PORSCHE

Technical Manual

Boxster

Technical Information

Repair

Contents:

Group 1
Engine
Part 1 (up to Repair Group 13)

WKD 483 521 19

Supplement Overview

Supple-ment	Edition	Topic	Article number
	05/1996	Basic edition	WKD483521
2	08/1996	Modified repair group	WKD483521.02
9	03/1997	General supplement	WKD483521.09
12	07/1997	General supplement	WKD483521.12
15	08/1997	General supplement	WKD483521.15
16	11/1997	General supplement	WKD483521.16
18	01/1998	General supplement	WKD483521.18
19	03/1998	General supplement	WKD483521.19
20	03/1998	General supplement	WKD483521.20
23	07/1998	General supplement	WKD483521.23
25	02/1999	General supplement	WKD483521.25
27	06/1999	General supplement	WKD483521.27
30	07/1999	General supplement	WKD483521.30
31	08/1999	General supplement	WKD483521.31
32	09/1999	General supplement	WKD483521.32
34	10/1999	General supplement	WKD483521.34
35	12/1999	General supplement	WKD483521.35
36	12/1999	General supplement	WKD483521.36
42	11/2000	General supplement	WKD483521.42

Table of Contents

Foreword

This manual contains Technical Information as well as instructions on repairs for Porsche vehicles. It is intended for the sole use of workshops belonging to Porsche AG.

The descriptions form the basis for professional and correct maintenance and repair work. The content of the work procedures described is based on the level of training of a fitter who has completed vocational training and has a sound knowledge of the product. This level of knowledge is necessary in order to carry out the work described.

Warning notes

The warning notes and safety instructions are classified by the respective signalising word (Danger, Warning, Caution) beside the warning symbol.

Danger!

Warns against death or very serious injury which will certainly occur if the instructions are not observed.

Warning!

Warns against death or very serious injury which may occur if the instructions are not observed.

Caution!

Warns against minor injury or damage to property if the instructions are not observed.

To prevent injury and restricted operating and traffic safety of the vehicle, or damage to the vehicle as the result of incorrect work, read these instructions carefully and observe them without fail.

It is not possible for Porsche AG to give a detailed evaluation of all danger situations for the persons carrying out the work. It is therefore imperative that all persons carrying out repair and maintenance work on Porsche vehicles use their specialist knowledge to ensure that their own safety is not at risk and the procedure chosen will not have any negative effects on the vehicle - especially with regard to safety.

It is therefore expressly specified that all work involved in the work procedures described should be carried out only in accordance with the valid guidelines and regulations of the local authorities responsible with respect to health and accident prevention and environmen-

tal protection, and in compliance with the legal requirements of individual countries.

Notes

Notes contain advisory information related to the work procedure which makes the fitter's work easier. The following pictogram indicates this information:

Note!

Contains advisory information which makes the work procedure easier.

Due to the continuous development and improvement of our vehicles, there may be discrepancies between the actual technical status of the vehicles and the work descriptions. Any existing deviations are corrected by means of supplements, and the scope of the descriptions is extended with supplements.

Porsche AG retains the right to implement changes at any time and without prior notice.

Use

The workshop documentation for the Boxster (986) model has the designation

-"Boxster (986)" Technical Manual- and contains Technical Information as well as instructions on repairs.

The integration of the technical information published in the "Boxster (986)" 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 (986)" Technical Manual consists of 15 folders, subdivided into the following Groups

- 0 Entire vehicle - General
- 0 Diagnosis, 1 Engine, part 1 (up to Repair Group 45)
- 0 Diagnosis, 1 Engine, part 2 (as of Repair Group 69)
- 1 Engine, part 1 (up to Repair Group 13)
- 1 Engine, part 2 (as of Repair Group 15)
- 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 '99 model)
- 9 Circuit diagrams, part 2 (as of and including '00 model)

The two folders with Group 0 are to be regarded as one folder; i.e. file the "Technical Information" notices only in the folder "Group 0 Diagnosis, part 1" **-up to Repair Group 45-**.

The second folder Group 0 Engine, part 2 **-as of Repair Group 69-** includes the further Repair Groups belonging to Group 1.

The two folders with Group 1 are to be regarded as one folder; i.e. file the "Technical Information" only in front of the repair descriptions in the folder Group 1 – Engine, part 1 **-up to Repair Group 13-**.

The second folder Group 1 Engine, part 2 **-as of Repair Group 15-** includes the further Repair Groups belonging to Group 1.

The two folders with Group 9 are to be regarded as one folder; i.e. file the "Technical Information" notices only in the folder Group 9 Circuit diagrams, part 1 **-up to '99 model-**.

The second folder Group 9 Circuit diagrams, part 2 **-as of '00 model-** includes the further Repair Groups belonging to Group 9.

The "Boxster (986)" Technical Manual has the same structure in each folder, with the following breakdown for all Groups:

Title page: "Boxster (986)" 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 folders.

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

Note!

Sheets that already exist in the "Boxster (986)" Technical Manual and are updated or revised and thereby exchanged by a supplement are designated in the footer with the supplement number corresponding to the current version: e.g. "Printed in Germany ***- 2,-*** *2000"*

Note!

Due to a system modification in the Technical Literature production, the following procedures have changed in model year 2000!

1 - **The previous record sheet in the folder "0-General" and the supplement contents sheet -red sheet- have been omitted. A supplement overview now appears separately in each folder. The new supplement contents sheet can be destroyed after the supplement is filed in the folder.**

Note!

The supplement overview sheet is replaced with the relevant supplement in the corresponding folder and must no longer be maintained by hand.

2 - **The page numbering in the new and the replaced chapters are no longer continuous. Each new chapter is now given an additional chapter number followed by the page number e.g. -2 Page 11 ⇒ Rep. Gr. 0; General**

3 - **The old page numbering still applies to existing chapters and those that are not replaced.**

Table of Contents

1 Engine, part 1 (up to Repair Group 13)

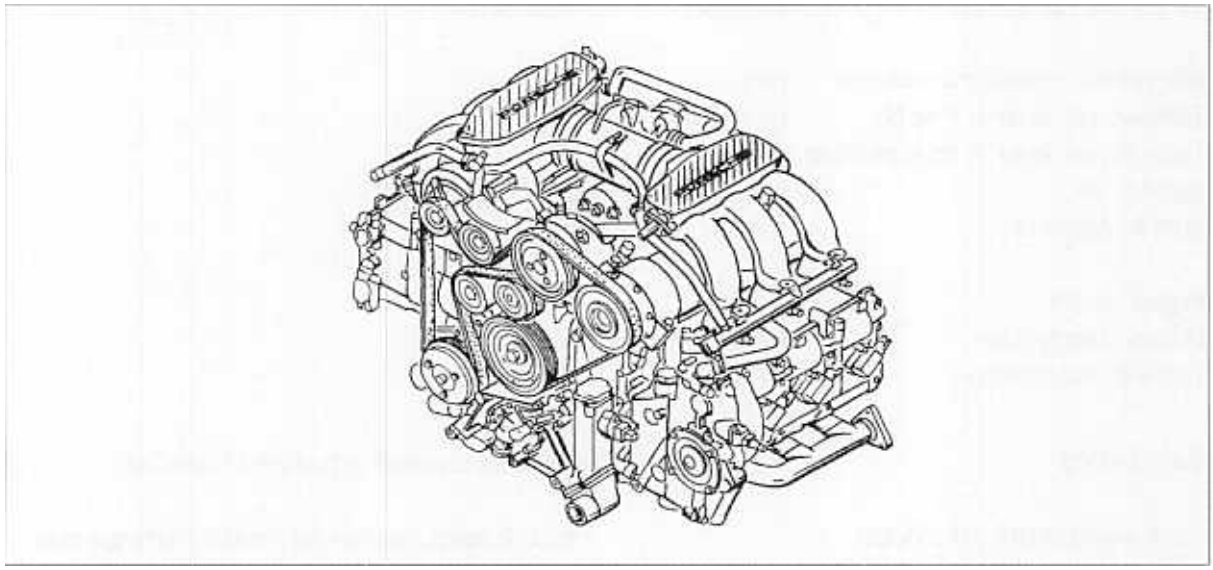
Tightening torques for engine M96/20 (2.5 l), M96/21 (3.2 l), M96/22 (2.7 l)

Location	Thread	Tightening torque Nm (ftlb.)
Screws, bearing housing Initial tightening: Final tightening:		 20 (15) 1 x 90°
Connecting-rod screws with connecting-rod designation...7R Initial tightening: Final tightening:	M9 x 1.25	 20 (15) 1 x 90°
Connecting-rod screws with connecting-rod designation...7R Initial tightening: Final tightening:	M9 x 1.25	 20 (15) 1 x 110°
Oil guide to bearing housing	M6 (micro-encapsulated)	10 (7.5)
Screws, crankcase halves	M6	10 (7.5)
Additional bolts	M9 x 150	22 (16)
Crankcase/bearing housing	M9 x 94	22 (16)
Oil suction pipe to crankcase	M6	10 (7.5)
Air/oil separator to crankcase	M6	10 (7.5)
Oil pan to crankcase	M6	10 (7.5)
Oil drain plug to oil pan	M18 x 1.5	50 (37)
Oil filter to crankcase	S80 x 3	25±1 (19±1)
Coolant guide housing to crankcase	M10	45 (33)
Intermediate-shaft flange	M6 (micro-encapsulated)	10 (7.5)
Lock nut on intermediate-shaft flange	M8 x 1	13 (9.5)
Screw plug for piston pin assembly bore of cylinder bank 4 — 6	M27 x 2	80 (59)
Bolt for slide rail	M6	10 (7.5)
Belt pulley to crankshaft Initial tightening: Final tightening:	M16 x 15	 50 (37) 1 x 90°
Thrust plate to double-mass flywheel	M8	23 (17)
Drive plate to crankshaft (Tiptronic) Initial tightening: Final tightening:	M10 x 1 x 25 (12.9)	 25 (18) 1 x 90°
Coolant pump to crankcase	M6	10 (7.5)
Chain tensioner to crankcase	M27 x 2	80 (59)
Belt tensioner roller to lever for tensioning element	M10	60 (44)
Belt deflection roller 1 to crankcase	M10 x 145 (8.8.)	46 (34)

Location	Thread	Tightening torque Nm (ftlb.)
Belt deflection roller 2 to bracket for hydraulic pump		23 (17)
Belt pulley to generator	M16 x 1.5	65±5 (48±3.5)
Belt pulley to hydraulic pump	M8 x 12	23 (17)
Cylinder head to crankcase 1st step Completely undone 2nd step 3rd step 4th step	M10 x 230	 30 (22) 60° torque angle 60° torque angle again
Flat-base tappet housing to cylinder head	M6	10 (7.5)
Camshaft bearing saddles to cylinder head	M6	10 (7.5)
Cylinder-head cover to cylinder head	M6	13 (9.5)
Spark plugs	M14 x 1.25	30+3 (22+2) first fitting 25+5 (18+3.5) re-fitting
Camshaft drive wheel and drive plate to camshaft	M6 x 15 (10.9)	14 (10)
Chain tensioner to cylinder head	M27 x 2	80 (59)
Intake pipe to cylinder head	M6 (micro-encapsulated)	10 (7.5)
Plug, oil-pressure duct to cylinder head	M10 x 1	10 (7.5)
Oil extraction pump to cylinder head	M6	10 (7.5)
Oil-level sender to crankcase	M14 x 1.25	max. 20 (15)
Oxygen sensor to catalytic converter	M18	55±5 (41±3.5)
Knock sensor	M8	20±2 (15±1.5)
Hall-effect sensor	M6 (micro-encapsulated)	10 (7.5)
Speed sender	M6	10 (7.5)
NTC coolant temperature sensor	M14 x 1.5	25±5 (18±3.5)
Oil pressure switch	M14 x 1.5	20±5 (15±3.5)
Starter	M10	45 (33)
Generator	M10	45 (33)
Ignition coil to cylinder head	M6	10 (7.5)
Power steering pump to bracket	M8	23 (17)
Pressure pipe of hydraulic pump	M16	24 (18)
Oil supply tank to hydraulic pump	M8	23 (17)
Check valve for auxiliary air injection	M22 x 1.5	32 (24)
Coolant pump to crankcase	M6	10 (7.5)

1 Technical data

Engine



140_98

Engine type:		M 96/20
Number of cylinders		6
Bore	mm	85.5
Stroke	mm	72
Displacement	cm^3	2480
Compression ratio		11.0 : 1
Max. engine power		
as per 80/1269/EWG	kW	150
as per SAE J 1349	HP	201
at engine speed	rpm	6000

Max. torque		
as per 80/1269/EWG	Nm (ftlb.	245 (181)
at engine speed	rpm	4500
Max. litre output		
as per 80/1269/EWG	kW/l, HP/l	60.48/82.26
Idle speed - manual transmission	rpm	790
Tiptronic sel. lever in P or N	rpm	750
Tiptronic sel. lever in drive position	rpm	790
and A/C on	rpm	800
Rpm limitation at	rpm	6700
Engine weight		
Manual transmission	kg	182.2
Tiptronic transmission	kg	172.7
Valve control		DOHC with camshaft adjustment (VarioCam)
Valve arrangement per cylinder		2 inlet, 2 outlet, suspended parallel V-arrangement
Valve clearance		Hydraulic valve clearance compensation
Valve timing with 1 mm valve travel		Inlet opens 15° after TDC Inlet closes 46° after BDC Outlet opens 38° before BDC Outlet closes 7° before TDC

Engine cooling

Type		Liquid cooling, two electric fans

Engine lubrication Integrated dry sump

Oil cooling		Via oil-water heat exchanger
Oil pressure at 5000 rpm		
Oil temperature 90 °C	bar	approx. 5
Oil consumption	l/1000 km	up to 1.5

Fuel system		DME 5.22 with sequential fuel injection
Fuel delivery		1 electr. fuel pump
System pressure without vacuum	bar	3.6 4.0
Fuel RON/MON		at least 98/88

Fuel consumption as per 93/116/EG

		Manual transmission	Tiptronic
City	l/100 km	14.3	15.8
Highway	l/100 km	7.1	8.1
Overall	l/100 km	9.7	10.9
Target CO_2 value	g/km	239	263

Emission control		Oxygen sensing and three-way catalytic converter (metallic substrate)

Electrical system

Nominal voltage	V	12
Alternator output	W/A	1680/120
Battery, manual transmission	Ah/A	60/280
Battery, Tiptronic	Ah/A	70/320
Ignition		DME 5.22, with static high-voltage distribution and cylinder-selective knock regulation
Ignition sequence		1 - 6 - 2 - 4 - 3 - 5
Spark plugs		
Bosch		FR 7 LDC 4
Beru		14 FR 7 LDU
Electrode gap	mm	0.8 + 0.1

1 Differences between Boxster 2.5 l, 2.7 and Boxster S (3.2 l) engines

Foreword

The following chapter describes the main engine differences which apply to the Boxster.

Technical data

Engine

Component	Unit	Boxster 2.5	Boxster 2.7	Boxster S (3.2 l)
Engine type		M 96/20	M96/22	M 96/21
Number of cylinders		6	6	6
Bore	mm	85.5	85.5	93
Stroke	mm	72	78	78
Cubic capacity	cm^3	2480	2687	3179
Compression ratio		11.0:1	11.0:1	11.0:1
Engine performance	KW	150	162	185
at engine speed	rpm	6000	6400	6250
Torque	Nm (ftlb.	245 (181)	260 (192)	305 (226)
at engine speed	rpm	4500	4750	4500
Max. engine speed	rpm	6700	7200	7200
Engine control		ME 5.2	ME 7.2 E-gas	ME 7.2 E-gas

1 Tightening torques for engine M96/20

Crankshaft, bearing housing, crankcase

Location	Thread	Tightening torque Nm (ftlb.)
Screws, bearing housing	M9 x 127	
Initial torque:		20 (15)
Final torque:		1 x 90°
Connecting-rod screws	M9 x 1.25	
Initial torque:		20 (15)
Final torque:		1 x 90°
Oil guide on bearing housing	M6 (micro-encaps.)	10 (7.5)
Screws for joining crankcase halves	M6	13 (10)
Additional bolts, crankcase/bearing housing	M9 x 150 M9 x 94	22 (16) 22 (16)
Oil suction pipe to crankcase	M6	10 (7.5)
Air/oil separator to crankcase	M6	10 (7.5)
Oil pan to crankcase	M6	10 (7.5)
Oil drain plug to oil pan	M18 x 1.5	50 (37)
Oil filter to crankcase	S80 x 3	25 ± 1 (18 ± 1)
Coolant guide housing to crankcase	M10	45 (33)
Intermediate-shaft flange to crankcase	M6 (micro-encaps.)	10 (7.5)
Lock nut on intermediate-shaft flange	M8 x 1	13 (10)

Location	Thread	Tightening torque Nm (ftlb.)
Screw plug for piston pin mounting bore of cylinder bank 4 - 6	M27 x 2	80 (59)
Bolt for slide rail	M6	10 (7.5)
Pulley to crankshaft	M16 x 15	
Initial torque:		50 (37)
Final torque:		1 x 90°
Double-mass flywheel to crankshaft	M10 x 1 x 50 (12.9)	
Initial torque:		25 (18)
Final torque:		1 x 90°
Thrust plate to double-mass flywheel	M8	23 (17)
Drive plate on crankshaft (Tiptronic)	M10 x 1 x 25 (12.9)	
Initial torque:		25 (18)
Final torque:		1 x 90°
Water pump to crankcase	M6	10 (7.5)
Chain tensioner to crankcase	M27 x 2	80 (59)
Belt tensioner roller on lever for tensioning element	M10	60 (44)
Belt deflection roller 1 on crankcase	M10 x 145 (8.8)	46 (34)
Belt deflection roller 2 on bracket for hydraulic pump	M8 x 55	23 (17)
Belt pulley on generator	M16 x 1.5	65 ± 5 (48 ± 3.5)
Belt pulley on hydraulic pump	M8 x 12	23 (17)

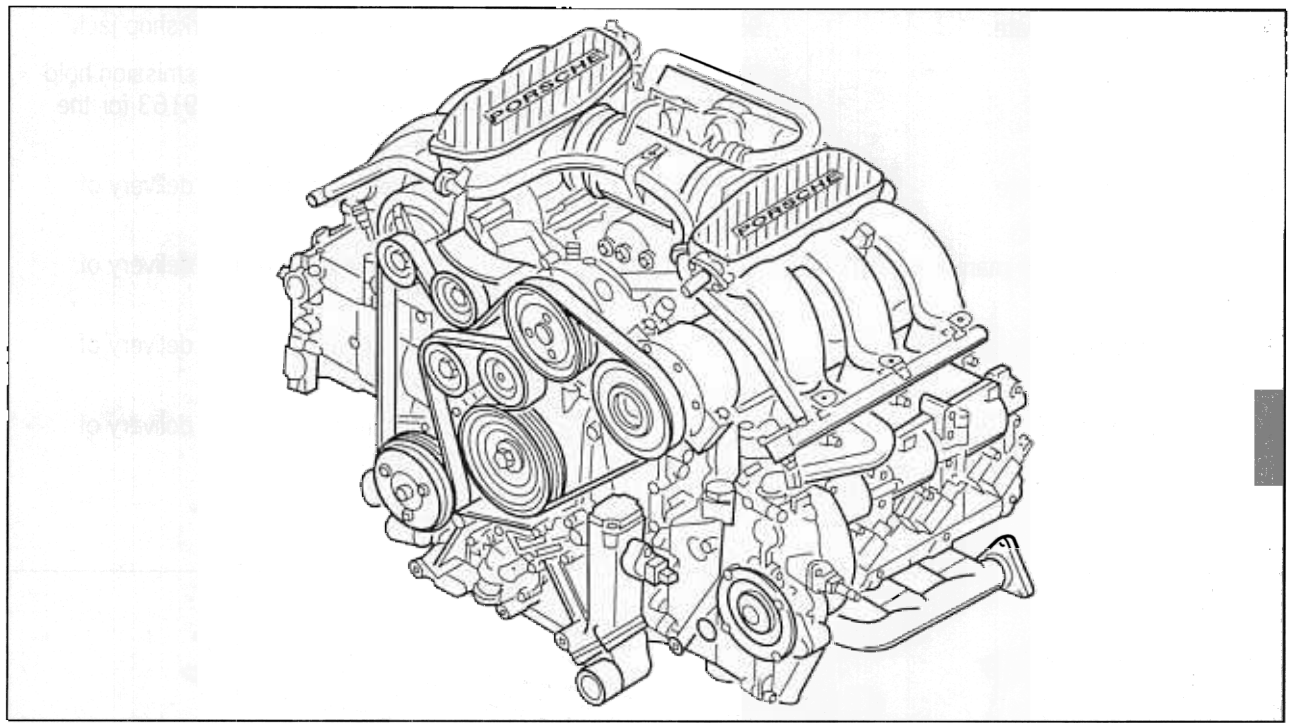
Cylinder head

Location	Thread	Tightening torque Nm (ftlb.)
Cylinder head to crankcase	M10 x 230	
Initial tightening or tightening to flatten		
1st step	30 (22)	
2nd step	Cylinder head screws completely undone	
Final tightening		
1st step	20 (15)	
2nd step	60 ° turn	
3rd step	60 ° turn	
Flat-base tappet housing on cylinder head	M6	10 (7.5)
Camshaft bearing saddles on cylinder head	M6	10 (7.5)
Cylinder-head cover on cylinder head	M6	13 (10.0)
Spark plugs	M14 x 1.25	30 (22) + 3 (2.0) first fitting 25 (19) + 5 (3.5) re-fitting
Camshaft drive pinion and drive plate on camshaft	M6 x 15 (10.9)	14 (10.5)
Chain tensioner on cylinder head	M27 x 2	80 (59)
Intake pipe on cylinder head	M6 (micro-encaps.)	10 (7.5)
Plug, oil-pressure duct on cylinder head	M10 x 1	10 (7.5)
Oil return pump on cylinder head	M6	10 (7.5)

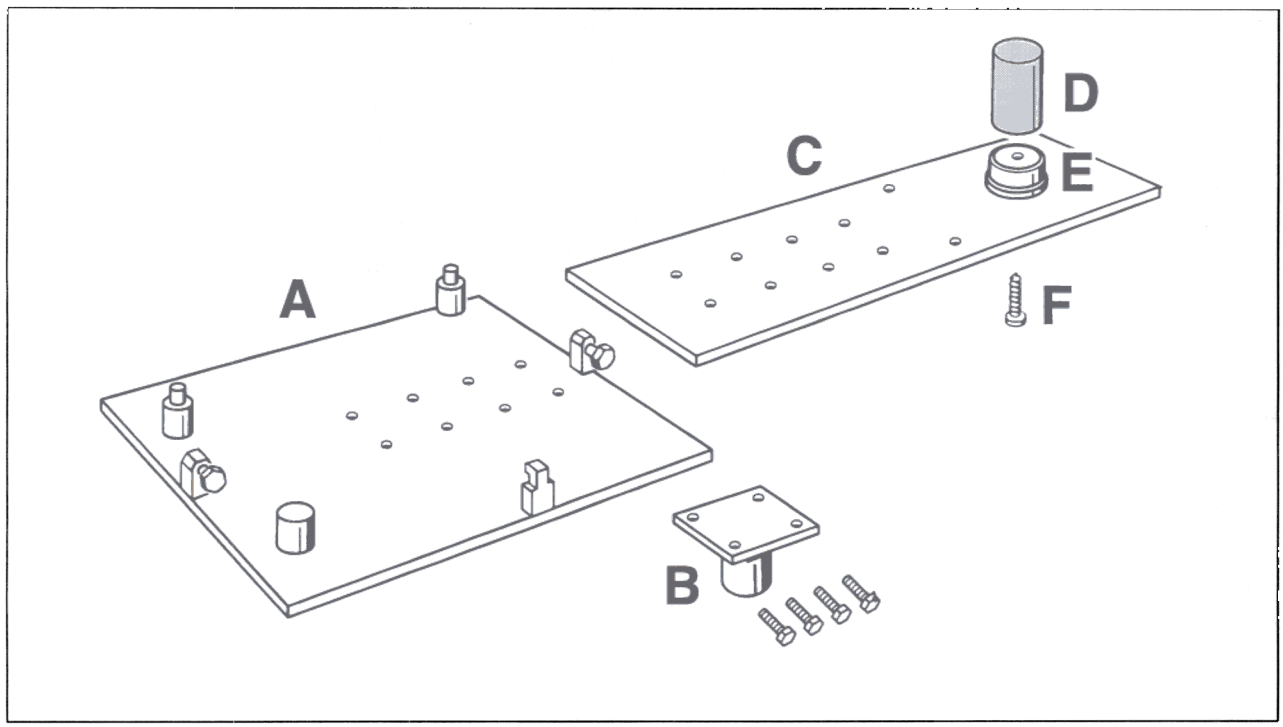
Sensors, sending units, switches and ancillaries

Location	Thread	Tightening torque Nm (ftlb.)
Oil-level sender on crankcase	M14 x 1.25	max. 20 (15)
Oxygen sensor on catalytic converter	M18	55 ± 5 (41 ± 3.5)
Knock sensor	M8	20 ± 2 (15 ± 1.5)
Hall sender	M6 (micro-encaps.)	10 ± 0.5 (7.5 ± 0.5
Speed sender	M6	10 ± 0.5 (7.5 ± 0.5)
NTC coolant temperature	M14 x 1.5	25 ± 5 (19 ± 3.5)
Oil-pressure switch	M14 x 1.5	20 ± 5 (19 ± 3.5)
Starter	M10	45 (33)
Generator	M10	45 (33)
Ignition coil on cylinder head cover	M6	10 (7.5)
Power steering pump (hydraulic pump) in bracket	M8	23 (17)
Pressure pipe on power steering pump	M16	24 (18)
Oil reservoir on power steering pump	M8	23 (17)
Check valve for auxiliary air pump	M22 x 1.5	32 (24)
Coolant pump on crankcase	M6	10 (7.5)

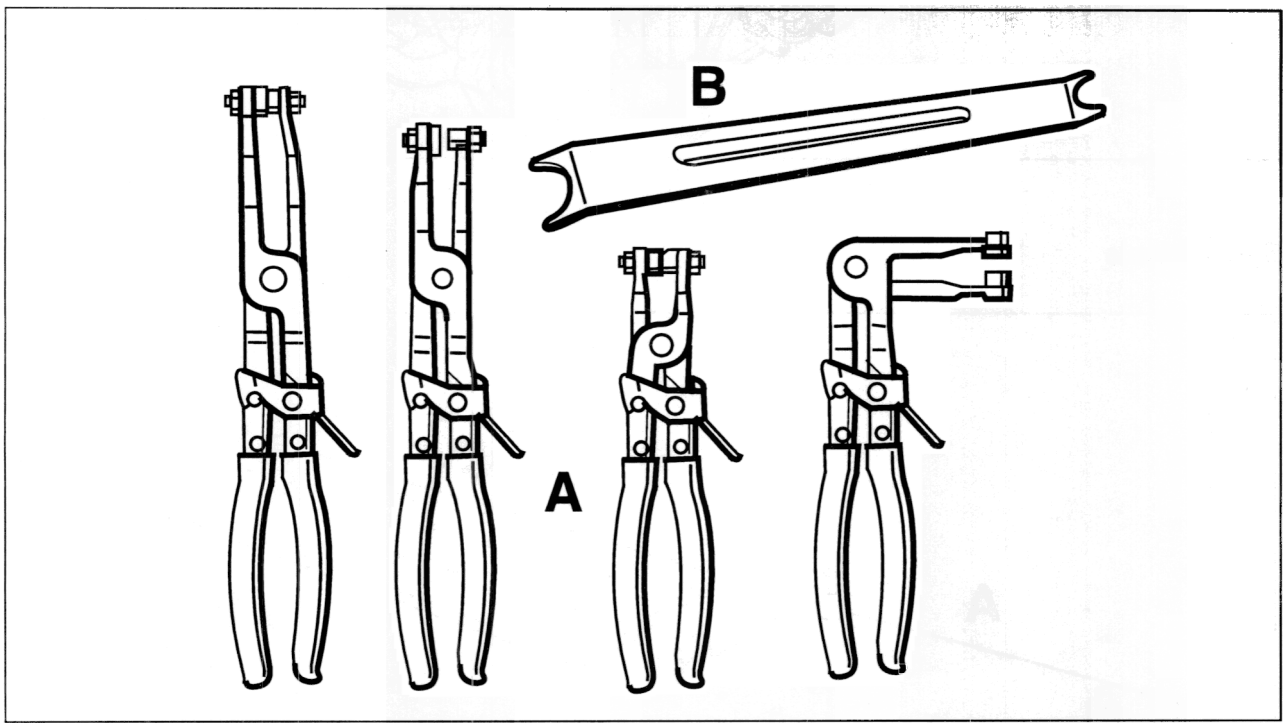
Removing engine, M96/20 (2.5 l) with manual transmission



Special tools



Item	Designation	Special tool	Explanation
	Retainer plate	9592	In conjunction with workshop jack
	Adapter	9163/2	Or use adapter of transmission holding plate, special tool 9163 for the 928 model
C	Support plate	9592/2	Contained in scope of delivery of 9592/1
D	Support for manual transmission		Contained in scope of delivery of 9592/1
E	Pressure piece		Contained in scope of delivery of 9592/1
F	Screw M8 x 25		Contained in scope of delivery of 9592/1



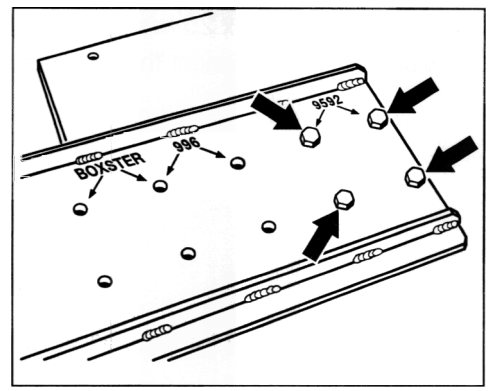
Item	Designation	Special tool	Explanation
-	Spring-band clamp pliers		Refer to Workshop Equipment Manual, Chapter 2.4, No.: 72
B	Testing tool for plug-in couplings	9623	Used to check whether the plug-in couplings are seated properly. Suitable for pressure and return lines (nominal diameter 6 and nominal diameter 10)

Adjusting tool

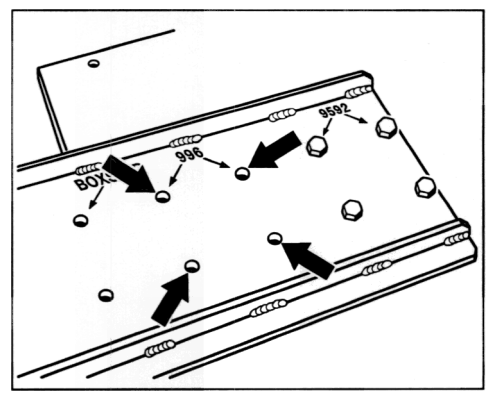
Note!

If the special tool 9592 is being used for the first time, (four) additional threaded holes must be applied.

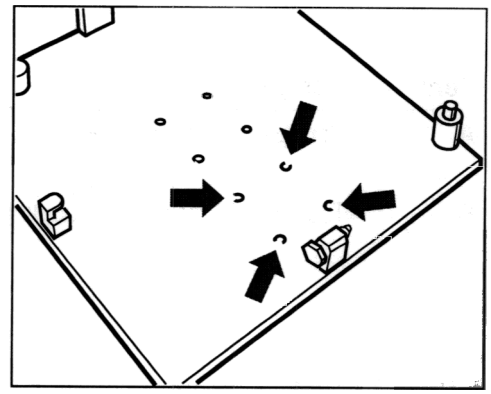
1. Lay the support plate 9592/1 on the rear of the retainer plate 9592 and fasten with four hexagon-head bolts M8 x 25.



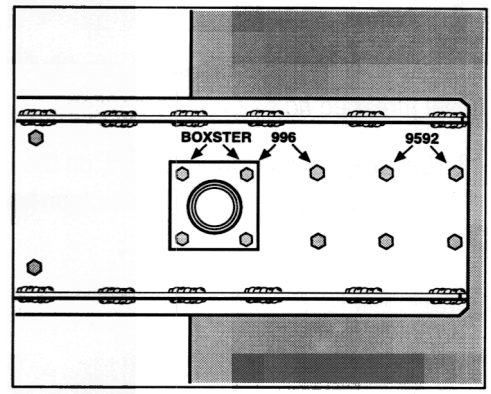
2. Countersink the retainer plate at the designated bores **-arrows-** with a 9 mm drill bit. The support plate serves as the drilling template.



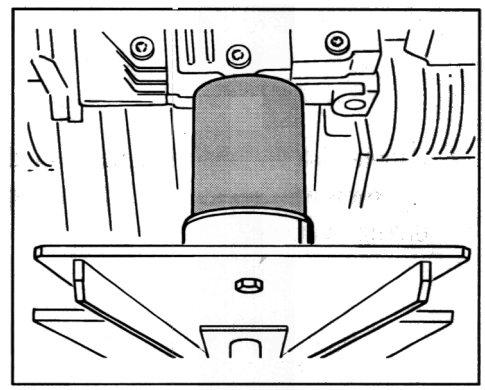
3. Drill through the countersunk bores on the retainer plate with a drill bit sized 6.8 mm and then cut an M8 thread.



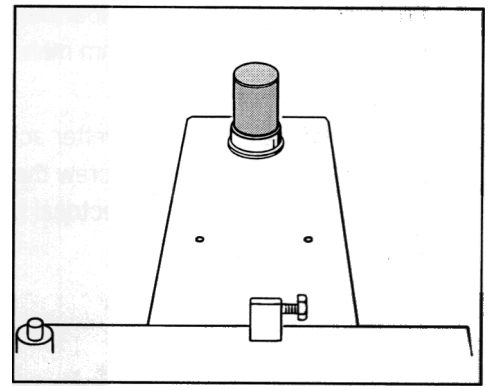
4. Fasten the special tool adapter 9163/2 with a hexagon-head bolt M8 x 25 (bolt quality 10.9) and hexagon-head bolts M8 x 16 (bolt quality 10.9) at the designated position "Boxster". The adapter and the support plate are fastened on the retainer plate with the M8 x 25 hexagon-head bolts. The M8 x 16 hexagon head bolts connect the adapter with the support plate.



5. Fasten the support for the manual transmission with 1 M8 x 25 bolt.
6. Fit complete retainer plate on the workshop jack.



Drawing shows complete engine retainer plate fitted on the workshop jack.

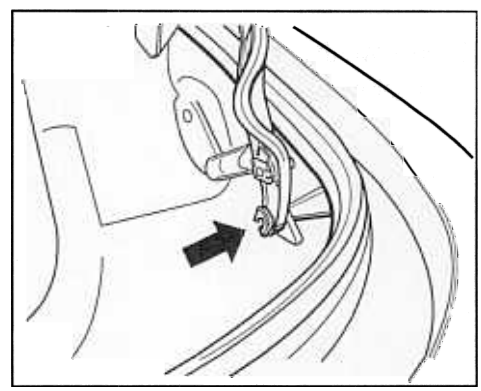


Removing engine

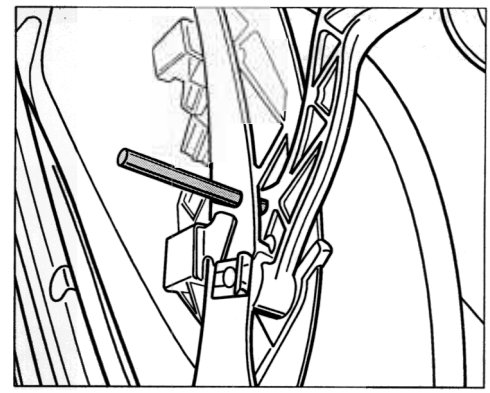
Note!

The engine is removed downwards complete with the manual transmission.

1. Position the vehicle at the specified points on a lifting platform.
2. Open both the luggage compartment lids.
3. Cover the vehicle. Cover the vehicle with protective covers in such a way that the body can not be damaged.
4. Move convertible top or convertible-top compartment lid to service position. Open the convertible top until the convertible-top compartment lid is half open.
5. Detaching cloth covering. Disengage the rear strip on the left and right sides of the cloth covering in downward direction.
6. Detach tension cables. Press the ball socket of the tension cable out of the ball head of the adjusting piece on the left and right.
7. Move convertible top to service position. To do so, press the tension bow of the convertible top towards the main bow, until it reaches its locking point.
8. Move the convertible-top compartment lid to service position and secure. Disengage the convertible-top compartment links at the extreme bottom. To do so, disengage the clips at the left and right and pull the links off the bolt.

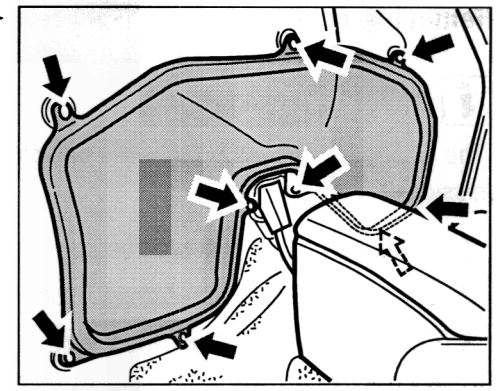


9. Press the converible-top compartment links forwards until the two bores coincide and a 5 mm mandrel can be pushed through them.



10. Remove left-hand seat. For better accessibility, remove the left-hand seat of the car. Unscrew the four internal-serration screws, disconnect all the electrical plug connections and remove the seat.

11. Open the rear wall cover. To do so, remove the oddments tray behind the seats and remove the rear wall lining. Then undo the 6 fastening screws and the 2 fastening nuts. (See **-arrows-**).



Caution!

Danger of short circuit!

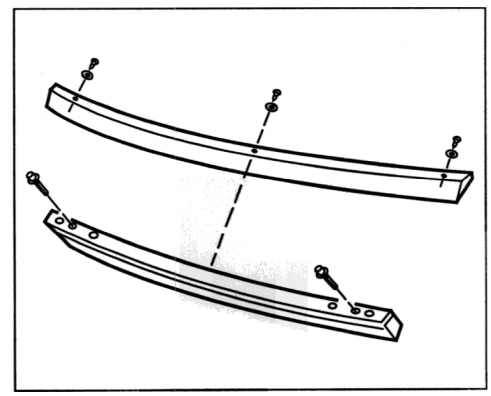
First remove the ground terminal.

Cover the terminals.

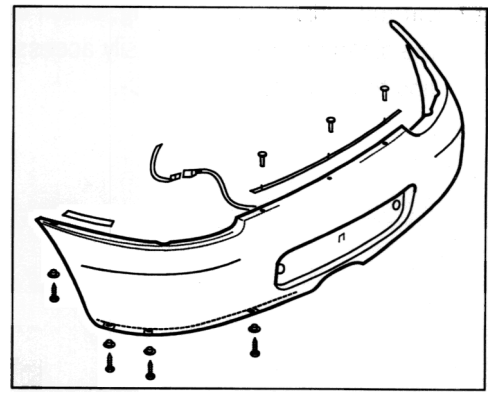
Never connect (short circuit) the terminals.

12. Disconnect battery. Before disconnecting, find out the relevant theft codes (e.g. radio) if necessary. At the battery, disconnect the ground terminal and remove the ground cable ⇒ Rep. Gr. 2706.

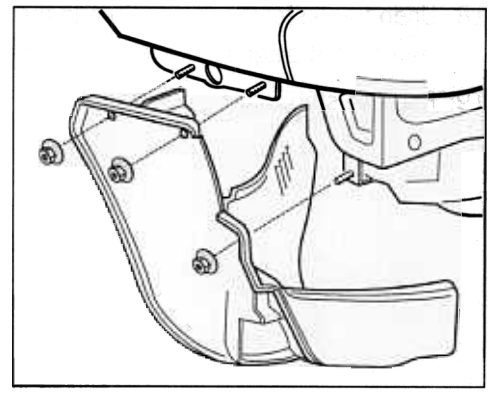
13. Remove the rear spoiler ⇒ **Rep. Gr. 66 58 19; Removing and installing rear spoiler.**



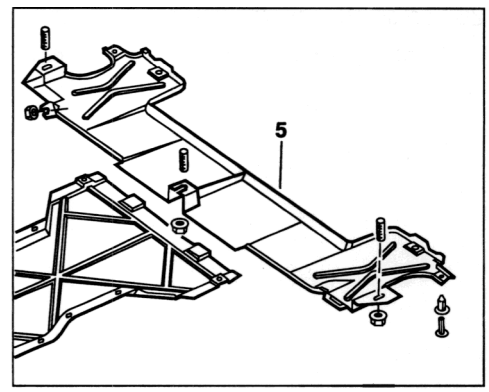
14. Remove rear bumper. While doing so, pay attention to the connection for the number plate lighting ⇒ 63; Rep. Gr. 63 58 19; Removing and installing rear bumper.



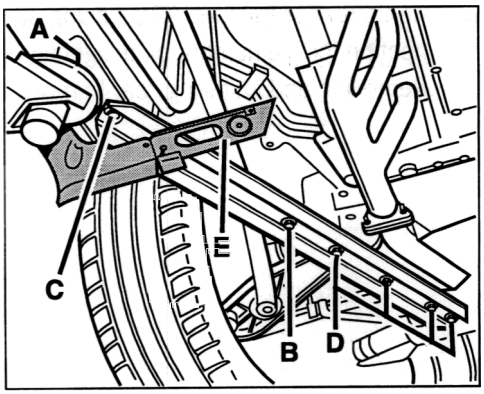
15. Remove left and right wheel housing trims.



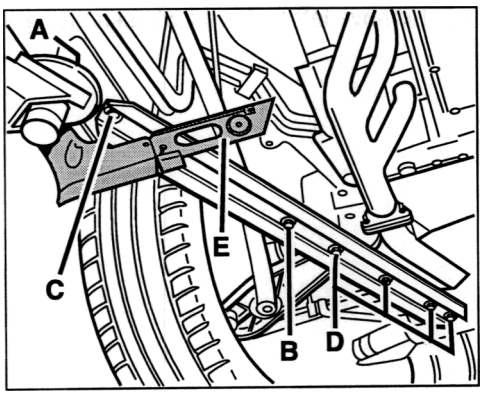
16. Remove the rear part of the underbody cover.



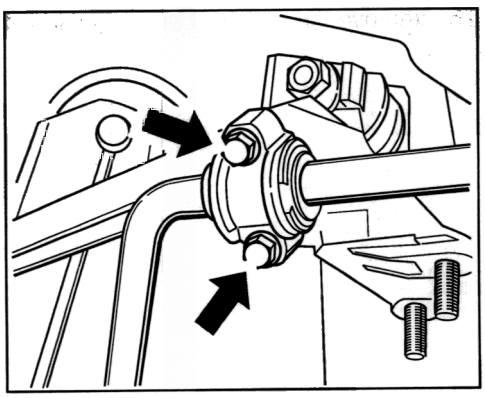
17. Lift the vehicle. Before lifting, check that all fastening points of the diagonal braces are easily accessible. Pay particular attention to the threaded part **-C-**.



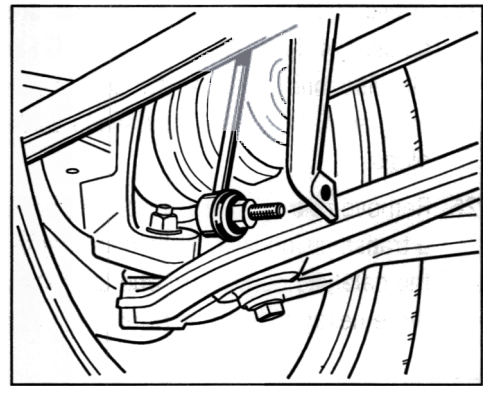
18. Undo the fastening screw **-C-** and the collar nuts **-D-** and remove the diagonal braces **-B-** together with the holder **-E-**.
19. Remove stabilizer.



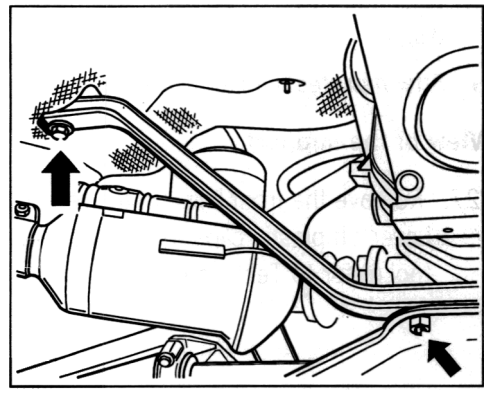
20. To do so, unscrew the two fastening screws at each of the two bearing surfaces on the left and right.



21. Unscrew the stabilizer on the left and right of the links. ►

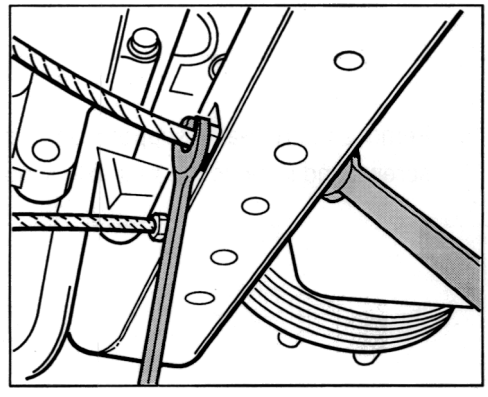


22. Detach rear cross member (aluminium V-member) on the body. ►

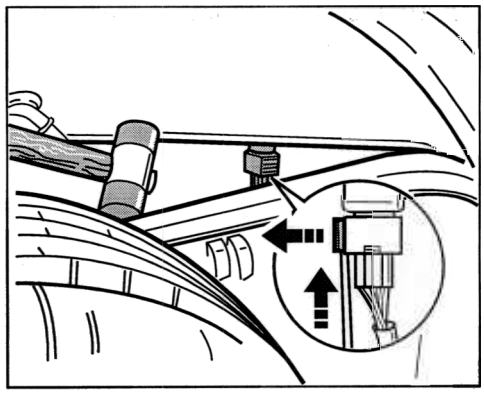


23. Undo the cable. Undo the engine cable on the rear-axle support. The cable must be countered with a suitable wrench and must not be twisted. ►

24. Undo halfshafts. To do so, undo the fastening screws of the halfshafts on the transmission. Fit protection on to the halfshafts.



25. Unclip and detach the oxygen sensor plug connection from the holders of the rear-axle support. On an OBD II vehicle, additionally disconnect the oxygen sensor plug connection in the rear wing area. Press the heat shield aside and disconnect the plugs.

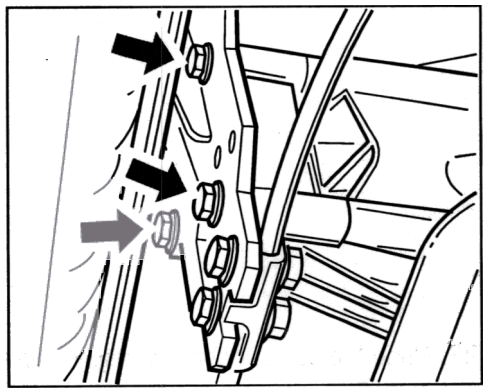


26. Remove rear mufflers. To do so, secure the rear mufflers with a transmission jack. Then undo the flange connection between the catalytic converters and the exhaust manifold. Undo the three hexagon-head bolts on the exhaust bracket.

Note!

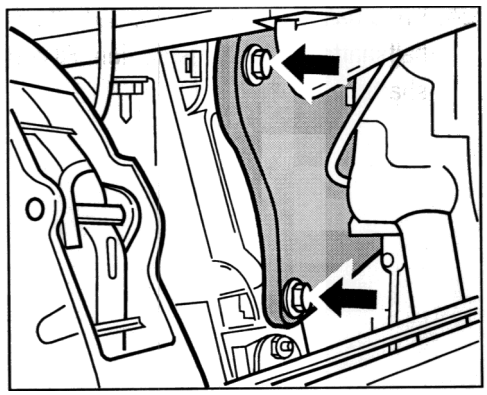
- *When lowering, do not damage the oxygen sensors, cables and plugs.*
- *Attach protective sleeves around the oxygen sensor plugs.*

View of the support

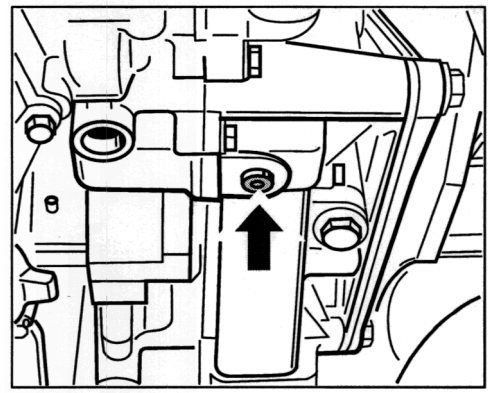


27. Remove the front lining in the rear luggage compartment. Lever off plastic clips using a commercially available removal tool (refer to Technical Equipment Manual, Chapter 2.4, No. 21).

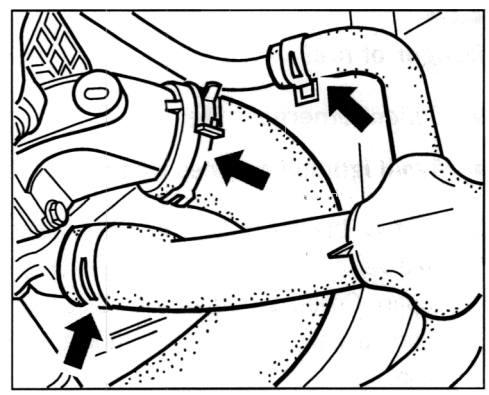
28. Remove the rear-axle support. Unscrew the four fastening screws and remove the rear-axle support to one side.



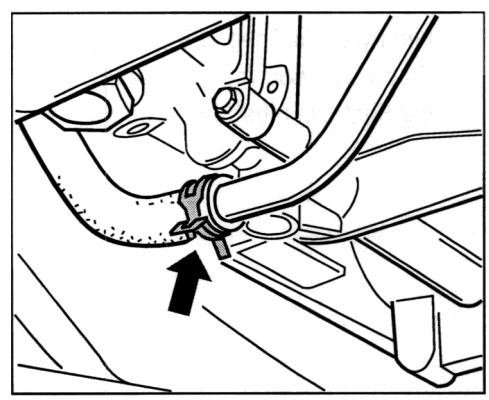
29. Drain coolant. To do so, remove the screw plug of the coolant circuit on the coolant guide housing. Collect coolant in a clean container. ►



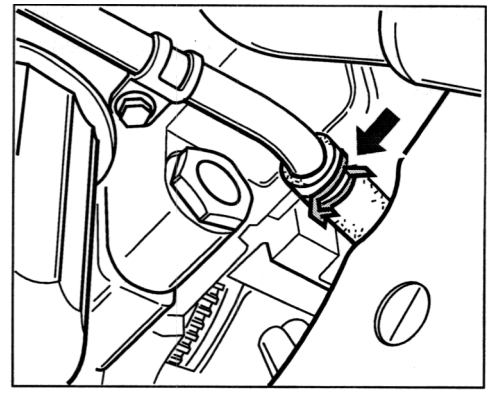
30. Disconnect coolant hoses. Open the supply and return lines for coolant on the engine and pull them off. Then close all openings. Collect emerging coolant in a clean container. ►



Open spring band clamp ►



Pull off the hose



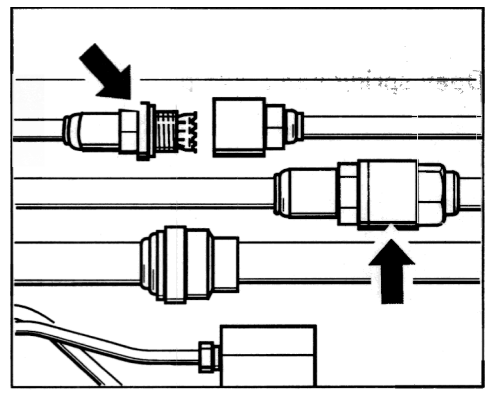
Caution!

Danger of fire!

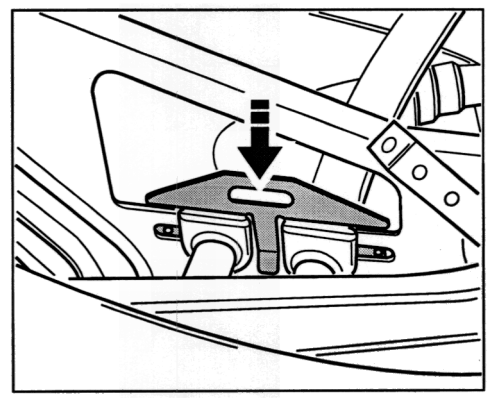
- ***Collect emerging fuel.***
- ***Avoid ignition sources and naked flames.***

31. Detach the fuel return line. Disconnect the fuel return line under the vehicle floor by pressing gently on the button and pull apart. Collect emerging fuel. Close off the open ends of the line immediately. Then open the holder on the body and remove the line.

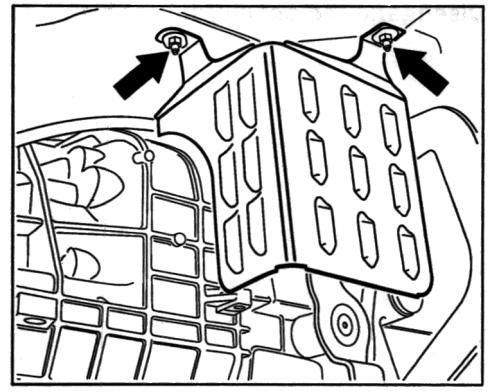
32. Disconnect the steering lines. Remove the small undersealing on the left vehicle underside (six plastic nuts). Disconnect the two hydraulic lines of the power steering on the vehicle floor. To do so, undo the threaded part and disconnect. Any emerging Pentosin must be collected.



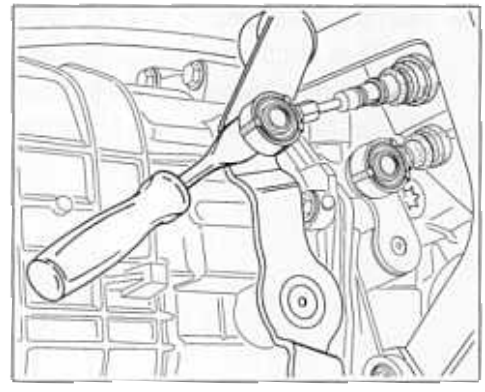
33. Disengage the retaining clips for the power-assisted steering lines and the brake vacuum hose and remove the lines.



34. Unscrew the heat shield on the transmission. To do so, unscrew the two fastening nuts and remove the plate.

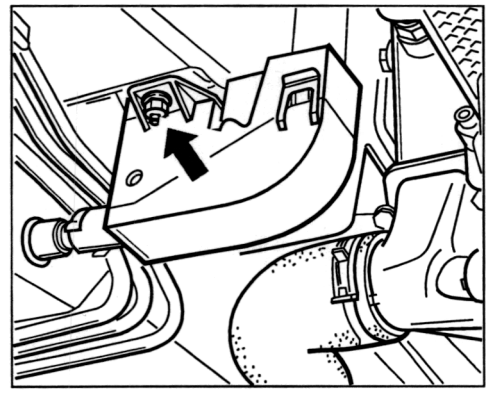


35. Disengage shift cables on the transmission. Disengage the cables with the commercially available tool (see Workshop Equipment Manual, Chapter 2.4, No.: 21).
36. Detach the shift cables. Unclip the shift cables on the transmission mount. Then pull the shift cables upwards out of the engine compartment and set them aside.

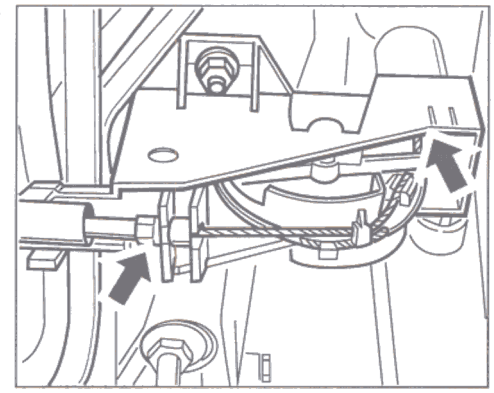


- ***When the slave cylinder is removed, do not actuate the clutch again.***

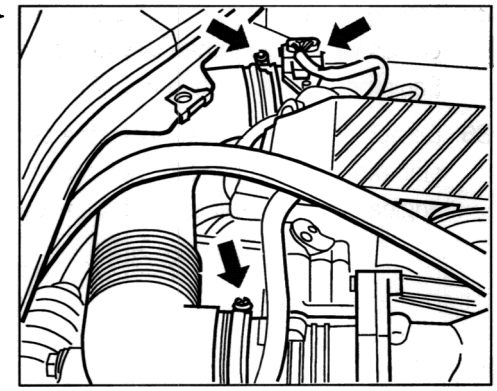
37. Uncouple clutch slave cylinder. To do so, unscrew the fastening screw and remove the clutch slave cylinder. Tie the cylinder with a wire.
38. Disengage the accelerator cable. Remove the cover on the deflector box and disengage the accelerator cable.



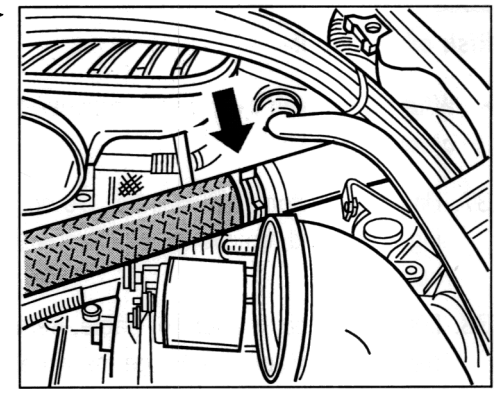
Disengage the accelerator cable



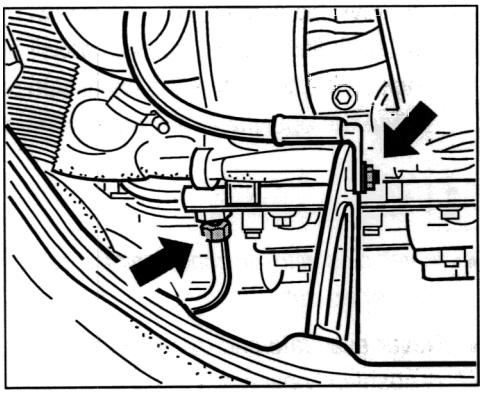
39. Disconnect the electric plug on the hot film mass air flow sensor. Then disconnect the connecting hose between the hot film mass air flow sensor and the throttle body. To do so, disconnect the hose clamp on the hot film mass air flow sensor.



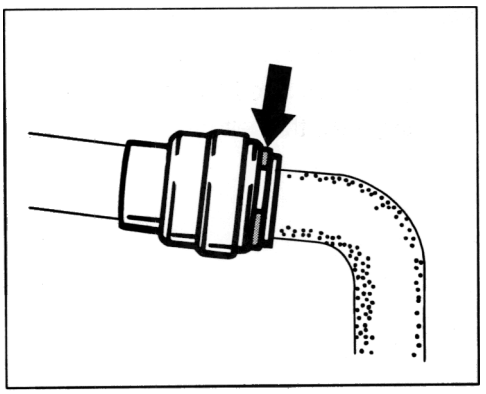
40. Press the spring band clamp on the oil filler hose apart and push it aside. Pull off the oil filler hose; heat, if necessary.



41. Disconnect the fuel supply hose. Make sure without fail to counter with a suitable wrench when doing this. Collect emerging residual fuel. Then disconnect the ground cable.
42. Disconnect vacuum line for the brake booster. To do so, remove the grey snap ring. Then push the inner sleeve **-1-** against the outer sleeve **-2-** and pull off both sleeves together in the direction of the arrow.

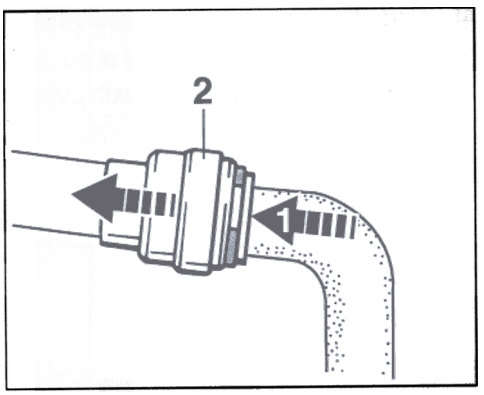


Snap ring

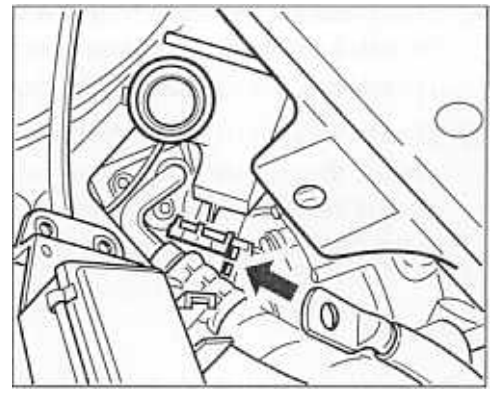


Inner and outer sleeve

43. Disconnect B+ separator box. To do so, undo the hexagon nut in the separator box. Remove the cable and lay to one side.



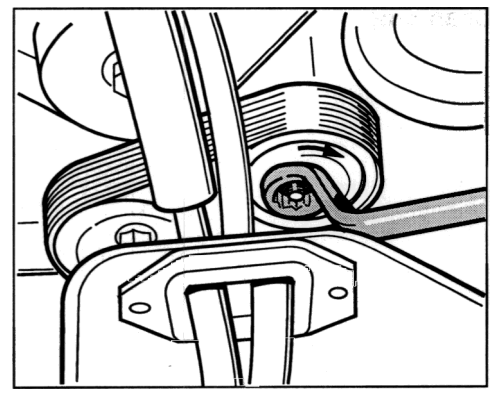
44. Remove the supply tank of the power steering system. To do so, suck fluid out as much as possible. Then open the bayonet lock on the bottom of the expansion tank and remove the tank. Close the opening in the servo pump with a clean plug.



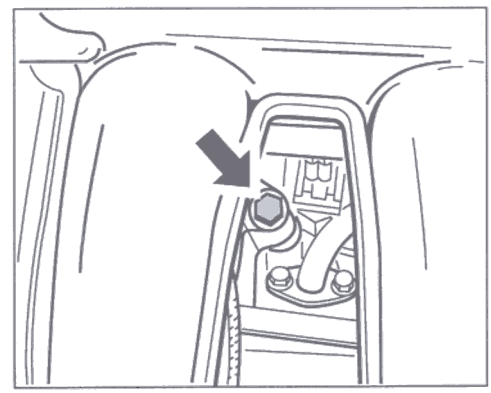
Note!

- *In vehicles with air conditioning, the points 45 to 48 must also be carried out.*
- *Never evacuate and open the air-conditioning circuit unless this is absolutely necessary.*

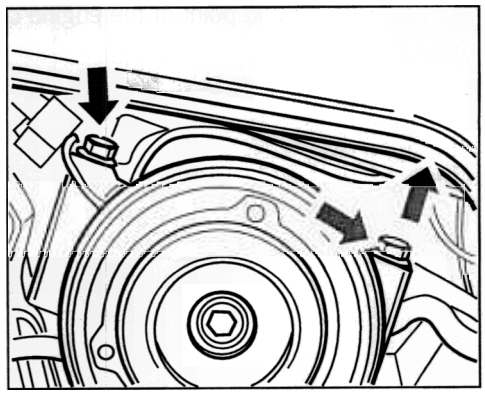
45. Remove drive belt. Mark the running direction of the drive belt with a coloured pen. Slacken belt by turning the tensioning pulley (wrench size 24 mm) clockwise, hold still and simultaneously take the belt off the drive pulleys.



46. Undo the rear fastening screw of the air-conditioning compressor from above. The screw is positioned between the intake manifolds of the fifth and sixth cylinders.



47. Loosen air-conditioning compressor. To do so, undo the two front fastening screws -**(arrows)**-. Disconnect the electrical plug.

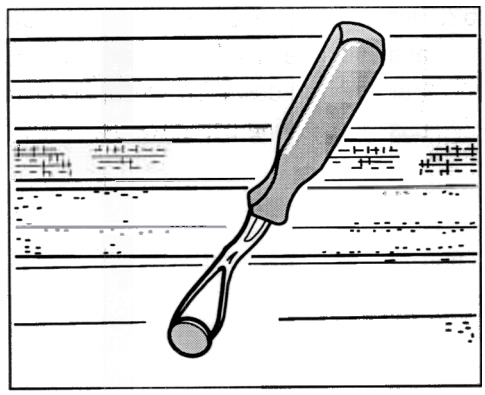


Note!

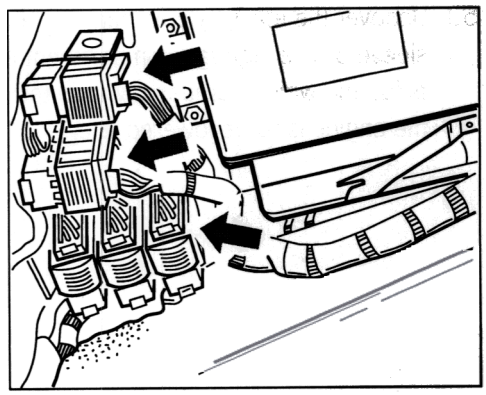
The air-conditioning compressor can be removed from the vehicle more easily if the engine has already been lowered.

48. Set the air-conditioning compressor with the hoses connected to one side or lift it out of the engine compartment and set it on a suitable base.

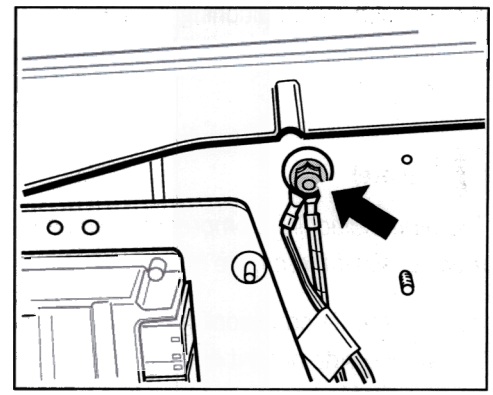
49. Remove the rear luggage compartment lining. To do so, lever out the rear fastening clips and remove the lining from the luggage compartment.



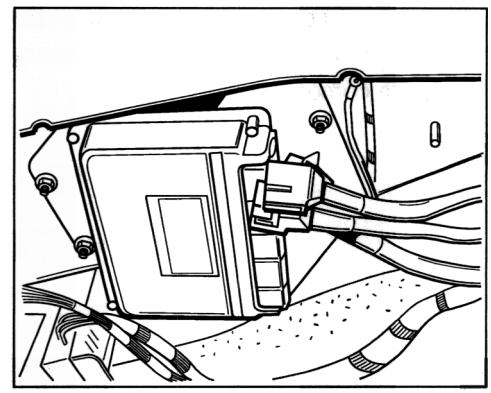
50. Disconnect the plug connections (X3/1, X3/2 and X59) of the engine wiring harness. To do so, raise the lock at the side and pull the plug out.



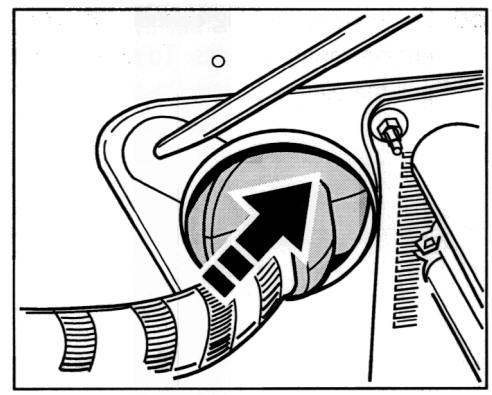
51. Lock the ground point of the engine control module.



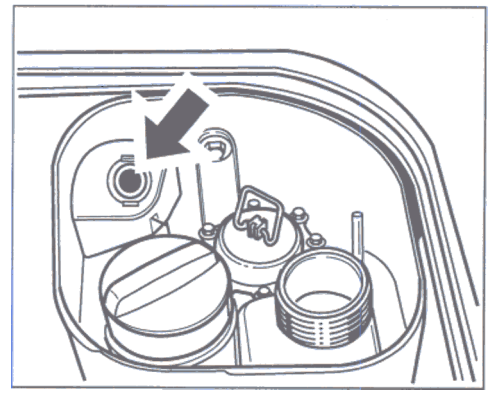
52. Unplug the engine control module. Open the topmost plug by actuating the side button and pull out. Remove the other plugs from the top down. To do so, press the locking button in and push the locking bar upwards.



53. Uncover the engine wiring harness. To do so, press the rubber sleeve on the luggage compartment rear wall inwards and guide the wiring harness towards the engine compartment, if the engine is to be lowered later.



54. Disconnect the plug connection at the guide tube of the oil dipstick. To do so, press the two tabs together and unclip the tube.



Note!

It is recommended to position the complete retainer plate using a transmission jack first. Only then should the workshop car jack be placed underneath.

55. Place pre-assembled engine retainer plate with transmission support on the crankcase or transmission.

View of the engine retainer plate

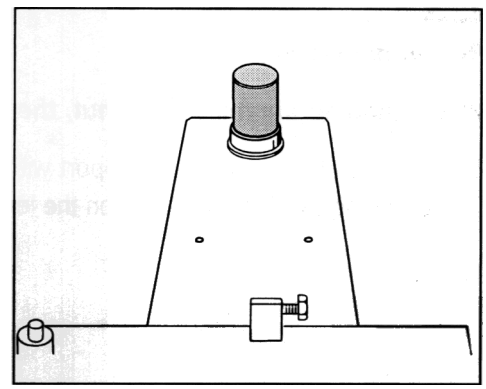
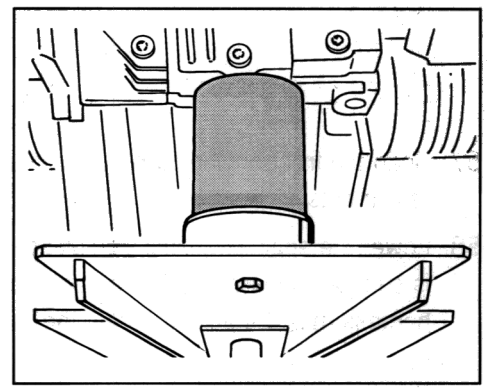
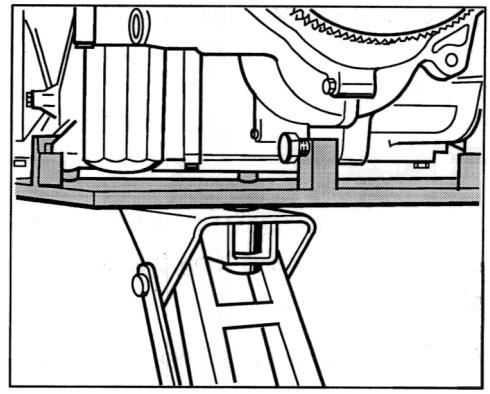


Plate positioned and secured



Car jack placed underneath

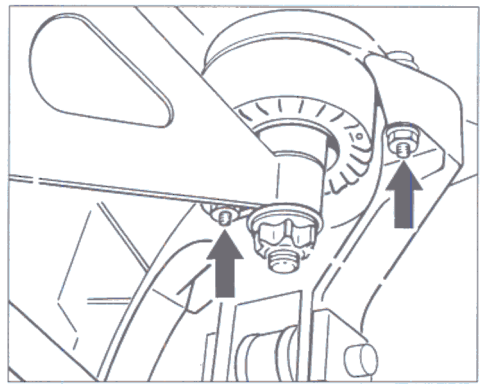


Caution!

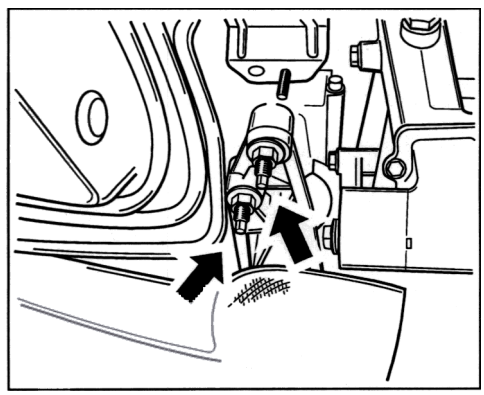
Risk of damage!

When undoing the multi-tooth nut, the mount is destroyed!

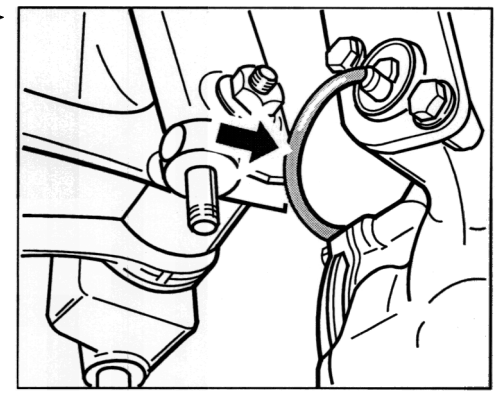
56. Remove the transmission support with the hydraulic mounts. Undo the two fastening nuts on the left and right.



57. Undo the front engine carrier. To do so, unscrew the four fastening nuts.
58. Lower the engine-transmission unit carefully. Ensure that there is sufficient clearance for the components. The engine wiring harness must be guided during the lowering procedure.



Pay attention to the VarioCam cable



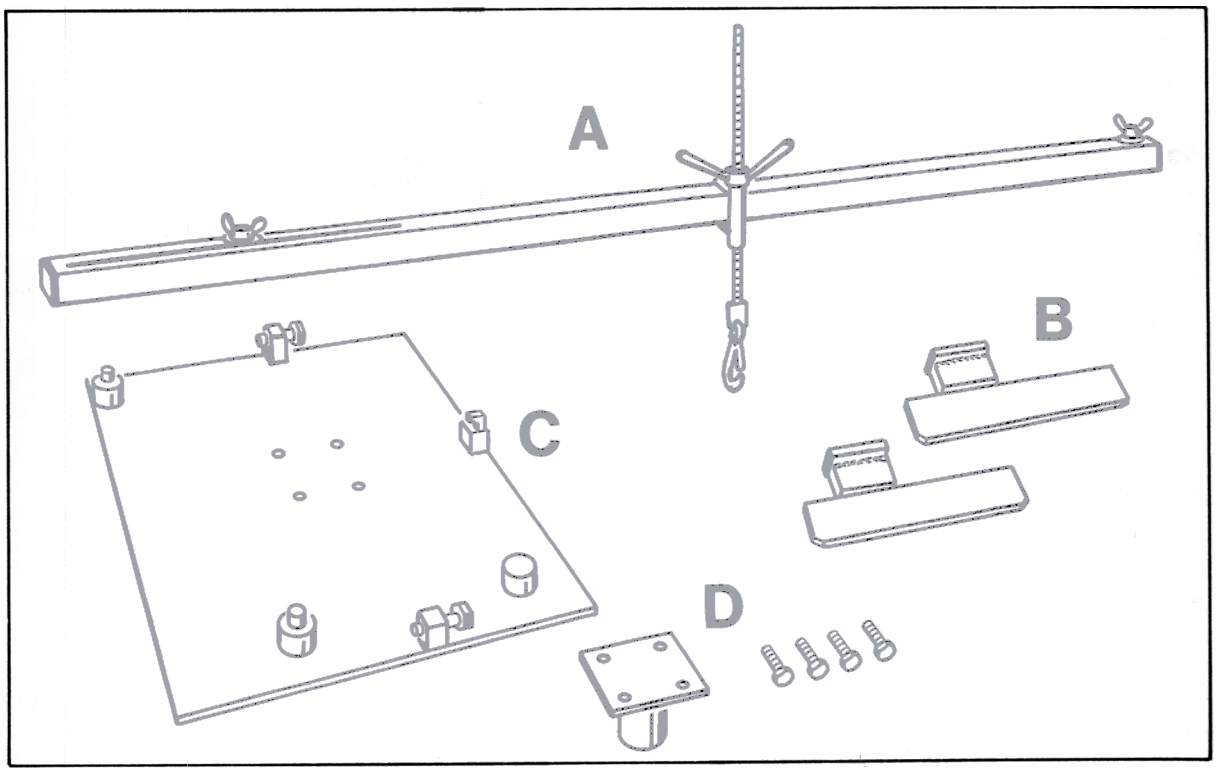
Warning!

Risk of damage!

Only place the vehicle on its wheels or push it after the rear-axle support, the sheetmetal brace and both the diagonal braces have been installed.

10 01 19 Removing and installing engine

Special tools



No.	Designation	Special tool	Explanation
A	Supporting bridge	10-222A	For engine suspension
B	Supports	9591/1	2 ea.
C	Retainer plate	9592	In conjunction with Steinbock car jack
D	Adapter		Adapter for transmission mounting plate; use special tool 9163, type 928

Removing and installing engine

The engine and transmission are removed downwards. Before engine is removed, the transmission must be detached.

Removal

1. Remove covers. Disconnect battery and cover terminal or battery.

Note

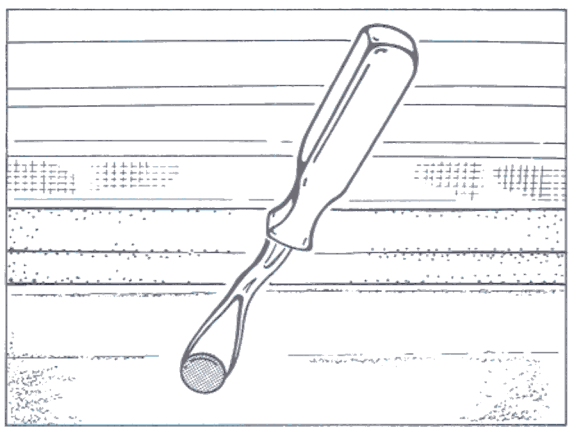
Before disconnecting battery, move convertible top and engine-compartment cover to service position.

2. Put body-protection covers on.

3. Raise car at specified jacking points.

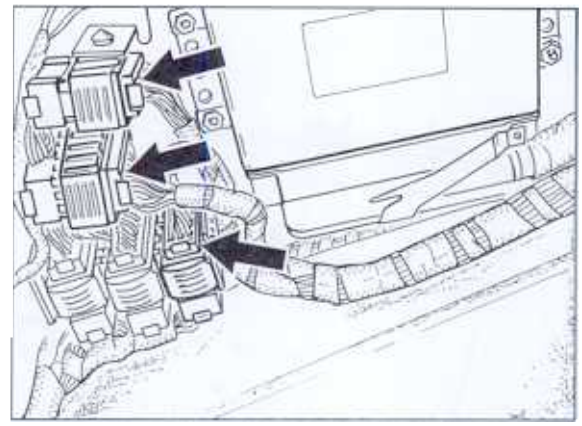
4. Undo engine wiring harness in rear luggage compartment:

a. Press out expanding rivets of lining with lever



459 - 96

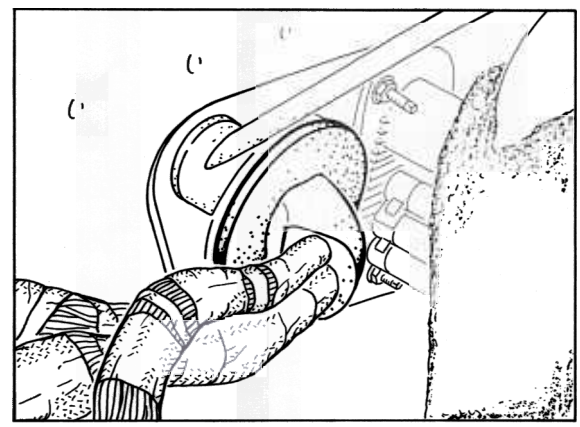
b. Disconnect plug connections.



460 - 96

c. Pull out control unit plug.

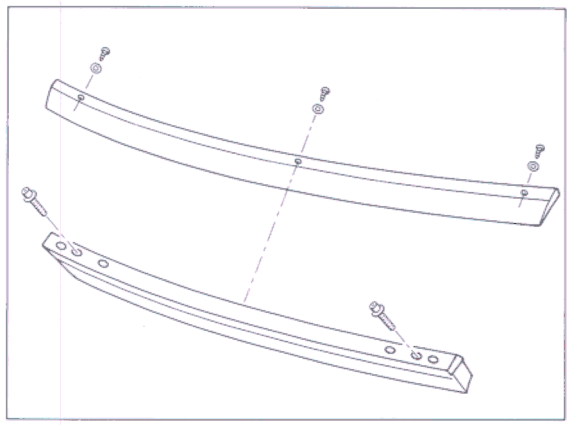
d. Push rubber boot through to engine compartment.



405 - 96

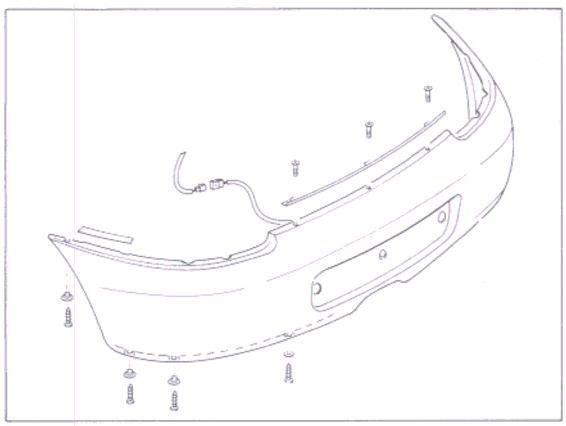
5. Remove complete exhaust system. The following operations must be carried out first:

a. Remove spoiler.



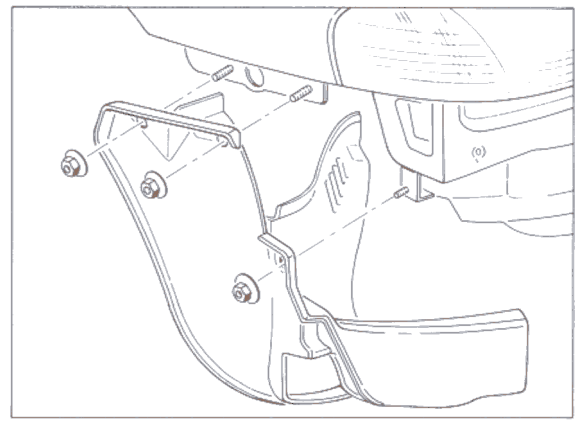
462 - 96

b. Remove rear panel.



463 - 96

c. Remove right and left wheel housing liners.



404 - 96

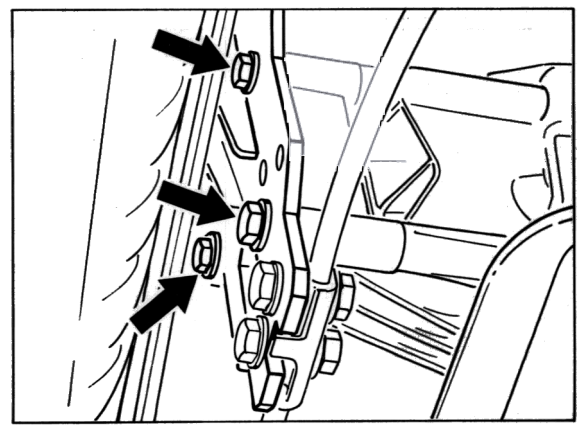
d. At rear axle, remove transverse member panel, left transverse member, right transverse member and stabilizer.

e. Disconnect oxygen sensor plug connection.

f. Separate flange between exhaust manifold and catalytic converter.

g. Place transmission jack under silencer.

h. Undo hexagon-head bolts (3 ea.) at holder.



464 - 96

Lower exhaust system with transmission jack.

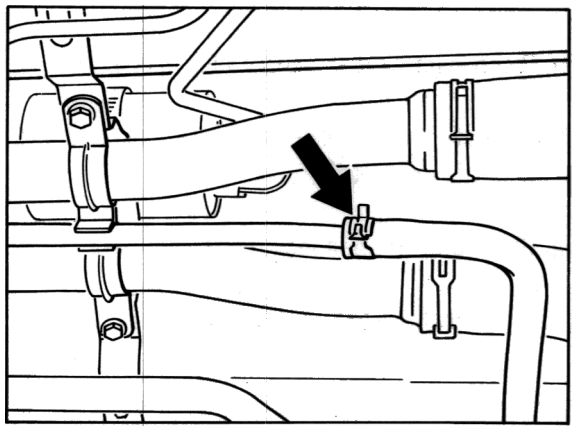
6. Remove transmission.
Removing and installing manual transmission:
See Group 34, Page 34 - 3.
Removing and installing Tiptronic transmission.
See Group 37, Page 37 - A1.

7. Remove underside panels.

8. Drain coolant:

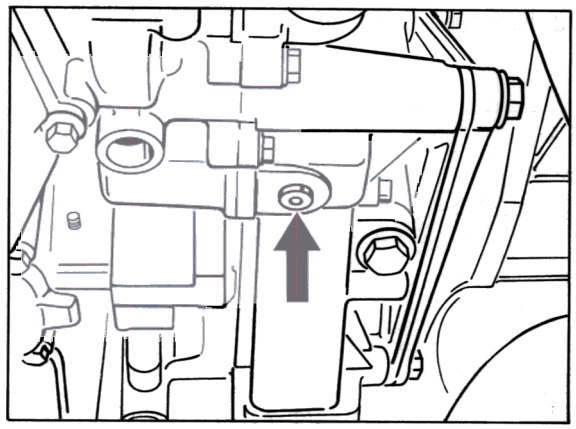
a. Remove cap from coolant expansion tank.

b. Disconnect vent line.



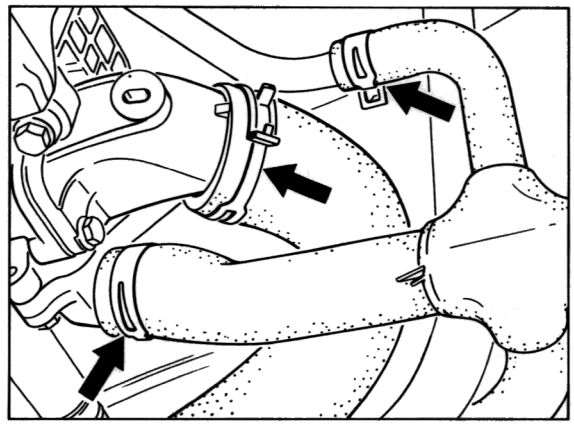
467 - 96

c. Undo drain plug on water guide housing.



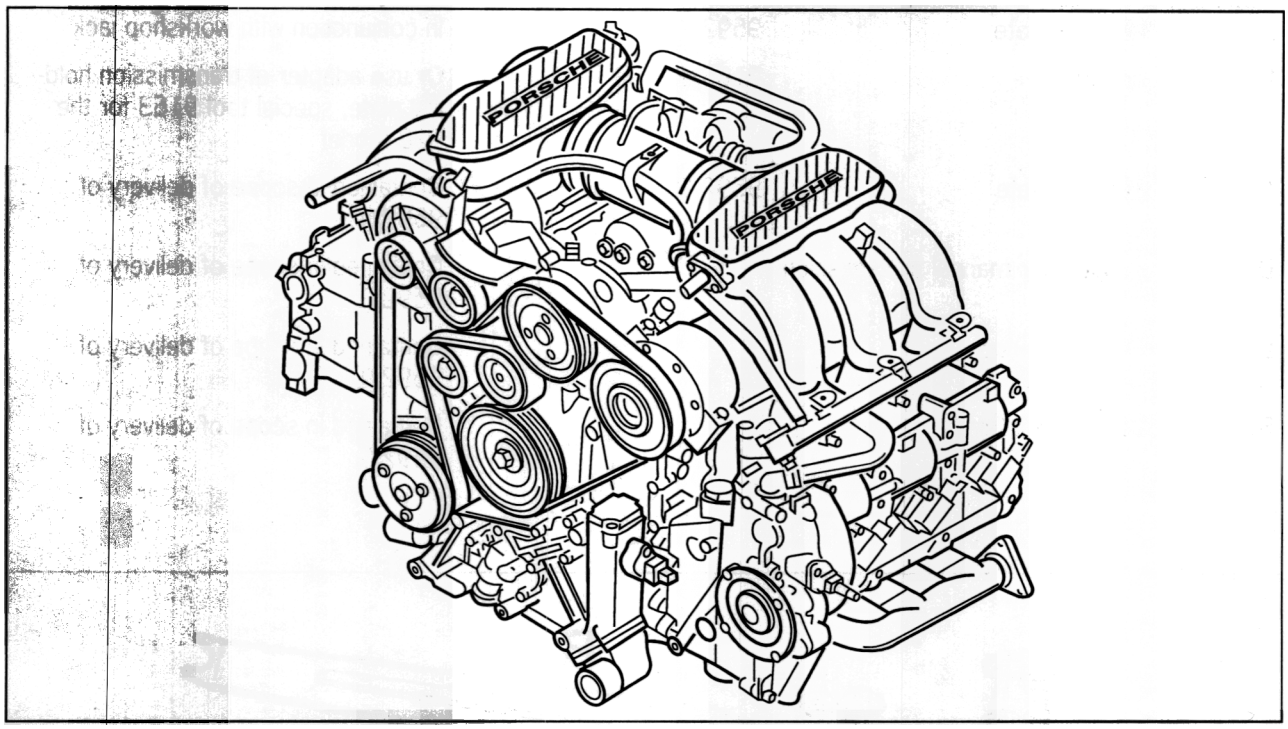
471 - 96

d. Clamp shut coolant hoses with hose clamps and drain coolant.

