

Technical Manual

*Boxster*

Technical Information

Repair

Contents:

Group 4  
Running gear

## Foreword

The workshop documentation for the Boxster model has the designation "**Boxster**" **Technical Manual** and contains **Technical Information** as well as instructions on **Repairs**.

The integration of the technical information published in the "Boxster" Technical Manual with the descriptive matter on repairs provides the user with a complex reference work that combines into one book associated or cross-referenced material of relevance to workshops and originating from various information media.

The "Boxster" Technical Manual consists of 15 folders, subdivided into the following Groups

0	Entire vehicle – General
0	Diagnosis, part 1 (up to Repair Group 45) * <sup>1</sup>
0	Diagnosis, part 2 (as of Repair Group 69) * <sup>2</sup>
1	Engine, part 1 (up to Repair Group 13) * <sup>3</sup>
1	Engine, part 2 (as of Repair Group 15) * <sup>4</sup>
2	Fuel, exhaust, engine electronics
3	Transmission, manual transmission
3	Transmission, automatic transmission
4	Running gear
5	Body
6	Body equipment, exterior
7	Body equipment, interior
8 / 9	Air conditioning / Electrics
9	Circuit diagrams, part 1 (up to and including the '99 model) * <sup>5</sup>
9	Circuit diagrams, part 2 (as of the '00 model) * <sup>6</sup>

- | \*<sup>1</sup> The two folders with Group 0 are to be regarded as one folder; i.e. file the "Technical Information" notices only in front of the repair descriptions in the folder "Group 0 – Diagnosis, part 1" (**up to Repair Group 45**).
- | \*<sup>2</sup> The **second folder** "Group 0 – Diagnosis, part 2" (**as of Repair Group 69**) includes the further Repair Groups belonging to Group 0.
- | \*<sup>3</sup> The two folders with Group 1 are to be regarded as one folder; i.e. file the "Technical Information" notices only in front of the repair descriptions in the folder "Group 1 – Engine, part 1" (**up to Repair Group 13**).
- | \*<sup>4</sup> The **second folder** "Group 1 – Engine, part 2" (**as of Repair Group 15**) includes the further Repair Groups belonging to Group 1.



- \*5 The two folders with Group 9 are to be regarded as one folder; i.e. file the "Technical Information" notices only in front of the repair descriptions in the folder "Group 9 – Circuit diagrams, part 1" (**up to the '99 model**).
- \*6 The **second folder** "Group 9 – Circuit diagrams, part 2" (**as of the '00 model**) includes the further circuit diagrams belonging to Group 9.

The "Boxster" Technical Manual has the same structure in each folder, with the following breakdown for all Groups:

**Title page, "Boxster" Technical Manual**

> Foreword

**Title page: "Technical Information"**

> Table of Contents, Technical information  
> Technical information

**Title page: "Repair"**

> Repair Groups: overview  
> Table of Contents, repairs  
> General / technical data  
> Instructions on repairs

As can be seen from the breakdown, the published Technical Information is in the front part of each folder – numbered according to the Groups. The Table of Contents assigned to each Group will be periodically updated.

Following the Technical Information, separated by a title page, the instructions on repairs – assigned according to the Groups or broken down into Repair Groups – are included in the folder.

The instructions on repairs will be extended and updated by means of supplements.

### Note

Sheets that already exist in the "Boxster" Technical Manual and are updated or revised and thereby exchanged by a supplement are designated "Replacement sheet". Revisions or technical modifications on pages of these replacement sheets are identified for the user with a vertical bar at the margin.

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## 4 Removing transport lock

### Securing facility

Securing points (brackets) **are not present** on the running gear or body.

### Spring strut locking devices

#### General

Spring strut locking devices are fitted on the **front axle** of new RoW vehicles with option M 030 (sport-type running gear) for the protection of the vehicle during transport (e.g. lorry transport while loading and unloading). They increase the ground clearance of the vehicle.

The spring-strut locking devices are yellow. As the shock absorber tubes are painted black, the yellow spring strut locking devices are clearly visible. This substantially reduces the likelihood of their being overlooked and therefore not removed.

It is not necessary to return the removed spring strut locking devices to Porsche.

#### Removing spring strut locking devices

1. Raise vehicle (wheels must be free).  
The wheels need **not** be removed.
2. Remove spring strut locking devices from all spring struts. To do this, pull spring strut locking devices from the springs.

## 4 Overview of Boxster running gear

### Front axle / steering

McPherson wheel suspension with offset spring.

Twin-pipe gas filled shock absorbers in standard or sports version.

In order to obtain greater stiffness with reduced intrinsic weight as compared with steel, the following components have been made from aluminium:

control arm, diagonal brace, track rod, wheel carrier and cross member / side member.

Rack-and-pinion steering gear ( $i = 16.9 : 1$ ) with hydraulic assistance.

**Steering wheel longitudinally adjustable (40 mm).**

See drawing on Page 4 - 4

### Rear axle

McPherson wheel suspension with offset spring.

Twin-pipe gas filled shock absorbers in standard or sports version.

In order to obtain greater stiffness with reduced intrinsic weight as compared with steel, the following components have been made from aluminium:

control arm, diagonal brace, track rod, wheel carrier and carrier side section.

See drawing on Page 4 - 5

### Wheels and tyres

	front	rear
<b>Standard</b>		
Wheels:	6J X 16	7J X 16
Tyres:	205/55 R 16	225/50 R 16

#### Special request

Wheels:	7J X 17	8J X 17
Tyres:	205/50 R 17	255/40 R 17

### Brakes

Hydraulic dual-circuit brake system with front-axle / rear-axle brake-circuit distribution.

Vacuum brake booster, internally ventilated brake disks with four-piston fixed caliper at front and rear axles.

ABS 5.3 (3-port system) standard.

ABS/TC 5.3 (4-port system) on special request.

TC = Traction Control, consisting of ASR (antislip control) und ABD (Automatic Brake differential).

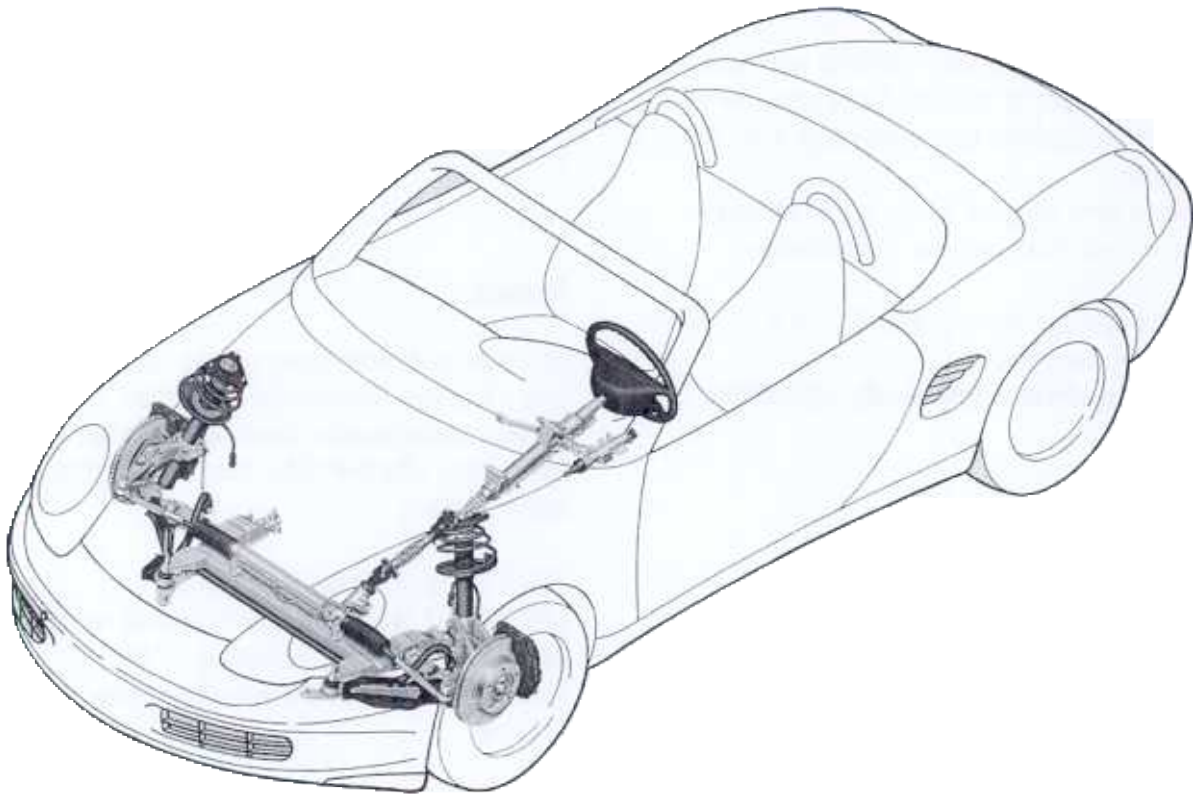
Parking brake (handbrake):

Drum brake acting mechanically on both rear wheels.

See drawing on Page 4 - 6

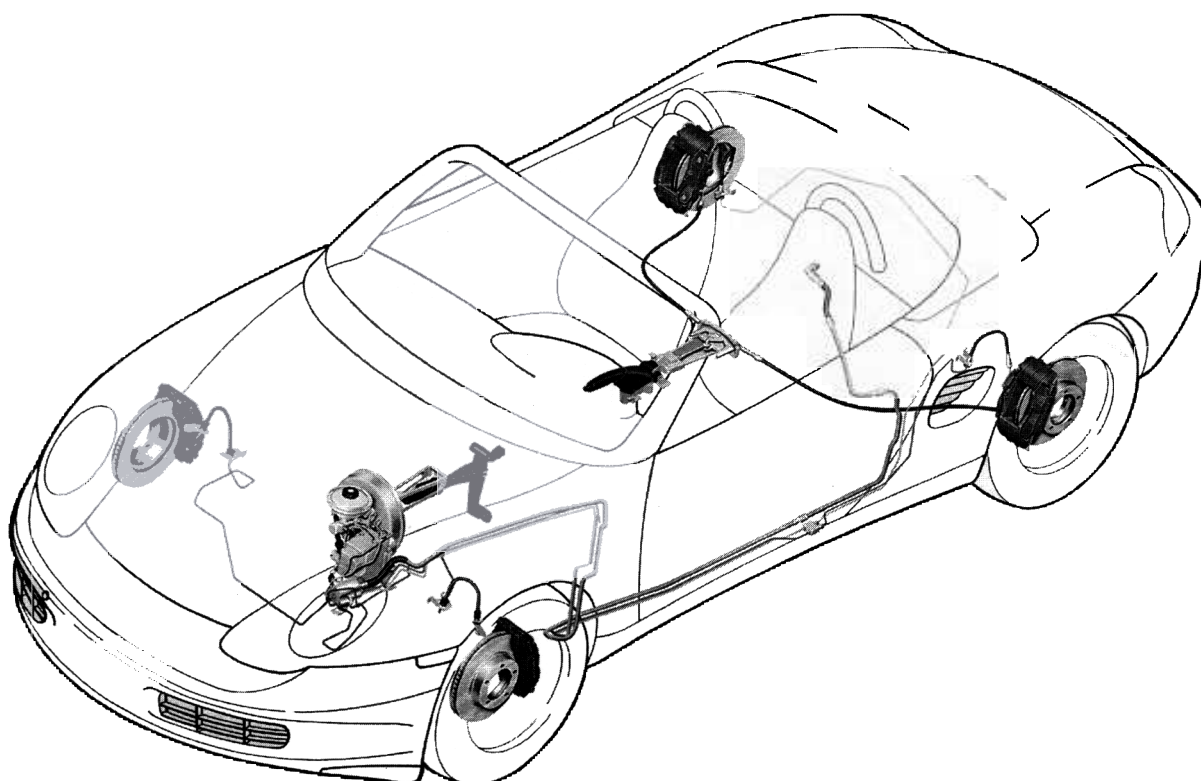


Front axle / steering



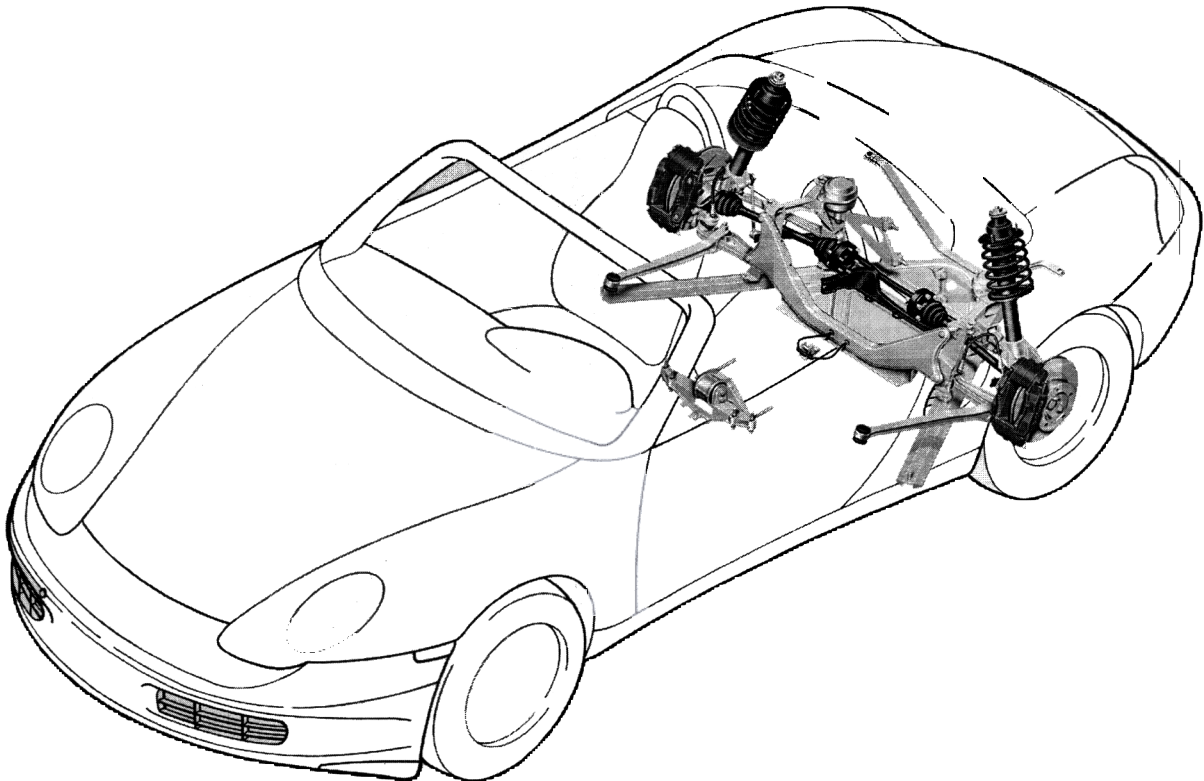
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## Brakes



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Rear axle



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#### 4 General information – Boxster S

**Visual external differences between the Boxster S and the Boxster:**

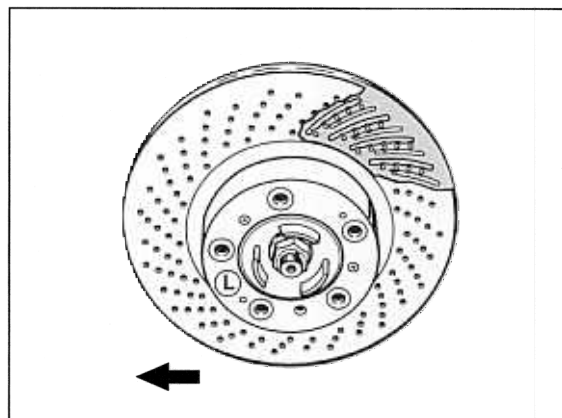
- perforated brake discs and red brake calipers

additional centre air inlet at the front

side air inlets at the front are titanium-coloured

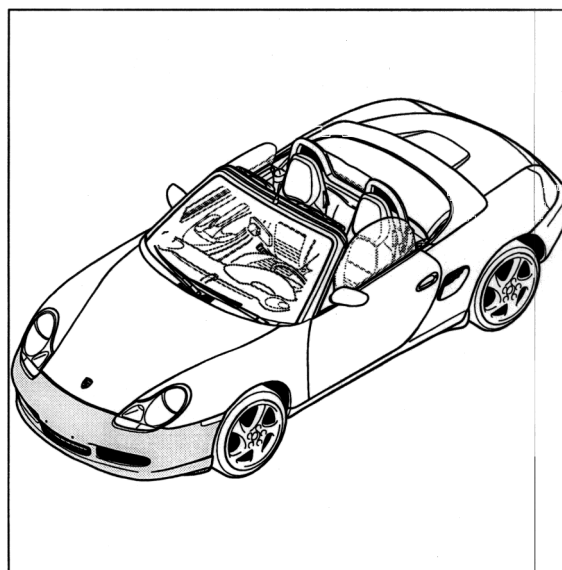
twin-pipe exhaust

Boxster S logo on rear lid.



Boxster S front left brake disc

140\_99



Centre air inlet at front

63150001

## 4 Note on repair instructions Boxster S

### General

The Boxster – **and also the Boxster S** – is the basic model covered by the description for repairs, fitting and adjustment work in the Boxster Technical Manual.

Only the Boxster S-specific procedures which deviate from this are additionally described in this Technical Manual.

### Tightening torques

The tightening torques for the Boxster and Boxster S are the same (status: July 1999). If tightening torques **from the Boxster S** are added in the future, or if the values change, these tightening torques will be included in the tables of the corresponding repair group, i.e. Boxster.

### Front and rear axle spring struts

The assembly procedures for the spring struts **of the Boxster S** are the same as for the Boxster.

Shock absorber tuning has been modified.

Modified shock absorber tuning will also be introduced for the Boxster 2.7 I (as of model year 2000/Y-range).

As of the model year 2000, a distinction will be made only between sport and standard shock absorbers for the Boxster 2.7 I and Boxster S.

### Rear axle

The wheel carrier on the rear axle has been modified. The wheel bearing diameter is 80 mm (Boxster 75 mm) and the steering arm is shorter. Assembly procedures for removing and installing the wheel bearing are the same as for the Boxster.

### Suspension alignment

The adjustment procedures and adjusting values on the front and rear axle are **not** different to the Boxster.

The adjusting values are also the same as for the Boxster (see Repair Group 44).

### Brakes – General

Repairs and assembly work on the wheel brakes are integrated into the Boxster description.

The procedure for changing brake pads is an exception. This is described separately **for the Boxster S**.

### Brakes – Bleed

Bleeding and brake fluid change is the same as for the Boxster.

Like the Boxster, the Boxster S is equipped with ABS and (as an option) with TC (Traction Control).

**40            Tightening torques for front axle**

**Caution:** Do not grease screwed connections in **Dacromet finish** – aluminium color.

Location	Thread	Tightening torque Nm (ftlb.)
<b>Cross member/side member (one component)</b>		
Cross member/side member to body (front and rear)	M14 x 1.5	160 (118)
Corner plate to side member	M10 x 1.5	65 (48)
Corner plate to body	M12 x 1.5	100 (74)
Corner plate to body (with diagonal arm and side member)	M14 x 1.5	160 (118)
<b>Diagonal brace</b>		
Diagonal brace to body and side member	M12 x 1.5	100 (74)
<b>Control arm</b>		
Control arm to side member	M12 x 1.5	120 (88)
Control arm to diagonal arm	M14 x 1.5	160 (118)
Control arm to wheel carrier (ball joint)	M12 x 1.5	75 (55)

Location	Thread	Tightening torque Nm (ftlb.)
<b>Spring strut/wheel carrier</b>		
Spring strut to wheel carrier (stabilizer mount)	M12 x 1.5	85 (63)
Spring strut mount to body	M8	37 (27)
Spring-strut mount to piston rod	M14 x 1.5	60 (44)
Brake cover plate to wheel carrier	M6	10 (7)
Brake caliper to wheel carrier *	12 x 1.5	85 (63)
Speed sensor to wheel carrier	M6	10 (7)
Retainer plate for wheel bearing to wheel carrier	M8	37 (27)
Wheel hub to wheel carrier	M22 x 1.5	460 (339)
<b>Stabilizer</b>		
to side member	M10 x 1.5	65 (48)
Stabilizer mount to stabilizer	M10	46 (34)
Stabilizer mount to shock-absorber tube and wheel carrier	M12 x 1.5	85 (63)
<b>Steering</b>		
(unlisted values in Repair Group 48)		
Track rod (ball joint) to steering arm	M12 x 1.5	75 (55)
Universal joint (steering shaft) to steering gear **	M8	23 (17)

Replace screws – at front and rear axle – whenever they have been removed.

Replace fitting bolt whenever it has been removed.

Location	Thread	Tightening torque Nm (ftlb.)
Steering gear to cross member *	M10 x 1.5	65 (48)
<b>Wheel fastening</b>		
Wheel at wheel hub **	M14 x 1.5	130 (96)

Replace fastening screws whenever they have been removed.

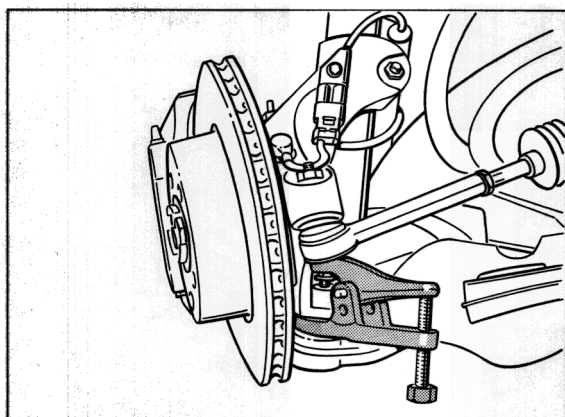
Apply a thin coating of Optimoly TA (aluminium paste) to the thread, shank and below the head of the wheel bolts (between bolt head bearing surface and spherical cap ring). **Do not** coat the spherical cap bearing surface facing the wheel. If heavily contaminated, clean screws first with a lint-free cloth.



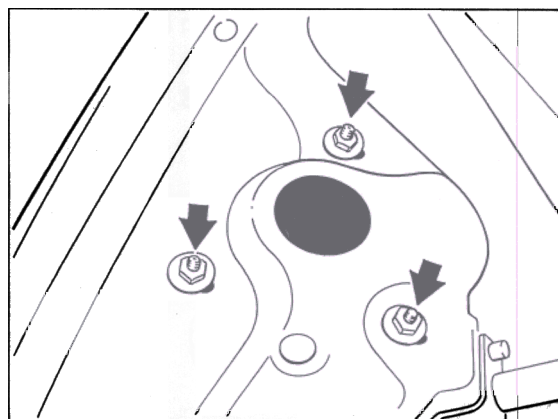
## 40 85 19 Removing and installing front spring strut

### Removal

1. Raise vehicle. Remove front wheel.
2. Loosen stabilizer mount at stabilizer (counter with open-ended wrench).
3. Loosen track rod and control arm at wheel carriers and press off the ball joints with special tool 9560.  
When loosening fastening nuts, counter with special tool 9546 (Torx screwdriver) at the ball joint bolts.
5. Loosen holder for brake line/brake hose at wheel carrier.  
Loosen brake caliper from wheel carrier and attach in wheel arch.
6. Loosen fastening nuts (3 ea. M8) at spring-strut mount.  
Before doing this, mark the installed position of the spring strut mount (position of the three collar nuts).  
**Draw out spring strut with wheel carrier.**



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4. Disconnect plug connection at wheel carriers and pull out plugs.  
Loosen plug connection at wheel carriers and unclip the electrical cables at spring strut.
7. Loosen clamped connection between spring strut/wheel carrier (ball joint from stabilizer mount). Counter with open-ended wrench.  
**Draw out spring strut from wheel carrier.**

### Installation

1. Install in reverse order. Before installing, give parts a visual check. Replace brake caliper fastening screws.
2. Do not grease screwed connections in Dacromet finish – aluminium color. **Use correct tightening torque.**
3. Insert spring strut into vehicle. Note the **installed position** of the spring strut mount. The arrow markings must point to the outer side of the vehicle (A). The shock-absorber piston rod is thereby shifted outwards. Use new fastening nuts.  
Before tightening the fastening nuts, adjust spring strut mount in accordance with the applied marking (position of the three collar nuts). Tightening torque 37 Nm (27 ftlb.).

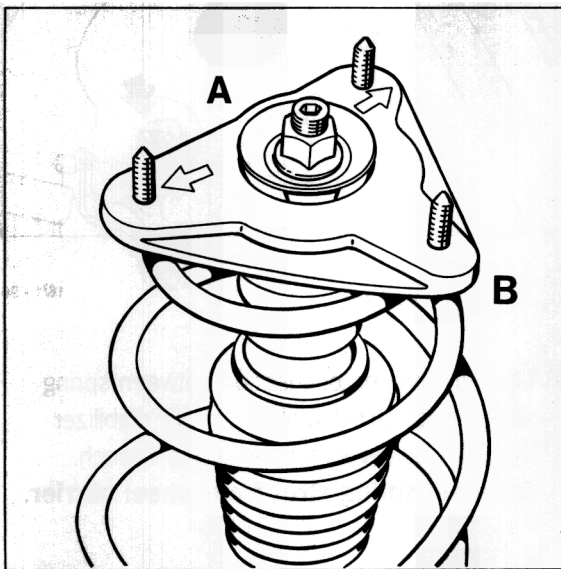
A = Outer side

B = Inner side

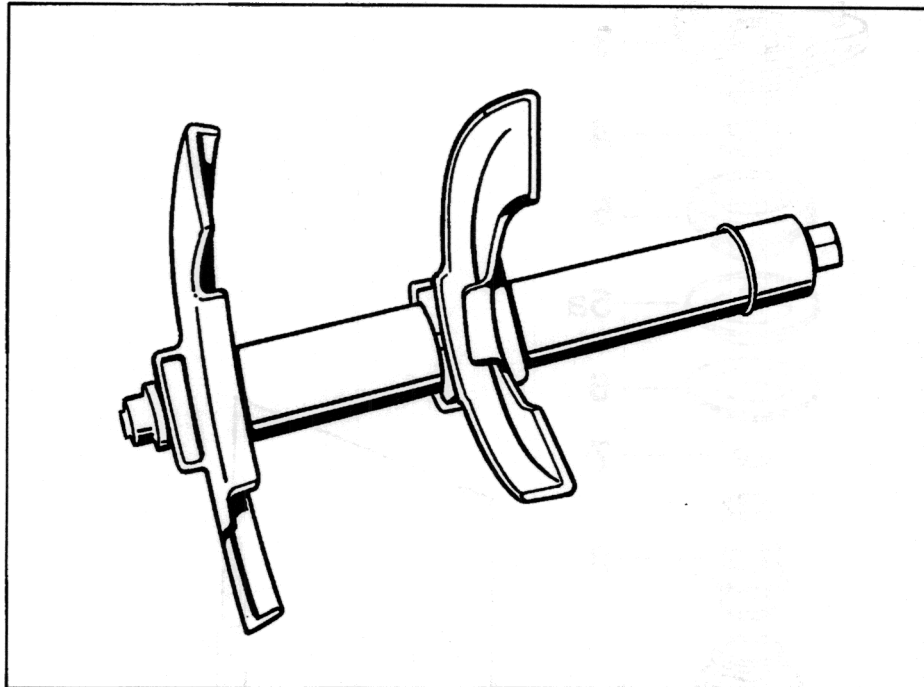
4. Check and adjust steering-geometry values at the front axle.

### Note

If assembling work has been performed or parts replaced that affect vehicle height, a complete wheel alignment is necessary.



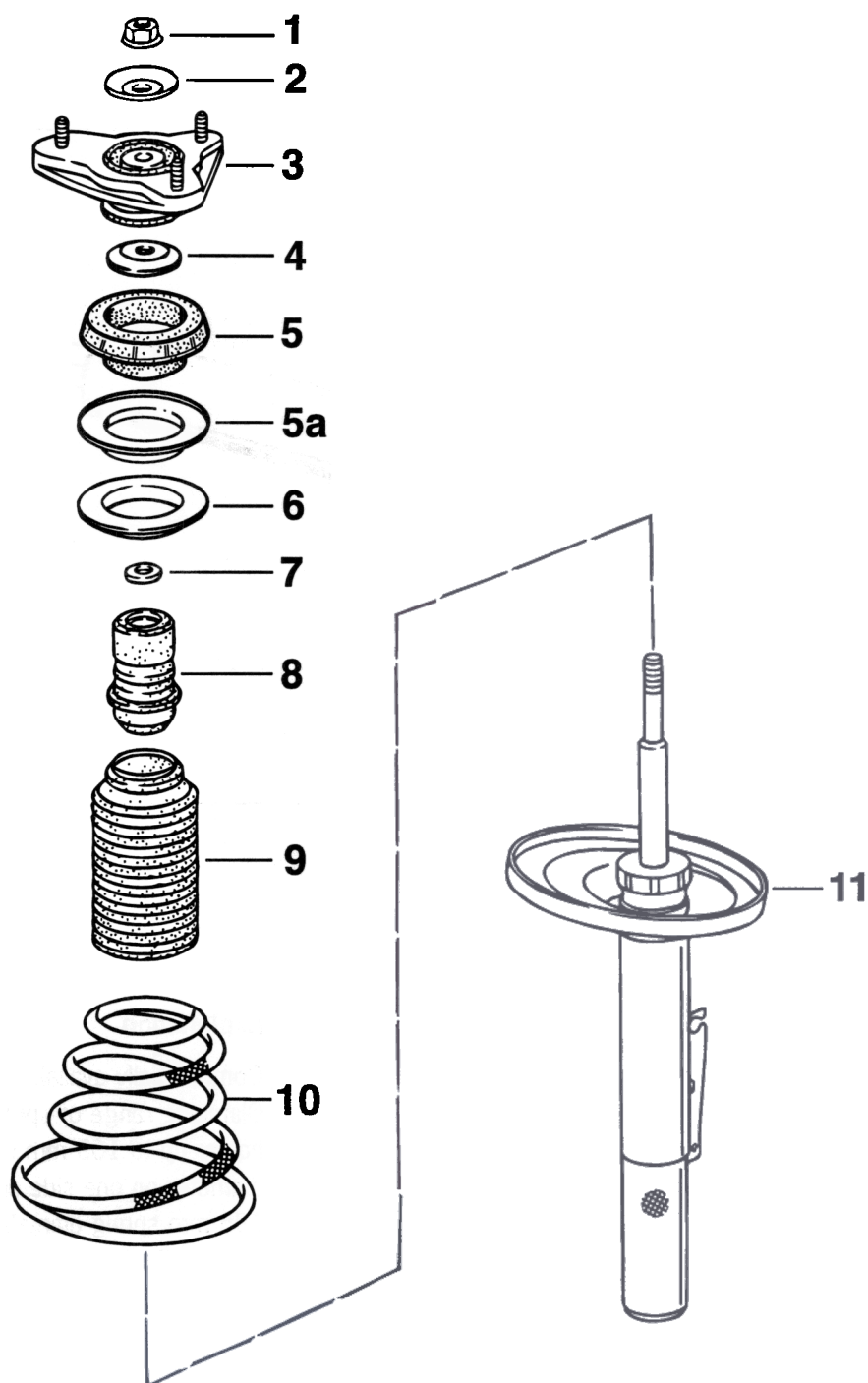
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**40 Disassembling and assembling front spring strut****Tools**

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No.	Designation	Special tool	Explanation
	Spring clamp, e.g. from Klann, with spring holder		Commercially available Clamping range of spring holder up to 165 mm spring diameter on one side and 195 mm spring diameter on the other side

# Disassembling and assembling front spring strut



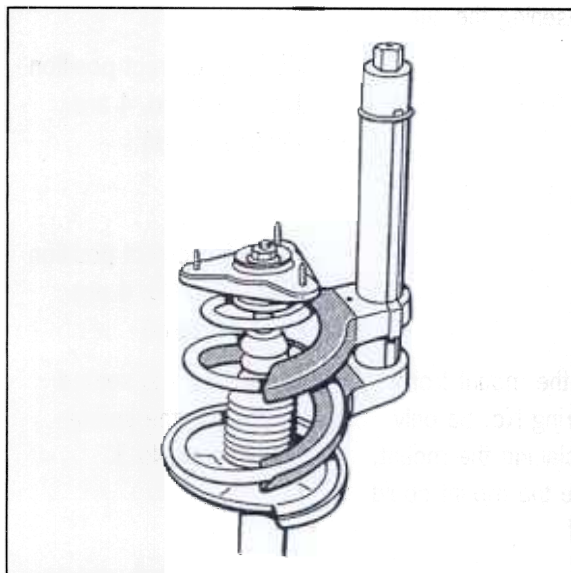
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No.	Designation	Qty.	Removal	Note:
				Installation
1	Fastening nut M 14 x 1.5	1	Before loosening the fastening nut, tension coil spring with the spring clamp. Counter at the piston rod when loosening the nut.	Use new fastening nut. Tighten to 80 Nm (59 ftlb.).
2	Stop plate	1		Mount in correct position (No. 2 and No. 4 are identical parts)
3	Spring strut mount	1		
4	Stop plate	1		Mount in correct position (No. 2 and No. 4 are identical parts)
5	Mount	1	Remove the mount from back-up ring No. 5a only when replacing the mount, otherwise the mount could come off.	Make sure it is seated properly in the spring strut mount No 3.
5a	Back-up ring	1		
6	Spring plate (compensation part)	1		Observe allocation (Page 40 - 11). Join in correct position with back-up ring.
7	Cup washer	1		Mount in correct position
8	Additional spring	1		Mount on protective bellows (No. 9)
9	Protective bellows	1		
10	Coil spring	1		Observe allocation as per Spare Parts Catalogue.
11	Vibration dampers	1		Observe allocation as per Spare Parts Catalogue. The vibration dampers for the right and left sides are identical parts.

## Disassembly and assembly instructions

### Disassembly

Tension the coil spring with the spring clamp until the piston rod is relieved.



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To undo the connection (piston rod to spring strut mount) counter at the piston rod with a 7-mm Allen key.

**Important:** Never use an impact bolter to loosen or tighten the fastening nut.

Remove all parts from the piston rod.

### Note

When installing new parts, observe the allocation according to the Spare Parts Catalogue.

### Preliminary work and notes on assembly

Replace nut for fastening the piston rod on the spring strut mount.

It is recommended to replace the coil springs only in pairs.

### Note

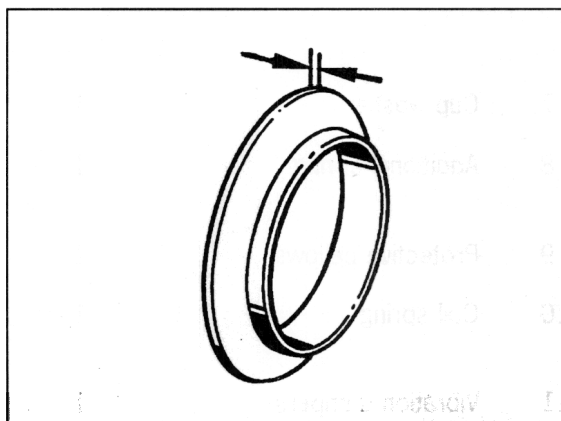
If the coil springs are exchanged, it might be necessary to use a different spring plate than before.

The following spring plates (compensation parts) are available:

**Allocation** of the spring plate according to the coil spring tolerance group (see P. 40 - 11).

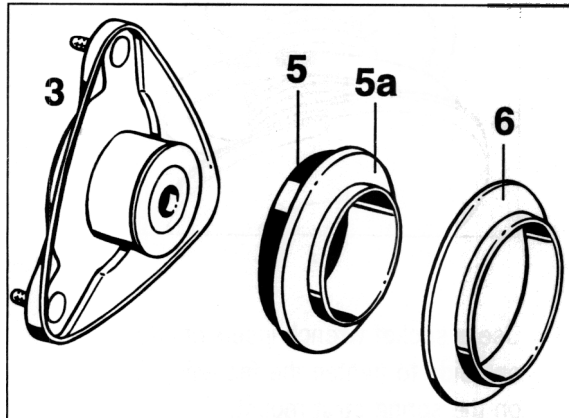
1 green line = 6.5 mm thick compensation part.

1 white line = 3.0 mm thick compensation part.



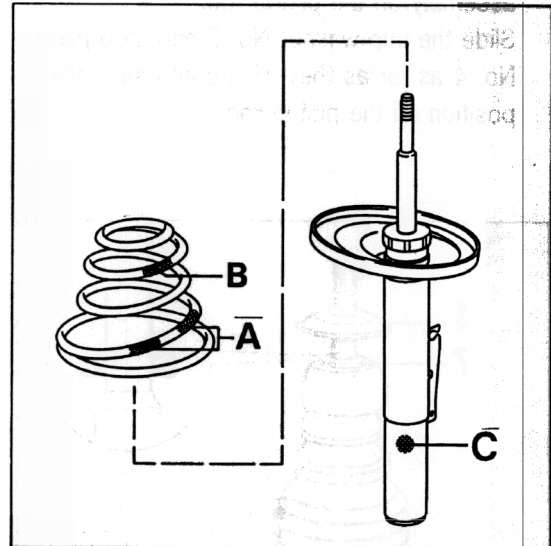
676\_1\_96

Press spring plate No. 6 (compensation part) into the assembly consisting of mount No. 5 and back-up ring No. 5a and complete with the spring strut mount No. 3.



680\_1\_96

### Distinguishing feature of coil springs and dampers



685\_1\_96

Fit protective bellows on additional spring.

Observe the correct allocation (running gear version) when installing new springs and/or dampers.

Tension coil spring with spring clamp.

A = Identification of the running gear version (spring constant/spring length) by two different coloured lines (for example, 1 x red and 1 x yellow). Refer to the Parts Catalogue for the allocation.

B = Identification of the coil spring tolerance group (load group) for determination of the compensation part (spring plate) thickness.

1 white line = 3.0 mm thick compensation part.

1 green line = 6,5 mm thick compensation part.

C = Colour dot (colour label) to differentiate the damper identifier.

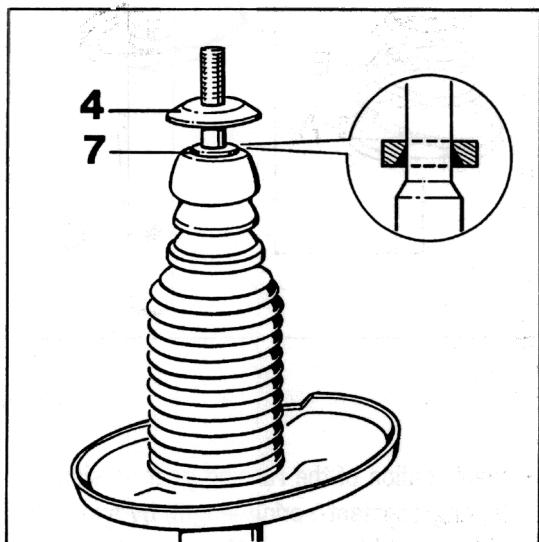
Blue dot = Standard running gear RoW/USA

Red dot = Sport-type running gear RoW/USA



## Assembly

- Slide the protective tube/additional spring assembly on the piston rod.  
Slide the cup washer No. 7 and stop plate No. 4 as far as they will go into the correct position on the piston rod.

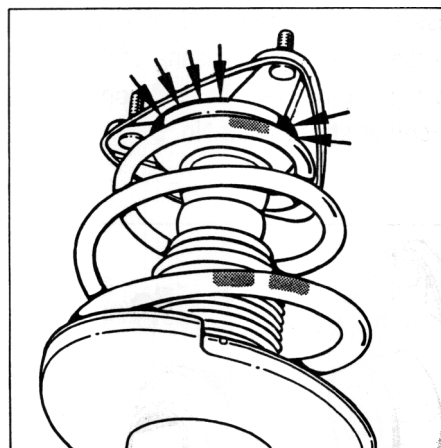


675\_1\_96

Push the pretensioned coil spring onto the vibration damper so that the end of the coil spring rests against the stop of the spring plate.

Place spring strut mount (assembly of mount/back-up ring/spring plate) onto the piston rod so that the end of the coil spring is located in the spring plate. Place stop plate in the correct position on the spring strut mount and screw a new fastening nut onto the piston rod.

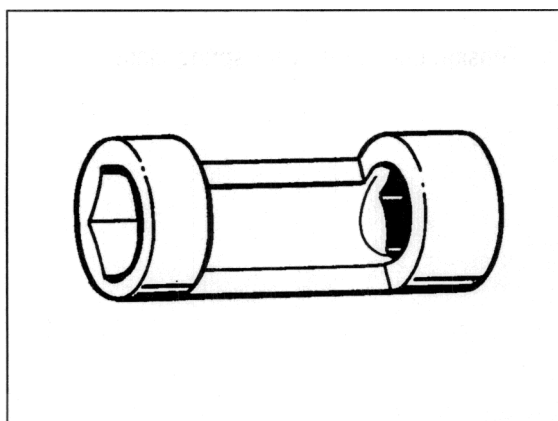
**Make sure** that the rubber part of the mount is properly seated in the recess in the mount (arrows).



679\_1\_96

Use a socket wrench insert open on one side to tighten the fastening nut on the spring strut mount. In this way the specified tightening torque can be adhered to exactly. Additionally counter at the piston rod with an angled 7 mm Allan key.

**Important:** Never use an impact bolter to tighten the fastening nut.



2047\_40



**40 19 23 Installing caster eccentric**

**Includes:** Replacing standard control arm by a service control arm with caster eccentric.

**Note**

The caster is not adjustable on **standard vehicles**. A caster eccentric can be **retrofitted** in the case of after sales service if necessary\*.

The standard control arm must be replaced by an adjustable control arm (service control arm) for this purpose.

The installation of only one service control arm is permissible.

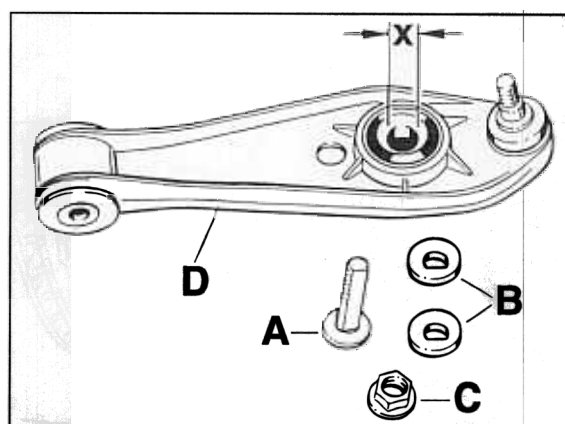
The service control arm is delivered with a caster adjusting facility (as a set). Refer to the Parts Catalogue for the spare part No.

The set consists of a special screw (A), two eccentrics (B) and the fastening nut (C). Only the fastening nut (C) is available as a single part.

**Differences compared with the standard control arm**

In order to realise caster adjustment, the service control arm is provided with a special bearing at the connecting point to the diagonal arm.

This special bearing has a larger bore compared with the standard control arm (dimension X). There are also corresponding bearing surfaces for the two eccentrics.



479\_97

A = Special screw

B = 2 Eccentrics

C = Fastening nut

D = Service control arm. Dimension X = 20 mm  
(dimension X on standard control arm = 14 mm)

\* **Requirement:** In the case of caster values lying outside the tolerance or excessive caster difference between the right and left sides, in combination with a complaint about the handling. Required values in Repair Group 44. Prerequisite for installation: wheel suspension parts and body mounting points are in order. The caster eccentric must never be used to compensate for **incorrect caster values** resulting from deformed parts.

### Installing caster eccentric

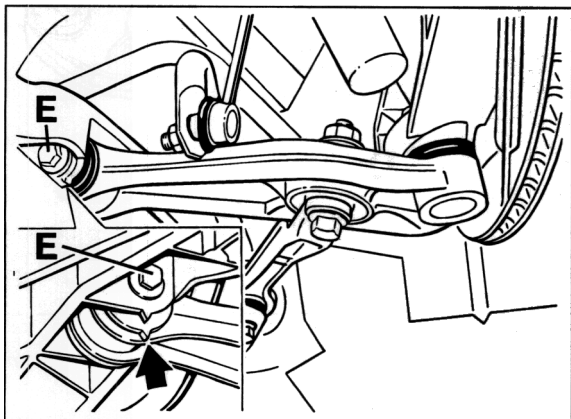
Replace standard control arm by the service control arm.

Use special tool 9560 to press it off the ball joint (see Page 40-5).

**When installing the control arm, make sure that the control arm fastening screw (e) is tightened only in vehicle position.**

**Vehicle position means:** Vehicle must be standing on its wheels, or the wheel suspension is lifted with a universal lift until the markings (arrow) line up.

Observe tightening torque values (Pages 40-1 to 40-3).



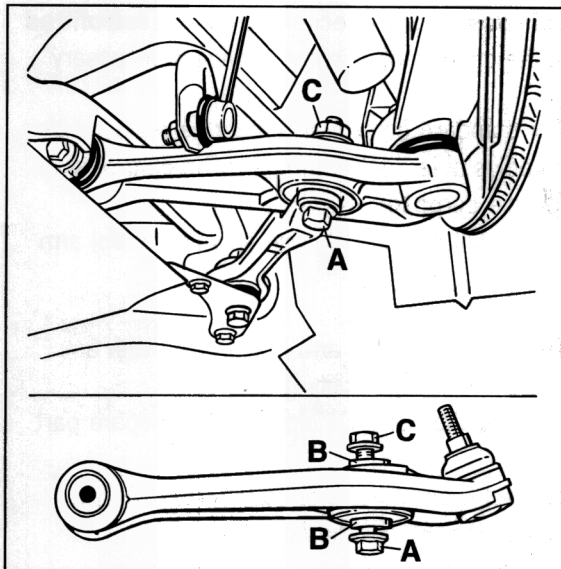
480\_97

### Adjusting caster

With the fastening nut (C) loosened, adjust the caster by turning the special screw (A).

Adjusting values and suspension alignment in Repair Group 44.

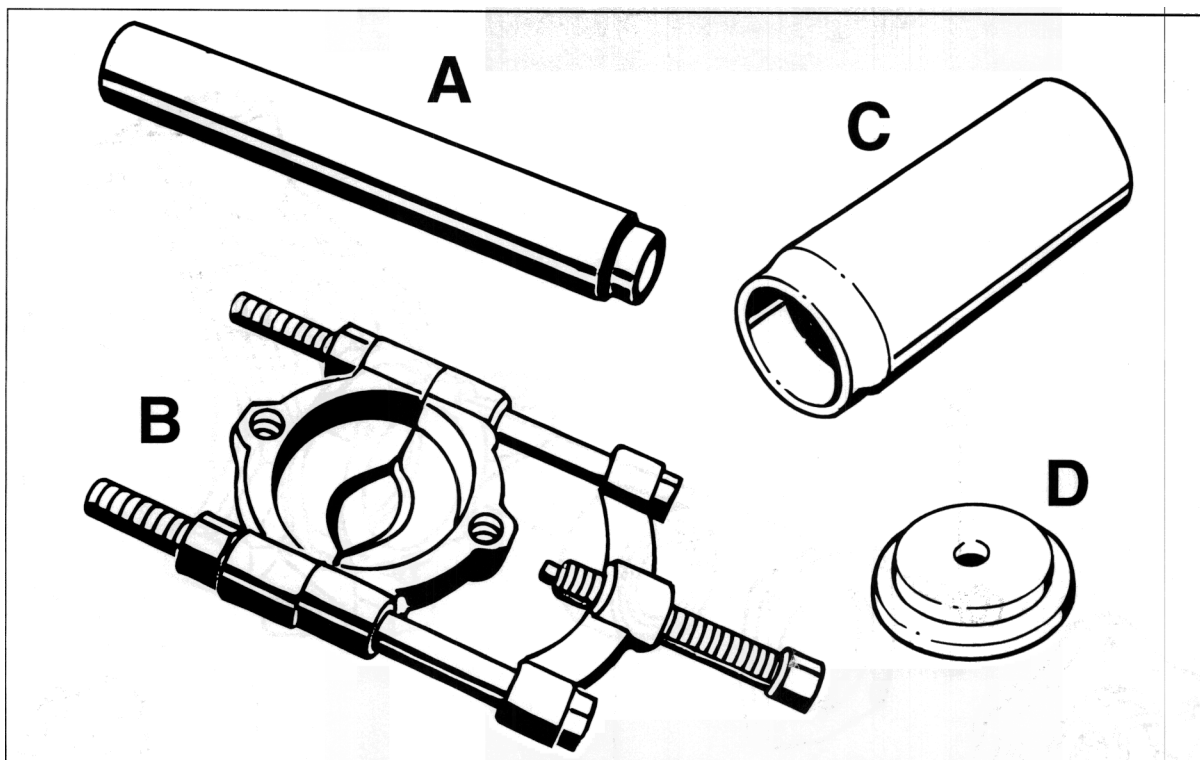
Tighten fastening nut (C) to 160 Nm (118 ftlb.).



481\_97

## 40 57 19 Removing and installing front wheel bearing

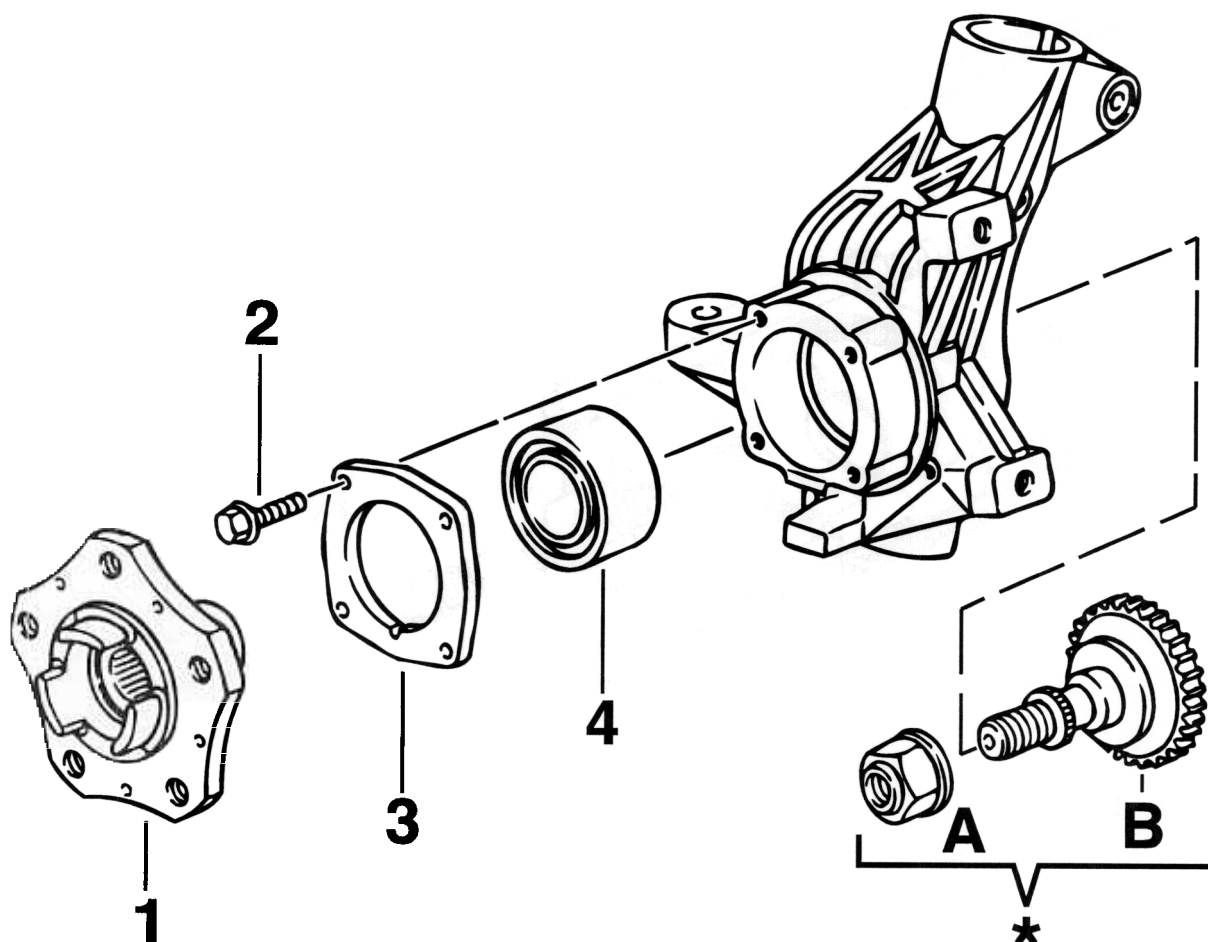
### Tools



422\_97

Item	Designation	Special tool	Explanation
A	Pressure piece	P 297 A	For pressing out the wheel hub
B	Separator (12 - 115 mm Ø)	Commercially available; refer to Workshop Equipment Manual, Chapter 2.4, No. 111	Used as a support when pressing out the wheel hub and when pressing the wheel bearing inner race off the wheel hub
C	Tubular piece	VW 415 A	For pressing the wheel bearing out and in
D	Pressure piece	9247/4	Use in combination with tubular piece C to press in the wheel bearing

## Removing and installing front wheel bearing



28\_99

Use a new fastening nut A after disassembling the wheel hub screw connection.  
Observe tightening torque: 460 Nm (340 ftlb.)

