# SERVICE MANUAL

## T3.60F / T3.70F / T3.80F

Tractor

**Part number 51553302**
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NEW HOLLAND AGRICULTURE

## Removal and re-fitting

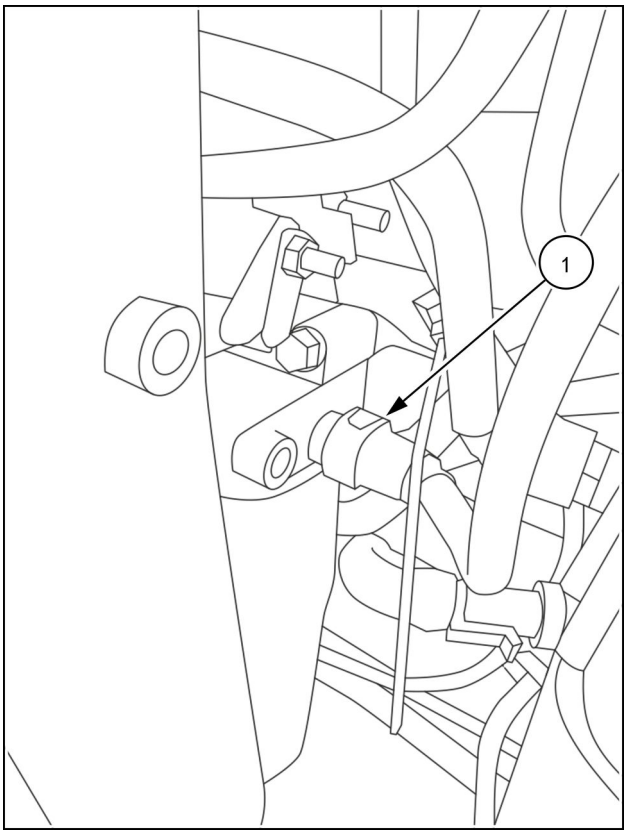
- Lift and handle all heavy parts using suitable hoisting equipment. Make sure that parts are sustained by appropriate hooks and slings. Use the hoisting eyebolts for lifting operations. Extra care should be taken if persons are present near the load to be lifted.
- Handle all parts with carefully. Do not put your hands or fingers between parts. Wear suitable safety clothing, i.e. safety goggles, gloves and footwear.
- Avoid twisting chains or metal cables. Always wear safety gloves when handling cables or chains.

# Contents

# Engine - 10

## Engine and crankcase - 001

23. Remove the electrical connections **(1)** on fuel filter

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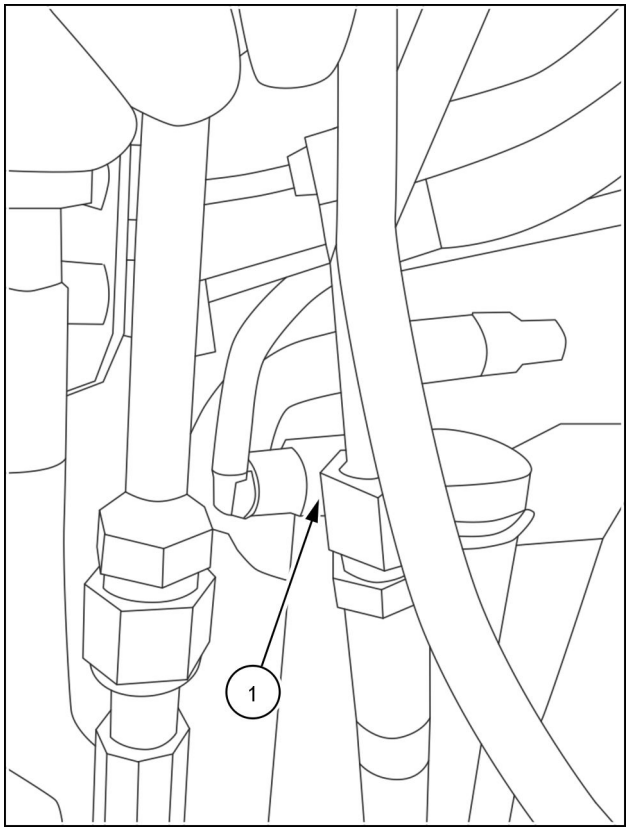


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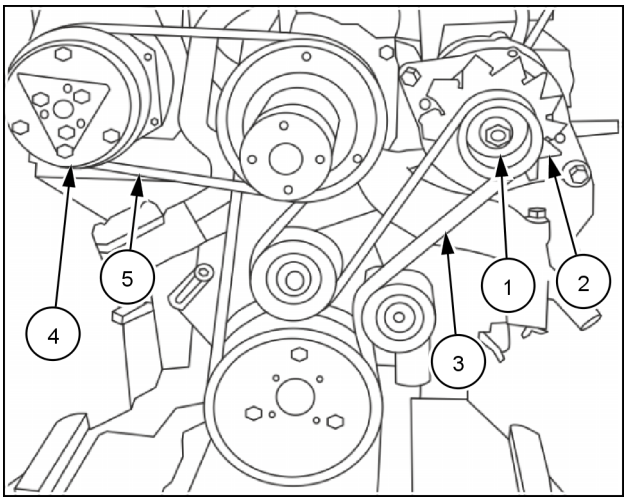
51. Loosen the compressor connection bolts **(4)**. Remove the belt **(5)**.
.Loosen the belt **(2)**. Remove the elastic belt **(3)**. Remove the alternator **(1)**.



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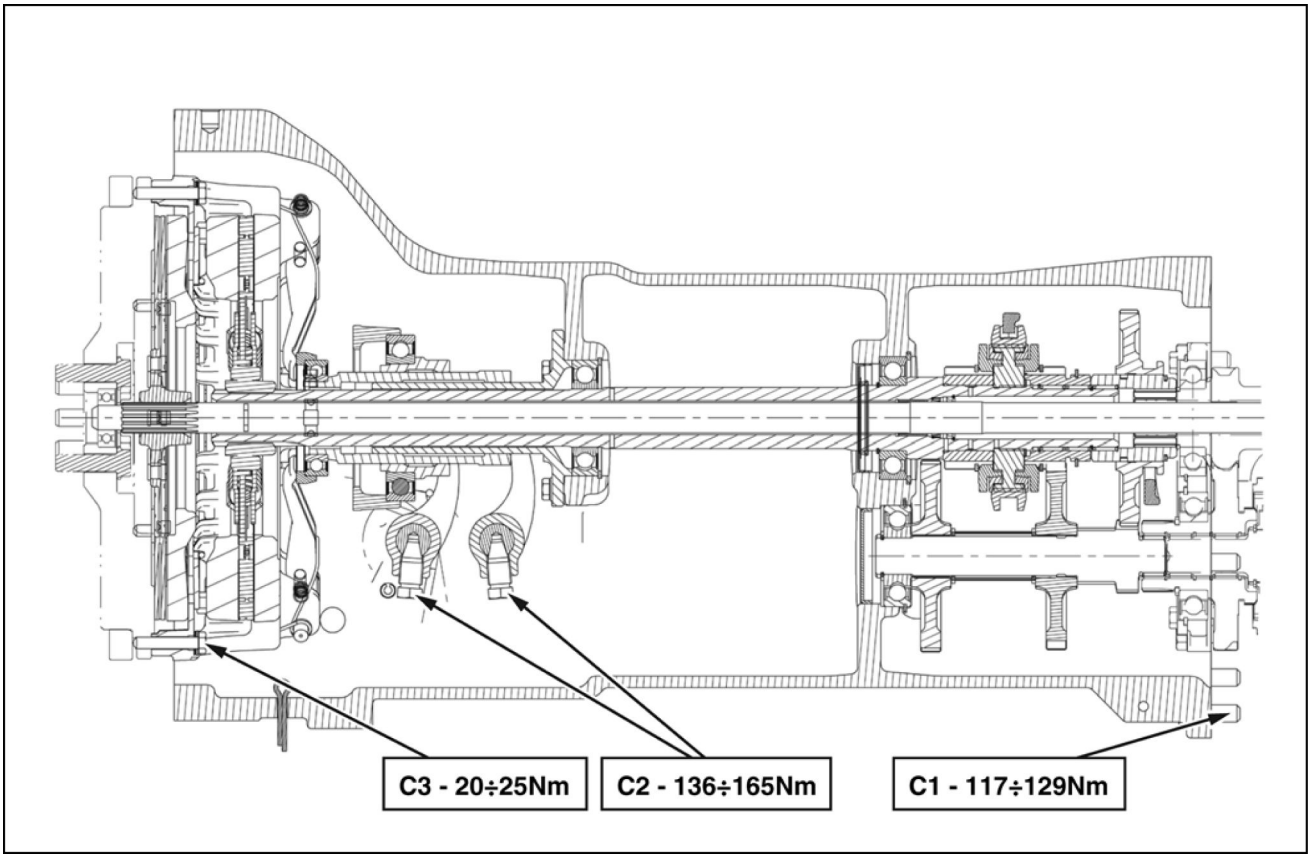
# Engine - Troubleshooting

| Problem | Possible Cause | Correction |
|---|---|---|
| **Engine does not start** | Batteries partially discharged | Check and recharge battery. Replace if necessary |
| | Battery terminal connections corroded or loose | Clean, inspect and tighten terminal nuts. Replace terminals and nuts if excessively corroded |
| | Incorrect injection pump timing | Adjust injection pump timing |
| | Impurities or water in fuel lines | Disconnect fuel lines from injection pump and clean thoroughly. If necessary clean and dry the fuel tank |
| | No fuel in tank | Fill tank |
| | Fuel supply pump malfunction | Check and replace pump if necessary |
| | Air in fuel system | Check fuel lines, unions, supply pump, filters and injection pump for air, then bleed system |
| | Starter motor faulty | Repair or replace starter motor |
| | Faulty thermostart | Check and replace thermostart, if necessary |
| **Engine stalls** | Idle speed too low | Adjust idle speed |
| | Irregular delivery from injection pump | Check injection pump delivery on test bench |
| | Impurities or water in fuel lines | Disconnect fuel lines from injection pump and clean thoroughly. If necessary clean and dry the fuel tank |
| | Fuel filters clogged | Renew filter cartridges |
| | Incorrect valve clearances | Adjust valve clearance |
| | Burnt or cracked valves | Replace the valves |
| | Air in fuel system | Check fuel lines, unions, supply pump, filters and injection pump for air, then bleed system |
| | Injection pump drive mechanism damaged | Replace damaged parts |
| **Engine overheats** | Coolant pump malfunction | Overhaul or replace pump |
| | Faulty thermostat | Replace the thermostat |
| | Radiator inefficient | Remove internal deposits by flushing. Check for leaks and rectify |
| | Deposits in cylinder head and crankcase coolant passages | Flush cooling system |
| | Coolant pump and fan drive belt slack | Check and adjust belt tension |
| | Coolant level low | Top up expansion tank with specified coolant mixture |
| | Incorrect timing | Check and adjust |
| | Injection pump calibration incorrect - delivering too much or too little fuel | Calibrate pump on test bench to values specified in calibration tables |
| | Air cleaner restricted | Clean filter unit and replace filter element if necessary |
| **Engine lacks power and runs unevenly** | Incorrect injection pump timing | Adjust pump timing |
| | Auto advance regulator in injection pump damaged | Overhaul injection pump and adjust on test bench to the values specified in calibration table |
| | Control valve journal worn | Overhaul injection pump and adjust on test bench to the values specified in calibration table |
| | Irregular delivery from injection pump | Overhaul injection pump and adjust on test bench to the values specified in calibration table |
| | All-speed governor damaged | Overhaul injection pump and adjust on test bench to the values specified in calibration table |

# Clutch - Torque

## Torque specifications

| Parts to be tightened | Thread | Tightening torque | |
|---|---|---|---|
| Clutch casing/engine retaining bolts | M 12 x 1.25 | **117 – 129 N·m** | **11.9 – 13.1 kgm** |
| Screws (C1) fixing clutch box to the rear transmission box | M 12 x 1.25 | **117 – 129 N·m** | **11.9 – 13.1 kgm** |
| Screw (C2) securing levers to release command fork (7, Fig. **1**) | M 16 x 1.5 | **136 – 165 N·m** | **13.9 – 16.9 kgm** |
| **11 in**/**11 in** clutch/flywheel retaining bolts (C3) | M 8 x 1.25 | **20 – 25 N·m** | **2 – 2.5 kgm** |

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# Clutch - Special tools

⚠ WARNING: The operations described in this section can only be carried out with ESSENTIAL tools indicated by an (X).
To work safely and efficiently and obtain the best results, it is also necessary to use the recommended specific tools listed below and certain other tools, which are to be made according to the drawings included in this manual.

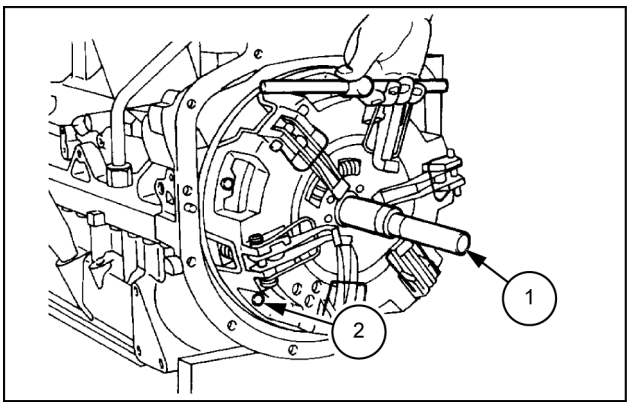
## List of specific tools required for the various operations described in this section

| | | |
|---|---|---|
| X | 380001612 | Pin for centering and adjustment of **11 in**/ **11 in** clutches. |
| X | 380000293 | Clutch adjustment gauge (with 380001612). |
| | 380000256 | Set of wrenches for adjustment of levers in **11 in**/ **11 in** LUK clutches. |

# Clutch - Adjust - Coplanarity adjustment

## Coplanarity adjustment of 11 in/ 11 in dual clutch release

1. After overhauling the clutch, fit the centering pin 380001612 **(1)** and fit the entire clutch assembly to the flywheel, then tighten the bolts **(2)**.

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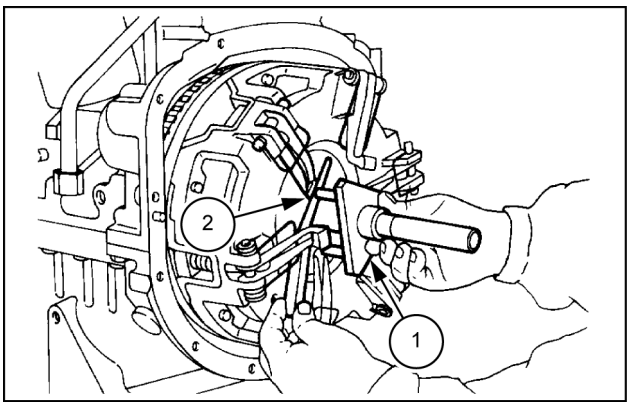
2. Fit gauge 380000293 **(1)** on the centering pin and, using a feeler gauge, adjust the main clutch release levers **(2)** to obtain a clearance of **0.1 mm**.

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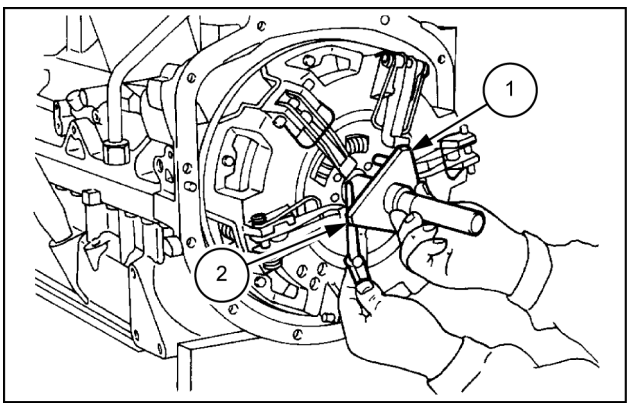
3. Rotate the gauge 380000293 **(1)** and, with the aid of a feeler gauge, adjust the PTO clutch release levers **(2)** to obtain a clearance of **0.1 mm**.

