SERVICE MANUAL

Workmaster™ 50 / Workmaster™ 60 / Workmaster™ 70
Tier 4B (final)
Tractor

Part number 47866583
1st edition English
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NEW HOLLAND AGRICULTURE

Foreword Ecology and the environment

Soil, air, and water are vital factors of agriculture and life in general. When legislation does not yet rule the treatment of some of the substances which are required by advanced technology, common sense should govern the use and disposal of products of a chemical and petrochemical nature.

NOTICE: *The following are recommendations which may be of assistance:*

- Become acquainted with and ensure that you understand the relative legislation applicable to your country.
- Where no legislation exists, obtain information from suppliers of oils, filters, batteries, fuels, antifreeze, cleaning agents, etc., with regard to their effect on man and nature and how to safely store, use and dispose of these substances.
- Agricultural consultants will, in many cases, be able to help you as well.

Helpful hints

- Avoid filling tanks using cans or inappropriate pressurized fuel delivery systems which may cause considerable spillage.
- In general, avoid skin contact with all fuels, oils, acids, solvents, etc. Most of them contain substances which may be harmful to your health.
- Modern oils contain additives. Do not burn contaminated fuels and or waste oils in ordinary heating systems.
- Avoid spillage when draining off used engine coolant mixtures, engine, gearbox and hydraulic oils, brake fluids, etc. Do not mix drained brake fluids or fuels with lubricants. Store them safely until they can be disposed of in a proper way to comply with local legislation and available resources.
- Modern coolant mixtures, i.e. antifreeze and other additives, should be replaced every two years. They should not be allowed to get into the soil but should be collected and disposed of properly.
- Do not open the air-conditioning system yourself. It contains gases which should not be released into the atmosphere. Your NEW HOLLAND dealer or air conditioning specialist has a special extractor for this purpose and will have to recharge the system properly.
- Repair any leaks or defects in the engine cooling or hydraulic system immediately.
- Do not increase the pressure in a pressurized circuit as this may lead to a component failure.
- Protect hoses during welding as penetrating weld splatter may burn a hole or weaken them, allowing the loss of oils, coolant, etc.

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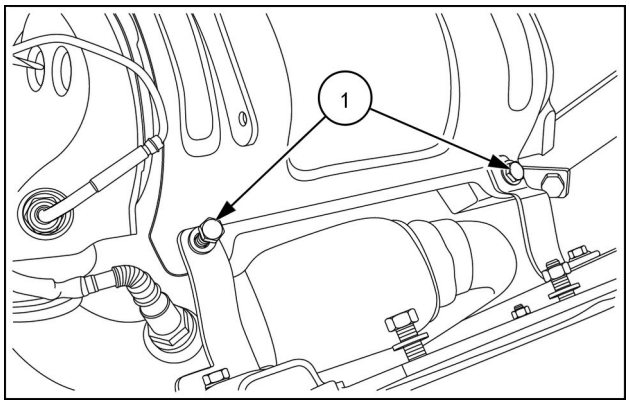
32. Loosen the bolts **(1)** securing cover of the SCR (Selective Catalytic Reduction) assembly to the fuel tank support plate.



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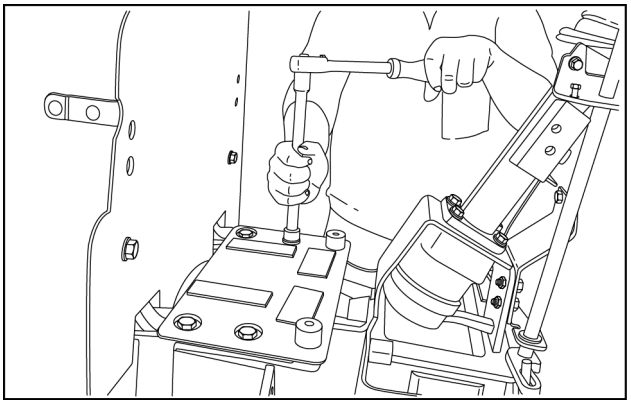
33. Remove all the bolts securing the fuel tank base plate to the clutch housing.
34. Remove the fuel tank base plate.



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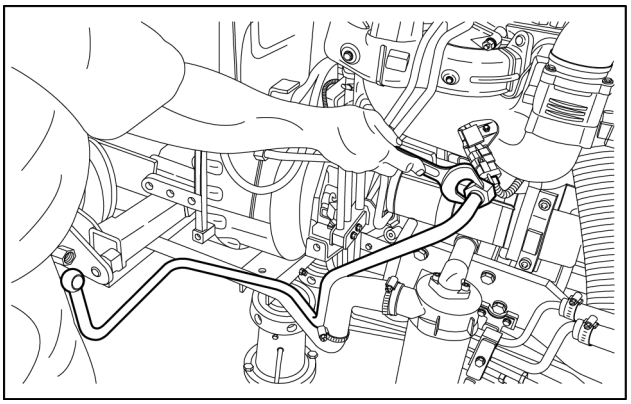
35. Disconnect the hydraulic line between the pump and the mid mount valve.



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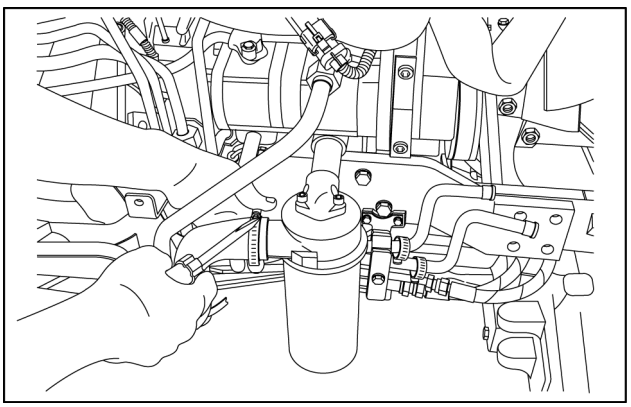
36. Loosen the clamp and remove the suction pipe from the hydraulic filter.



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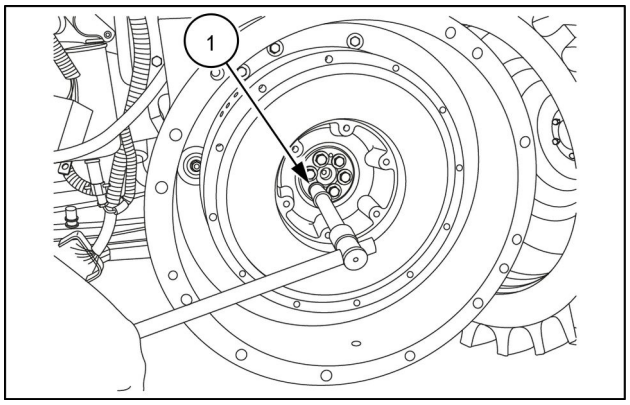
5. Remove the bolts **(1)** and take out the flywheel from the main clutch housing.



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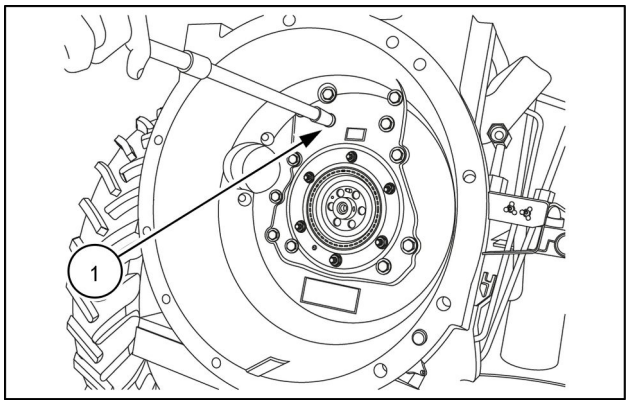
Clutch housing separation from the engine (if necessary)

6. Place a suitable support. Remove the bolts **(1)** and separate the clutch housing.



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Air cleaner - Assemble

Fitment

For assembly, follow the reverse order of disassembly. Clean the interior of the air filter housing using a clean cloth.

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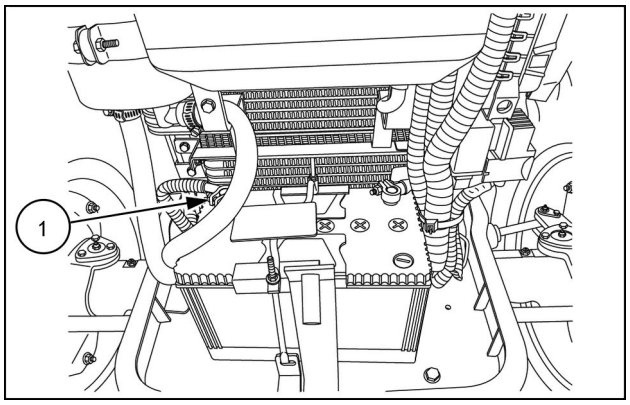
5. Connect the negative terminal **(1)** of the battery.



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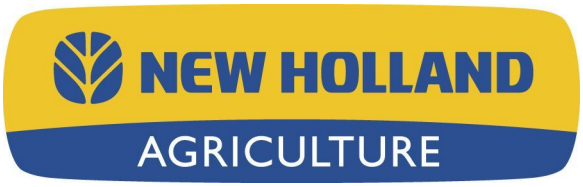
SERVICE - Technical Publications & Tools



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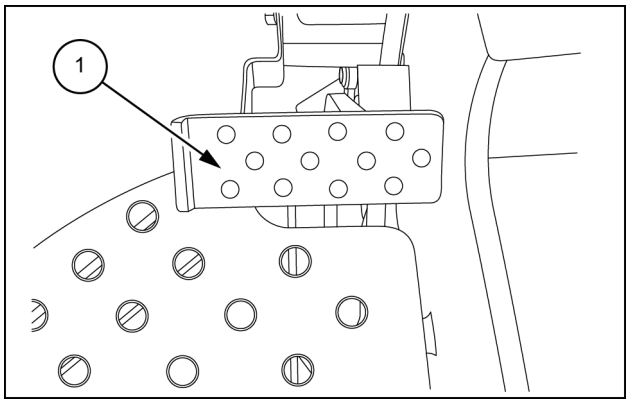
Clutch mechanical release control - Adjust

Clutch pedal free play should be **30.00 - 45.00 mm** (**1.18 - 1.77 in**). To adjust the clutch pedal free play proceed as follows:



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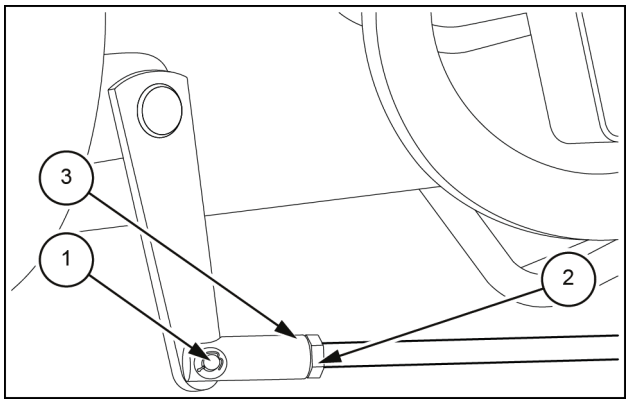
1. Remove the split pin **(1)** and disconnect the linkage.
2. Loosen the lock nut **(2)**.
3. Rotate the yoke **(3)** clockwise to reduce the play and anti-clockwise to increase the play.
4. Connect the linkage back to the cross shaft.



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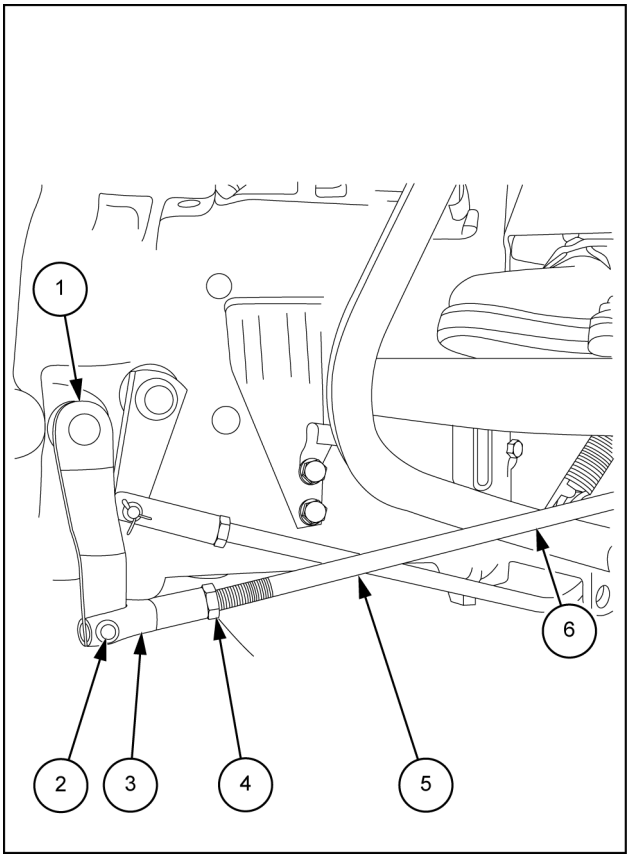
Power Take-Off (PTO) clutch lever free play (double speed)

1. Remove the pin **(2)**, fork **(3)** and rod **(5)** separately.
2. Keep lever **(1)** at the right most position such that the bearing just touches the clutch fingers.
3. Insert rod **(5)** into fork **(6)** and tight the threads up to **15.00 mm** (**0.59 in**).
4. Keep end of lever **(7)** at **30.00 - 35.00 mm** (**1.18 - 1.38 in**) from edge as shown in figure.
5. Keep the rod in static position and insert fork **(3)** into rod **(5)**.
6. Match the hole of fork **(3)** with hole of lever **(1)**. Keep the lever in initial position.
7. Insert pin **(2)** in matching holes and lock lever **(1)**.



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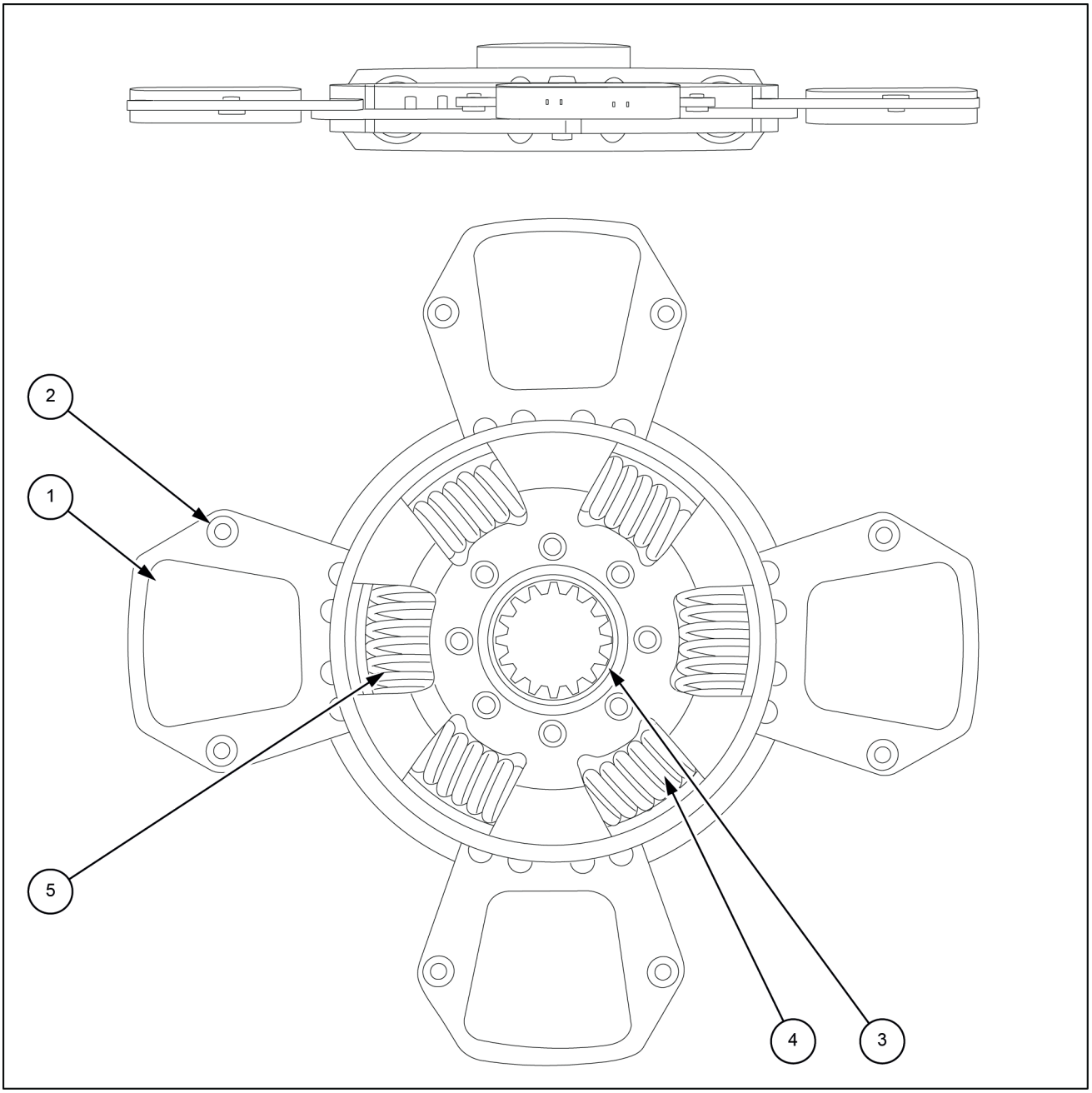

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(1) – Clutch facing
(2) – Facing rivet
(3) – Hub
(4) – Idle damper spring
(\5) – Main damper spring

Clutch control mechanism - Remove

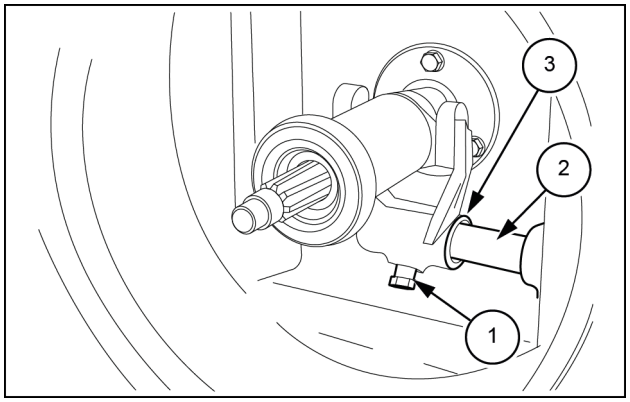
⚠ WARNING

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

It is necessary to split the tractor between engine and transmission housing to gain access to the clutch.

1. Loosen the set screw **(1)** from fork.
2. Pull out the cross shaft **(2)**.
3. Remove clutch release fork **(3)**.



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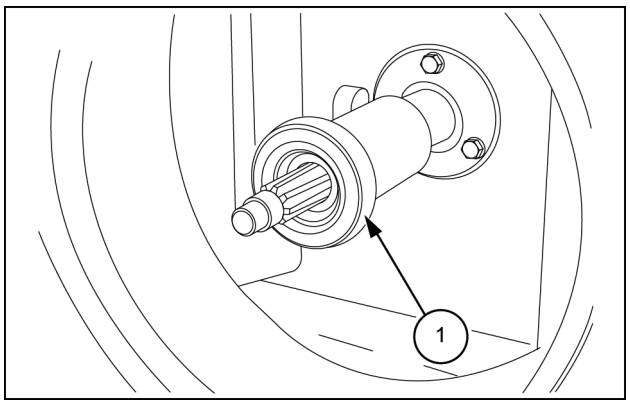
4. Slide out the clutch release bearing **(1)**.



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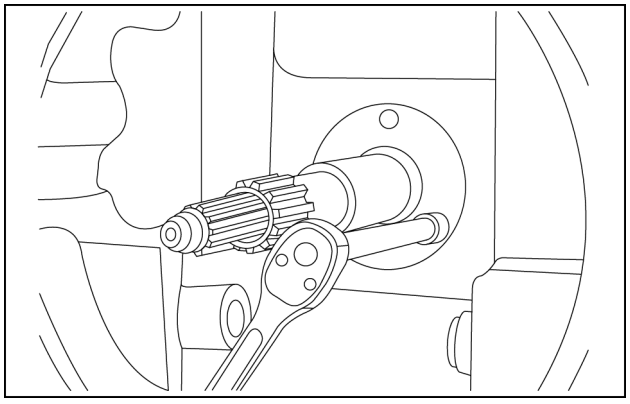
5. Loosen the bolts 3 numbers as shown in figure.