No.	Designation	Qty.	Removal	Note:	Installation
1	Wheel hub	1	Press out with pressure piece P 297 A under a hydraulic press. For this purpose, use the separator and corresponding shims for support.		Press in under a hydraulic press. To do this, place the wheel hub on the wheel centring device and press it on the <b>wheel bearing inner race</b> using pressure piece VW 415 A
2	Hexagon-head bolt (10.9)	4			Tighten to 37 Nm (27 ftlb.)
3	Lid	1			Fit in correct position (groove down)
4	Wheel bearing	1	Heat wheel bearing housing to approx. 100° C (max. 120° C). Press out wheel bearing with tubular piece VW 415 A (tool C).		Heat wheel bearing housing to approx. 100° C (max. 120° C). Insert <b>new</b> wheel bearing in correct position (inscription facing the wheel hub), and then press again <b>slightly</b> using pressure piece 9247/4 (tool D) and tubular piece VW 415 A (tool C).

## Notes on removal and installation

### Note

The wheel bearing is removed and installed with the wheel bearing housing removed.

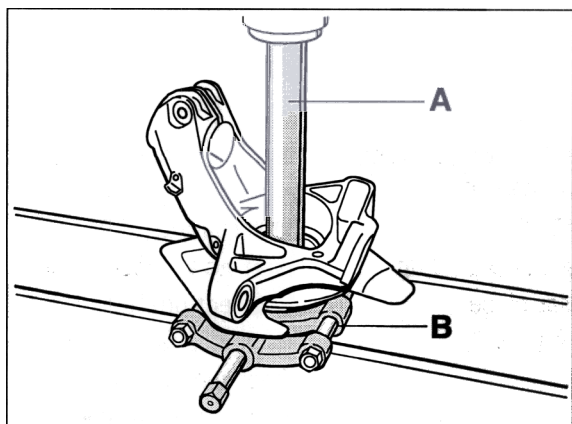
### Removal

- Remove brake disc and speed sensor.

Press out wheel hub with pressure piece P 297 A (tool A).

Use the separator (tool B) for support.

If there is not enough space for the wheel hub between the press, appropriate shims will additionally be necessary.

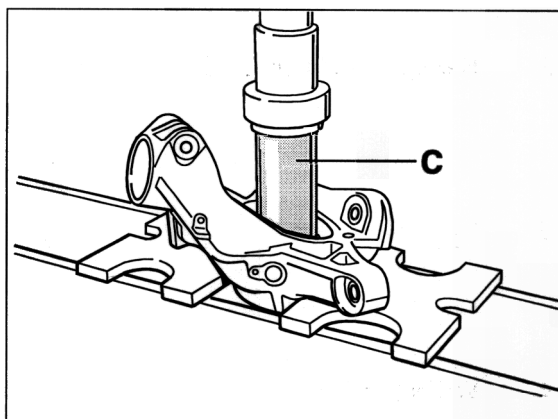


24\_99

Remove retainer plate (lid / four screws) and brake disc cover.

Heat wheel bearing housing to approx. 100° C (max. 120° C).

Press out wheel bearing with tubular piece VW 415 A (tool C).



25\_99

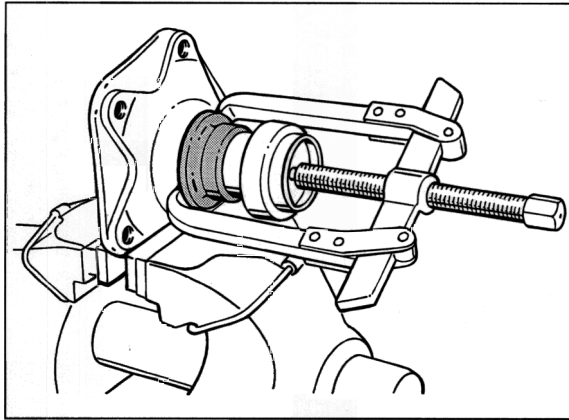
Press inner wheel bearing race off the wheel hub (Figure 426\_97).

To do this, use pressure piece P 297 A (tool A) in combination with the separator (tool B).

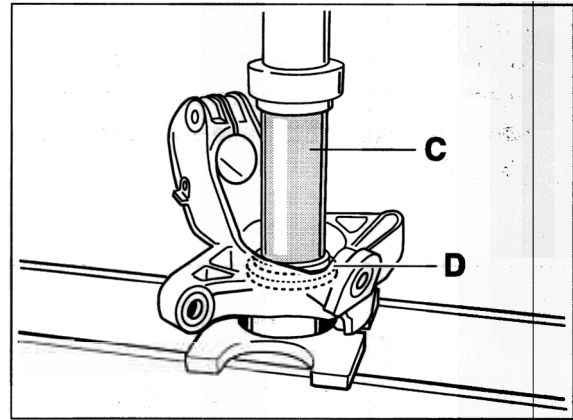
### Note

First pull the inner bearing race several millimetres off the wheel hub (Figure 741\_97) so that the separator can be put into place. For this purpose, use a two-claw puller in combination with a suitable pressure piece (e.g. VW 433).

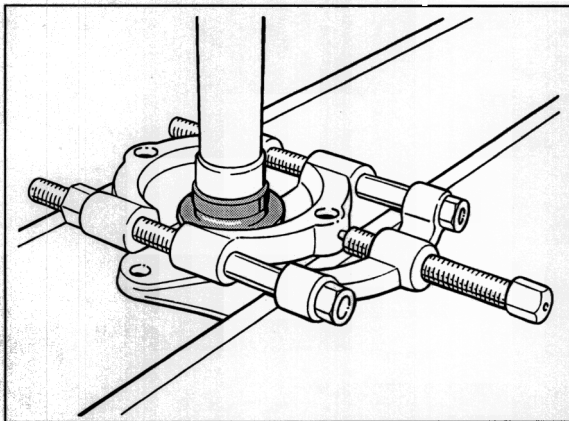




741\_97

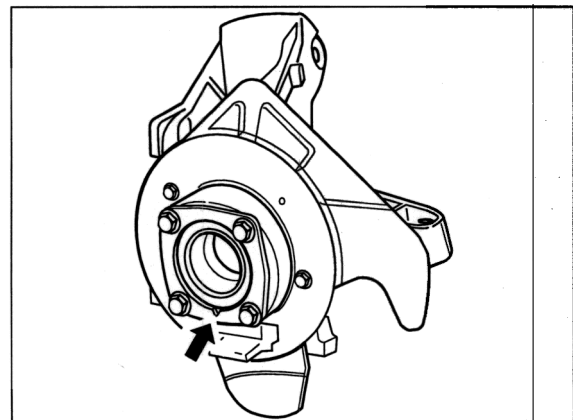


26\_99



426\_97

Fit brake disc cover and retainer plate (lid). Unless there is a water drain on both sides, fit the water drain (arrow) in the correct position – i.e. facing downward. Use correct tightening torques.  
Brake disc cover = 10 Nm (7.5 ftlb.)  
Retainer plate = 37 Nm (27 ftlb.)



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### Installation

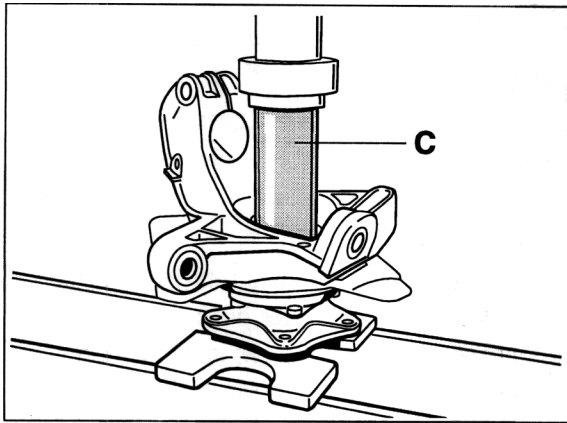
- Before installation, clean the bore in the wheel bearing housing and remove any surface irregularities with a polishing cloth.

Heat wheel bearing housing to approx. 100° C (max. 120° C).

Insert **new** wheel bearing, and then press again **slightly** using pressure piece 9247/4 (tool D) and tubular piece VW 415 A (tool C).

Press in wheel hub.

To do this, place the wheel hub on the wheel centring device and press it on the **wheel bearing inner race** using pressure piece VW 415 A (tool C).



29\_99



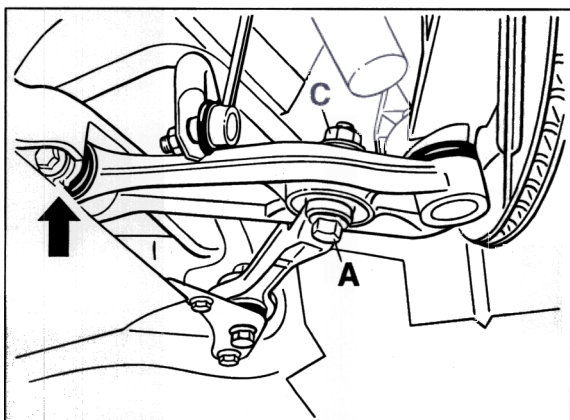
**40 17 19 Removing and installing front axle strut****Removal**

1. Raise vehicle and remove wheel.
2. Remove underside panel and air guide.

**Note**

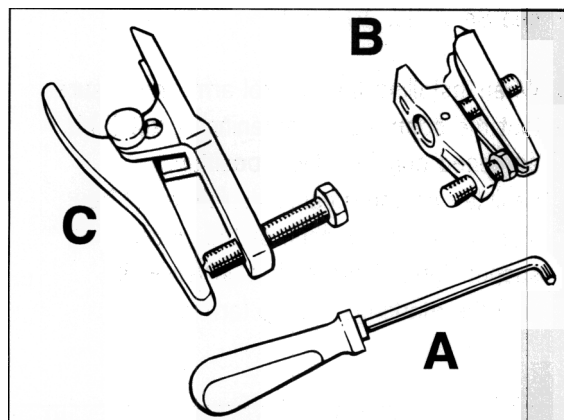
The sensor is seated on the left side for vehicles with headlight beam adjustment. Disengage the strut at the axle strut. It is not necessary to calibrate the headlight beam adjustment after these assembly procedures.

3. Undo the control arm from the axle strut (A / C) and the axle strut at the control arm (arrow).



40170001

4. Press off the ball head of the axle strut using special tool 9560 (C - press-out tool). When loosening the fastening nut, counter with special tool 9546 (A - Torx screwdriver).



A - Torx screwdriver  
C - Press-out tool

204\_99

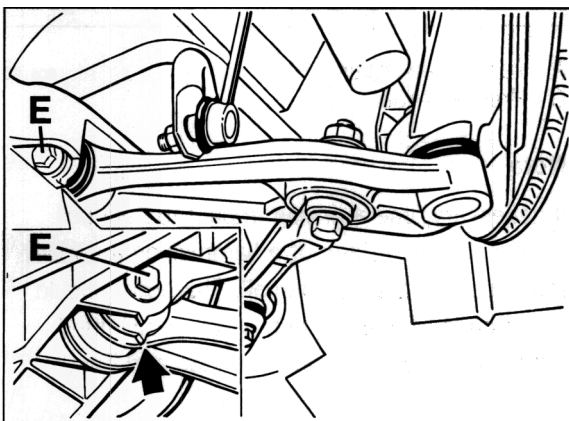
**Note**

If necessary, use a driving impact to help pull off the ball head (taps of a hammer on a copper mandrel near the ball journal). The puller should press on the fastening nut, which is still fitted but loosened (protection for thread and Torx).

5. Pull the ball journal of the axle strut downwards and out of the wheel carrier (pull axle strut downwards while making sure not to tilt it).

**Installation**

1. Install in reverse order.  
Before installing, give all parts a visual check.  
Replace self-locking nuts.  
**Use correct tightening torques.**
2. If an axle strut with an adjustable caster excenter is being installed, see Serv. No. 40 19 23.
3. When installing the control arm, make sure that the control arm fastening screw (E) is tightened only in vehicle position.  
Vehicle position means: Vehicle must be standing on its wheels, or the wheel suspension is lifted with a universal lift until the markings line up (arrow).



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4. Check wheel alignment values and correct if necessary.

**42 Tightening torques for rear axle**

**Caution:** Do not grease screwed connections in **Dacromet finish** – aluminium color.

Location	Thread	Tightening torque Nm (ftlb.)
<b>Carrier side section/cross member</b>		
Carrier side section to body	M10 x 1.5	65 (48)
Stud for carrier side section to body – only screwing-in torque	M10	20 (15)
Cross member to carrier side section	M10 x 1.5	65 (48)
Strut panel to carrier side section	M10 x 1.5	65 (48) (hexagon nut)
Strut panel to cross member	M10 x 1.5	46 (34) (hexagon-head bolt)
Strut panel to V - brace (transverse strut rear)	M10 x 1.5	65 (48) (hexagon nut)
V-brace (transverse strut rear) to body	M10 x 1.5	65 (48)
Diagonal brace to carrier side section	M10 x 1.5	65 (48)
Diagonal brace to body	M10 x 1.5	65 (48)
<b>Axle strut</b>		
Toe control arm (control arm 2) to wheel carrier	M12 x 1.5	75 (55)
on the cross member (toe eccentric)	M12 x 1.5	100 (81)

Location	Thread	Tightening torque Nm (ftlb.)
<b>Control arm</b>		
on the carrier side section (camber eccentric)	M12 x 1.5	100 (81)
to wheel carrier	M12 x 1.5	75 (55)
<b>Diagonal arm</b>		
to control arm	M14 x 1.5	160 (117)
to body	M14 x 1.5	160 (117)
<b>Wheel carrier</b>		
Wheel bearing to wheel carrier	M8	37 (27)
Speed sensors to wheel carrier	M6	10 (7)
Brake cover plate to wheel carrier	M6	10 (7)
Brake disc to wheel hub	M6	10 (7)
Brake caliper to wheel carrier *	M12 x 1.5	85 (63)
<b>Spring strut</b>		
to body	M8	37 (27)
to wheel carrier (stabilizer mount)	M12 x 1.5	85 (63)
Shock absorber to mount (piston rod)	M14 x 1.5	60 (44)

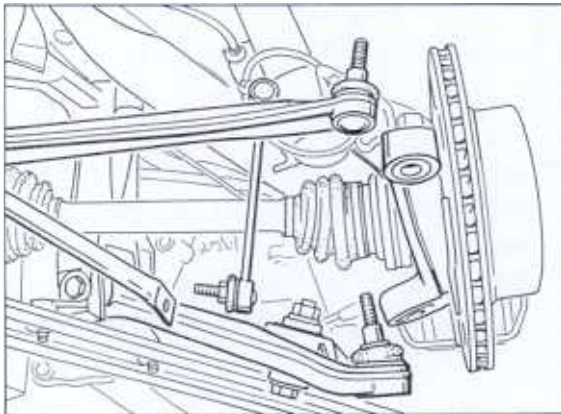
Replace screws at front and rear axle whenever they have been removed.

Location		Thread	Tightening torque Nm (ftlb.)
<b>Wheel fastening</b>			
Wheel to wheel hub *		M14 x 1.5	130 (96)
<b>Drive shaft</b>			
to transmission	<b>Boxster</b>	M8	39 (29)
	<b>Boxster S</b>	M10	81 (60)
to wheel hub		M22 x 1.5	460 (340)
<b>Stabilizer</b>			
to carrier side section		M8	23 (17)
to stabilizer mount		M10 x 1.5	46 (34)
Stabilizer mount to spring strut/wheel carrier		M12 x 1.5	85 (63)
<b>Ancillary equipment mounts</b>			
Engine support on body		M10 x 1.5	65 (48)
Stud for engine carrier in body		M10	20 (15)
Engine mount to engine carrier		M10 x 1.5	65 (48)
Engine bracket to engine		M10 x 1.5	46 (34)
Transmission bracket on transmission		M10 x 1.5	65 (48)
Hydraulic mount on carrier side section		M8	33 (24)
Hydraulic mount on transmission bracket		M12 x 1.5	85 (63)

Thinly grease thread, shank and under head (between screw head bearing surface and spherical cap ring) of the wheel bolts with Optimoly TA (aluminium paste). Do **not** grease bearing surface of the spherical cap facing the wheel. If heavily contaminated, clean bolts first with a lint-free cloth.

**42 71 19 Removing and installing rear spring strut****Removal**

1. Raise vehicle, remove rear wheel.
2. Loosen stabilizer mount at stabilizer (counter with open-ended wrench).
3. Loosen drive shaft from transmission.  
To prevent damage to the drive shaft, provide the drive shaft with a protective sheath.
4. Loosen toe control arm and control arm at wheel carrier and press off ball joints with special tool 9560.  
When loosening fastening nuts, counter with special tool 9546 (Torx screwdriver) at the ball-joint bolts.

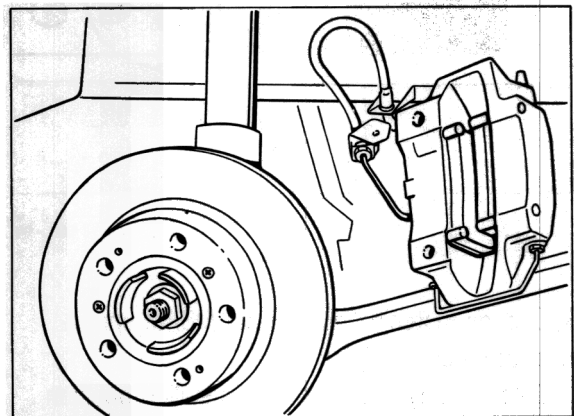


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**Note**

To pull the ball joint journal out of the wheel carrier, evenly pull down the control arm with both hands while swinging out the wheel carrier accordingly. Have a 2nd fitter assist with this task.

5. Separate plug connection at wheel carrier and pull out plug.  
Undo plug connection at wheel carrier and unclip the electrical cables at spring strut.
6. Loosen holder for brake line/brake hose at wheel carrier.  
Loosen brake caliper from wheel bearer and suspend in wheel arch.



326 - 96

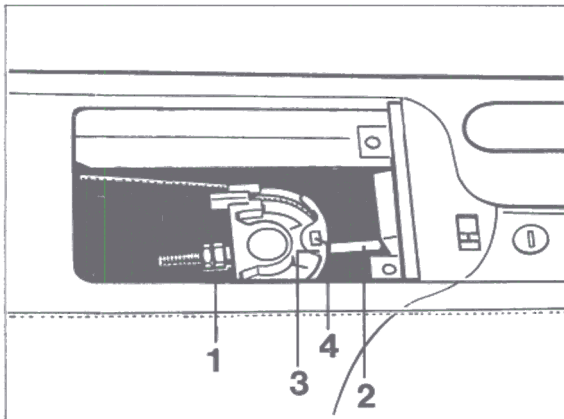
7. Remove appropriate handbrake cable at the turnbuckle of the handbrake lever.

**To do this:**

Loosen lock nut and adjusting nut (No. 1) from the pull rod (No. 2) and unscrew completely

Disengage tab washer (No. 3) for the handbrake cable from the holding catch (No. 4) at upper and lower side.

Detach appropriate handbrake cable and pull to the rear out of the guide.



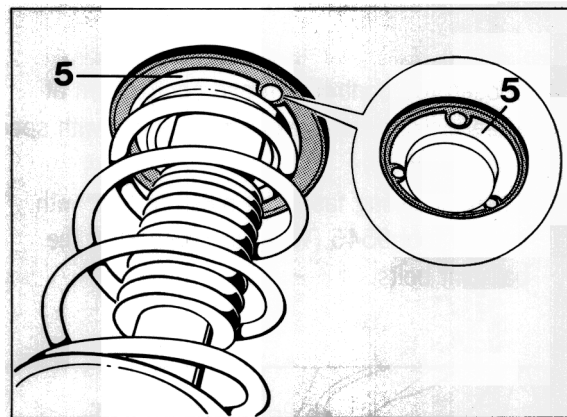
18/1 - 96

8. Loosen fastening nuts (3 ea. M8) at spring-strut mount.  
Before doing this, mark the installed position of the spring strut mount (position of the three collar nuts).  
**Pull out spring strut with wheel carrier.**

**Note**

When removing and installing, make sure that the boots of the ball joints and of the drive shaft are not damaged.

Furthermore, make sure that **back-up ring No. 5 is not shifted out of position** during removal and installation. Back-up ring No. 5 is positioned correctly if the three recesses of the ring are located between the collars of the fastening bolts on the spring strut mount.



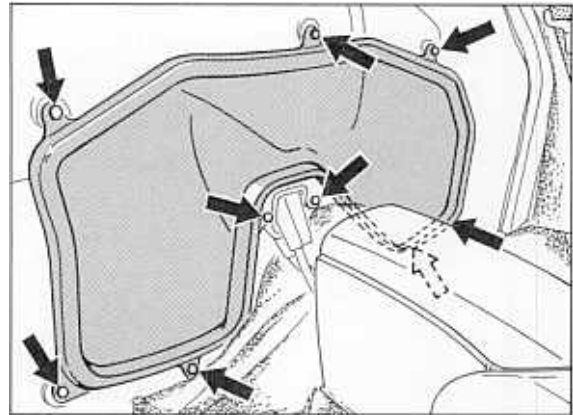
684/1 - 96

9. Loosen clamped connection between spring strut/wheel carrier (ball joint from stabilizer mount).  
Counter with open-ended wrench.  
**Pull out spring strut from wheel carrier.**



## Installation

1. Install in reverse order. Before installing, give the parts a visual check.
2. Renew replace caliper fastening screws.
3. Do not grease screwed connections in Da-cromet finish – aluminium color.  
**Use correct tightening torques.**



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4. Insert spring strut into vehicle.  
Before tightening the fastening nuts, adjust spring strut mount in accordance with the applied marking (position of the three collar nuts).  
Tightening torque 37 Nm (27 ftlb.).  
  
Then recheck whether the back-up ring on the spring strut mount is still in the correct position (see Figure 684/1 - 96 on Page 42 - 6). Return the back-up ring to the correct position if necessary.
5. Mount handbrake cable at the turnbuckle of the handbrake lever and adjust handbrake (Repair Group 46).  
To pull the parking brake cable into the deflection box, remove the rear wall lid behind the seats (Figure 274 - 96).

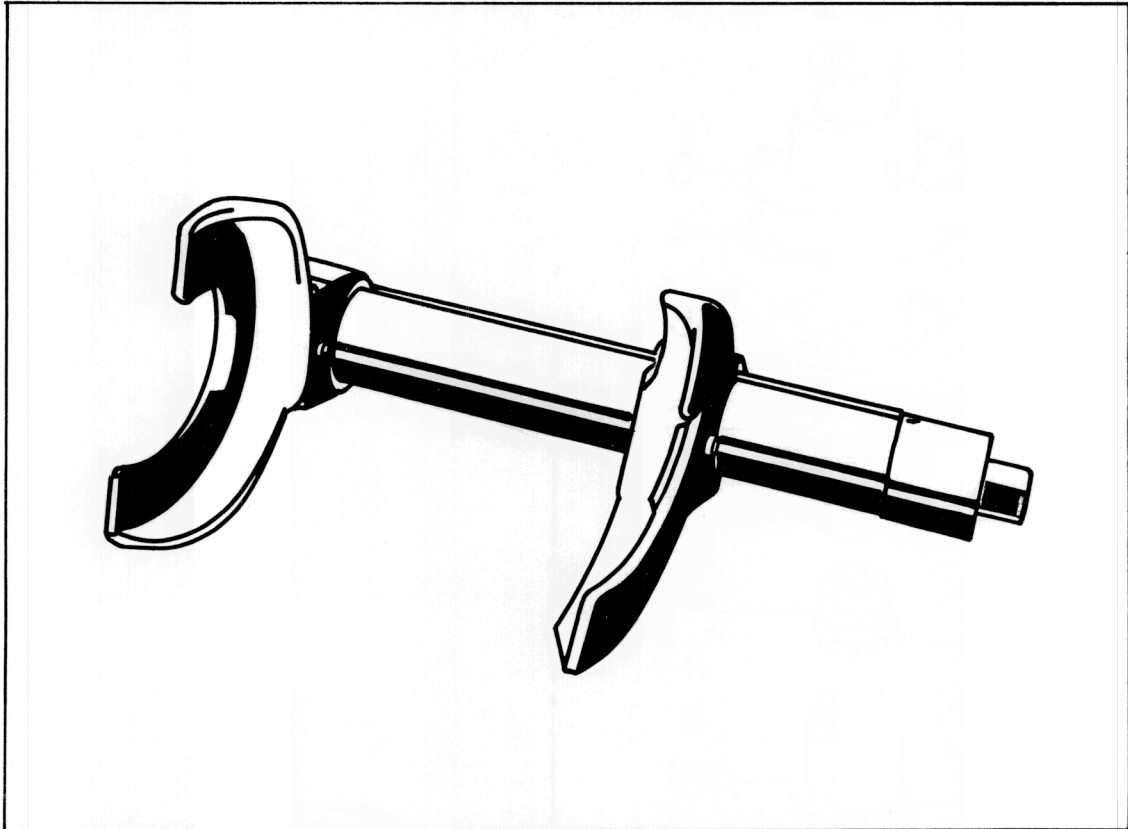
## Note

The **right-hand** parking brake cable can be fitted without removing the rear wall lid.

If the rear underbody lining **has already been removed** for other assembly work, the **left-hand** parking brake cable also can be fitted without removing the rear wall lid.

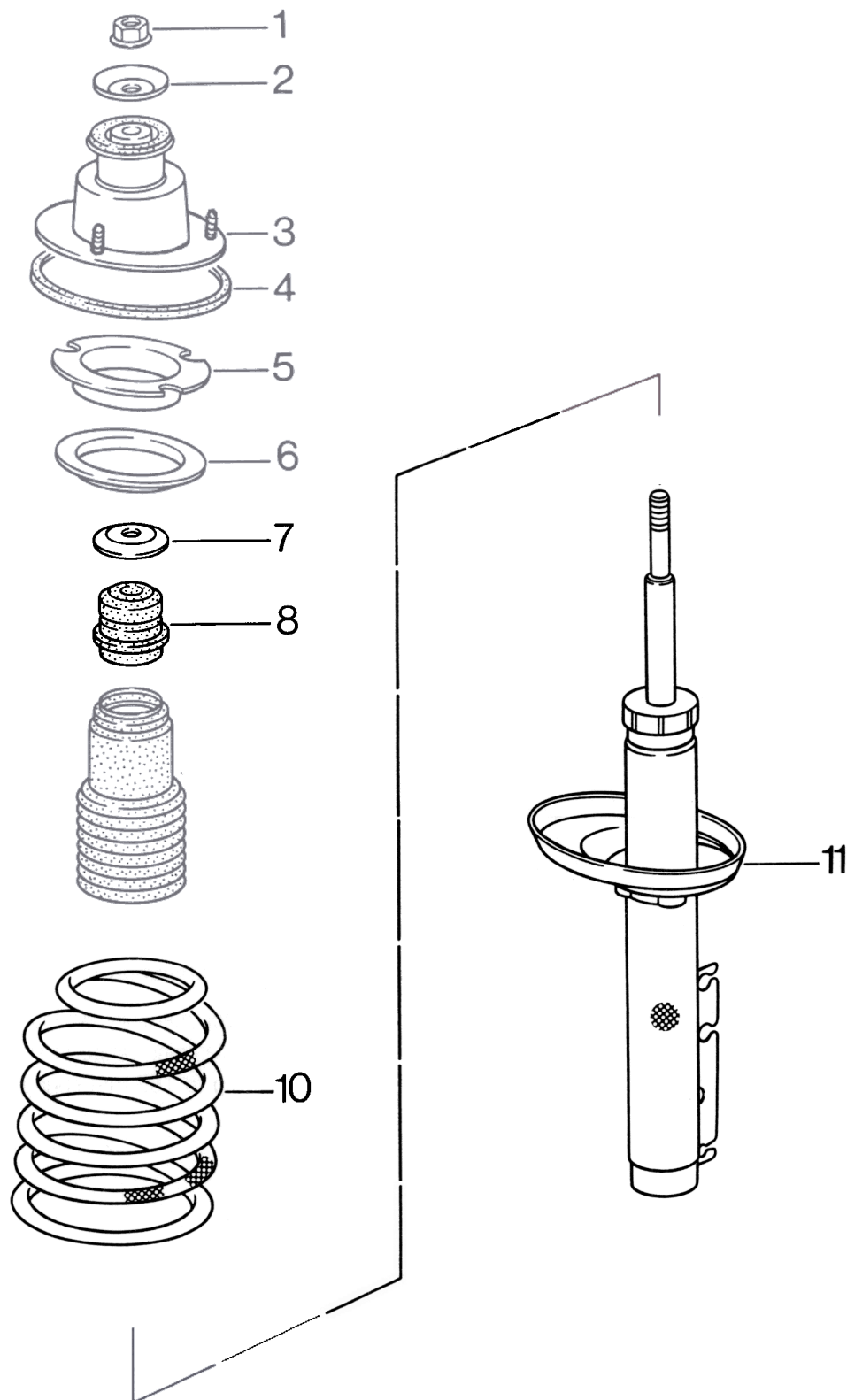
6. Fit brake caliper.
7. When new parts are installed that affect vehicle height, suspension alignment must be carried out.



**42 Disassembling and assembling rear spring strut****Tools**

No.	Designation	Special tool	Explanation
	Spring clamp, e.g. from Klann, with spring holder		commercially available Clamping range of spring holder up to 165 mm spring diameter

## Disassembling and assembling rear spring strut

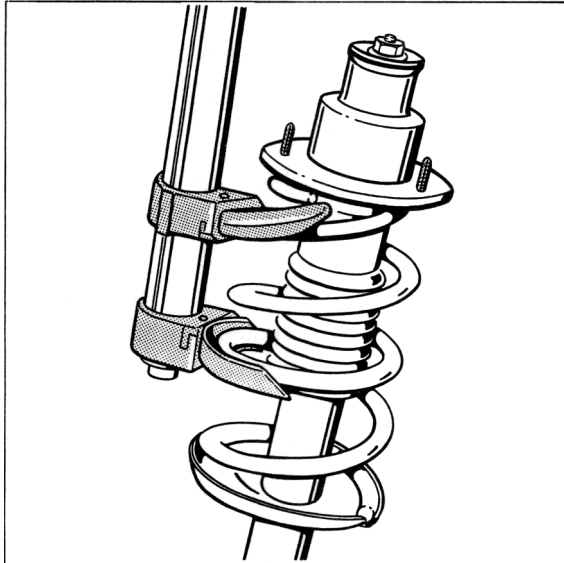


No.	Designation	Qty.	Removal	Note:	Installation
1	Fastening nut M 14 x 1.5	1	Before loosening the fastening nut, tension coil spring with the spring clamp. Support at the piston rod when loosening the nut.		Use new fastening nut. Tighten to 60 Nm (44 ftlb.). <b>First</b> position the spring strut mount (No. 3) (Page 42 - 15).
2	Stop plate	1			Mount in correct position (No. 2 and No. 7 are identical parts)
3	Spring strut mount	1	Remove mount with sealing ring No. 4		The mounts for the right and left sides are identical parts. Position the mount before tightening fastening nut No. 1 (Page 42 - 15).
4	Sealing ring	1			Replace
5	Back-up ring	1			Mount in correct position
6	Spring plate (compensation part)	1			Observe allocation (Page 42 - 12/13). Join in correct position with back-up ring No. 5.
7	Stop plate	1			Mount in correct position (No. 2 and No. 7 are identical parts)
8	Additional spring	1			Mount on protective bellows (No. 9)
9	Protective bellows				
10	Coil spring	1			Observe allocation as per Spare Parts Catalogue.
11	Vibration damper	1			Observe allocation as per Spare Parts Catalogue. The vibration dampers for the right and left sides are identical parts.

## Disassembly and assembly instructions

### Disassembly

Tension the coil spring with the spring clamp until the piston rod is relieved.



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To undo the connection – piston rod to spring strut mount – counter at the piston rod with 7-mm hexagon socket key.

**Important:** Never use an impact bolter to loosen or tighten the fastening nut.

Remove all parts from the piston rod.

### Note

When installing new parts, observe the allocation according to the Spare Parts Catalogue.

### Preliminary work and notes on assembly

Replace nut for fastening the piston rod on the spring strut mount.

It is recommended to replace the coil springs only in pairs.

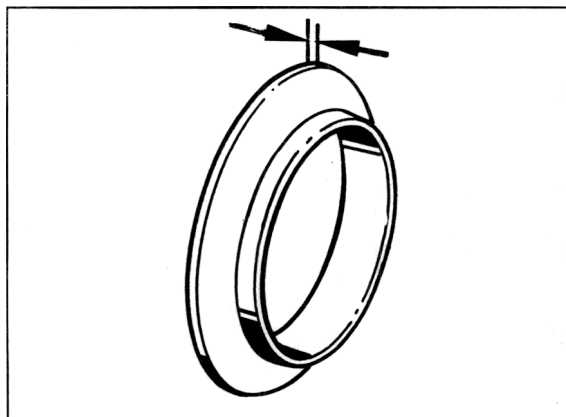
### Note

If the coil springs are exchanged, it might be necessary to use a different spring plate than before.

The following spring plates (compensation parts) are available:

**Allocation** of the spring plate according to the coil spring tolerance group (see Page 42 - 13).

- |                |                                |
|----------------|--------------------------------|
| 1 green line = | 6.5 mm thick compensation part |
| 1 white line = | 3.0 mm thick compensation part |



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Press spring plate (compensation part) into the ring.

Fit protective bellows on additional spring.

Observe the correct allocation (running gear version) when installing new springs and/or dampers.

B = Identification of the coil spring tolerance group (load group) for determination of the compensation part (spring plate) thickness.

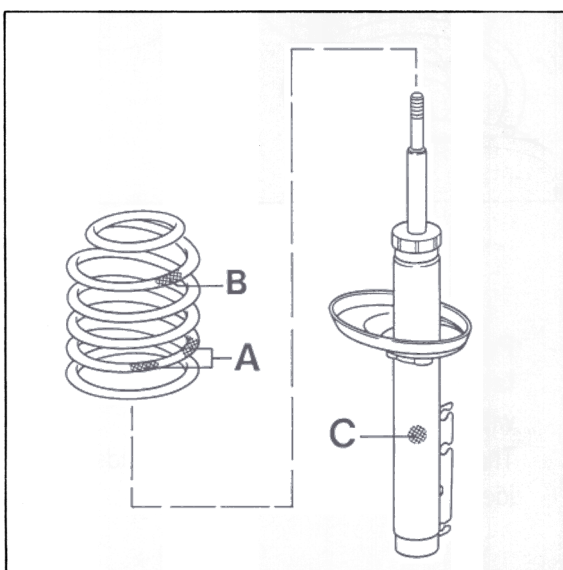
white line = 3.0 mm thick compensation part.

1 green line = 6.5 mm thick compensation part.

C = Colour dot (colour label) to differentiate the damper identifier.

Blue dot = Standard running gear RoW/USA  
Red dot = Sport-type running gear RoW/USA

### Distinguishing feature of coil springs and dampers



**Tension coil spring with spring clamp.**

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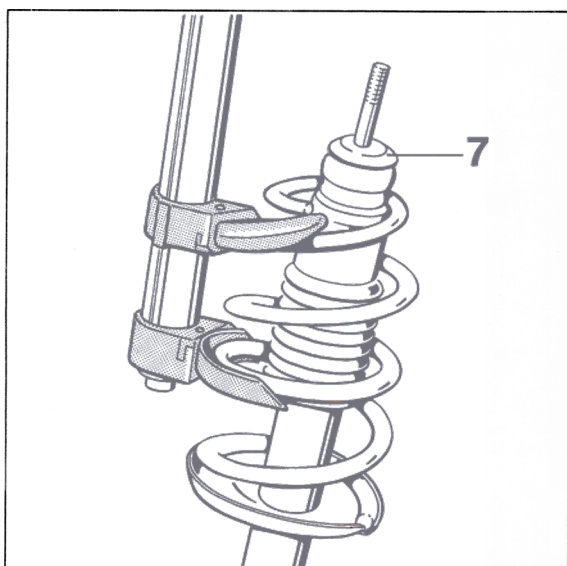
A = Identification for the running gear version (spring constant/spring length) by two different lines (for example, 1 x red and 1 x yellow). Refer to the Parts Catalogue for the allocation.

### Assembly

Slide the protective tube/additional spring assembly on the piston rod.

Slide the stop plate No. 7 as far as it will go into the correct position on the piston rod.

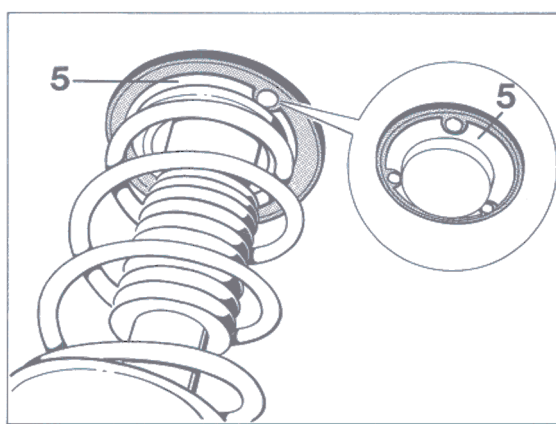
Push the coil spring onto the vibration damper so that the end of the coil spring rests against the stop of the spring plate.



683/1 - 96

Place ring No. 5 with the spring plate in the correct position (observe three recesses) on the spring strut mount and jointly fit them on the piston rod/coil spring.

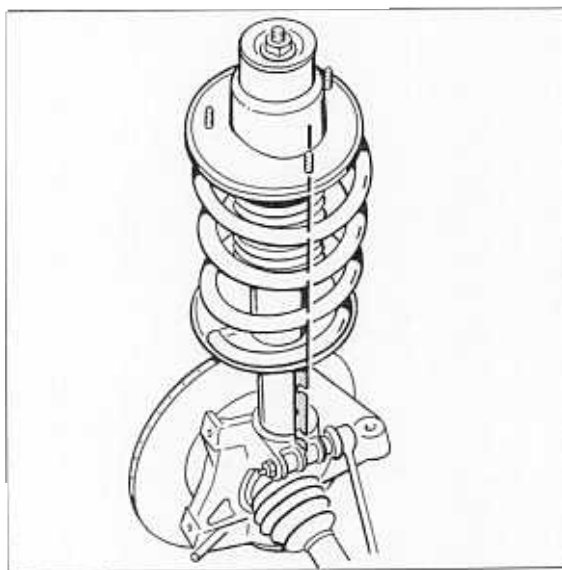
Screw new fastening nut onto the piston rod until approx. 1 to 2 threads are visible above the fastening nut.



684/1 - 96

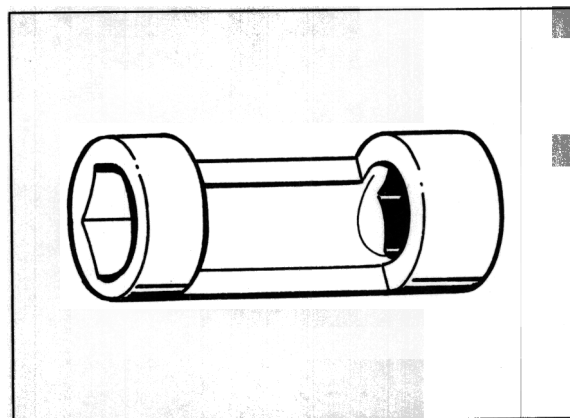
**Position the spring strut mount for installation** (correctly position spring strut mount with respect to the damper).  
The mounts for the right and left sides are identical parts.

The mount is positioned correctly if the fastening bolt in the downward-angled part of the spring strut mount is aligned with the retaining plate on the damper tube.



665/1 - 96

**Important:** Never use an impact bolter to tighten the fastening nut.



2047 - 40

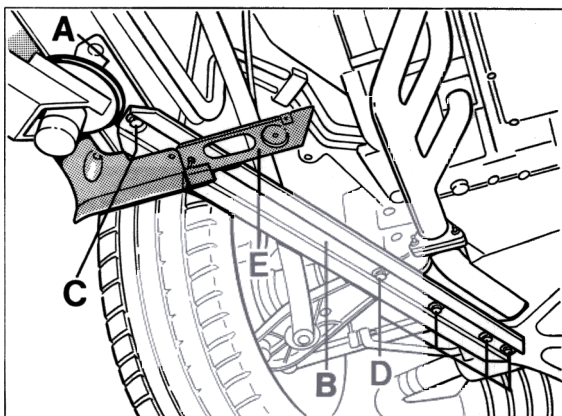
Tighten the fastening nut once the mount has been correctly positioned and the coil spring lies properly against the stop. Use a socket wrench insert half open on one side –e.g. Hazet– to tighten the fastening nut on the spring strut mount. This ensures that exactly the prescribed tightening torque of **60 Nm (44 ftlb.)** can be observed. Furthermore, it is possible to counter at the piston rod with an angled 7 mm hexagon socket key at the same time.



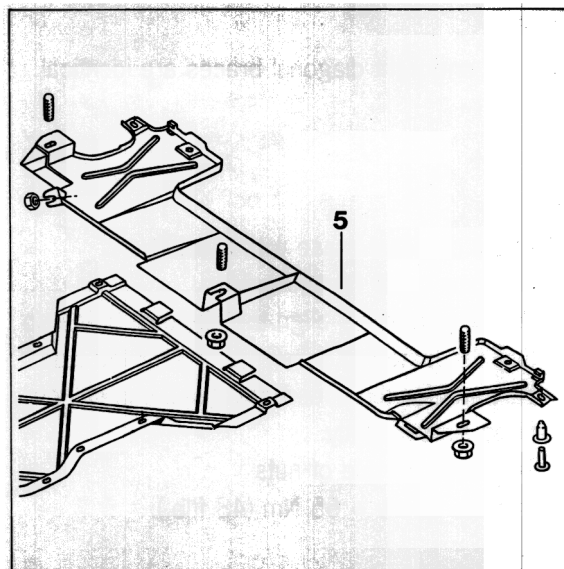
## 42 13 19 Removing and installing diagonal brace

### Removal

1. Raise vehicle. When raising the vehicle, make sure that the fastening screws (C) of the right and left diagonal brace (B) are still accessible.



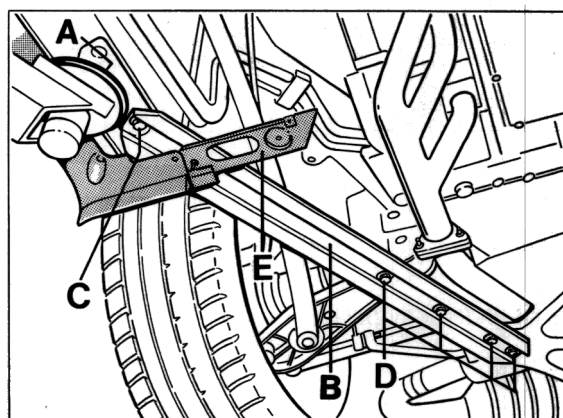
533/1 - 96



691 - 96

- A - Jacking point
- B - Diagonal brace
- C - Fastening screw
- D - Collar fastening nuts (4 ea.)
- E - Bracket for underbody panel

3. Undo fastening screw (C) and the collar fastening nuts (D), and remove the diagonal brace (B) together with the bracket (E).



533/1 - 96

2. Remove rear underbody panel No. 5

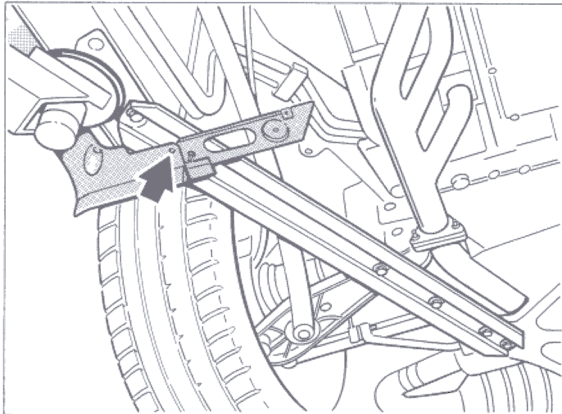


4. If replacing the diagonal brace, detach the bracket on the diagonal brace and fit it on the new brace.

**Note**

The left and right diagonal braces are identical parts.

5. Install diagonal brace with bracket.  
Use new collar fastening nuts.  
Before tightening, align the diagonal brace so that the fastening screw (arrow) for the side part and for the underbody panel can still be fitted subsequently.  
Tightening torque of nuts  
and the screw = 65 Nm (48 ftlb.).

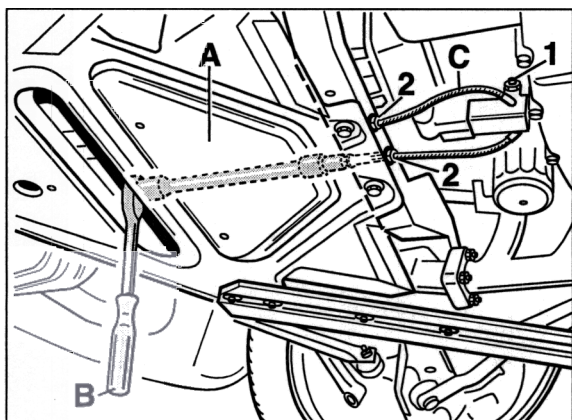


533/2 - 96

6. Fit underbody panel.

**42 83 19 Removing and installing cable****Manual transmission vehicles****Removal**

1. Lift the vehicle.
2. Remove cable fastening on engine (1).
3. Remove cable (C) on the rear axle cross member with a commercially available 1/2 inch changeover ratchet (B) with the corresponding extension and 13 mm socket wrench insert. When doing this, hold onto each hexagon of the cable (2). The tool (B) is inserted through the slot in the sheetmetal brace.



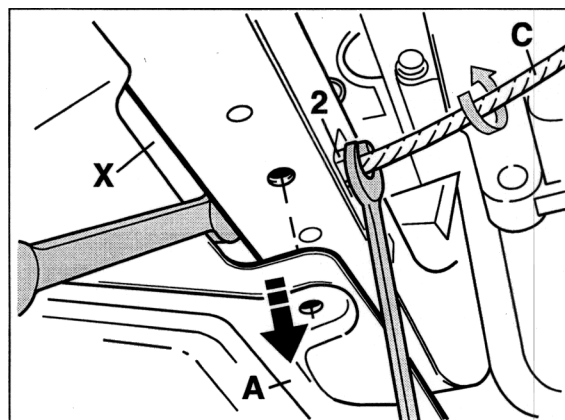
- 454\_98
- A - Sheetmetal brace
  - B - 1/2 inch changeover ratchet with extension and 13 mm socket wrench insert
  - C - Cable
  - 1 - Cable fastener on engine
  - 2 - Hexagon to hold onto

**Installation**

1. Install in reverse order.
2. Use correct tightening torques.  
Cable to motor and cross member = 23 Nm (17 ftlb.).

**Tiptronic vehicles****Removal**

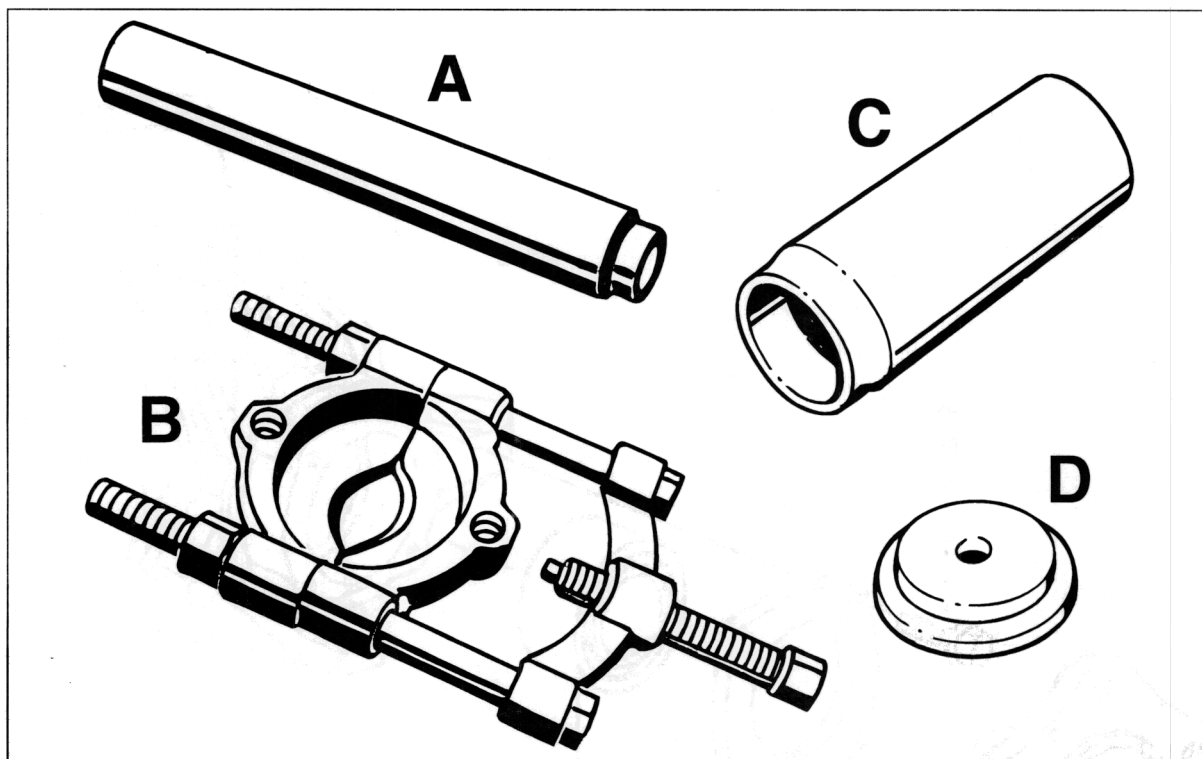
1. Lift the vehicle.
2. Remove cable from engine.
3. Undo front sheetmetal brace (A) (2 screws on rear axle cross member). Pull down sheetmetal brace by about 30 mm (direction arrow). If there are already two rubber spoilers on the sheetmetal brace (as of Mod. '98), remove these spoilers (area X).
4. Undo cable on rear axle cross member at one side.
5. Undo cable (C) at other side and use an open-ended wrench to turn the hexagon of the cable.



- 458\_98
- A - Sheetmetal brace
  - C - Cable
  - X - Rubber spoiler area
  - 2 - Hexagon on cable

### Installation

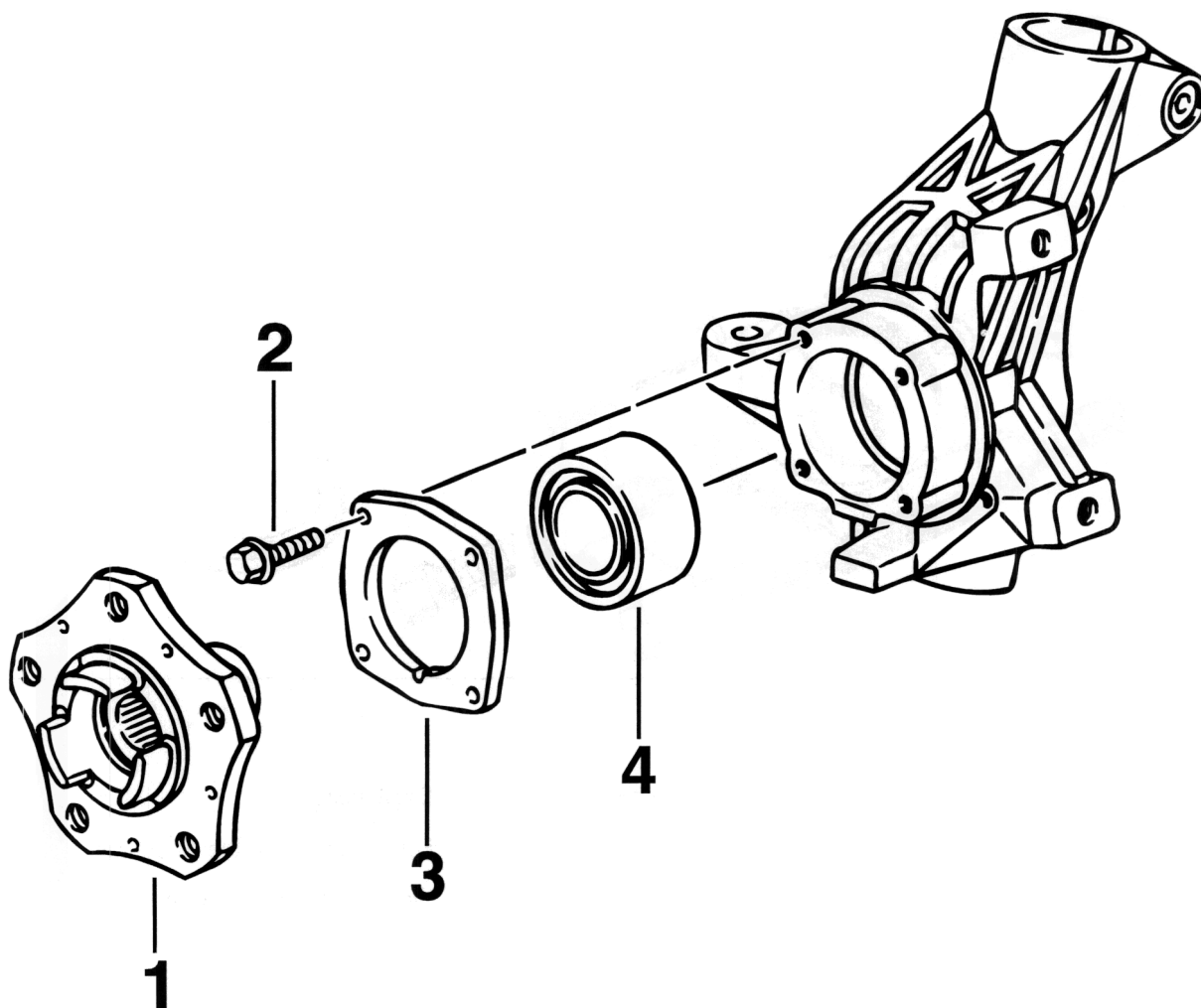
1. Install in reverse order.  
(Tightening torques: Cable to motor and cross member = 23 Nm (17 ftlb.) ).
2. Fit the two rubber spoilers to the sheetmetal brace if necessary.  
Fasten front sheetmetal brace (2 screws on rear axle cross member).  
Tightening torque = 46 Nm (34 ftlb.).

