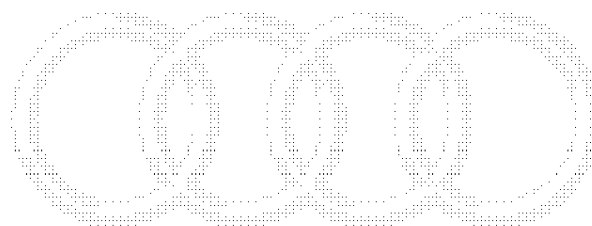


Workshop Manual

Audi 80 1992 ▶

Booklet 4WD Running gear

Edition 11.95



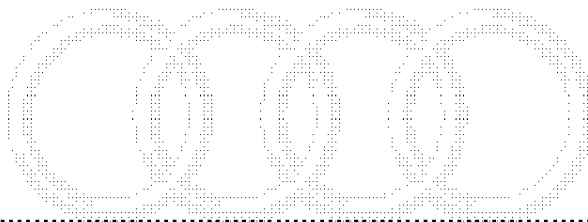
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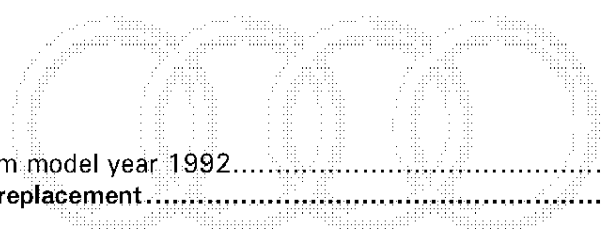
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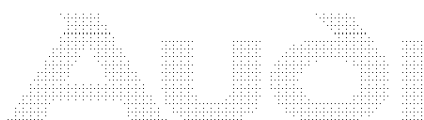
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Self-diagnosis (SD); Anti-lock braking system (ABS)

Note:

As of model year 1993, the control unit for ABS features self-diagnosis capability. This control unit is fitted with a fault memory which can be interrogated using the fault reader -V.A.G 1551-. The ABS switch -E83-, the longitudinal acceleration switch and the combi relay for the anti-lock braking system have also been discontinued.

Function

- The term "self-diagnosis" refers to the electrical/electronic part of the anti-lock braking system, i.e. only faults affecting electrical signals are detected.
- The first test step should always be to interrogate the contents of the fault memory.
- The control unit for ABS -J104 is equipped with a fault memory. If the monitored sensors or components malfunction, this is stored in the fault memory.

01-1

Notes:

- ◆ Switching of the relay can be heard when switching on the ignition, and the start-up of the return flow pump of the hydraulic modulator (self-check) is audible on driving off (at 5 – 6 km/h). The self-check is also apparent from slight vibration at the brake pedal. The hydraulic modulator is not to be replaced if a complaint is received about such noise.
- ◆ If a fault is detected, the ABS is automatically switched off and the ABS Attention lamp -K47 (in the dash insert) lights up. The conventional vehicle braking system remains fully operational. Except in the case of a fault in the supply voltage (when the ABS is reactivated as soon as the vehicle voltage regains a permissible level) the ABS remains switched off for the rest of this driving period.
- ◆ If a fault (possibly established and stored during the last driving period) is no longer present after switching the ignition off and on, or if it cannot be detected with the vehicle stationary (certain faults are only recognised after exceeding a minimum speed of 12 km/h), the ABS Attention lamp -K47 goes out shortly (approx. 2s) after switching on the ignition (as soon as self-test of ABS by control unit -J104 has been completed and no fault has been found).

01-2

- ◆ If there is no longer a fault present, the static fault stored in the fault memory is switched to a sporadic fault after switching the ignition off and on.
- ◆ If a sporadic fault no longer occurs over the course of a certain number of driving periods (switch-off and switch-on of ignition), it is cancelled automatically.
- ◆ "Sporadic faults" are additionally identified by "/SP" on the right-hand side of the display (of V.A.G 1551).
- ◆ The control unit for ABS -J104 distinguishes (following evaluation of information) between 13 different fault sources (= > Fault Table, Page 01-17) and stores these until the fault memory is erased (after fault memory interrogation) by the fault reader V.A.G 1551.
- ◆ The possibilities offered by self-diagnosis can only be utilised in conjunction with the fault reader V.A.G 1551, mode 1, "Rapid data transfer".

— 01-3 —

- ◆ In the case of ABS, self-diagnosis is not restricted to the storage, interrogation and cancelling of faults. Additional usage possibilities are provided with the control unit identification and measured value block reading. Mode 2 "Flashing code output" is not envisaged for the control unit ABS -J104. Further V.A.G 1551 modes are described in the appropriate operating instructions.
- ◆ Output of the (self-diagnosis) data by way of the fault reader V.A.G 1551 is only possible with the ignition switched on or the engine running.
- ◆ Entry into self-diagnosis is only possible with the vehicle stationary (the control unit -J104 no longer responds at vehicle speeds above 2.5 km/h).
- ◆ Interrogating and erasing of the fault memory, control unit identification and readout of the measured value block can only be performed at vehicle speeds of up to 20 km/h (self-diagnosis is terminated above this speed).

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Technical data of self-diagnosis

- ◆ Fault memory
 - Non-erasable memory, contents are retained even after disconnecting supply voltage.
- ◆ Data output
 - Rapid data transfer (mode 1)
 - ABS light in instrument panel lights up if ABS has been deactivated.
 - Flashing code output is not envisaged.
- ◆ Functions
 - 01 - Interrogating control unit version
 - 02 - Interrogating fault memory => Page 01-10
 - 05 - Erasing fault memory => Page 01-15
 - 06 - End of output => Page 01-15
 - 08 - Reading measured value block => Page 01-30

01-5

Notes:

- ◆ Control function cannot be implemented (ABS Attention light - K47 lights up) during self-diagnosis. Self-diagnosis is thus terminated as soon as the vehicle speed exceeds 20 km/h.
- ◆ The "Final control diagnosis" function cannot be implemented during self-diagnosis. The corresponding tests must be performed with the ABS tester -V.A.G 1710- in line with fault finding instructions.
=> Power train, running gear and Bosch ABS fault finding binder
- ◆ Component locations => Page 45-1
=> "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder



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Safety precautions and basic fault finding information

General notes on fault finding

- ◆ ABS is a vehicle safety system. Work on the system presupposes detailed system knowledge.
- ◆ Always interrogate fault memory before working on ABS.
- ◆ Never drive vehicle with the plug disconnected from ABS control unit.
- ◆ Always switch off ignition before detaching or attaching connectors of ABS system components.
- ◆ Hydraulic modulator bolts must never be loosened. Exception: cover bolt, when replacing the relays for the return flow pump and the solenoid valves.
- ◆ Observe the relevant safety precautions regarding the handling of brake fluid; =>Page 47-80.

01-7

- ◆ ABS faults are indicated by the ABS lamp lighting up. Certain faults are not recognised until the vehicle is moving at more than a minimum speed of 12 km/h (perform test drive).

- ◆ Notes on elimination of current faults

= > Service manual

Test requirements

- ◆ Permissible and identical wheels and tyre size Correct tyre pressure at all wheels.
- ◆ Conventional brake system with brake light switch and brake lights OK
- ◆ Hydraulic connections and pipes are not leaking (visual check of hydraulic unit, brake cylinders etc.).
- ◆ Wheel bearings and bearing clearance OK.
- ◆ Earth connection for return flow pump -V39 at hydraulic modulator OK.

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- ◆ ABS return flow pump relay -J105 and ABS solenoid valve relay -J106 properly connected
- ◆ Connector properly attached to control unit -J 104, catch engaged.
- ◆ When working with fault reader -V.A.G 1551-, test box -V.A.G 1598- must not be connected to control unit for ABS -J104-.
- ◆ Function of engageable differential lock OK (rear differential Attention lamp -K46 lights up after engagement and goes out completely following deactivation).
- ◆ Differential lock not engaged
- ◆ All fuses OK "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder
- ◆ Supply voltage OK (at least 10.5 V)

Technical publications required

- ◆ "ABS" current flow diagrams
- = > "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder
- ◆ ABS fault finding instructions with ABS tester -V.A.G 1710-
- = > Power train, running gear and Bosch ABS fault finding, ABS tester -V.A.G 1710-

Connecting fault reader V.A.G 1551, interrogating and erasing fault memory, ending output

Notes:

- ◆ The fault memory cannot be erased until it has been interrogated.
- ◆ During self-diagnosis, the main program of the control unit for ABS is shut down. There is no control function.

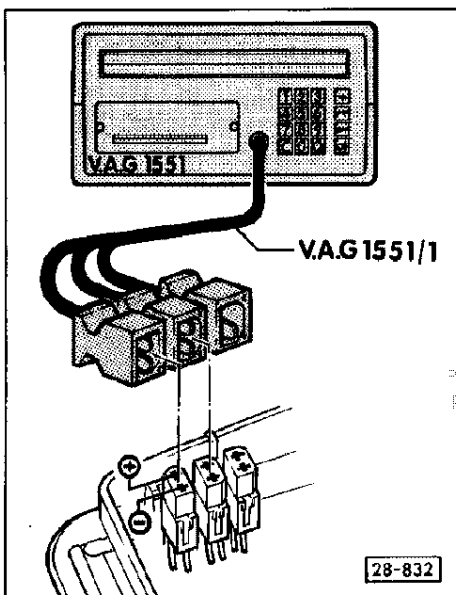
Interrogating fault memory

Test prerequisites => Page 01-8 satisfied.

- ◀ - Connect fault reader V.A.G 1551 with diagnosis cable V.A.G 1551/1 to diagnosis connector at relay socket 1 on left of plenum chamber.
- Attach black connector to black diagnosis connector

Note:

If there is no display, check voltage supply for black diagnosis connector => Page 01-37



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V.A.G self-diagnosis	HELP
1 - Rapid data transfer 1)	
2 - Flashing code output 1)	

Reading on display:

1) displayed alternately

- Attach white connector to white diagnosis connector

Note:

The blue connector is not required.

- Switch on ignition.

Notes:

◆ Additional user information can be printed out by pressing the HELP key on V.A.G 1551.

◆ The => key switches to the next step in the program sequence.

- Switch on printer by pressing PRINT key, indicator lamp in key comes on.

- Press key 1 for "Rapid data transfer" mode.

01-11

Rapid data transfer	HELP
Enter address word	XX

Reading on display:

- Press keys 0 and 3; 03 enters the address word "Brake electronics".

Rapid data transfer	Q
03 - Brake electronics	

Reading on display:

- Confirm entry with Q key.

4A0 907 379 X Brake electronics

The control unit identification is shown in the display

Index X	Allocation
None	Control unit with no wheel speed outputs
D	Control unit with wheel speed outputs

Notes:

◆ Refer also to Parts List for assignment of control unit for ABS - J104.

◆ Information on wheel speed outputs, e.g. on vehicles with automatic gearbox 01F.

=> "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

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01-12

No reply from control unit

- ◀ If adjacent display appears:
 - Press the HELP key to obtain a printout of the possible causes of fault.

or

K - wire not switching to earth/positive
HELP

- ◀ - Check wiring of diagnosis lines "L" and "K" => Page 01-37
or

No signal from control unit

- ◀ - Check voltage supply and earth connection to control unit -J 104.
=> "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder
- After eliminating the possible causes of the fault, once again enter address word 03 for brake electronics and confirm with the Q key.

Communication problem

- ◀ If adjacent display appears:
 - Fault elimination => Page 01-39
 - Press => key

Rapid data transfer HELP
Select function XX

- ◀ Reading on display:
 - Press keys 0 and 2. 02 selects the function "Interrogate fault memory".

Rapid data transfer Q
02 - Interrogate fault memory

- ◀ Reading on display:
 - Confirm entry with Q key.

X Fault detected

- ◀ The display shows the number of stored faults or "No fault detected".
 - Press => key
- The stored faults are displayed consecutively and printed out => Fault table, Page 01-17.
- Press => key after the last fault is displayed and printed.

Notes:

- ◆ If faults are detected: End output with function 06, switch off ignition, eliminate faults, interrogate and erase fault memory.
- ◆ In the event of a complaint that is not detected by the self-diagnosis: Perform fault finding with ABS tester -V.A.G 1710- in line with fault finding instructions.

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Erasing fault memory and ending output

Rapid data transfer	HELP
Select function	XX

- ◀ Reading on display:
– Press keys 0 and 5. 05 erases the fault memory.

Rapid data transfer	Q
05 – Erase fault memory	

- ◀ Reading on display:
– Confirm entry with Q key.

Attention	
Fault memory not interrogated	

- ◀ If adjacent display appears:

Notes:

- ◆ The fault memory cannot be erased until it has been interrogated.
- ◆ The fault memory is not erased if, for example, the ignition was switched off or the vehicle was driven at more than 20 km/h between fault memory interrogation and "Erase fault memory".

— 01-15 —

Rapid data transfer	
Fault memory erased	

- ◀ Reading on display:
– Press = > key

Rapid data transfer	HELP
Select function	XX

- ◀ Reading on display:
– Press keys 0 and 6. 06 ends output.

Rapid data transfer	Q
06 – End output	

- ◀ Anzeige am Display:
– Confirm entry with Q key.

Rapid data transfer	HELP
End of output	

- ◀ Reading on display:
– Switch off ignition.
– Disconnect fault reader V.A.G 1551.
– Switch on ignition. The ABS Attention lamp -K47- should go out after a brief period (approx. 2 seconds).
– Perform test drive, increasing vehicle speed at least once to more than 30 km/h (ABS Attention lamp -K47- must not come on again).

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— 01-16 —

Fault table

All faults which can be detected by the control unit for ABS -J 104, displayed on V.A.G 1551 and printed out, are listed in the following on the basis of the fault codes.

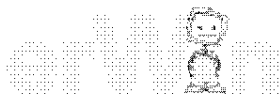
Notes:

- ◆ The content of the fault memory is retained until it is erased => Page 01-15.
 - ◆ Before renewing components, always check corresponding positive and earth connections using the current flow diagram as well as all associated plug contacts.
 - ◆ After renewing an ABS component, always check ABS following the fault finding instructions using ABS tester -V.A.G 1710-.
- => "Power train, running gear and Bosch ABS fault finding" binder
- ◆ After renewing a component of the ABS system always interrogate and erase the fault memory => Page 01-10. Perform a test drive. Drive the vehicle at a speed of at least 30 km/h for at least 30 seconds. The ABS Attention lamp -K47- must not come on.
 - ◆ The 07.92 supplement to the Bosch ABS fault finding instructions using the ABS tester -V.A.G 1710- lists all the modifications to these instructions necessary for performing fault finding on vehicles equipped with ABS.

— 01-17 —

- ◆ Use test box -V.A.G 1598- with adapter cable -V.A.G 1598/3- to check electrical connections to control unit for ABS -J104- in line with "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder.
- ◆ Sporadic faults are additionally indicated by "/SP" on the right-hand side of the display.
- ◆ In the case of sporadic faults, move the wiring leading to the component when checking (loose contact).
- ◆ Static faults, which cannot be detected with the vehicle stationary, are also marked "/SP" after switching the ignition off and on =>Page 01-1.
- ◆ The fault code (5-digit) is not displayed; it merely appears on the print-out.
- ◆ The "Fault rectification" column in the following tables makes reference to individual test steps in the fault finding instructions "Bosch ABS, ABS tester -V.A.G 1710-". Fault finding using -V.A.G 1710- is however always to be performed in full and in the prescribed sequence.

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— 01-18 —

V.A.G 1551 print-out	Possible causes of fault	Fault rectification
Fault code 00000 No fault detected	This display means that the self-diagnosis is finished. If there is a problem with the vehicle despite no faults having been detected by the control unit -J104-: Perform fault finding with ABS tester -V.A.G 1710-. => Power train, running gear and Bosch ABS fault finding with ABS tester -V.A.G 1710-.	
00277 ABS inlet/outlet valve, front left -N137-	<ul style="list-style-type: none"> ◆ Open circuit, short to positive or to earth in wiring between ABS hydraulic modulator -N55- and control unit -J104-. ◆ ABS inlet/outlet valve -N137- defective 	<ul style="list-style-type: none"> ◆ Locate and eliminate open circuit or short circuit in line with current flow diagram for all ABS inlet/outlet valves (-N137-, -N138-, -N160-) ◆ Check hydraulic modulator, perform functional test with -V.A.G 1710- (test steps 1 and 5) => Power train, running gear and Bosch ABS fault finding with ABS tester -V.A.G 1710-

— 01-19 —

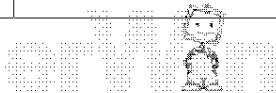
V.A.G 1551 print-out	Possible causes of fault	Fault rectification
Fault code 00283 Front left speed sensor -G47- Note: May mistakenly be displayed as sporadic fault if individual wheels turn at more than 6 km/h with ignition switched on.	<ul style="list-style-type: none"> ◆ Open circuit, short to positive or to earth in wiring between speed sensor -N55- and control unit -J104-. ◆ Rotor dirty or damaged ◆ Excessive play in wheel bearing ◆ Speed sensor -G47- not properly installed. ◆ Speed sensor -G47- defective 	<ul style="list-style-type: none"> ◆ Locate and eliminate open circuit or short circuit ◆ Check, clean or replace rotor ◆ Renew wheel bearing => Page 40-3 ◆ Check fitting location of speed sensor => Page 45-13 ◆ Check speed sensor -G47-, perform electrical testing with ABS tester -V.A.G 1710- (test step 6) => Power train, running gear and Bosch ABS fault finding with ABS tester -V.A.G 1710- binder
00284 ABS inlet/outlet valve, front right -N138-	<ul style="list-style-type: none"> ◆ Open circuit, short to positive or to earth in wiring between ABS hydraulic modulator -N55- and control unit -J104- ◆ ABS inlet/outlet valve -N138- defective 	<ul style="list-style-type: none"> ◆ Locate and eliminate open circuit or short circuit in line with current flow diagram for all ABS inlet/outlet valves (-N137-, -N138-, -N160-) ◆ Check hydraulic modulator, perform functional test with -V.A.G 1710- (test steps 1 and 5) => Power train, running gear and Bosch ABS fault finding with ABS tester -V.A.G 1710-

— 01-20 —

V.A.G 1551 print-out	Possible causes of fault	Fault rectification
Fault code 00285 Front right speed sensor -G45- Note: May mistakenly be displayed as sporadic fault if individual wheels turn at more than 6 km/h with ignition switched on.	<ul style="list-style-type: none"> ◆ Open circuit, short to positive or to earth in wiring between speed sensor -G45- and control unit -J104- ◆ Rotor dirty or damaged ◆ Excessive play in wheel bearing ◆ Speed sensor -G45- not properly installed ◆ Speed sensor -G45- defective 	<ul style="list-style-type: none"> ◆ Use current flow diagram to locate and rectify open circuit or short circuit ◆ Check, clean or replace rotor ◆ Renew wheel bearing => Page 40-3 ◆ Check fitting location of speed sensor => Page 45-13 ◆ Check speed sensor -G45-, perform electrical testing with ABS tester -V.A.G 1710- (test step 6) => Power train, running gear and Bosch ABS fault finding with ABS tester -V.A.G 1710- binder

V.A.G 1551 print-out	Possible causes of fault	Fault rectification
Fault code 00287 Rear right speed sensor -G44- Note: May mistakenly be displayed as sporadic fault if individual wheels turn at more than 6 km/h with ignition switched on.	<ul style="list-style-type: none"> ◆ Open circuit, short to positive or to earth in wiring between speed sensor -G44- and control unit -J104- ◆ Rotor dirty or damaged ◆ Excessive play in wheel bearing ◆ Speed sensor -G44- not properly installed ◆ Speed sensor -G44- defective 	<ul style="list-style-type: none"> ◆ Use current flow diagram to locate and rectify open circuit or short circuit ◆ Check, clean or replace rotor ◆ Service wheel bearing housing => Page 42-48 ◆ Check fitting location of speed sensor => Page 45-13 ◆ Check speed sensor -G44-, perform functional test with -V.A.G 1710- (test step 6) => Power train, running gear and Bosch ABS fault finding with ABS tester -V.A.G 1710-

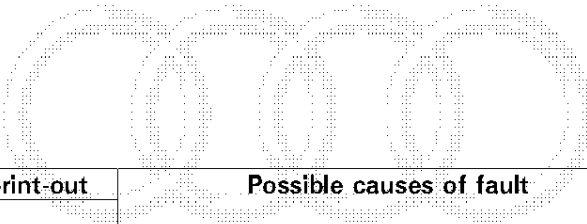
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V.A.G 1551 print-out	Possible causes of fault	Fault rectification
Fault code 00290 Rear left speed sensor -G46- Note: May mistakenly be displayed as sporadic fault if individual wheels turn at more than 6 km/h with ignition switched on.	<ul style="list-style-type: none"> ◆ Open circuit, short to positive or to earth in wiring between speed sensor -G46- and control unit -J104- ◆ Rotor dirty or damaged ◆ Excessive play in wheel bearing ◆ Speed sensor -G46- not properly installed ◆ Speed sensor -G46- defective 	<ul style="list-style-type: none"> ◆ Use current flow diagram to locate and rectify open circuit or short circuit ◆ Check, clean or replace rotor ◆ Service wheel bearing housing => Page 42-48 ◆ Check fitting location of speed sensor => Page 45-13 ◆ Check speed sensor -G46-, perform electrical testing with ABS tester -V.A.G 1710- (test step 6) => Power train, running gear and Bosch ABS fault finding with ABS tester -V.A.G 1710-

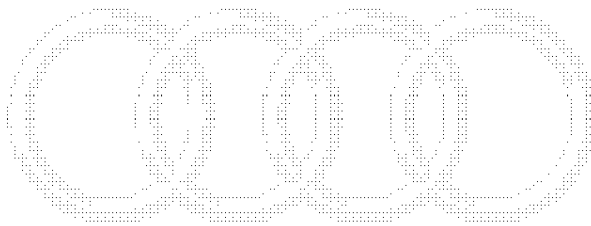
V.A.G 1551 print-out	Possible causes of fault	Fault rectification
Fault code 00301 ABS return flow pump -V39- <small>Protected by copyright. Copyright of Volkswagen Group of Companies. All rights reserved. No part of this publication permitted unless authorised by VW Group of Companies. ABS does not guarantee or accept any liability with respect to the content of this technical document. Copyright by VW Group of Companies.</small>	<ul style="list-style-type: none"> ◆ Open circuit or contact resistance in earth connection or voltage supply to return flow pump -V39- ◆ Open circuit or short to positive in wiring between relay -J105- and control unit -J104- ◆ ABS return flow pump relay -J105-, return flow pump -V39- or hydraulic modulator defective 	<ul style="list-style-type: none"> ◆ Use current flow diagram to locate and eliminate open circuit or contact resistance. ◆ Use current flow diagram to locate and eliminate open circuit or short circuit ◆ Check relay -J105-, return flow pump -V39- and hydraulic modulator -N55-, perform functional test with V.A.G 1710 (test step 3) => Power train, running gear and Bosch ABS fault finding with ABS tester -V.A.G 1710- binder


V.A.G 1551 print-out	Possible causes of fault	Fault rectification
Fault code 00302 ABS solenoid valve relay -J106- Note: If this fault is displayed, additionally check ABS inlet/outlet valve -N160-, fault code 00649.	<ul style="list-style-type: none"> ◆ Open circuit or contact resistance in earth connection or voltage supply to relay -J106- ◆ Open circuit, short to positive or to earth in wiring between relay -J106- and control unit -J104-. ◆ Solenoid valve relay -J106 or hydraulic modulator -N55 defective 	<ul style="list-style-type: none"> ◆ Use current flow diagram to locate and eliminate open circuit or contact resistance. ◆ Use current flow diagram to locate and eliminate short circuit or open circuit ◆ Check relay -J106- and hydraulic modulator -N55-, perform functional test with V.A.G 1710 (test step 1) => Power train, running gear and Bosch ABS fault finding with ABS tester -V.A.G 1710-



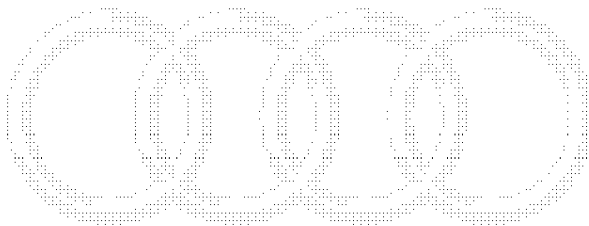
V.A.G 1551 print-out	Possible causes of fault	Fault rectification
Fault code 00526 Brake light switch -F-	<ul style="list-style-type: none"> ◆ Open circuit or short to positive in wiring between brake light switch and brake light bulbs -M9-, -M10- or control unit -J104-. ◆ Brake light bulbs -M9 or -M10 defective ◆ Brake light switch defective 	<ul style="list-style-type: none"> ◆ Use current flow diagram to locate and eliminate open circuit or short circuit ◆ Replace bulbs ◆ Check brake light switch Read measured value block => Page 01-30 or perform functional test with -V.A.G 1710- (test step 2) => Power train, running gear and Bosch ABS fault finding with ABS tester -V.A.G 1710- binder

V.A.G 1551 print-out	Possible causes of fault	Fault rectification
Fault code 00532 Supply voltage	<ul style="list-style-type: none"> ◆ Open circuit or contact resistance in voltage supply to control unit -J104- (contact 1) or in earth connection to control unit -J104- ◆ Voltage dips or overvoltage in vehicle electrical system Notes: <ul style="list-style-type: none"> ◆ As soon as vehicle voltage returns to permissible range, ABS is reactivated and ABS Attention lamp -K47 goes out. ◆ This fault is only stored if it occurs when vehicle speed is more than 6 km/h. 	<ul style="list-style-type: none"> ◆ Use current flow diagram to locate and eliminate open circuit or contact resistance. Perform functional test with -V.A.G 1710- (test step 1) = > Power train, running gear and Bosch ABS fault finding with ABS tester -V.A.G 1710- binder ◆ Check alternator and voltage regulator. = > Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder ◆ Perform functional test with -V.A.G 1710- (test steps 1 and 5) = > Power train, running gear and Bosch ABS fault finding with ABS tester -V.A.G 1710-



V.A.G 1551 print-out	Possible causes of fault	Fault rectification
Fault code 00597 Differing wheel speed pulses Note: May mistakenly be displayed as sporadic fault if individual wheels turn at more than 6 km/h with ignition switched on.	<ul style="list-style-type: none"> ◆ Rotor with wrong number of teeth fitted ◆ Rotor dirty or damaged  <ul style="list-style-type: none"> ◆ Speed sensor not properly installed ◆ Excessive wheel bearing clearance or wheel bearing defective ◆ Speed sensor defective 	<ul style="list-style-type: none"> ◆ Check all rotors =>Page 45-13 and read measured value block => Page 01-30 ◆ Check all rotors. Clean or replace faulty component. ◆ Check fitting location of all speed sensors => Page 45-13 ◆ Check all wheel bearings =>Page 40-1 and 42-48 ◆ Check all speed sensors, perform functional test with -V.A.G 1710- (test step 6) = > Power train, running gear and Bosch ABS fault finding with ABS tester -V.A.G 1710- binder

V.A.G 1551 print-out	Possible causes of fault	Fault rectification
Fault code 00649 BS inlet/outlet valve, rear -N160-	<ul style="list-style-type: none"> ◆ Open circuit, short to positive or to earth in wiring between ABS hydraulic modulator -N55- and control unit -J104-. ◆ ABS inlet/outlet valve -N160- defective 	<ul style="list-style-type: none"> ◆ Locate and eliminate open circuit or short circuit in line with current flow diagram for all ABS inlet/outlet valves (-N137-, -N138-, -N160-) ◆ Check hydraulic modulator, perform functional test with V.A.G 1710 (test steps 1 and 5) = > Power train, running gear and Bosch ABS fault finding with ABS tester -V.A.G 1710-
65535 Control unit faulty Note: If fault "ABS return flow pump -V39-" is displayed at same time, first eliminate the cause of this fault.	<ul style="list-style-type: none"> ◆ Open circuit or contact resistance in earth connection or voltage supply to ABS control unit -J104- ◆ Control unit -J104- defective 	<ul style="list-style-type: none"> ◆ Use current flow diagram to locate and eliminate open circuit or contact resistance. ◆ Replace control unit -J104-



Reading measured value block

Test prerequisites => Page 01-8 satisfied.

- ◆ Fault memory has been interrogated and any displayed faults have been located and eliminated.

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Notes:

- ◆ A display group with 8 measured values is provided

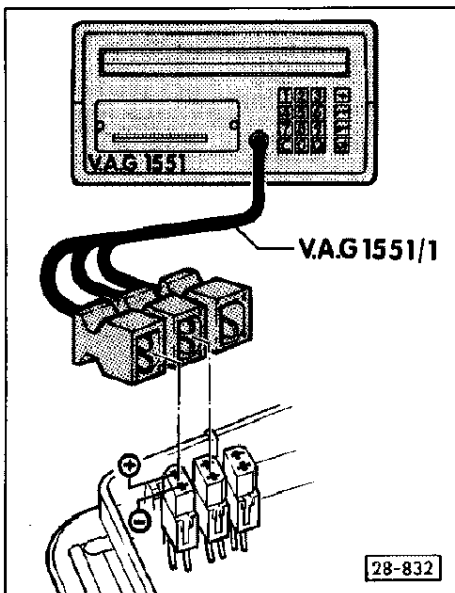
- ◆ If the printer is switched on, the display will be printed out on the record slip.

- Connect fault reader V.A.G 1551 with diagnosis cable V.A.G 1551/1 to diagnosis connector at relay socket 1 on left of plenum chamber.

- Attach black connector to black diagnosis connector

Note:

If there is no display, check voltage supply for black diagnosis connector => Page 01-37



V.A.G self-diagnosis HELP
 1 - Rapid data transfer 1)
 2 - Flashing code output 1)

◀ Reading on display:
 1) displayed alternately
 - Attach white connector to white diagnosis connector

Note:
The blue connector is not required.
 - Switch on ignition or start engine.

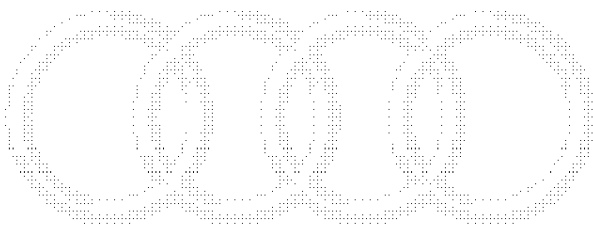
Notes:
 ♦ Additional user information can be printed out by pressing the HELP key on V.A.G 1551.
 ♦ The => key switches to the next step in the program sequence.
 - Switch on printer by pressing PRINT key, indicator lamp in key comes on.
 - Press key 1 for "Rapid data transfer" mode.

Rapid data transfer HELP
 Enter address word XX

◀ Reading on display:
 - Press keys 0 and 3; 03 enters the address word "Brake electronics".

Rapid data transfer Q
 03 - Brake electronics

◀ Reading on display:
 - Confirm entry with Q key.



4A0 907 379 X Brake electronics

◀ The control unit identification is shown in the display

Index X	Allocation
None	Control unit with no wheel speed outputs
D	Control unit with wheel speed outputs

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Notes:
 ♦ Refer also to Parts List for assignment of control unit for ABS - J104.
 ♦ Information on wheel speed outputs, e.g. on vehicles with automatic gearbox 01F.
 => "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

No reply from control unit

◀ If adjacent display appears:
 - Press the HELP key to obtain a printout of the possible causes of fault.

or

K -wire not switching to earth/positive
 HELP

◀ - Check wiring of diagnosis lines "L" and "K" => Page 01-37

or

No signal from control unit

- ◀ - Check voltage supply and earth connection to control unit - J104.
- = > "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder
- After eliminating the possible causes of the fault, once again enter address word 03 for brake electronics and confirm with the Q key.

Communication problem

- ◀ If adjacent display appears:
- Fault elimination => Page 01-39
- Press => key

Rapid data transfer	HELP
Select function	XX

- ◀ Reading on display:
- Press keys 0 and 8, 08 selects function "Read measured value block"

Rapid data transfer	Q
08 - Read measured value block	

- ◀ Reading on display:
- Confirm entry with Q key.



Read measured value block HELP	
Enter display group number	XX

- ◀ Reading on display:
- Press key 0 twice.
- Confirm entry with Q key.

Reading measured value block							
1	2	3	4	5	6	7	8

- ◀ Reading on display:

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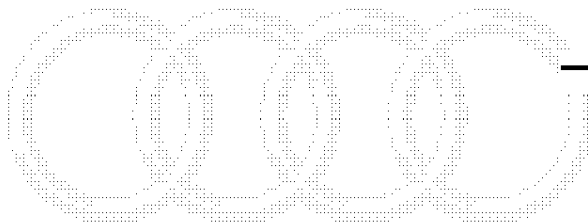
Notes:

- ◆ Display fields 1 to 4 indicate the wheel speed in km/h. This is calculated by the control unit -J104 on the basis of the incoming wheel speed sensor pulses. If a vehicle is evenly accelerated/moved on a dry surface, the maximum permissible difference between the display values 1 to 4 is ± 1 km/h (rounding error). If deviations exceed the above figure, check wheel speed sensors and rotors => Pages 45-13 and 45-17
 - ◆ To check whether wheel speed sensors have been mixed up, turn wheels by hand whilst securing the other driven wheels to prevent them turning.
 - ◆ If the measured values indicate a fault, test function with ABS tester -V.A.G 1710- in line with fault finding instructions.
- = > Power train, running gear and Bosch ABS fault finding binder

Test table: Reading measured value block

Display field	Designation	Test conditions	Reading on -V.A.G 1551-
1	Wheel speed front left (km/h)		1 (vehicle stationary) to 19 ¹⁾
2	Wheel speed front right (km/h)		1 (vehicle stationary) to 19 ¹⁾
3	Wheel speed rear left (km/h)		1 (vehicle stationary) to 19 ¹⁾
4	Wheel speed rear right (km/h)		1 (vehicle stationary) to 19 ¹⁾
5	Brake light switch -F- (contact 25 on -J104-)	◆ Brake pedal not depressed	0
		◆ Brake pedal depressed	1
6	Voltage at ABS return flow pump -V39-		0 Note: If reading is 1 (not permissible – return flow pump running) perform functional test with -V.A.G 1710- (test steps 3 and 5) => Power train, running gear and Bosch ABS fault finding binder

¹⁾ Control unit -J104- terminates self-diagnosis if vehicle speed exceeds 19 km/h



01-35

Display field	Designation	Test conditions	Reading on -V.A.G 1551-
7	ABS solenoid valve relay - J106- (contact 32 on -J104-)	ABS switched on	1 Note: If reading is 0 (not permissible – relay - J106- not energised) perform functional test with -V.A.G 1710- (test steps 1 and 5) => Power train, running gear and Bosch ABS fault finding binder
8	Rear final drive differential lock switch -F100- (contact 13 on -J104-)	◆ Differential lock not engaged	0
		◆ Differential lock engaged	1

01-36

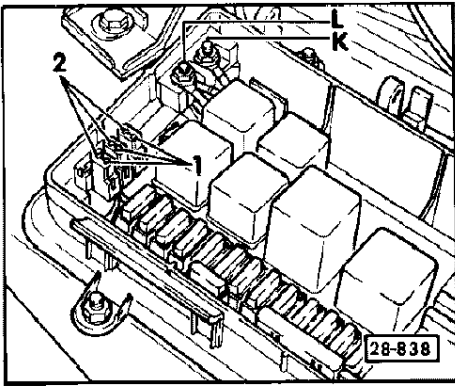
Checking wiring of diagnosis connectors

Notes:

- ◆ The diagnosis connectors and the adapters "K" and "L" of all vehicle systems featuring self-diagnosis are located in relay station 1 (on left of plenum chamber)
- ◆ Wiring colours and other vehicle systems connected to "white" diagnosis connector
- = > "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder
- ◆ For testing, use hand-held multimeter V.A.G 1526, adapter cable set V.A.G 1594 and test box V.A.G 1598 with adapter cable V.A.G 1593/3.
- ◆ Switch off ignition before checking wiring.

Black diagnosis connector, voltage supply

- Contact 1 connected to earth
- Contact 2 positive (via fuse 21 to terminal 30)



01-37

White diagnosis connector, data transfer

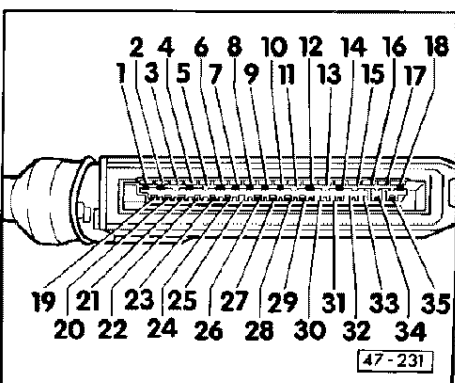
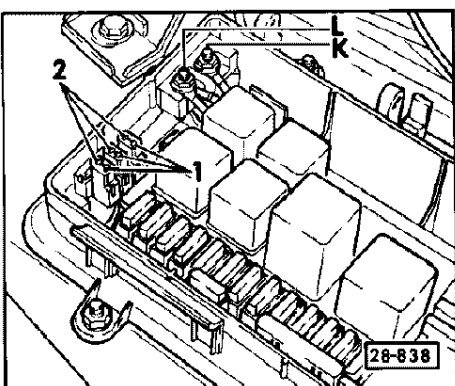
- Contact 1
 - _ Not required for brake electronics
- Contact 2
 - _ Data line for "Rapid data transfer". Wiring from diagnosis connector is routed via adapter "K" to control unit for ABS -J104- (contact 31).

= > "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

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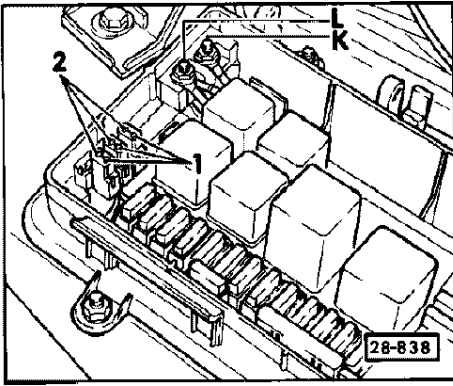
Notes:

- ◆ Pull plug off ABS control unit -J104- => Page 45-10, connect test box -V.A.G 1598- with adapter cable -V.A.G 1598/3- and measure at appropriate test box sockets
- = > "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder
- ◆ Use -V.A.G 1526- to check wiring for open circuit, short to positive or short to earth.



01-38

Checking wiring when "Communication problem" is displayed on V.A.G 1551



- Consecutively disconnect wiring between other vehicle systems featuring self-diagnosis "Rapid data transfer" and "white" diagnosis connector, contact 2 (in relay station 1) at adapter "K".

Note:

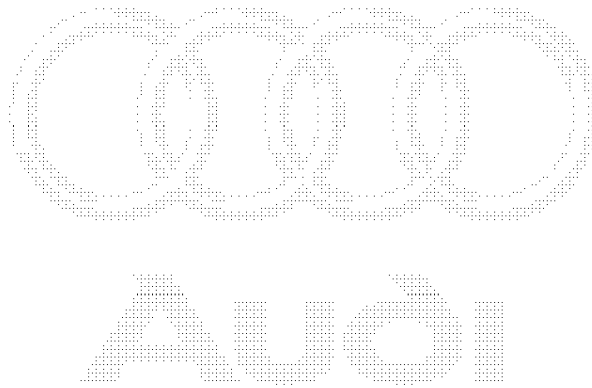
Other systems featuring self-diagnosis

= > "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

- After disconnecting the wiring to the respective vehicle system, enter address word "03" again in "Rapid data transfer" mode.
- If control unit identification is then displayed, check wiring to last control unit disconnected in line with current flow diagram.
- If no fault is found, renew last control unit disconnected and re-establish all wiring connections.

Note:

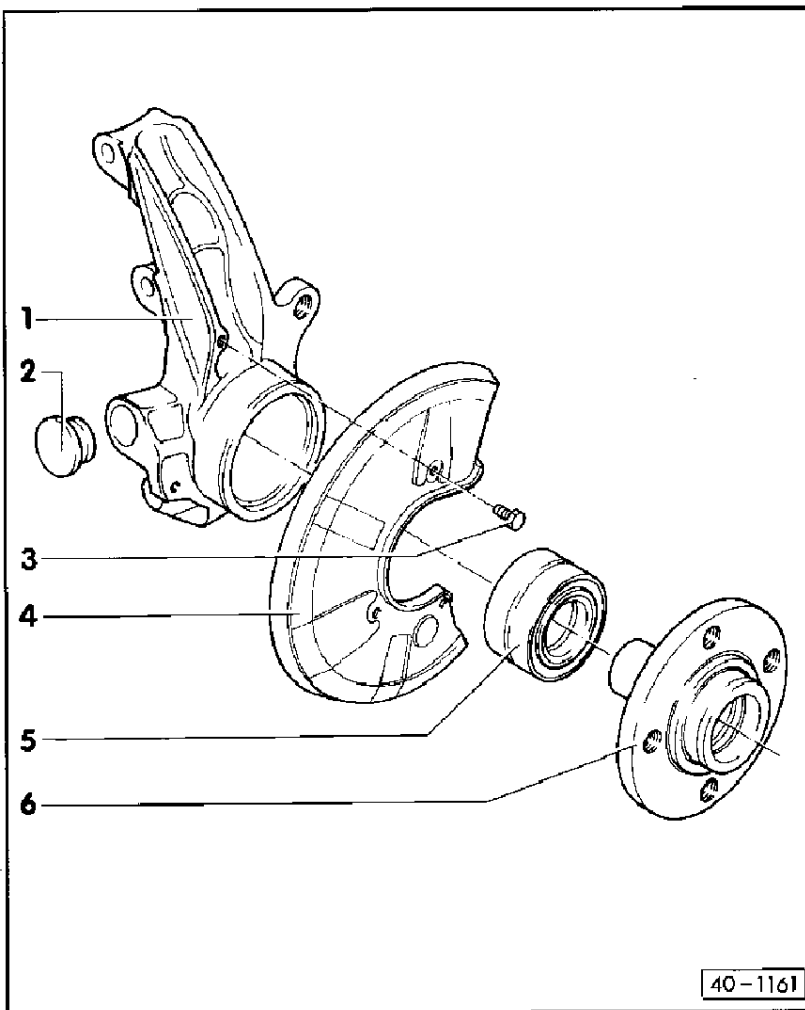
If "No reply from control unit" is displayed, this indicates that the wiring to the ABS control unit -J104- has been disconnected at some point.



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Replacing wheel bearing housing

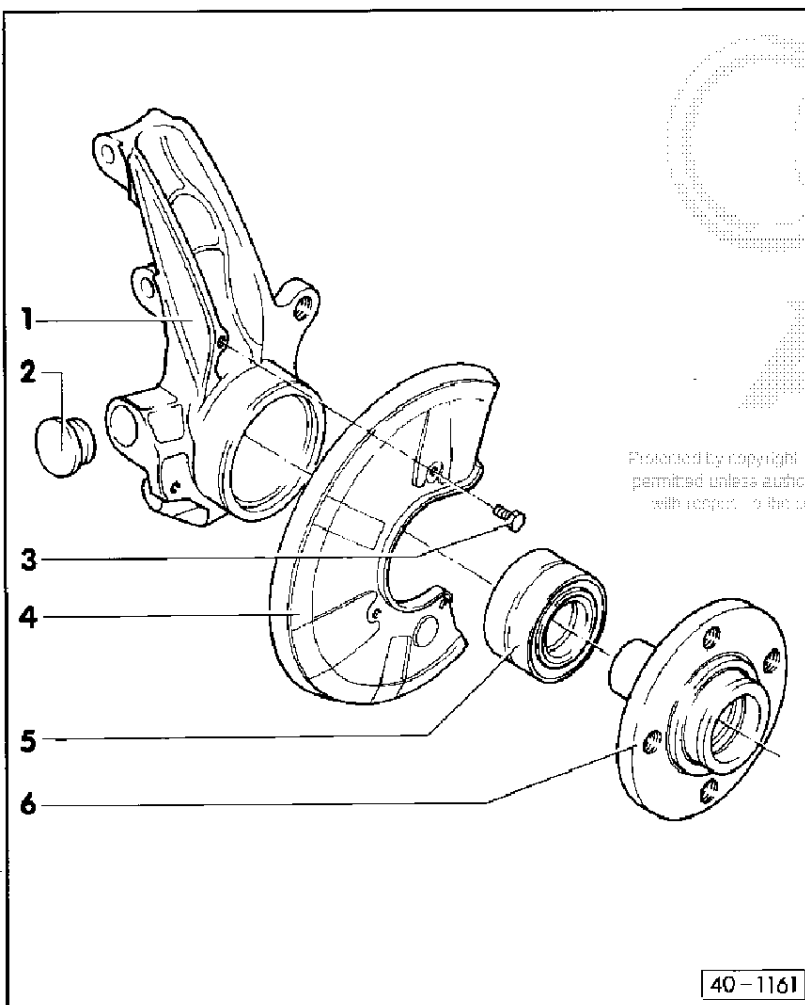


40-1161

1 - Wheel bearing housing

- ◆ With 75 mm diameter bearing bore for vehicles with engines up to 101 kW
- ◆ With 82 mm diameter bearing bore for vehicles with engines from 110 kW
- ◆ Do not grease bearing seat in wheel bearing housing before pressing in wheel bearing
- ◆ Never widen slot in wheel bearing housing (seat for joint pin) to press out joint pin
- ◆ Perform front axle wheel alignment after removing/installing or replacing wheel bearing housing
- ◆ Note different types of wheel bearing housing => Fig. 11

40-1



40-1161

2 - Plug

- ◆ Vehicles with ABS feature a spring sleeve for the wheel speed sensor instead of the plug

3 - Hexagon bolt, 10 Nm

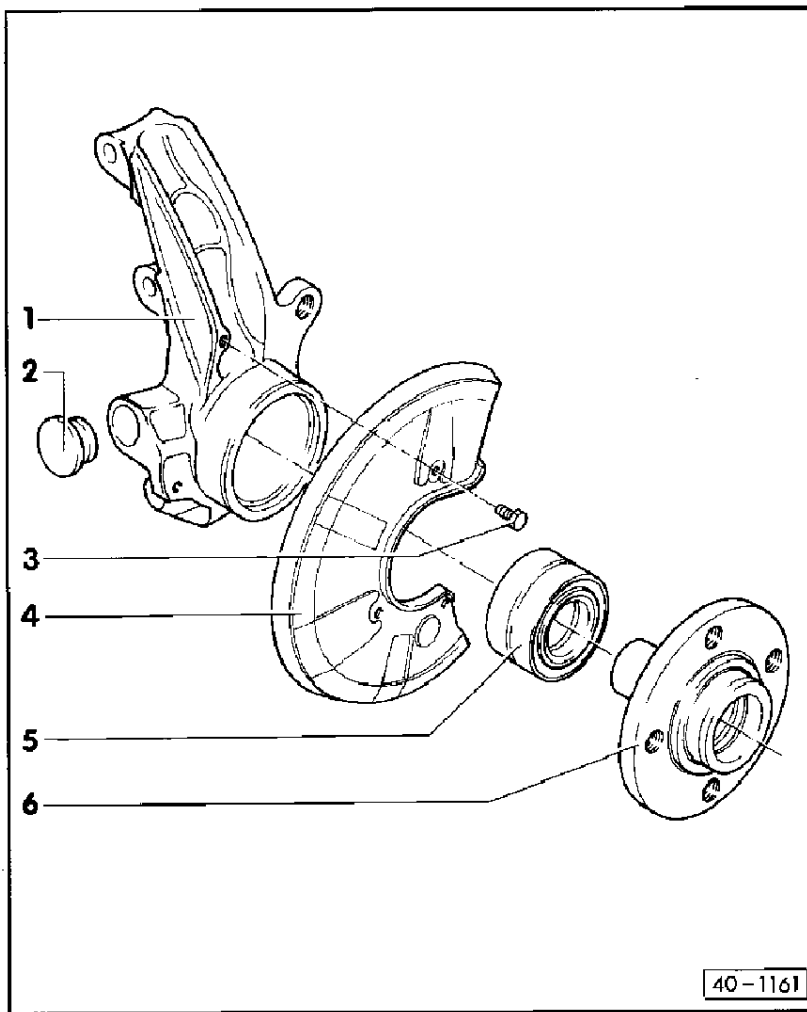
4 - Brake cover plate

Note:

Vehicles with cast and forged wheel bearing housings have different cover plates.

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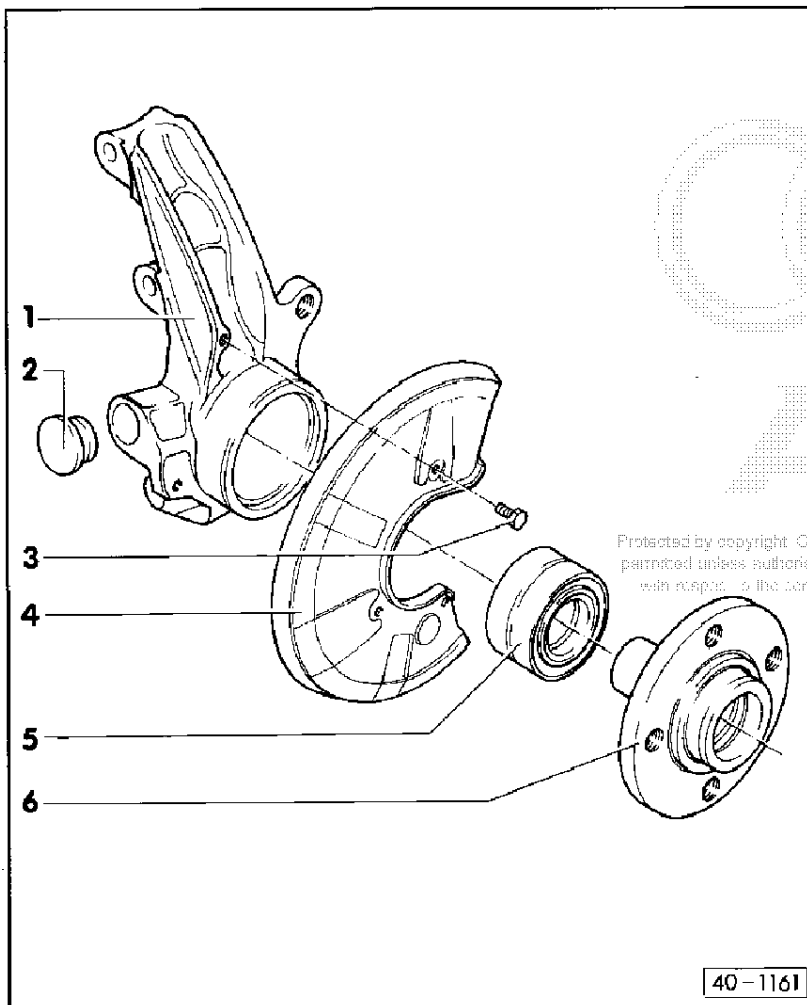
40-2



40-1161

5 - Wheel bearing

- ◆ With 75 mm diameter for vehicles with engines up to 101 kW
- ◆ With 82 mm diameter for vehicles with engines from 110 kW
- ◆ Stepped internal diameter
- ◆ Note correct installation position: Large internal diameter of wheel bearing points to wheel hub.
- ◆ Pressing out destroys the bearing
- ◆ Pressing out $\varnothing 75$ => Fig. 3
- ◆ Pressing in $\varnothing 75$ => Fig. 4
- ◆ Pressing out $\varnothing 82$ => Fig. 5
- ◆ Pressing in $\varnothing 82$ => Fig. 6

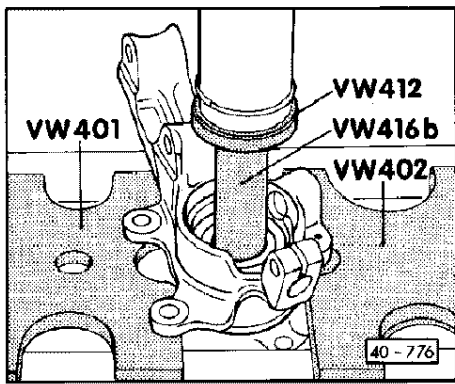


40-1161

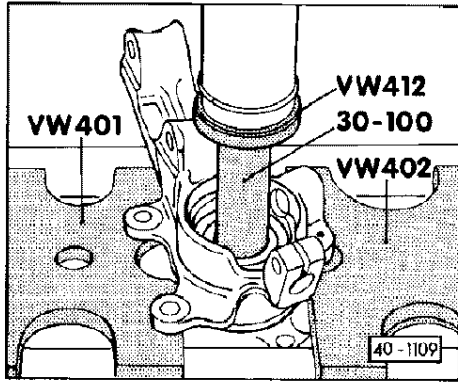
6 - Wheel hub

- ◆ Note different versions: 33 teeth up to 101 kW engine, 38 teeth as of 110 kW engine
- ◆ Pressing out $\varnothing 75$ => Fig. 1
- ◆ Pressing out $\varnothing 82$ => Fig. 2
- ◆ Pressing in $\varnothing 75$ => Fig. 7
- ◆ Pressing in $\varnothing 82$ => Fig. 8
- ◆ Pulling off bearing inner race => Fig. 9 and 10

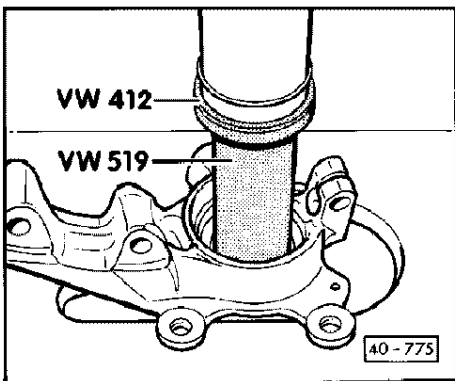
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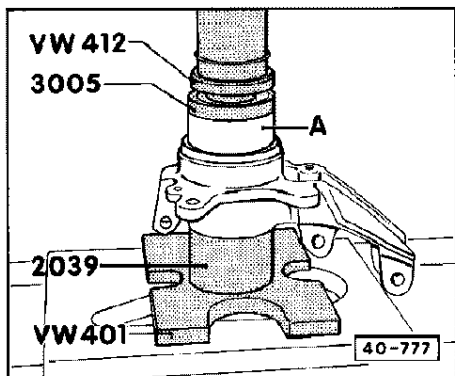
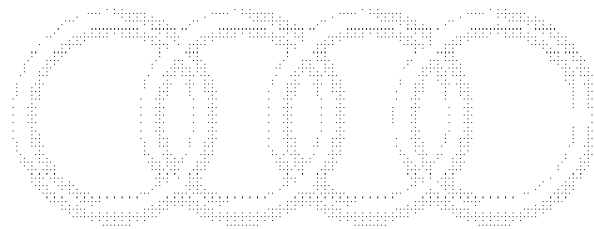
◀ Fig.1 Pressing wheel hub out of 75 mm diameter wheel bearing



◀ Fig.2 Pressing wheel hub out of 82 mm diameter wheel bearing



◀ Fig.3 Pressing out 75 mm diameter wheel bearing



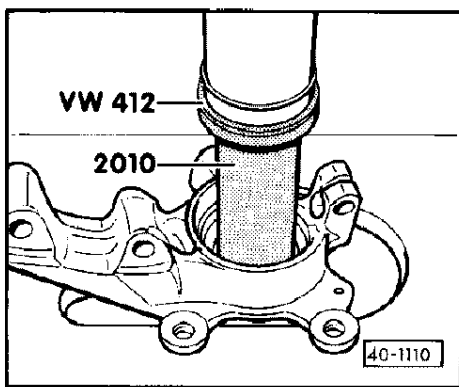
◀ Fig.4 Pressing home 75 mm diameter wheel bearing -A-

Note:

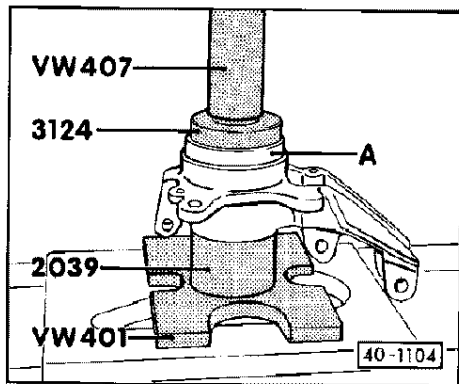
Large internal diameter of wheel bearing points to wheel hub.

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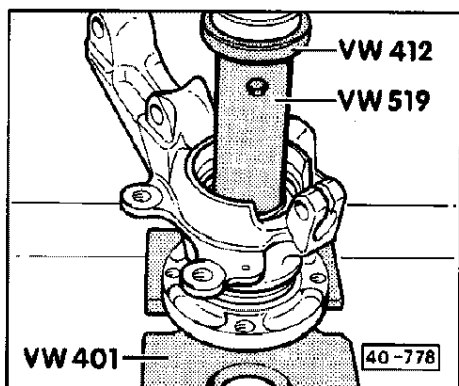
◀ Fig.5 Pressing out 82 mm diameter wheel bearing



◀ Fig.6 Pressing home 82 mm diameter wheel bearing -A-

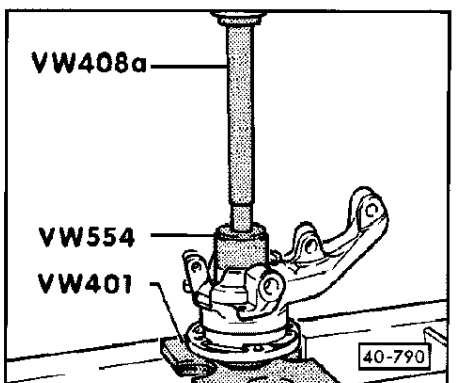
Note:

Large internal diameter of wheel bearing points to wheel hub.



◀ Fig.7 Pressing wheel hub into 75 mm diameter wheel bearing

- When pressing in, thrust piece -VW519- must only make contact with inner race.

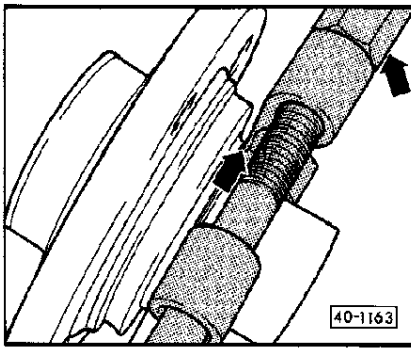


◀ Fig.8 Pressing wheel hub into 82 mm diameter wheel bearing

- When pressing in, thrust piece -VW455- must only make contact with the bearing inner race.

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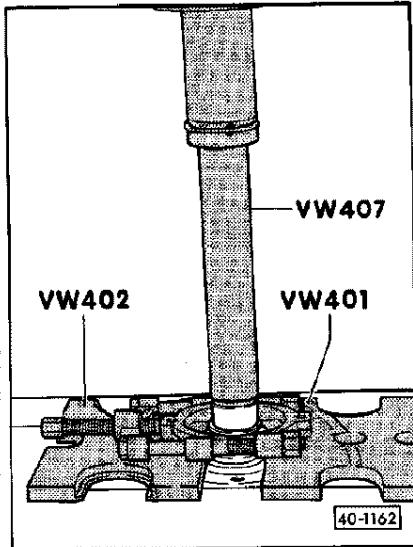


◀ Fig.9 Inserting separating device

- Insert separating device into annular groove of bearing inner race and pre-tension with spindle.

Note:

Use commercially available separating device e.g. 15-17 from Kukko.



◀ Fig.10 Pressing bearing inner race off wheel hub

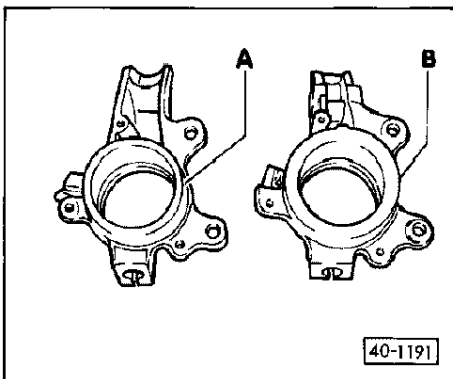


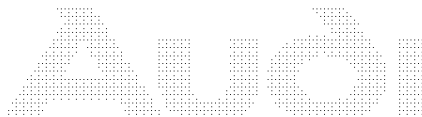
Fig.11 Forged and cast wheel bearing housings

- _ A = Forged version
- _ B = Cast version

Note:

Forged wheel bearing housings are installed with 75 and 82 mm bearing diameter. Cast versions are only fitted with 75 mm bearing diameter. From a technical point of view there are no reservations about installing different types of wheel bearing housing on the same axle.

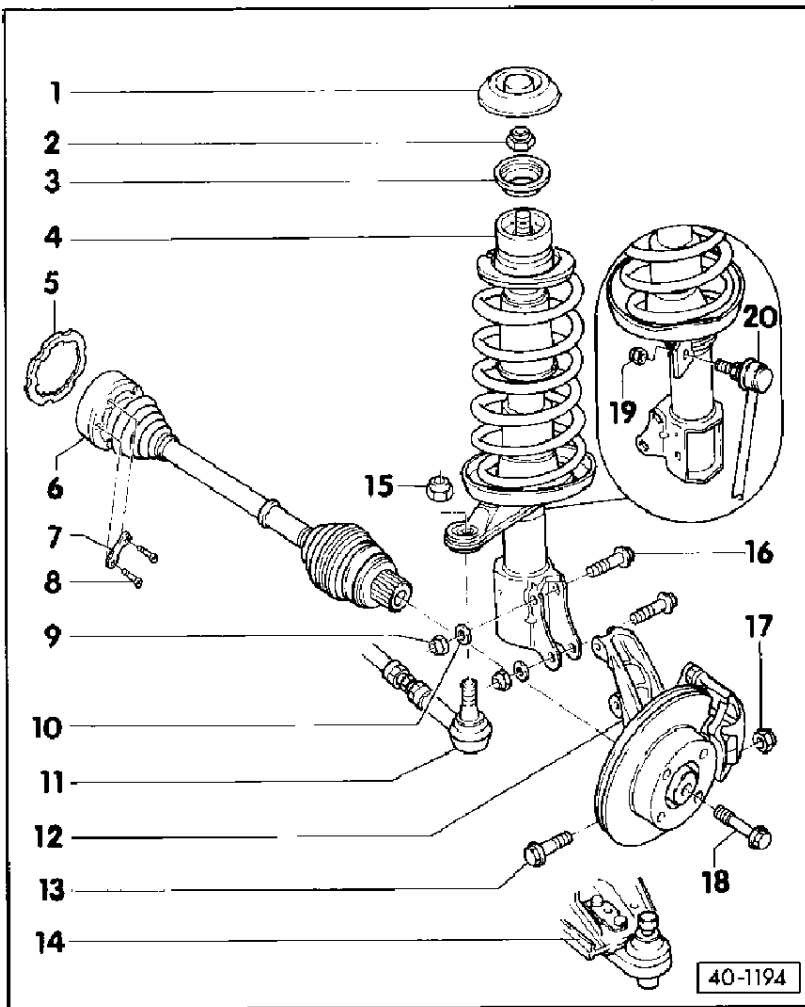
Attention
 If cast wheel bearing housings are fitted when performing repairs, then the modified cover plates and the corresponding ball joints should also be installed.
 Part no. 8A0 407 365 – left
 Part no. 8A0 407.366 – right



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Removing and installing suspension strut and drive shaft



1 - Cap

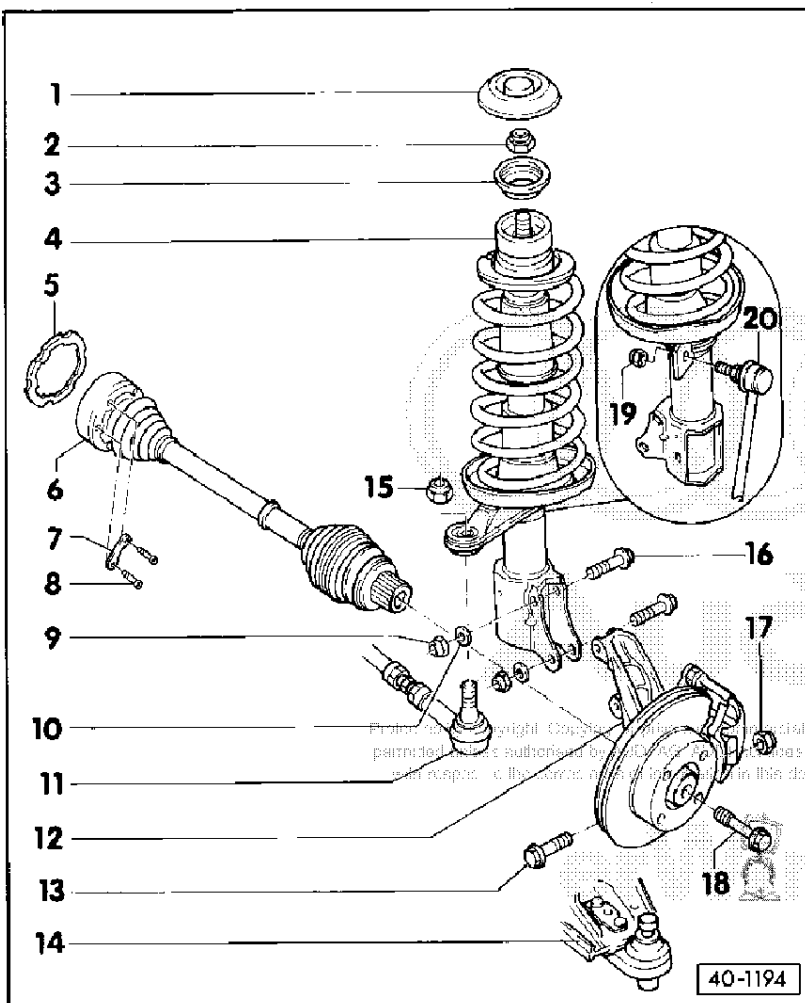
- ◆ Note different versions
- ◆ Bolt to wheel housing on vehicles with 6-cylinder engine

2 - Self-locking nut, 60 Nm

- ◆ Always replace
- ◆ Tightening with torque wrench => Fig. 2

3 - Stop shell

40-11



4 - Suspension strut

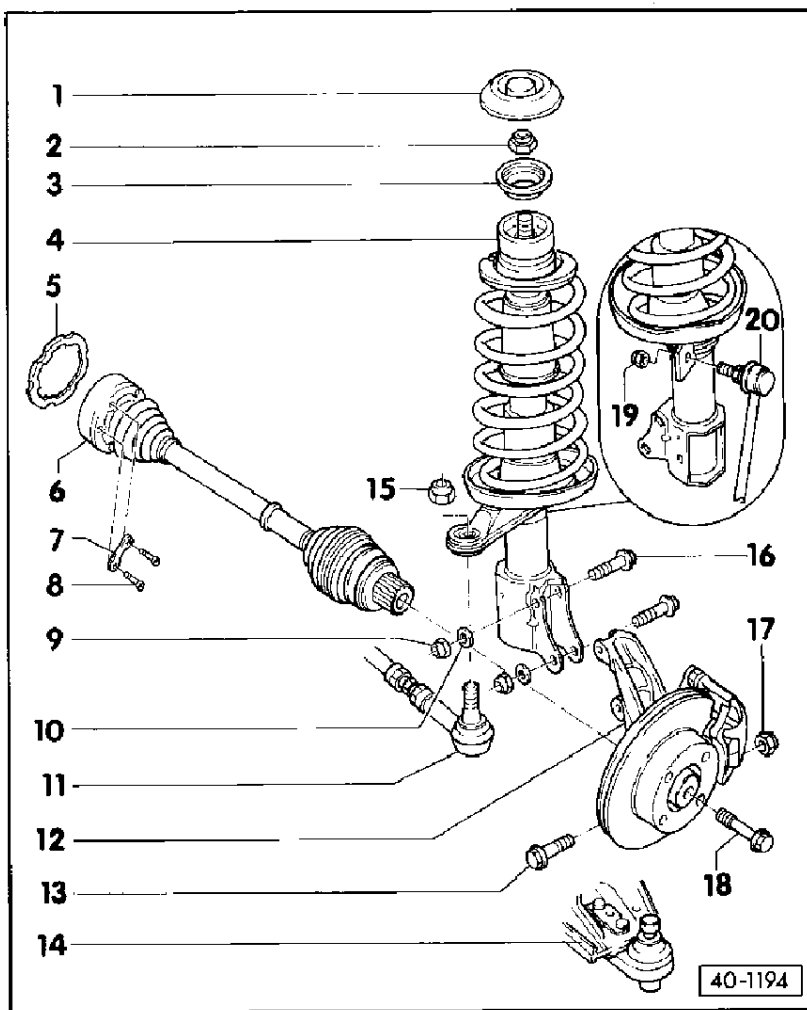
- ◆ Do not unscrew from wheel bearing housing to replace shock absorber, coil spring and wheel bearing; remove and install as a complete unit (camber setting)
- ◆ Do not remove drive shaft
- ◆ Servicing => Page 40-19

5 - Seal

- ◆ Always replace
- ◆ Pull off protective sheet and bond into joint

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40-12

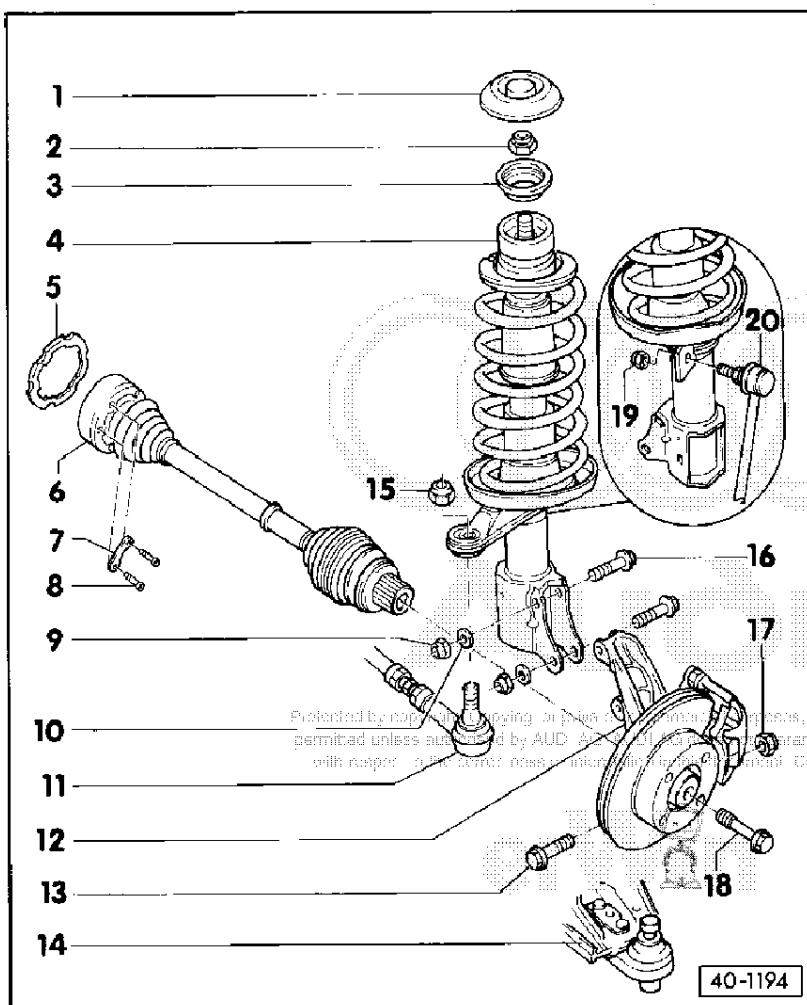


6 - Drive shaft

Note:

If vehicles on which the drive shaft has been taken out are to be moved, then an outer joint should be fitted beforehand in place of the drive shaft so as not to damage the wheel bearing.

- ◆ Installed in all vehicles with 4-, 5- and 6-cylinder engine with manual gearbox
- ◆ To remove, unscrew connecting links on both sides from strut and push anti-roll bar upwards, unscrew from flanged shaft and unscrew hexagon combi bolt



- ◆ To remove, set appropriate wheel angle
- ◆ Servicing => Page 40-32
- ◆ Different lengths on left and right
- ◆ Note different versions (joints) depending on engine power
- ◆ On vehicles with ABS, slightly pull back wheel speed sensor prior to removal and press home on installation

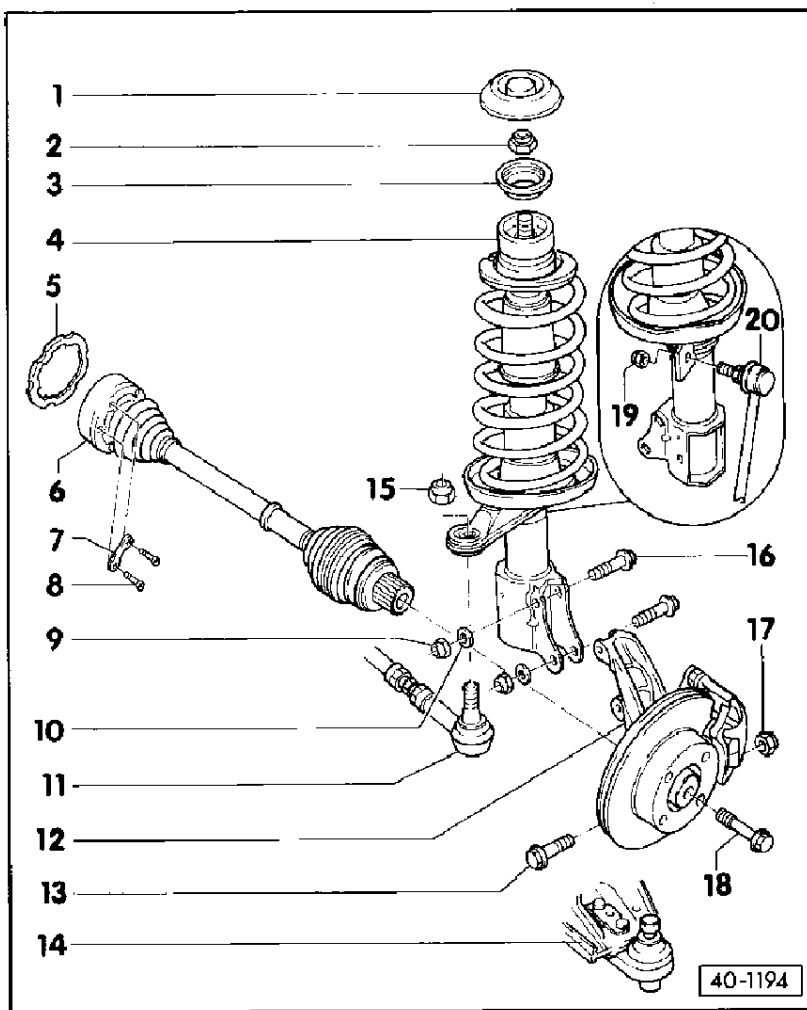
7 - Packing plate

- 8 - Cheese-head bolt**
- ◆ M8 = 45 Nm
 - ◆ M10 = 80 Nm

9 - Self-locking nut

- ◆ Always replace
- ◆ Tighten to 110 Nm, then tighten a further 90°

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10 - Shim

11 - Track rod

- ◆ Press off steering arm using two-legged puller => Fig. 1

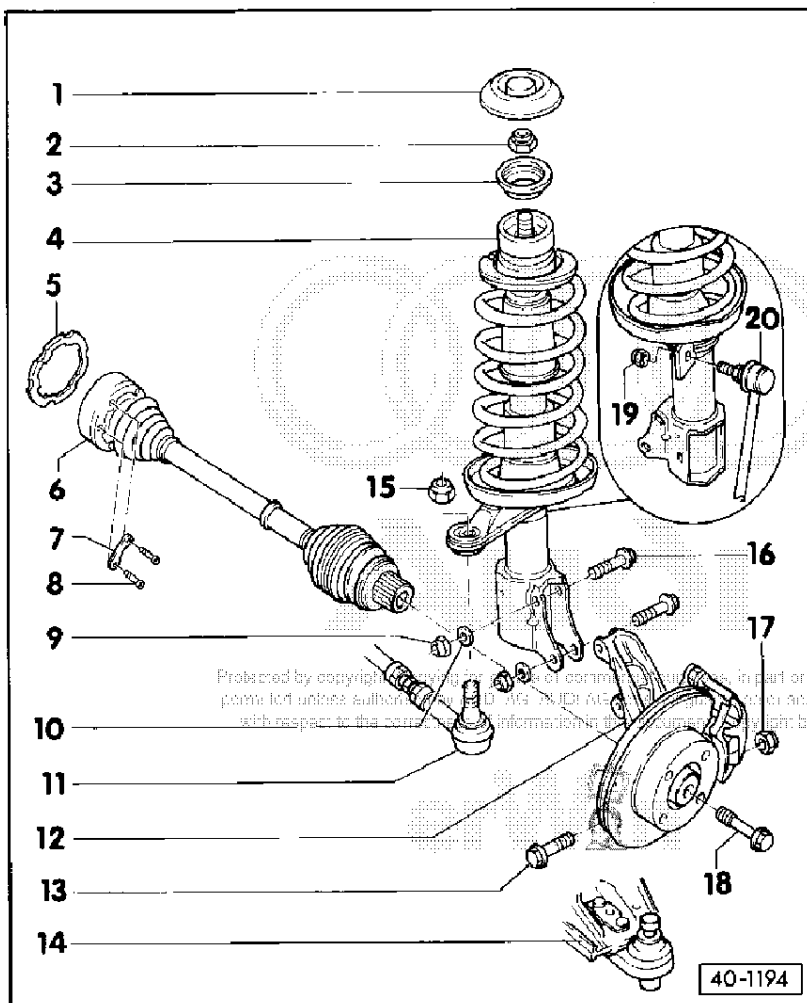
12 - Wheel bearing housing with wheel hub

- ◆ Never widen slot in wheel bearing housing (seat for joint pin) to press out joint pin
- ◆ Perform wheel alignment of front axle after installation
- ◆ Note different types of wheel bearing housing => Page 40-10, Fig. 11

13 - Hexagon bolt

- ◆ Always replace
- ◆ Head of bolt points in direction of travel.

40-15



14 - Transverse link with ball joint

- ◆ Do not widen slot in wheel bearing housing when removing from wheel bearing housing
- ◆ Joint pin diameter of ball joint 19.0 mm
- ◆ Sheet-steel and forged versions differ

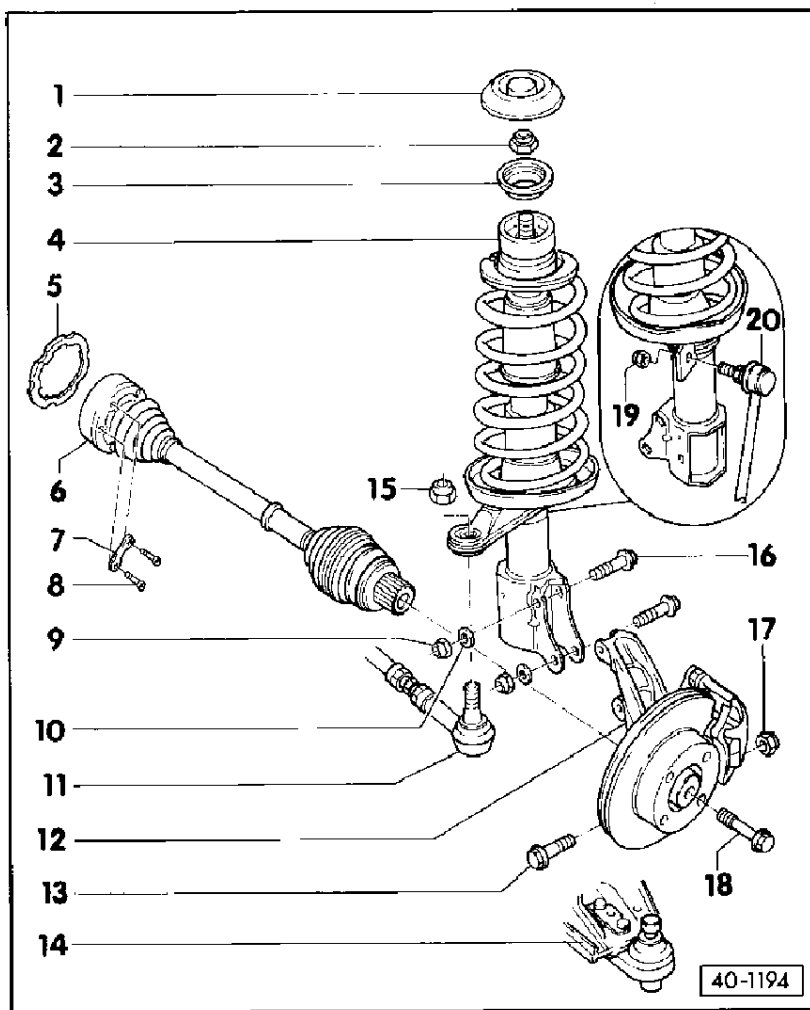
15 - Self-locking nut, 30 Nm

- ◆ Always replace

16 - Hexagon flange bolt/hexagon bolt

- ◆ Always replace
- ◆ Fit hexagon bolt instead of hexagon flange bolt
- ◆ When using hexagon bolt always fit washer between shock absorber housing and head of bolt

40-16

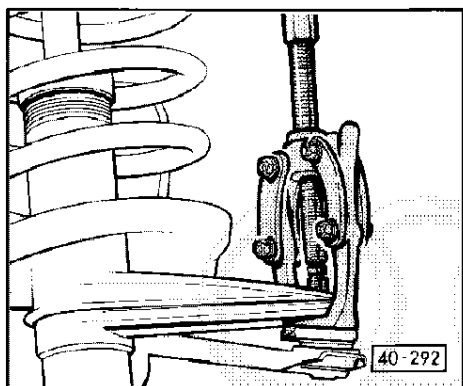


17 – Self-locking nut, 50 Nm
 ♦ Always replace

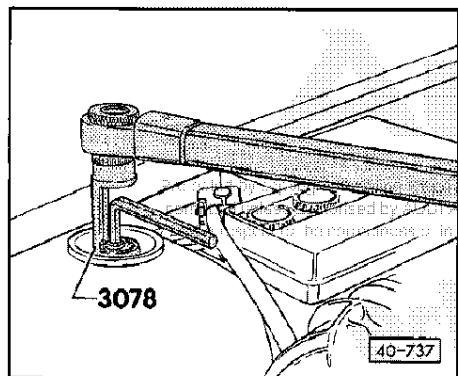
18 – Hexagon combi bolt/flange bolt
 ♦ Always replace
 ♦ Tighten M16 x 1.5 to 200 Nm and then give a further 90o turn
 ♦ Tighten M14 x 1.5 to 120 Nm and then give a further 90o turn
 ♦ Vehicle must be standing on its wheels when loosening and tightening (risk of accident).

19 – Self-locking nut, 40 Nm
 ♦ Always replace

20 – Connecting link



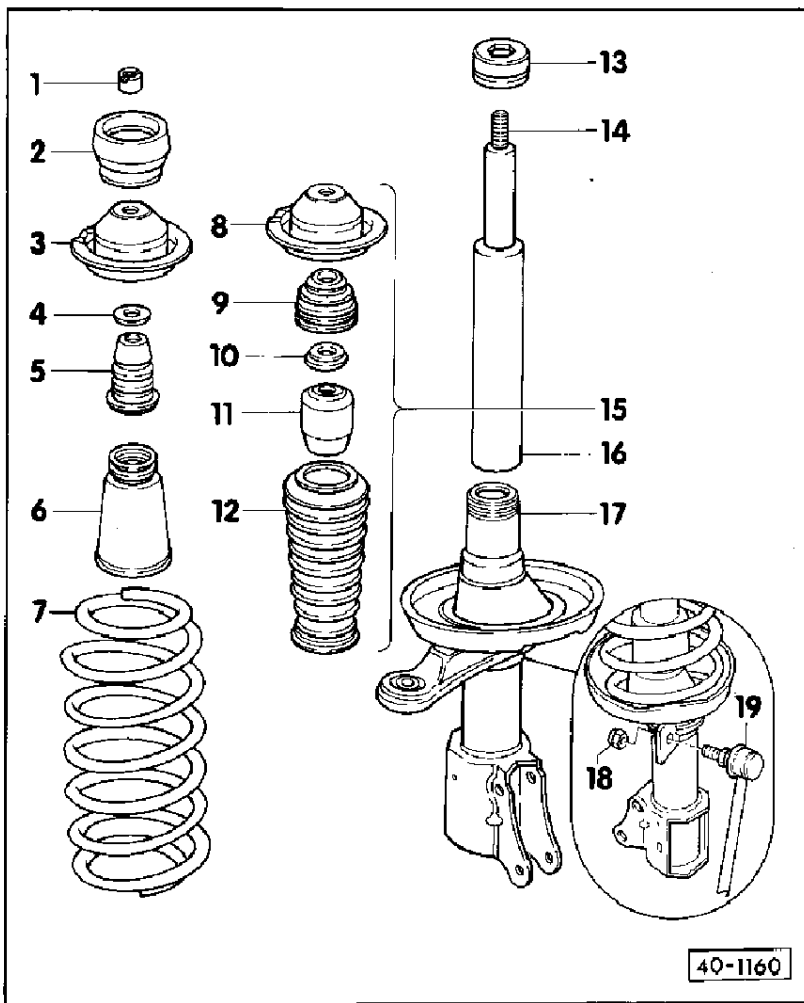
◀ Fig.1 Pressing off track rod joint



◀ Fig.2 Tightening nut with torque wrench
 – To do this counterhold the piston rod with an Allen key.

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Servicing suspension strut



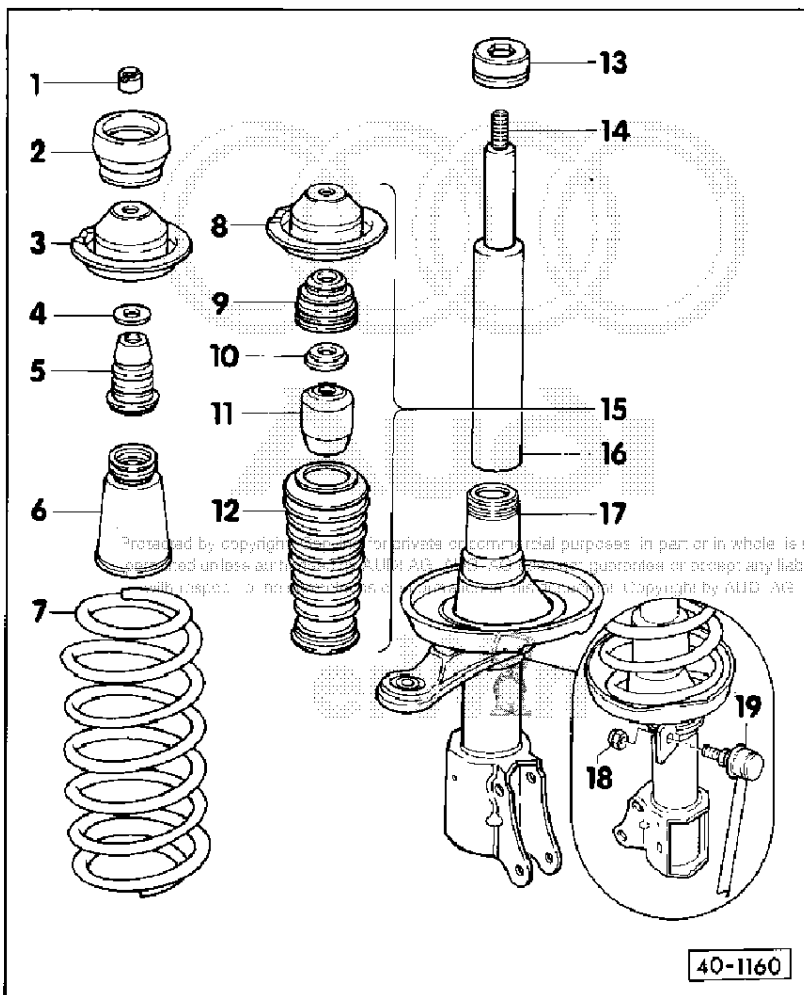
- 1 - Slotted nut, 50 Nm
 - ◆ Tensioning coil spring => Fig. 1
 - ◆ Unfastening and tightening => Fig. 2
 - ◆ Tightening with torque wrench => Fig. 3

- 2 - Suspension strut mounting
 - ◆ Replacement part supplied with integrated ball bearing

- 3 - Spring plate

- 4 - Shim

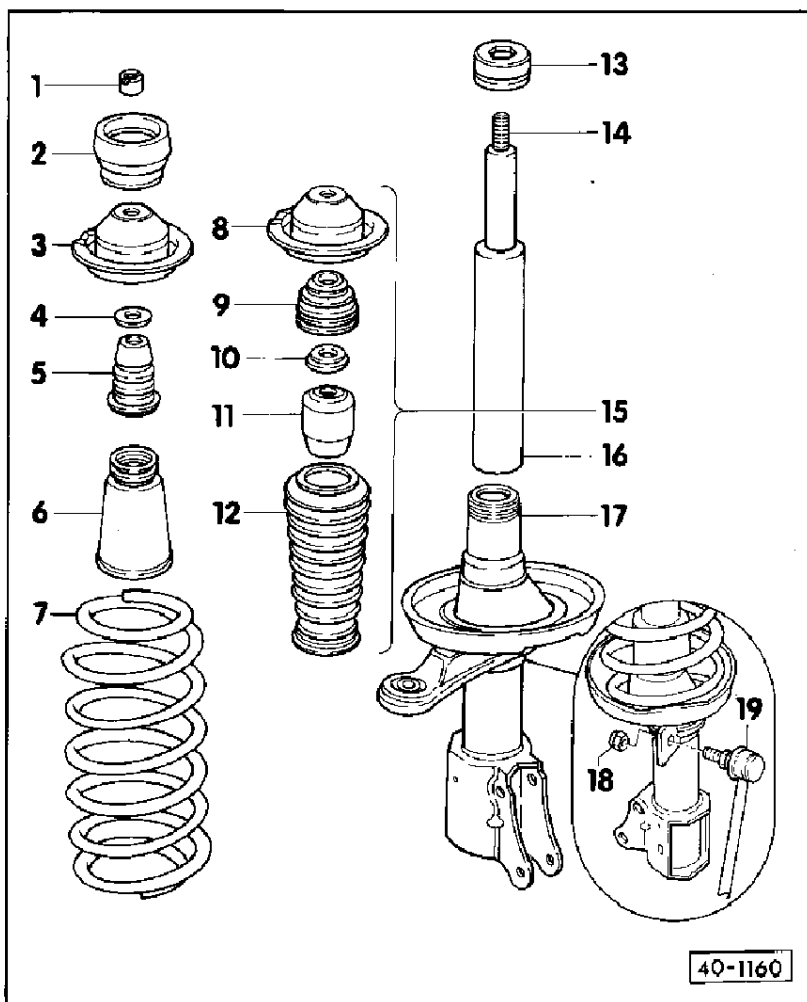
40-19



- 5 - Stop buffer
 - ◆ Note different versions depending on running gear design
 - ◆ The codes on the data sticker stand for:
 - 1BA = Standard version
 - 1BE = Sports version
 - 1BB = Heavy duty version

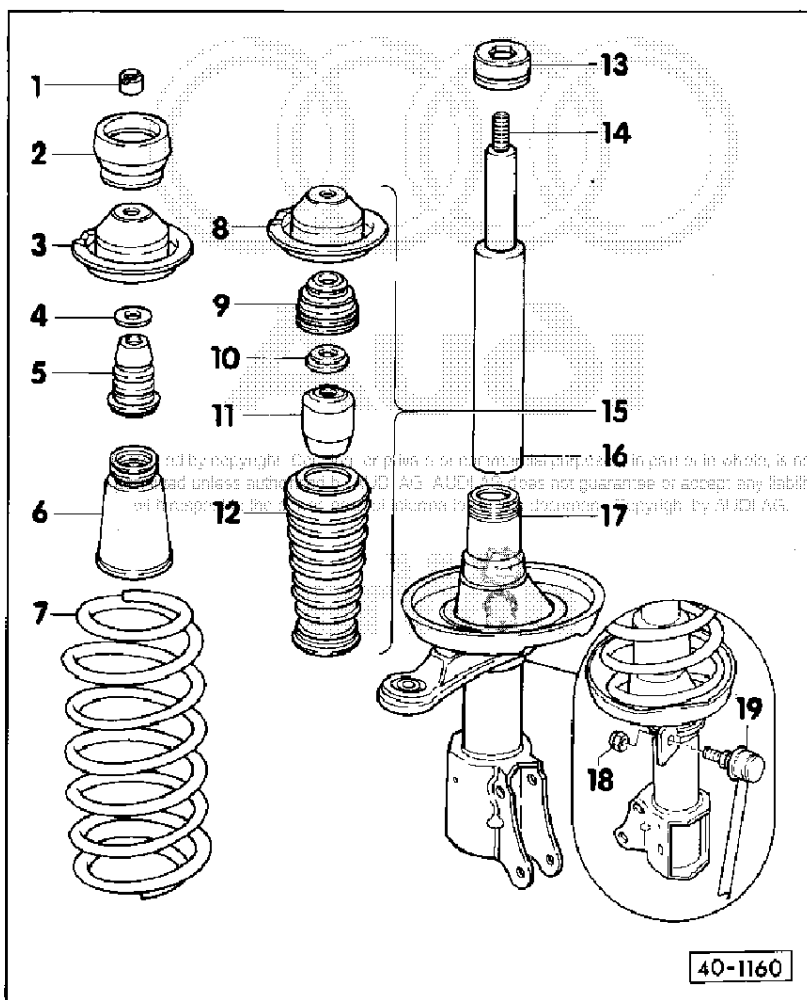
- 6 - Protective sleeve

40-20



7 - Coil spring

- ◆ Refer to Parts List
- ◆ Prior to replacement, consult vehicle data sticker as that is the only way to establish spring version
- ◆ The codes on the data sticker stand for:
 - 1BA = Standard version
 - 1BE = Sports version
 - 1BB = Heavy duty version
- ◆ Refer to notes under item - 16- shock absorber
- ◆ Replacing => Fig. 1 to 3
- ◆ Installation position: Colour code on spring points downwards towards shock absorber housing



8 - Spring plate

- ◆ With vent holes

9 - Bellows cover

10 - Shim

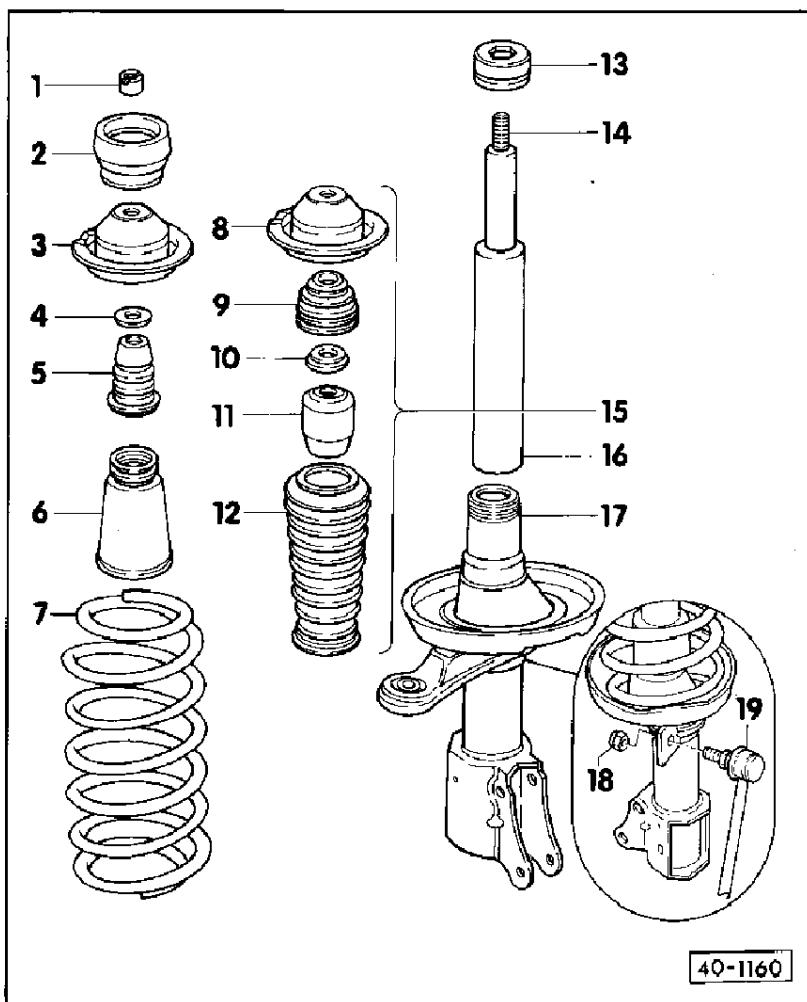
11 - Stop buffer

12 - Bellows

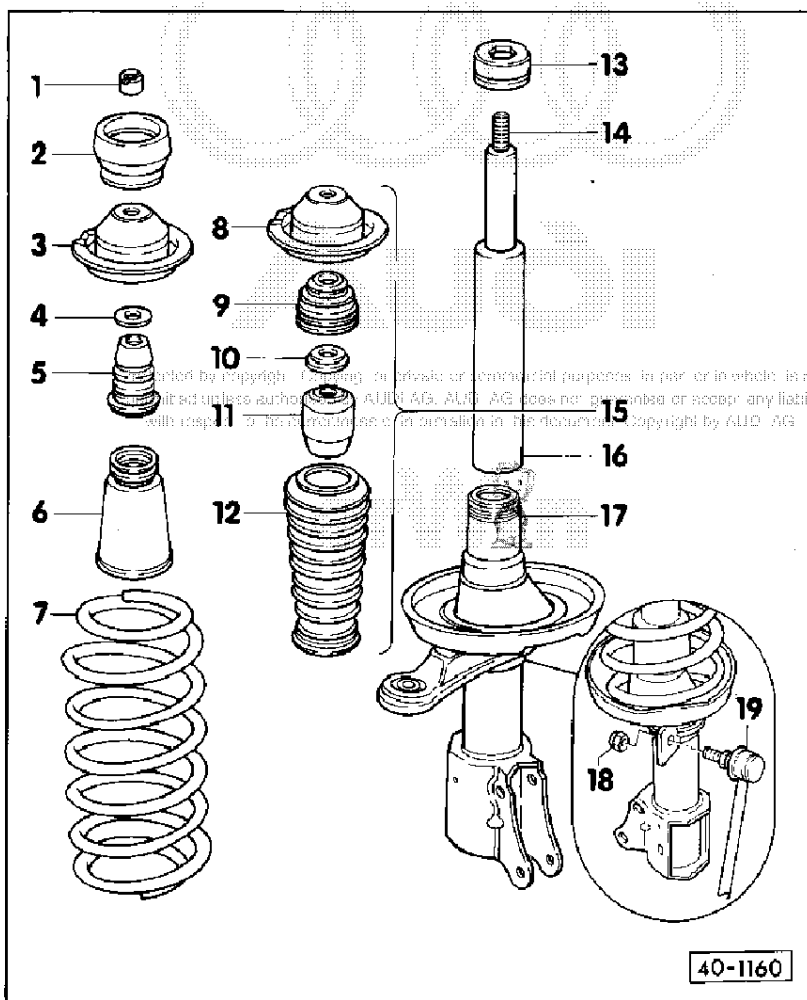
- ◆ Top: Fasten in position in cover
- ◆ Bottom: Pull over screw cap

13 - Screw cap, 180 Nm

- ◆ Unscrewing and screwing on => Fig. 4
- ◆ 220 Nm on Audi S2 => Fig. 5

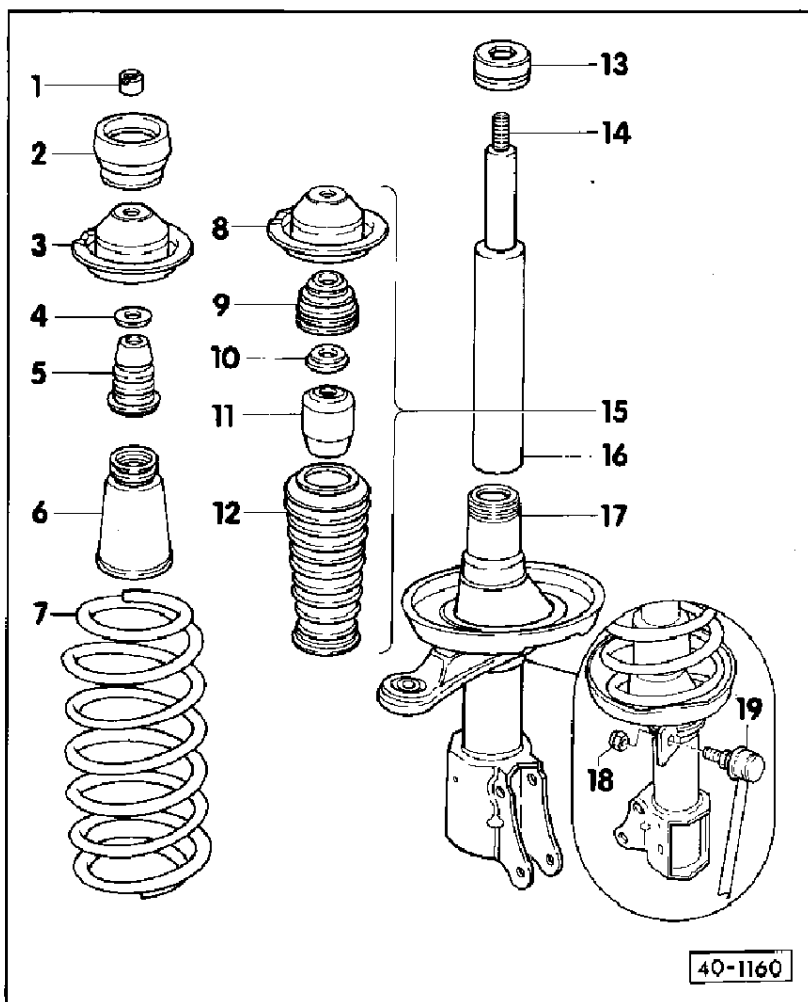


- 14 - Piston rod
 - ◆ Counterhold with Allen key when loosening and tightening slotted nut => Fig. 2
- 15 - For vehicles with heavy duty version only
- 16 - Shock absorber
 - ◆ Refer to Parts List
 - ◆ Prior to replacement, consult vehicle data sticker as that is the only way to establish spring version
 - ◆ The codes on the data sticker stand for:
 - 1BA = Standard version
 - 1BE = Sports version
 - 1BB = Heavy duty version
 - ◆ Can be replaced individually



Notes:

- ◆ Up to chassis no. 8C NA 015 724 there is no running gear information on the data sticker. In such cases, all vehicles are to be adjusted as indicated in the specified value table for vehicles with standard and sports version when performing wheel alignment. When replacing shock absorbers or coil springs, determine running gear version by way of part no. of rear shock absorbers in combination with parts list.
- ◆ As of chassis no. 8C NA 015 725 the data sticker is provided with the above identification.

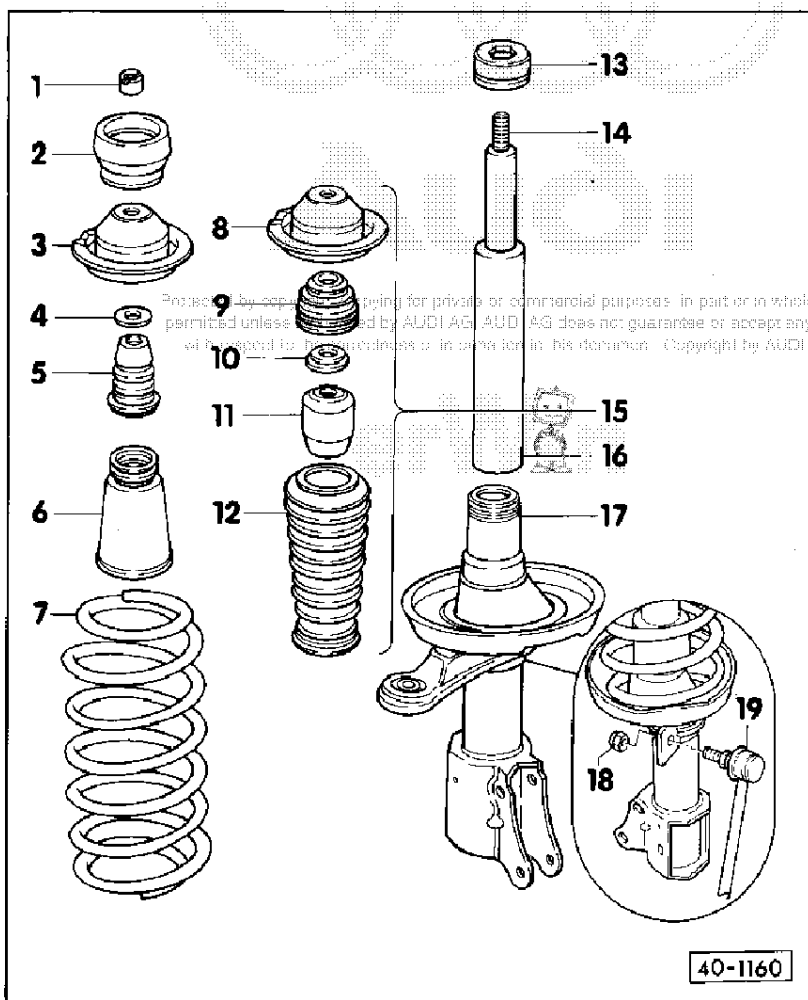


40-1160

- ◆ Defective shock absorbers must always be properly prepared before being scrapped.
- = > Special Information No. 2; edition 03. 90
- ◆ Wet-type shock absorbers are fitted as standard
- ◆ Remove piston and piston rod when performing repairs
- ◆ Drain and dispose of oil fill from housing
- ◆ Install shock absorber cartridges

Notes:

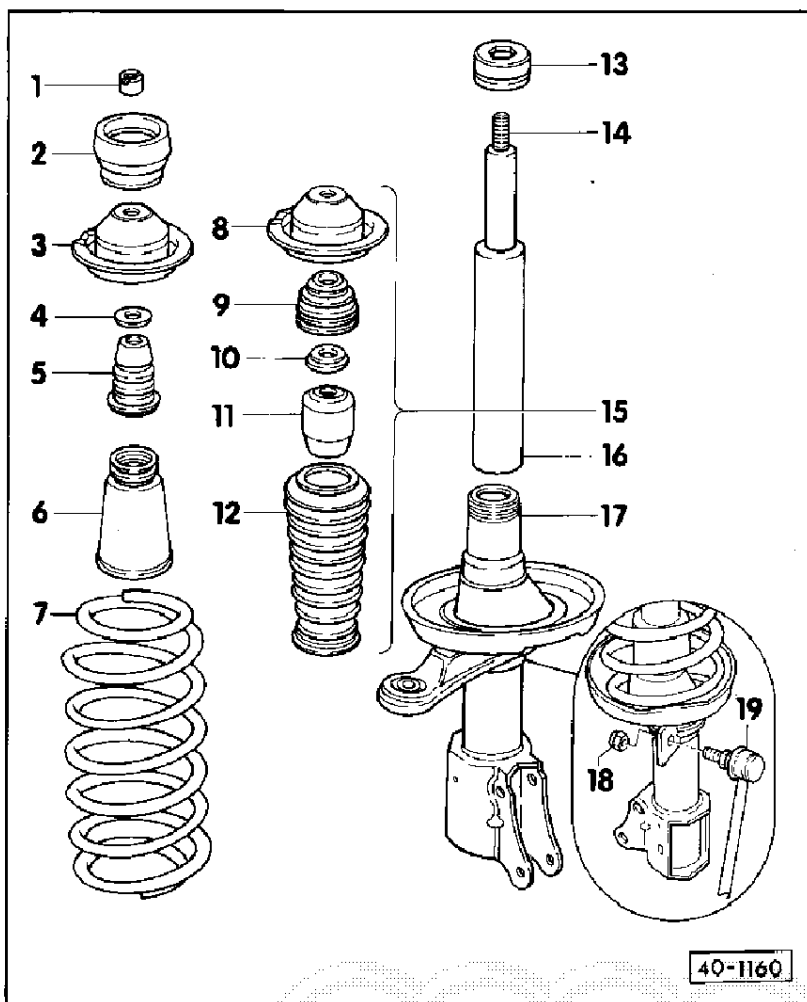
- ◆ Heavy duty version vehicles are equipped with shock absorber cartridges.
- ◆ Sports-version vehicles are fitted with shock absorber cartridges or gas-filled shock absorbers.



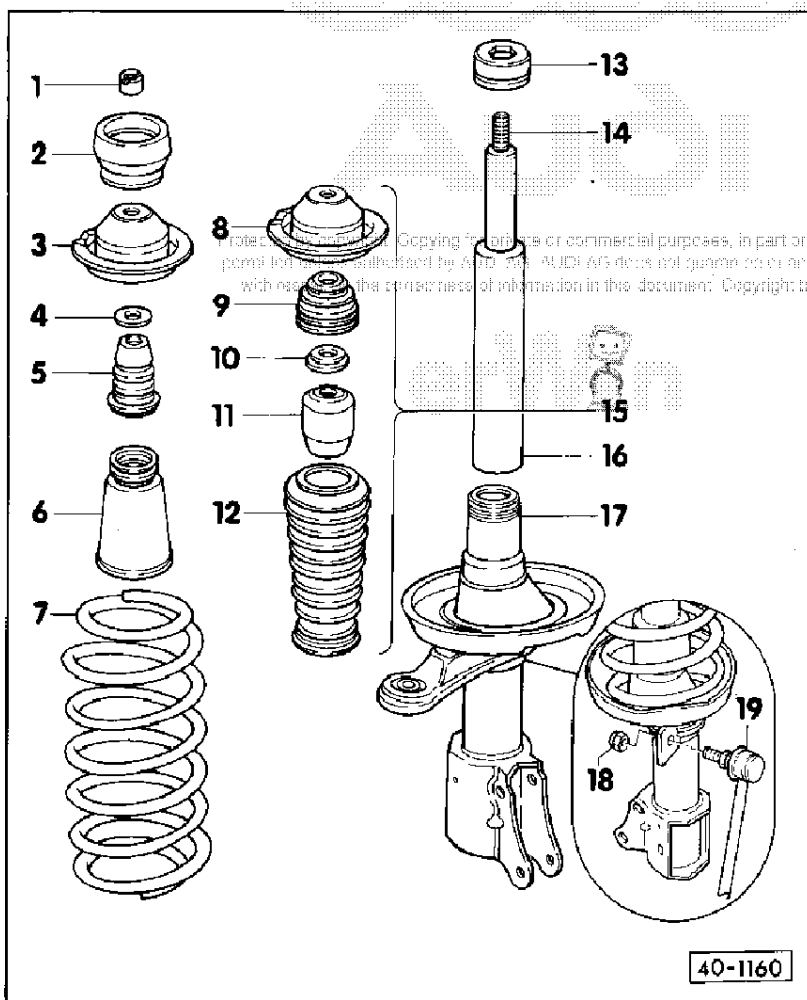
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40-1160

- ◆ Checking (removed) shock absorber: Check shock absorber by hand (hold in installation position) by extending and compressing it. Shock absorber must move evenly and smoothly over entire stroke. Shock absorbers that have been stored for a lengthy period may have to be pumped several times. Defective shock absorbers make a "banging" noise whilst driving. If they are functioning properly, slight traces of shock absorber oil do not signify that replacement is necessary. Considerable loss of oil will result in deficiencies in the expansion and compression stages.



◆ Checking gas-filled shock absorber: Compress shock absorber by hand. The piston rod must move evenly and smoothly over the entire stroke. Release piston rod. If shock absorbers have sufficient gas pressure, piston rod returns automatically to initial position. If this is not the case, the shock absorbers need not always be replaced. As long as there has not been a major loss of oil, the mode of operation corresponds to that of a conventional shock absorber.
 => "Special Service Information" binder: Running Gear No. 17



17 - Shock absorber housing

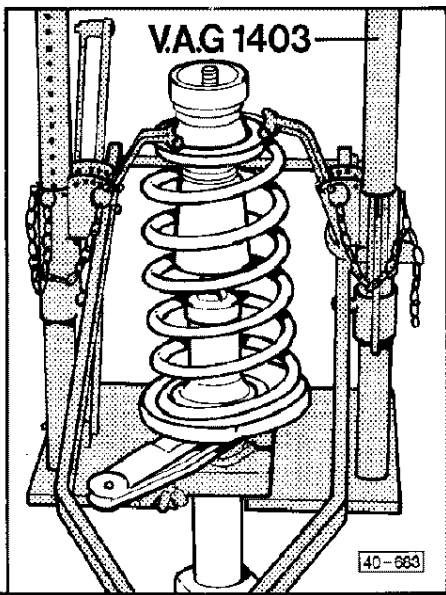
◆ Drain and dispose of oil fill from housing

18 - Self-locking nut, 40 Nm

◆ Always replace

19 - Connecting link

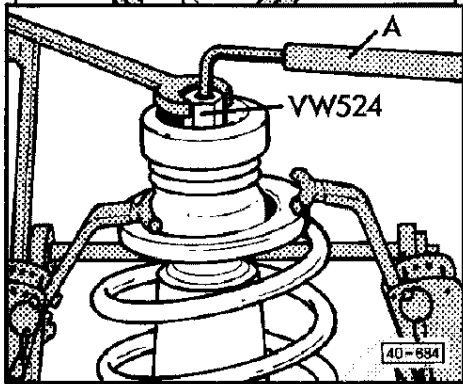
◆ Unscrew at shock absorber housing to remove suspension strut



◀ Fig.1 Tensioning coil spring
 – Jaws engage on spring plate

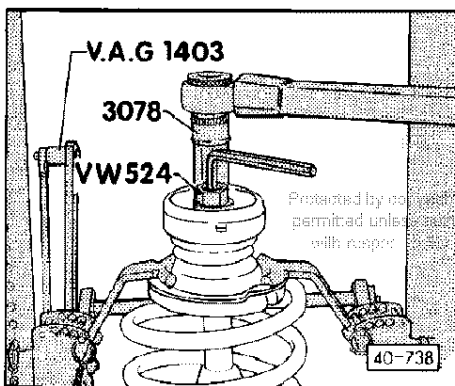
Note:

The coil springs can also be replaced using spring tensioner - V.A.G 1752/1- in conjunction with strut mounting -V.A.G 1752/2-.



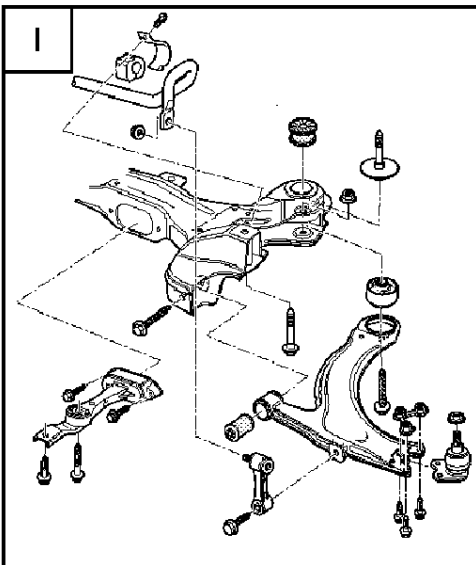
◀ Fig.2 Loosening and tightening slotted nut

- Slacken spring
- To move the piston rod up and down, the tubular end of the wrench can be screwed to the piston rod.
- A = Wrench



◀ Fig.3 Tightening slotted nut with torque wrench

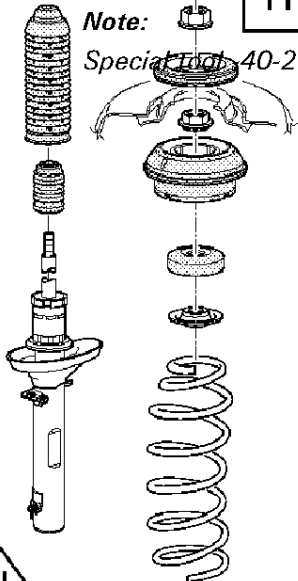
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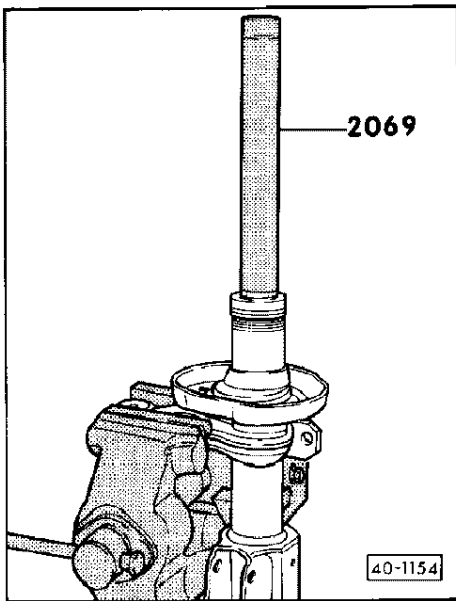


◀ Fig.4 Unscrewing and screwing on screw cap

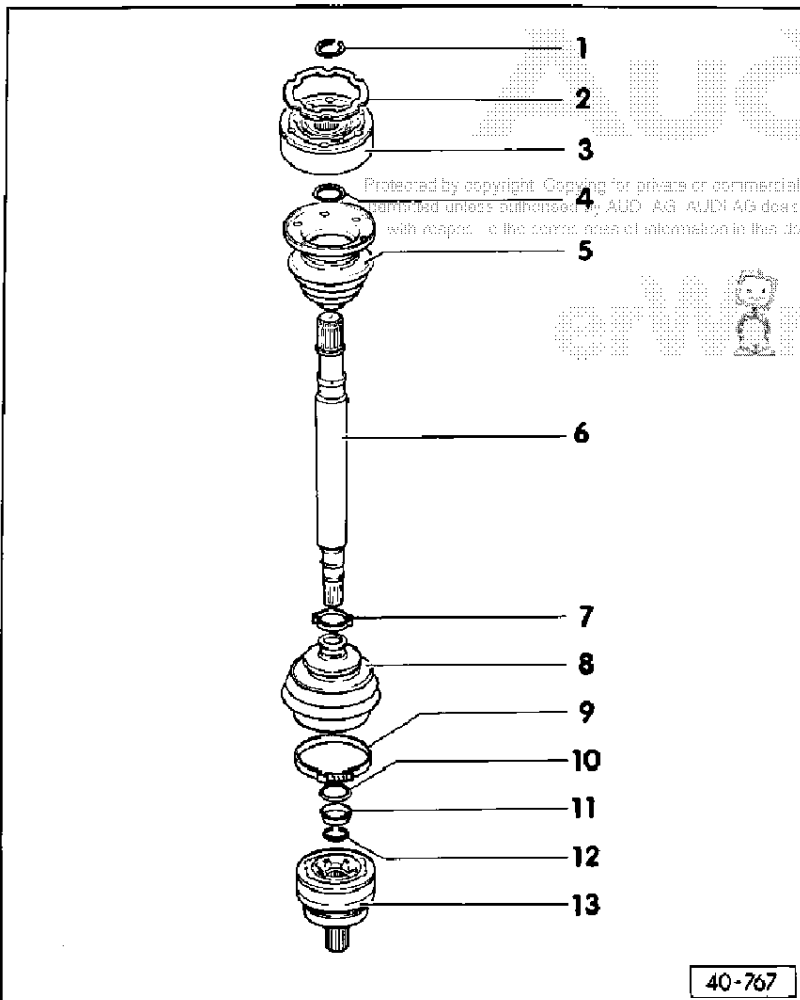
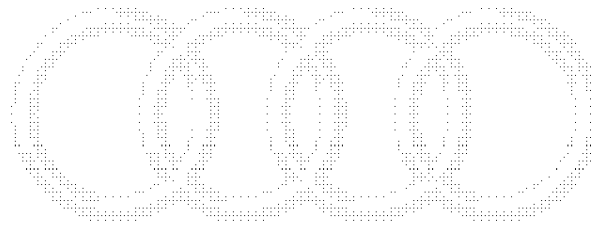
Note:

Special tool -40-201 A- is replaced by tool -40-201 B-.





◀ Fig.5 Unscrewing and screwing on screw cap



Servicing drive shaft with constant velocity joint

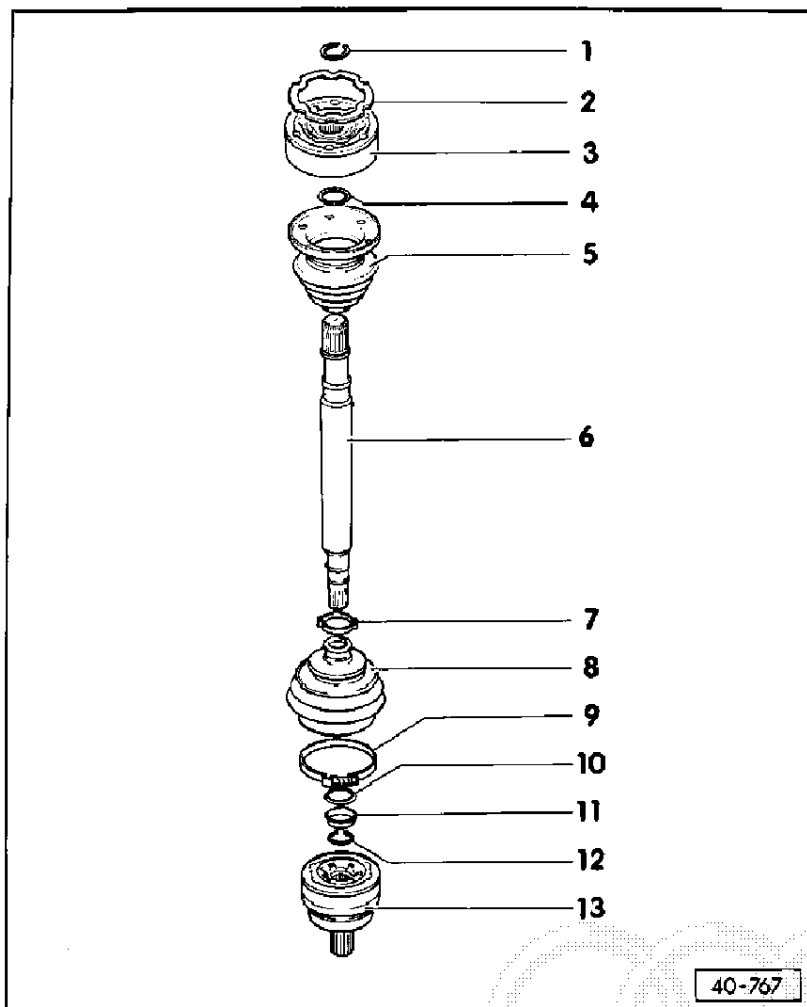
All vehicles with 4-, 5- and 6-cylinder engine and manual gearbox.

Note: Liability

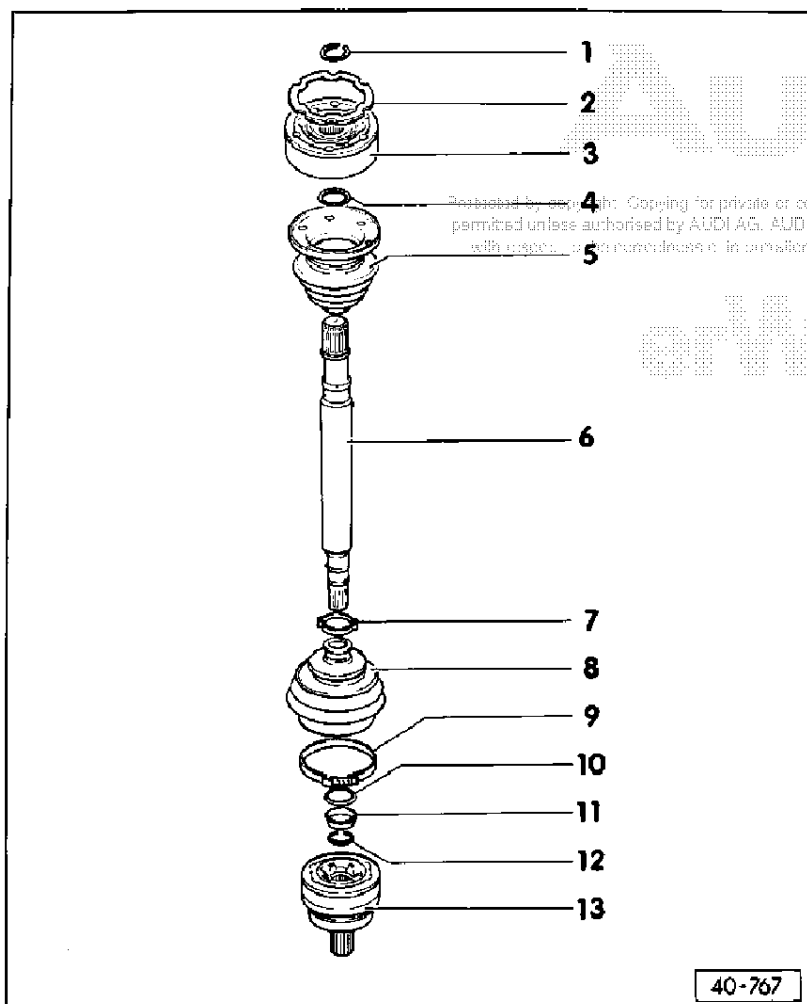
Outer constant velocity joints are packed with grease G-6:

Outer joint ø mm	Grease Total quantity [g]	of which in:	
		Joint [g]	Bellows [g]
88	90	40	50
98	120	80	40
Inner joint			
ø mm			
100	90	40	50
108	120	35	85

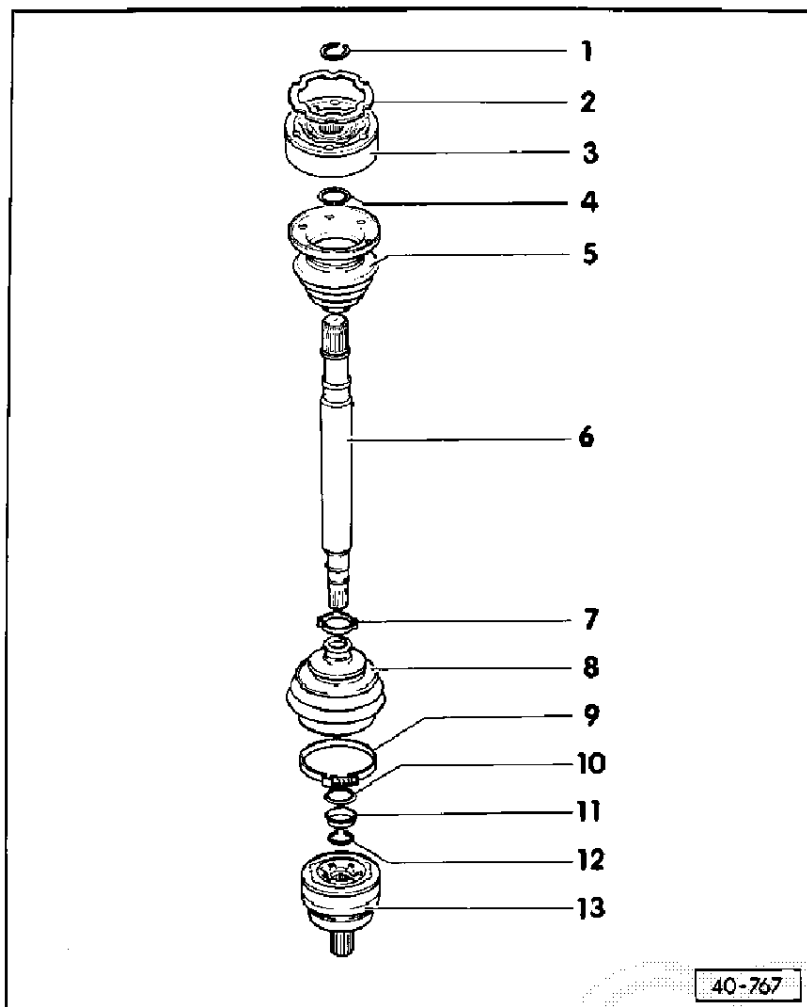
Top up fill in joint if necessary when renewing the protective bellows.



- 1 - Circlip
 - ◆ Always replace
 - ◆ Depending on version, remove and fit with commercially available circlip pliers or with - VW 161 a-, => Fig. 3
- 2 - Seal
 - ◆ Replace; pull off protective sheet and bond into joint.
- 3 - Inner constant velocity joint
 - ◆ Note different joint diameters
 - ◆ Outer diameter for engines up to 128 kW: 100 mm
 - ◆ Outer diameter for engines up to 169 kW: 108 mm
 - ◆ Only replace as complete unit
 - ◆ Pressing off $\varnothing 100$ mm => Fig. 4
 - ◆ Pressing off $\varnothing 108$ mm => Fig. 5



- ◆ Pressing on => Fig. 6
- ◆ Greasing => Notes Page 40-32
- 4 - Dished washer
 - ◆ Installation position => Fig. 7
 - ◆ Not fitted as of 169 kW engine
- 5 - Joint bellows with cap
 - ◆ Check for cracks and abrasion
 - ◆ Drive off with drift
 - ◆ Seal end face with D-3 before fitting on constant velocity joint
- 6 - Profiled shaft
 - ◆ Different lengths on left and right
- 7 - Hose clamp
 - ◆ Always replace
 - ◆ Tensioning => Fig. 1



40-767

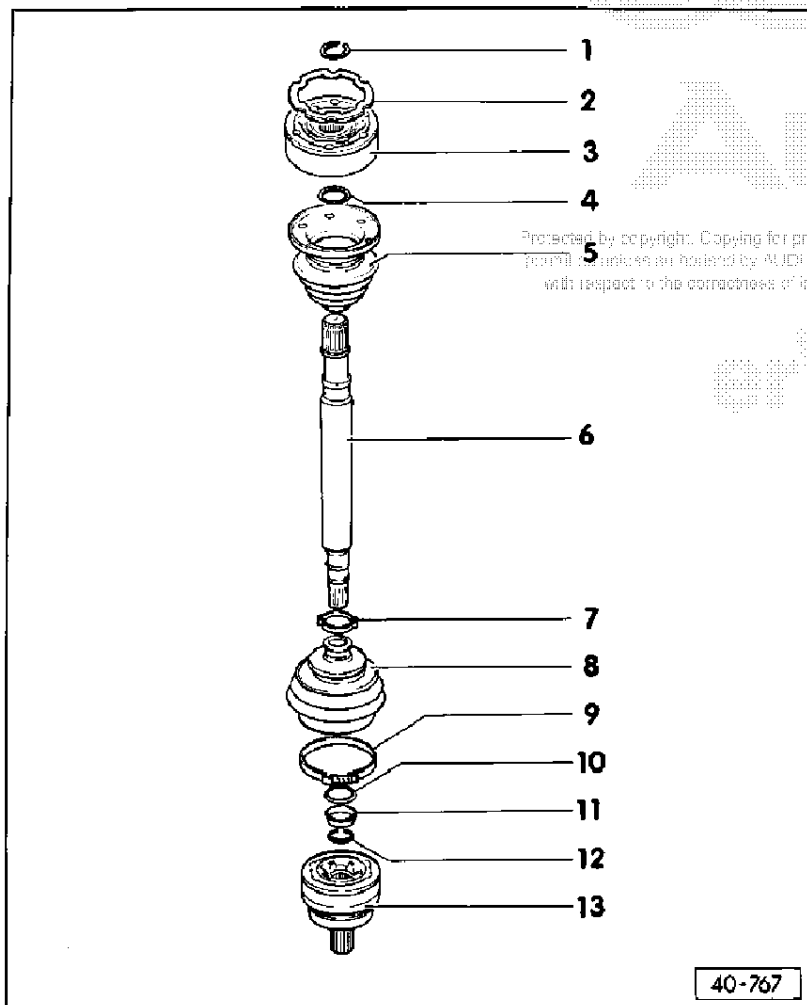
8 - Protective bellows
 ♦ Check for cracks and abrasion
 ♦ Before tensioning small hose clamp briefly vent joint bellows => Fig. 2

9 - Hose clamp
 ♦ Always replace
 ♦ Tensioning => Fig. 1

10 - Dished washer
 ♦ Installation position => Fig. 9

11 - Spacer
 ♦ Installation position => Fig. 9

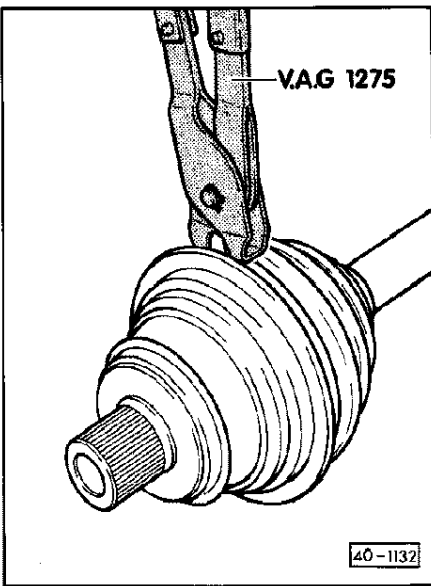
12 - Circlip
 ♦ Always replace
 ♦ Installation position => Fig. 9
 ♦ Fit into annular groove on shaft when installing (no longer visible once joint is installed)



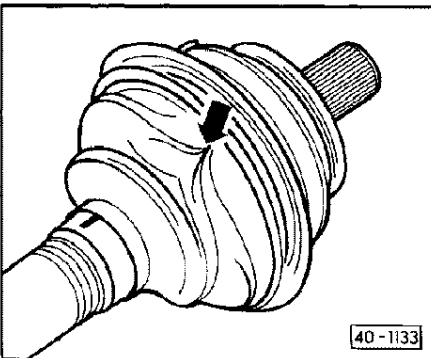
40-767

13 - Outer constant velocity joint
 ♦ Only replace as complete unit
 ♦ Note different joint diameters:
 ♦ Outer diameter for engines up to 128 kW: 88 mm
 ♦ Outer diameter for 169 kW engines: 98 mm

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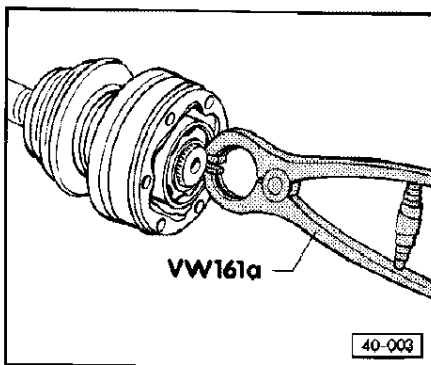


◀ Fig.1 Tensioning hose clamp/clip

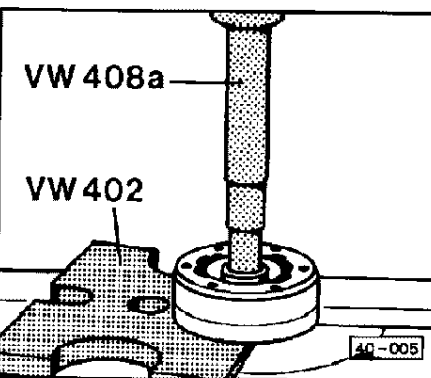


◀ Fig.2 Venting joint bellows

- The bellows are often squashed when installing them on the housing. This produces a vacuum in the bellows which causes an inward fold when driving -arrow-. Therefore, briefly vent the bellows at the small diameter end after fitting to equalise pressure.

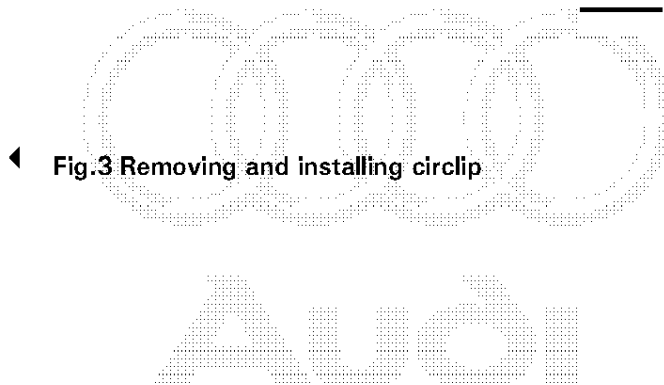


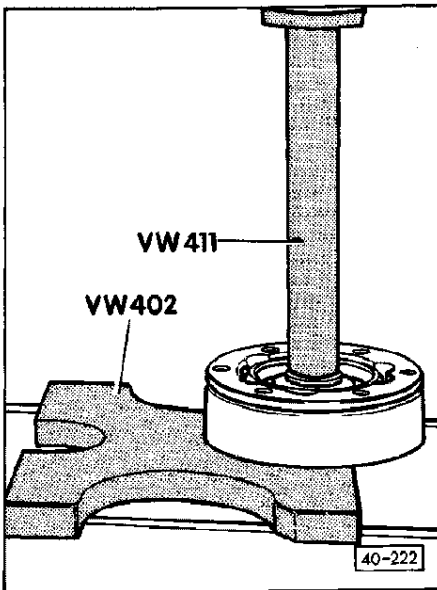
◀ Fig.3 Removing and installing circlip



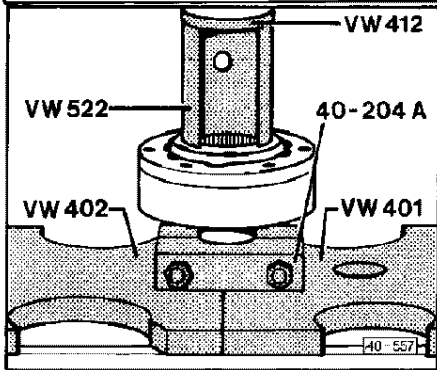
◀ Fig.4 Pressing off inner joint

- Support ball hub whilst doing so.





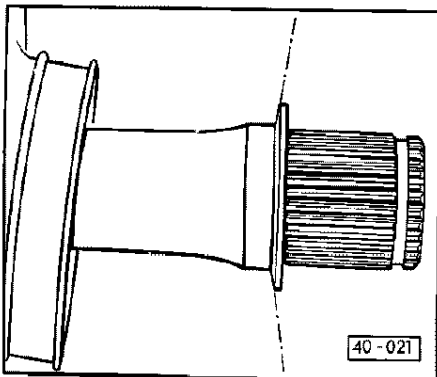
◀ **Fig.5 Pressing off inner joint**
 – Support ball hub whilst doing so.



◀ **Fig.6 Pressing on inner joint**
 – Press joint home, install circlip.

Note:

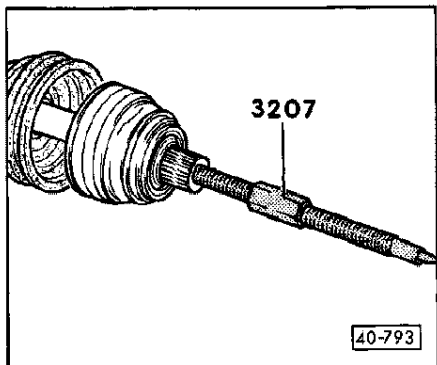
Chamfer on inner diameter of ball hub (splines) must face locating collar of drive shaft.



◀ **Fig.7 Correct positioning of dished washer**

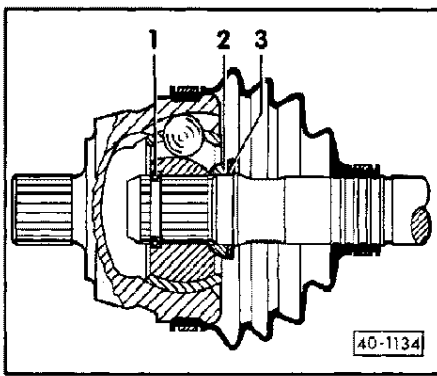


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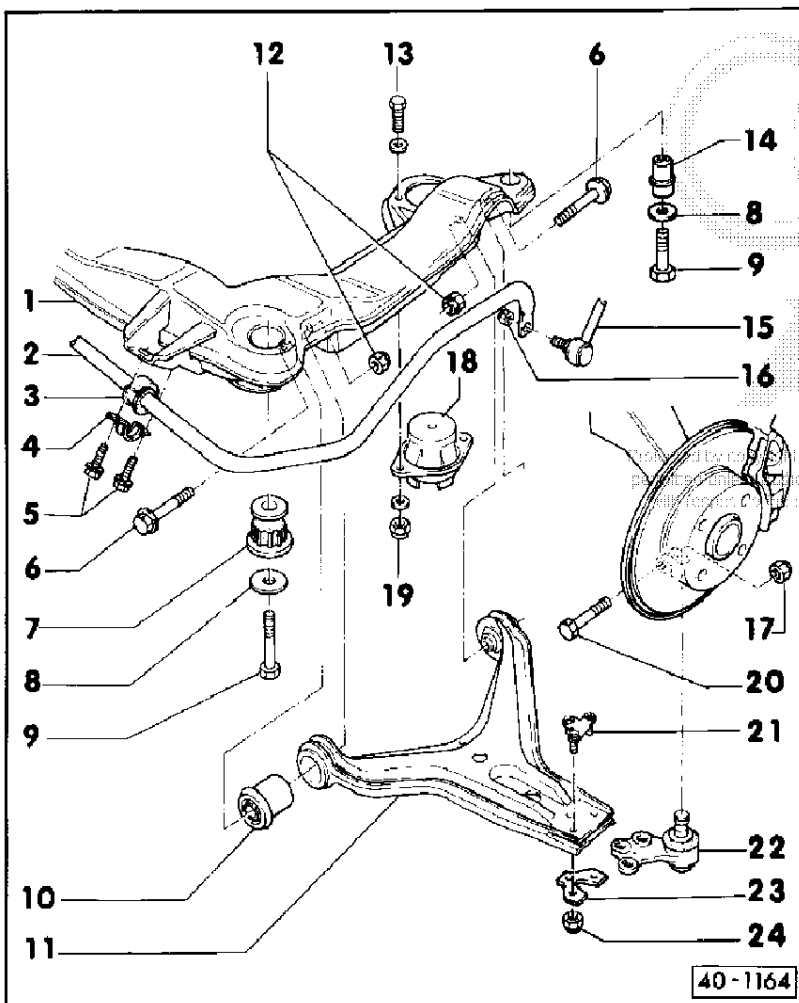
◀ **Fig.8 Pressing off outer constant velocity joint**

- Clamp drive shaft in vice using soft jaws.
- Remove clamp.
- Fold back bellows.
- Screw in special tool -3207- with M14 or M16 threaded end depending on thread of joint pin until constant velocity joint is pressed off profiled shaft.



◀ Fig.9 Installation position of dished washer, spacer and circlip

- 1 -Circlip
- 2- Spacer
- 3- Dished washer



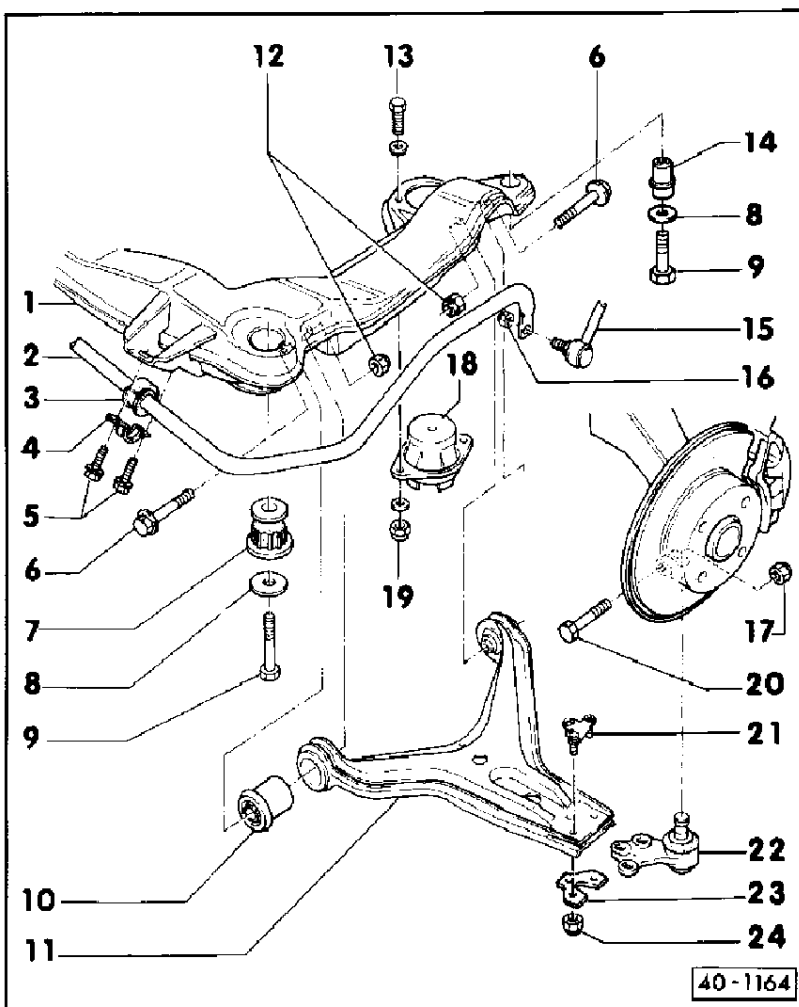
Servicing suspension

Note:

Welding and straightening operations are not permitted on load-bearing elements or components that locate the wheels.

1 - Subframe

- ◆ Different versions for vehicles with 4-, 5- and 6-cylinder engines
- ◆ Perform alignment of front axle every time after removal and installation
- ◆ Tighten fastening bolts on bodywork in following order:
Viewed in direction of travel:
 - 1. Rear left
 - 2. Rear right
 - 3. Front left
 - 4. Front right



2 - Anti-roll bar

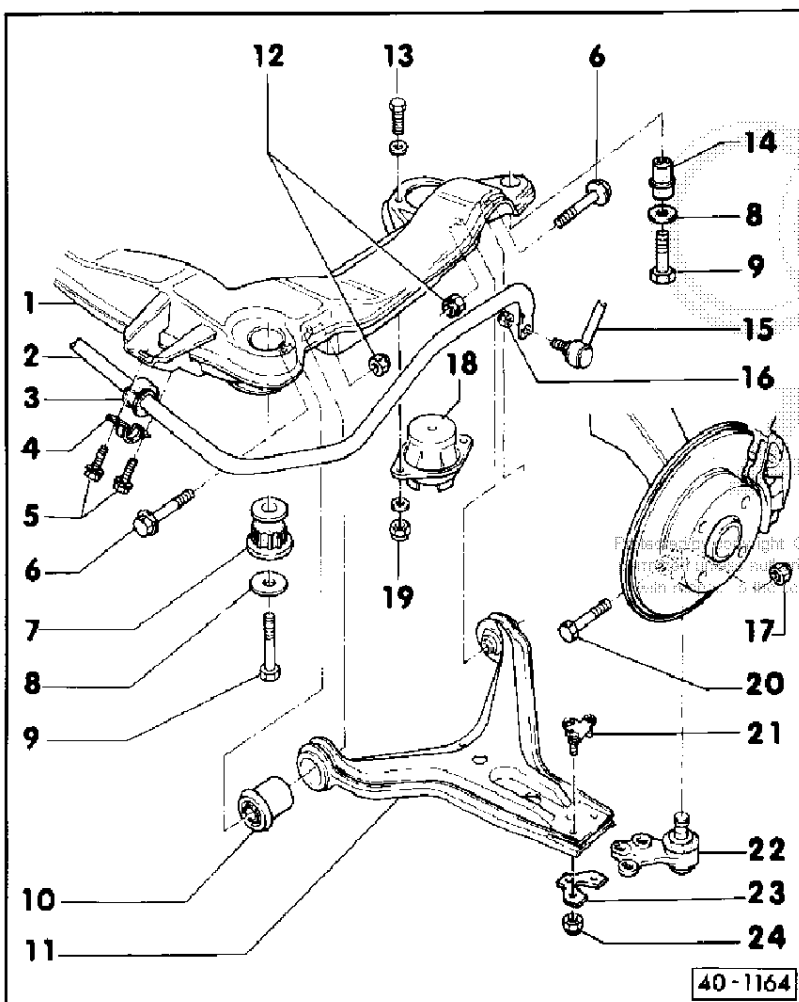
- ◆ Drive vehicle onto platform to facilitate assembly
- ◆ Before bolting to bracket, make sure distance from sub-frame is same on both sides
- ◆ \varnothing 25 mm on vehicles with 4-cylinder engine, \varnothing 26 mm on vehicles with 5- and with 6-cylinder engine as well as on vehicles with 4-cylinder 4-valve engine and Avant

3 - Bearing

- ◆ Apply talc before fitting
- ◆ Note different internal diameters

4 - Clip

- ◆ Pay attention to proper seating of anti-roll bar bearing during attachment



5 - Self locking bolts, 35 Nm

- ◆ Always replace

6 - Combi bolt

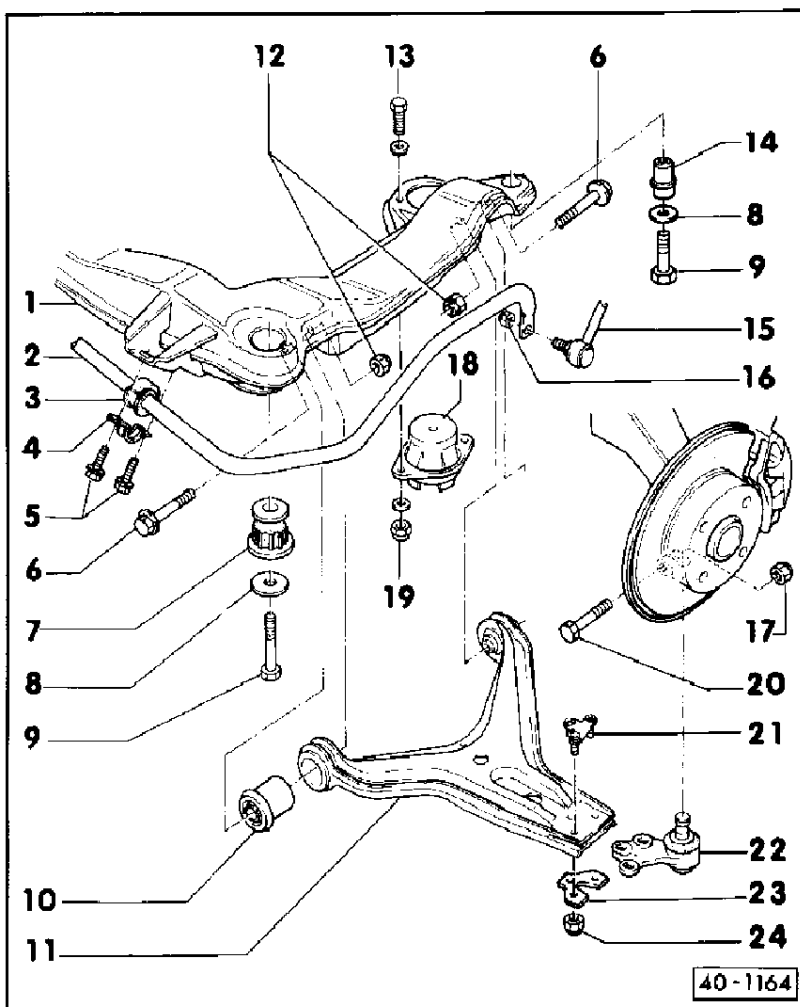
- ◆ Always replace

7 - Front bearings for subframe

- ◆ Removing front mounting => Fig. 3
- ◆ Fitting front mounting => Fig. 4
- ◆ Apply anti-friction assembly oil G 294 421 A1 beforehand
- ◆ Note different versions depending on engine

8 - Washer

- ◆ Always replace

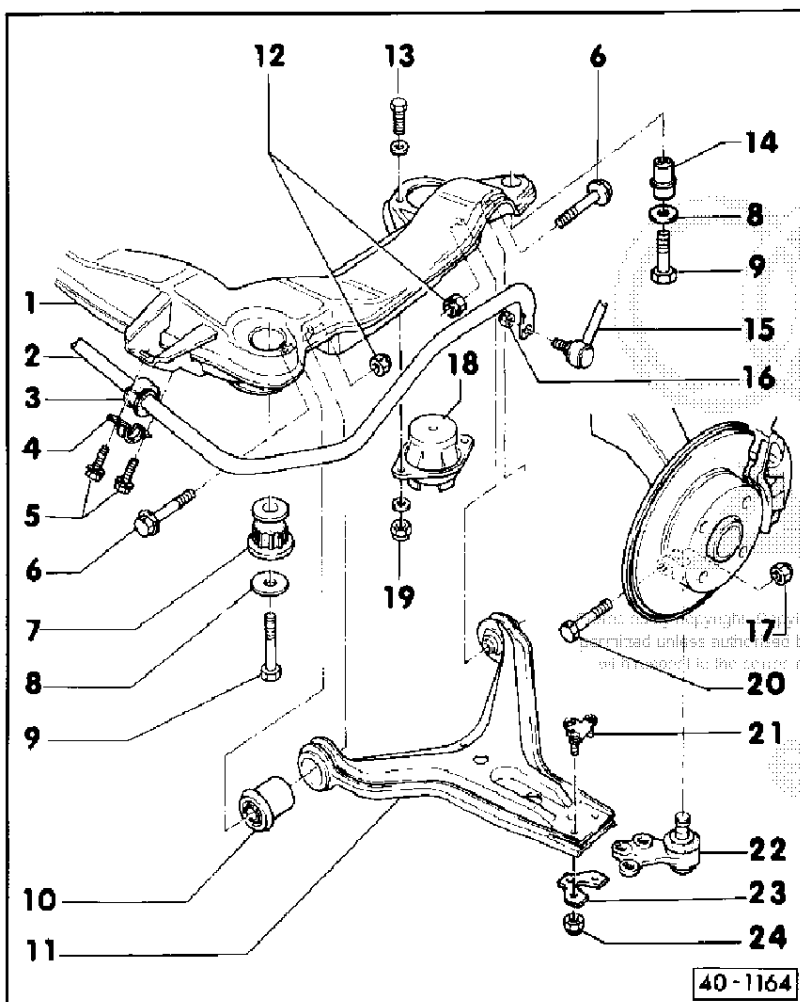


9 - Hexagon bolt

- ◆ Always replace
- ◆ Tighten M10 bolts to 35 Nm and then tighten a further 90°
- ◆ Tighten M12 bolts to 70 Nm and then tighten a further 90°
- ◆ Drill out sheared-off M10 bolts and repair using KNM 10 x 1.5 mm thread insert; drill out sheared-off M12 bolts and repair using KNM 12 x 1.5 mm thread insert

=> Special Information, Running Gear, No. 3, Edition 01.91

- ◆ Fit new genuine bolt



10 - Bearing for transverse link

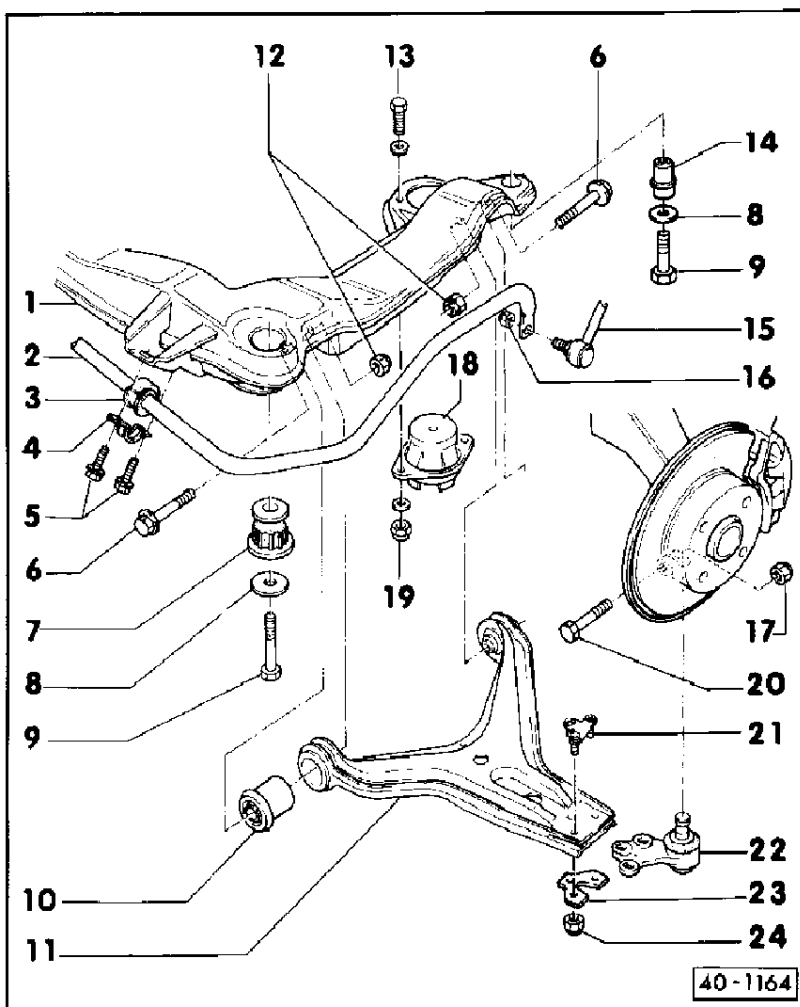
- ◆ Pressing out => Fig. 1
- ◆ Pressing in => Fig. 2
- ◆ Sheet-steel and forged transverse links have different bearings

11 - Sheet-steel transverse link

- ◆ Forged transverse link => Page 40-54
- ◆ Different versions on left and right

12 - Self-locking nut

- ◆ Always replace
- ◆ Tighten to 40 Nm, then tighten a further 180°
- ◆ Vehicle must be standing on wheels when tightening.



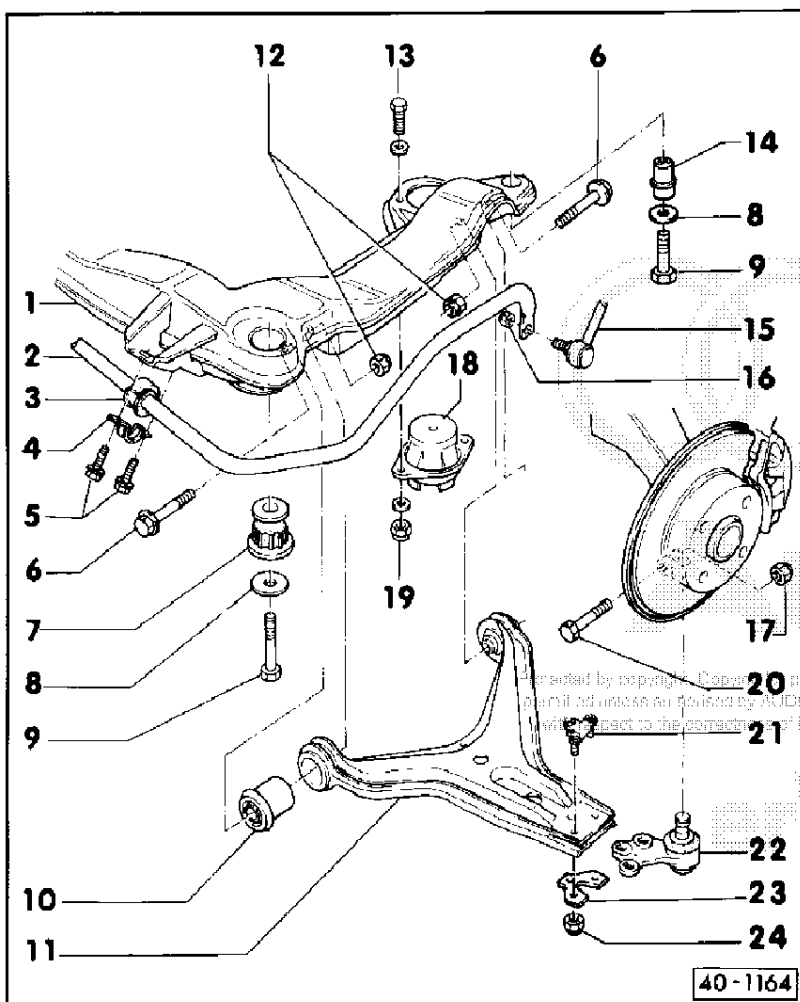
13 - Hexagon bolt

14 - Rear bearings for subframe
 ♦ Note different versions depending on engine
 ♦ Removing rear bearing => Fig. 5
 ♦ Fitting rear bearing => Fig. 6

15 - Connecting link
 ♦ Attach to anti-roll bar

16 - Self-locking nut, 40 Nm
 ♦ Always replace

17 - Self-locking nut, 50 Nm
 ♦ Always replace



18 - Bonded rubber bush
 ♦ Attach to bracket of subframe
 ♦ Note different versions

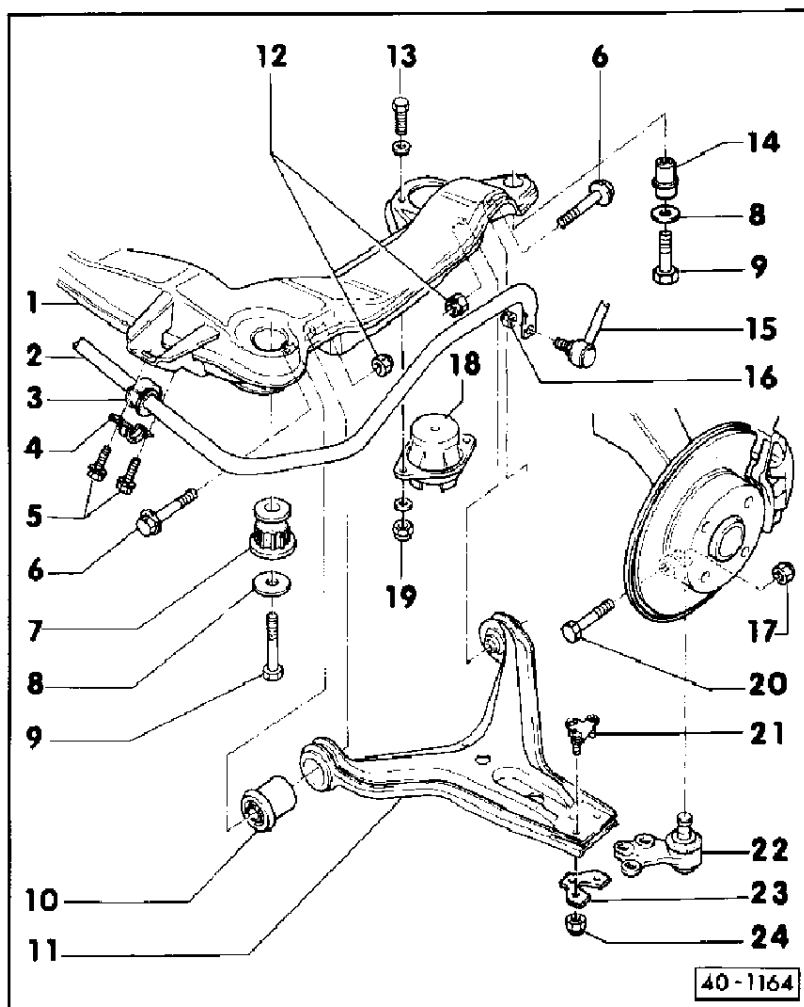
19 - Self-locking nut, 25 Nm
 ♦ Always replace

20 - Hexagon bolt
 ♦ Always replace
 ♦ Head of bolt points in direction of travel.

21 - Tab washer
 ♦ Supplied as replacement part with bolt

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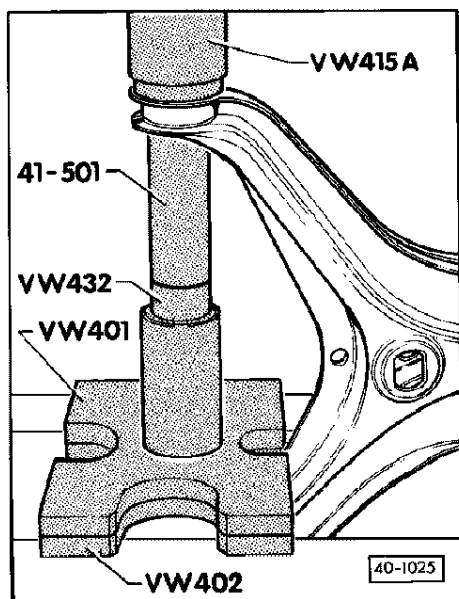
22 - Ball joint

- ◆ Ball joint must correspond to transverse link (sheet steel or forged)
- ◆ Do not widen slot at wheel bearing housing during disassembly
- ◆ Different versions on left and right
- ◆ Install joint with odd part no. on left and joint with even part no. on right
- ◆ Joint pin diameter 19 mm
- ◆ Perform wheel alignment of front axle after replacement
- ◆ Adjusting camber => Page 44-21

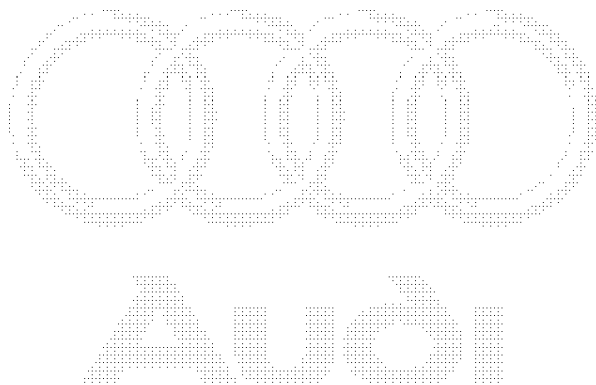
23 - Packing plate

24 - Self-locking nut, 65 Nm

- ◆ Always replace

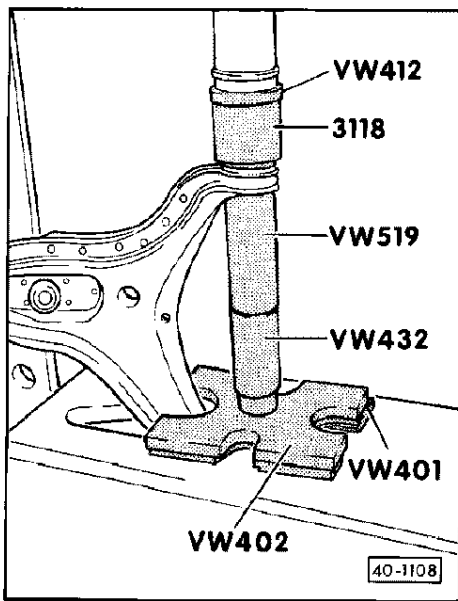


◀ Fig.1 Pressing out bearing for transverse link

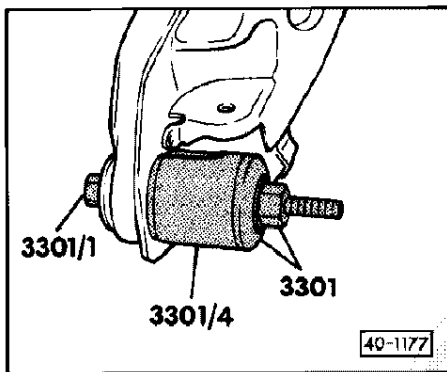


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◀ Fig.2 Pressing in bearing for transverse link
 – Press mounting in to stop.



