Document Title: **Power transmission, description**	Function Group: **400**	Information Type: **Service Information**	Date: **2014/3/13**
Profile: **BHL, BL60 [GB]**			

Go back to Index Page

Power transmission, description

Gearbox

The gearbox is a four forward, four reverse power shuttle gearbox with torque converter, hydraulic shuttle control and column mounted electro–hydraulic direction control. Equipped with a four-wheel drive option the transmission has switchable four wheel drive. The torque converter is a fluid clutch.

Front axle

The two-wheel drive front axle has permanently lubricated bearings and is attached to the frame with a pivot joint.

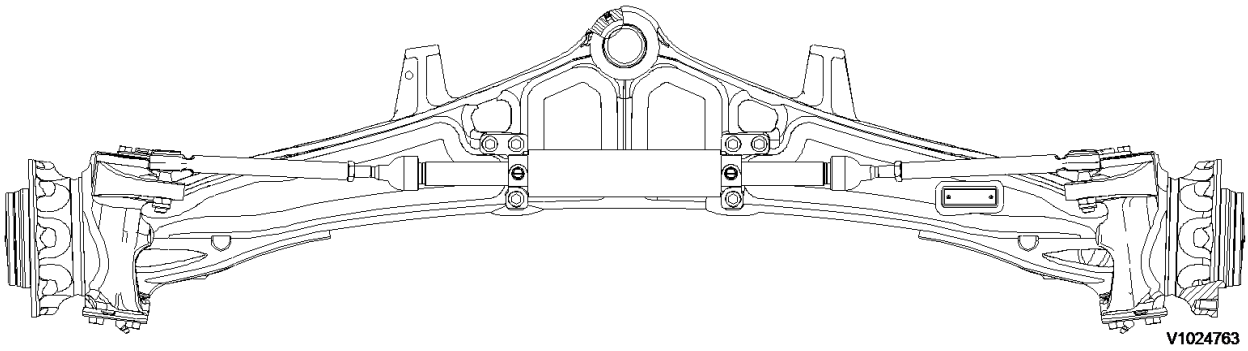

Figure 1
2WD front axle

Drive is provided to the four-wheel drive front axle by a propeller shaft direct from the transmission.

The four-wheel drive front axle consists of a beam casing, housing the differential in the middle and a wheel hub unit at each end. The differential, of "open" type, is supported by two bearings.

The wheel hubs containing the epicyclic reduction gears are supported by two tapered roller bearings and are powered by a hydraulically–operated steering valve.

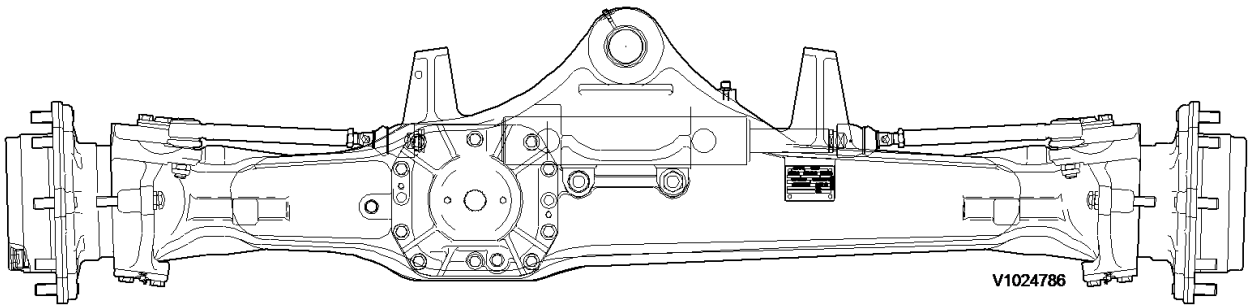

Figure 2
4WD front axle

Rear axle

The rear axle features permanent drive, via a propeller shaft direct from the transmission. The axle features spiral crown and pinion driving through epicyclic hubs, differential lock and inboard oil–immersed brakes.

The rear axle consists of a beam casing, housing the differential in the middle and a wheel hub unit at each end. The differential, type "mechanical lock", is supported by two bearings.

The wheel hubs containing the epicyclic reduction gears are supported by two tapered roller bearings.

Furthermore, the rear axle has a braking system, that provides braking force to both the service brake and the parking brake.

