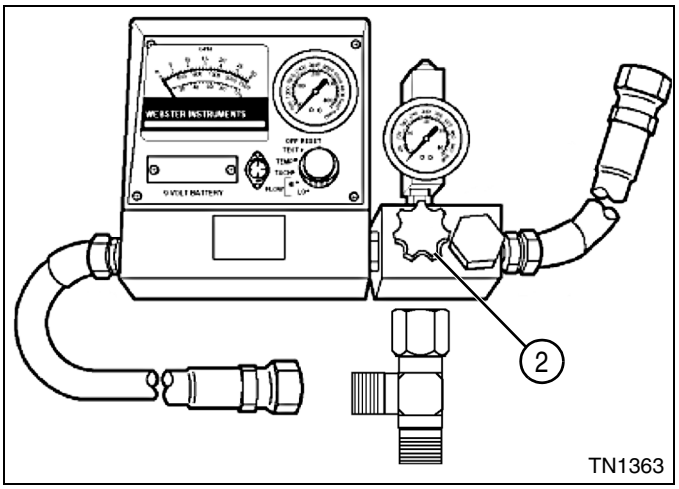


Figure 6-26

6. Open flow meter valve (2) completely.

Verify engine rpm is within specification (3150 rpm ± 50) to ensure accurate hydraulic test results.

7. Start engine and run at full throttle (3150 rpm ± 50).
8. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (2) until a reading of 1525 psi (105 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.
9. Engage cutting unit switch.
10. Slowly close flow meter valve (2) until pressure reaches 2300 psi (159 bar). Read and record the cutting unit/charge pump loaded flow.
11. Calculate mow/brake valve leakage. (Step 15 of previous test – Step 10 / Step 15 of previous test x 100 = Leak Percentage)

Is mow/brake valve leakage 10% or less?

YES *The mow/brake valve is good. Proceed to step 12.*

NO *Proceed to next question.*

Is mow/brake valve leakage 11% to 20%?

YES *The mow/brake valve is marginal. Additional testing is required.*

NO *Proceed to next question.*

Is mow/brake valve leakage 21% or more?

YES *Replace mow/brake valve. (See "Mow/Brake Valve" on page 6-51.)*

⚠ CAUTION

Do not exceed 3650 psi (252 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 mow/brake relief valve pressure.
13. Open flow meter valve (2) and stop engine.

NOTE

Pressure relief valve settings vary amongst models. Determine which model is being tested and choose the correct question below.

TR-3 and Early Model AR-3 30001. Is mow/brake relief valve pressure 3046 psi (210 bar)?

YES *Mow/brake pressure relief valve is good. Proceed to step 14.*

NO *Adjust mow/brake valve relief pressure. (See "Adjust Mow/Brake Valve Relief Pressure" on page 6-35.)*

Late Model AR-3 30002. Is mow/brake relief valve pressure 3626 psi (250 bar)?

YES *Mow/brake pressure relief valve is good. Proceed to step 14.*

NO *Adjust mow/brake valve relief pressure. (See "Adjust Mow/Brake Valve Relief Pressure" on page 6-35.)*

14. Disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
15. Check hydraulic oil level. Add oil as needed. (Refer to "Safety, Operation, and Maintenance Manual" for correct oil specifications.)

Adjust Mow/Brake Valve Relief Pressure

See Figure 6-27.

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 • Test Hose 4000 psi (276 bar) • Tee Fitting • Blocking Disk

IMPORTANT

This adjustment should be done in conjunction with mow/brake valve tests.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Perform mow/brake valve test. (See “Mow/Brake Valve Tests” on page 6-33.)
3. Raise seat platform.

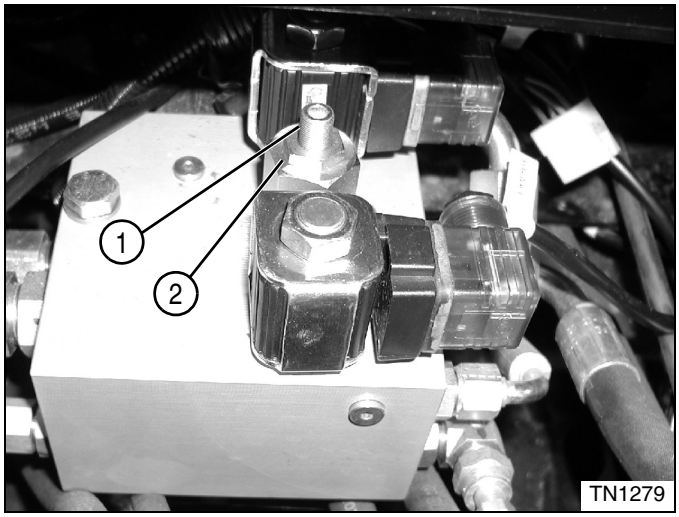


Figure 6-27

4. Loosen lock nut (2).
5. Rotate screw (1) 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).
6. Tighten lock nut (2).
7. Relief valve pressure reading should be:

   30001 AR-3—3046 psi (210 bar)

   30002 AR-3—3626 psi (250 bar)

   TR-3—3046 psi (210 bar)

   Could relief valve be adjusted to specification?

   YES *Mow/brake relief valve is good. Proceed to step 8.*

   NO *Repair or replace mow/brake relief valve. (See “Mow/Brake Valve” on page 6-51.)*
8. Disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
9. Check hydraulic oil level. Add oil as needed. (Refer to “Safety, Operation, and Maintenance Manual” for correct oil specifications.)

Cutting Unit Motors Test

TR-3 and Early Model 30001 AR-3

See Figures 6-28 and 6-29.

IMPORTANT

- **This test works together with the cutting unit system test to isolate a problem within the cutting unit circuit.**
- **Performing this test will isolate the individual cutting unit motors from the rest of the cutting unit 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 • Test Hose 3000 psi (207 bar) • Tee Fitting • Blocking Disk

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Before performing this test, perform cutting unit system test leaving flow meter connected as outlined.
3. Raise seat platform.
4. Bypass seat switch.

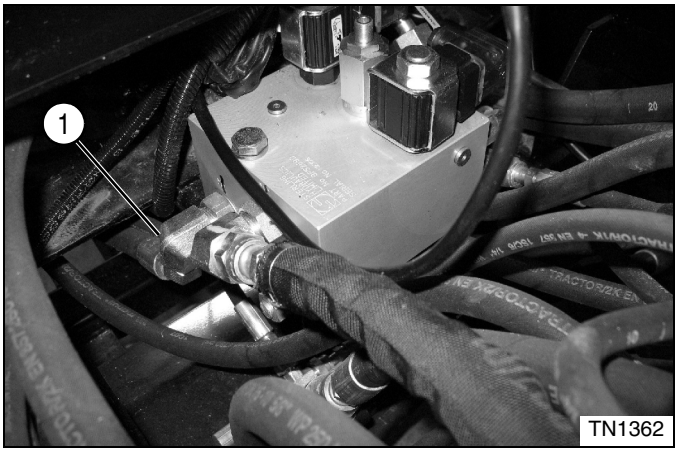


Figure 6-28

5. Remove blocking disk from fitting (1) and reconnect hose.

IMPORTANT

- **If performing this test after performing the cutting unit system test, and the test results proved the cutting unit pump, mow/brake valve, and left front cutting unit good, proceed to step 15.**
- **If performing this test to determine which component in system is at fault (left front cutting unit motor, right front cutting unit motor, or center rear cutting unit motor) proceed to step 6.**

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.

6. Install suitable blocking device or tool in left front cutting unit, preventing cutting unit from turning.

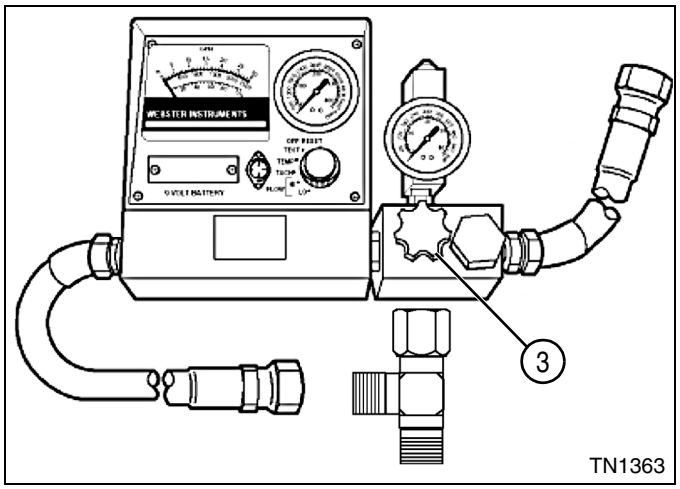


Figure 6-29

7. Open flow meter valve (3) completely.

NOTE

Verify engine rpm is within specification (3150 rpm ± 50) to ensure accurate hydraulic test results.

