Document Title: **Transmission, removing**	Function Group: **421**	Information Type: **Service Information**	Date: **2014/3/14**
Profile: **BHL, BL60B [GB]**			

Transmission, removing

Op nbr 421-070

9999954 Lifting equipment
11668010 Wheel forklift
885530 Rotation tool

For supporting/securing the transmission on the hydraulic jack, a support has to be built in the workshop (see drawing below). Mount the support to the hydraulic jack and assemble the transmission to the support.

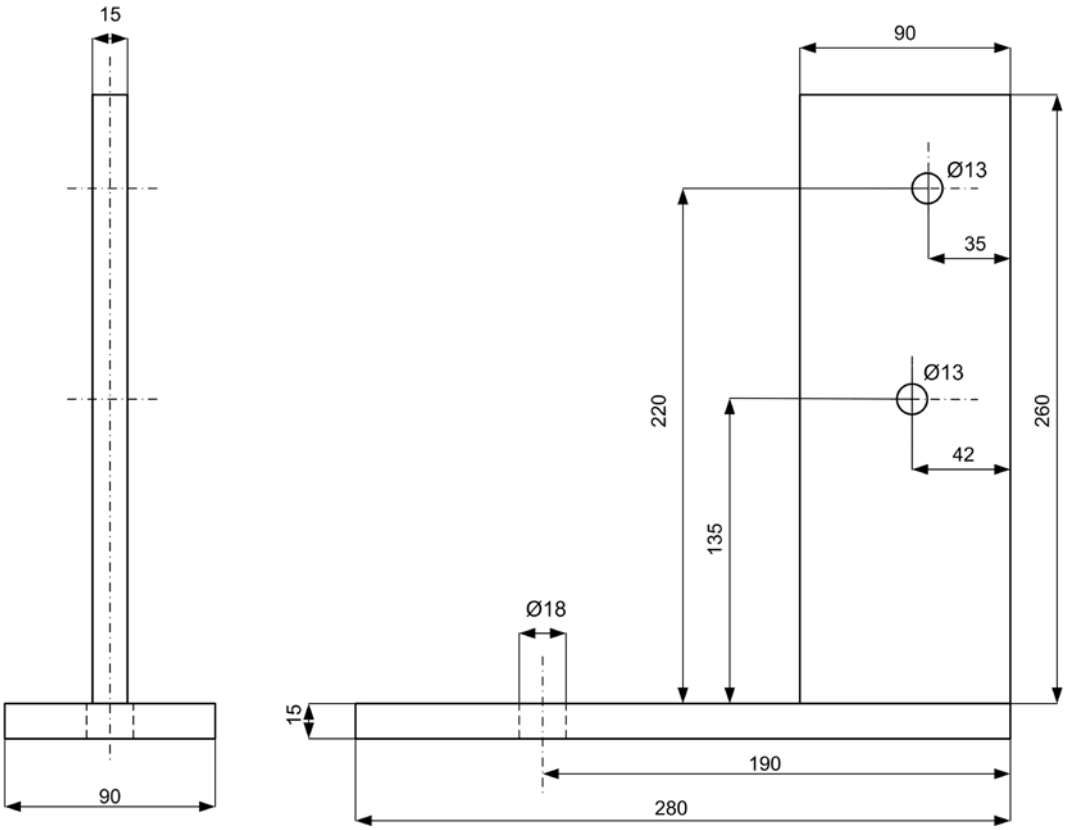


Figure 1
Transmission support drawing, measurements in mm

1. Place the machine in service position 2, see section 191 Service position 2.
2. Remove one rear wheel. See section 771 Rear wheel, removal.
3. Turn on the battery disconnect switch.
4. Start the engine and lift the front axle by dropping down the loader bucket.
   NOTE!
   The minimum required distance between frame and ground is 880 mm (2.9 ft) to easily remove the transmission

from under the machine. Raise the rear of the machine by lowering the stabilisers if needed.

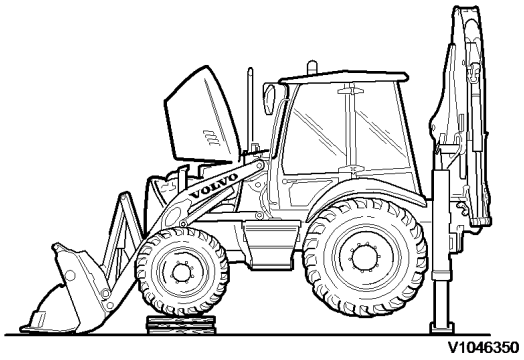


Figure 2
raised machine

5. **WARNING**
Never work under/on machines without using recommended support equipment.

Support the rear axle and front axle on blocks or preferably axle stands as a safety precaution.

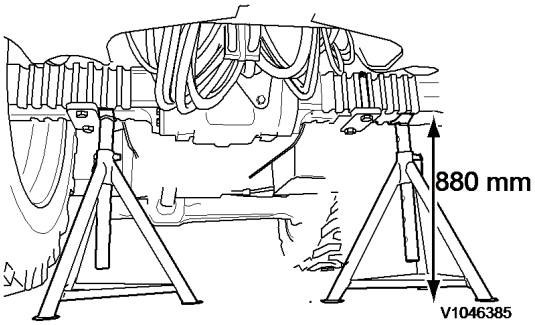


Figure 3
machine secured with axle stands/minimum distance frame to ground

6. Support the engine at the rear side by use of a support jack.

7. Drain the oil from the transmission, see section 173 Transmission, changing oil.

NOTICE
Always handle oils and other environmentally hazardous fluids in an environmentally safe manner.