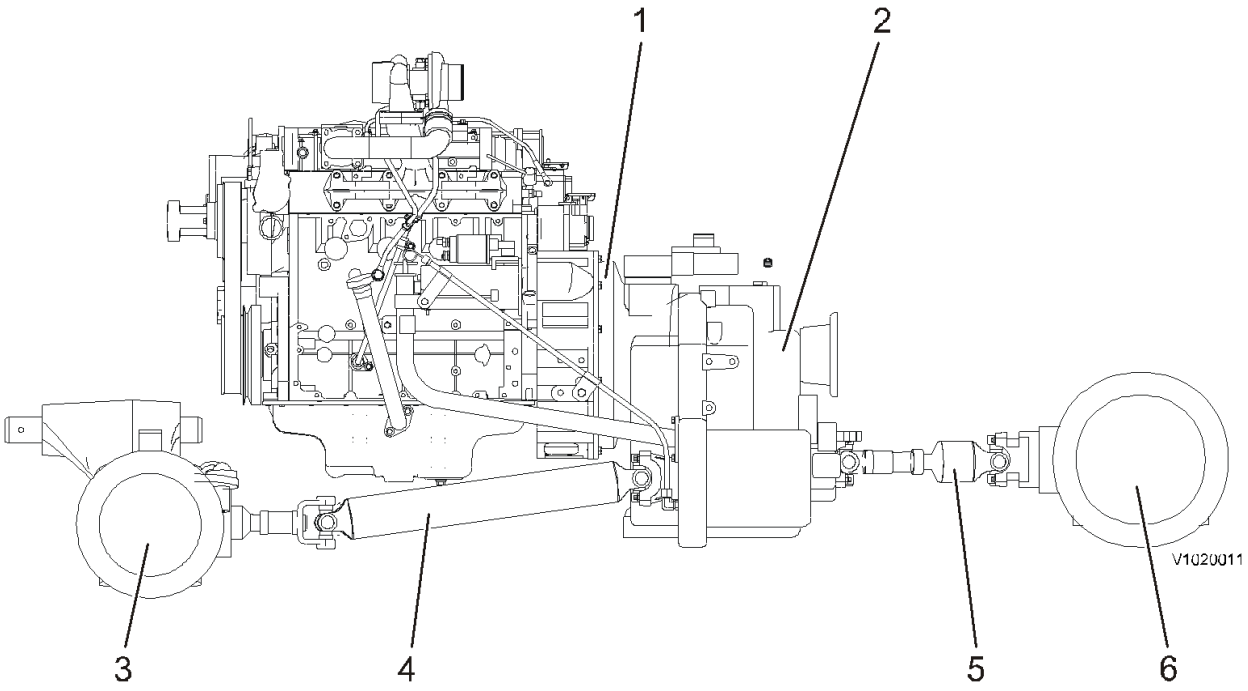

Figure 3
Drive train, 4WD

1. Torque converter
2. Gearbox
3. Front axle
4. Propeller shaft, front
5. Propeller shaft, rear
6. Rear axle

Document Title: **Power transmission, description**	Function Group: **400**	Information Type: **Service Information**	Date: **2014/3/13**
Profile: **BHL, BL60 [GB]**			

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Power transmission, description

Gearbox

The gearbox is a four forward, four reverse power shuttle gearbox with torque converter, hydraulic shuttle control and column mounted electro–hydraulic direction control. The transmission has switchable four wheel drive. The torque converter is a fluid clutch.

Front axle

Drive is provided to the front axle by a propeller shaft direct from the transmission.

The front axle consists of a beam casing, housing the differential in the middle and a wheel hub unit at each end. The differential, of "open" type, is supported by two bearings.

The wheel hubs containing the epicyclic reduction gears are supported by two tapered roller bearings and are powered by a hydraulically–operated steering valve.

Rear axle

The rear axle features permanent drive, via a propeller shaft direct from the transmission. The axle features spiral crown and pinion driving through epicyclic hubs, differential lock and inboard oil–immersed brakes.

The rear axle consists of a beam casing, housing the differential in the middle and a wheel hub unit at each end. The differential, type "mechanical lock", is supported by two bearings.

The wheel hubs containing the epicyclic reduction gears are supported by two tapered roller bearings.

Furthermore, the rear axle has a braking system, that provides braking force to both the service brake and the parking brake.