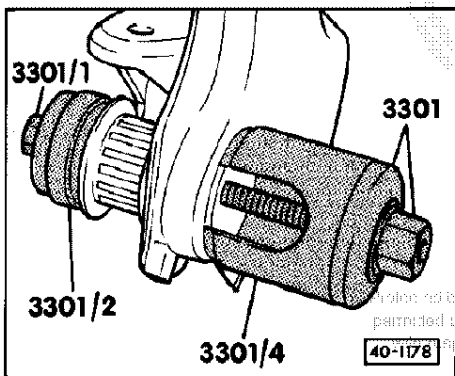
◀ Fig.3 Removing front subframe bearing

Note:

Turn pipe -3301/4- so that large recess is at bracket for transverse link attachment

Attention:

On removal, bearing and tool may suddenly jump out of subframe (risk of injury)



◀ Fig.4 Drawing front subframe bearing home

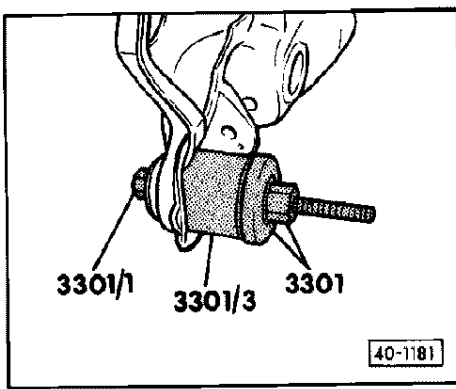
Apply anti-friction assembly oil G-294 421 A1 beforehand

Note:

Large collar of thrust piece -3301/2- faces bearing

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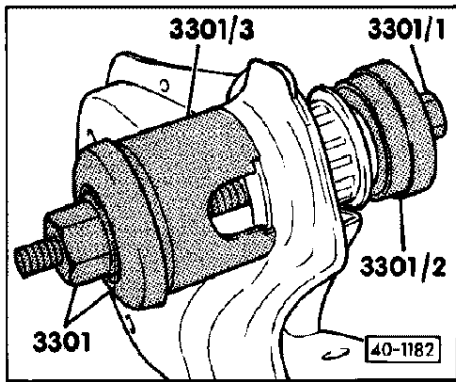
◀ Fig.5 Removing rear subframe bearing

Note:

Turn pipe -3301/3- so that recess is at bracket for transverse link attachment

Attention:

On removal, bearing and tool may suddenly jump out of subframe (risk of injury)

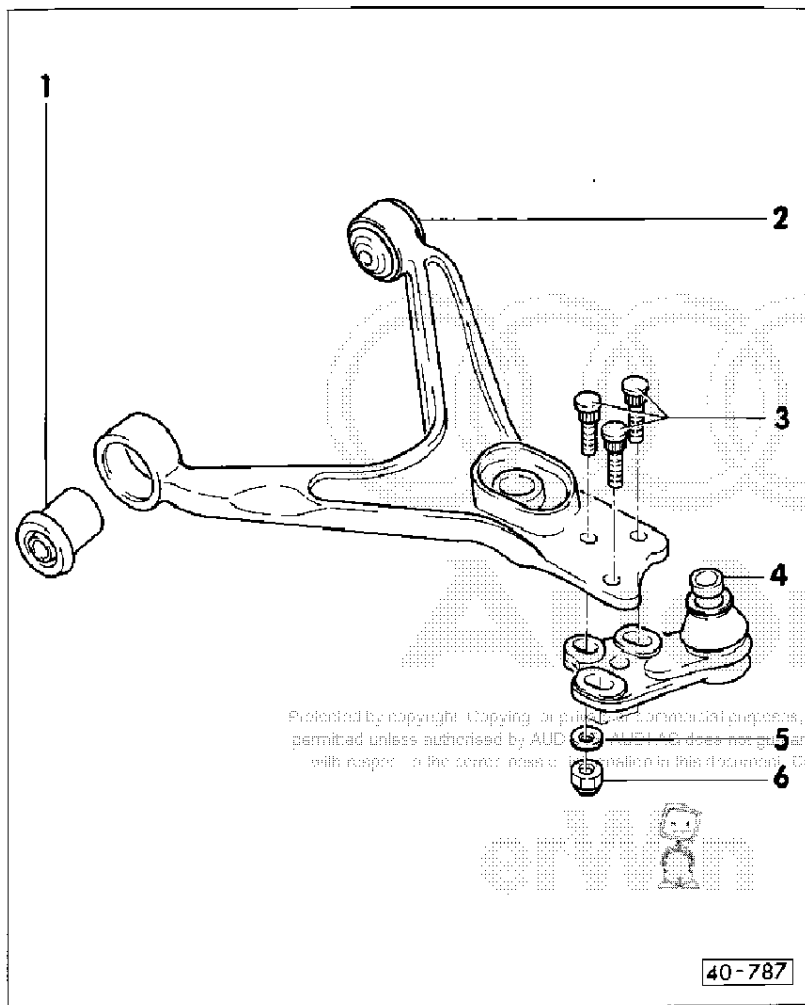


◀ Fig.6 Drawing rear subframe bearing home

Apply anti-friction assembly oil G 294 421 A1 beforehand

Note:

Small collar of thrust piece -3301/2- faces bearing

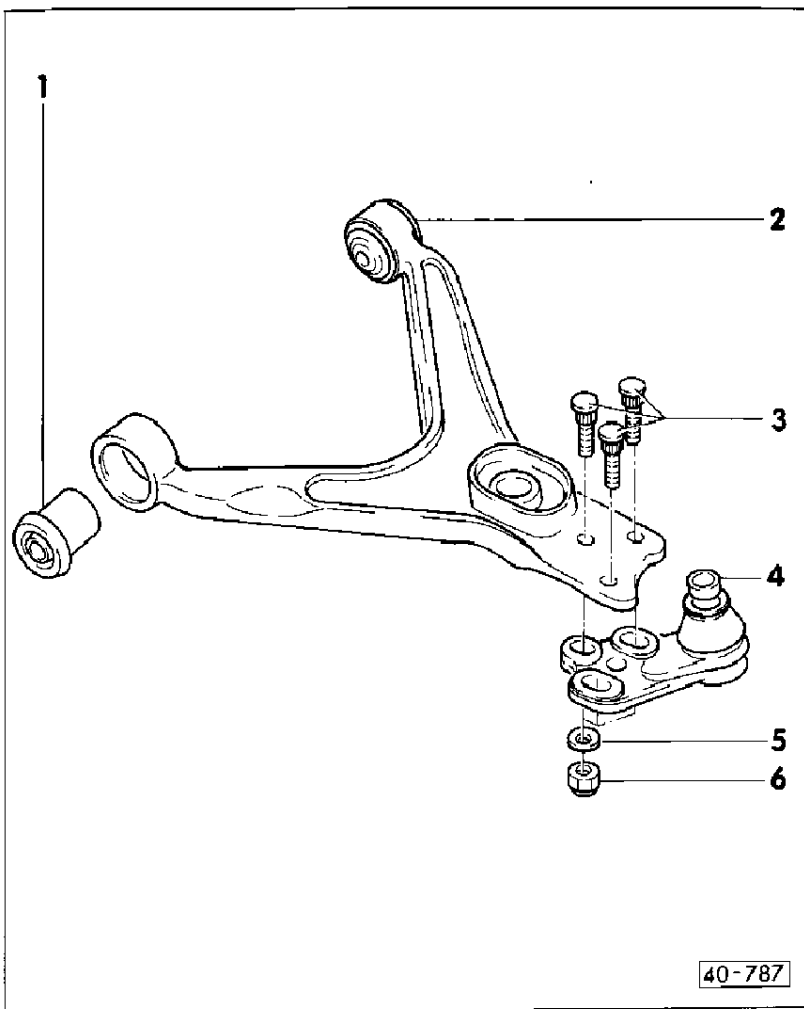


Servicing forged transverse link

- 1 - Bearing for transverse link
 - ◆ Driving out => Fig. 1
 - ◆ Pressing in => Fig. 2
- 2 - Transverse link
 - ◆ Different versions on left and right
- 3 - Threaded pin
 - ◆ Press home in transverse link

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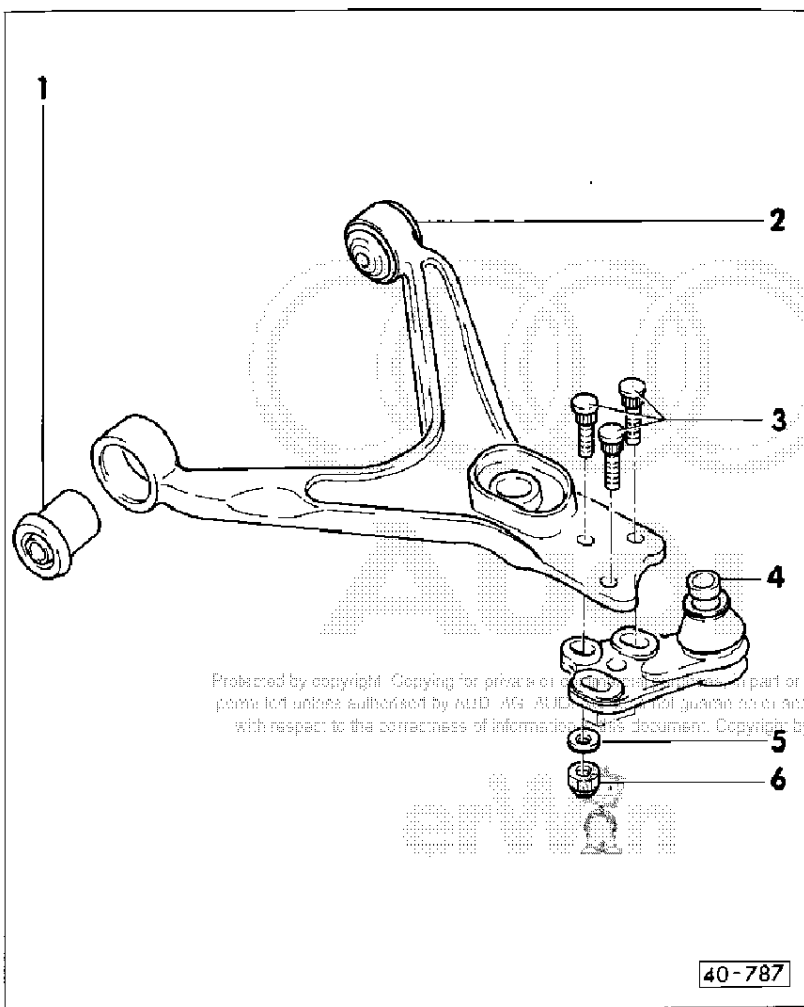
4 - Ball joint

- ◆ Do not widen slot at wheel bearing housing during disassembly
- ◆ Different versions on left and right
- ◆ Install joint with odd part no. on left and joint with even part no. on right
- ◆ Joint pin diameter 19.0 mm
- ◆ Perform wheel alignment of front axle after replacement

5 - Washer

- ◆ Discontinued with introduction of ribbed nut, i.e. when using a ribbed nut for repairs the washer no longer needs to be installed

40-55



6 - Self-locking nut, 65 Nm

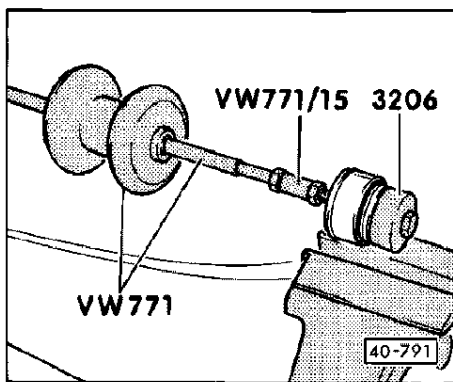
- ◆ Always replace

Notes:

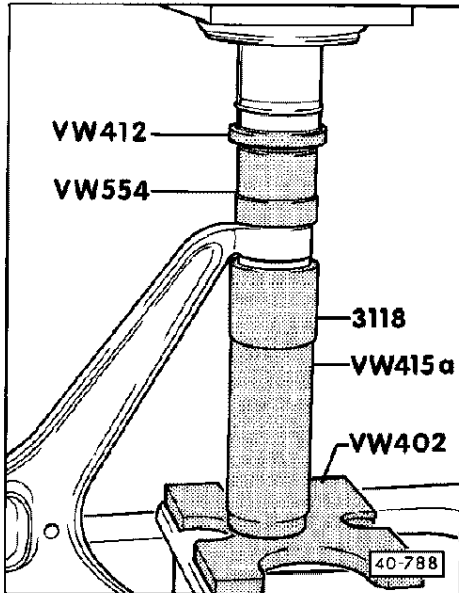
- ◆ The self-locking nut has been discontinued and is being replaced by a self-locking ribbed nut.
- ◆ The tightening torque of the ribbed nut is 85 Nm. When unscrewing the ball joint from the transverse link the ribbed nuts should also be renewed. To adjust camber, only loosen ribbed nuts and then retighten to 85 Nm.

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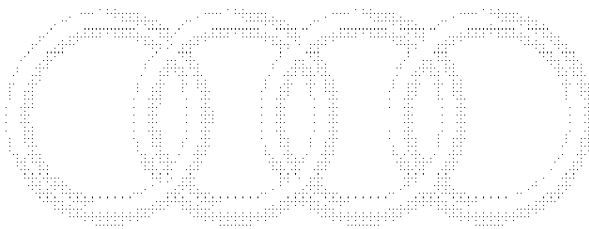
40-56



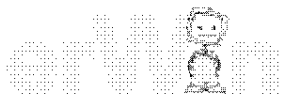
- ◀ **Fig.1 Driving out bearing for transverse link**
- Clamp transverse link in vice using soft jaws.
 - Insert hexagon bolt M10 x 80 and driver -3206- in transverse link. Screw on with special tool as shown.
 - Tighten lock nuts.



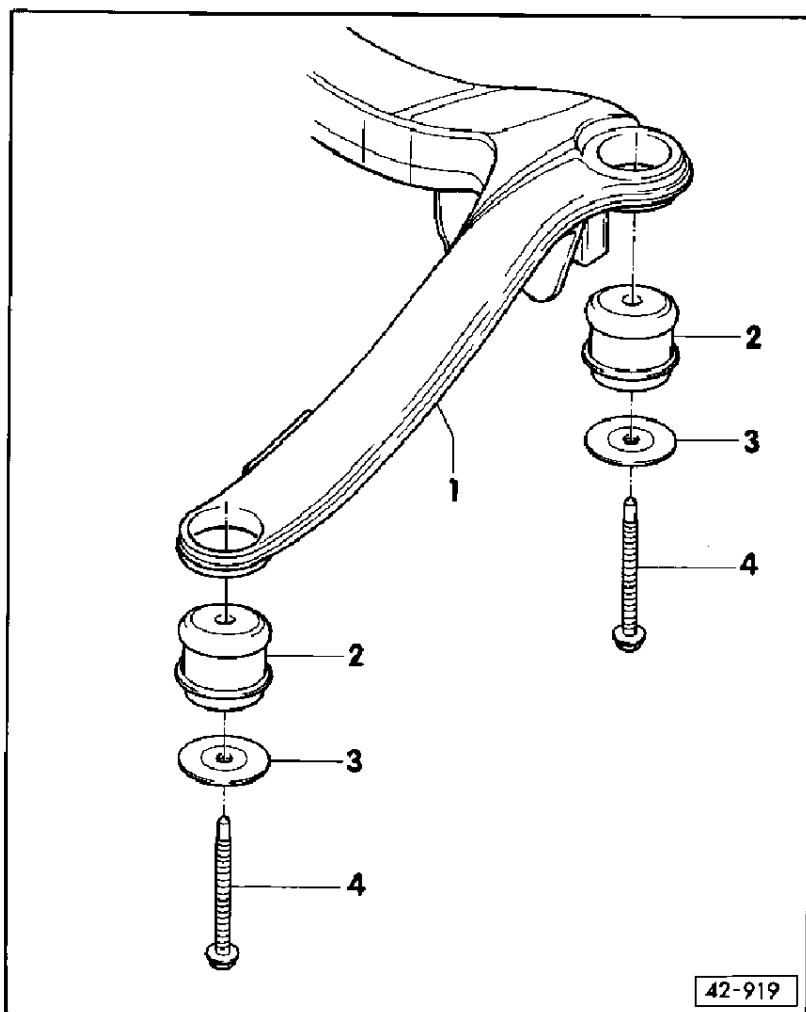
- ◀ **Fig.2 Pressing in bearing for transverse link**
- Press mounting in to stop.



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Servicing subframe



42-919

1 - Subframe

- ◆ Welding and straightening work must not be carried out on the subframe.
- ◆ Perform rear axle wheel alignment after removing/installing => Page 44-11

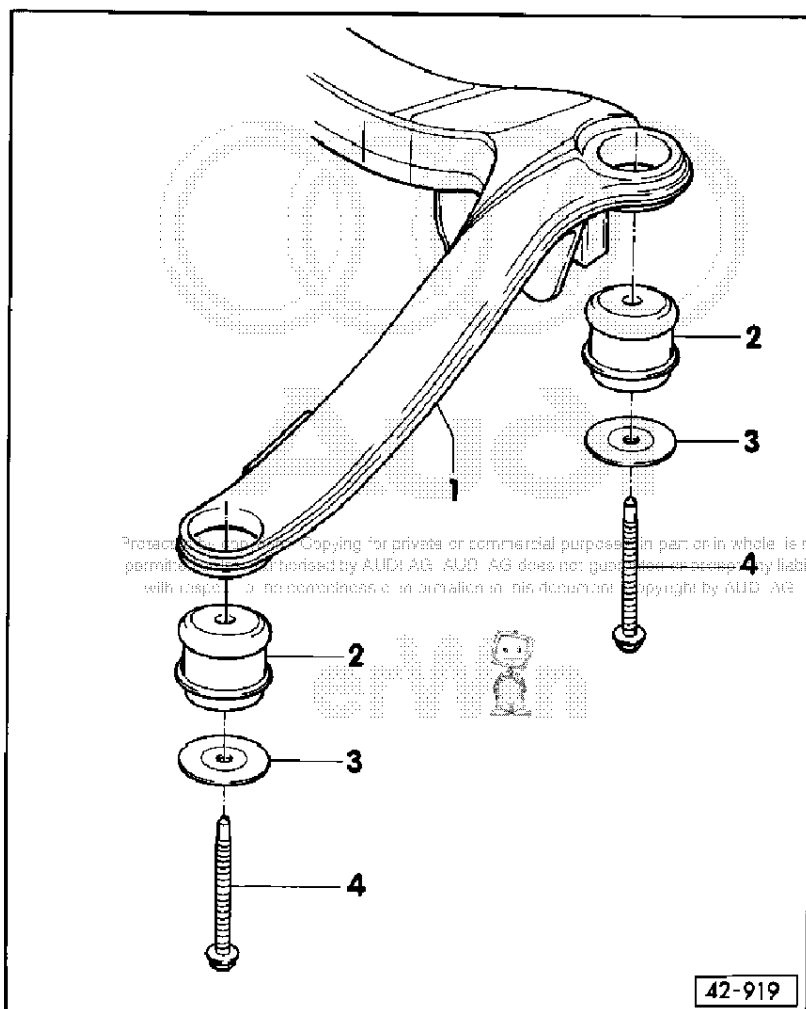
2 - Subframe bushes

- ◆ Removing front bush => Fig. 1
- ◆ Fitting front bush => Fig. 2
- ◆ Removing rear bush => Fig. 3
- ◆ Fitting rear bush => Fig. 4
- ◆ Installation position of bushes in subframe => Fig. 5

Note:

Before fitting, apply assembly lubricant G 294 421 A1 to bonded rubber bushes.

42-1



42-919

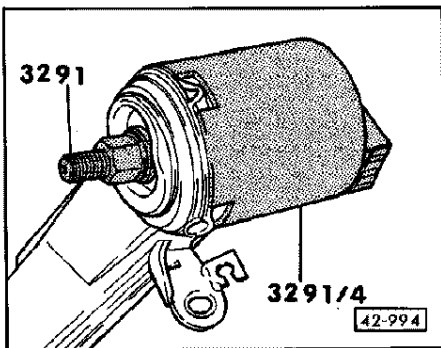
3 - Washer

- ◆ Always replace
- ◆ Ribbed side faces upwards

4 - Hexagon combi bolt

- ◆ Always replace
- ◆ Tighten to 110 Nm, then tighten a further 90°
- ◆ Tightening sequence:
 - 1. Rear right
 - 2. Rear left
 - 3. Front right
 - 4. front left

42-2

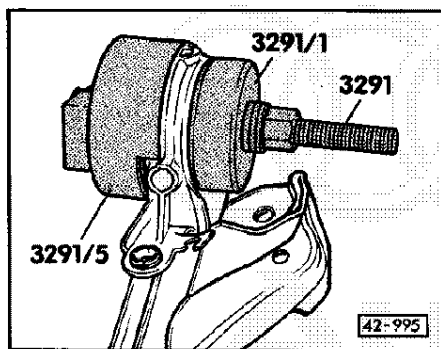


◀ Fig.1 Removing front bonded rubber bush from subframe

- Attach tube -3291/4- (note recesses) with threaded spindle -3291- at right angles to subframe.
- Attach the two brass washers with the annular grooves next to one another to the threaded spindle -3291-. Attach washer and screw on hexagon nut. Remove bonded rubber bush by turning the hexagon nut.

Note:

Insert hexagon head of threaded spindle -3291- into recess in tube -3291/4-. Apply grease to annular grooves of brass washers and threaded spindle.



◀ Fig.2 Pulling front bonded rubber bush into subframe

Note:

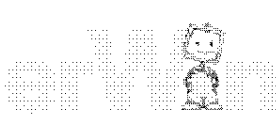
Before fitting, apply assembly lubricant G 294 421 A1 to bonded rubber bushes.

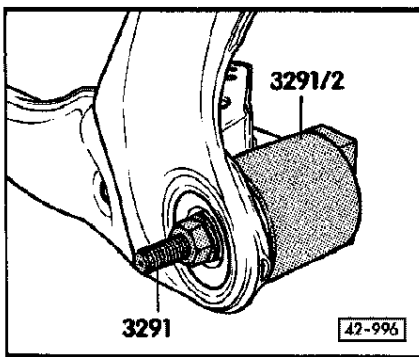
- Attach thrust piece -3291/1- to bonded rubber bush and insert at right angles in bore of subframe using tube -3291/5- (note recesses) and threaded spindle -3291-.
- Attach the two brass washers to the threaded spindle with the annular grooves facing each other-3291-.
- Attach washer and screw on hexagon nut.
- Pull in bonded rubber bush as far as it will go by turning hexagon nut. Whilst doing so, hold thrust piece -3291/1- and bonded rubber bush by hand to stop them turning.

Note:

Insert hexagon head of threaded spindle -3291- into recess in tube -3291/5-. Apply grease to annular grooves of brass washers and threaded spindle.

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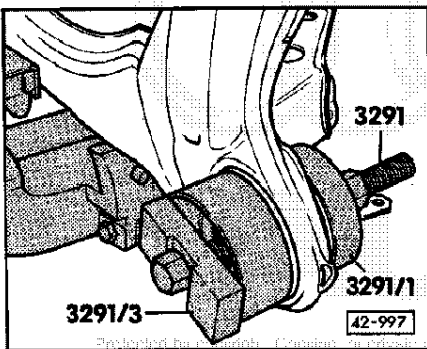


◀ Fig.3 Removing rear bonded rubber bush from subframe

- Attach tube -3291/2- with threaded spindle -3291- at right angles to subframe. Attach the two brass washers with the annular grooves next to one another to the threaded spindle -3291-. Attach washers and screw on hexagon nut. Remove bonded rubber bush by turning the hexagon nut.

Note:

Insert hexagon head of threaded spindle -3291- into recess in tube -3291/2-. Apply grease to annular grooves of brass washers and threaded spindle.



◀ Fig.4 Pulling rear bonded rubber bush into subframe

Note:

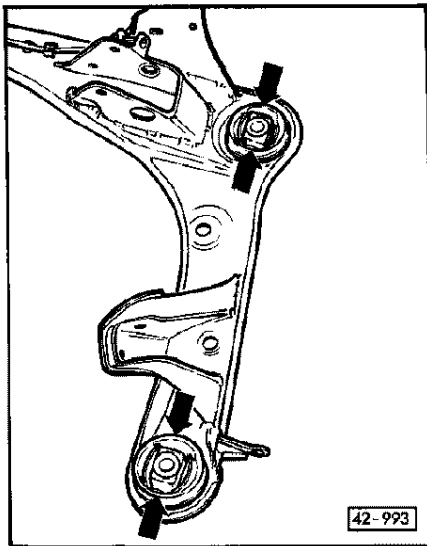
Before fitting, apply assembly lubricant G 294 421 A1 to bonded rubber bushes.

- Attach thrust piece -3291/1- to bonded rubber bush and insert at right angles in bore of subframe using tube -3291/3- (note recesses) and threaded spindle -3291-.
- Attach the two brass washers to the threaded spindle with the annular grooves facing each other -3291-.
- Attach washer and screw on hexagon nut.

- Pull in bonded rubber bush as far as it will go by turning hexagon nut. Whilst doing so, hold thrust piece -3291/1- and bonded rubber bush by hand to stop them turning.

Note:

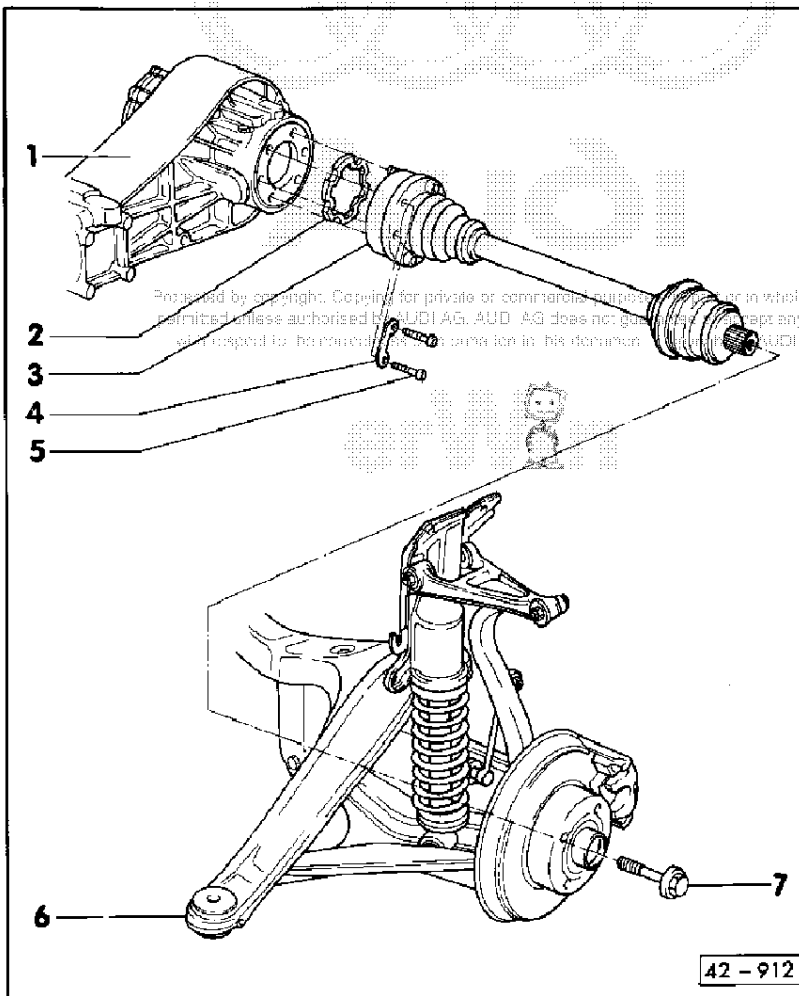
Insert hexagon head of threaded spindle -3291- into recess in tube -3291/3-. Apply grease to annular grooves of brass washers -3291/1- and threaded spindle.



◀ Fig.5 Installation position of bonded rubber bushes in rear subframe.

Note:

The kidney-shaped recesses (arrows) must be in the direction of the longitudinal axis of the vehicle. Deviations up to max. 10° to left or right are permitted.



Removing and installing drive shaft

1 - Differential

2 - Seal

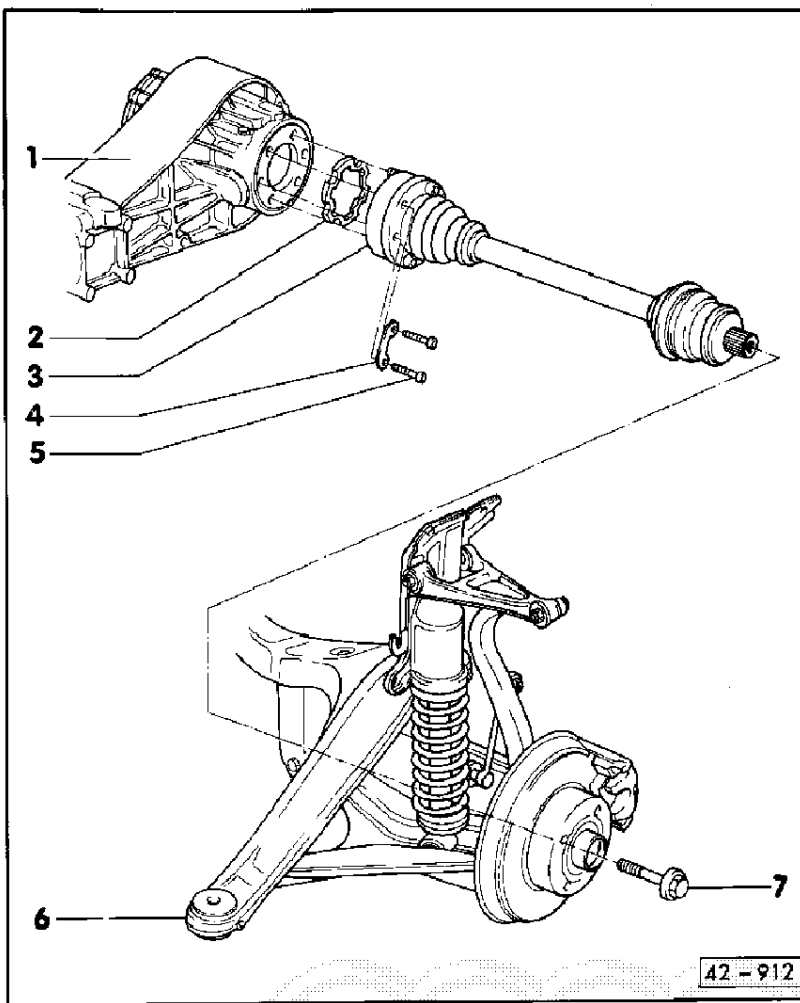
- ◆ Pull off protective sheet and bond into joint
- ◆ Only fitted on vehicles with 5- and 6-cylinder engine

3 - Drive shaft

- ◆ Servicing.
- Audi 80 Saloon => Page 42-13
- Audi 80 Avant and vehicles with 169 kW engine => Page 42-18

Note:

If vehicles on which the drive shaft has been taken out are to be moved, then an outer joint should be fitted beforehand in place of the drive shaft so as not to damage the wheel bearing.



4 - Packing plate

5 - Cheese-head bolt

◆ M8 = 45 Nm

◆ M10 = 80 Nm

6 - Subframe

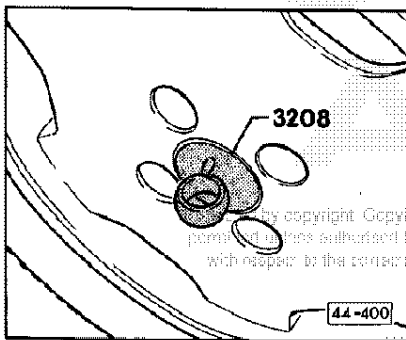
7 - Hexagon combi bolt/flange bolt

◆ Always replace

◆ Tighten M16 x 1.5 to 200 Nm and then give a further 90° turn

◆ Tighten M14 x 1.5 to 120 Nm and then give a further 90° turn

◆ Vehicle must be standing on its wheels when loosening and tightening (risk of accident).

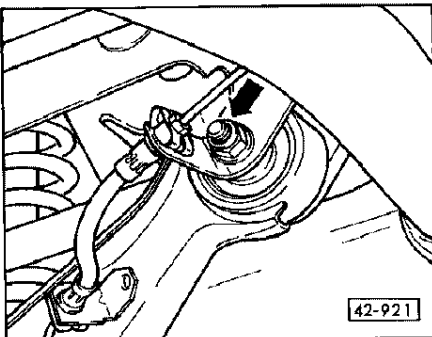


Removing:

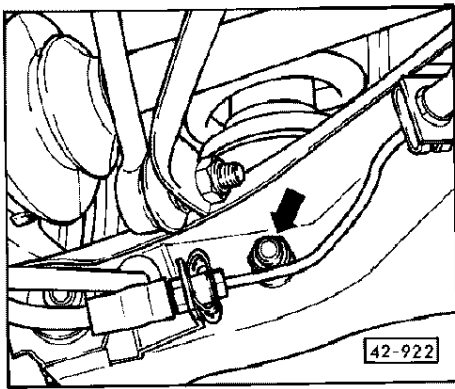
- ◀ - Remove wheel cap or, on vehicles with light alloy disc wheels, use special tool -3208- to pull cover off disc wheel.
- Unscrew hexagon combi bolt, c.f. => Page 42-9, Item 7
- Loosen wheel bolts.
- Unbolt drive shaft from flange shaft.

Remove wheel.

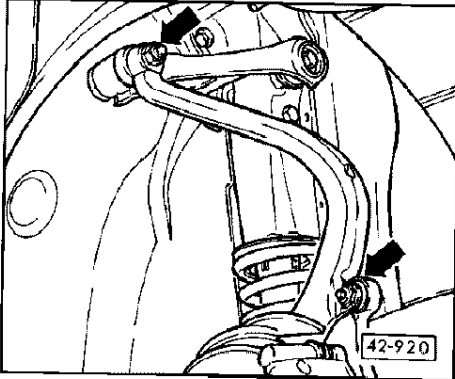
- ◀ - Slightly pull out ABS speed sensor from wheel bearing housing.



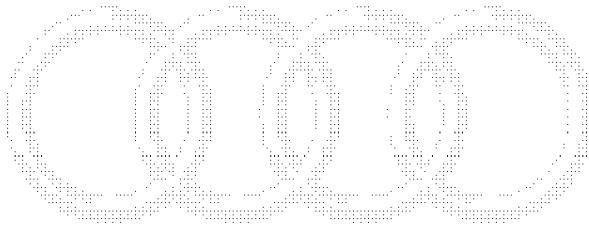
- ◀ - Unfasten the two subframe/lower transverse link securing bolts (one bolt not visible in illustration).



- ◀ – Remove suspension strut/lower transverse link securing bolts



- ◀ – Remove connecting link/wheel bearing housing securing bolts
- Remove wheel bearing housing/upper transverse link securing bolt
- Press down firmly on wheel bearing housing and remove drive shaft (second mechanic required)

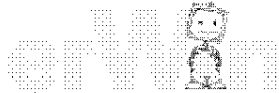


Installing:

The following points should be noted when installing:

- Insert drive shaft into wheel hub (second mechanic required) and then attach to flanged shaft.
- Press home wheel speed sensor in wheel bearing housing

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Servicing drive shaft with constant velocity joint

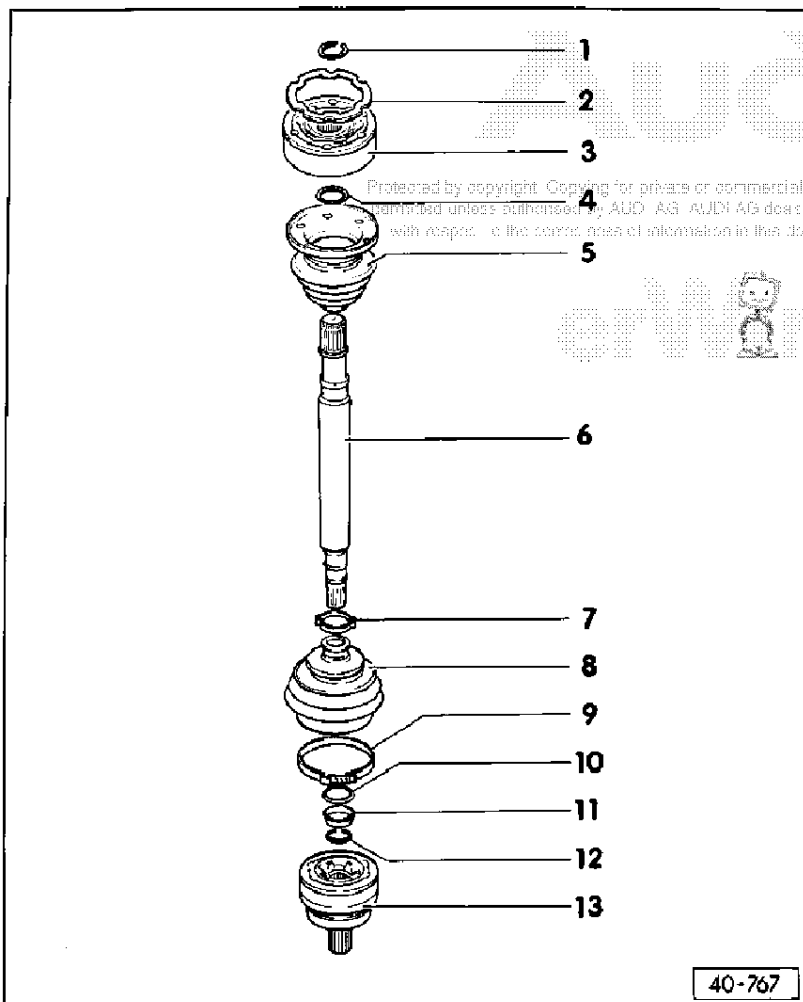
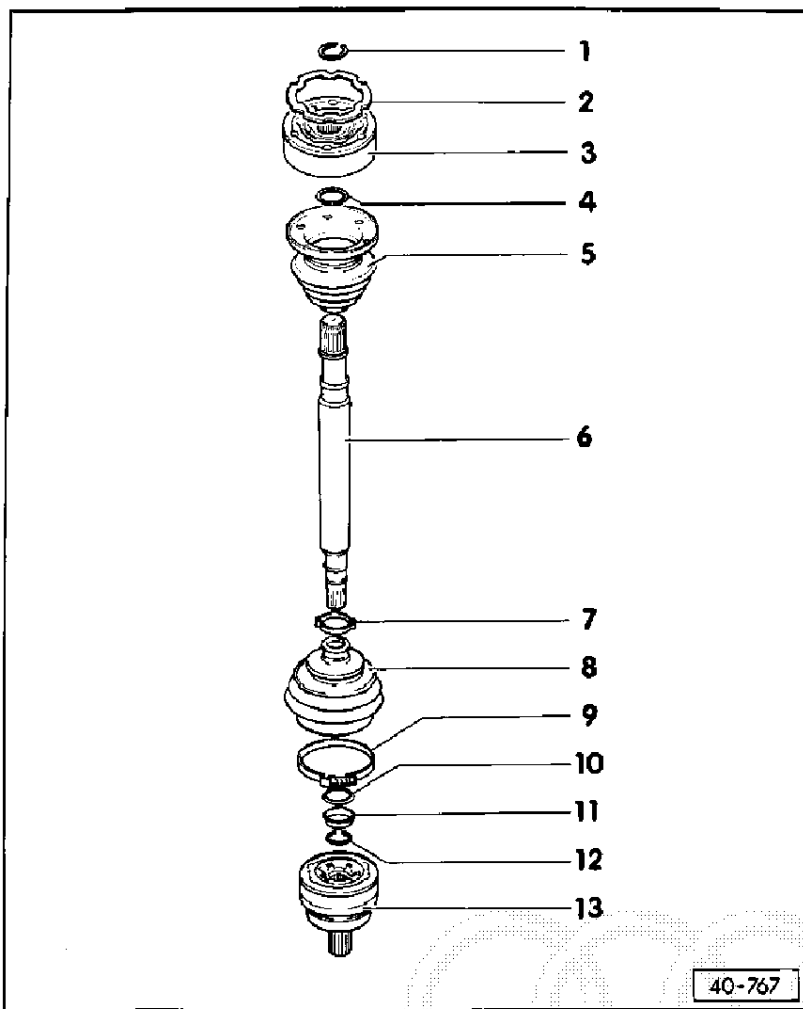
Audi 80 Saloon

Note:

Constant velocity joints are packed with grease G-6:

Outer joint	Grease Total quantity	of which in:	
		Joint	Bellows
ø mm	[g]	[g]	[g]
81/89	90	40	50
Inner joint			
ø mm			
90/100	90	40	50

Top up fill in joint if necessary when renewing the protective bellows.

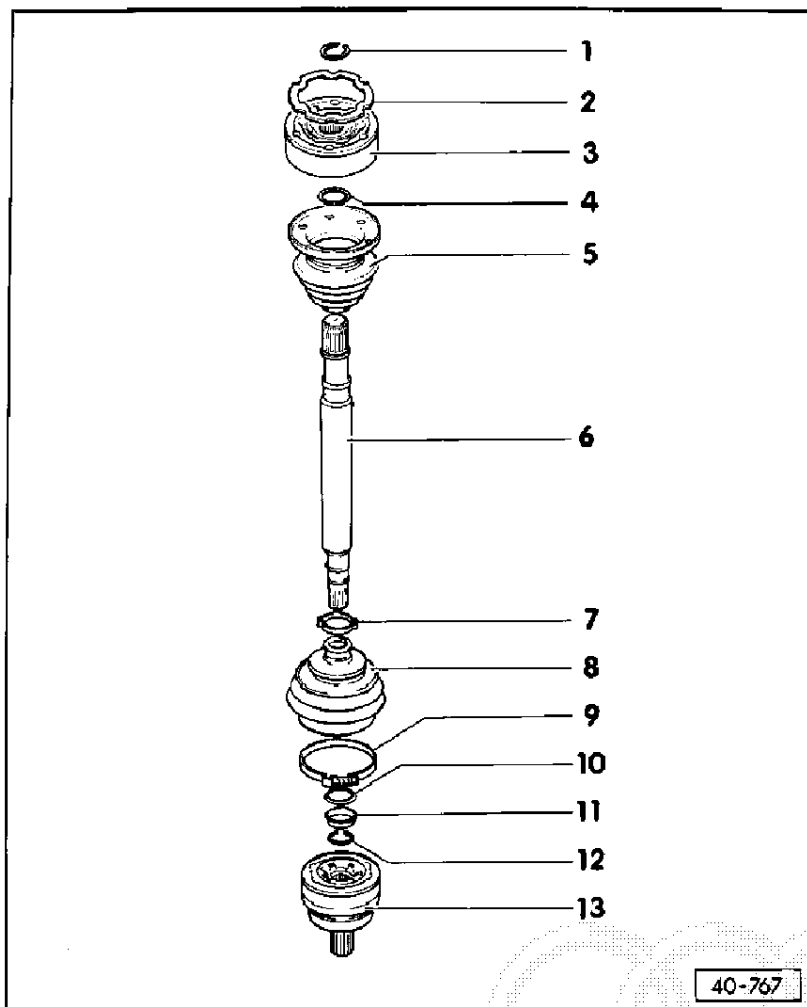


1 - Circlip

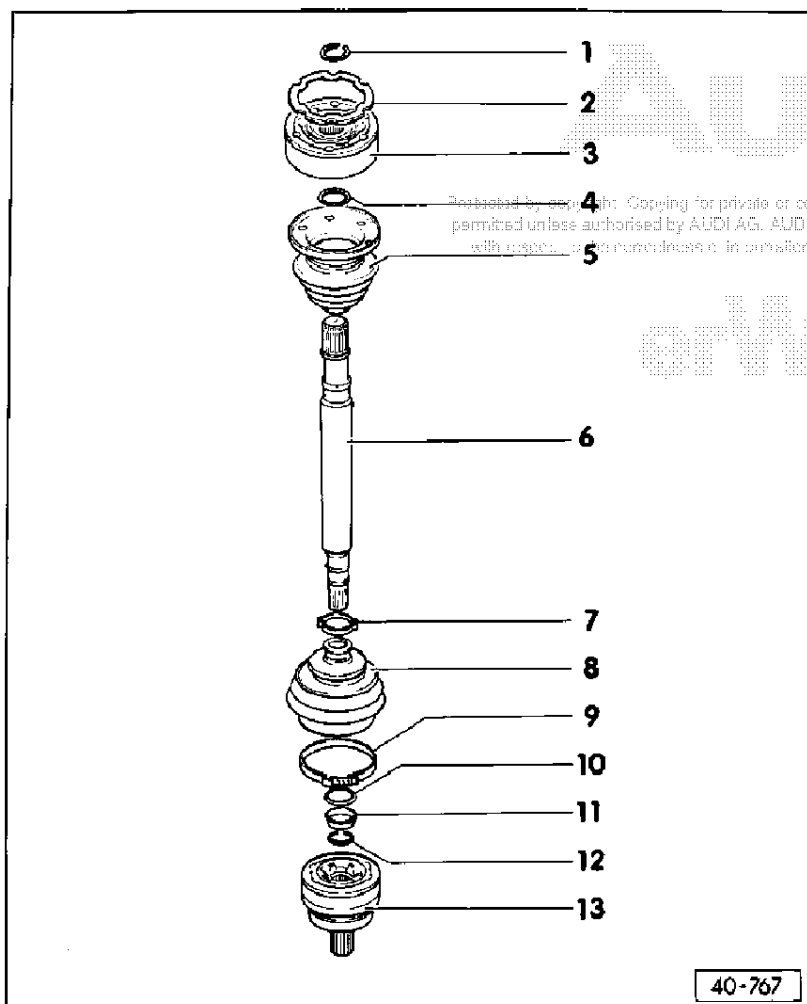
- ◆ Always replace
- ◆ Depending on version, remove and fit with commercially available circlip pliers or with - VW161 a-, => Fig. 6

2 - Seal

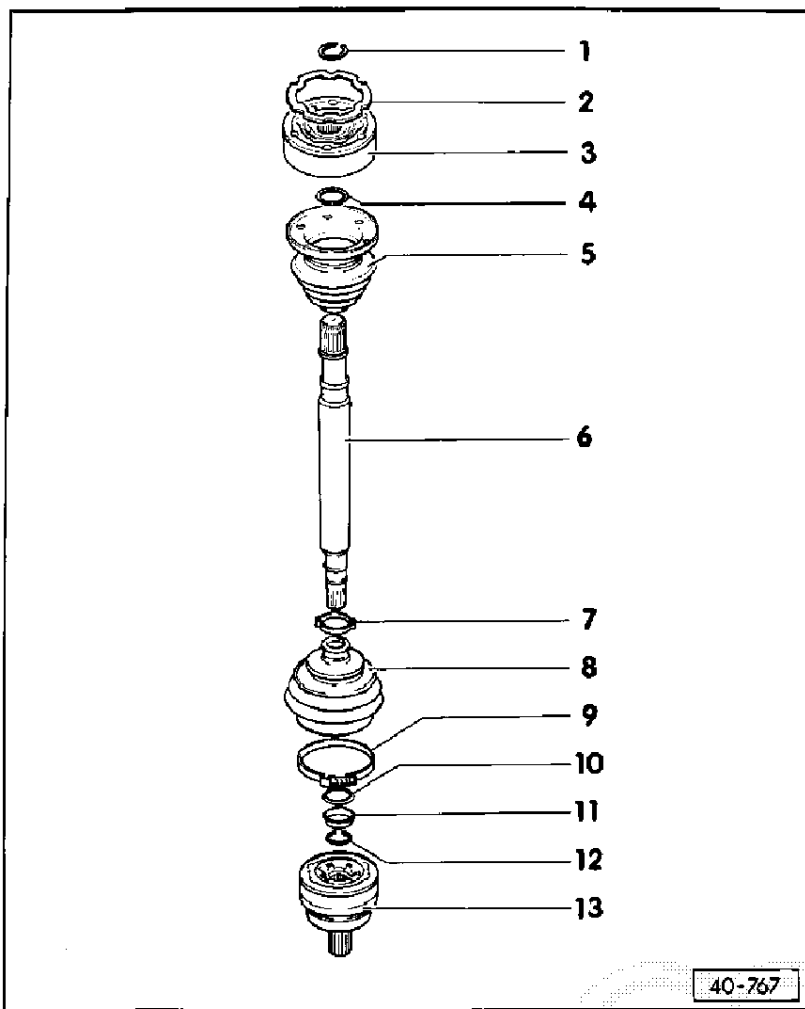
- ◆ Replace; pull off protective sheet and bond into joint.
- ◆ Only fitted on vehicles with 5- and 6-cylinder engine



- 3 - Inner constant velocity joint**
 - ◆ Outer diameter:
 - 4- and 5-cylinder engine: 90 mm
 - 6-cylinder engine: 100 mm
 - ◆ Only replace as complete unit
 - ◆ Pressing off => Fig. 3
 - ◆ Greasing => Notes Page 42-13
- 4 - Dished washer**
 - ◆ Installation position => Fig. 8
- 5 - Joint bellows with cap**
 - ◆ Check for cracks and abrasion
 - ◆ Drive off with drift
 - ◆ Seal end face with D-3 before fitting on constant velocity joint
- 6 - Profiled shaft**
 - ◆ Same length on left and right



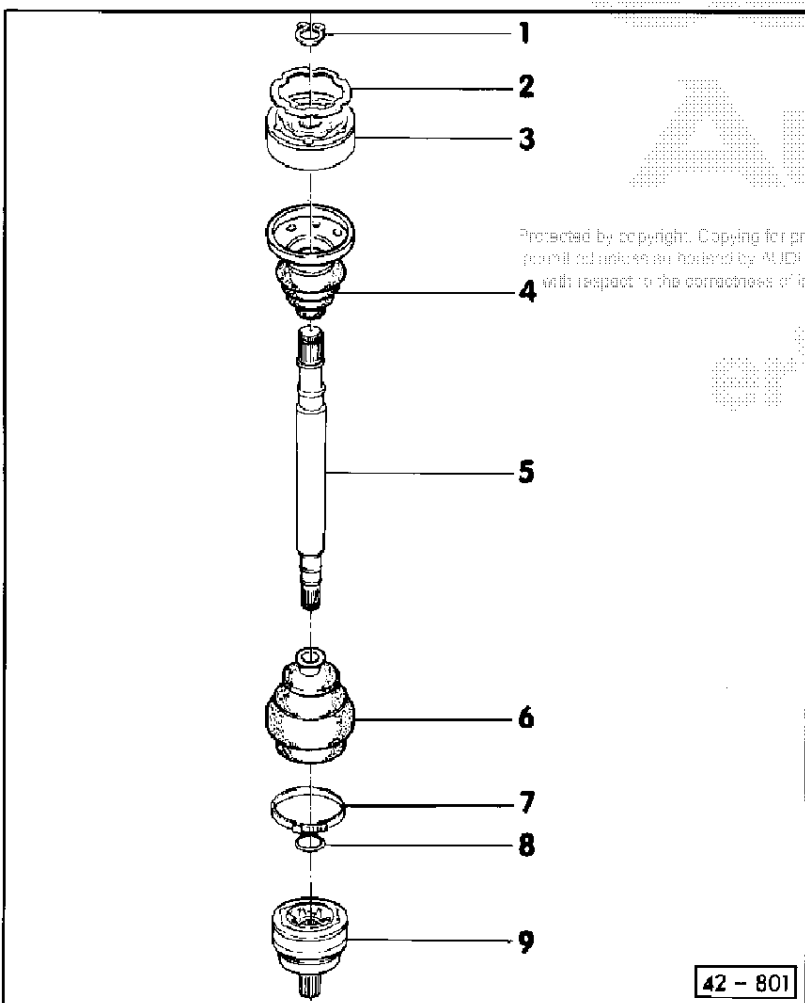
- 7 - Hose clamp**
 - ◆ Always replace
 - ◆ Tensioning => Fig. 1
 - ◆ Not used on vehicles with 6-cylinder engine
- 8 - Protective bellows**
 - ◆ Check for cracks and abrasion
 - ◆ Before tensioning small hose clamp briefly vent joint bellows => Fig. 2
- 9 - Hose clamp**
 - ◆ Always replace
 - ◆ Tensioning => Fig. 1
- 10 - Dished washer**
 - ◆ Installation position => Fig. 7
- 11 - Spacer**
 - ◆ Installation position => Fig. 7



40-767

- 12 - Circlip
- ◆ Always replace
 - ◆ Installation position => Fig. 7
 - ◆ Fit into annular groove on shaft when installing (no longer visible once joint is installed)

- 13 - Outer constant velocity joint
- ◆ Only replace as complete unit
 - ◆ Pressing off => Fig. 9
 - ◆ Installing: Drive joint onto shaft with plastic hammer until circlip engages in annular groove in profiled shaft
 - ◆ Greasing => Notes Page 42-13
 - ◆ Outer diameter:
 - 4- and 5-cylinder engine: 81 mm
 - 6-cylinder engine: 89 mm



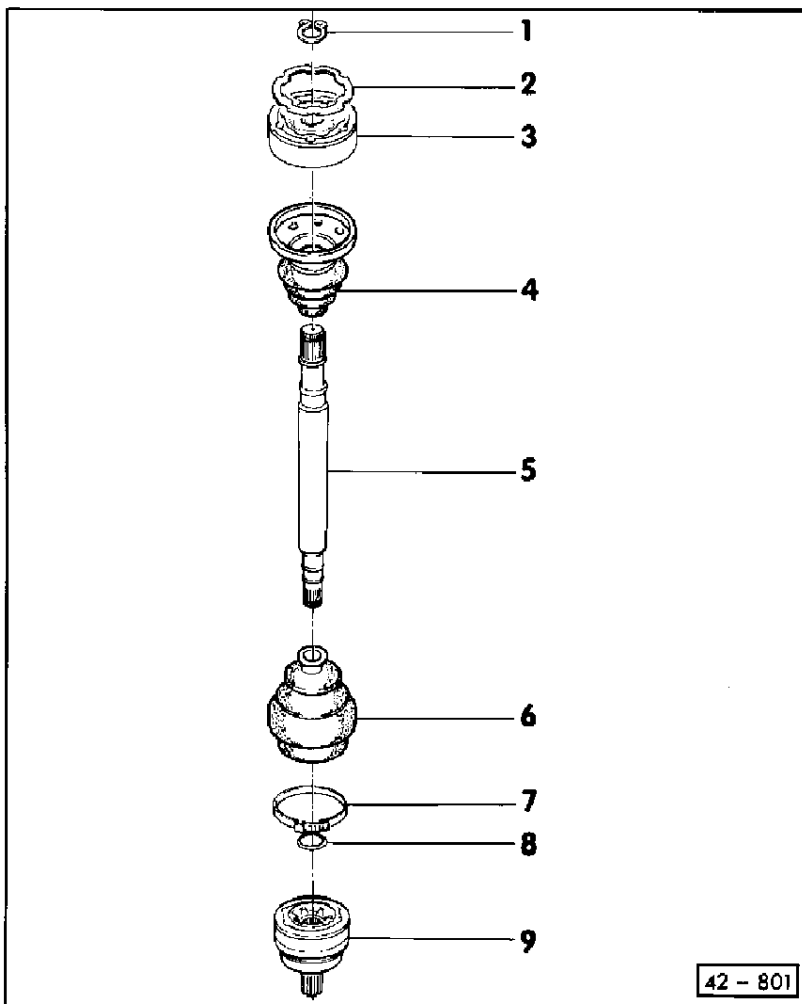
42 - 801

Audi 80 Avant and vehicles with 169 kW engine

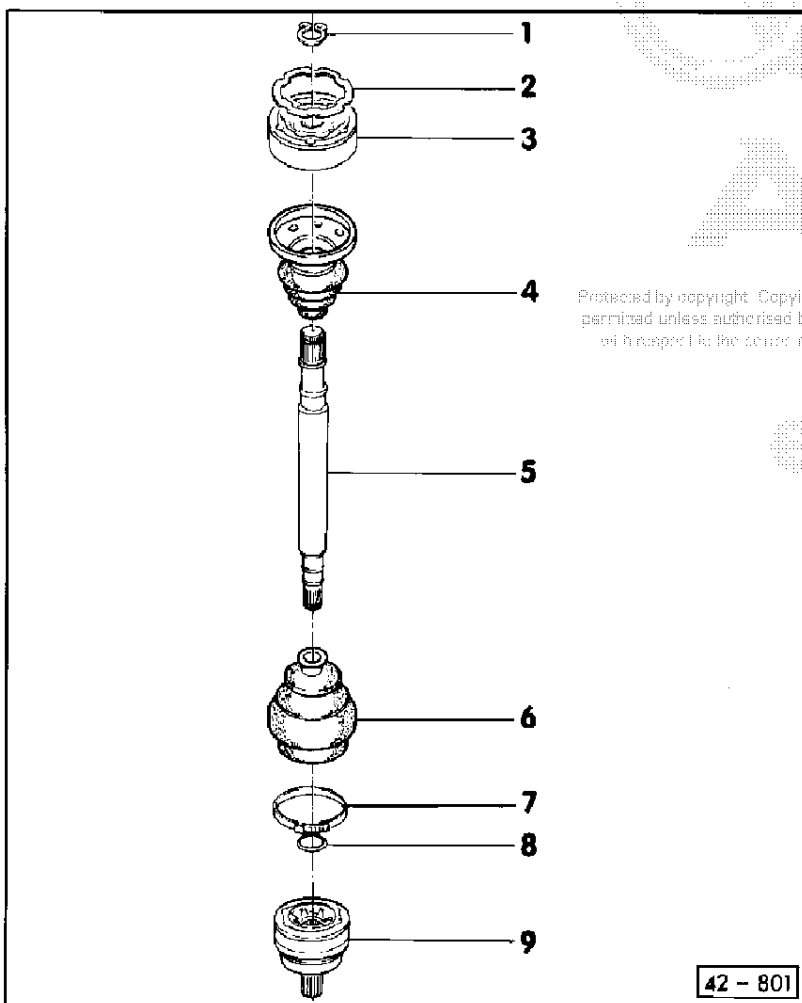
Note:
Constant velocity joints are packed with grease G-6:

Outer joint ø mm	Grease of which in:		
	Total quantity [g]	Joint [g]	Bellows [g]
89	90	40	50
Inner joint ø mm			
100	80	30	50
108	120	35	85

Top up fill in joint if necessary when renewing the protective bellows.

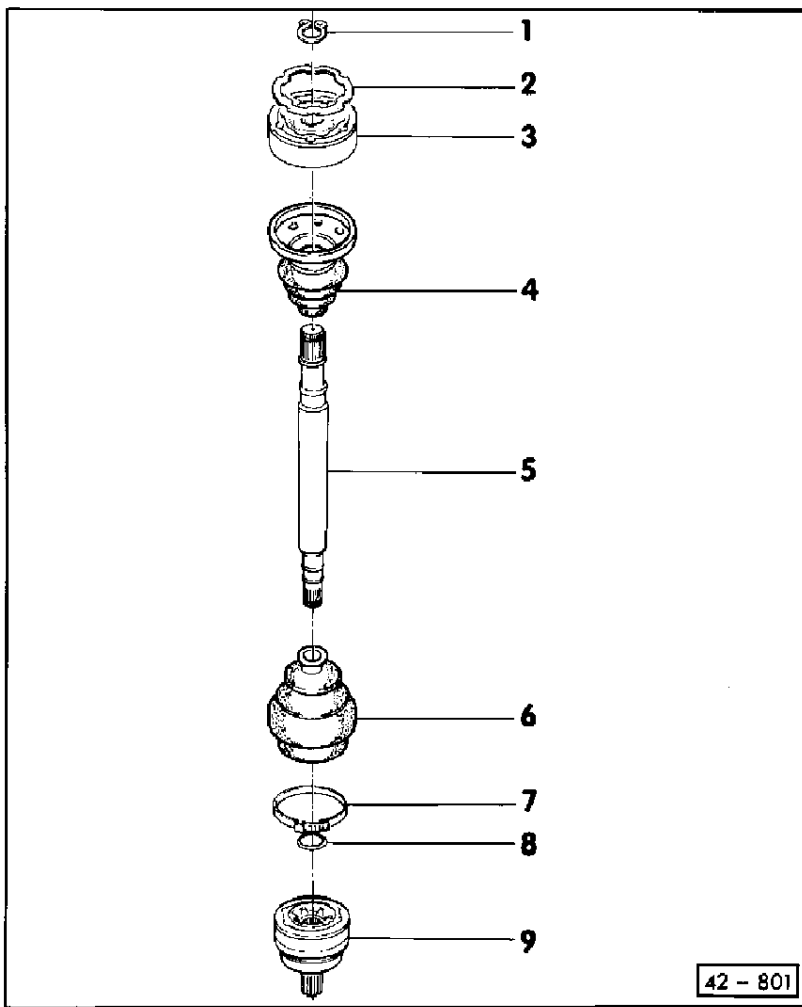


- 1 - Circlip
 - ◆ Remove and install using commercially available circlip pliers
- 2 - Seal
 - ◆ Replace; pull off protective sheet and bond into joint.
- 3 - Inner constant velocity joint
 - ◆ Outer diameter:
 - Audi 80 Avant: 100 mm
 - Vehicles with 169 kW engine: 108 mm
 - ◆ Only replace as complete unit
 - ◆ Pressing off => Fig. 3
 - ◆ Pressing on => Fig. 4
 - ◆ Greasing => Notes Page 42-18



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- 4 - Joint bellows with cap
 - ◆ Check for cracks and abrasion
 - ◆ Drive off with drift
 - ◆ Seal end face with D-3 before fitting on constant velocity joint.
- 5 - Profiled shaft
 - ◆ Different lengths on left and right
- 6 - Protective bellows
 - ◆ Check for cracks and abrasion
- 7 - Hose clamp
 - ◆ Always replace
 - ◆ Tensioning => Fig. 1

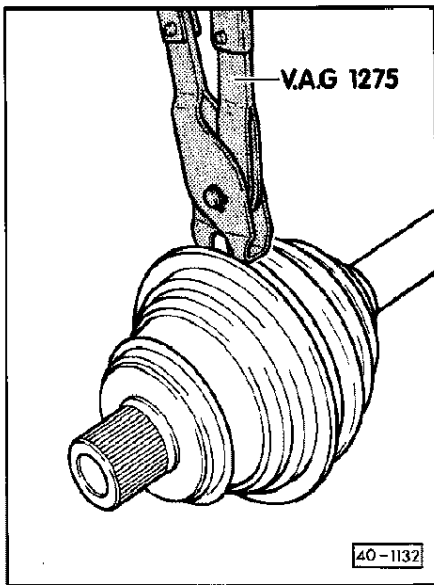


8 - Circlip

- ◆ Always replace
- ◆ Fit into annular groove on shaft when installing (no longer visible once joint is installed)

9 - Outer constant velocity joint

- ◆ Outer diameter: 89 mm
- ◆ Only replace as complete unit
- ◆ M16 x 1.5 mm thread in joint pin
- ◆ Pressing off => Fig. 5
- ◆ Installing: Drive joint onto shaft with plastic hammer until circlip engages in annular groove in profiled shaft
- ◆ Greasing => Notes Page 42-18



◀ Fig.1 Tensioning hose clamp/clip

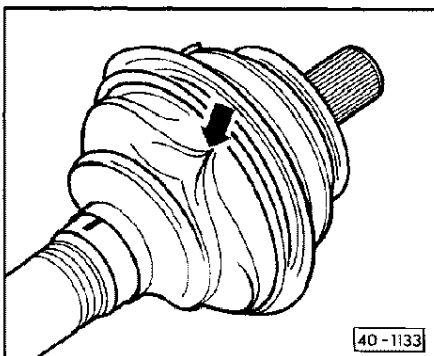


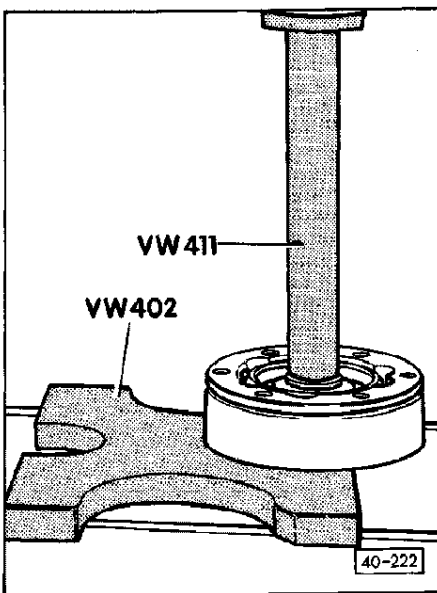
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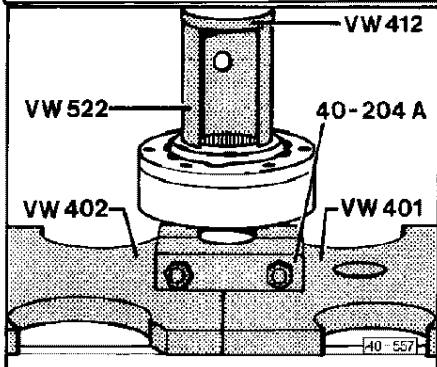
◀ Fig.2 Venting joint bellows

- The bellows are often squashed when installing them on the housing. This produces a vacuum in the bellows which causes an inward fold when driving -arrow-. Therefore, briefly vent the bellows at the small diameter end after fitting to equalise pressure.





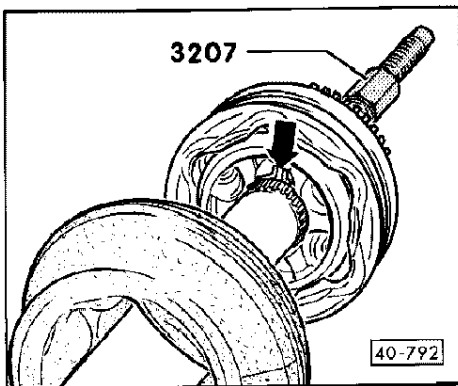
◀ Fig.3 Pressing off inner joint
 – Support ball hub whilst doing so.



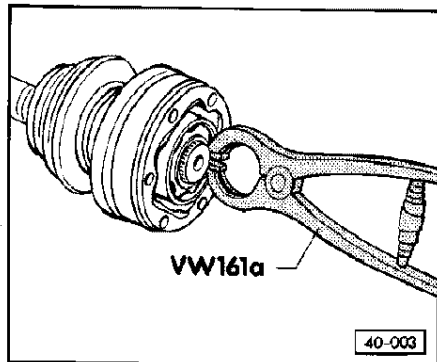
◀ Fig.4 Pressing on inner joint
 – Press joint home, install circlip.

Note:

Chamfer on inner diameter of ball hub (splines) must face locating collar of drive shaft.



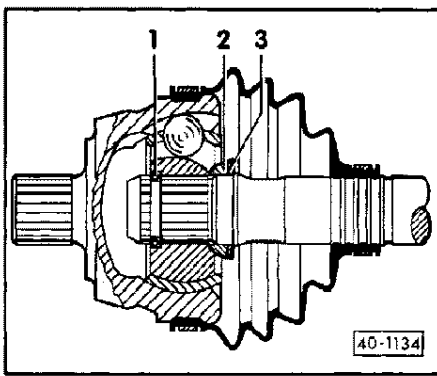
◀ Fig.5 Pressing off outer constant velocity joint
 – Clamp drive shaft in vice using soft jaws.
 – Remove clamp.
 – Fold back bellows.
 – Spread circlip (see arrow) and at the same time screw in M16 threaded end of special tool -3207- until constant velocity joint is pressed off profiled shaft.



◀ Fig.6 Removing and installing circlip

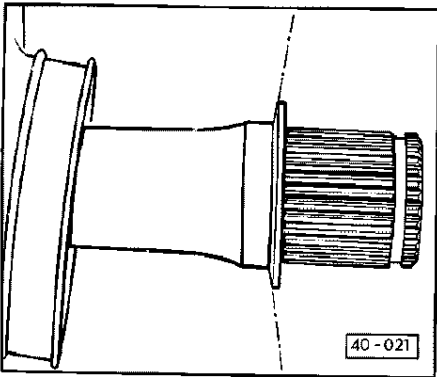
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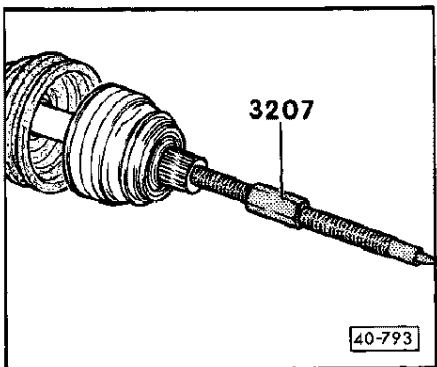


◀ Fig.7 Installation position of dished washer, spacer and circlip

- 1 -Circlip
- 2- Spacer
- 3- Dished washer

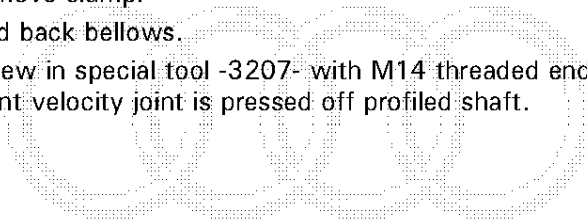


◀ Fig.8 Correct positioning of dished washer



◀ Fig.9 Pressing off outer constant velocity joint

- Clamp drive shaft in vice using soft jaws.
- Remove clamp.
- Fold back bellows.
- Screw in special tool -3207- with M14 threaded end until constant velocity joint is pressed off profiled shaft.



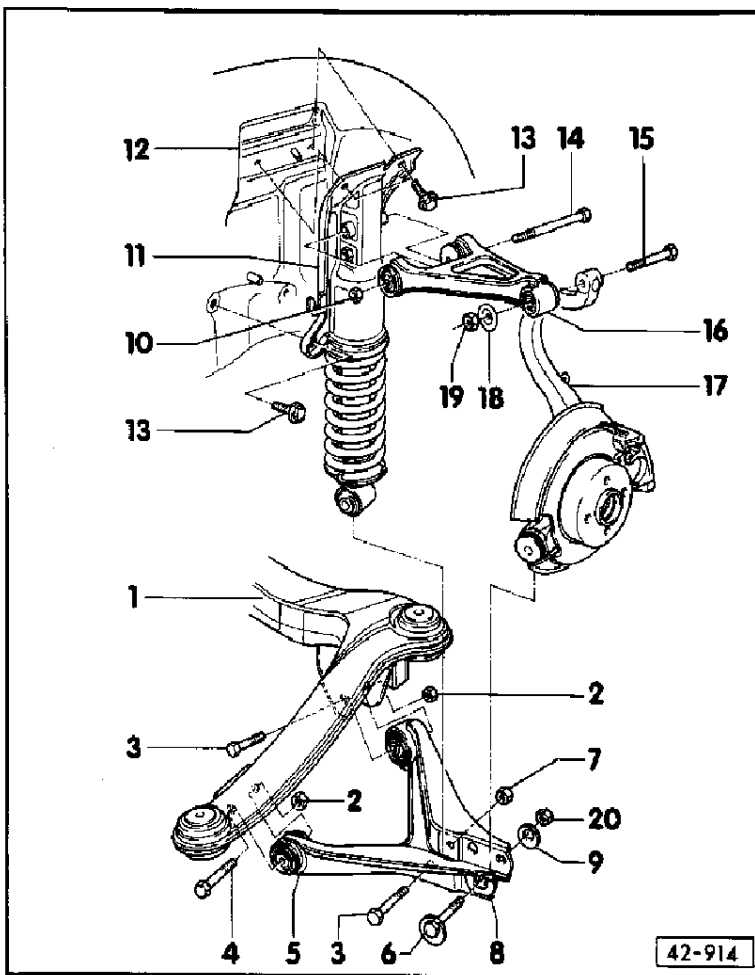
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Removing, installing and servicing rear axle

Note:

Welding and straightening operations are not permitted on load-bearing elements or components that locate the wheels.



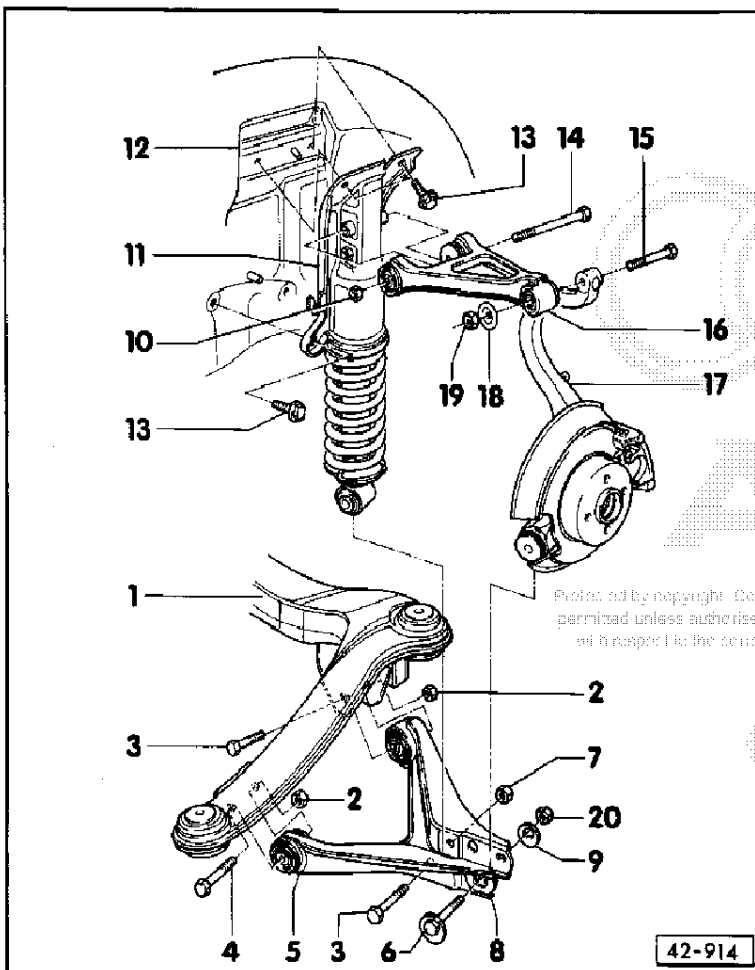
1 - Rear subframe

- ◆ Perform rear axle wheel alignment after removing/installing => Page 44-11
- ◆ Servicing => Page 42-1

2 - Self-locking nut

- ◆ Always renew
- ◆ Tighten to 70 Nm, then tighten a further 90°
- ◆ Vehicle must be standing on the ground when tightening.

42-27



3 - Hexagon bolt

- ◆ Always renew

4 - Hexagon bolt

- ◆ Always renew

5 - Lower transverse link

- ◆ Servicing => Page 42-44

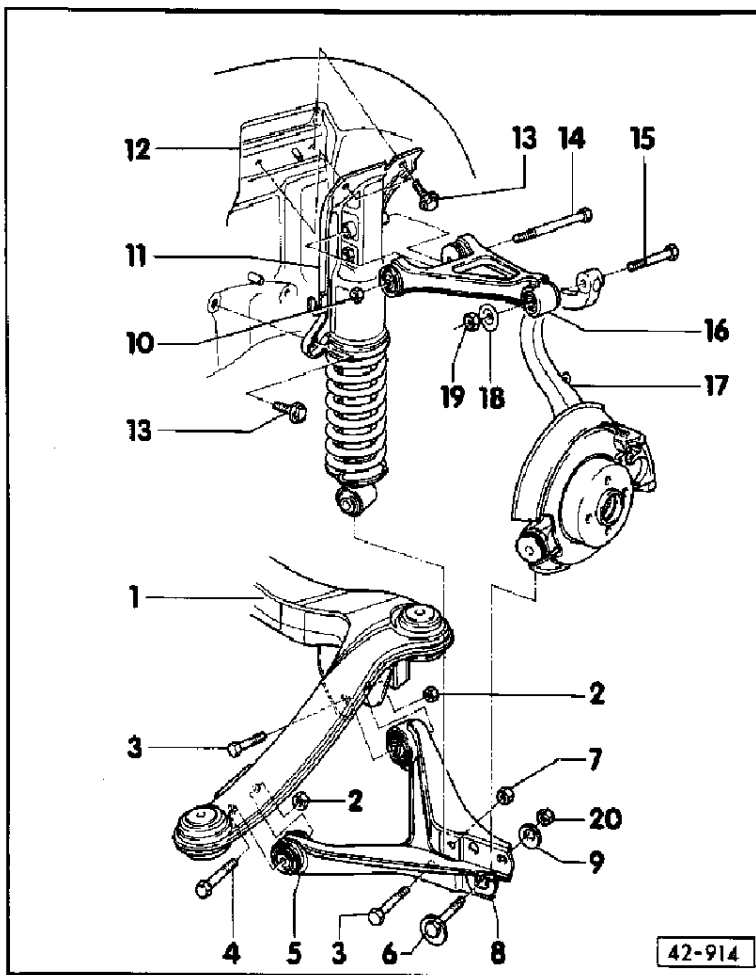
6 - Eccentric bolt

- ◆ Adjusting camber => Page 44-11
- ◆ Do not turn more than 90° to left or right from centre position (min. - max. adjustment).

7 - Self-locking nut

- ◆ Always renew
- ◆ Tighten to 70 Nm, then tighten a further 90°
- ◆ Vehicle must be standing on the ground when tightening.

42-28



8 – Support bracket for adjusting camber

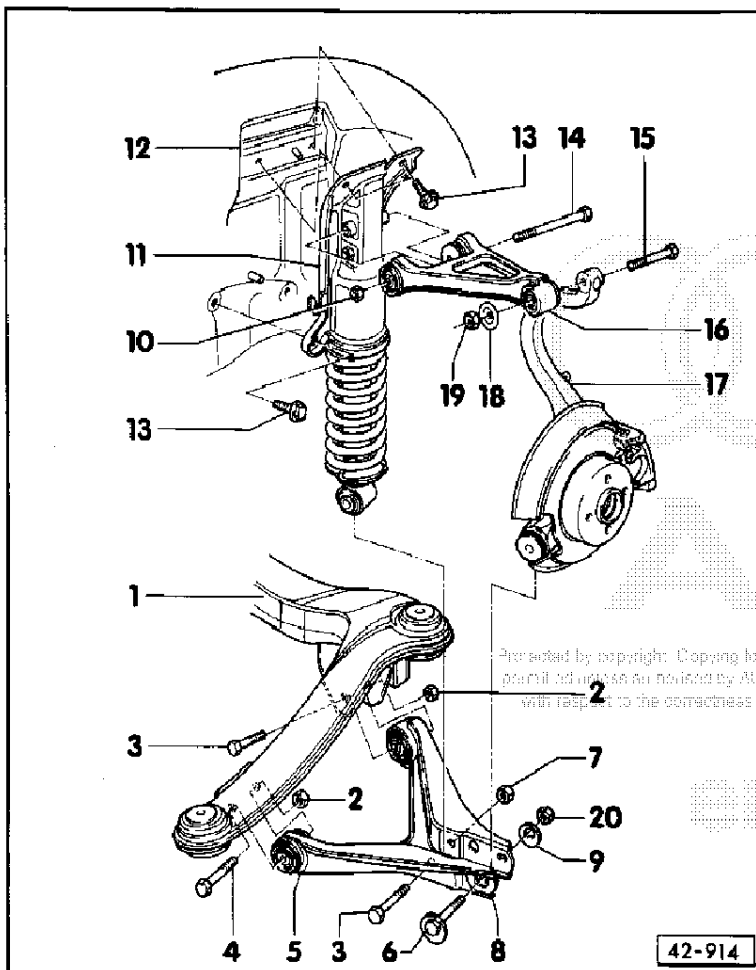
- ◆ Welded to transverse link on both sides.
- ◆ Ensure correct seating of eccentric bolt and washer.

9 – Eccentric washer

- ◆ Inner hole with lug

10 – Self-locking nut

- ◆ Always renew
- ◆ Tighten to 50 Nm and then give a further 90° turn.
- ◆ Hold upper transverse link horizontal whilst tightening.

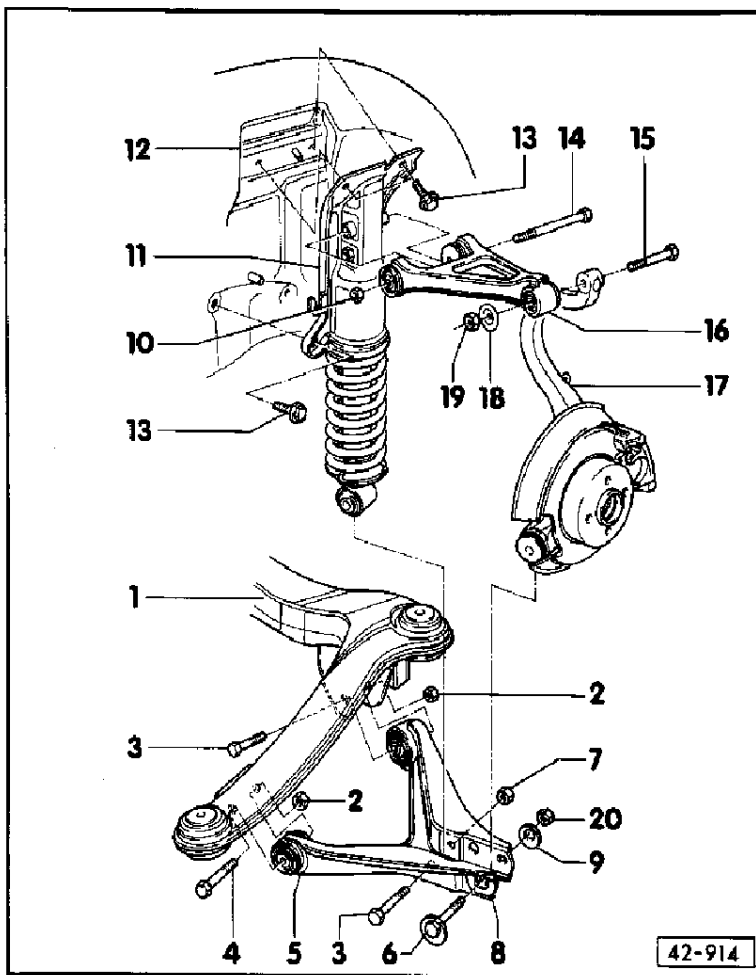


11 – Suspension strut

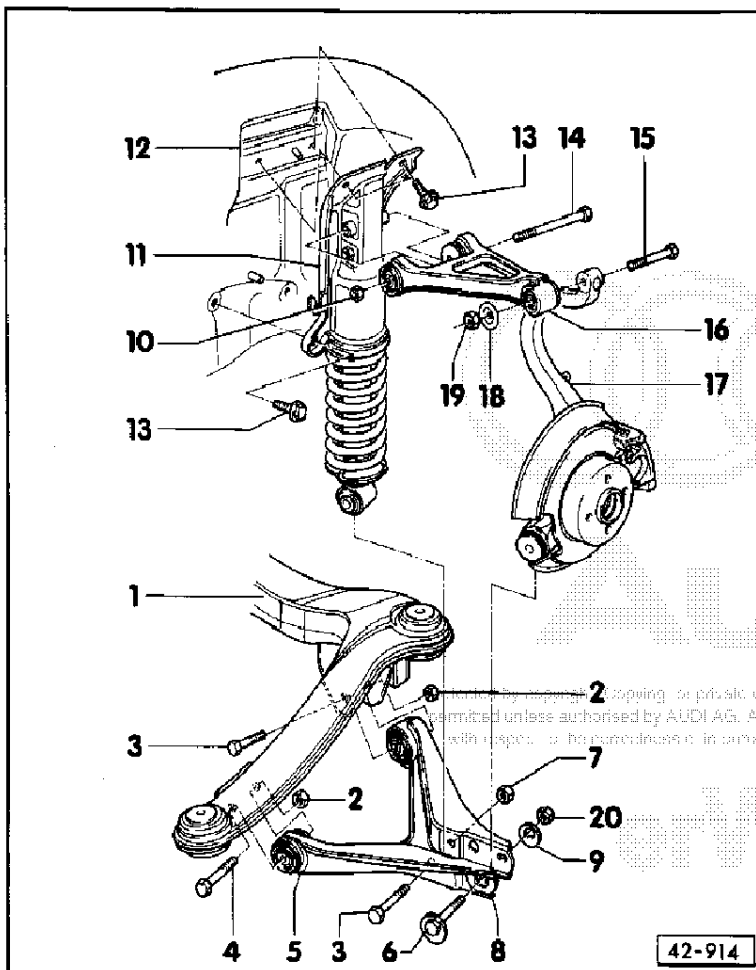
- ◆ Removing:
 - Remove wheel.
 - Remove suspension strut/lower transverse link securing bolt
 - Remove suspension strut/wheel housing securing bolts
 - Remove suspension strut/upper transverse link securing bolt
 - Take out suspension strut
- ◆ Servicing => Page 42-56
- ◆ Dismantling and assembling => Page 42-63

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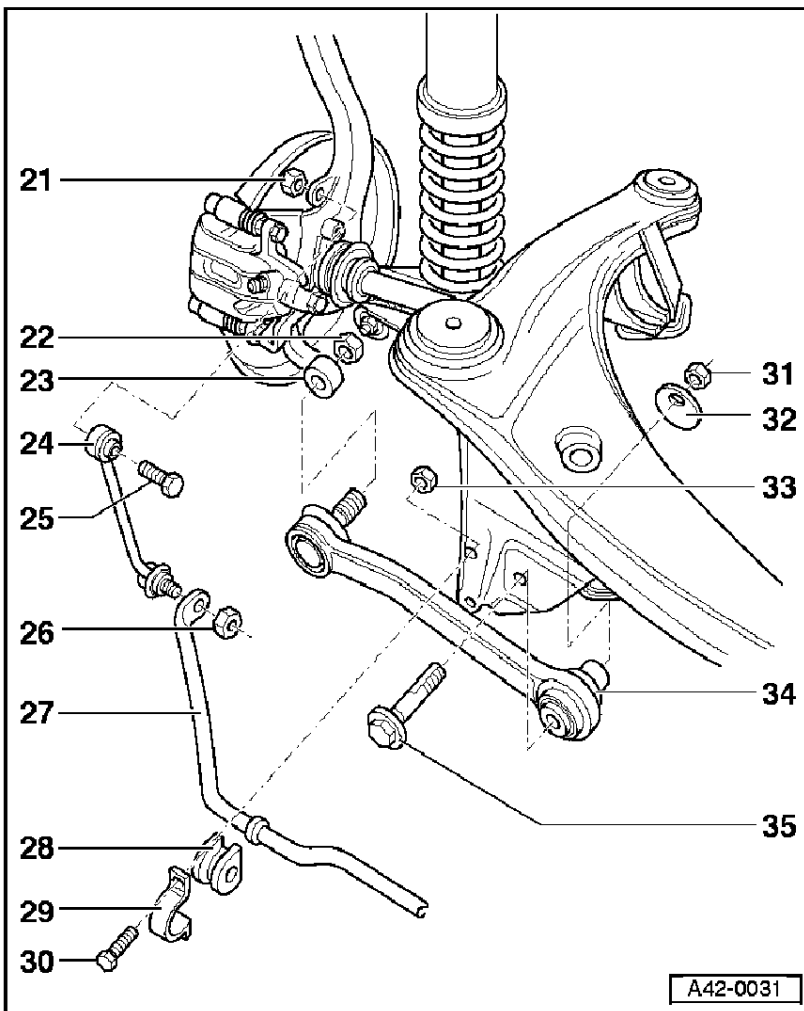




- 12 - Wheel housing
- 13 - Hexagon combi bolt, 55 Nm
- 14 - Hexagon bolt
 - ◆ Always renew
- 15 - Hexagon bolt
 - ◆ Always renew
- 16 - Upper transverse link
 - ◆ Servicing => Page 42-36

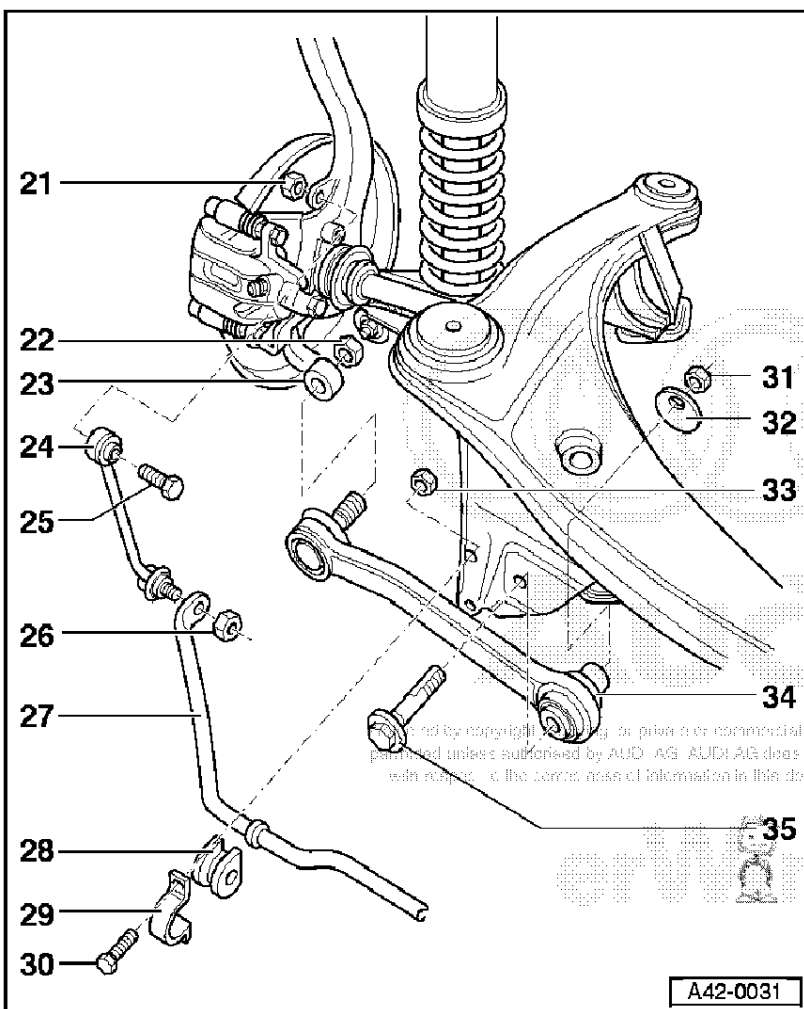


- 17 - Wheel bearing housing
 - ◆ Servicing => Page 42-48
- 18 - Washer
 - ◆ Always renew
- 19 - Self-locking nut
 - ◆ Always renew
 - ◆ Tighten to 50 Nm and then give a further 90° turn
- 20 - Self-locking nut, 95 Nm
 - ◆ Always renew
 - ◆ Vehicle must be standing on the ground when tightening.



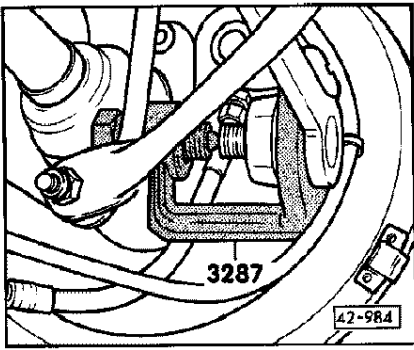
A42-0031

- 21 – Self-locking nut, 50 Nm
◆ Always renew
- 22 – Self-locking nut, 50 Nm
◆ Always renew
- 23 – Wheel bearing housing
◆ Servicing => Page 42-48
- 24 – Connecting link
- 25 – Hexagon bolt
- 26 – Self-locking nut, 40 Nm
◆ Always renew
- 27 – Anti-roll bar
- 28 – Mounting
- 29 – Clip
- 30 – Hexagon bolt, 25 Nm



A42-0031

- 31 – Self-locking nut, 85 Nm
◆ Always renew
◆ Vehicle must be standing on wheels when tightening.
- 32 – Eccentric washer
◆ Inner hole with lug
- 33 – Self-locking nut
◆ Always renew
- 34 – Track rod
◆ Pressing off => Fig. 1
- 35 – Eccentric bolt for adjusting toe
◆ Adjusting toe => Page 44-11
◆ Do not turn more than 90° to left or right from centre position (min. – max. adjustment).



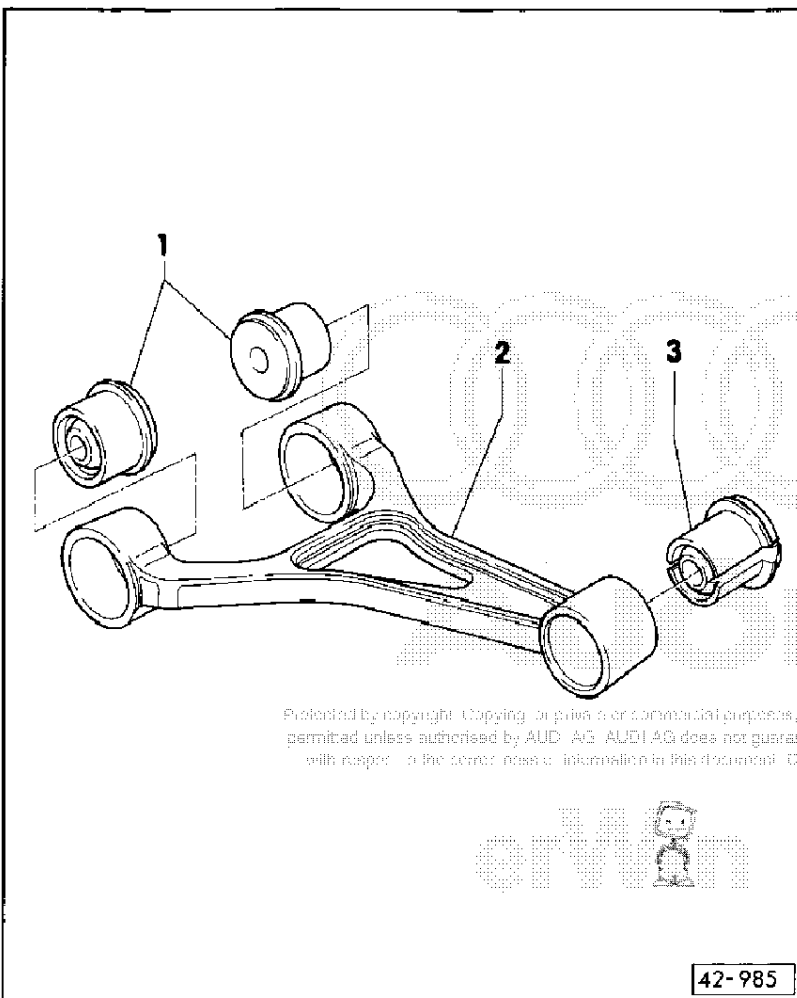
◀ Fig.1 Pressing track rod off rear axle steering arm

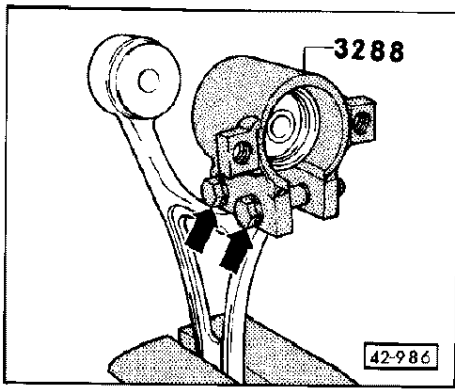
- Unscrew self-locking nut beforehand
- Take out eccentric bolt for removal

Servicing upper transverse link

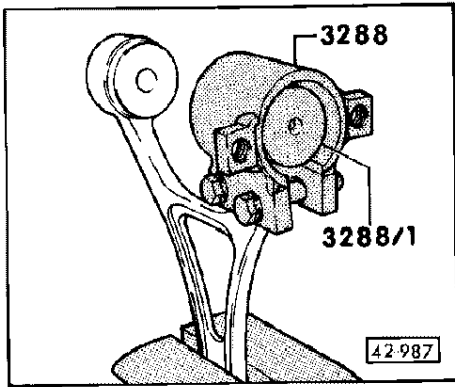
Servicing forged transverse link

- 1 - Bonded rubber bush
 - ◆ Replacing => Fig. 1 to 4
- 2 - Upper transverse link
 - ◆ Replacement part supplied with bonded rubber bushes installed
 - ◆ Identical part on left and right
- 3 - Bonded rubber bush
 - ◆ Replacing => Fig. 5 to 8
 - ◆ No installation position is envisaged for mounting with slot in outer casing

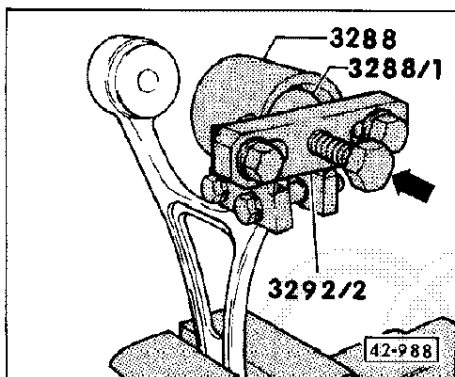




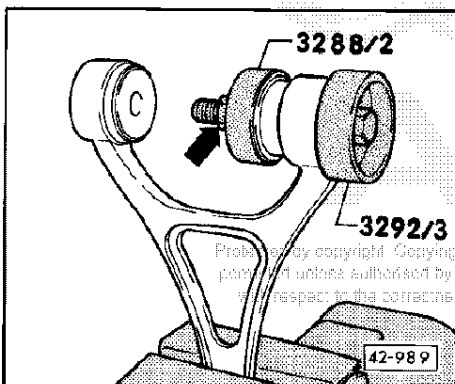
◀ **Fig.1 Inserting assembly tool in transverse link**
 – Insert assembly tool -3288- as shown in transverse link and firmly tighten both securing bolts.



◀ **Fig.2 Inserting thrust piece in transverse link**
Note:
Make sure thrust piece -3288/1- is correctly positioned. Otherwise eye of transverse link will be damaged.



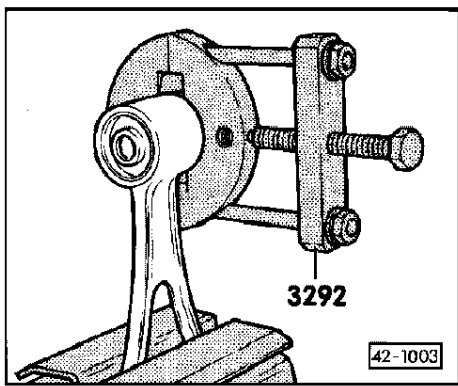
◀ **Fig.3 Inserting cross piece in assembly tool**
 – Align cross piece -3292/2- with assembly tool -3288- and screw on
 – Screw spindle into cross piece and, pressing bonded rubber bush out of transverse link with thrust piece -3288/1-.



◀ **Fig.4 Pulling bonded rubber bush into transverse link**
 – Attach bonded rubber bush at right angles to transverse link.
 – Screw thrust pieces -3288/3- and -3292/2- together as shown with hexagon bolts, thereby drawing mounting into transverse link eye to stop.

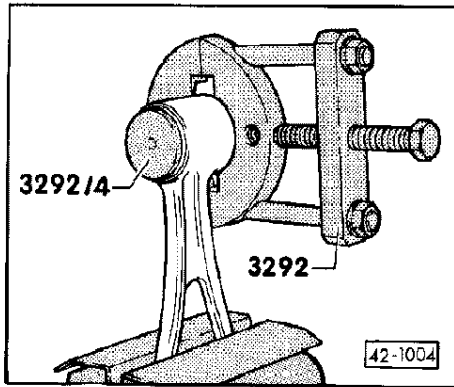
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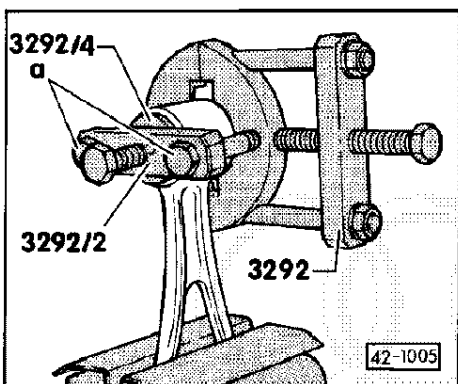


◀ Fig.5 Inserting assembly tool in transverse link

- Insert assembly tool -3292- in such a way that the radii of the two jaws of the special tool are positioned between mounting and transverse link eye.
- Screw in threaded spindle to stop so that the bonded rubber bush is slightly pressed off transverse link eye.

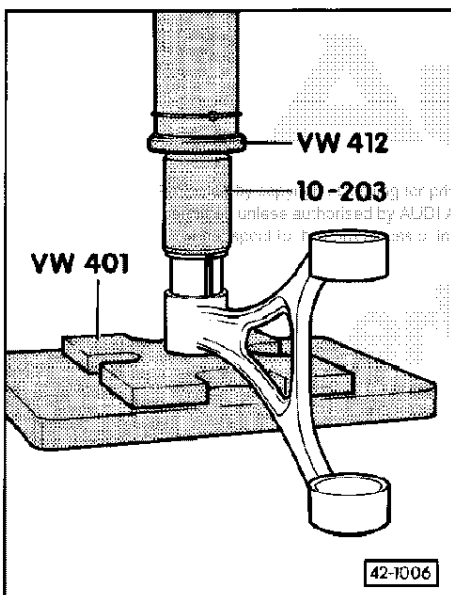


◀ Fig.6 Inserting thrust piece in transverse link



◀ Fig.7 Pressing bonded rubber bush out of transverse link

- Fasten cross piece -3292/2- with the hexagon bolts -a- (M10 x 80) provided to assembly tool -3292-.
- Centre cross piece with respect to thrust piece -3292/4-.
- Screw spindle into cross piece until bonded rubber bush is pressed out.

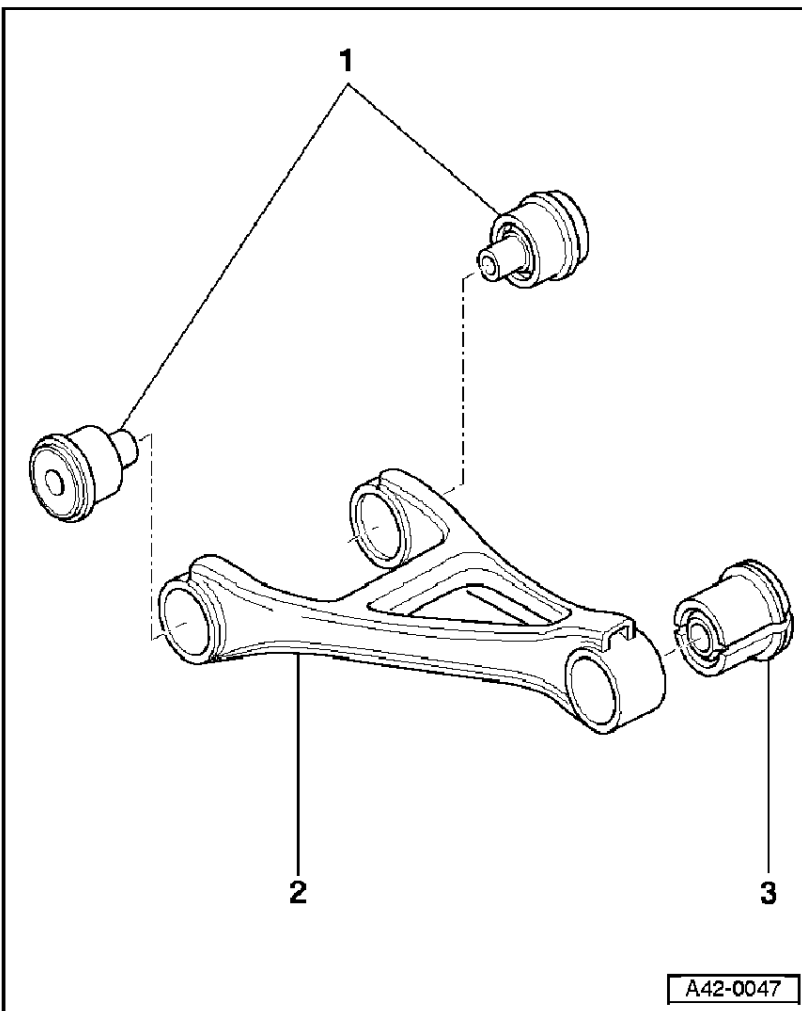


◀ Fig.8 Pressing bonded rubber bush into transverse link

- Press bush home.

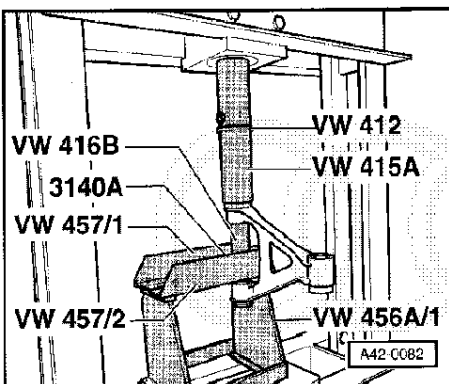
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Servicing sheet-steel transverse link

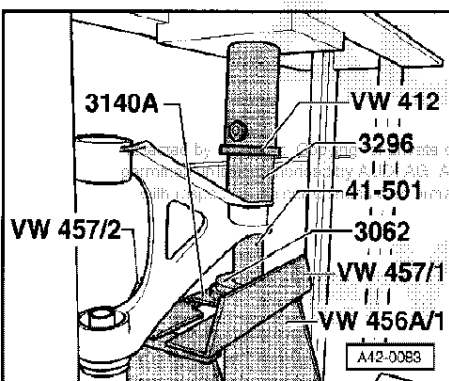


- 1 – Bonded rubber bush
 - ◆ Pressing out => Fig. 9
 - ◆ Pressing in => Fig. 11
- 2 – Upper transverse link
 - ◆ Replacement part supplied with bonded rubber bushes installed
 - ◆ Identical part on left and right
- 3 – Bonded rubber bush
 - ◆ Pressing out => Fig. 10
 - ◆ Pressing in => Fig. 12
 - ◆ No installation position is envisaged for mounting with slot in outer casing

42-41



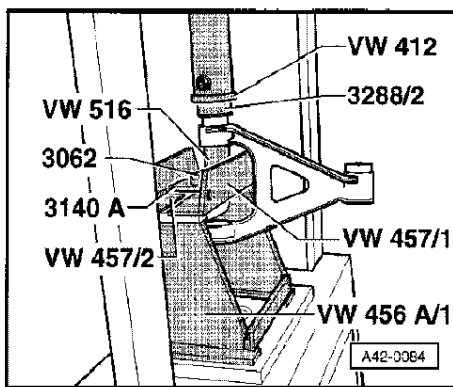
- ◀ **Fig.9 Pressing bonded rubber bush out of transverse link**
 - If tube -VW 416B- tilts when pressing out, relieve pressure and start again.
 - If surface protection of transverse link is damaged, treat accordingly to prevent corrosion.



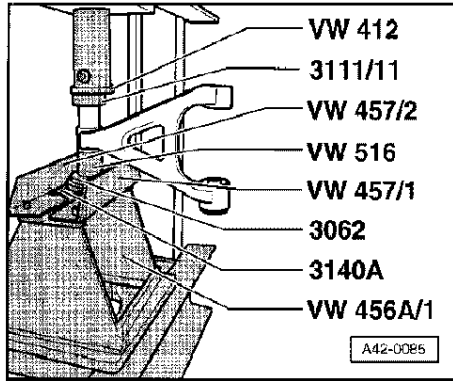
- ◀ **Fig.10 Pressing bonded rubber bush out of transverse link**

Note:
Ensure exact positioning of lower tube section -41-501-.

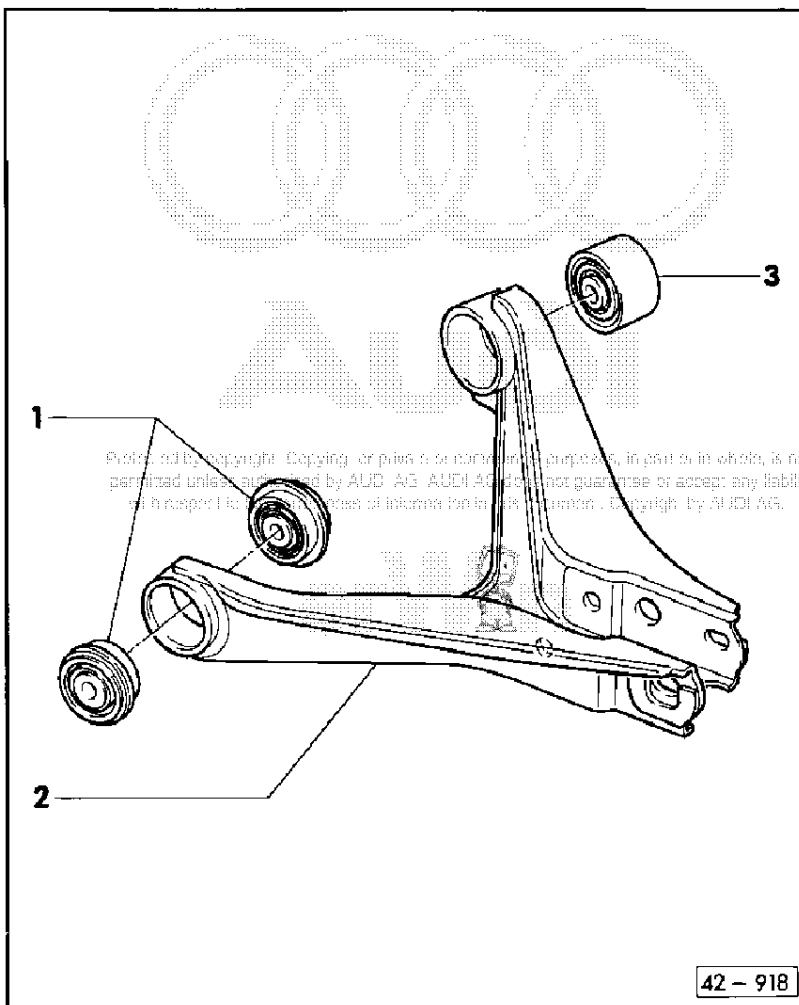
42-42



- ◀ Fig.11 Pressing bonded rubber bush into transverse link
- Attach bonded rubber bush at right angles to transverse link.
 - Press bush in to stop.

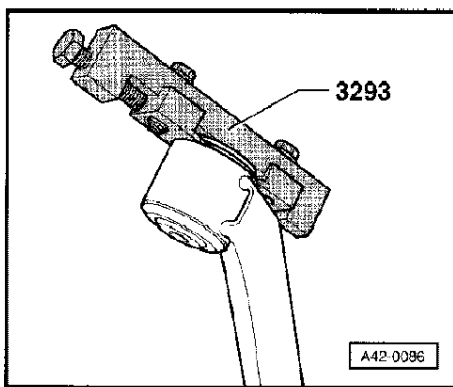


- ◀ Fig.12 Pressing bonded rubber bush into transverse link
- Press bush in to stop.



Servicing lower transverse link

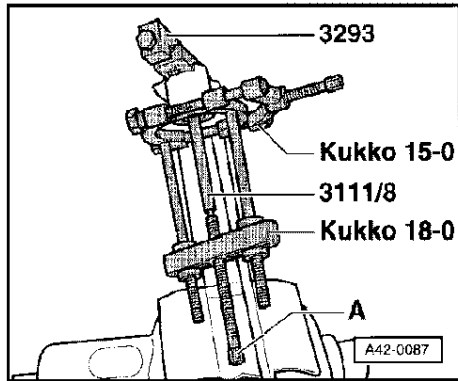
- 1 - Rear bonded rubber bush
 - ◆ Replacing => Fig. 1 to 4
 - ◆ Always replace both halves of bush
- 2 - Lower transverse link
 - ◆ Replacement part is supplied with bonded rubber bushes installed
- 3 - Front bonded rubber bush
 - ◆ Replacing => Fig. 5



◀ Fig.1 Inserting assembly tool in transverse link

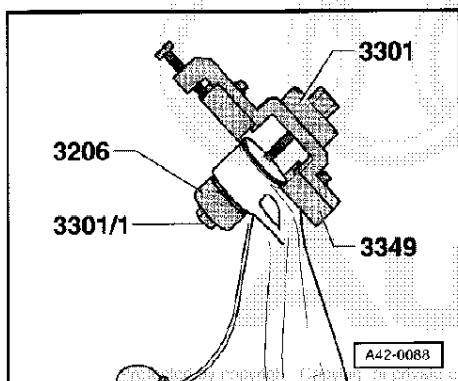
Notes:

- ◆ The two collars of the bonded rubber bushes must be flanged slightly before inserting the special tool.
- ◆ Insert the special tool very carefully.
- Insert assembly tool -3293- in such a way that the radii of both jaws of the special tool are positioned between mounting and transverse link eye.
- Screw in threaded spindle to stop so that the bonded rubber bush is slightly pressed off transverse link eye.



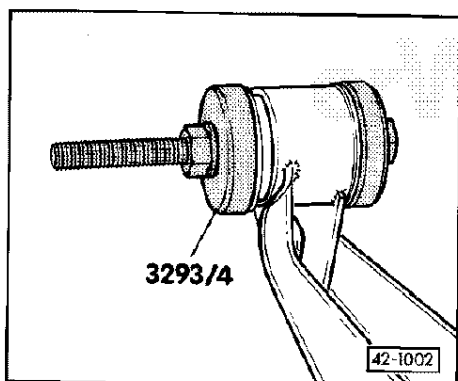
◀ Fig.2 Inserting puller in transverse link

- Insert the commercially available Kukko puller -15-0- in the transverse link.
- Insert the drift and special tool -3111/8- in bore of bonded rubber bush.
- Next, screw Kukko -18-0- into -Kukko -15-0- and centrally align.
- Then screw in threaded spindle -A- until the bonded rubber bush is pulled out.



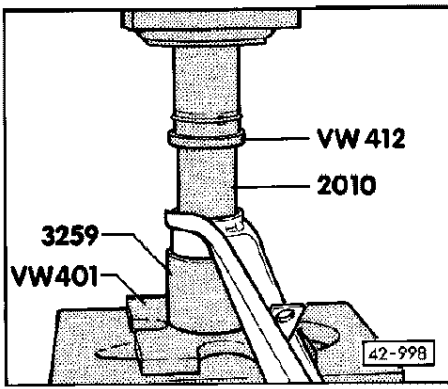
◀ Fig.3 Pulling second half of bonded rubber bush out of transverse link

- Insert the special tool -3349- in transverse link.
- Then remove second half of bush by screwing in spindle -3301/1-.



◀ Fig.4 Pulling bonded rubber bush into transverse link

- Insert both halves of the bonded rubber bush with the thrust pieces -3293/4- and the threaded spindle at right angles into the transverse link.
- Draw in mounting to stop by tightening threaded spindle -A-.



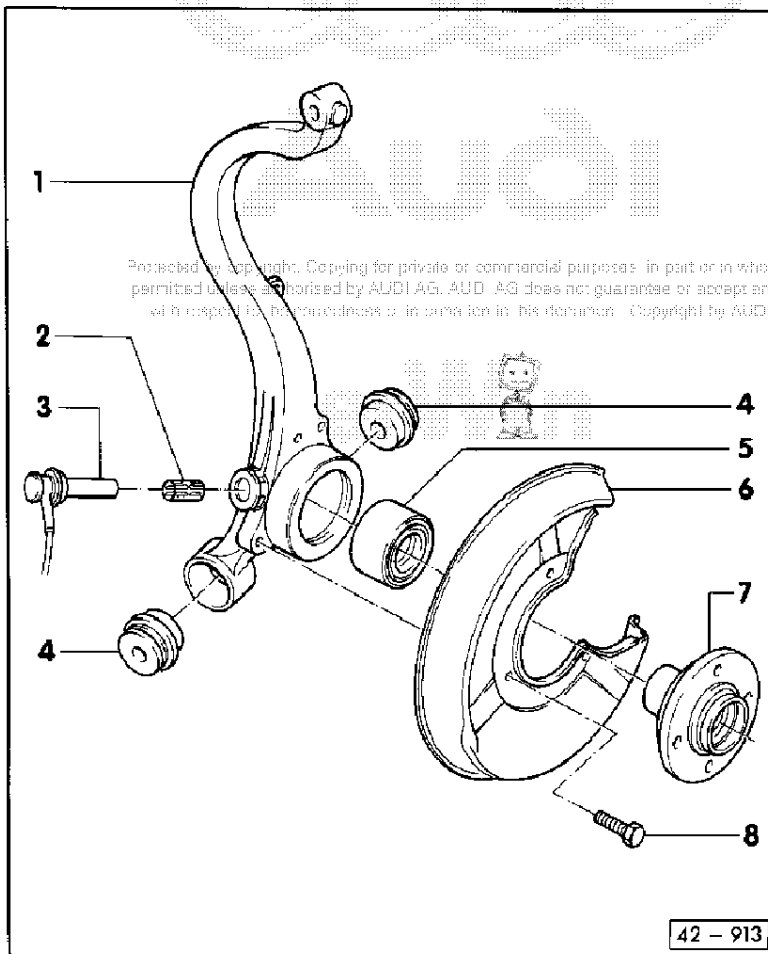
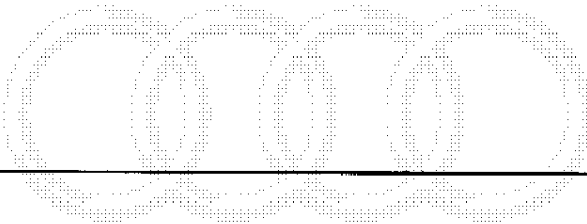
◀ Fig.5 Pulling out/pressing in bonded rubber bush for lower transverse link

– Press bush in flush.

Note:

When pressing out, ensure that the bonded rubber bush does not rest on front of special tool -3259-.

– Collar of special tool -3259- points to special tool -VW 401-.



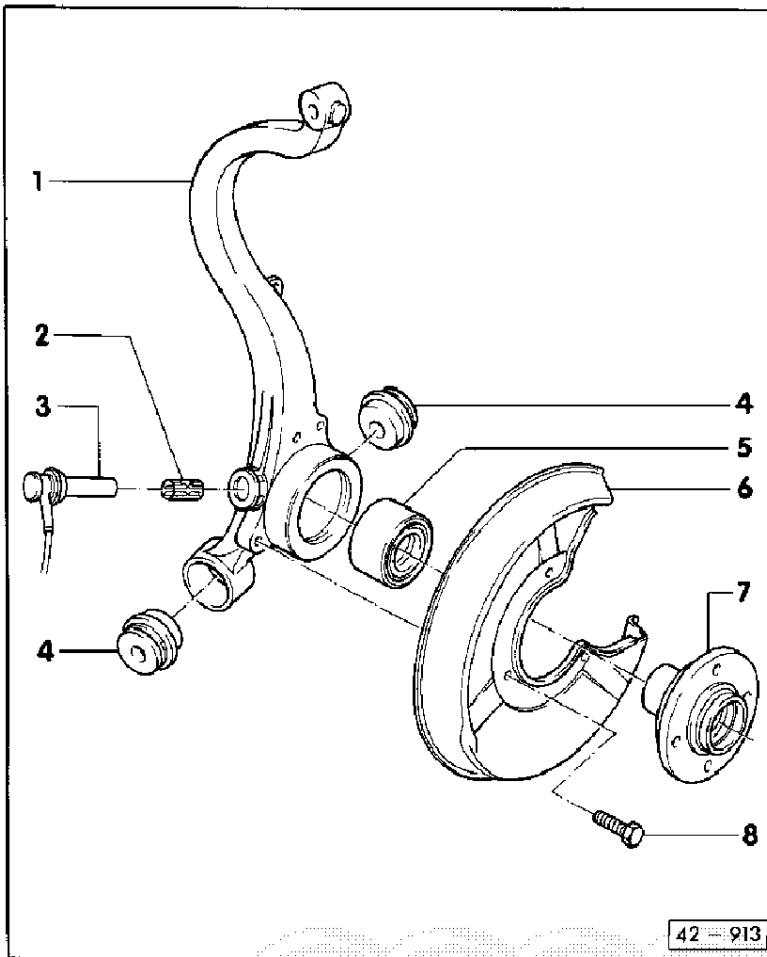
Servicing wheel bearing housing

1 – Wheel bearing housing

- ◆ Do not grease bearing seat in wheel bearing housing before pressing in wheel bearing
- ◆ After replacing wheel bearing housing, perform rear axle wheel alignment => Page 44-11
- ◆ Supplied as replacement part with hole for accommodating clamping sleeve/wheel speed sensor

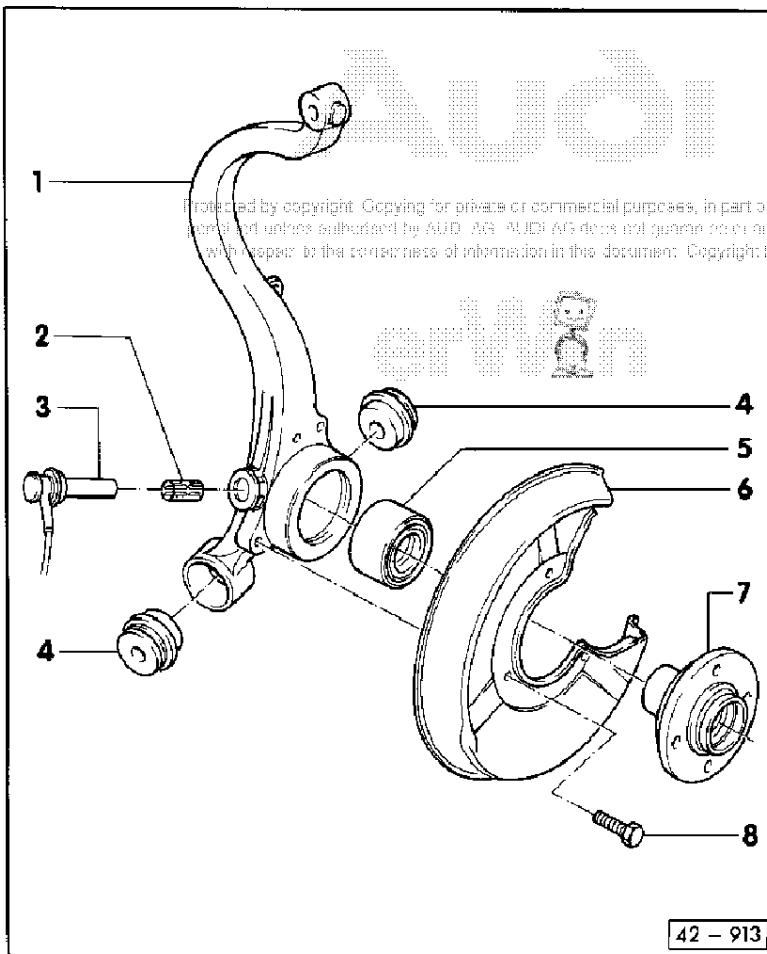
2 – Clamping sleeve

- ◆ Grease all round with brake cylinder paste before inserting in wheel bearing housing
- ◆ Press home in wheel bearing housing.



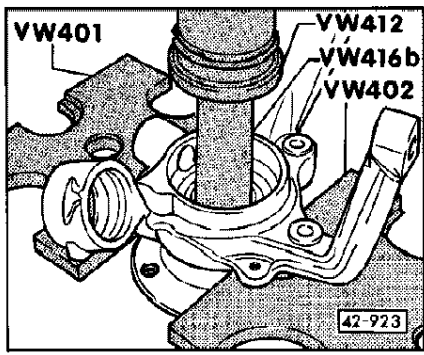
- 3 - Wheel speed sensor**
 - ◆ Pull out to remove
 - ◆ Press home by hand to install
- 4 - Bonded rubber bush**
 - ◆ Replacing => Fig. 8 to 10
 - ◆ Always replace both halves of bush
- 5 - Wheel bearing**
 - ◆ Stepped internal diameter
 - ◆ Note correct installation position: Large internal diameter of wheel bearing points to wheel hub.
 - ◆ Pressing out destroys the bearing
 - ◆ Pressing out => Fig. 2
 - ◆ Pressing in $\varnothing 75$ => Fig. 4
 - ◆ Pressing out $\varnothing 82$ => Fig. 5

42-49

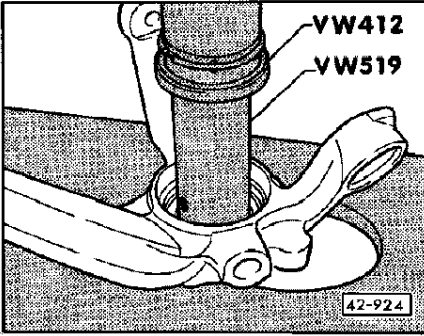


- 6 - Cover plate**
 - ◆ Bolt to wheel bearing housing
- 7 - Wheel hub**
 - ◆ Pressing out => Fig. 1
 - ◆ Pressing in => Fig. 3
 - ◆ Pressing off bearing inner race => Fig. 6 and 7
 - ◆ Vehicles with 169 kW engine and vehicles with 16" running gear feature 5-hole wheel hub
- 8 - Hexagon bolt, 10 Nm**

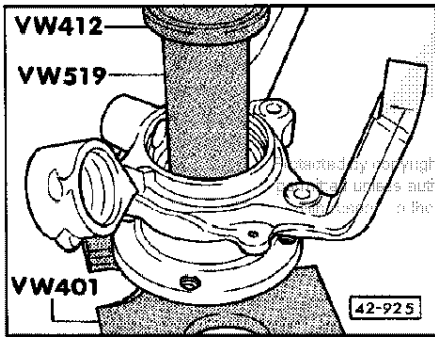
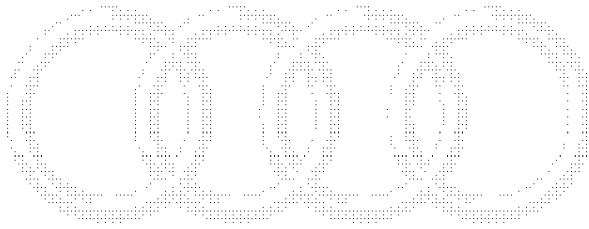
42-50



◀ Fig.1 Pressing out wheel hub



◀ Fig.2 Pressing out wheel bearing.

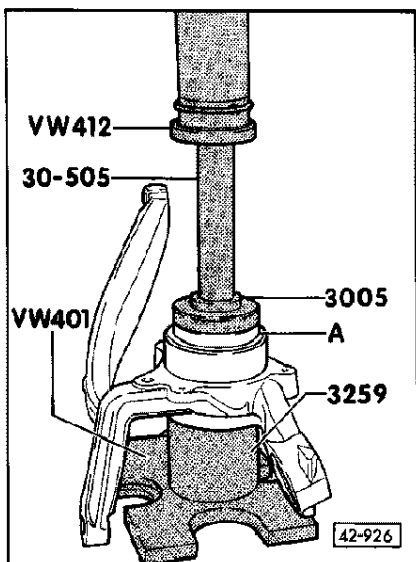


◀ Fig.3 Pressing in wheel hub

Note:

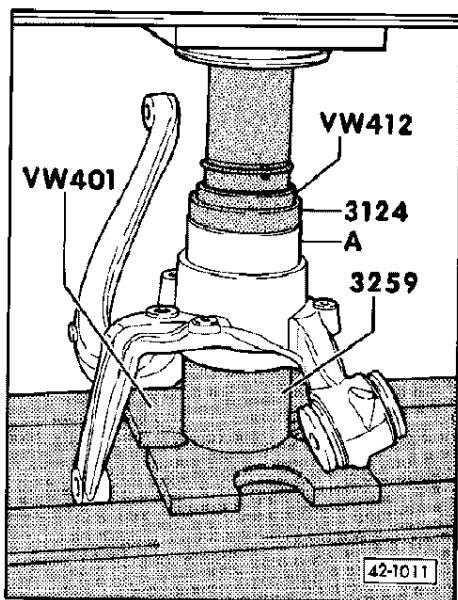
When pressing in, tool VW 519 must only rest on inner race.

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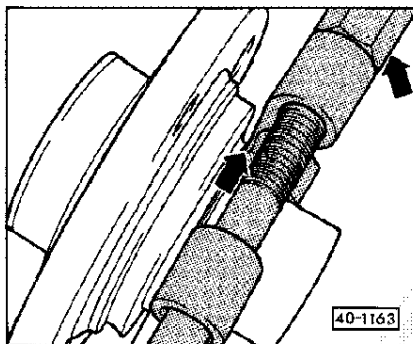


◀ Fig.4 Pressing home wheel bearing -A-, ø 75 mm

– Large internal diameter of wheel bearing points to wheel hub.



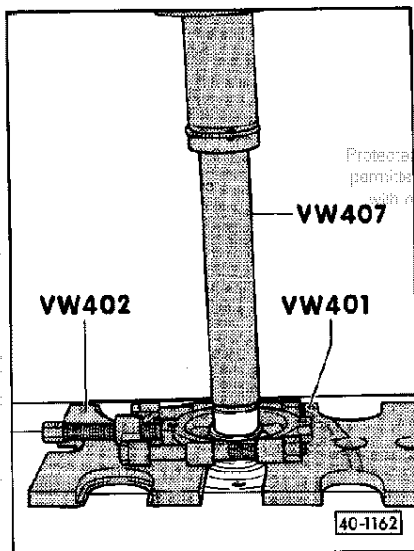
◀ Fig.5 Pressing home wheel bearing -A-, ø 82 mm
 – Large internal diameter of wheel bearing points to wheel hub.



◀ Fig.6 Inserting separating device
 – Insert separating device into annular groove of bearing inner race and pre-tension with spindle.

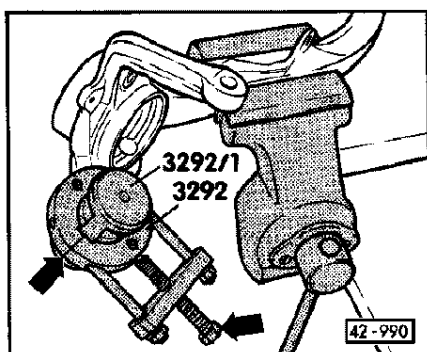
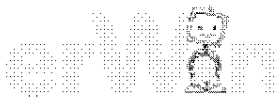
Note:

Use commercially available separating device e.g. 15-17 from Kukko.

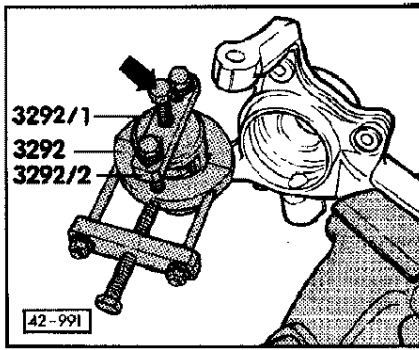


◀ Fig.7 Pressing bearing inner race off wheel hub

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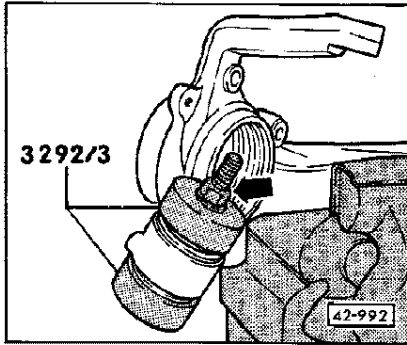


◀ Fig.8 Inserting assembly tool in wheel bearing housing
 – Position support 3292/1 on bonded rubber bush.
 – Push assembly tool -3292- over support -3292/1- until contact is made.
 – Tighten threaded spindle up to stop so that the two jaws of the assembly tool -3292- are positioned in the annular groove between the bonded rubber bush and wheel bearing housing.



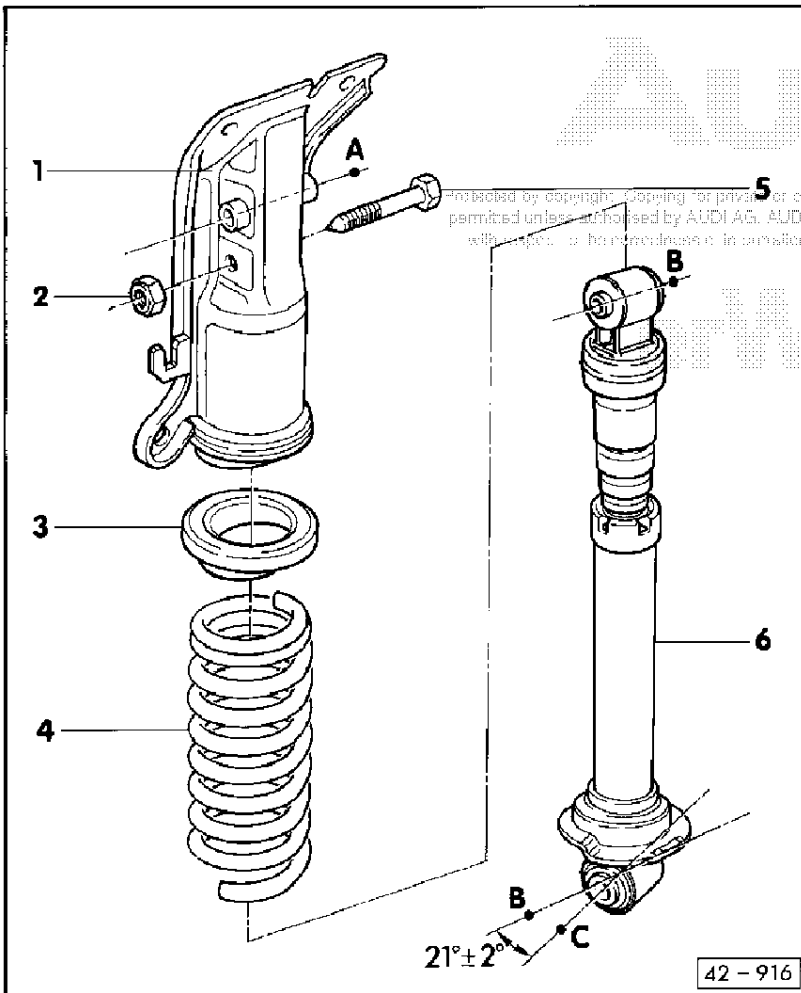
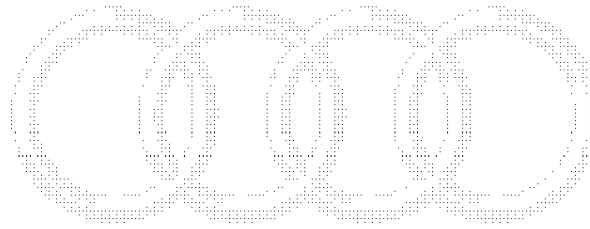
◀ Fig.9 Screwing cross piece to assembly tool

- Centre cross piece 3292/2 and position it in full contact with support 3292/1 by tightening the two hexagon bolts.
- Screw in spindle of cross piece 3292/2 until the mounting is pulled out.



◀ Fig.10 Pulling bonded rubber bush into wheel bearing housing

- Insert bonded rubber bush on both sides at right angles in hole in wheel bearing housing.
- Position a thrust piece 3293/3 on both mountings and draw in threaded spindle to stop.



Servicing suspension strut

Dismantling and assembling suspension strut => Page 42-63

1 - Adapter

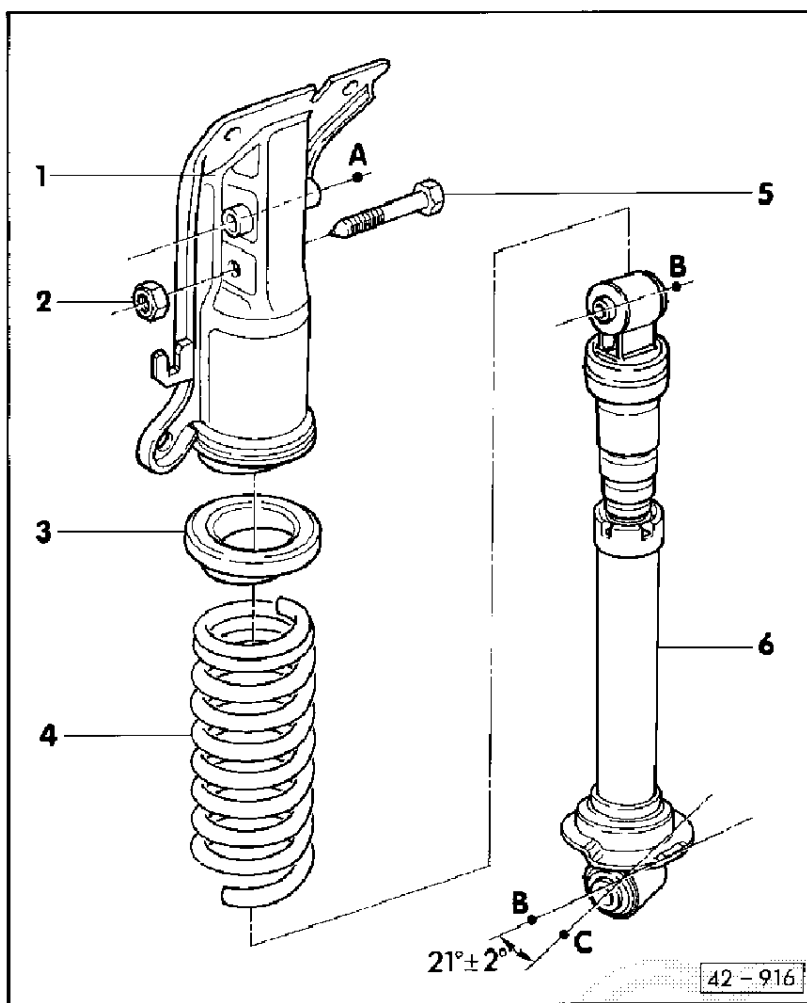
- ◆ Different versions on left and right
- ◆ Axes -A- and -B- are parallel.

2 - Self-locking nut

- ◆ Always renew
- ◆ Tighten to 95 Nm and then give a further 90° turn.

3 - Damping ring

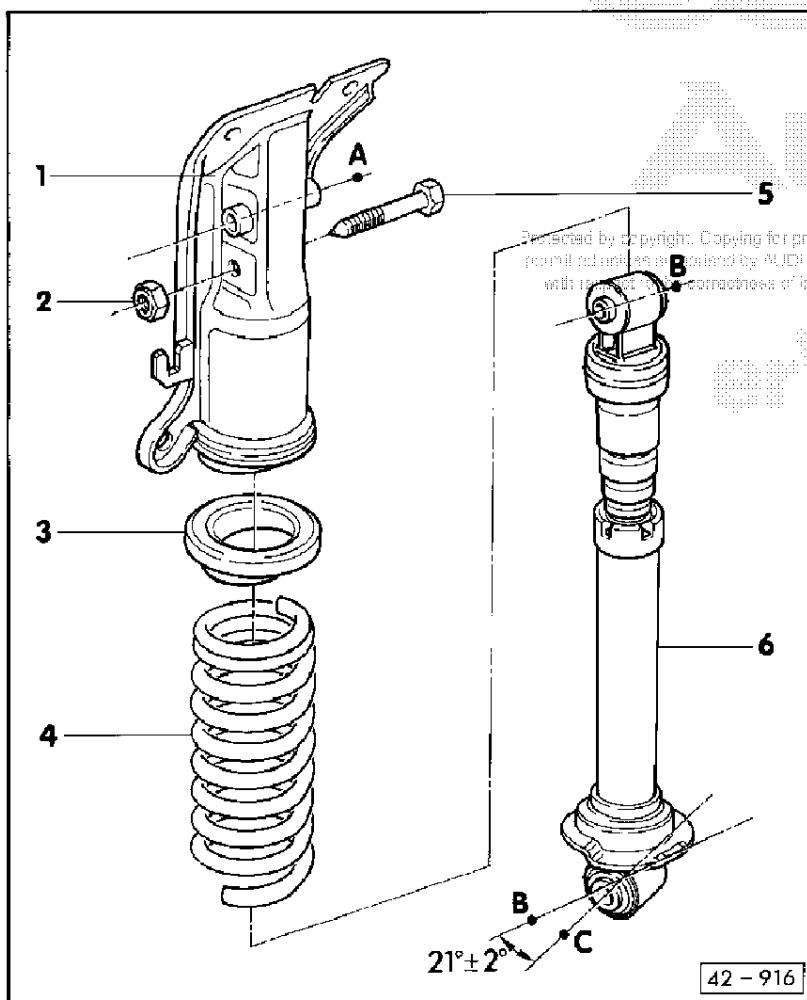
- ◆ Apply talc before fitting
- ◆ Attach to coil spring so that it touches the stop on the end of the spring



4 - Coil spring

- ◆ Refer to Parts List
- ◆ Prior to replacement, consult vehicle data sticker as that is the only way to establish spring version
- ◆ The codes on the data sticker stand for:
 - 1BA = Standard version
 - 1BE = Sports version
 - 1BB = Heavy duty version
- ◆ Attach to shock absorber and turn in such a way that the end of the spring coil touches the stop of the lower spring plate
- ◆ Installation position: Colour code on spring points downwards to spring plate
- ◆ If suspension strut has been installed properly, lower end of spring faces rear on left and front on right

42-57



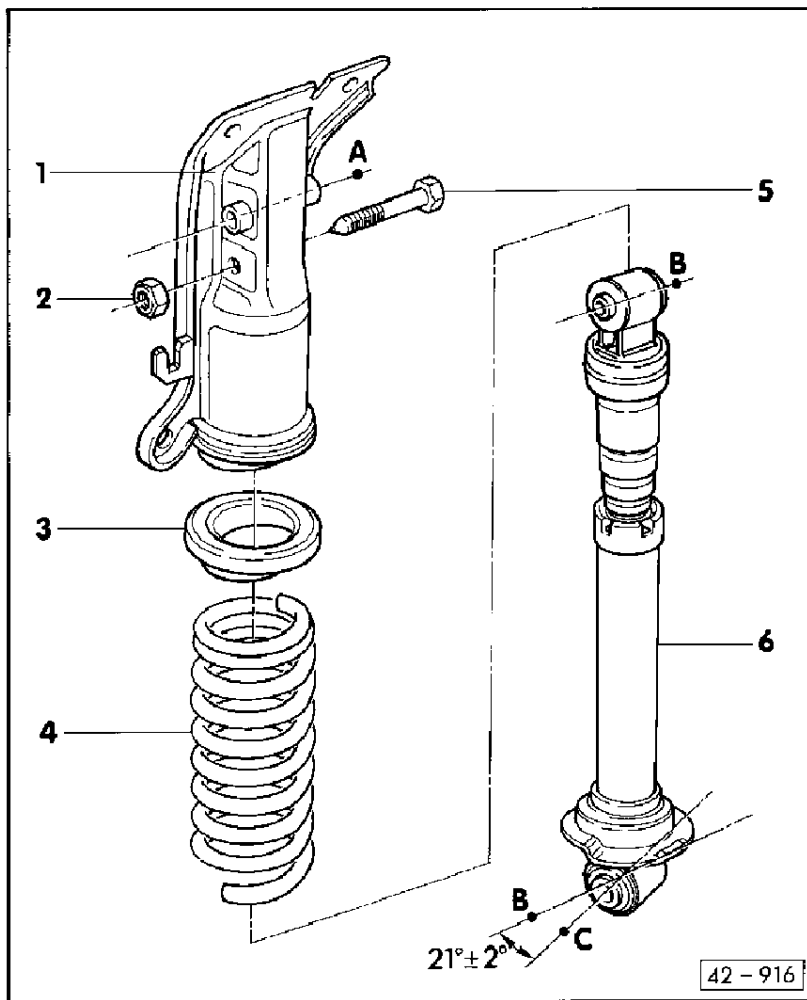
Notes:

- ◆ Up to chassis no. 8C NA 015 724 there is no running gear information on the data sticker. In such cases, all vehicles are to be adjusted as indicated in the specified value table for vehicles with standard and sports version when performing wheel alignment. When replacing shock absorbers or coil springs, determine running gear version by way of part no. of rear shock absorbers in combination with parts list.
- ◆ As of chassis no. 8C NA 015 725 the data sticker is provided with the above identification.

5 - Hexagon bolt

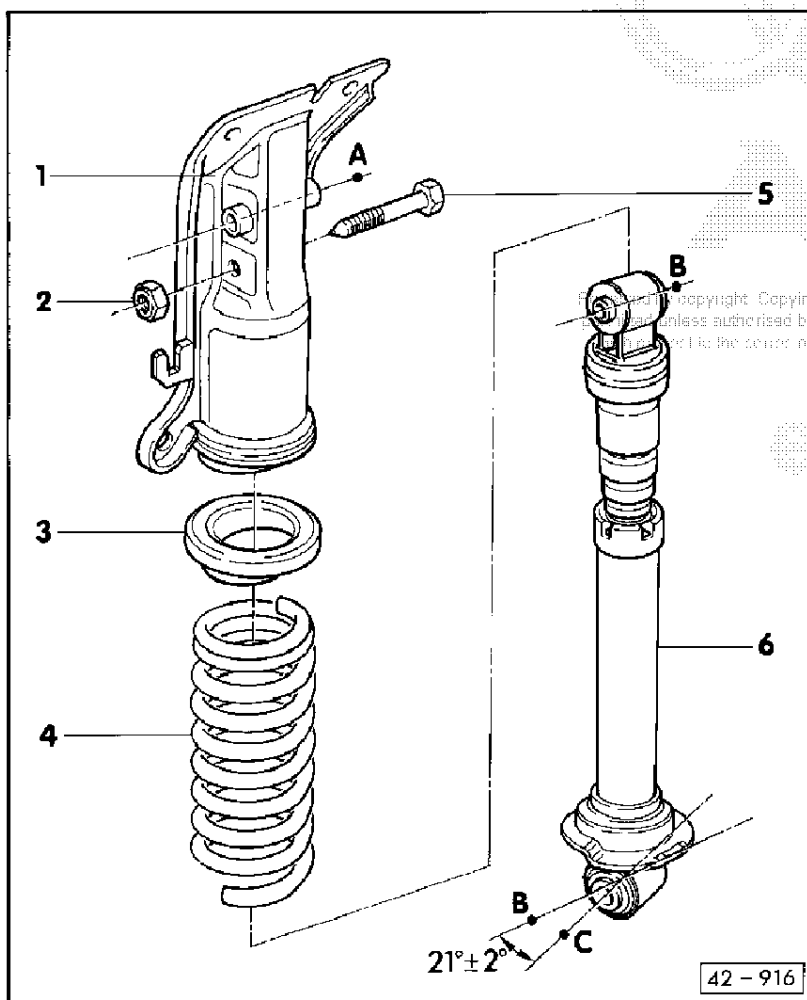
- ◆ Always replace

42-58

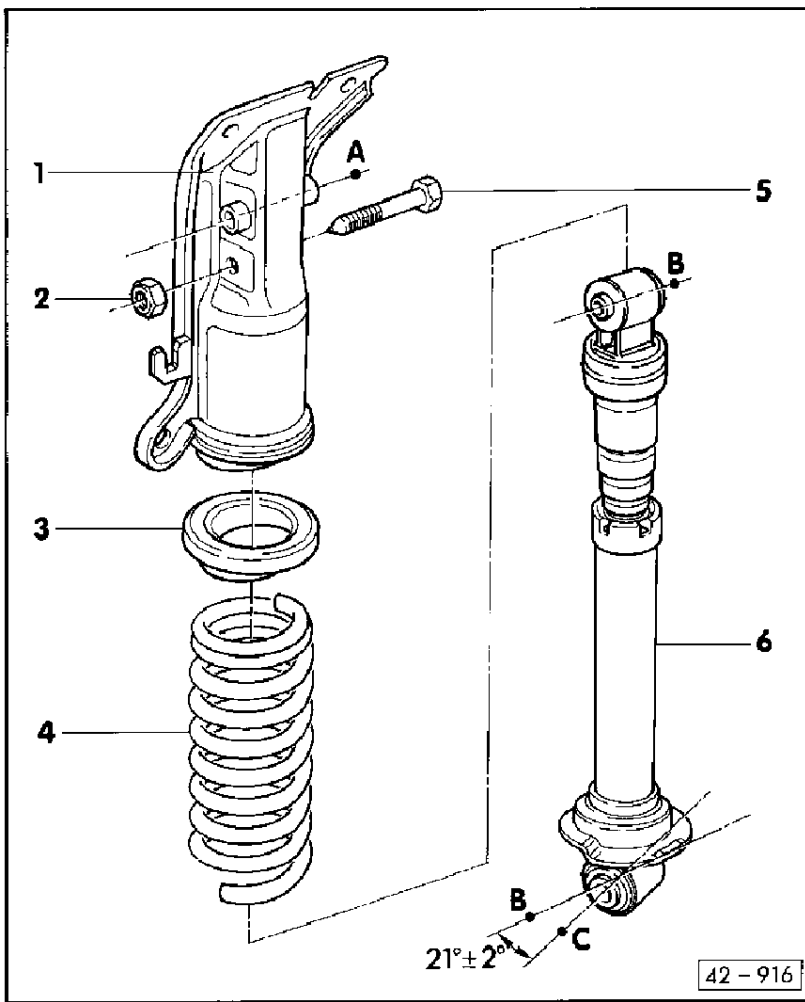


6 - Shock absorber

- ◆ Defective shock absorbers must always be properly prepared before being scrapped.
- = > "Special Service Information" binder: Running gear no. 2; edition 03.90
- ◆ Refer to Parts List
- ◆ Prior to replacement, consult vehicle data sticker as that is the only way to establish spring version
- ◆ The codes on the data sticker stand for:
 - 1BA = Standard version
 - 1BE = Sports version
 - 1BB = Heavy duty version
- ◆ => Notes on -Item 4-
- ◆ Can be replaced individually

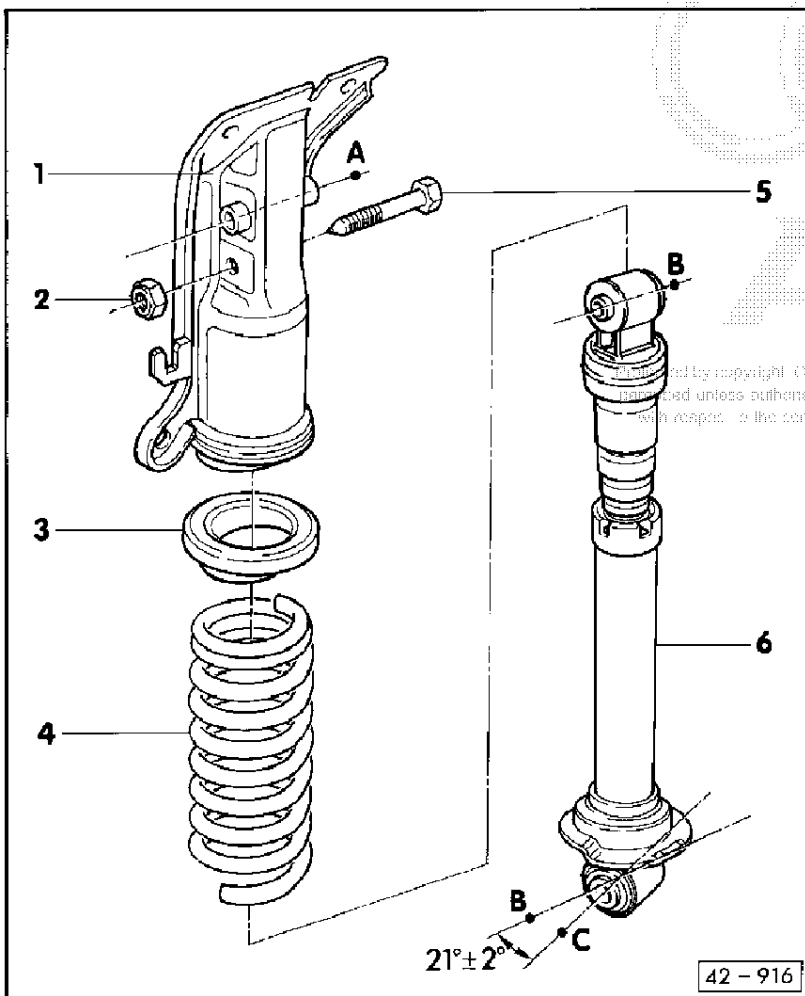


- ◆ Replacement part supplied with lower spring plate pressed on
- ◆ Vehicles with sports running gear are equipped with gas-filled shock absorbers.
- ◆ Axes -A- and -B- are parallel.
- ◆ On assembly note angle between axis -B- and axis -C- of $21^{\circ} \pm 2^{\circ}$



◆ Checking (removed) shock absorber: Check shock absorber by hand (hold in installation position) by extending and compressing it. Shock absorber must move evenly and smoothly over entire stroke. Shock absorbers that have been stored for a lengthy period may have to be pumped several times. Defective shock absorbers make a "banging" noise whilst driving. If they are functioning properly, slight traces of shock absorber oil do not signify that replacement is necessary. Considerable loss of oil will result in deficiencies in the expansion and compression stages.

42-61



◆ Checking gas-filled shock absorber: Compress shock absorber by hand. The piston rod must move evenly and smoothly over the entire stroke. Release piston rod. If shock absorbers have sufficient gas pressure, piston rod returns automatically to initial position. If this is not the case, the shock absorber need not always be replaced. As long as there has not been a major loss of oil, the mode of operation corresponds to that of a conventional shock absorber.

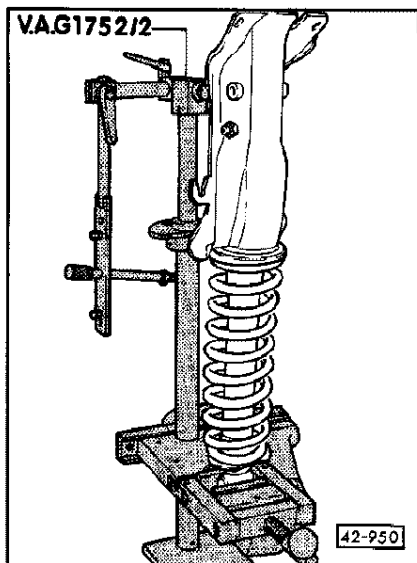
=> "Special service information" binder: Running Gear No. 17

42-62

Dismantling and assembling suspension strut

Dismantling:

- Remove suspension strut – refer to Servicing Rear Axle, Page 42-30, -Item 11-.

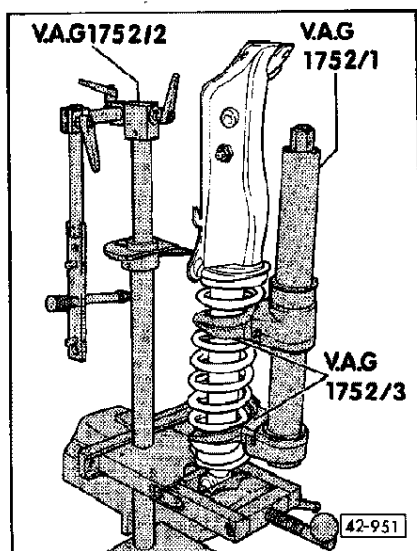


- ◀ - Suspension strut in spring tensioner V.A.G 1752.

Note:

Illustration shows left suspension strut.

— 42-63 —

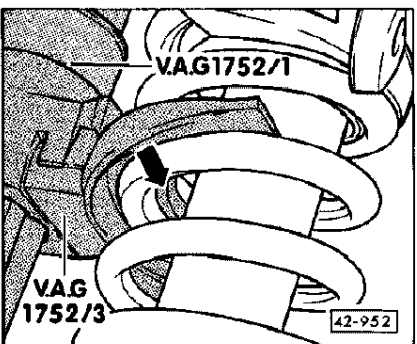


- ◀ - Pretension coil spring with tensioner V.A.G 1752/1 ...



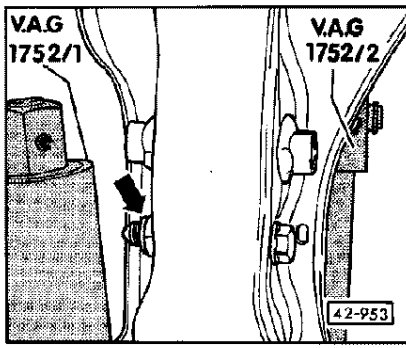
Audi

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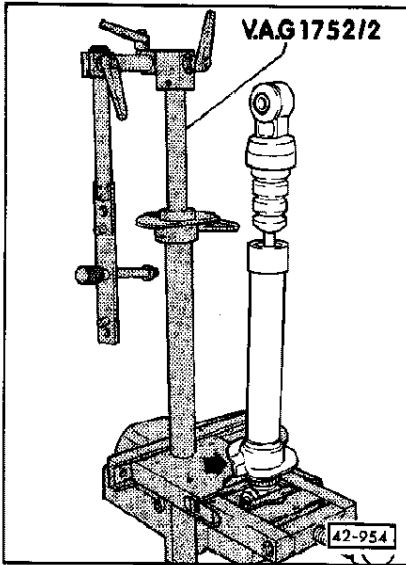


- ◀ - ... taking care to ensure that the coil spring is seated correctly in adapter V.A.G 1752/2 -arrow-.

— 42-64 —

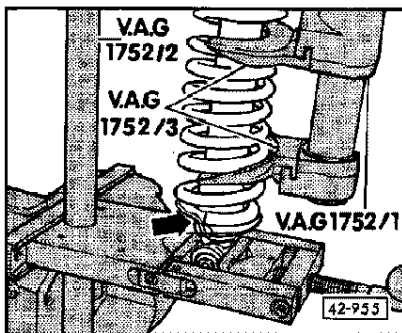


- ◀ – Unscrew nut -arrow- and remove bolt.
 - Remove adapter and damping ring.
 - Remove pretensioned spring with tensioner V.A.G 1752/1.
 - Remove defective shock absorber from spring tensioner V.A.G 1752 and treat appropriately prior to scrapping.
 - = > "Special Service Information" binder: Running gear no. 2; edition 03.90
- Assembly:**

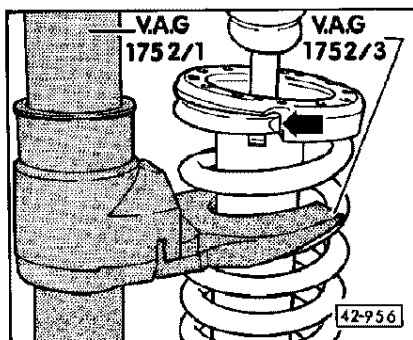
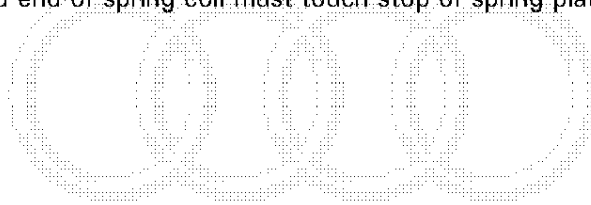


- ◀ – New shock absorber as shown in spring tensioner V.A.G 1752.
- Note:**
Note position of notch on lower spring plate -arrow-.

————— 42-65 —————



- ◀ – Pretension new coil spring with tensioner V.A.G 1752/1.
- Position pretensioned coil spring on shock absorber. Colour code on coil spring must point downwards towards spring plate and end of spring coil must touch stop of spring plate -arrow-.

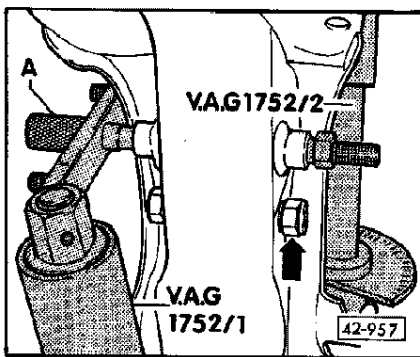


- ◀ – Attach damping ring in such a way that the end of the spring coil touches the stop of the damping ring -arrow-.

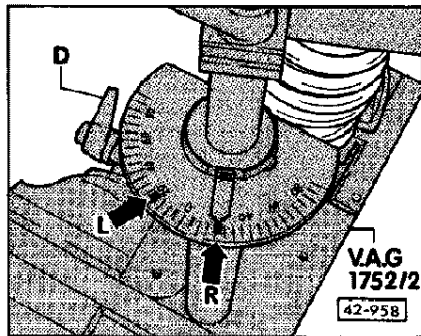
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————— 42-66 —————



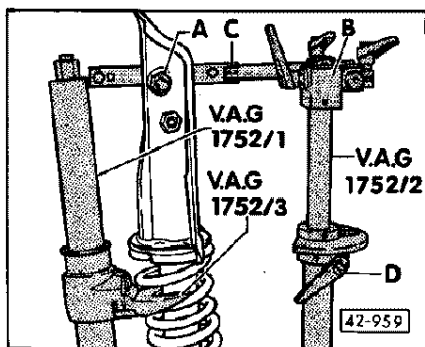
- Fit adapter.
 - Insert fastening bolt in adapter and loosely screw on nut - arrow-.
- Note:**
Nut points in direction of travel.
- Insert locating pin -A- in adapter and secure loosely with nut.



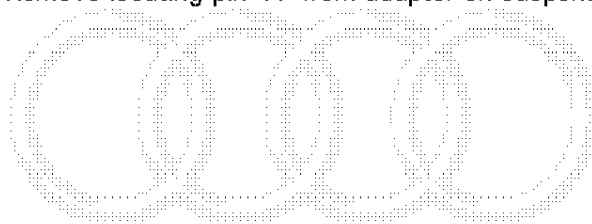
- Turn adapter accordingly until pointer on scale of spring tensioner V.A.G 1752 points to 210 ± 20 (lock bolt -D- slack) and ...
 - L = left suspension strut
 - R = right suspension strut

Note:
Illustration shows position of scale when assembling the right suspension strut.

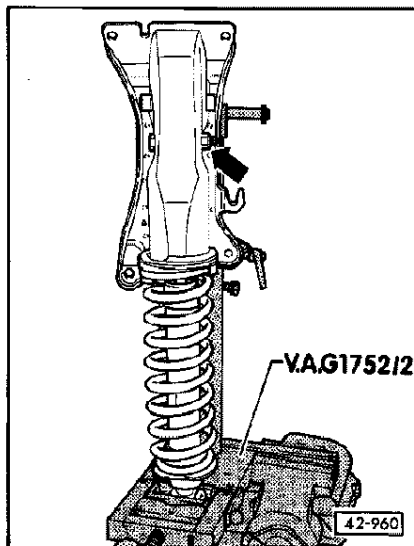
42-67



- ... move lever arm -C- with locating pin -A- such that it is horizontal with respect to height adjuster -B-.
- Tighten lock bolt -D-.
- Slacken off coil spring and remove tensioner V.A.G 1752/1.
- Remove locating pin -A- from adapter on suspension strut.



- Secure nut -arrow- tightening torque: 95 Nm, then turn a further 90°.
- Remove suspension strut from spring tensioner V.A.G -1752/2-



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42-68

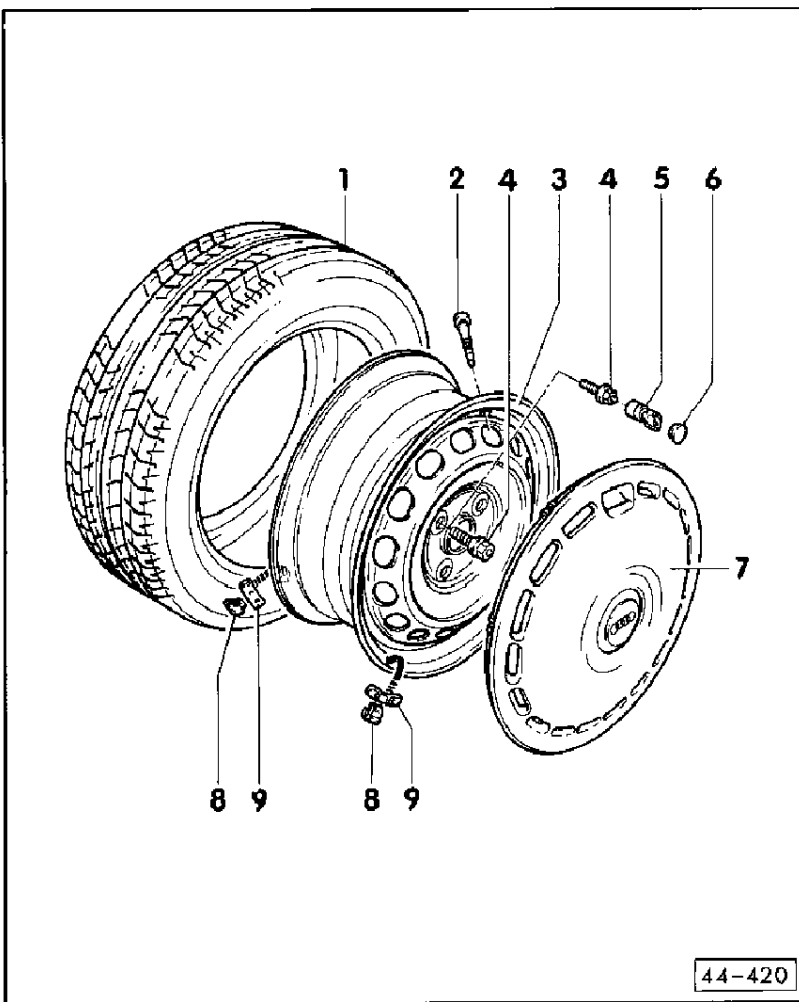
Wheels and tyres

The valid wheel/tyre combinations can be found in the
=> Fault finding binder,
Wheels/tyres

Steel disc wheel

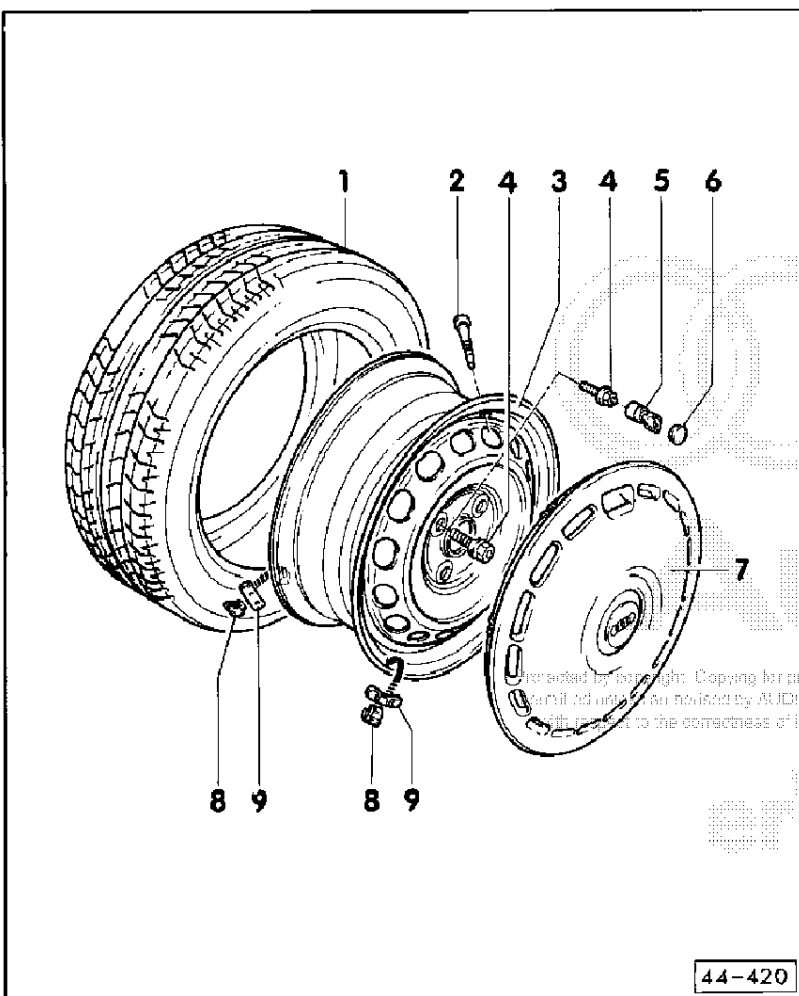
1 - Tyre

- ◆ For reasons of safety, tyres should not be replaced individually but at least for a whole axle.
- ◆ The tyres with the deeper tread should always be fitted to the front wheels.
- ◆ It is advisable to use tyres of the same make, design and tread pattern on all wheels.



