SERVICE MANUAL

Workmaster™ 33
Workmaster™ 37
Tier 4B (final)
Compact Tractor

Part number 47881877
1st edition English
January 2016

NEW HOLLAND AGRICULTURE

International symbols

Workmaster™ 33	NA
Workmaster™ 37	NA

As a guide to the operation of the machine, various universal symbols have been utilized on the instruments, controls, switches, and fuse box. The symbols are shown below with an indication of their meaning.


Thermostart starting aid


Alternator charge


Fuel level


Automatic Fuel shut-off


Engine speed (rev/min x 100)


Hours recorded


Engine oil pressure


Engine coolant temperature


Coolant level


Tractor lights


Headlamp main beam


Headlamp dipped beam


Work lamps


Stop lamps


Horn

Radio

Keep alive memory


Turn signals


Turn signals -one trailer

Turn signals -two trailers


Front wind-shield wash/wipe


Rear wind-shield wash/wipe


Heater temp-erature control


Heater fan


Air conditioner


Air filter blocked


Parking brake


Brake fluid level


Trailer brake


Roof beacon


Warning ! Corrosive substance


PTO

Transmission in neutral


Creeper gears


Slow or low setting


Fast or high setting

Ground speed


Differential lock


Rear axle oil tem-perature


Transmission oil pressure


FWD engaged


FWD dis-engaged


Warning!


Hazard warning lights


Variable control


Pressurized! Open carefully


Position Control


Draft Control


Accessory socket


Implement socket

%age slip


Hitch raise (rear)


Hitch lower (rear)


Hitch height limit (rear)


Hitch height limit (front)


Hitch dis-abled


Hydraulic and transmission filters


Remote valve extend

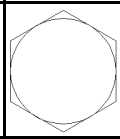
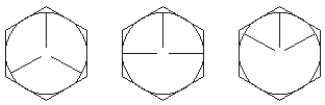
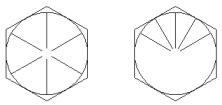
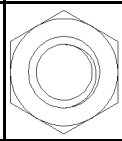
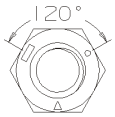
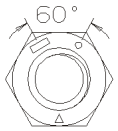

Remote valve retract


Remote valve float


Malfunction! See Operator's Manual


Malfunction! (alter-native symbol)

SAE HARDWARE IDENTIFICATION CHART

Grade	1 or 2	5	8
SAE Markings for Bolts and Cap Screws			
SAE Markings for Hex Nuts			
Grade A-B-C Locknuts	A (No Notches)	B (Three Marks)	C (Six Marks)

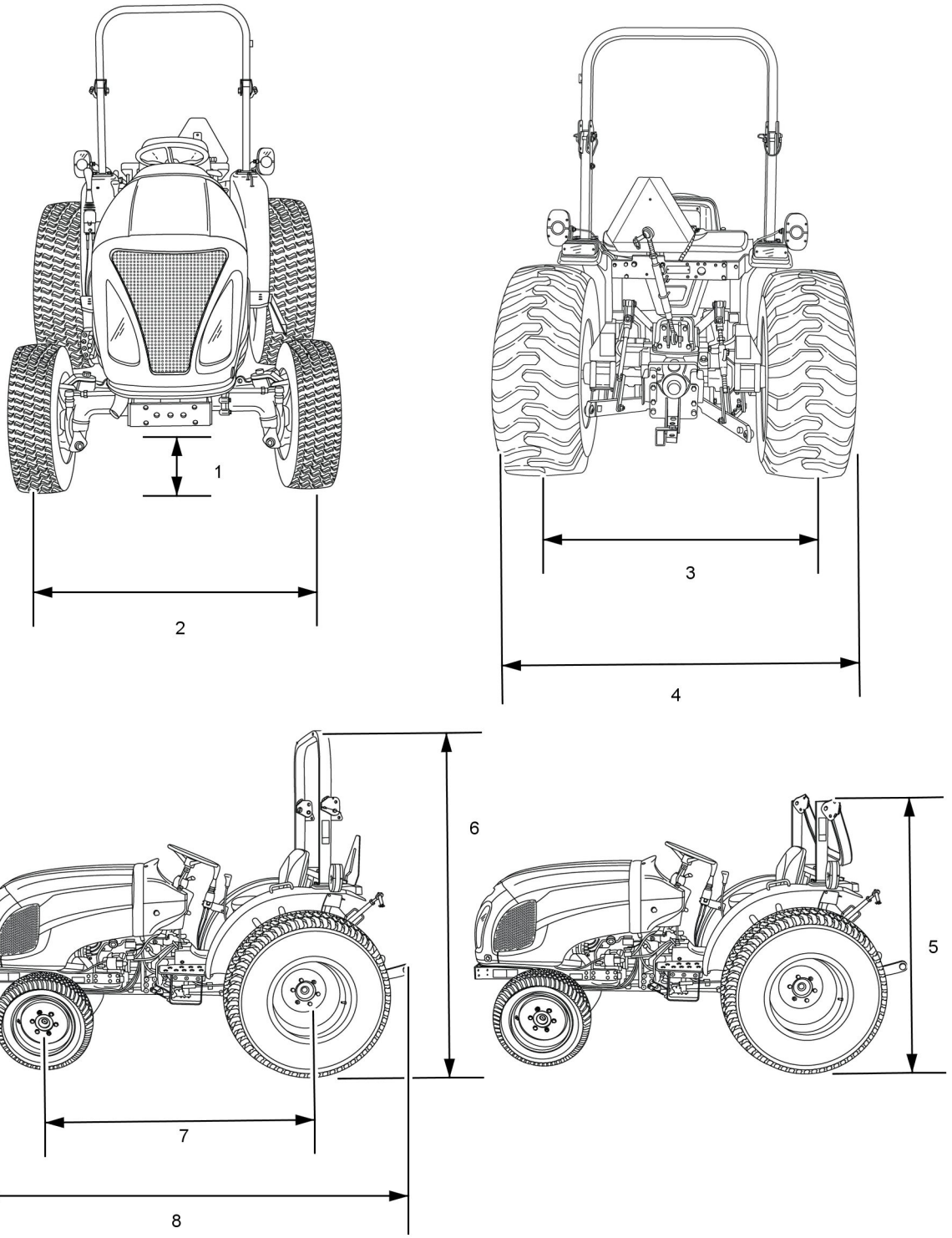
METRIC HARDWARE IDENTIFICATION CHART

Class	5.8	8.8	10.9
			
Hex Cap Screw and Carriage Bolts	Located on the face or flat, on the cap of the bolt	Located on the face or flat, on the cap of the bolt	Located on the face or flat, on the cap of the bolt
Hex Nuts and Locknuts	Located on the face or flat of the nut	Located on the face or flat of the nut	Located on the face or flat of the nut

Metric cap screws and nuts are identified by the grade number stamped on the head of the cap screw or on the surface of the nuts. U.S. customary cap screws are identified by radial lines stamped on the head of the cap screw.

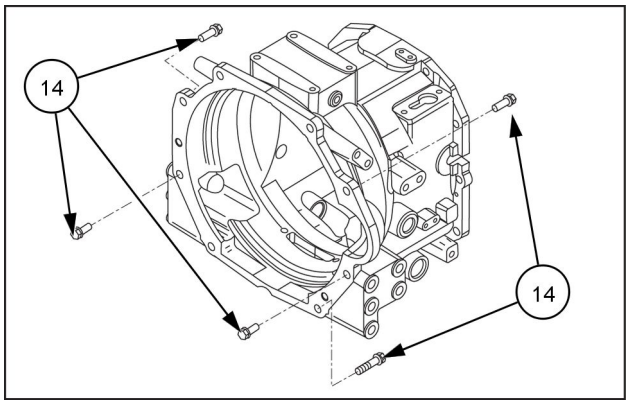
DEFINITIONS:

1. Break-Away Torque - Torque measured in the direction of tightening, the moment before the bolt/nut starts to turn.
2. Clamping Force - Force equal to the tension in the fastener that clamps the parts together.
3. Stabilized Torque - Torque measured on a joint that has had a settling time after fastener installation, and the torque is measured in the direction of tightening, the moment after the bolt/nut begins to turn.
4. Proof Load - Safe test load for fasteners, approximately 10% below the yield load.
5. Torque - Force on the wrench handle times the handle length.
6. Torque and Turn - Bolting method utilizing a torque sufficient to close the joint, followed by rotation of a specific angle to obtain the desired bolt stretch.
7. Torque to Yield - Bolting method that tightens the joint until 0.2% yield is detected. Generally requires a computer monitored tightening tool.
8. Target Torque - Torque specified by engineering, generally nominal torque.
9. Ultimate Load - Load when bolt failure occurs.
10. Yield Load - Load when 0.2% deformation occurs.



NHIL15CT00475HA 1

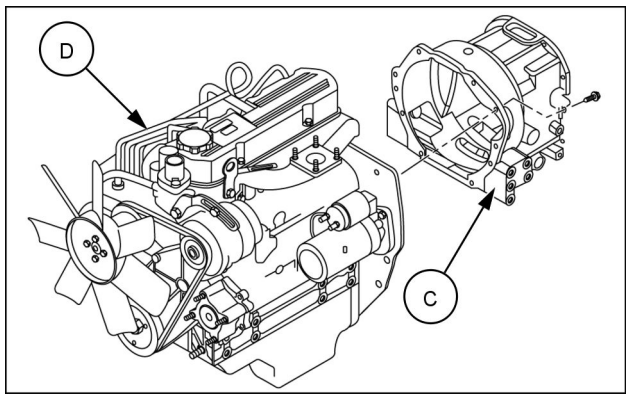
15. Unfasten eight M12 bolts **(14)** that fasten the engine and transmission, while checking front wheel drive shaft for separation from the transmission.



NHIL13CT00451AA 10

NOTE: *The hoist and/or the floor jack may need to be raised or lowered to allow the separation of the engine from the clutch housing.*

16. Carefully roll the drive train **(C)** away from the engine **(D)**, using the floor jack for support.



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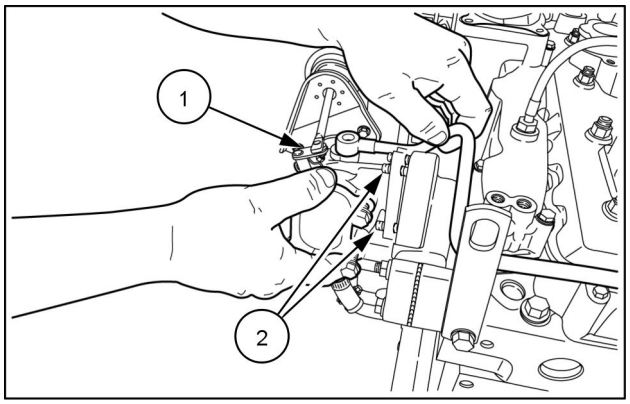
Air cleaners and lines - 202

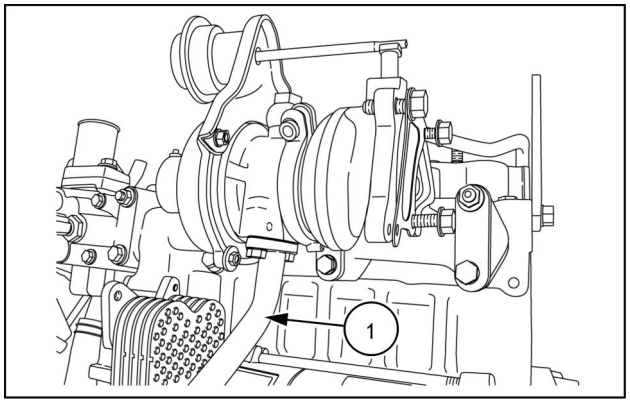
Turbocharger - Install

1. Install turbocharger **(1)** with a new gasket on exhaust manifold studs **(2)** and torque nuts to **23 - 28 N·m** (**17.0 - 21 lb ft**).



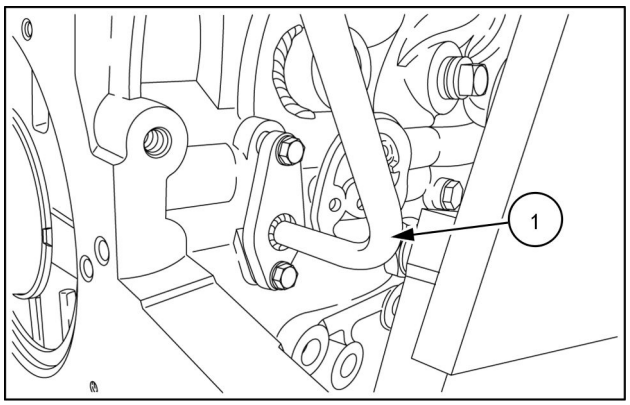
NHIL12ENG0232AA 1

2. Install oil return line **(1)** with a new gasket, between turbocharger and engine block.



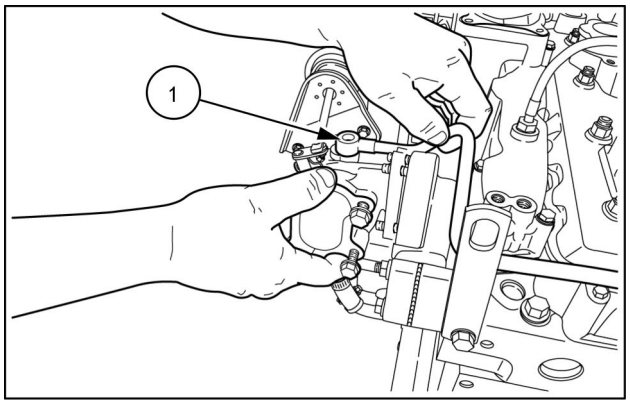
NHIL12ENG0181AA 2

3. Install oil supply line **(1)** with a new gasket, to the engine block.



NHIL12ENG0230AA 3

4. Install the oil supply line banjo fitting **(1)** with washers and torque to **8 - 11 N·m** (**6 - 8 lb ft**).
5. Check oil level before starting the engine to avoid damage to the turbocharger and engine.



NHIL12ENG0232AA 4

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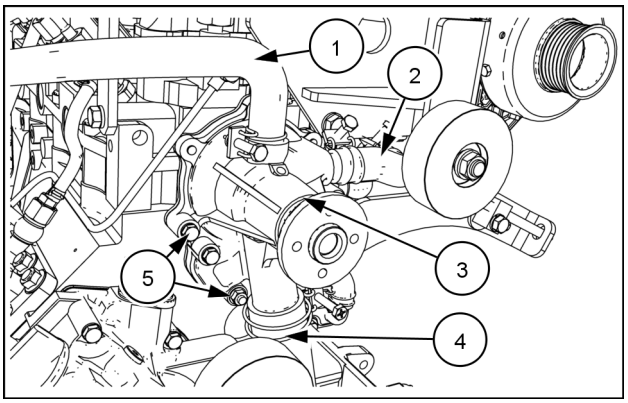
Engine - 10

Engine lubrication system - 304

Water pump - Remove

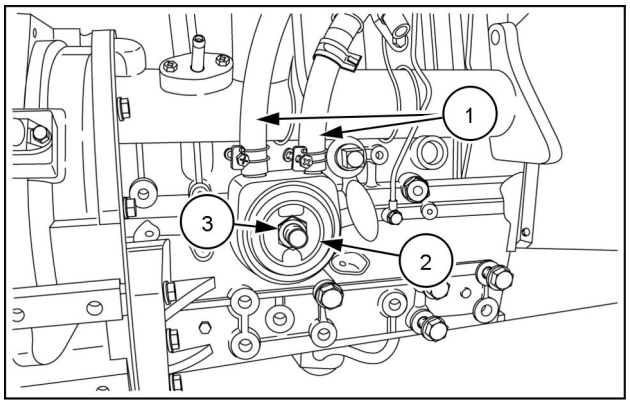
1. Remove the oil cooler hose **(1)**, bypass hose **(2)** and lower radiator hose **(4)** from the water pump **(3)**.
2. Remove the water pump retaining bolts **(5)** and remove the water pump **(3)** and gasket from the engine.



NHVM13ENG0196AA 1

Engine oil cooler - Install

1. Install the oil cooler **(2)** to the engine block and secure with nut **(3)**.
2. Install the coolant hoses **(1)** and tighten the hose clamps.
3. Thread the oil filter onto the oil cooler **(2)**.



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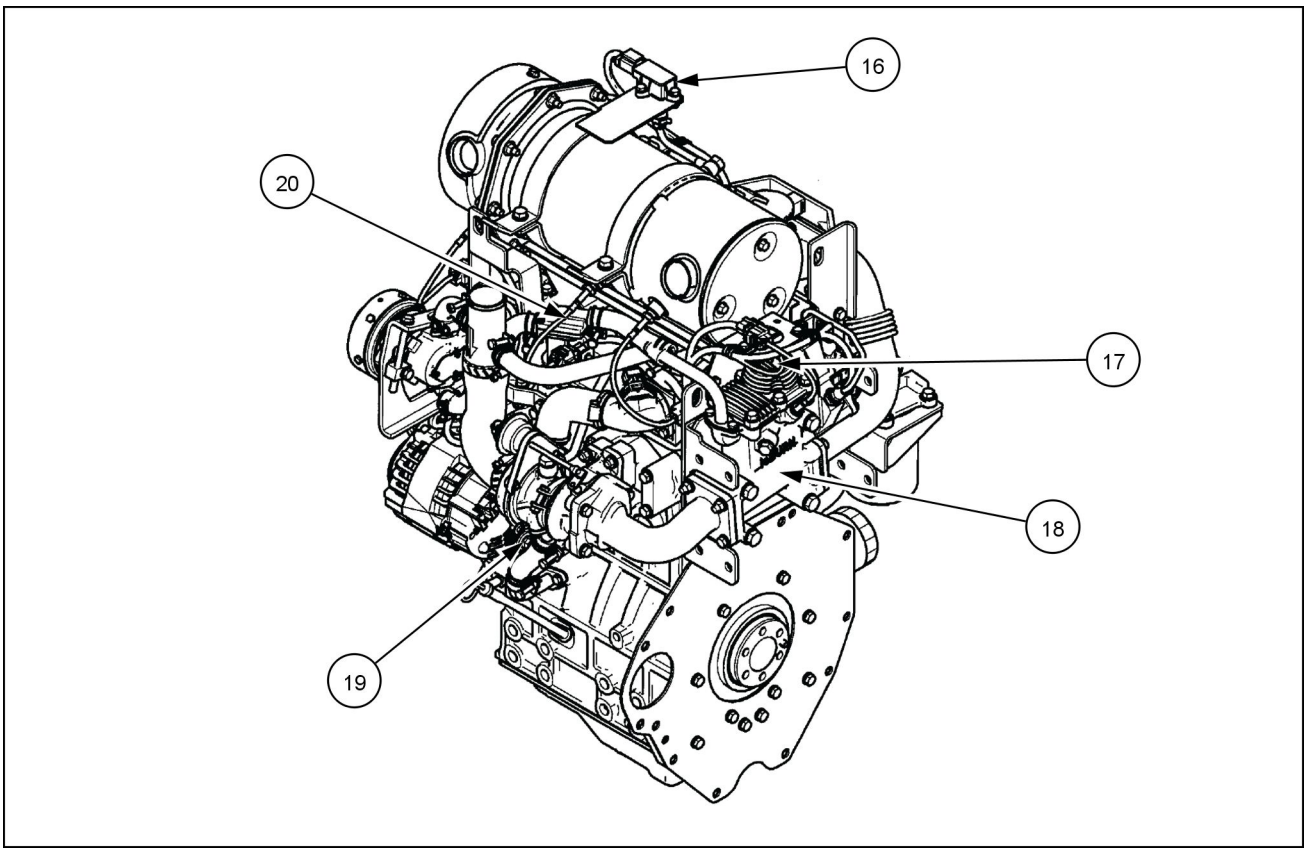


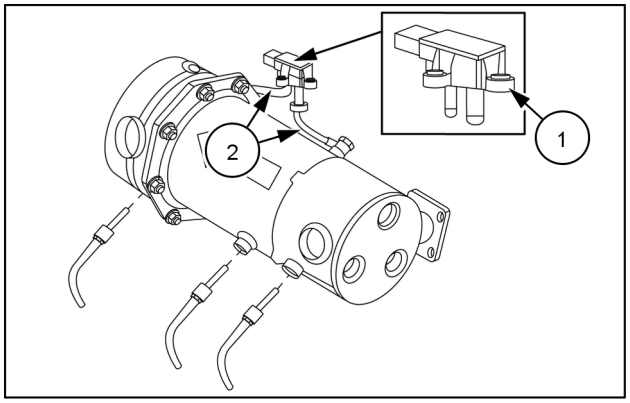
NHIL15CT00944FA 2

(16) Pressure sensor
(17) Burner glow plug
(18) Burner assembly
(19) Temperature sensor
(20) Reed valve

Diesel Particulate Filters (DPF) - Inspect – Differential pressure sensor

1. Inspect the differential pressure sensor **(1)**.
   - Check the differential pressure sensor piping **(2)**.
   - Check the differential pressure sensor electrical connections.

   If there is any damage, repair or replace as needed.
2. Replace the differential pressure sensor when indicated by the Engine Control Unit (ECU).

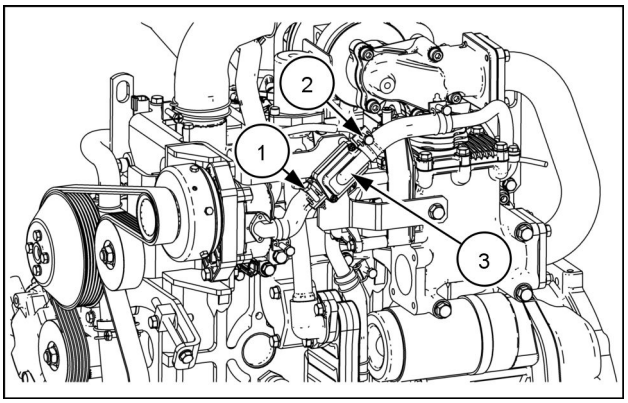


NHIL13ENG0168AA 1

Air pump - Install - Reed valve

1. Connect hoses **(1)** and **(2)** to the reed valve **(3)** and tighten the hose clamps.

NOTICE: *The arrow on the reed valve case needs to point toward the afterburner. Incorrect installation will result in air pump damage.*



NHVM13ENG0188AA 1

Clutch hydraulic release control - Adjust

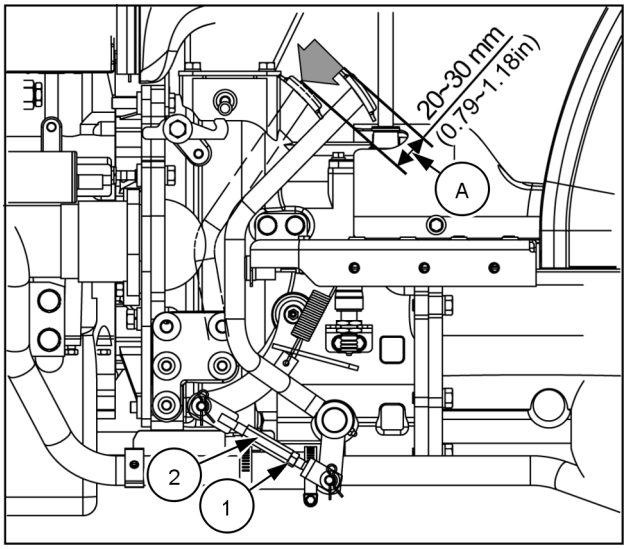
Workmaster™ 33	NA
Workmaster™ 37	NA

NOTE: *Check clutch pedal free travel after every 50 hours of operation.*

Clutch pedal free travel should be maintained at **(A) = 20 - 30 mm** (**0.79 - 1.18 in**).