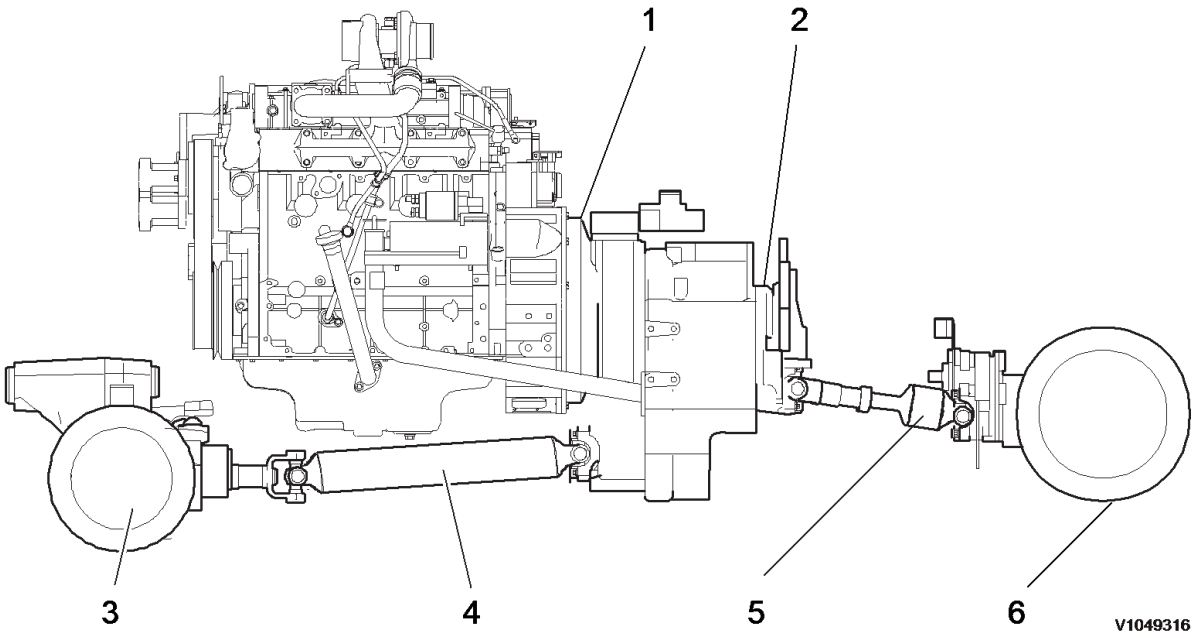

Figure 1

Power transmission

1. Torque converter
2. Gearbox
3. Front axle
4. Propeller shaft, front
5. Propeller shaft, rear
6. Rear axle

VOLVO

Construction Equipment

Service Information

Document Title: **Power transmission, troubleshooting**	Function Group: **400**	Information Type: **Service Information**	Date: **2014/3/13**
Profile: **BHL, BL60 [GB]**			

Power transmission, troubleshooting

Problem	Cause	Action
Machine does not move	Faulty supply to solenoid valves	Check/Replace
	Damaged wiring connections between transmission and machine	Repair/Replace
	Oxidised contacts in electrical wiring	Clean
	Break in electric cable	Replace
	Damaged solenoids	Replace
	Damaged sensors	Replace
	Short circuits or false contacts	Check/Replace fuses
	Incorrect oil level	Top up
	Check for leaks	Repair/Top up
	Blocked intake filter	Clean
	Damaged oil pump	Replace
	Damaged oil pump relief valve	Replace oil pump
	Blocked/Damaged transmission filter	Replace
	Damaged/Jammed control valve	Replace
	Damaged converter	Replace
	Oil temperature below 0 °C (32 °F)	Carefully warm up the machine and all subsystems until the oil has reached working temperature
	Damaged rotary seals	Replace
	Damaged synchronisers	Replace
	Blocked reverser lever	Repair
	Worn clutch unit	Replace/Repair clutch unit
	No drive transmission (broken gears, shafts, bearings, etc.)	Check/Repair/Replace
Machine has reduced power transmission	Incorrect oil temperature	Wait for oil to reach working temperature (stall test)
	Transmission oil overheating	Restore acceptable temperature values
	Incorrect operating pressure	Check hydraulic circuit and replace (oil pump, filters, control valve)
	Damaged converter	Replace
	Incorrect oil level	Top up
	Worn clutch unit	Replace/Repair
	4WD clutch failure	Repair/Replace 4WD shaft group
	Overheating solenoids	Replace
	Damaged transmission and machine wiring connections	Repair/Replace
	Damaged sensors	Replace

Overheating	Damaged hydraulic cooling system	Repair
	Dirty heat exchanger	Clean
	Parking brake inadvertently activated	Release
	Excessive dirt on axle wheel hubs	Clean
	Seizing (broken gears, shafts, bearings, etc.)	Check/Repair/Replace
	Braking force outside transmission: irregular axle operation	Check/Repair axle
	Clutch plate drag	Repair/Replace
	Damaged converter	Replace
	Damaged oil thermostat	Replace
	Incorrect oil level	Top up
	Worn oil pump	Replace
Wheels rotate when machine is raised	Clutch plate drag	Repair/Replace
	Low oil temperature (high oil viscosity)	Wait for oil to reach working temperature (stall test)
	Incorrect oil specifications	Replace oil and filters
	Damaged control valve	Replace
	Faulty reverser locking	Repair/Replace
Noise	Damaged converter	Replace
	Damaged oil pump	Replace
	Aeration/Cavitation	Check oil level/Check oil specifications
	Seizing (broken gears, shafts, bearings, etc.)	Check/Repair/Replace
	Worn clutch plates	Replace
	Worn synchroniser actuation unit	Replace
	Worn 4WD clutch	Replace
Irregular actuation	Damaged control valve	Replace
	Electrical system fault	Repair/Replace
	Worn clutch plates	Replace
	Damaged converter	Replace
	Low oil temperature (high oil viscosity)	Wait for oil to reach working temperature (stall test)
	Overheating	See "Overheating"
	Damaged hydraulic system	Repair/Replace
Gear remains engaged	Damaged/Jammed shuttleshaft lever	Repair/Replace
	Electrical system fault	Repair/Replace
	Damaged control valve	Replace
	Damaged hydraulic system	Repair/Replace
	Damaged clutch unit	Repair/Replace
	Damaged gear lever rod	Replace
	Damaged synchronisers	Replace
No 4WD power transmission	Damaged 4WD clutch	Replace
	Hydraulic system fault	Repair/Replace
	Damaged control valve	Replace
	Faulty brake sensor	Check/Replace
	Electrical system fault	Repair/Replace
Gear shift won't engage	Damaged shifter	Replace
	Damaged synchronisers	Replace

Document Title: **Torque converter, description**	Function Group: **414**	Information Type: **Service Information**	Date: **2014/3/13**
Profile: **BHL, BL60 [GB]**			

Torque converter, description

The engine output torque is transmitted and amplified by the torque converter.

The torque converter consists of an oil filled outer housing, an impeller, a turbine and a stator.