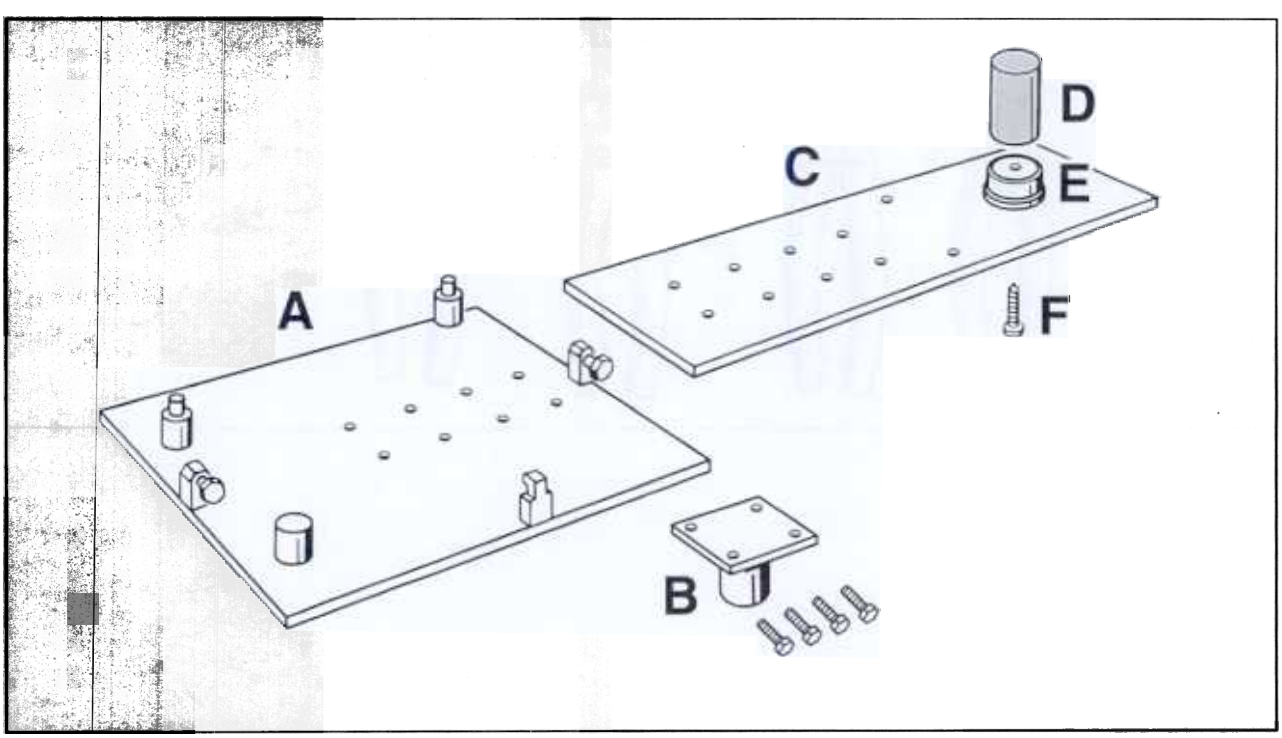


472 - 96

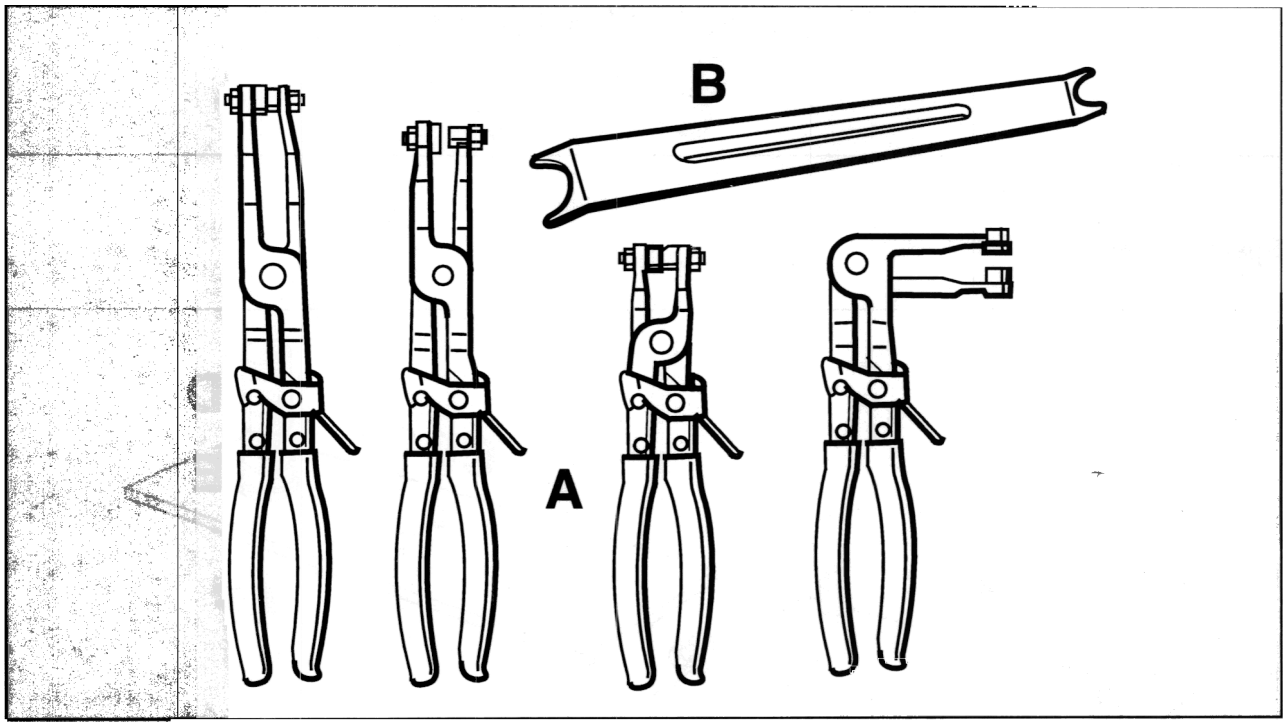
Installing engine, M96/20 (2.5 l) with manual transmission



Special tools



Item	Designation	Special tool	Explanation
	Retainer plate		In conjunction with workshop jack
B	Adapter		Or use adapter of transmission holding plate, special tool 9163 for the 928 model
C	Support plate	9592/2	Contained in scope of delivery of 9592/1
D	Support for manual transmission		Contained in scope of delivery of 9592/1
E	Pressure piece		Contained in scope of delivery of 9592/1
F	Screw M8 x 25		Contained in scope of delivery of 9592/1



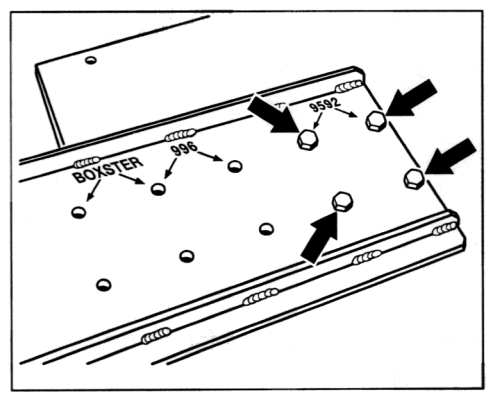
Item	Designation	Special tool	Explanation
	Spring-band clamp pliers		Refer to Workshop Equipment Manual, Chapter 2.4, No.: 72
B	Testing tool for plug-in couplings	9623	Used to check whether the plug-in couplings are seated properly. Suitable for pressure and return lines (nominal diameter 6 and nominal diameter 10)

Adjusting tool

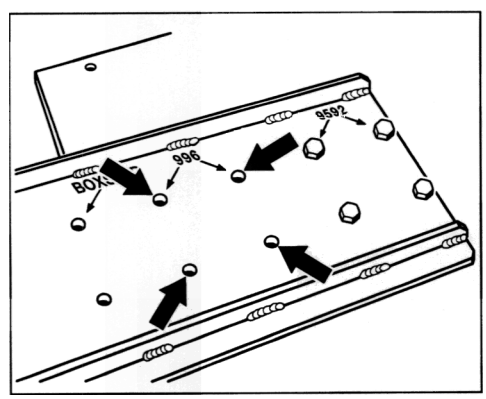
Note!

If the special tool 9592 is being used for the first time, (four) additional threaded holes must be applied.

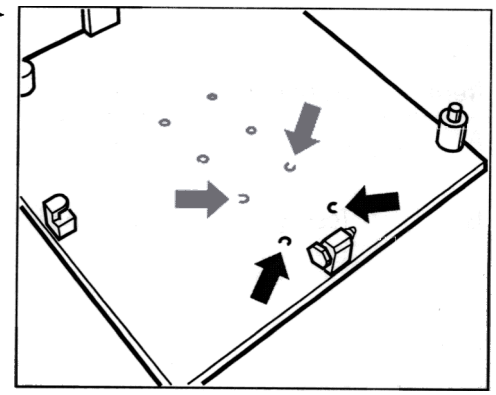
1. Lay the support plate 9592/1 on the rear of the retainer plate 9592 and fasten with four hexagon-head bolts M8 x 25.



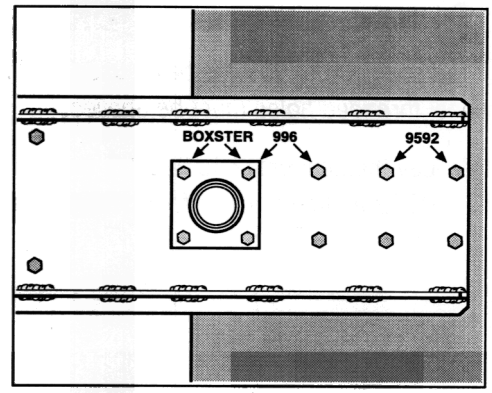
2. Countersink the retainer plate at the designated bores **-arrows-** with a 9 mm drill bit. The support plate serves as the drilling template.



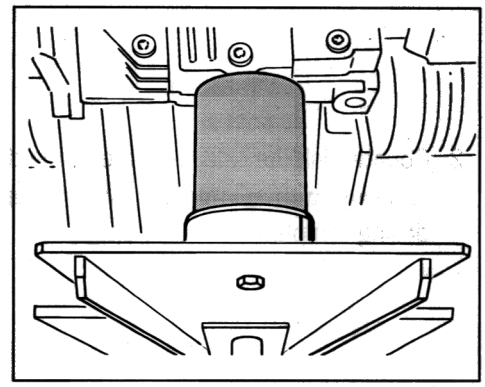
3. Drill through the countersunk bores on the retainer plate with a drill bit sized 6.8 mm and then cut an M8 thread.



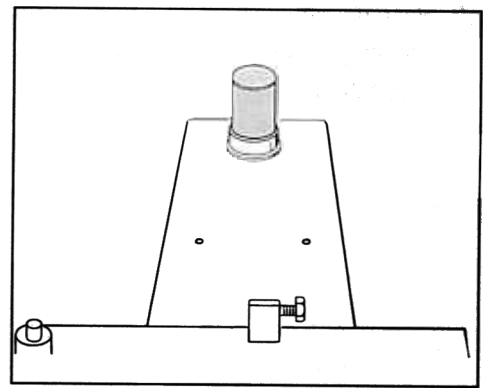
4. Fasten the special tool adapter 9163/2 with a hexagon-head bolt M8 x 25 (bolt quality 10.9) and hexagon-head bolts M8 x 16 (bolt quality 10.9) at the designated positions "Boxster". The adapter and the support plate are fastened on the retainer plate with the M8 x 25 hexagon-head bolts. The M8 x 16 hexagon head bolts connect the adapter with the support plate.



5. Fasten the support for the manual transmission with 1 M8 x 25 bolt.
6. Fasten complete retainer plate on the workshop jack.

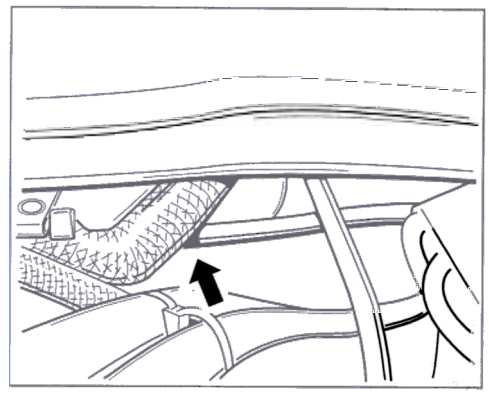


Drawing shows complete engine retainer plate fitted on the workshop jack.



Special notes

- Check the fuel hose for correct routing. The fuel hose is routed behind the engine wiring harness.
- When installing the rear-axle parts, it is essential to observe the correct sequence. The sheetmetal brace should be installed first, then the diagonal brace and finally the rear-axle support.
- The V-brace must be fitted before the exhaust system is installed.
- Finally, perform a suspension alignment.
- Read out fault memory.

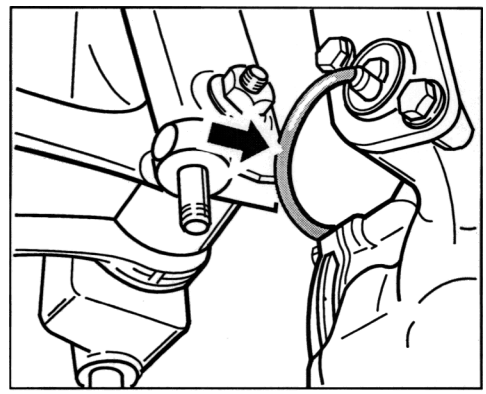


Installing engine

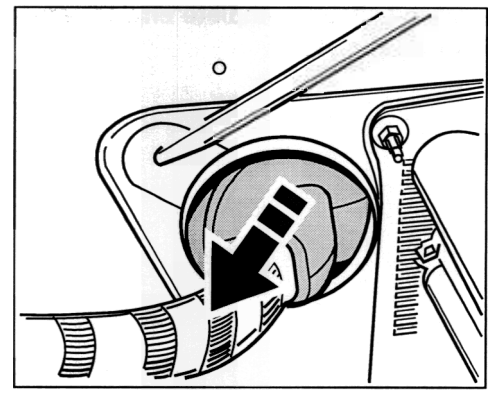
Note!

In order to facilitate the fitting of the air-conditioning compressor, it should be moved back into its installation position during the running-in of the engine.

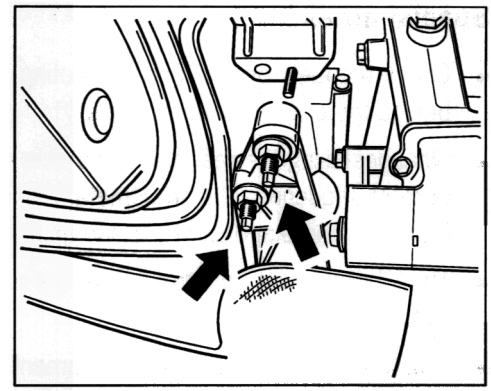
1. Lift the engine-transmission unit carefully and in steps. Have a second person observe the engine-transmission clearance at the same time. When lifting, pay particular attention to the clearance between the rear-axle longitudinal support and the VarioCam cable. Place the air-conditioning compressor in its installation position at this stage.



2. Push the engine wiring harness through the bulkhead and into the luggage compartment before the final installation position is reached.



3. Tighten engine mount. Tighten the four engine mount fastening screws to 46 Nm (34 ftlb.).

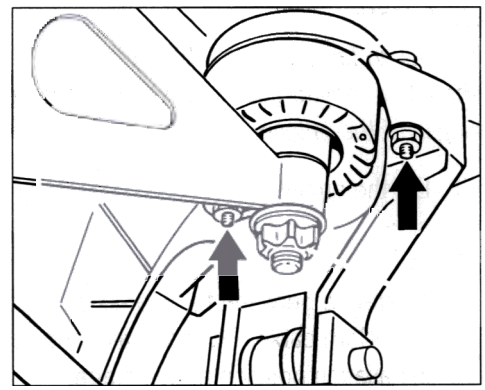


Warning!

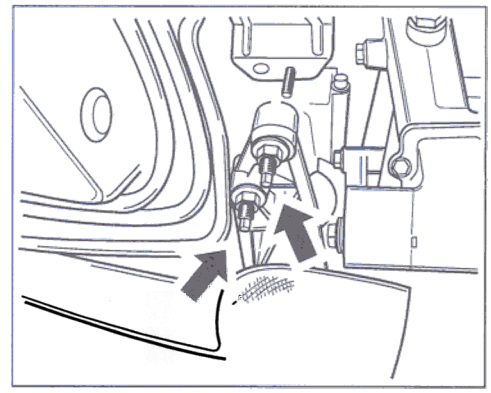
Risk of damage!

- ***Do not turn the multiple-tooth nut -C-!***

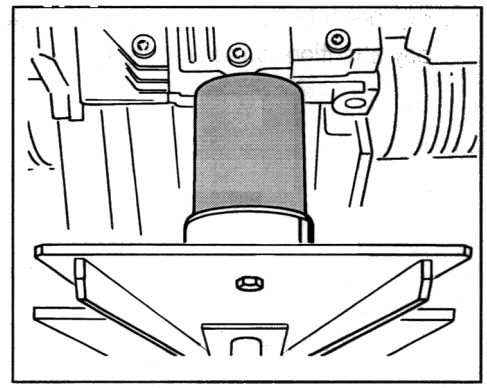
4. Install the transmission carrier and the hydraulic mount again. The M8 screws are tightened to 33 Nm (24 ftlb.).



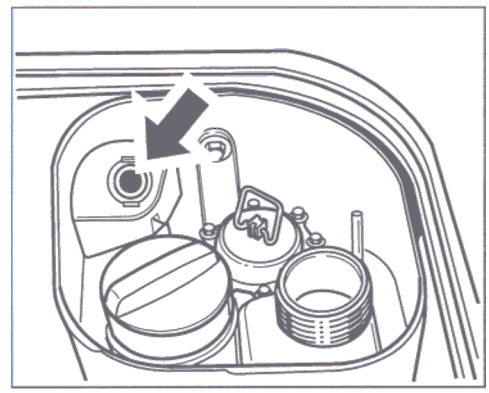
5. Install engine carrier again. Tighten the four fastening screws to 65 Nm (48 ftlb.).



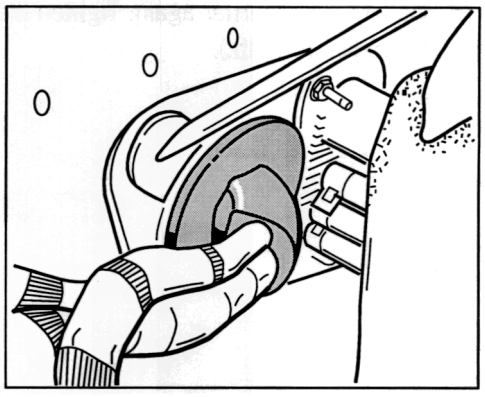
6. Remove the engine-transmission retainer plate. As soon as the engine has been fastened again, the car jack and the retainer plate can be removed.



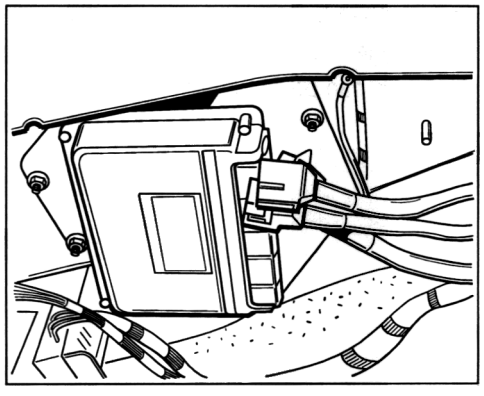
7. Clip the guide tube of the oil dipstick into the socket.



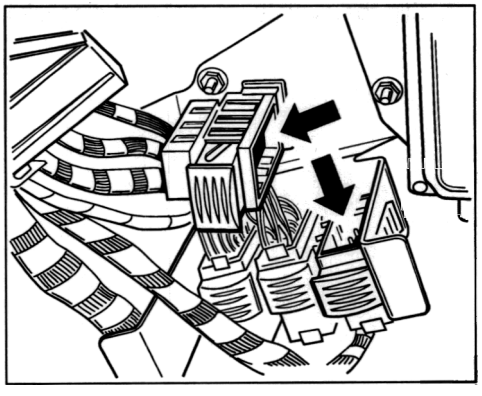
8. Fit the rubber sleeve of the wiring harness again.



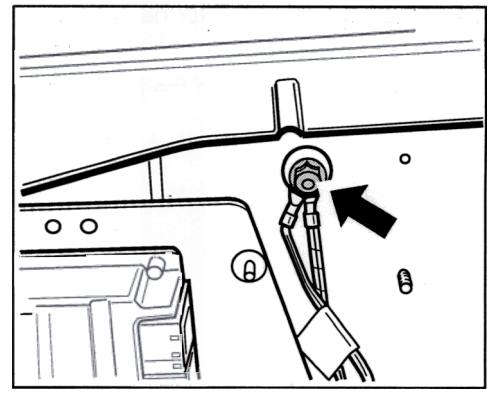
9. Re-connect engine control module. Start from the bottom and pay attention to the plug designations on the control module.



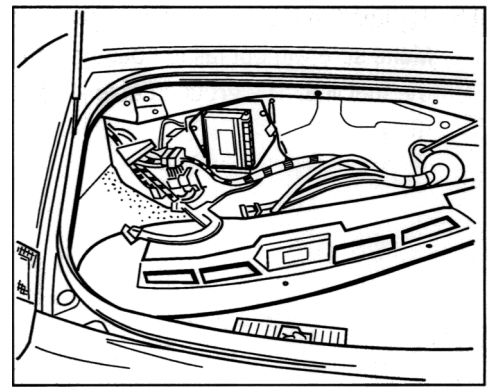
10. Connect the plug connections (X3/1, X3/2 and X59) of the engine wiring harness. To do so, insert the plug and lock the lateral slide.



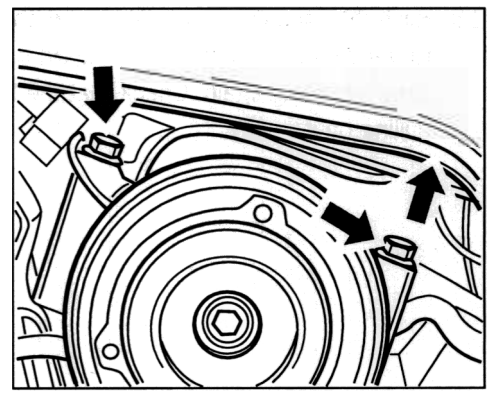
11. Connect the ground point of the control module again and tighten the fastening nut.



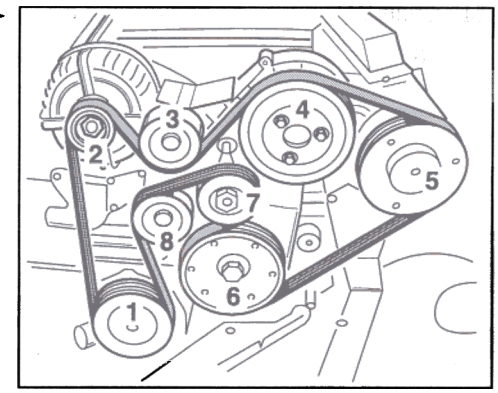
12. Install the luggage compartment lining of the rear luggage compartment.



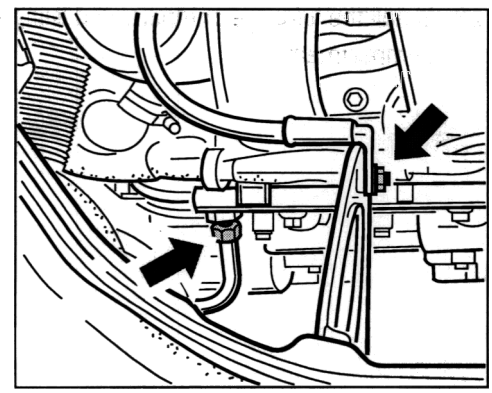
13. Screw air-conditioning compressor tight. Tighten the three fastening screws to 23 Nm (17 ftlb.).



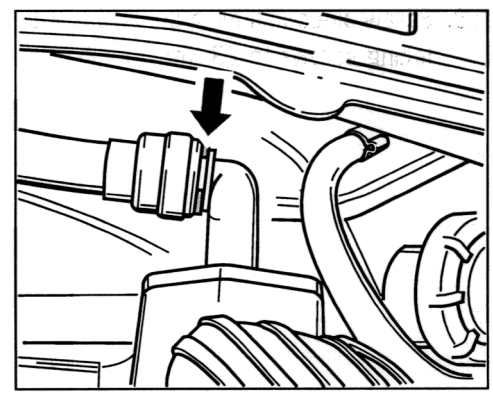
14. Check the drive belt for damage and replace it if necessary. Fit the belt in its original running direction once more. The fitting sequence is shown in the following illustration.



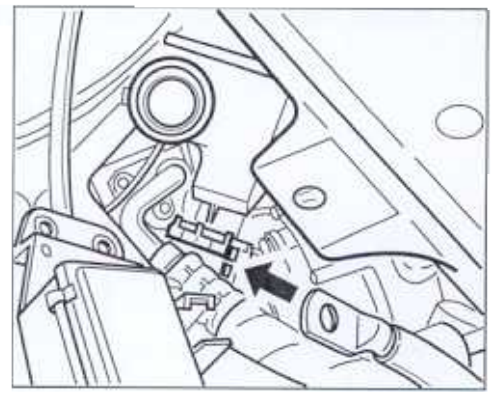
15. Tighten the fuel line on the engine and the ground cable again. Make sure without fail to counter with a wrench when tightening the fuel line. The ground cable is tightened with 23 Nm (17 ftlb.).



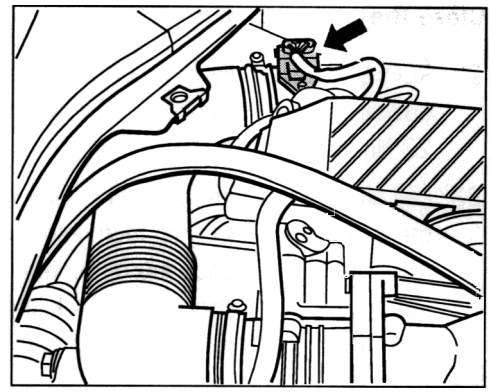
16. Push the vacuum line for the brake booster in a straight line on to the flange, until the plug is heard to engage. Then install the grey snap ring again. Check that the line is seated properly by pulling on it gently.



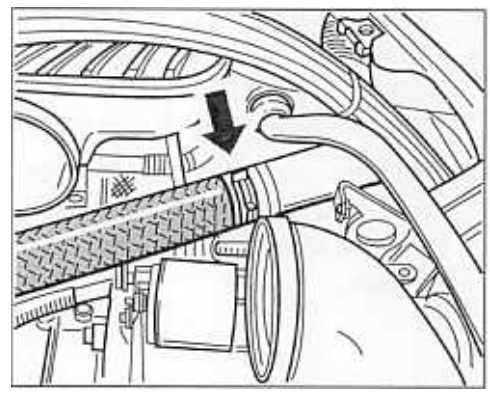
17. Install the expansion tank of the power steering again. Check the sealing rings and replace, if necessary. Turn the lower adjusting ring to its original position and position the tank of the power steering. Press the tank downwards and at the same time turn the ring until the markings coincide. Then fill the tank with Pentosin according to the regulations.
18. Lay the B+ line of the alternator over the connecting bolt and tighten the fastening screw with 10 Nm (7.5 ftlb.). Close the protective cap of the B+ box.



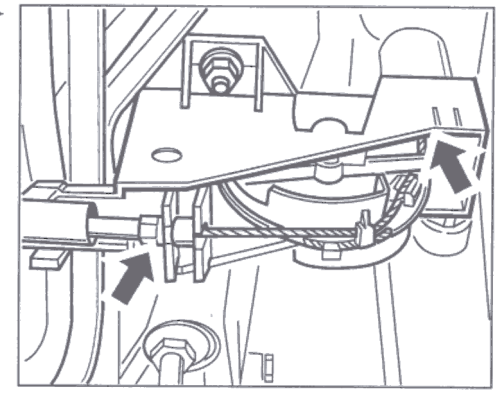
19. Re-connect hot film mass air flow meter. Connect the connecting tube between the hot film mass air flow meter and the intake system and tighten the hose clamp.



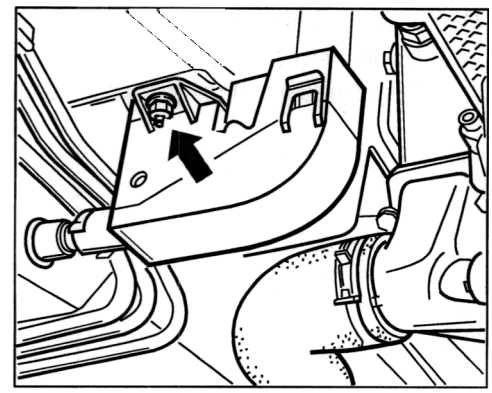
20. Fit the oil filler line. Push the oil filler line back onto the flange and secure with a spring band clamp.



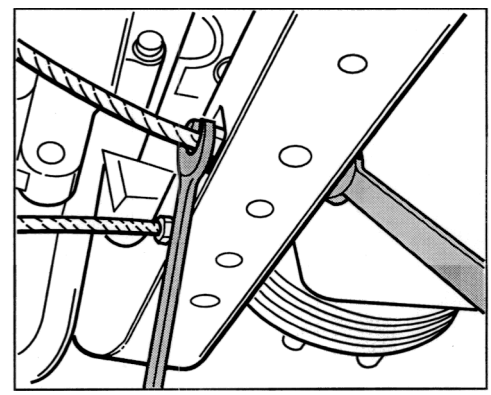
21. Engage the accelerator cable.



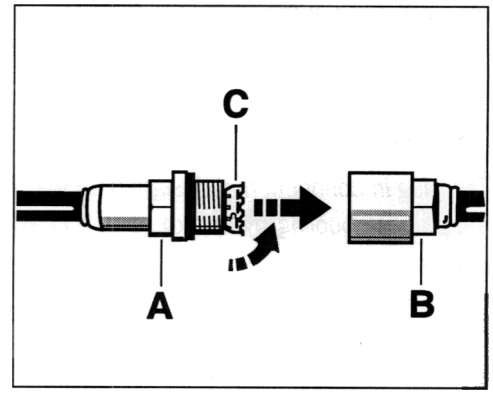
Close the deflector box.



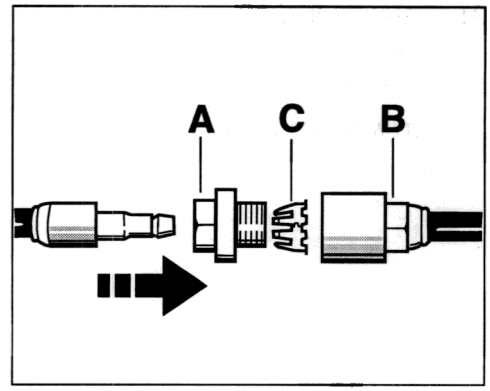
22. Refit clutch slave cylinder. Insert the cylinder back into the opening in the transmission. Tighten the fastening screw with 23 Nm (17 ftlb.).
23. Lay shift cables. Lay the shift cables in the engine compartment once more and clip them into the holder on the transmission. Then check once more that they are seated properly. Finally, press the shift cables back into the shift linkage. Check that the shift cables are installed correctly.
24. Screw heat shield tight. Fit the shield over the Tucker bolts and tighten the two sheetmetal nuts.
25. Screw the drive shafts on to the transmission again with new screws. The tightening torque is 39 Nm (29 ftlb.) for the Boxster 2.7 l and 81 Nm (60 ftlb.) for the Boxster 3.2 l. Subsequently remove the protective sheath.
26. Retighten cable. Fit the engine cable through the rear-axle support again and tighten the fastening nuts. Make sure to counter with a wrench when tightening. The tightening torque is 23 Nm (17 ftlb.).



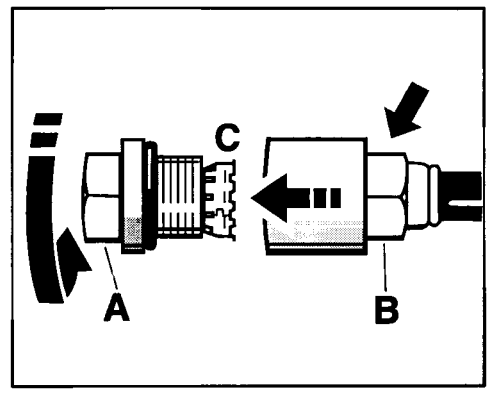
27. Connect the power-assisted steering lines. To do so, tilt the holder on one side and pull out simultaneously.



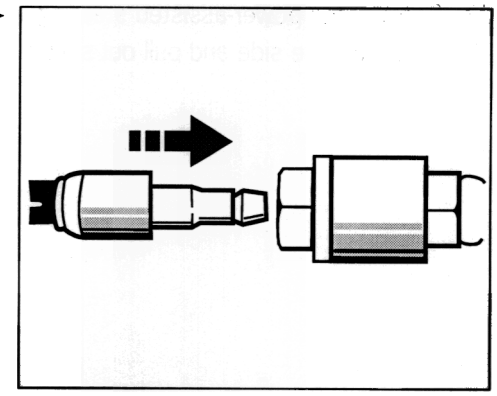
28. Detach threaded part **-A-** by pulling it off the nipple.



29. Insert the holder - **C** - into the threaded part **-A** - and screw both into the plug-in coupling - **B** - and tighten. Make sure to counter with a wrench when tightening. The tightening torque for the steering pressure line is 30 Nm (22 ftlb.) (wrench size 15). The tightening torque for the steering return line is 40 Nm (30 ftlb.) (wrench size 19).



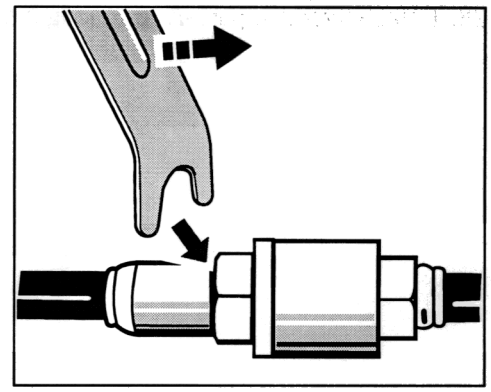
30. Insert the screwed plug into the plug-in coupling in a straight line. The plug must audibly engage in the holder.



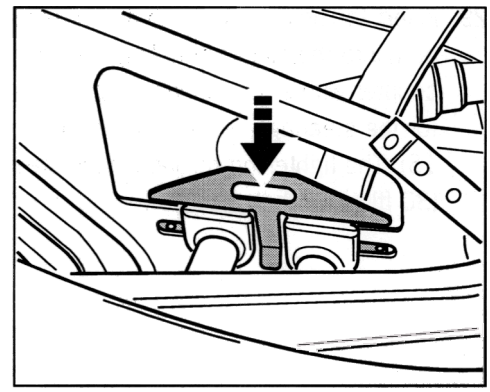
Note!

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.

31. The correct engagement of the plug-in couplings should be checked using the special tool 9623. To check this, insert the special tool 9623 between the plug-in coupling and the screwed plug and tilt the tool slightly. The plug must not slide out.



32. Install the servo lines, the return line and the vacuum hose for the brake booster again and insert the retaining clip.



Caution!

Risk of damage!

The fuel lines must not be kinked.

33. Connect the fuel lines. Re-connect the fuel lines on the vehicle underbody. The plug must engage audibly. Check correct seating by pulling gently.

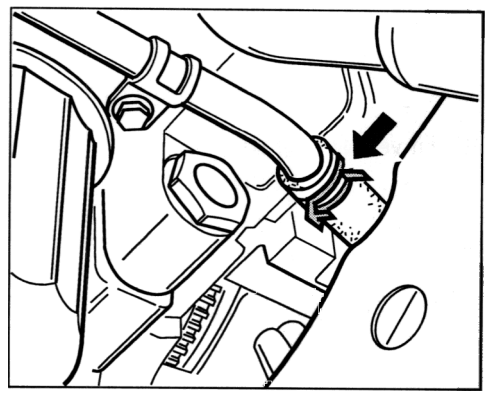
Caution!

Danger of slipping hoses.

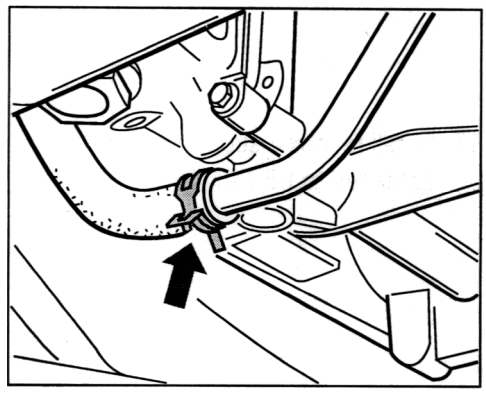
Never apply a lubricant to the coolant hoses to make fitting easier!

34. Fit all the coolant hoses again. To make fitting easier, the coolant hoses can be wetted with water in the fitting area.

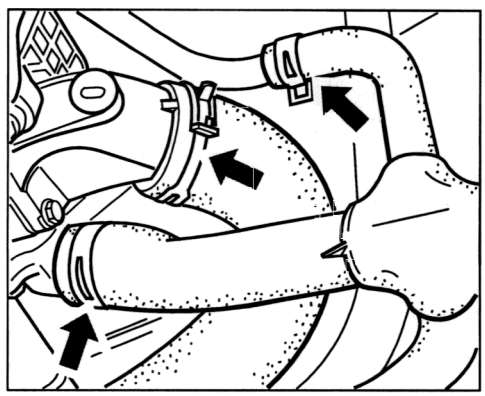
Connect the hose



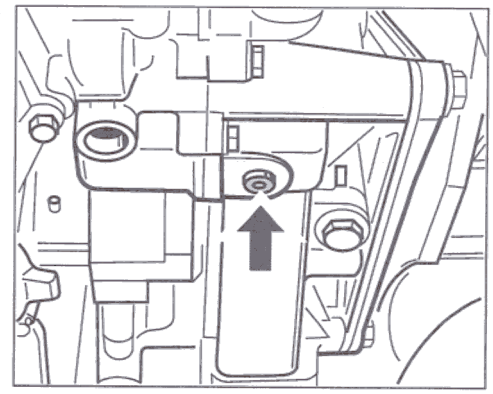
Close the line



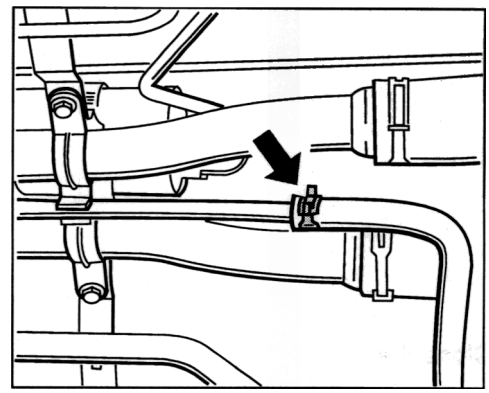
Reconnect the hoses



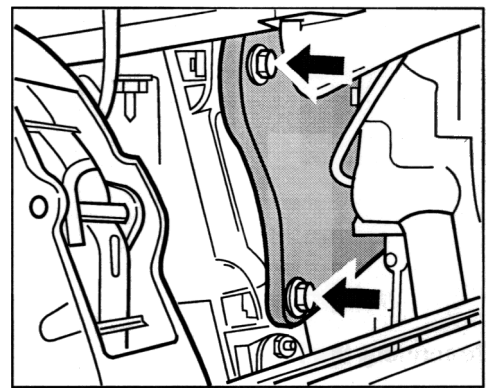
35. Check the coolant drain plug. If the drain plug is removed, it should be equipped with a new seal and re-mounted. The tightening torque for the screw is from 10 to 15 Nm (7.5 to 11 ftlb.).



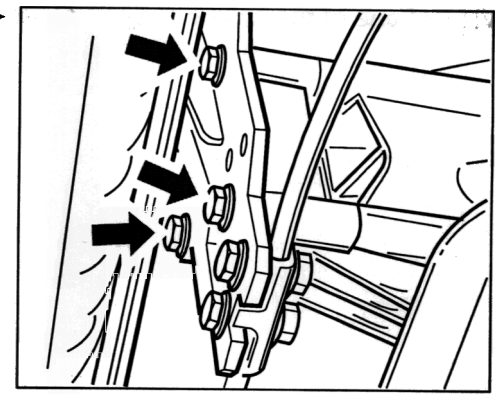
36. Fit vent line again.



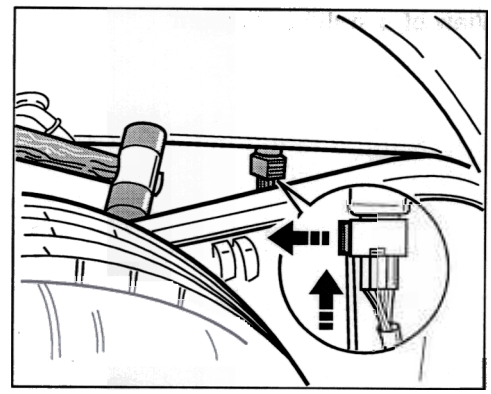
37. Install rear-axle support again. The four fastening screws are tightened to 65 Nm (48 ftlb.).



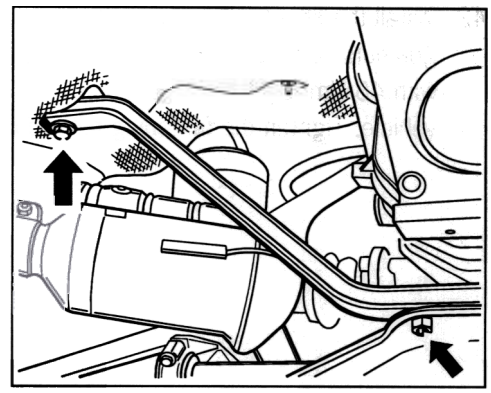
38. Move the exhaust system to its installation position again. In the process, replace all the seals at opened points. Tighten the three hexagon-head bolts again. Then tighten the screws on the exhaust manifold/catalytic converter with 25 Nm (18 ftlb.).



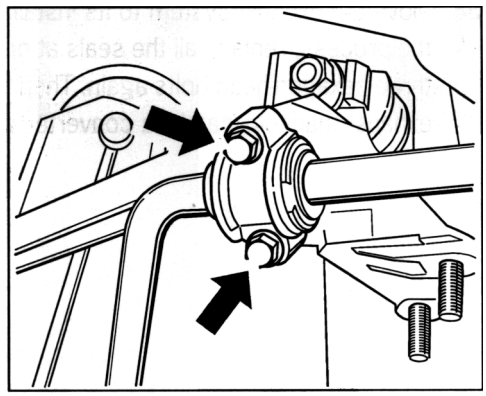
39. Connect the oxygen sensor cables. Connect the plugs and engage the holder in the rear-axle support.



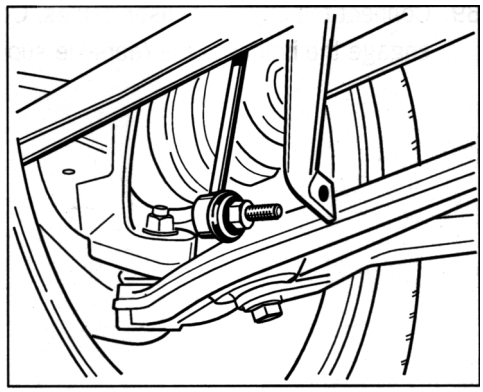
40. Install the rear V-member. The four fastening screws are tightened to 65 Nm (48 ftlb.).
41. Install stabilizer. To do so, insert the stabilizer on the left and right into the stabilizer mount and screw it tight to the two bearing surfaces. The fastening nuts on the mount are tightened with 46 Nm (34 ftlb.). The fastening screws on the bearing surfaces are tightened with 23 Nm (17 ftlb.).



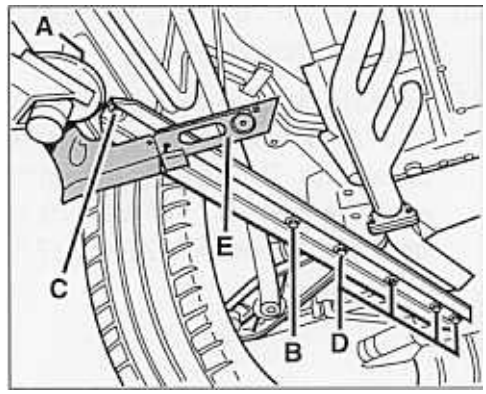
View of one of the two bearing surfaces



View of a stabilizer mount

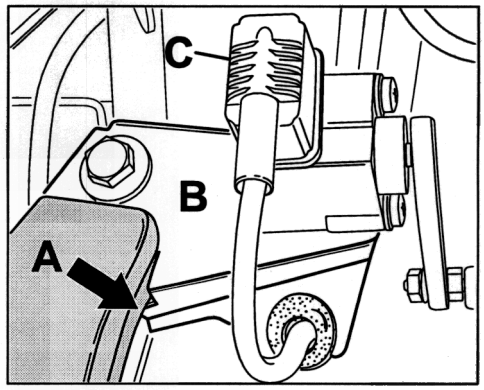


42. Install the sheetmetal brace into the vehicle. Tighten the hexagon nuts with 65 Nm (48 ftlb.) and tighten the fastening screws with 46 Nm (34 ftlb.). Install the two diagonal braces into the vehicle. Tighten the fastening nuts to 65 Nm (48 ftlb.).

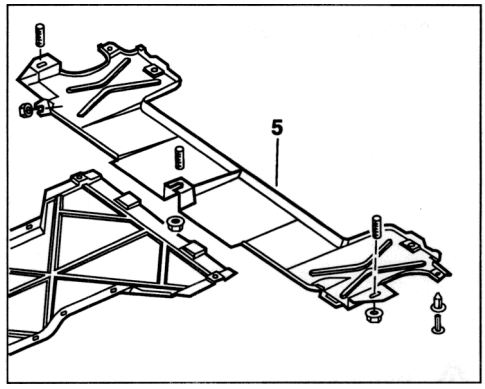


Note!

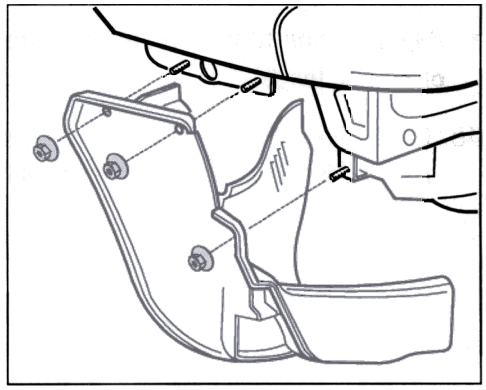
Vehicles with automatic headlight beam adjustment. Bear in mind that the angle sensor bracket (B) must be in contact at the bottom when the bolts on the rear-axle support (A) are tightened. Once installed, the control module must be calibrated with the PST 2. The headlights must then be reset. ***-A- Rear-axle support- -B - Angle sensor bracket- - C - Angle sensor-***



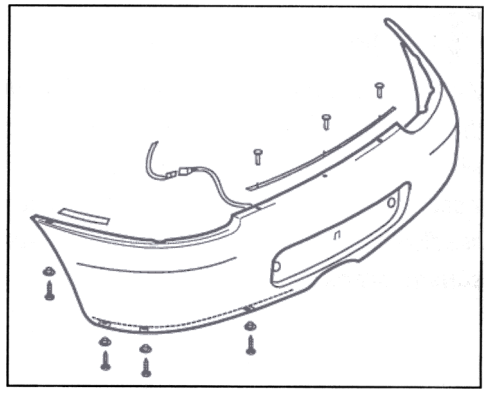
43. Mount the underside panel.



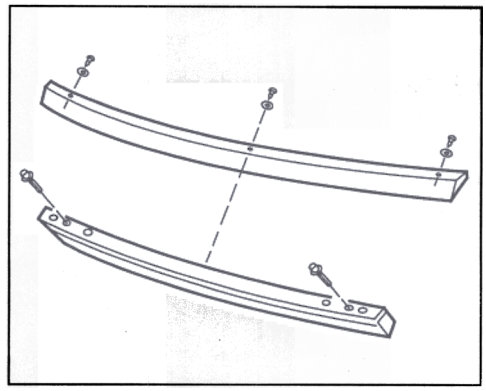
44. Install the right and left wheel housing trims again.



45. Re-install the rear spoiler.



46. Install the rear spoiler again.
47. Re-position the trim of the rear luggage compartment and press in the fastening rivets.

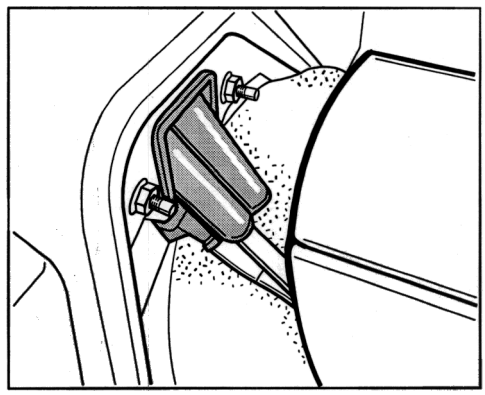


Warning!

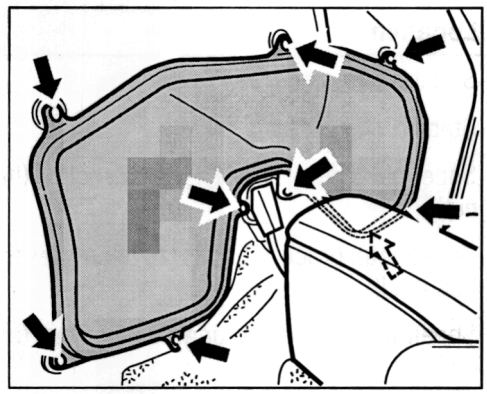
Danger of short circuit!

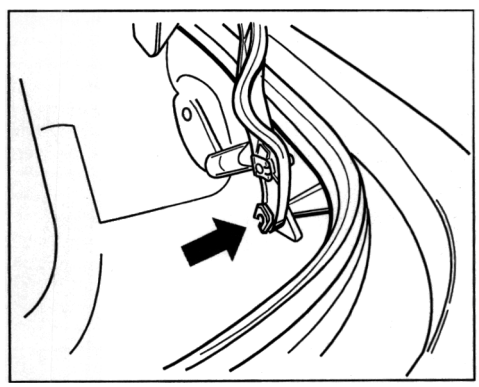
- ***Pay attention to the correct seating of the rubber sleeve of the B+ lead!***

48. Check the rubber sleeve. The rubber sleeve of the B+ lead must be fitted correctly and must not have slipped out of place.



49. Seal off the maintenance openings again. Seal off the upper and rear maintenance openings again. Tighten the seven fastening screws and the two fastening nuts of the rear maintenance opening with 10 Nm (7.5 ftlb.).
50. Re-install the left seat. Tighten the four fastening nuts to 65 Nm (48 ftlb.).
51. Top up operating fluids. Check that all operating fluids (engine oil, Pentosin, coolant) are at the correct level. Both the coolant circuit and the power steering must be bled according to regulations.
52. Connect battery. Connect the battery terminals again and tighten. Subsequently, the fault memories of the vehicle must be read out and the theft codes may possibly have to be entered again. Re-teach the power windows.
53. Carry out a test drive. After the test drive, check that all the operating fluids are at the correct level. Check all circuits for leaks.
54. Fit convertible top again. To do so, take the mandrel out of the fixing bore.
55. Move the convertible top towards the rear until the linkage can be pushed back onto the pin. Then push the retaining clip into place.
56. Close convertible top. To do so, pull the tension bow towards the rear again and engage the tension cables again on the left and right.
57. Engage the cloth covering of the convertible top on the left and right into the retaining lugs.



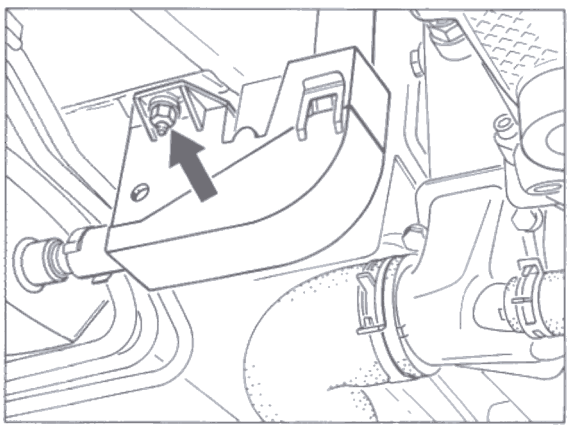


Tightening torques

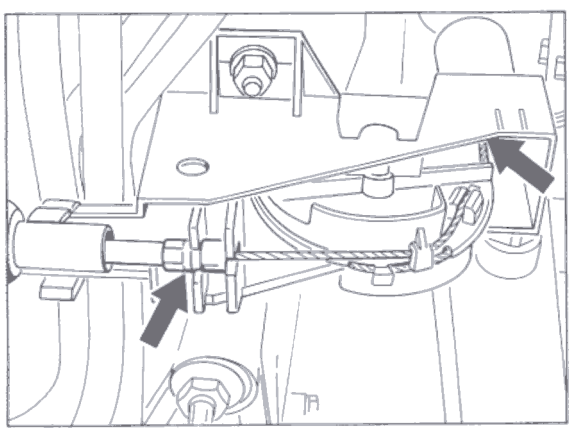
Location	Thread	Tightening torque Nm (ftlb.)
Torque converter to drive plate		39 (29)
Engine carrier to body		65 (48)
Transmission support on transmission		85 (63)
Hydraulic mount to carrier side section		23 (17)
Drive shaft on transmission M96/20 (Boxster 2.5 l)		39 (29)
Rear cross member (aluminium V-brace)	M10 x 1.5	65 (48)
Cable to rear-axle support	M8	23 (17)
Exhaust system to exhaust manifold	M8	25 (18)

Location	Thread	Tightening torque Nm (ftlb.)
Stabilizer to carrier side section		23 (17)
Stabilizer to coupling linkage		46 (34)
Sheetmetal brace to carrier side section (hexagon nut)		65 (48)
Sheetmetal brace to cross member (hexagon-head bolt)	M10 x 1.5	46 (34)
Sheetmetal brace to rear cross member (hexagon nut)	M10 x 1.5	65 (48)
Diagonal brace (front) to body	M10 x 1.5	65 (48)
Wheel to wheel hub	M14 x 1.5	130 (96)
Fuel supply line to fuel gallery	M16	30 to 35 (22 to 26)
Coolant drain plug	M10 x 1.5	10 to 15 (7.5 to 11)
Ground strap to secondary air pump bracket	M8	23 (17)

9. Disengage accelerator cable, remove cover from deflection box and detach accelerator cable.

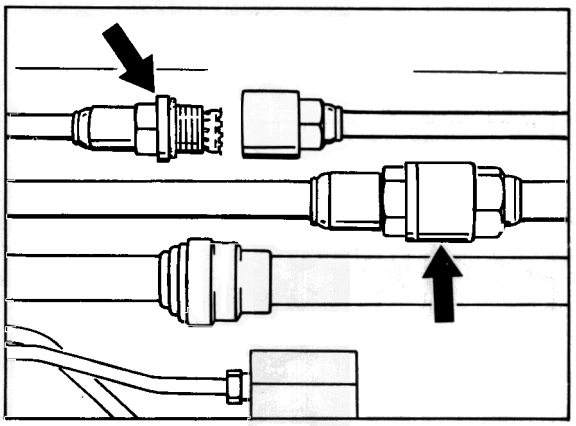


473 - 96



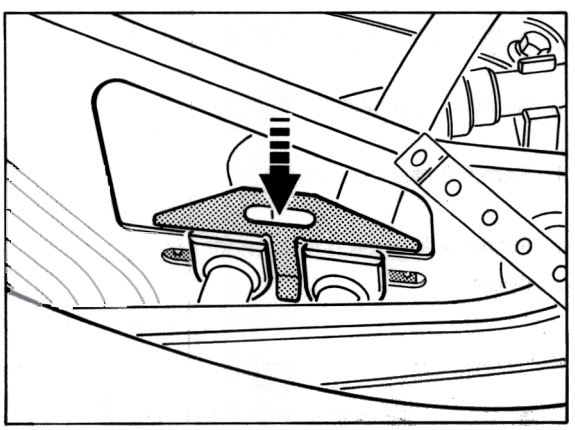
474 - 96

10. Undo connecting line for power-assisted steering while countering with a wrench.



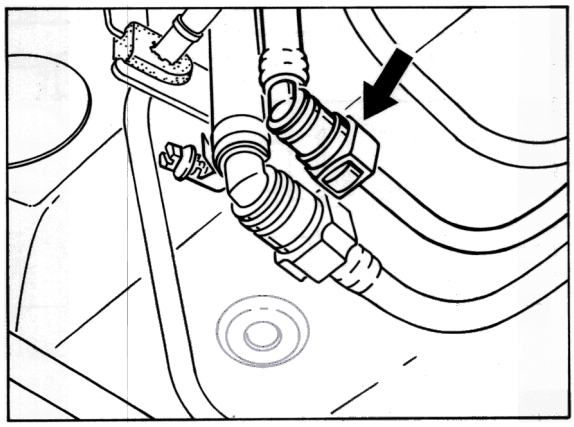
475 - 96

11. Detach clips for return hose/servo pipe and detach vacuum hose for brake booster.



476 - 96

12. Disconnect fuel return line.



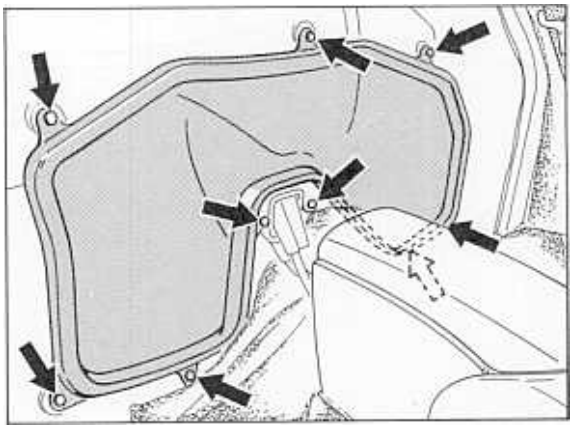
367 - 96

13. In vehicles with air conditioning, the following operations must be performed:

a. Remove left-hand seat.

b. Remove rear-wall lining.

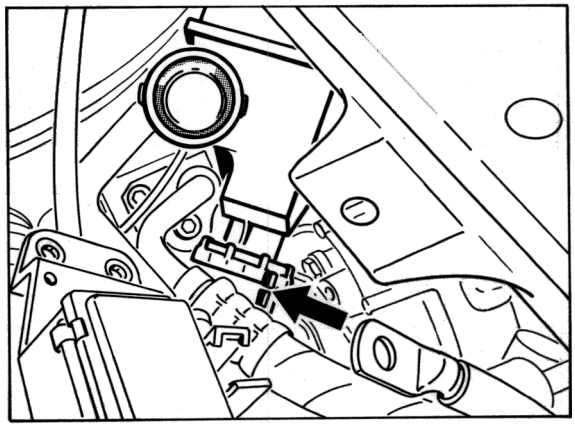
c. Remove engine-compartment cover (service cover).



274 - 96

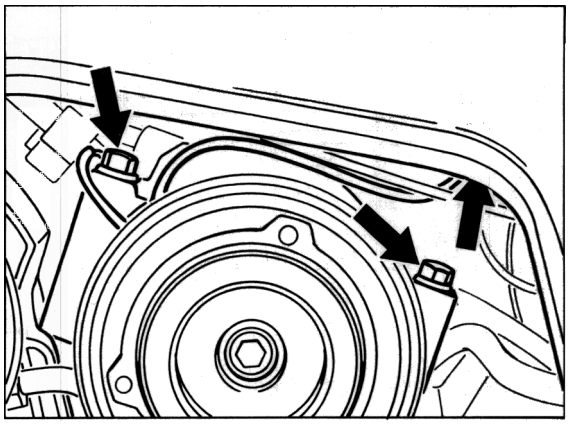
d. Disconnect battery positive at B+ disconnection point on engine. Disconnect B+ disconnection point (2 screws M6) at engine and put aside.

e. Extract power-assisted steering fluid from reservoir to beneath the joint. Remove servo reservoir (bayonet lock). When installing, observe marking (arrow). Seal joint against dirt.



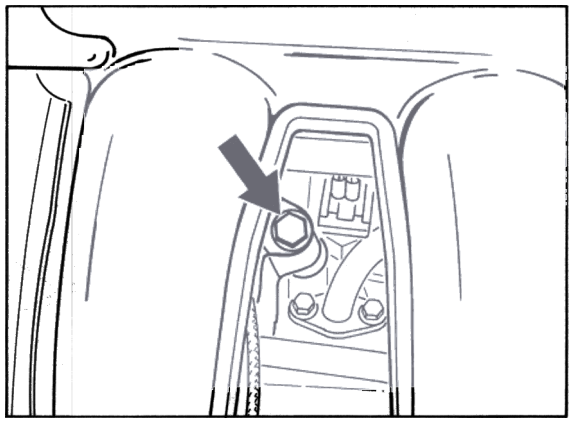
25 - 96

f. Undo front compressor fastening screws (2 ea.) and disconnect electrical plug connection.



27 - 96

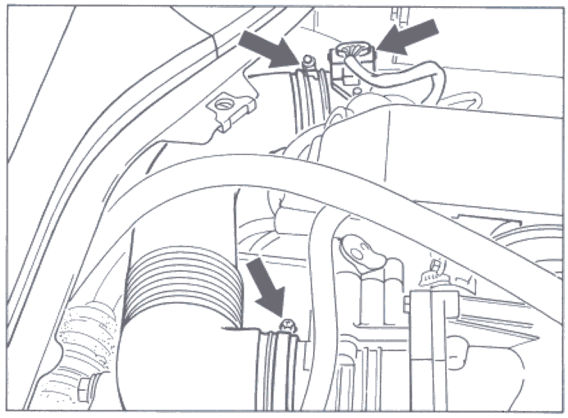
g. Undo compressor fastening screw between the intake pipes of cylinders 4 and 5.



26 - 96

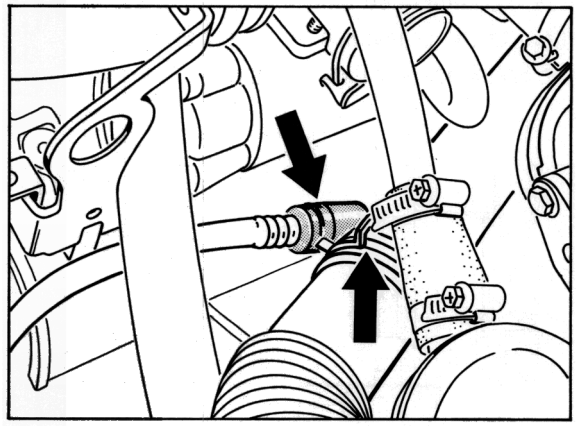
h. Set aside compressor with connected hoses.

14. Remove suction hose between air-flow sensor and throttle body. Detach electrical plug connection from air-flow sensor.



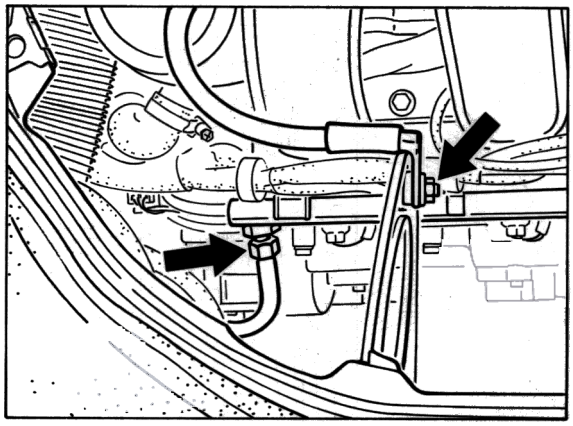
477 - 96

15. Disconnect plug connection at oil-dipstick guide tube, loosen spring-band clamp from oil filler hose and pull off hose.



478 - 96

16. Undo fuel feed hose, making sure to counter with a wrench. Collect residual fuel. Undo ground strap from fixing bracket for air pump.

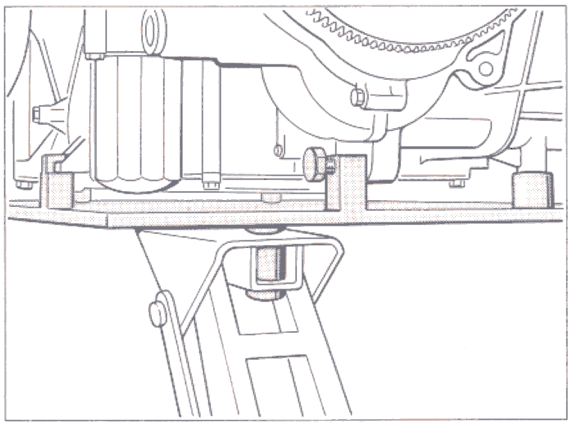


479 - 96

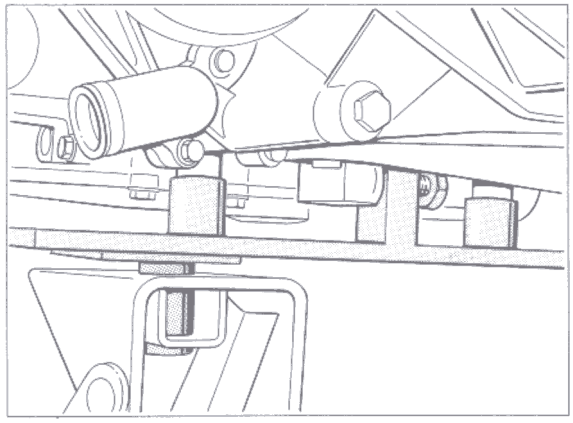
17. Put retainer plate (special tool 9592) on crankcase.

Note

It is recommended that the retainer plate be fitted to the crankcase first. Only then should the Steinbock car jack be fitted.



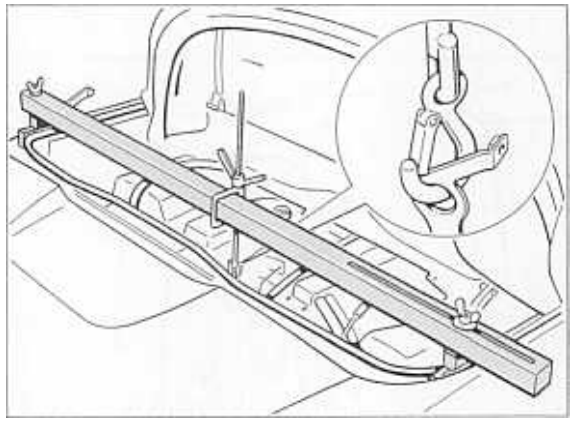
480 - 96



481 - 96

18. Undo engine cross member

19. Disengage suspension hook of supporting bridge and detach suspension hook from engine transport shackle.

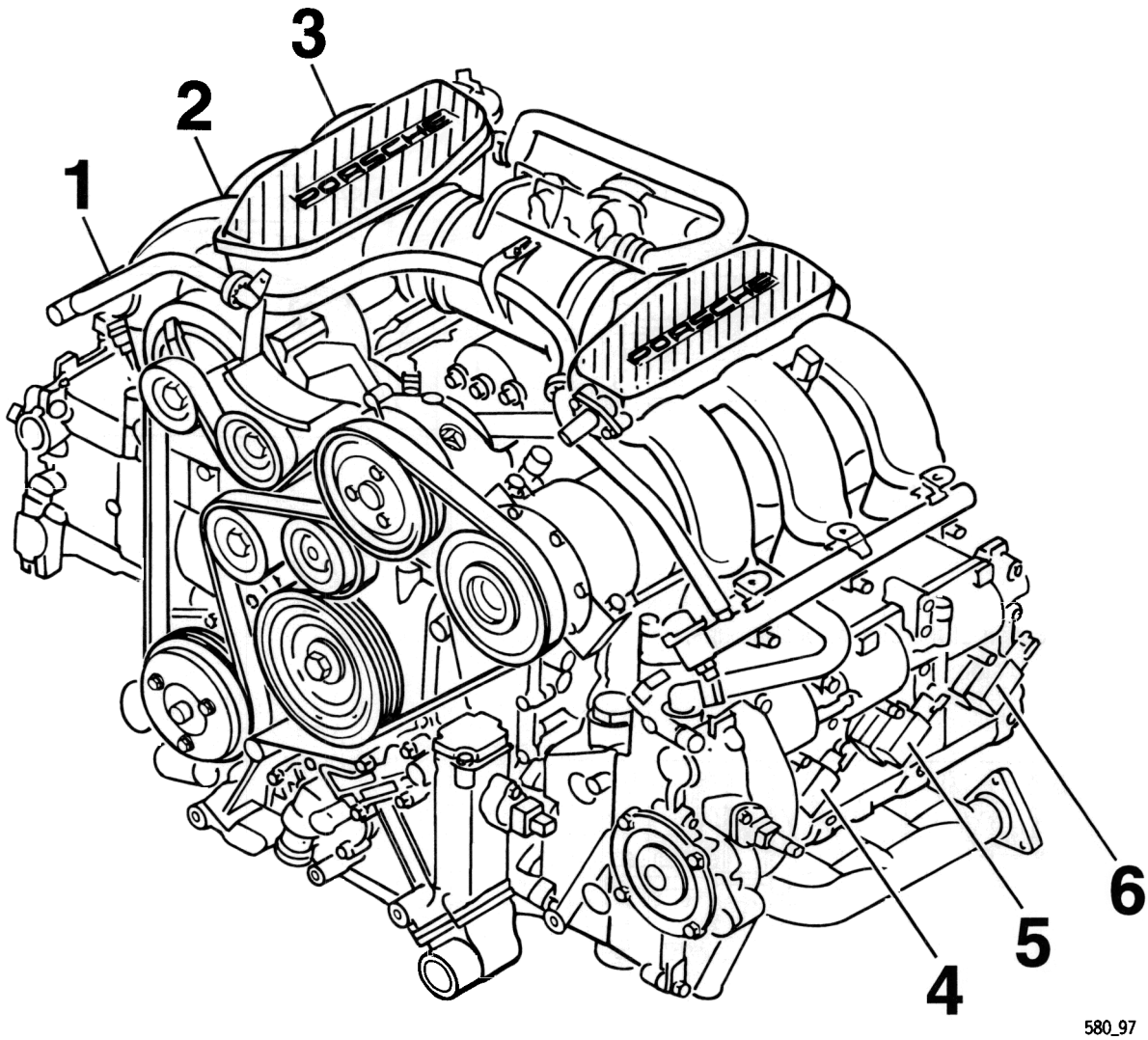


194 - 96

20. Lower engine **carefully** and **in stages.** Have a second person observe the engine clearance at same time.

10 01 37 Disassembling and assembling engine

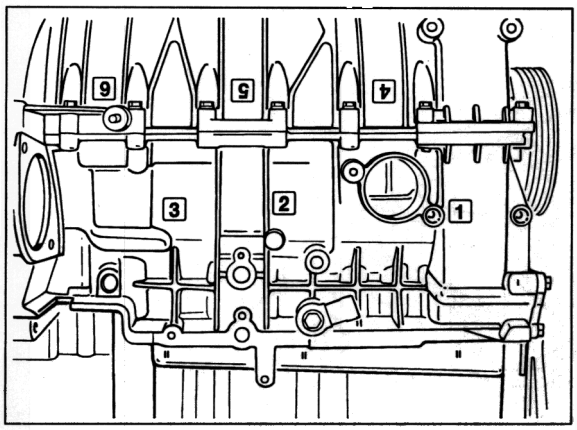
Designation of cylinders



FIRING ORDER 1 - 6 - 2 - 4 - 3 - 5

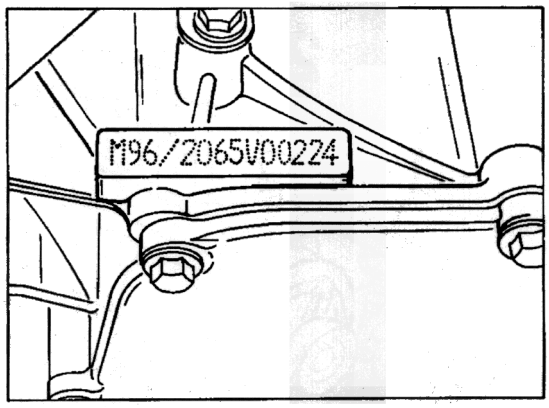
Identification on engine

Cylinder arrangement



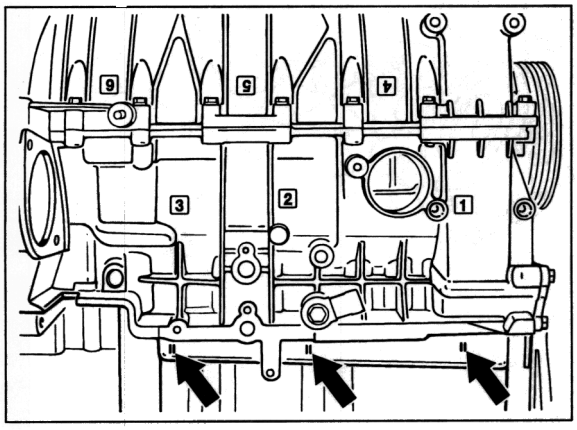
97-339

Engine type and engine number



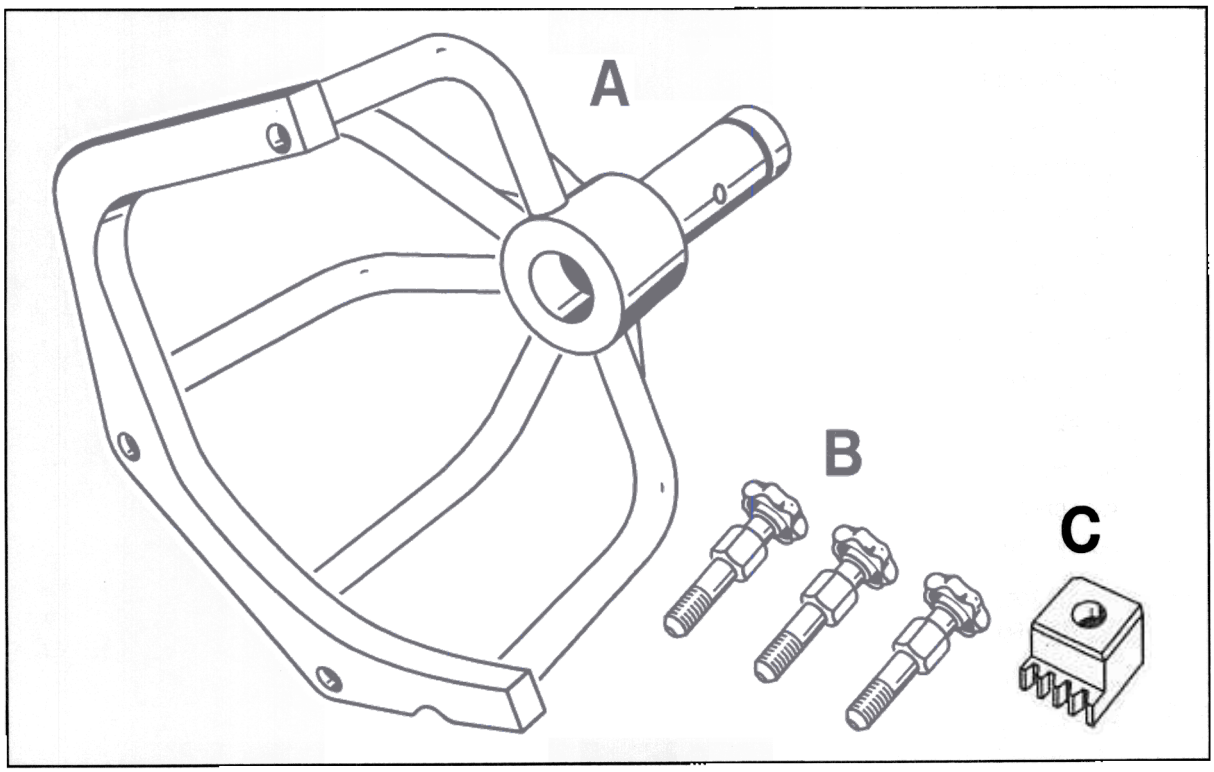
487-96g

Identification of the dimensional groups, cylinder/piston



97-340

Tools – overview, part 1



Item	Designation	Special tool	Explanation
A	Engine holder	9589	In conjunction with VW 313 and 3054
B	Parts for fastening engine to engine holder	9590	
C	Toothed segment	9538/1	Secure with hexagon-head bolt M 12 x 50 **Note** Do not use toothed segment to undo the belt pulley, use only the special tool "holder 9593".

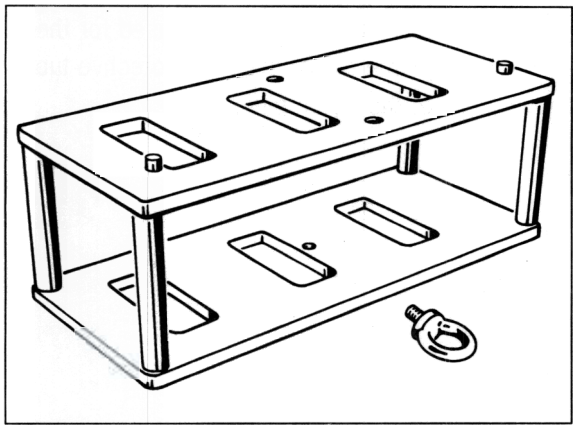
Tools – overview, part 2

Item	Designation	Special tool	Explanation
A	Mounting device for bearing housing	9607	
B	Insertion device for crankcase sealing ring (flywheel side)	9609	
C	Insertion device for crankcase sealing ring (pulley side)	9610	
D	Holder for pulley	9593	
E	Socket-wrench insert for screw connection of the pulley with engine installed	9594	
F	Holder for piston and connecting rod, for pre-assembly of piston pin, cyl. 1-3	9597	
G	Pressure piece for assembly of pistons in special position for piston pin assembly	9598	
H	Centering mandrel for aligning the connecting rod during piston pin assembly	9608	
	Assembly aid for pre-assembly of circlip in mounting device 9602	9603	

Item	Designation	Special tool	Explanation
J	Pressure piece (end pad)	9604	In combination with special tool 9602, special tool 9603 and special tool 9605, this can be used for the piston circlip and the protective tube of the spark plug.
K	Mounting device for piston pin and piston-pin circlip	9602	
L	Socket wrench	9110	
M	Coupling mandrel	VW 3176	

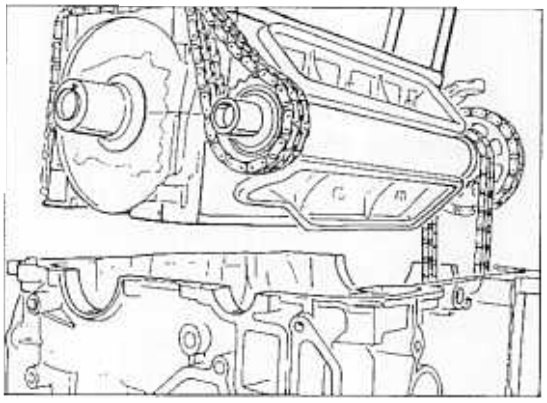
Locations for special tool (assembly fixture) 9607

Special tool 9607



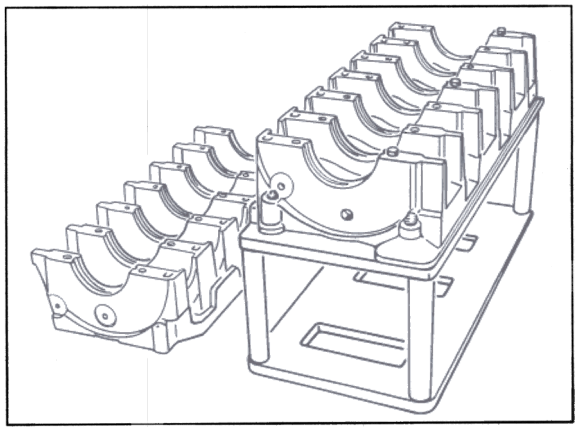
96-482

Disassembling and assembling bearing housing, crankshaft and connecting rods of cylinders 4 - 6.

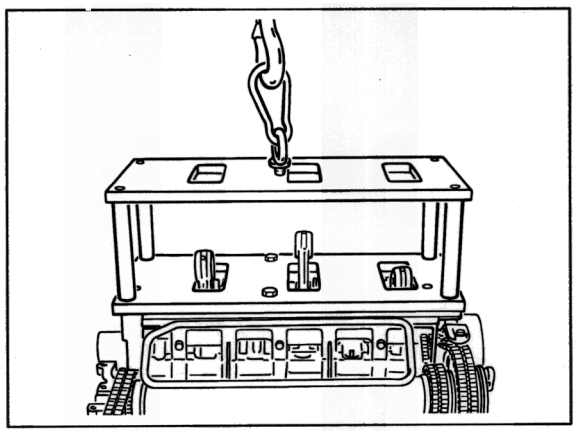


484_96

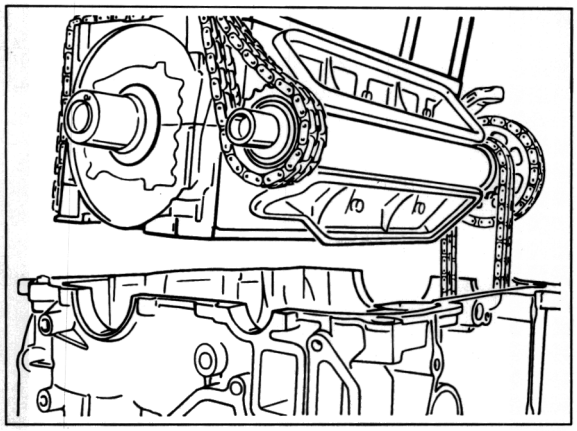
Removal or installation of the compete bearing housing in the crankcase half, cylinders 1 - 3. As the bearing housing is heavy, it should be removed and installed using a workshop crane.



96-483



97-345



97-382

Printed in Germany - 12, 1997 9861014a

Disassembling and assembling engine

The topic **"Disassembling and assembling engine"** includes the items listed below, which are each described in the respective Repair Groups.