8. Start engine and run at full throttle (3150 rpm ± 50).
9. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (3) until a reading of 1525 psi (105 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.
10. Engage cutting unit switch.
11. Slowly close flow meter valve (3) until pressure reaches 2300 psi (159 bar). Read and record the left cutting unit motor loaded flow.
12. Open flow meter valve (3) and stop engine.
13. Calculate left front cutting unit motor leakage. (Step 10 of mow/brake valve test – Step 11 / Step 10 of mow/brake valve test 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 14.*

    NO *Proceed to next question.*

    Is left front cutting unit motor leakage 11% to 20%?

    YES *The left front cutting unit motor is marginal. Additional testing is required.*

    NO *Proceed to next question.*

    Is left front cutting unit motor leakage 21% or more?

    YES *Replace left front cutting unit motor. (See “Cutting Unit Motor” on page 6-47.)*

14. Remove device or tool from left 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.

15. Install suitable blocking device or tool in right front cutting unit, preventing cutting unit from turning.
16. Open flow meter valve (3) completely.

NOTE

Verify engine rpm is within specification (3150 rpm ± 50) to ensure accurate hydraulic test results.

17. Start engine and run at full throttle (3150 rpm ± 50).
18. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (3) until a reading of 1525 psi (105 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. Engage cutting unit switch.
20. Slowly close flow meter valve (3) until pressure reaches 2300 psi (159 bar). Read and record the right cutting unit motor loaded flow.
21. Open flow meter valve (3) and stop engine.
22. Calculate right front cutting unit motor leakage. (Step 11 of left cutting unit motor test – Step 20 / Step 11 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 23.*

    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 required.*

    NO *Proceed to next question.*

    Is right front cutting unit motor leakage 21% or more?

    YES *Replace right front cutting unit motor. (See “Cutting Unit Motor” on page 6-47.)*
23. 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.

24. Install suitable blocking device or tool in center rear cutting unit, preventing cutting unit from turning.
25. Open flow meter valve (3) completely.

NOTE

Verify engine rpm is within specification (3150 rpm ± 50) to ensure accurate hydraulic test results.

26. Start engine and run at full throttle (3150 rpm ± 50).
27. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (3) until a reading of 1525 psi (105 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.
28. Engage cutting unit switch.
29. Slowly close flow meter valve (3) until pressure reaches 2300 psi (159 bar). Read and record the cutting unit/charge pump loaded flow.
30. Open flow meter valve (3) and stop engine.
31. Calculate center rear cutting unit motor leakage. (Step 20 of right cutting unit motor test – Step 29 / Step 20 x 100 = Leak Percentage)

    Is center rear cutting unit motor leakage 10% or less?

    YES *The center rear cutting unit motor is good. Proceed to step 32.*

    NO *Proceed to next question.*

    Is center rear cutting unit motor leakage 11% to 20%?

    YES *The center rear cutting unit motor is marginal. Replace as needed.*

    NO *Proceed to next question.*

    Is center rear cutting unit motor leakage 21% or more?

    YES *Replace center rear cutting unit motor. (See “Cutting Unit Motor” on page 6-47.)*
32. Disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
33. Check hydraulic oil level. Add oil as needed. (Refer to “Safety, Operation, and Maintenance Manual” for correct oil specifications.)

Late Model 30002 AR-3

See Figures 6-30 and 6-31.

IMPORTANT

- **This test works together with the cutting unit system test to isolate a problem within the cutting unit circuit.**
- **Performing this test will isolate the individual cutting unit motors from the rest of the cutting unit 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
• Test Hose 3000 psi (276 bar)
• Tee Fitting
• Blocking Disk

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Before performing this test, perform cutting unit system test leaving flow meter connected as outlined.
3. Raise seat platform.
4. Bypass seat switch.

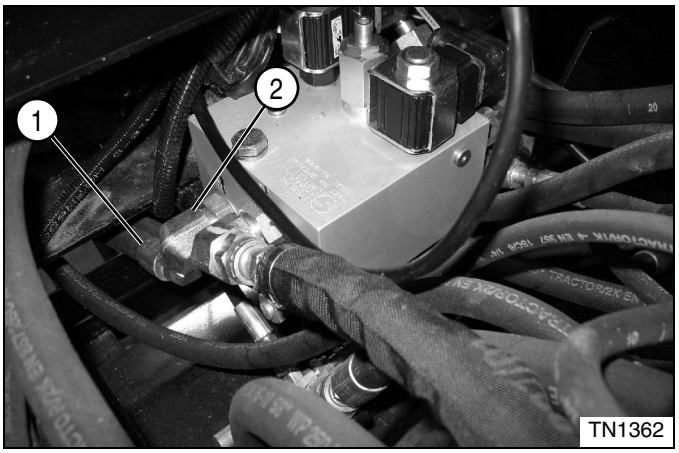


Figure 6-30

5. Remove blocking disk from location (2) and reconnect hose (1).

IMPORTANT

- **If performing this test after performing the cutting unit system test, and the test results proved the cutting unit pump, mow/brake valve, and right front cutting unit good, proceed to step 15.**
- **If performing this test to determine which component in system is at fault (right front cutting unit motor, left front cutting unit motor, or center rear cutting unit motor) proceed to step 6.**

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.

6. Install suitable blocking device or tool in right front cutting unit, preventing cutting unit from turning.

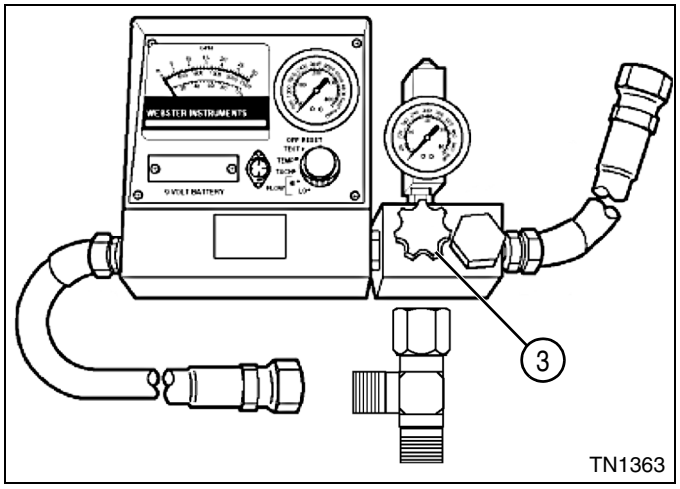


Figure 6-31

7. Open flow meter valve (3) completely.

NOTE

Verify engine rpm is within specification (3150 rpm ± 50*) to ensure accurate hydraulic test results.*

8. Start engine and run at full throttle (3150 rpm ± 50).
9. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (3) until a reading of 1525 psi (105 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.
10. Engage cutting unit switch.

11. Slowly close flow meter valve (3) until pressure reaches 2300 psi (159 bar). Read and record the right cutting unit motor loaded flow.
12. Open flow meter valve (3) and stop engine.
13. Calculate right front cutting unit motor leakage. (Step 10 of mow/brake valve tests – Step 11 / Step 10 of mow/brake 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 14.*

    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 required.*

    NO *Proceed to next question.*

    Is right front cutting unit motor leakage 21% or more?

    YES *Replace right front cutting unit motor. (See "Cutting Unit Motor" on page 6-47.)*
14. 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.

15. Install suitable blocking device or tool in left front cutting unit, preventing cutting unit from turning.
16. Open flow meter valve (3) completely.

NOTE

Verify engine rpm is within specification (3150 rpm ± 50) to ensure accurate hydraulic test results.

17. Start engine and run at full throttle (3150 rpm ± 50).
18. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (3) until a reading of 1525 psi (105 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. Engage cutting unit switch.
20. Slowly close flow meter valve (3) until pressure reaches 2300 psi (159 bar). Read and record the left cutting unit motor loaded flow.
21. Open flow meter valve (3) and stop engine.
22. Calculate left front cutting unit motor leakage. (Step 11 of right cutting unit motor test – Step 20 / Step 11 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 23.*

    NO *Proceed to next question.*

    Is left front cutting unit motor leakage 11% to 20%?

    YES *The left front cutting unit motor is marginal. Additional testing is required.*

    NO *Proceed to next question.*

    Is left front cutting unit motor leakage 21% or more?

    YES *Replace left front cutting unit motor. (See "Cutting Unit Motor" on page 6-47.)*
23. Remove device or tool from left 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.

24. Install suitable blocking device or tool in center rear cutting unit, preventing cutting unit from turning.
25. Open flow meter valve (3) completely.

NOTE

Verify engine rpm is within specification (3150 rpm ± 50) to ensure accurate hydraulic test results.

26. Start engine and run at full throttle (3150 rpm ± 50).
27. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (3) until a reading of 1525 psi (105 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.
28. Engage cutting unit switch.
29. Slowly close flow meter valve (3) until pressure reaches 2300 psi (159 bar). Read and record the cutting unit/charge pump loaded flow.
30. Open flow meter valve (3) and stop engine.

31. Calculate center rear cutting unit motor leakage. (Step 20 – Step 29 / Step 20 x 100 = Leak Percentage)

    Is center rear cutting unit motor leakage 10% or less?

    YES *The center rear cutting unit motor is good. Proceed to step 32.*

    NO *Proceed to next question.*

    Is center rear cutting unit motor leakage 11% to 20%?

    YES *The center rear cutting unit motor is marginal. Replace as needed.*

    NO *Proceed to next question.*

    Is center rear cutting unit motor leakage 21% or more?

