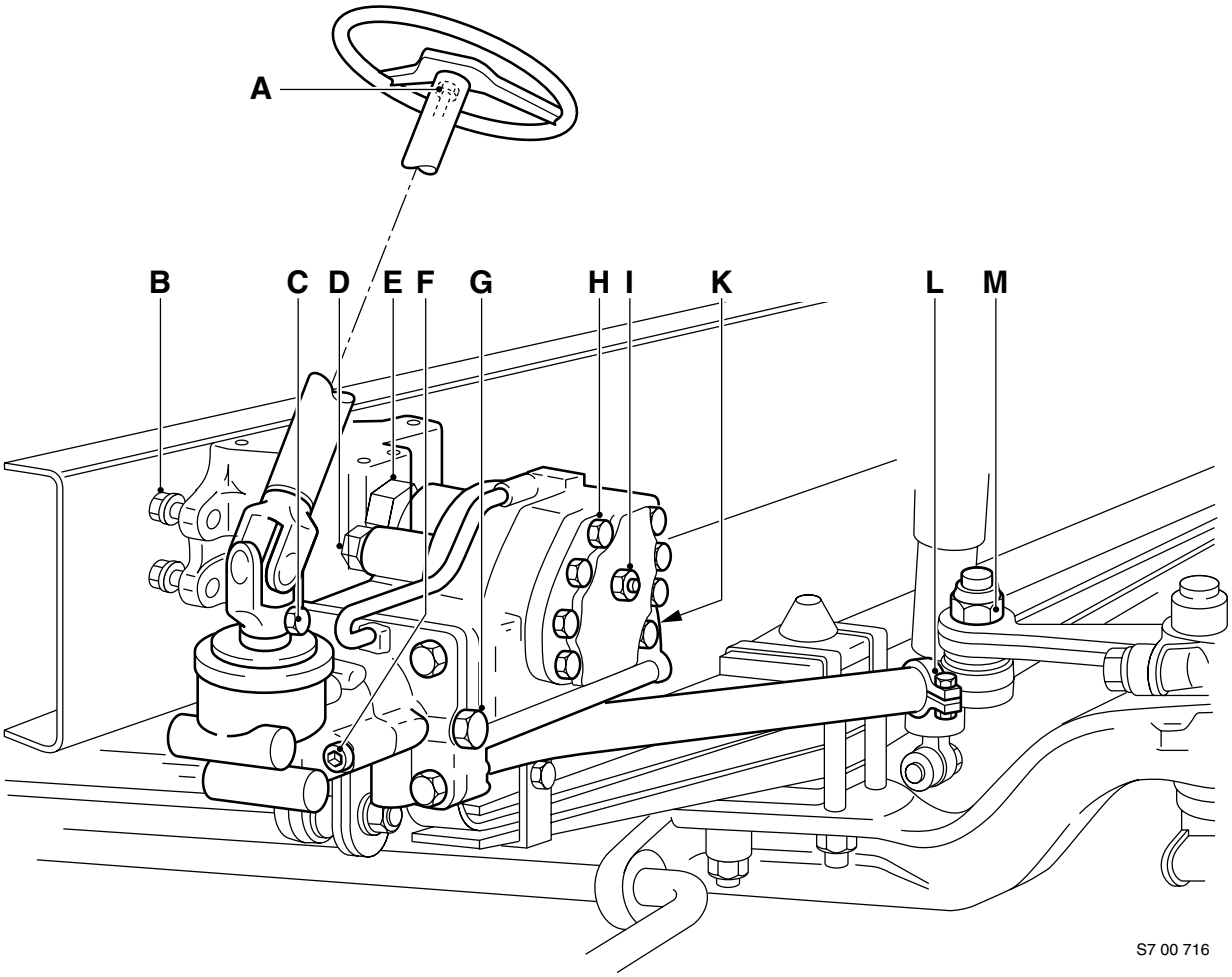
0

2.2 TIGHTENING TORQUES

The tightening torques stated in this section are different from the standard tightening torques stated in the overview of the standard tightening torques. The other threaded connections not specified must therefore be tightened to the torque stated in the overview of standard tightening torques.
When attachment bolts and nuts are replaced, it is important that - unless stated otherwise - these bolts and nuts are of exactly the same length and property class as those removed.



