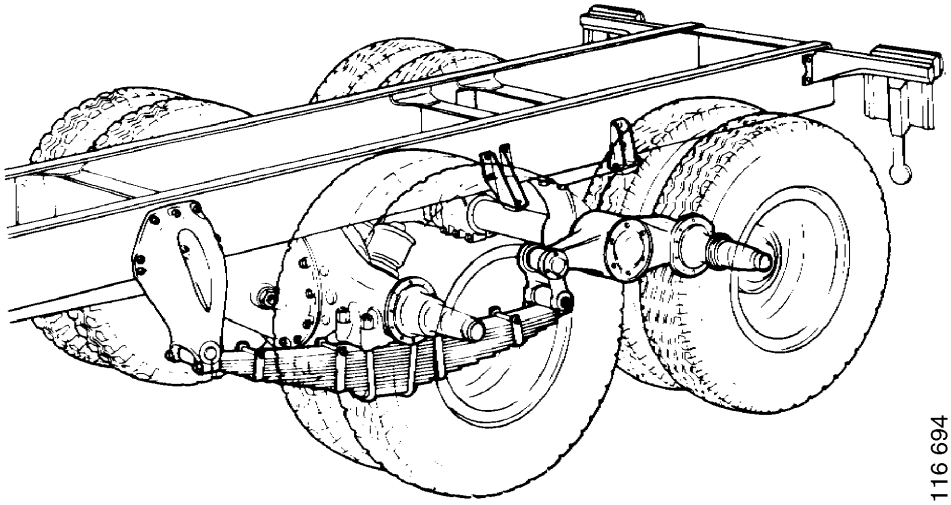
SCANIA

12:01-01

Issue 3 **en**

Leaf spring suspension



116 694

1 712 434

Contents

Function description

Work description

Function description

General

System components

There are two types of leaf springs on Scania trucks: multi-leaf springs and parabolic springs.

Multi-leaf springs

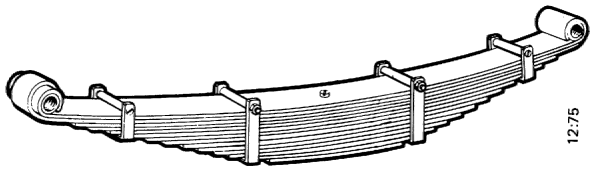
Multi-leaf springs are made up of several spring leaves of different lengths.

The spring leaves are the same width and are often the same thickness.

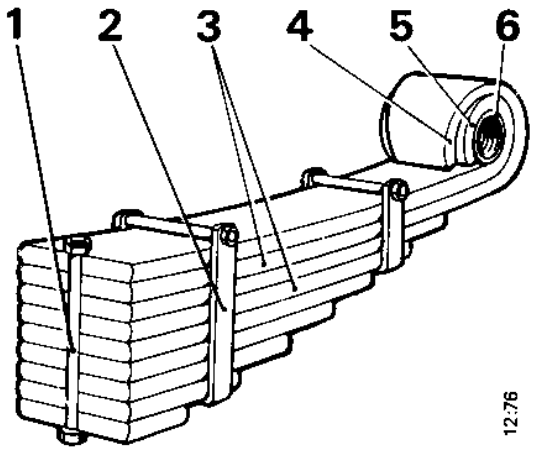
The longest leaf is called the main leaf or the 1st leaf. It has eyes in the ends if the spring is attached to the frame using spring bolts.

To prevent a failure of the main leaf causing the spring to coming loose from the spring bracket, the second leaf also has an eye at the front end.

The spring is held together by a centre bolt through the spring leaves, plus spring clips that prevent the spring leaves from moving laterally.



Multi-leaf spring



1 Centre bolt
2 Spring clip
3 Spring leaves
4 Safety eye
5 First leaf eye
6 Spring bush

Multi-leaf spring construction

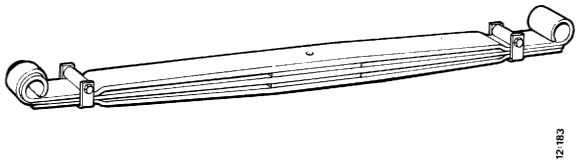
Parabolic spring

The parabolic spring is made up of two to four leaves of equal length and width.

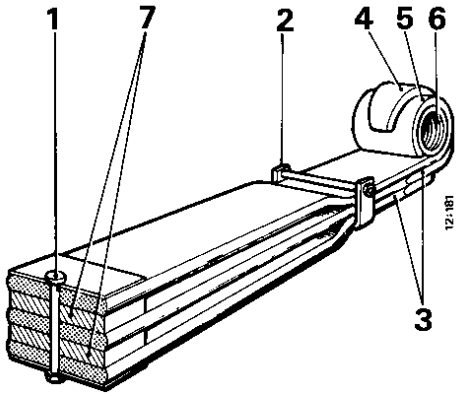
The spring leaves are slightly thicker in the centre and taper to a thinner cross section at the ends.

Unlike the multi-leaf spring, the spring leaves are not in contact with each other, but are separated by steel spacers. This gives a softer suspension action. Parabolic springs are therefore always combined with shock absorbers.

The spring has eyes in both ends where the spring bushes are pressed into place. The leaf under the leaf with bush eyes also has an eye at the front end to prevent the spring from detaching if it fails at the spring bush.



Parabolic spring

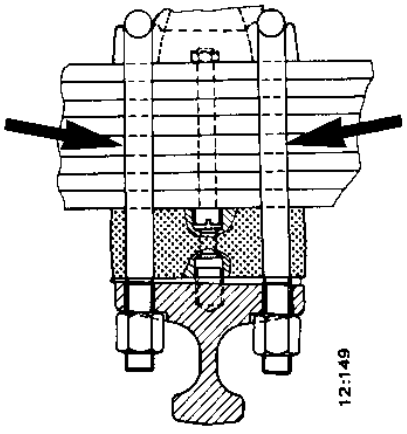


1 *Centre bolt*
2 *Spring clips*
3 *Spring leaves*
4 *Safety eye*
5 *First leaf eye*
6 *Spring bush*
7 *Separator inserts*

Parabolic spring construction

U-bolts

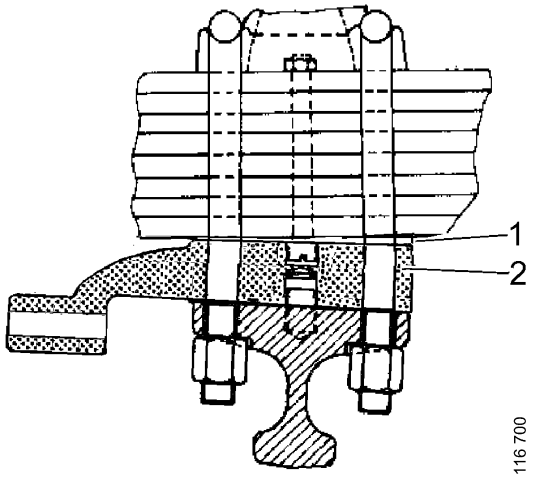
Both the front and rear spring assemblies are clamped to the axle using two U-bolts per side. The U-bolts are threaded and tightened with nuts to a specific torque. Consequently, the tightening torque of the U-bolts determines the clamping force in the joint between the spring and the axle. Therefore, this bolted joint requires periodic inspections and re-tightening.



U-bolts

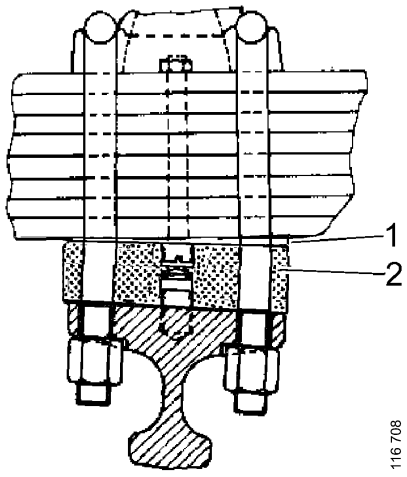
Front springs and spring brackets

A wedge-shaped bracket between the spring assembly and the front axle determines the angle of inclination of the front axle, i.e. the caster angle, and acts as a bracket for the anti-roll bar. Adjusting wedges of 0.5-4° can be used for re-adjustments.



