MASSEY FERGUSON

MF 4600

Series Tractors

Models: 4608 / 4609 / 4610

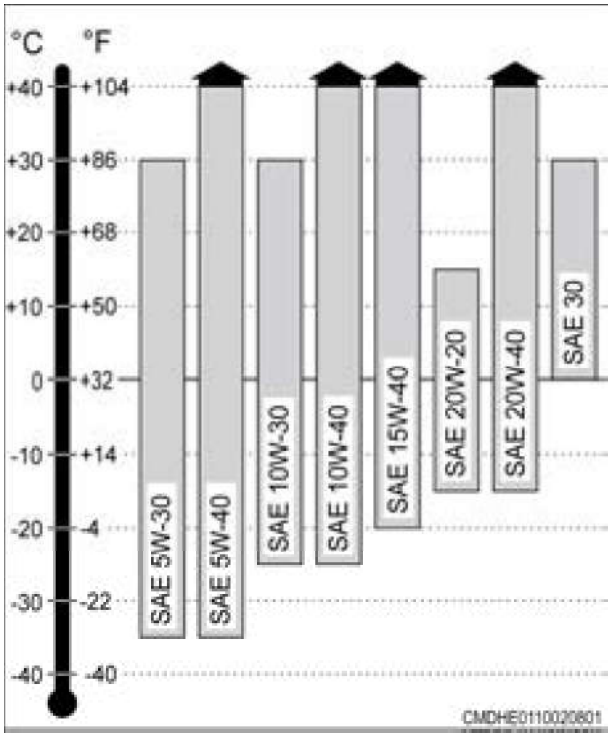
SERVICE MANUAL

FROM MASSEY FERGUSON

1.2.10 Operating slope angle

	4608	4609	4610
Up/down	20 degrees		
Side to side	20 degrees		

1.2.11 Lubrication specifications

	4608	4609	4610
Lubrication			
Lubrication fittings	Massey Ferguson M-1105 or equivalent lithium base grease No. 2		
Engine oil	Massey Ferguson Multiguard® or equivalent in the correct SAE viscosity. Oil must meet or exceed MIL-L-46152 requirements, API Service CJ-4, ACEA Service E7.		
Engine oil viscosity			
Transmission and differential housing (including hydraulic system)	AGCO Permatran® 821XL		
Front axle	AGCO Permatran® 821XL		
Engine coolant			
Freezing protection (original factory fill)	-34 °C		
Recommended coolant	50/50 mixture ethylene glycol and water		

After first 50 hours	
X	Inspect and adjust the tie rod end. If adjustment or service is necessary, see your dealer.
X	Inspect and correct the tire air pressure.
X	Inspect and adjust the wheel bolts and nuts.
X	Inspect the power steering hose, replace if necessary.
X	Inspect the fuel hose, replace if necessary.
X	Inspect the electrical wiring, replace if necessary.
X	Inspect the lamps, replace if necessary.
X	Inspect the warning device, replace if necessary.
X	Inspect the air conditioner belt, replace if necessary.
X	Clean the air conditioner condenser.

1.4.3 Lubrication fill and drain locations

- Grease fittings
- Fill location
- Drain location
- Oil level check location

Ref	Description	Type
1	Engine	Engine oil
2	Radiator overflow reservoir	Coolant
3	Fuel tank	Diesel fuel
4	Transmission housing	Hydraulic oil
5	Front axle, four-wheel drive only	Hydraulic oil
6	Axle pivots	Grease
7	Front spindles	Grease
8	Ball joint	Grease
9	Front brake pivots	Grease
10	Brake arm pivots	Grease
11	Parking brake pivots	Grease
12	Lift rod	Grease
13	Top link	Grease

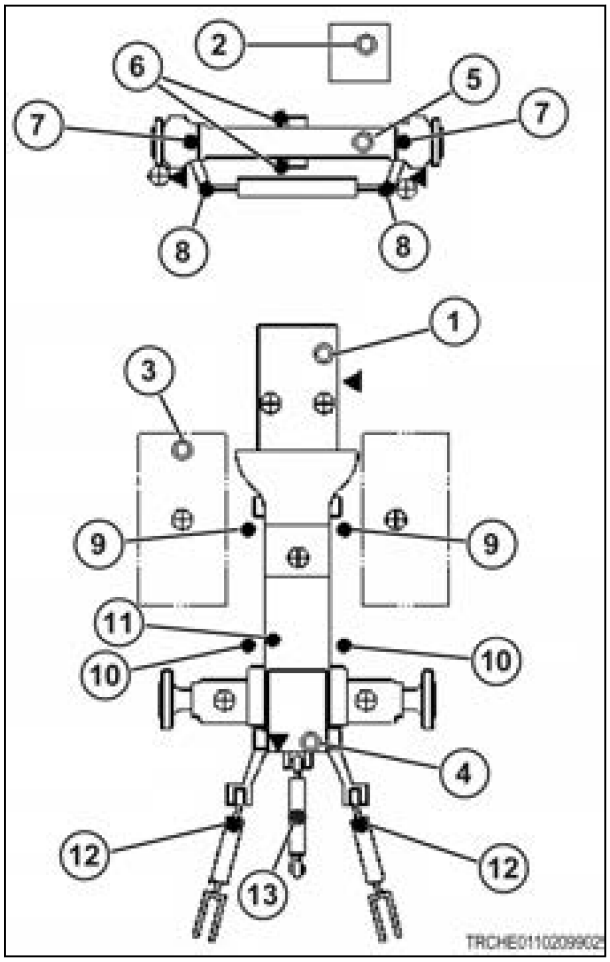


Fig. 7

2.1 Introduction

2.1.1 Safety alert symbol

The safety alert symbol means Attention! Become Alert! Your Safety Is Involved!

Look for the safety alert symbol both in this manual and on safety signs on this machine. The safety alert symbol will direct your attention to information that involves your safety and the safety of others.

Fig. 1

2.1.2 Informational messages

The words important and note are not related to personal safety, but are used to give additional information and tips for operating or servicing this equipment.

IMPORTANT: *Identifies special instructions or procedures which, if not strictly observed, could result in damage to or destruction of the machine, process, or its surroundings*

NOTE: *Identifies points of particular interest for more efficient and convenient repair or operation.*

2.1.3 Safety messages

The words DANGER, WARNING or CAUTION are used with the safety alert symbol. Learn to recognize these safety alerts and follow the recommended precautions and safety practices.

DANGER:
Indicates an imminently hazardous situation that, if not avoided, will result in DEATH OR VERY SERIOUS INJURY.

WARNING:
Indicates a potentially hazardous situation that, if not avoided, could result in DEATH OR SERIOUS INJURY.

CAUTION:
Indicates a potentially hazardous situation that, if not avoided, may result in MINOR INJURY.

Fig. 2

In the event of an overturn, hold the steering wheel firmly and keep your seat belt fastened. Do not attempt to leave the seat until the tractor has come to rest.

Watch for holes, rocks, or other hidden hazards. Always inspect area prior to operation.

Be observant of the operating area and terrain.

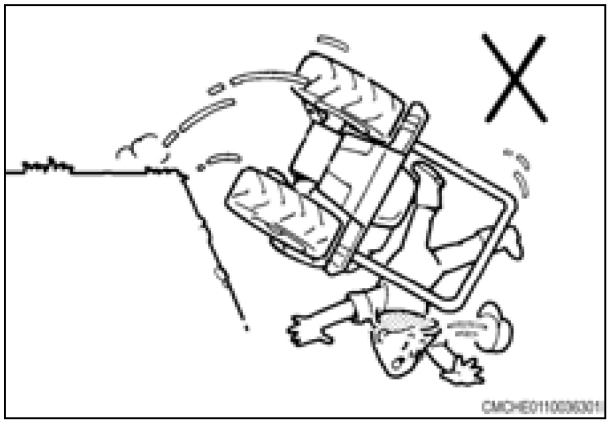


Fig. 28

Avoid contact with electrical power lines. Contact with electrical power lines can cause electrical shock, resulting in very serious injury or death.

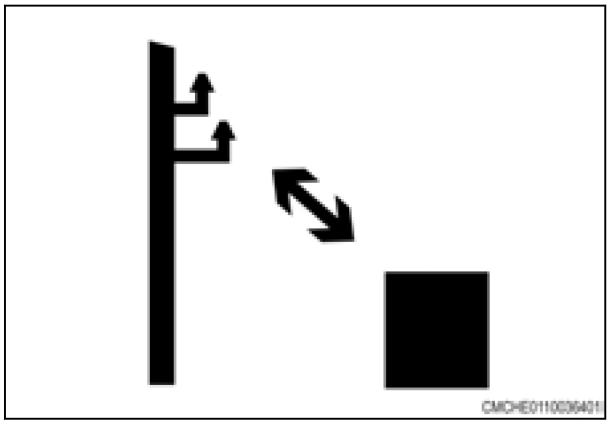


Fig. 29

Never allow anyone on any part of the tractor or attachments except in the operator's seat when the engine is running.

Do not get on or off the tractor or attachments while the tractor is moving.

Do not carry passengers.

Fig. 30

Always shut off the engine, shift the transmission to neutral, set parking brake and remove the start key before leaving the operator's seat or before permitting anyone to inspect, clean, lubricate, adjust or repair any part of the tractor or attachments. Never leave the tractor unattended while the engine is operating.

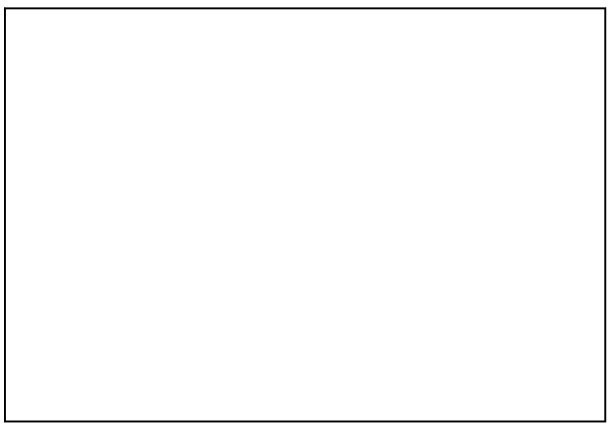


Fig. 31

2.4.4 Engine safety

Make sure all shields, guards and access doors are in place and properly closed before starting the engine.

Start the engine from the operator's seat only. Make sure all controls are in neutral and drives are disengaged.

Make sure all bystanders are clear of the machine before starting the engine.

Do not bypass the neutral start system. The neutral start system is designed to prevent starting the machine in gear. Any manual override of this system can cause death or serious injury.

Never connect booster cables to the starter terminals or short across the starter terminals.

Do not use aerosol starting fluid as a starting aid. The heaters in the intake manifold can cause the starting fluid to ignite resulting in an explosion. This explosion can cause death or very serious injury and damage to the engine.

Fig. 51

Fig. 52

Keep out of the engine compartment while the engine is running. Before opening the engine hood, shut off the engine and take the key with you.

Look and Listen! Make sure all moving parts have stopped.

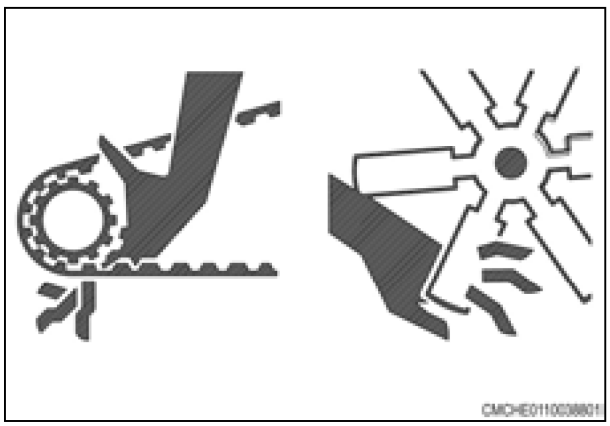


Fig. 53

4. Remove the rubber cap from the radiator bracket.

Fig. 11

5. Disconnect the radiator hose that connects to the engine side and tank side.

6. Remove the radiator bracket with the cooler assembly and the radiator assembly.

Fig. 12

7. Disconnect the fuel tank hose from the engine side.

Fig. 13

CONSTRUCTION

Technical Data

Engine Type	33	44
Principal Dimensions and Data		
Number of cylinders	3	4
Displacement (ltr)	3,3	4,4
Cylinder bore (mm)	108	108
Stroke (mm)	120	120
Combustion	Direct injection	
Injection advance	Automatically adjusted	
Valve clearance, intake and exhaust (mm)	0,35 mm (cold or hot)	
Direction of rotation from the engine front	Clockwise	
Fuel System		
High pressure pump	Bosch CB 18	
Fuel	The fuel must be according to norm EN 590:2009, see **Fuel Quality Requirements**	
Injection order	1 - 2 - 3	1 - 2 - 4 - 3
Injector	Bosch CRI2.2, electronic control six-hole nozzle	
Injection pressure	Max.1600 bar when CB 18 high pressure pump	
Fuel filters		
Pre-filter	Donaldson 10 µ	
Final filter	Donaldson 5 µ	
Lubrication System		
Oil pressure in hot engine at running speed	2,5...5,0 bar	
Oil pressure at idle speed, min	1,5 bar	
Oil capacity	9 liter	13 liter
Oil quality requirements	see **Lubricating Oil Quality Requirements**	
Cooling system		
Number of thermostats	1	1
Opening temperature	∅ 67 mm = 83℃	
Coolant quality requirements	see **Coolant Quality Requirements**	

Max valve movement with a valve clearance of 0,35 mm:
- Inlet valve . . . . . 10,9 mm
- Exhaust valve . . . . . 12,1 mm
Inlet valve stem diameter . . . . . 8,960...8,975 mm
Exhaust valve stem diameter . . . . . 8,925...8,940 mm
Inlet valve stem clearance . . . . . 0,025...0,055 mm
- Reject limit . . . . . 0,30 mm
Exhaust valve stem clearance . . . . . 0,060...0,090 mm
- Reject limit . . . . . 0,35 mm
Depth of valve head faces below cylinder head surface:
- Inlet valve . . . . . 0,7±0,05 mm (max.2,20 mm)
- Exhaust valve . . . . . 0,8±0,05 mm (max.2,20 mm)
Valve spring free length . . . . . 69,8 mm
Spring pressure when spring compressed to a length of:
- 48,6 mm . . . . . 327±17 N
- 37,4 mm . . . . . 500±23 N
Rocker arm shaft diameter . . . . . 22,970...22,990 mm
Diameter of rocker arm bore. . . . . 23,000...23,021 mm
Free length of rocker arm spring. . . . . 80 mm
Spring pressure when spring compressed to a length 58 mm . . . . . 70...90 N

Valves and rockers, 4V engines

With a valve clearance of 1,0 mm:
- Inlet valve opens. . . . . 2°±2° B.T.D.C
- Inlet valve closes . . . . . 18°±2° A.B.D.C
- Exhaust valve opens . . . . . 36°±2° B.B.D.C
- Exhaust valve closes . . . . . 21°±2° A.T.D.C
Valve clearance cold and hot:
- Inlet valve . . . . . 0,35 mm
- Exhaust valve . . . . . 0,35 mm
Angle of valve face:
- Inlet valve . . . . . 35°-20'
- Exhaust valve . . . . . 45°-20'
Outside diameter of valve head:
- Inlet valve . . . . . 39 mm
- Exhaust valve . . . . . 35 mm
Max valve movement with a valve clearance of 0,35 mm:
- Inlet valve . . . . . 9,5 mm
- Exhaust valve . . . . . 9,0 mm
Inlet valve stem diameter . . . . . 7,960...7,975 mm
Exhaust valve stem diameter . . . . . 7,925...7,940 mm
Inlet valve stem clearance . . . . . 0,025...0,055 mm
- Reject limit . . . . . 0,30 mm
Exhaust valve stem clearance . . . . . 0,060...0,090 mm
- Reject limit . . . . . 0,35 mm
Depth of valve head faces below cylinder head surface:
- Inlet valve . . . . . 0,8±0,05 mm (max.2,20 mm)
- Exhaust valve . . . . . 0,6±0,05 mm (max.2,20 mm)
Valve spring free length . . . . . 75,1 mm
Spring pressure when spring compressed to a length of:
- 41,0 mm . . . . . 300±10 N
- 31,0 mm . . . . . 420±15 N
Rocker arm shaft diameter. . . . . 24,970...24,990 mm
Diameter of rocker arm bore. . . . . 25,000...25,021 mm
Free length of rocker arm spring. . . . . 88 mm
Spring pressure when spring compressed to a length 66 mm . . . . . 75...95 N

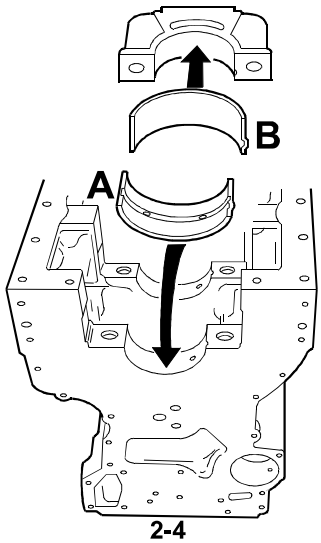
2.4 Fitting Crankshaft

1. Clean the oilways, bearing shells, bearing caps and bearing locations. Ensure that the crankshaft is clean.

2. Assemble the bearing with oilholes/groove (**A**) to the cylinder block and the bearing with no hole (**B**) to the bearing cap. Ensure that the bearing shell clamping claws fit into their notches and that the shells to be fitted in the cylinder block have a hole coinciding with the oil port.

3. Lubricate the bearing surfaces and fit the crankshaft. Fit the crankshaft thrust bearings with the lubricating grooves facing the crankshaft.

4. Fit the main bearing caps according to their numbering (bearing locks in the block and in the cap on the same side); the rear thrust bearings are provided with guide lugs. Lubricate the bolts and tighten them to **210 Nm.**



2-4

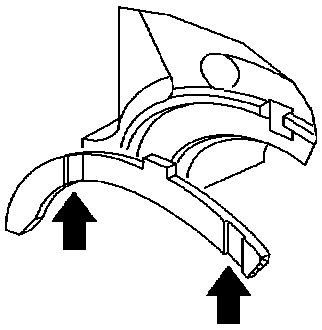
5. Check that the crankshaft can rotate without binding. Check the end float using a dial gauge. The correct end float is **0.10...0.30 mm**. If the end float is too large, oversize thrust bearings should be fitted. **Note!** Bearing shells should never be reamed or machined in any other way, nor should the sides of the bearing caps be filed.

6. Install the crankshaft rear oil seal, see instruction **2.5.**

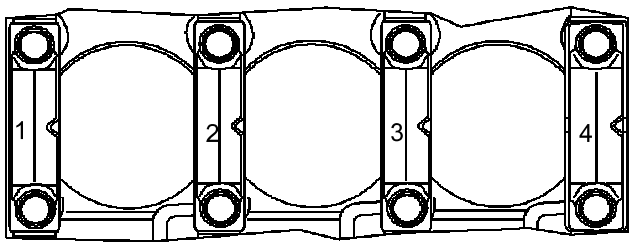
7. Mount the timing gear front cover, see instruction **5.3**.

8. Install the balancing unit (44 engines), see instruction **4.3.**

9. Install the oil suction pipe and oil sump, see instruction **8.3**.


2-5

10. Install the flywheel.



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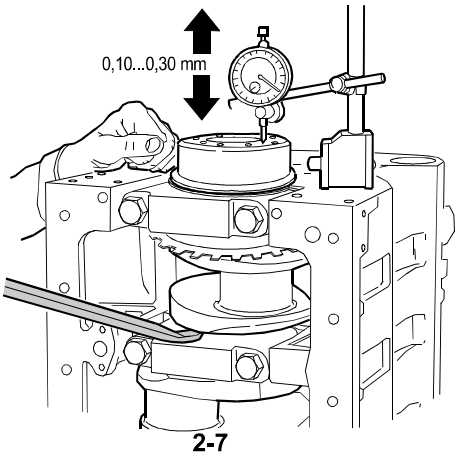
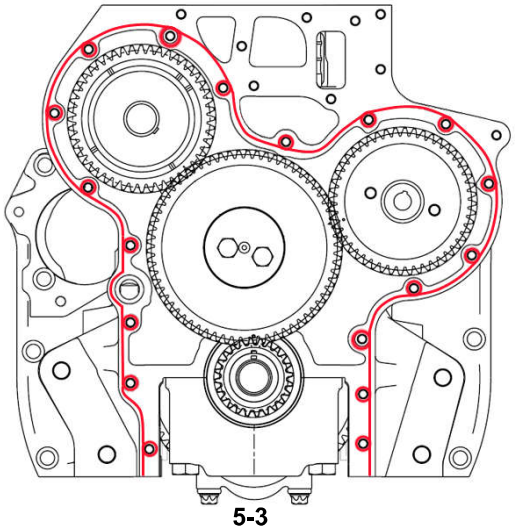


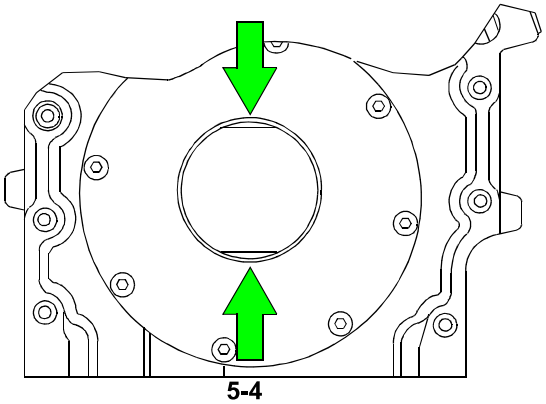
2-7

5.3 Fitting Timing Gear Casing

1. Tap the guide pins (2 pcs) into position
2. Apply sealant (For example Loctite 5910) to a sealing surface and fit the casing against the cylinder block.
3. Turn the oil pump inner gear so that the chamfers are horizontal.
4. Install the timing gear casing and tighten the screws to **25 Nm** tightness in sequence shown below. Make sure that the casing lower surface is in level with the cylinder block lower surface.
5. Tap the axle seal into place with special tool 9030 15200.
6. Lubricate the axle seal lightly and push the hub into place observing the guide pin position.
7. Tighten the crankshaft hub nut to **600 Nm** tightness. **Note!** Do not use oil, it may run into the conical surfaces.
8. If the trigger wheel has been removed, its position must be observed when installed as it differs between three- and four-cylinder engines.
9. Fit the other removed parts.



5-3



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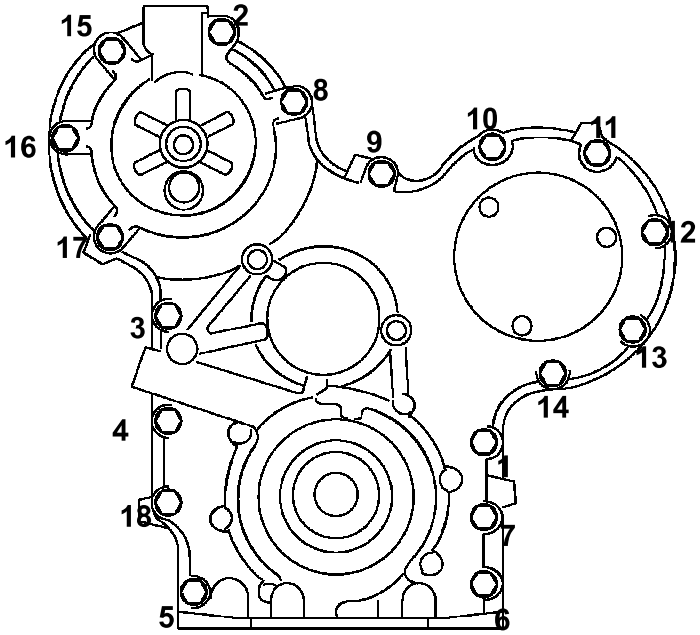
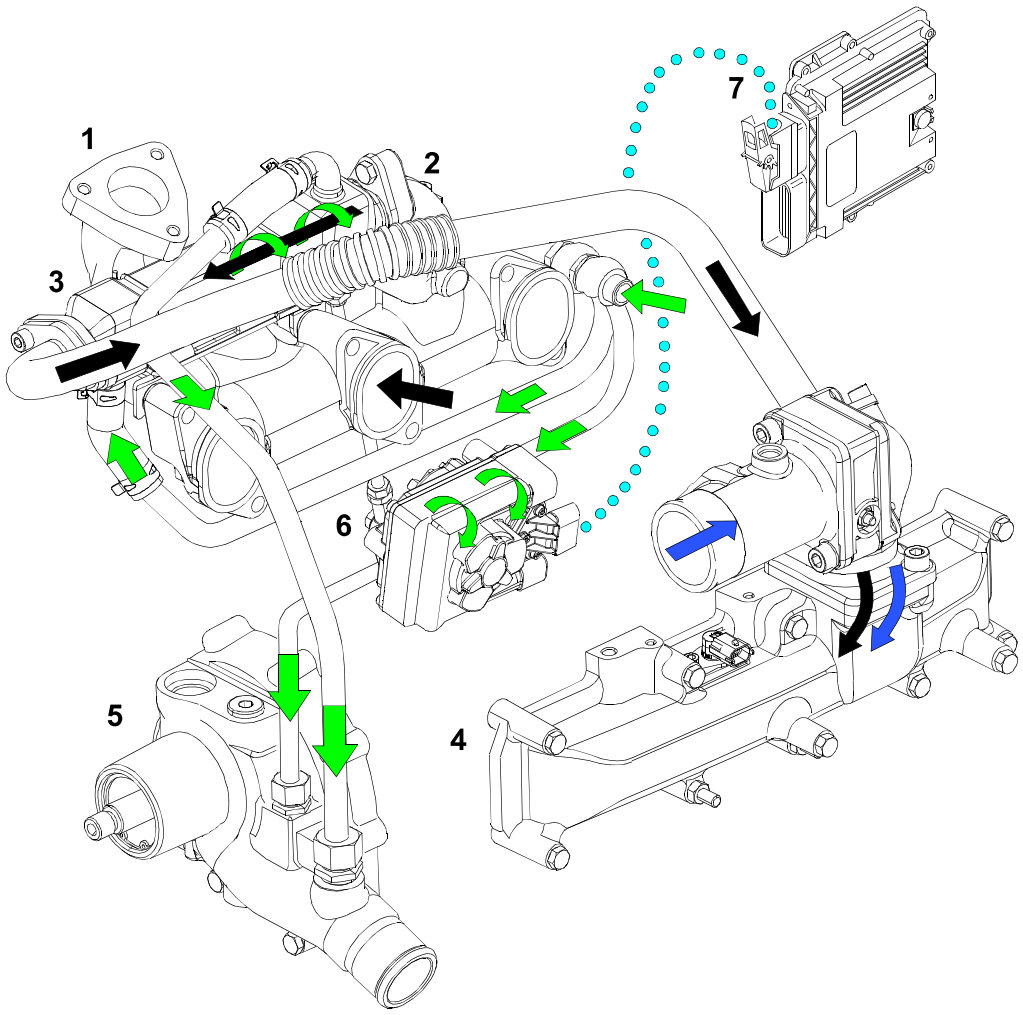


5-5

10.5 Cooled EGR system



10-5

1. Exhaust manifold
2. EGR valve
3. EGR cooler
4. Intake manifold
5. Cooling pump
6. Actuator
7. Engine control unit

The cooled exhaust gas recirculation system (EGR) used on AGCO POWER engines is controlled by electronic engine control unit EEM4. Part of exhaust gases is led from exhaust manifold (1) through EGR valve (2) to EGR cooler (3) where they are cooled with engine coolant. The cooled exhaust gas is mixed with fresh intake air in intake manifold (4) before it flows to combustion chamber.