To adjust the clutch pedal:

1. Loosen lock nut **(1)** and rotate adjuster **(2)**
2. Tightening the adjuster will decrease the free play travel and loosening the adjuster will increase the free play travel.
3. Tighten the lock nut when the correct free play travel is obtained
4. Check clutch for disengagement when clutch pedal is fully depressed.



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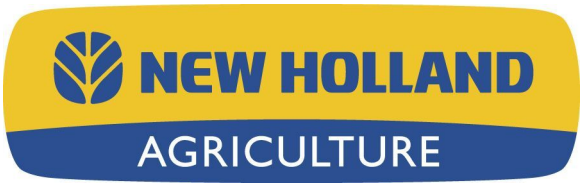

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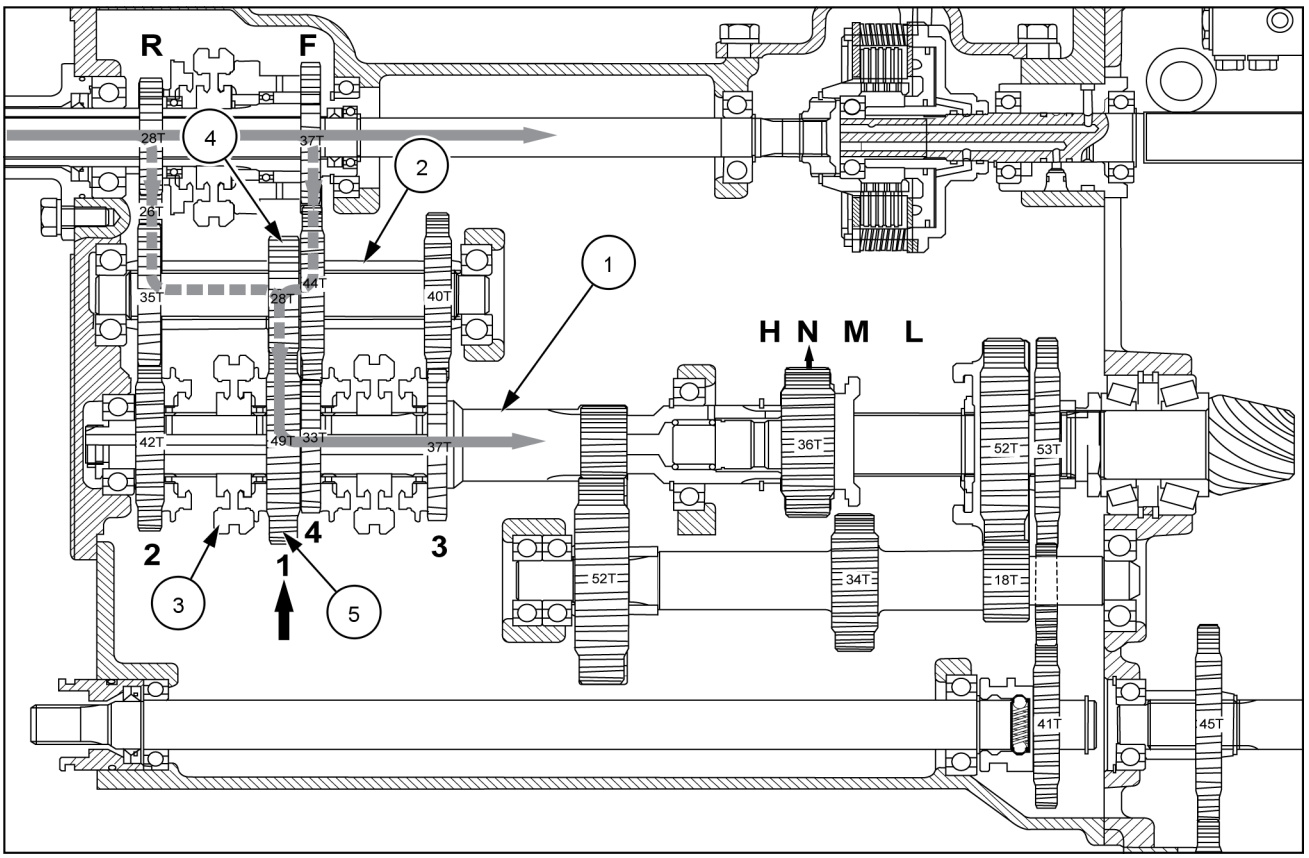


NHIL13CT00831FA 6

First Gear

Torque is applied to the 1-4 speed output shaft **(1)** in either the forward or reverse direction by the 1-4 speed counter shaft **(2)**. All of the gears on the counter shaft mesh with the gears on the output shaft. When the 1st and 2nd gear synchromesh selector **(3)** is in the 1st gear position, the torque from counter shaft 1st gear (28T) **(4)** is applied to the output shaft 1st gear (49T) **(5)**.

Mechanical transmission - Disassemble shift lever

Workmaster™ 33	NA
Workmaster™ 37	NA

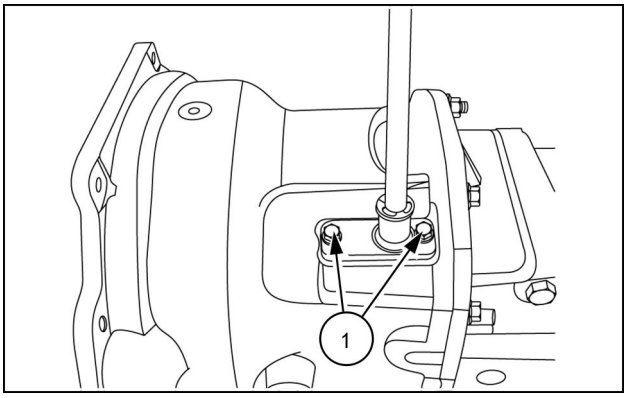
⚠ WARNING

Heavy object!
ALWAYS use a hoist or get assistance to lift the component.
Failure to comply could result in death or serious injury.

W0086A

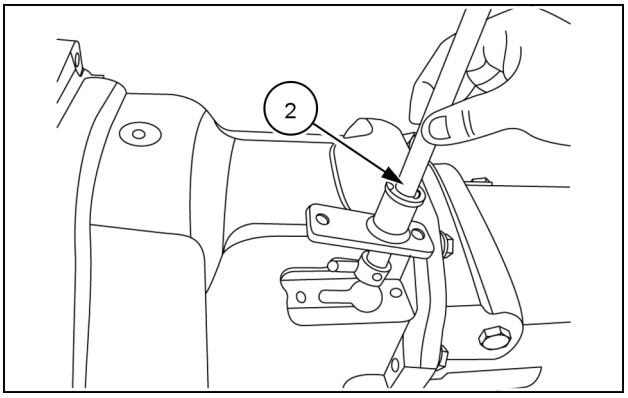
Refer to **Mechanical transmission - Exploded view shift lever and fork mechanical transmission (21.114)** for an exploded view.

1. Remove the two M8 x 25mm bolts **(1)**.



93102295 1

2. Remove the shift lever **(2)**.



93102296 2

Mechanical transmission - Overhaul Sub shaft and Counter shaft Disassembly

Workmaster™ 33	NA
Workmaster™ 37	NA

⚠ WARNING

Heavy object!
ALWAYS use a hoist or get assistance to lift the component.
Failure to comply could result in death or serious injury.

W0086A

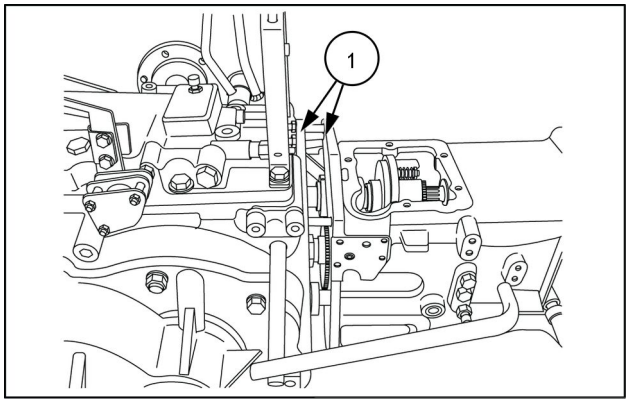
⚠ WARNING

Avoid injury!
Handle all parts carefully. Do not place your hands or fingers between parts. Use Personal Protective Equipment (PPE) as indicated in this manual, including protective goggles, gloves, and safety footwear.
Failure to comply could result in death or serious injury.

W0208A

Removal

1. Separate the case **(1)**.



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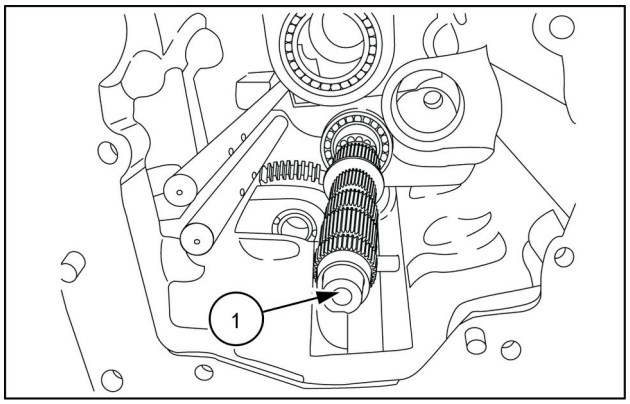
Sub shaft and Counter shaft Disassembly

1. To disassemble the shaft **(1)**, use a brass punch and hammer.



NHIL13CT00097AA 2

Mechanical transmission - Install PTO drive shaft

Workmaster™ 33	NA
Workmaster™ 37	NA

⚠ WARNING

Heavy object!
ALWAYS use a hoist or get assistance to lift the component.
Failure to comply could result in death or serious injury.

W0086A

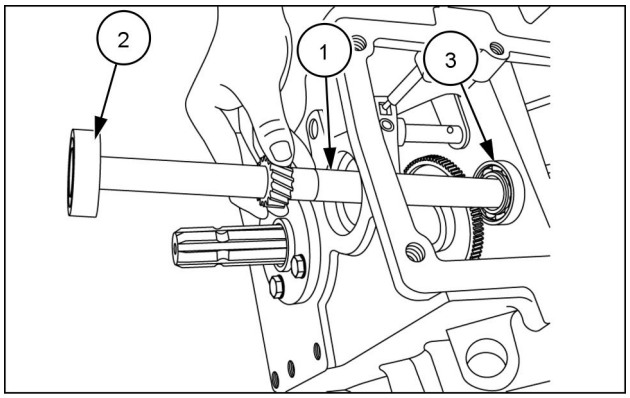
⚠ WARNING

Avoid injury!
Handle all parts carefully. Do not place your hands or fingers between parts. Use Personal Protective Equipment (PPE) as indicated in this manual, including protective goggles, gloves, and safety footwear.
Failure to comply could result in death or serious injury.

W0208A

Prior operation:
Mechanical transmission - Remove (21.114)

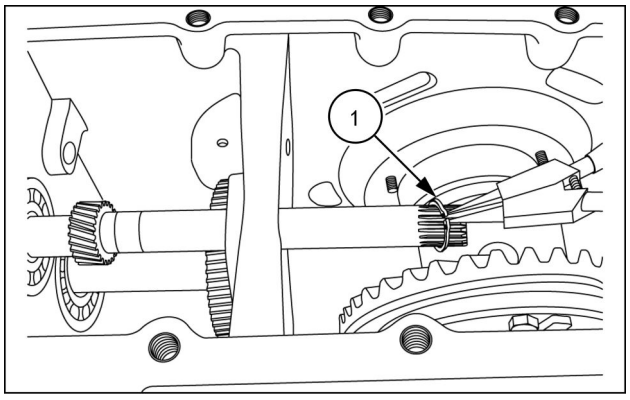
1. Install the drive shaft **(1)** and two bearings **(2)** and **(3)**.



761906811 1

2. Install the drive shaft snap ring **(1)**.

NOTICE: *Ensure that both snap rings are installed on each side of the coupler.*



76106812 2

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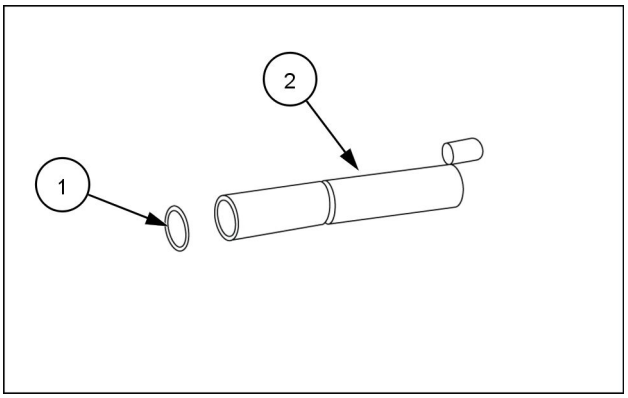
Mechanical transmission external controls - 130

(*) See content for specific models

NOTE: *Be sure to check the O-ring* ***(1)*** *on the engage lever* ***(2)****, replace if necessary.*



93102532A 13

Next operation:
Transmission shaft - Install (21.140)

Transmission internal parts - Remove - shuttle rail bolt

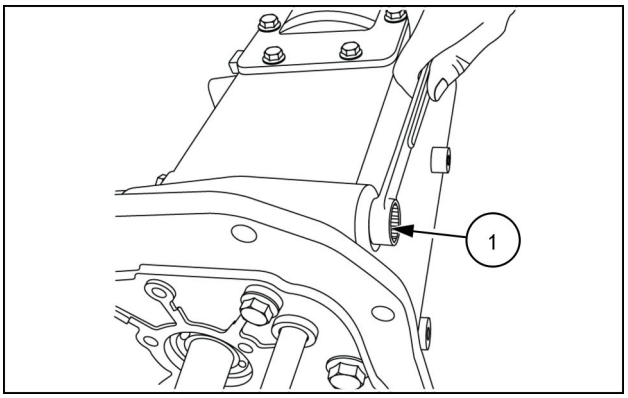
Workmaster™ 33	NA
Workmaster™ 37	NA

⚠ WARNING

Heavy object!
ALWAYS use a hoist or get assistance to lift the component.
Failure to comply could result in death or serious injury.

W0086A

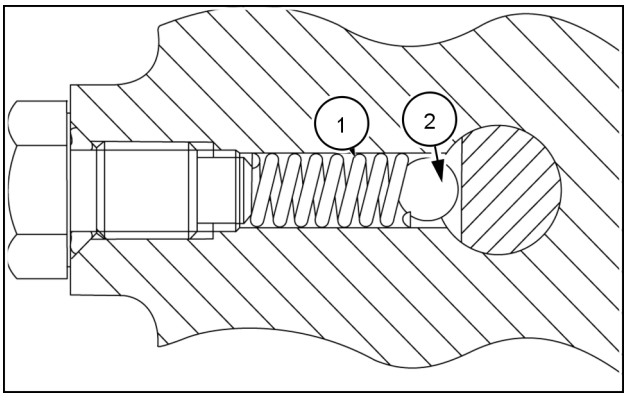
1. Remove shuttle rail bolt **(1)**.



93102298 1

NOTE: *Use a magnet to remove the spring and ball.*

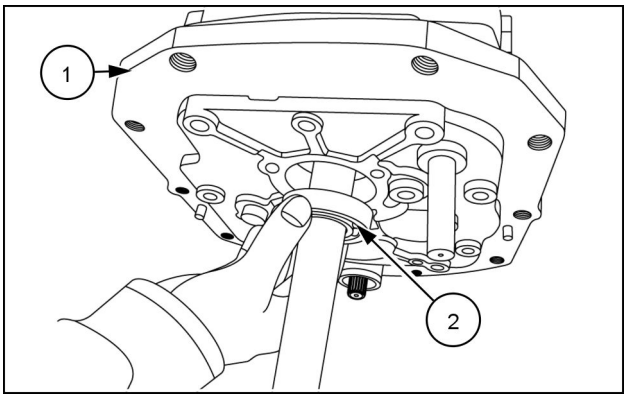
2. Remove the spring **(1)** and ball **(2)**.



93102299 2

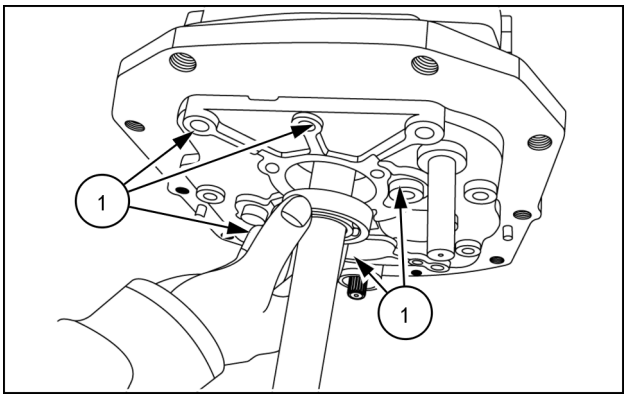
Next operation:
Transmission internal parts - Install (21.140)

6. Install transmission cover **(1)**.
7. Install the bearing **(2)** at the same time.

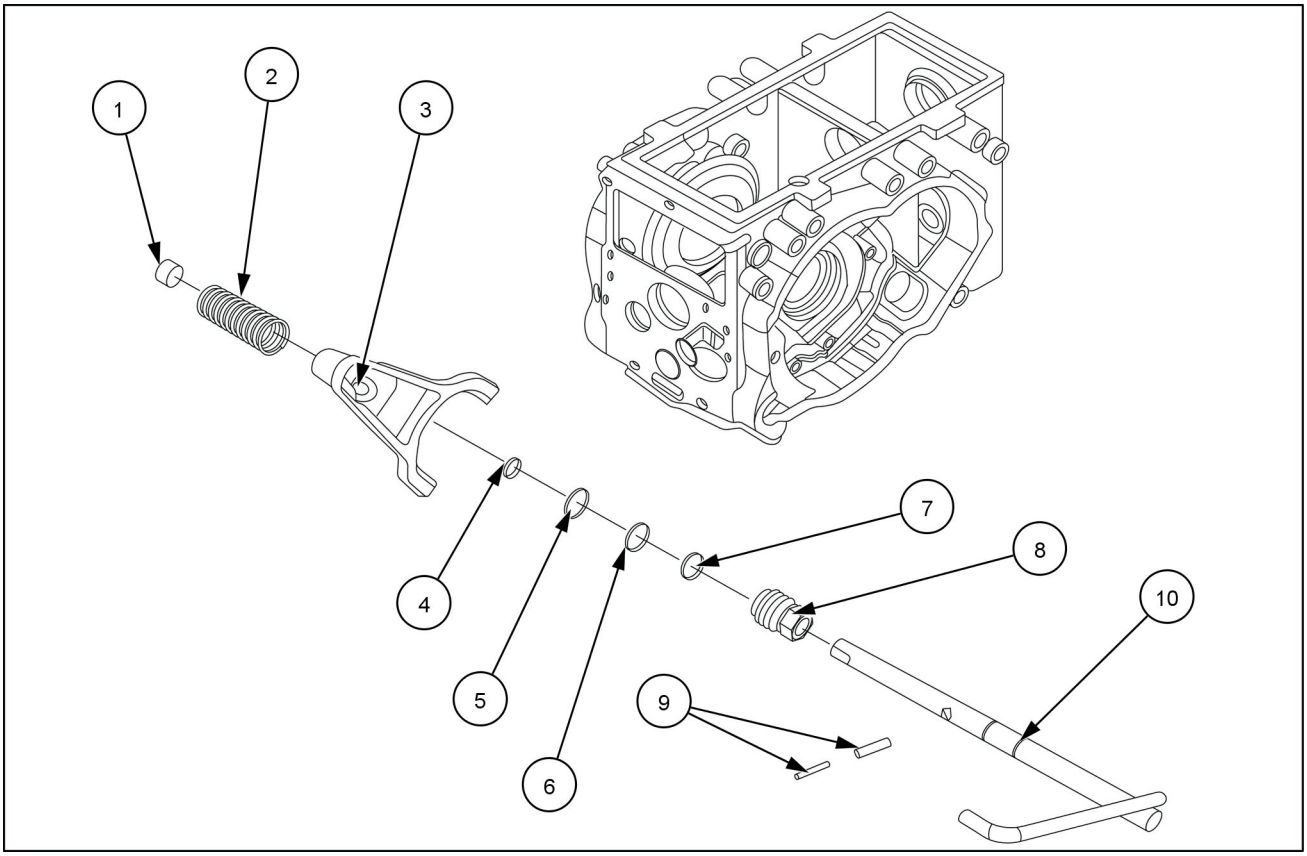


93102305 7

8. Install five **10 x 30 mm** bolts **(1)** and torque to **49 - 54 N·m** (**36 - 40 lb ft**).



93102305 8

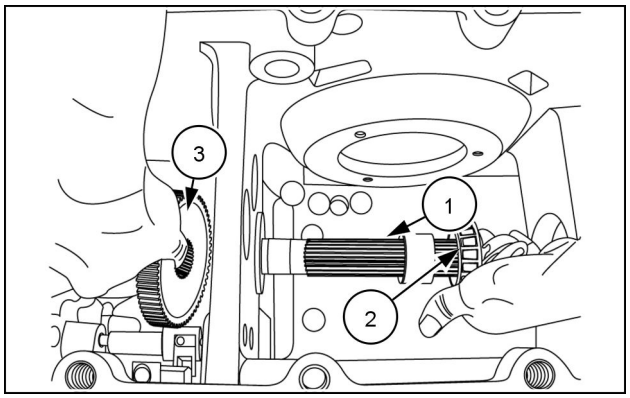


NHIL13CT00127FA 2

Differential Lock (Hydrostatic transmission)