Item 1 Disassembling and assembling intake distributor

Item 2 Removing and installing drive belt

Item 3 Removing and installing deflection rollers and tensioning roller for drive belt

Item 4 Removing and installing oil pump with coolant guide housing

Item 5 Removing and installing air/oil separator

Item 6 Removing and installing camshafts

Item 7 Disassembling and assembling cylinder head

Item 8 Disassembling and assembling crankcase halves

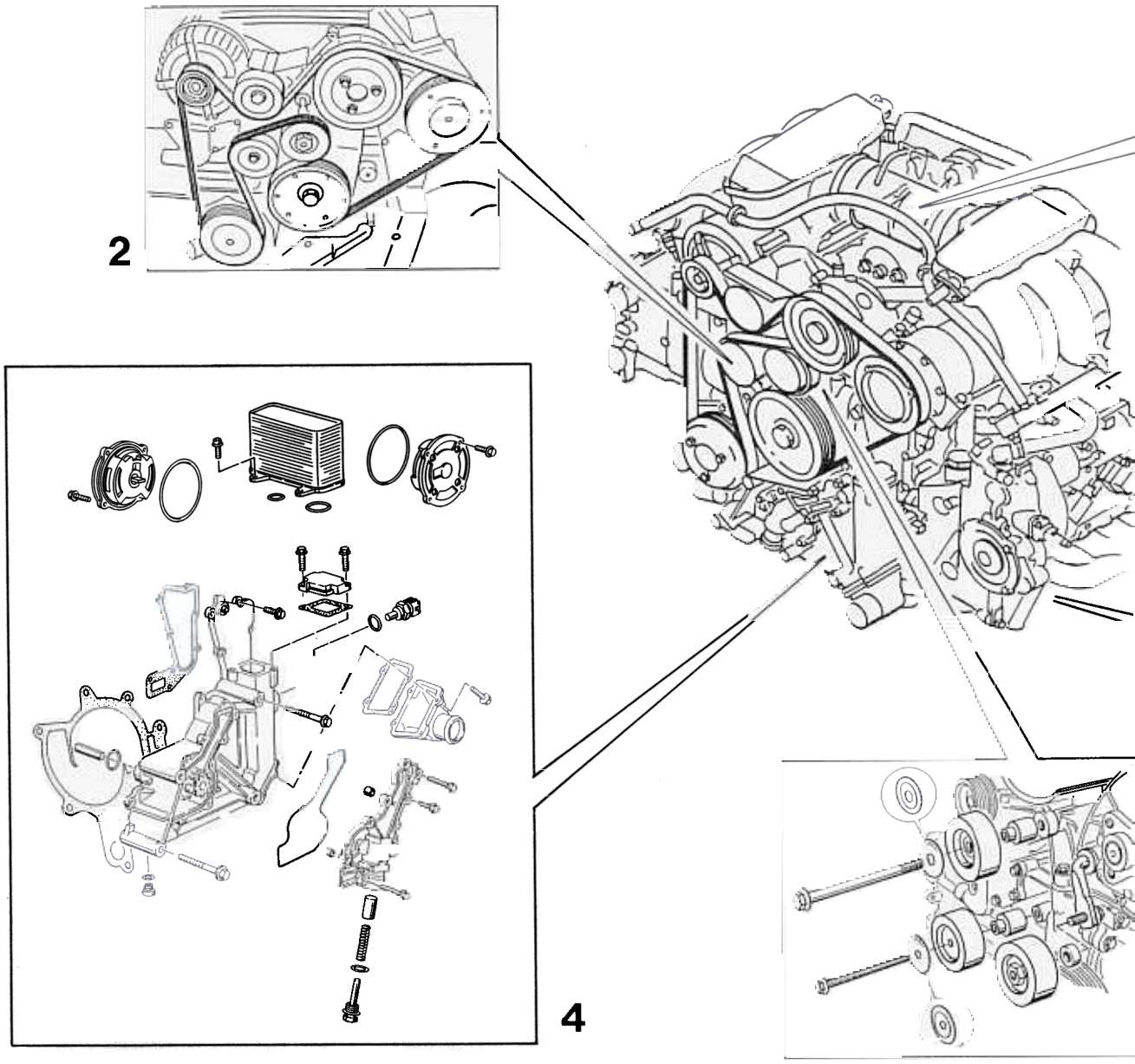
Item 9 Removing and installing pistons

Item 10 Disassembling and assembling bearing housing with intermediate shaft

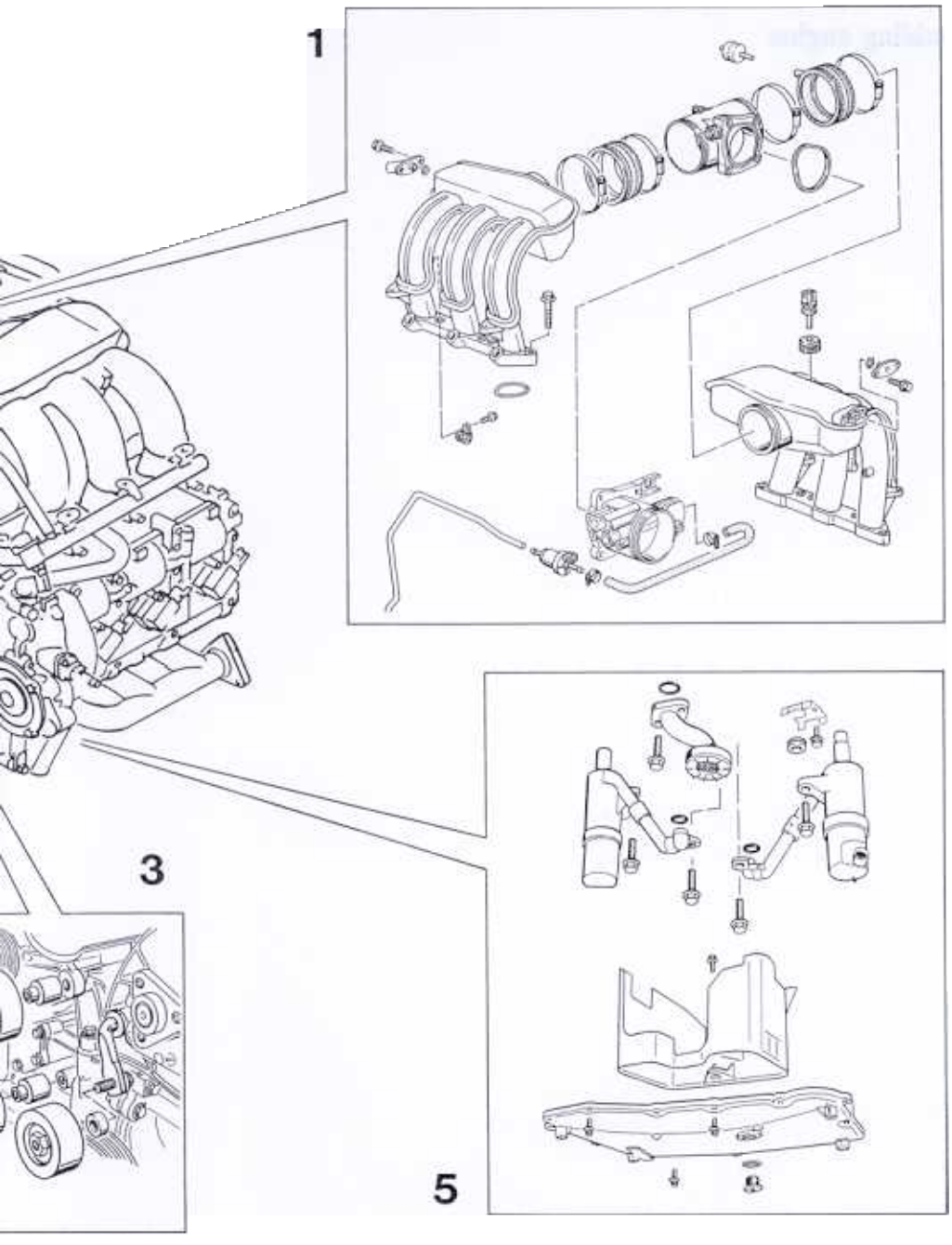
Item 11 Disassembling and assembling bearing housing with crankshaft

Printed in Germany – 6, 1996 9861015

Disassembling and assembling engine



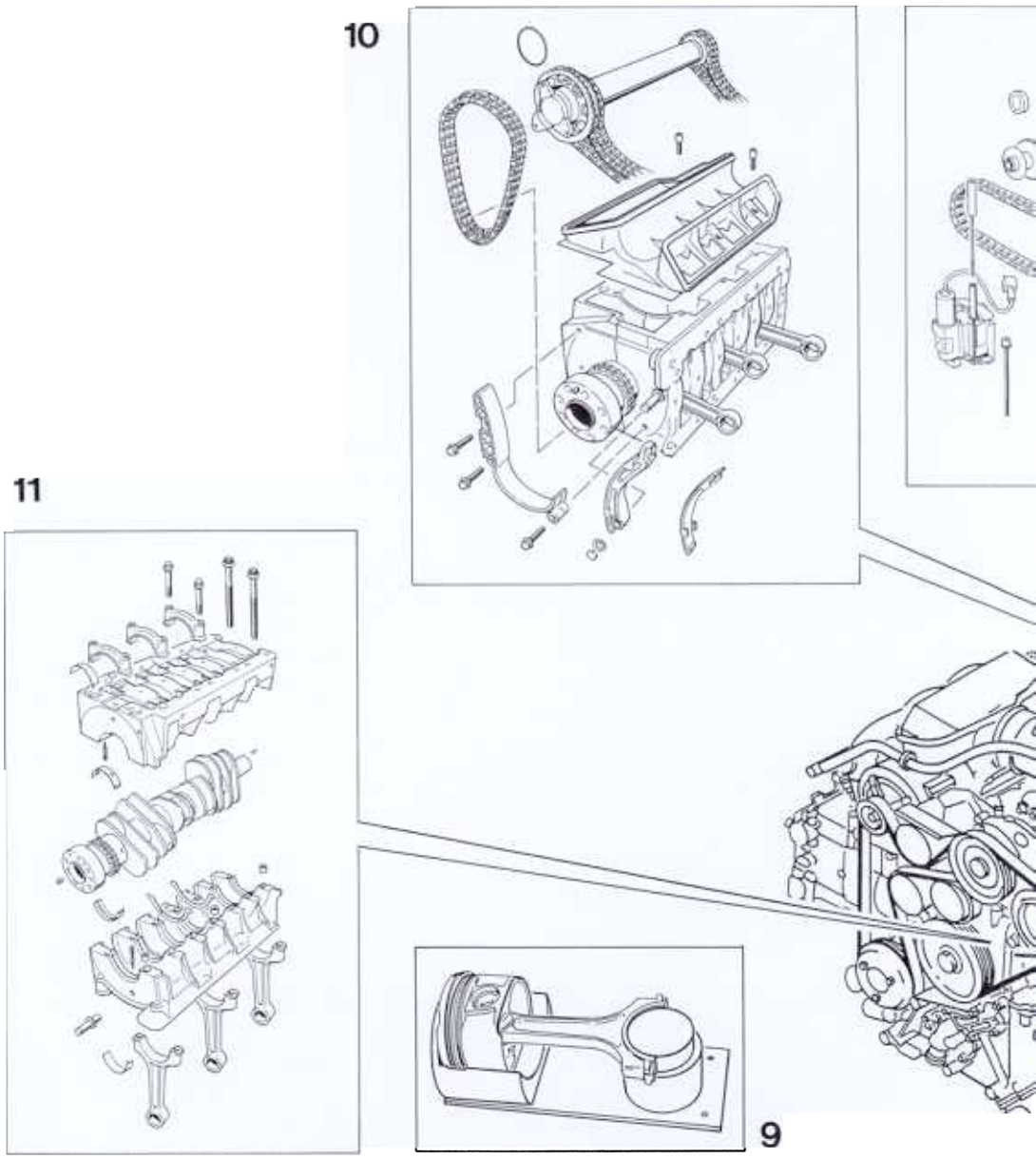
Item 1 Disassembling and assembling intake distributor
Item 2 Removing and installing drive belt
Item 3 Removing and installing deflection rollers and tensioning roller for drive belt
Item 4 Removing and installing oil pump with coolant guide housing
Item 5 Removing and installing air/oil separator



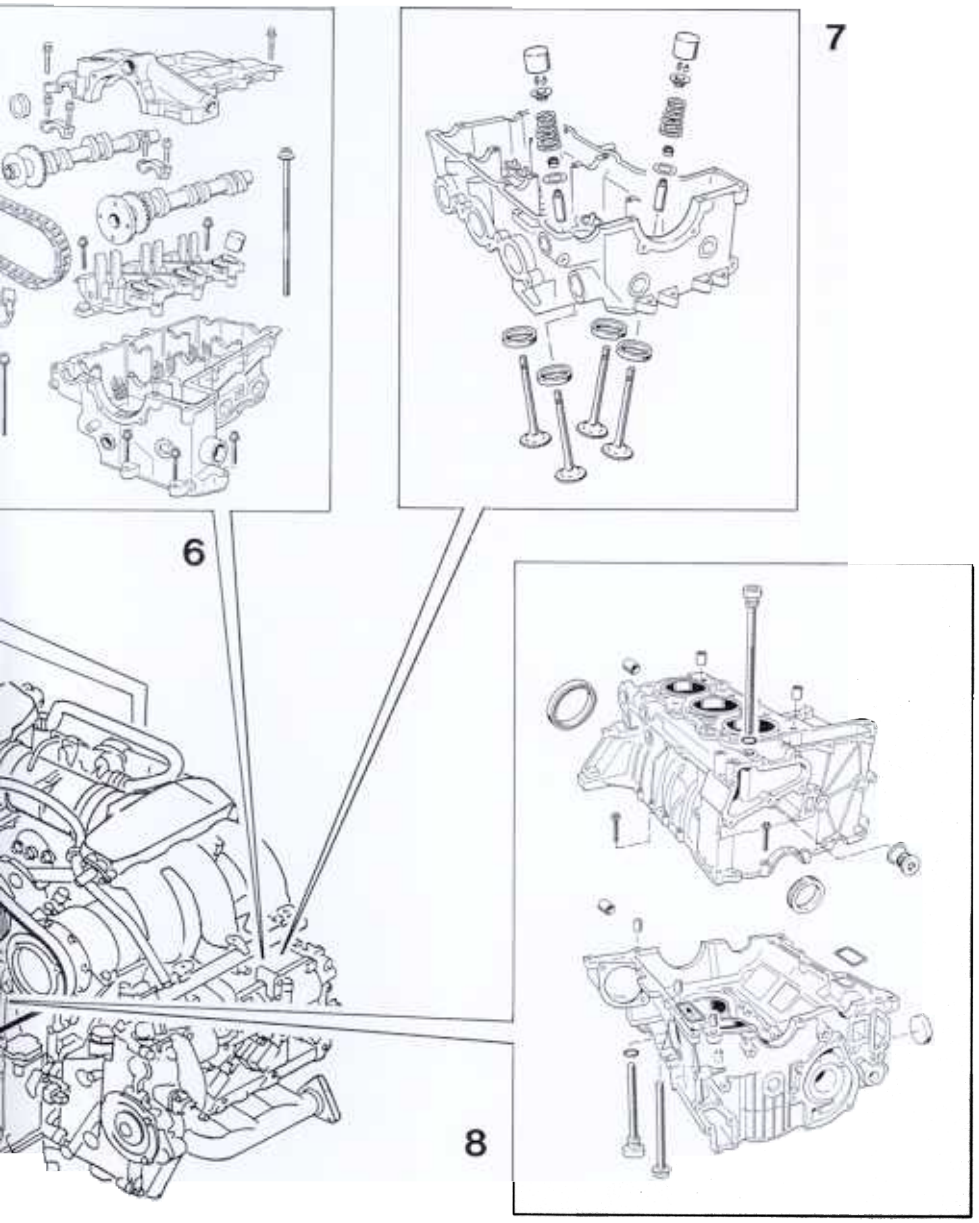
712 - 96

Printed in Germany – 6, 1996 9861015

Disassembling and assembling engine

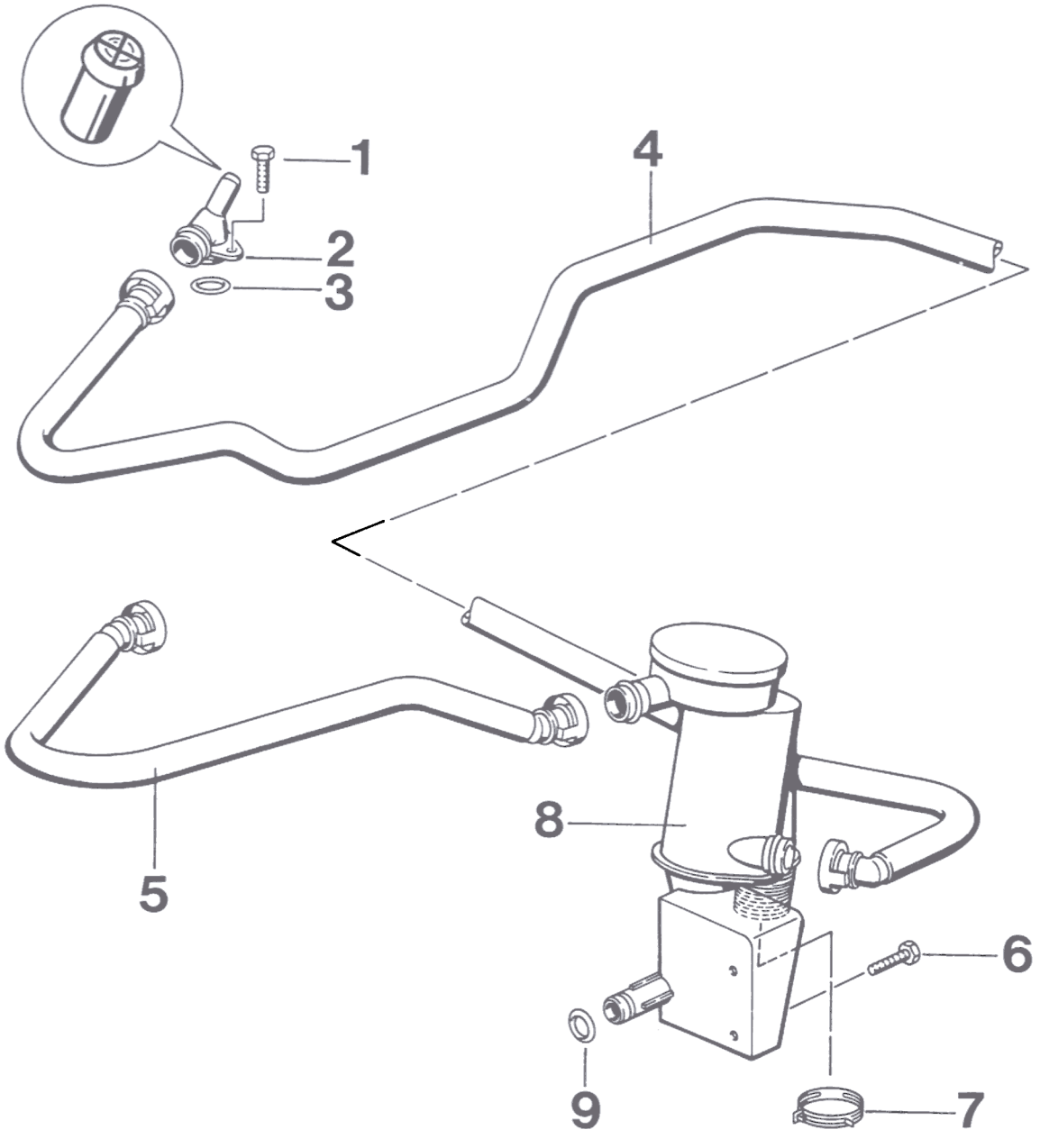


Item 6 Removing and installing camshafts
Item 7 Disassembling and assembling cylinder head
Item 8 Disassembling and assembling crankcase halves
Item 9 Removing and installing pistons
Item 10 Disassembling and assembling bearing housing with intermediate shaft
Item 11 Disassembling and assembling bearing housing with crankshaft



713 - 96

Disassembling and assembling positive crankcase ventilation

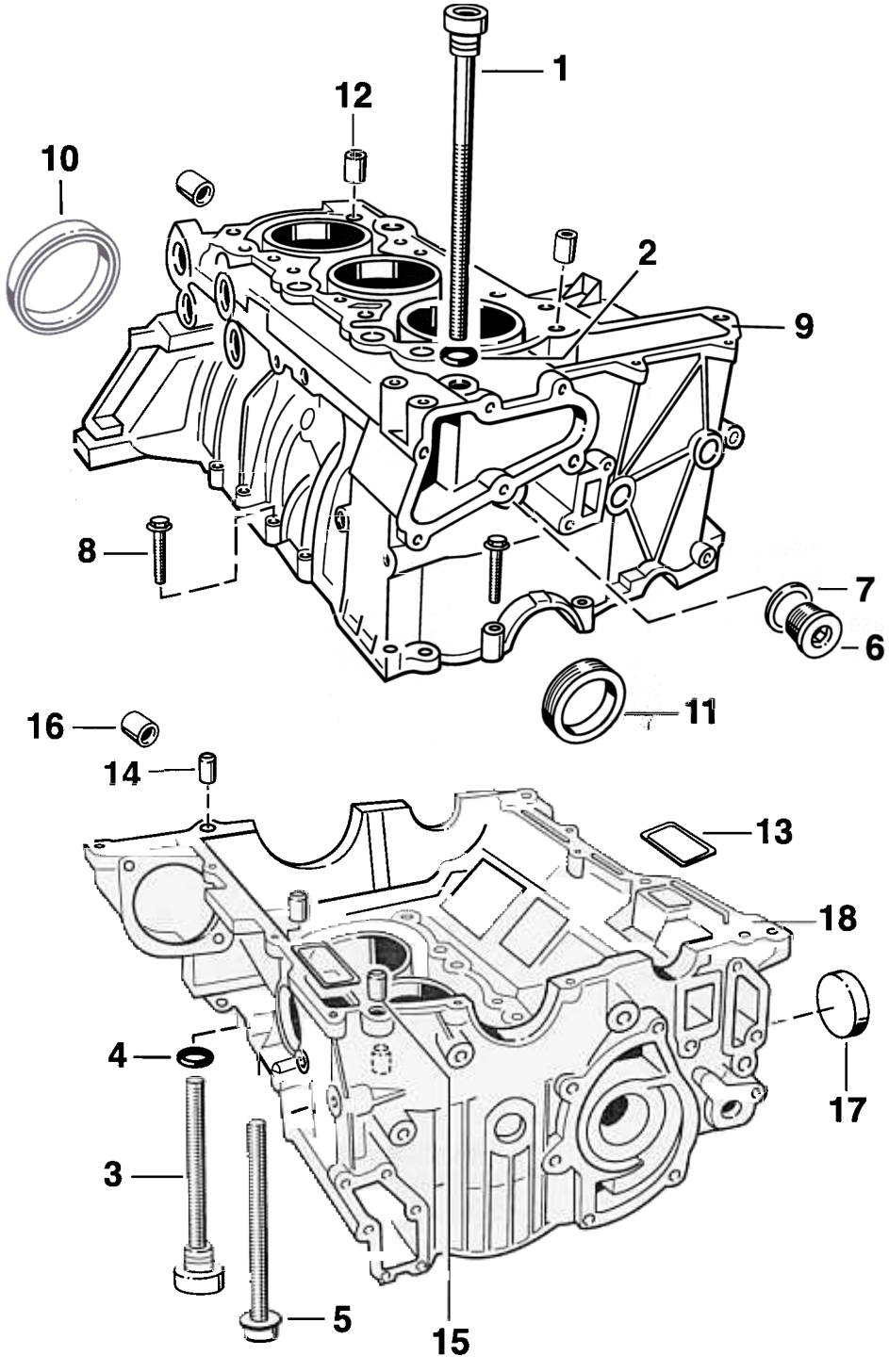


Disassembling and assembling positive crankcase ventilation

No.	Designation	Qty.	Removal	Note: Installation
1	Hexagon-head bolt M6 x 16	1		
2	Positive crankcase ventilation valve	1	The overpressure valve cannot be exchanged	Test; valve opening pressure: 180 ± 20 mbar
3	O-ring 18.77 x 1.78	1		Replace
4	Breather hose	1		
5	Breather hose	1		
6	Hexagon-head bolt M6 x 30	2		
7	Hose clamp 32 x 12	1		
8	Oil separator	1		
9	O-ring 13 x 2.5	1		Replace

Printed in Germany – 6, 1996 9861021

Disassembling and assembling crankcase halves, engine M96/20, M96/21, M96/22



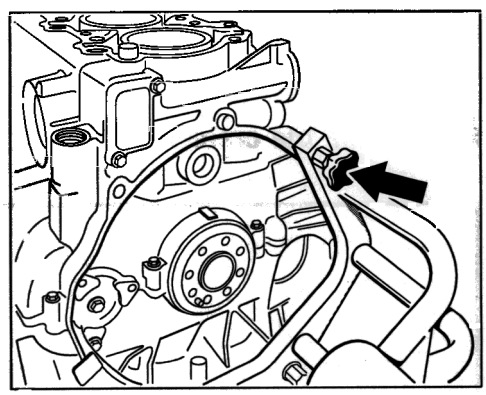
No.	Designation	Qty.	Removal	Note: Installation
	Fastening screw for bearing housing M9 x 150			Tighten only after the cylinder heads have been fastened
2	O-ring 12 x 2	1		Always replace
3	Fastening screw for bearing housing M9 x 94	1		Tighten only after the cylinder heads have been fastened
4	O-ring	1		Always replace
5	Fastening screw for bearing housing	1		Tighten only after the cylinder heads have been fastened Tightening torque 22 Nm (16 ftlb.)
6	Plug for assembly bore of piston pin M27 x 2	1		Tightening torque 80 Nm (59 ftlb.)
7	Sealing ring A27 x 2			Always replace
8	Hexagon-head bolt for screwing together crankcase halves M6 x 30	25		Tightening torque 13 Nm (9.5 ftlb.); for sequence, see Mounting instruction
9	Crankcase half, cylinder bank 4 - 6	1		Apply a silicone bead on the sealing surface; see Mounting instructions
10	Sealing ring			Replace; fit with insertion tool, special tool 9609
11	Sealing ring	1		Replace; fit with assembly sleeve, special tool 9610
12	Dowel sleeve M6 x 18.5	4		
13	Gasket	2		Replace
14	Cylindrical pin 12 x 22	3		
15	Dowel sleeve	2		
16	Dowel sleeve	1		
17	Closure cap	1		
18	Crankcase half, cylinder bank 1 - 3	1	For disassembly, fasten to engine holder, special tool 9589	For assembly, fasten to engine holder, special tool 9589

Mounting instructions

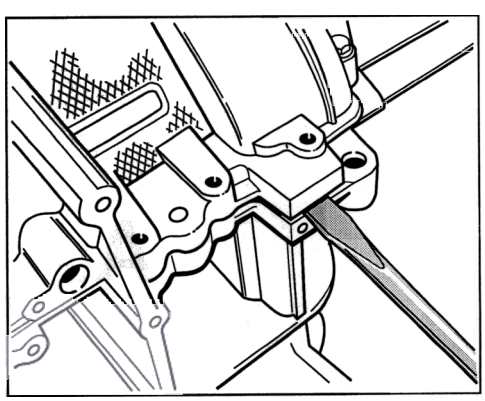
Note!

The black sealant "Loctite 5900" or "Drei Bond Type 1209" are used for sealing the crankcase halves. The separation of the crankcase halves is made rather more difficult if Loctite 5900 is used.

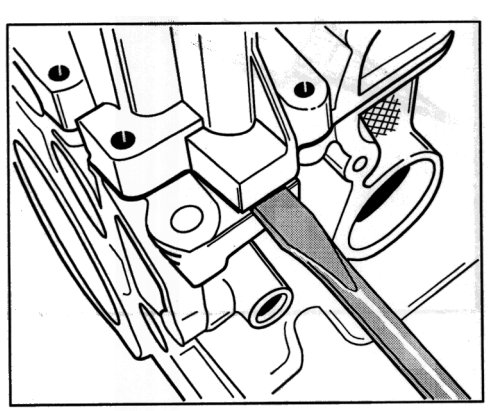
1. Undo ring-edge bolt. Unscrew the 25 hexagon-head bolts for this purpose.
2. Undo the third fastening point **-(arrow)-** on the crankcase half cylinder bank 4 - 6 from the engine holder.
3. Use a slotted screwdriver with a tip which is 14 mm wide and 250 mm long to separate the crankcase halves.



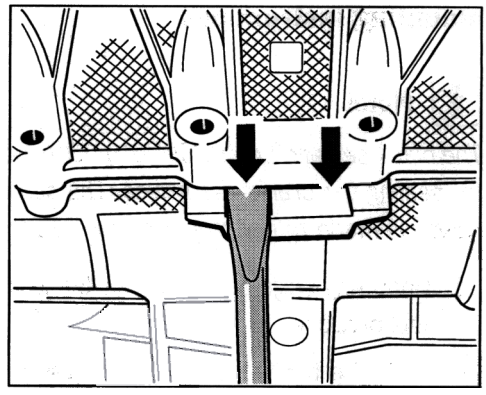
4. Insert the screwdriver in the lugs of the crankcase halves and separate the crankcase halves by tapping gently. Alternate the sides during separation.



Separate the crankcase half



Lug point on the crankcase

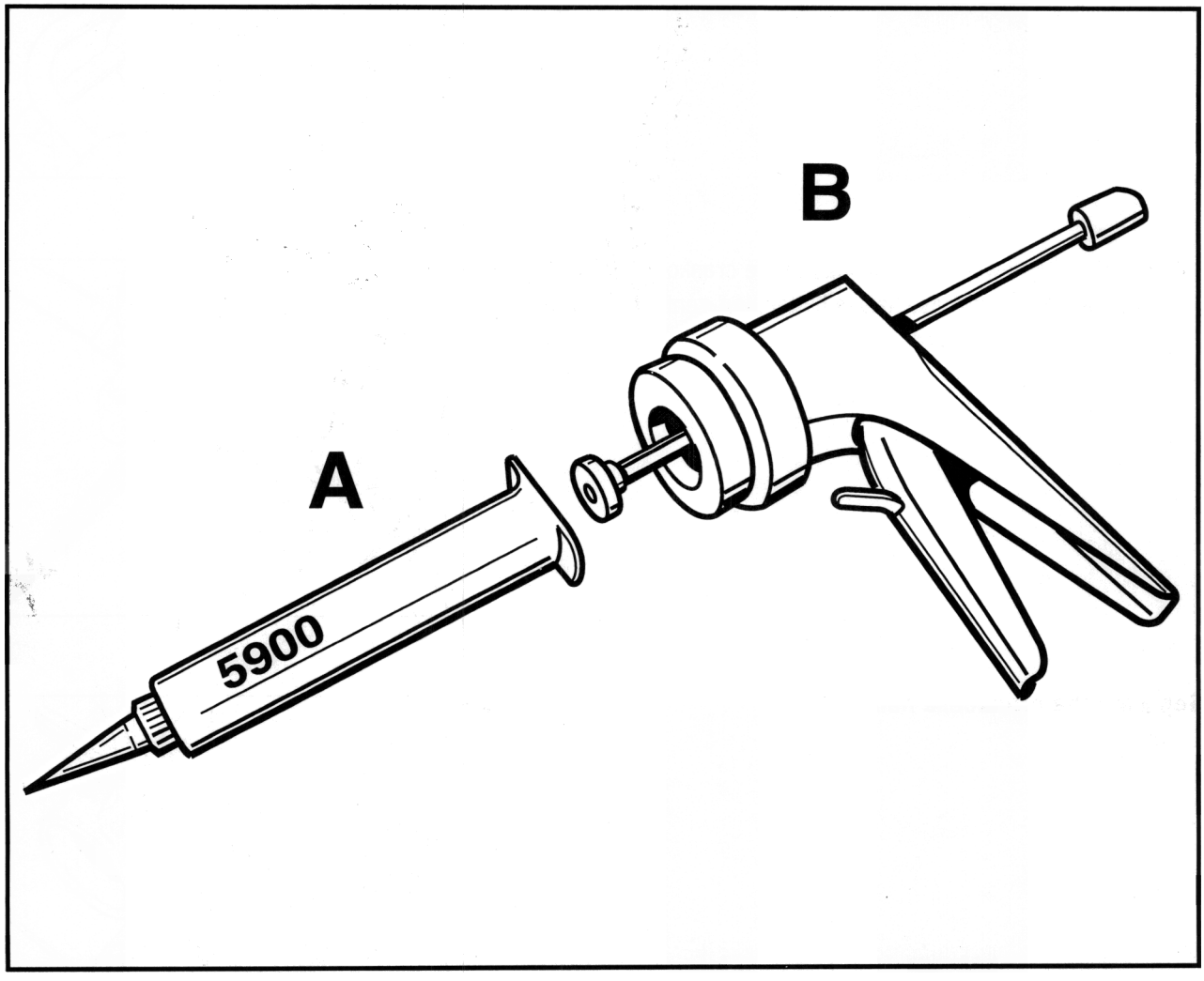


Note!

Clean the crankcase halves using a nylon brush.

5. Clean the crankcase halves and then remove any residual sealant with a nylon brush.

Assembling the crankcase halves

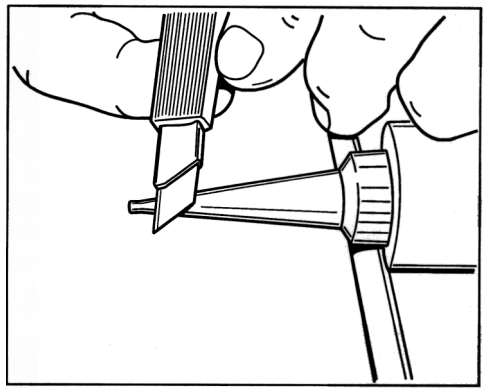


Item	Designation	Special tool	Explanation
	Surface seal Loctite 5900 or Drei Bond Type 1209		
B	Metering pistol	Refer to Workshop Equipment Manual, Chapter 2.4, No.: 75	Recommended for processing the surface seal Loctite 5900

Note!

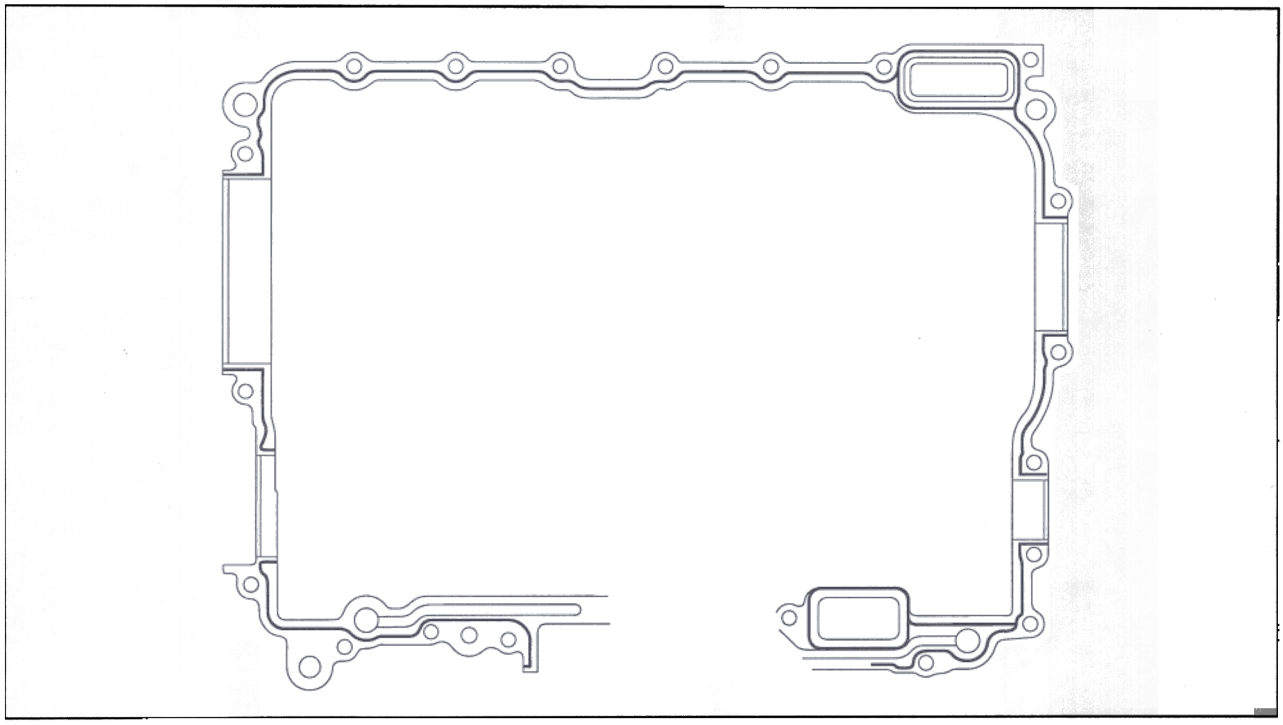
- *Only "Drei Bond Silicon Type 1209 " and "Loctite 5900" should be used for surface sealing.*
- *After application of surface seals (silicone bead), screw together within five minutes.*
- *Observe the expiry date of the surface seal.*

1. At the processing nozzle, cut off the first metering step at an angle.



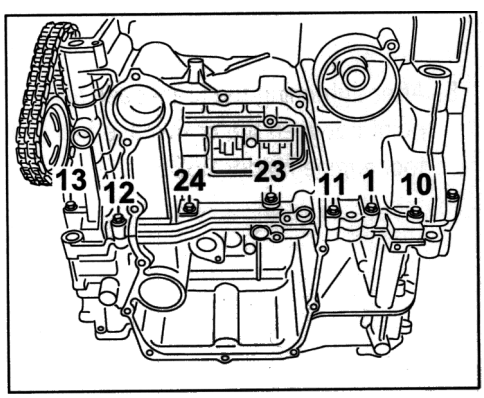
Note!

- *Do not process the sealant too generously.*
- *No sealant should be pressed into the crankcase when screwing.*

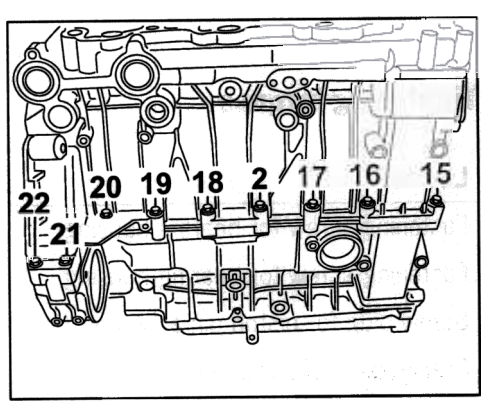


2. Apply a uniform bead of silicone approximately 1.5 mm wide to the cleaned sealing surface of the crankcase half of cylinder bank 4 to 6. The silicone bead should be applied as shown in the following illustration.
3. Position the crankcase halves carefully and evenly. The sealant bead must not be damaged during this procedure.
4. Screw the crankcase into place. Mount the crankcase with new screws. The tightening torque is 13 Nm (9.5 ftlb.). Observe the tightening sequence.

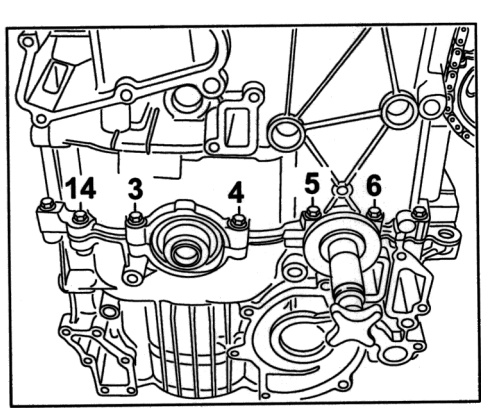
View from the oil pan side



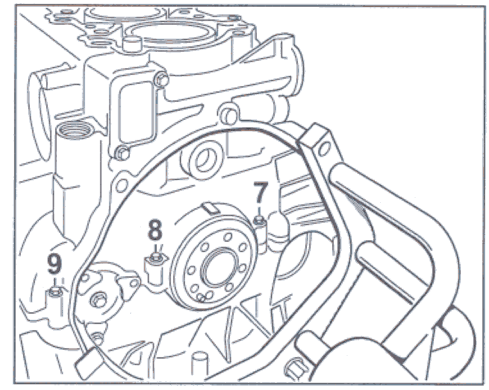
View from the starter side



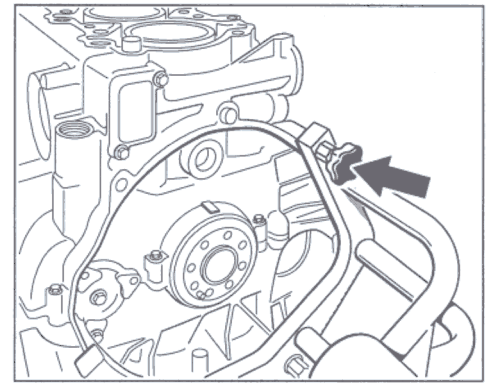
View from the belt pulley side



View from the flywheel side



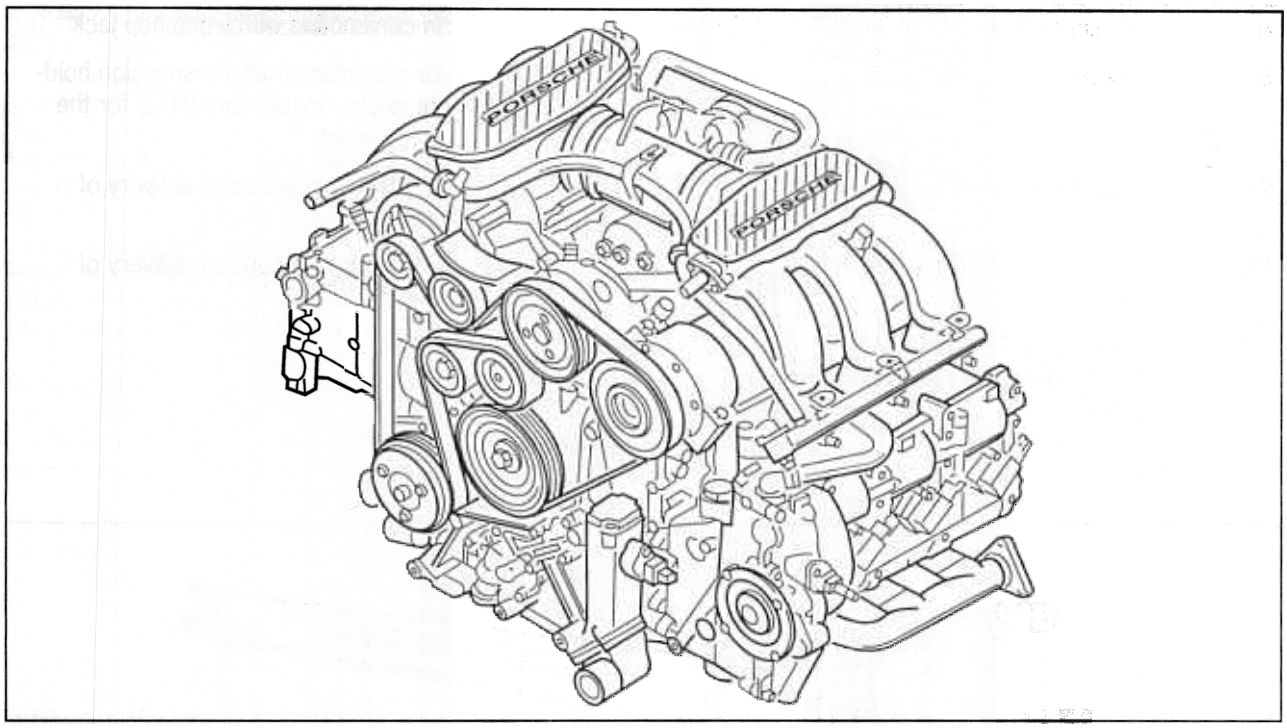
5. After tightening the crankcase halves, fasten the third fastening point between the crankcase half (cylinders 4 - 6) and special tool engine holder 9589.



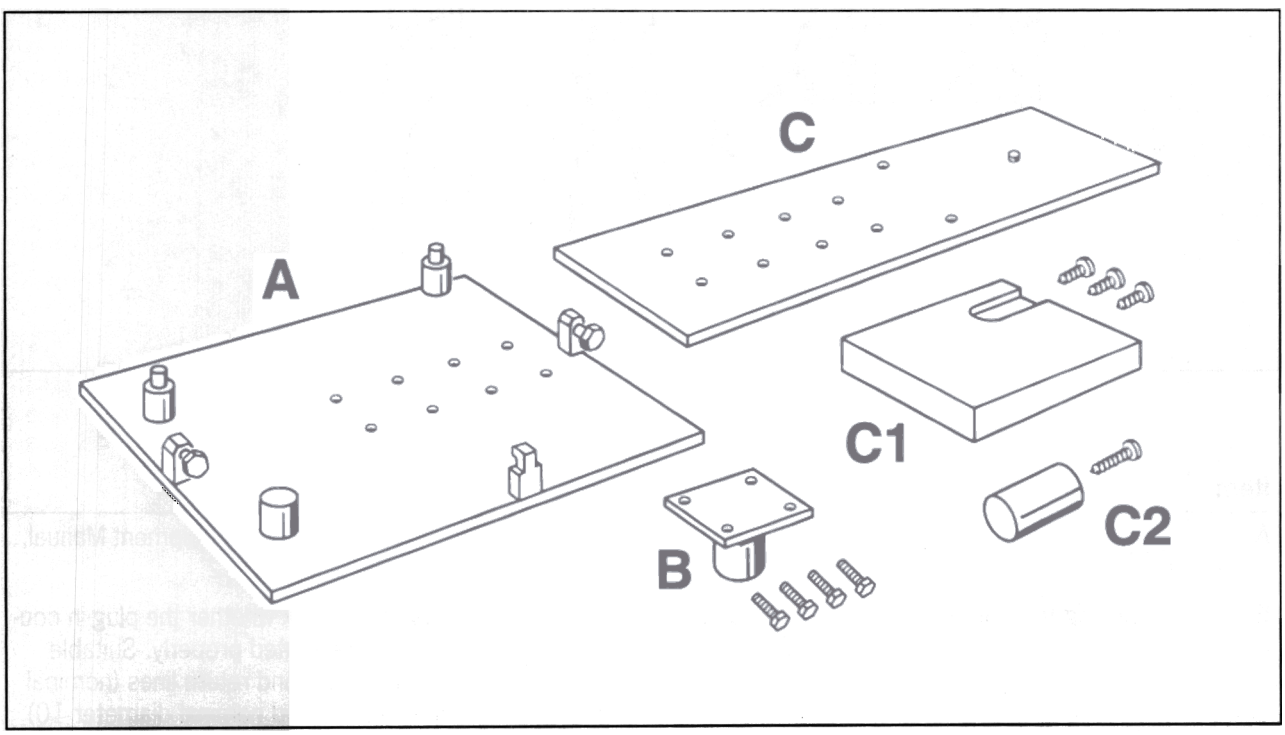
Tightening torques

Location	Thread	Tightening torque Nm (ftlb.)
Fastening screw for bearing housing		22 (16)
Fastening screw for bearing housing		22 (16)
Screw plug for piston pin assembly bore		80 (59)
Crankcase half threaded part		13 (9.5)

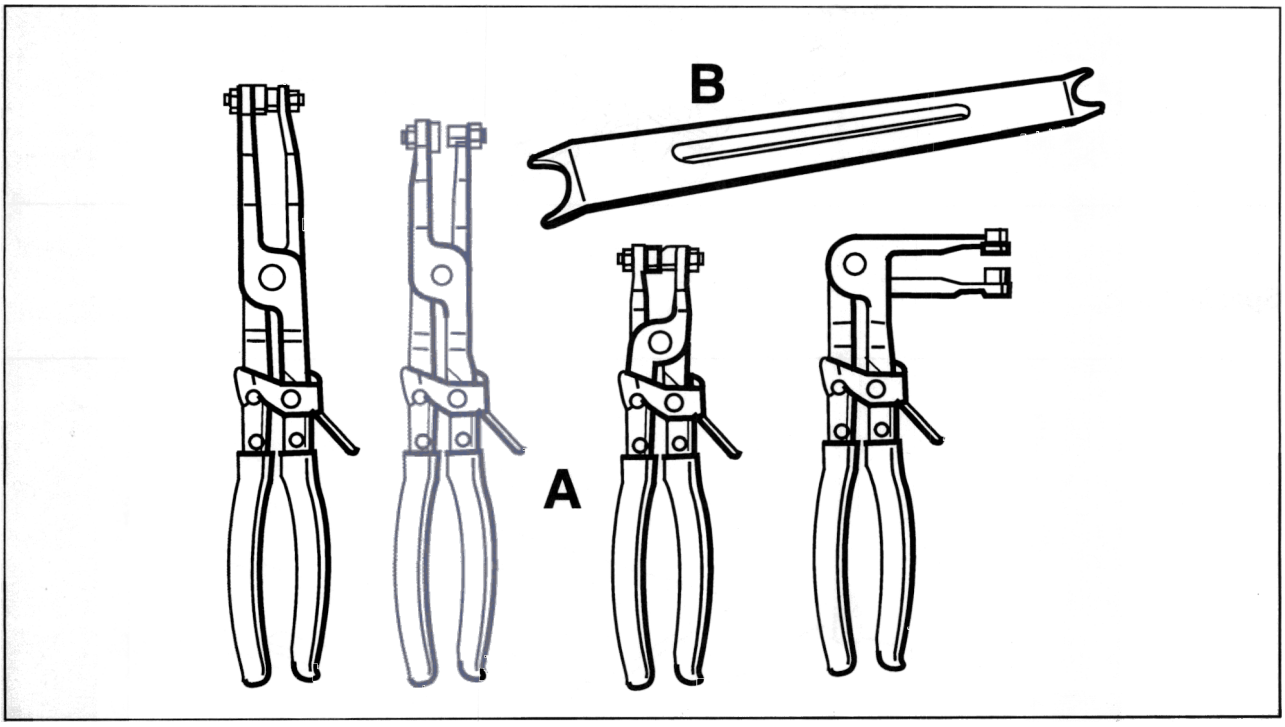
Removing engine, M96/20 (2.5 l) with Tiptronic transmission



Special tools



Item	Designation	Special tool	Explanation
	Retainer plate		In conjunction with workshop jack
	Adapter		Or use adapter of transmission holding plate, special tool 9163 for the 928 model
C	Support plate	9592/2	Contained in scope of delivery of 9592/1
C1	Support for Tiptronic transmission		Contained in scope of delivery of 9592/1
C2	Support for Boxster and 911 Carrera (996) manual transmissions		9592/1



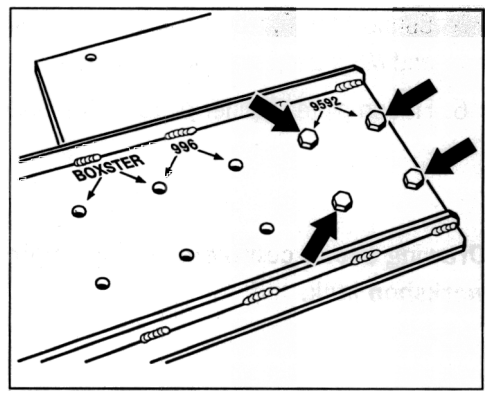
Item	Designation	Special tool	Explanation
	Spring-band clamp pliers		Refer to Workshop Equipment Manual, Chapter 2.4, No.: 72
B	Testing tool for plug-in couplings	9623	Used to check whether the plug-in couplings are seated properly. Suitable for pressure and return lines (nominal diameter 6 and nominal diameter 10)

Adjusting tool

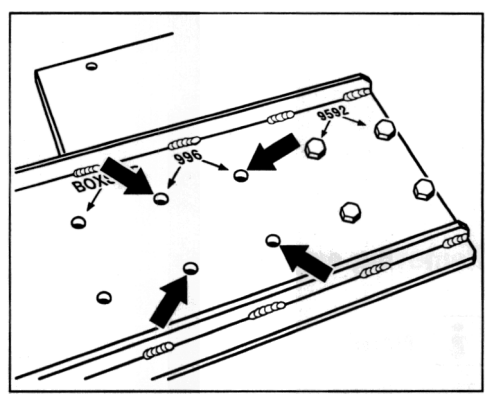
Note!

If the special tool 9592 is being used for the first time, (four) additional threaded holes must be applied.

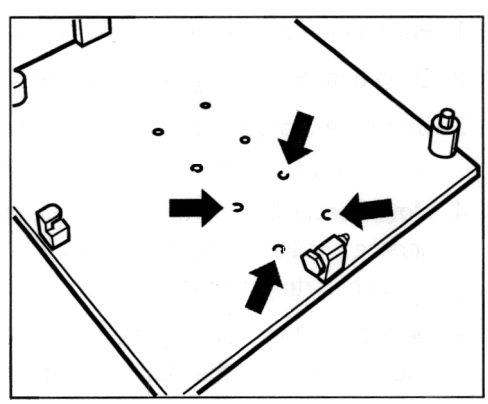
1. Lay the support plate 9592/1 on the rear of the retainer plate 9592 and fasten with four hexagon-head bolts M8 x 25.



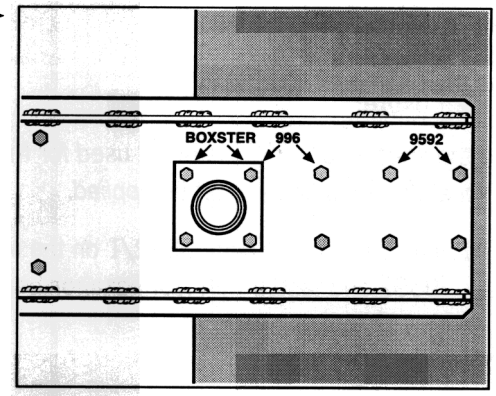
2. Countersink the retainer plate at the designated bores **-arrows-** with a 9 mm drill bit. The support plate serves as the drilling template.



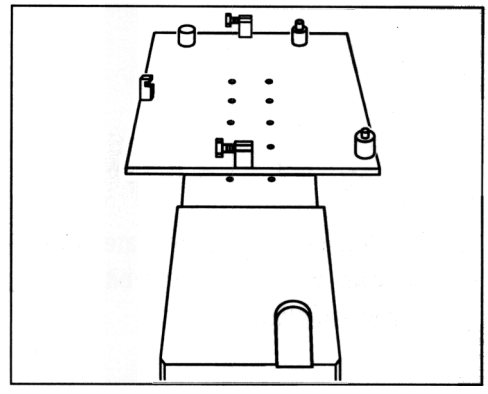
3. Drill through the countersunk bores on the retainer plate with a drill bit sized 6.8 mm and then cut an M8 thread.



4. Fasten the special tool adapter 9163/2 with a hexagon-head bolt M8 x 25 (bolt quality 10.9) and hexagon-head bolts M8 x 16 (bolt quality 10.9) at the designated position "Boxster". The adapter and the support plate are fastened on the retainer plate with the M8 x 25 hexagon-head bolts. The M8 x 16 hexagon head bolts connect the adapter with the support plate.
5. Support for Tiptronic transmission with three M6 x 20 (2 ea.) and M8 x 25 (1 ea.) wood screws.
6. Fit complete retainer plate on the workshop jack.



Drawing shows complete engine retainer plate fitted on the workshop jack.



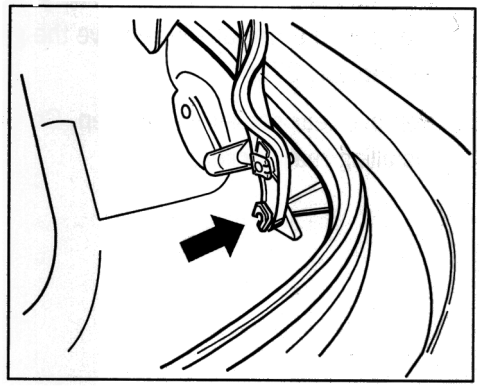
Removing engine

Note!

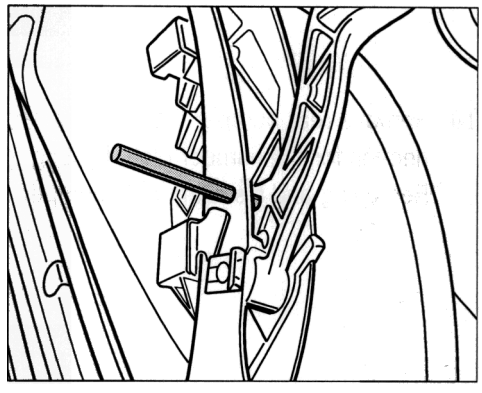
The engine is removed downwards complete with the manual transmission.

1. Position the vehicle at the specified points on a lifting platform.
2. Open both the luggage compartment lids.
3. Cover the vehicle. Cover the vehicle with protective covers in such a way that the body can not be damaged.
4. Move convertible top or convertible-top compartment lid to service position. Open the convertible top until the convertible-top compartment lid is half open.
5. Detaching cloth covering. Disengage the rear strip on the left and right sides of the cloth covering in downward direction.
6. Detach tension cables. Press the ball socket of the tension cable out of the ball head of the adjusting piece on the left and right.

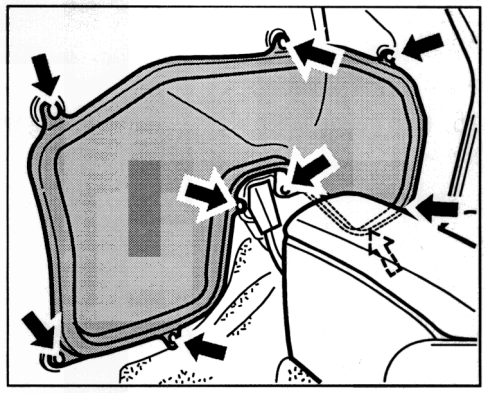
7. Move convertible top to service position. To do so, press the tension bow of the convertible top towards the main bow, until it reaches its locking point.
8. Move the convertible-top compartment lid to service position and secure. Disengage the convertible-top compartment links at the extreme bottom. To do so, disengage the clips at the left and right and pull the links off the bolt.



9. Press the converible-top compartment links forwards until the two bores coincide and a 5 mm mandrel can be pushed through them.
10. Remove left-hand seat. For better accessibility, remove the left-hand seat of the car. Unscrew the four Torx screws, disconnect all the electrical plug connections and remove the seat.



11. Open the rear wall cover. To do so, remove the oddments tray behind the seats and remove the rear wall lining. Then undo the 6 fastening screws and the 2 fastening nuts. (See **-arrows-**).



Caution!

Danger of short circuit!

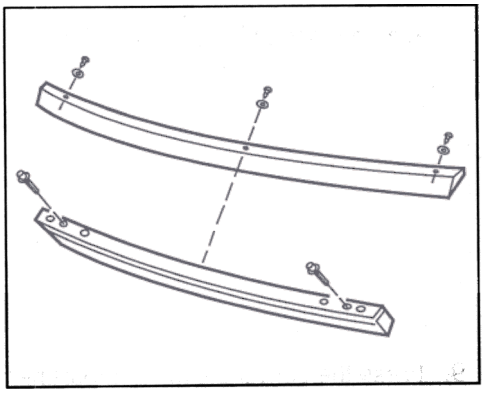
First remove the ground terminal.

Cover the terminals.

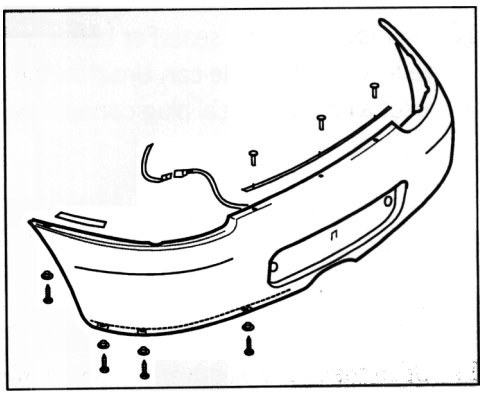
Never connect (short circuit) the terminals.

12. Disconnect battery. Before disconnecting, find out the relevant theft codes (e.g. radio) if necessary. At the battery, disconnect the ground terminal and remove the ground cable ⇒ Rep. Gr. 2706.

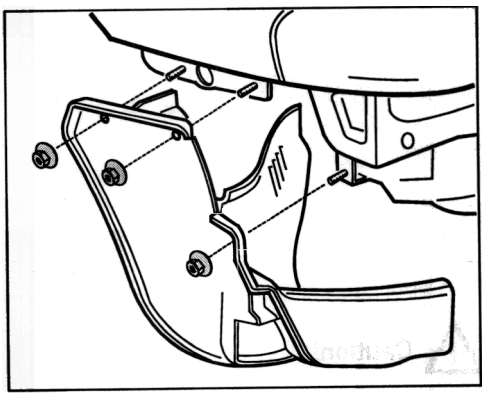
13. Remove rear spoiler ⇒ 66; Rep. Gr. 66 58 19; Removing and installing rear spoiler. ►



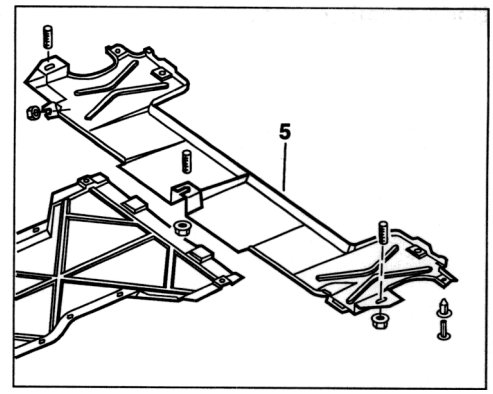
14. Remove rear bumper. While doing so, pay attention to the connection for the number plate lighting ⇒ 63; Rep. Gr. 63 58 19; Removing and installing rear bumper. ►



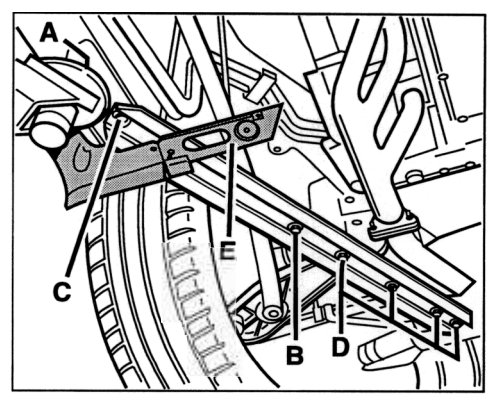
15. Remove left and right wheel housing trims. ►



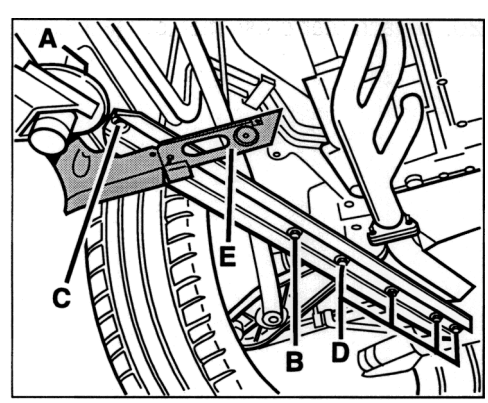
16. Remove the rear part of the underbody cover.



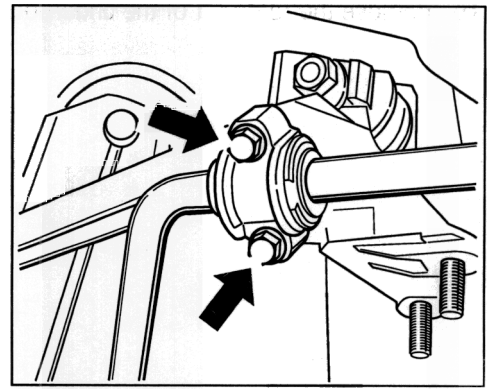
17. Lift the vehicle. Before lifting, check that all fastening points of the diagonal braces are easily accessible. Pay particular attention to the threaded part **-C-**.

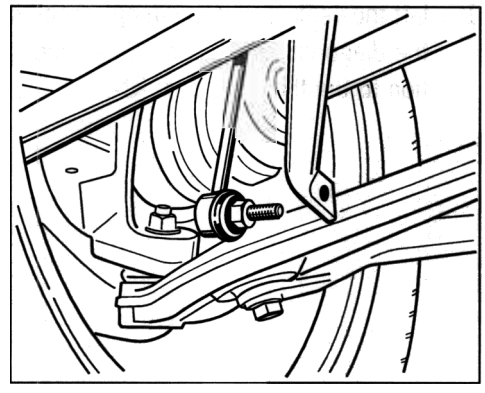


18. Undo the fastening screw **-C-** and the collar nuts **-D-** and remove the diagonal braces **-B-** together with the holder **-E-**.
19. Remove stabilizer. To do so, unscrew the two fastening screws on the left and right of the two bearing surfaces and unscrew the stabilizer on the left and right from the links.

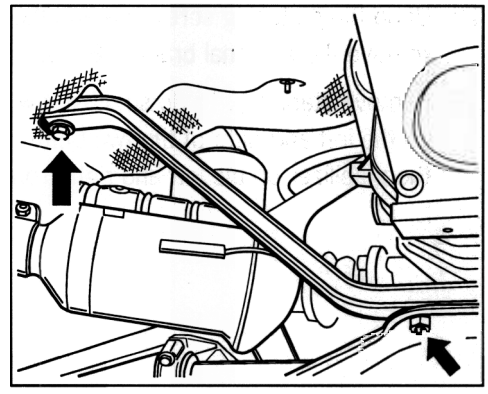


Undo stabilizer mount

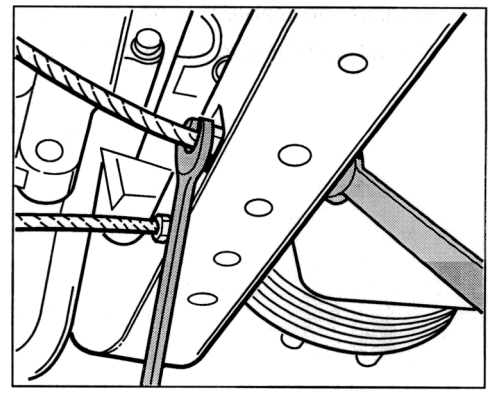




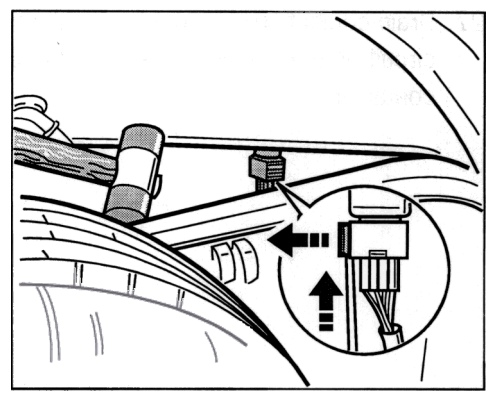
20. Detach rear cross member (aluminium V-member) on the body.



21. Undo the cable. Undo the engine cable on the rear-axle support. The cable must be countered with a suitable wrench and must not be twisted.
22. Undo halfshafts. To do so, undo the fastening screws of the halfshafts on the transmission. Fit protection on to the halfshafts.



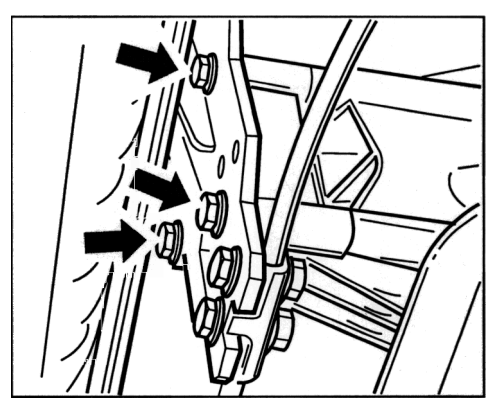
23. Unclip and detach the oxygen sensor plug connection from the holders of the rear-axle support. On an OBD II vehicle, additionally disconnect the oxygen sensor plug connection in the rear wing area. Press the heat shield aside and disconnect the plugs.
24. Remove rear mufflers. To do so, secure the rear mufflers with a transmission jack. Then undo the flange connection between the catalytic converters and the exhaust manifold. Undo the three hexagon-head bolts on the exhaust bracket.



Note!

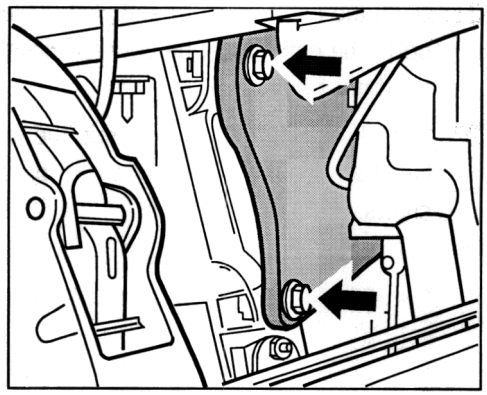
- *When lowering, do not damage the oxygen sensors, cables and plugs.*
- *Attach protective sleeves around the oxygen sensor plugs.*

View of the support

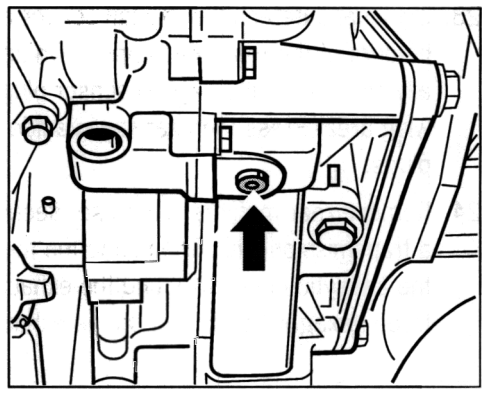


25. Remove the front lining in the rear luggage compartment. Lever off plastic clips using a commercially available removal tool (refer to Technical Equipment Manual, Chapter 2.4, No. 21).

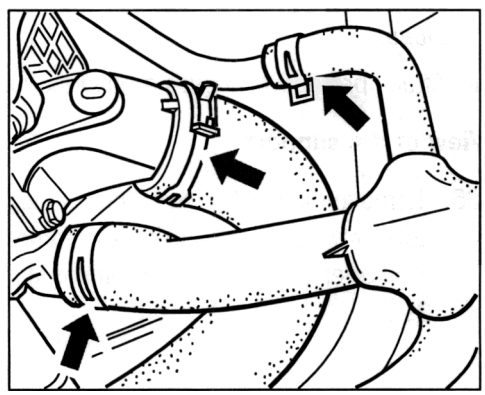
26. Remove the rear-axle support. Unscrew the four fastening screws and remove the rear-axle support to one side.



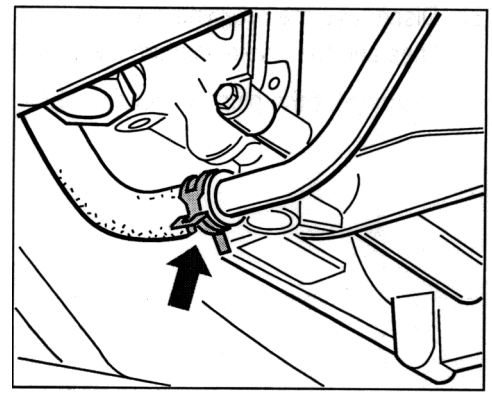
27. Drain coolant. To do so, remove the screw plug of the coolant circuit on the coolant guide housing. Collect coolant in a clean container.



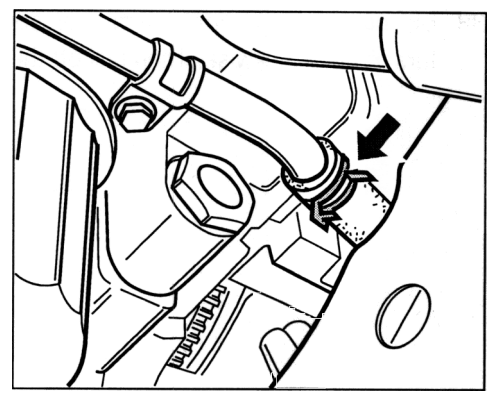
28. Disconnect coolant hoses. Open the supply and return lines for coolant on the engine and pull them off. Then close all openings. Collect emerging coolant in a clean container.



Open spring band clamp



Pull off the hose

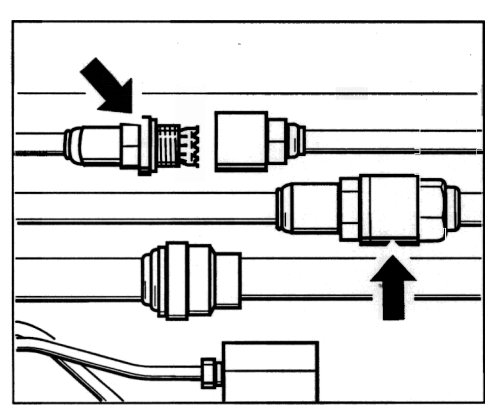


Caution!

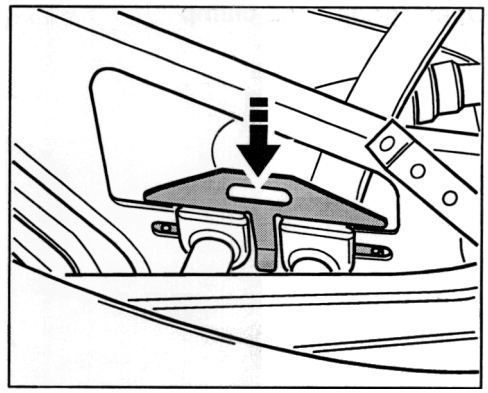
Danger of fire!

- ***Collect emerging fuel.***
- ***Avoid ignition sources and naked flames.***

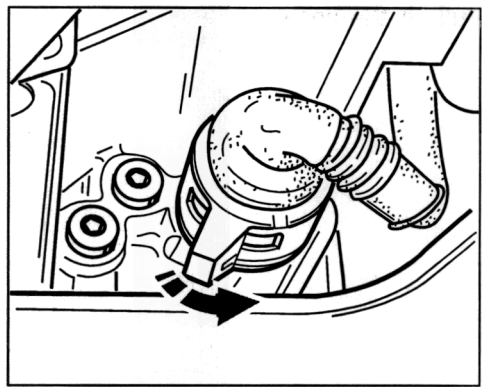
29. Detach the fuel return line. Disconnect the fuel return line under the vehicle floor by pressing gently on the button and pull apart. Collect emerging fuel. Close off the open ends of the line immediately. Then open the holder on the body and remove the line.
30. Disconnect the steering lines. Remove the small undersealing on the left vehicle side (six plastic nuts). Disconnect the two hydraulic lines of the power steering on the vehicle floor. To do so, undo the threaded part and disconnect. Any emerging Pentosin must be collected.



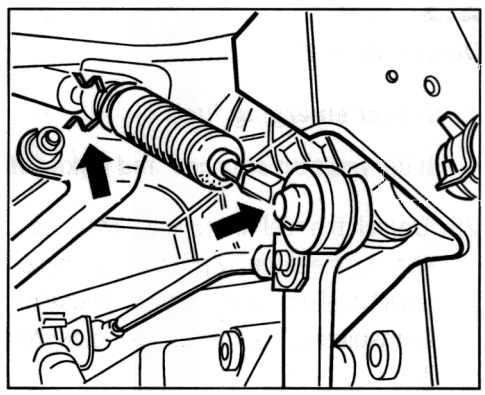
31. Disengage the retaining clips for the power-assisted steering lines and the brake vacuum hose and remove the lines.
32. Disconnect the plug connection of the multi-function switch.



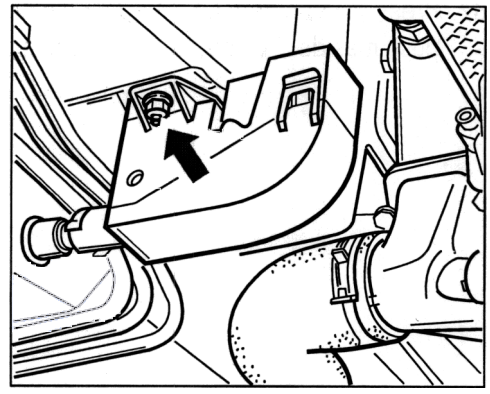
33. Disconnect plug from transmission socket. The plug must be turned anti-clockwise. Then pull off the plug.



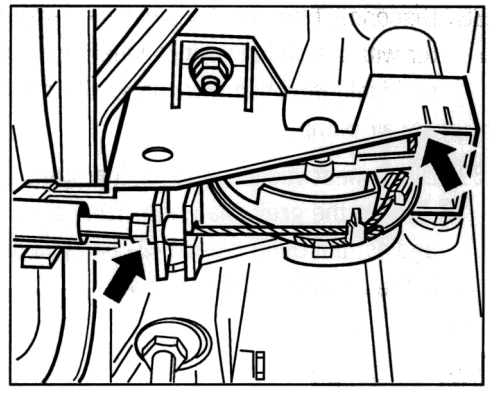
34. Detach selector lever cable at deflection linkage and at the transmission support.



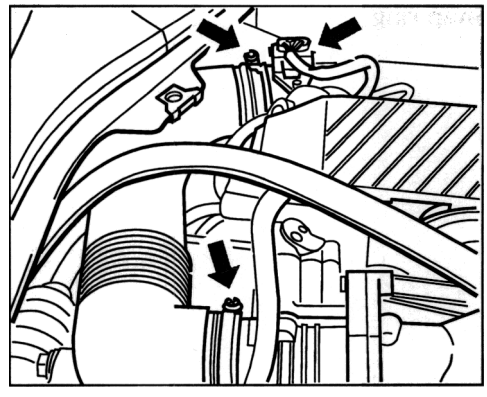
35. Disengage the accelerator cable. Remove the cover on the deflector box and disengage the accelerator cable.



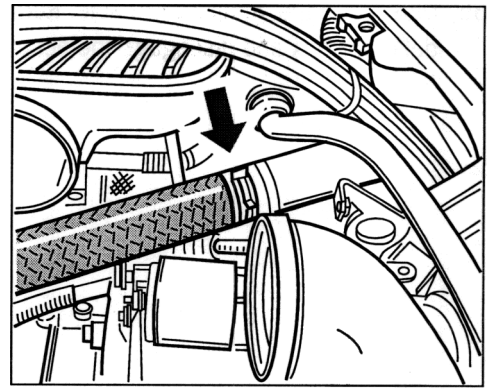
Disengage the accelerator cable



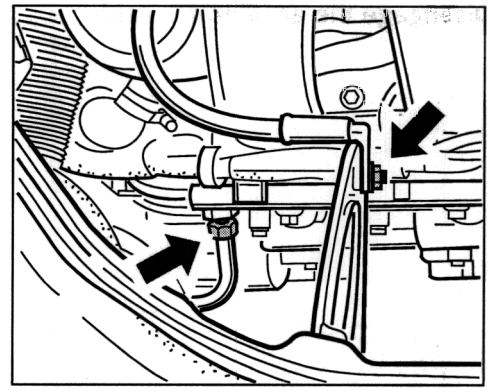
36. Disconnect the electric plug on the hot film mass air flow sensor. Then disconnect the connecting hose between the hot film mass air flow sensor and the throttle body. To do so, disconnect the hose clamp on the hot film mass air flow sensor.



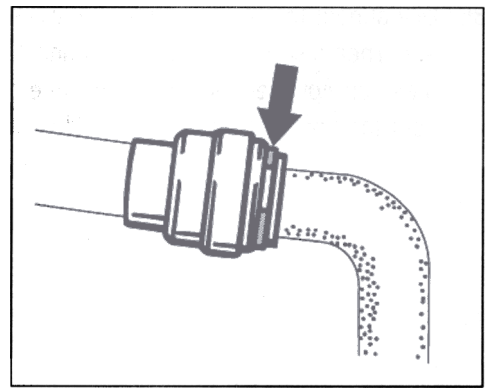
37. Press the spring band clamp on the oil filler hose apart and push it aside. Pull off the oil filler hose; heat, if necessary.



38. Disconnect the fuel supply hose. Make sure without fail to counter with a suitable wrench when doing this. Collect emerging residual fuel. Then disconnect the ground cable of the secondary air pump.
39. Disconnect vacuum line for the brake booster. To do so, remove the grey snap ring. Then push the inner sleeve **-1-** against the outer sleeve **-2-** and pull off both sleeves together in the direction of the arrow.

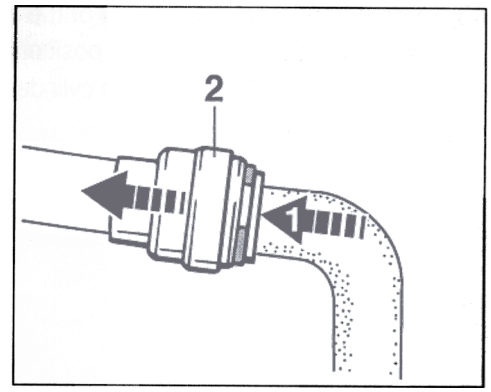


Snap ring

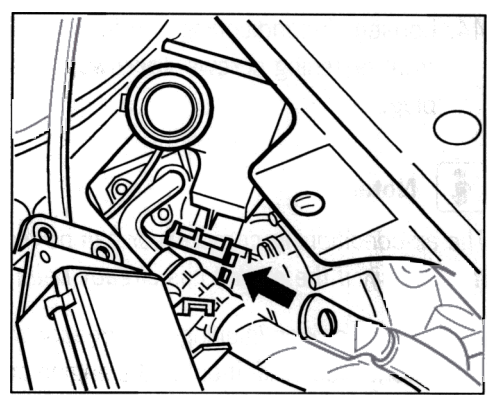


Inner and outer sleeve.

40. Disconnect B+ separator box. To do so, undo the hexagon nut in the separator box. Remove the cable and lay to one side.



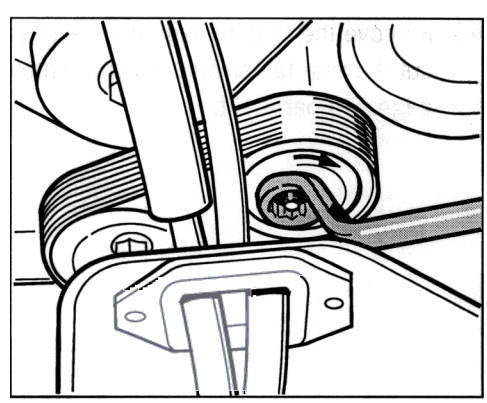
41. Remove supply tank of the power steering system. To do so, suck fluid out as much as possible. Then open the bayonet lock on the bottom of the expansion tank and remove the tank. Close the opening in the servo pump with a clean plug.



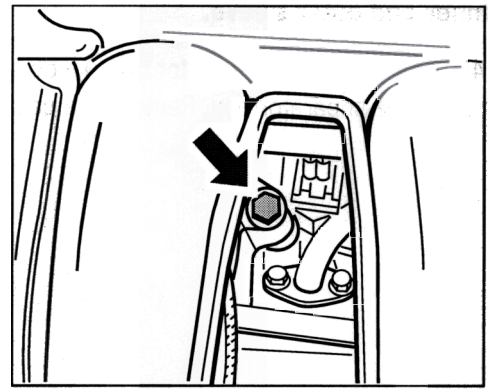
Note!

- *In vehicles with air conditioning, the points 42 to 45 must also be carried out.*
- *Never evacuate and open the air-conditioning circuit unless this is absolutely necessary.*

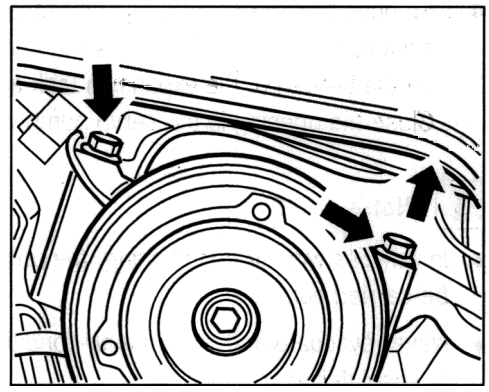
42. Remove drive belt. Mark the running direction of the drive belt with a coloured pen. Slacken the belt. Slacken belt by turning the tensioning pulley (wrench size 24 mm) clockwise, hold still and simultaneously take the belt off the drive pulleys.



43. Undo the rear fastening screw of the air-conditioning compressor from above. The screw is positioned between the intake manifolds of the fifth and sixth cylinders.



44. Loosen air-conditioning compressor. To do so, undo the two front fastening screws **-(arrows)-**. Disconnect the electrical plug.

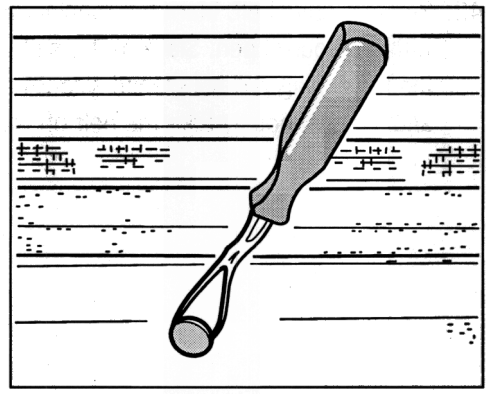


Note!

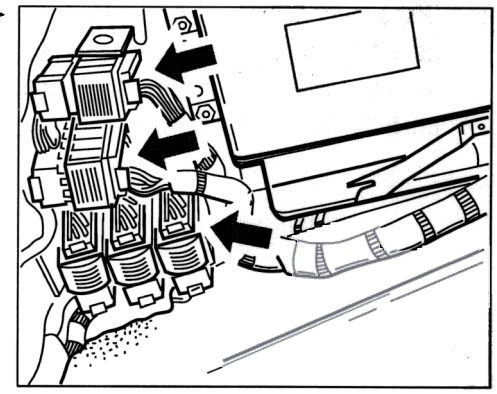
The air-conditioning compressor can be removed from the vehicle more easily if the engine has already been lowered.

45. Set the air-conditioning compressor with the hoses connected to one side or lift it out of the engine compartment and set it on a suitable base.

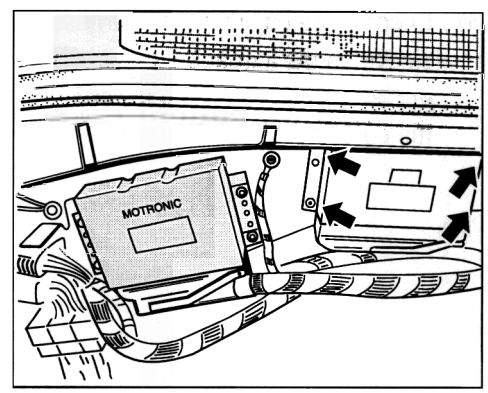
46. Remove the rear luggage compartment lining. To do so, lever out the rear fastening clips and remove the lining from the luggage compartment.



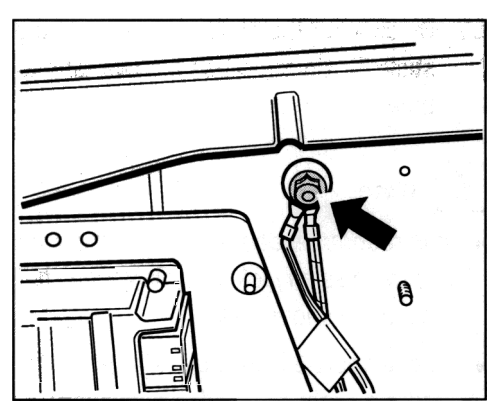
47. Disconnect the plug connections (X3/1, X3/2 and X59) of the engine wiring harness. To do so, raise the lock at the side and pull the plug out.



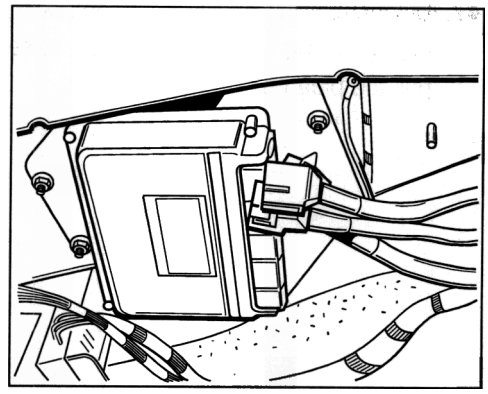
48. Remove the Tiptronic control module. Undo the three **-fastening nuts-** and pull off the control module plug.



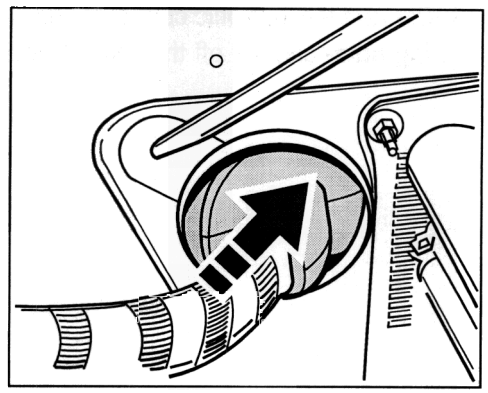
49. Disconnect control module. Disconnect the plugs of the Tiptronic control module. At the same time, lock the ground point of the engine control module.



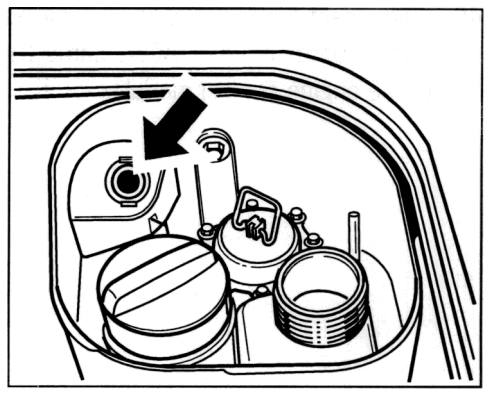
50. Disconnect engine control module. Open the topmost plug by actuating the side button and pull out. Remove the other plugs from the top down. To do so, press the locking button in and push the locking bar upwards.



51. Uncover the engine wiring harness. To do so, press the rubber sleeve on the luggage compartment rear wall inwards and guide the wiring harness towards the engine compartment, if the engine is to be lowered later.



52. Disconnect the plug connection at the guide tube of the oil dip-stick. To do so, press the two tabs together and unclip the tube.

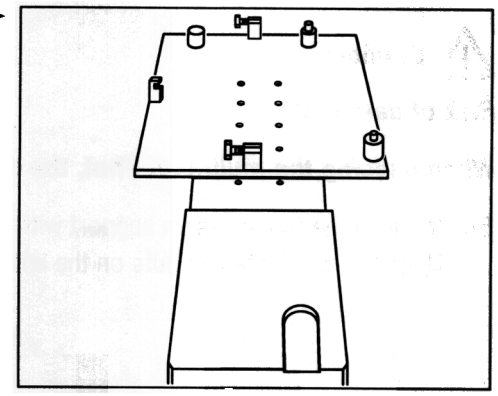


Note!

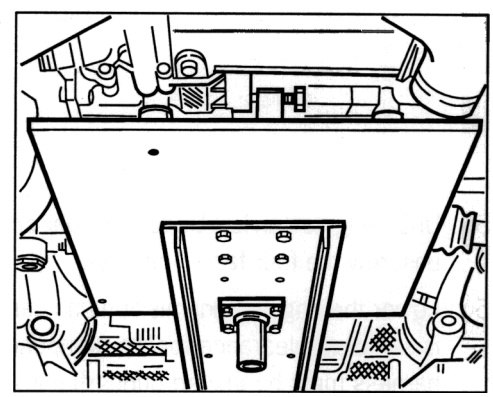
- *It is recommended to position the complete retainer plate using a transmission jack first. Only then should the workshop car jack be placed underneath.*
- *The support C1 should rest against the transmission oil pan under a slight pre-load. If necessary, fit the included spacer plate.*

53. Place pre-assembled engine retainer plate with transmission support on the crankcase or transmission.

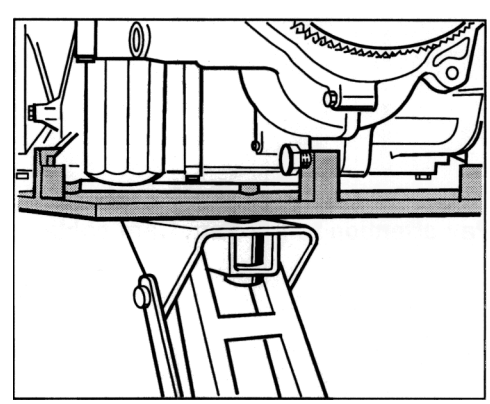
View of the engine retainer plate.



Engine retainer plate positioned and fastened.



Car jack placed underneath.

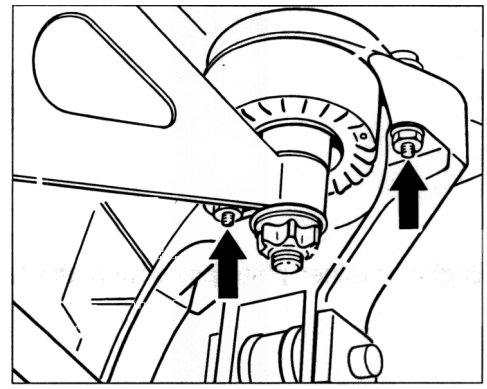


⚠ Caution!

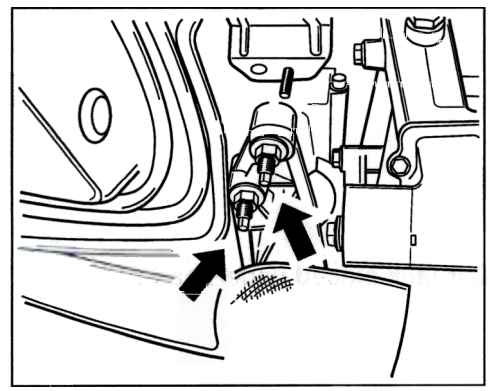
Risk of damage!

When undoing the multi-tooth nut, the mount is destroyed!

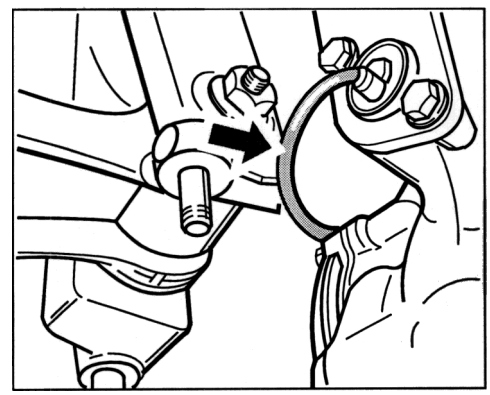
54. Remove the transmission support with the hydraulic mounts. Undo the two fastening nuts on the left and right.



55. Undo engine carrier. Undo the front engine carrier. To do so, unscrew the four fastening nuts.
56. Lower the engine-transmission unit carefully. Ensure that there is sufficient clearance for the components. The engine wiring harness must be guided during the lowering procedure.



Pay attention to the VarioCam cable

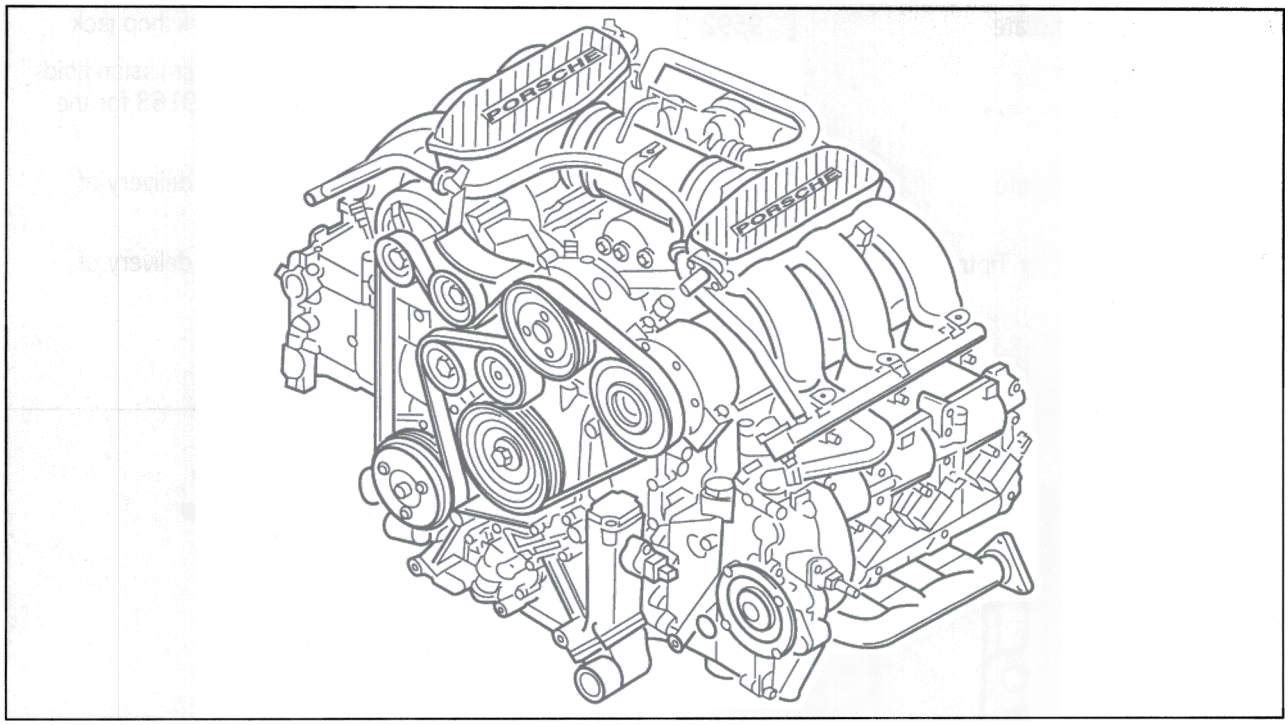


⚠ Warning!

