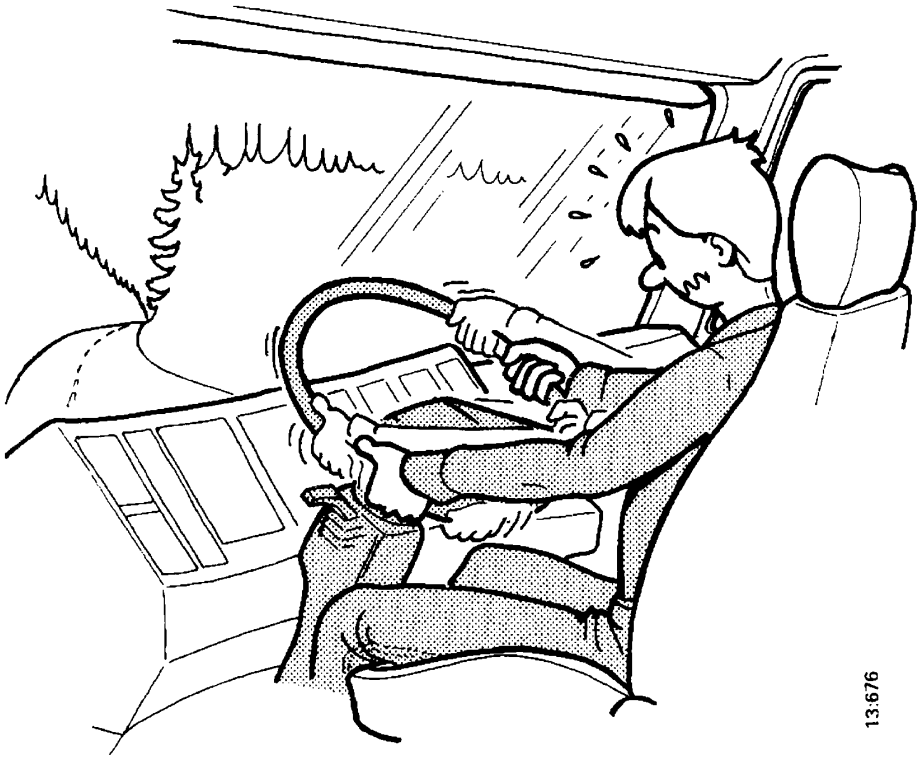
SCANIA

13:00-03

Issue 2 **en**

Steering

Checking and troubleshooting



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Contents

Power steering function

General

System oil pressure depends on the current steering resistance.

System oil flow depends on the capacity of the hydraulic pump which increases with increased engine speed.

The valve system of the power steering gear controls the oil flow so that the combined pressure and flow is optimal in every steering situation.

Variable steering resistance in the steering wheel gives the driver continuous information about and control of the steering process.

Controlling system pressure

Maximum oil pressure is controlled by a pressure limiting valve located in the power steering gear. When the pressure limiting valve opens it leads oil from the power steering gear pressure side to the return side.

The pressure limiting valve protects the hydraulic system against damage caused if the pressure is too high.

Controlling oil flow

Maximum oil flow is controlled by a flow control valve in the hydraulic pump. The valve cannot be renewed. Maximum oil flow is already reached at an engine speed of 800-1000 rpm. The flow control valve is then opened and leads the overflow to the suction side of the hydraulic pump.

Relationship between pressure and flow

Driving on a road

High engine speeds create a large flow in the system.

Relatively small and slow steering wheel movements mean a low steering resistance and thereby low system pressure.

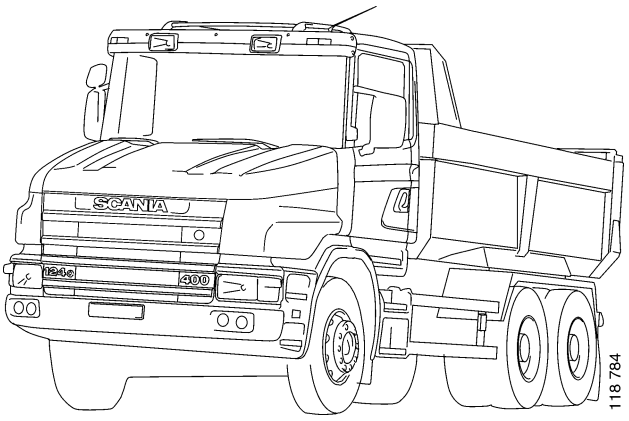
Shunting

Shunting is mainly done at relatively low engine speeds which means a low system flow. This results in limited steering wheel speed at low engine speeds. As steering resistance is often great when shunting the system pressure increases and the oil temperature rises as a result.

Pre-check

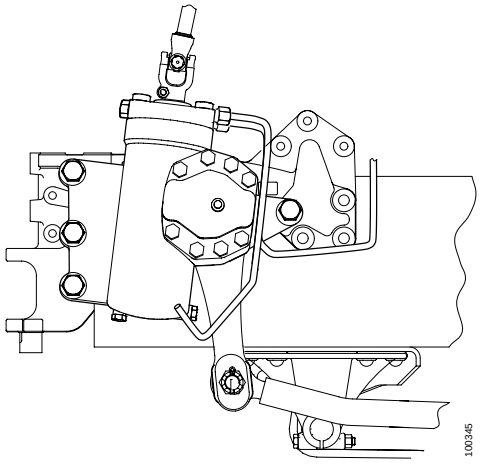
1. Load and tilting

- Check how the vehicle is loaded considering weight distribution and drive level.



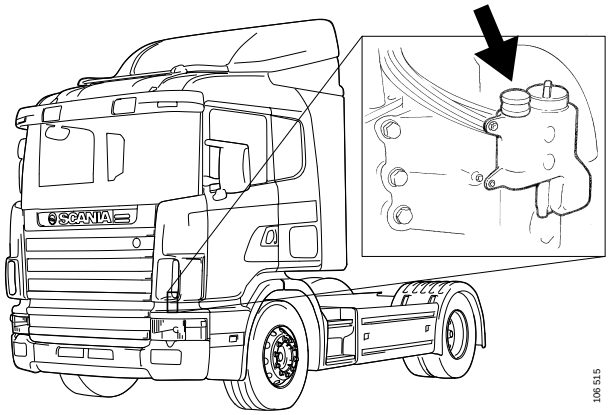
2. Power steering gear

- Check if there is any noise when the wheels are turned at engine speeds of 800-1000 rpm.



3. Power steering oil

- Check the oil level. If the oil level is low check the steering system for leakage with the engine running.
- Check the oil appearance and smell. If the oil is greyish it contains water and should be changed. If the oil has a strong and burnt smell it has been subject to heavy loads and should be changed.



