SCANIA

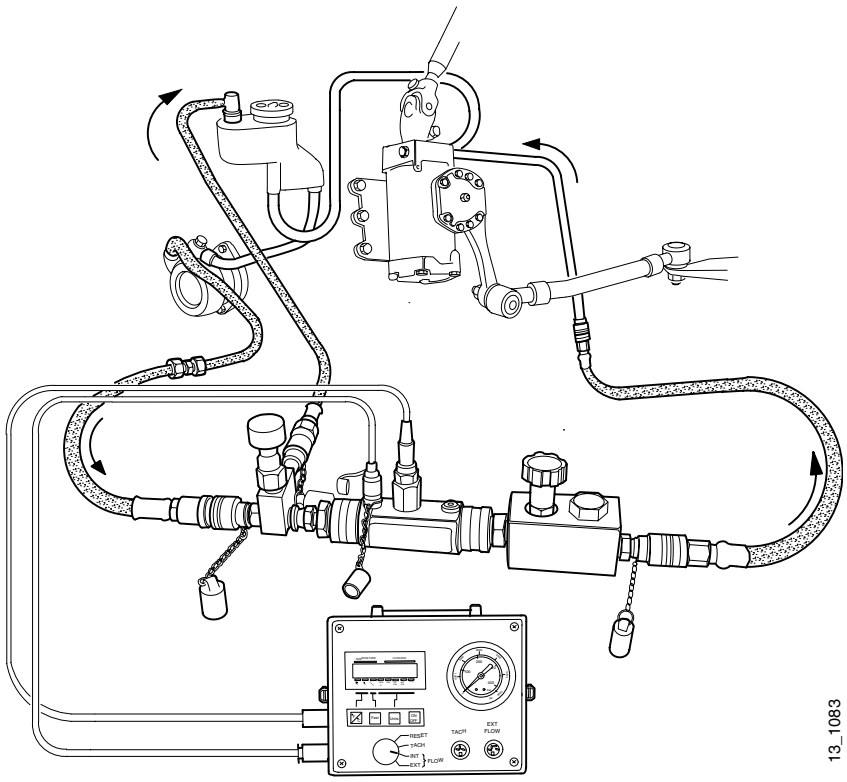
13:00-02

Issue 3 **en**

Testing the hydraulic system

Steering

Work description



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1 586 686

Contents

Work description

Measuring equipment 587 696

General

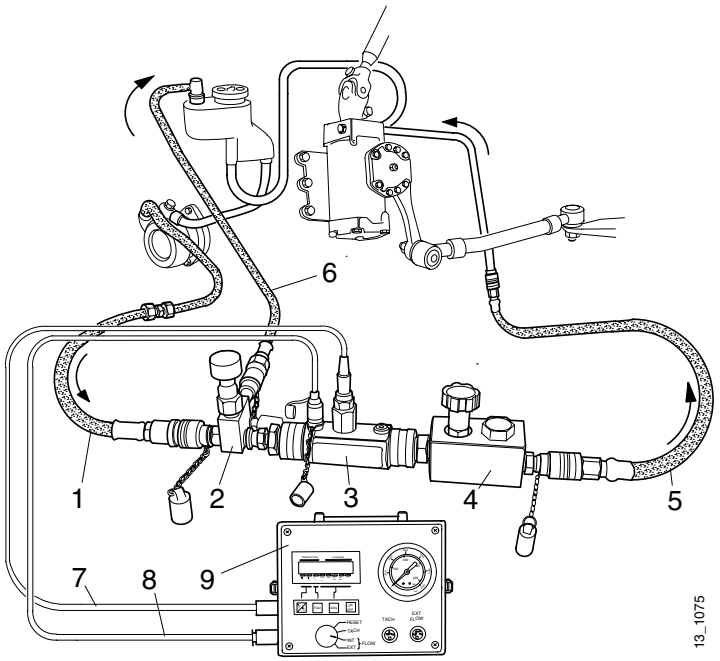
Connect the measuring equipment to the power steering system pressure line between the hydraulic pump and steering gear. A return line is connected to the oil reservoir for safety reasons and to relieve oil pressure while taking measurements.

Suitable connection points can be chosen depending on accessibility since the type of power steering gear and pipe layout differs between vehicle types.