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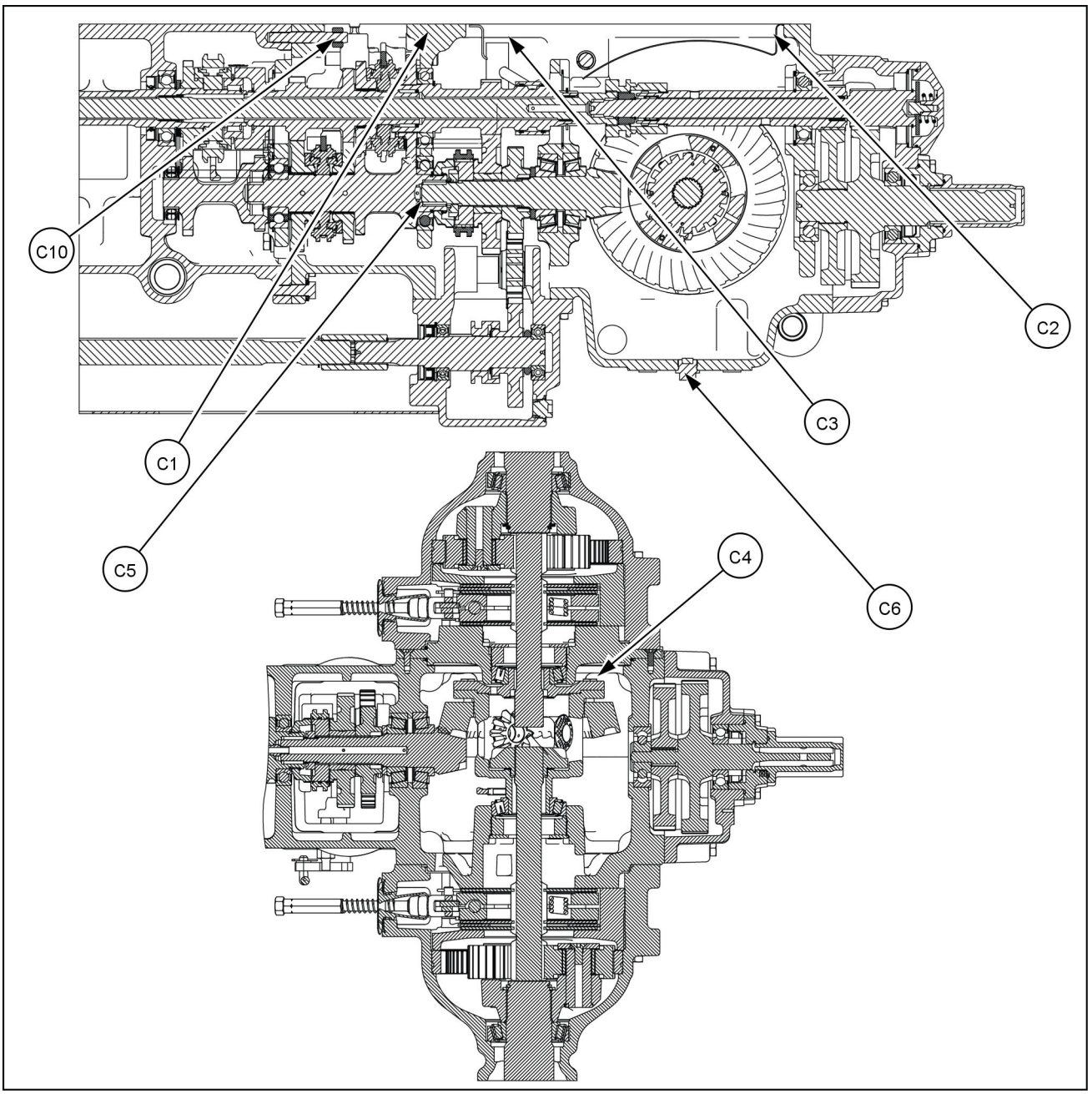

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Mechanical transmission - Remove

⚠ 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

⚠ DANGER

Heavy objects!
Lift and handle all heavy components using lifting equipment with adequate capacity. Always support units or parts with suitable slings or hooks. Make sure the work area is clear of all bystanders.
Failure to comply will result in death or serious injury.

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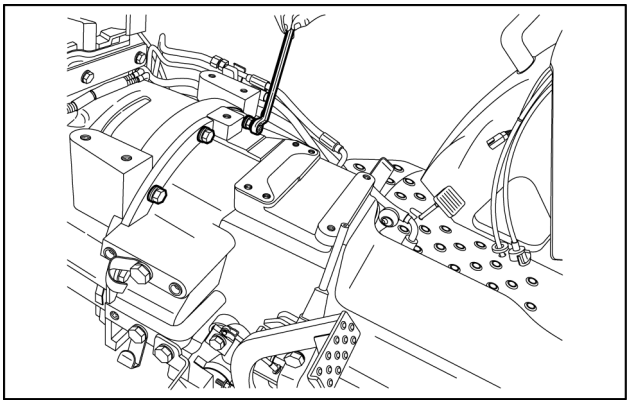
NOTE: *To remove the transmission housing from the tractor, tractor has to be split at clutch and transmission housing. Fenders, hydraulic housing, three point linkage, rear tires and final drive housing have to be removed from the tractor.*

1. Loosen the bolts and remove the transmission assembly from the tractor. See engine removal section.



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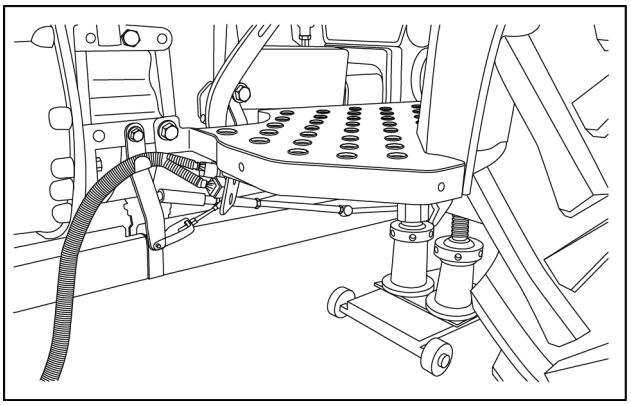
2. Loosen bolts securing foot boards on left-hand side and right-hand side fenders. Disconnect all the wirings. See **Protections and footboards - Remove (90.118)**.



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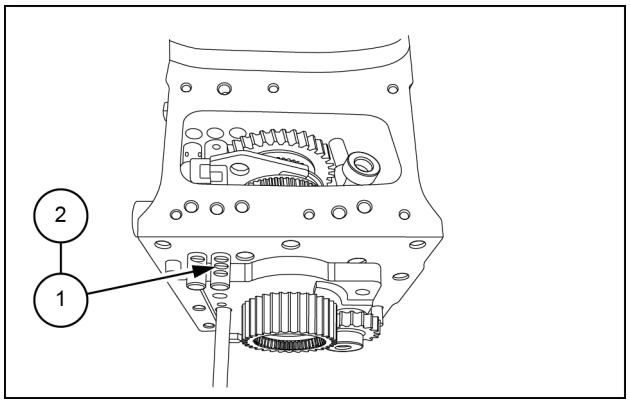
10. Install all the shift rails shift gates and shift forks after installing the springs **(1)** and detent balls **(2)**.



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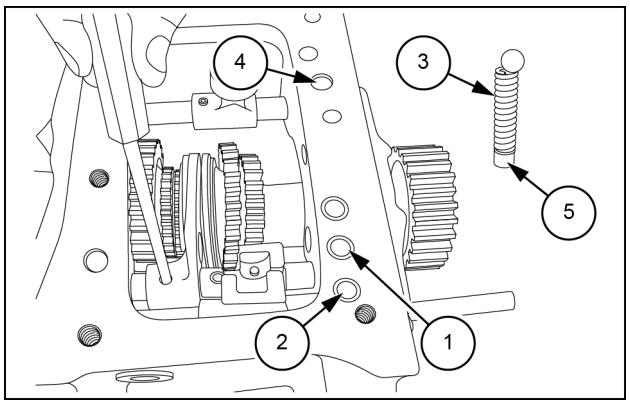
11. Install all roll pins to shift rails along with springs and detent balls.

NOTE: *Install the detent balls and springs where shown* ***(1)*** *and* ***(2)****. Insert the Hi/Low rail detent ball and spring* ***(3)*** *where shown* ***(4)****. Install the plug* ***(5)*** *above the Hi/Low rail detent ball and spring at* ***(4)****.*



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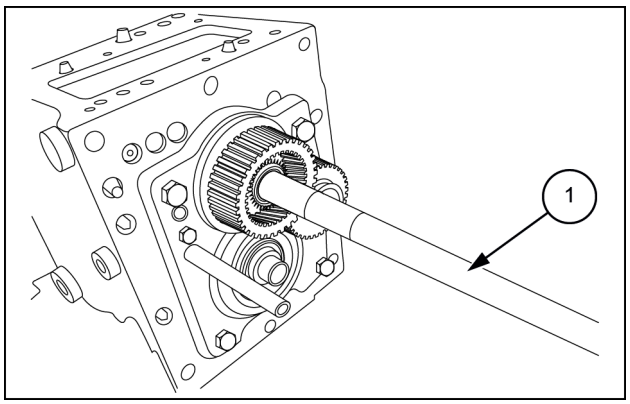
12. Install the Power Take-Off (PTO) shaft **(1)**.



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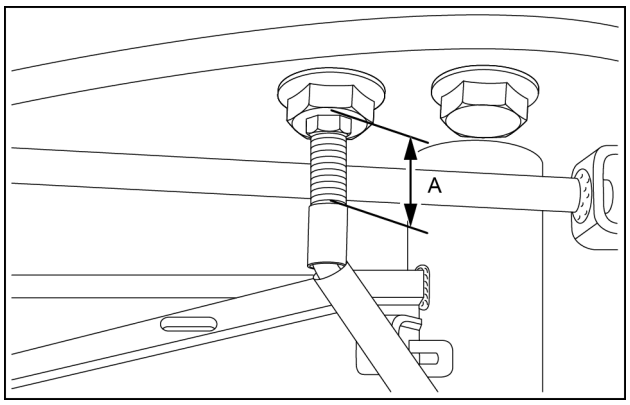
Mechanical transmission external controls - Adjust

Shuttle interlock cable

1. Measure dimension **(A)** at cable end as shown in figure **1**. (Top of nut to bottom of threads). The desired length of **(A)** is approximately **26.000 mm** (**1.024 in**), adjust if required.



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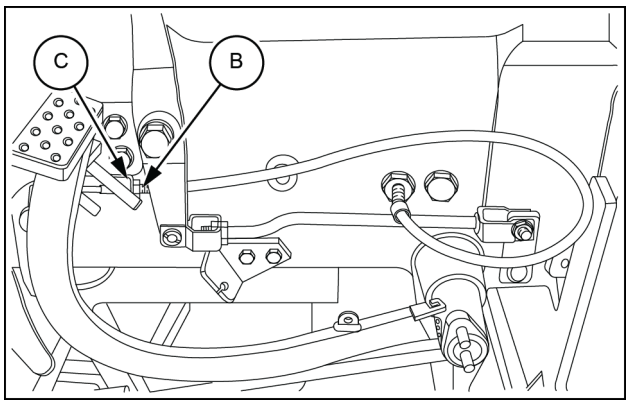
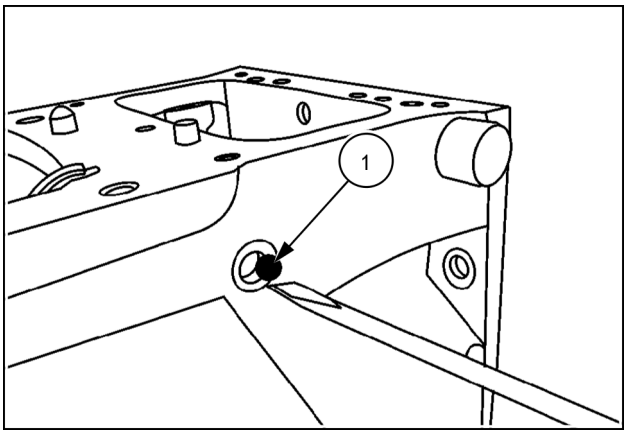
2. At the opposite cable end, count the number of visible threads **(B)**, there should be 6 or 7. Thread length can be changed by adjusting the nuts on either side of cable mounting bracket **(C)**.
3. Adjust the nuts so that the shuttle lever starts to move when clutch pedal is depressed beyond free play **50.00 - 55.00 mm** (**1.97 - 2.17 in**) from rest) and then tighten.



GNIL14TR04226AB 2

4. After fitting reverse rail insert ball **(1)**, applying some grease in the housing.



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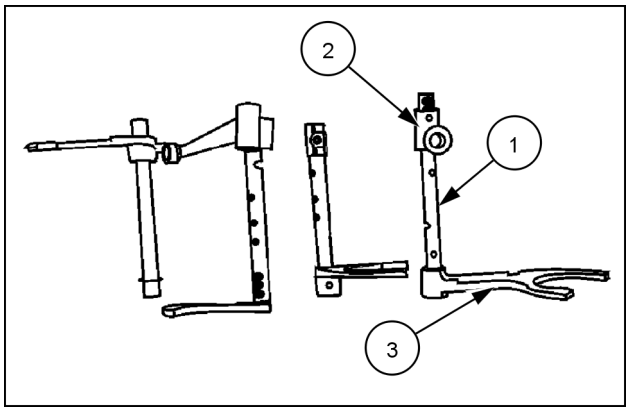
5. Insert the rail **(1)**, of 3rd/4th with gate **(2)**, passing through fork **(3)**, of 3rd/4th gear as shown in **5**.
   Insert gate of 1st/2nd rail shaft on the notch of 1st/2nd gear fork.



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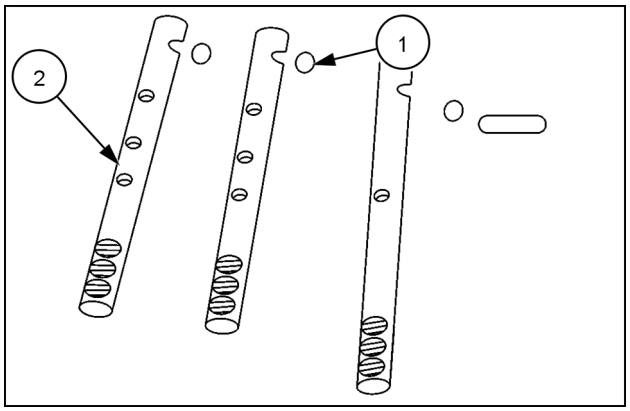
6. Insert the ball **(1)**, applying some grease in housing after removing bolt as shown in **4**.
7. Insert the 1st/2nd rail **(2)**, passing thru gate as shown in **5**.

NOTE: *Keep grooves of rails upward to make easy fitment of balls and springs.*



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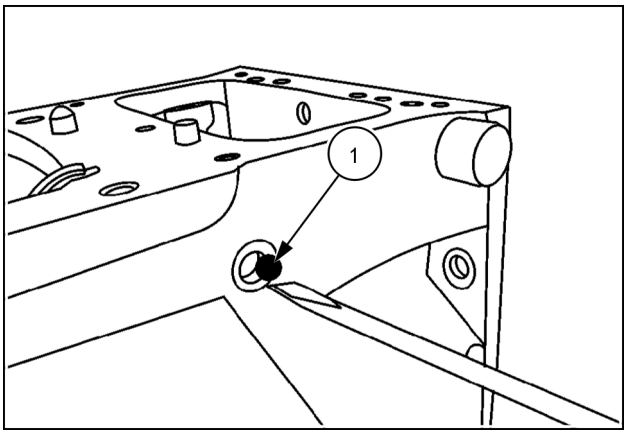
8. Insert the ball and pin **(1)**, after removing neutral safety switch for Hi/Lo rail then fit neutral safety switch and tighten it.



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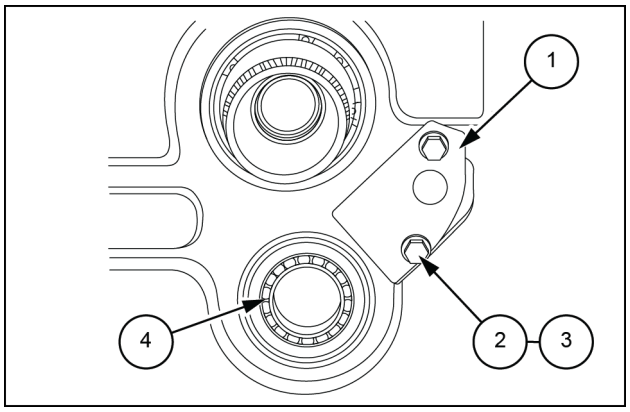
Gearbox internal components - Install

1. Place the oil trench plate **(1)** on the housing surface and tighten the bolts **(2)** with washer **(3)** to **25.5 N·m** (**18.8 lb ft**).
2. Install the ball bearing **(4)** from the rear of the clutch housing.



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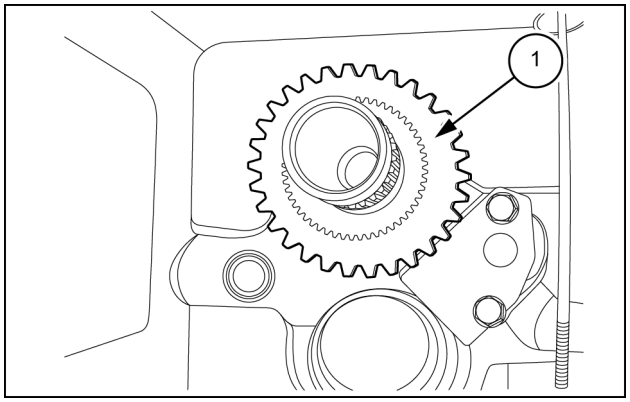
3. Install the reverse gear **(1)** over the input shaft spacer.



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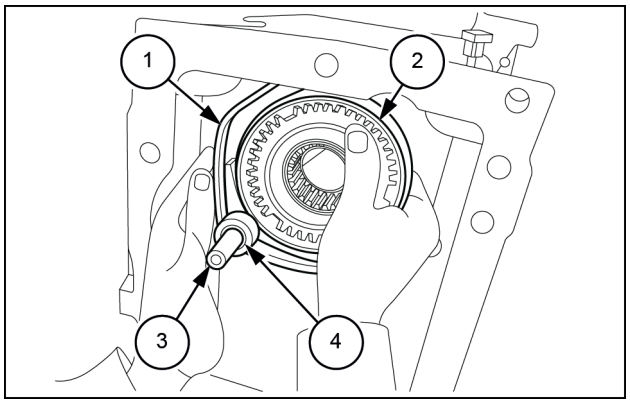
4. Install the shift fork **(1)** onto the synchronizer **(2)**.
5. Insert the shift rail **(3)** through the shift fork **(1)**.

NOTE: *Secure the spring and detent ball against the groove on the shift rail by installing the shuttle detent bolt on the left-hand side of the clutch housing.*

6. Install roll pin **(4)** after aligning the hole of the shift fork **(1)** and shift rail **(3)**.
7. Install the synchronizer kit **(1)** onto the spline of the input shaft.
8. Secure the synchronizer on the input shaft with the external retaining ring **(2)**.



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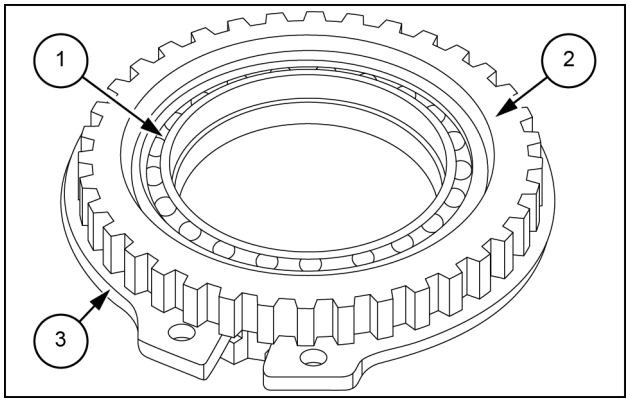
9. Press the ball bearing **(1)** inside the coupler shuttle gear **(2)**.
10. Attach the external snap ring **(3)** onto the groove of coupler shuttle gear **(2)**.



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Drive shaft - Inspect

1. Wash all parts in a suitable cleaning solution and allow to air-dry.
2. Inspect all gears for excess wear chipped gear teeth cracks or any other damage. Replace as necessary.
3. Inspect the gear coupler and synchromesh drive shaft for any cracks or damage. Replace as necessary.

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Four-Wheel Drive (4WD) axle - Remove

⚠ WARNING

Heavy objects!
Lift and handle all heavy components using lifting equipment with adequate capacity. Always support units or parts with suitable slings or hooks. Make sure the work area is clear of all bystanders. Failure to comply could result in death or serious injury.

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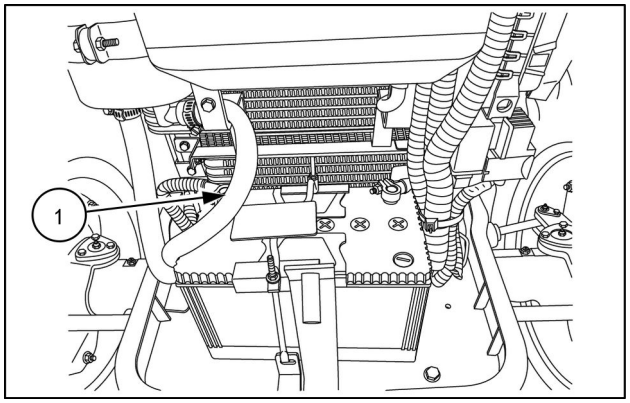
NOTE: *The front axle assembly can be removed from the tractor either with or without previously removing the drive shaft. The description below refers to removal of the front axle with the drive shaft installed on the tractor.*

1. Disconnect the negative battery terminal **(1)**.



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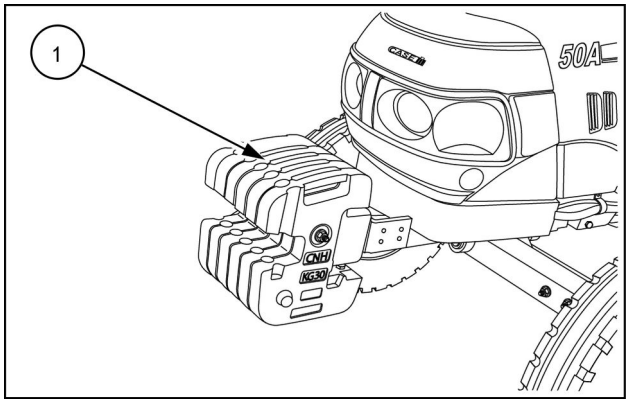
2. Remove the front weights **(1)**.



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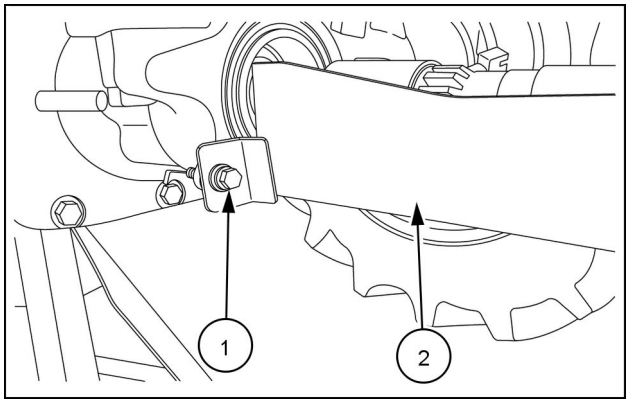
3. Remove the bolts **(1)**, and remove the drive shaft guards **(2)**.



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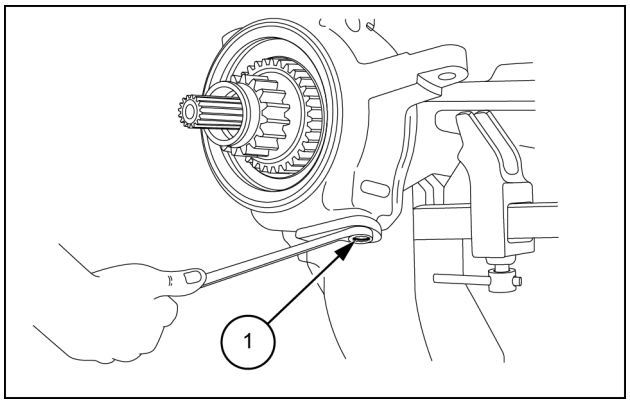
19. Remove the retaining bolts **(1)** of the lower pivot pin of the stub axle housing.
20. Remove the lower pivot pin and the relative adjustment shims.