A.	Steering wheel attachment nut	65 Nm
B.	Bolts for attaching the steering bracket to the chassis	260 Nm + 60° angular displacement
C.	Bolt, steering column universal joint	56 Nm(1)
D.	Bolts for attaching the steering box to the steering bracket	520 Nm + 90° angular displacement(2)
E.	Pitman arm attachment nut	900 Nm
F.	Right-angle transmission bolts	65 Nm
G.	Pressure-limiting valve plug	41 Nm

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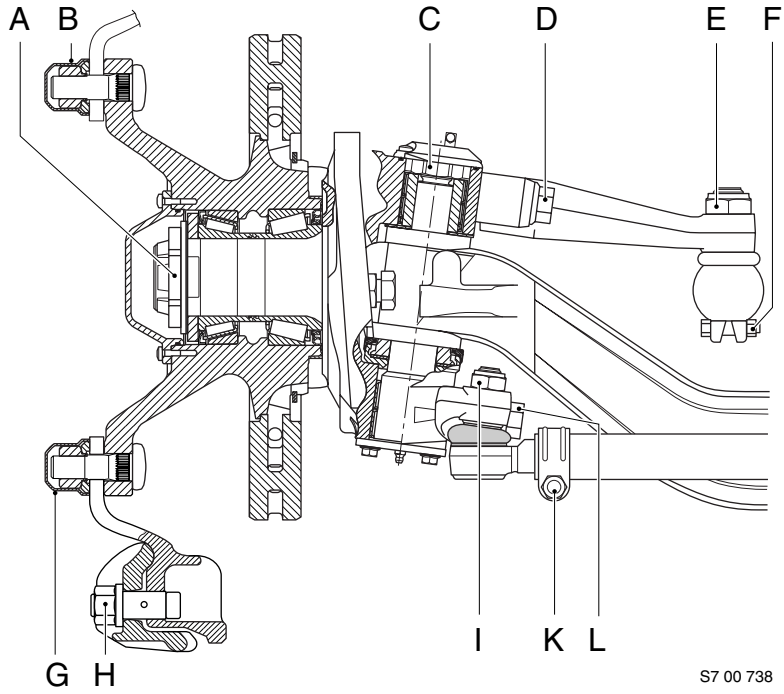
5.2 TIGHTENING TORQUES

The tightening torques stated in this section are different from the standard tightening torques stated in the overview of the standard tightening torques. The other threaded connections not specified must therefore be tightened to the torque stated in the overview of standard tightening torques.
When attachment bolts and nuts are replaced, it is important that - unless stated otherwise - these bolts and nuts are of exactly the same length and property class as those removed.



A.	Wheel hub unit lock nut	
	- 1st phase	400 Nm(1)
	- 2nd phase	turn the hub through 10 rotations(2)
	- 3rd phase	450 Nm
	- 4th phase	turn the hub through 10 rotations(2)
	- 5th phase, for 150N, 152N and 156N	950 Nm
	- 5th phase, for 182N and 186N	1000 Nm
B.	Wheel nut	700 Nm(3)
C.	King pin nut	
	- if M27 (150N/152N/156N)	595 Nm(4)
	- if M33 (182N/186N)	660 Nm(4)
D.	Steering rod arm bolt	500 Nm + 90° angular displacement(5)
E.	Steering rod attachment nut	
	- if M20 castle nut	225 Nm(6)
	- if M24 castle nut	285 Nm(6)
	- if self-locking M20 nut	225 Nm(7)
	- if self-locking M24 nut	285 Nm(7)

