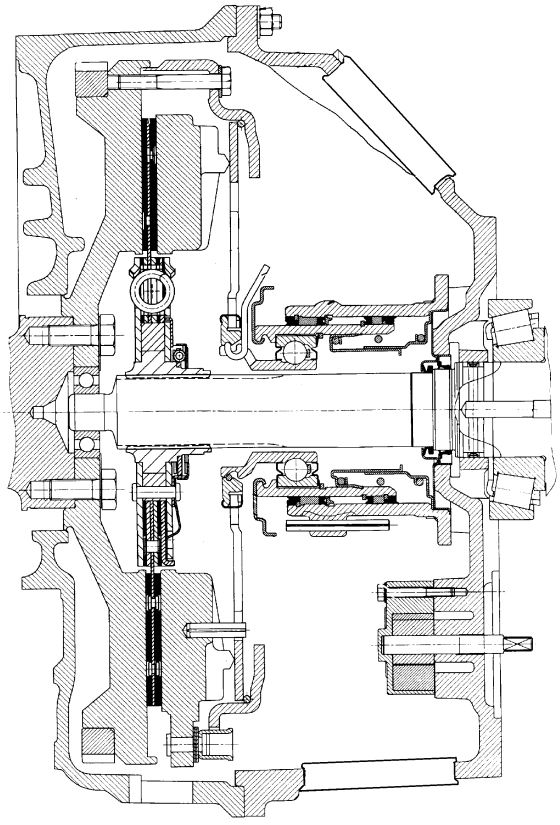
SCANIA

04:01-02

Issue 2 **en**

Clutch and clutch control

Function and work description



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Contents

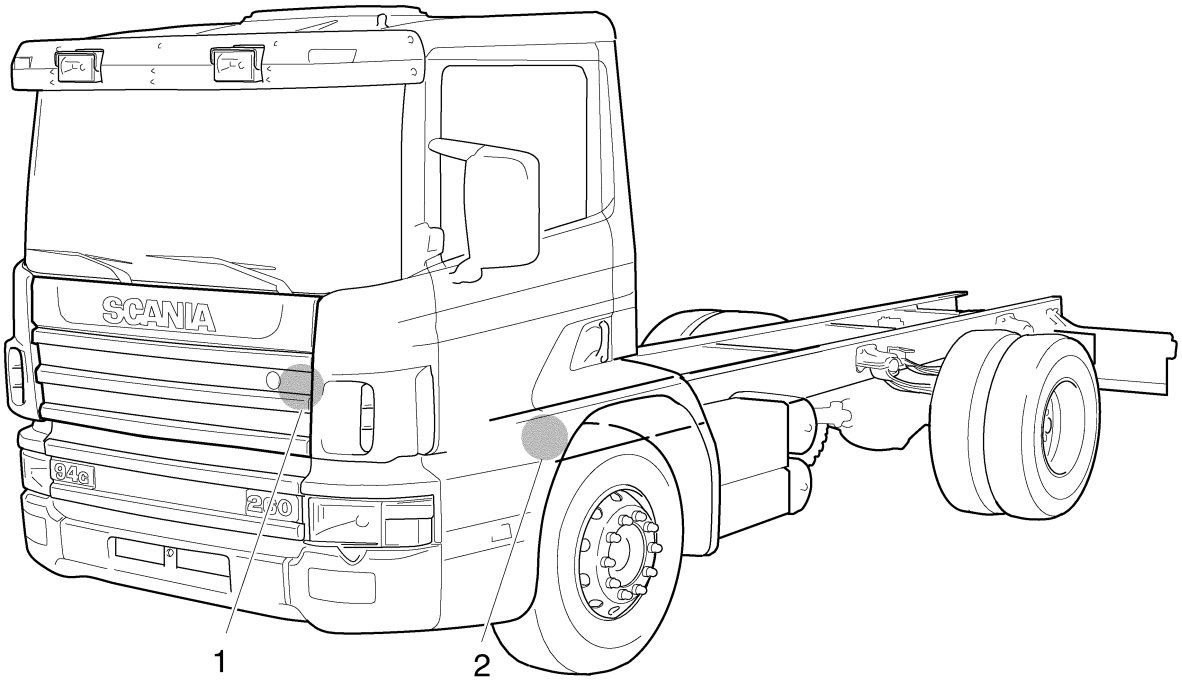
Function description

Clutch control

General

The Scania clutch control system is hydraulic and self-adjusting. It consists of two main components, a compressed-air fed master cylinder (servomaster) and a pull-type slave cylinder with integrated release bearing. On trucks equipped with EK power take-off, the slave cylinder is mounted separately and the release bearing is integrated in the clutch cover.

The system requires little pedal force which gives good comfort and performance.



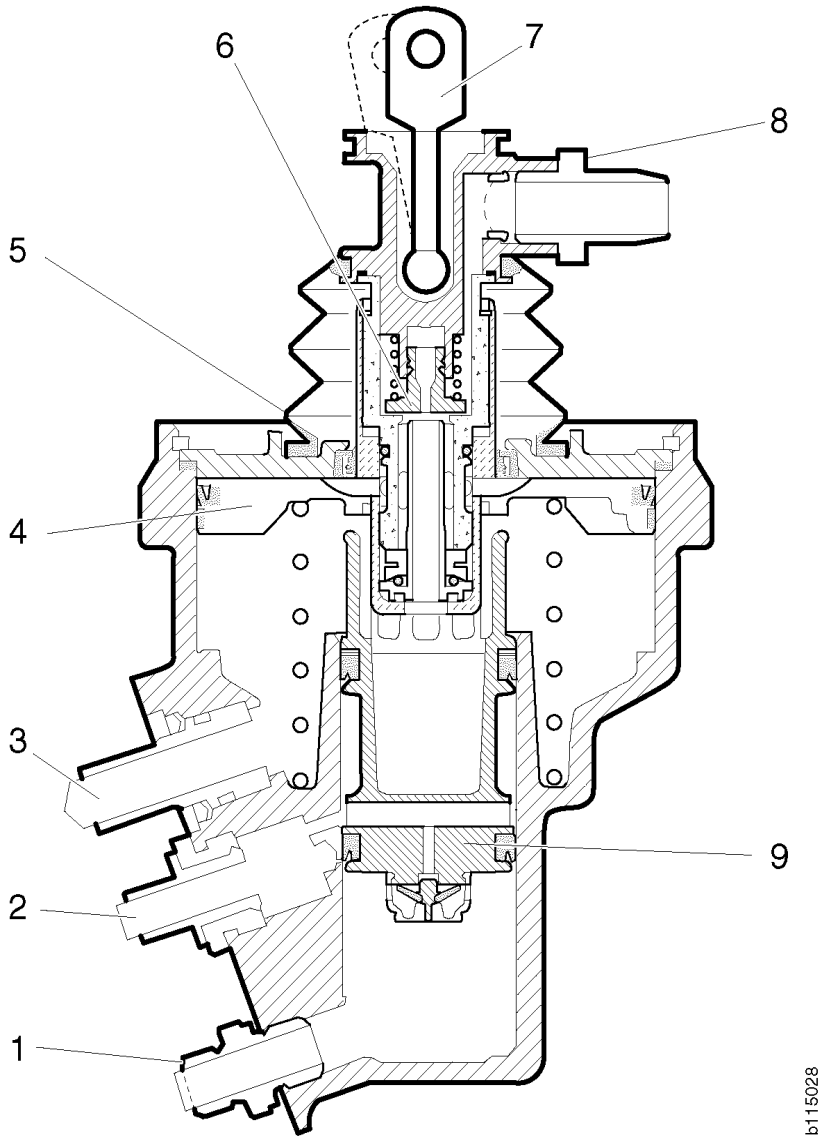
1 Position of the servomaster

2 Position of the master cylinder

Servomaster

The servomaster is actuated by the clutch pedal. When the clutch pedal is depressed a pushrod 7 acts on an air valve 6 in the servomaster. The air valve opens and compressed air forces the hydraulic piston 9 downwards, which presses the hydraulic fluid out to the slave cylinder. The hydraulic connection 1 is restricted on some clutches in order to reduce the flow in the system and thus counteract vibration in the clutch pedal.