44-420

44-1



44-420

2 - Valve

- ◆ Always replace when renewing disc wheel or tyre
- ◆ Only fit valve as per parts list

3 - Steel disc wheel

- ◆ 6J x15, ET 37

4 - Wheel bolt, 110 Nm

- ◆ M14 x 1.5 x 27.5mm

5 - Lock cylinder

- ◆ Attach to wheel bolt and lock

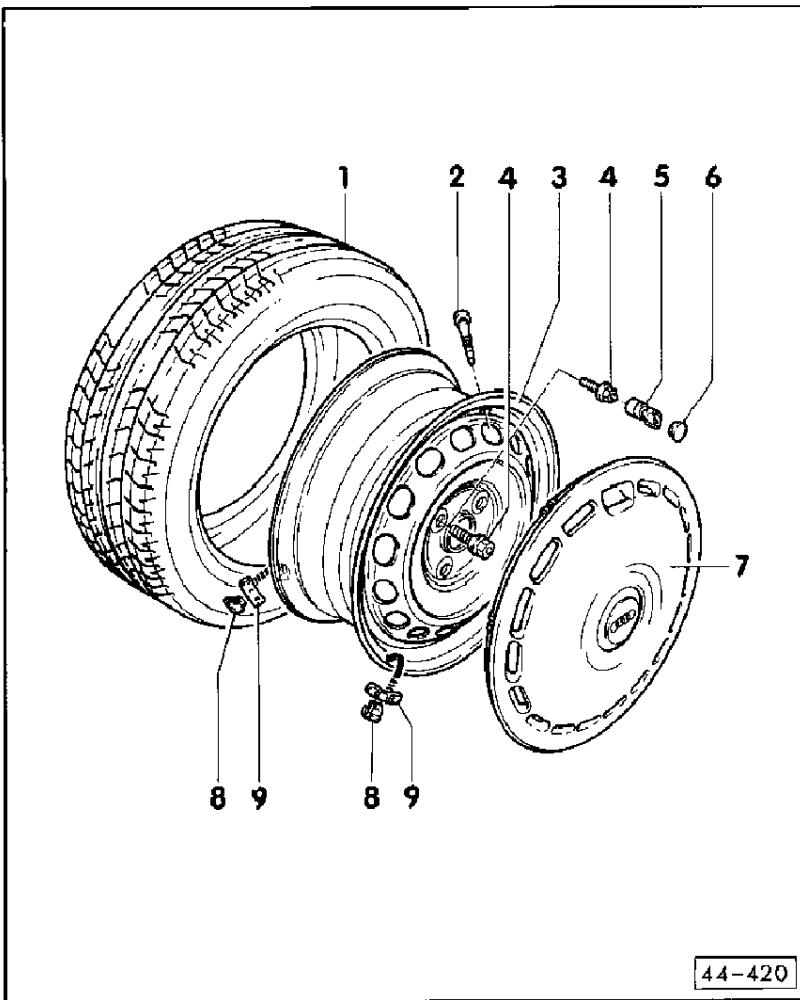
6 - Cap

- ◆ Attach to lock cylinder

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44-2



7 - Full diameter hub cap

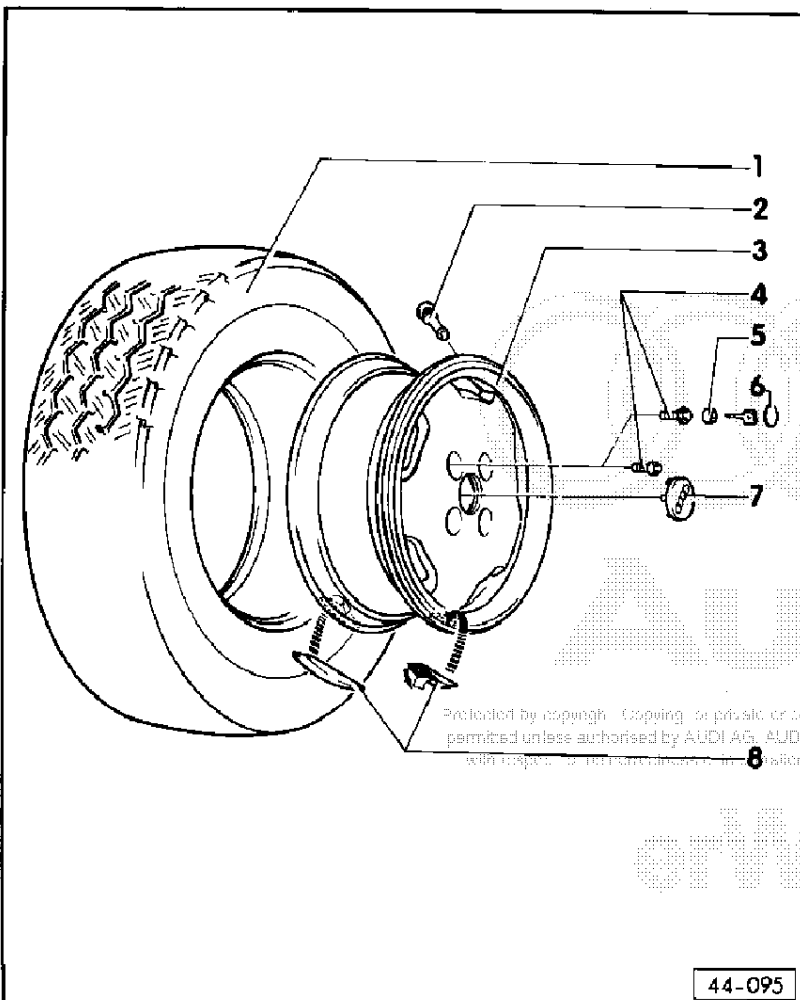
Note:

Place full diameter hub cap with enlarged hole (marked on back with tyre valve symbol) over valve and then press onto disc wheel to ensure proper fit

8 - Retainer spring for balancing weights

9 - Balancing weights

◆ Max 60 g permitted per rim flange



Light-alloy disc wheel, Aero design

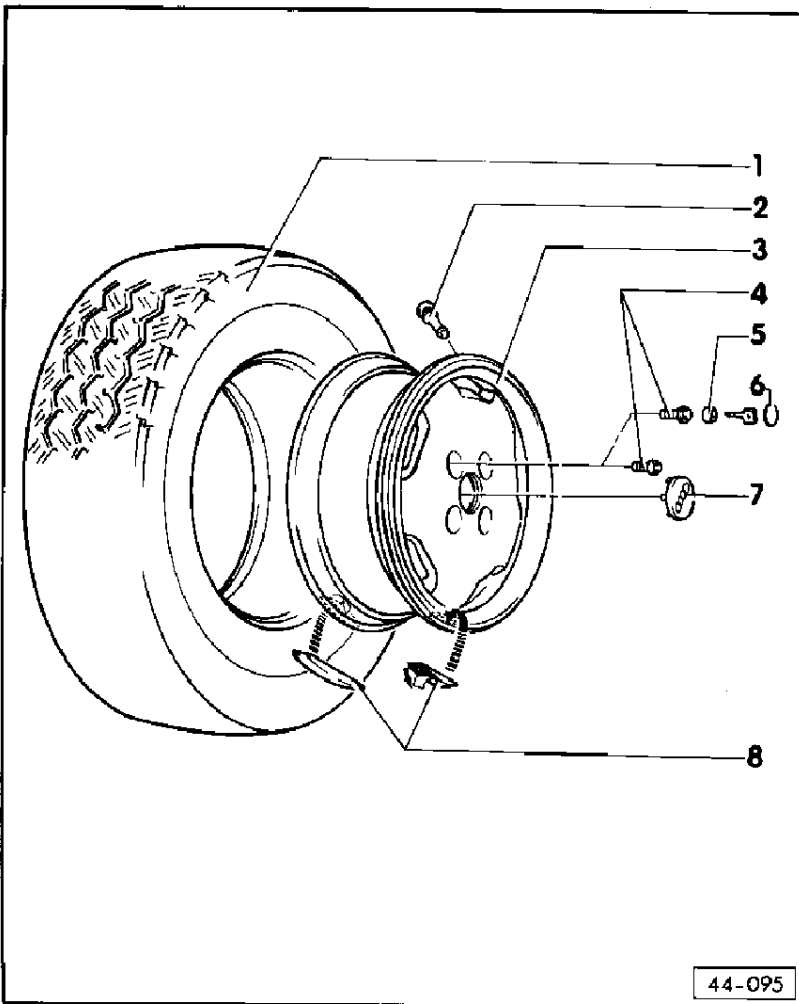
1 - Tyre

◆ For reasons of safety, tyres should not be replaced individually but at least for a whole axle.

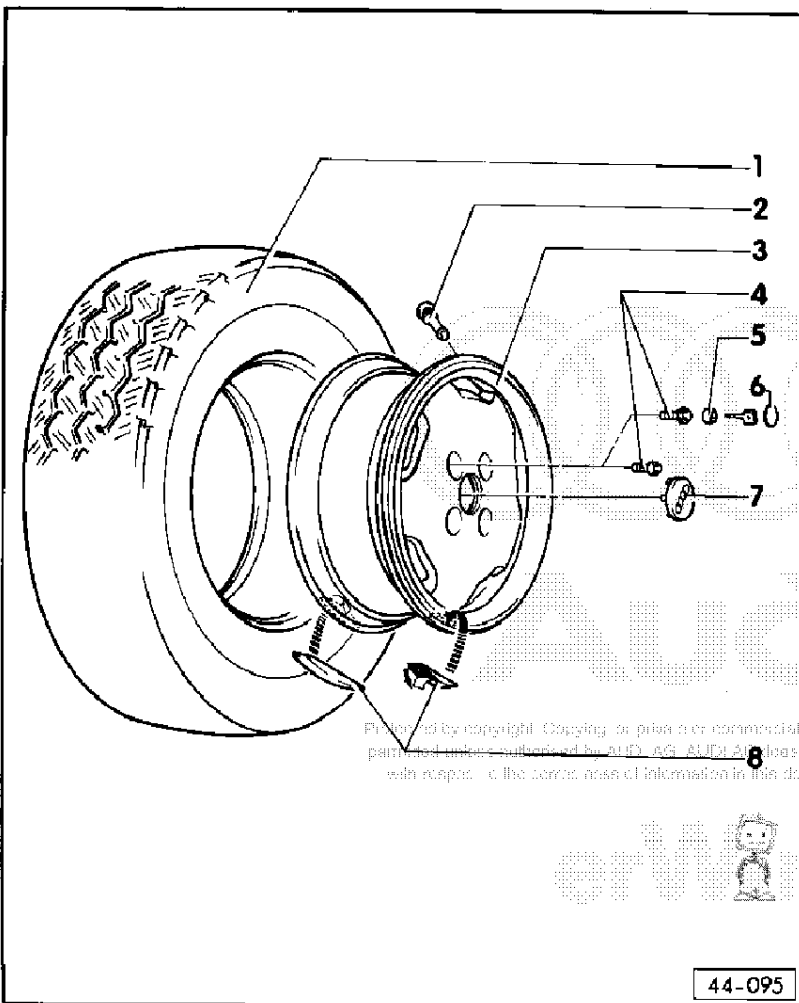
◆ The tyres with the deeper tread should always be fitted to the front wheels.

◆ It is advisable to use tyres of the same make, design and tread pattern on all wheels.

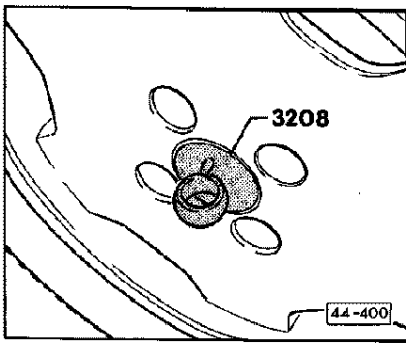
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- 2 - Valve
 - ◆ Always replace when renewing disc wheel or tyre
 - ◆ Only fit valve as per parts list
- 3 - Light-alloy disc wheel
 - ◆ 6J x15, ET 37
 - ◆ 7J x15, ET 37
- 4 - Wheel bolt, 110 Nm
 - ◆ M14 x 1.5 x 27.5 mm
- 5 - Lock cylinder
 - ◆ Attach to wheel bolt and lock
- 6 - Cap
 - ◆ Attach to lock cylinder

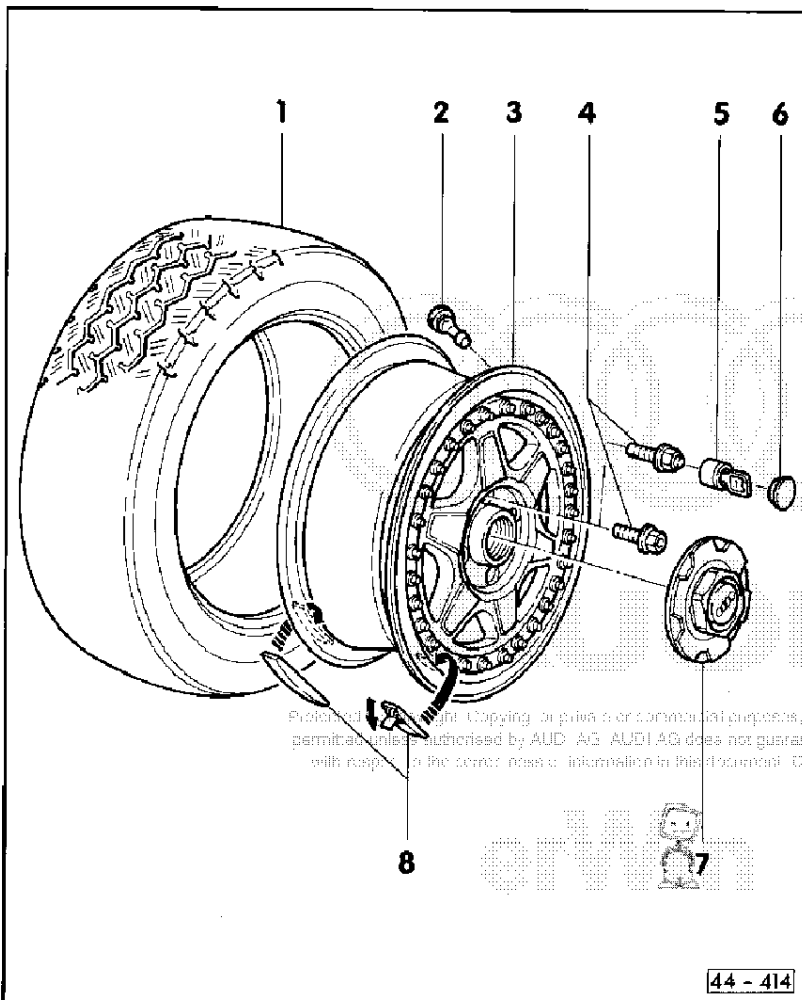


- 7 - Cap
 - ◆ Pulling off => Fig. 1
- 8 - Adhesive balancing weights
 - ◆ Max 60 g permitted per rim flange
 - ◆ Clean disc wheel
 - ◆ Pull off protective sheet.
 - ◆ Bond on balancing weight at designated locations



◀ Fig.1 Pulling off trim cap

- Clean trim cap with wet sponge
- Attach special tool to cap and press on.
- Pull off cap.
- Remove special tool from cap by moving the two rubber nipples to the side.



Light-alloy disc wheel, Speedline design

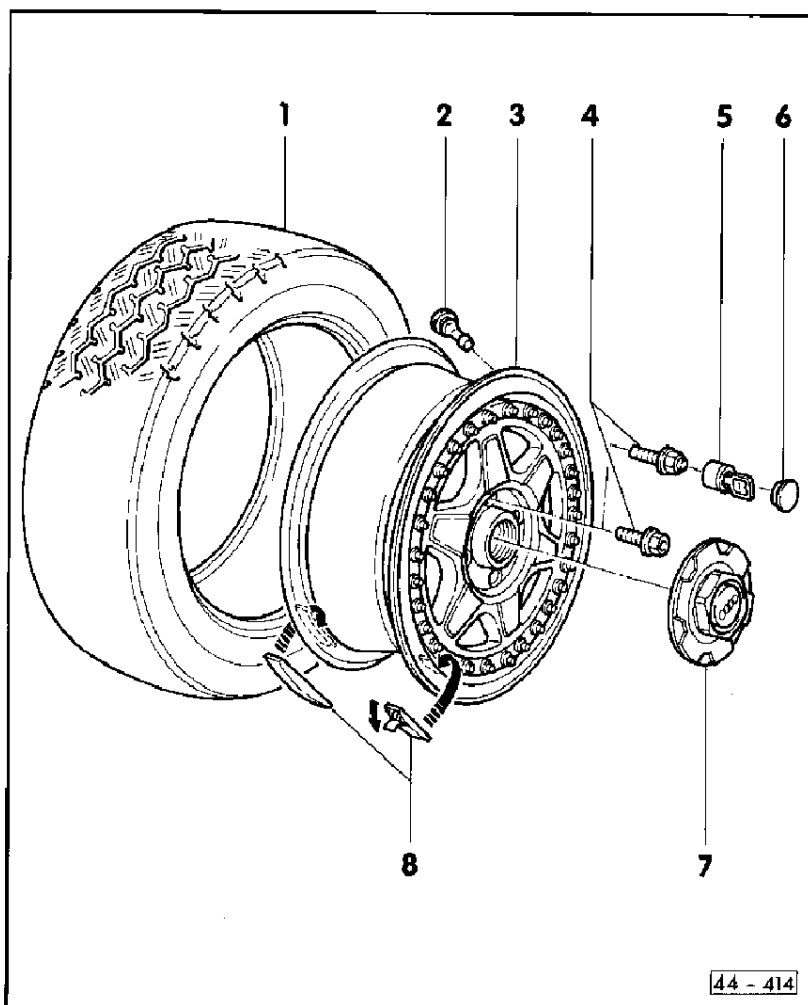
1 - Tyre

- ◆ For reasons of safety, tyres should not be replaced individually but at least for a whole axle.
- ◆ The tyres with the deeper tread should always be fitted to the front wheels.
- ◆ It is advisable to use tyres of the same make, design and tread pattern on all wheels.

2 - Valve

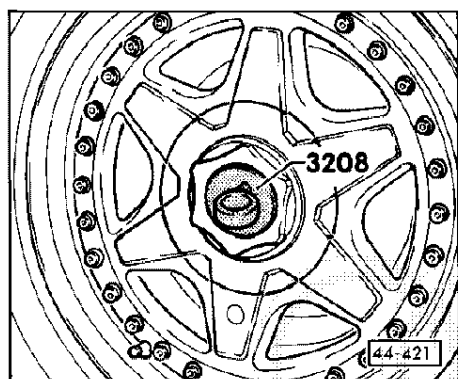
- ◆ Always replace when renewing disc wheel or tyre
- ◆ Only fit valve as per parts list

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- 3 - Light-alloy disc wheel
 - ◆ 7J x15, ET 37
- 4 - Wheel bolt, 110 Nm
 - ◆ M14 x 1.5 x 27.5 mm
- 5 - Lock cylinder
 - ◆ Attach to wheel bolt and lock
- 6 - Cap
 - ◆ Attach to lock cylinder
- 7 - Cap
 - ◆ Pulling off => Fig. 2
- 8 - Adhesive balancing weights
 - ◆ Max 60 g permitted per rim flange
 - ◆ Clean disc wheel
 - ◆ Pull off protective sheet.
 - ◆ Bond on balancing weight at designated locations

44 - 414



- ◀ **Fig.2 Pulling off trim cap**
- Clean trim cap with wet sponge
 - Attach special tool to cap and press on.
 - Pull off cap.
 - Remove special tool from cap by moving the two rubber nipples to the side.



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Wheel alignment

An appropriate means of performing wheel alignment is to use an optical axle measuring unit. If no optical equipment is available, the camber can also be checked with the protractor -3021-.

Test prerequisites

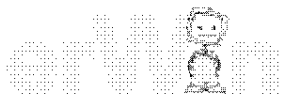
- ◆ Establish running-gear version (1BA, 1BE or 1BB)
- ◆ Measuring device properly adjusted and attached
- ◆ Vehicle unladen (kerb weight)
- ◆ Same tread depth on an axle (max. 2 mm difference)
- ◆ Tyres inflated to specified pressure.
- ◆ Vehicle accurately aligned, bounced several times and allowed to settle
- ◆ No unpermitted play or damage to suspension, steering and steering linkage.

44-11

Notes:

- ◆ Kerb weight means: the weight of the vehicle ready for the road (fuel tank completely filled, spare wheel, vehicle tools and vehicle jack in specified positions).
 - ◆ During adjustment operations, the relevant specifications are to be adhered to as closely as possible.
 - ◆ In the event of a complaint, it is only appropriate to carry out wheel alignment after the vehicle has driven approx. 1000 – 2000 km, as beforehand the vehicle is still subject to settling.
 - ◆ Following suspension repairs, perform test drive with laden vehicle prior to wheel alignment. Vibrations can also be caused by excessive residual imbalance and/or vertical wheel runout. Attention should therefore be paid to fault finding instructions if such complaints are received.
- = > Fault finding instructions, running gear/front end judder and steering wheel vibration

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44-12

Specified values for wheel alignment

Valid for all engines

Front axle

	Standard/sports running gear (1BA and 1BE)	Heavy duty running gear (1BB)
Overall toe (without load)	+15' ± 10'	+25' ± 10'
Camber (straight-ahead position) Maximum permissible difference between the two sides	-45' ± 30' max. 30'	-25' ± 30' max. 30'
Toe difference angle with 20° steering angle from left to right	-10 ± 30'	-10 ± 30'
Castor (non-adjustable) Maximum permissible difference between the two sides	+20 10' ± 30' max. 30'	+20 10' ± 30' max. 30'

44-13

Rear axle

	Standard/sports running gear (1BA and 1BE)	Heavy duty running gear (1BB)
Camber Maximum permissible difference between the two sides	-40' ± 20' max. 30'	-40' ± 20' max. 30'
Toe per wheel	+5' ± 5'	+5' ± 5'
Overall toe	+10' ± 10'	+10' ± 10'

Notes:

- ◆ Up to chassis no. 8C NA 015 724 there is no running gear information on the data sticker. In such cases, all vehicles are to be adjusted as indicated in the specified value table for vehicles with standard and sports version when performing wheel alignment.
- ◆ As of chassis no. 8C NA 015 725 the data sticker is provided with the above identification.

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44-14

Adjusting front axle toe

Only with optical axle measuring equipment and special tool -3279- or -3075-.

Attention:

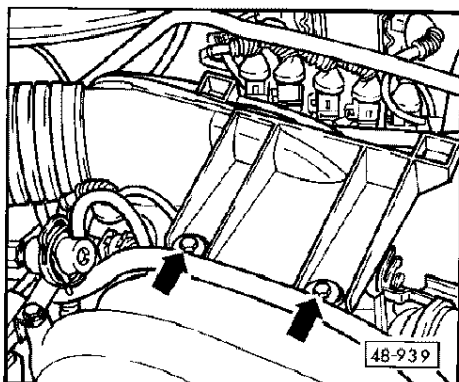
Special tool -3279- is only for use on LHD vehicles.

The existing special tool -3075- should still be used for RHD vehicles.

Note:

The following work only needs to be performed for vehicles with 6-cylinder engine.

– Use screwdriver to lever off cover from sound absorber



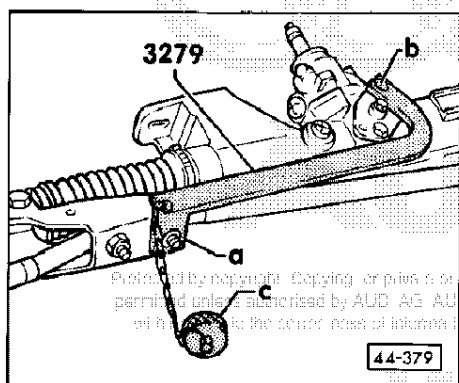
- Unscrew both securing bolts for sound absorber
- Unscrew air guide hose at air mass meter
- Squeeze the two quick-release couplings for the crankcase breather hoses together at the largest diameter and pull them off the valve covers.

44-15

- Press sound absorber to rear and at the same time lift it up.
- Pull vacuum hose off throttle housing and take out sound absorber.

Setting toe on LHD vehicles

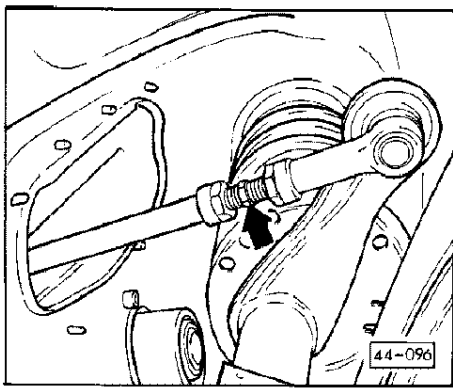
- Move wheels to straight-ahead position.
- Attach special tool -3279- to left securing nut of track rod using hole -a- and secure with knurled nut -c- on chain
- Position special tool on rear securing bolt of thrust piece cover using hole -b- by moving steering wheel backwards and forwards (second mechanic required)
- Check whether steering wheel spoke is horizontal; if necessary, re-position steering wheel and set straight.



Note: or accept any liability

For ease of illustration special tool -3279- is shown with the steering box removed.

44-16



- ◀ – Halve specified value for total toe and set to this position at left and right track rod.
- Secure track rod
- Remove special tool -3279-
- Perform test drive; steering wheel spoke must be horizontal.

Note:

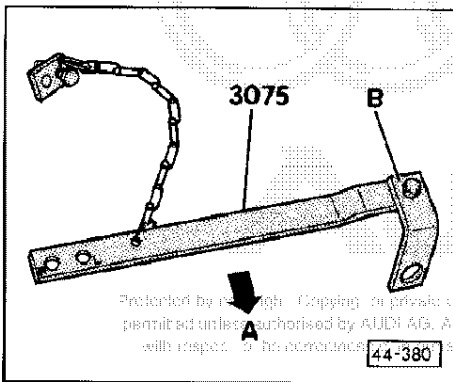
If slight steering wheel is slightly out of line following test drive, it can be corrected by way of even adjustment of the track rods on both sides.

Example:

If steering wheel spoke hangs slightly to the right, lengthen right track rod slightly and shorten left track rod by same amount.

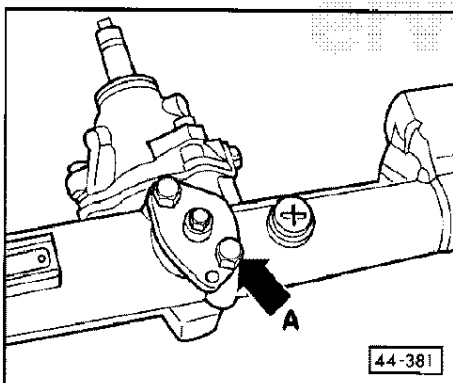
Check toe again if necessary.

Setting toe on RHD vehicles

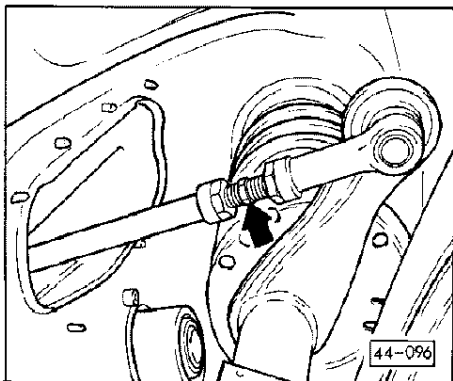
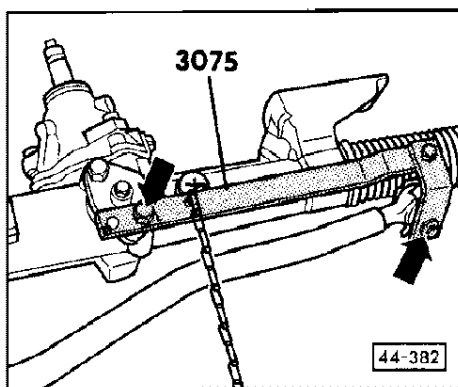


- ◀ – Use special tool -3075- as described below:
- Unfasten bracket -B- of special tool, turn through 180o and secure as shown
- Arrow A = direction of travel

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- ◀ – Move steering box to centre position.
- Unscrew bolt -A-.
- Unscrew bolt from spacer on chain

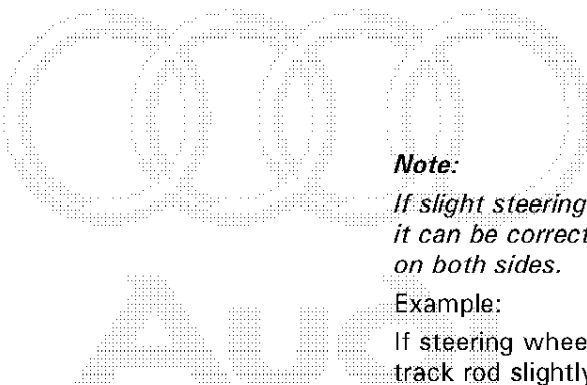


- ◀ – Attach special tool to securing nut of right track rod and fasten to steering box at hole marked -L- using the bolt previously screwed out of the spacer (second mechanic required).
- Check whether steering wheel spoke is horizontal; if necessary, re-position steering wheel and set straight.

Note:

For ease of illustration special tool -3075- is shown with the steering box removed.

- ◀ – Halve specified value for total toe and set to this position at left and right track rod.
- Secure track rod
- Remove special tool -3075-
- Test drive vehicle
- Steering wheel spoke must be horizontal



Note:

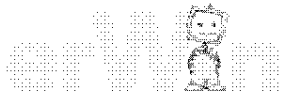
If slight steering wheel is slightly out of line following test drive, it can be corrected by way of even adjustment of the track rods on both sides.

Example:

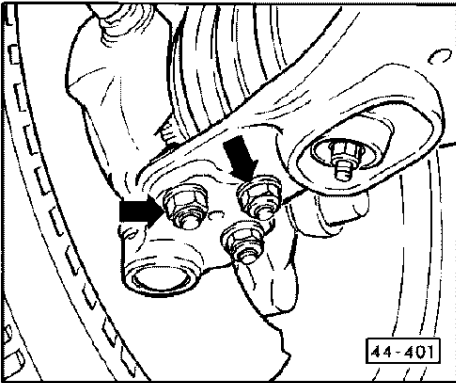
If steering wheel spoke hangs slightly to the right, lengthen right track rod slightly and shorten left track rod by same amount.

Check toe again if necessary.

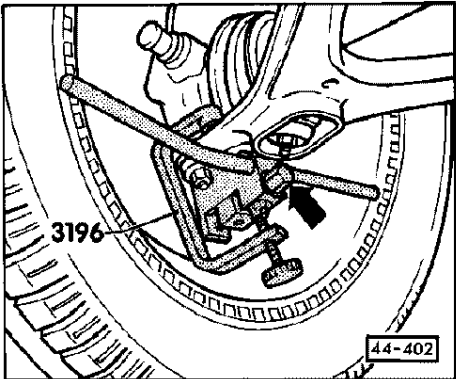
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Adjusting front axle camber

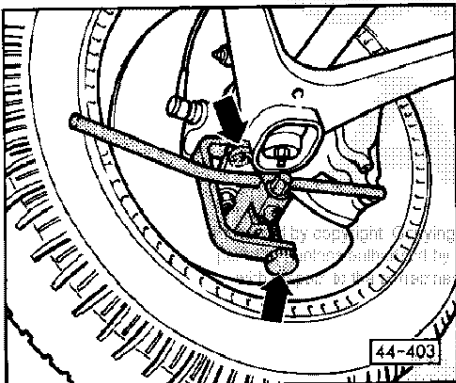


- ◀ – Loosen front and centre securing nuts such that shim can just be moved after loosening rear nut.

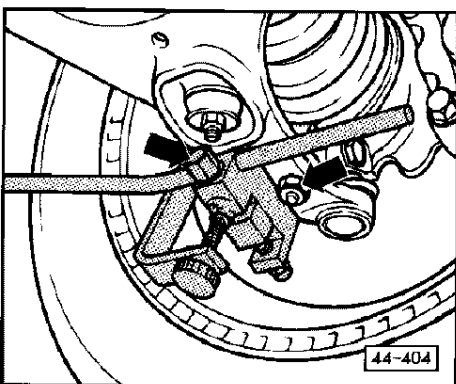


- ◀ – Use hole in special tool to attach it to centre securing nut.
- Turn spindle such that knurled pin of special tool engages in hole in lower ball joint and is thus supported by it.

— 44-21 —



- ◀ – Then use retaining bracket to attach special tool to lower ball joint.
- Position tubular section of retaining bracket on head of centre threaded pin and establish contact between bracket and knurled screw.



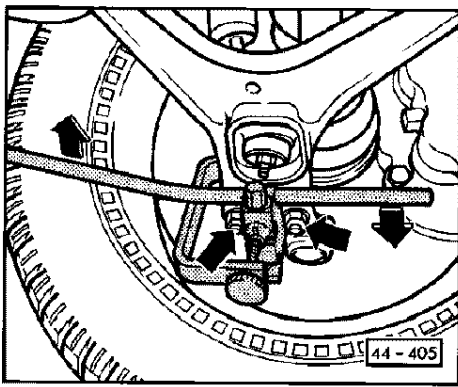
- ◀ – Loosen rear nut until shim can just be moved.
- Turn spindle until desired camber angle is attained.

Note:

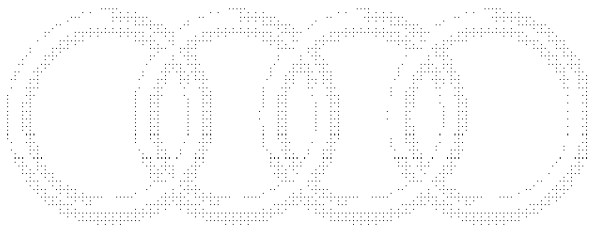
The front wheels must be standing on loose plates.

Should jamming of the lower ball joint in the transverse link become apparent on turning the spindle (no slight changes on the camber scale) then use the lever to move the special tool vigorously to the left and right several times.

— 44-22 —



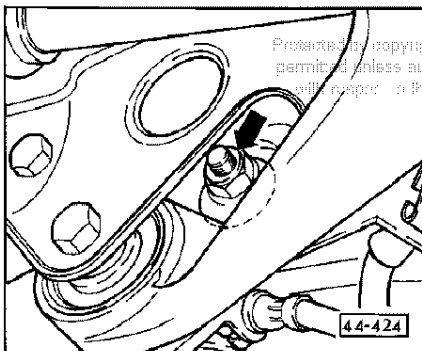
- ◀ – Pull front of special tool lever vigorously inwards as far as it will go and press rear of lever vigorously outwards as far as its stop.
- Tighten the two outer securing nuts in this position (second mechanic required)
- Remove special tool
- Tighten centre securing nut
- Tighten all securing nuts
- Check and if necessary adjust toe



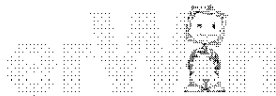
Adjusting rear axle toe

(Check left and right adjustment with optical measuring unit)

- ◀ – Slacken securing nut -arrow-.



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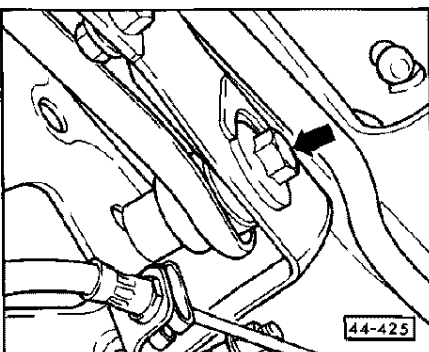


- ◀ – Adjust toe accordingly by turning eccentric bolt -arrow-.

Note:

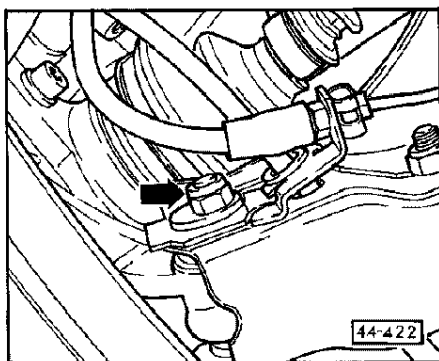
Do not turn more than 90° to left or right (min. – max. adjustment).

- Tighten securing nut, re-check toe value and re-adjust, if necessary.



Setting rear axle camber

- ◀ – Slacken securing nut -arrow-.

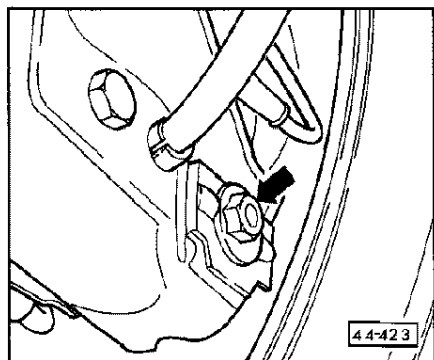


- ◀ – Adjust camber accordingly by turning eccentric bolt -arrow-.

Note:

Do not turn more than 90° to left or right (min. – max. adjustment).

- Tighten fastening nut, check camber again and re-adjust, if necessary.
- Check and if necessary adjust toe.



— 44-25 —

Rebalancing/balancing wheels on vehicle

Information about wheel balancing and the procedure involved is contained in

= > Fault finding binder, Running gear, -Item 10-

Use of the Torsen differential has led to the following changes in the procedure to be employed

- Jack up both axles of vehicle and fit stands beneath vehicle (follow operating instructions of balancing equipment manufacturer)

Attention:

Release handbrake

- Wheels must be driven by engine so that wheels run synchronously.
- Then balance axles one after another.

Note:

If the above procedure is not observed, the Torsen central differential is likely to be damaged.

— 44-26 —

General repair information

ABS fault finding instructions

= > Fault finding binder, ABS

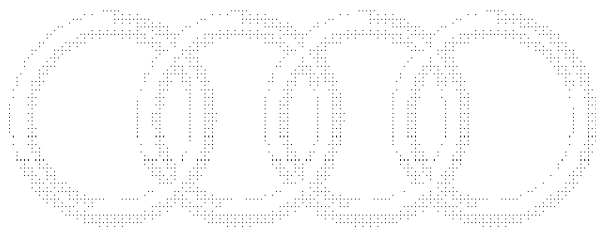
Note:

The ABS switch -E83- and the combi relay for ABS -J156- were discontinued as of model year 1993.

Attention:

The ABS system is basically maintenance free. Work on such a system requires specialist knowledge. Failure to observe the points described in this Workshop Manual may result in damage to the system and could make the vehicle unsafe.

- ◆ Pull plug off electronic control unit before performing electric welding.
- ◆ The electronic control unit must not be exposed to temperatures in excess of 90°C when carrying out painting work.
- ◆ If the battery has been removed, the battery terminals must be properly retightened after reinstallation.
- ◆ Disconnect battery negative terminal before removing hydraulic modulator.



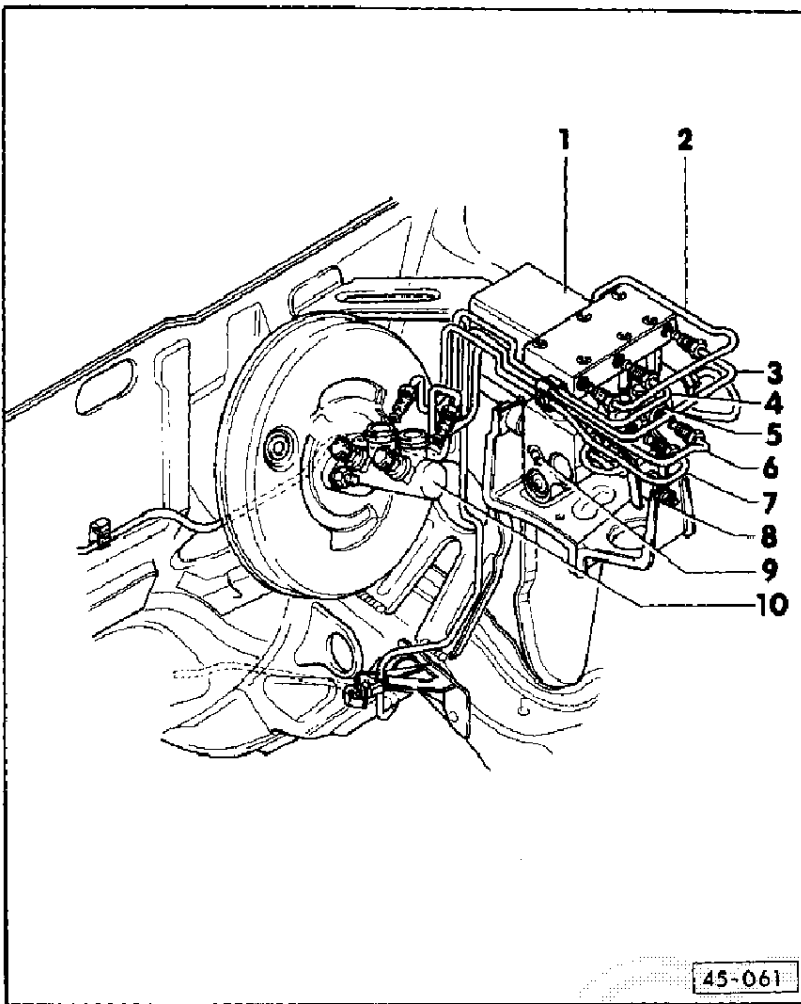
45-1

- ◆ Never drive with tester connected up.
- ◆ Whenever work has been carried out on the braking system which does not directly affect parts of the ABS, it is sufficient to perform a simple functional check. In other words, the Attention lamp in the dash panel must not light on exceeding a vehicle speed of 6 km/h if the ABS is intact. Such work includes the replacement or renewal of brake linings, brake hoses, brake discs, brake master cylinder, brake cables and handbrake components.
- ◆ If work is performed on the hydraulic modulator, the electronic control unit, the wheel speed sensors and the wiring harness or if assemblies are replaced (for example brake lines after a vehicle has been involved in an accident) a check is to be performed on the entire ABS. Carry out the self-diagnosis described in Repair Group 01 => Page 01-1.
- ◆ In the course of a subsequent test drive, make sure that ABS-controlled braking is implemented at least once.

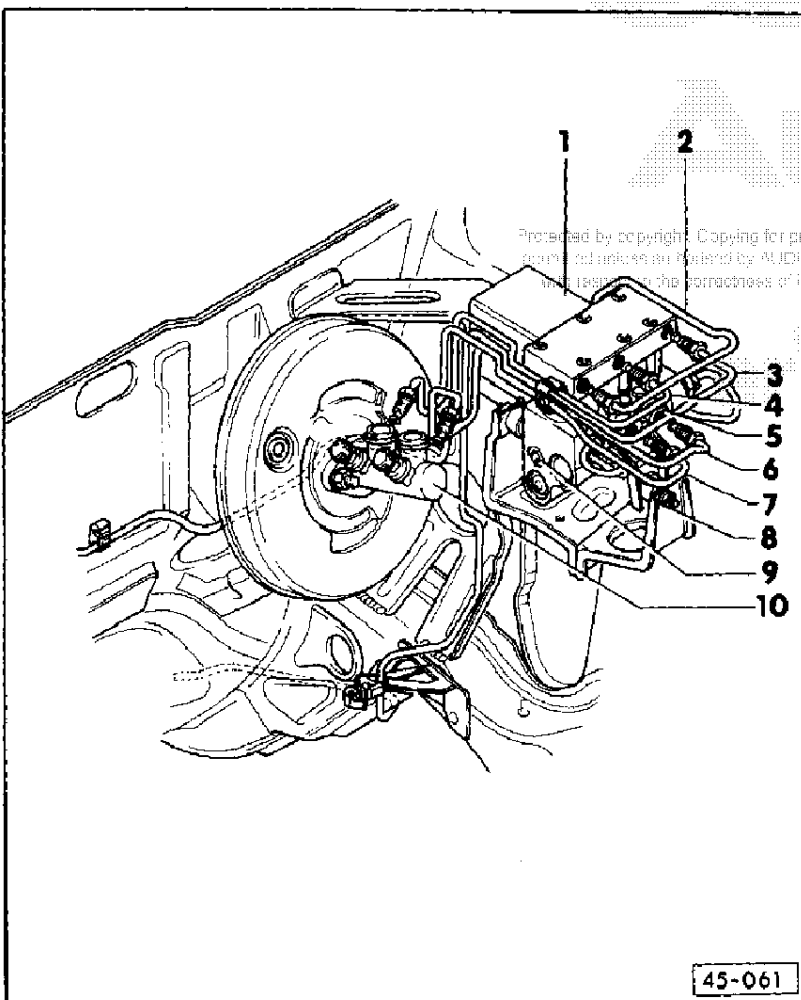
45-2

Removing and installing hydraulic modulator

- Disconnect battery earthing strap.
- Unscrew coolant expansion tank and set it aside.
- Unscrew/remove brake lines.
- Unscrew hydraulic modulator from bracket.



45-3

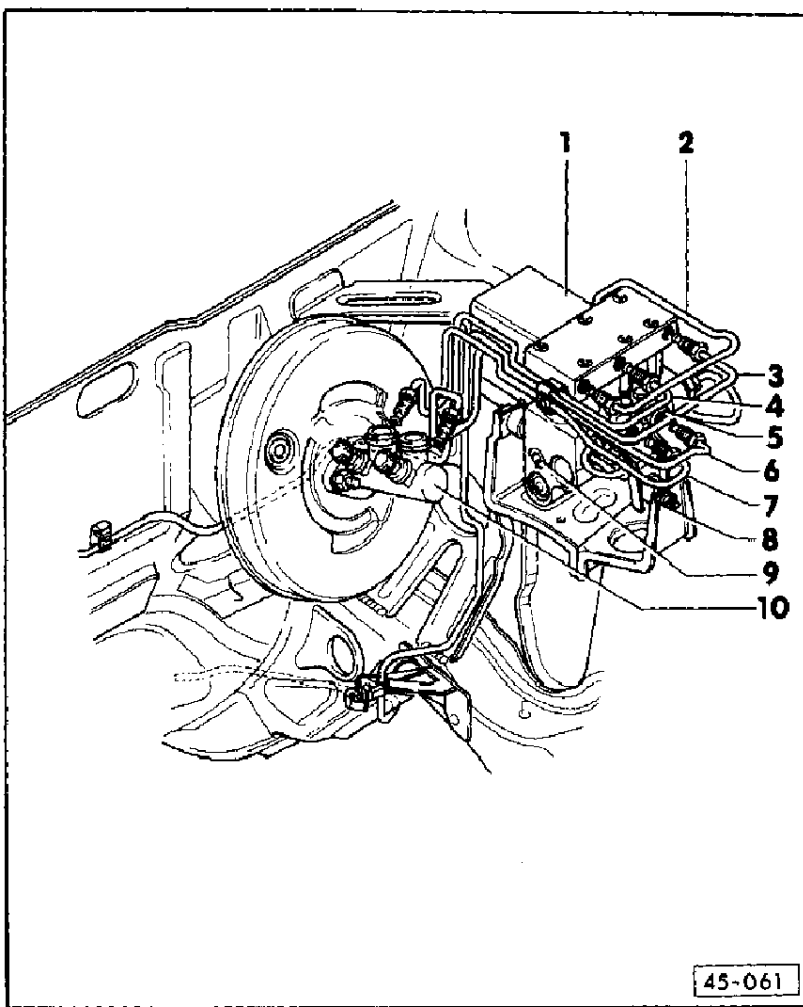


Attention

When removing and installing brake lines, make sure that lines are marked/installed in accordance with designations on hydraulic modulator. Where necessary, only fit genuine brake lines (not lines sold by the metre). Seal the brake lines and connections immediately with dummy plugs. Tightening torque for brake lines: 15 Nm. If the performance of the work involves opening the hydraulic system, bleed the braking system using the brake filling and bleeding unit VW 1238-B. In addition, a high- and low-pressure test should be carried out on the brake system

Page

45-4



45-061

Note:

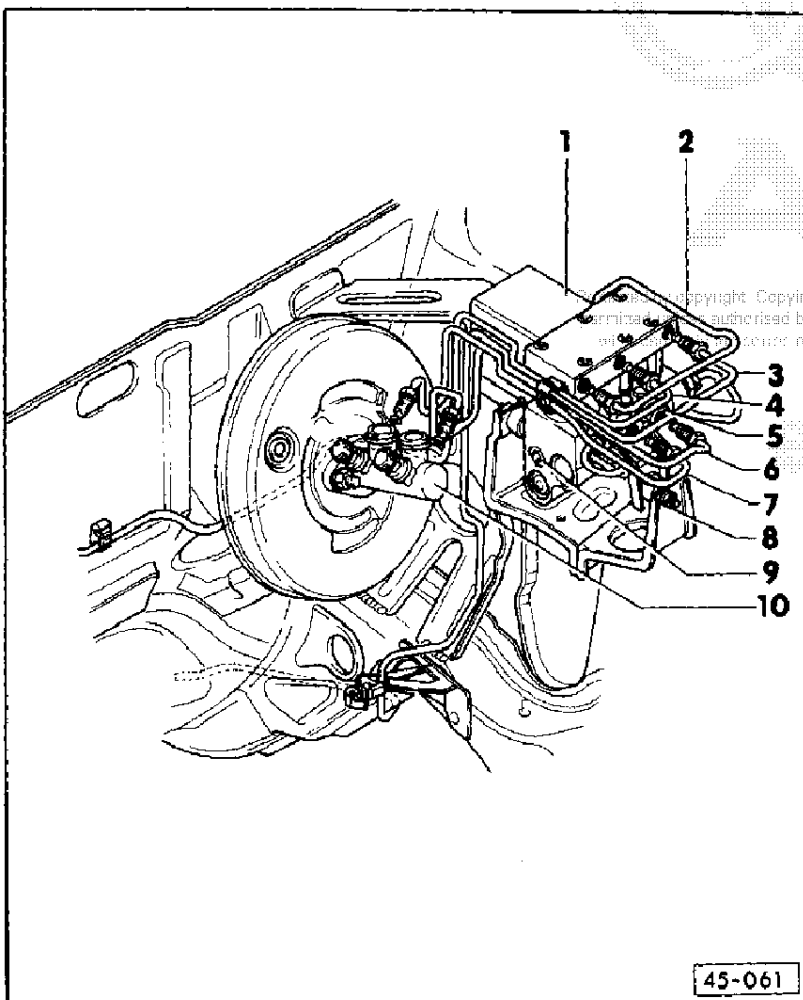
If no specially shaped brake lines are available, they should be produced from lines sold by the metre.

1 - Cover

- ◆ Unscrew from hydraulic unit so as to provide access to relay for return flow pump and valve relay => Page 45-8, Fig. 1

2 - Brake pipe

- ◆ Hydraulic unit to front left brake calliper
- ◆ Marked "VL" on hydraulic modulator



45-061

3 - Brake pipe

- ◆ Hydraulic modulator to rear axle
- ◆ Marked "HA" on hydraulic modulator

4 - Brake pipe

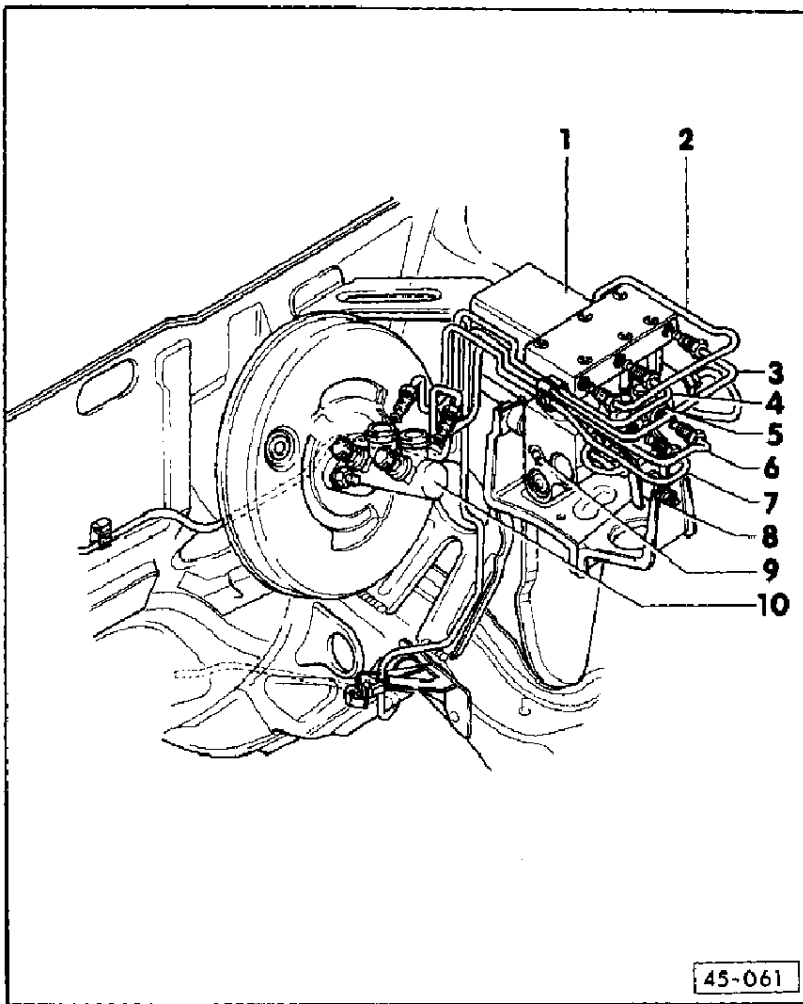
- ◆ Hydraulic unit to front right brake calliper
- ◆ Marked "VR" on hydraulic modulator

5 - Brake pressure regulator

- ◆ Replace only if defective

6 - Brake pipe

- ◆ Brake master cylinder to brake pressure regulator
- ◆ Floating piston circuit, rear axle



- 7 - Brake pipe**
- ◆ Hydraulic modulator to brake pressure regulator
 - ◆ Pushrod piston circuit, front axle

- 8 - Hexagon nut, 10 Nm**
- ◆ Insert hydraulic modulator in bracket and secure

9 - Hydraulic modulator

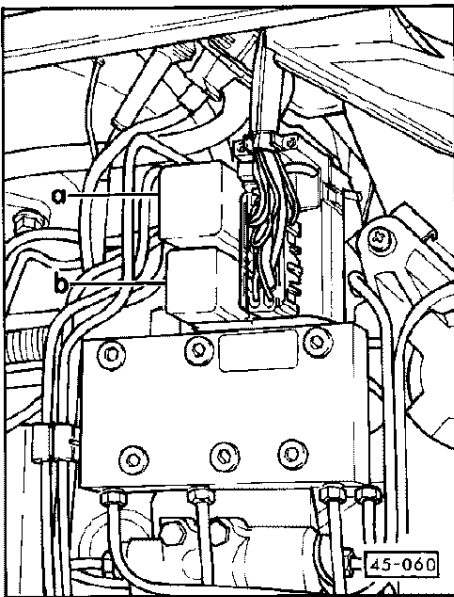
Attention

- ◆ The hydraulic modulator is not to be serviced in any way with the exception of pump and valve relay replacement. Never loosen screw connections.
- ◆ Where necessary, replace only as a complete unit. High- and low-pressure testing

Page

- 10 - Brake master cylinder with servo unit**

45-061



◀ **Fig.1 Relay locations**
 a = Relay for return pump
 b = Valve relay

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45-060

High- and low pressure testing

Test requirements:

- ◆ Conventional braking system (brake master cylinder, brake hoses, brake lines and brake callipers) functioning properly and not leaking.

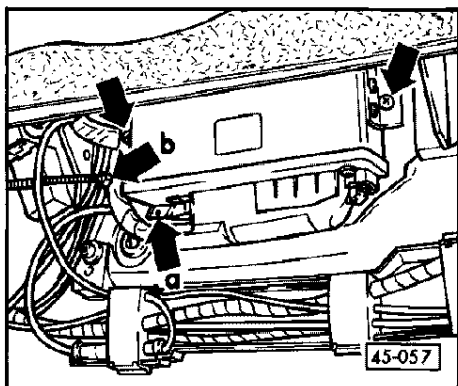
Remove bleeder screw at one of the front brake callipers. Connect pressure gauge -VW 1310- and bleed.

Insert brake pedal depressor between brake pedal and driver's seat. Apply pressure to brake pedal until the gauge indicates a pressure of 50 bar. The pressure must not drop by more than 4 bar during the test period of 45 seconds. Replace hydraulic unit if drop in pressure exceeds the above figure.

Adjust brake pedal depressor until pressure gauge indicates a line pressure of 6 bar. The pressure must not drop by more than 1 bar during the test duration of 3 minutes. Replace hydraulic unit if drop in pressure exceeds the above figure.

45-9

Removing and installing parts of electronic control system



◀ Fig.1 Removing and installing electronic control unit

Location:

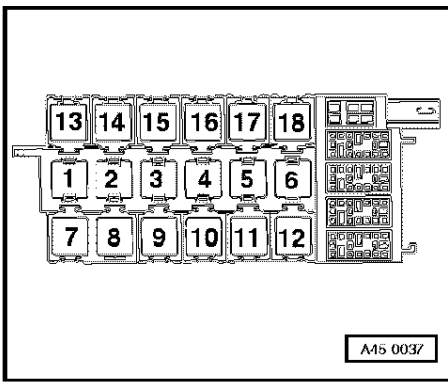
On left below rear seat bench

Notes:

- ◆ Switch off ignition for removal and installation
- ◆ Prior to removal on vehicles as of model year 1993, interrogate fault memory with fault reader -V.A.G 1551-
- Cut off cable tie -b-. Always attach new cable tie after installing control unit.
- Remove connector from control unit by pressing spring -a-. Unscrew both fastening screws.



45-10



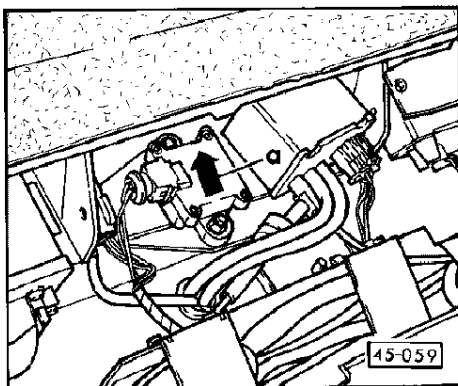
◀ **Fig.2 Removing and installing combi relay**

Location:

Front left, beneath instrument panel in auxiliary relay holder
 => Current Flow Diagrams, Electrical Fault Finding and Fitting Locations

Note:

Switch off ignition for removal and installation Not applicable as of model year 1993.



◀ **Fig.3 Removing and installing longitudinal acceleration switch**

Location:

On left below rear seat bench
 – Arrow -a- on switch points in direction of travel.

Notes:

- ◆ Switch off ignition for removal and installation
- ◆ The acceleration switch is a liquid-level switch (mercury) which operates as a function deceleration. During controlled braking by the ABS, it intervenes in the control cycle, thus affording additional stabilisation when braking the vehicle.



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Removing and installing components of ABS system

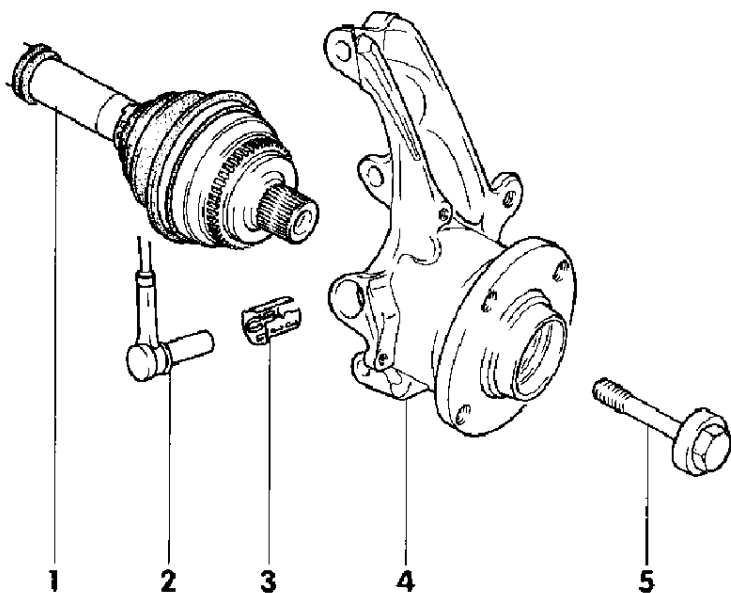
Front axle

1 - Drive shaft with rotor

- ◆ Outer CV joint is supplied as replacement part with rotor
- ◆ Pull wheel speed sensor back slightly before removing
- ◆ After installation, press home sensor by hand

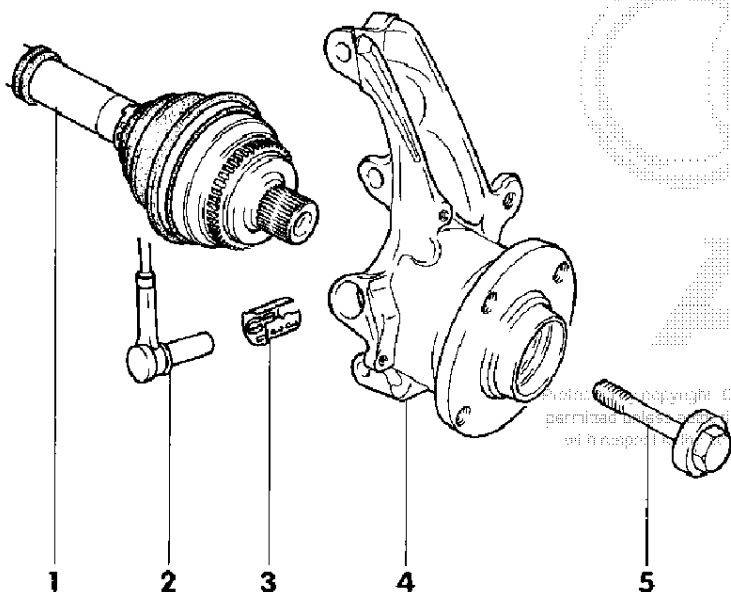
2 - Wheel speed sensor

- ◆ Identical part on left and right
- ◆ To remove, pull out of wheel bearing housing
- ◆ Press home by hand to install
- ◆ Detaching connector for sensor, front left => Fig. 1, front right => Fig. 2
- ◆ Pipe routing => Fig. 3 and 4



45-014

45-13



45-014

3 - Clamping sleeve

- ◆ Always replace
- ◆ Identical part on left and right
- ◆ Grease all round with brake cylinder paste before inserting in wheel bearing housing
- ◆ Press home in wheel bearing housing.

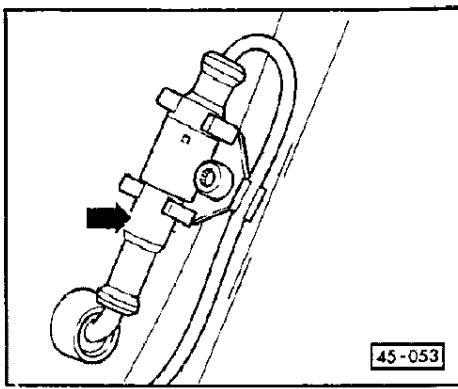
4 - Wheel bearing housing

- ◆ Supplied as replacement part with hole for accommodating clamping sleeve/wheel speed sensor

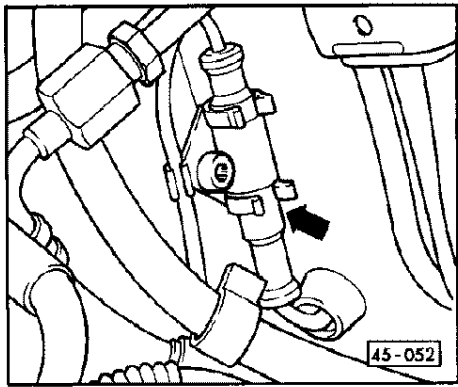
5 - Hexagon combi bolt/flange bolt

- ◆ Always replace
- ◆ Tighten M16 x 1.5 to 200 Nm and then give a further 90° turn
- ◆ Tighten M14 x 1.5 to 120 Nm and then give a further 90° turn
- ◆ Vehicle must be standing on its wheels when loosening and tightening (risk of accident).

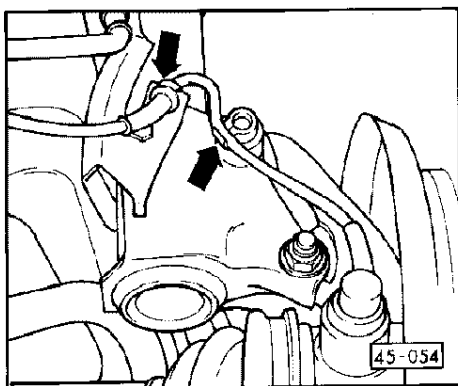
45-14



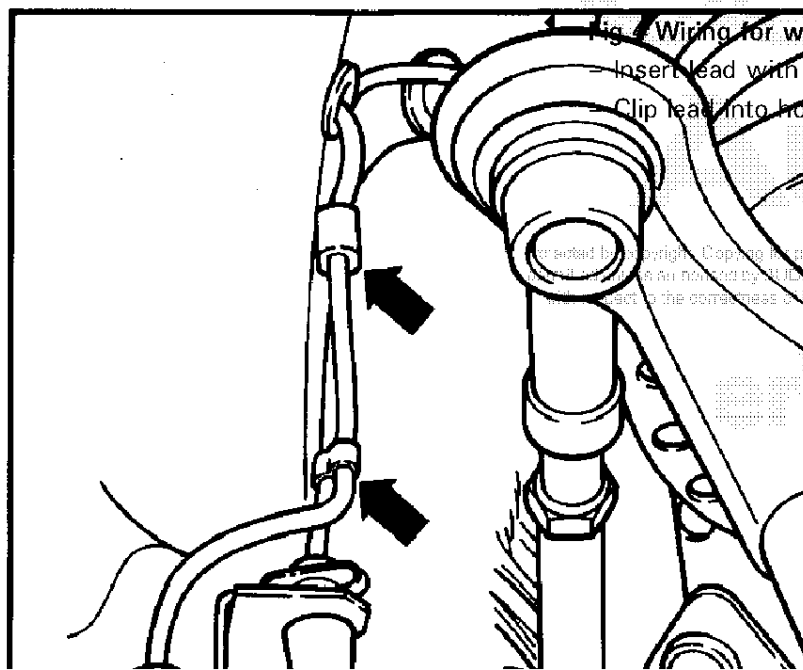
- ◀ **Fig.1 Connector for front left wheel speed sensor**
- Remove coolant system expansion tank and lay to one side.
 - Disengage connector from holder and then detach



- ◀ **Fig.2 Connector for front right wheel speed sensor**
- Disengage connector from holder and then detach



- ◀ **Fig.3 Wiring for wheel speed sensor at suspension strut**
- Insert lead with rubber grommet in retaining bracket at strut.
 - Clip lead into holder.

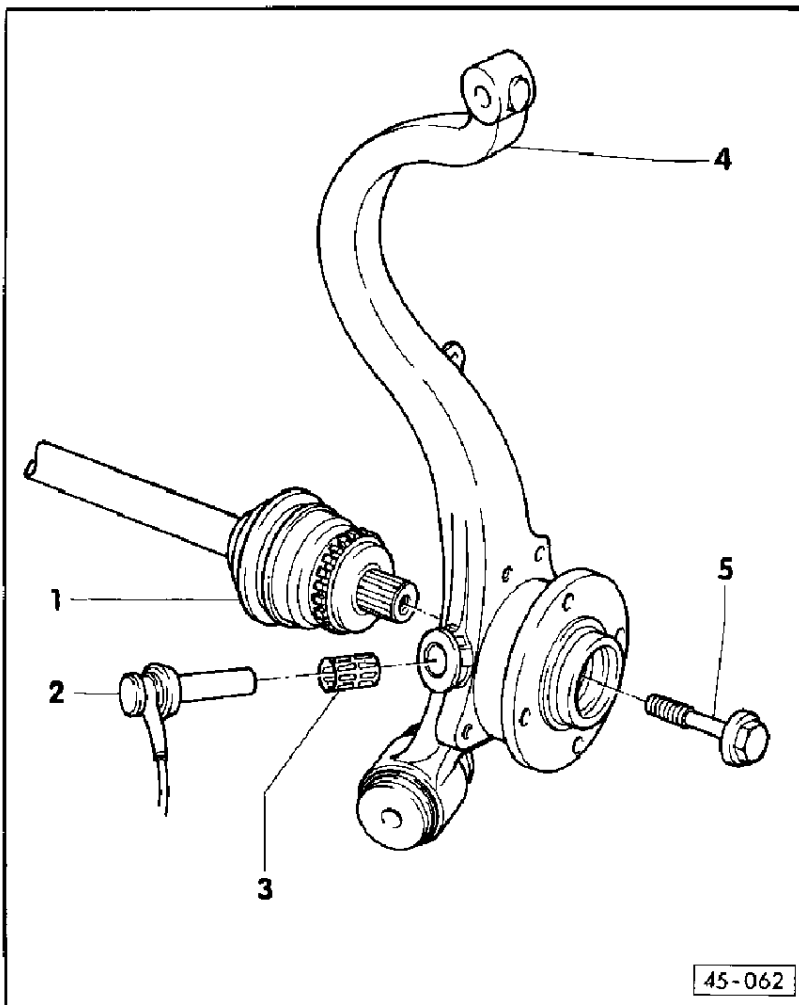


- ◀ **Fig.4 Wiring for wheel speed sensor at wheel housing**
- Insert lead with rubber grommet in retaining bracket at strut.
 - Clip lead into holders along brake line.

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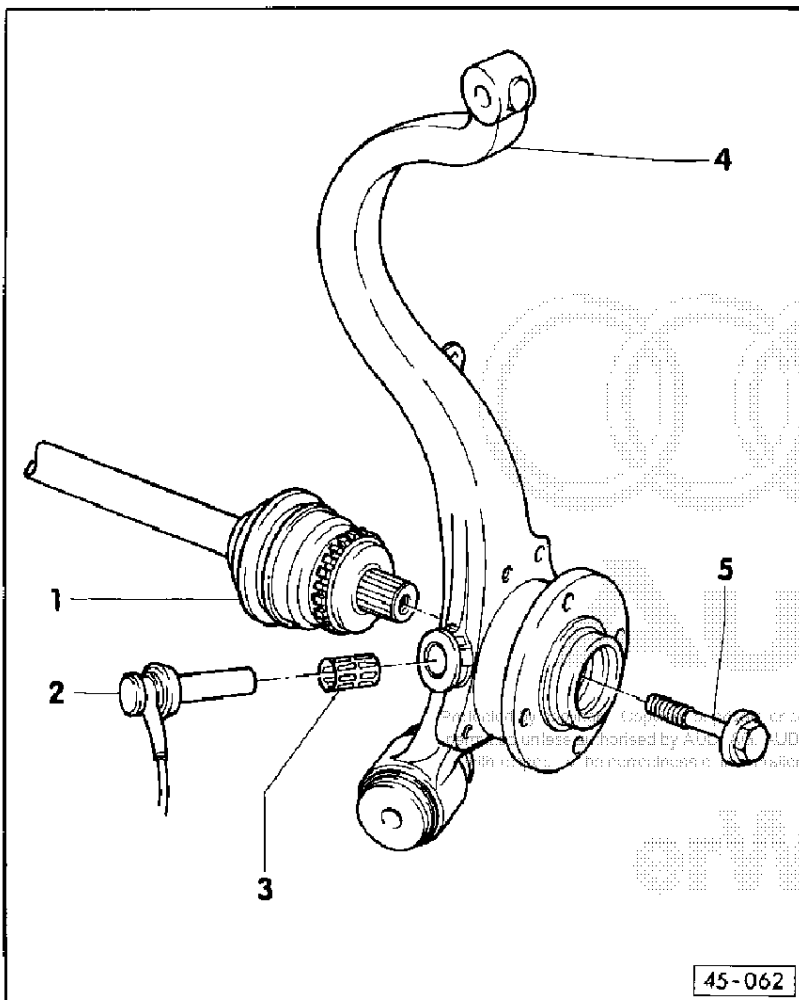


Rear axle



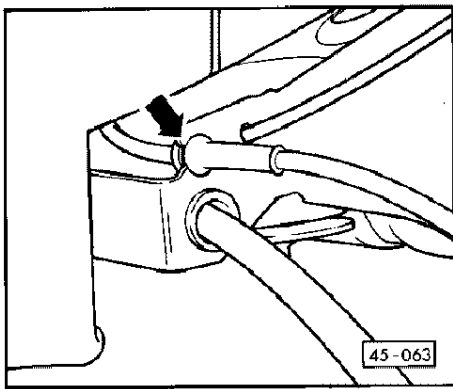
- 1 - Drive shaft with rotor
 - ◆ Outer CV joint is supplied as replacement part with rotor
 - ◆ Pull wheel speed sensor back slightly before removing
 - ◆ After installation, press home sensor by hand
- 2 - Wheel speed sensor
 - ◆ Identical part on left and right
 - ◆ To remove, pull out of wheel bearing housing
 - ◆ Press home by hand to install
 - ◆ Wiring routing => Fig. 1 and 2

45-17



- 3 - Clamping sleeve
 - ◆ Always replace
 - ◆ Identical part on left and right
 - ◆ Grease all round with brake cylinder paste before inserting in wheel bearing housing
 - ◆ Press home in axle beam
- 4 - Wheel bearing housing
 - ◆ Supplied as replacement part with hole for accommodating clamping sleeve/wheel speed sensor
- 5 - Hexagon combi bolt/flange bolt
 - ◆ Always replace
 - ◆ Tighten M16 x 1.5 to 200 Nm and then give a further 90° turn
 - ◆ Tighten M14 x 1.5 to 120 Nm and then give a further 90° turn
 - ◆ **Vehicle must be standing on its wheels when loosening and tightening (risk of accident).**

45-18

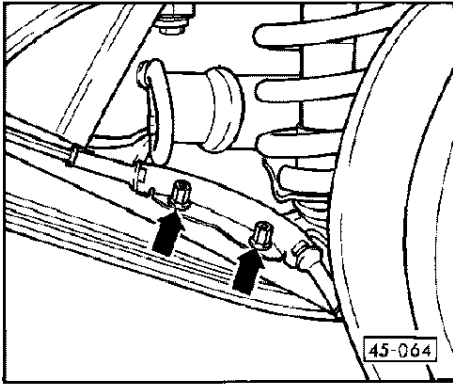


◀ Fig.1 Wiring routing for wheel speed sensor

- Insert lead with rubber grommets in holders provided at rear axle and on floor group.

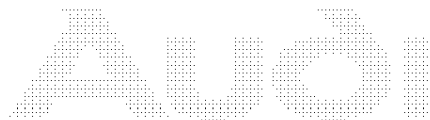
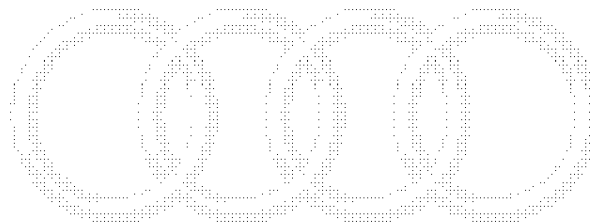
Note:

The two connectors for the rear wheel speed sensors are beneath the rear bench seat.



◀ Fig.2 Wiring routing for wheel speed sensor at subframe

- Screw lead with retainer to subframe.



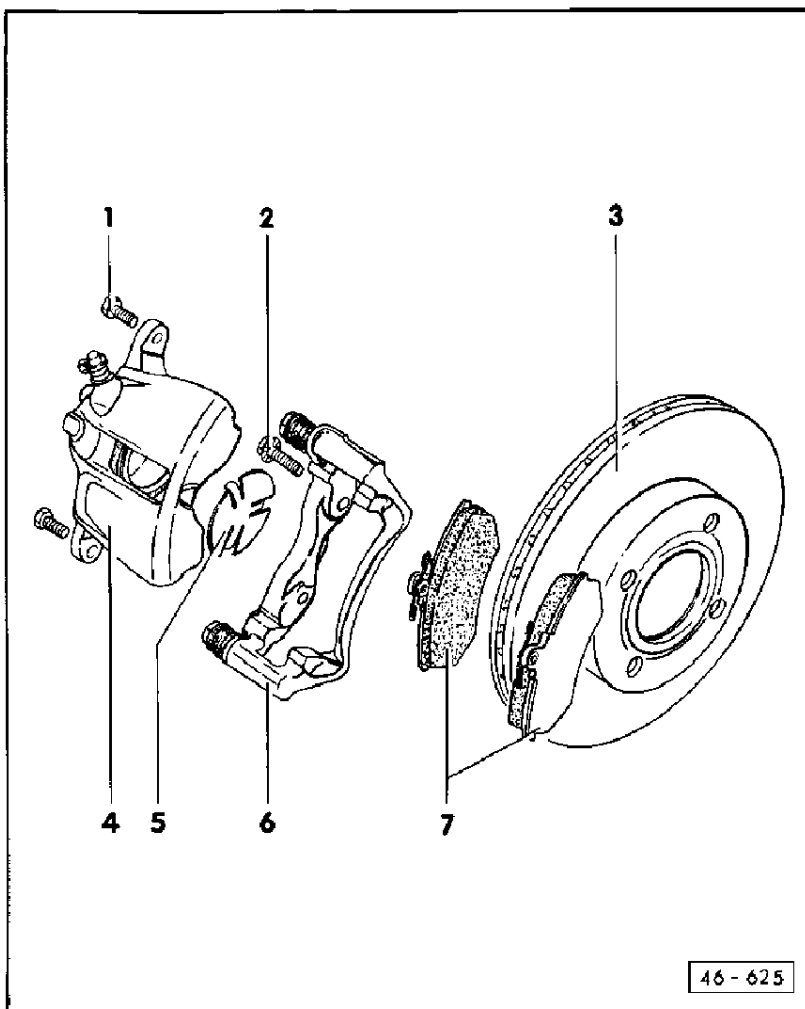
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Servicing front brakes, Girling

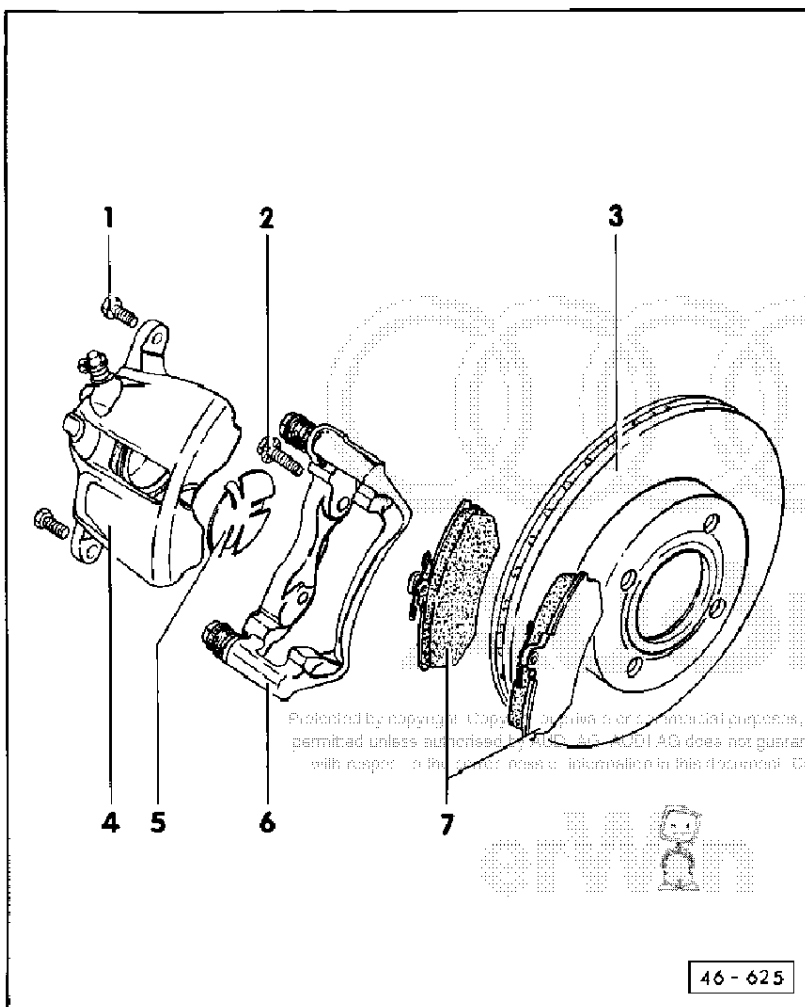
Notes:

- ◆ Always install the complete repair kit.
- ◆ Brakes can be checked on all commercially available brake test stands, provided that the driving speed of the two driving rollers of the test stand does not exceed 5.5 km/h.
- ◆ Brake linings for vehicles with ventilated and non-ventilated brake discs have the same dimensions, but the brake callipers differ.



46 - 625

46-1



1 - Self locking bolt, 35 Nm

- ◆ Always replace
- ◆ When loosening and tightening counter hold on guide pin

2 - Ribbed bolt, 125 Nm

- ◆ Clean ribbing if reusing

3 - Brake disc

- ◆ Replace on axle basis; to remove, unscrew brake calliper beforehand
- ◆ Always dress evenly, on both sides, starting from thickness when new
- ◆ Ensure adequate wear reserve
- ◆ Brake disc diameter: 256 mm

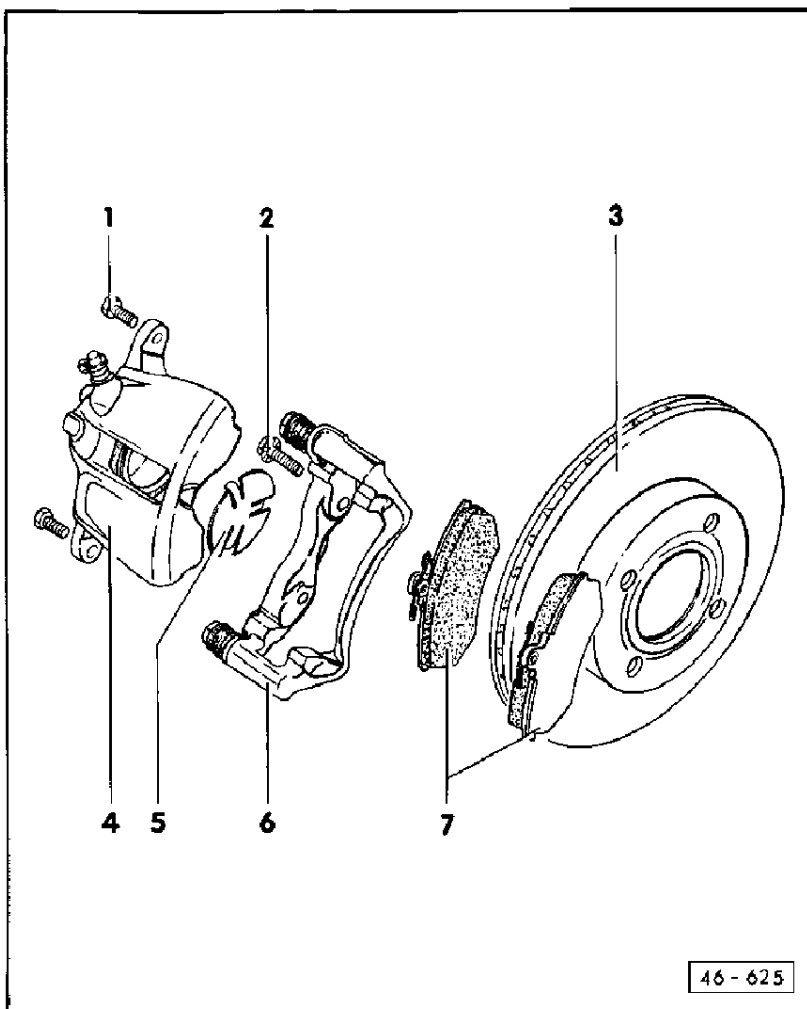
Note:

As of model year 1993, the brake disc diameter is 280 mm.

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46 - 625

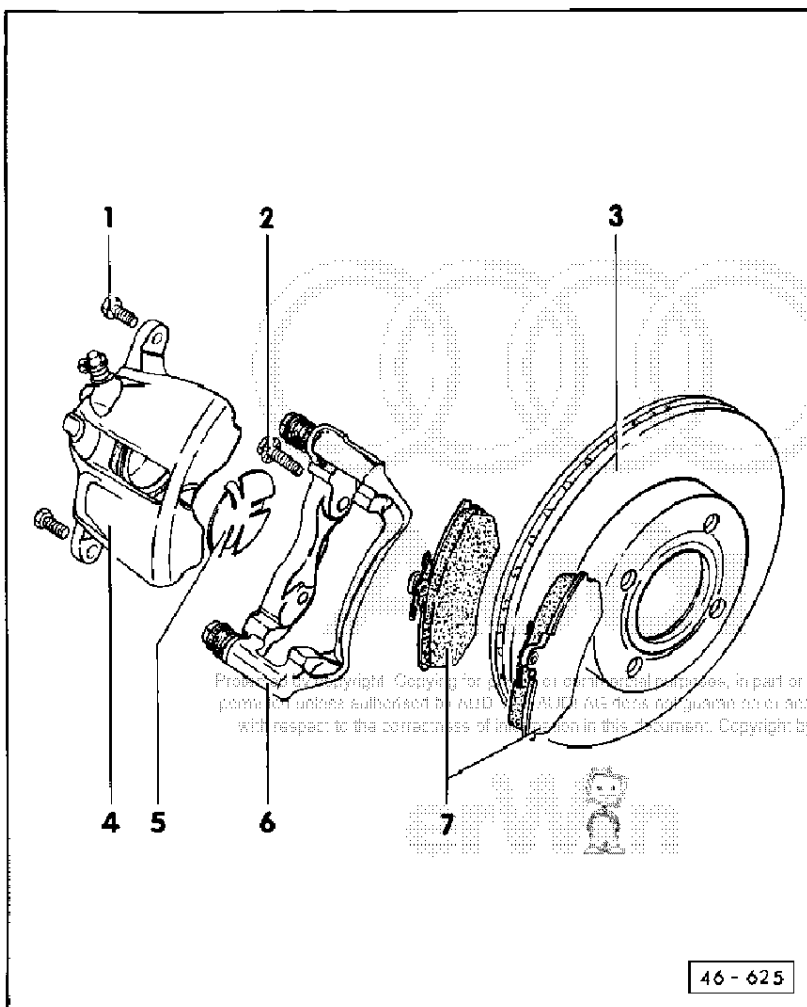
46-2



46 - 625

- ◆ Brake disc thickness:
 - Ventilated disc 22 mm
 - Non-ventilated disc 13 mm
- ◆ Wear limit:
 - Ventilated brake disc 20 mm
 - Non-ventilated brake disc 11 mm

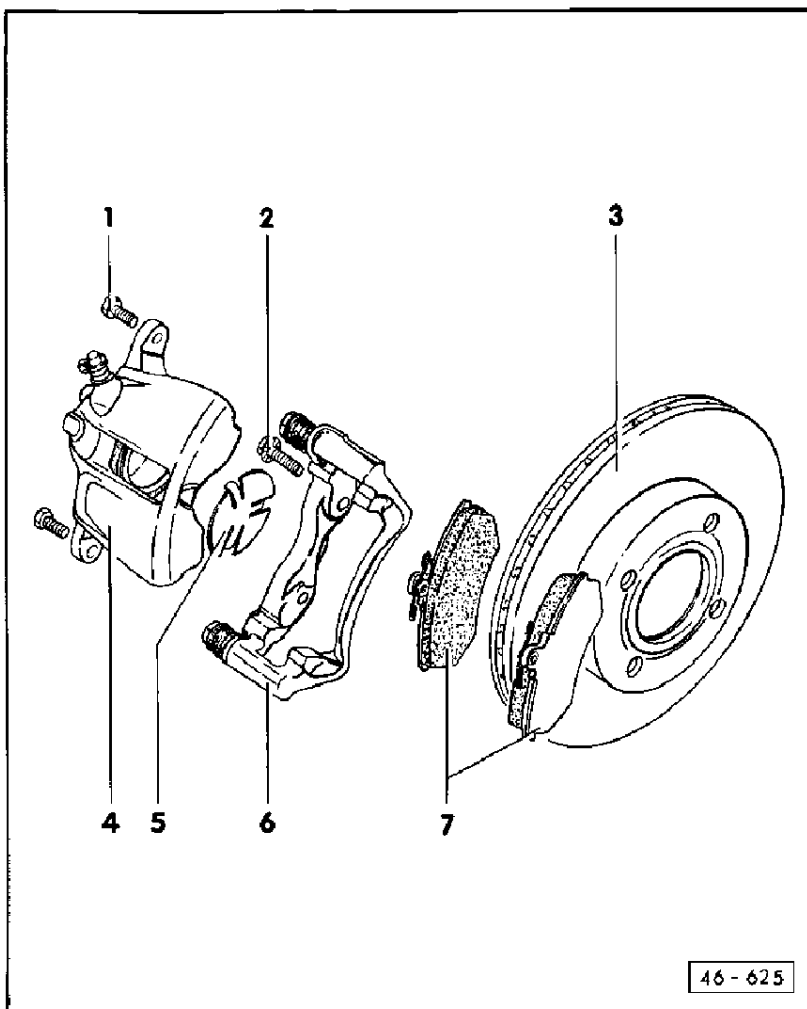
- 4 - Brake calliper housing
 - ◆ Do not disconnect brake hose when changing brake linings
- 5 - Heat shield
 - ◆ Insert into piston



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46 - 625

- 6 - Brake carrier with guide pin and protective cap
 - ◆ Supplied as replacement part, assembled with sufficient grease on guide pins
 - ◆ If protective caps are damaged install repair kit
 - ◆ Use grease sachet supplied to lubricate guide pins
 - ◆ Note different versions in relation to respective brake disc diameter.



7 - Brake linings

- ◆ Replace on axle basis => Page 46-6
- ◆ Brake lining thickness when new 14 mm
- ◆ Brake lining wear limit 2 mm
- ◆ Checking brake lining thickness => Page 46-6
- ◆ If the pad thickness is down to 7 mm (including backing plate), the brake linings have reached the wear limit and must be replaced.

Checking brake lining thickness

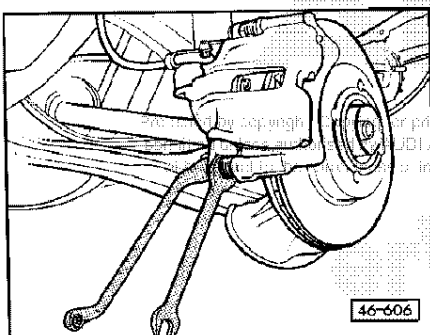
- Determine thickness of outer pads by checking visually (with help of flashlight) through cut-out in wheel.
- If the pad thickness is down to 7 mm (including backing plate), the brake linings have reached the wear limit and must be replaced.

Replacing brake linings (Girling)

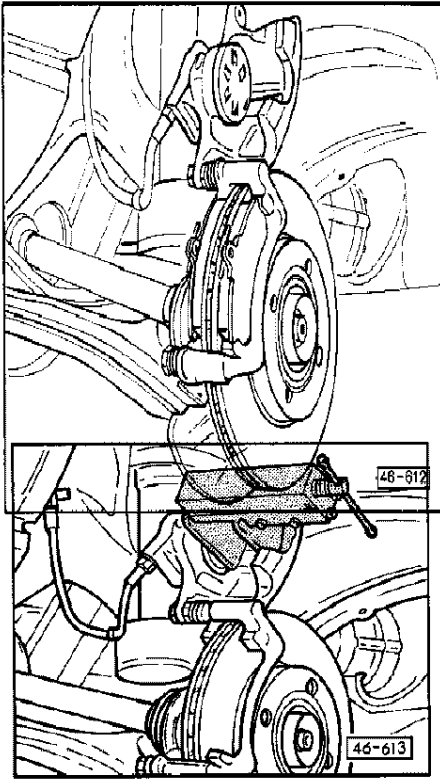
Note:

Mark brake linings to be reused on removal. Reinstall in their original position to prevent uneven braking.

- Remove wheels.
- Unscrew lower securing bolt for brake calliper housing. Counterhold at guide pin.



- ◀ – Brake calliper housing up and take out brake linings.



- ◀ – Press back pistons into brake calliper housing.

Note:

Before pressing back the pistons, draw off some of the brake fluid from the reservoir. Otherwise brake fluid which was used to top up the brake fluid reservoir may run out and cause damage. Use a bleeder bottle or a plastic bottle, which is only used for brake fluid.

Attention:

Brake fluid is poisonous and must on no account be siphoned orally through a hose.

- Insert brake linings.
- Swivel brake calliper housing down and tighten bolts to 35 Nm.
- Fit wheels.

Notes:

- ◆ The repair kit includes two self locking hexagon bolts which must be installed in all cases.
- ◆ Firmly depress brake pedal several times with vehicle stationary, so that the brake linings are properly seated in their normal operating position.
- Check brake fluid level and top up if necessary.

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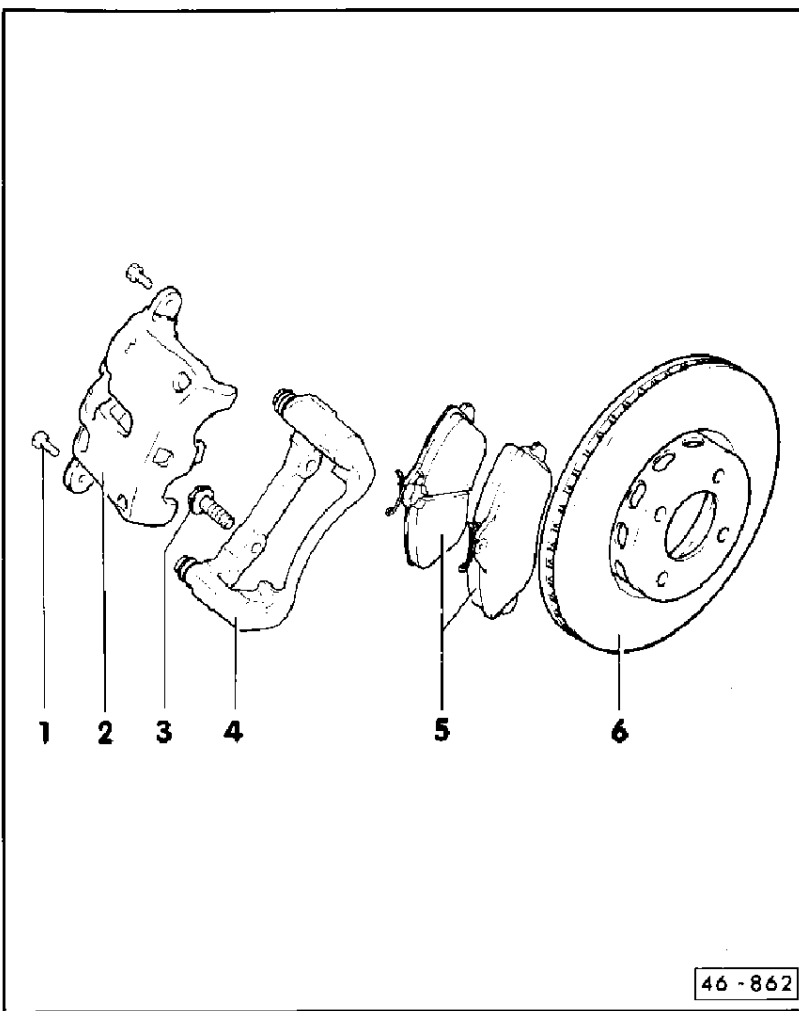
Servicing front brakes, dual-piston version

Notes:

- ◆ Always install the complete repair kit.
- ◆ Brakes can be checked on all commercially available brake test stands, provided that the driving speed of the two driving rollers of the test stand does not exceed 5.5 km/h.

1 – Self locking bolt, 35 Nm

- ◆ Always replace
- ◆ When loosening and tightening counter hold on guide pin



— 46-9 —

2 – Brake calliper housing

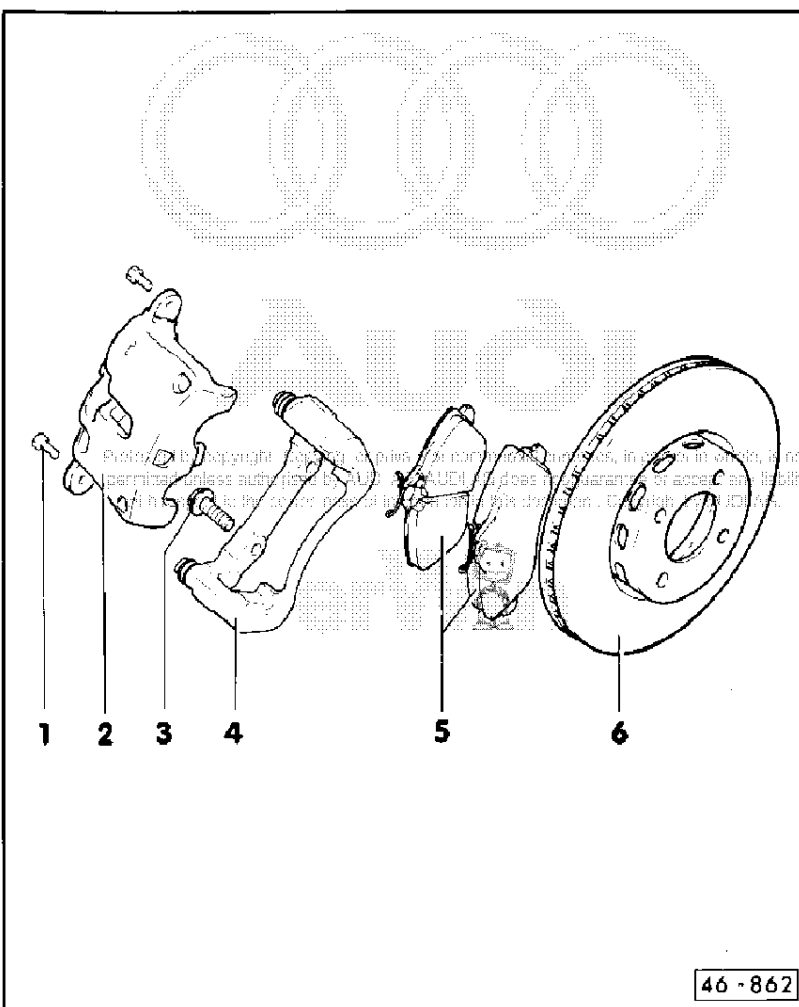
- ◆ Do not disconnect brake hose when changing brake linings

3 – Ribbed bolt, 125 Nm

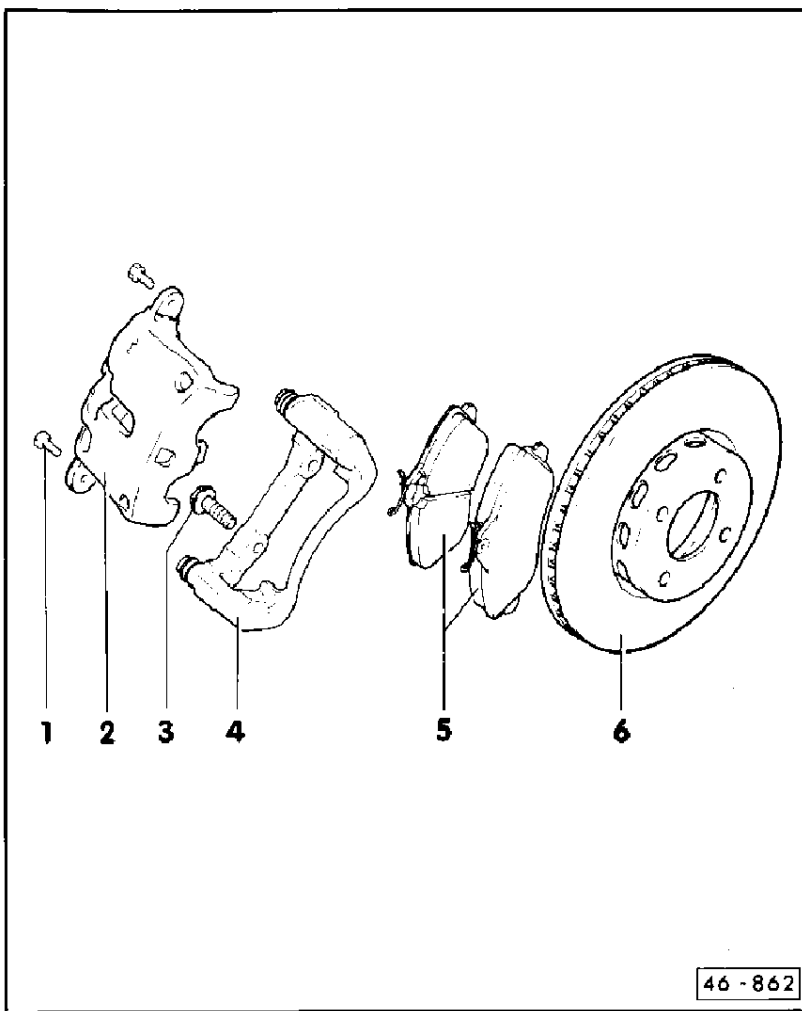
- ◆ Clean ribbing if reusing

4 – Brake carrier with guide pin and protective cap

- ◆ Supplied as replacement part, assembled with sufficient grease on guide pins
- ◆ If protective caps are damaged install repair kit
- ◆ Use grease sachet supplied to lubricate guide pins

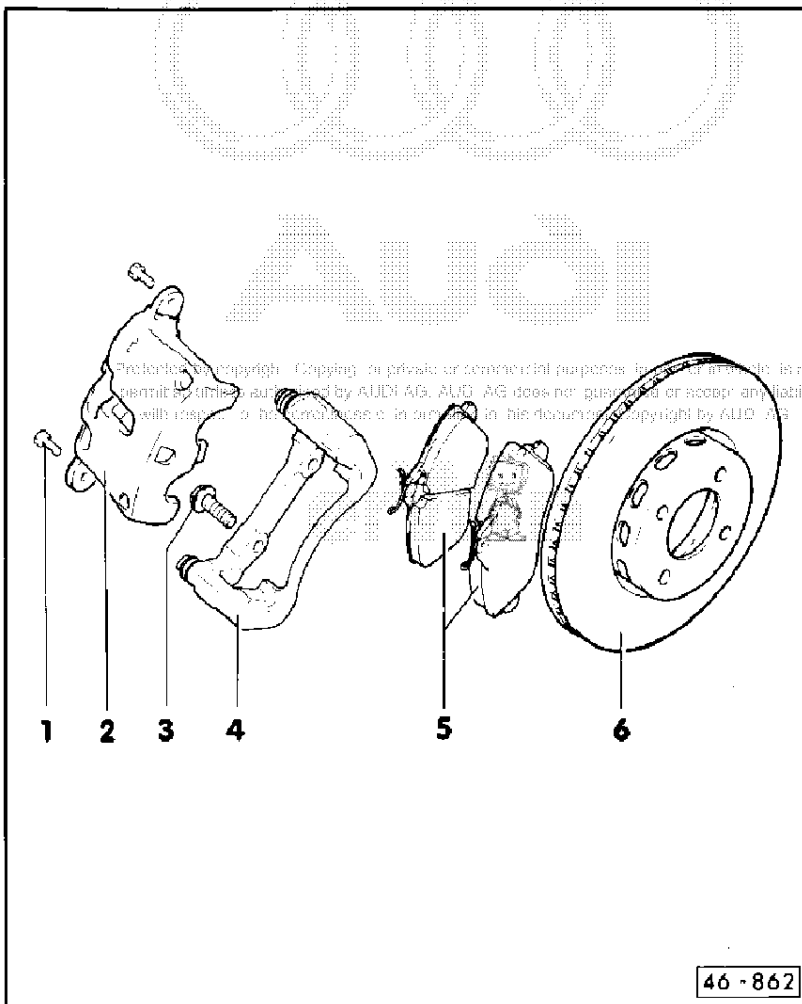


— 46-10 —



5 - Brake linings

- ◆ Replace on axle basis => Page 46-13
- ◆ Brake lining thickness when new 13 mm
- ◆ Brake lining wear limit 2 mm
- ◆ Checking brake lining thickness => Page 46-13
- ◆ If the pad thickness is down to 7 mm (including backing plate), the brake linings have reached the wear limit and must be replaced.



6 - Brake disc

- ◆ Replace on axle basis; to remove, unscrew brake calliper beforehand
- ◆ Always dress evenly, on both sides, starting from thickness when new
- ◆ Ensure adequate wear reserve
- ◆ Brake disc diameter: 276 mm
- ◆ Brake disc thickness: 25 mm
- ◆ Wear limit: 23 mm

Checking brake lining thickness

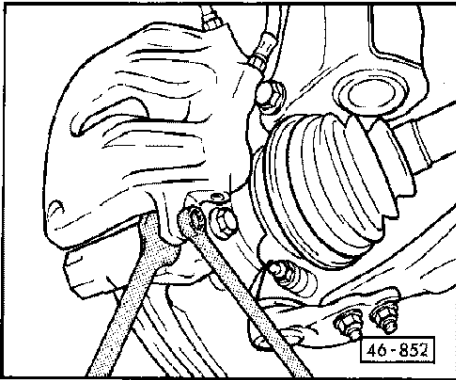
- Determine thickness of outer pads by checking visually (with help of flashlight) through cut-out in wheel.
- If the pad thickness is down to 7 mm (including backing plate), the brake linings have reached the wear limit and must be replaced.

Replacing brake linings (dual-piston)

Note:

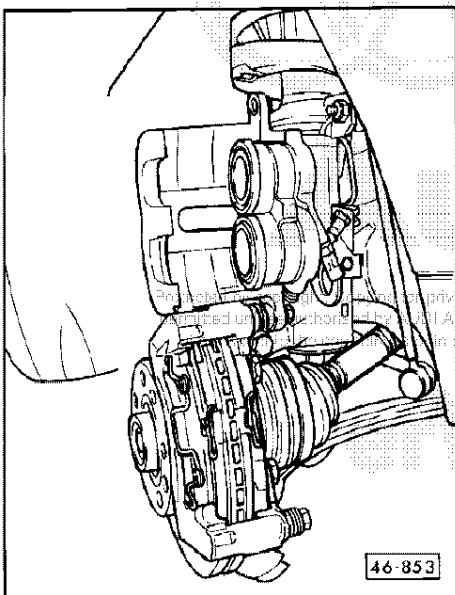
Mark brake linings to be reused on removal. Reinstall in their original position to prevent uneven braking!

- Remove wheels.
- ◀ - Unscrew lower securing bolt for brake calliper housing. Counterhold at guide pin.

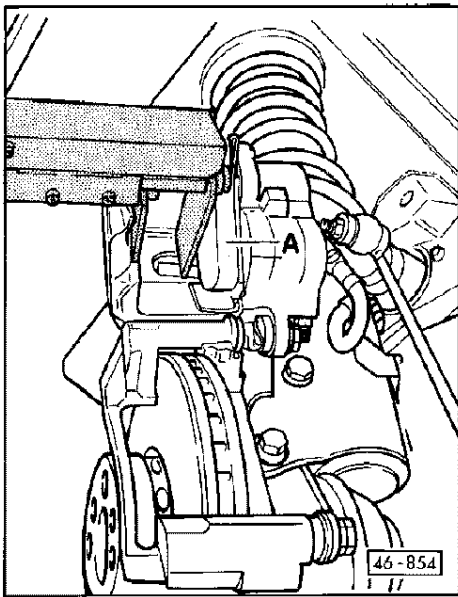


— 46-13 —

- ◀ - Swivel brake calliper housing up and take out brake linings.



— 46-14 —



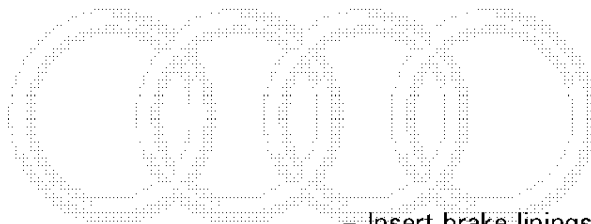
- ◀ – Press back pistons into brake calliper housing
- A = old, removed brake lining

Note:

Before pressing back the pistons, draw off some of the brake fluid from the reservoir. Otherwise brake fluid which was used to top up the brake fluid reservoir may run out and cause damage. Use a bleeder bottle or a plastic bottle, which is only used for brake fluid.

Attention:

Brake fluid is poisonous and must on no account be siphoned orally through a hose.



- Insert brake linings.
- Swivel brake calliper housing down and tighten bolts to 35 Nm.
- Fit wheels.

Notes:

◆ The repair kit includes two self locking hexagon bolts which must be installed in all cases.

◆ **Firmly depress brake pedal** several times with vehicle stationary so that the brake linings are properly seated in their normal operating position.

Check brake fluid level and top up if necessary.

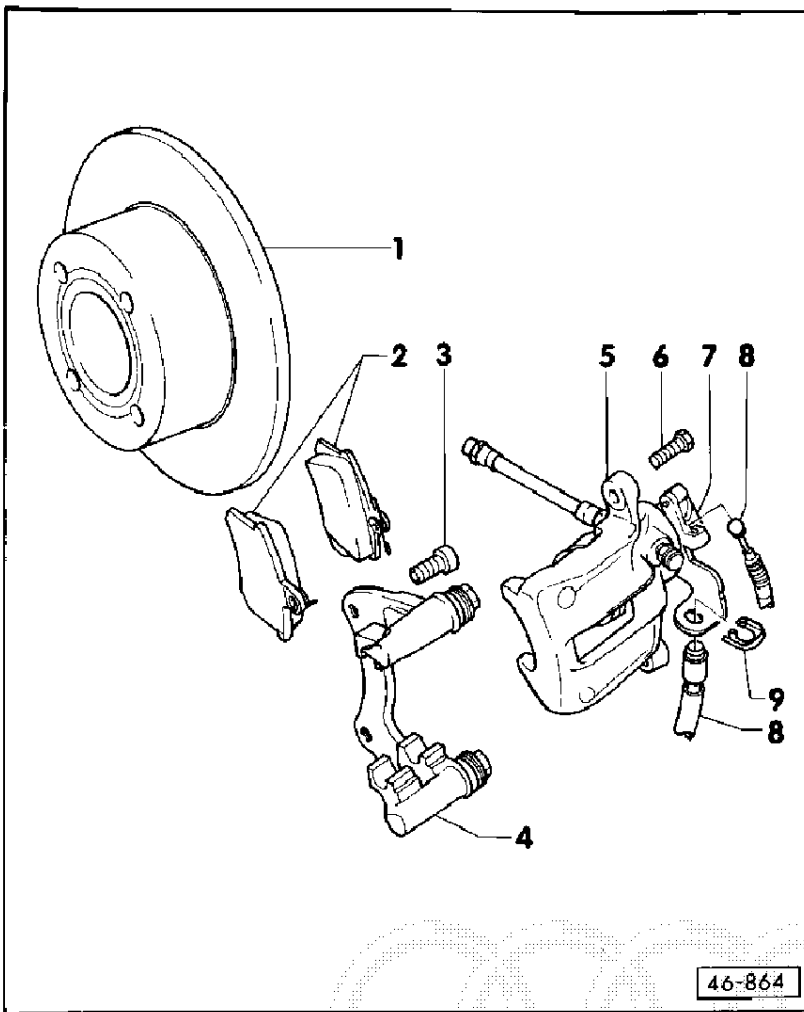


Servicing rear brake, disc brake

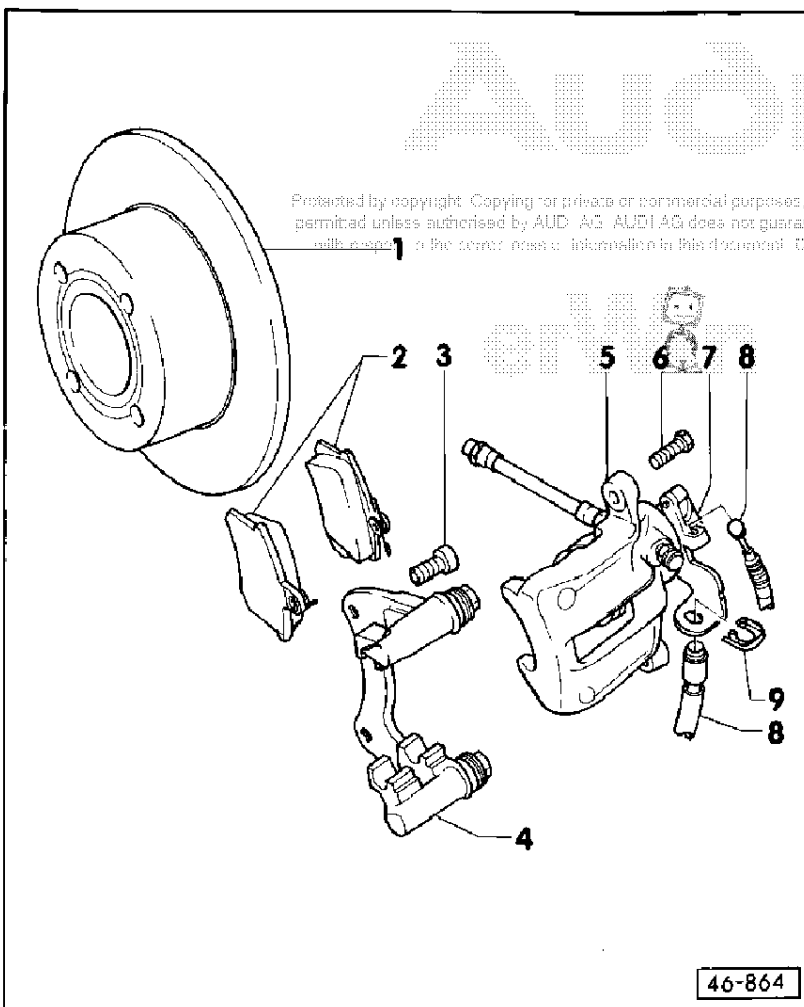
Rear brakes with automatic adjustment

Notes:

- ◆ Always install the complete repair kit.
- ◆ Brakes can be checked on all commercially available brake test stands, provided that the driving speed of the two driving rollers of the test stand does not exceed 5.5 km/h.



— 46-17 —



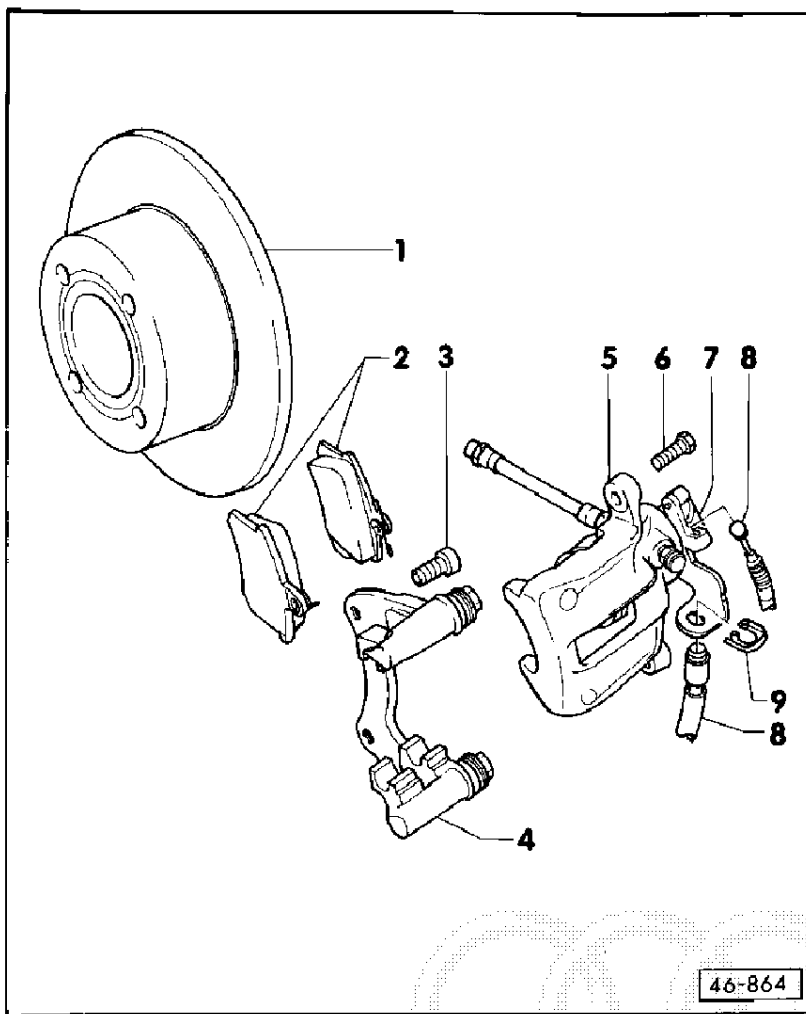
1 - Brake disc

- ◆ Replace on axle basis; to remove, unscrew brake calliper beforehand
- ◆ Always dress evenly, on both sides, starting from thickness when new
- ◆ Ensure adequate wear reserve
- ◆ Brake disc diameter: 245 mm
- ◆ Brake disc thickness: 10 mm
- ◆ Wear limit: 8 mm

2 - Brake linings

- ◆ Replace on axle basis => Page 46-21
- ◆ Brake lining thickness when new 12 mm
- ◆ Brake lining wear limit 2 mm

— 46-18 —



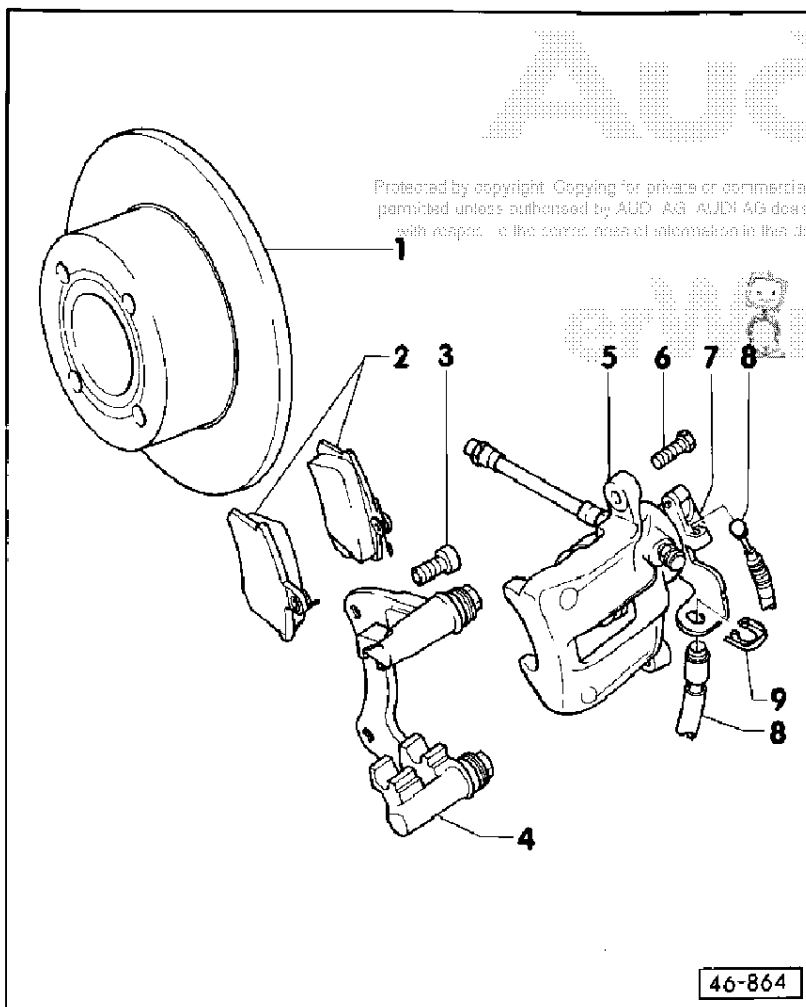
- ◆ Checking brake lining thickness => Page 46-21
- ◆ If the pad thickness is down to 7 mm (including backing plate), the brake linings have reached the wear limit and must be replaced.

3 – Cheese-head bolt, 60 Nm

- ◆ Cheese-head flange ribbed bolt, 80 Nm

4 – Brake carrier with guide pin and protective cap

- ◆ Supplied as replacement part, assembled with sufficient grease on guide pins
- ◆ If protective caps are damaged install repair kit
- ◆ Use grease sachet supplied to lubricate guide pins



5 – Brake calliper housing

- ◆ Unscrew from brake carrier to replace brake linings
- ◆ Do not unscrew brake hose

6 – Self locking bolt, 35 Nm

- ◆ Always replace
- ◆ When loosening and tightening counter hold on guide pin

7 – Lever for handbrake cable

- ◆ Insert handbrake cable

8 – Handbrake cable

- ◆ Adjusting handbrake => Page 46-30.

9 – Locking clip

- ◆ Attach handbrake cable to support bracket

Checking brake lining thickness

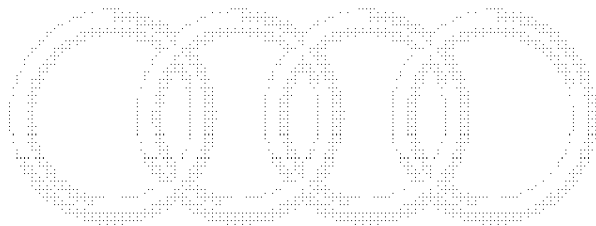
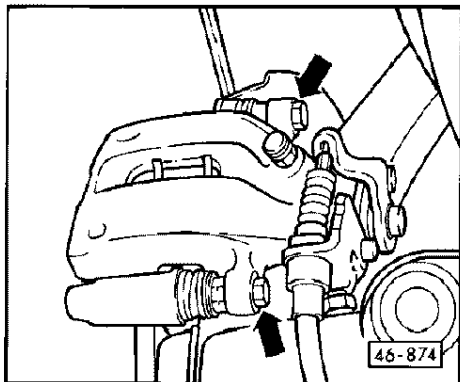
- Determine thickness of outer pads by checking visually (with help of flashlight) through cut-out in wheel.
- If the pad thickness is down to 7 mm (including backing plate), the brake linings have reached the wear limit and must be replaced.

Replacing rear brake linings

Note:

Mark brake linings to be reused on removal. Reinstall in their original position to prevent uneven braking.

- Remove wheels.
- Unscrew brake calliper housing.
- Remove brake linings.



46-21

Notes:

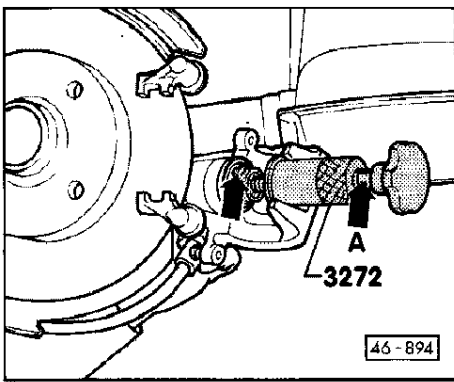
Before pressing back the pistons, draw off some of the brake fluid from the reservoir. Otherwise brake fluid which was used to top up the brake fluid reservoir may run out and cause damage. Use a bleeder bottle or a plastic bottle, which is only used for brake fluid.

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Attention:

Brake fluid is poisonous and must on no account be siphoned orally through a hose.

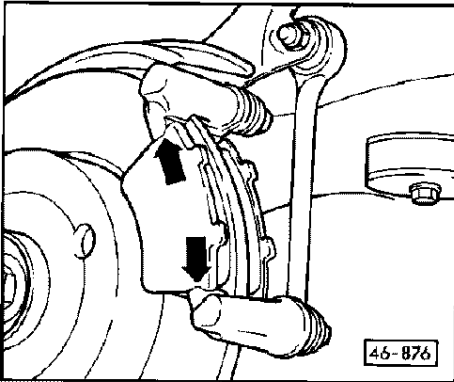
46-22



- ◀ – Screw in piston by turning the threaded spindle clockwise and the knurled section anticlockwise as far as the stop.

Note:

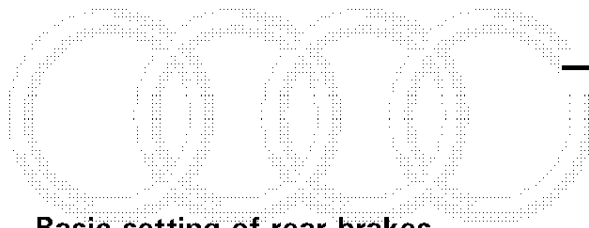
- ◆ If piston is difficult to move, use a 13 mm AF open jaw spanner on the flats (arrow A) provided for this purpose.
- ◆ Insert special tool -3272- so that the collar is positioned in front of the piston.



- ◀ – Insert brake linings.
- Screw on brake calliper housing, 35 Nm.
- Check brake fluid level and top up if necessary.

Notes:

- ◆ The repair kit includes two self locking hexagon bolts which must be installed in all cases.
- ◆ Firmly depress brake pedal several times with vehicle stationary, so that the brake linings are properly seated in their normal operating position.
- ◆ Always perform basic setting of rear brakes whenever brake linings have been replaced =>Page 46-24



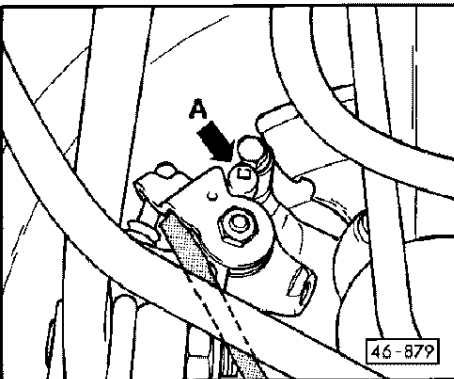
Basic setting of rear brakes

Handbrake cable must not be pretensioned when performing basic setting (handbrake off).

- ◀ Check:

Alternately press handbrake cable levers against stop -A- with a screwdriver.

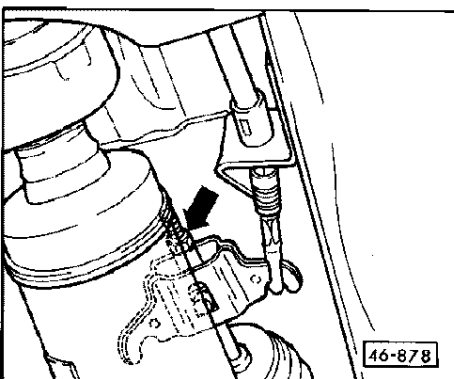
- If lever at opposite brake calliper in each case is pulled off stop, handbrake cable has been excessively pretensioned.
- Remove rear exhaust system guard plate



Note:

- ◀ The illustration shows the adjusting nut with the guard plate for the exhaust system removed. To adjust, use 10 mm long socket wrench with flexible extension and ratchet.

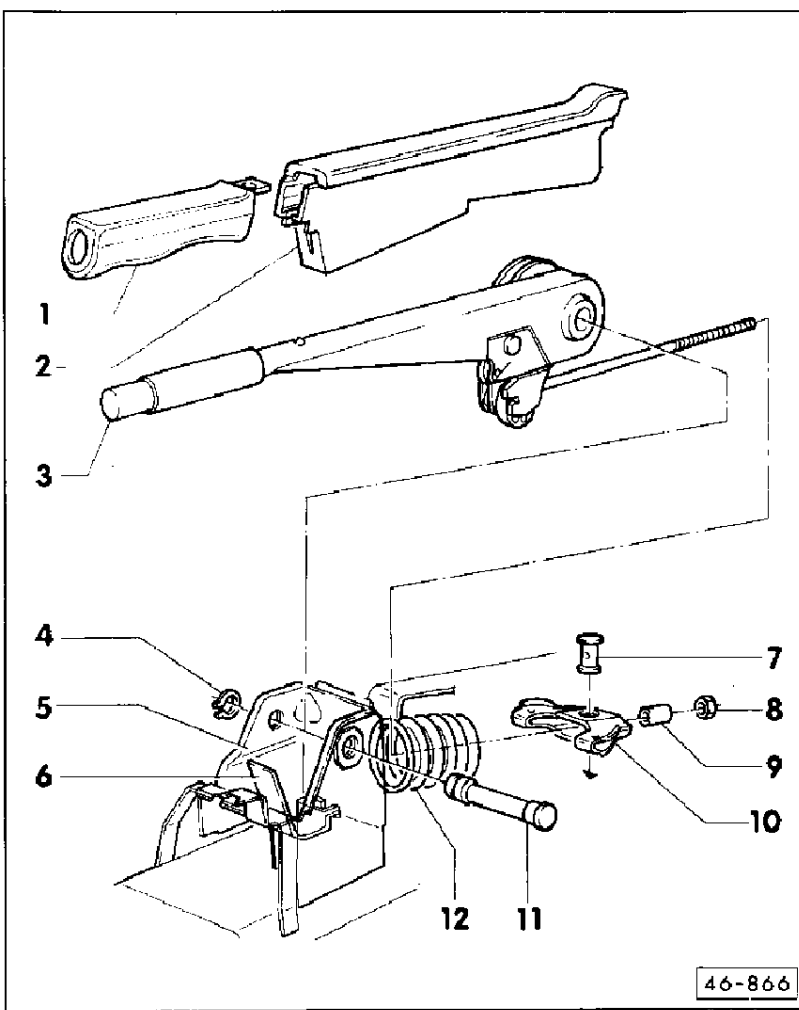
- Appropriately loosen adjusting nut for handbrake cable -arrow- until both levers make contact with stop.
- Position vehicle on its wheels and press brake pedal several times with engine stopped.
- Jack up vehicle and check whether both wheels turn freely



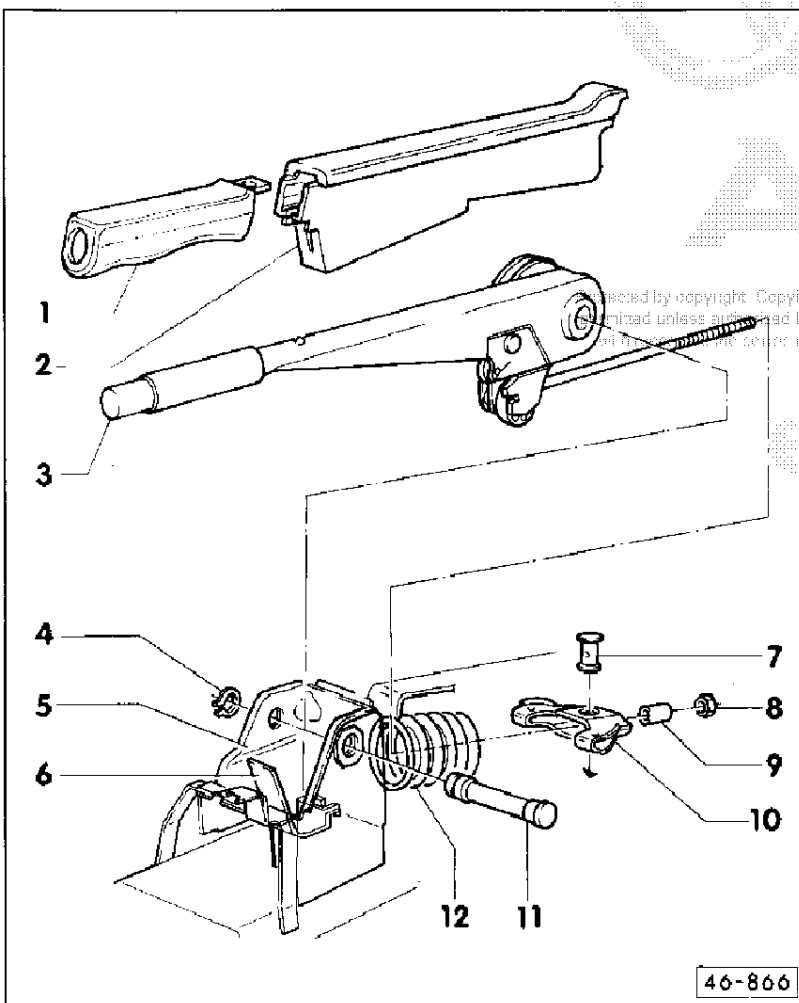
Servicing handbrake

Note:

Grease all bearings prior to assembly with white solid lubricating paste, part no. AOS 126 000 05.



46-25



3 - Handbrake lever

- ◆ Available as an assembled component with pull rod, locking pawl, pushrod, pushbutton, pressure spring and ratchet.

◆ Removing and installing
=> Page 46-28

4 - Circlip

- ◆ Always replace
- ◆ Ensure correct positioning

5 - Mounting for handbrake lever

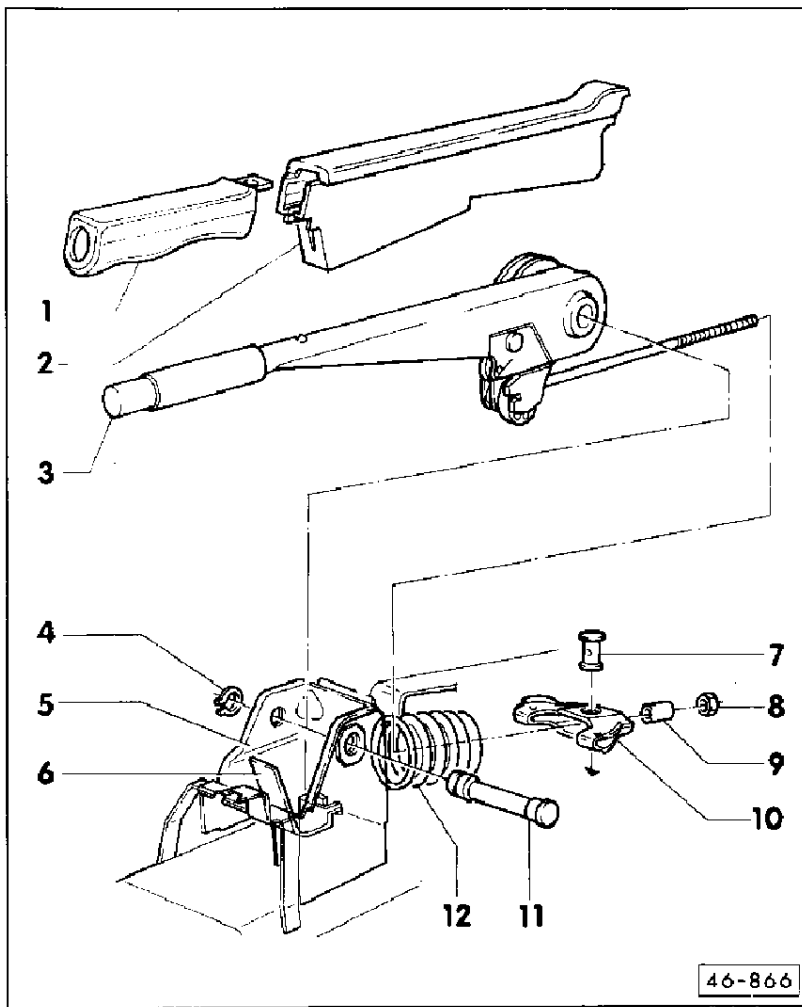
6 - Leaf spring

- ◆ Insert in bracket

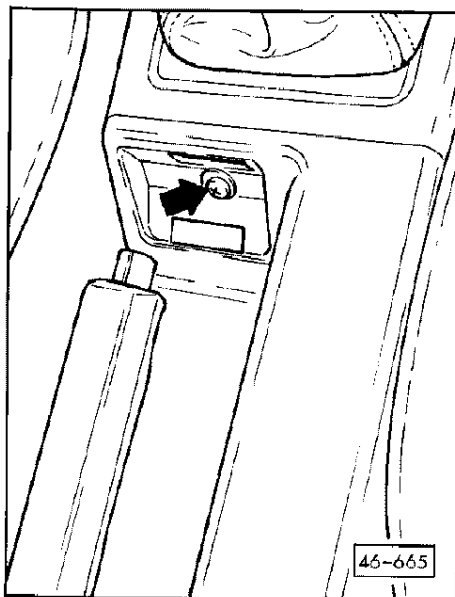
7 - Pin

- ◆ Insert in compensator bar
- ◆ Insert pull rod in hole in pin

46-26



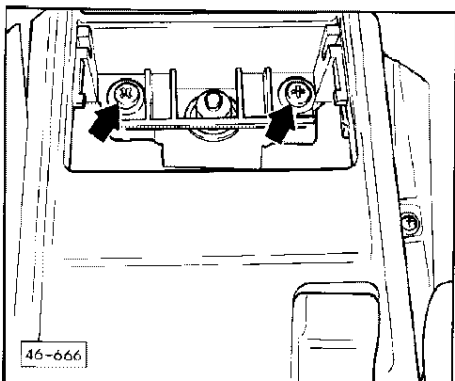
- 8 – Adjusting nut, self-locking
 - ◆ Adjusting hand brake:
 - Disc brake => Page 46-30
- 9 – Bushing
 - ◆ Slip onto pull rod
- 10 – Compensator bar
- 11 – Fulcrum pin
- 12 – Bellows
 - ◆ Ensure correct positioning



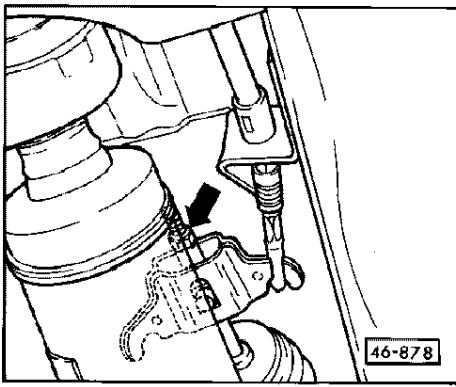
Removing and installing handbrake lever

- Use screwdriver to unclip cover
- Remove screw

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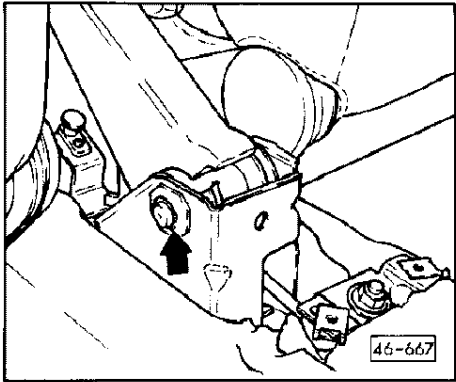
- Remove ashtray for rear compartment.
 - => General body repairs; Repair Group 70 =>
- Remove both screws
 - => General body repairs; Repair Group 70 =>
- Remove rear section of centre console
 - => General body repairs; Repair Group 70 =>
- Remove rear guard plate for exhaust system



Note:

◀ To adjust, use 10 mm long socket wrench with flexible extension and ratchet.

- Unscrew adjusting nut
- Remove compensator bar
- Remove bellows



- ◀ - Unfasten circlip
- Press out support pin
- Push handbrake lever slightly to rear and then remove

Note:

After installing handbrake lever adjust handbrake => Page 46-30.

Adjusting handbrake (vehicles with disc brake)

Note:

Due to the automatic rear wheel brake adjustment there is normally no requirement to adjust the handbrake. Adjustment is only necessary if the handbrake cables, brake callipers, brake discs and brake linings are renewed.

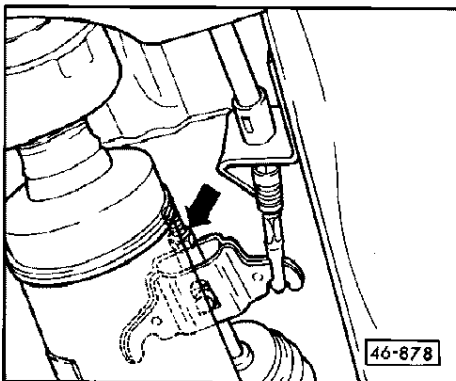
Attention:
Always perform basic setting of rear wheel brake first Page

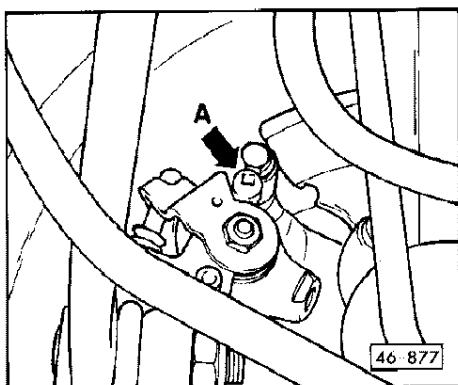
- Remove rear exhaust system guard plate

Note:

◀ The illustration shows the adjusting nut with the guard plate for the exhaust system removed. To adjust, use 10 mm long socket wrench with flexible extension and ratchet.

- Turn adjusting nut for handbrake

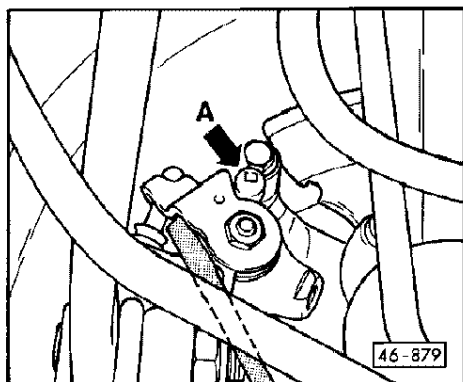




- ◀ - ... until both levers just lift off stop -A- (second mechanic required)

- Turn back adjusting nut two turns

Check:



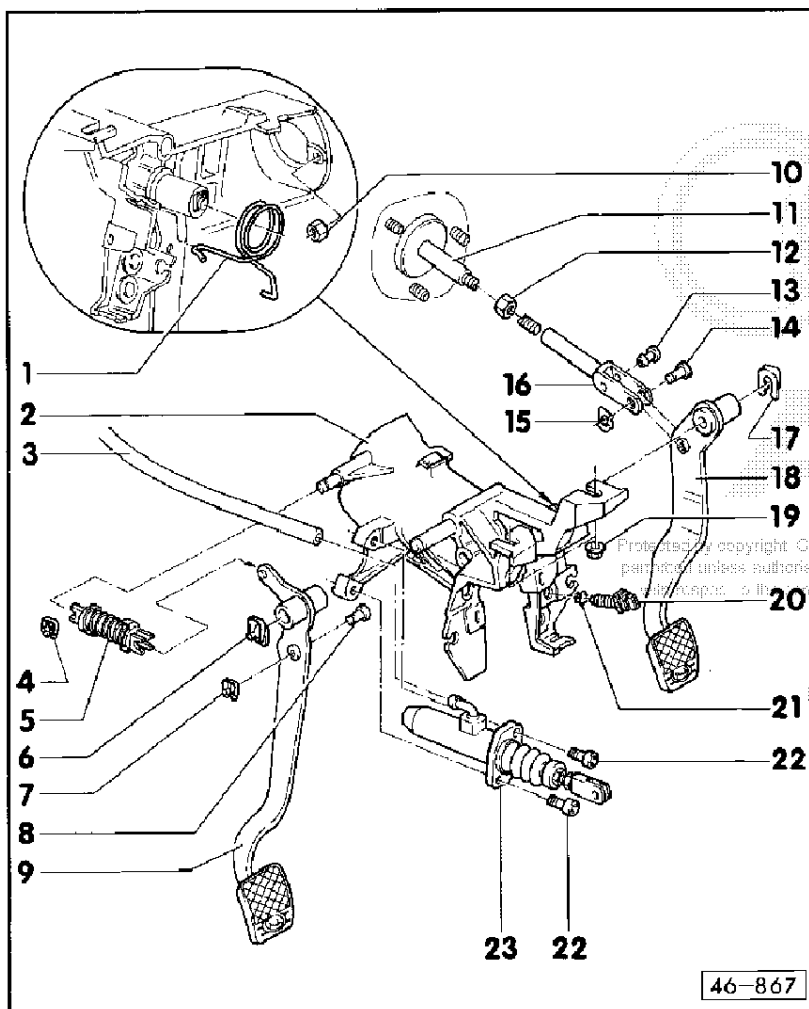
- ◀ - Alternately press handbrake cable levers against stop -A- with a screwdriver.

- If lever at opposite brake calliper in each case is pulled off stop, handbrake cable has been excessively pretensioned.

- Appropriately loosen adjusting nut for handbrake cable until both levers make contact with stop.

- Apply handbrake and then release it again.

- Check whether both wheels turn freely; if applicable check freedom of movement of handbrake mechanism.



Removing, installing and servicing pedal cluster

Attention:

The brake pedal travel must not be shortened by additional floor coverings.

Note:

Grease all bearings prior to assembly with solid lubricating paste, part no. G 052 142 A2

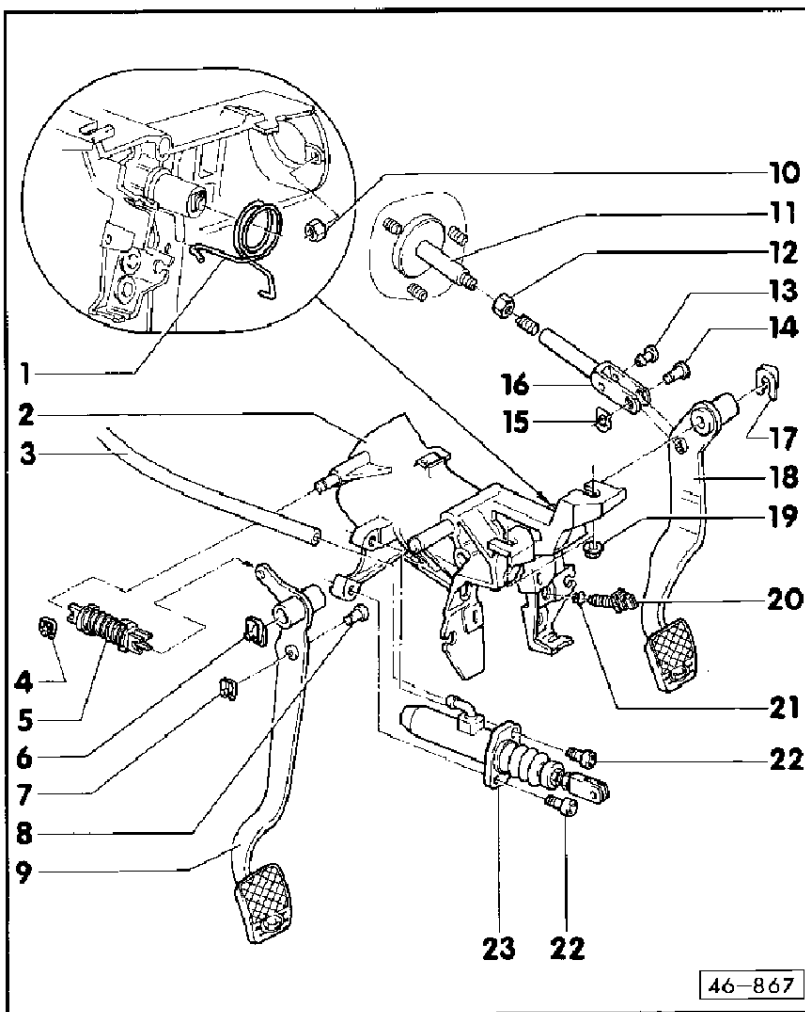
1 - Coil spring

◆ Insert U-shaped end in pedal bracket

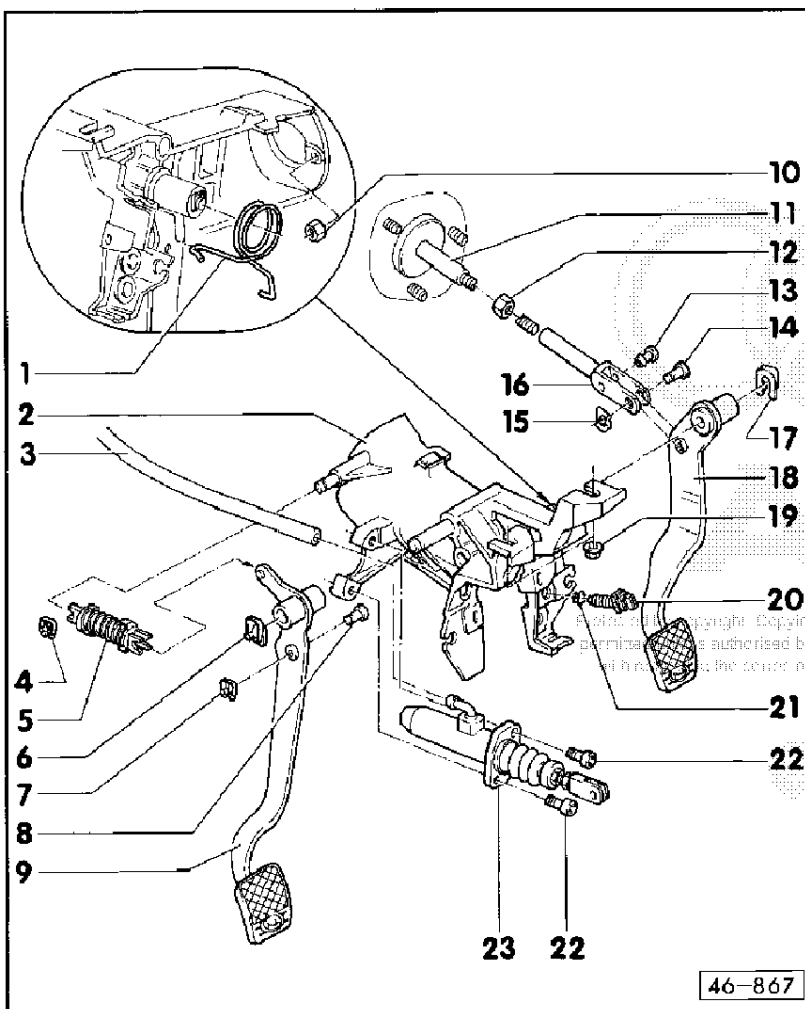
◆ Insert other end in grommet inserted in clevis

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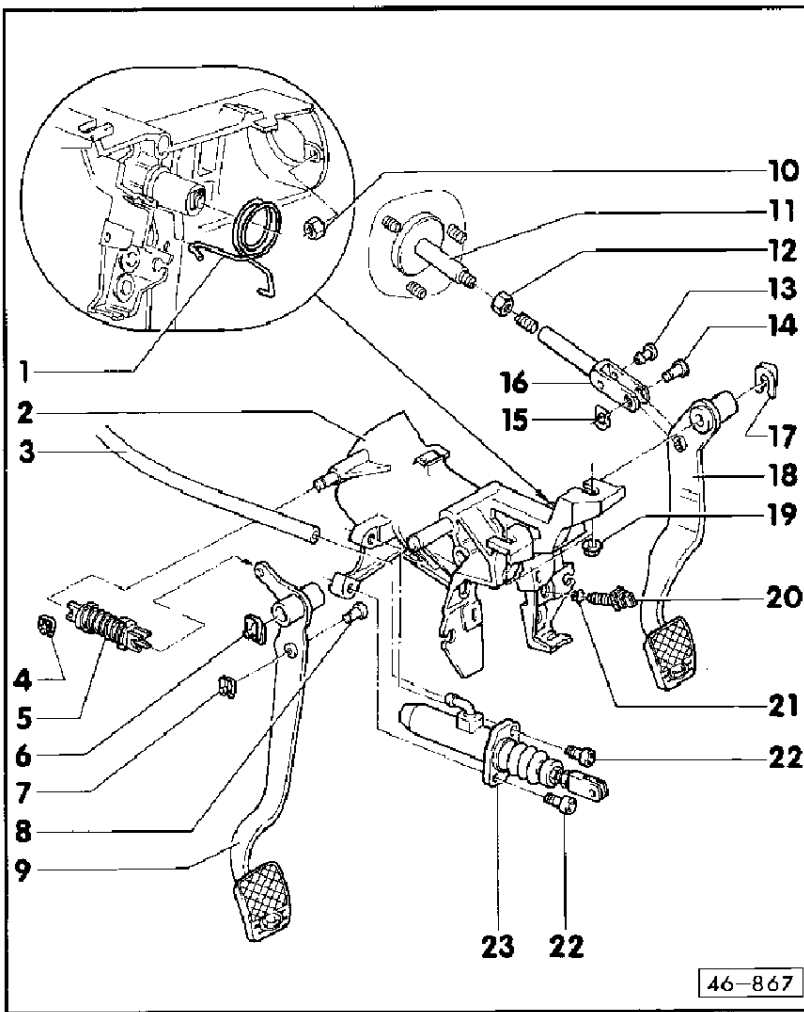




- 2 - Pedal bracket
 - ◆ Do not take out to remove brake or clutch pedal
- 3 - Supply hose
 - ◆ From brake fluid reservoir to clutch master cylinder
- 4 - Circlip
 - ◆ Replace, attach to shaft of pedal bracket
- 5 - Over-centre spring
 - ◆ Do not grease spring
 - ◆ Only grease bearings on pedal/pedal bracket
 - ◆ Removing and installing = > Fig. 2
 - ◆ Different versions on 4-, 5- and 6-cylinder engines.



- 6 - Circlip
 - ◆ Replace, attach to shaft of pedal bracket
- 7 - Circlip
 - ◆ Always replace
 - ◆ Fit onto pin
- 8 - Pin
 - ◆ Insert in clevis and clutch pedal
- 9 - Clutch pedal
 - ◆ Fixed in position by setting of clevis
 - ◆ Attach to shaft of pedal bracket
 - ◆ Can be removed and installed without taking out pedal bracket.
 - ◆ Available as replacement part with moulded bushing; bushing cannot be replaced



10 – Self-locking nut, 25 Nm
 ◆ Always replace
 ◆ Bolt pedal bracket to bulk-head/connector plate

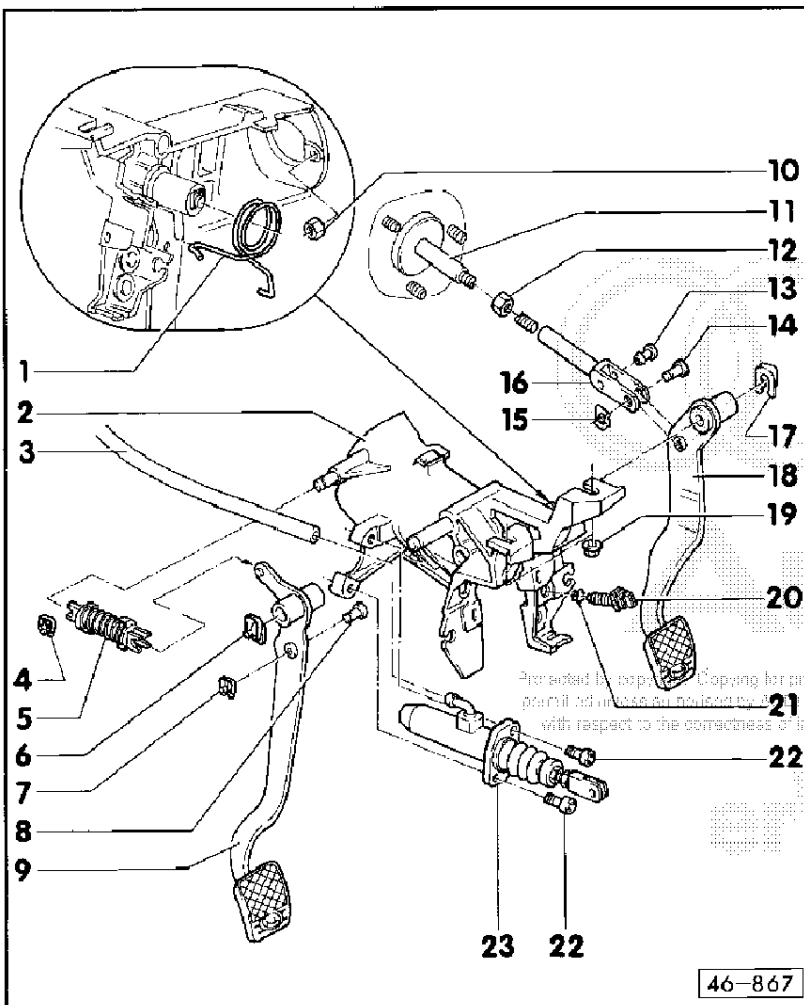
11 – Brake servo
 ◆ If faulty renew complete.

12 – Lock nut
 ◆ Tighten after adjusting clevis

13 – Grommet
 ◆ Insert in clevis

14 – Pin
 ◆ Insert in clevis and brake pedal

15 – Circlip
 ◆ Always replace
 ◆ Fit onto pin



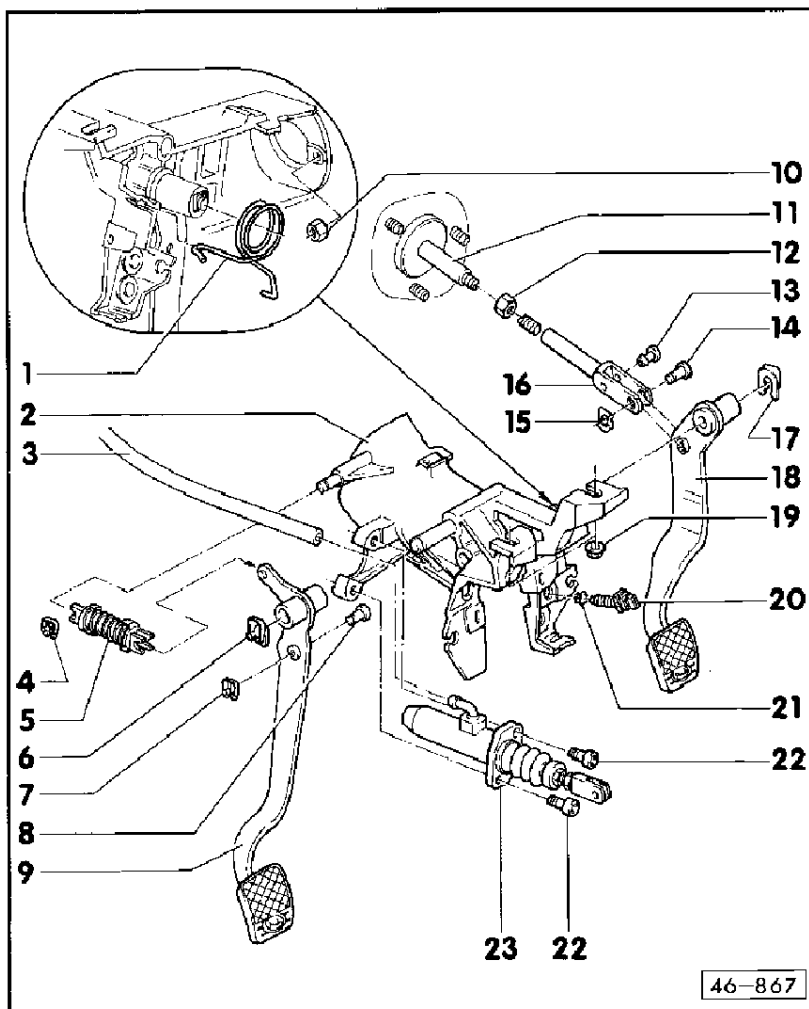
16 – Clevis of brake servo
 ◆ Adjusting:
 – Vehicles with pneumatic brake servo => Page 47-43, Fig. 1
 – Vehicles with hydraulic brake servo => Page 47-44, Fig. 2

17 – Circlip
 ◆ Always replace
 ◆ Attach to shaft of pedal bracket

18 – Brake pedal
 ◆ Attach to shaft of pedal bracket
 ◆ Can be removed and installed without taking out pedal bracket.
 ◆ Available as replacement part with moulded bushing; bushing cannot be replaced

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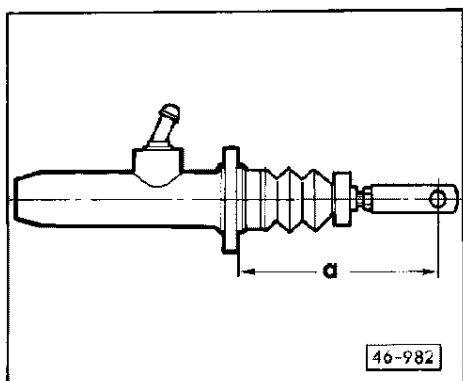
- 19 – Self-locking nut, 25 Nm
 - ◆ Always replace

- 20 – Brake light switch
 - ◆ Adjusting:
 - Brake pedal operated
 - Press in brake light switch as far as it will go
 - Pull back brake pedal by hand as far as stop

- 21 – Clip
 - ◆ Press home in pedal bracket

- 22 – Cheese-head bolt, 20 Nm
 - ◆ Screw master cylinder to pedal bracket

- 23 – Clutch master cylinder
 - ◆ Replace if leaking
 - ◆ Adjusting clevis => Fig. 1.



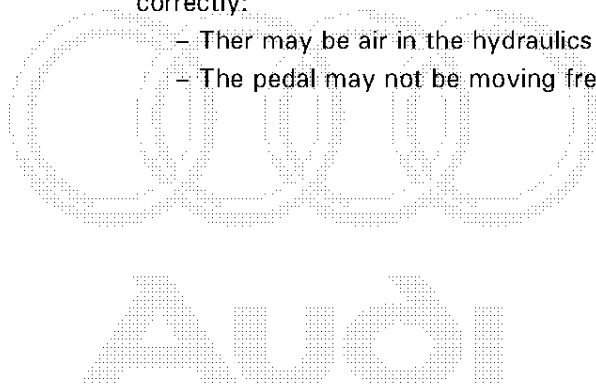
◀ Fig.1 Adjusting clevis of clutch master cylinder

$a = 109.5 \pm 0.5 \text{ mm}$

– To adjust, turn clevis accordingly

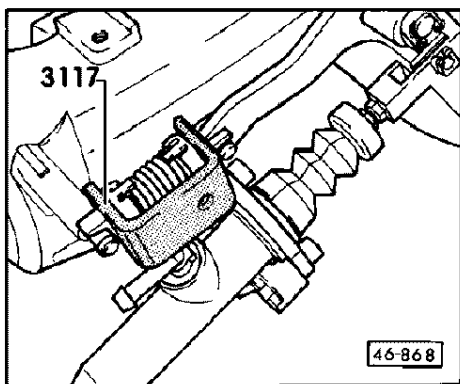
Notes:

- ◆ When measuring, the clevis should be aligned at right angles to the surface of the clutch master cylinder.
- ◆ If clutch pedal does not return automatically with clevis set correctly:
 - There may be air in the hydraulics
 - The pedal may not be moving freely in the mount



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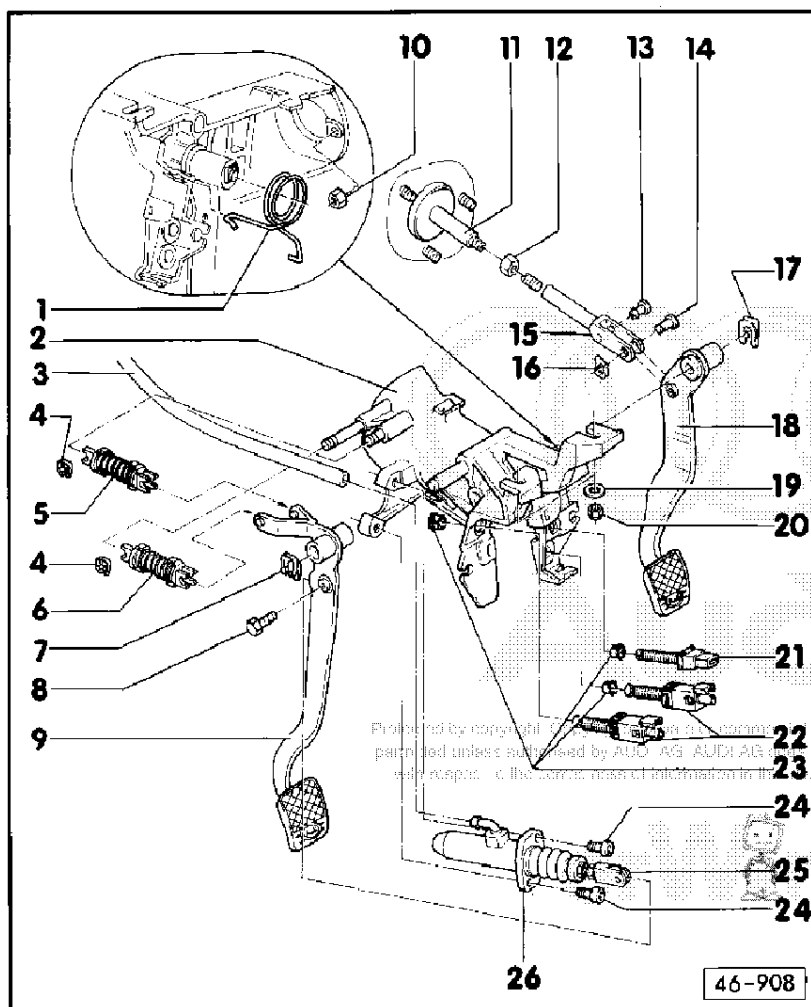


◀ Fig.2 Removing and installing over-centre spring

- Remove retainer from support pin
- Insert clamp -3117- as shown, press clutch pedal and while doing so remove over-centre spring from pedal bracket/clutch pedal.