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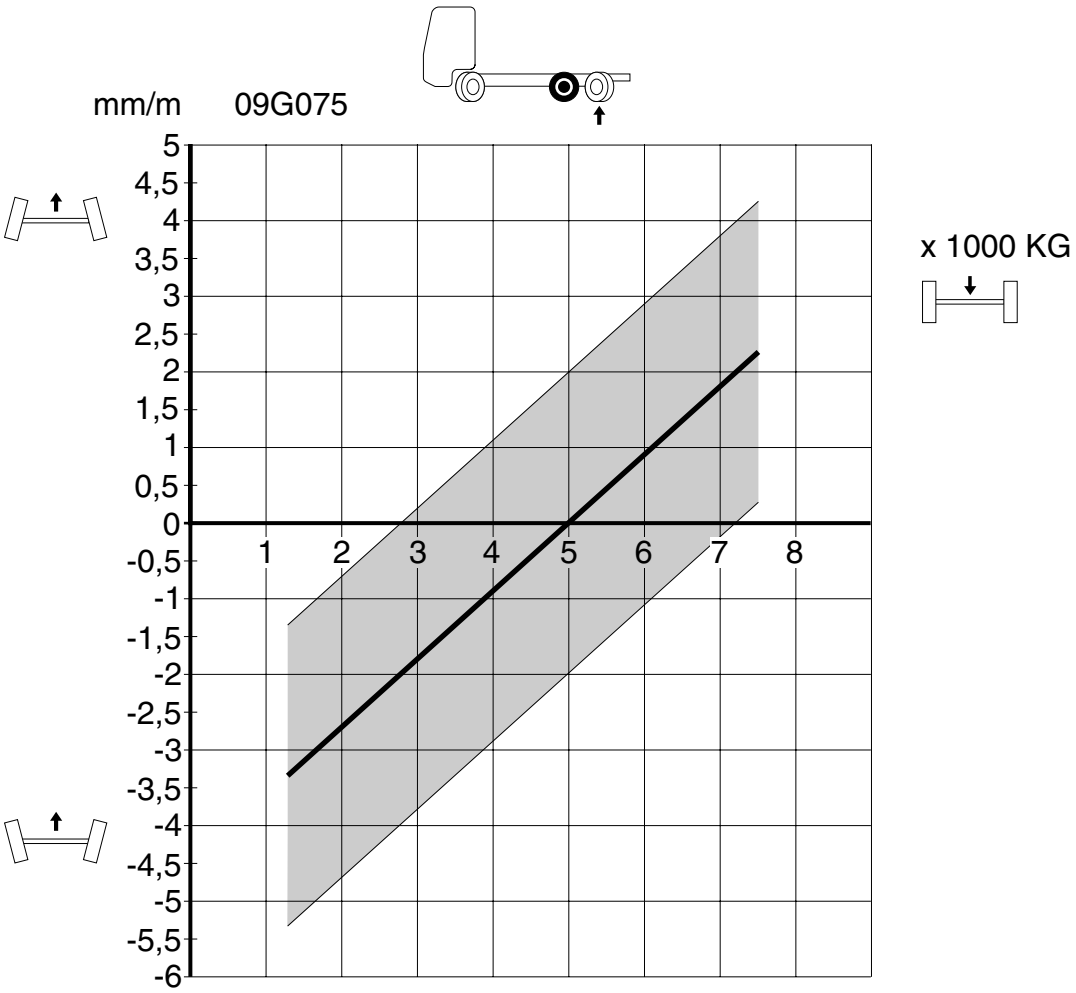
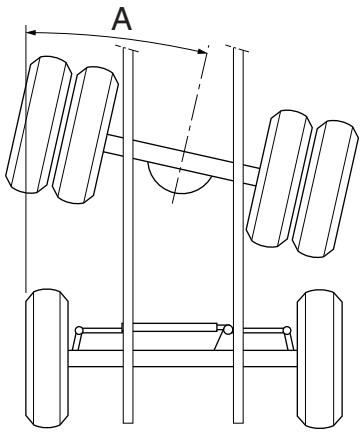
09G075-axle toe



S7 00 896

Alignment
Permissible deviation on a trailing axle blocked in central position.

In relation to the driven axle:
2 mm/m maximum (angle A)



S7 00 725

SYMPTOM: STEERING OIL LEAKAGE	
Possible cause	**Remedy**
Leaking steering box	On the steering box, check the following seals: - input shaft oil seal - sector shaft oil seal in side cover (plastic plug) - side cover gasket - valve housing/cylinder - sector shaft on pitman arm side - various plugs - adjusting bolt of wheel deflection limiting valves Depending on the leak, replace the input shaft oil seal, the sector shaft oil seals, the side cover gasket, and the sealing rings of the various plugs and the adjusting bolt. Replace the steering box in the case of leaks other than described above.
The melting point of the grease found behind the dust seal of the sector shaft or the input shaft is too low. It seems like the steering box is leaking, but in fact the grease has melted.	Replace the grease with grease of the specified type (melting point >130°C).

SOUND
Note:
The steering gear always produces sounds.

Normal sounds:
- a hissing sound in the steering box while steering. The sound level depends on the system pressure.
- an increasing sound level when opening the wheel deflection limiting valve.
- a maximum sound level when opening the pressure-limiting valve.
- the emergency steering pump (plunger pump) produces a considerably higher sound level than the main steering pump (vane pump).

SYMPTOM: STEERING PUMP PRODUCES A SQUEALING SOUND WHILE STEERING	
Possible cause	**Remedy**
Oil level too low, causing the pump to draw air.	Check the oil level. Top up oil and check for leaks.
Air in the steering oil	Check oil for the presence of air (foaming). Bleed system and find the cause.
Supply line kinked or pinched off.	Check the supply line.
The supply opening in the reservoir is (partially) blocked.	Check supply opening in the reservoir.

The output indicator (20) for circuit 2 is fitted in pipe connection (P2) (emergency steering pump (16) delivery pipe connection on the dual-circuit valve).
When the output from the emergency steering pump (16) is too low, the output indicator (20) activates the circuit 2 warning indicator.