The cooled EGR system decreases the temperature in combustion chamber, which in turn results as lower nitrogen oxide (NOx) emissions.

EGR cooler

The EGR cooler cools down the exhaust gases. The cooler is capable to decrease exhaust gas temperature even with 50%

11.7 Fuel Quality Requirements

	Requirement	Test method
Density, +15℃	0.82...0.84 kg/dm^3	EN ISO 3675:1998, EN ISO 12185
Viscosity, +40℃	2.0...4.5 mm^2/s	EN ISO 3104
Sulphur content	max. 15 mg/kg	EN ISO 14596:1998
Cetane number	min. 51	EN ISO 5165:1998
Water content	max. 200 mg/kg	prEN ISO 12937:1996
Lubricity/HFRR	max. 460 µm	ISO 12156-1

Note! Fuels according to EN 590:2009 may contain up to 7% FAME (fatty acid methyl ester) type biodiesel according to EN 141214:2008. Fuels according to ASTM D975-09b may contain up to 5% FAAE (fatty acid alkyl ester) type biodiesel according to ASTM D6751-08.Contact AGCO POWER R&D for more information of using different types of biodiesel!

The fuel must comply with the EN 590:2009 standard.

The engine output depends on the fuel quality.

Factors such as the temperature, density and viscosity of the fuel affect the actual output of the engine. Our outputs are based on fuel with a density of 0.84 kg/dm^3 and a specific heat rate of 42.7 Mj/kg at a fuel temperature of +15℃.

The percentage correction caused by the change in fuel quality is shown in the following illustrations.

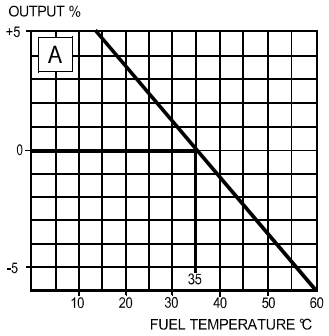


FIG. A. Dependence of engine output on fuel temperature. The reference temp is +35℃ (correction 0%). The fuel temperature is not only affected by ambient conditions, it also varies according to the fuel system of the model (tank size, location, return flow etc.).

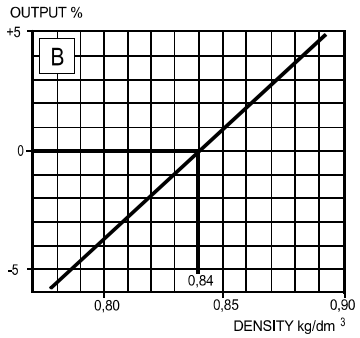


FIG. B. Dependence of engine output on fuel density. The normal value is 0.84 kg/dm^3 at +15℃.

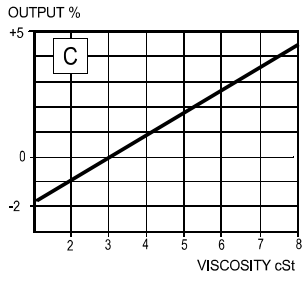


FIG. C. Dependence of engine output on fuel viscosity. The normal value is 3 cSt at +20℃.

Please note, fig. B and C are only relevant if the fuel quality is changed.

4. Power train

2. Remove the bolt from the front mount bracket on both the left-hand and right-hand side. Then remove the bolt under the transmission housing.

3. Remove the fuel tank from the engine.

Fig. 15

4. Remove the hydraulic suction lines and the supply lines.

Fig. 16

5. Remove the bolts connecting the front transmission housing and the mid-transmission housing. Separate the front transmission housing and the mid-transmission housing.

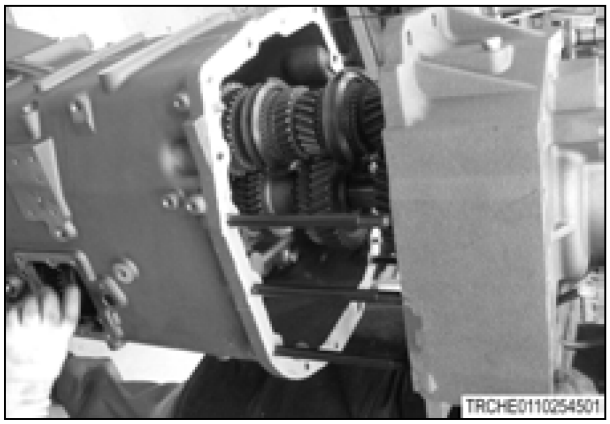


Fig. 17

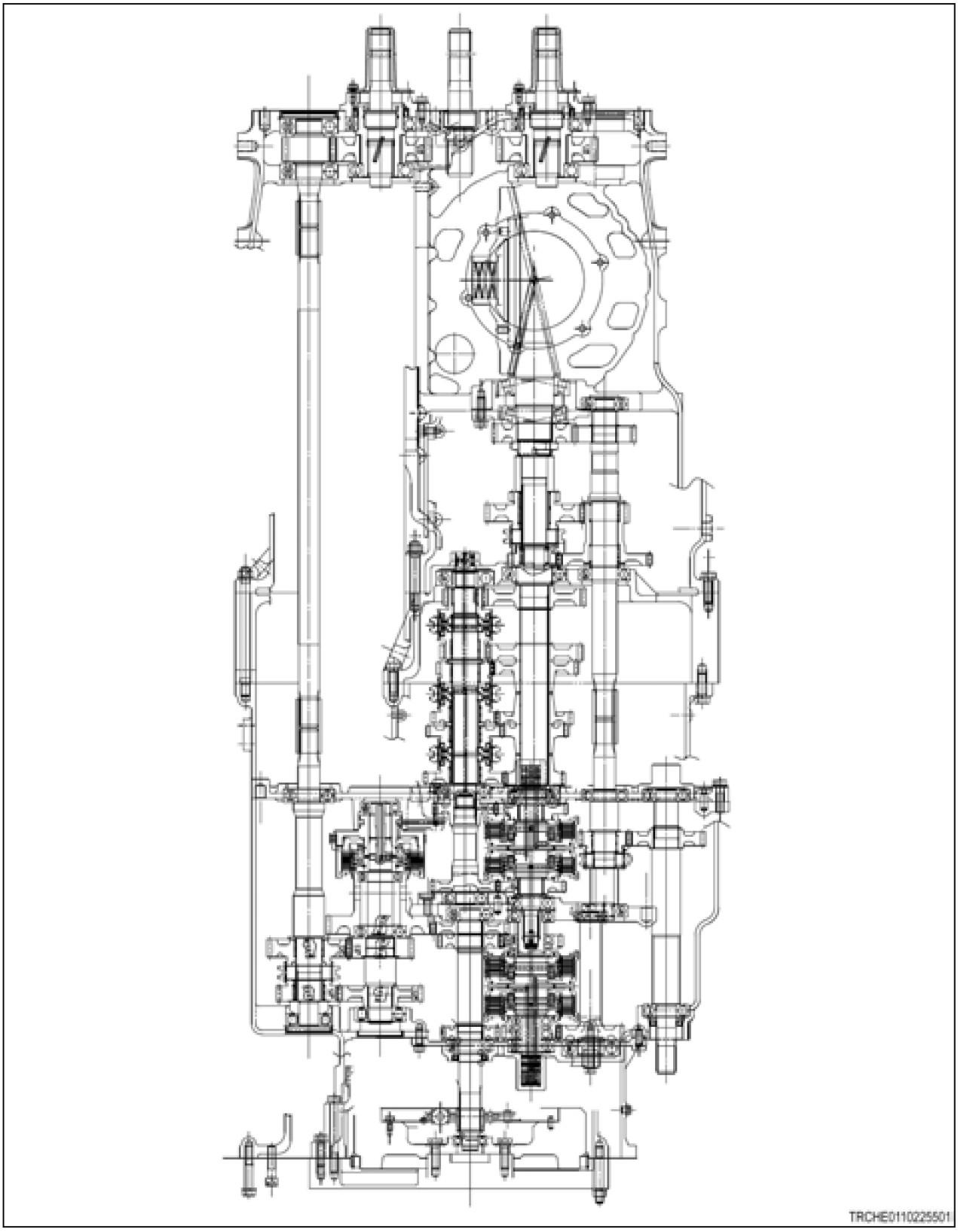


Fig. 39

Power shuttle type P1

4.10.2 Disassembling the reverse clutch

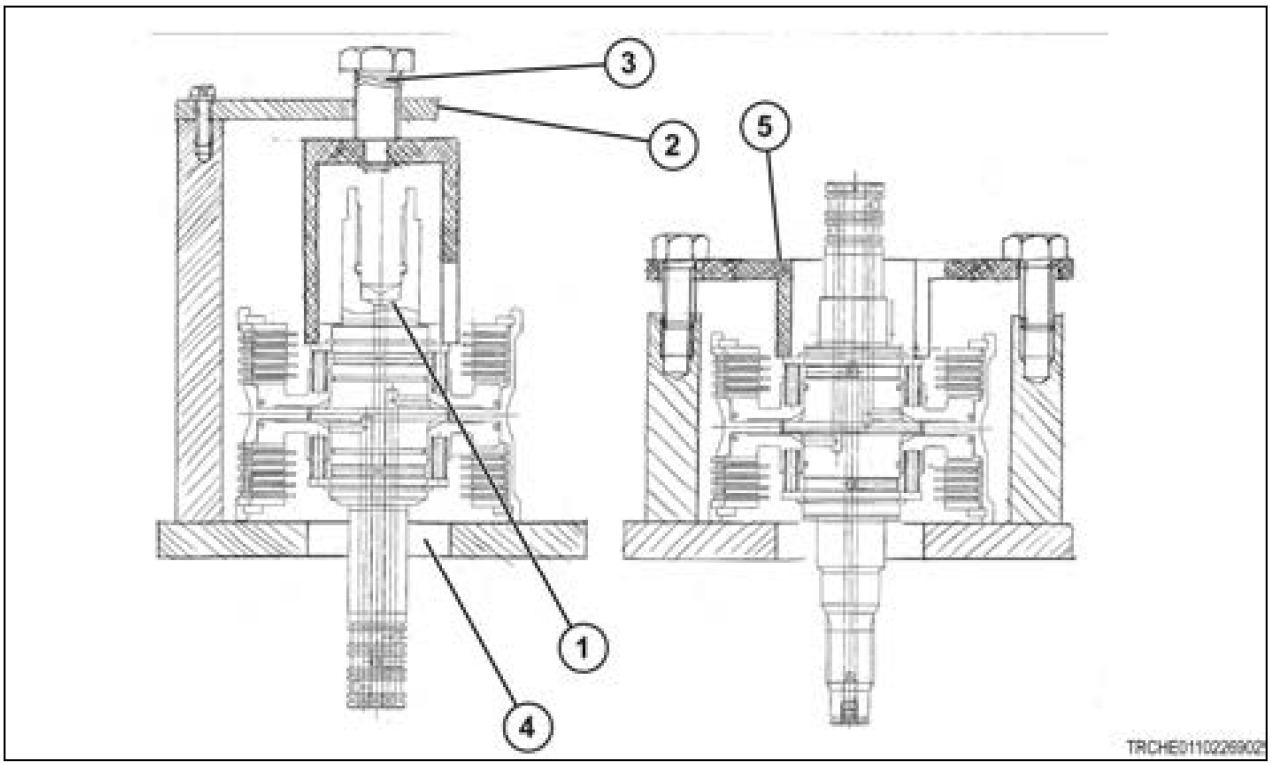


Fig. 49

(1) Collar
(2) Plate
(3) Handle comp
(4) Collar
(5) Simple jig

1. Remove the snap ring from the clutch disc.
2. Take out the friction plate and the separator plate
3. Install the collar on the setting gap of the collar and the snap ring.
4. Screw handle and compress the spring to reveal snap ring.
5. Remove the snap ring with the snap ring pliers.

4.12.1 Assembling precautions for main gear system

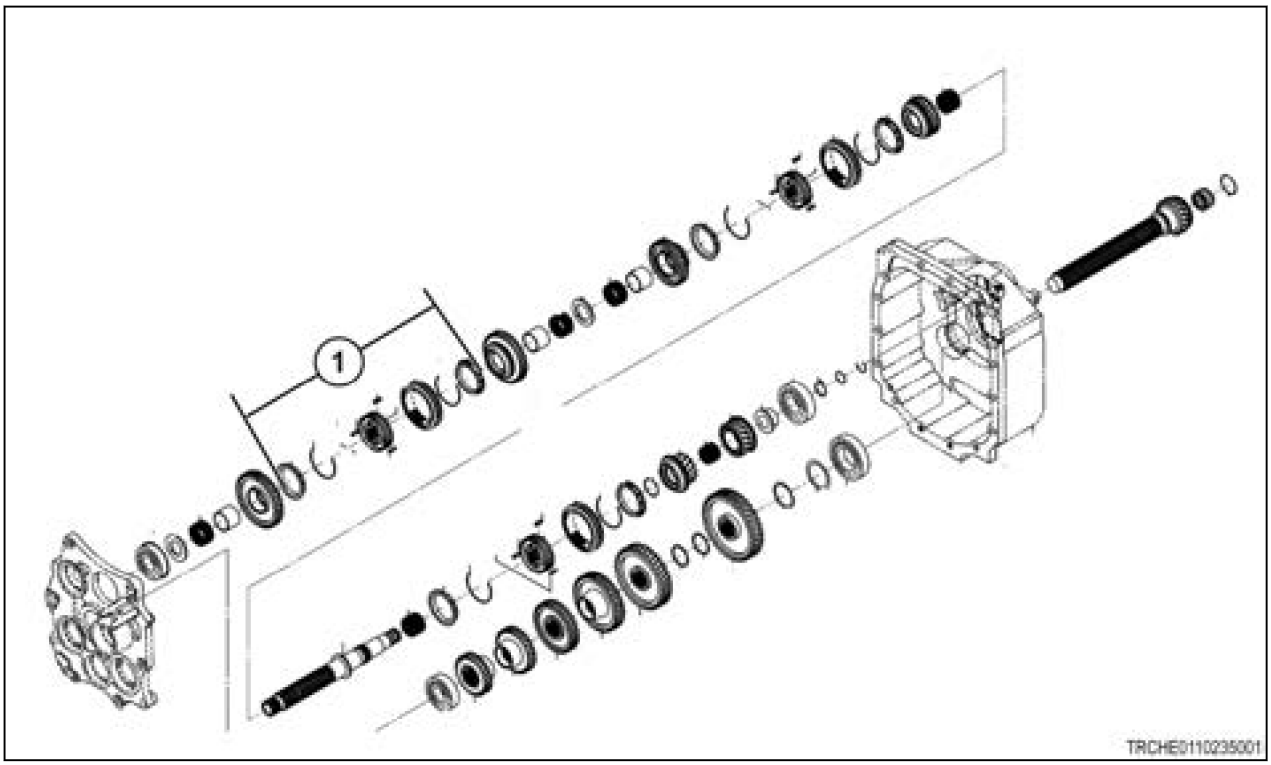


Fig. 71

1. Apply oil to the synchro mesh (1).

2. Install the washer in the correct direction.

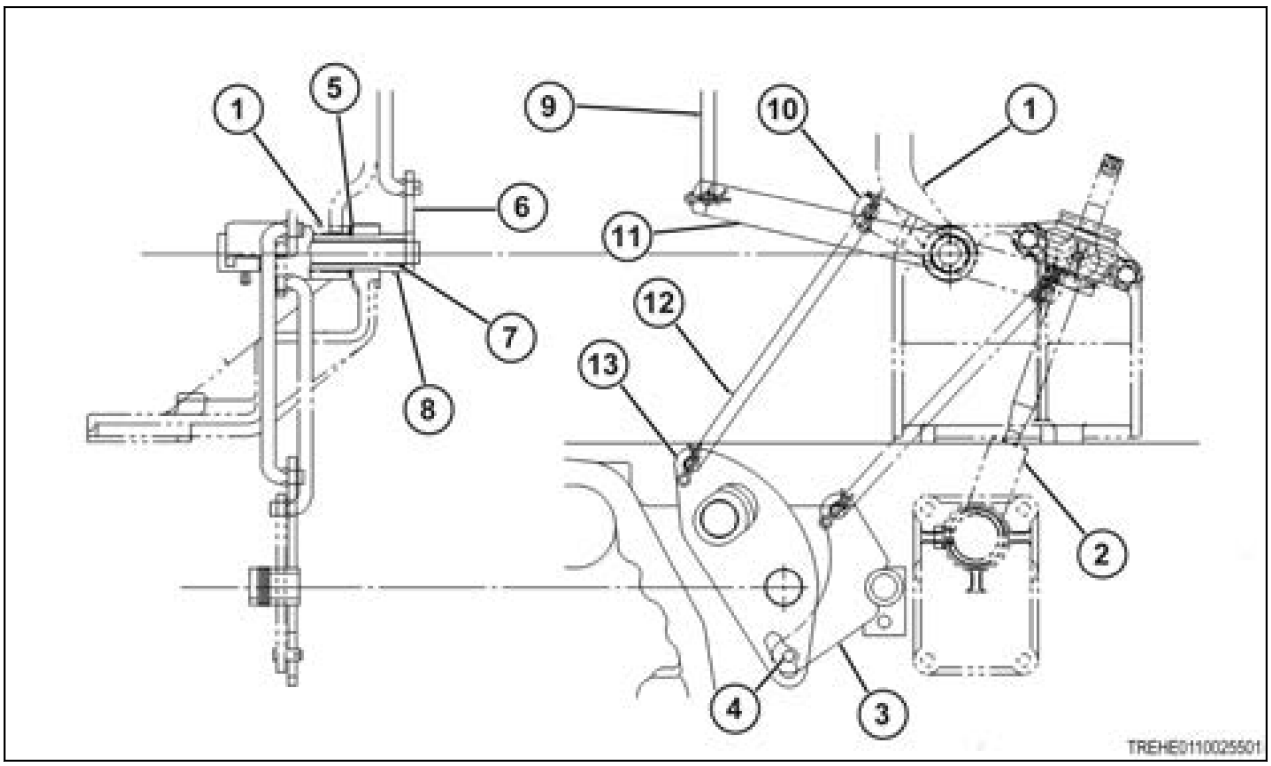


Fig. 85

6. Assemble the rear transmission and the spacer. Install the bolts and the nuts.

7. Install the gear sub-assembly to the rear transmissions.

8. Install the two O-rings, the plate, flange bolt, and the sub shift arm.

9. Install the sub arm with the spring pin. Set the spring pin in the sub arm notch.

10. With the lever arm (3) removed, install the the hub (1) inside the bracket (4). Secure the hub by inserting the arm (2) into the hub.

11. After assembly, make sure the arm (2) does not move while the lever arm (3) is out of the neutral position.

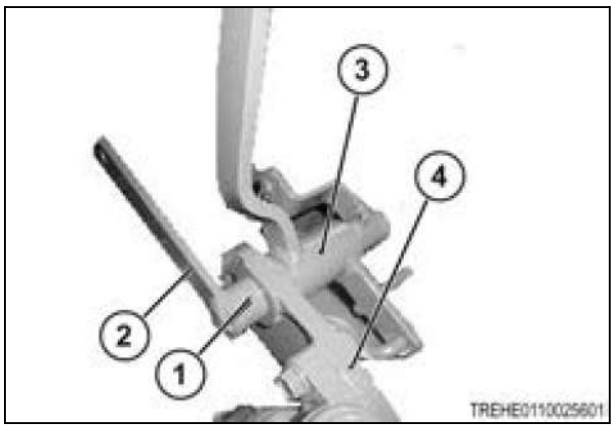


Fig. 86

12. Assemble all components in the reverse order of removal.

13. Install the cab or platform.

(9) Needle bearing
(10) Hub
(11) Coupling
(12) Bearing
(13) Ball bearing
(14) Sleeve
(15) Collar
(16) Washer
(17) Helical 31 tooth gear
(18) 4WD front shaft
(19) Retaining ring
(20) Bearing
(21) Oil seal
(22) Retaining ring

4.14.10 Two wheel-drive gear system

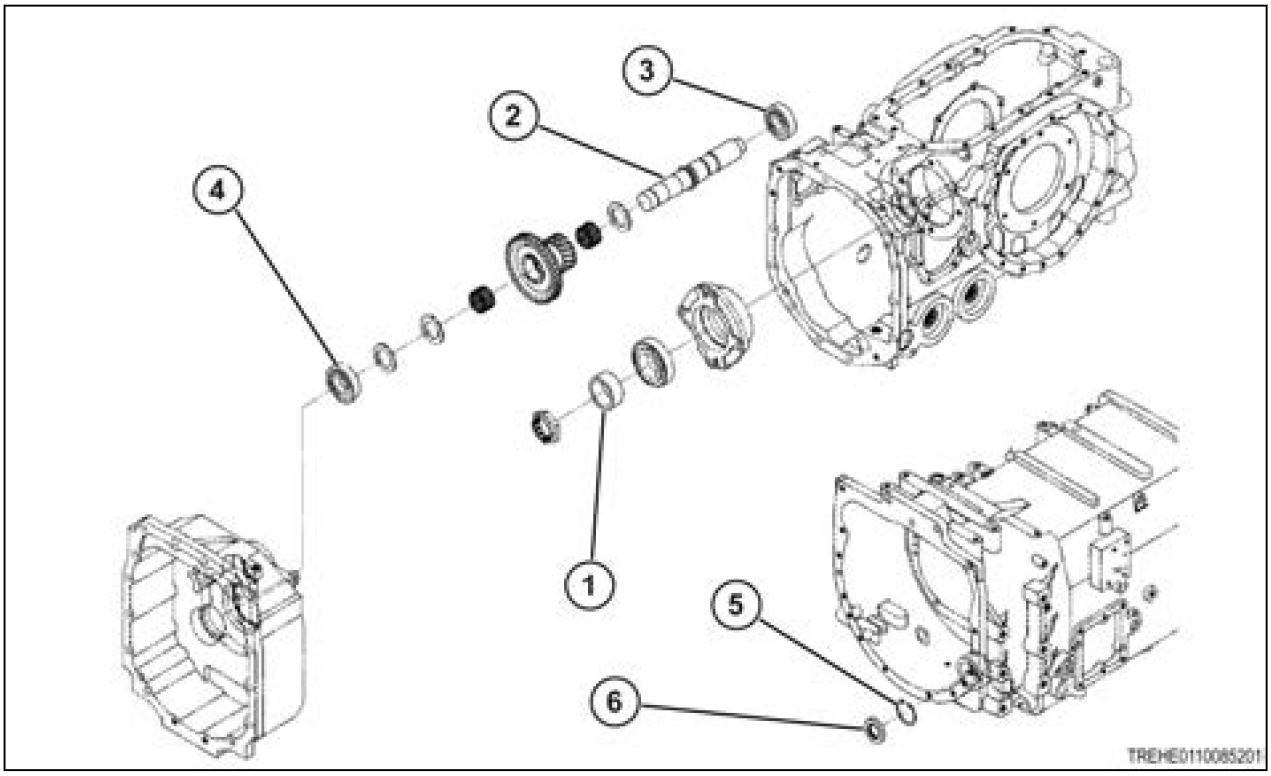


Fig. 103

(1) Collar
(2) Two wheel-drive rear shaft
(3) Bearing
(4) Ball bearing
(5) Retaining ring
(6) Seal

4.14.11 Power takeoff speed

North American models

Two power takeoff (PTO) types and speeds are available.