1 Adjusting wedge
2 Bracket
Front axle

Vehicles with double front axles do not have an anti-roll bar fitted to the rear front axle. A wedge-shaped spacer and any adjusting wedges are found between the springs and front axle 2.



1 Adjusting wedge
2 Wedge-shaped spacer
Front axle 2

Rear springs and wedge-shaped spacers

In some cases, wedge-shaped spacers are also used at the rear springs to adapt the rear axle angle of inclination.

For this purpose, wedge-shaped spacers are available in different angles.

A spacer is chosen that gives the rear axle a suitable angle of inclination, taking into account the angles of the propeller shaft universal joints.

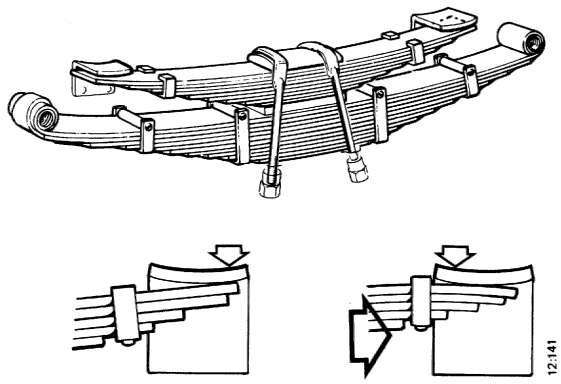
Rear springs with helper spring

On trucks with one rear axle and multi-leaf springs, the rear suspension consists of a main spring and a helper spring. The main spring is attached to the frame using a spring bolt and a spring bracket at the front end and using a spring bolt and a movable spring shackle at the rear end.

On top of the main spring is the helper spring, which is not fixed to the frame.

The helper spring on multi-leaf springs is a separate spring assembly. On parabolic springs, the helper spring is assembled together with the main spring using the centre bolt.

When the truck is laden, the main spring is placed under load. The ends of the helper spring makes contact with the two curved brackets that are riveted to the frame. If the load on the vehicle is increased further, the ends of the helper spring "roll" against the brackets, causing a reduction in the effective length of the helper spring, and the spring becomes stiffer.



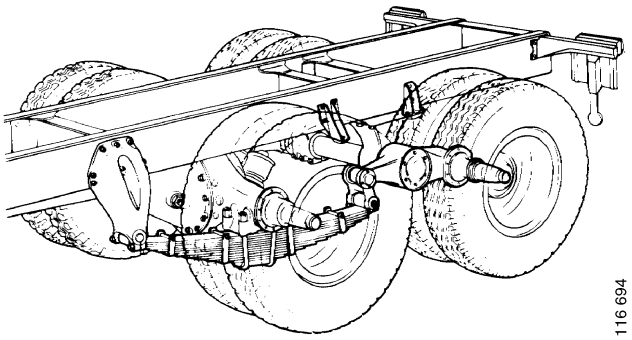
Main spring with helper spring

Rear springs with tag axle

On trucks with tag axle, the springs are located under the driving axle.

The front ends of the springs are attached to the spring brackets using spring bolts. The rear ends of the springs are attached to balance arms using spring shackles.

When under load, the driving axle will attempt to lift from the springs. This places large demands on the joint between the driving axle and the springs.

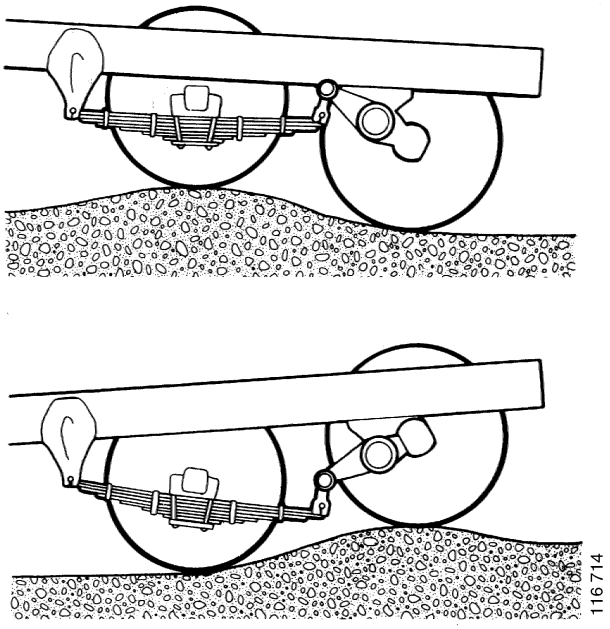


Suspension on trucks with tag axle

Suspension movement

The tag axle wheels are suspended separately on balance arms that are mounted in a shaft on the frame. The front arm of the balance arm is connected to the rear end of the driving axle spring by a link.

This method of suspension means that both the driving wheels and the tag axle wheels can follow the contours of the road. The weight distribution between the driving axle and the tag axle is more or less unchanged when the suspension is in action.

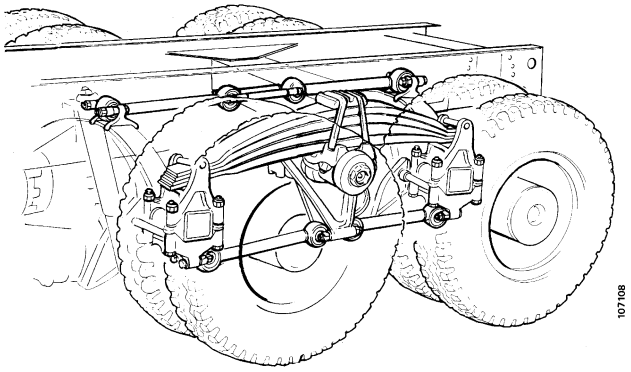


Rear springs for tandem bogie

Trucks with a tandem driven bogie are either equipped with a balance tandem or with a four-spring tandem. These are equipped with multi-leaf or parabolic springs, depending on the type of vehicle. The axles are held in place using torque rods.

Balance tandem

The balance tandem has one spring on each side of the frame. The springs are attached in the middle using spring bearings which can turn, and which are mounted in a frame bracket. The ends of the springs rest against each rear axle. When under load, the springs attempt to lift from the sliding surface on the bracket. This places large demands on the joint between the driving axle and the springs.

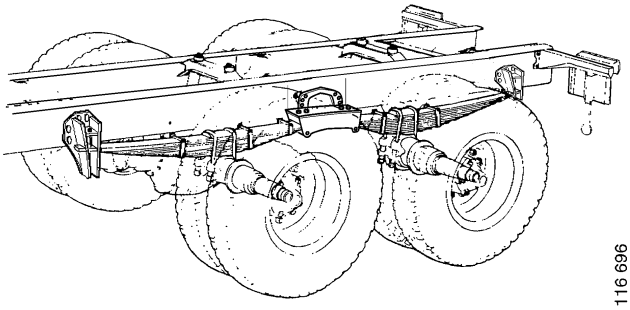


Balance tandem

Four-spring tandem

In some markets, a four-spring tandem may be fitted.

The four-spring tandem has two springs on each side. The axles are held in place using torque rods. The springs rest against their sliding surfaces on the frame bracket. A link between the springs evens out the loads between the front and rear axle during suspension action.



Four-spring tandem

Spring bolt

The purpose of the spring bolts is to transfer all the forces between the axles, springs and frame.

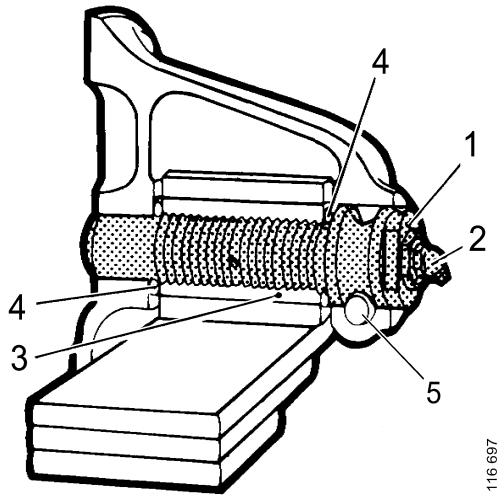
The spring bolts are threaded. They are threaded into the spring bushes, which are pressed into the spring eyes.