**42 58 19 Removing and installing rear wheel bearing****Tools**

422\_97

Item	Designation	Special tool	Explanation
A	Pressure piece	P 297 A	For pressing out the wheel hub
B	Separator (12 - 115 mm Ø)	Commercially available; refer to Workshop Equipment Manual, Chapter 2.4, No. 111	Used as a support when pressing out the wheel hub and when pressing the wheel bearing inner race off the wheel hub
C	Tubular piece	VW 415 A	For pressing the wheel bearing out and in
D	Pressure piece	9247/4	Use in combination with tubular piece C to press in the wheel bearing

## Removing and installing rear wheel bearing



23\_99

Nr.	Designation	Qty.	Removal	Note:	Installation
1	Wheel hub	1	Press out with pressure piece P 297 A under a hydraulic press. For this purpose, use the separator and corresponding shims for support		Press in under a hydraulic press. To do this, place the wheel hub on the wheel centring device and press it on the <b>wheel bearing inner race</b> using pressure piece VW 415 A
2	Hexagon-head bolt (10.9)	4			Tighten to 37 Nm (27 ftlb.)
3	Lids	1			Fit in correct position (groove down).
4	Wheel bearing	1	Heat wheel bearing housing to approx. 100° C (max. 120° C). Press out wheel bearing with tubular piece VW 415 A (tool C)		Heat wheel bearing housing to approx. 100° C (max. 120° C). Insert <b>new</b> wheel bearing in correct position (inscription facing the wheel hub), and then press again <b>slightly</b> using pressure piece 9247/4 (tool D) and tubular piece VW 415 A (tool C)

## Notes on removal and installation

### Note

The wheel bearing is removed and installed with the wheel bearing housing removed.

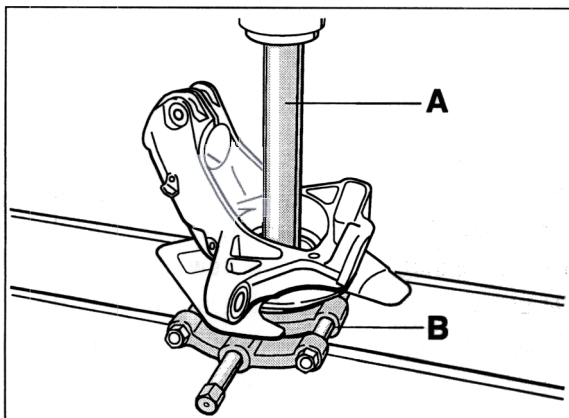
### Removal

- Remove brake disc, parking brake shoes and speed sensor.

Press out wheel hub with pressure piece P 297 A (tool A).

Use the separator (tool B) for support.

If there is not enough space for the wheel hub between the press, appropriate shims will additionally be necessary.

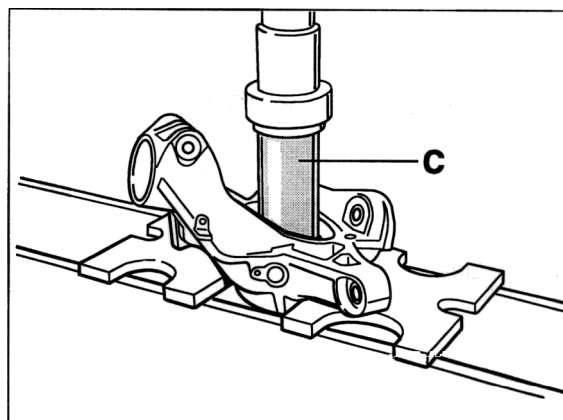


24\_99

Remove retainer plate (lid / four screws) and brake disc cover.

Heat wheel bearing housing to approx. 100° C (max. 120° C).

Press out wheel bearing with tubular piece VW 415 A (tool C).



25\_99

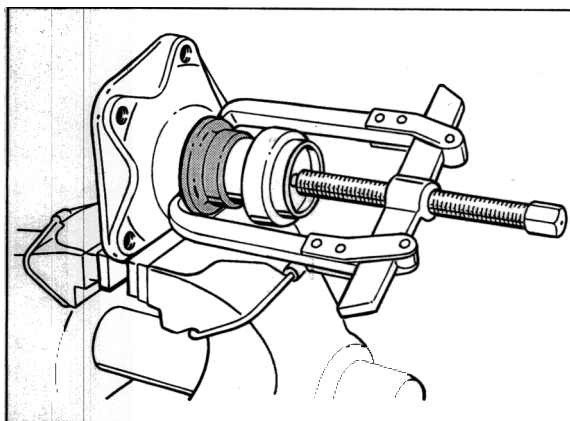
Press inner wheel bearing race off the wheel hub (Figure 426\_97).

To do this, use pressure piece P 297 A (tool A) in combination with the separator (tool B).

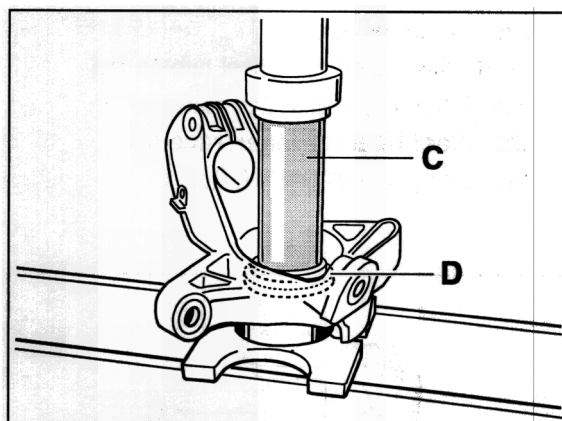
### Note

First pull the inner bearing race several millimetres off the wheel hub (Figure 741\_97) so that the separator can be put into place. For this purpose, use a two-claw puller in combination with a suitable pressure piece (e.g. VW 433).

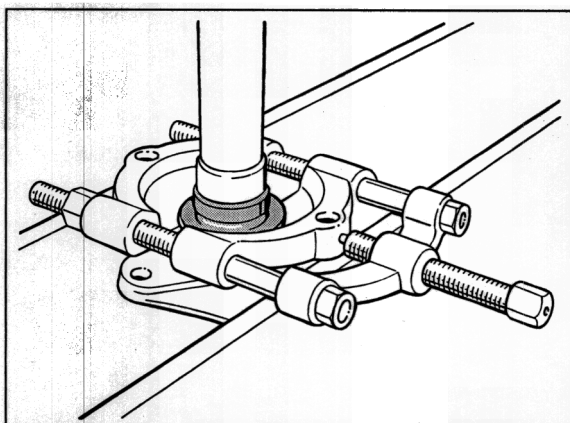




741\_97

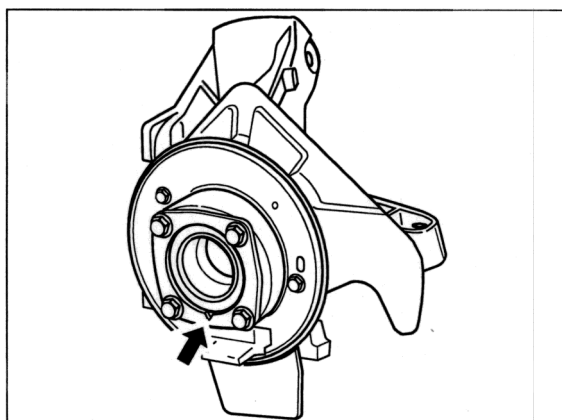


26\_99



426\_97

Fit brake disc cover and retainer plate (lid). Unless there is a water drain on both sides, fit the water drain (arrow) in the correct position – i.e. facing downward. Use correct tightening torques.  
Brake disc cover = 10 Nm (7.5 ftlb.)  
Retainer plate = 37 Nm (27 ftlb.)



27\_99

### Installation

- Before installation, clean the bore in the wheel bearing housing and remove any surface irregularities with a polishing cloth.

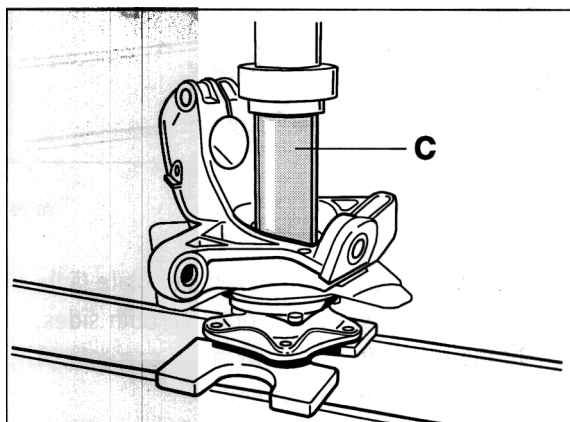
Heat wheel bearing housing to approx. 100° C (max. 120° C).

Insert **new** wheel bearing, and then press again **slightly** using pressure piece 9247/4 (tool D) and tubular piece VW 415 A (tool C).



Press in wheel hub.

To do this, place the wheel hub on the wheel centring device and press it on the **wheel bearing inner race** using pressure piece VW 415 A (tool C).



29\_99

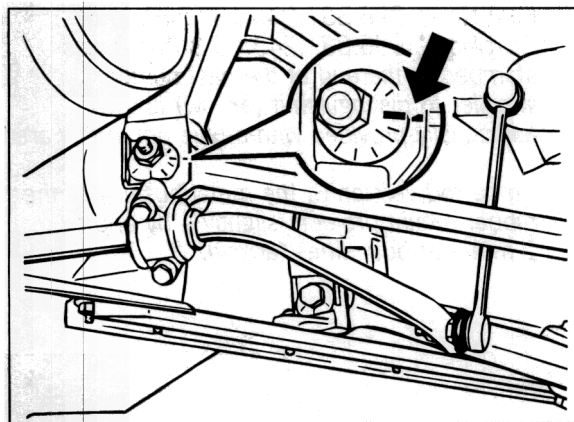
**42 09 19 Removing and installing rear tie rod (toe control arm)****Removal**

1. Raise vehicle and remove wheel.
2. Press off ball joint on the wheel carrier using a commercially available ball joint extractor (tie rod extractor) – refer to Workshop Equipment Manual, Chapter 2.4, No. 113. When loosening the locknut, hold it with special tool 9546 (Torx screwdriver).

**Note**

Do not damage the boot of the ball joint when pressing off the ball joint. If necessary, coat the boot and the ball joint extractor with tyre mounting paste.

3. Mark the position of the toe eccentric for re-installation. Remove the toe eccentric and pull out the tie rod.



42090002

**Installation**

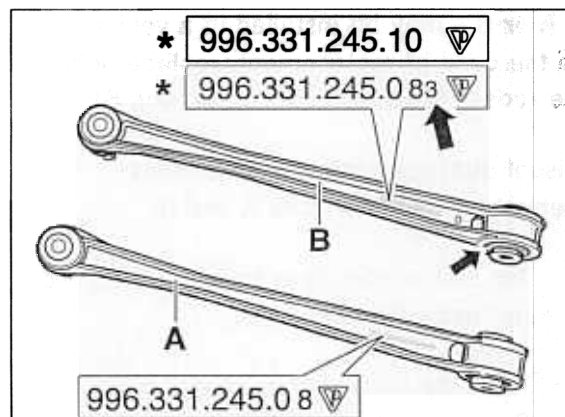
1. Install in reverse order. Before installing, give all parts a visual check.

**Note**

When replacing tie rods, pay close attention to the correct allocation.

**Install only identical tie rods – version A or B – on a vehicle.**

For a detailed explanation – distinguishing characteristics and Spare Part No. – refer to "Tie rod replacement" (after installation).



292\_99

2. Replace fastening nuts.  
**Use correct tightening torques.**
3. Perform a suspension alignment after installation.

## Tie rod replacement

Only tie rods with **harder rubber mounts** (optimised tie rods with spherical mounts) – **version (B)** – are still available from the Parts Service.

Introduction of the optimised tie rods in the current model year 1999 (X) in some cases, but generally from model year 2000 (Y).

Part No. of the optimised tie rod:

**996.331.045.10.**

These tie rods may be retrofitted – but only in pairs.

In general, the following applies: Only tie rods (toe control arms) of the same version – A or B – may be installed in a vehicle. In the case of replacement, replace both tie rods if necessary (install version B).

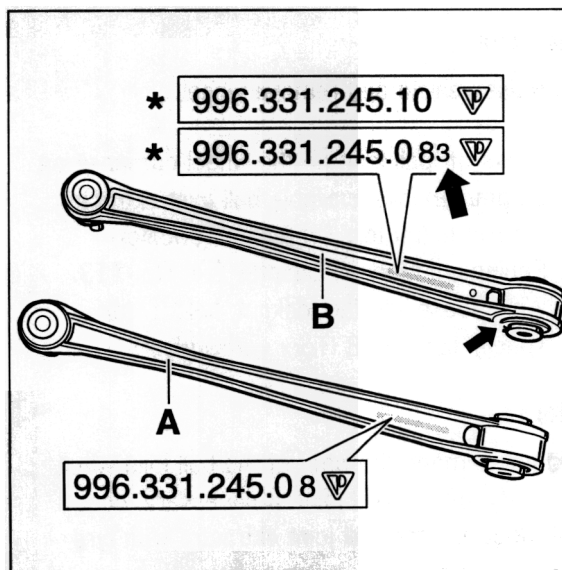
Visual distinguishing characteristics between tie rod versions A and B:

The cast number (refer to Fig. 292\_99 and text below the illustration).

The metal bushing of the rubber mount.

**On version A**, the metal bushing of the rubber mount is flush with the tie rod.

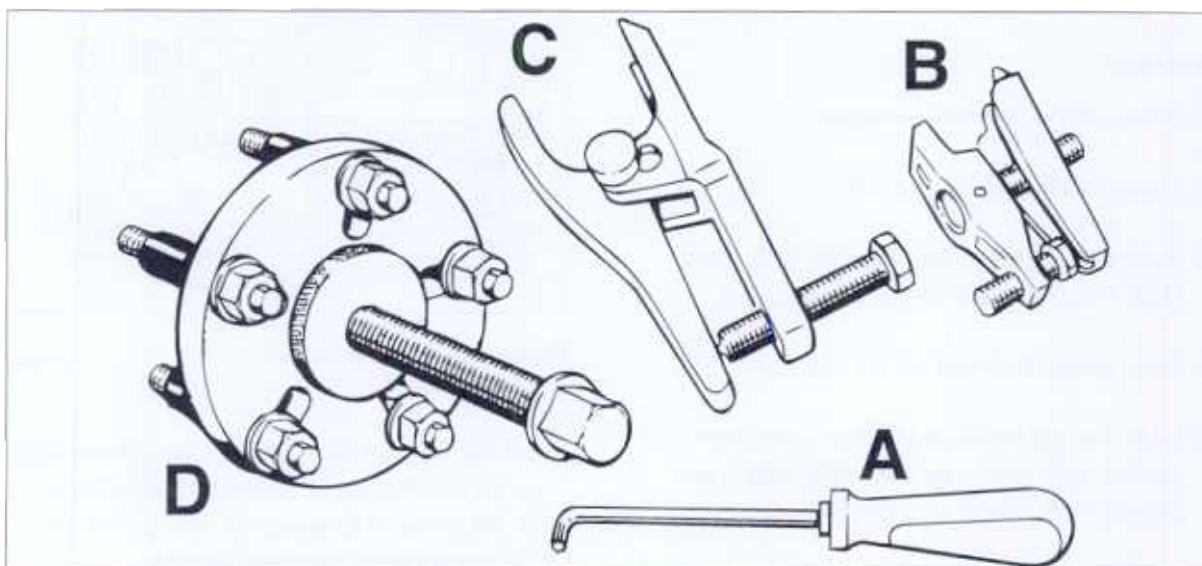
**On version B**, the metal bushing of the rubber mount projects slightly – by approx. 1 mm – at both sides (arrow).



A - Tie rods **without** spherical mount  
Part No. 996.331.045.06 / 07 / 08  
Cast No. 996.331.245.06 / 07 / 08

B - Tie rods **with** the spherical mount  
(optimised tie rods with harder rubber mount).  
Part No. 996.331.045.10  
Cast No. \* 996.331.245.10 (current) **or**  
Cast No. \* 996.331.245.08 **3** (the 3 was stamped at the end of the cast number in order to distinguish it (arrow) and was additionally provided with a blue dot in this area).

On tie rod version B, the metal bushing of the rubber mount projects slightly – by approx. 1 mm – at both sides (arrow).

**42 21 19 Removing and installing drive shaft****Tools**

42210001

Item	Designation	Special tool	Explanation
A	Torx screwdriver	9546	To counter the ball joint when assembling and disassembling the fastening nuts.
B	Ball joint extractor (track rod extractor)	Commercially available; refer to Workshop Equipment Manual, Chapter 2.4, No. 113.	
C	Press-out tool (ball joint extractor)	9560	To press off the ball joint on the wheel carrier.
D	Universal wheel hub extractor	Commercially available, refer to Technical Equipment Manual, Chapter 2.4, No. 87-1.	To press the drive shaft out of the wheel hub.

## Removing and installing right drive shaft

### Note

Removal and installation applies to vehicles with manual transmission or Tiptronic.

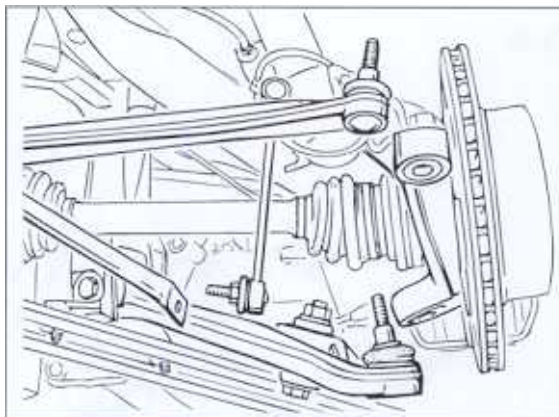
### Removal

1. Raise vehicle and remove wheel.
2. Loosen and unscrew axle nut.
3. Push suitable protection over the drive shaft.  
Undo the drive shaft on the transmission.
4. Undo stabilizer mount on the stabilizer.
5. Undo the ball heads of the toe control arm and the axle strut – **on the right side** – and counter with special tool 9546 (Torx).
6. Press out both ball heads using special tool 9560 (press-off tool) and a commercially available press-off tool. When positioning the puller, ensure that the boot of the ball head is not damaged. If necessary, coat the boot and the press-off tool with tyre mounting paste.

### Note

If necessary, use a driving impact to help pull off the ball head (taps of a hammer on a copper mandrel near the ball journal). The puller should press on the fastening nut, which is still fitted but loosened (protection for thread and Torx).

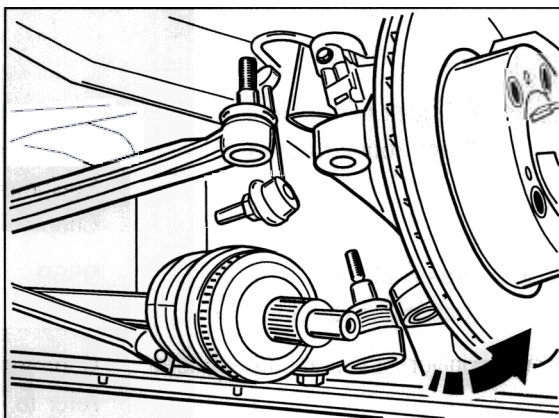
7. Pull the ball journal of the axle strut downwards and out of the wheel carrier (pull axle strut downwards while making sure not to tilt it).



*Preliminary work for right drive shaft installation*

42210002

8. Lift up the drive shaft on the transmission and press inwards out of the wheel hub toothing. At the same time, swivel the spring strut with the wheel carrier outwards (arrow). Bend the drive shaft and push out behind the wheel carrier (2 fitters necessary). Do not damage the ball joint boot! Observe the note in the following text.



*Right drive shaft removal*

42210005



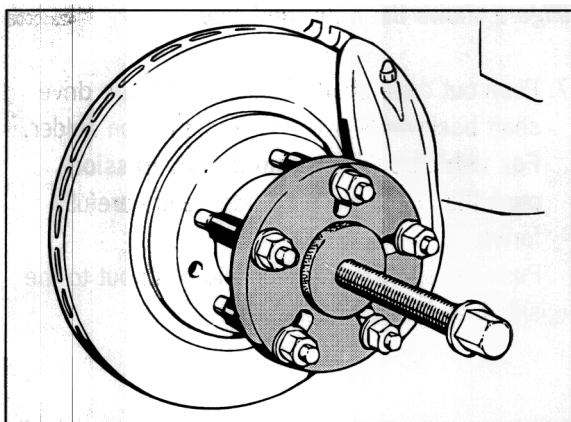
**Note**

Since the drive shaft can be moved only using great force, loosen the shaft inwards with taps on a copper mandrel. Lift up the shaft near the inner joint (possible damage to the closure cap of the drive shaft may occur).

For unfavourable tolerances, the drive shaft must be pressed out of the wheel hub toothing using a wheel hub extractor (Fig. 42210003).

Always check the boots for damage if continuing to use the drive shaft!

Replace the boots if necessary.



42210003

**Installation**

- Install in reverse order. Grease the toothing of the drive shaft with Optimoly HT.

Carry out a visual inspection of all parts.  
Replace self-locking nuts.

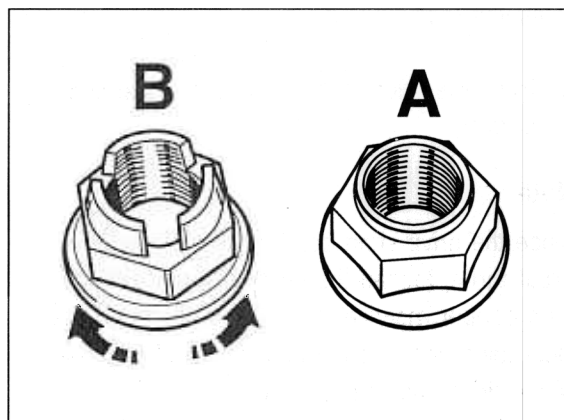
**Use correct tightening torques.**

**Note**

Only optimised axle nuts – **version B** – for drive shaft fastening are available from the Parts Service.

These two-part fastening nuts (M22) have a moveable washer (arrows).

Retrofitting is possible for all Boxster and all 911 Carrera (996) vehicles.



A - Single-part fastening nut

42210006

B - Two-part fastening nut  
(moveable washer/arrows)

Part No. 999 084 640 02 (status 06/99)

## Removing and installing left drive shaft

### Note

Removal and installation applies to vehicles with manual transmission or Tiptronic.

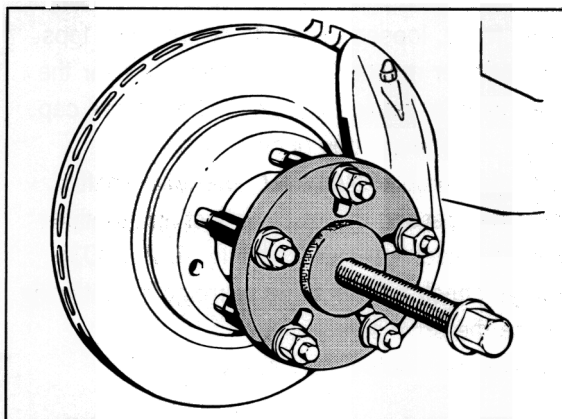
### Removal

1. Raise vehicle and remove wheel.
2. Loosen and unscrew axle nut.
3. Push suitable protection over the drive shaft.  
Undo the drive shaft on the transmission.
4. Undo stabilizer mount on the stabilizer.
5. **For vehicles with manual transmission,** carefully unclip the clutch slave cylinder lead over the drive shaft.
6. Press the drive shaft out of the wheel hub tooting.

### Note

Since the drive shaft can be moved only using great force, loosen the shaft inwards with taps on a copper mandrel. Lift up the shaft near the inner joint (possible damage to the closure cap of the drive shaft may occur).

For unfavourable tolerances, the drive shaft must be pressed out of the wheel hub tooting using a wheel hub extractor (Fig. 42210003). Always check the boots for damage if continuing to use the drive shaft!  
Replace the boots if necessary.



(Figure shows the right-hand side)

42210003

7. Push out drive shaft. To do this, lift the drive shaft backwards over the transmission holder.  
**For vehicles with manual transmission,** push the clutch slave cylinder lead carefully forwards.  
Push the shaft to the rear and push out to the side beside the wheel carrier.

### Installation

- Install in reverse order.  
Grease the tooting of the drive shaft with Optimoly HT.
- Carry out a visual inspection of all parts.  
Replace self-locking nuts.  
**Use correct tightening torques.**

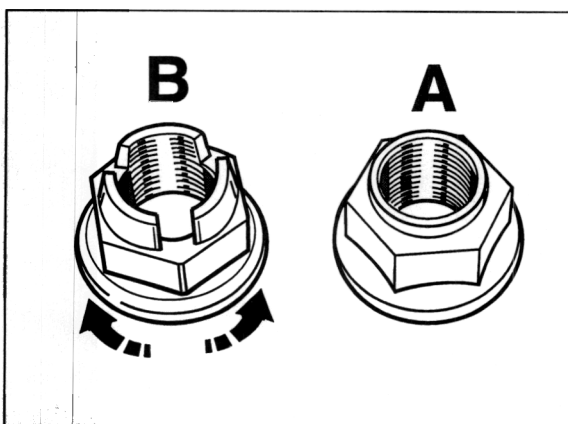
After assembly (for vehicles with manual transmission), check that the clutch slave cylinder lead is in its correct position and check for leaks.

**Note**

Only optimised axle nuts – **version B** – for drive shaft fastening are available from the Parts Service.

These two-part fastening nuts (M22) have a moveable washer (arrows).

Retrofitting is possible for all Boxster and all 911 Carrera (996) vehicles.



A - Single-part fastening nut

42210006

B - Two-part fastening nut  
(moveable washer/arrow)  
Part No. 999 084 640 02 (status 06/99)

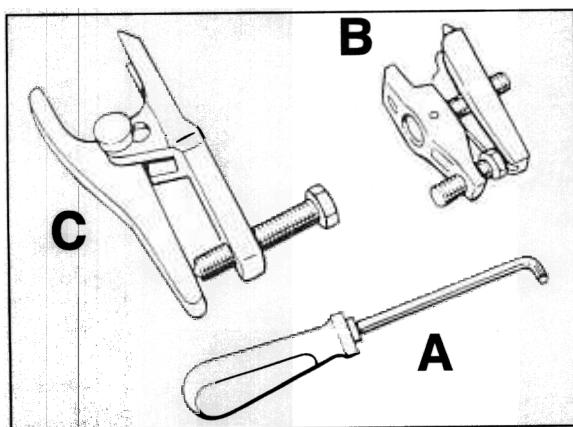


**42 11 19 Removing and installing rear axle strut****Removal**

1. Lift the vehicle. Remove the rear wheel.
2. Undo the control arm of the axle strut.
3. Remove axle strut on wheel carrier on the rear axle side sections.  
Counter with Torx screwdriver (A / Fig. 204\_99), special tool 9546, when undoing the fastening nuts on the wheel carrier.
4. Press the ball joint off the wheel carrier using press-out tool (C), special tool 9560.

**Note**

If necessary, use a driving impact to help pull off the ball head (taps of a hammer on a copper mandrel near the ball journal). The puller should press on the fastening nut, which is still fitted but loosened (protection for thread and Torx).



A - Torx screwdriver  
C - Press-out tool

204\_99

5. Pull the ball journal of the axle strut downwards and out of the wheel carrier (pull axle strut downwards while making sure not to tilt it).

**Note**

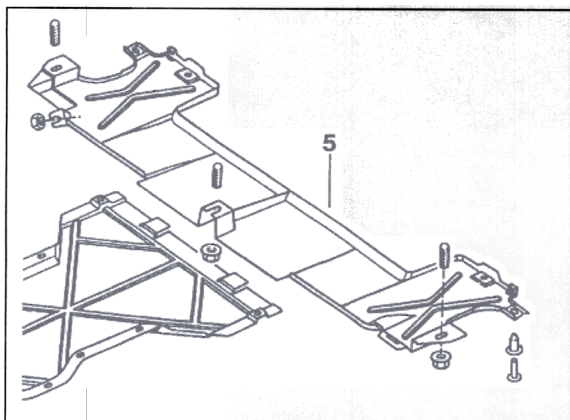
The sensor is seated on the axle strut for vehicles with headlight beam adjustment. Disengage the strut of the sensor on the axle strut. It is not necessary to calibrate the headlight beam adjustment after these assembly procedures.

**Installation**

1. Install in reverse order.  
Before installing, give all parts a visual check. Replace fastening nuts.  
**Use correct tightening torques.**
2. When installing the axle strut, make sure that the axle strut is tightened only in vehicle position.  
Vehicle position means: vehicle standing on its wheels.
3. Carry out suspension alignment.

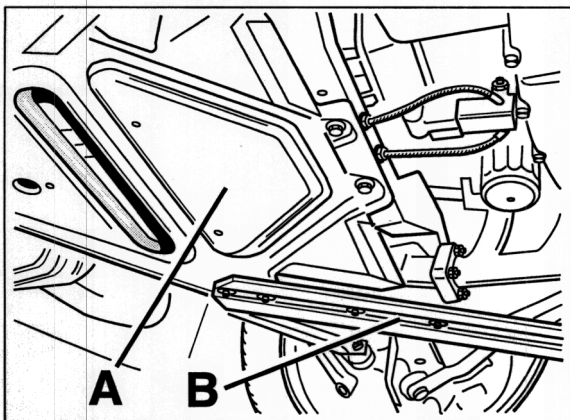
**42 90 19 Removing and installing stabilizer****Removal**

1. Lift the vehicle.
2. Remove rear underside panel (5).



691\_96

3. Disassemble the right and left strut and the sheetmetal brace.



A - Sheetmetal brace  
B - Strut (left)

4. Undo stabilizer on the stabilizer mount.  
Counter at the ball heads using an open-ended wrench.
5. Undo the stabilizer on the rear axle side sections and remove stabilizer.

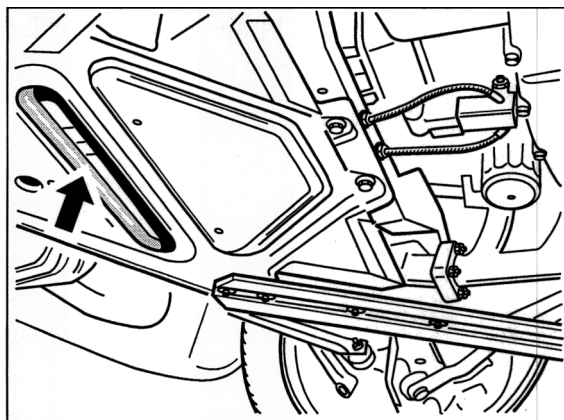
**Installation**

1. Install in reverse order. Inspect the stabilizer for correct installation position.

**Note**

The bend of the stabilizer must run downwards through the recess of the sheetmetal brace. Replace the stabilizer bearings if they are soiled or damaged. Before installing, visually inspect all parts. Replace fastening nuts.

**Use correct tightening torques.**

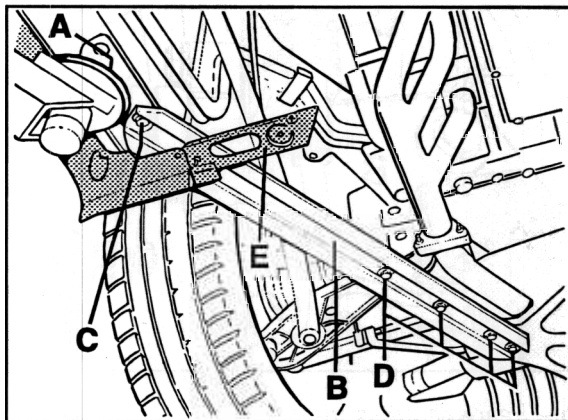


42900001

## 42 06 19 Removing and installing the rear-axle cross member

### Removal

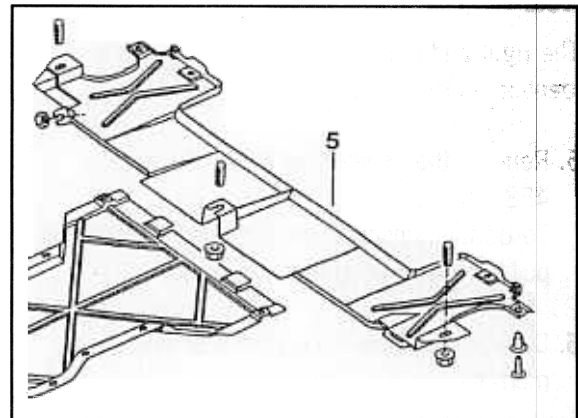
1. Lift the vehicle. When lifting, ensure that the fastening screws (C) of the right and left diagonal braces (B) are still accessible.



533\_1\_96

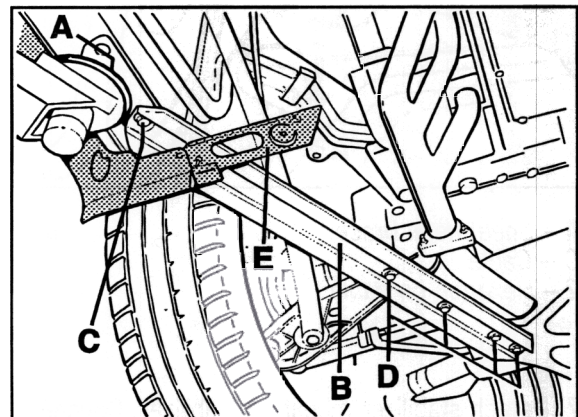
- A – Support point for lifting
- B – Diagonal brace
- C – Fastening screw
- D – Collar nuts (4 ea.)
- E – Holder for underbody cover

2. Remove underbody cover at rear (No. 5).



691\_96

3. Undo the fastening screw (C) and the collar nuts (D) and remove the diagonal brace (B) together with the holder (E).



533\_1\_96

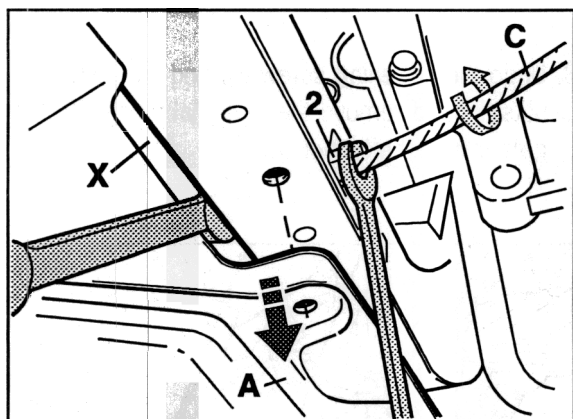
4. If the diagonal brace is to be replaced, detach the holder from the diagonal brace and fit it on the new brace.

#### Note

The right and left-hand diagonal braces are identical parts.

5. Remove the sheetmetal brace (A) (Figure 458\_98).  
To do this, unscrew the nuts and screws and pull the sheetmetal brace downward.

6. Detach the cable (C) on the rear-axle cross member.



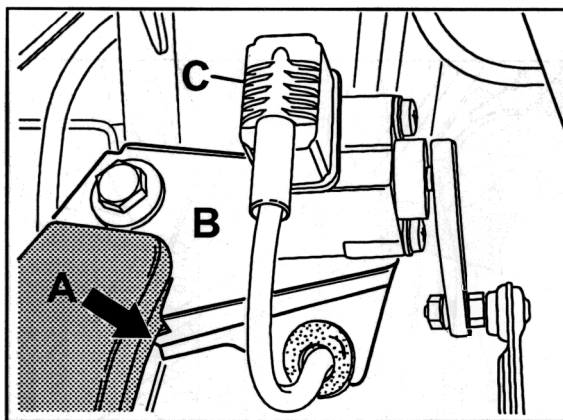
A – Sheetmetal brace  
C – Cable  
2 – Hexagon on cable

458\_98

7. Detach stabilizer mount on stabilizer. Counter with an open-ended wrench when doing this. Remove stabilizer support from the stabilizer and take out the stabilizer.
8. Remove the exhaust system (see section describing engine removal and installation/Serv. No. 10 01 19).

9. On vehicles with automatic headlight beam adjustment, remove the angle (C) sensor located on the left side of the vehicle.

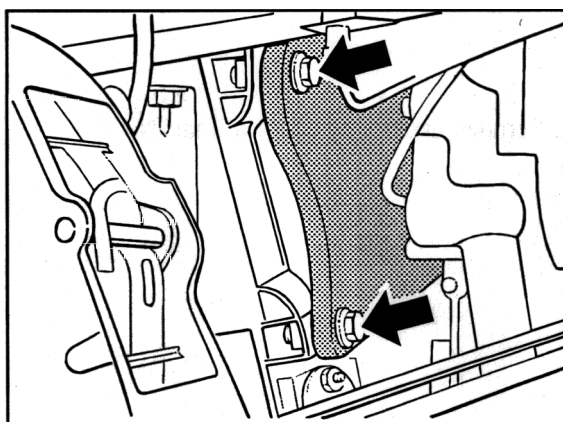
To do this, disconnect the plug for the angle sensor and remove the holder (B) with the angle sensor (C).



A – Rear-axle cross member  
B – Angle sensor holder  
C – Angle sensor for headlight beam adjustment

94790001

10. Detach the rear-axle cross member on the right and left sides (two screws per side/arrows) and remove.



707\_97



**Installation**

1. Install in reverse order. Before installing, visually inspect all parts.  
Make sure the rear-axle cross member is installed in the correct position (welded seam to the front).

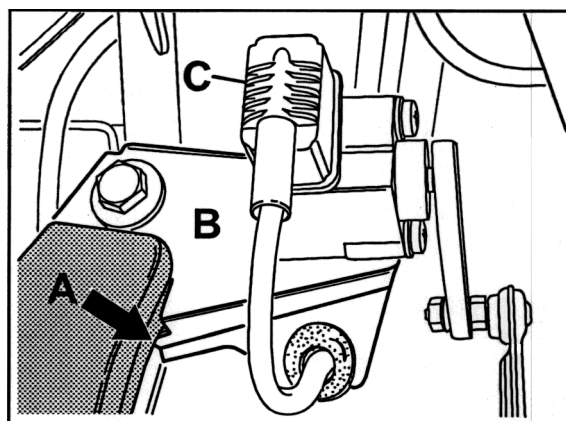
2. Replace fastening nuts.

**Use correct tightening torques.**

3. On vehicles with automatic headlight beam adjustment, fit the angle sensor (C) in the correct position on the left side of the vehicle.

**In the correct position means:**

The angle sensor holder (B) must be properly seated at the lower side on the rear-axle cross member (A) when the screw connection is tightened (arrow/Figure 94790001).



A – Rear-axle cross member

B – Angle sensor holder

C – Angle sensor for headlight beam adjustment

94790001

4. Carry out suspension alignment.

**Note**

Suspension alignment is necessary because the rear-axle wheel alignment values might be out of tolerance after removal and installation of the rear-axle cross member.

**Note**

After installation, the HBA control module must be calibrated with the Porsche System Tester (see HBT in Diagnosis/troubleshooting HBA, Serv. No. 94 92, Calibration menu). Then check the adjustment of the main headlights and readjust them if necessary.

**42 14 19 Removing and installing sheetmetal brace****Note**

Remove and install the sheetmetal brace only if the vehicle has been properly raised. Conditions:

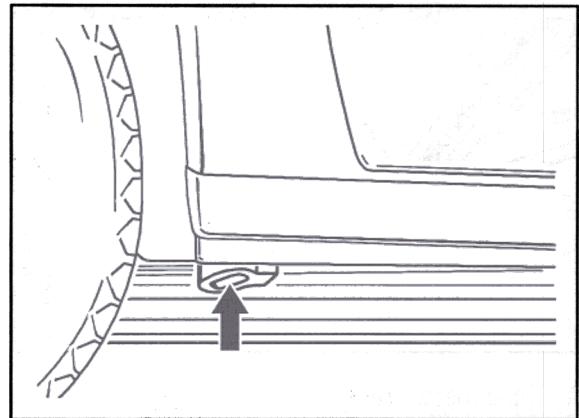
All wheels must be lifted (suspended freely).

The vehicle must be lifted at the prescribed support points - with the lifting platform adjusted uniformly. (The lifting arms must be aligned evenly in order to avoid distortion.)

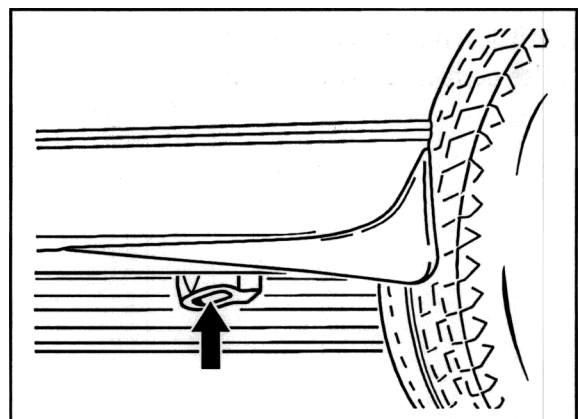
Suspension alignment is **not** necessary if the sheetmetal brace is removed and installed observing the aforementioned conditions. In the most unfavourable case, the rear-axle wheel alignment values may change slightly. This could cause a slight change in the steering wheel position (as compared with the position before removal) when the vehicle is driven straight ahead.

**Removal**

1. Raise the vehicle at the prescribed support points.

*Front*

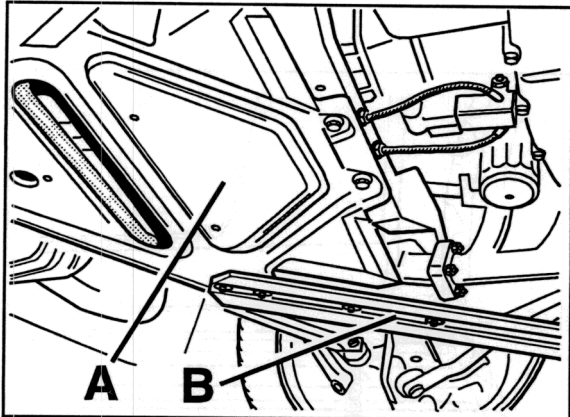
047\_97

*Rear*

048\_97

2. Remove the right and left diagonal braces and the sheetmetal brace.

Pull the sheetmetal brace without exerting excessive force.



A - Sheetmetal brace  
B - Strut (left)

42140001

### Installation

1. Install in reverse order.  
Use correct tightening torques.

## 44 Wheels and tyres

### Tyre condition / tyre pressure

Tyres are a safety element which fulfil the demands placed on them only if they have the correct air pressure and a sufficient tread depth.

The stated air pressures are minimum pressures and must never be fallen below, since in addition to the unfavourable driving performance, this would bring about a risk of serious tire damage.

Valve caps protect the valve from dust and dirt and therefore from leaks. Always screw caps tight and replace any missing caps.

For reasons of safety, besides a check on air pressure a visual check should be made for sufficient tread depth, foreign bodies, punctures, cuts, cracks and bulges in the sidewall (ply breakage).

**Cold tyre pressures (at approx. 20° C)**

**Boxster and Boxster S**

**16, 17 and 18-inch wheels**

(summer and winter tyres)

front 2.0 bar overpressure

rear 2.5 bar overpressure

**Spare wheel**

front/rear 4.2 bar overpressure

### Overview of tyres and wheels

The chart of tyres and wheels for summer and winter should be taken from Technical Information (TI) Group 4.

When replacing summer tyres, pay close attention to the tyre specification number. The specification characters N1, N2, N3 or N0 distinguish the summer tyres specially authorised by Porsche from other models of the same tyre type and size.

### Notes on mounting tyres

When fitting tyres, the direction of rotation and the inner and outer sides should be noted.

### Mounting wheel on vehicle

The wheel bolt consists of **two parts that are permanently joined together**.

**Other wheel bolts must not be used.**

Use suitable commercially available tools (wrench size 19 mm). **Never use an impact bolter to tighten the wheel bolts.**

Always apply a thin coat of Optimoly TA (aluminium paste) on the thread of the wheel bolts, on the shank and between the bolt head bearing surface and spherical cap ring (under the head).

**Do not grease the spherical cap bearing surface of the wheel bolts that faces the wheel!**



In the case of heavy soiling, first clean the wheel bolts and the concavities in the wheel with a lint-free cloth.

Damaged wheel bolts must always be replaced. This damage includes mechanical damage to the thread, the spherical cap and damage resulting from **seizure** of the bolt head bearing surface and spherical cap ring.

**Rework on wheel bolts is impermissible.**

Screw in wheel bolts by hand and then tighten evenly. Start at the top when tightening. Always observe the specified tightening torque of **130 Nm (96 ftlb.)**.

## 44 Adjustment values for suspension alignment

The following values relate to the empty weight. This means: full fuel tank, vehicle with spare wheel and tools, but without driver and without additional weights.

The vehicle height depends on the wheel size (16, 17 or 18-inch).

### Vehicle height – Boxster and Boxster S

	Wheel size	USA: Series and Sport	RoW: Series	RoW: Sport
<b>Front-axle height</b>				
From road contact surface to	16-inch	149 ± 10 mm	139 ± 10 mm	129 ± 10 mm
lower edge of hexagon-head bolt	17-inch	154 ± 10 mm	144 ± 10 mm	134 ± 10 mm
(a/f 18) of the tension-strut screw	18-inch	155 ± 10 mm	145 ± 10 mm	135 ± 10 mm
connection to the body				

Figure – Measuring point

Page 44 - 11

### Rear-axle height

From road contact surface to	16-inch	144 ± 10 mm	144 ± 10 mm	134 ± 10 mm
lowest surface of the diagonal	17-inch	148 ± 10 mm	148 ± 10 mm	138 ± 10 mm
brace at the control-arm	18-inch	151 ± 10 mm	151 ± 10 mm	141 ± 10 mm

securing point

Figure – Measuring point

Page 44 - 11

## Wheel alignment values

The following values relate to the empty weight. This means: full fuel tank, vehicle with spare wheel and tools, but without driver and without additional weights.

### Front axle – Boxster and Boxster S

	USA: Series and Sport	RoW: Series	RoW: Sport
Toe unpressed (total)	+ 5' ± 5'	+ 5' ± 5'	+ 5' ± 5'
Toe difference angle at 20° lock	– 1° 20' ± 30'	– 1° 50' ± 30'	– 2° 20' ± 30'
Camber (with wheels straight forward)	5° ± 30'	– 10' ± 30'	– 15' ± 30'
max. difference, left to right	20'	20'	20'
Caster *	8° ± 30'	8° ± 30'	8° ± 30'
max. difference, left to right	40'	40'	40'

\* A caster adjusting facility is normally not necessary for the Boxster and is therefore not present in series vehicles. In the event of repairs, a caster adjustment facility can be installed if necessary. Please refer to the description on Page 40-13 /40-14.

**Wheel alignment values**

The following values relate to the empty weight. This means: full fuel tank, vehicle with spare wheel and tools, but without driver and without additional weights.

**Rear axle – Boxster and Boxster S**

	USA: Series and Sport	RoW: Series	RoW: Sport
<b>Toe per wheel</b>	+ 5' ± 5'	+ 5' ± 5'	+ 5' ± 5'
max. difference, left to right	10'	10'	10'
<b>Camber</b>	- 1° 20' ± 30'	- 1° 20' ± 30'	- 1° 30' ± 30'
max. difference, left to right	20'	20'	20'

## 44 Boxster and Boxster S alignment cards

### Important notes

Since mainly electronic wheel-alignment analysers in conjunction with printers are used, a specimen alignment card is rarely required nowadays.

So that measured results can be documented in individual cases, however, a copy of the alignment cards shown on the following pages can be used.

The alignment cards can be used for **all Boxster vehicles** – USA (series / sport), RoW series and RoW sport **and Boxster S**.

In practice this means the following:

Alignment cards cannot be ordered for **the Boxster and Boxster S**.

Prepare copies of the corresponding alignment card shown.

**Before measurement**, enter the general data, vehicle model and the missing nominal values into the copied alignment card.

**Actual values that are equal for all designs have already been entered.**

Enter the appropriate version, e.g. USA, RoW series or RoW sport, in the **Model** column.

Carry out **incoming measurement** (actual state) and enter the values in the alignment card.

After adjustments (if any were necessary), enter the current values in the column **Outgoing measurement**.

**Porsche measurement of running gear Boxster**

Customer:			Rep. Order No.:		
Street:			Vehicle Ident No.:		
Place:			License number:		
Telephone:			Date of first registration:		
			Odometer reading: km/miles		
Measurement made by:			Date/Signature:		
<b>Vehicle: Boxster (986) Model:</b> Measurement precondition (vehicle weight): empty weight as in DIN 70020. This means: full fuel tank, vehicle with spare wheel and tools.					
Reason for measurement:					
Make of tyres:		Size/model: front		rear	
		front left	front right	rear left	rear right
Tyre pressure (cold tyres) bar					
Tyre/wheel (any damage)					
Tyres - tread depth (mm)					
		<b>Incoming measurement</b>	Nominal values max. difference L /R		<b>Outgoing measurement</b>
<b>Ve- hicle height</b>	Front height (mm)	left right			
	Rear height (mm)	left right			
<b>Rear axle</b>	Camber	left right		20'	
	Toe	left right total		+0°05' / +0°05' - 0°05' +0°10' / +0°10' - 0°10'	
	Drive-axle angle			+0°00' / +0°10' - 0°10'	
	Caster	left right		+8° / +0°30' - 0°30' 40'	
<b>Front axle</b>	Toe-difference angle	left right			
	Camber	left right		20'	
	Toe	left right		+0°03' / +0°03' - 0°03'	
				+ 0°05' / + 0°05' - 0°05'	

# Porsche measurement of running gear Boxster S

Customer:			Rep. Order No.:		
Street:			Vehicle Ident No.:		
Place:			License number:		
Telephone:			Date of first registration:		
			Odometer reading: km/miles		
Measurement made by:			Date/Signature:		
<b>Vehicle: Boxster S</b>					
Measurement precondition (vehicle weight): empty weight as in DIN 70020.					
This means: full fuel tank and vehicle with tools.					
Reason for measurement:					
Make of tyres:		Size/model: front		rear	
		front left	front right	rear left	rear right
Tyre pressure (cold tyres) bar					
Tyre/wheel (any damage)					
Tyres - tread depth (mm)					
		<b>Incoming measurement</b>		Nominal values max. difference L /R	<b>Outgoing measurement</b>
<b>Veh- icle height</b>	Front height/wheel left	/			/
	load (mm / kg) right	/			/
	Rear height/wheel left	/			/
	load (mm / kg) right	/			/
<b>Rear axle</b>	Camber left			20'	
	right				
	Toe left			+0°05' / +0°05' - 0°00'	
	right				
	total			+0°10' / +0°10' - 0°00'	
	Drive-axle angle			+0°00' / +0°10' - 0°10'	
<b>Front axle</b>	Caster left			+8° / +0°30' - 0°30'	
	right			40'	
	Toe-difference angle left				
	right				
	Camber left			20'	
	right				
	Toe left			+0°03' / +0°03' - 0°03'	
	right				
	total			+ 0°05' / + 0°05' - 0°05'	

## 44 Suspension alignment, complete

### Important notes

Suspension alignment on the Boxster differs in a number of respects from that on previous Porsche models. This involves the vehicle height adjustment, the wheel-load difference from left to right, special tools and corrections to wheel alignment.

### Vehicle height/wheel load

There is no facility for adjusting the vehicle height. This applies to both the front and the rear axle. The varying thickness of rubber pads between coil springs and spring seats on the right and left spring struts on the front and rear axles is not available for changing vehicle height but for compensating for differences in coil-spring load groups.

Since the vehicle height can no longer be adjusted, **there is no need for adjustment** (fine adjustment) of the wheel-load difference left to right at the front and rear axles. Because of the number of equipment variants (additional equipment), a **greater** wheel-load difference left to right is permissible than previously was the case in Porsche suspension alignment (over 20 kg is possible; max. was previously 20 kg). This is partly a result of heavier components compared with standard equipment and partly results from additional components that are asymmetrically arranged.

### Wheel-alignment corrections

**Rear axle:** The kinematic toe-in is not adjustable. Camber and toe can be adjusted via eccentrics.

**Front axle:** The caster is not adjustable as standard. In the event of repairs, a caster adjustment facility can be installed if necessary. Please refer to the description on pages 40-13 / 40-14.

Camber is adjusted by laterally displacing the spring strut. For this purpose, loosen the three fastening nuts of the spring-strut mount.

After adjusting the toe, **the lock nuts** on the track rods must be tightened to the prescribed tightening torque **of 50 Nm**.