2

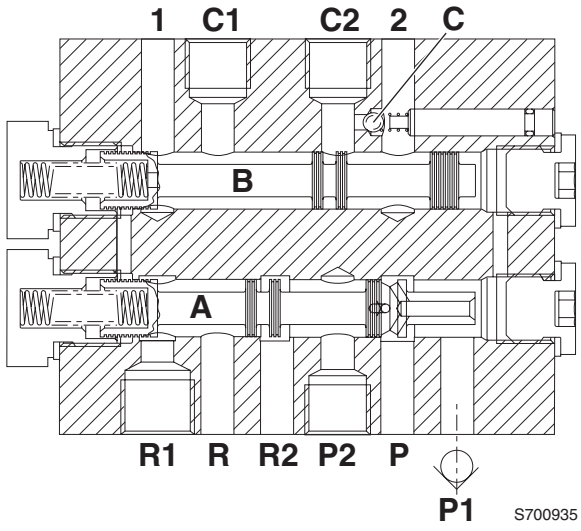
The emergency steering pump (16) is fitted with a pressure limiting valve with a higher opening pressure than the pressure limiting valve in the steering box. The function of this valve is to serve peak demands, which can occur when switching circuit 2 on and off. When the valve opens, the delivery pipe (17) is connected to the supply pipe (15).

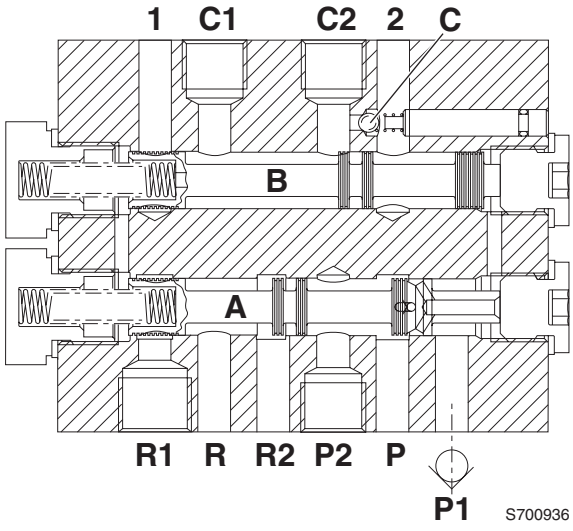
Operation of dual-circuit valve
When the engine is running, the pressure from the main steering pump (P1) will cause control slide A to move to the left against the spring pressure. The supply from the main steering pump goes to the steering box via exit (P). The return from the steering box (R) is connected to the main steering pump reservoir via exit (R1). At the same time the connection of the emergency steering pump (P2) and the steering box is broken. The oil supplied by the emergency steering pump while the vehicle is being driven goes to the emergency steering pump reservoir via entrance (P2) and exit (R2).

When the main steering pump is active, control slide B moves to the left against the spring pressure. Connections (C1) and (C2) of the slave cylinder are connected to the connections on the left (1) and right (2) of the steering box.

If a main steering pump failure causes the pressure (P1) drop to zero while the vehicle is being driven, the spring will move control slide A to the right. As a result, the emergency steering pump (P2) is connected to the steering box (P). The steering power is now produced by the emergency steering pump. To ensure that the oil of the main steering pump does not leak away in case of leakage, the return (R) of the steering box is led to the emergency steering pump reservoir (R2).

If the pressure of the main steering pump drops to zero, the spring pressure will cause control slide B to move to the right. The connections (C1) and (C2) between the slave cylinder (1) and the steering box (2) are closed off. At the same time the slave cylinder connections (C1) and (C2) are interconnected. While pressure is being built up in the slave cylinder due to the different capacities of the two chambers in the cylinder, valve C will open.





Drained steering oil must not be re-used. Store this hydraulic oil separately from the other drained oils and have the oil collected by a waste removal company authorised to do so.

Make sure that during filling and bleeding the reservoir always remains filled with oil so as to prevent the pump from drawing in air which would cause foaming in the oil.

Air in the hydraulic system may cause serious damage to the steering pump. Air in the hydraulic system could cause occasional "jamming" of the steering gear.

If the hydraulic system contains air, a squealing sound will be heard when the steering wheel is turned.

In the case of serious foaming, the steering oil should be completely drained. Trace and repair the leak, after which the system can be filled again and bled.

Filling/bleeding the dual-circuit steering system

1. The steering boxes are equipped with an automatic bleeding system. This bleeding system will only function if there is circulation pressure in the system.

2. Disconnect the propeller shaft from the gearbox.

Hang the propeller shaft properly to one side so that it cannot come into contact with the gearbox flange.

If the bolts cannot be removed from the gearbox flange, these should be provided with spacer sleeves and nuts. Tighten the nuts carefully, so that the bolts can no longer come into contact with the gearbox housing.

3. Fill both reservoirs to the rim with clean oil which complies with the specifications. Wait a little while and then fill the reservoirs to the brim again.

8. Remove the attachment bolts from the steering box to the steering bracket and remove the steering box from the vehicle. Keep the removed bolts to check the length of the new bolts.