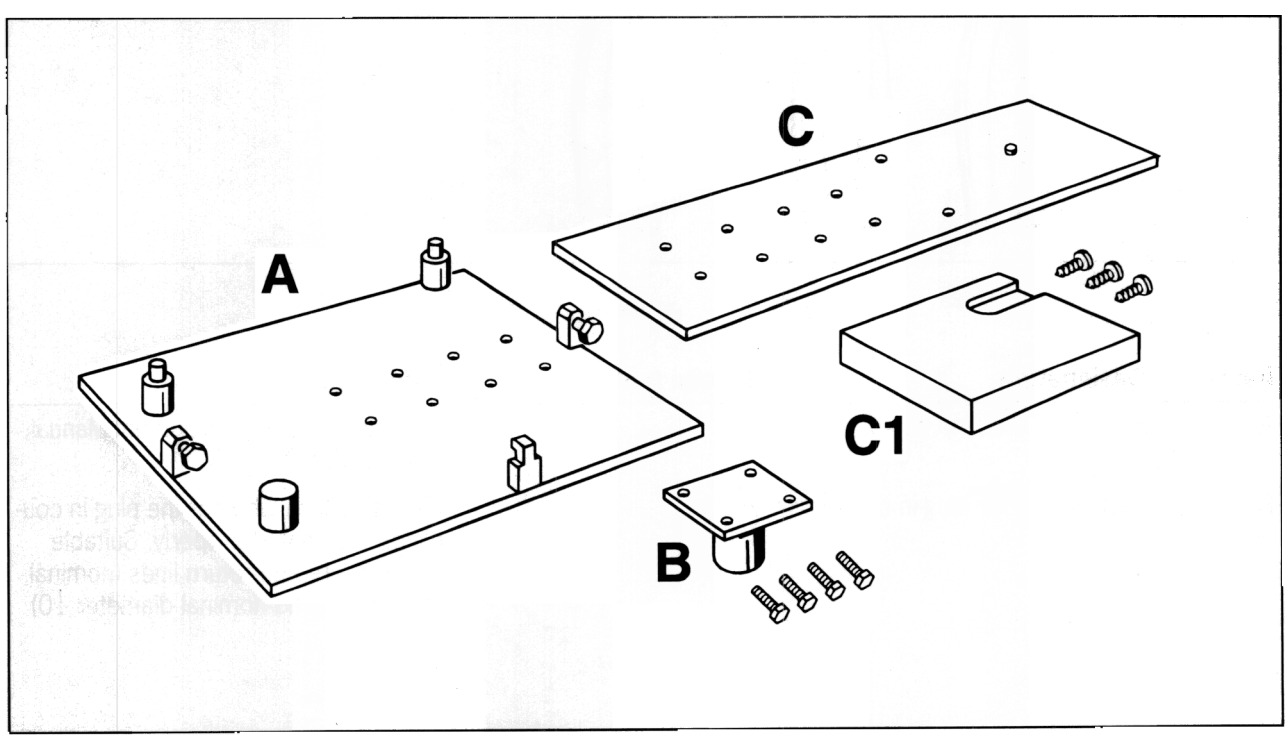
Risk of damage!

Only place the vehicle on its wheels or push it after the rear-axle support, the sheetmetal brace and both the diagonal braces have been installed.

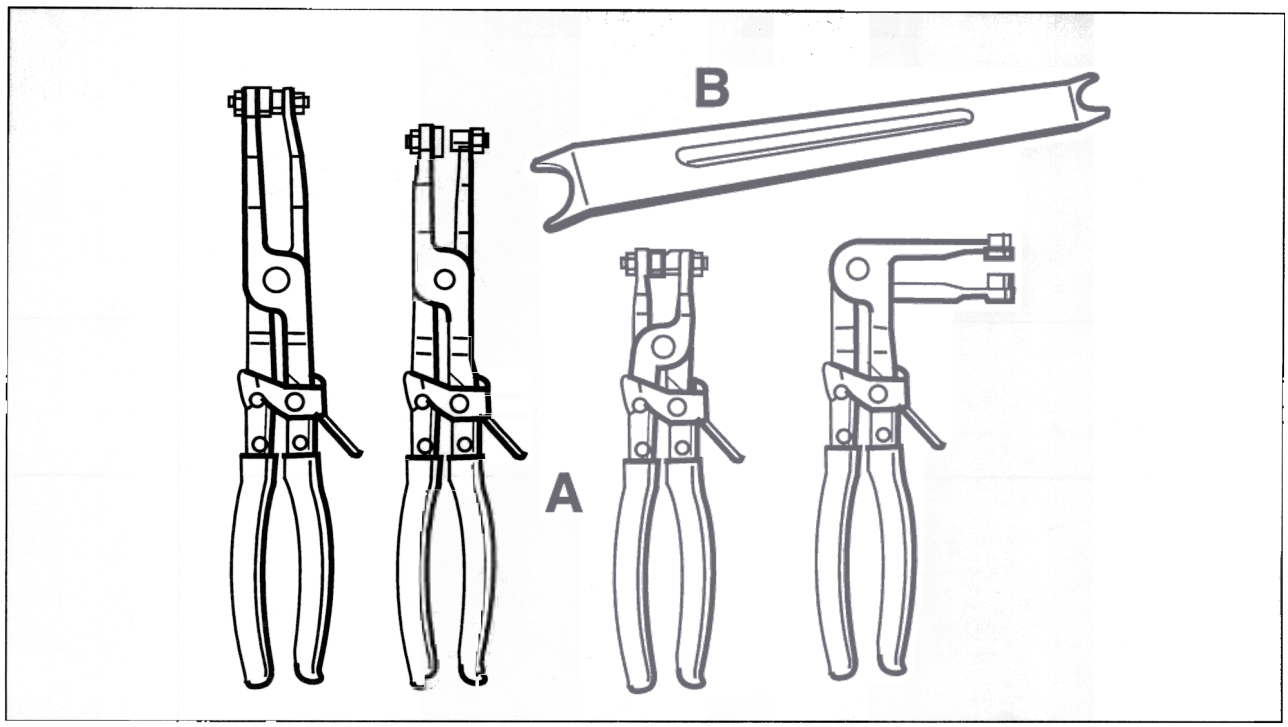
Installing engine, M96/20 (2.5 l) with Tiptronic transmission



Special tools



Item	Designation	Special tool	Explanation
	Retainer plate	9592	In conjunction with workshop jack
	Adapter	9163/2	Or use adapter of transmission holding plate, special tool 9163 for the 928 model
C	Support plate	9592/2	Contained in scope of delivery of 9592/1
C1	Support for Tiptronic transmission		Contained in scope of delivery of 9592/1



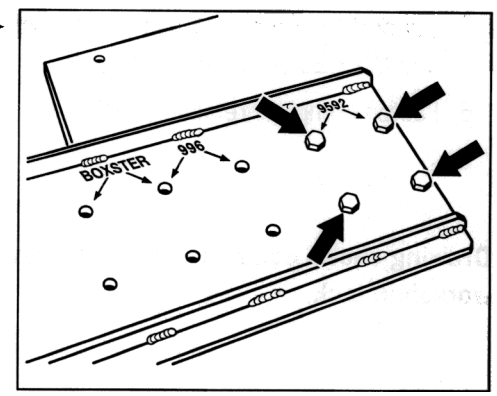
Item	Designation	Special tool	Explanation
	Spring-band clamp pliers		Refer to Workshop Equipment Manual, Chapter 2.4, No.: 72
B	Testing tool for plug-in couplings	9623	Used to check whether the plug-in couplings are seated properly. Suitable for pressure and return lines (nominal diameter 6 and nominal diameter 10)

Adjusting tool

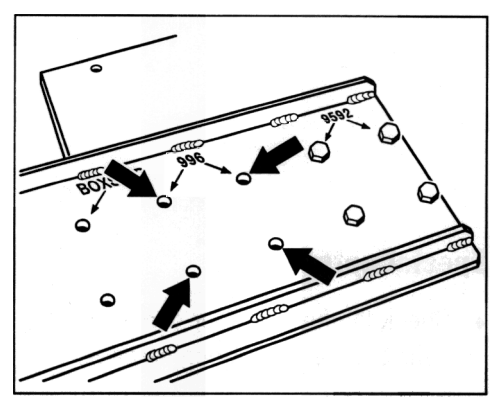
Note!

If the special tool 9592 is being used for the first time, (four) additional threaded holes must be applied.

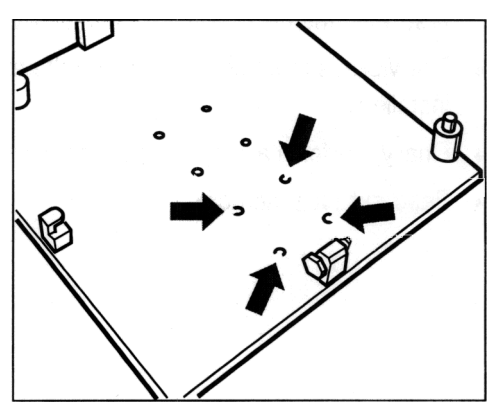
1. Lay the support plate 9592/1 on the rear of the retainer plate 9592 and fasten with four hexagon-head bolts M8 x 25.



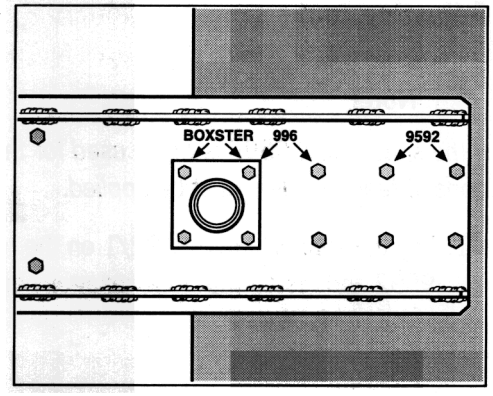
2. Countersink the retainer plate at the designated bores **-arrows-** with a 9 mm drill bit. The support plate serves as the drilling template.



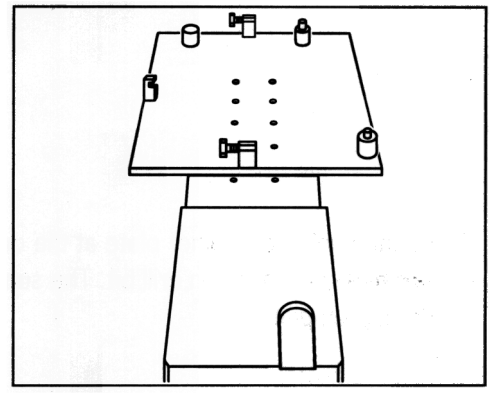
3. Drill through the countersunk bores on the retainer plate with a drill bit sized 6.8 mm and then cut an M8 thread.



4. Fasten the special tool adapter 9163/2 with a hexagon-head bolt M8 x 25 (bolt quality 10.9) and hexagon-head bolts M8 x 16 (bolt quality 10.9) at the designated positions "Boxster". The adapter and the support plate are fastened on the retainer plate with the M8 x 25 hexagon-head bolts. The M8 x 16 hexagon head bolts connect the adapter with the support plate.
5. Support for Tiptronic transmission with three M6 x 20 (2 ea.) and M8 x 25 (1 ea.) wood screws.
6. Fasten complete retainer plate on the workshop jack.

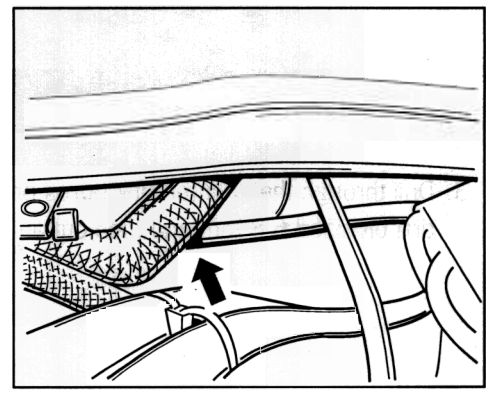


Drawing shows complete engine retainer plate fitted on the workshop jack.



Special notes

- Check the fuel hose for correct routing. The fuel hose is routed behind the engine wiring harness.
- When installing the rear-axle parts, it is essential to observe the correct sequence. The sheetmetal brace should be installed first, then the diagonal brace and finally the rear-axle support.
- The V-brace must be fitted before the exhaust system is installed.
- Finally, perform a suspension alignment.
- Read out fault memory.

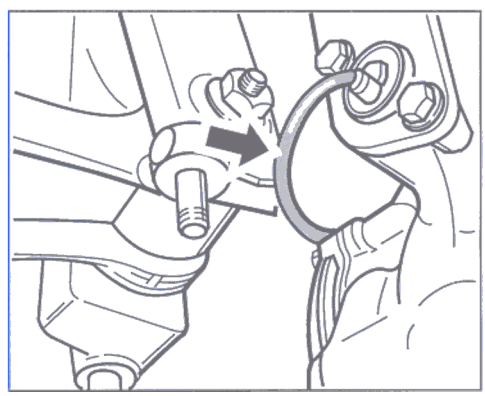


Installing engine

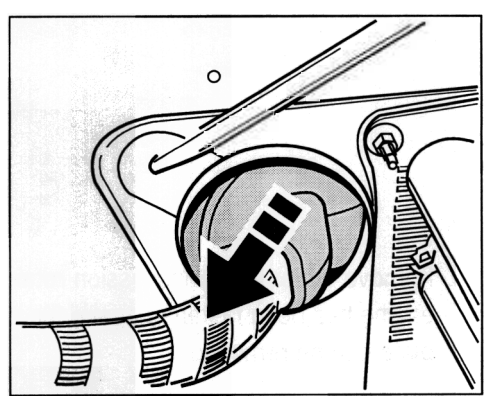
Note!

In order to facilitate the fitting of the air-conditioning compressor, it should be moved back into its installation position during the running-in of the engine.

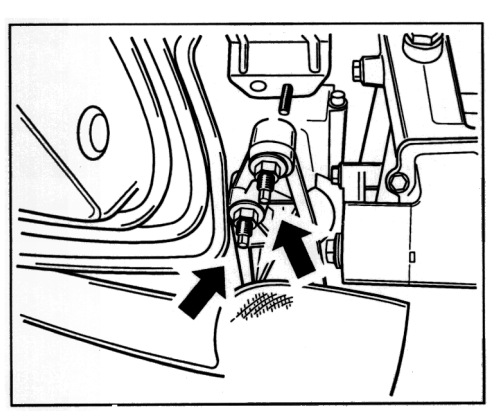
1. Lift the engine-transmission unit carefully and in steps. Have a second person observe the engine-transmission clearance at the same time. When lifting, pay particular attention to the clearance between the rear-axle longitudinal support and the VarioCam cable. Place the air-conditioning compressor in its installation position at this stage.



2. Push the engine wiring harness through the bulkhead and into the luggage compartment before the final installation position is reached.



3. Tighten engine mount. Tighten the four engine mount fastening screws to 46 Nm (34 ftlb.).

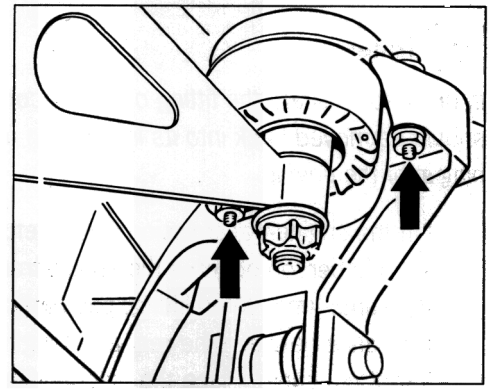


Warning!

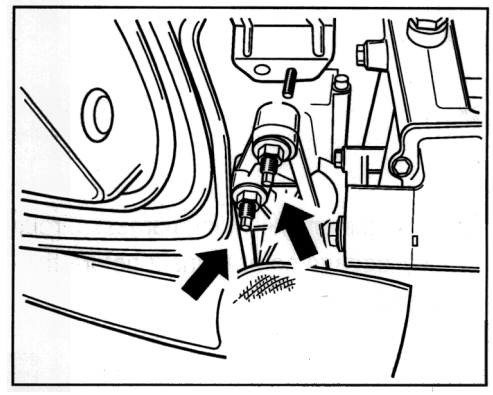
Risk of damage!

Do not turn the multiple-tooth nut -C-!

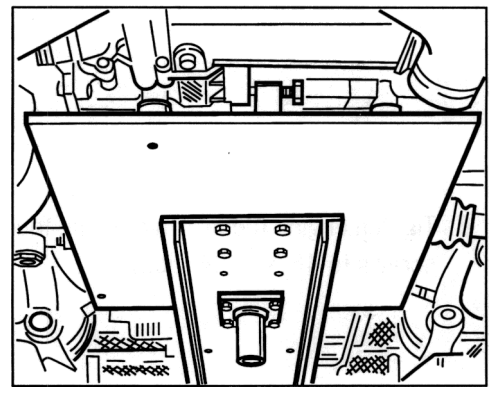
4. Install the transmission carrier and the hydraulic mount again. The M8 screws are tightened to 33 Nm (24 ftlb.).



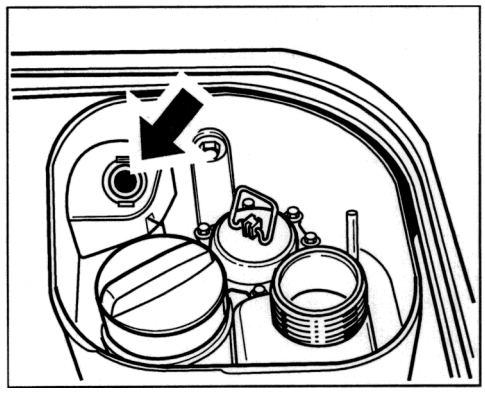
5. Install engine carrier again. Tighten the four fastening screws to 65 Nm (48 ftlb.).



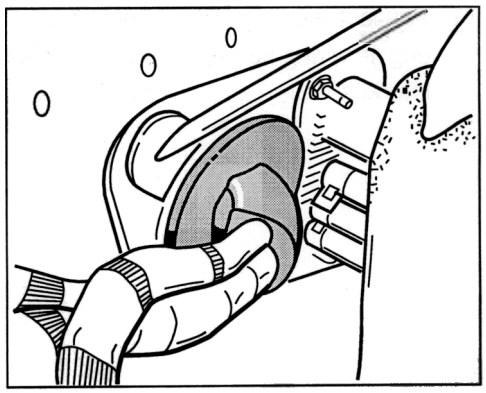
6. Remove the engine-transmission retainer plate. As soon as the engine has been fastened again, the car jack and the retainer plate can be removed.



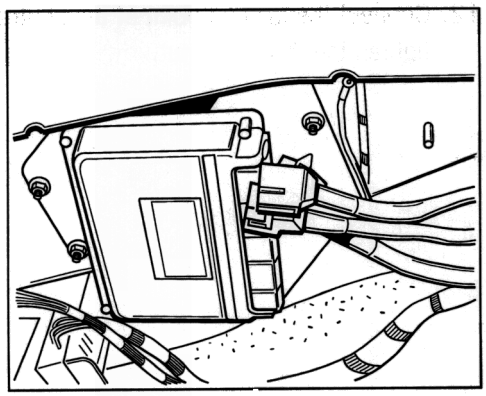
7. Clip the guide tube of the oil dipstick into the socket.



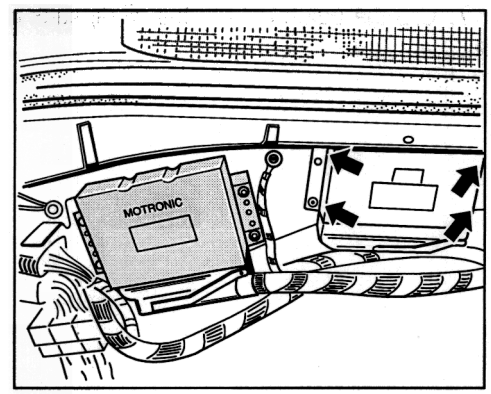
8. Fit the rubber sleeve of the wiring harness again.



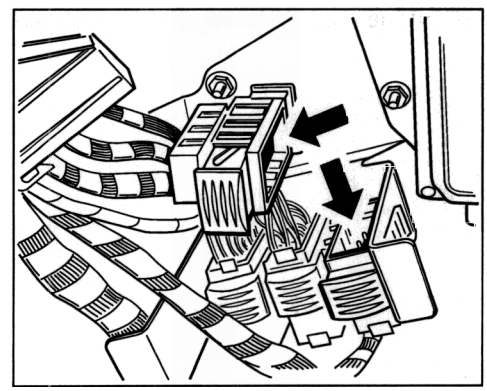
9. Re-connect engine control module. To do so, start at the bottom. Pay attention to the plug designations on the control module.



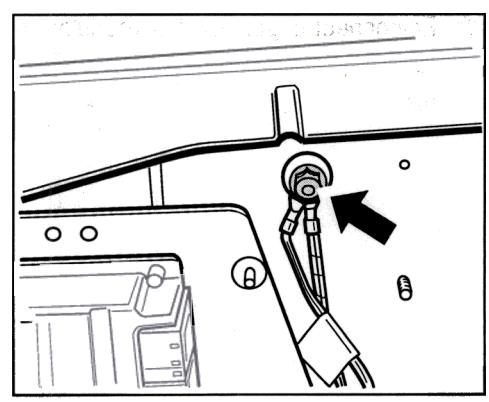
10. Re-connect and install the Tiptronic control module. Tighten the three fastening nuts.



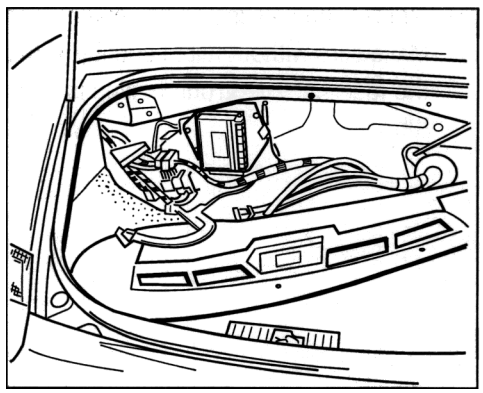
11. Connect the plug connections (X3/1, X3/2 and X59) of the engine wiring harness. To do so, insert the plug and lock the lateral slide.



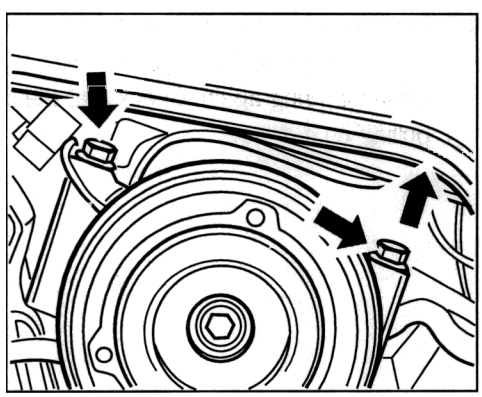
12. Connect the ground point of the control module again and tighten the fastening nut.



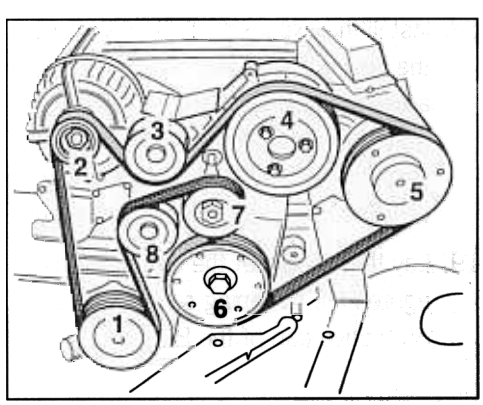
13. Install the luggage compartment lining of the rear luggage compartment.



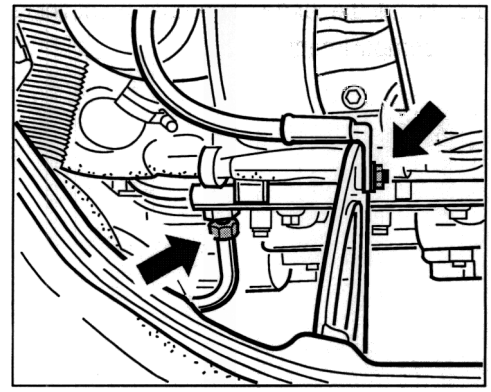
14. Screw air-conditioning compressor tight. Tighten the three fastening screws to 23 Nm (17 ftlb.).



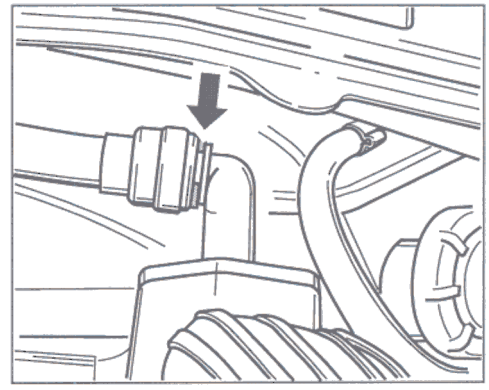
15. Check the drive belt for damage and replace it if necessary. Fit the belt in its original running direction once more. The fitting sequence is shown in the following illustration.



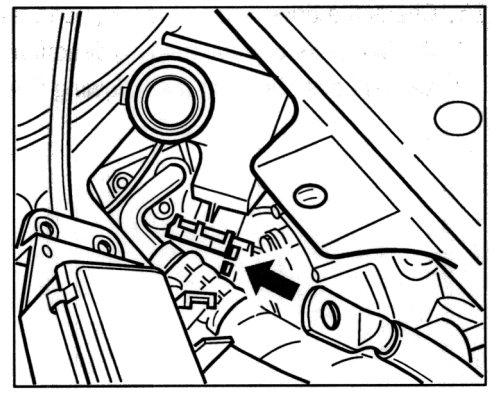
16. Tighten the fuel line on the engine and the ground cable again. ► Make sure without fail to counter with a wrench when tightening the fuel line. The ground cable is tightened with 23 Nm (17 ftlb.).



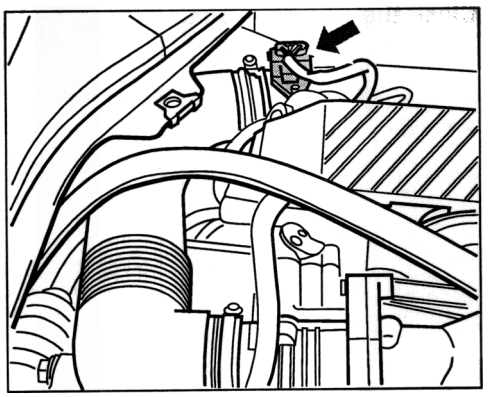
17. Push the vacuum line for the brake booster in a straight line on ► to the flange, until the plug is heard to engage. Then install the grey snap ring again. Check that the line is seated properly by pulling on it gently.



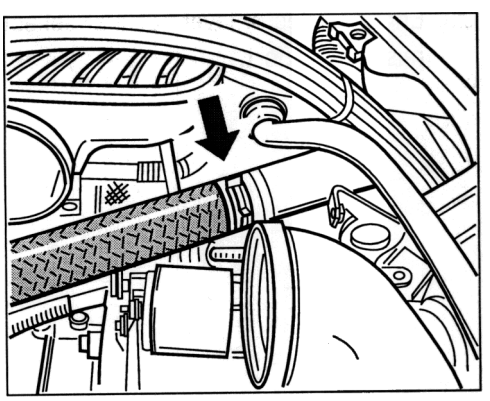
18. Install the expansion tank of the power steering again. Check ► the sealing rings and replace, if necessary. Turn the lower adjusting ring to its original position and position the tank of the power steering. Press the tank downwards and at the same time turn the ring until the markings coincide. Then fill the tank with Pentosin according to the regulations.
19. Lay the B+ line of the alternator over the connecting bolt and tighten the fastening screw with 10 Nm (7.5 ftlb.). Close the protective cap of the B+ box.



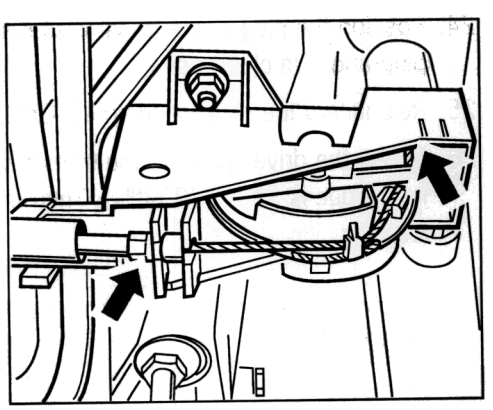
20. Re-connect hot film mass air flow meter. Connect the connecting tube between the hot film mass air flow meter and the intake system and tighten the hose clamp.



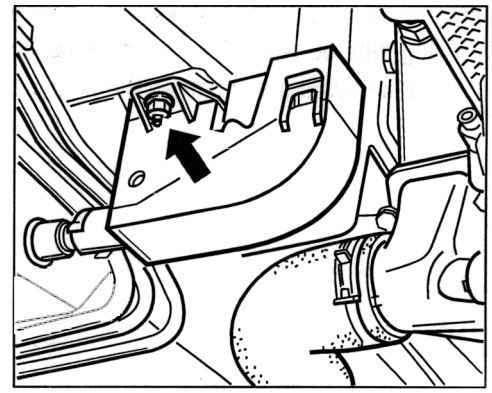
21. Fit the oil filler line. Push the oil filler line back onto the flange and secure with a spring band clamp.



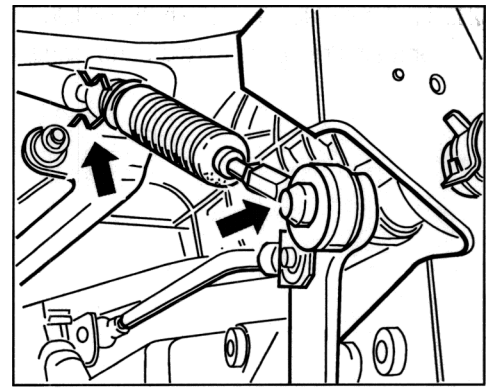
22. Engage the accelerator cable.



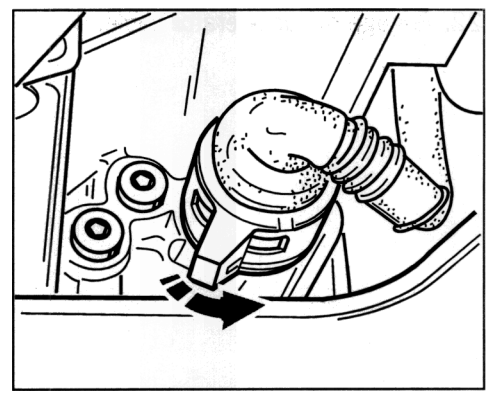
Close the deflector box.



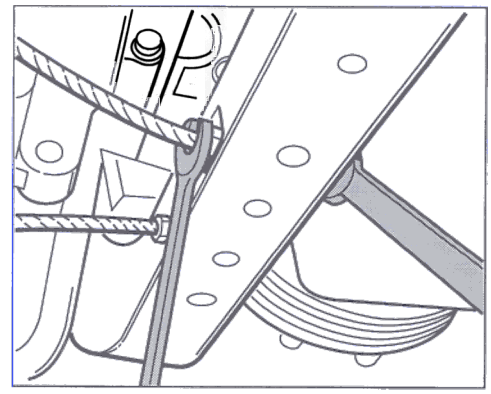
23. Engage selector lever cable at deflection lever and at the transmission support.



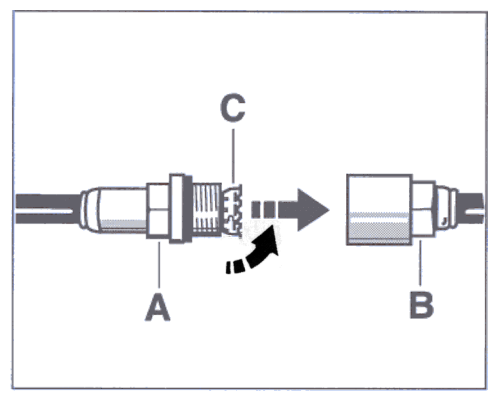
24. Position the plug at the transmission socket. Disconnect the plug and turn clockwise.
25. Re-connect the plug for the multi-function switch.
26. Screw the drive shafts to the transmission again. The tightening torque is 39 Nm (29 ftlb.). Then remove the protective sheaths.



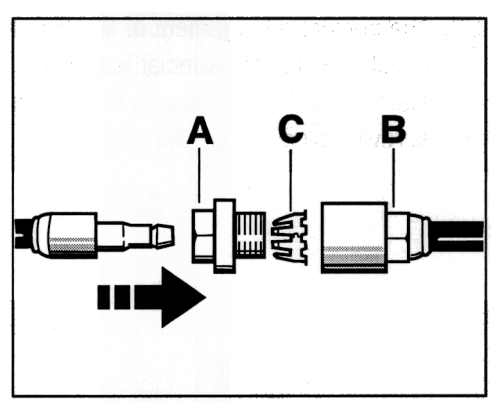
27. Re-tighten cable. Fit the engine cables through the rear-axle support again and tighten the fastening nuts. Make sure to counter with a wrench when tightening. The tightening torque is 23 Nm (17 ftlb.).



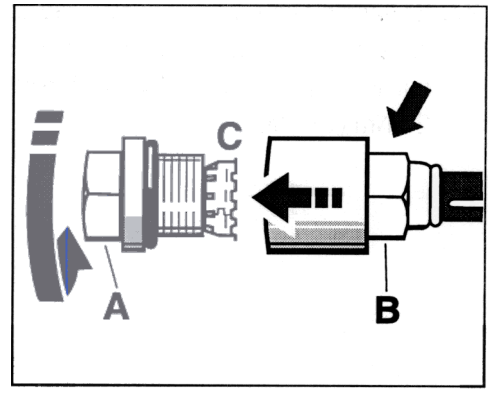
28. Connect the power-assisted steering lines. To do so, tilt the holder on one side and pull out simultaneously.



29. Detach threaded part -**A**- by pulling it off the nipple.



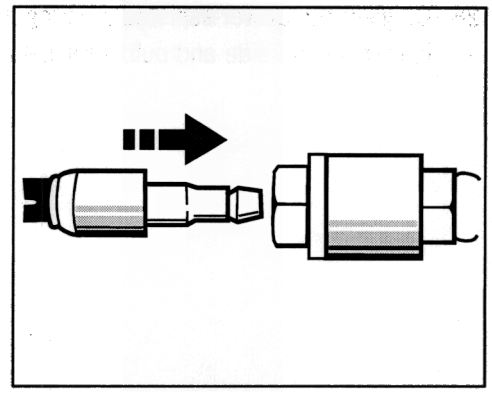
30. Insert the holder - **C** - into the threaded part -**A** - and screw both into the plug-in coupling - **B** - and tighten. Make sure to counter with a wrench when tightening. The tightening torque for the steering pressure line is 30 Nm (22 ftlb.) (wrench size 15). The tightening torque for the steering return line is 40 Nm (30 ftlb.) (wrench size 19).



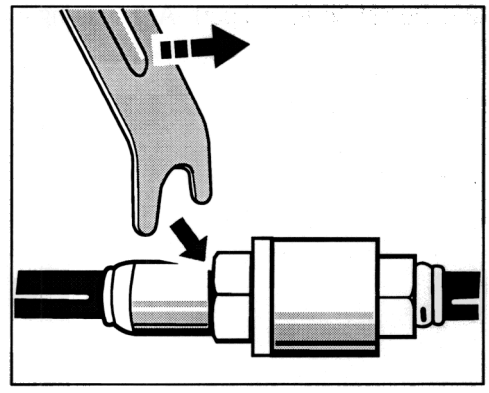
31. Insert the screwed plug into the plug-in coupling in a straight line. The plug must audibly engage in the holder.

Note!

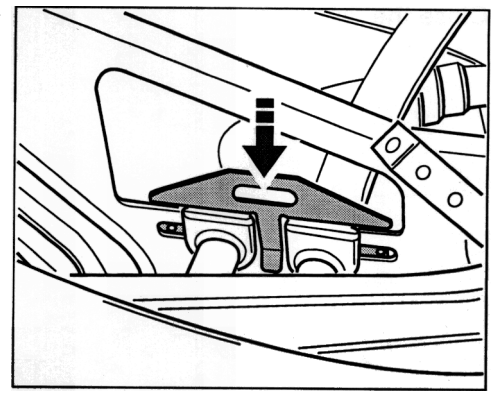
The plug-in connection is designed so that the plug can be shifted in the plug-in coupling by approx. 1 mm in axial direction by slightly pulling or pressing.



32. The correct engagement of the plug-in couplings should be checked using the special tool 9623. To check this, insert the special tool 9623 between the plug-in coupling and the screwed plug and tilt the tool slightly. The plug must not slide out.



33. Install the servo lines, the return line and the vacuum hose for the brake booster again and insert the retaining clip.



Caution!

Risk of damage!

The fuel lines must not be kinked.

34. Connect the fuel lines. Re-connect the fuel lines on the vehicle floor. The plug must engage audibly. Check correct seating by pulling gently.

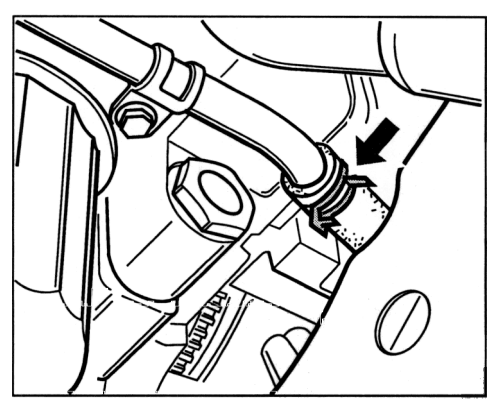
Caution!

Danger of slipping hoses.

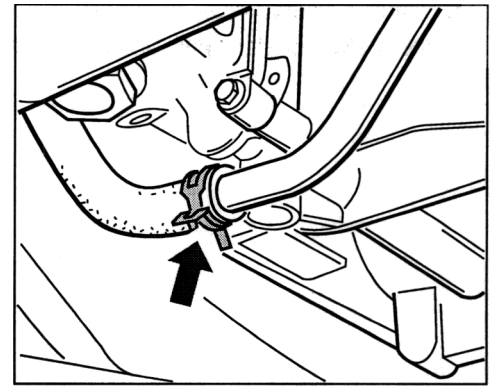
Never apply a lubricant to the coolant hoses to make fitting easier!

35. Fit all the coolant hoses again. To make fitting easier, the cool ant hoses can be wetted with water in the fitting area.

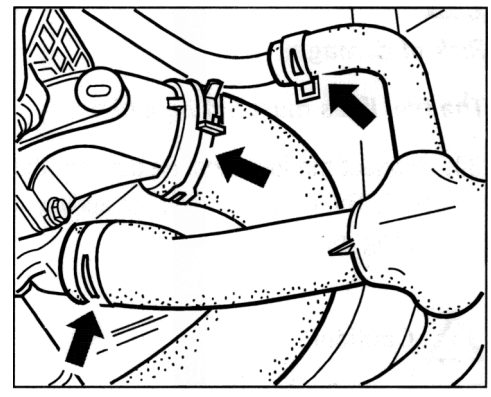
Connect the hose.



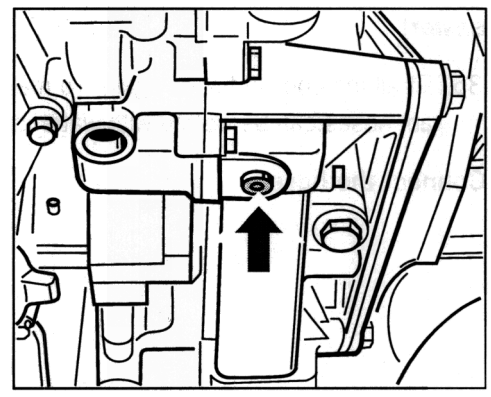
Close the line.



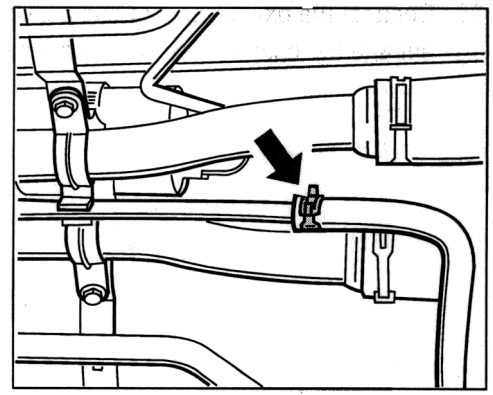
Reconnect the hoses.



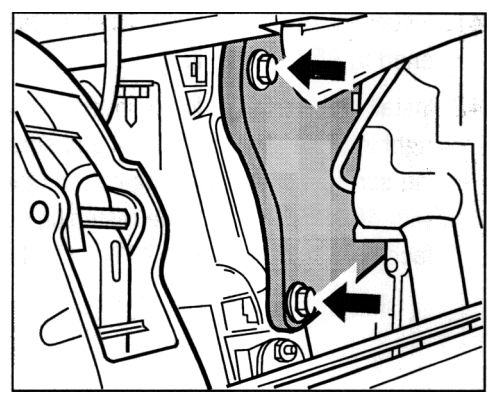
36. Check the coolant drain plug. If the drain plug is removed, it should be equipped with a new seal and re-mounted. The tightening torque for the screw is from 10 to 15 Nm (7.5 to 11 ftlb.).



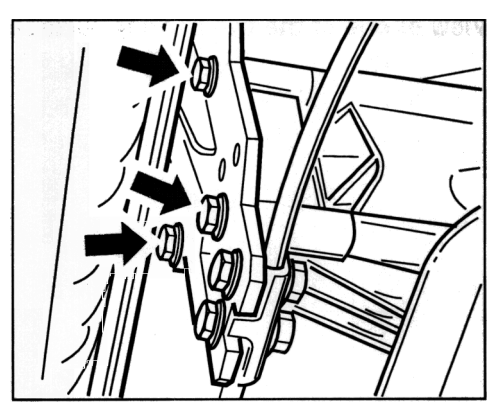
37. Fit vent line again.



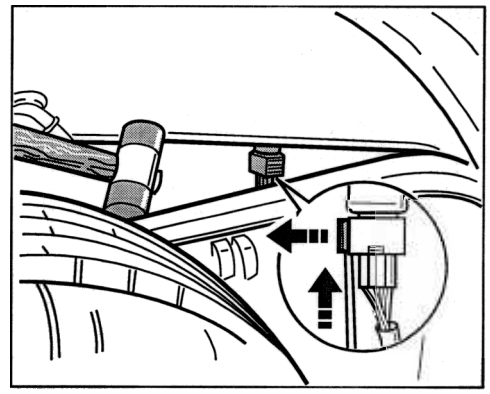
38. Install rear-axle support again. The four fastening screws are tightened to 65 Nm (48 ftlb.).



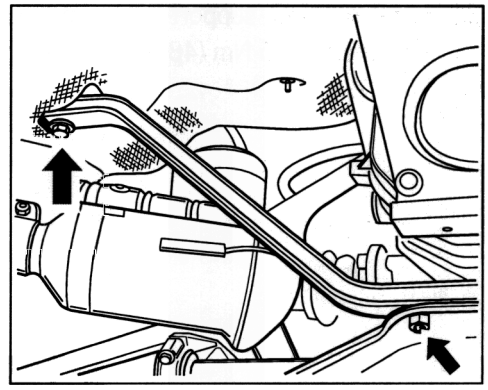
39. Move the exhaust system to its installation position again. In the process, replace all the seals at opened points. Tighten the three hexagon-head bolts again. Then tighten the screws on the exhaust manifold/catalytic converter with 25 Nm (18 ftlb.).



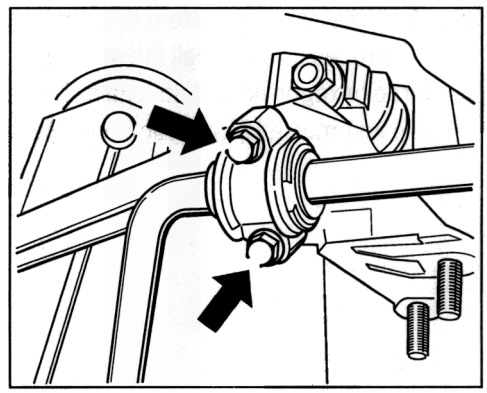
40. Connect the oxygen sensor cables. Connect the plugs and engage the holder in the rear-axle support.



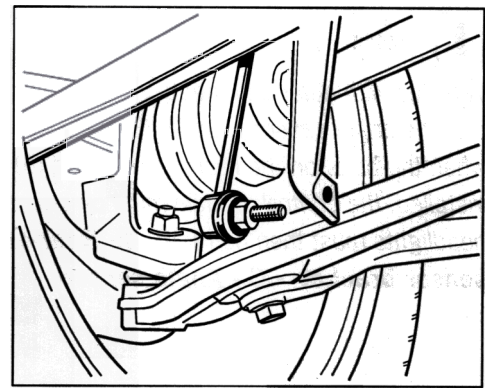
41. Install the rear V-member. The four fastening screws are tightened to 65 Nm (48 ftlb.).
42. Install stabilizer. To do so, insert the stabilizer on the left and right into the stabilizer mount and screw it tight to the two bearing surfaces. The fastening nuts on the mount are tightened with 46 Nm (34 ftlb.). The fastening screws on the bearing surfaces are tightened with 23 Nm (17 ftlb.).



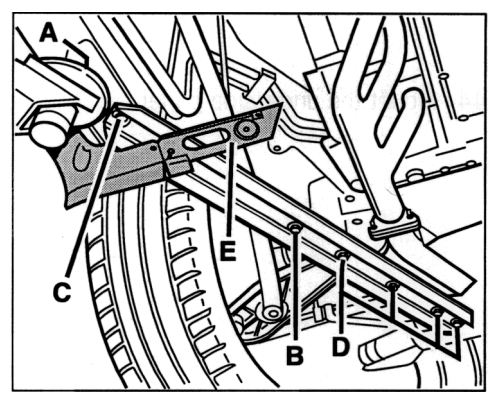
View of one of the two bearing surfaces



View of a stabilizer mount

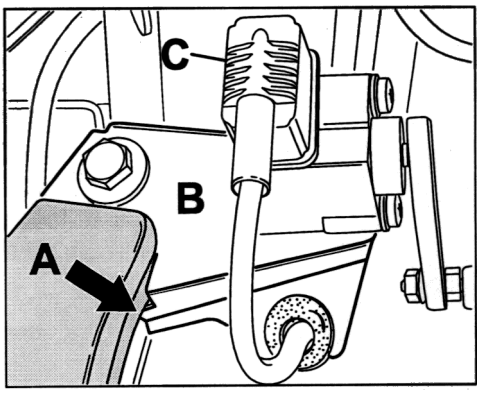


43. Install the sheetmetal brace into the vehicle. Tighten the hexagon nuts with 65 Nm (48 ftlb.) and tighten the fastening screws with 46 Nm (34 ftlb.). Install the two diagonal braces into the vehicle. Tighten the fastening nuts to 65 Nm (48 ftlb.).

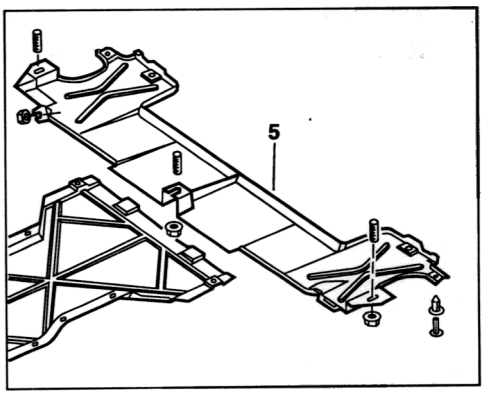


Note!

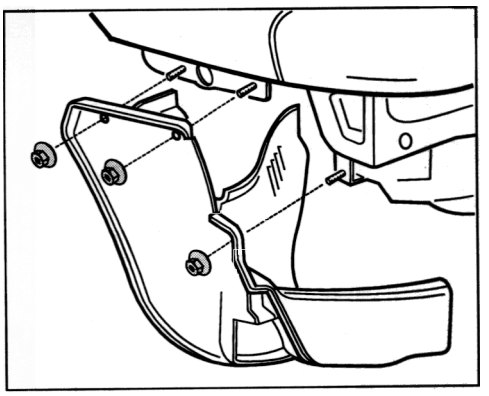
Vehicles with automatic headlight beam adjustment. Bear in mind that the angle sensor bracket (B) must be in contact at the bottom when the bolts on the rear-axle support (A) are tightened. Once installed, the control module must be calibrated with the PST 2. The headlights must then be reset. ***-A- Rear-axle support- -B - Angle sensor bracket- - C - Angle sensor-***



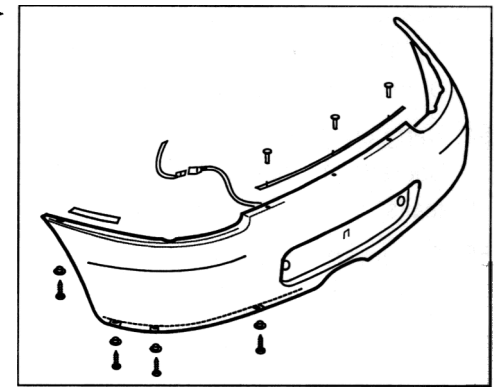
44. Mount the underside panel.



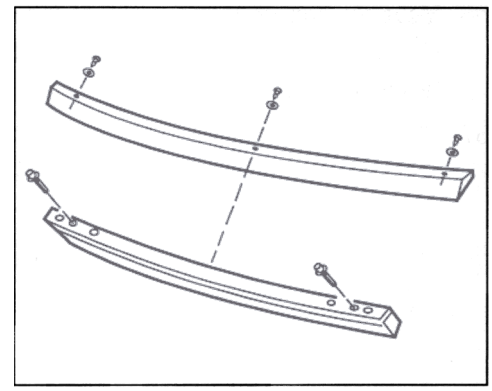
45. Install the right and left wheel housing trims again.



46. Re-install the rear spoiler.



47. Install the rear spoiler again.
48. Re-position the trim of the rear luggage compartment and press in the fastening rivets.

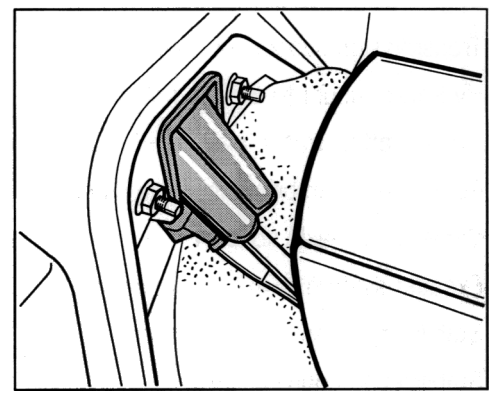


Warning!

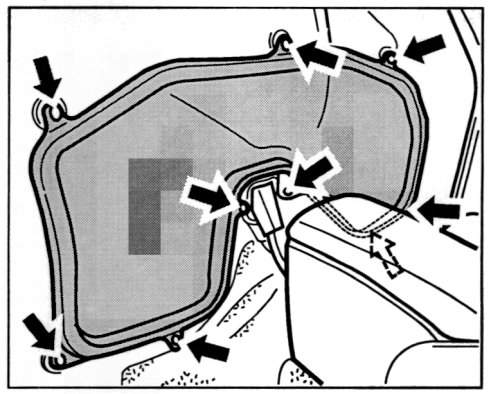
Danger of short circuit!

- ***Pay attention to the correct seating of the rubber sleeve of the B+ lead!***

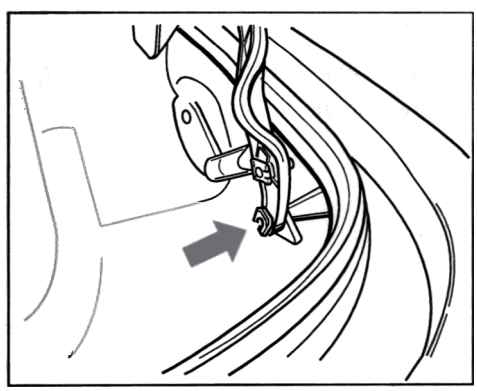
49. Check the rubber sleeve. The rubber sleeve of the B+ lead must be fitted correctly and must not have slipped out of place.
50. Re-install the left seat. Tighten the four fastening screws to 65 Nm (48 ftlb.).
51. Top up operating fluids. Check that all operating fluids (engine oil, Pentosin, coolant) are at the correct level. Both the coolant circuit and the power steering must be bled according to regulations.
52. Connect battery. Connect the battery terminals again and tighten. Subsequently, the fault memories of the vehicle must be read out and the theft codes may possibly have to be entered again. Re-teach the power windows.



53. Seal off the upper and rear maintenance openings again. Tighten the seven fastening screws and the two fastening nuts of the rear maintenance opening with 10 Nm (7.5 ftlb.).
54. Carry out a test drive. After the test drive, check that all the operating fluids are at the correct level. Check all circuits for leaks.
55. Fit convertible top again. To do so, take the mandrel out of the fixing bore.



56. Move the convertible top towards the rear until the linkage can be pushed back onto the pin. Then push the retaining clip into place.
57. Close convertible top. To do so, pull the tension bow towards the rear again and engage the tension cables again on the left and right.
58. Engage the cloth covering of the convertible top on the left and right into the retaining lugs.

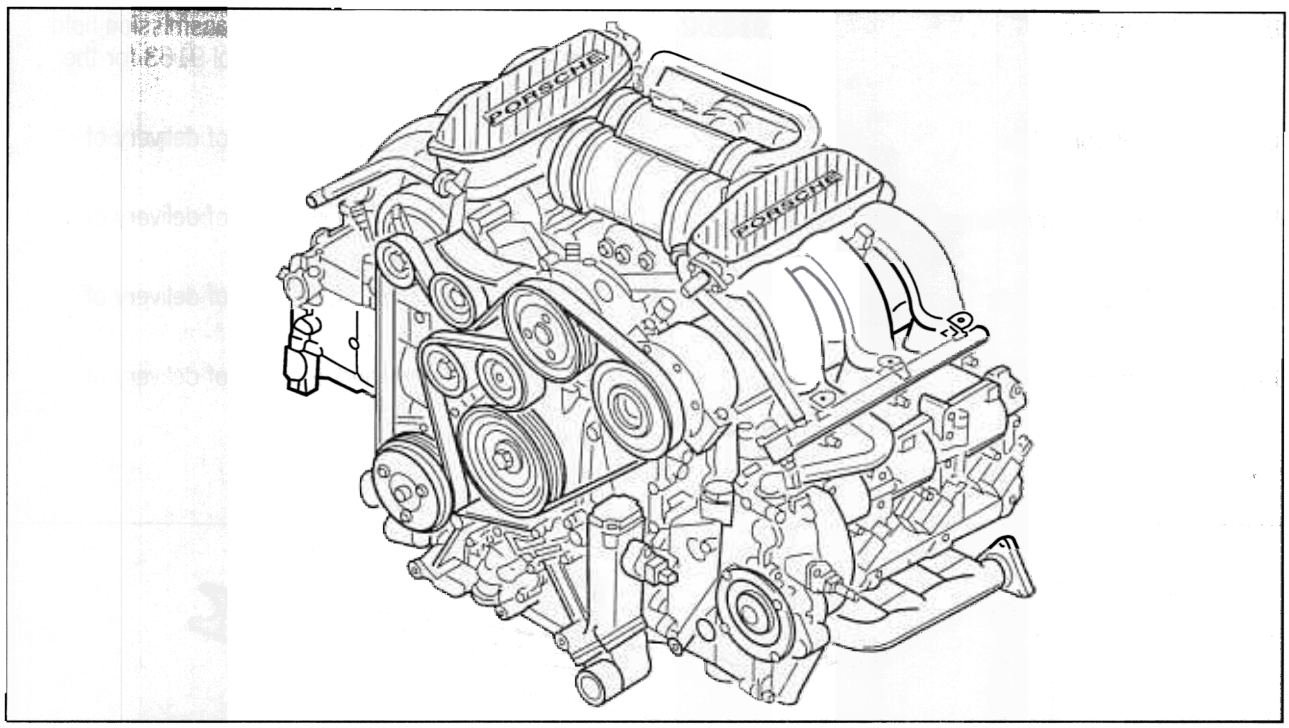


Tightening torques

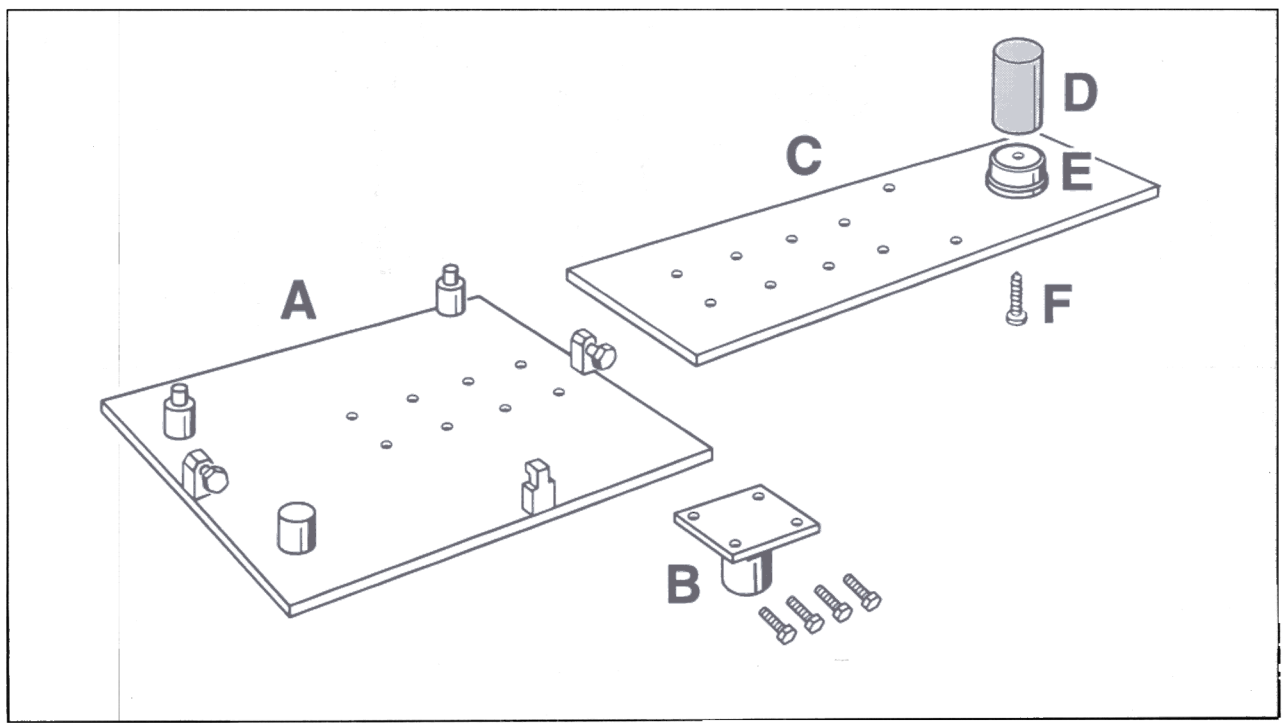
Location	Thread	Tightening torque Nm (ftlb.)
Torque converter to drive plate		39 (29)
Engine carrier to body		65 (48)
Transmission support on transmission		85 (63)
Hydraulic mount to carrier side section		23 (17)
Drive shaft to transmission M96/22		39 (29)
Rear cross member (aluminium V-brace)		65 (48)
Cable to rear-axle support		23 (17)
Exhaust system to exhaust manifold		25 (18)
Stabilizer to carrier side section		23 (17)
Stabilizer to coupling linkage		46 (34)
Sheetmetal brace to carrier side section (hexagon nut)		65 (48)
Sheetmetal brace to cross member (hexagon-head bolt)	M10 x 1.5	46 (34)
Sheetmetal brace to rear cross member (hexagon nut)	M10 x 1.5	65 (48)

Location	Thread	Tightening torque Nm (ftlb.)
Diagonal brace (front) to body	M10 x 1.5	65 (48)
Wheel to wheel hub	M14 x 1.5	130 (96)
Fuel supply line to fuel gallery	M16	30 to 35 (22 to 26)
Coolant drain plug	M10 x 1.5	10 to 15 (7.5 to 11)
Ground strap to secondary air pump bracket	M8	23 (17)

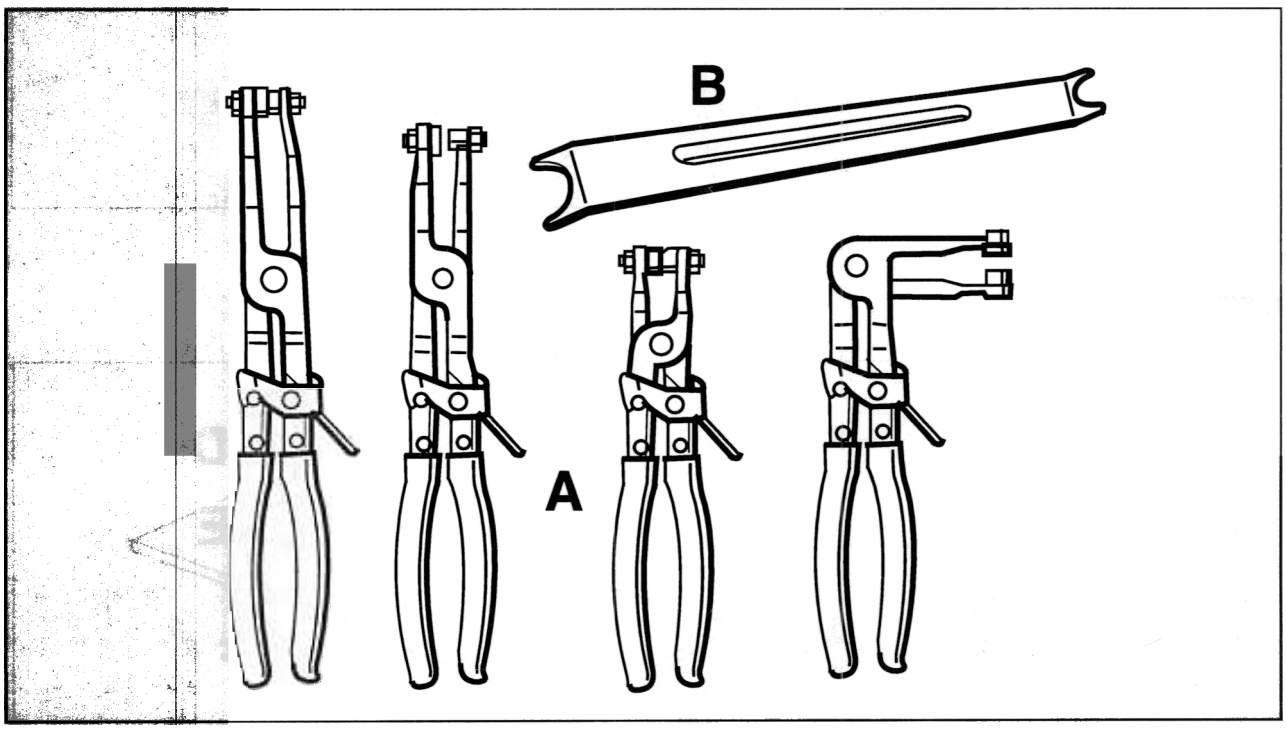
Removing engine, M96/21 (3.2 l) and M96/22 (2.7 l) with manual transmission



Special tools



Item	Designation	Special tool	Explanation
	Retainer plate	9592	In conjunction with workshop jack
	Adapter	9163/2	Or use adapter of transmission holding plate, special tool 9163 for the 928 model
C	Support plate	9592/2	Contained in scope of delivery of 9592/1
D	Support for manual transmission		Contained in scope of delivery of 9592/1
E	Pressure piece		Contained in scope of delivery of 9592/1
F	Screw M8 x 25		Contained in scope of delivery of 9592/1



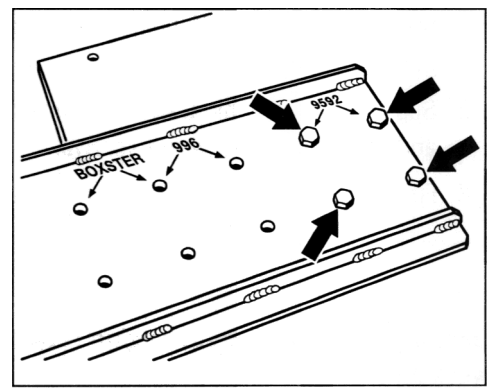
Item	Designation	Special tool	Explanation
			Refer to Workshop Equipment Manual, Chapter 2.4, No.: 72
B	Testing tool for plug-in couplings	9623	Used to check whether the plug-in couplings are seated properly. Suitable for pressure and return lines (nominal diameter 6 and nominal diameter 10)

Adjusting tool

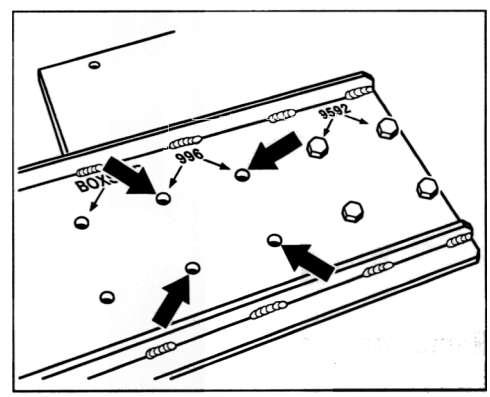
Note!

If the special tool 9592 is being used for the first time, (four) additional threaded holes must be applied.

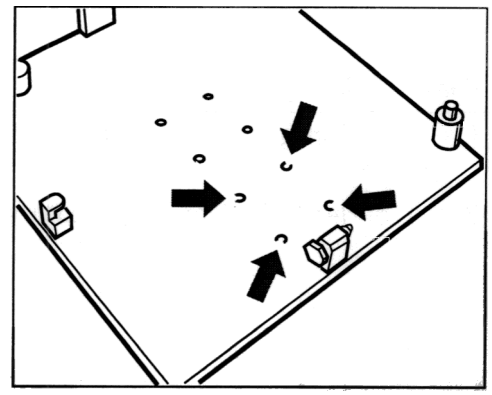
1. Lay the support plate 9592/1 on the rear of the retainer plate 9592 and fasten with four hexagon-head bolts M8 x 25.



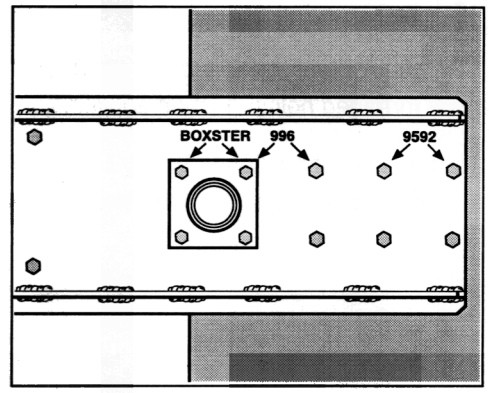
2. Countersink the retainer plate at the designated bores **-arrows-** with a 9 mm drill bit. The support plate serves as the drilling template.



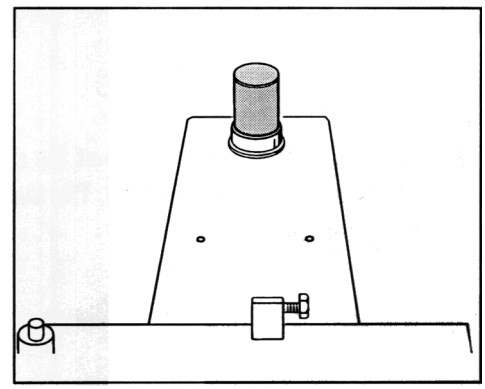
3. Drill through the countersunk bores on the retainer plate with a drill bit sized 6.8 mm and then cut an M8 thread.



4. Fasten the special tool adapter 9163/2 with a hexagon-head bolt M8 x 25 (bolt quality 10.9) and hexagon-head bolts M8 x 16 (bolt quality 10.9) at the designated position "Boxster". The adapter and the support plate are fastened on the retainer plate with the M8 x 25 hexagon-head bolts. The M8 x 16 hexagon head bolts connect the adapter with the support plate.
5. Support for Tiptronic transmission with three M6 x 20 (2 ea.) and M8 x 25 (1 ea.) wood screws.
6. Fit complete retainer plate on the workshop jack.



Drawing shows complete engine retainer plate fitted on the workshop jack.



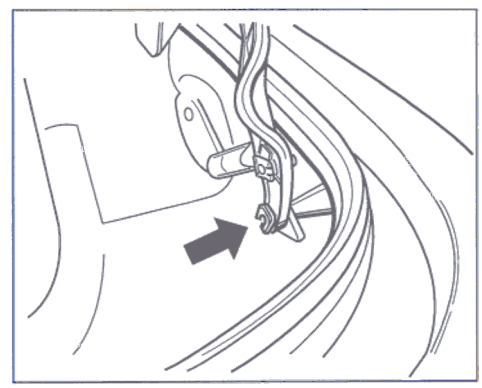
Removing engine

Note!

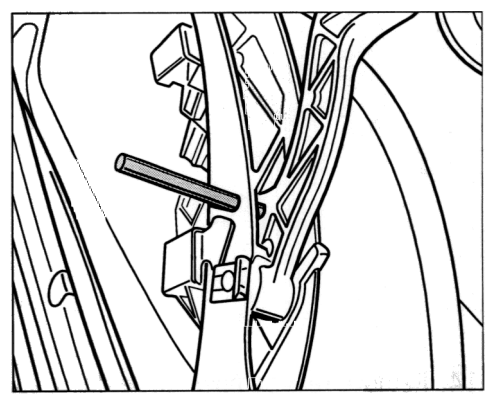
The engine is removed downwards complete with the manual transmission.

1. Position the vehicle at the specified points on a lifting platform.
2. Open both the luggage compartment lids.

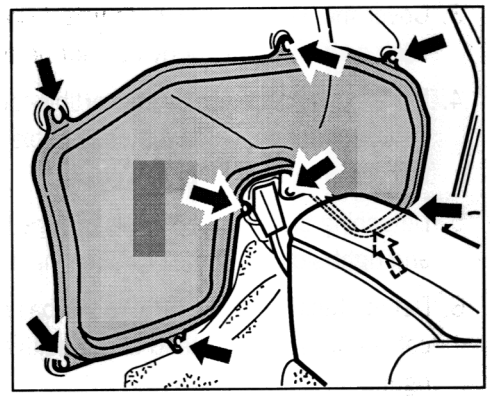
3. Cover the vehicle. Cover the vehicle with protective covers in such a way that the body can not be damaged.
4. Move convertible top or convertible-top compartment lid to service position. Open the convertible top until the convertible-top compartment lid is half open.
5. Detaching cloth covering. Disengage the rear strip on the left and right sides of the cloth covering in downward direction.
6. Detach tension cables. Press the ball socket of the tension cable out of the ball head of the adjusting piece on the left and right.
7. Move convertible top to service position. To do so, press the tension bow of the convertible top towards the main bow, until it reaches its locking point.
8. Move the convertible-top compartment lid to service position and secure. Disengage the convertible-top compartment links at the extreme bottom. To do so, disengage the clips at the left and right and pull the links off the bolt.



9. Press the converible-top compartment links forwards until the two bores coincide and a 5 mm mandrel can be pushed through them.
10. Remove left-hand seat. For better accessibility, remove the left-hand seat of the car. Unscrew the four internal-serration screws, disconnect all the electrical plug connections and remove the seat.



11. Open the rear wall cover. To do so, remove the oddments tray behind the seats and remove the rear wall lining. Then undo the 6 fastening screws and the 2 fastening nuts. (See **-arrows-**).



Caution!

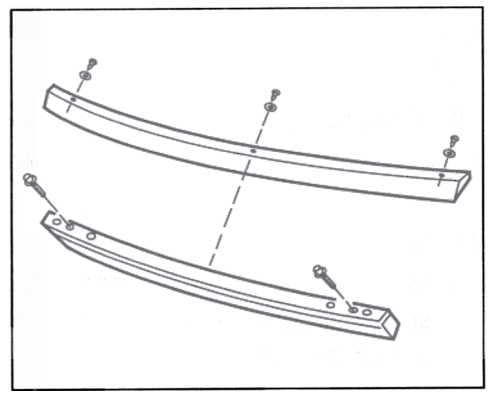
Danger of short circuit!

First remove the ground terminal.

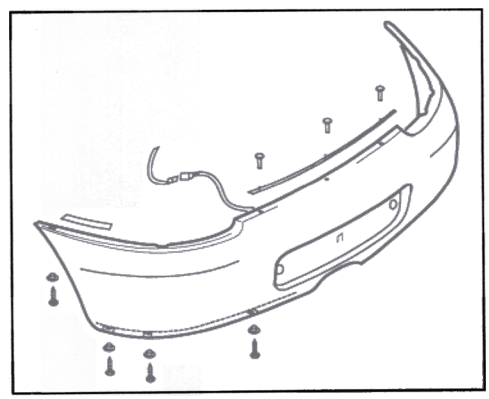
Cover the terminals.

Never connect (short circuit) the terminals.

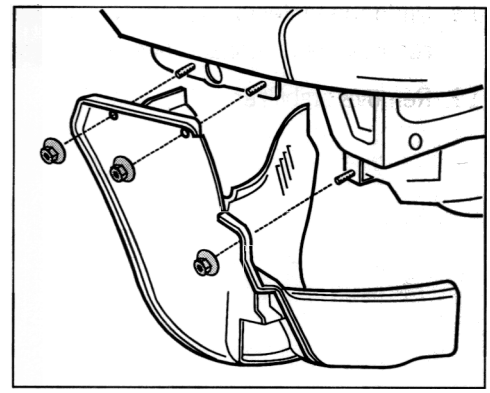
12. Disconnect battery. Before disconnecting, find out the relevant theft codes (e.g. radio) if necessary. At the battery, disconnect the ground terminal and remove the ground cable ⇒ Rep. Gr. 2706.
13. Remove the rear spoiler ⇒ Rep. Gr. 66 58 19; Removing and installing rear spoiler.



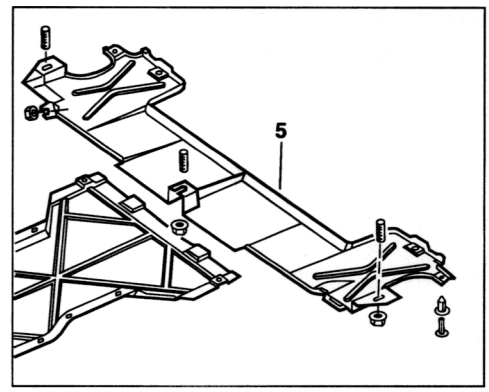
14. Remove rear bumper. While doing so, pay attention to the connection for the number plate lighting ⇒ Rep. Gr. 63 58 19; Removing and installing rear bumper.



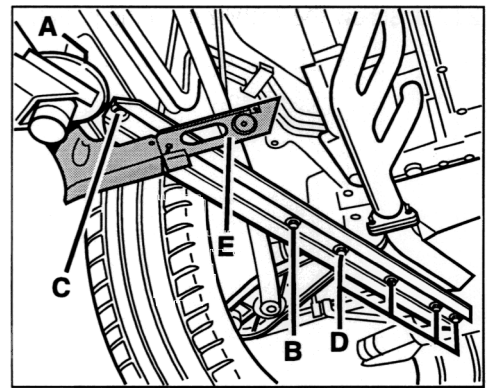
15. Remove left and right wheel housing trims.



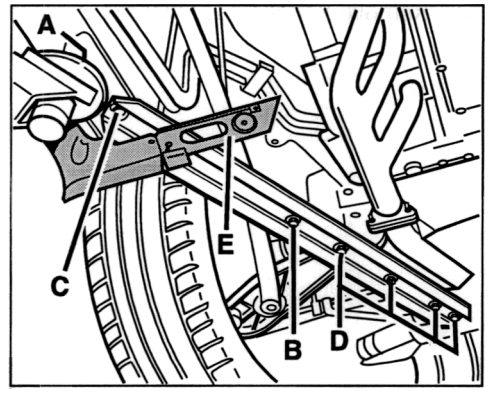
16. Remove the rear part of the underbody cover.



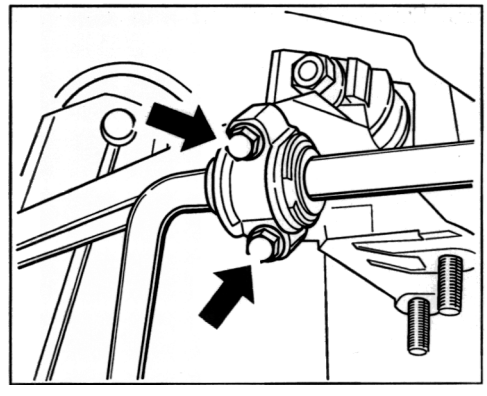
17. Lift the vehicle. Before lifting, check that all fastening points of the diagonal braces are easily accessible. Pay particular attention to the threaded part **-C-**.



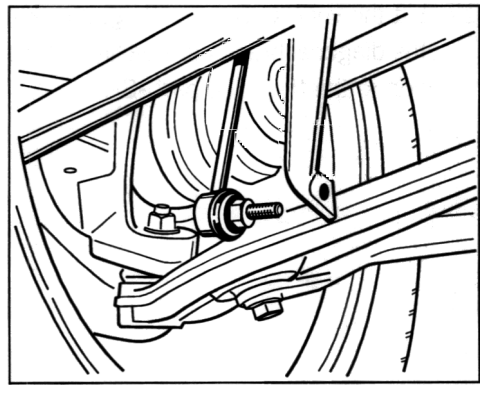
18. Undo the fastening screw **-C-** and the collar nuts **-D-** and remove the diagonal braces **-B-** together with the holder **-E-**.
19. Remove stabilizer.



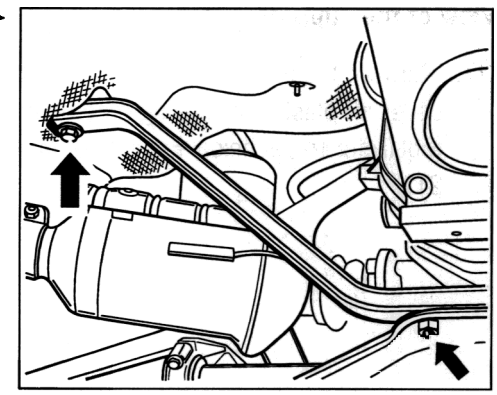
20. To do so, unscrew the two fastening screws at each of the two bearing surfaces on the left and right.



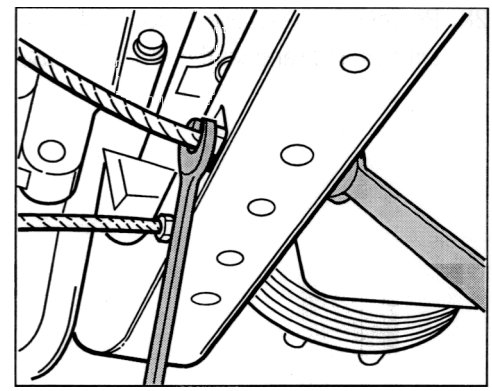
21. Unscrew the stabilizer on the left and right of the links.



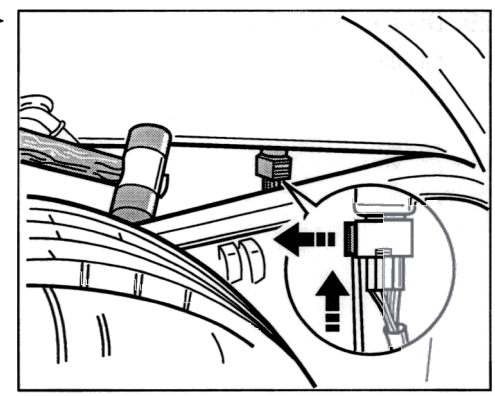
22. Detach rear cross member (aluminium V-member) on the body. ►



23. Undo the cable. Undo the engine cable on the rear-axle support. The cable must be countered with a suitable wrench and must not be twisted. ►
24. Undo halfshafts. To do so, undo the fastening screws of the halfshafts on the transmission. Fit protection on to the halfshafts.



25. Unclip and detach the oxygen sensor plug connection from the holders of the rear-axle support. On an OBDII vehicle, additionally disconnect the oxygen sensor plug connection in the rear wing area. Press the heat shield aside and disconnect the plugs. ►
26. Remove rear mufflers. To do so, secure the rear mufflers with a transmission jack. Then undo the flange connection between the catalytic converters and the exhaust manifold. Undo the three hexagon-head bolts on the exhaust bracket.

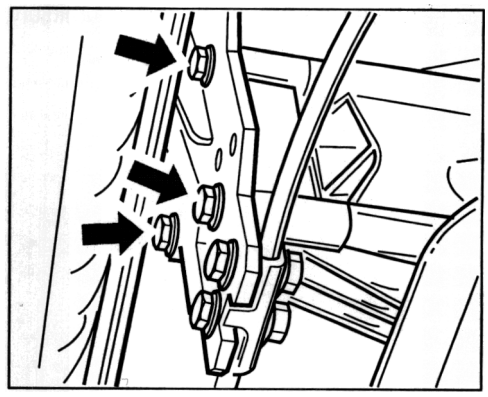


Note!

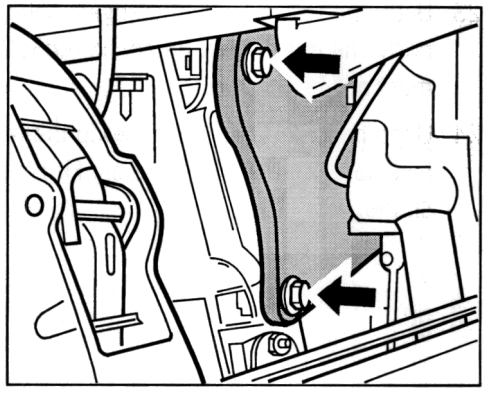
- *When lowering, do not damage the oxygen sensors, cables and plugs.*
- *Attach protective sleeves around the oxygen sensor plugs.*

View of the support

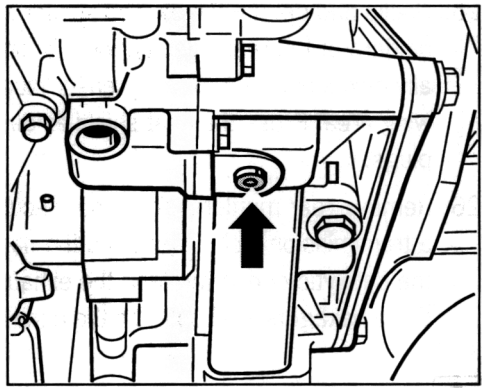
27 Remove the front lining in the rear luggage compartment. Lever off plastic clips using a commercially available removal tool (refer to Technical Equipment Manual, Chapter 2.4, No. 21).



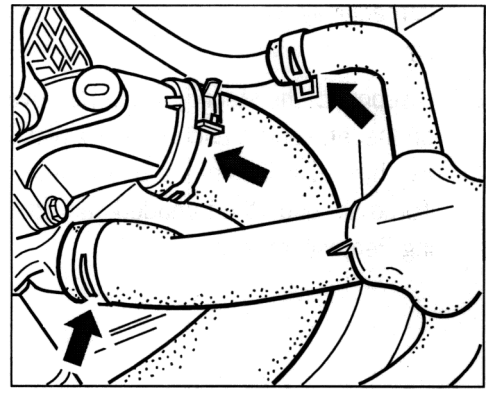
28. Remove the rear-axle support. Unscrew the four fastening screws and remove the rear-axle support to one side.



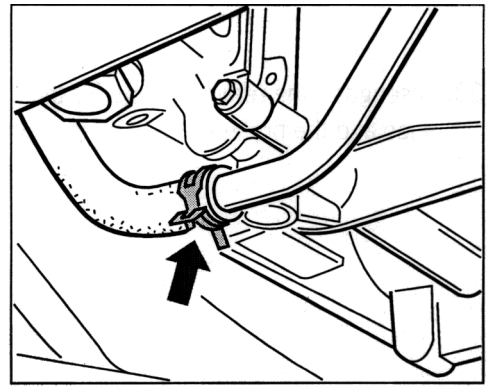
29. Drain coolant. To do so, remove the screw plug of the coolant circuit on the coolant guide housing. Collect coolant in a clean container.



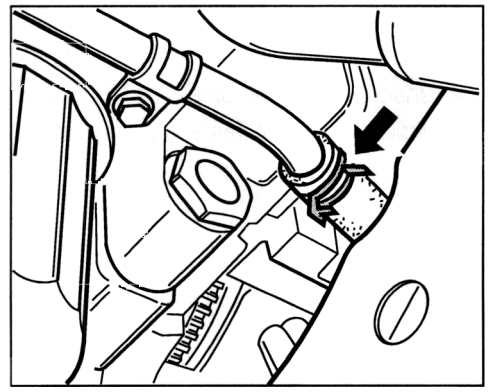
30. Disconnect coolant hoses. Open the supply and return lines for coolant on the engine and pull them off. Then close all openings. Collect emerging coolant in a clean container.



Open spring band clamp



Pull off the hose



Caution!

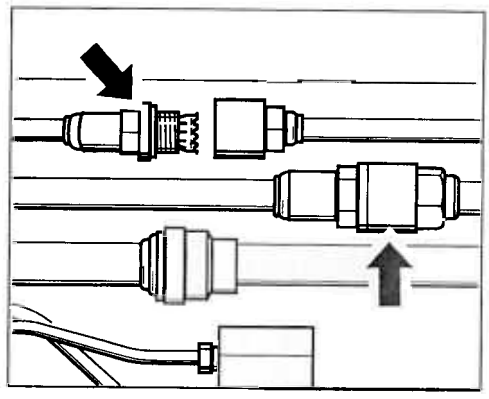
Danger of fire!

- ***Collect emerging fuel.***
- ***Avoid ignition sources and naked flames.***

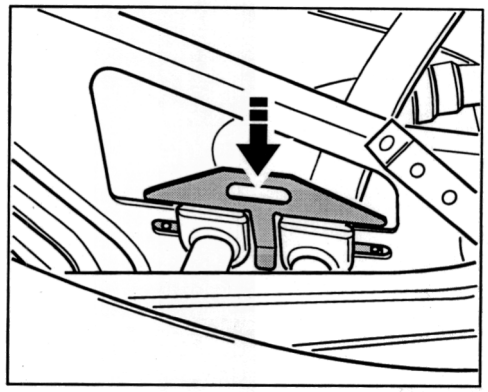
31. Detach the fuel return line. Disconnect the fuel return line under the vehicle floor by pressing gently on the button and pull apart. Collect emerging fuel. Close off the open ends of the line

immediately. Then open the holder on the body and remove the line.

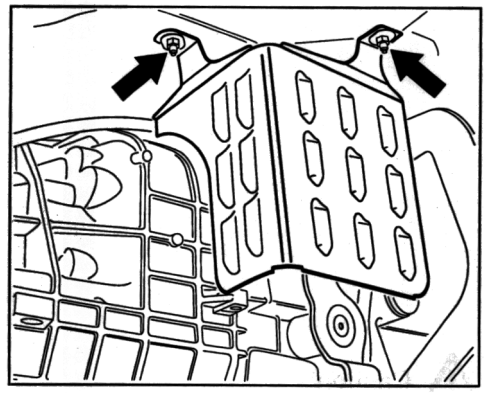
32. Disconnect the steering lines. Remove the small undersealing on the left vehicle underside (six plastic nuts). Disconnect the two hydraulic lines of the power steering on the vehicle floor. To do so, undo the threaded part and disconnect. Any emerging Pentosin must be collected.



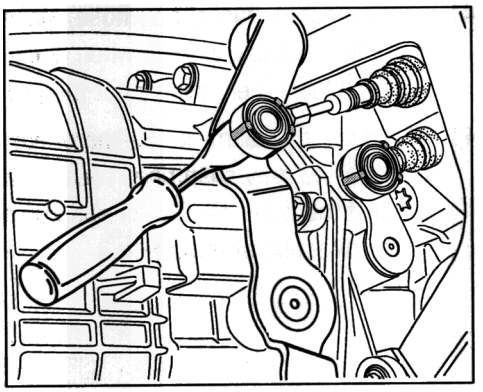
33. Disengage the retaining clips for the power-assisted steering lines and the brake vacuum hose and remove the lines.