### Special tools

No special tools are required. The prescribed tightening torque values at adjusters can be obtained with commercially available tools in conjunction with an commercially available torque wrench.



### General procedure for wheel alignment

Carry out suspension alignment with an optical or electronic wheel alignment tester. The measurement procedures should be taken from the operating instructions for the wheel alignment tester involved. In order to exclude erroneous measurements, the following preconditions must be met before alignment and the following points should be given special attention:

Empty weight of vehicle in accordance with DIN 70020, i.e. car ready for the road, with full fuel tank, spare wheel and tools.

Ball-joint and wheel-bearing play in order (wheel-bearing play cannot be adjusted)

Tyre pressure in accordance with regulations, fairly uniform tyre tread.

Quick-clamping holder with adapter (for the measured-value pickups) correctly secured to the wheels.

**Receiving surfaces** for the quick-clamping holder **on the wheels** and the adapter surfaces **must be clean and flat**. Always check the levelling surface on the wheels for precision in particular before fitting the quick-clamping holders.

Strictly comply with maintenance intervals for measuring equipment and measuring platform. If the levelling of the measuring platform is done in-house, levelling equipment is required. A hose level is inadequate.

Skilled handling of measuring equipment and measuring platform.

Sliding plates with transverse motion (rotary motion) at the rear axle are advisable.

Observe the Technical Literature of PAG, the manufacturer of the measuring equipment and the manufacturer of the measuring platform.

**Do not treat** measured values as a whole, **but very critically** in regard to driving dynamics, high-speed strength of the tyres, tyre wear and cost/benefit effects (time required for correction of insubstantial deviations). The **toe values** are of decisive significance for **driving dynamics and tyre wear**.

If the vehicle is measured front and rear, check and adjust the **wheel alignment values at the rear axle first**. Camber values at the front axle apply for the straight-ahead position of the wheels. Steering wheel and steering gear in center position when toe is being adjusted.

Before wheel alignment values are adjusted at front and rear axles, it is recommended that the vehicle height be checked at the DIN empty weight. Conclusions can then be drawn about wheel alignment values in the event of any suspension alignment that becomes necessary later.

## Vehicle height (height check)

### General

The vehicle height at front and rear axle is **not** adjustable.

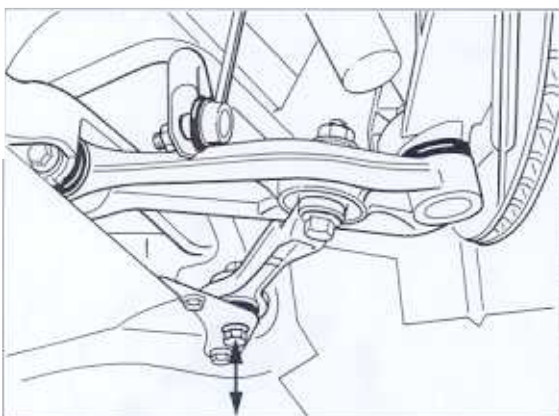
### Preliminary work

For the **height check**, place the vehicle on a level surface or on the measuring platform (ready to drive, with a full tank, spare wheel and tools). Compress vehicle by approximately 25 mm 2-3 times and allow it to spring back freely.

### Front axle

Measure from road contact surface to the lower edge of the hexagon-head bolt of the tension-strut screw connection to the body.

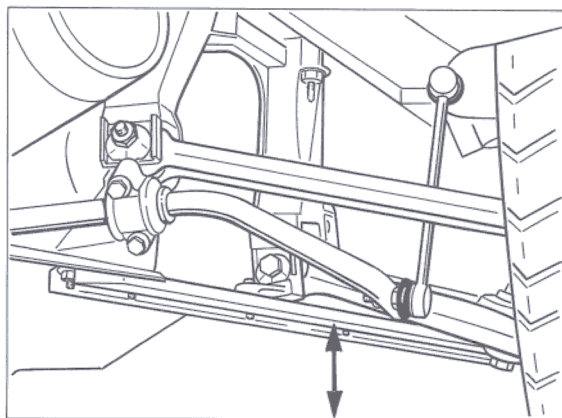
Nominal values for front and rear axles are given on Page 44 - 3.



17/2 - 96

### Rear axle

Measure from the road contact surface to the lowest surface of the diagonal brace at the control-arm securing point.



15/2 - 96

## Wheel alignment

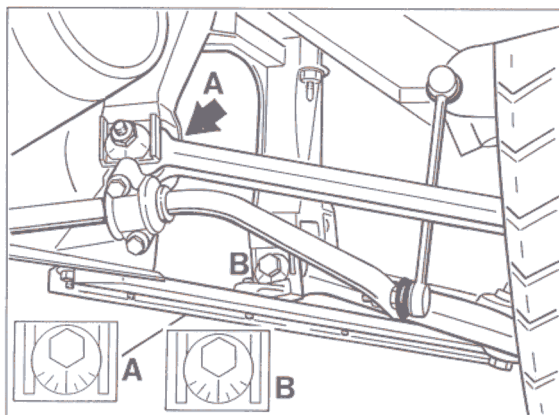
### Notes

Only check or adjust wheel alignment values when prescribed preconditions are met (Page 44 - 10).

If the vehicle is measured front and rear, check and adjust the rear axle first.

Nominal values are given on Page 44 - 4 / 44 - 5.

After the adjustment, tighten the appropriate screwed connections with the prescribed tightening torque. See tables in Rep. Gr. 40 and 42.



15/1 - 96

### Rear axle

Prepare vehicle for checking and/or adjustment of wheel alignment values. Place front wheels on rotary table and rear wheels on rotary / sliding plates. Compress vehicle by approximately 25 mm 2-3 times and allow it to spring back freely.

#### Adjusting toe

After loosening the lock nut, turn eccentric A appropriately.

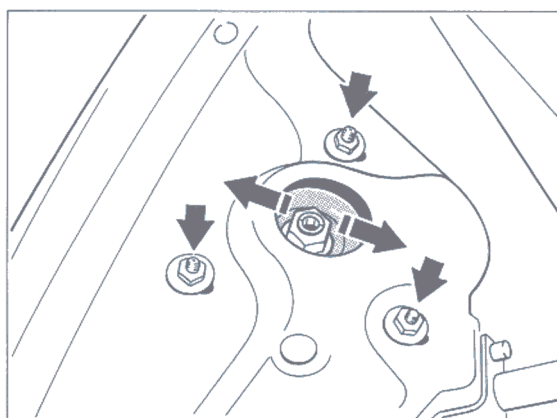
#### Adjusting camber

After loosening the lock nut, turn eccentric B appropriately.

### Front axle

#### Adjusting camber

The camber is adjusted by moving the spring strut transversely. For this purpose, loosen the three fastening nuts on the spring-strut mount and, for the purpose of displacement, remove the covering cap on the piston rod.



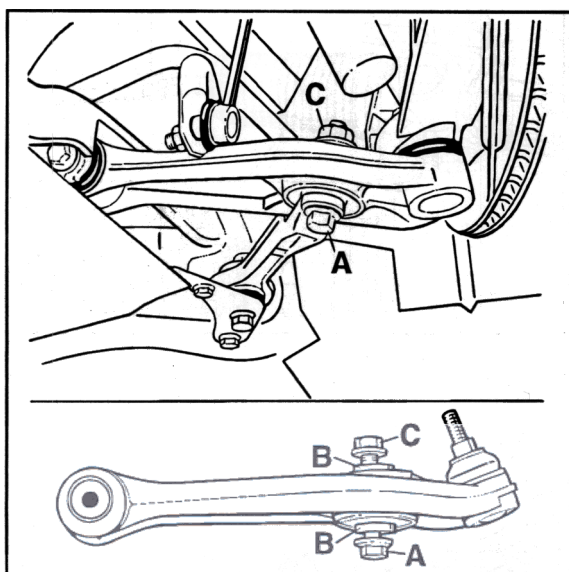
16 - 96

### Adjusting caster

The caster is not adjustable on **standard vehicles**. In the event of repairs, a caster adjustment facility can be installed if necessary. Refer to Serv. No. 40 19 (in repair group 40) for a description and for requirements.

**On vehicles with a caster adjustment facility**, adjust the caster by turning the special screw (A) with the fastening nut (C) loosened. Values on P. 44-4.

Then tighten the fastening nut (C) to 160 Nm (118 ftlb.).



481\_97

- A = Special screw
- B = 2 eccentrics
- C = Fastening nut

### Adjusting toe

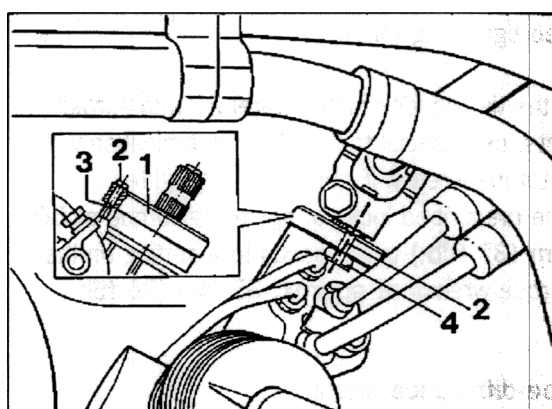
**Preliminary work:** Check whether the steering wheel is displaced with respect to the steering gear. To do this, centre the steering gear as described below.

Turn wheels to the straight-ahead position.

Then readjust the front wheel alignment, if necessary, until pin No. 2 in driver No. 1 and the lug on the steering gear housing No. 4 line up.

No. 3 is the desired breaking point for pins **in new steering gears**. (New) pin No. 2 is inserted into driver No. 1 and lies with its underside within the recess of lug No. 4. This locks the steering gear in the centre position. **After installation of a new steering gear**, the lower part of the pin is sheared off (at the desired breaking point No. 3) by turning the steering wheel. The upper part of the pin remains in the driver.

If necessary, reposition the steering wheel. When doing this, seek the best position.



19\_1\_96

**Warning!**

A triggering of the airbag (malfunction in the airbag system) caused by improper work on airbag components cannot be ruled out!

In the case of such a malfunction, an unsuitable steering wheel holder could cause injury or damage!

- > Use only steering wheel holders which **do not** project into the area of the airbag unit!
- > Observe safety regulations when working with airbag vehicles (see in Repair Group 69)!

Clamp steering wheel in **centre position** with **steering wheel holder** (Picture 106\_96).

Use only steering wheel holders which **do not** project into the area of the airbag unit! If necessary, shorten the guide rod (A) at top (arrow).

Then adjust **toe** at hexagon No. 2 of the track rod(s) after loosening the lock nut(s) No. 1 (Picture 133\_1\_96).

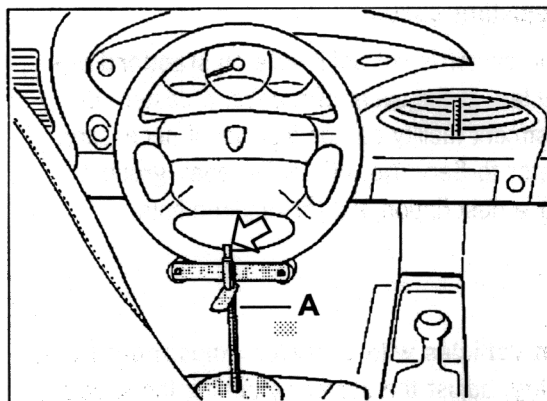
Then tighten the lock nut(s) No. 1 to the prescribed tightening torque.

If the tie rod lock nut(s) is(are) 21 mm across flats, use special tool 9625 in combination with a torque wrench (Figure 7\_97) to tighten.

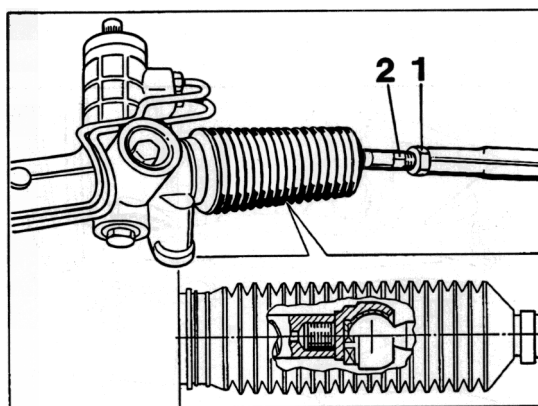
The prescribed lock nut tightening torque of **50 Nm (37 ftlb.)** corresponds to a setting on the torque wrench of **approx. 35 Nm (26 ftlb.)**.

**Toe-difference angle**

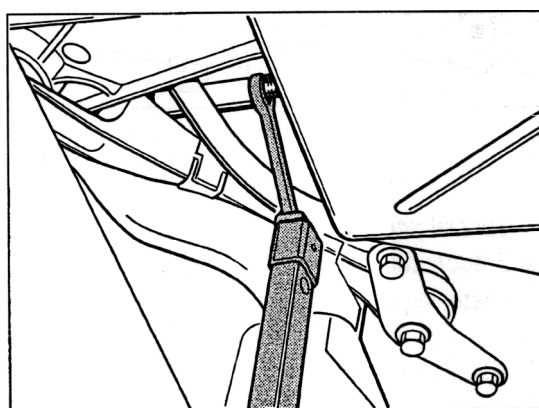
The toe-difference angle is not adjustable.



106\_96



133\_1\_96



Special tool 9625

7\_97



## 44 General tyre mounting instructions

### General

**Always use new rubber valves when changing tyres!**

**Important:** When mounting tyres, observe the direction of rotation or inside/outside identification.

When mounting tubeless tyres, check the sealing surface of the tyre and the disk wheel for cleanliness and any signs of damage. Bear in mind here that the bead base performs the sealing function on tubeless tyres. If the bead edge has to perform the sealing function, air can escape when the vehicle is driven aggressively (rabbit starts, hard cornering, etc.).

When mounting the tyre beads, use only the tyre mounting pastes specified below. The following can occur if an unsuitable mounting paste is used:

Turning of the tyre on the wheel, fracture of the bead core when the tyre is mounted and damage to the wheel surface by aggressive substances.

**Important:** Use only TIP TOP Universal, order No. 593 0601 (3.5-kg bucket) or Contifix as the mounting paste.

If Contifix is used, apply sparingly to the tyre bead (due to risk of the tyre turning on the wheel). If possible, the vehicle should not be driven for 24 hours after tyre mounting or matching.

In order to prevent the tyre from turning on the wheel when the vehicle is driven, also inform your customers that they should avoid extreme driving manoeuvres (acceleration, braking) during the first 100 to 200 km **with new or recently mounted tyres**. Mark the relative positions of the tyre and wheel for reference if necessary.

**The absolute limit on how far the tyre can turn on the wheel must be regarded as 20mm. An optimum balancing result will be worsened in this case.**

In order to optimise smoothness of rolling, it is expedient - and necessary in individual cases - to mount the tyre in a favourable position with respect to the wheel (matching).

Matching (**uncontrolled and controlled**) is explained below.

**Uncontrolled matching:** Turning the tyre on the wheel by 90° or 180° if necessary in order to achieve an acceptable value with regard to rolling smoothness (true running, imbalance and distribution of balance weights).

**Controlled matching:** With a balancing machine with matching program. In most cases, this produces an even better result with regard to the rolling smoothness (true running, imbalance and distribution of the balance weights) than can be achieved with uncontrolled matching.

Maximum permissible radial runout and lateral runout of the light alloy wheels = 0.7 mm.  
Maximum permissible radial runout and lateral runout of the wheel with tyre = 1.25 mm.  
Values less than 1.0 mm –, better around 0.5 mm –, are desirable.

After mounting the tubeless tyres, inflate them without valve insert to approximately 3 bar gauge pressure in order to ensure that they are seated properly on the wheel.

At the latest when the pressure reaches 3.0 bar, the tyre beads must pop out of the deep bed and over the hump of the wheel shoulder in order to avoid fractures of the bead core. If necessary, interrupt the process and coat all necessary surfaces with lubricant (tyre mounting paste) again. Then repeat the process. Screw in the valve insert and set the prescribed tyre pressure (Page 44 - 1).

If new tyres are to be mounted or the tyres of one axle are to be replaced, tyres of the same make and with the same specification code must always be used on each of the two axles. If tyres are replaced on one axle only, the different tread depth than on the other axle can cause a noticeable change in the familiar handling.

**This is especially the case if new tyres are mounted on the rear axle. This effect decreases with increasing tyre mileage.**

If a tyre is damaged and it cannot be determined with absolute certainty that there is no ply damage - with all of its consequences - or if the tyre was thermally or mechanically overloaded due to a loss of pressure or other prior damage, we recommend replacement of the tyre in question for safety reasons.

When replacing a tyre on an axle, make sure that the tread depth of the new tyre does not differ from that of the other tyre by more than 30 %.

Repairs on "ZR" tyres are impermissible, as is the use of inner tubes in tubeless tyres.

The overview of summer and winter tyres and wheels is included in Technical Information (TI), Group 4.

Always observe the tyre specification code when replacing summer tyres. The specification code N1, N2, N3 or N0 distinguishes summer tyres expressly approved by Porsche from other versions of the same tyre type and size.

### Tyre age

High-speed ZR tyres in particular should not be too old - **never older than 6 years.**

The age of the tyre can be determined via the manufacturer's code, which is listed behind the DOT code on the tyre sidewall. The date of manufacture (the last three digits) is located at



the end of the code.

**For the years 1990 to 1999**, the 3-digit code is sometimes supplemented by a **"triangle suffix"**. (Distinguishing feature.)

**Example:**

DOT DM CP 05 Y **065**

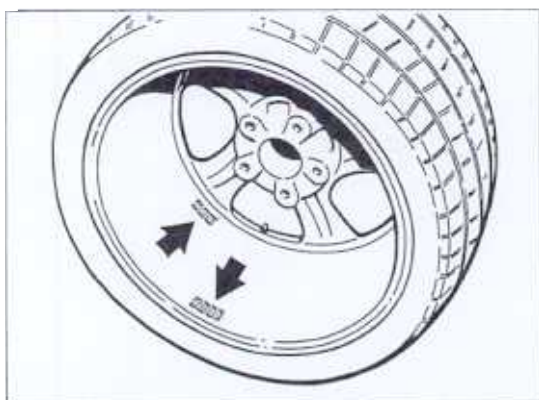
**06** = Production week 6

**5** = Production year 1995

**Balancing weights**

**Type of balancing weights:** Adhesive weights as used previously (no special version necessary). See Spare Parts catalogue.

**Arrangement:** Affix both weights on the inner side (arrows).\*



693 - 96

**Mounting wheel on vehicle**

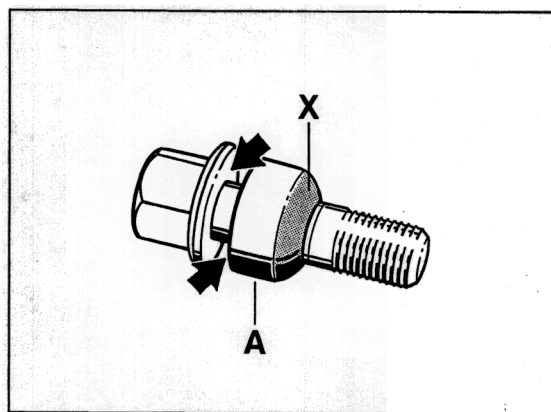
The wheels are mounted using M 14 x 1.5 wheel bolts. **The wheel bolt consists of two parts that are permanently connected to each other. Other wheel bolts must not be used.**

Use suitable commercially available tools (wrench size 19 mm). **Never use an impact bolter to tighten the wheel bolts.**

Always apply a thin coat of Optimoly TA (aluminium paste) (arrows) on the thread of the wheel bolts, on the shank and between the bolt head bearing surface and spherical cap ring (under the head).

**Do not coat the spherical cap surface of the wheel bolts that faces the wheel (X).**

In the case of heavy soiling, first clean the wheel bolt and the spherical caps in the wheel with a lint-free cloth.



8/1 - 97

Observe program selection and operating instructions of the balancing machine.

A = Spherical cap ring (captive on wheel bolt)  
X = Do **not** grease bearing surface of spherical cap ring that faces the wheel

**Damaged wheel** bolts must always be replaced. This damage includes mechanical damage to the thread, the spherical cap and damage resulting from **seizure** of the bolt head bearing surface and spherical cap ring.

It must be possible to rotate the spherical cap ring and shift it in axial direction on the bolt shank.

**Rework on wheel bolts is impermissible.**

Screw in wheel bolts by hand and then tighten evenly. Start at the top when tightening.

Always observe the specified tightening torque of **130 Nm (96 ftlb.)**.

## 44 Checking disc wheels

### Checking the radial and lateral runout

The measuring points for radial and lateral runout on the inside of the wheel are given in the following drawing (dimension "a").

**Maximum** permissible radial runout and lateral runout of the **light alloy wheels** = **0.7 mm**.

**Maximum** permissible radial runout and lateral runout of the **wheel with tyre** = **1.25 mm**.

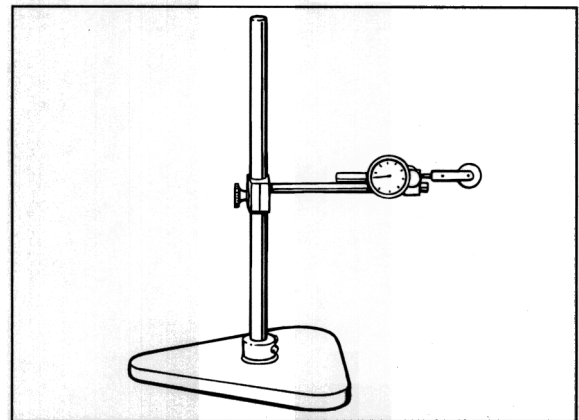
Values less than 1.0 mm – better around 0.5 mm – are desirable.

Also see Page 44-15/44-16.

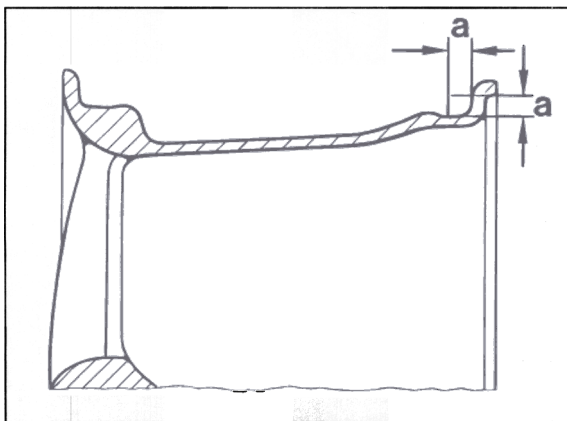
**Important:** Straightening and welding work on light alloy wheels is not permissible.

### Note

Use a tyre measuring gauge – e.g. V.A.G. 1435 – to measure wheels without tyres and wheels with tyres.



2272-44



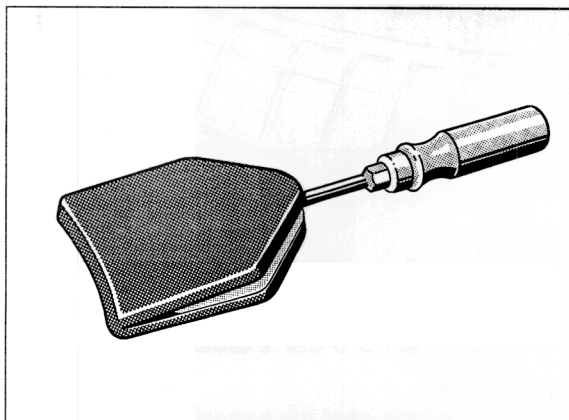
2273-44

Dimension "a" = 8 mm

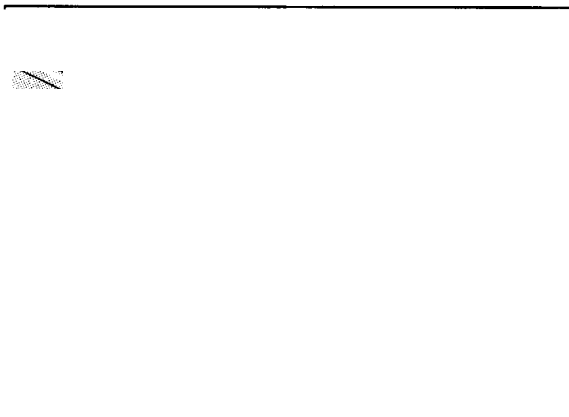
## 44 Tyre mounting with conventional mounting machines

### Instructions / tools

- In order to avoid paint damage, cover the rim flange with adhesive tape after pressing off.
- A holding down device – special tool 9593 – is required for tyre removal/mounting. Furthermore, the end of the mounting lever should be flattened and then rounded (arrow).



1012-44



1013-44

### Tyre mounting

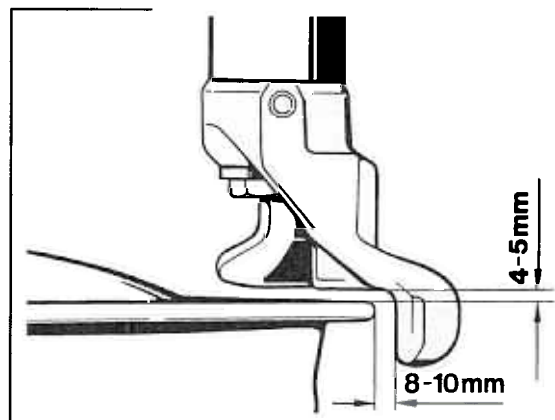
- Clamp wheel and coat inside of wheel and both tyre beads with mounting paste. The rubber valve must be replaced each time a tyre is mounted. When fitting tyres, the direction of rotation and the inner and outer sides should be noted if necessary.

#### Important:

Use only TIP TOP Universal, order No. 593 0601 (3.5 kg bucket) or Contifix as the tyre mounting paste.

See Page 44-15 for **important information** about these tyre mounting pastes.

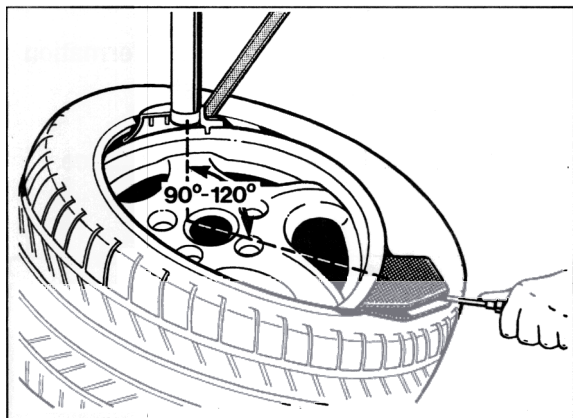
- Set mounting tool to the correct distance.



- Fit the first tyre bead following the usual procedure.

At the start of the mounting process for the **second bead**, the mounting arm should be **positioned opposite to the valve**. Then place the second tyre bead on the tyre as flat as possible, guide over the mounting head and hold down offset by approx. 90 - 120° with special tool 9539.

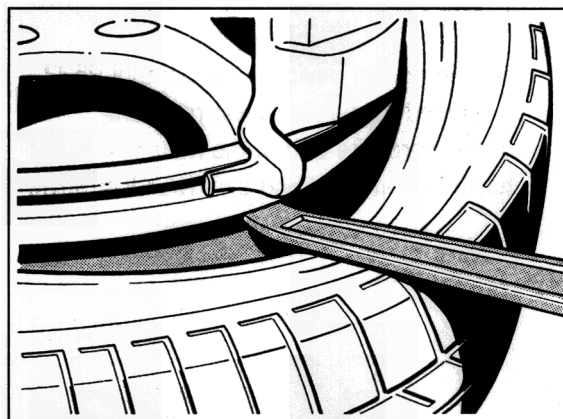
During the rotation and mounting of the **second bead**, the tyre bead must be held in the well base with a second tyre mounting lever and special tool 9539.



535\_97

### Note

It may be necessary (depending on the tyre/wheel combination) to position the additional tyre mounting lever below the hump.



536\_97

The beads must pop over the hump when the tyre is being filled – at the latest when 3.0 bar excess pressure is reached.

If necessary, coat the tyre with mounting paste again.

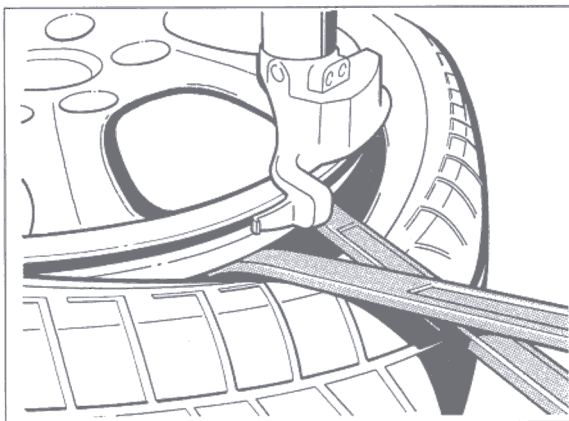
### Tyre removal

- Adjust the mounting head as for mounting (Figure 539\_97).

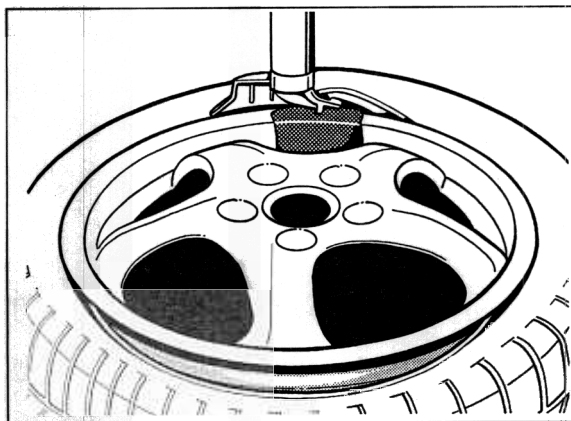
Press off tyre on both sides.

Coat tyre and the rim flange with mounting paste.

Lift the **first side of the tyre** over the mounting head (Figure 537\_97). Place a cloth or piece of leather between the wheel and mounting lever. Furthermore, make sure that the tyre is held in the well base opposite to the removal head (Figure 538\_97). Use special tool 9539 for this purpose.



537\_97



538\_97

Remove the **second side of the tyre** following the usual procedure.

## 44 Identifying size for 18-inch Turbo wheels

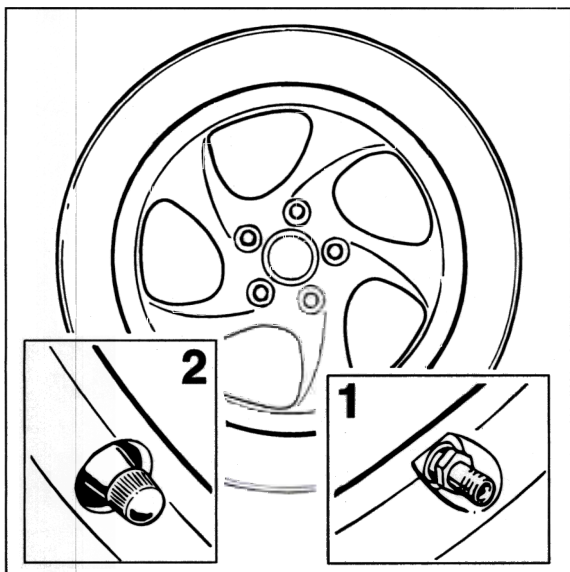
### General

Identifying **18-inch Turbo wheels** (Technologie wheels / hollow spoke wheels) with the dimensions **9J x 18 RO 52** and **10J x 18 RO 65** (RO= Rim Offset) is only possible when the wheels are disassembled.

These wheels can also be fitted on the 911 Carrera (1993) and the 911 Carrera (1996). Refer to the Technical Information, Group 4, Wheels and tyres overview, for the respective wheel alignment.

The basic difference between **Turbo wheels** (Technologie wheels / hollow spoke wheels) and **Turbo Look wheels** (Turbolook Design wheels) is their valves:

Turbo wheel:           screwed-in steel valve  
Turbo Look wheel:   rubber valve



1 - screwed-in steel valve  
2 - rubber valve

471\_98

### Identifying the wheel size:

Markings on the inner side of the wheels identify **18-inch Turbo wheels** with the sizes **9J x 18 RO 52** and **10J x 18 RO 65**.

The sizes together with the rim offset (RO) and spare part number are marked with A or B. The correct version for the model is marked with an X which is struck into the "A" or "B" boxes provided.

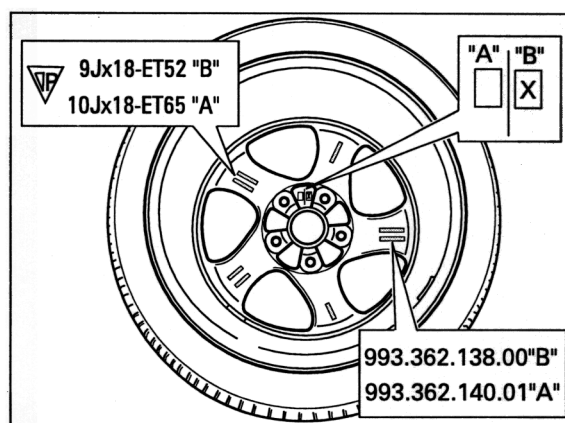


Figure shows model "B".

448\_98

### Marking "A"

18-inch Turbo wheel: **10 J x 18 - RO 65**  
Spare Part No. 993 362 140 01.

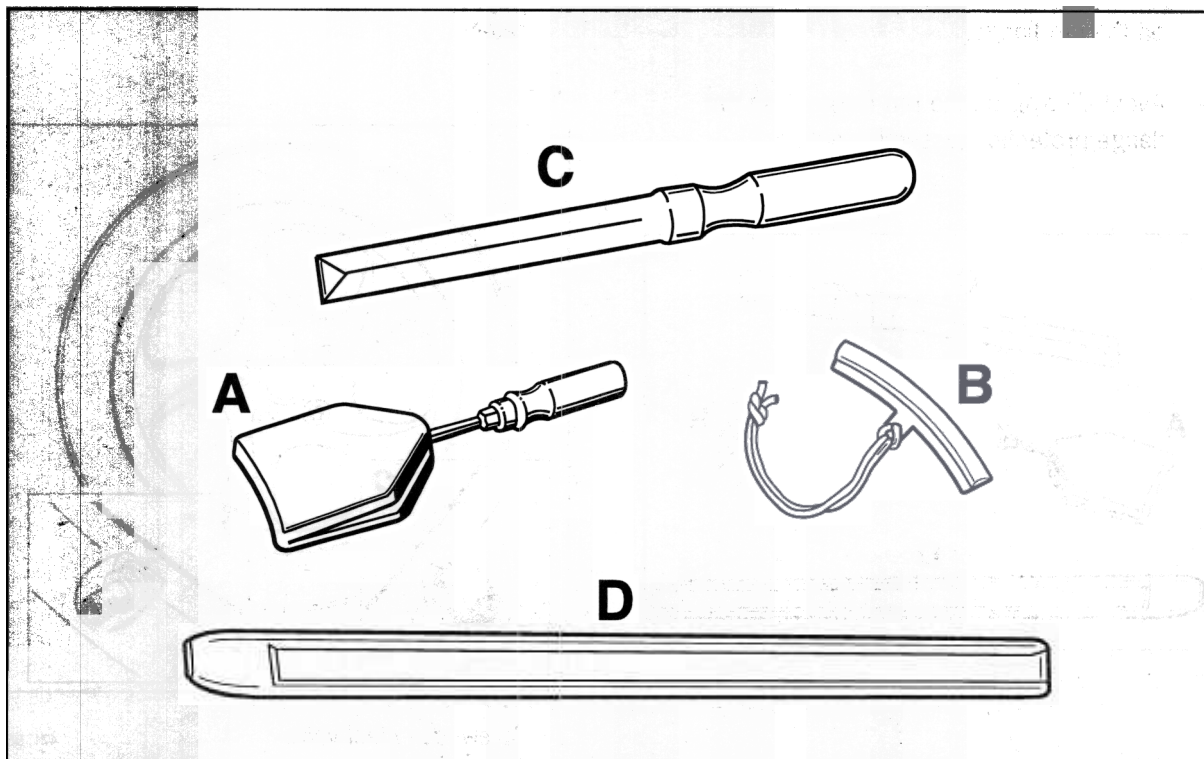
### Marking "B"

18-inch Turbo wheel: **9 J x 18 - RO 52**  
Spare Part No. 993 362 138 00.



**44 Tyre mounting for critical wheels/tyre pairs****Note**

The mounting machine described here is particularly suitable for difficult tyre constellations. All parts in contact with the wheel and the tyres are made of plastic. No large point load for wheel and tyres.

**Tools**

434\_99

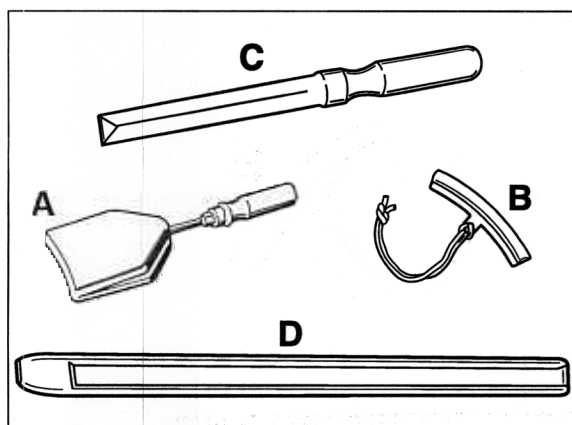
Item	Designation	Special tool	Explanation
A	Holding-down device	9539	To hold down the tyre bead
B	Assembly aid	Commercially available; refer to Workshop Equipment Manual, Chapter 2.5	As protection for the rim flange
C	Adhesive weight remover	Commercially available	
D	Mounting lever	Commercially available	

## Notes on removing/mounting tyres

Use "TIP TOP Universal" tyre paste, order No. 593 0601 or "Contifix" for fitting.

Ensure that no damage (scoring, soiling) is caused to the assembly head of the fitting machine during fitting. Such damage may result in paint damage and pressure marks on the rim flange.

Avoid slipping on the rim flange. Use rim flange protection (assembly aid B).

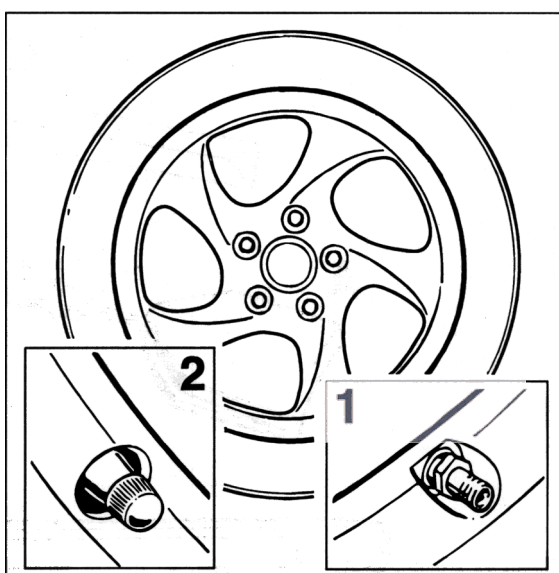


434\_99

Adhesive tape can be used to protect the rim flange in individual cases, in order to prevent any paint damage during fitting. The mounting lever can also be covered with adhesive tape in order to avoid damaging the area around the spokes during removal.

The rubber valves must always be replaced.

Steel valves – for 18-inch Turbo wheels – do not usually need to be replaced when a tyre change is necessary. The steel valves should, however, be replaced after every second tyre change or after 3 years at the latest.



471\_98

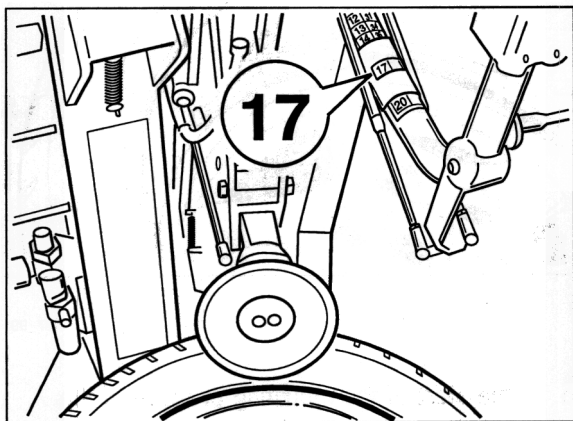
- 1 - Screwed-in steel valve (on Turbo wheel)
- 2 - Rubber valve (on Turbo Look wheel)

Check the wheel for damage.

Observe the running direction or the inside and outside of the tyre.

## Removal

1. Clamp wheel.
2. When pushing off the tyre, ensure that the bead press-off tool is set to the exact inch graduation. If this is not the case, the rim flange may be damaged by the press-off rollers.



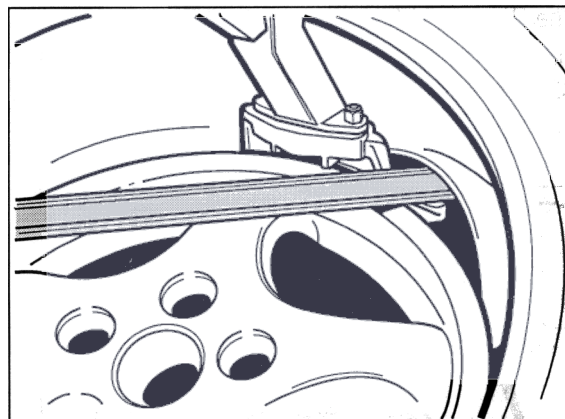
435\_99

3. The wheel must be turned anti-clockwise when pressing the tyre off the rim. Otherwise, excessive forces occur on the fastening bolts of the machine which can lead to bolt breakage.  
The tyre beads can be pressed off at the same time or individually.
4. Before removing the tyre, coat the tyre bead with mounting paste to facilitate removal.

5. Put the assembly head on the rim flange.  
Position the assembly aid. The mounting lever is pushed into the deep bed underneath the first tyre bead, and then guided over the assembly shoe and pushed down.

### Note

The mounting lever must be kept at a safe distance from the rim. This prevents damage (scratches, pressure marks) to the rim spokes.



436\_99

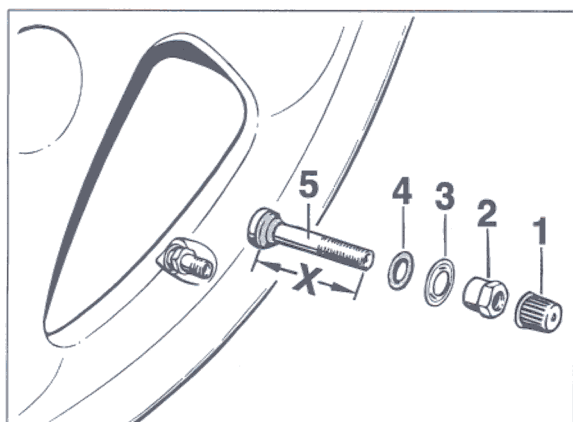
6. Lift the tyre bead out of the rim bed by **turning the wheel to the right**.
7. Position the assembly aid for the **second** tyre bead. Pull the tyre upwards and push it into the rim bed underneath the second tyre bead using the mounting lever.  
Make sure that the mounting lever is guided correctly (see Point 5).  
**Turn the wheel to the right** and remove the tyre.

## Fitting

1. Free the wheel from the abraded rubber particles and check for damage.
2. A new rubber valve must always be fitted.  
For wheels with steel valves (Turbo wheels), the valves can be reused if they are not damaged. The valves should, however, be replaced after every second tyre change or after 3 years at the latest.

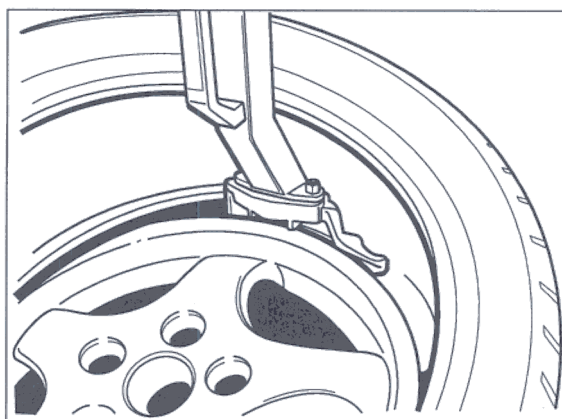
### Note

Do not use commercially available steel valves. The Porsche valves are shorter (dimension X, Figure 460\_99). The Porsche version measures 43 mm.



460\_99

5. Guide the tyre bead through the assembly head. Fit the tyre bead in the deep bed by turning the wheel to the right.

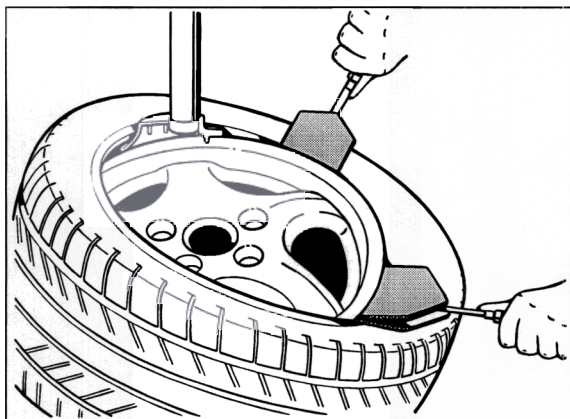


437\_99

6. At the start of the mounting process of the second tyre bead, the mounting arm should be positioned opposite to the valve. This prevents damage to the valve.
7. Press the second tyre bead onto the wheel as flat as possible and guide through the assembly head.

3. Coat the wheel and tyre with tyre mounting paste - TIP TOP Universal, order No. 593 0601 or Contifix.
4. Place the tyre in the correct position on the wheel. Push in mounting arm and position top of the rim flange.

8. Insert first holding-down device and position the second holding-down device offset by 90° - 120°. Fit tyre bead in deep bed by turning to the right.



438\_99

9. Fill tyre with compressed air.  
At approx. 4.0 bar, the beads should pop over the hump. Coat the tyre beads with mounting paste again if necessary so that they can pop over easily and gently.

## 45 Important information about ABS 5.3 and ABS/TC 5.3

### General

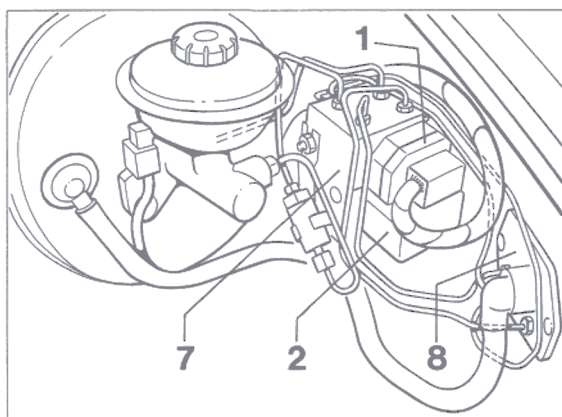
The Porsche Boxster is fitted as **standard** with an anti-lock braking system (ABS 5.3).

"Traction Control (TC)" can be obtained on **special request** on the basis of ABS 5.3.

**Traction Control (TC)** is a combination of anti-slip control (ASR) and Automatic Brake Differential (ABD).

**TC is a further system for increasing driving safety.**

**ABS 5.3** is optimized with regard to installed volume and weight **compared with the ABS 5** (ABS 5 in the 993). Control unit (No. 1), hydraulic unit (No. 7), pump-motor relay and valve relay (No. 2) of ABS 5.3 and ABS/TC 5.3 **are a single unit** that is positioned next to the brake master cylinder.



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**Diagnosis and system checks** on both systems are carried out with the **Porsche System Tester 2**.

### Differences between ABS 5.3 and ABS/TC 5.3

ABS 5.3 = **3-channel** system  
(diagram: see Page 45 - 3).

ABS/TC 5.3 = **4-channel** system  
(diagram: see Page 45 - 5).

The essential **distinguishing features** between ABS and ABS/TC **are:**

Number of brake lines at intermediate piece  
(No. 8 / Figure 181 - 96):

ABS 5.3 = 3 brake lines

ABS/TC 5.3 = 4 brake lines

TC off switch for switching driving-stability control on and off is not available on vehicles with Solo ABS (ABS 5.3)

**TC (ASR/ABD) warning light** and **TC (ASR/ABD) function light** (information light) in vehicles **with ABS/TC**. These lights are lit when the ignition is switched on (lamp check). In vehicles **with ABS 5.3** (Solo ABS) these lamps are **not fitted** in the instrument cluster.

A figure showing the warning and function lights is on Page 45 - 6.



**45 ABS 5.3 (3-channel system) system description****ABS operation**

The ABS control unit receives a signal from the brake light switch and the AC voltage signals from the four speed sensors. These signals are converted into digital wheel-speed signals independently of each other by two microprocessors. The wheel slip (approximately proportional to the computed vehicle reference speed) is formed from these wheel-speed signals.

If vehicle deceleration and excess slip are detected at a wheel, the pressure-holding phase is initiated as the first step, i.e. the inlet valve for the relevant wheel is closed to prevent a further increase in pressure. If in spite of the pressures being held constant the wheel tends to continue locking up, the pressure in the wheel cylinder is reduced. For this purpose, the outlet valve is opened and the brake fluid is pumped back to the brake master cylinder via the return pump (pressure-reduction phase), until the wheel turns again. Then, depending on the control cycle, further appropriate cycles are initiated.

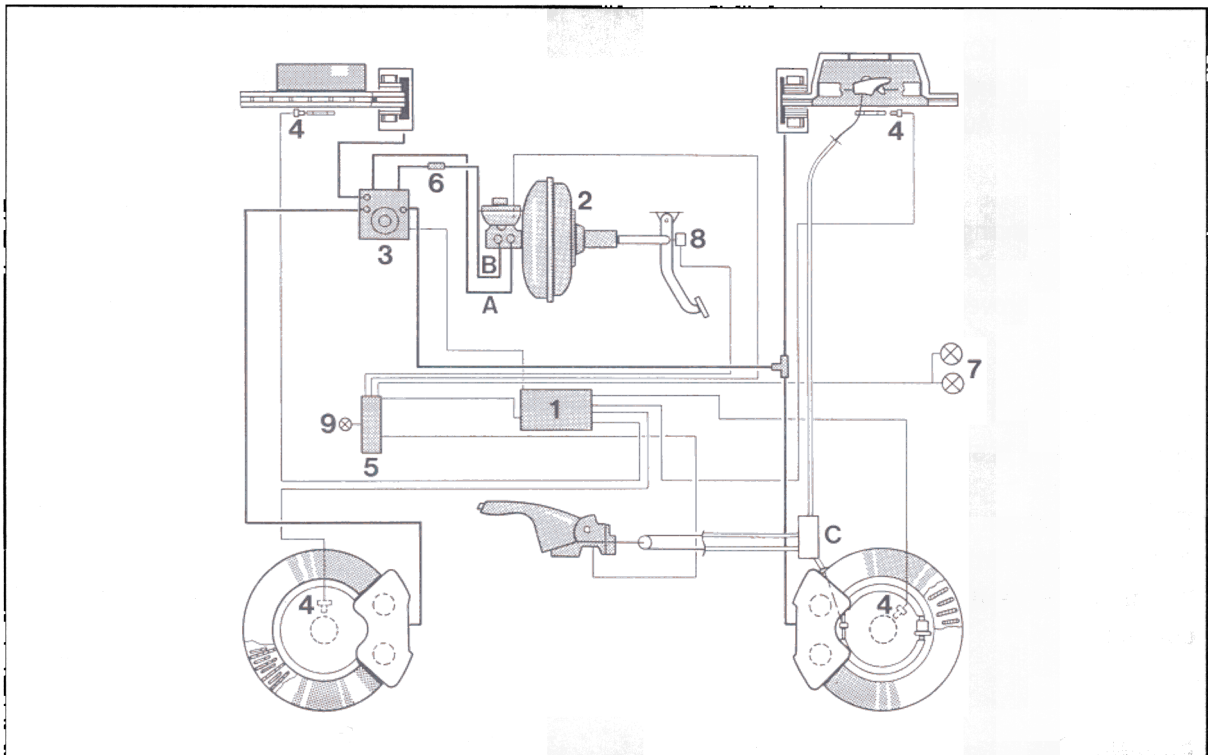
This function and the input signals are continuously monitored. If a fault is detected, the control unit switches the ABS function off, switches on the ABS warning light and stores the fault in a non-volatile memory in the control unit.

In addition, whenever a journey is begun and a speed of 6 km/h is exceeded, a test programme is started. The solenoid valves and the pump motor are electrically actuated and checked. If a fault is detected, the control unit switches the ABS function off, the ABS warning light is switched on and the fault is stored.

Function of the individual components on  
Page 45 - 7



Diagram: ABS 5.3 (3-channel system)



1 – ABS control unit \*

2 – Brake unit (brake booster with tandem brake master cylinder)

3 – ABS hydraulic unit \* (3 hydraulic outputs)

4 – ABS speed sensors

5 – Central Information System

6 – Brake proportioning valve (1x)

7 – Brake light

8 – Brake-light switch

9 – ABS warning light (yellow)

A = Front-axle braking circuit

B = Rear-axle braking circuit

C = Handbrake cable deflection box

Control unit, hydraulic unit, pump-motor relay and valve relay **form a unit**, which is located next to the brake master cylinder.

## 45 ABS/TC 5.3 (4-channel system) system description

### Note

Traction Control (TC) represents an extension of the ABS system and is a combination of anti-slip control (ASR) and Automatic Brake Differential (ABD).

