

Document Title: Power transmission, description	Function Group: 400	Information Type: Service Information	Date: 2014/3/18
Profile: BHL, BL71 PLUS [GB]			I

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
- Propeller shaft, front
- 9. 4. 5. 6. Propeller shaft, rear
- Rear axle



Service Information

Document Title: Powershift transmission, description	Function Group: 400	Information Type: Service Information	Date: 2014/3/18
Profile: BHL, BL71 PLUS [GB]			

Powershift transmission, description

The Power Shift transmission is a fully automatic transmission with torque converter. The transmission has four forward gears and four reverse gears and operator controlled 4WD/2WD. Gear shifting is controlled by the position of the gear selector, SW4, and an electronic control unit, T-ECU. Engagement of gears is controlled by the electro-hydraulic control system. The engine output torque is transmitted and reinforced by the torque converter to the transmission.

The transmission is supplied with hydraulic pressure from a pump driven by the input shaft from the engine.

Gears are selected by using the gear selector, SW4, placed on the steering column.

Engagement of gears is controlled by the transmission control unit after impulses from the speed sensor, SE5. Clutches in the transmission are activated by solenoid valves on the transmission control system.

The four wheel drive, is operated by a spring applied clutch in the transmission. When supplied with hydraulic pressure from the control valve, the four wheel drive is disengaged.



Figure 1 Power Shift transmission



Figure 2 Power shift transmission, cut view



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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	Тор ир		
	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	Тор ир		
	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	Check/Repair axle		
	axle operation			
	Clutch plate drag	Repair/Replace		
	Damaged converter	Replace		
	Damaged oil thermostat	Replace		
	Incorrect oil level	Тор ир		
	Worn oil pump	Replace		
Wheels rotate when	Clutch plate drag	Repair/Replace		
machine is raised	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	Damaged 4WD clutch	Replace		
transmission	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		



Service Information

Document Title: Torque converter, description	Function Group: 414	Information Type: Service Information	Date: 2014/3/18			
Profile: BHL, BL61 PLUS, BL71 PLUS [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



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Torque converter, removal	414	Service Information	2014/3/18		
Profile:					
BHL, BL71 PLUS [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



Figure 3 Transmission

- 1. Filler pipe
- Dipstick tube 2.
- 5. Remove the plate on the flywheel housing.



Figure 4 Underside of flywheel housing

- Plate 1.
- 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.

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