34. Unscrew the heat shield on the transmission. To do so, unscrew the two fastening nuts and remove the plate.



35. Disengage shift cables on the transmission. Disengage the cables with the commercially available tool (see Workshop Equipment Manual, Chapter 2.4, No.: 21).
36. Detach the shift cables. Unclip the shift cables on the transmission mount. Then pull the shift cables upwards out of the engine compartment and set them aside.

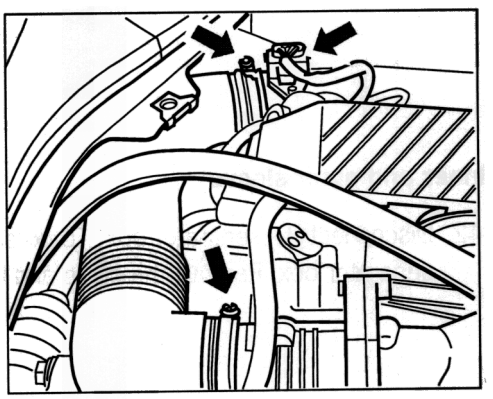


Warning!

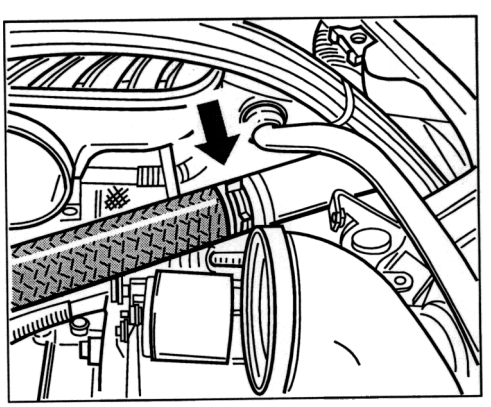
Risk of damage!

- ***When the slave cylinder is removed, do not actuate the clutch again.***

37. Uncouple clutch slave cylinder. To do so, unscrew the fastening screw and remove the clutch slave cylinder. Tie the cylinder with a wire.
38. Disconnect the electric plug on the hot film mass air flow sensor. Then disconnect the connecting hose between the hot film mass air flow sensor and the throttle body. To do so, disconnect the hose clamp on the hot film mass air flow sensor.

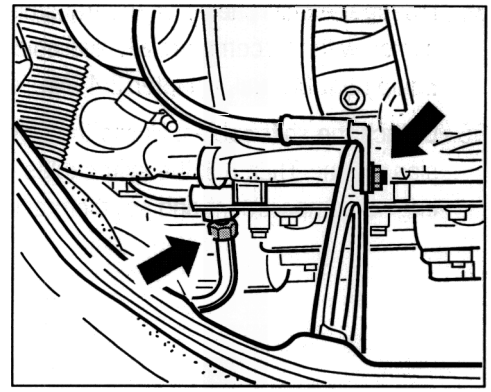


39. Press the spring band clamp on the oil filler hose apart and push it aside. Pull off the oil filler hose; heat, if necessary.

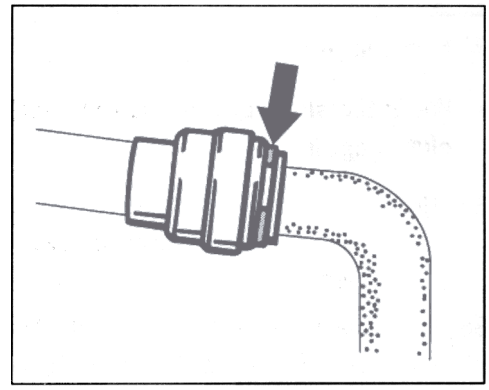


40. Disconnect the fuel supply hose. Make sure without fail to counter with a suitable wrench when doing this. Collect emerging residual fuel. Then disconnect the ground cable.

41. Disconnect vacuum line for the brake booster. To do so, remove the grey snap ring. Then push the inner sleeve **-1-** against the outer sleeve **-2-** and pull off both sleeves together in the direction of the arrow.

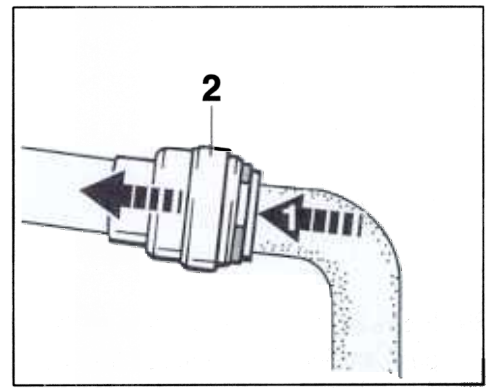


Snap ring

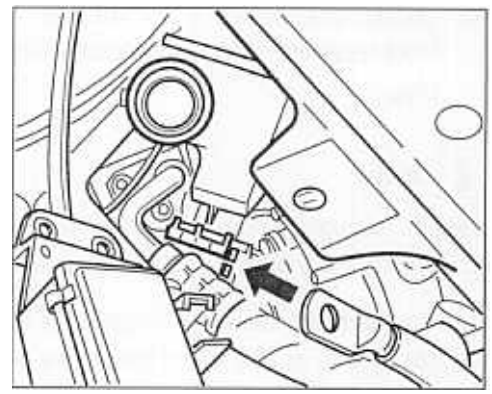


Inner and outer sleeve

42. Disconnect B+ separator box. To do so, undo the nut in the separator box. Remove the cable and lay to one side.



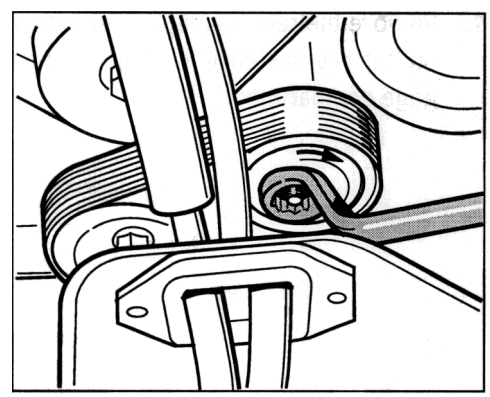
43. Remove supply tank of the power steering system. To do so, suck fluid out as much as possible. Then open the bayonet lock on the bottom of the expansion tank and remove the tank. Close the opening in the servo pump with a clean plug.



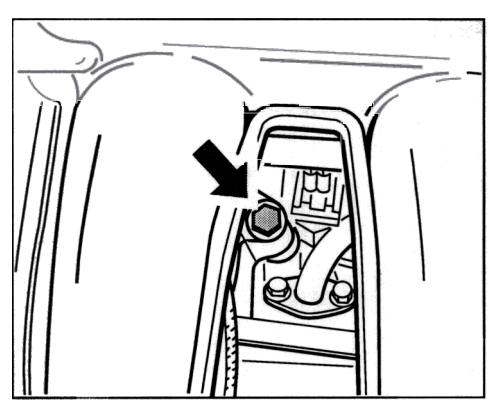
Note!

- *In vehicles with air conditioning, the points 44 to 47 must also be carried out.*
- *Never evacuate and open the air-conditioning circuit unless this is absolutely necessary.*

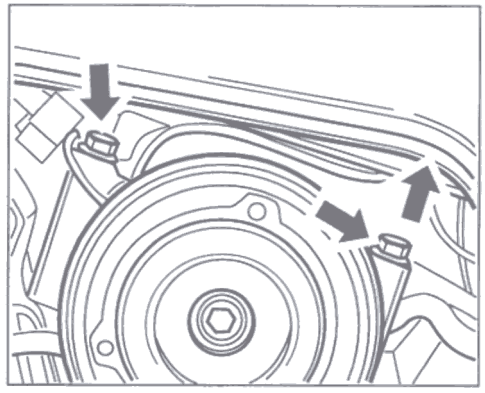
44. Remove drive belt. Mark the running direction of the drive belt with a coloured pen. Slacken the belt. Slacken belt by turning the tensioning pulley (wrench size 24 mm) clockwise, hold still and simultaneously take the belt off the drive pulleys.



45. Undo the rear fastening screw of the air-conditioning compressor from above. The screw is positioned between the intake manifolds of the fifth and sixth cylinders.



46. Loosen air-conditioning compressor. To do so, undo the two front fastening screws **-(arrows)-**. Disconnect the electrical plug.

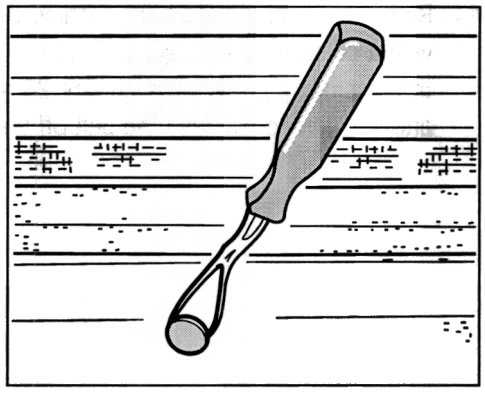


Note!

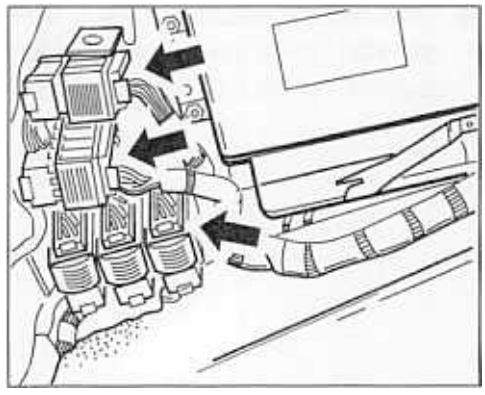
The air-conditioning compressor can be removed from the vehicle more easily if the engine has already been lowered.

47. Set the air-conditioning compressor with the hoses connected to one side or lift it out of the engine compartment and set it on a suitable base.

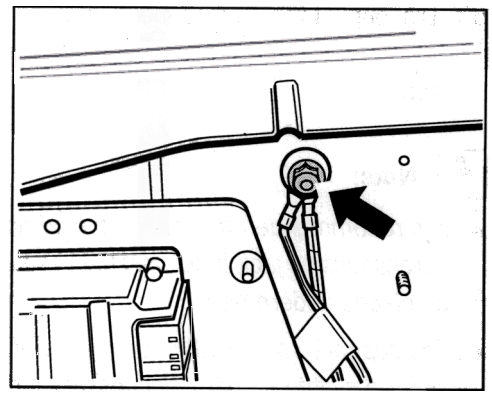
48. Remove the rear luggage compartment lining. To do so, lever out the rear fastening clips and remove the lining from the luggage compartment.



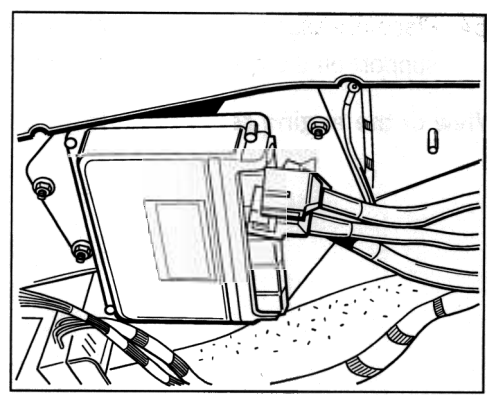
49. Disconnect the plug connections (X3/1, X3/2 and X59) of the engine wiring harness. To do so, raise the lock at the side and pull the plug out.



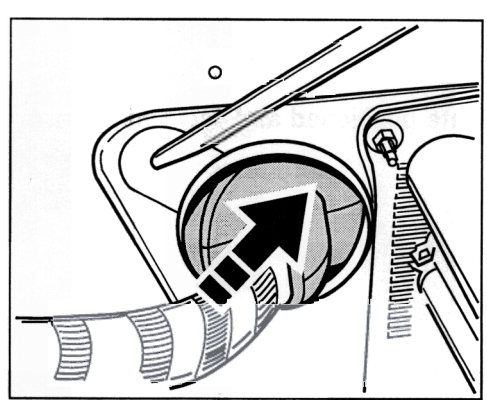
50. Lock the ground point of the engine control module.



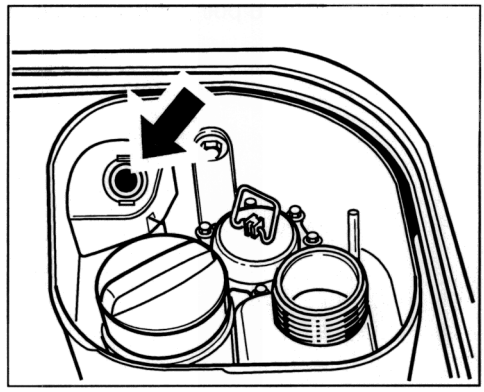
51. Unplug the engine control module. Open the topmost plug by actuating the side button and pull out. Remove the other plugs from the top down. To do so, press the locking button in and push the locking bar upwards.



52. Uncover the engine wiring harness. To do so, press the rubber sleeve on the luggage compartment rear wall inwards and guide the wiring harness towards the engine compartment, if the engine is to be lowered later.



53. Disconnect the plug connection at the guide tube of the oil dipstick. To do so, press the two tabs together and unclip the tube.



Note!

- *It is recommended to position the complete retainer plate using a transmission jack first. Only then should the workshop car jack be placed underneath.*
- *The support C1 should rest against the transmission oil pan under a slight pre-load. If necessary, fit the included spacer plate.*

54. Place pre-assembled engine retainer plate with transmission support on the crankcase or transmission.

View of the engine retainer plate

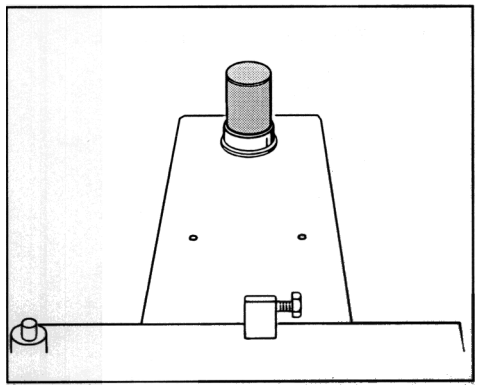
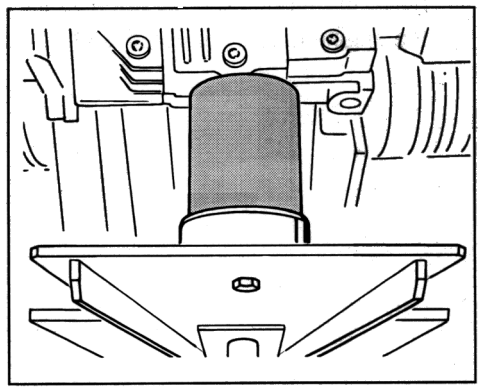
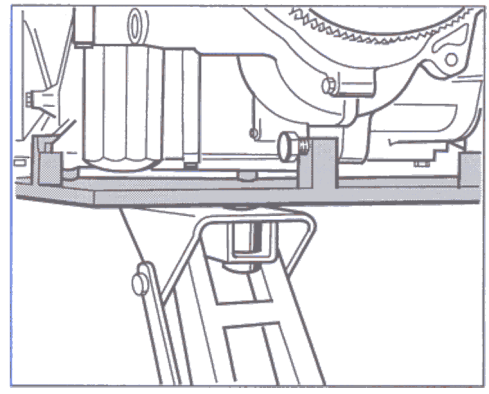


Plate positioned and secured



Car jack placed underneath

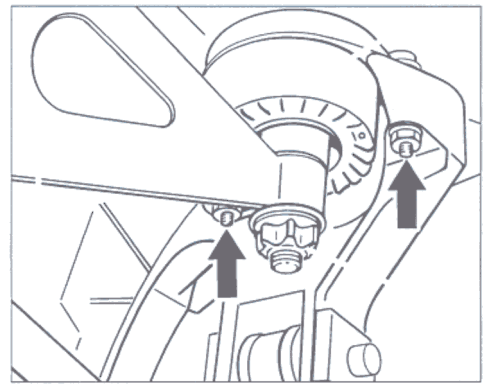


Caution!

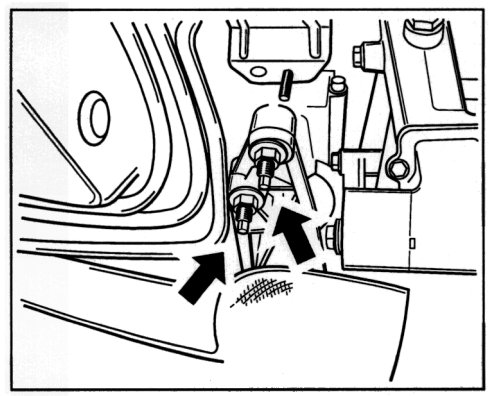
Risk of damage!

When undoing the multi-tooth nut, the mount is destroyed!

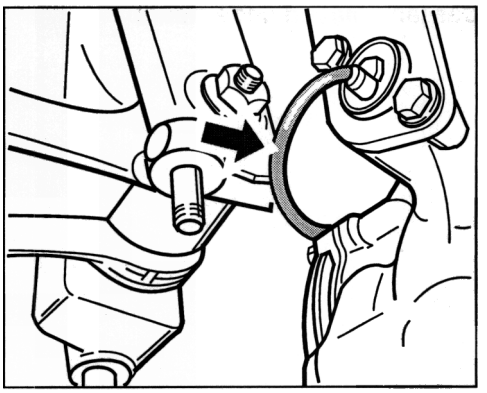
55. Remove the transmission support with the hydraulic mounts. Undo the two fastening nuts on the left and right.



56. Undo the front engine carrier. To do so, unscrew the four fastening nuts.
57. Lower the engine-transmission unit carefully. Ensure that there is sufficient clearance for the components. The engine wiring harness must be guided during the lowering procedure.



Pay attention to the VarioCam cable

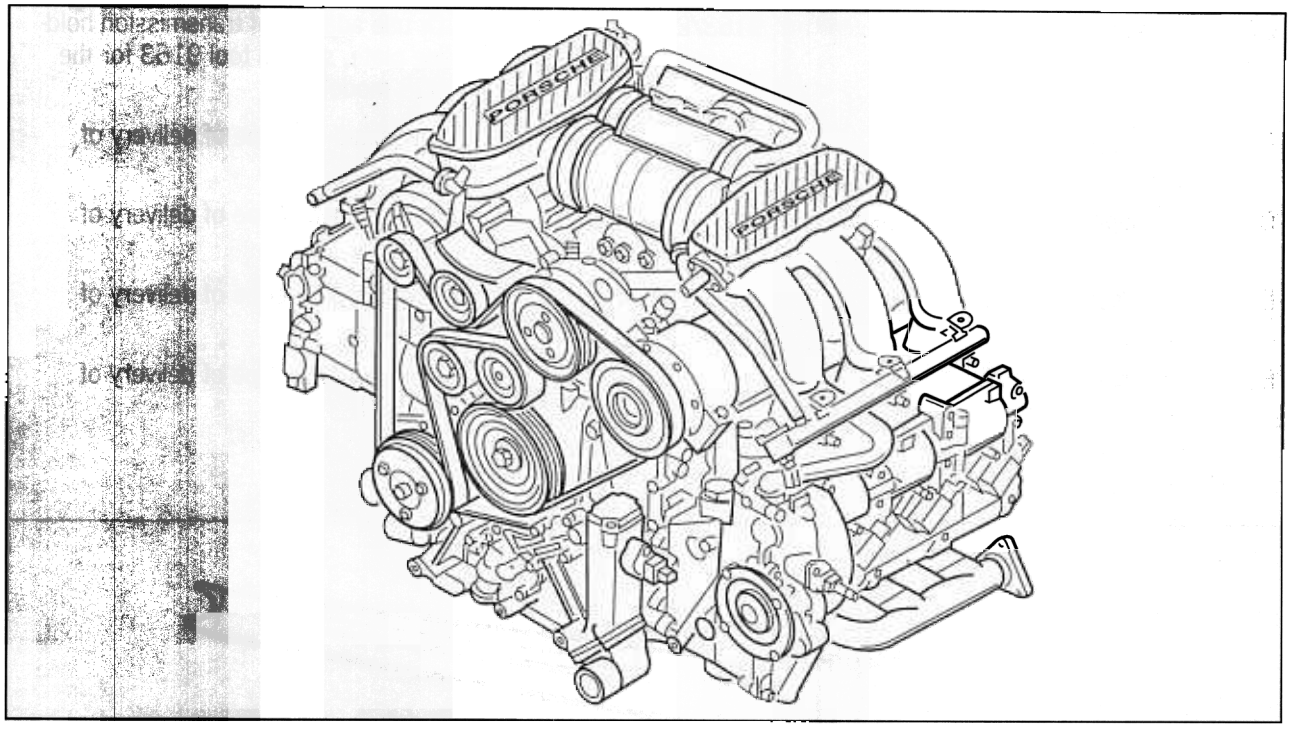


Warning!

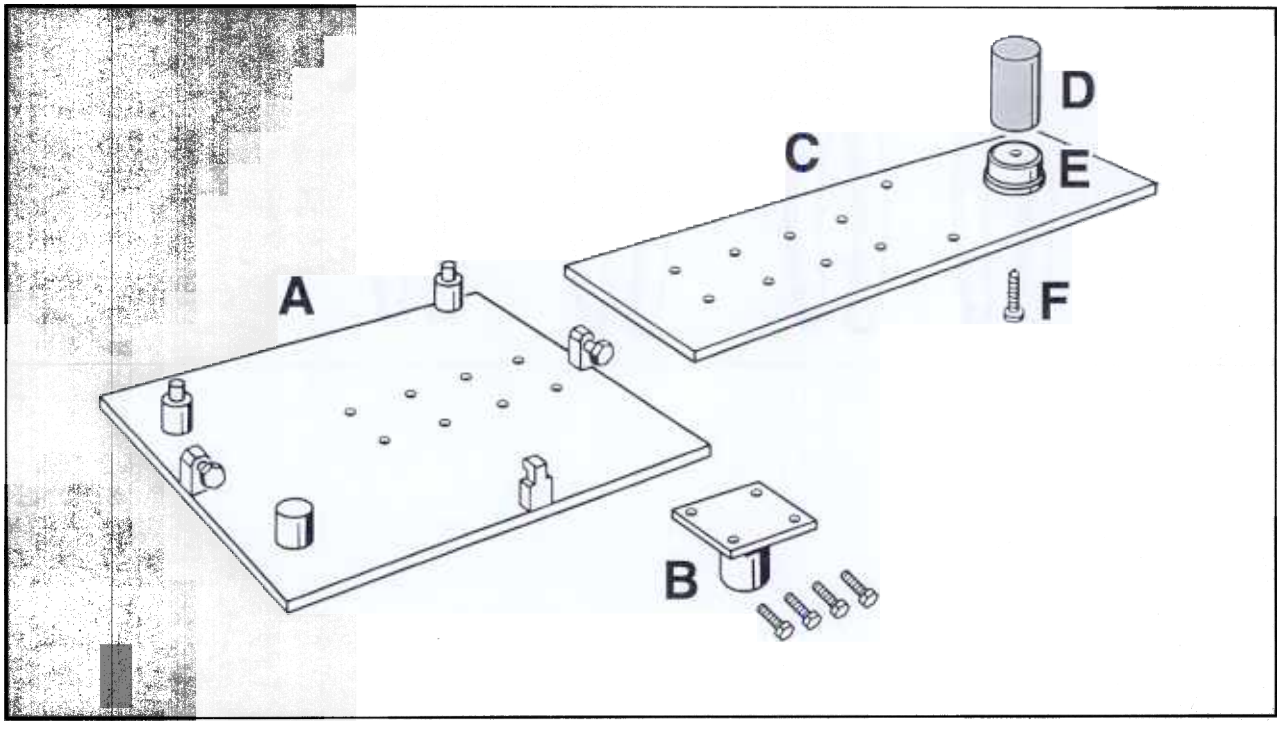
Risk of damage!

Only place the vehicle on its wheels or push it after the rear-axle support, the sheetmetal brace and both the diagonal braces have been installed.

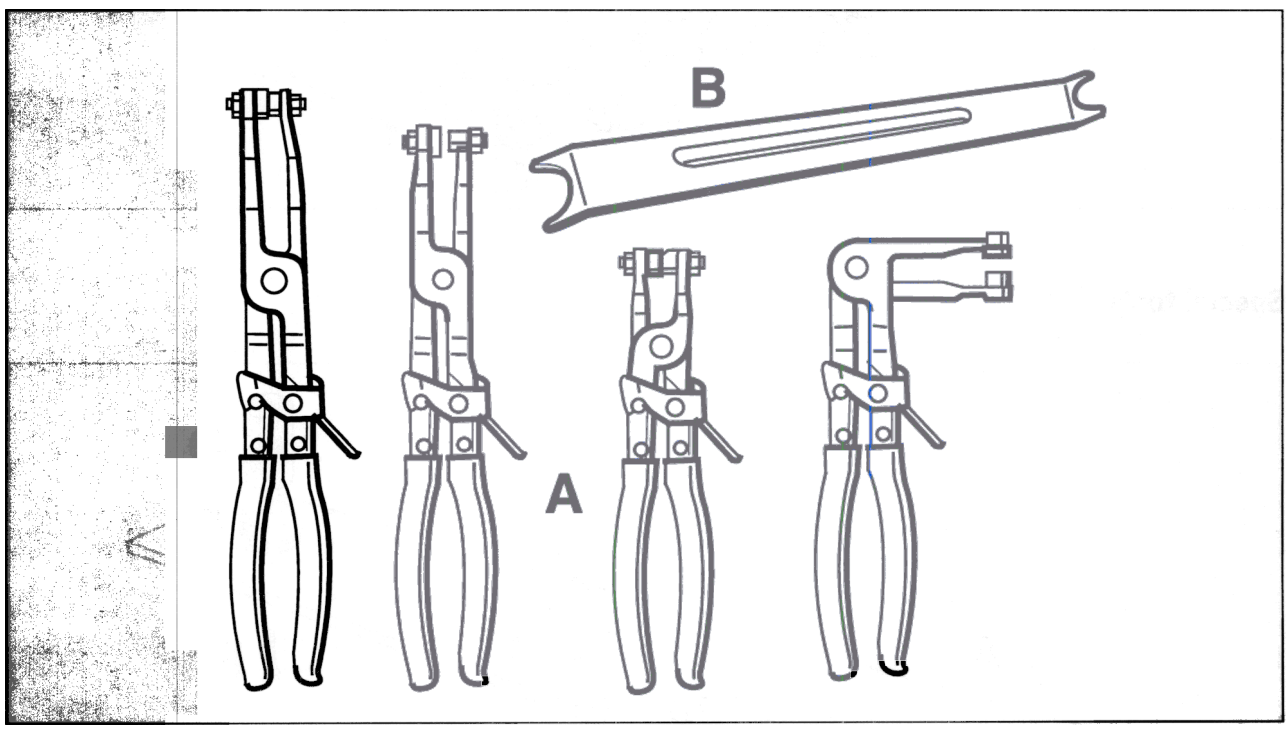
Installing engine, M96/21 (3.2 l) and M96/22 (2.7 l) with manual transmission



Special tools



Item	Designation	Special tool	Explanation
		9592	In conjunction with workshop jack
		9163/2	Or use adapter of transmission holding plate, special tool 9163 for the 928 model
C	Support plate	9592/2	Contained in scope of delivery of 9592/1
D	Support for manual transmission		Contained in scope of delivery of 9592/1
E	Pressure piece		Contained in scope of delivery of 9592/1
	Screw M8 x 25		Contained in scope of delivery of 9592/1



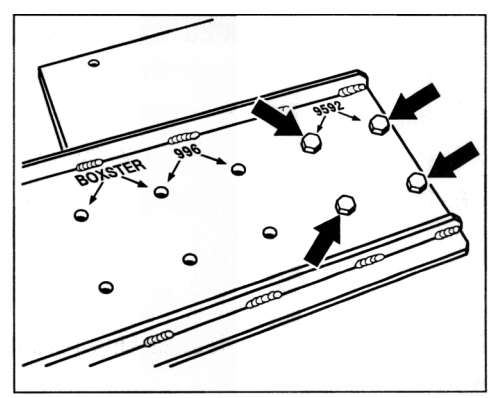
Item	Designation	Special tool	Explanation
	Spring-band clamp pliers		Refer to Workshop Equipment Manual, Chapter 2.4, No.: 72
B	Testing tool for plug-in couplings	9623	Used to check whether the plug-in couplings are seated properly. Suitable for pressure and return lines (nominal diameter 6 and nominal diameter 10)

Adjusting tool

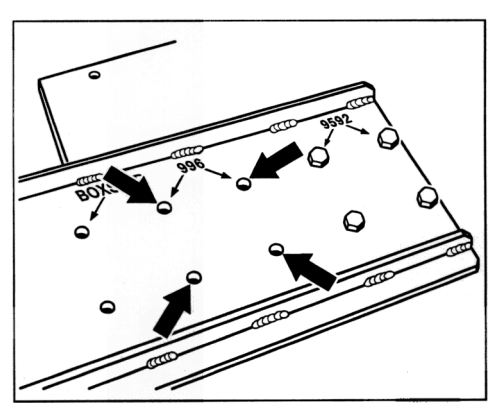
Note!

If the special tool 9592 is being used for the first time, (four) additional threaded holes must be applied.

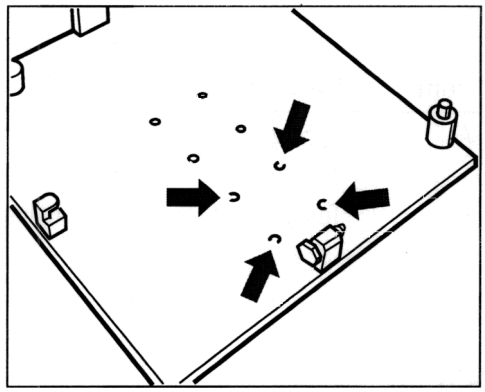
1. Lay the support plate 9592/1 on the rear of the retainer plate 9592 and fasten with four hexagon-head bolts M8 x 25.



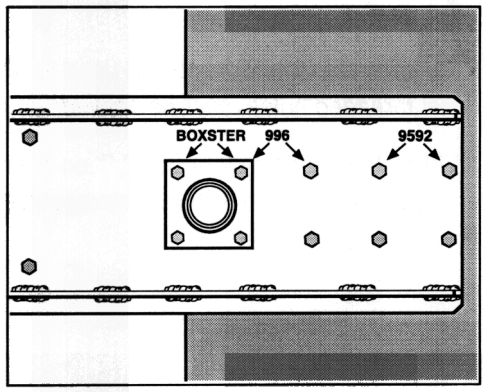
2. Countersink the retainer plate at the designated bores **-arrows-** with a 9 mm drill bit. The support plate serves as the drilling template.



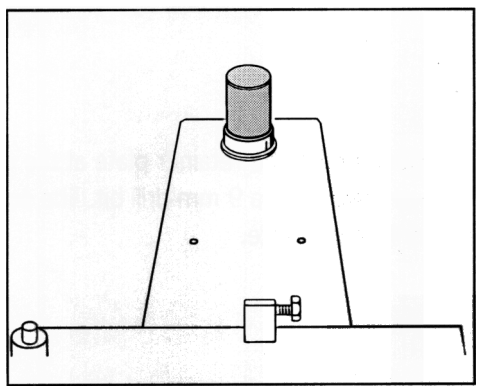
3. Drill through the countersunk bores on the retainer plate with a drill bit sized 6.8 mm and then cut an M8 thread.



4. Fasten the special tool adapter 9163/2 with a hexagon-head bolt M8 x 25 (bolt quality 10.9) and hexagon-head bolts M8 x 16 (bolt quality 10.9) at the designated positions "Boxster". The adapter and the support plate are fastened on the retainer plate with the M8 x 25 hexagon-head bolts. The M8 x 16 hexagon head bolts connect the adapter with the support plate.
5. Support for Tiptronic transmission with three M6 x 20 (2 ea.) and M8 x 25 (1 ea.) wood screws.
6. Fasten complete retainer plate on the workshop jack.

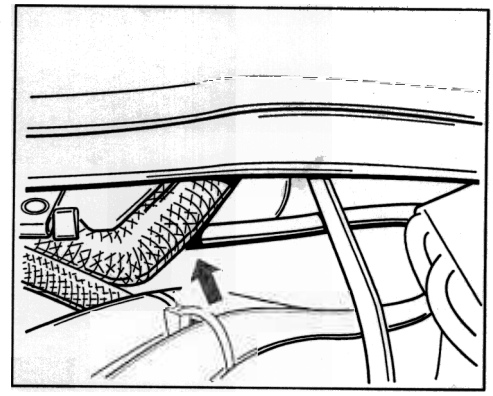


Drawing shows complete engine retainer plate fitted on the workshop jack.



Special notes

- Check the fuel hose for correct routing. The fuel hose is routed behind the engine wiring harness.
- When installing the rear-axle parts, it is essential to observe the correct sequence. The sheetmetal brace should be installed first, then the diagonal brace and finally the rear-axle support.
- The V-brace must be fitted before the exhaust system is installed.
- Finally, perform a suspension alignment.
- Read out fault memory.

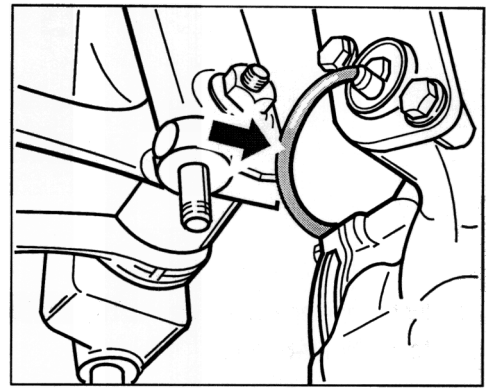


Installing engine

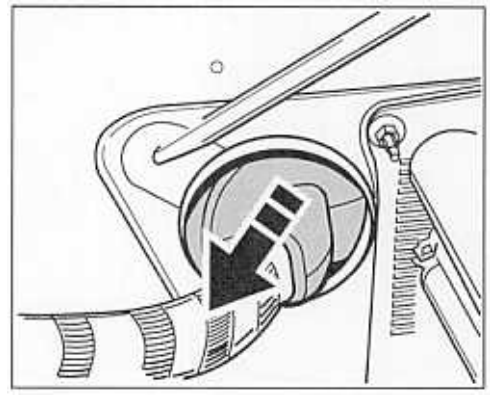
Note!

In order to facilitate the fitting of the air-conditioning compressor, it should be moved back into its installation position during the running-in of the engine.

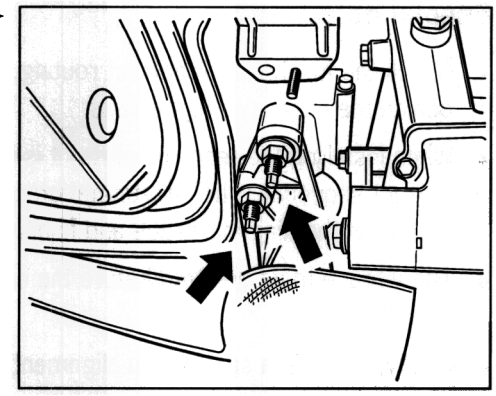
1. Lift the engine-transmission unit carefully and in steps. Have a second person observe the engine-transmission clearance at the same time. When lifting, pay particular attention to the clearance between the rear-axle longitudinal support and the VarioCam cable. Place the air-conditioning compressor in its installation position at this stage.



2. Push the engine wiring harness through the bulkhead and into the luggage compartment before the final installation position is reached.



3. Tighten engine mount. Tighten the four engine mount fastening screws to 46 Nm (34 ftlb.). ►

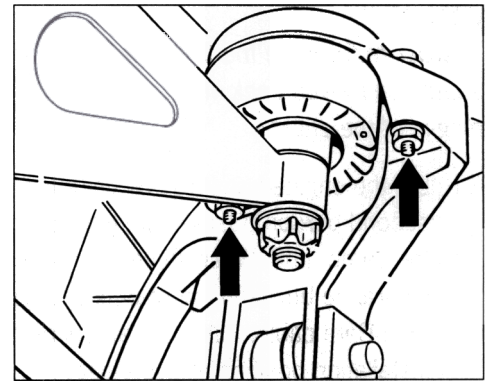


Warning!

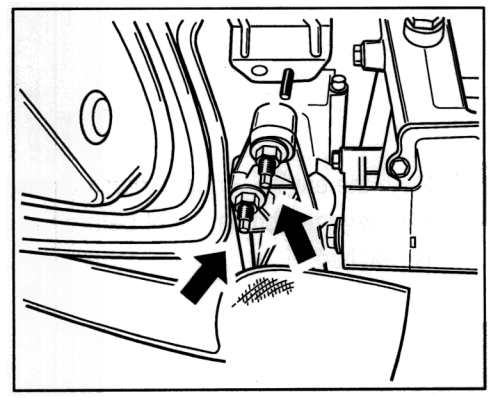
Risk of damage!

- ***Do not turn the multiple-tooth nut -C-!***

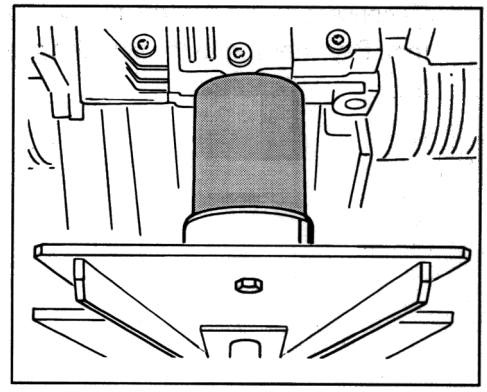
4. Install the transmission carrier and the hydraulic mount again. The M8 screws are tightened to 33 Nm (24 ftlb.). ►



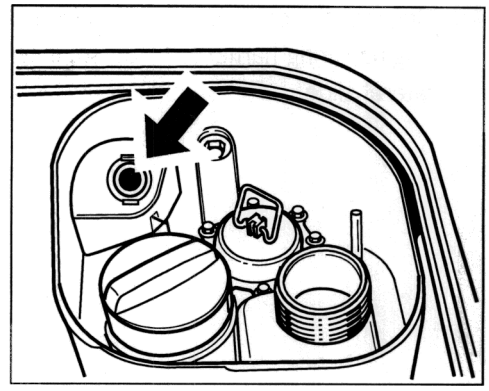
5. Install engine carrier again. Tighten the four fastening screws to 65 Nm (48 ftlb.). ►



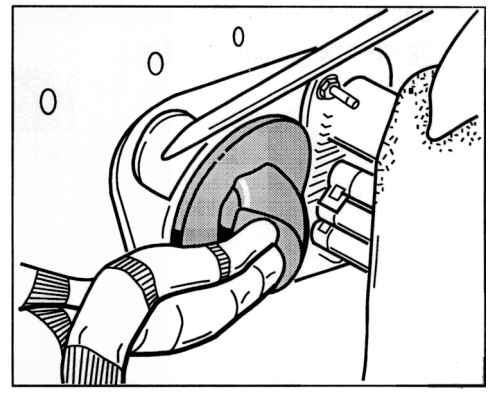
6. Remove the engine-transmission retainer plate. As soon as the engine has been fastened again, the car jack and the retainer plate can be removed.



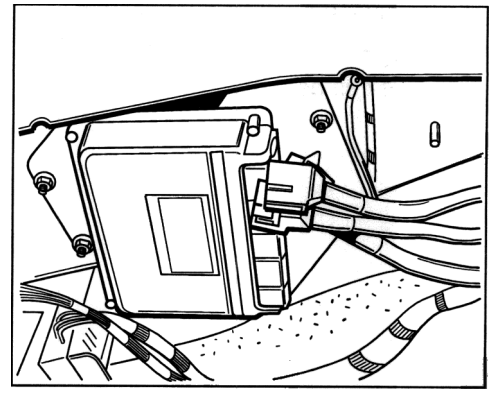
Clip the guide tube of the oil dipstick into the socket.



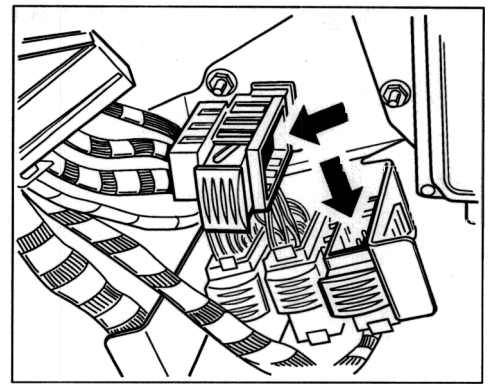
8. Fit the rubber sleeve of the wiring harness again.



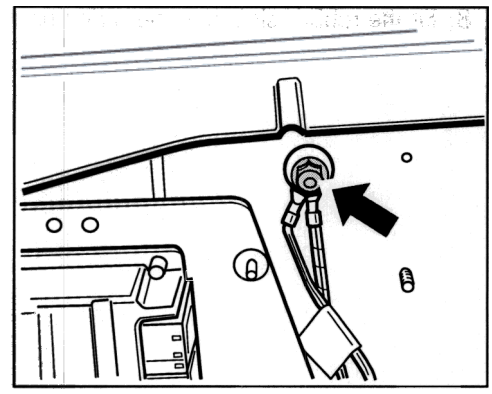
9. Re-connect engine control module. To do so, start at the bottom. Pay attention to the plug designations on the control module.



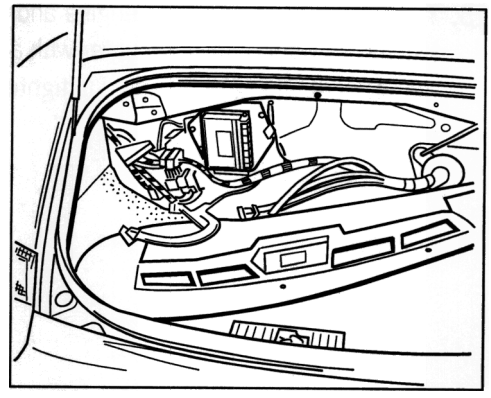
10. Connect the plug connections (X3/1, X3/2 and X59) of the engine wiring harness. To do so, insert the plug and lock the lateral slide.



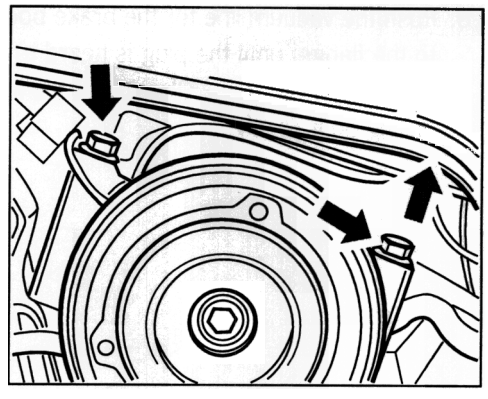
11. Connect the ground point of the control module again and tighten the fastening nut.



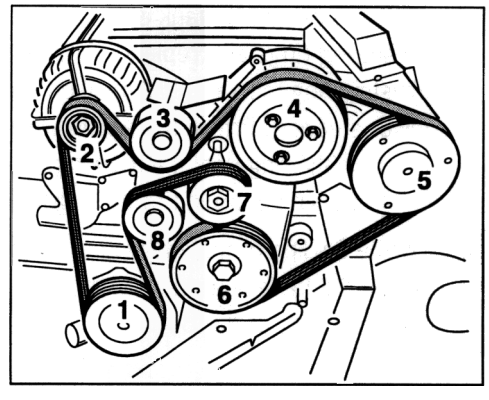
12. Install the luggage compartment lining of the rear luggage compartment.



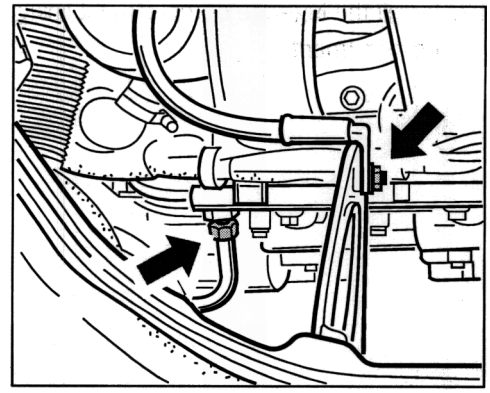
13. Screw air-conditioning compressor tight. Tighten the three fastening screws to 23 Nm (17 ftlb.).



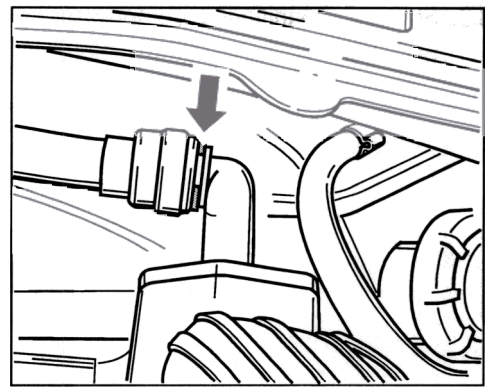
14. Check the drive belt for damage and replace it if necessary. Fit the belt in its original running direction once more. The fitting sequence is shown in the following illustration.



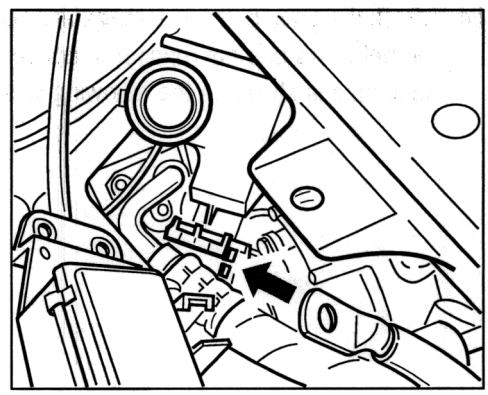
15. Tighten the fuel line on the engine and the ground cable again. ► Make sure without fail to counter with a wrench when tightening the fuel line. The ground cable is tightened with 23 Nm (17 ftlb.).



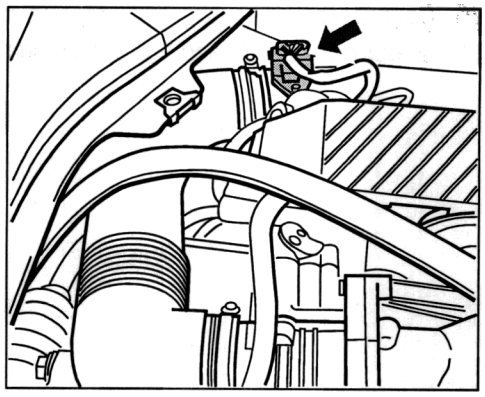
16. Push the vacuum line for the brake booster in a straight line on ► to the flange, until the plug is heard to engage. Then install the grey snap ring again. Check that the line is seated properly by pulling on it gently.



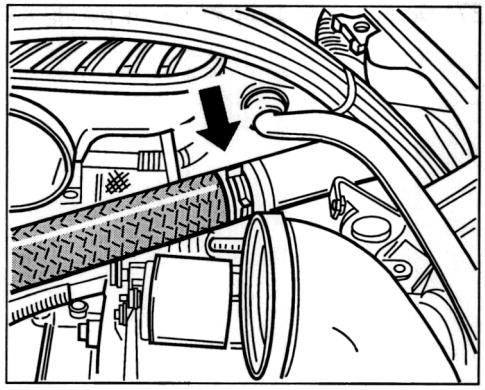
17. Install the expansion tank of the power steering again. Check ► the sealing rings and replace, if necessary. Turn the lower adjusting ring to its original position and position the tank of the power steering. Press the tank downwards and at the same time turn the ring until the markings coincide. Then fill the tank with Pentosin according to the regulations.
18. Lay the B+ line of the alternator over the connecting bolt and tighten the fastening screw with 10 Nm (7.5 ftlb.). Close the protective cap of the B+ box.



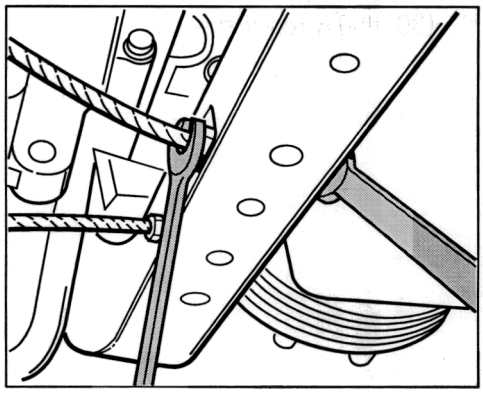
19. Re-connect hot film mass air flow meter. Connect the connecting tube between the hot film mass air flow meter and the intake system and tighten the hose clamp.



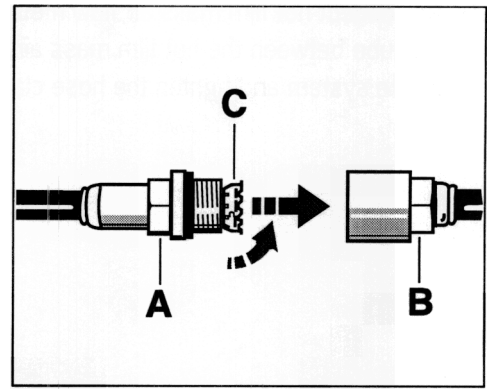
20. Fit the oil filler line. Push the oil filler line back onto the flange and secure with a spring band clamp.
21. Re-fit clutch slave cylinder. Insert the cylinder back into the opening in the transmission. Tighten the fastening screw with 23 Nm (17 ftlb.).
22. Lay shift cables. Lay the shift cables in the engine compartment once more and clip them into the holder on the transmission. Then check once more that they are seated properly. Finally, press the shift cables back into the shift linkage. Check that the shift cables are installed correctly.
23. Screw heat shield tight. Fit the shield over the Tucker bolts and tighten the two sheetmetal nuts.
24. Screw the drive shafts on to the transmission again with new screws. The tightening torque is 39 Nm (29 ftlb.) for the Boxster 2.7 l and 81 Nm (60 ftlb.) for the Boxster 3.2 l. Subsequently remove the protective sheath.



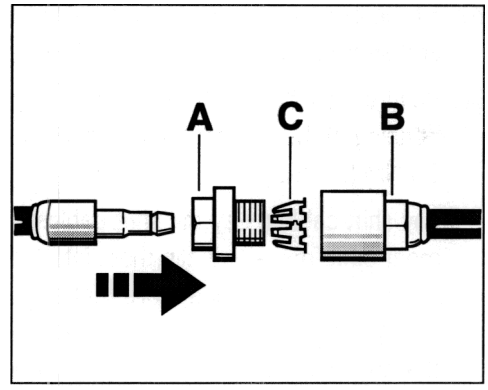
25. Re-tighten cable. Fit the engine cable through the rear-axle support again and tighten the fastening nuts. Make sure to counter with a wrench when tightening. The tightening torque is 23 Nm (17 ftlb.).



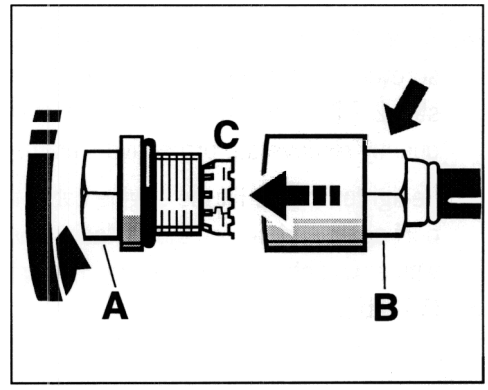
26. Connect the power-assisted steering lines. To do so, tilt the holder on one side and pull out simultaneously.



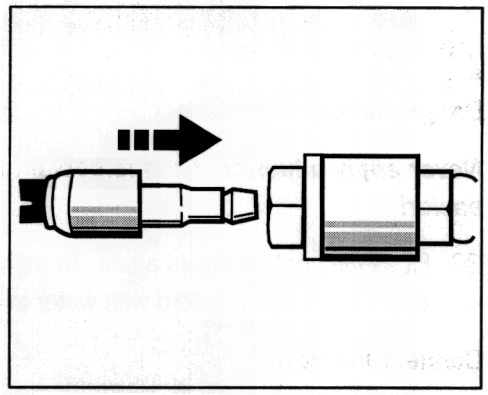
27. Detach threaded part -**A**- by pulling it off the nipple.



28. Insert the holder - **C** - into the threaded part -**A** - and screw both into the plug-in coupling - **B** - and tighten. Make sure to counter with a wrench when tightening. The tightening torque for the steering pressure line is 30 Nm (22 ftlb.) (wrench size 15). The tightening torque for the steering return line is 40 Nm (30 ftlb.) (wrench size 19).



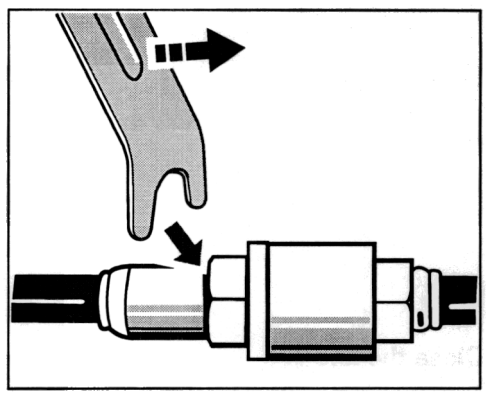
29. Insert the screwed plug into the plug-in coupling in a straight line. The plug must audibly engage in the holder.



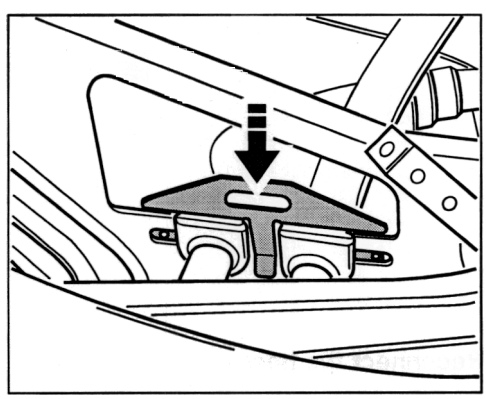
Note!

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.

30. The correct engagement of the plug-in couplings should be checked using the special tool 9623. To check this, insert the special tool 9623 between the plug-in coupling and the screwed plug and tilt the tool slightly. The plug must not slide out.



31. Install the servo lines, the return line and the vacuum hose for the brake booster again and insert the retaining clip.



Caution!

Risk of damage!

The fuel lines must not be kinked.

32. Connect the fuel lines. Re-connect the fuel lines on the vehicle underbody. The plug must engage audibly. Check correct seating by pulling gently.

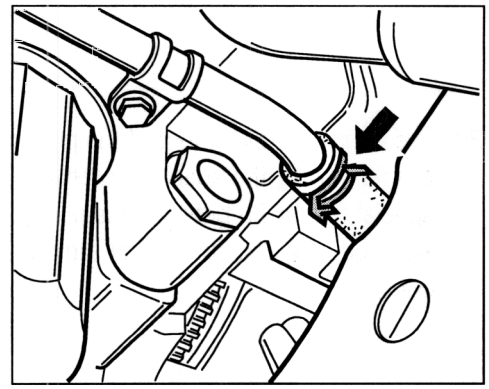
⚠ Caution!

Danger of slipping hoses.

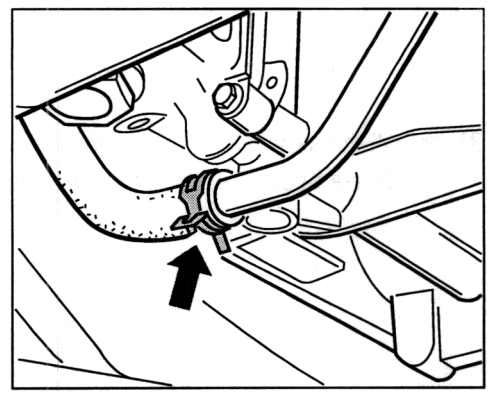
Never apply a lubricant to the coolant hoses to make fitting easier!

33. Fit all the coolant hoses again. To make fitting easier, the coolant hoses can be wetted with water in the fitting area.

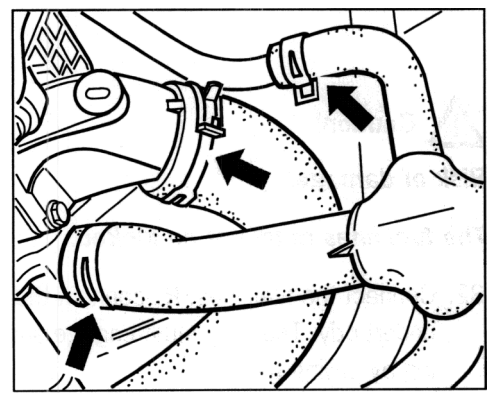
Connect the hose



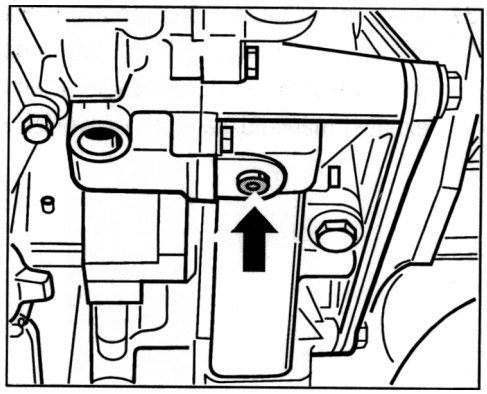
Close the line



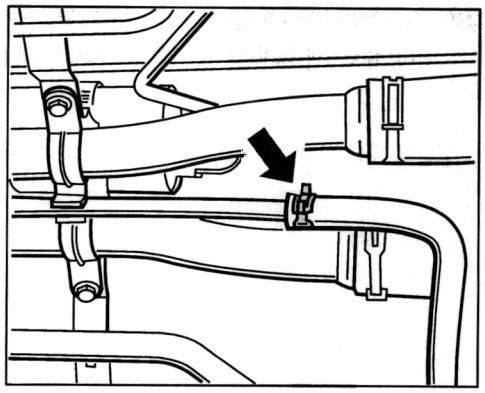
Reconnect the hoses



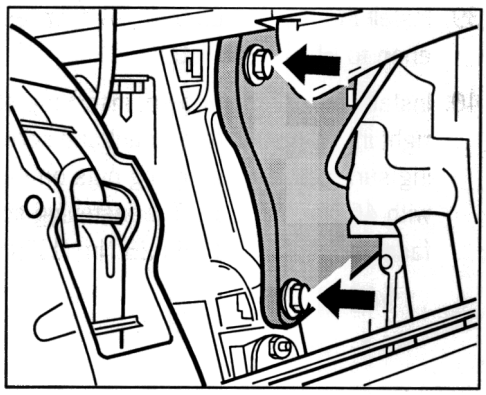
34. Check the coolant drain plug. If the drain plug is removed, it should be equipped with a new seal and re-mounted. The tightening torque for the screw is from 10 to 15 Nm (7.5 to 11 ftlb.).



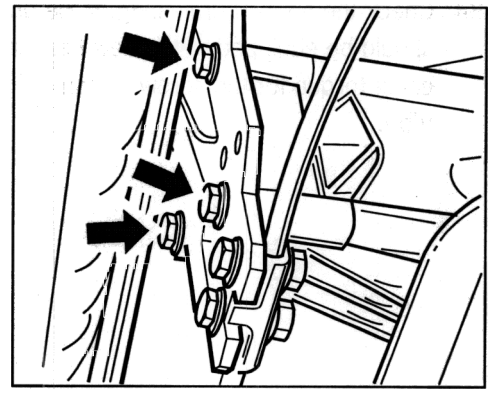
35. Fit vent line again.



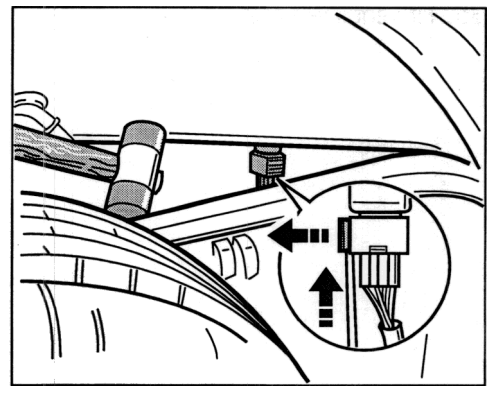
36. Install rear-axle support again. The four fastening screws are tightened to 65 Nm (48 ftlb.).



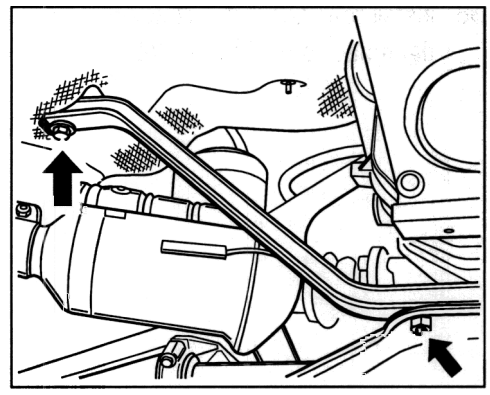
37. Move the exhaust system to its installation position again. In the process, replace all the seals at opened points. Tighten the three hexagon-head bolts again. Then tighten the screws on the exhaust manifold/catalytic converter with 25 Nm (18 ftlb.).



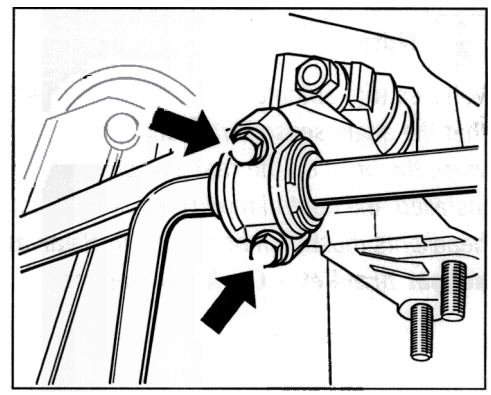
38. Connect the oxygen sensor cables. Connect the plugs and engage the holder in the rear-axle support.



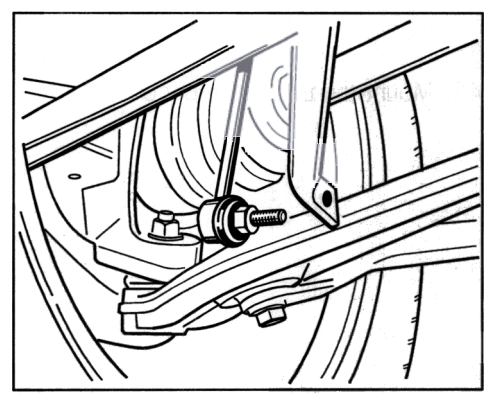
39. Install the rear V-member. The four fastening screws are tightened to 65 Nm (48 ftlb.).
40. Install stabilizer. To do so, insert the stabilizer on the left and right into the stabilizer mount and screw it tight to the two bearing surfaces. The fastening nuts on the mount are tightened with 46 Nm (34 ftlb.). The fastening screws on the bearing surfaces are tightened with 23 Nm (17 ftlb.).



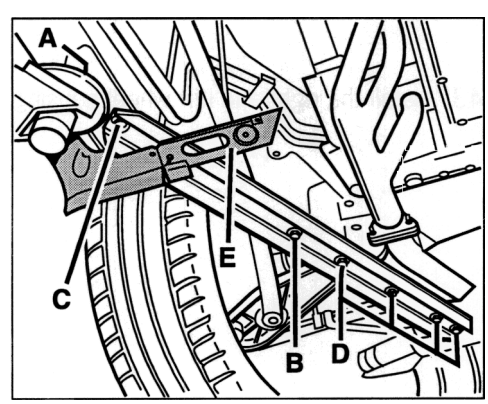
View of one of the two bearing surfaces



View of a stabilizer mount

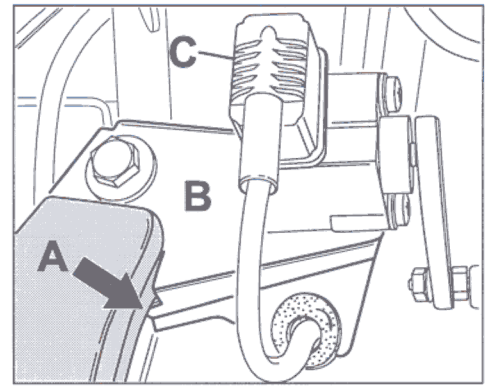


41. Install the sheetmetal brace into the vehicle. Tighten the hexagon nuts with 65 Nm (48 ftlb.) and tighten the fastening screws with 46 Nm (34 ftlb.). Install the two diagonal braces into the vehicle. Tighten the fastening nuts to 65 Nm (48 ftlb.).

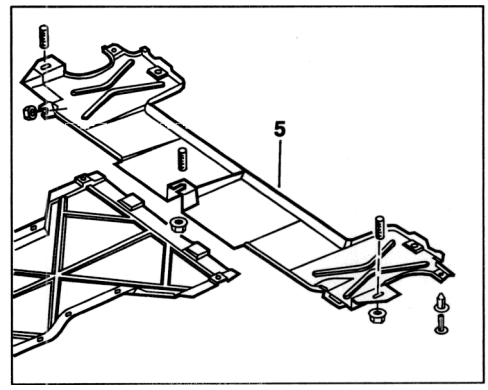


Note!

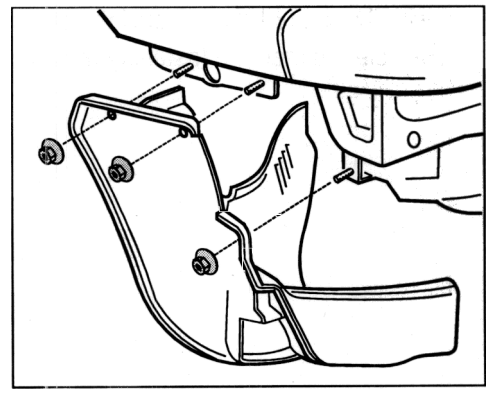
Vehicles with automatic headlight beam adjustment. Bear in mind that the angle sensor bracket (B) must be in contact at the bottom when the bolts on the rear-axle support (A) are tightened. Once installed, the control module must be calibrated with the PST 2. The headlights must then be reset. ***-A- Rear-axle support- -B - Angle sensor bracket- - C - Angle sensor-***



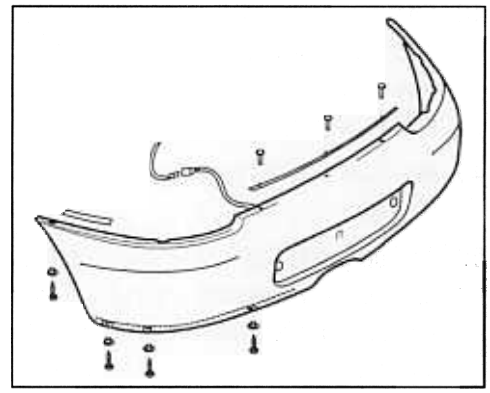
42. Mount the underside panel.



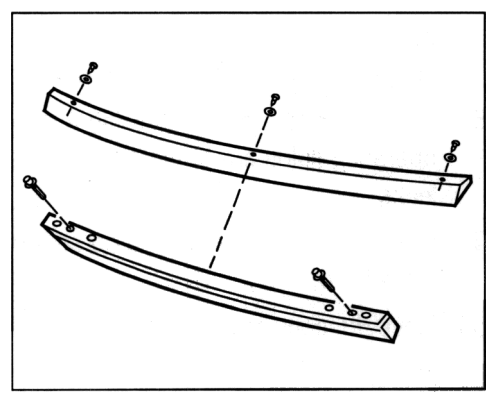
43. Install the right and left wheel housing trims again.



44. Re-install the rear spoiler.



45. Install the rear spoiler again.
46. Re-position the trim of the rear luggage compartment and press in the fastening rivets.

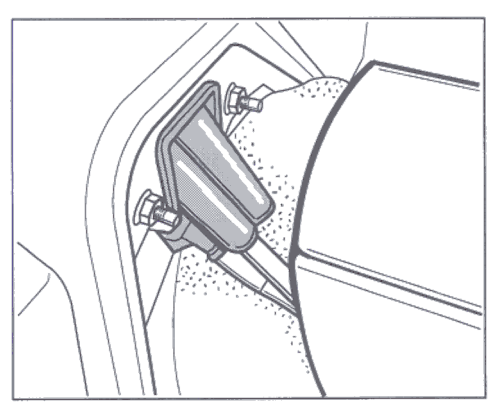


Warning!

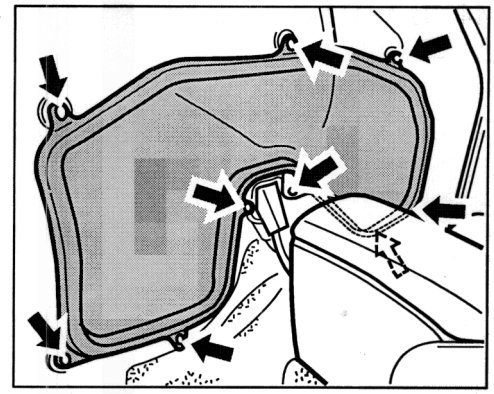
Danger of short circuit!

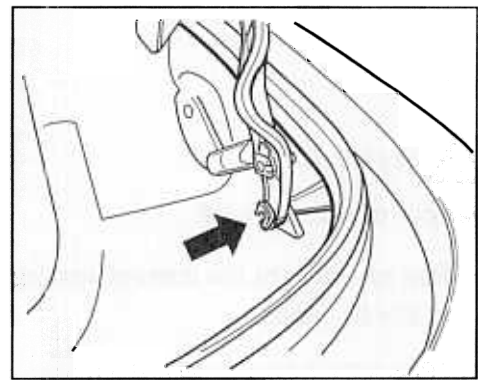
- ***Pay attention to the correct seating of the rubber sleeve of the B+ lead!***

47. Check the rubber sleeve. The rubber sleeve of the B+ lead must be fitted correctly and must not have slipped out of place.



48. Seal off the maintenance openings again. Seal off the upper and rear maintenance openings again. Tighten the seven fastening screws and the two fastening nuts of the rear maintenance opening with 10 Nm (7.5 ftlb.).
49. Re-install the left seat. Tighten the four fastening nuts to 65 Nm (48 ftlb.).
50. Top up operating fluids. Check that all operating fluids (engine oil, Pentosin, coolant) are at the correct level. Both the coolant circuit and the power steering must be bled according to regulations.
51. Connect battery. Connect the battery terminals again and tighten. Subsequently, the fault memories of the vehicle must be read out and the theft codes may possibly have to be entered again. Re-teach the power windows.
52. Carry out a test drive. After the test drive, check that all the operating fluids are at the correct level. Check all circuits for leaks.
53. Fit convertible top again. To do so, take the mandrel out of the fixing bore.
54. Move the convertible top towards the rear until the linkage can be pushed back onto the pin. Then push the retaining clip into place.
55. Close convertible top. To do so, pull the tension bow towards the rear again and engage the tension cables again on the left and right.
56. Engage the cloth covering of the convertible top on the left and right into the retaining lugs.



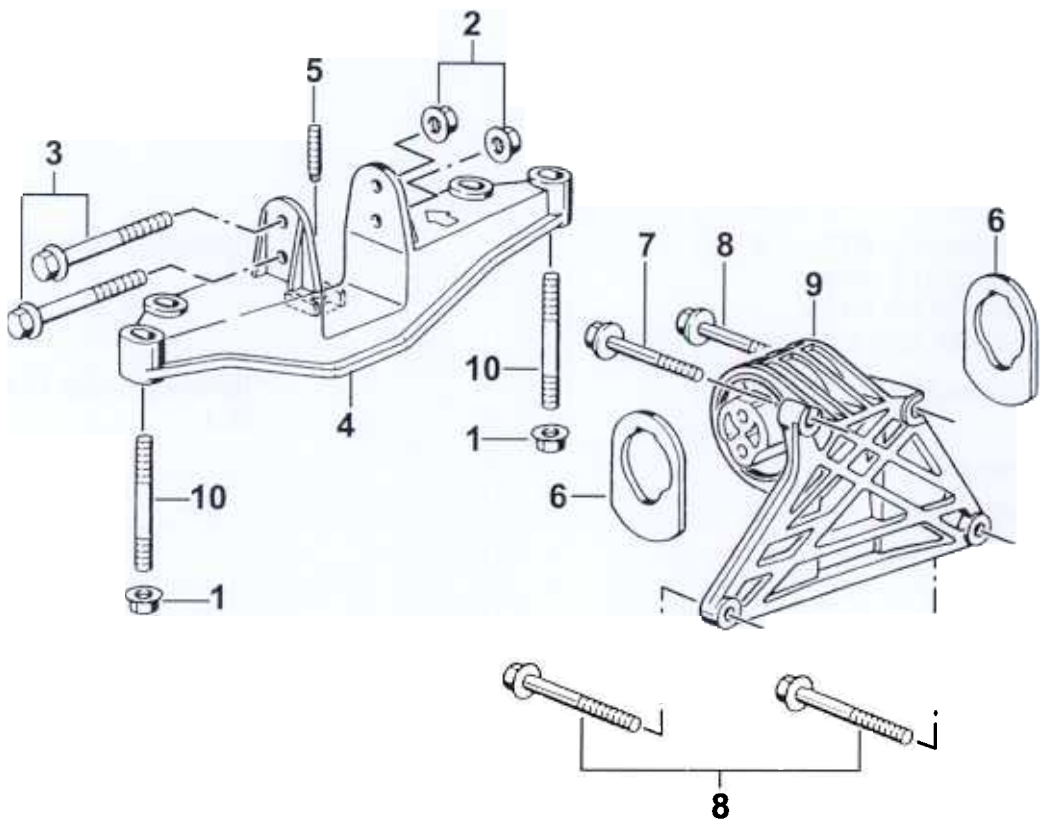


Tightening torques

Location	Thread	Tightening torque Nm (ftlb.)
Engine carrier to body		65 (48)
Transmission support on transmission		85 (63)
Hydraulic mount to carrier side section		23 (17)
Drive shaft on transmission M96/22 (Boxster 2.7 l)		39 (29)
Drive shaft on transmission M96/21 (Boxster 3.2 l)	M10	81 (60)
Rear cross member (aluminium V-brace)	M10 x 1.5	65 (48)
Cable to rear-axle support	M8	23 (17)

Location	Thread	Tightening torque Nm (ftlb.)
Exhaust system to exhaust manifold		25 (18)
Stabilizer to carrier side section		23 (17)
Stabilizer to coupling linkage		46 (34)
Sheetmetal brace to carrier side section (hexagon nut)		65 (48)
Sheetmetal brace to cross member (hexagon-head bolt)	M10 x 1.5	46 (34)
Sheetmetal brace to rear cross member (hexagon nut)	M10 x 1.5	65 (48)
Diagonal brace (front) to body	M10 x 1.5	65 (48)
Wheel to wheel hub	M14 x 1.5	130 (96)
Fuel supply line to fuel gallery	M16	30 to 35 (22 to 26)
Coolant drain plug	M10 x 1.5	10 to 15 (7.5 to 11)
Ground strap to secondary air pump bracket	M8	23 (17)

Disassembling and assembling engine carrier



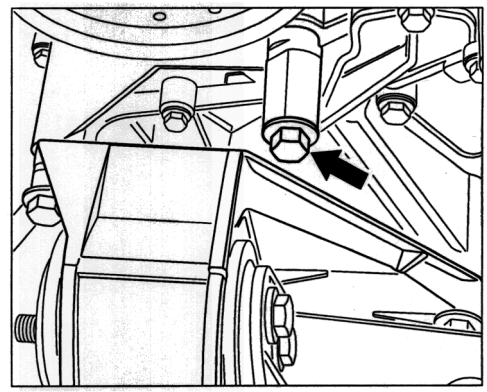
No.	Designation	Qty.	Removal	Note: Installation
	Hexagon nut M10			Tightening torque 46 Nm (34 ftlb.)
2	Hexagon nut M10	2		Tightening torque 46 Nm (34 ftlb.)
3	Hexagon-head bolt	2		Tightening torque 46 Nm (34 ftlb.)
4	Engine carrier	1		Stamped arrow points in direction of travel
5	Stud M6 x 11			
6	Rubber stop	2		
7	Hexagon-head bolt M10 x60 for 3-point suspension Hexagon-head bolt M10 x 80 for 4-point suspension	1		Tightening torque 46 Nm (34 ftlb.)
8	Hexagon-head bolt	3		Tightening torque 46 Nm (34 ftlb.)
9	Engine bracket			
10	Stud M10 x 83	4		

Note!

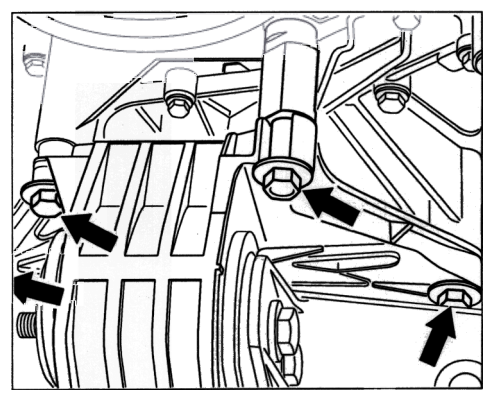
- *There are two model versions of engine brackets. Allocation occurs according to the number of screw connection points*
- *The 4-point engine bracket must not be installed with the 3-point coolant guide housing (from version 1).*

  – Coolant guide housing with 4-point screw connection and engine bracket with 3-point screw connection. The additional bolting point at the upper right-hand side **-arrow-** on the coolant guide housing is fastened with a hexagon-head bolt M10 x 60.

View of version I

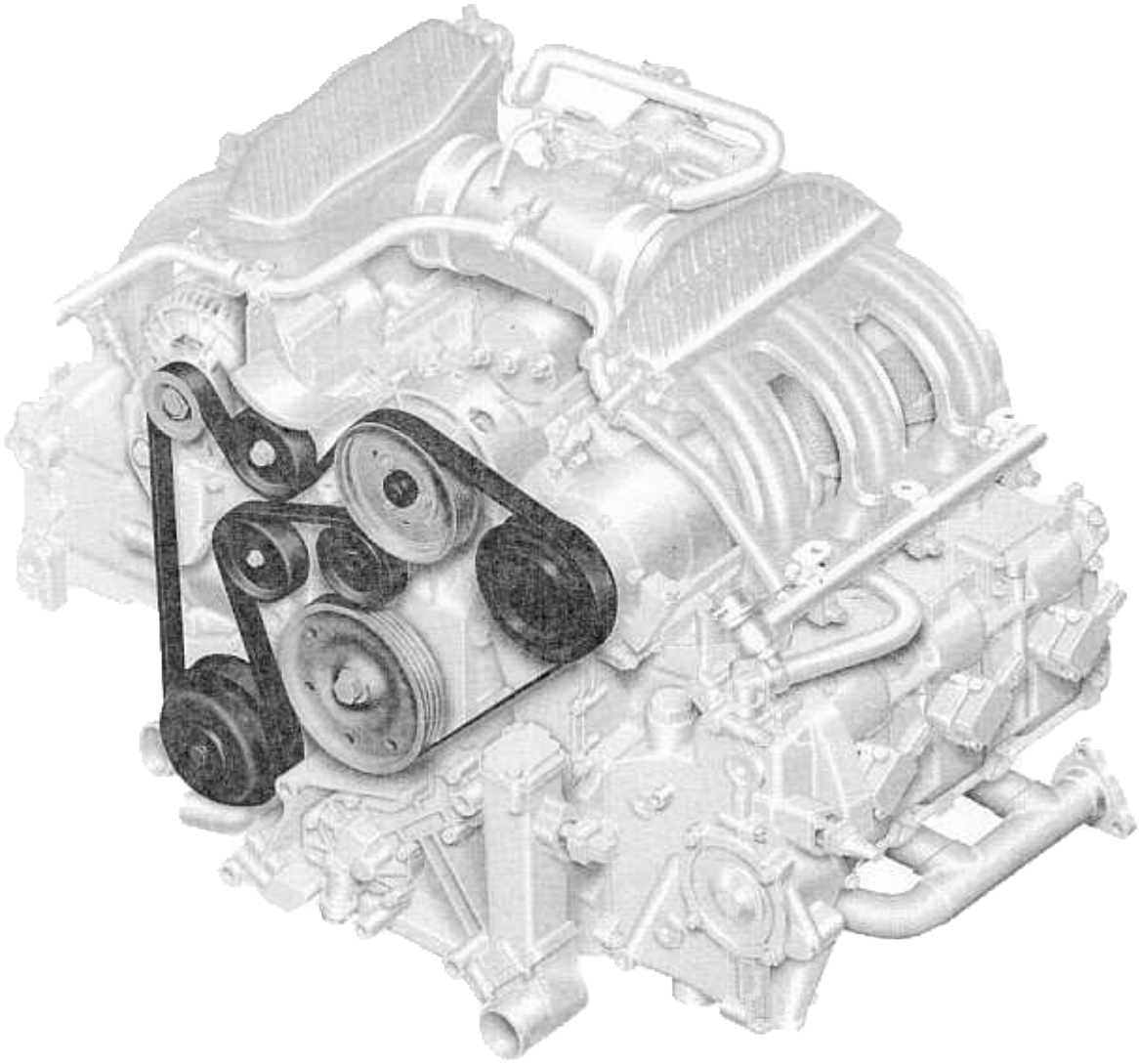


View of version II



– Coolant guide housing with 4-point screw connection and engine bracket with 4-point screw connection.

13 78 19 Removing and installing drive belt



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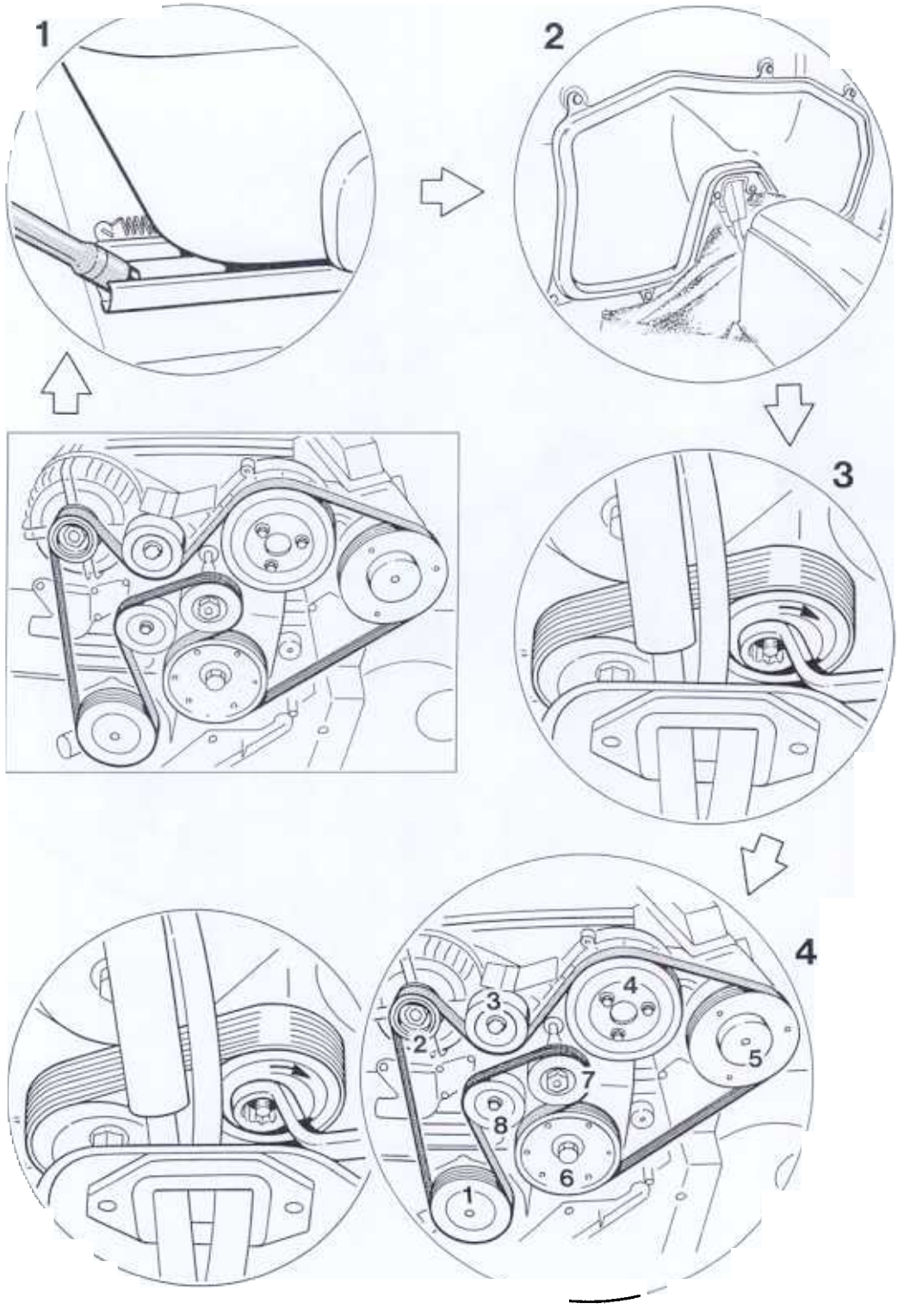
Removing and installing drive belt



Removing drive belt

No.	Procedure	Instruction
1	Remove left-hand seat	Disconnect electrical plug connection. Undo four Torx screws with socket TX 50 (3/8 inch).
2	Remove rear wall cover at passenger compartment rear wall	Remove rear wall lining. Undo seven hexagon-head bolts and two hexagon nuts (wrench size 10 mm) and remove cover.
3	Remove drive belt	Mark direction of belt travel with a coloured pen. Slacken belt by turning the tensioning roller (wrench size 24 mm) clockwise, hold still and at the same time take the belt off the drive pulleys. Visually check the state of the belt and replace if necessary.

Installing drive belt

No.	Procedure	Instruction
4	Fit and tension drive belt	With drive belt manually pre-tensioned, put it on in the following sequence: 1. Coolant-pump drive pulley (1) 2. Generator drive pulley (2) 3. Deflection roller 1 (3) 4. Power-steering pump drive pulley (4) 5. Air-conditioning compressor drive pulley (5) 6. Crankshaft pulley (6) 7. Tensioning roller (7) Then turn the tensioning roller (7) clockwise and simultaneously place the drive belt on deflection roller 2 (8). Slowly relieve the tensioning roller. **Check whether the belt is properly seated on all drive pulleys.**

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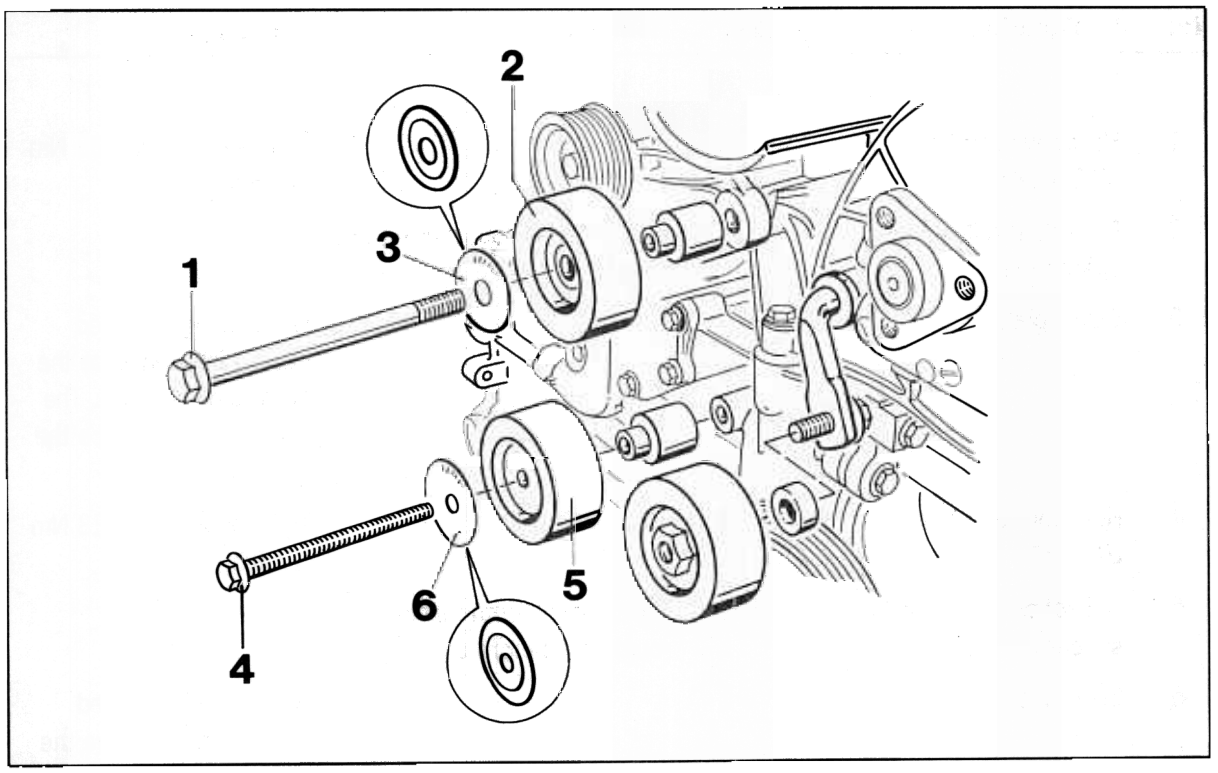
No.	Procedure	Instruction
	Install rear wall lining, rear wall cover and the left-hand seat	Insert rear-wall lining in lower area behind the heel-plate lining. Fasten rear wall cover with seven hexagon-head bolts and two hexagon nuts. Tightening torque 10 Nm (7 ftlb.). Connect electrical plug connection and fasten seat. Tightening torque of Torx screws 20 Nm (15 ftlb.).