The oil pump inside a torque converter is a type of centrifugal pump. As oil is flung to the outside, a partial vacuum is created that draws more oil in at the center.

The impeller driving member produces oil movement inside the torque converter whenever the engine is running. The turbine, a driven fan splined to the input shaft of the gear box, is not fastened to the impeller, but is free to turn independently. Oil is the only connection between the two. The stator, designed to improve oil circulation inside the torque converter, increases efficiency and torque by causing the oil to swirl around the inside of the housing.

The primary action of the torque converter results from the action of the impeller passing oil at an angle into the blades of the turbine.

The oil pushes against the faces of the turbine vanes, causing the turbine to rotate in the same direction as the impeller.

With the engine idling, the impeller rotates slowly. Only a small amount of oil is thrown into the stator and turbine. Not enough force is developed inside the torque converter to rotate the turbine. The machine remains stationary with the gearbox in gear.

During acceleration, the engine crankshaft, the converter housing, and the impeller begin to rotate faster. More oil is thrown out by centrifugal force, turning the turbine. As a result, the gearbox input shaft begins to rotate and the machine starts to move, but with some slippage. At speed, the impeller and turbine rotate at almost the same speed with very little slippage.

The stator is located in the very center of the torque converter, between the impeller and the turbine, and is mounted on a one way clutch that allows it to rotate clockwise, but not counter–clockwise. The purpose of the stator is to redirect the oil returning from the turbine and change its rotation back to that of the impeller, before it hits the pump (impeller) again.

Stator action is only needed when the impeller and turbine are turning at different speeds.

The one–way clutch locks the stator when the impeller is turning faster than the turbine. This causes the stator to route oil flow over the impeller vanes properly. Then, when turbine speed almost equals impeller speed, the stator can freewheel in its shaft so as not to obstruct flow.

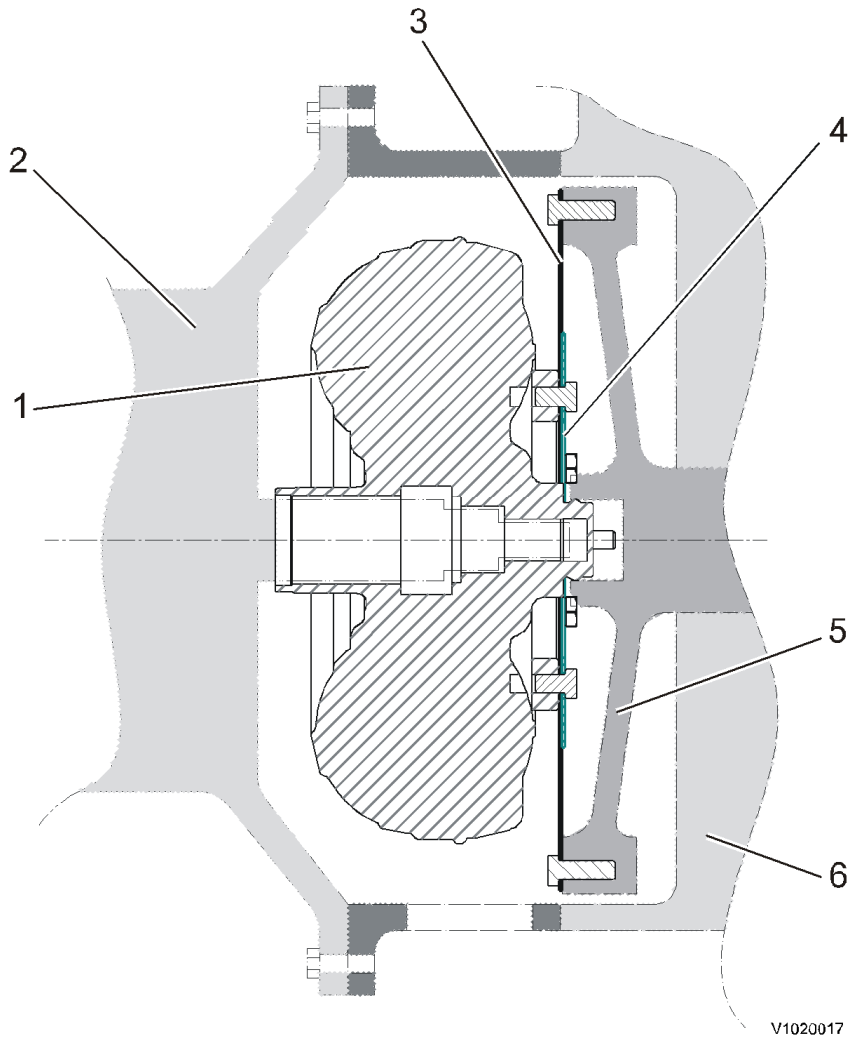

Figure 1
Torque converter, sectional view

1	Torque converter	3	Flexplate	5	Flywheel
2	Gear box	4	Flexplate	6	Engine

Document Title: **Torque converter, removal**	Function Group: **414**	Information Type: **Service Information**	Date: **2014/3/13**
Profile: **BHL, BL60 [GB]**			

Torque converter, removal

Op nbr 41404-1

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NOTE!
Oil that is being drained from the engine/transmission unit must be collected in a container.