4. Checking the wheels

- Air pressure
- Wear
- Type of tyre

5. Road test with customer

- If the fault only occurs in certain conditions the vehicle should be road tested in these conditions. On vehicles with a trailer the vehicle should be road tested both with and without the trailer as an incorrect trailer setting can affect the steering characteristics of the tractor.
- Road test the vehicle both with the tag axle up and down. Changes in steering indicate a problem with out of square rear axles.
- Note the position of the steering wheel when driving straight ahead. An out of square steering wheel may indicate an incorrectly fitted steering column, incorrect length of drag link or incorrect rolling direction on other axles.
- If the vehicle is heavy to steer it is recommended to road test the vehicle on a wide open area and turn to the right and to the left alternately.

  A vehicle which is always heavy to steer indicates a faulty king pin, seizing steering column or that the operating pressure is too low.

  Vehicles which are only heavy to steer when turning the steering wheel quickly, 1r/s, indicates that there is too little oil flow or too much internal leakage in the steering hydraulic system.

Steering play

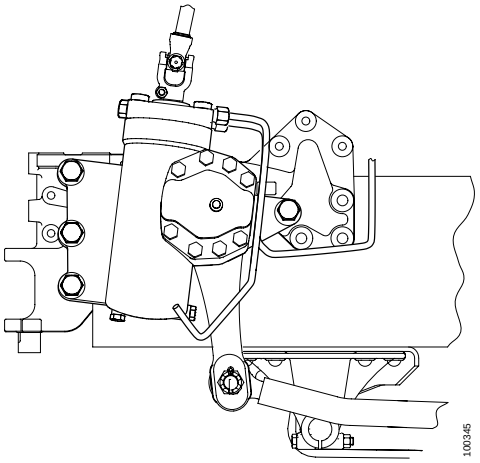
Types of fault:

- Attachment of the power steering gear
- Steering column play
- Ball joint play
- Power steering gear centre position and play

Attachment of the power steering gear

- With the engine running and while moving the steering wheel, check that the power steering gear is attached correctly.

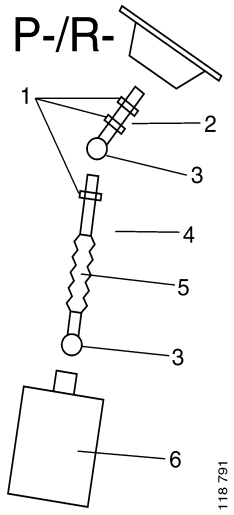
There must be no play between the power steering gear, the base bracket and the frame.



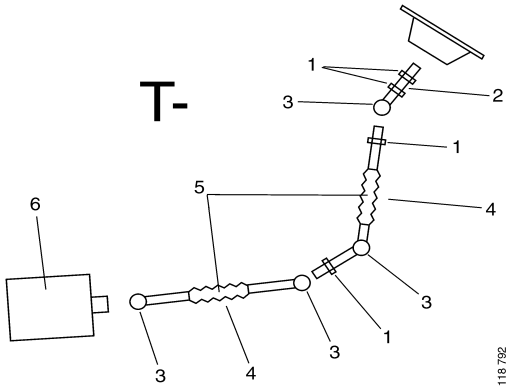
Steering column play

Change the steering column if there is apparent play in any parts.

1 *Bearing*
2 *Upper steering column*
3 *Joint*
4 *Lower steering column*
5 *Telescopic part*
6 *Power steering gear*



- Turn the wheels into the straight ahead position. Detach the steering column universal joint from the power steering gear and check that the markings are correct, +/- two splines is acceptable. Check that there is no play or stiffness in the universal joint.
- Turn the steering column one turn in both directions by hand. Is it possible to turn the steering column without jerking or stiffness? The turning force varies during turning due to the design of the steering wheel.
- Turn the steering column quickly in both directions of rotation to check if there is any play.
- Carefully push together and pull out the telescopic part of the steering column nearest to the power steering gear. Check that there are no signs of the telescopic part seizing.

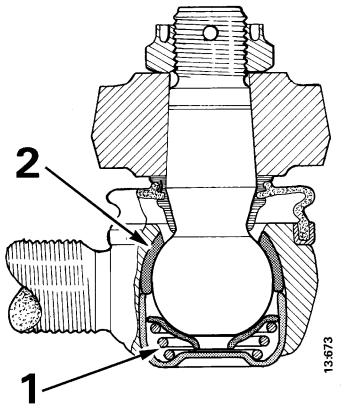


Note: Do not pull apart the steering column as it is not possible to reassemble it.

- Check that the steering column bellows is intact.
- Refit the steering column in the correct position on the power steering gear. Tightening torque 47 Nm.
- Turn the steering wheel quickly and with force in both directions with the engine off. Listen and feel if there is any play.

Ball joint play

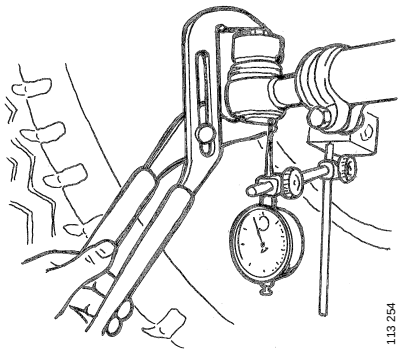
The ball joint pin is spring-loaded towards the upper bearing surface. Push the ball joint towards the ball joint pin to check for wear.



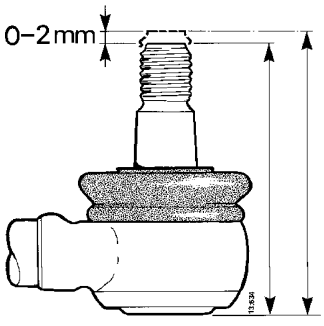
1. Coil spring
2. Upper bearing surface

Renew ball joints if there is evidence of play or seizing or if the rubber seal is damaged. Normal play in a ball joint is approximately 0.5 mm.

- Magnetic stand: 587 250
- Dial gauge: 98 075

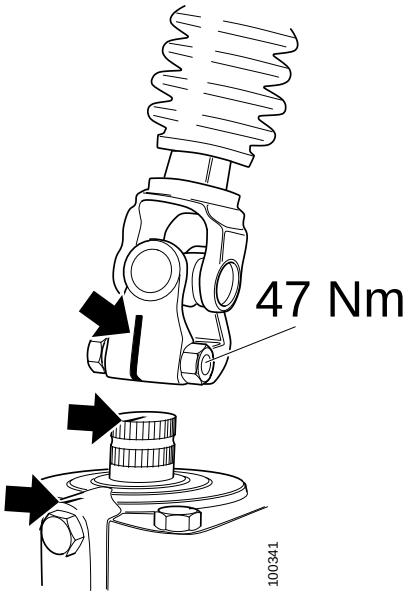


Maximum permissible play is 2 mm. The course stability of the vehicle is significantly impaired if the ball joints are worn.