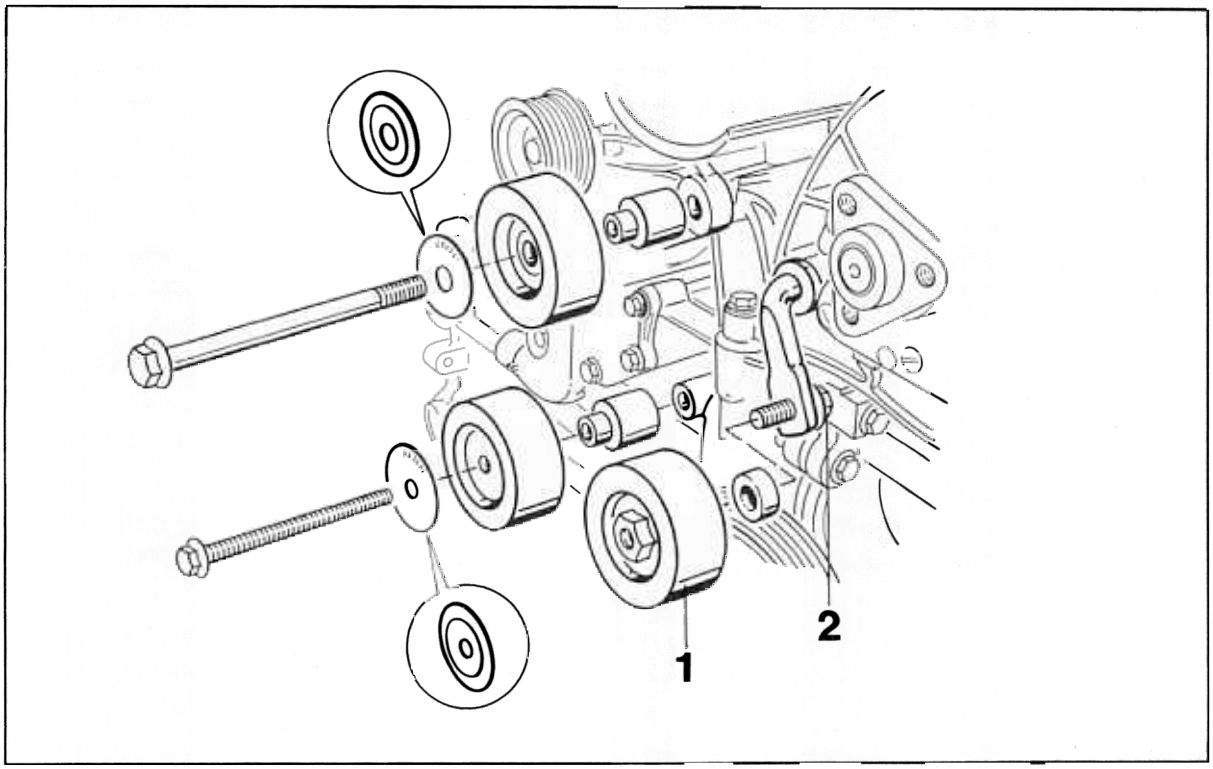
13 77 20 Removing and installing deflection rollers for drive belt



Removing and installing deflection rollers for drive belt

No.	Designation	Qty.	Note: Removal	Installation
1	Hexagon-head bolt M10 x 145	1		Tightening torque 65 Nm (48 ftlb.)
2	Deflection roller 1 with spacer pin	1	Check for smooth running or roughness before undoing	
3	Cover plate			When fitting a curved cover plate, observe the installation position. The inscription must face the bolt head.
4	Hexagon-head bolt M8 x 55	1		Tightening torque 23 Nm (17 ftlb.)
5	Deflection roller 2 with spacer pin	1	Check for smooth running or roughness before undoing	
6	Cover plate	1		When fitting a curved cover plate, observe the installation position. The inscription must face the bolt head.

13 82 19 Removing and installing tensioning roller for drive belt



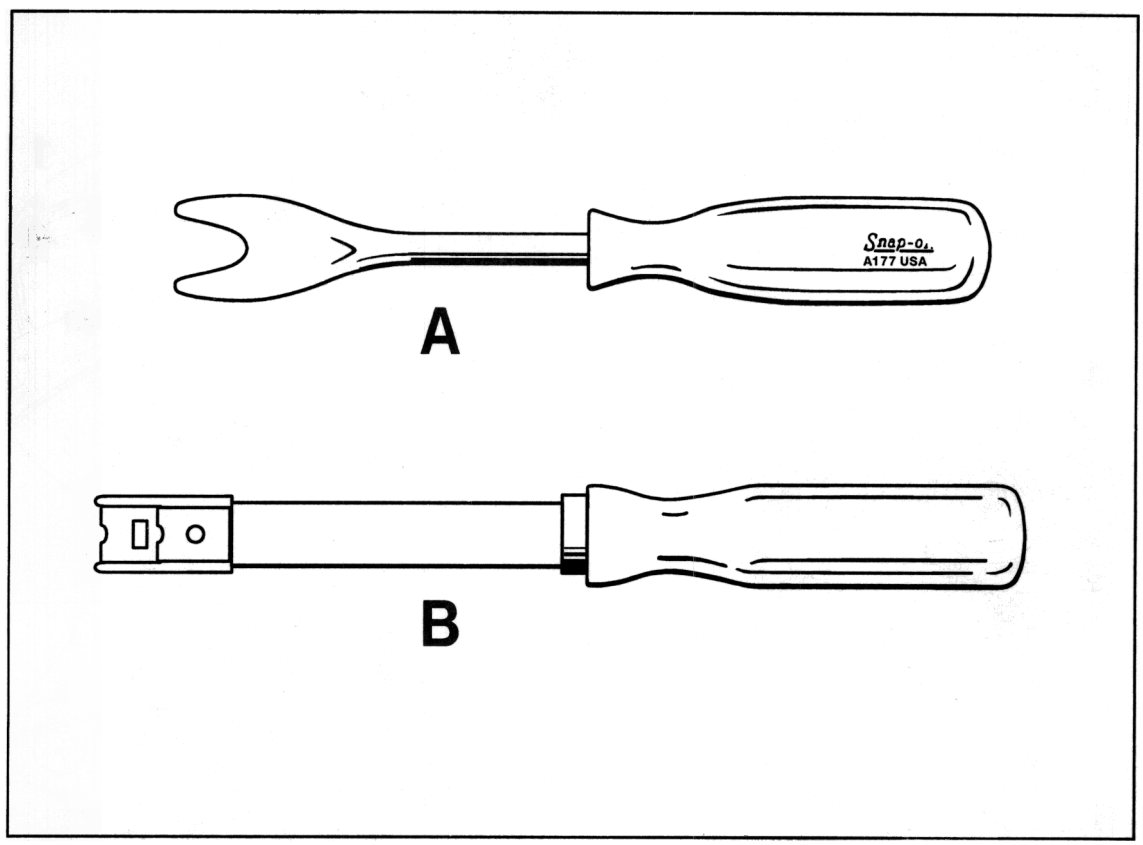
No.	Designation	Qty.	Removal	Note: Installation
1	Tensioning roller with spacer ring	1	Undo at the hexagon (wrench size: 24) and simultaneously counter at the hexagon-head bolt	Tightening torque 60 Nm (44 ftlb). Counter at the hexagon-head bolt when tightening. (wrench size: 15)
2	Hexagon-head bolt (micro-encapsulated)	1	**Not** necessary for removal and installation of the tensioning roller. The hexagon head bolt can be removed only after the belt tensioner or bracket has been loosened.	Apply a thin coat of screw locking lacquer to the thread of the hexagon head bolt. (Observe note.)

Note: Either the screw locking lacquer Loctite **242** "Mittelfest" (medium strength) or Loctite **270** "Hochfest" (high strength) can be used. **If screw locking lacquer 270 is used, coat only the first four threads.**

13 73 19 Removing and installing belt tensioner

Engine installed

Tools



No.	Designation	Special tool	Explanation
A	Removal tool	Commercially available, e.g. Snap - on Order No. A177A	Refer to Workshop Equipment Manual for supplier's address
B	Fitting tool for pin retainer, Springfix system	Commercially available, Art. No. 1 089 001 018 for retainer 85XN 58/59	Refer to Workshop Equipment Manual, Page 2.4 - 12, for supplier's address

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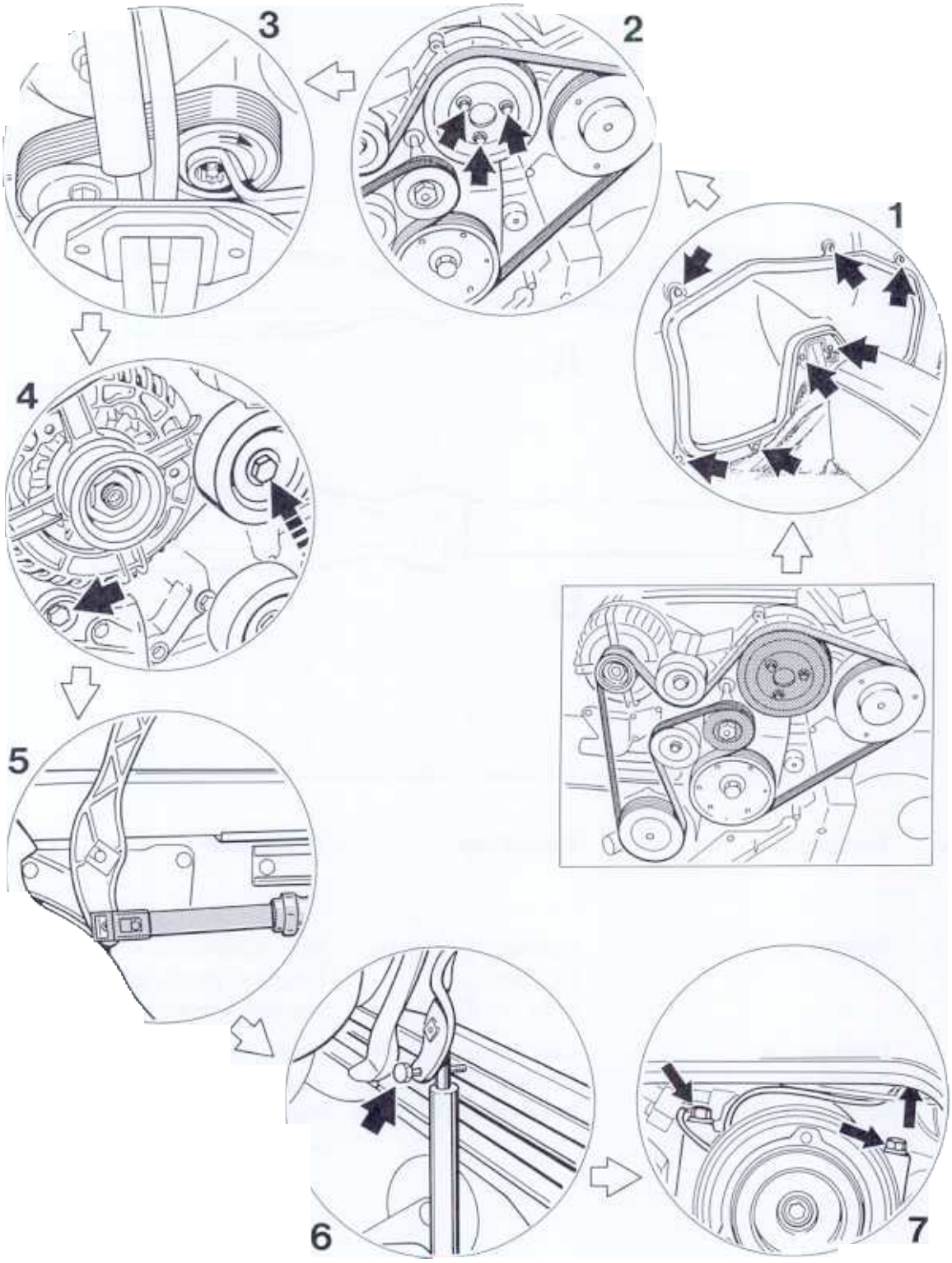
Removing belt tensioner



Removal overview of components

1 Removing rear wall lining

2 Loosening belt pulley of hydraulic pump

3 Relieving and removing drive belt

4 Loosening generator

5 Removing retainer on hinge lever

6 Setting up and securing convertible top compartment cover

7 Loosening A/C compressor

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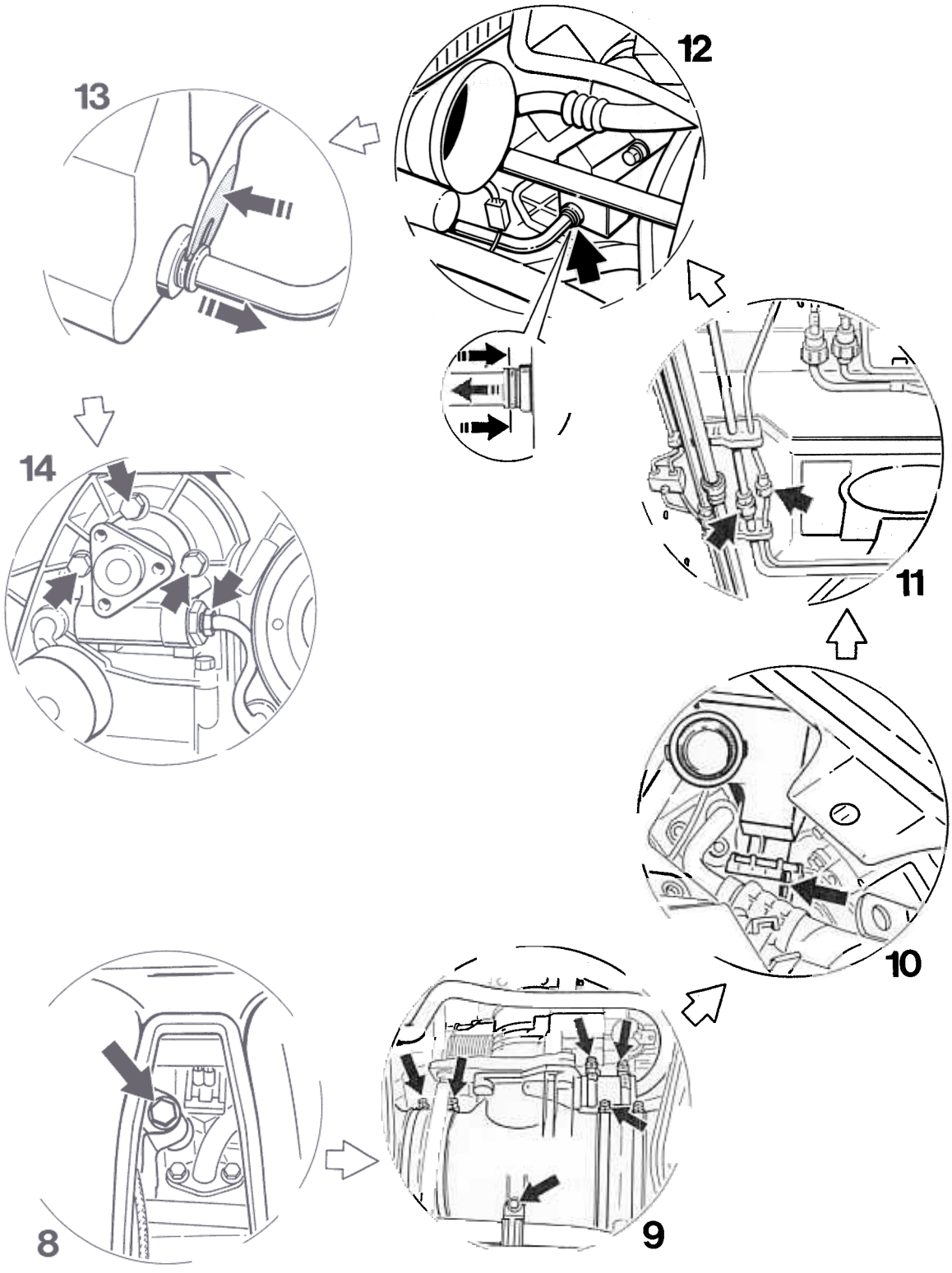
Removing belt tensioner



Removal overview of components

8 Loosening A/C compressor

9 Removing throttle body with intake distributor

10 Removing supply tank of power steering system

11 Separating steering pressure line and steering return line on underbody

12 Loosening steering return line in engine compartment

13 Separating steering return line from supply tank using tool

14 Loosening hydraulic pump and steering supply line in engine compartment

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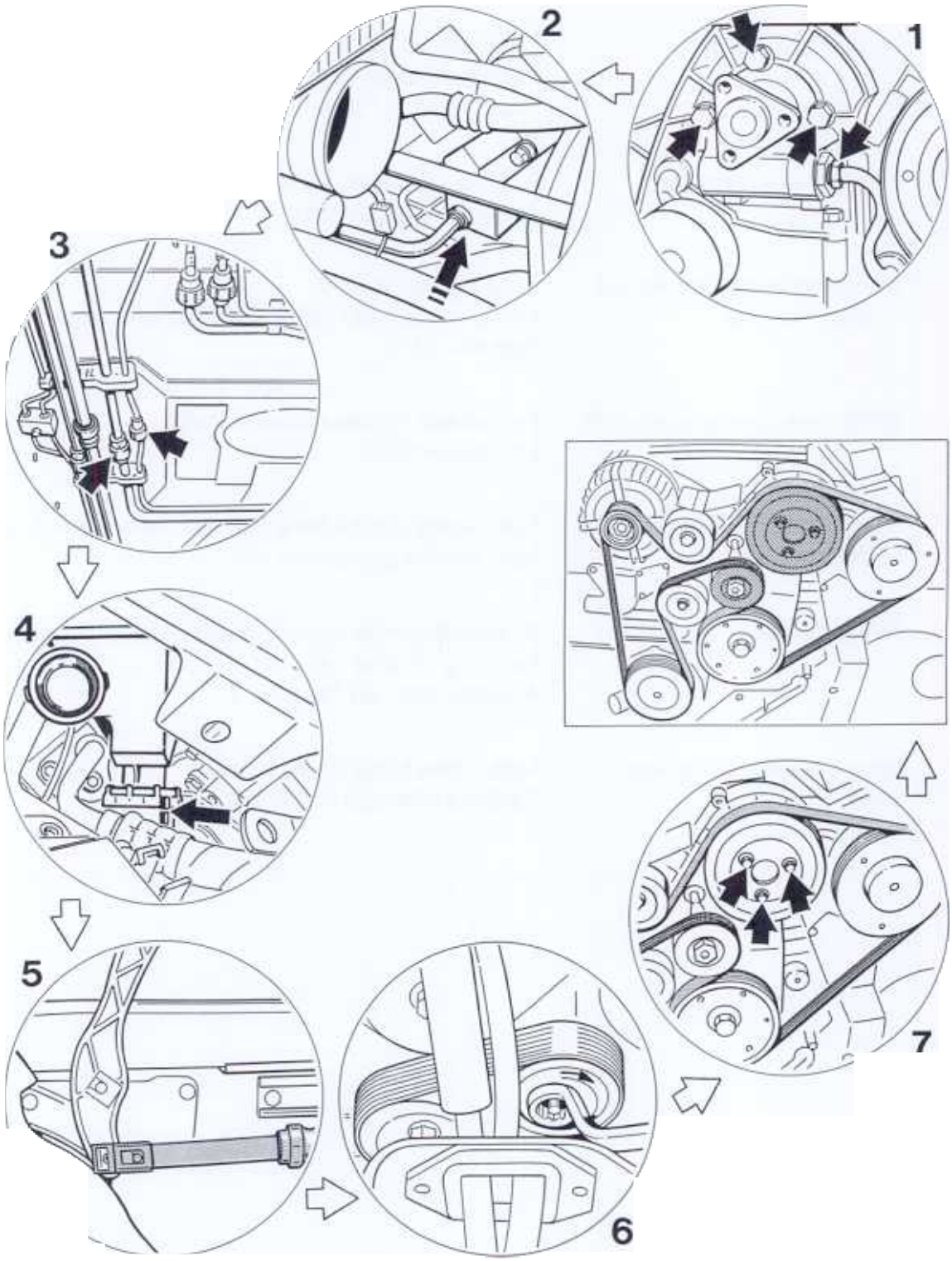
Removing belt tensioner

No.	Procedure	Instructions
	Removing left seat	Remove seat rail cover. Undo four Torx screws using a TX 50 (3/8 inch) socket. Disconnect electrical connection. Fit protective cover in seat area. Put a suitable wooden support in the area of the control module. Disconnect battery.
	Removing cover on rear wall of the passenger compartment	Remove rear wall covering. Undo seven hexagon head bolts and two hexagon nuts (wrench size 10 mm) and remove lid.
2	Loosening belt pulley	Undo three hexagon head bolts (M8 x 12) by about half a turn. **Note** Even after the drive belt has been removed, the belt pulley can be loosened using a clamping band.
3	Removing drive belt	Mark running direction on the belt with a coloured pen. Relieve belt; to do this, turn the tensioning roller (wrench size 24 mm) clockwise, hold and simultaneously remove the belt from the drive pulleys.
4	Loosening generator	Unscrew and remove right fastening screw (in direction of travel). Undo left fastening screw (with deflection roller) by 3 turns. The threaded bushing in the generator can be loosened by striking it lightly (use an aluminium mandrel).

No.	Procedure	Instructions
		Lift the generator up and out of the slotted generator bracket. Unscrew fastening screw and remove with deflection roller. **Note** Do not loosen electrical connections or plug connection.
5	Disengaging hinges on convertible top compartment cover	Pull off lower hinge retainers using the fitting tool and push out the pins.
6	Setting up and securing convertible top compartment cover.	Put convertible top compartment cover in vertical position secure with suitable pin.
	Loosening A/C compressor	Loosen front compressor fastening screws (2 ea.) and disconnect electrical plug connection.
8	Loosening A/C compressor	Undo compressor fastening screw between the intake pipes of cylinders 4 and 5.
9	Removing throttle body with intake distributor intermediate piece	Remove air guide between throttle body and air cleaner. Remove bleeder line between intake distributor and oil separator. Loosen both hose clamps on intake distributor. Unscrew fastening screw (M6) for fuel line on intake distributor.
10	Removing supply tank	Suck power steering fluid out of supply tank until the fluid level is below the joint. Power steering supply tank (bayonet lock).

No.	Procedure	Instructions
11	Separating steering lines on underbody	Remove cover on underbody. Separate steering pressure line and steering return line and collect fluid. Important instructions: See Technical Manual, Running gear, Page 48 - 13.
12	Loosening steering return line in engine compartment	To separate the line from the supply tank, press the **red unlocking ring forward (arrows)** and **simultaneously** pull out the line. Use two plastic spatulas to press the ring.
13	Separating steering return line from supply tank using tool	The line can also be separated using a commercially available tool. For example, the removal tool from Messrs. Snap-on is recommended. Insert the tool between the line and the red unlocking ring and unlock. Pull line to the rear and simultaneously press the tool against the red ring. Cover line with a cap to protect it against dirt and scratches.
14	Loosening hydraulic pump and steering supply line in engine compartment	Loosen steering supply line (wrench size 17) while holding at the flange (wrench size 22). Undo three hexagon head bolts (M8 x 12) and remove hydraulic pump to the rear. **Note** If coolant hoses come into contact with Pentosin, immediately clean them thoroughly.
	Removing bracket with tensioning element	Loosen oil filler neck at the right rear bracket fastening screw. Immediately close the bore in the crankcase with a plug. Undo four hexagon head bolts and remove bracket with tensioning element.

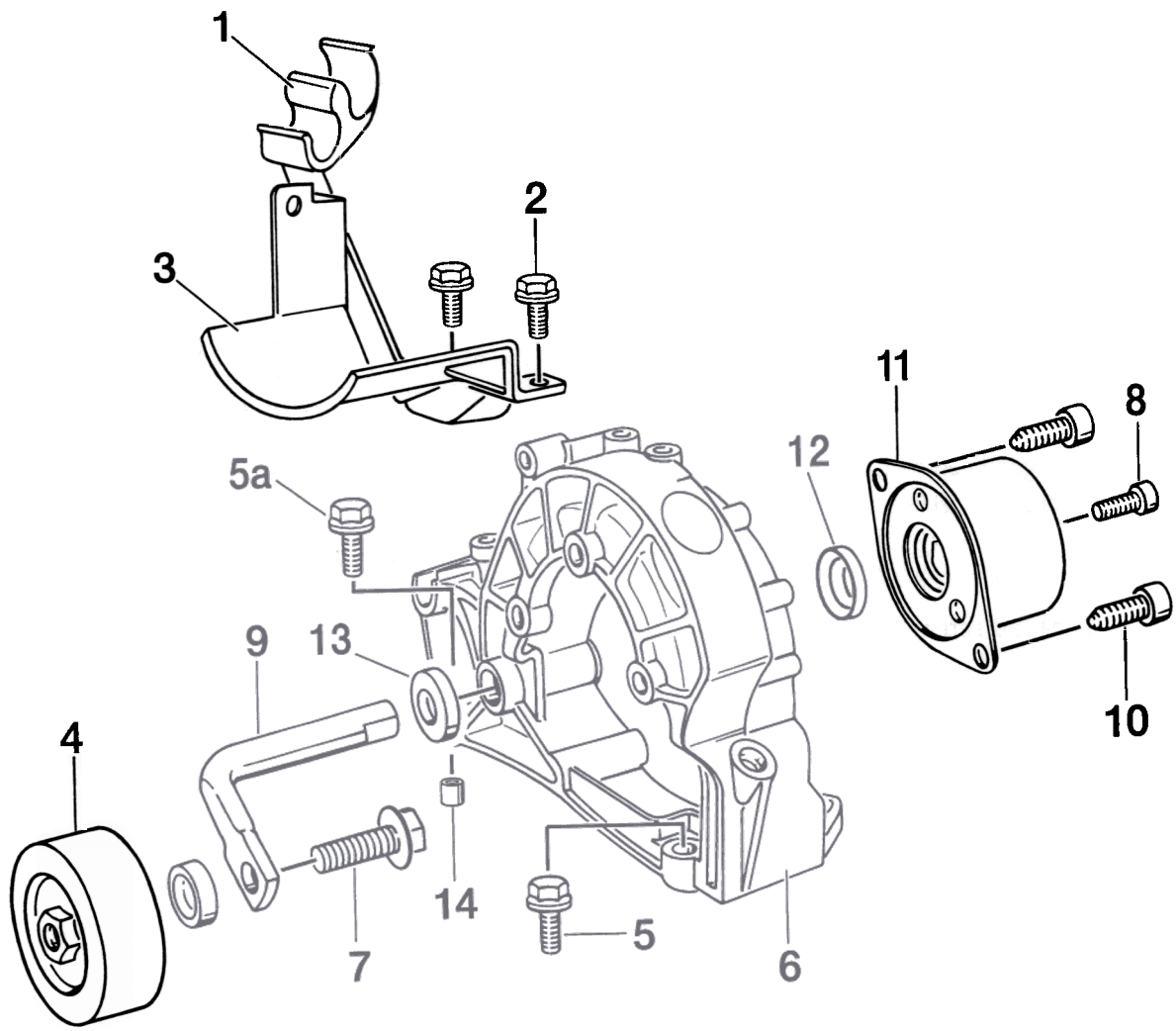
Installing belt tensioner



Installing belt tensioner

No.	Procedure	Instructions
1	Installing hydraulic pump	Fasten bracket with tensioning element on the crankcase. Insert hydraulic pump from behind and fasten. Tightening torque 23 Nm (17 ftlb.).
2	Fitting steering return line	Push line straight into the coupling. Then pull slightly to ensure it is engaged properly.
3	Fitting steering pressure line and steering return line	Fit by plugging together. Important notes: See Technical Manual, Running gear, Page 48 - 13 ff.
4	Fitting power steering supply tank	Put container into place (observe marks) Lock bayonet lock.
5	Fitting retainer for convertible top compartment cover hinge	Insert retainer into the fitting tool. Push fitting tool with retainer onto the pin and slide off.
6	Fitting drive belt	Fit belt pulley on the hydraulic pump and tighten hexagon head bolts. Fit drive belt. Assembly notes, see Page 13 - 1
7	Fitting belt pulley for hydraulic pump	Tighten three hexagon head bolts. Tightening torque 23 Nm (17ftlb.).

13 73 37 Disassembling and assembling belt tensioner



57 - 97

No.	Designation	Qty.	Removal	Note: Installation
1	Holder	1		Clip in refrigerant lines
2	Hexagon head bolt M6 x 16	2		
3	Cover	3		
4	Tensioning roller	1	Undo at hexagon (wrench size 24) and simultaneously hold at the hexagon head bolt	Tightening torque 60 Nm (44 ftlb). Hold at the hexagon head bolt when tightening (wrench size 15)
5	Hexagon head bolt M8 x 25	2		
5a	Hexagon head bolt M8 x 35	2		
6	Bracket for hydraulic pump and belt tensioner	1		Grease plastic bushings of the lever bearing with Olista Longtime 3 EP
	Hexagon head bolt (micro-encapsulated)	1	The hexagon head bolt can be removed only after the belt tensioner or bracket has been loosened!	Apply a thin coating of locking lacquer on the tread of the hexagon bolt. (Observe note)
8	Pan-head screw	1		Tightening torque 9.7 Nm (7.0 ftlb.)
9	Lever	1	Drive out of the tensioning element using a drift (ø 5)	Fit in correct position; grease in bearing area
10	Pan-head screw	2		Tightening torque 23 Nm (17ftlb.)
	Tensioning element			
12	Dust cap	1		

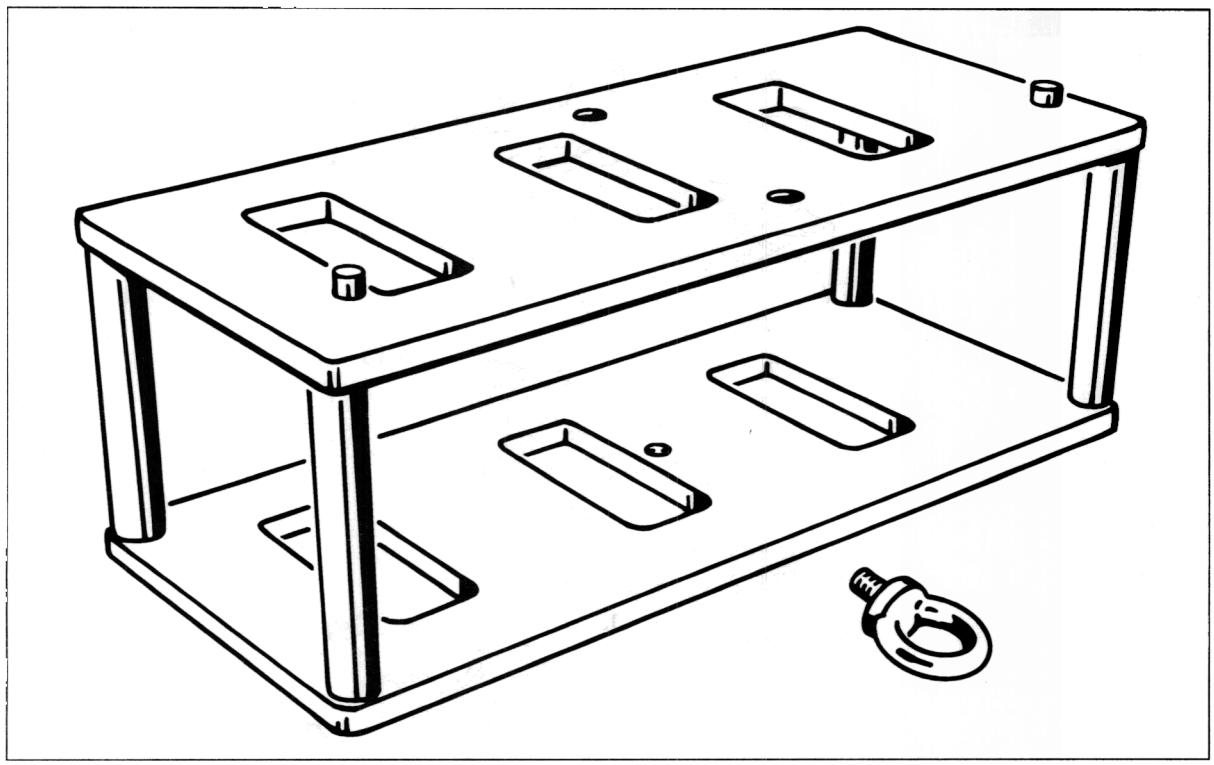
No.	Designation	Qty.	Removal	Note: Installation
13	Dust cap	1		
14	Dowel sleeve	2		Fit in the two bores of the bracket (on right in direction of travel).

Note

Either the screw locking lacquer Loctite **242** "Mittelfest" (medium strength) or Loctite **270** "Hochfest" (high strength) can be used.
If screw locking lacquer type 270 is used, coat only the first four threads.

13 49 37 Disassembling and assembling bearing housing with crankshaft

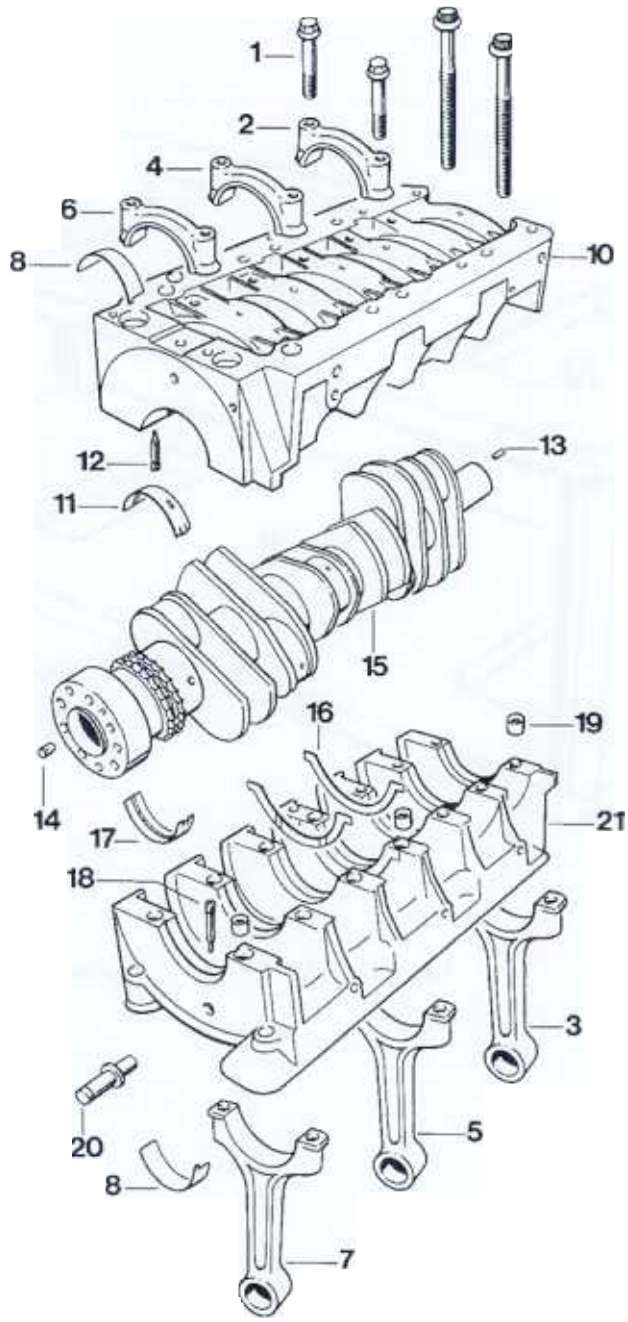
Tools



482_96

Item	Designation	Special tool	Explanation
	Assembly fixture for bearing housing	9607	

Disassembling and assembling bearing housing with crankshaft



183_96

Disassembling and assembling bearing housing with crankshaft

"WARNING"

Possible engine damage by confusing connecting-rod bearing caps and connecting rods.

>The connecting-rod bearing caps must always remain allocated to the respective connecting rods and must never be interchanged.

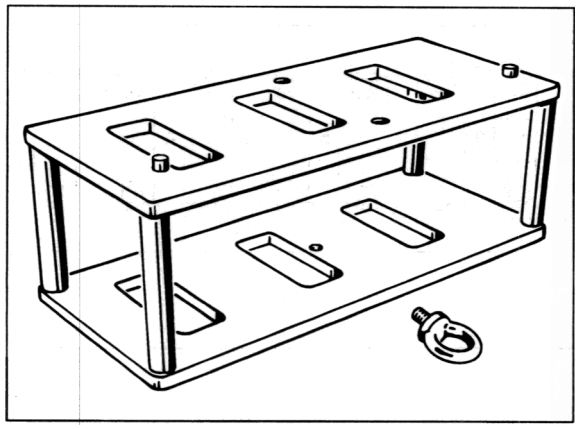
Recommendation: After disassembly, immediately re-join the connecting-rod bearing cap and connecting rod or mark them on the sides with an electric scribing tool (e.g. with the cylinder designation). **Never mark these parts with sharp objects such as prick punches or number embossing tools.**

No.	Designation	Qty.	Removal	Note: Installation
1	Connecting-rod bolt	6		Lightly oil thread and bearing surface
2	Connecting-rod bearing cap	1		
3	Connecting rod, cyl. 4	1	Immediately join with the connecting-rod bearing cap after removal	
4	Connecting-rod bearing cap			
5	Connecting rod, cyl. 5	1	Immediately join with the connecting-rod bearing cap after removal	
6	Connecting-rod bearing cap			
7	Connecting rod, cyl. 6	1	Immediately join with the connecting-rod bearing cap after removal	
8	Connecting-rod bearing shell half	6		Replace
9	Thrust-bearing screw M9 x 127	14		Lightly oil bearing surface and thread
10	Bearing housing half, cylinder bank 1 - 3			
11	Crankshaft bearing shell half	7		Replace; insert in correct position, locating stud faces towards dowel-sleeve side

No.	Designation	Qty.	Removal	Note: Installation
12	Spray nozzle for piston cooling in bearing housing half, cylinder bank 1 - 3	3	Drive out from rear side of bearing housing half using a plastic mandrel	Press in with plastic mandrel (4 mm)
13	Cylindrical pin A4.0 x 10	1		
14	Roll pin 6.0 x 16			
15	Crankshaft	1		Check axial play
16	Thrust plate	2		Replace; insert in correct position, oil groove faces the belt pulley or flywheel
17	Crankshaft bearing shell half	7		Insert in correct position, locating stud towards dowel-sleeve side
18	Spray nozzle for piston cooling in bearing housing half, cylinder bank 4 - 6	3		Press in with plastic mandrel (4 mm)
19	Dowel sleeve	3		
20	Pin for tensioning rail	1		Press into bearing housing half (cyl. 4 - 6)
21	Bearing housing half, cylinder bank 4 - 6	1	Do not damage sealing surfaces; fit on assembly fixture (special tool 9607)	

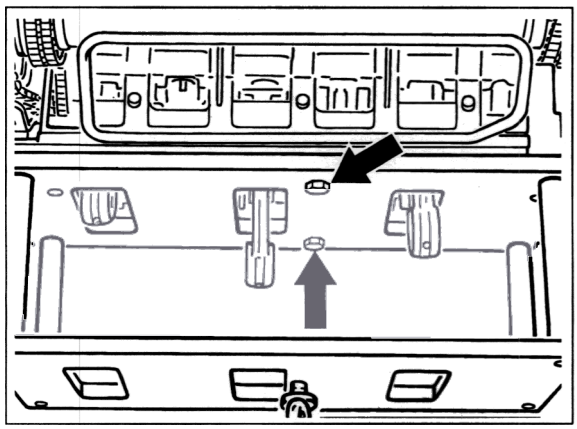
Assembly instructions

1. Use special tool, assembly fixture 9607, for disassembly and assembly of the bearing housing, crankshaft and connecting rods of cylinder bank 4 - 6.



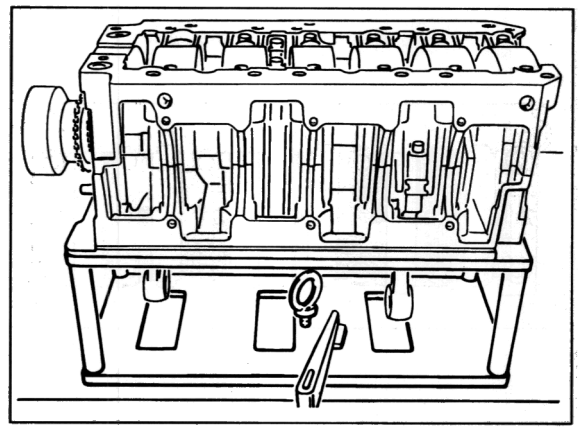
Special tool 9607 482_96

2. Fasten bearing housing on the assembly fixture with two M10 x 20 hexagon-head bolts. Tighten hexagon-head bolts only slightly.



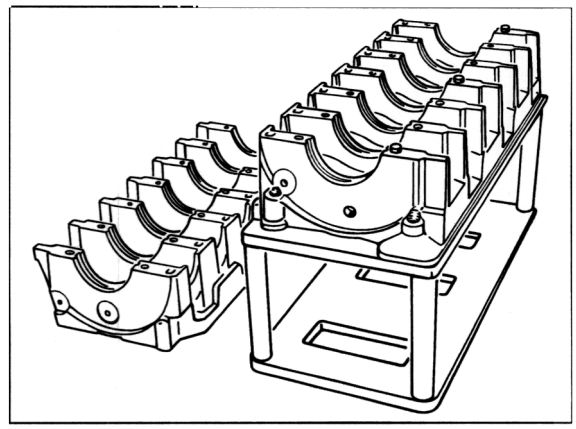
085_98

3. Additionally fasten the assembly fixture on the workbench using C-clamps.



484_96

4. Place and fasten the bearing housing half of cylinder bank 4 - 6 on the special tool for assembly.



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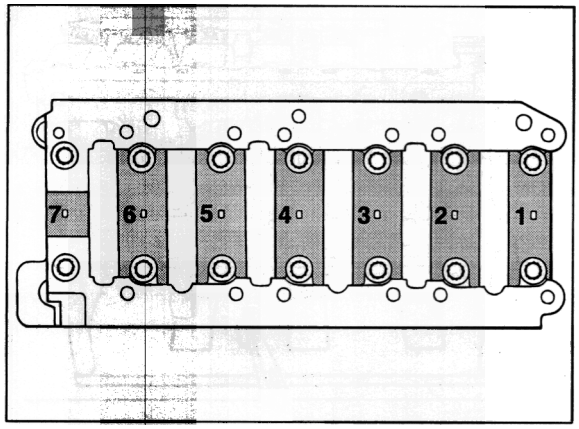
Assembly instructions

Arrangement of the main thrust bearings on the bearing housing.

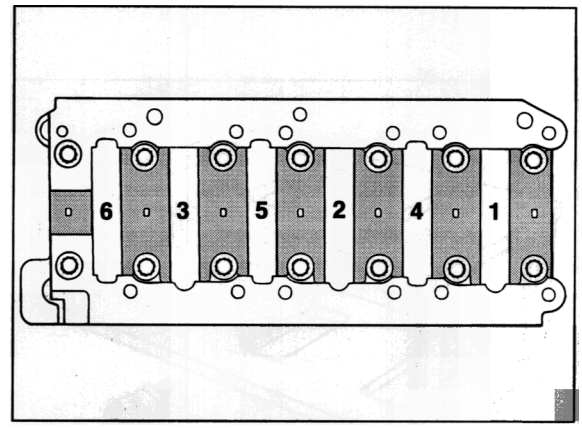


67_98

Main thrust bearing 1 on the **belt pulley side**

Main thrust bearing 7 on the **flywheel side**

Arrangement of the connecting-rod bearings in the bearing housing.



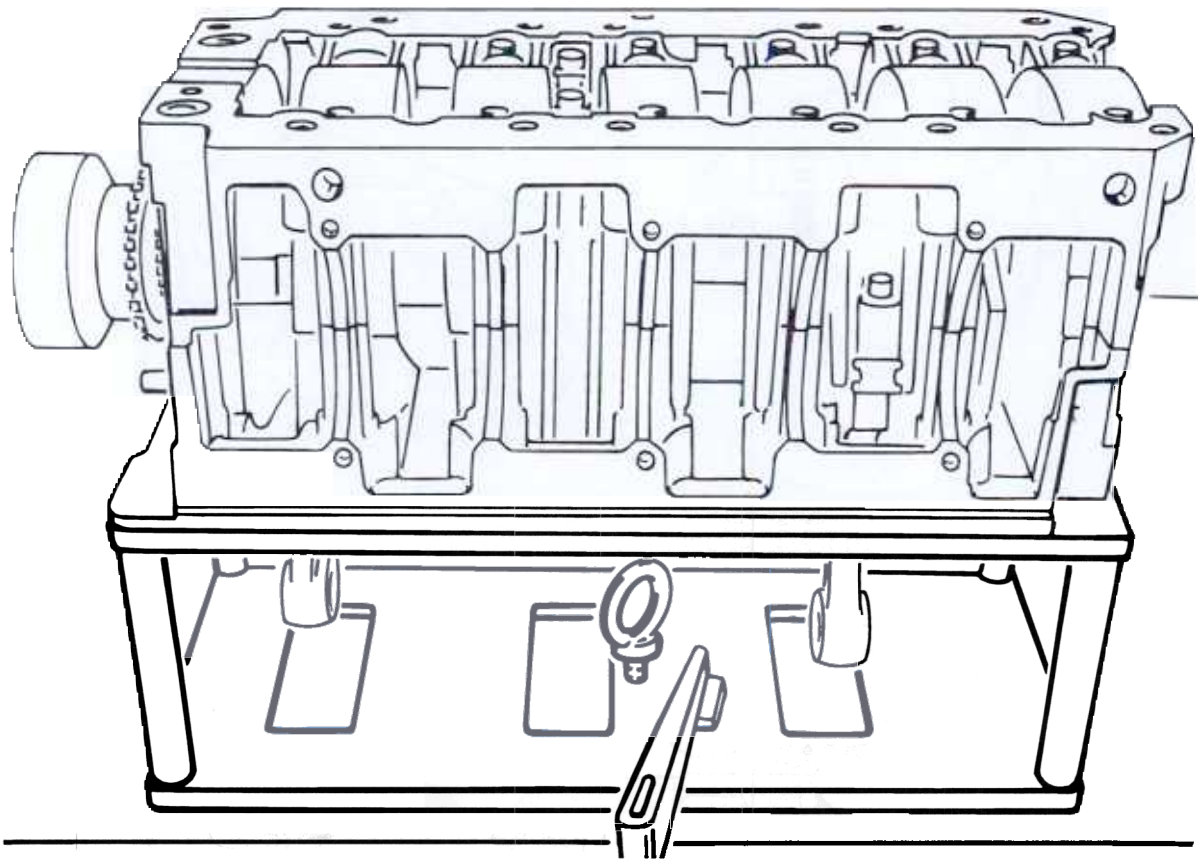
68_98

Connecting-rod bearing of cylinder 1 on the **belt pulley side**

Connecting-rod bearing of cylinder 6 on the **flywheel side**

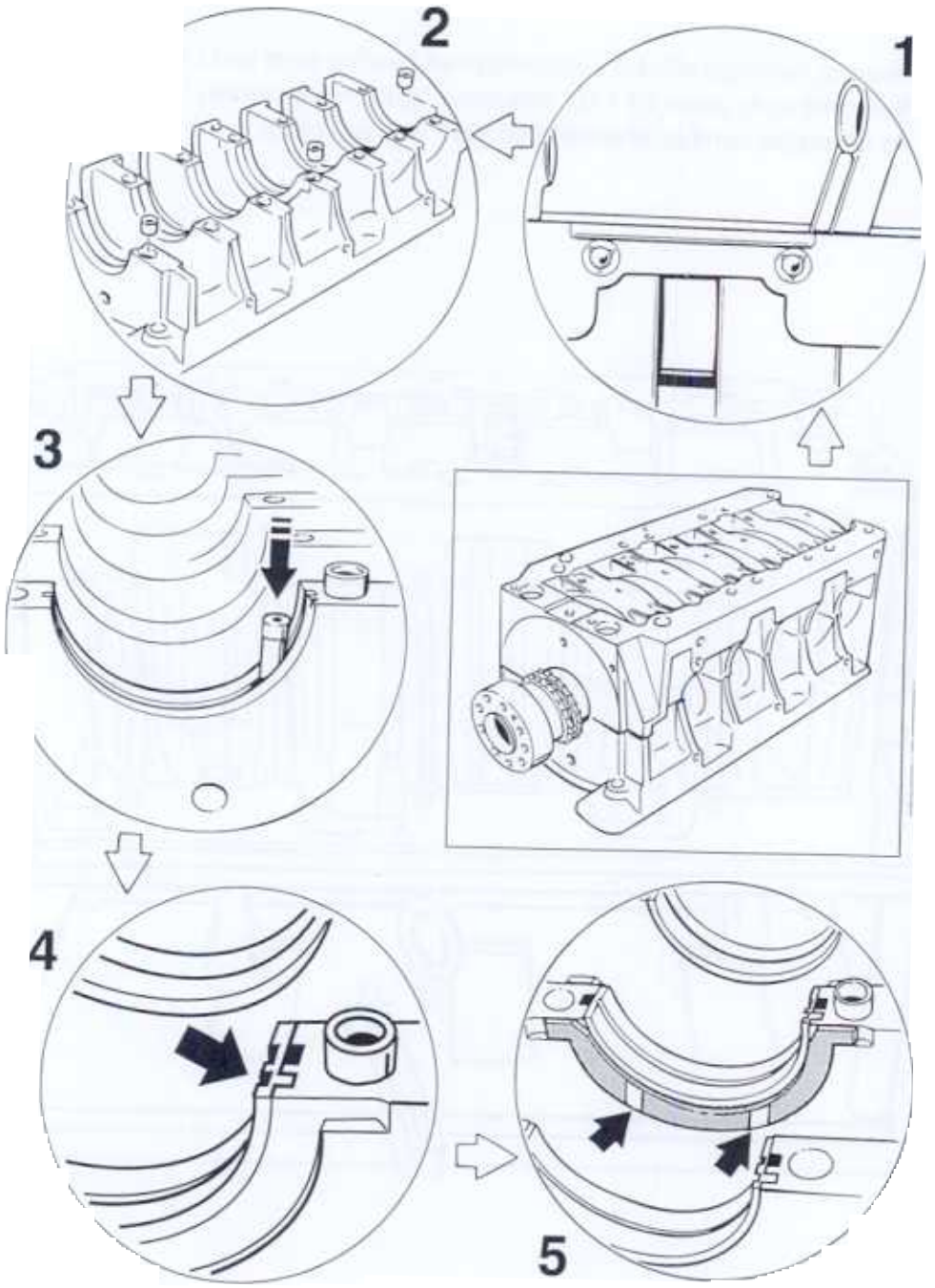
Disassembling and assembling bearing housing with crankshaft

Important: Bearing housings without connecting-rod bearing twist locks should not be installed.
See twist lock, page 13 - 10, sequence figure no. 4 (arrow).
As of engine number M962065W07047 with twist lock.



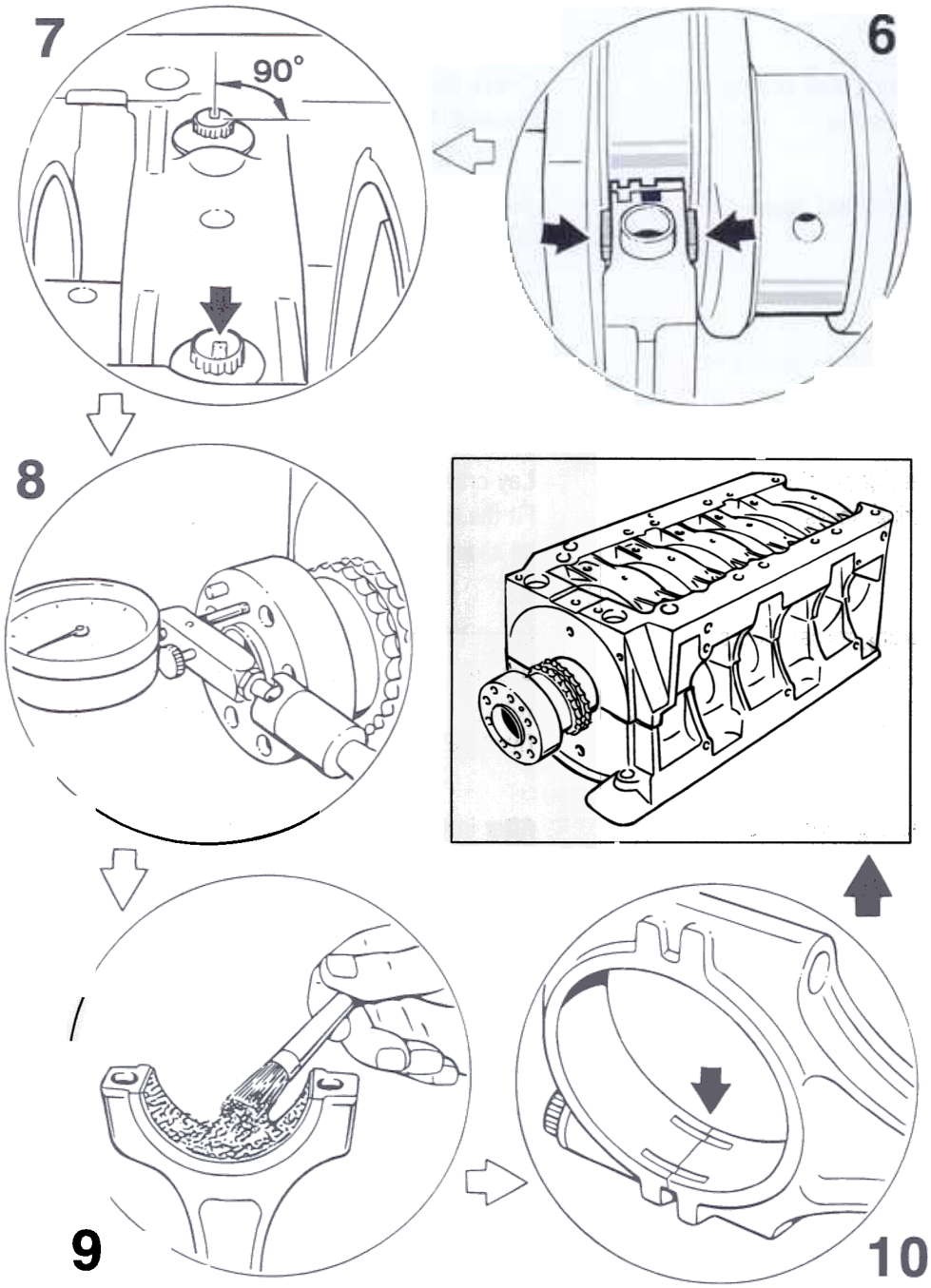
213_98

Disassembling and assembling bearing housing with crankshaft



64_98

Disassembling and assembling bearing housing with crankshaft



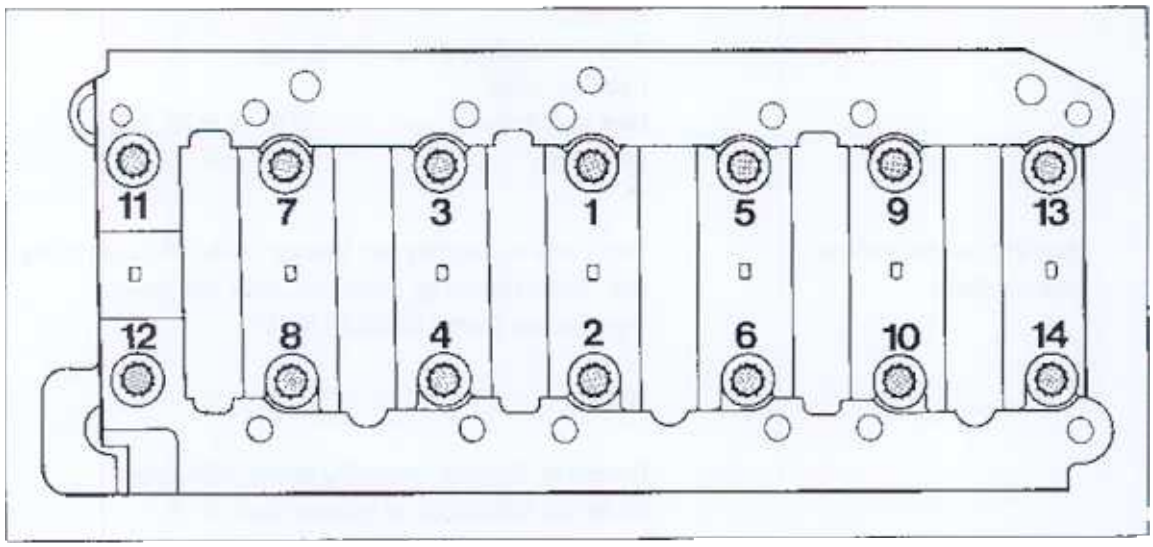
Disassembling and assembling bearing housing with crankshaft

No.	Procedure	Instructions
1	Checking that sealing balls are present	Check that sealing balls (6 ea.) are present and correctly caulked. Rework if necessary.
2	Fitting dowel sleeves	Push dowel sleeves (3 ea.) into the main thrust bearings 7, 4 and 1 of the bearing-housing half, cyl. 4 - 6, as far as the stop.
3	Fitting spray nozzles for piston cooling	Press spray nozzles into the receiving bore with a plastic mandrel (4 mm).
4	Inserting crankshaft bearing shells	Lay crankshaft bearing shells in the main thrust bearings. Fit the locating stud on the dowel-sleeve side. Lightly oil sliding surfaces.
5	Inserting thrust plates	Insert the thrust plates in the recess of main thrust bearing 4 of the bearing-housing half of cyl. 4 - 6 with grease. **The oil pockets must face pulley or flywheel side.**
6	Checking thrust plates	After inserting the crankshaft, check the two thrust plates at main thrust bearing 4 for correct seating.
7	Tightening thrust-bearing screws	Oil thread and contact surface.
	Tightening specification	**1. Initial tightening 20 Nm (15 ftlb.)** To facilitate subsequent checks it is recommended that, after initial tightening, the screw heads be marked with a colour line. **2. Final tightening 1 x 90° turn** Observe tightening sequence: see Assembly instructions.

No.	Procedure	Instructions
8	Checking axial play of crankshaft	Screw gauge with gauge holder VW 387 to bearing housing and place against crankshaft flange. Press crankshaft by hand against the gauge and set gauge to zero. Press crankshaft away from gauge. Read off value: New installation 0.05 to 0.24 mm Wear limit 0.28 mm
9	Inserting connecting-rod bearing shells	Insert new connecting-rod bearing shells into connecting rod. Lubricate sliding surface liberally with grease, e.g. Optimol Optipit (00004320417). **Note** Grease to facilitate assembly during subsequent piston pin installation of cylinder bank 4 - 6.
10	Completing connecting rod	Join connecting rod and connecting-rod bearing cap. The recesses of the connecting-rod bearing twist lock must face each other.
	Tightening specification	Oil thread and contact surface. **1. Initial tightening 20 Nm (15 ftlb.)** To facilitate subsequent checks it is recommended that, after initial tightening, the screw heads be marked with a colour line. **2. Final tightening 1 x 90° turn.**

Assembly instructions

Tightening sequence for thrust-bearing screws

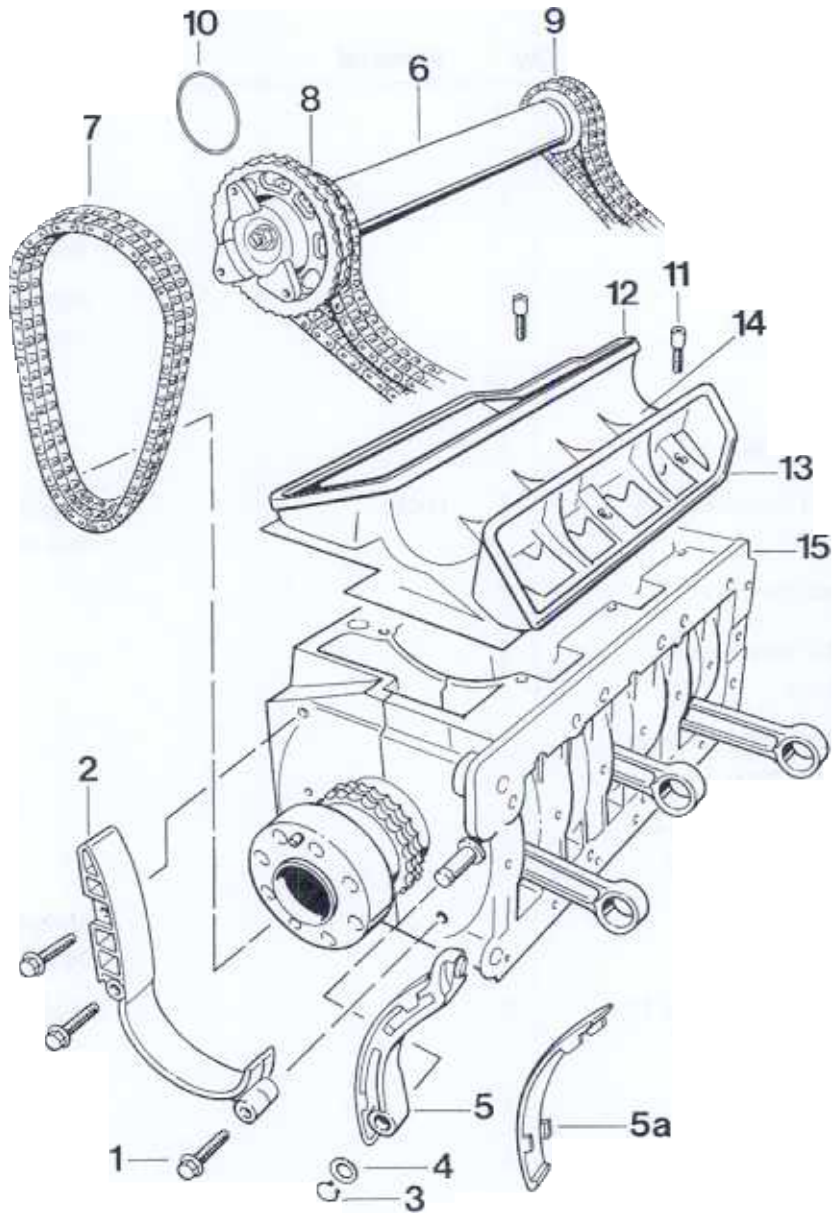


185_96

Screws, bearing housing

Initial tightening:	20 Nm (15 ftlb.
Final tightening:	1 x 90° turn

Disassembling and assembling bearing housing with intermediate shaft

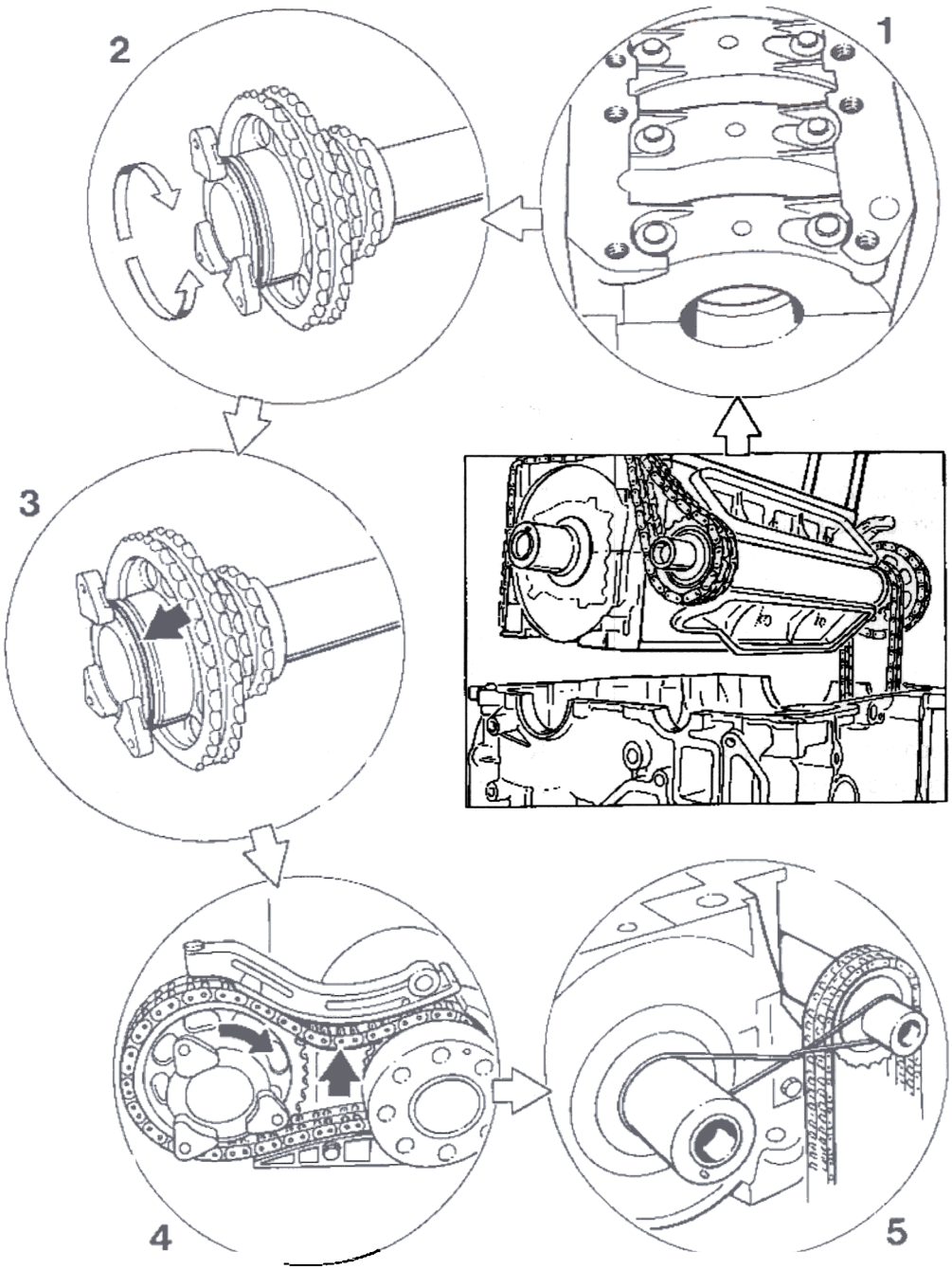


187_96

Disassembling and assembling bearing housing with intermediate shaft

No.	Designation	Qty.	Removal	Note: Installation
1	Hexagon-head bolt M6 x 35	3		
2	Guide rail	1		Check for wear marks and replace if necessary
3	Circlip	1		Replace; ensure correct seating
4	Washer			
5	Tensioning rail			
5a	Lining for tensioning rail	1	Unclip	Check for wear marks and replace if necessary
6	Intermediate shaft	1		
7	Chain for intermediate shaft drive			
8	Chain for camshaft drive of cylinder bank 1 - 3			
9	Chain for camshaft drive of cylinder bank 4 - 6			
10	O-ring 52 x 2.5	1		Always replace; do not fit twisted
1	Pan-head screw M6 x 16 (micro-encapsulated)	6		Replace
12	Gasket			
13	Gasket	1		Ensure correct seating
14	Oil separator			Ensure correct seating
15	Bearing housing, completely preassembled	1		Assemble on assembly fixture 9607

Disassembling and assembling bearing housing with intermediate shaft



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Disassembling and assembling bearing housing with intermediate shaft

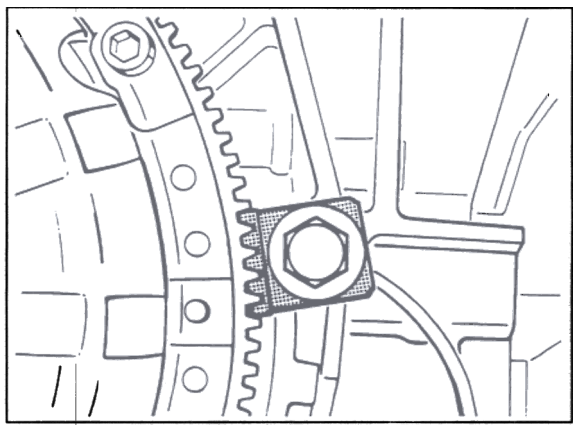
No.	Procedure	Instructions
1	Checking sealing surfaces	Check both sealing surfaces of bearing housing for damage and cleanliness before installation in the bearing housing. Grind off sharp edges if necessary.
2	Checking flange bearing of intermediate shaft	Check flange for ease of movement or roughness of bearing; replace intermediate shaft if necessary.
3	Fitting O-ring	Carefully fit O-ring in the groove of the intermediate-shaft flange. Do not fit twisted. Grease lightly
4	Fitting chain for intermediate shaft	Put on chain between crankshaft drive sprocket and intermediate shaft drive sprocket. Fit guide rail and tensioning rail. After installation, turn intermediate shaft sprocket slightly by hand in clockwise direction and check whether there is sag in the upper chain area. Check chain installation if necessary.
5	Preparing intermediate shaft and crankshaft for installation	To facilitate assembly, connect the crankshaft and intermediate shaft with an O-ring before installing the complete bearing housing unit in the crankcase half (cylinder bank 1-3).

13 48 19 Removing and installing crankshaft

Removing and installing crankcase and bearing housing with crankshaft

Removal

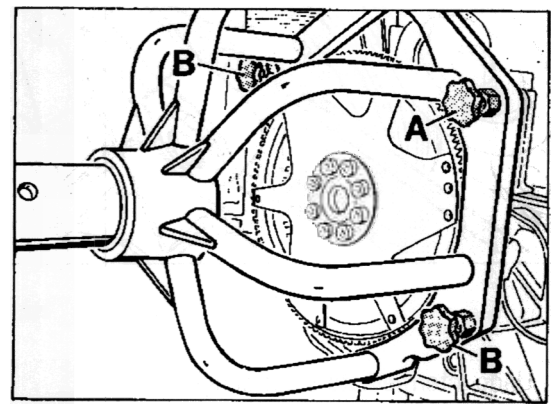
1. Detach thrust plate or flywheel. Fasten toothed segment (special tool 9538/1) on the crankcase half (cylinder bank 1 - 3) with hexagon-head bolt M12 x 50.



607_97

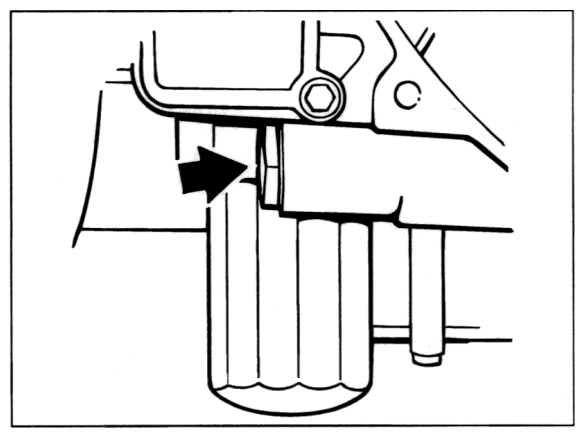
2. Detach thrust plate and remove with drive plate. Detach and remove the flywheel.

3. Clamp crankcase. Fasten engine holder, special tool 9589, to the crankcase half of cylinder bank 1 - 3.



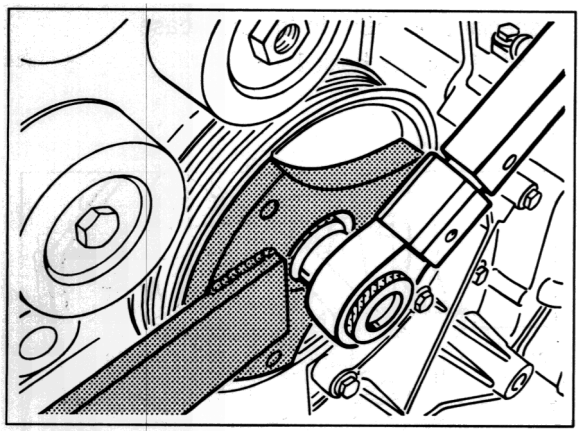
408_96

4. Turn primary chain tensioner out of the crankcase (cylinder bank 4 - 6).



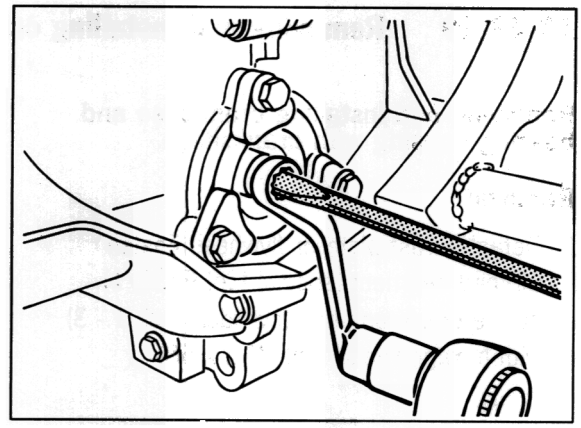
62_98

5. Loosen belt pulley. Undo hexagon-head bolt (M16 x 1.5 x 60) with special tool (socket wrench insert 9594); to do this, hold with holding device (special tool 9593).



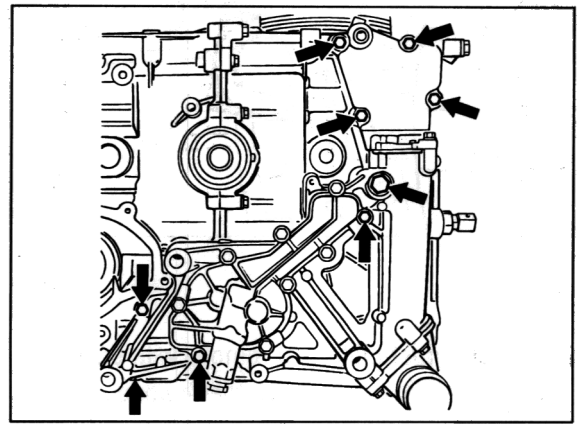
252_97

6. Undo intermediate shaft flange.
Unscrew the three fastening screws M6 x 20 on the intermediate-shaft flange. Undo the locknut using the socket wrench, special tool 9110. For this purpose, hold with a slotted screwdriver 7.0 x 1.1 at the slotted threaded pin.



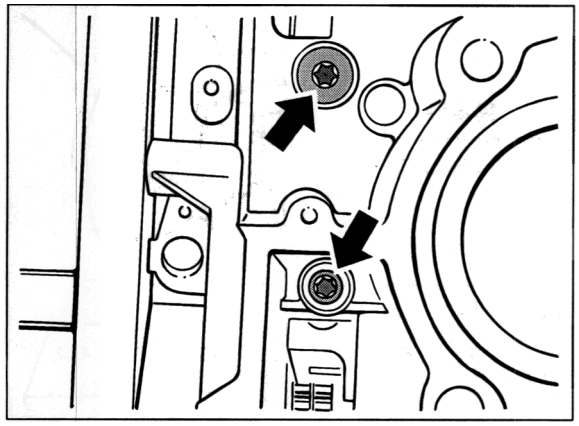
442_97

7. Remove coolant guide housing.



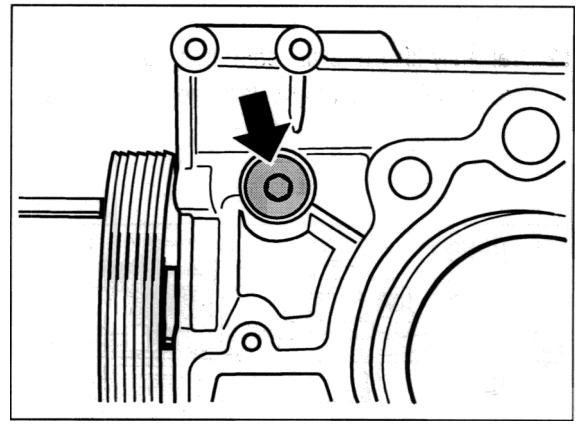
597_97

8. Undo fastening screws between crankcase half of **cylinder bank 1 - 3** and bearing housing.



594_97

9. Undo fastening screw between crankcase half of **cylinder bank 4 - 6** and bearing housing.



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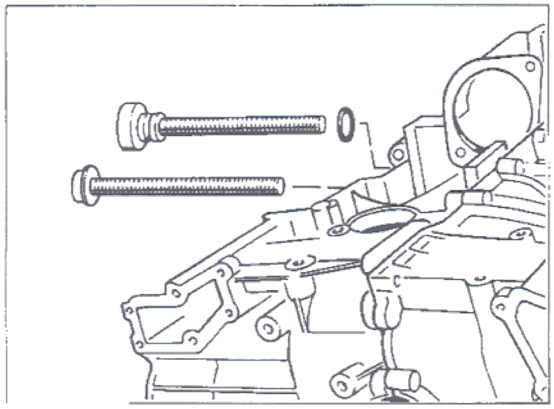
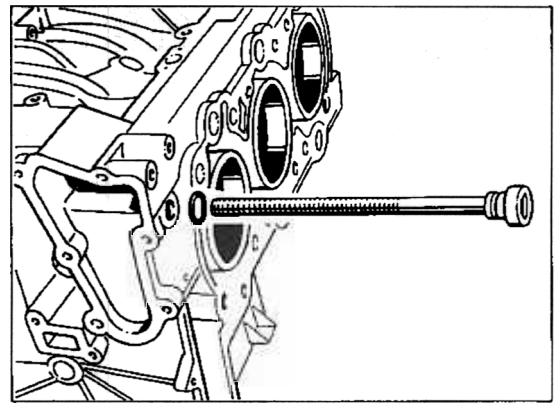


496_96

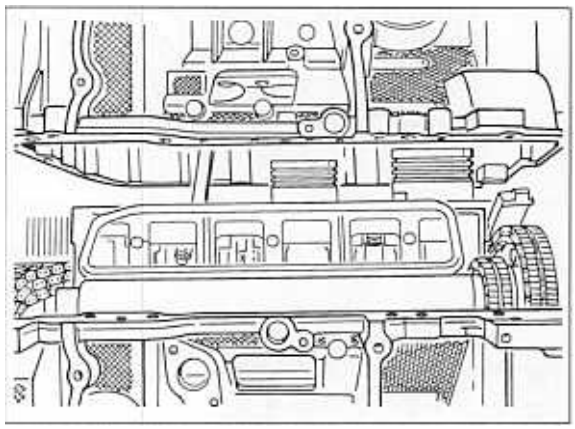


495_96

10. Turn crankcase by 180°.
Undo oil pan fastening screws (M6 x 16, 13 ea.). Detach oil pan by tapping it at the sides with a plastic hammer.
Remove air-oil separator.
See Group 17, Page 17 - 2.

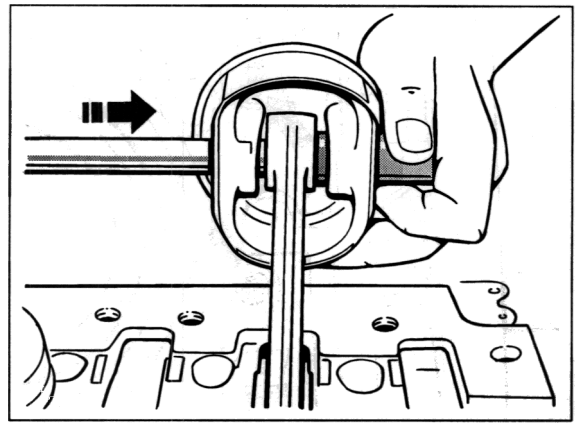
11. Turn crankcase 90° further. Crankcase half of cylinder bank 4 - 6 faces upward. Undo hexagon-head bolts (M6 x 35, 25 ea.) joining the crankcase halves.

12. Carefully lift the crankcase half up and off. Do not tilt – this might damage the pistons.



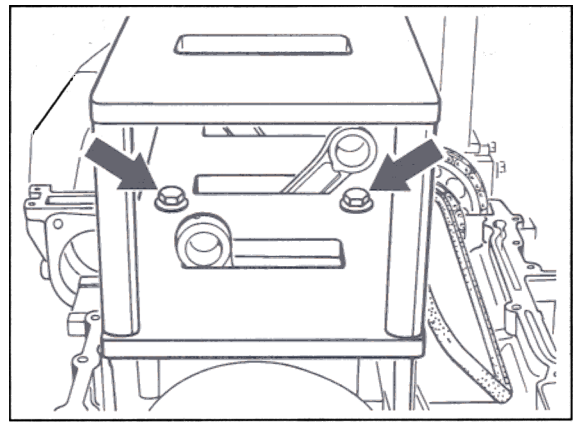
608_97

13. Mark pistons.
Lever off front piston pin circlip.
Push out piston pin.



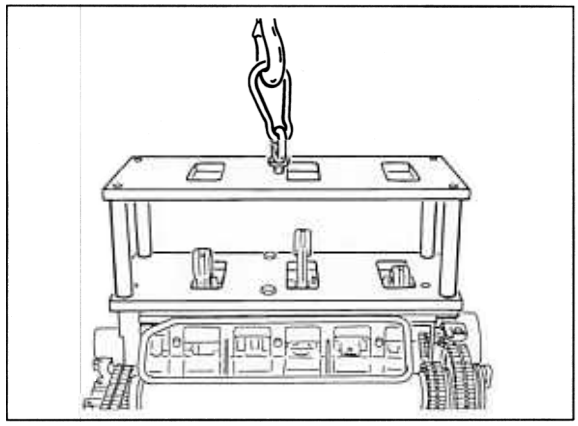
593_97

14. Fasten assembly fixture (special tool 9607) on the bearing housing with two M10 x 20 hexagon-head bolts.

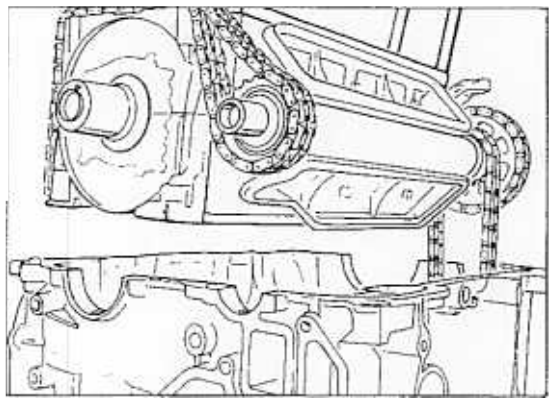


581_97

15. Fasten suspension eye, attach spring hook, and lift bearing housing out of the crankcase half using a workshop crane or engine lifter.



345_97

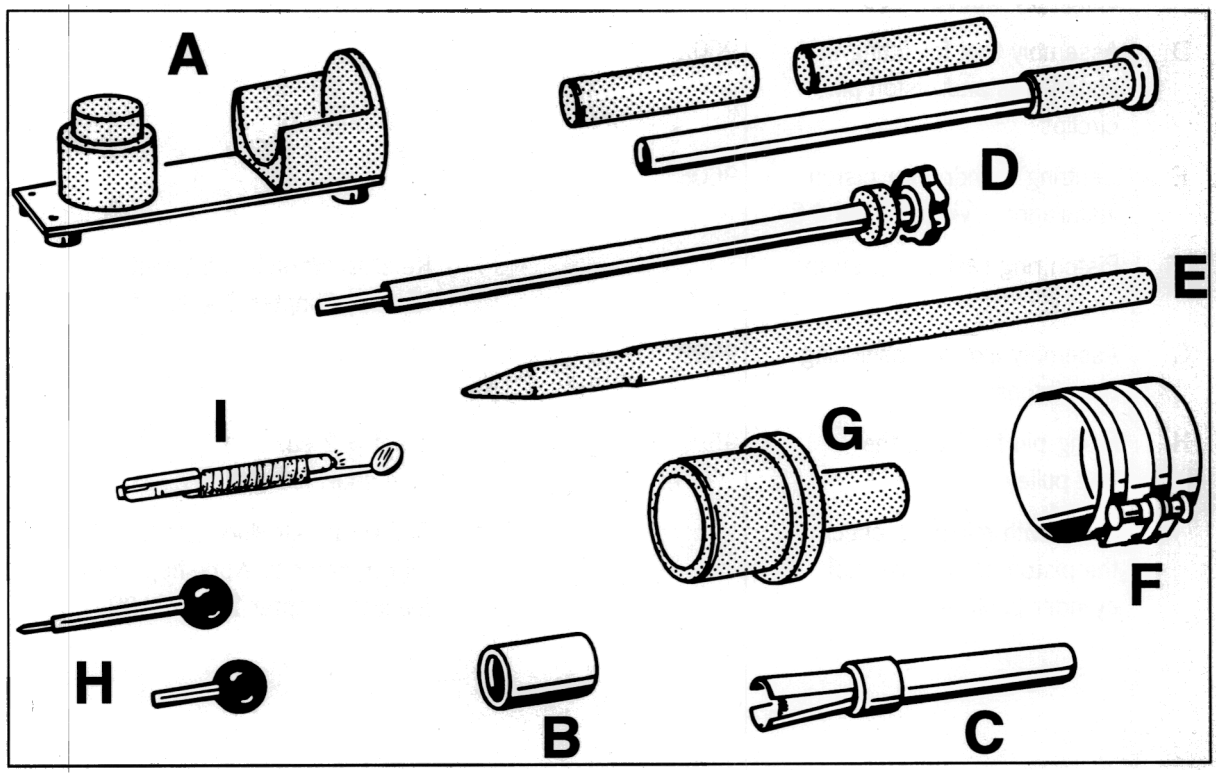


484_96

16. Disassemble bearing housing on intermediate shaft.
See Group 13, Page 13 - 5.

13 10 19 Removing and installing pistons

Tools



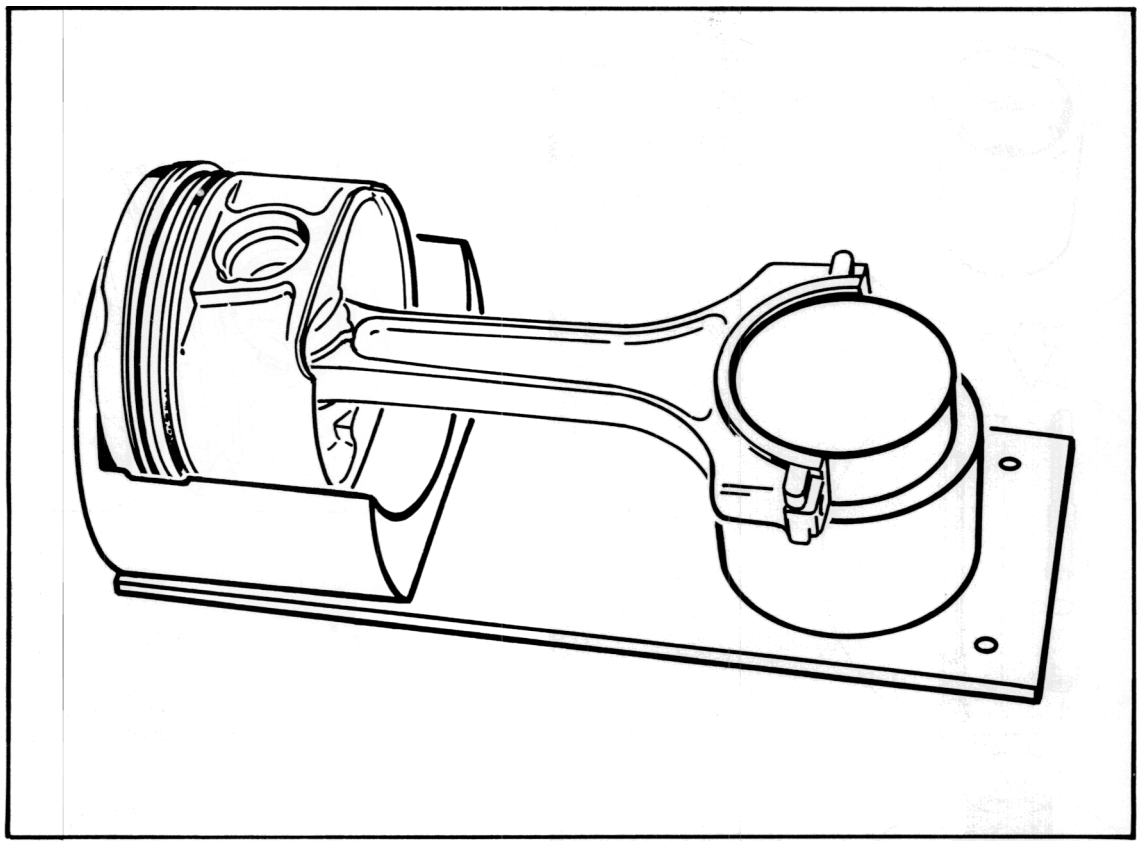
572_96

Item	Designation	Special tools	Explanation
A	Retaining device for pistons and connecting rods for pre-fitting the piston pins of cylinder bank 1 - 3	9597	
B	Assembly sleeve for pre-fitting the piston pin circlips	9603	

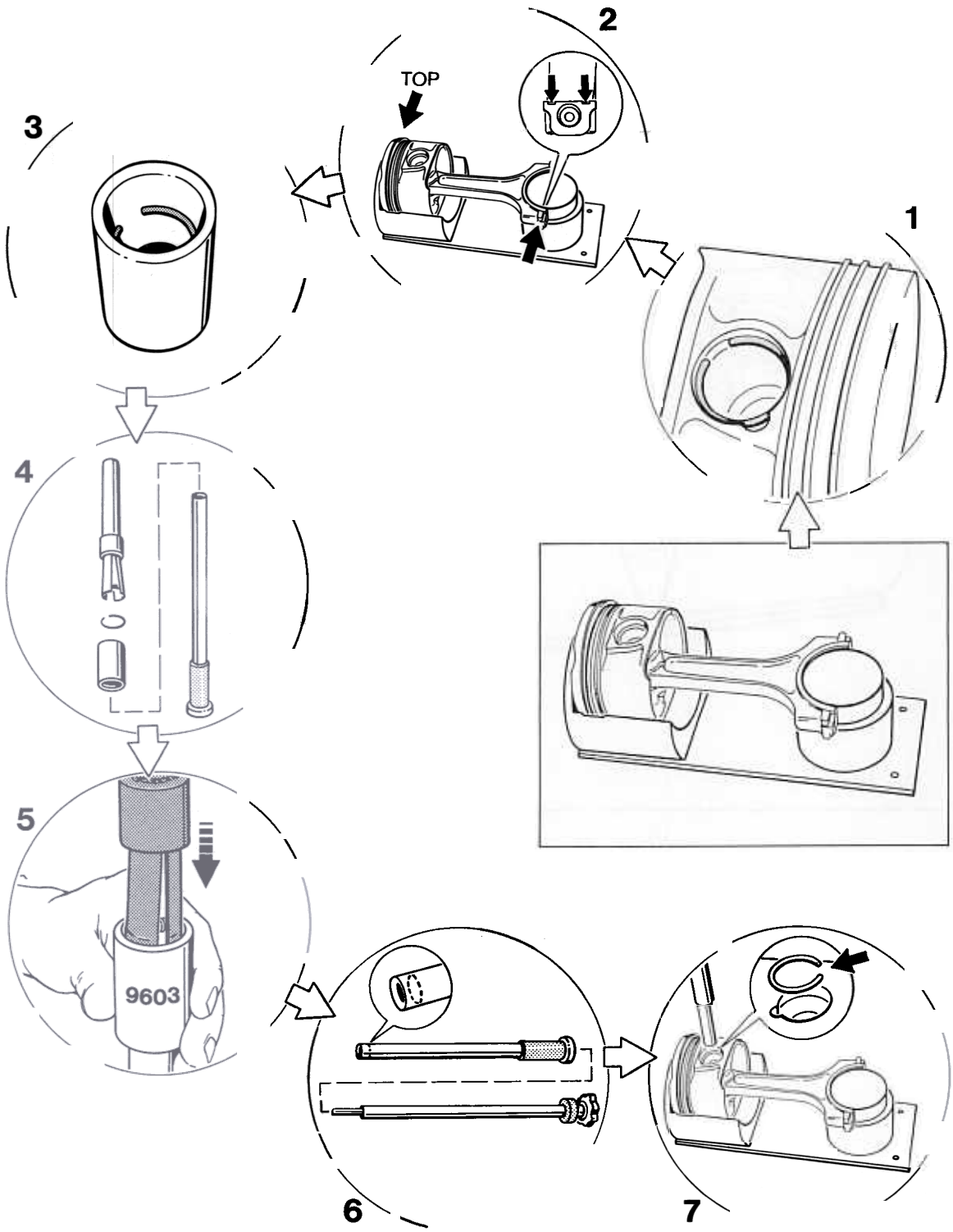
Item	Designation	Special tool	Explanation
C	Assembly aid for piston pin retainer mounting in assembly sleeve 9603	9500/3	
D	Assembly tool for fitting the piston pins and piston pin circlips	9602	
E	Centring mandrel for piston installation, cylinder bank 4-6	9608	
F	Piston ring restraining strap		Refer to Workshop Equipment Manual, Chapter 2.4, No. 57
G	Assembly aid for positioning the pistons	9598	
H	Fixing pin for fixing the belt pulley	9595	1 set = 2 ea. (use short fixing pin)
	Lamp with mirror to check the piston pin retainers of cylinder bank 4-6		Shop-made or illuminated, adjustable mirror; refer to Workshop Equipment Manual, Chapter 2.4, No. 20

Fitting pistons and connecting rods

Prepare pistons and connecting rods for installation in the crankcase half of **cylinders 1 - 3**.