PTO type	Shaft size	Splines	Speed	Engine speed
ISO type 1	35 mm (1-3/8 in)	6	540 rpm	1993 rpm
ISO type 2	35 mm (1-3/8 in)	21	1000 rpm	2178 rpm

14. Disconnect tail light connectors.

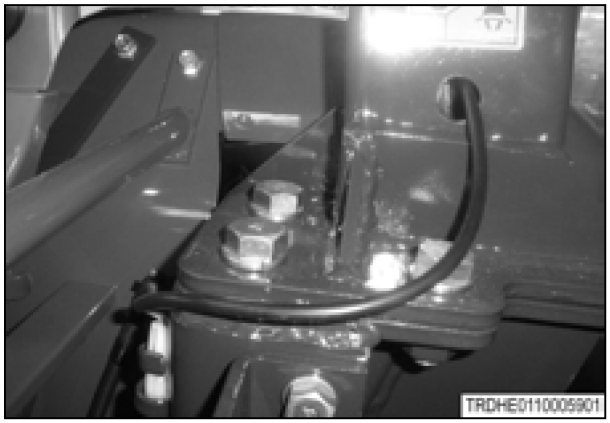


Fig. 11

15. Remove the bolts (1) connecting the roll over protection structure (ROPS).

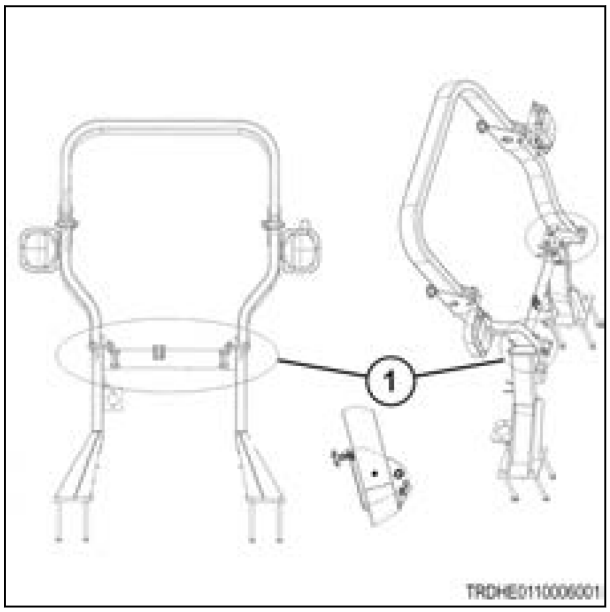


Fig. 12

16. Remove the ROPS.

Fig. 13

21. Disconnect the wire harnesses below the cab. This wire harness is for the power take-off (PTO), the cab harness, the power shuttle, and the sub control wire.

NOTE: *Identify all wire harness connections to assist in assembly.*

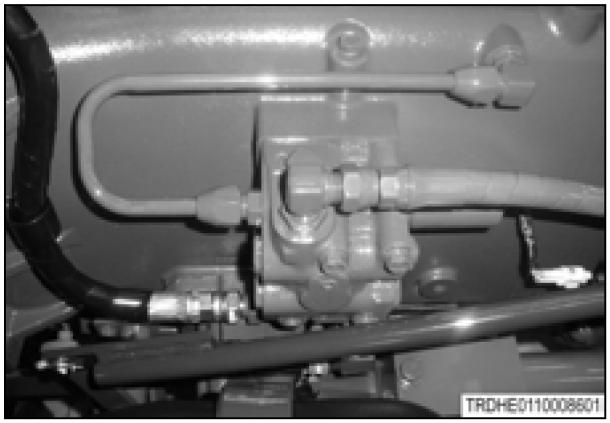


Fig. 37

22. To remove the cab with out opening up the air condition system. Remove the air cleaner assembly. Remove the radiator overflow reservoir. Without opening the lines or loosening any fittings, remove the condenser with the condenser brackets. Remove the receiver drier with the receiver drier brackets and the compressor with the compressor brackets. Put all the removed components on the floor or in the cab.

Fig. 38

23. Evacuate the air conditioning system with an approved recovery system.

24. Disconnect the front air conditioning line at the compressor (2).

25. Disconnect the air conditioning line at the receiver drier (1).

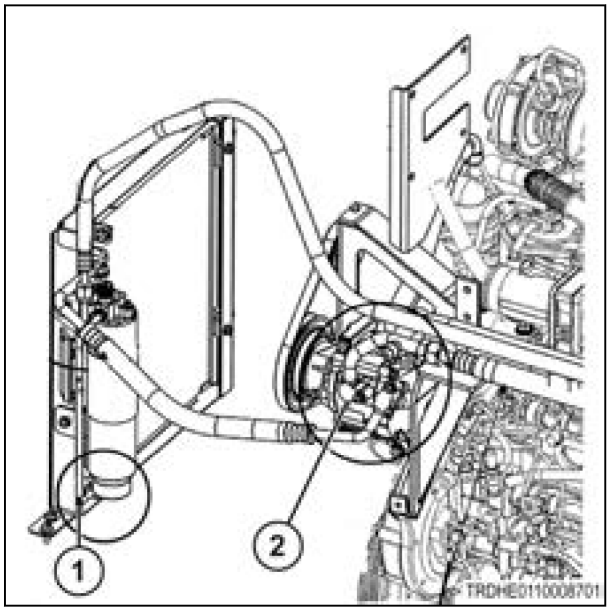


Fig. 39

5.2.12 Cab lamp

The cab lamp (1) works in each switch position as follows:

ON: It always turns on.

Neutral: It turns on when the door is opened and turns off when the door is closed.

OFF: It always turns off.

Fig. 61

5.2.13 Wiper and flood light switches

The wiper switch and the flood lamp switch are located on the right side of the cab, above the door.

(1) The front windshield wiper switch and the front washer switch.
(2) The rear windshield wiper switch and the rear washer switch, if equipped.

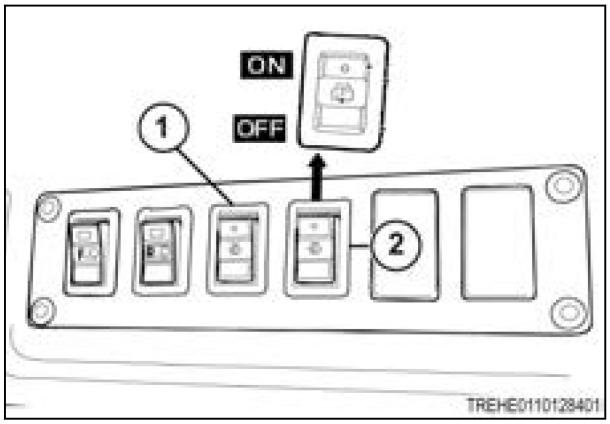


Fig. 62

(1) Flood lamp switch
(2) Rear flood lamp switch

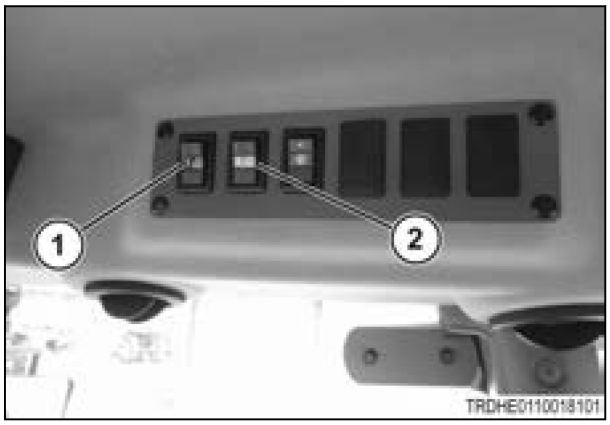


Fig. 63

5.5 Steering column

5.5.1 Removing the steering column

Procedure

1. Remove the front and the rear steering column covers.
2. Remove the console.
3. Remove the retaining plate (2), that attaches the column to the fire wall. Remove the retaining bolt (3) from the upper U-joint. Remove the column assembly (1).
4. Remove the retaining bolts form the appropriate U-joint to disconnect the steering shafts.

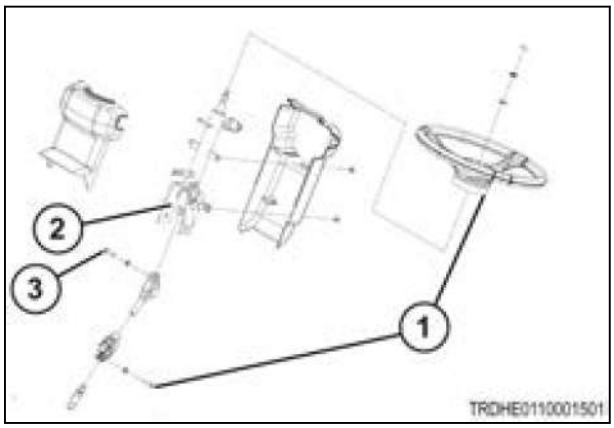


Fig. 86

5.5.2 Installing the steering column

Procedure

Install the steering column in the reverse order of removal.

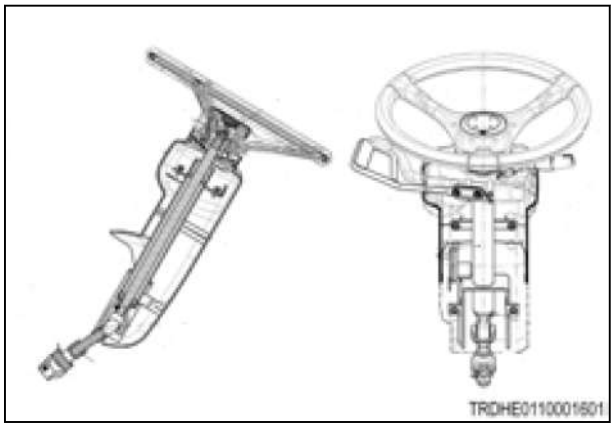


Fig. 87

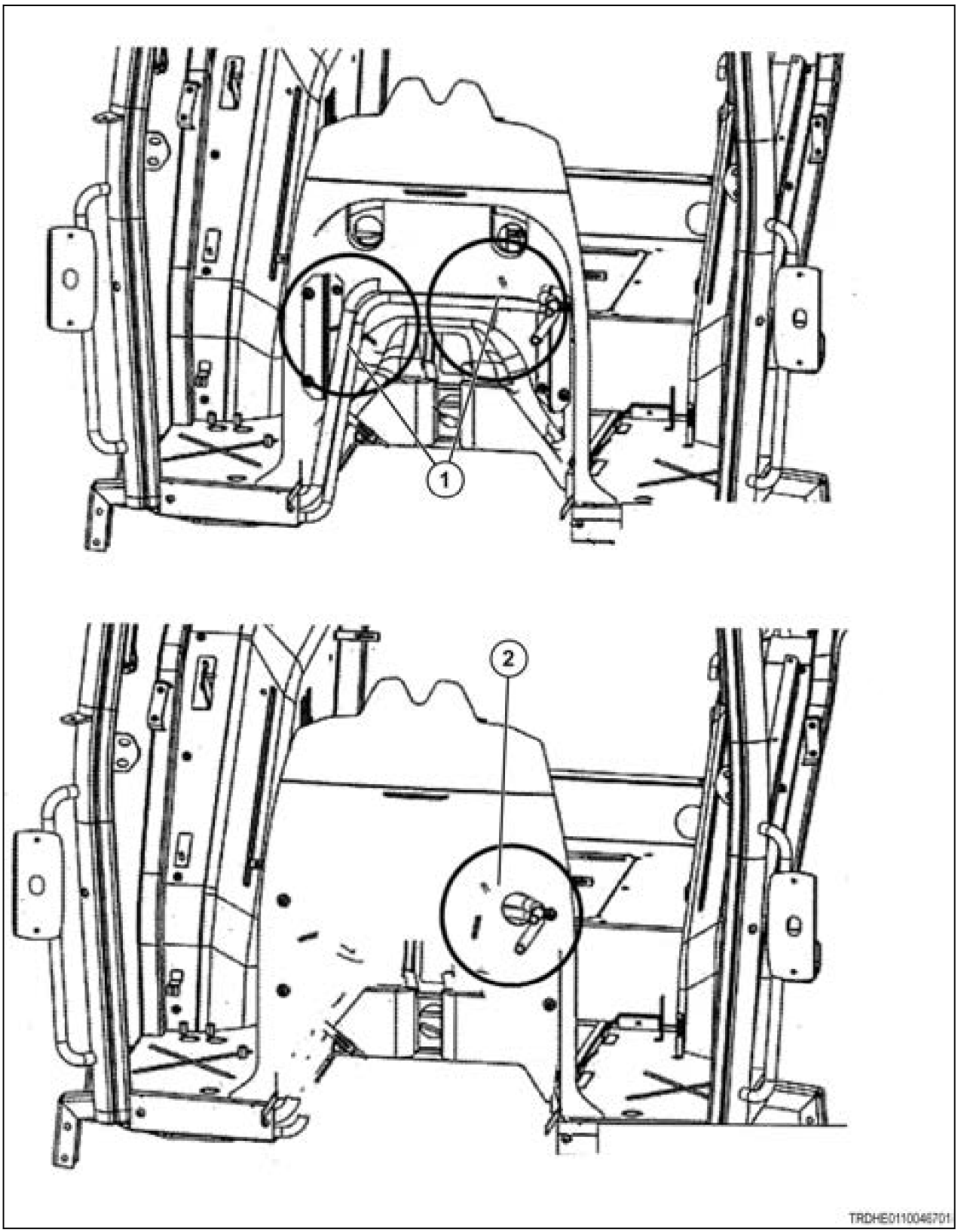


Fig. 98

(1) Heater hose
(2) Heater hose

2. Make sure that the cooler line (1) has no cracks or defects. Replace as required.

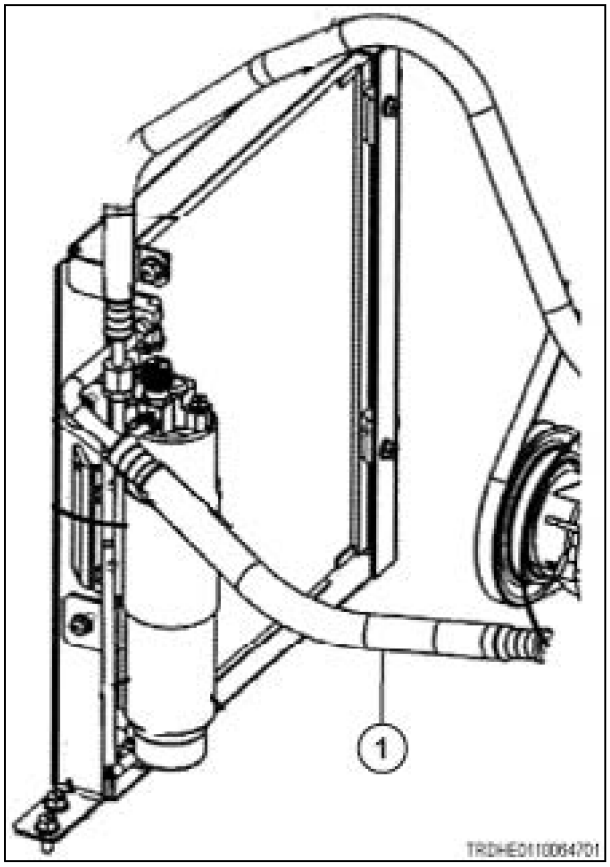


Fig. 110

Oil level in the compressor

Oil of 60 cc is sealed inside the compressor SCSA06C. When the oil level is lower than specified, it may become seized at high speeds. When the oil level is higher than specified, the result may be insufficient chilling.

When the air conditioner is started once, oil is spread among the related components. When parts shwon in the table are to be disassembled, replenish the oil in the respective components as shown in the table.

After operation, start the air conditioner and confirm the replacement parts are working properly.

Component	Charged amount
Evaporator	20 cc
Condenser	20 cc
Receiver	10 cc
Compressor	Extract from a new compressor the amount of oil which is gained by subtracting what remains in the old compressor from 60 cc.

5.8.32 Safety precautions when charging the refrigerant

Only certified technicians with correct equipment are to service the air conditioning system.

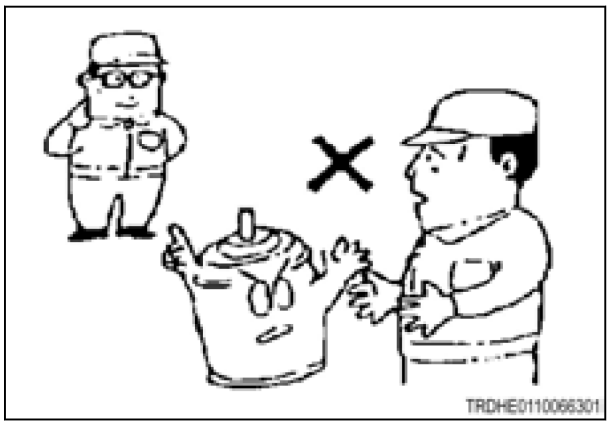


Fig. 125

Wear safety goggles during operation.

- Liquid refrigerant can cause loss of vision and frostbite to the eyes and skin. Wear eye protection and correct clothing when servicing the air conditioner system.

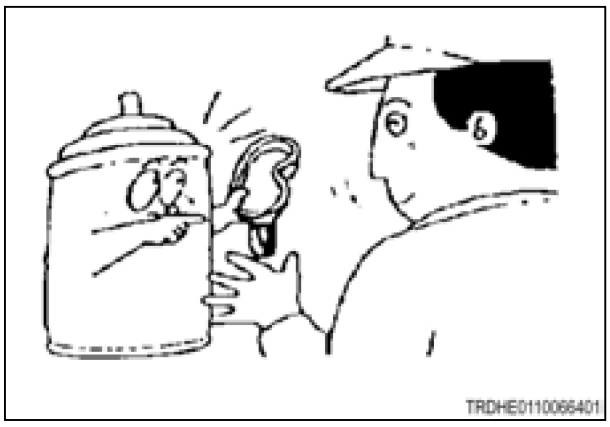


Fig. 126

Compressor will not engage	
Cause(s)	**Solution(s)**
Loose or broken belt.	Tighten or replace belt.
Low pressure switch in operation.	Leak test the system. Faulty low pressure switch.
Total loss of refrigerant.	Leak test the system.
Clutch failure.	Repair or replace clutch.
Electrical failure.	Inspect fuses. Inspect electrical connections and wiring. Check switch.

Excessive noise in the system	
Cause(s)	**Solution(s)**
Too much refrigerant.	Discharge and charge the system.
Blower motor failure.	Replace the blower motor.
Bearing failure.	Replace clutch or compressor.
Compressor failure.	Replace the compressor.

16. Remove the O-ring from the housing.

IMPORTANT: *Do not adjust the relief valve.*

IMPORTANT: *Replace the control valve assembly when the relief valve is defective.*

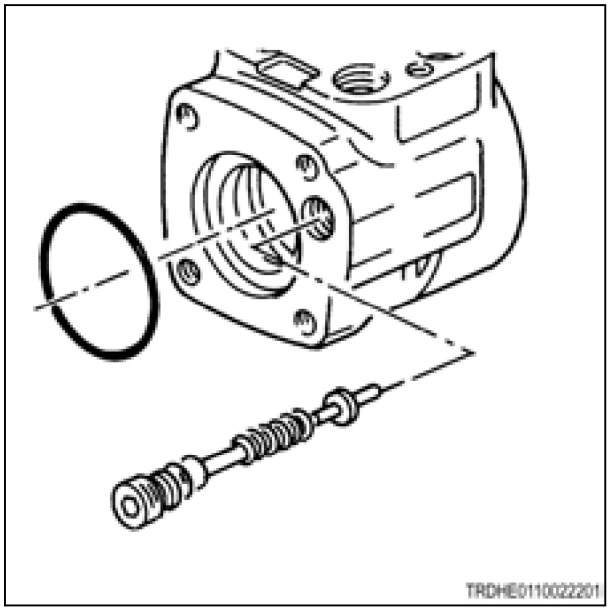


Fig. 15

6.1.6 Inspecting the orbit roll

Procedure

1. Check the contact surfaces of all of the components.

2. Replace the defective components.

3. Wash all metal parts in clean solvent and dry them with pressurized air.

NOTE: *Do not dry the components with cloth or paper. Lint and paper waste contaminate the hydraulic system.*

NOTE: *Never file parts or polish them with coarse sandpaper.*

NOTE: *Apply fresh grease to the O-rings.*

4. Replace old O-rings and seals whenever possible.

6.1.7 Assembling the control side

1. Install the spool into the sleeve while turning the spool slowly.

NOTE: *Make sure the spool turns smoothly by holding the spool's spline part.*

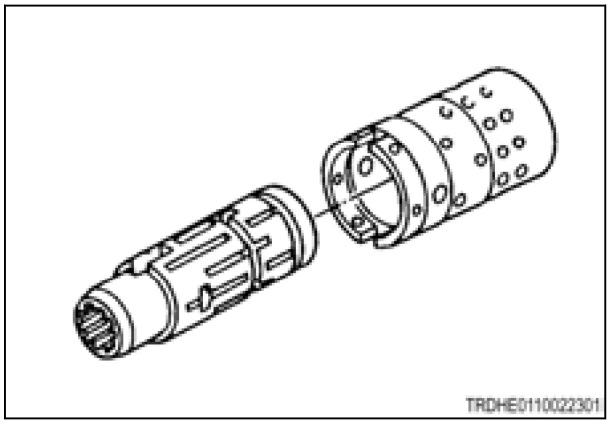


Fig. 16

6.3 Engine cover

6.3.1 Removing the engine cover

1. Raise the engine cover and disconnect the head light harness.
2. Disconnect the support belt assembly.
3. Remove the four bolts on both the left-hand and right-hand sides.
4. Slide the engine cover to the right and remove.

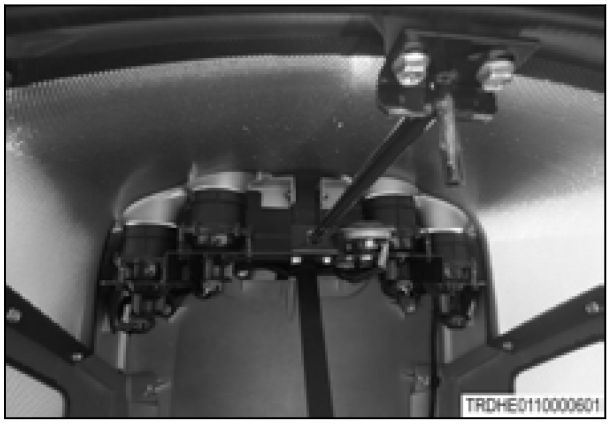


Fig. 33

6.3.2 Installing the engine cover

1. Install the engine cover on the pin and then slide the engine cover to the left.

   Result

   Enter the result of your step here (optional).
2. Install the four bolts on both the left-hand and right-hand sides.
3. Connect the support belt assembly.
4. Connect the head light harness and lower the engine cover.

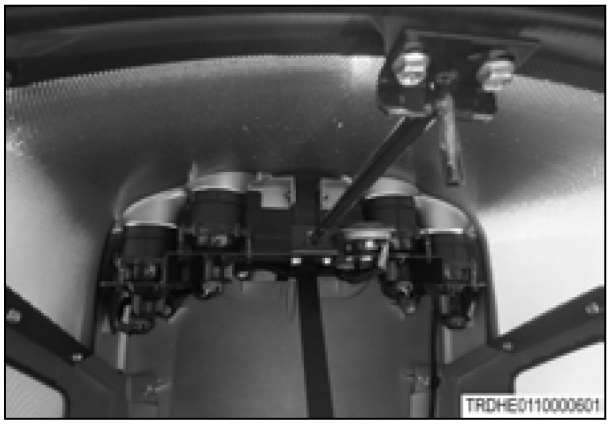


Fig. 34

6.3.3 Head lamp and engine cover net

(1) Low beam
(2) High beam

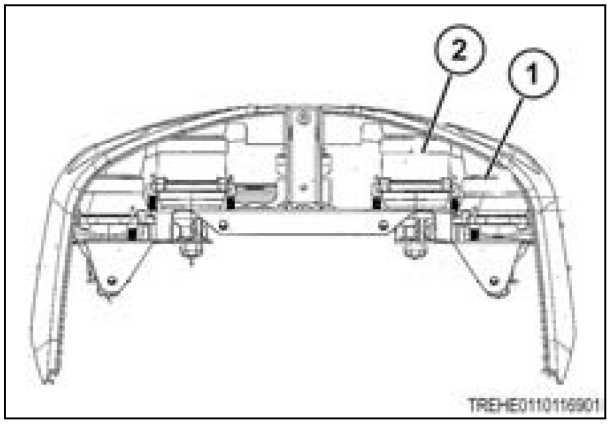


Fig. 35

6.5 Rear axle

6.5.1 General Information

The rear axle system is of the portal axle semi floating type. The rear axle system contains:

- The final reduction gears
- The differential gears
- The differential lock
- The wet type brakes

Power from the engine transmitts to the right-hand and left-hand wheel pinions through the differential gears. Power then transmitts to the rear wheels.