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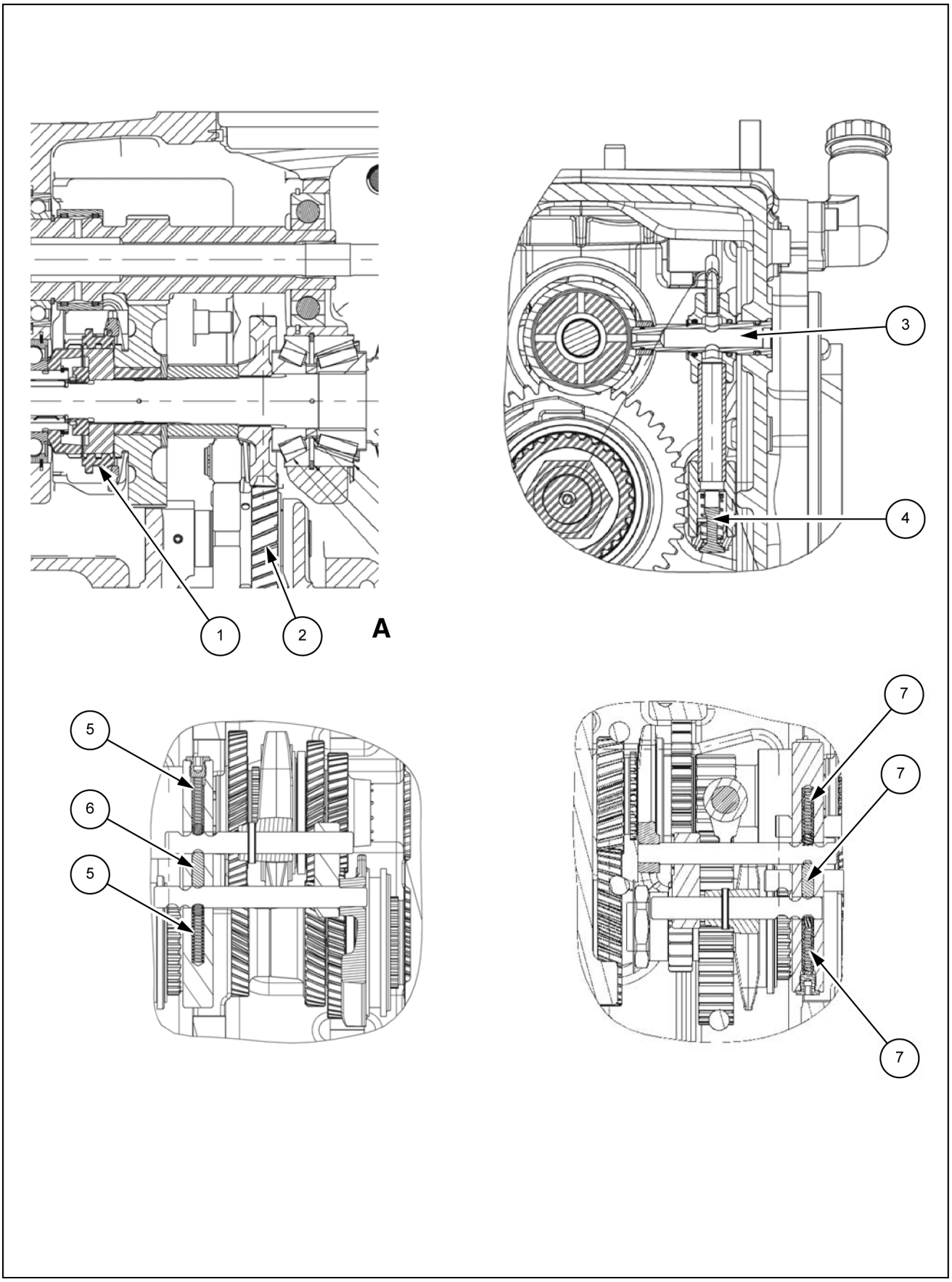
# Transmission - 21

## Cross--sectional view of gearbox and range gear

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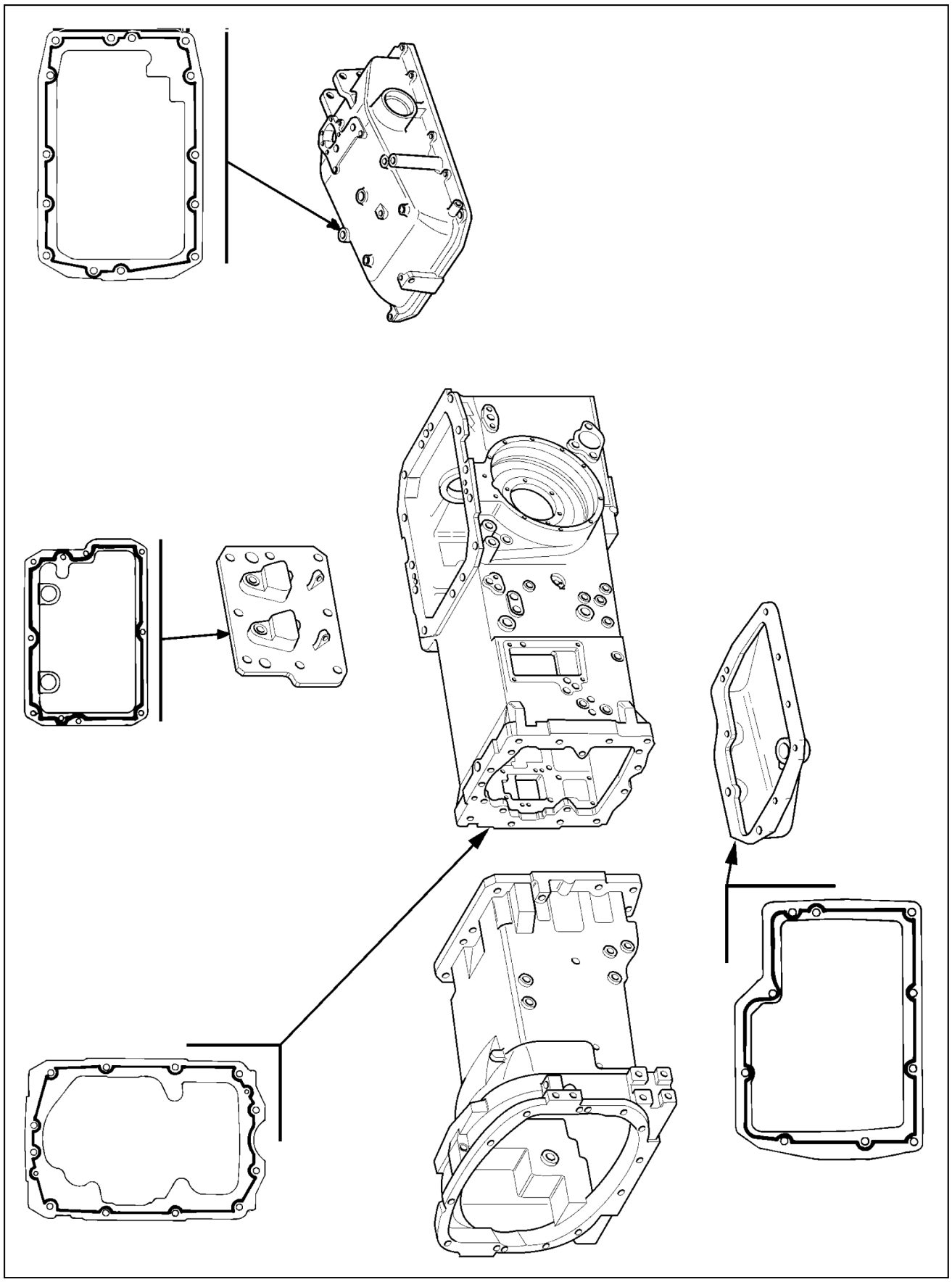
# Transmission housing cover - Overview



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**Sealing compound application diagram for transmission-gear box casing**

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# Transmission - 21

## Gearbox - 120

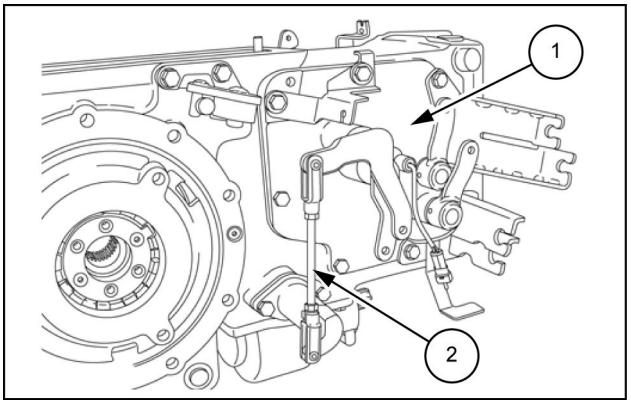
# Gearbox - Disassemble

## Gearbox transmission casing

***ATTENTION:*** *Handle all parts with care. Do not put your hands or fingers between parts. Wear the prescribed safety clothing, including goggles, gloves and safety footwear.*

With the rear transmission box detached from the clutch casing (see **Gearbox - Remove (21.120)**).

1. Position the rear transmission box on an adequate support.
2. Detach the parking brake lever **(2)**.
3. Unscrew the relevant fixing screws and remove the cover **(1)** supporting the control levers: gearbox, range gear and parking brake.

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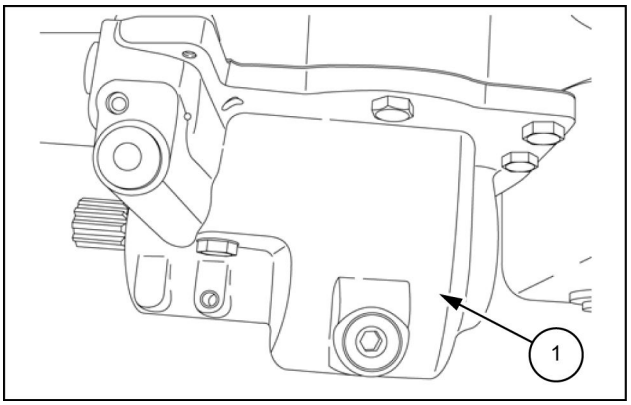
4. Unscrew the retaining bolts and detach the drive housing **(1)**.

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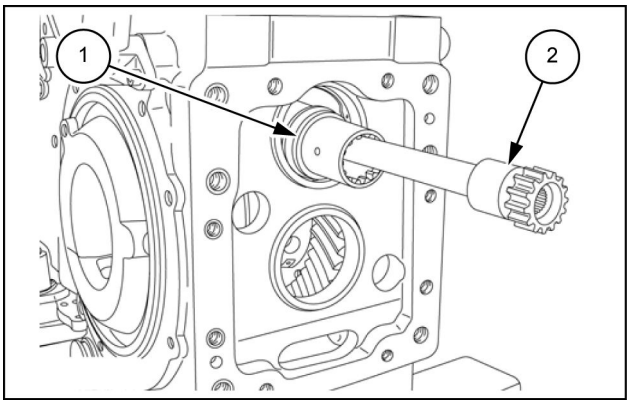
5. Extract the PTO shaft **(2)** together with the sliding sleeve **(1)**.

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## Four-Wheel Drive (4WD) system - 23

### Mechanical control - 101

# Electro-hydraulic control - Static description

## Description and operation of the 4WD drive gear with electrohydraulic coupling

The electrohydraulically operated 4WD is engaged by pressing the switch to the right of the operator.

By turning on the switch, the electrical impulse to the solenoid valve control relay is deactivated. With the solenoid valve de-energized, the oil supply to the mobile coupling internal chamber is interrupted, causing the parts to engage and the oil to drain from the control circuit.

The 4WD is disengaged by turning off the switch to the right of the operator. This sends an impulse to the relay which, in turn, energizes the control solenoid valve.

With the solenoid valve energized, oil is supplied to the mobile coupling internal chamber and the 4WD disengages.

Lubrication is guaranteed by the oil in the rear transmission gearbox.

# Drive shaft - Install - Drive gear housing

***ATTENTION:*** *Use suitable tools to align the holes. NEVER USE FINGERS OR HANDS.*

1. Respect the tightening torque values prescribed in **Mechanical transmission - Torque (21.114)**.
2. Carefully clean the contact surfaces.
3. Apply the sealing compound (a bead of approximately **2 mm**).
4. Position and secure the drive box.
5. Refit the transmission oil drainage plug.
6. Carry out operation **Drive shaft - Disassemble - Propeller shafts and guard (23.314)** Propeller shafts and guard, only installation (see page 7).
7. Refill the rear transmission gearbox (for products and quantities, see Section 00, page 6).

# Powered front axle - Torque

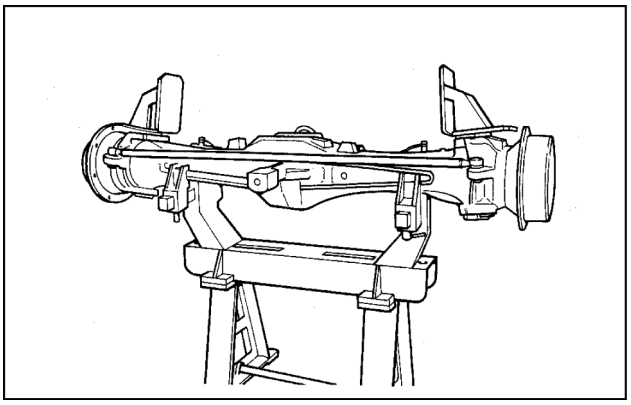
| Parts to be tightened | Thread | Tightening torque | |
|---|---|---|---|
| Front axle | | | |
| Crown wheel to differential gearbox retaining bolt ( **(C1)**, page 4) | M12 x 1.25 | **119 – 144 N·m** | **12.1 – 14.7 kgm** |
| Differential lock device retaining bolt **(C2)** | M10 x 1.25 | **60 – 70 N·m** | **6.1 – 7.1 kgm** |
| Differential bevel gear support to axle casing retaining bolt **(C3)** | M12 x 1.25 | **119 – 144 N·m** | **12.1 – 14.7 kgm** |
| Bevel pinion shaft locknut **(C4)** | M35 x 1.5 | **380 – 420 N·m** | **38.7 – 42.8 kgm** |
| Steering knuckle pin retaining bolt **(C5)** | M10 x 1.25 | **55 – 67 N·m** | **5.6 – 6.8 kgm** |
| Wheel hub bearing locknut **(C6)** | M70 x 2 | **392 N·m** | **40 kgm** |
| Epicyclic final drive housing retaining bolt **(C7)** | M10 x 1.25 | **55 – 67 N·m** | **5.6 – 6.8 kgm** |
| Front axle support to engine retaining bolt **(C8)** | M18 x 1.5 | **310 – 380 N·m** | **31.6 – 38.7 kgm** |
| Front axle pivot front and rear supports retaining bolt **(C9)** | M18 x 1.5 | **370 – 410 N·m** | **37.7 – 41.8 kgm** |
| Differential housing support cap retaining bolt **(C10)** | M12 x 1.25 | **119 – 144 N·m** | **12.1 – 14.7 kgm** |
| Ring nut fastening the steering control hydraulic cylinder to the front axle **(C11)** | - | **630 – 670 N·m** | **64.2 – 68.3 kgm** |
| Bolt retaining steering control linkage ball joint **(C12)** | - | **220 – 230 N·m** | **22.4 – 23.5 kgm** |
| Tie rod adjusting nut **(C13)** | - | **107.9 – 127.5 N·m** | **11.0 – 13.0 kgm** |
| Tie rod nut **(C14)** | - | **166.7 – 215.8 N·m** | **17.0 – 22.0 kgm** |
| Rim to disk retaining bolt | M18 x 1.5 | **170 – 208 N·m** | **17.3 – 21.2 kgm** |

# Powered front axle - Disassemble

***ATTENTION:*** *Handle all parts with care. Do not put your hands or fingers between parts. Wear the prescribed safety clothing, including goggles, gloves and safety footwear.*

***NOTE:*** *Front axle overhaul operations must be carried out on stand No. 380000251.*

1. Unscrew the plug **(1)** and drain the oil from the axle casing.



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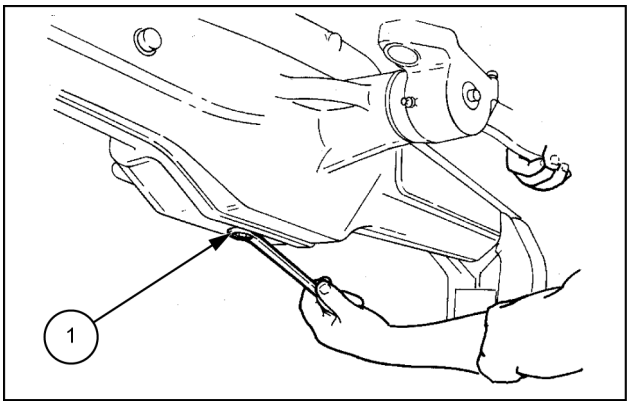
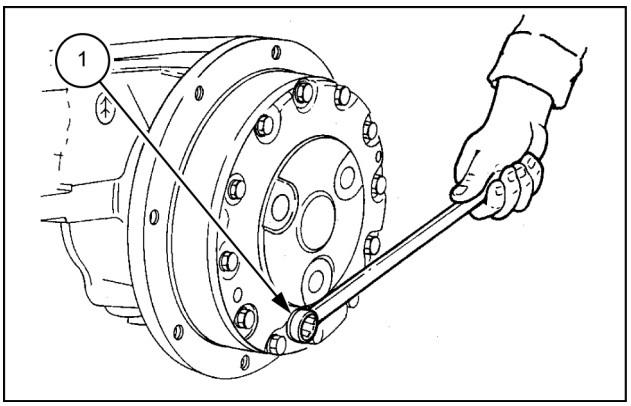



ANIL15TR00326AB 2

2. Unscrew the plug **(1)** on the left-hand epicyclic final drive housing; repeat the same operation on the right-hand housing.