    YES *Replace center rear cutting unit motor. (See "Cutting Unit Motor" on page 6-47.)*

32. Disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
33. 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 6-32 and 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
• Pressure Gauge 5000 psi (345 bar)
• 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 1-7.)
3. Raise seat platform.

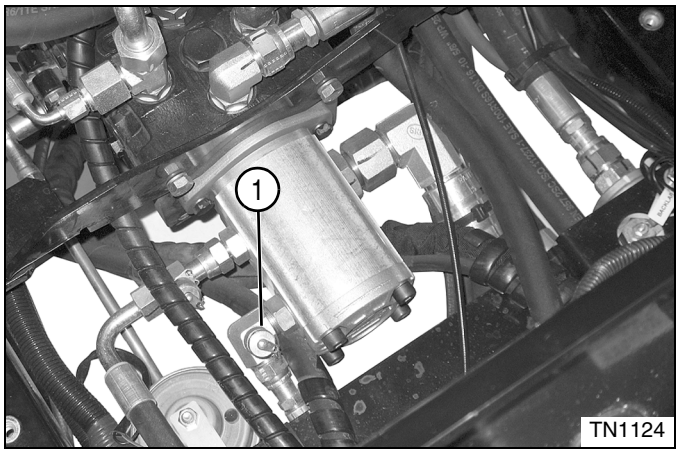


Figure 6-32

Figure 6-33

4. Connect test hose from test port (1) to pressure gauge (2).
5. Lower seat platform.

CAUTION

Do not run mower lift/steer system relief valve over relief longer then 10 seconds or damage may occur to hydraulic system.

6. Start engine and run at full throttle (3150 rpm ± 50).
7. Turn steering wheel fully right against stop.
8. Record pressure reading.

9. Stop engine.

   Is lift/steer system relief pressure 1595 psi (110 bar)?

   YES *Lift/steer system relief valve is good. Proceed to step 10.*

   NO *Test lift/steer pump. (See "Lift/Steer Pump Test" on page 6-42.) Test lift cylinder. (See "Lift Cylinder Leakage Test" on page 6-28.) Replace steering valve. (See "Steering Valve" on page 7-7.)*

10. Disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
11. Check hydraulic oil level. Add oil as needed. (Refer to "Safety, Operation, and Maintenance Manual" for correct oil specifications.)

Lift System Test

See Figures 6-34 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 • Test Hose 2000 psi (138 bar) • Tee Fitting • Blocking Disk

1. Park the mower safely. (See "Park Mower Safely" on page 1-7.)
2. Raise seat platform.
3. Bypass seat switch.

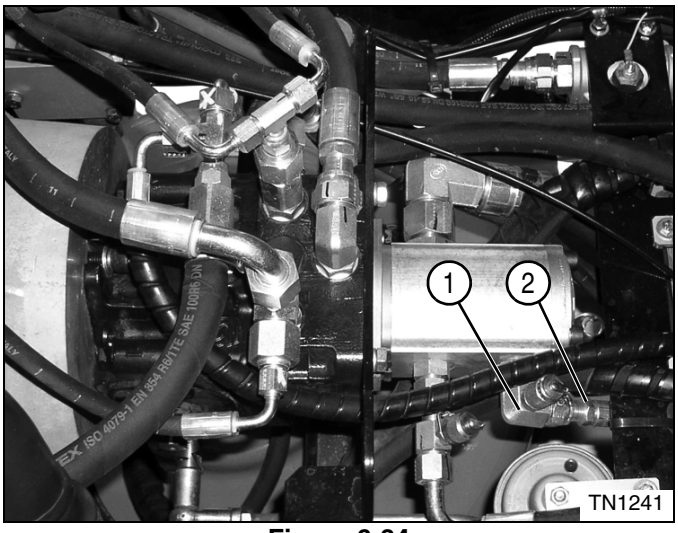


Figure 6-34

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

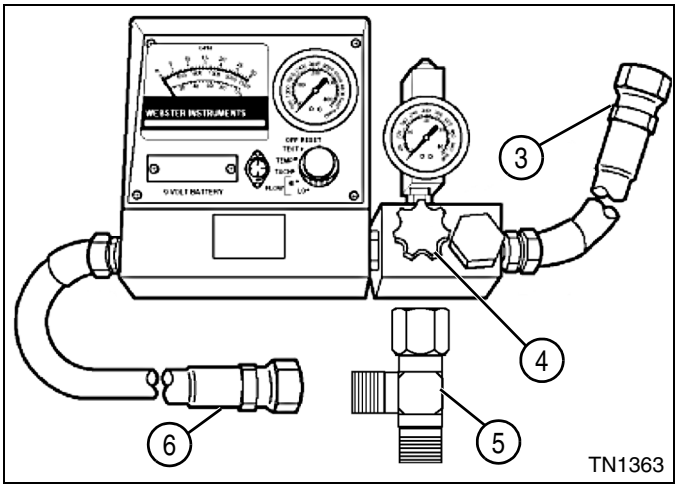


Figure 6-35

5. Install tee fitting (5) to fitting (1).
6. 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.

7. Connect flow meter outlet test hose (3) to the hydraulic tank.
8. Open flow meter valve (4) completely.

NOTE

Verify engine rpm is within specification (3150 rpm ± 50*) to ensure accurate hydraulic test results.*

9. Start engine and run at full throttle (3150 rpm ± 50).

CAUTION

Do not exceed 1200 psi (83 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 800 psi (55 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 switch in the raise position, slowly close flow meter valve (4) until pressure reaches 1200 psi (83 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. Disconnect and remove test equipment. Install all hoses and fittings as noted prior to removal.
19. 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 • Test Hose 2000 psi (138 bar) • Tee Fitting • Blocking Disk

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Raise seat platform.
3. Bypass seat switch.
4. 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 6-41.)*
5. Open flow meter valve (4) completely. (See Figure 6-35.)

NOTE

Verify engine rpm is within specification (3150 rpm ± 50*) to ensure accurate hydraulic test results.*

6. Start engine and run at full throttle (3150 rpm ± 50).
7. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (4) until a reading of 800 psi (55 bar) or one half of the relief valve rating is reached. Warm oil to 120—150°F (49—65°C).
8. Open flow meter valve (4) completely. Read and record the lift/steer pump no load flow.

CAUTION

Do not exceed 1200 psi (83 bar) as this test does not utilize system relief.

9. Slowly close flow meter valve (4) until pressure reaches 1200 psi (83 bar). Read and record the lift/steer pump loaded flow.
10. Open flow meter valve (4) and stop engine.

11. Calculate lift/steer pump leakage.
(Step 6 – Step 7 / Step 6 x 100 = Leak Percentage)

Is lift/steer pump leakage 10% or less?

YES *The lift/steer pump is good. Proceed to step 12.*

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 "Tandem Pump" on page 6-45.)*

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

Lift Valve Leakage Test

See Figures 6-36 and 6-37.

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 • Test Hose 2000 psi (138 bar) • Tee Fitting • Blocking Disk

1. Park the mower safely. (See "Park Mower Safely" on page 1-7.)
2. Before performing this test perform lift system test. Leave flow meter connected as outlined in lift system test, but remove blocking disk and reconnect hose to tee fitting.
3. Bypass seat switch and raise seat platform.

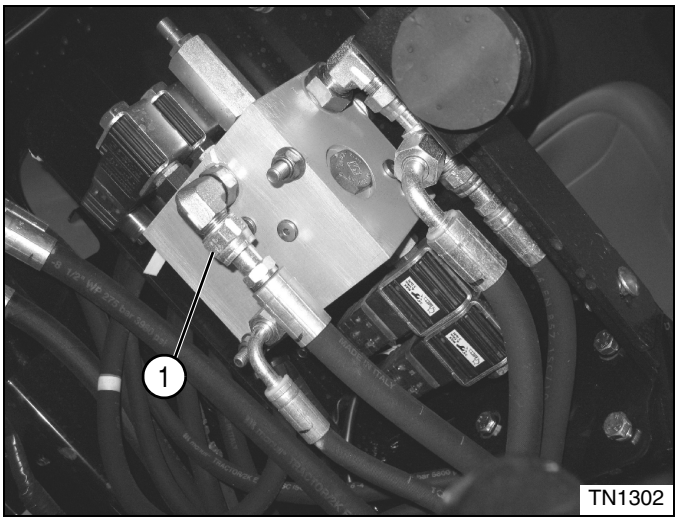


Figure 6-36

4. Install blocking disk at fitting (1) on lift valve, preventing oil flow from entering lift cylinders.

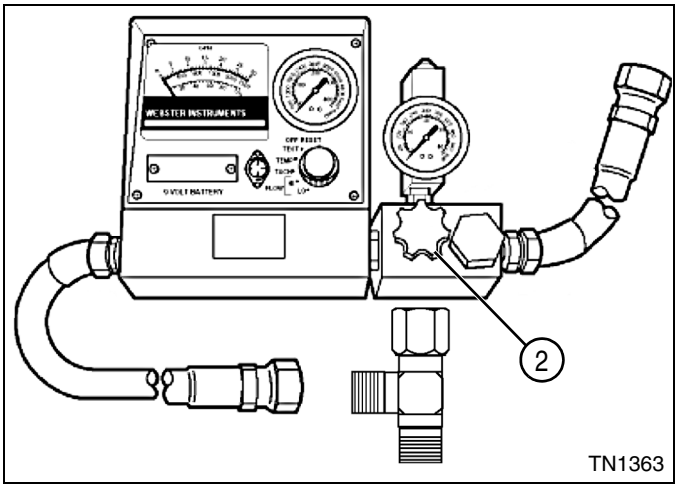


Figure 6-37

5. Open flow meter valve (2) completely.

Verify engine rpm is within specification (3150 rpm ± 50) to ensure accurate hydraulic test results.