6.5.2 Rear axle and brakes

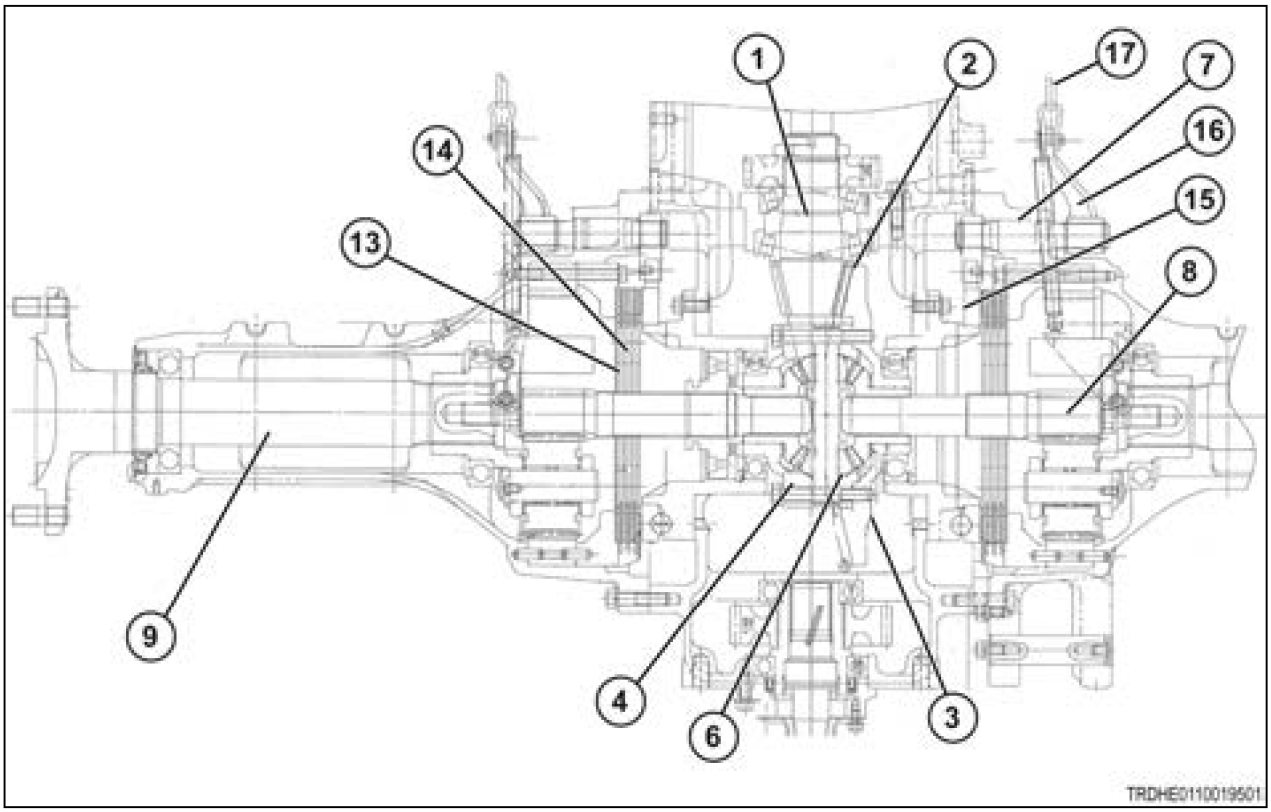


Fig. 52

(1) Spiral bevel gear
(2) Ring gear
(3) Differential case cover
(4) Differential case
(5) Differential pinion
(6) Differential side gear
(7) Wheel pinion
(8) Wheel gear
(9) Wheel shaft
(10) Differential lock shifter
(11) Differential lock shift fork
(12) Differential lock shaft
(13) Brake disk
(14) Brake plate
(15) Brake pressure plate
(16) Brake arm
(17) Brake rod

4. Make sure the drive pinion starting torque is 2.8 to 3.2 Nm (24.9 to 28.4 lbf in).

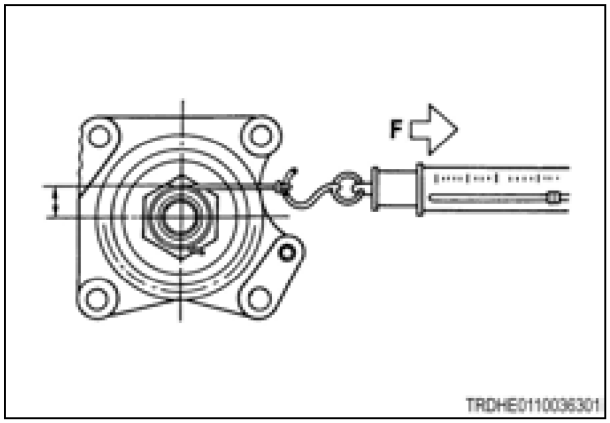


Fig. 70

5. Make sure the drive pinion starting torque meets the specified torque.

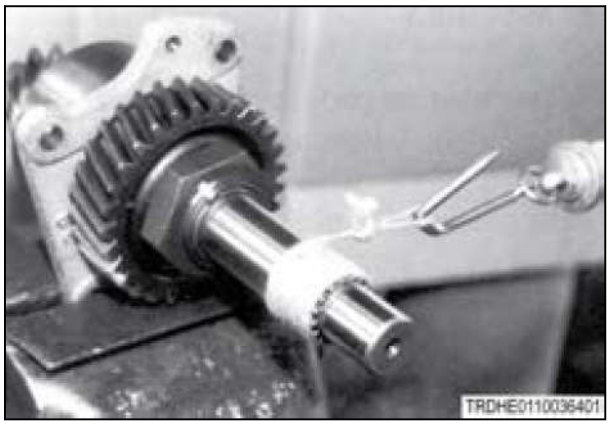


Fig. 71

6. Crimp the nut (1) until the crimp contacts the bottom of the groove as shown.

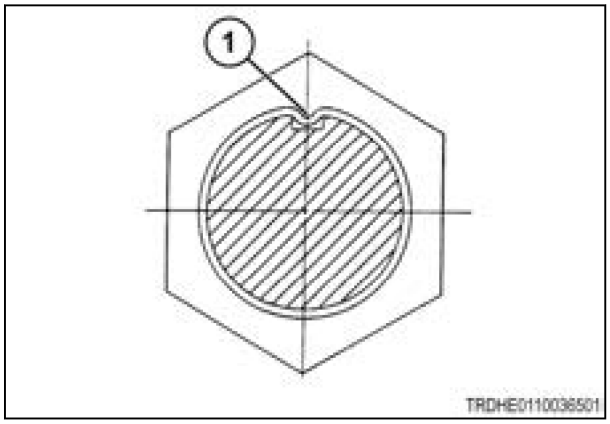


Fig. 72

7. Use the same shim thickness recorded during disassembly and tighten the drive pinion support to 79 to 93 Nm (58.7 to 69 lbf ft).

NOTE: *If the original ring gear and pinion gear are used, install the original shims removed during disassembly. If the ring gear and pinion gear are new, install the original shims removed during disassembly and check the tooth contact pattern. Move the shims as needed to obtain the correct tooth contact pattern.*

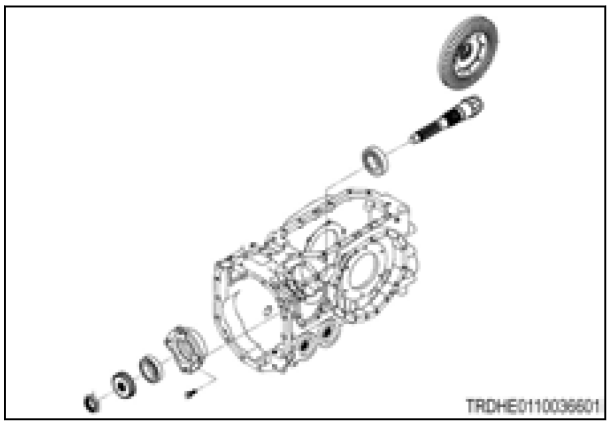


Fig. 73

6.9 Differential

6.9.1 Differential lock

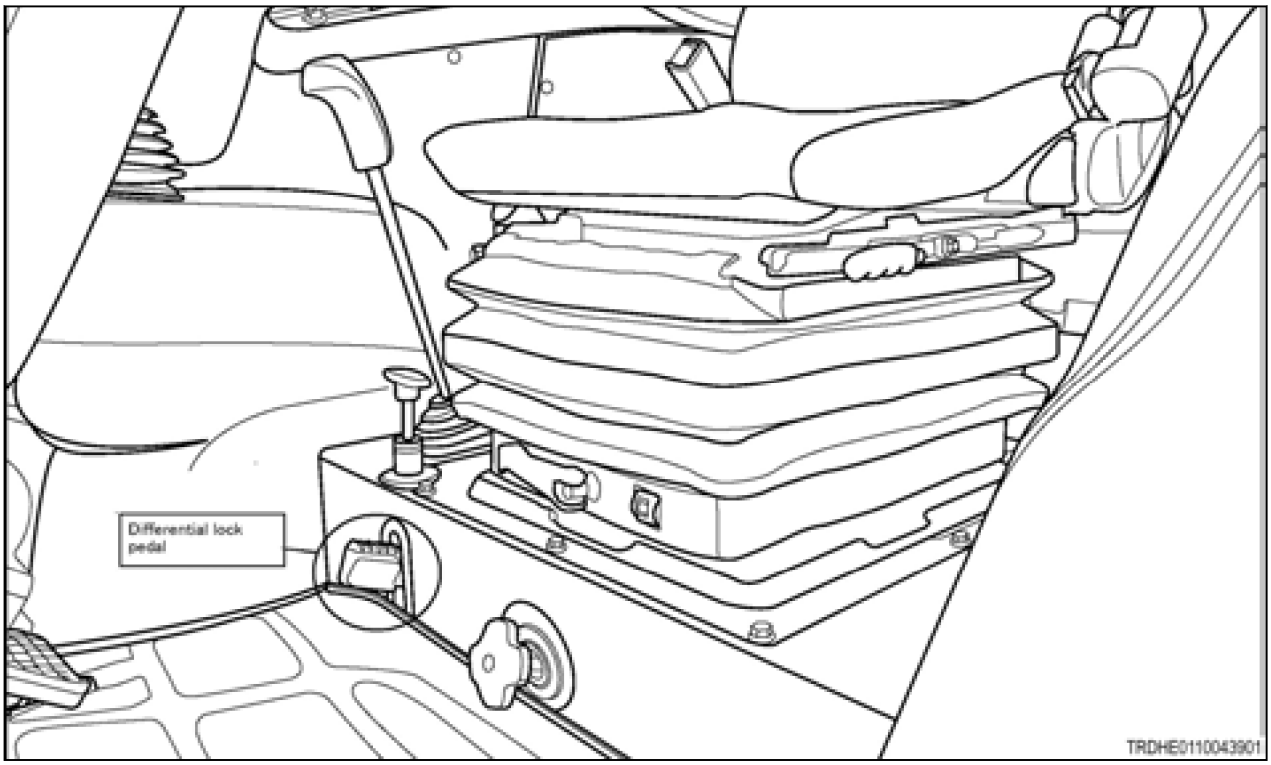


Fig. 91

Differential lock.

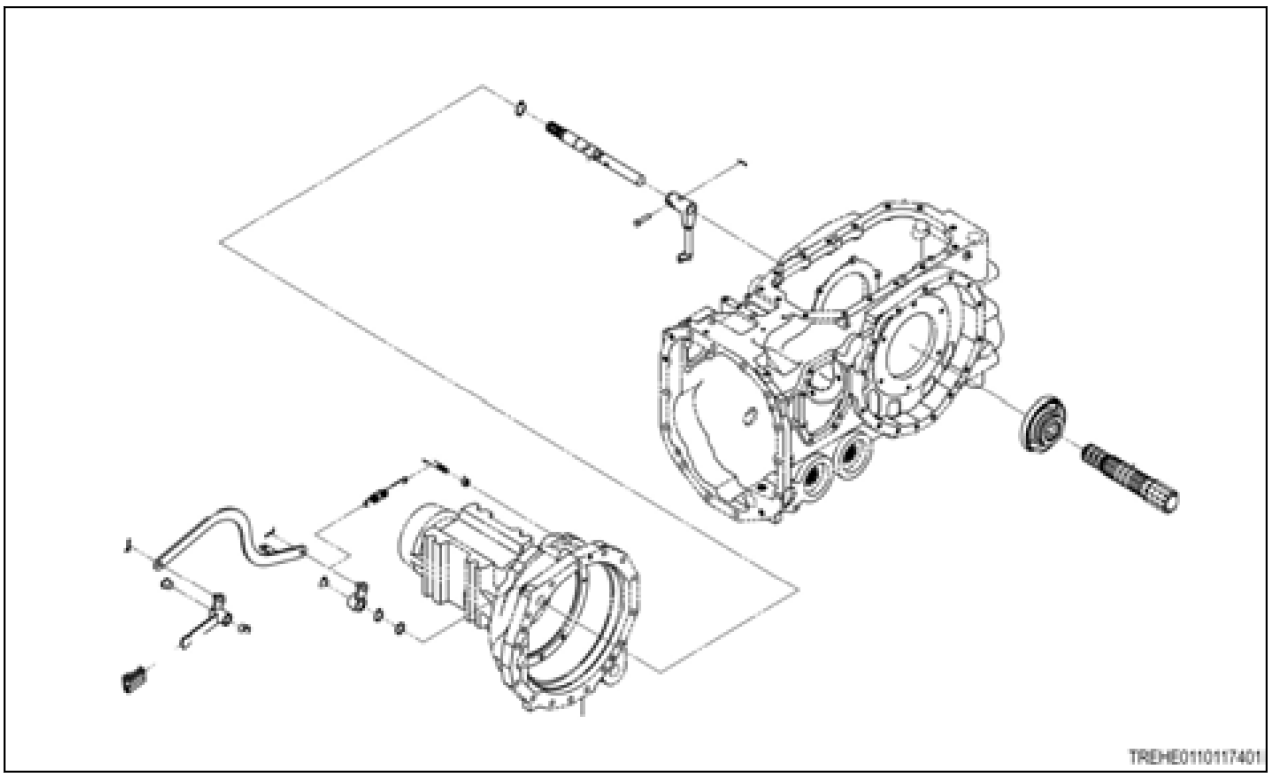
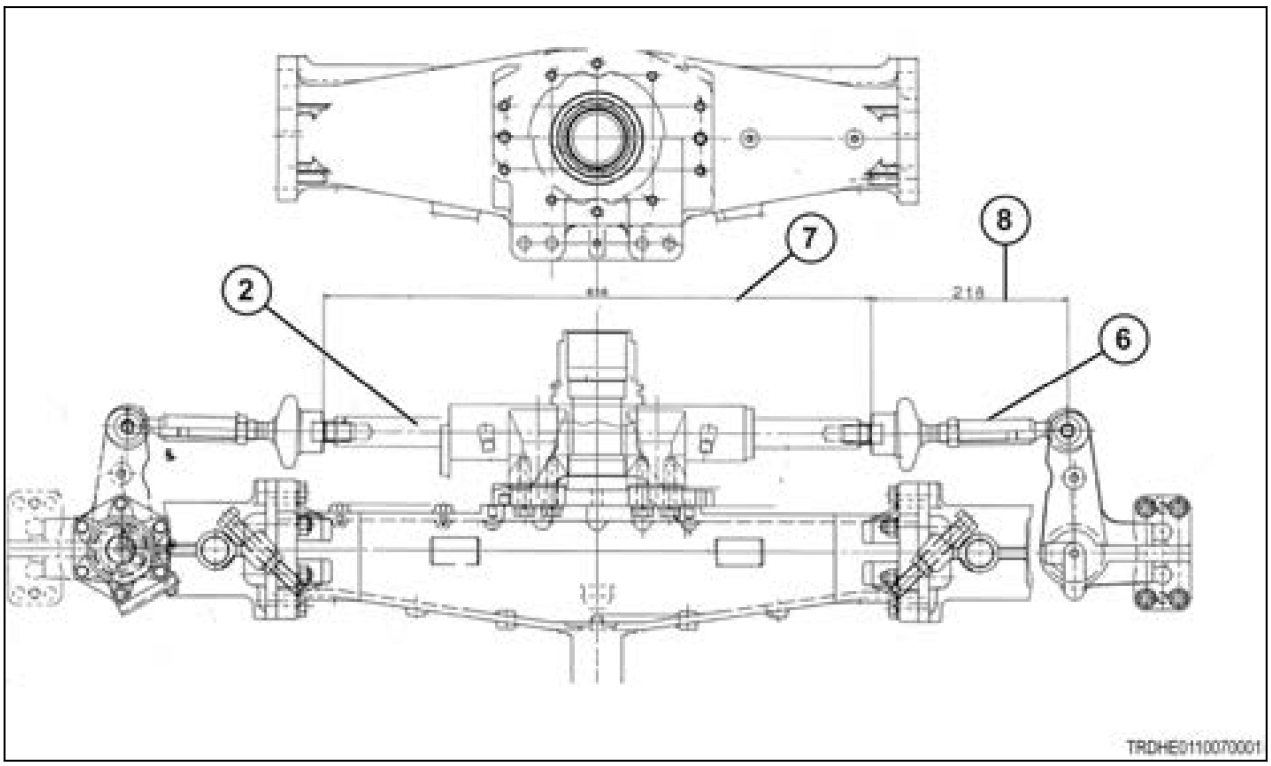


Fig. 92

Hydraulic steering circuit



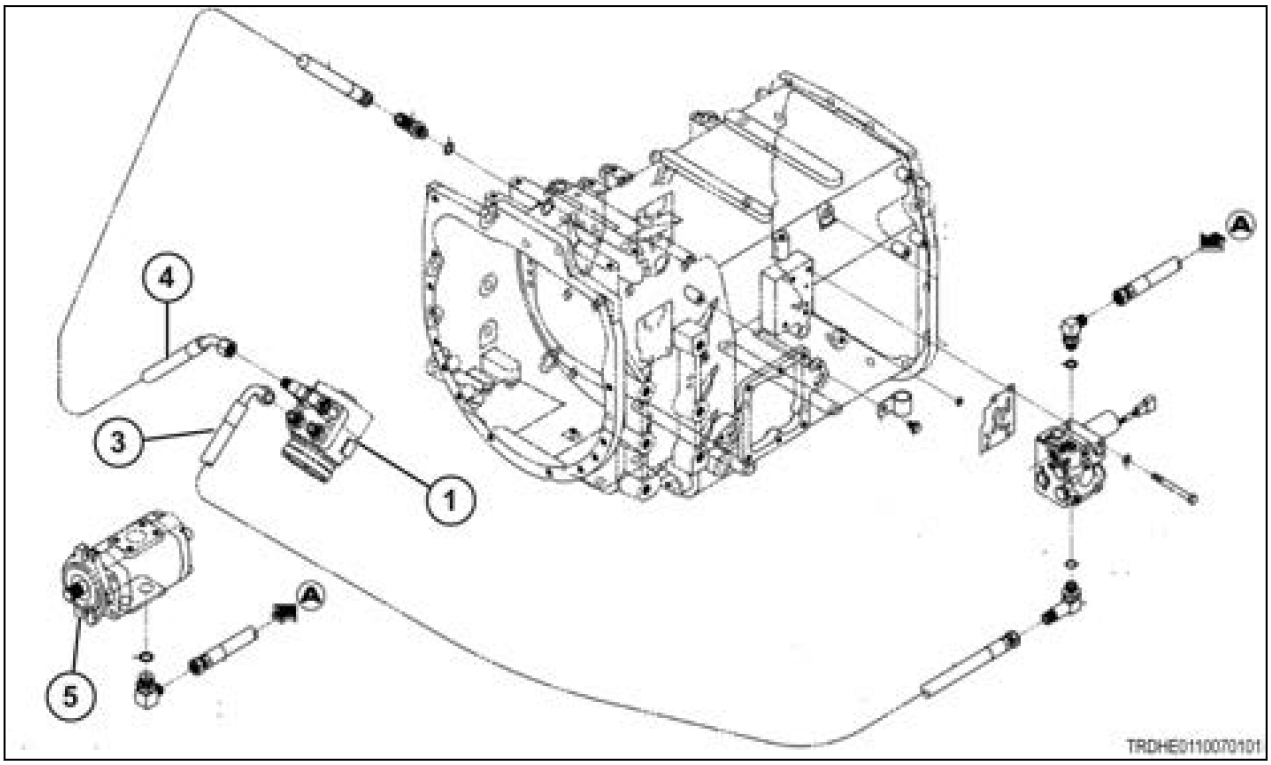


Fig. 107

(1) Steering controller
(2) Steering cylinder
(3) Delivery pipe
(4) Suction pipe
(5) Pump
(6) Tie rod
(7) Adjust to:
- 606 mm (23.9 in) - 4608
- 620 mm (24.4 in) - 4609, 4610

(8) Adjust to 218 mm (8.6 in) - 4608, 4609, 4610

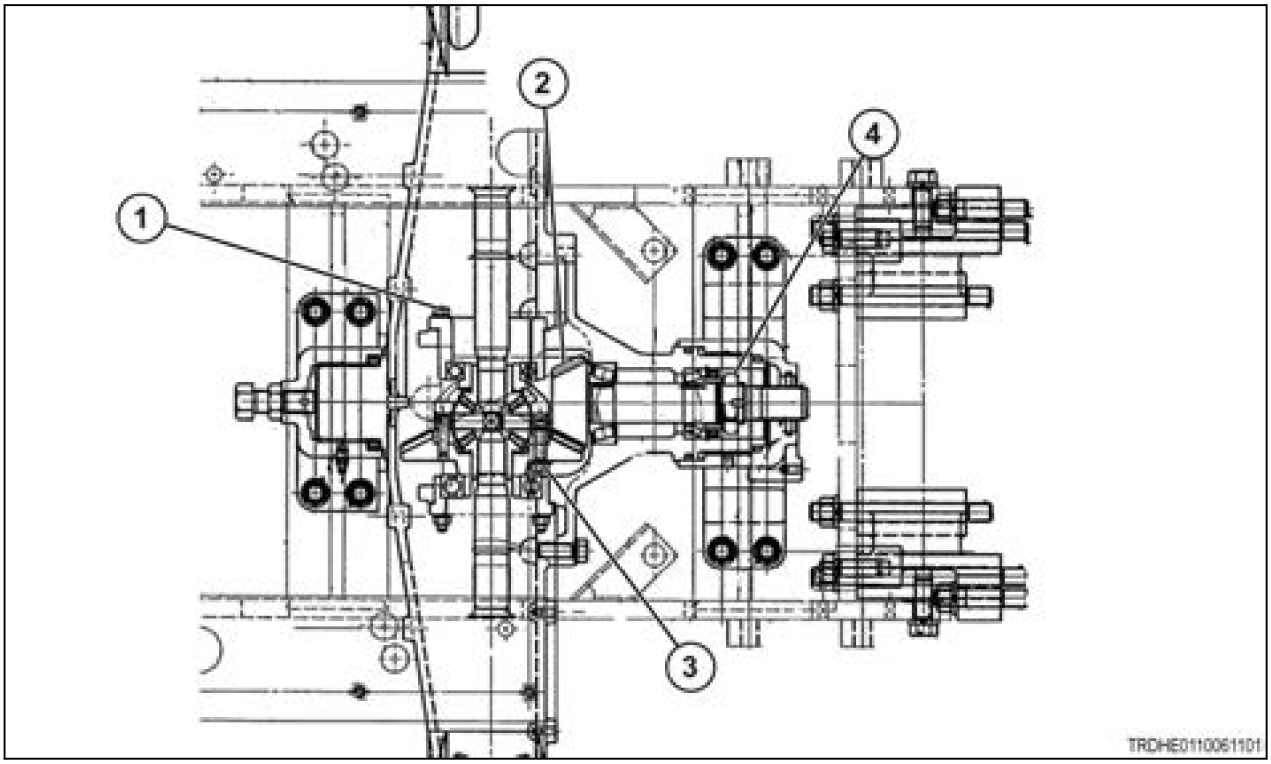


Fig. 126 Front axle assembly information

(1) Apply thread sealant and tighten to 29 Nm (21 lbf ft).

(2) Backlash must be 0.1 to 0.2 mm (0.004 to 0.008 in).

(3) Apply thread sealant and tighten to 59 Nm (44 lbf ft).

(4) Set rolling torque to 0.49 to 0.69 Nm (0.5 lbf ft).Firmly stake the lock nut.

13. Front axle assembly information

3. Install the ball cage assembly as shown.

4. Coat the oil seals with grease prior to assembly.

5. Use gasket eliminator between all housings.

6. Apply adhesive to the plugs before installation in the bottom of the housing.

7. Assemble the final drive in the reverse order of disassembly.

The assembled final drive must turn smoothly until it contacts the steering stop.