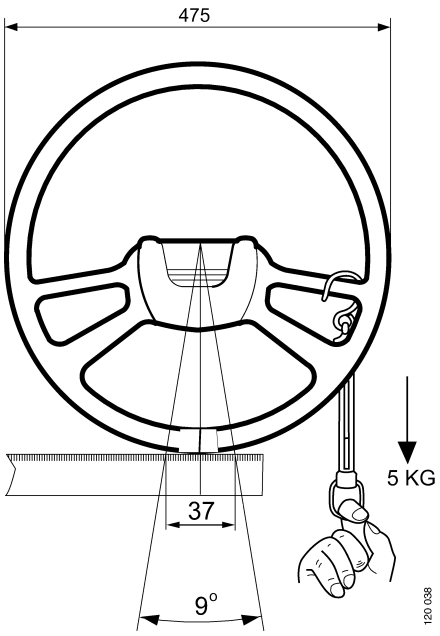


Power steering gear centre position and play

Check that the markings are correct between the steering column universal joint and the power steering gear, +/- two splines is permissible which is approximately 10°.



Maximum permissible play on the steering column including the power steering gear in centre position is 9°. This is equivalent to 37 mm on a 475 mm steering wheel in diameter.



Measure the turning clearance with the engine off and the wheels in the straight ahead position.

- Attach a piece of adhesive tape at the bottom of the steering wheel and make a marking on it.
- Hold a straight edge supported against the door and at a right angle against the marking on the steering wheel.
- Attach spring balance 587 590 around the upper steering wheel spoke.
- Pull the spring balance towards you with a force of 5 kg.
- Slowly release the steering wheel and mark the steering wheel marking position on the straight edge.
- Do the same measurement in the other direction and measure the distance between the markings on the straight edge.

If an adjustment of the centre position is required and for other information see the appropriate power steering gear *Workshop Manual, Group 13.*

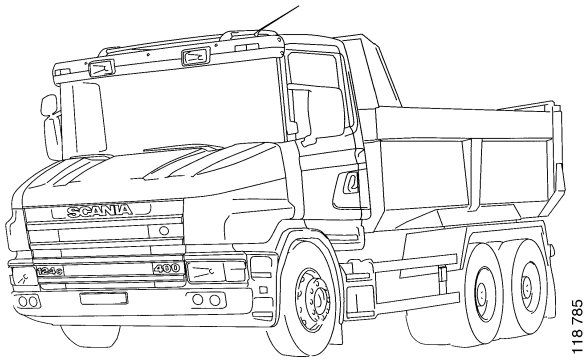
Heavy steering

Types of faults:

- The vehicle load and its position
- Steering column
- King pin
- The steering hydraulic system

The vehicle load

The position of the load affects the steering. High front axle weight leads to high steering resistance. Therefore, try to load the vehicle with as even a weight distribution as possible. This will give the vehicle the best driving characteristics.

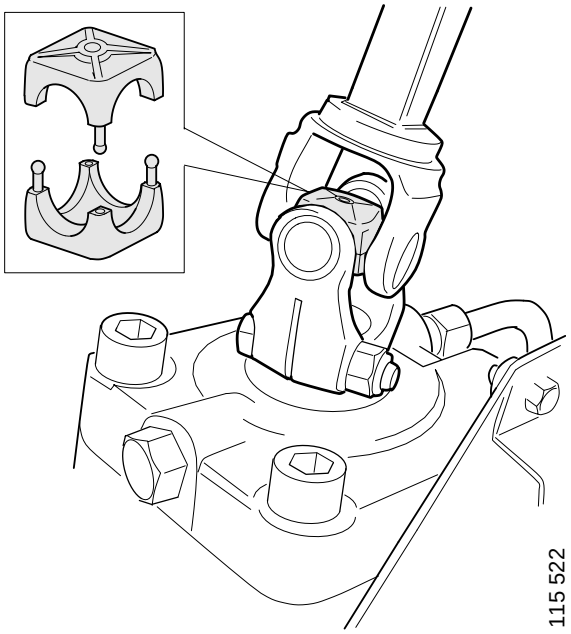


Steering column

If the steering column is heavy to turn when it is removed from the power steering gear this may be caused by a seized bearing in the upper steering column and cab grommet.

The steering column lower joint may be corroded which results in a seized joint. If there is no protective cap on the steering column lower joint a new one should be fitted. Lubricate the protective cap halves and fit them on the joint.

See also section Steering play, steering column.



The steering hydraulic system

The most common problem is that the flow from the pump is too low. When the steering wheel is turned quicker than there is flow, the steering feels heavy.

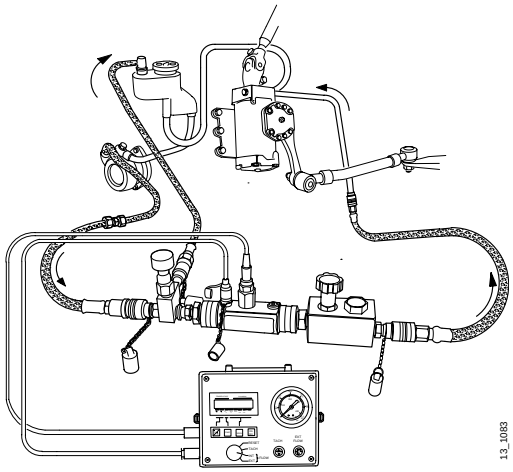
Check the oil level. If the oil level is low check the steering system for leakage with the engine running.

Check the oil appearance and smell. If the oil is greyish it contains water and should be changed. If the oil has a strong and burnt smell it has been subject to heavy loads and should be changed.

Check the condition of the king pins, the power steering oil level and condition and check for leakage with the engine running. Do this before testing the steering hydraulic system.

The steering system function is tested by measuring maximum pressure and flow and by checking for leakage.

See booklet *13:00-02, Testing the hydraulic system* for more information.



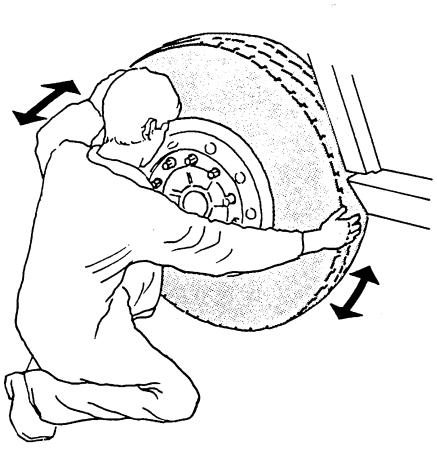
King pin

A seized, poorly lubricated or incorrectly adjusted king pin results in heavy steering. A higher torque is normally required irrespective of turning speed and direction if the king pin is faulty.