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## Front axle system - 25

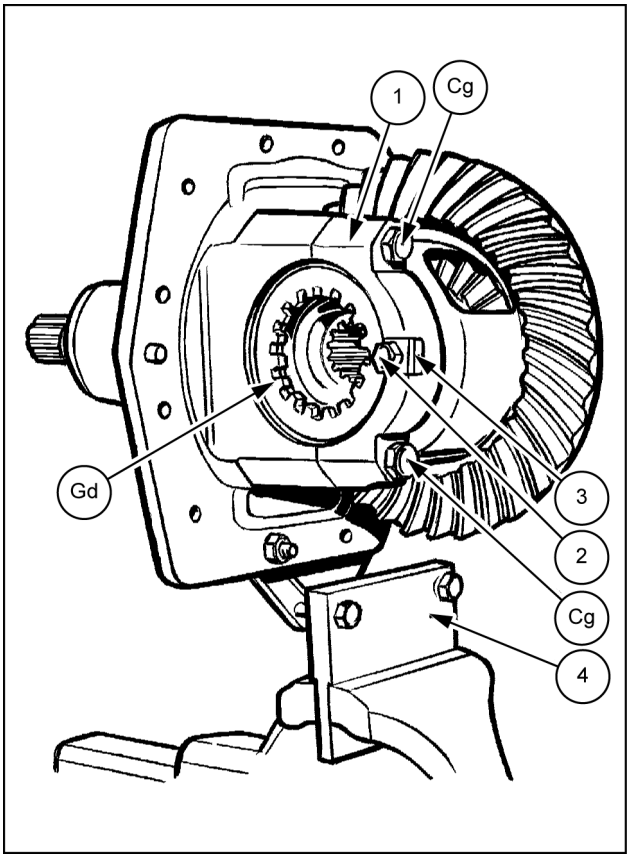
### Front bevel gear set and differential - 102

SERVICE

# Limited slip differential - Overhaul

***ATTENTION:*** *Handle all parts with care.*
*Do not put your hands or fingers between parts. Wear the prescribed safety clothing, including goggles, gloves and safety footwear.*

1. Remove the bevel drive-differential casing assembly from the front axle, attach to support 380000255 **(4)**, lock in a vice and proceed with disassembly operations as follows.
2. Remove the bolts **(2)** and the right-hand **(Gd)** and left-hand ring nut lock plates **(3)**.
3. Check that the right-hand and left-hand caps **(1)** are marked so as not to interchange them during assembly.
4. Remove the right and left-hand bearing adjustment ring nuts **(Gd)** from the bevel crown wheel.
5. Remove the bolts **(C9)**, and caps **(1)** and separate the crown wheel from the bevel pinion support.
6. If necessary, unscrew the retaining bolts ( **(C1)**, page **Powered front axle - Torque (25.100)**) and remove the crown wheel.

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Disassemble the LIM-SLIP self-locking differential lock as follows:

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## Front axle system - 25

### Final drive hub, steering knuckles, and shafts - 108

# Powered rear axle - Special tools

⚠ WARNING: The operations described in this section can only be carried out with ESSENTIAL tools indicated by an **(X)**.
To work safely and efficiently and obtain the best results, it is also necessary to use the recommended specific tools listed below and certain other tools, which are to be made according to the drawings included in this manual.

List of specific tools required for the various operations described in this section.

| | |
|---|---|
| 380000227 | Clutch casing lift hook. |
| 380000301 | Turning stand for overhaul. |
| 380001626 | Grooved wrench for bevel gear. |

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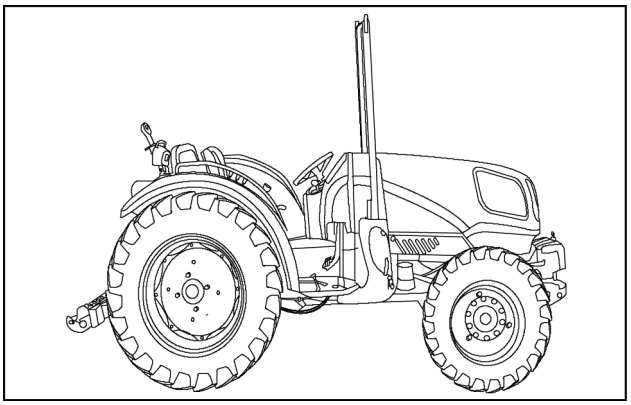
## Rear axle system - 27

### Rear bevel gear set and differential - 106

4. Place the tractor dismantling stand and remove the tiers.



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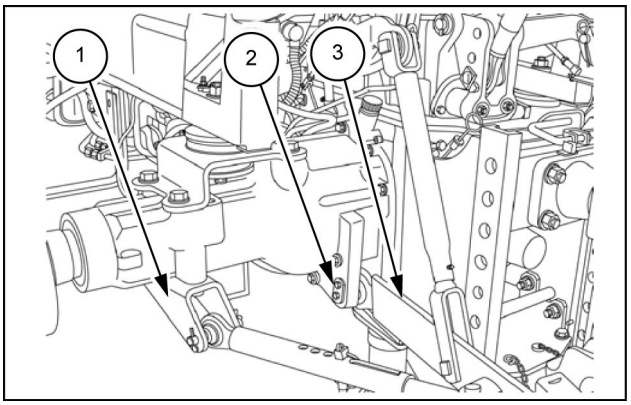
5. Screw the securing bolts and than disconnect the remove the pin and disconnect from left final reduction.

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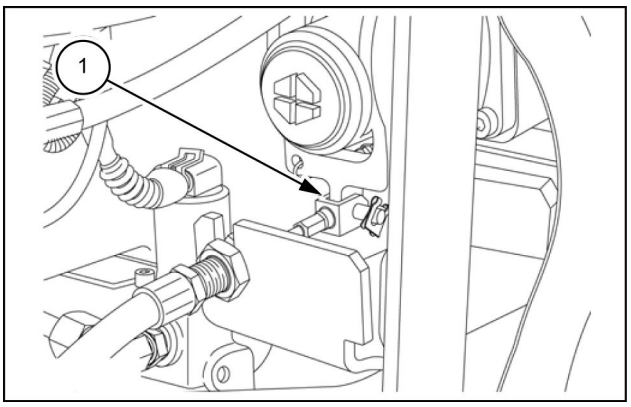
6. Remove the hand brake connection rod **(1)**.

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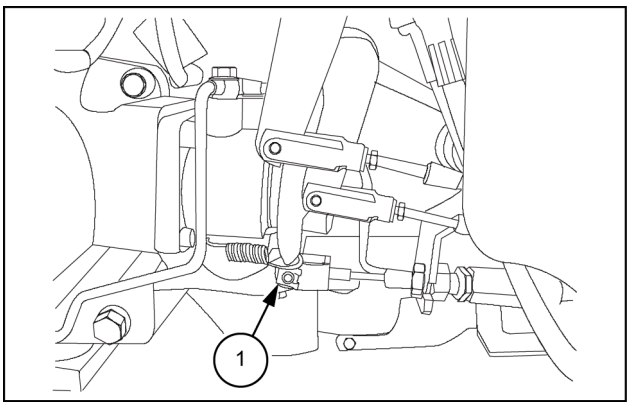
7. Remove the brake control hoses **(1)**.

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# Contents

# Hydrostatic drive - 29

# Rear mechanical control - Troubleshooting

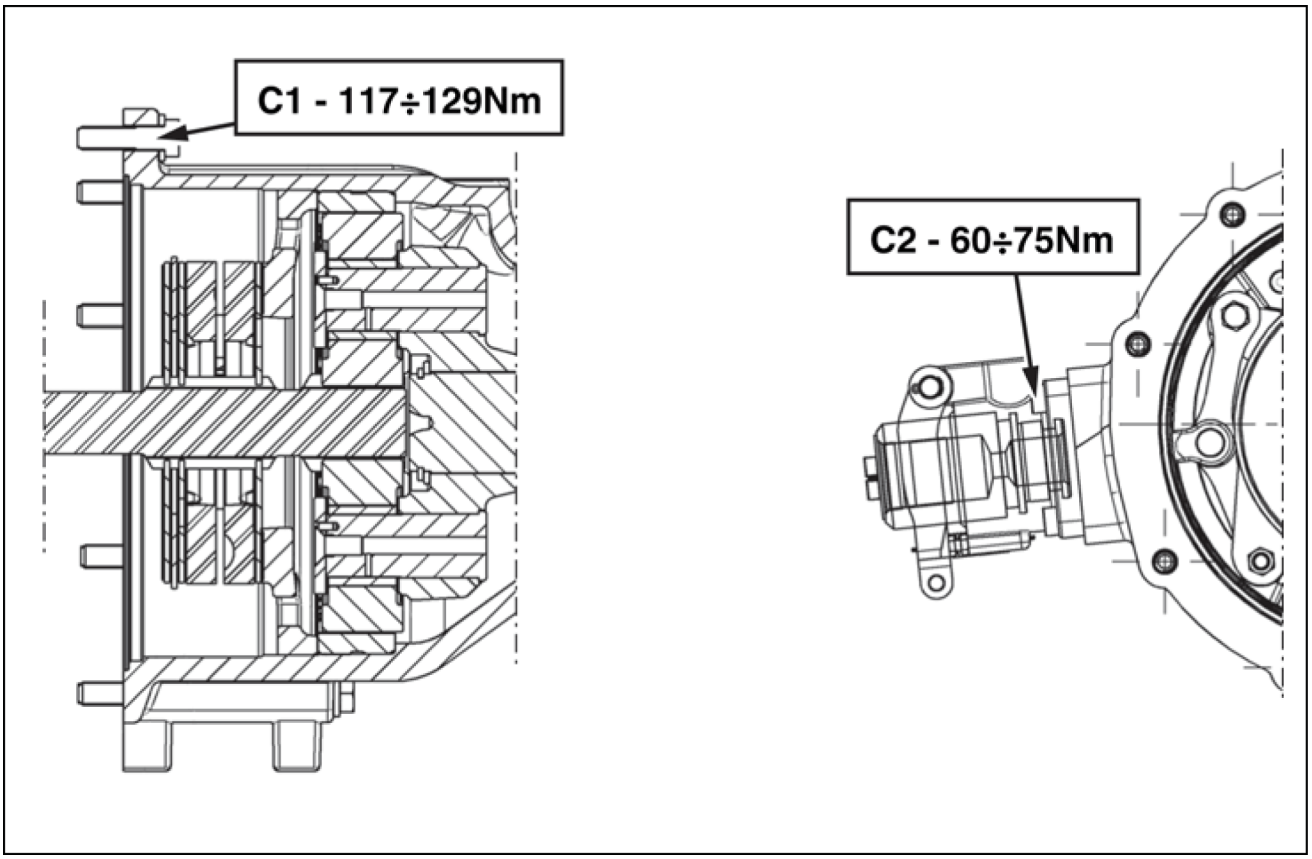
| Problem | Possible Cause | Correction |
|---|---|---|
| **Slipping with loss of speed of PTO output shaft** | Wear of clutch disc or of engine flywheel pressure plate<br>Poor adjustment of PTO clutch control lever | Check the data given in the appropriate pages of section 18, replace the worn parts and adjust the clutch control lever |
| **Difficulty in selecting PTO speed by means of lever** | External control stiff | Check the control lever |

5. Tighten the locknut **(3)** and attach the protective sleeve **(4)** to the fork pin **(2)**.

# Hydraulic service brakes - Torque

## Torque settings

| Parts to be tightened | Thread | Tightening torque |
|---|---|---|
| Screws or nuts securing gear casing to transmission casing **(C1)** | M12 x 1.25 | **117 – 129 N·m** (**86.29 – 95.15 lb ft**) |
| Brake control assembly retaining bolts **(C2)** | – | **60 – 75 N·m** (**44.25 – 55.32 lb ft**) |

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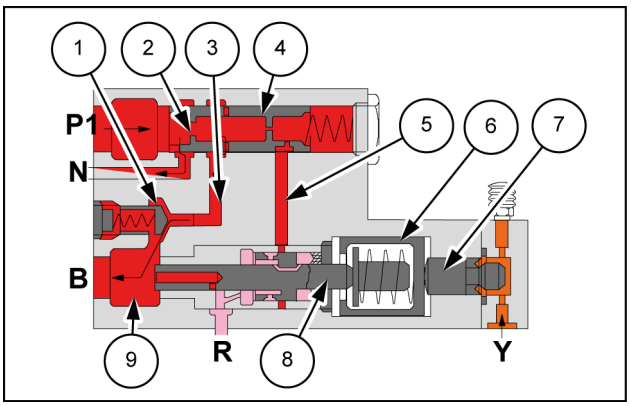
## Brakes and controls - 33

### Hydraulic service brakes - 202

# Trailer brake hydraulic control - Dynamic description

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Start of braking - On operating the tractor brake pedal **(P1)**, the fork shifts the pressure relief valve **(Y)** and the slide piston **(7)** to the left, which in its turn closes the passage between the oil return port **(R)**, trailer brake port **(B)** and the line **(5)**.

The oil inside the flow control valve **(4)** is maintained at a uniform pressure and so the valve element, under the action of the spring, shifts to the left to assume the position indicated in Fig. **1**.

Part of the oil from the hydraulic pump in union **(P1)** flows to the auxiliary control valves through union **(N)**. while the remaining part arrives at the trailer braking element via the diaphragm **(2)**, line **(3)**, check valve **(1)** and port **(B)**.

As the pressure of the oil in the trailer brake union **(B)** increases, it acts on the active surface **(9)** of the spool **(8)**, opposing the effect of control fork on relief valve **(7)** .

- Pressurised oil
- Oil in suction, delivery or return
- Brake system, Oil under pressure

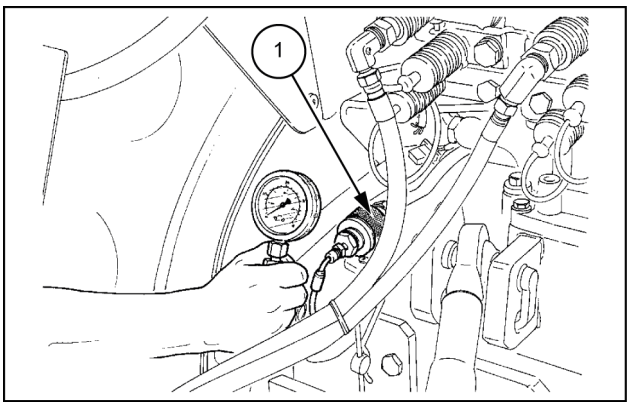
**Start of braking**

B. To trailer brake
N. To auxiliary control valves
P1. Oil from the hydraulic pump to lift circuit
R. Discharge line
Y. Brake system

# Trailer brake hydraulic control - Test

## Controlling the switches ( (8) and (16), Trailer brake hydraulic control - Dynamic description (33.220))

1. Insert union 380000550 **(1)** in the trailer brake coupling and connect to the pressure gauge with scale **0 – 40 Kg/cm²** from kit 380000240.
2. Without applying the service and parking brakes, operate the control lever of an auxiliary control (until the corresponding pressure relief valve is activated), hold this position for a few seconds then suddenly release the control lever.
3. Check that the parking brake release pressure remains at the prescribed level of: **11 – 12 bar** (**159.5 – 174.0 psi**).
4. Apply the parking brake and disconnect the pressure gauge and union 380000550 **(1)**.