6. Start engine and run at full throttle (3150 rpm ± 50).
7. Use the flow meter to warm the hydraulic oil. Turn the flow meter valve (2) until a reading of 800 psi (55 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 (2) until pressure reaches 1200 psi (83 bar). Read and record the lift/steer pump loaded flow.
10. Open flow meter valve (2) and stop engine.

11. Calculate lift valve leakage.
    (Step 7 of previous test – Step 9 / Step 7 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 6-47.)*

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

Repair

Tandem Pump

Removal and Installation

See Figure 6-38.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Remove seat and mounting plate. (See “Seat and Mounting Plate” on page 9-16.)
3. Drain hydraulic oil.

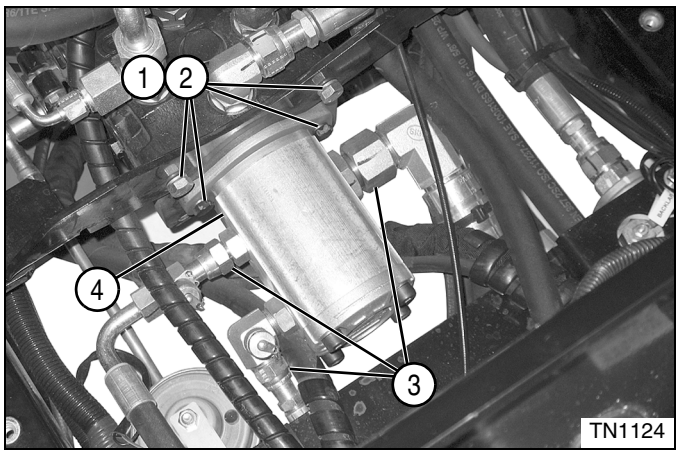


Figure 6-38

NOTE

Mark hydraulic hoses to aid in installation. Close all openings with caps or plugs to prevent contamination.

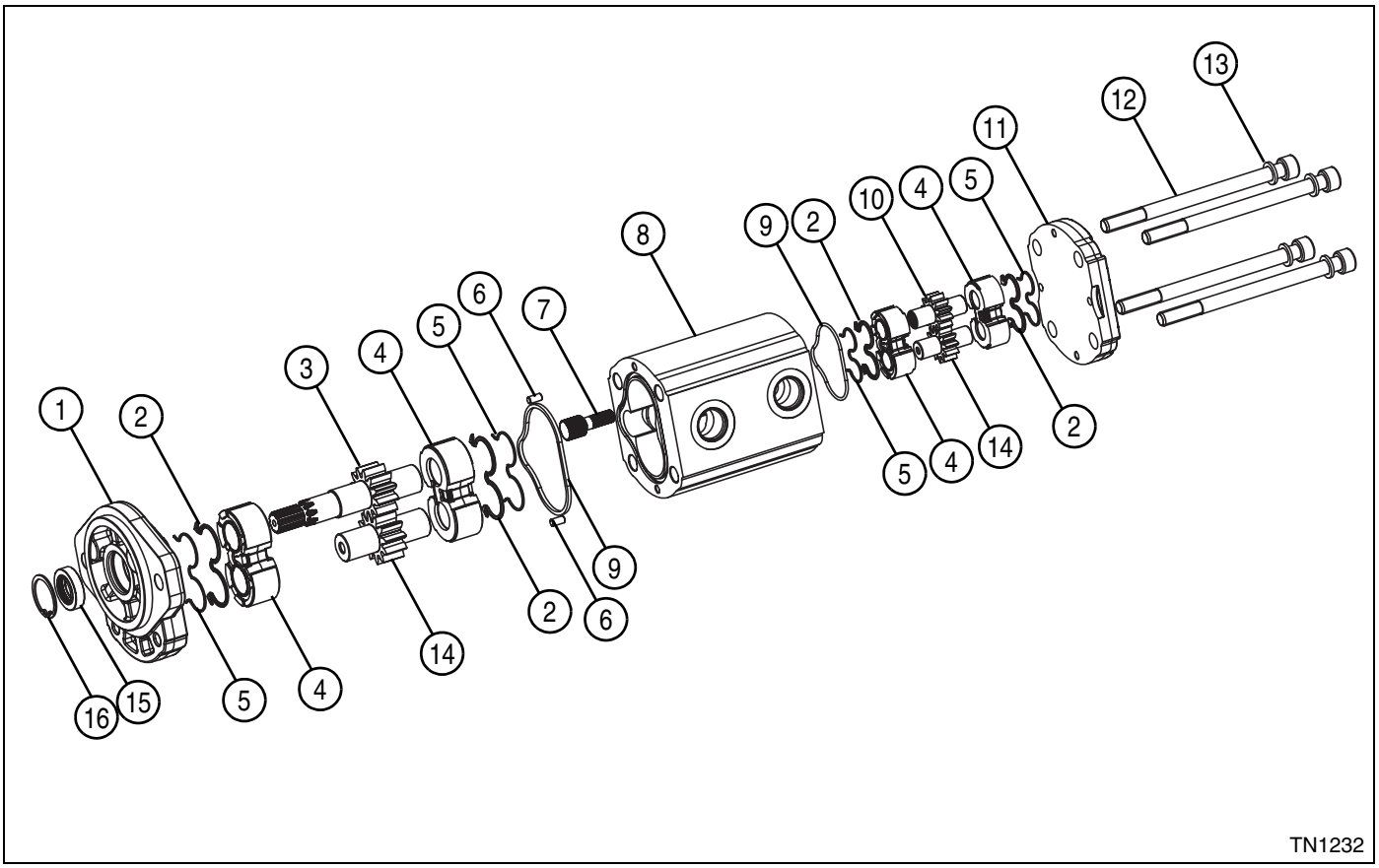
4. Disconnect hydraulic hoses (3).
5. Support the tandem pump (4).
6. Remove mounting bolts (2) and washers (1).
7. Remove the tandem pump (4).

Installation Notes

- *Install tandem pump by reversing the order of removal.*
- *Ensure new O-rings are in place before installing hoses on fittings.*
- *Replace hydraulic filter.*
- *Refill hydraulic tank. (Refer to “Safety, Operation, and Maintenance Manual” for oil specifications.)*
- *Install seat and mounting plate.*
- *Start engine. Check for leaks and repair as necessary.*

Disassembly and Assembly

See Figure 6-39.



1	Front Cover	5	Backup Ring (4)	9	O-Ring (2)	13	Washer (4)
2	Seal (4)	6	Dowel Pin (2)	10	Drive Gear	14	Driven Gear Shaft
3	Drive Shaft	7	Hub	11	Twin Rear Cover	15	Shaft Seal
4	Thrust Plate (4)	8	Body	12	Screw (4)	16	Ring

Figure 6-39

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)

NOTES

Never pry components apart. Use a soft face hammer to gently tap housing and shaft to separate pump body.

Scribe or mark pump body and end covers before disassembly to ease assembly.

2. Remove cap screws and disassemble pump one section at a time. Before removing drive shaft and driven gear shafts, mark a line across meshing gear teeth to ensure that shafts are reassembled in the same position.
3. Remove parts and place in assembly order on a clean work area.
4. 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.

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

Assembly Notes

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.

Required Materials
Seal Kit (Jacobsen P/N 4134713)

- *Assemble the tandem 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.*
- *Rotate drive shaft 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 32—36 lb-ft (43—49 N·m) and check rotation of pump drive shaft.*
- *Lubricate pump through ports with clean hydraulic oil prior to installation.*

Cutting Unit Motor

Removal, Disassembly, Inspection, and Assembly

NOTE

See Chapter 8—Cutting Units for cutting unit motor service information:

- *AR-3: See “Deck Drive Motor” on page 8-25.*
- *TR-3: See “Reel Drive Motor” on page 8-33.*

Lift Valve

Removal and Installation

See Figures 6-40 and 6-41.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)

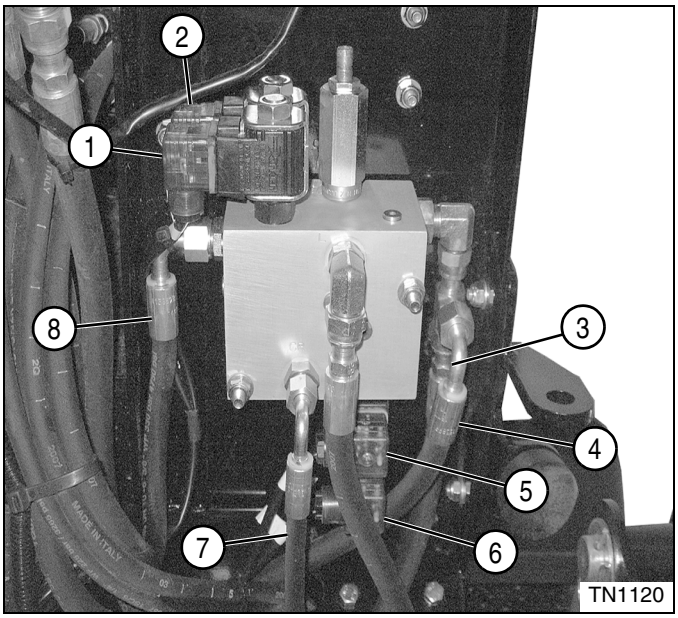


Figure 6-40

NOTE

Label all connectors before disconnecting to ensure correct installation.