9. With an EMAS-controlled trailing axle, remove the angle sensor from the steering box, if necessary.

Installing the entire steering box

1. Carefully clean and inspect the threaded holes of the steering box.

2. Remove all paint, dirt, grease, etc. from the contact surfaces of both the steering box and the steering bracket (a thin, factory-applied layer of paint is allowed). The contact surfaces should be absolutely free from dirt and grease.

3. In the case of the new or revised steering box, fit the pipe connections. For the connection points, see 'Technical data'.

4. With an EMAS-controlled trailing axle, fit the angle sensor to the steering box, if necessary.

5. Replace the attachment bolts. Because the yield stress is exceeded while tightening the bolts, they may not be re-used.
Check that the new bolts are exactly the same length as the removed bolts.
Grease the new bolt sparingly. On no account should you over apply the lubricant. This could result in the connection coming loose.

Carefully check the length of the new bolts. If the bolts used to fit the steering box are too long, they can lock in the steering box thus resulting in insufficient pre-load.

6. Fit the steering box equipped with a pitman arm to the steering bracket. Make sure that the locating bolt is fitted into the middle threaded hole under the steering box.

7. Tighten the attachment bolts evenly. Tighten the bolts to the specified tightening torque. See 'Technical data'.

8. Fit the pipes to the steering box.

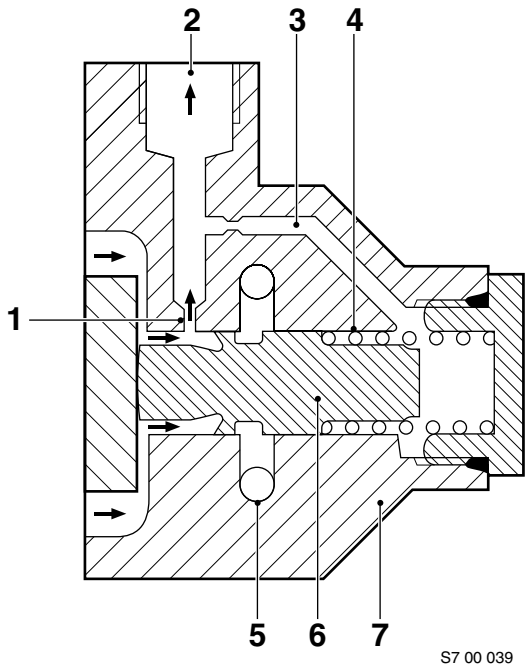
Regulated output control
In principle, the pump output depends on the speed.
The steering gear however should be provided with an oil volume which is as constant as possible. To achieve this constant oil volume, the pump is equipped with a regulated output control. The output at the steering box is controlled by a calibrated opening (1) in the internal delivery pipe and the flow control valve (6) with spring (4).

If the pump output has not yet reached the preset output, the flow control valve (6) is pushed at the front against a stop, thus closing the internal circulation channel (5).
The flow control valve (6) is held against the stop by the spring (4) and the oil pressure in the delivery pipe (2) which is exerted through the channel (3) at the back of the flow control valve. The entire pump output flows through the calibrated opening (1) to the delivery pipe connection (2).

If the pump output exceeds the preset output because the engine speed has increased, pressure builds up at the front of the flow control valve (6) which exceeds the delivery pressure at the back of the valve. The valve moves to the right and the connection to the internal circulation channel (5) is opened. Part of the pump output is returned to the pump inlet channel through the circulation channel.
If the pump output drops because the engine speed has been reduced, the flow control valve will move to the left and the connection to the internal circulation channel (5) will partly close again. A smaller part of the pump output is returned to the pump inlet channel.

This control system supplies a fairly constant oil output to the steering gear, despite the engine speed variations.

Note:
The pressure-limiting valve is fitted into the steering box.