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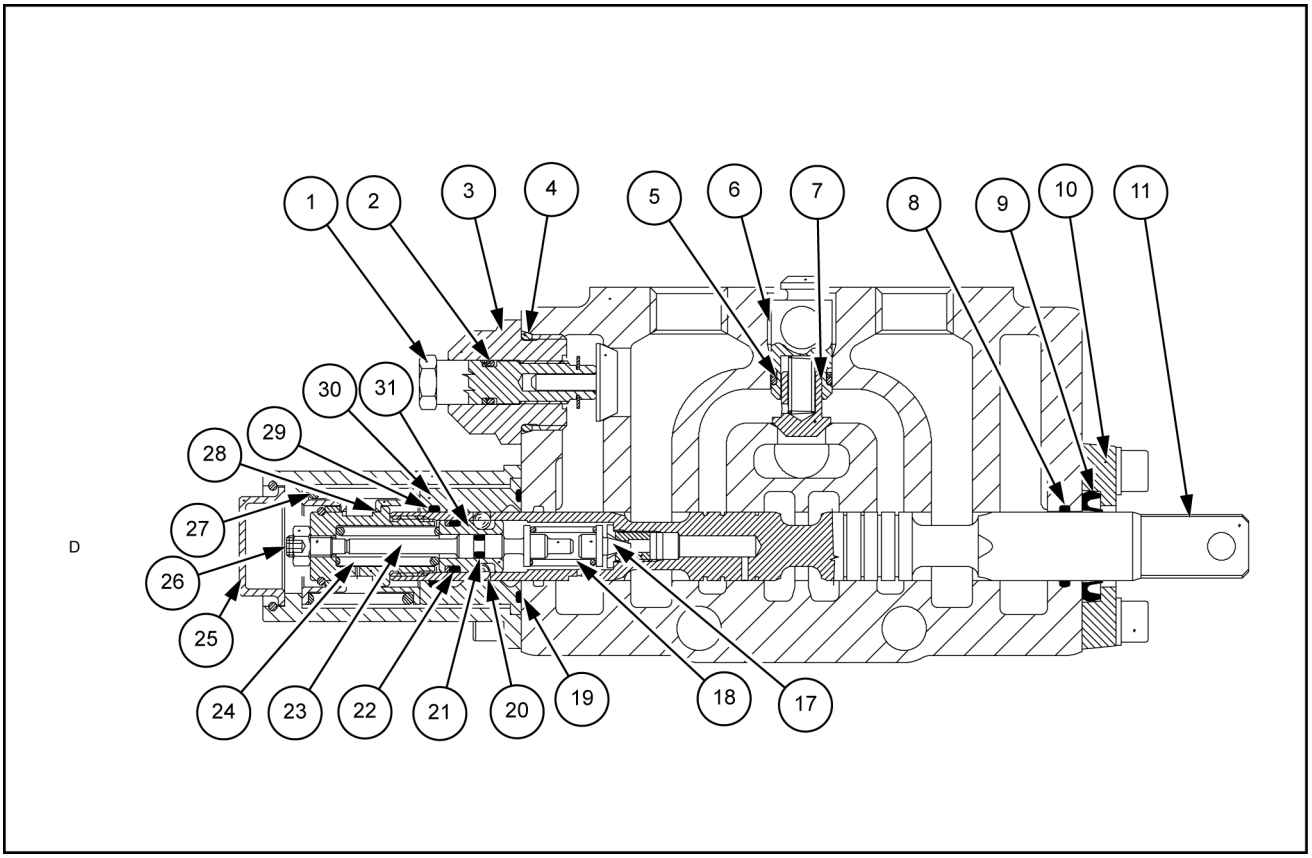
# Hydraulic systems - 35

32. Seal

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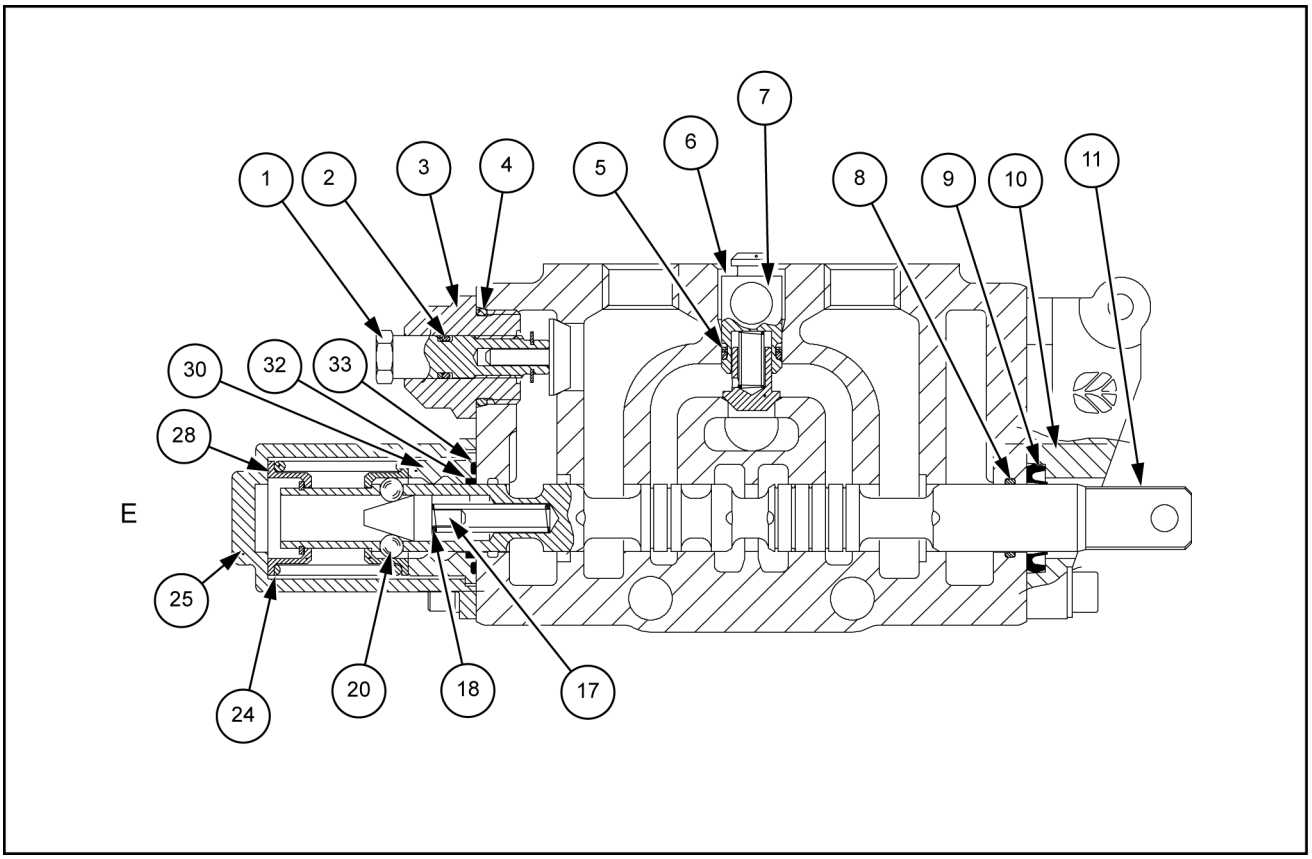


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# Auxiliary hydraulic valves and lines - Disassemble

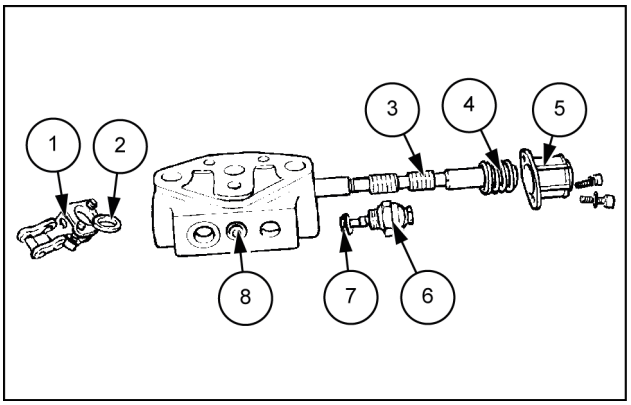
⚠ WARNING: Handle all parts with care.
Do not insert fingers or hands between one part and another.
Wear suitable safety clothing, i.e., safety goggles, gloves and shoes.

⚠ WARNING: Always use suitable tools to align holes. NEVER USE YOUR FINGERS OR HANDS.

## Convertible single/double acting auxiliary control valve

Disassemble the auxiliary control valve into its component parts, referring to the cross-sectional views in **Auxiliary hydraulic valves and lines - Sectional view (35.525)**.

1. Remove the cover **(5)**, recover the spring **(4)** and the relative spring cup.
2. Extract the control valve stem **(3)**.
3. Remove the control lever support **(1)** and recover the seal **(2)**.
4. Remove the plug **(6)** and recover the single/double action switching valve **(7)**.
5. Remove the valve housing **(8)** and recover the check valve and relative spring.
6. Check the condition of the seals before assembly.

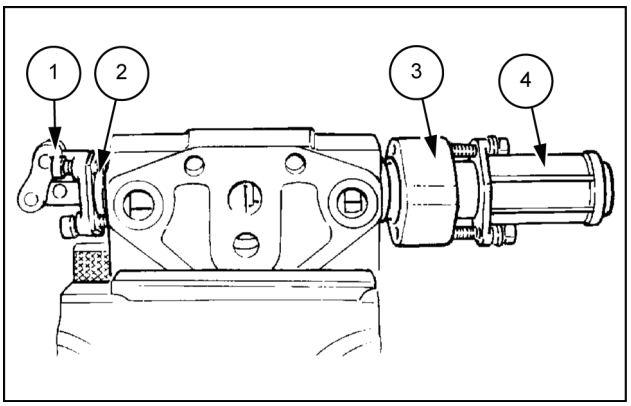



ANIL15TR00491AB 1

## Single/double-acting auxiliary control valve float and automatic detent release

Disassemble the auxiliary control valve into its component parts referring to the sectional views in **Auxiliary hydraulic valves and lines - Sectional view (35.525)** and the following instructions:

1. Unscrew the retaining bolts, remove the cover **(4)** and the spacer **(3)**.
2. Unscrew the retaining screws, recover the control lever support **(1)** and relative seal **(2)**.




ANIL15TR00492AB 2

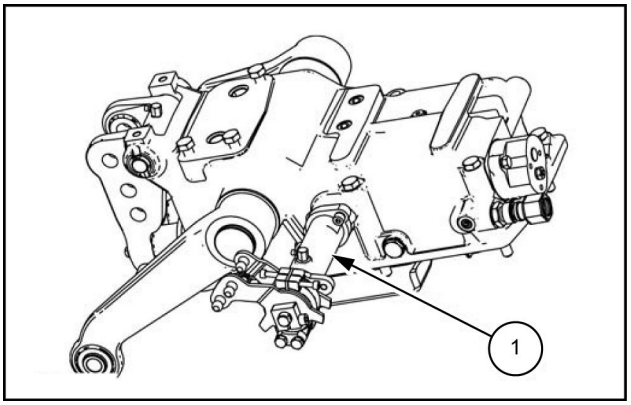
# Main lift system - General specification

| | |
|---|---|
| Type | Position or draft control with a combination of the two |
| Operating system | Two independent levers |
| LIFT-O-MATIC | Provides fast lifting/lowering operations using push buttons, without using the position or draft control levers |
| Single-acting cylinder: | |
| Rated diameter and stroke: | **90 mm** x **117 mm** |
| Capacity: | **750 cm³** |
| Pressure relief valve setting | **190 – 195 bar** |
| Cylinder safety valve setting | **220 bar** |
| Type – mm | Three-point linkage |
| Category: | I and II |
| Draft control | By means of lower arms |
| Lift capacity at ball ends | **2192 kg** |
| Lift capacity with centre of gravity at **610 mm** from the ball ends | **1662 kg** |
| Maximum stroke of lower arms | **636 mm** |
| With vertical tie-rods completely extended | **520 mm** |

# Main lift system - Remove

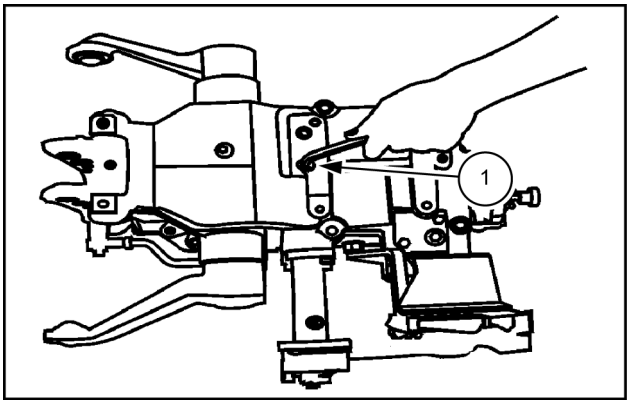
***ATTENTION:*** *Handle all components with the greatest care. Do not insert hands or fingers between one part and another. Wear suitable protection clothing, including goggles, gloves and footwear.*

1. Unscrew the fixing screws and remove the external lift control lever assembly **(1)**.



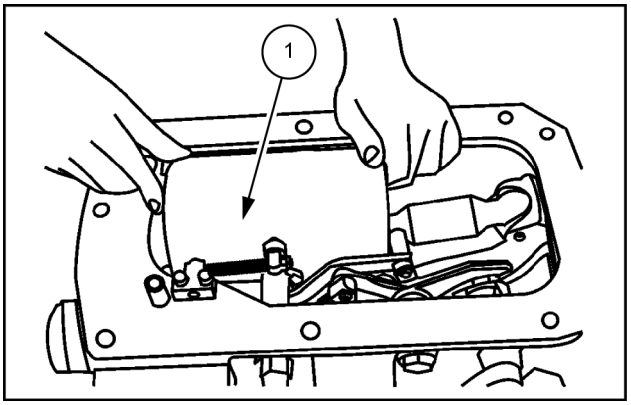

ANIL15TR00447AB 1

2. Unscrew the Allen screws **(1)**.



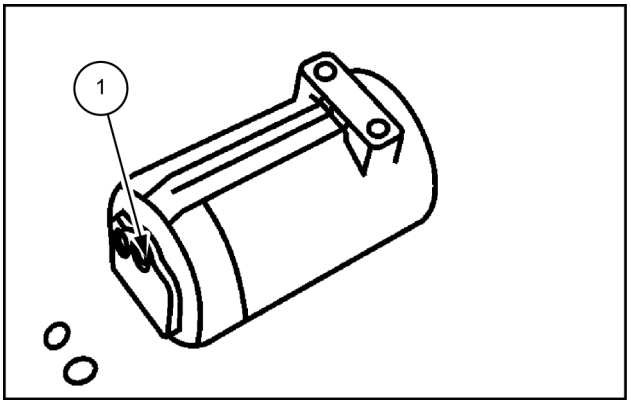

ANIL15TR00448AB 2

3. Remove the cylinder **(1)** from the hydraulic lift casing.




ANIL15TR00449AB 3

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




ANIL15TR00450AB 4

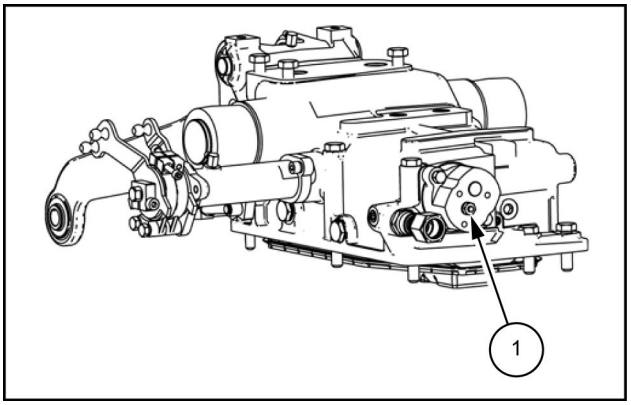
# Main lift system - Remove

***ATTENTION:*** *Handle all components with the greatest care. Do not insert hands or fingers between one part and another. Wear suitable protection clothing, including goggles, gloves and footwear.*