8. Install the wheel. Make sure the wheel turns smoothly and quietly.

9. Adjust the toe-in.

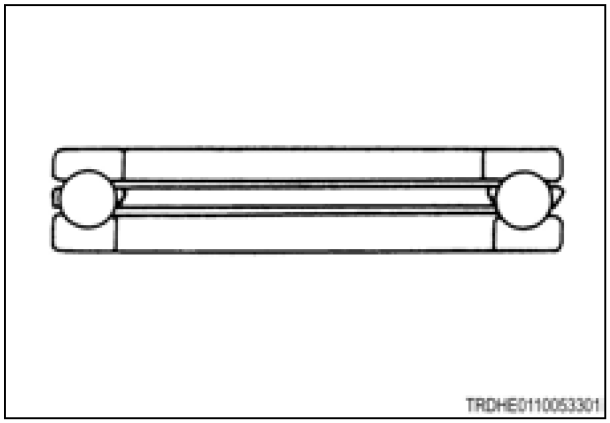


Fig. 147

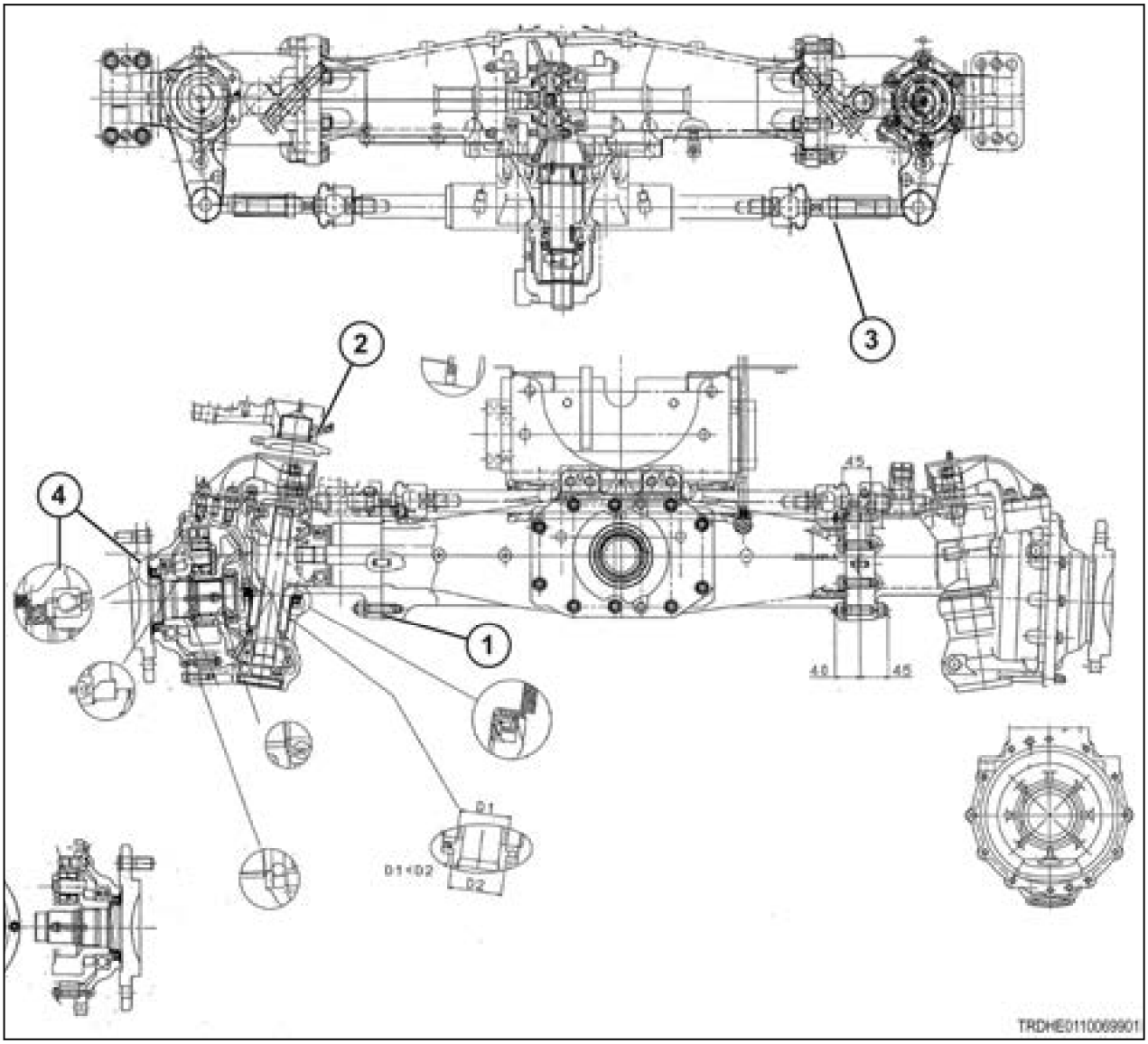


Fig. 148

(1) Use sealant between housing
(2) Note installed direction of the seal
(3) Adjust to 218 mm (8.6 in)-4608/4609/4610 models
(4) install the oil seal with a driver to prevent damage to the seal

10. Assemble the front axle using the information shown.

7.3.1 Battery wiring diagram

Battery wiring diagram
(*) The numbers on the left upper side correspond to the numbers on the connector.

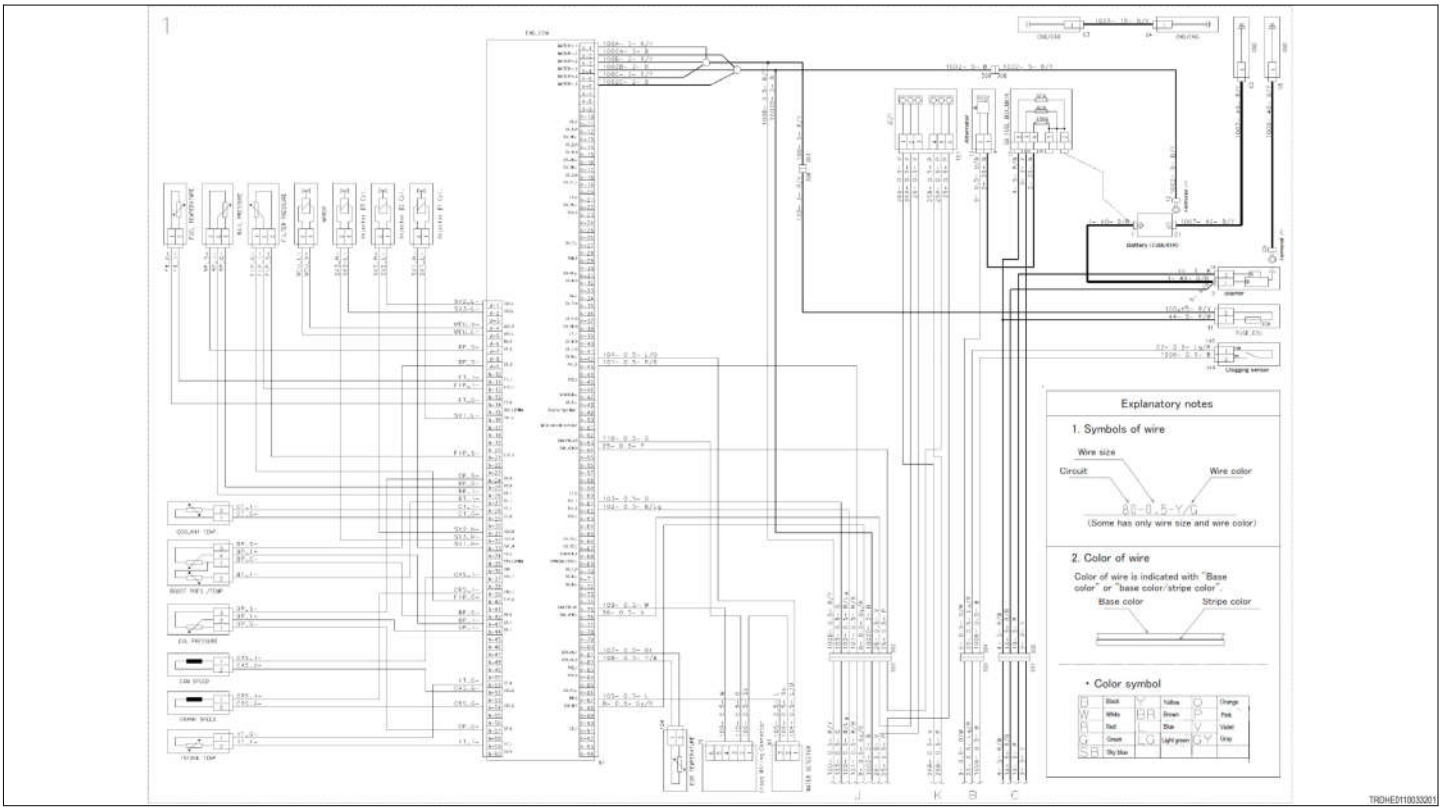


Fig. 1 Battery wiring diagram

(1) Slow-blow fuse
(2) Slow-blow fuse
(3) Compact disc (CD) radio
(4) Blower motor
(5) Blower resister
(6) Blower motor
(7) Air conditioner (A/C) switch
(8) 1.5A rating current
(9) Frost sensor
(10) Pressure switch
(11) Compressor clutch relay
(12) Compressor
(13) 3A rating current
(14) Blower switch
(15) Front wiper relay
(16) Front washer motor
(17) Rear wiper relay (optional)
(18) Rear washer motor (optional)
(19) Front wiper motor
(20) Rear wiper motor (optional)
(21) Left door switch
(22) Dome lamp
(23) Right door switch

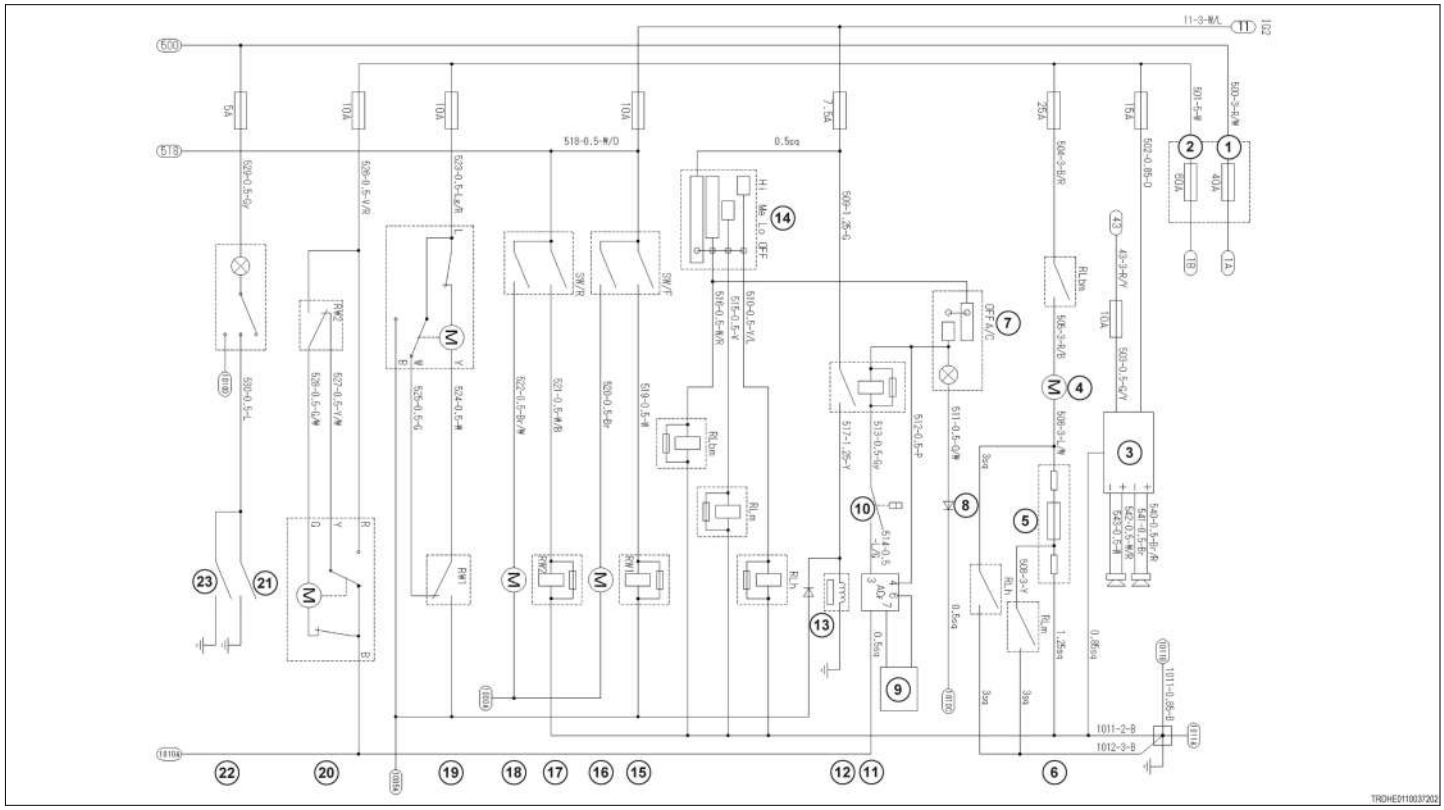


Fig. 9 Cab1 wiring diagram

7.4.5 Instrument panel switch location diagram

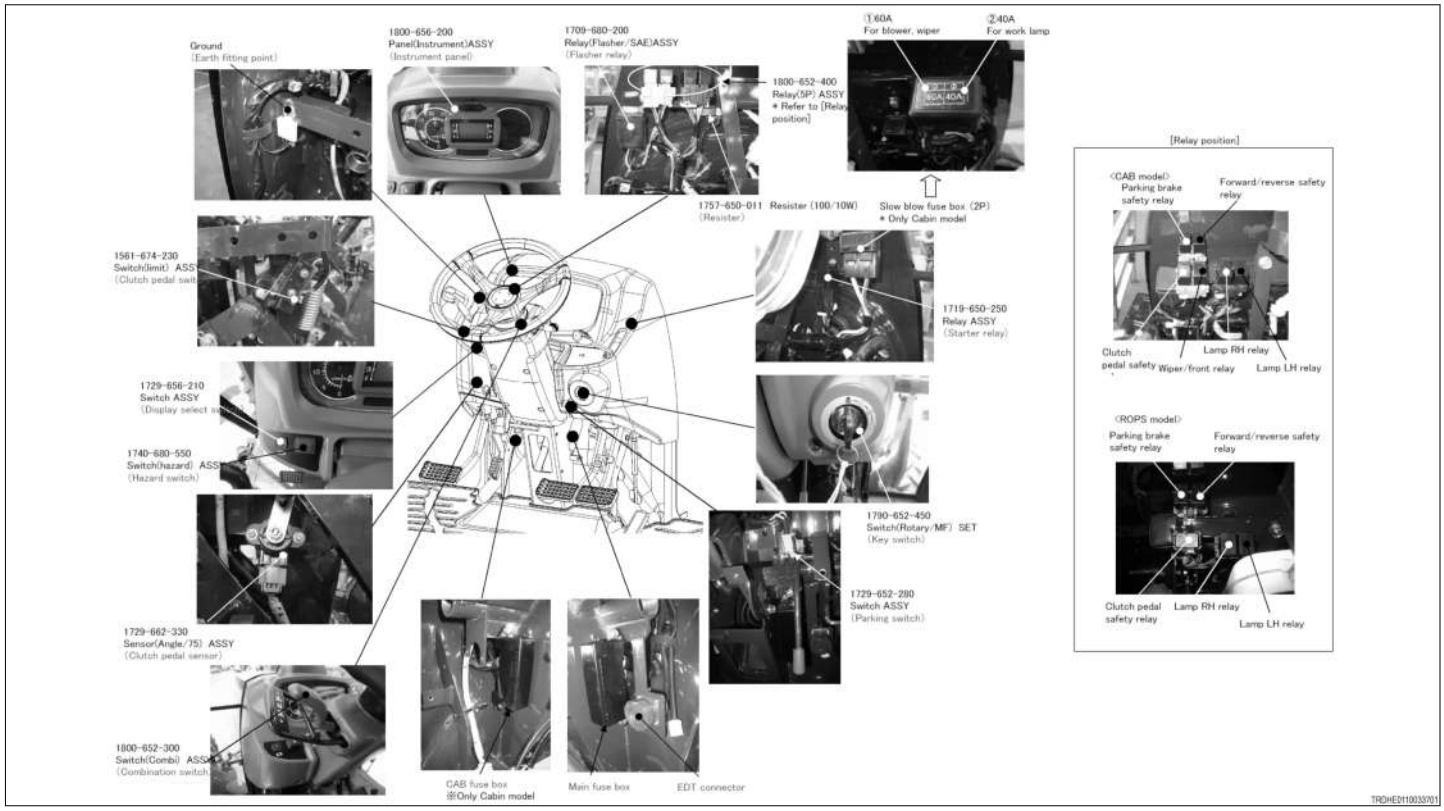


Fig. 17

The pressure port regularly supplies pressure measuring 2 MPa (290 psi) from the reduce valve.

When the power shuttle control proportional pressure valve is driven by an amount of current (1.4A) that is equivalent to the maximum pressure, the reduce valve applies pressure to the pilot spool to close the relief valve.

This is to stop the flow of fluid from the relief valve to the tank when the proportional pressure valve is not in operation.

The forward and reverse solenoids are not in operation. The reverse switch spool blocks the pressure from the reduce valve, therefore no pressure is supplied to the clutch side.

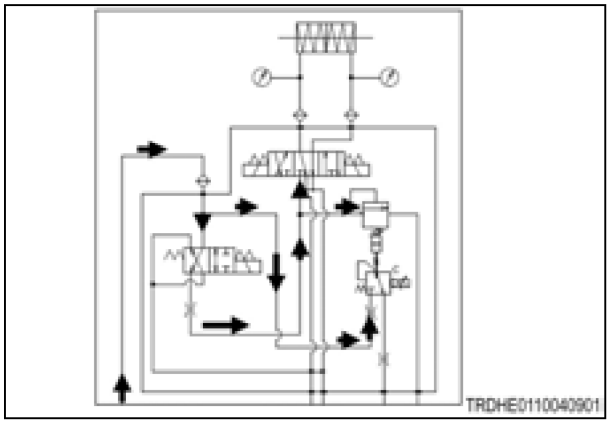


Fig. 27

Forward solenoid on

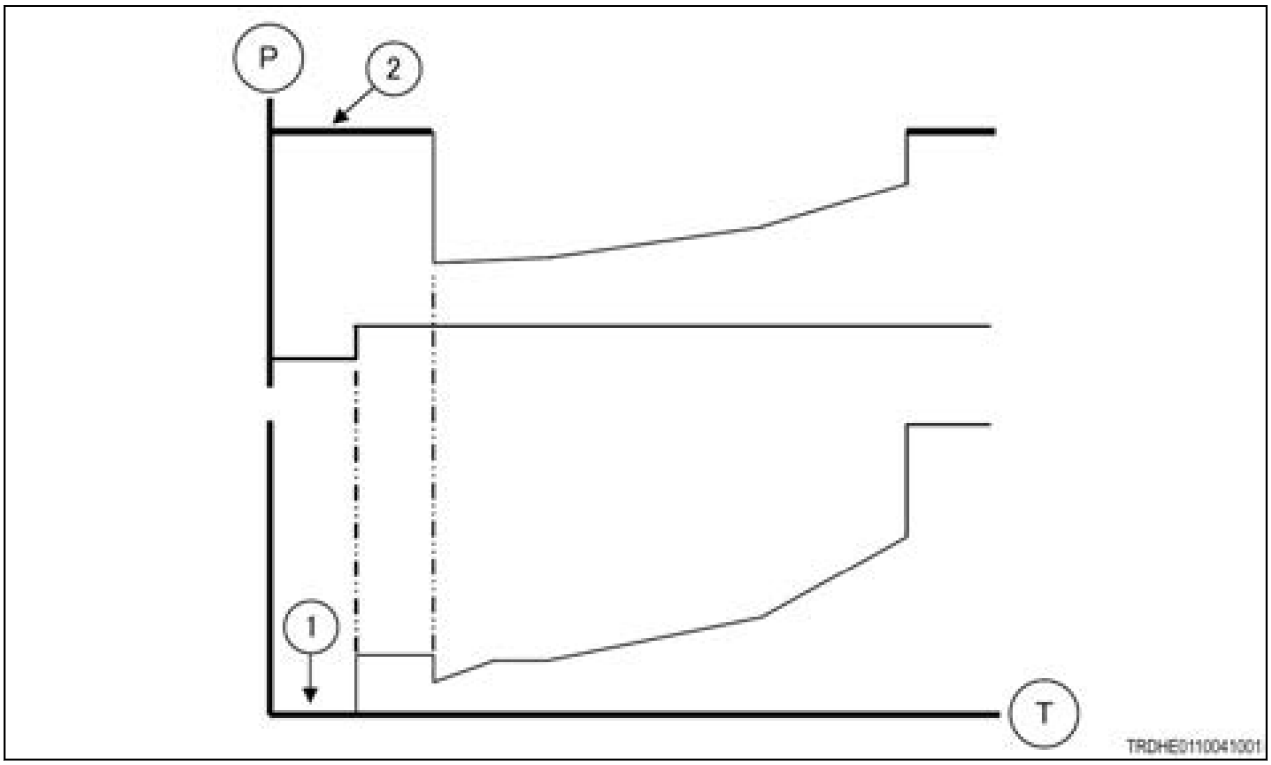


Fig. 28

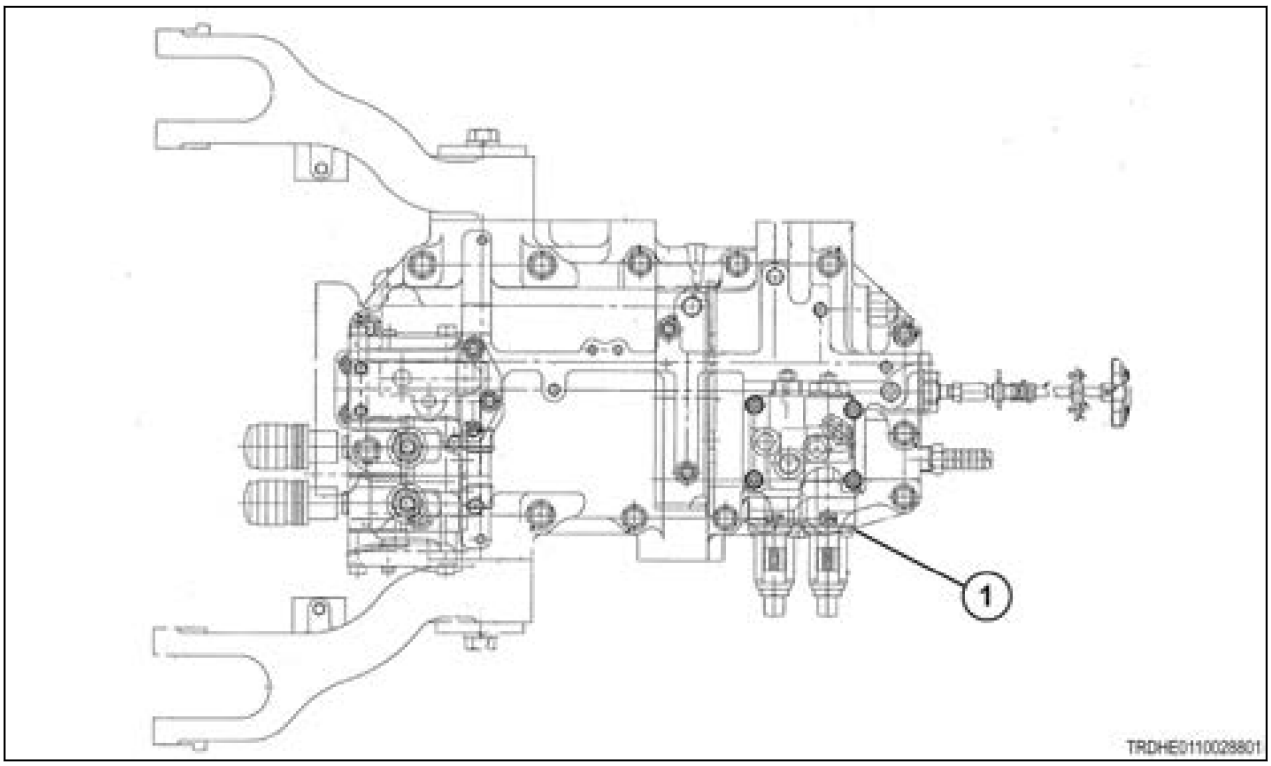
(1) Time after engine startup (neutral)

(2) Pressure control valve control current 1.6A

(1) Forward/reverse solenoid valve

(2) High-Low solenoid valve (P1 model)

Solenoid valve



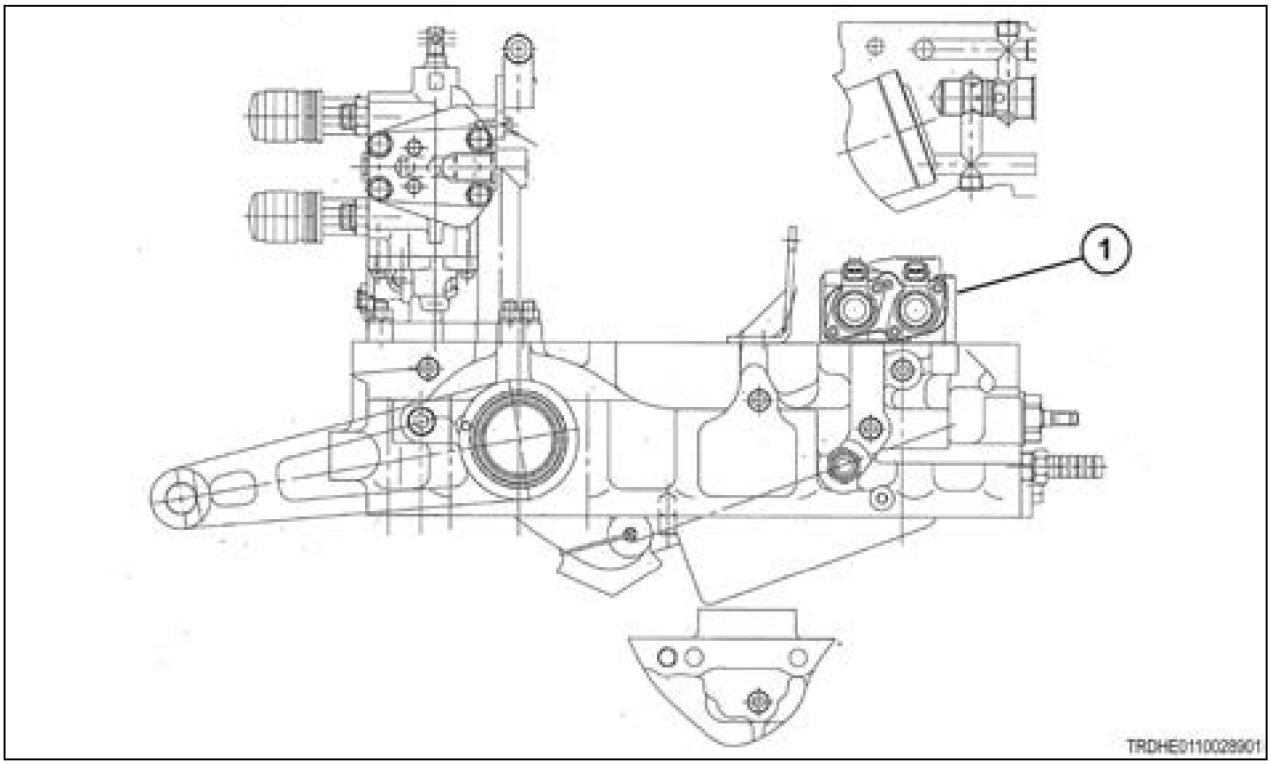


Fig. 46

(1) Three-point hitch solenoid valve

10. Complete the following within ten seconds.
   a) Turn the main switch from "STOP" to "ON".
   b) Turn the depth dial clockwise until the depth dial stops.
   c) Turn the depth dial counterclockwise until the depth dial stops.
   d) Turn the depth dial clockwise until the depth dial stops.