Because both the spring bolt and the spring bush are threaded, the surface under load is larger.

The spring bolt and bush together form a sliding bearing surface that is lubricated with grease. Because this bearing is exposed to dirt and water and due to the high internal loading, regular lubrication is required.

The bearing is sealed using O-rings, which play an important part in determining the service life of the bearing. To prevent the spring bolt from rotating, the spring bracket and the spring shackle are equipped with slits and two clamp bolts. The clamp bolt closest to the bolt head locks the bearing so that it cannot slide out of the spring bracket or the spring shackle.

Spring bushes with two different external diameters are used on 4 series trucks - 36 and 46 mm. The spring bolts are available in three different versions, with 37 mm bolt heads for 36 mm bushings and 47 and 56 mm bolt heads for 46 mm bushings.

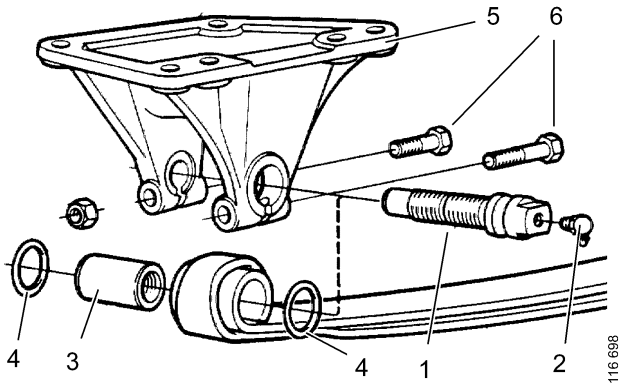


1 Spring bolt
2 Grease nipple
3 Spring bush
4 O-ring
5 Clamp bolt

Spring bolt

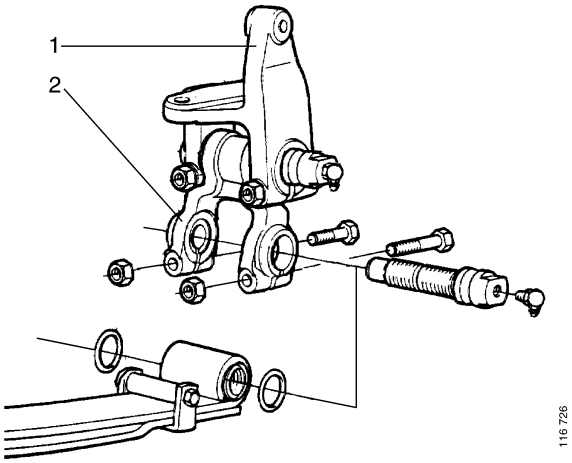
Frame bracket

The frame brackets are riveted to the frame. The rear bracket is equipped with a shackle that makes it possible for the spring to move longitudinally during suspension action.



1 Spring bolt
2 Grease nipple
3 Spring bush
4 O-ring
5 Front spring bracket
6 Clamp bolt

General illustration of the front bracket



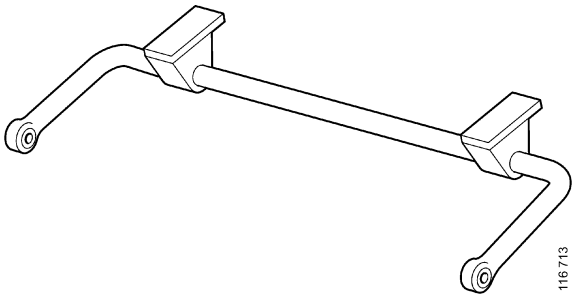
1 Rear spring bracket
2 Spring shackle

General illustration of the rear bracket

Anti-roll bar

The anti-roll bar prevents the body from rolling when cornering. The anti-roll bar is a steel bar, attached using rubber bushings in an articulated joint, either to the spring brackets for the front springs or the spring seats for the rear springs, and to the frame.

When cornering, the truck body is pressed outwards. The outer leaf spring is compressed whilst the inner spring has a higher deflection. This rolling is counteracted by the twisting of the bar, which attempts to balance the spring forces.



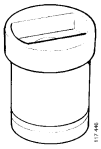
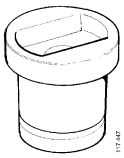
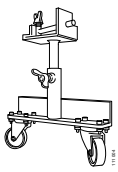
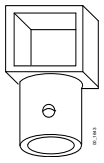
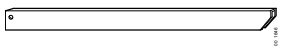
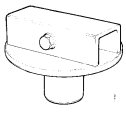
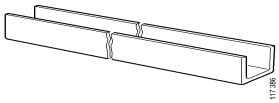
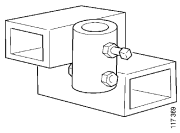
Anti-roll bar

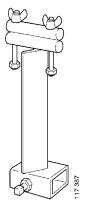
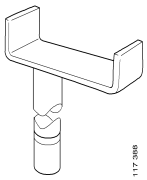
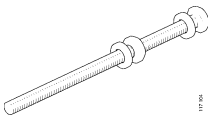
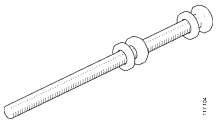
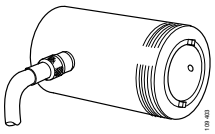
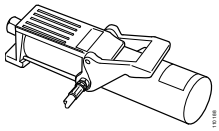
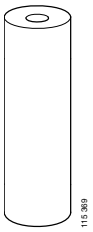
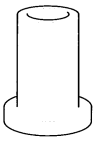
Work description

Supporting on stands

Refer to Workshop manual group 0

Special tools

Number	Designation	Picture	Tool board
87 203	Socket wrench		AM2
87 204	Socket wrench (46 mm)		AD/AS3
99 121	Torque wrench support		TV
98 402	Part of kit 98 400		F1
98 405-1	Part of kit 98 400		F1
98 405-2	Part of kit 98 400		F1
98 513	Part of kit 98 400		F1
98 744	Part of kit 98 400		F1

Number	Designation	Picture	Tool board
98 745-1	Part of kit 98 400		F1
98 745-2	Part of kit 98 400		F1
90 012	Threaded rod		H1
99 013	Threaded rod		H1
99 003	Hydraulic cylinder		H1
99 004	Pedal		H1
99 009-1	Socket		AD/AS3
99 009-2	Socket		H1
99 249	Socket		D3

Other tools

Number	Designation	Tool board
588 153	Socket wrench (56 mm)	AD/AS3
587 300	Socket, 32 mm (M22)	AD/AS3
587 322	Socket, 36 mm (M24)	AD/AS1
587 503	Torque socket, 0-800 Nm	XB3
587 072	Torque socket, 40-200 Nm	XB3
	Jack	
	Stands	
587 119	Spring press	

Lifting springs

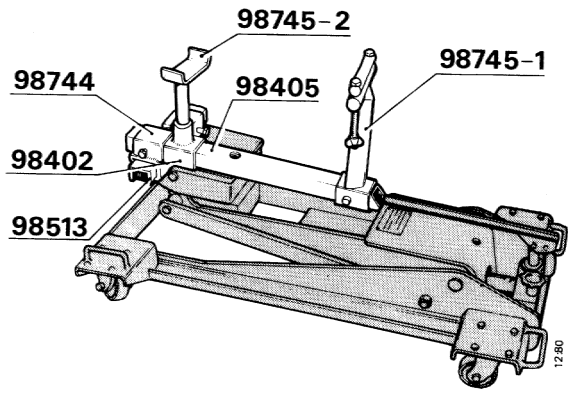
Using tools for lifting springs

To avoid heavy lifting when renewing springs, it is possible in most cases to use a gearbox jack with lifting tools fitted.