1. Unscrew the screws **(1)** and detach the distributor unit from the lift casing.

***NOTE:*** *It is not possible to make any repairs on the distributor, it must be replaced if faulty.*

2. Put the distributor unit back in position on the lift and tighten the screws **(1)**.




ANIL15TR00474AB 1

# Contents

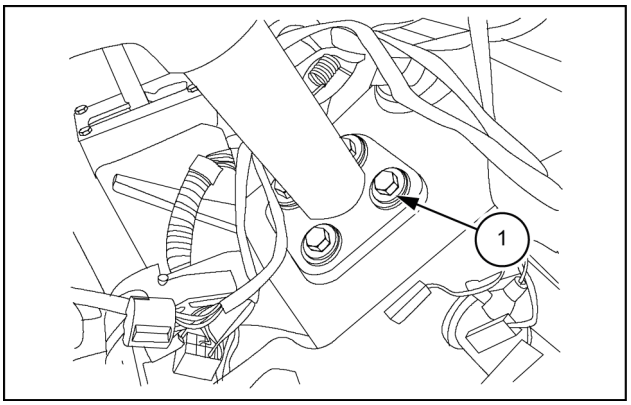
## Hydraulic systems - 35

### Front hitch cylinders and lines - 162

# Steering control - Torque

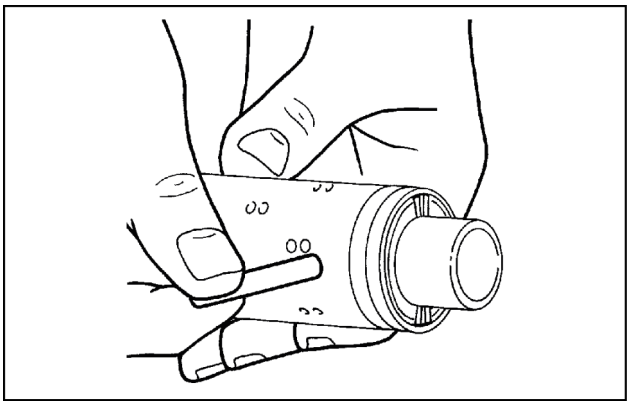
| Part | Thread | Torque setting | |
|---|---|---|---|
| Nut, power cylinder piston rod to steering arm | M8 x 1 | **24 – 36 N·m** | **2.5 – 3.7 kgm** |
| Bolt fixing cover to hydrostatic steering housing | M8 x 1 | **23 N·m** | **2.40 kgm** |
| Bolt fixing hydrostatic steering to tractor | M10 x 1.5 | **44 N·m** | **4.5 kgm** |
| Hydrostatic steering control pump fixing bolt | M6 x 1 | **8 N·m** | **0.8 kgm** |
| Nut for bolt fixing cover to pump housing | M10 x 1.25 | **39 N·m** | **4 kgm** |
| Nut for securing thrust sleeve to pump drive shaft | 7/16”–20UNF –2B | **28 N·m** | **2.8 kgm** |

7. Unscrew the screws **(1)** fixing the hydrostatic steering control valve to the steering column, recover the control valve from outside the cab.



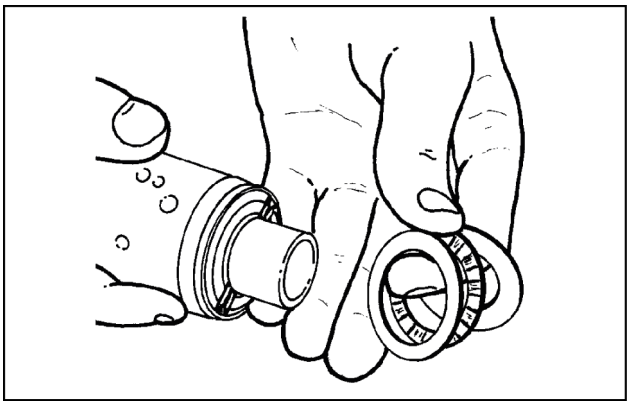

ANIL15TR00516AB 4

5. Insert the sleeve-rotor drive shaft trim pin.



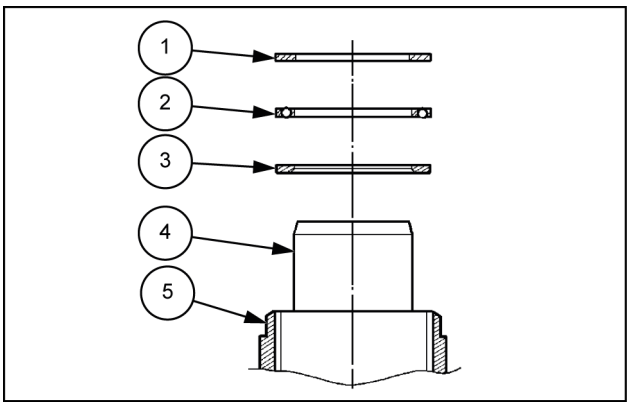
ANIL15TR00544AA 5

6. Fit the thrust bearing, following the order indicated in figure.



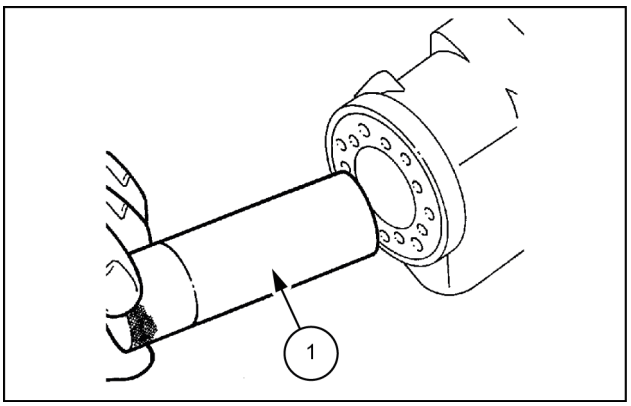
ANIL15TR00545AA 6

1. Bearing external ring
2. Thrust bearing
3. Bearing internal ring with bevel facing contact surface of part **(5)**
4. Rotary valve
5. Rotary valve seat sleeve




ANIL15TR00546AB 7

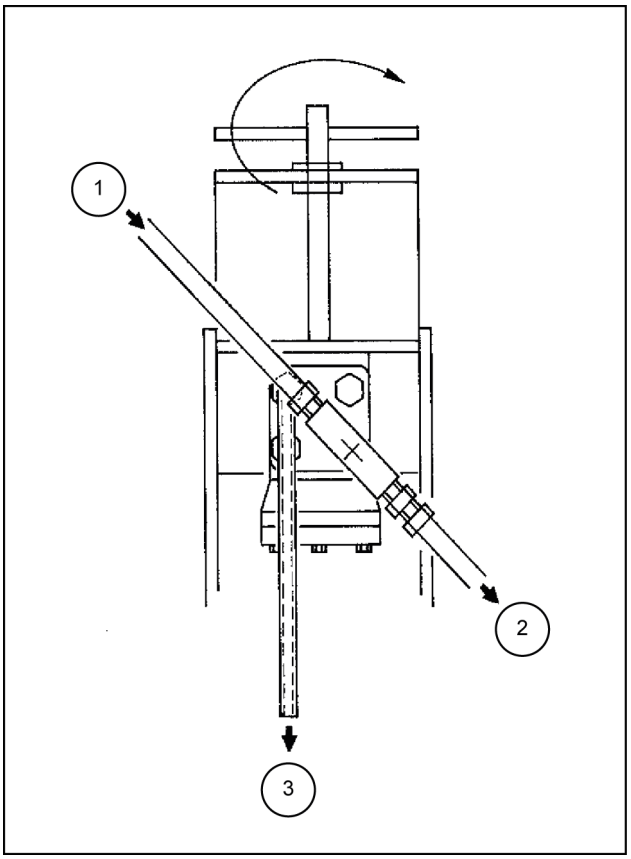
7. Position the control valve body so that the housing seat on the rotary valve sleeve is positioned horizontally, then insert the guide bushing **(1)** of tool.




ANIL15TR00547AB 8

## B - Checking return to neutral position

In the same test conditions as A, check that the valve automatically returns to neutral position when the control shaft **(1)** is released after each simulated steering movement.




ANIL15TR00577BB 2

## C - Checking seal efficiency

In the same test conditions as A, hold the valve in steering position with the control shaft **(1)** for about three minutes and check the seals for leaks.

## D - Setting the pressure relief valve

1. Make the connections as shown in **Steering control - Overview (41.101)** and complete the circuit as in **1**.
2. Using the control shaft **(1)**, simulate a steering cycle (to right or left) so as to interrupt the oil flow to the outlet.
3. Gradually increase the pressure in the circuit by turning the hand wheel **(5)**, Fig. 68 and check on the pressure gauge that the pressure relief valve **(24)**, Fig. (3) cuts in at the pressure shown on page 2. If not, increase or reduce the pressure relief valve setting by tightening or slackening the adjuster screw.

Cylinder safety valve calibration for steering to the left

1. From delivery line
2. To the restriction
3. Exhaust

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SERVICE

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### Electrical system - 000

## Wiring harnesses - Electrical schematic sheet 01 TITLE BLOCK

# Wiring harnesses - Electrical schematic sheet 06 POWER DISTRIBUTION MAIN IGNITION KEY

## Wiring harnesses - Electrical schematic sheet 11 GROUND CHASSIS 2

# Wiring harnesses - Electrical schematic sheet 16 PTO FRONT REAR SAFETY

## Wiring harnesses - Electrical schematic sheet 21 LIGHTS DIRECTIONS

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# Electrical systems - 55

## Engine starting system - 201

# Engine starting system - Disassemble - Starter motor

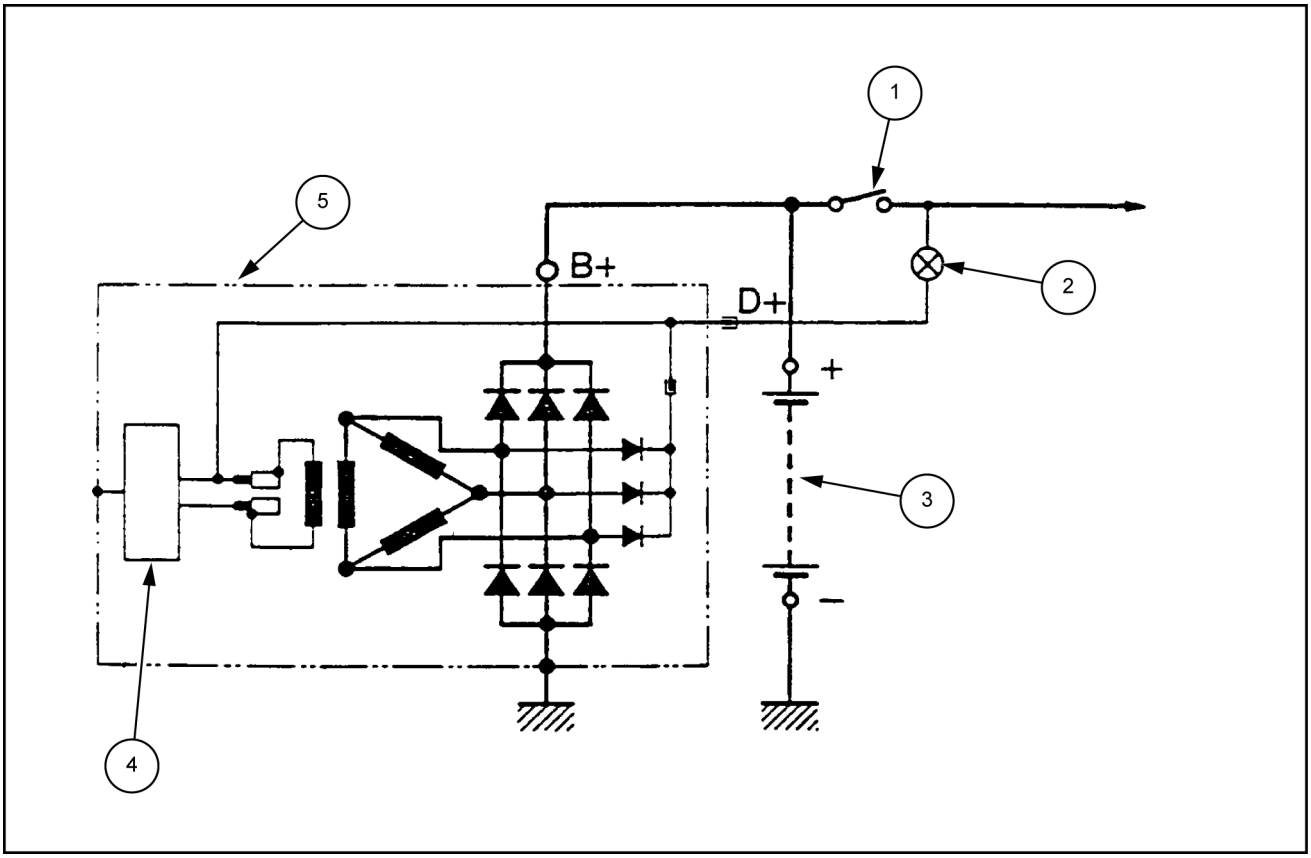
1. Place the starter motor in a vice with protected jaws.
2. Disconnect the biggest braided wire which runs from the field winding casing to the solenoid.
3. Remove the three screws from the front casing and remove the solenoid. Note that the plunger will remain connected to the control lever.
4. Remove solenoid plunger from the control lever by holding and lifting it at the front in order to unclip it from the lever.
5. Remove the two nuts from the rear casing and the two screws which fasten the rear cover and brush plate to the casing. Remove clamp C and armature shaft end play spacers, leaving the brush gear on the commutator. Remove the thin metal washer on the commutator side of the armature.
6. At this stage of the procedure, check the brushes and commutator. Check that the brushes are not sticking and, if necessary, clean the brushes and their respective channels with a rag and solvent. Check the brushes are not worn. If they are worn and minimum length is less than that shown in the technical information table, it will be necessary to change the starter motor.

***NOTE:*** *The brushes are not serviced separately. They are welded to their support and will not be changed for the whole operating life of the starter motor.*

7. Remove the motor casing from the armature and the control side bracket.
8. Remove the control lever knuckle pin from the control side of the casing.
9. Remove the retaining ring which holds the control group and the inner plate from the armature shaft, by first removing the pressure collar perpendicularly from the retaining ring support by means of an appropriately sized tube. Then lever the retaining ring from the groove.
10. Remove armature and control group.

# Alternator - Wiring schema

## Alternator charging circuit




ANIL15TR00710FB 1

1. Ignition switch
2. Alternator charge warning light
3. Battery
4. Alternator
5. Alternator electronic voltage regulation circuit

B+ Battery connection
D+ Alternator charge indicator

The voltmeter reading should be higher than the battery voltage and when the ammeter reading falls below **10 A**, the voltmeter reading should stabilise at **12 V**.

If the voltmeter reading is higher than **12 V** for alternators respectively, the alternator regulator must be changed, as described in this section. (After installing a new regulator, carry out tests 4 and 5).

If the voltmeter reading is less than **12 V**, there is either a faulty component in the alternator or a failure due to excessive resistance in the external charging system connections.

If the ammeter reads zero amps, then one of the alternator components is malfunctioning. Turn the engine off and carry out the alternator component test, as described in this chapter.

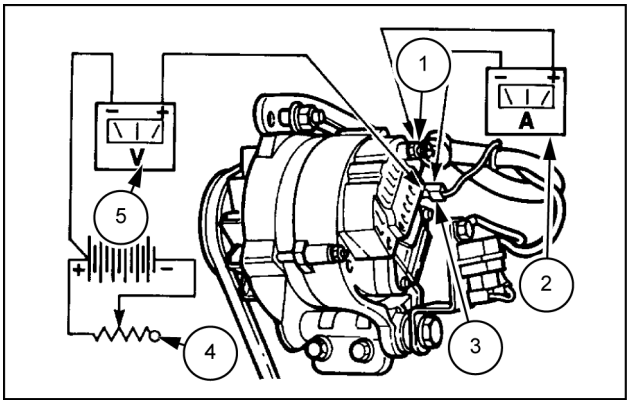
## Charging circuit voltage drop tests
## (a) Insulated side voltage drop test (Fig. 3)

Check the ignition key is in OFF position.