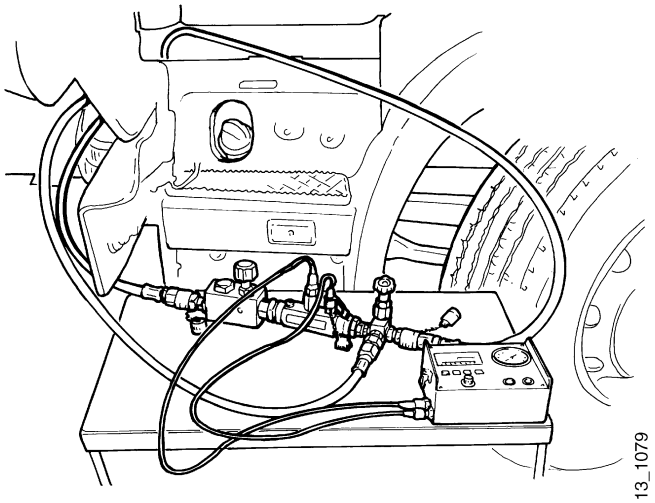
IMPORTANT! The power steering gear is very sensitive to contamination in the hydraulic system. Check that the measuring equipment is clean, and carefully clean the connection points before connecting the measuring equipment.

Test report

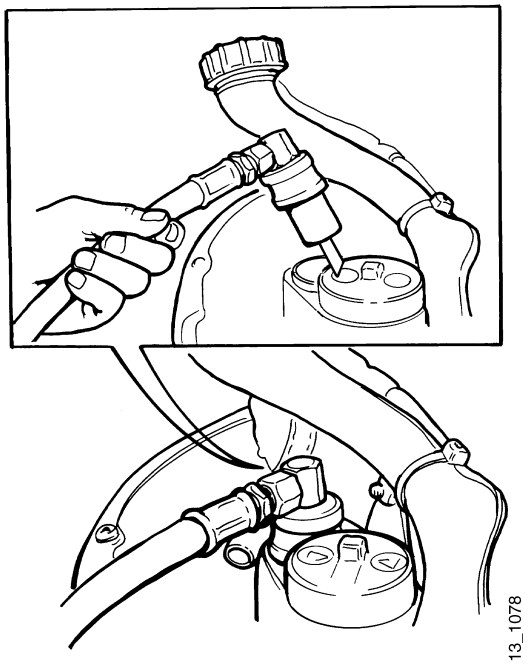
Copy the report located at the back of this booklet and use it while carrying out the measurements.



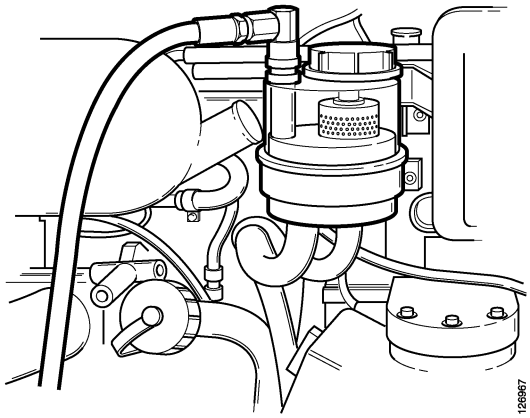
1 *Hydraulic hose*
2 *Adjustable pressure limiting valve*
3 *Flow meter*
4 *Adjustable restriction valve*
5 *Hydraulic hose*
6 *Return hose*
7 *Signal lead*
8 *Pipe assembly*
9 *Measuring instrument*