8. Drain the oil from the hydraulic system, see section 173 Hydraulic system, changing oil.

9. Remove both propeller shafts from the transmission, see sections 451 Propeller shaft, front, replacing and 451 Propeller shaft, rear, replacing.

10. Remove the plate under the engine to access the screws connecting engine to torque converter.

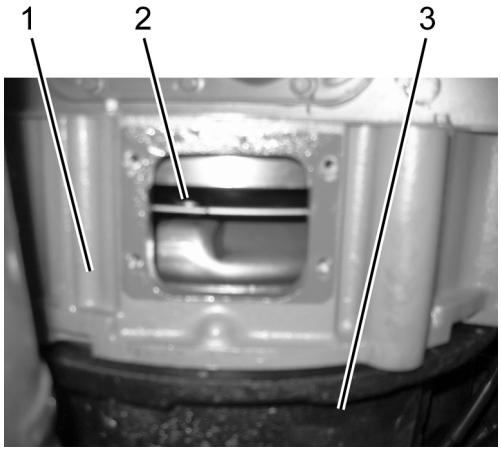


Figure 4
engine, retaining screws torque converter

1. engine
2. retaining screws, torque converter
3. transmission

11. Loosen the connection screws from engine to torque converter (4 pcs). To turn the engine and screws in the right position, use special tool.
    Special tool:
    885530 Rotation tool
    NOTE!
    The special tool can be attached to the engine from under the machine.

12. Remove the floor mat in the cab.

13. Remove the cab floor plate in front of the seat.

14. Loosen the retaining screws (1) connecting the hydraulic pump to the transmission flange.

    NOTICE
    Always handle oils and other environmentally hazardous fluids in an environmentally safe manner.

    NOTE!
    Secure the pump with a rope before removing the screws.

    Use a suitable container to collect draining oil from the pump.

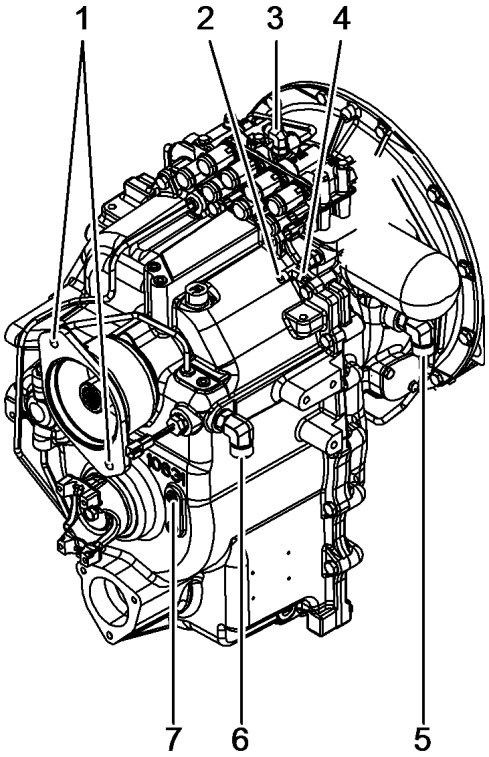


Figure 5
transmission, disassembly

1. retaining screws, transmission/hydraulic pump
2. boom lock supply (BL60B/BL61B only)
3. differential lock supply
4. brake supply
5. oil outlet to oil cooler
6. oil inlet from oil cooler
7. boom lock return (BL60B/BL61B only)

15. Remove the hydraulic pump from the transmission.

16. Loosen and remove all tubes and hoses (2, 3, 4, 5, 6, 7) from the transmission.

NOTICE

Always handle oils and other environmentally hazardous fluids in an environmentally safe manner.

NOTICE

Mark up all parts when dismantling so that they are assembled in the correct order when assembling.

NOTE!
Use a suitable container to collect draining oil from the hoses.

17. Plug all hoses.

18. Disconnect all electrical cables and connectors from the solenoids and the transmission.

NOTICE

Mark up all parts when dismantling so that they are assembled in the correct order when assembling.

19. Use a hydraulic jack to support the transmission.
Special tool:
9999954 Lifting equipment

Weight of transmission up to: **236 kg (520 lb)**
(depending on your machine configuration)