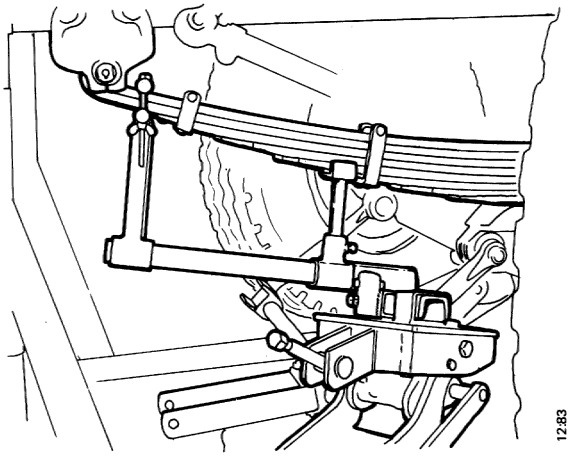
WARNING!

- The axle should be supported with a jack at all times when removing/fitting springs. Stands must also be used if the wheel has been removed.

- Risk of crush injuries



Lifting tools on gearbox jack. Kit number 98 400



Lifting tools on the spring

Renewing front spring

Removing front spring

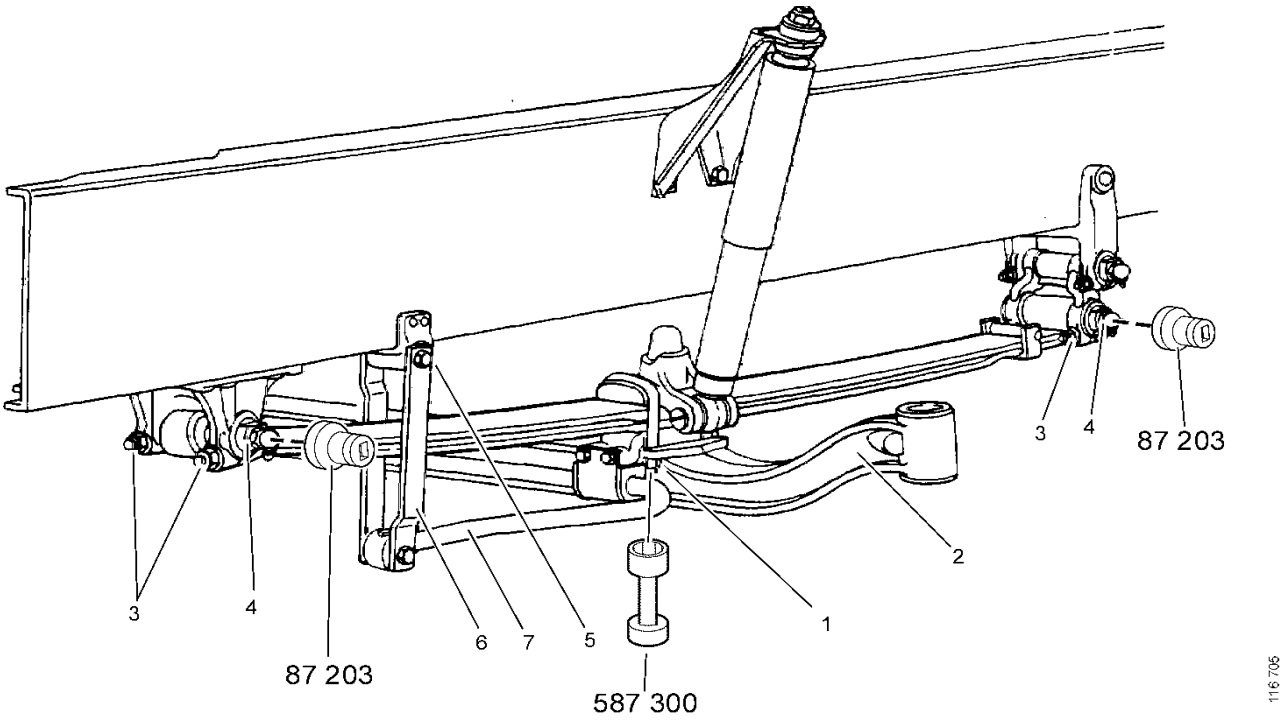
WARNING!

- The axle should be supported with a jack at all times when removing/fitting springs. Stands must also be used if the wheel has been removed.

- Risk of crush injuries

IMPORTANT! Loosen the clamp bolt nuts approximately 15 mm, lower the axle so that the spring is relieved of tension.

- If the spring bolt does not come loose from the spring bush, refer to "Removing spring bolt and spring bush as one unit".
- Note the position of any adjusting wedges and spacers, if fitted.



1 U-bolt nuts
2 Axle
3 Clamp bolts
4 Spring bolt
5 Bolt
6 Link
7 Anti-roll bar

General illustration of front spring

Fitting front spring

WARNING!

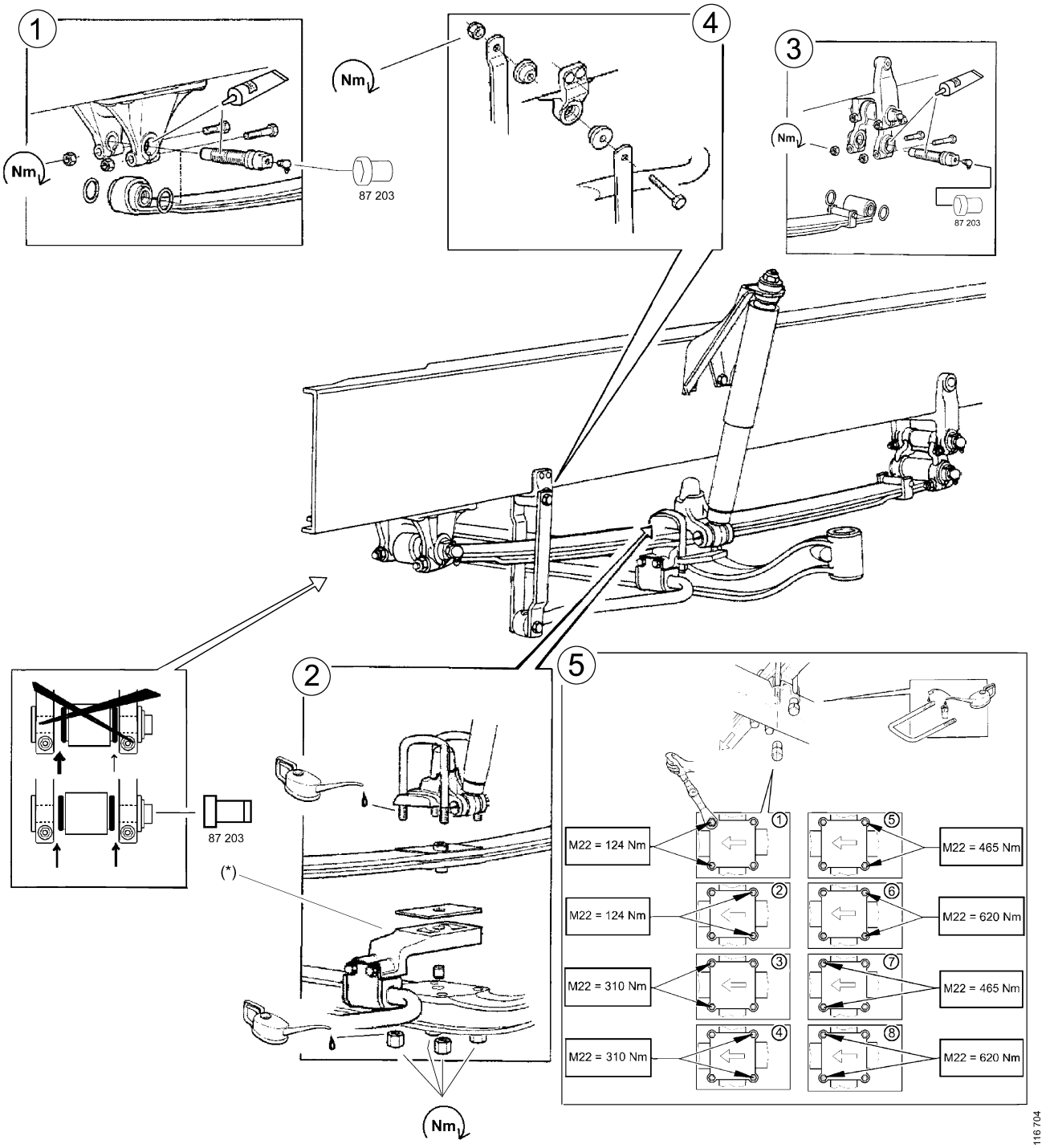
- The axle should be supported with a jack at all times when removing/fitting springs. Stands must also be used if the wheel has been removed.