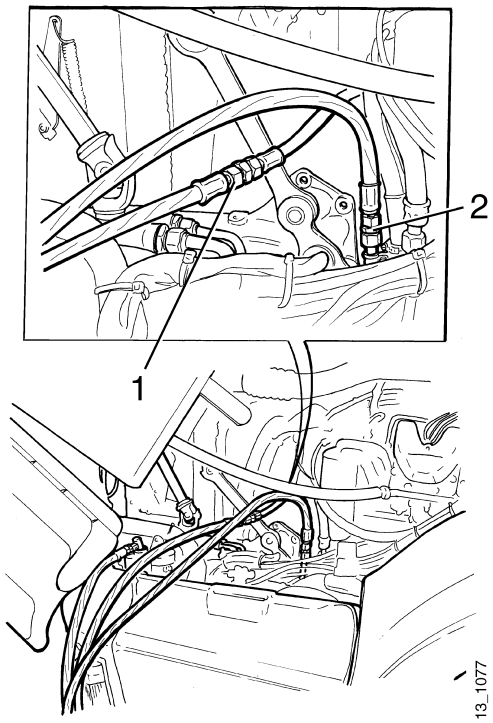
Location of measuring equipment



Connecting the return hose on trucks



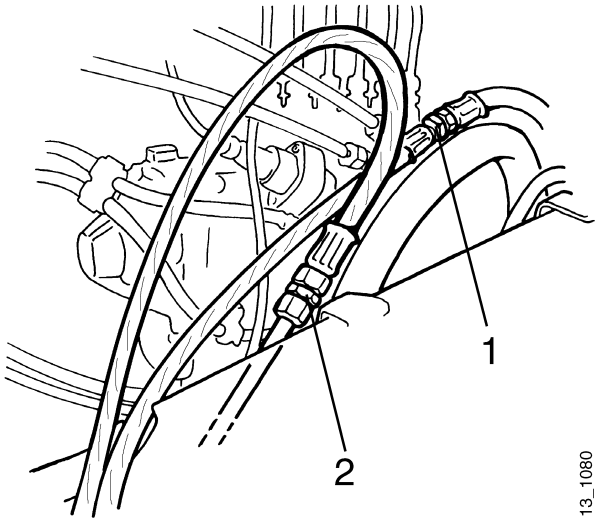
Connecting the return hose on buses



Connection on R144 truck

1 Connecting to hydraulic pump

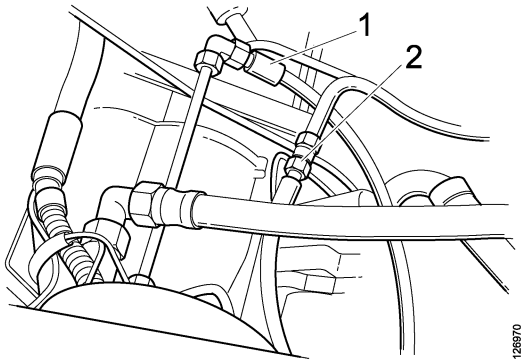
2 Connecting to power steering gear



Connection on R124 truck

1 Connecting to hydraulic pump

2 Connecting to power steering gear



Connection on L94 bus

1 Connecting to hydraulic pump

2 Connecting to power steering gear

Connecting the measuring equipment

This is a general description of how to connect the measuring equipment and must be adapted to each specific type of vehicle. The illustrations on the left show examples of connections.

1 Place the measuring equipment on a bench or similar next to the vehicle.

2 Tilt the cab to gain access to the hydraulic lines.

3 Separate the pressure line between the hydraulic pump and the power steering gear.

4 Connect a hydraulic hose from the hydraulic pump to the adjustable pressure limiting valve.

5 Connect a hydraulic hose from the power steering gear to the adjustable restriction valve.

WARNING!

The measuring equipment must under no circumstances be connected against the direction of flow.

6 Connect the return hose from the flow meter to the adapter for the oil reservoir and fit it in the place of the cover with dipstick.

WARNING!

The return hose must under no circumstances be omitted.

7 Lower the cab, making sure the hoses do not get jammed.

8 Turn on the measuring instrument and set the following parameters: Internal measurement, temperature in ºC and one measurement per second. Also refer to Workshop Manual, main group 13, Measuring equipment 587 696, Function and work description.

Bleeding

1 If the measuring equipment hoses are empty, it will be necessary to fill them with approximately 4 dl ATF as specified.

2 Fit the return hose connection.

3 Unscrew the adjustable pressure limiting valve fully (low opening pressure)

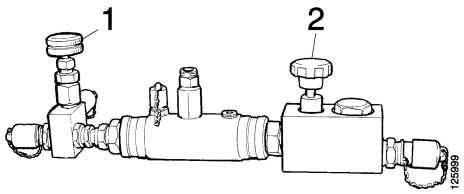
4 Start the engine and increase engine speed to 900 - 1000 rpm.

5 Screw in the adjustable pressure limiting valve completely. Let the engine run at fast idle speed and turn the steering wheel right to left

6 Switch off the engine.

7 Check the oil level. Top up if necessary.

8 Start taking measurements.



1 Adjustable pressure limiting valve

2 Adjustable restriction valve

Disconnecting the measuring equipment

1 Start by removing the flow meter and measuring unit. Plug the hoses with protection plugs.

2 Remove the return hose from the oil reservoir.

3 Remove the hydraulic hoses and reconnect the couplings. Tightening torque 70 Nm.

4 Start the engine and run it at fast idle speed for a few minutes. Turn the steering wheel right to left to ventilate the system.