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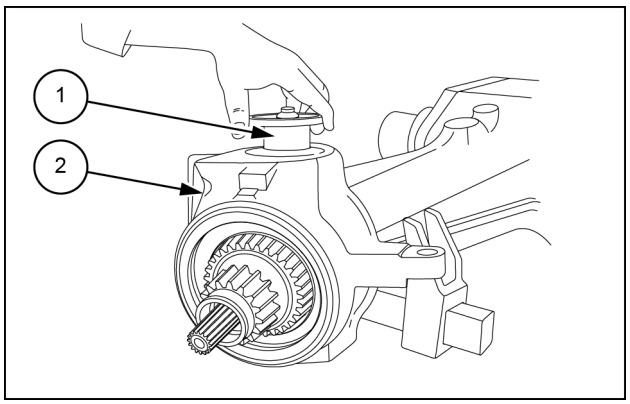
21. Remove the retaining bolts of the upper pivot pin.
22. Remove the upper pivot pin **(1)**.
23. Remove the stub axle housing **(2)**.



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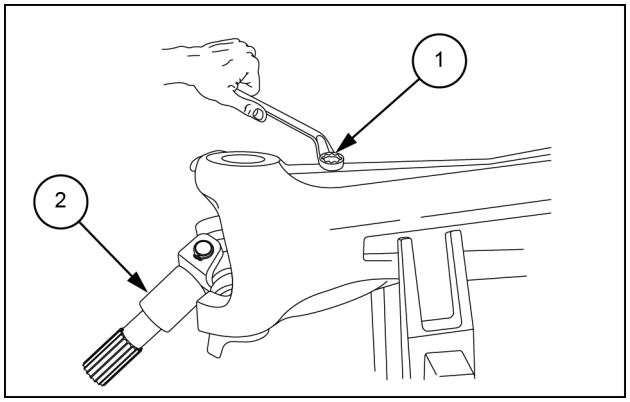
24. Remove the retaining bolt **(1)** of the axle shaft **(2)**.



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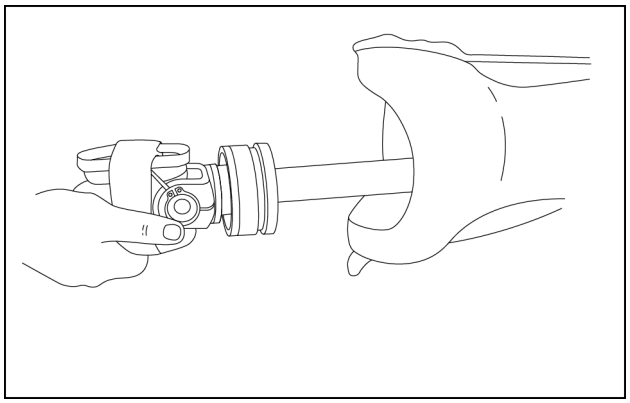
25. Using a pry bar, pull the axle shaft out of the casing.
26. To disassemble the right-hand final drive unit, repeat the above steps **[Invalid Reference]** to **[Invalid Reference]**.



GNIL14TR04383AA 16

Steering knuckle and king pin - Adjust (Stub Axle)

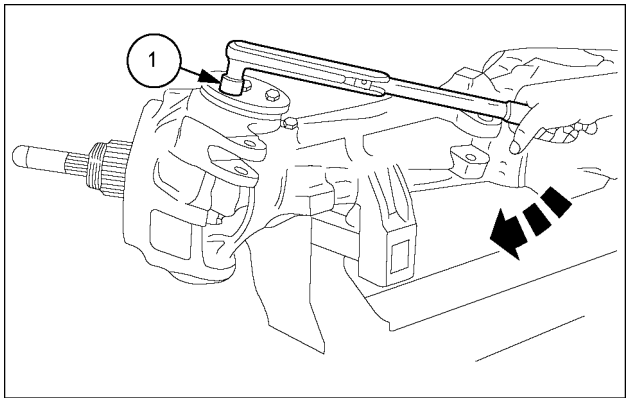
⚠ WARNING

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

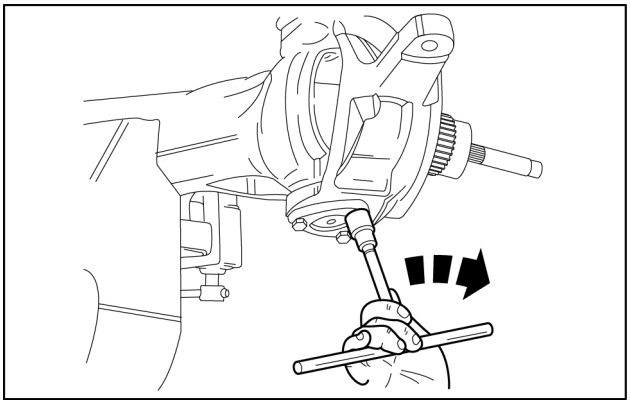
Install the front axle on a stand and proceed as follows.

1. Smear grease on the outer races of the bearings and fit the upper cover, without the adjustment plate, but with tool number **380000235 (1)**. Tighten the retaining bolts to a torque value of **64 N·m** (**47 lb ft**).



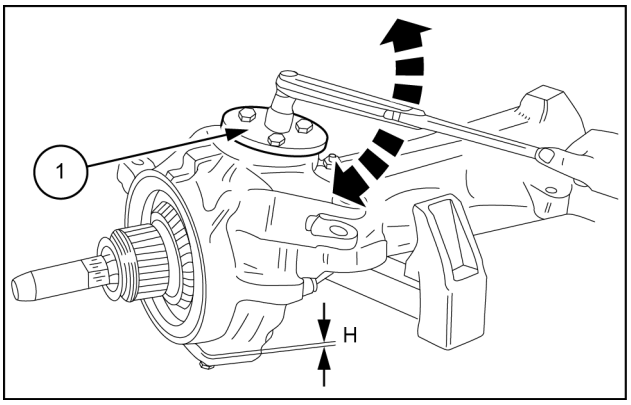
GNIL14TR04412AB 1

2. Install the lower cover without adjustment plate, lubricate the three retaining bolts with oil.
3. Gradually tighten the lower cover bolts in sequence, while simultaneously rotating the casing to allow the excess grease to escape.



GNIL14TR04413AA 2

4. Using a torque wrench, tool number **380000235 (1)**, check that the torque required to rotate the casing is **2.9 N·m** (**25.7 lb in**) without considering the peak starting value. If not, adjust by way of the lower cover bolts.
5. Measure the gap (H) created between the low cover and the casing in correspondence with the three bolts.

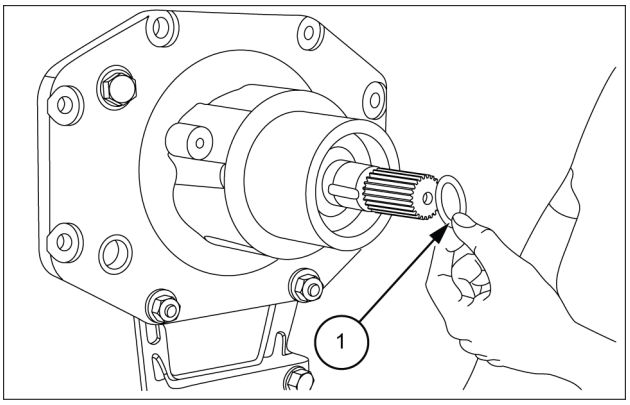


GNIL14TR04414AB 3

6. Calculate the average of the three values measured. The total thickness of the adjustment shims to be fitted under the lower cover is to be calculated as follows:
   S3= H
   If necessary, round up the value to the next **0.05 mm** (**0.002 in**).

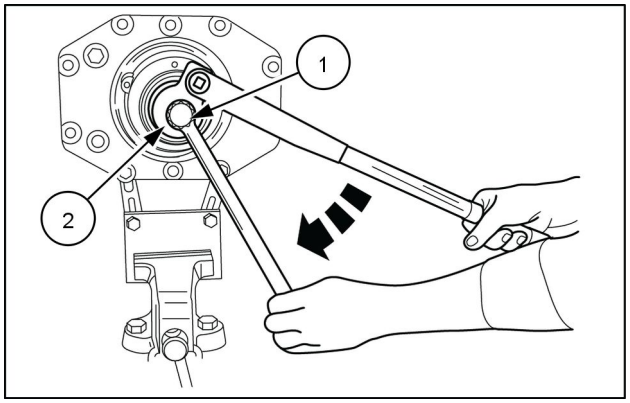
Available shim sizes	
2.6 mm (**0.102 in**)	**2.9 mm** (**0.114 in**)
2.65 mm (**0.104 in**)	**2.95 mm** (**0.116 in**)
2.7 mm (**0.106 in**)	

8. Install the O-ring seal **(1)** on the drive pinion shaft.
9. Then insert the spacer and then the detent ball, after having carefully lubricated the outer surface.



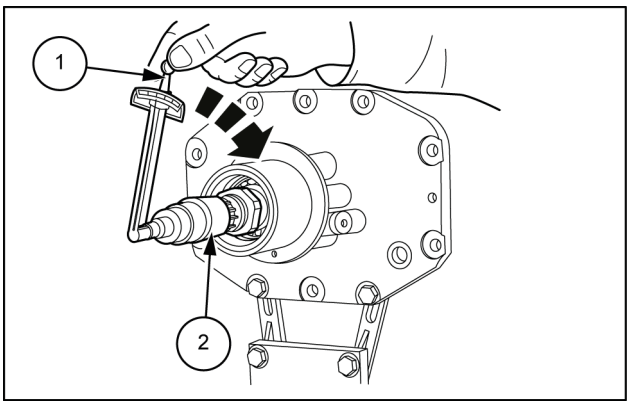
GNIL14TR04425AB 3

10. Install the pinion lock tool, tool number **380000257 (1)**.
11. Install wrench, tool number **380000268** on the threaded adjustment ring.
12. Using a wrench on the pinion lock tool **(1)**, hold the pinion against rotation, and using a torque wrench positioned exactly as shown in the figure on the threaded adjustment ring wrench **(2)**, tighten the adjustment ring to a torque value of **294 N·m** (**217 lb ft**) while simultaneously rotating the pinion shaft to ensure that the bearings are seated correctly.



GNIL14TR04430AB 4

13. With a torque wrench **(1)** on the pinion lock tool, tool number **380000257 (2)**, check that the pinion rolling torque, without oil seal and relative dust seal ring is **0 N·m** (**0 lb in**) - **0.2 N·m** (**1.8 lb in**).
    If the rolling torque is less than the prescribed value, install a thinner adjustment shim shown in Figure **2**, if the torque is greater than the prescribed value, install a thicker adjustment shim.
14. Unscrew the threaded adjustment ring and install the oil seal and the dust seal ring. Tighten the threaded ring to a torque of **294 N·m** (**217 lb ft**), while simultaneously rotating the pinion shaft to ensure that the bearings are seated correctly.
15. With a inch/pound torque wrench **(1)** on the pinion lock tool number **380000257 (2)**, check that the pinion rolling torque with the oil seal and relative dust seal ring is **0.5 N·m** (**4.4 lb in**) - **1 N·m** (**9 lb in**).
    Finally, carefully stake the threaded ring and fit the circlip on the drive pinion shaft.



GNIL14TR04355AB 5

Non-powered front axle - Remove

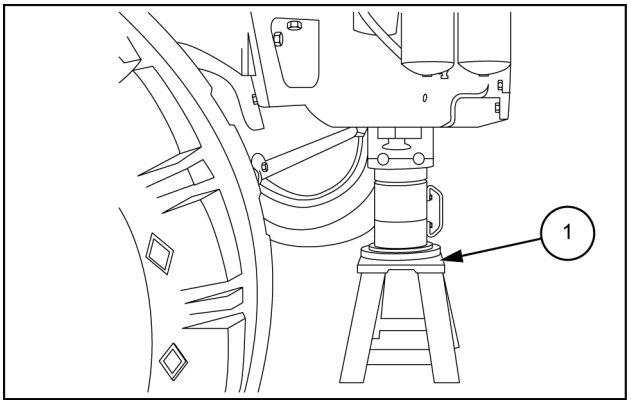
⚠ DANGER

Heavy objects!
Lift and handle all heavy components using lifting equipment with adequate capacity. Always support units or parts with suitable slings or hooks. Make sure the work area is clear of all bystanders. Failure to comply will result in death or serious injury.

D0076A

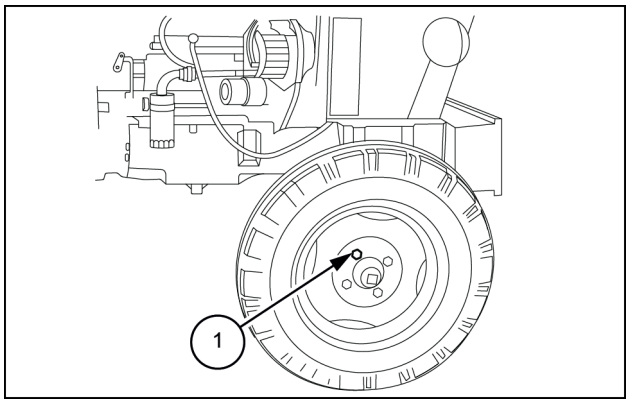
Remove the front axle assembly from the tractor as follows:

1. Open and raise front hood.
2. Disconnect the negative cable from the battery and insulate.
3. Safely block rear wheels.
4. Remove front weights and weight support, where fitted.
5. Jack up front tractor and place a stationary stand **(1)** under the sump.



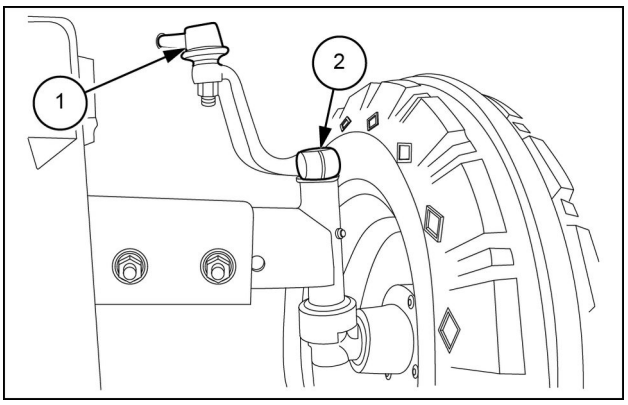
GNIL14TR04434AB 1

6. Loosen retaining bolts **(1)** and remove the front wheels.



GNIL14TR04435AB 2

7. Remove knuckle joint nut **(1)** and disconnect drag link **(2)** from control lever.



GNIL14TR04436AB 3

Non-powered front axle - Troubleshooting

Problem	Possible Cause	Correction
Premature tire wear	Wrong inflation pressure	Inflate tyres to correct pressure refer to values suggested in the operator's manual. Always comply with values specified by the tire manufacture
	Wrong front wheel toe-in	Adjust toe-in (see the procedure explained in this section under adjustment)
Poor tractor stability	Wrong inflation pressure	Inflate tyres to correct pressure

Contents

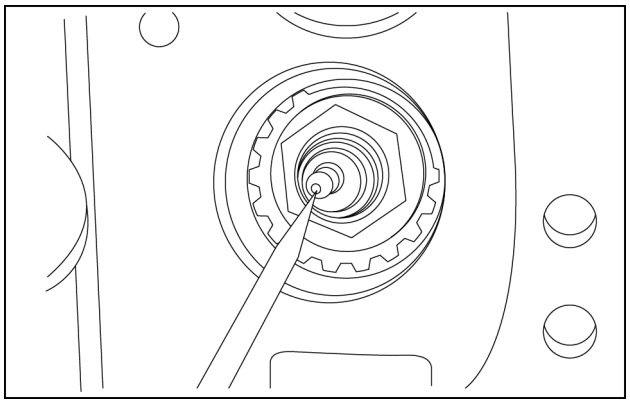
Rear axle system - 27

Rear bevel gear set and differential - 106

Rear bevel gear set and differential - Install

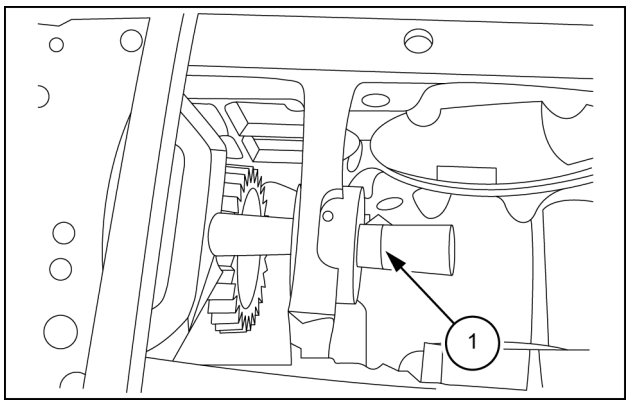
1. Re-install the differential housing observing the following.
   - Re-assembly follows the disassembly procedure in reverse. See **Rear bevel gear set and differential - Install (27.106)**.
   - Check seals and replace if damaged.
   - Before reassembling housings supports and covers thoroughly clean and degrease mating surfaces and apply a bead of liquid gasket of approx. **2.000 mm** (**0.079 in**) of diameter following the patterns shown in the figure.
   - Tighten to correct torques.
   - Preload tapper roller bearings by adding and removing shims and set crown pinion backlash by following the procedure given below.

4. Open the lock of pinion locking check nut with the help of screw driver.



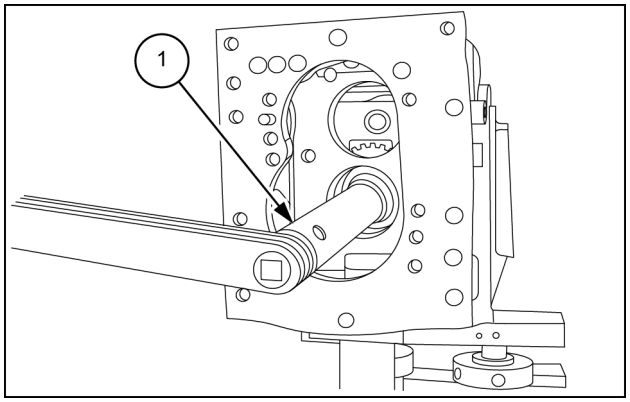
GNIL14TR04072AA 4

5. Fit pinion locking tool special tool **(1)** number 84261392.



GNIL14TR04073AB 5

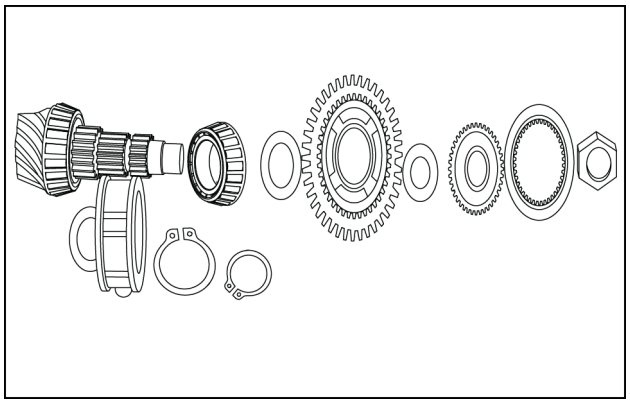
6. Remove the pinion shaft lock nut using special tool number 84261389.



GNIL14TR04074AB 6

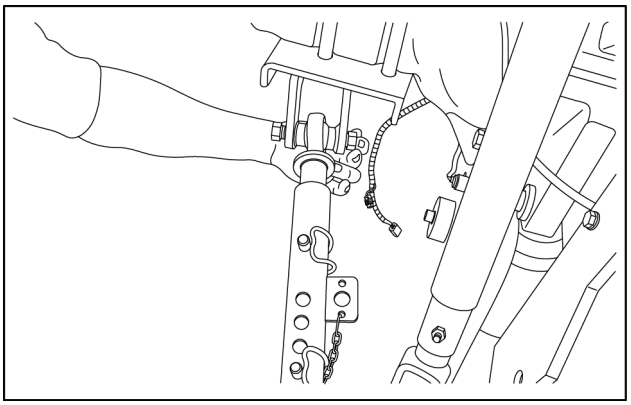
7. Withdraw pinion shaft from the differential housing and retrieve low gear, sleeve, coupling etc from the pinion shaft.

NOTE: *Keep deep cut of hub towards pinion check nut side.*



GNIL14TR04075AA 7

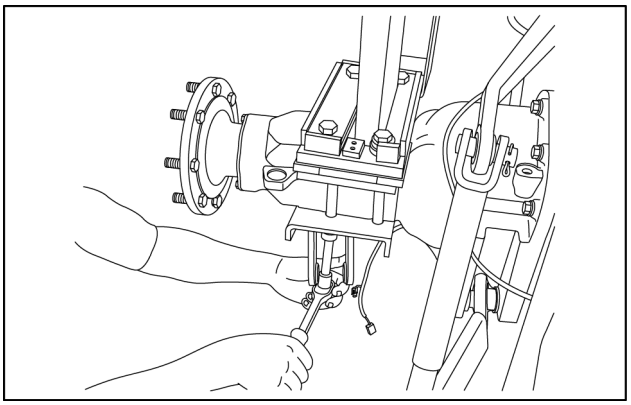
4. Remove the check chain and lower link of the three point linkage.



GNIL14TR00864AA 4

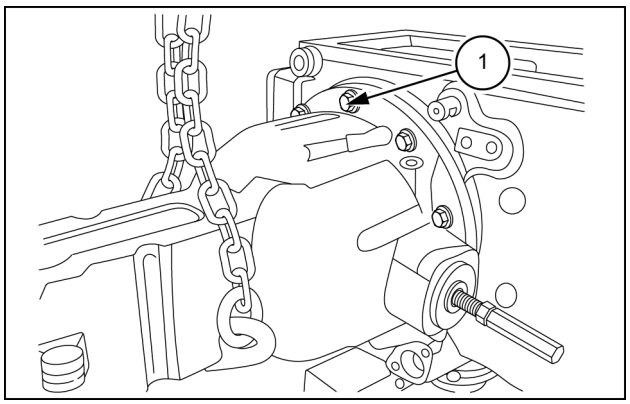
5. Remove the ROPS (Roll Over Protective Structure).

NOTE: *Use a suitable hoist.*



GNIL14TR00865AA 5

6. 1. Wrap chain around final drive housing and loosen bolts **(1)**.
   2. Remove the final drive housing.