TC prevents spinning of the drive wheels when moving off and accelerating. Driving stability and traction are improved over the entire speed range.

Traction Control (TC) is ready for operation whenever the engine is started.

The TC information light in the instrument panel is lit during a control process **and warns that the driving style must be matched to road conditions.**

### Function

#### Driving-stability control:

If Traction Control (TC) detects that a certain speed difference between the wheels has been exceeded (wheelspin), engine power is automatically reduced.

#### Brake control:

In addition to reducing the engine power (driving-stability control), the TC (via the ABD) brakes the drive wheel that is spinning.

Since this control requires the drive wheels to be individually controlled, the **ABS/TC system is a 4-channel system.**

When doing so, operate the switch for at least 0.1 seconds. An additional 0.3 seconds will then pass until the routine is complete. Only then will driving stability control have been switched off or on.

### Switching off driving-stability control\*

Press the "TC OFF" logo of the rocker switch. Driving-stability control cannot be switched off during a TC control process (information light on).

**One-sided** wheelspin on the drive axle is further prevented by brake control up to a speed of 100 km/h.

Driving stability is not monitored, since the drive wheels can start to spin at the same speed (slip).

With driving-stability control switched off, the TC warning light in the instrument panel and the indicator light in the rocker switch are lit.

It can be advantageous to switch off drive-stability control:

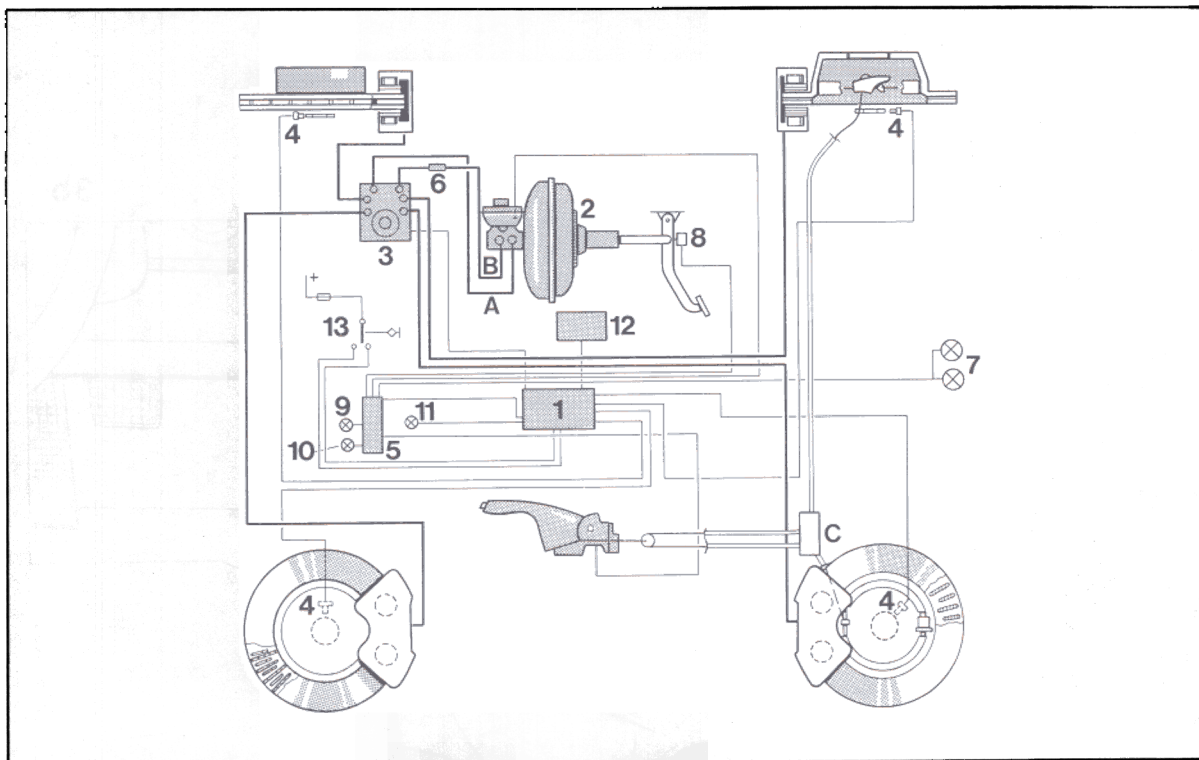
- on a loose surface and in deep snow
- when "rocking" the vehicle free
- when using snow chains.

### Switching driving-stability control back on\*

Press the indicator light in the rocker switch.

Driving-stability control cannot be switched on again during a TC control process (information light on).

Diagram: ABS / TC 5.3 (4-channel system)



1 – **ABS/TC** control unit \*

2 – Brake unit (brake booster with tandem brake master cylinder)

3 – **ABS/TC** hydraulic unit \*  
(4 hydraulic outlets)

4 – ABS speed sensors

5 – Central Information System

6 – Brake proportioning valve (1x)

7 – Brake light

8 – Brake-light switch

9 – **ABS** warning light (yellow)

10 – **TC** warning light (TC/yellow)

11 – **TC** function light (green)

12 – **DME** control unit

13 – TC rocker switch (see Page 45 - 6)

A = Front-axle braking circuit

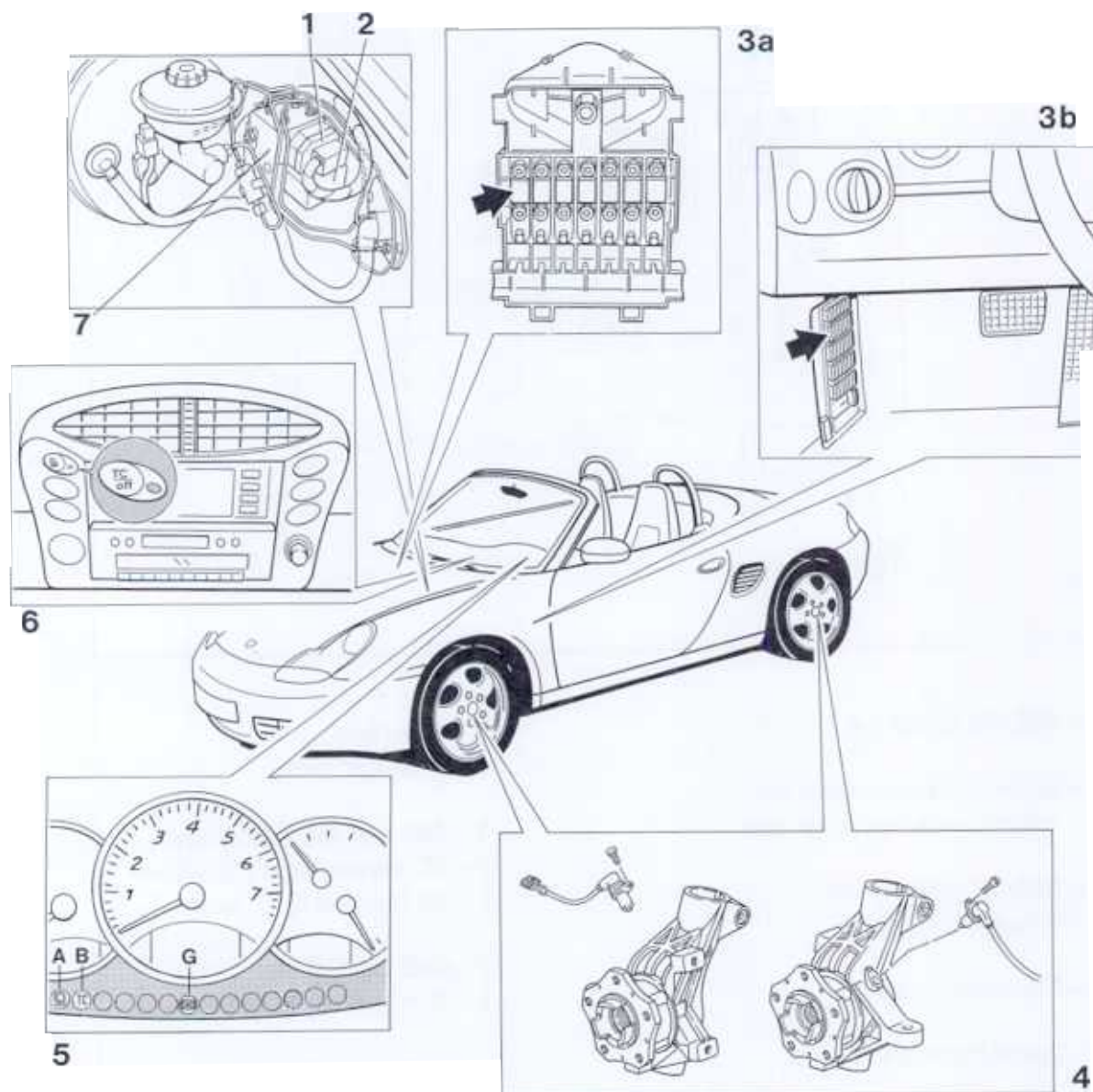
B = Rear-axle braking circuit

C = Handbrake cable deflection box

Control unit, hydraulic unit, pump-motor relay and valve relay form a unit, which is located beside the brake master cylinder.

45

Component arrangement (ABS 5.3 and ABS/TC 5.3)



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## 45 Function of individual components

### 1. Control unit (ABS 5.3 and ABS / TC 5.3)

This unit processes incoming signals and actuates the solenoid valves and/or the return pump in the hydraulic unit when wheel slip is excessive (see also System description).

If the ABS or ABS/TC switches off when detecting a system fault, it actuates the warning light and stores the fault in a non-volatile memory.

#### Note

Control unit and relay are not supplied individually. In the event of replacement, the complete hydraulic unit must be replaced.

### 2. Relay

The **solenoid valve relay** is actuated by the control unit (closes) as soon as the control unit receives voltage from the alternator (D+ / terminal 61).

As soon as the relay has closed (picked up), battery + (terminal 30) is present at the valve coils of all solenoid valves of the hydraulic unit.

If the ABS or the TC (ABD) begins controlling, the control unit applies negative potential to the appropriate valve coil of the valve to be controlled at the appropriate wheel.

The **return pump relay** is actuated (with a negative potential) by the control unit if required, and closes.

As soon as the relay has closed / picked up, battery + (terminal 30), is applied to the return pump, which then runs.

#### Note

The relays cannot be exchanged.

When replacement is necessary, the complete hydraulic unit must be replaced.

### 3. Fuses

#### 3a. A 50-A fuse in the current distributor

(F1 / arrow) protects the return pump and the solenoid valves.

The current distributor is located under the instrument panel. The fastening points are accessible from the luggage-compartment side.

#### 3b. The 15-A fuse F 2/9 (field 2, No. 9) on the central electrical board protects the control unit's electrical supply (ABS and ABS/TC). The arrow points to field 2.

On vehicles with Traction Control (TC), the 15-A fuse F 2/1 (field 2, No. 1) on the central electrical board protects the supply to the "TC off" rocker switch (switch for switching driving-stability control on and off).

### 4. Speed sensors

The speed sensors provide wheel speed information for each wheel to the control unit. These speed sensors operate according to the inductive principle, in which sinusoidal alternating voltages are generated in accordance with the number of teeth on a pulse wheel and at a frequency that is a measure of the wheel speed.

## 5. Warning and information lights

### Note

- A = TC information light (see Page 45 - 6)
- B = TC warning light (see Page 45 - 6)
- G = ABS warning light (see Page 45 - 6)

### Information light for TC (A)

- Lights for a lamp check when ignition is switched on
- Indicates control process (even when driving-stability control is switched off).

### Warning light for TC (B)

- Lights in conjunction with the indicator light in the rocker switch (TC off) for a lamp check when ignition is switched on

In conjunction with the indicator light in the rocker switch, indicates that driving-stability control is off

Indicates defect: TC is out of order

Lights together with the ABS warning light when there is an **ABS fault**.

### Warning light for ABS (G)

- Lights for a lamp check when ignition is switched on

If the ABS warning light lights up **with the engine running**, the ABS has switched off due to a fault.

## 6. TC (OFF) rocker switch with light

### For switching driving-stability control on and off.

The rocker switch has one contact for switching off and another for switching on.

**To switch off**, press the "TC OFF" logo on the rocker switch. This applies a positive voltage to the control unit while the switch is operated. This causes driving-stability control to be switched off.

Driving-stability control cannot be switched off during a TC control process (information light on).

When driving-stability control is off, the TC warning light in the instrument panel and the indicator light in the rocker switch are lit.

**To switch** driving-stability control on, press the indicator light in the rocker switch. This applies a positive voltage to the control unit while the button is operated. This causes driving-stability control to be switched on.

Driving-stability control cannot be switched back on during a TC control process (information light on).

Driving-stability control is ready for operation, i.e. is switched on automatically, whenever the engine is turned on.

System description on Page 45 - 4.

## 7. Hydraulic unit

The hydraulic unit essentially consists of fast-switching electromagnetic valves and a return pump. Regardless of the pressure in the brake master cylinder, the hydraulic unit can change the fluid pressure to the wheel brake cylinders (holding or reducing pressure). Increasing the pressure above that of the brake master cylinder is not possible, however.

The **ABS 5.3 hydraulic unit** has **three hydraulic outputs (3-channel system)** and six electromagnetic valves (three inlet and three outlet valves).

The **ABS / TC 5.3 hydraulic unit** has **four hydraulic outputs (4-channel system)** and ten electromagnetic valves (four inlet valves / four outlet valves, one switch-over valve and one intake valve).

The intake and switch-over valves are required so that the return pump can perform **two tasks**:

- I. Return flow to the brake master cylinder (pressure reduction) for **ABS control**.
- II. Supply (pressure increase) to the right or left rear-wheel brake cylinder for **TC control (ABD control)**.

In the case of **ABS control** at the rear axle, the solenoid valves for both rear wheels are actuated in parallel (joint control as in Solo ABS control (3-channel system)).



## 45 ABS check with Porsche System Tester 2

### Important instructions for ABS and ABS/TC

If work has been done on the hydraulic unit No. 7, the speed sensors and the cable harness or if the hydraulic unit is replaced, a **system check (functional check)** must be performed with the **Porsche System Tester 2 \***. This is the case, for example, after accident repairs. This prevents any confusion of electrical or hydraulic lines and ensures **faultless operation of the system**.

If certain brake lines are replaced, e.g. at the intermediate piece in the front-left wheel housing (No. 8), **a system check also must be performed**. The hydraulic allocation could be incorrect in spite of the different threads (M12 x 1 and M 10 x 1), due to unintentional bending of the brake lines.

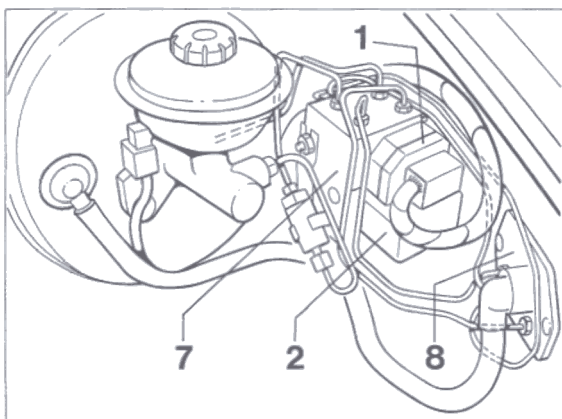
2. If there is a fault indication during operation (when no assembly work was carried out beforehand), **diagnosis and troubleshooting** are also carried out with the **Porsche System Tester 2 \***.

To do this, select the ABS or ABS/TC system and read out the fault memory there.

The fault can then be localized using the appropriate menus (Actuators/ Actual values).

### \* Porsche System Tester 2

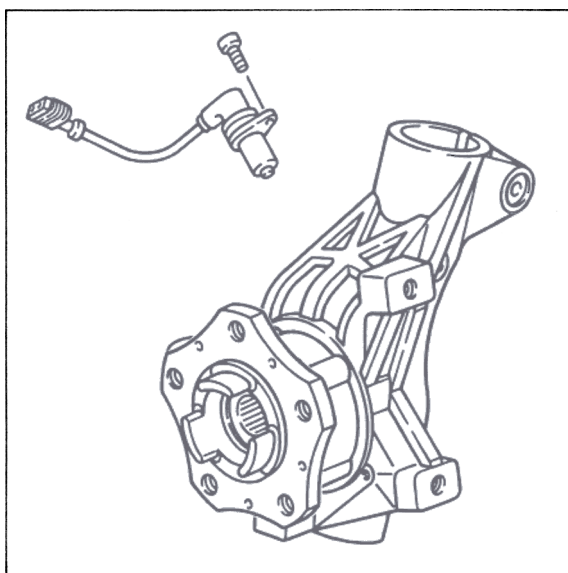
This new Porsche System Tester will be available in Autumn 1996.



181-96

**45 11 19 Removing and installing front speed sensors****Removal**

1. With ignition switched off, open the combination plug connection at the spring strut and pull out the plug for the speed sensor.
2. Loosen fastening screw (hexagon socket head bolt) and remove the speed sensor.



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**Installation**

1. Coat speed sensor and the bore in the wheel carrier with Molykote Longterm 2.

**Note**

There is no O-ring between speed sensor and wheel carrier.

The speed sensors at front and rear axles are the same.

2. Without using excessive force, insert speed sensor into wheel carrier and tighten the hexagon socket head bolt to 10 Nm (7 ftlb.).
3. If the speed sensor has been removed or replaced due to an ABS fault or Traction Control fault, or because of accident repairs, a functional check should be carried out with the Porsche System Tester 2 – via the Actual Values menu, Speed submenu.

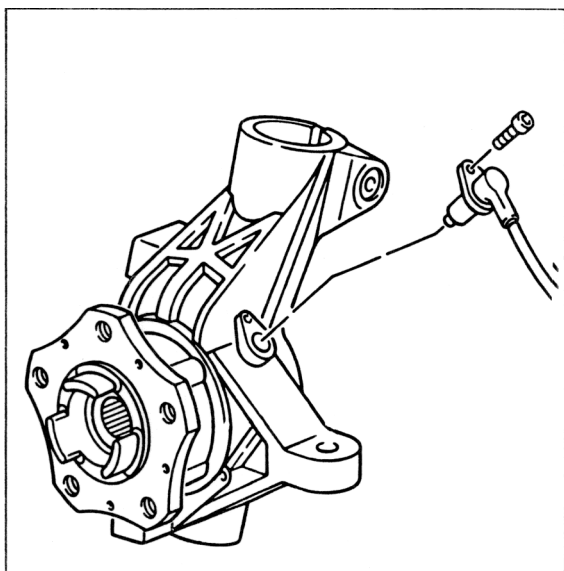
**Important instructions**

Before installation, ensure that there are no metal chips at the magnetic edge of the speed sensor.

The gap between speed sensor and pulse wheel is determined by the design and cannot be adjusted.

**45 15 19 Removing and installing rear speed sensors****Removal**

1. With ignition switched off, open the combination plug connection at the spring strut and pull out the plug for the speed sensor.
2. Loosen fastening screw (hexagon socket head bolt) and remove the speed sensor.



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**Installation**

1. Coat speed sensor and the bore in the wheel carrier with Molykote Longterm 2.

**Note**

There is no O-ring between speed sensor and wheel carrier.

The speed sensors at front and rear axles are the same.

2. Insert speed sensor into wheel carrier without using excessive force and tighten the hexagon socket head bolt to 10 Nm (7 ftlb.).
3. If the speed sensor has been removed or replaced due to an ABS fault or Traction Control fault, or because of accident repairs, a functional check should be carried out with the Porsche System Tester 2 – via the Actual Values menu, Speed submenu.

**Important instructions**

Before installation, ensure that there are no metal chips at the magnetic edge of the speed sensor.

The gap between speed sensor and pulse wheel is determined by the design and cannot be adjusted.

**45 30 19 Removing and installing hydraulic unit****Removal**

1. Switch off ignition.  
Remove cover for hydraulic unit.
2. Hold down brake pedal with pedal holder so that the brake fluid does not run out of the reservoir completely.
3. To remove the hydraulic unit, carry out the following removal procedure:

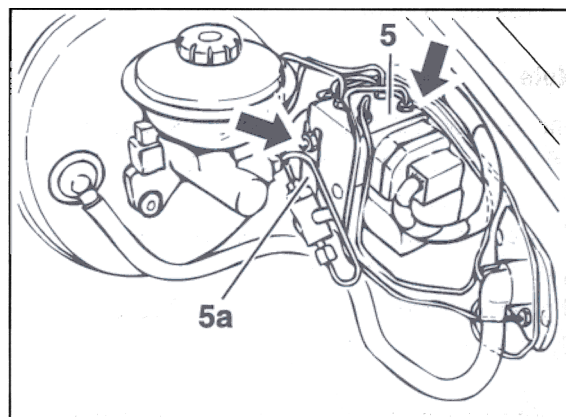
Undo the hydraulic lines on the hydraulic unit. Remove the lines between the brake master cylinder intermediate piston circuit and the hydraulic unit.

Unlock/disconnect the plug on the hydraulic unit.

Undo the 2 fastening nuts (arrows) and push hydraulic unit 5 out of holder 5a.

**Note**

Close the lines and the hydraulic unit connections with suitable plugs.



5 - Hydraulic unit  
5a - Holder for hydraulic unit

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**Installation**

1. Install in reverse order.
2. Bleed brakes (Serv. No. 47 01 07).

**Note**

After conventional bleeding, the ABD circuit must then be bled for vehicles with TC. The Porsche System Tester (PST 2) is required for this.

3. Check electrical and hydraulic lines (brake lines) for incorrect assignment using the Porsche System Tester 2.

**Note**

The test checks that the brake lines/solenoid valves are assigned to the correct brake calipers (wheels).

**To do this**, carry out a system test on vehicles with ABS or ABS/TC, see 45 02

Diagnosis/troubleshooting System ABS 5.3 or System ABS/TC 5.3.

4. When replacing the hydraulic unit in vehicles with ABS/TC (4-channel system), code the control module (manual transmission or Tiptronic).
5. Check brakes and ABS for correct functioning. Perform a short test drive to do this, and carry out at least one ABS control operation while taking into account the traffic situation. Then read out the fault memory.

**46 Tightening torques for mechanical brake**

Location	Thread	Tightening torque Nm (ftlb.)
Brake caliper on the front and rear axles**	M12 x 1.5	85 (63) *
Brake disc on wheel hub (front and rear axles)	M6	10 (7)
Brake cover plate on front and rear axles	M6	10 (7)
Speed sensor on front and rear axles	M6	10 (7)
Brake units on body	M8	23 (17)
Brake unit support on body	M8	23 (17)
Parking brake console on body	M8	23 (17)
Reversing box on body	M6	10 (7)
Wheel on wheel hub	M14 x 1.5	130 (96)

Replace the brake caliper fastening screws on the front and rear axles every time they are removed.

## 46 Technical data

Designation		Notes, dimensions	Wear limit
Operating brake (foot brake)		Hydraulic dual-circuit brake system with front axle - rear axle brake circuit distribution. Vacuum brake booster, internally ventilated brake discs with four-piston fixed caliper on front and rear axles. ABS as standard, optionally with traction control (TC). *	
Brake booster (vacuum)	∅	10 inches	
Boost factor		3.85	
Brake master cylinder	∅ front ∅ rear travel	23.81 mm 23.81 mm 18/18 mm	
Proportioning valve **			
Switching pressure reduction factor		25 bar - 0.46	
Identification		5/25	
Brake discs	∅ front ∅ rear	298 mm 292mm	
Effective brake discs	∅ front ∅ rear	250 mm 241 mm	
Piston ∅ in brake caliper	front rear	2 x 40 + 2 x 36 mm 2 x 30 + 2 x 28 mm	
Brake pad area	front rear	216 cm <sup>2</sup> 196 cm <sup>2</sup>	
Total brake pad area		412 cm <sup>2</sup>	
Pad thickness	front rear	approx. 11.0 mm approx. 11.0 mm	2 mm 2 mm

Description, Traction Control (TC) in Repair Group 45

Vehicles with ABS and vehicles with ABS/TC = 1 proportioning valve



Designation		Notes, dimensions	Wear limit
Brake disc thickness <b>new</b>	front	24 mm	
	rear	20 mm	
Brake discs			
Minimum thickness <b>*after machining</b>	front	22.6 mm	22.0 mm
	rear	18.6 mm	18.0 mm
Thickness tolerance of the brake disc, max.		0.02 mm	
Lateral runout of the brake disc, max.		0.03 mm	
Lateral runout of the wheel hub, max.		0.03 mm	
Lateral runout of the brake disc when installed, max.		0.06 mm	
Peak-to-valley surface roughness of the brake disc after machining, max.		0.006 mm	
Pushrod play (measured at the brake pedal plate)		approx. 1 mm	
<b>Parking brake (hand brake)</b>	Drum brake acting mechanically on both rear wheels		
Parking brake drum $\varnothing$		164 mm	165 mm
Brake shoe width		20 mm	
Brake lining thickness		3 mm	1 mm

The brake disc may be reworked only symmetrically, i.e. from both sides evenly.

**46 Technical data – Boxster S**

Designation		Notes, dimensions	Wear limit
<b>Operating brake (foot brake)</b>		Hydraulic dual-circuit brake system with front axle-rear axle brake circuit distribution. Vacuum brake booster, internally ventilated and perforated brake discs with four-piston monobloc fixed caliper at front and rear axles. The brake calipers are painted red for visual differentiation. Standard ABS (3-channel system), Traction Control* (4-channel system) available as an option.	
Brake booster (vacuum)	ø	10 inches	
Boost factor		3.85	
Brake master cylinder	ø front ø rear travel	23.81 mm 23.81 mm 18/18 mm	
Proportioning valve**			
Switching pressure			
reduction factor		25 bar - 0.46	
Identification		5/25	
Brake discs	ø front ø rear	318 mm 299 mm	
Effective brake disc	ø front ø rear	261.8 mm 247.6 mm	
Piston ø in brake caliper	front rear	2 x 40 + 2 x 36 mm 2 x 30 + 2 x 28 mm	
Brake pad area	front rear	254 cm <sup>2</sup> 196 cm <sup>2</sup>	
Total brake pad area		450 cm <sup>2</sup>	

Description, Traction Control (TC) in Repair Group 45

Vehicles with ABS and vehicles with ABS/TC = 1 brake proportioning valve

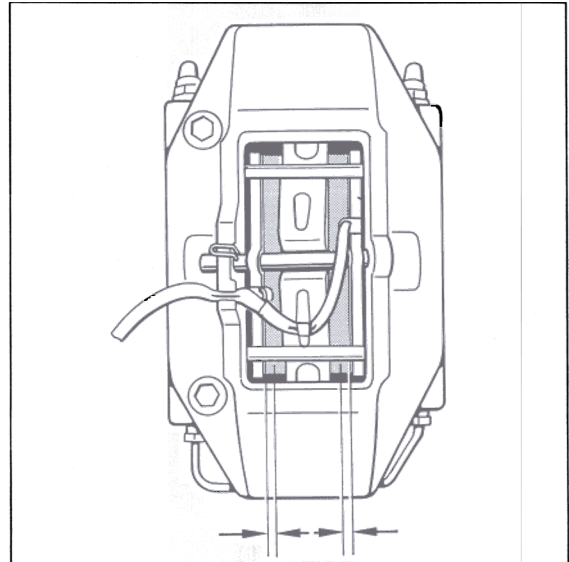
Designation		Notes, dimensions	Wear limit
Pad thickness	front	approx. 12.0 mm	2 mm
	rear	approx. 10.5 mm	2 mm
Brake disc thickness <b>new</b>	front	28 mm	
	rear	24 mm	
Brake discs minimum thickness	front		26.0 mm
	rear		22.0 mm
Thickness tolerance of the brake disc, max.		0.02 mm	
Lateral runout of the brake disc, max.		0.03 mm	
Lateral runout of the wheel hub, max.		0.03 mm	
Lateral runout of the brake disc when installed, max.		0.06 mm	
Peak-to-valley surface roughness of the brake disc after machining, max.		0.006 mm	
Pushrod play (measured at the brake pedal plate)		approx. 1 mm	
<b>Parking brake (hand brake)</b>		Drum brake acting mechanically on both rear wheels	
Parking brake drum $\varnothing$		180 mm	181 mm
Brake shoe width		25 mm	
Brake lining thickness		4.5 mm	2 mm

## 46 Checking the thickness of the disc brake pads

### Note

The brake pads must be replaced (both sets of pads per axle) if the brake pad warning indicator lights up, but no later than when there is a residual pad thickness of 2 mm.

If brake pad wear is signalled by the warning light, the warning contact (sensor including line and plug connection) must be replaced. Replacing the warning contact can be avoided by replacing the brake pads no later than when the pad thickness is 2.5 mm. Warning contacts with a worn cable core must be replaced. However, if only the plastic part of the warning contact is worn, replacement is not necessary.



1. To check the brake pads, remove the wheels.
2. Check the brake pads for wear by means of a visual inspection.

The wear limit is reached when the pad has a residual thickness of 2 mm.

22 - 96

**46 36 20 Removing and installing the front disc brake pads****Note**

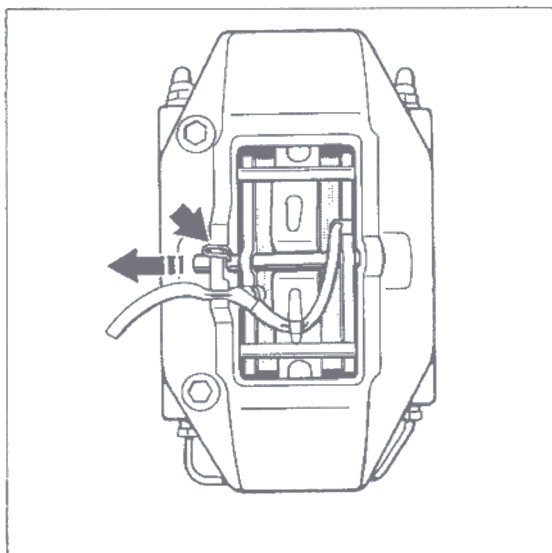
It is essential to observe the following points when changing the brake pads:

Use brake pads of the correct quality (in accordance with spare parts catalog).

The pad backing plates (rear of the brake pads) must not be greased.

**Removal**

- Remove the retainer (arrow) and extract the retainer pin inwards.



21-96

Extend the warning contact line on the brake caliper and remove the warning contacts from the brake pad plates.

**Note**

Replace the warning contacts if the core of the line is worn or worn through. The warning contact can continue to be used if there are only scrape marks on the plastic part of the warning contact.

Remove brake pads with a brake pad puller.

**In individual cases, first set back the brake pads as far as possible with the piston reset fixture.** If necessary, first remove some brake fluid by suction out of the brake fluid reservoir.

**Installation**

- If necessary, turn the piston back to its original position with the resetting fixture.

Insert the brake pads. **Ensure correct brake pad quality.**

**Note**

The brake pad quality on the front and rear axles differs.

Front axle: Galfer.

Rear axle: Textar.

Fit **new** spreading spring, **new** holding pin and **new retainer (retaining clip)** (refer to Figure 21-96).

**These parts are available as a repair set and must be "renewed" each time the pads are replaced.**

Insert the warning contact line and warning contacts.

Firmly press the brake pedal with the vehicle stationary so that the brake pads assume their fit in accordance with the operating state.

Next, check and, if necessary, correct the brake fluid level.

### **Bedding in the brake pads**

New brake pads require a bedding-in period of approx. 200 km. Not until then do they attain their best friction and wear coefficient. During this period, the brakes should be subjected to full stress only in emergencies when travelling at high speeds.

**46 38 20 Removing and installing the rear disc brake pads****Note**

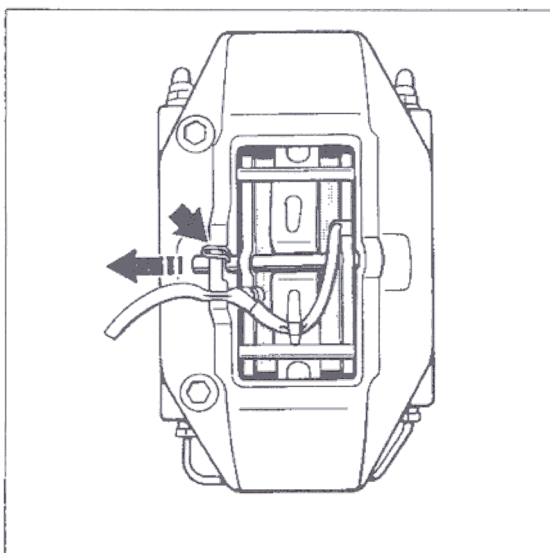
It is essential to observe the following points when changing brake pads:

Ensure correct brake pad quality (in accordance with the spare parts catalog).

The pad backing plates (rear side of the brake pads) must not be greased.

**Removal**

Remove the retainer (arrow) and extract the retainer pin inwards.



21-96

Extend the warning contact line on the brake caliper and remove the warning contacts from the brake pad plates.

**Note**

Replace warning contacts if the core of the cable is worn or worn through. The warning contact can continue to be used if there are only scrape marks on the plastic part of the warning contact.

Remove brake pads with a brake pad puller.

**In individual cases, first set back the brake pads as far as possible with the piston resetting fixture.** If necessary, first remove some brake fluid by suction from the brake fluid reservoir.

**Installation**

- If necessary, turn back the piston to its original position using the resetting fixture.

Insert the brake pads. **Ensure correct brake pad quality.**

**Note**

The brake pad quality on the front and rear axles differs.

Front axle: Galfer.

Rear axle: Textar.

Fit **new** spreading spring, **new** holding pin and **new retainer (retaining clip)** (refer to Figure 21-96).

**These parts are available as a repair set and must be "renewed each time the pads are replaced.**



Insert the warning contact line and warning contacts.

Firmly press the brake pedal several times with the vehicle stationary so that the brake pads assume their fit in accordance with the operating state.

Next, check and, if necessary, correct the brake fluid level.

### **Bedding in the brake pads**

New brake pads require a bedding-in period of approx. 200 km. Not until then do they achieve their best friction and wear coefficient. During this period, the brakes should be subjected to full stress only in emergencies when travelling at high speed.

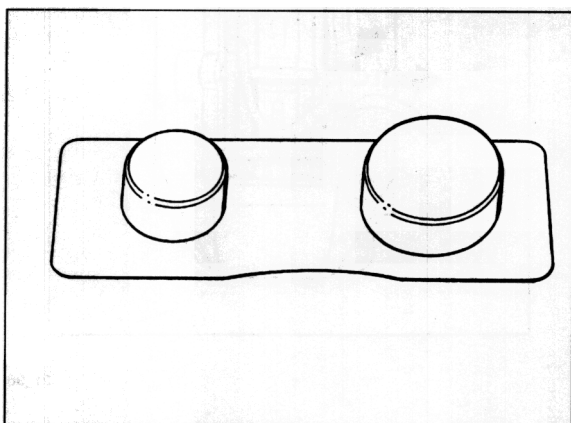
## 46 36 20 Removing and installing the front disc brake pads Boxster S

### Note

It is essential to observe the following points when changing brake pads:

Use brake pads of the correct quality (in accordance with spare parts catalogue).

Replace vibration dampers each time the pads are changed.



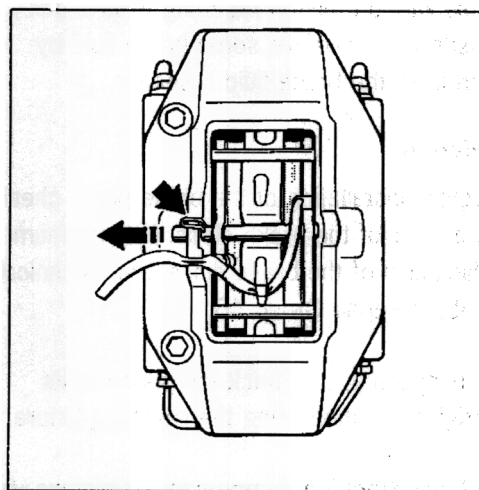
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The **vibration dampers** (damper plates with integrated compensating masses) have an adhesive protective film. The protective film should be pulled off before installation of the brake pads.

The pad backing plates (rear side of the brake pads) must not be greased.

### Removal

- Remove the retainer (arrow) and extract the retainer pin inwards.



21\_96

Pull out the warning contact wire on the brake caliper and remove the warning contacts from the brake pad plates.

### Note

Replace warning contacts if the core of the wire is worn or worn through. The warning contact can continue to be used if there are only scrape marks on the plastic part of the warning contact.

Remove brake pads with a brake pad puller. It is essential to observe the following notes:

Pull out brake pads together with the **vibration dampers**. If this is not possible (depending on wear of the brake pads), use a spatula to detach the vibration dampers from the brake pad plate before removing the pads. In both cases, first set back the brake pads as far as possible with the piston resetting fixture. If necessary, first remove some brake fluid by suction from the brake fluid reservoir.

### Installation

- Before installation of the brake pads, check the wear of the brake discs. For minimum thickness of the brake discs, see Technical data in Repair Group 46.

If necessary, turn back the piston to its original position using the resetting fixture.

Fit new vibration dampers in the pistons. As the vibration dampers are provided with a protective film, this protective film should be removed before installation of the brake pads.

Insert the brake pads. **Ensure correct brake pad quality.**

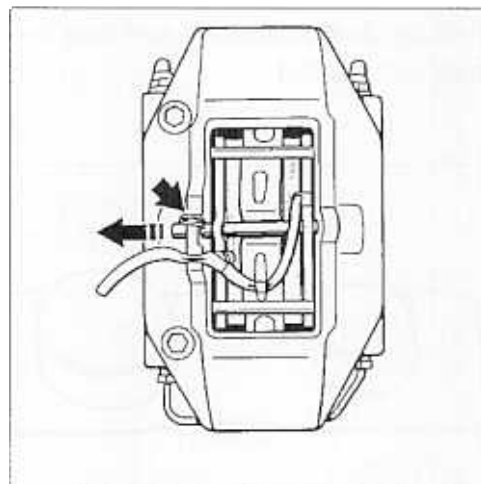
### Note

The brake pad quality on the front and rear axles is identical.

The pad backing plates (rear side of the brake pads) must not be greased.

Fit **new** expanding spring, **new** retaining pin and **new retainer (arrow)**.

**These parts are available as a repair set and must be "renewed" each time the pads are changed.**



21\_96

Insert the warning contact wire and warning contacts.

Firmly press the brake pedal several times with the vehicle stationary so that the brake pads assume their fit in accordance with the operating state.

Next, check and, if necessary, correct the brake fluid level.

### Bedding in the brake pads

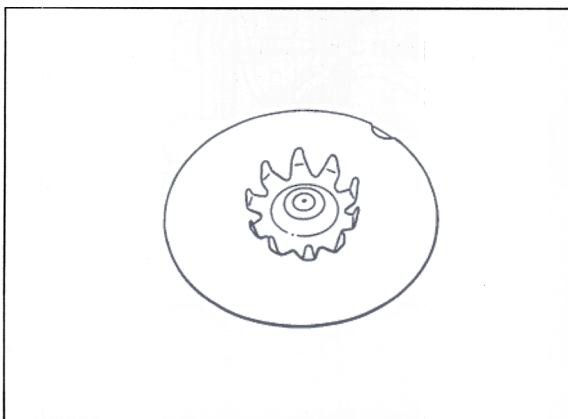
New brake pads require a bedding-in period of approx. 200 km. Not until then do they achieve their best friction and wear coefficient. During this period, the brakes should be subjected to full stress only in emergencies when travelling at high speed.

**46 38 20 Removing and installing the rear disc brake pads – Boxster S****Note**

It is essential to observe the following points when changing brake pads:

Use brake pads of the correct quality (in accordance with spare parts catalogue).

**Replace vibration dampers each time the pads are changed.**



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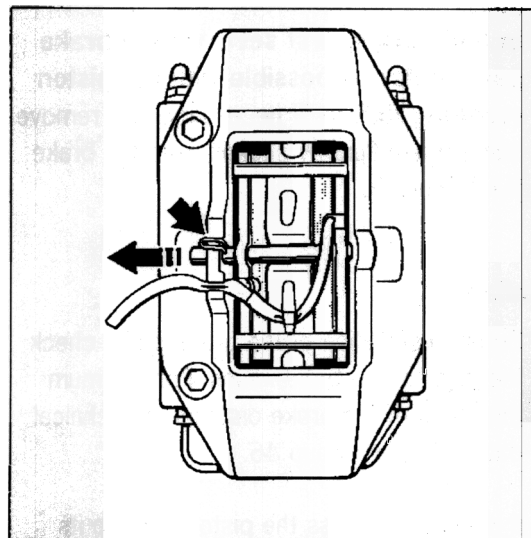
The damper plates have an adhesive protective film.

**The protective film must be pulled off before installation.**

The pad backing plates (rear side of the brake pads) must not be greased.

**Removal**

- Remove the retainer (arrow) and extract the retainer pin inwards.



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Pull out the warning contact wire on the brake caliper and remove the warning contacts from the brake pad plates.

**Note**

Replace warning contacts if the core of the wire is worn or worn through. The warning contact can continue to be used if there are only scrape marks on the plastic part of the warning contact.

Remove brake pads with a brake pad puller. It is **essential** to observe the following notes:

Pull out brake pads together with the **damper plates**. If this is not possible (depending on wear of the brake pads), use a spatula to detach the damper plates from the brake pad plate before removing the pads.

**In both cases, first set back the brake pads as far as possible with the piston resetting fixture.** If necessary, first remove some brake fluid by suction from the brake fluid reservoir.

### Installation

- Before installation of the brake pads, check the wear of the brake discs. For minimum thickness of the brake discs, see Technical data in Repair Group 46.

If necessary, press the piston back to its original position using the resetting fixture.

Fit **new damper plates** in the pistons. **Remove protective film** from the damper plates before installation.

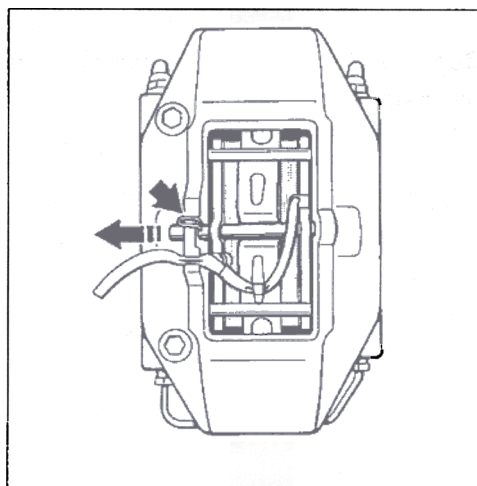
Insert the brake pads. **Ensure correct brake pad quality.**

### Note

The brake pad quality on the front and rear axles is identical. The pad backing plates (rear side of the brake pads) must not be greased.

Fit **new** expanding spring, **new** retaining pin and **new retainer (arrow)**.

**These parts are available as a repair set and must be "renewed" each time the pads are changed.**



21\_96

Insert the warning contact wire and warning contacts.

Firmly press the brake pedal several times with the vehicle stationary so that the brake pads assume their fit in accordance with the operating state.

Next, check and, if necessary, correct the brake fluid level.

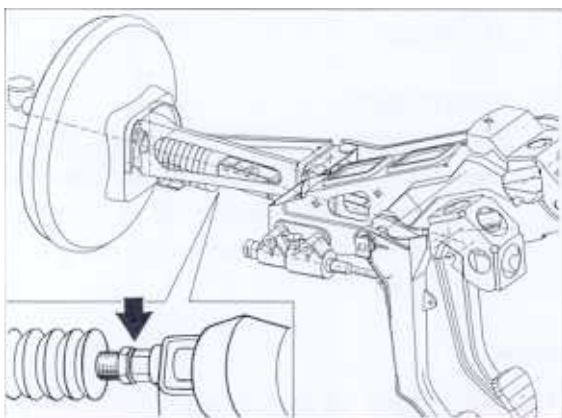
### Bedding in the brake pads

New brake pads require a bedding-in period of approx. 200 km. Not until then do they achieve their best friction and wear coefficient. During this period, the brakes should be subjected to full stress only in emergencies when travelling at high speed.

## 46 11 15 Adjusting the brake pushrod

The brake pedal has no stop. Since, when the brake pushrod is correctly set, the brake pedal has no support possibility in its original position, the permanently set free play in the brake unit is guaranteed. As a result, a pushrod play of **approx. 1 mm is noticeable** by manual actuation on the pedal plate of the brake pedal.

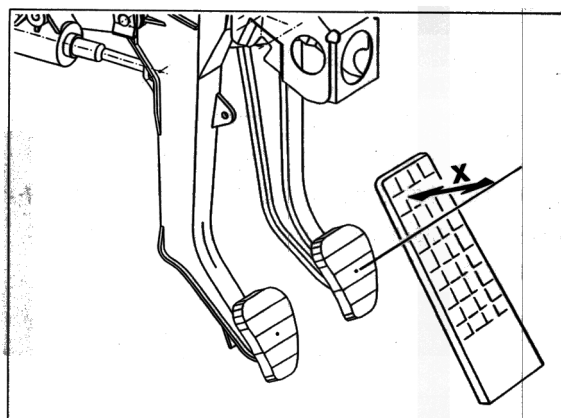
Adjusting the pushrod length changes the position of the brake pedal. To do this, undo the lock nut and turn the pushrod accordingly at the hexagon (arrow).



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The brake pushrod is correctly set if the **dimension X is 45 + 5 mm.**

Perform measurement between the center of the brake pedal plate and the accelerator.



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### Brake light switch setting

The switch travel of the brake light switch is designed so that the brake light lights up before braking pressure builds up. The switches **are self-adjusting** and are mounted in a bayonet lock in the pedal block through a 90° turn. By way of its self-adjustment function, the switch compensates for the tolerances in the pedals during initial assembly. However, if the switch is **"overpressed"** during work on the pedals or on the brake unit, the switch travel or pedal travel up to the switching point is lost.

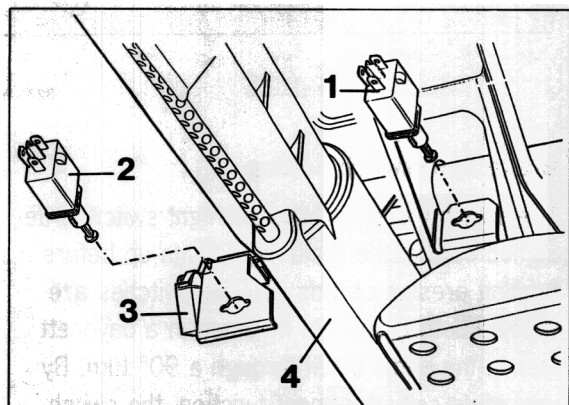
**The consequence:** The brake lights are always on or flicker when travelling over bumps. In vehicles with cruise control, the cruise control can be deactivated as a result of vehicle vibrations under certain circumstances.



Therefore, the switches must be **readjusted** after any work in which the brake pedal is moved out of its "normal" position (for example, work on the pedals or on the brake unit).

#### Checking stop light switch adjustment (No. 1)

The pedal must be felt to travel approx. 5 to 10 mm before the brake light lights up. At the same time, check (make sure) that the brake light lights up before the pedal meets perceptible resistance or before brake pressure builds up.



#### Adjusting switch in the event of insufficient pedal travel

There are **two** possible ways of adjusting the switch if the pedal travel to the operating point is **too small**.

##### 1st possibility:

- Press brake pedal and pull out plunger of the switch.

Release pedal. Check adjustment.

##### 2nd possibility:

- Release switch by turning it 90°, and pull it out of its installation opening.

Pull switch plunger out of the switch as far as it will go.

Reinstall switch.

When fitting the switch for the first time, it is important to press vertically against the bearing surface. It will otherwise not be possible to lock the switch (90° turn), even using a lot of force.

#### Note

The switch might not fit in its seat without play after it has been installed and removed several times. As soon as the switch perceptibly "wobbles" in its receiver, it must be replaced by a new switch.

#### Adjusting the switch if the pedal travel is too large

Press the pedal; press the plunger into the switch by one notch (audible click). This decreases the pedal travel **to the operating point** by approx. 3 ... 4 mm. Then recheck the adjustment.



**46 83 16 Adjusting the parking brake shoes**

Includes: adjusting parking brake shoes  
and parking brake cables

**Check the free play of the handbrake lever**

The handbrake has asbestos-free brake linings. The handbrake with asbestos-free brake linings must never be adjusted in such a way that the lining must "grind down" during operation.

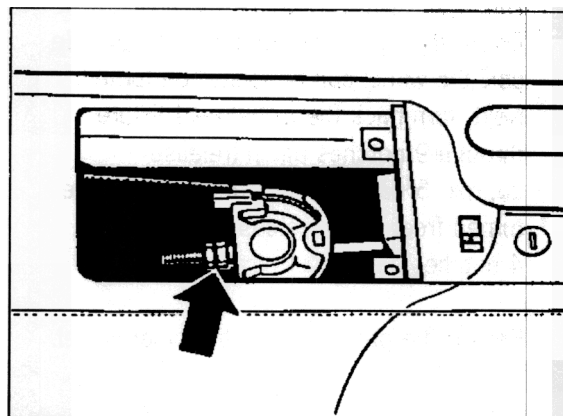
The handbrake must be adjusted if the handbrake lever can be pulled up by more than 4 teeth with medium force application without a braking effect being apparent.

**Adjusting the parking brake**

1. Remove the rear wheels.
2. Undo the handbrake lever and push back the disc brake pads of the rear axle until the brake disc can rotate freely.
3. Undo the adjustment nuts on the turnbuckle (arrow) until the cables are without pretension.

**Note**

To make the turnbuckle accessible, open the cover of the tray behind the handbrake lever and remove the rubber inlay and also the insert.



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4. Adjust the right and left parking brake shoes.

Boxster: see 4a in following text.

Boxster S: see 4b in following text.

**Note**

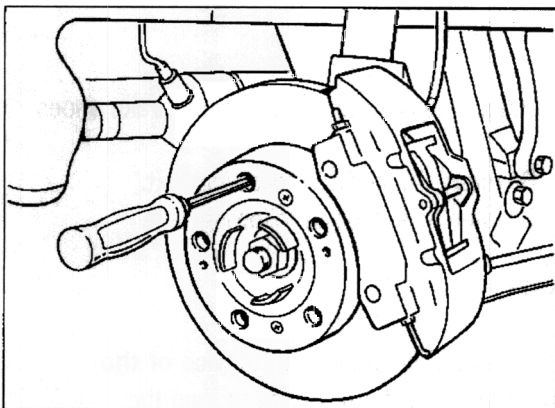
The brake shoe adjustment device **of the Boxster** has a **finer toothing** than the Boxster S.

The parking brake shoes and the return springs are also different.

4a. Adjusting parking brake shoes – Boxster

With a screwdriver, adjust the adjustment fixture through a threaded wheel bolt hole until the wheel can no longer be turned. Next, turn back the adjustment fixture through 9 notches again (release approx. 5 notches until the wheel can be turned freely, then release another 4 notches).

Repeat the procedure on the other wheel.



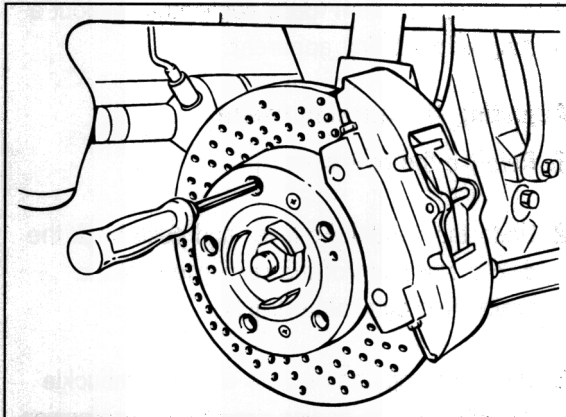
Boxster

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4b. Adjusting parking brake shoes – Boxster S

With a screwdriver, adjust the adjustment fixture through a threaded wheel bolt hole until the wheel can no longer be turned. Next, turn back the adjustment fixture through 5 notches again (release approx. 3 notches until the wheel can be turned freely, then release another 2 notches).

Repeat the procedure on the other wheel.



Boxster S

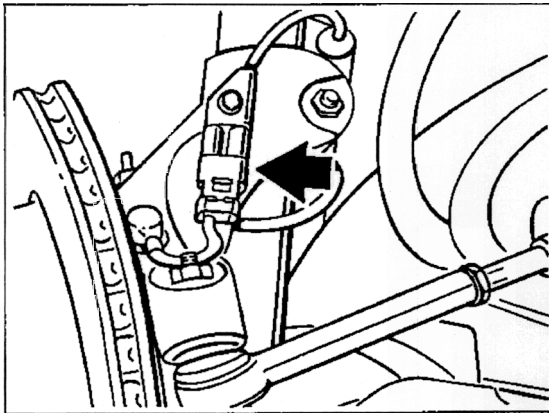
46530001

5. Pull up the handbrake lever by 2 teeth and turn the adjustment nut of the turnbuckle until both wheels can be turned manually with difficulty.
6. Release the handbrake lever and check whether both wheels can be turned freely.

**46 50 19 Removing and installing the front brake disc****Removal**

1. Remove front wheel.

Open the plug connection on the wheel carrier (arrow) and pull out the plug for the brake pad wear indicator. Unclip the electrical wire on the spring strut.



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2. Undo the holder for the brake hose/brake line on the wheel carrier.  
Undo the brake caliper on the wheel carrier and place or secure it in a suitable place. (Do not open the brake hydraulics.)
3. Take off the brake disc after removing the countersunk screws. If a stuck brake disc cannot be removed by gentle tapping with a plastic hammer, evenly screw hexagon-head bolts into the two M8 threads of the brake disc, thereby pressing off the disc.