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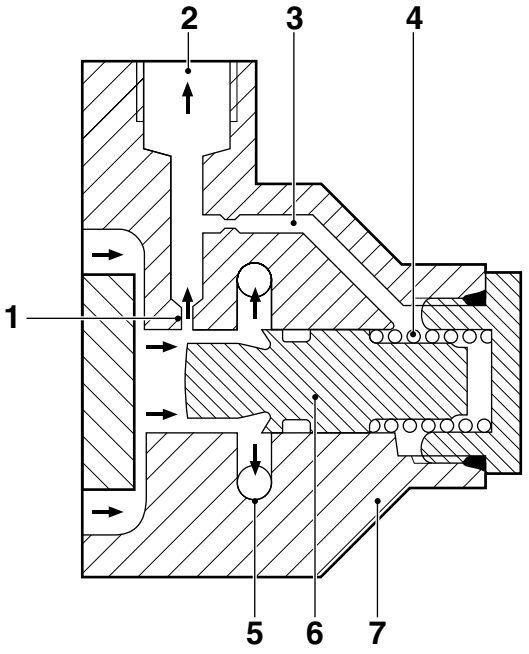
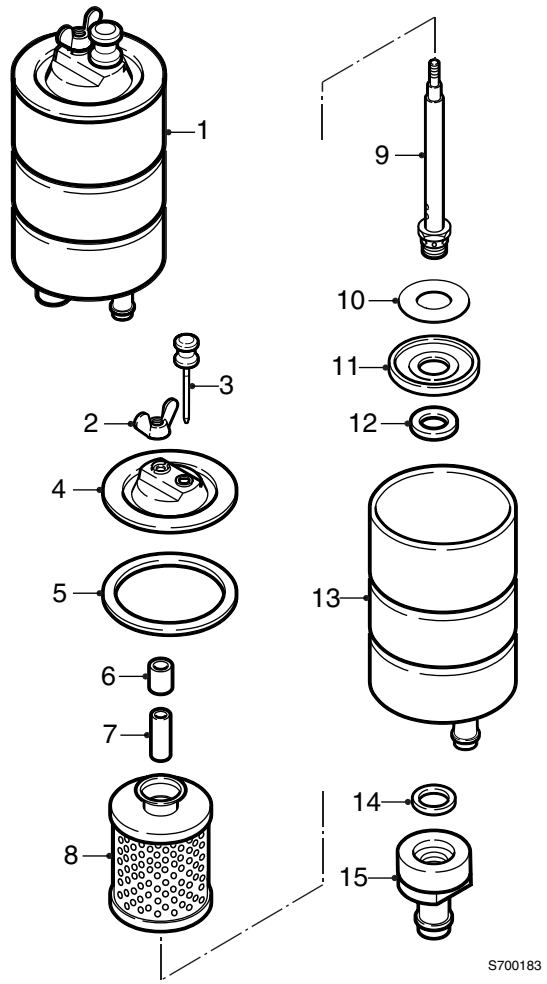


S7 00 040

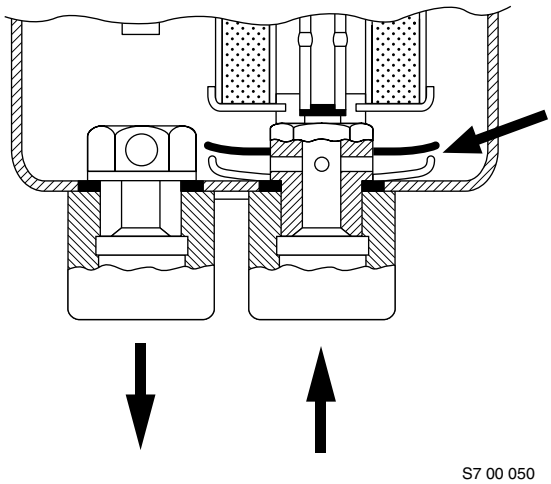
Steel reservoir

A steel reservoir is used on the dual-circuit system and the EMAS controlled trailing axle. In the dual-circuit system, two interconnected reservoirs are applied.
The reservoir is equipped with a steel lid (4), which is closed using a wing nut (2). The lid (4) is sealed with a rubber ring (5).
The lid (4) is equipped with a dipstick (3).
A rubber bush (6) is fitted between the lid (4) and the filter element (8), which pushes the filter element (8) onto the seat of the filter holder (9).
The by-pass valve consists of a clamping disc (10) placed under the filter element.



The force which the return oil exerts on the clamping disc (10) pushes the disc (10) off the seat (11). Part of the steering oil flows directly into the reservoir, see the arrow in the drawing.

The line connection (15) is sealed by the sealing ring (14).
The two reservoirs are interconnected by an overflow line.



CONTENTS

2.7 INSPECTION AND ADJUSTMENT, STEERING ROD

Work safely and block the vehicle so that it cannot slide off the turning plates.

Inspecting the steering rod adjustment

1. Engage the vehicle's parking brake and place chocks in front of and behind the rear wheels.

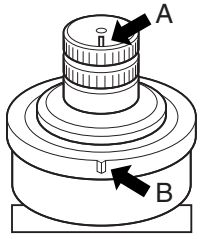
2. Jack up the steerable axle and place turning plates under the wheels.
   Only use turning plates which allow for wheel displacement caused by the wheel offset.

3. Place the wheels in the "straight ahead" position and lower them until they rest on the turning plates.

4. Measure the (mis)alignment of the wheel to which the steering rod is connected. This can be done using wheel alignment equipment or by measuring the distance from the wheel rim to the spring leafs at the front and rear of the wheel. The distances at the front and rear of the wheel should be equal.

5. Check using the markings (A) and (B) on the steering box that the input shaft of the steering box is in the central position. For the permitted deviation, see 'Technical data'.

6. Adjust the steering rod length, if the values deviate too much.
   If a large deviation is measured, the cause should be traced.
   The deviation may, for example, have been caused by a collision, during which components were bent. If so, the remaining steering gear components should be inspected carefully.