1. Remove the engine/transmission unit, see 210 Engine, removal.

2. Block and support the engine/transmission unit in a safe and stable manner.
   NOTE!
   Make sure that it is possible to remove the transmission.

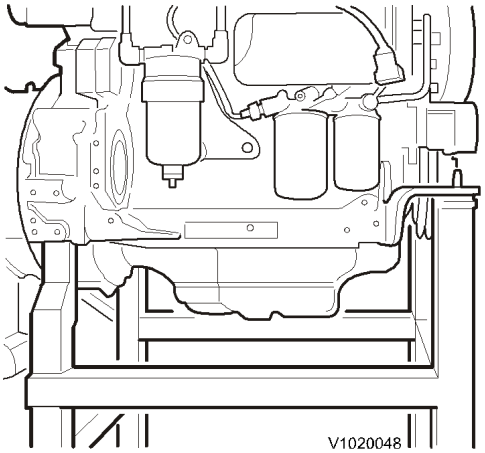

Figure 1
Supporting of engine/transmission unit

3. Remove the oil plug and drain the transmission oil (approx. 23 liters) into a clean container.

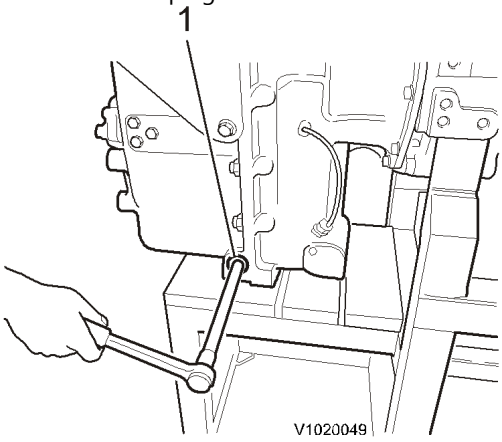

Figure 2
Draining transmission

1. Plug

4. Remove the filler pipe and the dipstick tube.

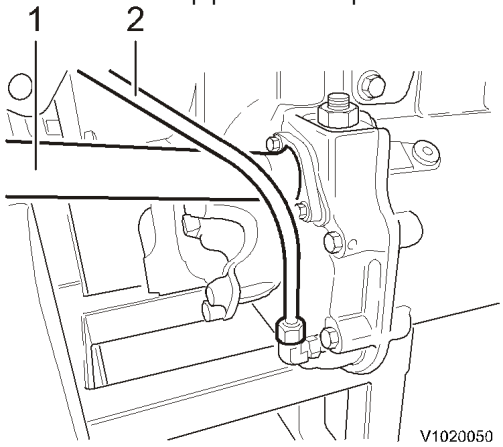

Figure 3
Transmission

1. Filler pipe
2. Dipstick tube

5. Remove the plate on the flywheel housing.

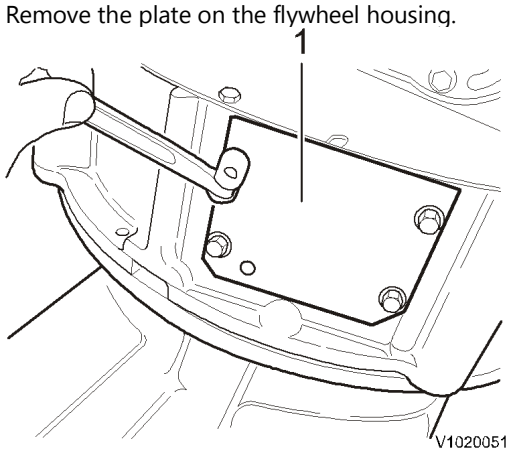

Figure 4
Underside of flywheel housing

1. Plate

6. Remove the bolt.

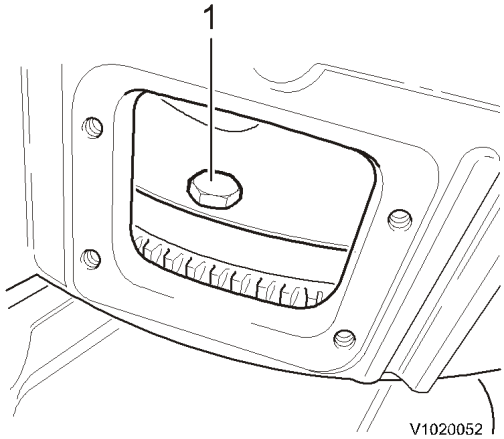

Figure 5
Underside of flywheel housing

1. Bolt

7. Rotate the engine by hand and remove the remaining bolts (3 pcs), through the plate opening under the flywheel housing.

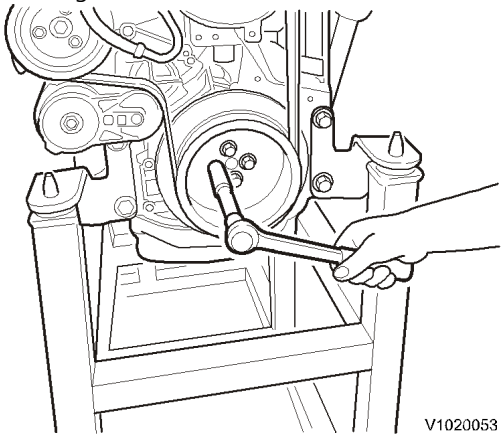

Figure 6
Rotating the engine

8. Loop a sling around the transmission and tighten the sling using a lifting device. Remove the bolts (12 pcs).

9. Move the transmission backwards from the engine and lift it away carefully.
NOTE!
Make sure that the torque converter does not fall off the gear box shaft.