20. Loosen the connection screws (12 pcs.) from engine to transmission.

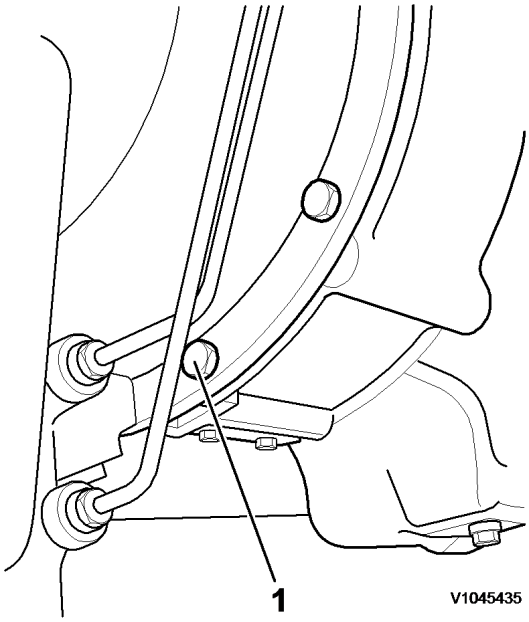


Figure 6
transmission, disassembly

1. connection screws

21. Disassemble both transmission mounts. See section 436 Transmission mounts, changing.

22. Assemble the above mentioned support to the hydraulic jack.

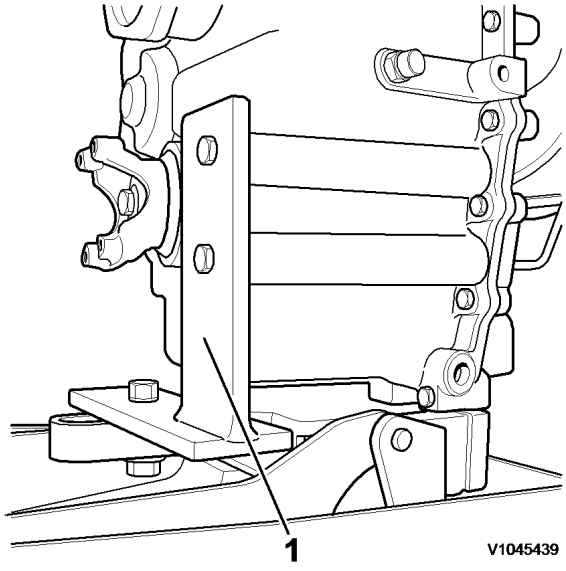


Figure 7
transmission, supported on hydraulic jack

1. support

23. Assemble the transmission to the support.

24. Pull back the hydraulic jack to disengage the torque convertor from the engine and slide down the hydraulic jack carefully with torque convertor fitted on transmission.

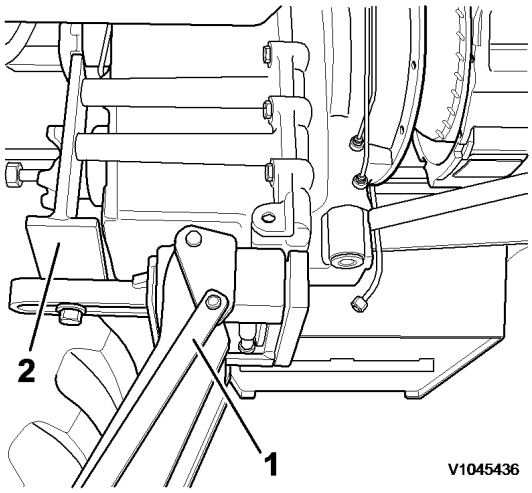


Figure 8
transmission, supported on hydraulic jack

1. hydraulic jack, part No. 9999954
2. transmission support

NOTE!
Take great care when sliding down the jack. Secure that the torque converter will not fall down from the transmission.

25. Plug all open holes and connections of the transmission to protect against dust and dirt.

26. Pull the transmission out from under the machine.

27. Remove the torque converter from the transmission.

Document Title: **Transmission, installing**	Function Group: **421**	Information Type: **Service Information**	Date: **2014/3/14**
Profile: **BHL, BL60B [GB]**			

Transmission, installing

Op nbr 421-072

9999954 Lifting equipment
11668010 Wheel forklift
885530 Rotation tool

1. Assemble the transmission to the support mounted on the hydraulic jack.

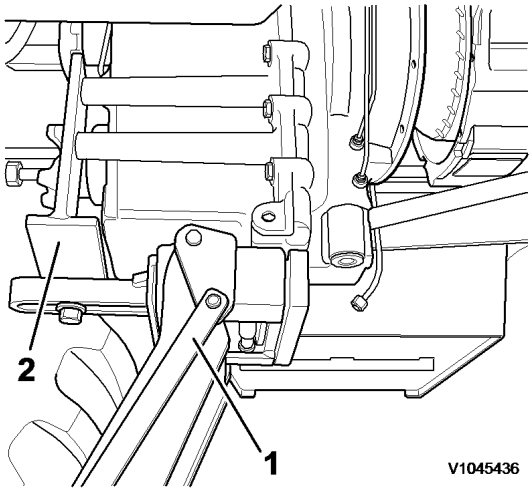


Figure 1
transmission, supported on hydraulic jack

1. hydraulic jack, part No. 9999954
2. transmission support

Weight of transmission up to: **236 kg (520 lb)**
(depending on your machine configuration)

2. Assemble the torque converter to the transmission.

3. Place the transmission under the machine.

4. Move and lift the transmission in mounting position, by carefully sliding the torque converter onto the engine.
NOTE!
Secure that the torque converter will not fall down from the transmission.

5. Remove all plugs from the transmission holes and connections.

6. Assemble both transmission mounts. See section 436 Transmission mounts, changing.

7. Assemble and fasten the connection screws (12 pcs.) connecting transmission to engine. See section 430 Transmission, tightening torques for recommended tightening torque.