1. Disconnect the negative battery cable and the B+ alternator wire **(1)**.
2. Connect a millivoltmeter **(5)** between the positive battery terminal clamp and D+ wire **(3)** (positive side of the wire).
3. Connect an ammeter **(2)** between the B+ alternator terminal and the D+ wire (negative side of the wire).
4. Reconnect the negative battery cable and connect a varying load resistance **(4)** with cursor in minimum current absorption position (maximum resistance) through the battery terminal clamps.
5. Start the engine and increase speed to **2000 RPM**.
6. Decrease resistance charging load (decreasing resistance) slowly until the ammeter reads **45 A** according to the type of alternator.
7. Note the reading on the millivoltmeter. This must not be higher than **400 mV**.

A reading higher than **400 mV** indicates malfunctioning due to excessive resistance in the external circuits.
If the alternator does not output required power and the millivoltmeter reading is less than **400 mV**, there is a malfunctioning component in the alternator. Carry out the alternator component tests, as described in this section.

8. Stop the engine.




ANIL15TR0631AB 3

## Charging the battery

Before charging a battery:

1. Clean the battery casing and element covers carefully with ammonia diluted in warm water and clean the terminals.
2. Check the electrolyte level and, if it is below the plate level, top up with distilled water to cover the plates.

## Normal charging (top up)

1. Charge the battery completely with a slow battery charger at **3 – 6 A** for the required time. This can last **36 h**, or more, if the battery is very flat. A severely sulphated battery may not charge. When the battery is completely charged, the elements will produce gas freely and the relative density will remain constant. Disconnect the battery charger after three consecutive densimeter readings, recorded every hour, showing that relative density has stabilized.
2. When using a fast or high ampere charge, follow the manufacturers instructions carefully. High charging amperage increases electrolyte temperature and, if the battery charger is not equipped with an automatic time or temperature switch, it can cause the electrolyte temperature to rise above **50 °C** (**122.0 °F**). This can cause violent boiling in the battery and damage internal components.
3. Check electrolyte level in each element again and, if necessary, top up with distilled water.

⚠ WARNING: Explosive gas is formed when a battery is charged. Do not smoke or use naked flames when checking electrolyte level. Check that the battery charger is switched off, before connection and disconnection, to avoid sparks which could ignite the gas.

## Charging very flat batteries

To recharge a Pb-Ca maintenance-free battery we recommend using a constant voltage battery charger. For very flat batteries, charge for **48 h**, at **16 V**, with current limitation ( **50 A**. for **105 A·h** and **66 A** for **120 A·h**).

This method is self-regulating. High current is provided at the beginning (when the battery voltage is very low). Current decreases progressively when the battery is fully charged (and its voltage is high).

If only constant voltage battery chargers are available, we recommend using voltage levels and times shown in below table. These figures refer to very flat batteries. If the battery is only **50%** discharged, use half the time shown (slow charging programme). For other conditions, reduce charging time proportionally. When feasible, use the slowest charging programme for increased battery life.

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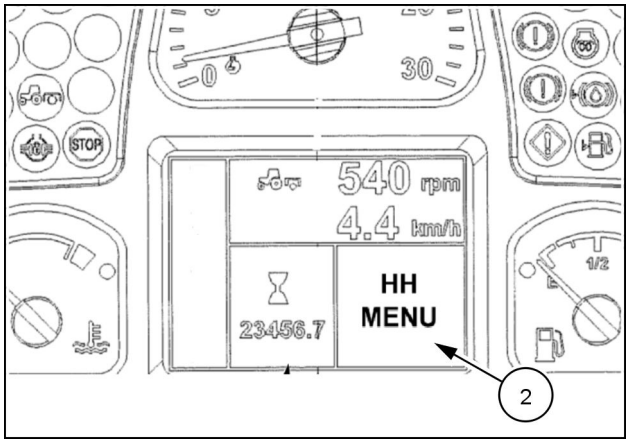
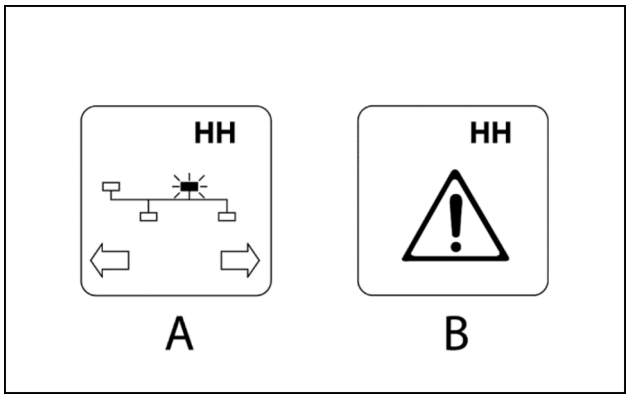
The following will be displayed on Dot Matrix Display Section **(2)** .




ANIL18TRO0159AA 3

The menu of the selected control unit **(A)** appears on the information monitor. If the control unit responds to the menu access Analog Digital Instrument Cluster message negatively **(B)** , the attention sign will appear, in this case you need to turn the switch OFF and repeat the HH menu access procedure after checking the supply and connection of the relevant control unit are correct..




ANIL18TRO0160AA 4

The first step now is to select the module that requires diagnostics/downloading., by pressing DOWN or UP push buttons, the Dot Matrix Display will show the identifier code of the current module listed above. Arrows on screen indicate there are other selections available at the same level. Once the selection has been done, the ENTER button has to be pressed to confirm

To select the HH menu number using UP switch we will scroll options selecting “H1”→ “H2”→“H3”→“H4”→“H5” →“H6”→ “H7”→“H8”→“H9”→“HA”→“HB”→“HC”→“HD” →“HE”→“HF”→“H1”.

Using DOWN switch we will scroll options selecting “HF”→“HE”→…→“H1”.

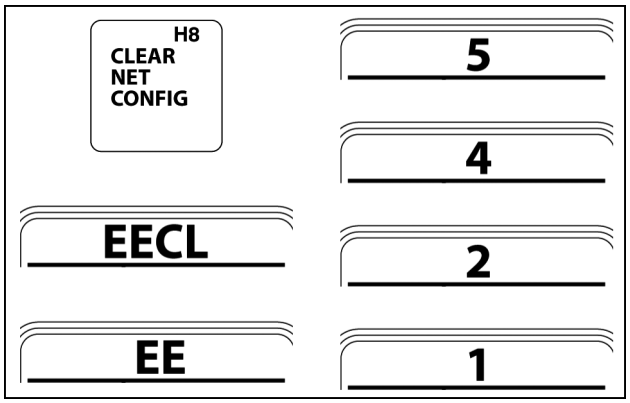
Not all HH menus could be available on a controller. If a controller does not implement a particular HH menu then it will not be shown when scrolling.

## CLEAR NET CONFIG

This is the menu to clear the configuration tables.
After selection the display will show " EECL" and for clear the configurations proceed as follows:
(refer to **3**)

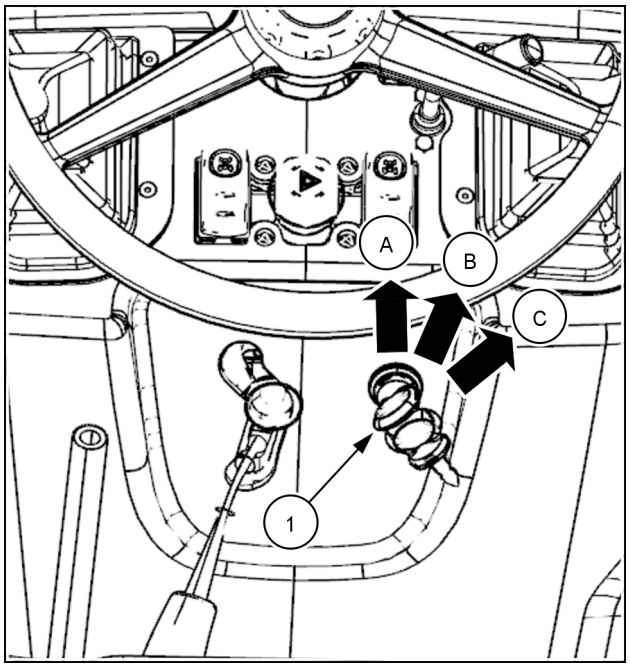
1. Press and hold down the button **(2)**.(image **1**)
2. The display will run a countdown from 5 to 1 and will then show " EE ".
   Release the button.

***NOTE:*** *If the button is released during the countdown, deletion will not take place.*




WLAPL4S55C1020A 3

The only permissible operation is to turn the key **(A)**, OFF position.
Once you have turned the key to ( **(B)**, ON position, the control panel is able to re-run a machine auto-configuration and identify the control units to which it is connected on the CAN line, or force a new configuration.




ANIL18TRO0711AA 4

# 3008 (DTC 131-04) - Engine coolant temperature sensor voltage is lower than expected

**Context:**
The Engine Control Unit (ECU) **A-9000** monitors the engine coolant temperature sensor **B-9003** signal circuit. If the ECU **A-9000** determines that voltage is lower than expected in the engine coolant temperature sensor **B-9003** signal circuit, this fault will occur. If this fault is active, the ECU **A-9000** will set the engine coolant temperature value to a fixed replacement value of **89.96 °C** (**193.93 °F**).

**Cause:**
The engine coolant temperature sensor **B-9003** signal voltage is less than **198.00 mV**.

**Possible failure modes:**

1. Faulty engine coolant temperature sensor **B-9003** wiring, short to ground condition.
2. Faulty engine coolant temperature sensor **B-9003**, 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 coolant temperature sensor **B-9003** for an internal failure.

   Disconnect the engine interface harness from the coolant temperature sensor **B-9003** at connector **X-9006**.

   Use a multimeter to measure the resistance of the coolant temperature sensor **B-9003** on the sensor pins :

| From | To | Value |
|---|---|---|
| **X-9006 (Receptacle) pin 1** | **X-9006 (Receptacle) pin 2** | At approximately **20.0 °C** (**68.0 °F**) there should be between **2,000 – 3,000 Ω** . |
| **X-9006 (Receptacle) pin 1** | Sensor body housing | There should be no continuity. |
| ***NOTE:*** *The coolant temperature sensor **B-9003** is a Negative Temperature Coefficient (NTC) thermistor. The thermistor's conductivity increases with increasing temperature and resistance decreases with increasing temperature.* | | |

   A. If the resistance value is relative, based on temperature, leave connector **X-9006** disconnected and continue to Step **3**.

   B. If the resistance value is not relative, based on temperature, the coolant temperature sensor **B-9003** has failed. Replace the coolant temperature sensor B-9003.

3. Check the coolant temperature sensor **B-9003** engine interface harness wiring for a short to ground condition.

   Disconnect the engine interface harness from the coolant temperature sensor **B-9003** at connector **X-9006**.

   Disconnect the engine harness 2 (EN2) from the engine interface at connector X-9138.

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

| To | From | Value |
|---|---|---|
| **X-9006 (Receptacle) pin 1** | **X-9006 (Receptacle) pin 2** | There should be no continuity. |
| **X-9006 (Receptacle) pin 1** | Chassis ground | There should be no continuity. |

# 3016 (DTC 135-04) - Fuel temperature sensor voltage is lower than expected

## Control Module: ECU

**Context:**
The Engine Control Unit (ECU) **A-9000** monitors the fuel temperature sensor **B-9002** signal circuit voltage. If the ECU **A-9000** detects a voltage less than **198.00 mV** in the signal circuit, this fault will occur. If this fault is not inhibited by another fault, the ECU **A-9000** will freeze the fuel temperature value to **39.96 °C** (**103.93 °F**).

**Cause:**
The fuel temperature sensor **B-9002** signal circuit voltage is less than **198.00 mV**.

**Possible failure modes:**

1. Faulty fuel temperature sensor **B-9002** wiring, short to ground condition.
2. Faulty fuel temperature sensor **B-9002**, 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 **5**.

2. Check the fuel temperature sensor **B-9002** for an internal failure.

   Disconnect the engine interface harness from the fuel temperature sensor **B-9002** at connector **X-9005**.

   Use a multimeter to measure the resistance of the fuel temperature sensor **B-9002** on the sensor pins :

| From | To | Value |
|---|---|---|
| **X-9005 (Receptacle) pin 1** | **X-9005 (Receptacle) pin 2** | At approximately **20.0 °C** (**68.0 °F**), there should be between **2351 – 2648 Ω**. |
| ***NOTE:*** *The fuel temperature sensor B-9002 is a Negative Temperature Coefficient (NTC) thermistor. The thermistor's conductivity increases with increasing temperature and resistance decreases with increasing temperature.* | | |

   A. If there is a nominal resistance value, e.g. greater than **100 Ω**, leave connector **X-9005** disconnected and continue to Step **3**.

   B. If there is not a nominal resistance value, e.g. **0 Ω**, the fuel temperature sensor **B-9002** has failed. Replace the fuel temperature sensor **B-9002**.

3. Check the fuel temperature sensor **B-9002** engine interface harness wiring for a short to ground condition.

   Disconnect the engine harness 2 (EN2) from the engine interface at connector **X-9138B**.

   With the key in the OFF position, use the a multimeter to perform the following continuity checks for a short to ground condition on the engine interface harness side :

| From | To | Value |
|---|---|---|
| **X-9005 (Receptacle) pin 1** | **X-9005 (Receptacle) pin 2** | There should be no continuity. |
| **X-9005 (Receptacle) pin 1** | Chassis ground | There should be no continuity. |
| **X-9138B (Plug) pin 16** | All pins in connector **X-9138B** | There should be no continuity. |

| From | To | Value |
|---|---|---|
| **X-9138A (Receptacle) pin 18** | Chassis ground | There should be no continuity. |
| **X-9138A (Receptacle) pin 18** | All pins in connector **X-9138A (Receptacle)** | There should be no continuity. |
| **X-9121 (Receptacle) pin 40** | All pins in connector **X-9121 (Receptacle)** | There should be no continuity. |

A. If there is continuity, there is a short circuit in the intake manifold pressure sensor **B-9001** wiring in the engine harness 2 (EN2).Use the appropriate electrical schematics, if necessary, to locate and repair the shorted conductor.

B. If there is no continuity, leave connector **X-9003** disconnected and continue to Step **4**.

4. Replace the intake manifold pressure sensor **B-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 software and re-flash, if necessary.

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

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

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

**Wiring harnesses - Electrical schematic sheet 01 ENGINE_1_S8000 (55.100.DP-C.20.E.01)**

B. If there is voltage, there is a short to battery or switched battery in the fuel injector number 2 **Y-9002** wiring in the engine interface harness. Use the appropriate electrical schematics, if necessary, to locate and repair the shorted conductor.

4. Check the fuel injector number 2 **Y-9002** engine interface harness wiring for a short to ground condition.

   Disconnect the engine harness 2 (EN2) from the engine interface at connector **X-9139B**.

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

| From | To | Value |
|---|---|---|
| **X-9033 (Receptacle) pin 1** | **X-9033 (Receptacle) pin 2** | There should be no continuity. |
| **X-9033 (Receptacle) pin 1** | Chassis ground | There should be no continuity. |
| **X-9033 (Receptacle) pin 2** | Chassis ground | There should be no continuity. |
| **X-9139B (Plug) pin E** | All pins in connector **X-9139B** | There should be no continuity. |
| **X-9139B (Plug) pin F** | All pins in connector **X-9139B** | There should be no continuity. |

   A. If there is no continuity, leave connectors **X-9033 (Receptacle)** and **X-9139B** disconnected and continue to Step **5**.

   B. If there is continuity, there is a short circuit in the fuel injector number 2 **Y-9002** wiring in the engine interface harness. Locate and repair the shorted conductor.

5. Check the fuel injector number 2 **Y-9002** engine harness 2 (EN2) wiring for a short circuit condition.

   Disconnect the engine harness 2 (EN2) from the ECU **A-9000** at connector **X-9121**.