Fitting pistons and connecting rods



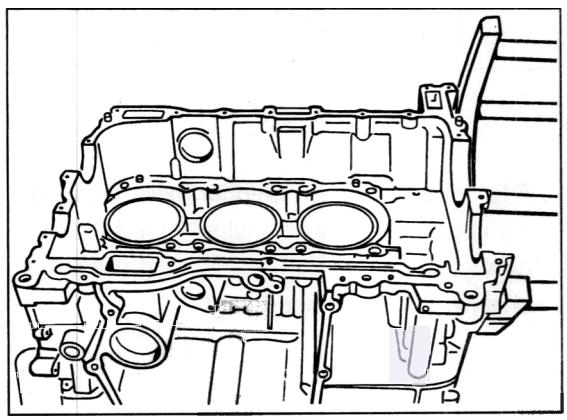
Fitting pistons and connecting rods

No.	Procedure	Instructions
		It is important to pre-fit the circlip on a firm surface. The circlip must be pre-fitted only immediately prior to fitting on the piston pin eye.
	Check piston pin circlip	Make sure that the circlip is present and seated securely. The circlip has been pre-fitted on one side of the piston pin by the manufacturer. The circlip opening must lie opposite the groove in the piston.
2	Insert piston and connecting rod	Insert piston in the retaining device, special tool 9597. The side with the pre-fitted circlip must face downwards. Fit the connecting rod and piston pin. Insert the connecting rod so that the recesses of the bearing twist lock are opposite the piston marking "TOP".
3	Fit piston pin circlip	Manually insert the new circlip into the conical assembly sleeve, special tool 9603.
4 + 5	Press piston pin circlip into the assembly tube	Place assembly sleeve 9603 onto the assembly tube of special tool 9602. Use assembly aid, special tool 9500/3, to slide the circlip from the conical sleeve into the assembly tube. Remove assembly aid 9500/3 and visually inspect the correct position of the circlip in the assembly tube.
6 + 7	Position piston pin circlip on the piston pin eye	Carefully insert the pressure pin of special tool 9602 into the assembly tube until it contacts the piston pin circlip. The circlip can pop out of the assembly tube in the case of improper handling – danger of injury! Position assembly tube and pressure pin on the piston pin eye. Press pressure pin down until the circlip is heard to engage in the ring groove. **Visually inspect correct seating.**

Fitting pistons and piston rods in the crankcase half or on the bearing housing of cylinder bank 1 - 3

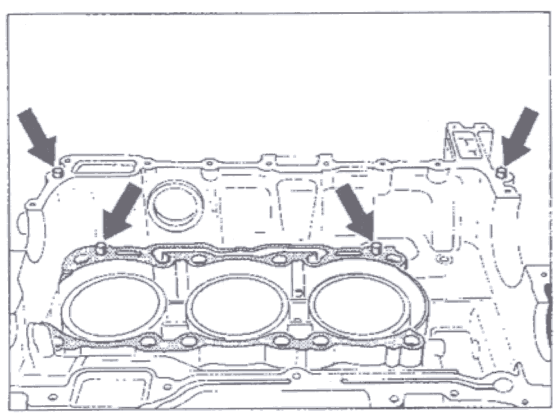
Installation

1. Fasten cylinder housing half, cyl. 1-3, in combination with mounting elements 9590 to engine holder 9589.



494_97

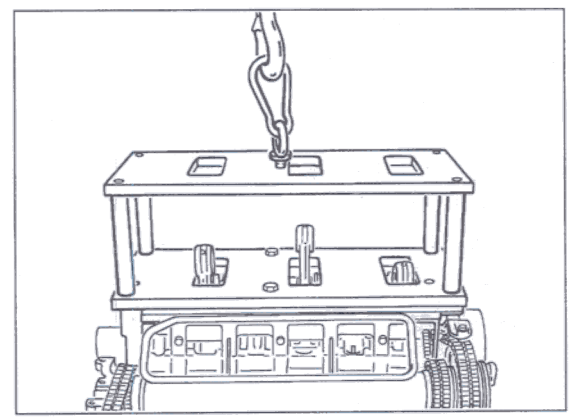
2. Clean bearing housing support surface, particularly in area of oil duct. Check dowel sleeves for correct seating.



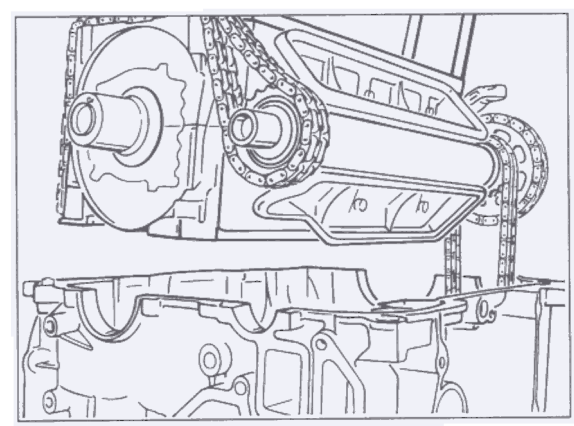
490-96

3. Installation of the complete bearing housing in the crankcase half, cylinders 1 - 3.
   As the bearing housing is heavy, it should be installed using a workshop crane.

   Carefully and in stages, lower bearing housing with fitted holder 9607 and workshop crane towards the dowel sleeves (2 ea.), observing the following points:

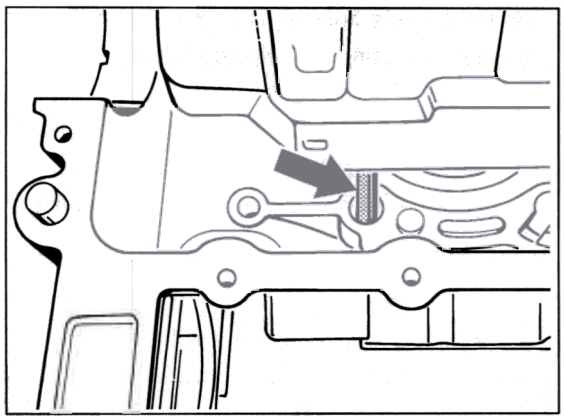


97-345



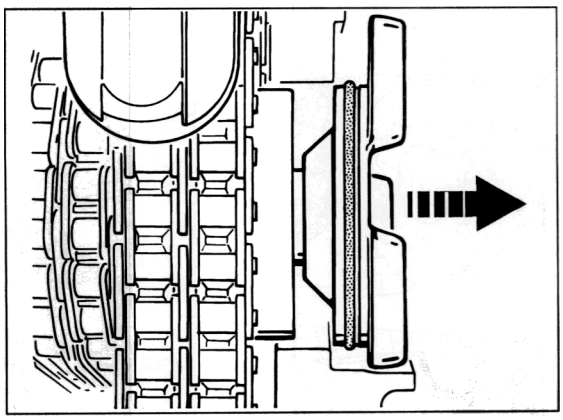
97-382

a. To aid in guiding, screw pan-head screws approx. 3 turns into the bearing housing from below.

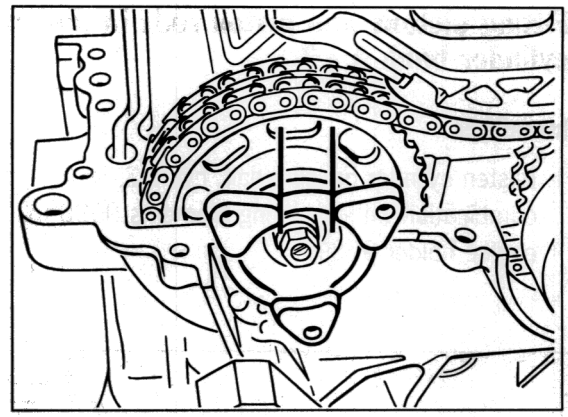


467-97

Just before reaching the final installation position, pull the loosened intermediate-shaft flange out of the housing area and rotate the flange so that the two flange lugs that are spaced closest together face upwards.

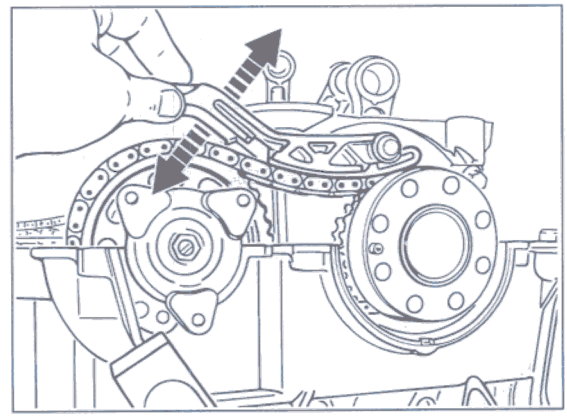


97-217



97-219

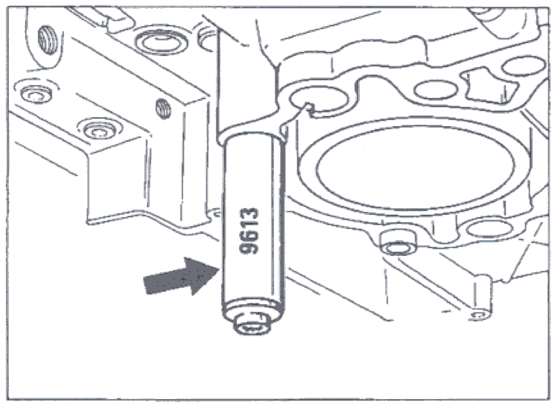
c. After lowering, check whether there is sag in the upper chain area or sufficient lever travel exists. Lift the bearing housing and check the chain installation if necessary.



440-97

d. Remove two pan-head screws (guide aid).

4. For the following assembly procedure – **piston installation, cylinders 1, 2 and 3** – the crankcase half and bearing housing unit **must be held by at least two screwed connections**.
For this purpose, fasten two original cylinder head screws and plastic spacer sleeves, special tool 9613, from below.
Tightening torque: 30 Nm (22 ftlb.).
Use Torx screwdriver insert T50.

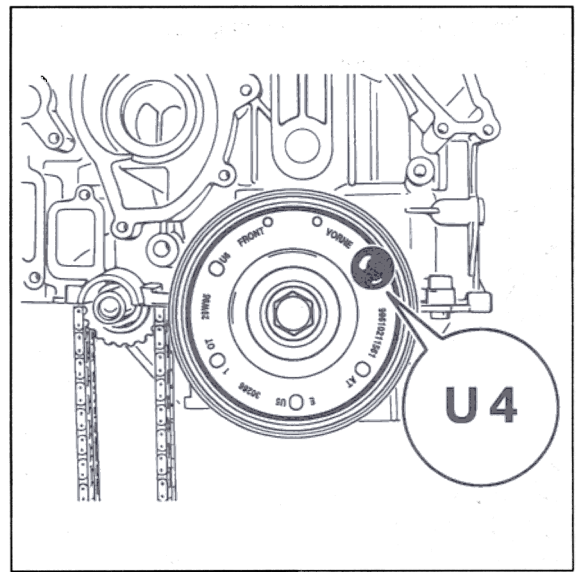


491_96

5. Turn crankcase by 90° on the assembly support. Cylinders 1, 2 and 3 face upwards.

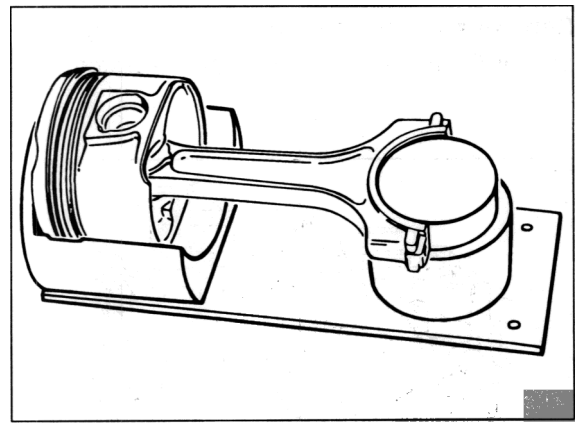
6. Fit belt pulley. Screw in fastening screw by hand.

7. Turn crankshaft clockwise until the bore **U4** on the pulley is aligned with the fixing bore on the crankcase. Position or fix with fixing pin (short) of special tool 9595.



604_97

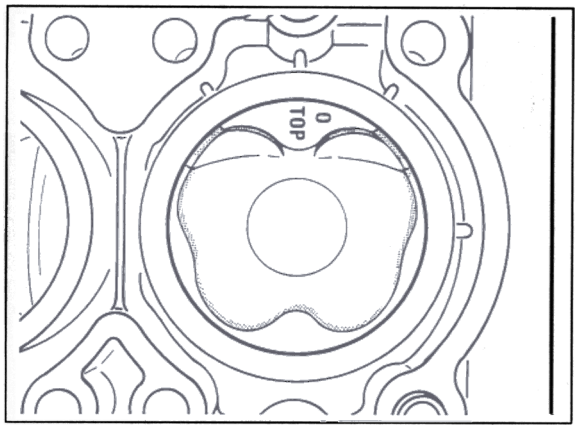
8. Remove preassembled connecting rod of **cylinder 1** from the assembly fixture.



255_97

9. Align the gaps of the piston rings offset by 120°.

10. Place piston with connecting rod in installation position.

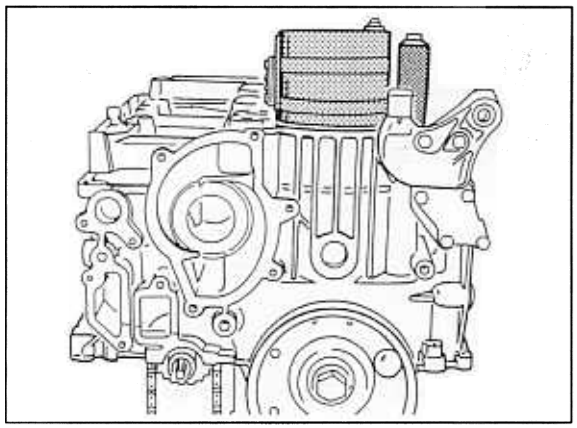


258_97

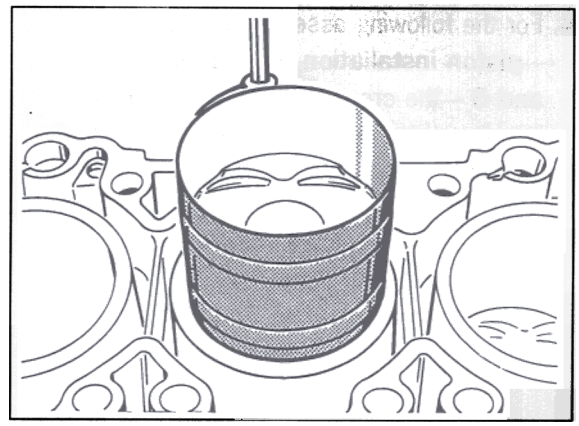
11. Tighten piston ring clamp and fit piston with connecting rod.

Note

Generously coat the piston and restraining strap with engine oil before fitting the piston.



505_97



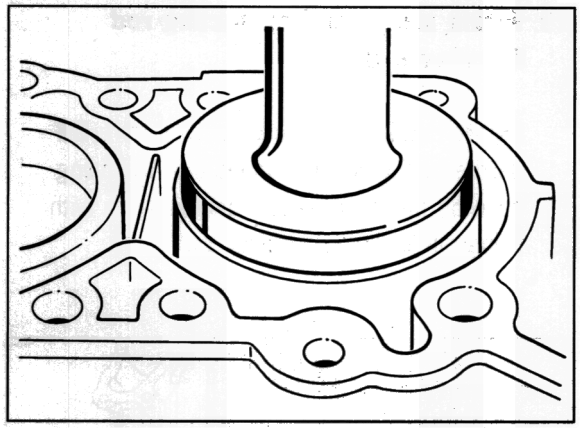
97-241

12. Use the handle of a hammer to tap the piston into the cylinder while firmly pressing on the edge of the restraining strap. Use protective gloves.

Note

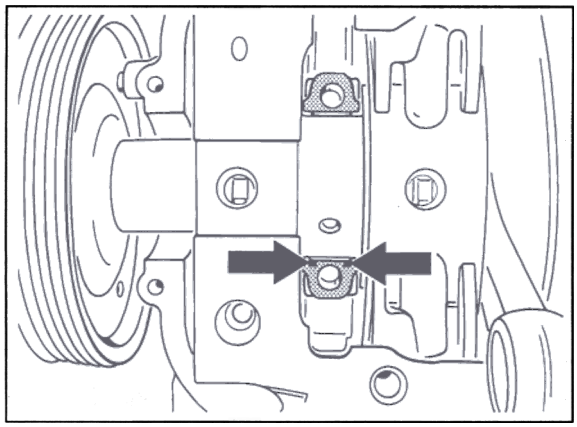
The piston must be fitted in the cylinder carefully and with feeling. If the resistance increases, immediately interrupt the assembly process. Reposition the piston ring restraining strap and repeat the assembly operation.

13. Centre the piston in the cylinder bore and carefully push it down with the assembly aid (special tool 9598).



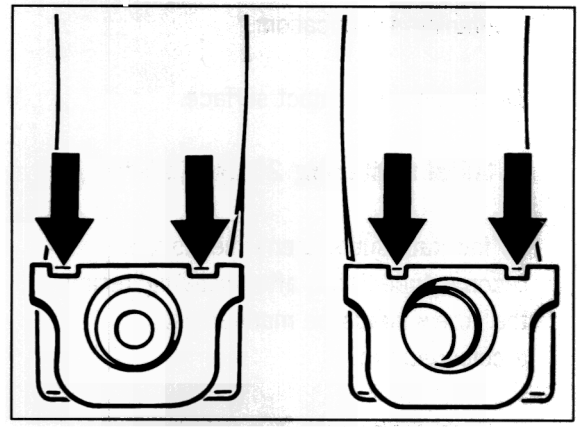
251_97

14. Turn crankcase by 90° to the left. Make sure the bearing shell is correctly seated in the connecting rod. The fixing lugs point to the oil pan.

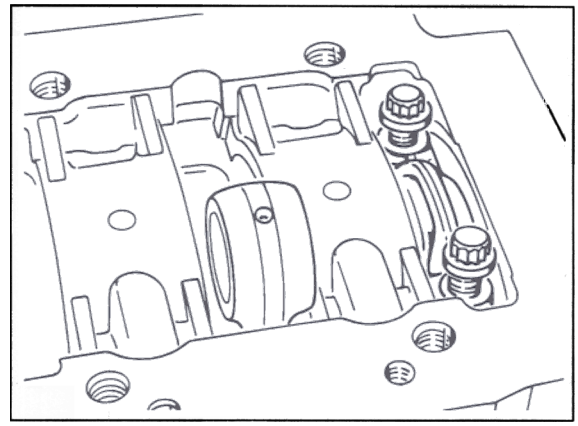


517_97

15. Fit end caps. Lubricate bearing shells. The recesses of the connecting-rod bearing twist lock must face each other.



97-256



506_97

16. Tightening specification:

    Oil thread and contact surface.

    1. Initial tightening 20 Nm (15 ftlb.)

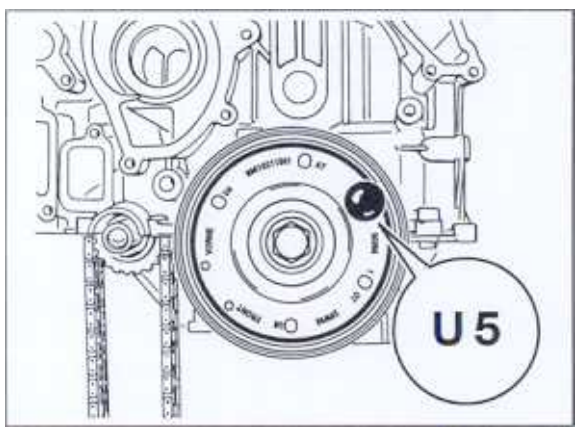
    To facilitate subsequent checks it is recommended that, after initial tightening, the screw heads be marked with a coloured pen.

    2. Final tightening 1 x 90° turn

    Use 10 mm socket wrench insert (double hexagon).

17. **Fitting piston and connecting rod in cylinder 2**

    Rotate crankshaft clockwise until bore **U5** on the belt pulley is aligned with the fixing bore on the crankcase. Position or fix with fixing pin (short) of special tool 9595.

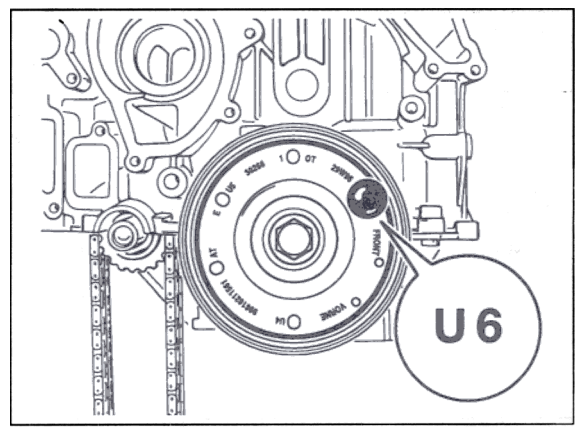


605_97

18. Prepare preassembled connecting rod of **cylinder 2** for installation.
    Perform the following assembly steps as described from Step 8 to Step 16.

19. **Fitting piston and connecting rod in cylinder 3**

    Rotate crankshaft clockwise until bore **U6** on the belt pulley is aligned with the fixing bore on the crankcase. Position or fix with fixing pin (short) of special tool 9595.



603_97

20. Prepare preassembled connecting rod of **cylinder 3** for installation.
    Perform the following assembly steps as described from Step 8 to Step 16.

Note

Leave crankshaft at position **U6** after fitting the piston and connecting rod in cylinder 3. This position is necessary for subsequent fitting of the piston of cylinder 6.

21. Remove belt pulley.

Fitting pistons on cylinder bank 4 - 6

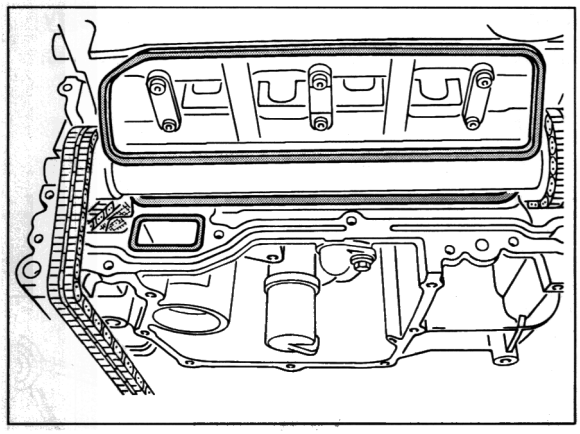
Note

The crankcase half of **cylinder bank 4 - 6** must be fitted before installation of the pistons.

Installation

1. Thoroughly clean sealing surface of the crankcase half of cylinder bank 1 - 3.

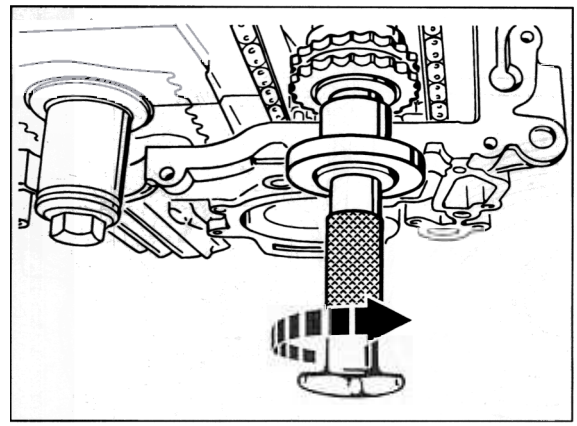
2. Ensure that the profile seals on the oil separator and the two seals on the coolant duct are seated correctly.



690_97

3. Apply a uniform bead of silicone approximately 1.5 mm wide to the cleaned sealing surface of the crankcase half of **cylinder bank 4 - 6**.
Instructions: see Group 10, Page 10 - 28.

4. Place special tool 9645 on the receiving bore of the oil pump and turn the knob clockwise until the centring mandrel is braced in the crankcase half.

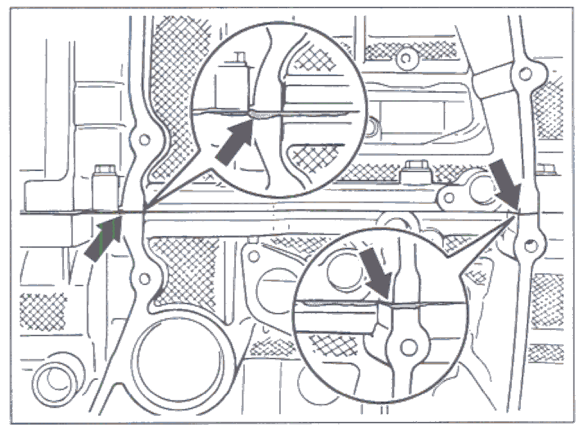


511_98

5. Before fitting the crankcase half, have a second person pull the drive chain out of the chain space using a wire.

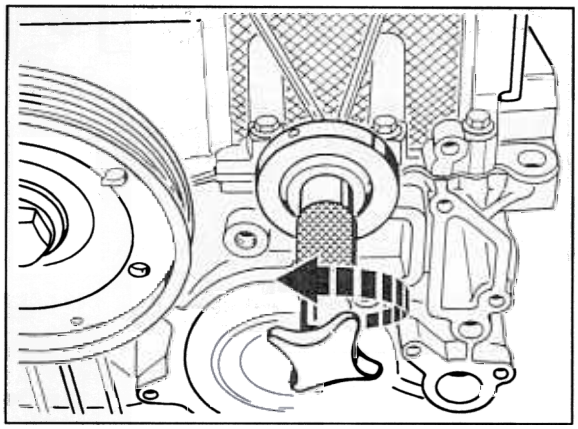
6. **Do not damage the sealing bead when setting the crankcase half in place.**

7. Fasten crankcase half. Tightening torque: 13 Nm (10 ftlb.) Tightening sequence: see Group 10, Page 10 - 29. Remove emerging silicone material.



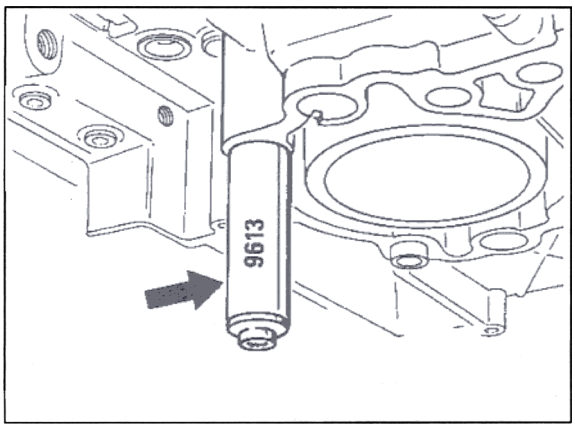
599_97

8. Turn the centring mandrel anti-clockwise and remove. Remove silicone residue.



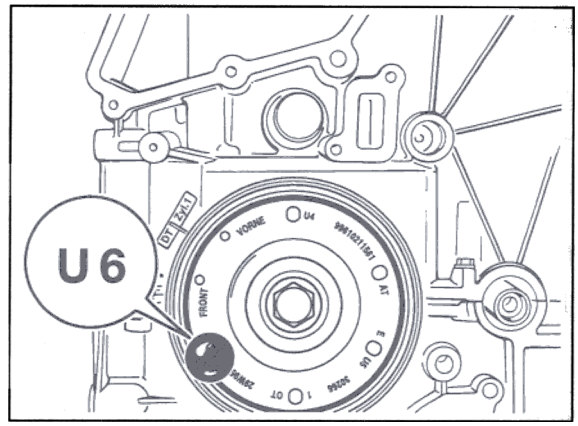
520_98

9. Remove special tool 9613.



491_96

10. Fit belt pulley. Screw in fastening screw by hand.
Cylinder bank 4 - 6 faces **upward**.
Bore **U6** on the belt pulley must be aligned with the fixing bore on the crankcase.
Position or fix with fixing pin (short) of special tool 9595.

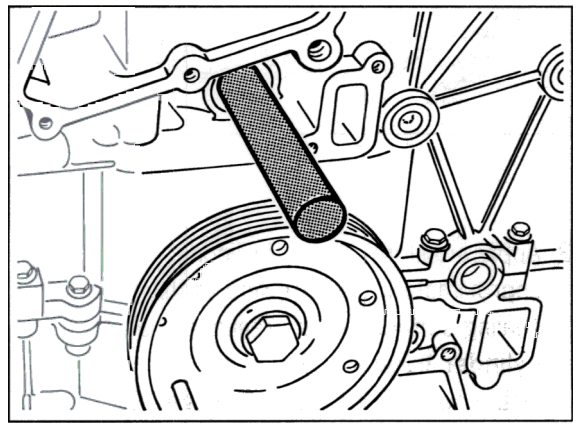


606_97

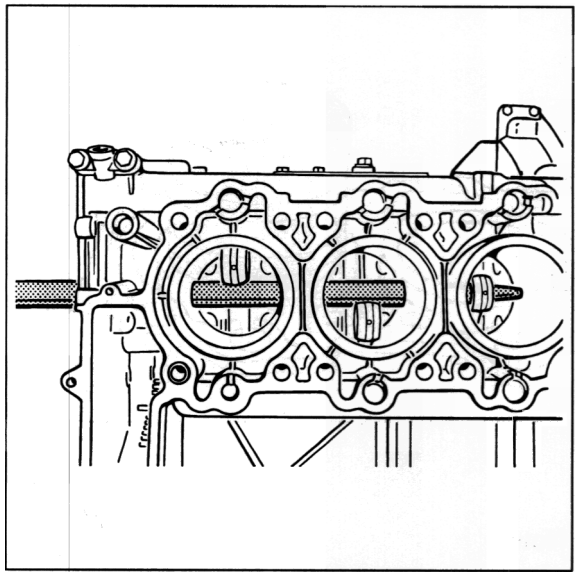
Note

Fixing of the belt pulley is absolutely necessary in order to ensure precise fitting of the pistons.

11. Align connecting rod of **cylinder 6**. Insert centring mandrel, special tool 9608, in the assembly bore.



221_97



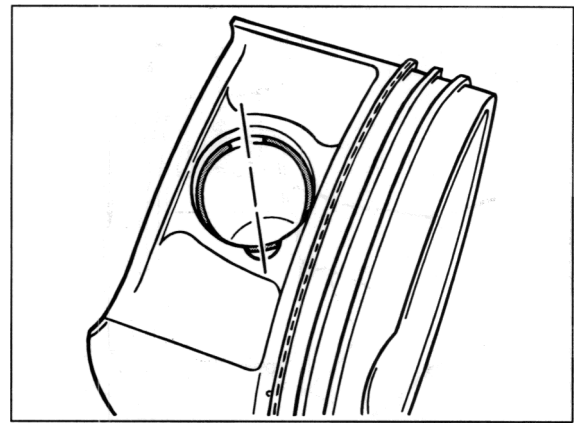
466_97

Note

The centring mandrel remains in the eye of the connecting rod until the piston contacts the centring mandrel during fitting.

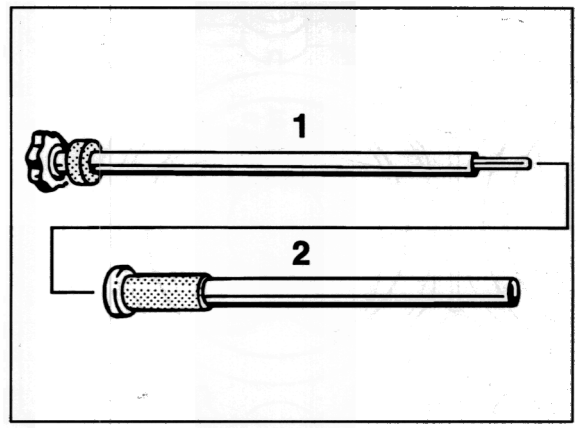
12. Install piston **of cylinder 6**.

12.1 Check whether the piston pin circlip is present and was fitted correctly (flywheel side).
The piston circlip opening must lie opposite the groove in the piston.

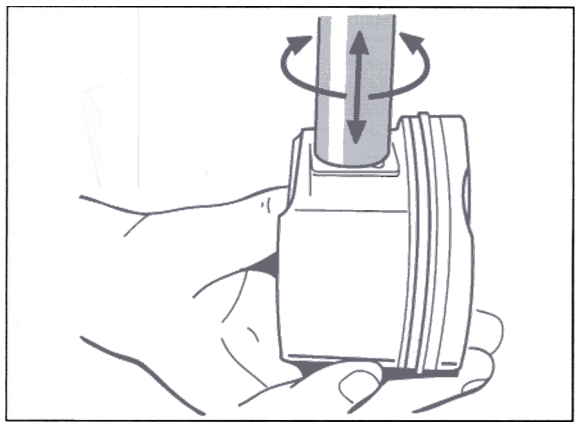


617_97

12.2 Before installation, check whether the assembly tube (2) can be moved easily in the piston; remove burr if necessary.

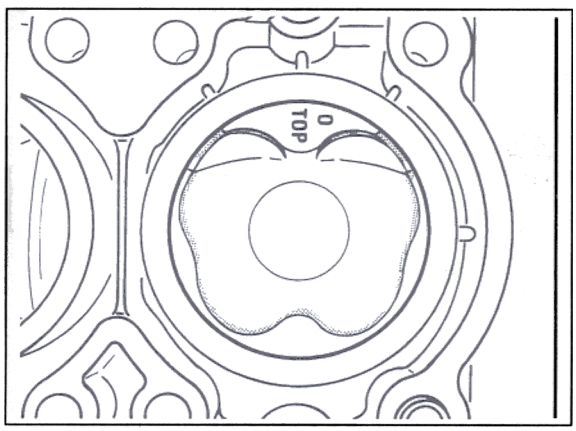


495_97

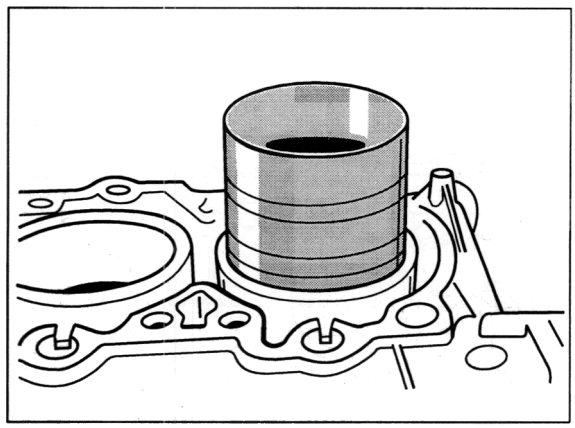


59_98

13. Move piston to installation position, position the piston ring restraining strap and insert the piston.



258_97



58_98

Note

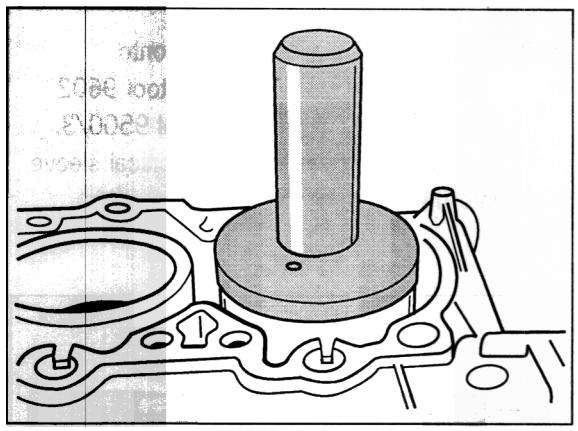
Generously coat the piston, cylinder and restraining strap with engine oil before fitting the piston.

14. Use the handle of a hammer to tap the piston into the cylinder while firmly pressing on the edge of the restraining strap. Use protective gloves.

Note

The piston must be fitted in the cylinder carefully and with feeling. If the resistance increases, immediately interrupt the assembly process. Reposition the piston ring restraining strap and repeat the assembly operation.

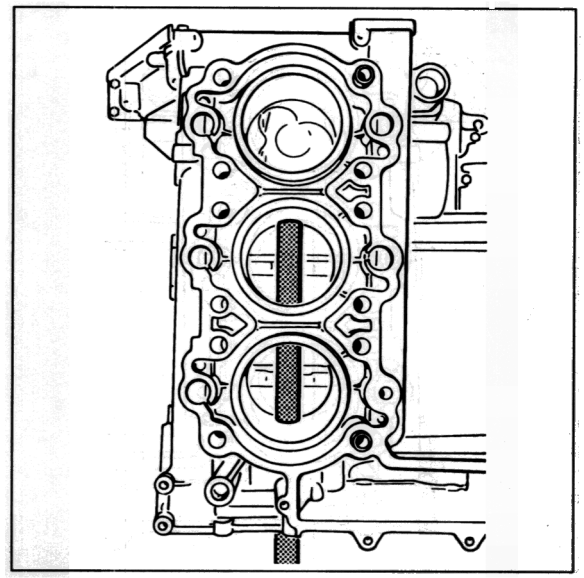
15. Centre the piston in the cylinder bore and carefully push it down with the assembly aid (special tool 9698) to the centring mandrel stop.



60_98

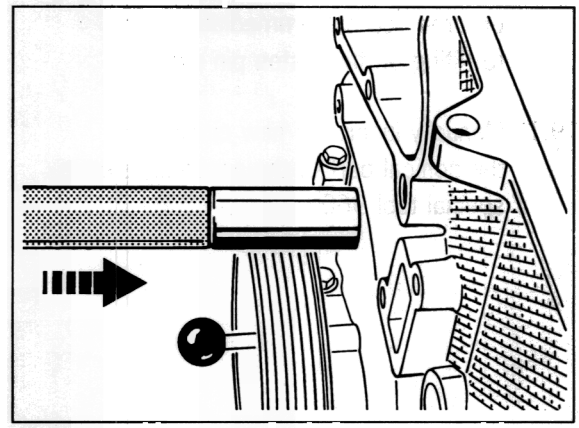
16. Carefully withdraw the centring mandrel and push the piston down to the stop.

17. Align piston and connecting rod again using the centring mandrel.

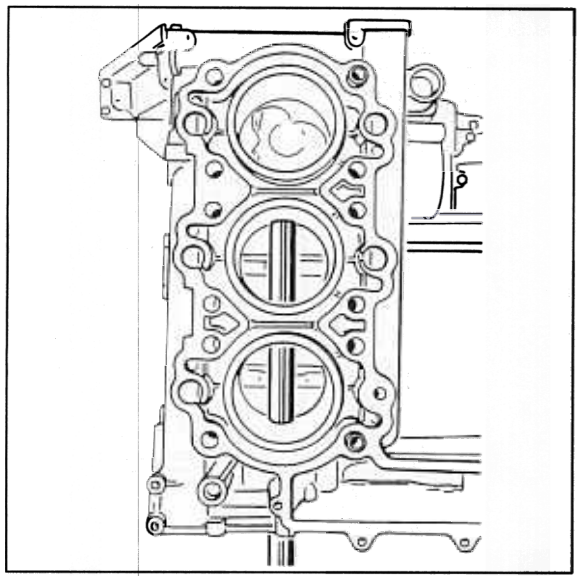


222_97

18. Push in piston pin as far as it will go using the pressure pin of special tool 9602.



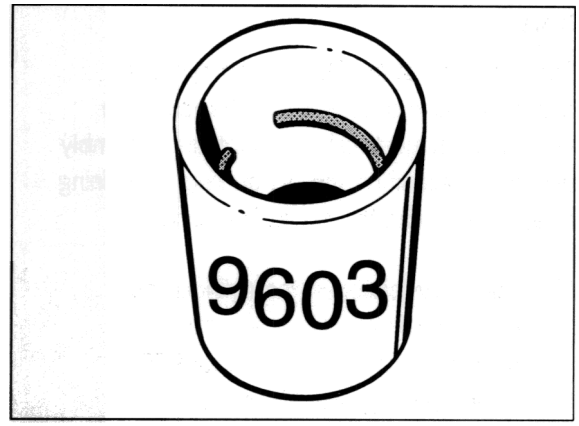
609_97



272_97

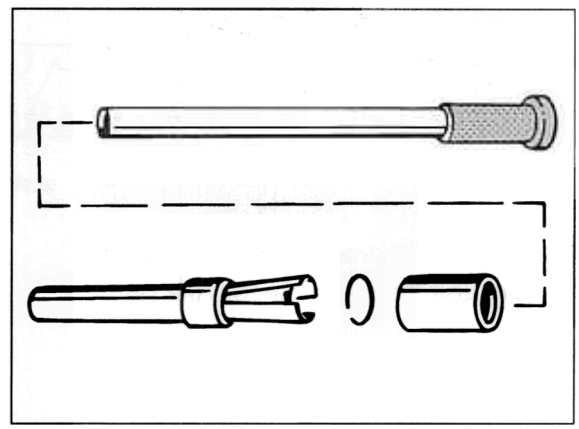
19. Prepare piston pin circlip for fitting on the piston.
It is important to pre-fit the circlip on a firm surface. The circlip must be pre-fitted only immediately prior to fitting on the piston pin eye.

19. Manually insert the new circlip into the conical part of the assembly sleeve, special tool 9603.

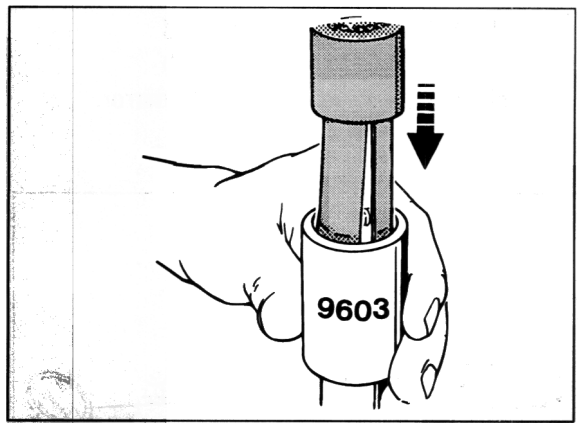


40_98

19.2 Place assembly sleeve 9603 onto the assembly tube of special tool 9602. Use assembly aid, special tool 9500/3, to slide the circlip from the conical sleeve into the assembly tube.

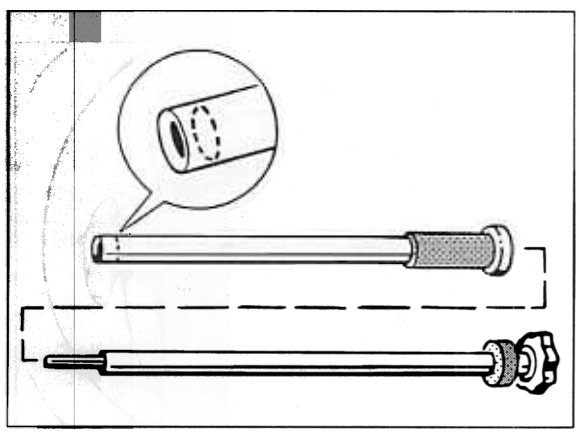


41_98



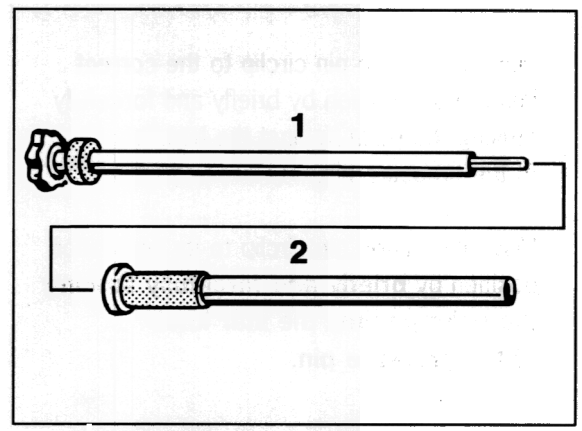
42_98

19.3 Remove assembly sleeve 9500/3 and visually inspect the correct position of the circlip in the assembly tube.



43_98

19.4 Carefully insert the pressure pin (1) of special tool 9602 into the assembly tube (2) until it contacts the piston pin circlip. **The circlip can pop out of the assembly tube in the case of improper handling – danger of injury!**

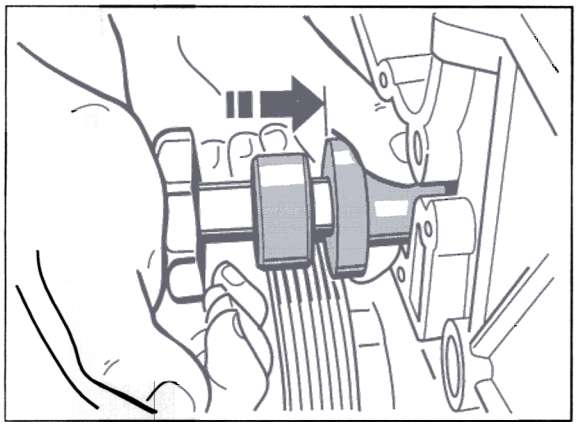


495_97

20. Carefully insert the complete unit, consisting of assembly tube with pressure pin, into the crankcase assembly bore. Press or position the assembly tube against the crankcase. Turn the assembly tube to move the piston pin circlip to the correct position. The piston circlip opening should lie opposite the groove in the piston for fitting.
Mark the assembly tube.

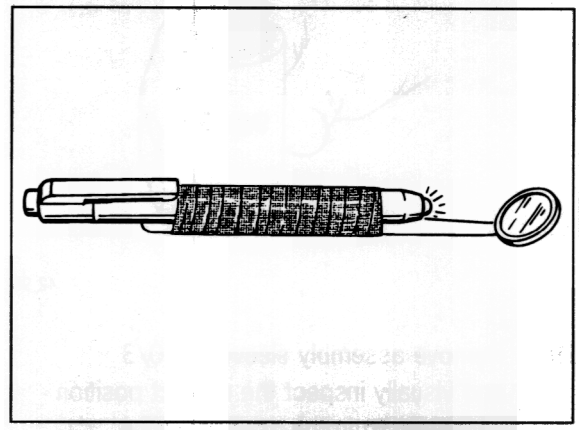
Move the piston pin circlip to the correct installation position by briefly and forcefully striking the palm against the handle of the pressure pin.

Move the piston pin circlip to its installation position by **briefly and forcefully striking the palm against the star knob of the pressure pin**.

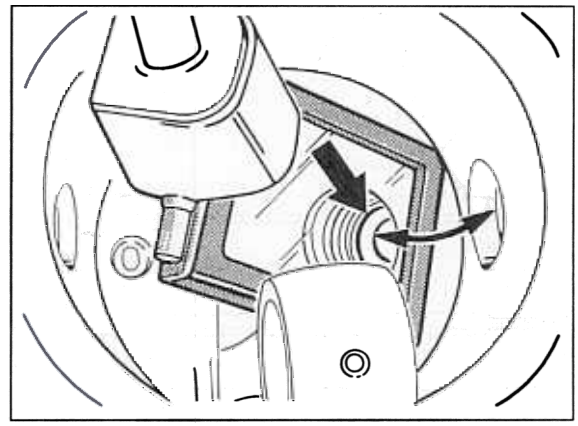


54_98

21. Visually inspect **correct seating** of the piston pin circlip, e.g. with a shop-made electric torch with mirror.



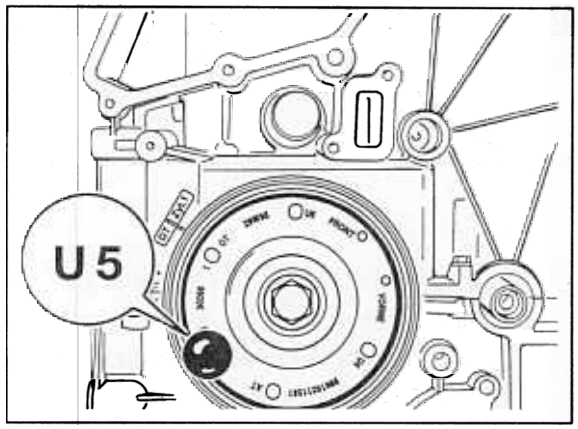
244_97



Drawing shows a torch with adjustable mirror.

259_97

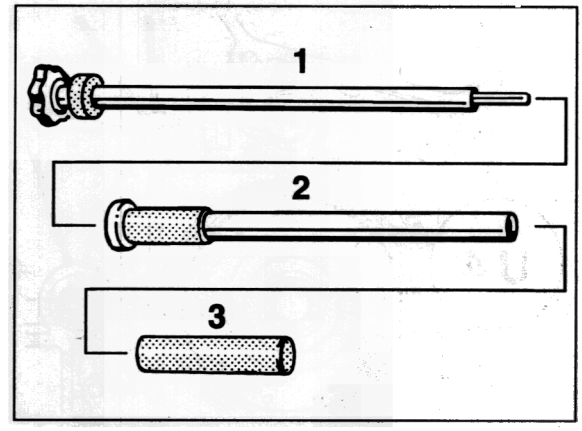
22. **Fitting piston in cylinder 5**. Advance the crankshaft clockwise until bore **U5** on the belt pulley is aligned with the fixing bore on the crankcase.
Position or fix fixing pin.



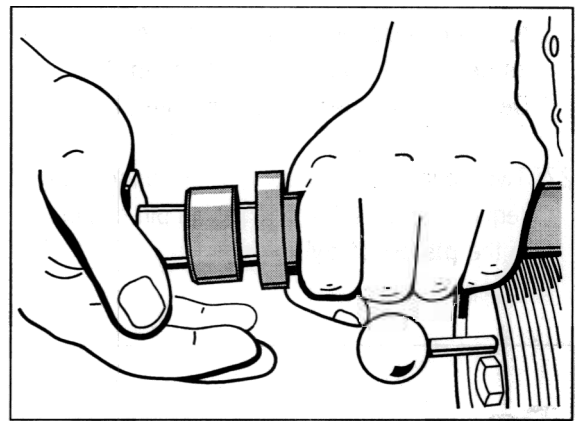
046_98

23. Perform the following assembly steps for piston installation in **cylinder 5** as described from Step 11 to Step 21. Deviating assembly steps as from Step 24.

24. A spacer sleeve (3) is additionally required when fitting the piston pin circlip in the piston of **cylinder 5**.

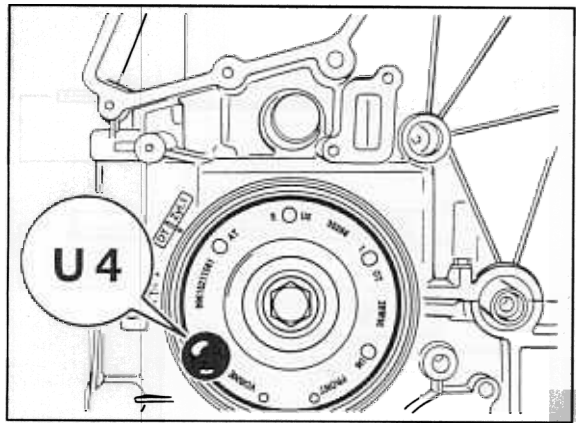


496_97

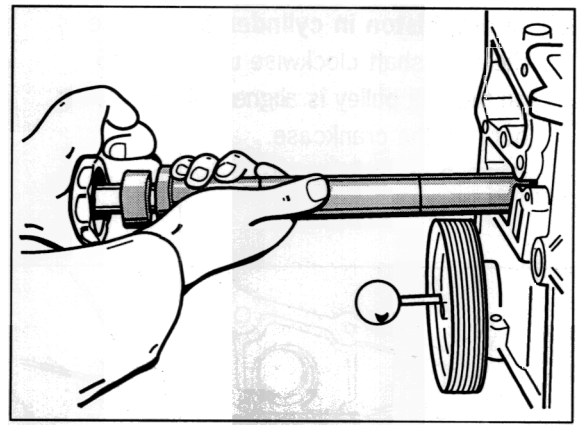


55_98

25. **Fitting piston in cylinder 4**.
Advance the crankshaft clockwise until bore **U4** on the belt pulley is aligned with the fixing bore on the crankcase.
Position or fix with fixing pin.



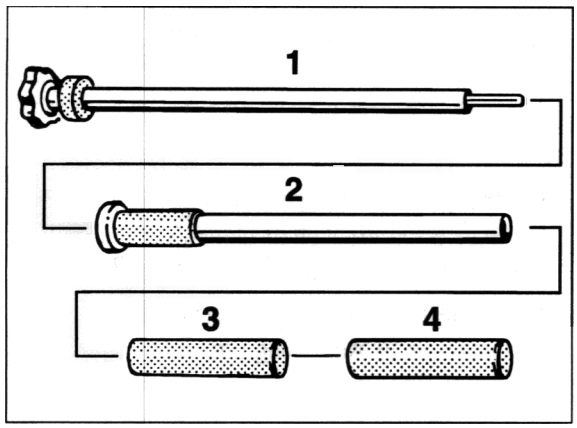
044_98



56_98

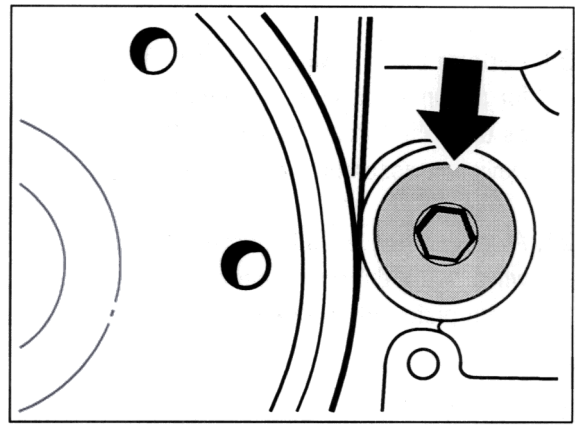
26. Perform the following assembly steps for piston installation in **cylinder 4** as described from Step 11 to Step 21. Deviating assembly steps as from Step 27.

27. Two spacer sleeves (3 + 4) are additionally required when fitting the piston pin circlip in the **piston of cylinder 4**.



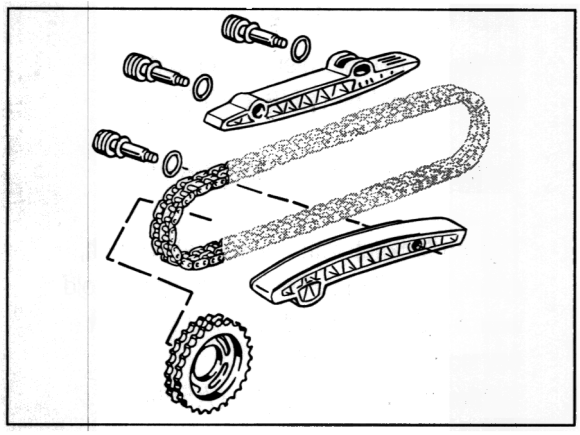
497_97

28. After fitting the pistons, fit a screw plug and new sealing ring in the assembly bore. Use a 12 mm hexagon socket wrench insert. Tightening torque: 80 Nm (59 ftlb.)



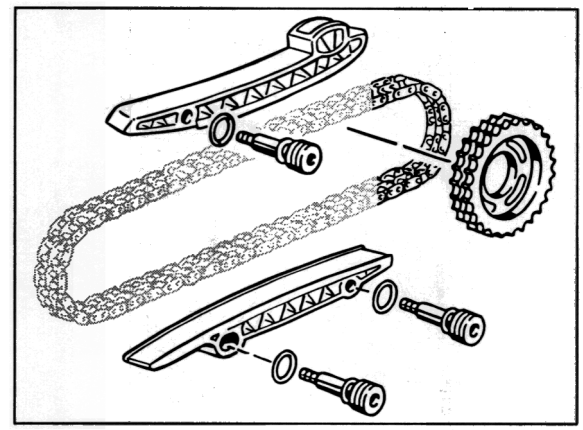
66_98

29. Fit guide rails of **cylinder bank 1 - 3** (flywheel side);
fit guide rails in correct position.

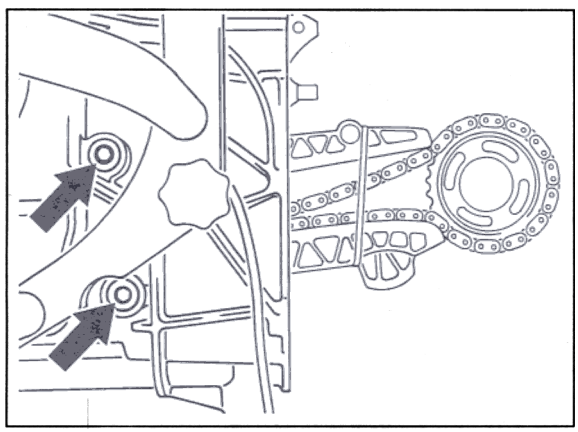


View from the belt pulley side 71_98

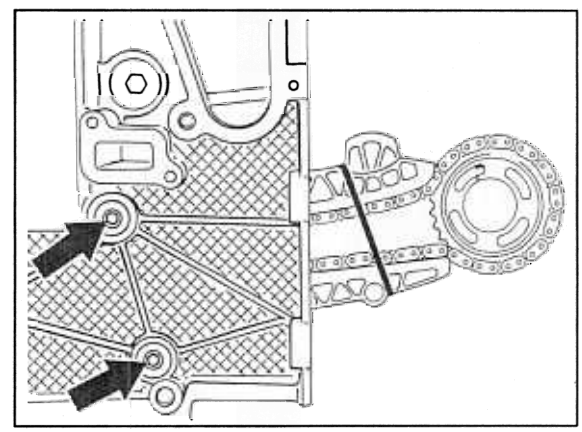
30. Fit guide rails of **cylinder bank 4 - 6** (pulley side);
fit guide rails in correct position.



View from the belt pulley side 72_98

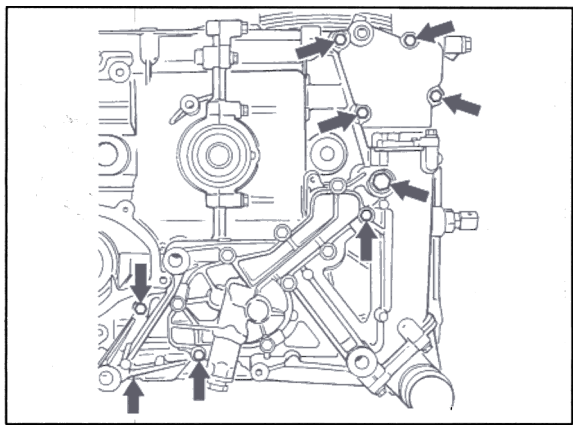


View from the flywheel side 469_97



View from the belt pulley side 073_98

31. Fit oil pump with coolant guide housing
Assembly instructions: Group 17, Page 17 - 5.



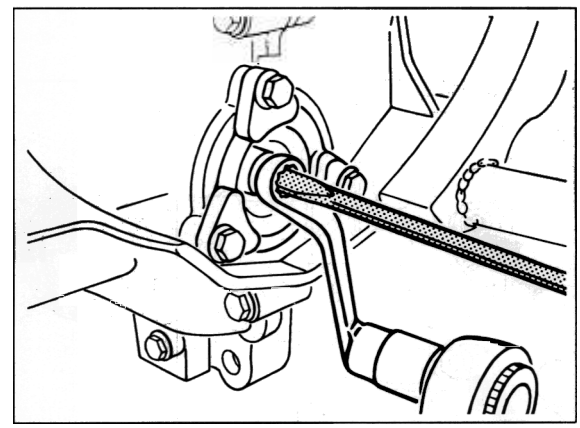
597_97

32. Fit intermediate shaft flange.
Grease sealing ring in area of intermediate shaft flange. Grease receiver bore in area of the crankcase. Carefully press in the intermediate flange.

Screw in new micro-encapsulated hexagon-head bolts M6 x 20 (3 ea.).

Tightening torque: 10 Nm (7.5 ftlb.)

Tighten locknut with the socket wrench, special tool 9110. For this purpose, hold with a slotted screwdriver 7.0 x 1.1 at the slotted threaded pin.
Tightening torque: 10 Nm (7.5 ftlb.)



442_97

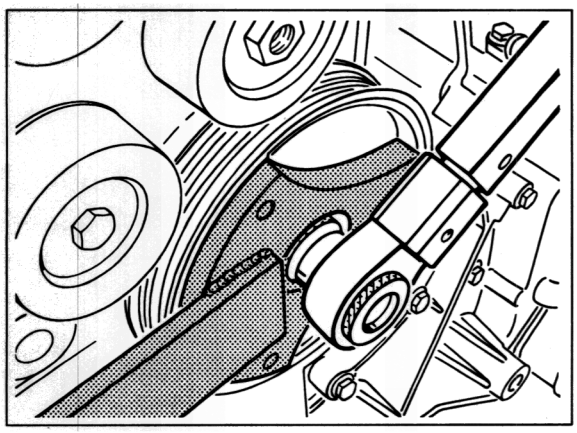
Further assembly instructions: Group 15, Page 15 - 81.

33. Fit belt pulley.

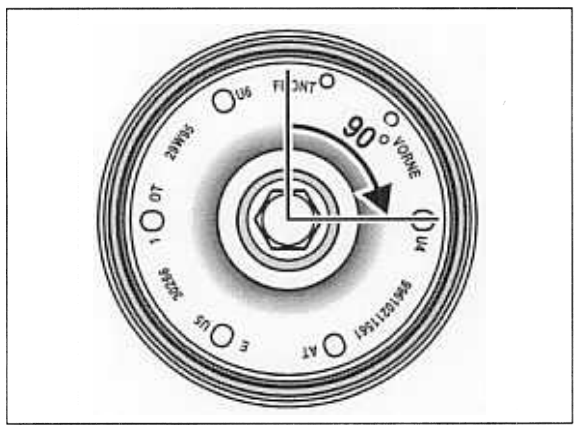
Note

Check whether there are foreign objects in the drive belt grooves of the pulley and remove them if necessary.

Tighten hexagon-head bolt using the socket wrench insert 9594; simultaneously hold with retaining device 9593.
Tightening torque: 50 Nm (37 ftlb.)



252_97



213_97

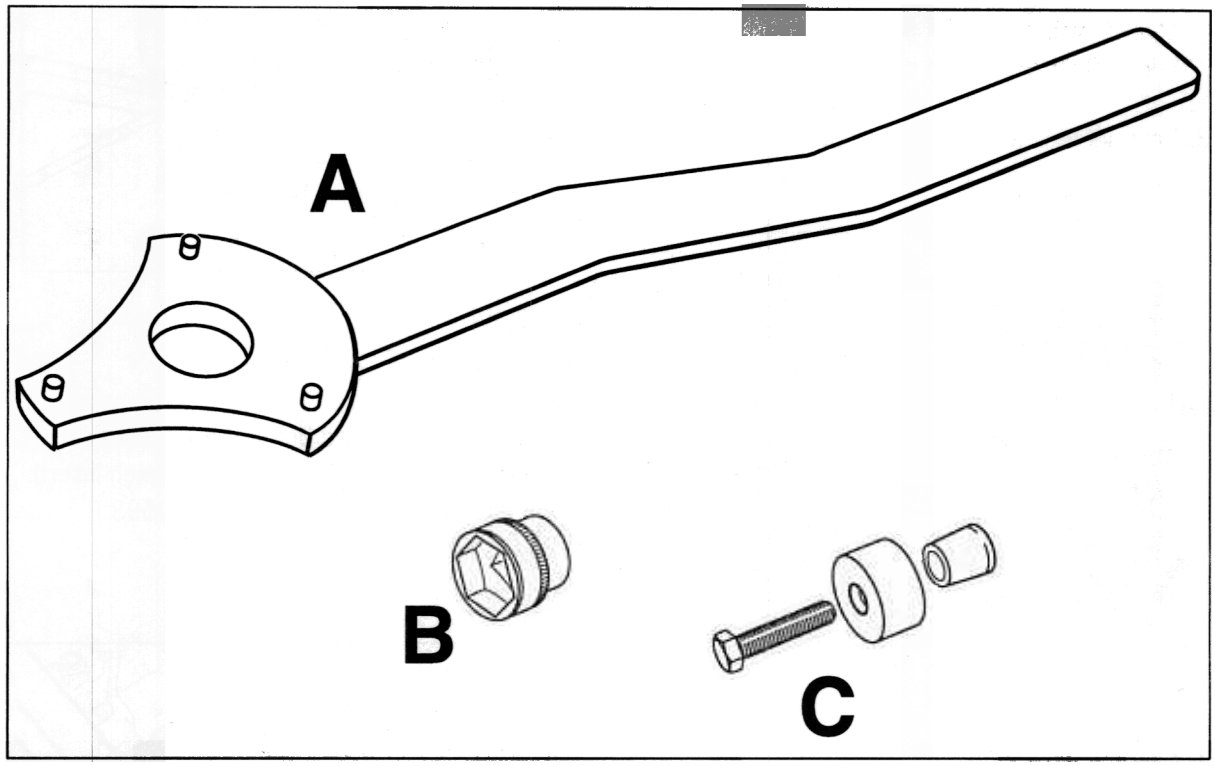
Tightening sequence:

Initial tightening	50 Nm (37 ftlb.)
Final tightening	1 x 90° turn

13 74 19 Removing and installing crankshaft sealing ring

Engine installed (pulley side)

Tools



711_97

Item	Designation	Special tool	Explanation
A	Retaining device	9593	
B	Socket wrench insert	9594	
C	Insertion tool	9610	

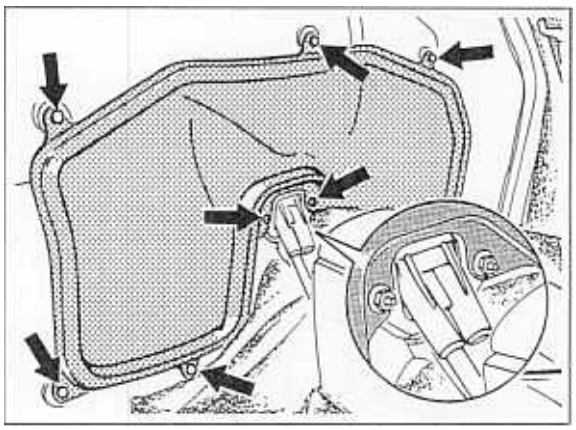
Removing and installing crankshaft sealing ring – engine installed (pulley side)

Removal

1. Disconnect battery.

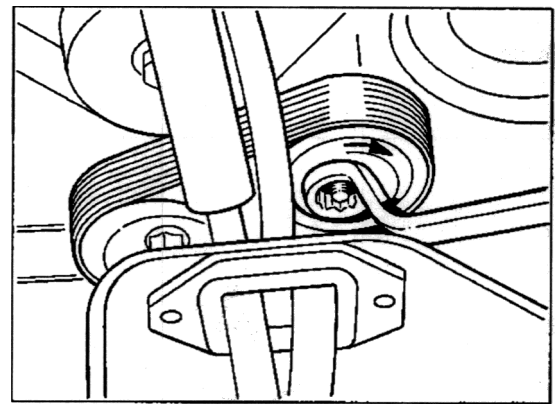
2. Remove left-hand seat. Disconnect the electrical plug connection. Undo four Torx screws with socket TX 50 (3/8 inch). Put on floor protection cover.

3. Remove rear wall lining and rear wall cover.



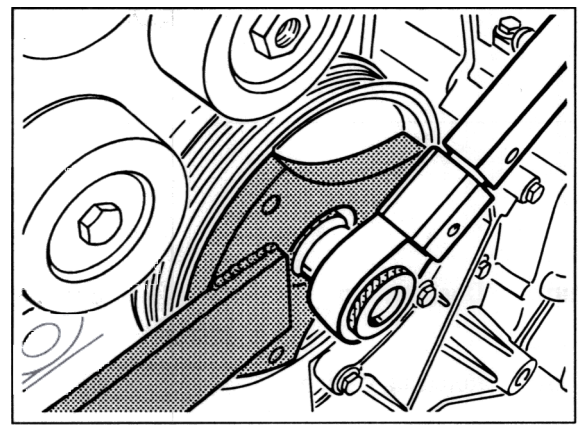
414-97

4. Remove drive belt.
   Mark the running direction of the belt with a coloured pen. Relieve the belt tension. To do this, turn the tensioning roller (wrench size 24 mm) clockwise and simultaneously remove the belt from the drive pulleys.



275-96

5. Loosen belt pulley.
   Undo hexagon-head bolt (M16 x 1.5 x 60) with special tool 9594 (socket wrench insert); to do this, hold with special tool 9593 (retaining device).



252_97

6. Remove crankshaft sealing ring.
The following tools and parts are required for removal of the crankshaft sealing ring:

Angle drill

Drill bit, ø 3 mm

Mounting lever, e.g. special tool 9182

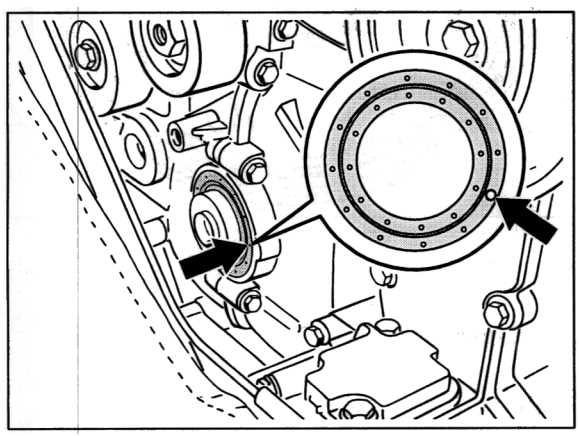
Sheetmetal screw with hexagon head (5.5 x 15)

Washer

Support, e.g. wooden block 50 x 30 x 20 mm

Removal procedure:

Drill sealing ring on face side (refer to drawing).

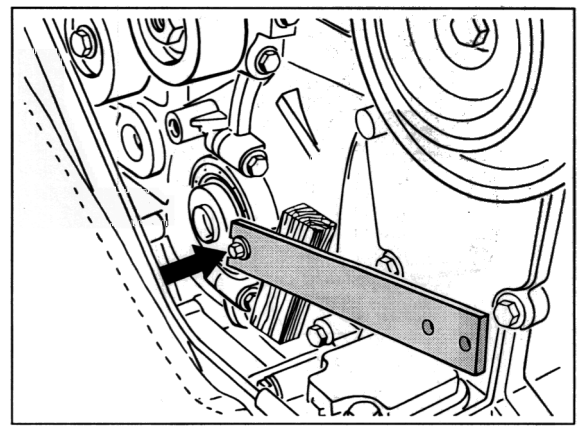


720_97

Screw sheetmetal screw with washer approx. 5 mm into the bore.

Position mounting lever on the sheetmetal screw; place support between the mounting lever and crankcase.

Lever crankshaft sealing ring out of the crankcase.



719_97

Installation

1. Insert new sealing ring using special tool 9610 (insertion tool):

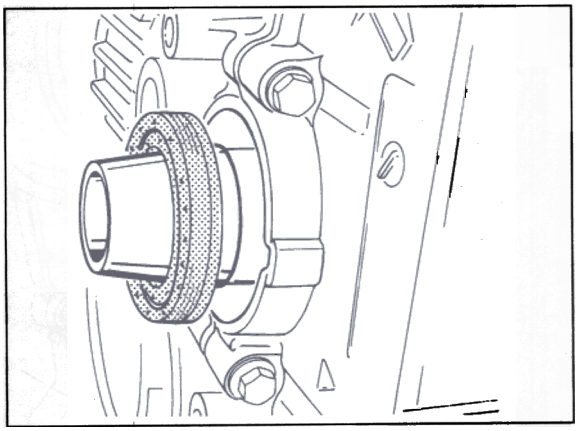
a. Place assembly sleeve on crankshaft journal.

b. Thoroughly lubricate the crankshaft journal, assembly sleeve and sealing lip.

Note

Coat outer diameter of sealing ring with **Loctite 574**.

c. Position sealing ring by hand and push off the assembly sleeve onto the crankshaft journal.



500_97

d. Remove assembly sleeve.

e. Position hexagon-head bolt (M16 x 1.5 x 60) and outer part of special tool and insert sealing ring as far as it will go.

2. Fit belt pulley.

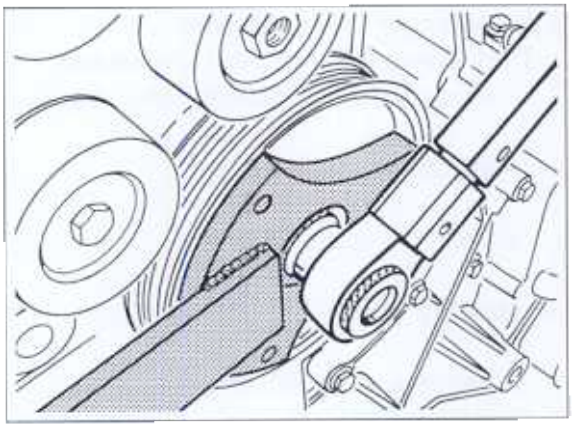
Note

Check whether there are foreign objects in the drive belt grooves of the pulley.

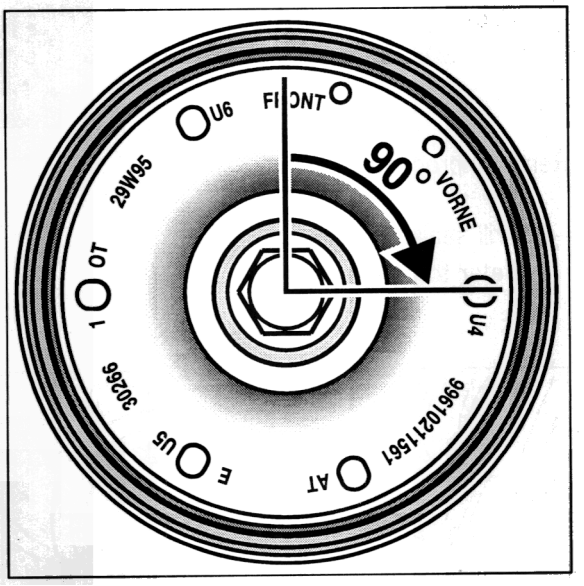
3. Tighten hexagon-head bolt using the socket wrench insert 9594; simultaneously hold with retaining device 9593.

Tightening sequence:

Initial tightening	50 Nm (37 ftlb.
Final tightening	1 x 90° turn



252_97



213_97

4. Fit drive belt.

Note

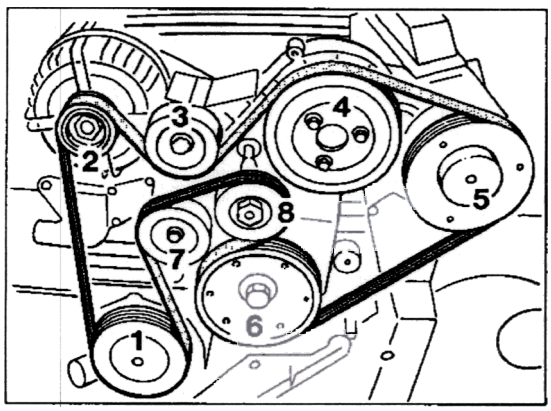
Visually inspect the condition of the belt; remove foreign objects from the grooves if necessary. Observe running direction (colour pen marking).

Installation

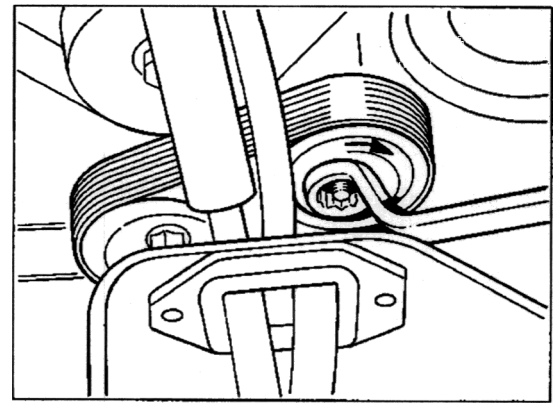
1. Fit drive belt by hand, slightly pre-tensioned, in the following sequence:

   1. Coolant pump drive pulley (1)
   2. Generator drive pulley (2)
   3. Deflection roller 1 (3)
   4. Power steering pump drive pulley (4)
   5. Air conditioning compressor drive pulley (5)
   6. Crankshaft pulley (6)
   7. Tensioning roller (7)

Then turn the tensioning roller (7) in clockwise direction and simultaneously fit the drive belt on the deflection roller 2 (8).



276-96



275-96

2. Slowly relieve the tensioning roller.

3. Visually check whether the belt is correctly positioned on all drive pulleys.

4. Fit rear wall lining, rear wall cover and seat again.

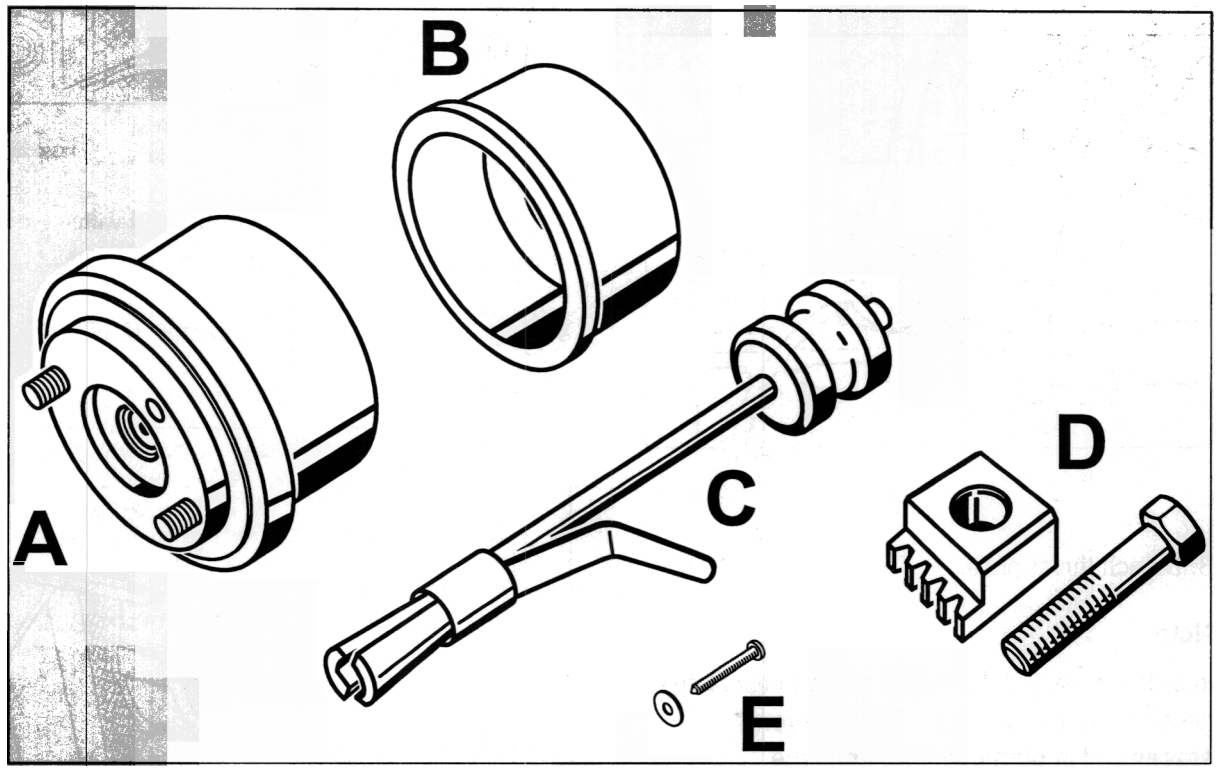
5. Connect the battery.

6. Perform tightness test.

13 59 19 Removing and installing crankshaft sealing ring – engine installed

Removing and installing transmission: refer to Boxster Technical Manual,
Group 3 – Manual transmission, Service No. 34 35 19 or
Group 3 – Tiptronic transmission, Service No. 37 01 19

Tools



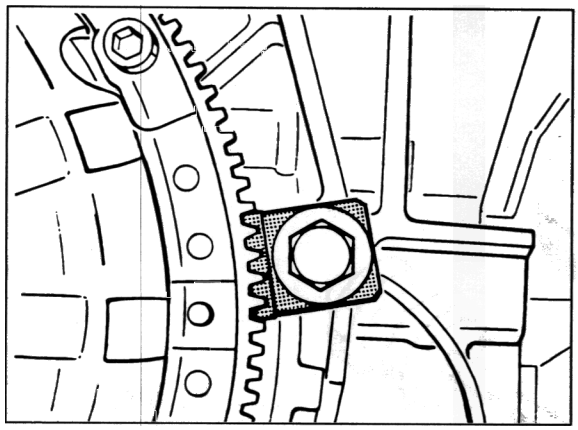
13590001

Item	Designation	Special tool	Explanation
A	Insertion tool	9609	
B	Mounting bell	9609/1	
C	Extractor	3237	
D	Toothed segment	9538/1	Fasten with hexagon-head bolt M12 x 50
E	Sheetmetal screw with washer		Commercially available

Removal

1. Remove clutch and flywheel (manual transmission) or drive plate (Tiptronic).

2. Fasten toothed segment (special tool 9538/1) on the crankcase half (cylinder bank 1 - 3) with hexagon-head bolt M12 x 50.



607_97

3. Detach thrust plate.

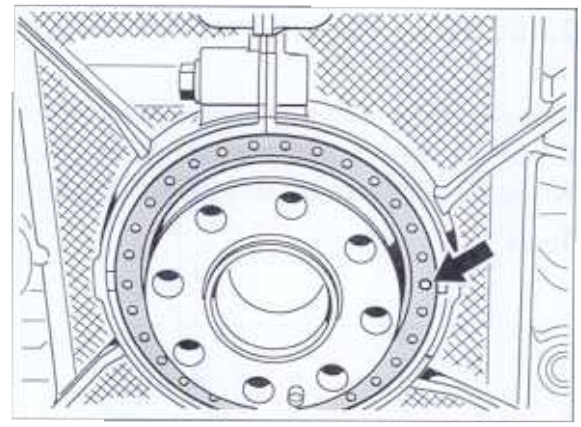
Note

In order to avoid deformation of the thrust plate housing, always loosen screws in **several stages** and in **diametrically opposite** sequence.

4. Remove thrust plate and drive plate.

5. Detach flywheel (Torx T55) and remove.

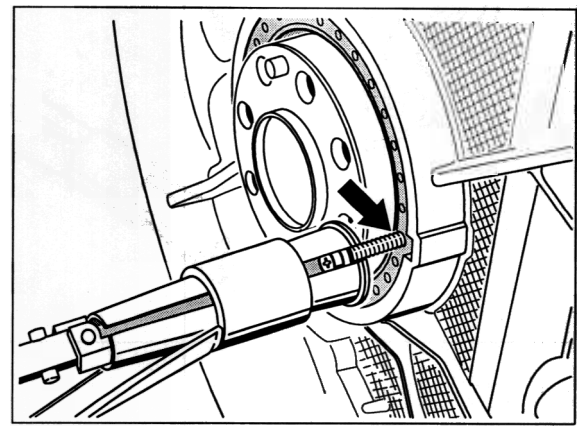
6. Drill sealing ring on face side, use ø 3 mm drill. Grease drill.



13590002

7. Screw sheetmetal screws (5.0 x 20) with washer approx. 5 mm into the bore.

8. Pull out sealing ring with extractor 3237.



13590003

9. Clean crankshaft journal and crankcase bore thoroughly. Remove any sharp edges which may be present.

Installation

Note

The tools should always be examined for burred spots before assembly of a sealing ring. Check all surfaces over which the sealing ring is pushed. Even minor damage to the tool can damage the **micro sealing lips** of the new sealing ring.

1. Remove any burred spots with a nail file, then pull off with a fine abrasive or polishing cloth.

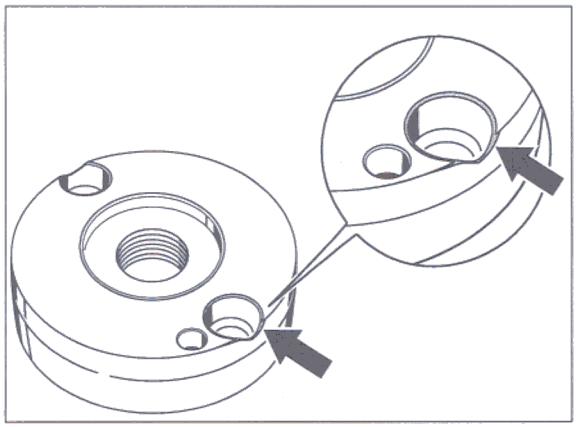


Illustration shows rounded edges on the recesses in the centring piece. 13590005

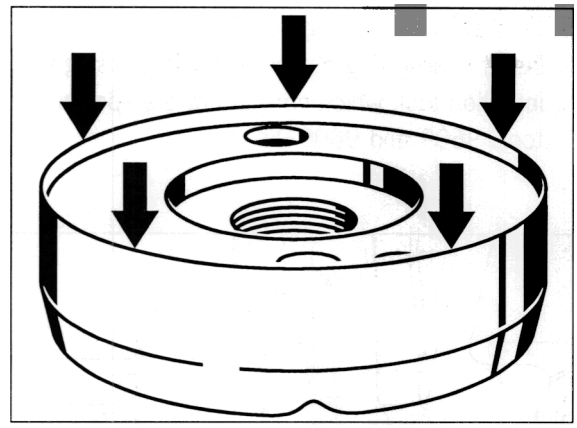


Illustration shows surrounding edge of centring piece. The surrounding edge must not be damaged. 13590004

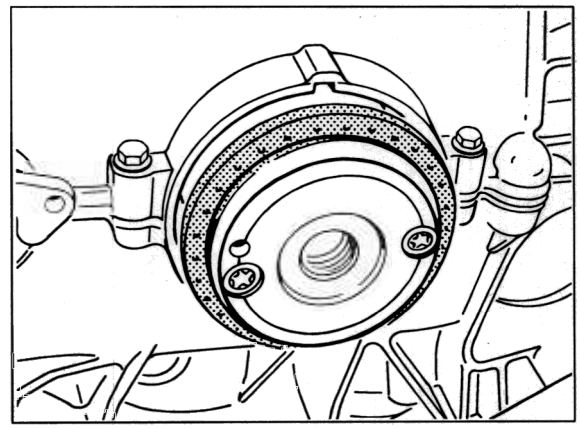
2. Fasten assembly sleeve of special tool 9609.