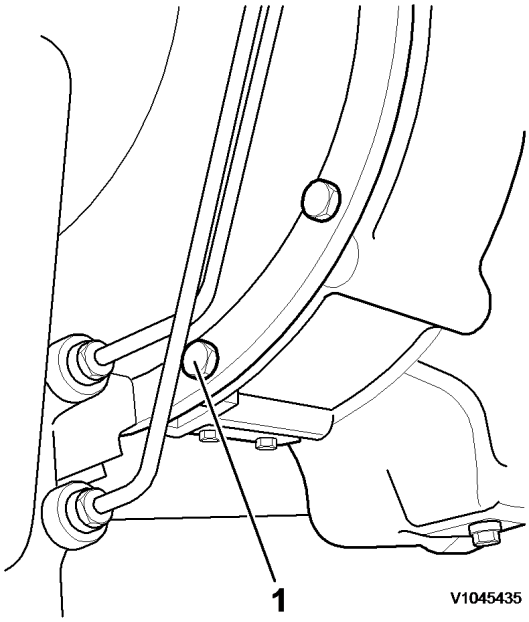


Figure 2
transmission, disassembly

1. connection screws

8. Disconnect the transmission from the support.
9. Lower and remove the hydraulic jack from the transmission.
10. Connect all electrical cables and connectors to the solenoids and the transmission (according to your marks).
11. Remove the plugs from the hoses.
12. Assemble and tighten all tubes and hoses (2, 3, 4, 5, 6, 7) to the transmission (according to your marks). See section 430 Transmission, tightening torques for recommended tightening torques.

NOTICE

Always handle oils and other environmentally hazardous fluids in an environmentally safe manner.

NOTE!
Use a suitable container to collect draining oil from the hoses.

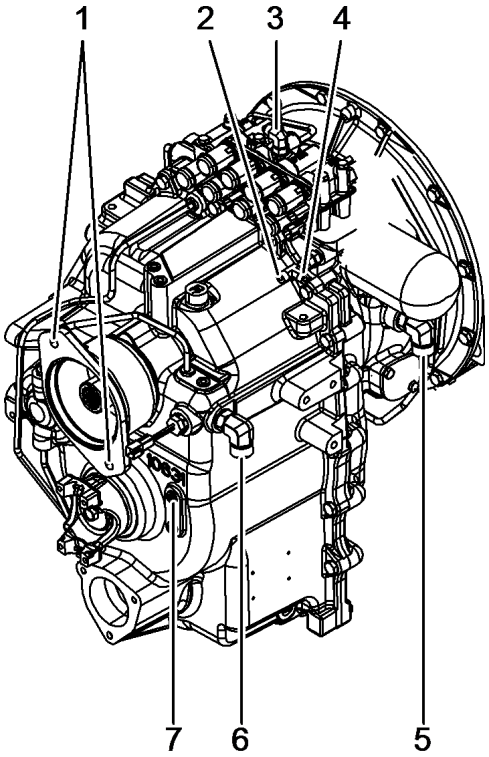


Figure 3
transmission, disassembly

1. retaining screws, transmission/hydraulic pump
2. boom lock supply (BL60B/BL61B only)
3. differential lock supply
4. brake supply
5. oil outlet to oil cooler
6. oil inlet from oil cooler
7. boom lock return (BL60B/BL61B only)

13. Assemble the hydraulic pump to the transmission.

14. Assemble and fasten the retaining screws (1) connecting the hydraulic pump to the transmission flange. See section 430 Transmission, tightening torques for recommended tightening torque.

15. Fit the cab floor plate in front of the seat.

16. Fit the floor mat in the cab.

17. Assemble and fasten the connection screws from engine to torque converter (4 pcs). To turn the engine and screws in the right position, use special tool.
    Special tool:
    885530 Rotation tool
    NOTE!
    The special tool can be attached to the engine from under the machine.

    See section 030 VOLVO standard tightening torques for recommended tightening torque.

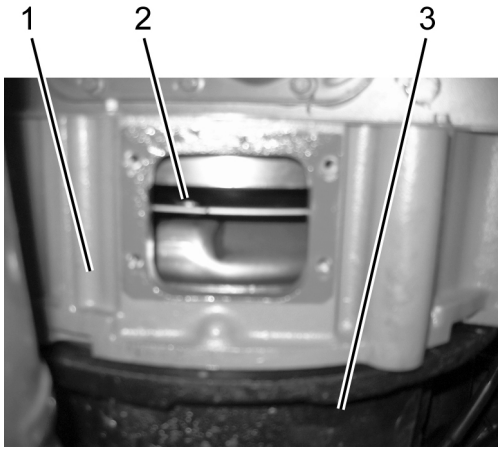


Figure 4
engine, retaining screws torque converter

1. engine
2. retaining screws, torque converter
3. transmission

18. Remove the special tool from the engine.

19. Assemble the plate under the engine.

20. Assemble both propeller shafts to the transmission, see sections 451 Propeller shaft, front, replacing and 451 Propeller shaft, rear, replacing.

21. Remove the support from the engine.

22. Refill the transmission oil, see section 173 Transmission, changing oil.

    NOTICE

    Always handle oils and other environmentally hazardous fluids in an environmentally safe manner.

23. Turn on the battery disconnect switch.

24. Refill the oil to the hydraulic system, see section 173 Hydraulic system, changing oil.
    NOTE!
    Also activate the levers and do the oil level check, as described in the section for hydraulic oil change.

25. Carefully lift up the machine by lowering the stabilisers and the loader bucket, so that both axle supports are free.

26. Stop the engine.

27. Remove the support from the front axle.

28. Start the engine and lower the front wheels to the ground, lower the rear axle to the support for rear wheel installation.

29. Install the rear wheel. See section 771 Rear wheel, installation.
    NOTE!
    Also remove the axle support and lower the rear wheels to the ground, as described in the section for rear wheel installation.