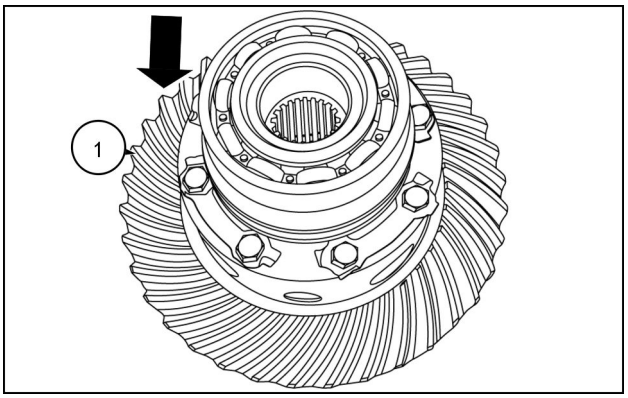
(1) Bushing	**(3)** Differential lock fork	**(5)** Teflon seal	**(7)** Teflon Seal	**(9)** Spring pin
(2) Spring	**(4)** Snap Ring	**(6)** O - ring	**(8)** Adapter	**(10)** Differential lock pedal

1. Install the pinion shaft **(1)** and bearing **(2)** and the gear **(3)**.



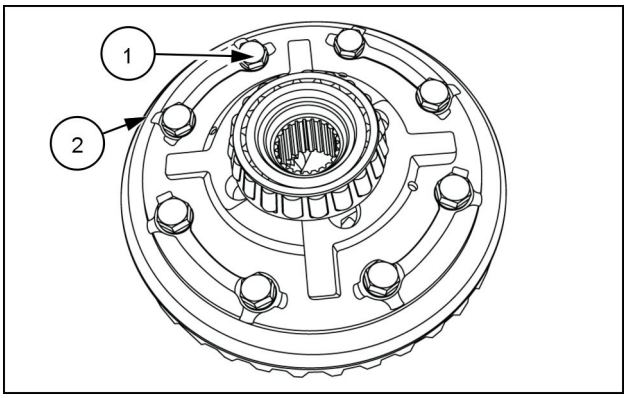
93102524 3

11. Install the ring gear **(1)**.



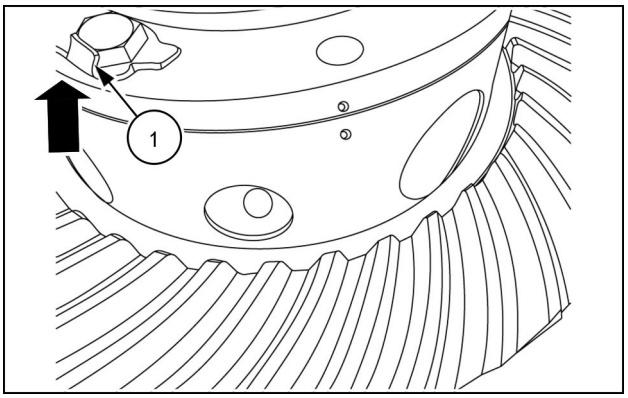
93104574 9

12. Secure the ring gear using eight **12x22 mm** bolts **(1)** and locking devices **(2)**.
13. Torque these bolts to **93.2 - 108 N·m** (**69 - 80 lb ft**)



93104579 10

14. Secure the locking device to the nut head by bending the tabs **(1)** upward.



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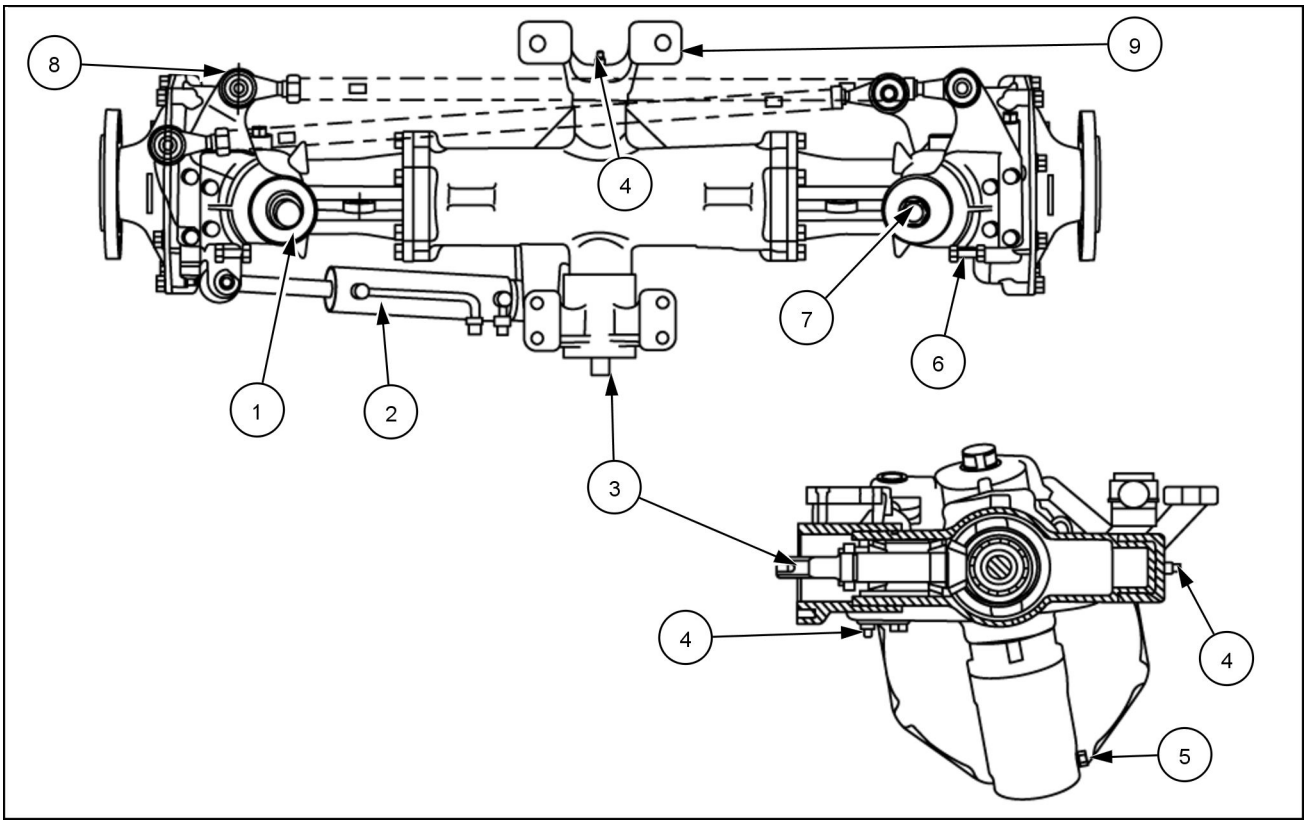
(*) See content for specific models

Powered front axle - Overview

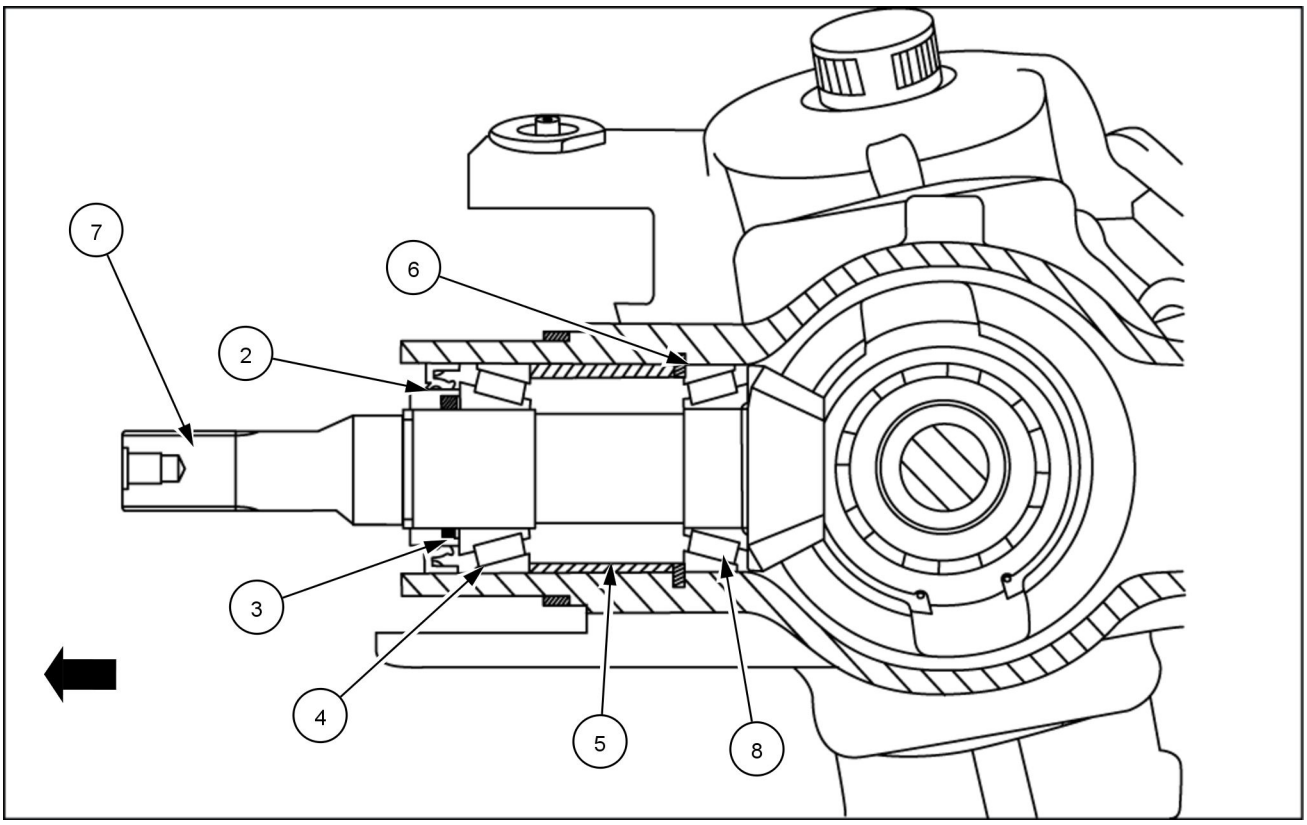
Workmaster™ 33	NA
Workmaster™ 37	NA



93105715 1

Illustration of the powered front axle

(1) Oil fill	**(4)** Grease zerk	**(7)** Dipstick
(2) Steering cylinder	**(5)** Oil drain plug	**(8)** Tie rod
(3) Drive shaft	**(6)** Steering angle adjuster bolt	**(9)** Support bracket

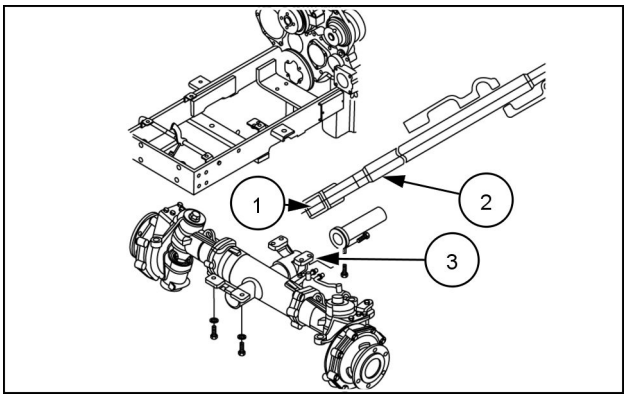


93105748 15

2. Remove seal **(2)**.
3. Remove snap ring **(3)**.
4. Remove tapered bearing **(4)**.
5. Remove spacer **(5)**.
6. Remove inner snap ring **(6)**.
7. Slide pinion shaft **(7)**, and inner bearing, race **(8)** towards the pinion shaft opening.

Next operation:
Powered front axle - Assemble (25.100)

5. Lubricate and install splined coupler **(1)** to drive shaft **(2)**.
6. Connect the coupler to axle input shaft **(3)**.

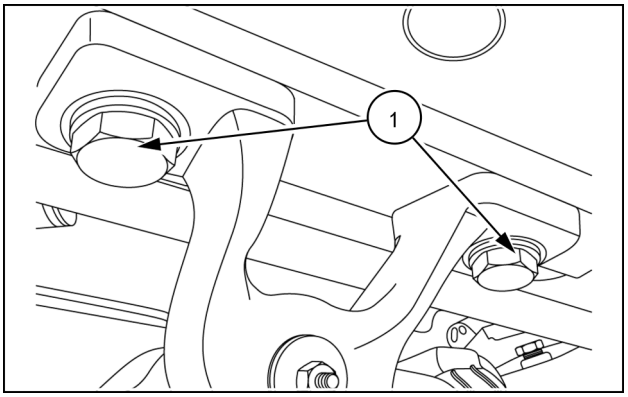


93100303 2

NOTICE: *Make sure drive shaft is properly engaged in both the front and rear.*

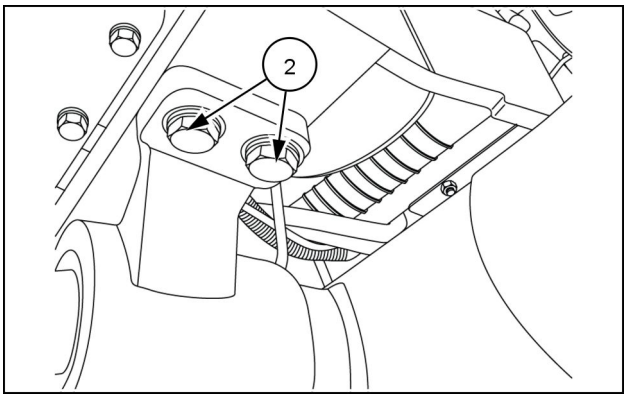
NOTICE: *Apply* ***LOCTITE® 242®*** *thread locking compound to front axle mounting bolts during installation.*

7. Install mounting flange pivots **(1)** and **(2)**.



93104524 3

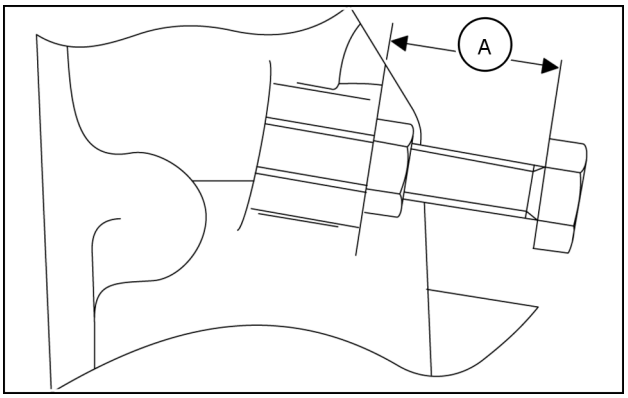
8. Connect the axle to the frame. Secure with four **M12 x 45 mm** fine thread bolts with lock washers on rear support **(2)** and two **M 16 x 40 mm** fine thread bolts with lock washers on front support **(1)** Torque the **M12 x 45 mm** bolts to **93 - 108 N·m** (**69 - 80 lb ft**), and the **M16 x 40 mm** to **177 - 196 N·m** (**131 - 145 lb ft**)



93104523 4

NOTICE: *Be sure the steering stop bolts are installed at the same length measurement* ***(A)*** *as before.*

NOTICE: *A reference measurement* ***(A)*** *will be* ***36.5 mm*** *or 1.44 inches.*



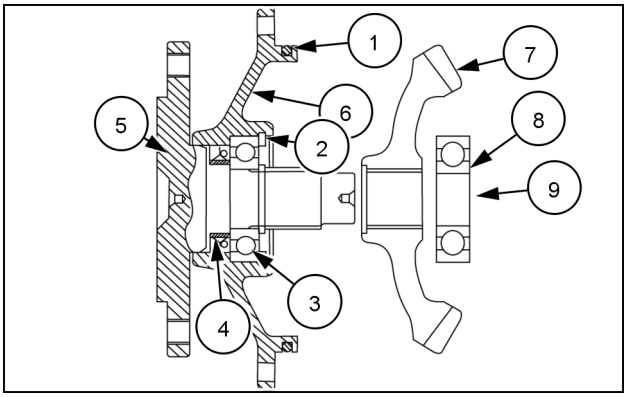
93105721 5

Final drive - Install - Bevel gear

Workmaster™ 33	NA
Workmaster™ 37	NA

Prior operation:
Final drive - Remove - Bevel gear (25.108)

1. Inspect O-ring **(1)**, replace if necessary.
2. Install snap ring **(2)**.



93105733 1

3. Install outer bearing **(3)**.
4. Install new seal **(4)**.
5. Install axle hub shaft **(5)** through seal **(4)** and bearing **(3)** located in gear housing **(6)**.

NOTE: *Apply grease to the hub shaft prior to installation.*

6. Install bevel gear **(7)** on hub shaft **(5)**.
7. Install inner bearing **(8)**.
8. Install a new lock nut **(9) 108.5 - 127 N·m** (**80 - 94 lb ft**) .

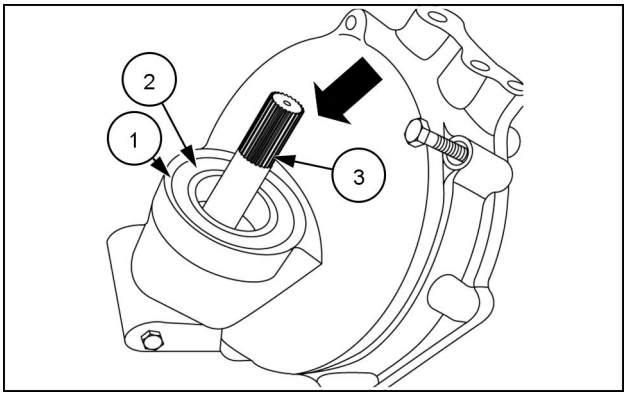
Next operation:
Final drives - Install (25.310)

Final drives - Install - Gear housing

Workmaster™ 33	NA
Workmaster™ 37	NA

Prior operation:
Final drives - Remove - Gear housing (25.310) Final drive hub, steering knuckles, and shafts - Install - Steering arm (25.108)

1. Inspect seal **(1)**, replace if necessary.
2. Install bearing **(2)**.
3. Align shaft **(3)** with spline at the top of the king pin housing, and gear in gear housing.



93105738 1

4. Secure the gear housing **(1)** to the steering arm **(2)**. Use two **M12 x 30 mm**, **(3)**. Torque to **106 N·m** (**78 lb ft**). Use two bolts **M12 x 36 mm**, **(4)**. Torque to **152 N·m** (**112 lb ft**)

Next operation:
Final drives - Install (25.310)

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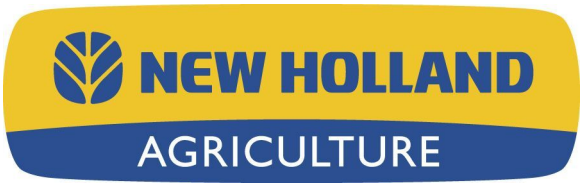
SERVICE - Technical Publications & Tools



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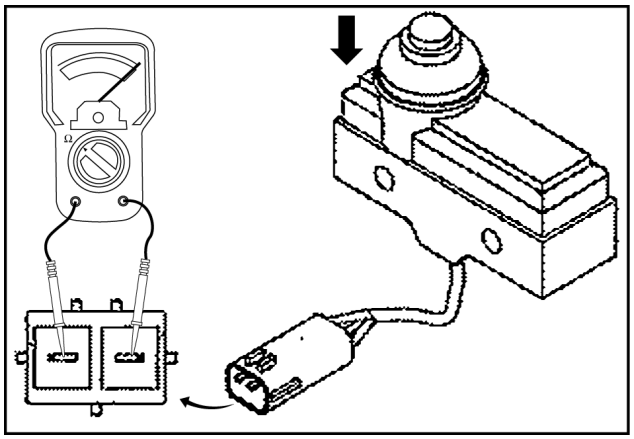
8. Remove bearings **(7)** and **(8)** from the axle housing.

Next operation:
Driving wheel shaft - Remove - Intermediate shaft, bearings, and seals (27.120)

Transmission and steering hand control Transmission command - Test - HST Neutral Switch

Workmaster™ 33	NA
Workmaster™ 37	NA

1. Use an ohmmeter to test for continuity of the switch terminals
2. With the switch plunger extended, there should not be continuity across the switch terminals.
3. With the switch plunger in the retracted position, continuity should exist across the terminals of the switch.



76105635 1

4. If test results are not as described, switch is faulty and needs to be replaced.

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Transmission and steering hydrostatic control - 100

(*) See content for specific models

Hydrostatic transmission - Remove - HST unit

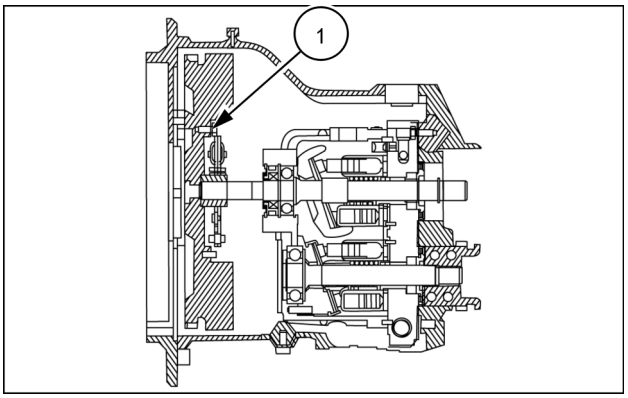
Workmaster™ 33	NA
Workmaster™ 37	NA

⚠ WARNING

Heavy object!
ALWAYS use a hoist or get assistance to lift the component.
Failure to comply could result in death or serious injury.