   With the key in the OFF position, use a multimeter to perform the following continuity checks on engine harness 2 (EN2) side :

| From | To | Value |
|---|---|---|
| **X-9139A (Receptacle) pin E** | **X-9139A (Receptacle) pin F** | There should be no continuity |
| **X-9139A (Receptacle) pin E** | Chassis ground | There should be no continuity |
| **X-9139A (Receptacle) pin F** | Chassis ground | There should be no continuity |
| **X-9139A (Receptacle) pin E** | All pins in connector **X-9139A (Receptacle)** | There should be no continuity |
| **X-9139A (Receptacle) pin F** | All pins in connector **X-9139A (Receptacle)** | There should be no continuity |

   A. If there is continuity, there is a short circuit in the fuel injector number 2 **Y-9002** wiring in the engine harness 2 (EN2). Use the appropriate electrical schematics, if necessary, to locate and repair the shorted conductor.

   B. If there is no continuity, continue with Step **6**.

6. Check the ECU **A-9000** voltage supply wiring.

   Disconnect the engine harness 2 (EN2) from the ECU **A-9000** at connector **X-9122**.

   Place a jumper wire between **X-9122 (Receptacle) pin 28** and chassis ground. This will energize the main relay.

   With the key in the ON position, use a multimeter to perform the following voltage checks from the engine harness 2 (EN2) side :

| From | To | Value |
|---|---|---|
| **X-9122 (Receptacle) pin 3** | chassis ground | There should be approximately **12.0 V** |
| **X-9122 (Receptacle) pin 5** | chassis ground | There should be approximately **12.0 V** |
| **X-9122 (Receptacle) pin 1** | chassis ground | There should be approximately **12.0 V** |

   A. If there is approximately **12.0 V**, leave connector **X-9122 (Receptacle)** disconnected and continue to Step **7**.

# 3091 (DTC 143-04) - Camshaft speed sensor pattern is not plausible

## Control Module: ECU

**Context:**
The Engine Control Unit (ECU) **A-9000** monitors the camshaft position sensor **B-9017** characteristics for angle, speed determination, signal plausibility, and quality. If the ECU **A-9000** determines that the camshaft signal does not match the expected pattern (edge, distance, level) or not all expected camshaft edges are detected during an engine revolution, this fault will occur.

**Cause:**
The ECU **A-9000** has detected a camshaft pattern signal error.

**Possible failure modes:**

1. Faulty camshaft position sensor **B-9017** wiring.
2. Faulty camshaft position sensor **B-9017**, improperly seated or mounted.
3. Faulty camshaft position sensor **B-9017**, 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 physical integrity of the camshaft speed sensor **B-9017**. The sensor should be fully seated and mounted tightly.

   A. If the sensor is not mounted/secured properly, repair as necessary.

   B. If the sensor is not damaged and is mounted/secured properly, continue to Step **3**.
3. Check the camshaft position sensor **B-9017** wiring in the engine interface harness.

   Disconnect the engine interface harness from the camshaft position sensor at connector **X-9008**.

   Disconnect the engine harness 2 (EN2) from the engine interface at connector **X-9138B**.

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

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 4** | **X-9008 (Receptacle) pin 2** | There should be continuity. |
| **X-9008 (Receptacle) pin 2** | Chassis ground | There should be no continuity. |
| **X-9008 (Receptacle) pin 2** | All pins in connector **X-9138B** | There should be no continuity. |

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

| From | To | Value |
|---|---|---|
| **X-9008 (Receptacle) pin 2** | Chassis ground | There should be no voltage |

   A. If the specified values are measured, leave connectors **X-9008** and **X-9138B** disconnected and continue to Step **4**.

# 3107 (DTC 259-03) - Fuel metering unit is shorted to battery voltage at the low side

## Control Module: ECU

**Context:**
The Engine Control Unit (ECU) **A-9000** monitors the fuel metering unit **Y-9000** signal circuit. If the ECU **A-9000** detects a short to a voltage source in the fuel metering unit **Y-9000** low side driver circuit, this fault will occur.

**Cause:**
There is a short to a voltage source in the fuel metering unit **Y-9000** low side driver circuit.

**Possible failure modes:**

1. Faulty fuel metering unit **Y-9000** wiring, short to a voltage source.
2. Faulty fuel metering unit **Y-9000**, 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. Test the fuel metering unit **Y-9000** internal resistance.

   Disconnect the engine interface harness from the fuel metering unit **Y-9000** at connector **X-9007**.

   Use a multimeter to measure the resistance on the fuel metering unit **Y-9000** pins :

| From | To | Value |
|---|---|---|
| **X-9007 (Receptacle) pin 1** | **X-9007 (Receptacle) pin 2** | There should be between **2.6 – 3.2 Ω** at approximately **20.0 °C** (**68.0 °F**). |

   A. If there is between **2.6 – 3.2 Ω**, leave connector **X-9007** disconnected and continue to Step **3**.

   B. If there is not between **2.6 – 3.2 Ω**, the fuel metering unit Y-9000 has failed. Replace the fuel metering unit **Y-9000**.

3. Check the fuel metering unit **Y-9000** low side driver wiring for a short to battery condition.

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

| From | To | Value |
|---|---|---|
| **X-9007 (Receptacle) 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 interface harness side :

| From | To | Value |
|---|---|---|
| **X-9007 (Receptacle) pin 2** | Chassis ground | There should be no voltage. |

   A. If there is voltage, there is a short circuit to battery or switched battery in the fuel metering unit **Y-9000** low side driver circuit wiring. Use the appropriate service manual, if necessary, to locate and repair the shorted conductor.

# 3146 (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 engine harness 1 (EN1) from the ECU **A-9000** at connector **X-9122**.

   With the key switch in the OFF position, use a multimeter to perform the following tests, on the engine harness 2 (EN2) from :

| From | To | Value |
|---|---|---|
| **X-9125 (Receptacle) pin 1** | **X-9122 (Receptacle) pin 30** | There should be continuity. |
| **X-9125 (Receptacle) pin 2** | Chassis ground | There should be continuity. |

# 3177 (DTC 54C-03) - Engine over speed condition detected

## Control Module: ECU

**Context:**
This fault is intended for information purposes only and does not require any further action. Other active faults may have caused this fault to occur. The Engine Control Unit (ECU) **A-9000** monitors for an engine overspeed condition. An engine overspeed condition can occur from such conditions as downhill travel. If an engine speed of at least **2800 RPM** has been detected for at least **0.05 s**, this fault will occur.

**Cause:**
The ECU has detected an engine speed of at least **2800 RPM** for at least **0.05 s**.

| From | To | Value |
|---|---|---|
| **X-9139A (Receptacle) pin A** | **X-9139A (Receptacle) pin E** | There should be no continuity. |
| **X-9139A (Receptacle) pin A** | **X-9139A (Receptacle) pin F** | There should be no continuity. |
| **X-9139A (Receptacle) pin B** | **X-9139A (Receptacle) pin E** | There should be no continuity. |
| **X-9139A (Receptacle) pin B** | **X-9139A (Receptacle) pin F** | There should be no continuity. |

A. If there is continuity, there is a short circuit condition in the fuel injector number 1 **Y-9001** engine harness 2 (EN2) wiring. Use the appropriate electrical schematics, if necessary, to 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.

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

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

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

**Wiring harnesses - Electrical schematic sheet 01 ENGINE_1_S8000 (55.100.DP-C.20.E.01)**

# 3241 (DTC 1D2-12) - ECU internal failure - EEPROM write/read error

## Control Module: ECU

**Context:**
The Engine Control Unit (ECU) **A-9000** has detected an error during the last EEPROM write operation. The hardware encapsulation of the ECU **A-9000** checks each data block of the EEPROM and sets a status flag depending on if an error is found or not found. These flags are processed every 20 milliseconds by the Diagnostic System Management (DSM) and if the value is out of range, this fault will occur.

**Cause:**
The ECU can not read the EEPROM calibrated parameters for the baud rate.

**Possible failure modes:**

1. Faulty ECU programming.
2. Faulty EEPROM.

**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, submit a Technical Help Desk (THD) request.

# 3283 (DTC 1E7-03) - ECU 5 volt sensor supply 2 out of range

## Control Module: ECU

**Context:**
The Engine Control Unit (ECU) **A-9000** provides three independent five volt sensor supplies. The ECU **A-9000** monitors each sensor supply voltage to ensure they operate within a given range. If the ECU **A-9000** determines that the voltage for sensor supply 2 is out of range, this fault will occur.

**Cause:**
The ECU **A-9000** has determined that the sensor supply 2 voltage is out of range.

**Possible failure modes:**

1. Faulty battery voltage.
2. Faulty ECU **A-9000** supply voltage.
3. Faulty ECU **A-9000** sensor supply 2 pins.
4. Faulty ECU **A-9000** connector **X-9121**, corrosion or damage.
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 **5**.
2. Check the battery voltage.

   Charge the battery, then, perform a load test on the battery.

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

   B. If the battery fails the load test, the battery has failed. Replace the battery.
3. Check the ECU **A-9000** supply voltage.

   Disconnect the ECU **A-9000** connector **X-9122**.

   Place a jumper wire between **X-9122 (Receptacle) pin 28** and chassis ground. This will energize the main relay.

   With the key in the ON position, use a multimeter to perform the following voltage check on the engine harness 2 (EN2) side :

| From | To | Value |
|---|---|---|
| **X-9122 (Receptacle) pin 3** | **X-9122 (Receptacle) pin 2** | There should be approximately **12 V**. |
| **X-9122 (Receptacle) pin 5** | **X-9122 (Receptacle) pin 4** | There should be approximately **12 V**. |
| **X-9122 (Receptacle) pin 1** | **X-9122 (Receptacle) pin 6** | There should be approximately **12 V**. |

   A. If there is approximately **12 V**, leave connector **X-9122 (Receptacle)** disconnected and continue to Step **4**.

   B. If there is not approximately **12 V**, there is a failure in the ECU **A-9000** supply wiring. Use the appropriate electrical schematics, if necessary, to locate and repair the failed conductor.
4. 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.

# 3334 (DTC 1C6-03) - CAN communication failure between vehicle controller and ECU controller - TSC1_PE message

## 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 timeout of vehicle data provided on CAN Node A.

**Possible failure modes:**

1. Faulty vehicle system, related CAN fault.
2. Faulty supply voltage or ground, missing.
3. Faulty CAN circuit wiring, open circuit, short to ground, or short circuit.
4. 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 **6**.
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 the vehicle CAN faults, 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 engine harness 1 (EN1) from the ECU **A-9000** at connector **X-9122**.

   Place a jumper wire between **X-9122 (Receptacle) pin 28** and chassis ground. This will energize the main relay.

   With the key in the ON position, use a multimeter to perform the following voltage check on the engine harness 1 (EN1) side :

| From | To | Value |
|---|---|---|
| **X-9122 (Receptacle) pin 1** | Chassis ground | There should be approximately **12 V**. |
| **X-9122 (Receptacle) pin 3** | Chassis ground | There should be approximately **12 V**. |
| **X-9122 (Receptacle) pin 5** | Chassis ground | There should be approximately **12 V**. |

   A. If the voltage is present on all of the checks, leave connector **X-9122** disconnected and continue with Step **4**.

   B. If the voltage is not present for one or more of the checks, refer to the appropriate electrical schematics to locate and restore supply power to the ECU **A-9000**.

# 3368 (DTC 19D-04) - Torque limitation caused by performance limiter

## Control Module: ECU

**Context:**
This fault is for informational purposes only and may have been caused by another fault. The Engine Control Unit (ECU) **A-9000** has detected higher level of NOx emissions than expected. If this fault occurs, a toque limitation of equal to or greater than **25%** will occur. Other active faults may have caused this fault to occur.

**Cause:**
The ECU has detected a power reduction or engine speed reduction of equal to or greater than **25%**.

# 3409 (DTC 238-04) - Low oil pressure

## Control Module: ECU

**Context:**
The Engine Control Unit (ECU) **A-9000** monitors the oil pressure switch **S-9016** for proper operation. The oil pressure switch **S-9016** changes from its off to on state between **0.6 – 0.9 bar** (**8.7 – 13.0 psi**). If the oil pressure switch **S-9016** does actuate once the engine has been running for **6.0 s** at greater than **500.0 RPM**, this fault will occur.

**Cause:**
The ECU **A-9000** has determined that the oil pressure switch **S-9016** did not actuate.

**Possible failure modes:**

1. Faulty oil level, too low.
2. Faulty oil pressure switch **S-9016**, failed internally.
3. Faulty oil pressure switch **S-9016** circuit wiring, shorted to chassis ground.
4. Faulty oil pressure, too low or blockage.
5. Faulty ECU **A-9000**, hardware or 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 **8**.

2. Check oil level.

   Use the appropriate operator or service manual, if necessary, to determine if the lubrication system has the appropriate amount of oil.

   There should be at least the minimum acceptable level of oil.

   A. If there is at least the minimum acceptable level of oil, continue with Step **3**.

   B. If there less than the minimum acceptable level of oil, use the appropriate operator or service manual, if necessary, to determine the type and quantity of oil required to re-fill the oil system.

3. Check the condition of the oil pressure switch **S-9016**.

   Disconnect the engine interface harness from the oil pressure switch **S-9016** at connector **X-9016**.

   With the engine not running, use a multimeter to check for continuity on the component side :

| From | To | Result |
|---|---|---|
| **X-9016 (Plug) pin 1** | chassis ground | There should be continuity. |

   Start the engine and allow it to run at greater than **500 RPM** for at least **6.0 s**.
   While the engine is running at greater than **500 RPM**, use a multimeter to check for continuity on the component side :

| From | To | Result |
|---|---|---|
| **X-9016 (Plug) pin 1** | chassis ground | There should be no continuity. |

   A. If the specified values are measured, leave connector **X-9016 (Plug)** disconnected and continue with Step **4**.

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

| From | To | Value |
|---|---|---|
| **X-9038 (Receptacle) pin 2** | Chassis ground | There should be no voltage. |

A. If there is voltage, there is a short to battery in the wastegate pressure modulator valve wiring. Use the appropriate electrical schematics, if necessary to locate and repair the shorted conductor.

B. If there is no voltage, continue to Step **5**.

5. Check the wastegate pressure modulator valve **Y-9008** wiring for a short to a voltage source.

   Disconnect the engine harness 2 (EN2) from the engine interface at connector **X-9138B**.

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

| From | To | Value |
|---|---|---|
| **X-9038 (Receptacle) pin 2** | Chassis ground | There should be no voltage. |

A. If there is voltage, there is a short to a voltage source in the wastegate pressure modulator valve wiring in the engine interface harness. Locate and repair the shorted conductor.

B. If there is no voltage, continue to Step **6**.

6. Check the wastegate pressure modulator valve **Y-9008** wiring for a short to a voltage source.

   Disconnect the engine harness 2 (EN2) from the ECU **A-9000** at connector **X-9121**.

   With the key in the ON position, use a multimeter to perform the following voltage check on the engine harness 2 (EN2) side :

| From | To | Value |
|---|---|---|
| **X-9138A (Receptacle) pin 27** | Chassis ground | There should be no voltage. |

A. If there is voltage, there is a short to a voltage source in the wastegate pressure modulator valve wiring in the engine harness 2 (EN2). Locate and repair the shorted conductor.

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

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

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

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

**Wiring harnesses - Electrical schematic sheet 01 ENGINE_1_S8000 (55.100.DP-C.20.E.01)**

# 3616 (DTC 39E-04) - Torque limitation caused by turbo charger protection

## Control Module: ECU

**Context:**
This fault is for information purposes only and may have been caused by another fault. The Engine Control Unit (ECU) **A-9000** has detected an active power reduction due to turbocharger protection. This fault may have been caused by a detection of high altitude or extreme working conditions for a period greater than **120.00 s**. If this fault occurs, a power reduction or engine speed reduction of equal to or greater than **25%** of the desired torque will be active in order to protect the turbocharger from a potential overspeed condition. If the power reduction occurred due to actual defect, the failure triggering the torque limitation should also be in the failure memory.