- Risk of crush injuries

IMPORTANT! Torque tighten the clamp bolts according to the order shown in the diagram. The clamp bolts should be relieved of tension when tightening to the highest torque.

- Renew the springs on one side at a time.
- Fit the clamp screws so that they will not collide with items mounted on the frame.
- The eye on the second leaf should always face the front of the vehicle.
- Ensure that the new O-rings are not damaged during fitting.
- Lock the heads of the front and rear spring bolts using the longer clamp bolts and use socket wrench 87 203 to adjust the distance between the leaf spring eye and the spring bracket.
- Fit in the order shown in the illustration.

	Tightening torques	
Bolt quality	8.8	10.9
M12	84 Nm	
M14	135 Nm	170 Nm
M16	210 Nm	



General illustration of front spring

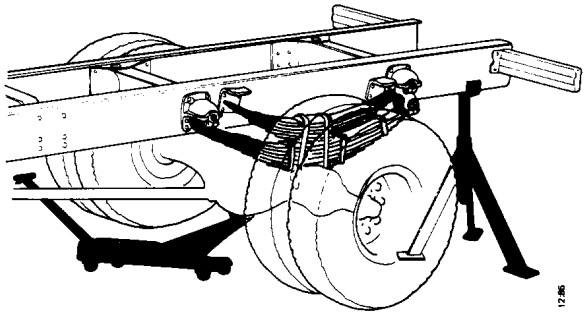
** The thicker bracket should be fitted on the driver's side of the vehicle*

Renewing rear spring

Note: When renewing springs on a balance tandem, refer to group 12, Work description BT 200, BT 201 and BT 300.

Supporting the frame on stands

Note: The vehicle must be supported on stands so that the wheels hang freely when the jack is lowered.



Supporting the frame of a vehicle with a single rear axle

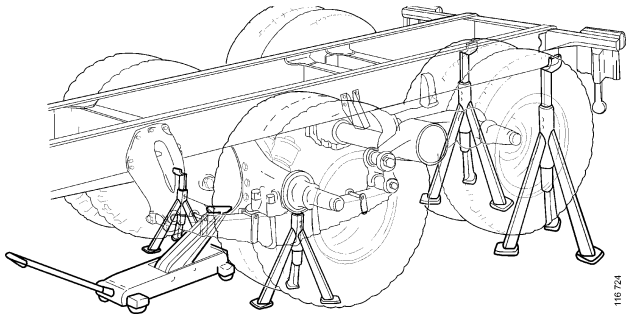
Supporting the frame of a vehicle with a tag axle

1 Raise the tag axle to its upper position.

2 Lift and support the driving axle on stands, so that the wheels can be removed.

3 Place stands under the frame.

4 Lower the tag axle so that the frame is resting on the stands and the yoke is relieved from the balance arm.



Supporting the frame of a vehicle with a tag axle

Removing rear spring

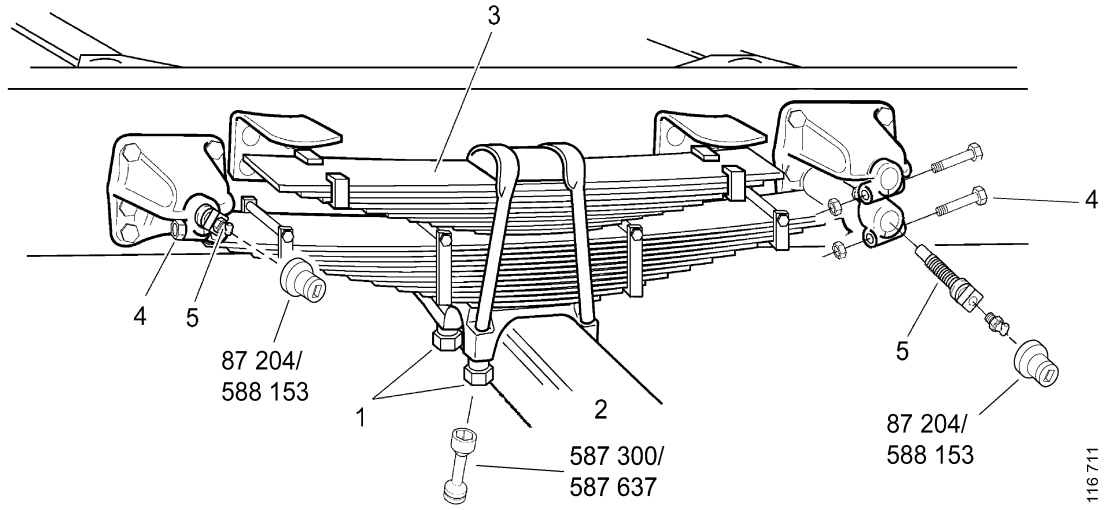
WARNING!

- The axle should be supported with a jack at all times when removing/fitting springs. Stands must also be used if the wheel has been removed.

- Risk of crush injuries

IMPORTANT! Loosen the U-bolt nuts approx. 15 mm; lower the axle so that the spring is relieved of tension. On vehicles with a tag axle, raise the tag axle so that the spring is relieved of tension from the driving axle.

- If the spring bolt does not come loose from the spring bush, refer to "Removing spring bolt and spring bush as one unit".
- Note the position of any adjusting wedges and spacers, if fitted.