S7 00 861

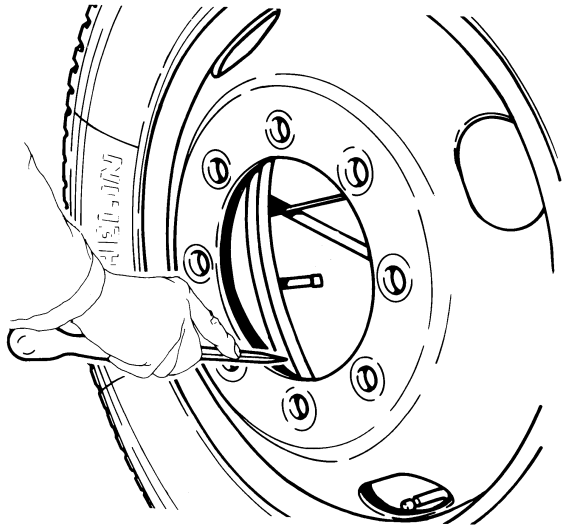
Adjusting the steering rod

1. Loosen the bolt of the clamping bracket on the steering rod.

2. Remove the steering rod from the steering rod arm. See 'Removal and installation'.

Installation of wheel

1. Clean the fitting edge of the wheel rim by scraping off dirt and corrosion with a scraper.

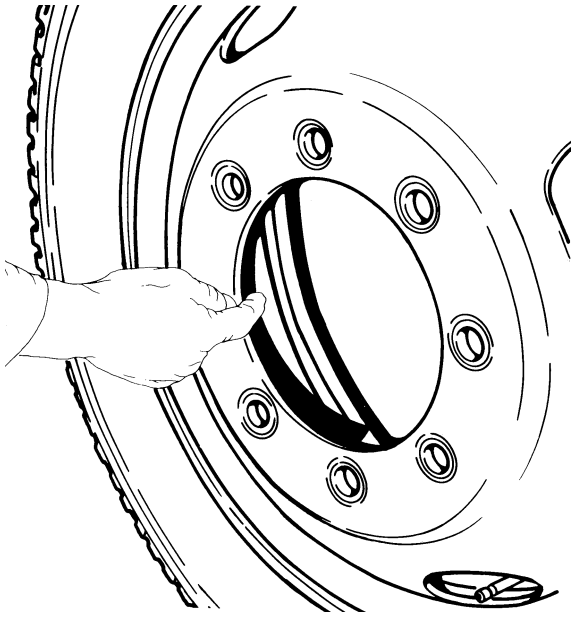


S7 00 096

2. Apply a **thin** layer of grease to the fitting edge of the wheel hub.

3. Also apply a **thin** layer of grease to the fitting edge of the wheel rim. This grease layer should prevent the wheel rim and the wheel hub from becoming "rust-bound".

4. Check whether the contact surfaces of the wheel rim and hub are clean. Clean them if necessary.

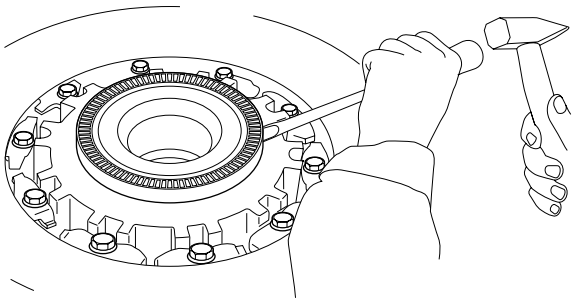


S7 00 097

3.6 REMOVAL AND INSTALLATION, WHEEL SPEED SENSOR RING

Removing the wheel speed sensor ring

1. Remove the wheel speed sensor.
2. Remove the wheel hub unit from the axle journal.
3. Make a notch in the side of the sensor ring, using a hammer and chisel. Make sure that the contact surface of the sensor ring to the wheel hub unit is not damaged in the process.
4. Remove the wheel hub unit sensor ring.

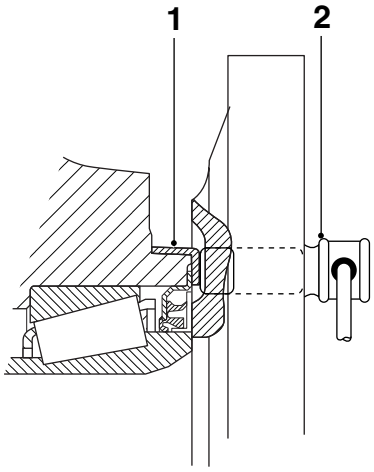


S7 00 554

Once removed, a sensor ring should not be re-installed.