Raise and support the vehicle.

Remove the drag link and/or track rod on one steered wheel at a time and check the turning force.

See the appropriate axle *Workshop Manual, Group 7* for further information regarding work on the king pin.



Jerky steering and/ or noise

Types of faults:

- Air in the steering system
- King pins seizing
- Wheel interference
- Incorrectly assembled steering column
- Mechanical faults in the power steering gear

Air in the steering system

If there are air bubbles in the steering hydraulic system noise will arise when they pass the hydraulic pump and the power steering gear.

Tighten all joints on the hydraulic pump suction line. Fill and bleed the system. See section *Filling and bleeding the steering system*.

King pin

The steering may feel jerky if the king pin is seized or damaged. See section *Heavy steering.*

Wheel interference

Check that the wheels do not make contact with any fixed parts on the vehicle. Check if there are any signs of damage near the wheels. Check the wheel angles according to the booklet for each axle, *Adjusting wheel angles, group 13*.

Steering column

If the steering column joints are incorrectly assembled the joints will be out of step when turning. The slot on the joint clamp sleeves should be aligned with the marking on the splined part.

Power steering gear

Place steered wheels on anti-friction plates.

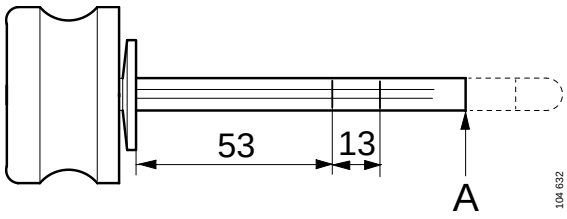
Start the engine. Turn to full wheel lock in both directions and check for jerking or noise from the power steering gear.

See the appropriate power steering gear *Workshop Manual, Group 13* for repairing the power steering gear.

Filling and bleeding the steering system

Note: Wipe the area around the dipstick clean before removing it from the reservoir as the steering system is very sensitive to dirt.

Check that the dipstick is the correct length and that the vent holes are not blocked.

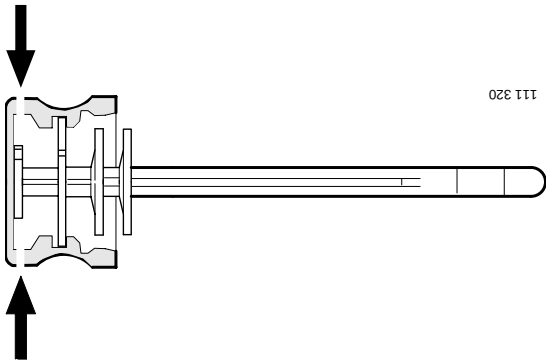


Adjusting the dipstick

1 Make new maximum and minimum markings on the dipstick as illustrated.

2 Cut the dipstick at the previously upper marking A.

3 Check measure the dipstick as illustrated.



Adjusting the dipstick vent holes

1 Remove the dipstick and detach the rubber cap.

2 Check that it is possible to see through both 1.5 mm vent holes.

3 Drill the holes if required. Clean the dipstick thoroughly so that there are no rubber or plastic remains.

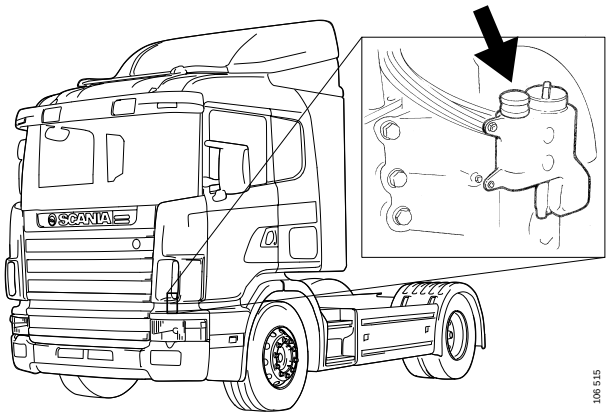
4 Refit the rubber cap and replace the dipstick.

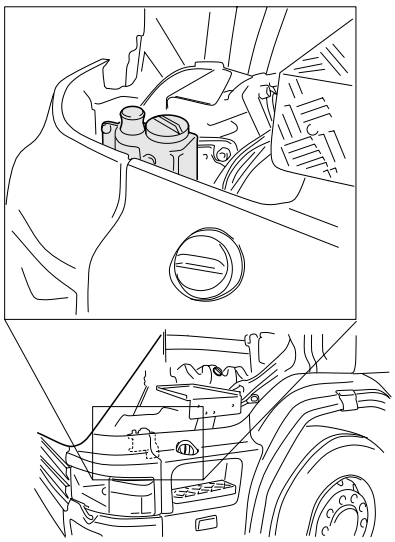
Oil top up and bleeding

1 Fill the oil reservoir to the maximum level.

2 Drive the vehicle turning the steering wheel to full wheel lock in both directions several times or lift the front axle and turn the steering wheel to full wheel lock.

3 Check the oil level with the wheels in the straight ahead position.





Course instability

Types of faults:

- King pin bearing play. See booklet *00:03-07/1, Maintenance instructions section 7*
- There is too little or too much resistance to rotation in the king pin bearing. See section *Heavy steering, king pin*
- If there is too much friction in the steering column, see section *Heavy steering*
- Difference in lateral stability between front and rear tyres.
- Course instability with a trailer
- Steering play, see section *Steering play*
- Intermediate steering arm play
- Suspension of steered axle
- Worn shock absorbers
- Wheel bearing play. See booklet *00:03-07/1, Maintenance instructions section 9*
- There is too little caster angle, toe-in. See booklet for each axle, *Adjusting wheel angles, group 13*
- Incorrect straight ahead position. See section *Steering play, power steering gear centre position.*

Difference in lateral stability between front and rear tyres

When using tyres with grooves on the front axle and tyres with a pattern made up of blocks on other axles the course stability may be affected as tyres with a block pattern have lower lateral stability.

If the tyres on the front axle and other axles are of a different make this can also affect the course stability.

Course instability with a trailer

When cornering a heavy trailer transfers large lateral forces to the tractor chassis frame.

This applies in particular to vehicles with a long axle distance, long rear overhang and vehicles with torsionally flexible bodywork.

If the bodywork is not torsionally rigid enough there is a risk that the vehicle will tend to self steer which leads to course instability.

Therefore it is important that draw beam, fifth wheel and all other body work are attached according to Scania instructions in the *Body work manual*.

Out of square axles will also lead to lateral pull and course instability.