   Result

   If the adjustment is correct, the lift lamp will illuminate one time. If the lift lamp flashes continuously, the adjustment has failed.

11. Turn the main switch to "STOP".

12. Repeat the procedure if the adjustment fails.

13. Install the check fuse when the adjustment is correct.

Fig. 61

7.7.2 Lift arm and draft sensor

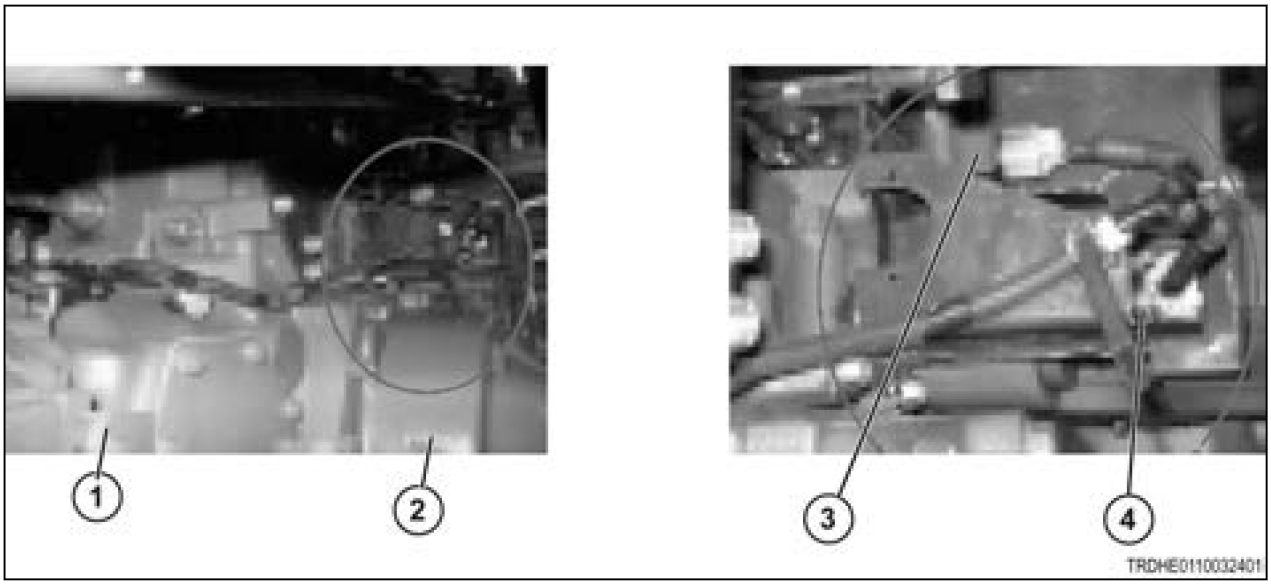


Fig. 62

(1) Transmission case
(2) Left-hand axle housing
(3) Draft sensor
(4) Lift arm sensor

7.7.18 Throttle lever

(1) Dash cover
(2) Throttle lever

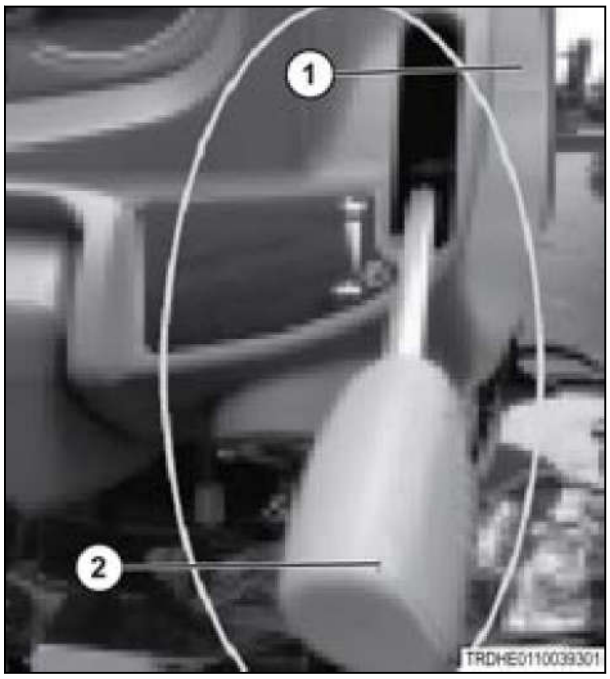


Fig. 80

7.7.19 Instrument panel

Fig. 81

Position lever sensor, lift arm sensor and draft sensor

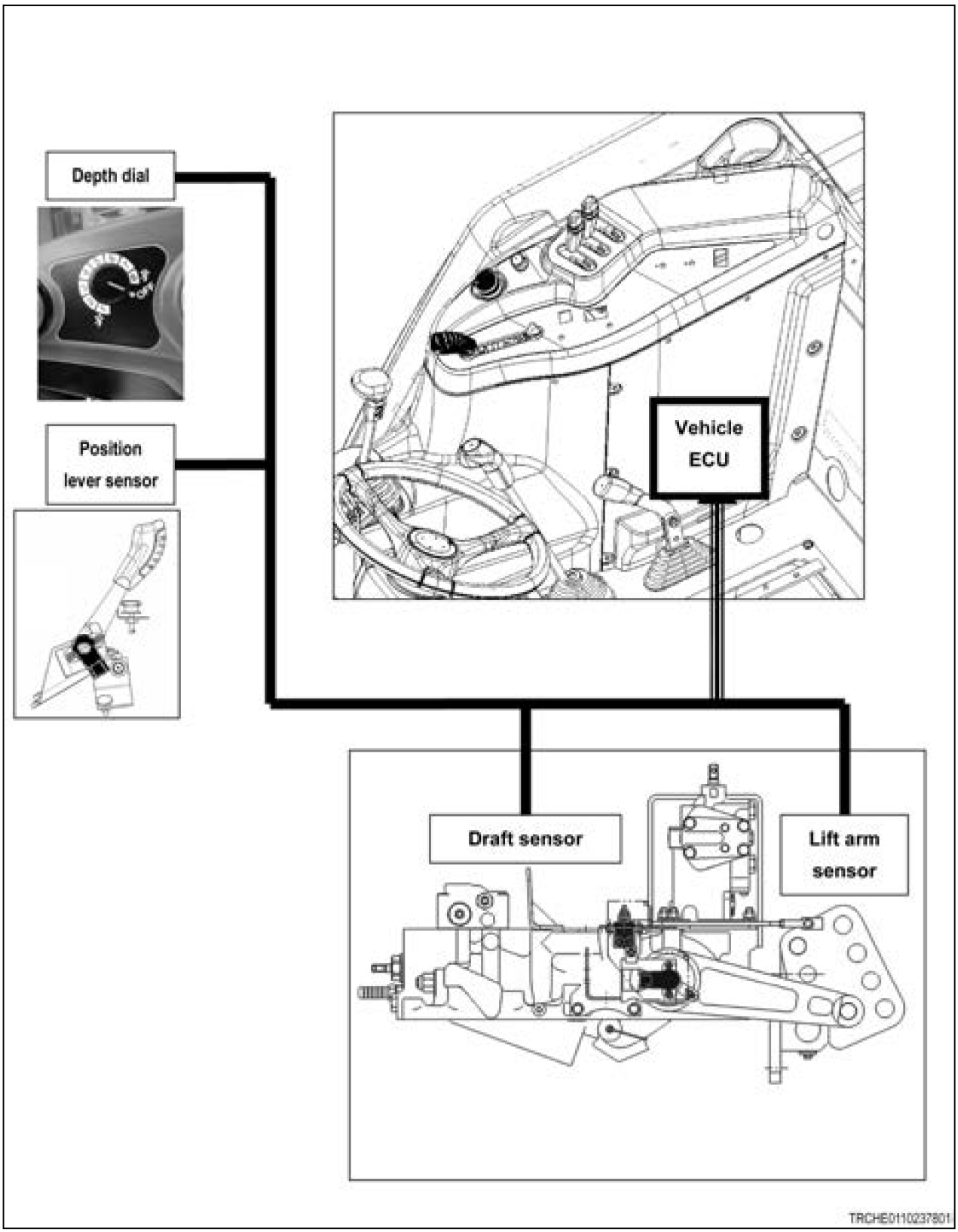


Fig. 86

Schematic legend	
Term	**Term description**
Depth dial	Depth dial
Position lever sensor	Position lever sensor
Vehicle ECU	Vehicle Electronic Control Unit
Draft sensor	Draft sensor
Lift arm sensor	Lift arm sensor

7.12.5 SPN 1002 FMI 2

The lift arm sensor is above the normal operating range. Fault value: 1016 to 1023. Standard Value 200 to 823.

Common failures

- Short circuit in the 12V power supply line and signal line.
- Short circuit in the 5V power supply line and signal line.
- Sensor failure.
- Sensor mounting bracket needs adjustment.

Diagnosis and solution

Use a digital multimeter for measurements in the test procedures.

1. Check for power at the sensor.
   a. Turn the key start switch and the battery disconnect switch to the on position.
   b. Measure for the correct signal at the signal line..

   Expected result: The signal is correct.

   Result:
   - Yes - the signal is correct.

     Go to see *step 2*.
   - No - the signal is not correct.

     Repair or replace the machine harness.

     Stop.
2. Check the signal wire for a short to 5V supply line.
   a. Remove the connector from the sensor.
   b. Check for continuity between the 5V supply line and the signal wire.

   Expected result: No continuity is found.

   Result:
   - Yes - no continuity is found. The circuit is correct.

     Go to see *step 3*.
   - No - continuity is found.

     Repair or replace the machine harness.

     Stop.

3. Check the sensor.
   a. Check the sensor for correct operation.

   Expected result: The sensor is correct.

   Result:
   - Yes - the sensor is correct.

     Go to see *step 4*.
   - No - the sensor has failed.

     Replace the sensor.

     Stop.
4. Check the sensor mounting bracket/arm.
   a. Make sure the sensor mounting bracket/arm is not damaged or bent.

   Expected result: The sensor mounting bracket/arm is correct.

   Result:
   - Yes - the mounting bracket/arm is correct.

     Go to see *step 5*.
   - No - the sensor mounting bracket/arm has failed.

     Repair or replace the sensor mounting bracket/arm as needed.

     Stop.
5. Check if the diagnostic code remains.
   a. Inspect the contacts of the harness connectors and clean the connectors.
   b. Connect all harness connectors.
   c. Turn the battery disconnect switch and the key start switch to the on position.
   d. Operate the machine.
   e. Check the status of the diagnostic code.

   Expected result: The diagnostic code is not active.

   Result:
   - Yes - the diagnostic code is not active. The diagnostic code does not exist.

     The initial diagnostic code was most likely caused by a poor electrical connection or a short at one of the harness connectors. Resume normal machine operation.
   - No - the diagnostic code is active. The diagnostic code has not been corrected. Failure of the ECM is possible but not common.

     Exit the procedure and perform the procedure again. If the cause of the diagnostic code is not found, replace the ECM.

     Stop.

2. Check the transmission oil temperature sensor signal wire for a short to ground.
   a. Remove the connector from the sensor.
   b. Check for continuity between the signal wire and the ground wire.

   Expected result: No continuity is found.

   Result:

   - Yes - no continuity is found. The ground circuit is correct.

     Go to see *step 3*.
   - No - continuity is found.

     Repair or replace the machine harness.

     Stop.
3. Check the clutch pedal sensor signal wire for a short to ground.
   a. Remove the connector from the sensor.
   b. Check for continuity between the signal wire and the ground wire.

   Expected result: No continuity is found.

   Result:

   - Yes - no continuity is found. The ground circuit is correct.

     Go to see *step 4*.
   - No - continuity is found.

     Repair or replace the machine harness.

     Stop.
4. Check the sensor.
   a. Check the sensor for correct operation.

   Expected result: The sensor is correct.

   Result:

   - Yes - the sensor is correct.

     Go to see *step 5*.
   - No - the sensor has failed.

     Replace the sensor.

     Stop.
5. Check if the diagnostic code remains.
   a. Inspect the contacts of the harness connectors and clean the connectors.
   b. Connect all harness connectors.
   c. Turn the battery disconnect switch and the key start switch to the on position.
   d. Operate the machine.
   e. Check the status of the diagnostic code.

   Expected result: The diagnostic code is not active.

   Result:

   - Yes - the diagnostic code is not active. The diagnostic code does not exist.

     The initial diagnostic code was most likely caused by a poor electrical connection or a short at one of the harness connectors. Resume normal machine operation.
   - No - the diagnostic code is active. The diagnostic code has not been corrected. Failure of the ECM is possible but not common.

     Exit the procedure and perform the procedure again. If the cause of the diagnostic code is not found, replace the ECM.

     Stop.

Pressure switch relay, solenoid valve function;
clutch pedal switch function

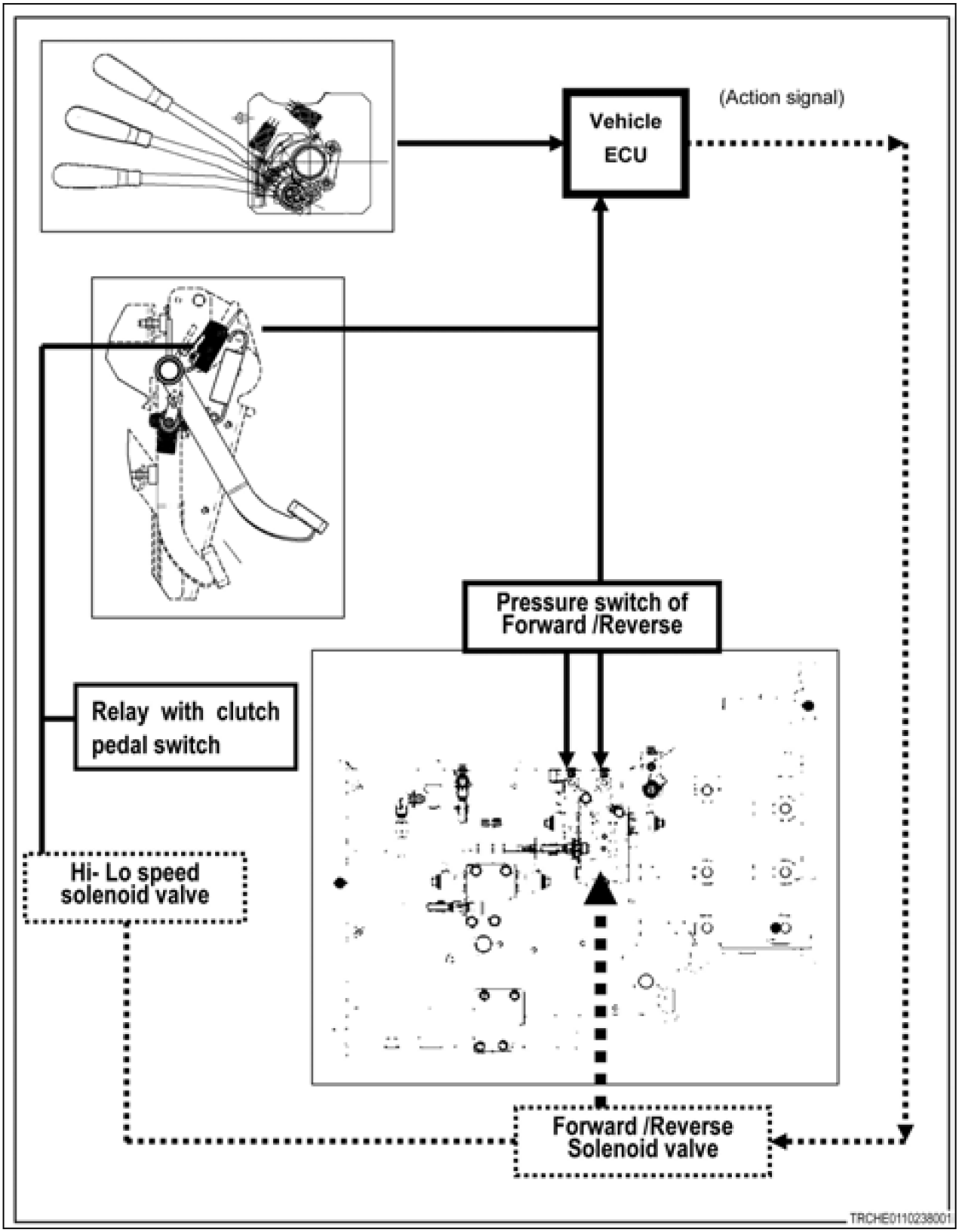


Fig. 101

Schematic legend	
Term	**Term description**
Vehicle ECU	Vehicle Electronic Control Unit
Pressure switch of Forward/Reverse	Forward/reverse pressure switch
Relay with clutch pedal switch	Clutch pedal switch relay
Hi-Lo speed solenoid valve	High/Low speed solenoid valve
Forward/Reverse Solenoid Valve	Forward/reverse solenoid valve

7.12.20 SPN 3156 FMI 09

The clutch pedal relay is on for more than one second when the clutch pedal switch is off.

Common failures

- Clutch pedal relay has failed.
- Clutch pedal switch has failed.
- There is an open in the clutch pedal switch signal line.
- There is a short between ground and the clutch pedal relaysignal line.

Diagnosis and solution

Use a digital multimeter for measurements in the test procedures.

1. Check the clutch pedal relay for a short.
   a. Check the clutch pedal relay for a short.

   Expected result: The relay is correct.

   Result:
   - Yes - the relay is correct.

     Go to see *step 2*.
   - No - the relay is not correct.

     Replace the relay.

     Stop.
2. Check for an open in the clutch pedal switch.
   a. Check the clutch pedal switch for an open.

   Expected result: The switch is correct.

   Result:
   - Yes - the switch is correct.

     Go to see *step 3*.
   - No - the switch is not correct.

     Replace the switch.

     Stop.

3. Check the pressure control solenoid wiring at the forward and reverse valve.
   a. Check the pressure control solenoid wiring at the forward and reverse valve.

   Expected result: The wiring is good.

   Result:

   - Yes - the wiring is good.

     Go to see *step 4*.
   - No - the wiring has failed.

     Repair or replace the machine harness.

     Stop.
4. Check the forward and reverse valve.
   a. Check the forward and reverse valve for proper operation.

   Expected result: The forward and reverse valve is correct.

   Result:

   - Yes - the valve is correct.

     Go to see *step 5*.
   - No - the valve has failed.

     Replace the valve.

     Stop.
5. Check the forward and reverse clutch.
   a. Check the forward and reverse clutch for proper operation.

   Expected result: The forward and reverse clutch is correct.

   Result:

   - Yes - the clutch is correct.

     Go to see *step 6*.
   - No - the clutch has failed.

     Replace the clutch.

     Stop.
6. Check if the diagnostic code remains.
   a. Inspect the contacts of the harness connectors and clean the connectors.
   b. Connect all harness connectors.
   c. Turn the battery disconnect switch and the key start switch to the on position.
   d. Operate the machine.
   e. Check the status of the diagnostic code.

   Expected result: The diagnostic code is not active.

   Result:

   - Yes - the diagnostic code is not active. The diagnostic code does not exist.

     The initial diagnostic code was most likely caused by a poor electrical connection or a short at one of the harness connectors. Resume normal machine operation.
   - No - the diagnostic code is active. The diagnostic code has not been corrected. Failure of the ECM is possible but not common.

     Exit the procedure and perform the procedure again. If the cause of the diagnostic code is not found, replace the ECM.

     Stop.