5 Switch off the engine and check the oil level. Top up if necessary.

Hydraulic measurements

Measuring internal leakage in power steering gear

General

An internal leak is:

- A leak from the power steering gear pressure side to its return side past the seals on the working piston.
- Prohibited leak in power steering gear valve system.

Pressure limitation

At full system pressure, the pressure limiting valve will open and allow oil to pass from the power steering gear pressure side to the return side.

The measurement is taken at a reduced system pressure of 100 bar so that it is not affected by the pressure limiting valve.

Wheel end lock

The power steering gear has a hydraulic wheel end lock that reduces the power steering gear oil pressure and thereby its torque when the wheels approach their end lock positions.

Valves are integrated in the power steering gear piston. The valves reduce the oil pressure in the power steering gear to approximately half the maximum pressure when the piston and the wheels approach their end lock positions.

For further information, refer to Workshop manual, main group 13, Power steering gear, work description for the appropriate power steering gear.

Internal leak at centre position

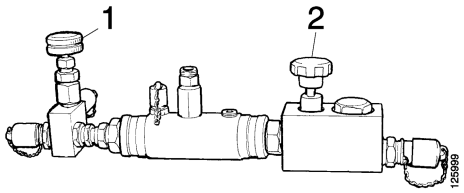
1 Connect the measuring equipment as described in Connecting the measuring equipment.

2 Screw in the adjustable pressure limiting valve completely and unscrew the adjustable restriction valve completely.

3 Start the engine and increase engine speed to 900 - 1000 rpm.

4 Check the oil temperature. Measurement must be taken at 50-85°C.

If the temperature is too low, reduce the flow of oil with the restriction valve (maximum pressure 50 bar) until the temperature has reached 50°C. Then open the valve completely. If the temperature is too high, let the engine idle until the temperature has dropped to the specified range.



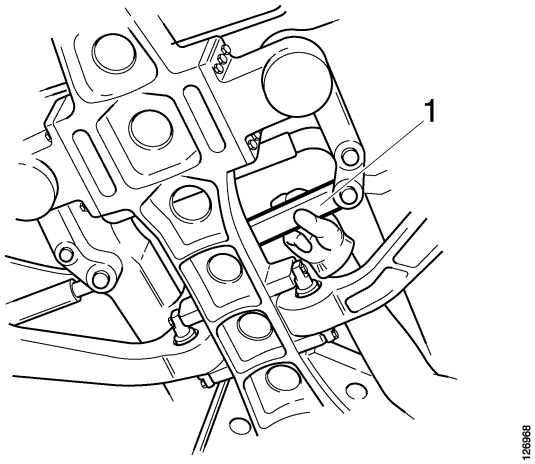
1 Adjustable pressure limiting valve
2 Adjustable restriction valve

5 Turn the wheels to the straight ahead position. Place the blocking tools 99 257 and 99 342 between the track rod arm and the spring assembly or in some other position to block the steering.

It may be difficult to use the blocking tools on some vehicles. A piece of square tube or some other suitable device can then be cut and placed between these components.

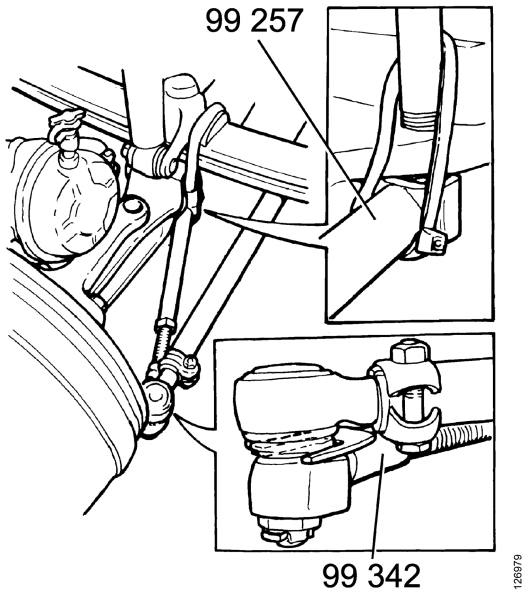
IMPORTANT! Do not apply the load in an unsuitable position so that part of the wheel suspension is damaged.