3. Lubricate crankshaft journal and assembly sleeve.

Note

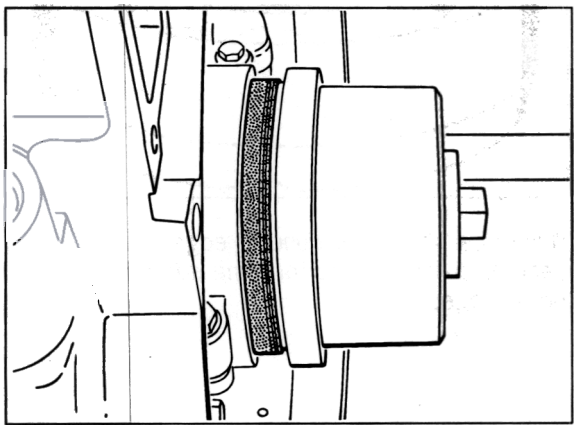
The micro sealing lip of the sealing ring must neither be touched by hand nor lubricated.

4. Put on sealing ring by hand. Do **not** lubricate outer diameter of sealing ring, do not use sealant, **it must be fitted dry**.



499_97

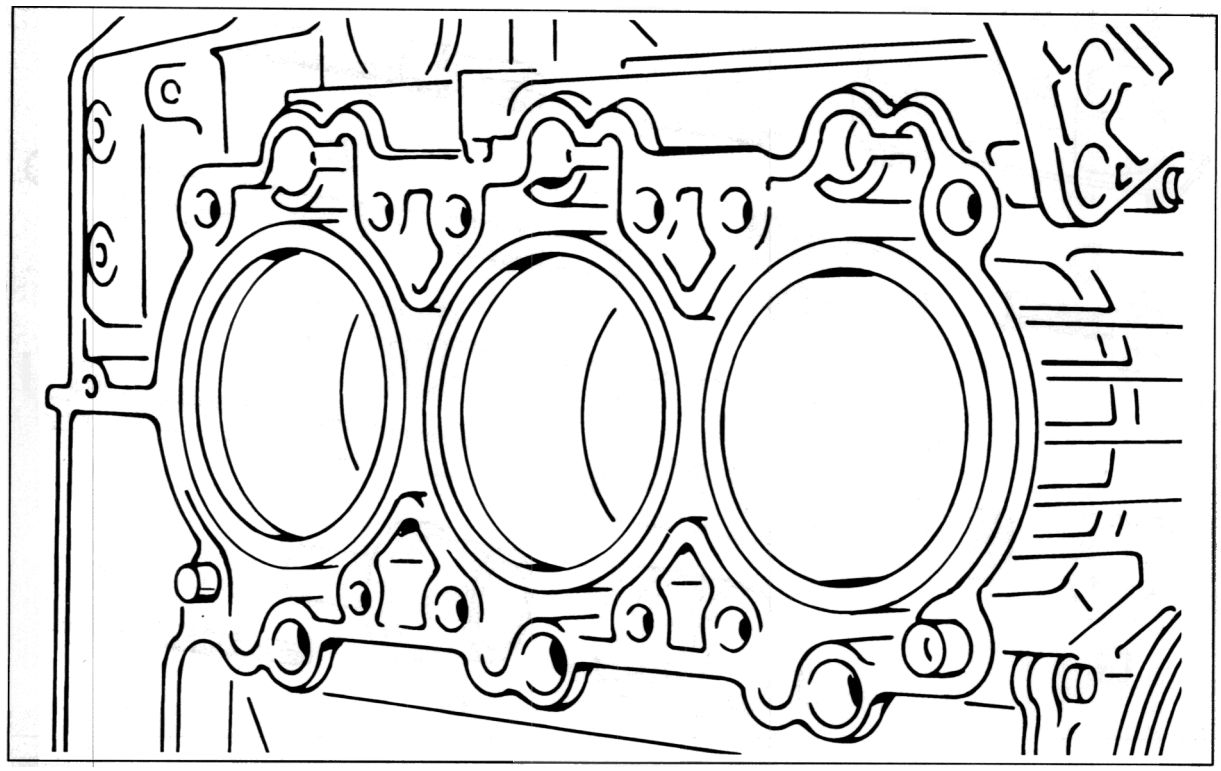
5. Fit crankshaft sealing ring.
   Insert sealing ring as far as it will go using the insertion tool, which consists of the special tools 9609 and 9609/1.



240_97

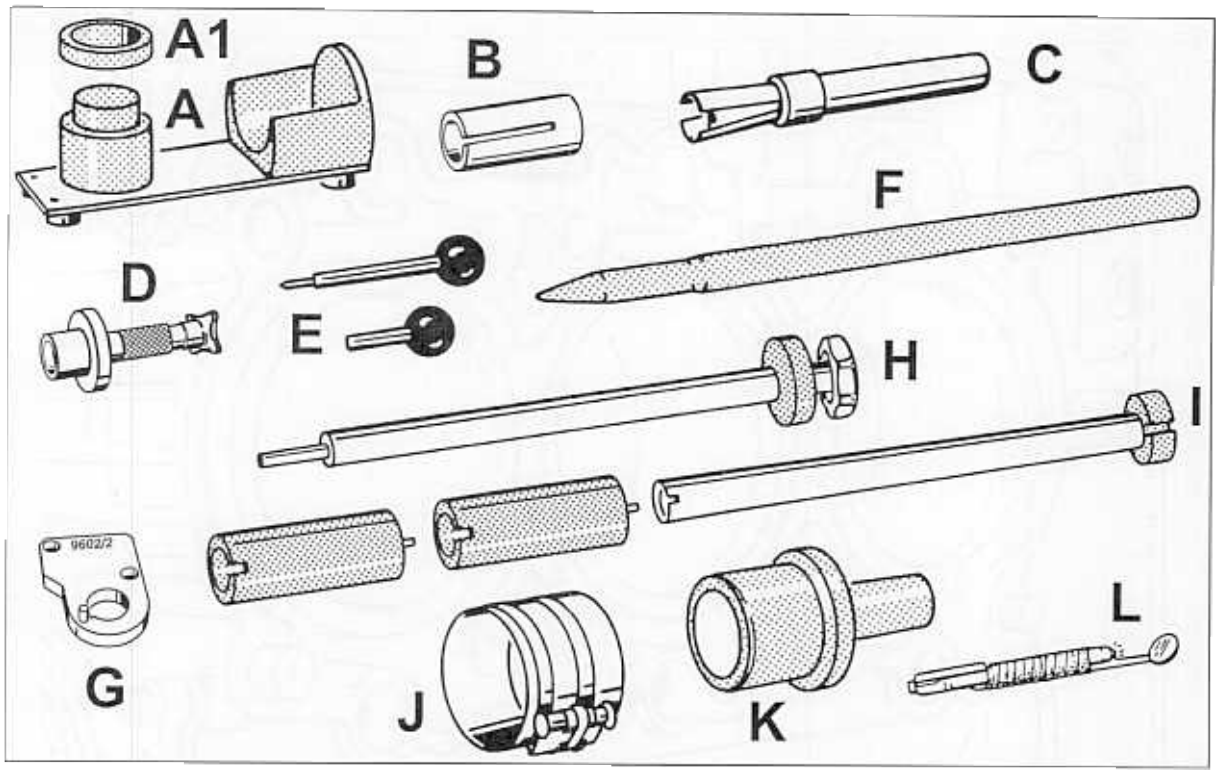
13 10 19 Removing and installing pistons Boxster S

Engine type M96/21



Removing and installing pistons

Tools



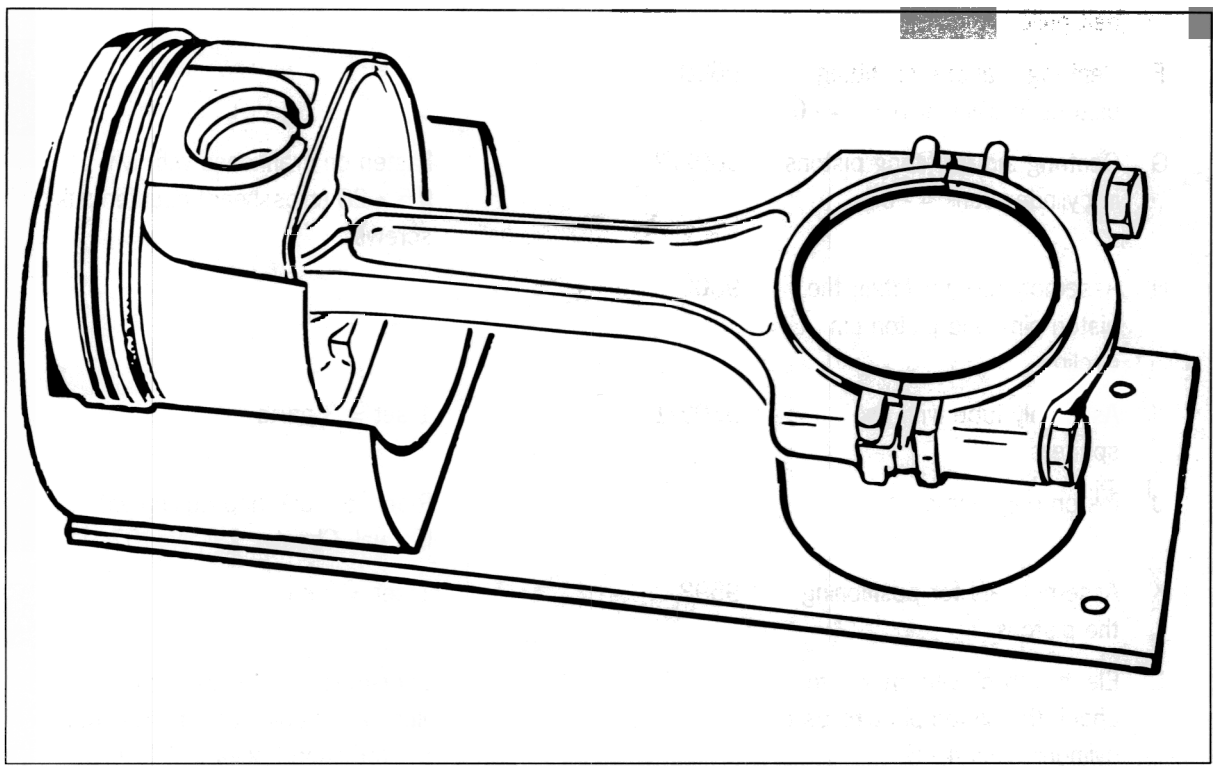
1310000

Item	Designation	Special tool	Explanation
A	Retaining device for pistons and connecting rods for pre-fitting the piston pins of cylinder bank 1 - 3	9597	
A1	Spacer ring	9597/1	required for the 911 Carrera (3.4 l) only
B	Assembly sleeves for pre-fitting the piston pin circlips	9603/1	
C	Assembly fixture for fitting piston pin circlips in assembly sleeve 9603/1	9500/3	

Item	Designation	Special tool	Explanation
D	Centring mandrel for centring crankcase halves	9645	
E	Fixing pin for fixing the belt pulley	9595/1	1 set = 2 parts (use short fixing pin)
F	Centring mandrel for fitting pistons in cylinder bank 4 - 6	9608	
G	Centring aid for fitting pistons in cylinder bank 4 - 6	9602/2	Fasten on crankcase with two M6 x 20 (crosshead) countersunk screws
H	Assembly tool for fitting the piston pins and piston pin circlips	9602	
	Assembly tube with two spacers	9602/1	1 set = 3 parts
J	Piston ring clamp		Refer to Workshop Equipment Manual, Chapter 2.4, No. 57
K	Assembly aid for positioning the pistons	9598	1 set = 2 ea.
L	Electric torch with mirror to check the piston pin circlips of cylinder bank 4 - 6		Shop-made or, for example, illuminated adjustable mirror. Refer to Workshop Equipment Manual, Chapter 2.4, No. 20

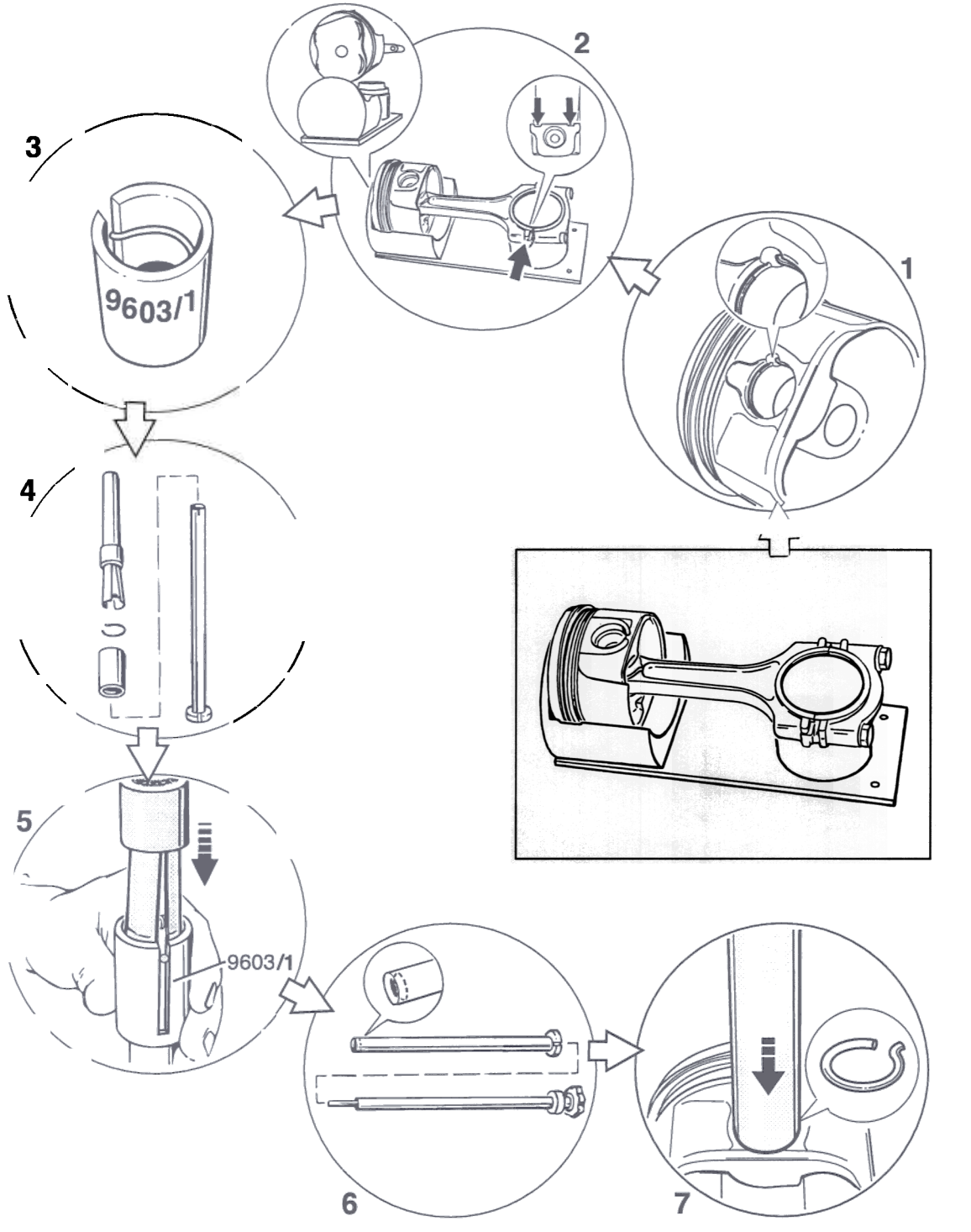
Fitting pistons and connecting rods

Prepare pistons and connecting rods for installation in the crankcase half of **cylinders 1 - 3**.



515_98

Fitting pistons and connecting rods



13100006

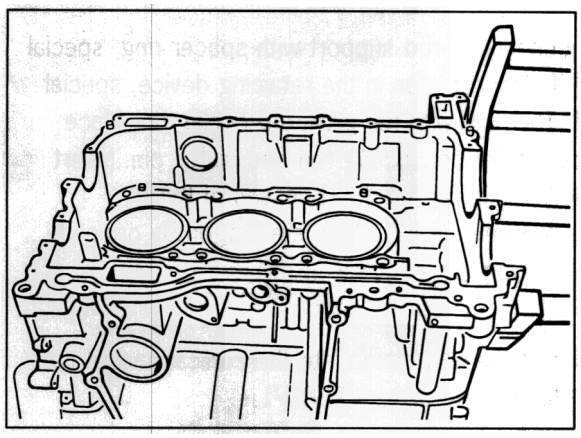
Fitting pistons and connecting rods

No.	Procedure	Instructions
1	Check piston pin circlip	Make sure that the circlip is present and seated securely. The circlip has been pre-fitted on one side of the piston pin by the manufacturer. The circlip opening must lie opposite the groove in the piston.
2	Insert piston and connecting rod	Complete connecting rod support with spacer ring, special tool 9597/1. Insert piston in the retaining device, special tool 9597. The side with the pre-fitted circlip must face downwards. Fit the connecting rod and piston pin. Insert the connecting rod so that the recesses of the connecting-rod bearing twist lock are diagonally opposite the "TOP" marking.
3	Fit piston pin circlip	Manually insert the new circlip into the conical part of the assembly sleeve, special tool 9603/1.
4 + 5	Press piston pin circlip into the assembly tube	Place the cylindrical part of the assembly sleeve 9603/1 on the assembly tube of special tool 9602. Use assembly aid, special tool 9500/3, to slide the circlip from the conical part of the assembly sleeve into the assembly tube. Remove assembly aid 9500/3 and visually inspect the correct position of the circlip in the assembly tube from the side.
6 + 7	Position piston pin circlip on the piston pin eye	Position assembly tube on the piston pin eye. Press pressure pin of special tool 9602 down until the circlip is heard to engage in the ring groove. **Visually inspect correct seating.** **It is important to pre-fit the circlip on a firm surface. The circlip must be pre-fitted only immediately prior to fitting on the piston pin eye.**

Fitting pistons and piston rods in the crankcase half or bearing housing of cylinder bank 1 - 3

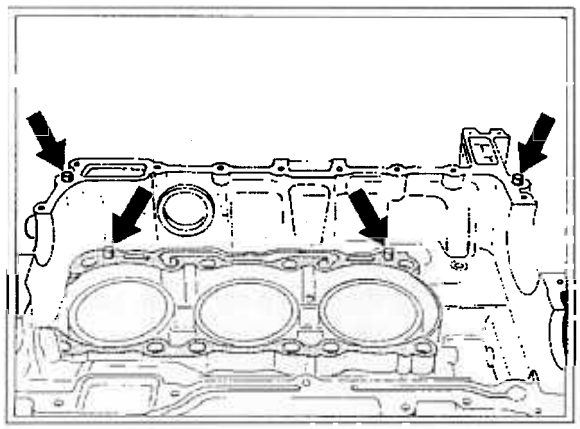
Installation

1. Fasten crankcase half, cylinders 1 - 3, in conjunction with mounting elements 9590 to engine holder 9589.



494_97

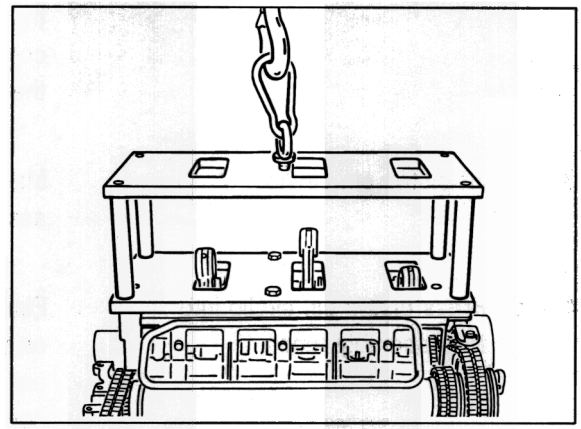
2. Clean bearing housing support surface, particularly in area of oil duct. Check dowel sleeves for correct seating.



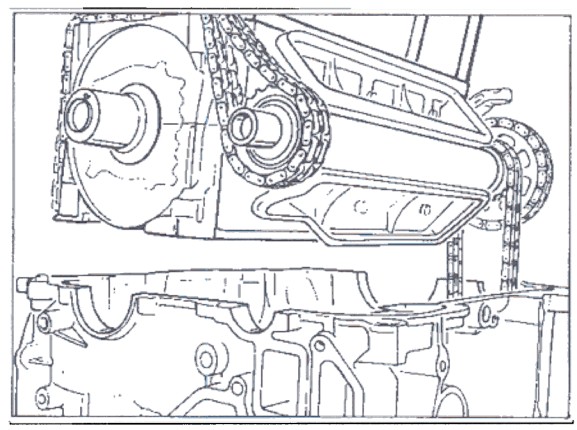
490_96

3. Installation of the complete bearing housing in the crankcase half, cylinders 1 - 3.
   As the bearing housing is heavy, it should be installed using a workshop crane.

   Carefully and in stages, lower bearing housing with fitted holder 9607 and using a workshop crane towards the dowel sleeves (2 ea.), observing the following points:

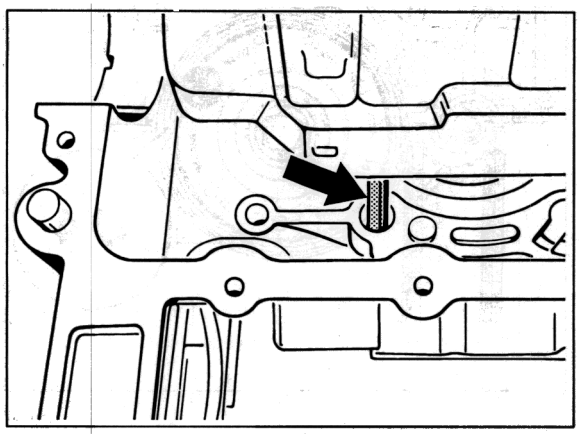


345_97



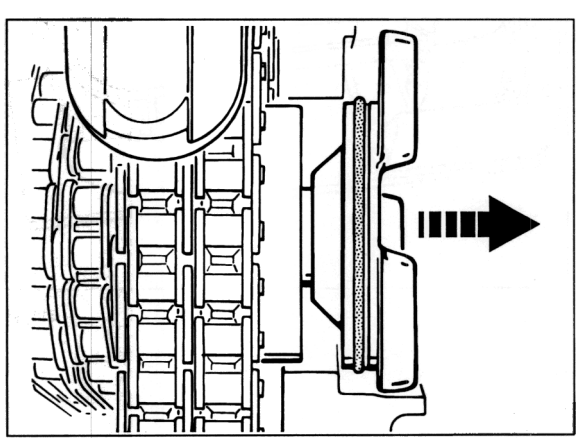
484_96

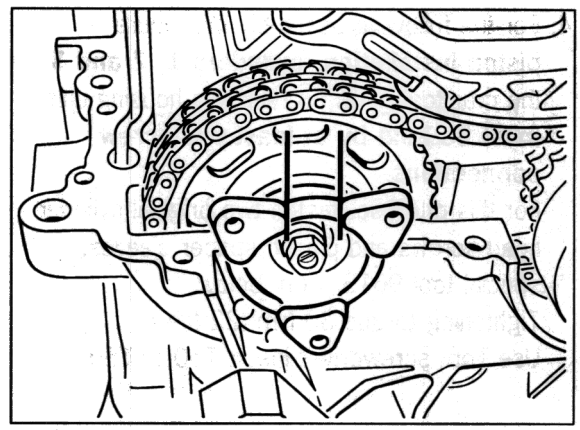
3.1 To aid in guiding, screw pan head screws approx. 3 turns into the bearing housing from below.



467_97

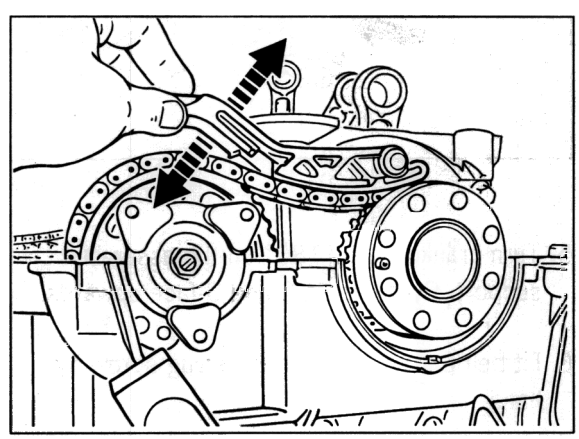
3.2 Just before reaching the final installation position, pull the loosened intermediate-shaft flange out of the housing area and rotate the flange so that the two flange lugs that are spaced closest together face upwards.





219_97

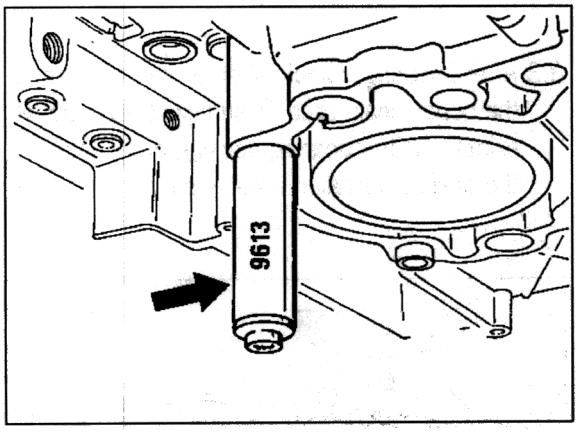
3.3 After lowering, check whether there is sag in the upper chain area or sufficient lever travel exists. Lift the bearing housing and check the chain installation if necessary.



440_97

3.4 Remove two cap head screws (guidance aid).

4. For the following assembly procedure – **piston installation, cylinders 1, 2 and 3** – the crankcase half and bearing housing unit **must be held by at least two screw connections**.
   For this purpose, fasten two original cylinder head screws and plastic spacer sleeves, special tool 9613, from below.
   Tightening torque 30 Nm (22 ftlb.).
   Use Torx screwdriver insert T50 or T55.

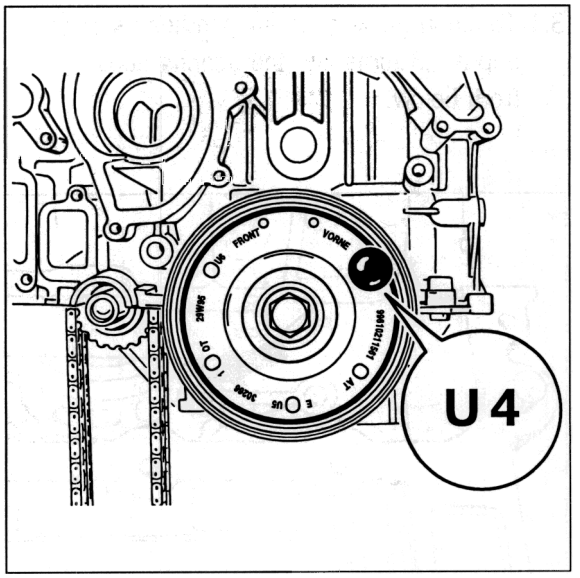


491_96

5. Turn crankcase by 180° on the assembly support. Cylinders 1, 2 and 3 face upwards.

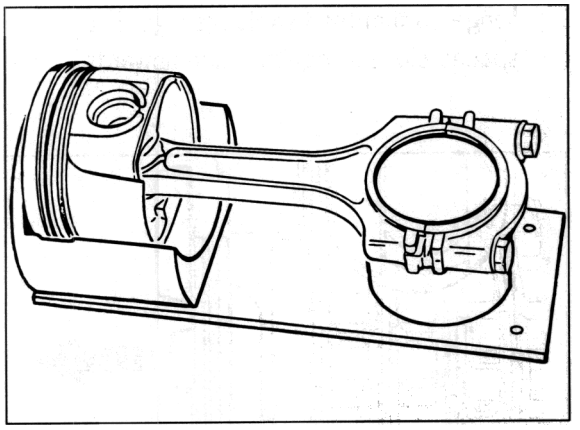
6. Fit belt pulley. Screw in fastening screw by hand.

7. Turn crankshaft clockwise until the bore **U4** on the pulley is aligned with the fixing bore on the crankcase. Position or fix with fixing pin (short) of special tool 9595.



604_97

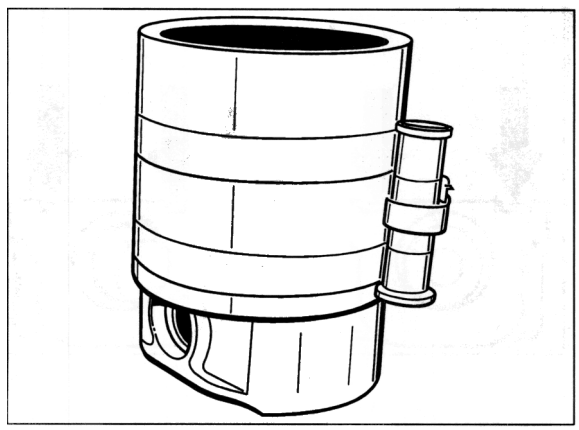
8. Remove preassembled connecting rod with piston of **cylinder 1** from the assembly fixture.



515_98

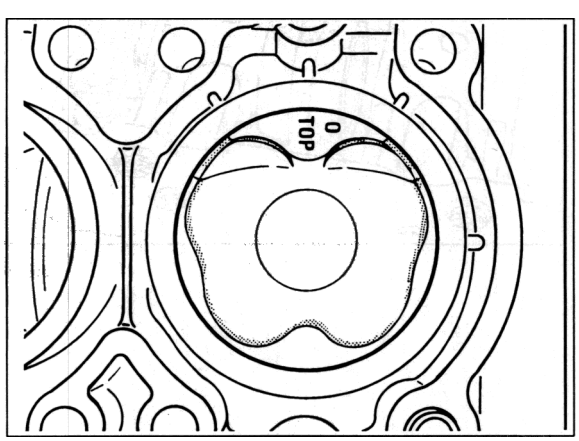
9. Align the gaps of the upper piston rings offset by 180°.

10. Tighten piston ring clamp and fit piston in the cylinder bore with connecting rod.



13100003

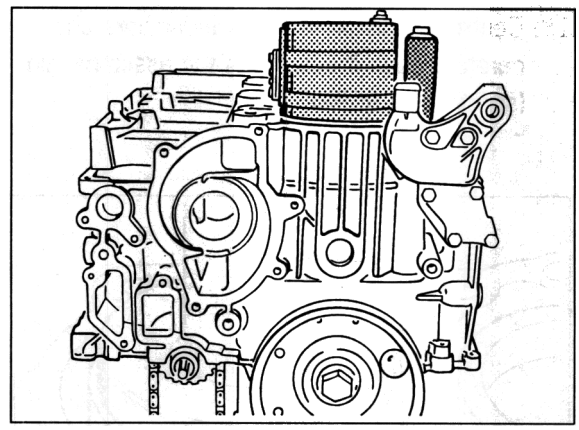
11. Place piston with connecting rod in installation position.



258_97

Note

Generously coat the piston and clamp with engine oil before fitting the piston.



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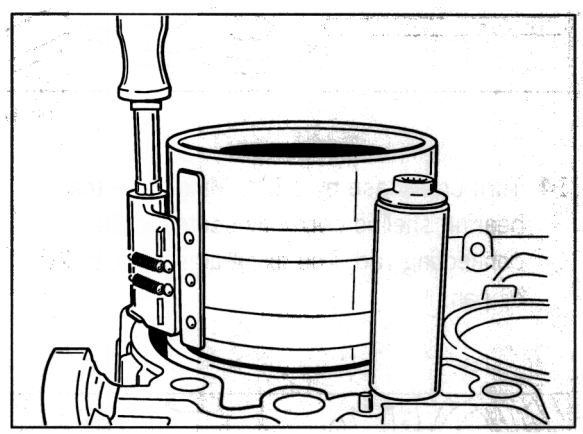


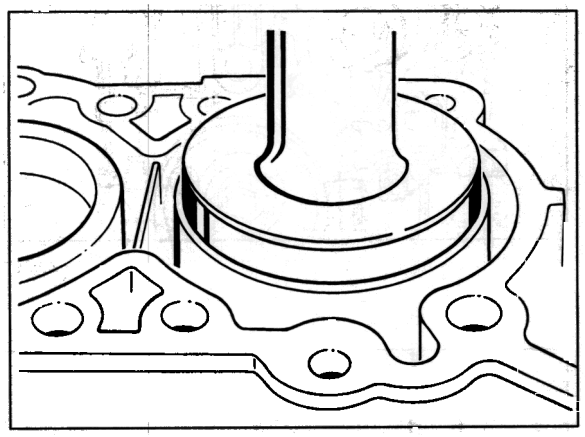
558_98

12. Use the handle of a hammer to tap the piston into the cylinder while firmly pressing on the edge of the clamp. Use protective gloves.

Note

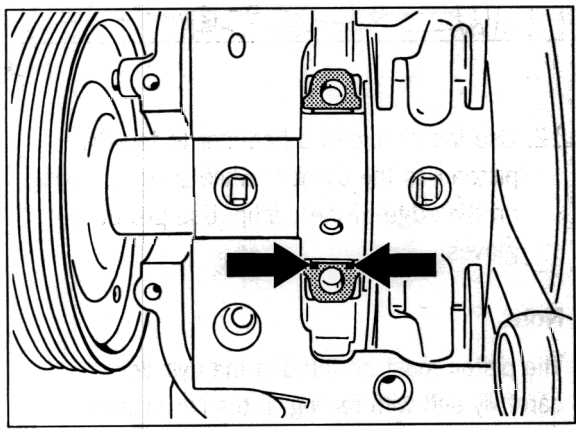
The piston must be fitted in the cylinder carefully and with feeling. If the resistance increases, **immediately interrupt** the assembly process. Reposition the piston ring clamp and repeat the assembly operation.

13. Centre the piston in the cylinder bore and carefully push it down with the assembly aid (special tool 9598).



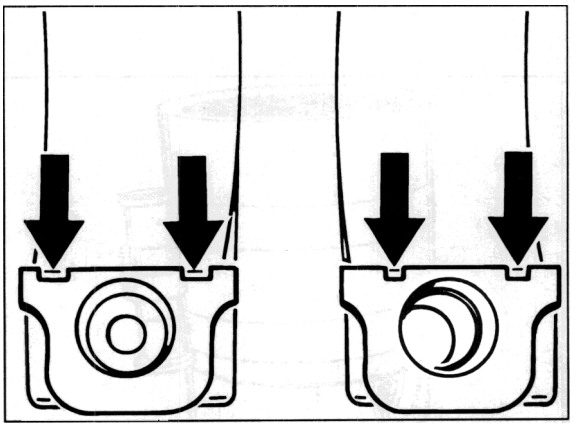
251_97

14. Turn crankcase by 180°. Make sure the bearing shell is correctly seated in the connecting rod. The fixing lugs point to the oil pan.

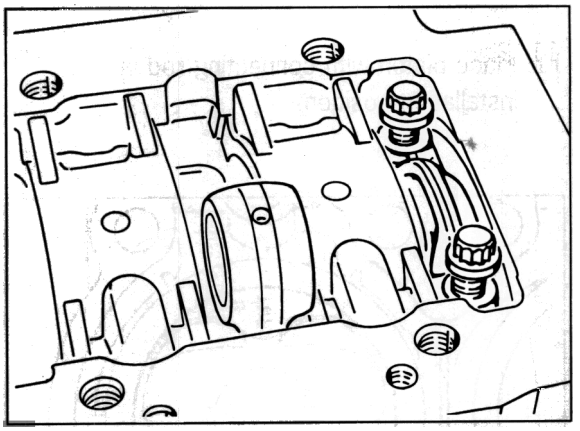


517_97

15. Fit end caps. Lubricate bearing shells. The recesses of the connecting-rod bearing twist lock must face each other.



256_97



506_97

16. Tightening specification:

    Oil thread and contact surface.

    1. Initial tightening 20 Nm (15 ftlb.

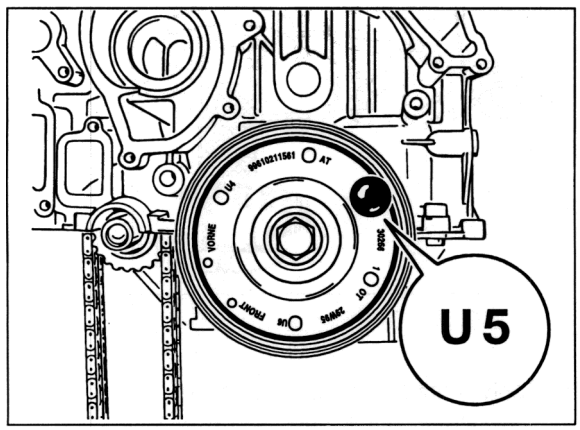
    To facilitate subsequent checks it is recommended that the screw heads be marked with a coloured pen after initial tightening.

    2. Final tightening 1 x 90° turn

    Use 10 mm socket wrench insert (double hexagon).

17. **Fitting piston and connecting rod in cylinder 2**

    Turn crankcase by 180°. Turn crankshaft clockwise until the bore **U5** on the pulley is aligned with the fixing bore on the crankcase. Position or fix with fixing pin (short) of special tool 9595.

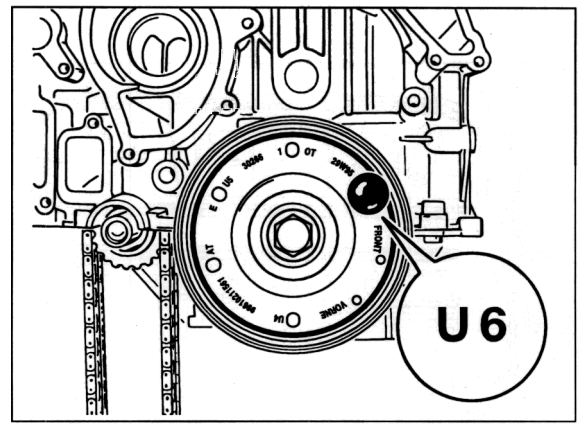


605_97

18. Prepare preassembled connecting rod of **cylinder 2** for installation.
    Perform the following assembly steps as described from Step 8 to Step 16.

19. **Fitting piston and connecting rod in cylinder 3**

    Rotate crankshaft clockwise until bore **U6** on the belt pulley is aligned with the fixing bore on the crankcase. Position or fix with fixing pin (short) of special tool 9595.



603_97

20. Prepare preassembled connecting rod of **cylinder 3** for installation. Perform the following assembly steps as described from Step 8 to Step 16.

Note

Leave crankshaft at position **U6** after fitting the piston and connecting rod in cylinder 3. This position is necessary for subsequent fitting of the piston of cylinder 6.

21. Remove belt pulley.

Fitting pistons on cylinder bank 4 - 6

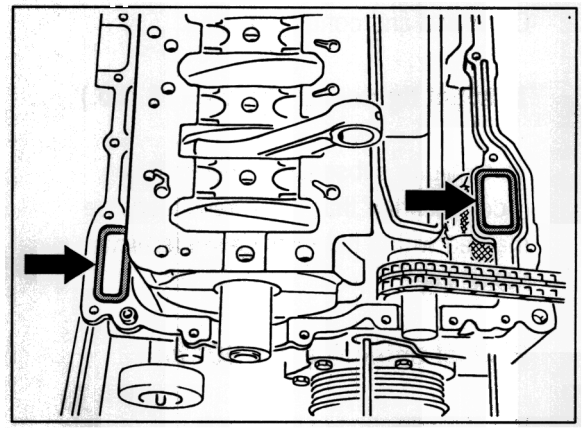
Note

The crankcase half of **cylinder bank 4 - 6** must be fitted before installation of the pistons.

Installation

1. Thoroughly clean sealing surface of the crankcase half of cylinder bank 1 - 3.

2. Ensure that the profile seals on the oil guide and the two seals left and right of the coolant duct are seated correctly.



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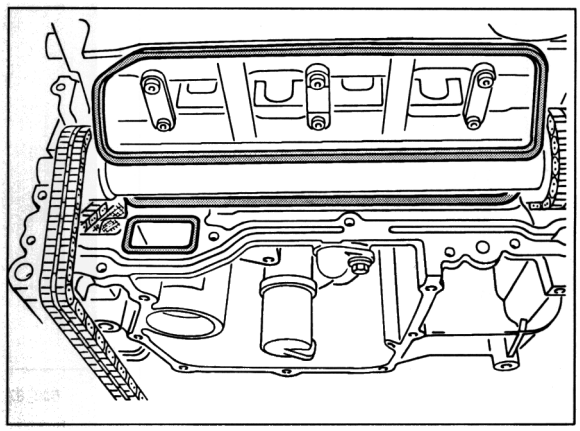
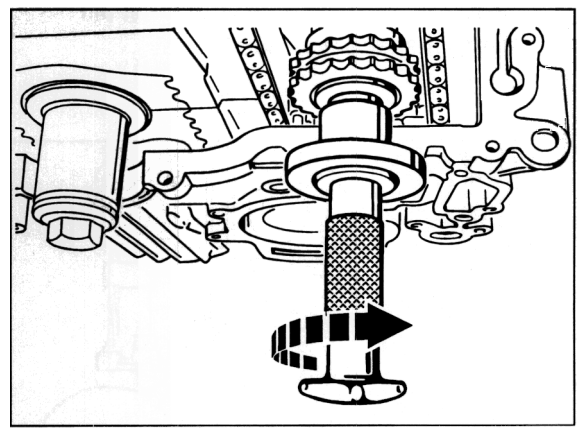


690_97

3. Place centring mandrel, special tool 9645, on the take-up bore of the oil pump and turn the star knob clockwise until the centring mandrel is braced in the crankcase half (oil pressure builds up in centring mandrel).



511_98

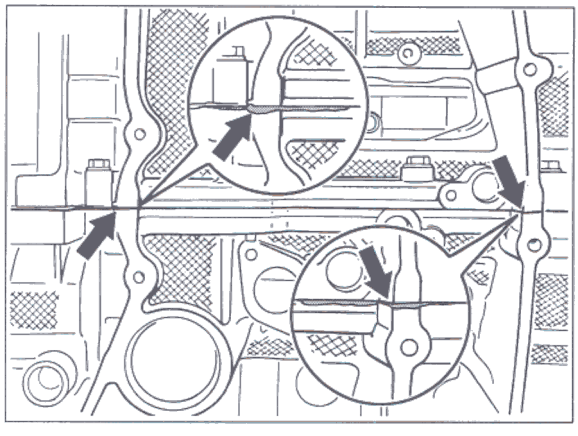
4. Apply a uniform bead of silicone approximately 1.5 mm wide to the cleaned sealing surface of the crankcase half of **cylinder bank 4 - 6**. Instructions: see Group 10, Page 10 - 36.

5. Before fitting the crankcase half, have a second person pull the drive chain out of the chain space using a wire.

6. Carefully set the crankcase half in place so that the sealing bead is not damaged.

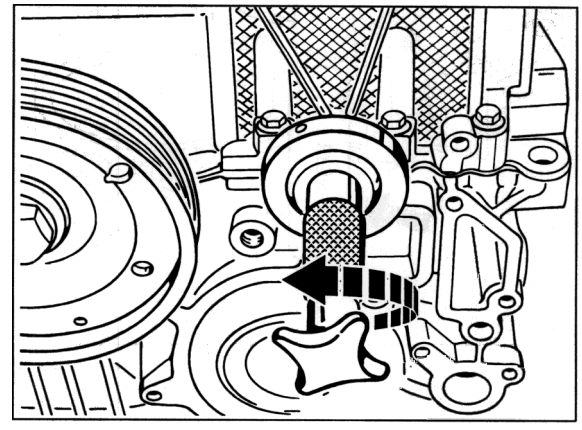
7. Fasten crankcase half. Tightening torque 13 Nm (10 ftlb.). Tightening sequence, see Group 10, Page 10 - 37.

   Immediately remove silicone material emerging in the area of the oil pan sealing surface.



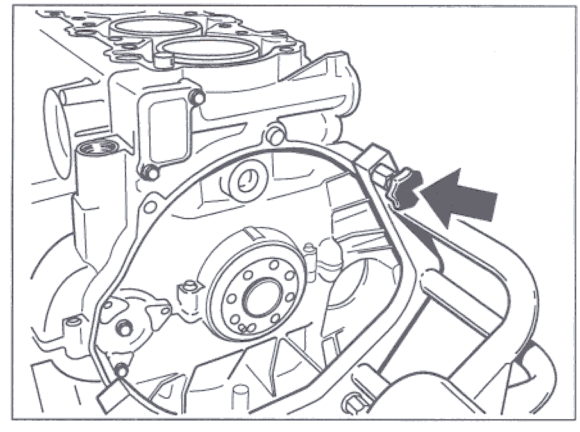
599_97

8. Relieve centring mandrel.
   Turn star knob anti-clockwise (oil pressure drops) and remove centring mandrel. Remove silicone residue.



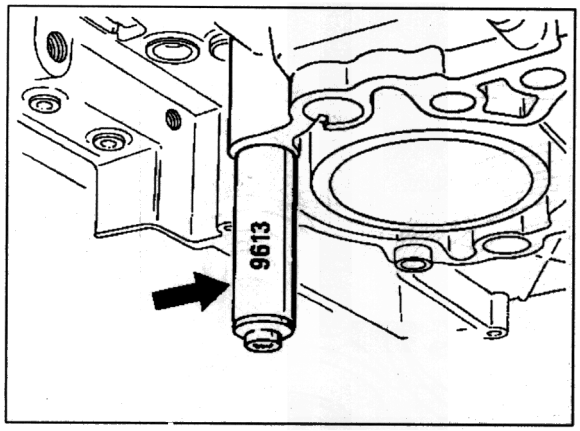
520_98

9. Fasten engine holder, special tool 9589, to the crankcase half of cylinder 4 - 6 (3rd fastening point).



567_98

10. Remove plastic spacer sleeves, special tool 9613.

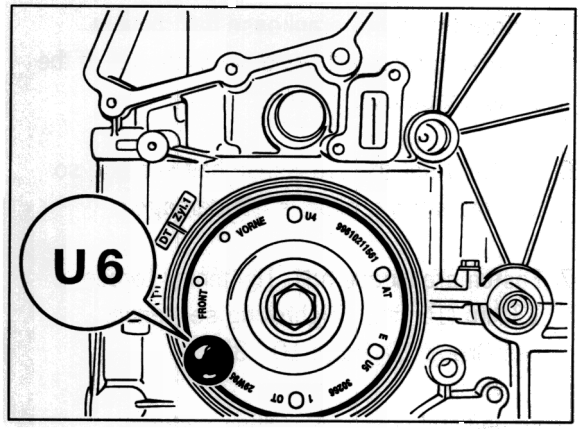


491_96

11. Fit belt pulley. Screw in fastening screw by hand.
Cylinder bank 4 - 6 faces **upward**.
Bore **U6** on the belt pulley must be aligned with the fixing bore on the crankcase.
Position or fix with fixing pin (short) of special tool 9595.

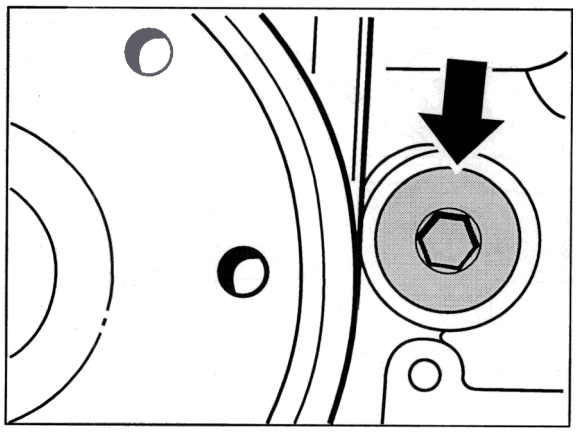
Note

Fixing of the belt pulley is absolutely necessary in order to ensure precise fitting of the pistons.



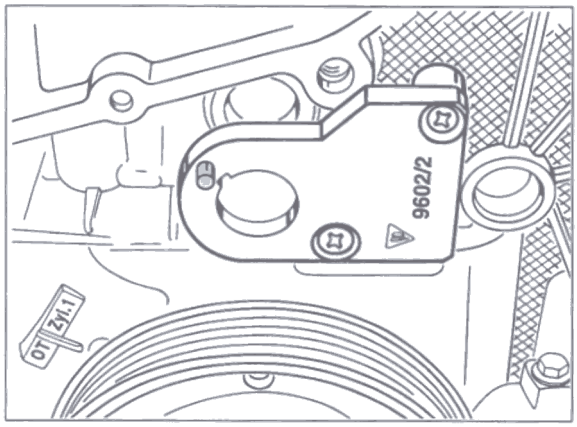
606_97

12. Unscrew plug for piston pin assembly bore.
Use a 12 mm hexagon socket wrench insert.



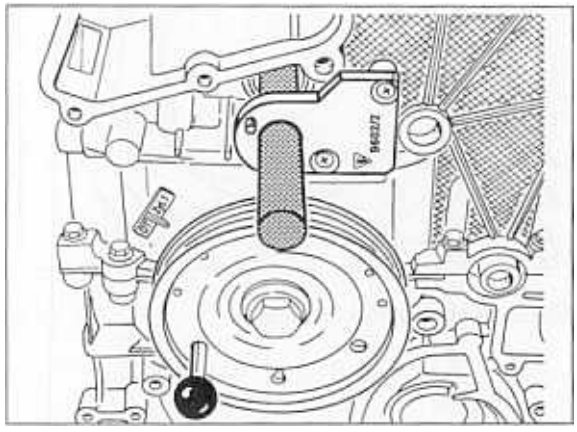
66_98

13. Fasten centring aid, special tool 9602/2, with two countersunk screws with crosshead (M6 x 20) on the crankcase.



448_99

14. Align connecting rod of **cylinder 6**. Insert centring mandrel, special tool 9608, in the assembly bore.



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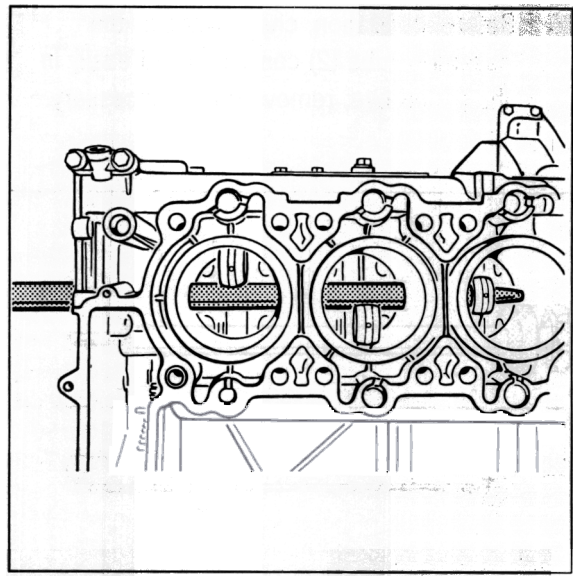


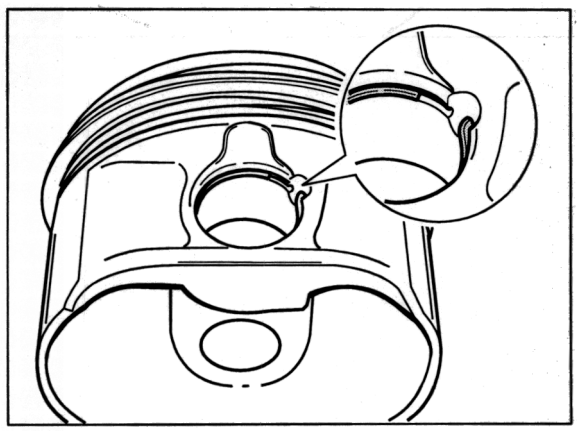
466_97

Note

The centring mandrel remains in the eye of the connecting rod until the piston contacts the centring mandrel during fitting.

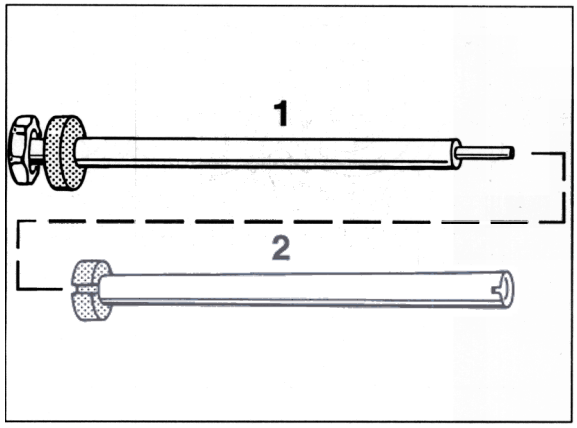
15. Install piston **of cylinder 6**

15.1 Check whether the piston pin circlip is present and was fitted correctly (flywheel side).

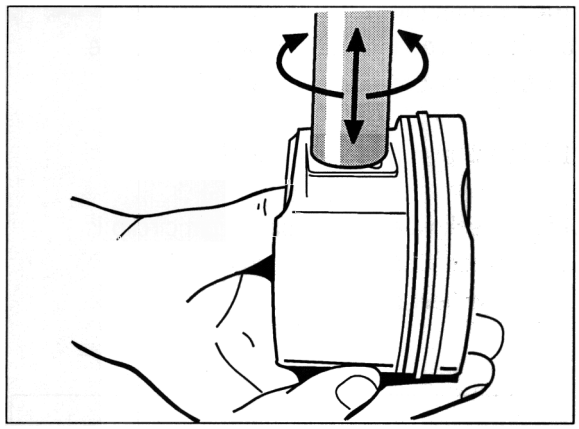


13100002

15.2 Before installation, check whether the assembly tube (2) can be moved easily in the piston eye; remove burr if necessary.

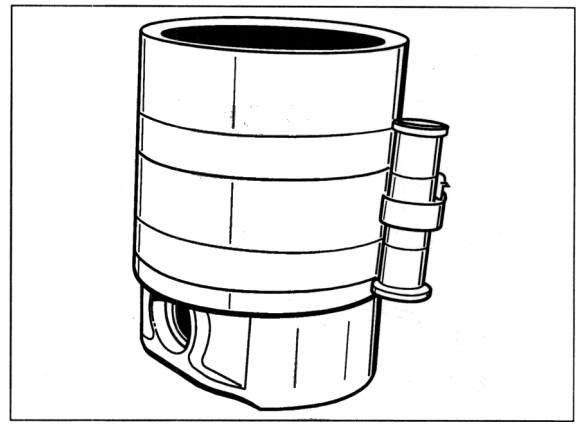


526_98

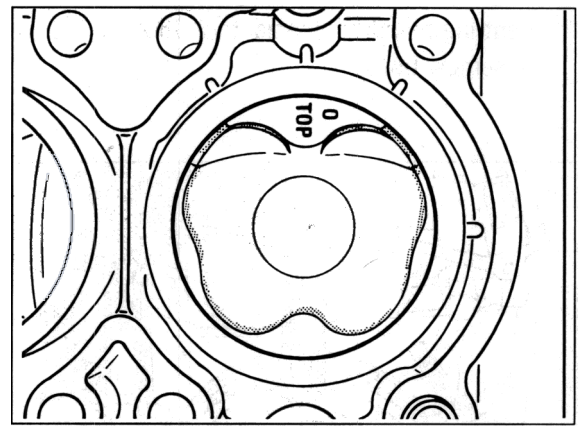


59_98

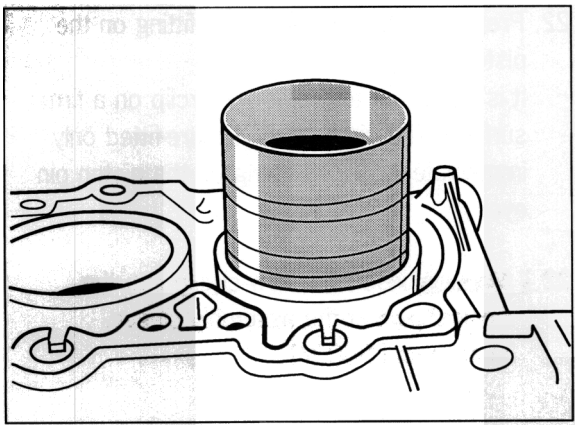
16. Align the gaps of the piston rings offset by 120°. Position piston ring clamp and fit piston.



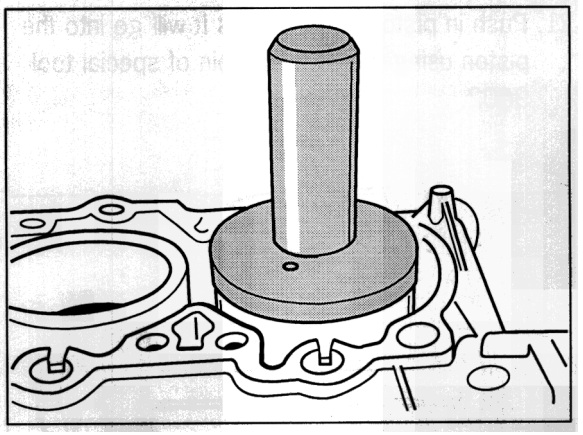
13100003



Piston in installation position 258_97



58_98



60_98

Note

Generously coat the piston, cylinder and clamp with engine oil before fitting the piston.

17. Use the handle of a hammer to tap the piston into the cylinder while firmly pressing on the edge of the clamp. Use protective gloves.

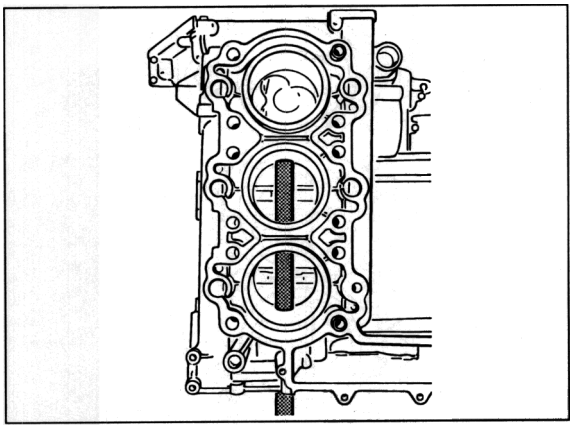
Note

The piston must be fitted in the cylinder carefully and with feeling. If the resistance increases, **immediately interrupt** the assembly process. Reposition the piston ring clamp and repeat the assembly operation.

18. Centre the piston in the cylinder bore and carefully push it down with the assembly aid (special tool 9598) to the centring mandrel stop.

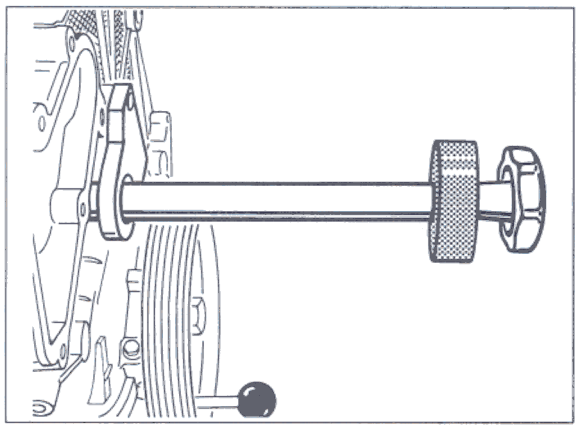
19. Carefully withdraw the centring mandrel and push the piston down to the stop.

20. Align piston and connecting rod again using the centring mandrel.

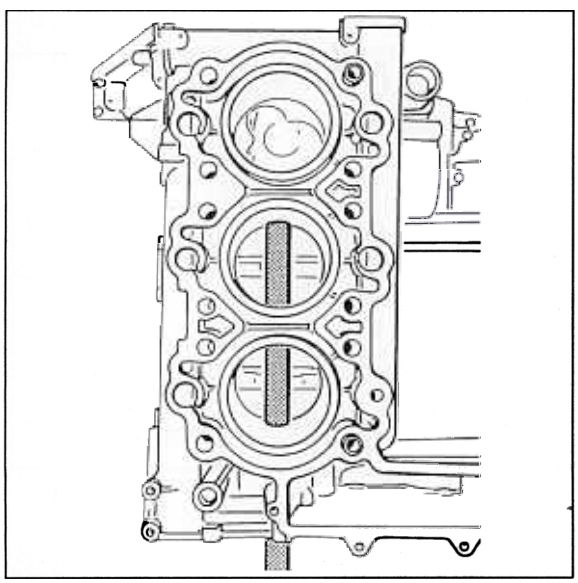


222_97

21. Push in piston pin as far as it will go into the piston using the pressure pin of special tool 9602.



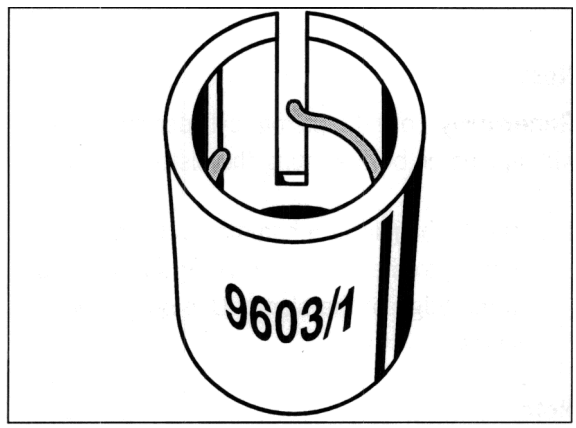
503_98



222_97

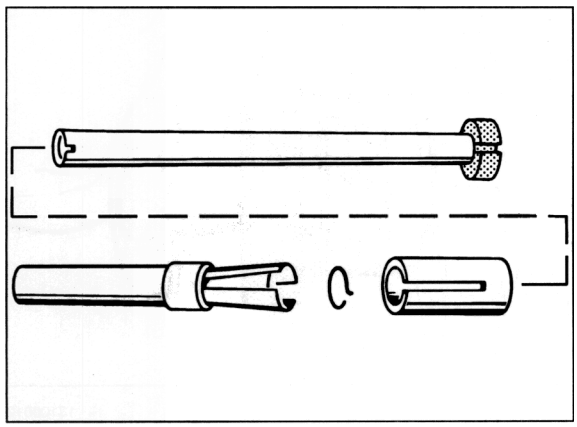
22. Prepare piston pin circlip for fitting on the piston.
It is important to pre-fit the circlip on a firm surface. The circlip must be pre-fitted only immediately prior to fitting on the piston pin eye.

22.1 Manually insert the new circlip into the conical part of the assembly sleeve, special tool 9603/1.

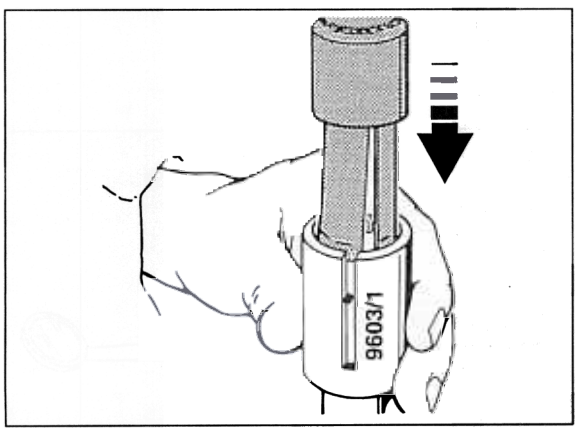


13100007

22.2 Place assembly sleeve 9603/1 onto the assembly tube of special tool 9602. Use assembly aid, special tool 9500/3, to slide the circlip from the conical sleeve into the assembly tube.



13100008



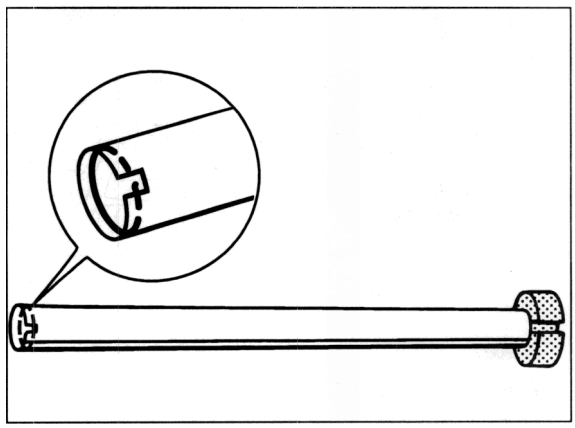
13100010

22.3 Remove assembly sleeve 9603/1 and visually inspect the correct position of the circlip in the assembly tube.

Caution!

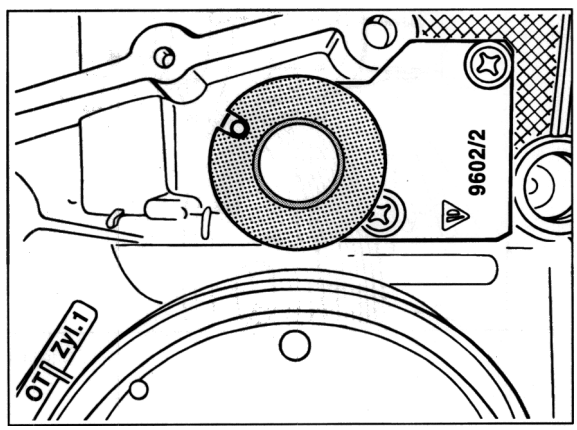
Danger of injury if circlip springs out!

> Check position of the circlip only by visual inspection of the assembly tube from the side.



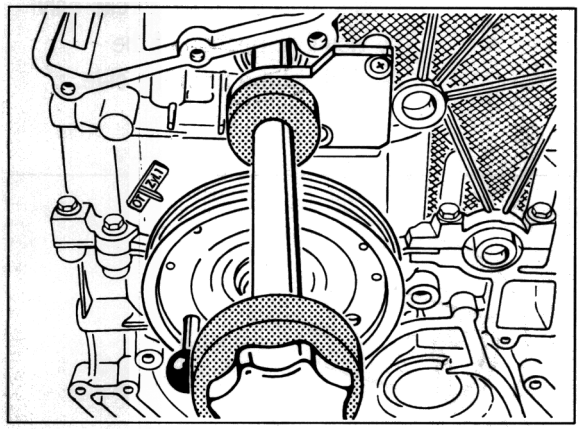
13100009

23. Push assembly tube through the centring piece into the crankcase assembly bore with the circlip fitted.



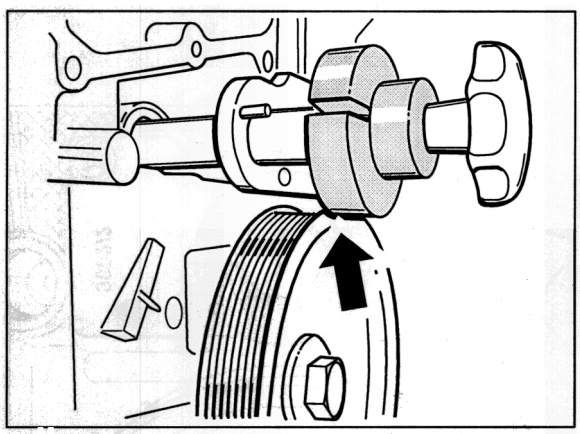
451_99

24. Carefully and gently insert the pressure pin until it contacts the piston pin circlip.



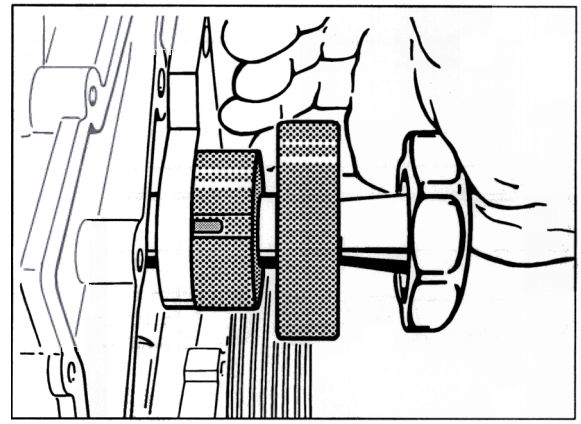
504_98

Note:
When inserting the pressure pin, the plastic ring on the pressure pin may touch the belt pulley. Either rework the plastic ring or remove the belt pulley briefly.



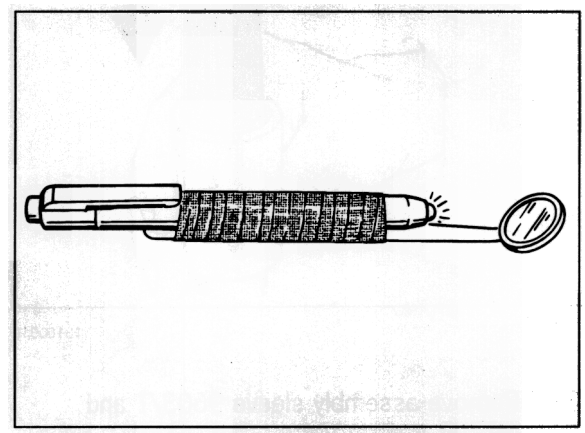
13100004

25. Move the piston pin circlip to its installation position by **briefly and forcefully striking the palm of your hand against the star knob of the pressure pin**.

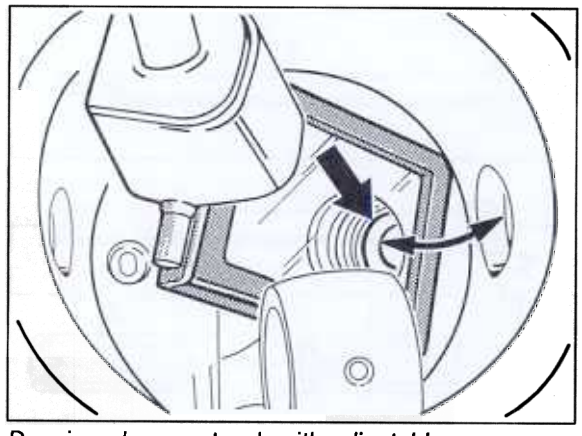


13100012

26. Visually inspect correct seating of the piston pin circlip, e.g. with a shop-made electric torch with mirror.

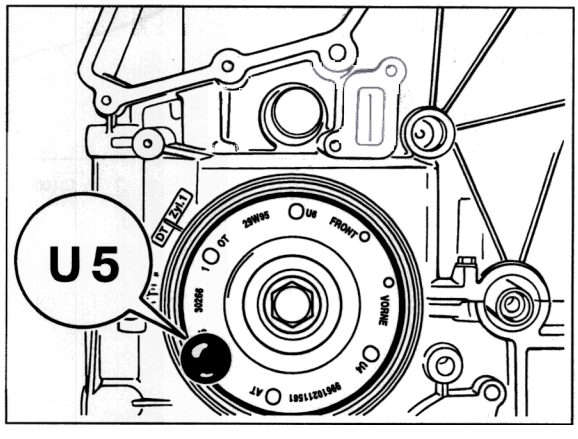


244_97



Drawing shows a torch with adjustable mirror 259_97

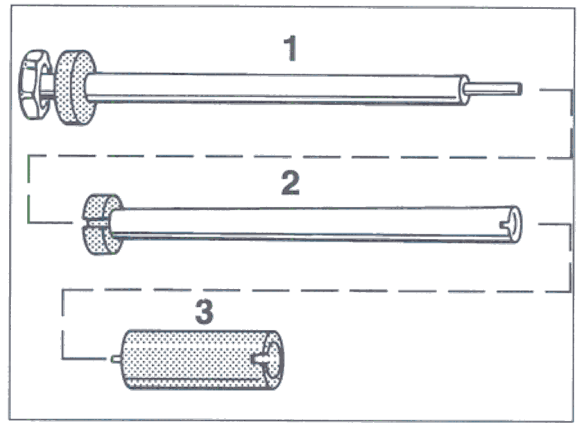
27. **Fitting piston in cylinder 5.** Advance the crankshaft clockwise until bore **U5** on the belt pulley is aligned with the fixing bore on the crankcase. Position or fix with fixing pin.



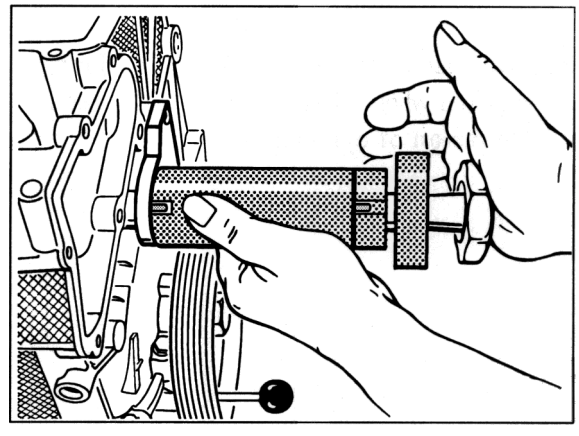
046_98

28. Perform the following assembly steps for piston installation in **cylinder 5** as described from Step 14 to Step 26.

A spacer sleeve (3) is additionally required when fitting the piston pin circlip in the piston of **cylinder 5**.

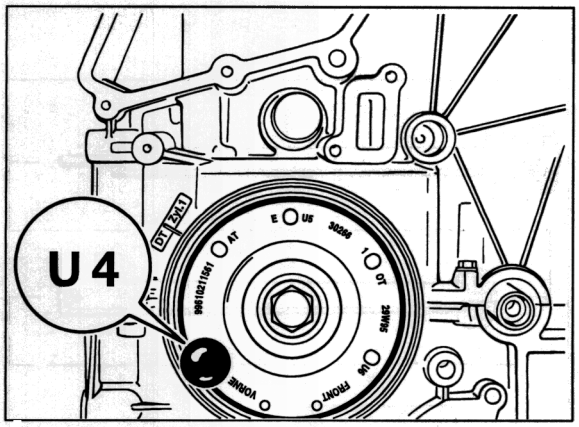


524_98



13100013

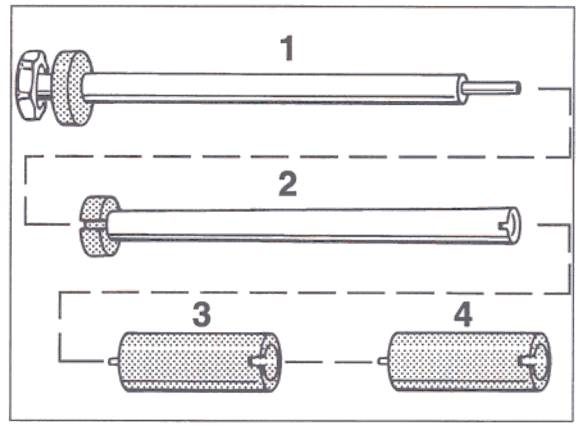
29. **Fitting piston in cylinder 4.**
Advance the crankshaft clockwise until bore **U4** on the belt pulley is aligned with the fixing bore on the crankcase. Position or fix with fixing pin.



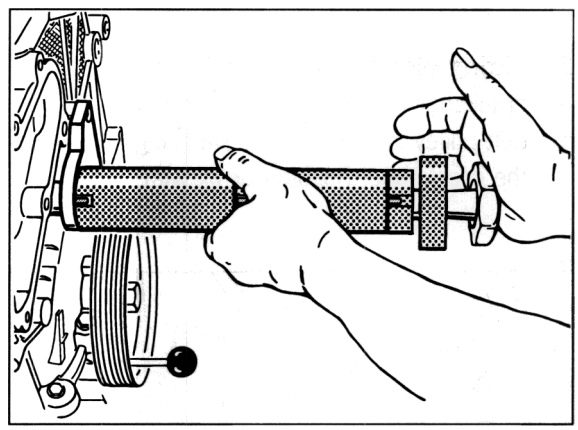
044_98

30. Perform the following assembly steps for piston installation in **cylinder 4** as described from Step 14 to Step 26.

31. Two spacer sleeves (3 + 4) are additionally required when fitting the piston pin circlip in the **piston of cylinder 4**.

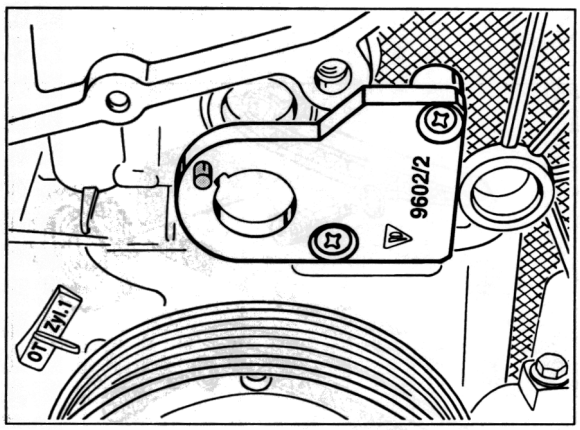


525_98



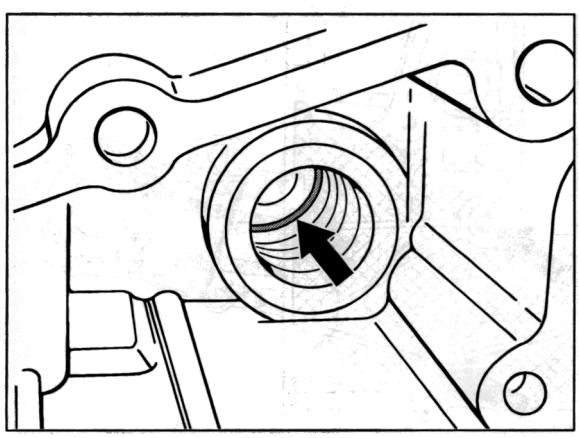
13100014

32. Remove centring aid 9602/2.



448_99

33. Visually inspect correct seating of the piston pin circlip on the piston of **cylinder 4**.

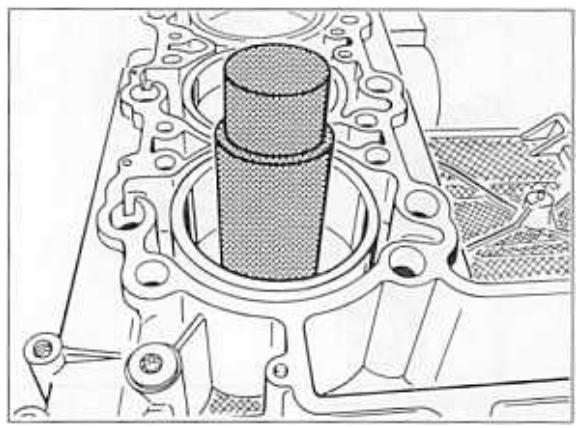


13100011

Note

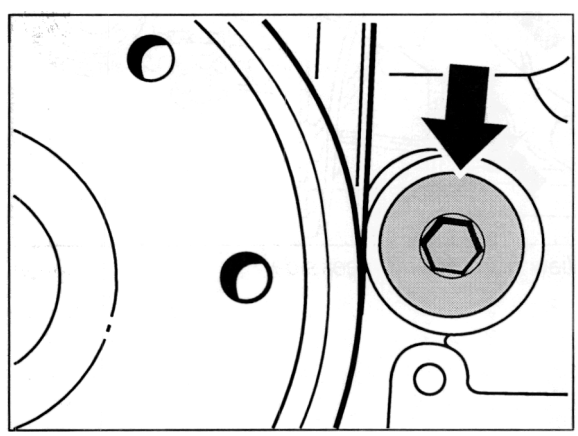
If the piston, piston pin or piston pin circlip are incorrectly assembled, the corresponding piston can be pulled out of the cylinder as follows.

Degrease centre of piston crown. Coat suitable plastic mandrel with instant adhesive. Allow the adhesive to cure. Pull out piston. Remove plastic mandrel immediately.



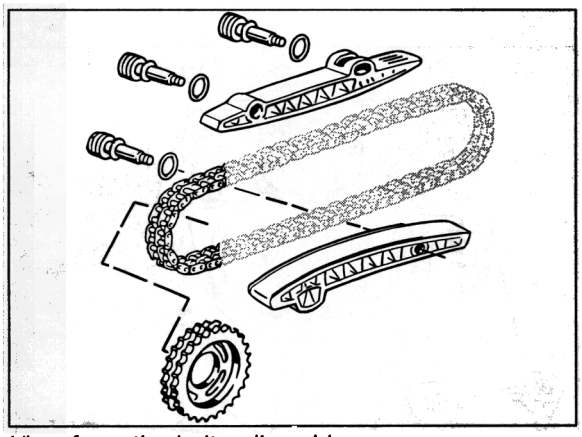
510_98

34. After fitting the pistons, fit a screw plug and new sealing ring in the assembly bore. Use a 12 mm hexagon socket wrench insert. Tightening torque 80 Nm (59 ftlb.).



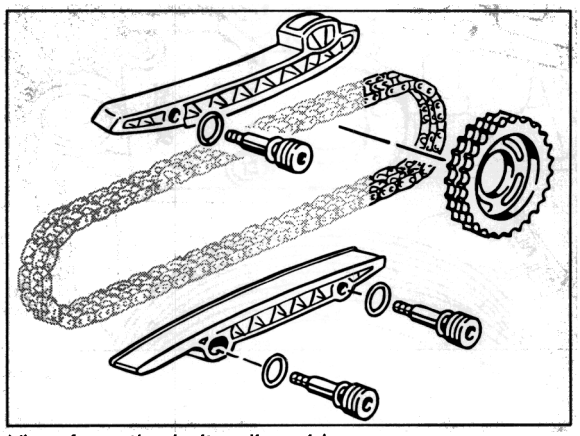
66_98

35. Fit guide rail and tensioning rail of **cylinder bank 1 - 3** (flywheel side);
fit guide rails in correct position.

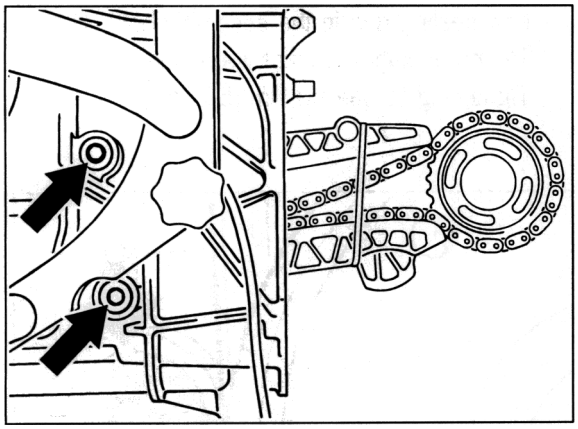


View from the belt pulley side 71_98

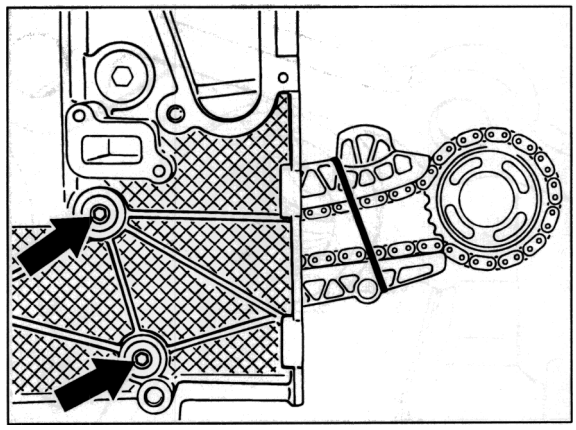
36. Fit guide rails and tensioning rails of **cylinder bank 4 - 6** (flywheel side);
fit guide rails in correct position.



View from the belt pulley side 72_98

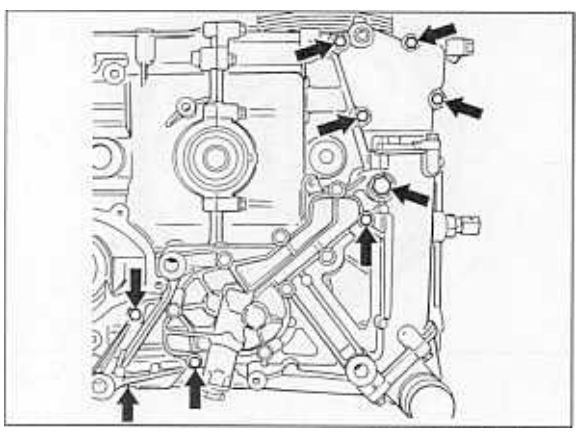


View from the flywheel side 469_97

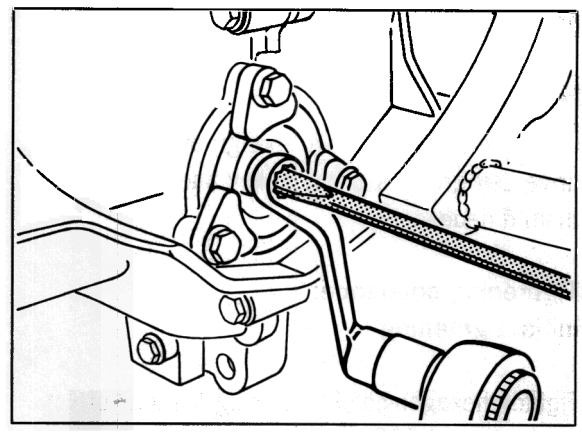


View from the belt pulley side 073_98

37. Fit oil pump with coolant guide housing
Assembly instructions: Group 17, Page 17 - 5.



597_97



442_97

38. Fit intermediate shaft flange.
Grease sealing ring in area of intermediate shaft flange. Grease take-up bore in area of the crankcase. Carefully press in the intermediate flange.

Screw in new micro-encapsulated hexagon-head bolts M6 x 20 (3 ea.).

Tightening torque 10 Nm (7.5 ftlb.)

Tighten locknut with the socket wrench, special tool 9110. For this purpose, hold with a slotted screwdriver 7.9 x 1.1 at the slotted threaded pin.
Tightening torque 11 Nm (8 ftlb.).

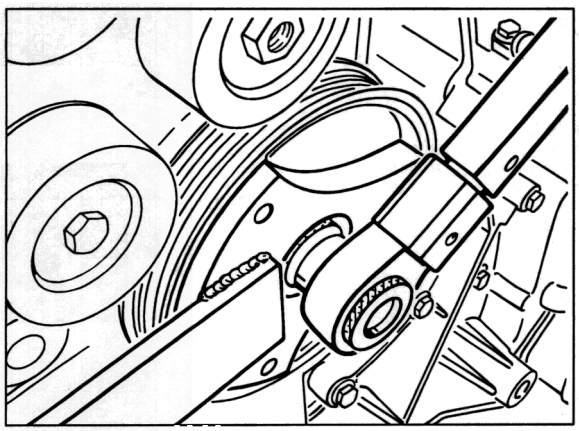
39. Fit belt pulley.

Note

Check whether there are foreign objects in the drive belt grooves of the pulley and remove them if necessary.

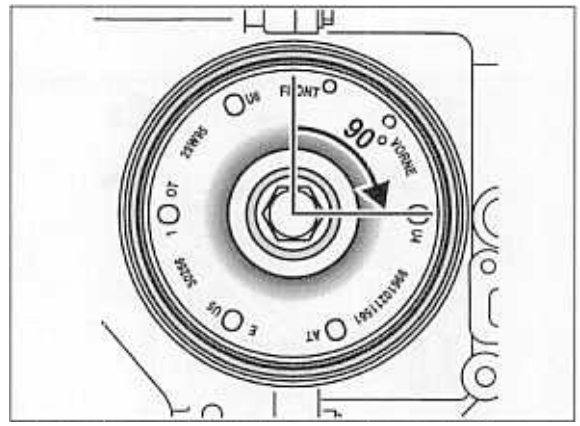
Tightening sequence:
Initial tightening

Tighten hexagon-head bolt using the socket wrench insert 9594; simultaneously hold with retaining device 9593.
Tightening torque 50 Nm (37 ftlb.)



252_1_97

Final tightening: 1 x 90° turn



213_97

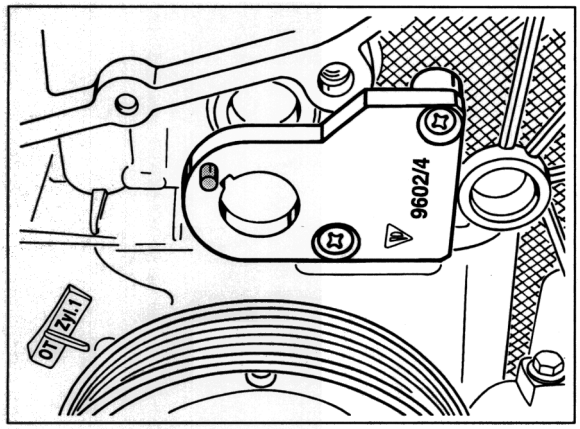
13 10 19 Removing and installing pistons for engine type M96/22 (2.7 l)

The installation of the pistons for engine type M96/22 (2.7 l) is the same as for the Boxster S (3.2 l), described on Page 13 - 49 to Page 13 - 76.

Only the **centring aid, special tool 9602/4,** must be used for fitting pistons on cylinder bank 4 - 6.

Distinguishing characteristic:

Thickness of centring aid 9602/4 8 mm.
Thickness of Boxster S centring aid 9602/2 10 mm.



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