8.1.1 Hydraulic schematic

Hydraulic schematic

(1) Safety valve
(2) Main cylinder
(3) Slow return valve
(4) Lift valve housing
(5) External Auxiliary Cylinder
(6) Main relief valve
(7) Joy stick valve
(8) Bucket cylinder
(9) Boom cylinder
(10) Priority valve
(11) Reduce valve
(12) Sub pump
(13) Main pump
(14) High-low clutch
(15) Suction filter
(16) Orbital roll
(17) Power steering
(18) Power takeoff (PTO) clutch
(19) L/C filter
(20) Power shuttle valve
(21) Oil cooler
(22) PTO valve
(23) Power shuttle clutch
(24) Relief valve
(25) Pressure proportional valve for the power shuttle
(26) Pressure proportional valve for the PTO

8.5 Suction filter

Suction filter components

Fig. 7

(1) Engine
(2) Main pump
(3) Sub pump
(4) Suction filter

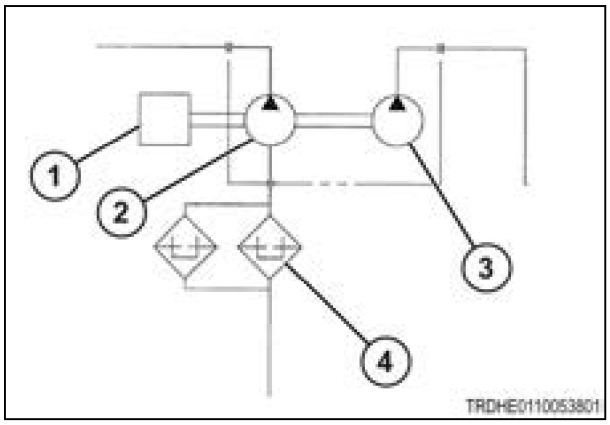


Fig. 8 Filter circuit

- Out
- Magnet
- Paper filter
- Punching metal
- In

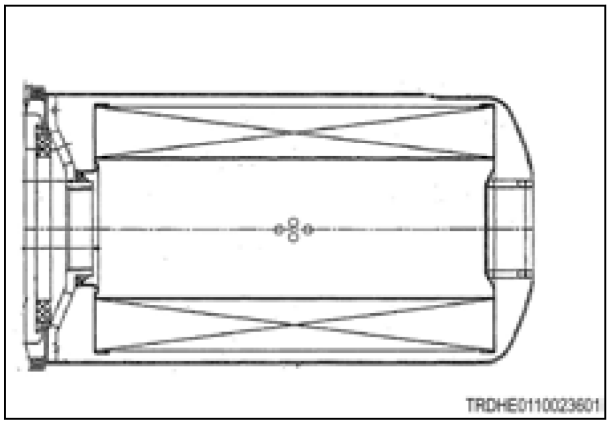


Fig. 9 Components and hydraulic diagram

8.5.1 Suction filter specifications

Filtration size: 10 micron

Filtration area: 6220 cm² (964 in²)

8.8 Valves

8.8.1 Main relief valve

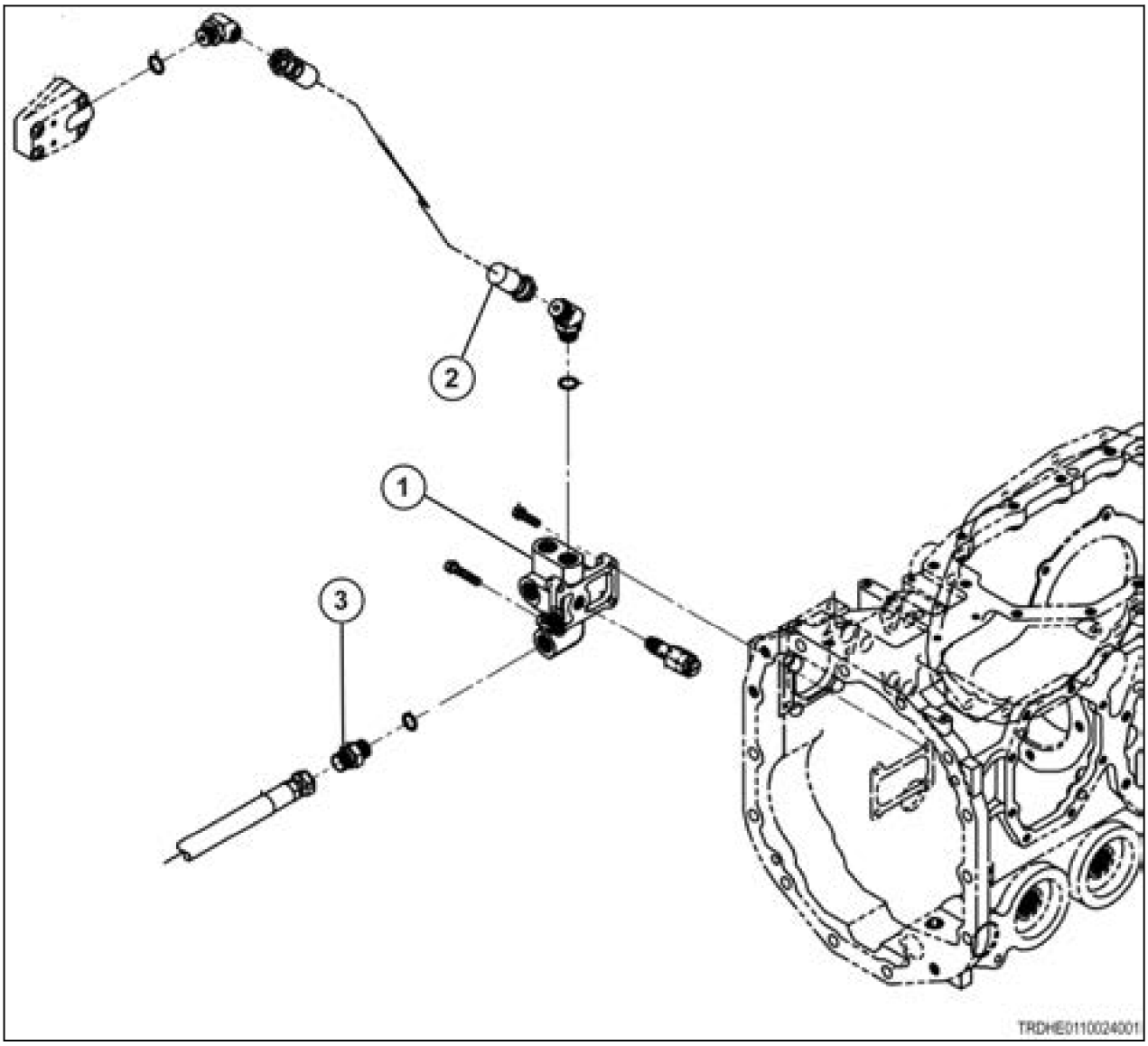


Fig. 25

(1) Relief valve housing
(2) Delivery hose to the rear remotes
(3) Input hose from the main hydraulic pump

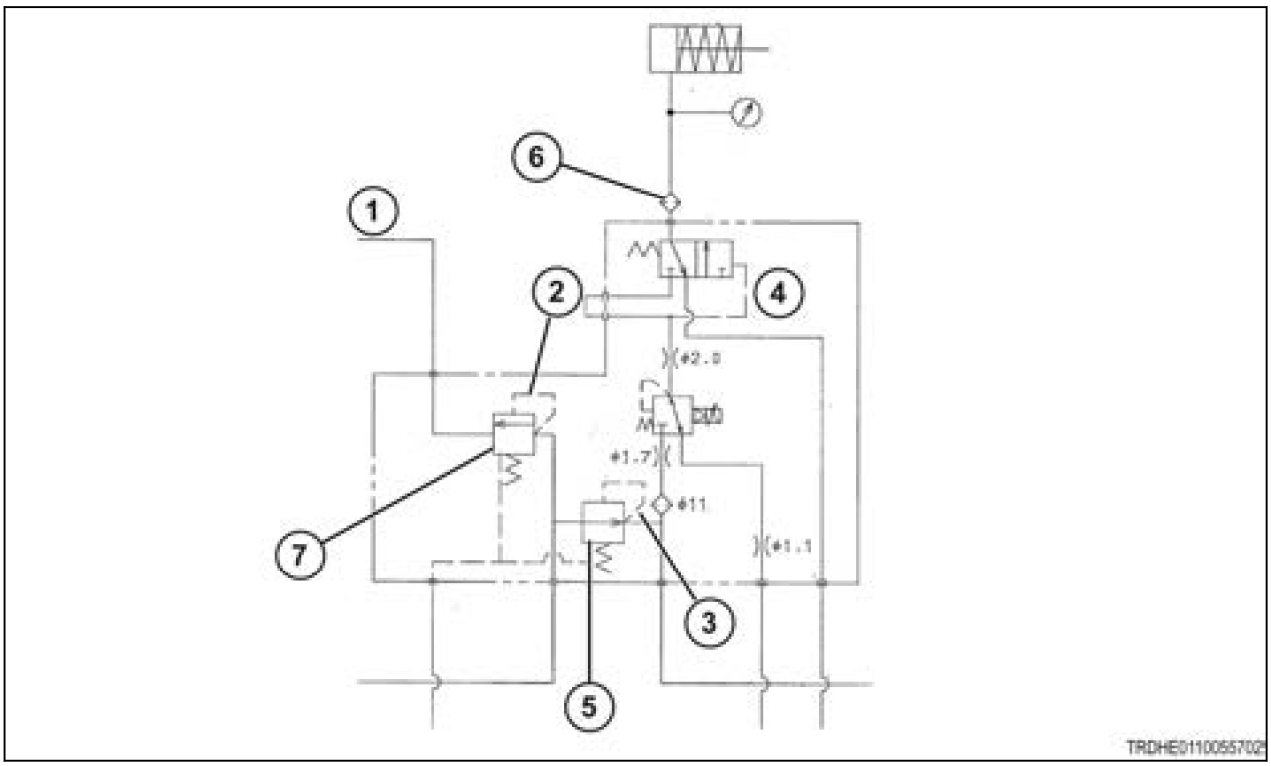


Fig. 39

Reduce valve circuit

(1) To orbit roll
(2) Power takeoff (PTO) clutch engaging oil
(3) Reduce/PTO valve housing
(4) Oil to the control valve
(5) Reduce valve
(6) L/C filter
(7) Steering priority valve

Joystick valve circuit

(1) Bucket

(2) Boom

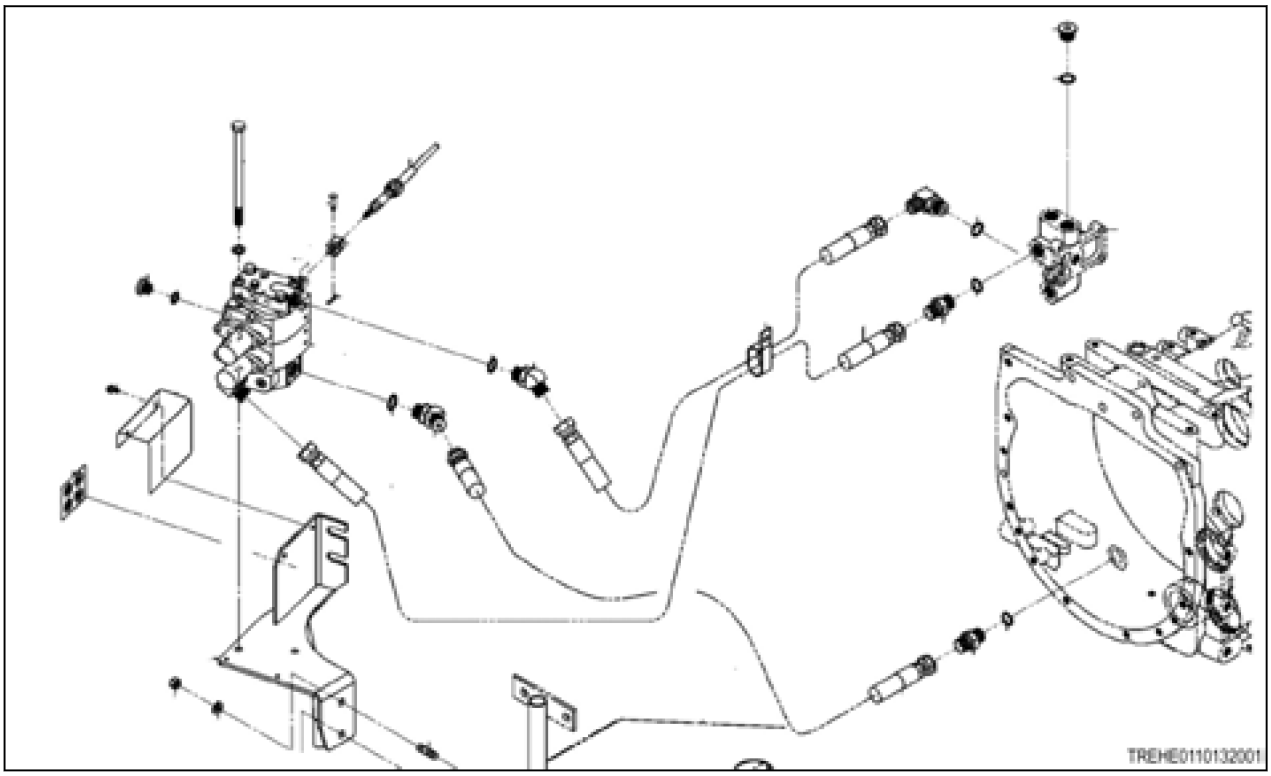


Fig. 52

Quick coupler of the front loader

Neutral

When the spool is in the neutral position, the hydraulic circuit between port (P) and port (N) is open. Port (P2) does not connect with ports (A) and (B).

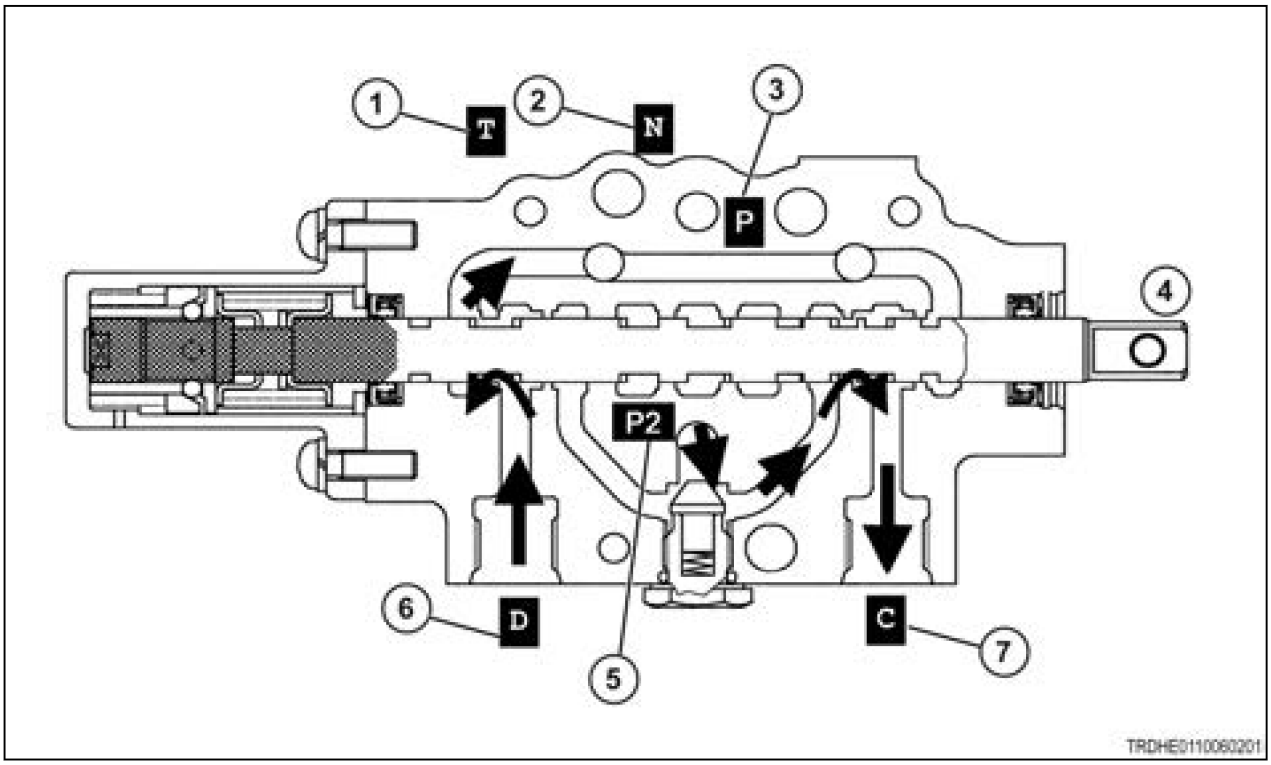


Fig. 68

When the shifting lever is in the bucket position, pressure will decrease.

The check valve prevents the bucket from lowering.

The hydraulic circuit between port (P) and port (N) is closed.

Fluid from port (P2) pushes the check valve and goes to port ©).

Fluid inside port (D) goes to the tank.

Front loader with the bucket.

Adjust the quantity of the fluid by adjusting the spool notch and the joystick lever.

The joystick lever will return to the neutral position by a return spring when released.

(1) T
(2) N
(3) P
(4) Neutral position
(5) P2
(6) D
(7) C

8.9.4 Auxiliary hydraulic valves

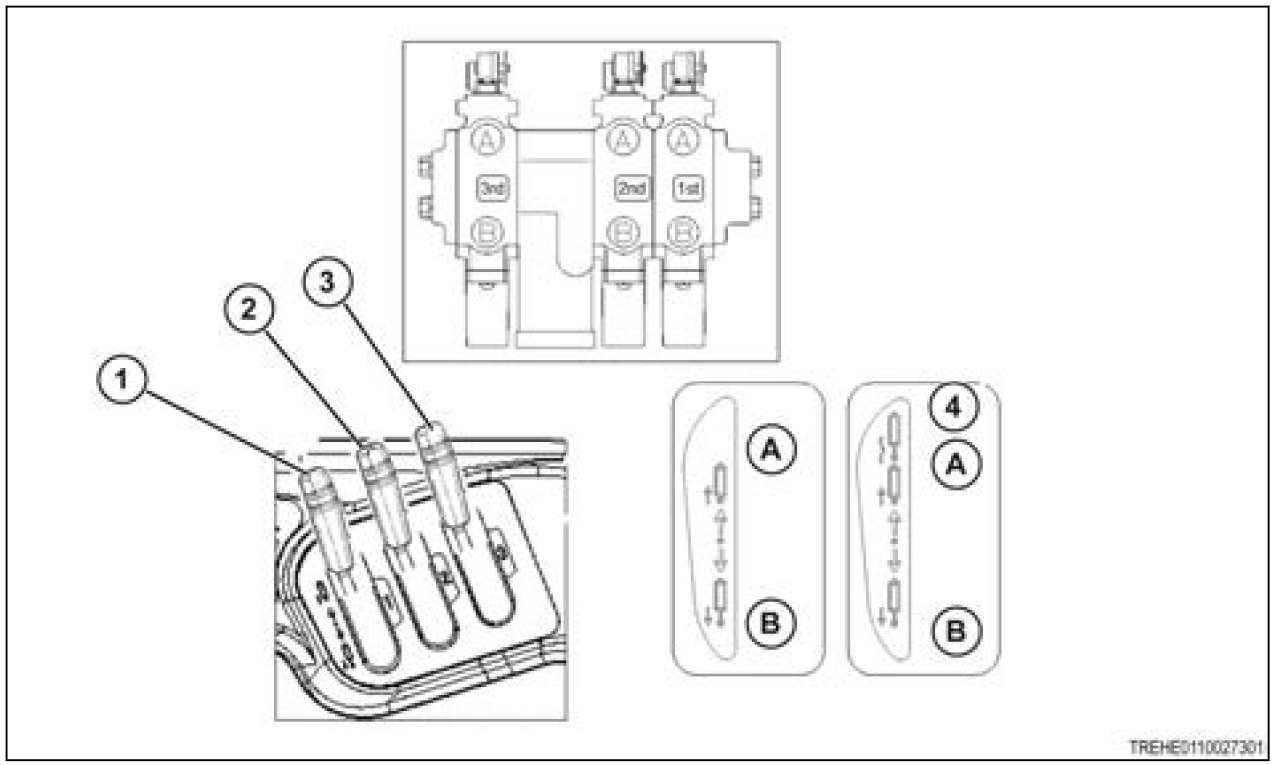


Fig. 82

The 4600 series is equipped with one or two auxiliary hydraulic valves. The 4600 series can be installed with an optional third auxiliary hydraulic valve.

(1) First position
(2) Second position
(3) Third position
(4) Flow lock
(A) Port A
(B) Port B

			Lever position						Lever position		
First, second (standard) three position standard valve	Double action	Port A	Return	Supply	-	Third (optional) three position standard valve	Double action	Port A	Return	Supply	-
		Port B	Supply	Return	-			Port B	Supply	Return	-
			Lever position						Lever position		
Third (optional) four position free	Double action	Port A	Return	Supply	Return	Third (optional) four position kick out and free	Double action	Port A	Return	Supply	Return
		Port B	Supply	Return	Return			Port B	Supply	Return	Return

Bucket (dump)

Shift the joystick lever to the outside.

The main spool will move forward.

The front loader arm will be down.

The front loader will dump.

The joystick lever, when released, will return to the neutral position by the return spring. The front loader will stop.

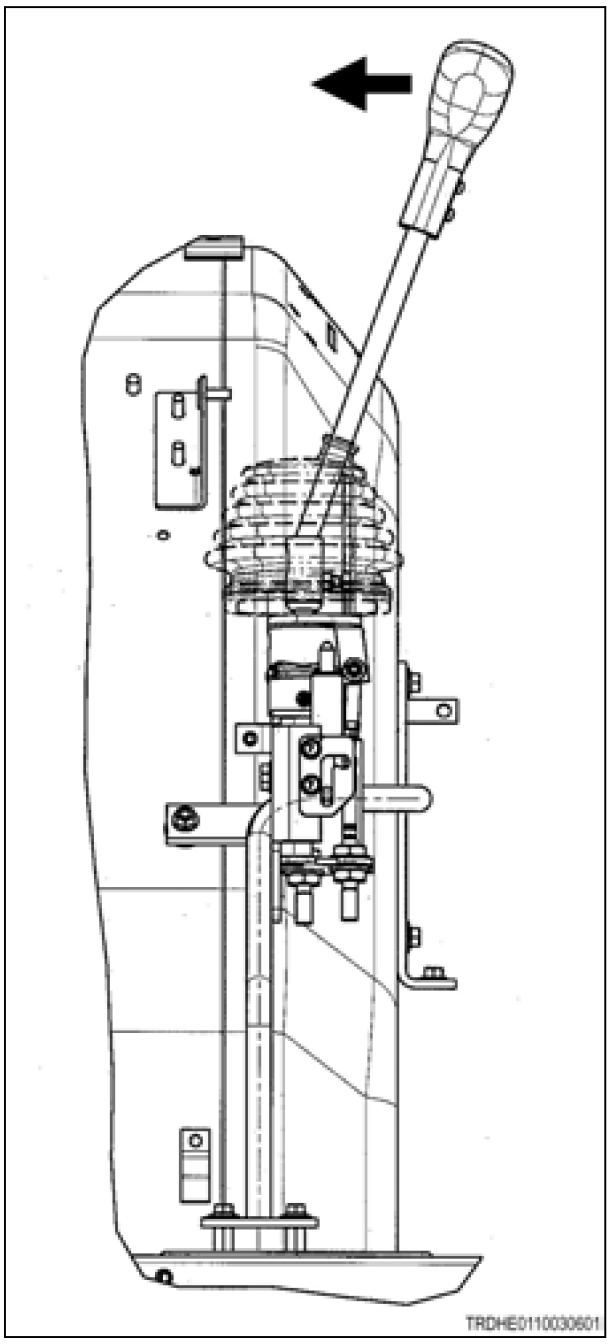


Fig. 91

Problem	Possible cause	Correction
	Seized lift shaft.	Apply grease and repair or replace bushing and shaft if necessary.
	Stuck poppet of slow - return check valve.	Clean poppet.
	Broken control valve.	Disassemble and clean, or replace assembly.
When the hydraulic control lever is raised, the relief valve beeps.	Insufficiently lowered control lever.	Lower lever completely.
	Closed flow control valve.	Open valve.
	Check valve lever stopper out of adjustment.	Adjust lever stopper guide position.
	Poor link mechanism.	Inspect, adjust, repair, and/or replace the link mechanism.
Fluid overheating.	Excessively high working pressure.	Inspect and adjust.
	Wrong viscosity of working fluid.	Replace with proper fluid.
	Insufficient fluid.	Fill to proper level.
	Internal friction of pump is to high.	Replace the fluid.
Pump noise.	Partially clogged suction - filter or suction piping.	Clean.
	Air inhaled through suction piping connections.	Inspect and tighten.
	Air inhaled through intake pipe connection for the pump.	Inspect and tighten.
	Pump cover bolts are loose.	Inspect and tighten.
	Trapped foreign matter.	Disassemble and clean.
Excessive wear, deflection, or damage to the pump.	Dirty fluid.	Eliminate foreign matters, inspect filters, and replace fluid.
	Circuit pressure exceeds pump capacity.	Adjust the relief valve or replace if necessary.
Oil leaks outside pump.	Broken or stressed oil seal or O-ring.	Replace.
Oil leaks from piping or joints.	Poorly connected piping.	Inspect, clean, and eliminate dust. Repair flaws with oilstone. Tighten.
	Poor O-rings.	Replace.
	Broken piping.	Replace with a new piping after washing related parts clean.
	Poor oil seal.	Replace the oil seal or bushing if necessary.

	Fault description	SPN	FMI
Fuel filter pressure	The main fuel filter inlet pressure sensor voltage is below normal	000094	04
	The main fuel filter inlet pressure sensor voltage is above normal or open circuit	000094	03
	The main fuel filter inlet pressure is above normal	000094	16
	The main fuel filter inlet pressure below normal	000094	18
	The main fuel filter inlet pressure is out of safe operating range and the alarm will actuate	000094	31
Electronic Control Unit (ECU) temperature	The ECU temperature sensor voltage is above normal or open circuit	001136	03
	The ECU temperature sensor voltage is below normal	001136	04
Ambient pressure	The ambient pressure sensor voltage is below normal	000108	04
	The ambient pressure sensor voltage is above normal or open circuit	000108	03
CAN BUS	Bus off Vehicle CAN (250k)	000639	19
	Bus off Engine CAN (1M)	520201	19
	Torque/Speed Control (TSC1) timeout	003349	08
	ECU internal fault 0132	520297	31
	ECU internal fault 0133	520298	31
5Vdc reference supplies	5Vdc Supply 1 voltage is out of range	003509	31
	5Vdc Supply 2 voltage is out of range	003510	31
	5Vdc Supply 3 voltage is out of range	003511	31
12V supply	12V sensor supply 1 voltage is above normal	003512	03
	12V sensor supply 1 voltage is below normal	003512	04
	Internal 12V supply voltage is above normal	001043	03
	Internal 12V supply voltage is below normal	001043	04
Main relay	Main relay early opening at previous afterrun	001485	31
	ECU internal fault 0100	001485	11

Fault Codes

3.1 SPN 100, FMI 1, Oil pressure LOW, ALARM

Description

The measured oil pressure is below the alarm limit. The low oil pressure signal may be caused by the following reasons:

- The engine oil level is too low
- The oil quality is poor
- The oil filter is clogged
- The oil grade is not correct
- The oil is too hot
- The oil is diluted by fuel
- The oil pressure control valve is not operating correctly
- The oil pump has excessive wearing
- The oil pressure sensor wiring is defective
- The oil pressure sensor is defective

Reaction in EEM

FC is stored and oil pressure warning lamp is activated. The engine will stop after 30 seconds. CAN message indicate, that shutdown is pending.

Solution

Find the cause for the low oil pressure indication. Check and repair the possible mechanical problems according to the service instructions:

- Check the oil level and condition of oil
- Check the oil filter
- Check mechanical condition of the engine

To check the electrical defects, check the oil pressure sensor, the sensor wiring and the controller input: First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Check the oil pressure sensor wiring, connectors and contact surfaces of the connector pins (possible oxidation).(see *Oil pressure sensor* (page 157))

- Check the solenoid valve wiring, connector and contact surfaces of the connector pins (possible oxidation).
- Measure low side from wiring terminal to engine ground, to see if there is short circuit to ground.
- Check the operation with another MPROP solenoid valve to see if solenoid valve is defective.