1 U-bolt nuts
2 Axle
3 Helper spring
4 Clamp bolts
5 Spring bolts

Rear spring

Fitting rear spring

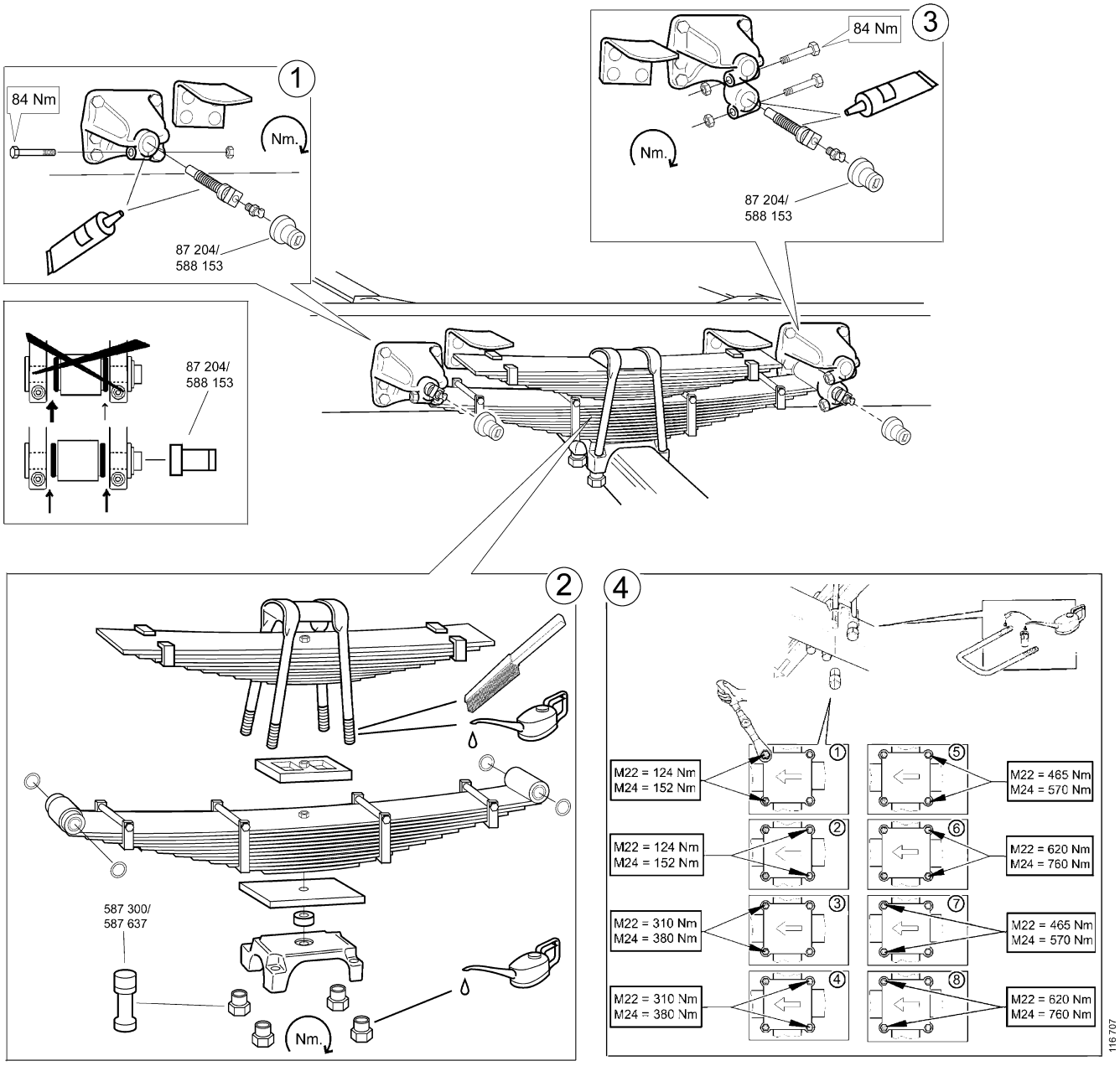
WARNING!

- The axle should be supported with a jack at all times when removing/fitting springs. Stands must also be used if the wheel has been removed.

- Risk of crush injuries

IMPORTANT! Torque tighten the U-bolt nuts as specified in the tightening torque table. Tightening to the highest torque should be carried out with the clamp bolts relieved of tension.

- Renew the springs one side at a time.
- Fit the clamp screws so that they will not collide with items mounted on the frame.
- The eye on the second leaf should always face the front of the vehicle.
- Ensure that the new O-rings are not damaged during fitting.
- Lock the heads of the front and rear spring bolts using the longer clamp bolts and use socket wrench 87 204 or 588 153 to adjust the distance between the leaf spring eye and the spring bracket.
- Fit in the order shown in the illustration.



General illustration of rear spring

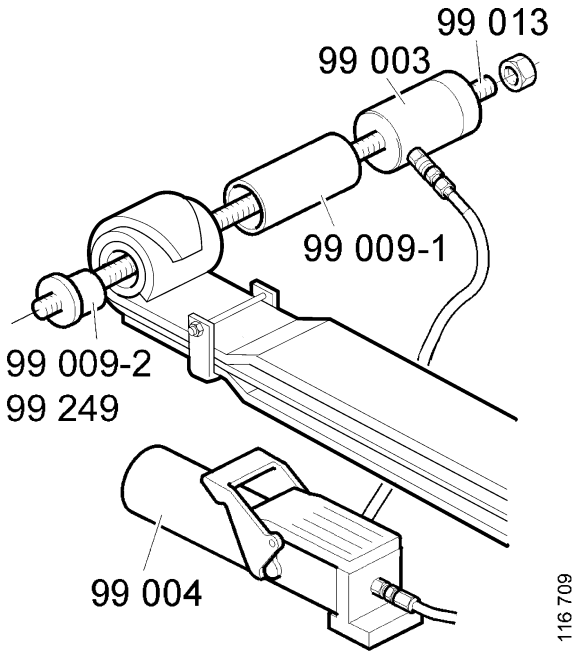
Renewing spring bush

Removal

- Carry out Removing rear spring/front spring to such an extent that the spring bush is accessible.

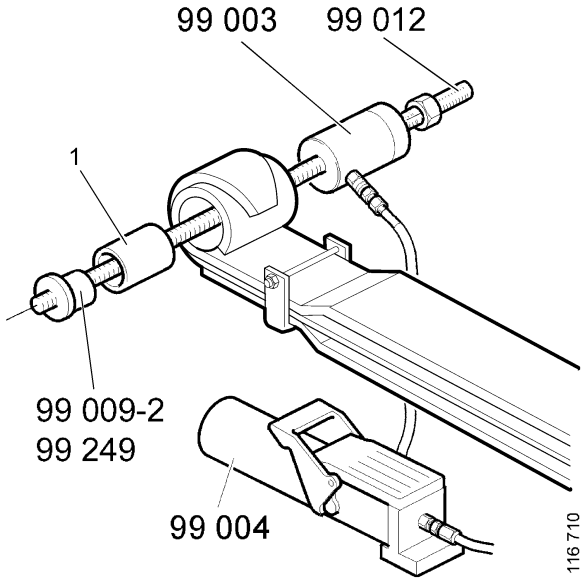
IMPORTANT! The hydraulic cylinder 99 003 should be positioned with the hydraulic connection closest to the leaf spring eye. Otherwise, there is a risk that puller 99 009 or the hole cylinder could become damaged.

Socket 99 249 is used for the 36 mm bush and socket 99 009-2 is used for the 46 mm bush.



Fitting

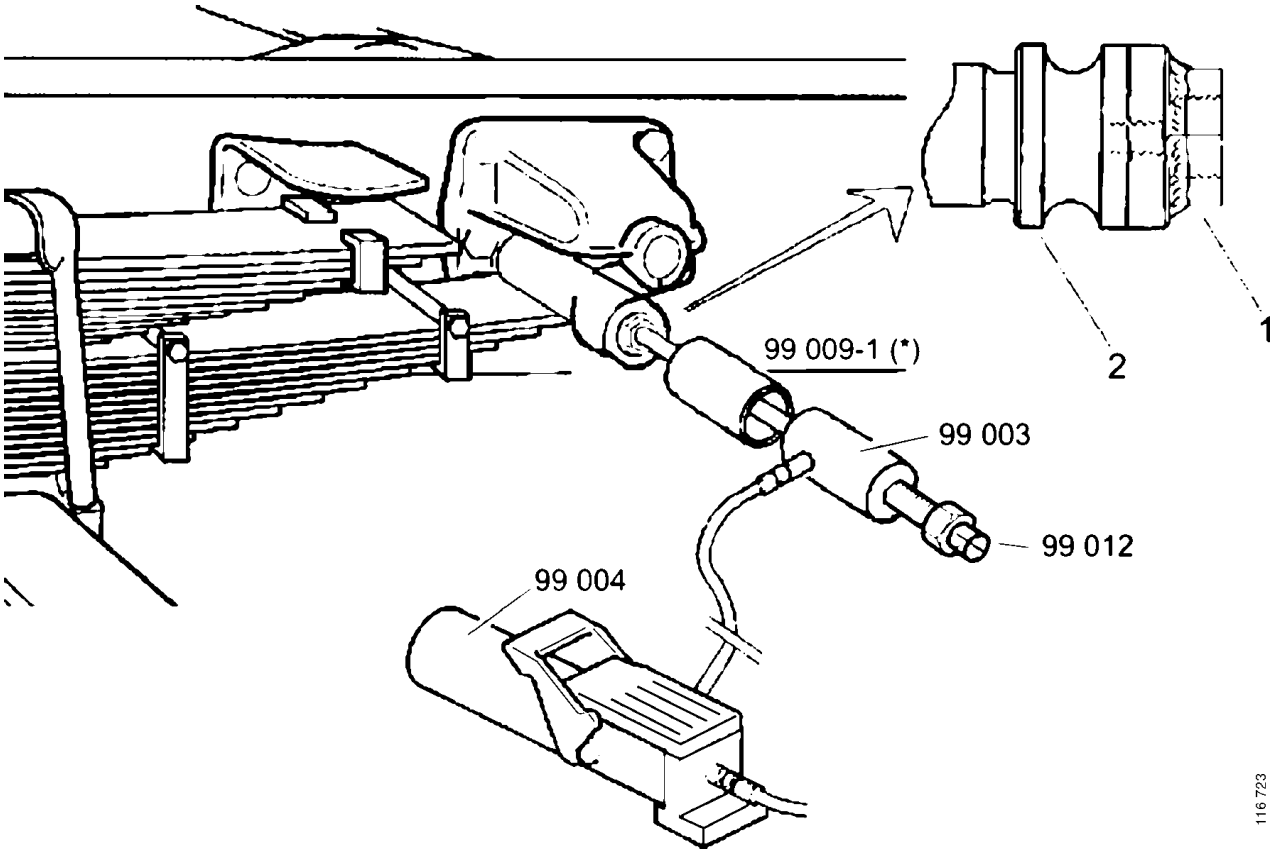
Socket 99 249 is used for the 36 mm bush and socket 99 009-2 is used for the 46 bush.