Note:

The illustration shows the clamp with the pedal bracket removed.



Removing, installing and servicing pedal cluster for vehicles with 169 kW engine

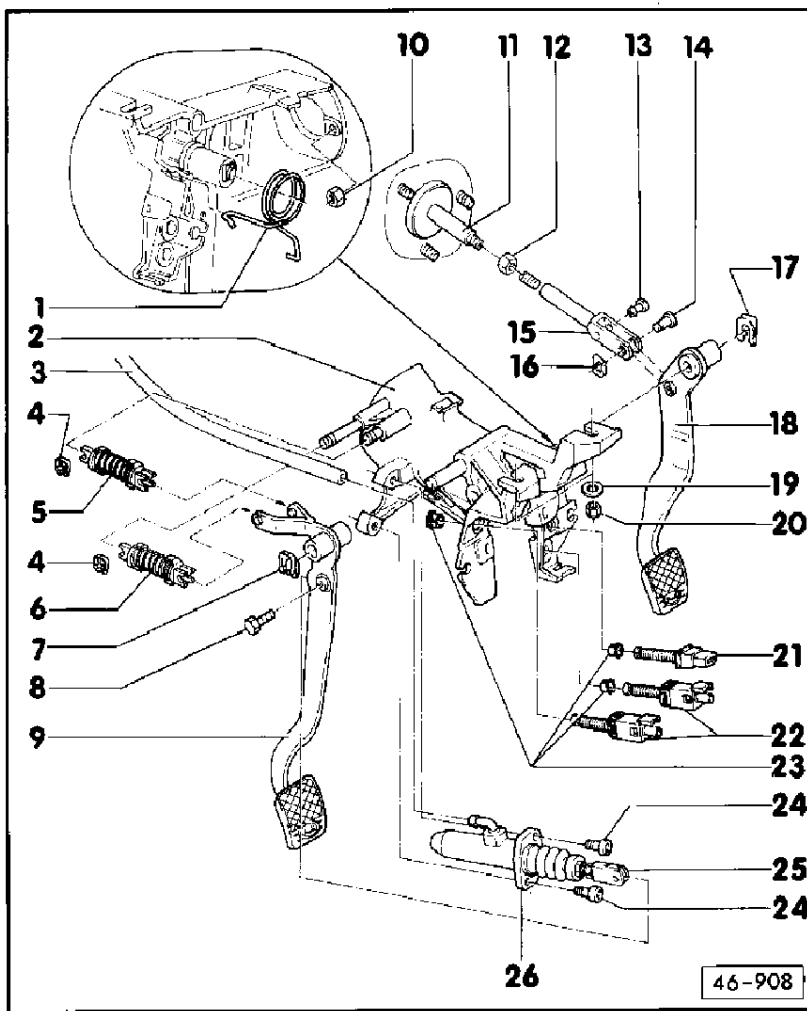
Attention

The brake pedal travel must not be shortened by additional floor coverings.

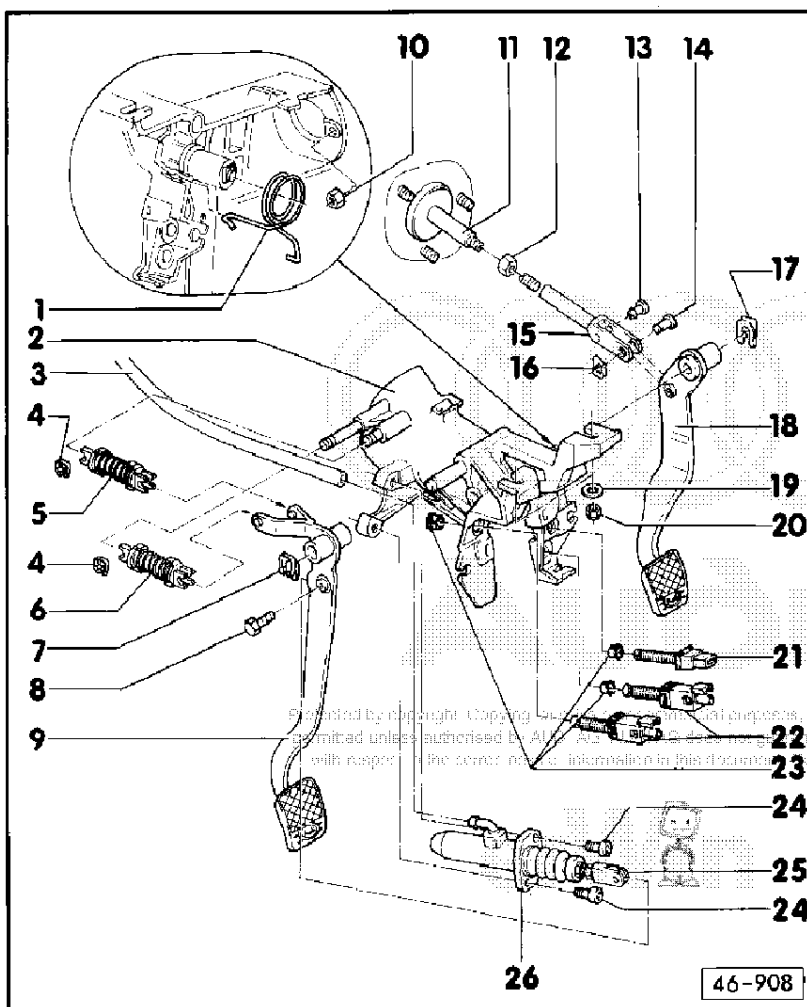
Note:

Grease all bearings prior to assembly with solid lubricating paste, part no. G 052 142 A2

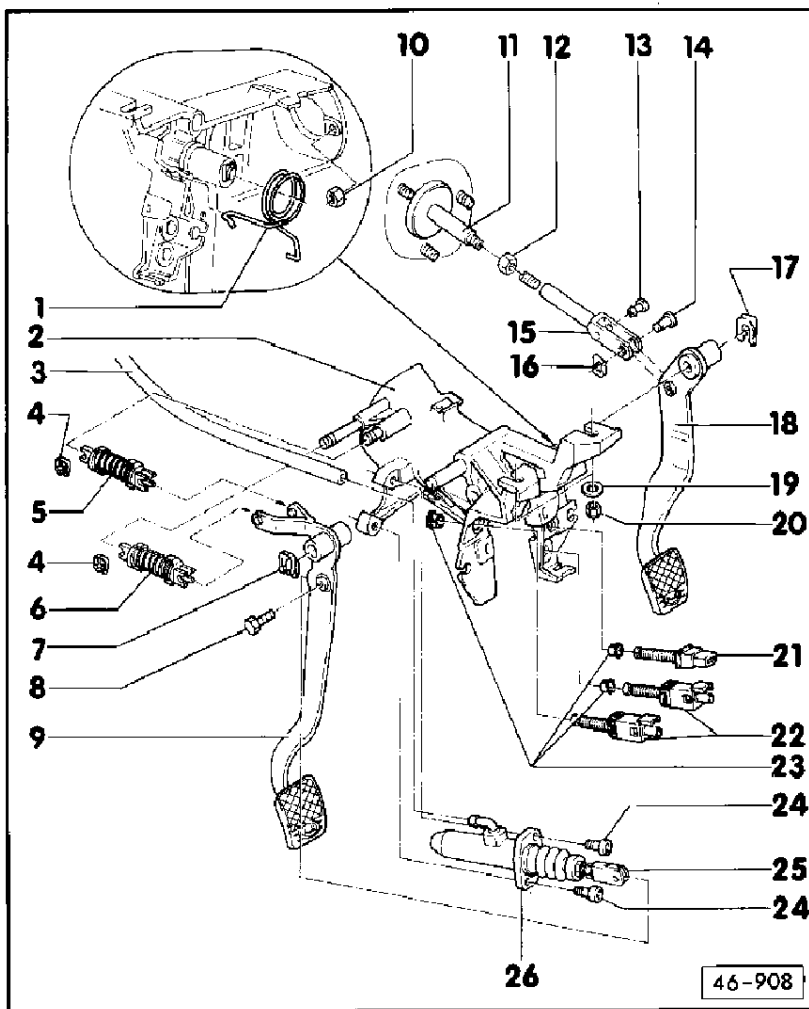
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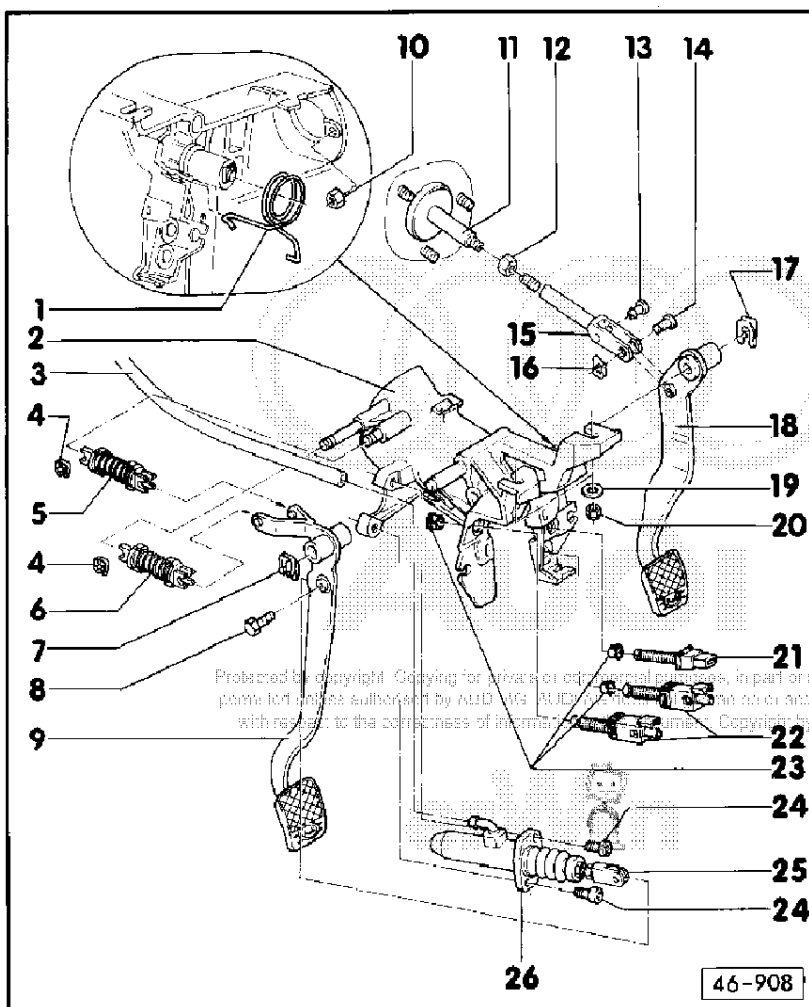
- 1 - Coil spring
 - ◆ Insert U-shaped end in pedal bracket
 - ◆ Insert other end in grommet inserted in clevis
- 2 - Pedal bracket
 - ◆ Do not take out to remove brake or clutch pedal
- 3 - Supply hose
 - ◆ From brake fluid reservoir to clutch master cylinder



- 4 - Circlip
 - ◆ Replace, attach to shaft of pedal bracket
- 5 - Support spring
 - ◆ Brown mark
 - ◆ Do not grease spring
 - ◆ Only grease bearings on pedal/pedal bracket
 - ◆ Removing and installing => Fig. 3
- 6 - Over-centre spring
 - ◆ Red mark
 - ◆ Do not grease spring
 - ◆ Only grease bearings on pedal/pedal bracket
 - ◆ Removing and installing => Fig. 4

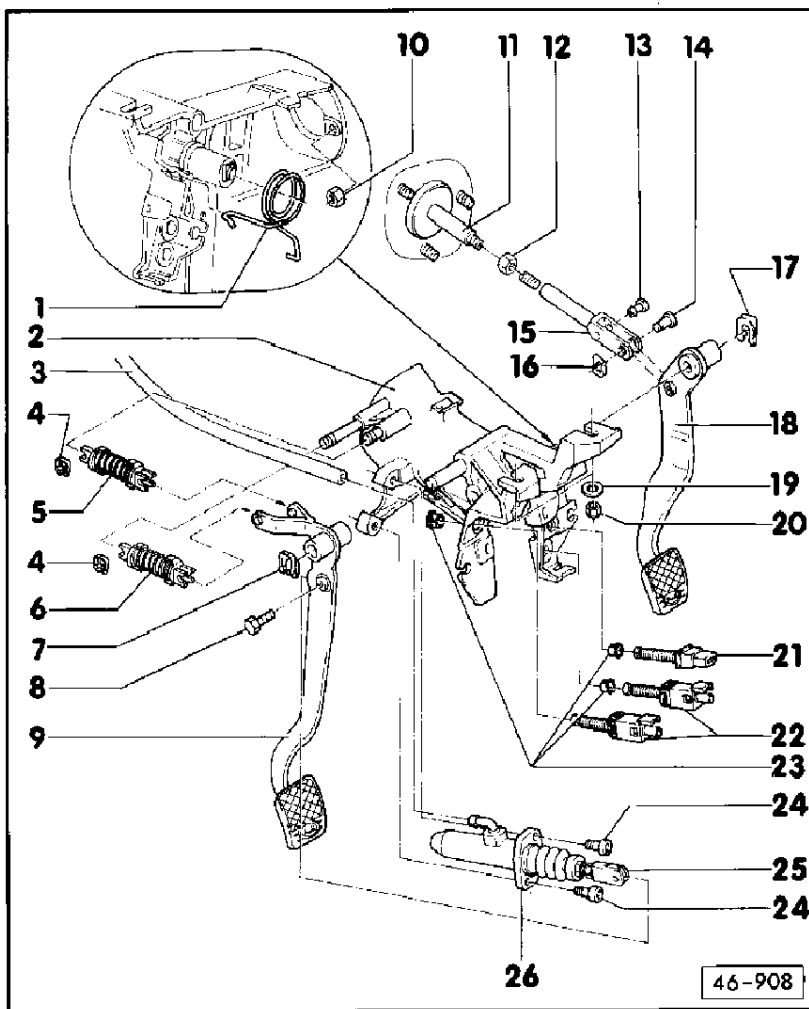


- 7 - Circlip
 - ◆ Replace, attach to shaft of pedal bracket
- 8 - Hexagon bolt, 25 Nm
 - ◆ Insert in clevis and bolt to clutch pedal
- 9 - Clutch pedal with swing support
 - ◆ Fixed in position by setting of clevis
 - ◆ Attach to shaft of pedal bracket
 - ◆ Can be removed and installed without taking out pedal bracket.
 - ◆ Available as replacement part with moulded bushing; bushing cannot be replaced



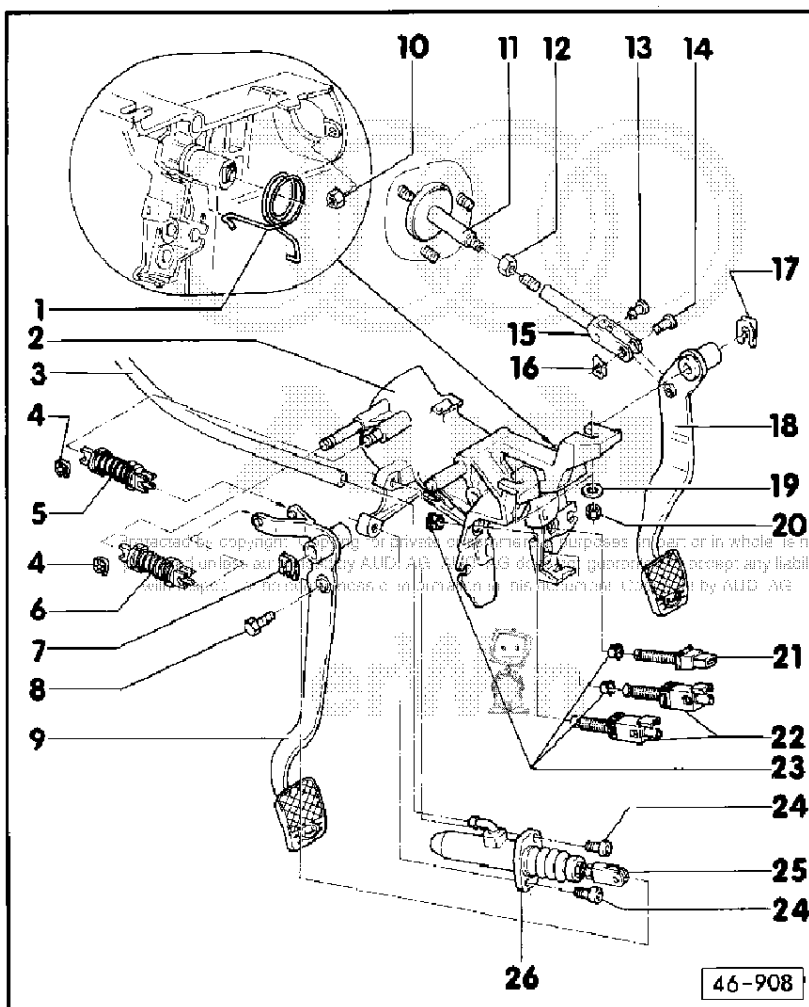
- 10 - Self-locking nut, 25 Nm
 - ◆ Always replace
 - ◆ Bolt pedal bracket to bulkhead/connector plate
- 11 - Pushrod for servo unit
- 12 - Lock nut
 - ◆ Tighten after adjusting clevis
- 13 - Grommet
 - ◆ Insert in clevis
- 14 - Pin
 - ◆ Insert in clevis and brake pedal

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- 21 - Brake light switch**
 ♦ Adjusting:
 - Press brake pedal
 - Press in brake light switch as far as it will go
 - Pull back brake pedal by hand as far as stop

- 22 - Bleeder valves**
 ♦ Adjust with clevis in position
 - Press brake/clutch pedal
 - Press in bleeder valve as far as it will go
 - Pull back brake/clutch pedal by hand as far as stop

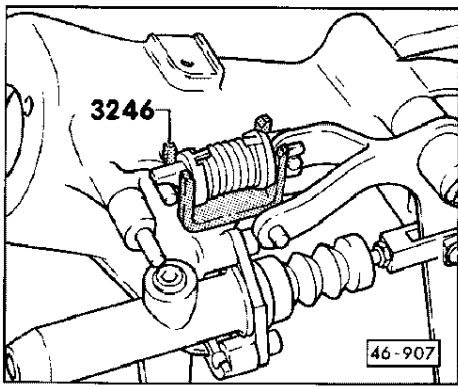


- 23 - Clip**
 ♦ Press home in pedal bracket

- 24 - Cheese-head bolt, 20 Nm**
 ♦ Screw master cylinder to pedal bracket

- 25 - Clevis**
 ♦ With welded-on nut, thread: M8
 ♦ Adjusting clevis => Page 46-38, Fig. 1

- 26 - Clutch master cylinder**
 ♦ Replace if leaking

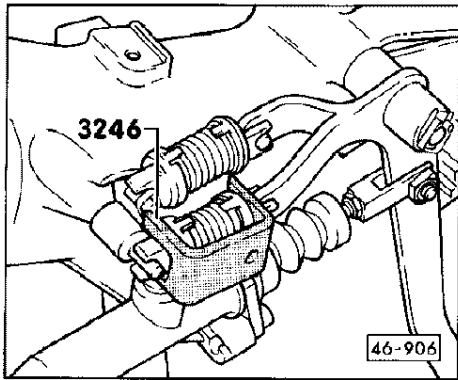


◀ **Fig.3 Inner support spring (brown)**

- Remove retainer from support pin
- Insert clamp -3117- downwards as shown by gently pressing clutch pedal, then actuate clutch pedal accordingly and while doing so remove over-centre spring from support pin/clutch pedal

Note:

The inner support spring can only be removed after taking out the outer over-centre spring.

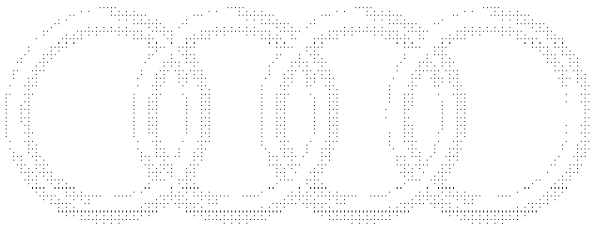


◀ **Fig.4 Outer over-centre spring (red)**

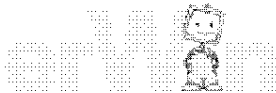
Note:

The illustration shows the clamp with the pedal bracket removed.

- Remove retainer from support pin
- Insert clamp -3117- as shown, press clutch pedal and while doing so remove over-centre spring from pedal bracket/clutch pedal.



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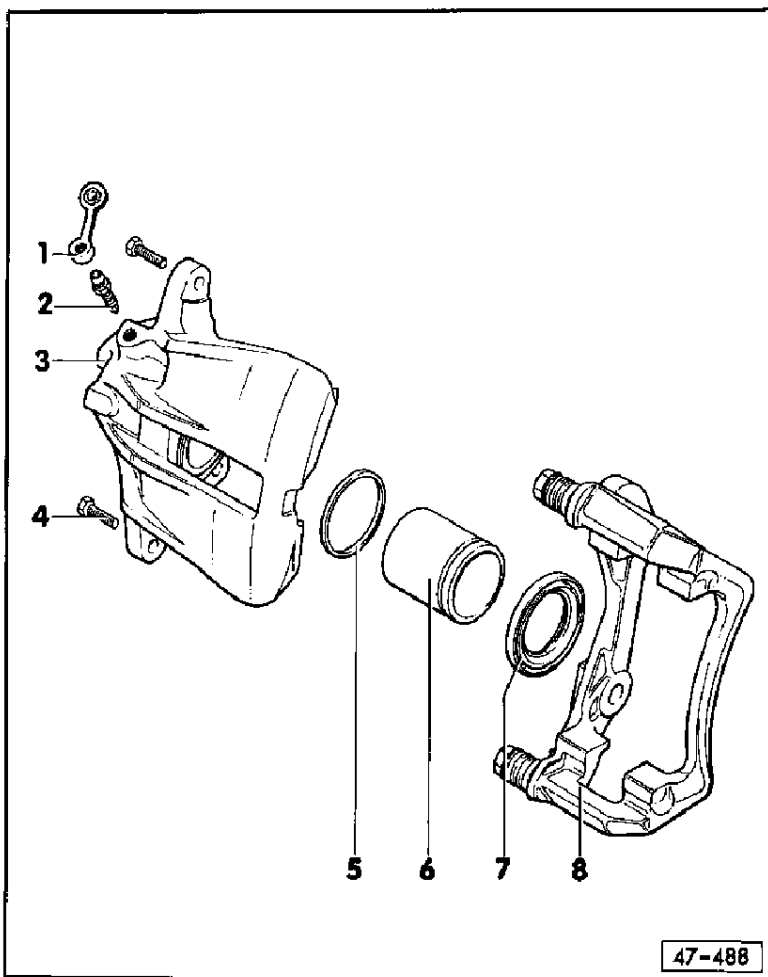
Servicing front brake caliper

Girling brake calliper

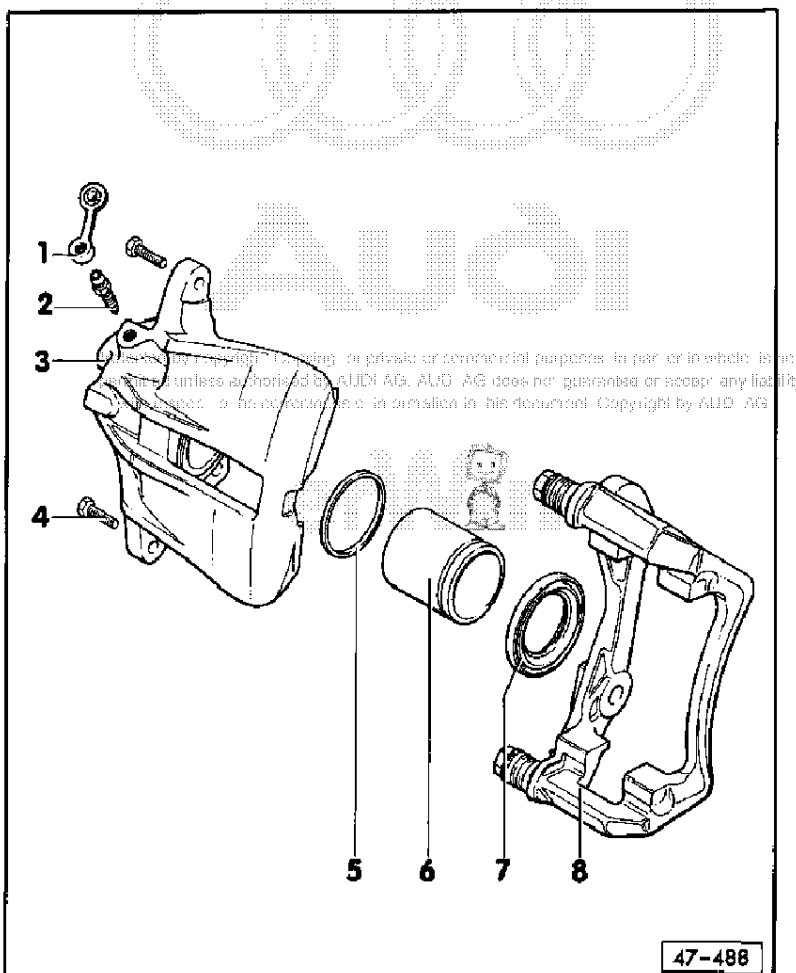
Notes:

- ◆ When carrying out repairs install all parts supplied in repair kit.
- ◆ Apply thin coat of brake cylinder paste B 000 100 to brake cylinder, piston and seal.

- 1 - Dust cap
 - ◆ Fit onto bleeder valve
- 2 - Bleeder valve
 - ◆ Apply thin coat of brake cylinder paste before screwing in.



— 47-1 —

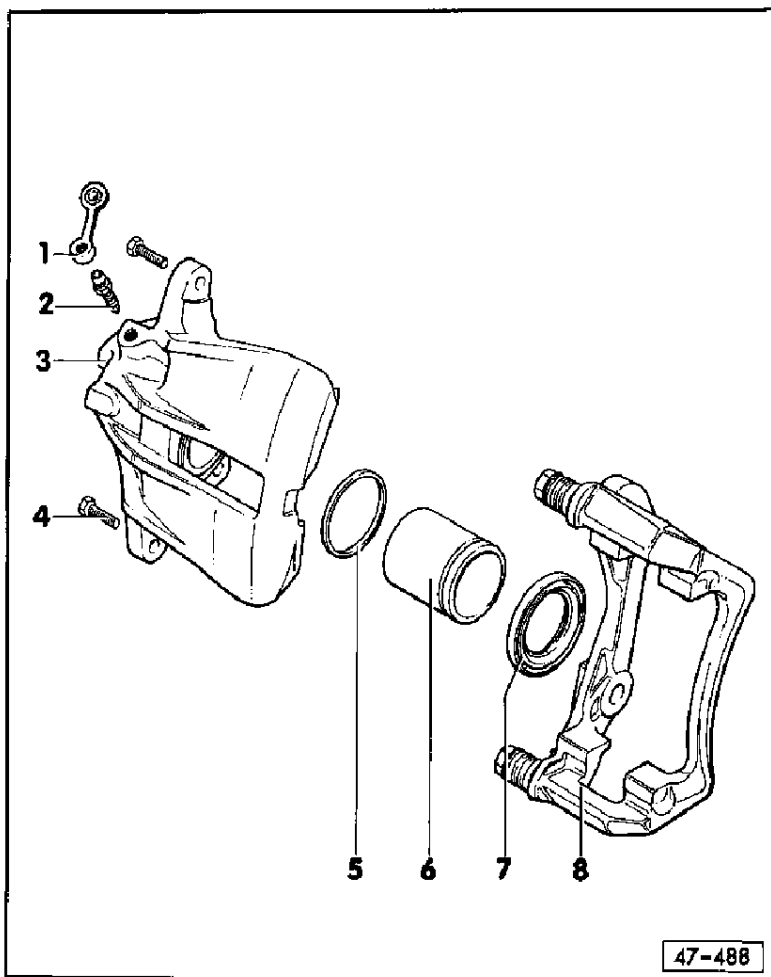


- 3 - Brake calliper housing
- 4 - Self locking bolt, 35 Nm
 - ◆ Always replace
 - ◆ When loosening and tightening counter hold on guide pin
- 5 - Oil seal
 - ◆ Remove with a screwdriver
=> Fig. 2
- 6 - Piston
 - ◆ Use compressed air to press out of brake calliper housing
=> Fig. 1
 - ◆ Piston diameter 54 mm

Attention

Place a piece of wood in the recess to prevent damaging the piston.

— 47-2 —



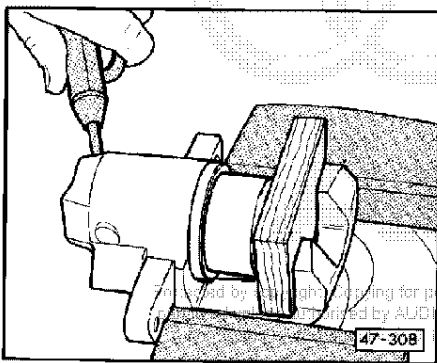
- ◆ Installing => Fig. 3, 4 and 5
- ◆ First coat the piston lightly with brake cylinder paste.

7 - Protective cap

- ◆ Do not damage when inserting piston

8 - Brake carrier with guide pins and protective caps

- ◆ Supplied as replacement part, assembled with sufficient grease on guide pins
- ◆ If protective caps are damaged install repair kit
- ◆ Use grease sachet supplied to lubricate guide pins



◀ Fig.1 Using compressed air to press pistons individually out of brake caliper housing

Note:

Place a piece of wood in the recess to prevent damaging the piston.

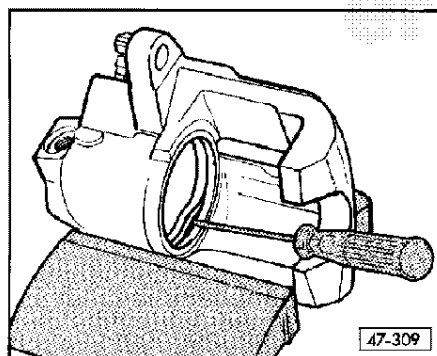
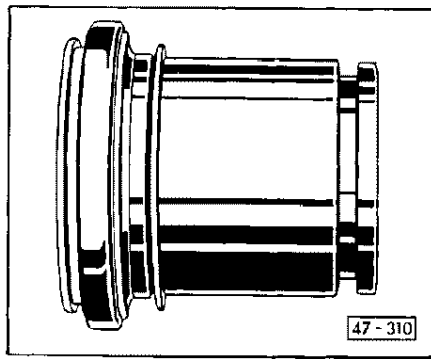
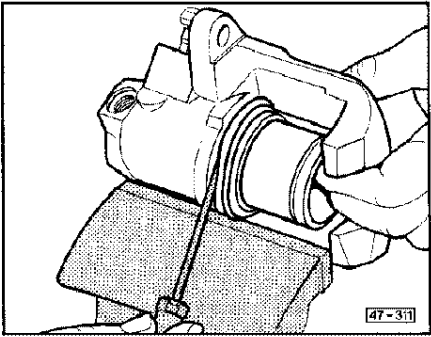


Fig. 2 Carefully removing seals with screwdriver



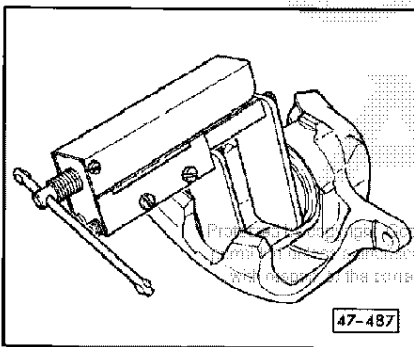
◀ Fig.3 Attaching outer sealing lip of protective cap to piston



◀ Fig. 4 Inserting inner sealing lip of protective cap into the caliper housing groove using a screwdriver

Note:

Hold piston in front of brake calliper housing.



◀ Fig. 5 Press the piston into the brake calliper housing using a piston resetting tool

Note:

When pressing in, outer sealing lip of protective cap jumps into groove in piston.

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Dual-piston brake calliper

Notes:

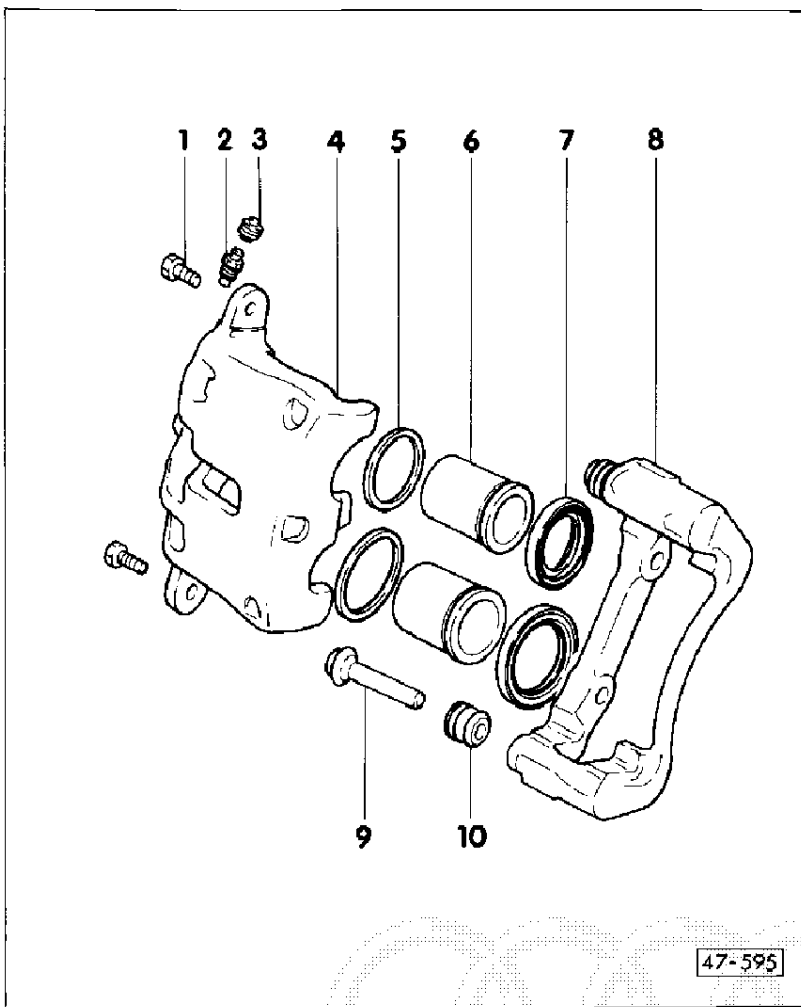
- ◆ When carrying out repairs install all parts supplied in repair kit.
- ◆ Apply thin coat of brake cylinder paste B 000 100 to brake cylinder, piston and seal.

1 – Self locking bolt, 35 Nm

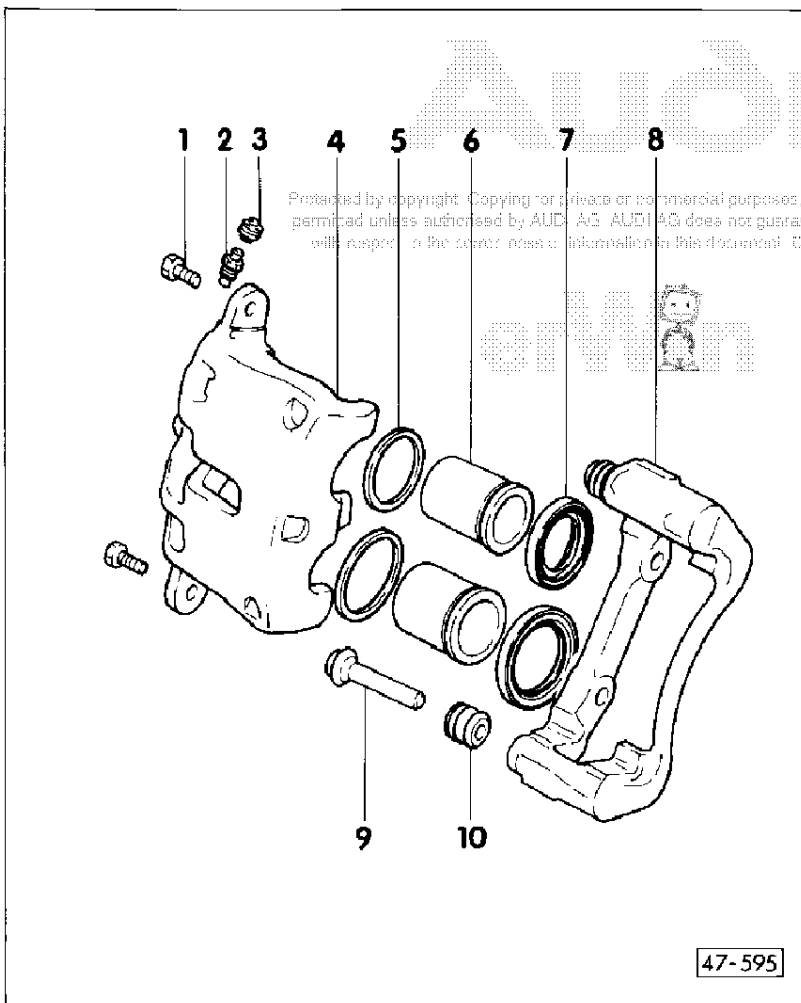
- ◆ Always replace
- ◆ When loosening and tightening counter hold on guide pin

2 – Vent valve

- ◆ Apply thin coat of brake cylinder paste to thread before screwing in.



— 47-7 —



3 – Dust cap

- ◆ Fit onto bleeder valve

4 – Brake calliper housing

5 – Oil seal

- ◆ Remove with a screwdriver
=> Fig. 2

6 – Piston

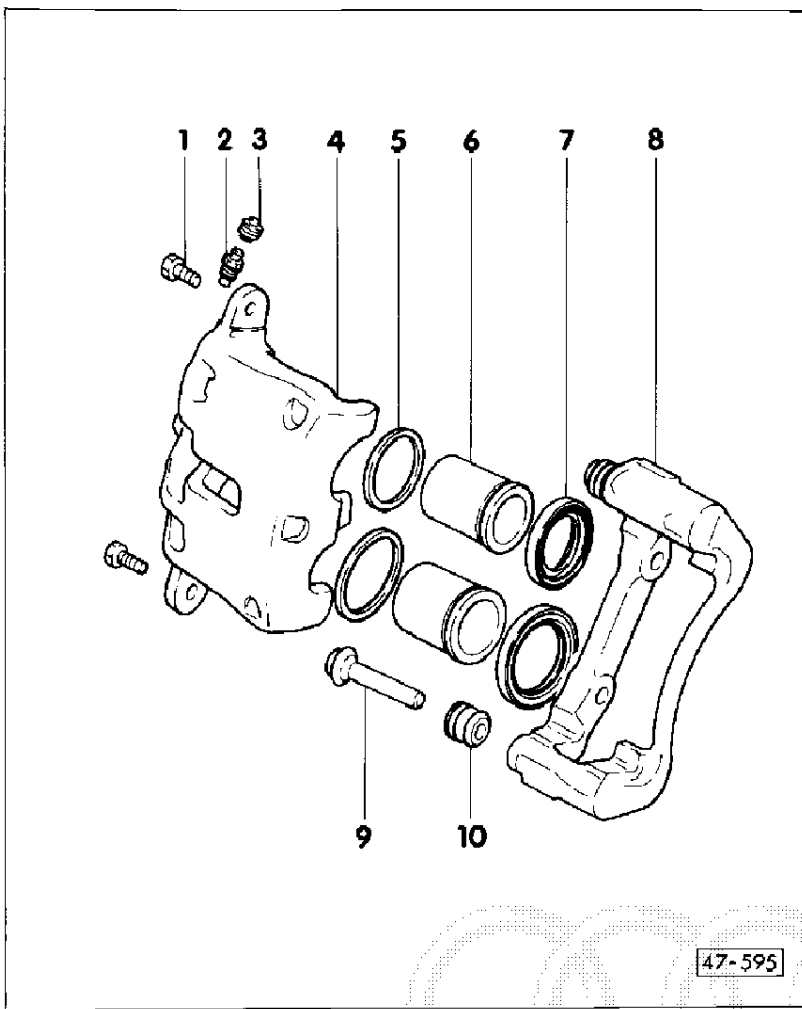
- ◆ Use compressed air to press out of brake calliper housing
=> Fig. 1

Attention

Place a piece of wood in the recess to prevent damaging the piston. Risk of accident!

- ◆ Piston diameter 40/45 mm
- ◆ Installing => Fig. 3, 4 and 5
- ◆ First coat the piston lightly with brake cylinder paste.

— 47-8 —

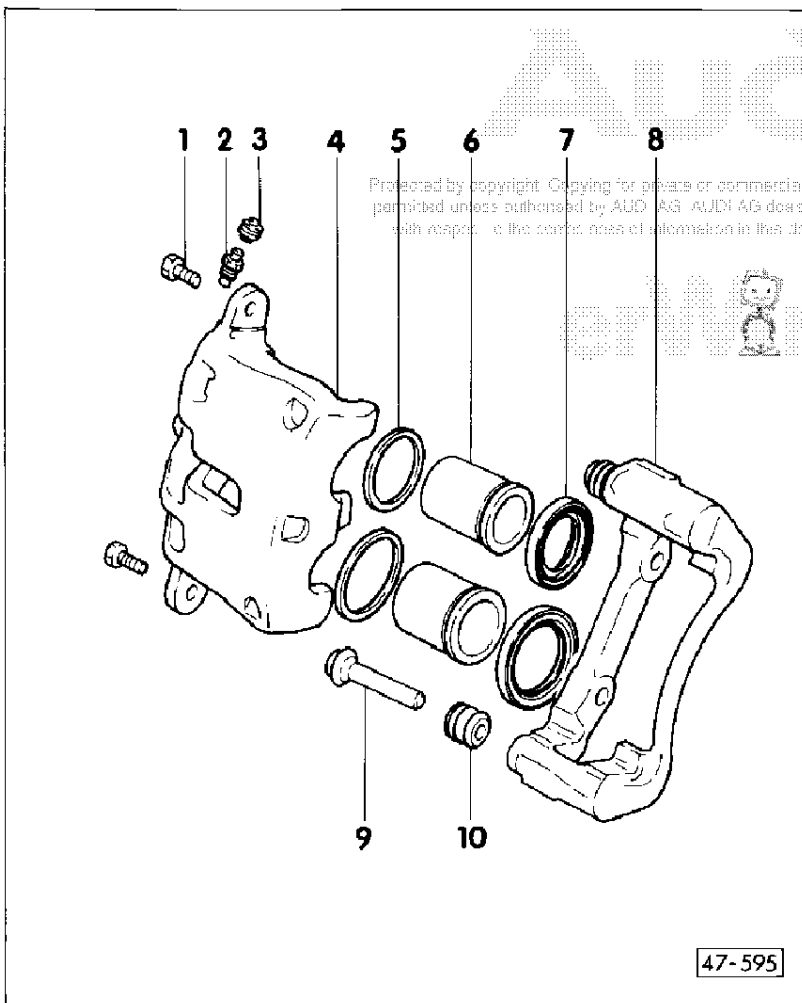


7 - Protective cap

- ◆ Fit onto piston with outer sealing lip => Fig. 3
- ◆ Insert with inner sealing lip in groove in brake calliper housing => Fig. 4

8 - Brake carrier with guide pins and protective caps

- ◆ Supplied as replacement part, assembled with sufficient grease on guide pins
- ◆ If protective caps are damaged install repair kit
- ◆ Use grease sachet supplied to lubricate guide pins

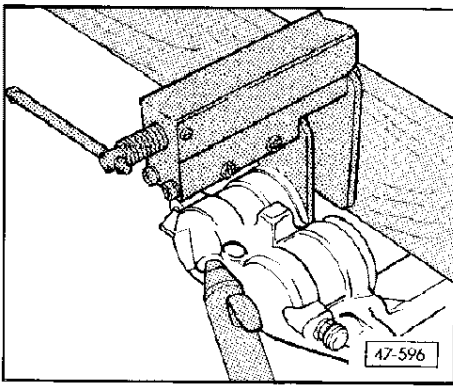


9 - Guide pin

- ◆ Grease before fitting protective caps

10 - Protective cap

- ◆ Pull onto brake carrier and guide pin

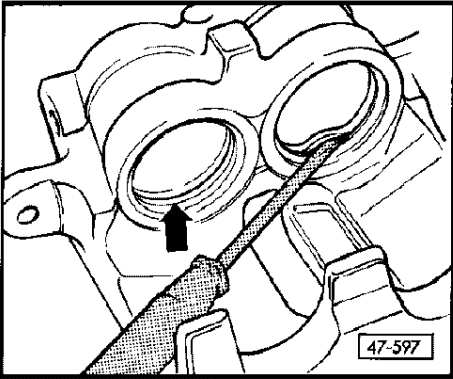


◀ Fig.1 Using compressed air to press pistons individually out of brake calliper housing

Note:

Place a piece of wood in the recess to prevent damaging the piston.

Only one piston can be pressed out at a time, when doing so, hold other piston in position in brake calliper housing using piston resetting tool.

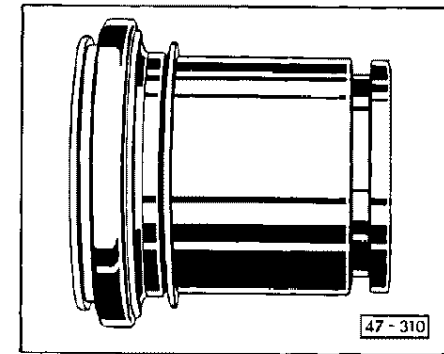


◀ Fig. 2 Carefully removing seals with screwdriver

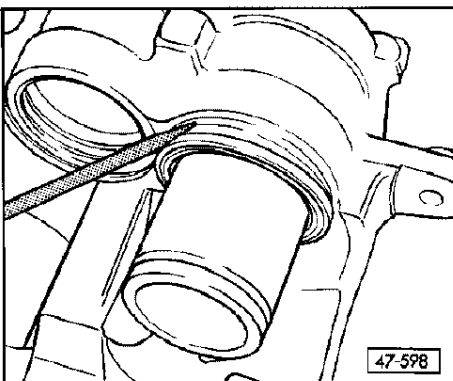
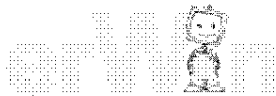


— 47-11 —

◀ Fig.3 Attaching outer sealing lip of protective cap to piston



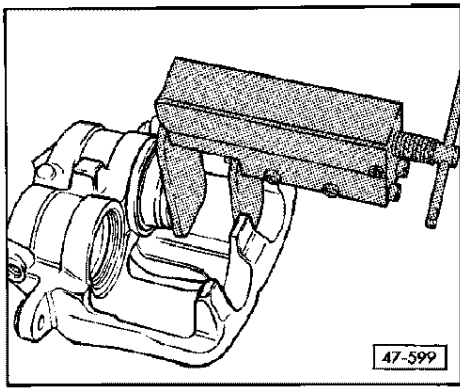
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◀ Fig. 4 Inserting inner sealing lip of protective cap into the calliper housing groove using a screwdriver

Note:

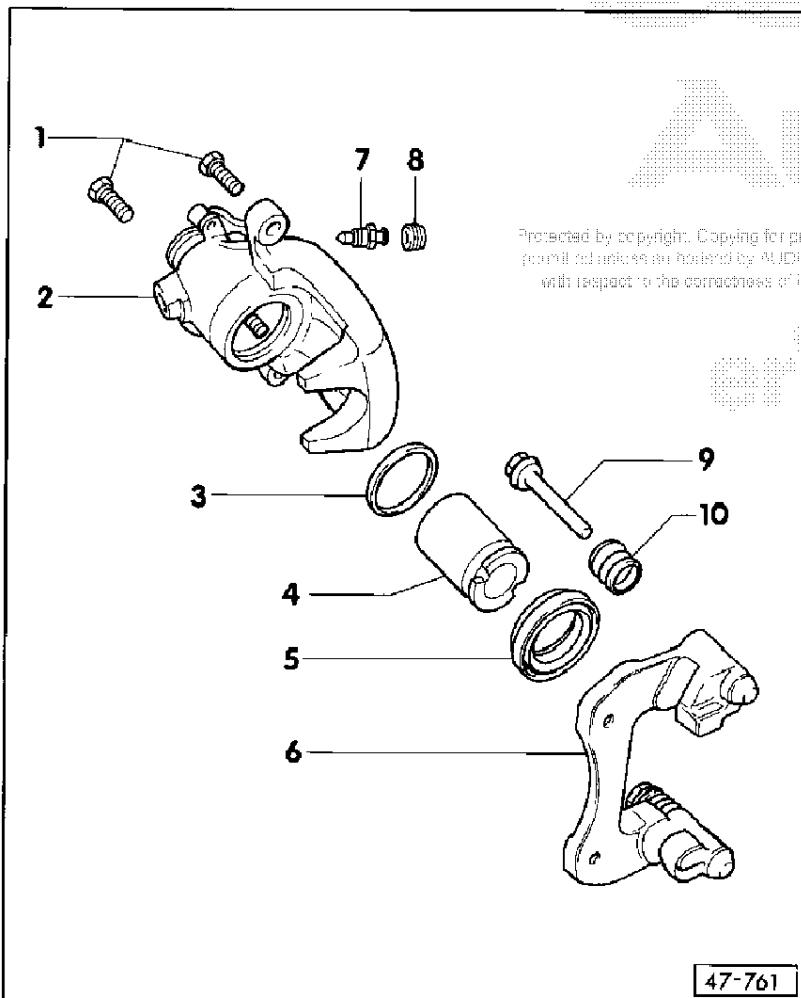
Hold piston in front of brake calliper housing.



◀ Fig. 5 Press the piston into the brake calliper housing using a piston resetting tool

Note:

When pressing in, outer sealing lip of protective cap jumps into groove in piston.



Servicing rear brake calipers

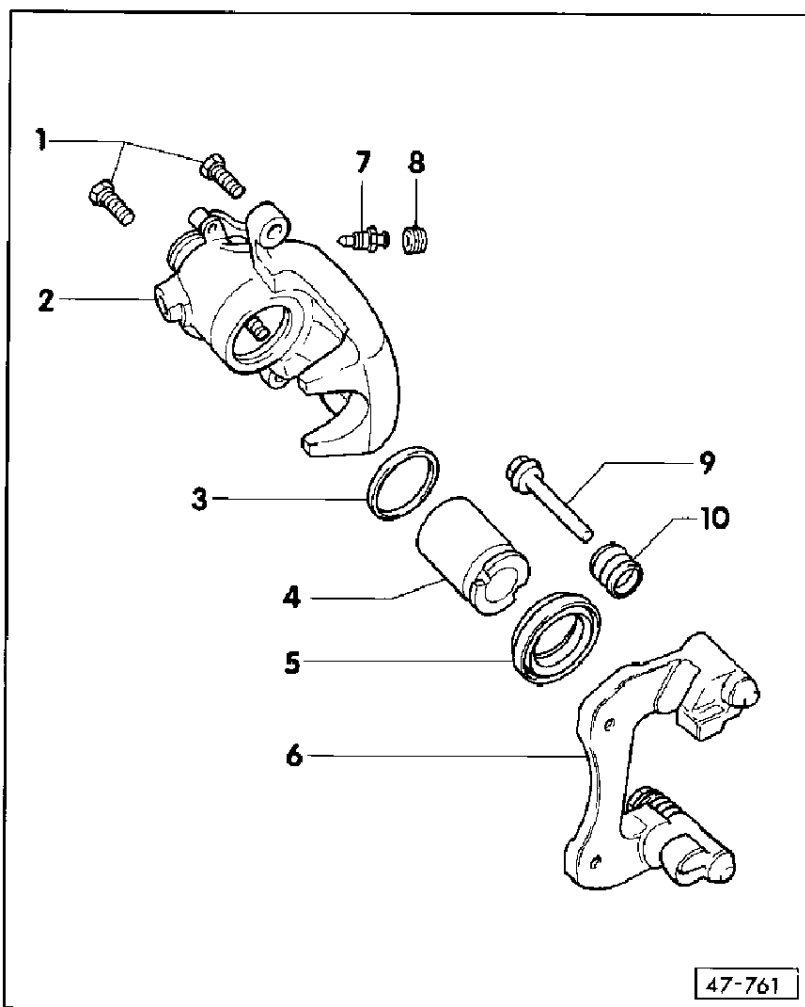
Notes:

- ◆ When carrying out repairs install all parts supplied in repair kit.
- ◆ Apply thin coat of brake cylinder paste B 000 100 to brake cylinder, piston and seals.



1 - Self locking bolt, 35 Nm

- ◆ Always replace
- ◆ When loosening and tightening counter hold on guide pin



2 - Brake calliper housing with handbrake cable lever

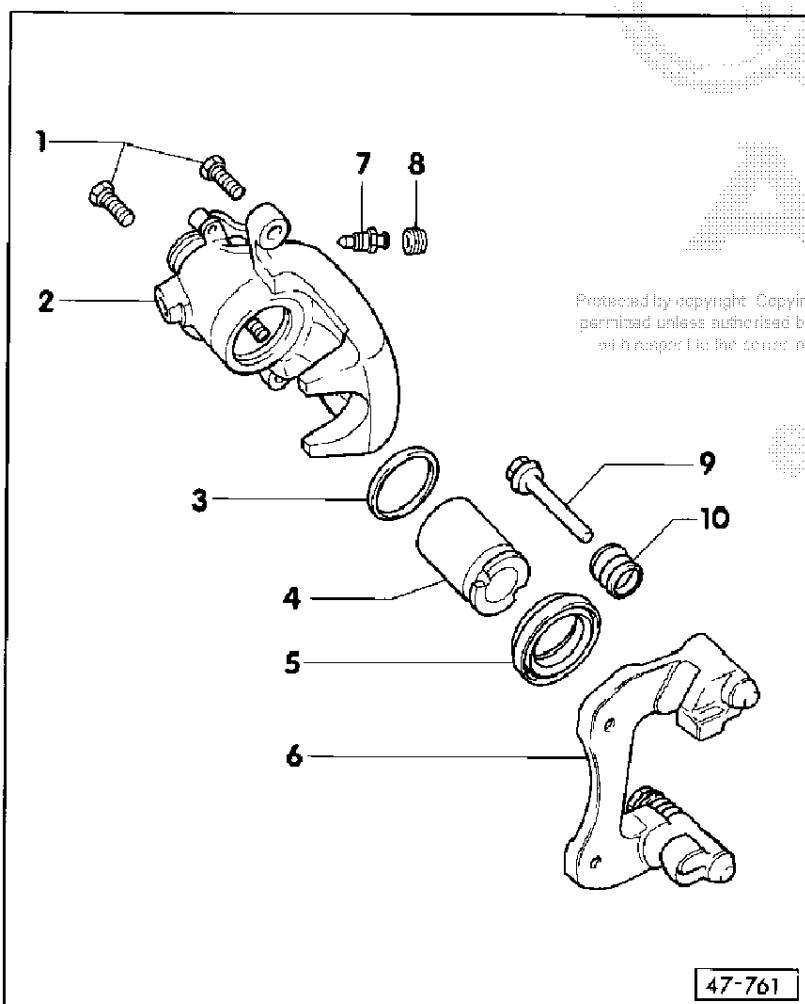
- ◆ Renew the brake calliper housing if there is a leak at the lever for the handbrake cable

3 - Oil seal

- ◆ Remove with a screwdriver => Fig. 3

4 - Piston with automatic adjustment

- ◆ Unscrewing from brake calliper housing => Fig. 1
- ◆ Screwing into brake calliper housing => Fig. 5
- ◆ Piston diameter 38 mm

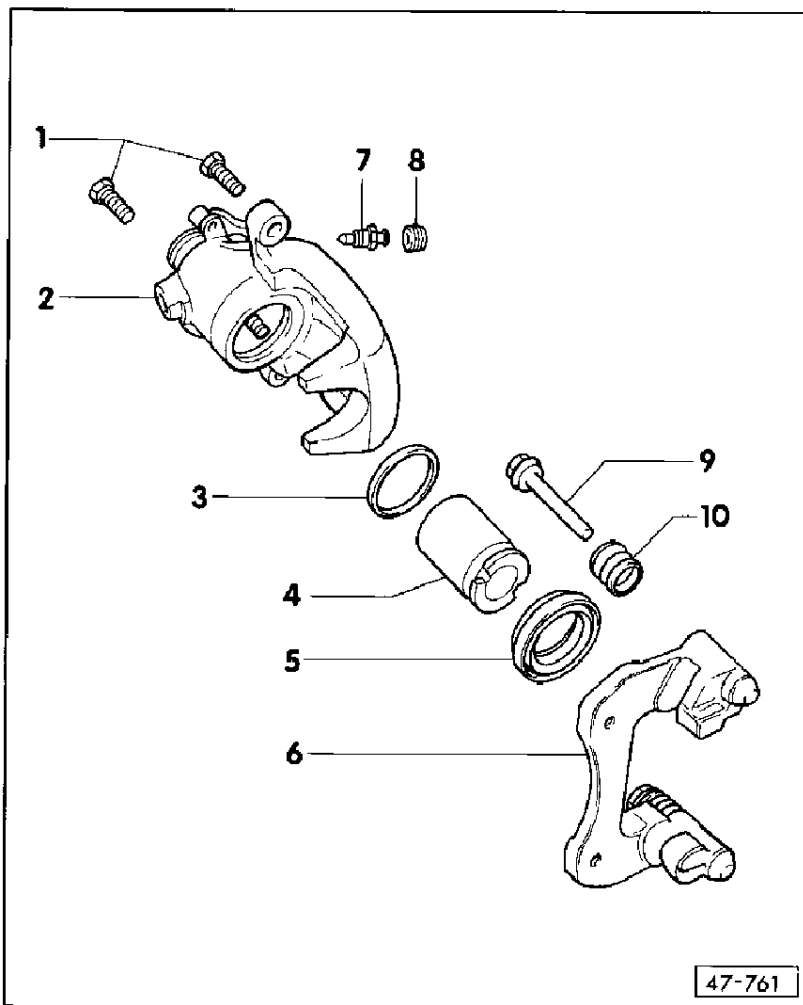


5 - Protective cap

- ◆ Fit onto piston with outer sealing lip => Fig. 2
- ◆ Insert with inner sealing lip in groove in brake calliper housing => Fig. 4

6 - Brake carrier with guide pins and protective caps

- ◆ Supplied as replacement part, assembled with sufficient grease on guide pins
- ◆ If protective caps are damaged install repair kit
- ◆ Use grease sachet supplied to lubricate guide pins



47-761

7 - Bleeder valve

- ◆ Apply thin coat of brake cylinder paste to thread before screwing in

8 - Dust cap

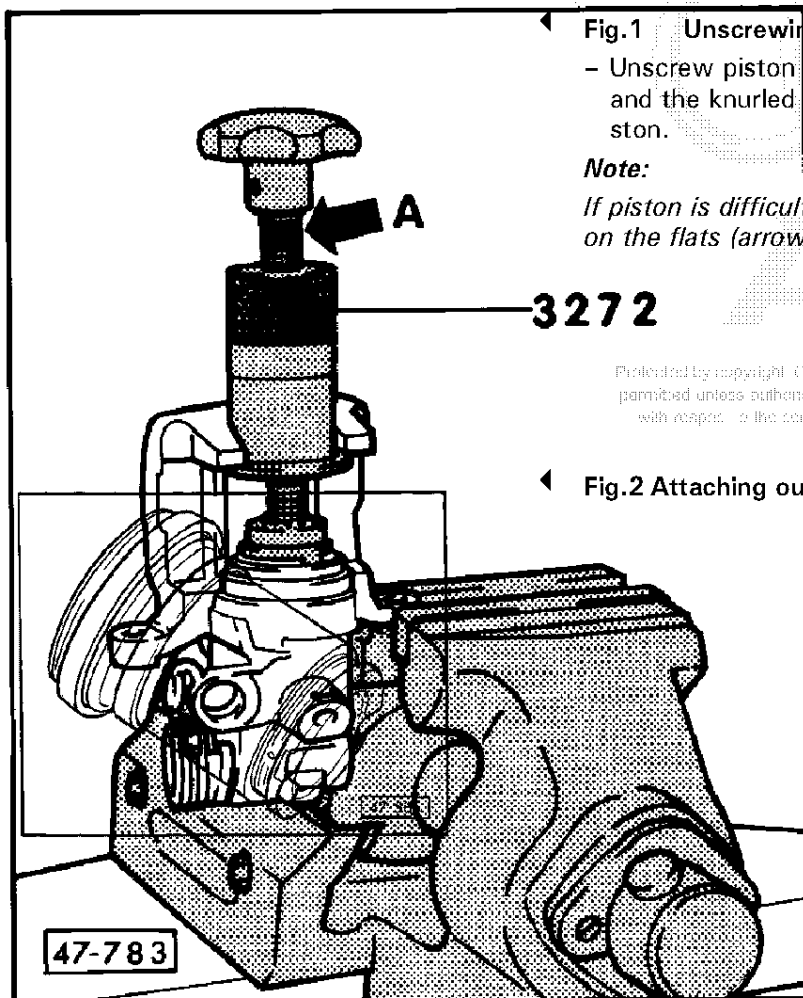
- ◆ Fit onto bleeder valve

9 - Guide pin

- ◆ Grease before fitting protective cap

10 - Protective cap

- ◆ Pull onto brake carrier and guide pin



◀ **Fig.1 Unscrewing piston from brake calliper housing**

- Unscrew piston by turning the threaded spindle anti-clockwise and the knurled section clockwise. Pull out sealing lip with piston.

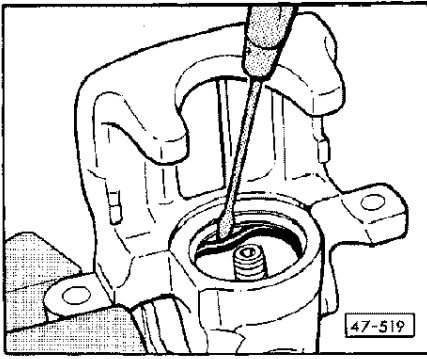
Note:

If piston is difficult to move, use a 13 mm AF open jaw spanner on the flats (arrow A) provided for this purpose.

3272

◀ **Fig.2 Attaching outer sealing lip of protective cap to piston**

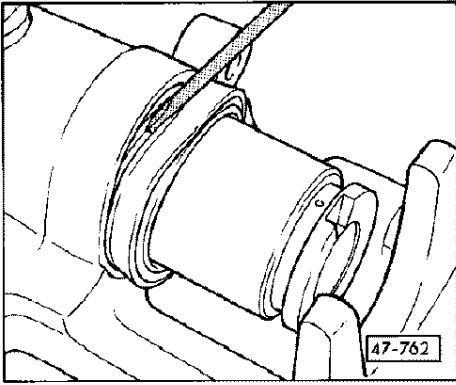
47-783



◀ Fig. 3 Carefully removing seal with screwdriver

Note:

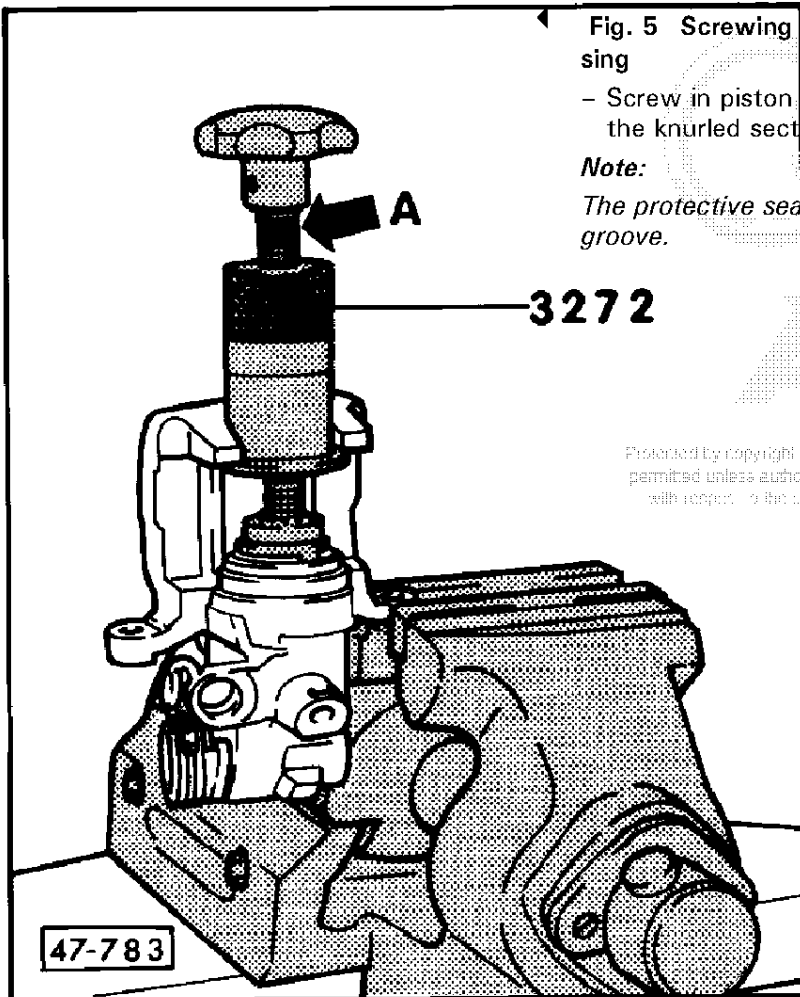
Ensure that the surface of the cylinder is not damaged during removal.



◀ Fig. 4 Inserting inner sealing lip of protective cap into the caliper housing groove using a screwdriver

Note:

Hold piston in front of brake caliper housing.



◀ Fig. 5 Screwing piston as far as its stop into brake caliper housing

– Screw in piston by turning the threaded spindle clockwise and the knurled section anti-clockwise.

Note:

The protective seal outer sealing lip will then locate in the piston groove.

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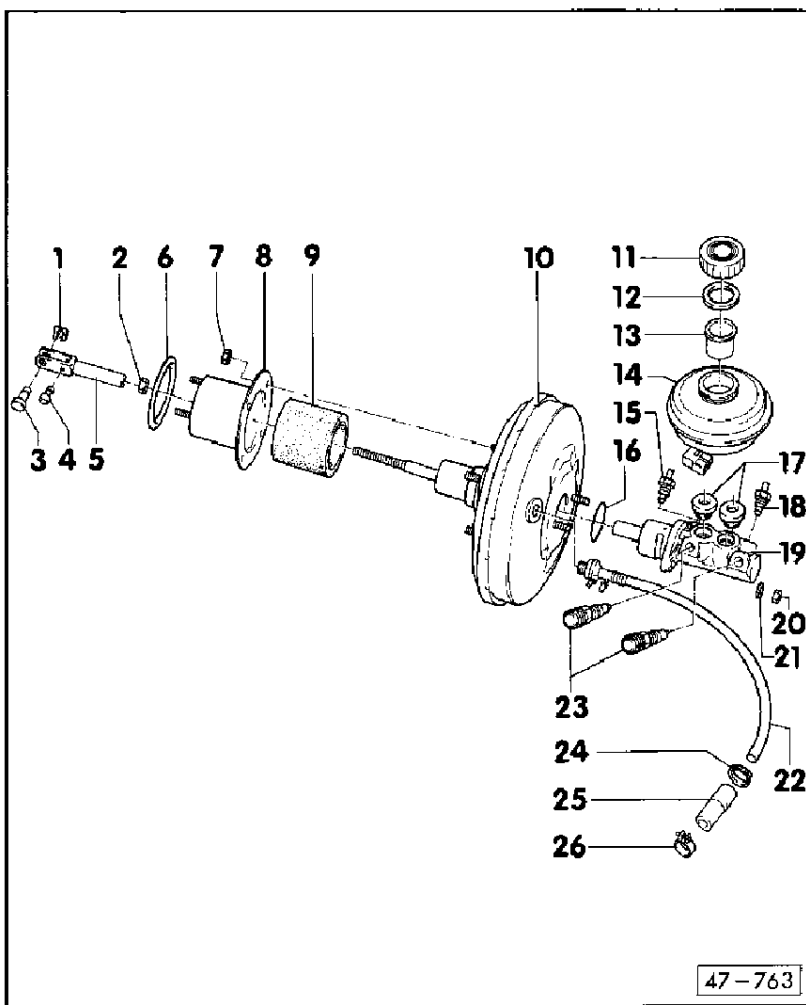
Servicing brake master cylinder/brake servo

Rear axle – front axle brake circuit configuration

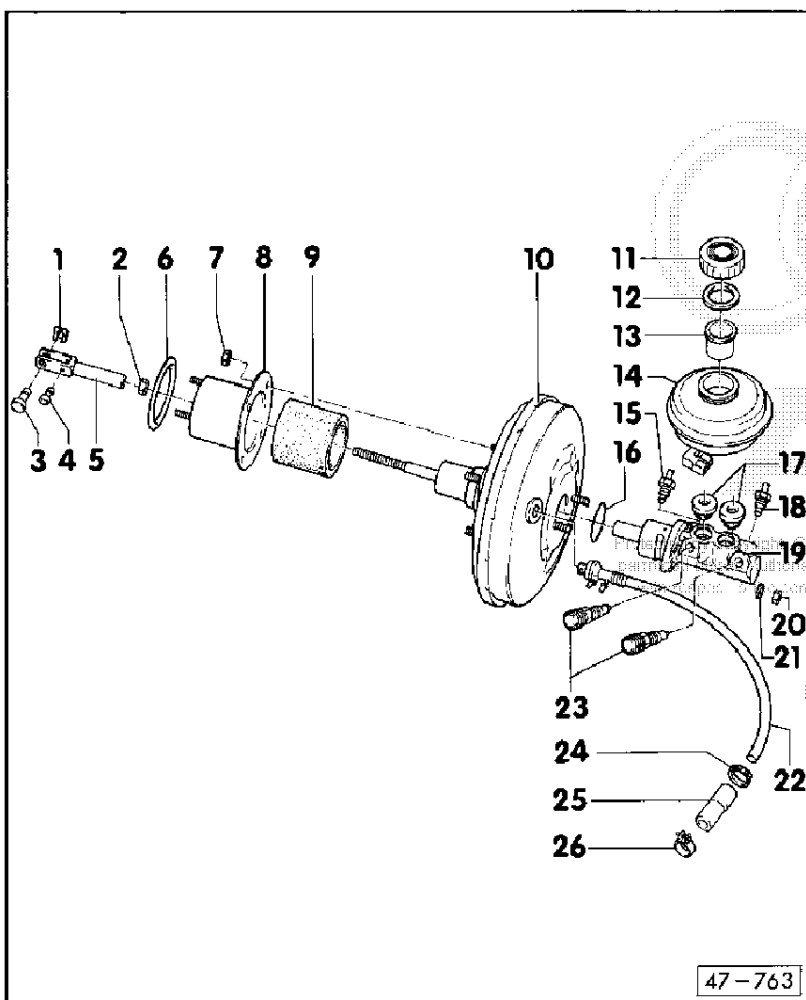
The pushrod piston of the brake master cylinder is applied to the brake callipers at the front axle, the floating piston to the brake callipers at the rear axle.

Note:

- ◆ Use only fresh brake fluid. Refer to label on brake fluid reservoir.



47-21



1 – Lock washer

- ◆ Always replace
- ◆ Fit onto pin

2 – Lock nut

- ◆ Tighten after adjusting clevis

3 – Pin

- ◆ Insert in clevis and brake pedal

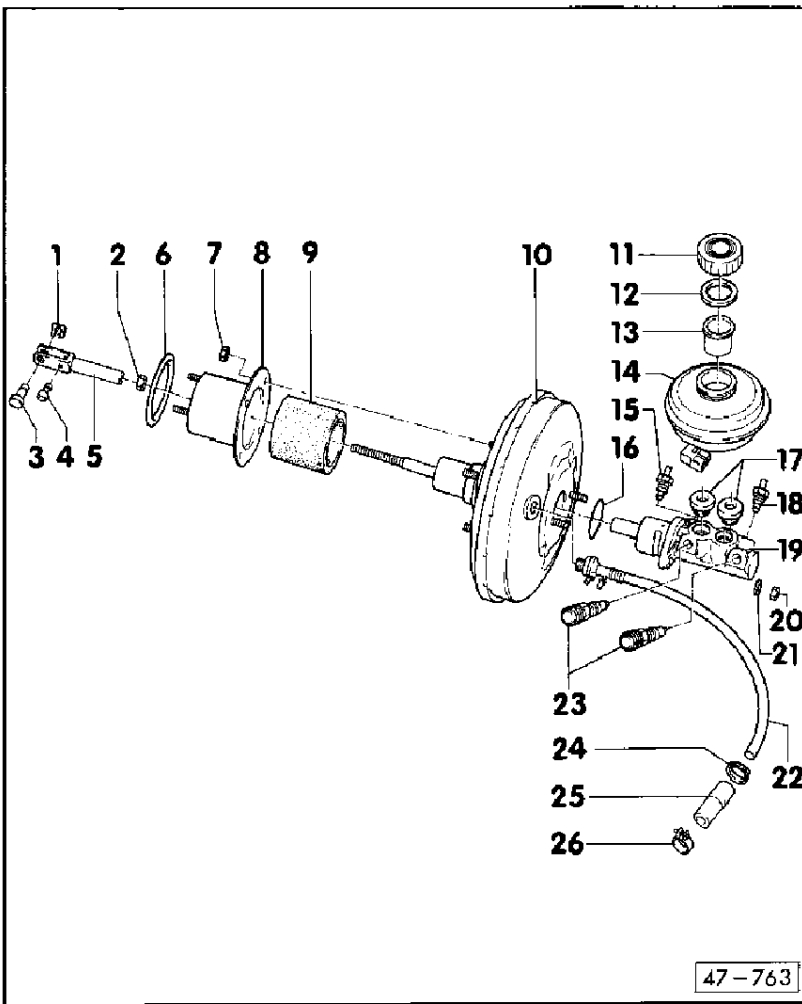
4 – Grommet

- ◆ Insert in clevis
- ◆ Insert coil spring in grommet

5 – Clevis

- ◆ Adjusting:
 - Vehicles with pneumatic brake servo: => Fig. 1
 - Vehicles with hydraulic brake servo: => Fig. 2

47-22

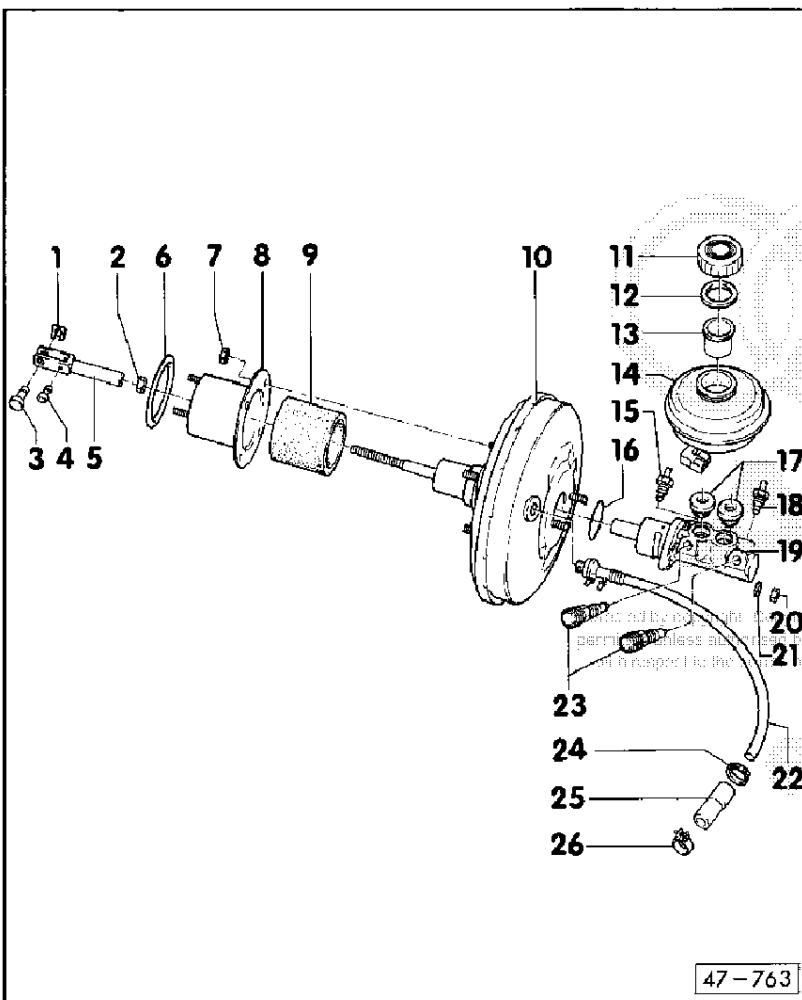


- 6 - Oil seal
 - ◆ Always replace
 - ◆ Attach to adapter before installing servo unit
 - ◆ Roll onto bulkhead after attaching servo unit

- 7 - Hexagon nut, 20 Nm

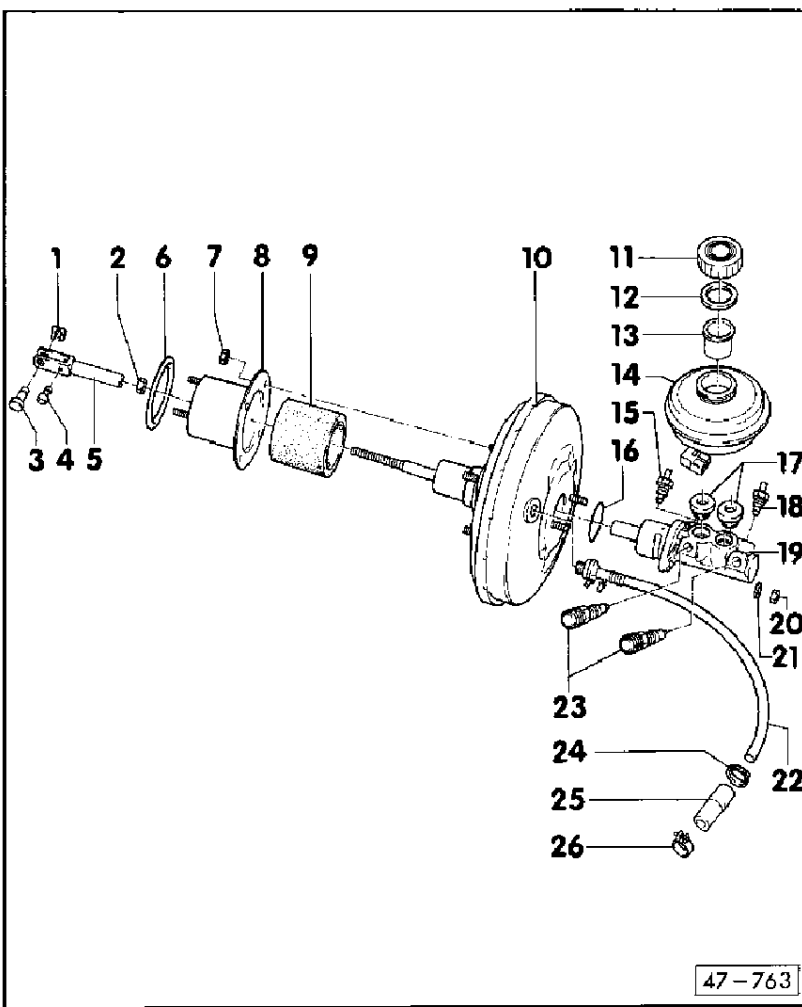
- 8 - Intermediate piece
 - ◆ Long version for 9" servo units
 - ◆ Short version for 10" servo units

- 9 - Oil seal
 - ◆ Insert in adapter
 - ◆ Note that there are different versions:

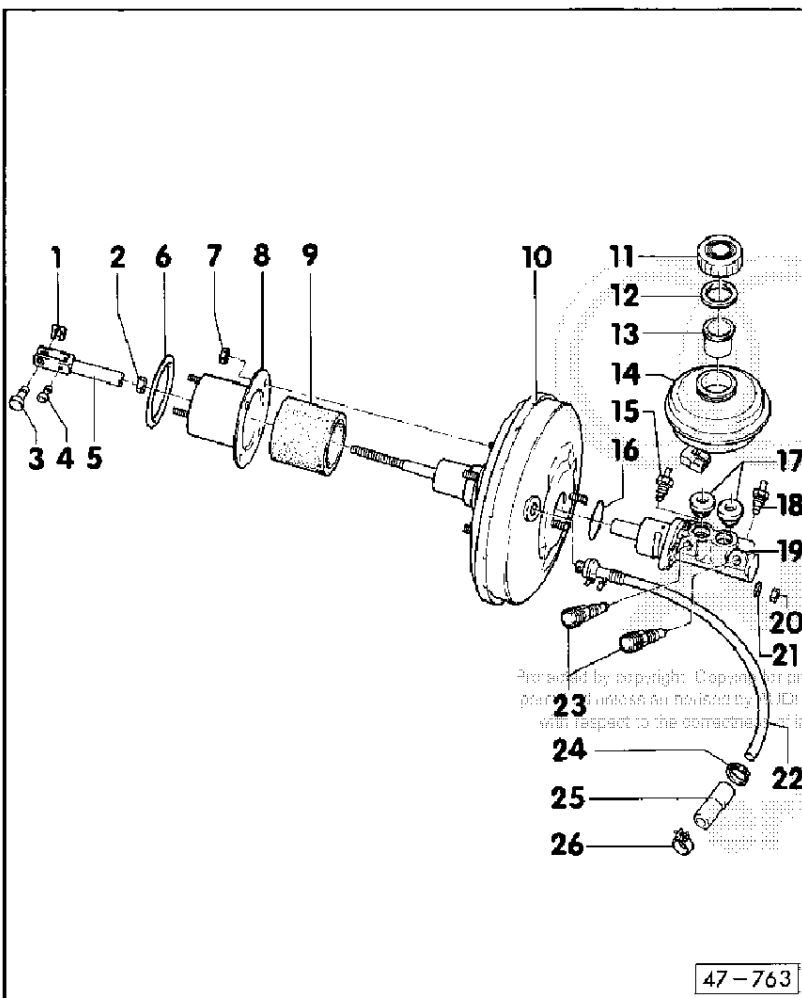


- 10 - Brake servo
 - ◆ 9" diameter on vehicles with 4 and 5 cylinder engine
 - ◆ 10" diameter on vehicles with 6 cylinder engine

Note:
 As of model year 1993, gradual introduction of 10" servo unit for all vehicles.
 This modification does not apply to RHD vehicles.



- ◆ Checking:
 - Firmly depress brake pedal several times with engine stopped. This dissipates the vacuum in the unit. Now depress brake pedal with moderate force, hold and start engine.
 - If the servo unit is working properly, the pedal will be felt to give slightly under foot (servo assistance becomes effective).

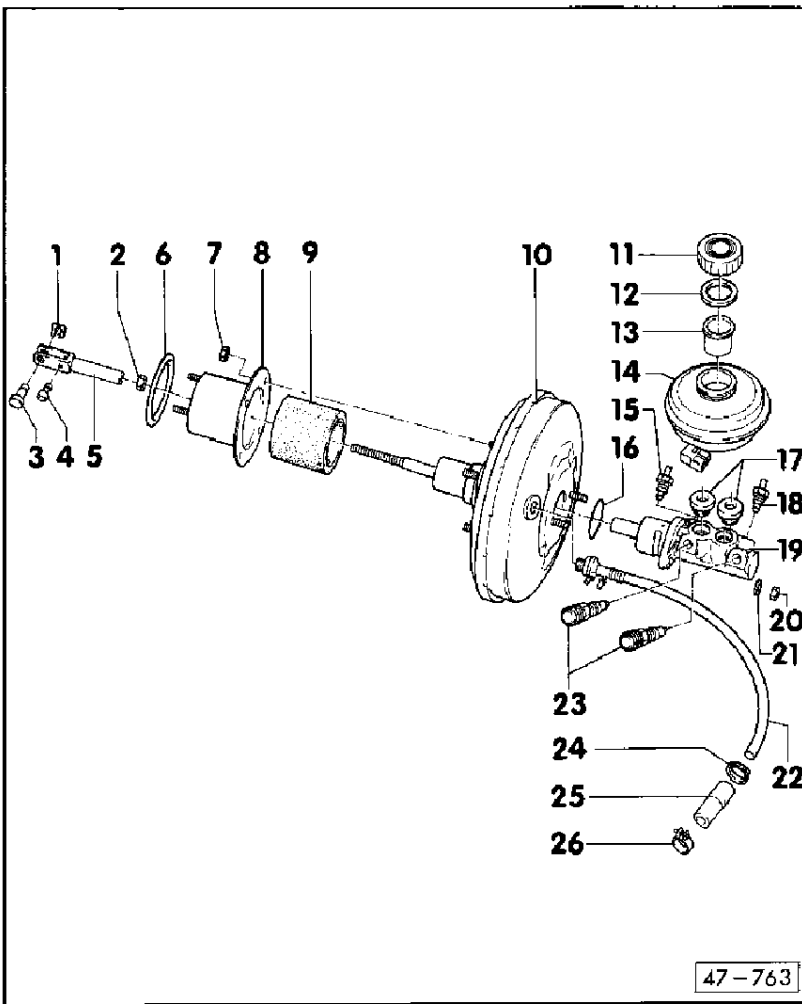


- ◆ If faulty renew complete.
- ◆ On 4-cylinder spark-ignition engines the vacuum is taken from the intake manifold
- ◆ On 5- and 6-cylinder engines vacuum is created by built-in vacuum pump.
- ◆ Boost factor:
 - 9" brake servo: 3.0 : 1
 - 10" brake servo: 3.85 : 1
- ◆ Functional check of vacuum pump:
 - Pull vacuum hose off pump and with engine idling use finger to check for suction effect at hose connection

11 - Cap

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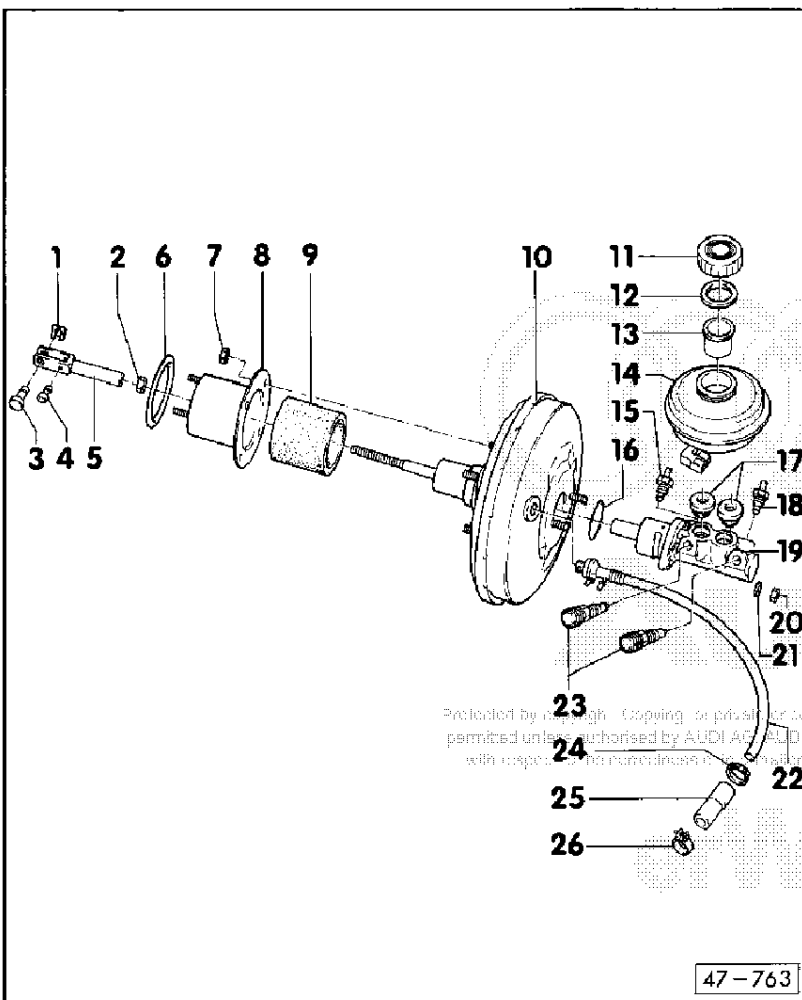
12 - Seal

- ◆ Insert in cap

13 - Strainer

14 - Brake fluid reservoir with float indicator

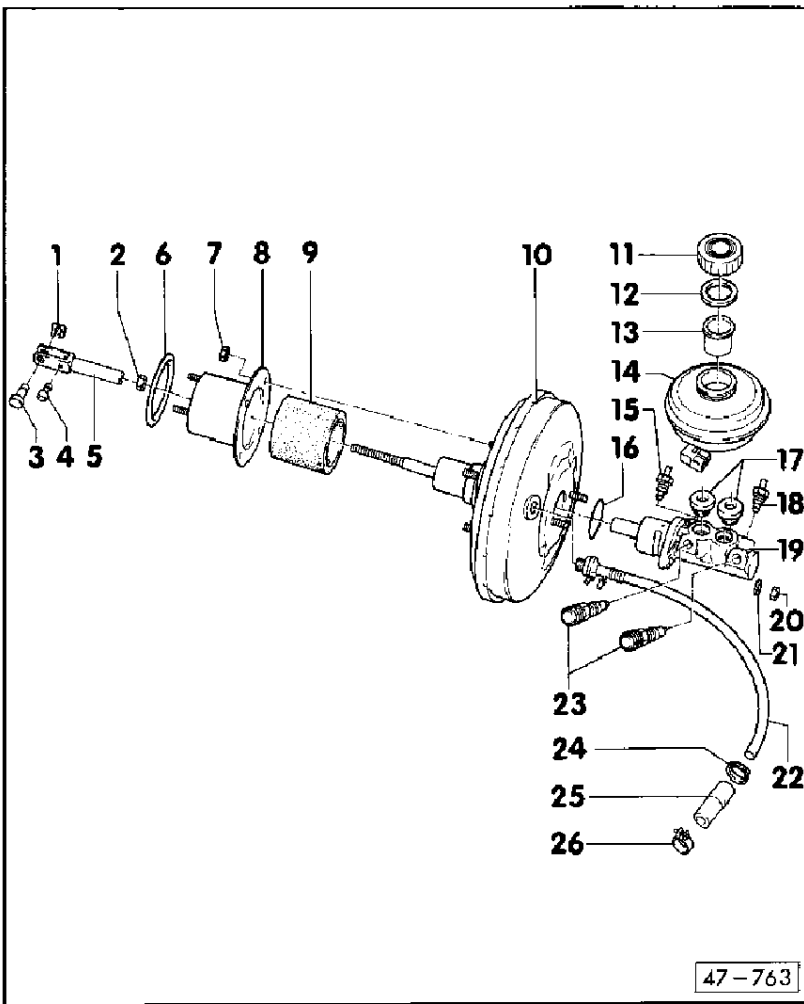
- ◆ Fill up with brake fluid to "Max" mark
- ◆ Refer to label on reservoir before topping up brake fluid
- ◆ Brake fluid, total quantity approx. 0.6 l in braking system
- ◆ Connection for hydraulic coupling is located on side



- ◆ Functional check of indicator:
 - With ignition on, press firmly on centre of cap (membrane). Warning lamp in instrument cluster lights and acoustic alarm sounds.
- ◆ Diaphragm was discontinued as of 07/92. To check indicator, unscrew yellow cap with brake symbol and press by hand on visible strainer with ignition switched on.

15 - Brake pipe

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16 - Oil seal

- ◆ Replace after removing brake servo or master cylinder

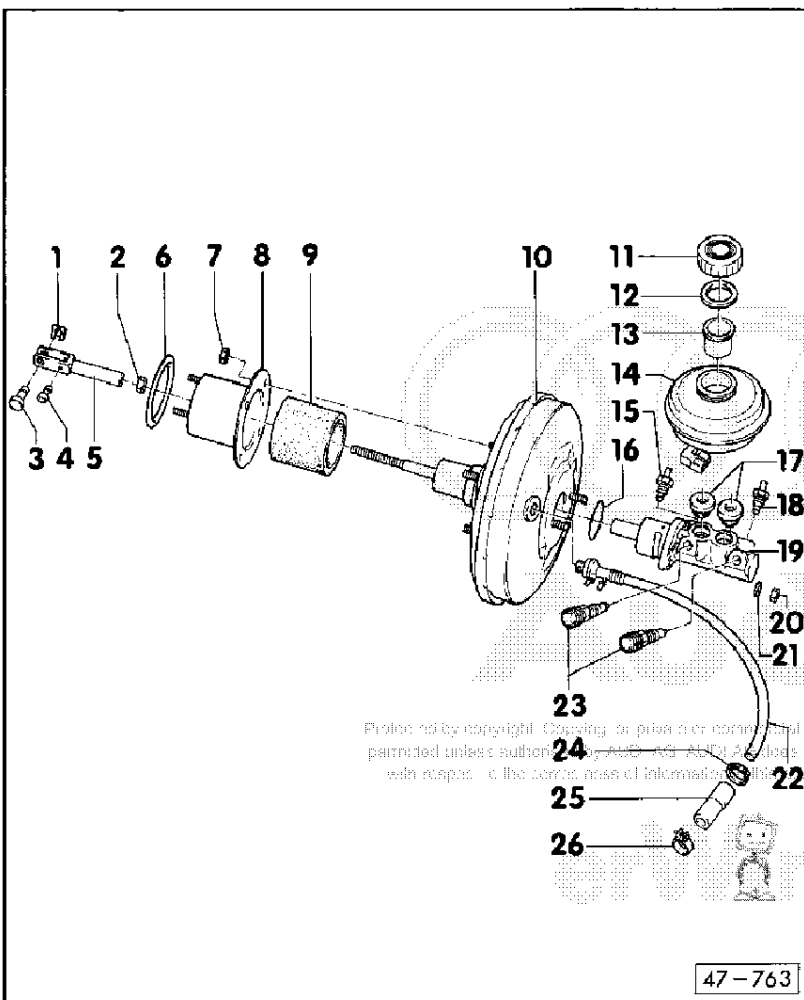
17 - Sealing plug

- ◆ Moisten with brake fluid and insert into brake master cylinder
- ◆ Press brake fluid reservoir into sealing plugs

Note:

Replacing plug for pushrod circuit in all Girling steel brake master cylinders => Page 47-45

18 - Brake pipe



19 - Brake master cylinder

- ◆ 22.2 mm diameter on vehicles with 4 and 5 cylinder engine
- ◆ 23.81 mm diameter on vehicles with 6 cylinder engine

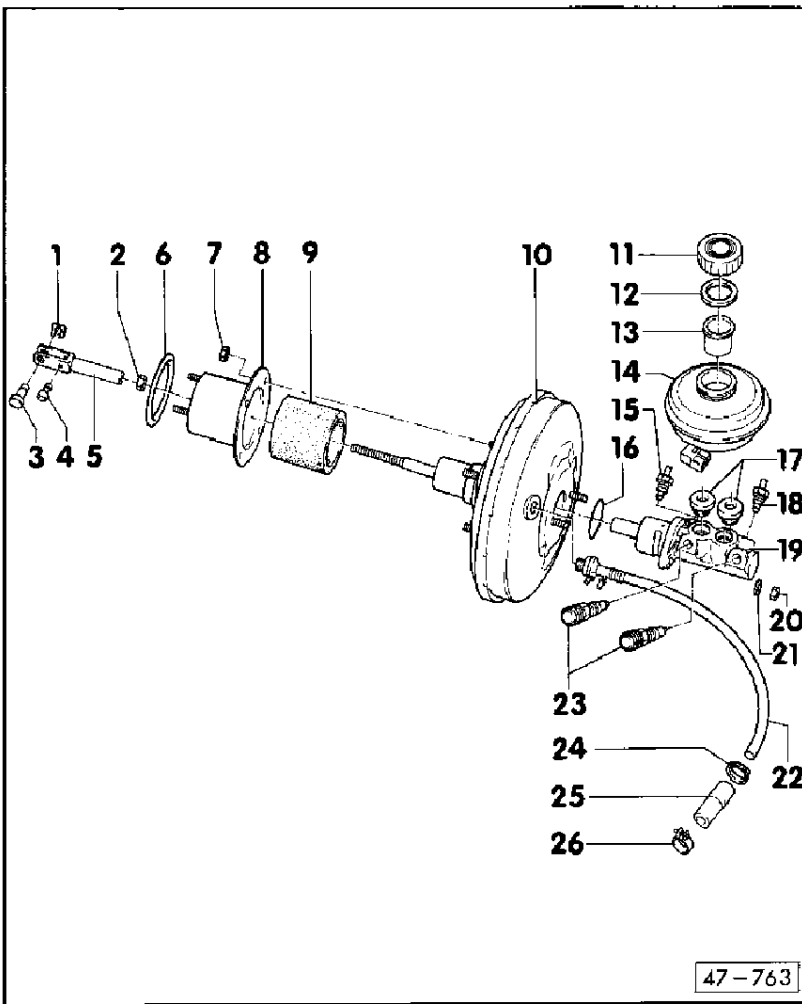
Note:

All vehicles as of chassis no. 8C PA 036 950 feature brake master cylinders with 23.81 mm diameter instead of 22.2 mm

This modification does not apply to RHD vehicles.

- ◆ Pull vacuum unit (Item - 22-) off servo unit before removing
- ◆ Carefully remove from or insert in servo unit (do not tilt); non-compliance will result in servo unit damage.
- ◆ Replace as complete unit if necessary.

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20 - Hexagon nut, 25 Nm

21 - Washer

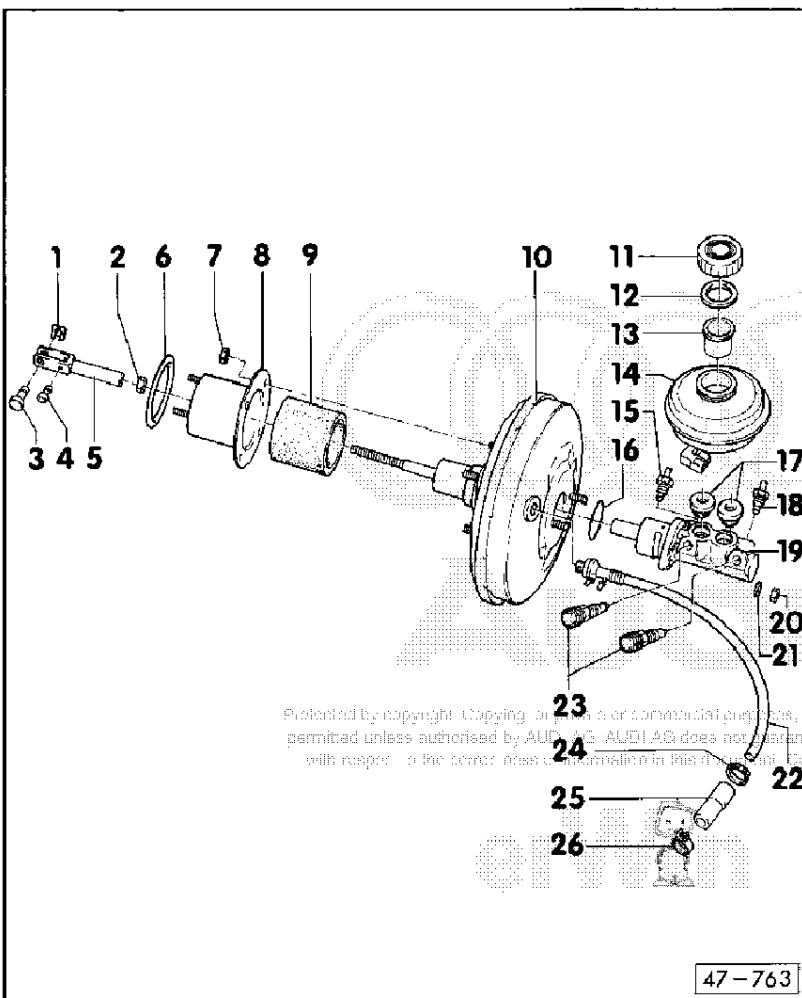
22 - Vacuum line with non-return line

◆ To check function of non-return valve:

- It must be possible to blow air through valve in direction of arrow, but not in opposite direction.

◆ Insert into brake servo unit

◆ Note different versions depending on engine



23 - Bleeder valves

◆ Brake master cylinder has one or two valves depending on braking system

◆ Always bleed when bleeding braking system

24 - Clip

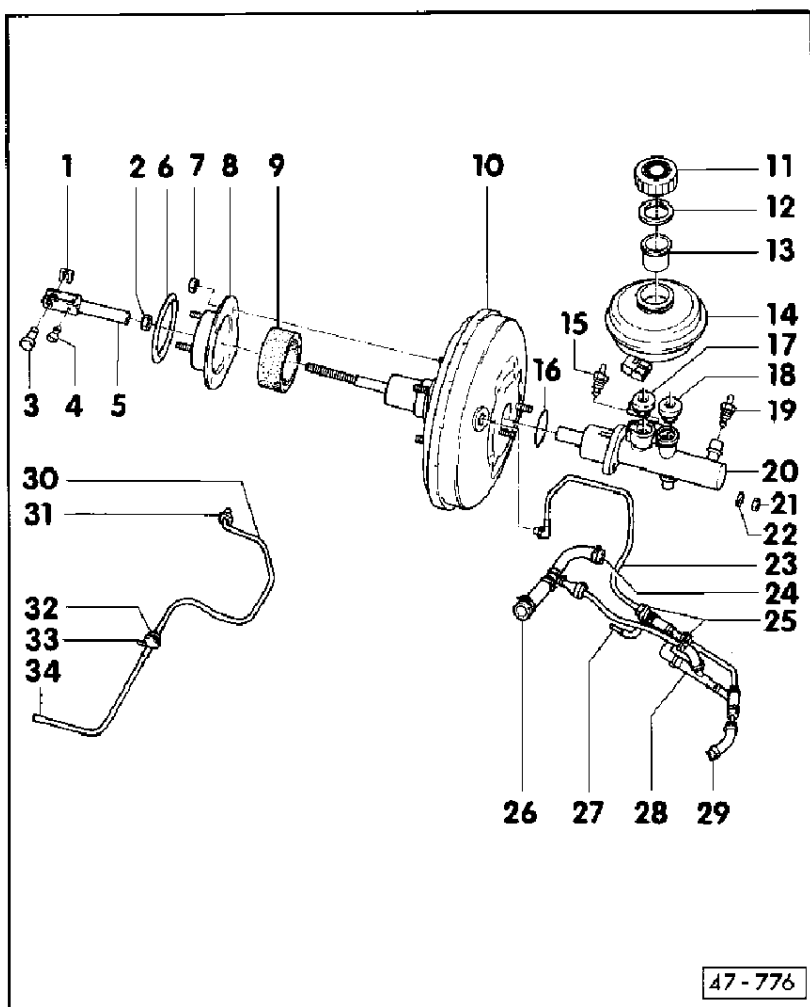
25 - Vacuum hose

26 - Hose clamp

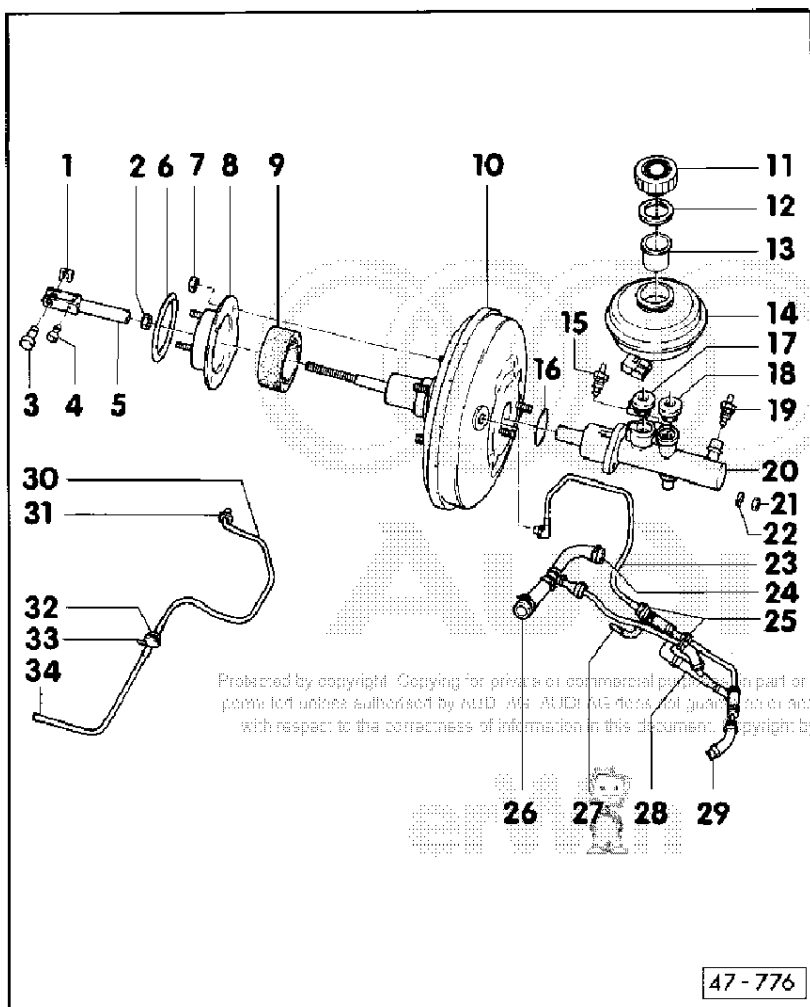
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Vehicles with 6-cylinder engine
as of chassis no. 8C NA 132
158

Notes => See Page 47-21.

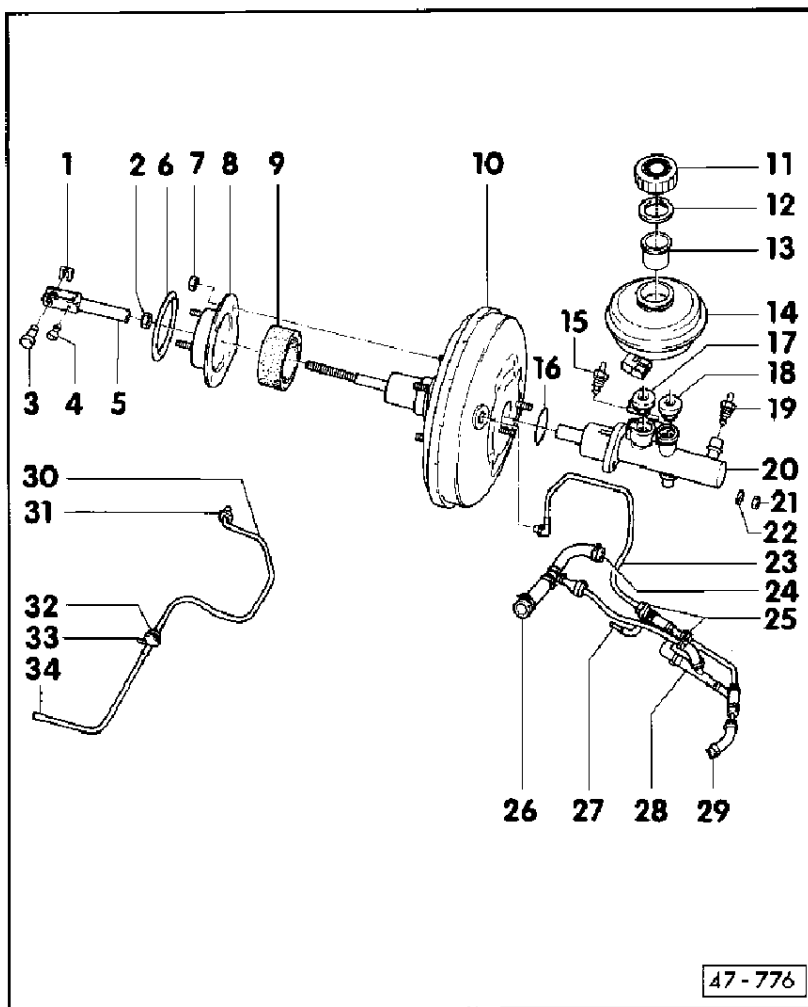


- 1 - Lock washer
 - ◆ Always replace
 - ◆ Fit onto pin
- 2 - Lock nut
 - ◆ Tighten after adjusting clevis
- 3 - Pin
 - ◆ Insert in clevis
- 4 - Grommet
 - ◆ Insert in clevis
 - ◆ Insert coil spring in grommet



- 5 - Clevis
 - ◆ Adjusting:
 - Vehicles with pneumatic brake servo: => Fig. 1
 - Vehicles with hydraulic brake servo: => Fig. 2
- 6 - Oil seal
 - ◆ Always replace
 - ◆ Attach to adapter before installing servo unit
 - ◆ Roll onto bulkhead after attaching servo unit
- 7 - Hexagon nut, 20 Nm
- 8 - Adapter
- 9 - Oil seal
 - ◆ Insert in adapter

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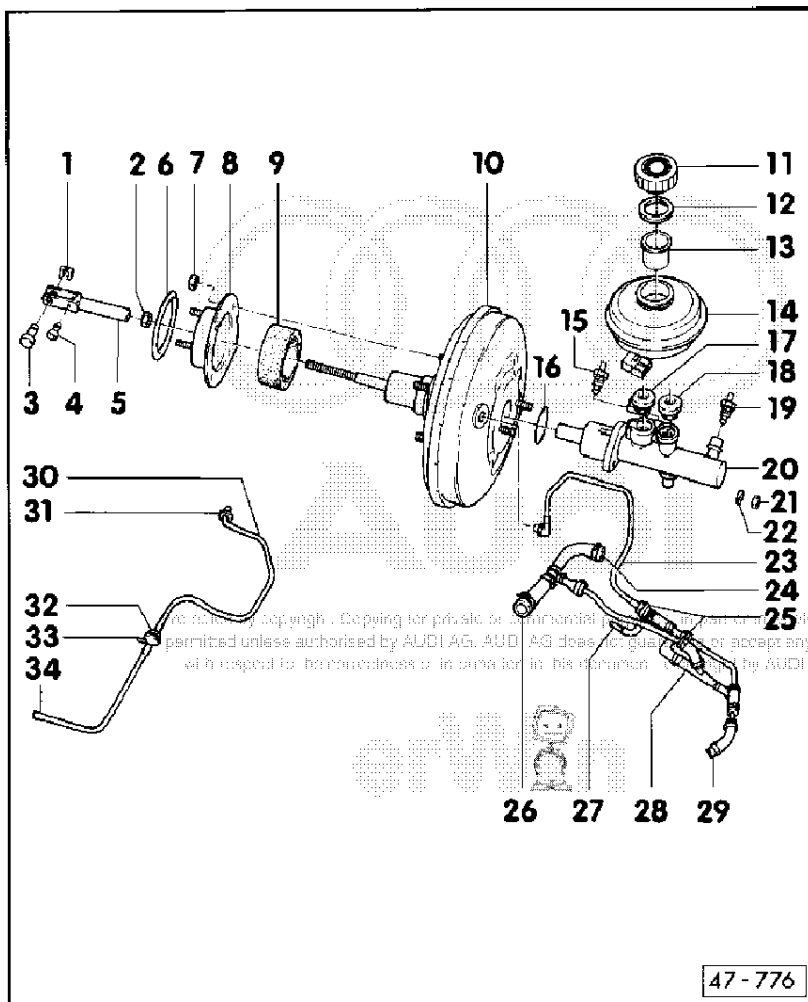
10 - Servo unit, diameter 10"

◆ **Checking:**

- Firmly depress brake pedal several times with engine stopped. This dissipates the vacuum in the unit. Now depress brake pedal with moderate force, hold and start engine.
- If the servo unit is working properly, the pedal will be felt to give slightly under foot (servo assistance becomes effective).

◆ **If faulty renew complete.**

- ◆ **On vehicles with manual gear-box the vacuum is taken from the intake manifold**



11 - Cap

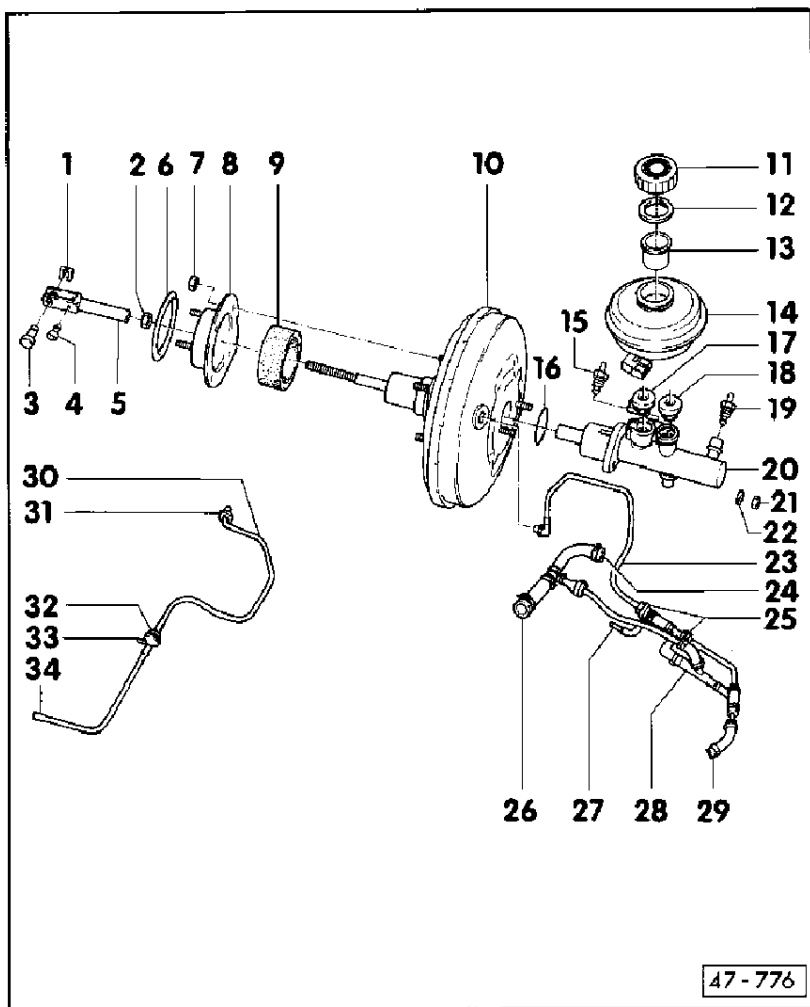
12 - Seal

- ◆ **Insert in cap**

13 - Strainer

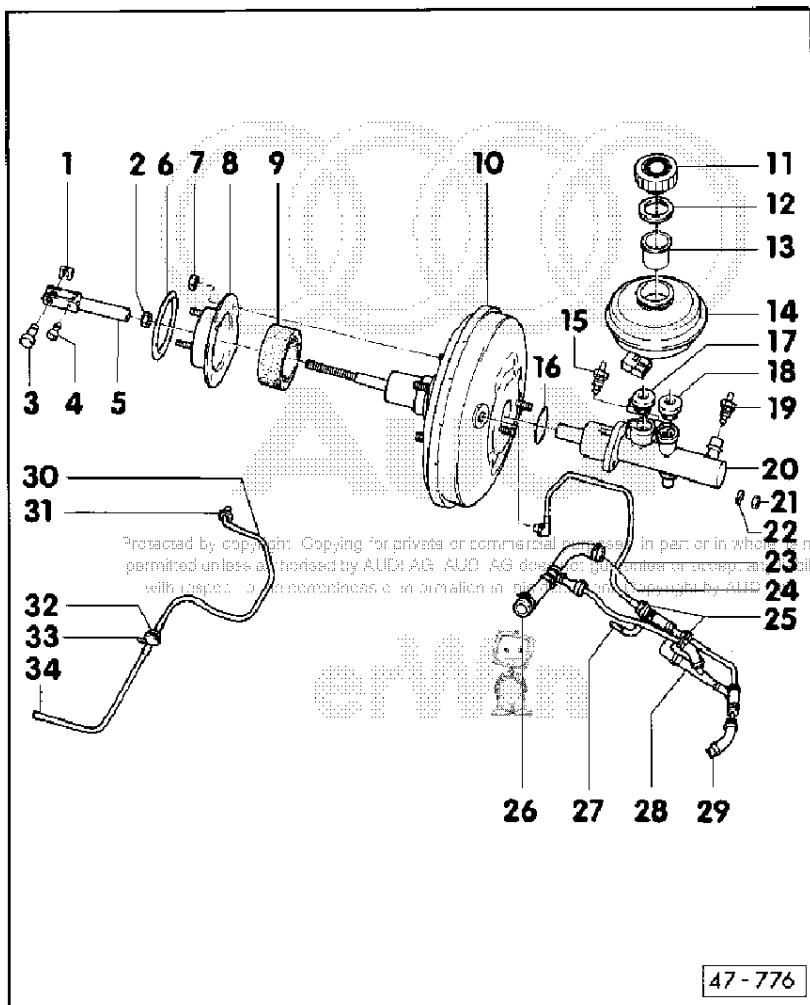
14 - Brake fluid reservoir with float indicator

- ◆ **Fill up with brake fluid to "Max" mark**
- ◆ **Refer to label on reservoir before topping up brake fluid**
- ◆ **Brake fluid, total quantity approx. 0.6 l in braking system**
- ◆ **Connection for hydraulic coupling is located on side**



- ◆ Functional check of indicator:
 - With ignition on, press firmly on centre of cap (membrane). Warning lamp in instrument cluster lights and acoustic alarm sounds.
- ◆ Diaphragm was discontinued as of 07/92. To check indicator, unscrew yellow cap with brake symbol and press by hand on visible strainer with ignition switched on.

15 - Brake pipe



16 - Oil seal

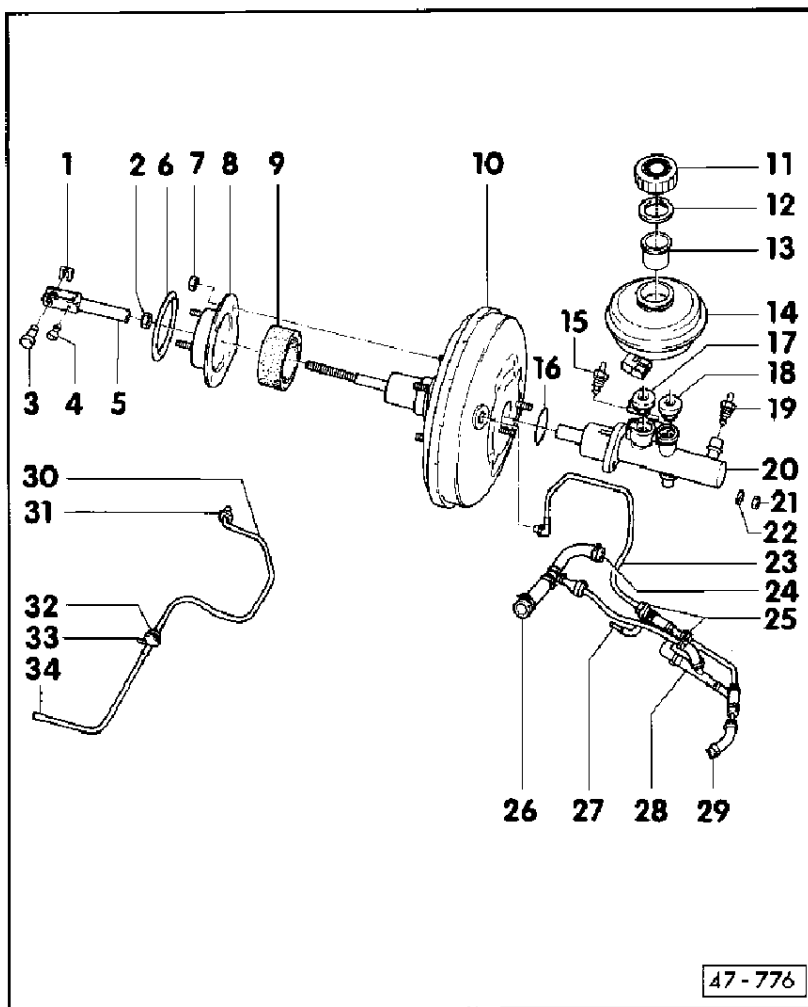
- ◆ Replace after removing brake servo or master cylinder

17 - Sealing plug

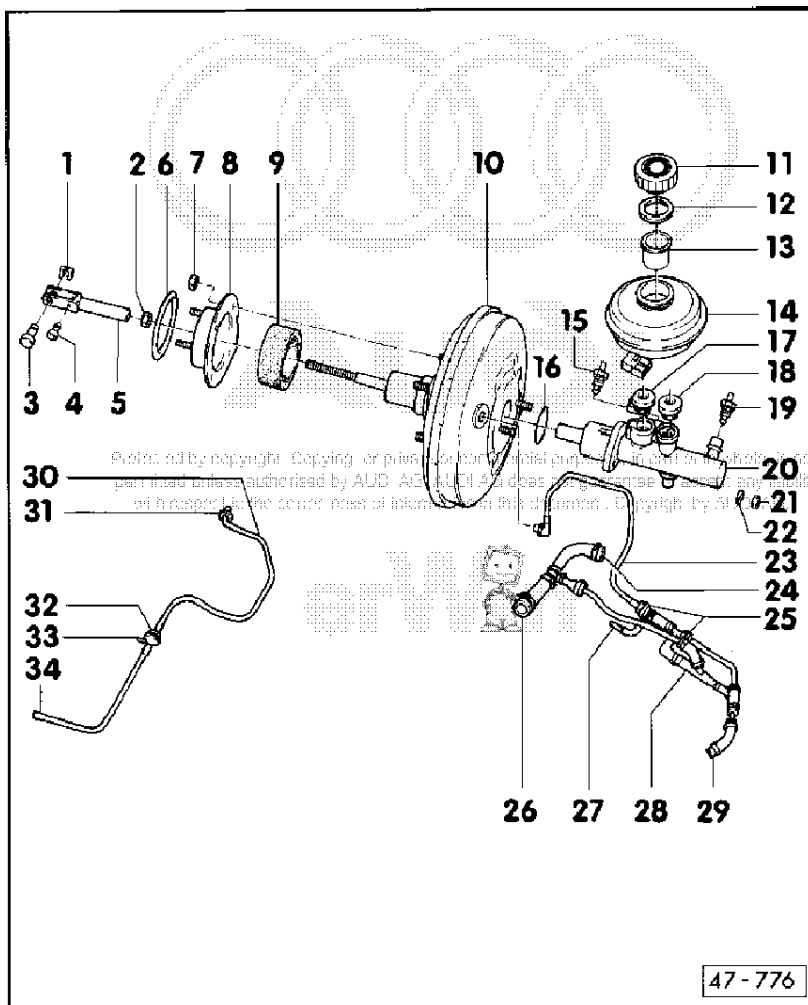
- ◆ Moisten with brake fluid and insert into brake master cylinder
- ◆ Press brake fluid reservoir into sealing plugs

Note:

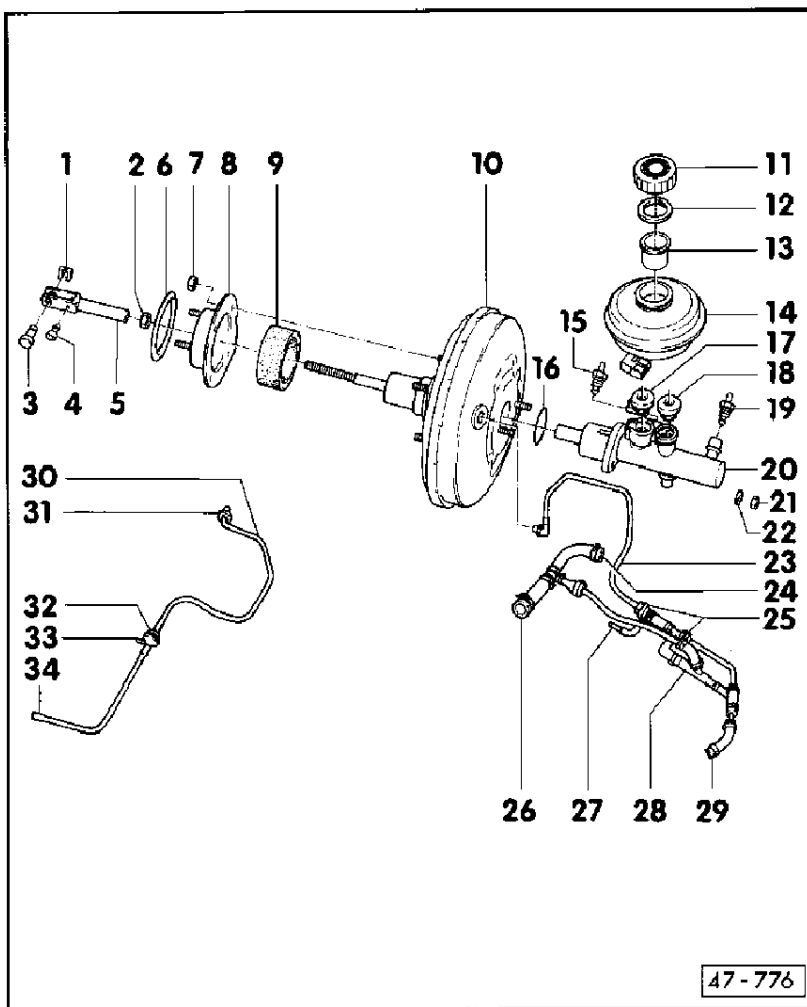
Replacing plug for pushrod circuit in all Girling steel brake master cylinders => Page 47-45



- 18 - Sealing plug
 - ◆ Moisten with brake fluid and insert into brake master cylinder
 - ◆ Press brake fluid reservoir into sealing plugs
- 19 - Brake pipe
- 20 - Brake master cylinder, diameter 23.81 mm
 - ◆ Pull vacuum line (Item - 23- or - 31-) off servo unit before removing
 - ◆ Carefully remove from or insert in servo unit (do not tilt); non-compliance will result in servo unit damage.
 - ◆ Replace as complete unit if necessary.



- 21 - Hexagon nut, 25 Nm
- 22 - Washer
- Note:*
Items - 23- to - 29- do not apply to 4WD vehicles
- 23 - Vacuum line
- 24 - Vacuum line
- 25 - Non-return valves
- 26 - Vacuum line



27 - Vacuum connection for AC

28 - Suction jet pump

29 - Vacuum line

30 - Vacuum line

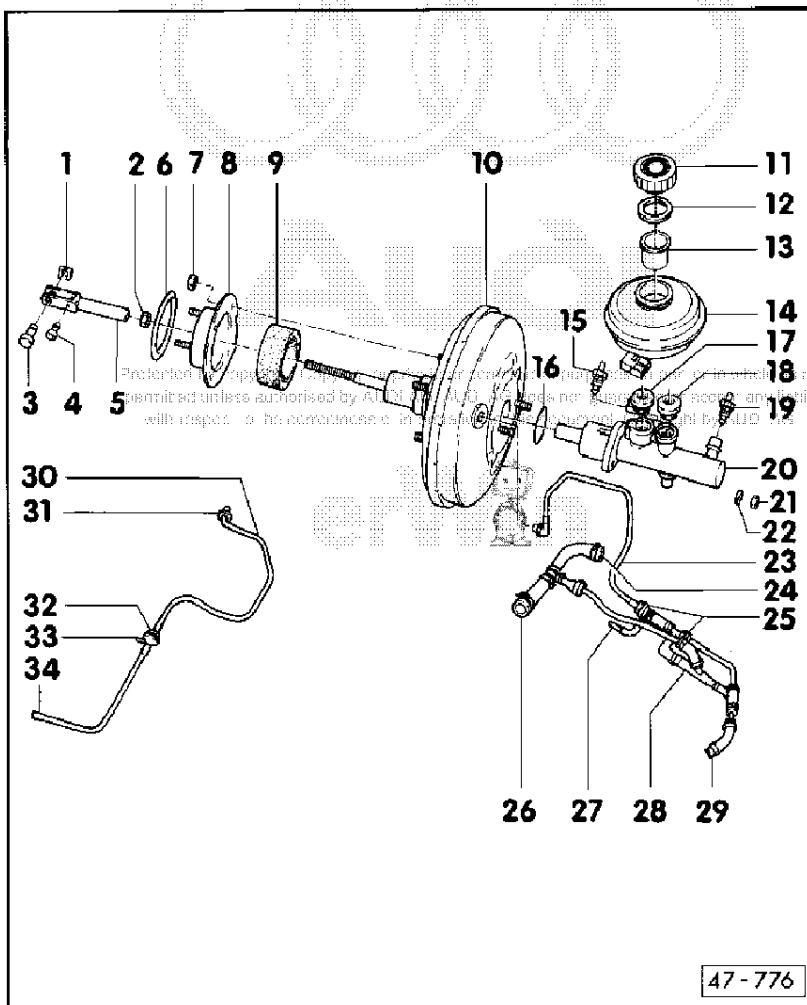
◆ For vehicles with manual gearbox only

31 - Vacuum line

◆ Connection to servo unit

32 - Non-return valve

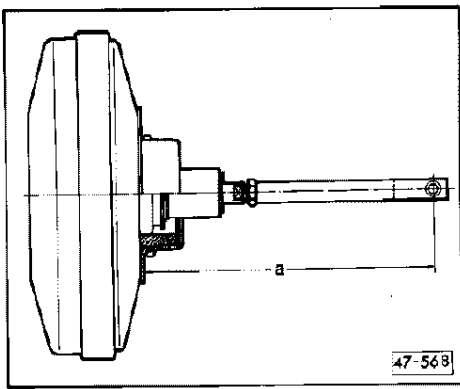
◆ It must be possible to blow air through valve in direction of arrow, but not in opposite direction.



33 - Vacuum line

◆ Connection for AC

34 - Connection for vacuum line at intake manifold



◀ Fig.1 Adjusting clevis, vehicles with pneumatic brake servo

LHD vehicles:

With 9" servo unit, $a = 269.0 \pm 0.5$ mm

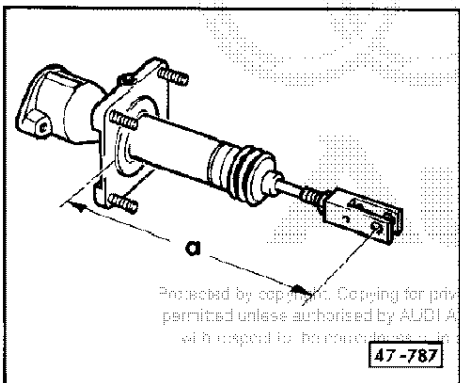
With 10" servo unit, $a = 223.0 \pm 0.5$ mm

RHD vehicles

With 9" servo unit only, $a = 230.0 \pm 0.5$ mm

Notes:

- ◆ When measuring, the clevis should be aligned at right angles to the surface of the brake servo unit.
- ◆ Measured without gasket as far as clevis



◀ Fig.2 Adjusting clevis, vehicles with hydraulic brake servo

LHD vehicles:

$a = 225.0 \pm 0.5$ mm

RHD vehicles

$a = 202.0 \pm 0.5$ mm

Notes:

- ◆ Pull out of servo as far as stop prior to measurement
- ◆ When measuring, the ball head should be aligned at right angles to the surface of the brake servo unit.

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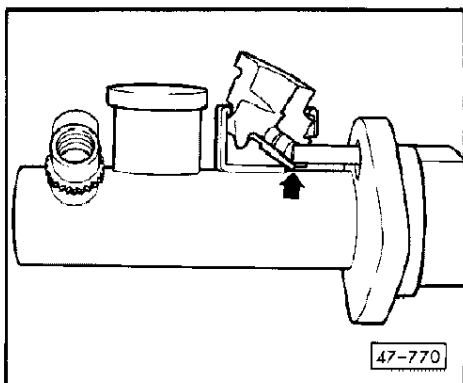


Replacing sealing plug (pushrod circuit)

Note:

For the sake of simplicity, this operation is illustrated on a cut-away model.

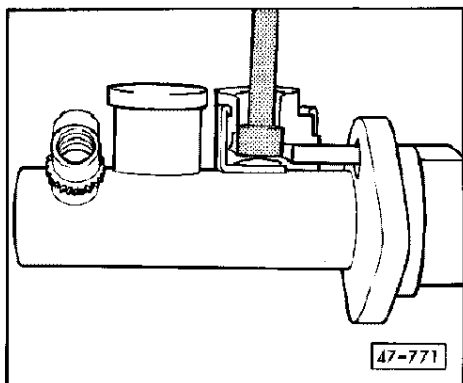
- Only moisten inside of sealing plug with brake fluid.
- Insert sealing plug.
- Make sure that bushing in sealing plug is slipped over tube of pushrod circuit (arrow).



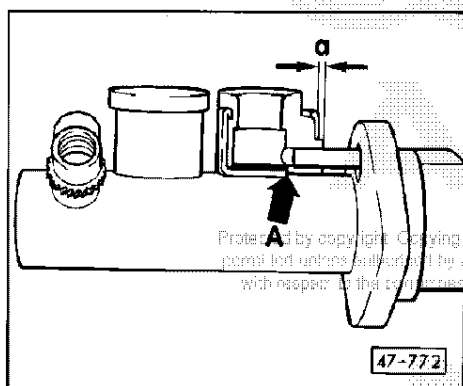
- Use rounded pins, screws or tools to press bushing of sealing plug onto tube.

Attention

Never use pointed objects, as otherwise there is a danger of the bottom of the sealing plug being pierced.



47-45



- The bushing of the sealing plug must protrude roughly 1 mm (dimension "a") out of the housing to ensure that shoulder -A- engages behind housing plate.

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47-46

Components of hydraulic brake servo system

Notes:

◆ The hydraulic brake servo system is filled with hydraulic fluid, part no. G 002 000.

◆ Always replace seals between the line connections.

1 - Distribution piece

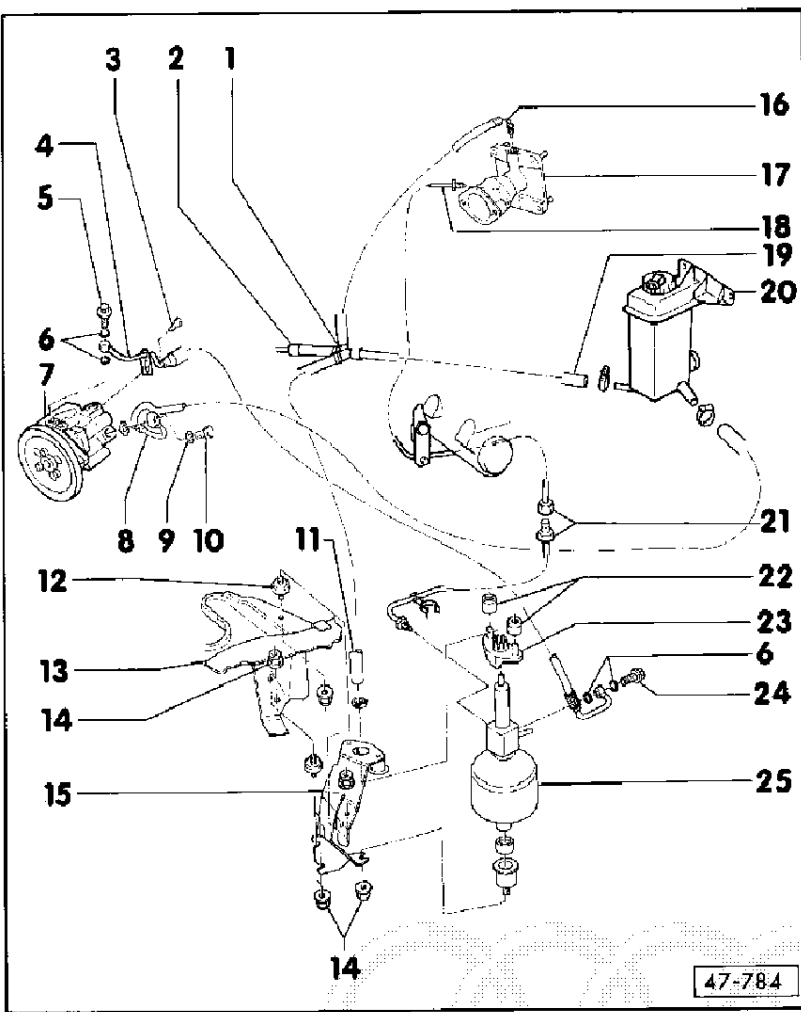
2 - Return pipe

◆ Rotary slide valve housing - distribution piece

◆ Attach annular nipple with banjo bolt to rotary slide valve housing

- Tightening torque: 40 Nm

3 - Hexagon bolts, 20 Nm



47-47

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4 - High-pressure hose

◆ Hydraulic pump - pressure accumulator

◆ Check sealing surfaces of banjo union for damage

5 - Banjo bolt, 25 Nm

◆ Only use banjo bolt with strainer on end face

6 - O-rings

◆ Always replace

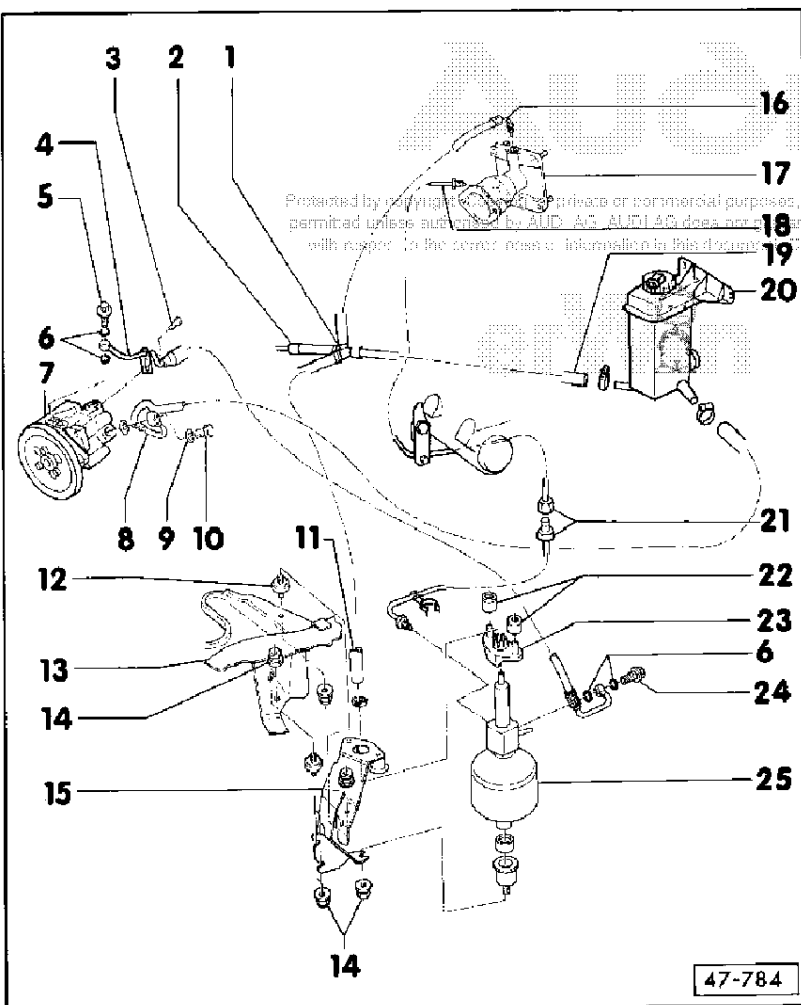
7 - Tandem pump

◆ Removing and installing
=> Page 48-140

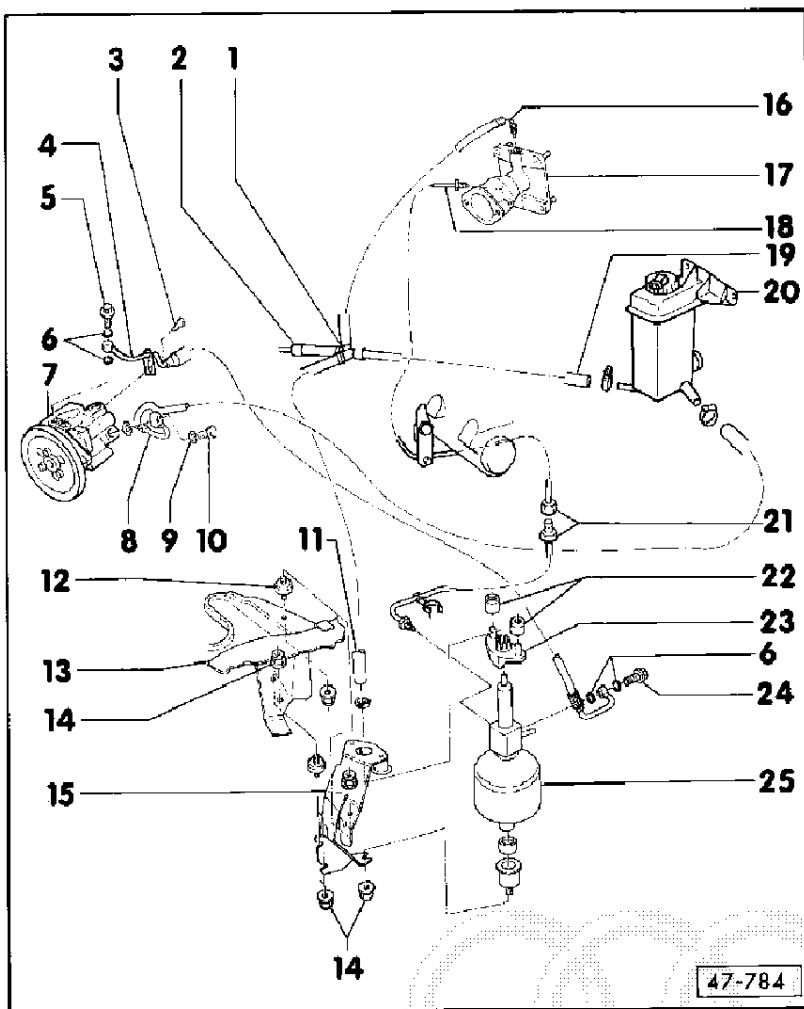
◆ Before installing, fill with hydraulic fluid at suction end and crank by hand until fluid comes out at pump outlet.

◆ Measuring piston pump delivery => Page 47-57

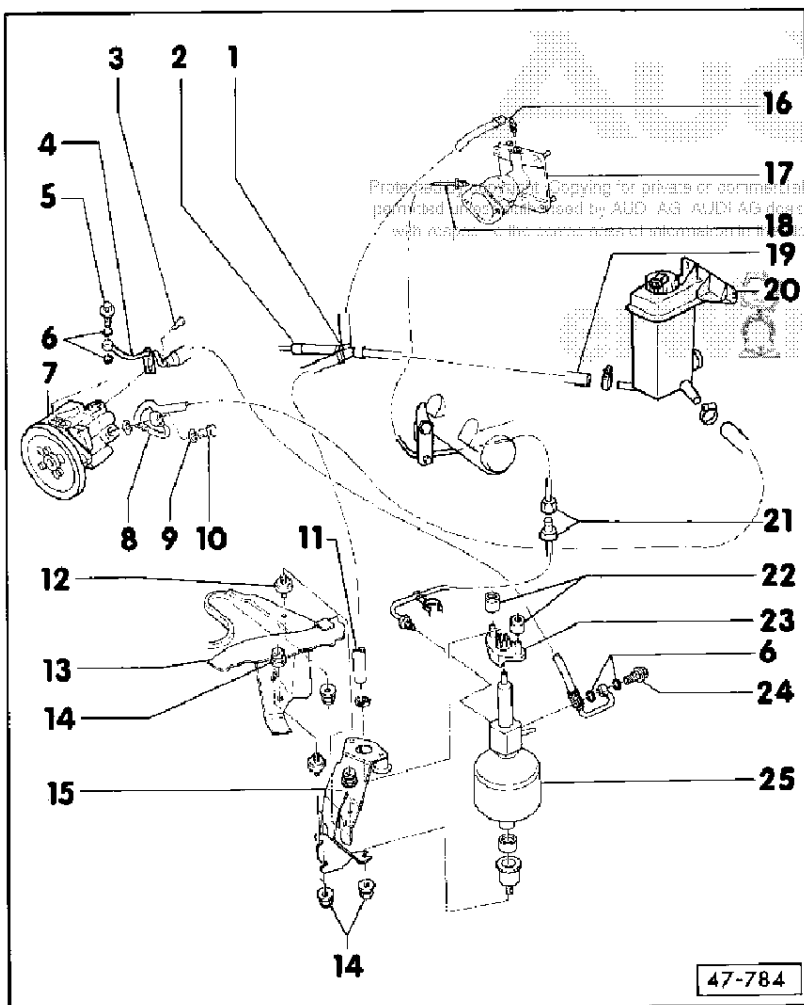
◆ Servicing not envisaged, fit exchange pump if necessary



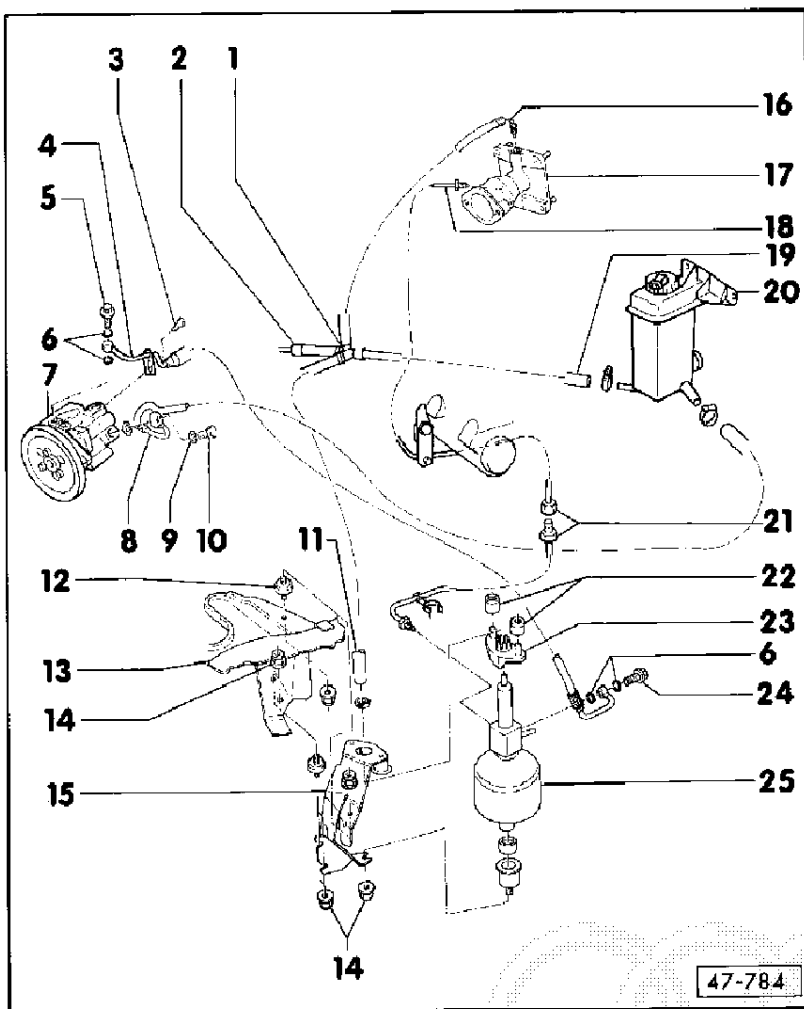
47-48



- 8 - Suction hose
 - ◆ Hydraulic pump - oil cooler
- 9 - Seals
 - ◆ Always replace
- 10 - Banjo bolt, 50 Nm
- 11 - Return hose
 - ◆ Pressure accumulator - distribution piece - reservoir
- 12 - Bonded rubber bush
- 13 - Longitudinal member
- 14 - Collar nut 10 Nm
- 15 - Bracket for pressure accumulator



- 16 - Return pipe
 - ◆ Servo unit - distribution piece, distribution piece - reservoir
- 17 - Brake servo
 - ◆ Boost factor:
 - LHD 3.8 : 1
 - RHD 4.7 : 1
 - ◆ Servicing not envisaged
 - ◆ Checking operating pressure => Page 47-55
 - ◆ Check for leaks:
 - Unscrew return line - 16- with engine stopped; if servo unit is defective hydraulic fluid will emerge from connection hole; individual droplets have no significance

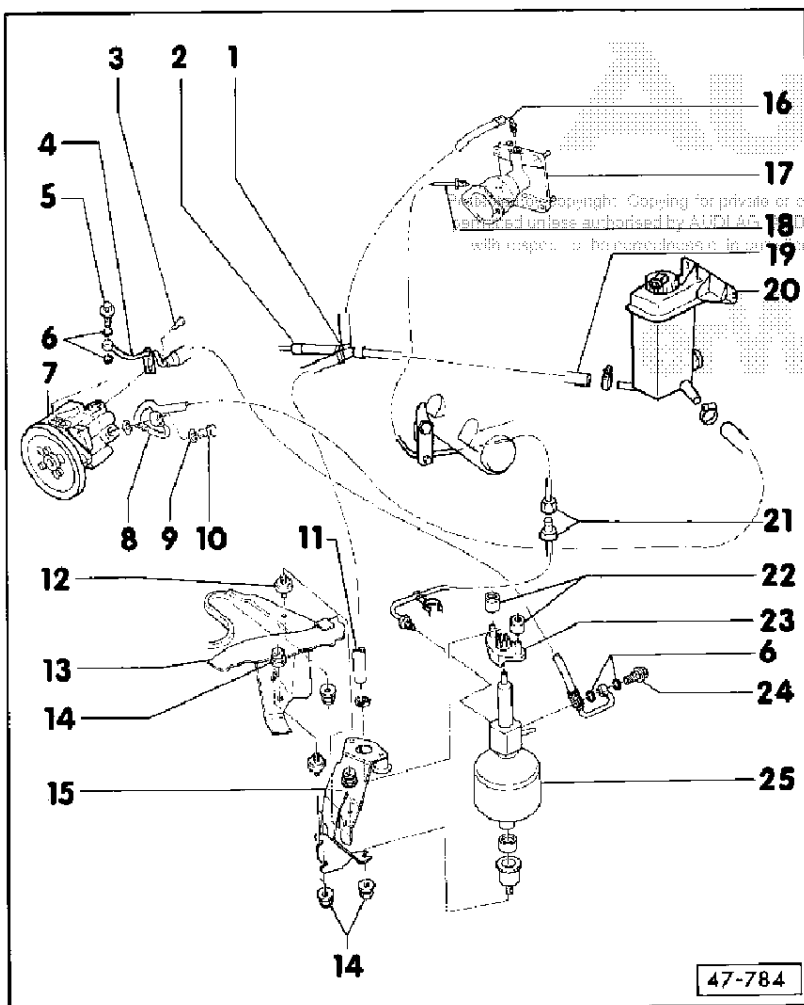


18 - Pressure pipe

- ◆ Pressure accumulator – servo unit
- ◆ Before removing, dissipate operating pressure by pressing brake pedal roughly 20 times with engine switched off

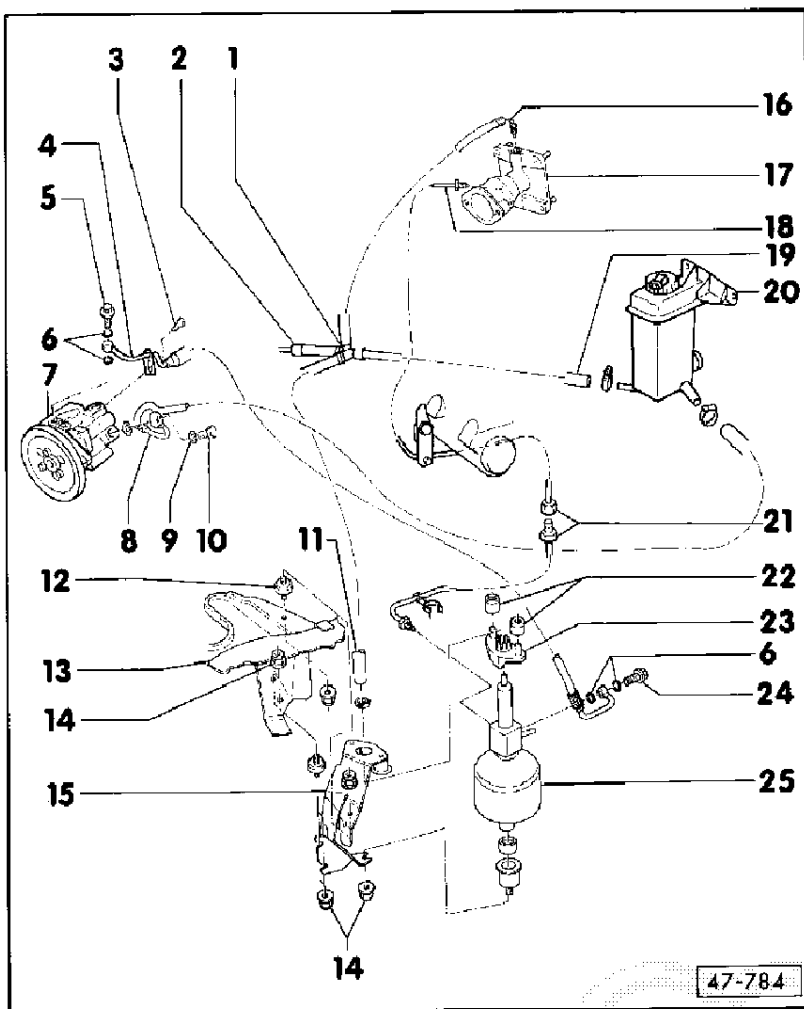
19 - Return hose

- ◆ Distribution piece – reservoir



20 - Reservoir with float indicator

- ◆ New hydraulic fluid fill approx. 1.05 l
- ◆ Checking hydraulic fluid level:
 - Start engine and let it idle for approx. 2 minutes with front wheels set to straight-ahead position.
 - Switch off engine and immediately check hydraulic fluid level, paying attention to marks on reservoir/dipstick; top up to "MAX" mark if necessary
- ◆ If hydraulic fluid level drops to "MIN" this is indicated by a warning lamp in the dash insert



47-784

21 - Line connector

22 - Buffer

- ◆ Attach to mount for pressure accumulator and apply anti-friction assembly oil G 294 421 A1 to exterior

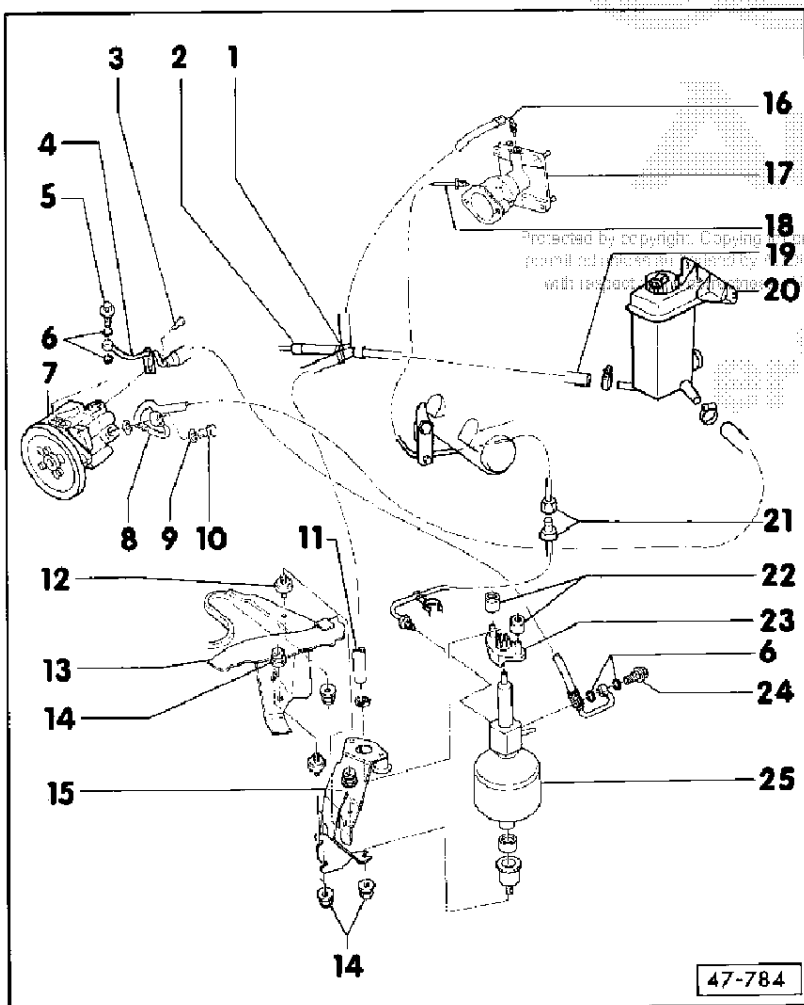
23 - Mount for pressure accumulator

- ◆ Attach with pre-assembled buffers to pressure accumulator

24 - Banjo bolt, 25 Nm

- ◆ Fitted with side strainer

47-53



47-784

25 - Pressure accumulator

- ◆ Thread in pressure accumulator M10 x 1
- ◆ As-new charging pressure 73-77 bar at 20 oC
- ◆ With integrated non-return valve and relief valve

◆ Checking charging pressure => Page 47-59

◆ Checking non-return valve => Page 47-63

◆ Checking relief valve => Page 47-61

◆ Before removing, dissipate operating pressure by pressing brake pedal roughly 20 times with engine switched off

◆ Disposal

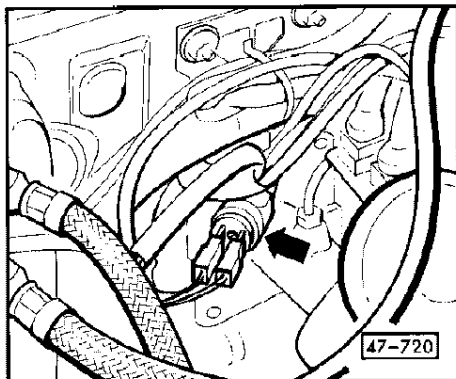
=> Special Information. No. 2; Edition 03.90

47-54

Checking operating pressure of hydraulic servo unit

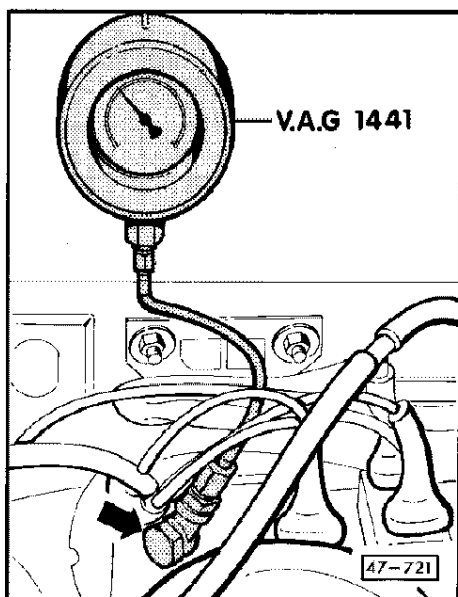
Test prerequisites

- V-belt tension OK, no leaks in servo system.
- Dissipate operating pressure, to do this press brake pedal approx. 20 times with engine switched off.



- ◀ - Pull leads off warning switch
- Unscrew warning switch

47-55



- ◀ - Screw hose of tester -V.A.G 1441- to servo unit using the banjo bolt and copper seals provided with the tester

Note:

Fit thick seal between servo unit and banjo union

- Let engine idle until pointer on pressure gauge indicates operating pressure in excess of 140 bar.

If this pressure level is not attained.

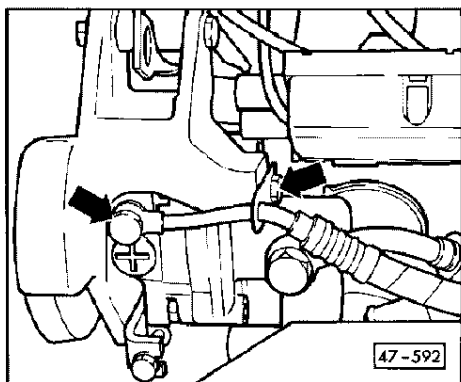
- Switch off engine and check piston pump delivery amount =>

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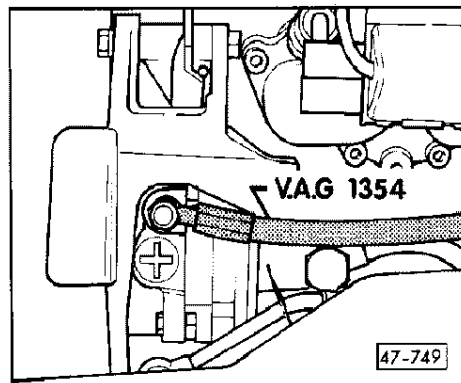


47-56

Measuring piston pump delivery

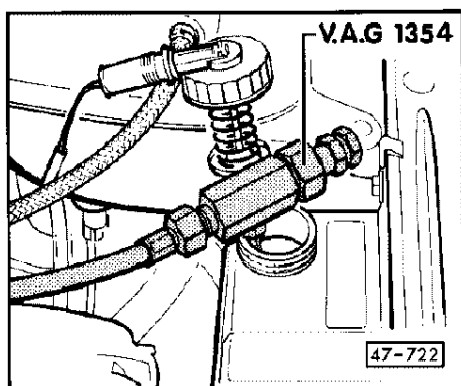


- ◀ - Unscrew pressure line from pump and swivel bracket



- ◀ - Screw hose of pressure limiter -V.A.G 1354- with genuine banjo bolt to pump, use new 10 mm diameter metal seals => Parts List.

47-57



- ◀ - Unscrew reservoir cap.
- Insert pressure limiter -V.A.G 1354- in reservoir
- Leave engine idling until pipe has been bled.
- Stop engine.
- Hold the end of the pressure limiter pipe in a suitable measuring glass.
- Allow the engine to idle; specified delivery value: at least 0,25 l/min.

Note:

Renew tandem pump if specified value is not attained.

- Remove pressure limiter -V.A.G 1354-
- Attach pressure pipe to pump and check for leaks
- Top up hydraulic fluid in reservoir

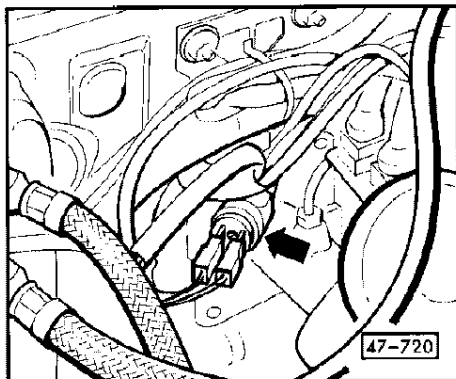
47-58

Checking charging pressure of pressure accumulator

As-new charging pressure: 73-77 bar at 20 °C

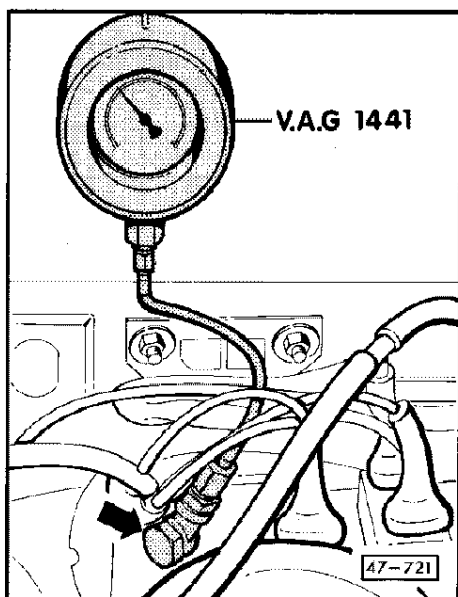
Min. charging pressure: 30 bar at 20 °C

- Dissipate operating pressure, to do this press brake pedal approx. 20 times with engine switched off.



- ◀ - Pull leads off warning switch
- Unscrew warning switch

— 47-59 —



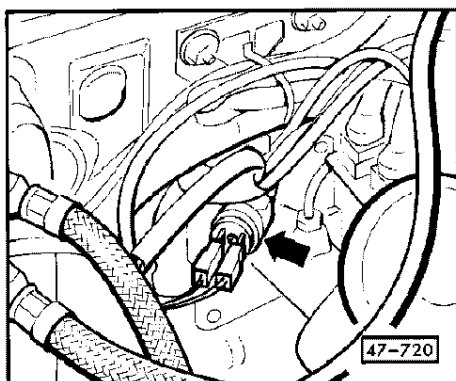
- ◀ - Screw hose of tester -V.A.G 1441- to servo unit using the banjo bolt and copper seals provided with the tester
- Note:**
Fit thick seal between servo unit and banjo union; thin seal between banjo bolt and banjo union.
- Let engine idle until pointer on pressure gauge indicates operating pressure (approx. 140 bar).
 - Switch off ignition.
 - Observe pressure gauge and pump with brake pedal until pressure gauge reading slowly starts to decrease
 - The pressure at which the pointer stops dropping slowly and drops abruptly to 0 bar, is the charging pressure of the pressure accumulator.
 - Replace the accumulator if this pressure is less than 30 bar.
 - Remove tester -V.A.G 1441-.
 - Install warning switch and check it for leaks.