2. Mark and disconnect solenoid connectors (1, 2, 5, and 6) from solenoids.

NOTES

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

3. Disconnect hydraulic hoses (3, 4, 7, and 8) from fittings.

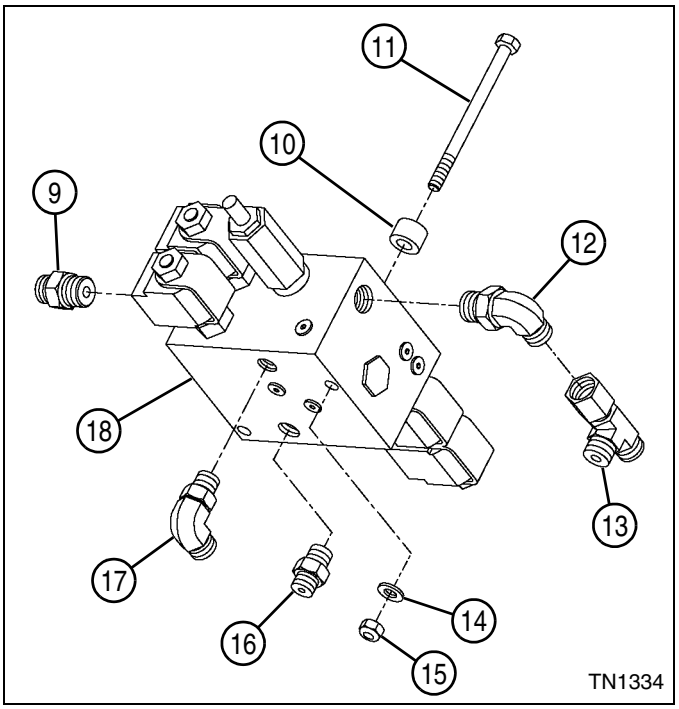


Figure 6-41

4. Support the lift valve (18).
5. Remove two nuts (15), flat washers (14), screws (11) and spacers (10), and remove lift valve (18) from mower.

NOTE

Record the location and orientation of fittings on lift valve to ensure correct installation.

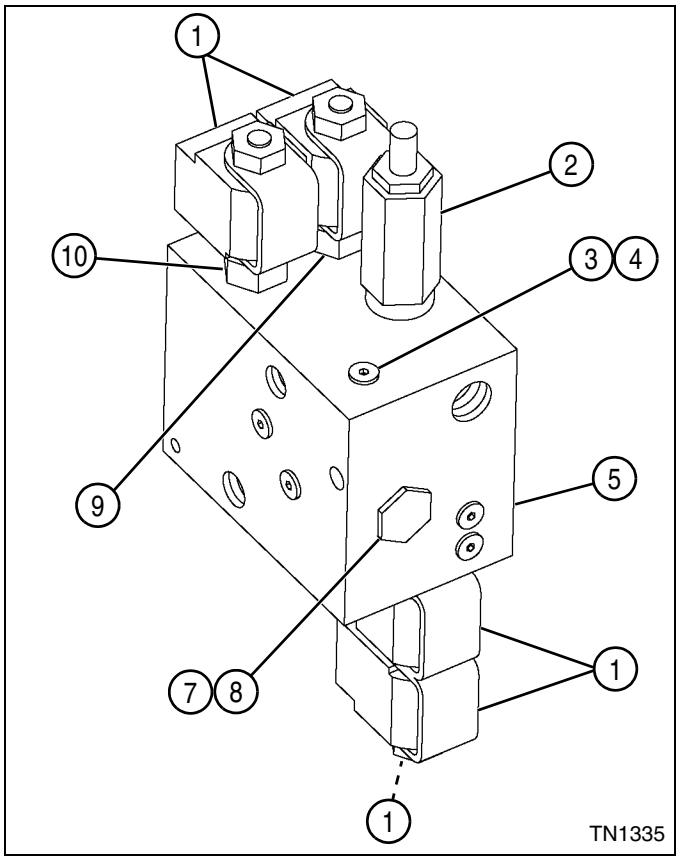
6. Remove fitting (9) from the lift valve (18).
7. Remove tee fitting (13) and elbow fitting (12) from the lift valve (18).
8. Remove fitting (16) from the lift valve (18).
9. Remove elbow fitting (17) from the lift valve (18).

Installation Notes

- *Install lift valve by reversing the order of removal.*
- *Ensure new O-rings are in place before installing hoses on fittings.*
- *Replace hydraulic filter.*
- *Refill hydraulic tank. (Refer to "Safety, Operation, and Maintenance Manual" for oil specifications.)*
- *Start engine and check lift valve operation. Check for leaks and repair as necessary.*

Disassembly, Inspection, and Assembly

See Figure 6-42.



1	Solenoid Coil (4)	6	Raise/Lower Solenoid Valve
2	Relief Valve	7	Check Valve
3	Hollow Hex Plug (9)	8	Pilot Piston
4	Orifice Plug	9	Primary Weight Transfer Solenoid Valve
5	Lift Valve Block	10	Secondary Weight Transfer Solenoid Valve

Figure 6-42

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

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.

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 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.

Required Materials
Seal Kit, Raise/Lower Solenoid Valve (Jacobsen P/N 4137264)
Seal Kit, Secondary Weight Transfer Solenoid Valve (Jacobsen P/N 4137265)
Seal Kit, Primary Weight Transfer Solenoid Valve (Jacobsen P/N 4137266)
Seal Kit, Check Valve (Jacobsen P/N 4137267)
Seal Kit, Pilot Piston (Jacobsen P/N 4137268)
Seal Kit, Relief Valve (Jacobsen P/N 4137269)

- *Assemble lift valve by reversing the order of removal.*
- *Lubricate all O-rings prior to assembly.*
- *Tighten the primary weight transfer (9), secondary weight transfer (10) and raise/lower (6) solenoid valves to 22 lb-ft (30 N·m).*
- *Tighten all solenoid coils (1) to 3 lb-ft (36 lb-in.) (4 N·m).*
- *Tighten the relief valve (2) to 37 lb-ft (50 N·m).*
- *Tighten check valve (7) to 30 lb-ft (40 N·m).*
- *Tighten orifice plug (4) to 2 lb-ft (27 lb-in.) (3 N·m).*
- *Tighten hollow hex plugs (3) to 5 lb-ft (58 lb-in.) (6.5 N·m).*

Flushing Valve

Removal and Installation

See Figure 6-43.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Drain hydraulic oil.

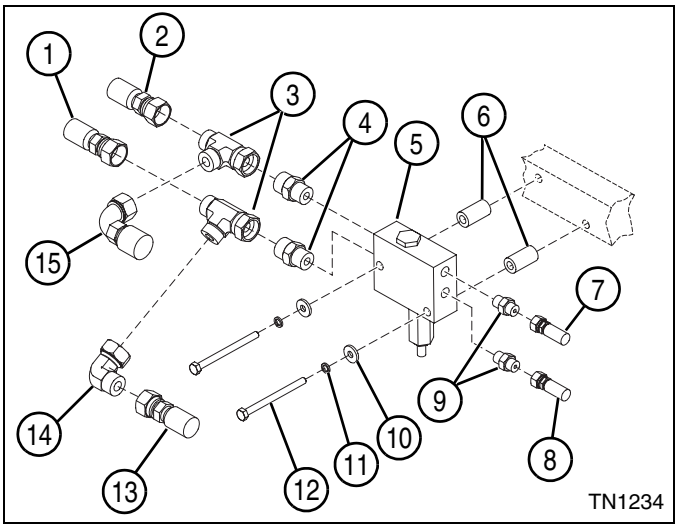


Figure 6-43

NOTES

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

3. Disconnect hydraulic hoses (1, 2, 7, 8, 13, and 15).
4. Remove two screws (12), lock washers (11), and flat washers (10) and spacers (6), and remove flushing valve (5) from mower.

NOTE

Record the location and orientation of fittings on lift valve to ensure correct installation.