Examples of how to block the steering are shown in the illustrations.

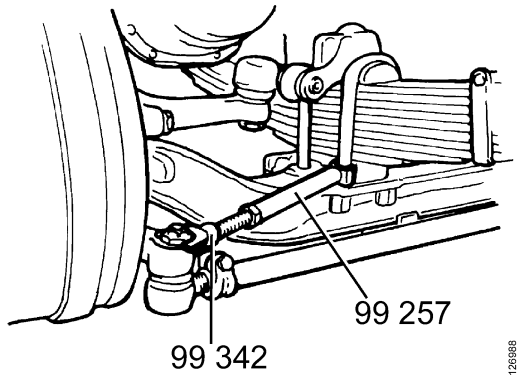


Blocking on vehicles with AMI.

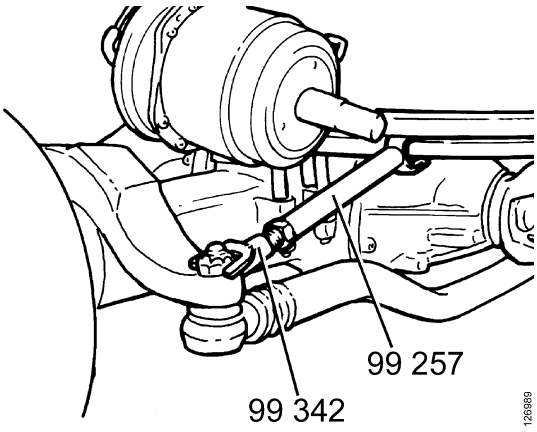
1 Suitable square tube, e.g. 30 x 30 x 3 mm. Approximately 50-160 mm long



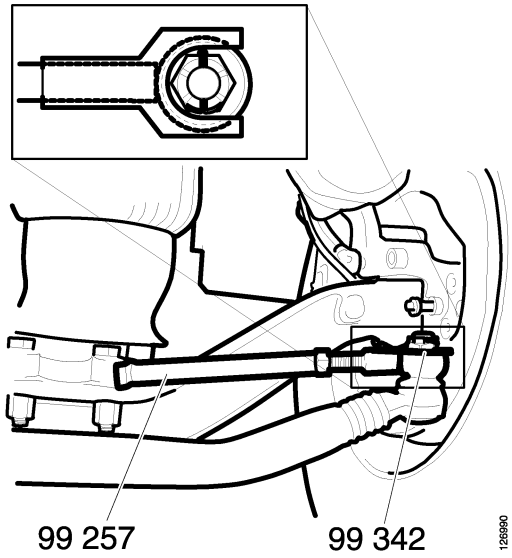
Blocking on vehicle with leaf spring suspension with ball joint fitted from above



Blocking on vehicle with leaf spring suspension with ball joint fitted from below



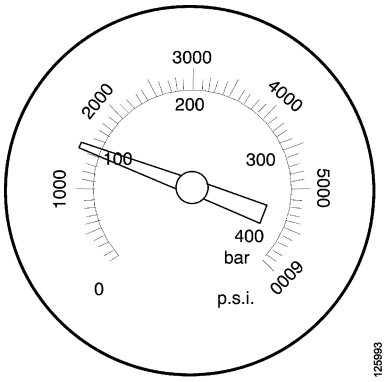
Blocking on all-wheel-drive vehicles

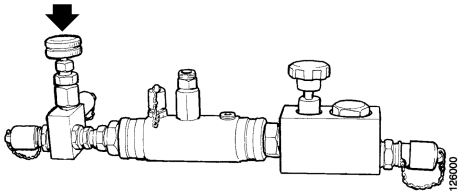


Blocking on vehicles with air suspension

6 Increase the engine speed to 900 - 1,000 rpm and turn the steering wheel in the direction that is blocked. Do not turn so hard that there is a risk of bending the blocking tool. When 100 bar is exceeded, it is necessary to reduce the system pressure and repeat the test. Lower the system pressure to 100 bar, at full load, with the adjustable pressure limiting valve.

IMPORTANT! Maximum pressure must only be maintained for 10 seconds. If the maximum pressure is not reduced, it creates a high load on the pump and a rapid increase in temperature.





Adjustable pressure limiting valve

7 Take a reading of the leakage flow and make a note of it.

Note: Maximum permitted leakage flow: 2.5 l/min.