— 47-60 —

Checking relief valve in pressure accumulator

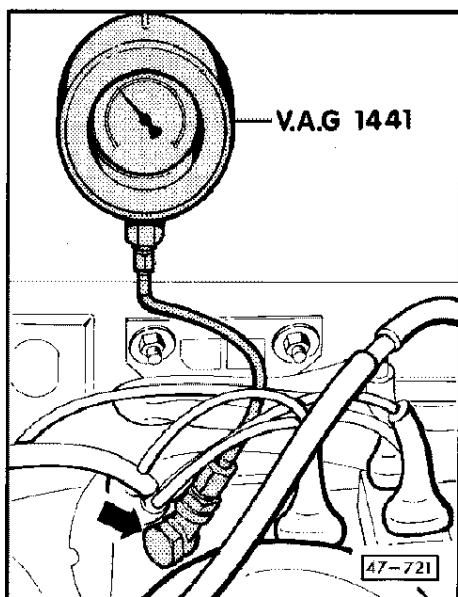
Test requirements

- Delivery of piston pump =>Page 47-57 (brake circuit) OK (when pressurised at least 0.25 l/min, with engine idling)



- ◀ – Pull leads off warning switch
- Unscrew warning switch

47-61



- ◀ – Screw hose of tester -V.A.G 1441- to servo unit using the banjo bolt and copper seals provided with the tester

Note:

Fit thick seal between servo unit and banjo union

- At idling speed, operating pressure must be more than 140 bar.
- A low operating pressure indicates that the relief valve is defective.
- Renew pressure accumulator
- Measure operating pressure again as a check.
- Dissipate operating pressure by pumping with brake pedal.
- Remove tester -V.A.G 1441-.
- Install warning switch
- Check all screw connections for leaks

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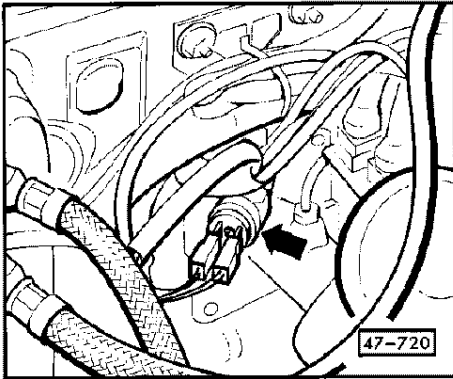


47-62

Checking non-return valve in pressure accumulator for leaks

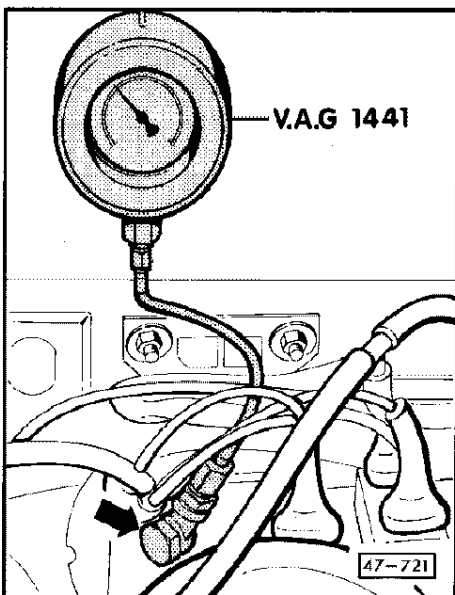
Test requirements

- No leaks in servo unit



- ◀ - Pull leads off warning switch
- Unscrew warning switch

47-63



- ◀ - Screw hose of tester -V.A.G 1441- to servo unit using the banjo bolt and copper seals provided with the tester

Note:

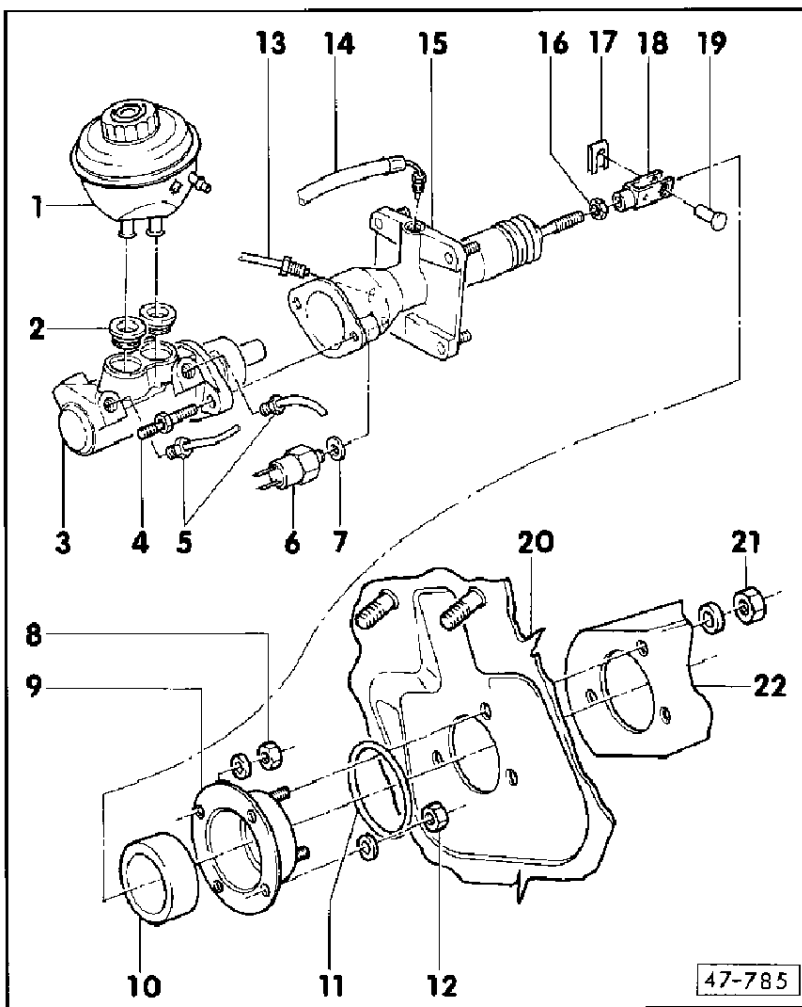
Fit thick seal between servo unit and banjo union

- Leave engine idling until max. pressure has built up.
- Switch off engine.
- Reduce pressure to approx. 135 bar by pressing brake pedal several times.
- After approx. 5 minutes the pressure must not have dropped below 130 bar.
- If the drop in pressure is greater then the non-return valve is leaking and the pressure accumulator should be renewed.
- Dissipate operating pressure by pumping with brake pedal.
- Remove tester -V.A.G 1441-.
- Install warning switch
- Check all screw connections for leaks

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47-64



Removing and installing brake master cylinder/hydraulic servo unit

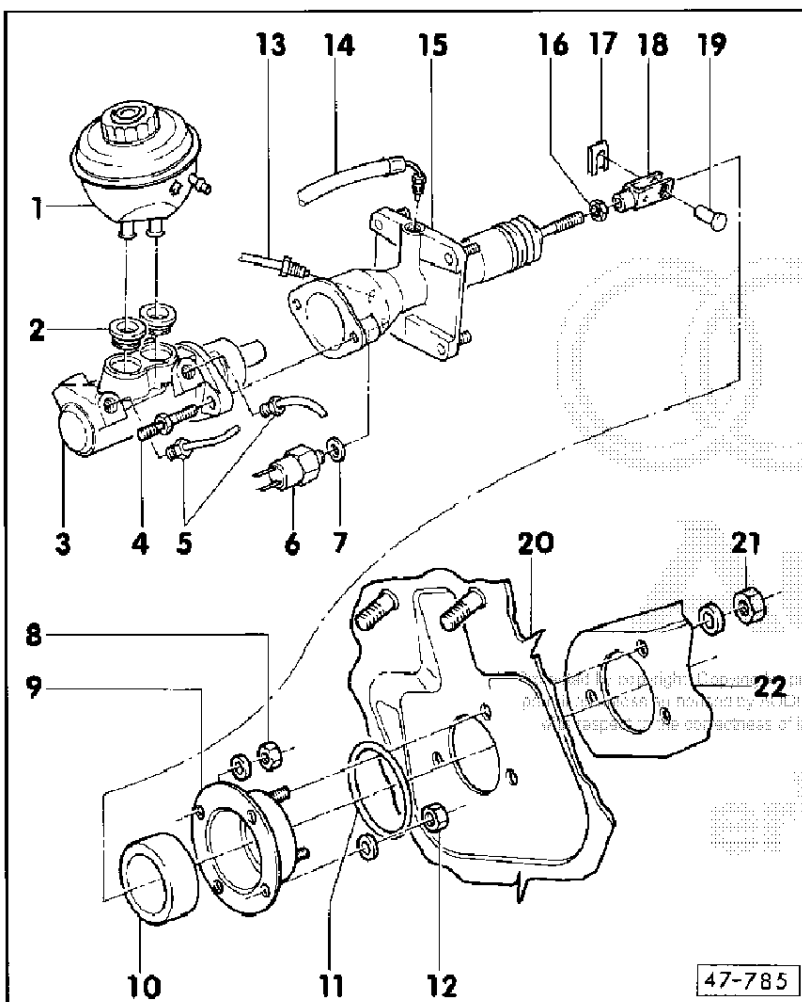
Notes:

- ◆ Brake master cylinders cannot be dismantled any further, i.e. no provision is made for servicing.
- ◆ Use only fresh brake fluid. Refer to information on brake fluid reservoir.

1 - Brake fluid reservoir with float indicator

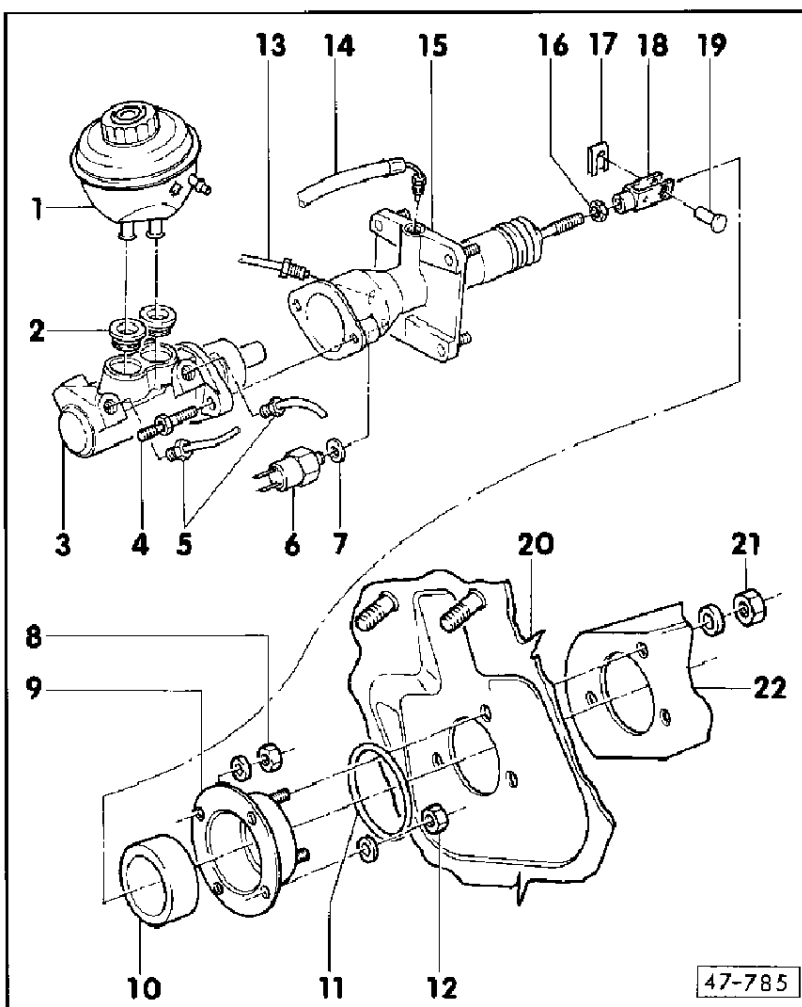
- ◆ Fill up with brake fluid to "Max" mark

47-65



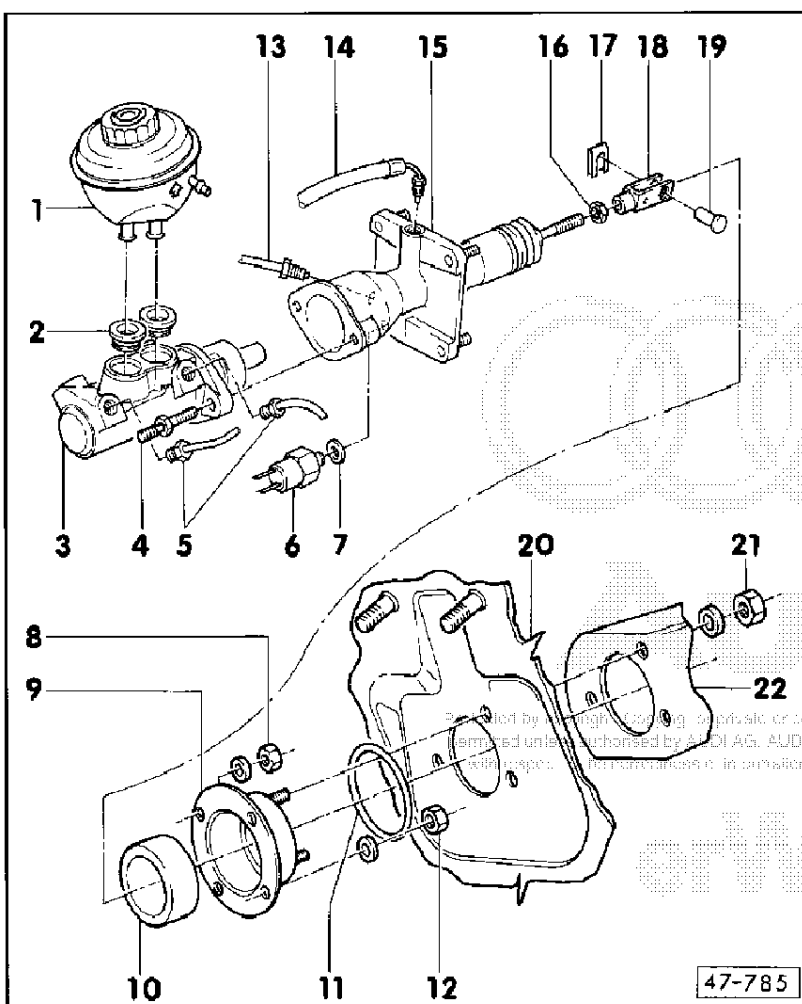
- ◆ Functional check of indicator:
 - With ignition on, press firmly on centre of cap (membrane). Warning lamp in instrument cluster lights and acoustic alarm sounds.
- ◆ Diaphragm was discontinued as of 07/92. To check indicator, unscrew yellow cap with brake symbol and press by hand on visible strainer with ignition switched on.
- ◆ Connection for hydraulic coupling is located on side

47-66



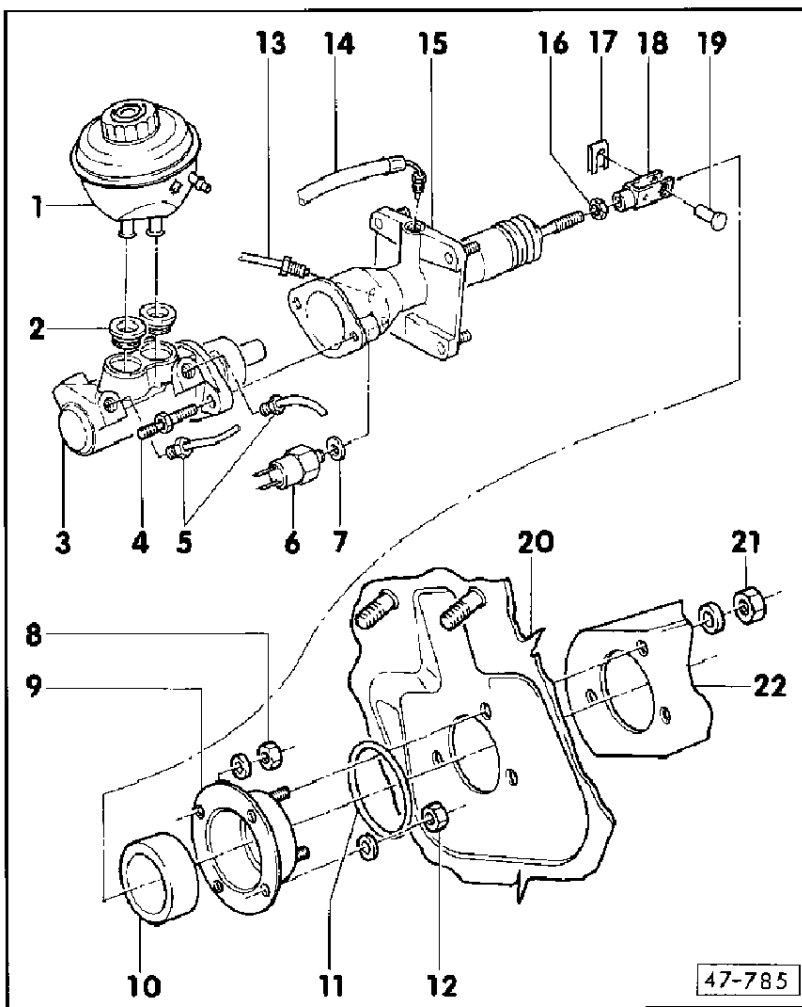
- 2 – Sealing plug
 - ◆ Moisten with brake fluid and insert into brake master cylinder
 - ◆ Press brake fluid reservoir into sealing plugs
- 3 – Brake master cylinder
 - ◆ \varnothing 25.4 mm
 - ◆ Replace as complete unit if necessary.
- 4 – Double-ended bolts, 25 Nm
 - ◆ For attachment of brake line bracket, screw M8 nut onto right end
- 5 – Brake lines
 - ◆ Unscrew

47-67



- 6 – Warning switch, 20 Nm
 - ◆ For monitoring pressure of hydraulic servo unit; if pressure drops to a value between 127 and 87 bar, warning lamp in dash insert lights and buzzer sounds
 - ◆ Screw into servo unit
- 7 – Oil seal
 - ◆ Always replace
- 8 – Hexagon nut, 20 Nm

47-68



9 - Mounting

10 - Oil seal

11 - Oil seal

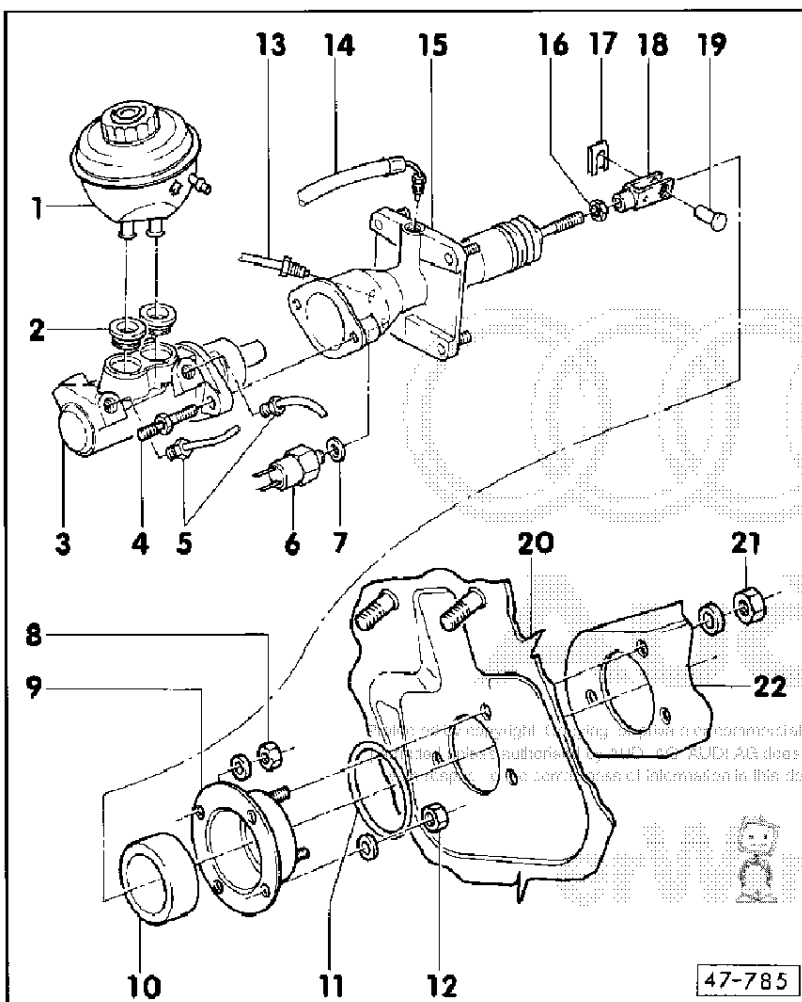
- ◆ Always replace
- ◆ Attach to adapter before installing servo unit
- ◆ Roll onto bulkhead after attaching servo unit

12 - Hexagon nut, 20 Nm

13 - Pressure pipe

- ◆ Pressure accumulator/servo unit
- Before removing, dissipate operating pressure by pressing brake pedal roughly 20 times with engine switched off

47-69



14 - Return pipe

- ◆ Servo unit - reservoir

15 - Hydraulic servo unit

- ◆ Do not press brake pedal with brake master cylinder removed

16 - Lock nut

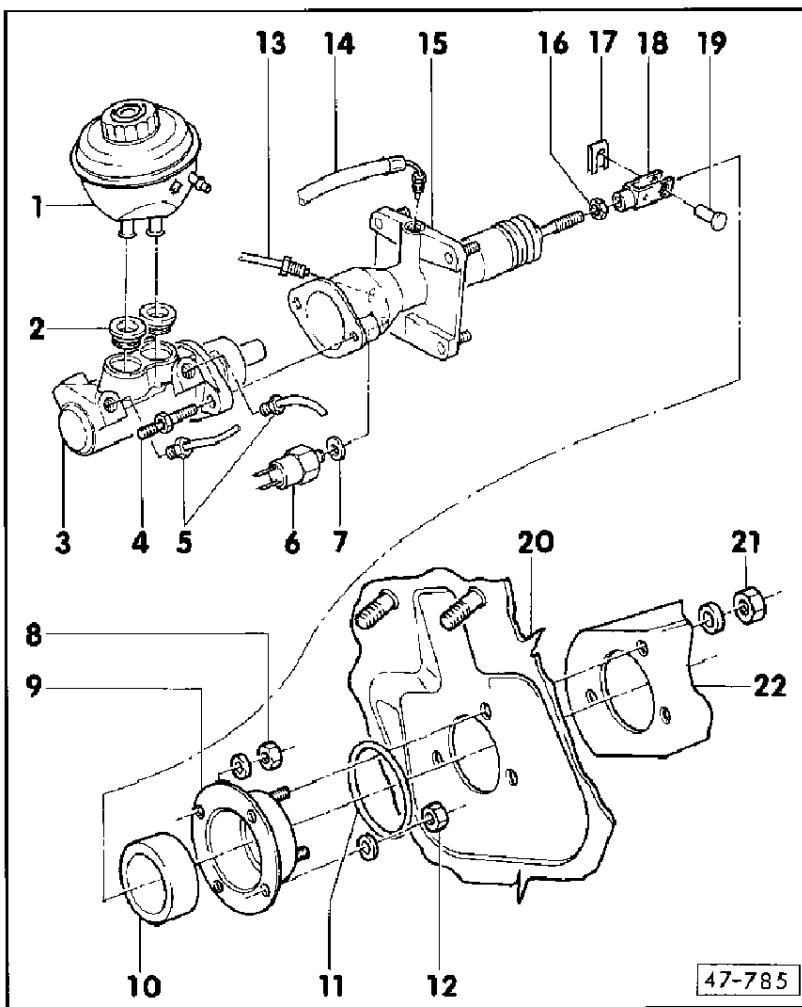
17 - Circlip

- ◆ Always replace
- ◆ Fit onto pin

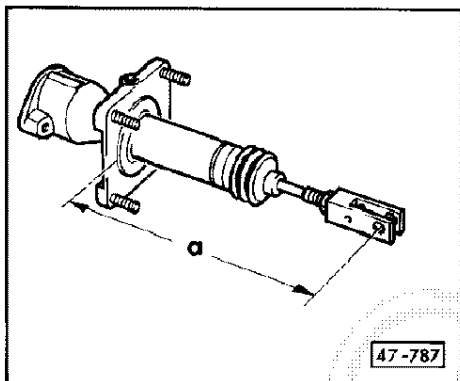
18 - Clevis

- ◆ Adjusting:
- Vehicles with hydraulic brake servo: => Fig. 1

47-70



- 19 – Pin
 - ◆ Grease slightly before inserting
- 20 – Bulkhead
- 21 – Self-locking nut, 25 Nm
 - ◆ Always replace
- 22 – Pedal bracket



◀ Fig.1 Adjusting clevis, vehicles with hydraulic brake servo

LHD vehicles:

$$a = 225.0 \pm 0.5 \text{ mm}$$

RHD vehicles

$$a = 202.0 \pm 0.5 \text{ mm}$$

Notes:

- ◆ Pull out of servo as far as stop prior to measurement
- ◆ When measuring, the ball head should be aligned at right angles to the surface of the brake servo unit.

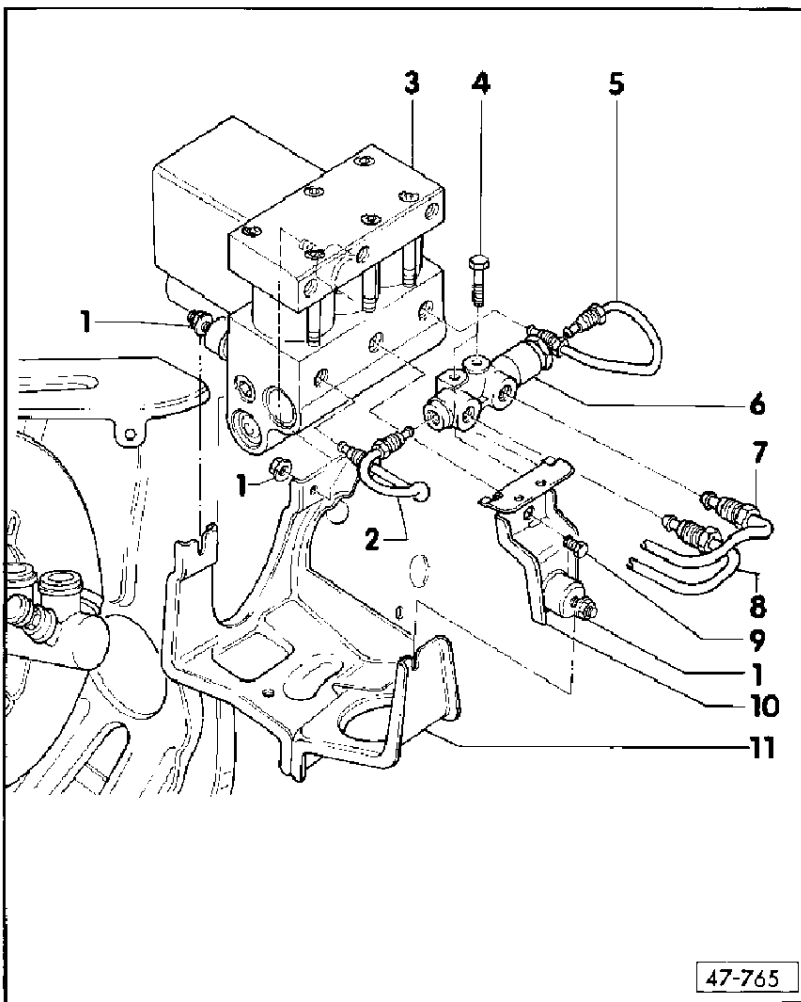
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Location of brake pressure regulator

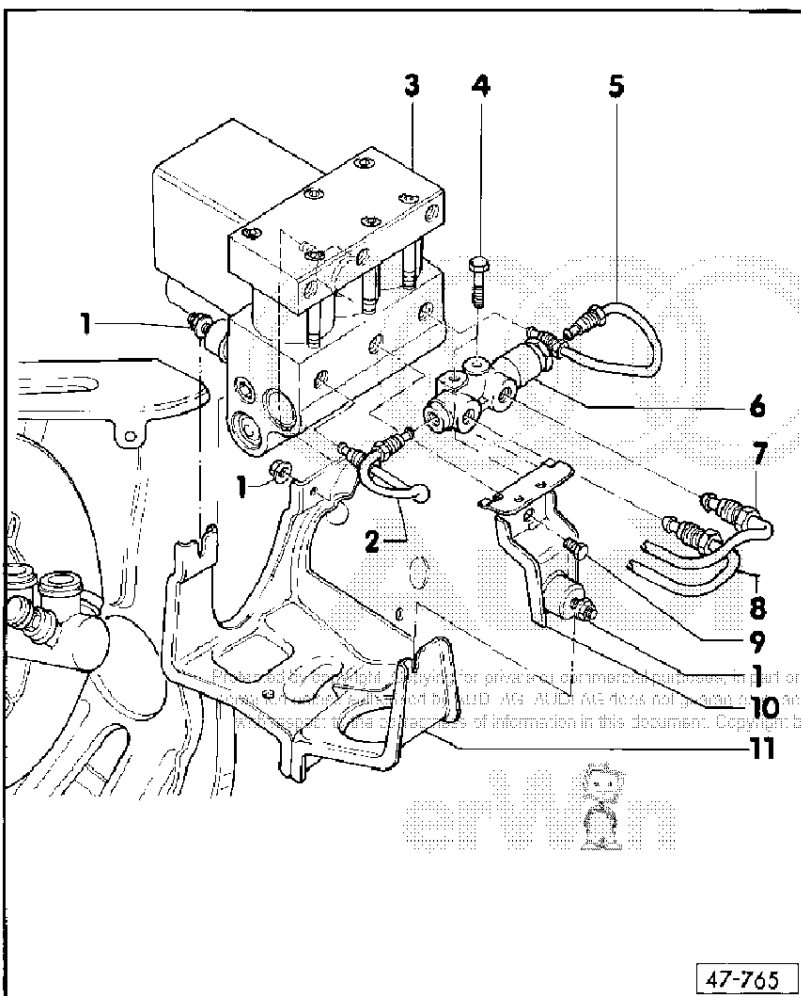
Note:

The tightening torque of the brake lines is 15 Nm.



47-765

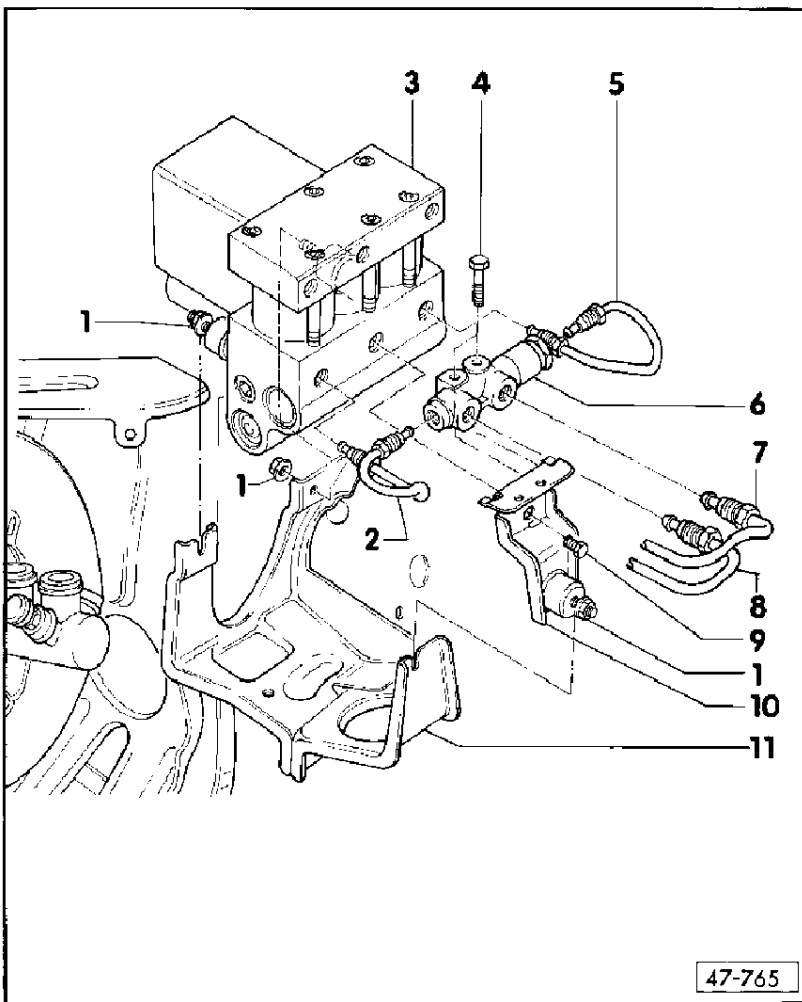
47-73



47-765

- 5 - Brake pipe
 - ◆ Brake pressure regulator - hydraulic modulator
- 6 - Brake pressure regulator
 - ◆ Non-adjustable
 - ◆ Checking:
 - Vehicles up to model year 92 => Page 47-76.
 - From model year `92 => Page 47-78.
- 7 - Brake pipe
 - ◆ Brake master cylinder to brake pressure regulator
 - ◆ Floating piston circuit, rear axle
 - ◆ Not to be interchanged with line, -Item 8-.

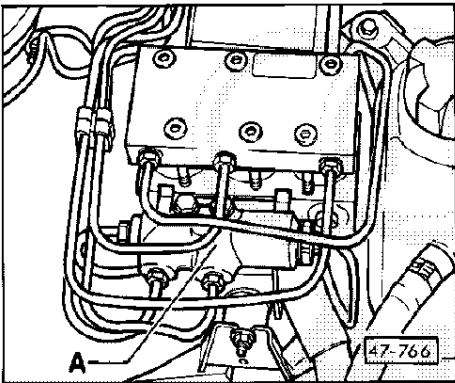
47-74



- 8 – Brake pipe
 - ◆ Brake master cylinder to brake pressure regulator
 - ◆ Pushrod piston circuit, front axle
 - ◆ Not to be interchanged with line, -Item 7-.
- 9 – Hexagon bolt, 10 Nm
- 10 – Bracket for brake pressure regulator
- 11 – Bracket
 - ◆ Insert hydraulic modulator and secure.

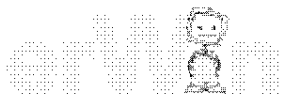
Checking brake pressure regulator, up to model year 1992

All vehicles up to chassis no. 8C NA 237 552

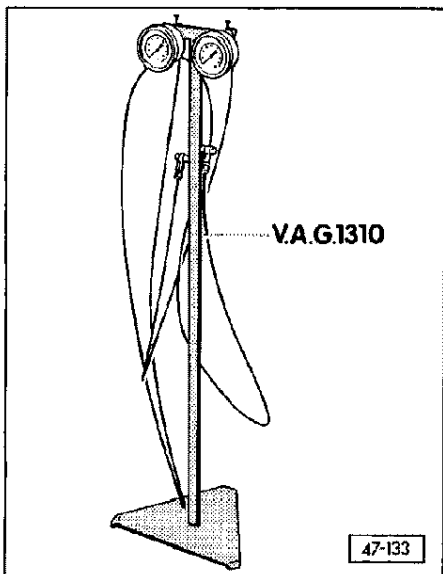


◀ The pressure sensitive brake pressure regulator -A- with stop is located in front of the hydraulic modulator
 It reduces the brake pressure at the rear axle in a predetermined manner. Failure of the front axle brake circuit activates a stop piston which enables the entire brake pressure to be passed to the rear brake callipers.

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Pressure test

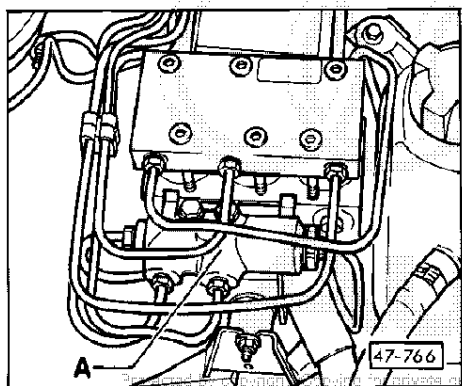


- ◀ – Jack up vehicle and connect pressure gauge -V.A.G 1310- to front left and rear left brake calliper
- Vent both pressure gauges
- Apply pressure to brake pedal and measure pressure at both axles
 - With 50 bar at front axle => rear axle 30-35 bar
 - With 100 bar at front axle => rear axle 45-50 bar
- Replace brake pressure regulator if test pressure is not within specified tolerance
- Remove pressure gauge and bleed braking system => Page 47-80

— 47-77 —

Checking brake pressure regulator, from model year 1992

All vehicles from chassis no. 8C PA 000 001



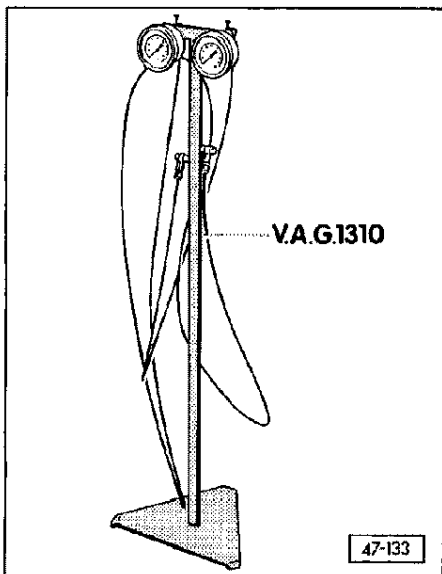
- ◀ The pressure sensitive brake pressure regulator -A- with stop is located in front of the hydraulic modulator
- It reduces the brake pressure at the rear axle in a predetermined manner. Failure of the front axle brake circuit activates a stop piston which enables the entire brake pressure to be passed to the rear brake callipers.
- For identification of the new controller it is marked with the number 35 on the end face. It also features a blue dot.

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— 47-78 —

Pressure test



- Jack up vehicle and connect pressure gauge -V.A.G 1310- to front left and rear left brake calliper
- Vent both pressure gauges
- Apply pressure to brake pedal and measure pressure at both axles
 - With 50 bar at front axle => rear axle 37.5-41.5 bar
 - With 100 bar at front axle => rear axle 51.5-57.5 bar
- Replace brake pressure regulator if test pressure is not within specified tolerance
- Remove pressure gauge and bleed braking system => Page 47-80

47-79

Bleeding braking system and brake fluid replacement

Only use new genuine VW/Audi brake fluid according to US standard FMVSS 116 DOT 4.

Attention

- ◆ Do not under any circumstances allow brake fluid to come into contact with liquids which contain mineral oils (e.g. oil, petrol, cleaning agents). Mineral oils damage the plugs and seals in the brake system.
- ◆ Brake fluid is poisonous and must on no account be siphoned orally through a hose. Because of its caustic properties it must also not come into contact with paintwork.
- ◆ Brake fluid is hygroscopic, i.e. it absorbs moisture from the surrounding air, and should therefore always be stored in airtight containers.
- ◆ Always observe the relevant environmental regulations for disposal.

Ensure correct handling of brake fluid, brake components and brake tools.

=> Special information, Running Gear No. 21

47-80

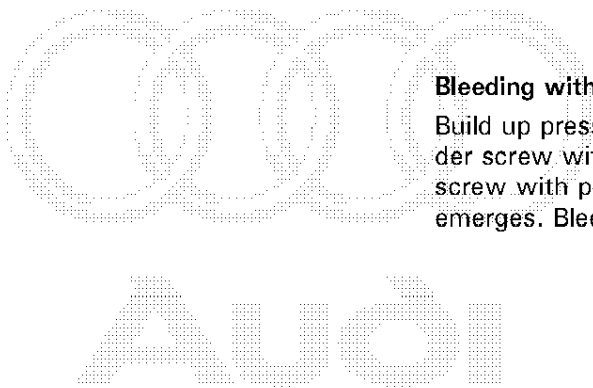
Bleeding brake system

With brake filling and bleeding unit VW1238/B or V.A.G 1869

- Connect VW1238/B or V.A.G 1869
- Attach bleeder hose of collector to bleeder screw in line with specified sequence. Open bleeder screw until there are no bubbles in brake fluid emerging from brake calliper.
- Collect the old brake fluid in bleeder bottle forming part of the unit.
- Close bleeder screw.

Bleeding sequence

- _ 1 - Brake master cylinder (if bleeder screw fitted)
- _ 2 - Rear right wheel brake cylinder/calliper
- _ 3 - Rear left wheel brake cylinder/calliper
- _ 4 - Front right brake calliper
- _ 5 - Front left brake calliper



Bleeding without -VW 1238/B-

Build up pressure in braking system by pumping pedal Open bleeder screw with hose of bleeder bottle attached. Close bleeder screw with pedal depressed. Repeat procedure until no further air emerges. Bleeding sequence => Page 47-81.

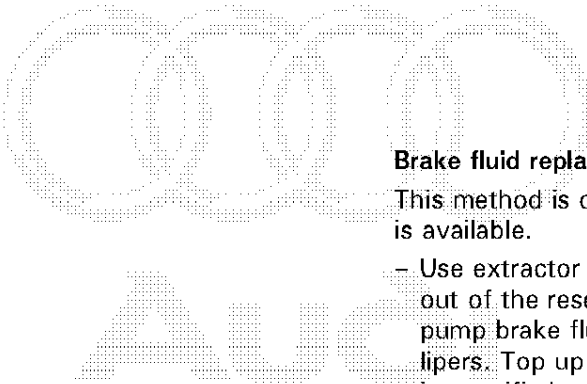
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Brake fluid replacement

- Connect VW 1238/B, open bleeder screws in line with information given in table below and allow appropriate amount of brake fluid to drain out. Pumping in new brake fluid flushes the used brake fluid out of the system.

Sequence: Brake master cyl. Wheel brake cyl. Brake callipers	Amount of brake fluid which must flow out of brake master cylinder, brake callipers or wheel bra- ke cylinders:
Brake master cyl.	250 cm ³ (per bleeder screw, if fitted)
Rear right	500 cm ³
Rear left	500 cm ³
Front right	500 cm ³
front left	500 cm ³

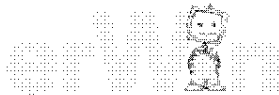


Brake fluid replacement without -VW 1238/B-

This method is only to be used if no brake filling and bleeding unit is available.

- Use extractor bottle to draw as much brake fluid as possible out of the reservoir. Pump pedal with bleeder screw open to pump brake fluid out of brake master cylinder and brake callipers. Top up with fresh brake fluid and bleed braking system in specified sequence => Page 47-81, bleeding.

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Steering box components

Notes:

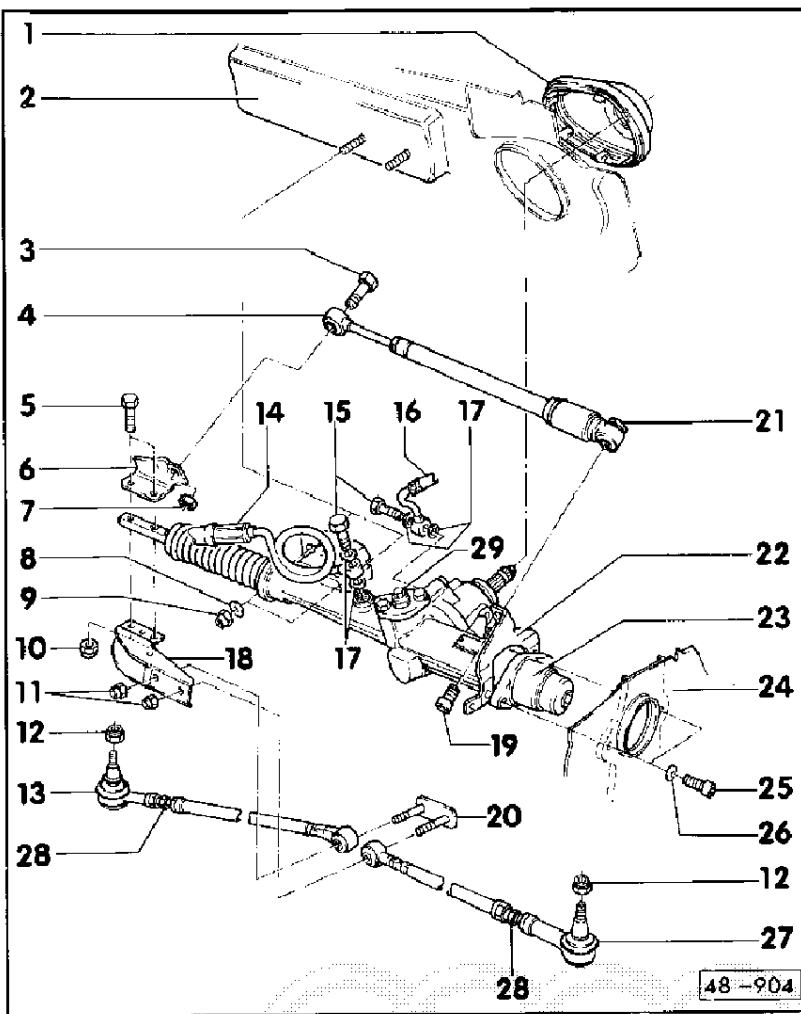
- ◆ Welding and alignment works on the steering components are not permitted.
- ◆ Topping up hydraulic fluid – bleeding steering system => Page 48-151
- ◆ Check steering system for leaks => Page 48-152

1 – Bulkhead seal

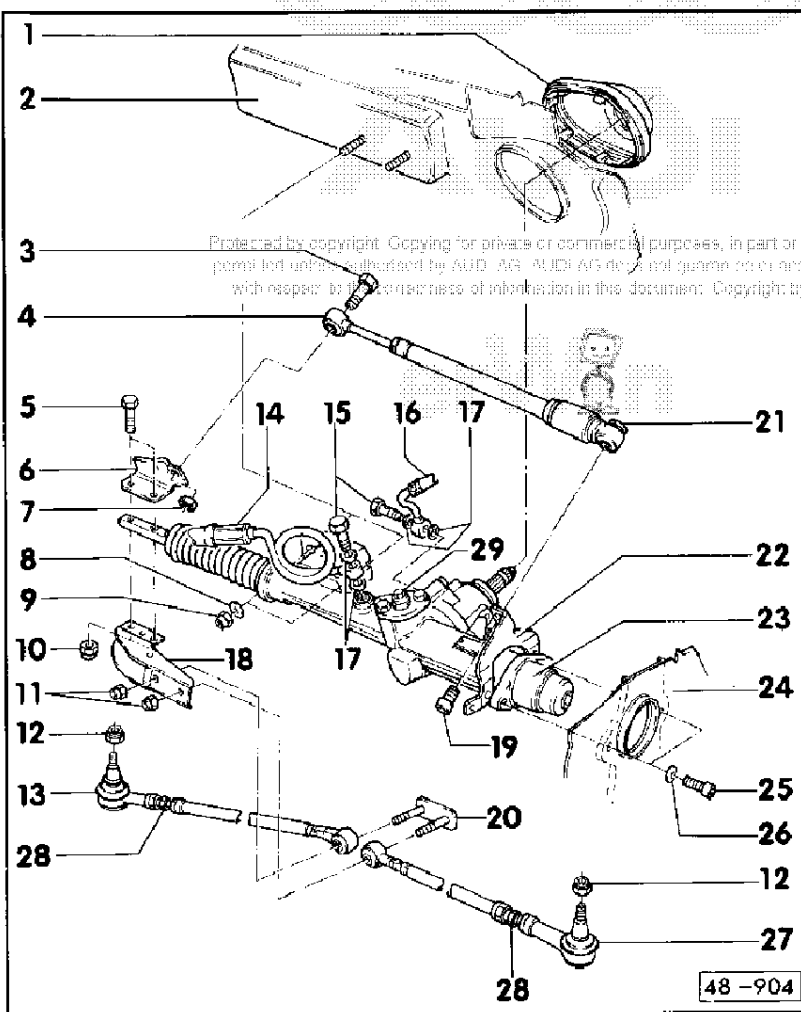
- ◆ Insert carefully into annular groove of rotary valve housing and into bulkhead

2 – Bulkhead

3 – Hexagon bolt



48-1

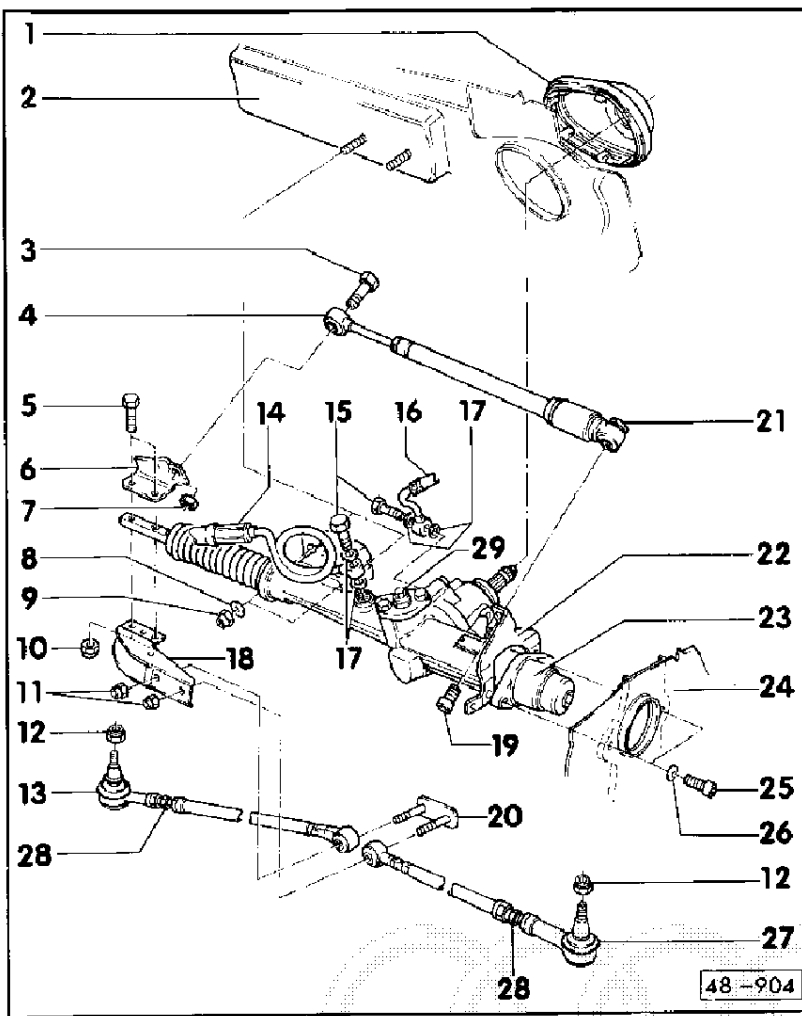


4 – Steering damper

- ◆ Only installed on vehicles with 4-cylinder engine and sports running gear as of model year 1993 as well as on vehicles with 6-cylinder engine
- ◆ Can be replaced without removing steering box, take out servo unit beforehand
- ◆ Remove with bracket before taking out steering box
- ◆ Unscrew from bracket to check
- ◆ Treat appropriately before scrapping

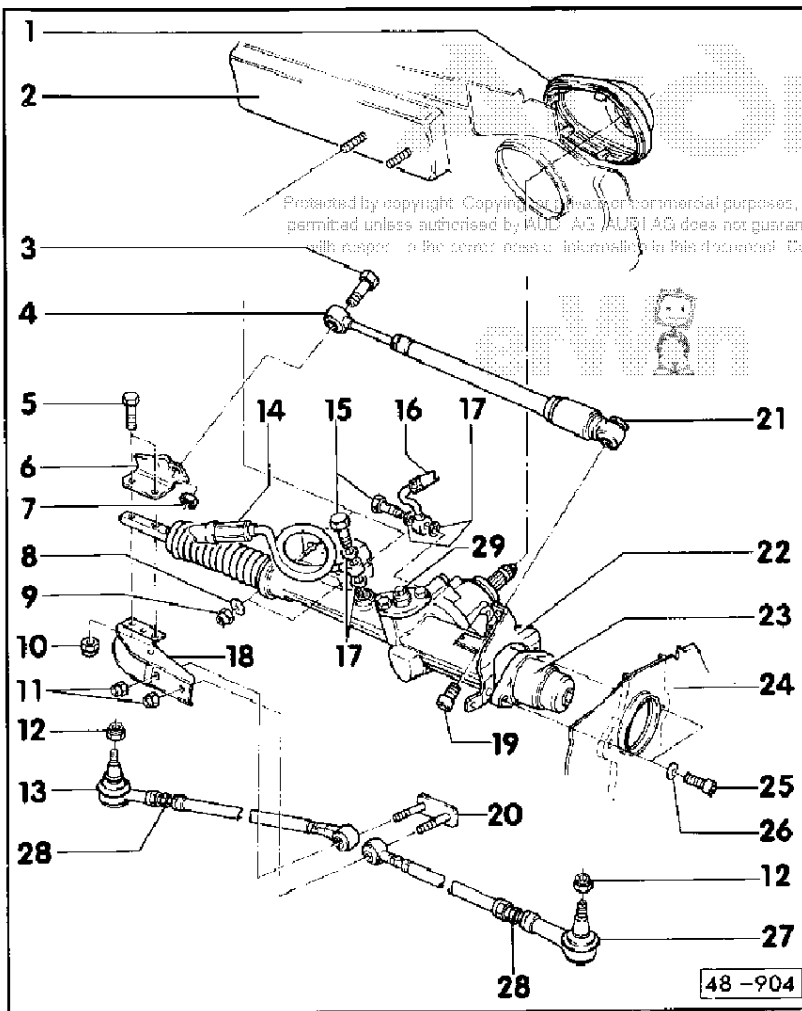
=> Special Information. No. 2; Edition 03.90

48-2

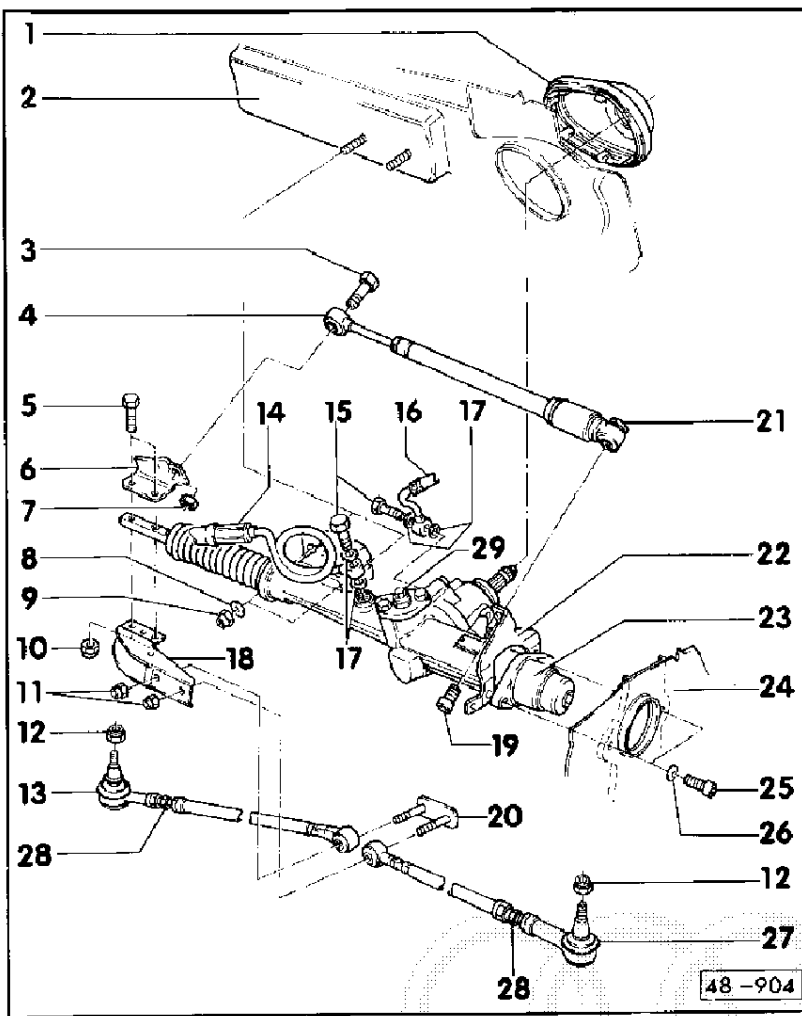


◆ Checking:
 - Piston rod must move uniformly and smoothly over entire stroke; if appropriate, compare with new damper (move damper several times over its entire stroke whilst holding it in installation position). If they are functioning properly, slight traces of shock absorber oil do not signify that replacement is necessary.

- 5 - Hexagon bolt, 45 Nm
 - ◆ First tighten these bolts, then nuts - 10-
 - ◆ See tightening sequence => Page 48-13
- 6 - Steering damper bracket, rack end
- 7 - Hexagon nut, 35 Nm
- 8 - Washer



- 9 - Self-locking nut, 45 Nm
 - ◆ Always replace
 - ◆ Tighten cheese-head bolts at left wheel housing before fastening
- 10 - Self-locking nut, 45 Nm
 - ◆ Always replace
 - ◆ Tighten bolts - 5- first
 - ◆ See tightening sequence => Page 48-13
- 11 - Self-locking nut, 40 Nm
 - ◆ Always replace
- 12 - Self-locking nut, 30 Nm
 - ◆ Always replace



13 - Right-hand track rod

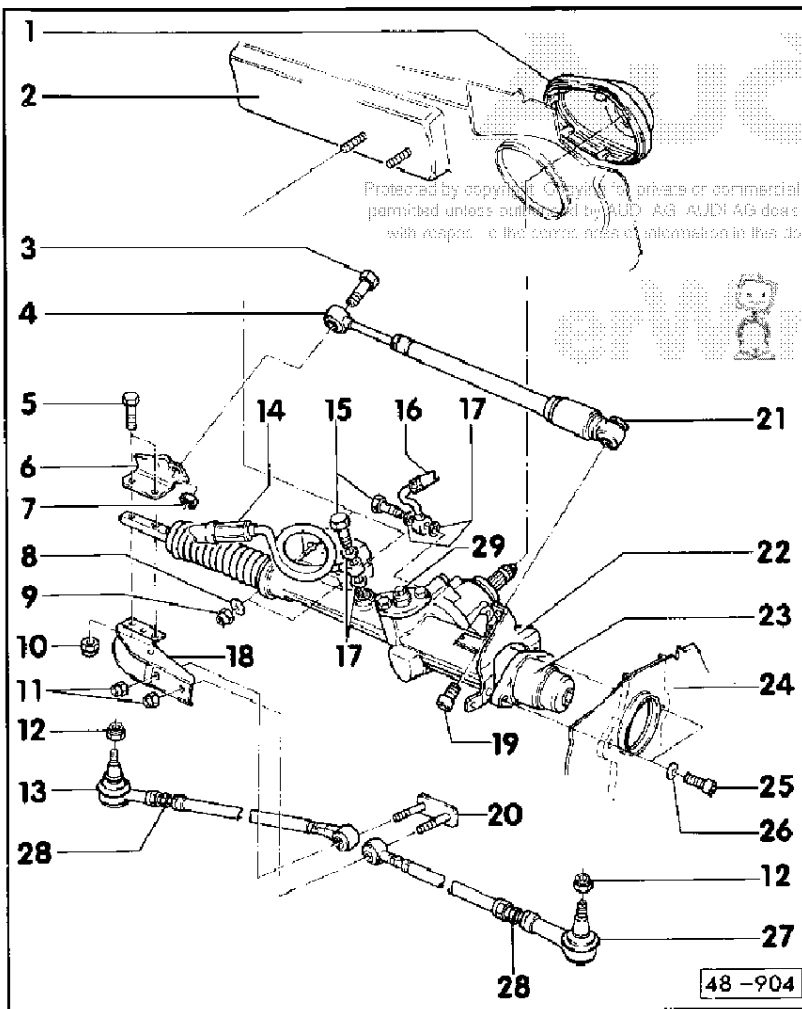
- ◆ Press off steering arm => Fig. 3

Note:

When fitting the two track rod joints, i.e. when adjusting the toe, make sure that the two swivel heads for the joint pins are neither tilting forwards nor backwards.

14 - Expansion hose

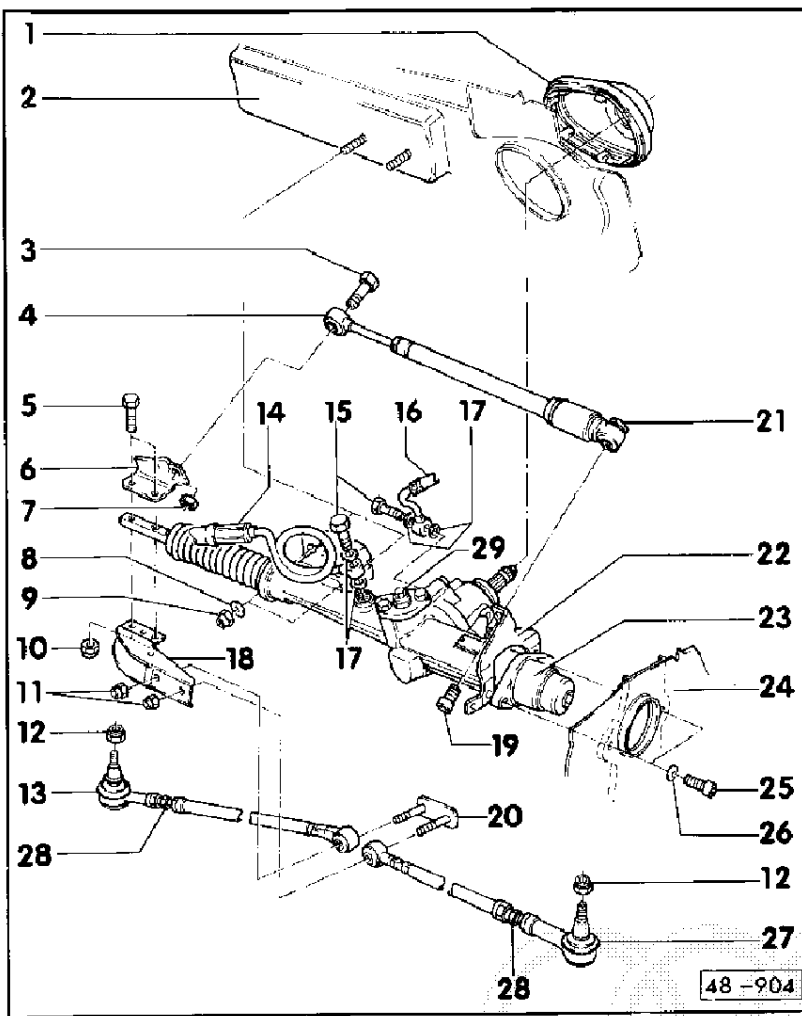
- ◆ Note that there are different versions:
- ◆ Routing at steering box differs depending on engine version => Figs. 1 and 2
- ◆ To unscrew at steering box, remove servo unit on vehicles with 6-cylinder engine



15 - Banjo bolts, 40 Nm

16 - Return hose

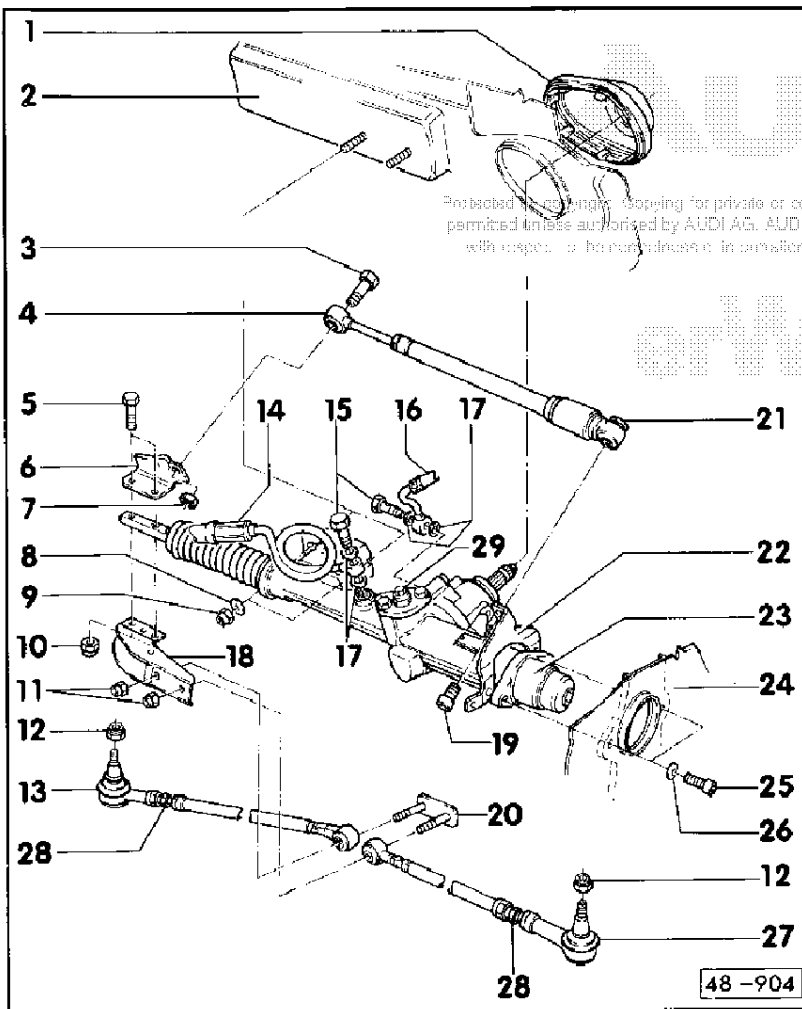
- ◆ Note that there are different versions:
- ◆ Routing at steering box => Figs. 1 and 2
- ◆ Before unscrewing banjo bolt - 15- insert hose clamp -3094- in return hose
- ◆ To unscrew at rotary valve housing, remove servo unit on vehicles with 6-cylinder engine and unscrew steering damper at holder on wheel housing end and swivel upwards



- 17 - O-rings**
- ◆ Always replace
 - ◆ Insert in either end in banjo unions of return and expansion hose

- 18 - Driver**
- ◆ Unscrew from rack
 - ◆ Follow the tightening sequence during installation => Page 48-13
 - ◆ Vehicle must be standing on wheels when securing track rods to driver
 - ◆ After removing from rack, check and if necessary adjust toe

- 19 - Cheese-head bolt, 40 Nm**
- ◆ Counterhold at hexagon of threaded bush when unscrewing and screwing in



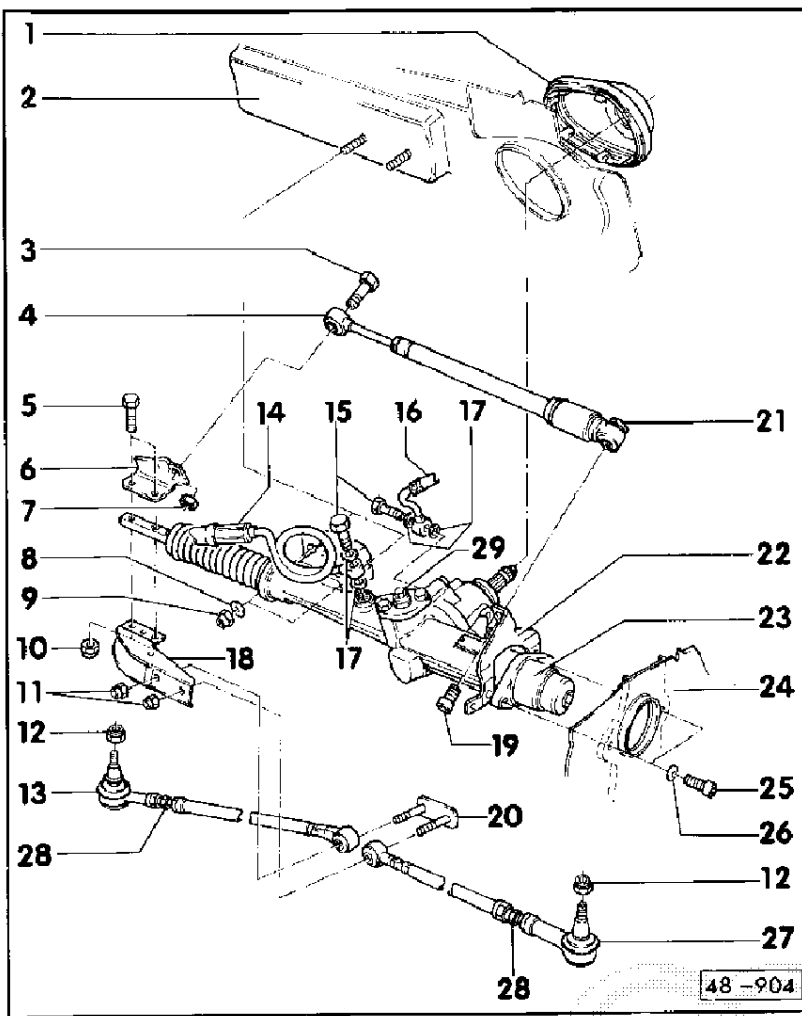
- 20 - Tab**
- ◆ Inset in both track rods and screw to driver with vehicle standing on its wheels

- 21 - Threaded bushing**
- ◆ Counterhold at hexagon when unscrewing and screwing in cheese-head bolt

- 22 - Holder for steering damper, wheel housing end**

- 23 - Steering box**
- ◆ Overall ratio 16.8 : 1
 - On 169 kW engine 14.6 : 1
 - ◆ Removing and installing => Page 48-17
 - ◆ Treat appropriately before scrapping

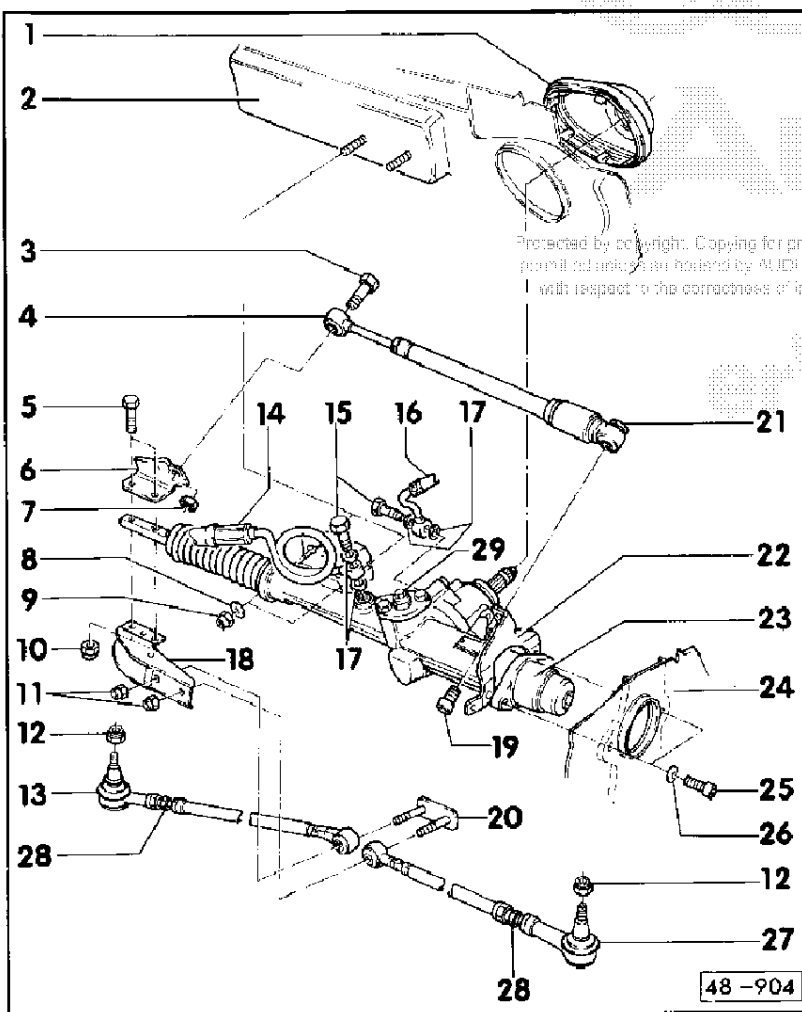
=> Special Information. No. 2; Edition 03.90



Attention

Before removing steering box on vehicles with airbag, disconnect battery earth strap and 1-pin red connector for airbag voltage supply to ensure that subsequent assembly work does not result in accidental actuation of airbag system. Front wheels are then to be moved to the straight-ahead position and the steering wheel removed (this ensures that the coil spring in the steering wheel is not damaged).

48-9

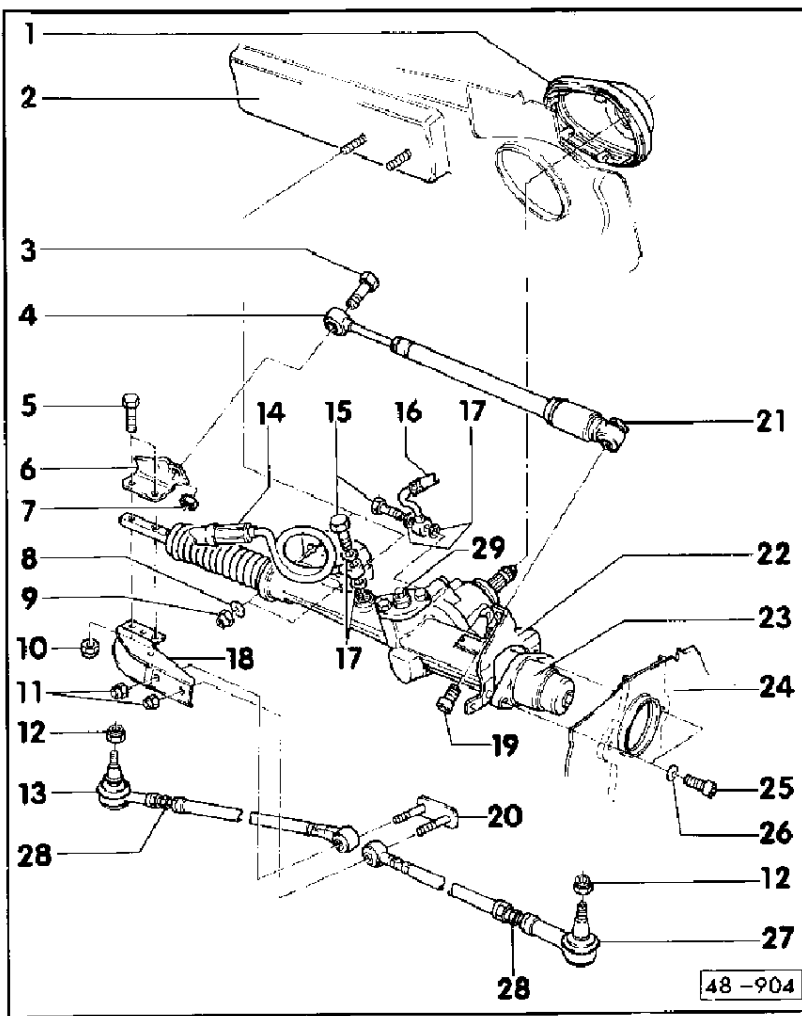


- ◆ Centre with steering column on installation
- ◆ Make sure there is no steering torsion on installation; move accordingly at securing points if necessary
- ◆ After installation, move steering box to centre position and fit and attach steering wheel in correct position (spoke horizontal)
- ◆ Servicing => Page 48-29
- ◆ Servicing with Servotronic => Page 48-45
- ◆ Adjusting toe => Page 44-15
- ◆ Attach battery earthing strap

24 - Left wheel housing

25 - Cheese-head bolt, 20 Nm
 ◆ Tighten before fastening steering box to bulkhead

48-10



26 – Spring lock washer

◆ Always replace

Note:

On vehicles with no steering damper, steering box is attached on wheel housing end with a self-locking nut (tightening torque 20 Nm). Always renew self locking nuts. Fit washer between steering box flange and self-locking nut.

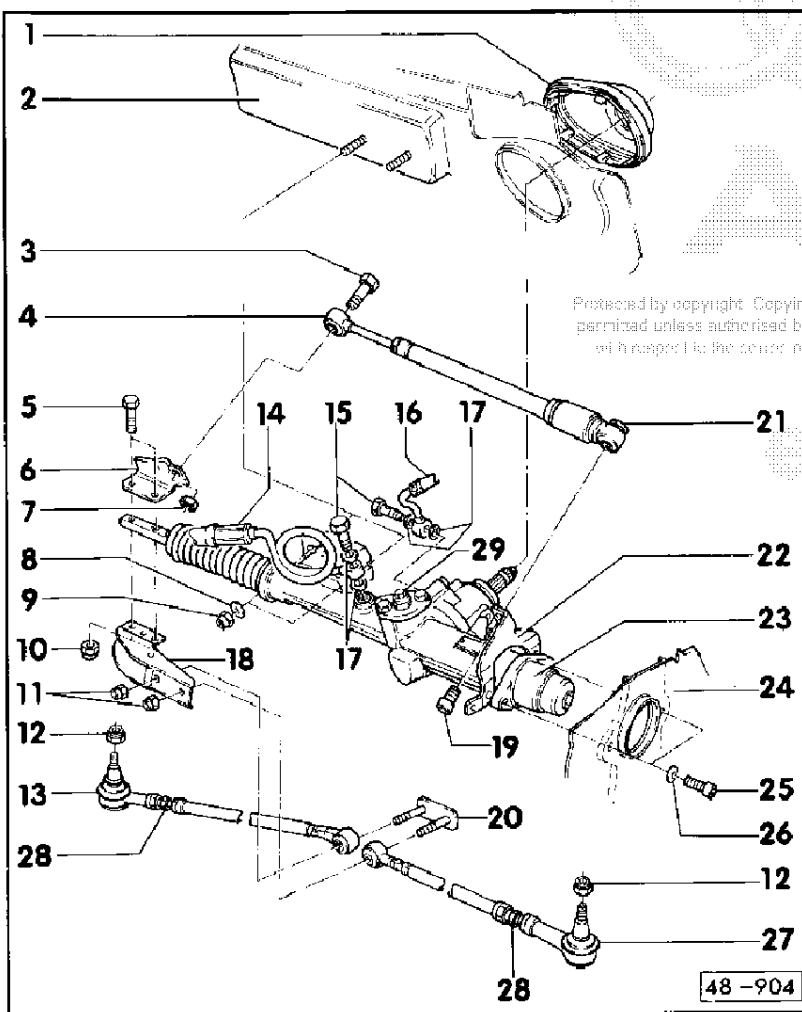
27 – Left track rod

◆ Press off steering arm => Fig. 3

Note:

When fitting the two track rod joints, i.e. when adjusting the toe, make sure that the two swivel heads for the joint pins are neither tilting forwards nor backwards.

48-11



28 – Threaded piece

◆ Always adjust toe at both track rods => Page 44-15

29 – Adjusting screw

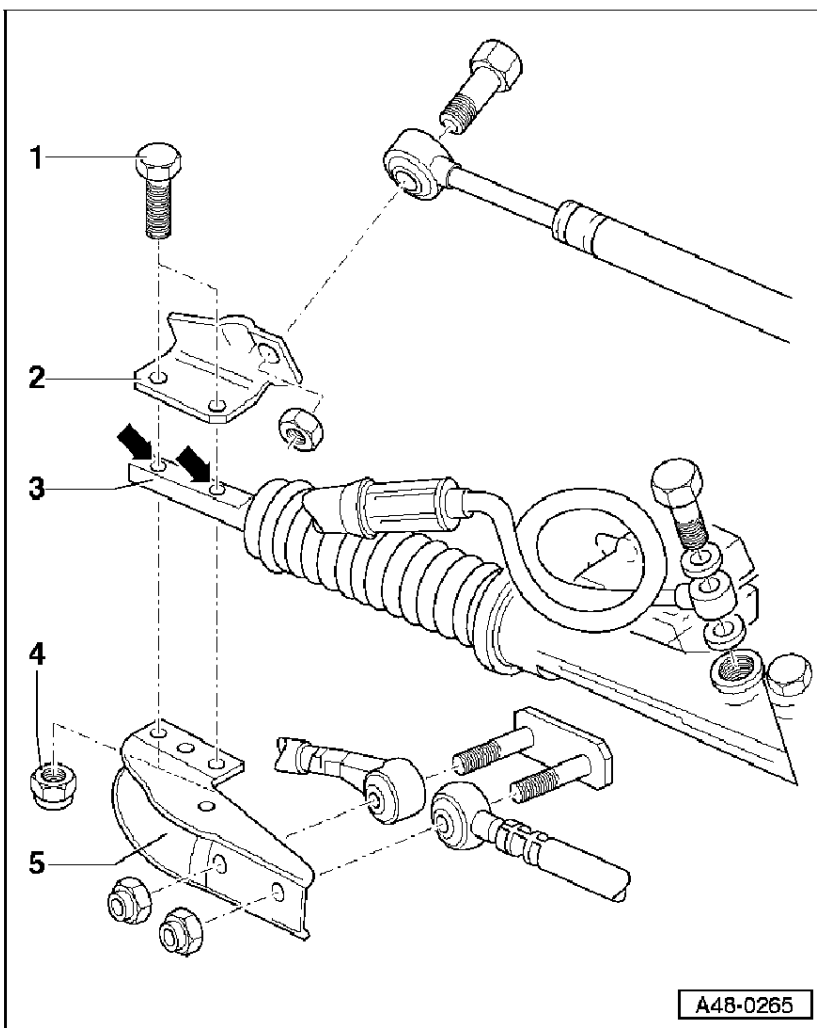
◆ Adjusting steering play => Page 48-56, Fig. 7

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48-12

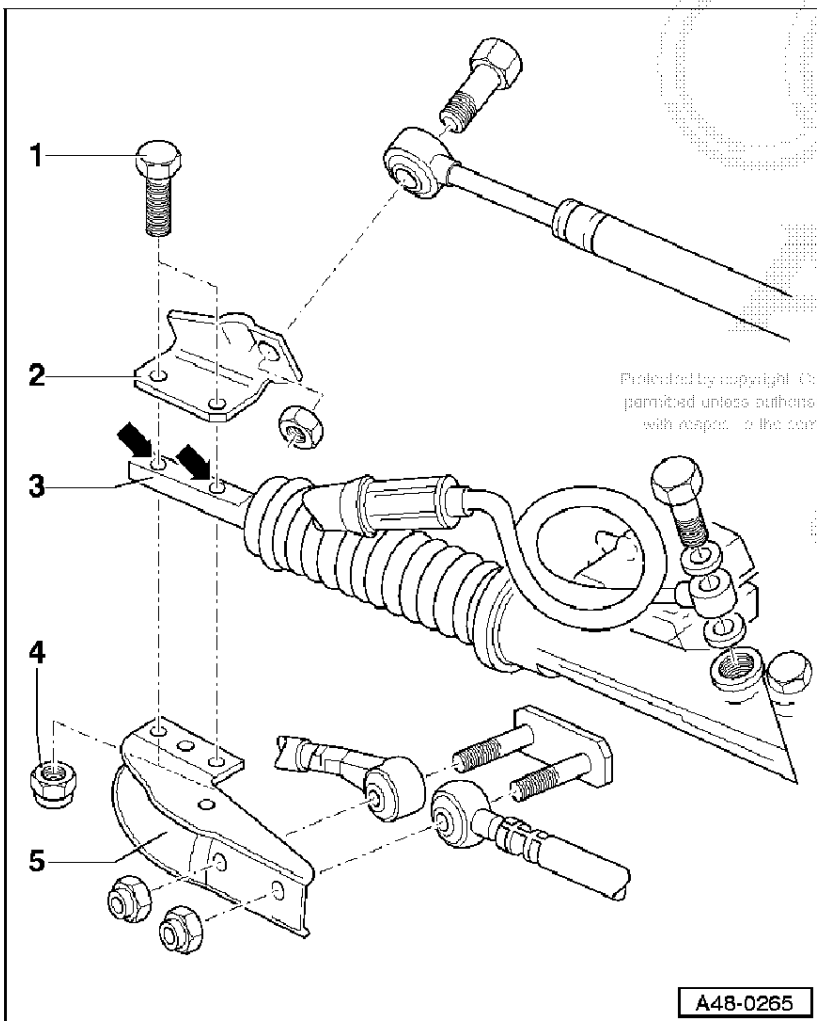
Tightening sequence for bolted connection between steering box and track rod driver



A48-0265

- 1 – Hexagon bolts, 45 Nm
 - ◆ First tighten these bolts, then nuts -4-
- 2 – Steering damper bracket, rack end
 - ◆ Only installed on vehicles with 4-cylinder engine and sports running gear as of model year 1993 as well as on vehicles with 6-cylinder engine
- 3 – Rack
 - ◆ With internal threads M10 - arrows-
- 4 – Self-locking nuts, 45 Nm
 - ◆ Always replace
- 5 – Driver for track rods

48-13



A48-0265

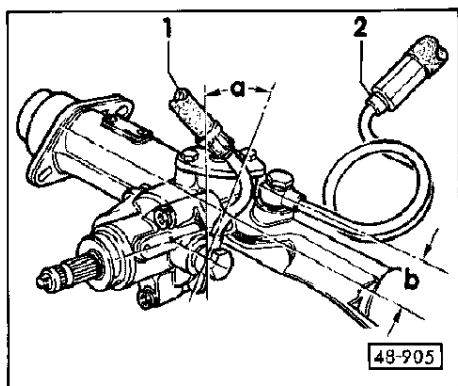
Note the following when installing the driver:

- ◆ The threads of rack -3- and bolts -1- must not be damaged. They must be free of dirt, oil etc.
- ◆ Position driver -5- and first tighten the hexagon bolts -1-.
- ◆ Afterwards screw on new self-locking nuts -4- from underneath and tighten.

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48-14

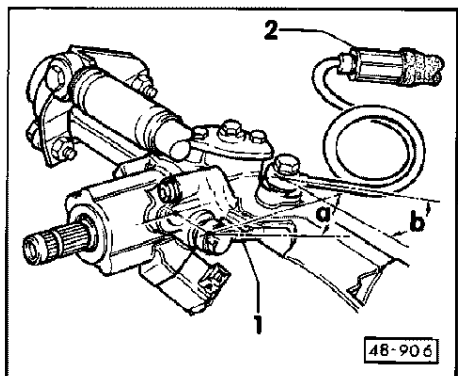
Vehicles with 4- and 5-cylinder engine



◀ Fig.1 Routing at steering box

- _ 1 - Return hose
- _ 2 - Expansion hose
- Pay attention to specifications when attaching lines to steering box
 - _ a = approx. 300
 - _ b = parallel

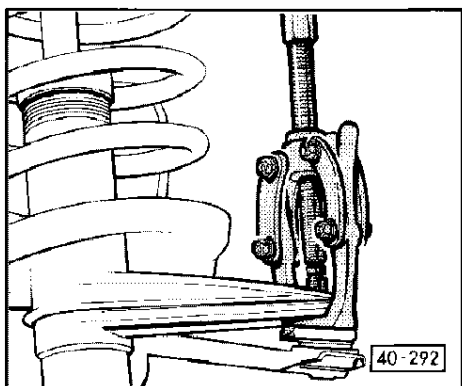
Vehicles with 6-cylinder engine



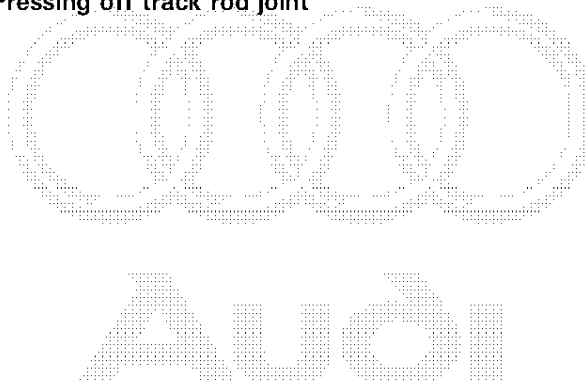
◀ Fig.2 Routing at steering box

- _ 1 - Return hose
- _ 2 - Expansion hose
- Pay attention to specifications when attaching lines to steering box
 - _ a = approx. 300
 - _ b = approx. 50

— 48-15 —



◀ Fig.3 Pressing off track rod joint



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— 48-16 —

Removing and installing steering box

Attention

Before removing steering box on vehicles with airbag, disconnect battery earth strap and 1-pin red connector for airbag voltage supply to ensure that subsequent assembly work does not result in accidental actuation of airbag system. Front wheels are then to be moved to the straight-ahead position and the steering wheel removed (this ensures that the coil spring in the steering wheel is not damaged).

Notes:

- ◆ As of the introduction of the 10" servo unit, this has to be taken out when removing and installing the steering box.
- ◆ Removing and installing the steering box is described for a vehicle with 6-cylinder engine and ABS, as this represents the greatest difficulties.

48-17

Assembly work listed below is only required on vehicles with 4- and 5-cylinder engine

- Detach both front wheels
- Unscrew track rods on both sides from steering arm and remove together with driver
- After removing bulkhead seal, unscrew return hose at rotary valve housing from footwell
- Remove steering box through break-out (for track rod) in right wheel house

Audi

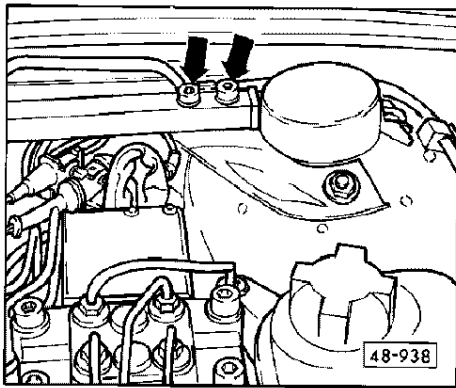
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erwin

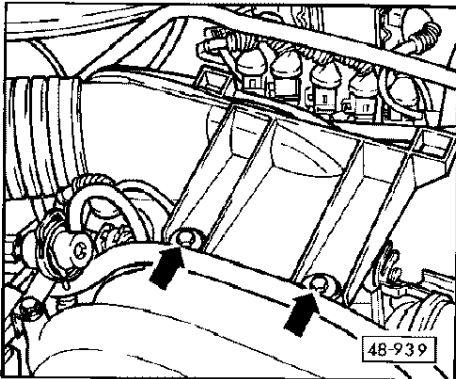
48-18

Removing:

- Disconnect battery earth strap



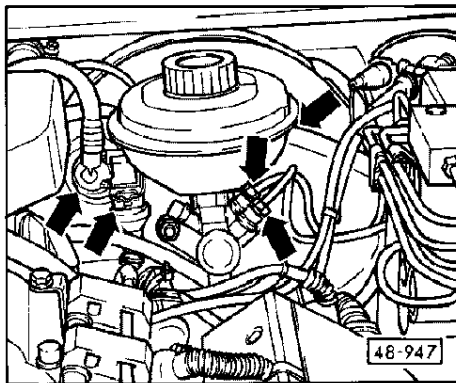
- ◀ - Remove anti-roll bar -arrows-.
- Use screwdriver to lever off cover from intake silencer



- ◀ - Unscrew both securing bolts for intake silencer
- Unscrew air guide hose at air mass meter
- Squeeze the two quick-release couplings for the crankcase breather hoses together at the largest diameter and pull them off the valve covers.
- Press intake silencer to rear and at the same time lift it up.

48-19

- Pull vacuum hose off throttle housing and take out intake silencer.
- Draw off brake fluid, to do this remove strainer from brake fluid reservoir.



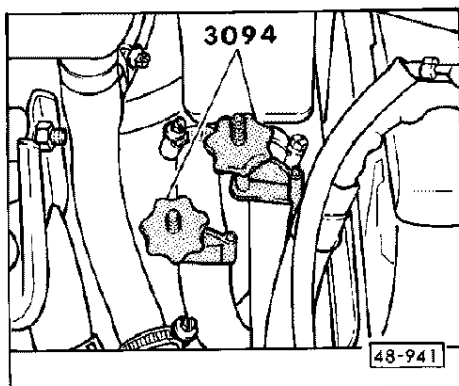
- ◀ - Remove both brake lines from brake master cylinder to brake pressure regulator (attached to hydraulic modulator)
- Seal holes for brake lines at brake master cylinder and brake pressure regulator with bleeder screws.
- Pull connector for float indicator off brake fluid reservoir.
- Unscrew brake master cylinder from brake servo.
- Screw threaded pin out of valve cover for attaching crankcase breather.
- Pull off cruise control vacuum line.
- Unscrew cruise control diaphragm unit with holder from throttle housing.
- Unclip connectors for knock sensor, lambda probe heating and lambda probe from holder.

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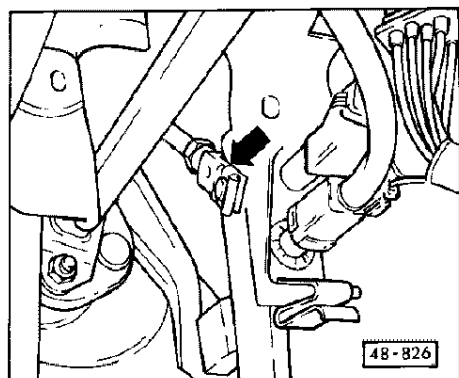


48-20

- Pull non-return valve with vacuum out of servo unit.
- Pull hose for clutch master cylinder off brake fluid reservoir



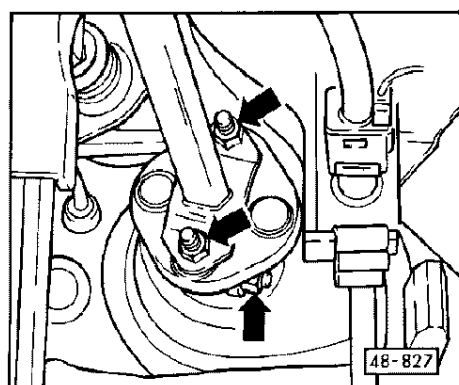
- ◀ - Disconnect suction and return pipes with hose clamps -3094-.



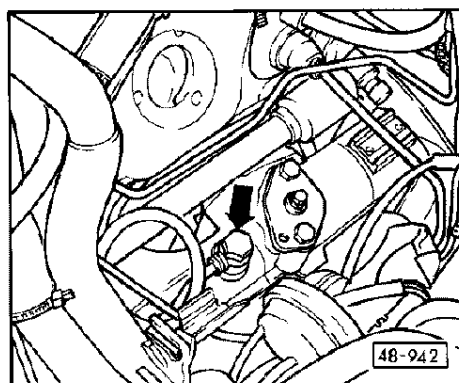
- Pull off connector for thermoswitch at rear coolant pipe
- Removing driver's side compartment.

- ◀ = > General body repairs
- Remove fastener from pin
- Remove pin from clevis
- Detach coil spring at clevis

48-21



- ◀ - Remove securing bolts for flanged tube with shackle at steering pinion and steering column
- Use screwdriver to press steering column off disc coupling
- Pull flanged tube with shackle off steering pinion, then press steering column slightly to the side
- Unscrew servo unit from pedal bracket
- Carefully remove servo unit

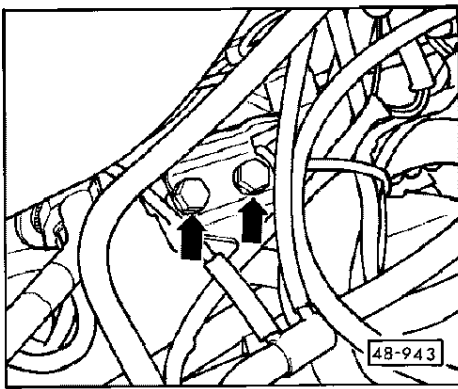


- ◀ - Unscrew banjo bolt for expansion hose from steering box.
- Turn steering by moving wheels from stop to stop so that hydraulic fluid in steering can escape from connection hole for expansion hose.
- Seal hole in steering box with dummy plug.
- Unscrew self-locking nuts from driver - rack securing bolts.

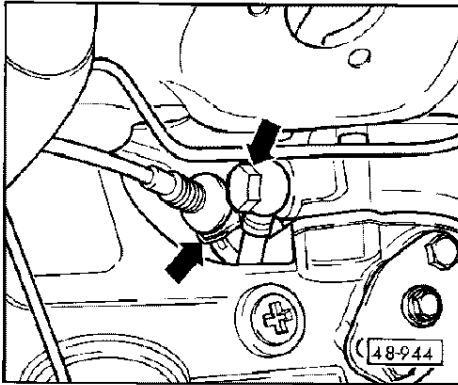
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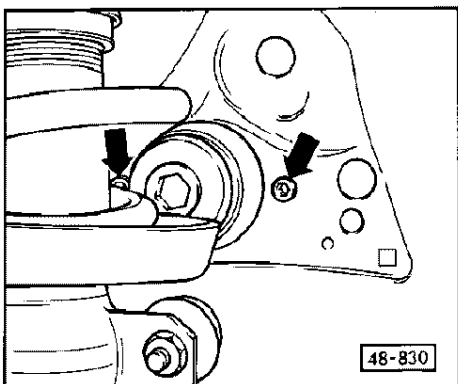
48-22



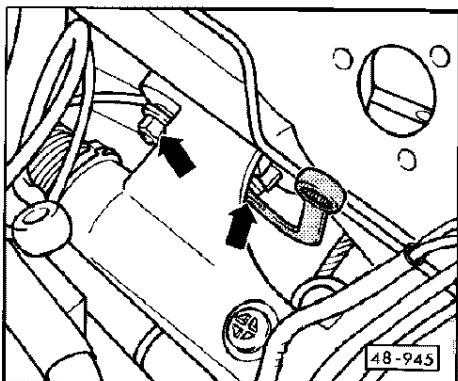
- ◀ - Unscrew steering damper – damper holder securing bolts on wheel housing end.
- Unscrew both driver – rack securing bolts.
- Remove driver from rack.
- Remove steering damper with holder.



- ◀ - Unscrew banjo bolt for return hose from steering box.
- Seal hole with dummy plug.
- On vehicles with Servotronic, disconnect plug from Servotronic valve.



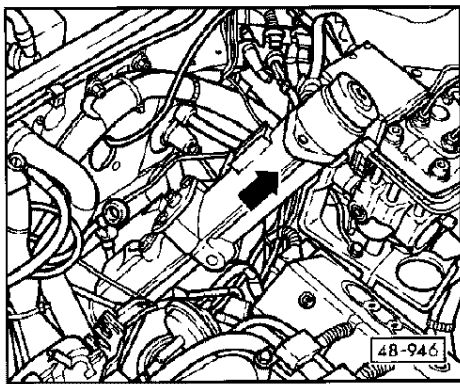
- ◀ - Unscrew securing bolts for steering box at left wheel housing.
- Remove holder for steering damper on wheel housing side, detaching brake line from retaining clip.



- ◀ - Unclip bulkhead seal fasteners from bulkhead working from engine compartment.
- Remove bulkhead seal from footwell.
- Unscrew securing nuts for steering box from bulkhead with offset box spanner.
- Pull steering box slightly in direction of travel so that it comes free from bulkhead.

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- ◀ - Then lift steering box upwards by turning it appropriately and remove.

Installing:

Note:

Install in reverse order, paying particular attention to the following:

- Tightening sequence for bolted connection between steering box and track rod driver => Page 48-13.
- Insert steering box and screw to bulkhead by hand.
- Screw steering box to left wheel housing with holder for steering damper (second mechanic required).
- Screw steering box to bulkhead with offset box wrench.
- Carefully insert bulkhead seal.
- Insert brake line in retaining clip at holder for steering damper on wheel housing end.
- Attach return hose to rotary valve housing and expansion hose to steering box such that pipes have no contact => Page 48-15, Fig. 1 and 2
- Attach connector to Servotronic valve.

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- Insert servo unit in bulkhead and screw on, then roll sealing ring for bulkhead seal onto bulkhead.
- Attach connector for thermoswitch at rear coolant pipe.
- Insert threaded pin.
- Screw cruise control diaphragm unit with holder to throttle housing.
- Attach cruise control vacuum line.
- Clip in connectors.
- Attach coil spring to clevis
- Insert pin in clevis/brake pedal and fit with new fastener.
- Attach connector for float indicator to brake fluid reservoir.
- Attach hose for clutch master cylinder to brake fluid reservoir.
- Remove hose clamps -3094- from suction and return hose.

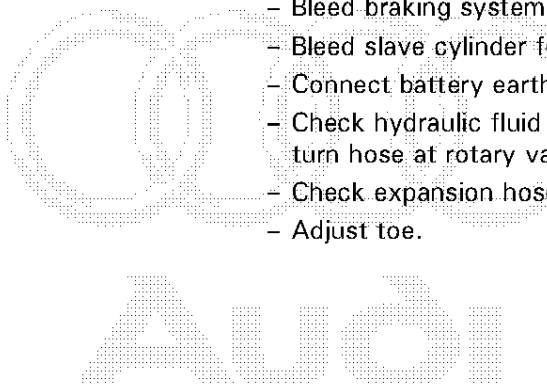
———— 48-27 ————

- Attach vacuum hose to throttle housing.
- Attach both crankcase breather hoses to valve cover.
- Install anti-roll bar (tightening torque 20 Nm).
- With engine switched off, turn steering wheel several times from lock to lock to bleed steering box.

Note:

This process must be repeated if noise is heard during test drive.

- Bleed braking system and check for leaks
- Bleed slave cylinder for hydraulic clutch controls.
- Connect battery earth strap.
- Check hydraulic fluid level and top up if necessary. Check return hose at rotary valve housing for leaks.
- Check expansion hose at steering box for leaks.
- Adjust toe.



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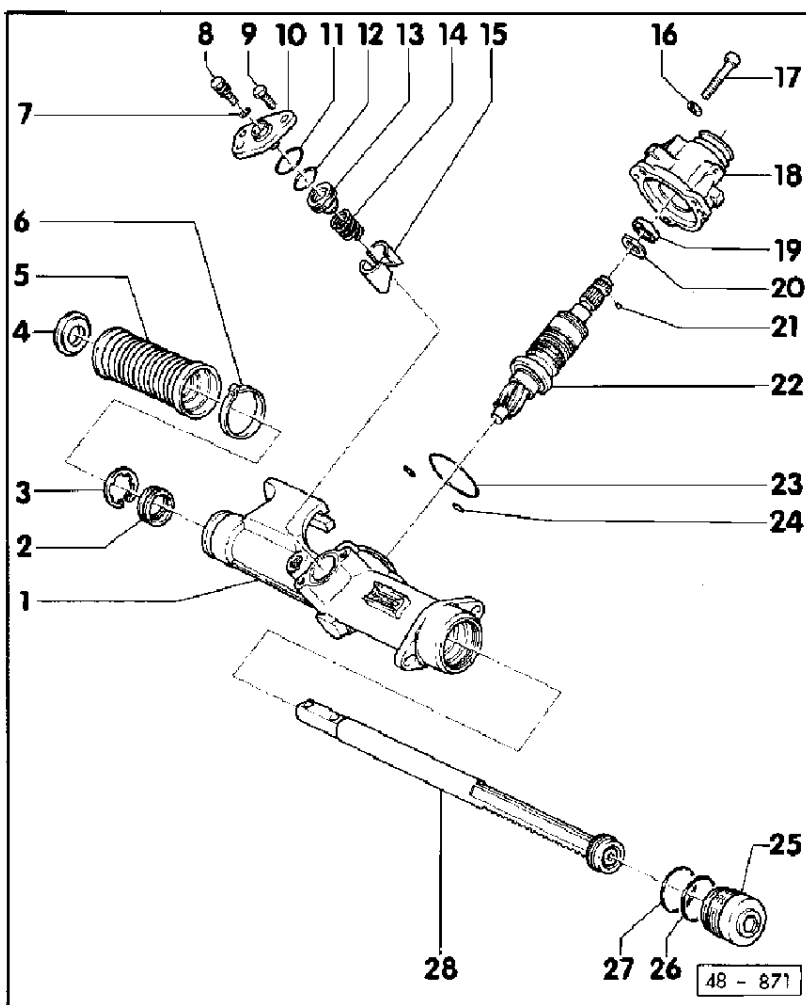
Servicing power-assisted steering

Attention

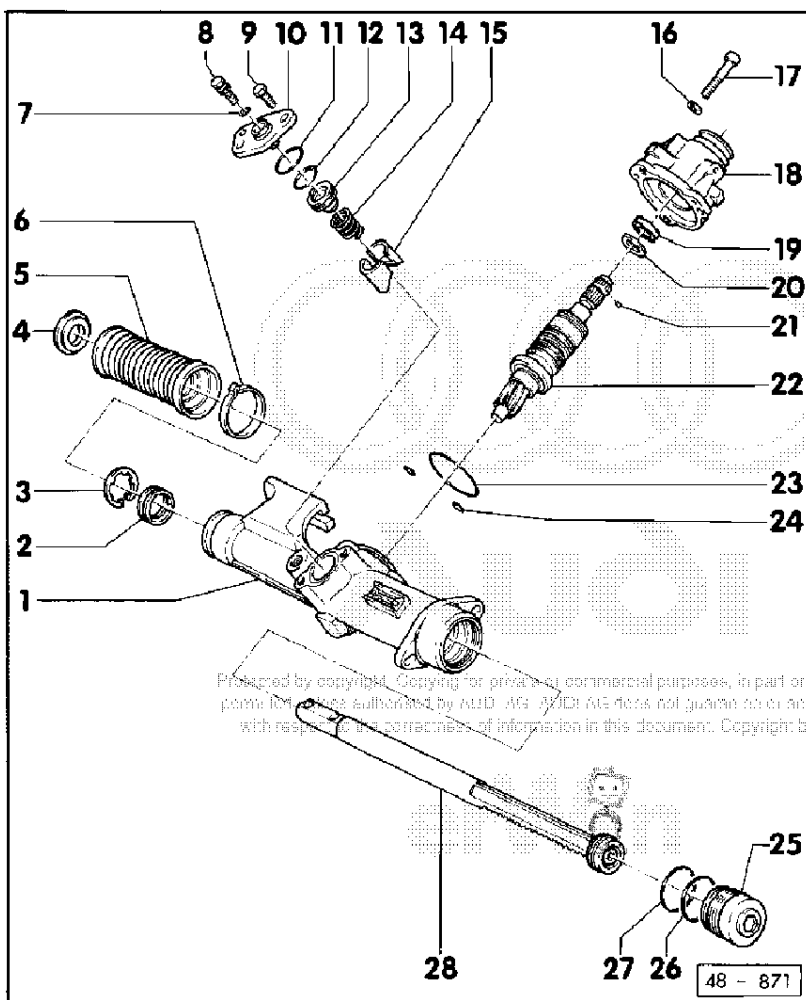
Keep workplace and components spotlessly clean

Notes:

- ◆ The power-assisted steering uses hydraulic fluid, part no. G 002 000.
- ◆ All parts marked with an asterisk are contained in the repair set and are to be replaced when servicing.
- ◆ Moisten all sealing elements with hydraulic fluid before installing.
- ◆ Welding and straightening repairs are not permitted on the steering components.
- ◆ Screw clamps can also be used in place of wing hose clamps.



48-29



1 - Steering box

- ◆ Removing and installing
=> Page 48-1
- ◆ Adjust toe after removing and installing
- ◆ Adjusting toe => Page 44-15
- ◆ Vehicles with 169 kW engine do not feature Servotronic

2 - Rack seal *

- ◆ Always replace
- ◆ Extracting => Figs. 1 and 2

3 - Circlip

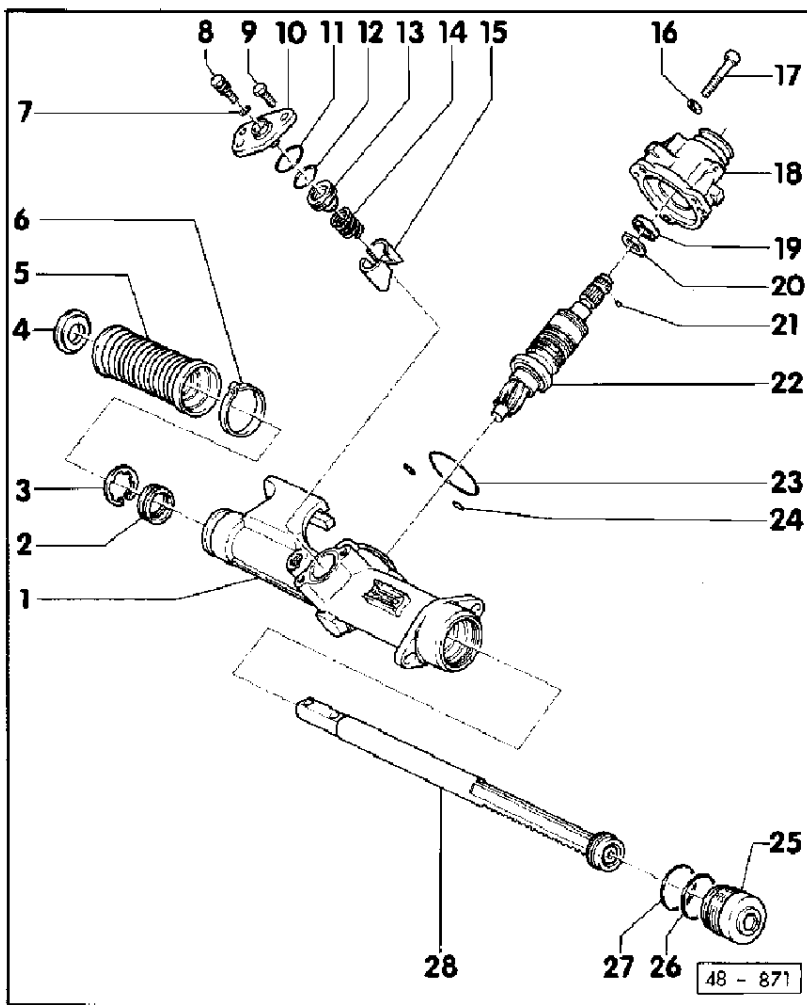
- ◆ Can only be removed and fitted after taking out rack.

4 - Retaining ring

- ◆ Slip on rack as far as it will go.
- ◆ Insert bellows in annular groove.

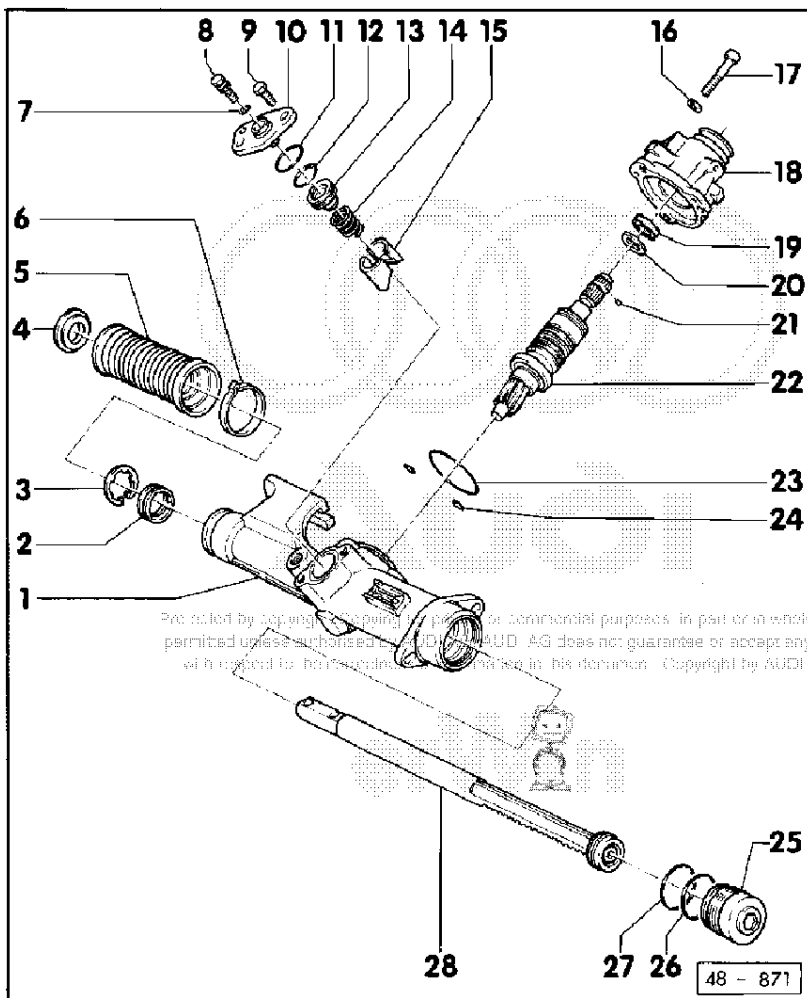
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48-30



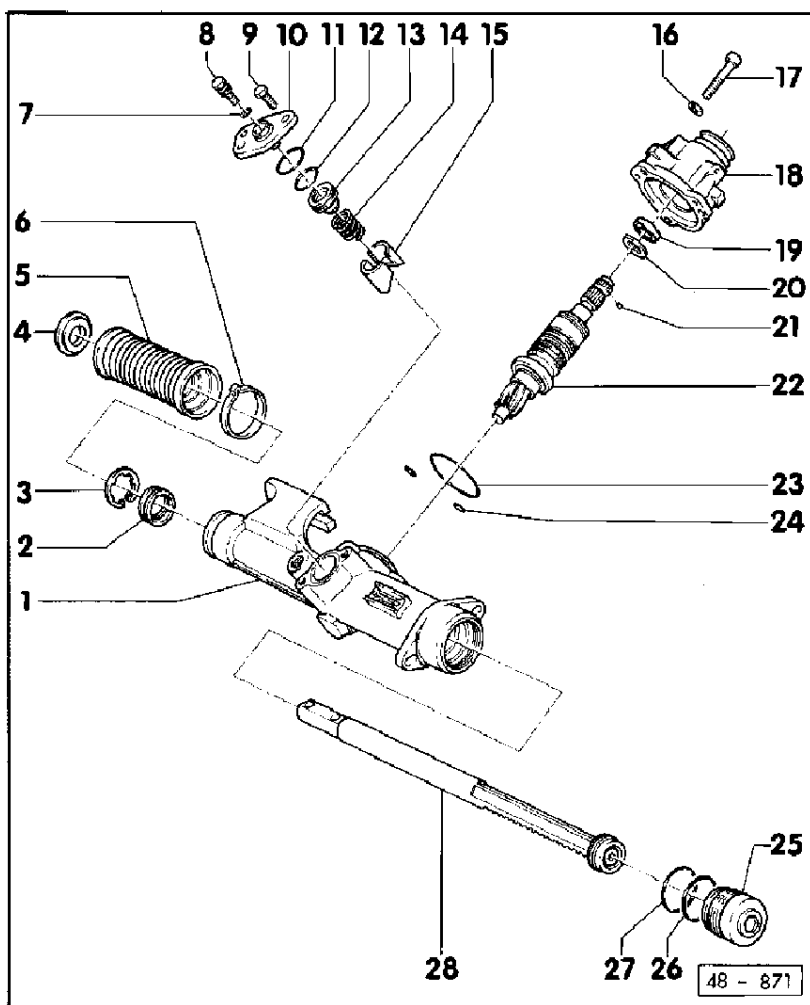
- 5 - Bellows
 - ◆ Can be replaced without removing steering box
 - ◆ Adjust toe after replacement
 - ◆ Adjusting toe => Page 44-15
- 6 - Wing hose clamp
 - ◆ Use screw clamps when performing repairs
 - ◆ Screw connection faces bulkhead
- 7 - O-ring *
 - ◆ Always replace

48-31

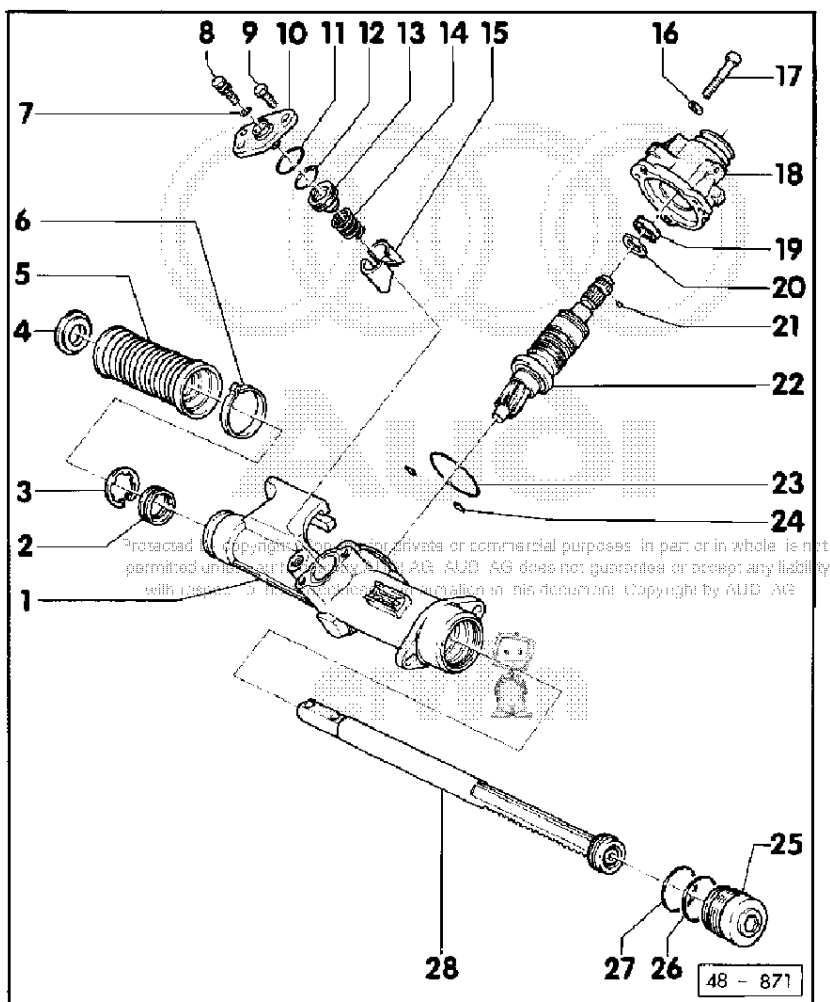


- 8 - Adjusting screw
 - ◆ Adjusting steering play => Fig. 5
- 9 - Hexagon bolt, 20 Nm
- 10 - Cover
 - ◆ Screw onto steering box
 - ◆ The two adjacent holes must face forwards when viewed in direction of travel.
- 11 - Sealing ring 35 x 2 mm *
 - ◆ Always replace
 - ◆ Insert in annular groove in steering box

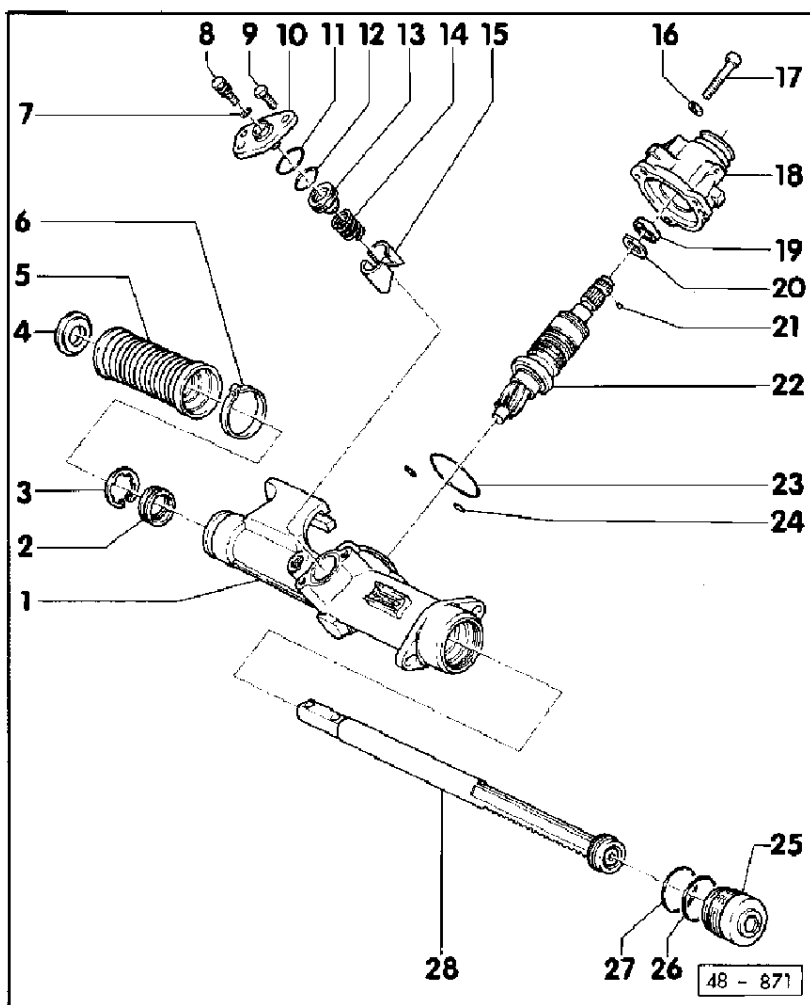
48-32



- 12 - Sealing ring 27 x 2,5 mm *
 ♦ Always replace
 ♦ Insert in annular groove in gasket holder
- 13 - Gasket holder
 ♦ Disassembling => Fig. 3
- 14 - Spring
 ♦ Insert in thrust piece
- 15 - Thrust piece
- 16 - Washer
- 17 - Cheese-head bolt, 20 Nm



- 18 - Valve housing
- 19 - Seal *
 ♦ Replacing => Page 48-40
- 20 - Backing ring
- 21 - Straight pin 2.5 x 6 mm *
 ♦ Always replace
 ♦ Pull out with universal pliers before removing valve housing
- 22 - Rotary valve/steering pinion
 ♦ Knocking out of steering box => Fig. 4
- 23 - Sealing ring 60 x 2 mm *
 ♦ Always replace
- 24 - Sealing ring 9 x 2 mm *
 ♦ Always replace



- 25 - Cap, 50 Nm
 - ◆ Secure with two centre punch marks offset by 180°
- 26 - Thrust ring *
 - ◆ Always replace
 - ◆ Attach to cap.
 - ◆ Installation position => Fig. 6
- 27 - Sealing ring 44 x 2.5 mm *
 - ◆ Always replace
 - ◆ Attach to cap.
 - ◆ Installation position => Fig. 6
- 28 - Rack
 - ◆ Unscrew cap and push rack to left out of steering box.
 - ◆ Watch for scoring around rack seal
 - ◆ Fitting => Page 48-42

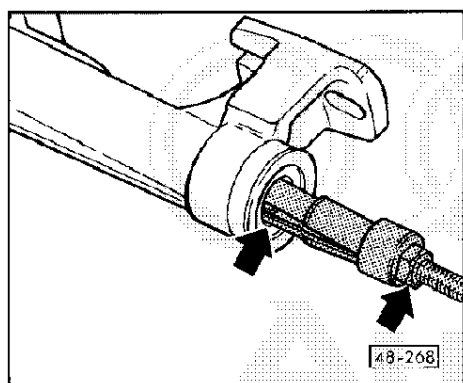


Fig.1 Pulling out rack seal

- Insert commercially available internal extractor (e.g. KUKKO 21/4) in sealing lip

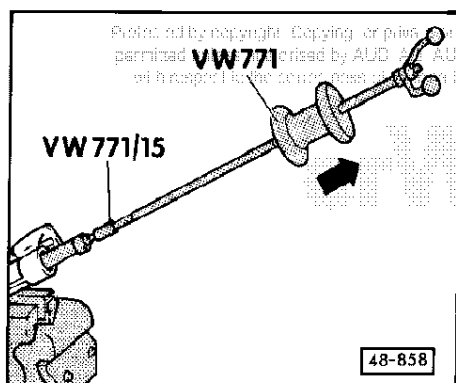
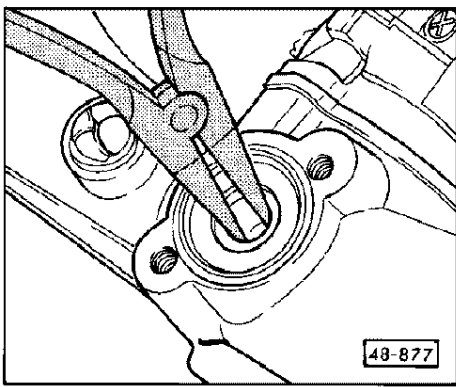
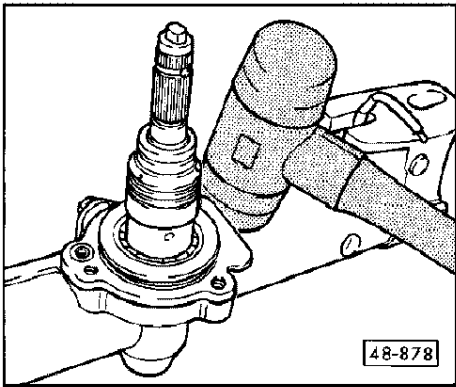


Fig.2 Screwing multi-purpose tool to internal extractor

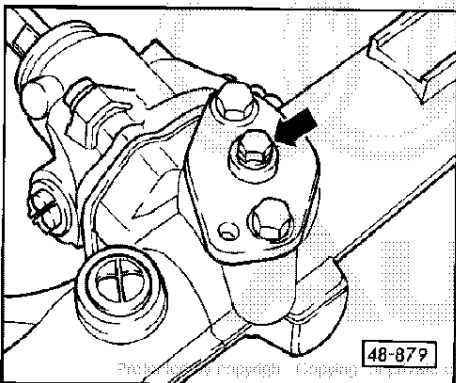
- Clamp steering box in vice using soft jaws.
- Screw -VW 771- with -VW 771/15- to internal extractor and knock out rack seal



◀ **Fig.3 Disassembling gasket holder**
 – Pull out using commercially available external circlip pliers



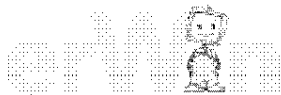
◀ **Fig.4 Driving out steering pinion**
 – Hold steering pinion by hand and knock out by hammering on steering box with commercially available rubber hammer.

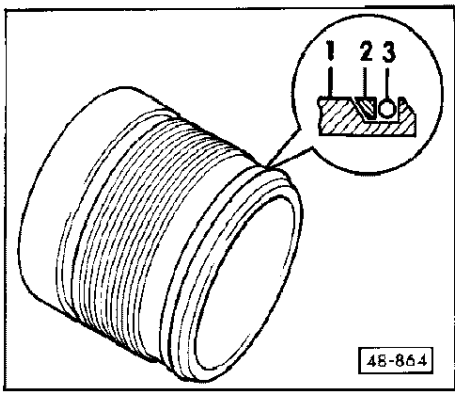


◀ **Fig.5 Adjusting steering play**
Note:
Two mechanics are required to perform adjustment. Adjustment work is to be performed with the engine switched off and the vehicle standing on its wheels. For ease of illustration the steering box is shown removed.

- Move wheels to straight-ahead position.
- Turning the steering wheel back and forth (roughly 30° about centre axis) produces a rattling and cracking noise.
- The second mechanic carefully screws in adjusting screw (arrow) into the cover until rattling and cracking noises can no longer be heard inside the vehicle.
- Perform test drive and correct adjustment of necessary.

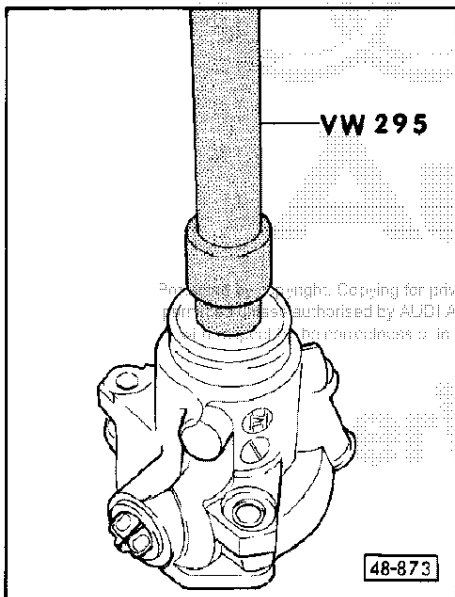
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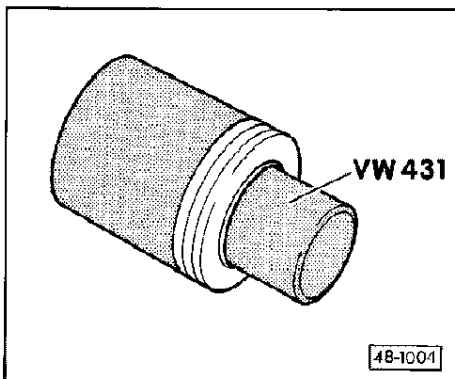
◀ **Fig.6 Installation position of thrust ring**

- _ 1 - Screw cap
- _ 2 - Thrust ring
- _ 3 - O-ring

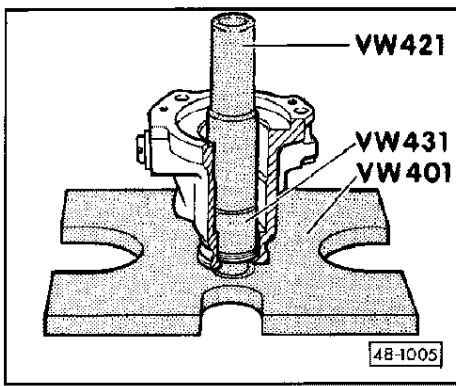


Replacing seal in valve housing

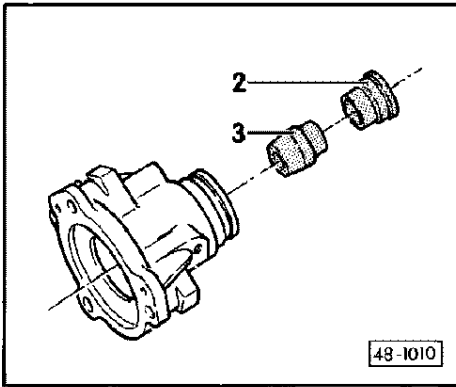
- ◀ - Knock seal ring out of valve housing



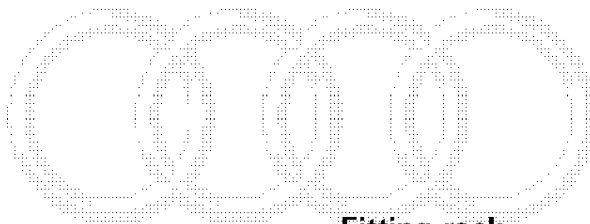
- ◀ - Attach new seal to special tool with sealing lip facing special tool -VW 431-
- Insert special tool -VW 431- with seal in valve housing



- ◀ - Attach special tool -VW 421- to special tool -VW 431- and drive seal home
- Fill space between sealing and dust lips with multipurpose grease.

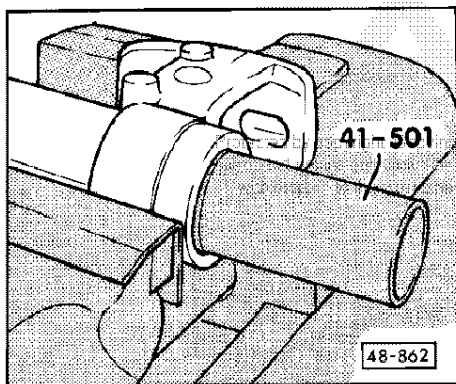


- ◀ - Slip assembled positioning bush (contained in repair set and consisting of protective sleeve -2- and fitting sleeve -3-) into seal.
- Press fitting sleeve -3- out of protective sleeve.



Fitting rack

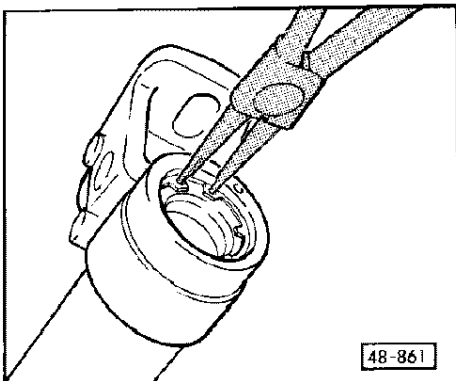
— 48-41 —



Note:

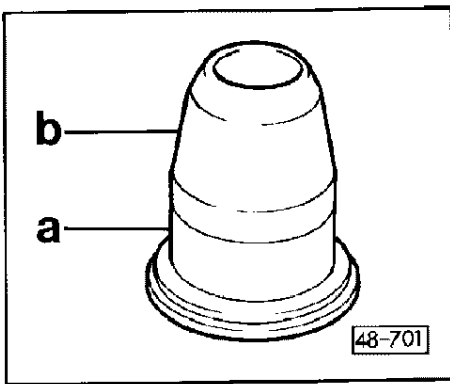
◀ Before fitting rack, wash out steering box with white spirit, blow it out with compressed air and thoroughly clean rack. Prior to assembly, use hydraulic fluid to moisten parts of fitting sleeve, rack and rack seal. All new repair sets contain a fitting sleeve.

- Insert rack seal by hand in steering box and drive home.

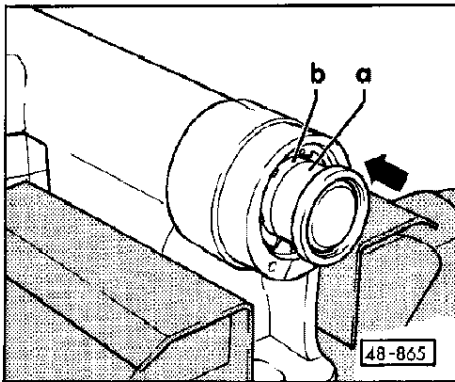


- ◀ - Use commercially available circlip pliers to fit circlip.

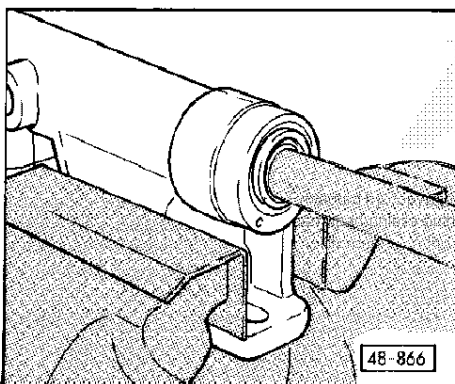
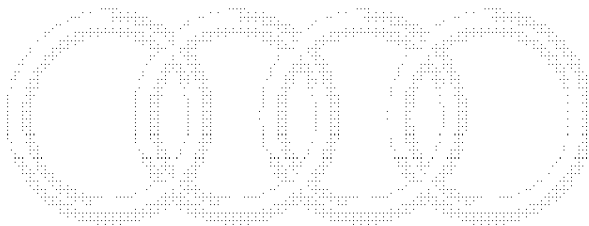
— 48-42 —



- ◀ – Insert fitting sleeve -b- in fitting sleeve -a-, placing both parts on a flat surface as shown.

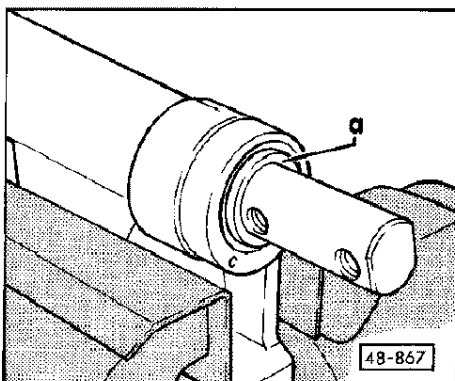
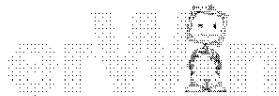


- ◀ – Press home fitting sleeve -a- with fitting sleeve part -b- in steering box by hand.



- ◀ – Use commercially available mandrel to drive fitting sleeve part into steering box and remove on opposite end.

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- ◀ – Push rack through steering box and fitting sleeve -a- from opposite end of fitting sleeve; counterhold fitting sleeve -a- by hand until flattened end of rack is past fitting sleeve -a-.
- Remove fitting sleeve -a- from rack.
- Screw on cap by hand so that rack can no longer fall out (seal could otherwise be damaged).

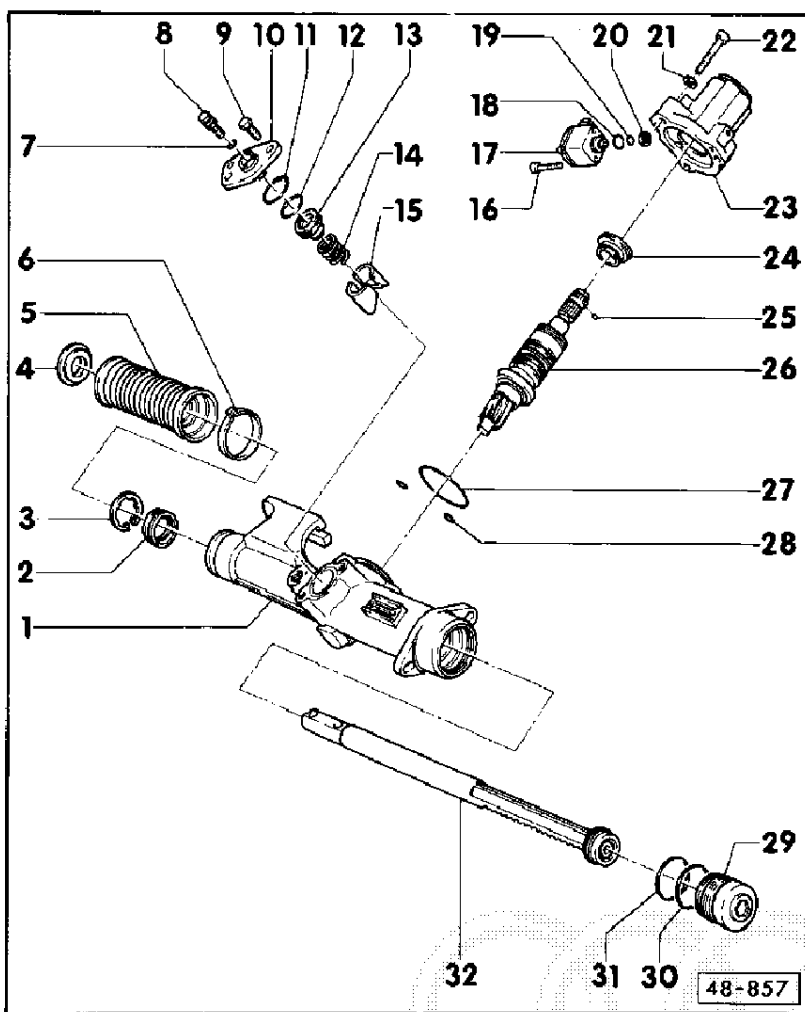
Servicing power-assisted steering with Servotronic

Attention

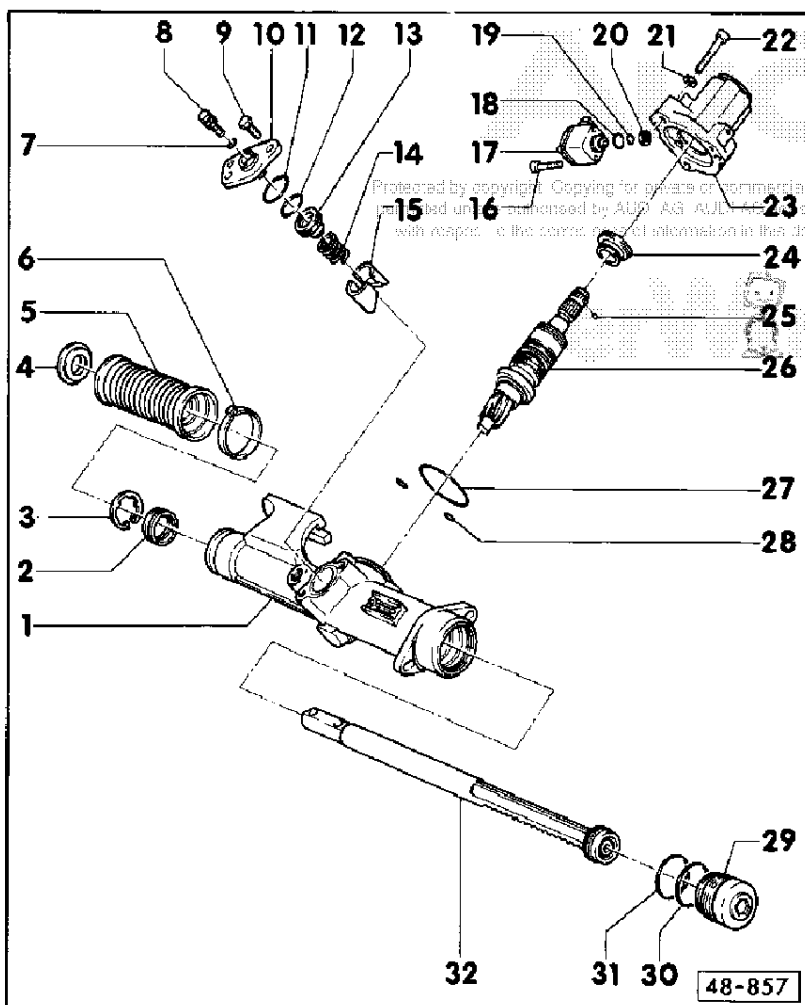
Keep workplace and components spotlessly clean

Notes:

- ◆ The power-assisted steering uses hydraulic fluid, part no. G 002 000.
- ◆ All parts marked with an asterisk are contained in the repair set and are to be replaced when servicing.
- ◆ Moisten all sealing elements with hydraulic fluid before installing.
- ◆ Welding and straightening repairs are not permitted on the steering components.
- ◆ Screw clamps can also be used in place of wing hose clamps.



48-45



1 - Steering box

- ◆ Removing and installing
=> Page 48-1
- ◆ Adjust toe after removing and installing
- ◆ Adjusting toe => Page 44-15
- ◆ Vehicles with 169 kW engine do not feature Servotronic

2 - Rack seal *

- ◆ Always replace
- ◆ Extracting => Fig. 3 and 4

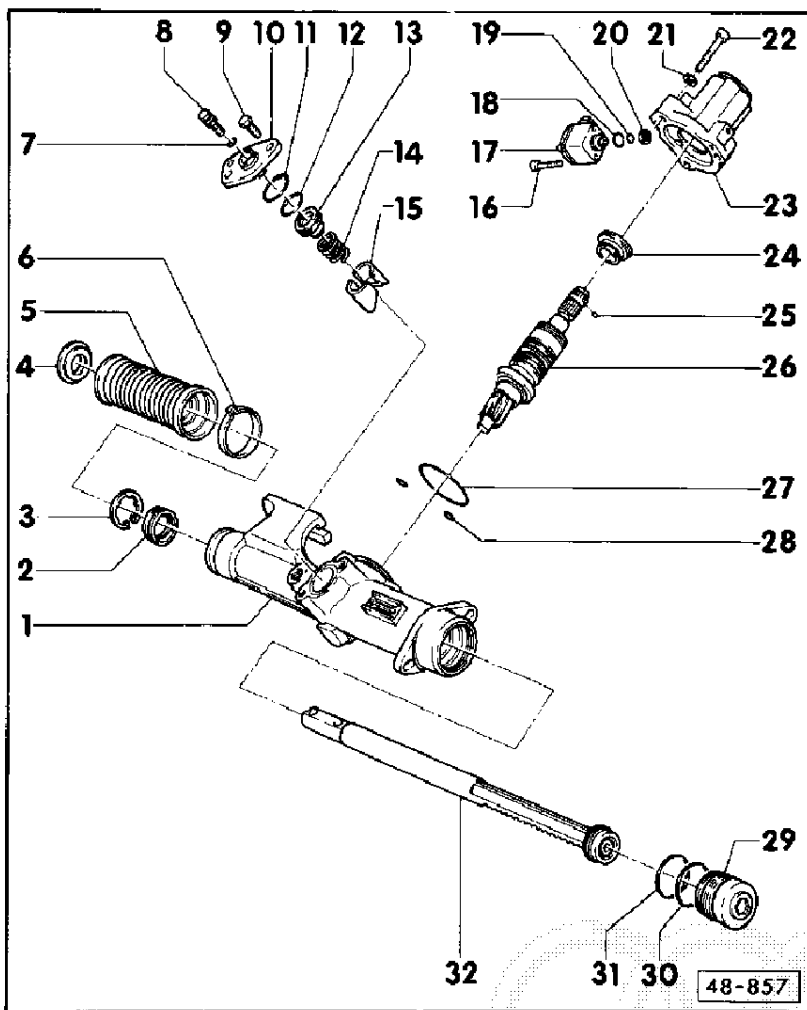
3 - Circlip

- ◆ Can only be removed and fitted after taking out rack.

4 - Retaining ring

- ◆ Slip on rack as far as it will go.
- ◆ Insert bellows in annular groove.

48-46



5 - Bellows

- ◆ Can only be replaced with steering box installed
- ◆ Adjust toe after replacement
- ◆ Adjusting toe => Page 44-15

6 - Clamp

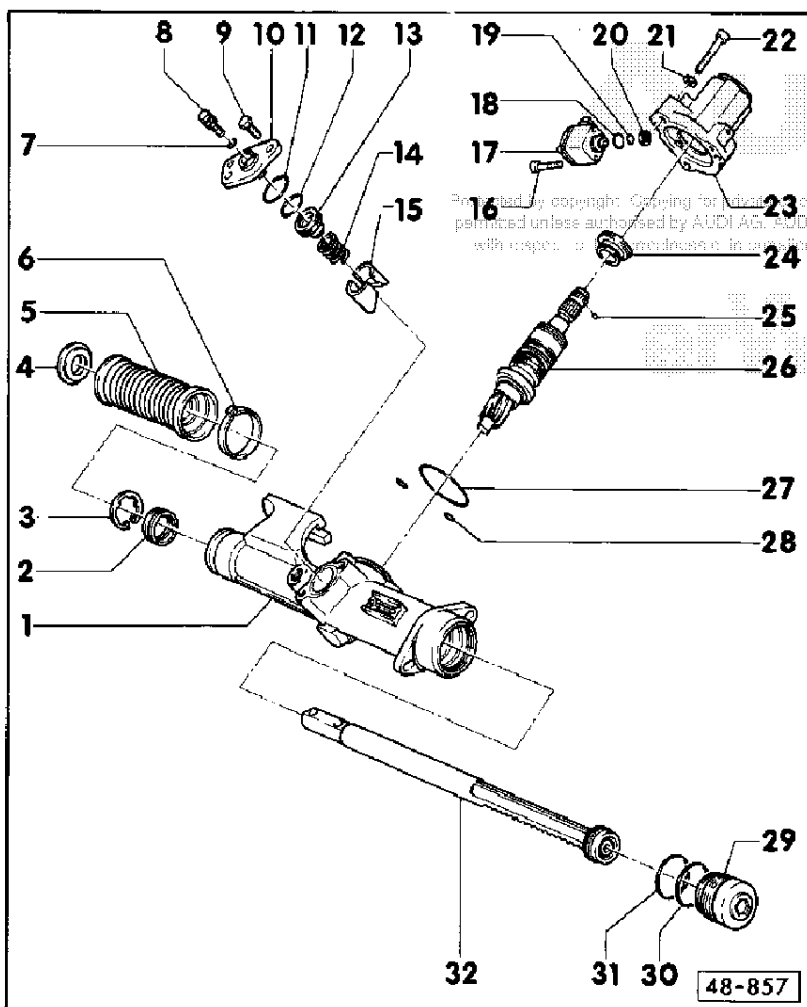
- ◆ Use screw clamps when performing repairs
- ◆ Screw connection faces bulkhead

7 - O-ring *

- ◆ Always replace

8 - Adjusting screw

- ◆ Adjusting steering play => Fig. 7



9 - Hexagon bolt, 20 Nm

10 - Cap

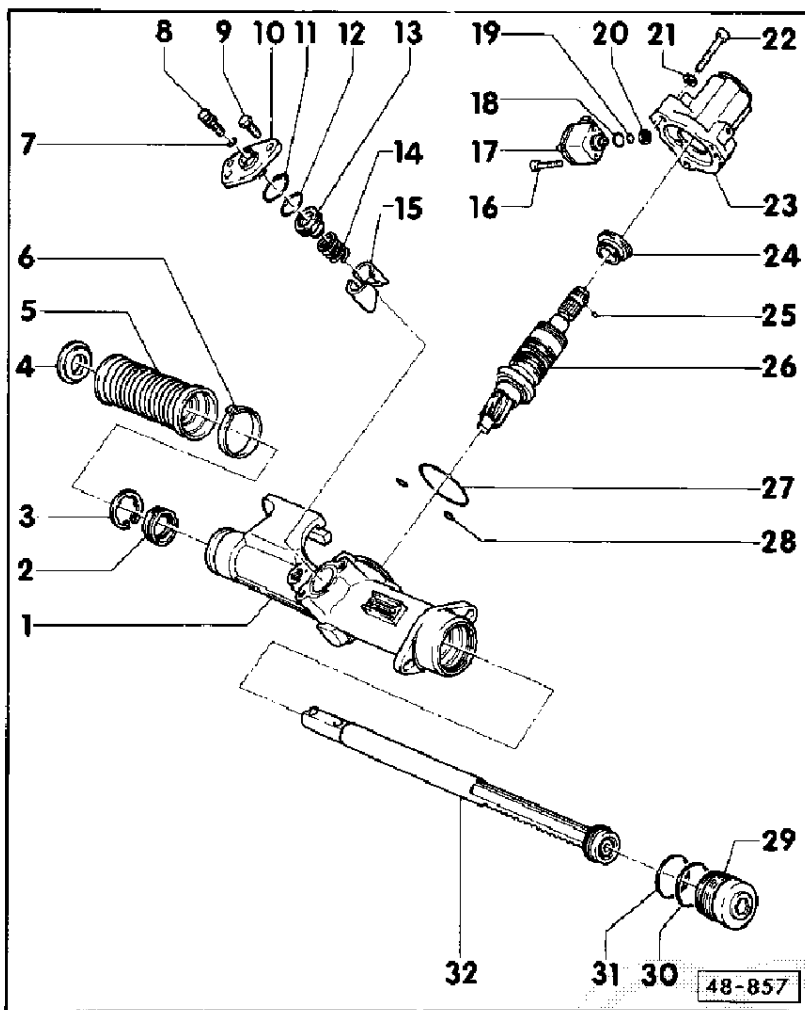
- ◆ Screw onto steering box
- ◆ The two adjacent holes must face forwards when viewed in direction of travel.

11 - Sealing ring 35 x 2 mm *

- ◆ Always replace
- ◆ Insert in annular groove in steering box

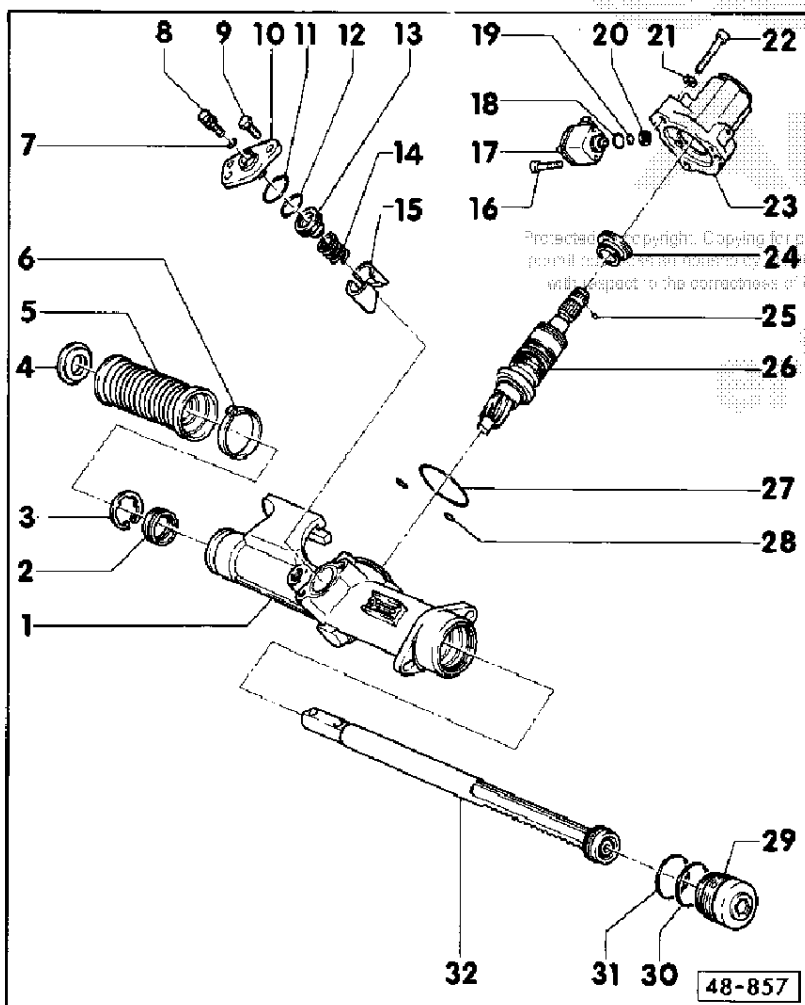
12 - Sealing ring 27 x 2.5 mm *

- ◆ Always replace
- ◆ Insert in annular groove in gasket holder



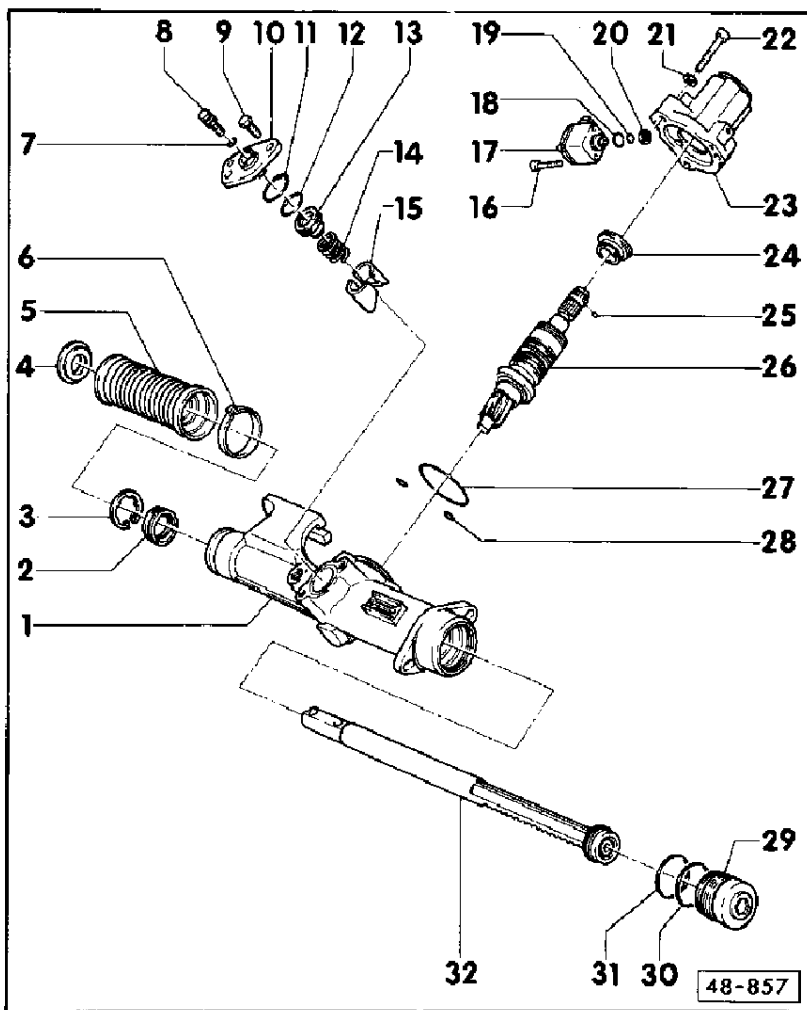
- 13 - Gasket holder
 - ◆ Disassembling => Fig. 5
- 14 - Spring
 - ◆ Insert in thrust piece
- 15 - Thrust piece
- 16 - Cheese-head bolt, 3 Nm
 - ◆ For attaching Servotronic valve to valve housing
 - ◆ Not marked with locking compound
- 17 - Servotronic valve
 - ◆ Cannot be installed and removed with steering box in position

48-49

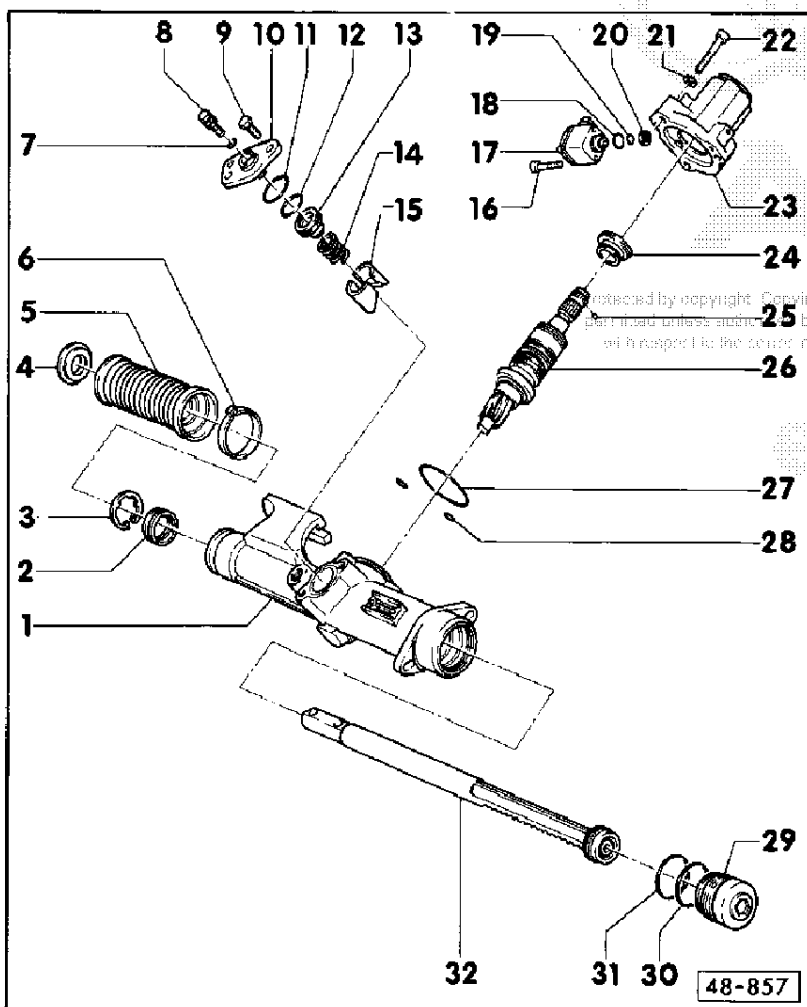


- 18 - Sealing ring 12 x 1,5 mm *
 - ◆ Always replace
- 19 - Sealing ring 7 x 1 mm *
 - ◆ Always replace
- 20 - Strainer * in whole is not
 - ◆ Always replace
- 21 - Washer
- 22 - Cheese-head bolt, 20 Nm
- 23 - Valve housing
- 24 - Gasket holder *
 - ◆ Always replace
 - ◆ Driving out => Fig. 1
 - ◆ Pressing in => Fig. 2
 - ◆ Fill space between sealing and dust lips with multipurpose grease.

48-50

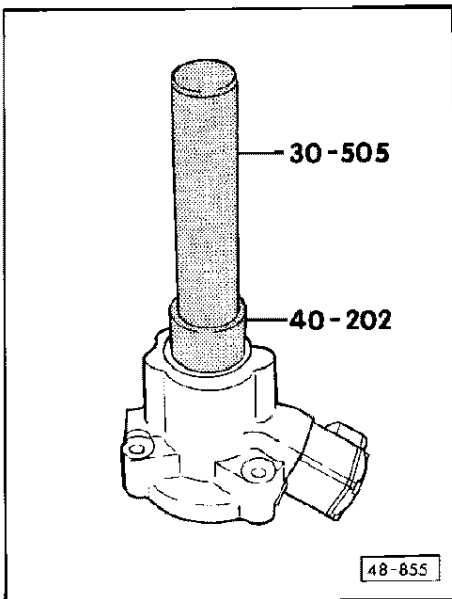


- 25 - Straight pin 2.5 x 6 mm *
 - ◆ Always replace
 - ◆ Pull out with universal pliers before removing valve housing
- 26 - Rotary valve/steering pinion
 - ◆ Knocking out of steering box => Fig. 6
- 27 - Sealing ring 60 x 2 mm *
 - ◆ Always replace
- 28 - Sealing ring 9 x 2 mm *
 - ◆ Always replace
- 29 - Cap, 50 Nm
 - ◆ Secure with two centre punch marks offset by 180°
- 30 - Thrust ring *
 - ◆ Always replace
 - ◆ Attach to cap.
 - ◆ Installation position => Fig. 8

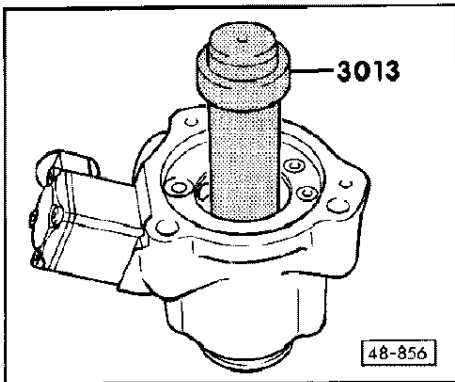


- 31 - Sealing ring 44 x 2.5 mm *
 - ◆ Always replace
 - ◆ Attach to cap.
- 32 - Rack
 - ◆ Unscrew cap and push rack to left out of steering box.
 - ◆ Watch for scoring around rack seal
 - ◆ Fitting => Page 48-58

◀ Fig.1 Driving out gasket holder, valve housing



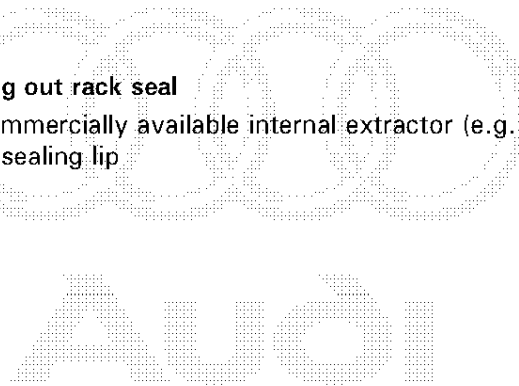
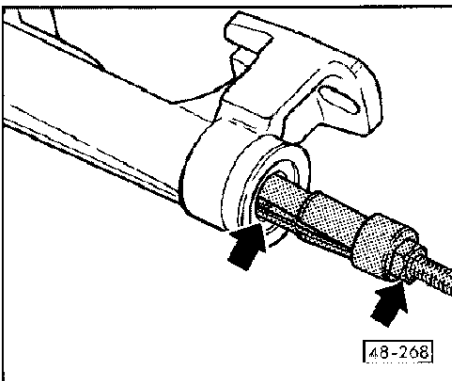
◀ Fig.2 Driving home gasket holder, valve housing



———— 48-53 ————

◀ Fig.3 Pulling out rack seal

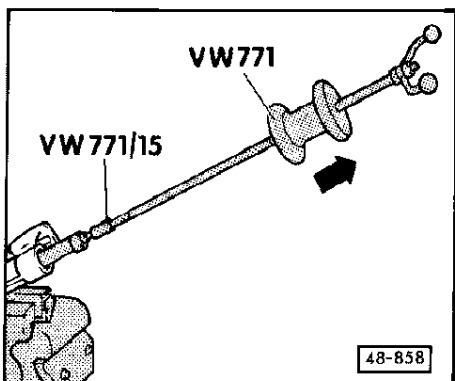
- Insert commercially available internal extractor (e.g. KUKKO 21/4) in sealing lip



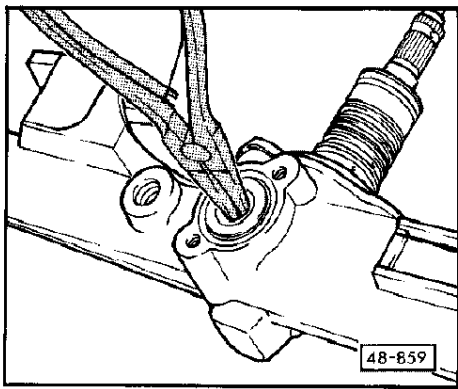
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◀ Fig.4 Screwing multi-purpose tool to internal extractor

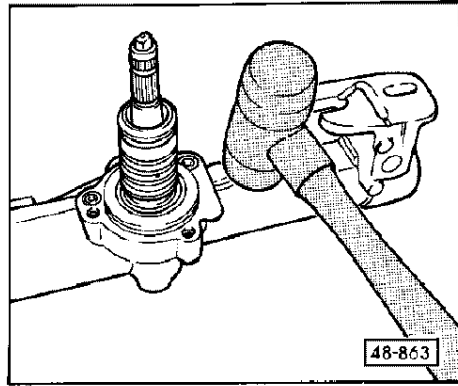
- Clamp steering box in vice using soft jaws.
- Screw -VW 771- with -VW 771/15- to internal extractor and knock out rack seal



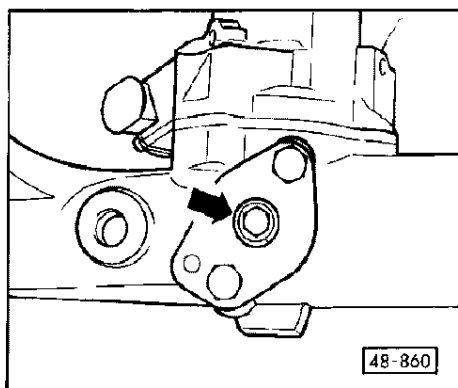
———— 48-54 ————



◀ **Fig.5 Disassembling gasket holder**
 – Pull out using commercially available external circlip pliers



◀ **Fig.6 Driving out steering pinion**
 – Hold steering pinion by hand and knock out by hammering on steering box with commercially available rubber hammer.

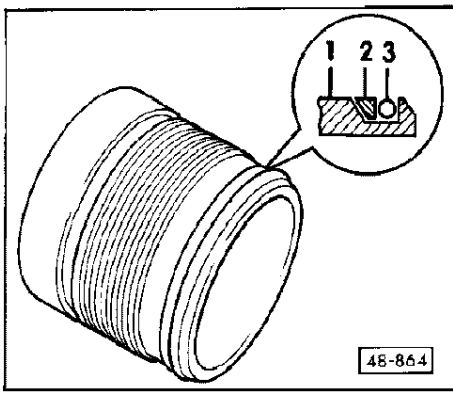


◀ **Fig.7 Adjusting steering play**
Note:
Two mechanics are required to perform adjustment. Adjustment work is to be performed with the engine switched off and the vehicle standing on its wheels. For ease of illustration the steering box is shown removed.