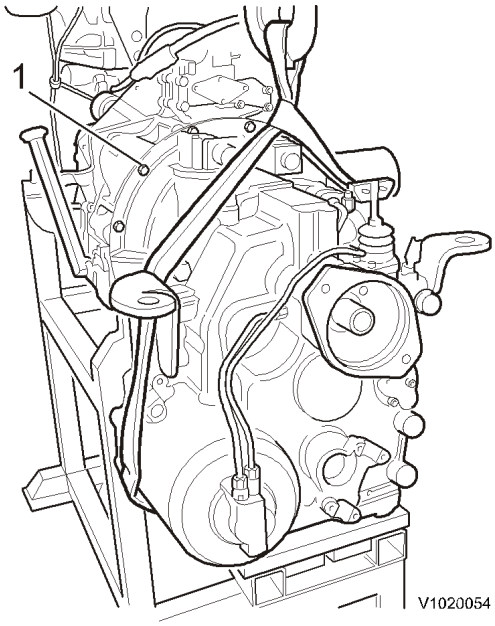

Figure 7
Removing transmission

1. Bolt

10. Lift away the torque converter.
NOTE!
Ensure that the transmission oil seal is not damaged in the process.

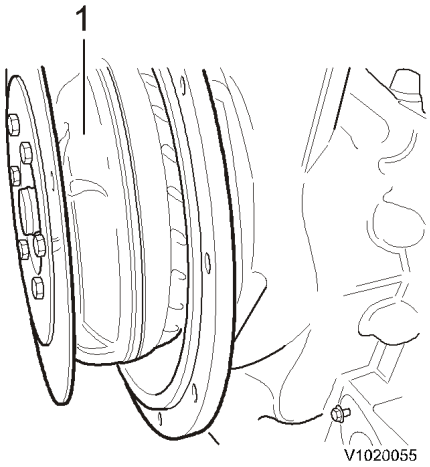

Figure 8
Removing torque converter

1. Torque converter

Document Title: **Torque converter, installation**	Function Group: **414**	Information Type: **Service Information**	Date: **2014/3/13**
Profile: **BHL, BL60 [GB]**			

Torque converter, installation

Op nbr 41405-1

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NOTE!
The flexplates should be transferred to the new torque converter before installing.

NOTE!
When installing the torque converter, the bolt heads must be inserted in the bolt holes.

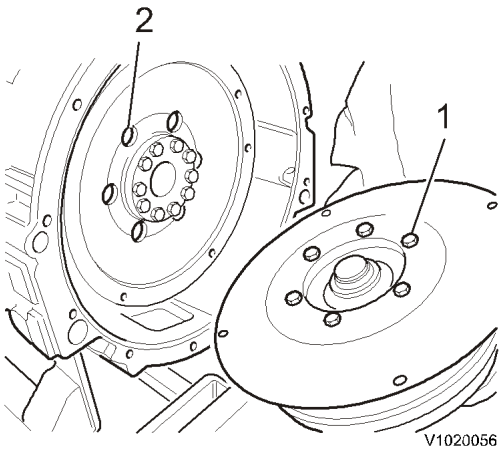


Figure 1
Before installing

1. Bolt head
2. Bolt hole

1. Measure the distance between the flywheel and the flywheel housing.

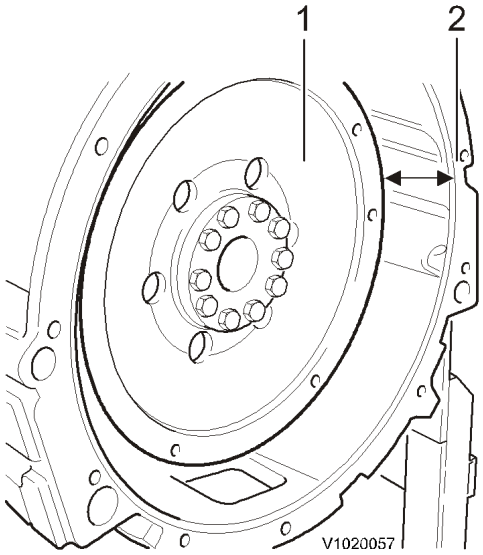


Figure 2
Check measurement

1. Flywheel
2. Flywheel housing

2. Carefully lift the torque converter into place.
   NOTE!
   Ensure that the transmission oil seal is not damaged in the process.

   Measure the distance between the flexplate and the transmission housing. Check that the result agrees with the result in step 1.