Servomaster, overview figure



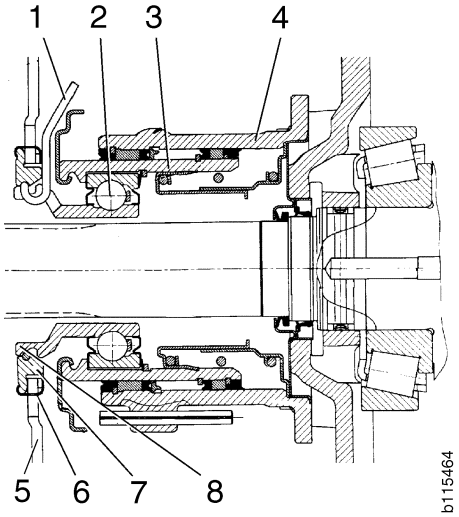
1 *Hydraulic connection to slave cylinder*
2 *Connection to fluid reservoir*
3 *Connection for ventilation hose*
4 *Air piston*
5 *Rubber bellows*
6 *Air valve, servo valve*
7 *Push rod to clutch pedal*
8 *Compressed air connection*
9 *Hydraulic piston*

Slave cylinder

The slave cylinder is a pull-type, mounted on the inside of the clutch housing, around the gearbox input shaft. The moving part 3 of the slave cylinder is connected to the diaphragm spring 5 of the clutch with a retaining ring 1. When the slave cylinder is pressurized by the servomaster, its moving part moves pulling the diaphragm spring with it, and declutching occurs.

The connection between the clutch and the slave cylinder consists of a retaining ring positioned on the nose of the slave cylinder 8. When fitting the gearbox, the retaining ring will snap into the thrust washer 7 for the diaphragm spring, locking the slave cylinder and the diaphragm spring together.

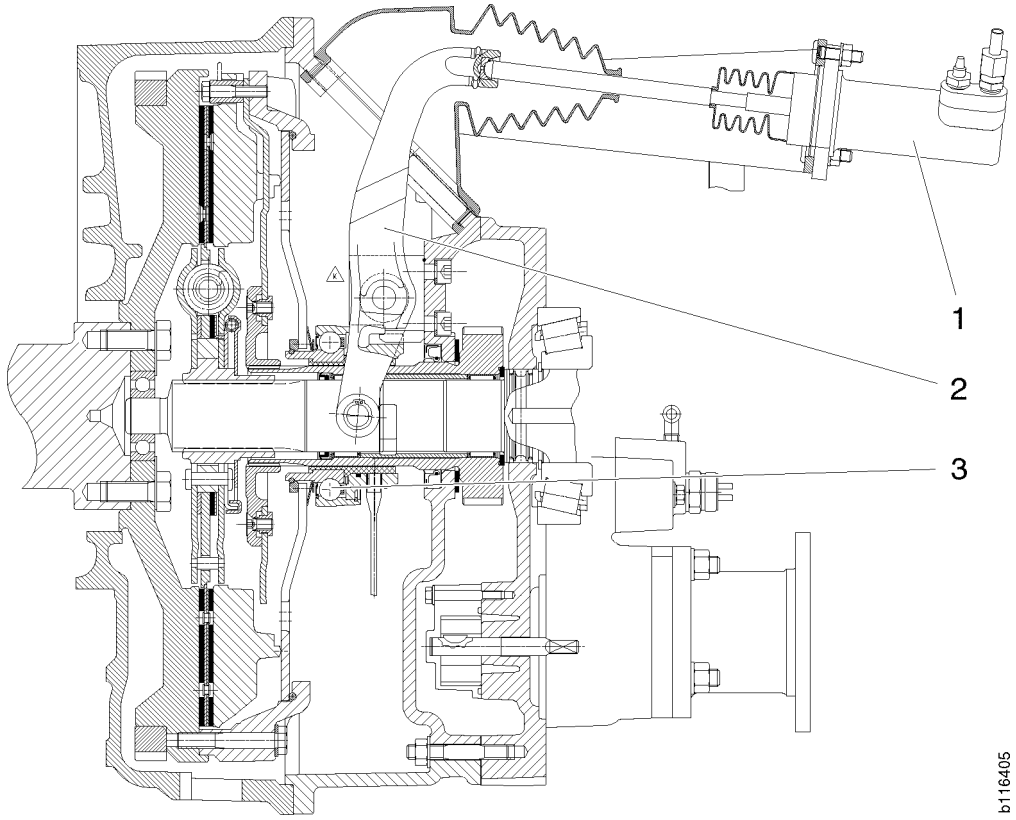
Slave cylinder on vehicles without EK power take-off



1 Retaining ring
2 Release bearing
3 Slave cylinder, moving part
4 Slave cylinder, fixed part
5 Diaphragm spring
6 Retainer for thrust washer
7 Thrust washer
8 Nose

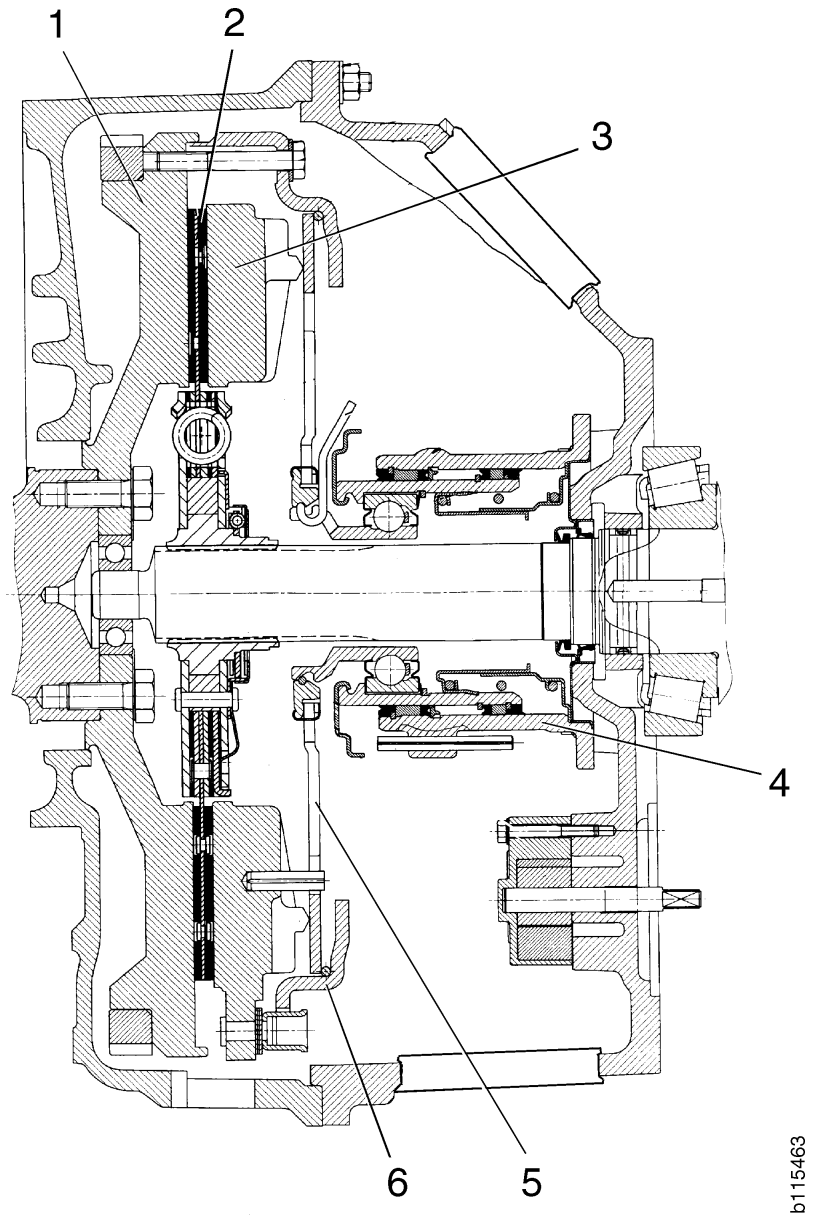
On vehicles equipped with EK power take-off, the slave cylinder is mounted on a separate bracket outside the clutch housing. The release bearing is actuated via a lever and is integrated in the clutch cover.