3.20 SPN 1076, FMI 5, MPROP control, Low side short circuit to HIGH SOURCE

Description

The EEM4 system has detected short circuit to battery on high pressure pump control (MPROP) low side. Possible causes are:

- The solenoid valve connector is defective
- The solenoid valve wiring is defective
- The solenoid valve is defective

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Check the solenoid valve wiring, connector and contact surfaces of the connector pins (possible oxidation).
- Measure low side from wiring terminal to engine ground, to see if there is short circuit to battery.
- Check the operation with another MPROP solenoid valve to see if solenoid valve is defective.

3.21 SPN 1076, FMI 6, MPROP control, High side short circuit to GROUND

Description

The EEM4 system has detected short circuit to ground on high pressure pump control (MPROP) High side. Possible causes are:

- The solenoid valve connector is defective
- The solenoid valve wiring is defective
- The solenoid valve is defective

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Check the solenoid valve wiring, connector and contact surfaces of the connector pins (possible oxidation).
- Measure high side from wiring terminal to engine ground, to see if there is short circuit to battery.

- Change the both/all fuel filter elements (and tank vent filter) according to the fuel filter service instructions.
- If the filter service does not remove the issue, the restriction/too low pressure is caused by fuel line.

NOTE: If the error code occurs in cold climate/weather, make sure the tank is filled with winter grade diesel fuel!

- Check the fuel supply pump pressure sensor wiring, connectors and contact surfaces of the connector pins (possible oxidation).(see *Fuel supply pump inlet pressure sensor* (page 173))
- Check the 5 V power supply to the sensor.(see *Fuel supply pump inlet pressure sensor* (page 173))
- Check the operation with another pressure sensor to see if fuel filter pressure sensor is defective.(see *Fuel supply pump inlet pressure sensor* (page 173))

3.42 SPN 94, FMI 3, Fuel supply pump inlet pressure sensor voltage above normal or open circuit.

Description

The measured fuel supply pump pressure signal is above the normal operating range (> 4,7 V) or open circuit. Possible causes are:

- The fuel supply pump pressure sensor wiring is defective
- The fuel supply pump pressure sensor power supply is not correct
- The fuel supply pump pressure sensor is defective

Reaction in EEM

FC is stored and warning lamp is activated. Engine power will be reduced (Degradation Level 1). CAN message indicate active fault. Engine functions dependent on the fuel supply pump pressure are not active.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Check the fuel supply pump pressure sensor wiring, connectors and contact surfaces of the connector pins (possible oxidation).(see *Fuel supply pump inlet pressure sensor* (page 173))
- Check the 5 V power supply to the sensor.(see *Fuel supply pump inlet pressure sensor* (page 173))
- Check the operation with another pressure sensor to see if fuel filter pressure sensor is defective.(see *Fuel supply pump inlet pressure sensor* (page 173))

3.43 SPN 94, FMI 4, Fuel supply pump inlet pressure sensor voltage below normal.

Description

The measured fuel supply pump pressure signal is below the normal operating range (< 0,4 V). Possible causes are:

- The fuel supply pump pressure sensor wiring is defective
- The fuel supply pump pressure sensor power supply is not correct

- The pressure relief valve is not working properly(leakage)
- The high pressure pump is not working properly
- MPROP solenoid valve in the high pressure pump is not working properly(defective)
- There is a leakage at high pressure side(external leakage)
- The rail pressure sensor wiring is defective

Reaction in EEM

FC is stored and warning lamp is activated. Engine power is heavily reduced (Degradation Level 3). CAN message indicate active fault. Engine functions dependent on rail pressure are not active.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Stop the engine. Check visually the engine high pressure pipes etc. for possible leakage.
- Check the rail pressure sensor wiring, connectors and contact surfaces of the connector pins (possible oxidation). (see *Rail pressure sensor* (page 169))
- Check the 5 V power supply to the sensor. (see *Rail pressure sensor* (page 169))
- Check the operation with another rail pressure sensor to see if sensor is defective.
- Check the pressure relief valve visually, in case of inpurities. If there are impurities, clean the valve or replace with new. Thighten the valve according service manual.
- Check the nozzles operation with Service Tool test function or have the injectors inspected by an authorized Bosch service dealer.
- Check the high pressure pump operation with Service Tool test function. If test results are showing leakage at high pressure pump, defective part can be high pressure pump or MPROP solenoid valve.
- In case of damaged injector,pressure relif valve, high pressure pipe, rail pressure sensor or wiring harness, replace damaged parts according service manual.

Solution2: valid only for 4-valve engines.

- Check the tightness of injectors side feed pipes. See correct tightening torque and operating instructions from engine repair manual.
- Check the ECU operation with another EEM4 controller. If the system is functional and the fault is not active with the replacement ECU, then the original ECU is defective.

3.57 SPN 157, FMI 4, Rail pressure sensor voltage below normal

Description

The measured rail pressure signal is below the normal operating range (< 0,4 V). Possible causes are:

- The rail pressure sensor wiring is defective
- Rail pressure sensor power supply is not correct
- The rail pressure sensor is defective

Reaction in EEM

FC is stored and warning lamp is activated. Engine power is heavily reduced (Degradation level 3). CAN message indicate active fault. Engine functions dependent on rail pressure are not active.

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Check EGR actuator assembly to detect defective control shaft.
- Check the operation with another EGR actuator to see if actuator is defective.

3.80 SPN 2791, FMI 12, EGR Valve short cut

Description

EGR actuator short circuit. Possible causes are:

- The EGR actuator motor shorted to ground, battery or across the motor.
- The EGR actuator is defective.

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Check the EGR actuator wiring, connectors and contact surfaces of the connector pins (possible oxidation).
- Check the operation with another EGR actuator to see if actuator is defective.

3.81 SPN 2791, FMI 13, EGR Valve mechanical fault

Description

The EEM monitoring system has detected that EGR Valve is mechanically defective. Possible causes are:

- The shaft between EGR actuator and valve is defective.
- The valve is stuck
- The EGR actuator is defective

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault.

NOTE: Present fault is classified as a emission related fault. Engine power will be reduced after certain time which is defined by authorities.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Check that shaft between actuator and valve is in order. Shaft should be movable when ignition and ECU is shutted OFF.
- Check operation with another EGR actuator.

- Check the DEF dosing valve wiring, connectors and contact surfaces of the connector pins (possible oxidation). (see *Dosing module* (page 179))
- Check the operation with another dosing valve to see if valve is defective.

3.102 SPN 3361, FMI 6, DEF dosing valve low side short circuit to GROUND or open load

Description

EEM4 monitoring system has detected short circuit to ground or open load on DEF dosing valve low side. Possible causes are:

- The DEF dosing valve wiring is defective. (Shorted to ground or open load)
- The DEF dosing valve is defective

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault.

NOTE: Present fault is classified as a emission related fault. Engine power will be reduced after certain time which is defined by authorities.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Check the DEF dosing valve wiring, connectors and contact surfaces of the connector pins (possible oxidation). (see *Dosing module* (page 179))
- Check the operation with another dosing valve to see if valve is defective.

3.103 SPN 3363, FMI 3, DEF tank heater coolant valve solenoid short circuit to HIGH SOURCE

Description

EEM4 monitoring system has detected short circuit on DEF tank heater coolant valve solenoid. Possible causes are:

- The solenoid valve wiring is defective (Shorted to high source)
- The solenoid valve is defective

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault.

NOTE: Present fault is classified as a emission related fault. Engine power will be reduced after certain time which is defined by authorities.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Check the solenoid valve wiring, connectors and contact surfaces of the connector pins (possible oxidation).
- Check the operation with another tank coolant valve to see if valve is defective.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Remove the DEF dosing valve and check the nozzle of dosing valve to see possible blockage.
- Check pressure line visually to detect any mechanical failure eg. hose is flattened.
- If vehicle was started in cold conditions and SCR system was frosted, there could be ice in the pressure line.
- Change the DEF supply module main filter.
- Change the DEF supply module backflow connector.
- Check used reducing agent (DEF/Adblue) contamination and change it if necessary.
- Check the operation with another DEF supply module to see if supply module is defective.

3.122 SPN 4332, FMI 16, SCR system ERROR: DEF dosing pressure above normal

Description

EEM4 monitoring system has detected SCR system ERROR. Pressure during Metering control is too high in DEF supply module. Possible causes are:

- The DEF backflow line is defective (Possible blockage or mechanicalle defective)
- The DEF supply module backflow connector is blocked
- The DEF supply module main filter is defective
- The used reducing agent (DEF/Adblue) is contaminated
- DEF supply module is defective

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault.

NOTE: Present fault is classified as a emission related fault. Engine power will be reduced after certain time which is defined by authorities.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Check bakflow line visually to detect any mechanical failure eg. hose is flattened.
- Remove backflow line from the supply module. Perform dosing test with service tool. There should be ongoing flow from the hose. Check backflow connection from the DEF tank also.
- Change the DEF supply module backflow connector.
- Change the DEF supply module main filter.
- Check used reducing agent contamination and change it if necessary.
- Check the operation with another DEF supply module to see if supply module is defective.

3.142 SPN 4346, FMI 31, DEF pressure line heater ECU power stage over temperature

Description

EEM4 monitoring system has detected over temperature on DEF pressure line heater relay. Possible causes are:

- The DEF pressure line heater wiring is defective.
- The DEF pressure line heater relay is defective
- The control unit is defective

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault.

NOTE: Present fault is classified as a emission related fault. Engine power will be reduced after certain time which is defined by authorities

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Check the DEF pressure line heater relay wiring, connectors and contact surfaces of the connector pins (possible oxidation).
- Check the operation with another heater relay to see if relay is defective.
- Check the ECU operation with another EEM4 controller. If the system is functional and the fault is not active with the replacement ECU, then the original ECU is defective.

3.143 SPN 4346, FMI 4, DEF pressure line heater control circuit short circuit to GROUND

Description

EEM4 monitoring system has detected short circuit on DEF pressure line heater control circuit. Possible causes are:

- The DEF pressure line heater wiring is defective. (Shorted to ground)
- The DEF pressure line heater is defective

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault.

NOTE: Present fault is classified as a emission related fault. Engine power will be reduced after certain time which is defined by authorities.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Check the DEF pressure line heater wiring, connectors and contact surfaces of the connector pins (possible oxidation).
- Check the operation with another heater relay to see if relay is defective.

- Check the operation with another DEF supply module to see if supply module is defective.
- Check the ECU operation with another EEM4 controller. If the system is functional and the fault is not active with the replacement ECU, then the original ECU is defective.

3.163 SPN 4374, FMI 31, DEF pump motor not available for actuation

Description

DEF supply module pump motor is not availabe for actuation. Possible causes are:

- The DEF supply module wiring is defective. (control circuit)
- The DEF supply module is defective

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault.

NOTE: Present fault is classified as a emission related fault. Engine power will be reduced after certain time which is defined by authorities.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Check the DEF supply module wiring, connectors and contact surfaces of the connector pins (possible oxidation). (see *Supply module* (page 178))
- Check the operation with another DEF supply module to see if supply module is defective.

3.164 SPN 4374, FMI 8, DEF pump motor speed deviation

Description

EEM4 monitoring system has detected deviation on DEF pump motor speed. Possible causes are:

- The DEF supply module wiring is defective. (Shorted to ground)
- The DEF supply module is defective
- The control unit is defective

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault.

NOTE: Present fault is classified for emission related fault. Engine power will be reduced after certain time which defined by authorities.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Check the DEF supply module wiring, connectors and contact surfaces of the connector pins (possible oxidation). (see *Supply module* (page 178))
- Check the operation with another DEF supply module to see if supply module is defective.
- Check the ECU operation with another EEM4 controller. If the system is functional and the fault is not active with the replacement ECU, then the original ECU is defective.

3.184 SPN 520203, FMI 4, ECU Main Relay 1 short circuit to GROUND

Description

High and low power outputs of the ECU are supplied via the main relays (FET transistors). When short circuit to ground or battery is detected, Main relays (MR) will automatically shut off. To ensure that the short circuit to GND or Bat is either temporary or permanent, the MR shall be reactivated after delay time. If monitoring system detects continuously short circuit to ground or bat MR will be shut off.

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Measure the Pin (K70) from wiring terminal, to see if there is a short circuit to ground.

Solution2:

- Check the ECU operation with another EEM4 controller. If the system is functional with the replacement ECU, then the original ECU is defective.

3.185 SPN 520204, FMI 3, ECU Main Relay 2 Short circuit to HIGH SOURCE

Description

High and low power outputs of the ECU are supplied via the main relays (FET transistors). When short circuit to ground or battery is detected, Main relays (MR) will automatically shut off. To ensure that the short circuit to GND or Bat is either temporary or permanent, the MR shall be reactivated after delay time. If monitoring system detects continuously short circuit to ground or bat MR will be shut off.

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault.

Solution

- Measure the Pin (K27) from wiring terminal, to see if there is a short circuit to bat.

Solution2:

- Check the ECU operation with another EEM4 controller. If the system is functional with the replacement ECU, then the original ECU is defective.

3.186 SPN 520204, FMI 4, ECU Main Relay 2 short circuit to GROUND

Description

High and low power outputs of the ECU are supplied via the main relays (FET transistors). When short circuit to ground or battery is detected, Main relays (MR) will automatically shut off. To ensure that the short circuit to GND or Bat is either temporary or permanent, the MR shall be reactivated after delay time. If monitoring system detects continuously short circuit to ground or bat MR will be shut off.

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault.

3.211 SPN 520230, FMI 31, Engine specification mismatch

Description

The engine specification number don't match with EEM software specification number. Possible causes are:

- The engine software is defective
- The control unit is defective

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault. Engine power and speed will be reduced.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Download new software with correct specification number to the engine or activate the ECU.
- Check the ECU operation with another EEM4 controller. If the system is functional and the fault is not active with the replacement ECU, then the original ECU is defective.

3.212 SPN 520231, FMI 31, PTO input error

Description

EEM4 controller has detected invalid PTO cruise controller request. For some reason there are up & down request demand active simultaneously

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Check the wirings from vehicle switches to EEM4 controller.
- Check the vehicle PTO cruise up & down switches operation.

3.213 SPN 520232, FMI 31, Bad digital input configuration

Description

EEM4 monitoring system has detected bad digital input configuration. Possible causes are:

- The EEM software is defective
- The control unit is defective

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Download new software to the engine control unit.

3.236 SPN 520294, FMI 0, Rail over pressure monitoring count exceeded

Description

The EEM monitoring system has detected that rail over pressure monitoring count has been exceed. In fault condition e.g. rail pressure sensor is defective, there is possibility that rail pressure might rise too high. Rail over pressure counter is always increment by one in fault condition. When counter is full this error is relesaed.

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault. Engine start is disabled.

Solution

Contact a local representative service.

3.237 SPN 520294, FMI 16, Rail over pressure monitoring time exceeded

Description

The EEM monitoring system has detected that rail over pressure monitoring count has been exceed. In fault condition e.g. rail pressure sensor is defective, there is possibility that rail pressure might rise too high. Rail over pressure timer is always running in fault condition. When timer is full this error is relesaed.

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault. Engine start is disabled.

Solution

Contact a local representative service.

3.238 PN 520297, FMI 31, ECU internal fault 0132

Description

EEM4 monitoring system has detected internal failure. Possible reason is ECU hardware defect.

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Check the ECU operation with another EEM4 controller. If the system is functional and the fault is not active with the replacement ECU, then the original ECU is defective.

3.239 PN 520298, FMI 31, ECU internal fault 0133

Description

- Possible tampering

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault.

NOTE: Present fault is classified as a emission related fault. Engine power will be reduced after certain time which is defined by authorities.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Check the upstream NOx sensor assembly. Make sure the sensor is assembled according to ASP installation instructions.(see *Engine sensors overview* (page 157))
- Check the operation with another upstream NOx sensor to see if the sensor is defective. (see *NOx sensor* (page 164))
- Possible tuning chip may interfere NOx sensor signal.

3.259 SPN 521006, FMI 12, Nox conversion implausible

Description

EEM4 system detects error in NOx conversion. Possible causes are:

- The DEF supply module main filter is blocked
- The used reducing agent (DEF/Adblue) is invalid
- The dosing valve is blocked
- The DEF pressure line is blocked
- The mounting boss is blocked
- The DEF catalyst is deteriorated or blocked

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault.

NOTE: Present fault is classified for emission related fault. Engine power will be reduced after certain time which defined by authorities.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Change DEF supply module main filter.(see *Supply module* (page 178))
- Check the used reducing agent (DEF/Adblue) quality. Change reducing agent if it doesn't reply to ASP recommendation.
- Check the DEF dosing valve by visually and with Service tool test function.
- Check DEF pressure line hose and connector. Remove the hose to detect possible blockage.
- Remove DEF dosing valve and check the mounting boss condition.
- Check DEF catalyst condition.

- Measure between solenoid valve 1 cables, to see if there is short circuit between cables.
- Check the operation with another diesel injector to see if diesel injector is defective.
- (For 7-cyl engine see *7-cyl engine injector harness* (page 184)), (For 6-cyl engine see *6-cyl engine injector harness* (page 184)), (For 4-cyl engine see *4-cyl engine injector harness* (page 184))

3.279 SPN 652, FMI 13, Solenoid valve 2, Calibration value missing

Description

The EEM monitoring system has detected that calibration is missing from solenoid valve 2.

Reaction in EEM

FC is stored and warning lamp is activated. Engine power is heavily reduced (Degradation Level 3). CAN message indicate active fault.

Solution

Contact a local representative service. New injection calibration can be done by engine service tool.

3.280 SPN 652, FMI 14, Solenoid valve 2, Short circuit

Description

The EEM4 system has detected short circuit on solenoid valve 2 control. Possible causes are:

5/6 Cyl, 2/4 Cyl, 2/7 Cyl

- The solenoid valve connector is defective
- The solenoid valve wiring is defective
- The solenoid valve is defective

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault. Engine power will be heavily reduced (Degradation Level 3).

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Check the solenoid valve 2 wiring, connector and contact surfaces of the connector pins (possible oxidation).
- Measure cables from solenoid valve 2 to engine ground, to see if there is short circuit to ground.
- Check the operation with another diesel injector to see if diesel injector is defective.
- (For 7-cyl engine see *7-cyl engine injector harness* (page 184)), (For 6-cyl engine see *6-cyl engine injector harness* (page 184)), (For 4-cyl engine see *4-cyl engine injector harness* (page 184))

3.281 SPN 652, FMI 5, Solenoid valve 2, Current below normal: Open circuit

Description

FC is stored and warning lamp is activated. CAN message indicate active fault. Engine power will be heavily reduced (Degradation Level 3).

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Check the solenoid valve wiring, connector and contact surfaces of the connector pins (possible oxidation). (see *7-cyl engine injector harness* (page 184))
- Measure between solenoid valve 7 connectors and ECU connector, to see if there is faul in cables.
- Check the operation with another diesel injector to see if diesel injector is defective.

3.301 SPN 657, FMI 6, Solenoid valve 7, Current above normal: Short circuit between cables

Description

The measured solenoid valve 7 current is above normal. Reason is short circuit between solenoid valve 7 cables.

3/7 Cyl

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault. Engine power will be heavily reduced (Degradation Level 3). Engine running may be odd due to short circuit between cables.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Check the solenoid valve wiring, connector and contact surfaces of the connector pins (possible oxidation). (see *7-cyl engine injector harness* (page 184))
- Measure between solenoid valve 7 cables, to see if there is short circuit between cables.
- Check the operation with another diesel injector to see if diesel injector is defective.

3.302 SPN 677, FMI 3, Start relay low side voltage above normal or short to HIGH SOURCE

Description

Start relay low side voltage is above normal operating range. Possible causes are:

- The start relay wiring is defective. (Shorted to high source)
- The start relay is defective

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Check the 5 V power supply to the sensor.
- Check the operation with another throttle sensor to see if throttle sensor is defective.

3.321 SPN 977, FMI 3, Fan control output short circuit to HIGH SOURCE

Description

EEM4 monitoring system has detected short circuit on fan control output. Possible causes are:

- The fan wiring is defective (Shorted to high source)
- The fan is defective

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Check the fan control wiring, connectors and contact surfaces of the connector pins (possible oxidation).
- Check the fan operation.

3.322 SPN 977, FMI 5, Fan control output open circuit

Description

EEM4 monitoring system has detected open circuit on fan control output. Possible causes are:

- The fan wiring is defective
- The fan is defective

Reaction in EEM

FC is stored and warning lamp is activated. CAN message indicate active fault.

Solution

First save the error log and then erase it. Restart the ECU after erasing the error log. If the fault occurs again during next driving cycle, check following paths:

- Check the fan control wiring, connectors and contact surfaces of the connector pins (possible oxidation).
- Check the fan operation.

3.323 SPN 977, FMI 6, Fan control output current above normal

Description

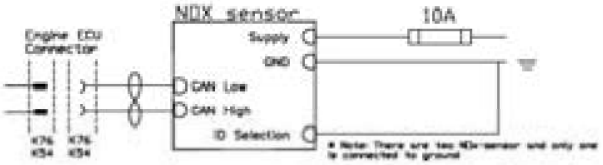
The measured fan control output current is above normal operating range. Possible causes are:

- The fan wiring is defective (Short circuit)
- The fan is defective
- The control unit is defective

```
EDC17CV54       K76 CAN vehicle LOW
EDC17CV54       K54 CAN vehicle HIGH

EDC17CV41       1.47 CAN vehicle LOW
EDC17CV41       1.46 CAN vehucle HIGH

NOTE: Sensor is CAN -sensor. ID selection is made by ground connection.
```



Engine sensors overview, see *Engine sensors overview* (page 157)

4.9 Exhaust gas temperature sensor

Description

There are two sensor in a exhaust line. First is before SCR catalyst and second is after the catalyst. Sensors are similar both side of the catalyst. In EGR engines exhaust gas temperature sensor is used to measure EGR gas temperature and it's connected to same pins with upstream temperature sensor.

Agco Power part number: 837074294

ECU connection

Pin numbers at ECU:

```
Downstream:
EDC17CV54       K56 Analog input
EDC17CV54       K55 Ground
EDC17CV41       1.09 Analog input
EDC17CV41       1.10 Ground

Upstream:
EDC17CV54       K81 Analog input
EDC17CV54       K82 Ground
EDC17CV41       1.31 Analog input
EDC17CV41       1.10 Ground
```

Characteristics

Nominal resistance:

```
At 25°C = 201 ohm
At 200°C = 350 ohm
```

Engine sensors overview, see *Engine sensors overview* (page 157)

4.10 Boost pressure sensor

Description

Characteristics

Nominal resistance:

```
At 25°C = 2 kohm
At 100°C = 197 ohm
```

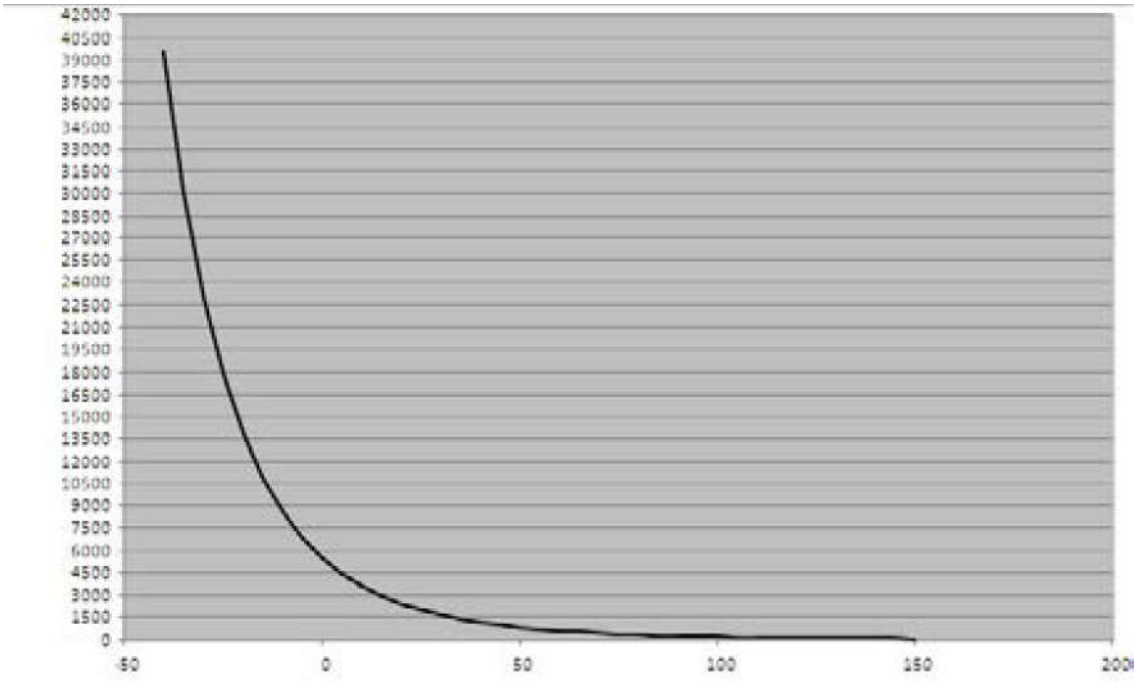


Figure 4.25: Characteristics, Engine EGR mixer intake temperature

Engine sensors overview, see *Engine sensors overview* (page 157)