W0086A

1. Loosen bolts **(1)** and remove damper **(2)**, figure **2**.



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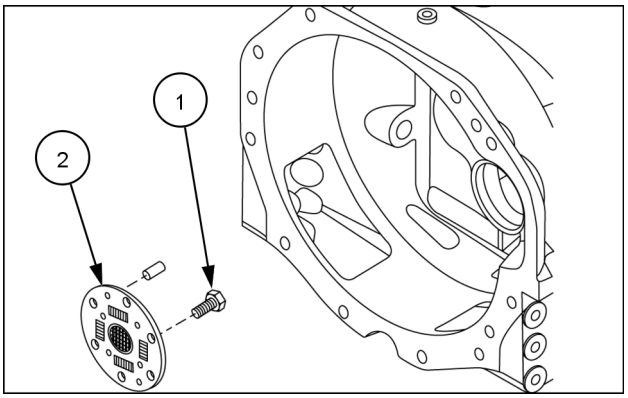
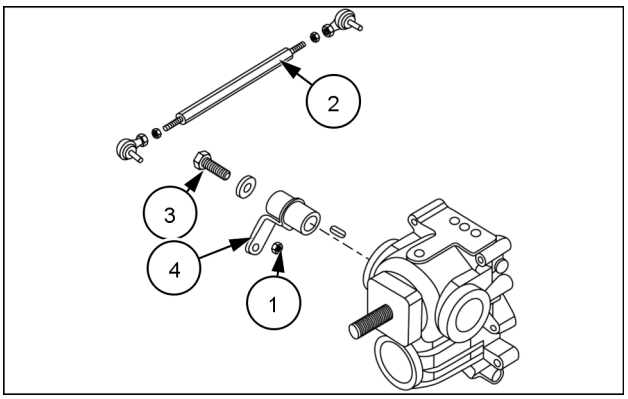


93102277 2

2. Remove nut **(1)** to remove link assembly **(2)**.
3. Remove bolt **(3)** to remove transmission arm **(4)**.

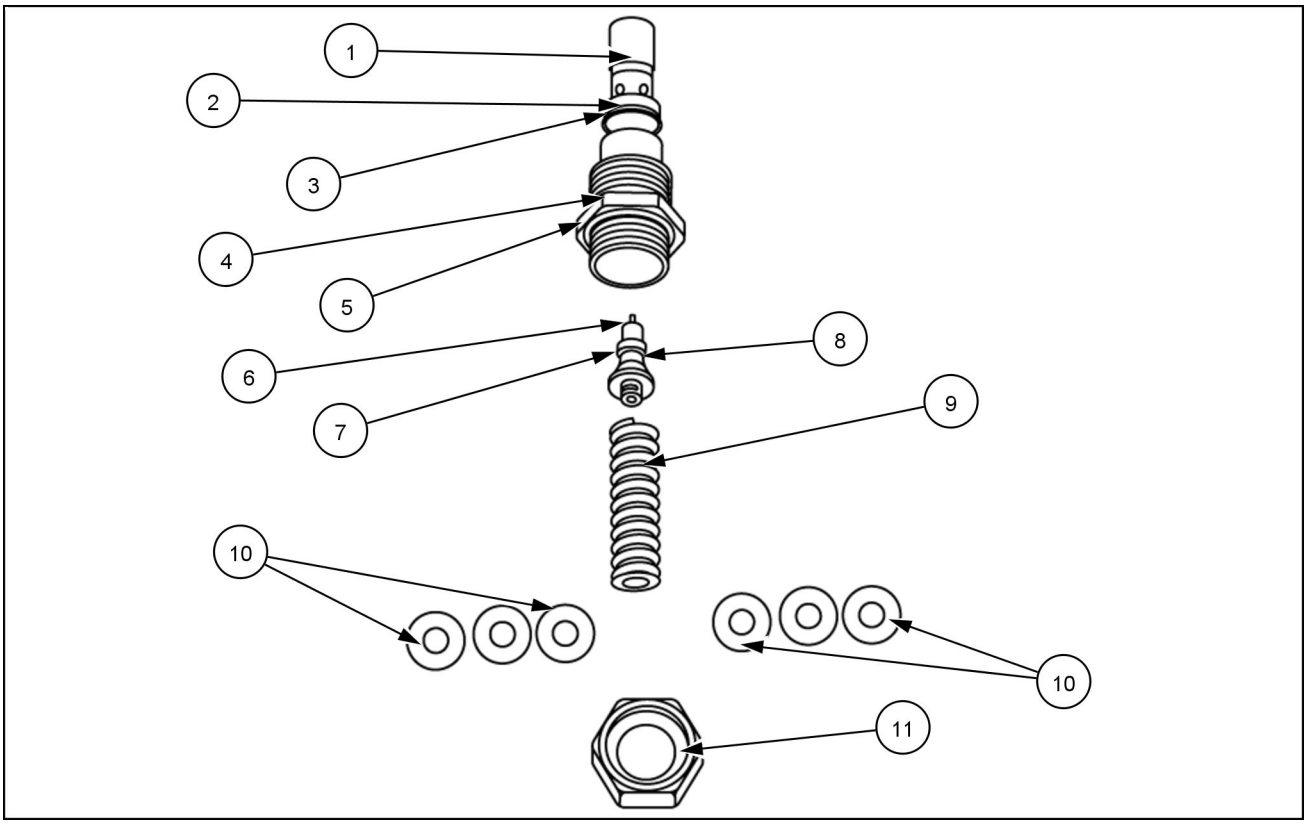


93102278 3

High pressure relief valve removal and disassembly

NOTE: *The high pressure relief valve is located in the port block It protects the drive motor from overloads in both the forward and reverse directions.*

NOTICE: *The shims under the cap establish the relief setting, one shim of* ***.05 mm*** *in thickness increases pressure* ***2760 kPa*** *(****400 psi****)*



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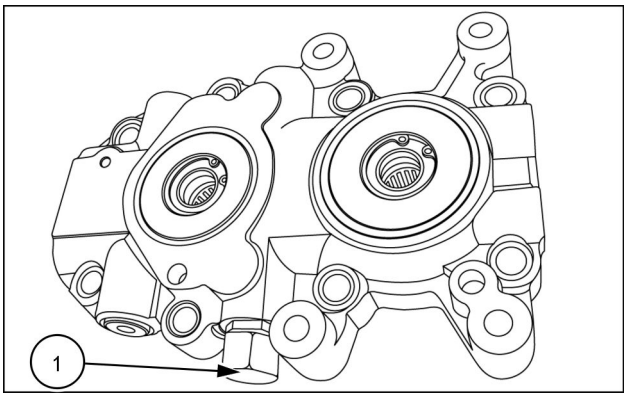
High pressure relief valve

(1) Relief valve housing
(2) O ring
(3) Teflon seal
(4) Housing nut **26 mm**
(5) O ring
(6) Relief poppet
(7) O ring
(8) Teflon seal
(9) Spring
(10) Shims
(11) Outer nut **26 mm**

NOTICE: *The pressure setting shims are located under the nut. Account for all, and reinstall at assembly.*

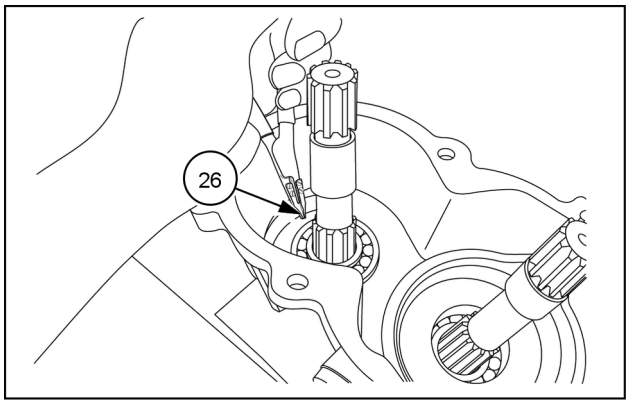
1. Remove the outer nut **(1)** with a **26 mm** socket.



93109688 23

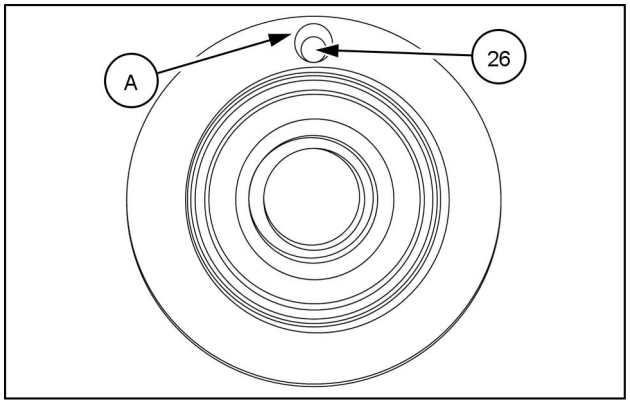
Swash plate assembly on the motor side

1. Install pin **(26)**.



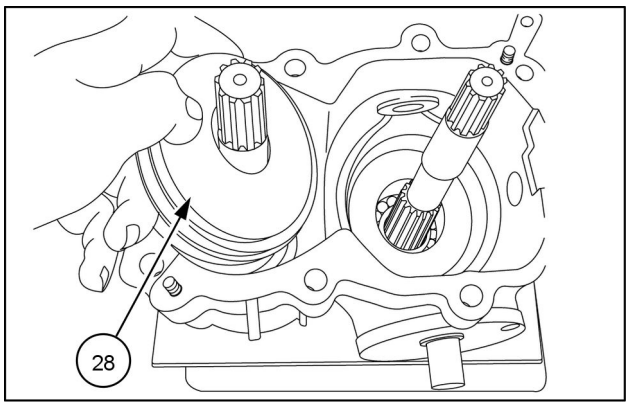
NHIL12CT01062AA 20

2. Align hole **(A)** with pin **(26)**.



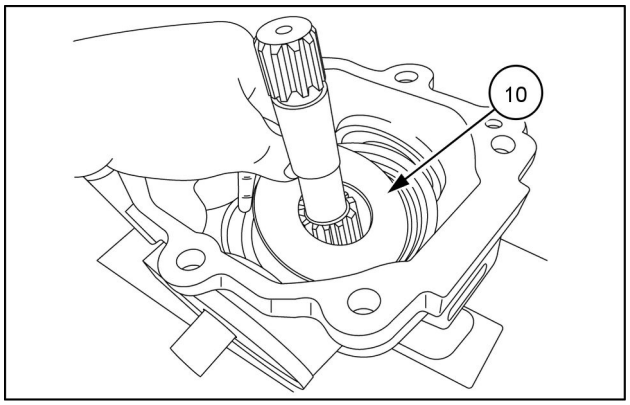
NHIL12CT01064AA 21

3. Install the motor side swash plate **(28)**.



NHIL12CT01065AA 22

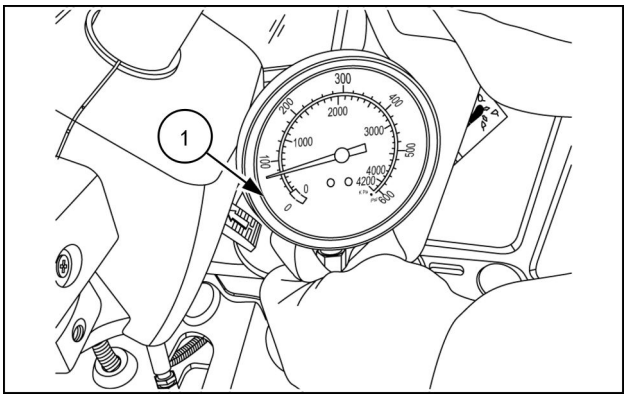
4. Install the thrust plate **(10)** on the pump side.



NHIL12CT01066AA 23

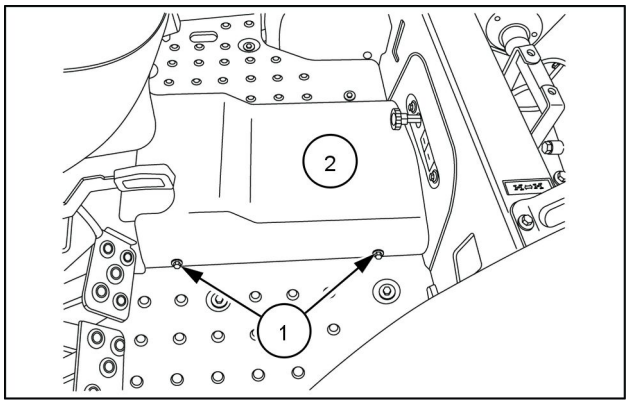
10. With the HST in the neutral position, HST charge pressure should read **490 kPa** (**71 psi**) **(1)**.

11. With the test completed, remove gages and hoses, and install test port plugs, torque to **30 N·m** (**22 lb ft**) MAXIMUM.

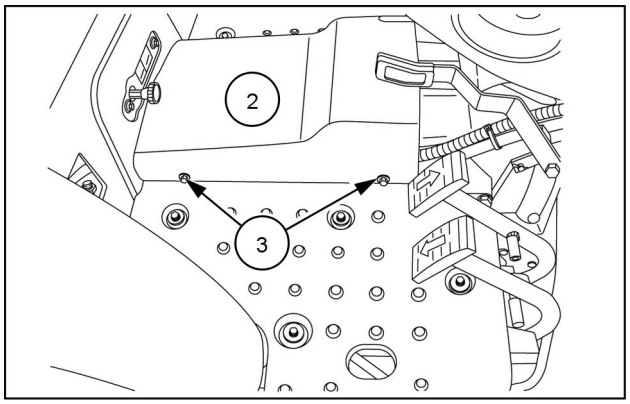


93109711 10

12. Install the transmission cover **(2)**, secure with two bolts **(1)** on the left side, (Refer to figure **11**) and two bolts **(3)** on the right side. (Refer to figure **12**.)



NHIL12CT00733AA 11



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(*) See content for specific models

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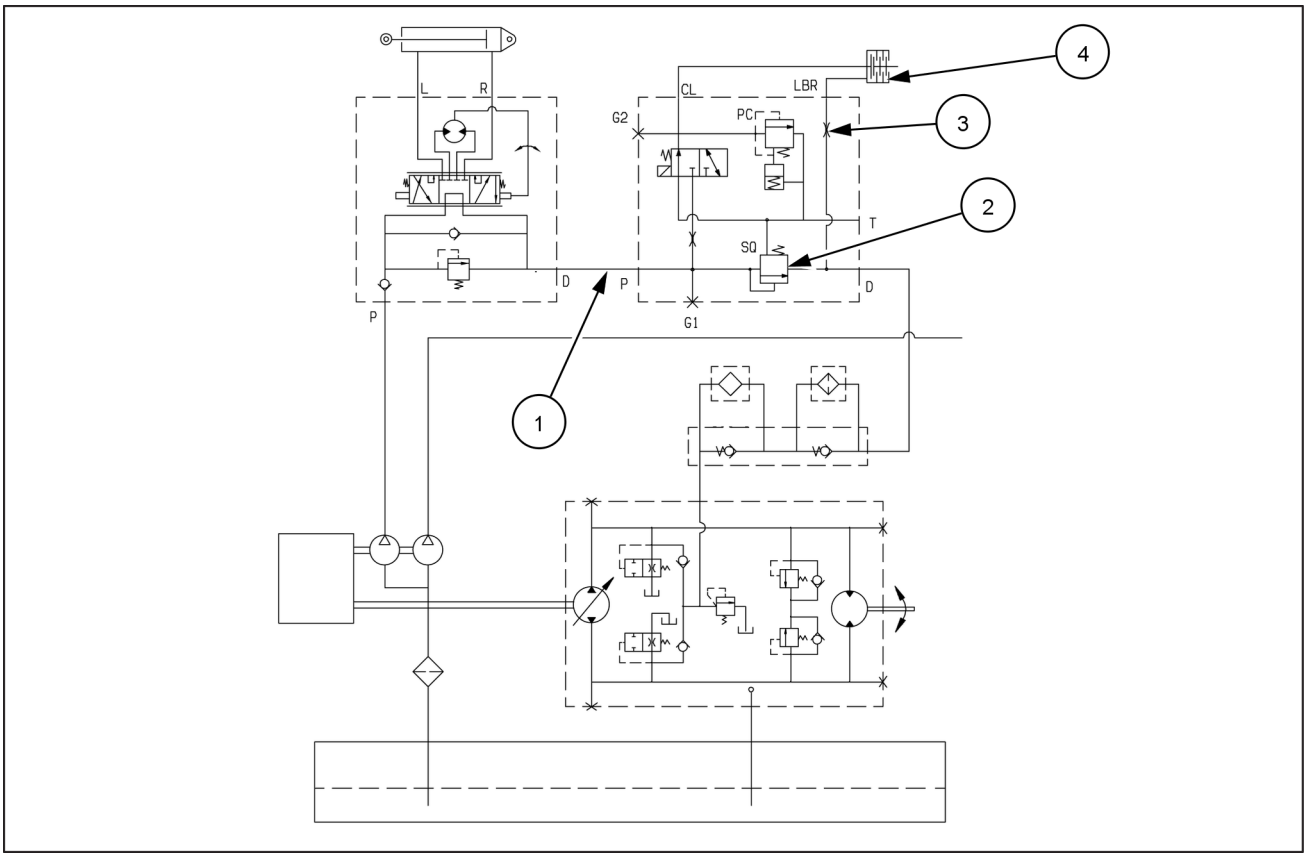
SERVICE

(*) See content for specific models

One-speed rear Power Take-Off (PTO) - Static description Independent PTO valve HST transmission

Workmaster™ 33	NA
Workmaster™ 37	NA

PTO valve operation (solenoid not energized)



NHL13CT00359FA 1

With the engine running and the PTO switch in the OFF position, system hydraulic pressure **(1)** is applied to sequence valve **(2)**.

The sequence valve maintains a hydraulic pressure of **1565 kPa** (**227 psi**).

The sequence valve supplies hydraulic flow through a 1.3 mm orifice **(3)**. The orifice reduces the flow to the PTO clutch **(4)**. This reduced flow is used for lubrication of the clutch pack. The PTO clutch will remain disengaged.

Power Take-Off (PTO) clutch - Install

⚠ WARNING

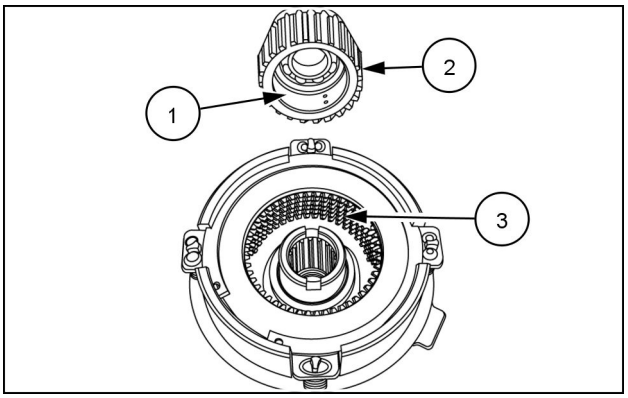
Heavy object!
ALWAYS use a hoist or get assistance to lift the component.
Failure to comply could result in death or serious injury.

W0086A

Prior operation:
Power Take-Off (PTO) clutch - Assemble (31.114)

PTO clutch install

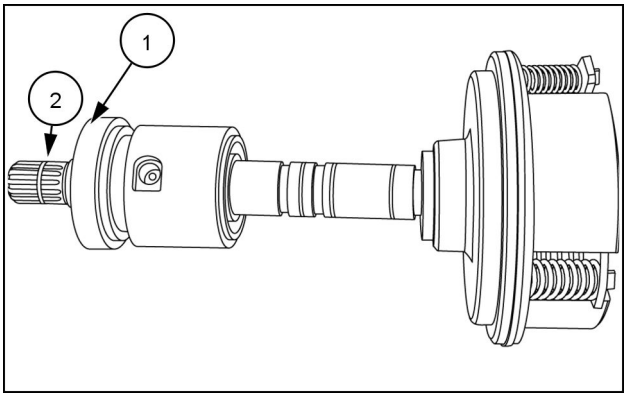
1. Insert the bearing **(1)** into the PTO clutch drive gear **(2)**. Check that the bearing is properly seated in the drive gear.
2. Align the fins of the friction discs **(3)**.



93106751 1

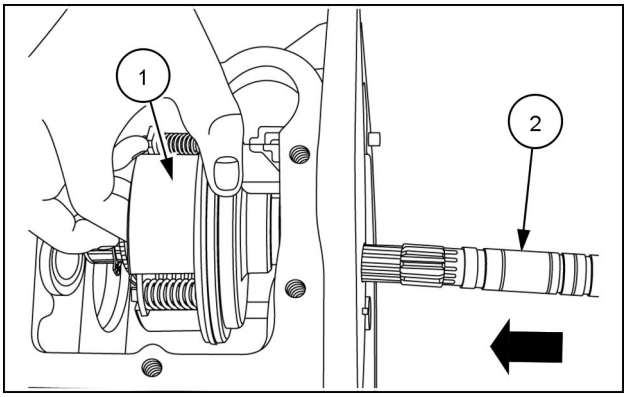
3. Check the bearing **(1)**, if it is damaged, replace.

NOTICE: *When installing the snap ring,* ***(2)*** *ensure the correct edge is installed first.*



93102351 2

4. Support the PTO clutch **(1)**, while inserting the shaft **(2)**.



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Power Take-Off (PTO) - 31

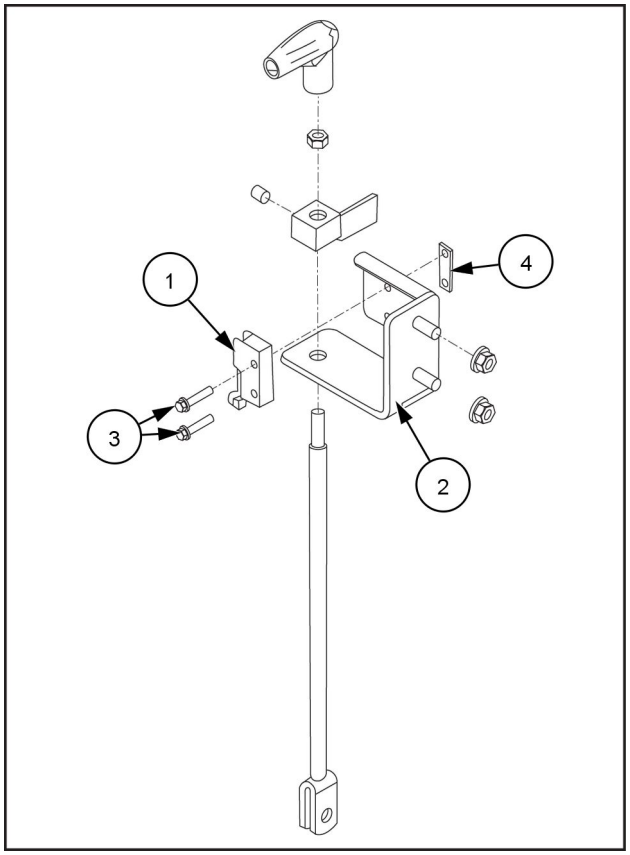
Central Power Take-Off (PTO) - 120

(*) See content for specific models

Central Power Take-Off (PTO) - Install - Switch

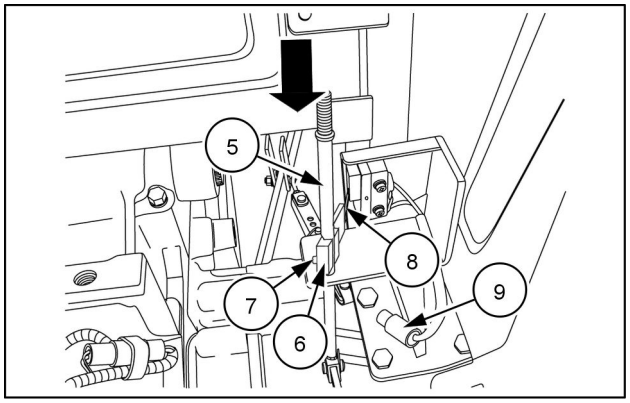
Workmaster™ 33	NA
Workmaster™ 37	NA

1. Install the mid PTO switch **(1)** to mounting bracket **(2)** using two M4 x 30 machine screws, with flat and lock washers **(3)** and locking plate **(4)**.