8 Transfer the blocking tool to the other side.

9 Turn the steering wheel in the other direction, repeat the measurement and make a note of it.

If the internal leakage is too great - remedy this as described in the Workshop manual, main group 13, Power steering gear, work description for the appropriate power steering gear.

Measuring maximum system pressure and flow

General

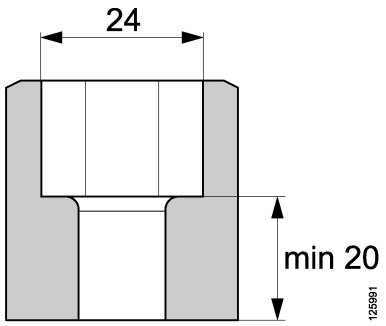
This measurement is designed to check the following:

- that the pump supplies the specified maximum system pressure.
- that the pressure limiting valve opens at the correct pressure.
- that the hydraulic pump supplies the specified flow at a determined engine speed and system pressure.
- that the wheel end lock reduces the pressure to the correct value.

Refer to Workshop Manual, main group 13, Power steering gear and hydraulic pumps, Specifications, for maximum system pressure and flow values.

Reducing wheel lock angle

The wheel lock angle must be reduced so that the wheel end lock does not affect the measurement. Do this by placing a separator plate that is at least 20 mm thick on the front axle set screw before starting the measurement, e.g. a 24 mm power socket.

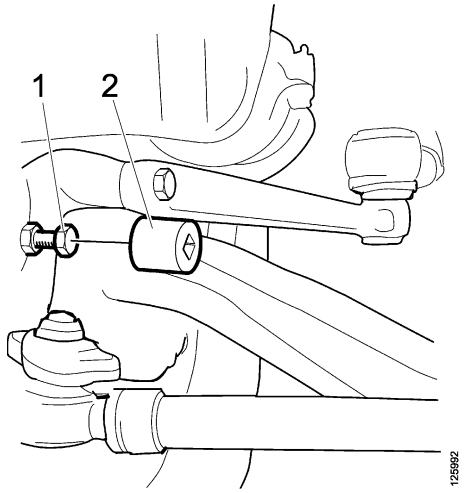


Note: On vehicles which have front axles with considerable downward travel and air suspension, it is possible to continue to turn the steering wheel after the wheels have reached their end lock position. This depends on the steering geometry and the tendency of the air suspension to lift the chassis. If the steering wheel is turned too far, the chassis is raised when the droparm transfers power to the draglink. The power steering gear piston will then move too far. As a result the wheel end lock valve may be pressed into the piston for longer than it should be for the maximum wheel lock angle concerned. Therefore check carefully when the steering wheel is turned to the left on left-hand drive vehicles and to the right on right-hand drive vehicles that the wheel end lock engages at the right moment.

Checking the maximum system pressure of the hydraulic pump

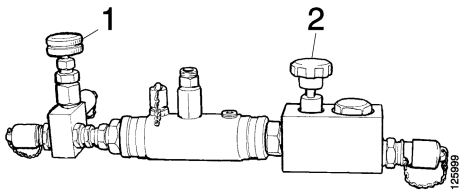
1 Connect the measuring equipment as described in Connecting the measuring equipment.

2 Fit the separator plate on the front axle set screw. The separator plate should be fitted on the left-hand side on left-hand drive vehicles and on the right-hand side on right-hand drive vehicles.



1 Front axle set screw
2 Separator plate (24 mm power socket)

3 Screw in the adjustable pressure limiting valve completely and unscrew the adjustable restriction valve completely.



1 Adjustable pressure limiting valve
2 Adjustable restriction valve

4 Start the engine and increase engine speed to 900 - 1000 rpm.

5 Check the oil temperature. Measurement must be taken at 50-85°C.

   If the temperature is too low, reduce the flow of oil with the adjustable restriction valve (maximum pressure 50 bar) until the temperature has reached 50°C. Then open the restriction valve completely. If the temperature is too high, let the engine idle until the temperature has dropped to the specified range.

6 Turn the wheels to the end lock position, i.e. to the left on left-hand drive vehicles and to the right on right-hand drive vehicles.

IMPORTANT! Maximum pressure must only be maintained for 10 seconds. If the maximum pressure is not reduced, it creates a high load on the pump and a rapid increase in temperature.

7 Take a reading and make a note of it.

   If the prescribed maximum pressure is not attained, proceed to check the power steering gear pressure limiting valve.