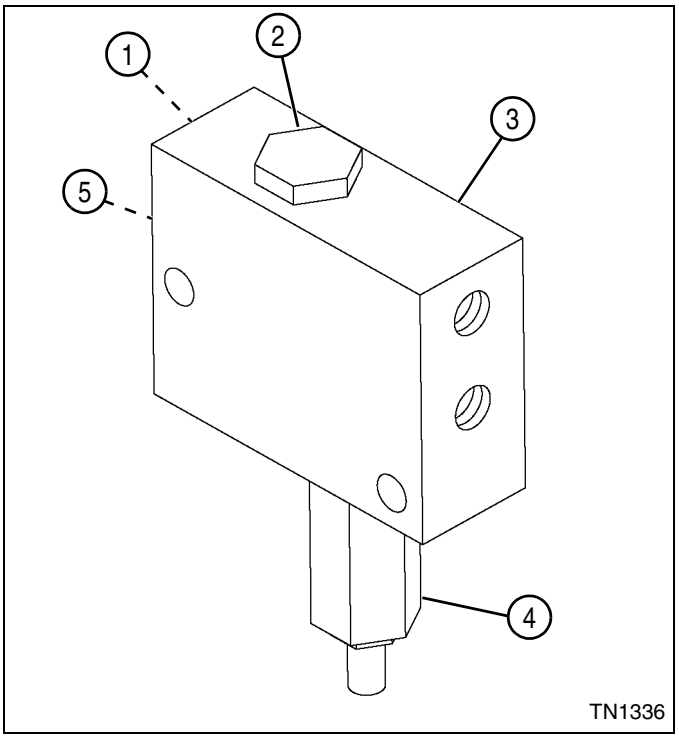
5. Remove fittings (3, 4, and 9) from flushing valve (5).

Installation Notes

- *Install flushing valve by reversing the order of removal.*
- *Ensure new O-rings are in place before installing hoses on fittings.*
- *Replace hydraulic filter.*
- *Refill hydraulic tank. (Refer to “Safety, Operation, and Maintenance Manual” for oil specifications.)*
- *Start engine and check flushing valve operation. Check for leaks and repair as necessary.*

Disassembly, Inspection, and Assembly

See Figure 6-44.



1	Orifice Plug	4	Sequence Valve
2	Check Valve	5	Orifice Plug
3	Flushing Valve Block		

Figure 6-44

1. Remove, inspect, and replace flushing valve components as needed.

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.

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 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.

Required Materials
Seal Kit, Sequence Valve (Jacobsen P/N 4137262) Seal Kit, Check Valve (Jacobsen P/N 4137263)

- *Assemble flushing valve by reversing the order of removal.*
- *Lubricate all O-rings prior to assembly.*
- *Tighten the check valve (2) to 37 lb-ft (50 N·m).*
- *Tighten sequence valve (4) to 37 lb-ft (50 N·m).*
- *Tighten M5 x 1.00 diameter orifice plug (5) to 2 lb-ft (27 lb-in.) (3 N·m).*
- *Tighten M5 x 0.50 diameter orifice plug (1) to 1.7 lb-ft (20 lb-in.) (2.5 N·m).*

Mow/Brake Valve

Removal and Installation

See Figures 6-45 and 6-46.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Drain hydraulic oil.

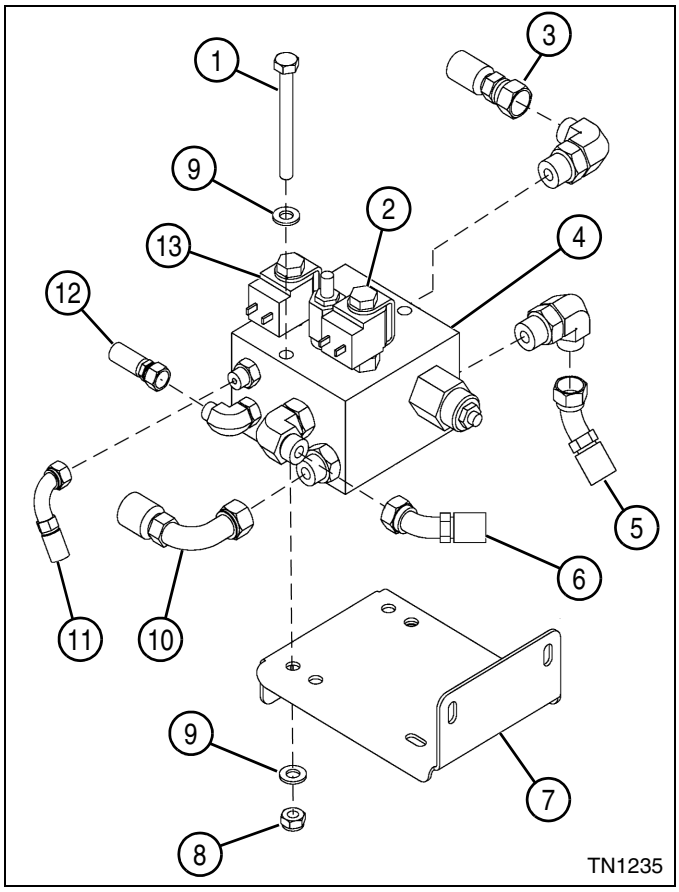


Figure 6-45

NOTE

Label all connectors before disconnecting to ensure correct installation.

3. Disconnect electrical connectors from solenoids (2 and 13).

NOTES

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

4. Disconnect six hydraulic hoses (3, 5, 6, 10, 11, and 12) from mow/brake valve assembly (3).
5. Remove two nuts (8), screws (1), and four fat washers (9), and remove mow/brake valve (3) from bracket (7).

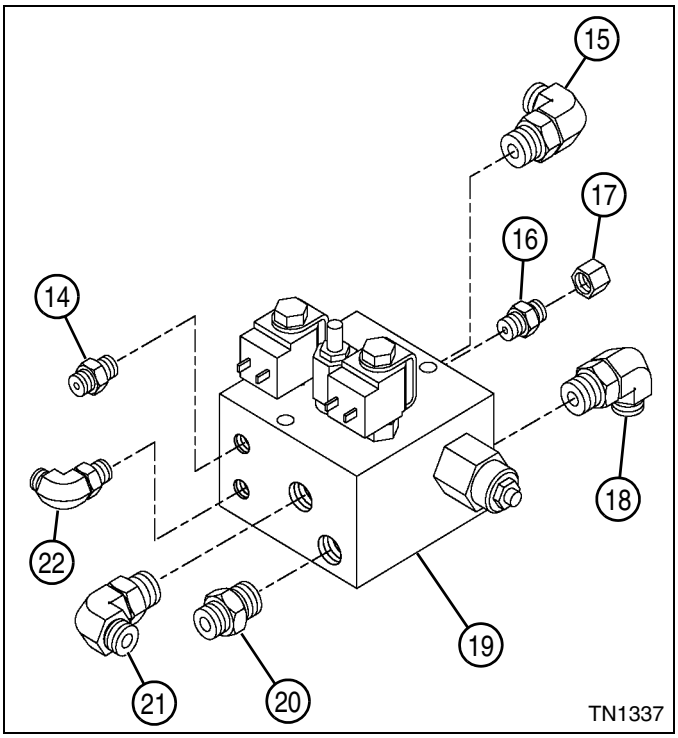


Figure 6-46

NOTE

Record the location and orientation of fittings on lift valve to ensure correct installation.

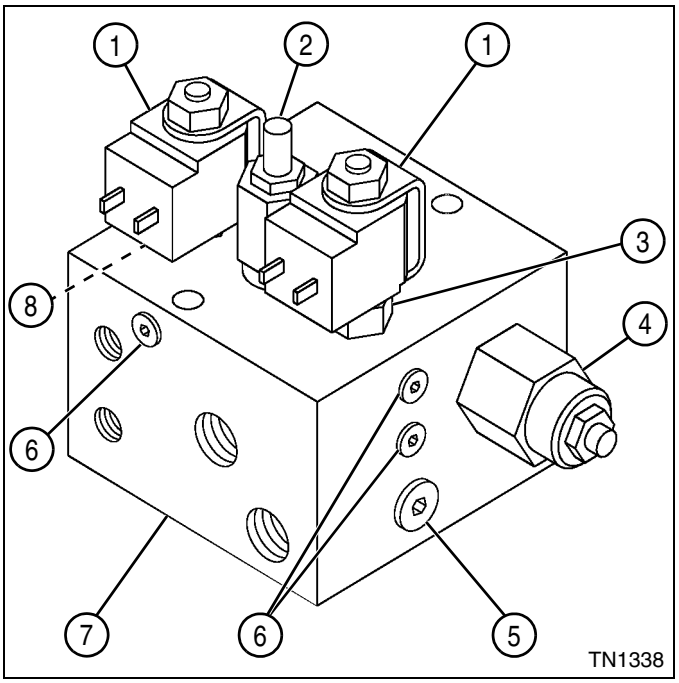
6. Remove fitting (14) from mow/brake valve (19).
7. Remove elbow fittings (15, 18, and 21) from mow/brake valve (19).
8. Remove fitting (16) and cap (17) from mow/brake valve (19).
9. Remove fitting (20) from mow/brake valve (19).
10. Remove elbow fitting (22) from mow/brake valve (19).