Slave cylinder on vehicles with EK power take-off



1 Slave cylinder
2 Lever
3 Release bearing, integrated in clutch housing

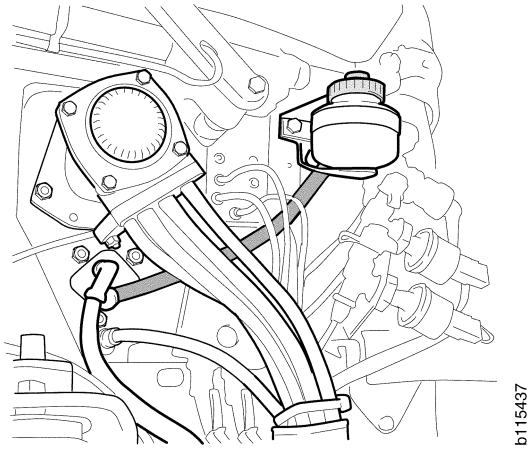
Clutch, overview figure



1 *Flywheel*
2 *Clutch disc*
3 *Pressure plate*
4 *Slave cylinder*
5 *Diaphragm spring*
6 *Clutch cover*

Hose routing and connections

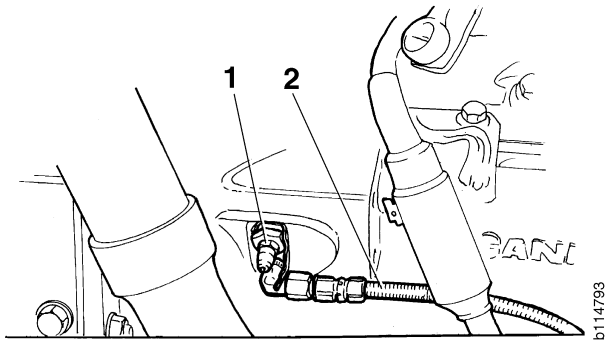
There are several different configurations of hose routing and connections.



Hose routing between servomaster and fluid reservoir.

Older configuration on trucks and buses

- The older configuration has a bleed nipple on the slave cylinder and **is bled like a conventional** hydraulic system. The bleed nipple 1 is positioned above the hydraulic line 2 to the servomaster.



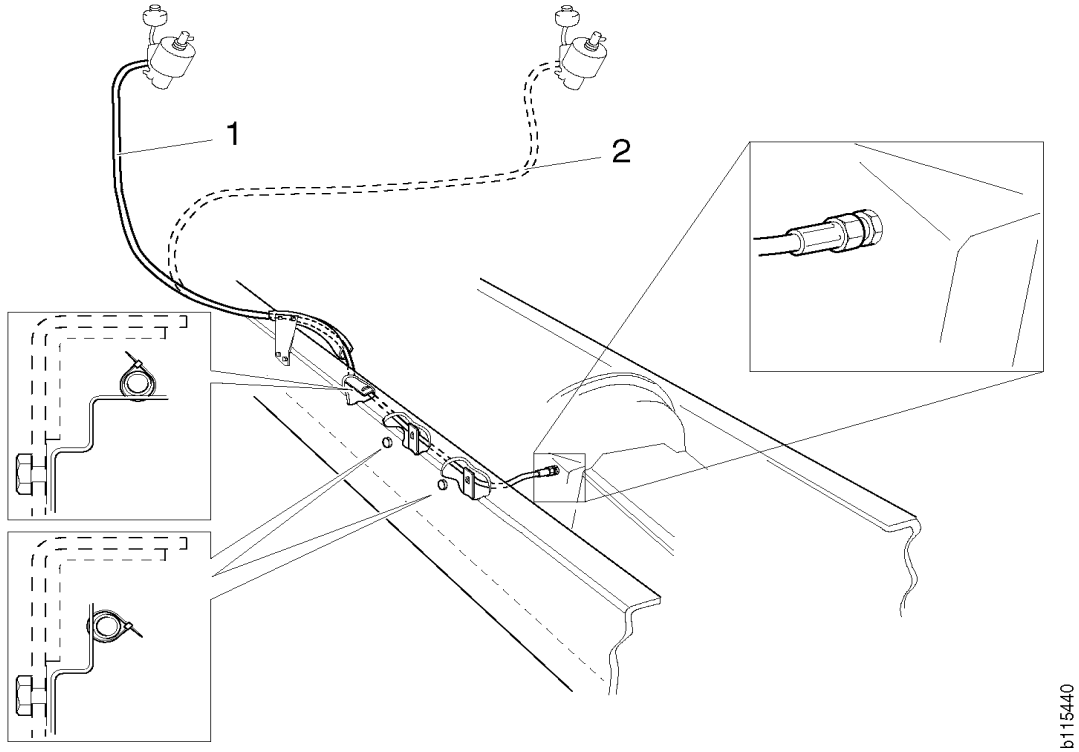
Older configuration.

1 Bleed nipple

2 Hydraulic line to servomaster

Configuration on trucks built after 9907

- The system is **self bleeding** and there is no bleed nipple on the slave cylinder. Self bleeding is possible due to the fact that both the hydraulic line from the slave cylinder to the servomaster and the hose from the servomaster to the fluid reservoir are routed upwards. All bleeding of the system is carried out via the fluid reservoir. After working on the system, bleeding is carried out by using a special tool to pressurize the fluid reservoir with compressed air.



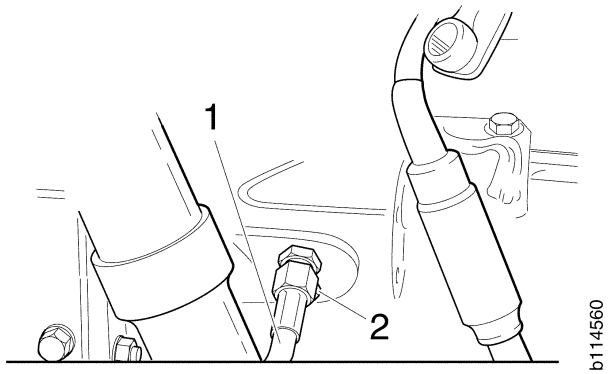
Hose routing of the self-bleeding system.

1 Left-hand drive vehicle

2 Right-hand drive vehicle

Newer configuration on buses

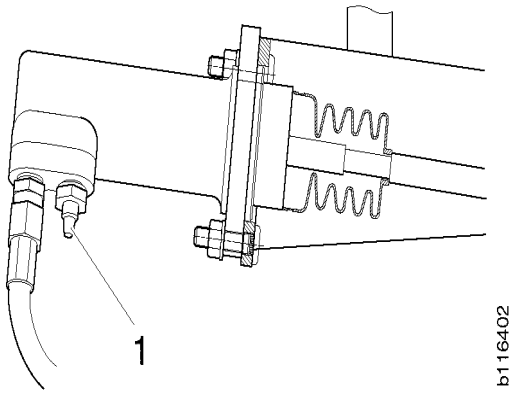
- The bleed nipple 2 is positioned below the hydraulic line 1 to the servomaster. The system **is bled like a conventional** hydraulic system



1 Hydraulic line routing and connection
2 Bleed nipple position on buses

On trucks with EK power take-off

- The bleed nipple is positioned on the slave cylinder. The system is bled **like a conventional** hydraulic system**,** using the bleed nipple.