Installation of wheel speed sensor ring

1. Check the contact surface of the sensor ring to the wheel hub unit for damage.
2. Check the new sensor ring carefully for possible damage in transit.
3. Fit a new sensor ring to the wheel hub unit using a press and flat plate.
4. Check that the sensor ring makes good contact around the entire circumference.
5. Install the wheel hub unit on the axle journal.
6. Press the wheel speed sensor (2) against the sensor ring (1) by hand. While the vehicle is being driven, the air gap between the sensor and the sensor ring is adjusted. If the sensor has no freedom of movement, remove, clean and refit it.



S7 00 543

Never tap the sensor with a hammer. This may damage both the sensor and the sensor ring.

7. Check the operation of the EBS or ABS system.

Installation of thrust bearing, split version

1. Fit the shoulder ring (4) in the swivel axle using a press or a plastic mallet. Make sure that no needles fall out of the needle bearings.

2. Check that the shoulder ring (4) makes contact with the swivel axle in all places.

3. Fit the bearing ring (3) into the shoulder ring (4) without greasing it.
   Make sure that the bearing ring lug falls into the hole of the shoulder ring.

4. Fit the thrust washer (2) without the sealing ring (1) to the bearing ring (3).

5. Install the swivel axle (10) on the axle end and adjust the axial play using the correct shim. See 'Inspection and adjustment'.

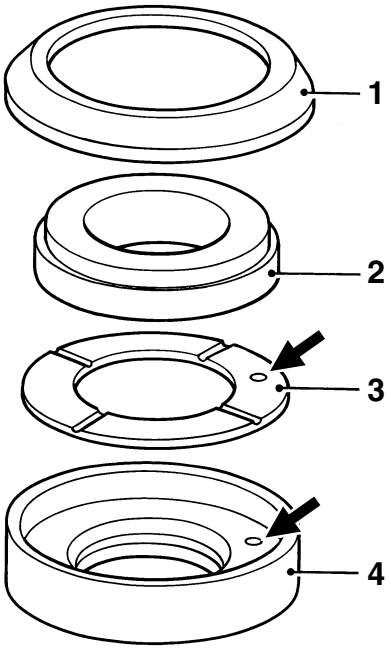
6. After determining the correct shim (9), remove the swivel axle from the axle end.

7. Disassemble the thrust bearing and apply plenty of grease to the top side of bearing ring (3) (ribbed side with lubricating grooves).

8. Fit a new sealing ring (1) to the thrust washer (2).
   Make sure that the top of the seal (1) is positioned under the top of the thrust washer (2).

9. Place the thrust washer (2) on the bearing ring (3).

10. Fit the swivel axle with the correct shim on the axle end.



S7 00 114

6

2. INSPECTION AND ADJUSTMENT

2.1 INSPECTION AND ADJUSTMENT, SWIVEL AXLE PLAY

Inspection of swivel axle play

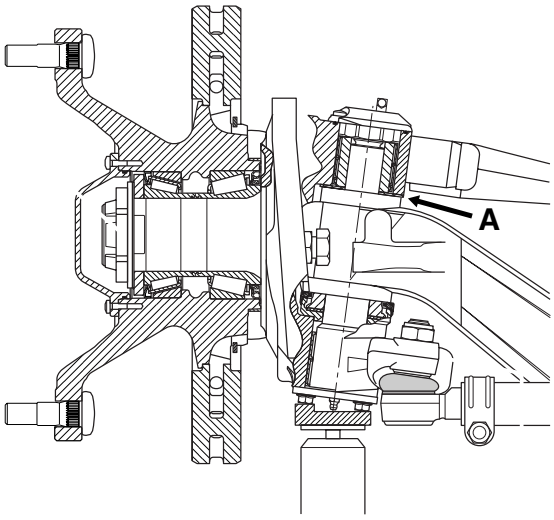
1. The vehicle should have its wheels on the ground.

   Note:
   If the wheels have been removed from the front axle, e.g. for overhaul purposes, the swivel axle will hang at the axle end.
   In that case, the swivel axle should be supported by a jack, pushing the swivel axle against the bottom of the axle end.

2. Using a feeler gauge measure the distance between the shim and the swivel axle at (A). Take measurements in several places. Compare the reading with the admissible play. See 'Technical data'.

   Note:
   The play should be about equal along the entire circumference of the axle end. If the play is not equal, this is caused by radial play in the needle bearings. If the radial play of one of the values measured along the circumference differs from the specified value, the needle bearings should be replaced, see the chapter 'Removal and installation'.

   If an excessive axial play is measured along the entire circumference of the axle end, this is probably caused by a worn swivel axle thrust bearing.



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Adjusting the swivel axle play, thrust bearing, split version

1. Remove the swivel axle from the axle end. See 'Removal and installation'.

2. Degrease and clean the thrust bearing.

3. Check the thrust bearing for wear or damage. If in doubt, replace the thrust bearing.

4. Check the machined surfaces of the axle end and the swivel axle for damage.