- Move wheels to straight-ahead position.
- Turning the steering wheel back and forth (roughly 30° about centre axis) produces a rattling and cracking noise.
- The second mechanic carefully screws in adjusting screw - arrow- into the cover until rattling and cracking noises can no longer be heard inside the vehicle.
- Perform test drive and correct adjustment of necessary.

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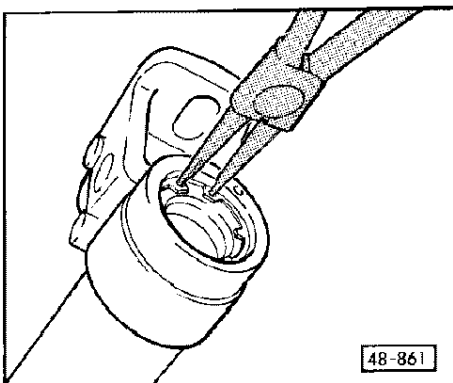
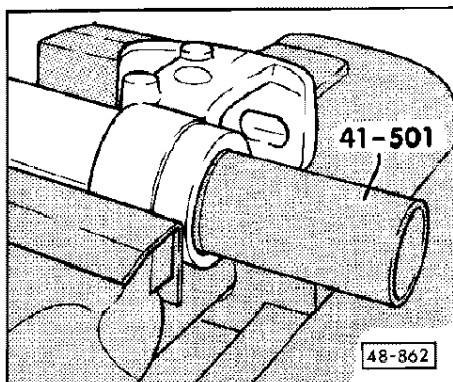
◀ Fig.8 Installation position of thrust ring

- _ 1 - Screw cap
- _ 2 - Thrust ring
- _ 3 - O-ring

Fitting rack

Note:

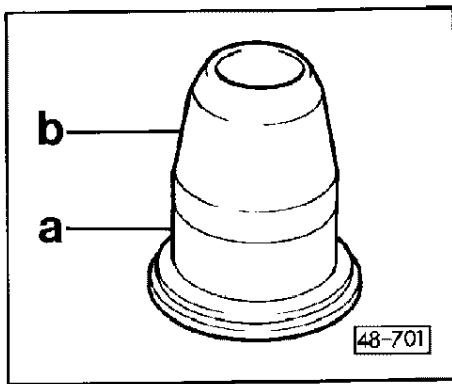
- ◀ *Before fitting rack, wash out steering box with white spirit, blow it out with compressed air and thoroughly clean rack. Prior to assembly, use hydraulic fluid to moisten parts of fitting sleeve, rack and rack seal. All new repair sets contain a fitting sleeve.*
- Insert rack seal by hand in steering box and drive home.



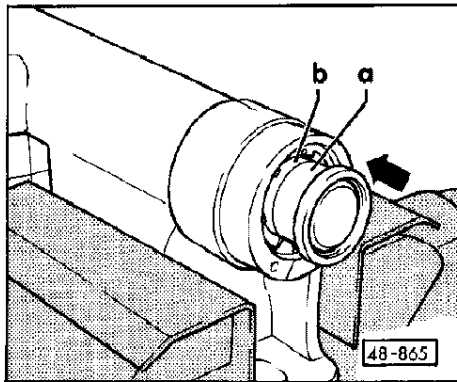
- ◀ - Use commercially available circlip pliers to fit circlip.

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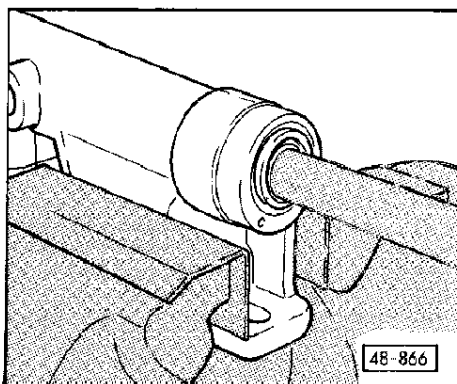


- ◀ – Insert fitting sleeve -b- in fitting sleeve -a-, placing both parts on a flat surface as shown.

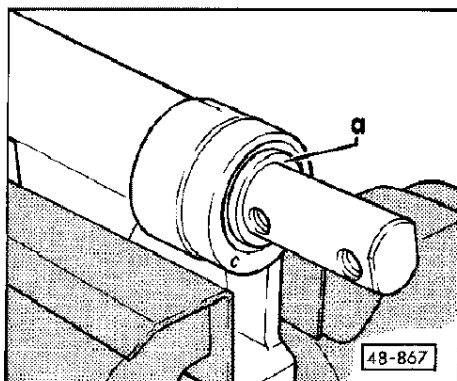
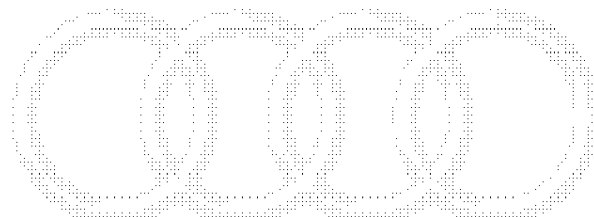


- ◀ – Press home fitting sleeve -a- with fitting sleeve part -b- in steering box by hand.

— 48-59 —



- ◀ – Use commercially available mandrel to drive fitting sleeve part into steering box and remove on opposite end.



- ◀ – Push rack through steering box and fitting sleeve -a- from opposite end of fitting sleeve; counterhold fitting sleeve -a- by hand until flattened end of rack is past fitting sleeve -a-.
- Remove fitting sleeve -a- from rack.
- Screw on cap by hand so that rack can no longer fall out (seal could otherwise be damaged).

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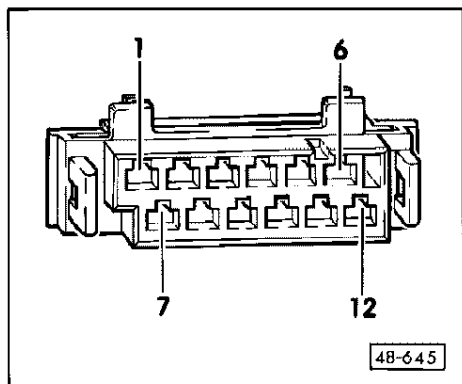
— 48-60 —

Checking power supply for Servotronic control unit

Note:

The Servotronic control unit-J236- is installed on the right beneath the rear bench seat.

- Remove the rear bench seat.
- Pull off connector from Servotronic control unit -J236-.
- Switch on ignition.



- ◀ - Set 20 V measuring range on digital multimeter -V.A.G 1526- and insert between contacts 2 and 7 or 3 and 7 at connector of Servotronic control unit -J236-. Specified value: approx. 12 V.
- If specified value is not attained, use current flow diagram to check for and if necessary eliminate open circuit.

48-61

Checking wiring between plug at Servotronic control unit and plug at Servotronic valve

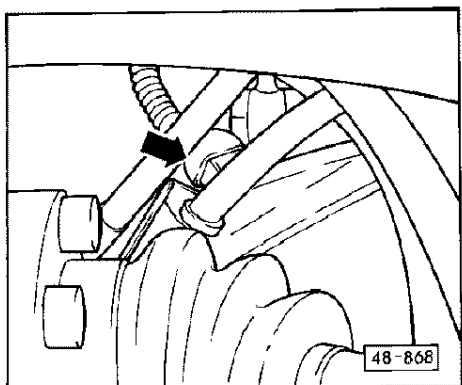
This test involves driving the vehicle onto a lifting platform, as the plug for the Servotronic solenoid valve -N119- is only accessible from underneath.

Note:

The Servotronic control unit -J236- is installed on the right beneath the rear bench seat.

- Remove the rear bench seat.
- Pull off connector from Servotronic control unit -J236-.

- ◀ - Disconnect plug for Servotronic solenoid valve -N119-.

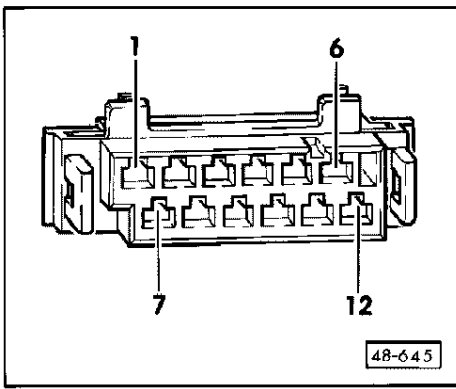


AUDI

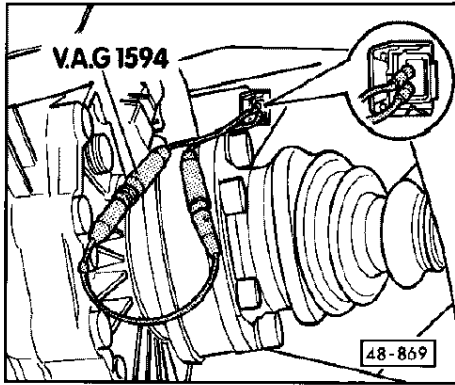
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48-62



- ◀ – Set ohm range on digital multimeter -V.A.G 1526- and insert between contacts 8 and 11 at plug of Servotronic control unit - J236-. Specified value: ∞ Ohm
- If specified value is not attained, use current flow diagram to check for and if necessary eliminate short in wiring.



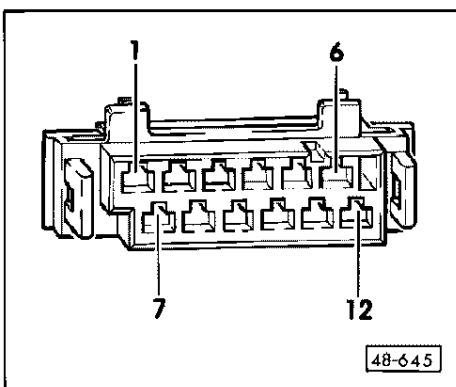
- ◀ – If specified value is attained, jumper contact at plug of Servotronic solenoid valve -N119- using adapter cable set V.A.G 1594
- Specified value: > 0 Ohm
- If specified value is not attained, use current flow diagram to check for and if necessary eliminate short in wiring.

————— 48-63 —————

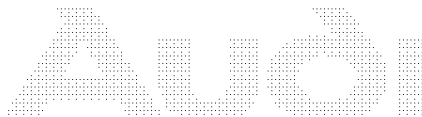
Checking Servotronic valve

Note:

The Servotronic control unit -J236- is installed on the right beneath the rear bench seat.



- Remove the rear bench seat.
- Pull off connector from Servotronic control unit -J236-.
- Set ohm range on digital multimeter -V.A.G 1526- and insert between contacts 8 and 11 at plug of Servotronic control unit - J236-. Specified value: approx. 6-12 ohm.
- If desired value is not attained, replace Servotronic valve - N119-, to do this remove steering box => Page 48-17

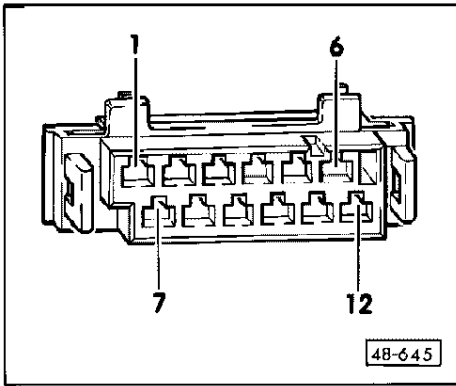


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————— 48-64 —————

Checking valve wiring for short to earth



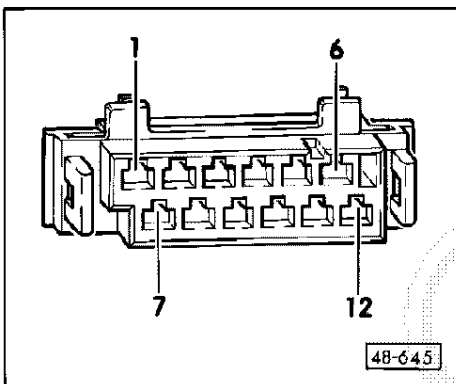
Note:

The Servotronic control unit -J236- is installed on the right beneath the rear bench seat.

- Remove the rear bench seat.
- Pull off connector from Servotronic control unit -J236-.
- Set ohm range on digital multimeter -V.A.G 1526- and insert between contacts -2- and -11-, -3- and -11-, -2- and -8- or -3- and -8- at plug of Servotronic control unit -J236-. Specified value: ∞ Ohm
- If specified value is not attained, check wiring and renew defective lead if necessary.

48-65

Checking valve wiring for short to positive



Note:

The Servotronic control unit -J236- is installed on the right beneath the rear bench seat.

- Remove the rear bench seat.
- Pull off connector from Servotronic control unit -J236-.
- Set ohm range on digital multimeter -V.A.G 1526- and insert between contacts -7- and -8- or -7- and -11- at plug of Servotronic control unit -J236-. Specified value: ∞ Ohm
- If specified value is not attained, check wiring and renew defective lead if necessary.

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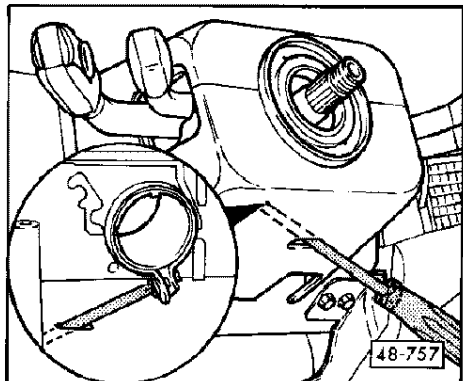
48-66

Removing and installing steering column with column tube

Removing:

Vehicles with no airbag

- Disconnect battery earth strap
- Remove steering wheel =>Page 48-83 (tightening torques for hexagon nut: 40 Nm)



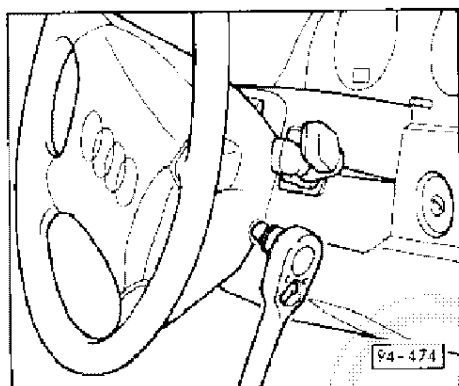
- ◀ - Unfasten clamp of steering column switch.
- Removing steering column switch

Vehicles with airbag

Note:

Before performing any work on the airbag system, disconnect battery earth strap and 1-pin red connector for airbag voltage supply to ensure that subsequent assembly work does not result in accidental actuation of airbag system. Before removing steering column, move wheels to straight-ahead position, then remove steering wheel (this ensures that coil spring in steering wheel is not damaged).

— 48-67 —



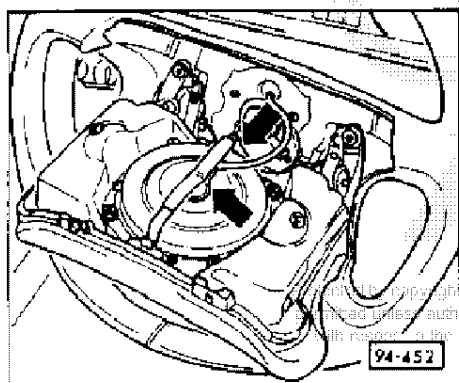
- Disconnect battery earth strap
- ◀ - Unscrew airbag unit on left and right of steering wheel from behind using Torx socket (e.g. Hazet T 30 H).
- Fold airbag unit to rear.

Installation note:

Screw in securing bolts for airbag unit by hand, then tighten right bolt to 6 Nm followed by left bolt to 6 Nm..

Attention

Make sure there is nobody in the vehicle when connecting battery earth strap.

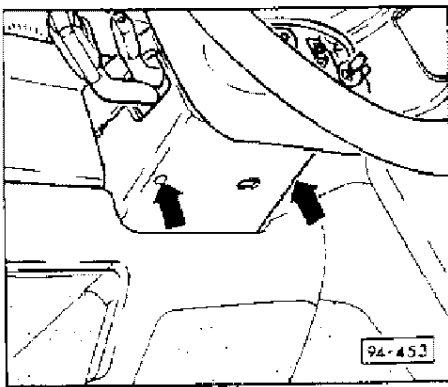


- ◀ - Detach fastener for plug of airbag unit.
- Pull connector off airbag unit.
- Set the airbag down with the Audi rings on the airbag still visible (safety specification).

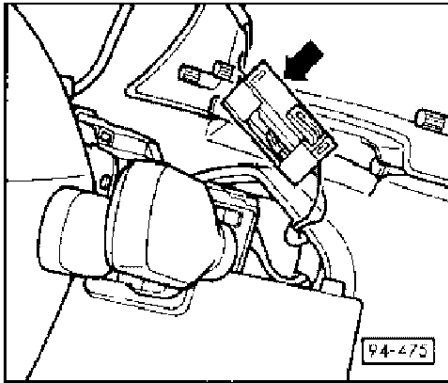
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— 48-68 —



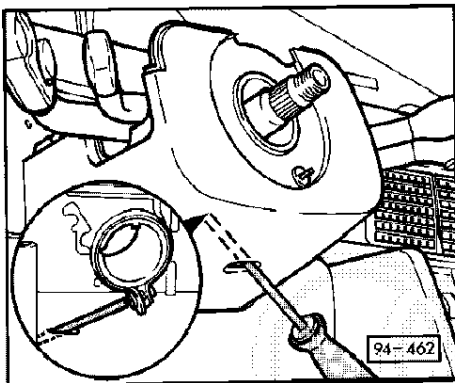
- ◀ - Remove top part of trim for steering column switch.



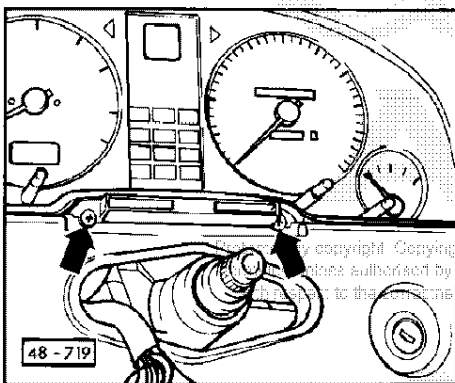
- ◀ - Pull connector of lead for airbag unit out of bottom part of trim; to do this press in lug in centre of lower part of plug slightly using a screwdriver and pull out.
- Detach connector
- Remove steering wheel

Installation note:

Move wheels to straight-ahead position before installing steering wheel. Steering wheel spoke must be horizontal with wheels in straight-ahead position.



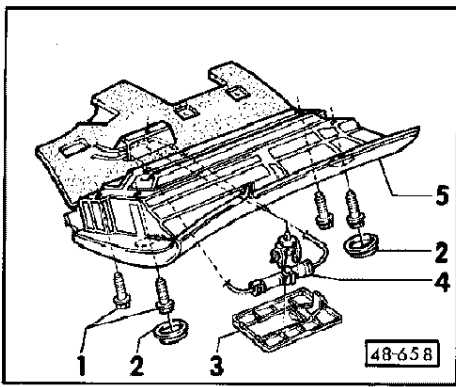
- ◀ - Unfasten clamp of steering column switch.
- Removing steering column switch



- ◀ - Remove dash panel insert
- Pull off plug housing at ignition/starting lock.

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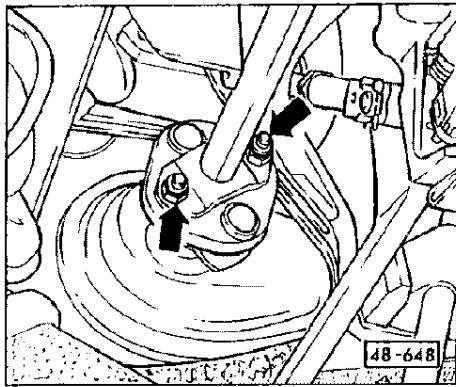
- ◀ – Unscrew fastening screws for tray on driver's side.

Vehicles with airbag

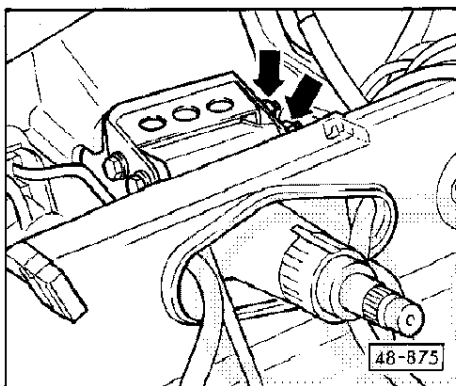
Lever cover -3- for airbag connector out of knee cushion and unclip and detach connector -4-.

Lever caps -2- out of knee cushion. Unscrew hexagon bolt -1-.

- Remove driver's side tray/knee cushion -5-.

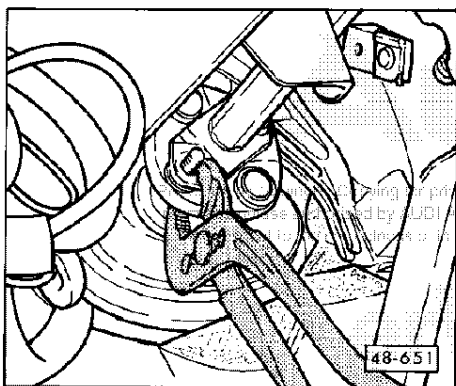


- ◀ – Unscrew steering column from shackle.
- Use screwdriver to press steering column approx. 15 mm off disc coupling



- ◀ – Unscrew column tube from bracket.
- Remove screws from bracket.
- Push steering column with column tube downwards and turn appropriately to enable it to be removed beneath instrument panel.

Installing:



- Push steering column from underneath into cut-out in instrument panel.

- Insert column tube in bracket.

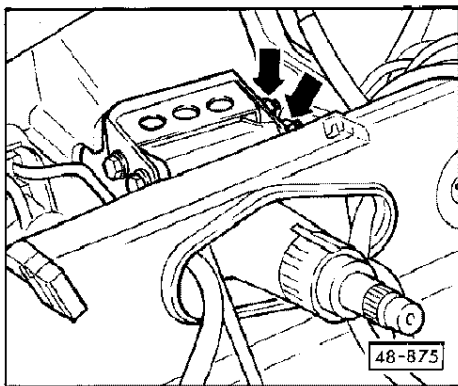
- Insert screws in bracket and column tube.

- Insert ignition key in steering lock.

Release steering lock so that steering column can be turned as required.

- Use pipe wrench to press steering column onto disc coupling.

- Insert shackle in steering column and screw the two together.



- Insert cable in column tube
- By moving it upwards or downwards in the bracket, align column tube so that there is no disc coupling torsion when turning the steering wheel.
- Fasten column tube to bracket.
- Attach connector housing to ignition/starter switch.

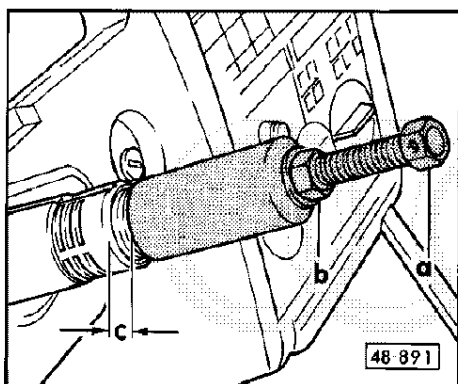
Attention

Should it not be possible to effect alignment as described above, loosen steering box at its attachment points and move appropriately until stress-free alignment of steering mechanism becomes possible.

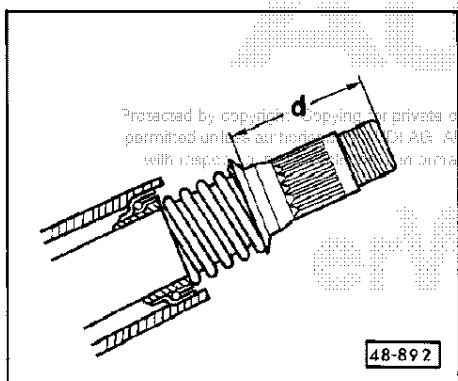
Note:

If steering column and column tube have been separated, fit spring on steering column with the two clamp washers as described below:

- Attach spring to steering column
- Attach clamp washers



- Screw special tool with spindle -a- onto steering column as far as it will go (screw back nut -b-).
- Counterhold spindle -a- Tighten hexagon nut -b- until dimension -c- between end face of column tube and end face of special tool is between 10 and 12 mm.
- Loosen nut -b-.
- Unscrew spindle -a- from steering column.



- Perform check measurement on dimension -d-.
- $d = 54.5 \text{ mm to } 55.5 \text{ mm}$

Note:

If dimension -d- is not attained, reinstall fitting tool -3168- and correct dimension -d-

- Install dash panel insert.
- Install steering column switch.
- Install steering wheel => Page 48-83.

Note:

Vehicles with airbag: attach connector for airbag unit.

- Fit driver's tray.
- Fit self-diagnosis plug in tray.

Note:

Vehicles with airbag: connect 1-pin plug (labelled airbag) for power supply of airbag system.

- Connect battery earth strap.

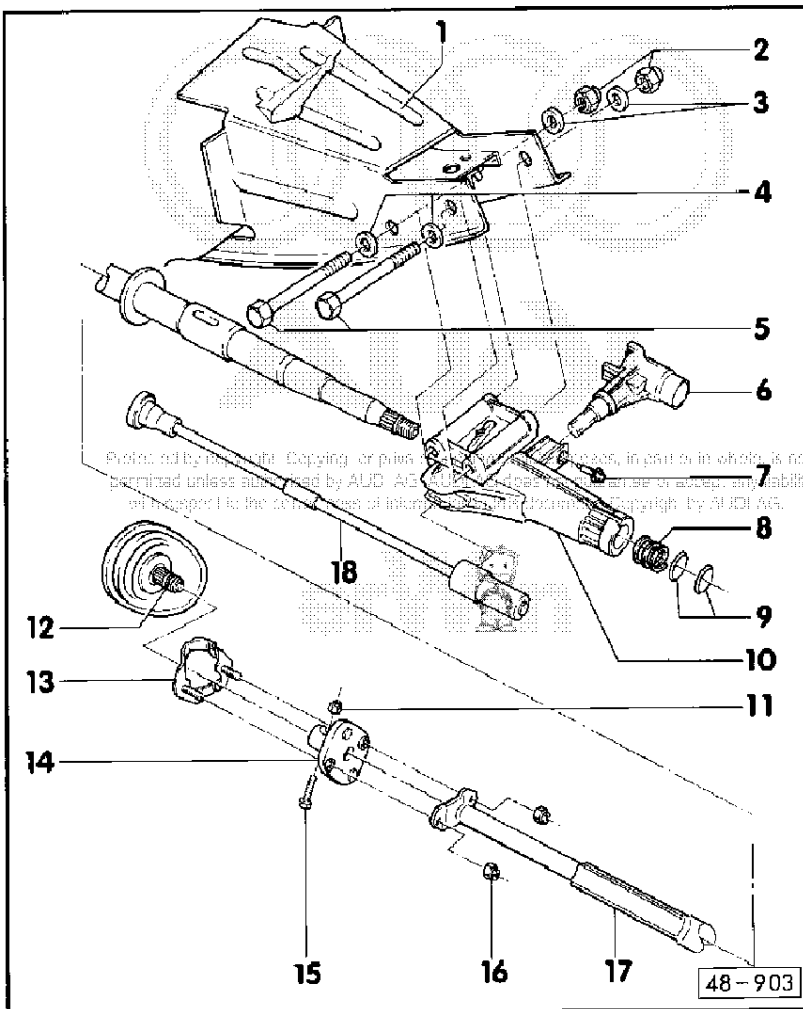
Attention

Make sure there is nobody in the vehicle when connecting battery earth strap.

- Check function of steering column switch.

Note:

Steering wheel spoke must be horizontal with wheels in straight-ahead position.



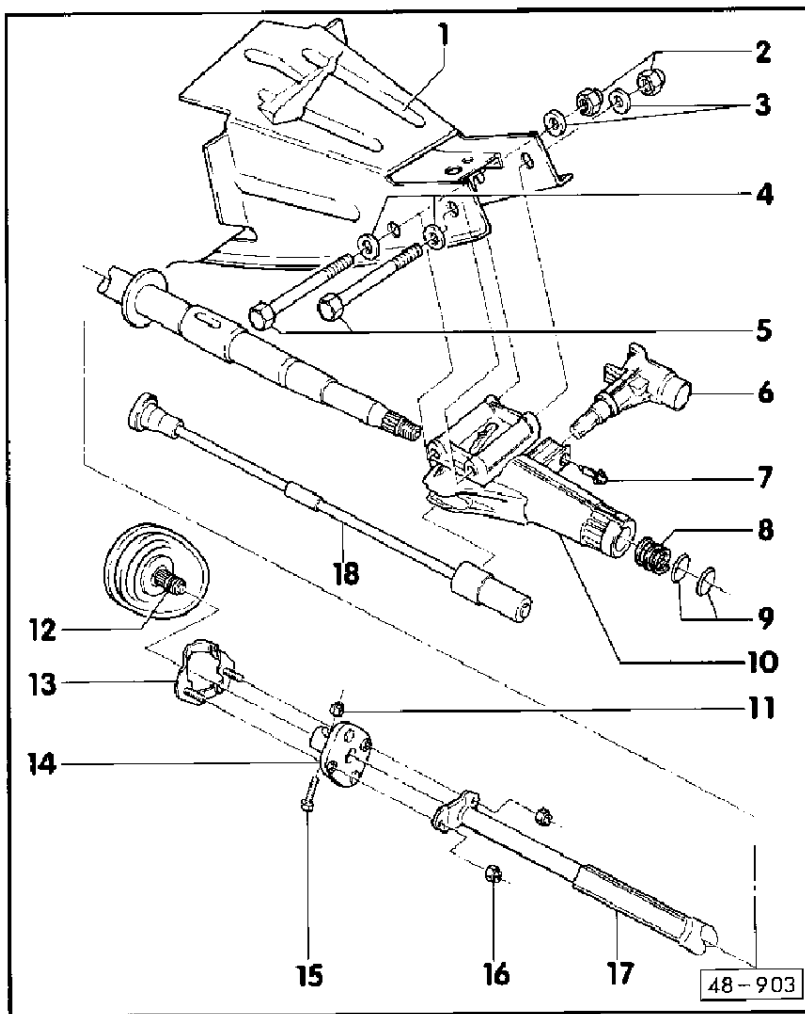
Servicing steering column with column tube

Note:

Procon cable routing

=> General body repairs; Repair Group 68 =>

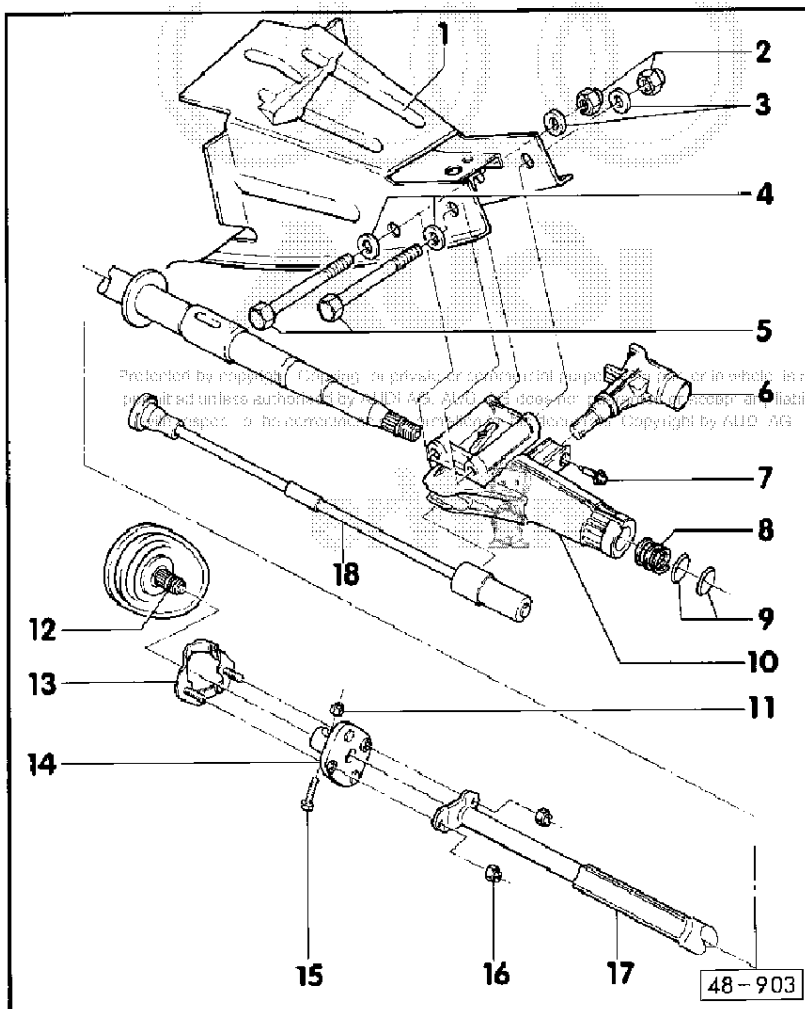
- 1 - Bracket
- 2 - Self-locking nut, 35 Nm
◆ Always replace
- 3 - Washer
- 4 - Washer
- 5 - Hexagon bolt



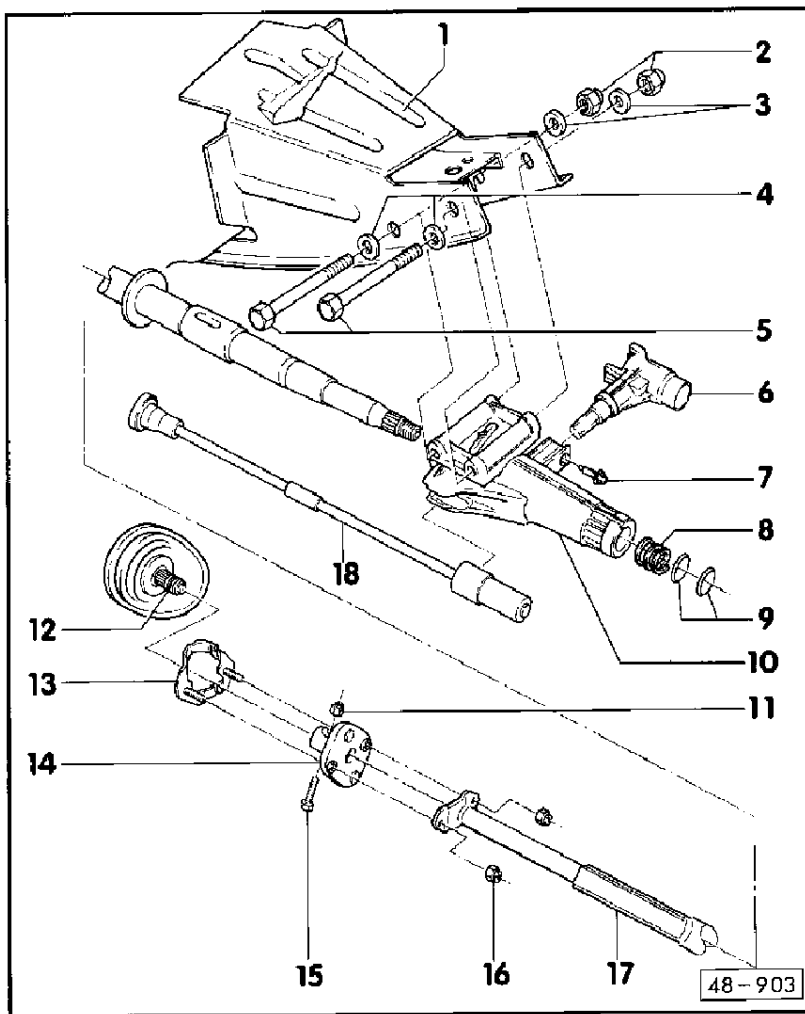
- 6 - Steering lock housing**
 - ◆ Insert in column tube and secure
 - ◆ Attach connector housing for ignition/starter switch.
- 7 - Torx bolt, 7 Nm**
 - ◆ Remove and install using commercially available Torx insert with end-face hole (e.g. Hazet T 30 H)
- 8 - Spring**
 - ◆ Attach to steering column
- 9 - Clamp washers**
 - ◆ Always replace
 - ◆ Grind carefully with small parting-off wheel, then lever off with screwdriver

Attention

Washers are pre-tensioned.



- ◆ Caution: Sparks - if appropriate, cover instrument panel and windscreen
- ◆ Press on with special tool => Page 48-74
- 10 - Column tube**
 - ◆ Consists of top and bottom part
 - ◆ Replacement part supplied with bearing
 - ◆ Top and bottom section are lined with plastic
 - ◆ Do not exert any radial or axial forces in the form of hammering on the steering column

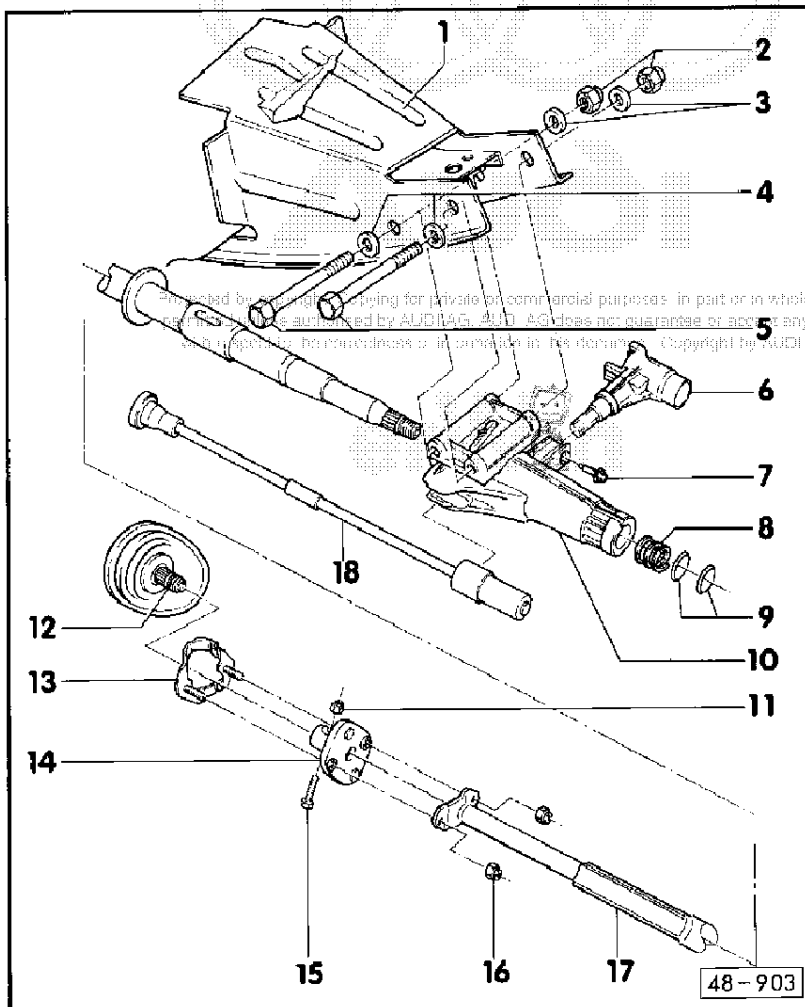


- ◆ Avoid temperatures in excess of 100 °C (connection between top and bottom part may work loose)
- ◆ Never use cleaning agents (e.g. white spirit or similar)
- ◆ Never use lubricants or solvents (connection between top and bottom part may work loose).

Attention

If the slightest misalignment is found in an axial direction between the top and bottom section (accident) always replace column tube.

48-79



Note:

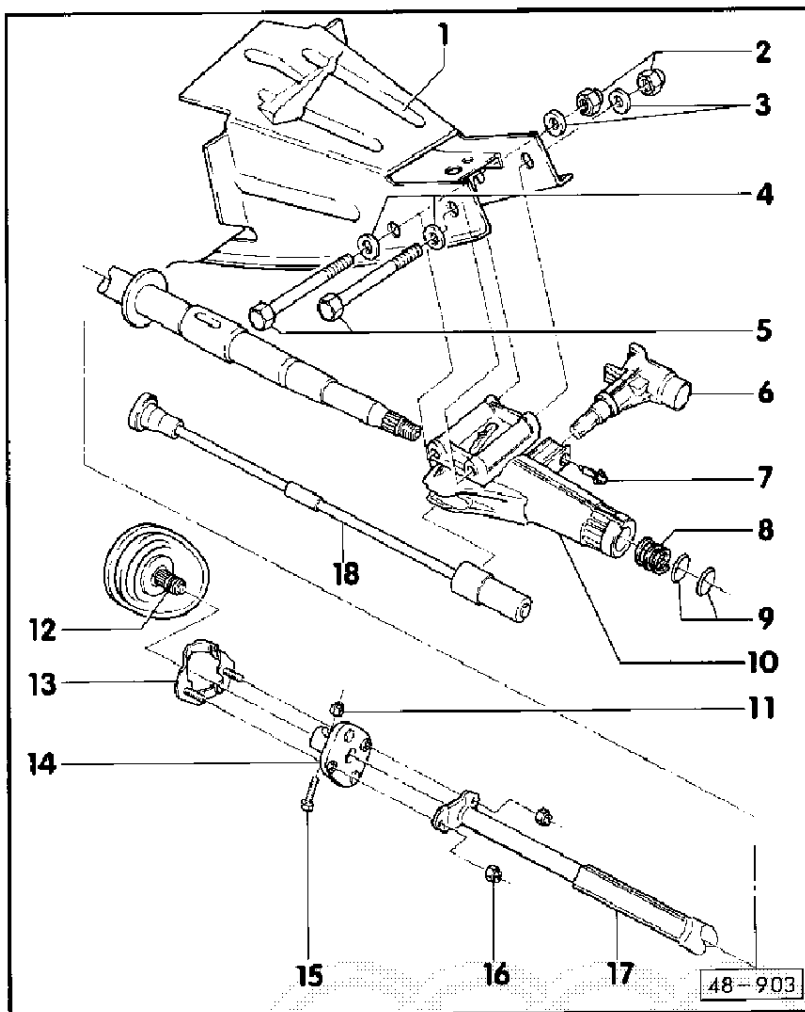
Top and bottom part of column tube have a red dot (sealing wax). Column tube should be replaced if this coloured dot has sheared off

- 11 – Self-locking nut, 25 Nm
 - ◆ Always replace

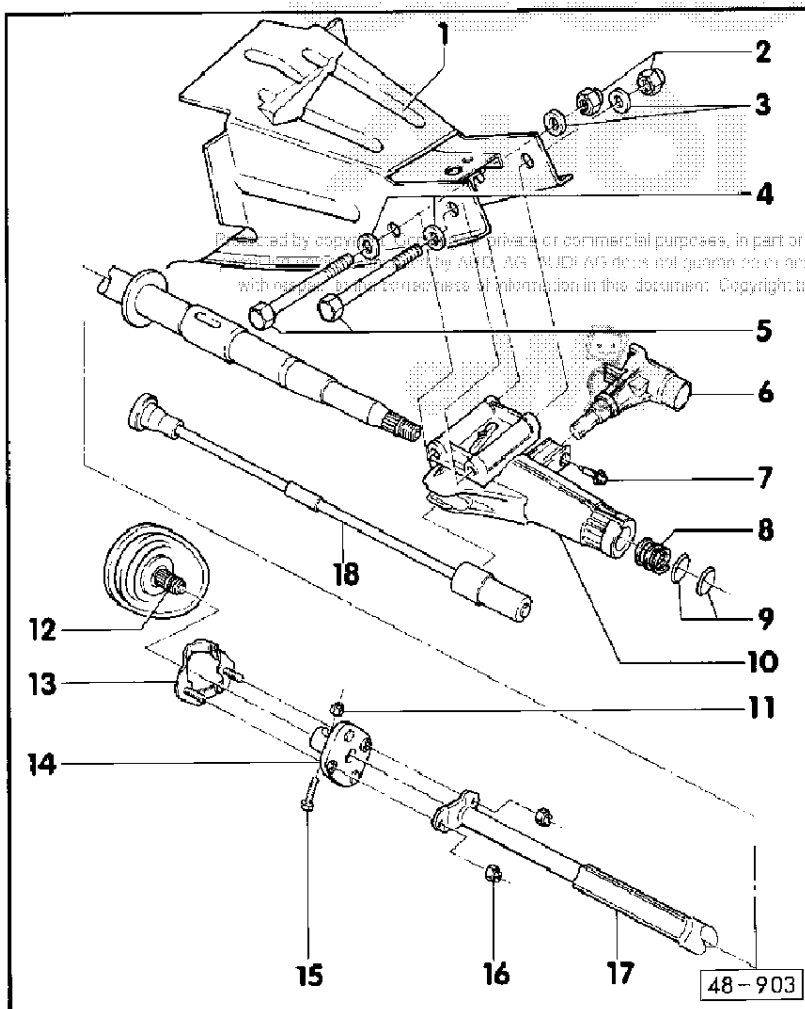
- 12 – Steering pinion
 - ◆ Attach flanged tube to steering pinion

- 13 – Shackle
 - ◆ Screw to flanged tube and steering column

48-80



- 14 - Flanged tube
 - ◆ Supplied as replacement part with riveted-on disc coupling
 - ◆ Move appropriately on steering pinion; screw to steering column and shackle
- 15 - Clamping bolt
 - ◆ Always replace
- 16 - Self-locking nut, 25 Nm
 - ◆ Always replace
- 17 - Steering column
 - ◆ Removing and installing => Page 48-67
 - ◆ Insert in column tube as far as it will go
 - ◆ Fit free of stress



- 18 - Cable
 - ◆ Insert in column tube at top
 - ◆ Insert with rubber grommet in bulkhead at bottom
 - ◆ Further information on cable routing => General body repairs; Repair Group 68 =>

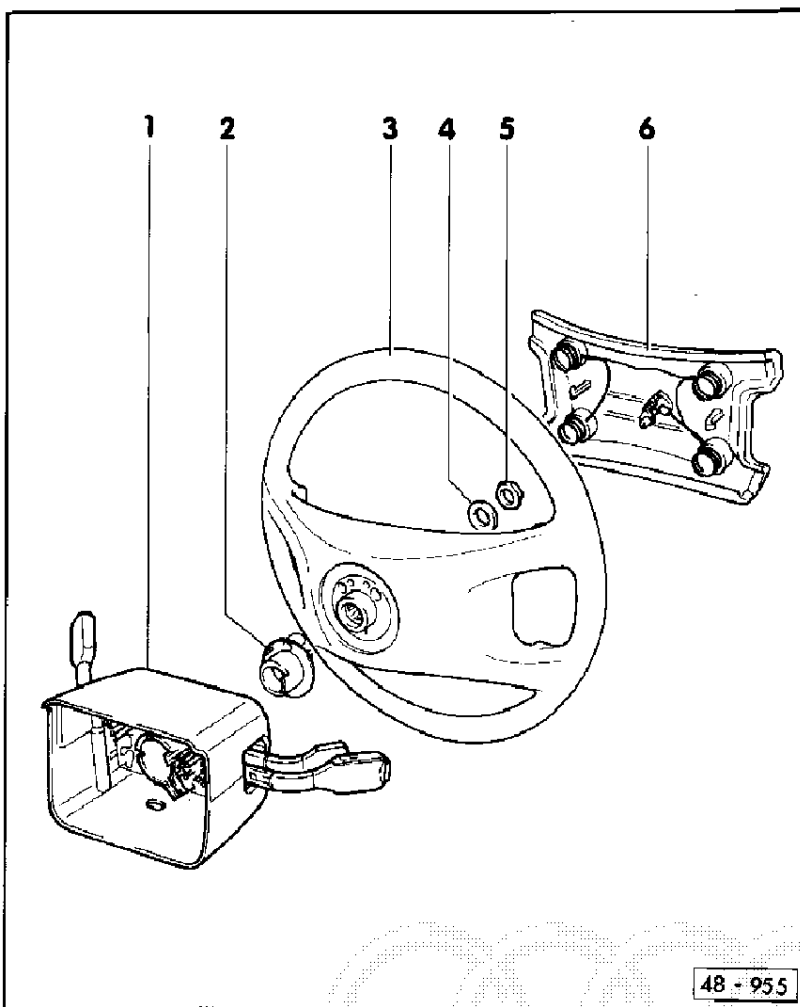
Attention

If the slightest misalignment (accident) is found between the top and the bottom parts of the column tube or if the coloured dot (sealing wax) on the column tube has sheared off, the cable is to be replaced.

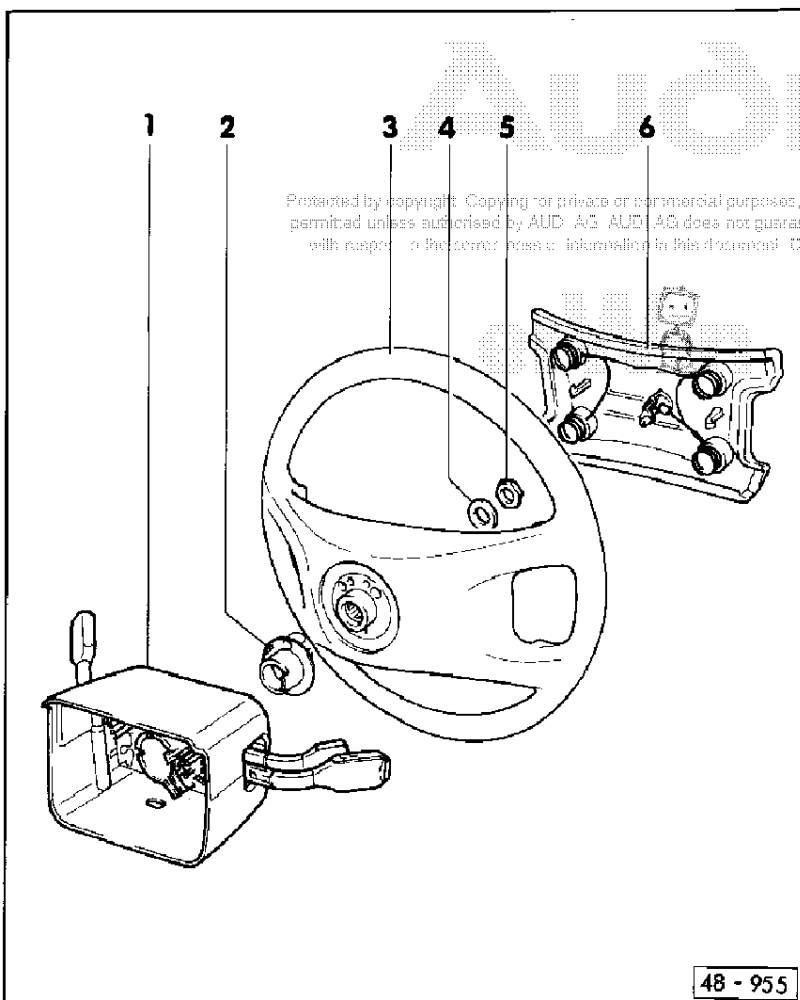
Removing and installing steering wheel

Standard version

- 1 – Steering column switch with bracket
 - ◆ Apply small quantity of grease to slip ring
- 2 – Driver with carbon brush
 - ◆ Insert in steering wheel
 - ◆ Can be replaced separately if necessary
- 3 – Steering wheel
 - ◆ Attach to steering column with wheels in straight-ahead position
 - ◆ On attachment, turn signal indicator stalk must be in centre position
 - ◆ Only install factory-approved steering wheels



48-83



- 4 – Spring lock washer
- 5 – Hexagon nut, 40 Nm
- 6 – Trim panel

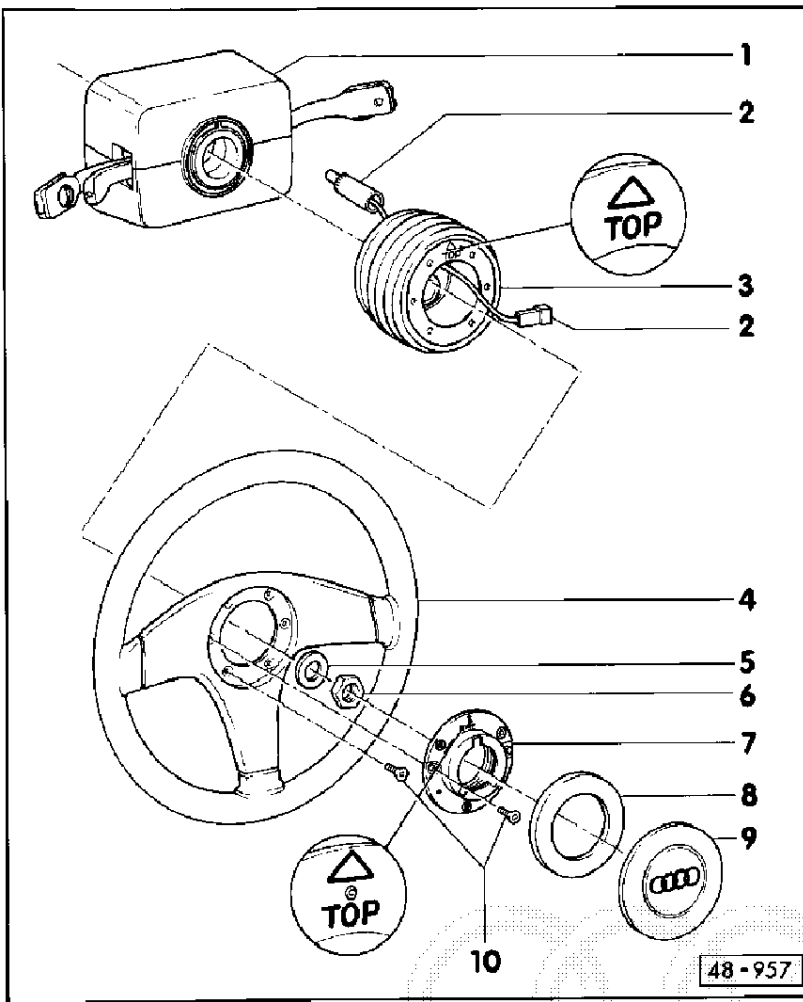
- ◆ Removing:
 - Unfasten by pulling firmly but carefully by hand on upper half of trim panel
 - Proceed in the same way with the lower half
 - Then push panel to one side and detach.

Note:

Non-compliance with the above will cause the fasteners to break on the trim panel.

48-84

Sports steering wheel



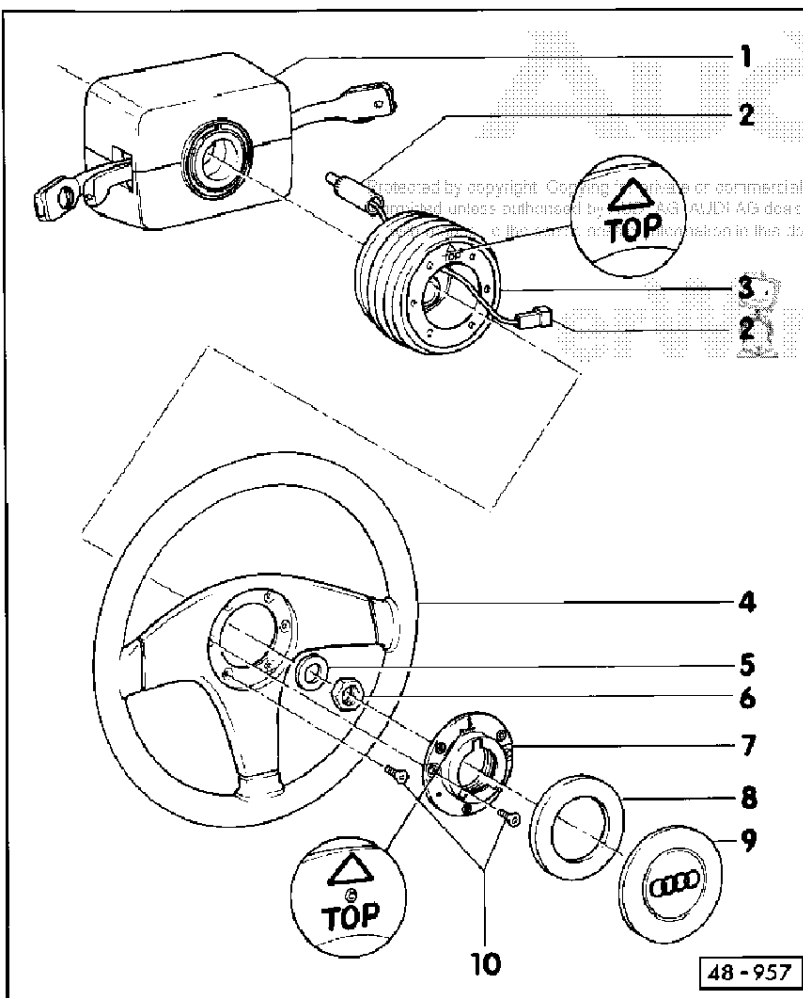
1 - Steering column switch with bracket

- ◆ Apply small quantity of grease to slip ring

2 - Carbon brush

- ◆ Removing:
 - Pressing out of hub
- ◆ Installing:
 - Press home
- ◆ Attach flat connector to lug of horn actuator
- ◆ Can be replaced separately if necessary

48-85



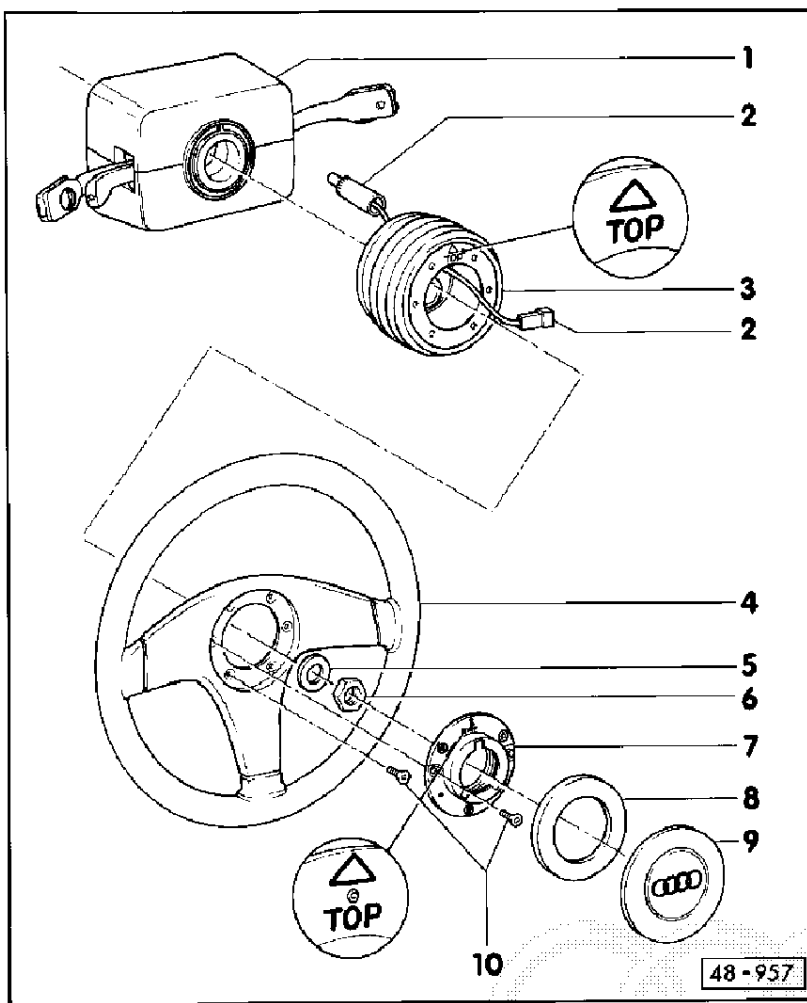
3 - Hub

- ◆ Attached to steering wheel with countersunk bolts which are fitted with locking compound -D6-
- ◆ Can be replaced separately if necessary

Installation note:

The hub features an arrow and is labelled "TOP". On insertion in steering wheel, make sure that arrow on hub is facing upwards. Initially attach hub with the two upper and lower bolts. Then insert horn actuator in steering wheel in such a way that location marked with arrow and designated "TOP" is also pointing upwards and coincides with arrow on hub. Screw horn actuator to steering wheel and hub.

48-86



4 - Steering wheel

- ◆ Attach to steering column with wheels in straight-ahead position
- ◆ On attachment, turn signal indicator stalk must be in centre position
- ◆ Only install factory-approved steering wheels

5 - Spring lock washer

6 - Hexagon nut, 40 Nm

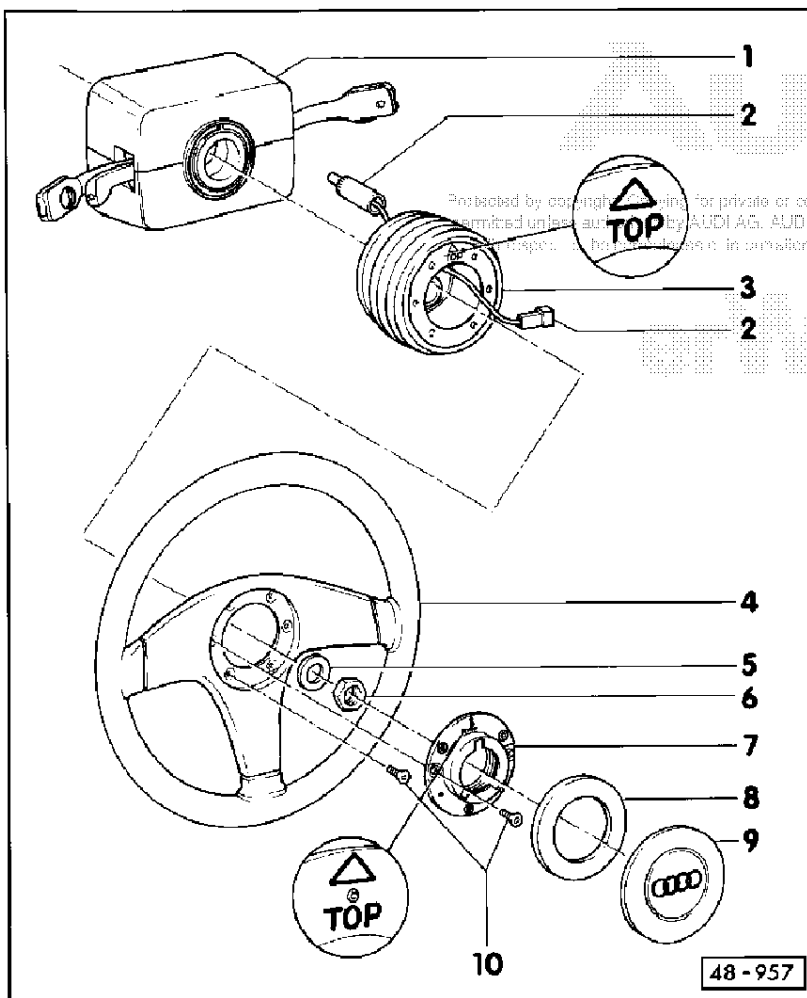
7 - Horn actuator

- ◆ Insert in steering wheel with location marked with arrow and designated "TOP" facing upwards and then screw to hub.

8 - Oil seal

- ◆ Insert in steering wheel

48-87



9 - Horn actuator trim

- ◆ Removing:

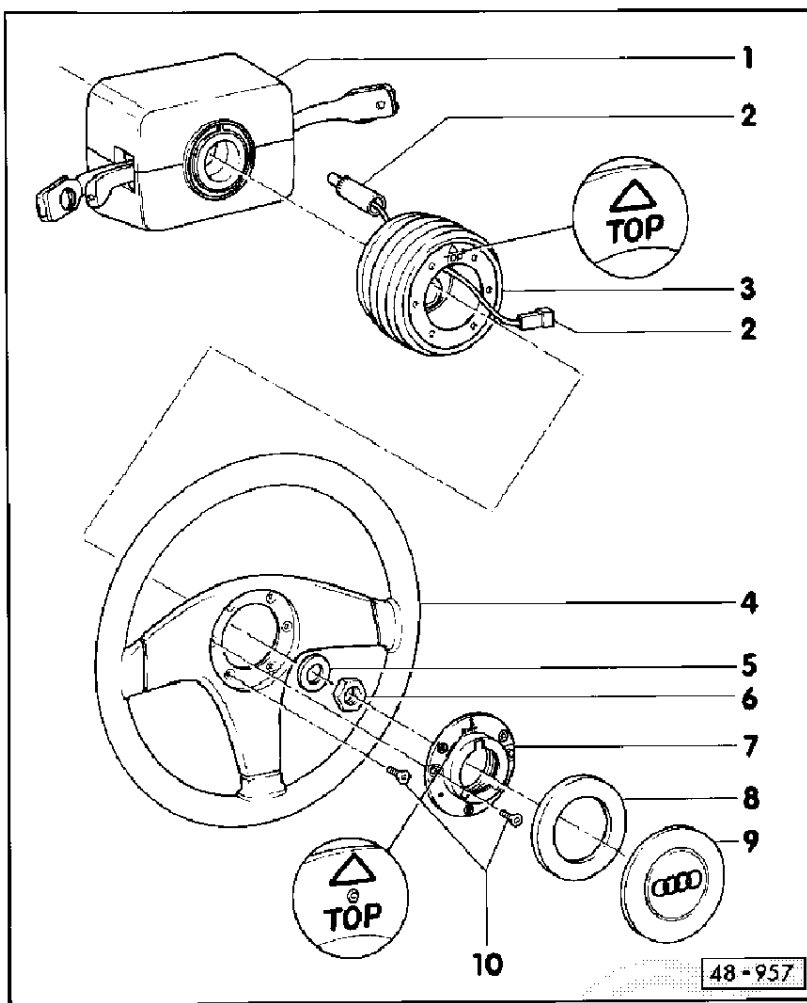
- Press on horn actuator and turn anti-clockwise as far as stop (bayonet fit).

- Remove horn actuator from steering wheel

- ◆ Installing:

- Insert horn actuator with bracket into horn actuator recesses provided, press on and turn clockwise as far as stop.

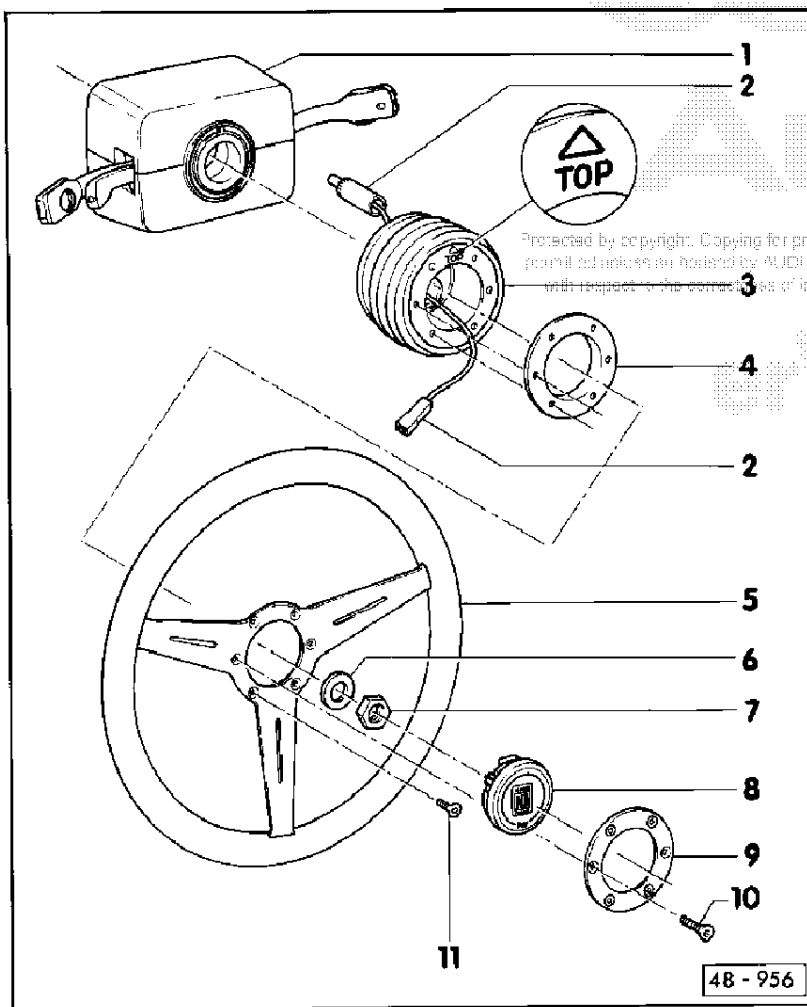
48-88



- 10 - Countersunk bolt, 7 Nm
 - ◆ Fitted with locking compound
 - ◆ Apply -D6- before fitting
 - ◆ Can be replaced separately if necessary

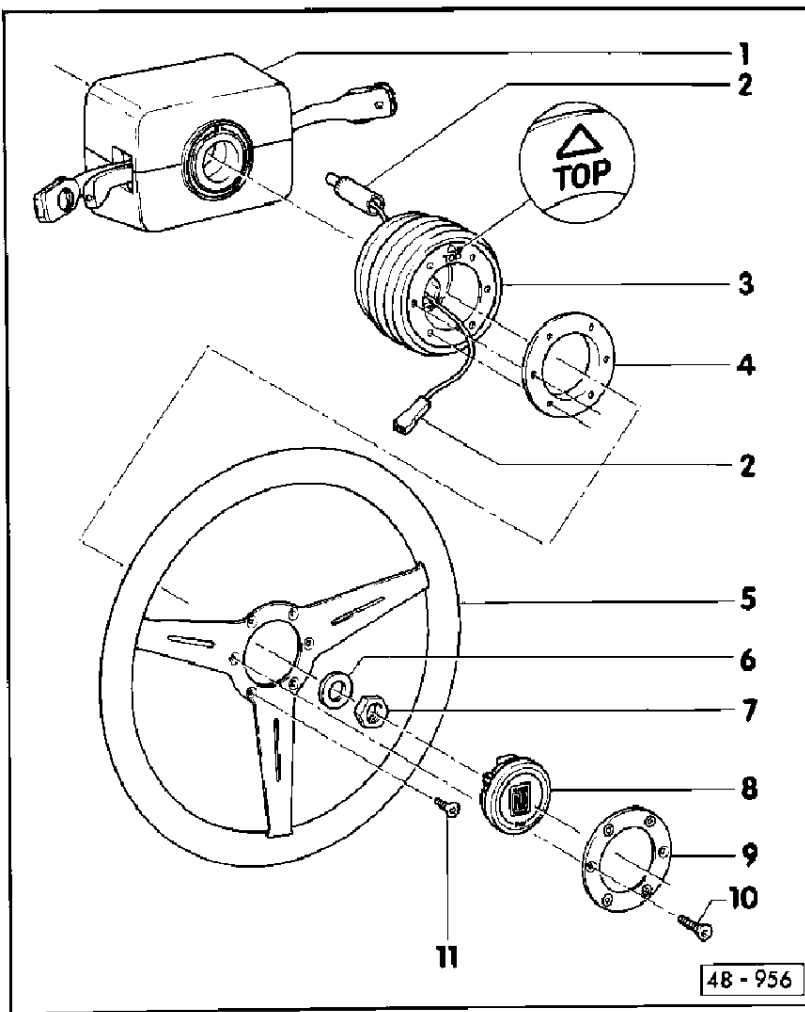
Note:

Due to the use of locking compound, the hexagon socket head of the bolts may be damaged when unscrewing them. If this is the case, carefully drill bolt heads taking care not to damage the countersunk holes in the steering wheel/horn actuator.



Solid-wood steering wheel

- 1 - Steering column switch with bracket
 - ◆ Apply small quantity of grease to slip ring
- 2 - Carbon brush
 - ◆ Removing:
 - Press out of hub
 - ◆ Installing:
 - Press home
 - ◆ Attach flat connector to lug of horn actuator
 - ◆ Can be replaced separately if necessary



48 - 956

3 - Hub

- ◆ Attached to steering wheel with countersunk bolts which are fitted with locking compound -D6-
- ◆ Can be replaced separately if necessary

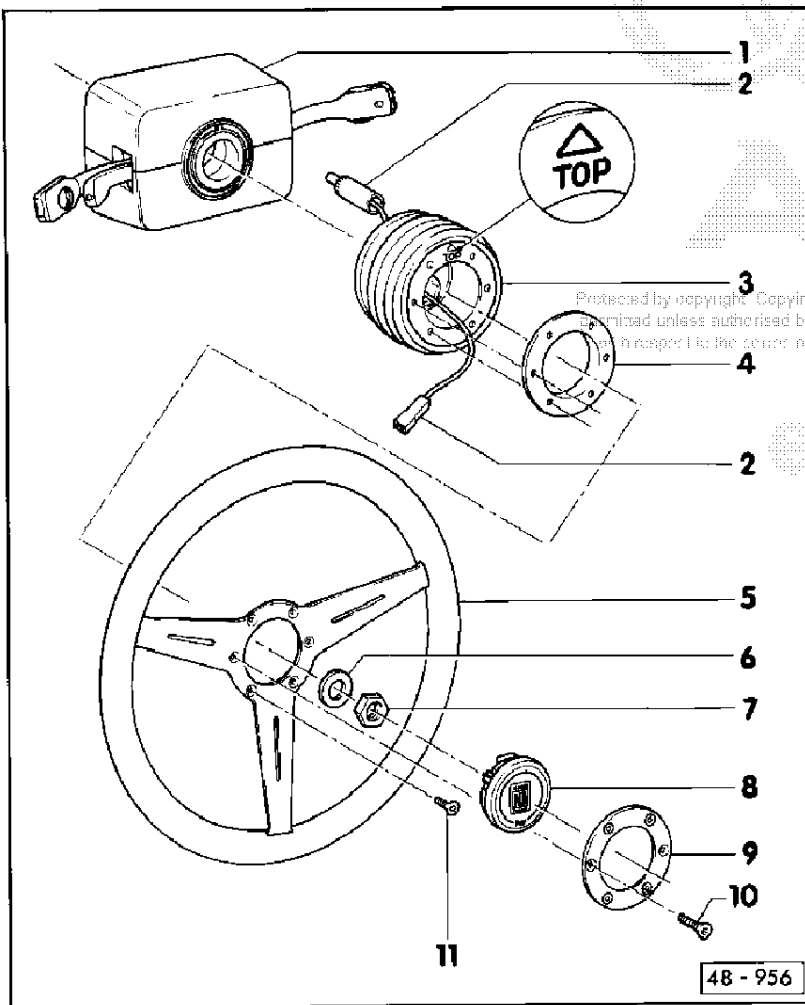
Installation note:

The hub features an arrow and is labelled "TOP". On insertion in steering wheel, make sure that arrow on hub is facing upwards.

4 - Retaining ring

- ◆ On insertion, the two lugs on the retaining ring are centred with the arrow direction ("TOP" on hub)
- ◆ Initially attach hub to steering wheel with the two upper and lower bolts.

48-91



48 - 956

5 - Steering wheel

- ◆ Attach to steering column with wheels in straight-ahead position
- ◆ On attachment, turn signal indicator stalk must be in centre position
- ◆ Only install factory-approved steering wheels

6 - Spring lock washer

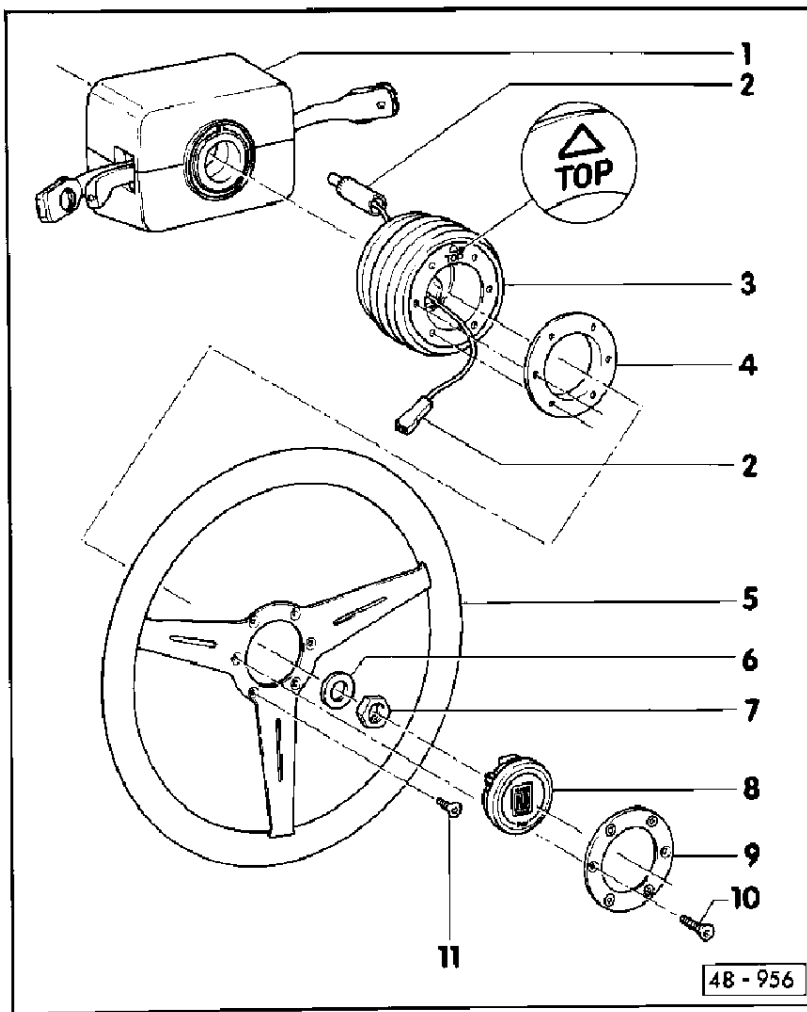
7 - Hexagon nut, 40 Nm

8 - Horn actuator

9 - Cover ring

- ◆ To unscrew, move wheels to straight-ahead position and screw in/screw out the bolts at the 3 and 9 o'clock positions.

48-92

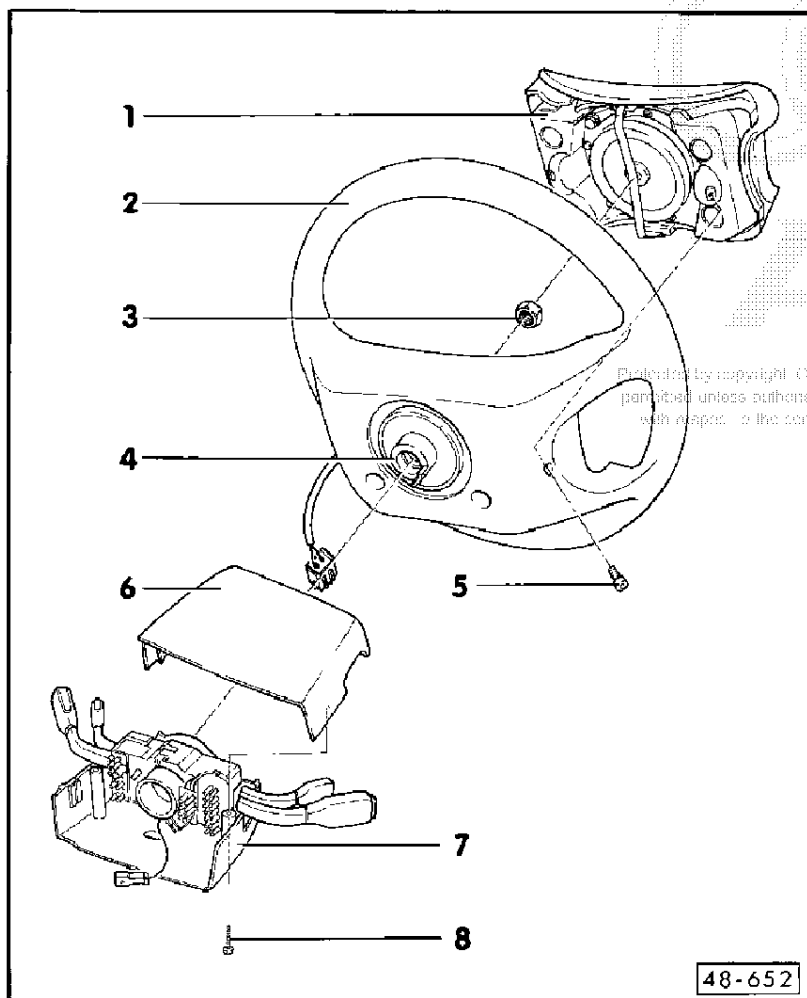


10 – Countersunk bolt M5 x 17.7 Nm
 ♦ Attach cover ring
 ♦ Can be replaced separately if necessary

11 – Countersunk bolt M5 x 10.7 Nm
 ♦ Fitted with locking compound
 ♦ Apply -D6- before fitting
 ♦ Can be replaced separately if necessary

Note:

Due to the use of locking compound, the hexagon socket head of the bolts may be damaged when unscrewing them. If this is the case, carefully drill bolt heads taking care not to damage the countersunk holes in the steering wheel/horn actuator.



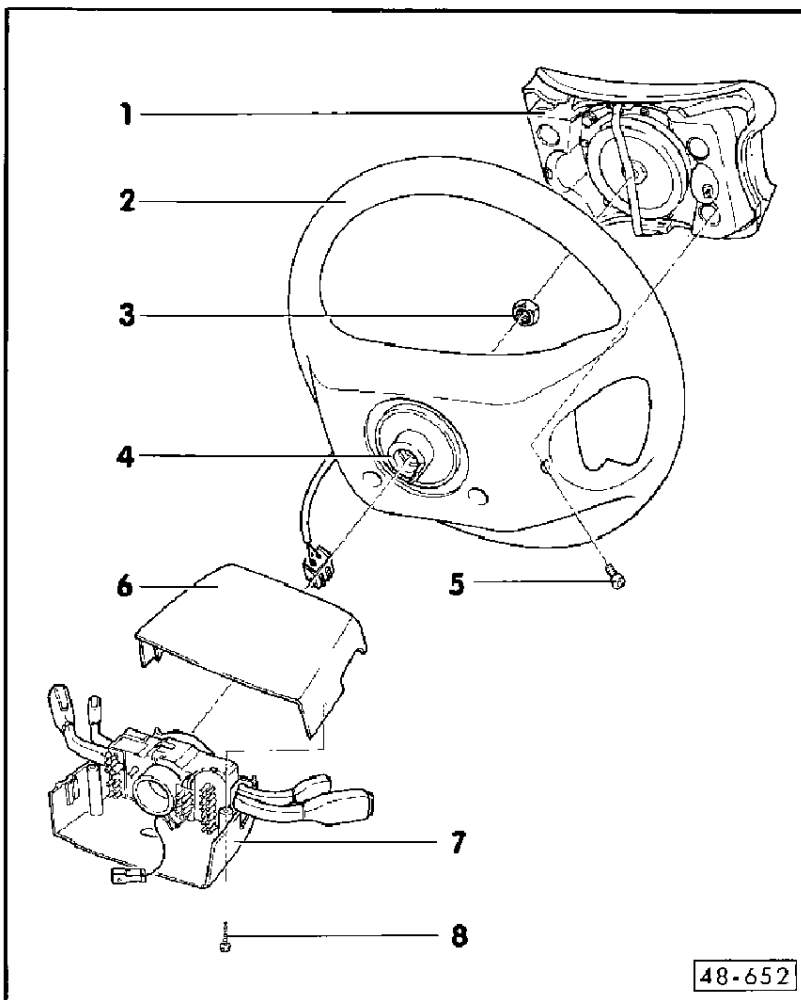
Airbag steering wheel

1 – Airbag unit

Note:

♦ Before performing any work on the airbag system, disconnect battery earth strap and 1-pin red connector for airbag voltage supply to ensure that subsequent assembly work does not result in accidental actuation of airbag system. Before removing steering column, move wheels to straight-ahead position, then remove steering wheel (this ensures that coil spring in steering wheel is not damaged).

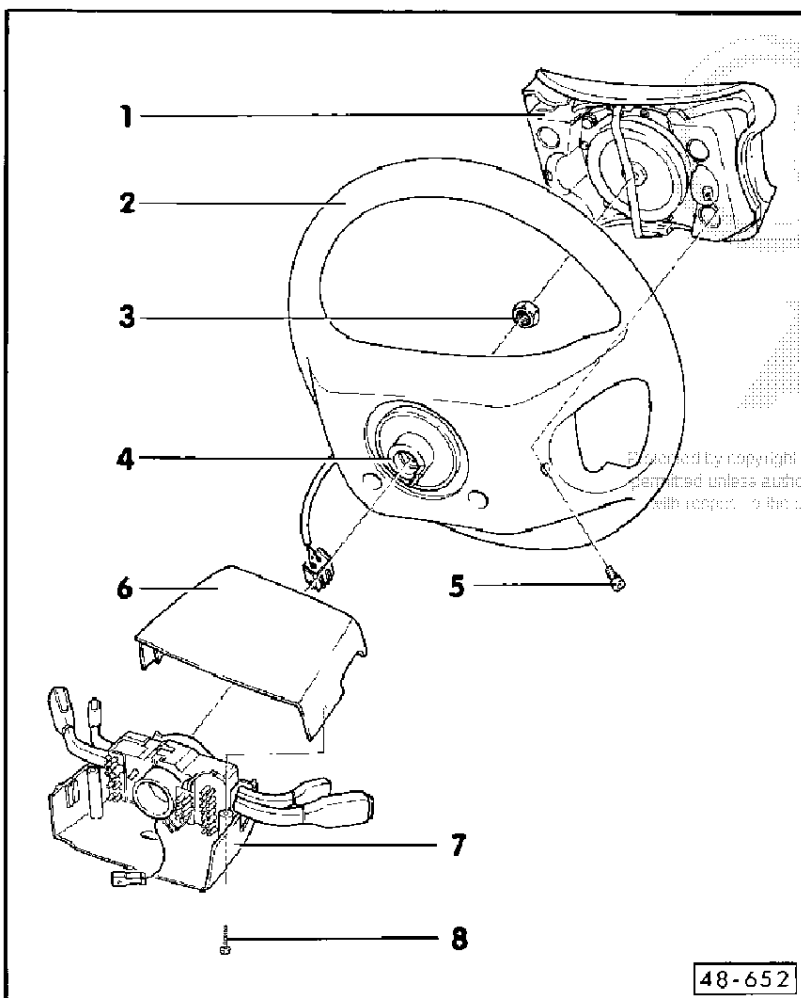
♦ Observe the safety instructions = > Electrical System; Repair Group 96; Servicing airbag, Safety precautions = >



2 - Steering wheel

- ◆ Removing and installing
=> Page 48-67
- ◆ Attach to steering column with wheels in straight-ahead position
- ◆ On attachment, turn signal indicator stalk must be in centre position
- ◆ Only install factory-approved steering wheels
- ◆ Replacement part supplied with self-centring ring and slip ring

3 - Hexagon nut, 40 Nm



4 - Self-centring ring with slip ring

- ◆ Available as replacement part
- ◆ Replace
=> Electrical System; Repair Group 96; Servicing airbag =>

5 - Securing bolt for airbag unit, 6 Nm

- ◆ Read installation note => Page 48-68.

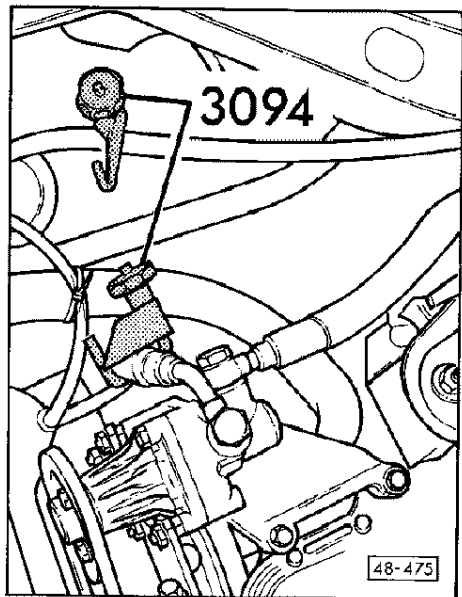
6 - Cover for steering column switch

7 - Steering column switch with bracket

8 - Self-tapping screw

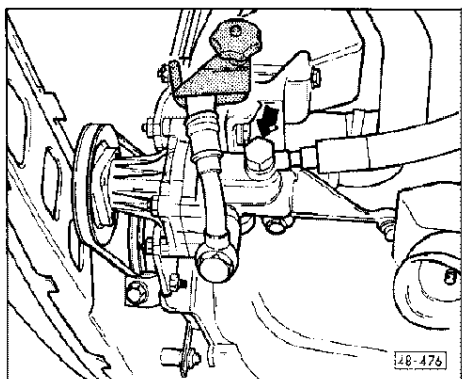
Checking delivery pressure of vane pump

Vehicles with 4-cylinder engine

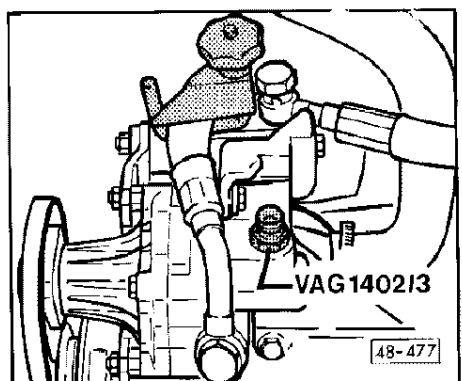


- ◀ - Pinch off suction and return pipes with hose clamps -3094-.

— 48-97 —



- ◀ - Unscrew expansion hose -arrow- from vane cell pump.

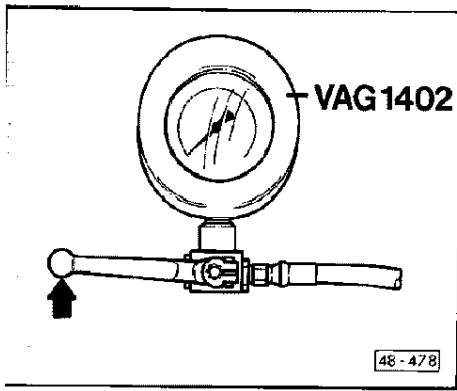


- ◀ - Remove copper seal from banjo bolt and attach to adapter - V.A.G 1402/3-.
- Screw adapter -V.A.G 1402/3- into vane pump in place of hollow bolt.

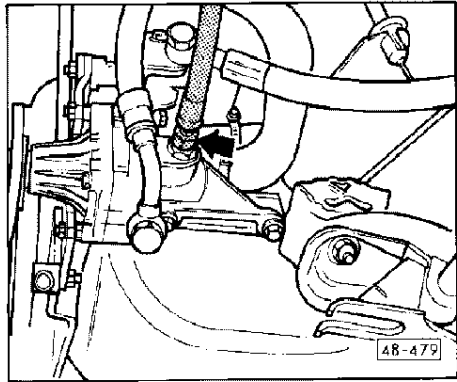
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— 48-98 —



- ◀ - Pressure gauge shutoff valve (lever set to left).
- Route hose of pressure gauge -V.A.G 1402- downwards to valve pump.

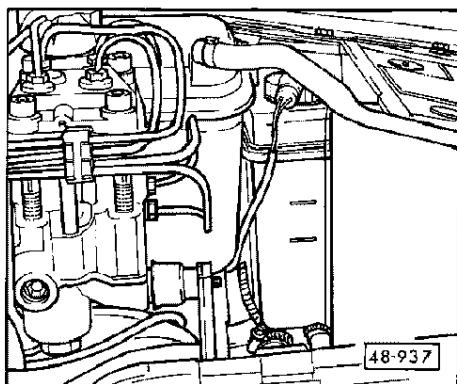


- ◀ - Screw hose for pressure gauge -V.A.G. 1402- to adapter - V.A.G 1402/3-.
- Remove hose clamps and start engine.
- Take pump pressure reading from pressure gauge at idling speed (measurement not longer than 10 seconds). Specified value: 110 – 110 bar.
- Switch off engine.

Note:

If specified value is not attained, check pressure and current limiting valve =>Page 48-127.

- Pinch off suction and return pipes with hose clamps -3094-.
- Unscrew hose for pressure gauge -V.A.G. 1402- from adapter - V.A.G 1402/3-.
- Unscrew adapter from pump
- Reattach expansion hose with banjo bolt and new seals to pump.
- Remove hose clamps and start engine.
- Start engine and let it idle for approx. 2 minutes with front wheels set to straight-ahead position.

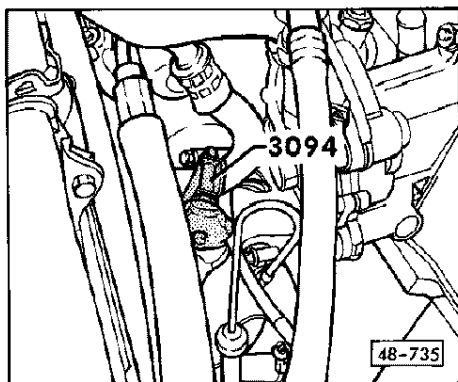


- ◀ - Switch off engine and immediately check hydraulic fluid level, paying attention to marks on reservoir/dipstick; top up to "MAX" mark if necessary
- Check steering system for leaks

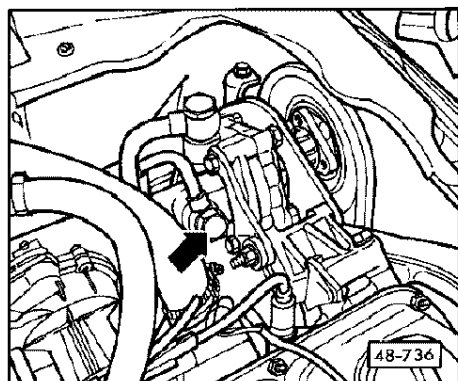
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Vehicles with 5-cylinder engine

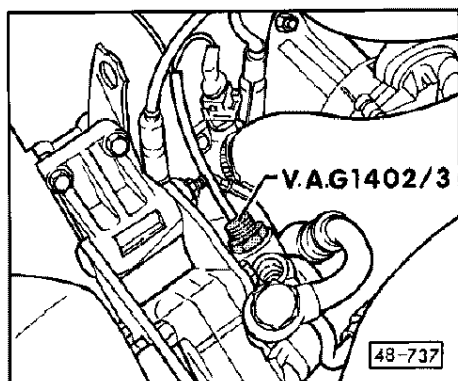


- ◀ – Attach hose clamp -3094- to suction hose.

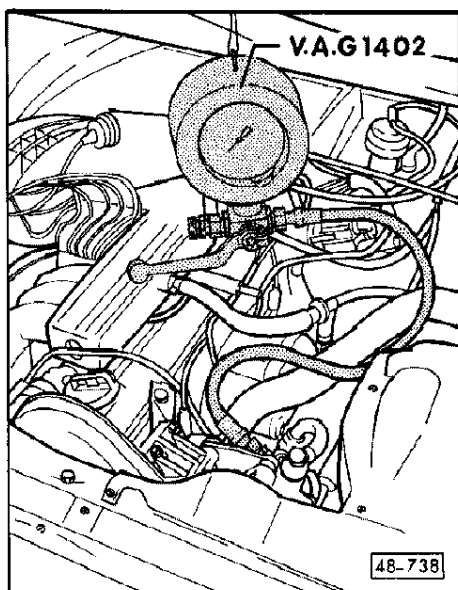


- ◀ – Unscrew expansion hose -arrow- from vane cell pump.
- Remove copper seal from banjo bolt and attach to adapter - V.A.G 1402/3-.

48-101



- ◀ – Screw adapter -V.A.G 1402/3- into vane pump in place of banjo bolt.



- ◀ – Pressure gauge shutoff valve (lever set to left).
- Screw hose for pressure gauge -V.A.G. 1402- onto adapter - V.A.G 1402/3-.
- Remove hose clamp and start engine.
- Take pump pressure reading from pressure gauge at idling speed (measurement not longer than 10 seconds). Specified value: 110 – 110 bar.
- Switch off engine.

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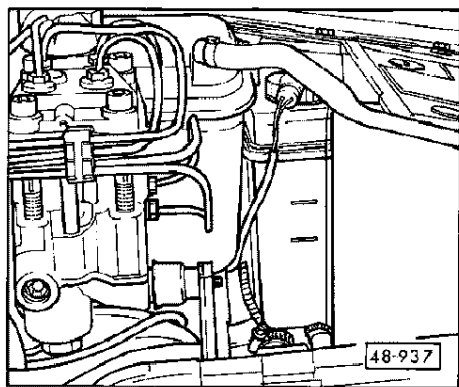


48-102

Note:

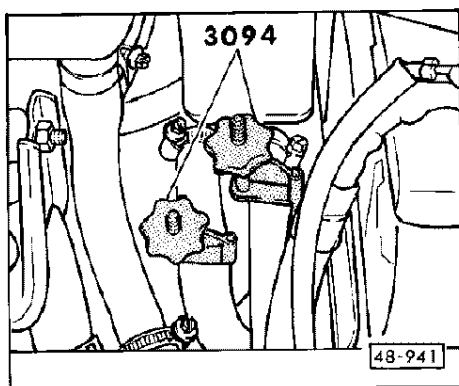
If specified value is not attained, check pressure and current limiting valve => Page 48-127.

- Pinch off suction hose with hose clamp -3094-
- Unscrew hose for pressure gauge -V.A.G. 1402- from adapter - V.A.G 1402/3-
- Unscrew adapter from pump
- Reattach expansion hose with banjo bolt and new seals to pump.
- Remove hose clamp and start engine.
- Start engine and let it idle for approx. 2 minutes with front wheels set to straight-ahead position.

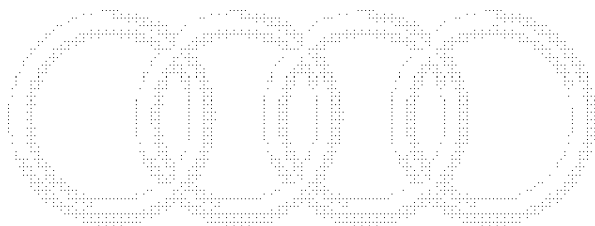


- ◀ - Switch off engine and immediately check hydraulic fluid level, paying attention to marks on reservoir/dipstick; top up to "MAX" mark if necessary
- Check steering system for leaks

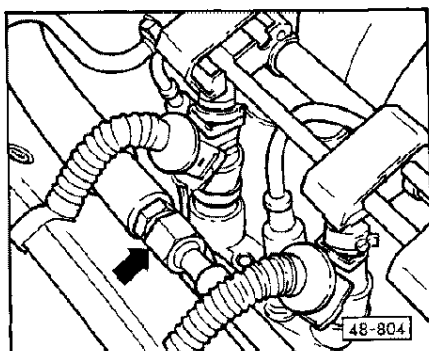
Vehicles with 6-cylinder engine



- ◀ - Pinch off suction and return pipes with hose clamps -3094-

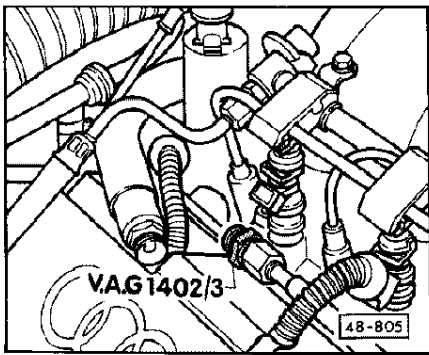


- ◀ - Press spring clip and remove plug from injector.
- Unscrew pipe from expansion hose (arrow); counterhold on hexagon of expansion hose.

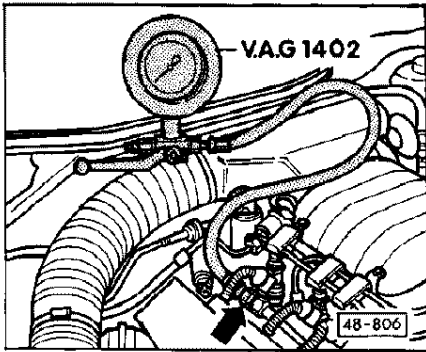


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- ◀ – Screw adapter V.A.G 1402/3 into pipe in place of expansion hose.



- ◀ – Screw hose of pressure gauge onto adapter V.A.G 1402/3.
- Close pressure gauge shutoff valve (lever set to left).
- Attach injector plug to injector.

- Remove hose clamps and start engine.
- Take pump pressure reading from pressure gauge at idling speed (measurement not longer than 10 seconds). Specified value: 110 – 110 bar.
- Switch off engine.

Note:

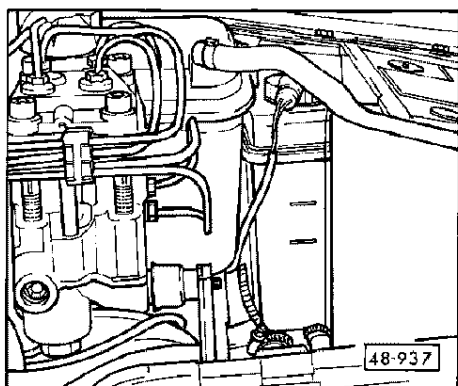
Replace vane pump if specified value is not attained => Page 48-133.

- Pinch off suction and return pipes with hose clamps -3094-.
- Press spring clip and remove plug from injector.
- Unscrew hose for pressure gauge -V.A.G. 1402- from adapter -V.A.G 1402/3-.
- Unscrew adapter from pipe.
- Screw pipe to expansion hose (arrow); for this purpose, counterhold at hexagon of expansion hose.
- Attach injector plug to injector.

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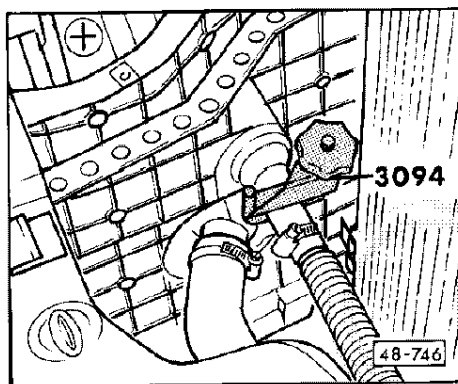


- Remove hose clamps and start engine.
- Start engine and let it idle for approx. 2 minutes with front wheels set to straight-ahead position.

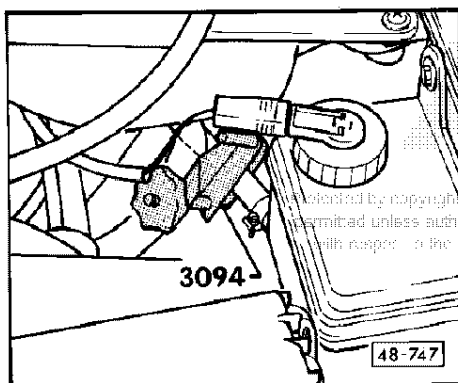


- ◀ - Switch off engine and immediately check hydraulic fluid level, paying attention to marks on reservoir/dipstick; top up to "MAX" mark if necessary
- Check steering system for leaks

169 kW engine, tandem pump



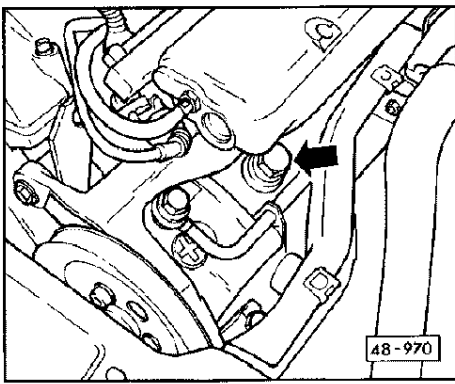
- Remove cover for air intake elbow.
- ◀ - Attach hose clamp -3094- to suction hose.



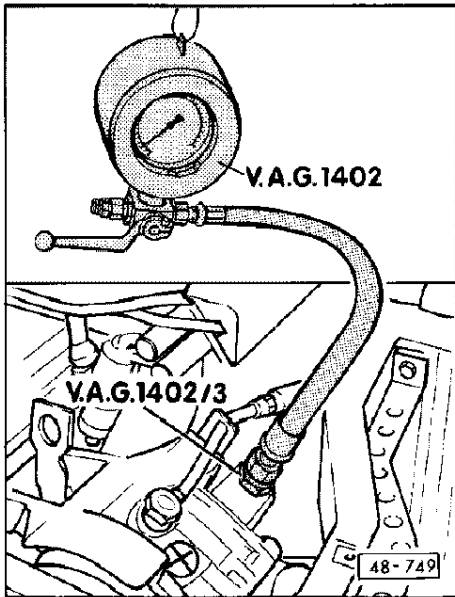
- ◀ - Attach hose clamp -3094- at return hose to reservoir

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- ◀ - Unscrew expansion hose -arrow- from vane cell pump.
- Remove copper seal from banjo bolt and attach to adapter - V.A.G 1402/3-.

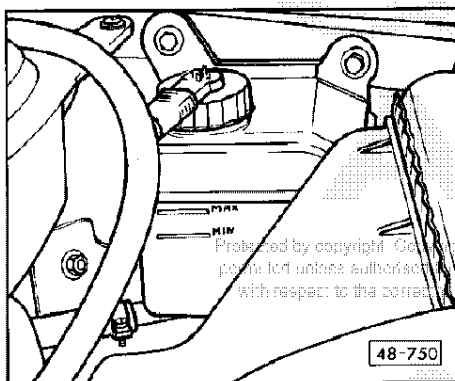


- ◀ - Screw adapter -V.A.G 1402/3- into vane pump in place of hollow bolt.
- Pressure gauge shutoff valve (lever set to left).
- Screw hose for pressure gauge -V.A.G. 1402- onto adapter - V.A.G 1402/3-.
- Remove hose clamps and start engine.
- Take pump pressure reading from pressure gauge at idling speed (measurement not longer than 10 seconds). Specified value: 110 – 110 bar.
- Switch off engine.

Note:

If specified value is not attained, replace tandem pump.

- Disconnect suction and return pipes with hose clamps -3094-.
- Unscrew hose for pressure gauge -V.A.G. 1402- from adapter - V.A.G 1402/3-.
- Unscrew adapter from pump
- Reattach expansion hose with banjo bolt and new seals to pump.
- Remove hose clamps and start engine.
- Start engine and let it idle for approx. 2 minutes with front wheels set to straight-ahead position.
- ◀ - Switch off engine and immediately check hydraulic fluid level, paying attention to marks on reservoir/dipstick; top up to "MAX" mark if necessary
- Check steering system for leaks



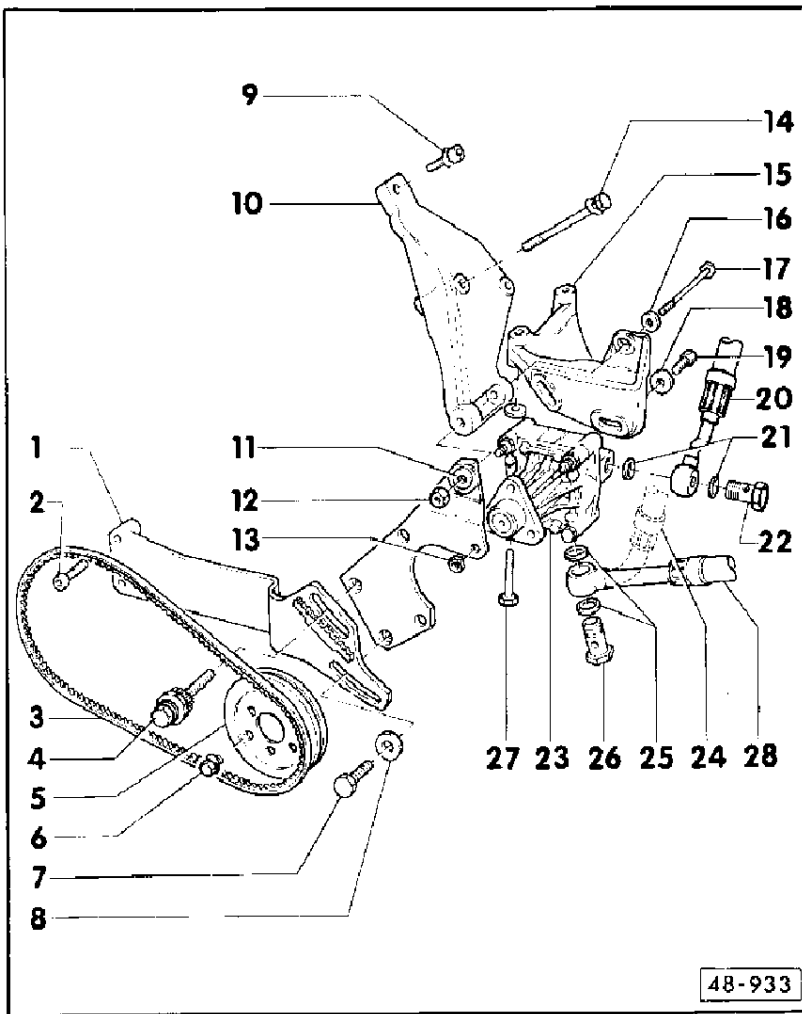
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Removing and installing vane pump, 4-cylinder engine

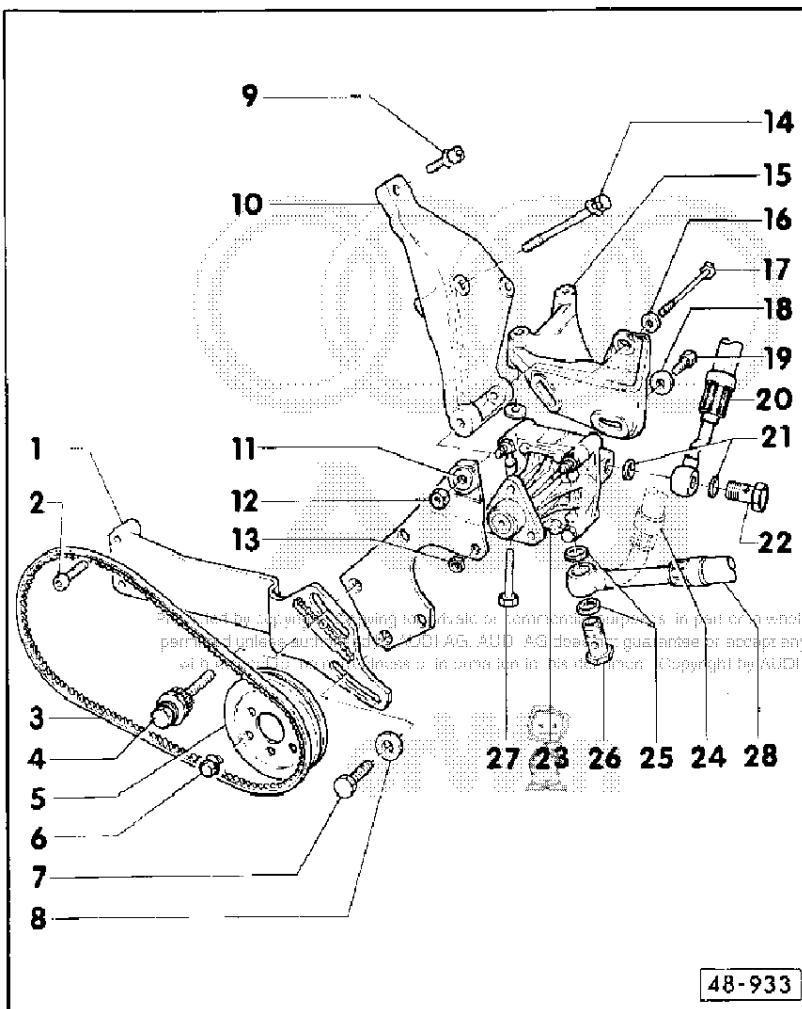
Note:

The power-assisted steering uses hydraulic fluid, part no. G 002 000.



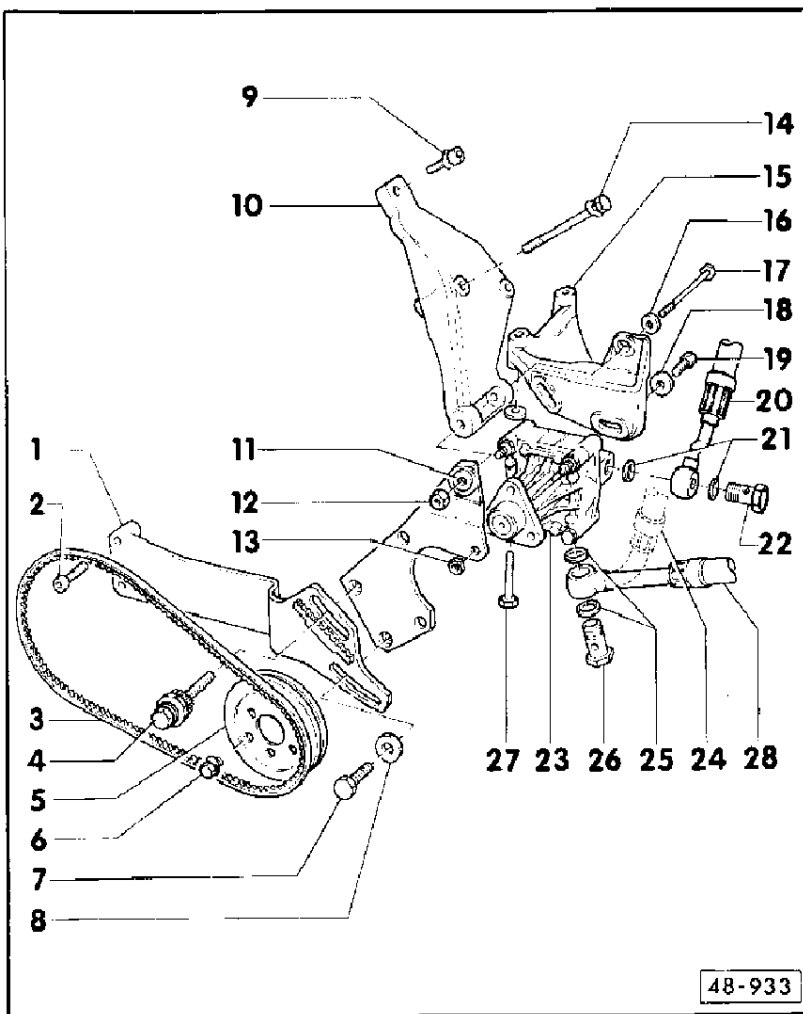
- 1 - Tensioning bracket
- 2 - Cheese-head bolt, 20 Nm
- 3 - V-belt
 - ◆ 2-valve spark-ignition engines: 9.5 x 910 mm
 - ◆ 4-valve engines: 9.5 x 880 mm
- 4 - Bolt with tensioning nut
 - ◆ Tensioning or replacing V-belt => Page 48-116

48-111

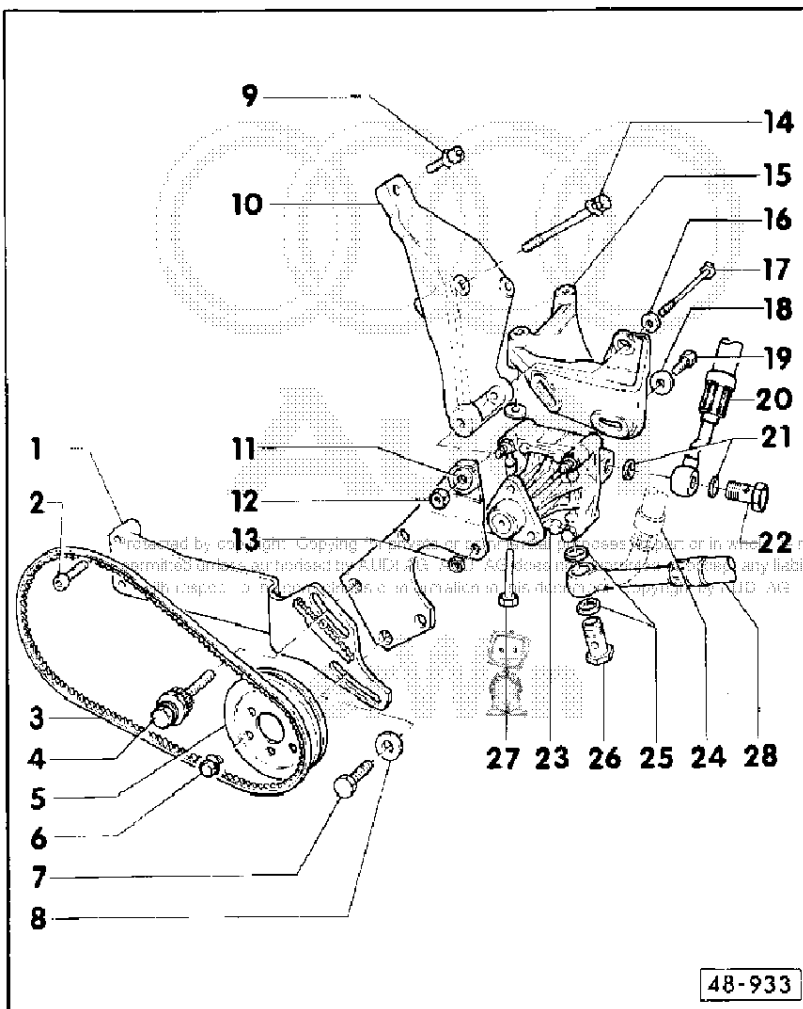


- 5 - V-belt pulley
 - ◆ V-belt pulley of crankshaft and vane pump must line up.
 - ◆ Different versions for vehicles with 2- and 4-valve engines
- 6 - Hexagon bolt, 20 Nm
- 7 - Hexagon bolt, 25 Nm
- 8 - Washer
- 9 - Cheese-head bolt, 20 Nm
- 10 - Bracket
- 11 - Front swivel bracket
- 12 - Self-locking nut, 20 Nm
 - ◆ Always replace
- 13 - Hexagon nut, 20 Nm

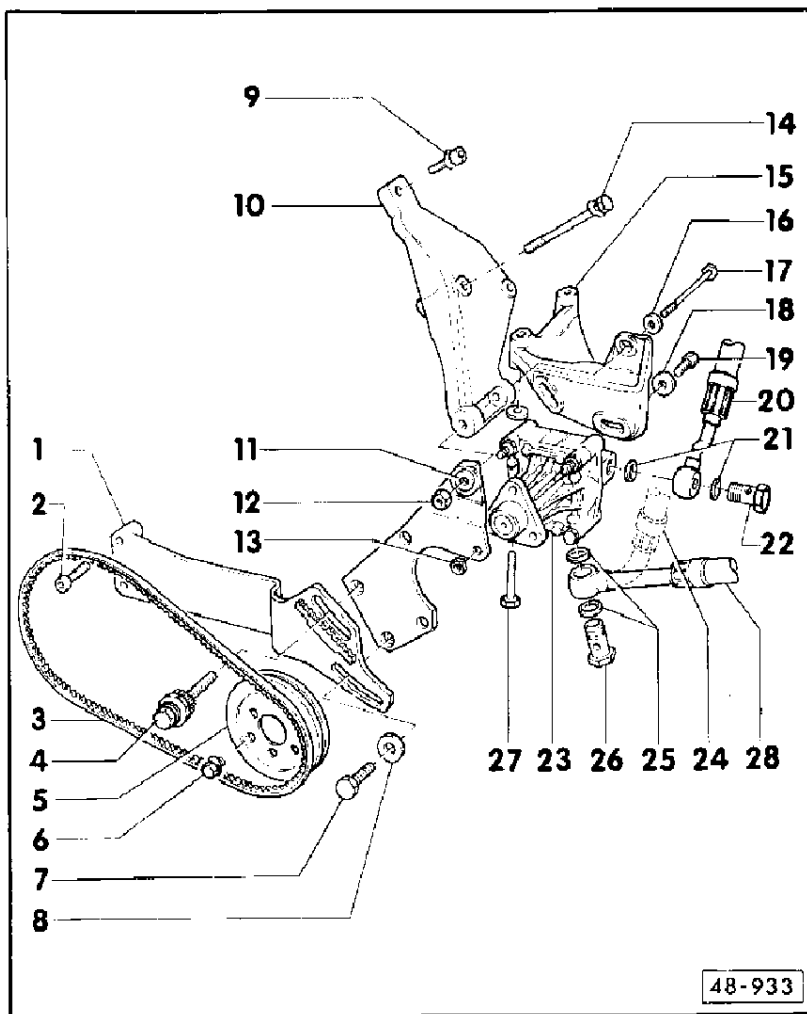
48-112



- 14 - Hexagon bolt, 20 Nm
- 15 - Rear swivel bracket
- 16 - Washer
- 17 - Hexagon bolt
- 18 - Washer
- 19 - Hexagon bolt
- 20 - Expansion hose
 - ◆ Note different versions for LHD and RHD vehicles
- 21 - Oil seal
 - ◆ Always replace
- 22 - Banjo bolt, 50 Nm



- 23 - Vane cell pump
 - ◆ Checking delivery pressure => Page 48-97
 - ◆ Servicing => Page 48-121
 - ◆ Before installing, fill with hydraulic fluid at suction end and crank by hand until fluid comes out at pump outlet.
- 24 - Suction hose
 - ◆ For vehicles with 2-valve engine
- 25 - Oil seal
 - ◆ Always replace



26 – Banjo bolt, 50 Nm

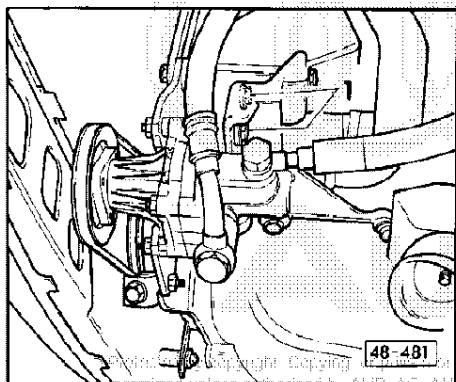
27 – Hexagon bolt, 20 Nm

28 – Suction hose

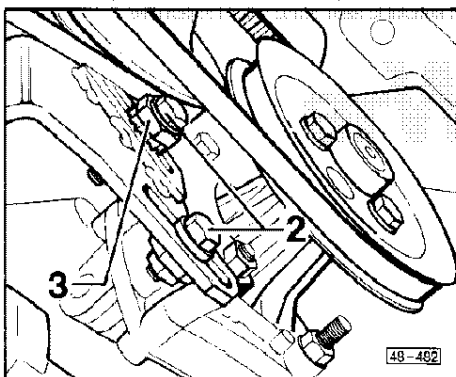
◆ For vehicles with 4-valve engine

◆ If vane pump is provided with screw fitting, suction hose is secured by means of a hose clamp => Page 48-137, -Item 15- and => Page 48-138, -Item 16-.

Tensioning or replacing V-belt for vane pump



← – Loosen bolts -1- (second bolt not invisible)



← – Undo bolt -2-.
– Turn tensioning nut -3- accordingly.

Note:

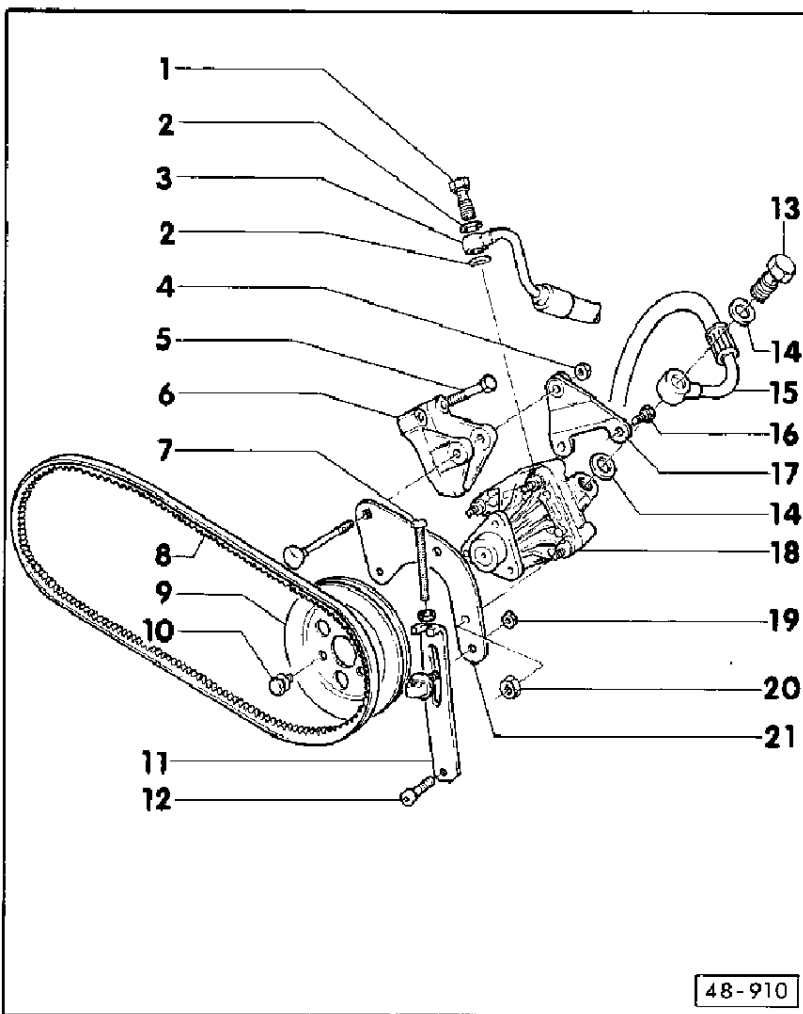
V-belt is properly tensioned if it can be deflected approx. 10 mm with thumb between the two pulleys.

– Retighten all the loosened bolts.

Removing and installing ZF vane pump, 5-cylinder engine

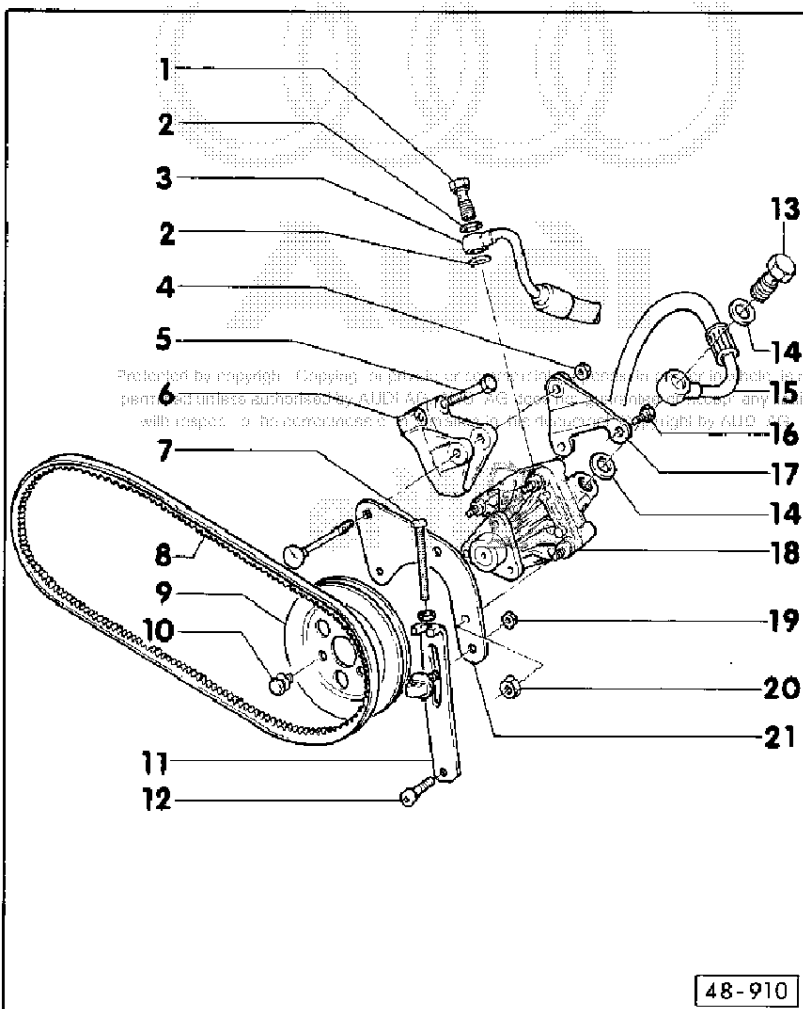
Note:

The power-assisted steering uses hydraulic fluid, part no. G 002 000.



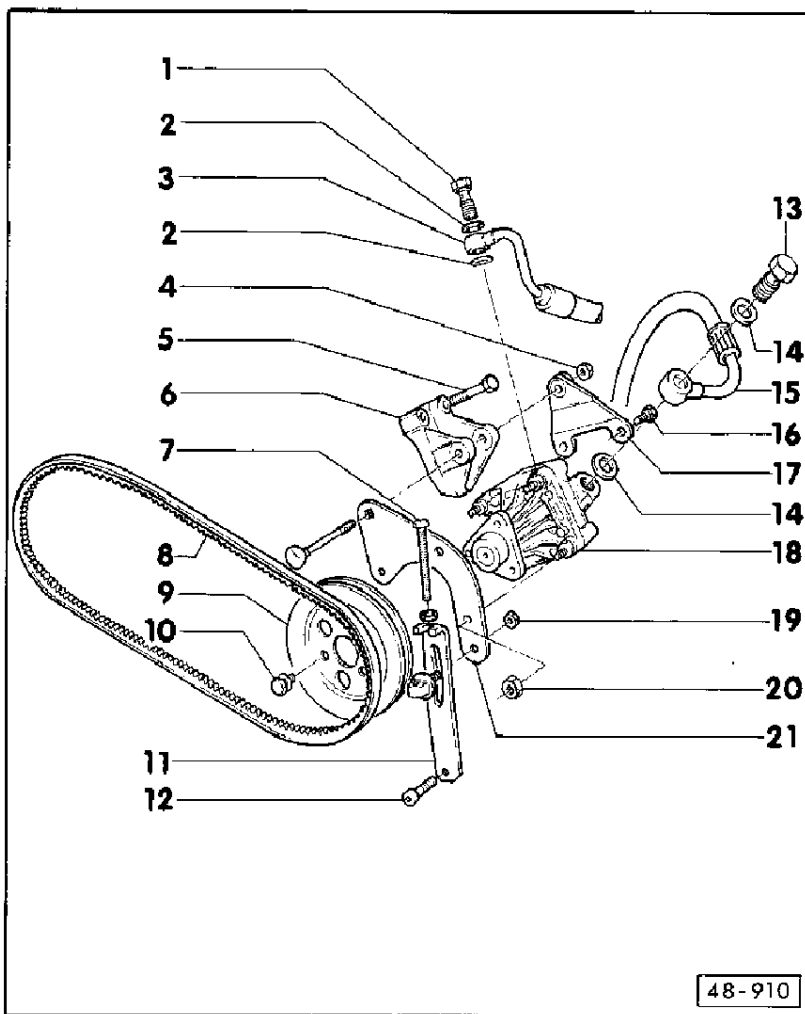
- 1 - Banjo bolt, 50 Nm
- 2 - Oil seal
 - ◆ Always replace
- 3 - Expansion hose
 - ◆ Note that there are different versions:
- 4 - Self-locking nut, 20 Nm
 - ◆ Always replace
- 5 - Hexagon bolt, 20 Nm
- 6 - Bracket

48-117



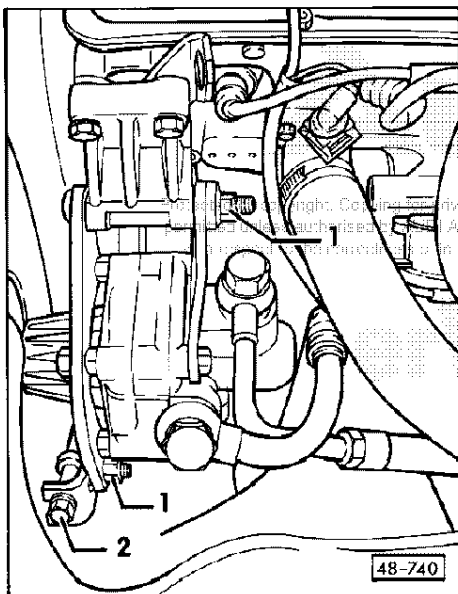
- 7 - Tensioning bolt
 - ◆ Tensioning or replacing V-belt
=> Page 48-120
- 8 - V-belt
 - ◆ Size: 12.5 x 992 mm
- 9 - V-belt pulley
 - ◆ V-belt pulley of crankshaft and vane pump must line up.
 - ◆ Installation position: With pulley fitted, "4Z" must be visible from front.
- 10 - Hexagon bolt, 20 Nm
- 11 - Retainer
- 12 - Cheese-head bolt, 20 Nm
- 13 - Banjo bolt, 50 Nm

48-118



- 14 - Oil seal
◆ Always replace
- 15 - Suction hose
- 16 - Hexagon bolt, 20 Nm
- 17 - Rear swivel bracket
- 18 - Vane cell pump
◆ Checking delivery pressure => Page 48-101
◆ Servicing => Page 48-121
◆ Before installing, fill with hydraulic fluid at suction end and crank by hand until fluid comes out at pump outlet.
- 19 - Self-locking nut, 20 Nm
◆ Always replace
- 20 - Hexagon nut, 20 Nm
- 21 - Front swivel bracket

Tensioning or replacing V-belt for ZF vane pump



- ◀ - Undo nut -1-.
- Turn bolt -2- of tensioner appropriately.

Note:

V-belt is properly tensioned if it can be deflected approx. 10 mm with thumb between the two pulleys.

- Tighten nut -1-

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Servicing vane pump, ZF pump

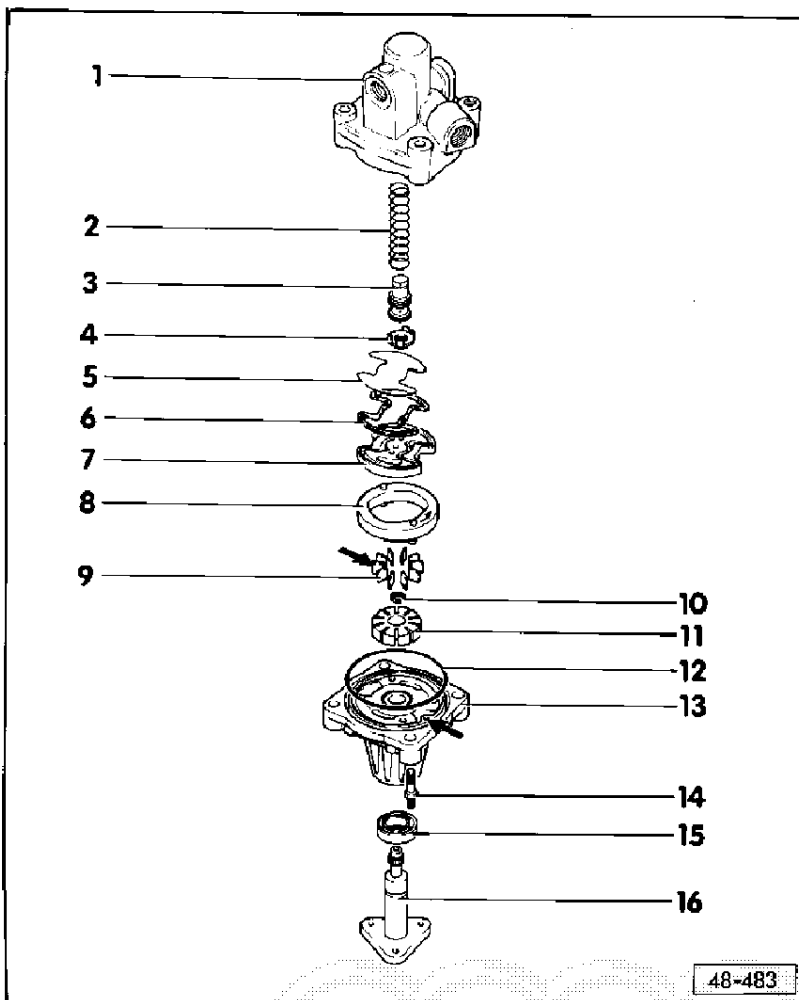
Notes:

- ◆ The vane pump uses hydraulic fluid, part no. G 002 000
- ◆ All parts marked with an asterisk are contained in the repair set and are to be replaced when servicing.
- ◆ Moisten all sealing elements with hydraulic fluid before installing.

1 - Housing

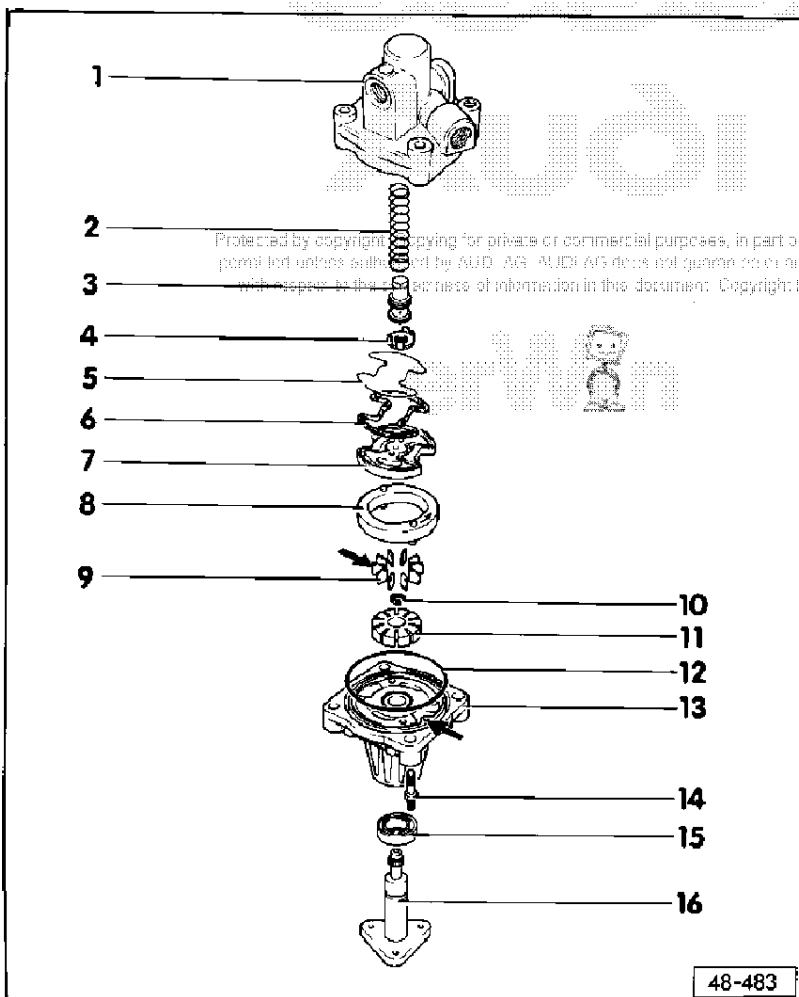
- ◆ Blow through ducts

2 - Spring



48-483

48-121



48-483

3 - Pressure and current limiting valve

- ◆ Insert in housing
- ◆ Checking => Page 48-127, do not disassemble

4 - Assembly fastener for pressure and current limiting valve

- ◆ Carefully prise out with a small screwdriver

Note:

Assembly fastener is pretensioned with pressure spring.

- ◆ Inserting => Fig. 1

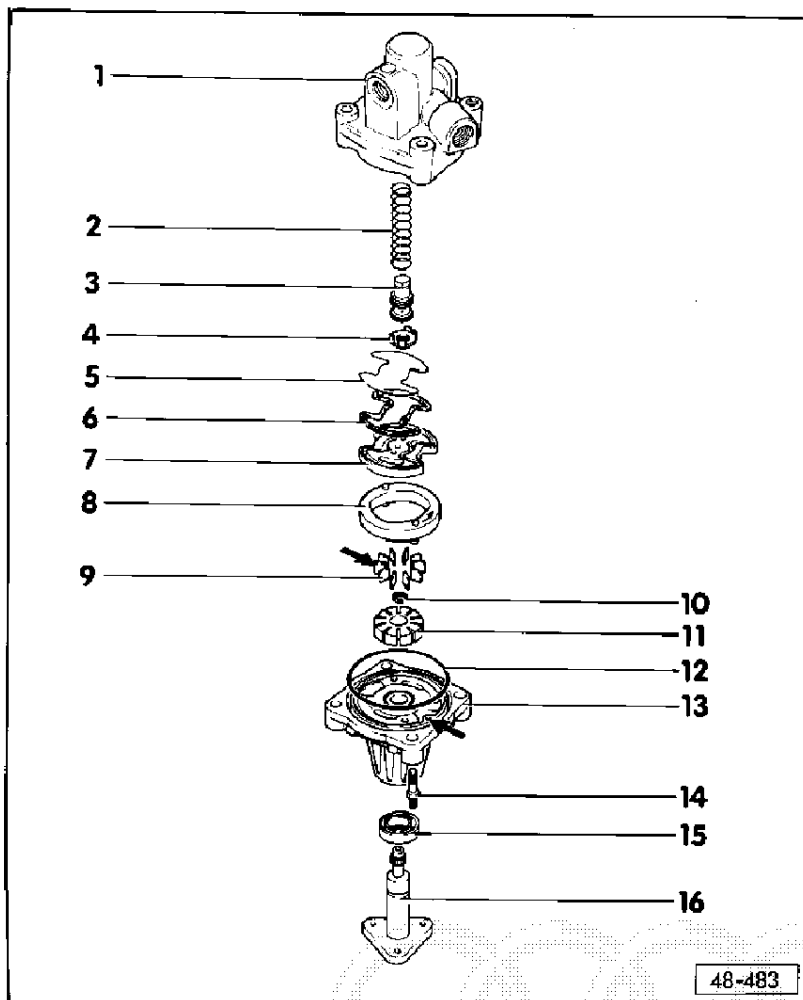
5 - Moulded support for seal *

- ◆ Position on seal

6 - Seal *

7 - Transfer plate

48-122



48-483

8 - Stator

- ◆ Installation position: Arrow on stator must be visible after assembly.

9 - Vane cells

- ◆ Ground (bright) end face - arrow- faces outwards

10 - Circlip *

- ◆ Removing and installing => Fig. 4

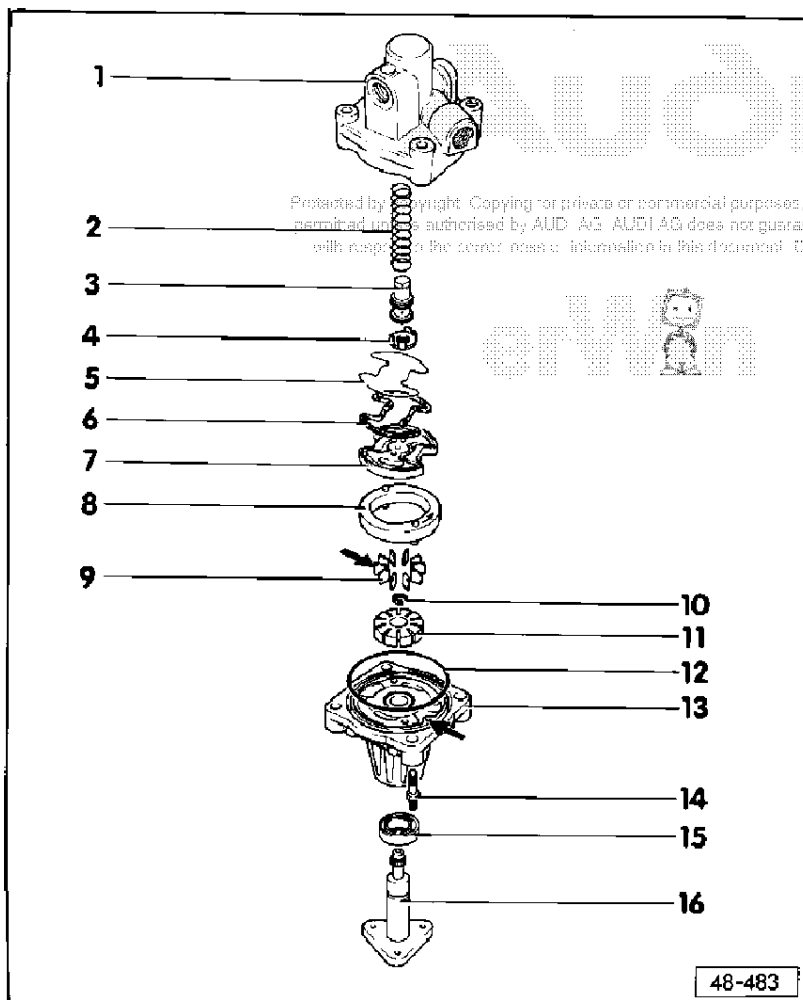
Note:

The repair set contains two different circlips. Always fit the same type of new circlip.

11 - Rotor

- ◆ Removing and installing => Fig. 4

12 - O-ring *



48-483

13 - Housing

- ◆ Fluid duct in both housing halves -arrow- must coincide on assembly

14 - Bolt, 15 Nm

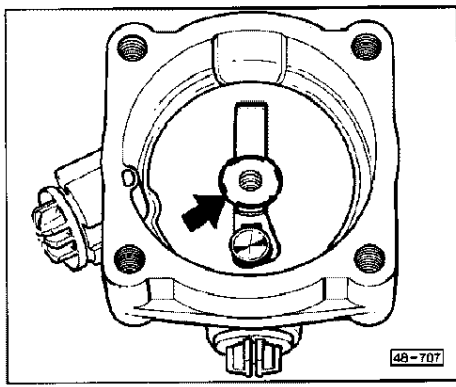
- ◆ Apply -D6- when fitting, screw long end into pump housing

15 - Seal *

- ◆ Disassemble pump to replace
- ◆ Extracting => Fig. 2
- ◆ Driving home => Fig. 3

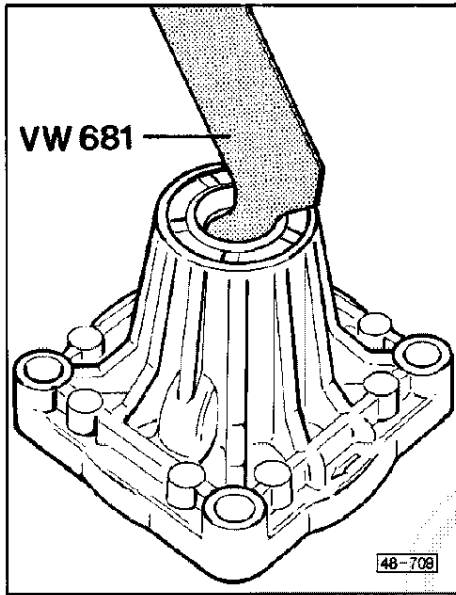
16 - Pump shaft with flange

- ◆ Check for scoring and running marks, replace entire pump if necessary
- ◆ Remove rotor and pump shaft to replace seal

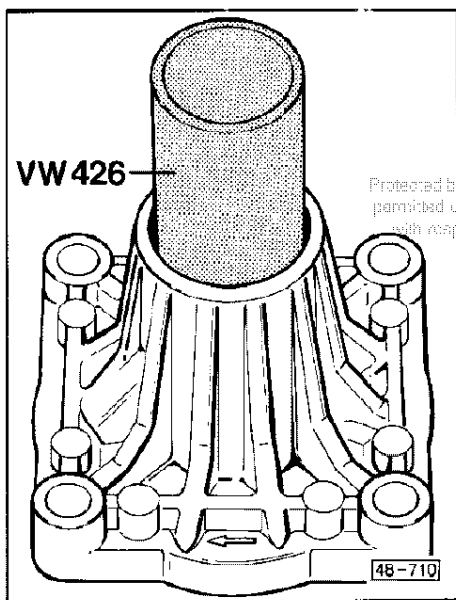


◀ **Fig.1 Inserting assembly fastener for pressure and current limiting valve in hole in housing**

- The fastener holds the valve in position. Press in fastener flush with hole in housing.

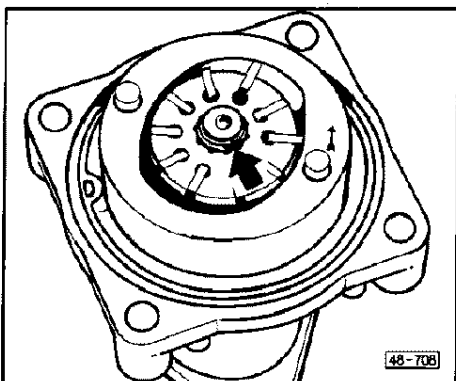


◀ **Fig.2 Pulling out seal**



◀ **Fig.3 Driving seal home**

- Fill space between sealing lips with multi-purpose grease.



◀ **Fig.4 Removing and installing circlip**

- Use pointed pliers to remove circlip -arrow- from groove; take off rotor.

Checking pressure and current limiting valve

Attention

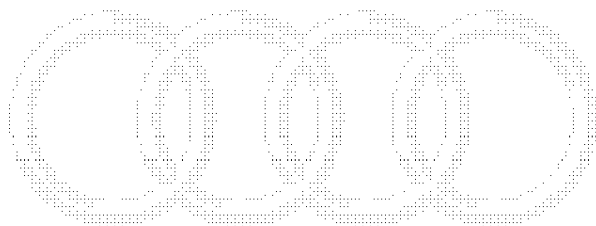
If the pressure and current limiting valve is not functioning properly, this will result in sporadic failure of the power steering.

- Check valve piston and hole in pump housing for wear.

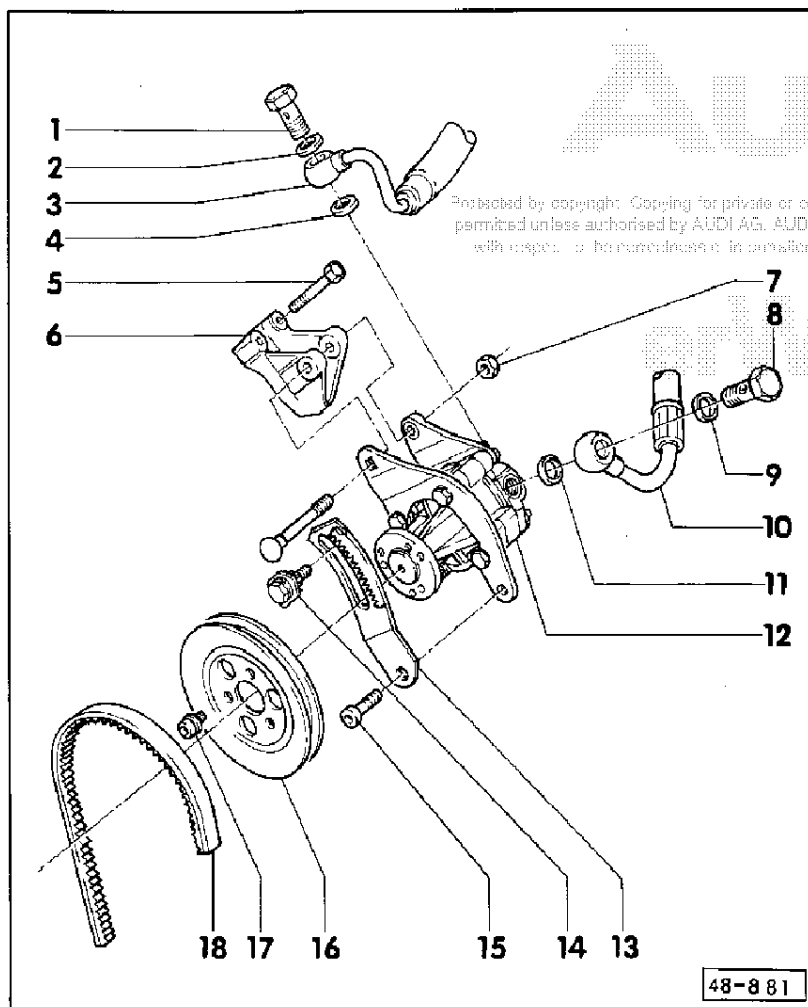
Note:

There must not be any dirt in the holes in the valve piston. Furthermore, the piston must move freely in the hole in the housing.

- Replace vane pump if maximum pump pressure is not attained after performing this check.



48-127

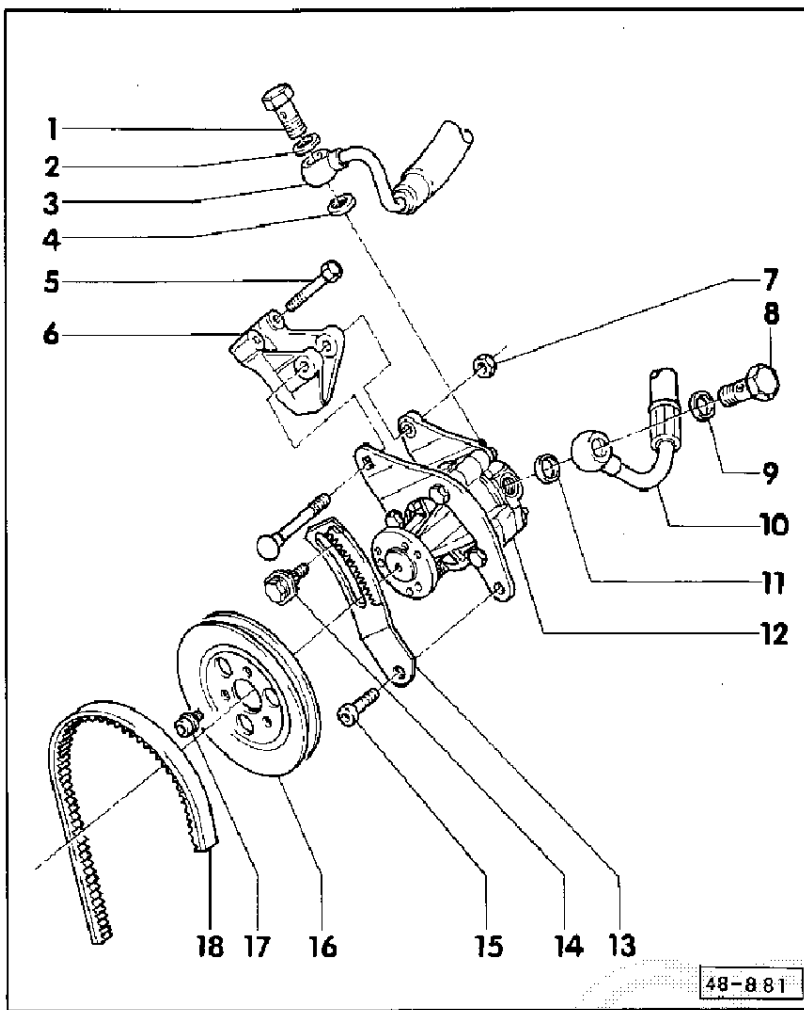


Removing and installing Vickers vane pump, 5-cylinder engine

Notes:

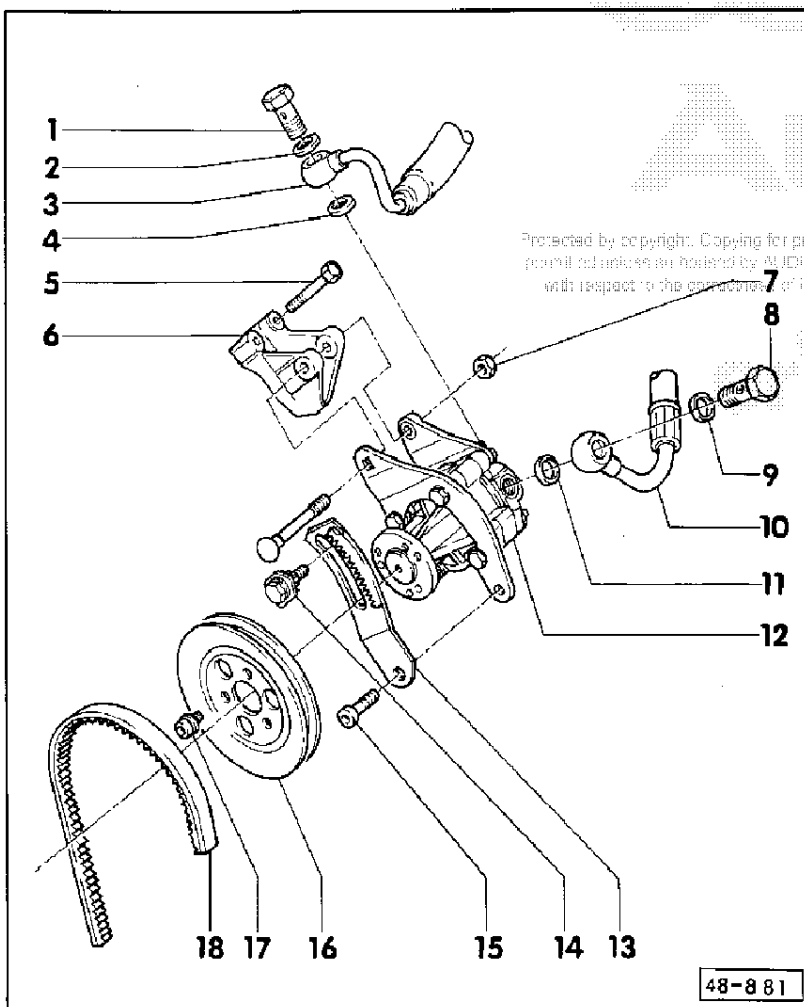
- ◆ The power-assisted steering uses hydraulic fluid, part no. G 002 000.
- ◆ The Vickers pump is supplied as replacement part complete with fitted V-belt pulley and front and rear swivel brackets. Vickers pump servicing is not envisaged. If a ZF pump is fitted instead of a Vickers pump, the front and rear swivel brackets must be ordered separately and fitted on the ZF pump. For cost reasons the same make should therefore always be fitted if at all possible when performing repairs.

48-128



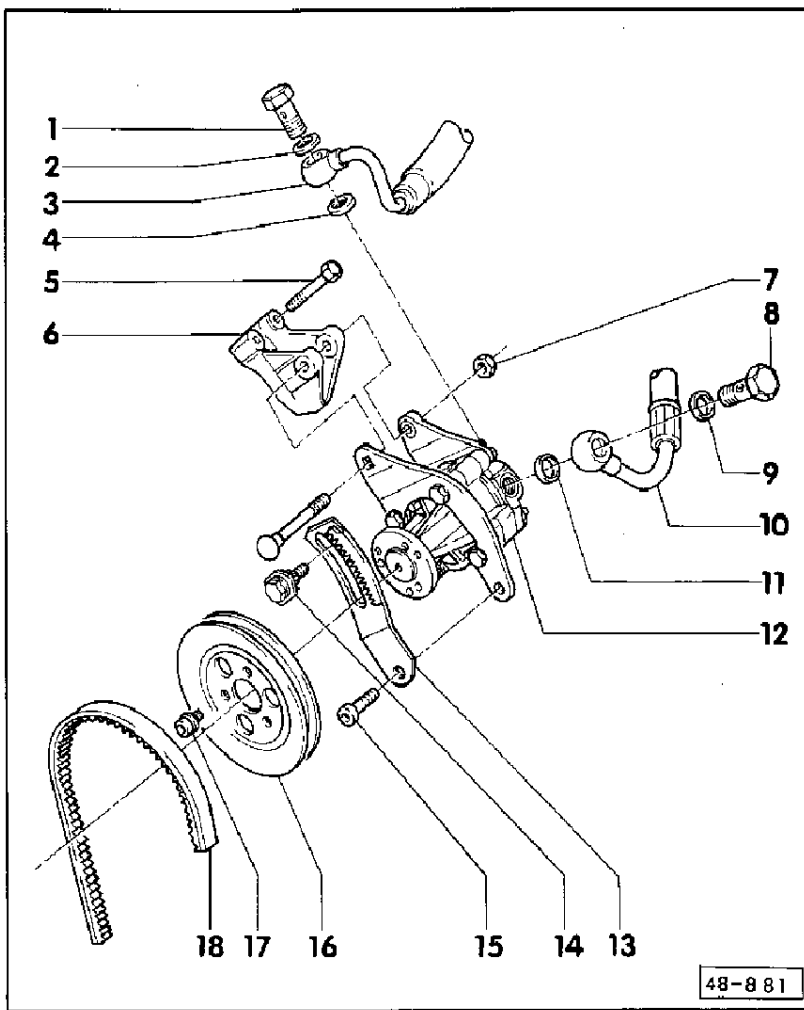
- 1 - Banjo bolt, 50 Nm
- 2 - Oil seal
◆ Always replace
- 3 - Expansion hose
◆ Note that there are different versions:
- 4 - Oil seal
◆ Always replace
- 5 - Hexagon bolt, 20 Nm
- 6 - Bracket
- 7 - Self-locking nut, 20 Nm
◆ Always replace
- 8 - Banjo bolt, 50 Nm
- 9 - Oil seal
◆ Always replace

48-129



- 10 - Suction hose
- 11 - Oil seal
◆ Always replace
- 12 - Vane cell pump
◆ Supplied as replacement part with fitted V-belt pulley and front and rear swivel brackets.
◆ Checking delivery pressure => Page 48-101
◆ Before installing, fill with hydraulic fluid at suction end and crank by hand until fluid comes out at pump outlet.
- 13 - Tensioning bracket
- 14 - Bolt with tensioning nut
◆ Tensioning or replacing V-belt => Page 48-132

48-130



15 – Cheese-head bolt, 20 Nm

16 – V-belt pulley

◆ With pulley fitted, "4Z" must be visible from front.

◆ V-belt pulley of crankshaft and vane pump must line up.

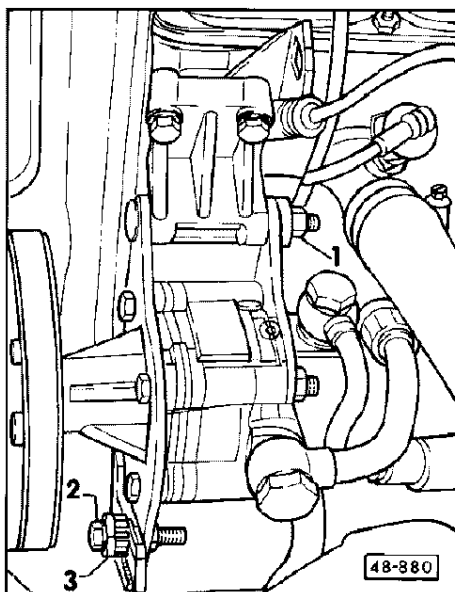
17 – Cheese-head bolt, 25 Nm

18 – V-belt

◆ Size: 12.5 x 992 mm

48-131

Tensioning or replacing V-belt for Vickers vane pump



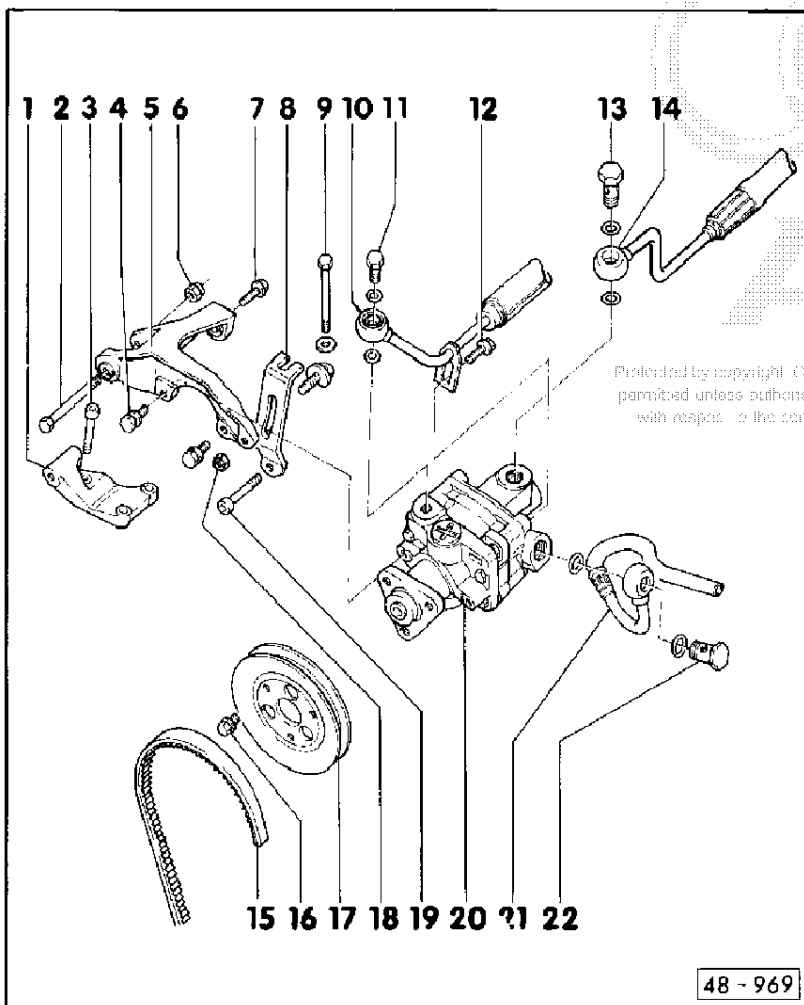
- ◀ – Loosen nut -1-.
- Loosen bolt -2-.
- Turn tensioning nut -3- accordingly.

Note:

V-belt is properly tensioned if it can be deflected approx. 10 mm with thumb between the two pulleys.

- Tighten bolt -2-.
- Tighten nut -1-.