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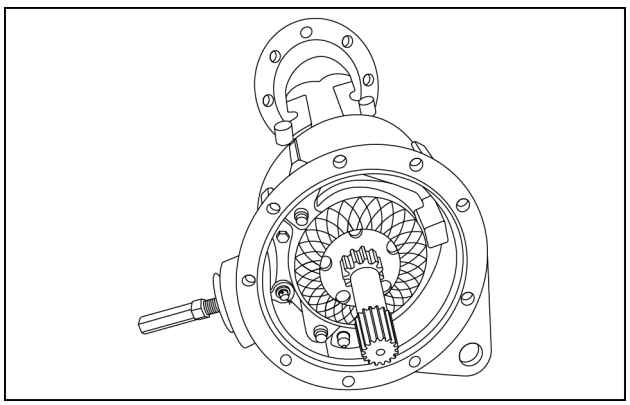
7. Place the trumpet housing assembly on plane surface.



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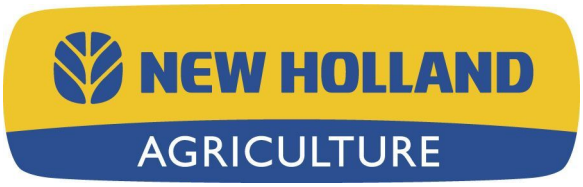

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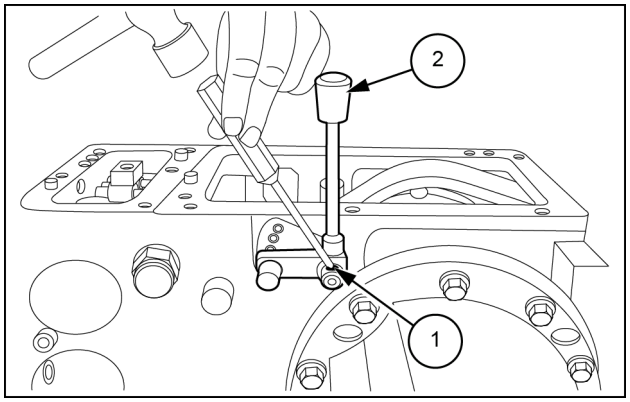
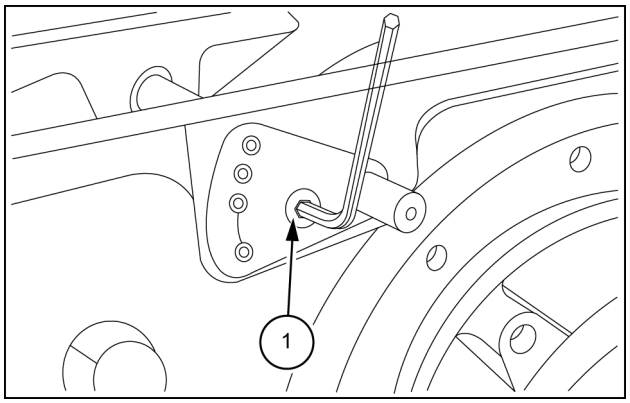
5. Push out roll pin **(1)** and remove main PTO lever **(2)** from the shaft.



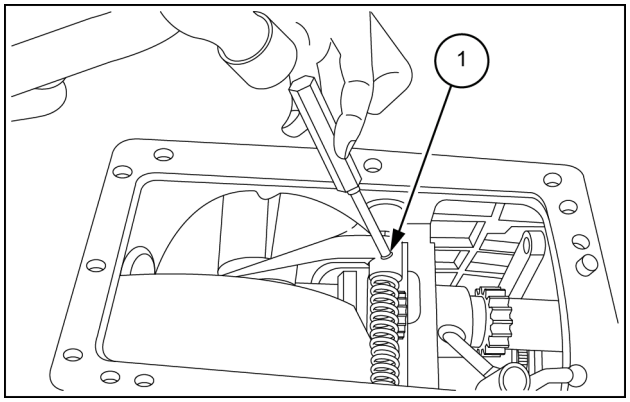
GNIL14TR04303AB 4

6. Loosen set screw **(1)** and remove plate.



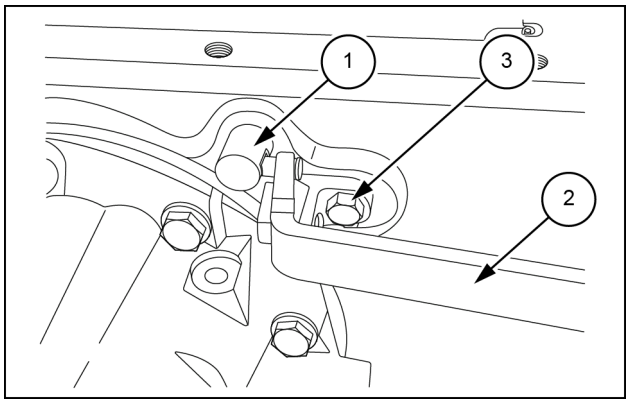
GNIL14TR04304AB 5

7. Remove roll pin holding differential lock fork **(1)** and PTO coupler fork.



GNIL14TR04305AB 6

8. Remove the differential pedal lever **(2)** by unscrewing two bolts **(3)** securing the bracket.



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One-speed rear Power Take-Off (PTO) - 110

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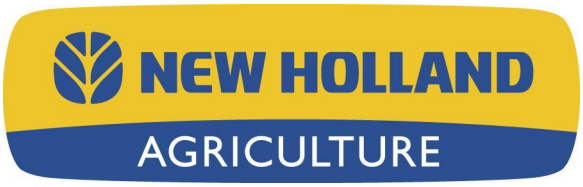

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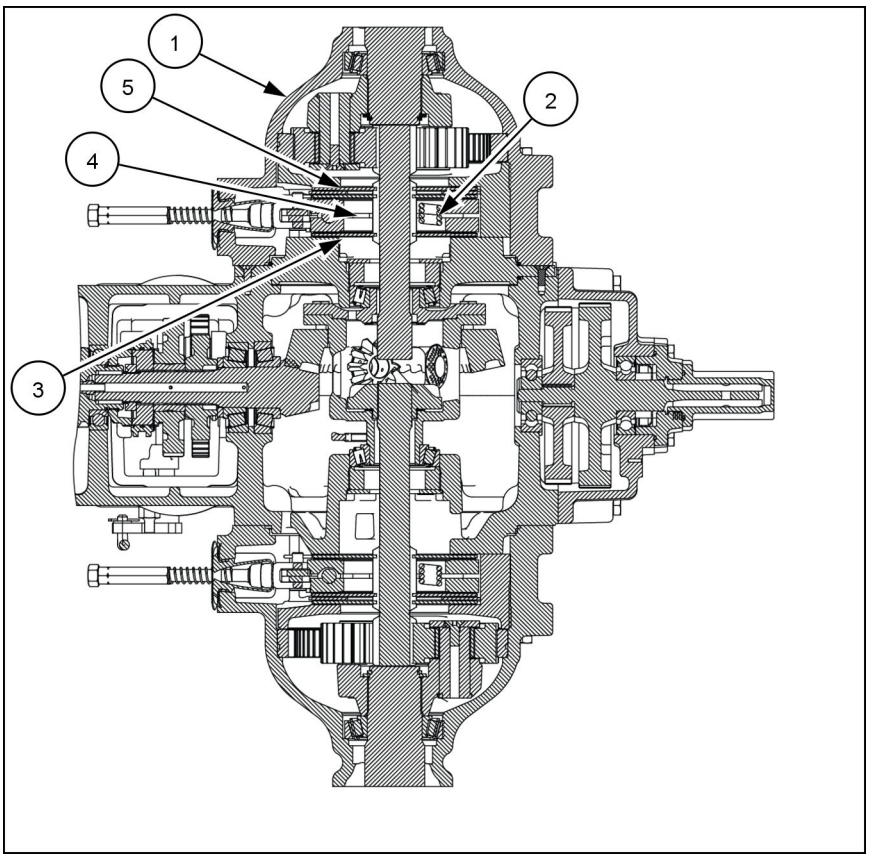
Mechanical service brakes - Sectional view



GNIL14TR00833FA 1

(1) Final drive housing
(2) Actuator return spring
(3) Inner friction plate
(4) Actuating discs
(5) Outer friction plate

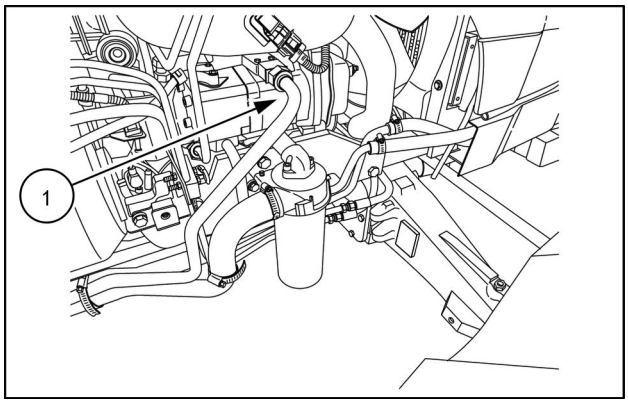
Mechanical service brakes - Troubleshooting

Problem	Possible Cause	Correction
Brake actuate only when pedal is depressed fully	Incorrect Pedal adjustment	Check and adjust
Tractor pulls to one side when brakes applied	Brakes not equally adjusted	Adjust
	Wrong tire pressure	Inflate tires to correct pressure
	Wrong liners on one side	Replace discs
Brakes noisy	Oil contamination	Check and change with recommended oil.
	Wrong brake disc	Replace brake discs.
Brakes remain applied when pedals are released	Seized brake actuating linkages	Clean and lubricate linkages
Pedals are hard to operate	Seized brake actuating linkages	Clean and lubricate linkages

Hydraulic systems - Component identification

Pump

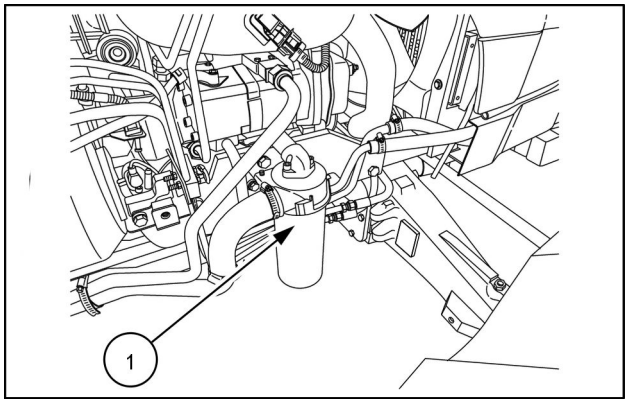
Open centre hydraulic pump assembly is of high pressure gear pump **(1)**.



GNIL14TR00519AA 1

Filter

Full-flow spin on type filter **(1)** mounted on right side of the engine on suction pump.

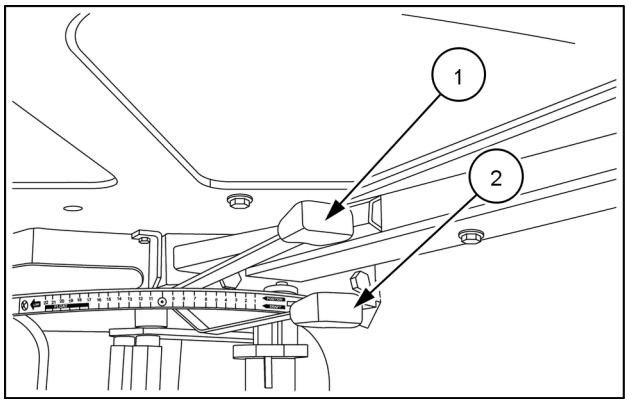


GNIL14TR00519AA 2

Mechanical hydraulic lift assembly

Mounted on top of transmission housing comprising of following components:

- Position control lever **(1)**
- Draft control lever **(2)**



GNIL14TR00580AA 3

Main lift system - Dynamic description

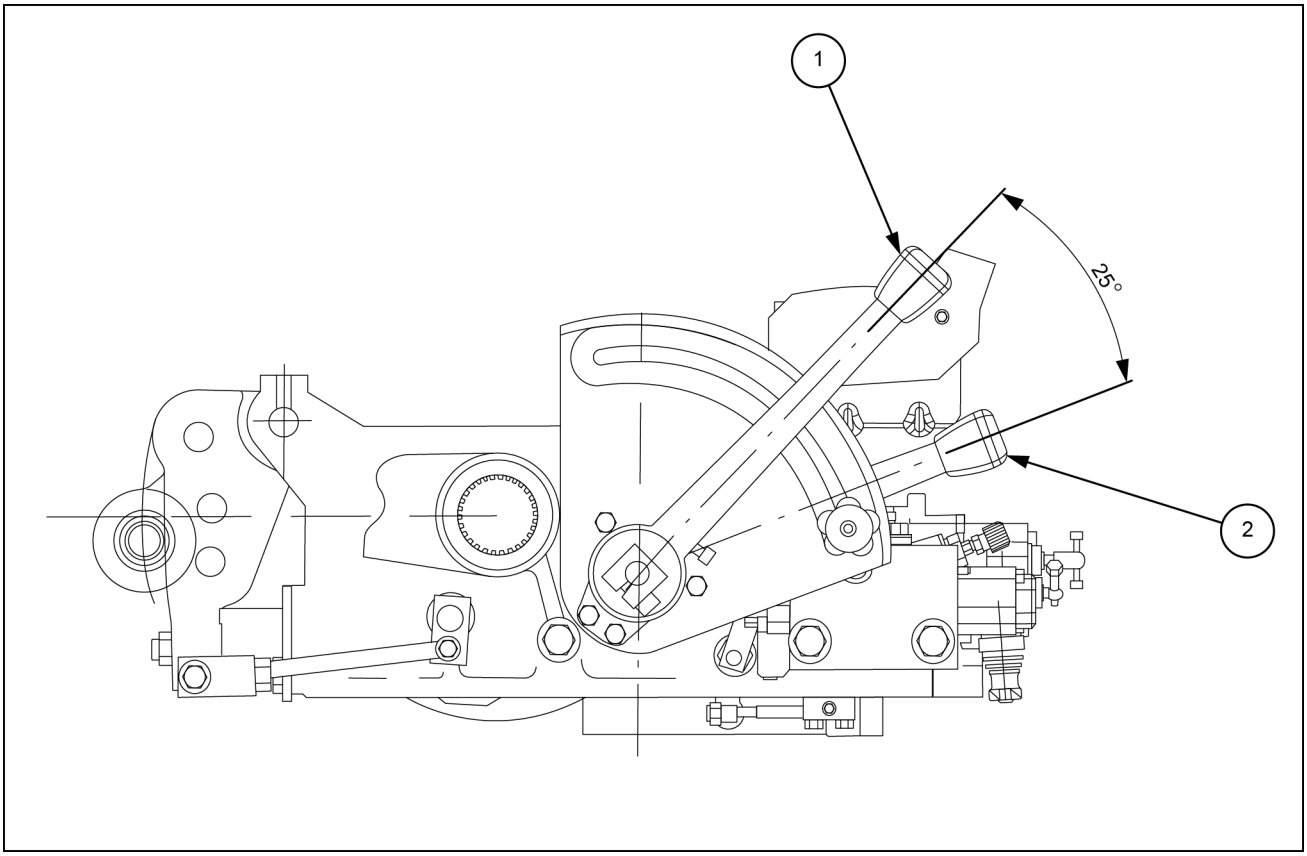
Control levers

A) Position control

B) Draft control

C) Combined operation for position and draft control

The above operations may be chosen in consideration of the work to be carried out, the implement type and the soil superficial hardness.



GNIL14TR04603FB 1

Position control

Move the draft control lever **(2)** fully down. Fix the implement position, inside or outside the soil, by moving the lever **(1)** up for raising and down for lowering.

The implement movement is proportional to the movement range fixed by means of lever **(1)**.

Draft control

Move the position control lever **(2)** fully down, have the implement penetrated into the ground till reaching the desired depth by gradually moving the lever **(2)** down.

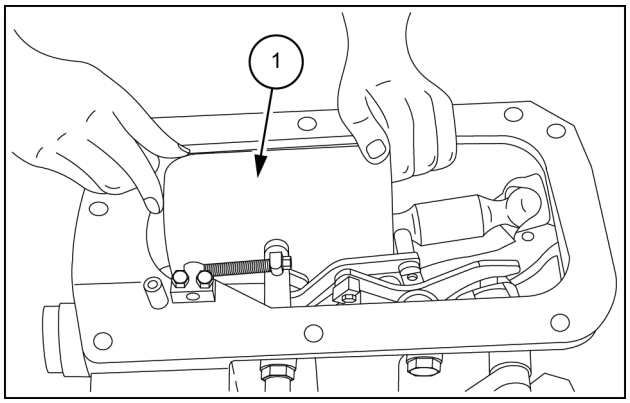
The implement depth reached is proportional to the draft determined by soil hardness.

In this condition the rock shaft keeps the draft required automatically constant.

Once the draft is regulated at the end of the rope is possible to lift the implement with position lever **(2)** in order to keep in memory the draft.

During last movement stroke of lever **(2)** a floating function is obtained and the rock shaft does not control the draft.

10. Remove the cylinder **(1)** from hydraulic lift housing.



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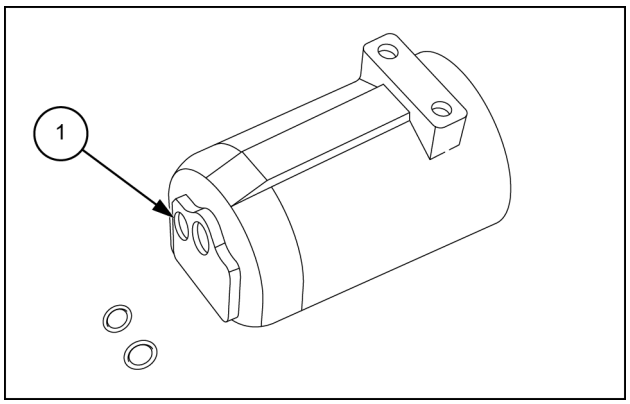
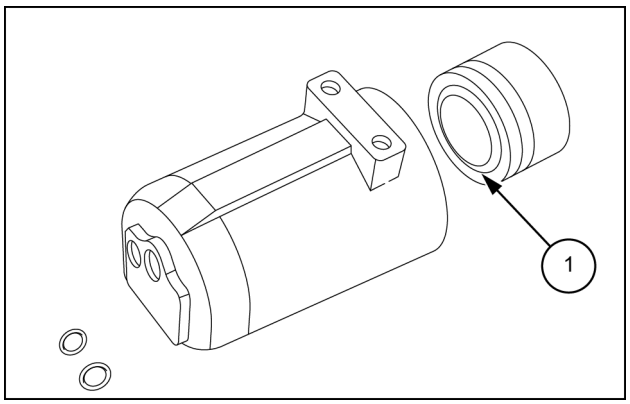
NOTE: *Retrieve the seal **(1)** from head of cylinder.*



GNIL14TR04626AB 8

11. Remove the piston **(1)** from the cylinder by pushing with a suitable aluminium rod from the front side.



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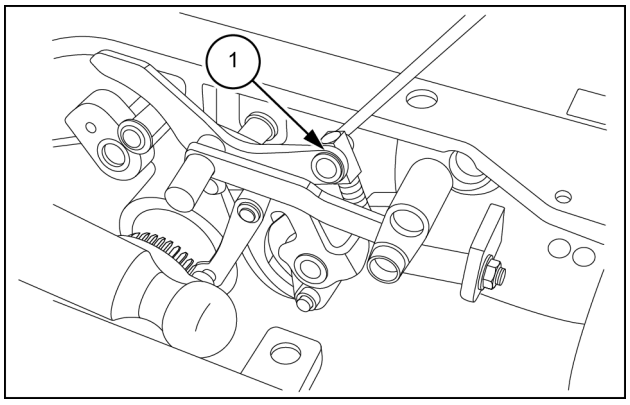
12. Remove locks and disassemble lever **(1)**.



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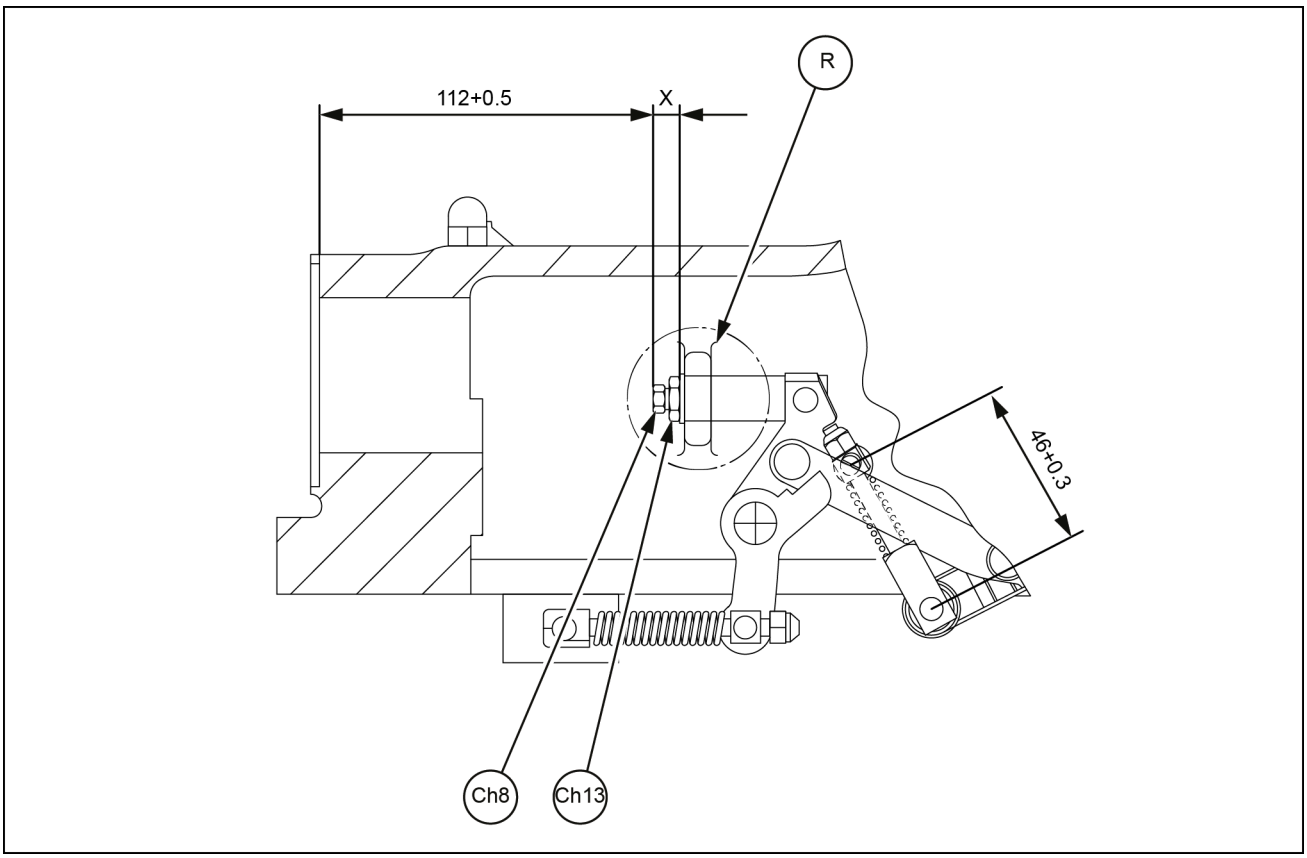


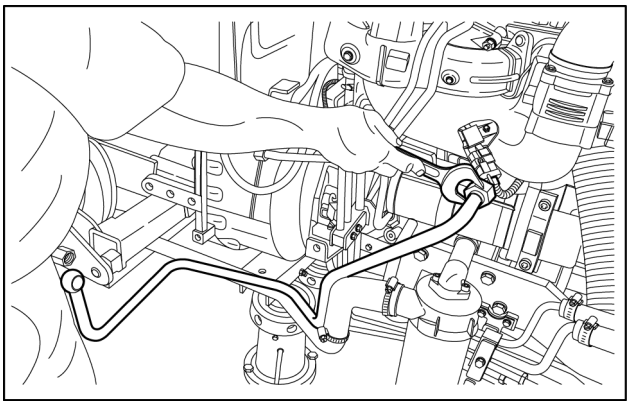
GNIL14TR04655FB 4

Fixed displacement pump - Install

For installation, follow the removal process in reverse order.