1 Position of bleed nipple on trucks equipped with EK power take-off.

Work Description

Renewing the servomaster

Removal

Depressurize the system.

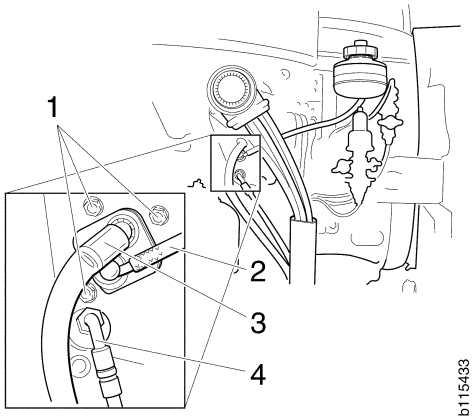
WARNING!

Wear protective goggles. Hydraulic fluid is corrosive and can cause permanent eye damage.

1 Remove hose 2 to the fluid reservoir and fold it upwards so the fluid does not drain from the reservoir.

2 Remove the ventilation hose 3.

3 Remove the hydraulic hose 4 to the slave cylinder. Plug both the hose and the connections to the cylinder.



1 Retaining nuts
2 Hose to fluid reservoir
3 Ventilation hose
4 Hydraulic hose to slave cylinder

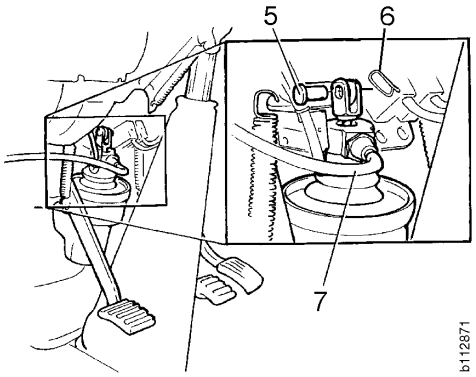
4 Remove the panel below the steering wheel.

5 Remove the union for the air supply hose 7.

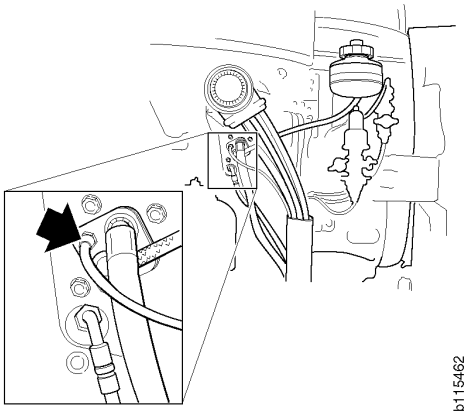
Note: Use a counterhold when loosening the union.

6 Remove the three retaining nuts 1 for the servomaster.

7 Remove the lock pin 6 and the parallel pin 5.



5 Parallel pin
6 Lock pin
7 Air supply hose



Alternative position for the air supply hose on trucks built after 9912.

Fitting

Specifications

Tightening torque

Union, air supply hose	20 Nm

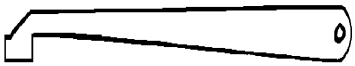
- Refit the servomaster in reverse order.

Note: Use a counterhold when tightening the union for the air supply hose.

Disc wear

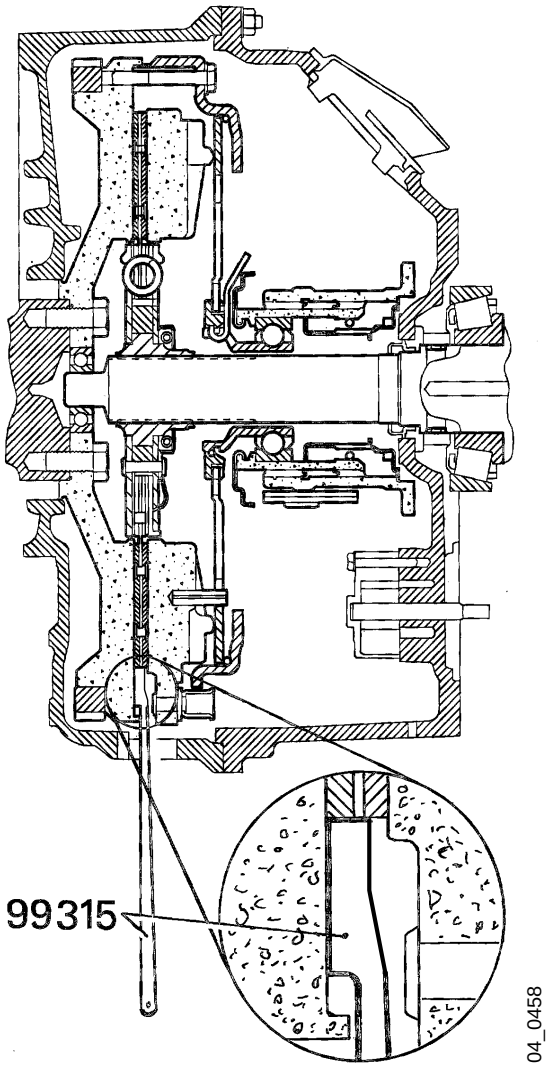
Check

Special tools

Number	Designation	Illustration	Tool board
99 315	Gauge		F1

To check disc wear, the measurement must be taken directly on the disc. Remove the protection cover over the inspection opening on the bottom of the flywheel housing. Use gauge 99 315 and measure through the inspection opening in the flywheel housing as shown in the illustration.

A new disc is 10 mm thick and has a wear limit of 7 mm. It may be difficult to reach the disc with the gauge in some cases. If so, turn the crankshaft using turning tool 99 309.



Renewing the slave cylinder

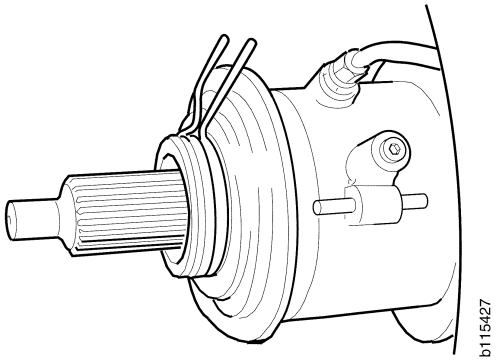
Removal

Vehicles without EK power take-off

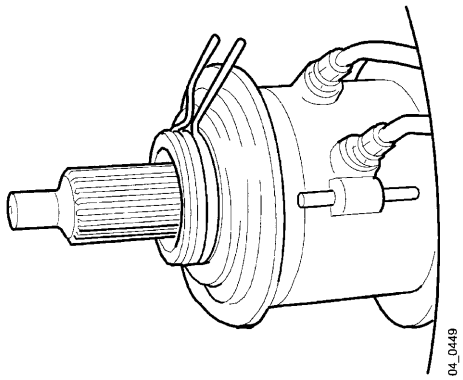
1 Remove the gearbox, refer to Main group 5, Manual gearbox, Removal and fitting.

2 Clean around the pipe connections.

3 Loosen the pipe grommet on the clutch housing. Remove the pipes inside the clutch housing. Older versions of trucks and buses have two pipes. Plug the pipe connections to prevent dirt entering the hydraulic system.



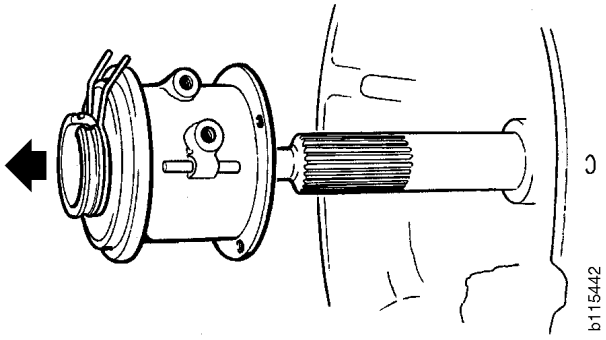
Slave cylinder, truck, newer version.