WARNING!

Remove the separator plate from the set screw.

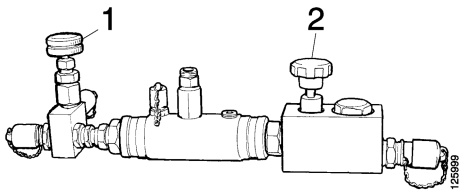
Checking the power steering gear pressure limiting valve

If the system pressure is too low, check whether it is the pressure limiting valve in the power steering gear that is opening at too low a pressure.

1 Increase engine speed to 900-1000 rpm.

2 Screw in the adjustable pressure limiting valve completely.

3 Screw in the adjustable restriction valve and take a reading at the same time. Stop when the specified maximum pressure is reached or when the pressure stops rising.



1 Adjustable pressure limiting valve
2 Adjustable restriction valve

IMPORTANT! Maximum pressure must only be maintained for 10 seconds. If the maximum pressure is not reduced, it creates a high load on the pump and a rapid increase in temperature.

If the pressure rises above the maximum pressure noted during the test Measuring the maximum system pressure, the hydraulic pump is undamaged and can provide enough pressure. The fault may be in the power steering gear pressure limiting valve or a large internal leak in the power steering gear.

If the prescribed maximum pressure is not attained, refer to Workshop manual main group 13, Hydraulic pump, Work description.

Measuring flow

1 Connect the measuring equipment as described in Connecting the measuring equipment.

2 Check the oil temperature. Measurement must be taken at 50-85°C.

If the temperature is lower, reduce the flow of oil with the restriction valve (max. pressure 50 bar) until the temperature has reached 50°C. Then open the valve completely. If the temperature is higher, let the engine idle until the temperature has dropped to the specified range.

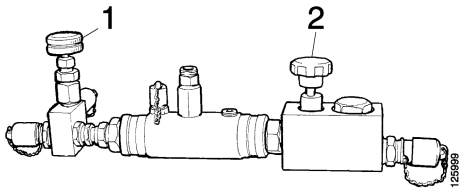
3 Screw in the adjustable pressure limiting valve completely.

4 Set the engine to 500 rpm and adjust the system pressure to 50 bar with the adjustable restriction valve. Take a flow reading and make a note of it.

5 Repeat for 1000 and 1900 rpm at 50 bar system pressure. Make a note of all the readings.

6 Compare the readings with the specifications in Workshop Manual, main group 13 for the pump in question.

7 Renew the hydraulic pump if the flow is too low.

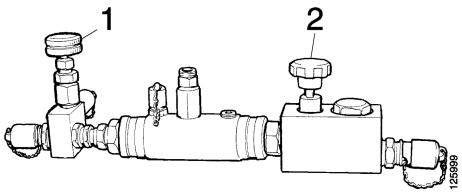


1 Adjustable pressure limiting valve
2 Adjustable restriction valve

Checking the power steering gear wheel end lock

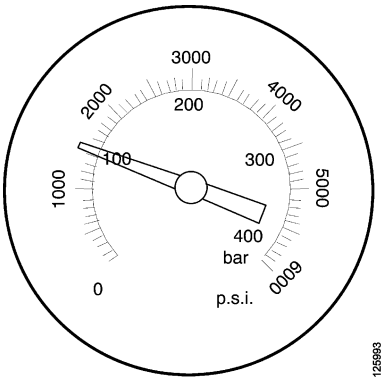
1 Connect the measuring equipment as described in Connecting the measuring equipment.

2 Screw in the adjustable pressure limiting valve completely and unscrew the adjustable restriction valve completely.



1 Adjustable pressure limiting valve
2 Adjustable restriction valve

3 Check that the wheel end lock starts to operate at full wheel lock in both directions. Turn the steering wheel in both directions. The system pressure must not exceed 110 bar at full wheel lock and with the wheel end lock activated.



System pressure 110 bar

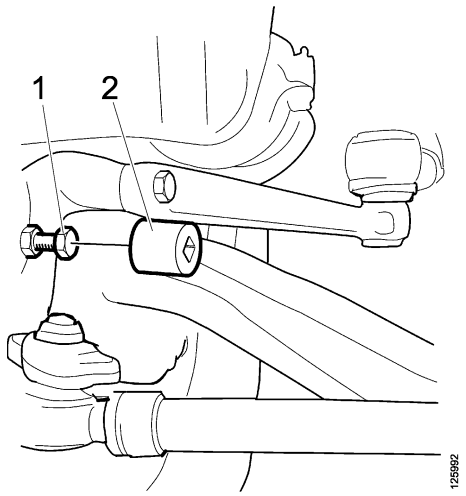
WARNING!