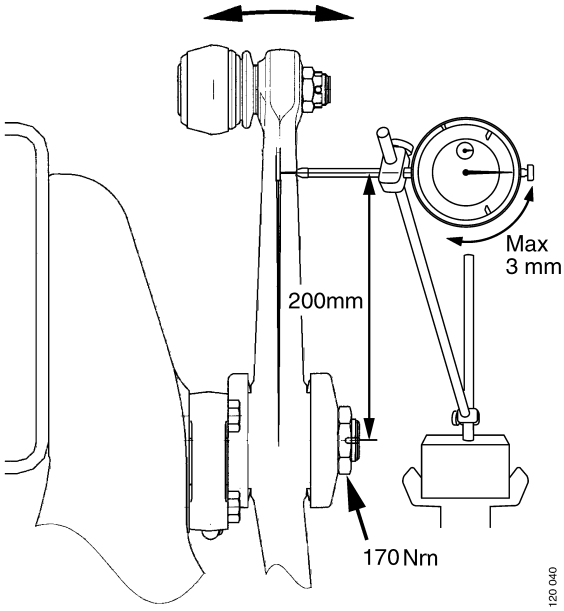
Intermediate steering arm play

Check that the bearing is tightened to the correct torque, 170 +/- 20 Nm.

Measure the play 200 mm from the bearing centre line with a dial gauge. Refer to the illustration.

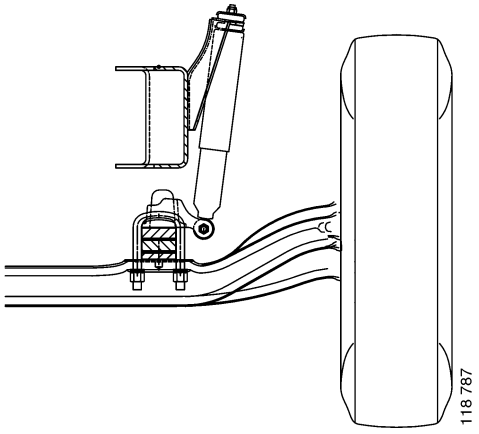
Note: Measure the play, not the axial play.

If the play is more than 3 mm the bearing should be changed. See booklet *13:01-01, Steered tag axle.*



Suspension of steered axle

- Check shock absorbers for leakage.
- Check leaf springs for attachment, broken spring leaves and other damage.
- Check attachment and any damage to torque rods.



Worn shock absorbers

Check if the shock absorbers are worn by road testing the vehicle on a rough road. This will place the shock absorber under load.

Feel the shock absorbers with the hand. After such a test, a worn shock absorber will feel cooler than a correctly functioning shock absorber.

See *TI 12-990913*, for information on checking shock absorbers.

Lateral pull

Causes:

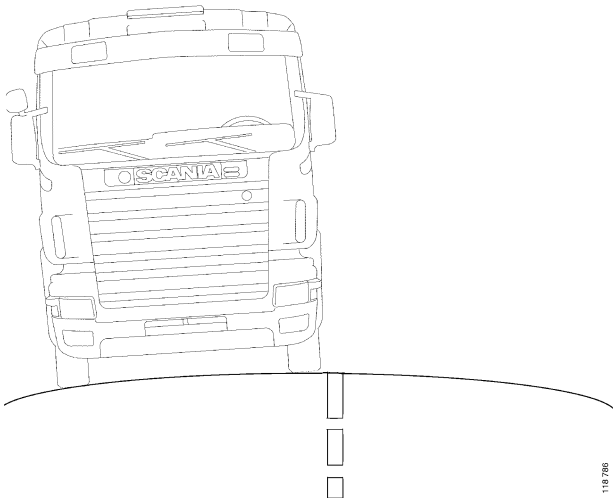
- Binding brake or seizing wheel bearing
- Road surface camber
- Lateral wear, incorrect front tyres
- Geometric fault in the steering system
- Caster angle
- Out of square rear axles
- Out of square steered axles
- Hydraulic imbalance
- Lateral pull when braking

Binding brake or seizing wheel bearing

If any brake is binding or if any bearing is seized this must be rectified. *See Workshop manual group 7 and group 10.*

Road surface camber

When driving on roads with a strong lateral incline, i.e. camber, this causes lateral wear on the front wheel tread pattern. This results in lateral pull.

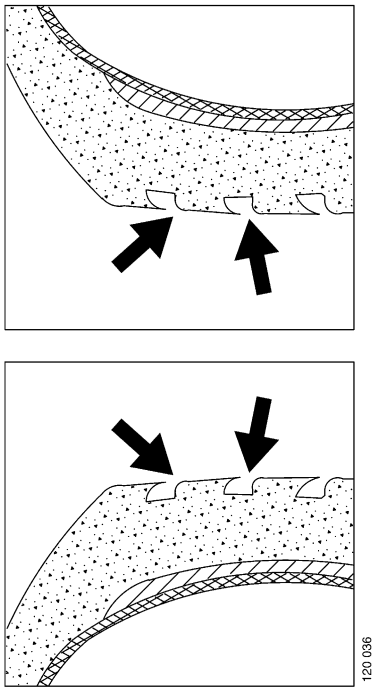


Lateral wear, incorrect front tyres

Incorrect wheel alignment or lateral wear on front tyres quickly lead to lateral pull. Switch the right and the left wheel with each other if in doubt. Then check if the tyres are causing the lateral pull.

The vehicle must not have tyres with lateral wear when carrying out wheel alignment.

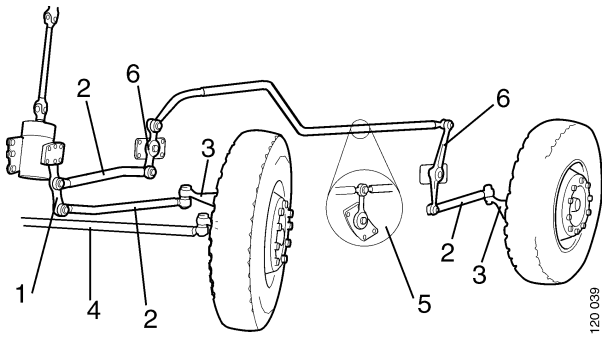
See *Workshop manual group 13 for adjusting wheel angles.*



Geometrical fault

Check that the correct type of steering arm, drag link, drag link arm etc. is fitted on the vehicle. Incorrect type or incorrectly fitted part can cause incorrect steering geometry which results in lateral pull. Occasionally lateral pull only happens together with suspension action.

See TI 07-981104 for further information.