VOLVO
Construction Equipment

Service Information

Document Title:	Function Group:	Information Type:	Date:
Powershift Transmission (option), oil pressures, checking	**421**	**Service Information**	**2014/3/14**
Profile: **BHL, BL60B [GB]**			

Powershift Transmission (option), oil pressures, checking

Op nbr 421-098

88830055 Pressure checking set

Additional parts for transmission pressure testing:
VOE936440 testing nipple
VOE933859 T-nipple
VOE935650 plug
VOE935331 nipple
VOE936439 testing nipple

1. Apply the parking brake. The parking brake control lamp illuminates on the front instrument panel.

2. Press on the spring plate (1) with a suitable tool, in the direction that the arrow indicates, to activate the transmission. When it is activated, the parking brake lamp on the front panel should switch off.

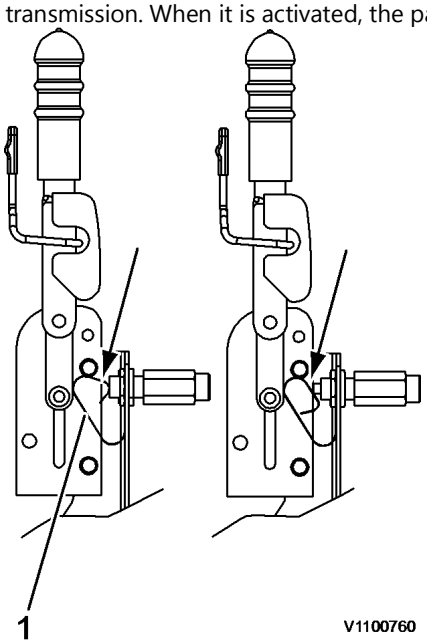


Figure 1
parking brake lever

1. spring plate

3. Start the engine and warm up the transmission oil to a temperature of 70–80 °C (158–176 °F).
   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.

4. Place the machine in Service position 2, see section 191 Service position 2.
5. Remove the floor mat in the cab.
6. Remove the cab floor plate in front of the seat.

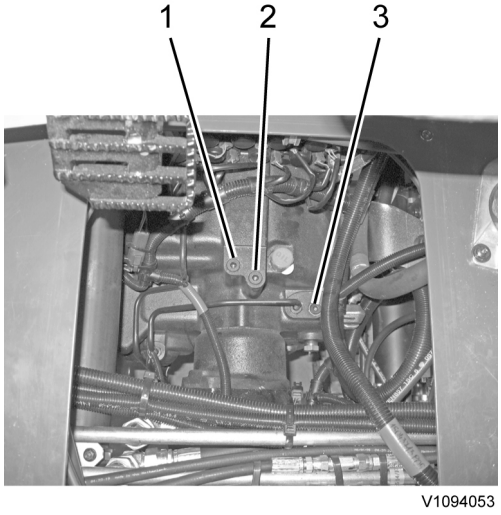


Figure 2
Powershift transmission, pressure check ports

1. reverse clutch, pressure check port
2. forward clutch, pressure check port
3. lubrication, pressure check port

Checking forward clutch pressure

7. Remove the plug and fit the testing nipple (part no. 936440) to the forward clutch pressure check port.
8. Connect a pressure sensor (6.0 MPa (60 bar) (870 psi)) between the pressure check port and the digital pressure gauge.
9. Reset the digital pressure gauge to zero, see special instruction.
10. Start the engine and apply the service brakes.
11. Shift the forward/reverse lever into position F.
12. Raise the engine to the recommended engine speed for checking the forward clutch pressure, see 420 Powershift transmission, specifications.
13. Read off the pressure. See 420 Powershift transmission, specifications for correct forward clutch pressure.
14. Turn off the engine and shift the forward/reverse lever into position N.
15. Remove the checking equipment and refit the plug, for recommended tightening torque see 430 Transmission, tightening torques.

Checking reverse clutch pressure

16. Remove the plug and fit the testing nipple (part no. 936440) to the reverse clutch pressure check port.
17. Connect a pressure sensor (6.0 MPa (60 bar) (870 psi)) between the pressure check port and the digital pressure

gauge.

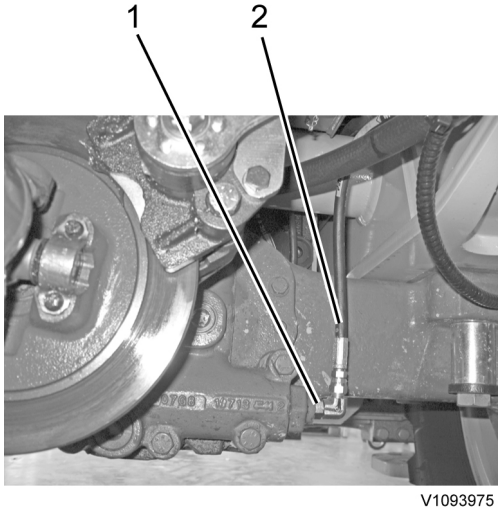
18. Reset the digital pressure gauge to zero, see special instruction.
19. Start the engine and apply the service brakes.
20. Shift the forward/reverse lever into position R.
21. Raise the engine to the recommended engine speed for checking the reverse clutch pressure, see 420 Powershift transmission, specifications
22. Read off the pressure. See 420 Powershift transmission, specifications for correct reverse clutch pressure.
23. Turn off the engine and shift the forward/reverse lever into position N.
24. Remove the checking equipment and refit the plug, for recommended tightening torque see 430 Transmission, tightening torques