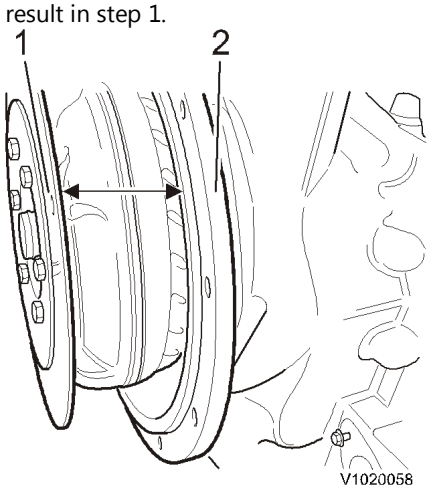


Figure 3
Check measurement

1. Flexplate
2. Transmission housing

3. Carefully lift the transmission into place.
   NOTE!
   Make sure that the torque converter does not fall off the gear box shaft.

4. Fit the bolt without tightening it.

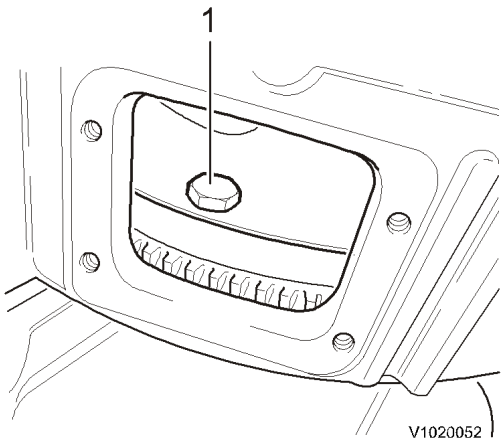


Figure 4
Underside of flywheel housing

1. Bolt

5. Fit the bolts (12 pcs)

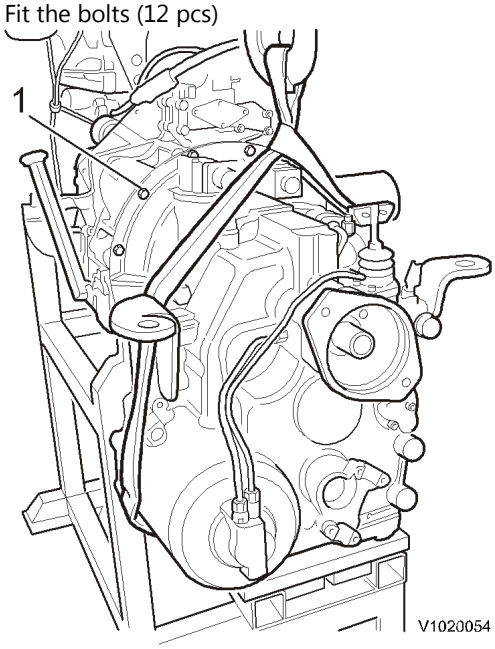


Figure 5
Installing transmission

1. Bolt

6. Rotate the engine by hand and fit the remaining bolts (3 pcs) without tightening them, through the plate opening under the flywheel housing.

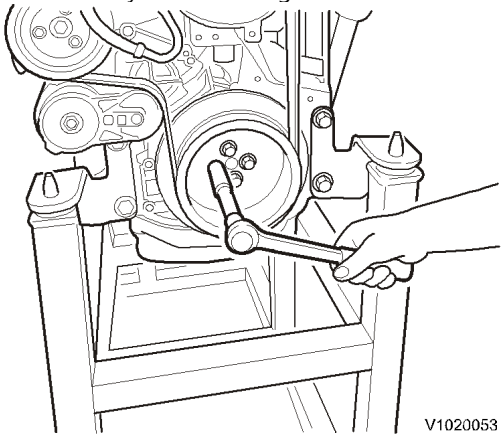


Figure 6
Rotating engine

7. Tighten the bolts (4 pcs). Rotate the engine once more and make sure that all four bolts are tight.
8. Fit the plate on the flywheel housing.
9. Clean the contact surface where the filler pipe is to be installed.
10. Apply sealing compound on the filler pipe flange and to the bolt threads.
11. Fit the filler pipe and the dipstick tube.

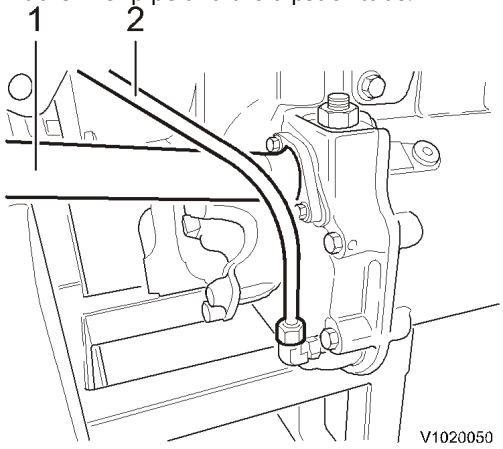


Figure 7
Transmission

1. Filler pipe
2. Dipstick tube

12. Fill the transmission with oil, see Operator's Manual
13. Fit the engine/transmission unit, see 210 Engine, installation.

Document Title: **Transmission, replacing solenoid**	Function Group: **420**	Information Type: **Service Information**	Date: **2014/3/13**
Profile: **BHL, BL60 [GB]**			

Transmission, replacing solenoid

Op nbr 421-025

NOTE!

For the correct tightening torques of the valves see 030 Transmission, tightening torques.

1.