Slave cylinder, bus and older trucks.

4 Remove the retaining bolts and the slave cylinder.

Note: The slave cylinder cannot be overhauled, renew as a complete unit.



Removal of the slave cylinder.

Fitting

Vehicles without EK power take-off

Specifications

Tightening torques

Slave cylinder	22 Nm
Pipe	30 Nm

1 Screw the slave cylinder onto the clutch housing.

2 Fit the pipes and torque tighten them.

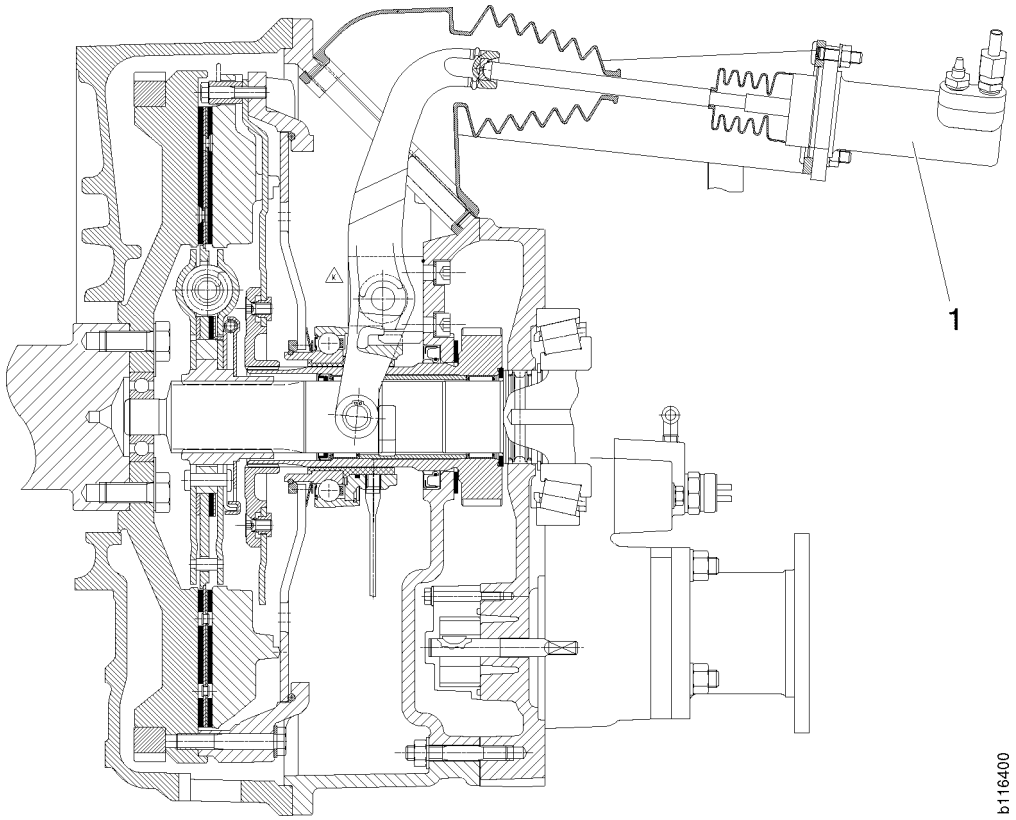
3 Screw the grommet onto the clutch housing.

4 Fit the gearbox, refer to Main group 5, Manual gearbox, Removal and fitting.

Vehicles with EK power take-off

Removal and fitting

The slave cylinder is mounted on a bracket on the outside of the clutch housing.

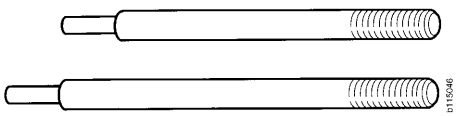
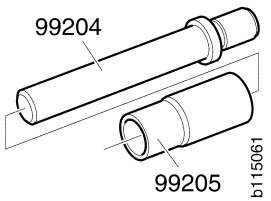


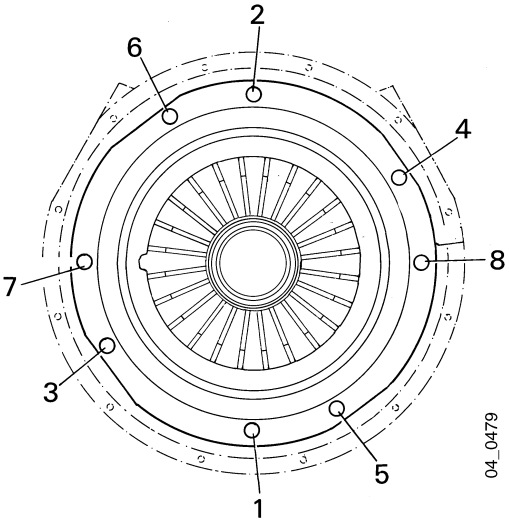
1 Slave cylinder position on vehicles with EK power take-off.

Renewing the clutch

Removal

Special tools

Number	Designation	Illustration	Tool board
98 747	Guide pins		F1
99 204 99 205	Mandrel Sleeve		D4



1 Remove the gearbox, refer to Main group 5, Manual gearbox, Removal and fitting.

2 Remove bolts 7 and 8.

3 Fit the guide pins 98 747 in the bolt holes.

4 Fit the mandrel 99 204 with the sleeve 99 205 in the centre of the disc.

5 Remove the clutch cover and the clutch disc by alternately loosening the remaining bolts.

6 Clean the flywheel and check it for thermal cracks and wear.

7 Check the pressure plate, refer to Checking the pressure plate.

Checking the pressure plate

Specifications

Maximum concavity

Pressure plate	1 mm

Check the friction surface of the pressure plate for heat damage.

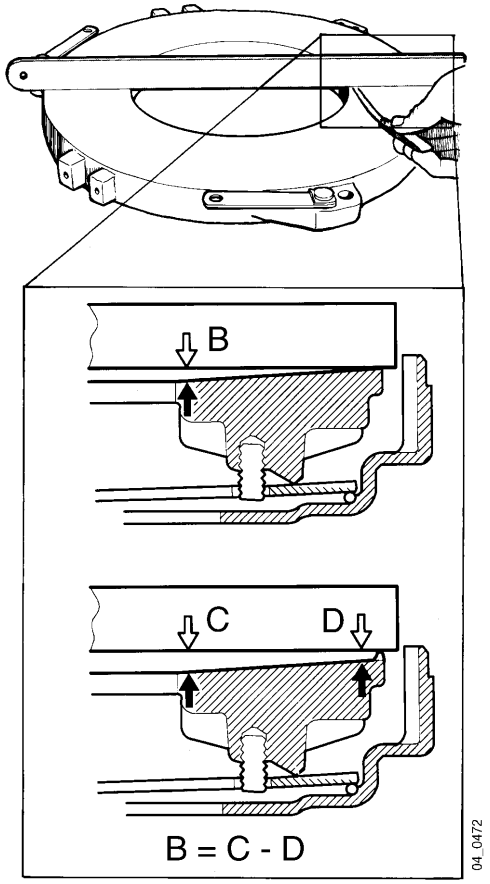
If the friction surface of the pressure plate has deep thermal cracks or blueing that may sometimes be obvious as a movement of the material, the clutch cover should not be re-used. The method of machining or grinding the friction surface of the pressure plate should not be used, as this affects the clamping force.

Heat, caused by incorrect use of the clutch, will often lead to the friction surface of the pressure plate distorting and becoming concave.

The concavity is not detrimental if the same clutch cover and disc are refitted. However, when renewing discs it is advisable to check how deep this concavity is.