Checking lubrication pressure

25. Remove the plug and fit the testing nipple (part no. 936440) to the lubrication pressure check port.
26. Connect a pressure sensor (6.0 MPa (60 bar) (870 psi)) between the pressure check port and the digital pressure gauge.
27. Reset the digital pressure gauge to zero, see special instruction.
28. Start the engine and apply the service brakes.
29. Shift the forward/reverse lever into position N.
30. Raise the engine to the recommended engine speed for checking the lubrication pressure, see 420 Powershift transmission, specifications
31. Read off the pressure. See 420 Powershift transmission, specifications for correct lubrication pressure.
32. Turn off the engine.
33. Remove the checking equipment and refit the plug, for recommended tightening torque see 430 Transmission, tightening torques

Checking differential lock pressure

34. Disassemble the hose from the differential lock supply port.



V1093975

Figure 3
rear axle, differential lock supply port

1. differential lock supply port
2. supply hose

35. Connect the T-nipple (part no. 933859) to the supply hose.

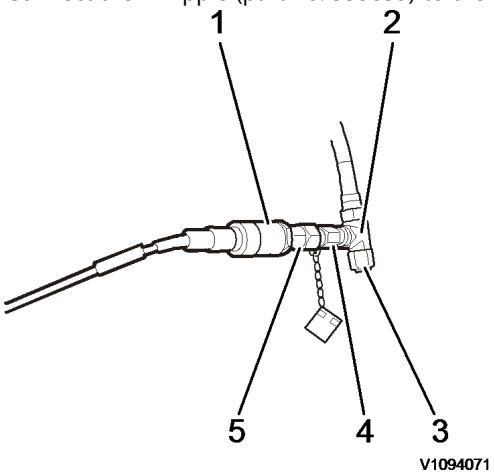


Figure 4
checking equipment connected to supply hose

1. pressure sensor
2. T-nipple (part no. 933859)
3. plug (part no. 935650)
4. nipple (part no. 935331)
5. testing nipple (part no. 936439)

36. Fit the plug (part no. 935650) to the T-nipple.

37. Fit the nipple (part no. 935331) to the T-nipple.

38. Fit the testing nipple (part no. 936439) to nipple.

39. Connect a pressure sensor (6.0 MPa (60 bar) (870 psi)) between the pressure check port and the digital pressure gauge.

40. Reset the digital pressure gauge to zero, see special instruction.

41. Start the engine and raise it to the recommended engine speed for checking the differential lock pressure, see 420 Powershift transmission, specifications.

42. Read off the pressure. See 420 Powershift transmission, specifications for correct differential lock pressure.

43. Turn off the engine.

44. Remove the checking equipment.

45. Reassemble the hose to differential lock supply port, for recommended tightening torque see 463 Rear axle, tightening torques.

Control valve supply pressure

46. Disassemble the hose from the brake pressure port fitting and seal the hose.

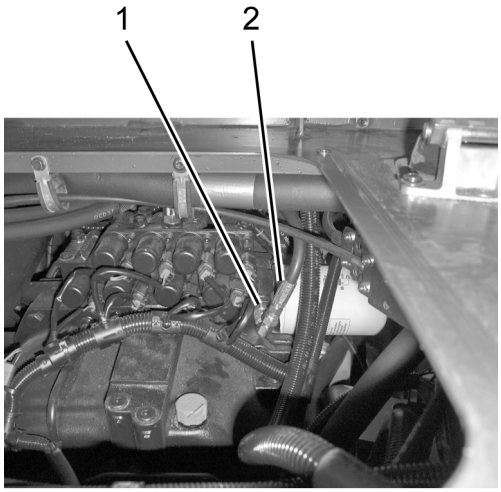


Figure 5
Powershift transmission, pressure check port

1. brake pressure port with fitting
2. hose

47. Fit the nipple (part no. 935331) to the brake pressure port fitting.

48. Fit the testing nipple (part no. 936439) to nipple.

49. Connect a pressure sensor (6.0 MPa (60 bar) (870 psi)) between the pressure check port and the digital pressure gauge.

50. Reset the digital pressure gauge to zero, see special instruction.

51. Start the engine and apply the service brakes.

52. Shift the forward/reverse lever into position N

53. Raise the engine to the recommended engine speed for checking the control valve supply pressure, see 420 Powershift transmission, specifications.

54. Read off the pressure. See 420 Powershift transmission, specifications for correct control valve supply pressure.

55. Turn off the engine and shift the forward/reverse lever into position N.

56. Remove the checking equipment and reassemble the hose to the brake pressure port fitting. For recommended tightening torque see 430 Transmission, tightening torques.
    NOTE!
    Repeat the following 9 steps for 1st, 2nd, 3rd and 4th gear. Use the regarding pressure check port for the gear to check.