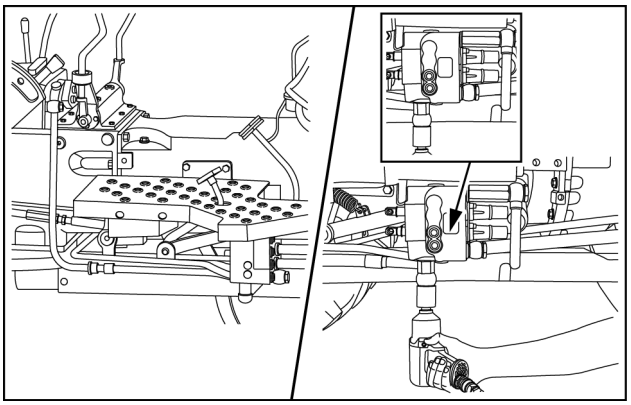
Mid-mount remote control valve - Remove

1. Disconnect the two joystick cable from the mid-mount valve. See **Joystick and Electric Hydraulic (EH) control - Remove (55.512)**.
2. Disconnect the hydraulic delivery pipe between hydraulic pump and mid-mount valve.



GNIL14TR00783AA 1

3. Disconnect the hydraulic delivery pipe between mid-mount valve and main control valve.



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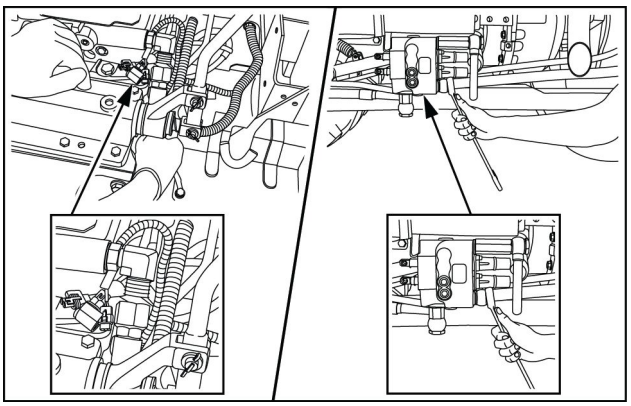
4. Disconnect the hydraulic line between the mid-mount valve and hydraulic lift body.



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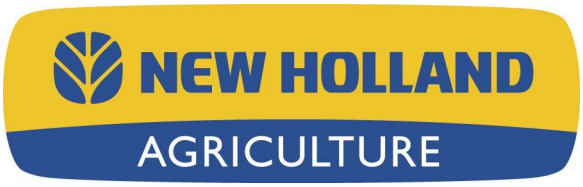

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All data given in this publication is subject to production variations. Dimensions and weight are approximate only and the illustrations do not necessarily show products in standard condition. For exact information about any particular product, please consult your NEW HOLLAND Dealer.

The control valve incorporates a metering unit which regulates the volume of oil supplied to the cylinder so that it is proportional to the angular movement of the steering wheel. The metering unit in combination with the check value also allows the steering to be operated manually without pressurised oil being supplied from the pump.

The system is fully hydrostatic and as such there is no mechanical connection between the steering column and the steering wheels.

Straight - ahead driving (A, a, d)

With steering wheel **(V)** stationary, rotary valve **(5)** takes neutral position relative to sleeve **(6)**. This position is maintained through the action of springs **(2)**, (see figure **2** section A-A) and the following conditions exist:

- Pin **(1)**, (see figure **2** section B-B) is central in the valve **(5)** aperture.
- Ports **(13)** and **(14)** are in alignment (see figure **2** section C-C) and the oil pressure from pump **(P)** is returned to tank.
- Passages **(15)**, **(17)** and **(19)** on the valve (see figure **2** sections D-D and E-E) are off register relative to ports **(16)**, **(18)** and **(20)** on the sleeve (i.e. all ports in communication with the power cylinder remain closed).

Right-hand side steer (B, Sd, b, e, f)

Upon turning steering wheel **(V)** clockwise, springs **(2)**, (see figure **2** section A-A) deflect allowing valve **(5)** to rotate relative to sleeve **(6)** until gap **(G)**, (see figure **2** section B-B) is taken up.

Thus:

- Ports **(13)** and **(14)**, (see figure **2** section C-C) go out of alignment to discontinue oil return.
- Six passages **(15)**, (see figure **2** section D-D) line up with an equal number of ports **(16)** connected instant by instant with the rotor recesses during the inlet phase.
- Six pressure passages **(17)**, (see figure **2** section E-E) line up with ports **(18)** communicating with the power cylinder. Moreover, the oil pressure passages communicate with the remaining ports **(16)**, (see figure **2** section D-D) connected instant by instant with the rotor recesses during the actuation phase.
- Six exhaust passages **(19)** line up with ports **(20)**, (see figure **2** section E-E) communicating with the power cylinder.

Once the gap **(G)** is eliminated valve **(5)** positively transmits steering wheel input to both sleeve **(6)** and rotor **(9)** through pin **(1)** and shaft **(7)**. Diagrams (e and f) show the principle of operation at start of right-hand side steer and after a certain amount of wheel rotation.

The flow of oil pressure from pump to rotor during inlet, and from rotor to power cylinder line during the power actuation phase, is provided instant by instant.

Left-hand side steer (B, Ss)

Upon turning the steering wheel anti-clockwise, a reversal of the above sequence is obtained and delivery passages **(17)**, (see figure **2** section E-E) supply ports **(20)** to bring about left-hand side steering.

Emergency hydraulic steer (C, Sed, Ses)

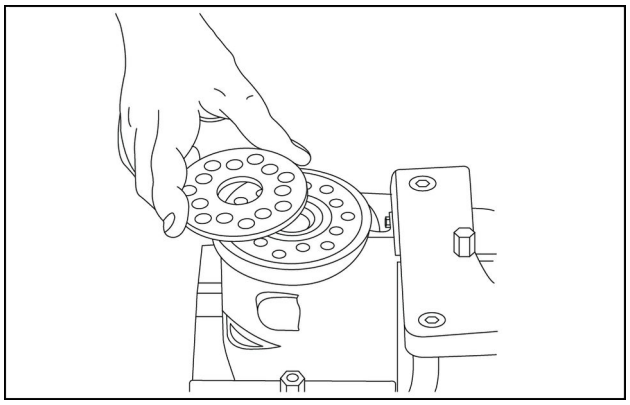
Steering is possible even in cases of loss of hydraulic pressure. Upon turning the steering wheel, valve **(5)** takes up the normal operating position, whilst the rotor functions as a hand pump directing oil pressure to the power cylinder.

Check valve **(4)** opens, thereby permitting the flow of oil from tank to rotor by-passing the pump. Valve **(23)** remains closed preventing leakage in connecting line between pump and control unit.

Power cylinder safety and make-up valves (N2)

As of safety valves open **(33)**, pressure created by piston **(H)** is exhausted in one cylinder chamber under the action of strong external stress on wheels. Simultaneously, vacuum in the opposite chamber is compensated by oil flow through the opening of the associated make up valve **(34)**. Pressure in one cylinder chamber deriving from small external stress which are not sufficient to open cylinder safety valve, is exhausted through normal leakage past control valve **(D)**, while vacuum in the opposite chamber is compensated through make-up **(34)**, as shown in detail N2, for DANFOSS OSPC 100 control valve.

6. Remove distributor plate.



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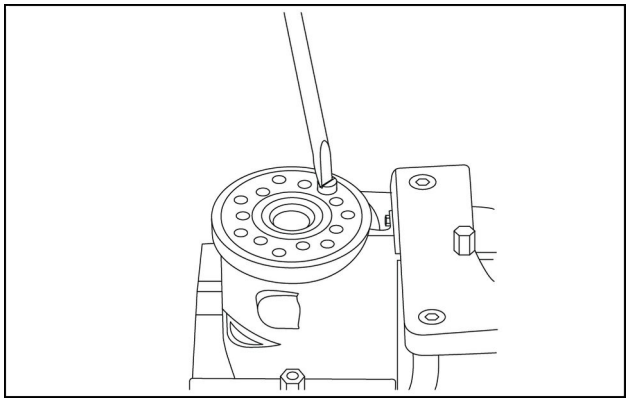
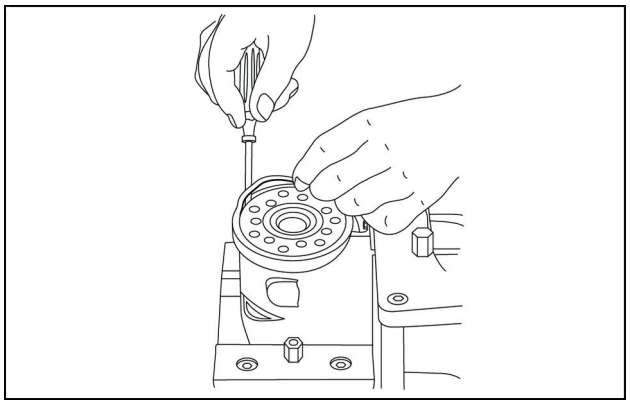
7. Screw out the threaded bush over the check valve.



GNIL14TR04497AA 6

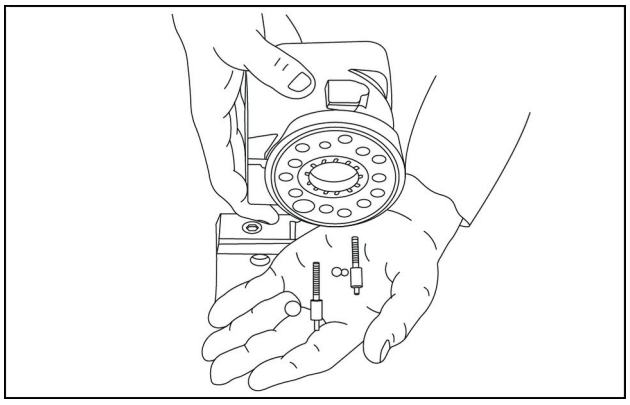
8. Remove O-ring.



GNIL14TR04498AA 7

9. Shake out the check valve ball and suction valve pins and balls.

NOTE: *Replace pins prior to the reassembly.*



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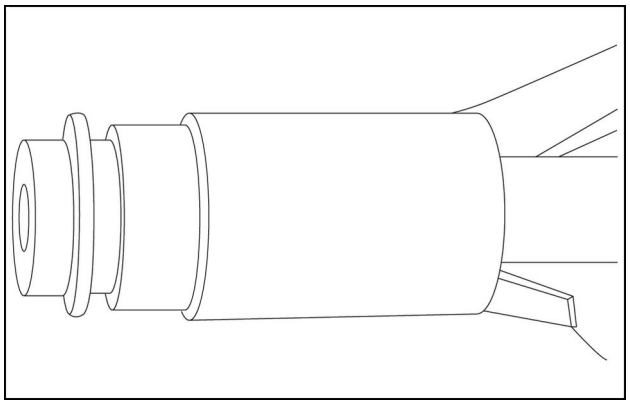
2. Grease O-ring and king ring/roto glyd with hydraulic oil and place them on the tool.



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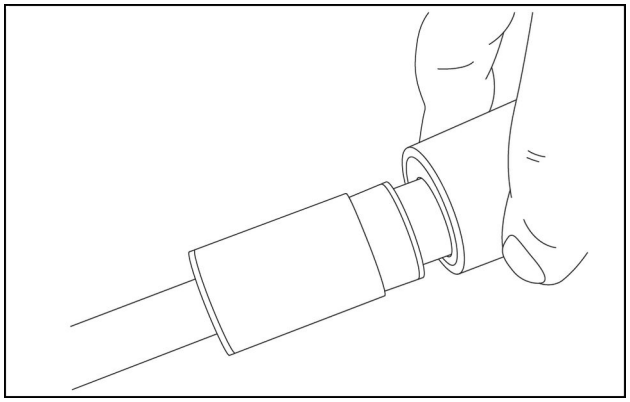
3. Hold the outer part of the assembly tool in the bottom of the steering unit housing and guide the inner part of the tool right to the bottom.



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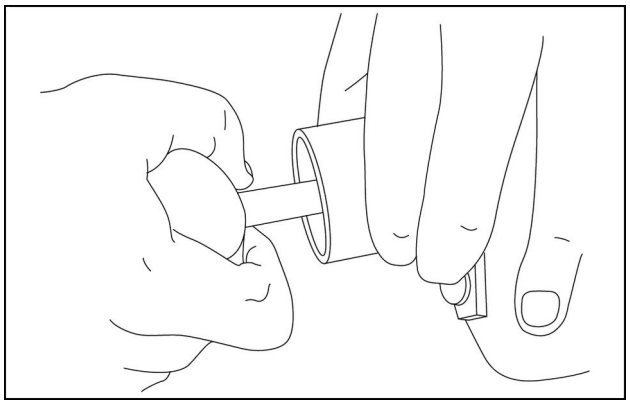
4. Press and turn the O-ring/kin-ring into position in the housing.



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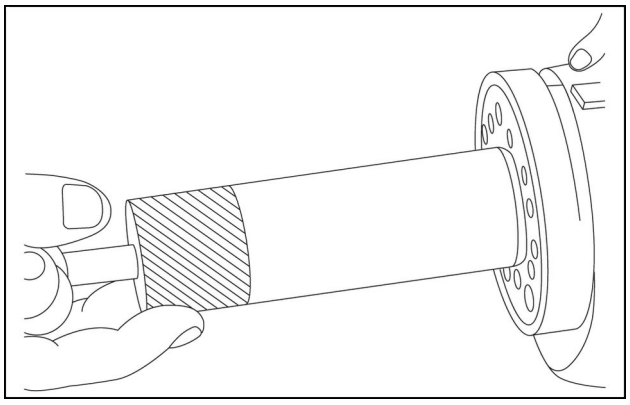
5. Draw the inner and outer parts of the assembly tool out of the steering unit bore, leaving the guide from the inner part in the bore.



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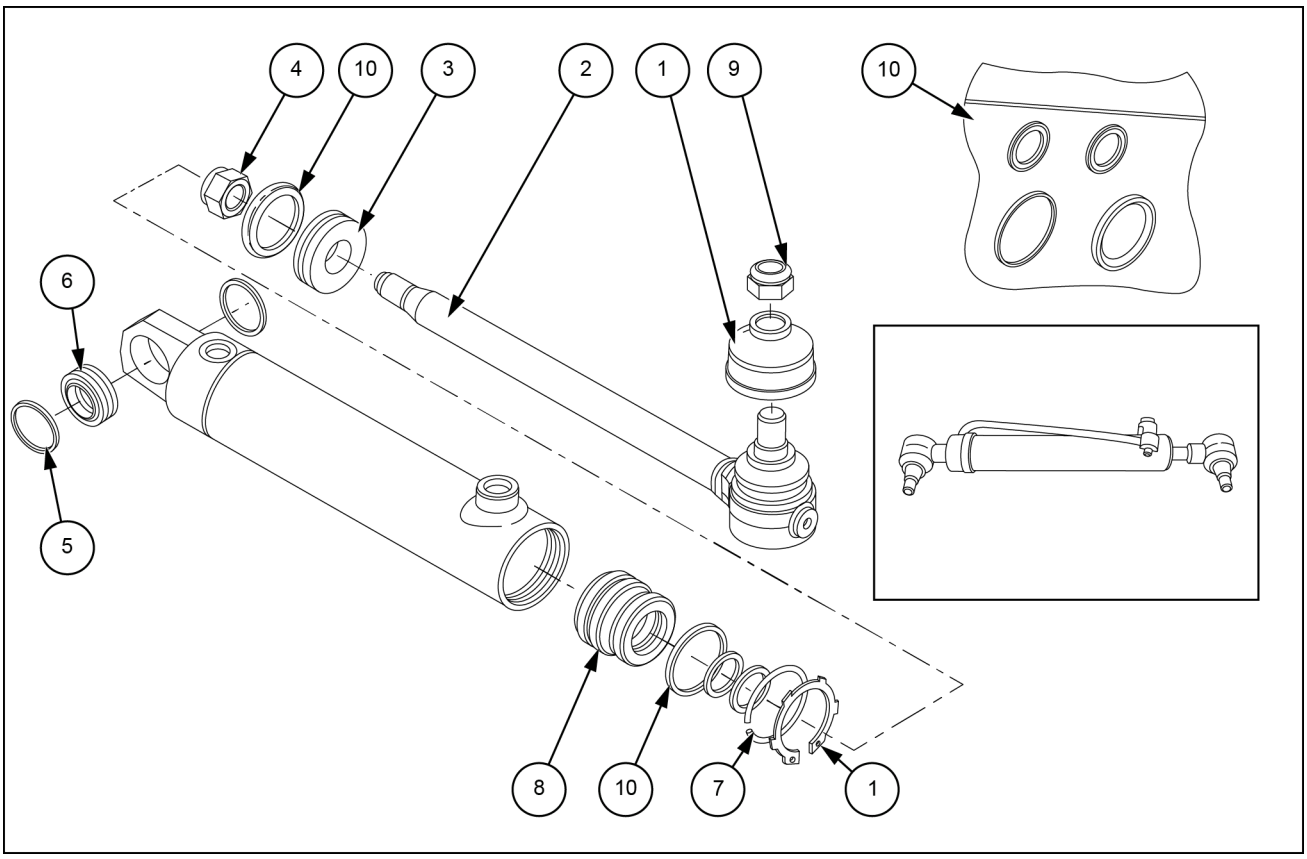

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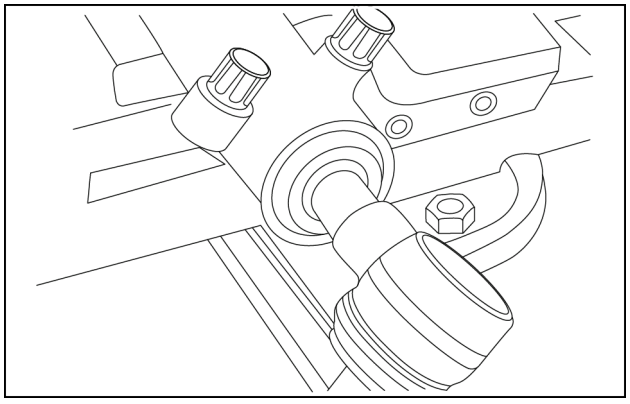
1. Seeger (5 and 7 also)
2. Assembled rod
3. Piston
4. Lock nut
5. Ball joint
6. Head
7. Nut
8. Seal kit

1. Fix the body taking care not to scratch it.
2. Push the rod to the end of the stroke (in the welded side).
3. Use the seeger clamp to remove the head seeger.
4. Use the head bell and the plastic hammer to push the head inside the body **20.00 - 30.00 mm** (**0.79 - 1.18 in**).



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Rear Power Take-Off (PTO) control system - 048

Wiring harnesses - Electrical schematic sheet 03 SH03-STARTING/ CHARGING SYSTEM

Type	Component	Connector / Link	Description
Fuse	**F-001**	**X-015 X-017**	MEGA FUSE
Voltage source	**G-001**	**X-001A X-001B**	BATTERY
Voltage source	**G-002**	**X-209**	ALTERNATOR
Motor	**M-001**	RT001 **X-004A X-206**	STARTER MOTOR
Connector	X-001A	**X-001A**	
Connector	X-001B	**X-001B**	
Connector	X-004A	**X-004A**	
Connector	X-009	**X-009**	CRANKING RELAY
Connector	X-015	**X-015**	TO MEGA FUSE
Connector	X-017	**X-017**	FROM MEGA FUSE
Connector	X-206	**X-206**	TO STARTER MOTOR
Connector	X-209	**X-209**	ALTERNATOR D+
Connector	X-404A	X-404A	ENGINE-MAIN INTERCONNECT
Connector	X-404B	**X-404B**	MAIN-ENGINE INTERCONNECT
Connector	X-712	**X-712**	ALTERNATOR B+
Connector	X-713	**X-713**	TO STARTER MOTOR
Connector	X-901	**X-901**	ALTERNATOR B+

Wiring harnesses - Electrical schematic sheet 08 SH08-ENGINE CONTROL UNIT: ECU

Type	Component	Connector / Link	Description
Connector	X-003	**X-003**	IGNITION SWITCH
Connector	X-026	**X-026**	SENSOR WATER IN FUEL
Connector	X-027	**X-027**	PRE HEATER
Connector	X-101	**X-101**	GCU
Connector	X-201	**X-201**	ECU VEHICLE
Connector	X-207	**X-207**	TO ENGINE GLOW PLUGS
Connector	X-212	**X-212**	LAMBDA SENSOR
Connector	X-214	**X-214**	INLET DOC TEMP SENSOR
Connector	X-215	**X-215**	OUTLET POC TEMP SENSOR
Connector	X-404A	X-404A	ENGINE-MAIN INTERCONNECT
Connector	X-404B	**X-404B**	MAIN-ENGINE INTERCONNECT
Connector	X-406A	X-406A	TO ENGINE HARNESS
Connector	X-406B	**X-406B**	TO MAIN HARNESS

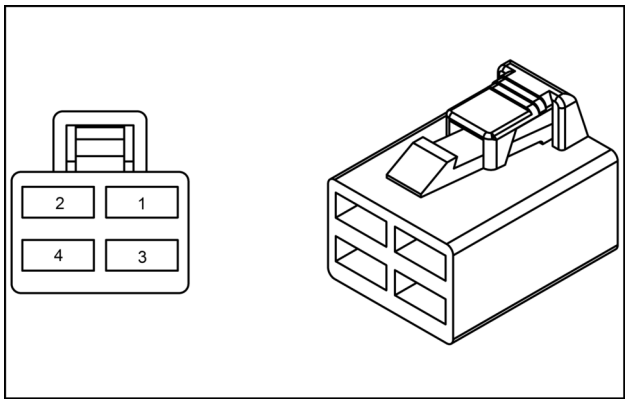
Wiring harnesses - Electrical schematic sheet 01 – Power distribution and glow plugs (engine schematics)

Component Identifier	Description
K-9104	Starter control relay
R-9001	Cylinder 1 glow plug
R-9002	Cylinder 2 glow plug
R-9003	Cylinder 3 glow plug
Z-9101	Glow plug control unit
(1) to machine starting circuit, see machine schematics.	