NHIL13CT00343BA 1

2. Adjust mid PTO switch, with the control rod **(5)** in the down "OFF" position. Align the switch contact bracket **(6)** on the rod so that the set screw **(7)** contacts the flat area of the rod. Secure the contact bracket to the rod by tightening the set screw at this time. Check that the switch arm **(8)** is in the depressed "CLOSED" position.
3. Connect the switch connector **(9)** to the tractor wire harness.
4. Connect negative (-) battery cable to the negative (-) battery terminal.



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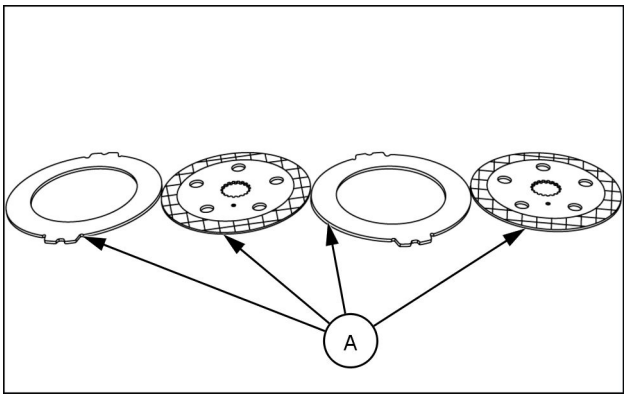
(*) See content for specific models

6. Separate the discs and with a micrometer measure the thickness **(A)** of each component, ensuring that they are within specified tolerances as listed in the specification section of this instruction. Replace if necessary.



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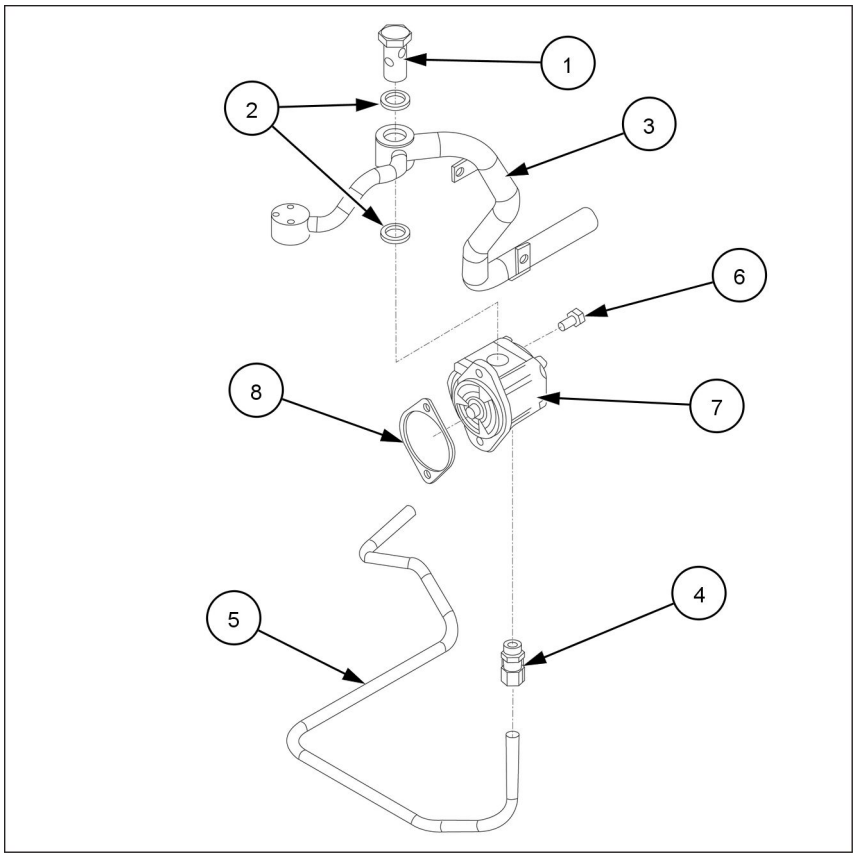
Hydraulic systems - 000

(*) See content for specific models

Fixed displacement pump - Remove

Workmaster™ 33	NA
Workmaster™ 37	NA



NHIL13CT00379GA 1

1. Remove banjo bolt **(1)** and copper seal washers **(2)** from top inlet tube **(3)**.
2. Loosen fitting **(4)** from bottom pressure tube **(5)**.
3. Remove the two bolts **(6)** that retain hydraulic pump **(7)**.
4. Remove the hydraulic pump **(7)** and gasket **(8)** from the engine.

Next operation:
Fixed displacement pump - Install (35.104)

Contents

Hydraulic systems - 35

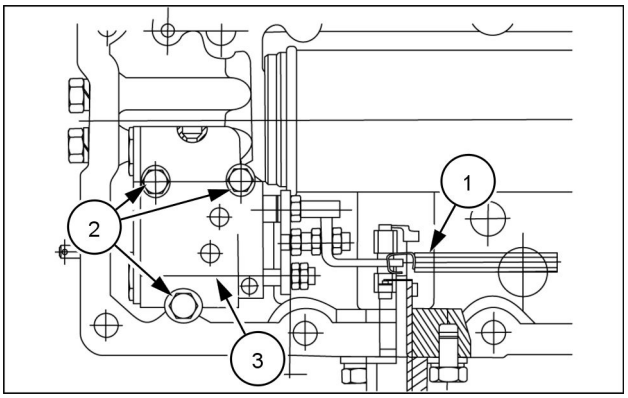
Three-point hitch control valve - 114

(*) See content for specific models

Hitch control valve - Remove

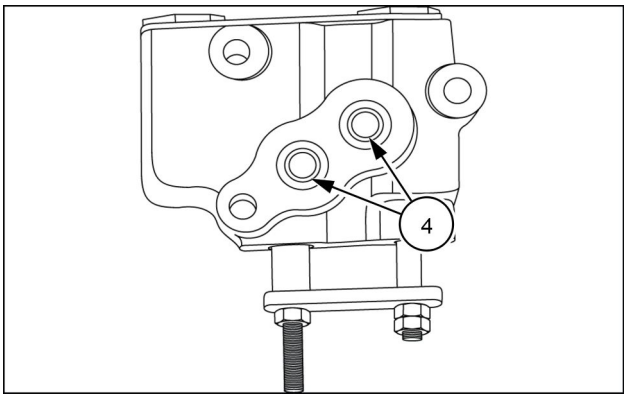
Workmaster™ 33	NA
Workmaster™ 37	NA

1. Lower 3pt hitch completely, to relieve all oil pressure in HPL system.
2. Remove HPL housing from the transmission case.
3. Remove spring **(1)** and the three retaining bolts **(2)**.
4. Remove control valve **(3)** from the HPL housing.



93102615 1

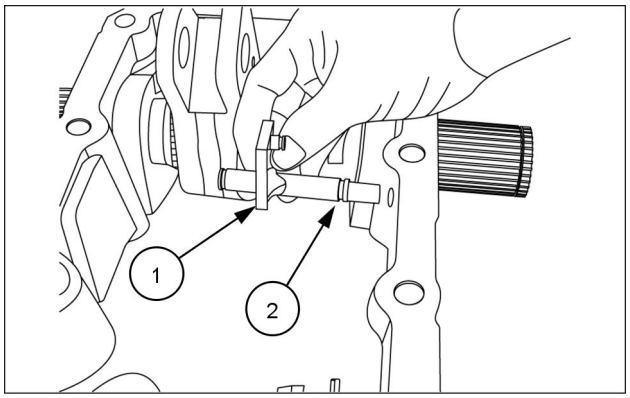
5. Verify the two O-rings **(4)** are present on the control valve and are not damaged.



93102617 2

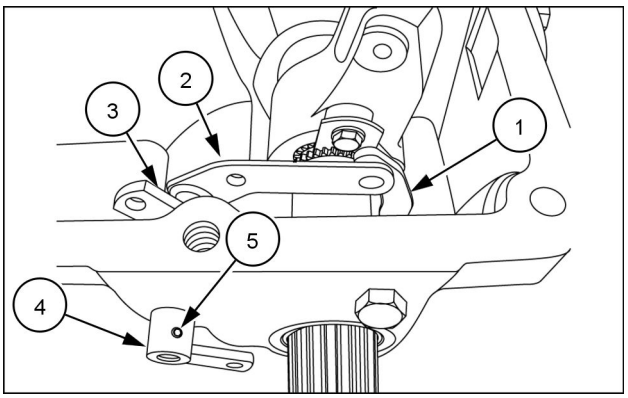
Next operation:
Hitch control valve - Disassemble (35.114)

7. Install draft control shaft **(1)** with O-ring, **(2)** from the inside of the housing.



93102628 2

8. Install feed back connector link **(1)** and onto feed back pin .
9. Install feed back link **(2)** onto feed back connector link **(1)** and draft control shaft **(3)**. Secure links with "E" rings
10. Install draft arm **(4)** to the end of the draft control shaft. Secure arm to shaft with roll pin **(5)**.



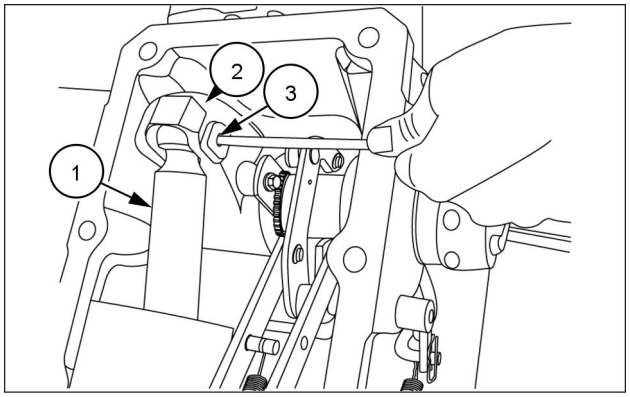
93109585 3

Three-point hitch cylinder - Remove - HPL

Workmaster™ 33	NA
Workmaster™ 37	NA

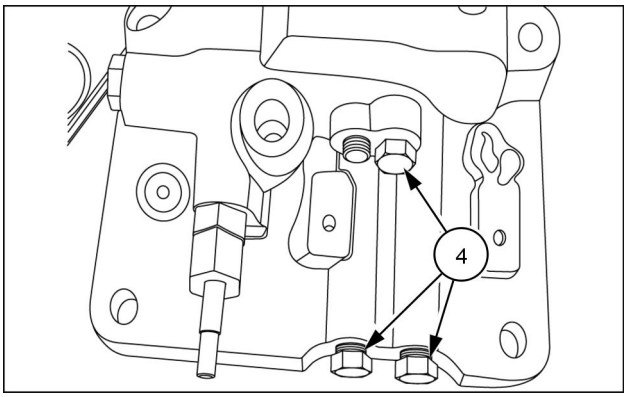
1. Remove the HPL housing from the tractor.
2. Disconnect the connecting rod **(1)**from the pivot arm **(2)**, by driving pins **(3)** out of the pivot arm, with a punch and hammer.

NOTE: *The pins **(3)** are a smaller diameter pin inside a larger diameter pin, remove pins separately during disassembly.*



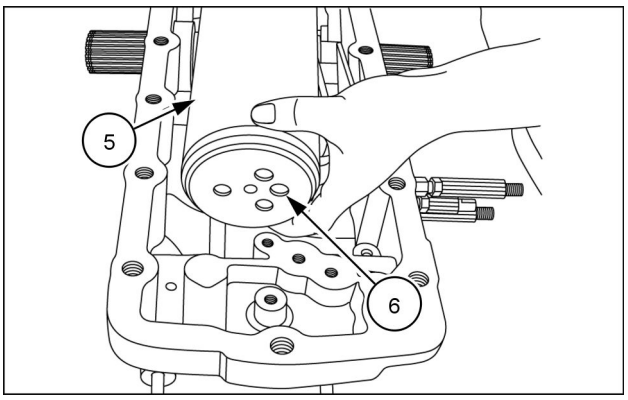
93102618 1

3. Remove the connecting rod from the cylinder.
4. Remove the three bolts **(4)** on the top, front of the HPL housing.



93102619 2

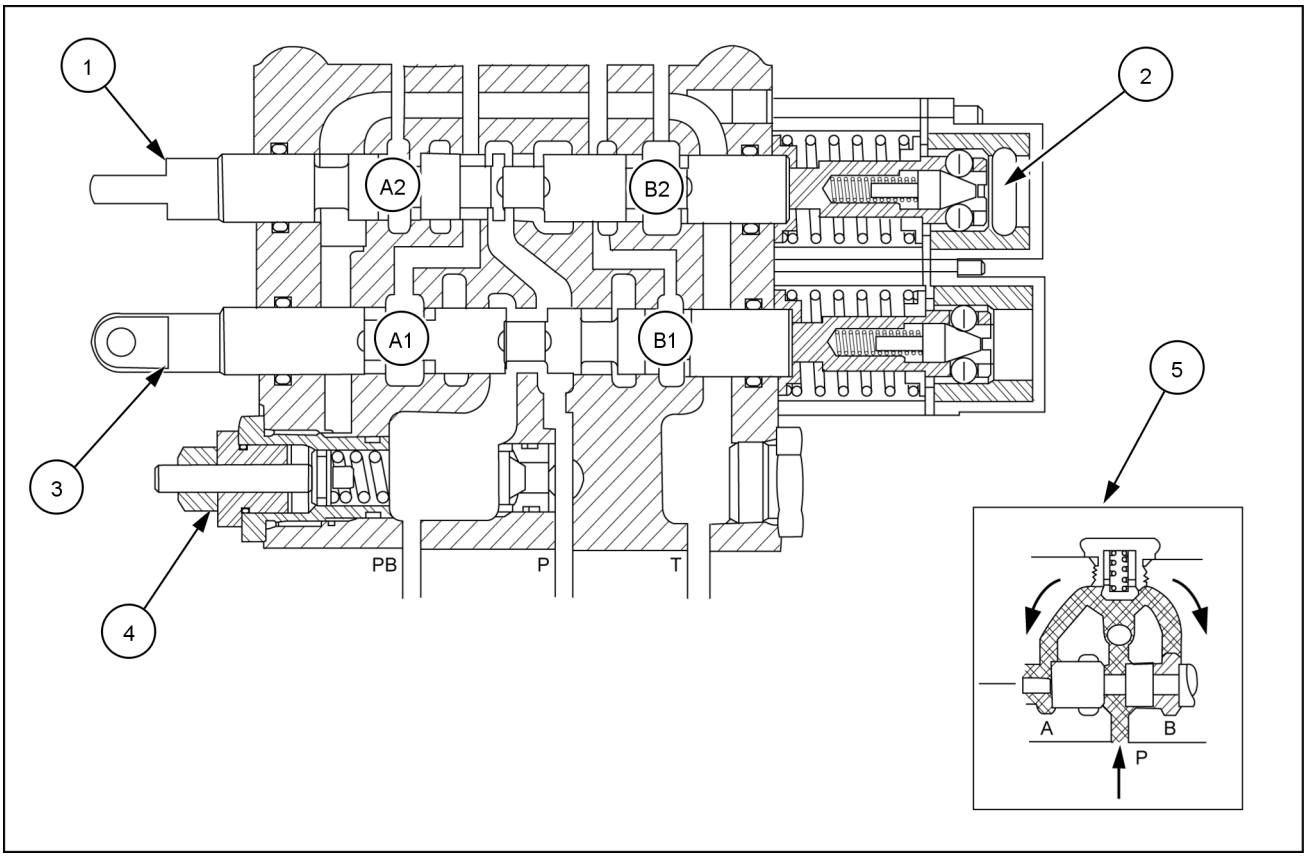
5. Remove the cylinder **(5)** from the HPL housing. Use care not to lose O-ring **(6)** on the end of the cylinder.



93102620 3

Next operation:
Three-point hitch cylinder - Disassemble (35.116)

Valve Components and Porting



NHIL13CT00393FA 3

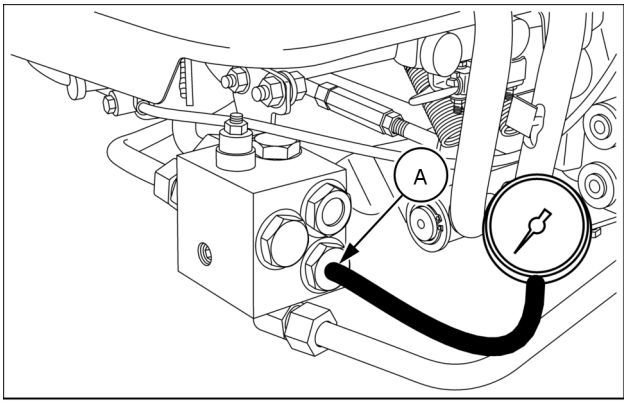
Valve Components and Porting			
P Pressure inlet port	A1 Loader application, bucket dump	B2 Loader application, boom raise	3. Non-detented valve spool Loader application, bucket spool
T Return to reservoir port	B1 Loader application, bucket curl	1. Detented valve spool (float position) Loader application, boom spool	4. System relief valve (Relief valve present but does not function, tractor main hydraulic relief valve used)
PB Power beyond port	A2 Loader application, boom lower	2. Detent assembly	5. Load check valve (one per spool)

Main relief valve - Test

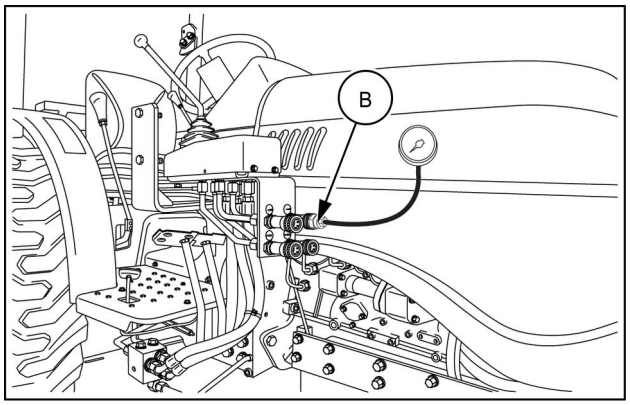
Workmaster™ 33	NA
Workmaster™ 37	NA

The hydraulic system relief pressure can be checked at the following locations:

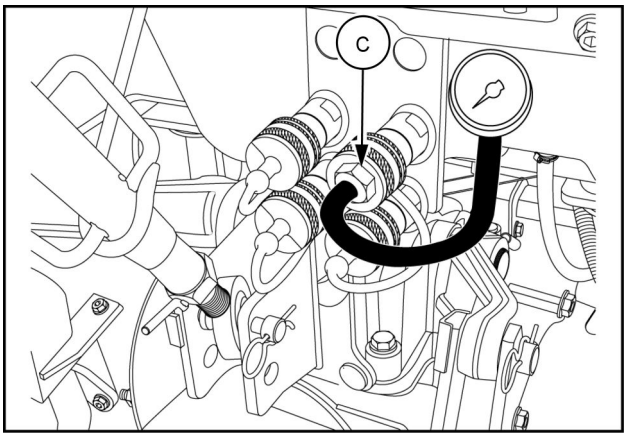
- Front outlet valve block **(A)**
- Front mid mount valve couplers **(B)**
- Rear remote valve couplers **(C)**



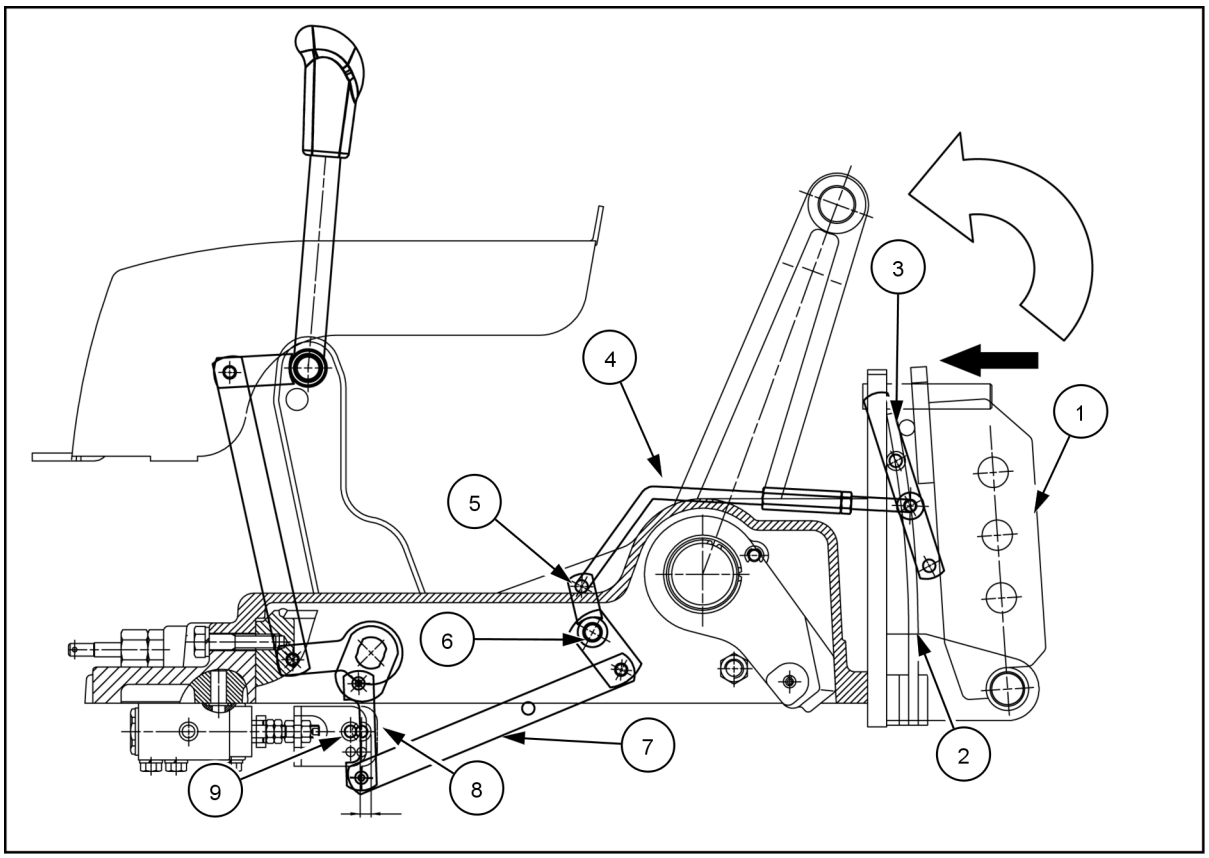
NHIL14CT00673AA 1



NHIL13CT00388AA 2



76109569 3

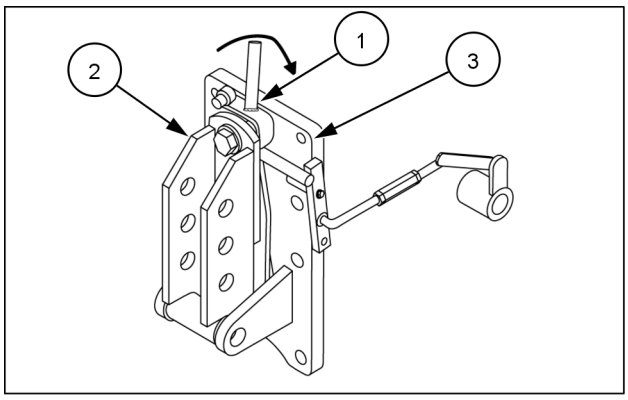


76109594 4

The draft control uses a top link compression bracket **(1)** to signal the hydraulic system for raising or lowering the implement to maintain a constant draft load. As the draft load of the implement increases, the top link of the 3pt hitch pivots forward and flexes the spring **(2)** on the top link bracket. As the spring flexes, the pivot link **(3)** on the on the bracket pivots forward which pulls draft link **(4)** rearward. Link **(4)** is connected to arm **(5)** which is pinned to internal pivot shaft **(6)**. When arm **(6)** moves rearward the internal pivot shaft pivots and pushes draft link **(7)** forward. When link **(7)** moves forward, the draft connector link **(8)** moves forward. The draft connector link moves the HPL control valve spool **(9)** inward and the implement raises until the draft load is decreased. When the draft load is decreased, the draft linkage will return to the original set position.