**Cause:**
The ECU has detected a power reduction or engine speed reduction of equal to or greater than **25%**.

# 3665 (DTC 589-03) - EGR valve will not open to commanded position

## Control Module: ECU

***NOTE:*** *Because the Engine Control Unit (ECU)* ***A-9000*** *stores historical data relevant to the operation of the EGR valve* ***Z-9000****, it is necessary to perform the Replacement of the Exhaust GAs Recirculation Valve (EGR) – Reset ECU Data with the Electronic Service Tool (EST), if the EGR valve* ***Z-9000*** *is replaced. See* ***Exhaust Gas Recirculation (EGR) valve - Configure - Reset ECU data (EGR valve) (10.501)****, if necessary.*

**Context:**
The Engine Control Unit (ECU) **A-9000** controls the position of the EGR valve **Z-9000** with an H-bridge Pulse Width Modulated (PWM) circuit. The ECU **A-9000** also monitors the position of the EGR valve **Z-9000** by monitoring the potentiometer feedback voltage. If the ECU **A-9000** determines that the feedback position signal is **12%** greater than it should be for the commanded position for a period of time longer than that established by the ECU **A-9000**, this fault will occur. For information regarding the functional operation of the Exhaust Gas Recirculation (EGR) valve **Z-9000** see **Exhaust Gas Recirculation (EGR) valve - Overview (10.501)**.

**Cause:**
The ECU **A-9000** has determined that the positive deviation between the required and measured position of the EGR valve **Z-9000** has been exceeded.

**Possible failure modes:**

1. Faulty EGR valve **Z-9000**, valve sticks, clean or replace, as required.
2. Faulty EGR valve **Z-9000** position sensor, internal failure.

# 3671 (DTC 68B-01) - EGR valve H-bridge control circuit shorted to ground

## Control Module: ECU

***NOTE:*** *If the Exhaust Gas Recirculation (EGR) valve* ***Z-9000*** *is replaced, it is necessary to perform the Replacement of the Exhaust Gas Recirculation Valve (EGR) – Reset ECU Data with the Electronic Service Tool (EST) before you return the machine to service. See* ***Exhaust Gas Recirculation (EGR) valve - Configure - Reset ECU data (EGR valve) (10.501)****, if necessary.*

**Context:**
The Engine Control Unit (ECU) **A-9000** internally monitors the operation of the H-bridge Pulse Width Modulated (PWM) control circuit for the Exhaust Gas Recirculation (EGR) valve **Z-9000** actuator for electrical defects. If the ECU **A-9000** detects a short circuit of the circuit wiring to chassis ground, this fault will occur. For information regarding the functional operation of the EGR valve **Z-9000**, see **Exhaust Gas Recirculation (EGR) valve - Overview (10.501)**. For more information regarding the technical specifications of the EGR valve **Z-9000**, see **Exhaust Gas Recirculation (EGR) valve actuator - Technical Data (55.989)**.

**Cause:**
The ECU **A-9000** is sensing a short to chassis ground condition in the EGR valve **Z-9000** motor actuator control circuit.

**Possible failure modes:**

1. Faulty EGR valve **Z-9000** motor, failed internally.
2. Faulty EGR valve **Z-9000** circuit wiring, short to ground.
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 **6**.

2. Check the EGR valve **Z-9000** motor actuator for a short to ground condition.

   Disconnect the engine interface harness from the EGR valve **Z-9000** at connector **X-9010**.

   Use a multimeter to check on the component for a grounded condition :

| From | To | Result |
|---|---|---|
| **X-9010 (Receptacle) pin 1** | chassis ground | There should be no continuity. |

   A. If there is no continuity, leave connector **X-9010** disconnected and continue with Step **3**.

   B. If there is continuity, the EGR valve **Z-9000** motor has failed internally, replace the EGR valve **Z-9000**. Then use the EST, see **Exhaust Gas Recirculation (EGR) valve - Configure - Reset ECU data (EGR valve) (10.501)** if necessary, to perform the Replacement of the Exhaust Gas Recirculation Valve (EGR) – Reset ECU Data.

3. Check the EGR valve **Z-9000** motor actuator control circuit for a short to ground condition.

   With the key switch in the OFF position, use a multimeter to check for continuity on the engine interface harness side :

| From | To | Result |
|---|---|---|
| **X-9010 (Receptacle) pin 1** | chassis ground | There should be no continuity. |

   A. If there is continuity, continue with Step **4**.

# 3677 (DTC 789-01) - EGR valve position sensor voltage is lower than expected

## Control Module: ECU

***NOTE:*** *If the Exhaust Gas Recirculation (EGR) valve* ***Z-9000*** *is replaced, it is necessary to perform the Replacement of the Exhaust Gas Recirculation Valve (EGR) – Reset ECU Data with the Electronic Service Tool (EST) before you return the machine to service. See* ***Exhaust Gas Recirculation (EGR) valve - Configure - Reset ECU data (EGR valve) (10.501)****, if necessary.*

**Context:**
The Engine Control Unit (ECU) **A-9000** monitors the electrical signal provided by the Exhaust Gas Recirculation (EGR) valve **Z-9000** position feedback potentiometer. If the signal level becomes less than **0.225 V** the ECU **A-9000** provides a replacement value and this fault will occur. For information regarding the functional operation of the EGR valve **Z-9000**, see **Exhaust Gas Recirculation (EGR) valve - Overview (10.501)**. For more information regarding the technical specifications of the EGR valve **Z-9000**, see **Exhaust Gas Recirculation (EGR) valve actuator - Technical Data (55.989)**.

**Cause:**
The ECU **A-9000** is sensing the EGR valve Z-9000 position signal is less than **0.225 V**.

**Possible failure modes:**

1. Faulty EGR valve **Z-9000**, failed internally.
2. Faulty EGR valve **Z-9000** position sensor circuit wiring, shorted to ground.
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 **6**.
2. Check the EGR valve **Z-9000** potentiometer for a short to ground condition.

   Disconnect the engine interface harness from the EGR valve **Z-9000** at connector **X-9010**.

   Use a multimeter to check for continuity on the EGR valve **Z-9000** potentiometer side :

| From | To | Result |
|---|---|---|
| **X-9010 (Receptacle) pin 2** | chassis ground | There should be no continuity. |
| **X-9010 (Receptacle) pin 2** | **X-9010 (Receptacle) pin 4** | There should be no continuity. |

   A. If there is continuity, the EGR valve **Z-9000** has failed internally, replace the EGR valve **Z-9000**. Then use the EST, see **Exhaust Gas Recirculation (EGR) valve - Configure - Reset ECU data (EGR valve) (10.501)** if necessary, to perform the Replacement of the Exhaust Gas Recirculation Valve (EGR) – Reset ECU Data.

   B. If there is no continuity, leave connector **X-9010** disconnected and continue with Step **3**.
3. Check the EGR valve **Z-9000** potentiometer signal circuit for a short to ground condition.

   With the key switch in the OFF position, use a multimeter to check for continuity on the engine interface harness side :

| From | To | Result |
|---|---|---|
| **X-9010 (Receptacle) pin 2** | chassis ground | There should be no continuity. |

A. If there is no continuity on all of the checks, leave connector **X-9138B** disconnected and continue with Step **4**.

B. If there is continuity on one or more of the checks, there is a short to ground circuit condition in the engine interface harness between the engine interface connector **X-9138B** and the respective glow plug. Locate and repair the damaged conductor.

4. Check the glow plug control circuits in the engine harness 2 (EN2) for a short to ground circuit condition.

   Carefully disconnect the engine harness 2 (EN2) from the glow plug control module **Z-9101** at connector **X-9113**.

   With the key switch in the OFF position, use a multimeter to check for continuity on the engine harness 2 (EN2) side :

| From | To | Result |
|---|---|---|
| **X-9113 (Receptacle) pin 2** | chassis ground | There should be continuity. |
| **X-9113 (Receptacle) pin 7** | chassis ground | There should be continuity. |
| **X-9113 (Receptacle) pin 1** | chassis ground | There should be continuity. |

   A. If there is continuity on one or more of the checks, there is a short circuit to ground condition in the engine harness 2 (EN2) between connector **X-9113 (Receptacle) pin 2** and connector **X-9138A (Receptacle) pin 61** and/or connector **X-9113 (Receptacle) pin 7** and connector **X-9138A (Receptacle) pin 60** and/or connector **X-9113 (Receptacle) pin 1** and **X-9138A (Receptacle) pin 58**, wire EN2-010, EN2-012, and/or EN2-009. Use the appropriate electrical schematics, if necessary, to locate and repair the grounded conductor.

   B. If there is no continuity on all of the checks, continue with Step **5**.

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

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

   B. If the fault has not been resolved, check the ECU **A-9000** for the appropriate software 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.

**Wiring harnesses - Electrical schematic sheet 01 ENGINE_1_S8000 (55.100.DP-C.20.E.01)**

A. If there is voltage, there is a short circuit to battery or switched battery in the fuel metering unit **Y-9000** low side driver circuit wiring. Use the appropriate electrical schematics, if necessary, to locate and repair the shorted conductor.

B. If there is no voltage, leave connector **X-9007** disconnected and continue to Step **4**.

4. Check the fuel metering unit **Y-9000** low side driver engine interface harness wiring for a short circuit condition.

   Disconnect the engine harness 2 (EN2) from the engine interface at connector **X-9138**.

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

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 2** | All pins in connector **X-9138B**. | There should be no continuity. |

   A. If there is no continuity, leave connector **X-9138B** disconnected and continue to Step **5**.

   B. If there is continuity, there is a short circuit condition in the fuel metering unit **Y-9000** low side driver engine interface harness wiring. Locate and repair the shorted conductor.

5. Check the fuel metering unit **Y-9000** low side driver engine harness 2 (EN2) wiring for a short circuit condition.

   Disconnect the engine harness 2 (EN2) from the ECU **A-9000** at connector **X-9121**.

   With the key in the OFF position, use a multimeter to perform the following continuity check from the engine harness 2 (EN2) side :

| From | To | Value |
|---|---|---|
| **X-9138A (Receptacle) pin 2** | All pins in connector **X-9138A (Receptacle)** | There should be no continuity. |
| **X-9121 (Receptacle) pin 60** | All pins in connector **X-9121 (Receptacle)** . | There should be no continuity. |

   A. If there is continuity, there is a short circuit condition in the fuel metering unit **Y-9000** low side driver engine harness 2 (EN2) wiring. Use the appropriate electrical schematics, if necessary, to 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.

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

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

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

**Wiring harnesses - Electrical schematic sheet 01 ENGINE_1_S8000 (55.100.DP-C.20.E.01)**

# 3747 (DTC 5D4-04) - ECU internal failure - Positive test failed

## Control Module: ECU

**Context:**
The Engine Control Unit (ECU) **A-9000** performs “shut-off paths” which deactivate all power stages relevant to fuel injection if certain ECU **A-9000** errors are detected. If the ECU **A-9000** determines that the test has failed, this fault will occur.

**Cause:**
The ECU has determined that the test has failed.

**Possible failure modes:**

1. Faulty ECU programming.
2. Faulty ECU.

**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, submit a Technical Help Desk (THD) request.

# 3761 (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.

**Cause:**
The calculated engine torque is greater than max acceptable engine torque.

**Possible failure modes:**

1. Faulty ECU programming.
2. Faulty ECU.

**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, submit a Technical Help Desk (THD) request.

# 3799 (DTC 237-04) - Fuel pressure relief valve is forced to open, perform pressure shock

## Control Module: ECU

**Context:**
This fault is intended for information purposes only. Other active faults may have caused this fault to occur. The Engine Control Unit (ECU) **A-9000**, if necessary, will set the engine into limp home mode. This process is achieved in two steps by the ECU **A-9000**, a pressure increase and a pressure shock. The ECU **A-9000** will execute step two by a fuel pressure shock. This is achieved by setting injection quantity to zero. If this fault is active, the ECU **A-9000** has performed step two for achieving limp home mode, a fuel pressure shock.

**Cause:**
The ECU **A-9000** has performed a fuel pressure shock to achieve limp home mode.

# 3811 (DTC 1E6-12) - ECU 5 volt sensor supply 1 out of range

## Control Module: ECU

**Context:**
The Engine Control Unit (ECU) **A-9000** provides three independent five volt sensor supplies. The ECU **A-9000** monitors each sensor supply voltage to ensure they operate within a given range. If the ECU **A-9000** determines that the voltage for sensor supply 1 is out of range, this fault will occur.

**Cause:**
The ECU **A-9000** has determined that the sensor supply 1 voltage is out of range.

**Possible failure modes:**

1. Faulty battery voltage.
2. Faulty ECU **A-9000** supply voltage.
3. Faulty ECU **A-9000** sensor supply 1 pins.
4. Faulty ECU **A-9000** connector **X-9121**, corrosion or damage.
5. Faulty Exhaust Gas Recirculation (EGR) valve **Z-9000**, position sensor wiring or internal failure.
6. Faulty intake manifold pressure and temperature sensor **B-9001**, wiring or internal failure.
7. Faulty rail pressure sensor **B-9004**, wiring or internal failure.
8. Faulty exhaust manifold pressure sensor **B-9005**, wiring to internal failure.
9. Faulty camshaft speed sensor **B-9017**, wiring or internal failure.
10. 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 **12**.
2. Check the battery voltage.

   Charge the battery, then, perform a load test on the battery.

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

   B. If the battery fails the load test, the battery has failed. Replace the battery.
3. Disconnect the ECU **A-9000** connector **X-9121 (Receptacle)** .

   Check the following pins listed below on the ECU **A-9000** and in connector **X-9121 (Receptacle)** .

| Pin | Physical condition |
|---|---|
| **X-9121 (Receptacle) pin 10** | The pin and connector should be free of corrosion or damage. |
| **X-9121 (Receptacle) pin 11** | The pin and connector should be free of corrosion or damage. |
| **X-9121 (Receptacle) pin 12** | The pin and connector should be free of corrosion or damage. |
| **X-9121 (Receptacle) pin 13** | The pin and connector should be free of corrosion or damage. |

# 3845 (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, submit a Technical Help Desk (THD) request.

**Wiring harnesses - Electrical schematic sheet 01 ENGINE_1_S8000 (55.100.DP-C.20.E.01)**

# 3916 (DTC 237-03) - Fuel pressure relief valve has reached maximum allowed open time

## 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 - Configure - Reset ECU data (10.218)****, if necessary.*

**Context:**
The Engine Control Unit (ECU) **A-9000** monitors the fuel Pressure Relief Valve (PRV). If the ECU **A-9000** determines that the PRV has been open for too long, this fault will occur. The PRV opening duration is monitored by the ECU **A-9000** and stored in the EEPROM during after run. This fault is for informational purposes only. If this fault is active, other fuel system faults may be active that 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 PRV has reached its maximum allowed open time.

**Possible failure modes:**

1. Faulty PRV, stuck open or worn.
2. Faulty fuel back-flow, clogged or damaged.
3. Faulty fuel metering unit **Y-9000**, internal failure.
4. Faulty rail pressure sensor **B-9004**, internal failure.
5. Faulty ECU **A-9000**, software.

# 14022 - Cranking line - shorted to GND

## Control Module: ADIC

***NOTE:*** *When the cause of the error code has been rectified, clear the error code and test the system for normal operation.*

**Cause:**
A short to ground has been detected at the instrument cluster unit ( ADIC ), connector **X-460**, pin 17, wire 1.0 (BL/YE) or a jump start has occurred.

**Possible failure modes:**

1. Engine has been jump started
2. Faulty connectors
3. Faulty wiring
4. Ignition relay faulty
5. Instrument cluster unit ( ADIC ) defective

**Solution:**

1. Check for other error codes being displayed.
   A. If any other error codes are being displayed , continue to these tests.
   B. If no other error code is displayed, continue to step **2**
2. Check the connector X-011 on the instrument cluster unit ( ADIC ) and the connector X1B-R4 on the starter relay K-029.
   A. Ensure the connectors were connected, not damaged, the pins are in the correct position and that the fit is tight. Repair or replace as required.
   B. If the connectors are okay, continue to step **3**
3. Check for a short circuit to ground.
   A. Place the shuttle lever to neutral and disconnect the connectors X-011 and X1B-R4.
   Check between connector X-011, pin 1, wire 0.5 (GN) and ground.
   If short to ground is indicated, Repair or replace the wiring harness as required.
   B. If the harness is okay, download the correct level software. If the fault re-occurs, remove and replace the instrument cluster unit ( ADIC ).

**Wiring harnesses - Electrical schematic sheet 15 ANALOG DIGITAL INSTRUMENT CLUSTER (ADIC) 1 (55.100.DP-C.20.E.15)**
**Wiring harnesses - Electrical schematic sheet 15 ANALOG DIGITAL INSTRUMENT CLUSTER (ADIC) 1 (55.100.DP-C.20.E.15)**

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