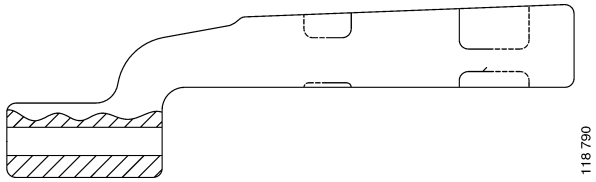
1 *Steering arm*
2 *Drag link*
3 *Drag link arm*
4 *Track rod*
5 *Intermediate steering arm*
6 *Auxiliary steering arm*

Vehicles with leaf-spring suspension:

Make sure that the vehicle does not lean on the suspension.

Check that the correct type of mounting is fitted between the front axle and the front spring. Only one mounting per side must be fitted. Otherwise the steering geometry may be incorrect.

Check other suspension parts.



Mounting between the front axle and the front spring.

Vehicles with air suspension:

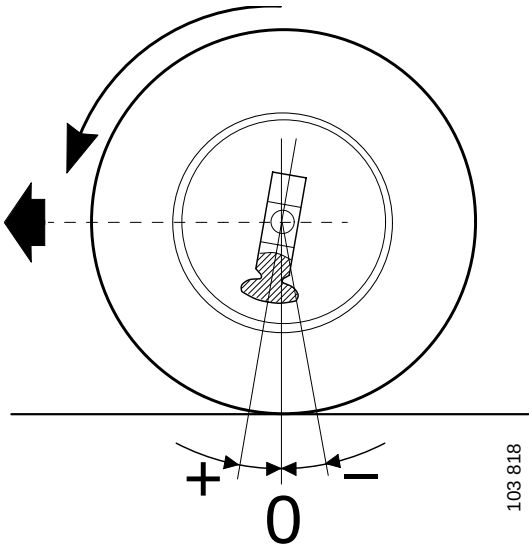
Make sure that the vehicle does not lean on the suspension.

Check that the air spring heights are correct and that there is no damage on other suspension parts.

Caster angle

Lateral pull is already noticeable at a difference of 0.5° between right and left caster angle on an even road surface.

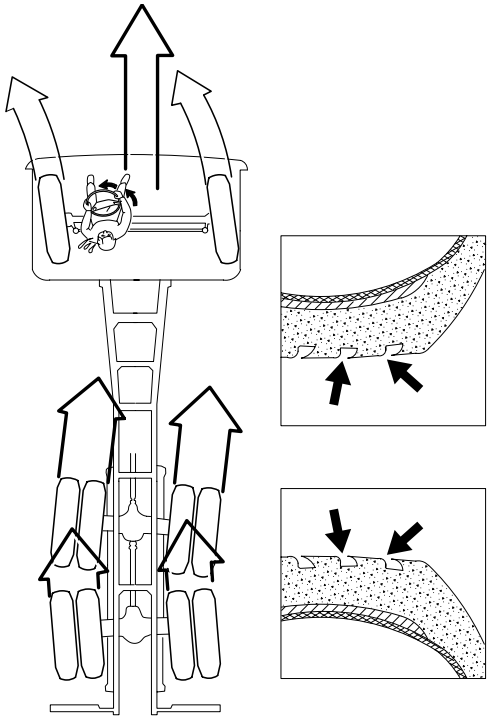
See booklet for each axle, *Adjusting wheel angles, group 13*.



Out of square rear axles

Out of square rear axles result not only in lateral pull and course instability but also in great tyre wear and high fuel consumption.

See booklet 13:00-05, Adjusting wheel angles.



Hydraulic imbalance

If the power steering wants to steer from the centre position by itself the power steering gear should be checked. See the appropriate power steering gear *Workshop manual, group 13.*

Lateral pull when braking

If an incorrect drag link arm is fitted to the vehicle the steering may be affected when braking. This is caused when the spring partly winds up when braking. See section 7 *Geometric fault.*

Steering wheel vibrations, even road surface

Types of faults:

- Wheel imbalance
- Seizing telescopic part in the steering column
- Distorted wheels, radial run-out

Wheel imbalance

Wheel imbalance leads to steering wheel vibrations.

Front wheels should be balanced dynamically before fitting.

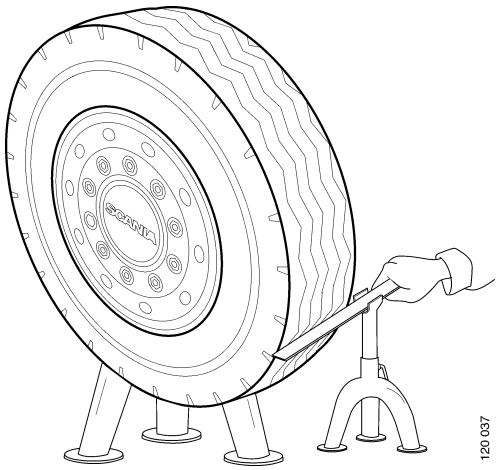
Seizing telescopic part in the steering column

When the cab moves in relation to the chassis a seizing telescopic part in the steering column may lead to vibrations in the steering wheel.

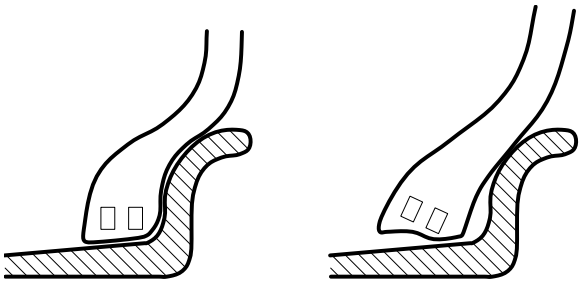
Distorted wheels, radial run-out

Vibrations in the steering wheel can happen at a radial run-out above 2.5 mm. These vibrations are often felt in the cab as well.

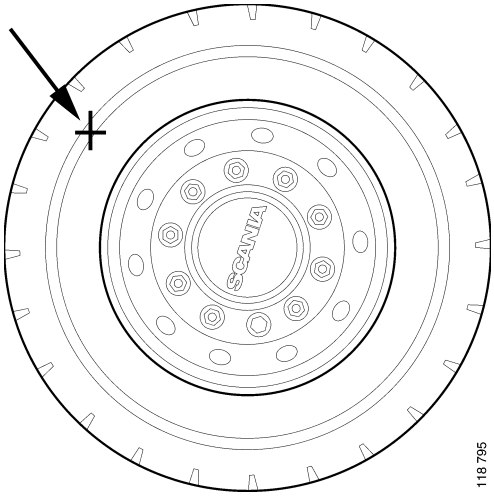
1 Support the front axle and measure the wheel radial run-out on the tyre wear pattern. Measure both the centre of the wear pattern and the tyre edges.



2 If the radial run-out is greatest at any of the edges the tyre is incorrectly fitted on the rim. The distance to the rim from the centre line on the tyre sides is less in one place.