Do not turn the steering wheel too hard in the direction which does <u>not</u> have a power steering gear (to the right on left-hand drive vehicles and to the left on right-hand drive vehicles), because this may affect the wheel end lock setting on vehicles which have front axles with considerable downward travel and air suspension. The wheel end lock should engage when the wheels still have approximately 10 mm left to the stop.

4 Place a separator plate (refer to Reducing wheel lock angle) on the front axle set screw and check that the wheel end lock is not starting to operate. Turn the steering wheel in both directions. Check that the system pressure is approximately 150 bar.

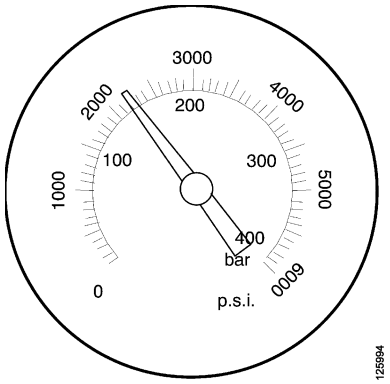
5 Adjust the wheel end lock if necessary. Refer to Workshop manual main group 13, Power steering gear TAS 85, Work description or Workshop manual main group 13, Steering gear ZF 8098,Work description.

IMPORTANT! Maximum pressure must only be maintained for 10 seconds. If the maximum pressure is not reduced, it creates a high load on the pump and a rapid increase in temperature.



1 Front axle set screw

2 Separator plate (24 mm power socket)



System pressure approximately 150 bar

Specifications

Power steering gear - measuring internal leakage

Engine speed	900 - 1000 rpm
Oil temperature[1]	50 - 85°C
Oil pressure when measuring leakage	100 bar
Max. permitted internal leakage:	
Separate power steering gear	2.5 l/min

Hydraulic pump - measuring maximum pressure and flow

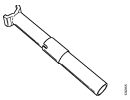
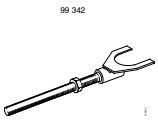
Engine speed when measuring maximum pressure	900 - 1000 rpm
Oil temperature[1]	50 - 85°C
Engine speed when measuring flow	500 / 1000 / 1900 rpm
Oil pressure when measuring flow	50 bar

1) Check with the customer whether the fault arises after a brief period of driving or when driving with intensive manoeuvres. In this case try to carry out the test at an oil temperature just at the top of the temperature range.

Special tools and report

Special tools

Special tools

Number	Description	Illustration	Tool board
99 257	Blocking tool		AM3-A4
99 342	Blocking tool		AM3-B5

Other tools

Number	Description	Illustration	Tool board
587 558	Power socket from kit	-	-
587 696	Measuring equipment	-	-

Report, troubleshooting the steering system

Local distributor	Reg. No.	Vehicle type	Chassis no.	Delivery date
	Mileage	Date	WO no.	

A. Notes during road test	Trailer - semi-trailer

B. Measures taken

Note

C. Power steering gear - internal leakage		**D. Hydraulic pump - flow/pressure**	
Oil temperature	50–85 °C	Oil temperature	50–85 °C
Engine speed	900–1,000 rpm	Oil pressure	50 bar
Oil pressure	100 bar	Min. - max. flow[1]	_____
Max. permitted leakage	2.5 l/min	Max. system pressure[1]	_____
Turn to:		Engine speed	Flow
Right centre position against blocking tool, 99 257 + 99 342	_____ l/min	500 rpm	_____ l/min[2]
Left centre position against blocking tool, 99 257 + 99 342	_____ l/min	1,000 rpm	_____ l/min[2]
		1,900 rpm	_____ l/min[2]
		Max. system pressure	_____ bar
		[1] Refer to Workshop Manual, main group 13, Power steering gear and hydraulic pumps, specifications	
		[2] At 50 bar counterpressure	

E Checking wheel end lock		
Turn to:		
Right end lock	_____ bar	Max. pressure 110 bar[3]
Left end lock	_____ bar	Max. pressure 110 bar[3]
		[3] If the max. pressure is exceeded, the wheel end lock can be modified. Refer to function description for the relevant power steering gear.