Gear clutch pressure

57. Remove the plug and fit the testing nipple (part no. 936440) to the gear clutch pressure test port.

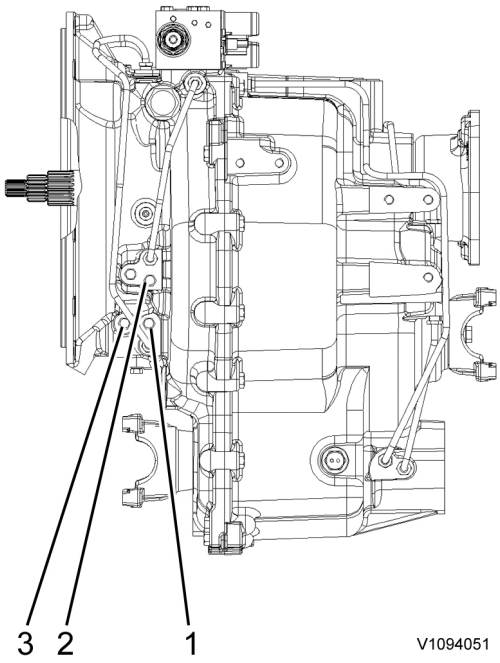


Figure 6
Gear clutch pressure check ports

1. 4th gear pressure check port
2. 2nd gear pressure check port
3. 1st gear pressure check port

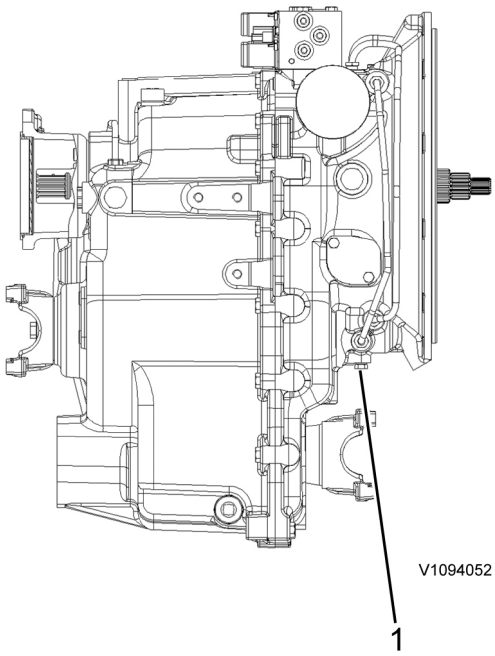


Figure 7
Gear clutch pressure check ports

1. 3rd gear pressure check port

58. Connect a pressure sensor (6.0 MPa (60 bar) (870 psi)) between the gear pressure check port and the digital pressure gauge.

59. Reset the digital pressure gauge to zero, see special instruction.

60. Start the engine and apply the service brakes.

61. Select a gear and shift the forward/reverse lever into position F.

62. Raise the engine to the recommended engine speed for checking the gear clutch pressure test port. see 420 Powershift transmission, specifications

    NOTE!
    Abort test if transmission oil temperature is getting to high (indicated by high temperature warning light), and allow the transmission to cool down to normal operating temperature before resuming tests.

63. Read off the pressure. See 420 Powershift transmission, specifications for correct gear clutch pressure. Repeat the procedure with reverse selected on the gear selector.

64. Turn off the engine and shift the forward/reverse lever into position N.

65. Release the parking brake and apply it again for normal parking brake functionality and to deactivate the transmission.

66. Remove the checking equipment and refit the plug, for recommended tightening torque see 430 Transmission, tightening torques

67. Fit the cab floor plate in front of the seat.

68. Fit the floor mat in the cab.

Document Title: **Hydraulic control valve, reconditioning**	Function Group: **421**	Information Type: **Service Information**	Date: **2014/3/14**
Profile: **BHL, BL60B [GB]**			

Hydraulic control valve, reconditioning

Disassembly

Op nbr 421-101

1. Place the machine in service position 2, see section 191 Service position 2.
2. Turn off the battery disconnect switch.

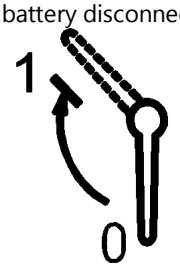


Figure 1
battery disconnect switch

1. position 0: battery disconnect switch off
2. position 1: battery disconnect switch on

3. Place a suitable container under the transmission to collect draining oil.

NOTICE

Always handle oils and other environmentally hazardous fluids in an environmentally safe manner.

4. Drain some oil (2 l / 0.5 gal) from the transmission before disassembling the hydraulic control valve. See section 173 Transmission, changing oil

NOTE!
Take care to keep the oil clean, it has to be refilled to the transmission.

5. Remove the floor mat in the cab.
6. Remove the cab floor plate in front of the seat.
7. Place a suitable container under the control valve to collect draining oil from the differential lock hose.

NOTICE

Always handle oils and other environmentally hazardous fluids in an environmentally safe manner.

8. Disassemble the differential block hose (3) from the connection.

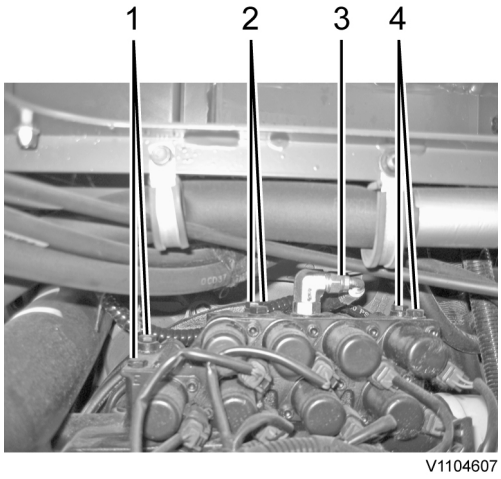


Figure 2
hydraulic control valve, disassembly

1. retaining screws
2. retaining screws
3. differential lock hose
4. retaining screws

9. Plug the differential lock hose and the connection on the transmission.

10. Loosen and remove the retaining screws of the hydraulic control valve (1, 2, 4).

11. Remove all electrical connectors from the solenoids.

NOTICE

Mark up all parts when dismantling so that they are assembled in the correct order when assembling.