X-004A - [M-001] (Male)

Pin	From	Wire	Description	Color-Size	Frame
PIN1	**X-001A (Male) pin PIN1**	001	BATTERY CABLE POSITIVE	RD - 40.0	**SHEET 03**

X-005 - LIGHT SWITCH (84179574) (Female)

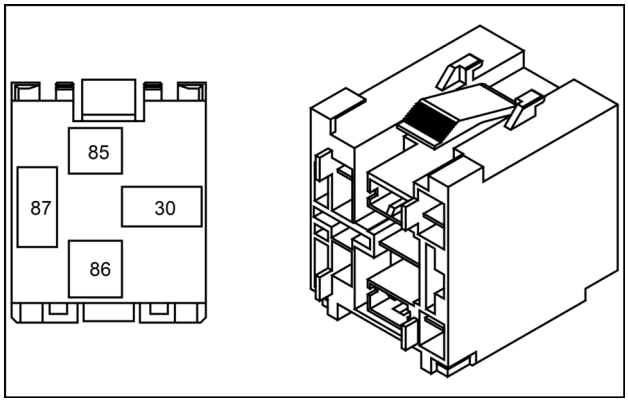


84179574 7

84179574

Pin	From	Wire	Description	Color-Size	Frame
1	SP-060-P-X	060	060	BL/YE - 0.75	**SHEET 06**
2	SP-029-P-X	029C	029C	GN/OR - 1.5	
2	HORN/LIGHT/TURN SWITCH-P-PWR1	WIRE235	WIRE235		
3	X-406A-P-10	073	073	GN/YE - 0.75	
4	SP-058-P-X	058	058	BL/BK - 0.75	

X-006 - ECU RELAY (47781083) (Male)

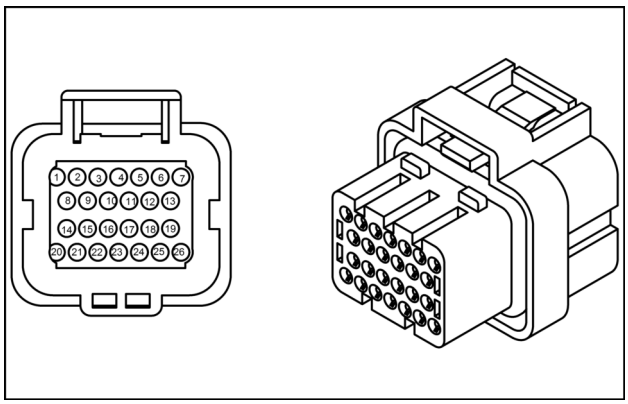


47781083 8

47781083

Wire connectors - Component diagram 05

X-050 - INSTRUMENT CLUSTER CN-1 (82028493) (Female)

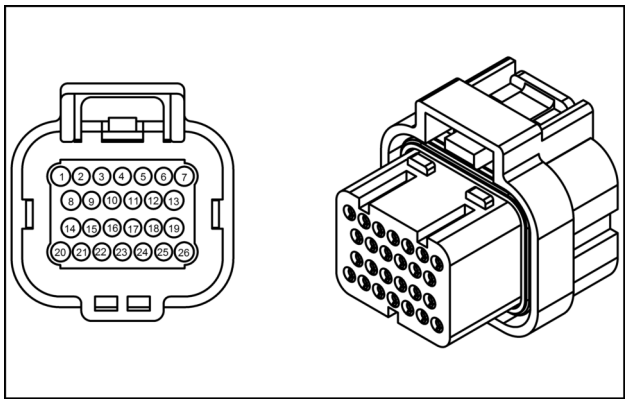


82028493 1

82028493

Pin	From	Wire	Description	Color-Size	Frame
2	**X-507 (Female) pin 2** FUEL SENDER UNIT	042	FUEL SENDER UNIT	BL - 0.75	**SHEET 07**
3	SP-015-P-X	015	CAN HIGH	YE - 0.75	
4	SP-016-P-X	016	CAN LOW	GN - 0.75	
5	**X-402B pin 9** MAIN-FENDER INTERCONNECT	138	138	GY/BL - 1.0	
6	SP-140-P-X	140C	SENSOR GND	BK - 1.0	
7	**X-402B pin 6** MAIN-FENDER INTERCONNECT	142	142	YE/GN - 1.0	
8	**X-023 (Male) pin 2** HAND THROTTLE	130	HAND THROTTLE	YE - 0.75	
9	SP-136-P-X	136B	136B	PK/WH - 0.5	
12	**X-023 (Male) pin 3** HAND THROTTLE	129	HAND THROTTLE SENS GROUND	BK - 0.75	
17	**X-011 pin 5** TURN FLASHER	118	118	LG/BL - 0.5	
20	**X-018 (Female) pin 1** HOME ENTER SWITCH	038	NAVIGATION SW ENTER	YE/GN - 0.75	
21	**X-018 (Female) pin 4** HOME ENTER SWITCH	039	NAVIGATION SW HOME	YE/BL - 0.75	
22	**X-020 (Female) pin 1** UP/DOWN SWITCH	040	NAVIGATION SW DWN	PK/BK - 0.75	
23	**X-020 (Female) pin 4** UP/DOWN SWITCH	041	NAVIGATION SW UP	BL/BK - 0.75	
25	**X-702A pin 5** TO DIAGONESTIC SOCKET	020	SERVICE SWITCH	BK/WH - 1.0	

X-051 - INSTRUMENT CLUSTER CN-2 (82016219) (Female)



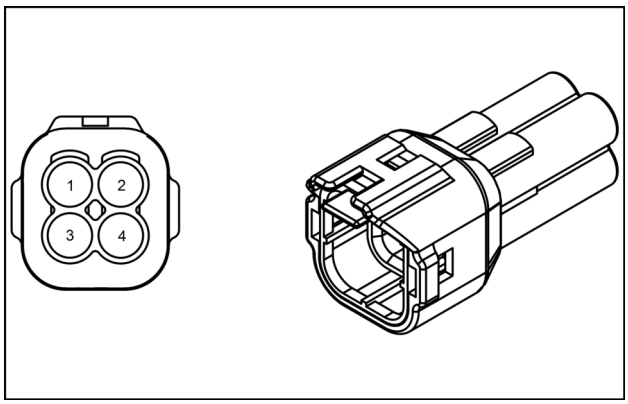
82016219 2

82016219

Pin	From	Wire	Description	Color-Size	Frame
1	SP-103-P-X	103C	103C	BK - 1.0	**SHEET 10**

Wire connectors - Component diagram 61

X-612 - ROPE LAMP RH (84182907) (Male)

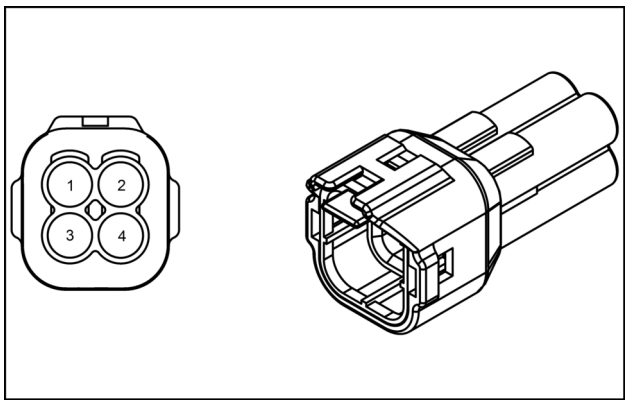


84182907 1

84182907

Pin	From	Wire	Description	Color-Size	Frame
3	SP-014-P-X	164B	164B	BK - 0.75	**SHEET 11**
4	SP-020-P-X	172	172	BL/BK - 0.75	

X-613 - ROPE LAMP LH (84182907) (Male)



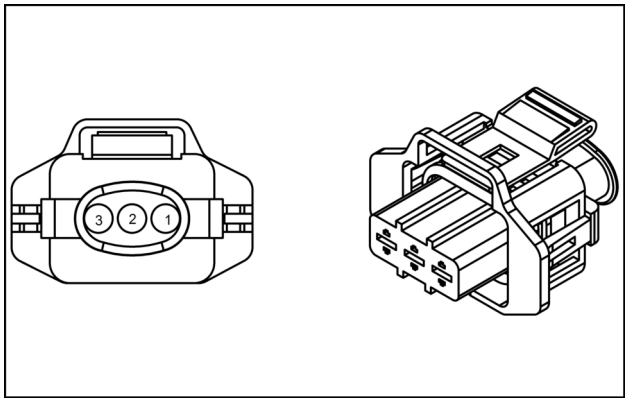
84182907 2

84182907

Pin	From	Wire	Description	Color-Size	Frame
1	SP-163-P-X	163	163	LG - 0.5	**SHEET 11**
2	X-400B-P-7	111	111	GY - 0.75	
3	SP-014-P-X	164A	164A	BK - 0.75	
4	SP-020-P-X	171	171	BL/BK - 0.75	

Wire connectors - Component diagram 02 - Connectors X-9020 to X-9029

Connector X-9026 - Rail pressure sensor

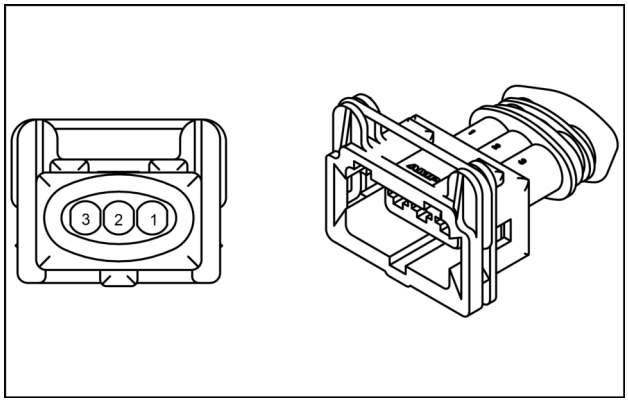


84130322 1

84146683

CONNECTOR X-9026 - Rail pressure sensor			
PIN NUMBER	**WIRE NUMBER**	**CIRCUIT REFERENCE**	**ELECTRICAL SCHEMATIC FRAME**
1	EN-9106	Reference ground, Engine Control Unit (ECU)	**SHEET 03**
2	EN-9107	Input signal, ECU	
3	EN-9108	**+5 V** sensor supply, ECU	

Connector X-9125 - Water in fuel sensor

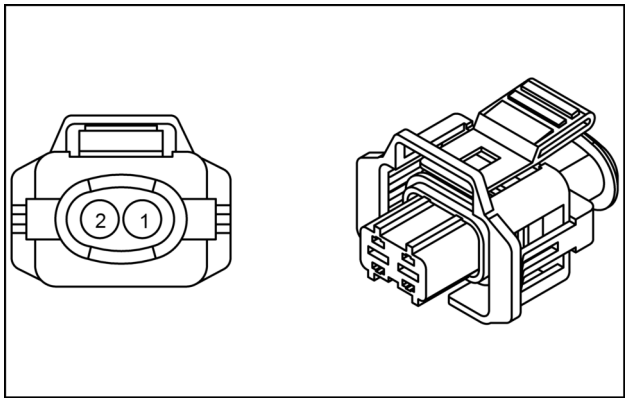


84806091 2

84806091

CONNECTOR X-9125 - Water in fuel sensor			
PIN NUMBER	**WIRE NUMBER**	**CIRCUIT REFERENCE**	**ELECTRICAL SCHEMATIC FRAME**
1	VE-9077	Input signal, Engine Control Unit (ECU)	**SHEET 02**
2	VE-9085	Switched source voltage, Main ECU power relay	
3	VE-9078	Frame ground	

Connector X-9126 - Exhaust gas temperature Diesel Oxidation Catalyst (DOC) sensor



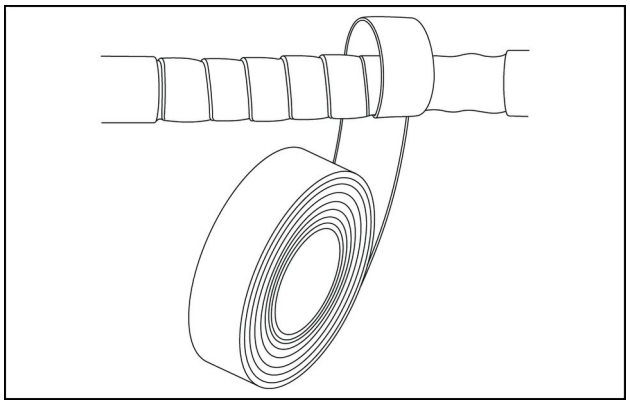
87709793 3

87709793

CONNECTOR X-9126 - Exhaust gas temperature DOC sensor			
PIN NUMBER	**WIRE NUMBER**	**CIRCUIT REFERENCE**	**ELECTRICAL SCHEMATIC FRAME**
1	VE-9147	Input signal, Engine Control Unit (ECU)	**SHEET 02**
2	VE-9188	Reference ground, ECU	

6. Allow the compound to cure, then cover the area with insulating tape taking the tape well over each end of the repair. An overlap of at least **50.00 mm** (**1.97 in**) of tape at each end is necessary, figure **4**.
7. Check to ensure the repair is satisfactory and secure the repaired cable so that repeat damage is avoided.

NOTE: *This is a temporary repair only. Ensure the damaged cable is replaced as soon as possible to prevent ingress of water or chemicals.*



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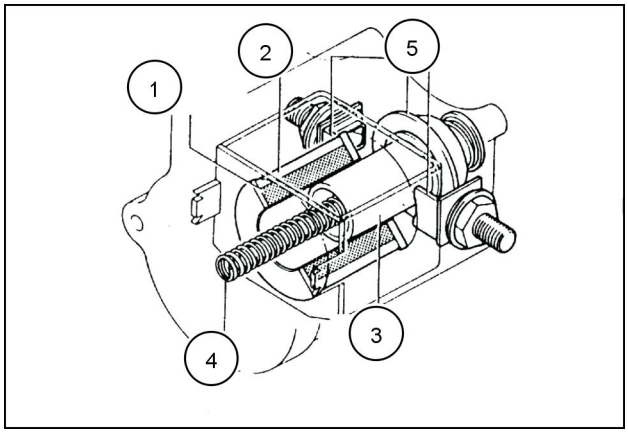
Starter solenoid

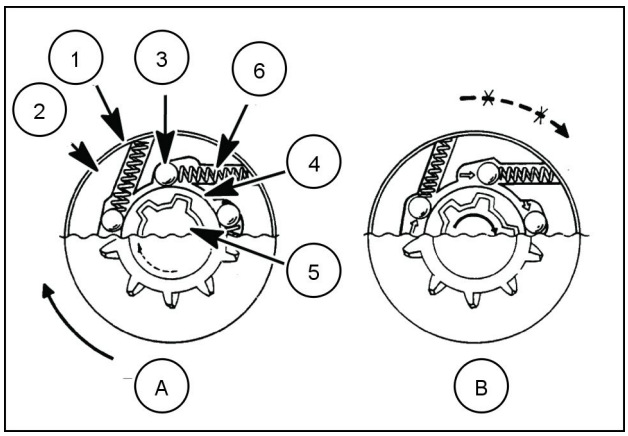
The starter solenoid is an electromagnetic type solenoid that is located on the bottom of the starter motor assembly. The solenoid contains two coils, a pull-in coil, **(1)** and a hold-in coil **(2)** When the key switch is turned to the "START" position and the safety start relay is closed (safety switches closed), current from the battery will energize the solenoid's two coils. With the coils energized, the solenoid plunger, **(3)** pushes a spring **(4)** which will then push the pinion gear out to engage the flywheel. At the same time, a set of contacts **(5)**, on the solenoid become closed, allowing current to flow to the starter motor. Closing the contacts also supplies current to both ends of the solenoid pull in coil which makes the coil become non-energized. The hold-in coil continues to engage the pinion gear with the flywheel.



SEC55CH4PG29_1 2

Pinion clutch

To prevent the engine from driving the starter motor once the engine is running, the pinion gear is equipped with an overrunning clutch. The clutch will disengage the pinion gear from the rest of the starter components once the engine has been started and the key switch is in the "START" position. The clutch consists of an outer gear/shell, **(1)**, a cam with tapered notches, **(2)**, rollers, **(3)**, roller springs, **(4)**, a splined pinion collar/tube that acts as a clutch hub, **(5)**, and the pinion shaft, **(6)**. As the starter motor engages and rotates, the rollers are locked against the pinion collar with the tension provided by the roller springs. While the rollers are locked, the clutch assembly is locked, allowing the pinion gear to rotate the flywheel. When the engine starts, the flywheel moves faster than the starter motor and this causes the rollers to become unlocked. With the rollers unlocked, the clutch assembly is unlocked, allowing the pinion gear and shaft to turn independently of the starter motor.



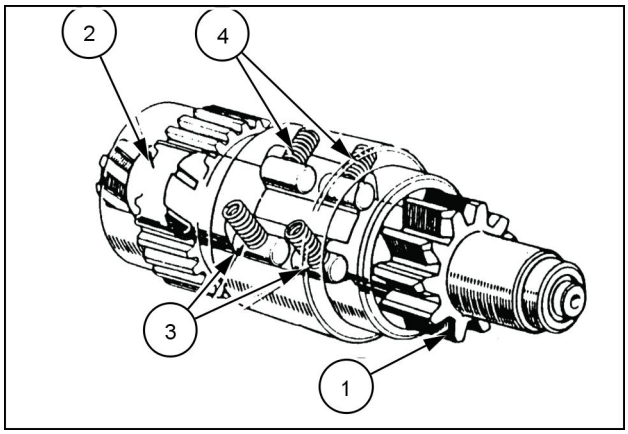
SEC55CH4P29_2 3

A - Engaged, B - Disengaged

(1) Clutch Gear
(2) Cam
(3) Roller
(4) Spline Tube - Inner (Pinion Collar)
(5) Pinion Shaft
(6) Roller Spring

The clutch is not serviceable and is replaced as a complete assembly.

Once the engine is started and the key switch is released from the "START" position, the solenoid's pull in coil becomes energized, pulling the solenoid plunger in, which disengages the pinion from the flywheel.



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Battery - 302

SERVICE

Turn signal and/or hazard lights - Troubleshooting Hazard lighting circuit

Problem	Possible Cause	Correction
Hazard Signal Lights will not illuminate or flash	Blown fuse hazard, **15 A** hazard signal fuse.	Inspect fuse and replace as necessary.
	Hazard signal bulb(s) burnt out.	Inspect bulb(s) and replace as necessary.
	Defective hazard switch.	Test switch and replace as necessary.
	Defective flasher cutoff relay.	Test flasher relay by using a known functioning flasher relay and replace as necessary.
	Defective hazard/turn flasher module.	Test module and replace as necessary.
	Faulty wiring or ground connection.	Inspect the tractor's wiring harness and ground terminals for damage, corrosion, and short circuits. Repair or replace as needed.
Instrument panel hazard indicator(s) does not illuminate	Indicator bulb(s) burnt out	Inspect bulb and replace as necessary
	Faulty wiring or ground connection	Inspect the tractor s wiring harness and ground terminals for damage, corrosion, and short circuits. Repair or replace as needed

Turn signal and/or hazard lights - Troubleshooting Right turn signal circuit

Problem	Possible Cause	Correction
Directional signal will not illuminate or flash	Blown fuse turn/horn, **15 A** hazard or directional signal fuse.	Inspect fuse and replace as necessary.
	Blown fuse hazard, **15 A** fuse.	Inspect fuse and replace as necessary.
	Directional signal bulb burnt out.	Inspect bulb and replace as necessary.
	Defective directional signal switch.	Test switch and replace as necessary.
	Defective hazard/turn flasher module.	Test module and replace as necessary.
	Faulty wiring or ground connection.	Inspect the tractor's wiring harness and ground terminals for damage, corrosion, and short circuits. Repair or replace as needed.
Instrument panel turn indicator does not illuminate	Indicator bulb burnt out.	Inspect bulb and replace as necessary.
	Faulty wiring or ground connection.	Inspect the tractor's wiring harness and ground terminals for damage, corrosion, and short circuits. Repair or replace as needed.

Turn signal and/or hazard lights - Troubleshooting Left turn signal circuit

Problem	Possible Cause	Correction
Directional signal will not illuminate or flash	Blown fuse turn/horn, **15 A** hazard or directional signal fuse.	Inspect fuse and replace as necessary.
	Blown fuse hazard, **15 A** fuse.	Inspect fuse and replace as necessary.
	Directional signal bulb burnt out.	Inspect bulb and replace as necessary.
	Defective directional signal switch.	Test switch and replace as necessary.
	Defective hazard/turn flasher module.	Test module and replace as necessary.