1 Bush

Removing spring bolt and spring bush as one unit

- Carry out Removing rear spring/front spring to such an extent that the spring bush is accessible.
- Nut 1 must be welded in place around its edge.
- For spring bolts with a 56 mm head, use a pipe with a suitable internal diameter. The length of the pipe must be 150 mm.



1 M20 nut

2 Spring bolt

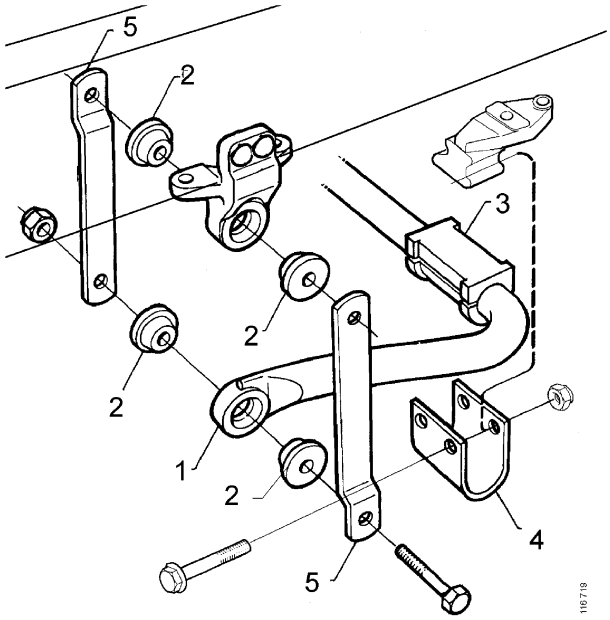
(*) Alternative pipe, internal diameter ~60 mm

Renewing anti-roll bar bushes

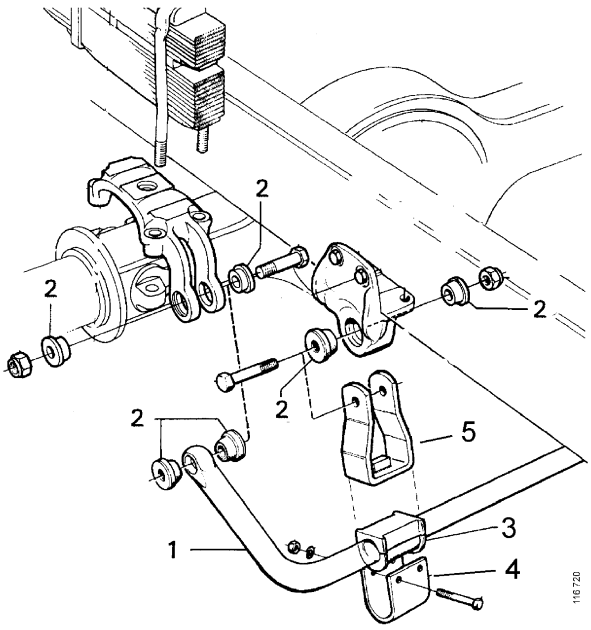
IMPORTANT! Ensure that the truck is on a level surface so that the torsion bar is relieved of tension.

Tightening torques

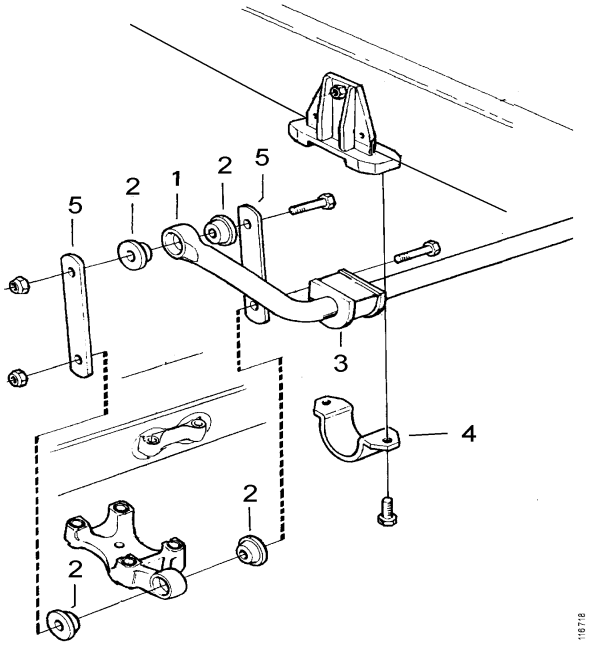
M18 castle nut	290 Nm, then on to closest split pin hole
M20 castle nut	420 Nm, then on to closest split pin hole
M20 lock nut	100 Nm



Front axle



Rear axle



Rear axle with tag axle

1 *Torsion bar*
2 *Bush*
3 *Bearing*
4 *Clamp*
5 *Link*

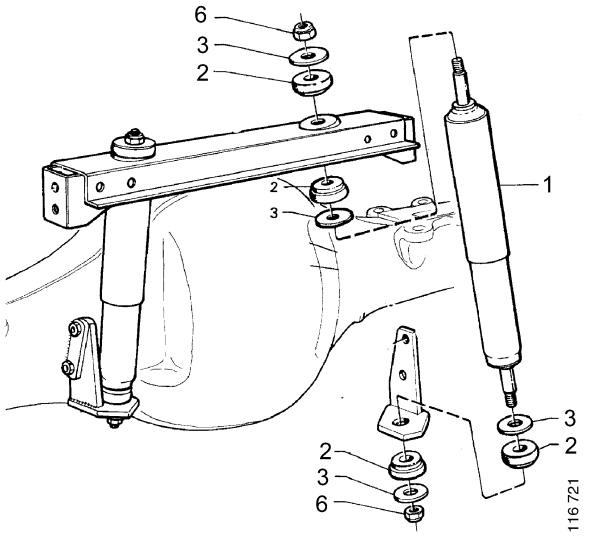
Renewing shock absorber

IMPORTANT! Ensure that the axle is not hanging from the shock absorbers.

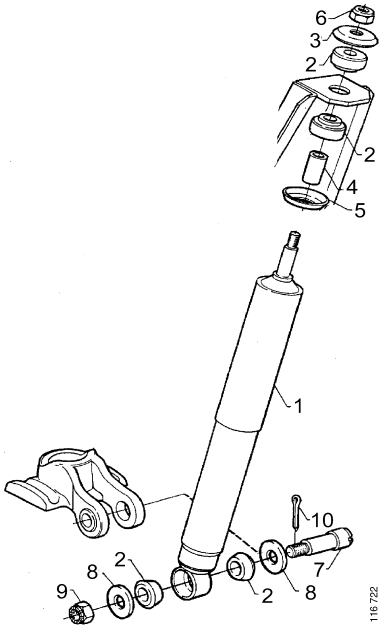
Note: Bleed the new shock absorber before fitting by compressing and expanding it several times. Hold the shock absorber vertical during bleeding and until it is in position.