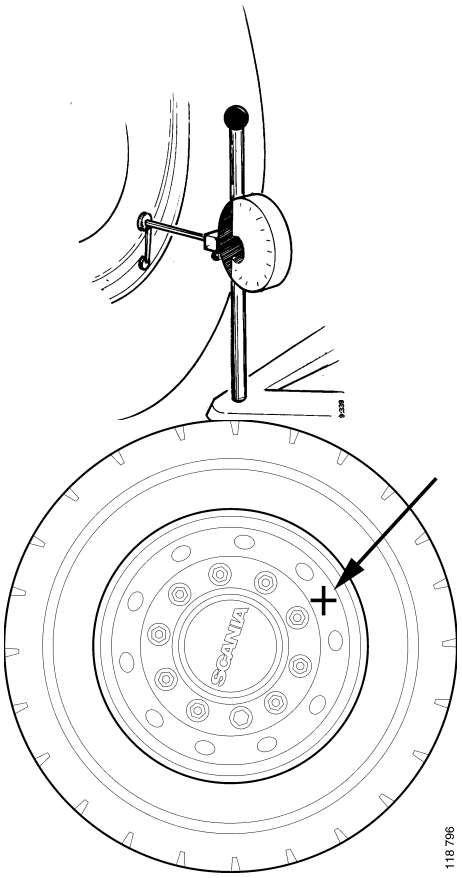
3 If the radial run-out is greatest in the centre of the wear pattern the rim may cause the radial run-out. Mark the position of maximum radial run-out on the side of the tyre.



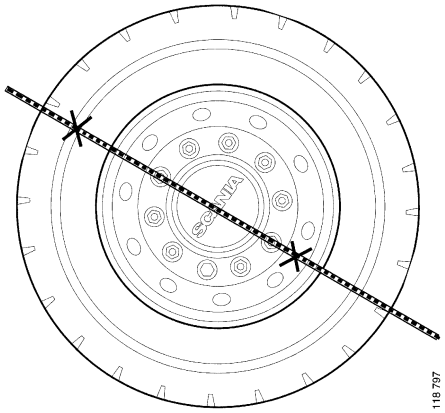
4 Measure and mark the positions of maximum radial run-out on the inside and the outside of the rim.

Change the rim if the radial run-out is above 2.0 mm.

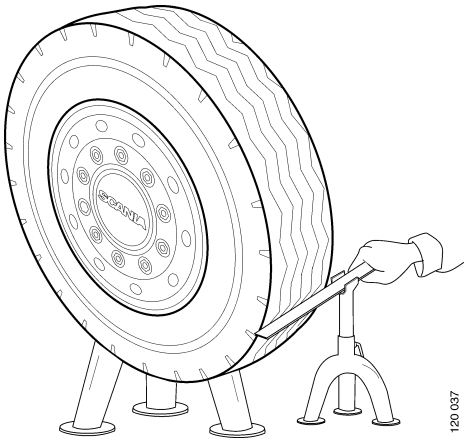
Dial gauge: 587 581



5 Detach the tyre from the rim. Turn the tyre in relation to the rim so that the tyre and the rim maximum radial run-out are 180° to each other.



6 Check that the radial run-out is a maximum of 2.5 mm.



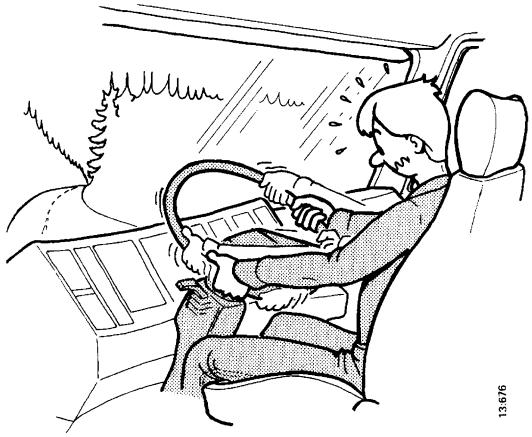
Steering wheel vibrations, uneven road surface

Types of faults:

- Shimmy
- Seizing telescopic part in the steering column. See section *Steering wheel vibrations, even road surface*
- Wheel imbalance. See section *Steering wheel vibrations, even road surface*
- Worn shock absorbers. See section *Worn shock absorbers*
- Steering play. See section *Steering play*
- Faulty caster angle. See booklet for each axle, *Adjusting wheel angles, group 13*

Shimmy

Shimmy is a more unusual and more prominent type of steering wheel vibrations. Vibrations in the front wheels occur when driving on a road with potholes.



The impact creates strong lateral forces in the wheel and these are reinforced by resonance oscillations in the steering system.

The intensity of the oscillations increases and the only way of reducing the powerful steering wheel vibrations is to reduce the vehicle speed.

Shimmy can be caused by several interacting things.

- The caster angles are too large
- Wheel imbalance
- Worn shock absorbers
- Steering play

Steering wheel vibrations when braking

Types of faults:

- Incorrectly tightened wheel nuts
- Uneven rim
- Faulty brake drums
- Faulty brake discs
- Wheel bearing play

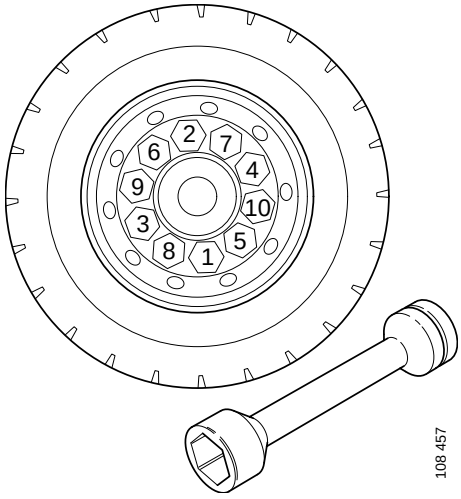
Incorrectly tightened wheel nuts

Incorrectly tightened brake drum wheel nuts can lead to brake vibrations. Loosen the wheel nuts and make sure the brake is released on the wheel concerned if the vehicle is equipped with brake drums.

Tighten the nuts in sequence as shown in the figure. Tighten the nuts in two stages. Use a torque wrench or a nut runner with a torque range of 1,700-2,100 Nm, fitted with torque socket 98661 for 600 Nm.

Stage one: tighten to torque 60 Nm.

Stage two: tighten to torque 600 Nm.