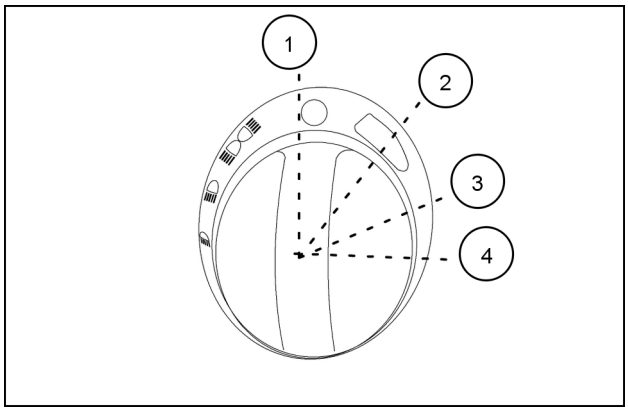
Horn Button

Press the horn button **(7)** for warning arrival

Head Light Switch Positions

The head light switch **(8)** consists of four positions,

Position **(1)** - Off
Position **(2)** - Parking lights on.
Position **(3)** - Head lamp low beam.
Position **(4)** - Head lamp high beam.



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Key start/stop switch

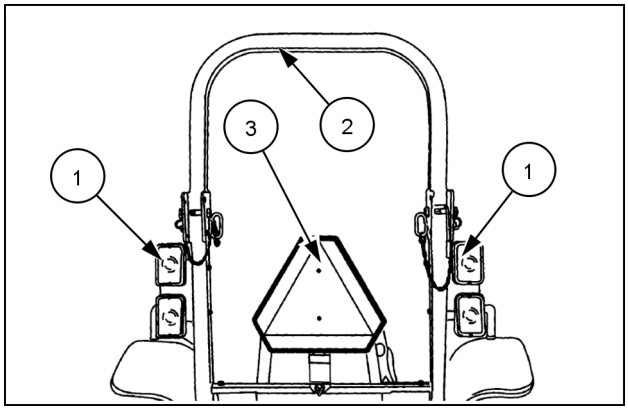
The key start switch **(9)** activates electrical equipment, lights, gauges and starting motor.

Electronic service tool socket

The Electronic Service Tool (EST) socket **(10)** is used to connect the EST to the tractor.

Hazard warning light switch

The hazard warning lights switch **(3)** (**1**) activates the hazard flashing warning lights **(1)** located on each side of the ROPS **(2)**.
The hazard flashing warning lights can be activated with the key switch in any position. For your protection, use the flasher warning lights and the SMV (Slow Moving Vehicle) emblem **(3)** when travelling on public roads, day or night.



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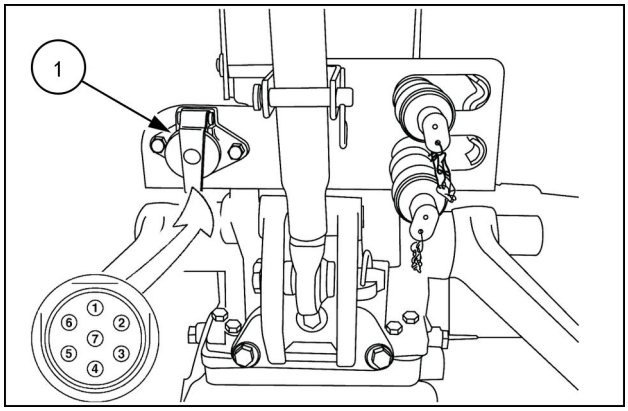
Trailer electrical socket

A standard 7-pin trailer socket **(1)** is provided as standard equipment and is mounted to the left side of ROPS cross brace.
The socket pin connections (see insert) are as follows:

Pin No.	Circuit
1	Ground
2	Work Lights
3	Left Hazard Flasher Light
4	Current Input (not switched)
5	Right Hazard Flasher Light
6	Taillights
7	Current Input (Switched)



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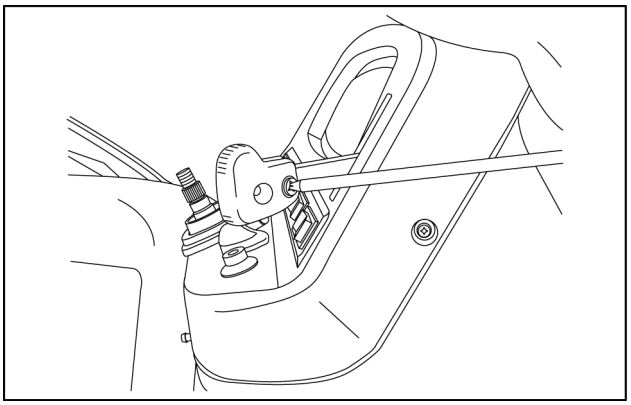
9. Fit the hand throttle knob.



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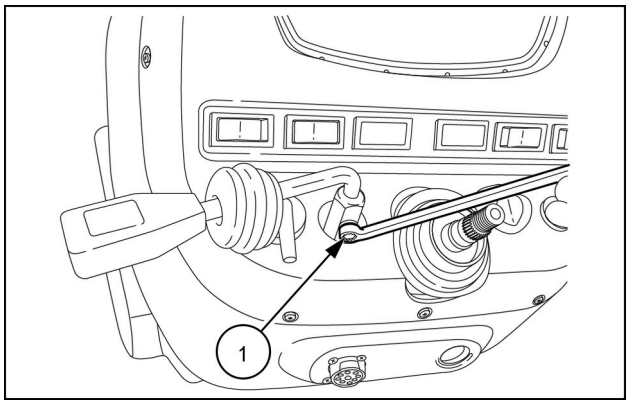
10. Fit the shuttle lever and tighten the bolt **(1)**.



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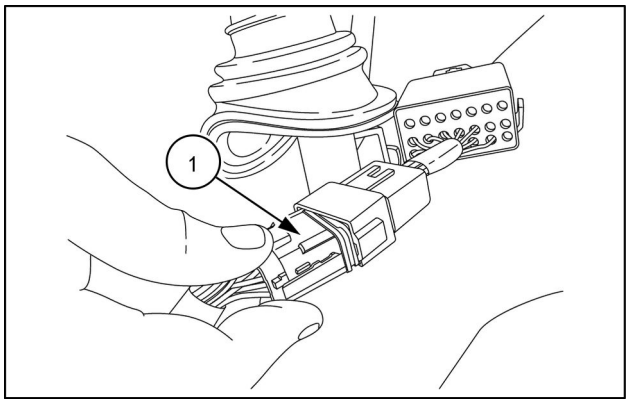
11. Connect the wiring coupler **(1)** near the steering column.



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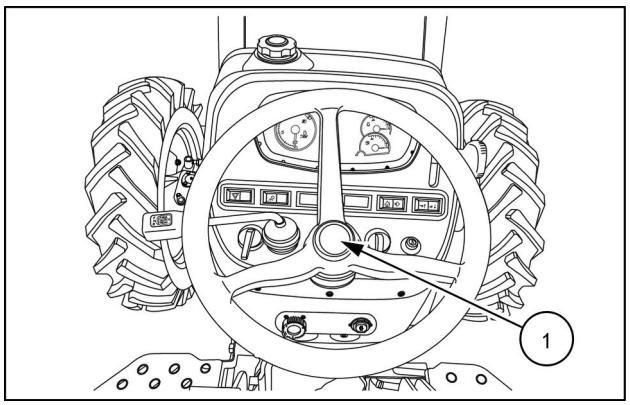
12. Install the steering wheel and cover **(1)**.



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DTC 11C-03-Water in fuel detected or water in fuel circuit failure

Control Module : ECU

NOTE: *This fault code is for the Water in Fuel switch with black connector housing.*

Context:
The Engine Control Unit (ECU) A-9000 monitors the voltage output from the water in fuel switch S-9102 to determine if water is present in the fuel supply. If water is detected in the fuel, warnings will be displayed to alert the operator of potential engine damage if operation continues. High voltage signal from the water in fuel switch S-9102 indicates water present.

Cause:
This fault code is displayed to warn the operator that the Engine Control Unit (ECU) A-9000 has detected excess water in the fuel system or a fault in the water in fuel switch circuit.

Possible failure modes:

1. Excess water in the fuel supply.
2. Faulty water in fuel switch S-9102, wiring or internal (mechanical and/or electrical) failure.
3. Faulty ECU A-9000, software.

Solution:

1. Verify this fault code is still present and in an active state.

   Use the Easy Engine software provided on the Electronic Service Tool (EST) to check the fault status.

   A. If the fault is still present and active, continue with Step **2**.

   B. If the fault is no longer present or is in an inactive state, Continue with Step **7**.
2. Check fuel for water contamination.

   A. If there is water contamination, continue with Step **3**.

   B. If there is no water contamination, Continue with Step **4**.
3. Verify proper water in fuel switch S-9102 operation.

   Purge fuel supply system, replace fuel filter(s) and refill with fuel that is free of water contamination.

   Start and run engine for 5 minutes.

   Check for code to return to active status.

   A. If code returns in an active status, replace water in fuel switch S-9102.

   B. If code remains inactive, return the machine to service.
4. Check for open, short and grounded circuit conditions in the water in fuel switch S-9102 circuit.

   Disconnect the water in fuel switch S-9102 at connector **X-9125**.

   Disconnect the vehicle harness (VE) from the ECU A-9000 at connector **X-9102**.

   With the key switch in the OFF position, use a multimeter to perform the following tests, on the vehicle (VE) harness from :

From	To	Value
X-9125 pin 1	**X-9102 pin K88**	There should be continuity.
X-9125 pin 2	Chassis ground	There should be continuity.
X-9125 pin 3	**X-9102 pin K01**	There should be continuity.

DTC 134-00-Intake manifold pressure sensor drifted high

Control Module : ECU

Context:
The Engine Control Unit (ECU) A-9000 monitors boost pressure using the intake manifold pressure sensor B-9001. Boost pressure is compared to environmental pressure by the ECU A-9000. If the ECU A-9000 determines that the difference between measured boost pressure and environmental pressure is greater than **0.1 bar** (**1.5 psi**), this fault will occur.

Cause:
The ECU A-9000 has determined that boost pressure is greater than environmental pressure by **0.1 bar** (**1.5 psi**).

Possible failure modes:

1. Faulty intake manifold pressure sensor B-9001, internal failure.
2. Faulty ECU A-9000, software.

Solution:

1. Verify fault is present and active.

   Use the Electronic Service Tool (EST) to check the status of this fault.

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

   B. If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active. Continue with Step **4**.
2. Use the Electronic Service Tool (EST) to check the status of following related faults:

   DTC 134-03 - Intake manifold pressure sensor voltage is higher than expected

   DTC 134-04 - Intake manifold pressure sensor voltage is lower than expected

   A. If any of the listed faults are active, diagnose them first and then return to this fault.

   B. If none of the listed faults are active, continue to Step **3**.
3. Replace the intake manifold pressure sensor B-9001.

   Use the EST to verify the status of this fault, .

   A. If the fault is no longer active, return the machine to service.

   B. If the fault is still active, check the ECU A-9000 for the appropriate software and re-flash, if necessary.
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.

DTC 136-03-Fuel rail pressure sensor voltage is higher than expected

Control Module : ECU

NOTE: *If the rail pressure sensor B-9004 is replaced, it is necessary to perform the Replacement of the Rail Pressure sensor - Reset ECU Data with the Electronic Service Tool (EST) before you return the machine to service. See* ***Common rail pressure sensor - Configure - Reset ECU data (Rail pressure sensor) (55.010)****, if necessary.*

Context:
The Engine Control Unit (ECU) A-9000 monitors the rail pressure sensor B-9004. If the ECU A-9000 detects a voltage greater than **4.90 V** in the rail pressure sensor B-9004 signal circuit, this fault will occur.

Cause:
The ECU A-9000 has detected a voltage greater than **4.90 V** in the rail pressure sensor B-9004 signal circuit.

Possible failure modes:

1. Faulty rail pressure sensor B-9004 wiring, short to a voltage source.
2. Faulty rail pressure sensor B-9004 wiring, open circuit.
3. Faulty rail pressure sensor B-9004, internal failure.
4. Faulty ECU A-9000, software.

Solution:

1. Verify fault is present and active.

   Use the Electronic Service Tool (EST) to check the status of this fault.

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

   B. If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active. Continue with Step **6**.

2. Check the rail pressure sensor B-9004 wiring for a short circuit condition.

   Disconnect the engine harness (EN) from the rail pressure sensor B-9004 at connector **X-9026**.

   With the key in the OFF position, use a multimeter to perform the following voltage check on the engine harness (EN) side :

From	To	Value
X-9026 pin 2	Chassis ground	There should be no voltage.

   With the key in the ON position, use a multimeter to perform the following voltage check on the engine harness (EN) side :

From	To	Value
X-9026 pin 2	Chassis ground	There should be less than **5.5 V**

   A. If the specified values are not measured, there is a short to battery or switched battery in the rail pressure sensor B-9004 wiring in the engine harness (EN). Locate and repair the broken conductor.

   B. If the specified values are measured, leave connector **X-9026** disconnected and continue to Step **3**.

3. Check the rail pressure sensor B-9004 engine harness (VE) wiring for an open circuit.

   Disconnect the engine harness (EN) from the ECU A-9000 at connector **X-9001**.

   With the key in the OFF position, use a multimeter to perform the following continuity check on the engine harness (EN) side :

DTC 141-04-Crankshaft speed sensor pattern is not plausible

Control Module : ECU

Context:
The Engine Control Unit (ECU) A-9000 monitors the crankshaft position sensor B-9007 characteristics for angle, speed determination, signal plausibility, and quality. If the ECU A-9000 detects greater than 80 crankshaft position signal plausibility errors, this fault will occur.

Cause:
The ECU A-9000 has detected more than 80 crankshaft position signal plausibility errors.

Possible failure modes:

1. Faulty crankshaft position sensor B-9007, not fully seated or loose.
2. Faulty crankshaft tone wheel, damaged or misaligned.
3. Faulty crankshaft position sensor B-9007 wiring, short circuit.
4. Faulty crankshaft position sensor B-9007, internal failure.
5. Faulty ECU A-9000, software.

Solution:

1. Verify fault is present and active.

   Use the Electronic Service Tool (EST) to check the status of this fault.

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

   B. If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active. Continue with Step **7**.
2. Check the physical integrity of the crankshaft position sensor B-9007. The sensor should be fully seated and mounted tightly.

   Remove the crankshaft position sensor B-9007 and inspect the crankshaft tool wheel. The tone wheel should not be damaged or loose.

   A. If the sensor or tone wheel is damaged or is not mounted/secured properly, repair as necessary.

   B. If the sensor or tone wheel is not damaged and is mounted/secured properly, continue to Step **3**.
3. Check the crankshaft position sensor B-9007 wiring for a short to a voltage source.

   Disconnect the engine harness (EN) from the crankshaft position sensor B-9007 at connector **X-9039**.

   With the key in the OFF position, use a multimeter to perform the following voltage check on the engine harness (EN) side :

From	To	Value
X-9039 pin 2	Chassis ground	There should be no voltage.

   With the key in the ON position, use a multimeter to perform the following voltage check on the engine harness (EN) side :

From	To	Value
X-9039 pin 2	Chassis ground	There should be **2.4 - 2.6 V** voltage.

   A. If there is no voltage, leave connector **X-9039** disconnected and continue to Step **4**.

   B. If there is voltage, there is a short to battery or key switch battery in the crankshaft position sensor B-9007 wiring. Locate and repair the shorted conductor.

DTC 154-03-Fuel rail pressure has dropped below the minimum limit

Control Module : ECU

NOTE: *If the Pressure Relief Valve (PRV) is replaced, it is necessary to perform the Replacement of the Rail Pressure Relief Valve (PRV) - Reset ECU Data with the Electronic Service Tool (EST) before you return the machine to service. See* ***Common rail Relief valve - Configure - Reset ECU data (10.218)****, if necessary.*

NOTE: *If the rail pressure sensor B-9004 is replaced, it is necessary to perform the Replacement of the Rail Pressure sensor - Reset ECU Data with the Electronic Service Tool (EST) before you return the machine to service. See* ***Common rail pressure sensor - Configure - Reset ECU data (Rail pressure sensor) (55.010)****, if necessary.*

Context:
The Engine Control Unit (ECU) A-9000 monitors fuel rail pressure using the rail pressure sensor B-9004. If the ECU A-9000 determines that the measured rail pressure is less than a dependent engine speed value, this fault will occur. Other active faults may have caused this fault to occur. For more information regarding fuel system troubleshooting, see **Fuel injection system - Troubleshooting (10.218)**.

Cause:
The ECU A-9000 has determined that the measured rail pressure is less than a dependent engine speed value.

Possible failure modes:

1. Faulty fuel filters, clogged.
2. Faulty low pressure fuel lines, clogged or damaged.
3. Faulty high pressure fuel lines, clogged or damaged.
4. Faulty electric fuel pump (if equipped).
5. Faulty charge gear pump, low efficiency.
6. Faulty high pressure pump, low efficiency or excessive leak-off.
7. Faulty fuel injectors, excessive or leaking internally.
8. Faulty Pressure Relief Valve (PRV), leaking or stuck open.
9. Faulty rail pressure sensor B-9004 or sensor leaking.
10. Faulty fuel metering unit Y-9000
11. Faulty ECU A-9000, software.

Wiring harnesses - Electrical schematic sheet 01 – Power distribution and glow plugs (engine schematics) (55.100.DP-C.20.E.01)
Wiring harnesses - Electrical schematic sheet 02 – Engine Control Unit (ECU) power and after treatment system (engine schematics) (55.100.DP-C.20.E.02)
Wiring harnesses - Electrical schematic sheet 03 – Engine sensors and fuel injection (engine schematics) (55.100.DP-C.20.E.03)

Wiring harnesses - Electrical schematic sheet 01 – Power distribution and glow plugs (engine schematics) (55.100.DP-C.20.E.01)
Wiring harnesses - Electrical schematic sheet 02 – Engine Control Unit (ECU) power and after treatment system (engine schematics) (55.100.DP-C.20.E.02)
Wiring harnesses - Electrical schematic sheet 03 – Engine sensors and fuel injection (engine schematics) (55.100.DP-C.20.E.03)

DTC 173-03-Injection bank 2 short circuit failure (all injectors of the same bank can be affected)

Control Module : ECU

Context:
The Engine Control Unit (ECU) A-9000 monitors the fuel injector harness for a short circuit condition. If the ECU A-9000 detects a short circuit pattern in the fuel injector harness of both bank 2 fuel injections, this fault will occur. The bank 2 fuel injectors are fuel injector number 2 Y-9002 and fuel injector number 3 Y-9003.

Cause:
The ECU A-9000 has detected a a short circuit pattern between both bank 2 fuel injectors.

Possible failure modes:

1. Faulty bank 2 fuel injector wiring, short circuit.
2. Fault ECU A-9000, software.

Solution:

1. Verify fault is present and active.

   Use the Electronic Service Tool (EST) to check the status of this fault.

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

   B. If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active. Continue with Step **4**.
2. Use the Electronic Service Tool (EST) to check for other active faults that may have caused this fault to occur.

   A. If any of the related faults are active, diagnose them first and then return to this fault.

   B. If none of the related faults are active, continue to Step **3**.
3. Check the fuel injector 2 and 3 harnesses for a short circuit condition.

   Disconnect the engine harness (EN) from fuel injector number 2 Y-9002 at connector **X-9032**.

   Disconnect the engine harness (EN) from fuel injector number 3 Y-9003 at connector **X-9031**.

   With the key in the OFF position, use a multimeter to perform the following continuity check on the engine harness (EN) side :

From	To	Value
X-9032 pin 1	**X-9031 pin 2**	There should be no continuity.
X-9032 pin 2	**X-9031 pin 1**	There should be no continuity.
X-9032 pin 1	**X-9031 pin 1**	There should be no continuity.
X-9032 pin 2	**X-9031 pin 2**	There should be no continuity.
X-9032 pin 1	**X-9032 pin 2**	There should be no continuity.
X-9031 pin 1	**X-9031 pin 2**	There should be no continuity.

   A. If there is continuity, there is a short circuit in the fuel injector bank 2 harness. Locate and repair the shorted conductor.

   B. If there is no continuity, check the ECU A-9000 for the appropriate software and re-flash, if necessary.
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.

DTC 18F-03-Lambda sensor heater power stage short circuit to battery

Control Module : ECU

NOTE: *If the Lambda sensor B-9123 is replaced, it is necessary to perform the Replacement of the Lambda Sensor - Reset ECU Data with the Electronic Service Tool (EST) before you return the machine to service. See* ***Lambda sensor - Configure - Reset ECU data (Lambda sensor) (55.989)****, if necessary.*

Context:
The Lambda sensor B-9123 has a heating element encased in ceramic that heats the sensor tip. Whenever the heater is operating, the heater low side driver power stage contained in the Engine Control Unit (ECU) A-9000 is monitored for a short circuit to battery condition. If a short circuit to a power source condition exists in the heater control circuit, this fault will occur. For information regarding the functional operation of the Lambda sensor B-9123 see **Lambda sensor - Overview (55.989)**. For more information regarding the technical specifications of the lambda sensor B-9123, see **Lambda sensor - Technical Data (55.989)**.

Cause:
The Lambda sensor B-9123 low side driver heater control circuit is shorted to a voltage source.

Possible failure modes:

1. Faulty Lambda sensor B-9123 heater control circuit wiring, short to a voltage source.
2. Faulty Lambda sensor B-9123, internal failure.
3. Faulty ECU A-9000, software.

Solution:

1. Verify that the fault present and active.

   Use the Electronic Service Tool (EST) to check the status of this fault.

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

   B. If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active. Continue with Step **5**.

2. Check the Lambda sensor B-9123 heater control circuit wiring for a short to voltage source condition.

   Disconnect the vehicle harness (VE) from the Lambda sensor B-9123 at connector **X-9123**.

   With the key switch in the ON position, use a multimeter to perform the following voltage check on the vehicle harness (VE) side :

From	To	Value
X-9123 pin 3	Chassis ground	There should be no voltage.

   A. If there is voltage, leave connector **X-9123** disconnected and continue to Step **3**.

   B. If there is no voltage, leave connector **X-9123** disconnected and continue to Step **4**.

3. Locate the Lambda sensor B-9123 heater control circuit wiring short to voltage source condition.

   Disconnect the vehicle harness (VE) from the ECU A-9000 at connector **X-9102**.

   With the key in the OFF position, use a multimeter to perform the following continuity check on the vehicle harness (VE) side :

From	To	Value
X-9102 pin K07	to all other pins in connector **X-9102**	There should be no continuity.

DTC 1B1-04-CAN A Bus off passive failure

Control Module : ECU

Context:
The Engine Control Unit (ECU) A-9000 is capable of connecting to and communicating on two separate Controller Area Networks (CAN). Proper configuration and monitoring of the two twisted pair configured networks is also a function of the ECU A-9000. CAN Node A Bus is the main vehicle interface bus. The ECU A-9000 provides a CAN termination resistor for the CAN Node A Bus, internal to the ECU A-9000. If the ECU A-9000 senses that CAN Node A Bus is not functioning properly, this fault will occur.