12. Bring the hydraulic control valve to front and remove the electrical connector of the oil pressure sensor (1).

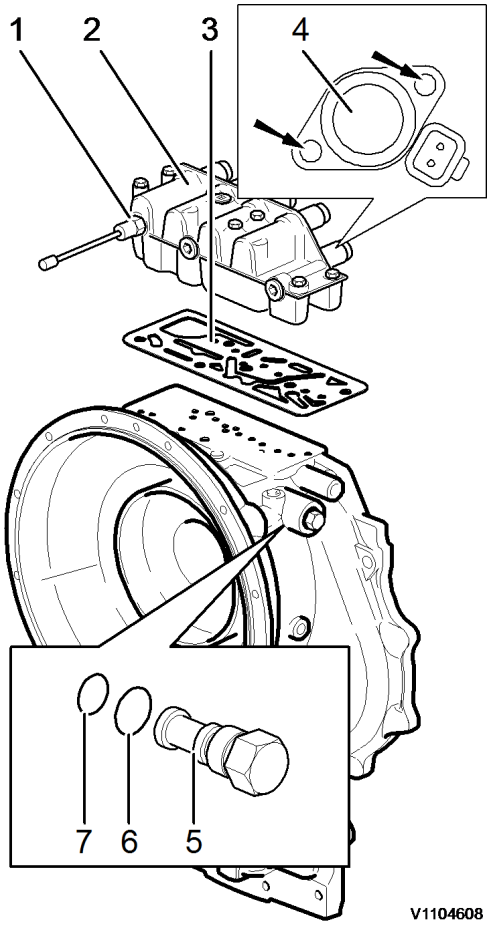


Figure 3
hydraulic control valve, disassembly

1. oil pressure sensor
2. hydraulic control valve
3. gasket
4. solenoid valve
5. oil flow divider
6. O-ring
7. O-ring

13. Remove the hydraulic control valve from the transmission.

14. Remove the gasket (3) from the transmission.

15. Loosen and remove the oil flow divider (5) from the transmission.

16. Remove the O-rings (6, 7) and check the condition of the oil flow divider.

17. Place the control valve on a clean workbench.

18. Disassemble the oil pressure sensor (1) from the hydraulic control valve.

19. Loosen and remove the retaining screws of the solenoid valves (4) and carefully remove the solenoid valves by use of a screwdriver.

    NOTICE

    Mark up all parts when dismantling so that they are assembled in the correct order when assembling.

20. Check the condition of the solenoid valves.

Assembly

21. Assemble the solenoid valves (according to your marks) and the retaining screws (4), fasten the retaining screws.

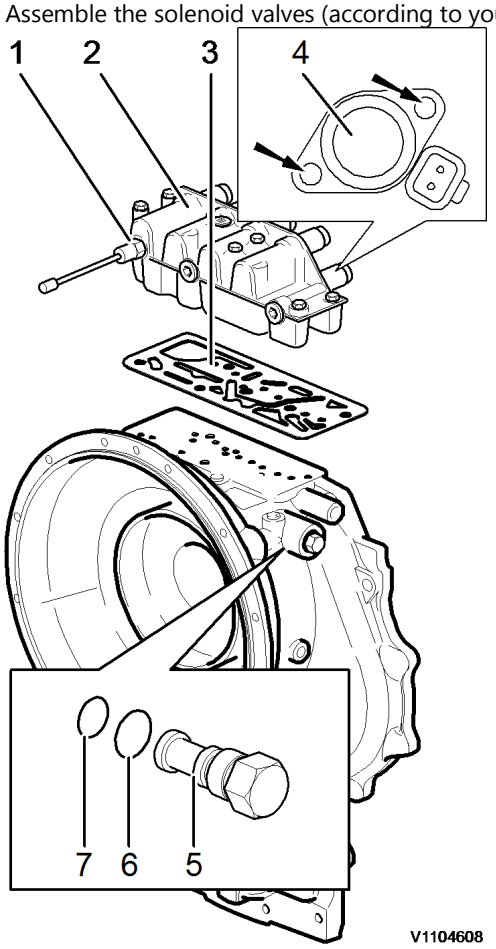


Figure 4
hydraulic control valve, assembly

1. oil pressure sensor
2. hydraulic control valve
3. gasket
4. solenoid valve
5. oil flow divider
6. O-ring
7. O-ring

22. Assemble the oil pressure sensor (1) to the hydraulic control valve and tighten it. For recommended tightening torque see section 430 Transmission, tightening torques.

23. Assemble new O-rings (6, 7) on the oil flow divider.

24. Assemble the oil flow divider (5) to the transmission and tighten it. For recommended tightening torque see section 430 Transmission, tightening torques.

25. Assemble a new gasket (3) on the transmission.

26. Bring the hydraulic control valve in mounting position and assemble the electrical connector to the oil pressure sensor (1).

27. Assemble and tighten the retaining screws of the hydraulic control valve (1, 2, 4). For recommended tightening torque see section 430 Transmission, tightening torques.

28. Assemble all electrical connectors to the solenoids (according to your marks).

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