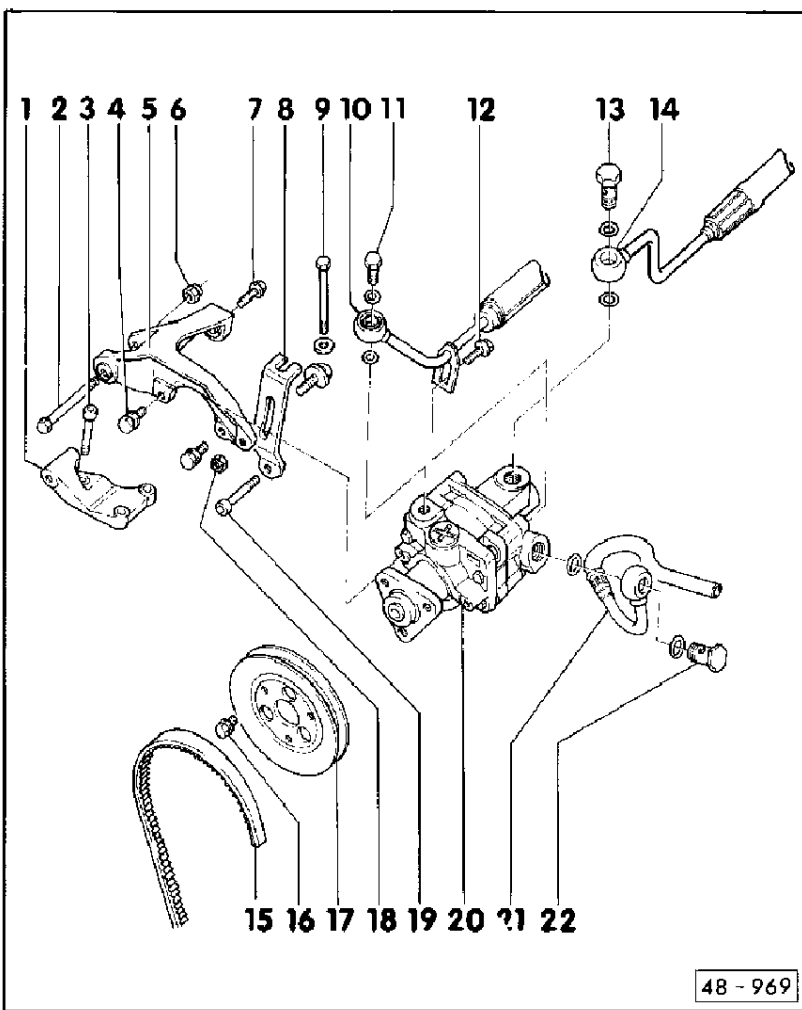
48-132



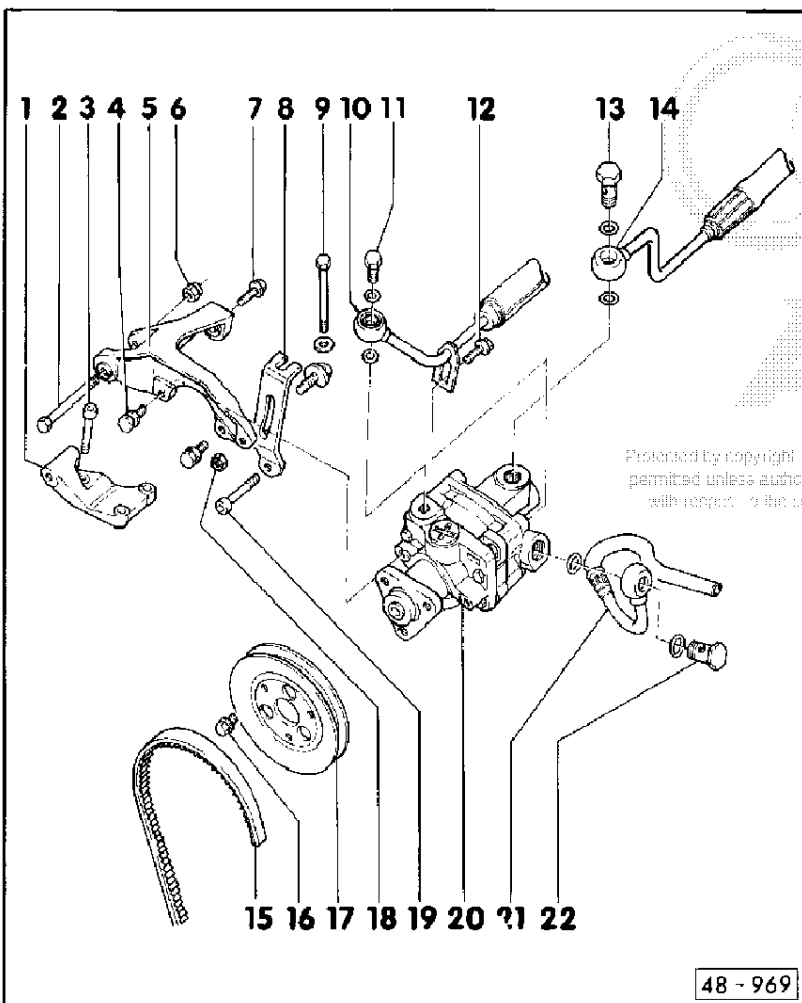
Removing and installing tandem pump, vehicles with 169 kW engine

Notes:

- ◆ The tandem pump uses hydraulic fluid, part no. G 002 000.
- ◆ Always replace seals between the line connections.
- ◆ Servicing of tandem pump is not envisaged.
- Remove cover for air intake elbow
- Unscrew securing bracket for air intake elbow at cowl panel.



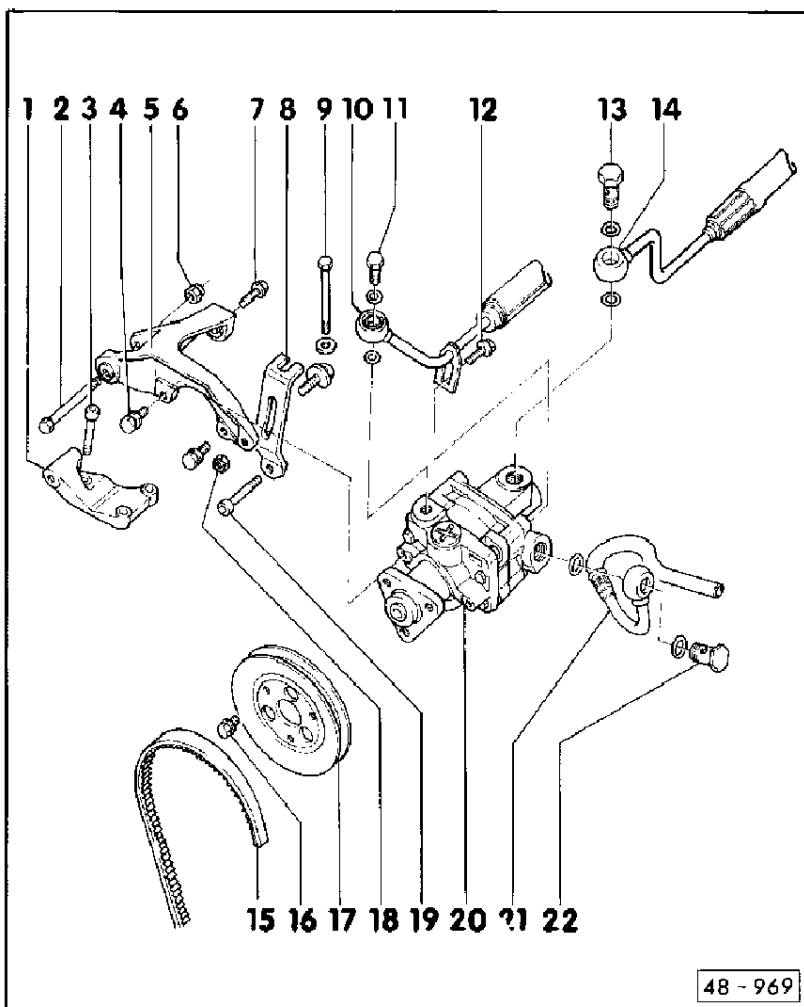
- Unfasten bolt securing swivel bracket to bracket
- Unscrew tensioning bracket from swivel bracket
- Remove V-belt
- Unscrew lines from tandem pump
- Unfasten centre section of lock plate
- Remove bolt securing swivel bracket to bracket and take out pump



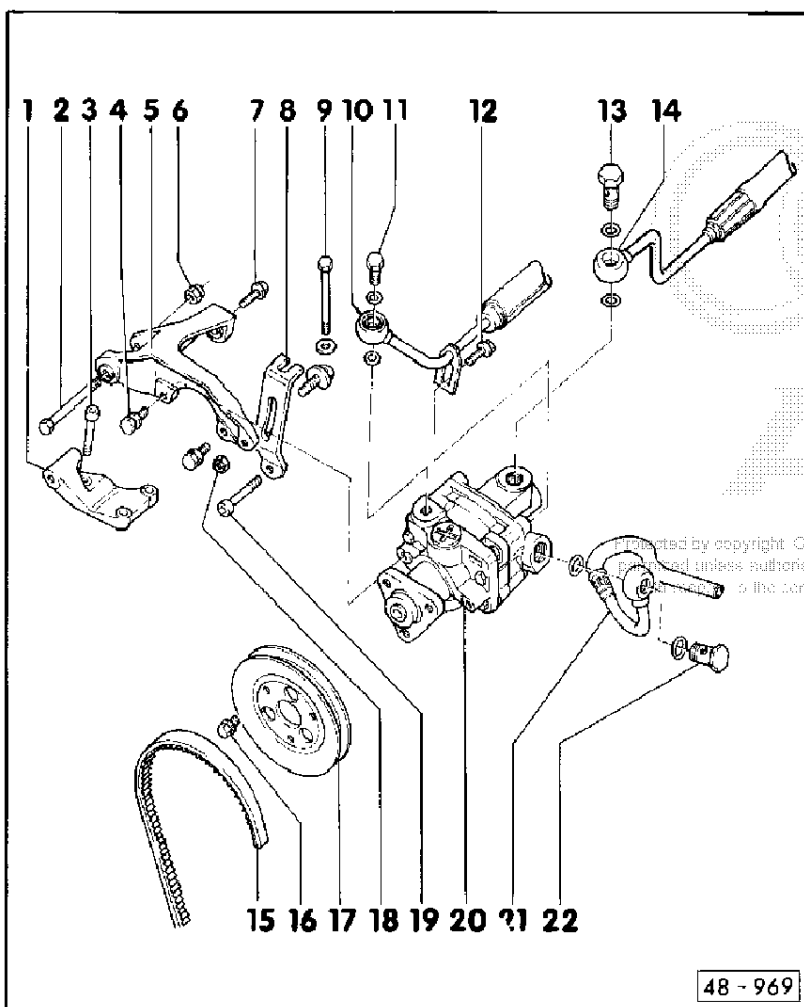
- 1 - Bracket
- 2 - Hexagon bolt, 20 Nm
- 3 - Cheese-head bolt, 20 Nm
- 4 - Self locking bolt, 30 Nm
◆ Always replace

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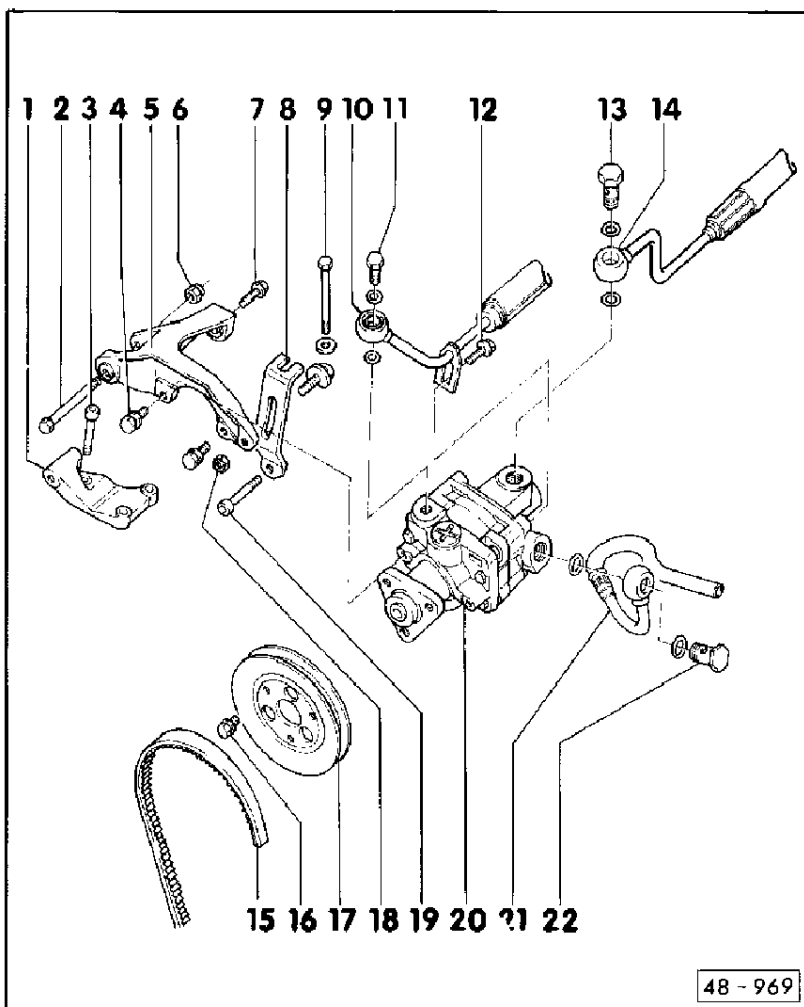


- 5 – Swivel bracket
- 6 – Collar nut
- 7 – Hexagon bolt, 20 Nm
- 8 – Retainer
- 9 – Hexagon bolt
 - ◆ Turn accordingly to tension V-belt
- 10 – High-pressure hose
 - ◆ Hydraulic pump – pressure accumulator
- 11 – Banjo bolt, 35 Nm
 - ◆ Only use banjo bolt with strainer on end face
- 12 – Hexagon bolt, 20 Nm



- 13 – Banjo bolt, 50 Nm
- 14 – Expansion hose
- 15 – V-belt
 - ◆ Size: 12.5 x 1045 mm
 - ◆ Tensioning and replacing => Page 48-146
- 16 – Hexagon bolt, 20 Nm
- 17 – V-belt pulley
 - ◆ Installation position: With pulley fitted, "5Z" must be visible from front

- 18 – Collar nut, 20 Nm



19 – Cheese-head bolt, 20 Nm

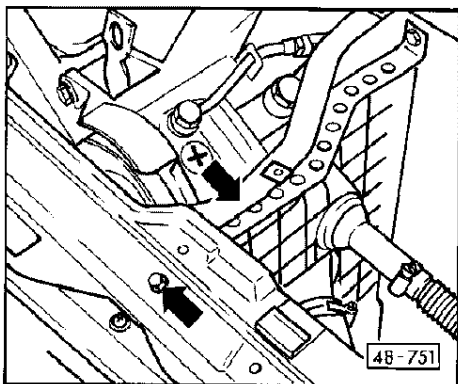
20 – Tandem pump

- ◆ Checking delivery pressure of vane pump => Page 48-108
- ◆ Before installing, crank suction end by hand until fluid comes out at pump outlet
- ◆ Measuring piston pump delivery => Page 47-57
- ◆ Servicing not envisaged, fit exchange pump if necessary

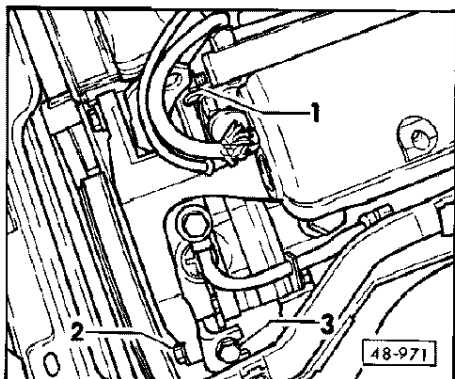
21 – Suction hose

22 – Banjo bolt, 50 Nm

Tensioning or replacing V-belt for tandem pump



- Remove cover for air intake elbow
- Unscrew securing bolt for holder of air intake elbow at cowl panel
- Press air intake elbow aside



- Unfasten nuts -1- and -2-
- Turn bolt -3- of tensioner accordingly.

Note: *V-belt is properly tensioned if it can be deflected approx. 10 mm with thumb between the two pulleys.*

- Tighten nuts -1- and -2-

Removing and installing hydraulic fluid cooler for vane pump

Vehicles with 4-cylinder and 4-valve engine, vehicles with 6-cylinder engine

1 – Oval-head bolt, 10 Nm

2 – Lock carrier

3 – Washer

4 – Bracket

5 – Tab

6 – Self-locking nut, 10 Nm
◆ Always replace

7 – Washer

8 – Return hose

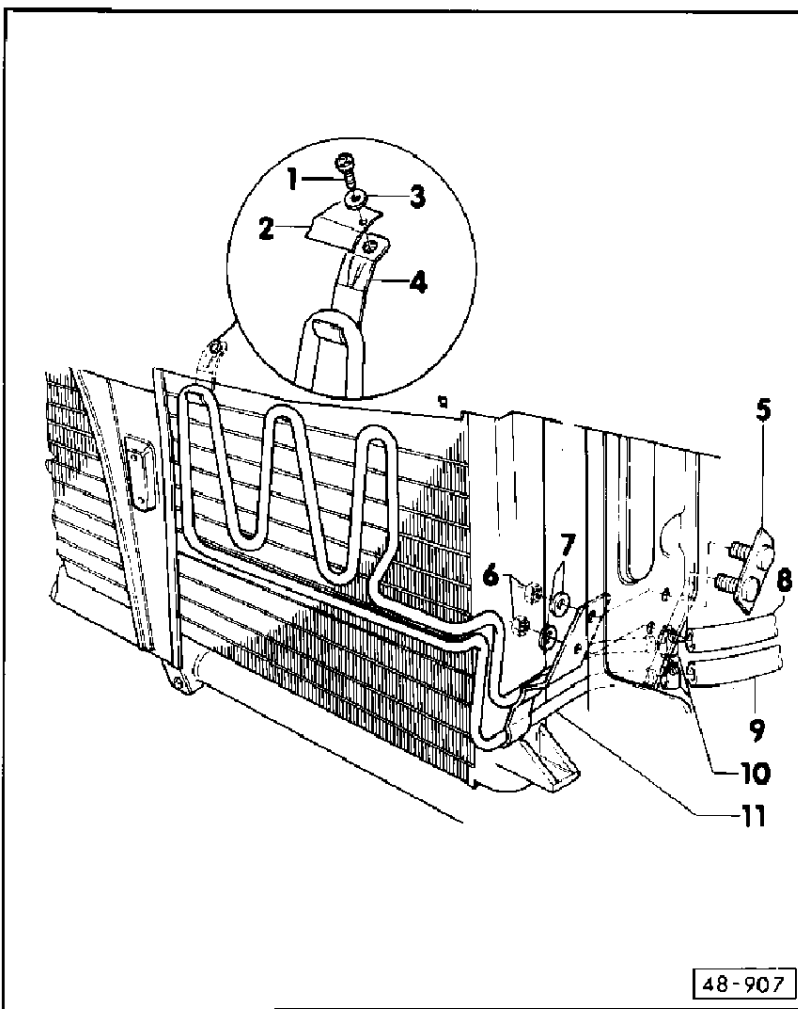
◆ Rotary valve housing – fluid cooler

9 – Return hose

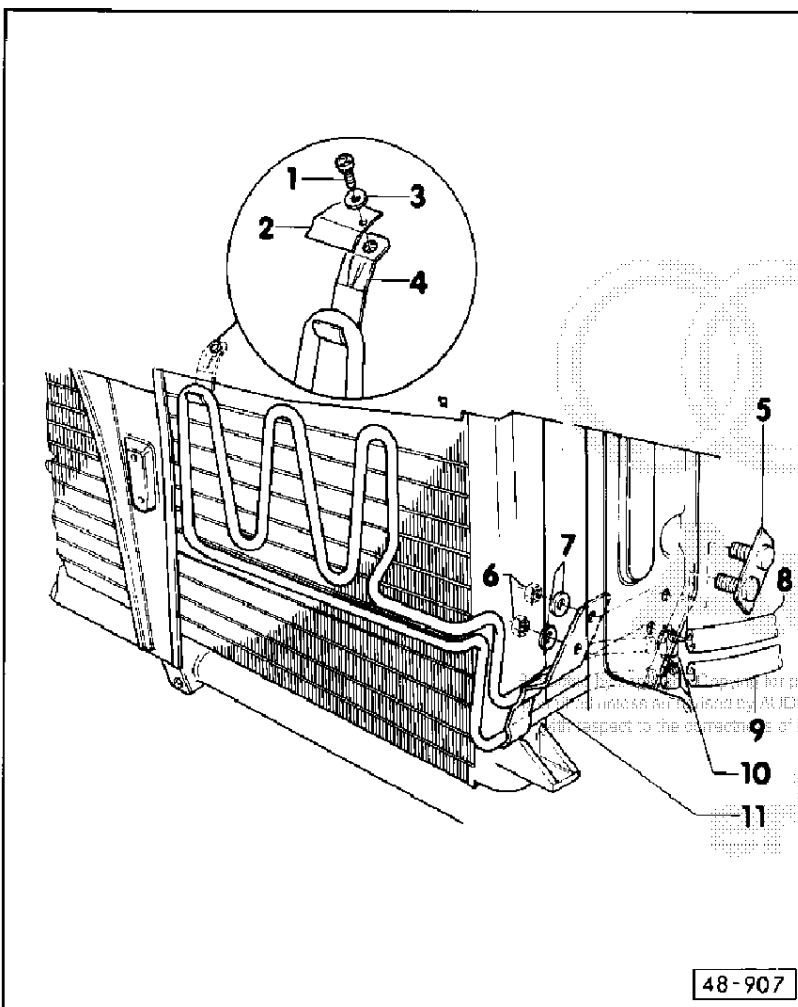
◆ Fluid cooler – reservoir

10 – Wing hose clamp

11 – Hydraulic fluid cooler



— 48-147 —

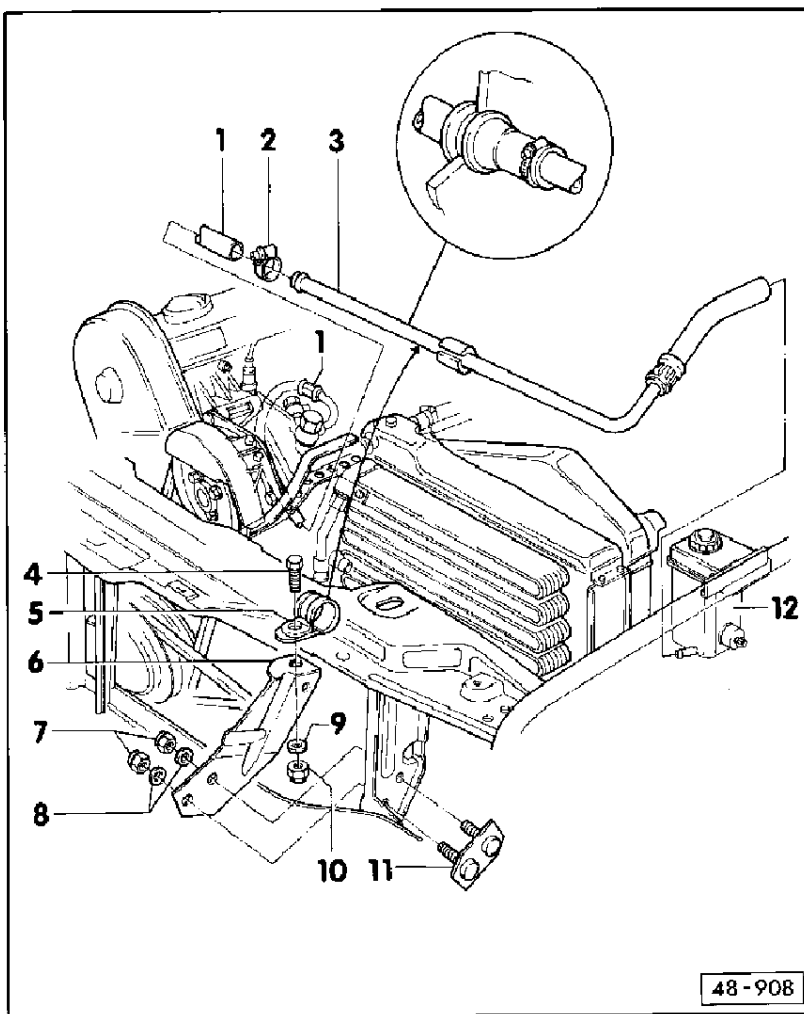


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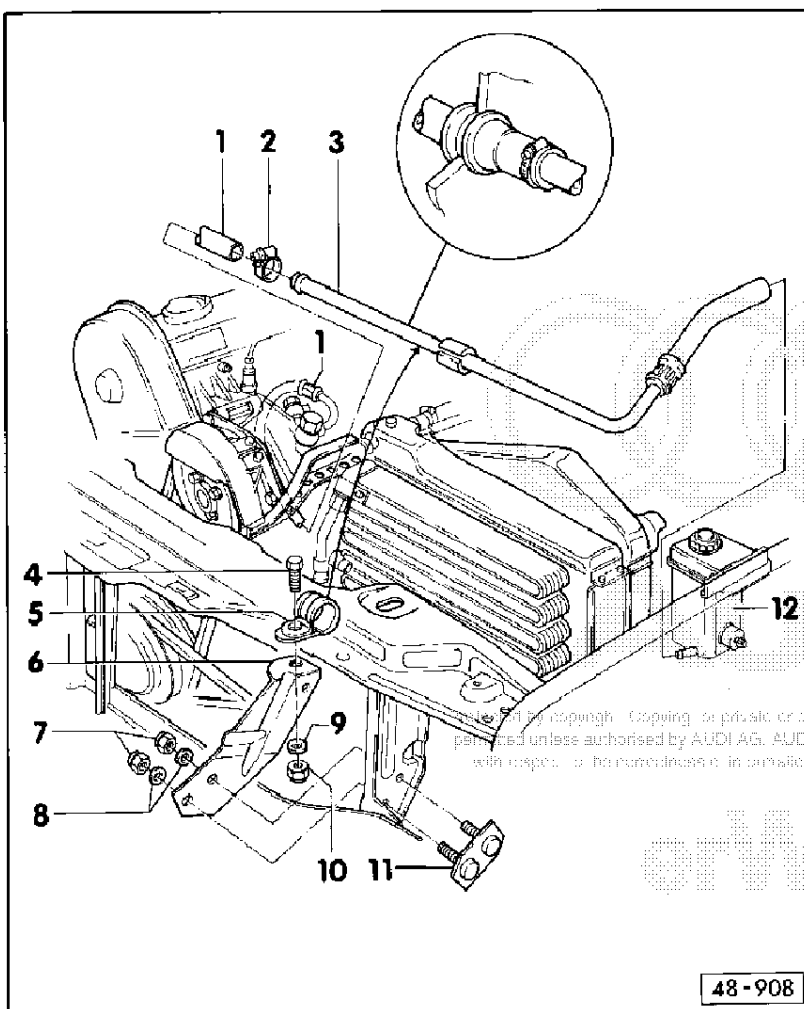


Vehicles with 5-cylinder engine



- 1 - Suction hose
 - ◆ Route so that it does not chafe
- 2 - Wing hose clamp
- 3 - Hydraulic fluid cooler
 - ◆ Vehicles with 4-valve engine feature an oil cooler with cooling fins
- 4 - Hexagon bolt
- 5 - Pipe clamp
- 6 - Bracket
 - ◆ Screw to lock carrier at top and lock support at bottom

48-149



- 7 - Self-locking nut, 10 Nm
 - ◆ Always replace
- 8 - Washer
- 9 - Washer
- 10 - Self-locking nut, 10 Nm
 - ◆ Always replace
- 11 - Tab
- 12 - Reservoir
 - ◆ Checking hydraulic fluid level:
 - Start engine and let it idle for approx. 2 minutes with front wheels set to straight-ahead position.
 - Switch off engine and immediately check hydraulic fluid level, paying attention to marks on reservoir/dipstick; top up to "MAX" mark if necessary

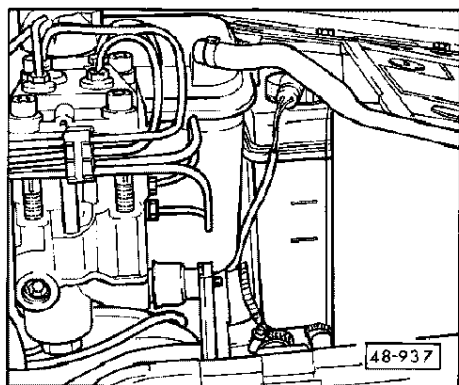
48-150

Topping up hydraulic fluid – bleeding steering system

Notes:

- ◆ After performing assembly work or if there is a lack of hydraulic fluid in the reservoir, always check steering system for leakage => Page 48-152.
- ◆ Do not re-use hydraulic fluid which has been drained off.
- ◆ After removing and installing steering components or renewing hydraulic fluid, it must be ensured on starting the engine that the reservoir is not sucked completely empty.

When the engine is running, the steering system is automatically bled after a while.



- ◀ – Top up with hydraulic fluid to "MAX" mark on dipstick
- Start engine and let it idle for approx. 2 minutes with front wheels set to straight-ahead position.
- Observe fluid level in reservoir during this process. As soon as there are no more bubbles rising in the reservoir, switch off engine and immediately top up hydraulic fluid, paying attention to mark on reservoir/dipstick

— 48-151 —

Check steering system for leaks

= > Fault finding binder, Running gear

With engine idling

Attention

Always check steering system for leaks if there is a lack of fluid in the reservoir.

- Turn steering from lock to lock and hold briefly (max. 20 seconds). This builds up the maximum possible pressure.
- Perform the following visual inspections in this position:

Note:

Visual inspection -1- must be carried out in both positions.

- 1 - Rack seal (to do this loosen tie band of bellows and push bellows aside)
- 2 - Rotary valve housing
- 3 - Vane pump
- 4 - Line connections

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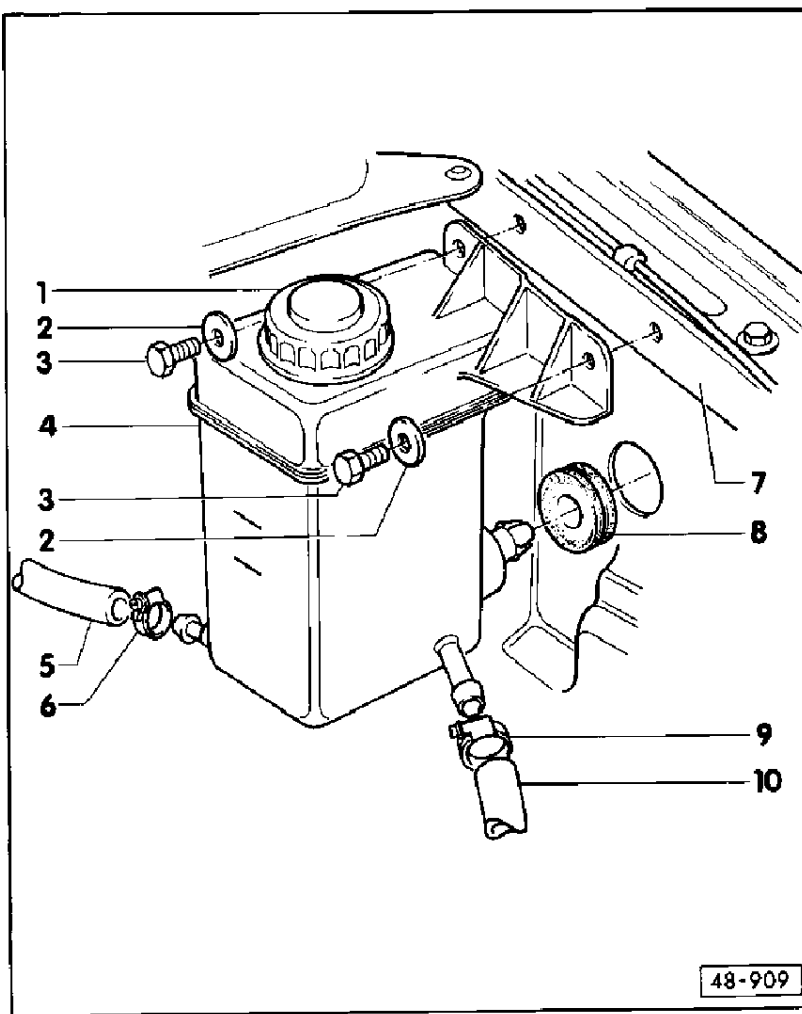


— 48-152 —

Removing and installing fluid reservoir

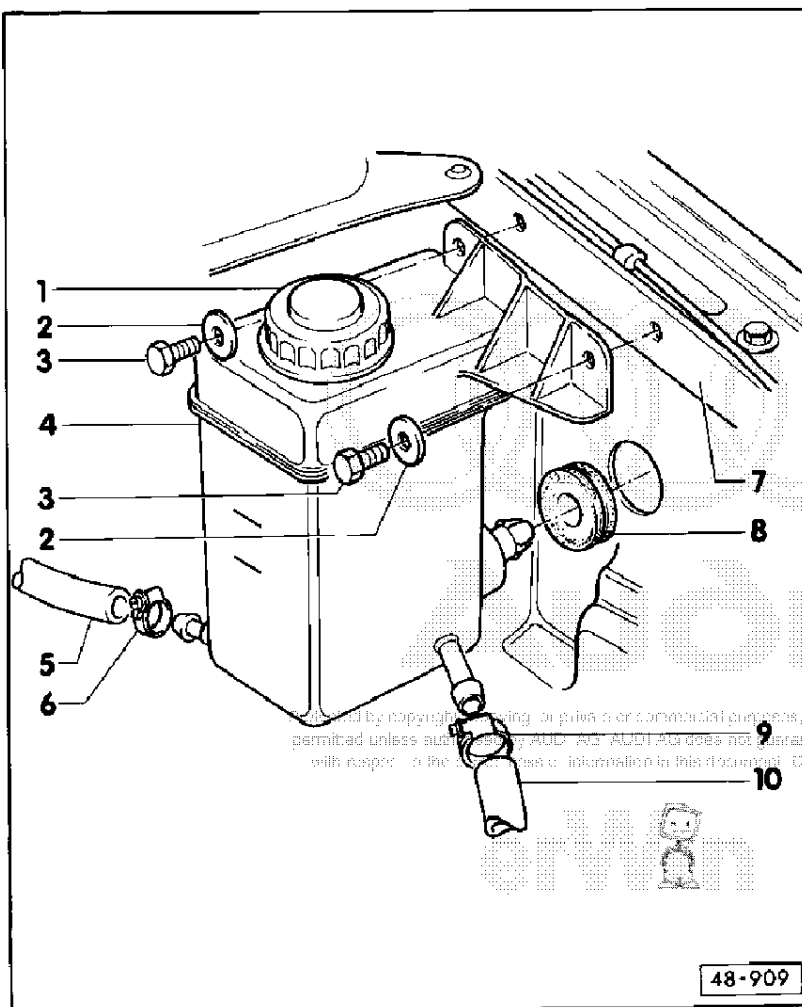
Note:

The power-assisted steering uses hydraulic fluid, part no. G 002 000.



48-909

48-153



48-909

- 1 - Cap with dipstick and gasket
 - ◆ Tighten firmly by hand
 - ◆ Observe "MAX" and "MIN" marks on dipstick

- 2 - Washer
 - ◆ Not fitted when using combi bolt, item 3

- 3 - Hexagon bolt, 10 Nm; Combi Bolt, 10 Nm

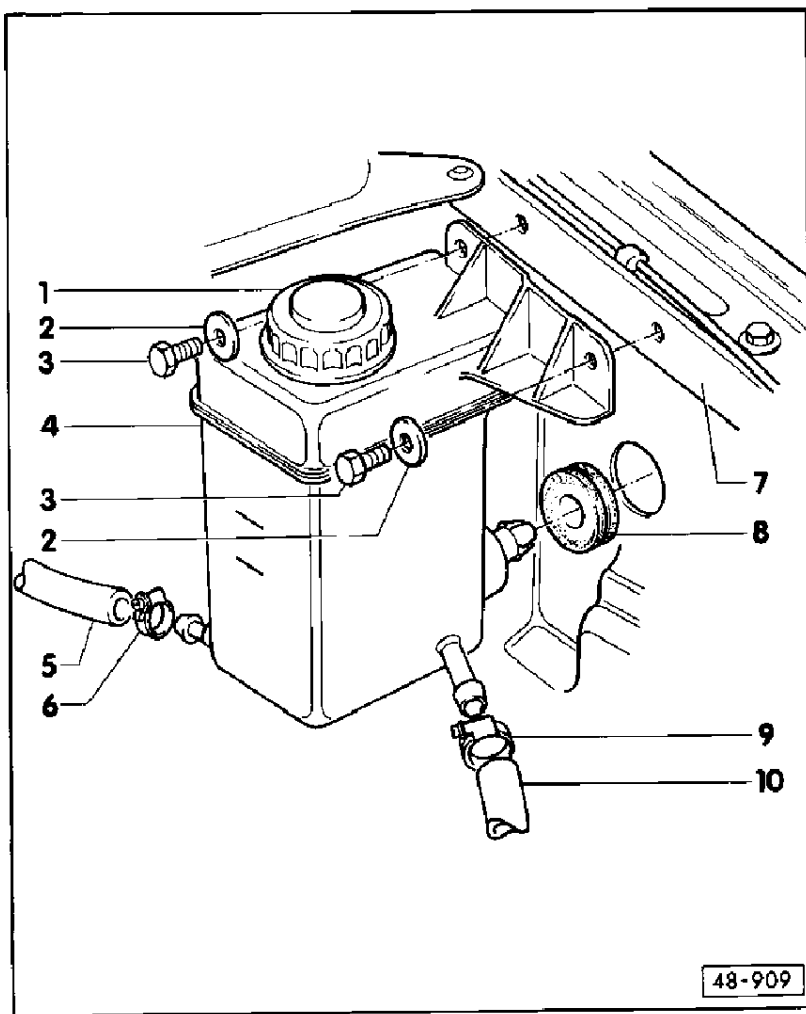
- 4 - Reservoir
 - ◆ Capacity: approx. 0.85 l
 - ◆ If necessary, clean strainer with white spirit

- ◆ Note different versions on vehicles with 4 and 5-cylinder engine and on vehicles with 4-cylinder/4-valve and 6-cylinder engine
- ◆ Checking hydraulic fluid level:
 - Start engine and let it idle for approx. 2 minutes with front wheels set to straight-ahead position.
 - Switch off engine and immediately check hydraulic fluid level, paying attention to marks on reservoir/dipstick; top up to "MAX" mark if necessary

- 5 - Return hose
 - ◆ Note different versions depending on engine
 - ◆ Remove servo unit to replace on vehicles with 6-cylinder engine

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48-154



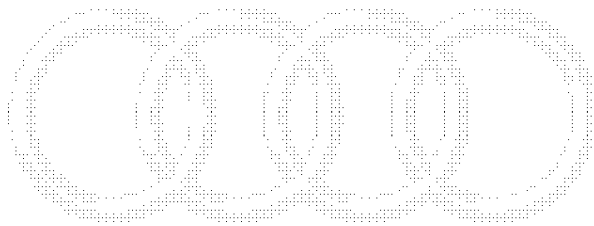
6 – Wing hose clamp

7 – Wheel housing

8 – Grommet
 ◆ Insert in wheel housing

9 – Wing hose clamp

10 – Suction hose
 ◆ Note different versions depending on engine



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Workshop Manual

Audi 80 1992 ▶

Booklet Electrical system

Edition 07.96

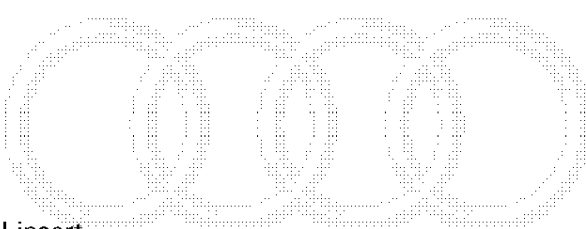


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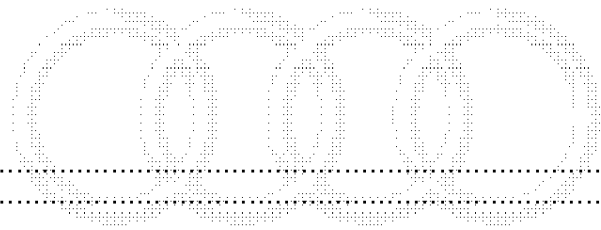
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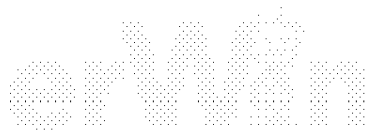
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Self-diagnosis

Note:

Synchronising keys in vehicles with infrared remote control

= > General Body Repairs; Repair Group 57; Central locking system; Synchronising keys for infrared remote control = >

Immobiliser self-diagnosis

The electronic immobiliser is equipped with self-diagnosis capability. If faults occur in system components, fault codes are stored in the immobiliser control unit -J362 which can then be read out using the V.A.G 1551 or V.A.G 1552 fault reader.

The electronic immobiliser has the following self-diagnosis functions:

- ◆ Interrogate fault memory
- ◆ Erase fault memory
- ◆ Reading measured value block
- ◆ Adapt vehicle key
- ◆ Adapt immobiliser control unit on engine control unit replacement

01-1

Connecting V.A.G 1551 fault reader

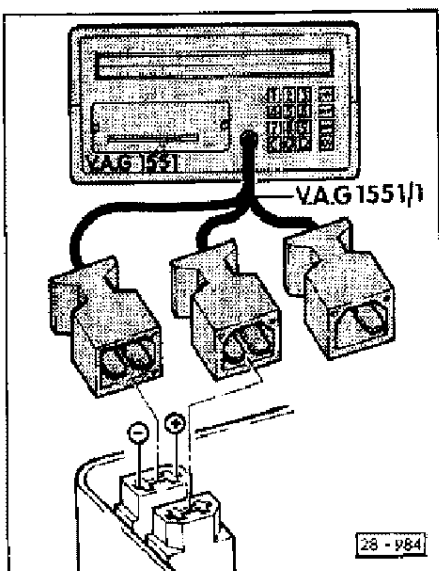
- Switch off ignition.
- Connect V.A.G 1551/1 diagnosis cable to the diagnosis connectors at relay plate with fuse box in the plenum chamber as follows:
- Attach black connector of V.A.G 1551/1 diagnosis cable to black diagnosis connector and white connector to white diagnosis connector.

Note:

The V.A.G 1551/1 blue diagnosis connector is not required.

- Switch ignition on.

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V.A.G SELF DIAGNOSIS
1 - Rapid data transfer 1)
2 -Flashing code output 1).

HELP

Reading on display:

1) Displayed alternately

Notes:

- ◆ Additional operating instructions can be obtained by pressing the V.A.G 1551 HELP key.
- ◆ The → key switches to the next step in the program sequence.

01-2

Starting immobiliser self-diagnosis

– Press key 1 for mode 1, "Rapid data transfer".

Rapid data transfer	HELP
Enter address word XX	

◀ Reading on display:

– Press keys 2 and 5 for "Immobiliser" address word.

Rapid data transfer	Q
25 – Immobiliser	

◀ Reading on display:

– Confirm entry with Q key.

Rapid data transfer
Tester transmits address word 25

◀ Reading on display:

– Wait approx. 5 seconds.

4A0953234	IMMO	AUZxxxxxxxx	D66
Coding	00000	WSC06388	

◀ Reading on display:

– 4A0953234: Number of control unit

– IMMO: System designation

– AUZ9Z0R2000323: 14-position ident-no.

– D66: Software version

– Press → key to continue.

Rapid data transfer	HELP
Select function XX	

◀ Reading on display:

— 01-3 —

Interrogate fault memory

– Press keys 0 and 2 for "Interrogate fault memory" function.

Rapid data transfer	Q
02 – Interrogate fault memory	

◀ Reading on display:

– Confirm entry with Q key.

No fault detected!

◀ Reading on display:

– Press → key.

or

X faults detected!

◀ Reading on display:

If the printer is switched on, the stored faults will be displayed and printed out in sequence.

Note:

If the printer is off, press → key to display the next fault.

– Press → after the last fault has been displayed and printed.

Rapid data transfer	HELP
Select function XX	

◀ Reading on display:

– Rectify printed faults according to fault table => Page 01-8, then erase fault memory and interrogate it again as a check.

— 01-4 —

Erase fault memory

Prerequisite:

- Fault memory interrogated => Page 01-4.

Rapid data transfer	HELP
Select function XX	

- ◀ Reading on display:
 - Press keys 0 and 5 for "Interrogate fault memory".

Rapid data transfer	Q
05 – Erase fault memory	

- ◀ Reading on display:
 - Confirm entry with Q key.

Rapid data transfer	HELP
Select function XX	

- ◀ Reading on display:

— 01-5 —

Reading measured value block

Rapid data transfer	HELP
Select function XX	

- ◀ Reading on display:
 - Press buttons 0 and 8 to read "Measured value block".

Rapid data transfer	Q
08 – Reading measured value block	

- ◀ Reading on display:
 - Confirm entry with Q key.

Read measured value block	HELP
Enter display group number XX	

- ◀ Reading on display:
 - Press buttons 0 and 1 for Display Group number 01 and confirm using the Q button.

The measured value block which has been selected will appear in standard format. Evaluation => Page 01-7

Read measured value block	1→	
1	1	1

- ◀ Example of display

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- ◀ Reading on display:

Rapid data transfer	HELP
Select function XX	

— 01-6 —

Read measured value block	1→
1	1

Evaluate measured value block
Display Group 01:

Display/ test value	Designation
1 1)	1 = Engine may be started
1 1)	2 = Engine control unit reply
1 1)	3 = Key OK

¹⁾ Example of display.

- ◆ Display/test value 0 = no
- ◆ Display/test value 1 = yes

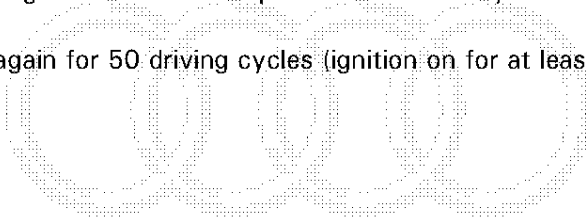
Fault evaluation:

- ◆ Engine may not be started:
Key used is not been coded or has been incorrectly coded.
- ◆ No response from engine control unit:
Fault in engine control unit or wiring.
- ◆ Key status OK no:
Key used is defective.

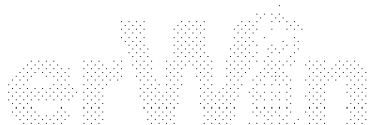
Immobiliser fault table

Notes:

- ◆ All static and sporadic faults are stored in the fault memory.
- ◆ A fault is recognised as being static if it is present for at least 2 seconds. If the fault does not occur again it is registered as a sporadic fault. "/SP" appears on right of display.
- ◆ When the ignition is switched on, all existing faults are set to sporadic and will only be stored as static faults if they still exist after checking.
- ◆ Sporadic faults which have not occurred again for 50 driving cycles (ignition on for at least 2 minutes) are erased.



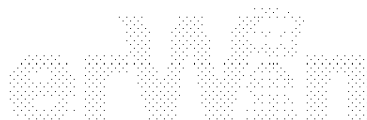
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V.A.G 1551 print-out	Possible causes of fault	Possible effect	Fault remedy
00750 Fault lamp Short to earth/open circuit Short circuit to positive	<ul style="list-style-type: none"> ◆ Wiring damaged. ◆ Open circuit ◆ Warning lamp -K117 defective ◆ Wiring damaged. 	<ul style="list-style-type: none"> ● Warning lamp flashes ● Warning lamp does not blink ● Warning lamp does not blink ● Warning lamp does not blink 	<ul style="list-style-type: none"> - Eliminate wiring damage. - Rectify open circuit. Replace warning lamp => Page 90-11. - Eliminate wiring damage.
01128 Immobiliser reader coil	<ul style="list-style-type: none"> ◆ Immobiliser reader coil -D2 defective ◆ Open circuit 	<ul style="list-style-type: none"> ● Engine will not start and warning lamp is on 	<ul style="list-style-type: none"> - Replace reader coil => Page 96-55. Rectify open circuit.

V.A.G 1551 print-out	Possible causes of fault	Possible effect	Fault remedy
01176 Key Signal too small Not authorised	<ul style="list-style-type: none"> ◆ Transponder defective ◆ Wrong key ◆ Immobiliser reader coil -D2 defective 	<ul style="list-style-type: none"> ● Engine will not start and warning lamp is on 	<ul style="list-style-type: none"> - Make new key. - Perform vehicle key adaptation - Replace reader coil => Page 96-55.
01177 Engine control unit not authorised	<ul style="list-style-type: none"> ◆ Replace engine control unit 	<ul style="list-style-type: none"> ● Engine will not start and warning lamp is on 	<ul style="list-style-type: none"> - Perform adaptation during engine control unit replacement
01179 Incorrect key programming	<ul style="list-style-type: none"> ◆ Incorrect key adaptation 	<ul style="list-style-type: none"> ● Warning lamp flashes 	<ul style="list-style-type: none"> - Read out fault memory Erase fault memory. Perform vehicle key adaptation
65535 Control unit faulty	<ul style="list-style-type: none"> ◆ Immobiliser control unit -J362 defective 	<ul style="list-style-type: none"> ● Engine will not start and warning lamp is on 	<ul style="list-style-type: none"> - Replace immobiliser control unit -J362 => Page 96-54.

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Performing vehicle key adaptation

Prerequisites:

- All vehicle keys available.
- Key ring with code number available, otherwise code number has to be established => Page 01-19
- Connect fault reader V.A.G 1551 => Page 01-2.
- Switch ignition on.
- Starting immobiliser self-diagnosis => Page 01-3.

Rapid data transfer	HELP
Select function XX	

- ◀ Reading on display:
- Press key 1 twice for "Login procedure" function.

Rapid data transfer	Q
11 - Login procedure	

- ◀ Reading on display:
- Confirm entry with Q key.

01-11

Login procedure	Q
Enter code number XXXXX	

- ◀ Reading on display:
- Enter code number.

Notes:

- ◆ When entering code number, precede the 4-digit number with a 0.
 - ◆ The code number is marked beneath a rubber coating on the key ring issued to the customer when the vehicle was handed over. The rubber coating can be removed by rubbing.
 - ◆ If the code number is incorrectly entered twice, the control unit is disabled for 30 minutes. The ignition must be set to "On" for 30 minutes before the next attempt.
- Confirm entry with Q key.

Rapid data transfer	HELP
Select function XX	

- ◀ Reading on display:
- Press 1 and 0 for "Adaptation" function.
- Confirm entry with Q key.

Adaptation	Q
Enter channel number XX	

- ◀ Reading on display:
- Press 0 and 1 for channel 1.
- Confirm entry with Q key.

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01-12

Channel 1 Adaptation 2 → ◀

Reading on display:
– Press → key to continue.

Channel 1 Adaptation 2 → ◀
Enter adaptation value XXXXX

Reading on display:
– Press key 0 four times and enter number of keys to be adapted (0 to 8 keys).

Note:

Entering "0 keys" results in electronic locking of the vehicle.

– Confirm entry with Q key.

Channel 1 Adaptation 3 Q ◀

Reading on display:
– Confirm entry with Q key.

or

Channel 1 Adaptation 2 → ◀

Reading on display:
– Press key 1 to decrease number of keys, or key 3 to increase, e.g. to 3.

Channel 1 Adaptation 3 Q ◀

Reading on display:
– Confirm entry with Q key.

Channel 1 Adaptation 3 Q ◀
Store changed value?

Reading on display:
– Confirm entry with Q key.

Channel 1 Adaptation 3 → ◀
Changed value is stored

Reading on display:
Key in ignition lock has now been adapted.
– The ignition must be switched on using all the other keys for this vehicle until the warning lamp goes off.

Note:

Adaptation is complete, when:

- ◆ The number of keys to be adapted has been reached,
 - ◆ A key that has already been adapted is adapted again:
 - ◆ The total adaptation time of 30 seconds has been exceeded.
- Finish adaptation on the V.A.G 1551 by pressing the → key and return to function mode.

Rapid data transfer HELP ◀
Select function XX

Reading on display:

Adaptation during engine control unit replacement

Prerequisite:

- Authorised vehicle key available
- Connect fault reader V.A.G 1551 => Page 01-2.
- Switch ignition on.
- Starting immobiliser self diagnosis => Page 01-3

Rapid data transfer	HELP	◀
Select function XX		

- Reading on display:
- Press 1 and 0 for "Adaptation" function.
 - Confirm entry with Q key.

Adaptation	Q	◀
Enter channel number XX		

- Reading on display:
- Press key 0 twice.
 - Confirm entry with Q key.

01-15

Adaptation	Q	◀
Erase learned values?		

- Reading on display:
- Confirm entry with Q key.

Adaptation	→	◀
Learnt values have been erased		

- Reading on display:
- Press → key to continue.

Rapid data transfer	HELP	◀
Select function XX		

- Reading on display:
- Note:**
The next time the ignition is switched on, the engine control unit identifier is read into the immobiliser control unit.

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01-16

Testing system

- Not for vehicles with engine code letters NG-engine (KE III 2.3 I)

Prerequisite

- The ignition must have been switched off for at least 30 seconds.
- Cover receiving coil with a slotted metal plate, e.g. place shim between ignition lock and ignition key. or detach reader coil electrical cable at ignition/starter switch.
- Attempt to start vehicle – the engine should not run and warning lamp should flash.
- Connect fault reader V.A.G 1551 => Page 01-2.
- Starting immobiliser self diagnosis => Page 01-3
- Interrogate fault memory => Page 01-4. Error message: "Key signal too low" or "Immobiliser reader coil".
- Erasing fault memory => Page 01-5.

01-17

- Only for vehicles with engine code letters NG-engine (KE III 2.3 I)

- Connect fault reader V.A.G 1551 => Page 01-2.
- Starting immobiliser self diagnosis => Page 01-3
- Select final control element diagnosis function (03).
- Attempt to start three times in succession, engine should not start:

1. Path	Pin 5 12V (NC relay)
2. Path	Pin 4, high impedance (NO relay)
3. Path	Open circuit in starting relay

The fault lamp blinks Fault lamp goes off after 3rd path.

- Erase fault memory in FEI control unit
=> KE III Jetronic/ignition system (5-cylinder); Repair group 01;
Self-diagnosis with fault reader V.A.G 1551; Fault memory interrogation with V.A.G 1551 =>

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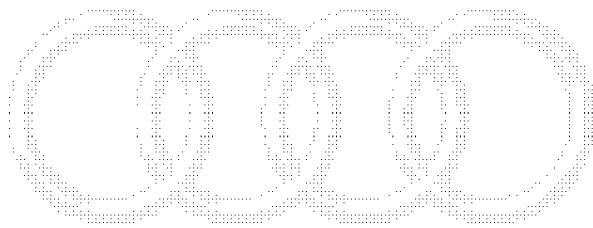
01-18

Lost key procedure

- Make replacement key using locking mechanism number.
- Perform key adaptation => Page 01-11.

Establishing code number

- Connect fault reader V.A.G 1551 => Page 01-2.
- Starting immobiliser self diagnosis => Page 01-3
- 14Read out 14-position immobiliser control unit ident. no. .
- Using the ident. no., obtain the code number via the appropriate Sales Centre or Importer using the dealer on-line system (HOLS).



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Checking and charging battery

Warning

Always disconnect battery earth strap before working on electrical system.

Checking electrolyte level

- ◆ Only top up with distilled water if electrolyte level is below "min" mark.
- ◆ Highly charged batteries with excessive electrolyte level (long journeys using few consumers) may "boil over". Having too little electrolyte may reduce the service life of the battery.

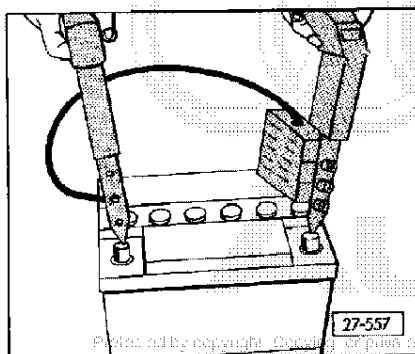
27-1

Measuring voltage under load

The voltage can be measured under load using a battery tester such as the V.A.G 1498.

- ◆ The load current and minimum voltage differ depending on the battery capacity and should be taken from the label on the tester or the following table.

Capacity	Cold test current	Load current	Minimum voltage
36 Ah	175 A	100 A	10.0 V
40 Ah	220 A	200 A	9.4 V
50 Ah	265 A	200 A	9.6 V
63 Ah	300 A	200 A	9.5 V
88 Ah	395 A	300 A	9.5 V
92 Ah	450 A	300 A	9.5 V



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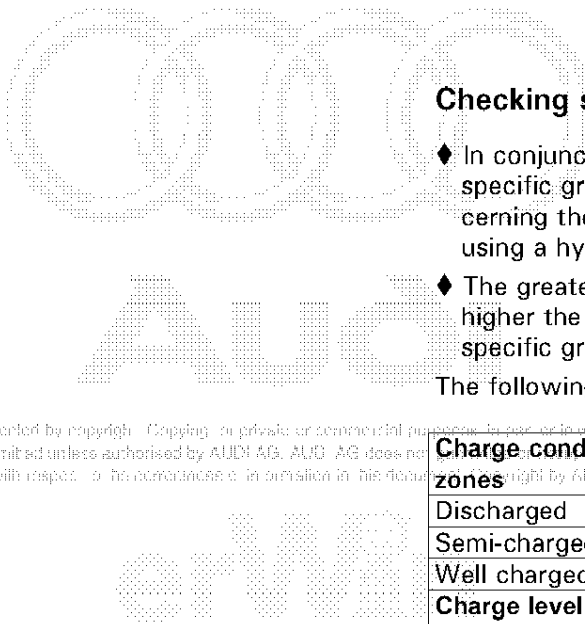
27-2

- ◆ If the minimum voltage is not attained for a loading period of 5 to 10 seconds, the battery is flat or defective. Check specific gravity of acid.

Note:

To avoid the risk of explosion, never test a battery that is gas-sing.

- ◆ Batteries with a capacity of more than 63 Ah are not to be checked using the VW 1266 battery tester and charger, since this testing facility is only designed for batteries up to max. 63 Ah.
- ◆ The battery tester V.A.G 1498 is suitable for batteries with capacities between 30 and 200 Ah.



Checking specific gravity of acid.

- ◆ In conjunction with the voltage measurement (under load), the specific gravity of the acid provides accurate information concerning the state of charge of a battery. Testing is performed using a hydrometer.
- ◆ The greater the specific gravity of the extracted electrolyte the higher the float rides. The density can be read off the scale as specific gravity or degrees Baumé.

The following values must be attained:

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Charge condition in normal climatic zones	o Bé	Spec. gravity
Discharged	16	1,12
Semi-charged	24	1,20
Well charged	32	1,28
Charge level in tropical countries	o Bé	Spec. gravity
Discharged	11	1,08
Semi-charged	18	1,14
Well charged	27	1,23

Notes on handling batteries

Batteries that have not been used for lengthy periods (e.g. vehicles in storage) are subject to self-discharge and may also be sulphated. If fast charging is performed on these batteries using standard charging units they do not accept charge current, or are shown as being "fully charged" before they actually are due to so-called surface charging. They appear to be defective.

Before these batteries are considered to be defective, perform the following checks:

- ◆ If the specific gravity of the acid in all the cells does not differ by more than 0.02 kg/dm³ (e.g. 1.13 to 1.11), the battery should be charged. When charging is complete the battery should be subjected to a load test. The battery is only defective if the test values are not complied with.
- ◆ If the specific gravity of the acid in one or two adjacent cells is appreciably lower (e.g. five cells indicate 1.16 and one cell indicates 1.08), the battery has a short circuit and is defective.

27-5

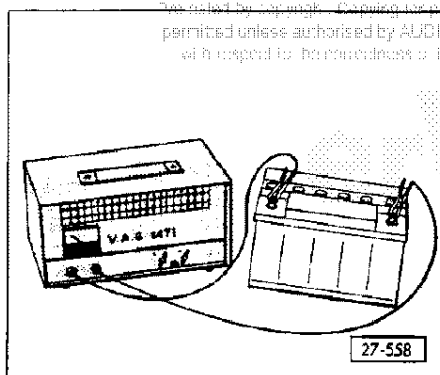
Charging battery

Notes:

- ◆ Frozen batteries must be thawed out before charging.
- ◆ Do not enter rooms in which batteries are being charged with a naked flame or whilst smoking.
- ◆ Precision tools should also be kept away from such areas.

The V.A.G. 1471 battery charger can be used for normal charging of up to four 12 V batteries as well as batteries with different capacities (Ah = ampere-hours) and rated voltage.

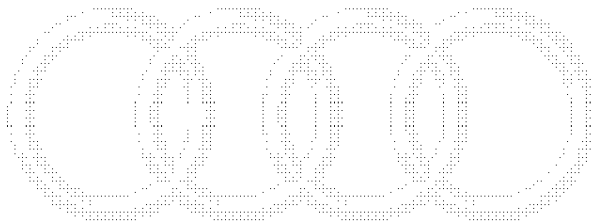
- Disconnect battery earth strap and then positive cable from battery.
- Connect battery to charging unit, positive to positive, negative to negative.
- Switch on charging current. The charging current depends on the capacity of the battery. The current should be about 10% of the battery capacity. In other words, the charge current should be about 4 A for a 40 Ah battery.



27-6

Quick charging/starting boost

Fast charging can be carried out using the battery tester and charger VW 1266, whereas additional starting assistance can be provided by the V.A.G 1572 battery starting charger.



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Dash panel insert

Removing and installing dash panel insert => Page 90-8.

Removal and installation of dash panel insert components:

◆ Model without Auto-check system/on-board computer => Page 90-41.

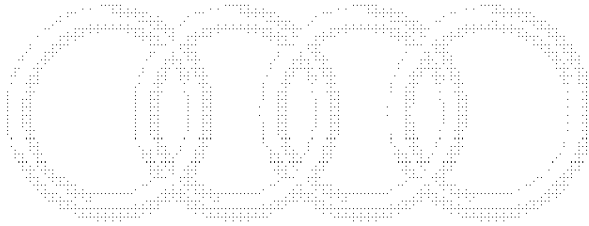
◆ Model with Auto-check system/on-board computer => Page 90-55.

Emergency flasher relay installation position => Fig. 1, Page 90-7.

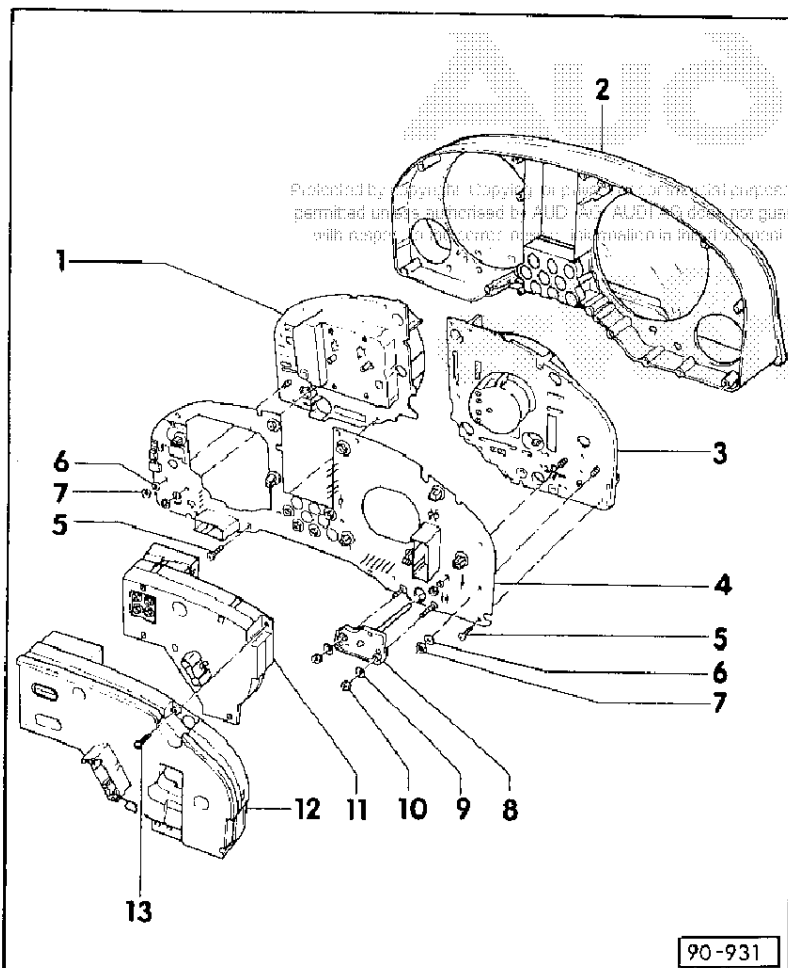
Assignment of lamps in dash panel insert => Page 90-9.

Note:

Use the V.A.G 1526 manual multimeter, the V.A.G 1301 tester, the V.A.G 1598 test box and the V.A.G measuring tool kit for testing.



90-1



VDO dash panel insert – exploded view

1 – Base plate with speedometer

◆ Checking speedometer sensor => Page 90-37.

◆ Removing and installing => Page 90-50

2 – Front frame with glass

◆ Removing and installing => Page 90-50

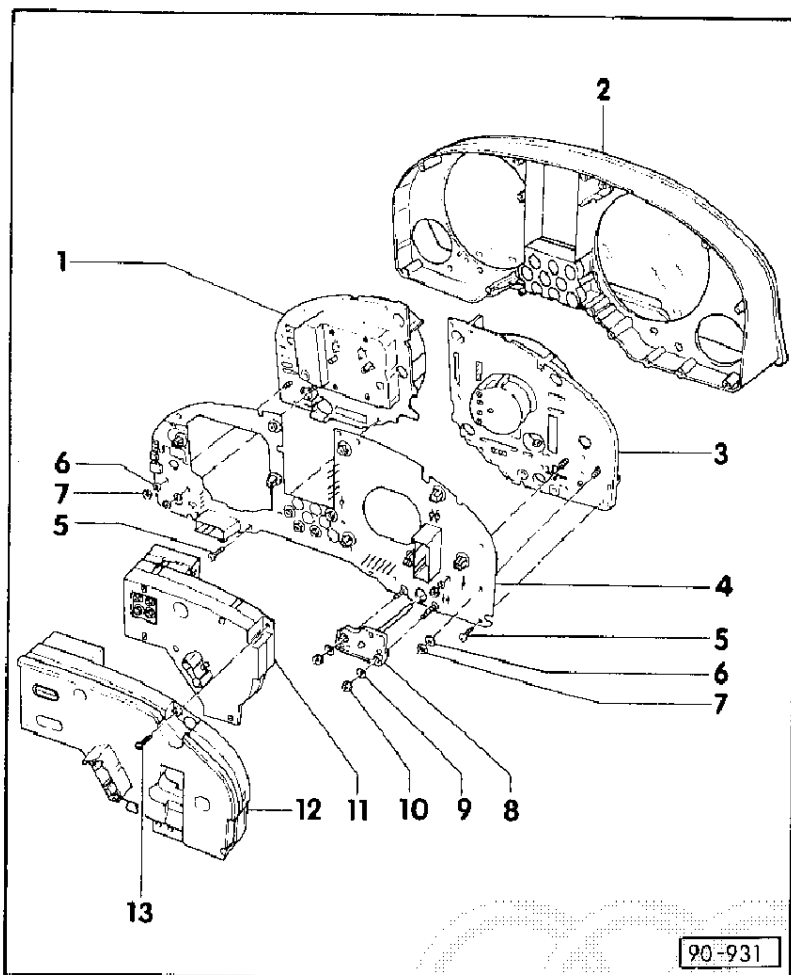
◆ Set down carefully onto soft cloth to avoid scratching glass

3 – Base plate with rev counter

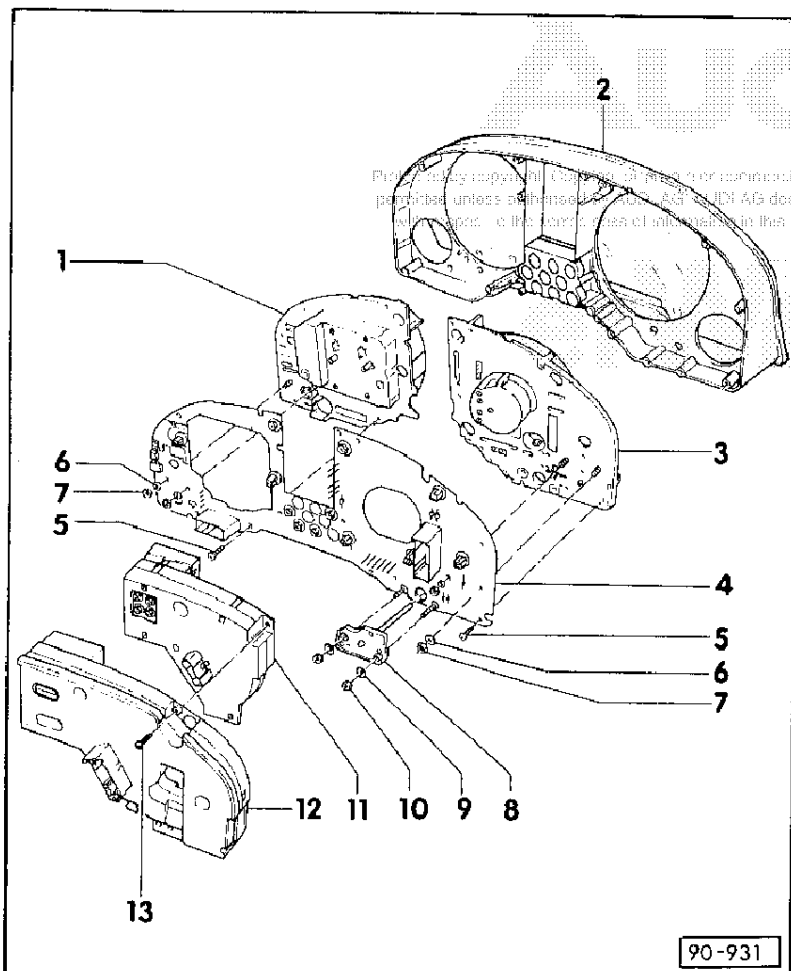
◆ Checking engine speed signal => Page 90-40

◆ Removing and installing => Page 90-51

90-2

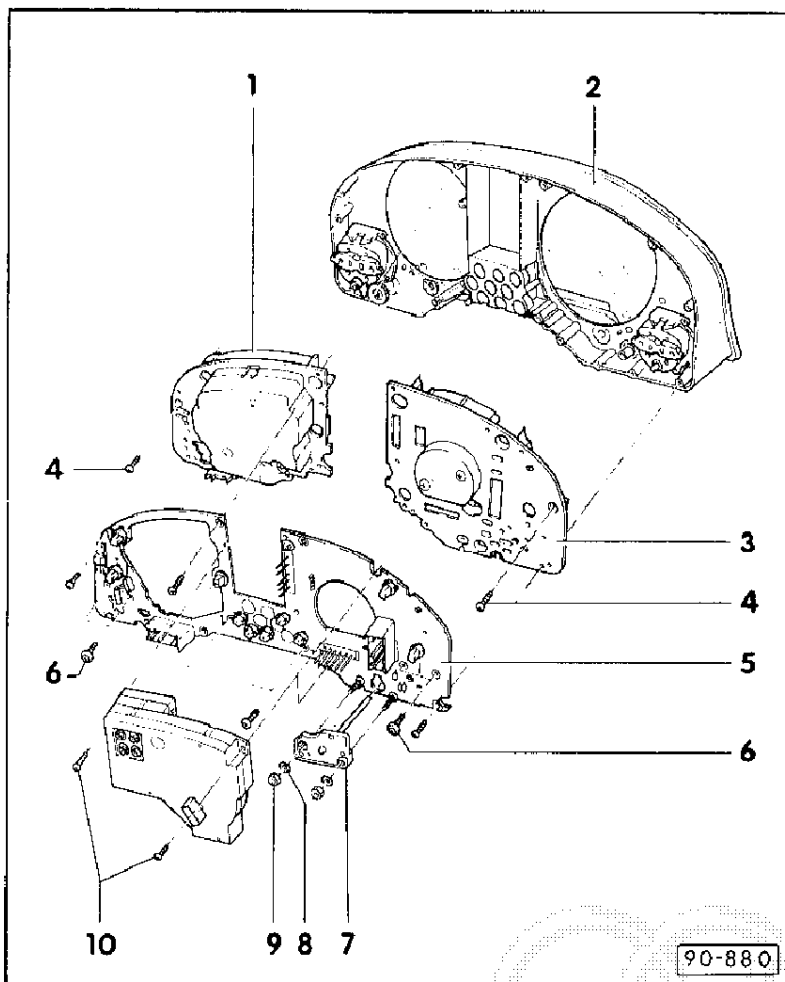


- 4 - Printed circuit board
 - ◆ Assignment of multi-pin connectors => Page 90-13 onwards
 - ◆ Removing and installing => Page 90-49
- 5 - Securing bolts
 - ◆ For printed circuit board
- 6 - Washer
- 7 - Hexagon nut
- 8 - Controller
 - ◆ For dash panel insert, switch and instrument lighting
 - ◆ Removing and installing => Page 90-71



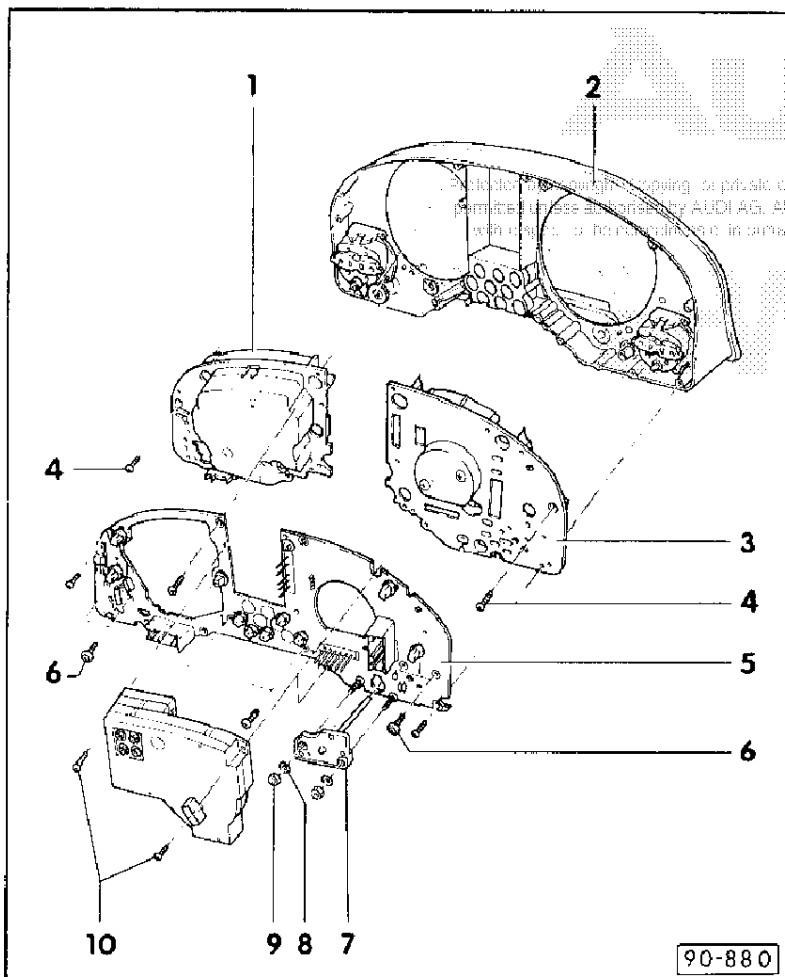
- 9 - Washer
- 10 - Hexagon nut
- 11 - Display unit
 - ◆ For mini-check system
 - ◆ Removing and installing => Page 90-72
- 12 - Display unit
 - ◆ for auto-check system/on-board computer
 - ◆ Removing and installing => Page 90-72
- 13 - Securing bolts
 - ◆ for mini-check/auto-check system/on-board computer

Nippon Seiki dash panel insert – exploded view



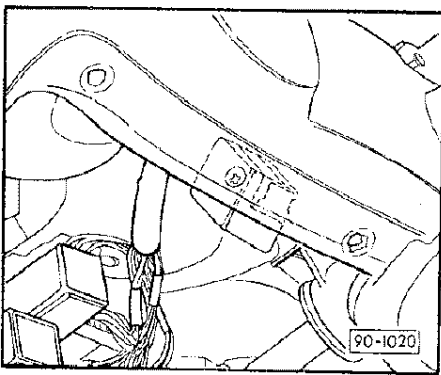
- 1 – Base plate with speedometer
 - ◆ Removing and installing => Page 90-66
- 2 – Front frame with glass
 - ◆ Removing and installing => Page 90-64
 - ◆ Set down carefully onto wool- len cloth to avoid scratching glass
- 3 – Base plate with rev counter
 - ◆ Removing and installing => Page 90-67
- 4 – Securing bolts
 - ◆ For base plates

— 90-5 —

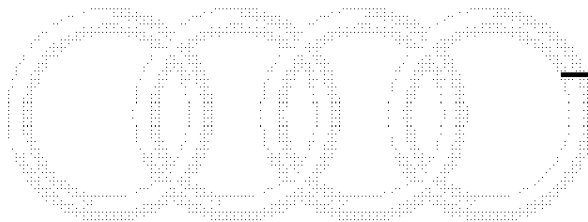


- 5 – Printed circuit board
 - ◆ Assignment of multi-pin connec- tors => Page 90-13 on- wards
 - ◆ Removing and installing => Page 90-49
- 6 – Securing bolt
- 7 – Controller
 - ◆ For dash panel insert, switch and instrument lighting
 - ◆ Removing and installing => Page 90-71
- 8 – Washer
- 9 – Hexagon nut
- 10 – Securing bolts
 - ◆ For printed circuit board

— 90-6 —

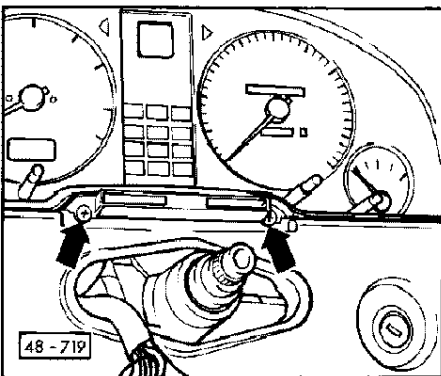


- ◀ **Fig.1 Signal indicator/hazard warning relay installation position**
 The emergency flasher relay is clipped to the bottom of the instrument panel.
- Removal and installation involves taking out the driver's-side tray
 - = > General Body Repairs; Repair Group 70; Instrument Panel, Removing driver's side tray =>



Removing and installing dash panel insert

- Removing steering wheel and steering column switch => Page 94-28.



- ◀ - Unscrew recessed-head screws-arrows-.
- Process - Carefully pull dash panel insert out of instrument panel, placing a soft cloth over the steering column if necessary.
- Removing plug for multi-pin connectors => Page 90-19
 - Detach all connectors
 - Remove dash panel insert.

Assignment of lamps in dash panel insert

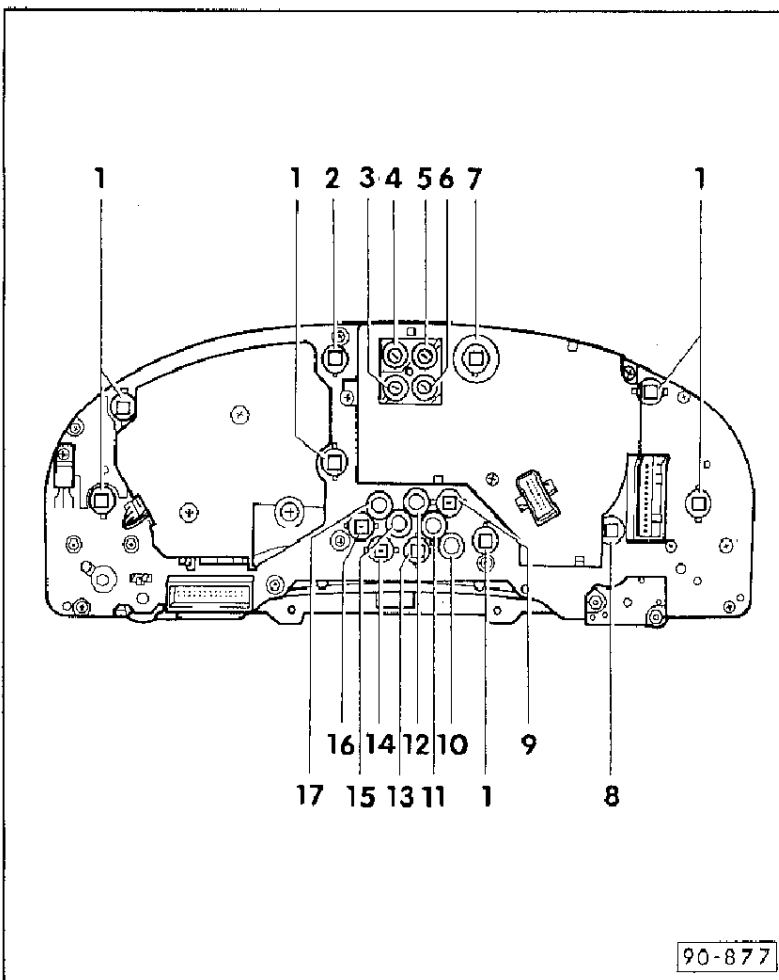
- Removing and installing cap-type lamps => Page 90-71.

1 - Dash panel insert illumination
◆ 1.2 W (6x)

2 - Right turn signal warning lamp
◆ 1.2 W

3 - Unallocated

4 - Brake warning lamp
◆ 1.2 W
◆ Only in vehicles with no auto-check system



90-877

90-9

5 - Coolant temperature warning lamp (overheating)
◆ 1.2 W

◆ Only in vehicles with no auto-check system

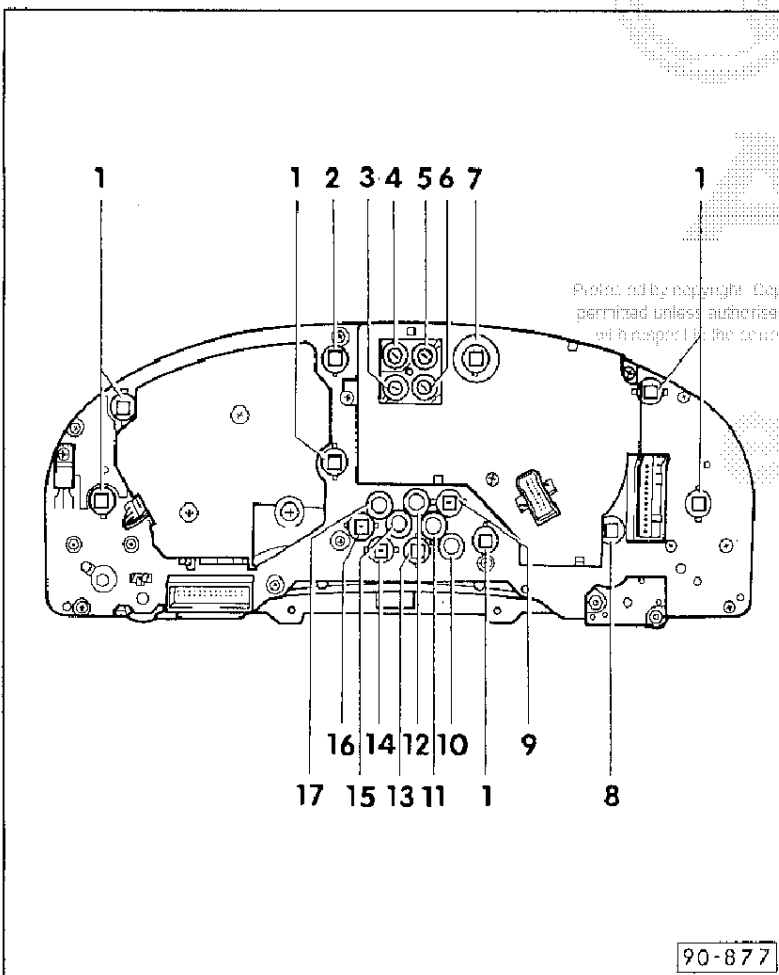
6 - Oil pressure warning lamp
◆ 1.2 W

◆ Only in vehicles with no auto-check system

7 - Left turn signal warning lamp
◆ 1.2 W

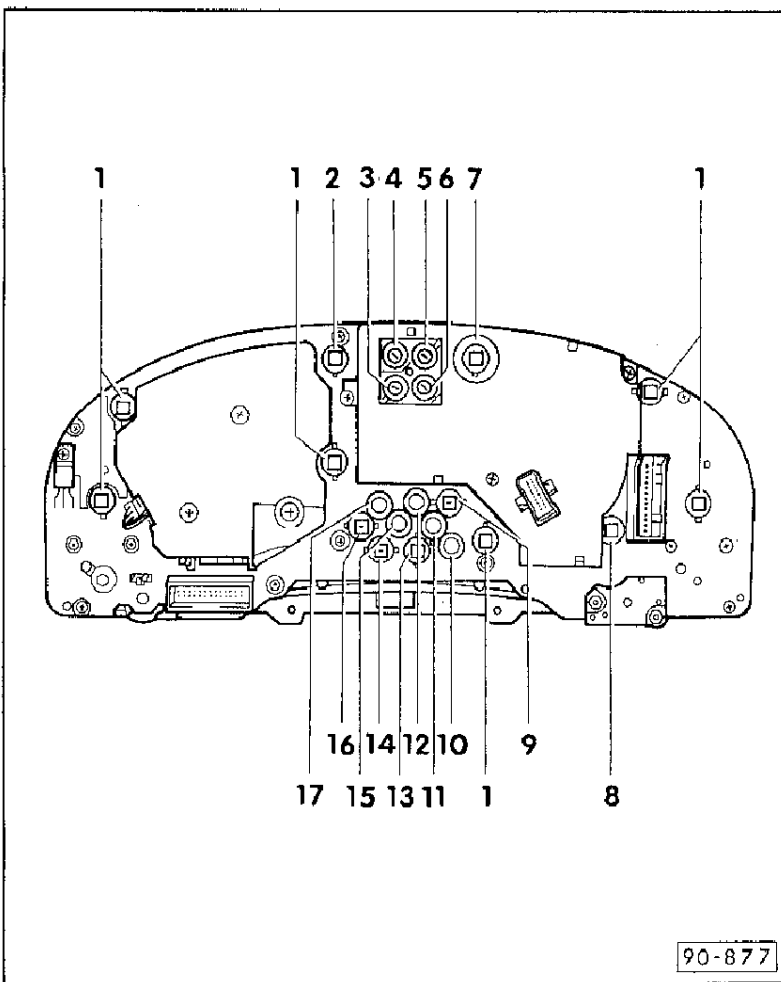
8 - Digital clock illumination
◆ 1.2 W

9 - Charge warning lamp
◆ 2 W

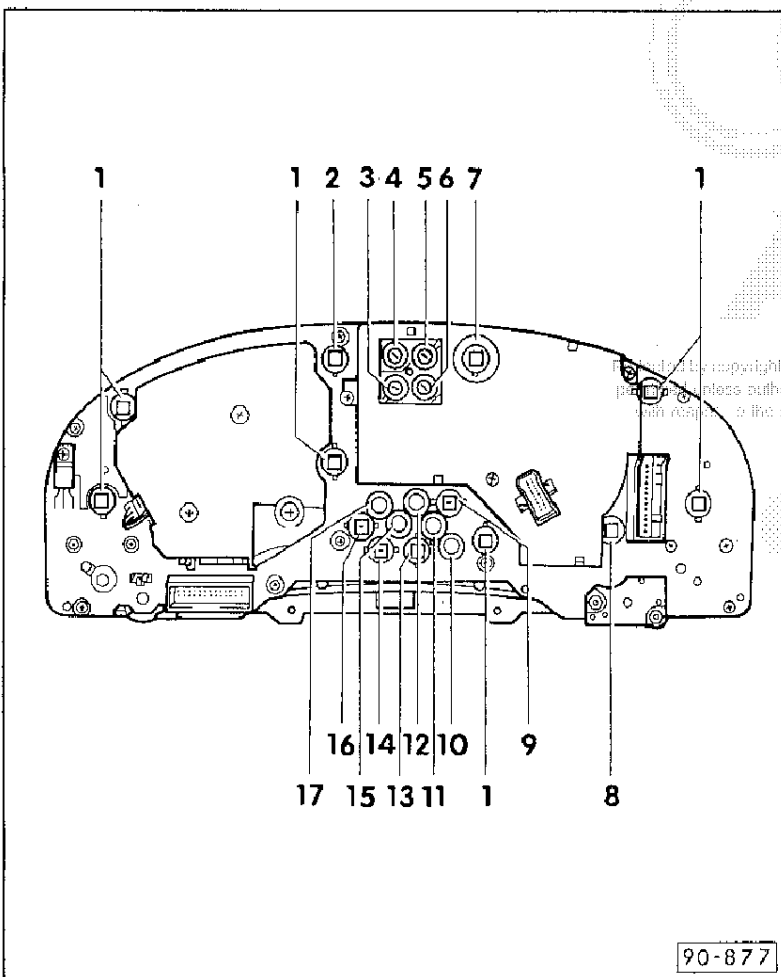


90-877

90-10



- 10 – Immobiliser warning lamp
 - ◆ 1.2 W
 - ◆ Differing assignment
CAT 6-cylinder engine:
- 11 – Diesel choke warning lamp
 - ◆ 1.2 W
 - ◆ Differing assignment
CAT
- 12 – Lamp for trailer turn-signal indicator
 - ◆ 1.2 W
 - ◆ Retrofitted
 - ◆ Differing assignment
Side lights/airbag/engine electronics
- 13 – Brake/handbrake warning lamp
 - ◆ 1.2 W



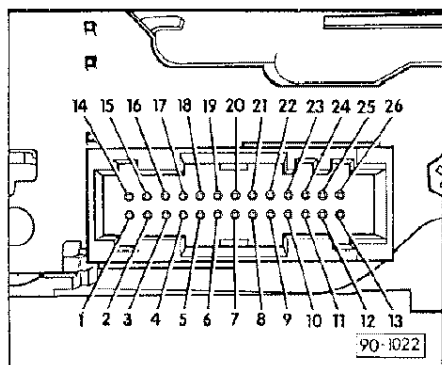
- 14 – Seat-belt warning lamp
 - ◆ 1.2 W
 - ◆ Differing assignment
Engine electronics/hazard warning/airbag
- 15 – Anti-lock braking system warning lamp
 - ◆ 1.2 W
- 16 – Main beam warning lamp
 - ◆ 1.2 W
- 17 – Airbag warning lamp
 - ◆ 1.2 W
 - ◆ Differing assignment
Engine electronics/seat-belt warning

Assignment of contacts at multi-pin dash panel insert connectors

Contacts on blue dash panel insert multi-pin 26-pin connector

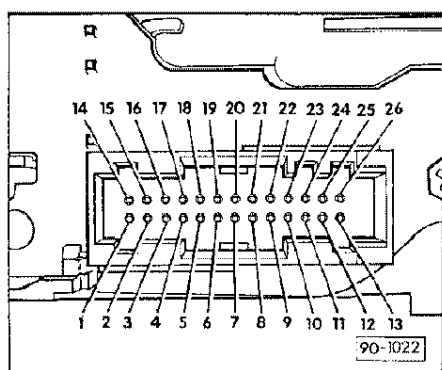
Notes:

- ◆ Use appropriate current flow diagram.
- ◆ Assignment of lamps in dash panel insert and assignment of illuminated symbols => Page 90-9.



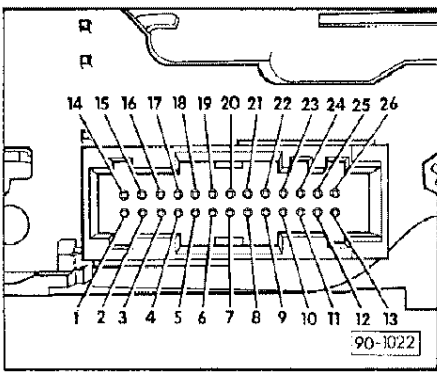
- ◀ - 1 - Not used
- 2 - Not used
- 3 - Not used
- 4 - Not used
- 5 - Not used
- 9 - Not used
- 7 - Not used
- 8 - Not used
- 9 - Not used
- 10 - Negative for lamp in illuminated symbol no.15 (ABS)
- 11 - Not used
- 12 - Not used

90-13



- ◀ - 13 - Negative for lamp in illuminated symbol no. 12 (trailer turn-signal indicator/side lights/airbag/engine electronics)
- 14 - Not used
- 15 - Negative for fuel gauge
- 16 - Positive for electronic speedometer; connected to voltage stabiliser and lamps in illuminated symbols nos. 9, 10, 12, 13, 15, 17
- 17 - Positive for lamp in illuminated symbol no.2 (right turn-signal indicator)
- 18 - Vehicle speed signal (output)
- 19 - Not used
- 20 - Vehicle speed signal (input from travel sensor)
- ◆ Protected by copyright. Copying or using for commercial purposes in part or in whole is not permitted unless authorized by AUDI AG. AG does not guarantee or accept any liability with regard to the content of this document. Checking => Page 90-37
- 21 - Negative for lamps in dash panel insert lighting, connected to electronic speedometer, voltage stabiliser and lamp in illuminated symbol no. 16 (main beam).
- 22 - Variable positive for dash panel insert brightness control; connected to lamps for dash panel insert lighting, lamp for digital clock lighting and multi-pin connector (yellow, 26-pin, contacts 1 and 4, 6-pin plug connector)

90-14

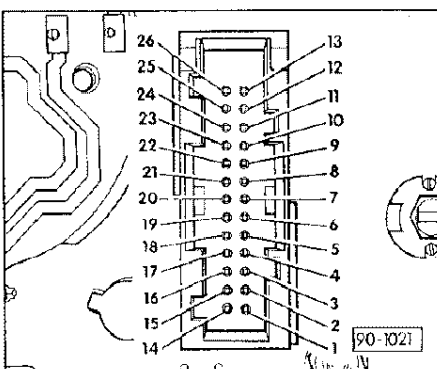


- ◀ - 23 - Positive for lamp in illuminated symbol no.16 (Main beam)
- 24 - Negative for lamp in illuminated symbol no.17 (air-bag/engine electronics/seat belt warning)
- 25 - Positive for lamp in illuminated symbol no.14 (seat belt warning/engine electronics/airbag)
- 26 - Negative for lamp in illuminated symbol no.14 (seat belt warning/engine electronics/airbag)

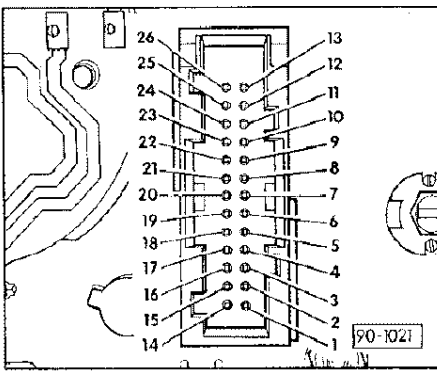
Contacts at yellow dash panel insert multi-pin (26-pin) connector

Notes:

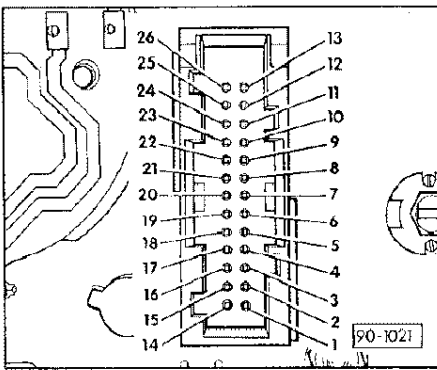
- ◆ Use appropriate current flow diagram.
- ◆ Assignment of lamps in dash panel insert and assignment of illuminated symbols => Page 90-9.



- ◀ - 1 - Positive from light switch to brightness control for instrument lighting, for lamps for dash panel insert lighting and lamp for digital clock lighting; connected to contact 4; connected to 6-pin plug connector
- 2 - Negative for coolant temperature gauge
- 3 - Positive (terminal 15), connected to lamp for digital clock lighting
- 4 - Positive from light switch; connected to contact 1; connected to 6-pin plug connector
- 5 - Positive; connected to brightness control for dash panel insert lighting
- 6 - Not used
- 7 - Not used



- ◀ - 8 - Negative; connected to lamps for dash panel insert lighting, to lamp in illuminated symbol no. 7 (left turn-signal indicator), to lamp for digital clock lighting, to digital clock, to lamp in illuminated symbol no. 2 (right turn-signal indicator) and to 5-pin plug connector
- 9 - Positive; connected to lamp in illuminated symbol no.7 (left turn-signal indicator)
- 10 - Negative for lamp in illuminated symbol no.5 (coolant overheating)
- 11 - Negative for lamp in illuminated symbol no.4 (brake warning)
- 12 - Not used
- 13 - Negative for lamp in illuminated symbol no. 9 (charge warning lamp); connected to display unit, coolant temperature warning lamp (overheating) and brake warning lamp
- 14 - Not used
- 15 - Not used
- 16 - Not used
- 17 - Not used
- 18 - Not used
- 19 - Positive (terminal 30) for analog clock/digital clock, 6-pin plug connector



- ◀ - 20 - Not used
- 21 - Not used
- 22 - Signal input for rev counter
- 23 - Negative for rev counter, for 5-cyl. engine only (coding)
- 24 - Negative for lamp in illuminated symbol no.10 (immobiliser/CAT 6-cyl. engine)
- 25 - Negative for lamp in illuminated symbol no.13 (brake/handbrake)
- 26 - Negative for lamp in illuminated symbol no.11 (diesel choke/CAT)



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Removing and attaching multi-pin connector plugs

Removal:

- Use small screwdriver or plastic wedge to lift plug catch upwards -arrow- as far as it will go.

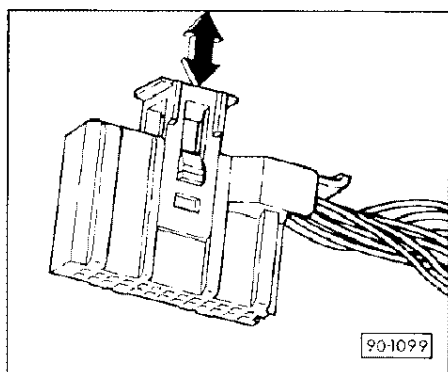
Note:

The plug cannot be removed unless the catch has been raised

- Pull off plug by hand.

Installation:

- Push plug by hand on as far as it will go
- Slide in the catch



90-19

Repairing multi-pin connector plugs

Notes:

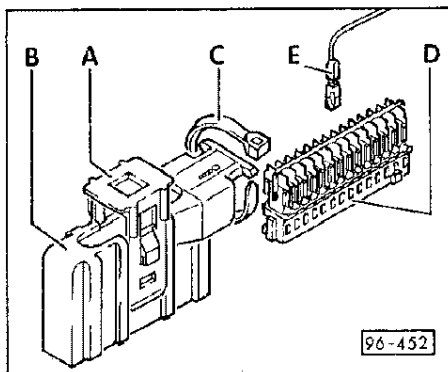
- ◆ A separate repair kit 893 998 315 must be used for repairing the connector (poor contact, loose contact, damage, open circuit, retrofitting).

= > Parts list

- ◆ Appropriate cavity assignment

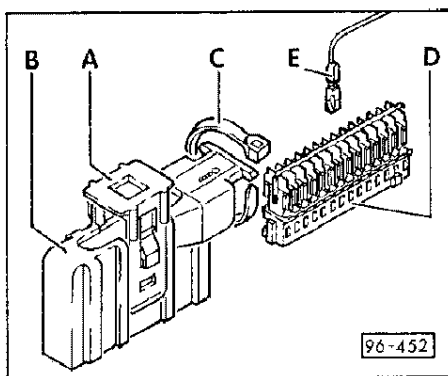
= > "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

- Remove cable tie -C-.
- Pull inner section of plug -D- out of outer section -B-.
- Release damaged contact, pull it out and remove it from the lead.
- Insert contact -E- of the new lead (from repair kit) into the relevant cavity



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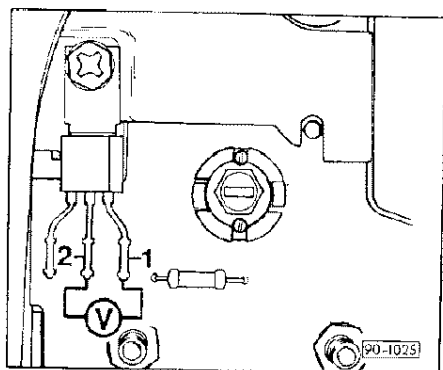
90-20



- ◀ - Slide inner section of plug -D- in until it engages and secure using cable tie -C-.
- Use provided housing to attach inserted lead to lead that has been detached from wiring harness.
- Stop repaired cable and connector housing from rattling using cable tie and insulating tape.

Checking dash panel insert components

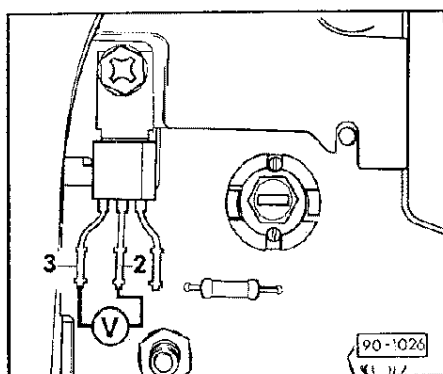
Checking voltage stabilizer



- Removing dash panel insert => Page 90-8

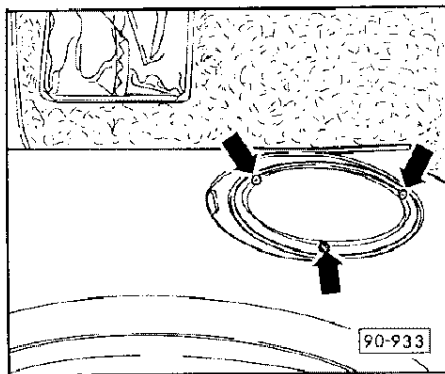
Note:

- ◀ *Do not detach battery earthing strap; leave all plugs attached to dash panel insert.*
- Check supply voltage by connecting a voltmeter between positive input -1- and earth -2-. Switch ignition on.
 - Specified value: approx. battery voltage

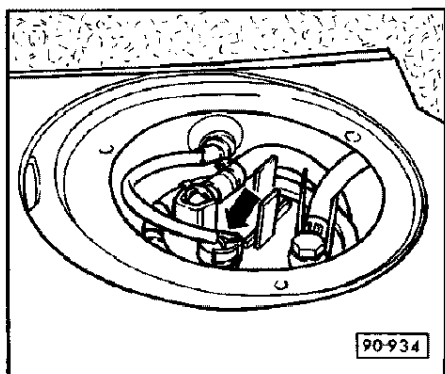


- ◀ - If specified value is not attained, locate open circuit using current flow diagram and rectify fault.
- Check output voltage by connecting a voltmeter between positive output -3- and earth -2-. Switch ignition on.
 - Specified value: 9,8 V / 10,4 V
- If specified value is not attained, replace circuit board.

Checking and adjusting fuel gauge

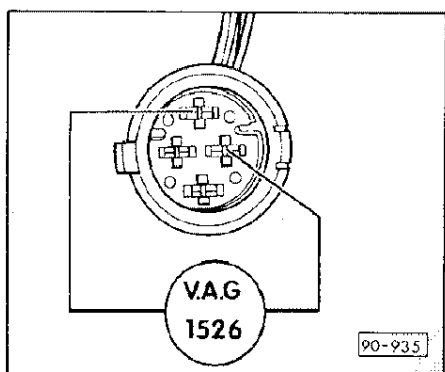


- Lift up carpet at front right of luggage compartment.
- Remove self-tapping screws -arrows- and detach cover.

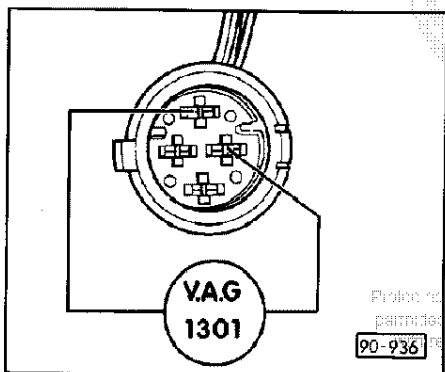


- Pull connector -arrow- off fuel gauge sensor.

90-23



- Use auxiliary cable to connect hand-held multimeter V.A.G 1526 between contacts of connector for fuel gauge sensor and switch to DC voltage measuring range.
- Switch ignition on.
 - Specified value: 9,8 ... 10.4 V
- Switch off ignition.
- If specified value is not attained, locate open circuit using current flow diagram and rectify fault or replace voltage stabilizer = > Page 90-22.



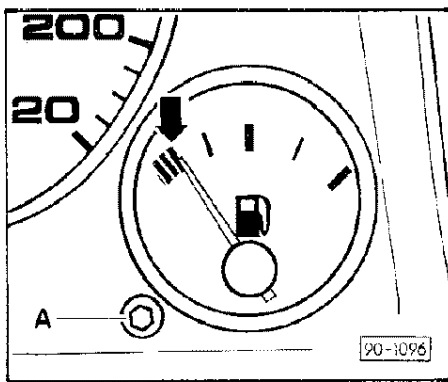
- Connect tester V.A.G 1301 to tank sensor lead plug connector in trunk using auxiliary cable.
- Adjust V.A.G 1301 tester as follows:
 - 280
- Switch on ignition for at least 2 minutes.

Note:

When making connection, ensure that the cavities in the connector are not pushed back.

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90-24



- ◀ – The needle on the gauge must be at the right edge of the third red mark (reserve zone) -arrow-.
- Whilst taking the reading, tap your finger lightly against the glass on the dash panel insert.
- If the specified value is not attained, use pointed-nose pliers to carefully pull off the adjusting screw cap.

Note:

To avoid scratches, cover the glass panel of the dash panel insert with a cloth.

- Turn adjusting screw -A- using Allen key/screwdriver to set pointer to specified value.

Notes:

- ◆ Whilst performing adjustment, tap your finger lightly against the glass on the dash panel insert.
- ◆ Do not start the engine.
- If the measured value is still not attained, replace the gauge.

Checking oil pressure switch – vehicles with mini-check system

- Removing dash panel insert => Page 90-8
- Detach 14-pin multi-pin connector from dash panel insert.
- Connect test adapter V.A.G 1598/13 to 14-pin connector (do not connect test adapter to dash panel insert).

Checking 0.3 bar oil pressure switch.

- Connect hand multimeter V.A.G 1526 to test box V.A.G 1598, socket 17 and earth using auxiliary cable and switch to resistance measuring range.
 - Specified value 0 Ω
- Run engine.
 - Specified value ∞ Ω
- Stop engine.
- If specified value is not attained, locate open circuit using current flow diagram and rectify or replace oil pressure switch.

Checking 0.9/1.8 bar oil pressure switch.

- Connect hand multimeter V.A.G 1526 to test box V.A.G 1598, socket 14 and earth using auxiliary cable and switch to resistance measuring range.
 - Specified value $\infty \Omega$
- Run engine (engine speed more than 2800 rpm).
 - Specified value 0Ω
- Stop engine.
- If specified value is not attained, locate open circuit using current flow diagram and rectify or replace oil pressure switch.

———— 90-27 ————

Checking oil pressure switch – vehicles with auto-check system

- Dash panel insert removed
- Detach 26-pin multi-pin connector (white) from dash panel insert.
- Connect test adapter V.A.G 1598/4 to 26-pin connector (do not connect test adapter to dash panel insert).

Checking 0.3 bar oil pressure switch.

- Connect hand multimeter V.A.G 1526 to test box V.A.G 1598, socket 19 and earth using auxiliary cable and switch to resistance measuring range.
 - Specified value 0Ω
- Run engine.
 - Specified value $\infty \Omega$
- Stop engine.
- If specified value is not attained, locate open circuit using current flow diagram and rectify or replace oil pressure switch.

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erwin

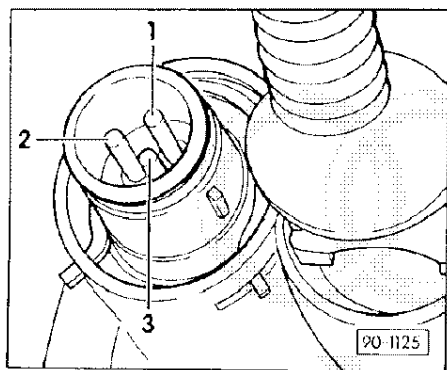
———— 90-28 ————

Checking 0.9/1.8 bar oil pressure switch.

- Connect hand multimeter V.A.G 1526 to test box V.A.G 1598, socket 17 and earth using auxiliary cable and switch to resistance measuring range.
 - Specified value $\infty \Omega$
- Run engine (engine speed more than 2800 rpm).
 - Specified value 0Ω
- Stop engine.
- If specified value is not attained, locate open circuit using current flow diagram and rectify or replace oil pressure switch.

90-29

Checking coolant temperature gauge

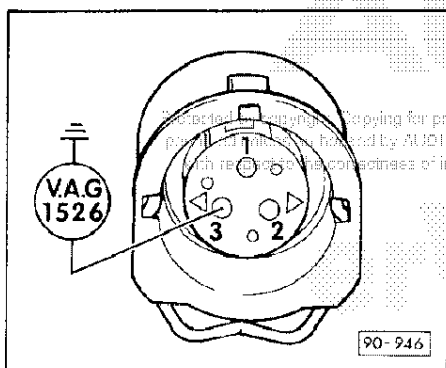


Vehicles with coolant temperature control switch (overheating) - F14 and coolant temperature gauge sensor - G2

Switch/sensor connections:

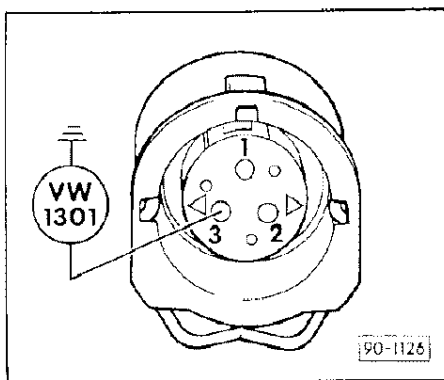
- 1 - Actuation of coolant temperature warning lamp (overheating)
- 2 - Earth
- 3 - Actuation of coolant temperature gauge

Location in 4-cylinder engine: Back of coolant connection.

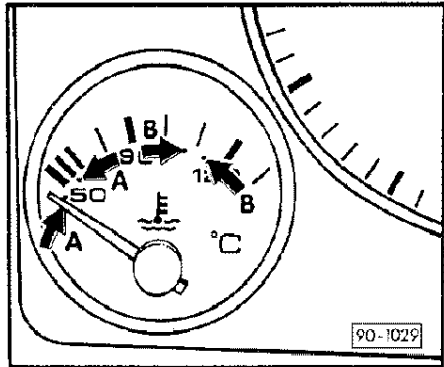


- Remove connector from switch/sensor.
 - Use auxiliary cable to connect hand-held multimeter V.A.G 1526 between contact 3 of plug and earth and switch to DC voltage measuring range.
 - Switch ignition on.
 - Specified value: 9.8 ... 10.4 V
 - Switch off ignition.
 - If specified value is not attained, locate open circuit using current flow diagram and rectify fault or check voltage stabilizer
- => Page 90-22.

90-30



- ◀ - Connect tester V.A.G 1301 to connector contact -3- and earth.
- Adjust V.A.G 1301 tester as follows:
 - cold - 560
 - hot - 58
- Switch ignition on.



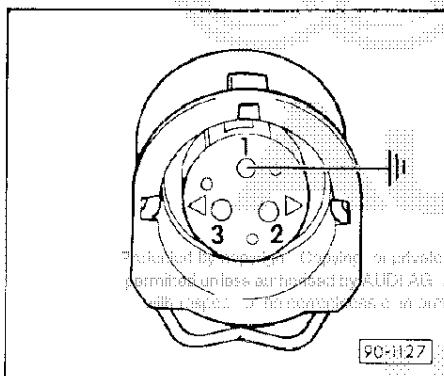
- ◀ At a test setting of 560, the needle must be within the tolerance range of the two test positions-A- in the coolant temperature gauge.
- At a test setting of 58, the needle must be within the tolerance range of the two test positions-B- on the coolant temperature gauge.
- If the specified values are not attained in spite of this, check the voltage supply to the coolant temperature gauge, including the voltage stabilizer.
- If these are OK, replace the gauge.
- If the specified values are not attained, but the indicating instrument either does not function or gives an incorrect reading, check earth connection to contact 2 or replace defective coolant temperature sensor.

Checking coolant temperature warning lamp (overheating)

Note:

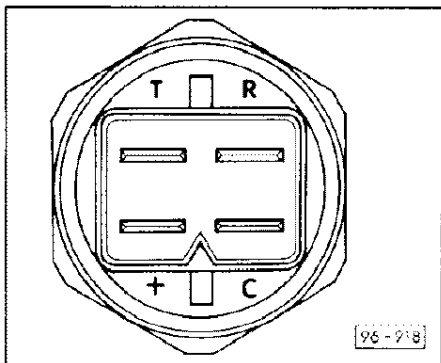
Connections on coolant temperature control switch (overheating)/coolant temperature sensor and fitting location => Page 90-30.

- Remove plug from coolant temperature warning switch (overheating).



- ◀ - Connect contact -1- to earth using auxiliary cable.
- Run engine.
 - Warning lamp in display unit for mini-check system must flash.
- If the warning lamp does not flash, check bulb (1.2 W) or locate open circuit using current flow diagram and remedy.
- If this is OK, check display unit for mini-check system in dash panel insert in line with troubleshooting instructions.
- => "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

Vehicles with electronic thermo switch -F76

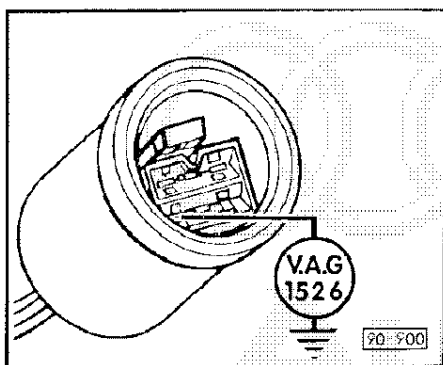


- ◀ Connections at electronic thermo switch:
 - + - Voltage supply, term. 15a
 - C - Actuation of coolant temperature warning lamp (overheating)
 - R - Air conditioner safety shutdown
 - T - Actuation of coolant temperature gauge

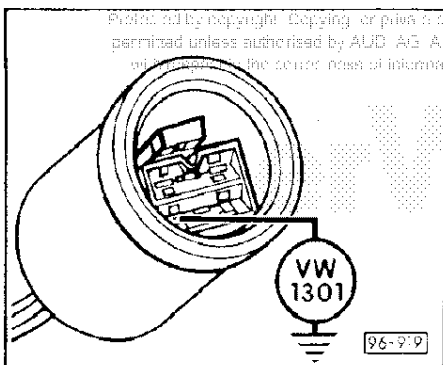
Locations:

- ◆ 4-cylinder engine: on front or back of coolant connection
- ◆ 5-cylinder engine: on front of coolant connection.
- ◆ 6-cylinder engine: at coolant pipe on right, between plenum chamber and engine.

90-33

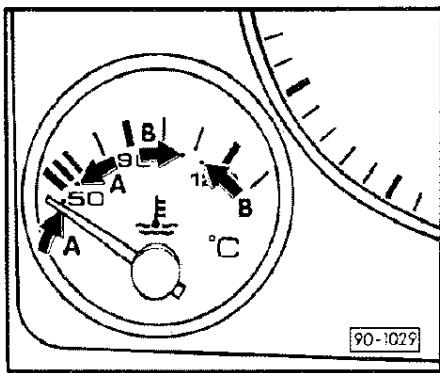


- Disconnect plug from thermo switch.
- Use auxiliary cable to connect hand-held multimeter V.A.G 1526 between contact -T- of plug and earth and switch to DC voltage measuring range.
- Switch ignition on.
 - Specified value: 9,8 ... 10.4 V
- Switch off ignition.
- If specified value is not attained, locate open circuit using current flow diagram and rectify fault or check voltage stabilizer => Page 90-22.



- ◀ - Connect tester V.A.G 1301 to connector contact -T- and earth using auxiliary cable.
- Adjust V.A.G 1301 tester as follows:
 - cold - 560
 - hot - 58
- Switch ignition on.

90-34



- ◀ At a test setting of 560, the needle must be within the tolerance range of the two test positions -A- in the coolant temperature gauge.

At a test setting of 58, the needle must be within the tolerance range of the two test positions -B- on the coolant temperature gauge.

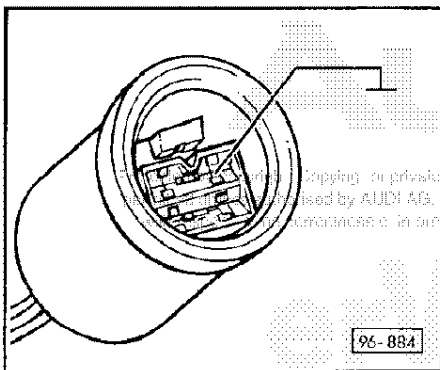
- If specified values are not attained, locate open circuit using current flow diagram and rectify or check voltage stabilizer => 90-22.
- If these are OK, replace the gauge.
- If the specified values are attained, but the indicating instrument fails to function or gives an incorrect reading, check earth connection to electronic thermo switch or replace defective thermo switch.

Checking coolant temperature warning lamp (overheating)

Note:

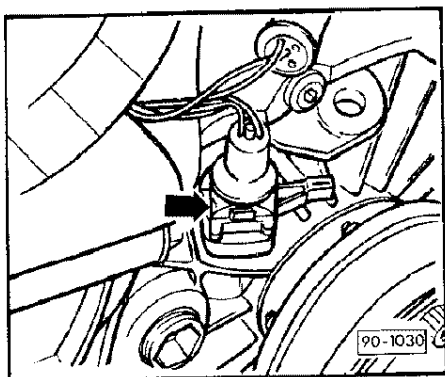
Connections at electronic thermo switch: => Page 90-33.

- Disconnect plug from thermo switch.



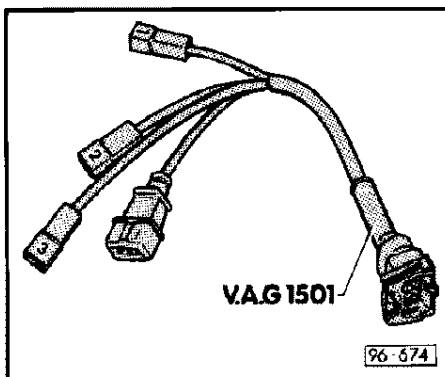
- ◀ - Connect contact -C- to earth using auxiliary cable.
 - Run engine.
 - Warning lamp in display unit for mini-check system must flash.
 - If the warning lamp does not flash, check bulb (1.2 W) or locate open circuit using current flow diagram and remedy.
 - If this is OK, check display unit for mini-check system in dash panel insert in line with troubleshooting instructions.
- => "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

Checking speedometer sensor



Location: On left of gearbox next to drive shaft flange.

- Squeeze spring clip and pull 3-pin connector -arrow- from sensor.
- Connect test adapter V.A.G 1501 to speedometer sensor.



- Connect hand-held multimeter V.A.G 1526 between flat-pin plugs -2- and -3- of test adapter V.A.G 1501 and switch to resistance measuring range 2 k Ω .
- Release hand brake, move gear lever to neutral or engage position N (automatic gearbox).
- Move vehicle forwards and backwards slightly.

Warning

Test must be performed on a perfectly horizontal surface.

90-37

Specified value:

- Reading on hand-held multimeter V.A.G 1526 must fluctuate between 0 Ω and $\infty\Omega$.
- If specified value still not attained, replace the speedometer sensor.
- If specified value attained but speedometer still not working, measure sensor signal at instrument panel wiring loom.

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Checking speedometer signal at instrument panel wiring harness

- Dash panel insert removed
- Detach 26-pin multi-pin connector (blue) from dash panel insert.
- Connect test adapter V.A.G 1598/4 to 26-pin connector (do not connect test adapter to dash panel insert).
- Connect hand-held multimeter V.A.G 1526 between contacts 20 and 21 of test box V.A.G 1598 and switch to resistance measuring range.

90-38

- Release hand brake, move gear lever to neutral or engage position N (automatic gearbox).

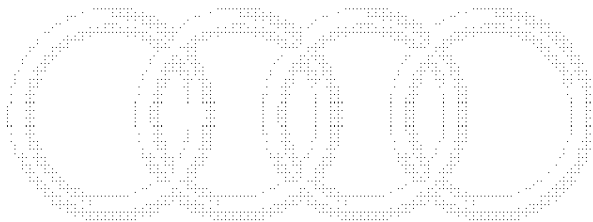
Warning

Test must be performed on a perfectly horizontal surface.

- Move vehicle forwards and backwards slightly.

Specified value:

- Reading on hand-held multimeter V.A.G 1526 must fluctuate between 0Ω and $\infty \Omega$.
 - If specified value is not attained, eliminate open circuit using current flow diagram.
 - If specified value is attained but speedometer is still not working, check speedometer voltage supply as per current flow diagram or use troubleshooting instructions to check speedometer.
- = > "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder



90-39

Checking engine speed signal

- Dash panel insert removed
 - Detach 26-pin multi-pin connector (yellow) from dash panel insert.
 - Connect measuring adapter V.A.G 1598/4 between 26-pin plug and dash panel insert.
 - Connect test box V.A.G 1598 to test adapter V.A.G 1598/4.
 - Use auxiliary cable to connect red terminal of V.A.G 1362 mini-tester to socket 19 and black terminal to socket 22 of test box V.A.G 1598 and switch to engine speed measurement.
 - Run engine.
 - Specified value: Engine speed
 - If specified value is not attained, eliminate open circuit using current flow diagram.
 - If specified value attained but rev counter still not working, check rev counter voltage supply as per current flow diagram.
- = > "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

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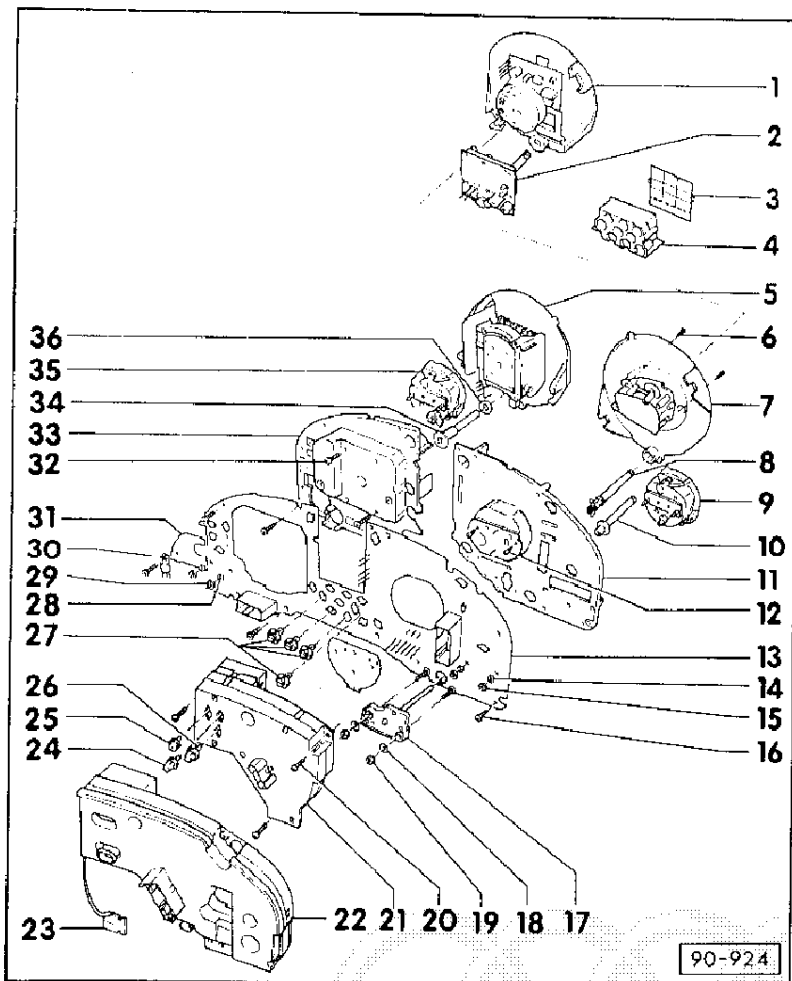


90-40

Removal and installation of dash panel insert components:

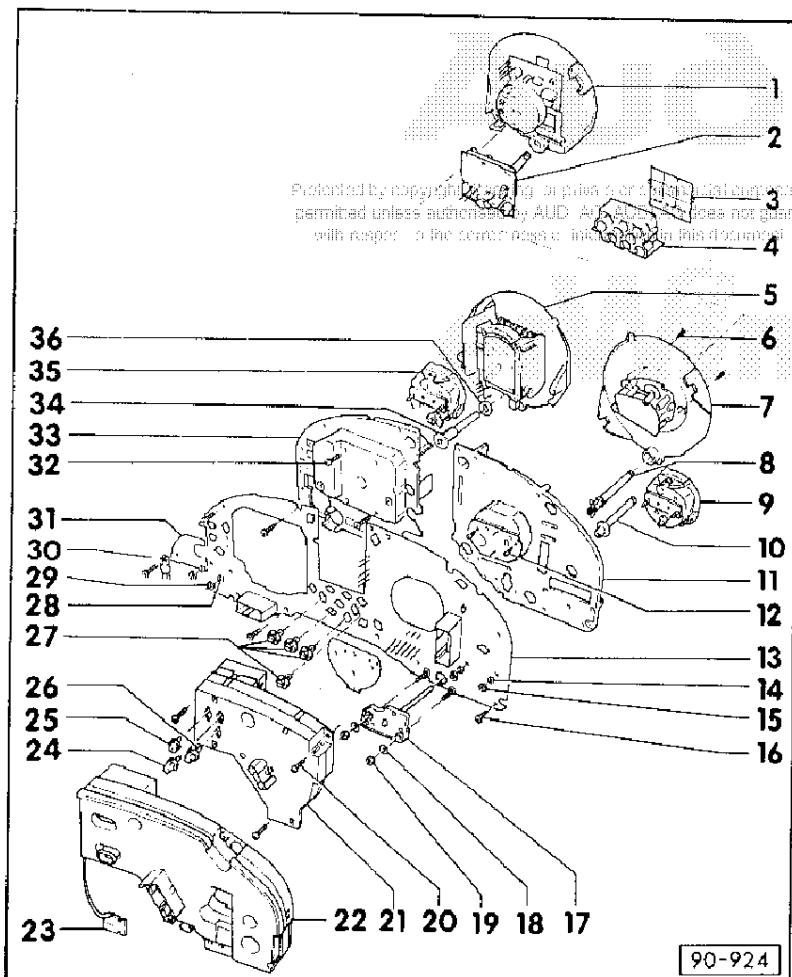
VDO dash panel insert

- Removing and installing dash panel insert => Page 90-8.



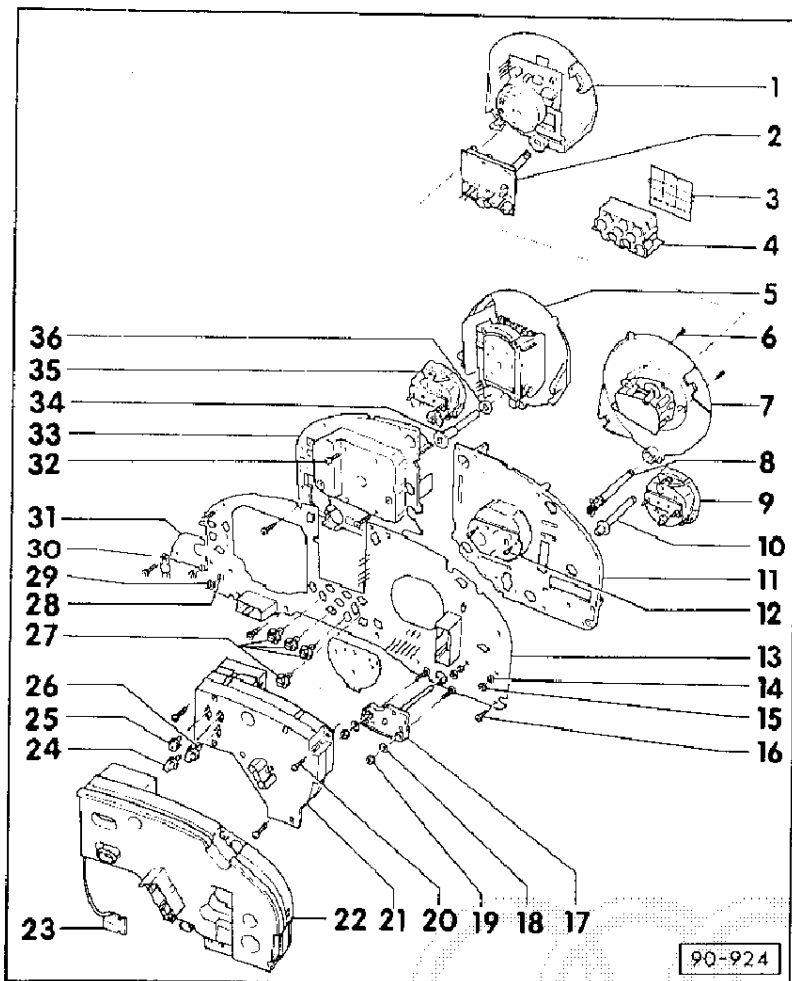
- 1 - Rev. counter
 - ◆ Checking engine speed signal => Page 90-40
 - ◆ Removing and installing => Page 90-51
- 2 - Digital clock
 - ◆ Removing and installing => Page 90-52
- 3 - Symbol panel
 - ◆ For indicator/warning lamps

90-41



- 4 - Light guide
 - ◆ For dash panel insert housing
- 5 - Speedometer
 - ◆ Checking speedometer sensor => Page 90-37.
 - ◆ Removing and installing => Page 90-50
- 6 - Securing bolts
- 7 - Analog clock
 - ◆ For vehicles with no rev counter
 - ◆ Removing and installing => Page 90-53
- 8 - Adjuster
 - ◆ For digital/ Analog clock

90-42



9 - Coolant temperature gauge:

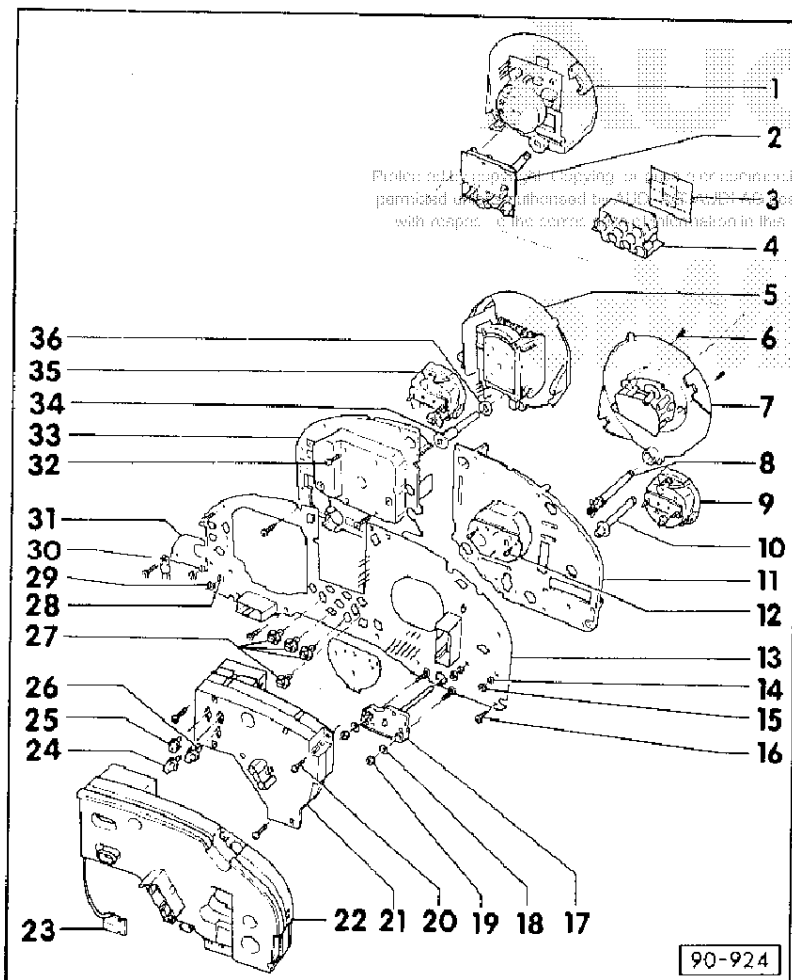
- ◆ Checking:
- ◆ Vehicles with coolant temperature control switch (overheating) -F14 and coolant temperature gauge sensor -G2 => Page 90-30
- ◆ Vehicles with electronic thermo switch -F76 => Page 90-33
- ◆ Removing and installing => Page 90-52

10 - Rotating pin

- ◆ For dash panel insert brightness/auto-check system button

11 - Mounting plate

- ◆ For rev counter/analog clock



12 - Securing bolt

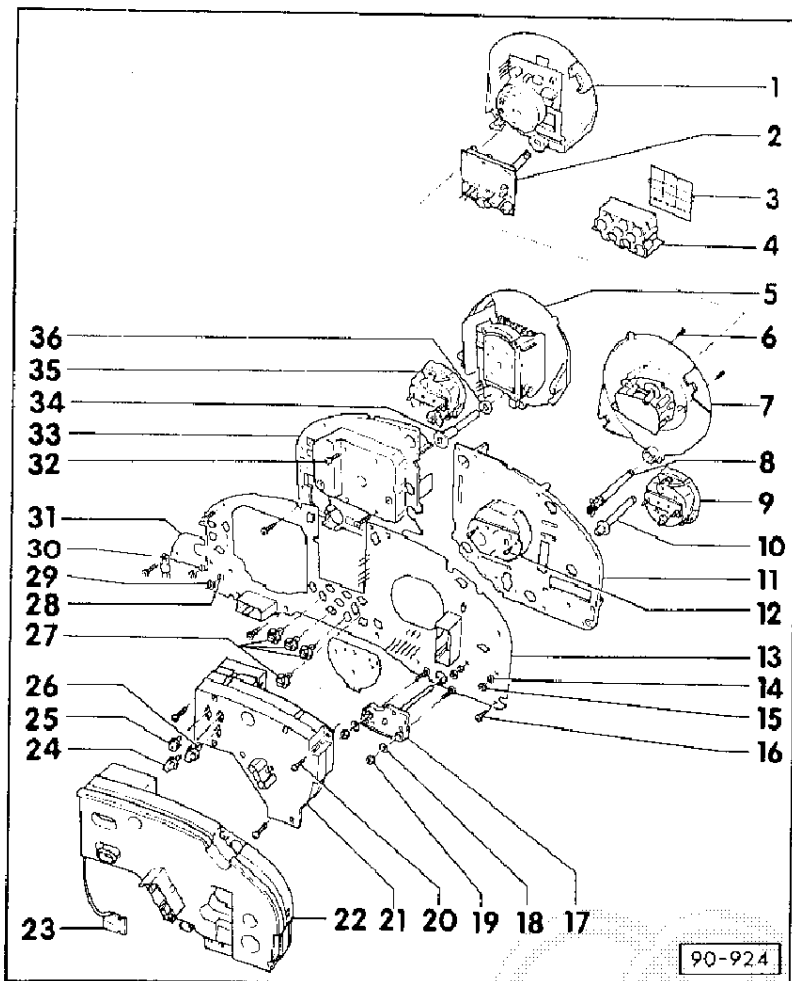
13 - Printed circuit board

- ◆ Assignment of multi-pin connectors => Page 90-13 onwards
- ◆ Removing and installing => Page 90-49
- ◆ Removing and attaching multi-pin connector => Page 90-19
- ◆ Repairing multi-pin connector => Page 90-20

14 - Corrugated washer

15 - Hexagon nut M4

16 - Securing bolt



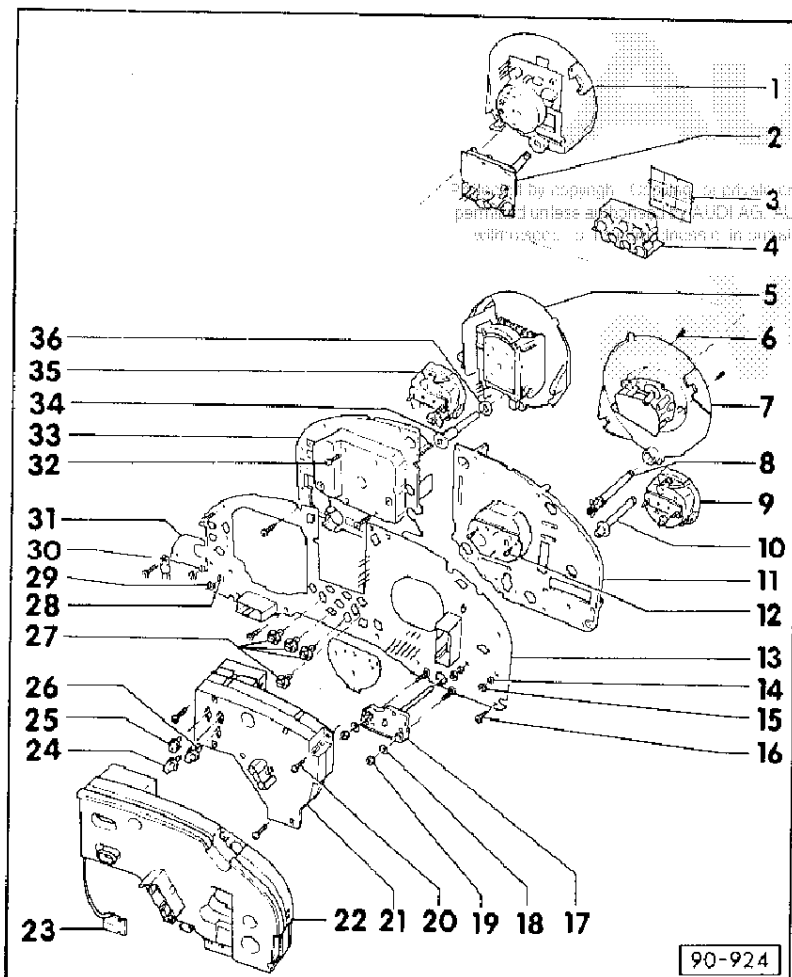
- 17 - Controller**
 - ◆ For dash panel insert, switch and instrument lighting
 - ◆ Removing and installing = > Page 90-71

 - 18 - Washer**

 - 19 - Hexagon nut M3**

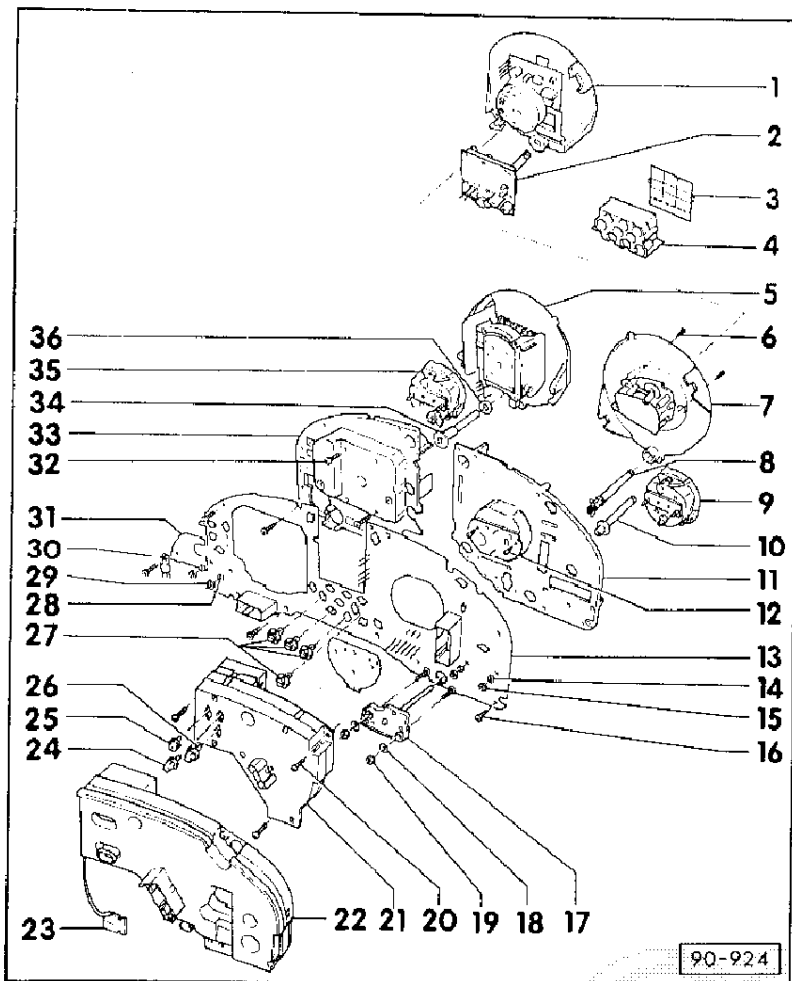
 - 20 - Securing bolt**
 - ◆ for mini-check/auto-check system/on-board computer

 - 21 - Display unit**
 - ◆ For mini-check system
 - ◆ Removing and installing = > Page 90-72
 - ◆ checking
- = > "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

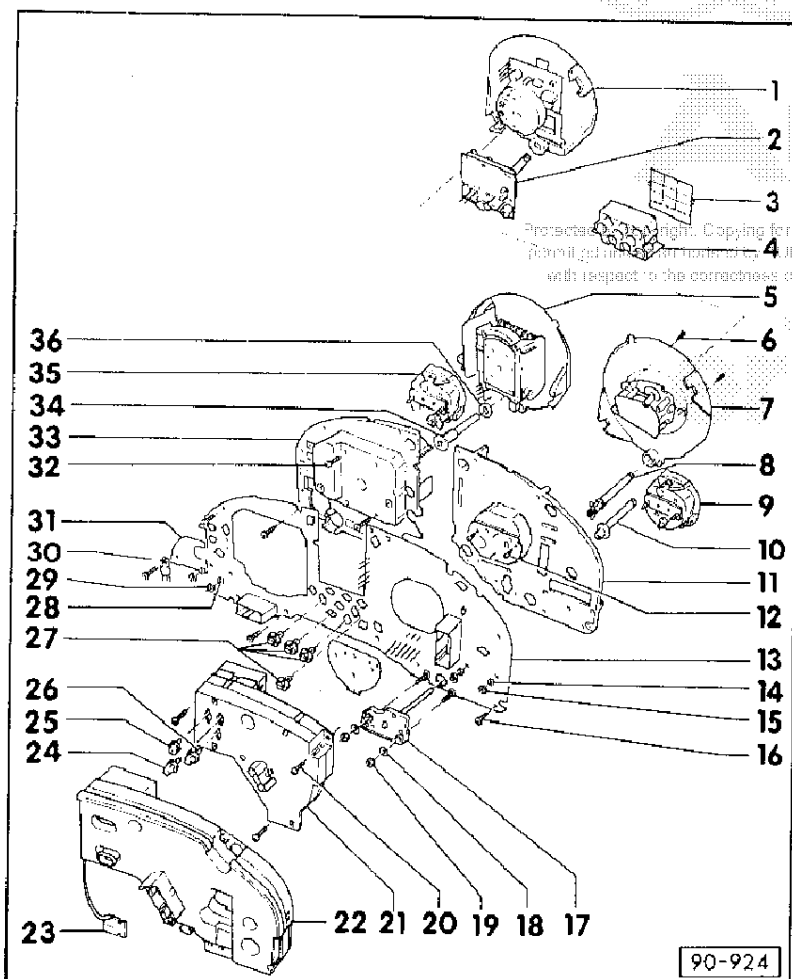


- 22 - Display unit**
 - ◆ for auto-check system/on-board computer
 - ◆ Removing and installing = > Page 90-72
 - ◆ checking
- = > "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder
- 23 - Controller**
 - ◆ For range calibration with on-board computer

 - 24 - Coolant temperature warning lamp (overheating)**
 - ◆ Checking:
 - ◆ Vehicles with coolant temperature control switch (overheating) -F14 and coolant temperature gauge sensor -G2 = > Page 90-30
 - ◆ Vehicles with electronic thermo switch -F76 = > Page 90-33

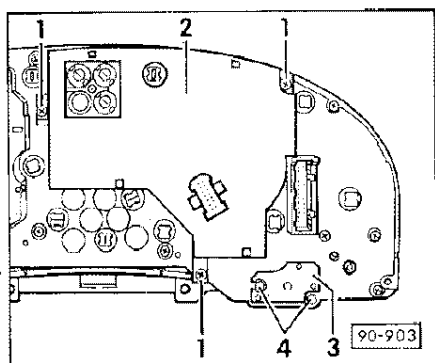


- 25 - Brake warning lamp
- 26 - Oil pressure warning lamp
- 27 - Warning and indicator lamps
 - ◆ Assignment => Page 90-9
- 28 - Corrugated washer
- 29 - Hexagon nut M4
- 30 - Voltage stabiliser
 - ◆ Checking => Page 90-22
 - ◆ Removing and installing => Page 90-73
- 31 - Heat sink
- 32 - Securing bolt
 - ◆ For speedometer

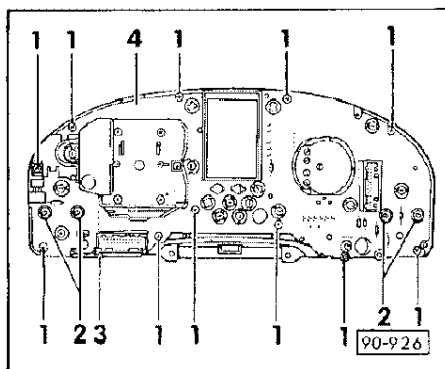


- 33 - Mounting plate
 - ◆ For speedometer
- 34 - Adjusting screw
 - ◆ For fuel gauge
- 35 - Fuel gauge
 - ◆ Checking => Page 90-23
 - ◆ Removing and installing => Page 90-51
- 36 - Felt ring

Removing and installing VDO printed circuit board



- ◀ – Unscrew hexagon nut -4- with washers and remove brightness control -3- for dash panel insert lighting.
- Release fastening screws -1- and remove display unit for mini-check system-2-.



- ◀ – Remove fastening screws -1- and securing nuts -2-.
- dash panel insert with analog clock: Pull off contact plate for analogue clock => Page 90-54.
- Press back catch -3- and carefully remove printed circuit board -4-.

Note:

Remove carefully to avoid breakage!

90-49

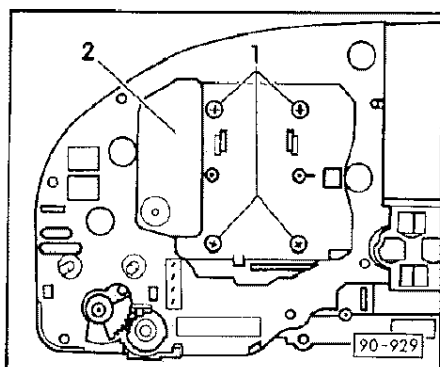
Removing and installing VDO front surround

- Removing printed circuit board => Page 90-49
- Remove base plates for analog clock/and rev counter and speedometer from front surround.

Removing and installing VDO speedometer

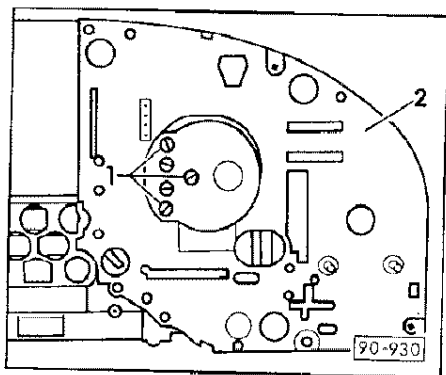
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- ◀ – Removing printed circuit board => Page 90-49
- Unscrew fastening screws -1- for speedometer.
- Remove base plate -2- for speedometer from front surround.
- Carefully remove speedometer from base plate.



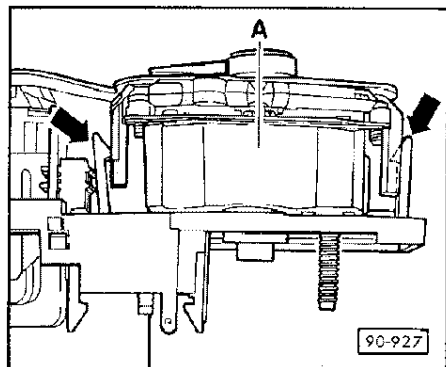
90-50

Removing and installing VDO rev counter



- ◀ - Removing printed circuit board => Page 90-49
- Unscrew fastening screws -1- for rev counter.
- Remove base plate -2- for rev counter from front surround.
- Carefully remove rev counter from base plate.

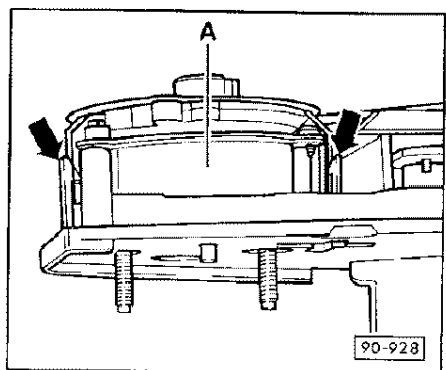
Removing and installing VDO fuel gauge



- ◀ - Removing printed circuit board => Page 90-49
- Press back catches -arrows- and remove fuel gauge -A- from base plate.

90-51

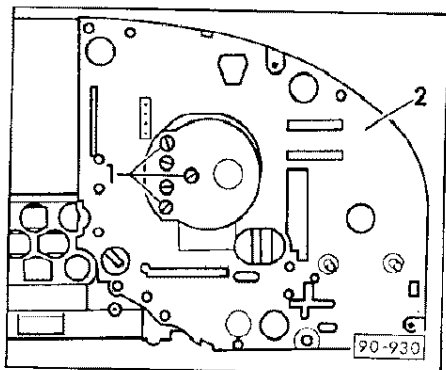
Removing and installing VDO coolant temperature gauge



- ◀ - Removing printed circuit board => Page 90-49
- Press back catches -arrows- and remove coolant temperature gauge -A- from base plate.

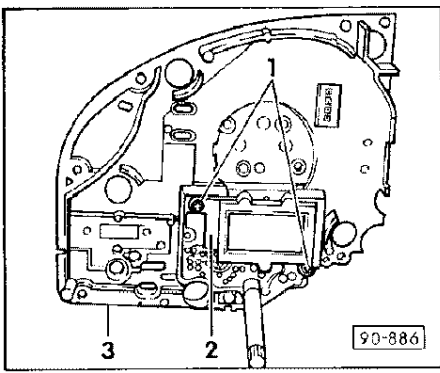
Removing and installing VDO digital clock

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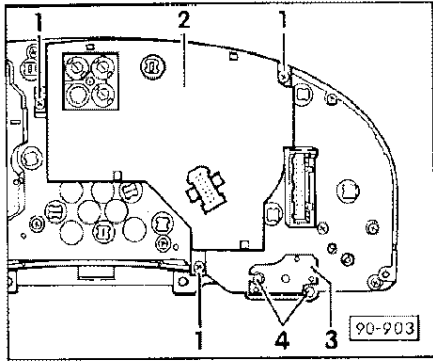
- ◀ - Removing printed circuit board => Page 90-49
- Unscrew fastening screws -1- for rev counter.
- Remove base plate -2- for rev counter from front surround.
- Carefully remove rev counter from base plate.

90-52



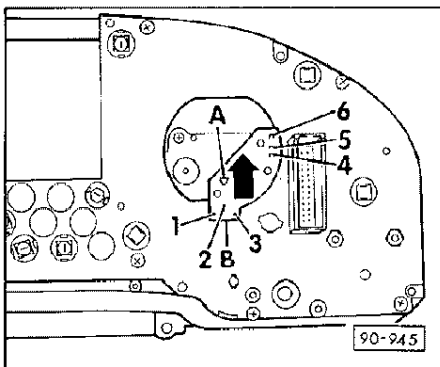
- ◀ - Unscrew fastening screws -1- for digital clock.
- Remove digital clock -2- from base plate -3- for rev counter.

Removing and installing VDO analogue clock

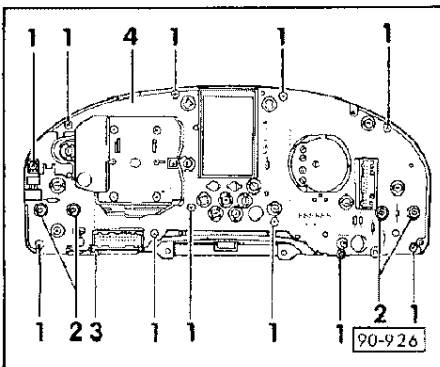
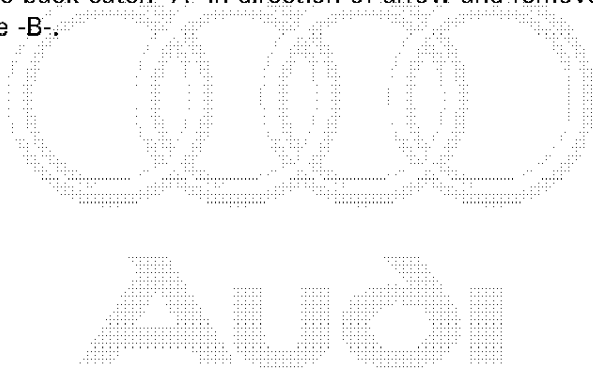


- ◀ - Unscrew hexagon nuts -4- with washers and remove brightness control -3- for dash panel insert lighting.
- Release fastening screws -1- and remove display unit for mini-check system-2-.

— 90-53 —



- ◀ - Press back catch -A- in direction of arrow and remove contact plate -B-.



- ◀ - Remove fastening screws -1- and securing nuts -2-.
- Press back catch -3- and carefully remove printed circuit board -4-.

Note:

Remove carefully to avoid breakage!

- Remove base plate for analog clock from front surround.

— 90-54 —

Nippon Seiki dash panel insert

- Removing and installing dash panel insert => Page 90-8.

1 - Oil pressure warning lamp

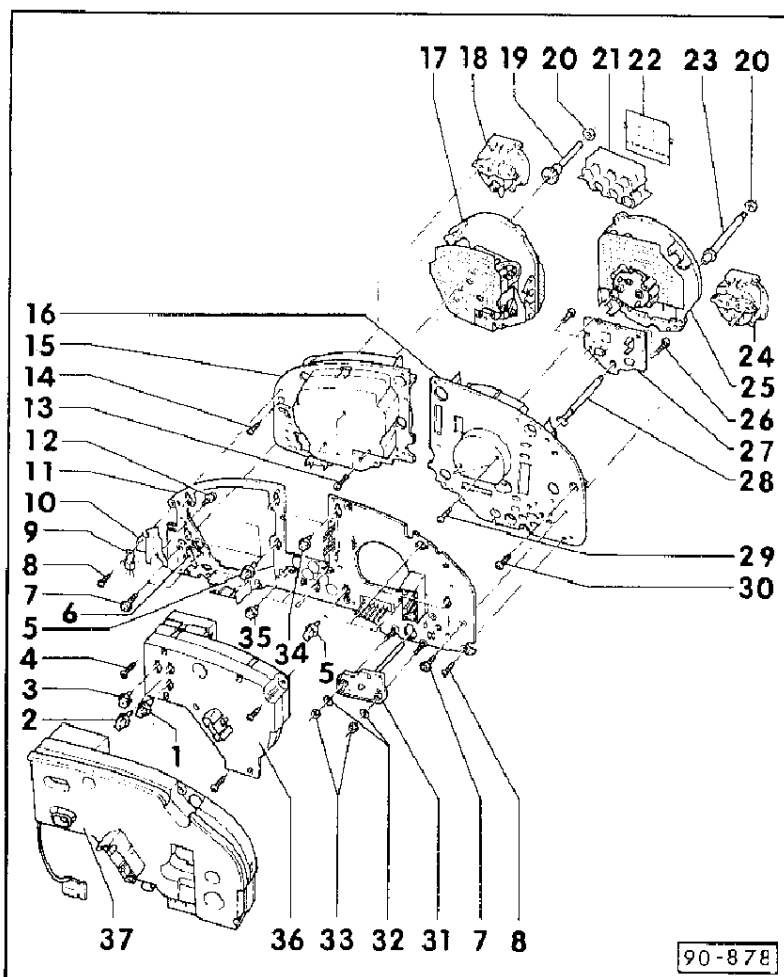
2 - Coolant temperature warning lamp (overheating)

◆ Checking:

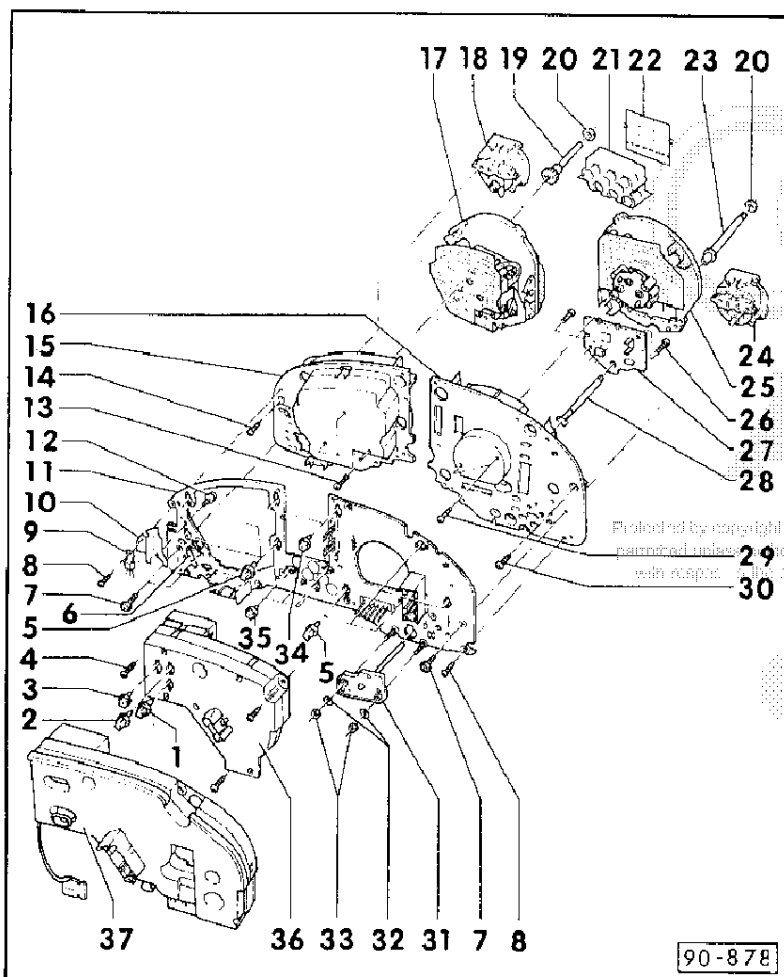
◆ Vehicles with coolant temperature control switch (overheating) -F14 and coolant temperature gauge sensor -G2 => Page 90-30

◆ Vehicles with electronic thermo switch -F76 => Page 90-33

3 - Brake warning lamp



90-55



4 - Securing bolt

◆ for mini-check/auto-check system/on-board computer

5 - Lamps for dash panel lighting

6 - Connector

◆ For speedometer

7 - Securing bolt

8 - Securing bolt

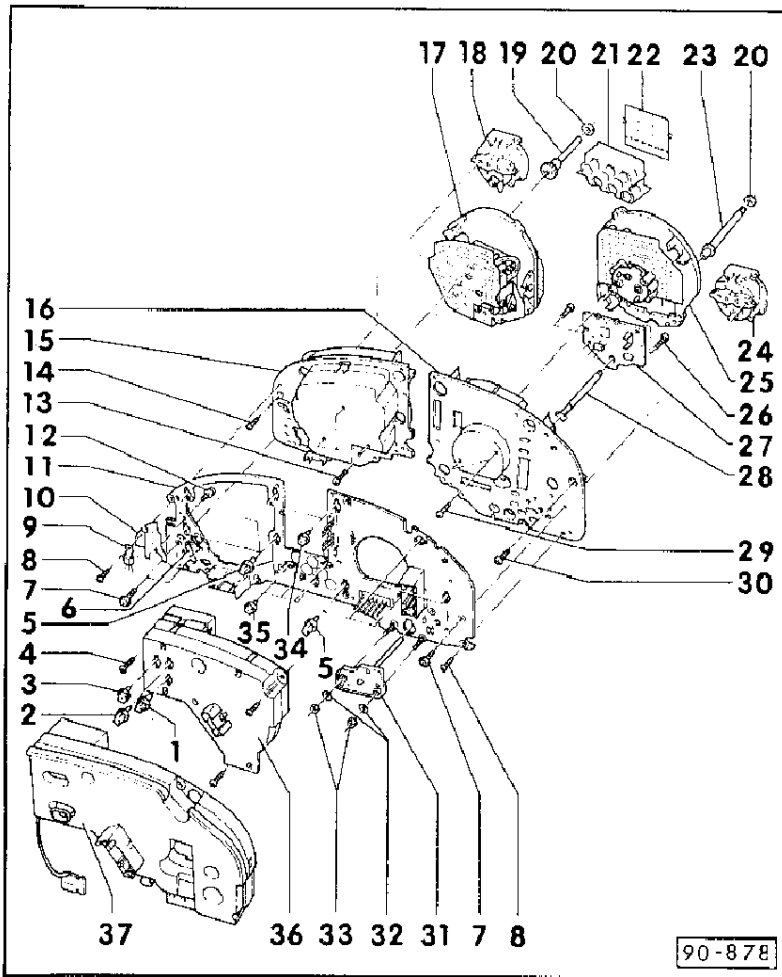
9 - Voltage stabiliser

◆ Checking => Page 90-22

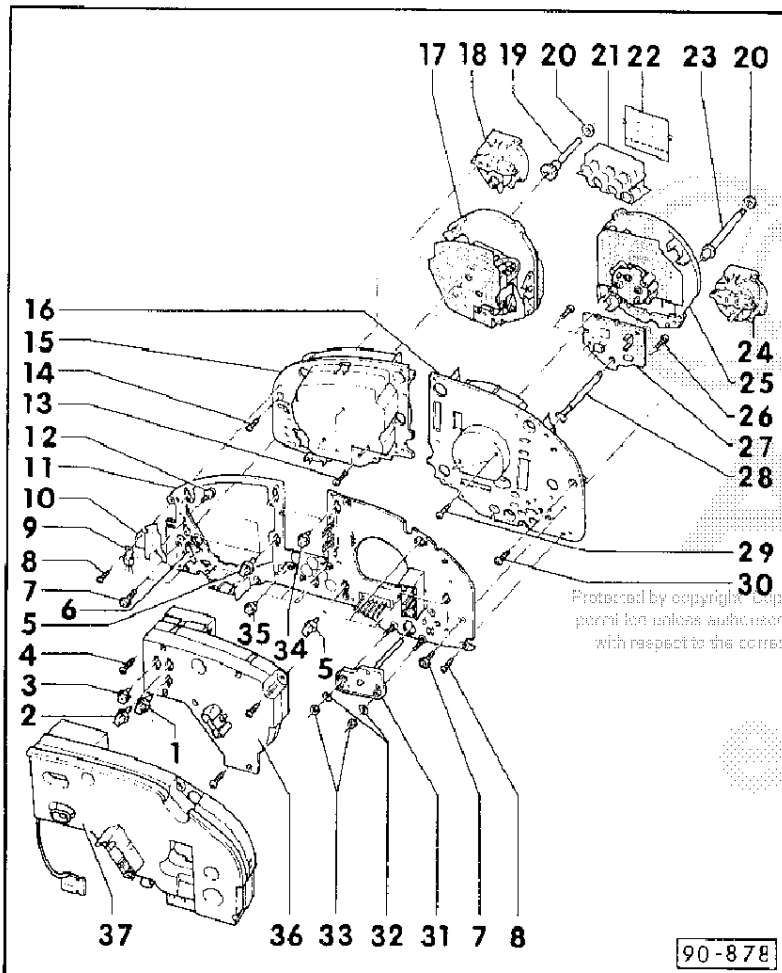
◆ Removing and installing => Page 90-73

10 - Heat sink

90-56

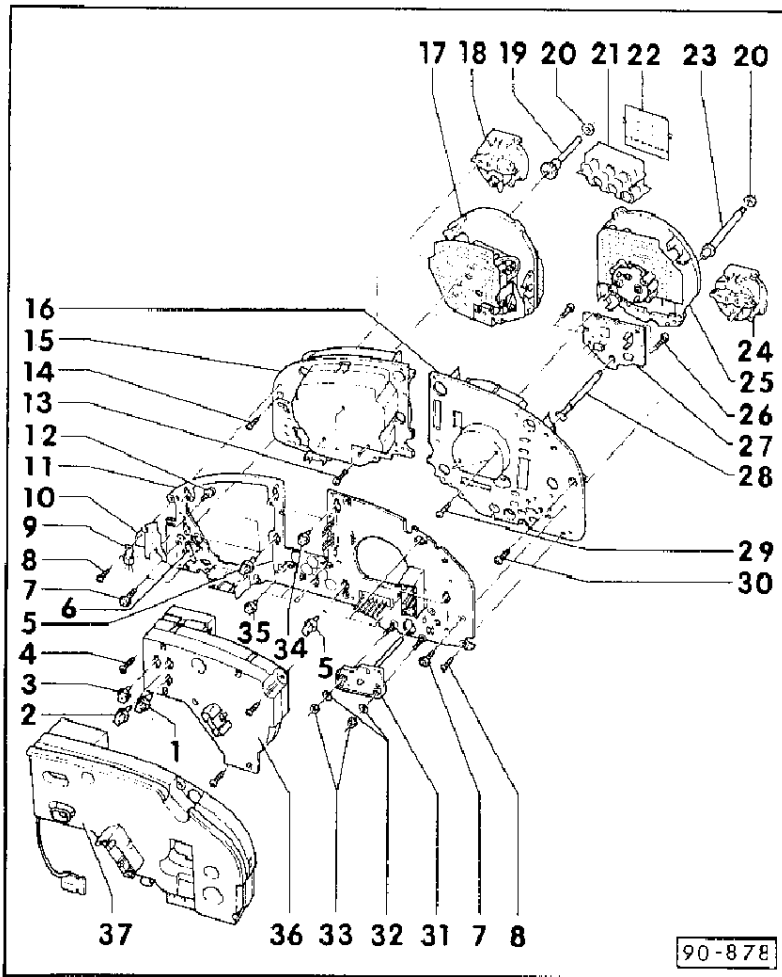


- 11 - Printed circuit board
 - ◆ Assignment of multi-pin connectors => Page 90-13 onwards
 - ◆ Removing and installing => Page 90-63
 - ◆ Removing and attaching multi-pin connector => Page 90-19
 - ◆ Repairing multi-pin connector => Page 90-20
- 12 - Securing bolt
- 13 - Securing bolt
 - ◆ For speedometer
- 14 - Securing bolt
 - ◆ For speedometer base plate

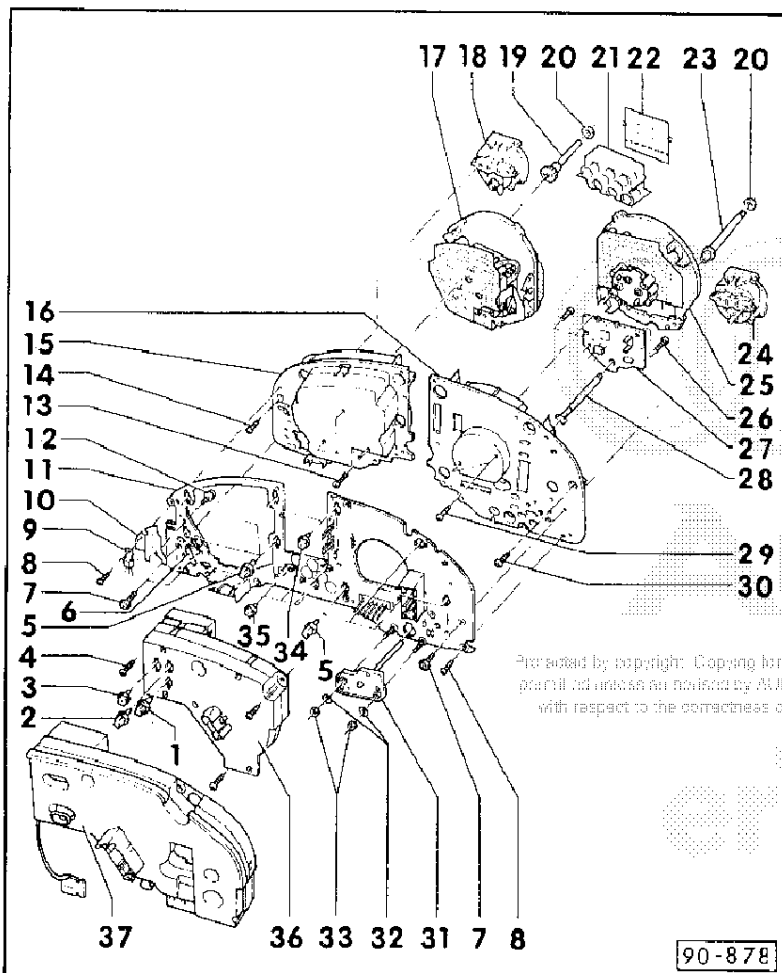


- 15 - Mounting plate
 - ◆ For speedometer
- 16 - Mounting plate
 - ◆ For rev. counter
- 17 - Speedometer
 - ◆ Checking speedometer sensor => Page 90-37.
 - ◆ Removing and installing => Page 90-66
- 18 - Fuel gauge
 - ◆ Checking => Page 90-23
 - ◆ Removing and installing => Page 90-68
- 19 - Adjusting screw
 - ◆ For fuel gauge
- 20 - Felt ring

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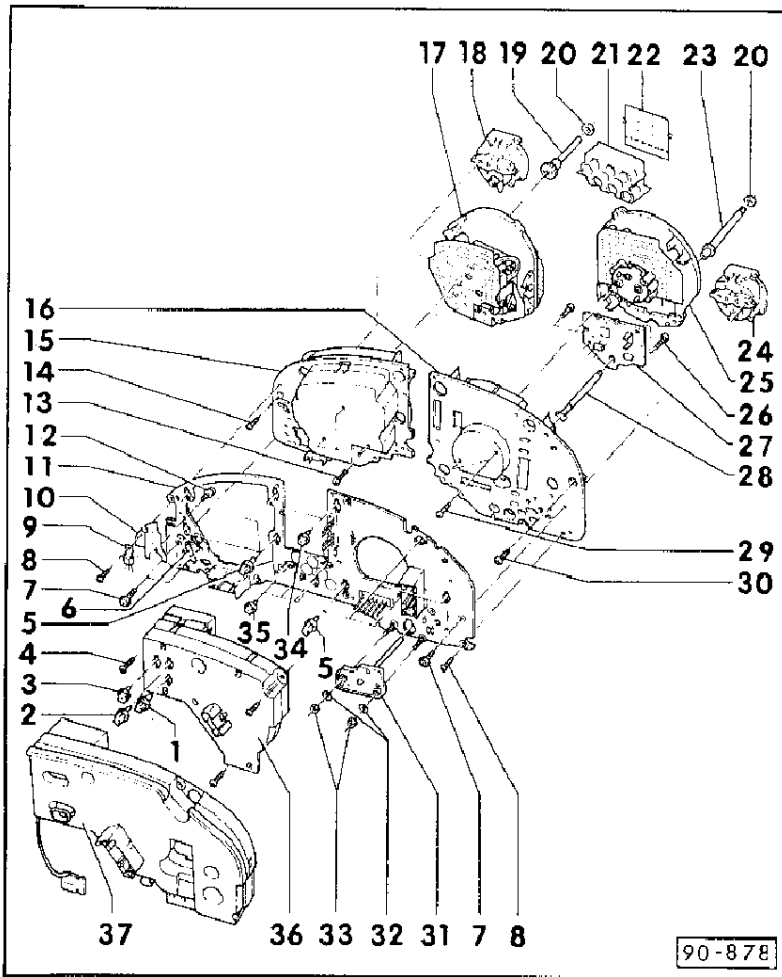


- 21 - Light guide
 - ◆ For dash panel insert housing
- 22 - Symbol panel
 - ◆ For indicator/warning lamps
- 23 - Rotating pin
 - ◆ For dash panel insert lighting/auto-check system button controller
- 24 - Coolant temperature gauge:
 - ◆ Inserted into front surround
 - ◆ Checking:
 - ◆ Vehicles with coolant temperature control switch (overheating) -F14 and coolant temperature gauge sensor -G2 => Page 90-30

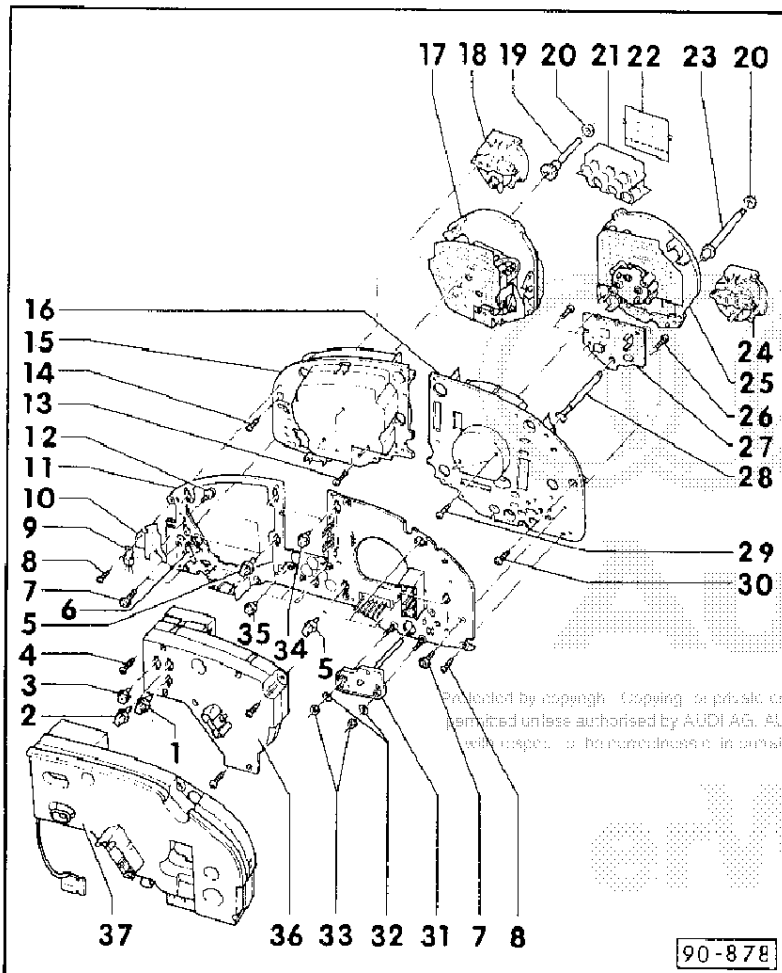


- ◆ Vehicles with electronic thermo switch -F76 => Page 90-33
- ◆ Removing and installing => Page 90-69
- 25 - Rev. counter
 - ◆ Checking engine speed signal => Page 90-40
 - ◆ Removing and installing => Page 90-67
- 26 - Securing bolt
 - ◆ For digital clock
- 27 - Digital clock
 - ◆ Removing and installing => Page 90-70
- 28 - Adjuster
 - ◆ For digital clock

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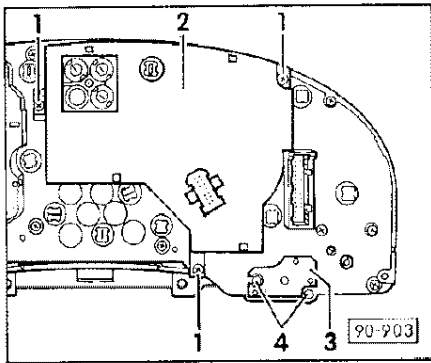


- 29 - Securing bolt
 - ◆ For rev counter
- 30 - Securing bolt
 - ◆ For rev counter base plate
- 31 - Controller
 - ◆ For dash panel insert, switch and instrument lighting
 - ◆ Removing and installing => Page 90-71
- 32 - Washers
- 33 - hexagon nuts
- 34 - Turn signal indicator lamp
- 35 - Warning and indicator lamps
 - ◆ Assignment => Page 90-9

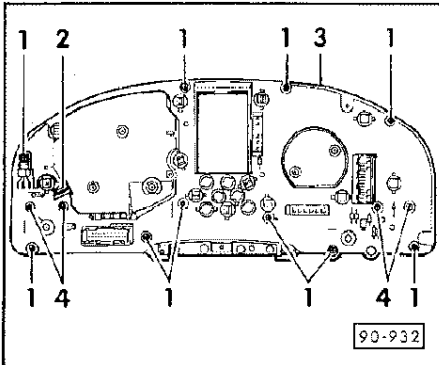


- 36 - Display unit
 - ◆ For mini- check system
 - ◆ checking
 - => "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder
 - ◆ Removing and installing => Page 90-72
- 37 - Display unit
 - ◆ for auto-check system/on-board computer
 - ◆ checking
 - => "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder
 - ◆ Removing and installing => Page 90-72

Removing and installing Nippon Seiki printed circuit board



- ◀ – Unscrew hexagon nut -4- with washers and remove brightness control -3- for dash panel insert lighting, switches and instruments.
- Release fastening screws -1- and remove display unit for mini-check system-2-.