Cause:
ECU A-9000 has sensed a “Bus Off” state to be present at the CAN Node A.

Possible failure modes:

1. Faulty supply voltage or ground, missing.
2. Faulty CAN circuit wiring, open circuit, short to ground, or short circuit.
3. Faulty ECU A-9000, termination resistor or software.

Solution:

1. Verify fault is present and in active state.

   Use the Electronic Service Tool (EST) to check the status of this fault.

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

   B. If the fault is no longer present or is in an inactive state, the fault may be intermittent and not currently active. Continue with Step **5**.
2. Check for other vehicle CAN faults.

   Use the EST to determine if vehicle CAN faults exist.

   A. If other vehicle CAN faults do exist, resolve those vehicle CAN faults first, then check to see that this fault is also resolved.

   B. If other vehicle CAN faults do not exist, continue with Step **3**.
3. Check the ECU A-9000 supply voltage.

   Disconnect the vehicle (VE) harness from the ECU A-9000 at connector **X-9102**.

   To energize the Main relay K-9102, place a jumper wire between the vehicle harness (VE) side of connector **X-9102 pin K28** and chassis ground.

   Use a multimeter to check for voltage on the vehicle (VE) harness side:

From	To	Value
X-9102 pin K01	**X-9102 pin K02**	There should be approximately **12.0 V**.
X-9102 pin K03	**X-9102 pin K04**	There should be approximately **12.0 V**.
X-9102 pin K05	**X-9102 pin K06**	There should be approximately **12.0 V**.

   A. If the voltage is present on all of the checks, leave connector **X-9102** disconnected and continue with Step **4**.

   B. If the voltage is not present for one or more of the checks, see the appropriate vehicle service manual and electrical schematics, if necessary, to locate and restore supply power to the ECU A-9000.

DTC 1D1-03-ECU internal failure

Control Module : ECU

Context:
The Engine Control Unit (ECU) A-9000 performs a diagnostic check of the sensor supplies by monitoring the sensor supplies communication. If the ECU A-9000 detects a communication error during this diagnostic check, this fault will occur.

Solution:

1. Check the ECU A-9000 for the appropriate software and re-flash, if necessary.
   A. If the fault has been resolved, return the machine to service.
   B. If the fault has not been resolved, escalate an ASIST concern.

DTC 1D9-12-ECU internal failure - NTP error in ADC monitoring

Control Module : ECU

Context:
The Engine Control Unit (ECU) A-9000 monitors the Analog Digital Converter (ADC) plausibility by running a No-load Test Pulse operation (NTP). If the ECU A-9000 detects an error during this operation, this fault will occur.

Solution:

1. Check the ECU A-9000 for the appropriate software and re-flash, if necessary.
   A. If the fault has been resolved, return the machine to service.
   B. If the fault has not been resolved, escalate an ASIST concern.

With the key in the OFF position, use a multimeter to perform the following continuity checks on the engine harness (EN) side :

From	To	Value
X-9011 pin 1	Chassis ground	There should be no continuity.
X-9011 pin 1	**X-9011 pin 3**	There should be no continuity.
X-9011 pin 1	**X-9011 pin 2**	There should be no continuity.
X-9011 pin 1	**X-9011 pin 6**	There should be no continuity.

With the key in the OFF position, use a multimeter to perform the following continuity checks on the vehicle harness (VE) side :

From	To	Value
X-9001 pin A08	All pins in connector **X-9001**.	There should be no continuity.

A. If the specified values are measured, leave the ECU A-9000 connectors **X-9102** and **X-9001** disconnected. Then, continue to Step **7**.

B. If the specified values are not measured, there is a failure in the TVA Z-9001 voltage supply wiring. Use the appropriate service manual, if necessary, to locate and repair the failed conductor.

7. Check the intake manifold pressure and temperature sensor B-9001 voltage supply wiring.

With the key in the ON position, use a multimeter to perform the following voltage check on the engine harness (EN) side :

From	To	Value
X-9003 pin 3	Chassis ground	There should be no voltage.

With the key in the OFF position, use a multimeter to perform the following continuity checks on the engine harness (EN) side :

From	To	Value
X-9003 pin 3	Chassis ground	There should be no continuity.
X-9003 pin 3	**X-9003 pin 1**	There should be no continuity.

With the key in the OFF position, use a multimeter to perform the following continuity checks on the vehicle harness (VE) side :

From	To	Value
X-9001 pin A10	All pins in connector **X-9001**.	There should be no continuity.

A. If the specified values are measured, leave the ECU A-9000 connectors **X-9102** and **X-9001** disconnected. Then, continue to Step **8**.

B. If the specified values are not measured, there is a failure in the intake manifold pressure and temperature sensor B-9001 voltage supply wiring. Use the appropriate service manual, if necessary, to locate and repair the failed conductor.

8. Check the rail pressure sensor B-9004 voltage supply wiring.

With the key in the ON position, use a multimeter to perform the following voltage check on the engine harness (EN) side :

From	To	Value
X-9026 pin 3	Chassis ground	There should be no voltage.

With the key in the OFF position, use a multimeter to perform the following continuity checks on the engine harness (EN) side :

From	To	Value
X-9026 pin 3	Chassis ground	There should be no continuity.
X-9026 pin 3	**X-9026 pin 1**	There should be no continuity.

DTC 1F7-03-PMCat inlet temperature sensor voltage is higher than expected

Control Module : ECU

Context:
The Engine Control Unit (ECU) A-9000 monitors the Particulate Matter (PM) catalytic converter inlet temperature sensor B-9127. If the ECU A-9000 detects a voltage greater than **3.59 V** in the PM catalytic converter inlet temperature sensor B-9127 signal circuit, this fault will occur. If this fault is active, the last valid temperature value will be frozen for a preliminary failure or set to a fixed replacement value of **99.96 °C** (**211.93 °F**) if the failure is validated.

Cause:
The ECU A-9000 has detected a voltage greater than **3.59 V** in the PM catalytic converter inlet temperature sensor B-9127 signal circuit.

Possible failure modes:

1. Faulty PM catalytic converter inlet temperature sensor B-9127 wiring, short to a voltage source.
2. Faulty PM catalytic converter inlet temperature sensor B-9127, internal failure.
3. Faulty ECU A-9000, software.

Solution:

1. Verify fault is present and active.

   Use the Electronic Service Tool (EST) to check the status of this fault.

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

   B. If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active. Continue with Step **6**.

2. Check the PM catalytic converter inlet temperature sensor B-9127 for an internal failure.

   Disconnect the vehicle harness from the PM catalytic converter inlet temperature sensor B-9127 at connector **X-9127**.

   Use a multimeter to measure the resistance on the PM catalytic converter inlet temperature sensor B-9127 :

From	To	Value
X-9127 pin 1	**X-9127 pin 2**	There should be between **170.2 - 849.7 Ω**.

   A. If there is between **170.2 - 849.7 Ω**, leave connector **X-9127** disconnected and continue to Step **3**.

   B. If there is between **170.2 - 849.7 Ω**, the PM catalytic converter inlet temperature sensor B-9127 has failed. Replace the PM catalytic converter inlet temperature sensor B-9127.

3. Check the PM catalytic converter inlet temperature sensor B-9127 vehicle harness (VE) wiring for a short circuit to battery.

   With the key in the OFF position, use a multimeter to perform the following voltage check on the vehicle harness side :

From	To	Value
X-9127 pin 2	Chassis ground	There should be no voltage.

   With the key in the ON position, use a multimeter to perform the following voltage check on the vehicle harness side :

From	To	Value
X-9127 pin 2	Chassis ground	There should be less than **5.5 V**

DTC 226-04-Battery voltage is lower than expected

Control Module : ECU

Context:
The Engine Control Unit (ECU) A-9000 monitors the battery voltage. If the ECU A-9000 detects a voltage lower than expected, this fault will occur.

Cause:
The ECU A-9000 has detected a battery voltage of less than **8.3 V**.

Possible failure modes:

1. Faulty battery.
2. Faulty alternator, failed regulator.
3. Engine started in extreme cold conditions.
4. Faulty ECU A-9000, software.

Solution:

1. Verify fault is present and active.

   Use the Electronic Service Tool (EST) to check the status of this fault.

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

   B. If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active. Continue with Step **6**.

2. Charge the battery and perform a battery load test.

   A. If the pass battery does not pass the load test, replace the battery.

   B. If the battery passes the load test, continue to Step **3**.

3. Start the engine and raise the Revolutions Per Minute (RPM) to about **1500 RPM** for **1.00 min**. Lower the RPM to idle speed and check the battery voltage with the engine running.

   With the engine running, use a multimeter to perform the following voltage check on the battery posts :

From	To	Value
Battery +	Battery -	**14.8 - 16.2 V**

   A. If the voltage is low, out of range (normal engine running operating range is approximately **14.8 - 16.2 V**, the alternator has failed. Replace the alternator.

   B. If the voltage is within range (normal engine running operating range is approximately **14.8 - 16.2 V**, continue to Step **4**.

4. Check the ECU A-9000 voltage supply wiring.

   Disconnect the vehicle harness (VE) from the ECU A-9000 at connector **X-9102**.

   Place a jumper wire between **X-9102 pin K28** and chassis ground. This will energize the main relay K-9102.

   With the key in the ON position, use a multimeter to perform the following voltage check on the vehicle harness (VE) side :

From	To	Value
X-9102 pin K01	Chassis ground	There should be approximately **12 V**.
X-9102 pin K03	Chassis ground	There should be approximately **12 V**.
X-9102 pin K05	Chassis ground	There should be approximately **12 V**.

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.

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DTC 27F-12-Missing adjustment value programming for injector in cylinder 2

Control Module : ECU

Context:
The Engine Control Unit (ECU) A-9000 uses an IMA code to correct fuel trim for each fuel injector equipped with the engine at every key ON. If the ECU A-9000 determines that this trim correction for fuel injector number 2 Y-9002 can not be performed, this fault will occur.

Cause:
The ECU A-9000 has determined that the fuel injector number 2 Y-9002 fuel trim correction can not be performed.

Solution:

1. Use the Electronic Service Tool (EST) ensure that the correct IMA code is programmed to fuel injector number 2 Y-9002.

   A. If the correct code is not programmed. Use the EST to program the correct code.

   B. If the correct code is programmed, continue to Step **2**.

   NOTE: *The IMA code may be under the paint on the fuel injector.*

   NOTE: *For more information regarding programming IMA codes, see* ***Fuel injectors - Configure - IMA codes (10.218)****.*
2. Check the ECU A-9000 for the appropriate software and re-flash, if necessary.

   A. If the fault has been resolved, return the machine to service.

   B. If the fault has not been resolved, escalate an ASIST concern.

DTC 2D3-12-ECU internal failure - Software resets in DSM 1

Control Module : ECU

Context:
The Engine Control Unit (ECU) A-9000 will perform a software reset if a software failure is detected. If this fault is active, a software failure has been reported and a software reset has occurred.

Solution:

1. Check the ECU A-9000 for the appropriate software and re-flash, if necessary.
   A. If the fault has been resolved, return the machine to service.
   B. If the fault has not been resolved, escalate an ASIST concern.

DTC 32B-02-Glow plug control circuits open

Control Module : ECU

Context:
For information regarding the functional operation of the glow plug control module Z-9101 see **Glow plug system Glow plug control module - Overview – Glow plug control module (55.202)**. The Engine Control Unit (ECU) A-9000 requests operation of the glow plug control module Z-9101 via a Pulse Width Modulated (PWM) control circuit and monitors the status of possible electrical defects via a diagnostic feedback signal from the glow plug control module Z-9101. If the ECU A-9000 is notified of an open circuit condition in one or more of the glow plugs or glow plug circuits, this fault will occur.

Cause:
The glow plug control module Z-9101 has communicated to the ECU A-9000, via a diagnostic connection, that an open circuit condition exists in one or more of the glow plugs or glow plug circuits.

Possible failure modes:

1. Faulty glow plug, internal failure.
2. Faulty glow plug control circuit wiring, open circuit.
3. Faulty ECU A-9000, software.

Solution:

1. Verify that the fault is present and active.

   Use the Electronic Service Tool (EST) to check the status of this fault.

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

   B. If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active. Continue with Step **5**.

2. Check each of the glow plugs for an open circuit condition.

   Disconnect the vehicle harness (VE) from each of the glow plugs at connectors **X-9034**, **X-9035**, and **X-9036**.

   Use a multimeter to measure the resistance of the glow plugs on the glow plug pin :

From	To	Result
X-9034 pin 1	chassis ground	There should be **0.2 - 5.0 Ω**.
X-9035 pin 1	chassis ground	There should be **0.2 - 5.0 Ω**.
X-9036 pin 1	chassis ground	There should be **0.2 - 5.0 Ω**.

   A. If there is a nominal amount of resistance measured on each of the glow plugs, leave all of the glow plugs disconnected and continue with Step **3**.

   B. If there is infinite resistance measured on any of the glow plugs, that glow plug has failed internally, replace the faulted glow plug.

3. Check the glow plug control circuits for an open circuit condition.

   Disconnect the vehicle harness (VE) from the glow plug control module Z-9101 at connector **X-9113**.

   Use a multimeter to perform the following continuity check for an open circuit on the vehicle harness (VE) side :

From	To	Result
X-9113 pin 2	**X-9034 pin 1**	There should be continuity.
X-9113 pin 7	**X-9035 pin 1**	There should be continuity.
X-9113 pin 1	**X-9036 pin 1**	There should be continuity.

DTC 35A-03-Error in comparing energizing time to maximum value for injector in cylinder 2

Control Module : ECU

Context:
The Zero Fuel Calibration (ZFL) evaluates energizing time for injectors at low idle. The ZFL uses learned calibration values to change the energizing time of the pilot fuel injection. If the Engine Control Unit (ECU) A-9000 determines that there is an error during this process, this fault will occur.

Cause:
The ECU A-9000 has determined that there is an error in the ZFL process for fuel injector number 2 Y-9002.

Solution:

1. Verify that the correct IMA injector code has been programmed to injector number 2.

   A. If the correct IMA code is present, continue to Step **2**.

   B. If the correct IMA code has not been uploaded, program the correct IMA code.

   NOTE: *The IMA code may be under the paint on the fuel injector.*

   NOTE: *For more information regarding programming IMA codes, see* ***Fuel injectors - Configure - IMA codes (10.218)****.*
2. Replace the fuel injector number 2 Y-9002.

   Use the Electronic Service Tool (EST) to verify the status of this fault.

   A. If the fault has been resolved, return the machine to service.

   B. If the fault has not been resolved, continue to Step **3**.
3. Check the ECU A-9000 for the appropriate software and re-flash, if necessary.

   A. If the fault has been resolved, return the machine to service.

   B. If the fault has not been resolved, escalate an ASIST concern.

DTC 3E3-00-ECU internal failure - Fuel injection energizing time is not plausible

Control Module : ECU

Context:
The Engine Control Unit (ECU) A-9000 monitors fuel injector energizing time for plausibility. If the ECU A-9000 determines that this value is implausible for either pilot, main or post injection, this fault will occur.

Solution:

1. Check the ECU A-9000 for the appropriate software and re-flash, if necessary.

   A. If the fault has been resolved, return the machine to service.

   B. If the fault has not been resolved, escalate an ASIST concern.

DTC 426-03-Level 2 Monitoring : Reported Overvoltage of Supply

Control Module : ECU

Context:
The Engine Control Unit (ECU) A-9000 monitors the ECU A-9000 internal **5 V** supply. If the **5 V** supply exceeds the maximal limit, this fault will occur.

Cause:
The ECU A-9000 has determined that the **5 V** internal voltage supply is too high.

Possible failure modes:

1. Faulty voltage supply.
2. Faulty ECU A-9000, software.

Solution:

1. Verify fault is present and active.

   Use the Electronic Service Tool (EST) to check the status of this fault.

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

   B. If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active. Continue with Step **3**.

2. Check the ECU A-9000 supply voltage.

   Disconnect the vehicle (VE) harness from the ECU A-9000 at connector **X-9102**.

   To energize the Main relay K-9102, place a jumper wire between the vehicle harness (VE) side of connector **X-9102 pin K28** and chassis ground.

   Use a multimeter to check for voltage on the vehicle (VE) harness side:

From	To	Value
X-9102 pin K01	**X-9102 pin K02**	There should be approximately **12.0 V**.
X-9102 pin K03	**X-9102 pin K04**	There should be approximately **12.0 V**.
X-9102 pin K05	**X-9102 pin K06**	There should be approximately **12.0 V**.

   A. If the voltage is not present for one or more of the checks, use the appropriate service manual, if necessary, to repair the faulty conductor.

   B. If the voltage is present on all of the checks, check the ECU A-9000 for the appropriate service manual and re-flash, if necessary.

3. 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.

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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.

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DTC 52C-01-Glow Control Unit (GCU) data error

Control Module : ECU

Context:
For information regarding the functional operation of the glow plug control module Z-9101 see **Glow plug system Glow plug control module - Overview – Glow plug control module (55.202)**. For more information regarding glow plugs, see **Glow plug system - Overview (55.202)**. The Engine Control Unit (ECU) A-9000 requests operation of the glow plug control module Z-9101 via a Pulse Width Modulated (PWM) control circuit and monitors the status of possible electrical defects via a diagnostic feedback signal from the glow plug control module Z-9101. If the ECU A-9000 determines the diagnostic data transmission is faulty, this fault will occur.

Cause:
The glow plug control module Z-9101 diagnostic connection with the ECU A-9000 is damaged or the data protocol is incorrect.

Possible failure modes:

1. Faulty glow plug control module Z-9101 diagnostic circuit wiring, open, shorted or grounded circuit.
2. Faulty glow plug control module Z-9101, internal failure.
3. Faulty ECU A-9000, software.

Solution:

1. Verify that the fault is present and active.

   Use the Electronic Service Tool (EST) to check the status of this fault.

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

   B. If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active. Continue with Step **4**.

2. Check for damaged diagnostic circuit wiring.

   Disconnect the vehicle harness (VE) from the ECU A-9000 at connector **X-9102**.

   With the key in the OFF position, use a multimeter to check for continuity on the vehicle harness (VE) side :

From	To	Result
X-9102 pin K22	chassis ground	There should be no continuity.
X-9102 pin K22	all other pins in connector **X-9102**	There should be no continuity.

   Carefully disconnect the vehicle harness (VE) from the glow plug control module Z-9101 at connector **X-9113**.

   Place a jumper wire between connector **X-9113 pin 3** and chassis ground.

   With the key in the OFF position, use a multimeter to check for continuity on the vehicle harness (VE) side :

From	To	Result
X-9102 pin K22	chassis ground	There should be continuity.

   A. If there is continuity from connector **X-9102 pin K22** to ground or any other pin in connector **X-9102** there is a short to ground condition. If there is no continuity from **X-9102 pin K22** to connector **X-9113 pin 3**, there is an open circuit condition is in the vehicle harness (VE), wire VE-9073.
   Use the appropriate service manual, if necessary, to locate and repair the damage in the circuit.

   B. If there is no continuity from connector **X-9102 pin K22** to ground or any other pin in connector **X-9102** and there is continuity from **X-9102 pin K22** to connector **X-9113 pin 3**, continue with Step **3**.

3. Replace the glow plug control module Z-9101, then use EST to check to see that this fault has been resolved.

B. If there is no continuity, leave connectors **X-9011** and **X-9001** disconnected and continue to Step **4**.

4. Check the throttle valve actuator Z-9001 engine harness (EN) wiring for a short to high source condition.

   With the key in the OFF position, use a multimeter to perform the following continuity check on the engine harness (EN) side :

From	To	Value
X-9001 pin A49	All pins in connector **X-9001**	There should be no continuity.

   A. If there is continuity, there is a short to high source in the throttle valve actuator Z-9001 output 1 h-bridge circuit. Locate and repair the shorted conductor.

   B. If there is no continuity, leave connector **X-9011** disconnected and continue to Step **5**.

5. Replace the throttle valve actuator Z-9001.

   Use the Electronic Service Tool (EST) to check the status of this fault.

   A. If the fault is no longer active, return the machine to service.

   B. If the fault is still active, check the ECU A-9000 for the appropriate service manual and re-flash, if necessary.

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.

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DTC 5E3-12-ECU internal failure - Torque request exceeds maximum torque limit

Control Module : ECU

Context:
The Engine Control Unit (ECU) A-9000 calculates and monitors “inner torque”, torque produced by the engine. The ECU A-9000 compares “inner torque” to allowed “inner torque”. If the ECU A-9000 determines that “Inner torque” is greater than allowed “inner torque”, this fault will occur.

Solution:

1. Check the ECU A-9000 for the appropriate software and re-flash, if necessary.

   A. If the fault has been resolved, return the machine to service.

   B. If the fault has not been resolved, escalate an ASIST concern.

DTC 607-04-Lambda sensor O2 calibrator too low error

Control Module : ECU

NOTE: *If the Lambda sensor B-9123 is replaced, it is necessary to perform the Replacement of the Lambda Sensor - Reset ECU Data with the Electronic Service Tool (EST) before you return the machine to service. See* ***Lambda sensor - Configure - Reset ECU data (Lambda sensor) (55.989)****, if necessary.*

Context:
The Engine Control Unit (ECU) A-9000 performs an electrical zero-offset calibration every **10 min** of engine operation on the Lambda sensor B-9123 as long as the engine has been running for longer than **10 s** after start, after-treatment regeneration is not active, the engine is in operating range one (speed between **300 - 1200 RPM** and load between **2.00 - 11.00 mg** per stroke), and the calibration is not inhibited due to a failure. The measured oxygen signal during calibration should be between **- 0.200 - 0.200 V**. If the oxygen signal, during this calibration, is out of range, less than **- 0.200 V**, this fault will occur. For more information regarding fuel system troubleshooting, see **Fuel injection system - Troubleshooting (10.218)**. For information regarding the functional operation of the Lambda sensor B-9123 see **Lambda sensor - Overview (55.989)**. For more information regarding the technical specifications of the lambda sensor B-9123, see **Lambda sensor - Technical Data (55.989)**.

Cause:
The Lambda sensor B-9123 oxygen level signal, during calibration, to the ECU A-9000 is less than **– 0.200 V**.

Possible failure modes:

1. Faulty fuel back-flow, excessive.
2. Faulty Exhaust Gas Recirculation (EGR) Z-9000 valve, stuck open. (If applicable)
3. Faulty Lambda sensor B-9123, contaminated.
4. Faulty ECU A-9000, software.