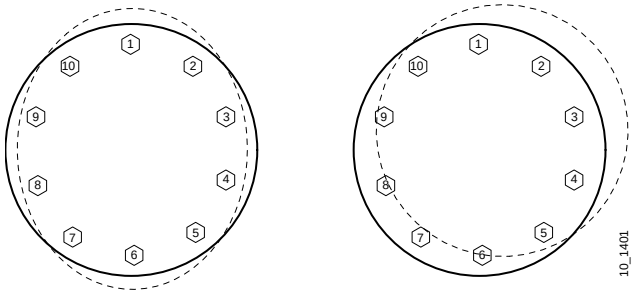


Uneven rim

Steering wheel vibrations during light brake application can also be caused by unevenness of the contact surface between rim and brake drum.

In order to avoid brake drum distortion when tightening the wheel the rim must comply with Scania requirements for evenness.

Faulty brake drums



Steering wheel vibrations during light brake application in speeds of 50-20 km/h are often caused by brake drum ovality or brake drum radial run-out.

Regular vibrations with the same intensity is a sign of ovality or radial run-out on one of the front wheel brake drums.

Irregular vibrations may be caused by the interaction between both front wheel brake drums.

First check whether the vibrations are caused by the front brake drums by road testing the vehicle. Vibrations which are mostly felt in the cab can also be caused by the rear wheel brake drums.

If the vibrations are evident directly after a wheel change the problem must be rectified immediately.

Make sure all contact surfaces are clean.

The brake drum may become oval if the wheel and brake drum are fitted incorrectly. The brake drum must be turned in a lathe or renewed. Fit locking bolts to brake drums if these are missing.

See booklet 10:02-06, Wheel brake components for brake drums for more information.

Faulty brake discs

Steering wheel vibrations during light brake application in speeds of 85-40 km/h are often caused by variable brake disc thickness or brake disc axial run-out.

Regular vibrations with the same intensity is a sign of variable thickness or axial run-out on one of the front wheel brake discs.

Irregular vibrations may be caused by the interaction of radial run-out between both front wheel brake discs.

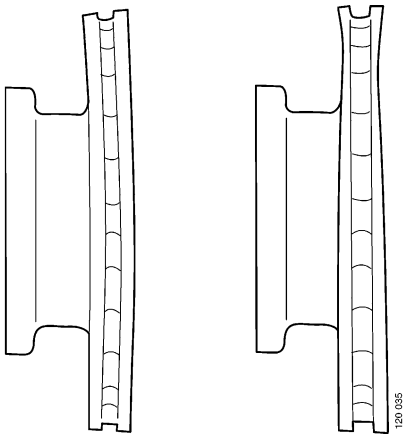
First check whether the vibrations are caused by the front brake discs by road testing the vehicle. Vibrations which are mostly felt in the cab can also be caused by the rear wheel brakes.

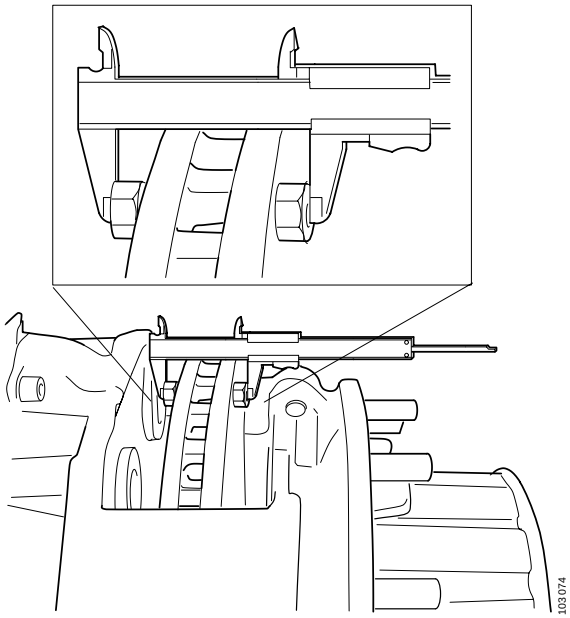
Check the thickness of the brake disc at each wheel bolt. Measure inside any wear edge using spacers, e.g. two nuts.

If there is much axial run-out on the brake disc, there is radial run-out, or there is variable brake disc thickness, the brake disc must be renewed or turned in a lathe. When turning a brake disc in a lathe both sides of the brake disc should be turned simultaneously.

Note: The variable brake disc thickness must not exceed 0.08 mm.

See booklet 10:02-10, Wheel brake components for brake discs for more information.



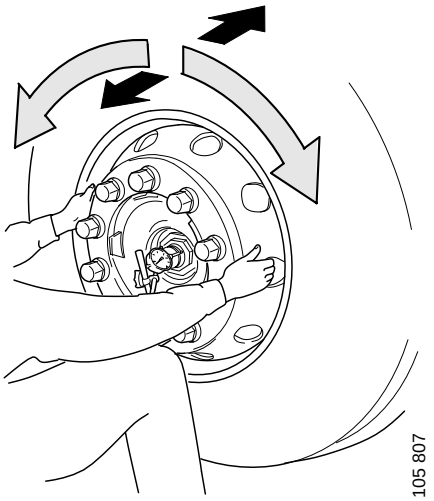


Wheel bearing play

Check wheel bearing play, renew if necessary.

See booklets:

- *09:01-01, Drum brake hub*
- *09:01-02, Disc brake hub*



Steering wheel knock on uneven road surface

Types of faults:

- Worn shock absorbers, *see section Worn shock absorbers*
- Steering play, see section *Steering play*
- Wheel bearing play, see booklets *09:01-01, Drum brake hub* or *09:01-02, Disc brake hub*
- King pin bearing play, see booklet *00:03-07/1, Maintenance instructions section 7*

Specifications

Maximum steering wheel turning clearance with wheels in straight ahead position	9°/37.5 mm
Maximum ball bearing play	2.0 mm
Maximum angle difference, caster, left/right side	0.5°
Maximum deviation in rear wheel rolling direction	2.0 mm/m
Maximum deviation between rear wheels	1.5 mm/m
Vehicles with several steered wheels:	
Maximum deviation between left hand side steered wheels*	3.0 mm/m

Maximum radial run-out, steered wheels	2.5 mm
Maximum radial run-out, rim	2.0 mm
Maximum ovality, brake drum	0.12 mm
Maximum radial run-out, brake drum	0.20 mm
Maximum variable thickness per axle, brake disc	0.08 mm
Maximum axial run-out, brake disc	0.20 mm
Minimum thickness, brake disc	37 mm
Tightening torque, steel disc wheel	550 - 650 Nm
Tightening torque, spoke wheel	335 - 360 Nm
Tightening torque, steering column	47 Nm
Tightening torque, intermediate steering arm bearing	170 Nm
Ball joint play	0.5 - 2.0 mm

*See booklet 13:00-13 for hydraulically steered rear axle

Report - Checking and troubleshooting

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

A. Notes during road test	Trailer - semi-trailer ❑

B. Measures taken

Note