Tightening torques

M16 castle nut	130 Nm, then on to closest split pin hole
M16 lock nut with plastic insert	210 Nm
Nut for stud, 9/16 or M14	70 Nm
Nut for stud, M16	90 Nm
M12 nut	84 Nm
Nut M16	210 Nm
M20 bolt	350 Nm
M20 nut	350 Nm



General illustration of rear shock absorber



General illustration of front shock absorber

1 *Shock absorber*
2 *Slide ring*
3 *Washer*
4 *Spacing sleeve*
5 *Washer*
6 *Nut*
7 *Bolt*
8 *Washer*
9 *Nut*
10 *Split pin*

Renewing spring leaves and spring clips

Dismantling spring

WARNING!

If the spring assembly is not secured, the nut will fly off.

Use spring press 587 119 when reconditioning leaf springs.

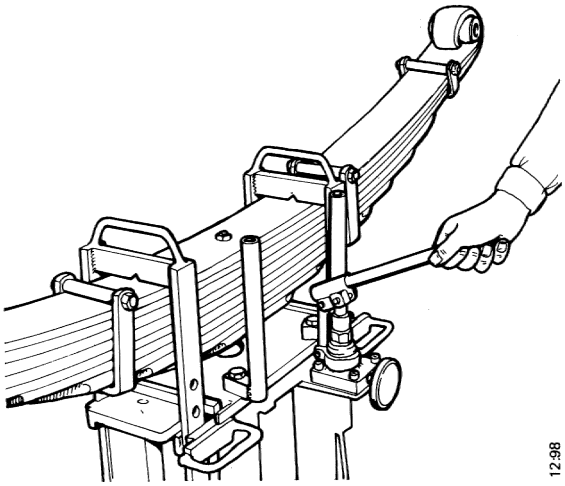
1 Remove the spring clip bolts.

2 Secure the spring in a spring press so that the nut on the centre bolt faces upwards; refer to the illustration.

3 Mark the spring leaves so that they can be refitted in the same positions.

4 Cut or grind off the nut from the centre bolt.

5 Loosen the spring press and dismantle the spring. Renew damaged spring leaves.



1 Centre bolt nut

Spring secured in spring press

Assembling the spring

1 Insert a new centre bolt through the lowest spring leaf.

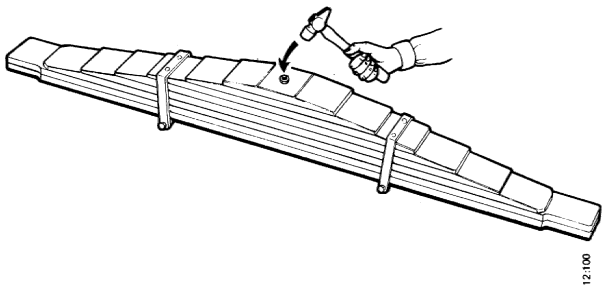
2 Place the lowest spring leaf in the press with the head of the centre bolt in the lifting head of the hydraulic pump.

3 Fit the spring leaves according to the markings made when dismantling.

4 Secure the spring in the spring press. Tighten the centre bolt nut to 87 Nm for M12 and 90 Nm for M14.

5 Cut off the centre bolt approximately 5 mm above the nut.

6 Upset the end of the bolt; refer to illustration. Screw the spring clip bolts into place.



Upsetting the centre bolt

Renewing the spring clip

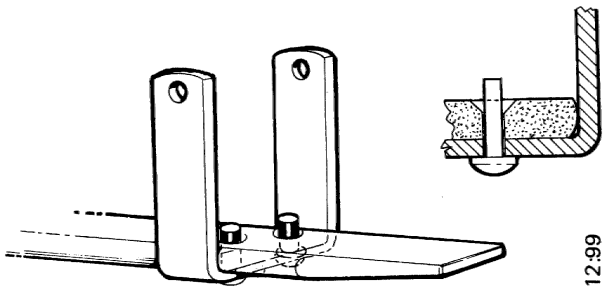
1 Disassemble the spring.

2 Drill away the upsetting. Tap out the rivet using a drift.

3 Remove the spring clip.

4 Rivet a new spring clip onto the spring leaf. Ensure that it is securely fitted; refer to the illustration.

5 Grind away any access rivet material. Ensure that no burrs are left.



Riveting spring clips

Leaning vehicles

Background

It has been shown that some 4 series trucks lean to one side. If the truck leans to one side this does not necessarily mean that the chassis frame is twisted or deformed.

The chassis frame has relatively low resistance to torsional forces. An asymmetrical load, due to for example fuel tanks and other equipment, may therefore cause the chassis frame to appear to be twisted when in fact this is not the case.

If the chassis was not true when the bodywork was added, the chassis frame may be held in the twisted position by a stiff bodywork.

The following pages describe different steps that can be taken to compensate for the leaning.

Note: Before checking the vehicle suspension, the cab suspension should be checked.

Front axle, bracket

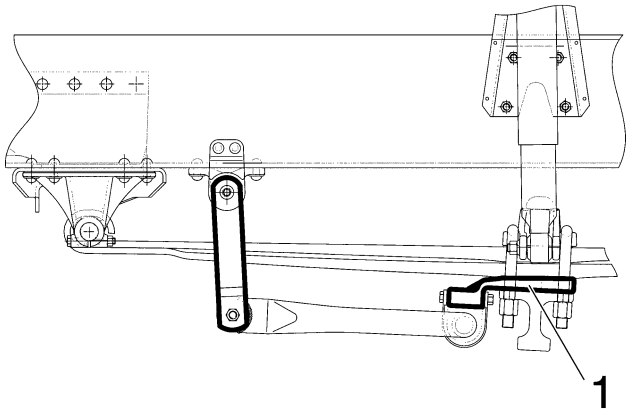
Note: Do not tilt the cab whilst the truck is being rectified

Check that the correct bracket 1 is fitted between the front axle beam and the front spring. Otherwise the steering geometry may be negatively affected.

The bracket 1 is thicker on the side where the steering gear is fitted.

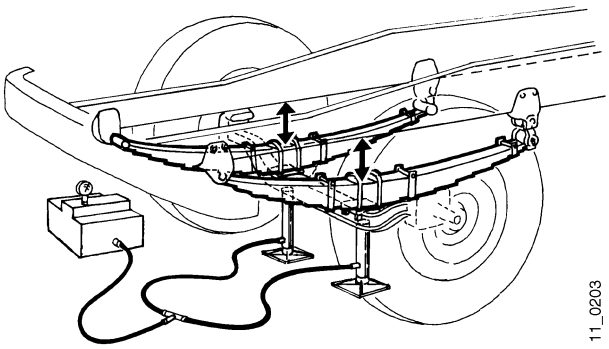
Only one bracket per side of the above named parts may be fitted. Otherwise there is a risk of the steering geometry being incorrect.

Test drive the truck and afterwards measure the amount of lean if a bracket has been renewed.



Spring deflection

Check that the front springs have the same deflection on both sides. For the work description, refer to Workshop manual 11:01-02 Chassis frame alignment.



1 Obtain two hydraulic cylinders of the same type, for example I-CF 210, and place them under the front springs. Connect them to the same pump and lift until the wheels are free from the ground. The connection between the cylinders must be open.

2 Measure the distance between the upper edge of the spring and the lower edge of the frame on the left hand and right hand springs. It helps if the vehicle is laden.

3 If a difference is noted between the springs, this indicates that the load bearing capacity of one of the springs is weaker, causing the vehicle to lean.

4 Repeat the measurement on the rear springs by placing the cylinders under the rear springs and raising until the wheels are free from the ground. Note the readings on the report.

Permissible deviation:

Max. difference between right hand and left hand spring is 6 mm.

Anti-roll bar link

If the lean of the vehicle is still incorrect and a check indicates that spring deflection is within permitted tolerances, you can alter the length of the anti-roll bar link 2.

Fit the link 1 391 150 on the side that is lowest. The link has only one hole. Drill the other hole at a suitable distance to compensate for the amount of lean.

Test drive the truck and afterwards measure the amount of lean if a link has been renewed.