Installation Notes

- *Install mow/brake valve by reversing the order of removal.*
- *Ensure new O-rings are in place before installing hoses on fittings.*
- *Replace hydraulic filter.*
- *Refill hydraulic tank. (Refer to “Safety, Operation, and Maintenance Manual” for oil specifications.)*
- *Start engine and check mow/brake valve operation. Check for leaks and repair as necessary.*

Disassembly, Inspection, and Assembly

See Figure 6-47.



1	Solenoid Coil (2)	5	Hollow Hex Plug
2	Relief Valve	6	Hollow Hex Plug (6)
3	Brake Solenoid Valve	7	Mow/Brake Valve Block
4	Load Control Valve	8	Mow Solenoid Valve

Figure 6-47

1. Remove, inspect, and replace mow/brake valve components as needed.

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.

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 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.

Required Materials
Seal Kit, Load Control Valve (Jacobsen P/N 4137270) Seal Kit, Brake Solenoid Valve (Jacobsen P/N 4137265) Seal Kit, Mow Solenoid Valve (Jacobsen P/N 4137271) Seal Kit, Relief Valve (Jacobsen P/N 4137272)

- *Assemble mow/brake valve by reversing the order of removal.*
- *Lubricate all O-rings prior to assembly.*
- *Tighten the mow solenoid valve (8) to 20 lb-ft (27 N·m).*
- *Tighten the brake solenoid valve (3) to 22 lb-ft (30 N·m).*
- *Tighten the load control valve (4) to 50 lb-ft (68 N·m).*
- *Tighten the relief valve (2) to 37 lb-ft (50 N·m).*
- *Tighten all solenoid coils (1) to 3 lb-ft (36 lb-in.) (4 N·m).*
- *Tighten hollow hex plugs (6) to 5 lb-ft (58 lb-in.) (6.5 N·m).*
- *Tighten hollow hex plugs (5) to 37 lb-ft (50 N·m).*

Brake Release Valve

Removal and Installation

See Figure 6-48.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Drain hydraulic oil.

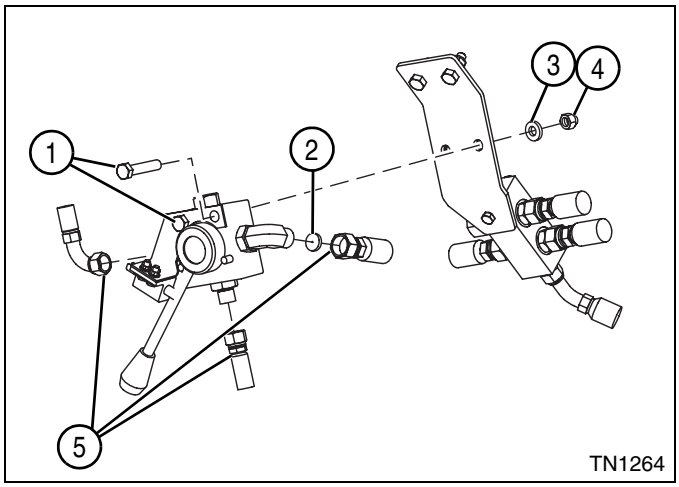


Figure 6-48

NOTE

Mark hydraulic hoses to aid in installation. Close all openings with caps or plugs to prevent contamination.

3. Disconnect three hydraulic hoses (5). Retain orifice disc (2) and mark hose where removed from.
4. Remove mounting cap screws (1), nuts (3) and washers (4). Remove brake release valve from mower.

Installation Notes

- *Install brake release valve by reversing the order of removal.*
- *Ensure new O-rings are in place before installing hoses on fittings. Insert orifice disc in proper hose connection.*
- *Replace hydraulic filter.*
- *Refill hydraulic tank. (Refer to “Safety, Operation, and Maintenance Manual” for oil specifications.)*
- *Start engine and check brake release valve operation. Check for leaks and repair as necessary.*

Disassembly, Inspection, and Assembly

NOTE

Mark location and orientation of fittings on brake release valve.

1. Remove fittings from brake release valve.
2. Inspect and repair, or replace brake release valve as needed.

Assembly Notes

- *Always use new O-rings and seals.*
- *Lubricate all O-rings prior to assembly.*
- *Assemble brake release valve by reversing the order of removal.*

Hydraulic Filter

Removal and Installation

See Figure 6-49.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Drain hydraulic oil.

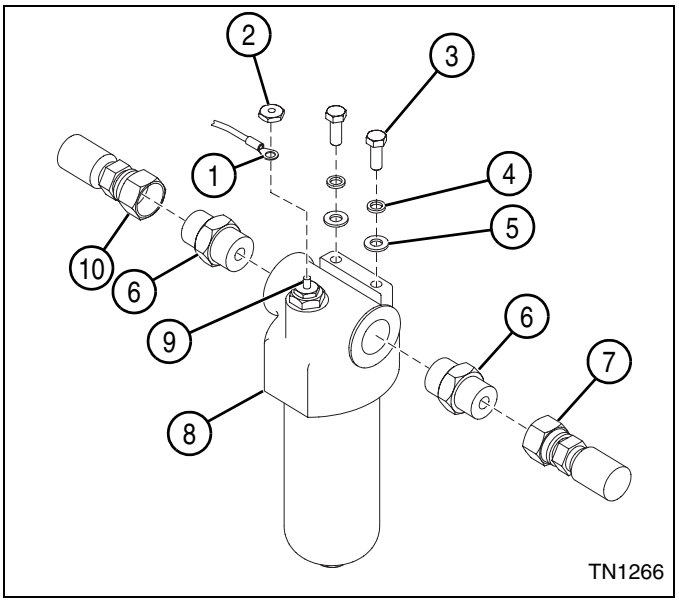


Figure 6-49

3. Remove nut (2) and ring connector with wire (1) from sensor (9).

NOTES

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

4. Disconnect two hydraulic hoses (7 and 10).
5. Remove two screws (3), lock washers (4), and flat washers (5), and remove hydraulic filter assembly (8) from mower.
6. Remove fittings (6) from hydraulic filter assembly (8).

Installation Notes

- *Install hydraulic filter by reversing the order of removal.*
- *Ensure new O-rings are in place before installing hoses on fittings.*
- *Replace hydraulic filter.*
- *Refill hydraulic tank. (Refer to “Safety, Operation, and Maintenance Manual” for oil specifications.)*
- *Start engine. Check hydraulic filter for leaks and repair as necessary.*

Hydraulic Manifold

Removal and Installation

See Figure 6-50.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Drain hydraulic oil.

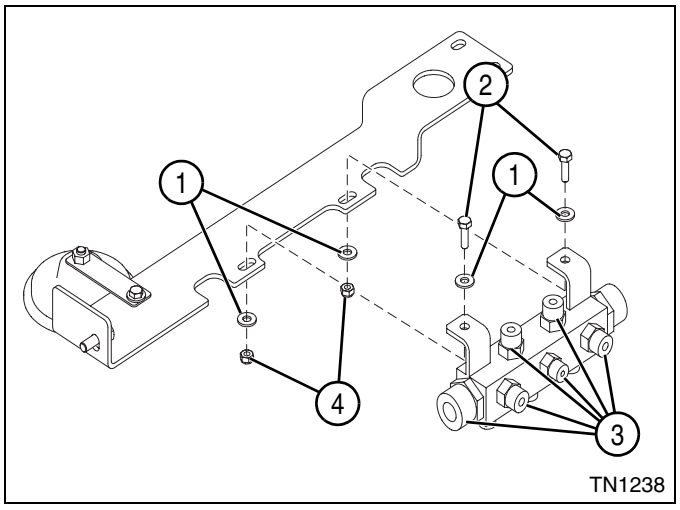


Figure 6-50

NOTES

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

3. Disconnect seven hydraulic hoses from fittings (3).
4. Remove bolts (2), washers (1), and nuts (4). Remove hydraulic manifold from mower.

Installation Notes

- *Install hydraulic manifold by reversing the order of removal.*
- *Ensure new O-rings are in place before installing hoses on fittings.*
- *Replace hydraulic filter.*
- *Refill hydraulic tank. (Refer to “Safety, Operation, and Maintenance Manual” for oil specifications.)*
- *Start engine. Check hydraulic manifold for leaks and repair as necessary.*

Backlap Valve

Removal and Installation

See Figure 6-51.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Drain hydraulic oil.

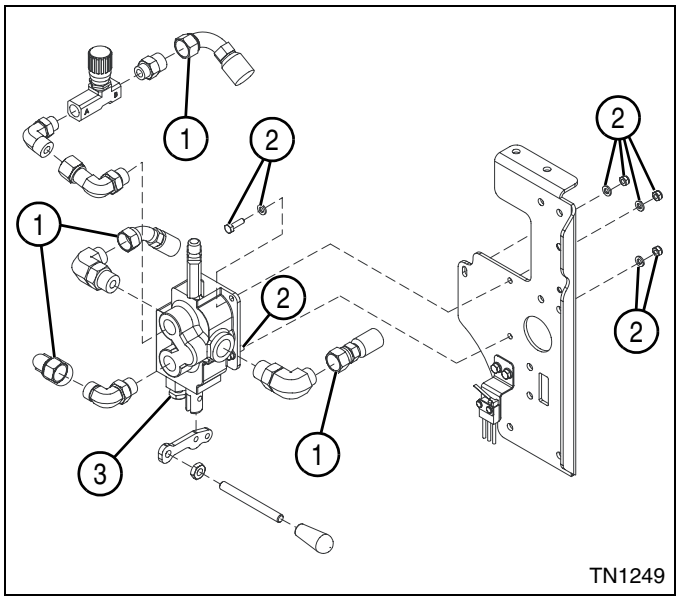


Figure 6-51

NOTES

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

3. Disconnect four hydraulic hoses (1).
4. Remove mounting hardware (2). Remove backlap valve (3) from mower.

NOTE

Record the location and orientation of fittings on lift valve to ensure correct installation.