Draft Control Lock Out

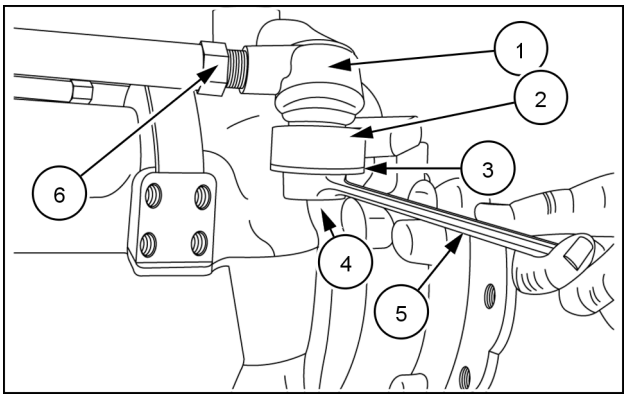
The draft control lock out **(1)** can be placed between the top link pivot plate **(2)** and the mounting bracket **(3)**. When the lock out is placed between the plate and bracket, the draft control leaf spring cannot move the linkage to actuate the HPL control valve. When using the draft control rotate the lock out from behind the top pivot plate.



76109578 5

NOTE: *Angling of the ball joints will be necessary to install ball joint threaded ends into the steering knuckle.*

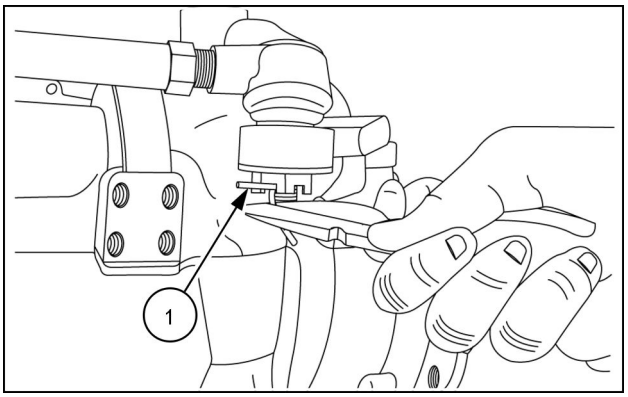
5. Install tie rod ends **(1)** into the steering knuckle **(2)** as shown.
6. Install flat washer **(3)**.
7. Install the castle nut **(4)**, with **24 mm** combination wrench. **(5)**.
8. Torque castle nuts to **49 - 54 N·m** (**36 - 40 lb ft**)



93105723 3

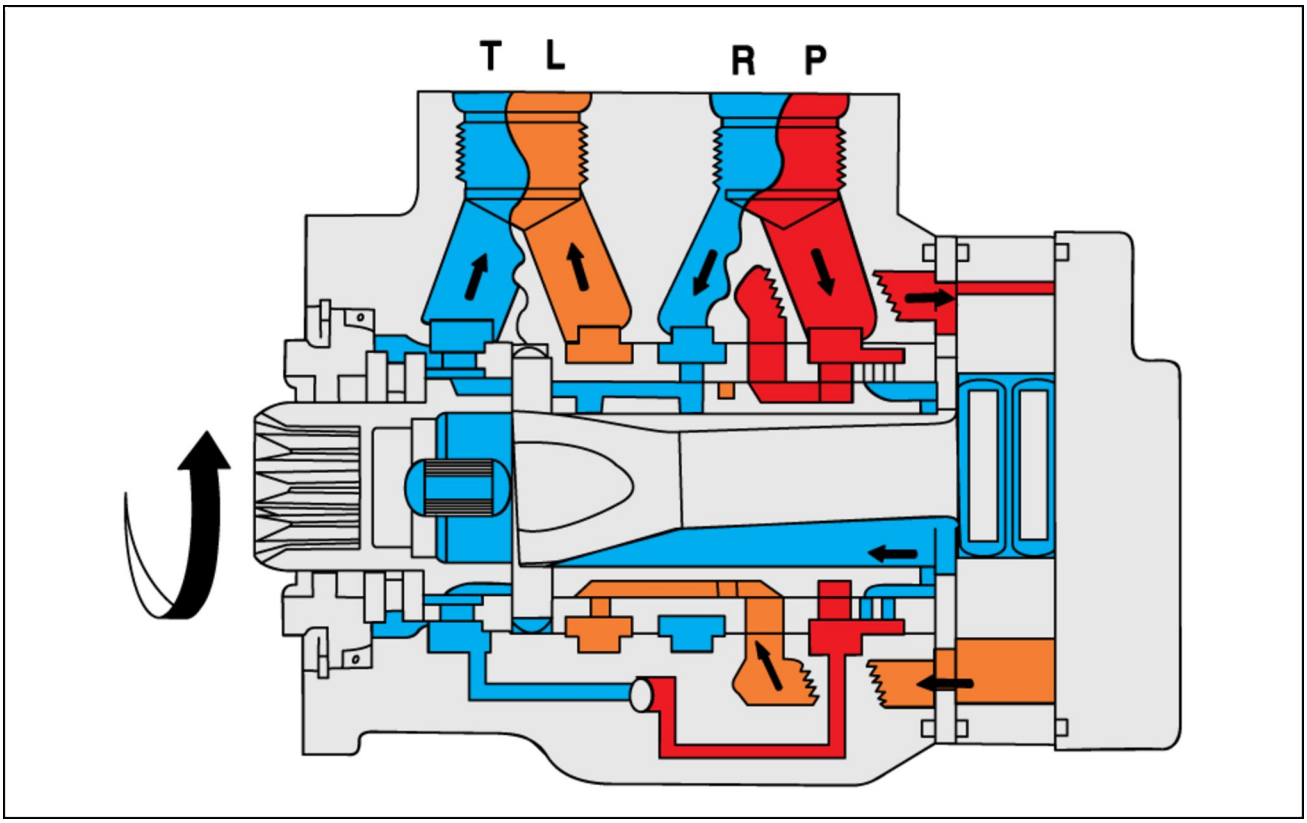
NOTE: *The tie rod can be adjusted for alignment by loosening nut **(6)** and turning ball joint in or out.*

9. With the holes aligned insert cotter pin, **(1)** and bend pin over, to prevent the pin from falling out and the nut from loosening.



93105722 4

Steering to the left



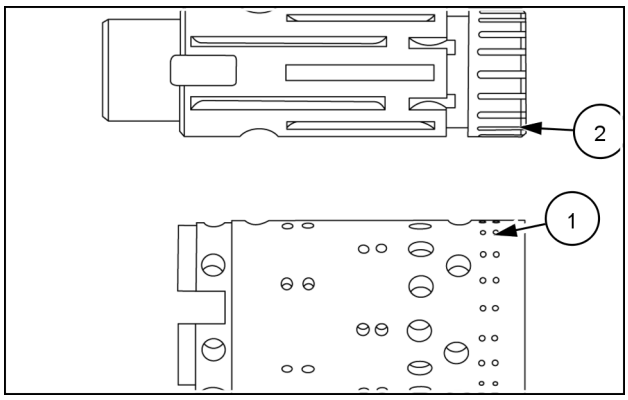
93102638 9

Steering to the left

(T) - Tank
(L) - Left steer port
(R) - Right steer port
(P) - Pump discharge

Pressurized oil from pump
Oil from rotor
Discharge
Suction
Suction or discharge
Neutral

While steering to the left, port **(1)** and groove **(2)** cross each other. In this condition, the oil returning to the sump is interrupted.



93102640 10

Hydraulic control components - Assemble Steering valve

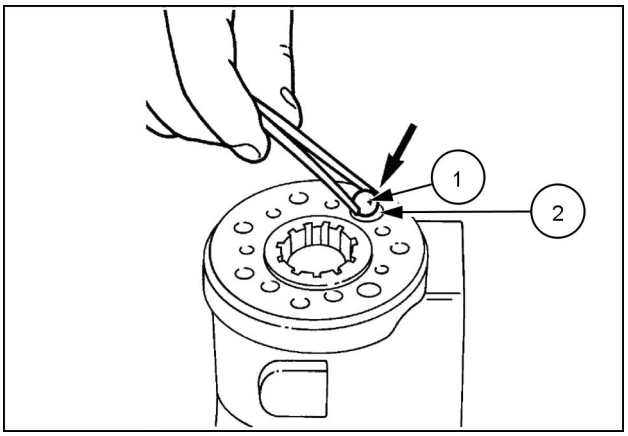
Workmaster™ 33	NA
Workmaster™ 37	NA

Prior operation:
Hydraulic control components - Visual inspection of hydraulic steering control valve parts (41.200)

Assembly of the control side

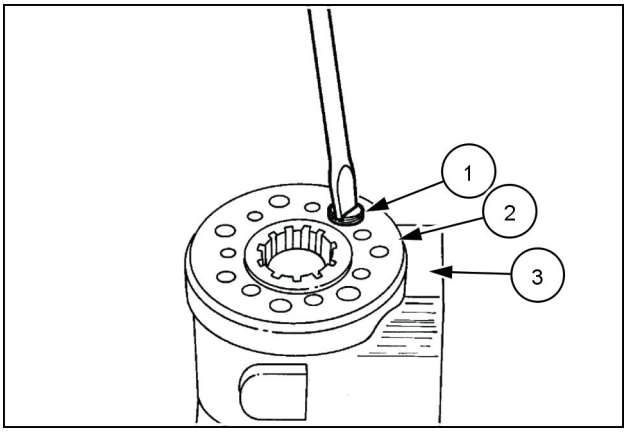
NOTICE: *Protect the housing with suitable material when clamped in a vice.*

1. Place the housing in a vice, spool side up.
2. Insert the ball **(1)** into the hole **(2)**.



24741 1

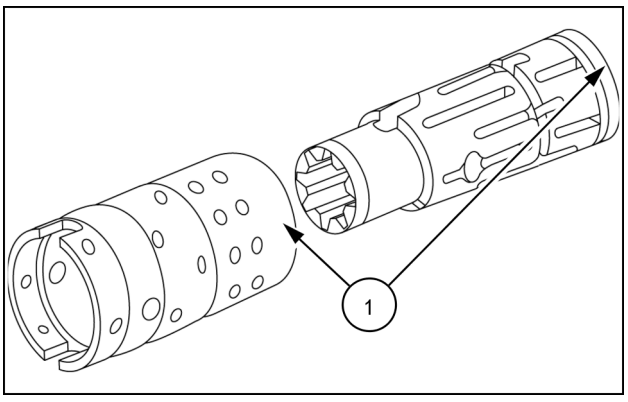
3. Screw the threaded seat **(1)** into the valve body until the upper surface is below the mating surface **(2)** of the control valve body **(3)**



24742 2

NOTICE: *Lubricate spool assembly with* ***NEW HOLLAND AMBRA MULTI G 134™ HYDRAULIC TRANSMISSION OIL****.*

4. Align the spring holes between the spool and sleeve and insert the spool according to the reference mark **(1)**. Rotate the spool slowly to insure smooth operation.



93102655 3

Contents

Steering - 41

Cylinders - 216

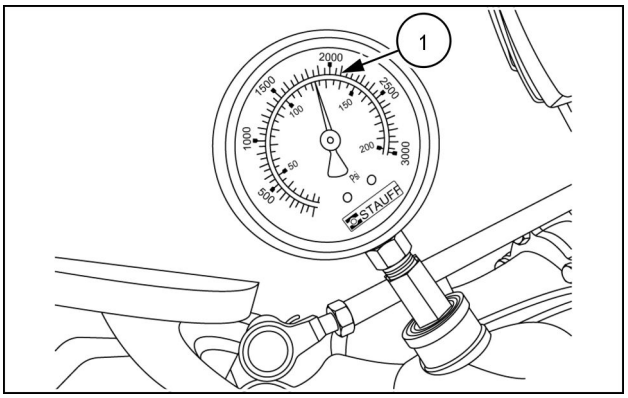
SERVICE

(*) See content for specific models

6. Increase engine speed to **2500 RPM**
7. Turn the steering wheel hard to the left or to the right. The pressure gage will rise to a point and no higher.

NOTE: *At* ***2500 RPM*** *the pressure gage should indicate* ***12000 kPa*** *(****1740 psi****). This will be the maximum psi, indicating the relief valve is set at this pressure.*

8. Shut off the tractors engine.
9. Disassemble the temporary gage and return the steering system to normal.

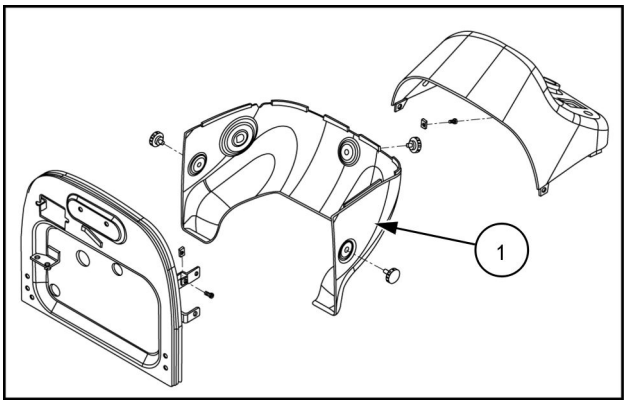


93104552 7

Water-In-Fuel sensor - Remove - Fuel filter sensor relay

Workmaster™ 33	NA
Workmaster™ 37	NA

1. Remove negative (-) battery cable from negative (-) battery terminal.
2. Remove instrument rear hood panel **(1)** from the tractor.



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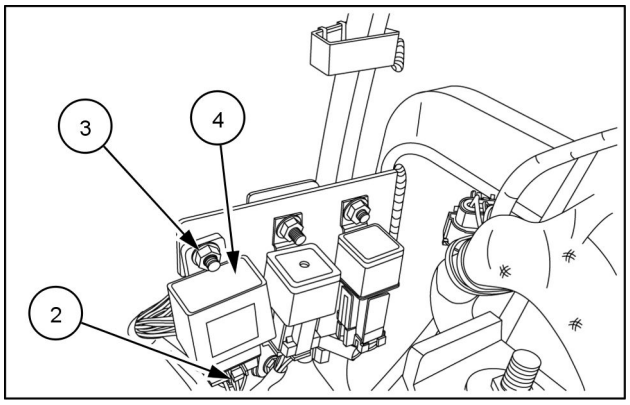
3. Disconnect the relay connector **(2)** from the tractor wire harness.
4. Remove retaining bolt **(3)** from relay mounting tab and remove relay **(4)** from the tractor.



NHIL13CT00313AA 2

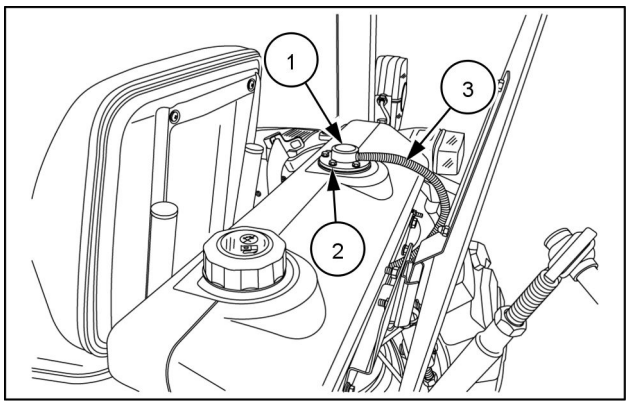
Next operation:
Water-In-Fuel sensor - Test - Fuel filter sensor relay (55.010)

Fuel level sensor - Install

Workmaster™ 33	NA
Workmaster™ 37	NA

Prior operation:
Fuel level sensor - Test (55.011)

1. Install the fuel sender **(1)** with gasket into the opening on top of the fuel tank.
2. Secure sender to tank with five M5 x 16mm bolts **(2)**.
3. Connect sender connector **(3)** to the tractor wire harness.
4. Connect negative (-) battery cable to the negative (-) battery terminal.



NHIL12CT00683AA 1

Contents

Electrical systems - 55

Engine oil system - 013

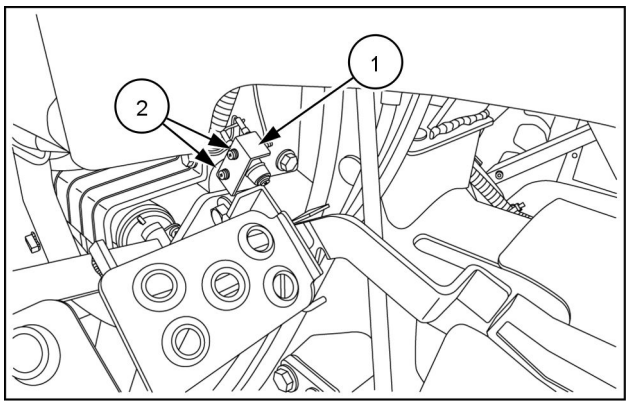
(*) See content for specific models

Parking brake electrical system - Install - Park brake switch

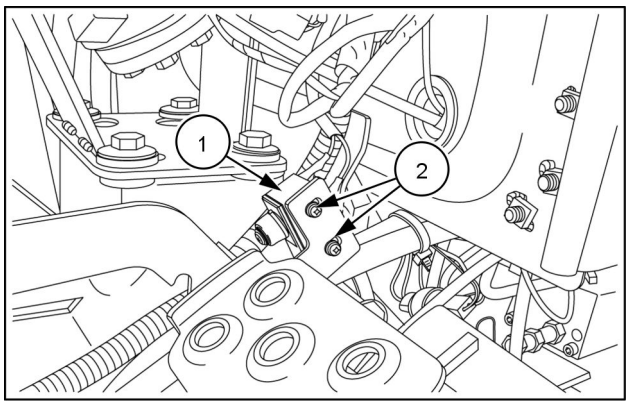
Workmaster™ 33	NA
Workmaster™ 37	NA

Prior operation:
Parking brake electrical system - Test - Park brake switch (55.031)

1. Install the switch **(1)** to the mounting bracket using two M4 x 30mm machine screws **(2)**.



NHIL13CT00256AA 1



NHIL13CT00249AA 2

2. Connect the switch connector to the tractor wire harness.
3. Adjust switch in the slots on the mounting bracket, so that the switch plunger is depressed when the brake pedals are in the off position.
4. Connect the negative (-) battery cable to the negative (-) battery terminal

Wiring harnesses - Electrical schematic sheet 03 – Throttle control, fuel and air pumps

Component ID	Description
A-9000	Engine Control Unit (ECU)
B-9111	Foot throttle position potentiometer
B-9112	Hand throttle lever potentiometer
K-9102	Fuel pump motor relay
K-9103	Air pump clutch solenoid relay
M-9102	Fuel pump motor
Y-9001	Air pump clutch solenoid

Wiring harnesses - Electrical schematic sheet 04 – Power distribution – fuse box 2 (Hydrostatic Transmission (HST) models)

Type	Component	Connector / Link	Description
ECU	**A-002**	**X-9115**	FUSE BOX
Fuse	**F-010**		ECU POWER 1
Fuse	**F-011**		ECU POWER 2
Fuse	**F-012**		ECU POWER 3
Fuse	**F-013**		ECU POWER 4
Connector	X-9115	**X-9115**	
Connector	X-9140	**X-9140**	FUEL PUMP RELAY

Wiring harnesses - Electrical schematic sheet 10 – Lights 1 (Hydrostatic Transmission (HST) models)

Type	Component	Connector / Link	Description
ECU	**A-003**	**X-003**	FLASHER UNIT
Relay	**K-001**	**X-031**	HEAD LAMP_HIGH (WORK) [RELAY BOX #2]
Relay	**K-002**	**X-032**	HEAD LAMP_LOW (DRIVE) [RELAY BOX #3]
Relay	**K-004**	**X-101**	BRAKE LAMP RELAY [RELAY BOX #1]
Switch	**S-002**	**X-050**	COMBI SWITCH TYPE 1
Connector	X-003	**X-003**	
Connector	X-031	**X-031**	
Connector	X-032	**X-032**	
Connector	X-050	**X-050**	
Connector	X-075	**X-075**	7-POLE CONNECTOR
Connector	X-101	**X-101**	
Connector	X-201	**X-201**	
Connector	X-205	**X-205**	
Connector	X-209	**X-209**	

Wiring harnesses - Electrical schematic sheet 03 – Power distribution – fuse box 1 (Gear transmission models)

Type	Component	Connector / Link	Description
ECU	**A-002**	**X-9115**	FUSE BOX
Fuse	**F-003**		CONTROLLER
Fuse	**F-004**		CONTROL SWITCH
Fuse	**F-005**		SOLENOID
Fuse	**F-006**		WORK/BRAKE LAMP
Fuse	**F-007**		HEAD LAMP
Fuse	**F-008**		TURN SIGNAL
Fuse	**F-009**		HAZARD LAMP
Switch	**S-9101**	**X-9190B X-9190A**	KEY SWITCH
Connector	X-001	**X-001**	
Connector	X-9115	**X-9115**	
Connector	X-9190A	**X-9190A**	
Connector	X-9190B	**X-9190B**	