If, by measuring as shown in the illustration, it is found that dimension B is greater than 0.6 mm, there is an increased risk of rapid disc wear in the future.

If the distortion or wear, dimension B, is greater than approx. 1 mm, the clutch cover should be renewed.



Checking the pressure plate.

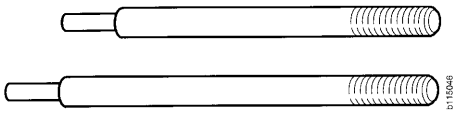
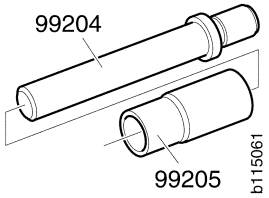
Fitting

Specifications

Tightening torque

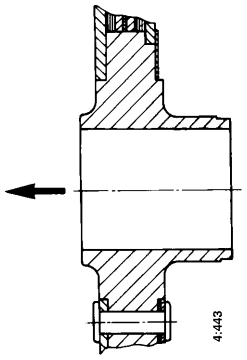
Clutch cover	47 Nm

Special tools

Number	Designation	Illustration	Tool board
98 747	Guide pins		F1
99 204 99 205	Mandrel Sleeve		D4

1 Fit the mandrel 99 204 into the flywheel bearing. Fit the sleeve 99 205 to the mandrel and fit the disc onto the sleeve.

Note: Turn the disc as illustrated.

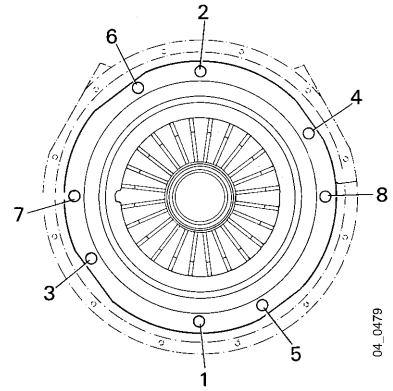


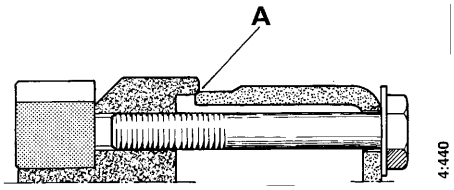
Fitting the disc, arrow towards the flywheel.

2 Fit guide pins 98 747 in the threaded holes 7 and 8. Place the clutch cover on the guide pins.

IMPORTANT! To enable the clutch cover to lie completely flat and even against the contact surface of the flywheel, the guide edges of the clutch cover and flywheel must be thoroughly cleaned.

3 Tighten the bolts 1-6 in the order shown in the illustration, so that the guide edge of the clutch cover mates evenly all around with the guide edge A of the flywheel.





4 Remove the guide pins and fit bolts 7 and 8.

5 Check that the clutch cover sits completely flat and even against the contact surface of the flywheel.

6 Torque tighten bolts 1-8 to 47 Nm in the order shown in the illustration.

7 Check tighten all the bolts to 47 Nm.

8 Remove the mandrel and the sleeve.

9 Check the diaphragm spring, refer to Checking the diaphragm spring.

10 Fit the gearbox, refer to Main group 5, Manual gearbox, Removal and fitting.

Checking the diaphragm spring

Specifications

Maximum deviation from the flat

Diaphragm spring fingers	1 mm

If the diaphragm spring fingers deviate too much from the flat when the clutch cover is fitted to the flywheel, vibration can occur in the release bearing.

The different heights of the diaphragm spring fingers are probably caused by a break in the diaphragm spring or by the bolts for the clutch cover being tightened to different torques.

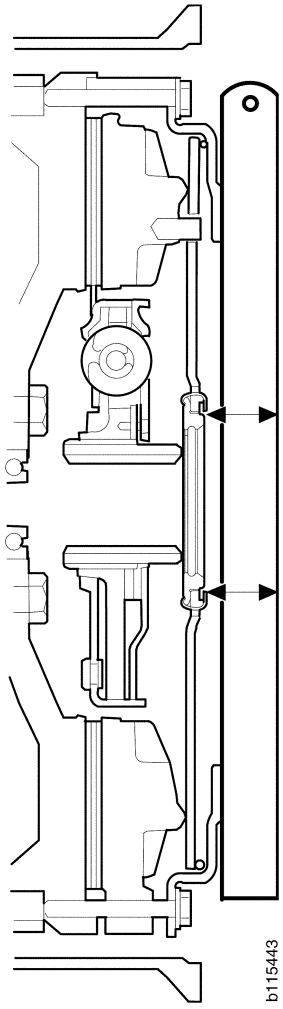
Check as follows, that the diaphragm spring fingers do not deviate more than 1 mm from the flat due to other causes.

1 Screw the clutch cover onto the flywheel.

2 Fit the clutch cover and torque tighten the bolts to 47 Nm.

3 Using a rule and a sliding caliper, it is possible to determine the greatest deviation from the flat position of the thrust washer.

If the deviation is greater than 1 mm the clutch cover should be renewed, provided that the cause of the deviation cannot be attributed to faults that can be rectified i.e. incorrect fitting.

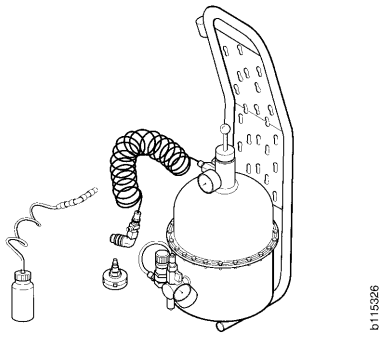
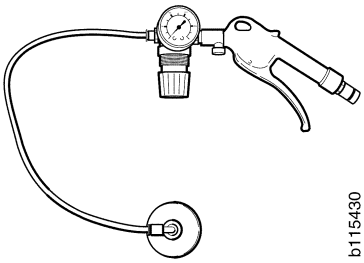


Checking the diaphragm spring fingers.

Hydraulic system

Bleeding the hydraulic system using the bleed nipple

Other tools

Number	Designation	Illustration	Tool board
587 949	Replenishing equipment	 b115326	
99 405	Bleeding tool	 b115430	D6

WARNING!

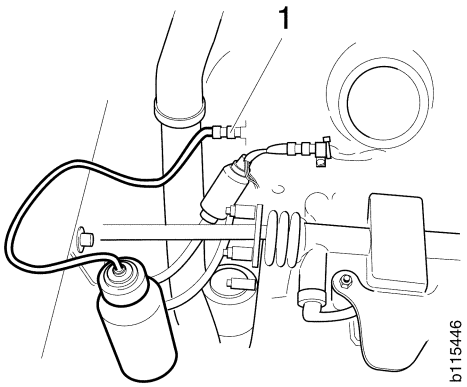
Wear protective goggles. Hydraulic fluid is corrosive and can cause permanent eye damage.

Bleeding without replenishing equipment 587 949

IMPORTANT! Use hydraulic fluid of the type SAE J 1703 D.O.T:3-4 Brake Fluid.

1 Connect a suitable container to the bleed nipple 1 at the clutch housing.

IMPORTANT! Used brake fluid must be discarded.



Bleeding container connected to the bleed nipple 1 at the gearbox.

2 Fill with fluid up to the maximum level of the fluid reservoir.

IMPORTANT! Ensure that the fluid reservoir does not become empty during bleeding.

3 Pump the clutch pedal until a resistance is felt. Keep the pedal depressed in its lowest position. Alternatively, the system can be pressurized using bleeding tool 99 405.