5. Remove fittings from backlap valve.

Installation Notes

- *Install backlap valve by reversing the order of removal.*
- *Ensure new O-rings are in place before installing hoses on fittings.*
- *Replace hydraulic filter.*
- *Refill hydraulic tank. (Refer to “Safety, Operation, and Maintenance Manual” for oil specifications.)*
- *Start engine and check backlap valve operation. Check for leaks and repair as necessary.*

Lift Cylinder

Removal and Installation

See Figure 6-52.

1. Park the mower safely. (See “Park Mower Safely” on page 1-7.)
2. Lower cutting units.

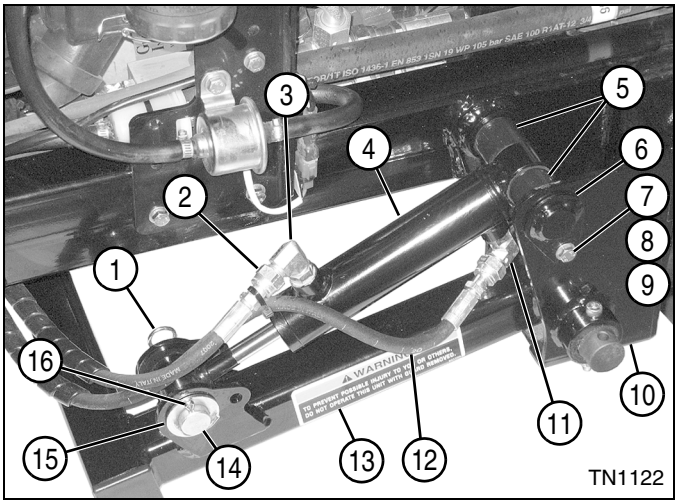


Figure 6-52

NOTES

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

3. Disconnect hydraulic hoses (2 and 12) from fittings (3 and 11).
4. Remove pin (1), cotter pin (16), washer (15) and lift arm pin (14) from lift arm (13).
5. Remove bolt (7), washer (8), lock nut (9), pivot shaft (6) and lift cylinder pivot shaft spacers (5) from cylinder (4) and frame (10), and remove cylinder from mower.

NOTES

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

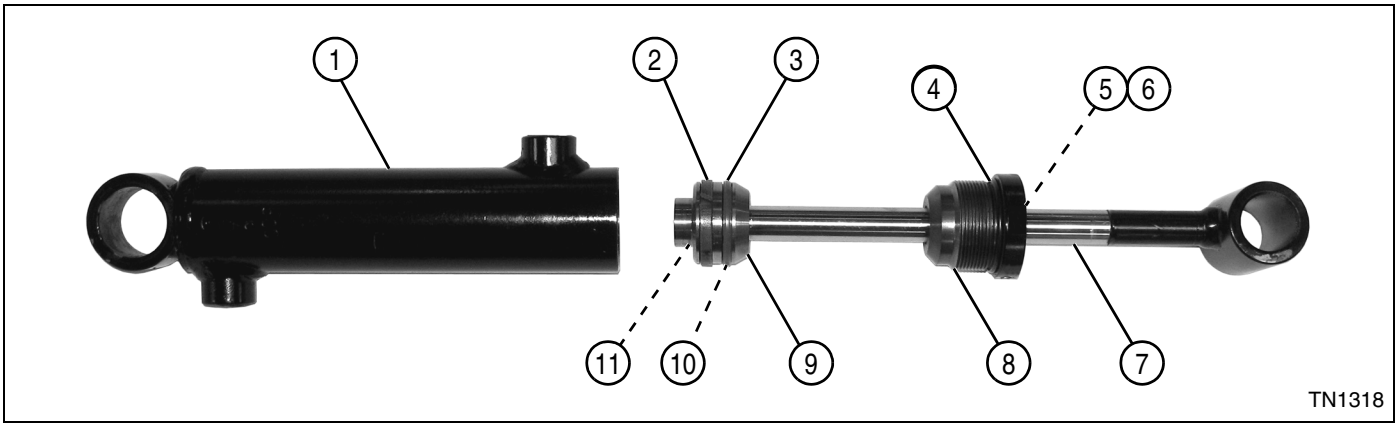
6. Remove hydraulic hose fittings (9) from cylinder barrel (3).

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 filter.*
- *Refill hydraulic tank. (Refer to "Safety, Operation, and Maintenance Manual" for oil specifications.)*
- *Start engine and check lift cylinder operation. Check for leaks and repair as necessary.*

Disassembly and Assembly

See Figure 6-53.



1	Barrel	4	O-Ring	7	Rod	10	O-Ring
2	Piston Ring	5	Wiper Seal	8	Rod Guide	11	O-Ring
3	Seal	6	Rod Wiper	9	Piston		

Figure 6-53

NOTES

- *During repair of cylinder, use extreme care not to damage the barrel, piston, rod, and sealing surfaces of the cylinder.*
- *Seal kit accommodates more than one cylinder ram design and may contain unused components. During disassembly, retain and compare existing O-rings and seals to seal kit components to ensure correct O-rings and seals are used.*

1. Drain oil from lift cylinder.
2. Disassemble the lift cylinder as shown.
3. Use a spanner wrench to remove rod guide assembly (8) from barrel.

NOTE

Note orientation of rod end to barrel to ease assembly.

4. Pull rod assembly out of barrel.
5. Remove piston (9) from rod (7). Be careful not to damage piston end when unscrewing from rod.

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.

6. Clean all parts using clean solvent, and dry using compressed air.
7. 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 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.

Required Materials
Seal Kit (Jacobsen P/N 002301010)

- *Lubricate all parts, O-rings, seals, and wiper with clean hydraulic oil before assembly.*
- *Assemble the lift cylinder by reversing the order of disassembly.*

Hydraulic Oil Cooler

Removal and Installation

NOTE

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 3-13.)

Hydraulic Oil Tank

Removal and Installation

See Figure 6-54.

1. Park the mower safely. (See "Park Mower Safely" on page 1-7.)
2. Remove instrument panel. (See "Instrument Panel" on page 4-77.)

NOTE

Place a suitable container of 6.6 U.S. gal (25 liters) capacity beneath hydraulic oil tank drain plug.

3. Remove drain plug from bottom of hydraulic oil tank to drain tank.

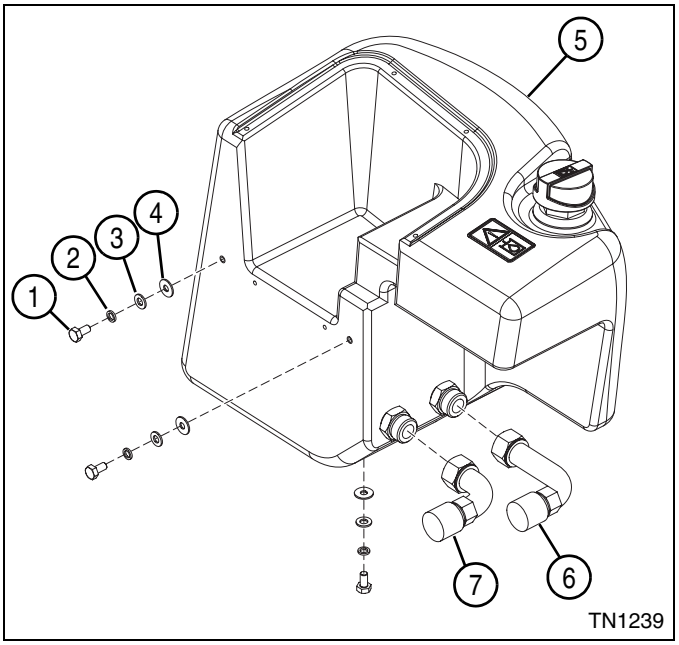


Figure 6-54

NOTES

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

4. Disconnect two hydraulic hoses (6 and 7) from hydraulic oil tank (5).
5. Support the hydraulic oil tank (5).
6. Remove three screws (1), lock washers (2), and six flat washers (3 and 4), and remove hydraulic oil tank (5) from mower.

Installation Notes

- *Install hydraulic oil tank by reversing the order of removal.*
- *Ensure new O-rings are in place before installing hoses on fittings.*
- *Replace hydraulic filter.*
- *Refill hydraulic tank. (Refer to "Safety, Operation, and Maintenance Manual" for oil specifications.)*
- *Start engine. Check hydraulic oil tank for leaks and repair as necessary.*

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