Wiring harnesses - Electrical schematic sheet 09 – Vehicle control (Gear transmission models)

Type	Component	Connector / Link	Description
ECU	**A-004**	**X-004**	SAFETY CONTROLLER
Sensor	**B-9112**	**X-9112**	HAND LEVER
Switch	**S-008**	**X-055**	SEAT SWITCH
Switch	**S-009**	**X-056**	M-PTO SWITCH
Switch	**S-010**	**X-057**	PARKING BRAKE SWITCH
Switch	**S-013**	**X-060**	CLUTCH SWITCH
Switch	**S-014**	**X-061**	FNR NEUTRAL SWITCH
Switch	**S-016**	**X-063**	BRAKE SWITCH
Switch	**S-9007**	**X-9130**	DPF SWITCH
Connector	X-001	**X-001**	
Connector	X-004	**X-004**	
Connector	X-012	**X-012**	
Connector	X-055	**X-055**	
Connector	X-056	**X-056**	
Connector	X-057	**X-057**	
Connector	X-060	**X-060**	
Connector	X-061	**X-061**	
Connector	X-063	**X-063**	
Connector	X-201	**X-201**	
Connector	X-205	**X-205**	
Connector	X-9112	**X-9112**	
Connector	X-9130	**X-9130**	

X-007 - [E-002] (Male)

Pin	From	Wire	Description	Color-Size	Frame
1	SP-X26-P-X	44E	44E	TN/BK - 0.5	**SHEET 10**
2	SP-X34-P-X	202L	202L	BK - 0.5	**SHEET 05**

X-008 - [E-003] (Male)

Pin	From	Wire	Description	Color-Size	Frame
1	SP-X34-P-X	202H	202H	BK - 0.85	**SHEET 05**
2	SP-X27-P-X	38G	38G	RD/GN - 0.5	**SHEET 11**
3	SP-X25-P-X	43D	43D	TN - 0.5	**SHEET 10**
4	SP-X28-P-X	45B	45B	GN/RD - 0.5	

X-009 - [E-004] (Male)

Pin	From	Wire	Description	Color-Size	Frame
1	SP-X34-P-X	202K	202K	BK - 0.85	**SHEET 05**
2	SP-X27-P-X	38F	38F	RD/GN - 0.5	**SHEET 10**
3	SP-X26-P-X	44D	44D	TN/BK - 0.5	
4	SP-X28-P-X	45C	45C	GN/RD - 0.5	

X-9003 - [B-9003] (Male)

Pin	From	Wire	Description	Color-Size	Frame
2	**X-9000 (Male) pin 68**	368	368	GN/RD - 0.5	**SHEET 06**
3	**X-9000 (Male) pin 70**	370	370	RD/WH - 0.5	
5	**X-9000 (Male) pin 67**	367	367	GY - 0.5	
6	**X-9000 (Male) pin 69**	369	369	PK - 0.5	

X-9004 - [Y-9000] (Male)

Pin	From	Wire	Description	Color-Size	Frame
1	**X-9000 (Male) pin 1**	301	301	BK - 0.5	**SHEET 06**
2	**X-9000 (Male) pin 21**	321	321	WH - 0.5	

X-9005 - [B-9005] (Male)

Pin	From	Wire	Description	Color-Size	Frame
1	**X-9000 (Male) pin 74**	374	374	YE/RD - 0.5	**SHEET 06**
2	**X-9000 (Male) pin 54**	354	354	GN/WH - 0.5	

X-9006 - [B-9006] (Male)

Pin	From	Wire	Description	Color-Size	Frame
1	**X-9000 (Male) pin 75**	375	375	YE/GN - 0.5	**SHEET 06**
2	**X-9000 (Male) pin 55**	355	355	GN/YE - 0.5	

X-9007 - [B-9011] (Male)

Pin	From	Wire	Description	Color-Size	Frame
1	**X-9000 (Male) pin 6**	306	306	BL/BK - 0.5	**SHEET 06**
2	**X-9000 (Male) pin 26**	326	326	VT - 0.5	

X-9008 - [B-9008] (Male)

Pin	From	Wire	Description	Color-Size	Frame
1	**X-9000 (Male) pin 7**	307	307	TN/RD - 0.5	**SHEET 06**
2	**X-9000 (Male) pin 27**	327	327	BK - 0.5	

X-9009 - [B-9009] (Male)

Pin	From	Wire	Description	Color-Size	Frame
1	**X-9000 (Male) pin 11**	311	311	RD - 0.5	**SHEET 06**
2	**X-9000 (Male) pin 13**	313	313	BK - 0.5	
3	**X-9000 (Male) pin 12**	312	312	WH - 0.5	

X-9010 - [B-9010] (Male)

Pin	From	Wire	Description	Color-Size	Frame
1	**X-9000 (Male) pin 10**	310	310	RD - 0.5	**SHEET 06**
2	**X-9000 (Male) pin 8**	308	308	BK - 0.5	
3	**X-9000 (Male) pin 9**	309	309	WH - 0.5	

X-9017 - [S-9000] (Male)

Pin	From	Wire	Description	Color-Size	Frame
1	**X-9000 (Male) pin 37**	337	337	WH/BL - 0.5	**SHEET 06**
2	**X-9000 (Male) pin 17**	317	317	GN/BK - 0.5	

X-9020 - [B-9012] (Male)

Pin	From	Wire	Description	Color-Size	Frame
1	**X-9000 (Male) pin 30**	330	330	RD/GN - 0.5	**SHEET 06**
2	**X-9000 (Male) pin 28**	328	328	BK/OR - 0.5	
3	**X-9000 (Male) pin 29**	329	329	BL/OR - 0.5	

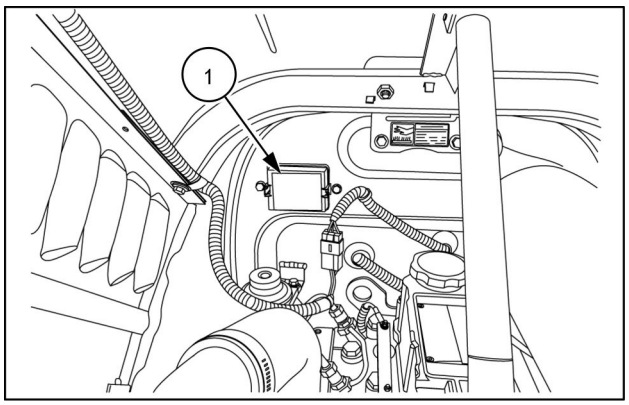
Wire connectors - Component diagram 07 – Connectors X-070 to X-079 (Gear transmission models)

X-075 - 7-POLE CONNECTOR [SH10: A-1] (Male)

Pin	From	Wire	Description	Color-Size	Frame
1	SP-X26-P-X	44F	44F	TN/BK - 0.5	**SHEET 10**
2	SP-X27-P-X	38E	38E	RD/GN - 0.5	
3	SP-X34-P-X	202M	202M	BK - 0.5	**SHEET 05**
4	SP-X46-P-X	11E	11E	YE/RD - 0.5	**SHEET 11**
5	SP-X25-P-X	43F	43F	TN - 0.5	**SHEET 10**
6	SP-X28-P-X	45D	45D	GN/RD - 0.5	

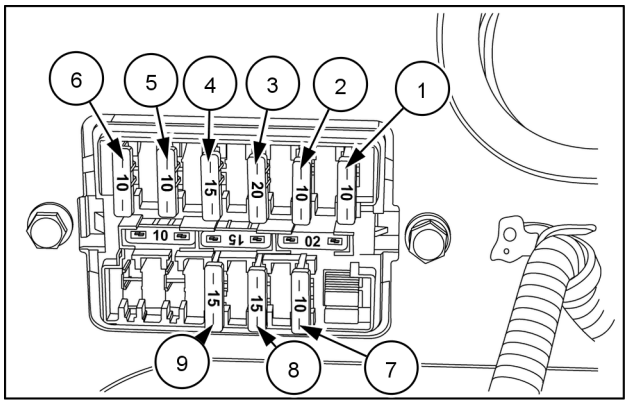
Fuse and relay box Fuse - Static description

The fuse block **(1)** is located on the right-hand side of the engine firewall. Always replace blown fuse with the same size specified for that circuit. Identified from top to bottom, the fuse block contains the following fuses.



NHIL12CT00676AA 1

From right to left, the fuse block contains the following fuses:



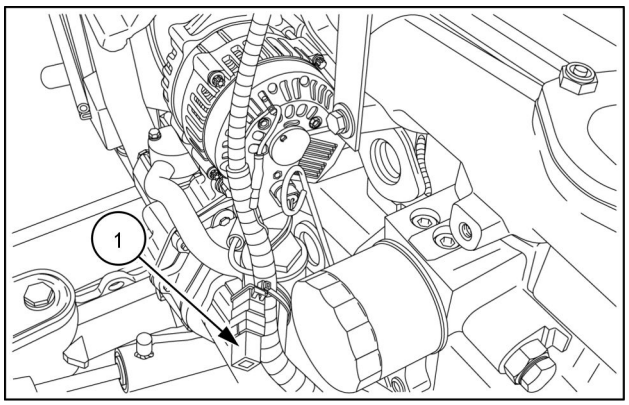
NHIL12CT00685AA 2

Fuse #	Fuse Size	Circuit Protected
1	**10 A**	Fuel shut off, Alternator
2	**10 A**	Instrument Panel, Glow plugs, Horn,Brake lights
3	**20 A**	Headlights
4	**15 A**	Rear work light (optional)
5	**10 A**	PTO
6	**10 A**	Safety controller
Bottom Row		
7	**10 A**	Spare
8	**15 A**	Turn signals
9	**15 A**	Hazard lights, Headlights switch, Position lights

Main Maxi-Fuse

The main fuses are two 50 amp maxi-fuses **(1)** located on the right-hand side of the engine and positioned in the area of the engine starter. This fuse protects the tractor's entire electrical system.

NOTICE: *Always replace these fuses with a 50 amp fuse, DO NOT increase the amperage rating.*



NHIL12CT00694 3

Electrical components - Resistor description

R-003 - RESISTOR(0.6â ¦, 50W) (Resistor)

Component Type	Resistor
Wiring frames	**SHEET 08**
Connectors	**X-9086 (Male)**

Electrical components - Speaker description

H-001 - WARNING BUZZER (Speaker)

Component Type	Speaker
Wiring frames	**SHEET 13**
Connectors	**X-017 (Male)**

H-002 - HORN (Speaker)

Component Type	Speaker
Wiring frames	**SHEET 13**
Connectors	**X-005 (Male)**

Contents

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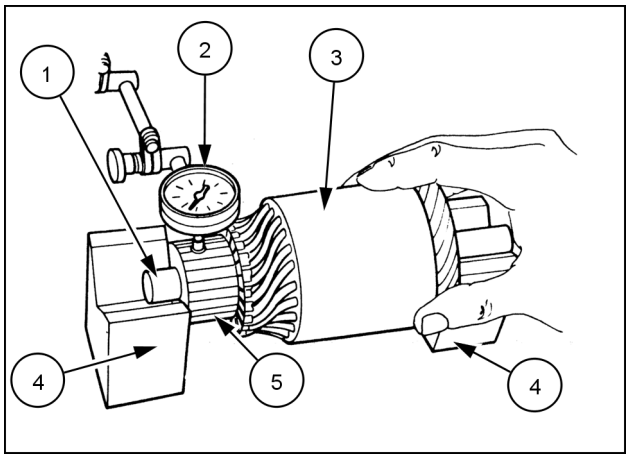
Engine starting system - 201

NOTICE: *If not previously removed, the armature bearings will need to be removed for this test.*

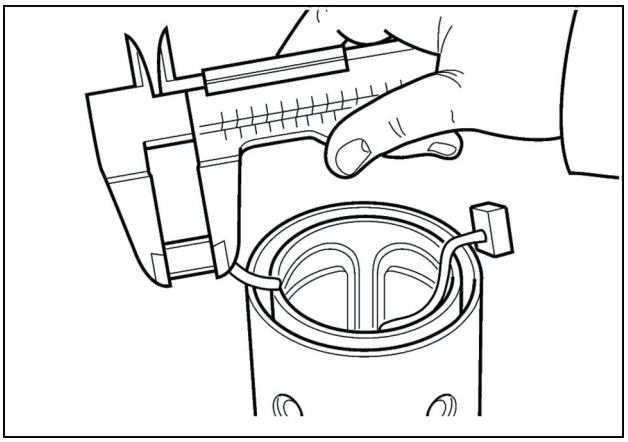
11. Place the armature **(3)** in a set of precision V-blocks **(4)** and use a dial indicator **(2)** to measure commutator **(5)** runout and shaft **(1)** runout. Commutator runout should not be more than **0.2 mm** (**0.008 in**). Shaft runout should not be more than **0.5 mm** (**0.002 in**)



20002266 6

NOTICE: *When measuring the brush length, remove the brush from the brush support and measure the middle portion of the brush.*

12. Use a suitable measuring device to measure the length of the armature brushes. Compare the measurement of each brush with brush length specifications. If the brush is not within specifications or is damaged in any way, replace the brushes.



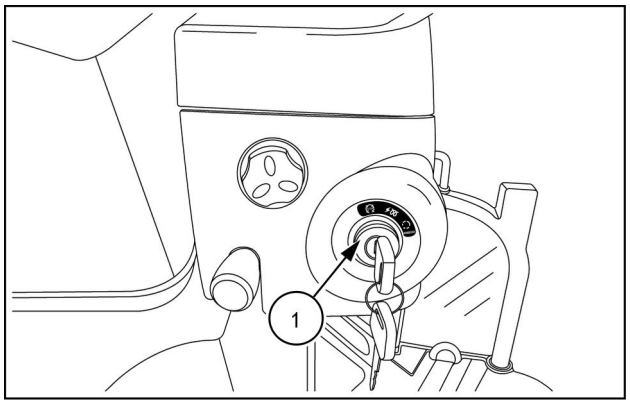
SEC55CH4PG37_3 7

13. Test the brush spring tension by connecting a spring balance to the brush spring and pulling until the spring moves. Observe the reading indicated on the spring balance. If the reading is between **26 - 35 N** (**5.8 - 7.9 lb**), the spring tension is within specifications. Otherwise, replace the brush springs

Ignition switch - Install

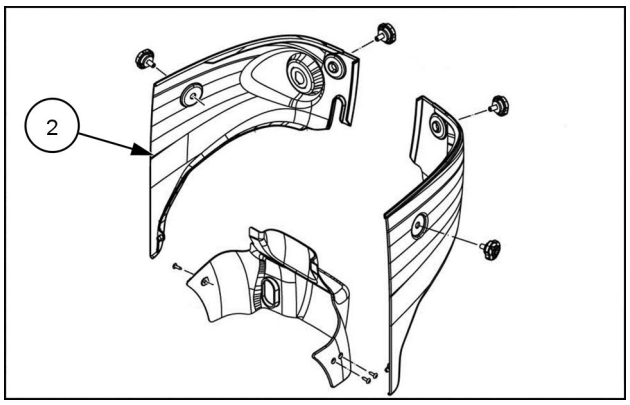
Prior operation:
Ignition switch - Test (55.201)

1. Install switch from the back side of the right-hand side console panel and install retaining nut **(1)**.



NHIL13CT01006AA 1

2. Connect the two switch connectors to tractor wire harness.
3. Reinstall right-hand side console panel **(2)**.

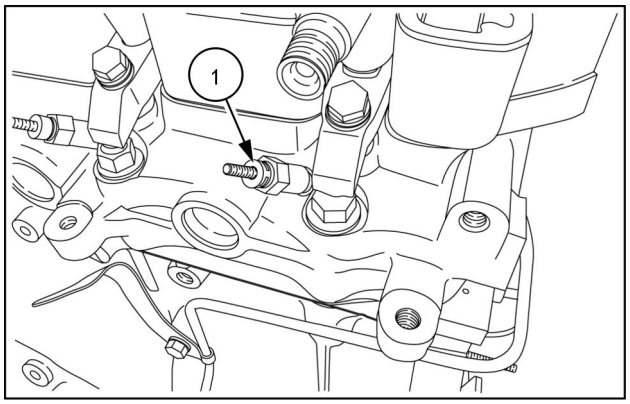


NHIL14CT00141AA 2

4. Reconnect negative (-) battery cable to the negative (-) battery terminal.

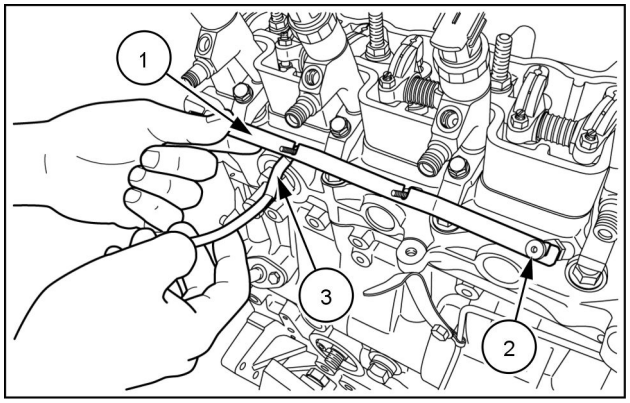
Glow plug system - Install - Glow plug

1. Install the glow plugs **(1)** and torque to **15 - 20 N·m** (**11 - 14.5 lb ft**).



NHIL12ENG0221AA 1

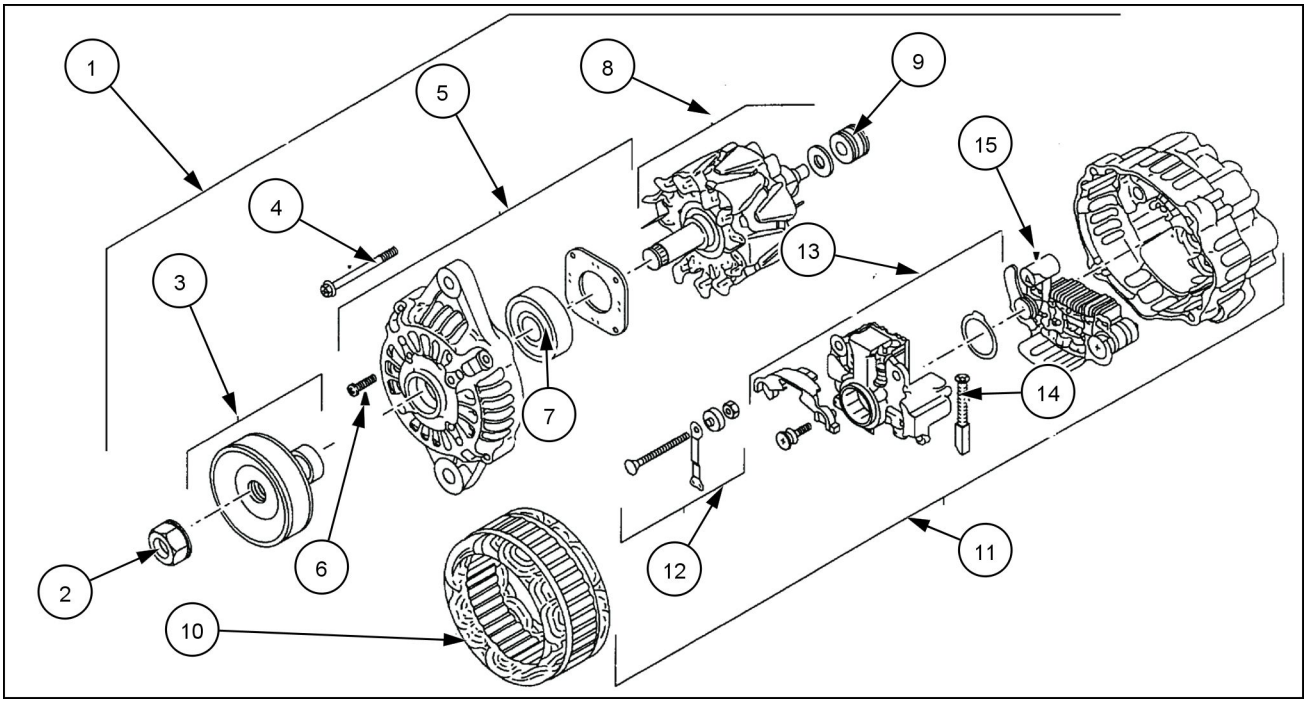
2. Attach the glow plug connector bar **(1)** to the screw terminals on the glow plugs.
3. Attach the power supply **(3)** to the screw terminal.
4. Tighten the screw terminals **(2)** on the glow plugs until the connector is tight on all glow plugs.
5. Connect the negative battery cable to the battery.