4 Open the bleed nipple at the clutch housing and release the fluid/air mix by depressing the clutch pedal.

5 Close the bleed nipple and release the clutch pedal.

6 Repeat steps 2-5 until all the air has been removed and only pure hydraulic fluid flows from the bleed nipple.

Bleeding using replenishing equipment 587 949

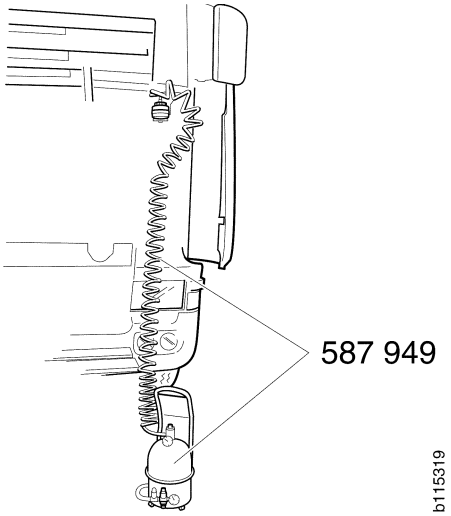
WARNING!

Wear protective goggles. Hydraulic fluid is corrosive and can cause permanent eye damage.

IMPORTANT! Use hydraulic fluid of the type SAE J 1703 D.O.T:3-4 Brake Fluid.

1 Fill the reservoir of the replenishing equipment with hydraulic fluid. The reservoir volume is 5 litres.

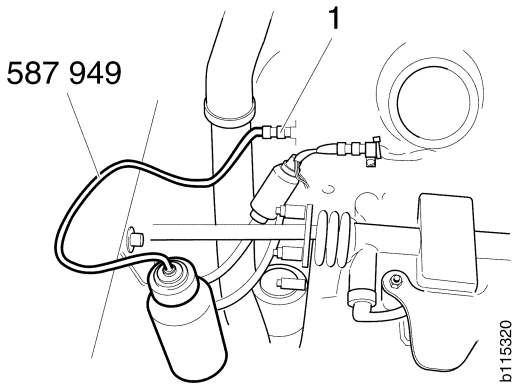
2 Connect the replenishing equipment according to the illustrations and connect a supply of compressed air.



Replenishing equipment connected to the hydraulic fluid reservoir.

3 Fill and bleed the system by opening the bleed nipple 1 on the gearbox. Repeat the bleeding until all the air has been removed and only pure hydraulic fluid flows from the bleed nipple. The hydraulic system volume is approximately 0.5 litres.

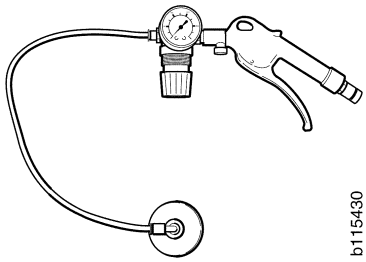
IMPORTANT! Ensure that the hydraulic fluid reservoir does not become empty during bleeding.



Bleeding container of replenishing equipment 587 949 connected to bleed nipple 1 at the gearbox.

Bleeding the hydraulic system without the bleed nipple

Special tools

Number	Designation	Illustration	Tool board
99 405	Bleeding tool	 b115430	D6

WARNING!

Wear protective goggles. Hydraulic fluid is corrosive and can cause permanent eye damage.

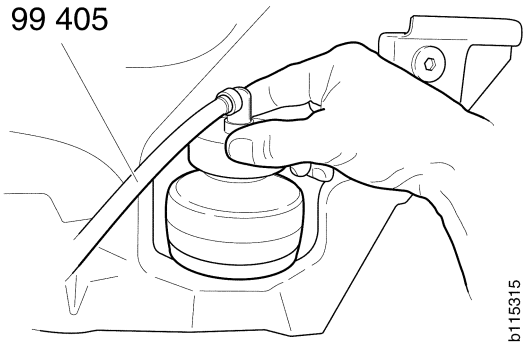
WARNING!

The hydraulic fluid reservoir may be pressurized to a maximum of 2 bar.

IMPORTANT! Use hydraulic fluid of the type SAE J 1703 D.O.T:3-4 Brake Fluid.

1 Fill with fluid up to the maximum level of the hydraulic fluid reservoir.

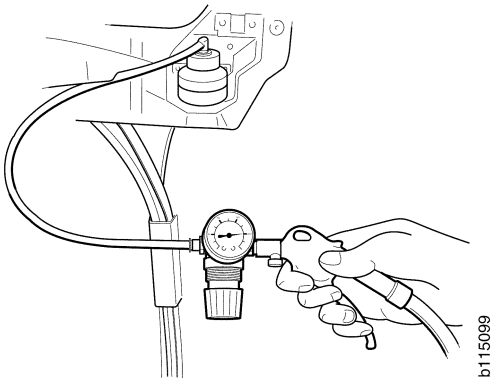
2 Connect the cap of the bleeding tool to the hydraulic fluid reservoir. Ensure that the cap is correctly secured in the threads.



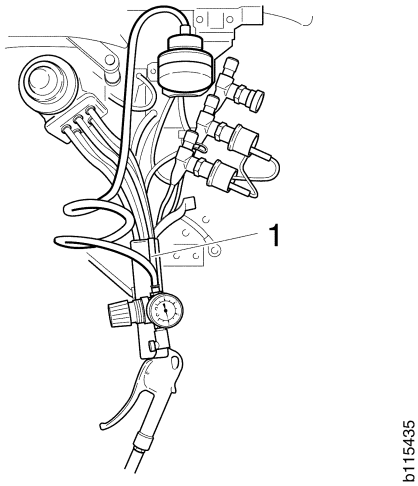
Fitting the cap of the bleeding tool.

3 Connect the bleeding tool to a compressed air supply. The tool is pre-set to 2 bar.

4 Build up a pressure of 2 bar. Keep the reservoir pressurized for 20 seconds. The bleeding tool is equipped with a hook to allow the tool to be hung up whilst the system is being pressurized.



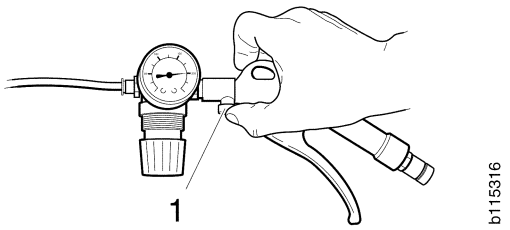
Pressurizing the hydraulic system



Hanging up the bleeding tool

1 Hook

5 Release the pressure using the ventilating valve on the bleeding tool. The air in the system will rise as bubbles in the reservoir.



1 Ventilating valve

6 Repeat the procedure according to steps 4-5 five times, though with a reduced pressurizing time.

IMPORTANT! Ensure that the hydraulic fluid reservoir does not become empty during bleeding.

7 Depress the clutch pedal ten times.

8 Repeat the bleeding twice according to steps 3-7.

9 Top up the hydraulic fluid reservoir to the maximum level.

10 Depress the clutch pedal a further 10-15 times.

11 The hydraulic system should now be sufficiently free from air for the clutch to function. If not, repeat the bleeding until the clutch functions.

12 Remove the tool.

Note: There may be a small amount of air still in the hydraulic system after bleeding, but this disappears during driving.

Troubleshooting

Clutch and clutch control

When the clutch malfunctions, the following trouble shooting schedule can be used to help identify the cause and carry out remedial action.

The position numbers in the text refer to the illustration at the end of the trouble shooting section.

Faults

Symptom

Vibration in the clutch pedal when it is held still with the foot, irrespective of position.

Cause

Burrs in the guide edge of the clutch cover or the diaphragm spring not lying parallel to the pressure plate.

Action

Remove the burrs from the guide edge of the clutch cover. Refer to Main group 4, Fitting the clutch and Checking the diaphragm spring.