**Installation**

1. Check that all parts are in perfect condition and replace them if necessary.
2. Clean the levelling and centering surfaces on the brake disc and wheel hub. Then apply a very thin coat of Optimoly TA to the centering surface on the wheel hub.
3. Fit the brake disc.  
The brake discs on the left and right of the Boxster S are different (see following note).

**Note for Boxster S only**

Do not confuse the right and left brake discs during assembly (Boxster S). Distinguishing characteristic: Involute shape and spare part number (SP No.). The flat surface of the brake discs is marked with **R** = right or **L** = left (Figure 140\_99).

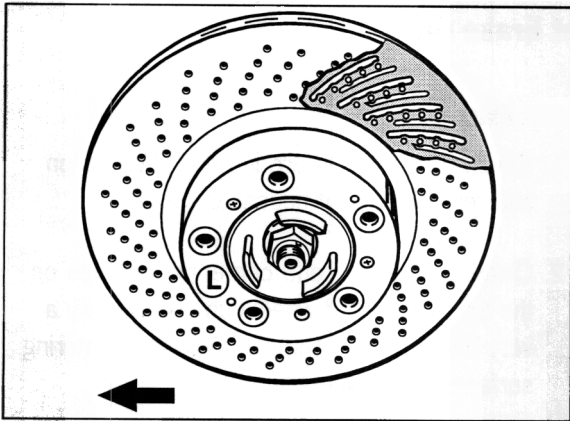
Spare part on left-hand side  
third group number is odd

Spare part on right-hand side  
third group number is even

**Example:**

SP No. Left brake disc:  
996.351.**405**.01

SP No. Right brake disc:  
996.351.**406**.01



L = left brake disc (Boxster S)

140\_99

4. Fit the brake caliper.

Tighten the **new** screws of the brake caliper with 85 Nm (63 ftlb.). Ensure that the brake hose and brake line are in a perfect position.

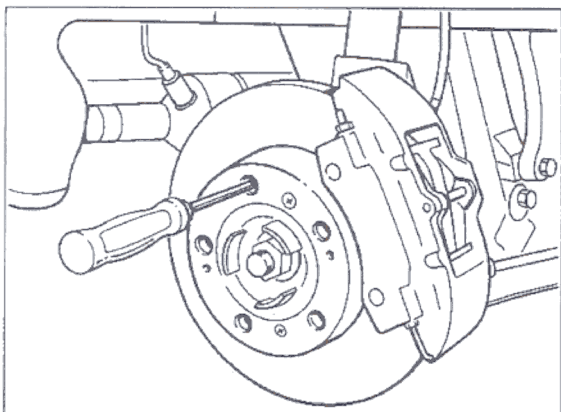
**Note**

Replace the brake caliper fastening screws after each removal.

## 46 53 19 Removing and installing the rear brake disc

### Removal

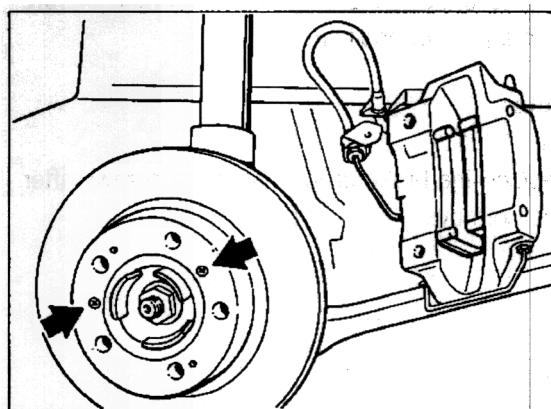
1. Remove the rear wheel. Open the plug connection on the wheel carrier and pull out the plug for the brake pad wear indicator. Unclip the electrical wire on the spring strut.
2. With a screwdriver, turn the adjustment device towards "release" through a wheel bolt threaded hole.



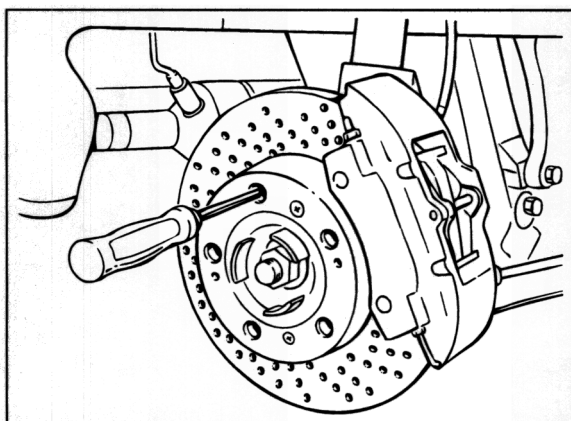
Boxster

177\_96

3. Undo the holder for the brake hose/brake line on the wheel carrier. Remove the brake caliper from the wheel carrier and suspend it in the wheel arch (do not open brake hydraulics).
4. Take off the brake disc after removing the countersunk screws (arrows). If a stuck brake disc cannot be removed by gentle tapping with a plastic hammer, evenly screw hexagon-head bolts into the two M8 threads of the brake disc, thereby pressing off the disc.



326\_1\_96



Boxster S

46530001

### Installation

1. Clean the levelling and centering surfaces on the brake disc and wheel hub. Then apply a very thin coat of Optimoly TA to the centering surface on the wheel hub.

2. Fit the brake disc.

#### Note

The right and left brake discs are the same part.

Boxster: internally ventilated brake discs  
( $\varnothing$  292 mm / new thickness 20 mm)

Boxster S: internally ventilated and perforated  
brake discs  
( $\varnothing$  299 mm / new thickness 24 mm)

3. Adjust the parking brake shoes and the  
parking brake cables (Page 46 -13).

Fit the brake caliper. Tighten the new screws  
of the brake caliper with 85 Nm (63 ftlb.).

Ensure that the brake hose and brake line are  
in a perfect position.

#### Note

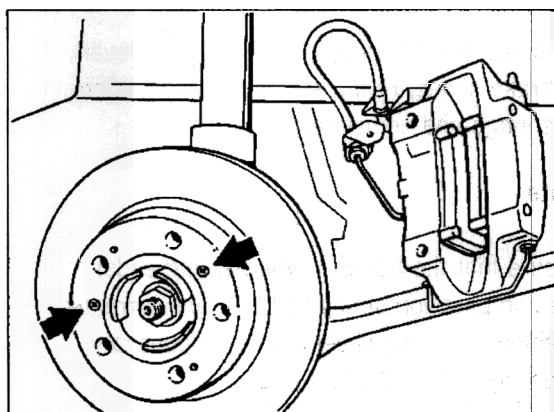
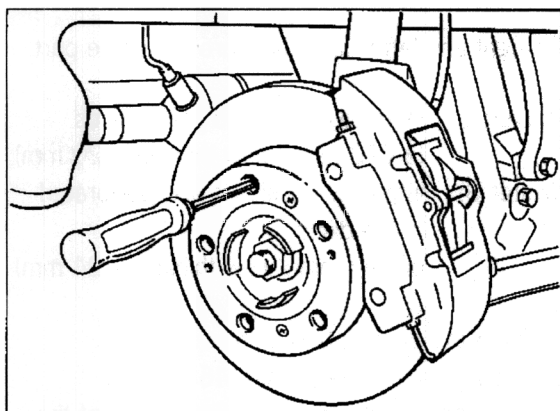
Replace the brake caliper fastening screws after  
each removal.





**46 83 20 Removing and installing the parking brake shoes****Removal**

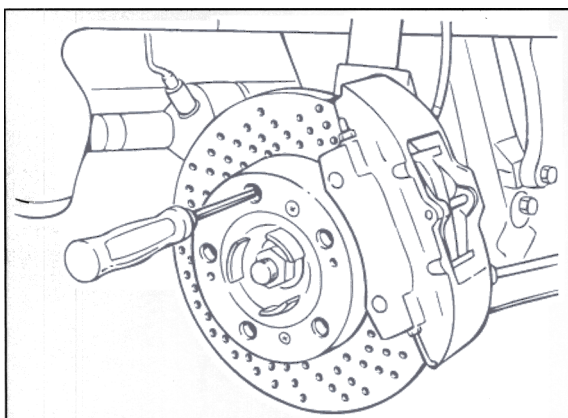
1. Remove the rear wheel. Open the plug connection on the wheel carrier and pull out the plug for the brake pad wear indicator. Unclip the electrical wire on the spring strut.
2. With a screwdriver, turn the adjustment device towards "release" through a wheel bolt threaded hole.
3. Remove the brake caliper from the wheel carrier and suspend it in the wheel arch (do not open brake hydraulics. Undo the holder for the brake hose/brake line on the wheel carrier).
4. Take off the brake disc after removing the countersunk screws (arrows).



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Boxster

177\_96



Boxster S

5. Remove compression springs, adjustment fixture and return spring. Remove parking brake shoes and return spring (see Figure 180\_96).



## Installation

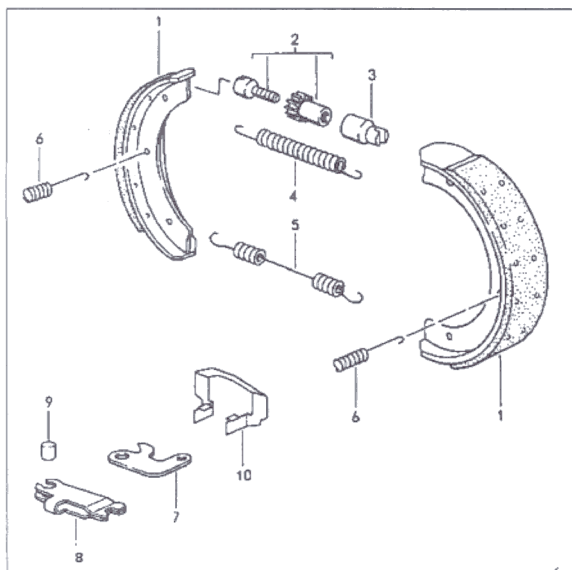
### Note

The brake shoe adjustment device (No. 2 Figure 180\_96) of the Boxster has a finer toothing than the Boxster S. The parking brake shoes and the return springs are also different.

1. Lightly grease the adjustment device (No. 2), pins on the actuating lever (spreading lever) and the sliding surfaces of the parking brake shoes.
2. Install the actuating lever (spreading lever), brake shoes, return springs, compression springs and adjustment device.

### Note

Ensure that the hooks (curved spring ends) of the compression springs (No. 6) are correctly positioned on the wheel carrier (if necessary, check with the aid of a mirror).



180\_96

3. Again check to ensure that the parking brake shoes, adjustment device, return springs, compression springs and spreading lever are positioned correctly, and adjust if necessary.
4. Clean the levelling and centering surfaces on the brake disc and wheel hub. Then apply a very thin coat of Optimoly TA to the centering surface on the wheel hub.
5. Fit the brake disc.

### Note

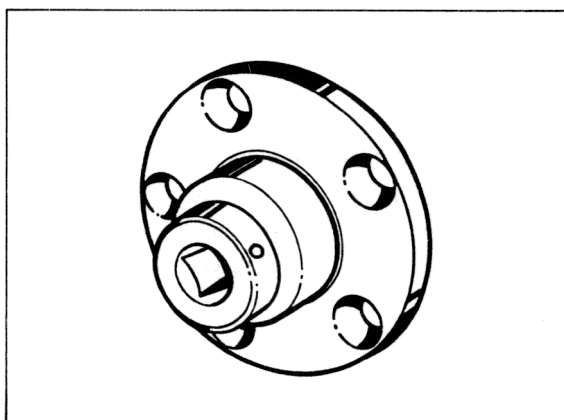
The right and left brake discs are the same part.

- |            |  |
|------------|--|
| Boxster:   | internally ventilated brake discs<br>( $\varnothing$ 292 mm / new thickness 20 mm)                   |
| Boxster S: | internally ventilated and perforated<br>brake discs<br>( $\varnothing$ 299 mm / new thickness 24 mm) |

6. Adjust the parking brake shoes and the parking brake cables (Page 46 - 13).  
Fit the brake caliper. Tightening torque of the fastening screws: 85 Nm (63 ftlb.).  
Use new fastening screws.

**46 50 04 Measuring the front brake disc lateral runout****Includes: Measuring the brake disc thickness**

1. Measuring requirement: No tilt play at the wheel.
2. Fit the adapter plate (special tool 9510/1) to the **wheel hub**. Tightening torque of the wheel bolts (fastening screws) 130 Nm (96 ftlb.).



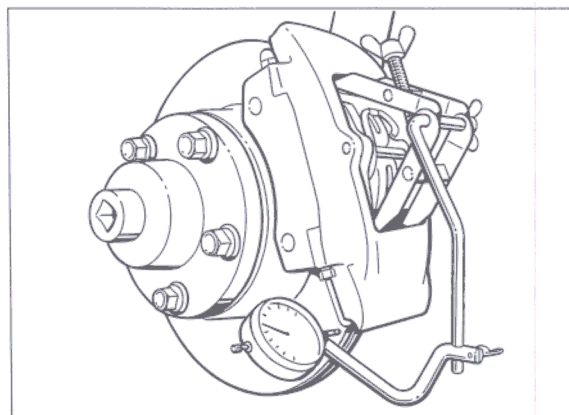
1035 - 46

3. Insert dial gauge holder, e.g. Ate order No. 03.9314 - 5500.3/01, into the brake caliper, align it and secure it by turning the clamping wing screw.  
If the brake disc cannot be turned freely, set the brake pads back a little.  
Do not damage the spreader spring when fitting the dial gauge holder.

**Note**

If necessary, provide the dial gauge holder with the Ate conversion set, order No. 03.9314 - 5510.3/01 (longer clamping wing screw and, if necessary, also a bracket for the dial gauge).

4. Secure the dial gauge with some preload. Put the measuring tip against the largest diameter of the braking surface.



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5. Turn the brake disc and, when doing so, read off the lateral runout on the dial gauge.  
The permissible lateral runout for the installed brake disc is **max. 0.06 mm**.

**Note**

**Lateral runout of the removed brake disc:** max. 0.03 mm.  
**Wheel hub lateral runout:** max. 0.03 mm.

6. If the brake disc lateral runout exceeds 0.06 mm, remove the brake disc and check the wheel hub lateral runout. First mark the position with respect to the wheel hub.
7. Check the wheel hub lateral runout as follows: Measure 1 x outside (arrow) and 1 x inside (arrow) of the wheel bolt area (**5-point measuring procedure**) on the front face of the wheel hub. Use a universal dial gauge holder, e.g. from SNAP - ON (order No. PMF 137), to secure the dial gauge.

#### Note

Do not damage the brake hoses or brake lines during removal/installation of the brake caliper.

The above SNAP - ON order number PMF 137 applies to a complete dial gauge set, because the dial gauge is not available on its own.

The dial gauge set can also be used to check the brake disc lateral runout.

#### 8. Wheel hub lateral runout too great:

Replace the wheel hub.

#### Wheel hub lateral runout in order:

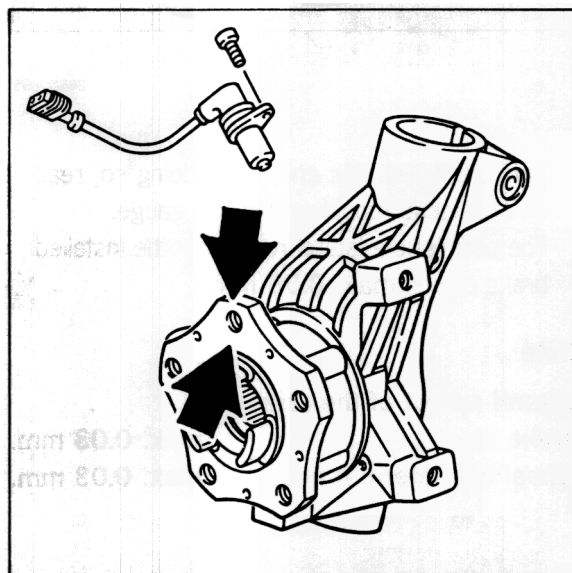
Clean the levelling and centering surface on the brake disc and wheel hub. Next, apply a very thin coat of Optimoly TA to the centering surface on the wheel hub.

Secure the brake disc to the wheel hub in a different position to the one before and offset radially with respect to the wheel hub.

Repeat the measurement with the fitted adapter plate – special tool 9510/1. If the lateral runout is still greater than 0.06 mm, replace the brake disc.

#### Note

If the brake disc lateral runout was reduced by radially offsetting the brake disc with respect to the wheel hub, one M6 screw can be left off, provided that two M6 countersunk screws were fitted.

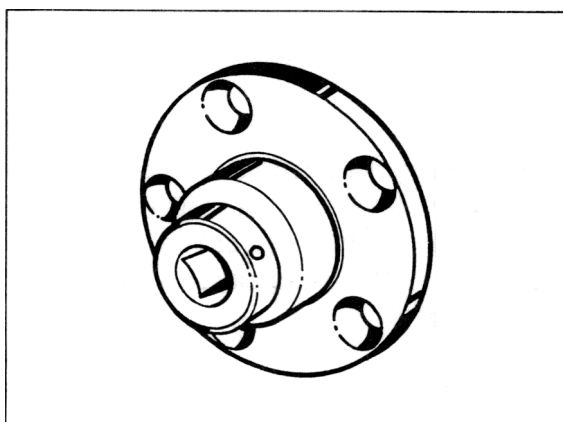


#### Measuring the brake disc thickness tolerance

Measure the brake disc thickness deviation within the braking surface at approx. 8 points by using the micrometer. Thickness tolerance of the brake disk **max. 0.02 mm** (new condition max. 0.01 mm).

**46 53 04 Measuring the rear brake disc lateral runout****Includes: Measuring the brake disc thickness**

1. Measuring requirement: No tilt play at the wheel.
2. Fit the adapter plate (special tool 9510/1) to the wheel hub. Tightening torque of the wheel bolts (fastening screws) 130 Nm (96 ftlb.).



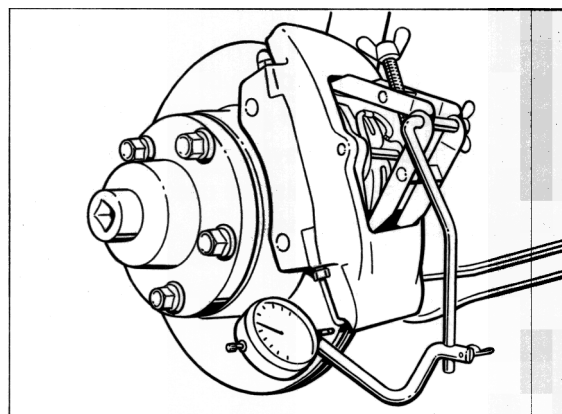
1035 - 46

3. Insert dial gauge holder, e.g. Ate order No. 03.9314 - 5500.3/01, into the brake caliper, align it and secure it by turning the clamping wing screw. If the brake disc cannot be turned freely, set the brake pads back a little. Do not damage the spreader spring when fitting the dial gauge holder.

**Note**

If necessary, provide the dial gauge holder with the Ate conversion set, order No. 03.9314 - 5510.3/01 (longer clamping wing screw and, if necessary, also a bracket for the dial gauge).

4. Secure the dial gauge with some preload. Position the measuring tip outside the perforation on the largest diameter of the braking surface.



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5. Turn the brake disc and, when doing so, read off the lateral runout at the dial gauge. The permissible lateral runout of the installed brake disc is **max. 0.06 mm**.

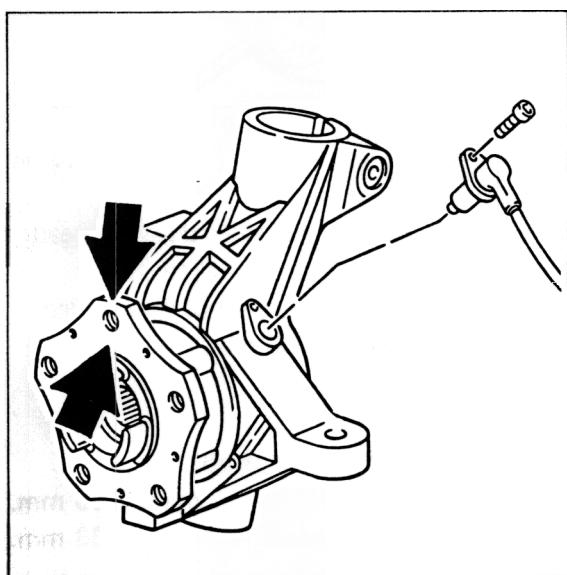
**Note****Lateral runout of the removed**

brake disc: max. 0.03 mm.  
Wheel hub lateral runout: max. 0.03 mm.

6. If the brake disc lateral runout exceeds 0.06 mm, remove the brake disc and check the wheel hub lateral runout. First mark the position with respect to the wheel hub.
7. Check the wheel hub lateral runout as follows: Measure 1 x outside (arrow) and 1 x inside (arrow) of the wheel bolt area (**5-point measuring procedure**) on the front face of the wheel hub. Use a universal dial gauge holder, for example from SNAP - ON (order No. PMF 137), to secure the dial gauge.

**Note**

The above SNAP - ON order number PMF 137 applies to a complete dial gauge because the dial gauge holder is not available on its own. The dial gauge set can also be used to check the brake disc lateral runout.

**8. Wheel hub lateral runout too great:**

Replace the wheel hub.

**Wheel hub lateral runout in order:**

Clean the levelling and centering surface on the brake disc and wheel hub. Next, apply a very thin coat of Optimoly TA to the centering surface on the wheel hub.

Secure the brake disc to the wheel hub in a different position to the one before and offset radially with respect to the wheel hub.

Repeat the measurement with the fitted adapter plate – special tool 9510/1.

If the lateral runout is still greater than 0.06 mm, replace the brake disc.

**Note**

If the brake disc lateral runout was reduced by radially offsetting the brake disc with respect to the wheel hub, one M6 screw can be left off, provided that two M6 countersunk screws were present fitted.

**Measuring the brake disc thickness tolerance**

Measure the brake disc thickness within the braking surface at approx. 8 points by using the micrometer.

Thickness tolerance of the brake disc

**max. 0.02 mm** (new condition max. 0.01 mm).

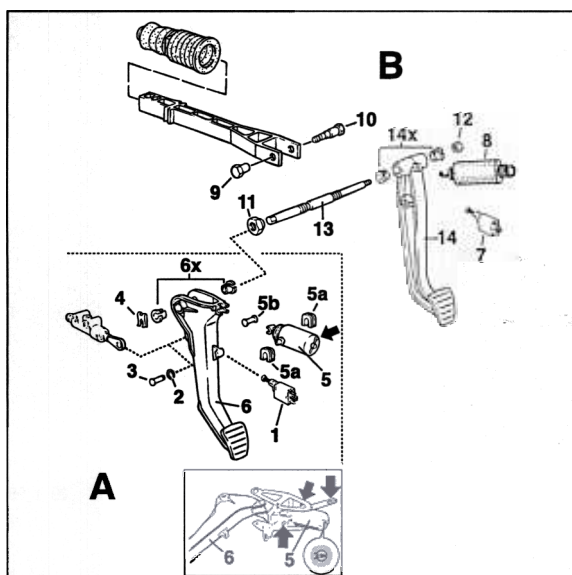
## 46 05 19 Removing and installing brake pedal

### Important notes

The description below applies to left-hand drive vehicles with manual transmission or Tiptronic. On Tiptronic vehicles, start removal with No. 7 (stop light switch/area B). Pedal bearing axle (No. 13) is shorter because there is no clutch pedal lever.

On right-hand drive vehicles, the clutch pedal lever is located directly next to the brake pedal (separated by the steering outer tube in the case of left-hand drive vehicles). Assembly/disassembly for right-hand drive vehicles is similar to the procedure for left-hand drive vehicles.

Before the start of disassembly work on the pedals, **the clutch boost spring must be fixed with a cotter pin (arrow at No. 5) in the case of vehicles with manual transmission.** Important: secure the cotter pin (bend it over).



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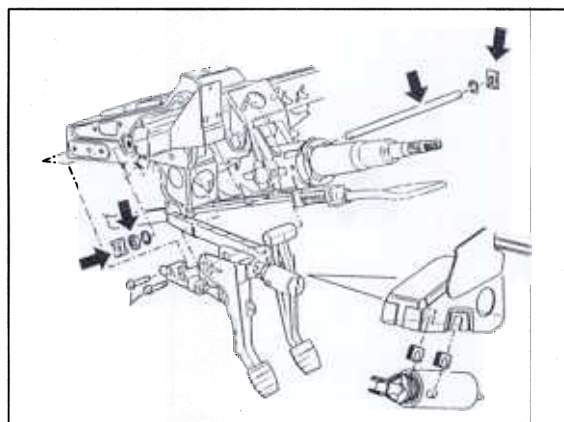
### Pedal-group versions (distinction)

1. The pedals of Boxster vehicles **as of** Mod. '98 (as of Mod. W) are identical to the 996 pedals, with the exception of the boost spring and boost-spring bracket.
2. The Boxster pedals **before** Mod. '98 (before Mod. W) differ from the pedals **as of Mod. '98** in the following respects:

Bracket for clutch boost spring cannot be unscrewed. Consequently, the boost-spring bracket cannot and need not be adjusted. Furthermore, the distance between the bearing pins of the boost spring is 3 mm less

Pedal bearing axle with different fastening method **>arrows<** (clamping of the steering outer tube and fixing of the pedal-bearing axle)

No return spring on the brake pedal

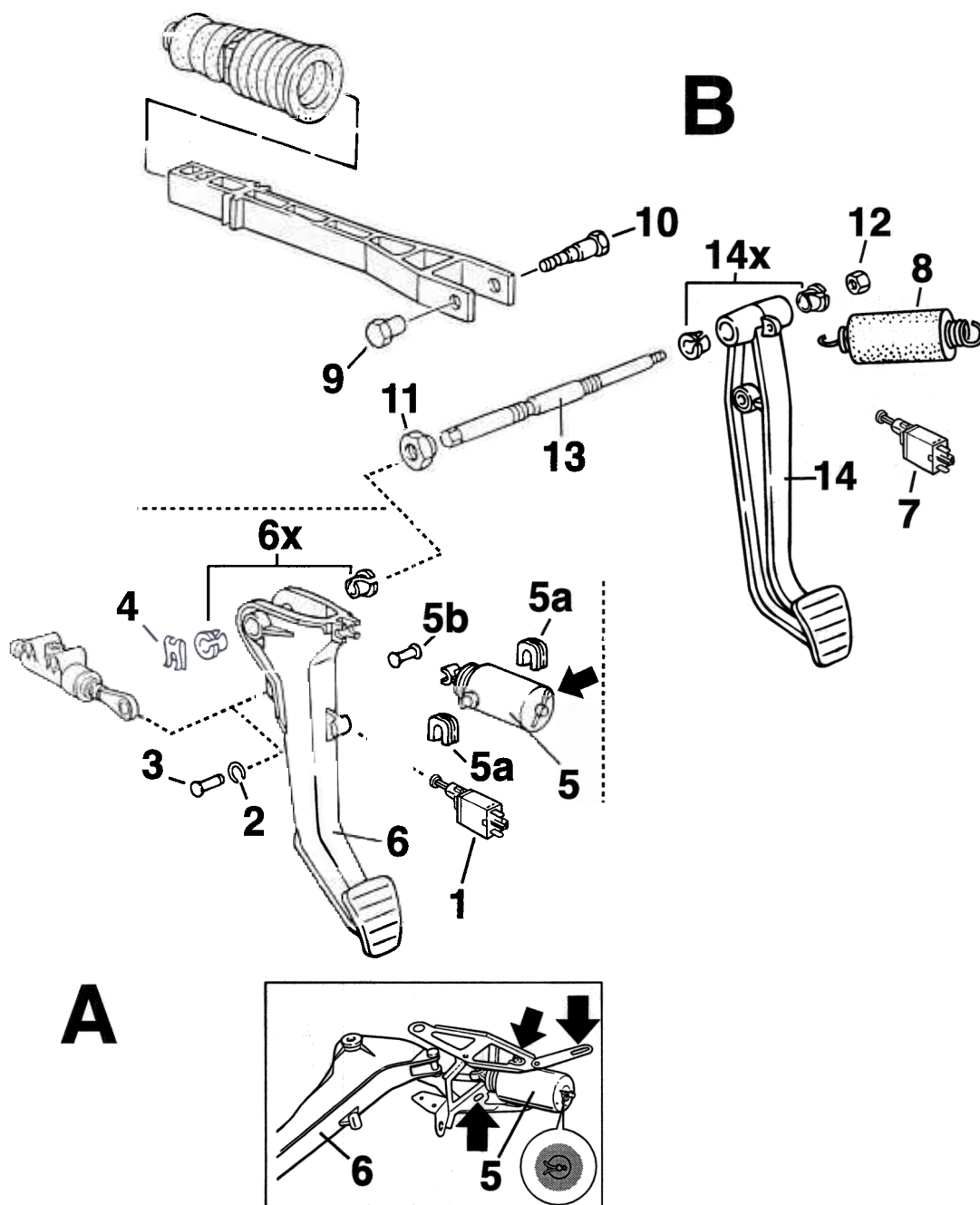


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Boxster pedals before Mod. '98



# Removing and installing brake pedal



29\_1\_98

A = Clutch pedal area

B = Brake pedal area



A = Clutch pedal area

No.	Designation	Qty.	Removal	Note:
				Installation
	Switch	1	Release by turning 90°, and pull out of the installation opening	Before installation, pull operating plunger out of the switch as far as it will go
2	Retaining clip	1		Replace if necessary
3	Pin	1		
4	Clamp	1		Replace
5	Boost spring with bracket (bracket cannot be removed before Mod. '98)	1	Secure boost spring with cotter pin (arrow at No. 5) Insert the cotter pin (ø 3 mm) into the assembly bore and bend over ends. Then undo the three fastening nuts of the bracket (arrows) and remove the boost spring together with bracket and clutch pedal lever (No. 6)	Install the assembly consisting of bracket, boost spring and clutch pedal lever. Observe proper allocation when replacing the boost spring.* * Observe assembly and adjustment specification for the bracket (assembly instructions under Installation, step 4)
5a	Boost spring bearing	2		Replace if necessary. Always observe note with regard to greasing* *
5b	Pin	1		Always observe note with regard to greasing* *
6	Clutch pedal lever	1	Remove together with boost spring No. 5 and bracket	
6X	Bushings	2	Remain in the clutch pedal lever	Check, replace if necessary. Lubricate. Use grease specified*

\* Lubricate the bushings of the clutch and brake pedals (6X and 14X) with "Optimol, Optitemp LG 2" grease, part No.: 000.043.203.37 (delivery quantity: 80 g tube).

\* \*Information can be found in Repair Group 30 – Serv. No. 30 Clutch boost spring: allocation and grease specification. In the case where lubricating the boost spring bearing surfaces is not permissible, the assembly instructions under Installation, steps 3.1 and 3.2 can also be followed.

B = Brake pedal area

No.	Designation	Qty.	Removal	Note: Installation
7	Stop light switch	1	Release by turning 90°, and pull out of the installation opening	Adjust stop light switch if necessary; refer to Repair Group 46 in the passage describing stop light adjustment
8	Return spring	1	Disengage at body. Not present on vehicles before Mod. '98	If return spring has no sleeve (protective sheath), provide sleeve
9	Threaded bushing	1		Tighten to 10 Nm (7.5 ftlb.)
10	Pin	1		
11	Lock nut	1		Tighten to 20 Nm (15.0 ftlb.) (tighten to 30 Nm (22 ftlb.) on Boxster <b>before</b> Mod. '98)
12	Hexagon nut M8	1		Replace; tighten to 10 Nm (7.5 ftlb.)
13	Pedal bearing axle	1	Unscrew at hexagon	Grease in area of the bearing bushings 6X and 14X*, and tighten to 8...10 Nm (6.0...7.5 ftlb.)
14	Brake pedal	1	Pull out; to do this, turn the brake pedal and/or push rod accordingly if necessary	
14X	Bushings	2	Remain in the brake pedal	Check, replace if necessary. Lubricate. Use grease specified*

\* Lubricate the bushings of the clutch and brake pedals (6X and 14X) with "Optimol, Optitemp LG 2" grease, part No.: 000.043.203.37 (delivery quantity: 80 g tube). Any residues of the previous grease need not be removed when doing this.

## Notes on removal and installation

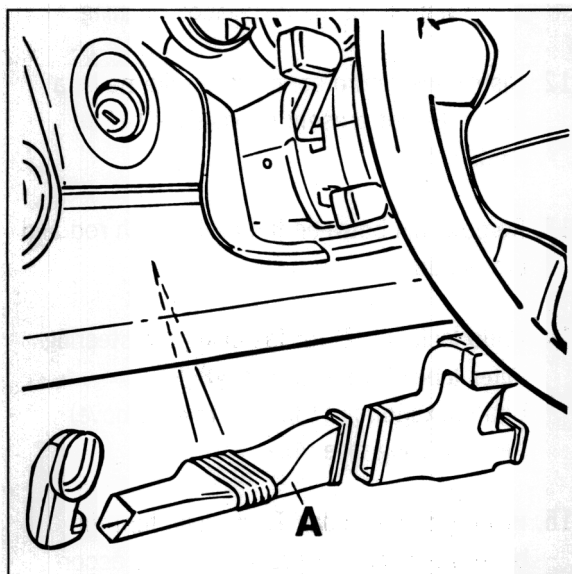
### Removal



**Warning**  
 Danger of injury and damage  
 during disassembly and  
 assembly work!  
 Clutch boost spring can  
 disassemble automatically!

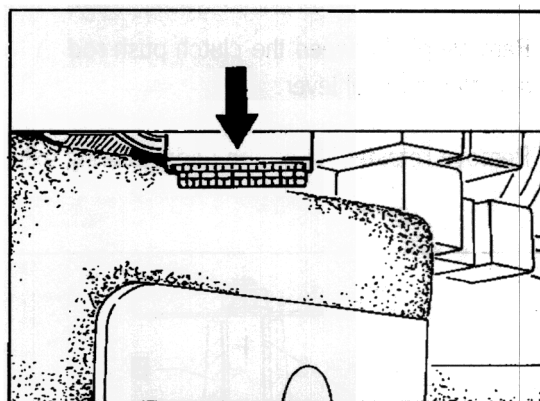
> Before the start of disassembly  
 work in the area of the clutch  
 pedal lever (exception: clutch  
 pedal switch), the clutch boost  
 spring must be fixed with a  
 cotter pin (Fig. 478\_98).

1. Disconnect battery ground cable.
2. Remove driver's seat (to facilitate work).
3. Remove air duct (A).  
 The air duct is plugged in.



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4. Detach diagnostic socket.

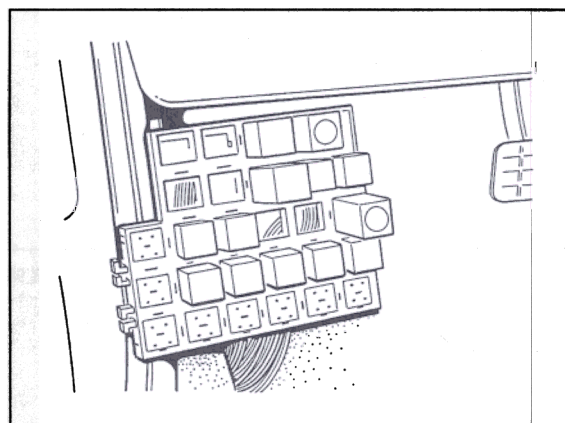


12\_96

5. Detach relay carrier, unclip and lower into the footwell.

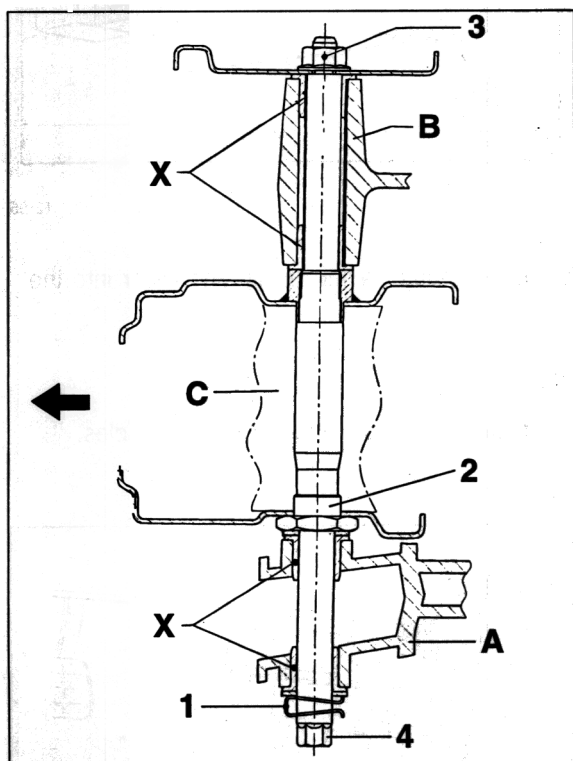
### Note

Continue with Step 11 for Tiptronic vehicles



86\_98

6. Release clutch pedal switch by turning it 90° and pull it out of the installation opening.
7. There is an assembly bore in the guide rod for the clutch boost spring. Insert a 3 mm  $\varnothing$  cotter pin in this bore, and bend over the ends (securing: refer to Fig. 478\_98).
8. Remove pin between the clutch push rod and clutch pedal lever.
9. Remove retainer (1) on the pedal bearing axle.

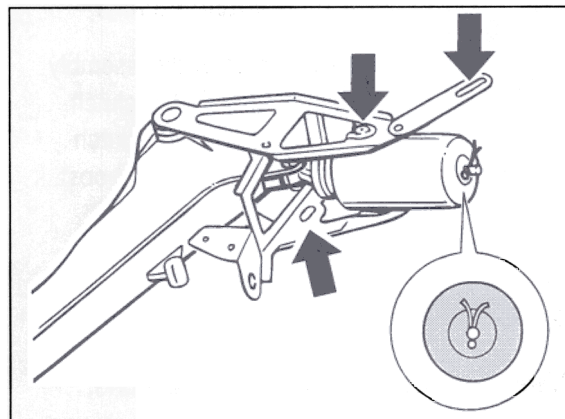


48\_98

10. Undo fastening nuts from boost spring bracket (arrows).

**Requirement:** Boost spring secured with a cotter pin.

Remove clutch pedal lever together with boost spring and bracket. The bracket is not removable on the Boxster before Mod. '98.

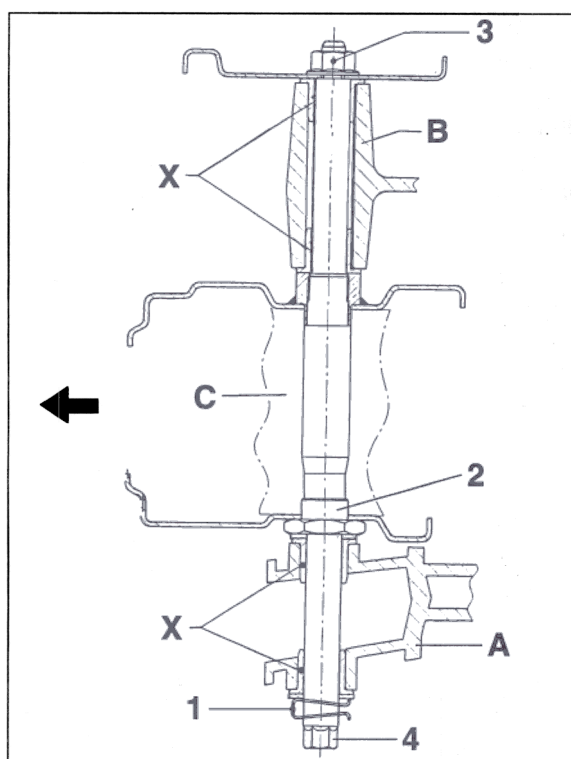


478\_98

11. Release stop light switch by turning it 90° and pull it out of the installation opening.
12. Disengage return spring for brake pedal at the body (not present on vehicles before Mod. '98).
13. Remove pin between the brake push rod and brake pedal.
14. Undo lock nut (2) for fastening the steering outer tube C; refer to Fig. 48\_98. Undo hexagon nut (3). Unscrew (remove) pedal bearing axle (4).
15. Pull out brake pedal. To do this, turn the brake pedal and/or brake push rod accordingly.

**Installation**

1. Inspect all bearing bushings X for clutch pedal lever and brake pedal and replace them if necessary. Lubricate sliding surfaces of the bearing bushings X and the pedal bearing axle with Optimol, Optitemp LG 2, part No. 000.043.203.37.



A – Clutch pedal lever  
 B – Brake pedal  
 C – Steering outer tube  
 X – Bearing bushings

1 – Retainer  
 2 – Lock nut  
 3 – Hexagon nut  
 4 – Pedal bearing axle  
 (1...4) – Removal sequence

2. Fit brake pedal and stop light switch.  
 Tightening sequence of the pedal bearing axle (refer to Fig. 48\_98):  
 No. 4 = Pedal bearing axle  
 (8...10 Nm (6.0...7.5 ftlb.))  
 No. 3 = Hexagon nut (10 Nm (7.5 ftlb.))  
 No. 2 = Lock nut for steering outer tube  
 (20 Nm (15 ftlb.) / before  
 Mod. '98 = 30 Nm (22 ftlb.))

**Note**

Stop light switch installation and stop light switch adjustment: refer to Repair Group 46, "Checking stop light switch setting".

3. Assemble boost spring, bracket and clutch pedal lever.  
 Description in 3.1 or 3.2.  
 3.1 Boxster Mod. '98 / partly Mod. '99  
 3.2 Boxster from current Mod. '99

**Note**

Different types of boost springs can be fitted in the Boxster.  
 Observe proper allocation when replacing the boost spring and/or the bracket.

In some cases, a modified (optimised) clutch pedal must also be used when replacing the boost spring.

Lubricating the boost spring bearing surfaces is sometimes necessary and sometimes prohibited (according to boost spring version).

Information can be found in the Technical Manual – Repair Group 30, Serv. No. 30 Clutch boost spring: allocation and grease specification.

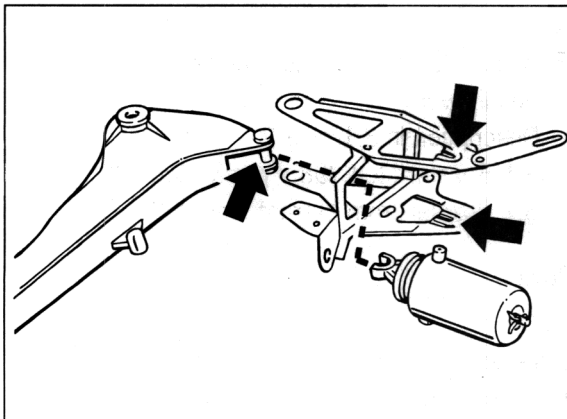
## 3.1 Boxster Mod. '98 / partly Mod. '99

## Identification/distinction:

Boost-spring push rod open on one side,  
boost spring components not coated.

Grease pin for boost spring (arrow) with mating bearing on the boost spring push rod, the boost spring bearing (arrows) and the bearing pins on the boost spring with Optimol, Optitemp LG 2, part No. 000.043.203.37.

First remove old grease with solvent naphtha.



Lubrication necessary (arrows)

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## 3.2 Boxster from current Mod. '99

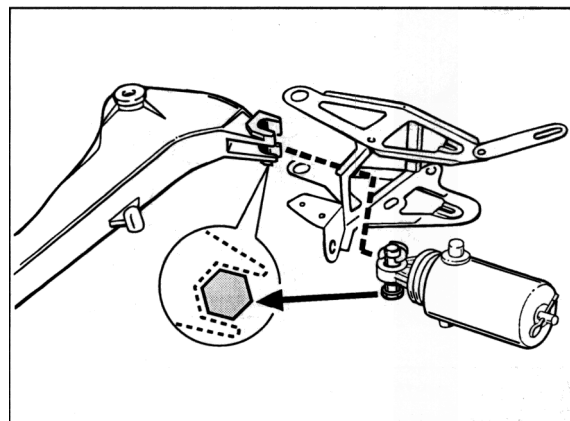
## Identification/distinction:

Push rod closed / boost spring components coated.

The date of introduction for this boost spring is contained in the Parts Catalogue.

Engage the hexagon-socket bolts of the boost spring into the hexagon on the clutch pedal (arrow).

**Important:** Do not lubricate since the sliding surfaces of this boost spring version are coated. 'Do not lubricate' applies to all sliding surfaces (boost spring pins, boost spring bearing in the bracket, bearing pins on the boost spring, and the boost spring in the boost spring pot).



Do not lubricate (prohibited)

467\_98

## Note

Silver bracket (986.423.571.00) and boost spring with white marking (986.423.081.08 Mod. '98 / partly Mod. '99 or 986.423.081.11 from current Mod. '99) must be used only in this combination and installed only in the Boxster.



4. Installation and adjustment specification for boost spring bracket.  
 Install preassembled boost spring bracket with clutch pedal lever.  
 Valid only for Boxster vehicles before Mod. '98 (bracket cannot be unscrewed or adjusted).

**To do this:**

**Step 1:**

Tighten the three fastening nuts (arrows) only slightly (the bracket must still be movable).

**Step 2:**

Tighten the clutch master cylinder to 10 Nm (7.5 ftlb.) (if the clutch master cylinder was detached).

**Step 3:**

Press the clutch pedal against the direction of travel until the pull stop in the clutch master cylinder is reached.

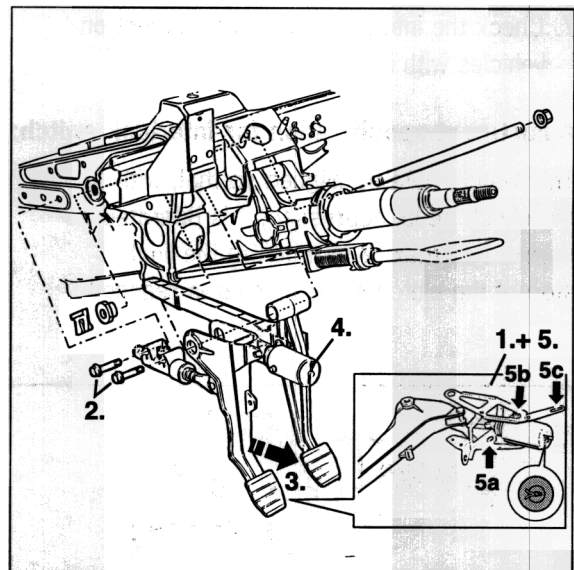
**Step 4:**

Remove cotter pin (retaining pin) on the spring cup so that the clutch pedal is pressed against the rubber stop in the boost spring bracket.

**Step 5:**

The bracket is screwed down with the clutch pedal pressed back (to make full use of the slots). Tighten hexagon nuts (arrows) in the prescribed sequence. Tightening torque: 7.5 Nm (5.5 ftlb.).

**Sequence: 5a / 5b / 5c**



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**Note**

The push rod of the clutch slave cylinder should **not** be lubricated in general (for all versions).

5. Fit new retainer on the pedal bearing axle.

On vehicles as of Mod. '98, subsequently secure the retainer by wedging it with a mandrel.

6. Install clutch pedal switch.

First pull operating plunger out of the switch as far as it will go.

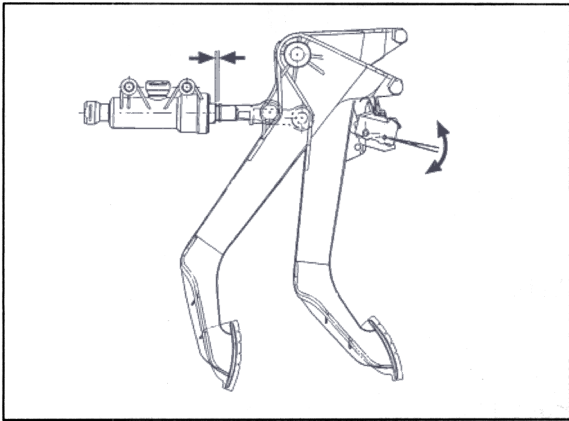
By means of its self-adjustment function, the switch then compensates for tolerances in the pedals.



7. Check the interlock switch adjustment on vehicles with interlock.

**Adjustment specification for interlock switch:**

The switch must be aligned so that, with the clutch pedal depressed, it is operated approx. 1 to max. 2 mm before the limit stop of the clutch slave cylinder is reached.



49\_98

8. Install relay carrier, diagnostic socket and air duct.
9. Perform a function test on clutch and brake operation.

**47 Tightening torques for brake hydraulics**

Location	Thread	Tightening torque Nm (ftlb.)
<b>Brake master cylinder circuits/ hydraulic unit</b>		
Brake pressure pipe to brake master cylinder, brake hose, distributor, brake caliper and hydraulic unit	M10 x 1 M12 x 1	12 - 14 (9 - 10) 20 (15)
Brake proportioning valve to brake pipe	M10 x 1	14 (10)
Hydraulic unit to holder	M8	10 (7)
Hydraulic unit to body	M6	10 (7)
<b>Brake caliper</b>		
Connecting pipe to brake caliper	M10 x 1	12 (9)
Bleeder screw to brake caliper	M10 x 1	8 - 12 (6 - 9)
Brake pressure hose to brake caliper	M10 x 1	12 - 14 (9 - 10)
<b>Brake unit</b>		
Brake unit to body	M8	23 (17)
Brake unit support to body	M8	23 (17)
Brake master cylinder to brake booster	M14	49 (36)

**47 01 07 Bleeding the brakes****Important instructions**

Use only new brake fluid DOT 4. **Observe brake-fluid quality.**

The brake-fluid change interval using Super DOT 4 brake fluid is two years. This brake fluid is available under the following part number:

Container volume 1 litre = 000.043.203.66

Container volume 30 litres = 000.043.203.67.

**Procedure for bleeding**

- Fill reservoir to its top edge with new brake fluid. **Attach bleeding device to reservoir.** Switch bleeding device on. Bleeding pressure approximately 1.5 bar.

Continue bleeding at the brake calipers in the sequence: rear right / rear left / front right / front left.

Open each bleeder valve until clear, bubble-free brake fluid emerges. Take care to bleed at each brake caliper and at both bleeder valves. Bleed the outer bleeder valve first.

Use a draining bottle to make a precise check on the emerging brake fluid for cleanliness and freedom from bubbles and to measure the used brake fluid.

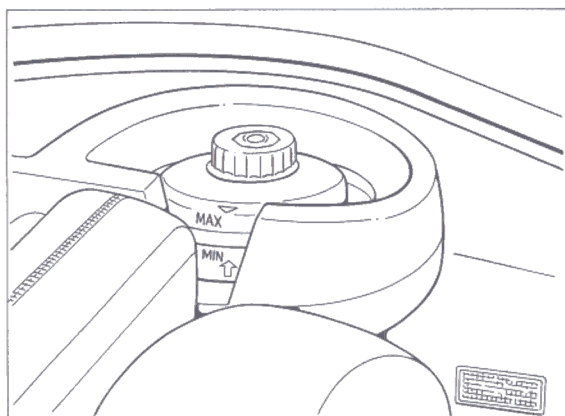
After installing a new brake master cylinder and/or a new hydraulic unit, do the following while bleeding: **open the right** rear bleeder valves, then fully depress the brake pedal several times. Hold for 2 - 3 seconds after each depression, then release slowly. Repeat this procedure in the sequence **rear left / front right / front left**. This will remove all air bubbles (from the primary circuit).

**Note**

Also carry out this procedure if the brake hydraulics were largely empty or if after bleeding residual air can be detected by **excessive brake-pedal travel**.

**Caution:** In vehicles with high mileage or in old vehicles, double the pumping cycles and use only half the brake master cylinder stroke (damage to the brake master cylinder could occur / primary boot damage).

Switch off and close bleeder device. Correct brake fluid level if necessary.



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#### Note

On vehicles with Traction Control (TC) consisting of ASR and ABD (4-channel system), the ABD circuit (in the hydraulic control unit) must be additionally bled **when the hydraulic control unit is replaced or removed** (see following text).

#### Bleeding the ABD circuit (secondary circuit) on vehicles with Traction Control (TC)

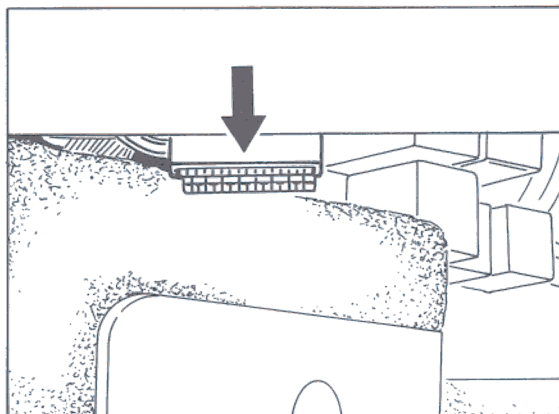
Preliminary work: Bleed brakes as usual (Page 47 - 3/4).

To bleed the ABD circuit, the bleeding device remains connected (switched on).  
Bleed pressure approximately 1.5...2.0 bar.

Connect Porsche System Tester 2 to the diagnosis socket.

The diagnosis socket is located in the driver's footwell (left-hand drive vehicles) or passenger's footwell (right-hand drive vehicles) near the fuse box.

Switch ignition on. In the ABS / TC system, select the "Bleed" menu.