NHIL12ENG0222AA 2

Alternator - Disassemble

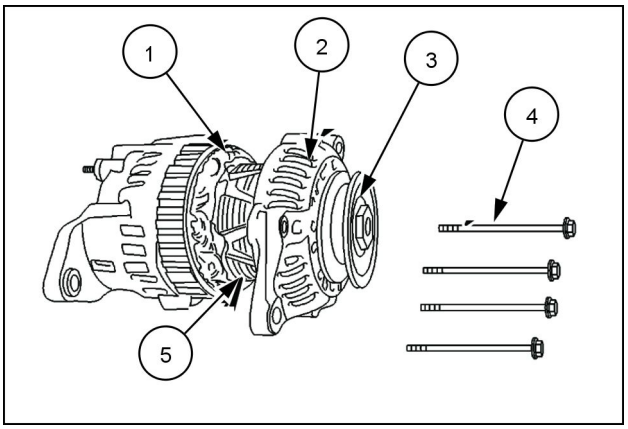
NOTICE: *Heat from a soldering gun can damage diodes. To avoid damage to diodes, use a pair of needle-nose pliers to remove excess heat from the area being soldered. Hold the pliers just below the solder joint to remove excess heat. Use a damp cloth to cool the components once they have been joined or separated. Failure to comply could damage diode.*



SECT55C04P11_2 1

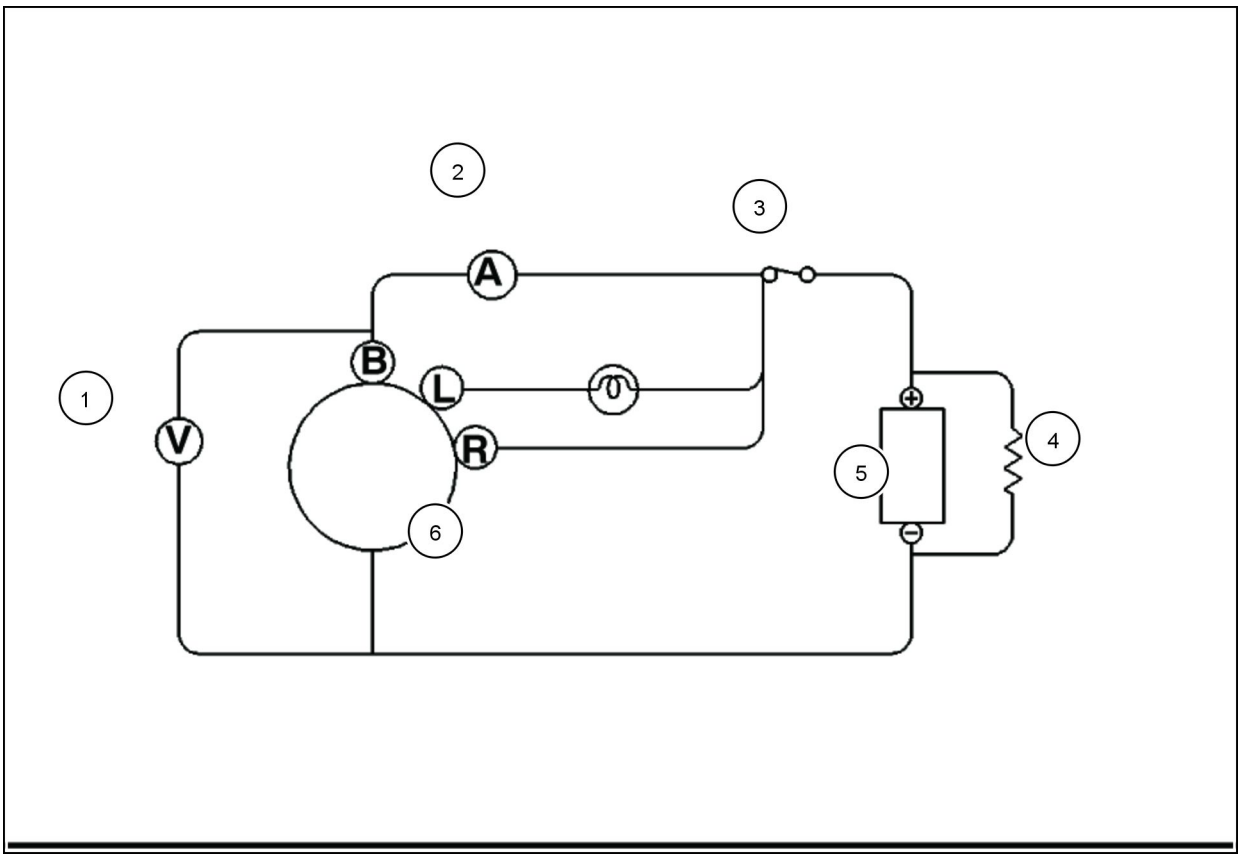
1. Alternator assembly
2. Pulley nut
3. Pulley assembly
4. Bolt
5. Front alternator frame assembly
6. Bolt
7. Front rotor bearing
8. Rotor assembly
9. Rear rotor assembly
10. Stator
11. Rear alternator frame assembly
12. Terminal assembly
13. IC Regulator assembly
14. Rotor brush and spring
15. Rectifier

1. Mark the front alternator frame **(5)** the rear alternator frame **(11)** and the stator **(10)** with scribe marks to insure that the alternator is assembled as taken apart.
2. Remove the alternator frame retaining bolts **(4)**.
3. Carefully separate the front frame **(2)** and the rear frame and stator **(1)**. The rotor assembly **(5)** and the pulley **(3)** , will be removed with the front frame **(2)**.



SECT55C04PG12_1 2

Alternator - Test - Bench check



SEC55CH4PG23_2 1

(1) Voltmeter
(2) Ammeter
(3) Switch
(4) Load resistor
(5) Battery
(6) Alternator

1. Connect the alternator to a testing circuit, as shown. Set the load resistance to zero

NOTICE: *Alternator rotation direction is clockwise, as viewed looking at the pulley.*

2. Slowly increase the alternator rotational speed and observe the voltage reading indicated on the voltmeter.
3. If the voltage is uncontrolled when increasing alternator speed and increases above **15.5 V**, disassemble and check the alternator for malfunctioning components.
4. If the voltage reading is below **15.5 V**, set alternator's rotational speed to **5000 RPM** and set the load resistance to achieve maximum output from the alternator.
5. If the amperage value is more than **70 %** of the nominal alternator output as described in alternator specifications, the alternator is considered to be working satisfactorily.

Contents

Electrical systems - 55

External lighting - 404

SERVICE

DIAGNOSTIC

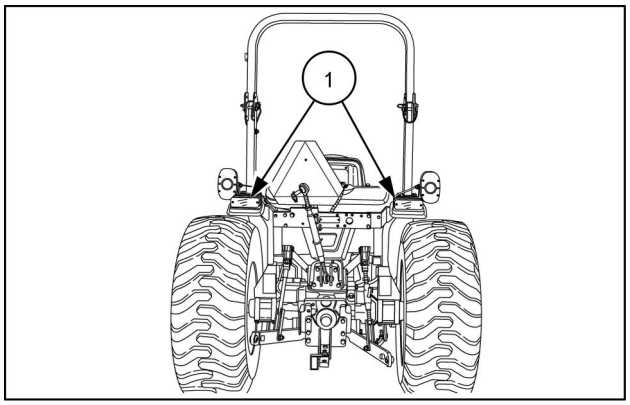
(*) See content for specific models

Brake light - Service instruction

Workmaster™ 33	NA
Workmaster™ 37	NA

Description

1. The tail/brake lights **(1)** are located at the rear of the tractor in the fenders. The taillights will illuminate when the road or work lights are illuminated. The brake lights will illuminate when the brake pedals are depressed and the park brake not engaged. The key switch has to be in the "ON" position for these lights to function.



NHIL12CT00671AA 1

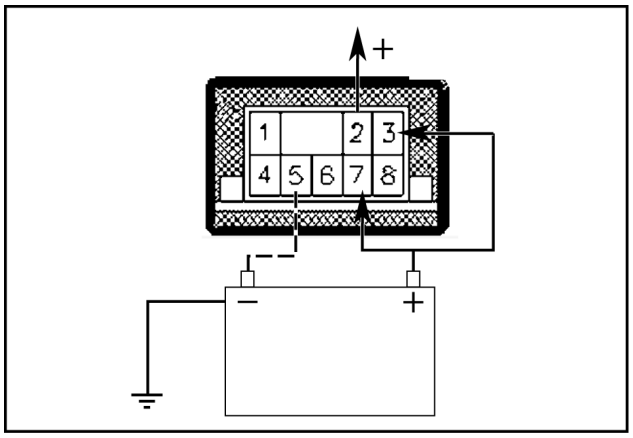
Next operation:
Brake light - Replace - Bulb (55.404)

Work Lights Circuit Test

1. To test the work lights circuit of the headlight relay supply a 12 volt current and ground source to the terminals listed in the chart.

Terminal #	Function
2	Output current for work lights
3	Input current for work lights coil
5	Ground (-) for work lights coil
7	Input current for work lights coil

2. When current is supplied to terminals 3 and 7 and ground source supplied to terminal 5, output current should be available at terminal 2.



76105644 3

3. If test result do not match as test describes, relay is faulty and needs to be replaced.

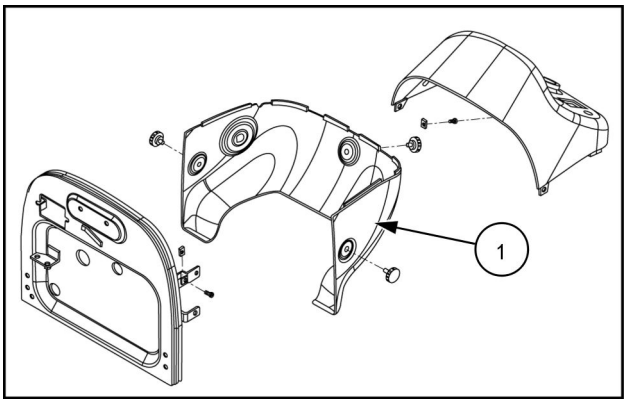
Next operation:
Headlight relay - Install (55.405)

Brake light relay - Remove

Workmaster™ 33	NA
Workmaster™ 37	NA

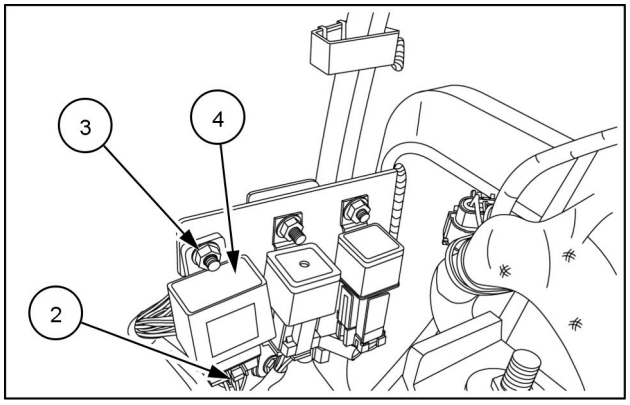
Prior operation:
Engine start relay - Service instruction (55.201)

1. Remove negative (-) battery cable from negative (-) battery terminal.
2. Remove instrument rear hood panel **(1)** from the tractor.



NHIL13CT 00299A 1

3. Disconnect the relay connector **(2)** from the tractor wire harness.
4. Remove retaining bolt **(3)** from relay mounting tab and remove relay **(4)** from the tractor.



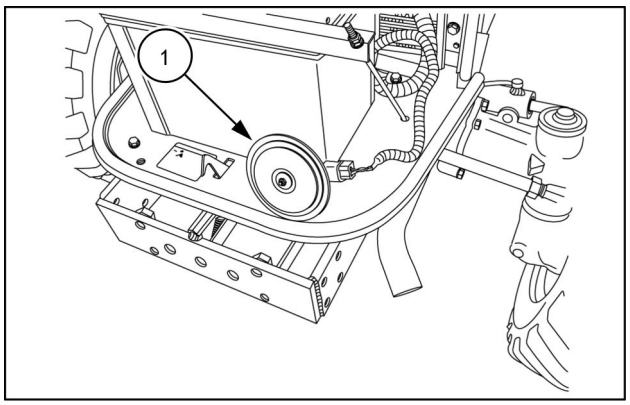
NHIL13CT00313AA 2

Next operation:
Brake light relay - Test Start Relay (55.405)

Buzzer - Service instruction - Horn

Workmaster™ 33	NA
Workmaster™ 37	NA

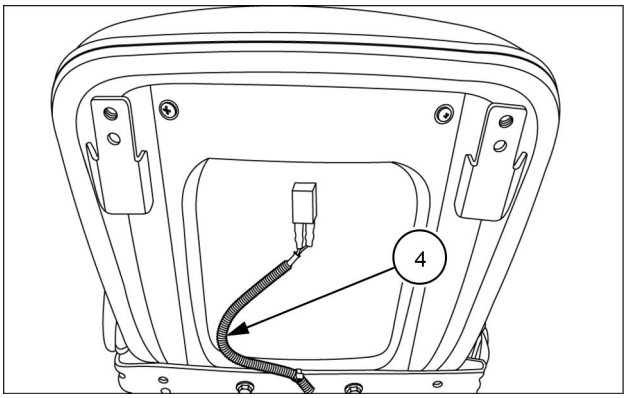
The optional horn **(1)** is located at the front of the tractor, underneath the engine hood. The horn can only be sounded when the key switch is in the "ON" position.



NHIL12CT00726AA 1

Next operation:
Buzzer - Remove - Horn (55.408)

5. Connect wire harness connector **(4)**to seat switch



93105610 4

Hourmeter - Troubleshooting

Workmaster™ 33	NA
Workmaster™ 37	NA

NOTE: *See* ***Electrical system - Electrical schematic sheet 15 - Tachometer (55.000)***

Problem	Possible Cause	Correction
Tachometer does not operate when tractor engine is running.	Blown #2 10-amp fuse	Replace 10-amp fuse
	Tachometer sensing wire from alternator damaged, corroded, disconnected or short circuited.	Inspect wire repair as necessary
	Improper ground	Check ground location, for clean contact area
	Faulty instrument panel	Test instrument panel, replace if necessary
	Faulty alternator component	Test alternator for output at terminal "2"
Inaccurate tachometer reading	Malfunctioning instrument panel	Replace instrument panel
	Loose alternator belt	Tighten alternator belt
	Improper ground	Check ground location, for clean contact area

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SERVICE

(*) See content for specific models

Check	Action
Condition of fuel	• Check the color. There should be no color, brownish, or milky substance. • Check for separation of materials. There should be no water, or foreign objects in the tank. • Check the viscosity. There should not be a waxy or sticky consistency.
Diesel particulate filter and Diesel Oxidation Catalyst	Check the condition of the DOC/DPF system. • Make sure there is no damage to the DOC. • Make sure there is no damage to the DPF. • The ash service for the DPF service interval is every **3000 h**.
Air pump • V-belt for air pump • Air line to burner • Reed valve	Check the air pump assembly. • See **Air pump - Inspect (10.501)**. Check the reed valve. • See **Air pump - Inspect — Reed valve (10.501)**.
Hoses/lines • Fuel line/hose • DPF line/hose	Check and/or replace any damaged hoses or lines.

A. If no issues are found, see **Electronic module - Electrical test Engine Control Unit (ECU) verification (55.640)** to verify the ECU is working properly.

B. If there are any issues found, repair or replace as required.

B. If the fault code 102-4 is present, the sensor has failed. Replace the sensor.

5. Check the wiring harness for a short to high source.

   Place the key switch OFF.

   Disconnect the wiring harness from ECU.

   Place the key switch ON.

   Use a multimeter to perform the following checks on the wiring harness.

From	To	Value
Connector X-9020 pin 1	Chassis ground	There should be no voltage.
Connector X-9020 pin 2	Chassis ground	There should be no voltage.
Connector X-9020 pin 3	Chassis ground	There should be no voltage.

   A. If the wiring harness test passes, continue with Step **6**.

   B. If the wiring harness test fails, locate and repair the broken conductor.

6. Check for an open or short circuit.

   Place the key switch OFF.

   Use a multimeter to perform the following checks on the wiring harness.

From	To	Value
Connector X-9020 pin 1	Connector X-9000 pin 30	There should be continuity.
Connector X-9020 pin 2	Connector X-9000 pin 28	There should be continuity.
Connector X-9020 pin 3	Connector X-9000 pin 29	There should be continuity.
Connector X-9020 pin 1	Connector X-9020 pin 2	There should be no continuity.

   A. If the wiring harness test passes, see **Electronic module - Electrical test Engine Control Unit (ECU) verification (55.640)** to verify the ECU is working properly.

   B. If the wiring harness test fails, locate and repair the broken conductor.

7. Visually inspect the relevant harnesses and connectors for damage, bent or dislocated pins, corroded terminals, or broken wires. Verify that the connectors are fully installed. Flex the harnesses involved to reveal intermittent breaks or shorts in the wiring concerned. Operate the machine while you monitor the display.

   A. If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved.

   B. If you do not find damage and the display indicates only normal readings, then erase the fault code and continue operation.

Wiring harnesses - Electrical schematic sheet 05 – Engine Control Unit (ECU) (55.100.DP-C.20.E.05)

168-3-Battery potential / power input 1: voltage above normal

Control Module : ECU

Context:
The Engine Control Unit (ECU monitors the battery voltage for too high or too low of voltage. The normal operating range is **10 - 15 V**.

Cause:
The ECU has sensed the battery voltage is greater than **16.5 V**.

Possible failure modes:

1. The alternator has failed.
2. The wiring harness has failed.
3. The battery has failed.
4. The ECU has an internal failure.

Solution:

1. Use the Service Tool I to verify the fault is active.

   Select the “Active Diagnostic Codes” icon.

   A. If the fault code is present, continue with Step **2**.

   B. If the fault is not present, the fault may be intermittent and not currently active. Continue with Step **5**.
2. Check the wiring from the battery to the ECU.

   Check the wiring from the battery to the alternator.

   A. If there is no damage, loose or dirty connections, continue with Step **3**.

   B. If there is damage, loose or dirty connections, repair as necessary.
3. Check the battery voltage when charging.

   Start the machine.

   Use a multimeter to check for voltage from the battery positive terminal to the negative terminal.

   There should be approximately **10 - 15 V**.

   A. If the voltage reading is greater than **16.5 V**, continue with Step **4**.

   B. If the voltage reading is between **10 - 15 V**, see **Electronic module - Electrical test Engine Control Unit (ECU) verification (55.640)** to verify the ECU is working properly.
4. Check the battery voltage.

   Place the key switch OFF.

   Use a multimeter to check for voltage from the battery positive terminal to the negative terminal.

   There should be approximately **10 - 15 V**.

   A. If the battery voltage is in range, the alternator has failed. Replace the alternator.

   B. If the battery voltage is greater than **16.5 V**, the battery has failed. Replace the battery.

B. If the results of this test are not as expected, the idle validation switch in the low idle switch and accelerator pedal position sensor (B-9111) has failed. Replace the low idle switch and accelerator pedal position sensor (B-9111).

4. Visually inspect the relevant harnesses and connectors for damage, bent or dislocated pins, corroded terminals, or broken wires. Verify that the connectors are fully installed. Flex the harnesses involved to reveal intermittent breaks or shorts in the wiring concerned. Operate the machine while you monitor the display.

   A. If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved.

   B. If you do not find damage and the display indicates only normal readings, then erase the fault code and continue operation.

Monitor the diagnostic screen for fault code 723-4.

A. If the fault code 723-4 is not present, continue with Step **5**.

B. If the fault code 723-4 is present, the sensor has failed. Replace the sensor.

5. Check the wiring harness.

   Place the key switch OFF.

   Disconnect the wiring harness from ECU.

   Use a multimeter to perform the following checks on the wiring harness.

From	To	Value
Connector X-9010 pin 1	Connector X-9000 pin 11	There should be continuity.
Connector X-9010 pin 2	Connector X-9000 pin 13	There should be continuity.
Connector X-9010 pin 3	Connector X-9000 pin 12	There should be continuity.
Connector X-9010 pin 1	Chassis ground	There should be no continuity.
Connector X-9010 pin 2	Chassis ground	There should be no continuity.
Connector X-9010 pin 3	Chassis ground	There should be no continuity.
Connector X-9010 pin 2	Connector X-9010 pin 1	There should be no continuity.
Connector X-9010 pin 2	Connector X-9010 pin 3	There should be no continuity.

   A. If the wiring harness test passes, see **Electronic module - Electrical test Engine Control Unit (ECU) verification (55.640)** to verify the ECU is working properly.

   B. If the wiring harness test fails, locate and repair the broken conductor.

6. Visually inspect the relevant harnesses and connectors for damage, bent or dislocated pins, corroded terminals, or broken wires. Verify that the connectors are fully installed. Flex the harnesses involved to reveal intermittent breaks or shorts in the wiring concerned. Operate the machine while you monitor the display.

   A. If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved.

   B. If you do not find damage and the display indicates only normal readings, then erase the fault code and continue operation.

Wiring harnesses - Electrical schematic sheet 05 – Engine Control Unit (ECU) (55.100.DP-C.20.E.05)

1485-7-Engine Control Module (ECM) (Engine Control Unit (ECU)) relay: not responding properly

Control Module : ECU

NOTE: *Check the battery cables. If the cables were interrupted during shutdown this fault could occur.*

Context:
The Engine Control Unit (ECU) supplies the main ECU relay control circuit with **12.0 V** from the ECU connector X-9100 pin 4 and a ground reference at the ECU connector X-9100 pin 3 and pin 23. The main relay becomes open during engine running.

Cause:
The ECU is sensing the main relay circuit has failed during engine running.

Possible failure modes:

1. The main ECU relay has failed.
2. The wiring harness has failed.
3. The ECU has an internal failure.

Solution:

1. Use the Service Tool I to verify the fault is active.

   Select the “Active Diagnostic Codes” icon.

   A. If the fault code is present, continue with Step **3**.

   B. If the fault is not present, the fault may be intermittent and not currently active. Continue with Step **7**.

   NOTE: *Check the battery cables. If the cables were interrupted during shutdown this fault could occur.*
2. Verify that the battery is fully charged.

   Inspect the battery terminals to make sure they are clean and tight.

   A. The battery is fully charged and terminals are secure and clean. Continue with Step **4**.

   B. The battery is not fully charged or terminals are loose or dirty. Charge or replace the battery and repair or secure the cables as required.
3. Verify that the wiring and connectors are free of damage.

   Inspect the harness from the main ECU relay to the ECU.

   Verify that the harness is free of damage, corrosion, abrasion and incorrect attachment.

   A. The connectors are secure and the harness is free of damage. Continue with Step **4**.

   B. The connectors or the harness has damage. Repair or replace the harness or connectors as required.
4. Check the main ECU relay.

   Place the key switch OFF.

   Disconnect the main ECU relay from the fuse and relay panel.

   Use a multimeter to perform the following check.

From	To	Value
Relay terminal 86	Relay terminal 85	There should be continuity.

From	To	Value
Connector X-9006 pin 1	Chassis ground	There should be no continuity.
Connector X-9006 pin 2	Chassis ground	There should be no continuity.
Connector X-9006 pin 2	Connector X-9006 pin 1	There should be no continuity.

A. If the wiring harness test passes, see **Electronic module - Electrical test Engine Control Unit (ECU) verification (55.640)** to verify the ECU is working properly.

B. If the wiring harness test fails, locate and repair the broken conductor.

5. Visually inspect the relevant harnesses and connectors for damage, bent or dislocated pins, corroded terminals, or broken wires. Verify that the connectors are fully installed. Flex the harnesses involved to reveal intermittent breaks or shorts in the wiring concerned. Operate the machine while you monitor the display.

A. If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved.

B. If you do not find damage and the display indicates only normal readings, then erase the fault code and continue operation.

Wiring harnesses - Electrical schematic sheet 05 – Engine Control Unit (ECU) (55.100.DP-C.20.E.05)

A. If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved.

B. If you do not find damage and the display indicates only normal readings, then erase the fault code and continue operation.

6. Check the burner injectors.

   Disable the fuel supply to the burner injectors.

   Use the Service Tool I to actuate the burner injector 1.

   Listen for movement (clicking noise) during actuation.

   A. Clicking noise heard (injector moves) when actuated. see **Electronic module - Electrical test Engine Control Unit (ECU) verification (55.640)** to verify the ECU is working properly.

   B. Clicking noise not heard. The injector is not moving when actuated. Replace the burner assembly.

Wiring harnesses - Electrical schematic sheet 05 – Engine Control Unit (ECU) (55.100.DP-C.20.E.05)