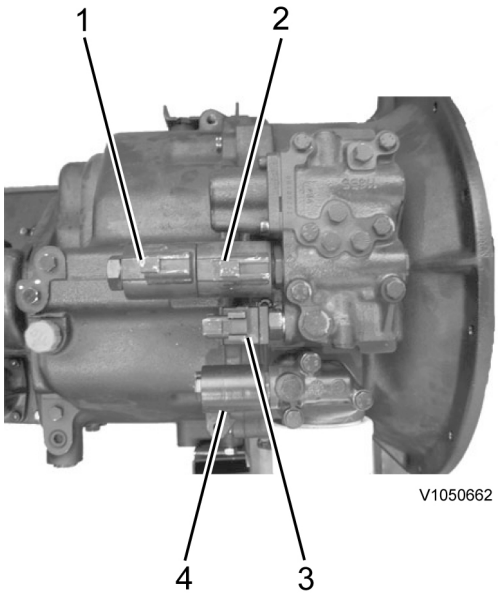


Figure 1
V1050662

1. Rev
2. Fwd
3. HDL
4. 4WD

Place the machine in service position two, see 173 Service positions.

2. Remove the floor mat.
3. Remove the front floor plate inside the cab.
4. Remove the electrical connection to the solenoid.
5. Remove the two screws holding the solenoid in place.
6. Pull the solenoid valve straight out from the valve block.
7. Push the new solenoid valve into place.
8. Fit the two screws.

9. Fit the electrical connection.
10. Fit the floor plate and floor mat.

VOLVO
Construction Equipment

Service Information

Document Title: **Transmission, check oil pressure**	Function Group: **420**	Information Type: **Service Information**	Date: **2014/3/13**
Profile: **BHL, BL60 [GB]**			

Transmission, check oil pressure

Op nbr 421-002

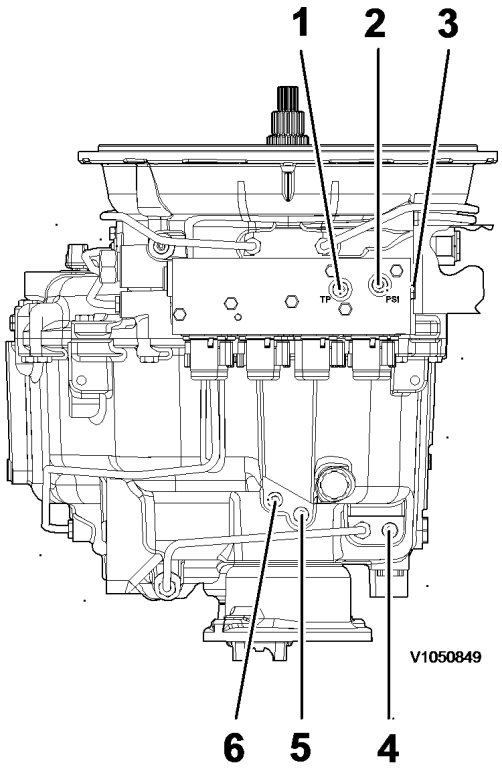
936446 Testing nipple
14290266 Hose
14290262 Adapter
11666018 Pressure gauge

General rules for pressure checking:

- Transmission oil temperature: 80 °C (176 °F)
- The values must **always** be checked against the latest issued service bulletin.

A way of quickly warming up the transmission oil to the correct temperature is to have the parking brake on, service (foot) brake on, start the engine and keep it ticking over at low idle speed (900 rpm), select the 4th gear and move the forward/ reverse lever to forward. Rev the engine for short periods to a maximum of 1500-1700 rpm, to bring the oil up to working temperature.

NOTE!
Do not exceed a maximum duration of 30 seconds each time. After this 30 second period, put the forward/reverse lever in neutral for 15 seconds, then repeat the procedure.



1.

Figure 1

1. Gear pressure
2. Control valve supply pressure
3. HDL pressure
4. Lubrication pressure
5. Forward clutch pressure
6. Reverse clutch pressure

Place the machine in service position 2, see 173 Service positions.

2. Remove the floor mat.
3. Remove the front floor plate.

Forward clutch pressure

4. Remove the plug and connect the test nipple 936446 on the forward clutch test port. Connect the pressure gauge to the test nipple.
5. Start the engine.
6. Apply the service brakes.
7. Shift the forward/reverse lever into position F
8. Increase the engine speed to high idle (see 030 Powershift transmission, specifications for required idle). Read off the oil pressure. See 030 Powershift transmission, specifications for check value.
9. Turn off the engine.
10. Shift the forward/reverse lever into position N
11. Remove the test nipple and refit the plug.

Reverse clutch pressure

12. Remove the plug and connect the test nipple 936446 on the reverse clutch test port. Connect the pressure gauge to the test nipple.
13. Start the engine.
14. Apply the service brakes.
15. Shift the forward/reverse lever into position R
16. Increase the engine speed to high idle (see 030 Powershift transmission, specifications for required idle). Read off the oil pressure. See030 Powershift transmission, specifications for check value.
17. Turn off the engine.
18. Shift the forward/reverse lever into position N
19. Remove the test nipple and refit the plug.

Lubrication oil pressure

20. Remove the plug and connect the test nipple 936446 on the lubrication oil test port. Connect the pressure gauge to the test nipple.
21. Start the engine.

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