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Open rear right bleeder valve (use draining bottle).

Press Start button on the System Tester.

This initiates certain functions in the hydraulic control unit (return pump, switch-off and switch-over valves are actuated).

Bleed until clear, bubble-free brake fluid emerges.

In addition (throughout bleeding operation) fully depress (pump) brake pedal as far as the stop at least ten times.

**Caution:** In vehicles with high mileage or in old vehicles, double the pumping cycles and use only half the brake master cylinder stroke (damage to the brake master cylinder could result / primary boot damage).

Close right rear bleeder valve. Then immediately press Stop button on the System Tester.

Switch ignition off and disconnect System Tester.

Switch off and close bleeder device.  
Correct brake fluid level if necessary.

**47 08 55 Changing brake fluid****Important instructions**

Use only new brake fluid DOT 4. **Comply with change interval and brake-fluid quality.**

Total brake-fluid change quantity  
**approximately 1 litre.**

**The brake-fluid change interval using Super DOT 4 brake fluid is two years.**

This brake fluid is available using the following **part numbers:**

Container volume 1 litre = 000.043.203.66

Container volume 30 litres = 000.043.203.67

Use a draining bottle to make a precise check on the emerging brake fluid for cleanliness and freedom from bubbles and to measure the used brake fluid.

Also bleed some brake fluid (approximately 50 cm<sup>3</sup>) at the bleeder valve of the clutch slave cylinder.

Switch off and close bleeder device. Correct brake fluid level if necessary.

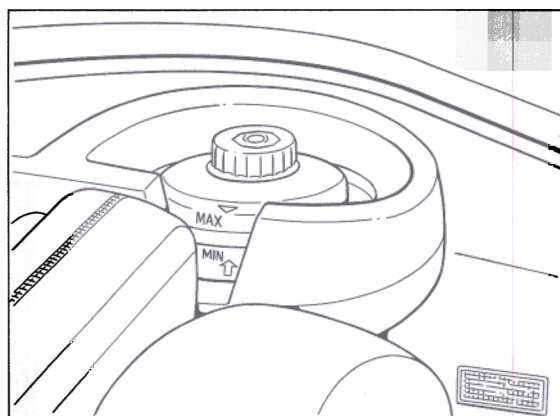
**Procedure for brake-fluid change**

- Fill reservoir to the top with new brake fluid.  
**Connect bleeding device to the reservoir.**  
Switch bleeder device on. Bleed pressure approximately 1.5 bar.

Continue bleeding at the brake calipers (no special sequence).

Open each bleeder valve until clear, bubble-free brake fluid emerges or the appropriate change quantity per brake caliper has been reached (approximately 250 cm<sup>3</sup>).

Ensure that brake fluid is bled **at both** bleeder valves of each brake caliper.



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**47 15 19 Removing and installing brake master cylinder****Removal**

1. Remove cover for hydraulic unit.
2. Remove brake fluid from reservoir using suction.
3. For vehicles with manual transmission, remove the clutch line at the reservoir. Press on the ring to do this (unlocking) and pull the line out of the reservoir at the same time.
4. Disconnect the electrical line (plug) on the reservoir.
5. Undo the brake lines on the brake master cylinder.  
Undo the fastening nuts (A) from the brake master cylinder. Pull out brake master cylinder.

**Note**

Close the brake lines and the brake line connections with suitable plugs.

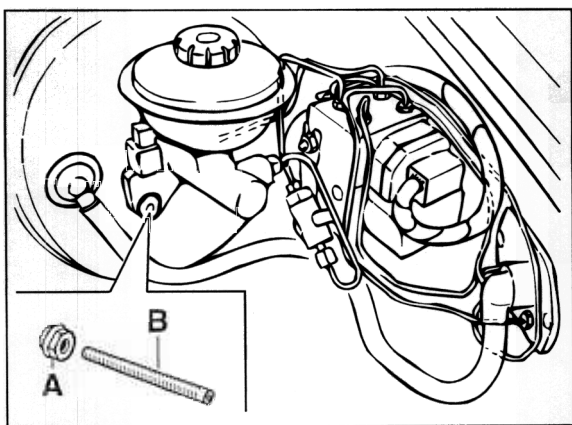
**Installation**

1. Install in reverse order.
2. Bleed brakes (Serv. No. 47 01 07).

**Note**

After conventional bleeding, the ABD circuit must then be bled for vehicles with TC. The Porsche System Tester (PST 2) is required for this.

3. Bleed the clutch system (Serv. No. 30 01 07) for vehicles with manual transmission.
4. Carry out a function check of the brakes.



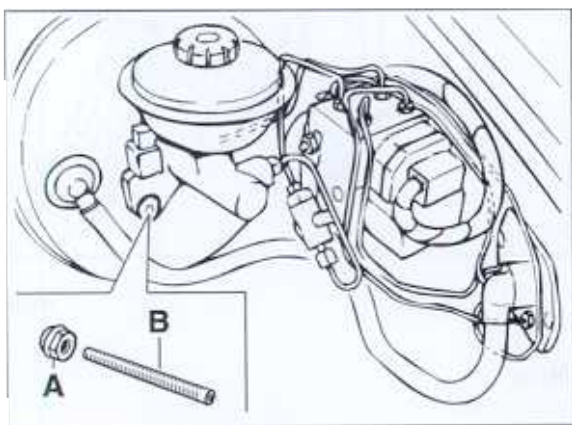
- A = Fastening nuts for  
brake master cylinder  
B = Fastening screws (Torx) for  
brake booster

459\_99



**47 70 19 Removing and installing brake booster****Removal**

1. Remove cover for hydraulic unit.
2. Remove brake fluid from reservoir using suction.
3. For vehicles with manual transmission, remove the clutch line at the reservoir. Press on the ring to do this (unlocking) and pull the line out of the reservoir at the same time.
4. Disconnect the electrical line (plug) on the reservoir.
5. Undo the brake lines on the brake master cylinder.  
Undo the fastening nuts (A) from the brake master cylinder. Close the brake lines and the brake line connections with suitable plugs. Pull out brake master cylinder.

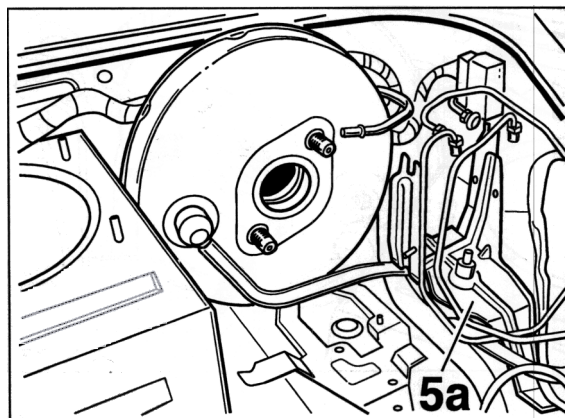


- A = Fastening nuts for  
brake master cylinder  
B = Fastening screws (Torx) for  
brake booster

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6. Remove drive belt (refer to service No. 45 30 19).

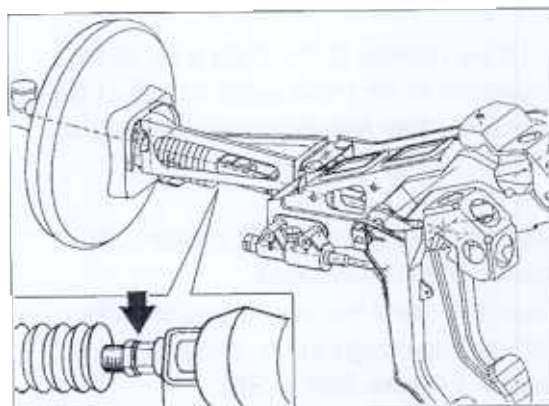
7. Remove holder of hydraulic unit (5a) (3 nuts).



5a - Holder for hydraulic unit

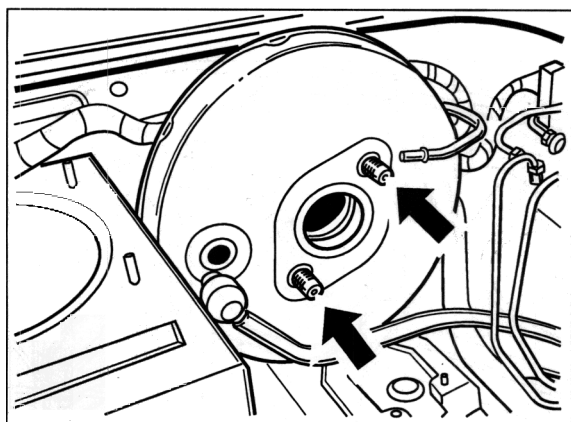
461\_99

8. Remove the pushrod of the brake unit at the pushrod of the brake pedal.  
To do this, undo the lock nut and turn the pushrod accordingly at the hexagon (arrow).

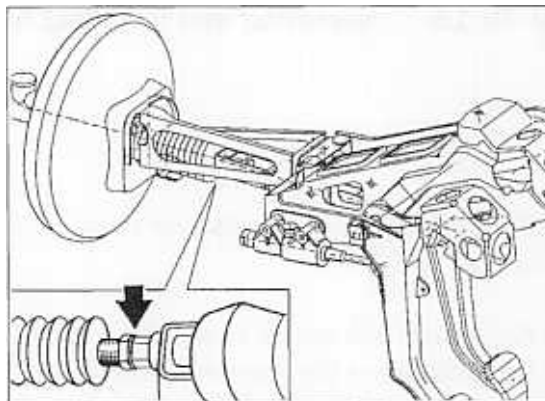


266\_g\_96

9. Disengage the vacuum line on the brake booster.  
Undo the fastening screws (arrows) of the brake booster (Torx T 45).  
Pull out brake booster.



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The brake pushrod is correctly set if  
**dimension X = 45 + 5 mm.**  
Perform measurement between the centre of the brake pedal plate and the accelerator.

### Installation

1. Insert brake unit. Tighten fastening screws (Torx T 45) to 23 Nm (17 ftlb.).

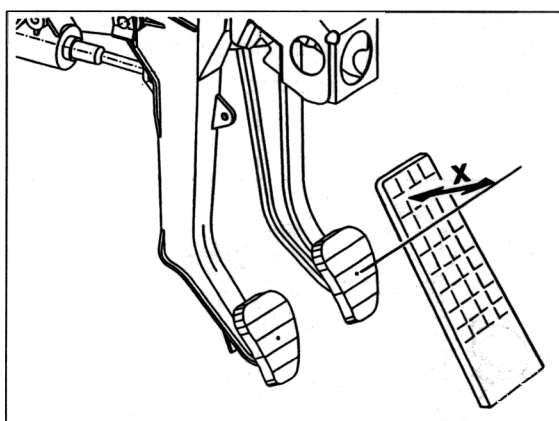
### Note

Do not trap wiring harness.

2. Fit the pushrod of the brake units on the pushrod of the brake pedal and adjust the pushrod (see Adjusting the brake pushrod, Serv. No. 46 11 15).

Adjusting the pushrod length changes the position of the brake pedal.

To do this, undo the lock nut and turn the pushrod accordingly at the hexagon (arrow / Figure 266\_g\_96).



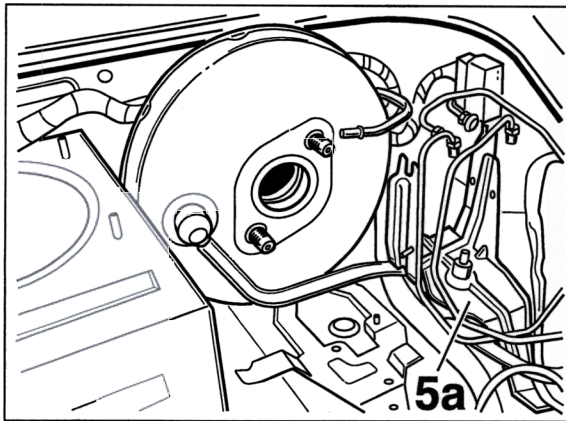
327\_96

### Note

After the brake pushrod is adjusted, check the brake light switch adjustment.

3. Fit the vacuum hose for the brake booster.

4. Install holder for hydraulic unit 5a (3 nuts).



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5. Install hydraulic unit.

6. Fit the brake lines on the brake master cylinder.

#### Note

Ensure that the reservoir is engaged correctly on the brake master cylinder.

7. Bleed brakes in the conventional manner (see Serv. No. 47 01 07).

#### Note

After conventional bleeding, the ABD circuit must then be bled for vehicles with TC. The Porsche System Tester (PST 2) is required for this.

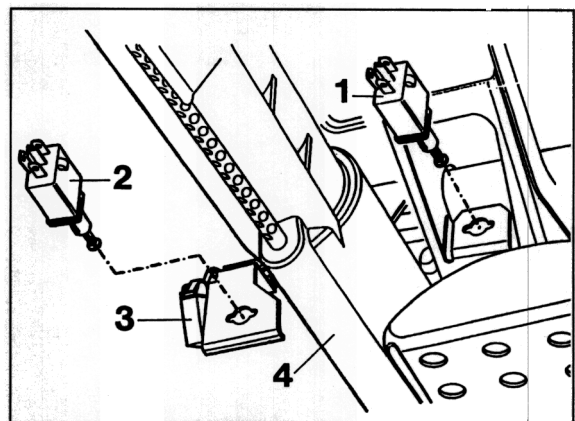
8. Bleed the clutch system (Serv. No. 30 01 07) for vehicles with manual transmission.

9. Check the setting of the brake light switch (1).

The pedal must move a perceptible distance of approx. 5 to 10 mm before the brake light lights up.

At the same time, check (make sure) that the brake light lights up before the pedal meets perceptible resistance or before brake pressure builds up.

Set / adjust again if necessary (see 46 Checking brake light switch setting).



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10. Check electrical and hydraulic lines (brake lines) for incorrect assignment using the Porsche System Tester 2.

#### Note

The test checks that the brake lines/solenoid valves are assigned to the correct brake calipers (wheels).

**To do this**, carry out a system test on vehicles with ABS or ABS/TC, see 45 02 Diagnosis/troubleshooting System ABS 5.3 or System ABS/TC 5.3.

11. When replacing the hydraulic unit in vehicles with ABS/TC (4-channel system), code the control module (manual transmission or Tiptronic).
12. Check brakes and ABS for correct functioning.  
Perform a short test drive to do this, and carry out at least one ABS control operation while taking into account the traffic situation. Then read out the fault memory.

**48            Tightening torques for steering**

Location	Thread	Tightening torque Nm (ftlb.)
Steering gear to cross member *	M10 / 10.9	65 (48) *
Track rod (ball joint) to steering arm	M12 x 1.5 / 10.9	75 (55)
Universal joint (steering shaft) to steering gear **	M8	23 (17) **
Track rod to ball joint (lock nut)	M16 x 1.5	50 (37)
Track rod to steering rack	M16 x 1.5	80 (59)
Steering wheel to steering shaft	M16 x 1.5	46 (34)
Steering outer tube to pedal bearing block, top	M10 x 1.5	46 (34)
Steering outer tube to pedal bearing block, bottom <b>before Mod. '98</b> <b>as of Mod. '98</b>	M16	30 (22)
	M14	20 (15)
Steering lock to steering outer tube	M6	13 (10.0)
Pressure and return pipes to steering gear	M10 x 1.5	20 (15)

\* Replace screws whenever removed.

\* Replace fit bolt whenever removed.

## 48 Test and assembly work on power-assisted steering

### General

Damage to power-assisted steering results from lack of oil in the hydraulic system. Because of the high oil pressure in the hydraulic circuit, even small leaks can cause loss of fluid and damage the servo pump.

Grinding noises when the steering is on lock or the formation of foam in the reservoir indicates lack of oil and/or the sucking in of air. Before filling the reservoir, any existing leaks must be eliminated on the suction side. Alternatively, the defective part on the pressure side should be replaced.

Only **Pentosin CHF 11 S** may be filled into the reservoir. Pentosin CHF 11 S can be ordered with the following part number:  
Quantity supplied **1 litre** = 000.043.203.33.

### Important note

Rack-and-pinion steering gear and servo pump must not be repaired or dismantled.

### Servo-pump drive belt

The drive-belt pretension cannot be adjusted.

### Checking the steering system for leaks (visual check)

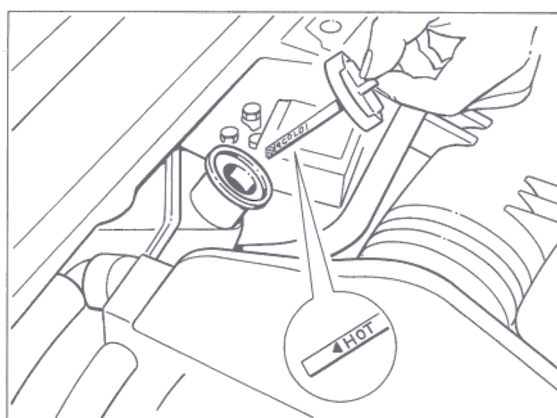
With engine idling, turn steering wheel as far as the stop and hold still. The maximum possible line pressure results in this way.

In this position, check all pipe connections for leaks and retighten if necessary.

Perform the check for a maximum of ten seconds. A longer check should always be interrupted by a brief pause after approximately ten seconds.

### Checking Pentosin CHF 11 S hydraulic fluid in the power-steering system

The reservoir is located in the engine compartment. There are two marks on the dipstick located on the reservoir cap. One side bears the mark "Cold" for a cold engine (approximately 20° C) and the other "Hot" for a hot engine (approximately 80° C).



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Check the fluid level (Pentosin CHF 11 S) **with the engine stationary and cold** (approximately 20° C).\*

1. Open engine compartment lid. Open reservoir cap.
2. Wipe dipstick.  
Close reservoir cap and open it again. The fluid level should lie in the hatched area **below** the "Cold" mark (mark = maximum level at 20° C).  
Top up with Pentosin if necessary.\*  
**The upper "Hot" mark is intended for a fluid temperature of 80° C.**

**In no case add too much Pentosin!\***

**The respective marks are for the maximum fluid level at the "COLD" or "HOT" temperature.**

#### Notes

If assembly work was performed previously, check the fluid level **with the engine idling** and without operating the steering.\*

**Multiple steering operations (manoeuvring) with the engine switched off change the fluid level in the reservoir - the fluid level increases. In this case, the engine must be run for at least 5 seconds immediately before the fluid level is checked.\***

#### Bleeding the steering system

1. To fill the whole system after the installation of new steering components or lines or after a substantial loss of hydraulic fluid, briefly start the engine a few times and, when it fires, switch it off again immediately.

This procedure causes the fluid level in the reservoir to fall rapidly, so constantly add Pentosin CHF 11 S.\* The reservoir must not be sucked dry.

2. If the fluid level in the reservoir does not fall any further when the engine is briefly turned over, start the engine and let it to run at idling speed.
3. Rapidly turn the steering wheel from stop to stop several times so that the air can escape from the cylinders. At the end positions of the piston, do not pull the steering wheel with more force than is necessary in order to turn the steering (to prevent unnecessary build-up of pressure).
4. Observe fluid level during this procedure. If it continues to fall, add fluid until the level in the reservoir remains constant and no more air bubbles rise in the reservoir when the steering wheel is turned.
5. Correct the fluid level with the engine at idling speed – without operating the steering.\*

- \* **When topping up or filling in Pentosin, make sure that it does not come into contact with the coolant hoses!**

In order to avoid overfilling and thus overflowing, observe the specifications on Pages 48-3/48-4.

**If coolant hoses come into contact with Pentosin, thoroughly clean them with water IMMEDIATELY!**

**Replace visibly swollen coolant hoses!**



**48 10 19 Removing and installing steering wheel (airbag)****Removal**

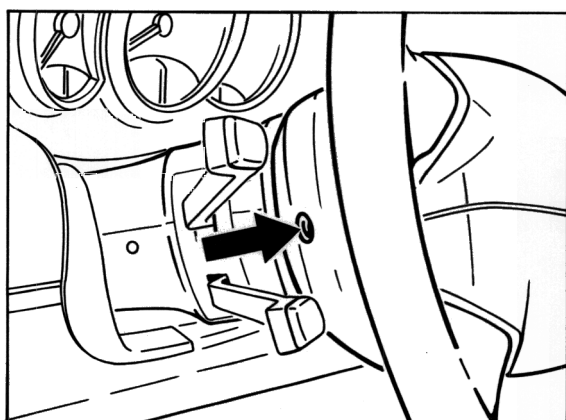
1. Disconnect battery and cover terminal or battery.
2. Remove driver's airbag unit. For this purpose, loosen the two fastening screws with a screwdriver for internal Torx T 30. Disconnect plug connection at airbag unit and at steering wheel (for horn).

**Note**

Replace fastening screws whenever they have been loosened.

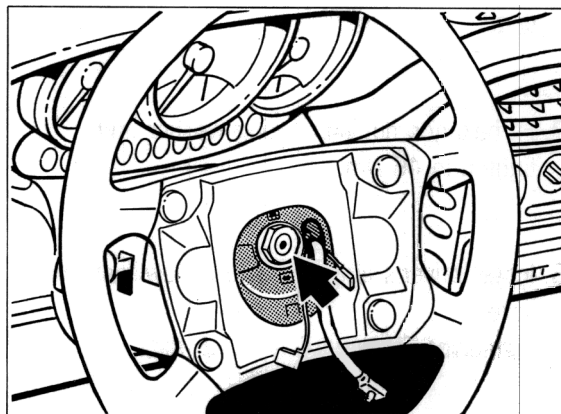
The airbag unit must always be set down so that the cushioned side faces upward.

If removed for a lengthy period, the airbag unit must be stored under lock and key. Observe safety regulations.



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3. Loosen hexagon nut and remove together with spring washer.



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4. Turn wheels to straight-ahead position. Then mark the position of the steering wheel with respect to the steering shaft (for refitting). Remove steering wheel (in straight-ahead position).

**Note**

To prevent **unintended rotation of the contact unit (KE)** when the steering wheel has been removed, the contact unit locks itself when the steering wheel is pulled back. Likewise, the contact unit unlocks automatically when the steering wheel is refitted.

### Installation

1. Refit the steering wheel with the wheels in the straight-ahead position or in accordance with the marking so that the upper spokes of the steering wheel are horizontal.

Caution: Do not trap the cable of the contact unit.

2. Fit hexagon nut with spring washer and tighten to 46 Nm.

3. Install driver's airbag unit. Use new fastening screws.

Tightening torque: 10 Nm (7.5 ftlb).

4. Check horn for operation.

## 48 Replacement of steering after accident damage

### A. Fundamentals

Various kinds of damage can be caused to the steering gear in the event of accidents or **driving conditions resembling accidents**. In cases where the steering gear shows no external damage it can be difficult and costly to detect damage. Nevertheless, this damage represents an unacceptable risk for the vehicle, since it could lead to failure of the steering system.

Since a comprehensive check on all individual parts of the steering gear would not make sense, as a rule, and is not possible using the ordinary means of a workshop, **instead** the condition of other components that are easier to check should be considered.

The following guidelines (section B) serve for a decision on whether the steering gear of a vehicle involved in an accident should be replaced or may continue to be used.

### B. Assessment of the steering of a vehicle involved in an accident

The steering gear **can** remain in the vehicle if **all the following conditions are met**:

No visible damage to such front-axle parts as wheel rims, spring struts, wheel carriers, control arms, steering arms, track rods, front-axle cross member, front-axle side members, the steering shaft or to the points on the body where wheel suspension parts are bolted on.

No impermissible rise in torque and no jamming or catching when the steering gear is turned from stop to stop. When the steering is turned, the front wheels must be free (front axle raised) and, in addition, the engine must be switched off (pump of power steering undriven).

The permissible tolerances for wheel alignment must not be exceeded.

The steering gear **must be repaired or replaced if one of the following points applies**:

**Visible or detectable damage to the steering gear.**

**Fire damage (e.g. steering bellows burnt).**

**Permanent deformation or breakage of:**

Steering-gear mounts

Track rods

Steering arms

Spring struts

Wheel carriers

Control arms

Front-axle side members

Front-axle cross members

If the listed criteria are **insufficient** for a decision, we recommend that the steering gear be repaired or replaced.

**C. Exceptional regulation/order handling**

If a workshop's **intended exchange of steering gear** is refused by a customer or insurer for reasons of costs, an expert or –if this is impossible abroad, the importer – should be called in at the cost of the refusing party. If the decision contradicts the guideline, we recommend that a memorandum be drawn up on the point and that it be countersigned by the expert.

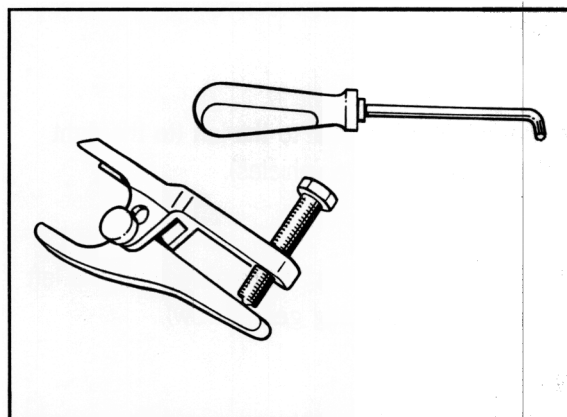
Externally undamaged power-assisted steering gear that has to be exchanged will be obtainable as an exchange part at a later time (as far as is known in March 1996).

**48 90 19 Removing and installing power-steering gear****Removal**

1. Remove underside panel.
2. Loosen universal joint (steering shaft) at steering gear. For this purpose, take out the clamping screw and slide the joint upwards.

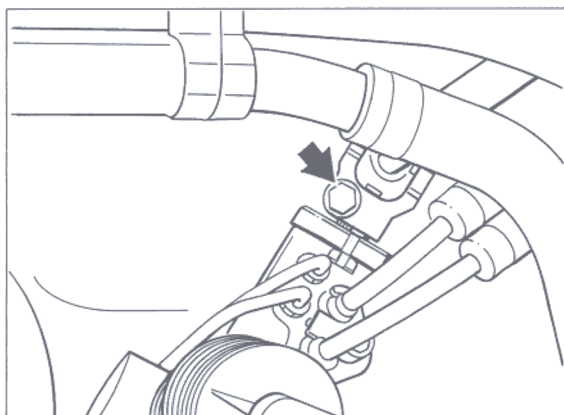
**Note**

First fix the steering wheel with the wheels in straight-ahead position or removes the steering wheel with the wheels in straight-ahead position. If this is not done, the airbag contact unit will have to be put in center position after installation of the steering gear (Page 48 - 12).



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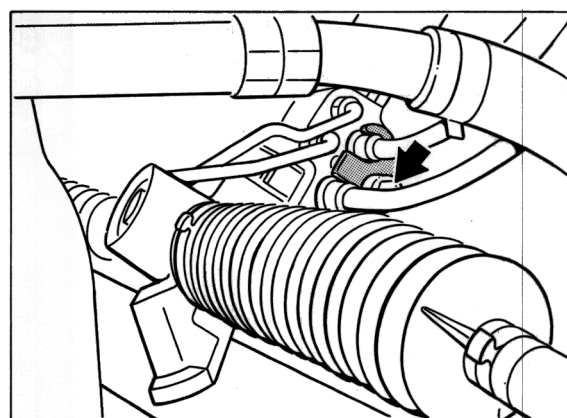
4. Repeat procedure on the other side.



19-96

3. Press out track-rod ball joint from steering arm. Use special tool 9560 (ball-joint extractor).

When loosening the locknut, hold it with special tool 9546 (Torx screwdriver).



20-96

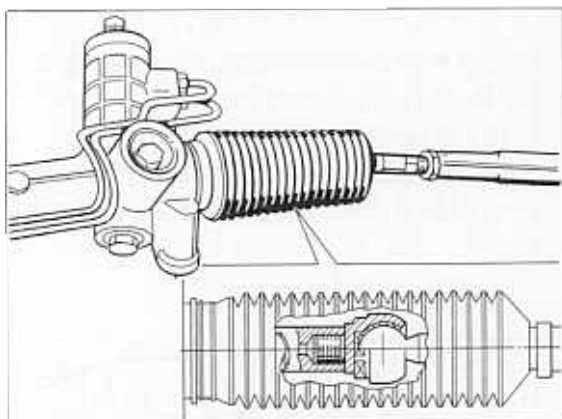
5. Loosen feed and return pipe at steering gear. For this purpose, loosen the hexagon socket head bolt (arrow) and remove the retainer plate. Seal pipes or use collection containers. If necessary, cover pipes to prevent contamination.

6. Loosen the two steering-gear fastening screws (on the underside of the cross member).
7. Extend steering gear to the left (to the right for right-hand drive vehicles).
8. If necessary, loosen and remove right and left track rod at steering gear (arrow).

**Note**

Ensure that no damage (scoring) is caused to the steering rack.

To loosen and tighten the track rods, secure the steering gear on a suitable plate.



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**Installation**

Install in the reverse order. Ensure you **comply** with the following points while doing so:

**Replace steering-gear fastening screws and the fit bolt of the steering shaft whenever removed.** Screw threads must be clean and free of grease.

**Ensure that no damage (scoring) is caused to the steering rack.**

With steering rack in fully extended state, grease with VW steering-gear grease AOF 063 000 04.

Also grease outside of steering pinion shaft at the teeth for the universal joint of the steering shaft.

Mount the track rods on the steering gear (Figure 133-96).

Then secure the appropriate bellows with new circlips.

With steering gear, steering wheel and airbag contact unit (spiral spring) in center position, push on universal joint (steering shaft) in the correct position.

For ease of assembly, put steering-gear fastening screws just in place.

**Comply with notes for sliding piece and airbag contact unit (Page 48 - 12).**

**Observe note on steering-gear center position in the section describing front track adjustment in Repair Group 44.**

After fitting the pressure pipes, fill steering hydraulics with Pentosin CHF 11S and **bleed steering system.**

#### Important notes

**When topping up or filling in Pentosin, make sure that it does not come into contact with the coolant hoses!**

Observe the specifications in order to avoid overfilling and thus overflowing.

**If coolant hoses come into contact with Pentosin, thoroughly clean them with water IMMEDIATELY!**

**Replace visibly swollen coolant hoses!**

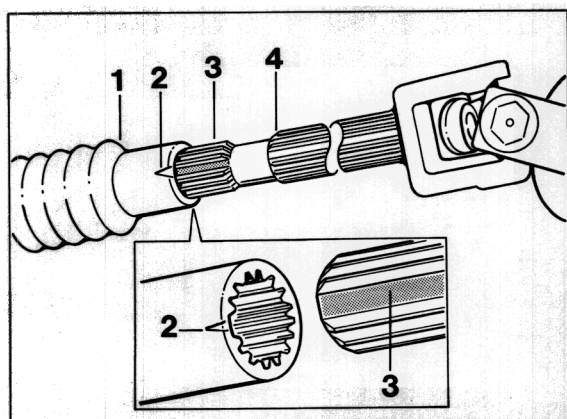
Tighten all screwed connections with the prescribed tightening torque values.

Check and/or adjust track.



# Notes for sliding piece and airbag contact unit

1. If sliding piece No. 1 was pulled off steering shaft No. 4, notch No. 2 must point to the tooth gap (No. 3) on assembly.



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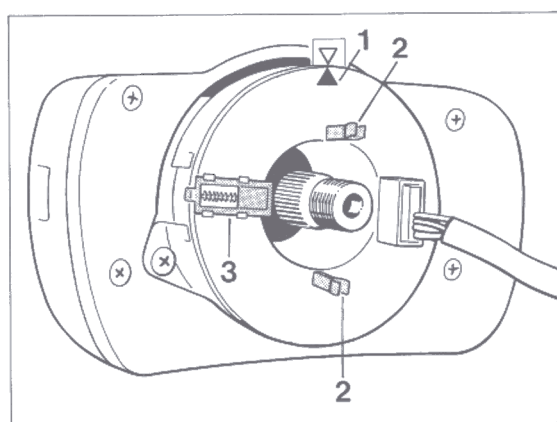
2. If the steering wheel was **not fixed before** the steering gear was removed, **the position of the contact unit (spiral spring) may no longer be correct.**

In this event, remove steering wheel and move contact unit to center position.

If this is not done, the spiral spring may be damaged.

**Center position:** First move contact unit against the end stop. Turn contact unit two revolutions back from the end stop and then continue turning as far as the center position mark. The exact center position is indicated by the two arrows (No. 1).

Turn front wheels to straight-ahead position before fitting the steering wheel (steering shaft mounted on steering gear).



1741-48

- 1 = Center position mark (arrows)
- 2 = Drivers that engage in the steering wheel
- 3 = Locking (securing against turning), which becomes effective after removal of the steering wheel

## 48 Plug-in couplings for steering hydraulic system

### Important notes

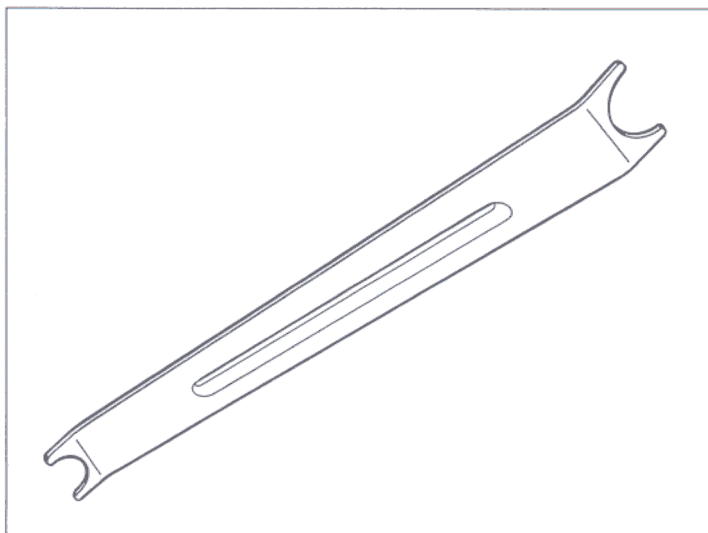
The principle of the plug-in couplings for the pressure and return lines is the same. It is the diameter of the plug-in coupling and of the pipelines that differ (return line = large diameter / pressure line = small diameter).

Plug-in couplings are components that permit simple, fast and precise connection of pipelines.

**These precision components must be handled carefully during repairs. Excess force during assembly work, damage to the sealing surface and soiling can cause leakage.**

Perform preparations carefully when handling plug-in couplings - e.g. cleaning and fitting the plugs  
- **as repairs are possible only by replacing the affected line in most cases.** Only the threaded part A (with fitted O-rings) and the holder C are available as individual parts for the plug-in coupling (see Page 48 - 14).

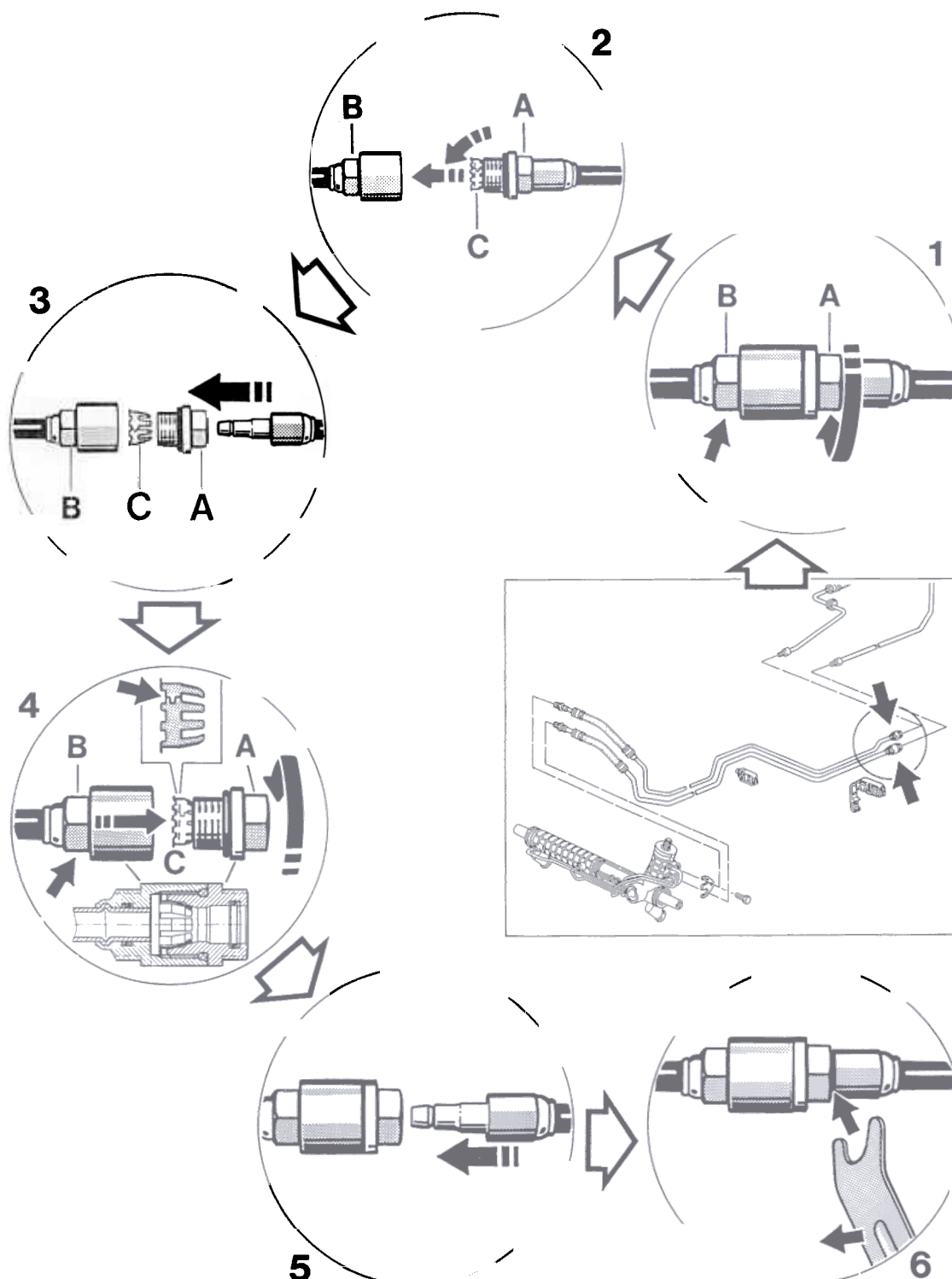
### Tools



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No.	Designation	Special tool	Explanation
A	Testing tool for plug-in couplings	9623	Used to check whether the plug-in couplings are seated properly. Suitable for pressure and return lines (nominal diameter 6 and nominal diameter 10)

# Plug-in couplings for steering hydraulic system



## Plug-in couplings for steering hydraulic system

### Note

Pressure and return lines have different dimensions.

Pressure line = nominal diameter 6, return line = nominal diameter 10.

The plug-in coupling is **opened** by unscrewing.

It is **joined** by plugging together.

Join the plug-in connection only in a straight line. Never use excess force.

After separating the plug and socket piece, carefully protect them against dirt and scratches with caps.

Pull slightly to make sure the connection is locked properly. Use special tool 9623 for this purpose.

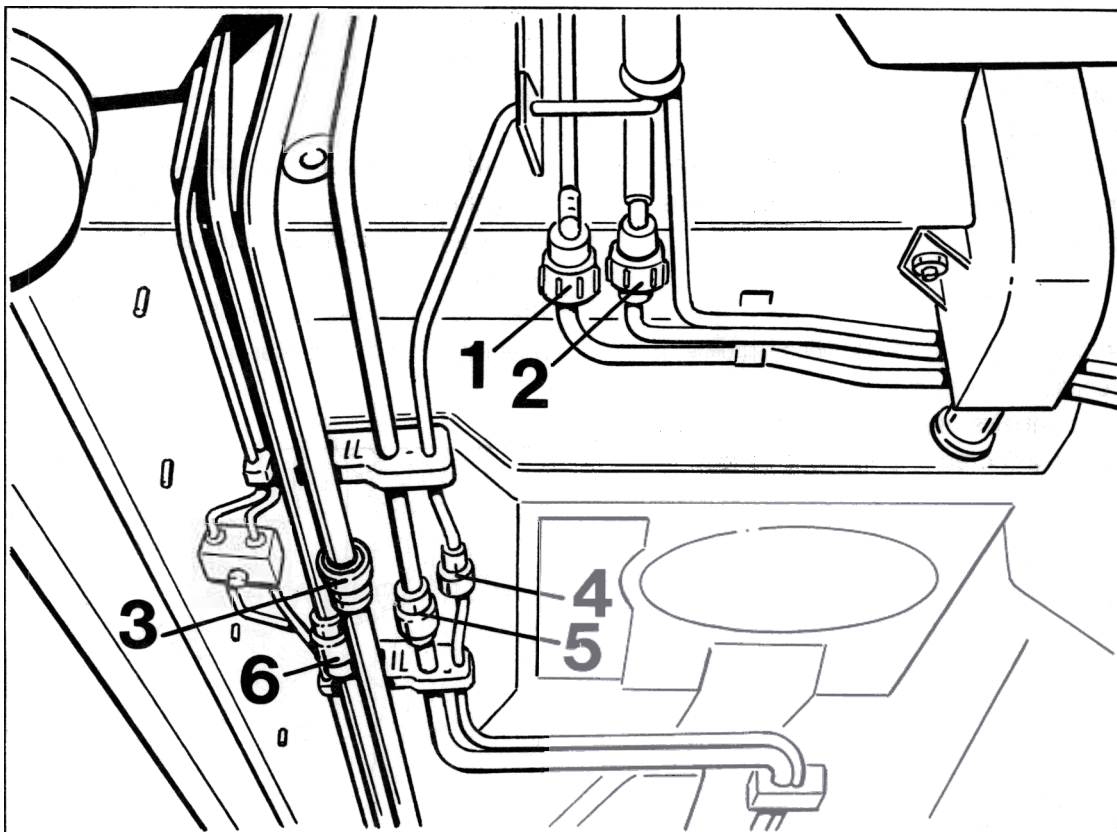
No.	Procedure	Instructions
	Open plug-in coupling.	Turn at threaded part A to open the plug-in coupling. When doing so, counter at plug-in coupling B.
	Open corresponding retainers on the body.	Carefully disengage clip and fold down.
2	Remove holder C.	Tilt holder C on one side and simultaneously pull to disengage.
3	Pull threaded part A from the plug.	Detach threaded part A by pulling it off the plug.
4	Screw together plug-in coupling.	Close holder C (arrow / dovetail system). Screw threaded part A with fitted holder C into plug-in coupling B and tighten. Counter when tightening. Replace holder C and threaded part A if necessary in order ensure that the plug-in connection functions properly (holding function and tightness).

No.	Procedure	Instructions
5	Join plug-in coupling.	Insert the plug (line with plug) into the plug-in coupling in a straight line. The plug must audibly engage in the holder.
6	Use special tool 9263 to check whether the plug-in coupling was engaged properly.	Insert special tool 9263 into the groove (arrow) and apply <b>slight pressure</b> on the special tool <b>to check whether the connection is securely locked (holder is seated properly)</b> . <b>The plug must not slide out.</b> If the special tool cannot be inserted in the groove of the plug, shift the plug in the plug-in coupling (pull on plug with-out using excess force).
		<b>Note</b>  The plug-in connection is designed so that the plug can be shifted in the plug-in coupling by approx. 1 mm in axial direction by slightly pulling or pressing.
	Close corresponding retainers on the body.	Carefully fold the clip up and engage.

## 48 Plug-in couplings for pipelines

Different plug-in couplings are used for various applications (see Allocation).

### Allocation of plug-in couplings / pipelines\*



- 1 = Fuel line with two unlocking buttons
- 2 = Fuel line with one unlocking button
- 3 = Vacuum line (for brake booster)
- 4 = Steering pressure line
- 5 = Steering return line
- 6 = Clutch line (hydraulic actuating system / blue line)
- = Steering return line on hydraulic pump (see Figure on Page 48-22)

\* All listed plug-in couplings are used at various installation locations and on different components, e.g. on the carbon canister and on the oil dipstick guide tube.

## Opening and joining plug-in couplings

### Important notes

Plug-in couplings are components that permit simple, fast and precise connection of pipelines.

**These precision components must be handled carefully during repairs. Excess force during assembly work, damage to the sealing surface and soiling can cause leakage.**

Perform preparations carefully when handling plug-in couplings - e.g. cleaning and fitting the plugs - **as repairs are possible only by replacing the affected line in most cases.**

After separating the plug and socket piece, carefully protect them against dirt and scratches with caps.

Join the plug-in connection only in **a straight line**. Never use excess force. Pull slightly to make sure the connection is locked properly.

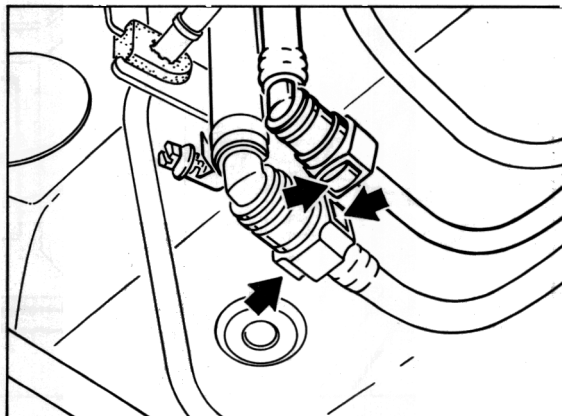
### Fuel lines

Operate unlocking button(s) (press) - see arrows - and simultaneously separate the pipelines by pulling them apart.

Join the connection by plugging together in a straight line.

The plug (the plug-in part) must audibly engage in the plug-in coupling.

Then pull the connection slightly to check whether it was locked properly.



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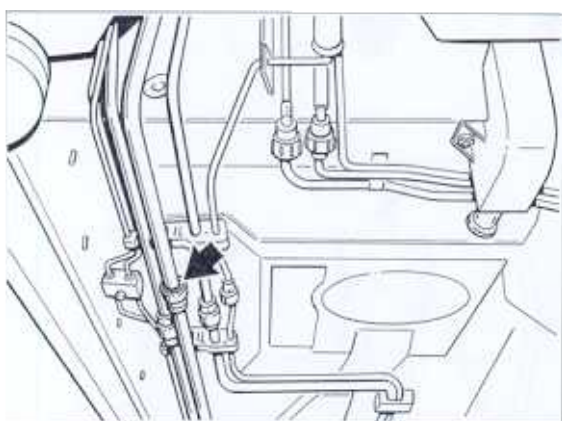


### Vacuum line

In order to undo the vacuum line, **press the black unlocking ring (arrow)** and simultaneously pull the lines apart.

Join the connection by plugging together in a straight line.

Then pull the connection slightly to check whether it was locked properly.



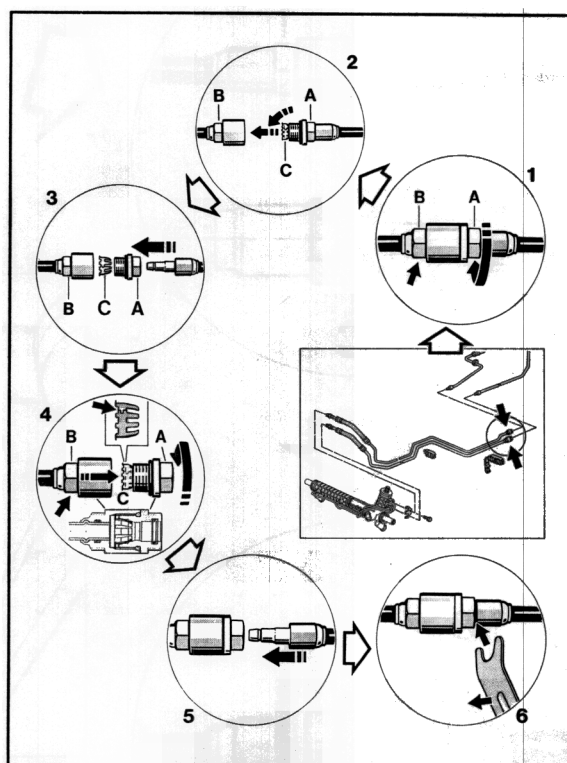
664/2 - 96

### Steering pressure line and return line

The plug-in couplings are **opened** by unscrewing.

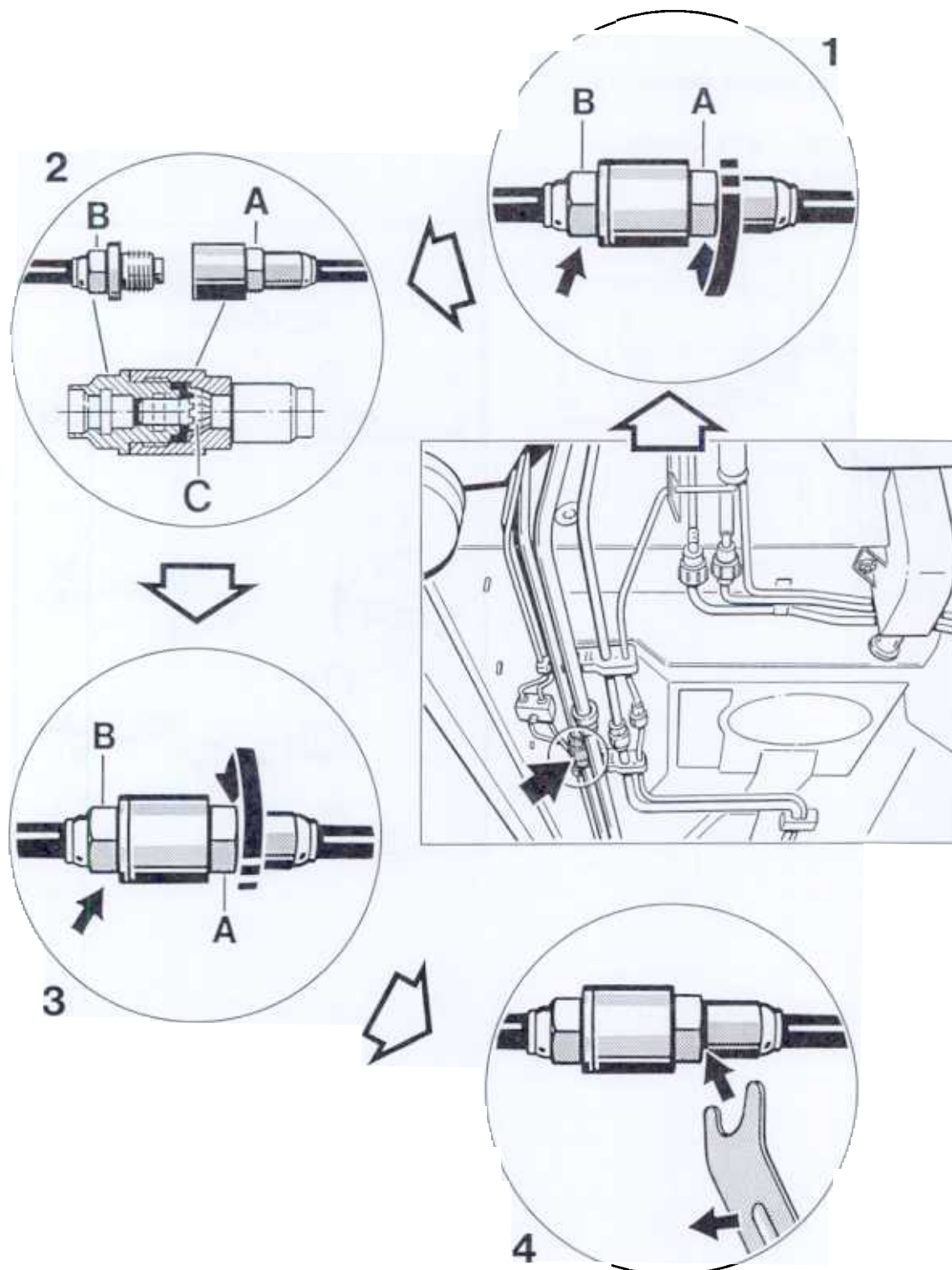
They are **joined** by plugging together.

A detailed description about opening and joining is given on Pages 48 - 13 to 48 - 16.



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# Clutch line



**Note**

The plug-in coupling is opened by unscrewing.

**Pipelines that were fitted once before are joined by screwing together** (as opposed to new lines and steering lines, which are plugged together). This is necessary because **holder C** is located very deep in the threaded part of the plug-in coupling and cannot be removed with conventional workshop equipment.

No.	Procedure	Instructions
1	Open plug-in coupling.	Turn at threaded part A to open the plug-in coupling. When doing so, counter at plug-in coupling B.
2	Separate lines.	Remove lines from the retainers on the body and separate.
3	Screw together plug-in coupling.*	Turn at threaded part A when joining the plug-in coupling. When doing so, counter at plug-in coupling B.
4	Use special tool 9263 to check whether the plug-in coupling was engaged properly.	<p>Insert special tool 9263 into the groove (arrow) and apply <b>slight pressure</b> on the special tool <b>to check whether the connection is securely locked (holder is seated properly)</b>.</p> <p><b>The plug must not slide out.</b></p> <p>If the special tool cannot be inserted in the groove of the plug, shift the plug in the plug-in coupling (pull on plug with-out using excess force).</p>

**Note**

The plug-in connection is designed so that the plug can be shifted in the plug-in coupling by approx. 1 mm in axial direction by slightly pulling or pressing.