Symptom

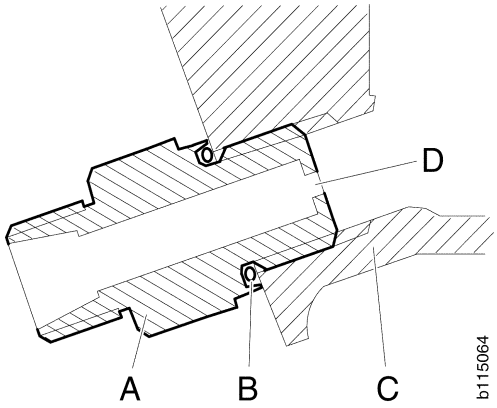
Vibration in the clutch pedal when it is depressed or released.

Cause

Instability in the control valve of the servomaster. Applies to servomasters with an older date code than 9750.

Action

Replace the existing unrestricted union A at the hydraulic connection 1 of the servomaster, with a restricted union and fit a new O-ring.



A. Union

B. O-ring

C. Servomaster

D. Restriction

Symptom

The clutch begins to engage.

Cause

1 Fluid leak from the servomaster, slave cylinder, hydraulic hose or its connections.

2 Internal hydraulic leak in the servomaster due to particles of dirt, or a swollen rubber disc caused by contamination in the hydraulic fluid.

Action

1 Tighten or renew leaking components.

2 Renew the servomaster.

Symptom

Soft pedal movement, varying position for clutch engagement or insufficient longitudinal stroke at the slave cylinder.

Cause

Air leaking into the hydraulic fluid.

Action

- Check all connections.
- Check the hose routing between the servomaster union 2 and the fluid reservoir.
- Bleed the system.

Symptom

Slow pedal movement, reduced or no servo function.

Cause

- No compressed air supply to the servomaster.
- Internal air leakage from bleeding hose 3.
- Air leakage from rubber bellows 5 due to a damaged cover seal.
- Air leak from the cover retaining ring due to a damaged O-ring.

Action

1 Check the air supply to the servomaster.

2 Renew the servomaster.

Symptom

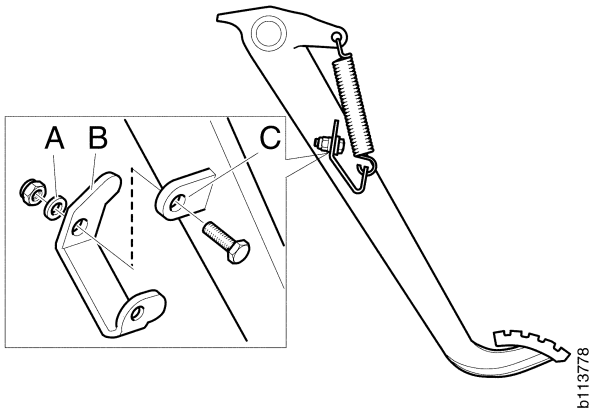
The Retarder is unintentionally activated.

Cause

The pedal return spring is too weak to hold the pedal in the upper position.

Action

Replace the spring and spring retainer. Use conversion kit 550 552.



A. Spacing washer
B. Spring retainer
C. Attaching lug

Symptom

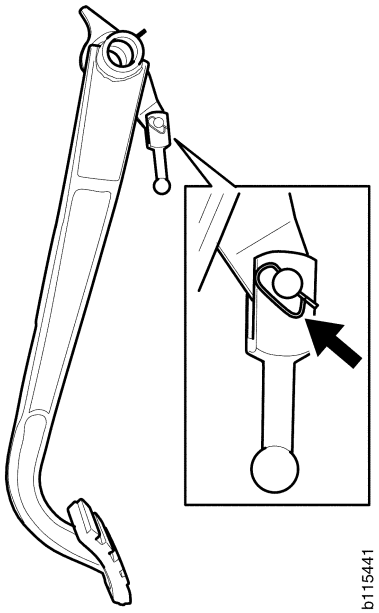
Cruise control or fixed engine speed function temporarily deactivated.

Cause

Lock pin for push rod fastens in vertical position and prevents the pedal from returning to the upper position.

Action

Check that the lock pin is of the correct type and is fitted correctly according to the illustration.



Lock pin, clutch pedal

Symptom

Air leaks from the connection 3 for the ventilation hose.

Cause

Internal air leakage in the servomaster.

Action

Renew the servomaster.

Symptom

Air leaks out through rubber bellows 5 when the servo master is not in operation.

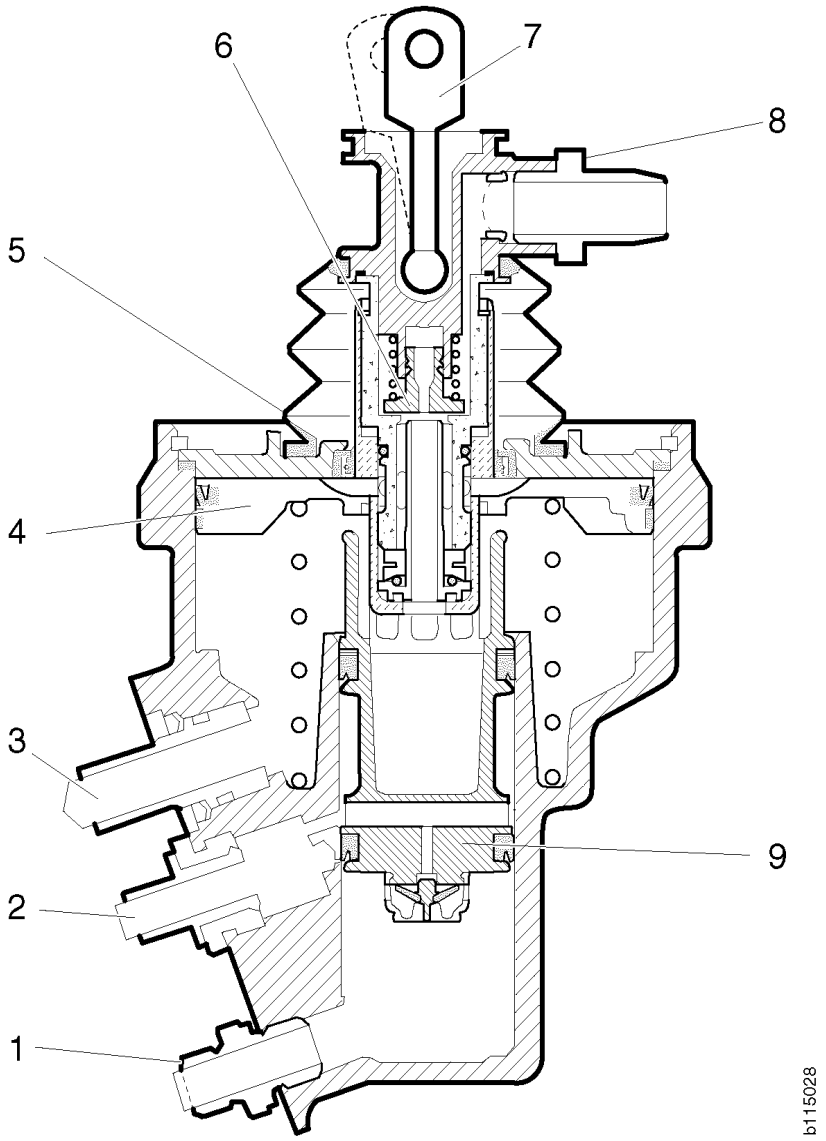
Cause

- Crack in the valve seat for the servo valve 6 due to the head of the push rod 7 having collided with the edge of the seat in the servomaster.
- Crack in the valve seat for the servo valve 6 caused by striking of, or tightening without using a counterhold, the union for compressed air connection 8.

Action

- If possible, replace the pushrod with a longer one.
- Renew the servomaster.

Servomaster, overview figure



1 Hydraulic connection to slave cylinder
2 Connection for fluid reservoir
3 Connection for ventilation hose
4 Air piston
5 Rubber bellows
6 Air valve, servo valve
7 Push rod to clutch pedal
8 Compressed air connection
9 Hydraulic piston