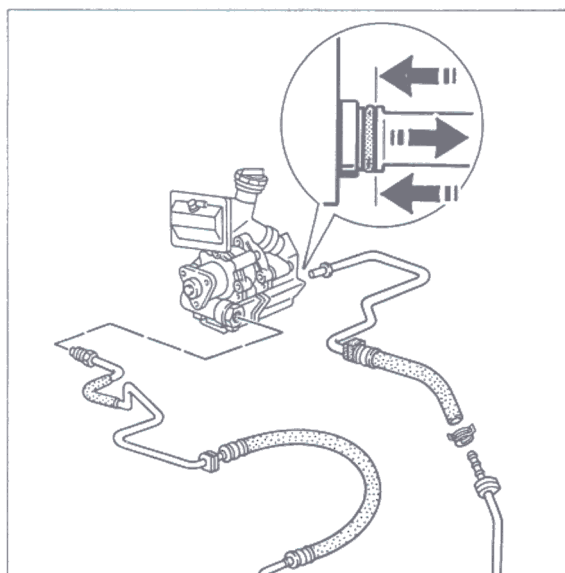
**On new pipelines**, the plug-in coupling - including holder C - has already been screwed together. All that remains is to insert (engage) the plug of the mating pipeline in a straight line.

### Steering return line on hydraulic pump

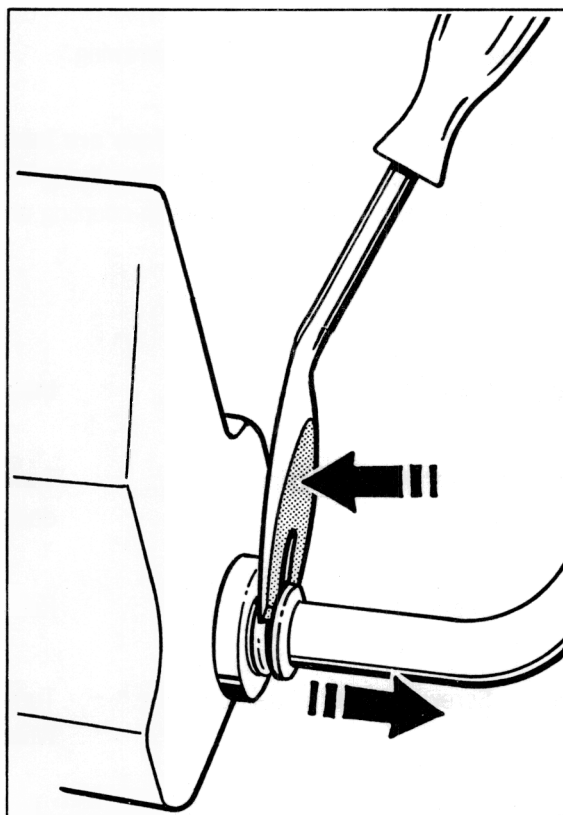
To release the return line, press the **red unlocking ring (arrows)** and simultaneously pull the line out of the hydraulic pump.

**To unlock** the return line, it is practical to use a commercially available removal tool – e.g. Snap-on, order No. A177A (see Fig. No. 87-97).

**Join** by plugging together in a straight line. Then pull slightly to ensure that the connection is properly locked.



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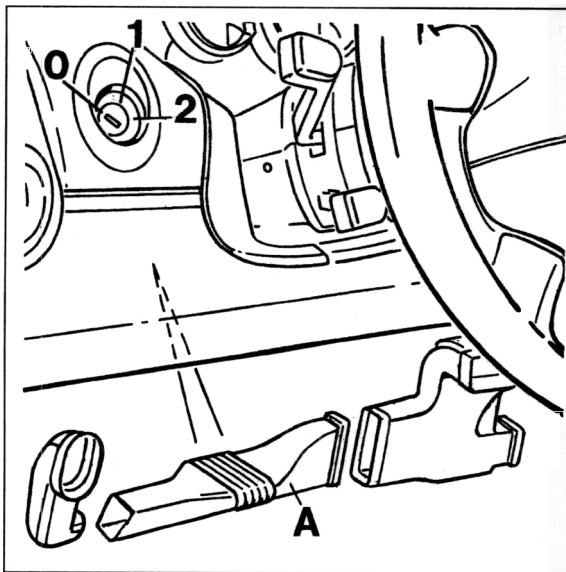


87 - 97

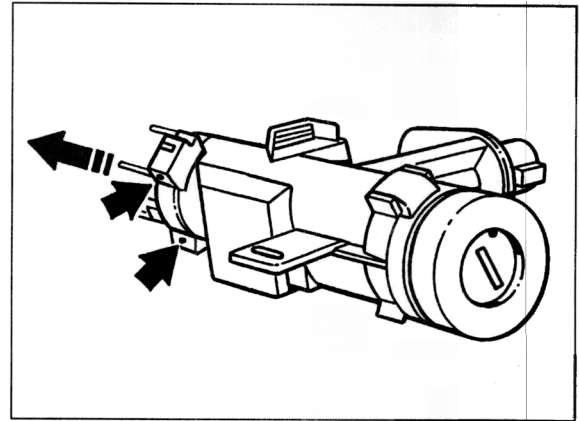
## 48 04 19 Removing and installing starting switch

### Removal

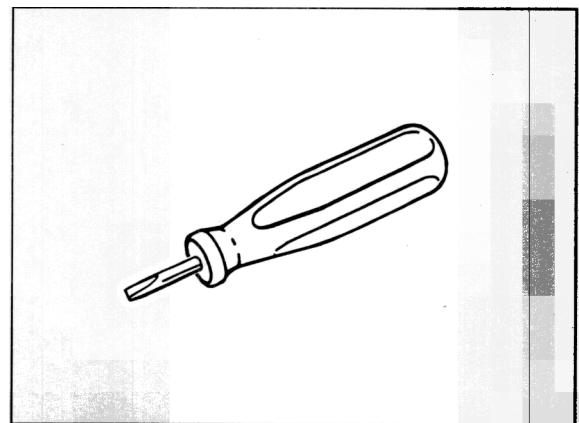
1. Disconnect battery ground cable.
2. Turn ignition key to position 0 and remove.
3. Remove air duct (A).  
The air duct is plugged in.



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291-97



483-97

4. Pull connecting plug off ignition switch.
5. Remove screw locking paint in the threaded bores of the two fastening screws (short arrows).  
Slightly loosen both fastening screws (short arrows) **using special tool 9631** (Figure 483-97) and pull the ignition switch out of the housing (motion arrow).

### Installation

1. Move ignition switch to position 0 (same position as lock barrel).
2. Insert ignition switch into the housing.  
Tighten fastening screws using **special tool 9263** (Figure 483-97) and subsequently secure with screw locking paint.

3. Push plug onto ignition switch and fit air duct.
4. Connect battery ground cable.  
Perform function test.



**48 07 19 Removing and installing lock barrel****Removal**

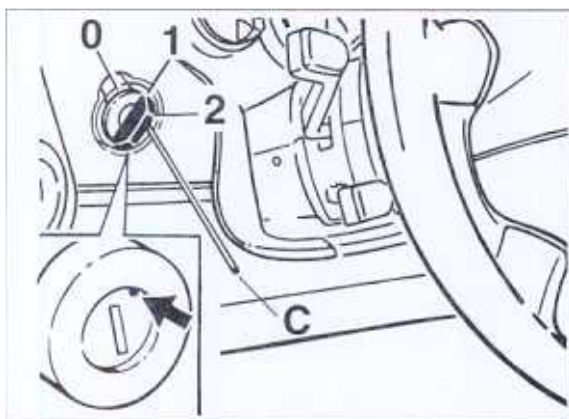
1. Disconnect battery ground cable.
2. Pull cover (rosette) off the steering lock.
3. Insert ignition key to and turn to **position 1** (ignition on).  
Insert a steel wire (C) with a diameter of approx. 1.3 mm (max. 1.5 mm Ø) into the bore next to the ignition key (arrow) as far as it will go.  
Pull the lock barrel with induction coil out of the steering lock housing.

**Note**

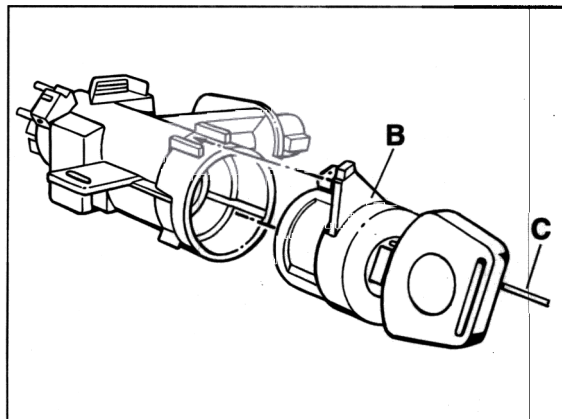
Inserting the steel wire (C) unlocks the lock barrel in the steering lock housing.

**Installation**

1. Ignition lock must be in position 1 (ignition on).
2. Press on the pawl of the lock barrel (locking pawl). With the pawl depressed, insert the ignition key and turn the key as far as it will go to **position 1** (ignition on).  
In this position, insert the steel wire (C) that was used for removal.
3. Plug connector onto the ignition coil (B).  
Position the induction coil (B) and push the lock barrel all the way into the housing. Turn the ignition key correspondingly, if necessary, until the lock barrel has been pushed in fully.  
Pull out the steel wire (C) in this position so that lock engages.



527\_97



540\_97

4. Carefully unlock and disconnect the plug connection on the lock barrel (at the induction coil for the immobilizer).



4. Connect battery ground cable.  
Perform function test.
5. If a **new transponder** (new lock barrel with new key) is used, the new key must be taught.  
Refer to service No. 90 01 in the Technical Manual (in diagnosis section).

**Note**

The **transponder** is located in the key.

The **new transponder** is taught with the **Porsche System Tester 2**.

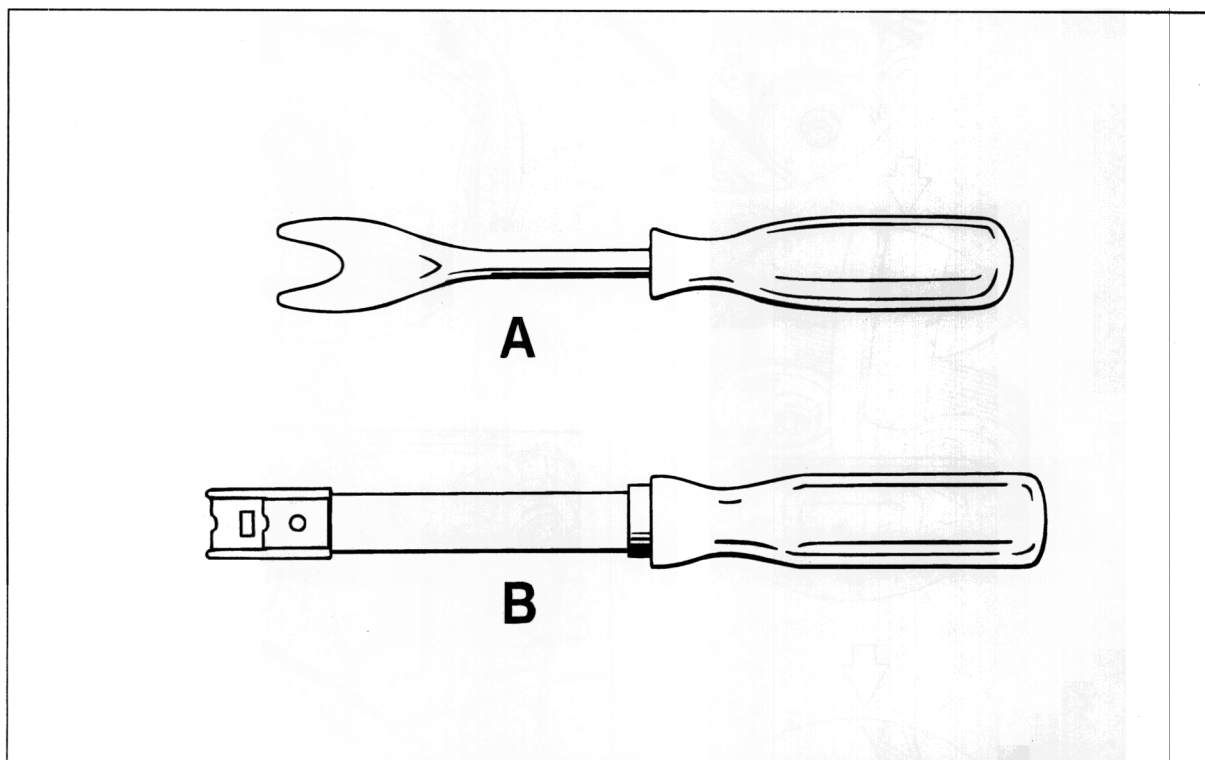
A new transponder can be taught to the vehicle in the system "Alarm system", menu "Teaching functions" / submenu "Transponder key".

Access to **IPAS** is necessary in order to teach the transponder.

**48 98 19 Removing and installing hydraulic pump**

Engine installed

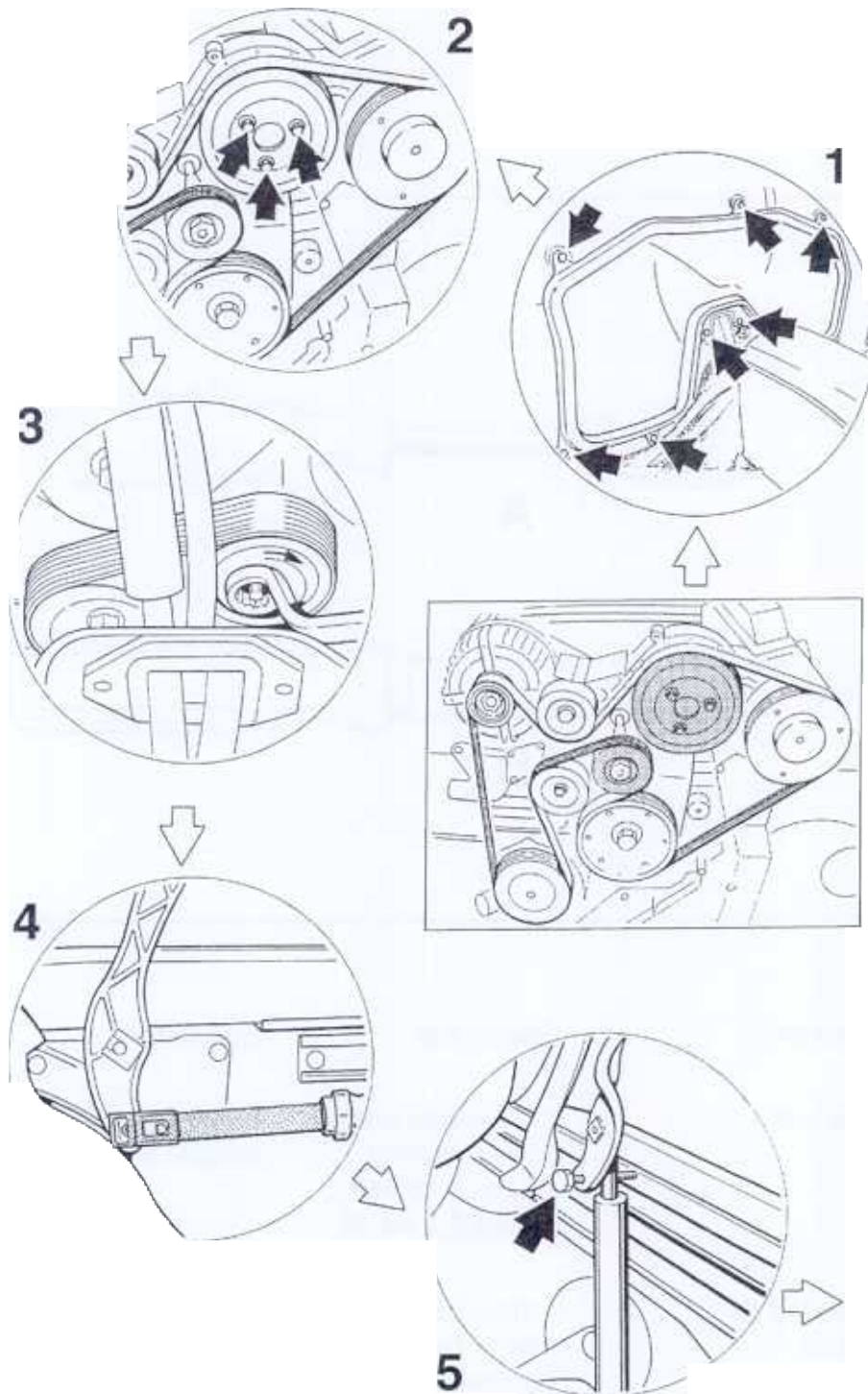
Tools



62\_97

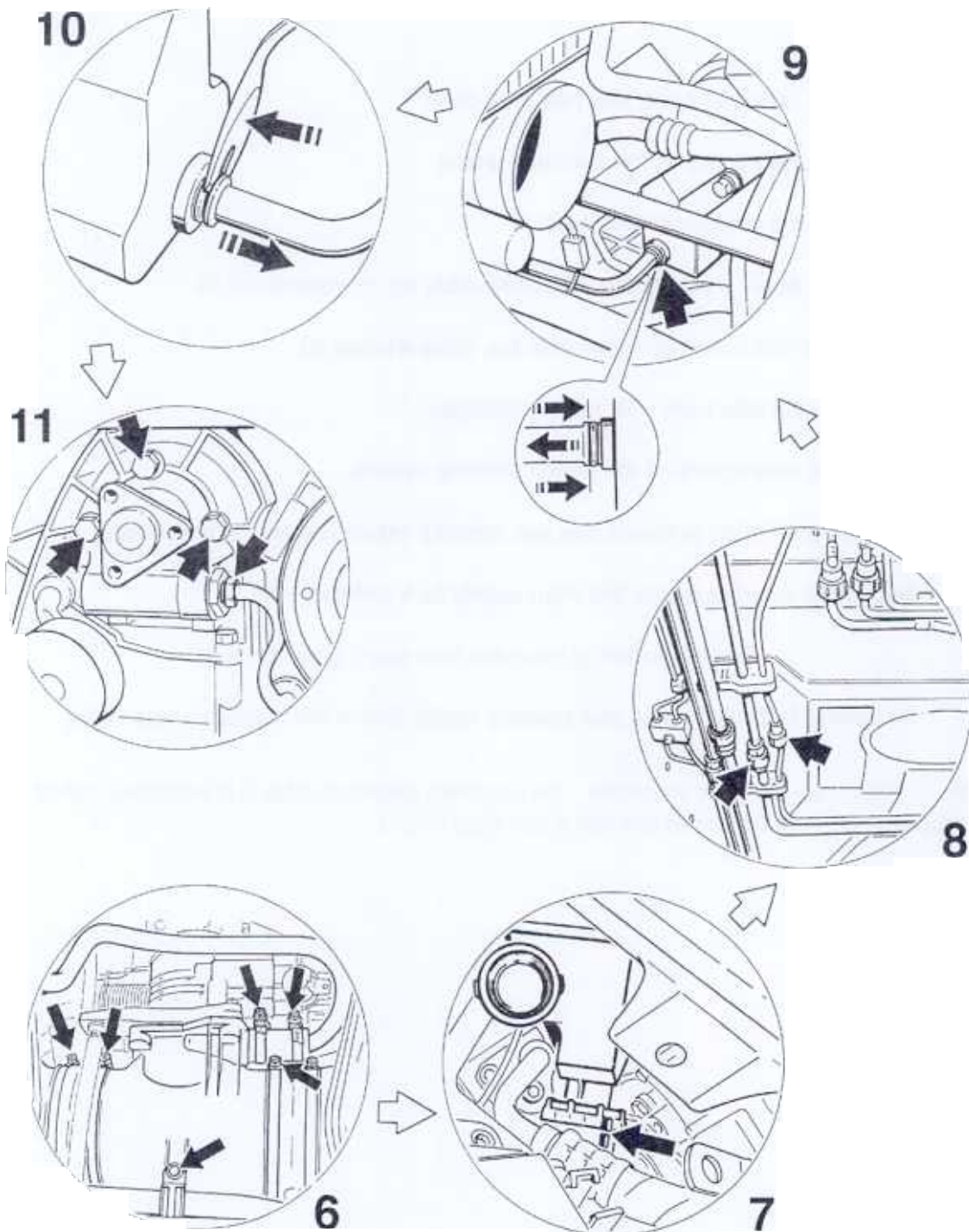
No.	Designation	Special tool	Explanation
A	Removal tool	Commercially available; refer to Technical Equipment Manual, Chapter 2.4, No. 21	Disconnecting steering return line on hydraulic pump
B	Assembly tool for pin retainer	Commercially available; refer to Technical Equipment Manual, Chapter 2.4, No. 131	Removing/fitting hinge retainer on convertible top compartment lid

## Removing hydraulic pump



525\_97

## Removing hydraulic pump



526\_97

**Removing hydraulic pump****Removal overview of the components**

- 1      Removing rear wall lining and rear wall cover**
- 2      Loosening belt pulley of the hydraulic pump**
- 3      Relieving and removing drive belt**
- 4      Removing hinge lever retainer on convertible top compartment lid**
- 5      Setting up and securing convertible top compartment lid**
- 6      Removing throttle body with intake distributor**
- 7      Removing supply tank of the power steering system**
- 8      Detaching steering pressure line and steering return line on the underbody**
- 9\*     Detaching steering return line from supply tank (without tool)**
- 10\*                      Detaching steering return line from supply tank (with tool)**
- 11     Detaching hydraulic pump and steering supply line in the engine compartment**

Nos. 9 and 10 are the same procedure. The procedure described in No. 9 is performed without tools. Procedure No. 10 is performed with tool A (see Page 48-27).

**Removing hydraulic pump**

No.	Procedure	Instructions
	Removing left-hand seat.	Remove seat rail cover. Undo four Torx screws with socket TX 50 (3/8 inch). Disconnect the electrical plug connection. Put on protective cover in seat area. Put on a suitable wood base in the area of the control module. Disconnect battery.
1	Removing rear wall cover on passenger compartment rear wall	Remove rear wall lining. Unscrew seven hexagon-head bolts and two hexagon nuts (a/f 10 mm) and remove cover.
2	Loosening belt pulley	Undo three hexagon-head bolts (M8 x 12) by approx. one half turn.
		<b>Note</b> The belt pulley can also be loosened with a clamping strap after removal of the drive belt.
3	Removing drive belt	Mark belt travel direction with a coloured pen. Slacken belt, turning the tensioning pulley (wrench size 24 mm) clockwise, hold still and simultaneously take the belt off the drive pulleys.
4	Disengaging hinges on convertible top compartment lid	Pull off lower hinge retainers with assembly tool and press out pin.
5	Setting up and securing convertible top compartment lid	Position convertible top compartment lid vertically and secure with a suitable pin.



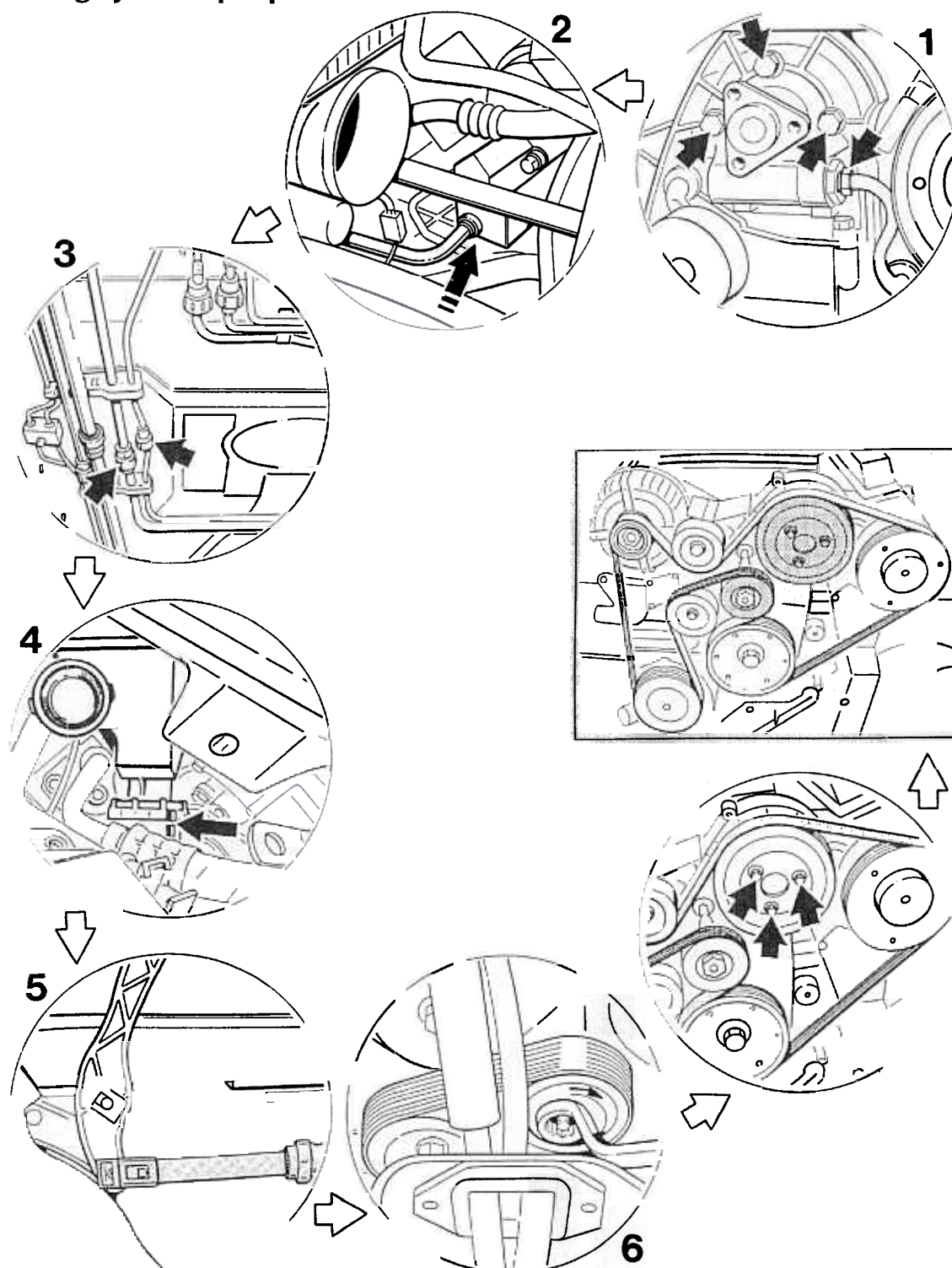
No.	Procedure	Instructions
6	Removing throttle body with intermediate piece of intake distributor	<p>Remove air guide between throttle body and air cleaner. Take out vent line between intake distributor and oil separator.</p> <p>Loosen both hose clamps at intake distributor. Unscrew fastening screw (M6) for fuel pipe at intake distributor.</p>
7	Removing supply tank	Suck fluid from the supply tank until level is just below the joint. Remove the power steering supply tank (bayonet lock).
8	Detaching steering lines at underbody	<p>Remove underbody cover. Detach steering pressure line and steering return line and collect fluid.</p> <p>Important instructions: see Page 48 - 13.</p>
9*	Detaching steering return line at supply tank (without tool)	<p>In order to detach the line from the supply tank, <b>push the red unlocking ring forward (arrows) and simultaneously</b> pull out the line. Use two plastic spatulas to press the ring.</p> <p>Carefully protect the line against dirt and scratches with a cap.</p>
10*	Detaching steering return line at supply tank (with tool)	<p>The line can also be detached using a commercially available tool. Refer to <b>Removal tool A</b> on Page 48-27. Insert tool between line and red unlocking ring and unlock. Pull line to the rear and simultaneously press the tool against the red ring.</p>

Nos. 9 and 10 are the same procedure. The procedure described in No. 9 is performed without tools. Procedure No. 10 is performed with tool A (see Page 48-27).



No.	Procedure	Instructions
	Detaching hydraulic pump and steering supply line in the engine compartment	Undo steering supply line (wrench size 17); simultaneously counter at the body (wrench size 22). Undo three hexagon-head bolts (M8 x 12) and remove hydraulic pump to the rear.
		<b>Note</b> If coolant hoses come into contact with Pentosin, clean them thoroughly without delay.

## Installing hydraulic pump

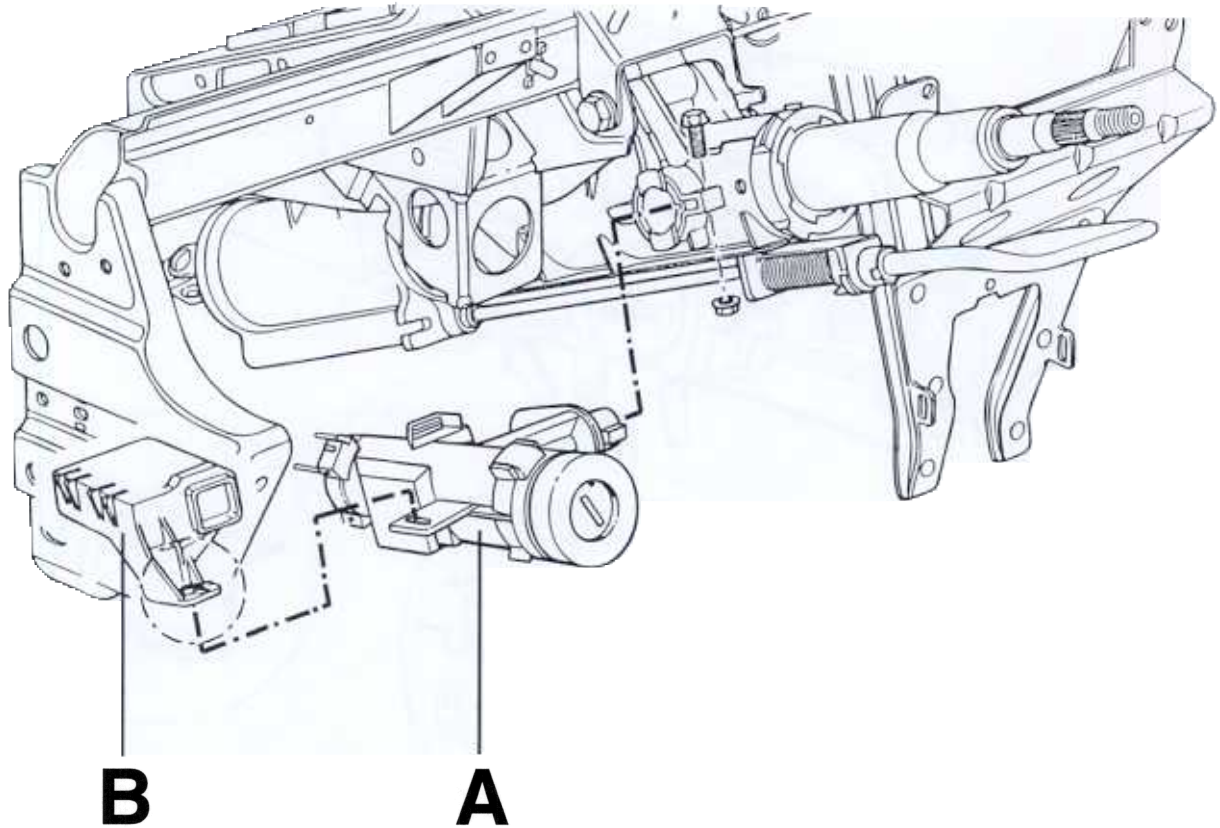


63-97

## Installing hydraulic pump

No.	Procedure	Instructions
1	Installing hydraulic pump	Fasten bracket with tensioning element on the crankcase. Insert hydraulic pump from the rear and fasten. Tightening torque: 23 Nm (17 ftlb.)
2	Fitting steering return line	Insert line into the plug-in coupling in a straight line. Then pull slightly to ensure that the connection is properly locked.
3	Fitting steering pressure line and steering return line	The lines are plugged together. Important instructions: see Page 48 - 13 ff.
4	Fitting supply tank for power steering system	Position supply tank (observe markings); lock bayonet lock.
5	Fitting retainer for convertible top compartment lid	Insert retainer in the assembly tool. Slide assembly tool with retainer onto the pin and slide off.
6	Fitting drive belt	Fit belt pulley of the hydraulic pump and screw in hexagon-head bolts. Fit drive belt. Assembly instructions: refer to <b>service No. 13 78</b> (repair group 13).
7	Fastening belt pulley for hydraulic pump	Tighten three hexagon-head bolts. Tightening torque: 23 Nm (17 ftlb.)

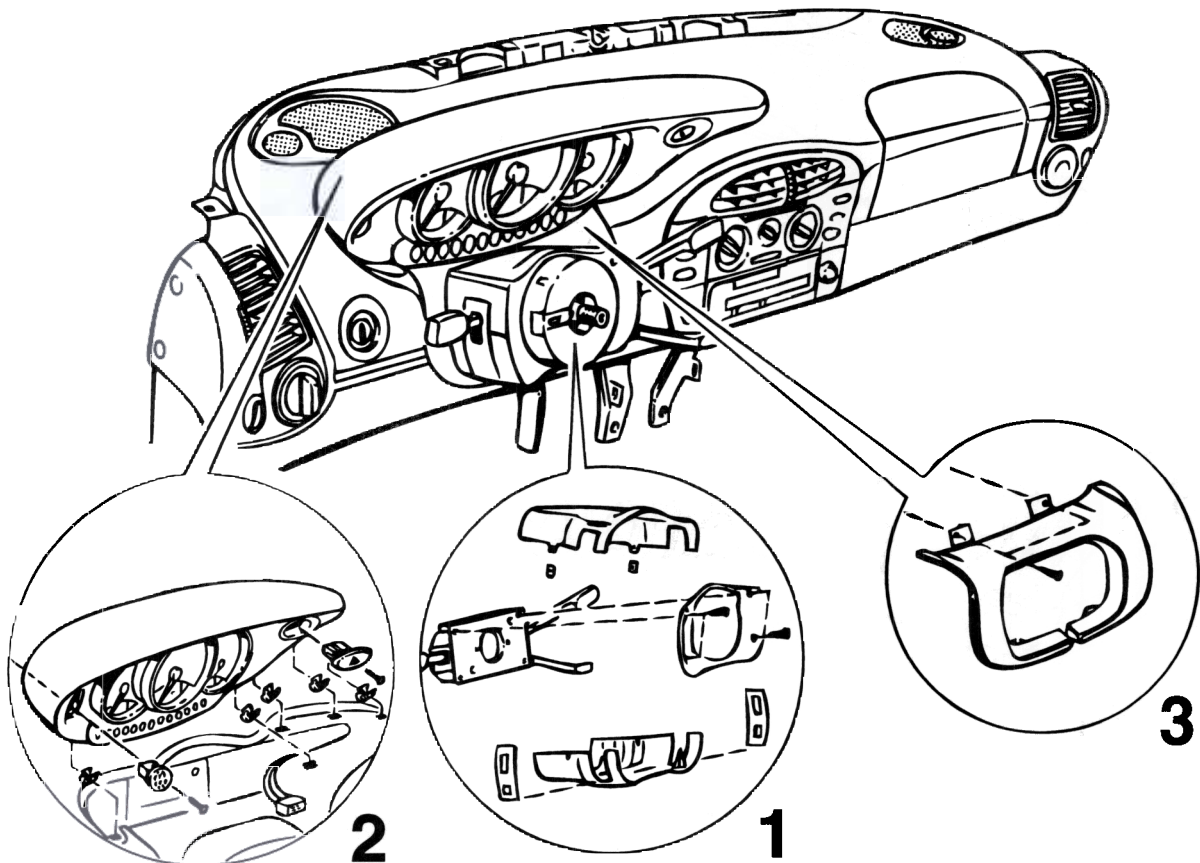
**48 08 55 Replacing steering lock**



587\_97

A – Steering lock  
B – Signal converter

## Replacing steering lock



135\_98

**Overview of dashboard components that must be removed before removal and installation of the steering lock.**

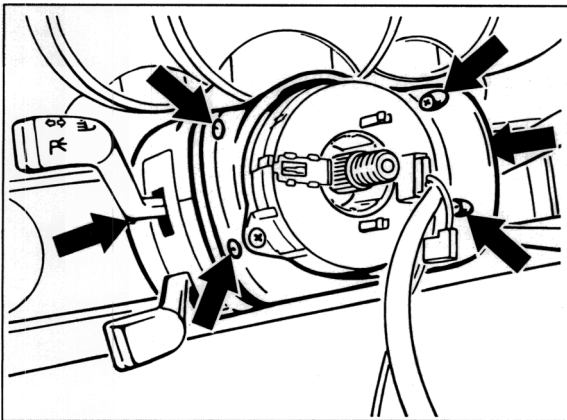
- 1        Steering column switch with the associated covers**
- 2        Instrument cluster (instrument mount)**
- 3        Steering column cover**

**Note**

The steering wheel must be removed before components 1 - 3 can be removed, refer to Serv. No. 48 10 19 (Page 48 - 5).

**Removing steering lock**

1. Remove ignition key. Disconnect the battery ground cable and cover terminal or battery.
2. Remove steering wheel, refer to Serv. No. 48 10 19 (Page 48 - 5).  
Observe the safety regulations for handling airbag units (Repair Gr. 69).
3. Undo and remove the trim elements.

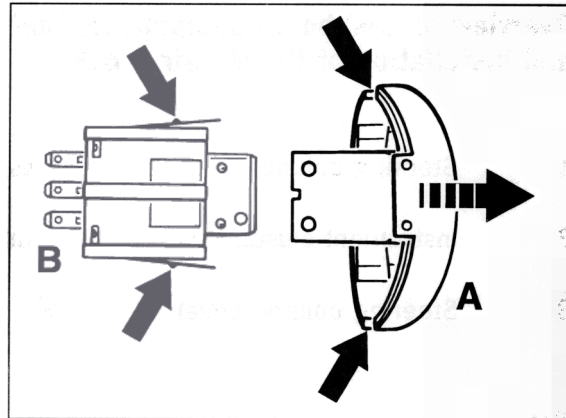


96-030

4. Remove steering column switch.  
To do this, undo the central screw on the clamp of the steering column switch. Disconnect electrical plug connection and remove steering column switch with airbag contact unit.
5. Remove instrument cluster (instrument mount).  
To do this:

Switch on the hazard warning light switch (button comes out).

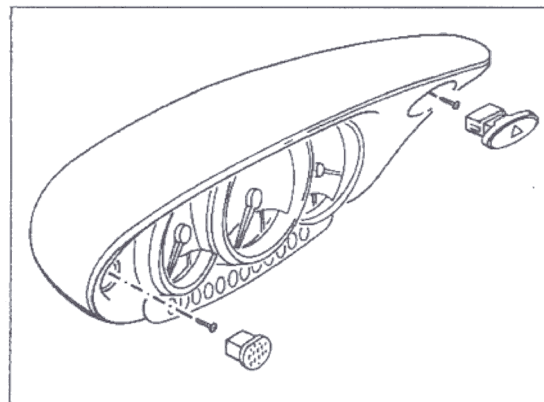
There are small openings on the sides of the button which now project over the instrument cowl. Insert two small screwdrivers into the openings and use them to pull off the button (A) toward the front.



96-507

The hazard warning light switch (B) is held in the instrument bridge by two locking hooks. Press the right locking hook toward the switch, grip the button holder with a pair of pliers and pull out the switch toward the front.

Pull off plug on the left side and undo the 5.0 x 22 Torx screws. Lift the instrument cluster at the left and right and unclip; disconnect electrical plug connections. If the vehicle is equipped with a "handsfree telephone", disconnect the microphone plug connection instead of the dummy plug.



108-96



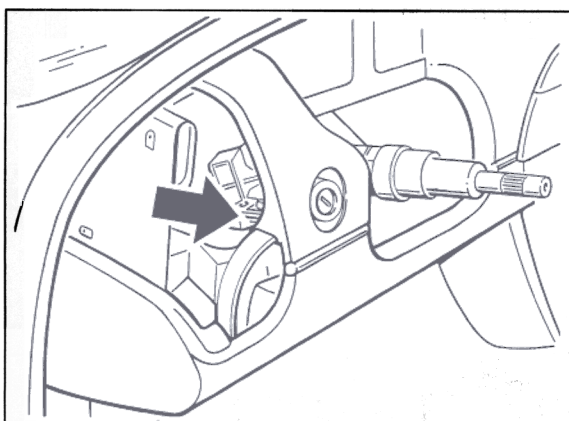
6. Pull cover (collar) off the steering lock.
7. Remove steering column cover (undo Torx screws, unclip the cover and lift it off).
8. Detach support of steering lock on the assembly (arrow).

The support is fastened with a screw.

**The side nozzle must be removed** to allow access to this screw.

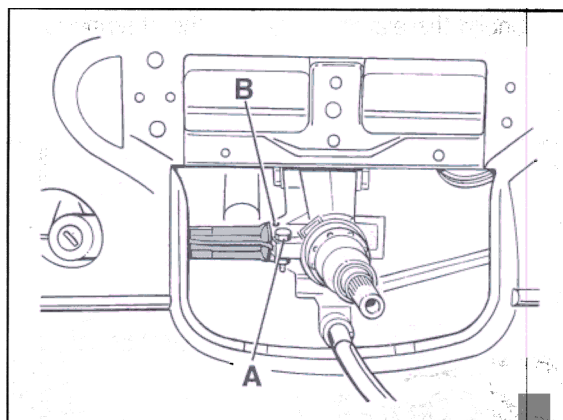
This procedure is almost identical to the procedure – "Removing and installing main light switch" – refer to Serv. No. 94 05 19 (P. 94 -7).

The difference here is that the electrical plug connection of the main light switch does not need to be disconnected.



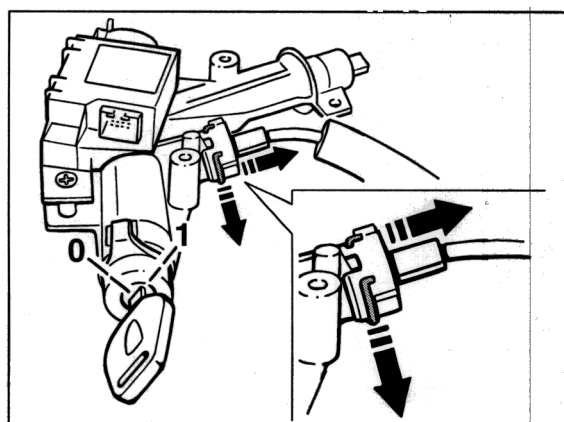
743\_97

9. Undo steering lock fastening screw **A**.  
Unlock steering lock on the steering column (press spring-loaded pin **B** with a scriber) and simultaneously pull the steering lock out of the steering column.



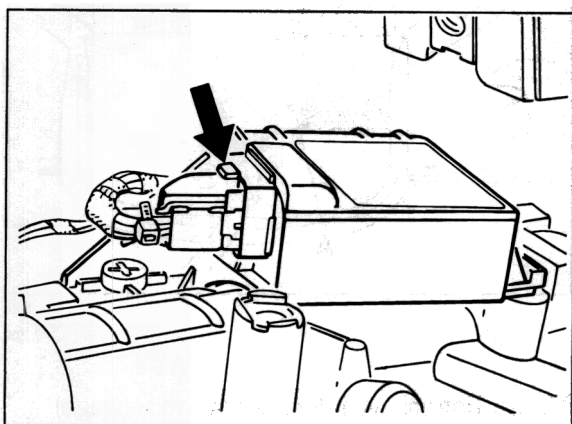
10\_98

10. On Tiptronic vehicles, remove (disengage) the keylock cable from the steering lock housing. First turn ignition key to position "1" (ignition on).



612\_1\_97

11. Pull plug off ignition switch. Carefully unlock and disconnect the plug connection on the lock barrel (at the induction coil for the immobilizer).
12. Unlock the electrical plug connection on the signal converter from above and disconnect. Unclip the electrical wire on the steering lock housing.



96-529

13. Remove steering lock from the vehicle.

### Installing steering lock

1. Fit the steering lock in the vehicle with the locking pin in unlocked position (ignition steering lock position 1)

### Note

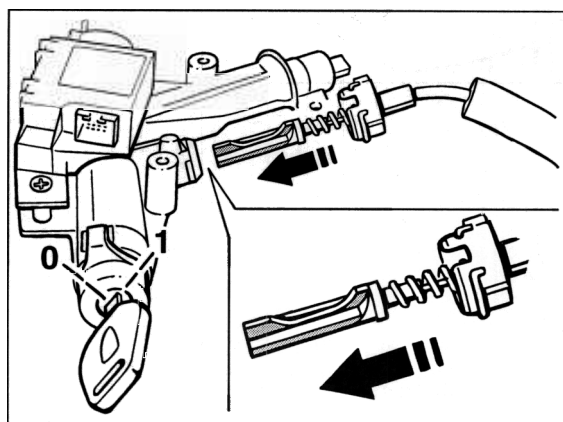
If necessary, first modify the lock barrel (use previous lock barrel) or modify the key head (handheld transmitter). This makes it unnecessary to teach the transponder (refer to Installation, step 11).

2. Align steering lock housing; the peg of the steering lock must engage easily. Tighten fastening screws.

3. On Tiptronic vehicles, join the keylock cable with the steering lock (in steering lock position 1).

To do this, line up the pusher on the keylock cable with the steering lock and insert (press in) in this position until the connection nipple engages on the steering lock housing. (Selector lever **not** in position "P".)

**Then** select position "P" and subsequently turn steering lock to position "O".



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**Note**

If the steering lock cannot be turned to position "0", this may be due to the following:

Pusher of keylock cable not correctly fitted on the steering lock

Keylock cable not correctly fitted on the selector console

Defective parts (replace if necessary).

The keylock cable is not adjustable. However, the following procedure (mounting instructions) must be followed when mounting on the selector console.

**Instructions for mounting keylock cable on the selector lever**

- Turn ignition key to position "1" (ignition on) and move selector lever to position "D".

Engage nipple (1) of the cable in the keylock lever (2) of the selector console.

Insert housing adjustment device (3) in the selector console housing until the clip (4) engages.

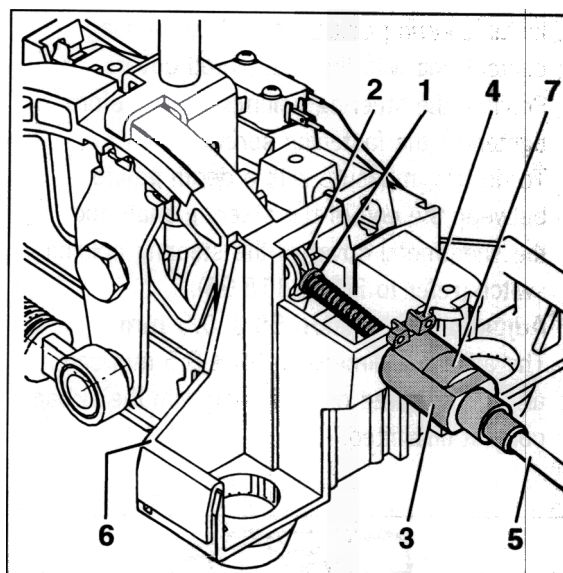
Press cable sleeve (5) toward the selector console (6).

Release cable and press locking button (7) until it engages.

**Check keylock function:**

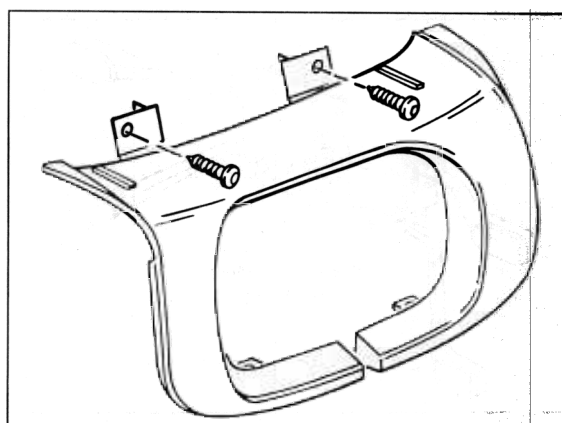
Insert ignition key and turn to position 1 (ignition on). Move selector lever from "P" to "D". Turn ignition key counter-clockwise. It must not be possible to reach the pull-out position. Then release key again and move selector lever to position "P".

In this position, it must be possible to remove the ignition key and the selector lever button must be locked.



613\_97

4. Push plugs onto induction coil, lock barrel, ignition starting switch and onto the signal converter.
5. Steering lock function (perform locking pin function and keylock function tests).
6. Insert steering column cover from below, position and fasten (with Torx screws).

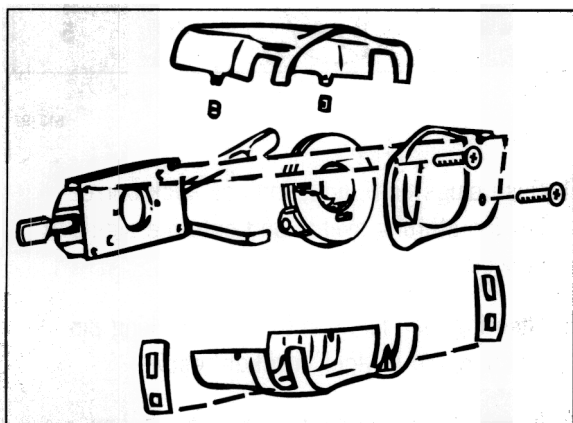


97-046

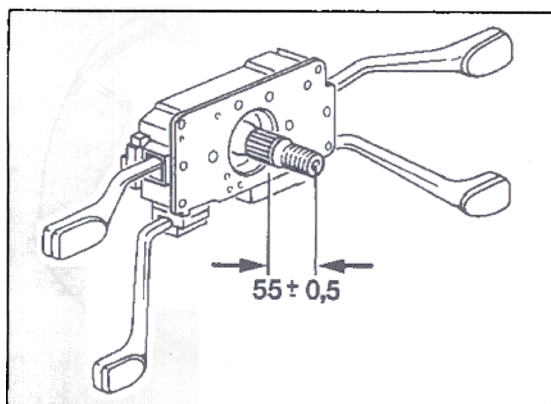
7. Install steering column switch and airbag contact unit with the associated covers. Position the steering column switch before tightening the fastening screw. To do this, measure with a depth gauge between the end of the steering shaft and the sheetmetal cover of the steering column switch (refer to Figure 115-96).

**Adjusting dimension  $55 \pm 0.5$  mm**

The adjusting dimension  $55 \pm 0.5$  mm can also be adjusted or measured with the airbag contact unit fitted.

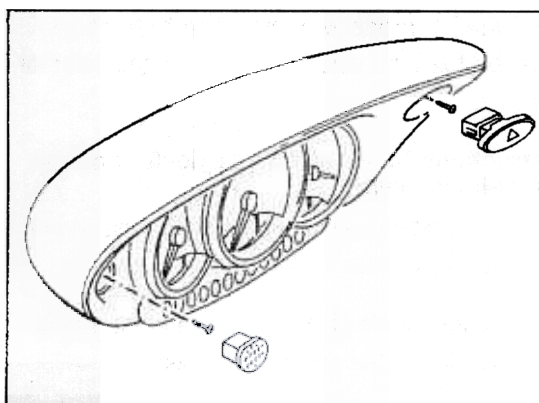


614\_97



115\_96

8. Install the instrument cluster. Connect the electrical plug connection on the instrument cluster. Push in the instrument cluster at the left and right and clip into place; fasten it with the Torx screws 5.0 x 22. Press in the hazard warning light switch and fit the plug on the left side. In the version with "telephone with handsfree unit", plug in the microphone plug instead and engage the microphone in position.



108-96

9. Install side nozzle and main light switch, refer to Serv. No. 94 05 19 (P. 94 - 7 / 94 - 8).
10. Install steering wheel and airbag unit, refer to Serv. No. 48 10 19 (Page 48 - 5). Observe the safety regulations for handling airbag units.
11. Connect battery ground cable. Perform function test.
12. If a **new transponder** (new lock barrel with new key) is used, the new key must be taught. Refer to Serv. No. 90 01 in the Technical Manual (in diagnosis section).

**Note**

The **transponder** is located in the **key head**. The **new transponder** is taught with the **Porsche System Tester 2**.

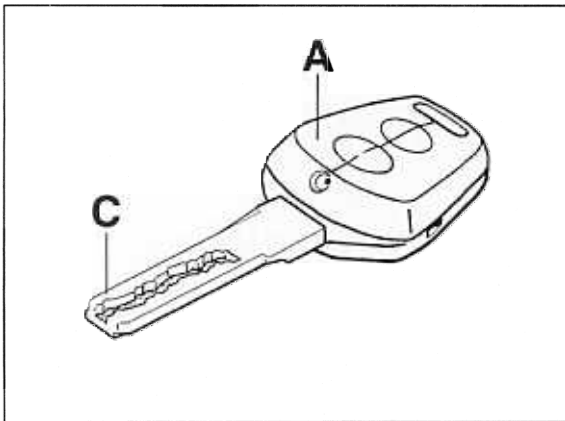
A new transponder can be adapted to the vehicle in the system "Alarm system", menu "Learning functions"/submenu "Transponder key" Access to **IPAS** is necessary in order to teach the transponder.

The transponder **does not have to be taught** if:

The **previous key head A** (handheld **transmitter**) is fitted **on the new key C**. (Disassembling and assembling handheld transmitter – Serv. No. 90 73 37)

A new lock barrel with **defined locking** is installed (the **entire previous key** can thus be used).

The **previous lock barrel with key** is used. Removing and installing lock barrel, refer to Serv. No. 48 07 19.



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