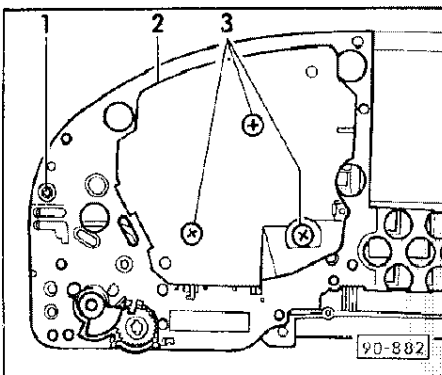
- ◀ – Remove fastening screws -1- and -4-.
- Detach connector -2- for speedometer.
- Carefully remove printed circuit board -3-.

Note:

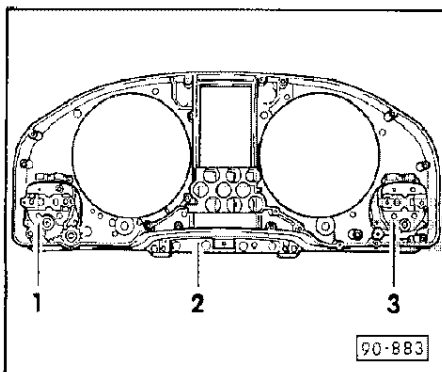
Remove carefully to avoid breakage!

90-63

Removing and installing Nippon Seiki front surround



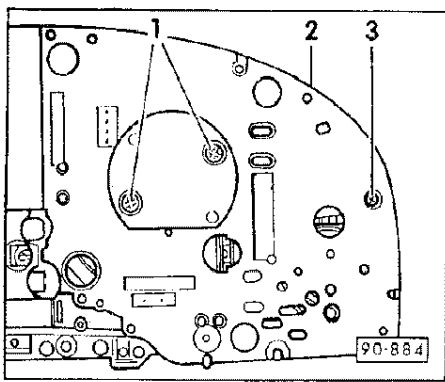
- Removing printed circuit board => Page 90-63
- ◀ – Remove fastening screw -1- for speedometer base plate -2-.
- Remove speedometer base plate and speedometer.



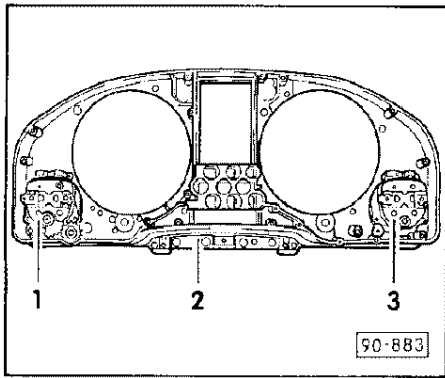
- ◀ – Remove fuel gauge -1- from front surround -2-.

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90-64

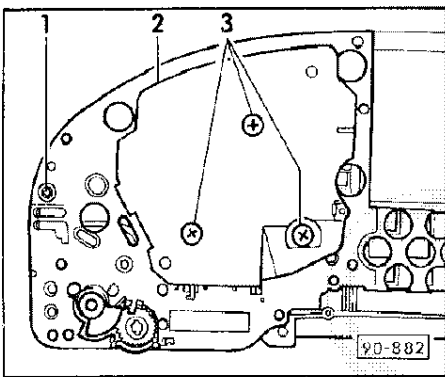


- ◀ - Remove fastening screw -3- for rev counter base plate -2-.
- Remove rev counter base plate and rev counter.

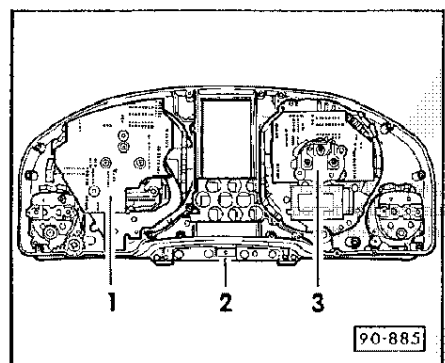


- ◀ - Remove coolant temperature gauge -3- from front surround -2-.

Removing and installing Nippon Seiki speedometer



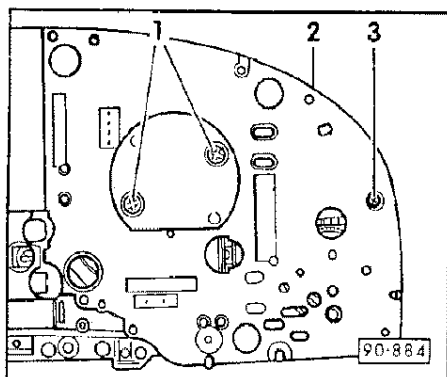
- Removing printed circuit board => Page 90-63
- ◀ - Remove fastening screws -1- and -3- for speedometer base plate -2-.
- Remove speedometer base plate



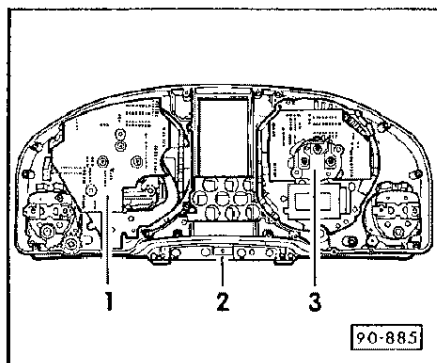
- ◀ - Remove speedometer -1- from front surround -2-.

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Removing and installing Nippon Seiki rev counter



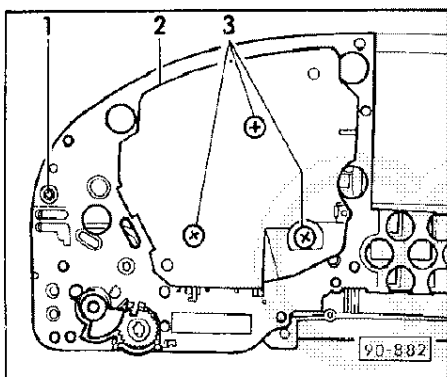
- Removing printed circuit board => Page 90-63
- ◀ - Remove fastening screws -1- and -3- for rev counter base plate -2-.
- Remove rev counter base plate



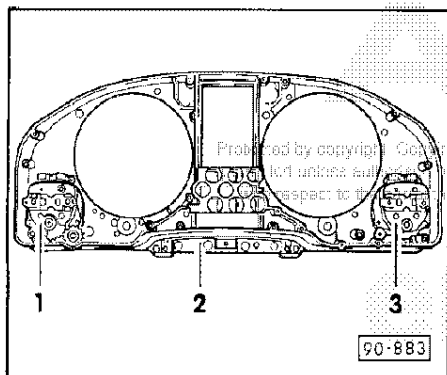
- ◀ - Remove rev counter -3- from front surround -2-.

90-67

Removing and installing Nippon Seiki fuel gauge



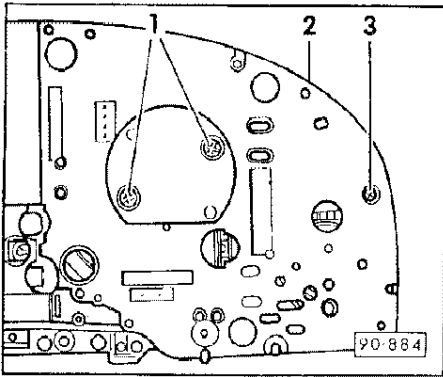
- Removing printed circuit board => Page 90-63
- ◀ - Remove fastening screw -1- for speedometer base plate -2-.
- Remove speedometer base plate and speedometer.



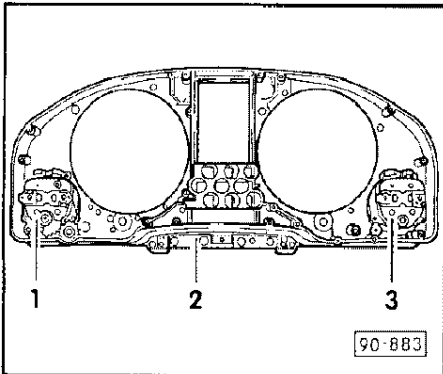
- ◀ - Remove fuel gauge -1- from front surround -2-.

90-68

Removing and installing Nippon Seiki coolant temperature gauge



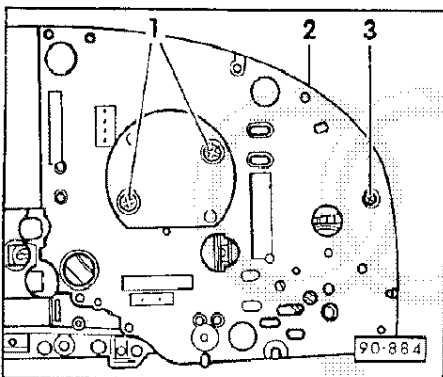
- ◀ - Removing printed circuit board => Page 90-63
- Remove fastening screws -3- for rev counter base plate -2-.
- Remove rev counter base plate and rev counter.



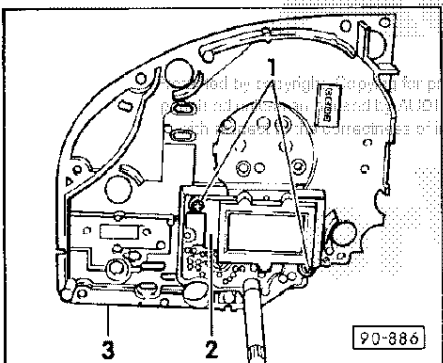
- ◀ - Remove coolant temperature gauge -3- from front surround -2-.

90-69

Removing and installing Nippon Seiki digital clock



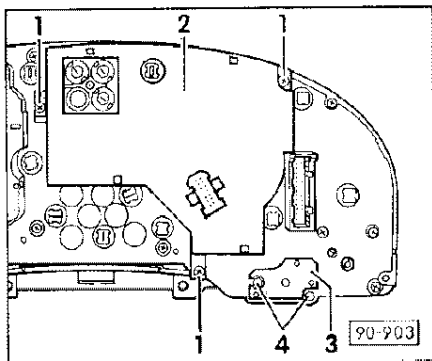
- ◀ - Removing printed circuit board => Page 90-63
- Remove fastening screws -1- and -3- for rev counter base plate -2-.
- Remove rev counter base plate



- ◀ - Unscrew fastening screws -1- for digital clock.
- Remove digital clock -2- from base plate -3- for rev counter.

90-70

Removing and installing brightness control for dash panel insert lighting, switches and instruments



- ◀ – Remove hexagon nuts -4- with washers.
- Remove brightness control for dash panel insert lighting, switches and instruments -3-.

Note:

When replacing the dash panel insert lighting control unit, ensure that the flat surface of the adjusting arbor fits exactly into the adjusting pin. If necessary, remove adjusting pin and install together with the lighting control unit.

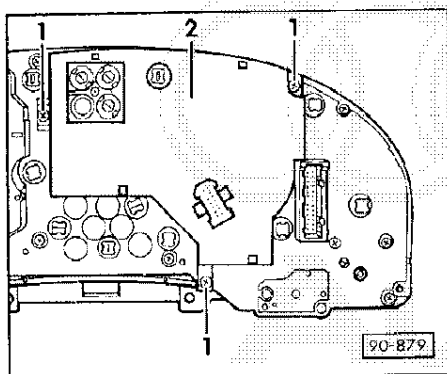
Removing and installing pedestal lamps

Lamp assignments => as of Page 90-9.

- Give cap-type lamps 1/4 one quarter of a turn (90o) anticlockwise and remove.

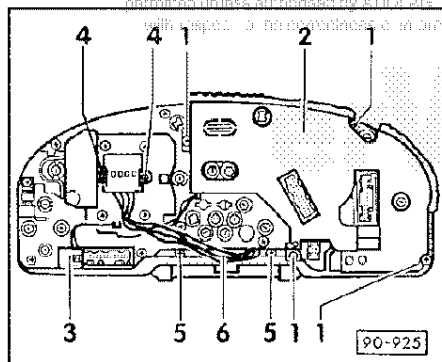
90-71

Removing and installing display unit for mini-check system.



- ◀ – Remove fastening screws -1-
- Remove display unit for mini-check system .

Removing and installing display unit for auto-check system/on-board computer.

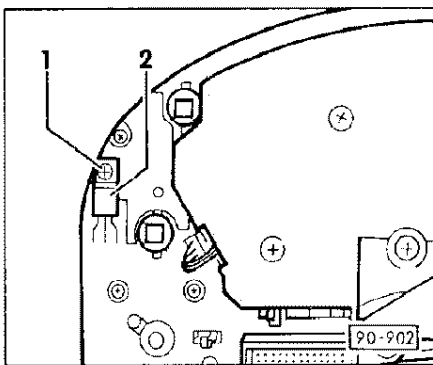


- ◀ – Remove fastening screws -1-
- Unclip adjuster for range calibration -3- (with on-board computer system only).
- Remove display unit for auto-check system/on-board computer -2-.

90-72

Removing and installing voltage stabilizer

- ◀ - Loosen fastening screw -1- and carefully remove voltage stabilizer.

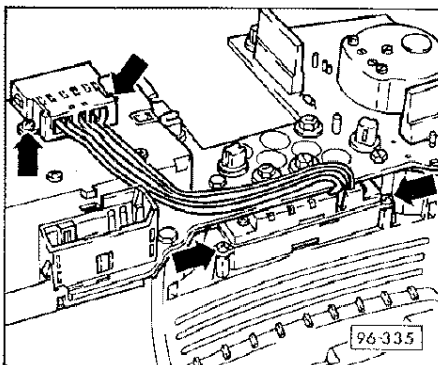


Removing and installing gear indicator

- Removing dash panel insert => Page 90-8
- ◀ - Disconnect 5-pin connector for gear indicator.
- Unscrew fastening screws for plug-in coupling and gear indicator-arrows- on dash panel insert and remove gear indicator.

Note:

When replacing the dash panel insert, break out the dummy cover on the warning lamp symbol panel.

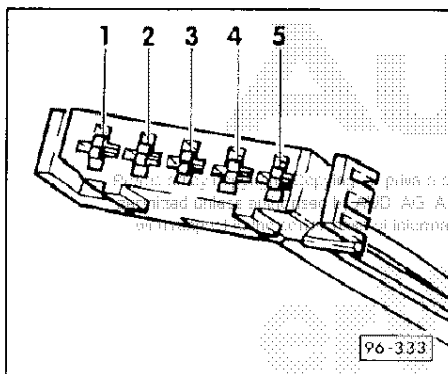


90-73

5-pin connector behind dash panel insert for gear indicator

Signal assignment and checking

- Removing dash panel insert => Page 90-8 Leave multi-pin connectors attached.
- Remove connector for gear indicator.



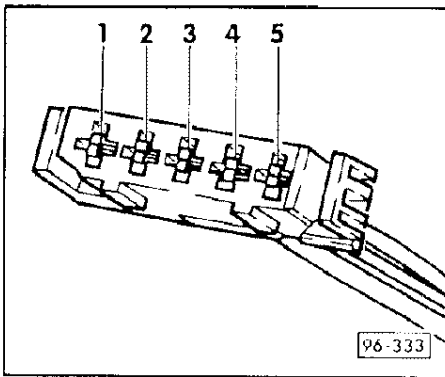
Cavity 1. Gear signals

- Use hand-held multimeter V.A.G 1526 (measuring range: DC) to measure against earth
- Switch ignition on.

Specifications:

Selector lever position	Specified value
P	approx. 6.0 V.
R	approx. 4.2 V.
N	approx. 3.4 V.
D	approx. 2,8 V.
3	approx. 2.5 V.
2	approx. 2.2 V.
1	approx. 2.0 V.

90-74



◀ Cavity 2. earth

- Use hand-held multimeter V.A.G 1526 (measuring range: DC) to measure against terminal 30.

- Specified value: Battery voltage

Cavity 3. Lighting terminal 58d

- Use hand-held multimeter V.A.G 1526 (measuring range: DC) to measure against earth

- Switch side lights on

- Specified value: Depending on setting of brightness control for dash panel insert lighting

2.75 V ... approx. battery voltage

Cavity 4. Positive terminal 15a

- Switch ignition on.

- Use hand-held multimeter V.A.G 1526 (measuring range: DC) to measure against earth

- Specified value: Battery voltage

Cavity 5. Unallocated

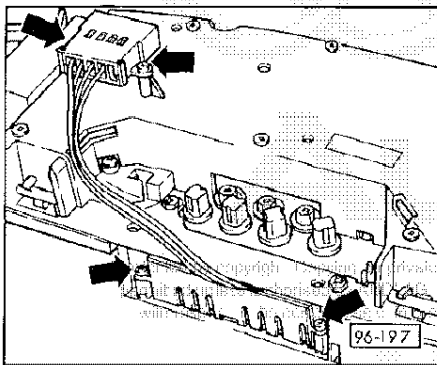
90-75

Removing and installing outside temperature gauge

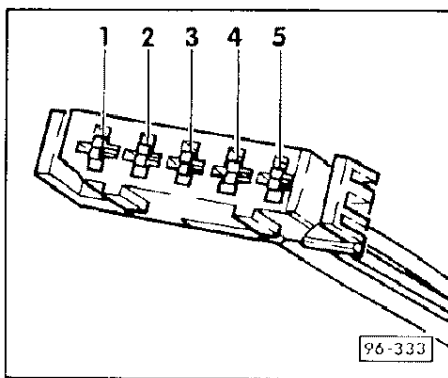
- Removing dash panel insert => Page 90-8
- Disconnect 5-pin outside temperature gauge connector.
- Unscrew attachment screws for plug-in coupling and outside temperature gauge-arrows- on dash panel insert and remove outside temperature gauge.

Note:

When replacing the dash panel insert, break out the dummy cover on the warning lamp symbol carrier.



90-76



5-pin connector behind dash panel insert for outside temperature gauge

Signal assignment and checking

- Removing dash panel insert => Page 90-8
- Remove outside temperature gauge connector.

◀ Cavity 1. Speed signal

- Use hand-held multimeter V.A.G 1526 (measuring range: AC) measure against earth

- Specified value: approx. 4 mV at inching speed

◀ Cavity 2. temperature sensor

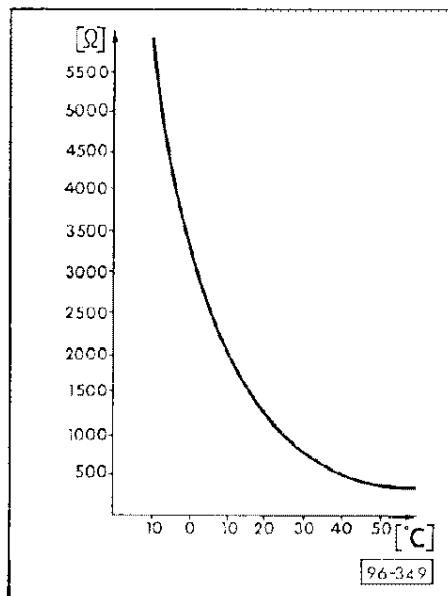
- Use hand-held multimeter V.A.G 1526 (measuring range: resistance) measure against earth

- Specified value: Ω -Value depending on outside temperature => diagram

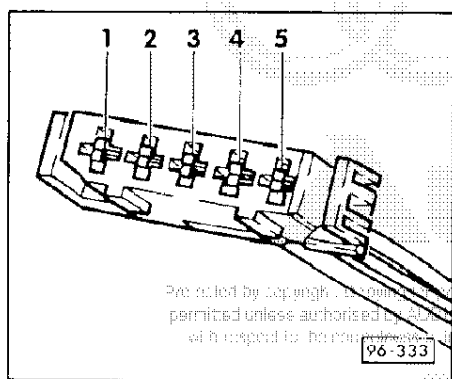
Cavity 3. Earth

- Use hand-held multimeter V.A.G 1526 (measuring range: DC) to measure against terminal 30.

- Specified value: Battery voltage



90-77



◀ Cavity 4. Lighting terminal 58d

- Switch side lights on
- Use hand-held multimeter V.A.G 1526 (measuring range: DC) to measure against earth

- Specified value: Depending on setting of brightness control for dash panel insert lighting
2.75 V ... approx. battery voltage

Cavity 5. Positive terminal 15a

- Switch ignition on.
- Use hand-held multimeter V.A.G 1526 (measuring range: DC) to measure against earth

- Specified value: Battery voltage

90-78

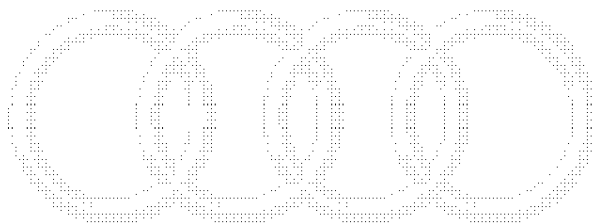
Checking outside temperature gauge



- ◀ – Connect digital potentiometer V.A.G 1630 to detached outside temperature gauge sensor (near left headlight).
- Switch ignition on.
- Adjust V.A.G 1630 digital potentiometer as follows:

Setting	Specified value
5600	-10 °C
3200	0 °C
1200	20 °C
500	40 °C

- If specified values are not attained, check signals at detached 5-pin connector behind dash panel insert => Page 90-77/eliminate open circuit as per current flow diagram or replace outside temperature gauge.

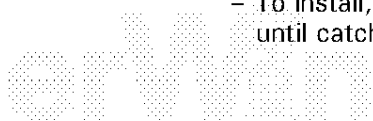


90-79

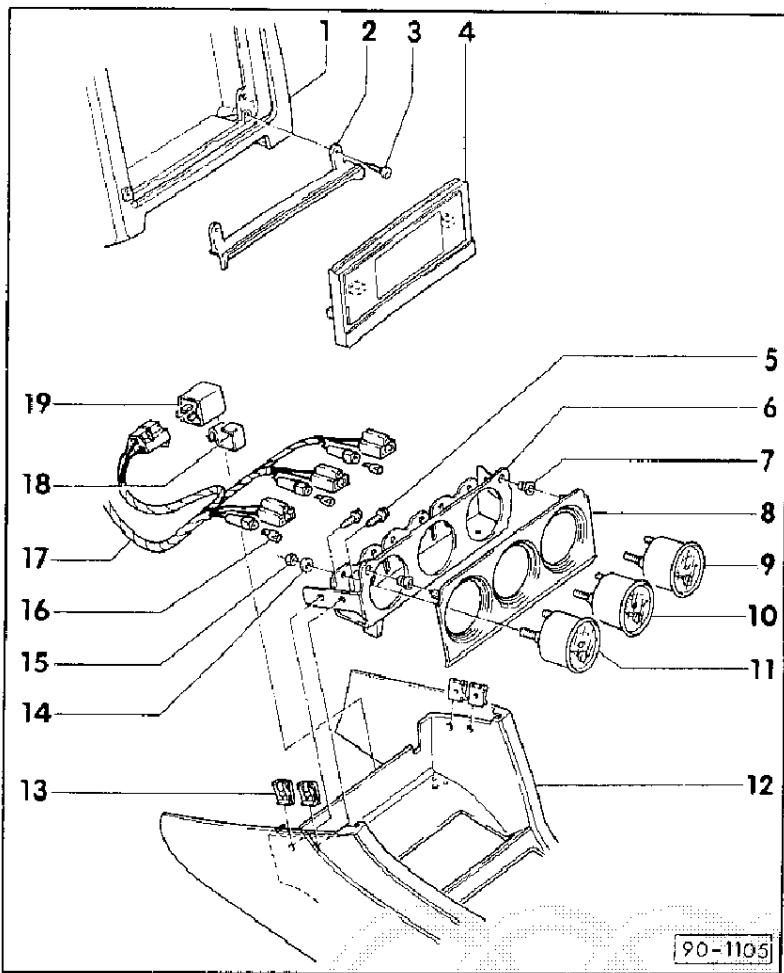
Removing and installing outside temperature gauge sensor

- Remove bumper
=> General Body Repairs; Repair Group 63; Front bumper; Front bumper – exploded view =>
- Detach connector near left headlight.
- Unclip outside temperature gauge sensor behind bumper.
- To install, press outside temperature gauge sensor into holder until catches engage.

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90-80



Additional instruments

Troubleshooting

=> "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

- Removing front centre console
=> Body Assembly Work; Repair Group 70; Dash Panel; Removing and installing the front centre console =>

Servicing additional instruments > 01.92

1 - Centre section of instrument panel

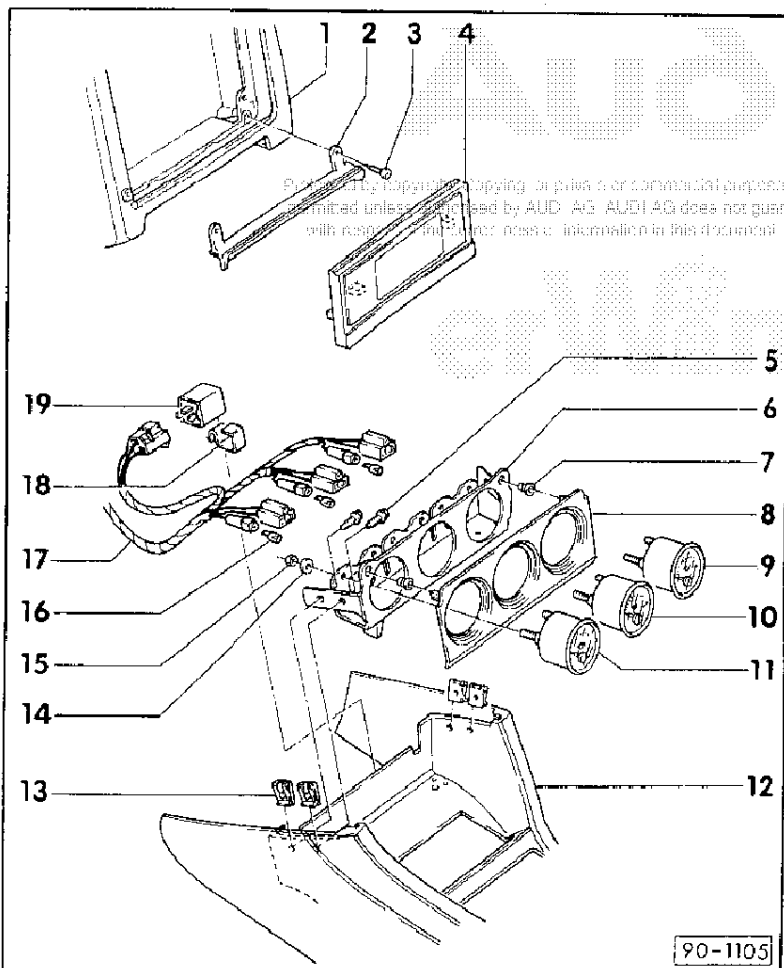
2 - Locking piece

3 - Bolt, 2 Nm

◆ 2x

◆ Only accessible after prising off trim

90-81



4 - Trim

◆ Vehicles with air conditioner:
Prise off carefully using
screwdriver.

◆ Vehicles with no AC => Item
4, Page 90-85

5 - Hexagon bolt -5 Nm

◆ 4x

6 - Angle bracket

7 - Grommet

◆ 2x

8 - Trim

9 - Oil temperature gauge

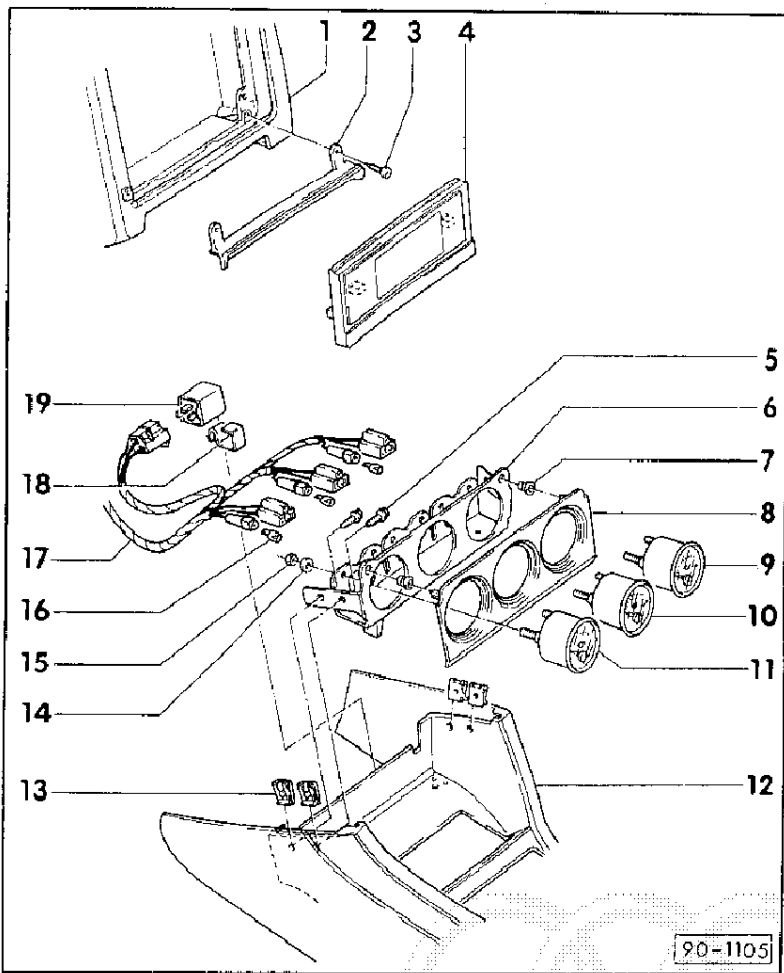
◆ Checking => Page 90-93

◆ Removal:

- Remove the connector.

- Twist and pull off lamp socket

90-82



- Remove hexagon nuts -Item
15- and pull out indicator.

10 - Oil pressure gauge
◆ Checking => Page 90-92
◆ Removal: as for Item 9-

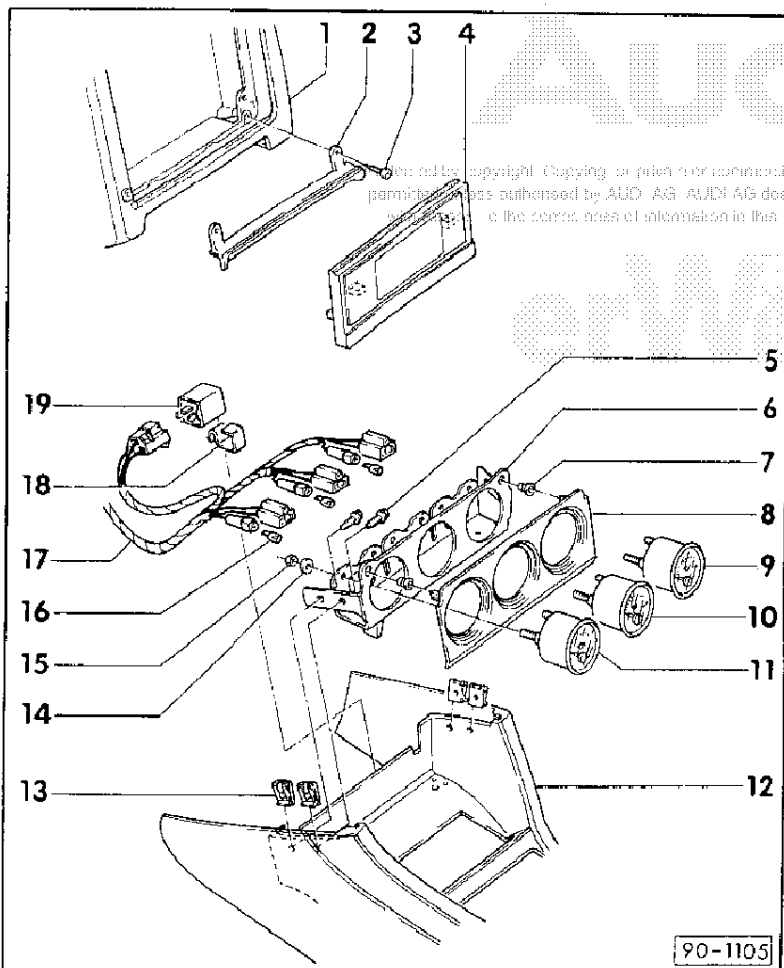
11 - Voltmeter
◆ Checking => Page 90-94
◆ Removal: as for Item 9-

12 - Centre console

13 - Snap nut
◆ 4x

14 - Washer
◆ 6x

90-83



15 - Hexagon nut
◆ 6x

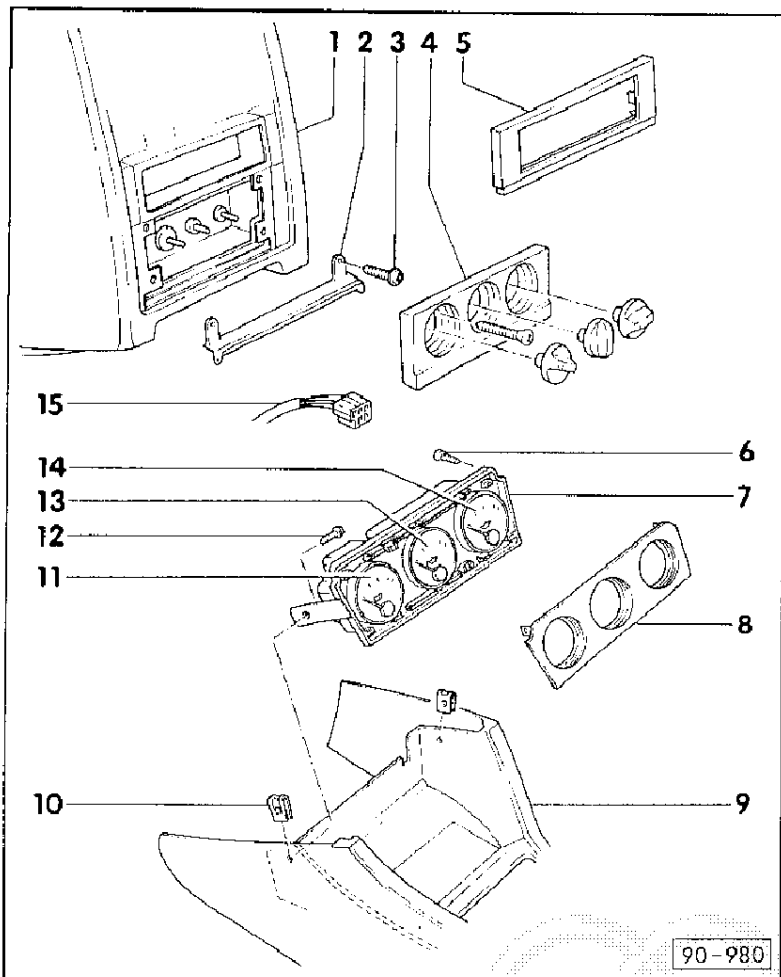
16 - Lighting for additional instru-
ments
◆ 1,2 W (3x)

17 - Wiring loom
◆ Routing of wiring and cavity
assignments
=> "Current Flow Diagrams, Electrical
Fault Finding and Fitting Loca-
tions" binder

18 - Retaining clip

19 - Amplifier for instrument lighting
◆ Clipped with retainer to rear of
centre console

90-84



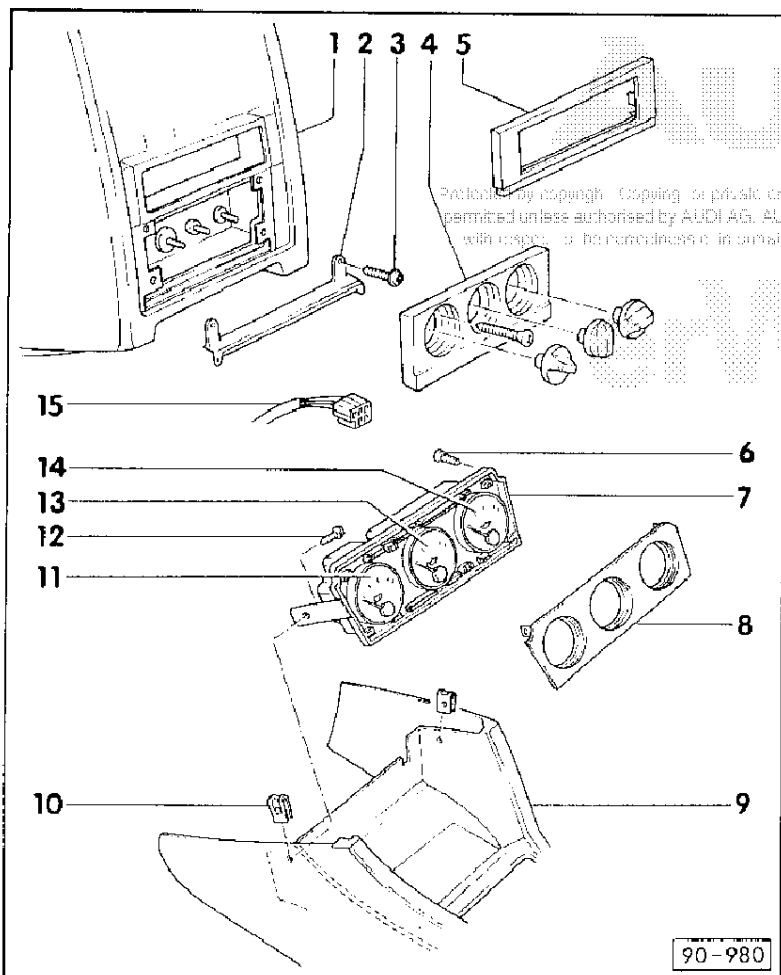
Servicing additional instruments 02.92 >

Note:

The indicator instruments 02.92 > are interchangeable with the individual instruments > 01.92.

- 1 - Dash panel
- 2 - Locking piece
- 3 - Bolt, 2 Nm
 - ◆ 2x
 - ◆ Only accessible after prising off trim
- 4 - Trim
 - ◆ Unscrew after pulling off rotary knobs

— 90-85 —



- 5 - Trim
 - ◆ Automatic AC only
 - ◆ Prise off carefully using screwdriver.

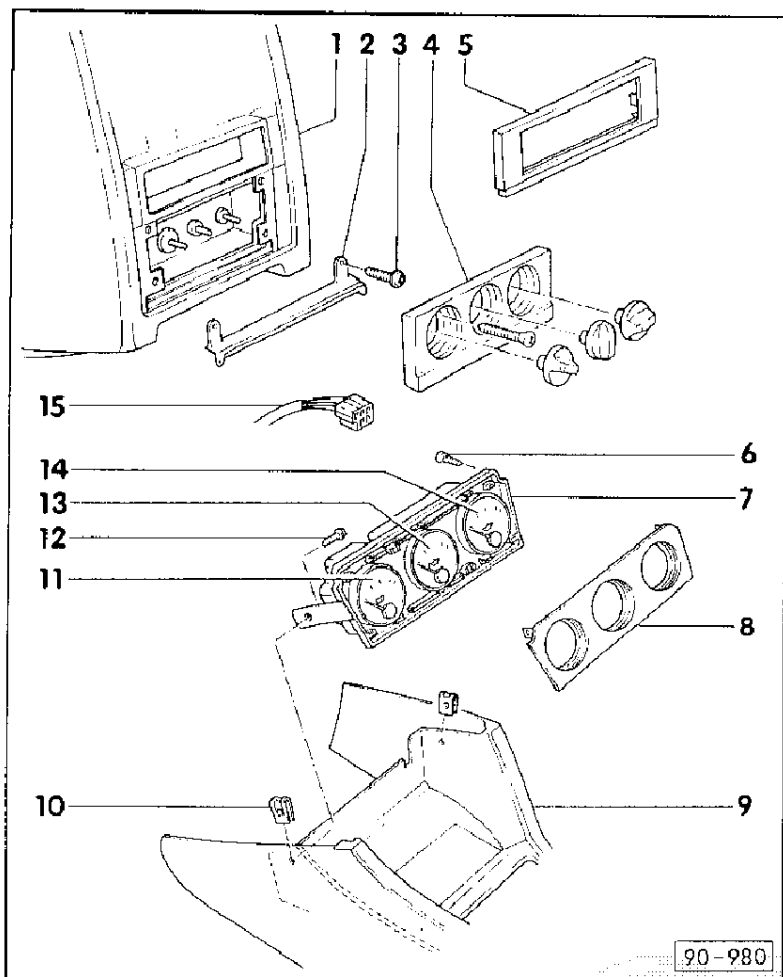
- 6 - Bolt, 2 Nm
 - ◆ 6x

- 7 - Housing for additional instruments with transparent cover panel

- ◆ Removal: Pull off connector and remove hexagon bolts - Item 12-
- ◆ Connector assignment => Page 90-89.

- 8 - Trim
 - ◆ Secured with screws - Item 6-

— 90-86 —



9 - Centre console

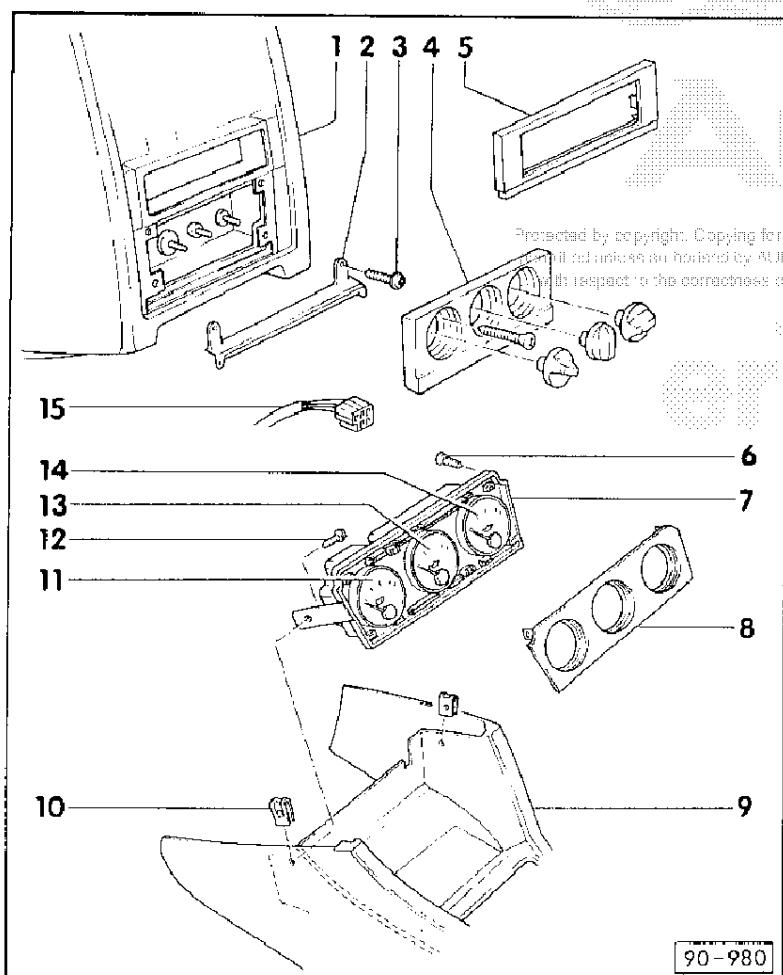
10 - Snap nut
◆ 4x

11 - Oil temperature gauge
◆ Checking => Page 90-93
◆ Before removing, unscrew hexagon nut with washer => Page 90-91

12 - Hexagon bolt
◆ 2x

13 - Oil pressure gauge
◆ Checking => Page 90-92
◆ Removing and installing => Page 90-91

90-87

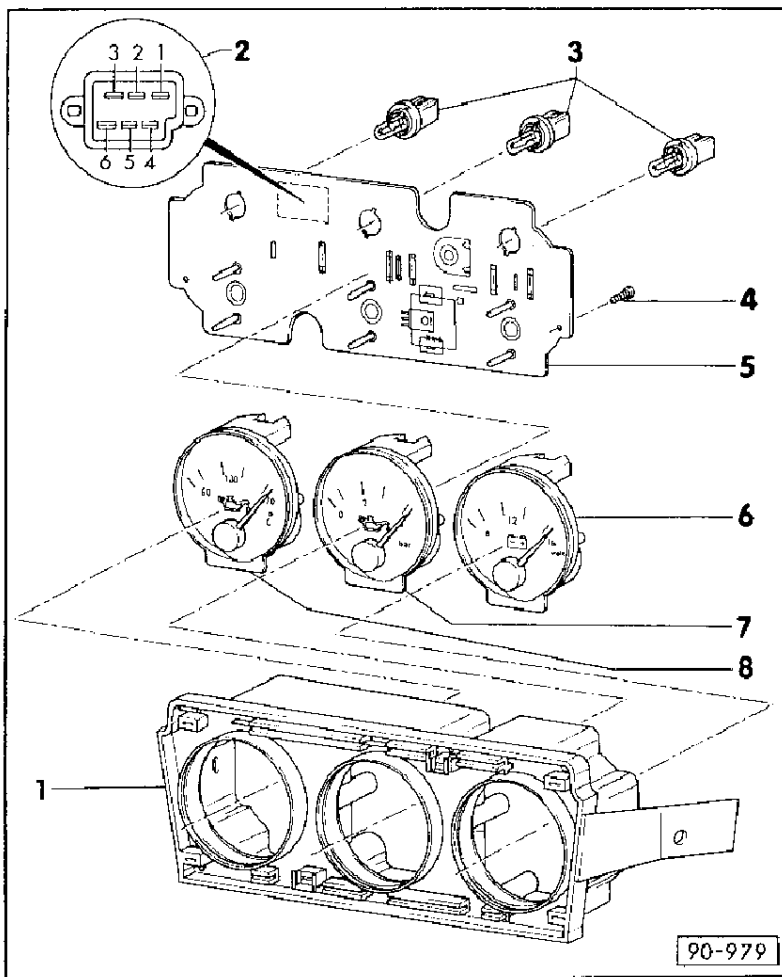


14 - Voltmeter
◆ Checking => Page 90-94
◆ Removing and installing => Page 90-91

15 - Wiring loom
◆ Connector assignment => Page 90-89

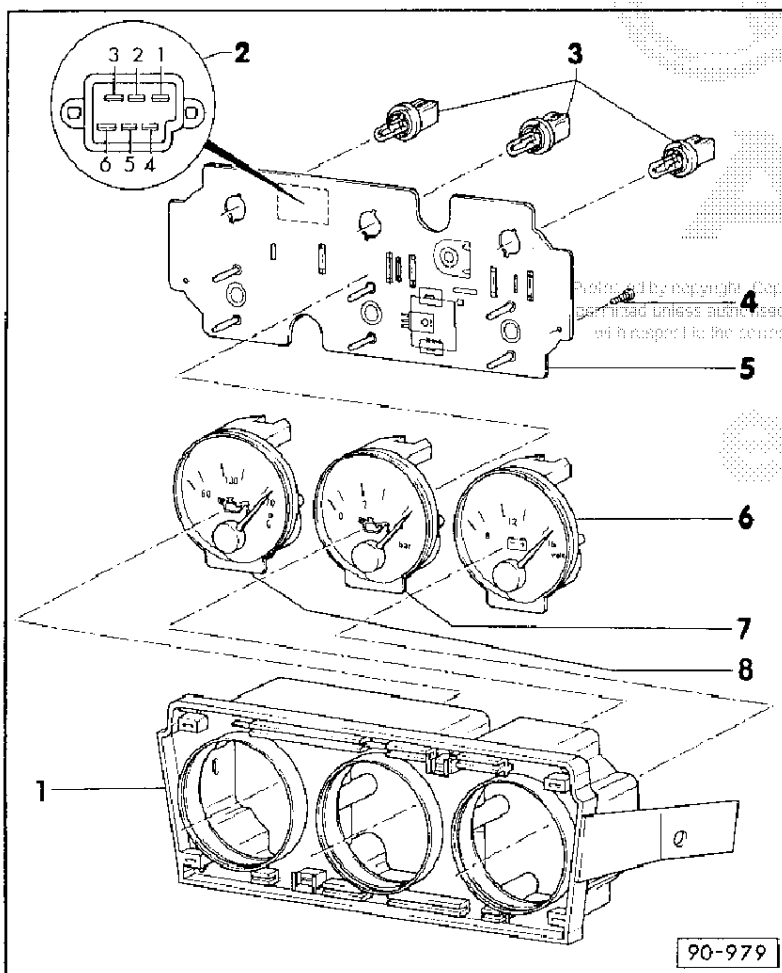
90-88

Removing and installing components of additional instruments 02.92 >



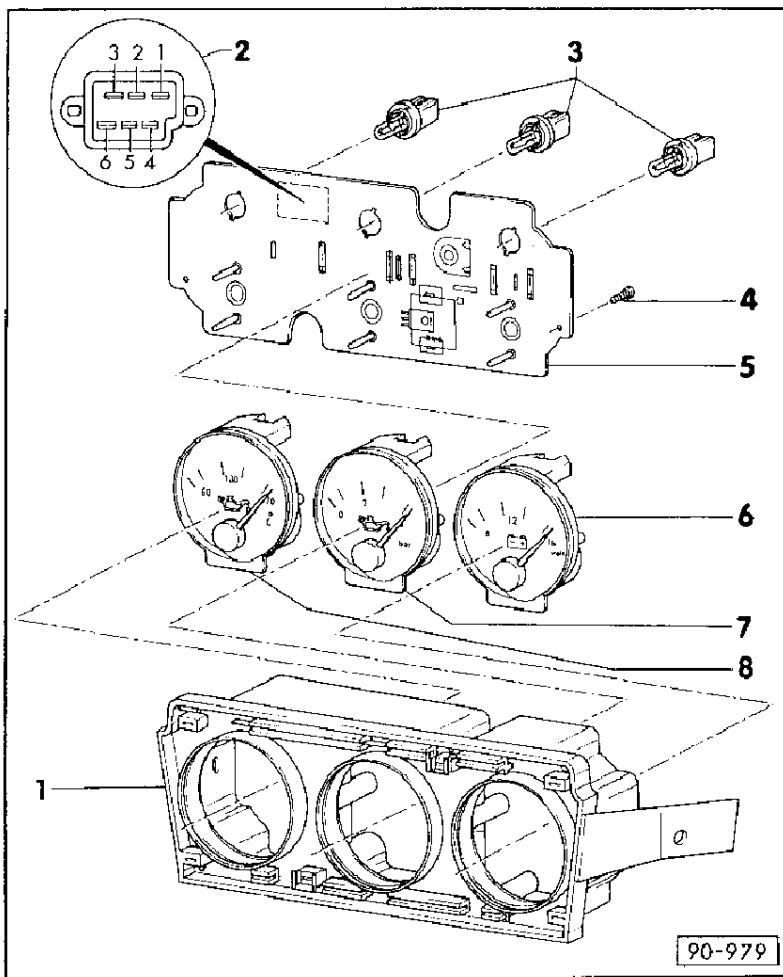
- 1 – Housing with transparent cover panel
 - ◆ Ultrasonically welded
- 2 – Multi-pin connector
 - ◆ Use appropriate current flow diagram.
 - ◆ Contact assignment
 - 1 – Variable positive from brightness control for dash panel insert lighting to amplifier for additional instrument lighting
 - 2 – Negative from oil pressure gauge sensor

90-89



- 3 – Negative for additional instrument lighting, oil temperature gauge and voltmeter
- 4 – Positive for light switch to amplifier for additional instrument lighting
- 5 – Negative from oil temperature gauge sensor
- 6 – Positive (terminal 15)
- 3 – Lighting for additional instruments
 - ◆ 1.2 W (3x)
- 4 – Fastening screw
 - ◆ For printed circuit board
 - ◆ 7x

90-90



5 - Printed circuit board

6 - Voltmeter

◆ Only replace in conjunction with printed circuit board -Item 5-

7 - Oil pressure gauge

8 - Oil temperature gauge

90-91

Checking oil pressure gauge

- Remove noise insulator.
- Pull connector off oil pressure sensor, terminal -G-.

Note:

Illustration shows 5-cyl. engine.

Location on 4-cyl. engine: At oil filter housing.

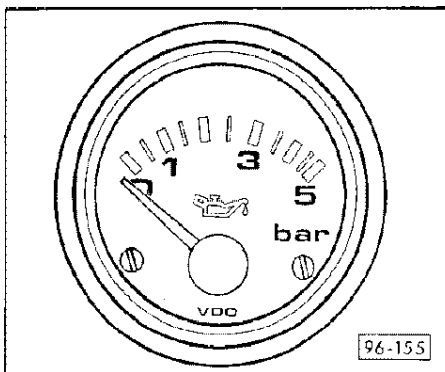
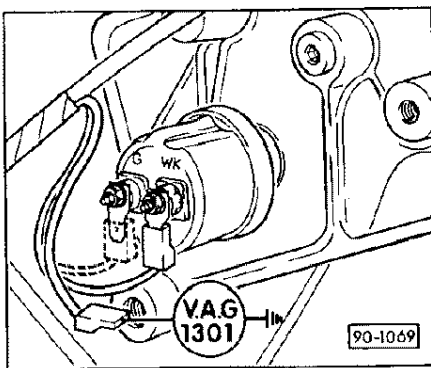
Location on 6-cyl. engine: At oil filter housing or on back of engine.

- Switch ignition on.
- Connect tester V.A.G 1301 to plug and earth using auxiliary cable.

- Adjust V.A.G 1301 tester as follows:

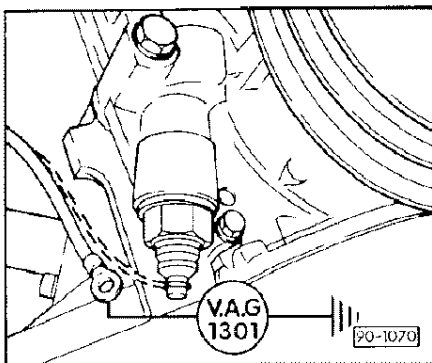
Setting	Specified value
350	5 bar
150	2 bar
10	0 bar

- If specified value is not attained, locate open circuit using current flow diagram and rectify fault.



90-92

Checking oil temperature gauge



- Remove noise insulator.
- Unscrew connector from oil temperature sensor (at oil pump).

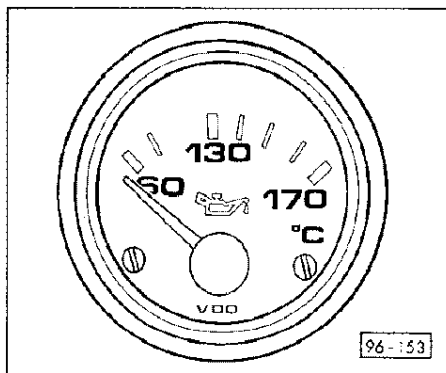
Note:

Illustration shows 5-cyl. engine.

Location on 4-cyl. engine: At oil filter housing.

Location on 6-cyl. engine: On end face of engine at oil pump

- Connect test unit V.A.G 1301 to screw connection and earth.
- Switch ignition on.



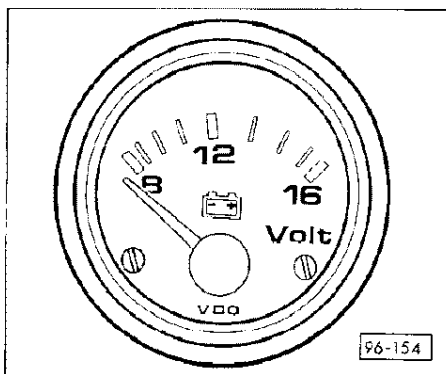
- Adjust V.A.G 1301 tester as follows:

Setting	Specified value
26	170 °C
150	130 °C
690	60 °C

- If specified value is not attained, locate open circuit using current flow diagram and rectify fault.

90-93

Checking voltmeter



- Switch ignition on.
 - Specified value: approx. battery voltage
- If specified value is not attained, locate open circuit using current flow diagram and rectify fault.

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90-94

Car radio systems

Notes:

- ◆ Disconnect battery earth strap before working on electrical system.
- ◆ If complaints are received, it is vital to be familiar with the functionality and operation of the relevant radio system. Additional information
 - = > Operating instructions for the radio concerned.
 - = > "Special information" binder; Electrics section
- ◆ For retrofitting, repair work and troubleshooting
 - = > "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder
 - = > Installation instructions
- ◆ Detailed assembly instructions for removing and replacing the trim
 - = > General Body Repair
- ◆ Only radio devices and built-in components from the V.A.G range or original replacement parts should be used. This is the only way to guarantee problem-free installation and good reception.

91-1

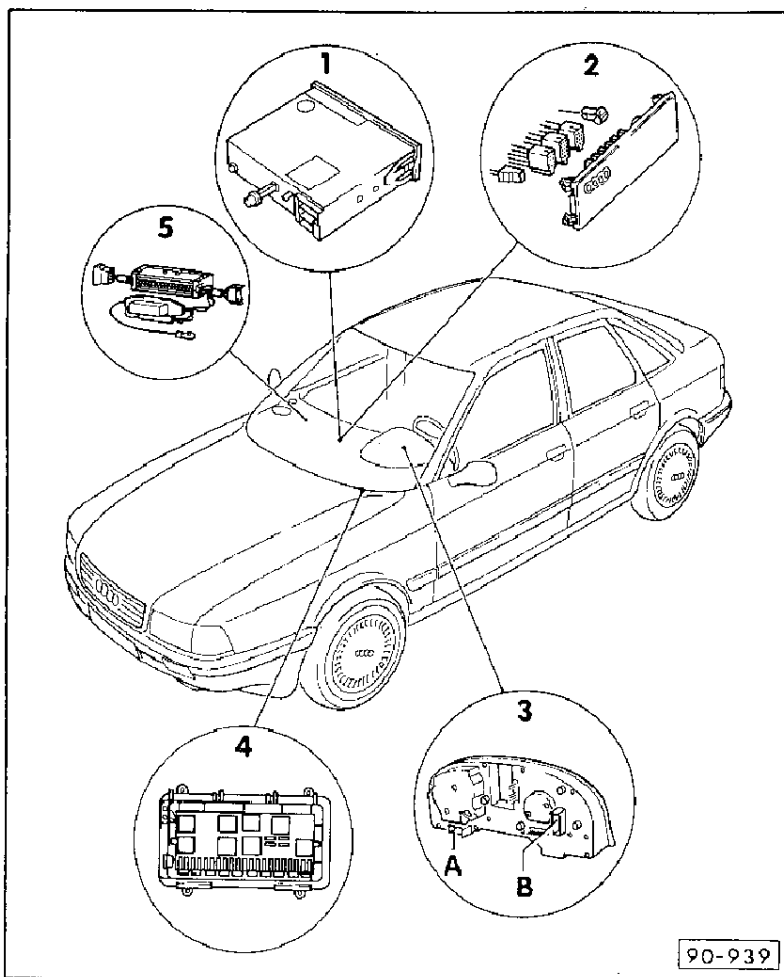
- ◆ A distinction is made between active and passive loudspeaker systems,
- ◆ The voltage for the radio systems is supplied via a fuse in the fuse box.
- ◆ The anti-theft coding (not for "alpha" and "beta" radios > 06.94) features a fixed code. Operation is only possible using the U and M keys.

Notes on radio retrofitting

- ◆ The provided connectors for original Audi radio systems should be used for preparing the radio.
- ◆ Radios with other plug connectors must be connected using adapter leads (fitted in glove compartment during radio preparation).
- ◆ When connecting the speed signal (radios with GALA function) care must be taken not to short circuit the signal, since otherwise vehicle malfunctions may occur (e.g. in engine control unit).
- ◆ Connecting the speed signal to other makes of radio can also lead to vehicle malfunctions.

91-2

Radio systems – general layout



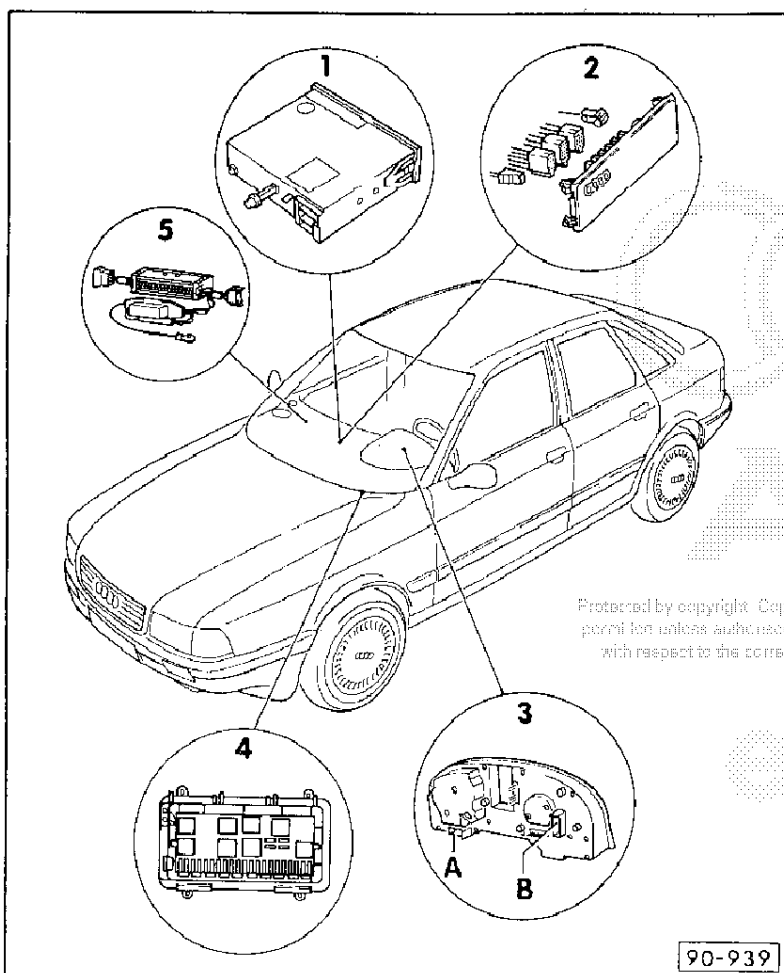
1 – Radio -R

- ◆ Installed in centre console
- ◆ Removing and installing => Page 91-5 and 91-6

2 – Radio preparation

- ◆ Not available in Germany
- ◆ Use screwdriver to prise off trim
- ◆ Unclip plug from trim
- ◆ Adapter leads for radio connection (old generation) are provided
- ◆ Only for front and rear passive loudspeakers

91-3



3 – Dash panel insert

- ◆ Speed signal tap for radios with GALA function at 26-pin connector -A-
- ◆ Removing, installing and assigning the contacts on the dash panel insert multipin connectors => from Page 90-13

4 – Relay carrier with fuse box

- ◆ Radio voltage supply
- ◆ Wire routing/fuse assignment => "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

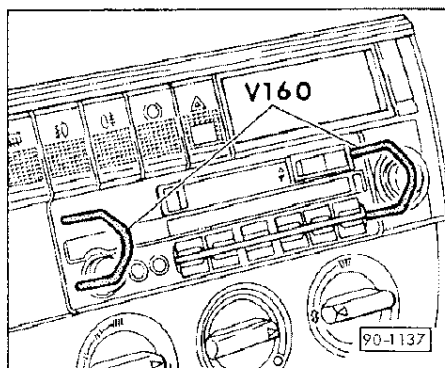
5 – Amplifier -R12

- ◆ gamma CD radio only
- ◆ Installed in instrument panel
- ◆ 2 x 20 W

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91-4

Removing and installing the radio > 06.94

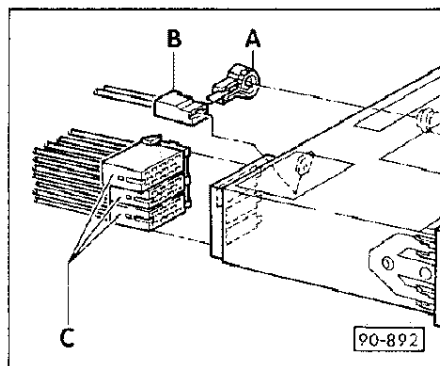


Note:

Check that the code is present in radios with anti-theft coding.

Removal:

- Insert the two V160 release clips into the front of the radio, as shown in the illustration.
- Pull the radio out of centre console by pushing the release clips outwards,



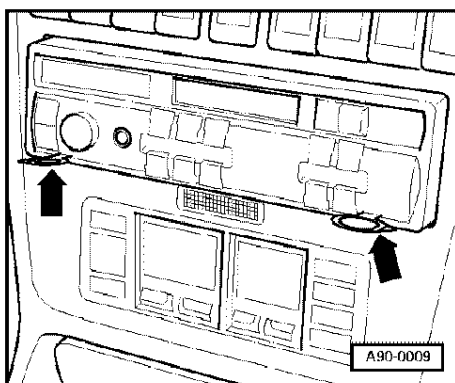
- Pull off aerial connector -A-, earth connection -B- and connector -C- (2 or 3 x).

Installation:

- Pull the two release clips out of the radio.
- Plug in the connector.
- Carefully slide radio into centre console until rubber buffer makes contact with bracket at rear.

91-5

Removing and installing radio 07.94 >



Note:

Check for presence of anti-theft code.

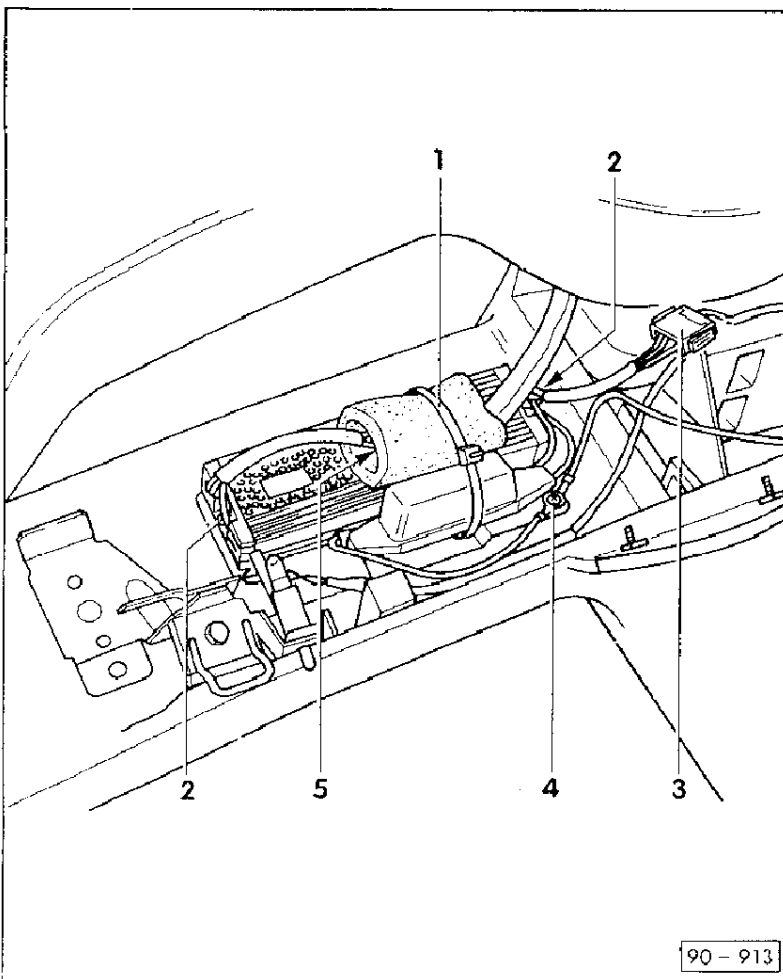
- Insert release tool 3344 into the front of the radio, as shown.
 - Top L - top left
 - Top R - top right
- Extract radio together with release tool

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91-6

Removing and installing amplifier ("gamma CD" radio only)

- Removing glove compartment
=> Body Assembly Work; Repair Group 70; Dash Panel; Removing and installing glove compartment =>
- Loosen cable tie -1-
- Remove earth connection screw -4-
- Unplug connectors -3- and -5-
- Loosen fastening screws -2- and remove amplifier.

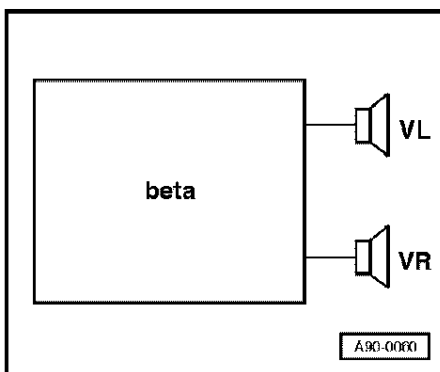


91-7

Structure of radio systems

"Alpha" and "Beta" radio > 06.94

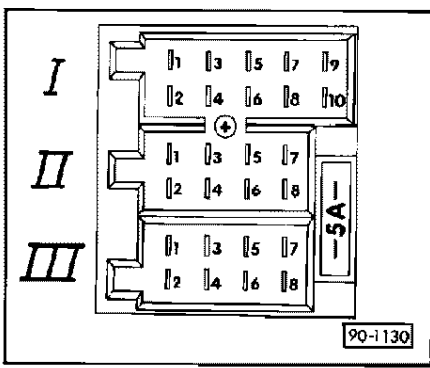
- Front loudspeaker system – passive
- ◀ Wide-band loudspeakers, front right and left
- ◆ Installed in instrument panel



Technical data	
Nominal power PN	15 Watts
Music power PM	25 Watts
Nominal impedance ZN	4 Ω
Frequency (transmission range) "alpha" radio	60 ... 17000 Hz
Frequency (transmission range) "beta" radio	50 ... 17000 Hz

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91-8



Assignment of multipin connectors I, II and III on the rear of the radio

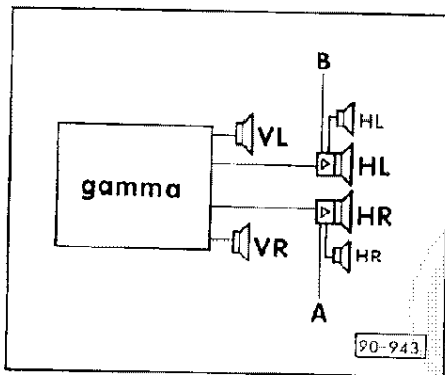
- ◆ Multipin connector I, 10-pin, red
– not connected/used
- ◆ Multipin connector II, 8-pin, brown

Pin 3	Loudspeaker +, front right
Pin 4	Loudspeaker -, front right
Pin 5	Loudspeaker +, front left
Pin 6	Loudspeaker -, front left

- ◆ Multipin connector III, 8-pin, black

Pin 5	Switched positive for aerial with electronic amplifier/electronic power aerial
Pin 6	Lighting (term.58 d)
Pin 7	Battery + (term.30)
Pin 8	Battery - (term.31)

"Gamma CC" radio > 06.94



- Front loudspeaker system – passive
- Rear loudspeaker systems – active
 - A - Rear right amplifier (permanently attached to bass loudspeaker in door)
 - A - Rear left amplifier (permanently attached to bass loudspeaker in door)

Front right and left bass loudspeakers

- ◆ Installed in instrument panel

Technical data	
Nominal power PN	15 Watts
Music power PM	25 Watts
Nominal impedance ZN	4 Ω
Frequency (transmission range)	50 ... 17000 Hz

Rear right and left bass loudspeakers

- ◆ Fitted in bottom of door.

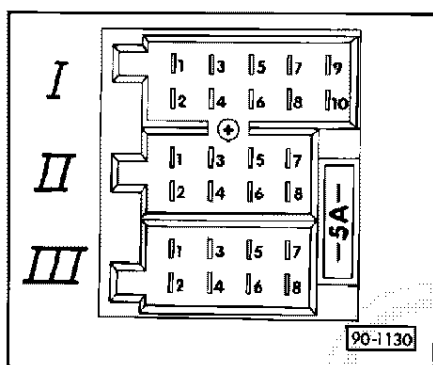
Technical data	
Nominal power PN	20 Watts
Music power PM	25 Watts
Nominal impedance ZN	4 Ω
Frequency (transmission range)	50 ... 8000 Hz

Rear right and left mid-range/treble loudspeakers

- ◆ Installed in top of door trim, connected to/supplied from bass loudspeaker

Technical data	
Music power PM	25 Watts
Nominal impedance ZN	4 Ω
Frequency (transmission range)	2000 ... 16000 Hz

91-11



Assignment of multipin connectors I, II and III on the rear of the radio

- ◆ Multipin connector I, 10-pin, red

Pin 1	Data 1)
Pin 2	Clock 1)
Pin 3	Enable 1)
Pin 5	Earth
Pin 8	Low frequency, rear right 2)
Pin 10	Low frequency, rear left 2)

1) only for 2nd display with auto-check system

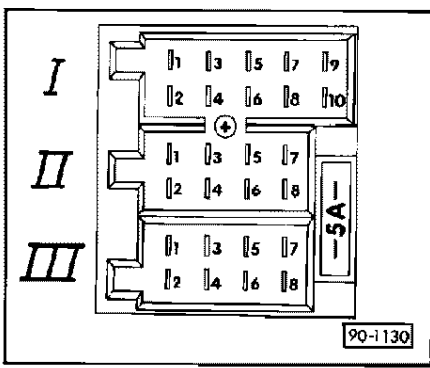
2) only for rear active loudspeaker

- ◆ Multipin connector II, 8-pin, brown

Pin 3	Loudspeaker +, passive front right
Pin 4	Loudspeaker -, passive front right
Pin 5	Loudspeaker +, passive front left
Pin 6	Loudspeaker -, passive front left

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91-12



◆ Multipin connector III, 8-pin, black

Pin 1	GALA (speed signal)
Pin 5	Switched positive for aerial with electronic amplifier/electronic power aerial
Pin 6	Lighting (term.58 d)
Pin 7	Battery + (term.30)
Pin 8	Battery - (term.31)

"Gamma CD" radio > 06.94

● Front loudspeaker systems – passive with amplifier (booster)

● Rear loudspeaker systems – active

Note:

The system may only be operated with active loudspeakers and amplifier (booster).

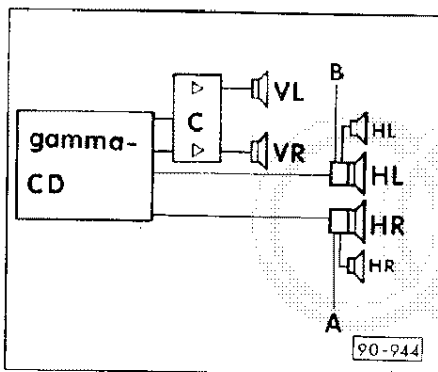
– A - Rear right amplifier (permanently attached to bass loudspeaker)

– B - Rear left amplifier (permanently attached to bass loudspeaker)

– C - Front amplifier (booster)

◆ 2 x 20 W

◆ Removing => Page 91-7



Front right and left bass loudspeakers

- ◆ Installed in instrument panel

Technical data	
Nominal power PN	15 Watts
Music power PM	25 Watts
Nominal impedance ZN	4 Ω
Frequency (transmission range)	50 ... 17000 Hz

Rear right and left bass loudspeakers

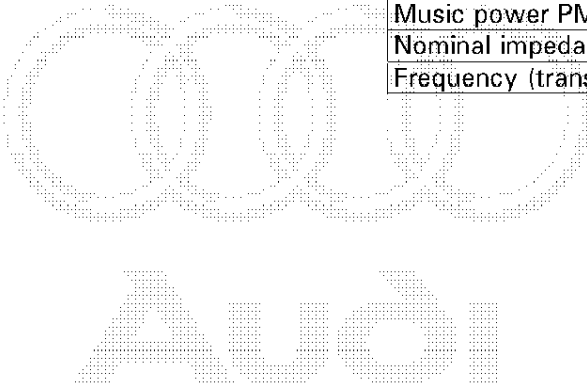
- ◆ Fitted in bottom of door.

Technical data	
Nominal power PN	20 Watts
Music power PM	25 Watts
Nominal impedance ZN	4 Ω
Frequency (transmission range)	50 ... 8000 Hz

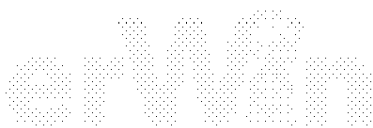
Rear right and left mid-range/treble loudspeakers

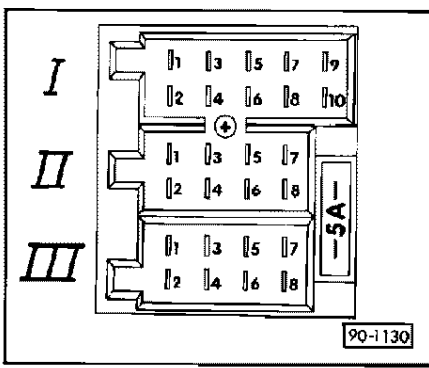
- ◆ Installed in top of door trim, connected to/supplied from bass loudspeaker

Technical data	
Music power PM	25 Watts
Nominal impedance ZN	4 Ω
Frequency (transmission range)	2000 ... 16000 Hz



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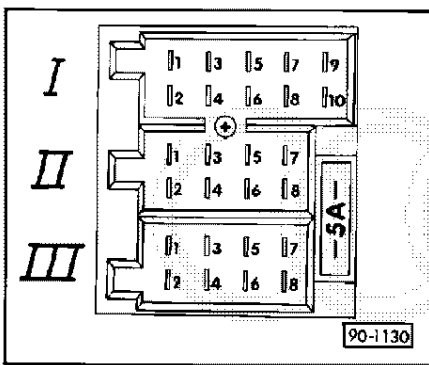
Assignment of multipin connectors I, II and III on the rear of the radio

◆ Multipin connector I, 10-pin, red

Pin 1	Data 1)
Pin 2	Clock 1)
Pin 3	Enable 1)
Pin 5	Earth
Pin 7	Low frequency, front right 2)
Pin 8	Low frequency, rear right 2)
Pin 9	Low frequency, front left 2)
Pin 10	Low frequency, rear right 2)

¹⁾ Only for 2nd display with auto-check system

²⁾ For front and rear loudspeakers (active) /amplifier (booster)



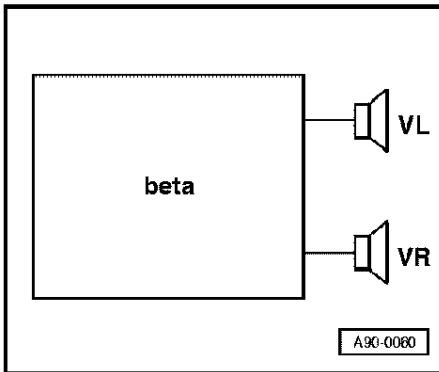
◆ Multipin connector II, 8- pin, brown

- Not connected/used

◆ Multipin connector III, 8-pin, black

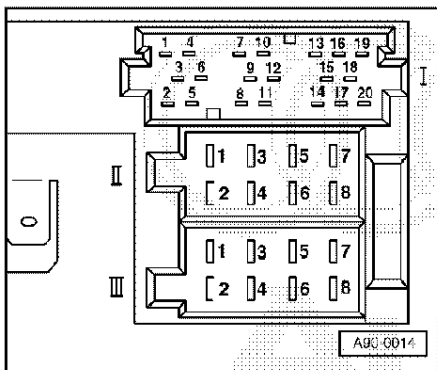
Pin 1	GALA (speed signal)
Pin 5	Switched positive for aerial with electronic amplifier/electronic power aerial
Pin 6	Lighting (term.58 d)
Pin 7	Battery + (term.30)
Pin 8	Battery - (term.31)

"Beta" radio 07.94 >



- Front loudspeaker system – passive
- ◀ **Wide-band loudspeakers, front right and left**
- ◆ Installed in instrument panel

91-19



Assignment of multipin connectors I, II and III on the rear of the radio

- ◆ Multipin connector I, 20-pin
 - Unallocated
- ◆ Multipin connector II, 8-pin, brown

Pin 3	Loudspeaker +, front right
Pin 4	Loudspeaker -, front right
Pin 5	Loudspeaker +, front left
Pin 6	Loudspeaker -, front left

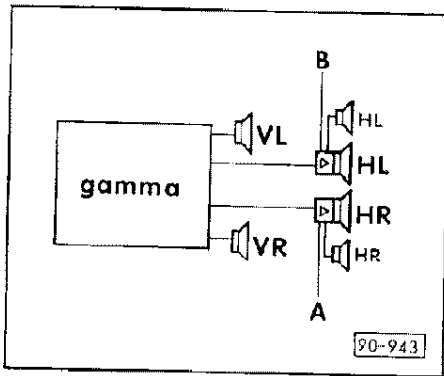
- ◆ Multipin connector III, 8-pin, black

Pin 2	NF mute circuit
Pin 4	Terminal 86 s
Pin 5	Control positive for aerial
Pin 6	Lighting
Pin 7	Terminal 30
Pin 8	Terminal 31

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91-20

"Gamma" radio 07.94 >



- Front loudspeaker system – passive
- Rear loudspeaker systems – active
 - A - Rear right amplifier (permanently attached to bass loudspeaker in door)
 - A - Rear left amplifier (permanently attached to bass loudspeaker in door)

Front right and left bass loudspeakers

- ◆ Installed in instrument panel

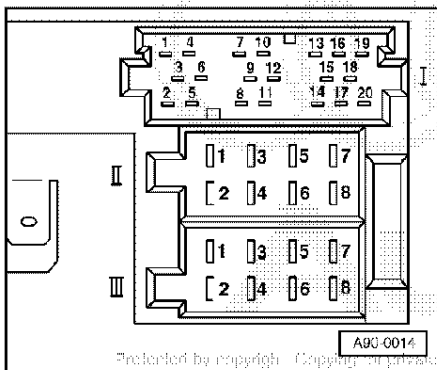
Rear right and left bass loudspeakers

- ◆ Fitted in bottom of door.

Rear right and left mid-range/treble loudspeakers

- ◆ Installed in top of door trim, connected to/supplied from bass loudspeaker

91-21



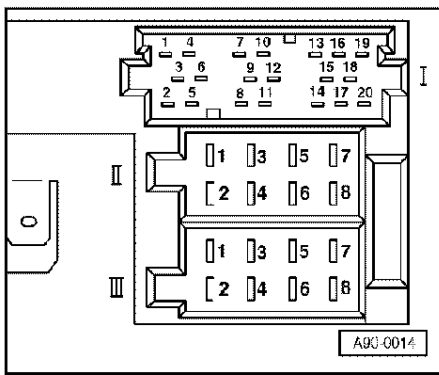
Assignment of multipin connectors I, II and III on the rear of the radio

- ◆ Multipin connector I, 20-pin

Pin 1	Rear left line
Pin 2	Rear right line
Pin 3	Earth line
Pin 6	Loudspeaker control plus
Pin 8	Clock
Pin 9	Data
Pin 10	Enable

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91-22

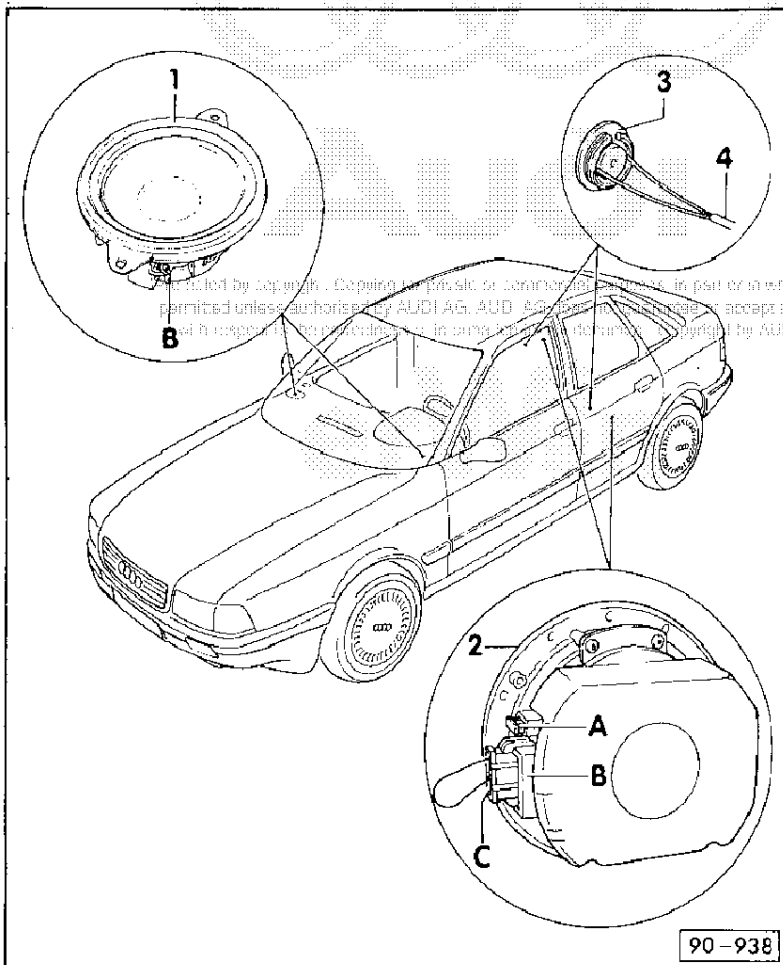


◆ Multipin connector II, 8- pin, brown

Pin 3	Loudspeaker +, front right
Pin 4	Loudspeaker -, front right
Pin 5	Loudspeaker +, front left
Pin 6	Loudspeaker -, front left

◆ Multipin connector III, 8-pin, black

Pin 1	Speed sensor
Pin 2	NF mute circuit
Pin 3	Terminal 30
Pin 4	Terminal 86 s
Pin 5	Control positive for aerial
Pin 6	Lighting
Pin 7	Terminal 30
Pin 8	Terminal 31



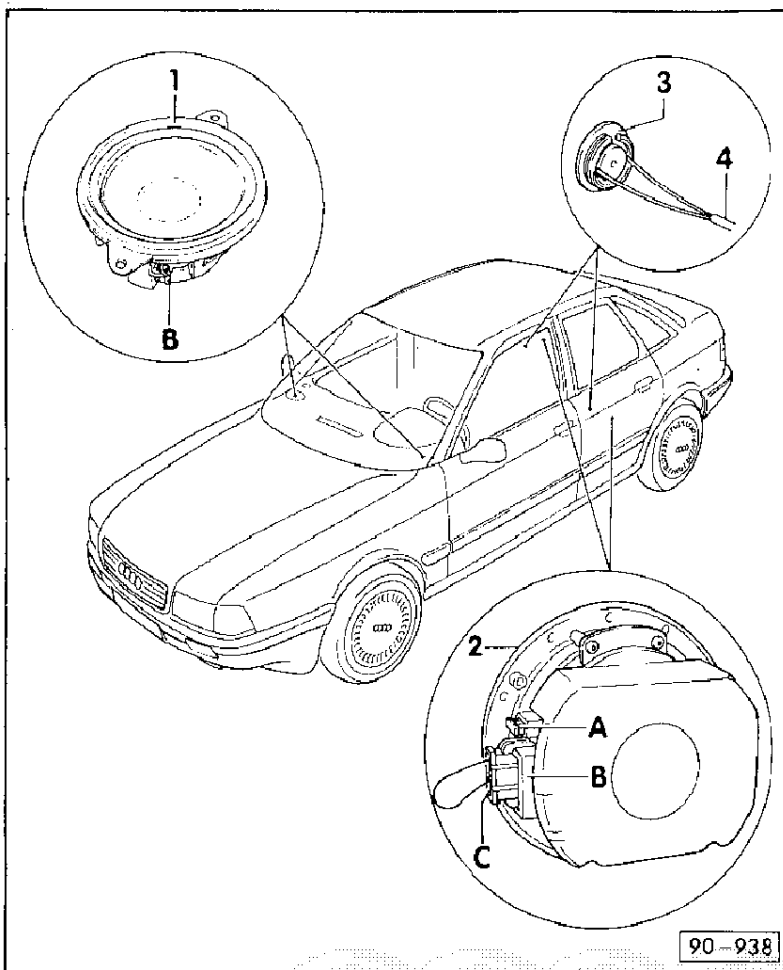
Layout of loudspeaker systems

Notes:

- ◆ Technical data for the individual loudspeakers => from Page 91-8.
- ◆ Wiring and contact assignment => "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

1 - Passive front loudspeaker

- ◆ Wide-band loudspeaker
- ◆ B - connector
- ◆ Removing and installing => Page 91-26



2 - Rear loudspeaker, passive or active

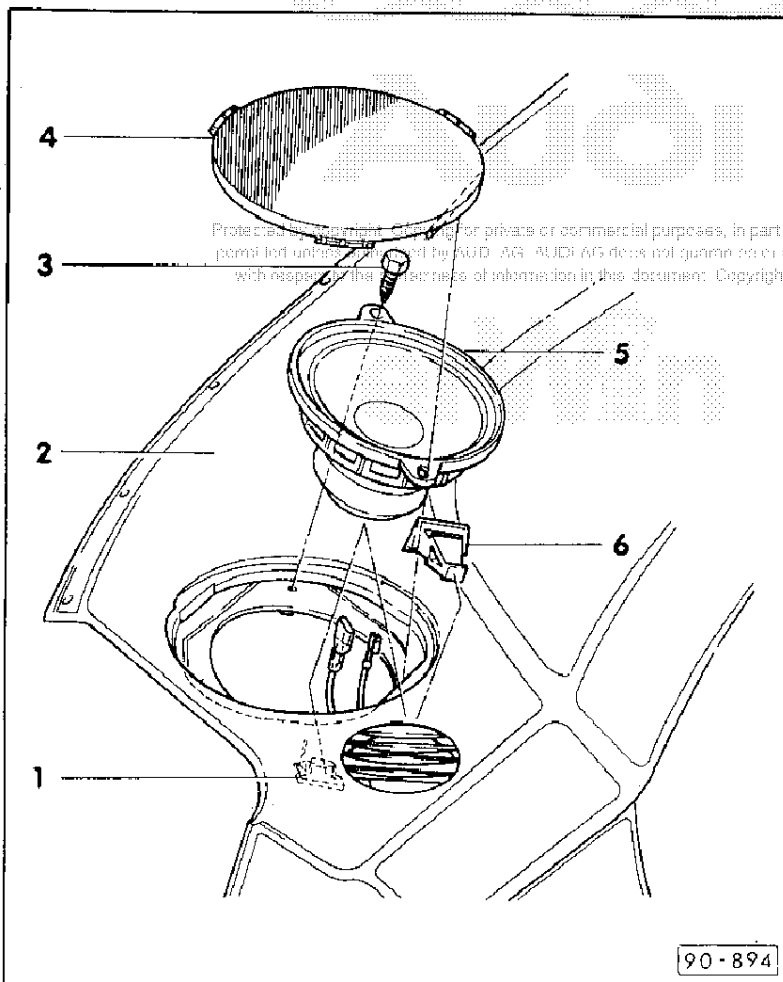
- ◆ Passive bass loudspeaker
- ◆ Active bass loudspeaker
- ◆ A - Fuse
- ◆ B - Wiring loom connector
- ◆ C - Cable link (absolute prerequisite for operation)
- ◆ Removing and installing = > Page 91-27

3 - Mid-range/treble loudspeakers

- ◆ Removing and installing = > Page 91-30

4 - Connecting cable

- ◆ For mid-range/treble loudspeaker
- ◆ Connected to bass loudspeaker



Removing and installing front loudspeaker

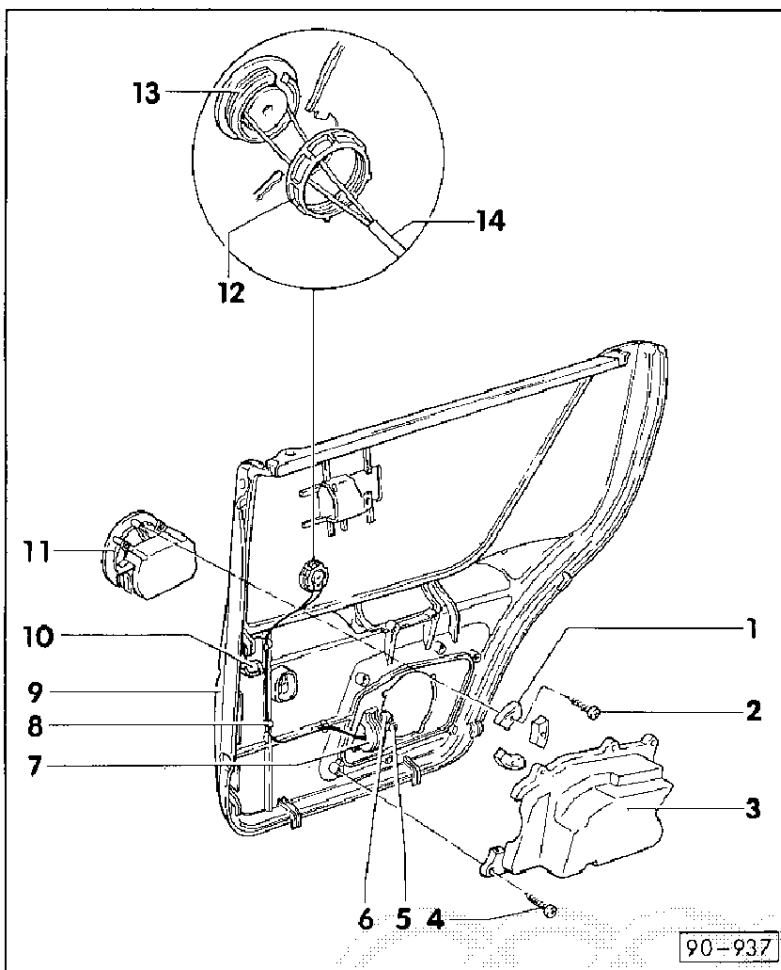
- Use small screwdriver to carefully prise off trim -4-.
- Remove hexagon bolt -3-.
- Carefully pull out loudspeaker -5- upwards (avoid touching diaphragm), pull off connector.

Note:

Leave socket -6- in holder -1- on instrument panel.

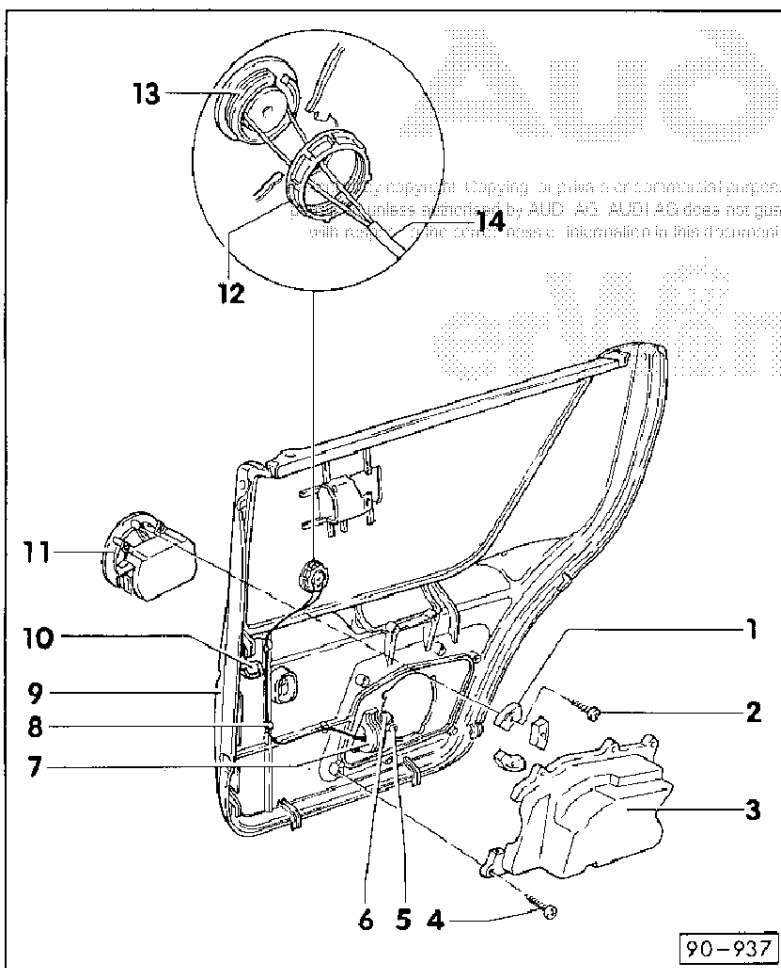
- On installation, press home loudspeaker retainer in socket-6-.
- Screw in hexagon bolt.
- Press in trim by hand

Removing and installing rear loudspeaker



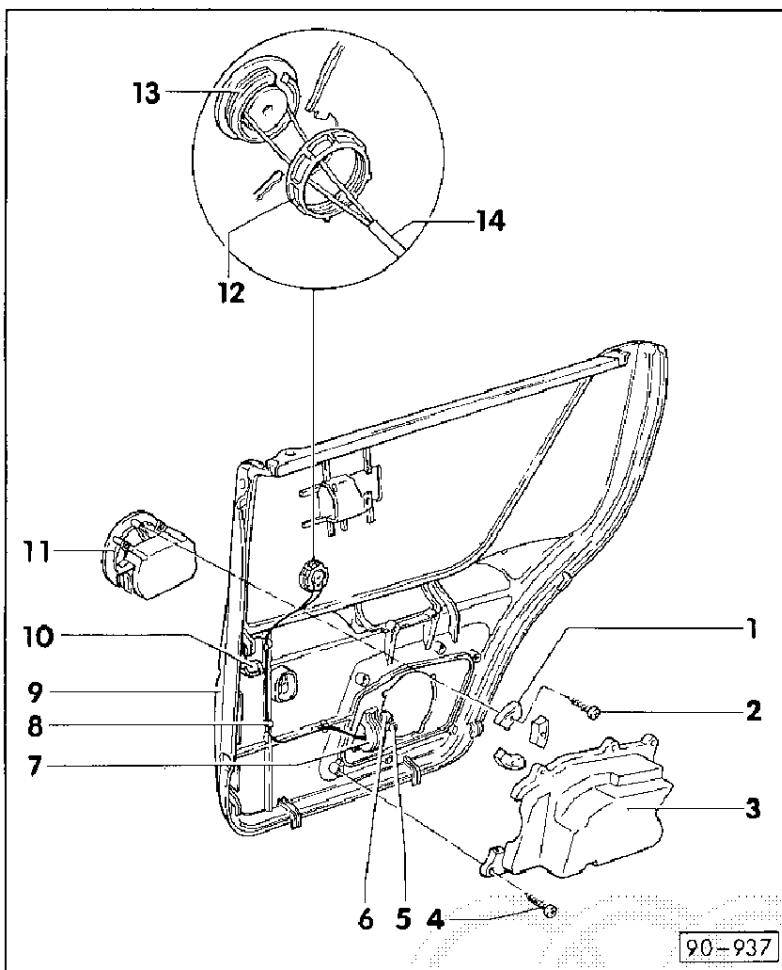
- 1 - Assembly segment
- 2 - Fastening screw
◆ 4.2 x 16
- 3 - Loudspeaker box
- 4 - Fastening screw
◆ 4.2 x 16
- 5 - 2-pin connector
◆ For mid-range/treble loudspeaker
- 6 - 5-pin connector
◆ For bass loudspeaker

91-27



- 7 - Sealed socket
◆ For cable transition piece
- 8 - Retaining clip
◆ For loudspeaker wiring loom
- 9 - Door trim
- 10 - Receptacle
◆ For loudspeaker wire
- 11 - Active or passive bass loudspeaker
◆ Removal:
- Remove door trim
=> General Body repairs; Repair group 70; Door trim; Removing and installing front door trim (4- and 5-cyl. > 06.93) or removing and installing front door trim (4- and 5-cyl. 07.93 >, 6-cyl., S2) =>

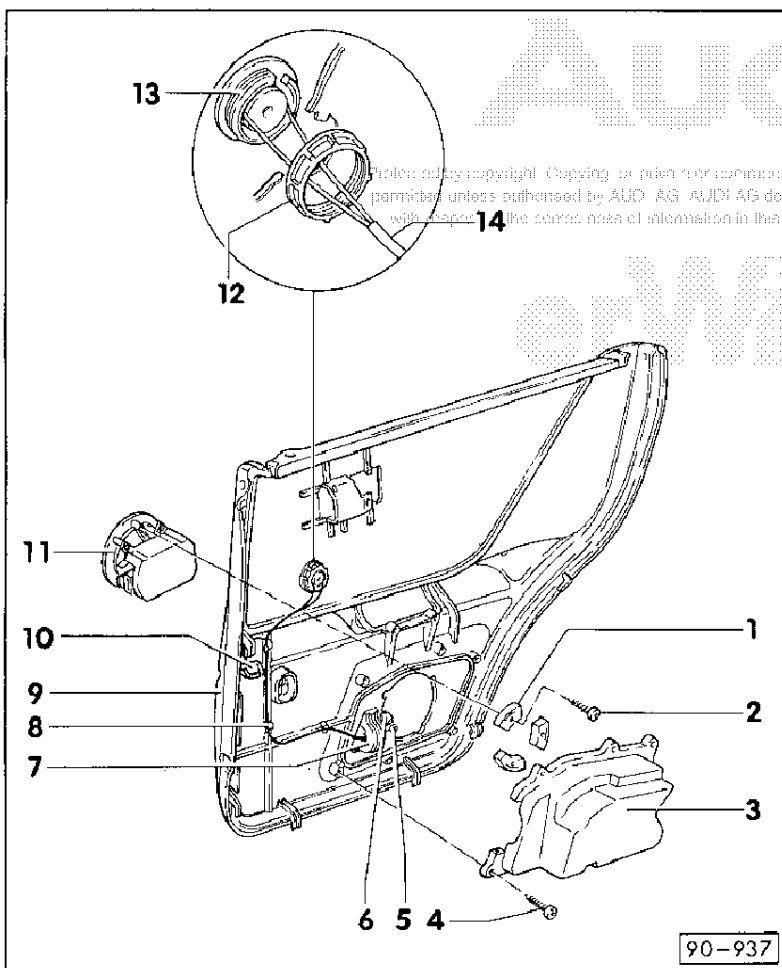
91-28



- Pull off connector at receptacle -Item 10-
- Unscrew fastening screws -Item 4- and remove loudspeaker box.
- Pull off connectors -Item 5- and -Item 6-.
- Remove fastening screws -Item 2-.
- Remove assembly segments -Item 1- and take bass loudspeaker out forwards out of door trim -Item 9-.

12 - Threaded ring

- ◆ For attaching mid-range/treble loudspeaker



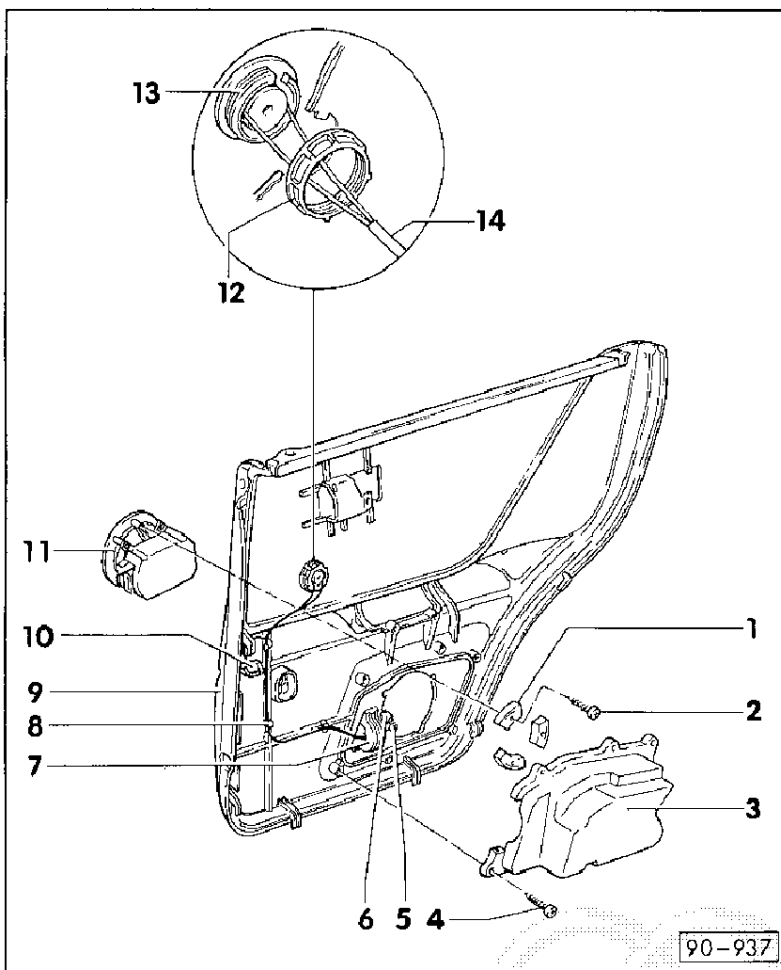
13 - Mid-range/treble loudspeakers

- ◆ Removal:

- Remove door trim

=> General Body repairs; Repair group 70; Door trim; Removing and installing front door trim (4- and 5-cyl. > 06.93) or removing and installing front door trim (4- and 5-cyl. 07.93 >, 6-cyl., S2) =>

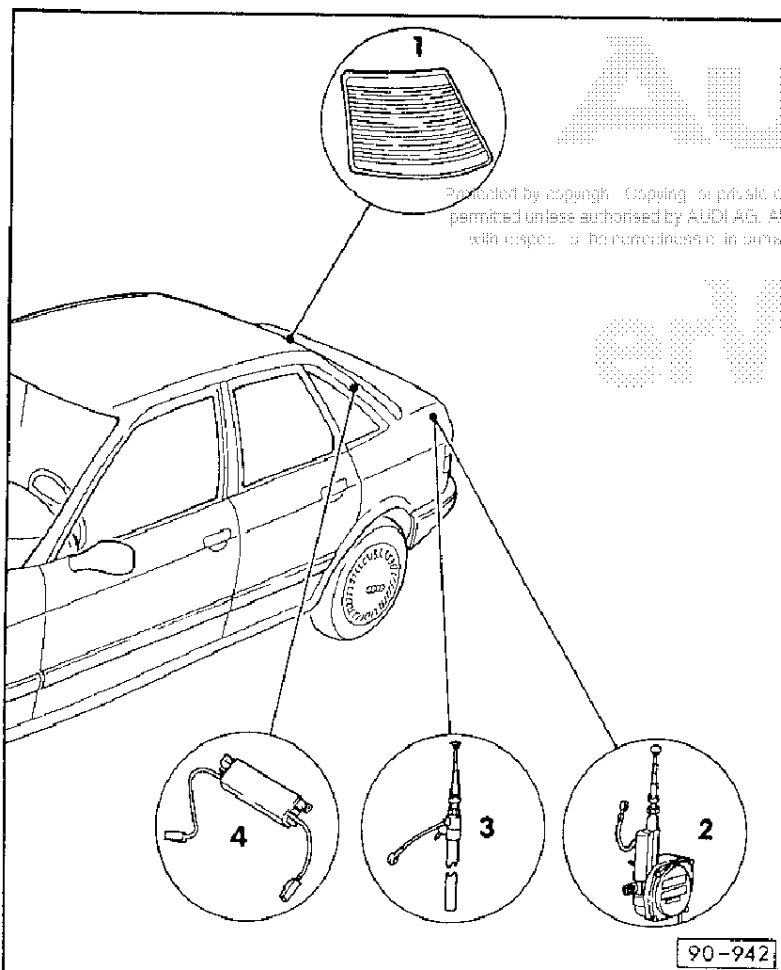
- Pull off connector at receptacle -Item 10-
- Unscrew fastening screws -Item 4- and remove loudspeaker box.
- Pull connector for mid-range/treble loudspeaker -Item 5- from bass loudspeaker -Item 11-.



- Remove connecting cable for mid-range/treble loudspeaker - Item 14- from retaining clips -Item 8- and socket -Item 7-.
- Unscrew threaded ring -Item 12- from mid-range/treble loudspeaker and take mid-range/treble loudspeaker forwards out of door trim -Item 9-.

14 - Connecting cable

- ◆ For mid-range/treble loudspeaker



Layout of aerial systems

Notes:

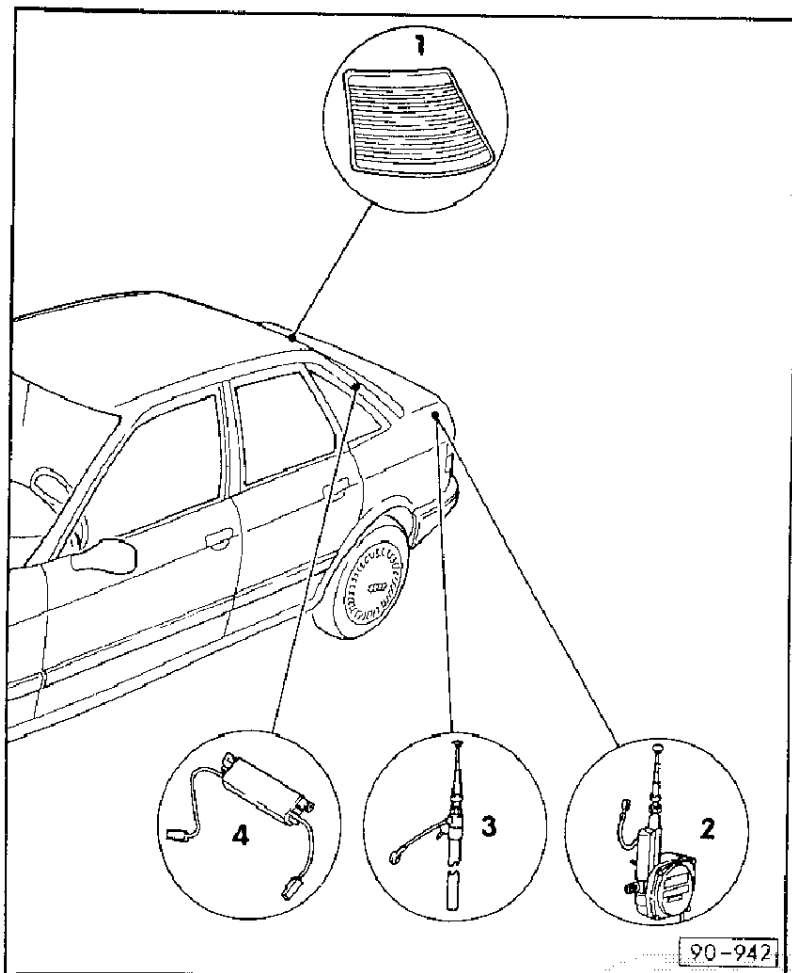
- ◆ When retrofitting it is advisable to use a telescopic or power aerial.
- ◆ Dimensions for subsequent installation => Fig. 2.

◆ Repairing roof aerial

- Avant > 06.94 => Page 91-42.
- Avant 07.94 > => Page 91-44.

1 - Heated rear windscreen with window aerial -Z24

- ◆ Top 3 filaments not heated; MW aerial only (AM)
- ◆ Remaining filaments: Heater and VHF aerial (FM)
- ◆ Removing and installing => General Body Repairs; Repair Group 64; Removing and installing rear window; Removing and installing (saloon) =>



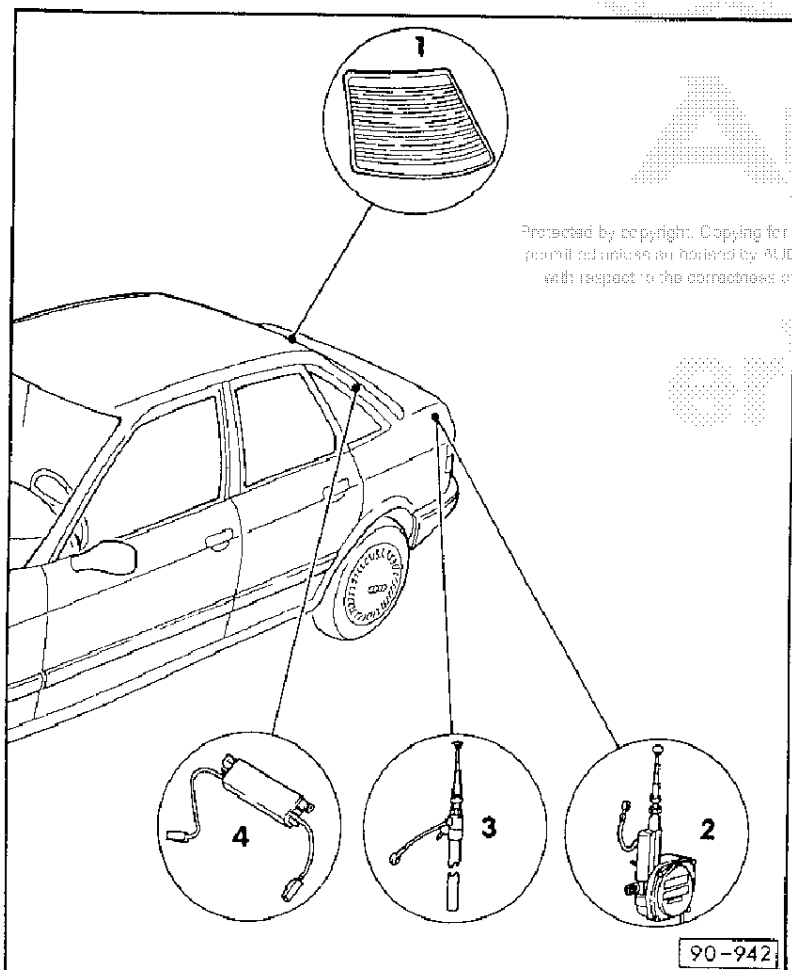
2 - Power aerial

- ◆ Only with special thermally-insulated glass
- ◆ Removing and installing => Page 91-40
- ◆ Subsequent aerial installation => Fig. 2.
- ◆ Wiring and contact assignment

=> "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

3 - Rod aerial

- ◆ Removing and installing => Page 91-38
- ◆ Subsequent aerial installation => Fig. 2.

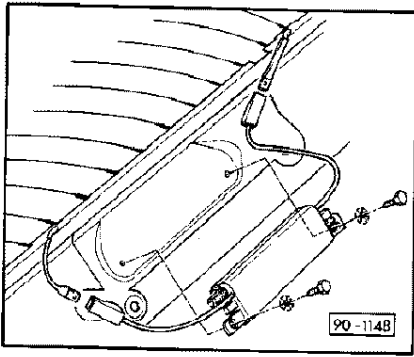


4 - Aerial amplifier - R24

- ◆ only in conjunction with window aerial
- ◆ Location: Inside of left D pillar
- ◆ Removing and installing => Fig. 1

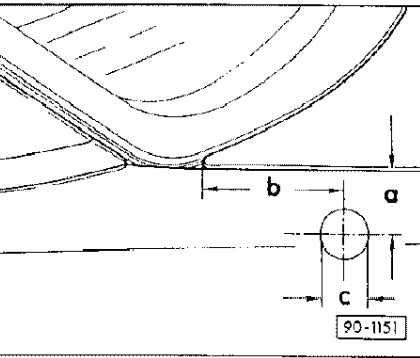
◆ Troubleshooting

=> "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder



◀ Fig.1 Removing and installing aerial amplifier

- Remove inner D pillar trim
- Unscrew aerial cable and pull off all connectors.
- Loosen hexagon screws and remove aerial amplifier.
- Ensure that there is a good earth connection when installing.



◀ Fig.2 Subsequent aerial installation.

- Power and rod aerial

Note:

When retrofitting an aerial, original spare parts (Vortex) must be used. Other commercially available aerials may not fit correctly and cause wind noise at high speed.

- Mark dimensions for aerial hole on rear left side panel using felt or fibre-tipped pen.

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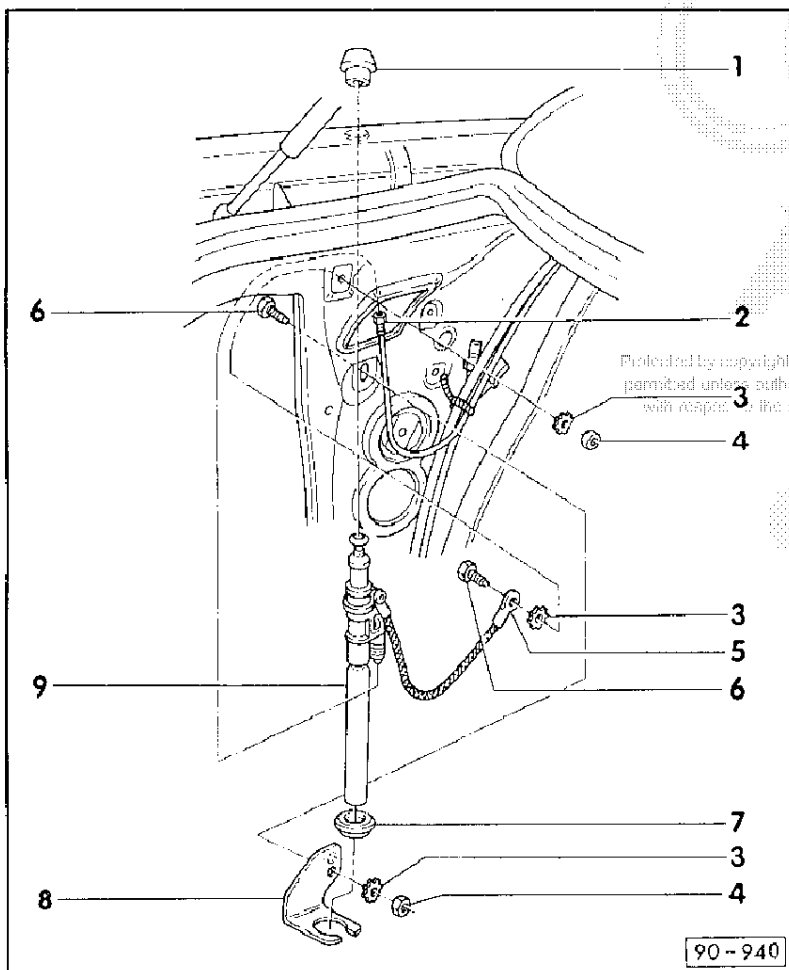
- Distance a = 50 mm

- Distance b = 120 mm

- Dimension c = 16.5 mm

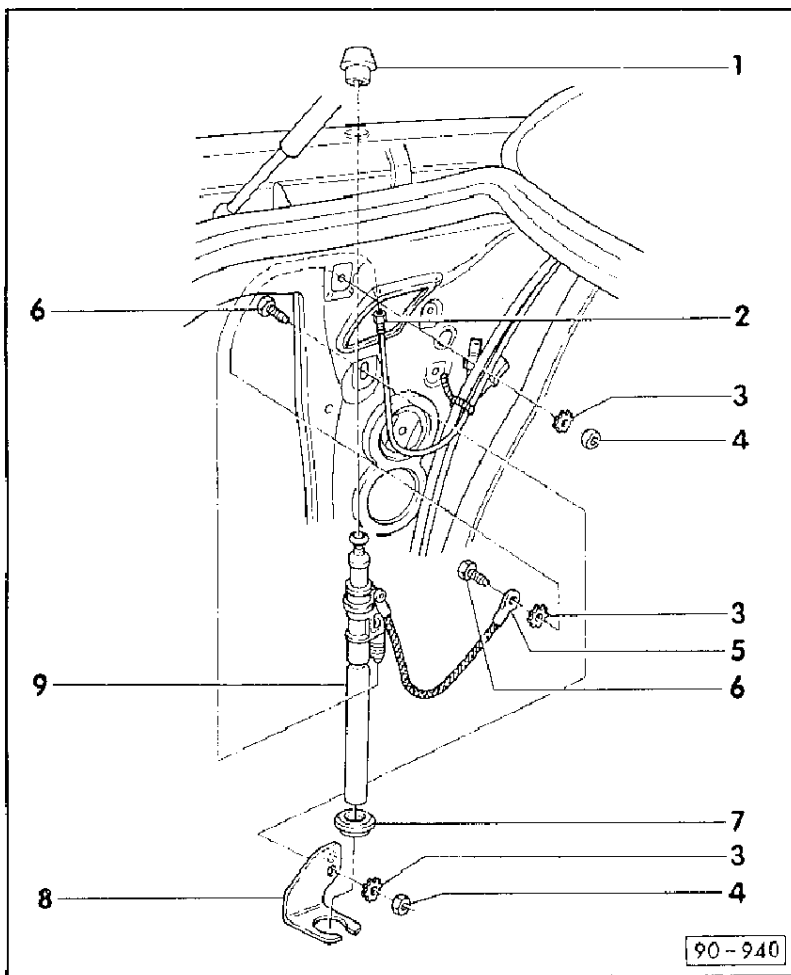
- Drill aerial hole and carefully deburr.
- Carefully extract/remove all drillings and filings (avoid scratches).

- Repair paintwork around hole as specified
- = > Vehicle paintwork
- Take anti-corrosion measures if necessary
- = > "Surface treatment/chemical materials" binder
- Installing telescopic or power aerals.
- Install and connect cabling
- = > "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder



Removing and installing rod aerial

- 1 - Sealed socket
- 2 - Aerial cable
- 3 - Toothed washer, 5 mm
- 4 - Hexagon nut M5
- 5 - Earthing strap for aerial
- 6 - M5 hexagon nut (10 x) - 2.5 Nm
- 7 - Rubber grommet
- 8 - Bracket

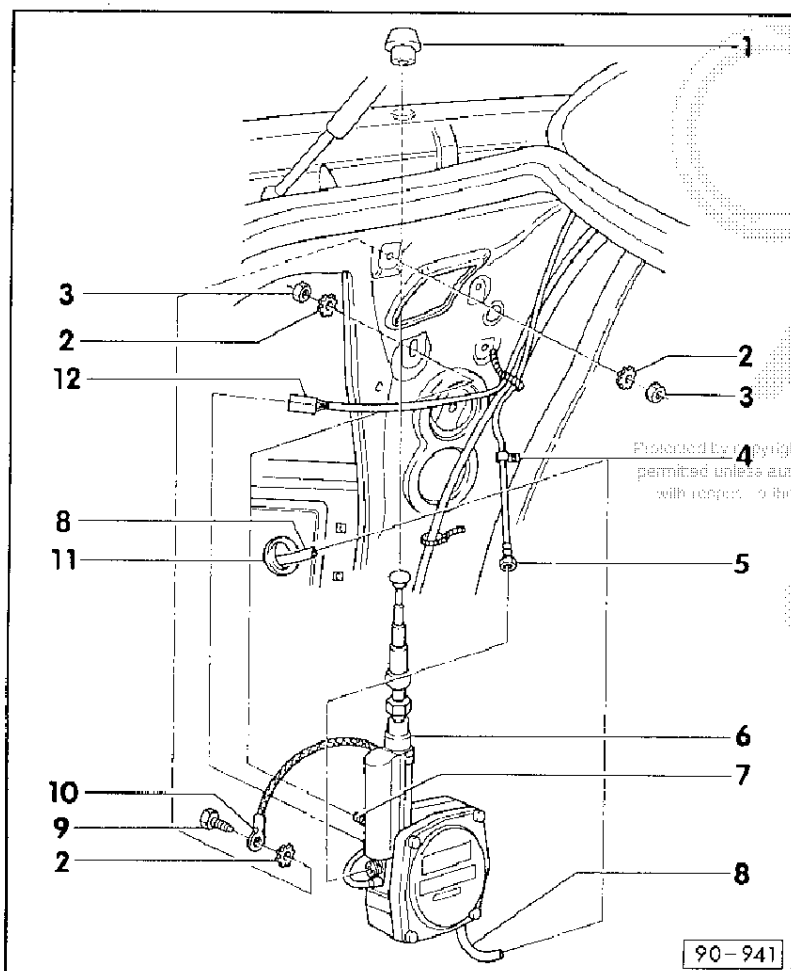


9 - Rod aerial

◆ Removal:

- Remove hexagon bolts -Item 6- for bracket and earthing strap.
- Unscrew aerial cable -Item 2-
- Pull rod aerial with bracket -Item 8- downwards out of socket -Item 1- by pulling and pressing firmly on telescopic head.

91-39



Removing and installing power aerial

1 - Sealed socket

2 - Toothed washer, 5 mm

3 - Hexagon nut M5, 2.5 Nm

4 - Earthing clip for aerial cable

◆ Secured with hexagon bolt -Item 9-

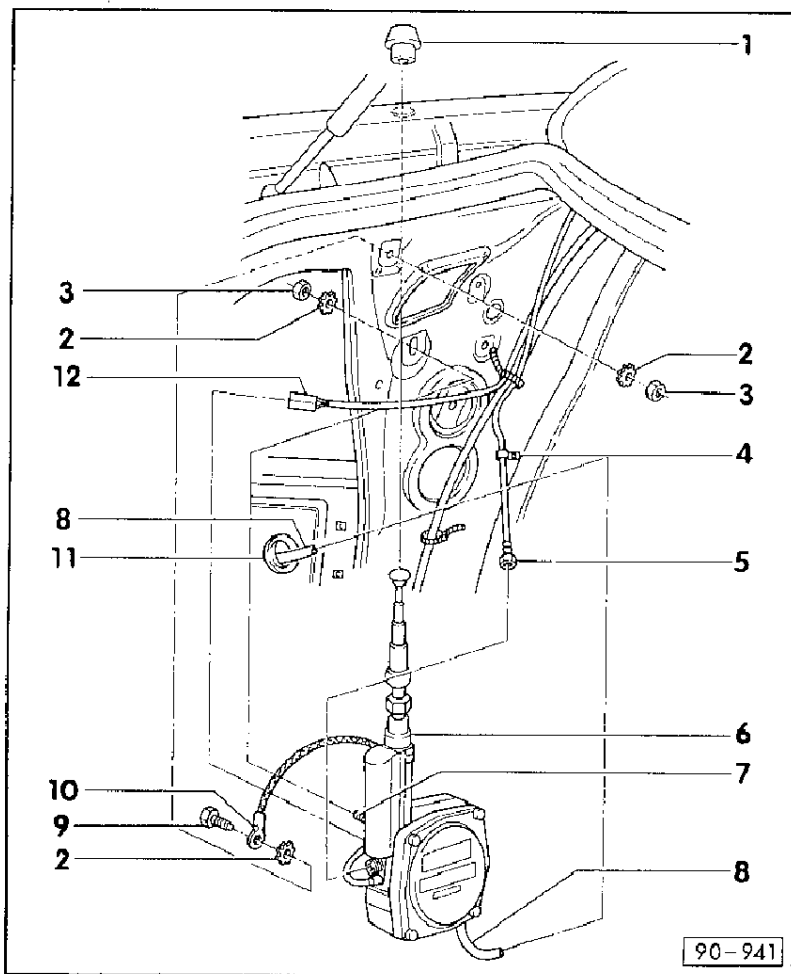
5 - Aerial cable

6 - Electronic power aerial

◆ Removal:

- Remove both hexagon nuts -Item 3- for power aerial and earthing strap -Item 10-.

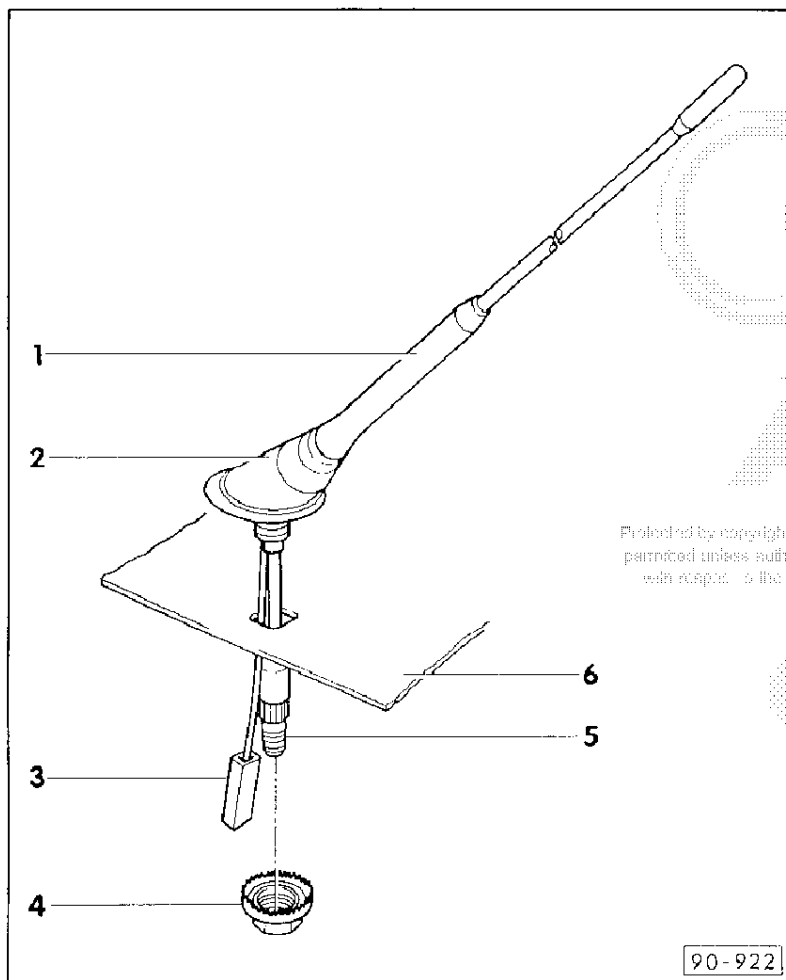
91-40



- Remove aerial cable -Item 5-, connector -Item 12- and water drain hose -Item 8-.
- Pull power aerial downwards out of socket -Item 1- by pulling and pressing firmly on telescopic head.

- 7 - Threaded pin M5**
 - ◆ Permanently installed in power aerial
- 8 - Water drain hose**
- 9 - Hexagon bolt M5 x 10**
- 10 - Earthing strap for aerial**
- 11 - Rubber grommet**
 - ◆ For water drain hose
- 12 - Connector**
 - ◆ For power aerial

91-41



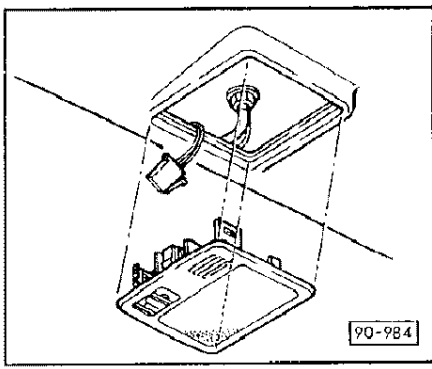
Avant roof aerial > 06.94

Note:
 Removing and installing roof aerial
 => Page 91-43.

- 1 - Aerial rod**
- 2 - Aerial base**
- 3 - Connector**
- 4 - Securing nut - 3,5 Nm**
- 5 - Aerial cable connection**
- 6 - Roof skin**

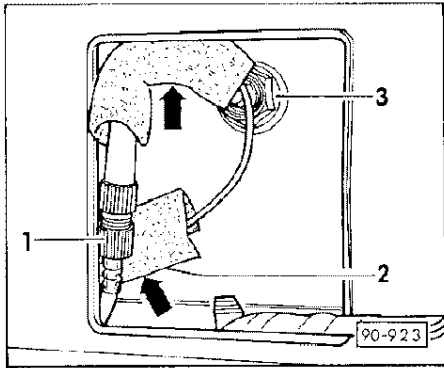
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91-42

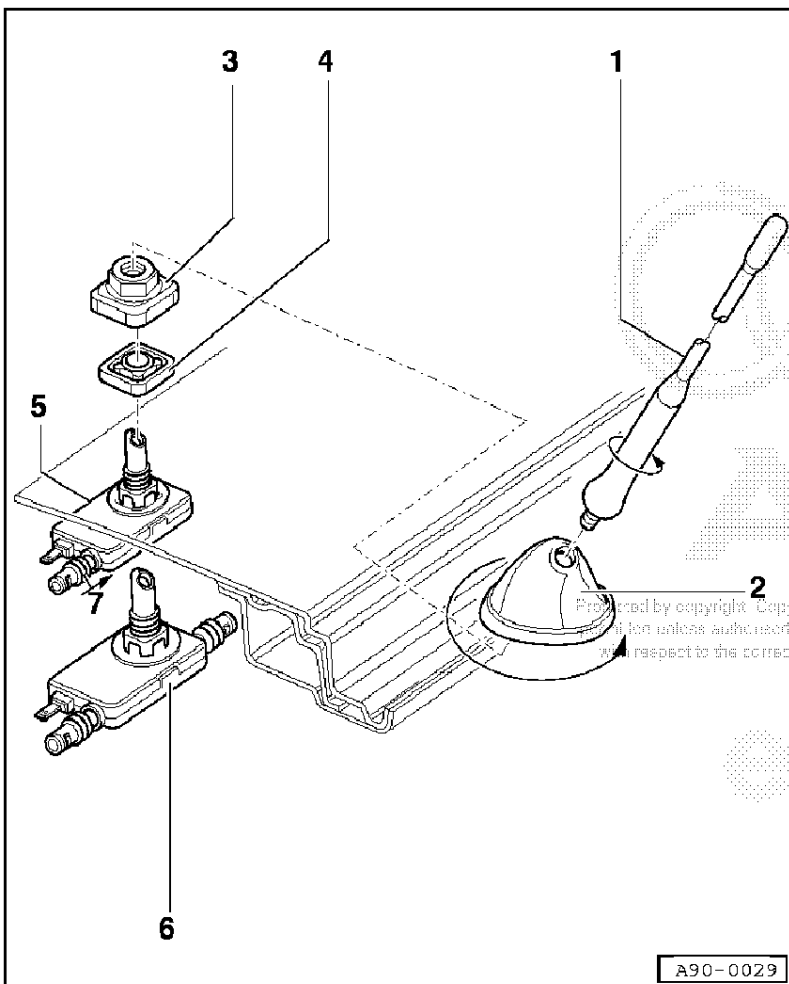


Removing and installing roof aerial

- Switch off radio.
- Carefully prise out boot light using flat screwdriver.
- Remove plug.



- Push back foam tubes -Arrows-.
- Loosen screw connection -1- and plug-in connector -2-.
- Unscrew fastening nut -3- (3.5 Nm).
- Remove roof aerial from above.

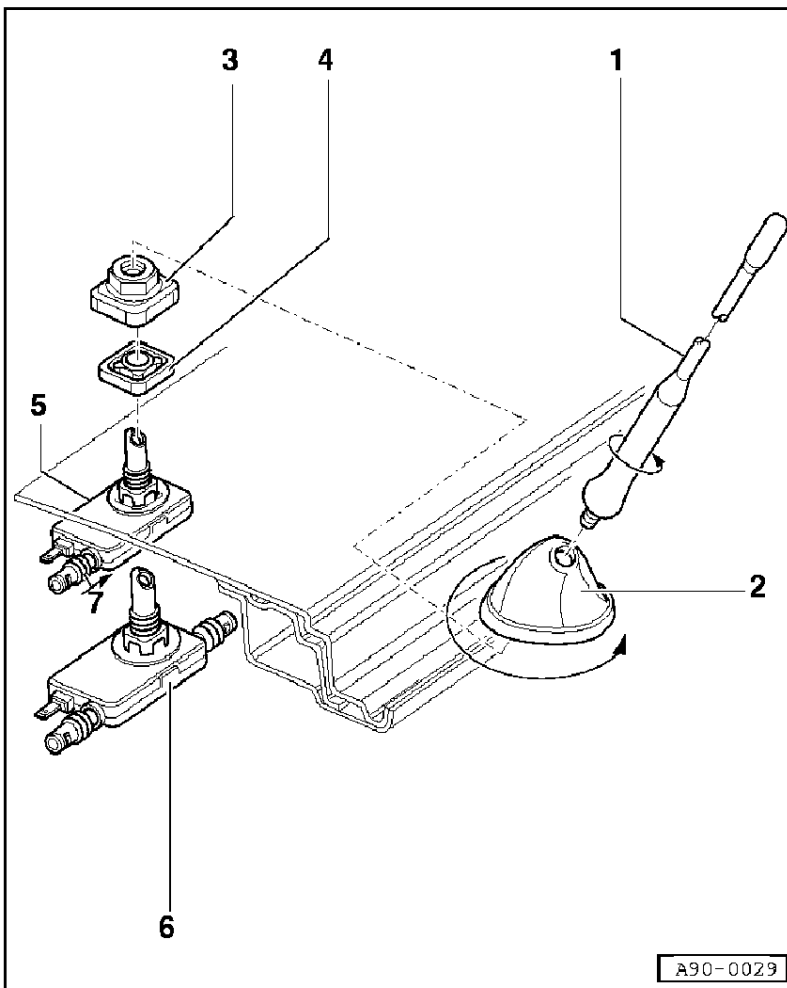


Roof aerial with amplifier, Avant 07.94 >

Note:

Removing and installing roof aerial with amplifier => Page 91-45.

- 1 - Aerial rod
- 2 - Cover
- 3 - Securing nut - 3.5 Nm
- 4 - Seal
- 5 - Aerial base with amplifier
◆ For radio operation
- 6 - Aerial base with amplifier
◆ For radio and telephone operation (if telephone installed)
- 7 - Aerial cable locking mechanism

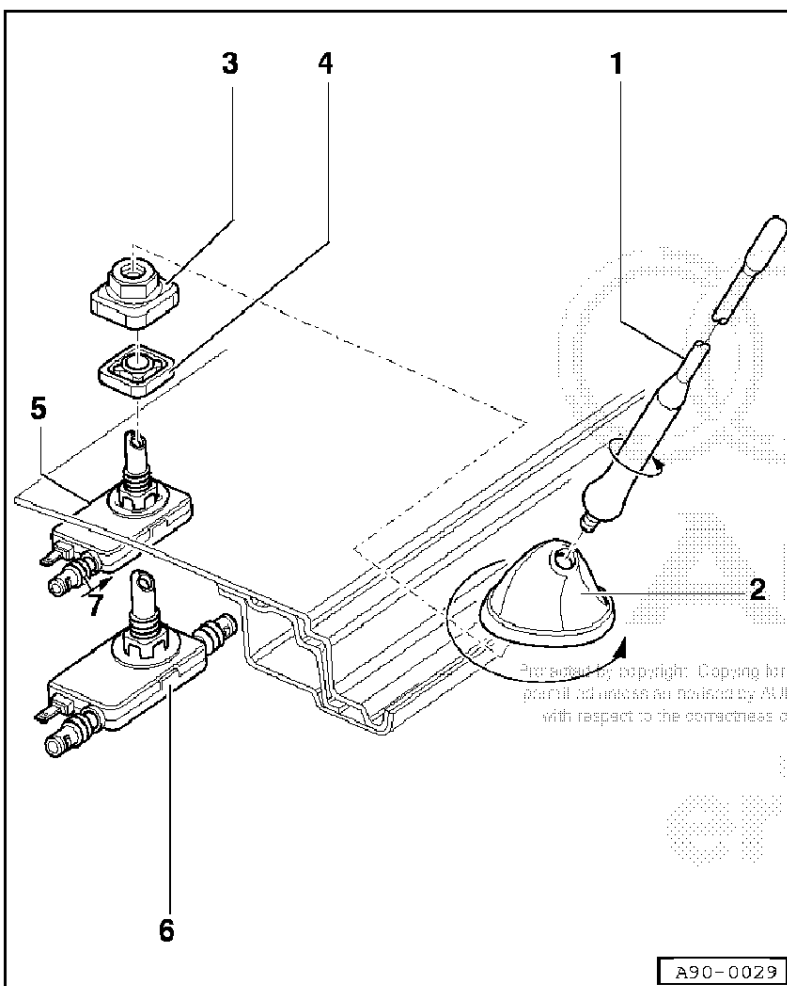


A90-0029

Removing and installing roof aerial with amplifier.

- Switch off radio.
- Carefully prise out boot light using flat screwdriver.
- Screw out aerial rod -1-
- Turn cover -2- 1/4 turns to the left and pull off from above.
- Unscrew nut -3-.
- Remove seal -4-.

91-45



A90-0029

- Release aerial cable locking mechanism -7- in direction of arrow.
- Remove power supply connector.
- Pull off aerial base-5- or -6- downwards.

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91-46

Servicing windscreen washer system

Warning

Always switch off ignition when performing assembly work on installed wiper motor.

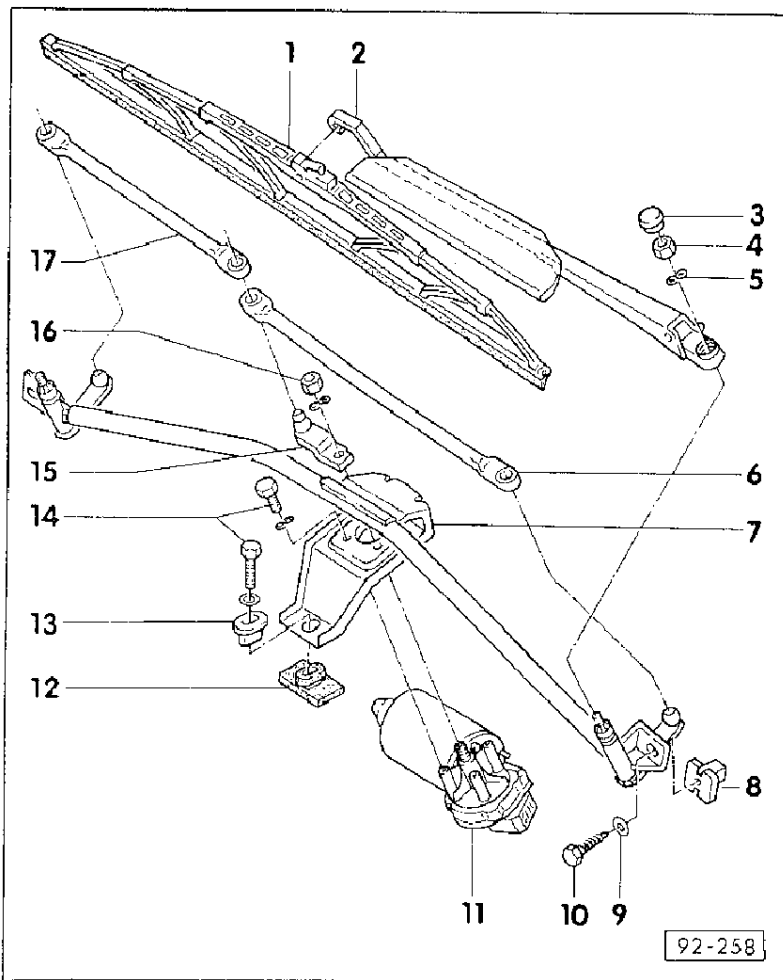
Note:

Wiper motor can only be removed complete with frame. To do this, remove cowl, mounting rail and water guard.

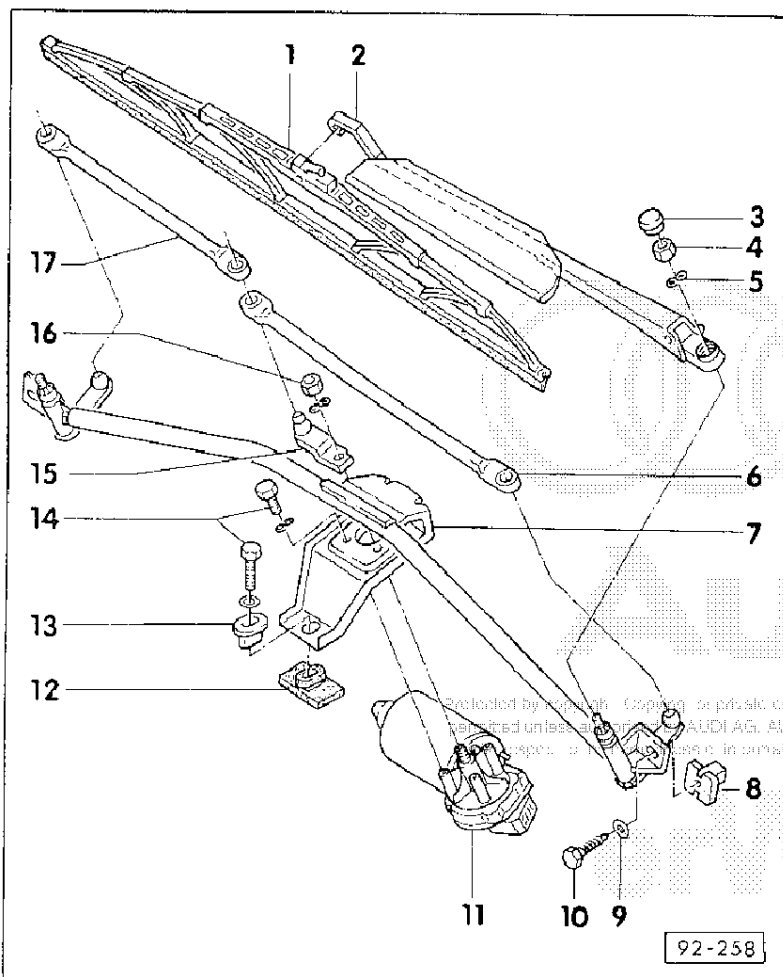
1 - Wiper blade

2 - Wiper arm

◆ Adjusting => Fig. 2



92-1



3 - Trim cap

◆ Prise off

4 - M8 nut - 16 Nm

5 - Washer

6 - Lever off left thrust rod

◆ and coat bearing shells with MoS₂-grease.

7 - Windscreen wiper frame

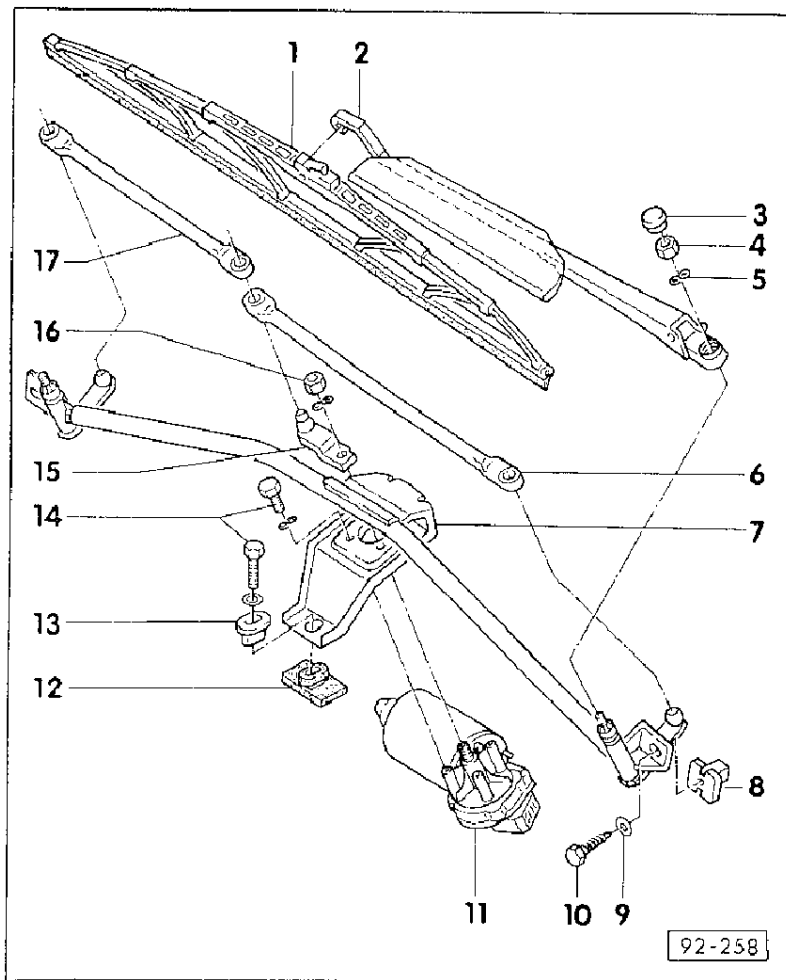
◆ with firmly compacted wiper bearings

◆ If repair required, replace entire windscreen washer frame, including both wiper bearings.

◆ Removing => Fig. 1

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92-2



8 - Clip

9 - Washer

10 - Hexagon self-tapping bolt

11 - Wiper motor

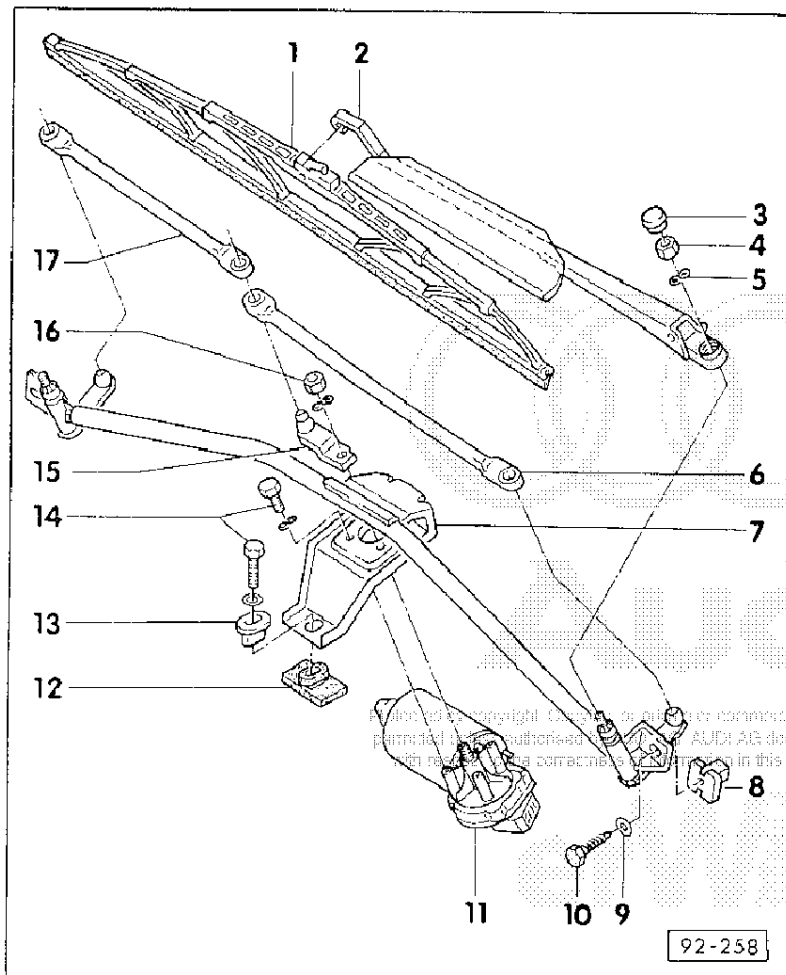
◆ Remove and install only with wiper frame removed

◆ Removal:

- Lever off thrust rods.
- Remove 3 fastening screws.
- Remove motor.

12 - Rubber plate

13 - socket



14 - Securing bolts

15 - Crank

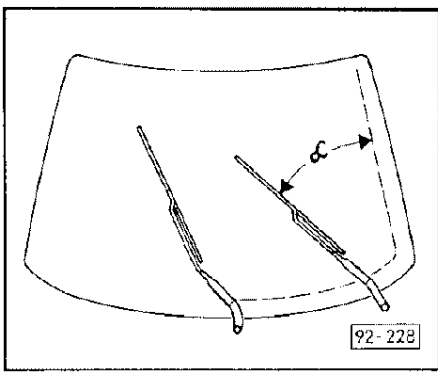
◆ Installation position => Fig. 3

16 - Nut - 22 Nm

17 - Lever off right thrust rod

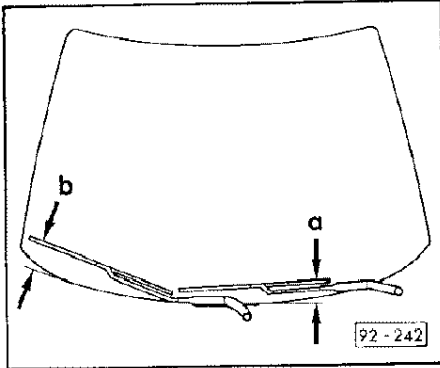
◆ and coat bearing shells with MoS2-grease.

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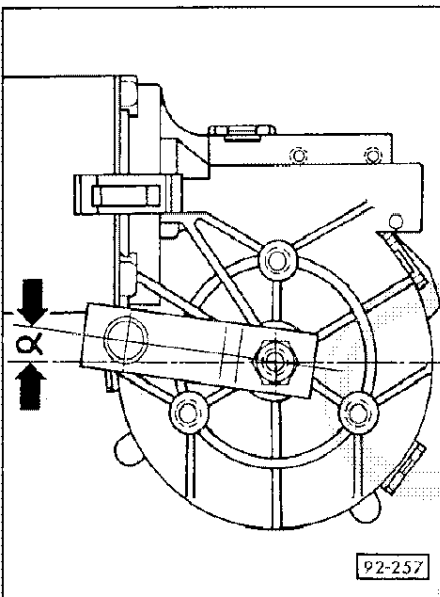
◀ **Fig.1 Wiper arm assembly position**

- Switch ignition on.
- Operate wipers until left wiper arm is in following position:
 - $\angle = \text{approx. } 45^\circ$
- Switch off ignition.
- Remove wiper motor together with wiper frame.



◀ **Fig.2 Wiper arm adjustment**

- Move wiper motor to park position.
 - Switch ignition on.
 - Switch on connected wiper motor and switch off using wiper switch. Wiper motor stops in park position.
- Set wiper arm (passenger side) to dimension -b- = 90 mm and tighten (16 Nm)
- Set wiper arm (driver's side) to dimension -b- = 65 mm and tighten (16 Nm)



◀ **Fig.3 Crank installation position**

- Allow wiper motor to run to park position and install.
- Put on the crank and align.
 - $\angle = \text{approx. } 6^\circ$

Servicing windscreen washer system and headlight washer system

Note:

Troubleshooting

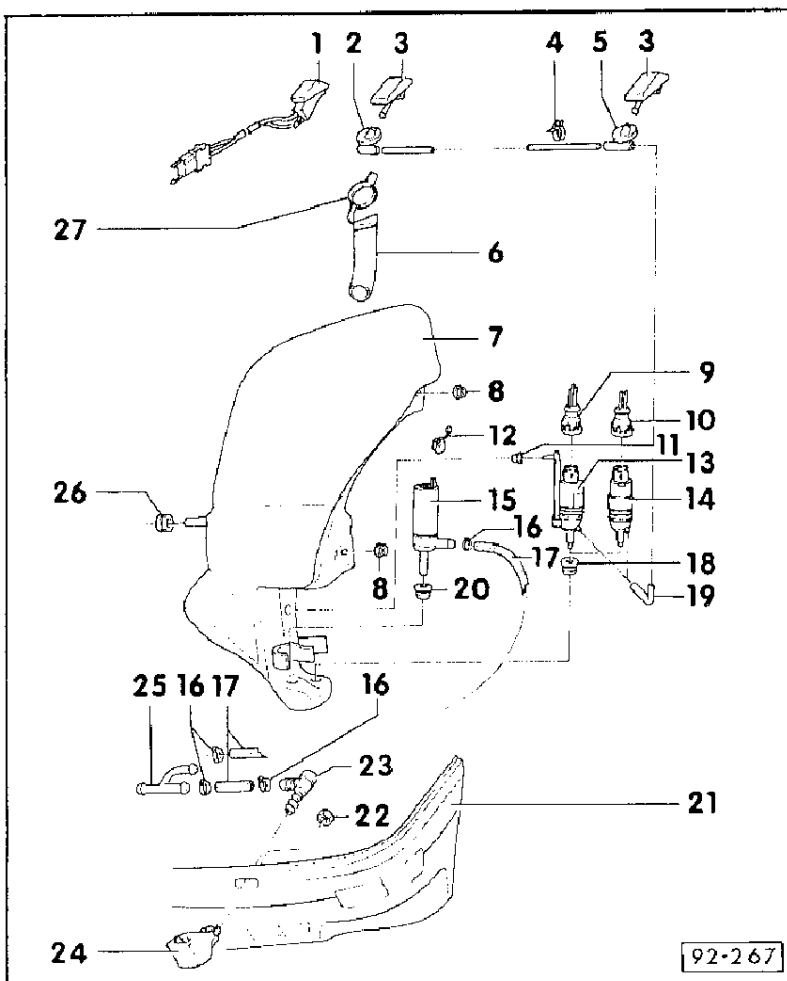
=> "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

1 - Heated jet

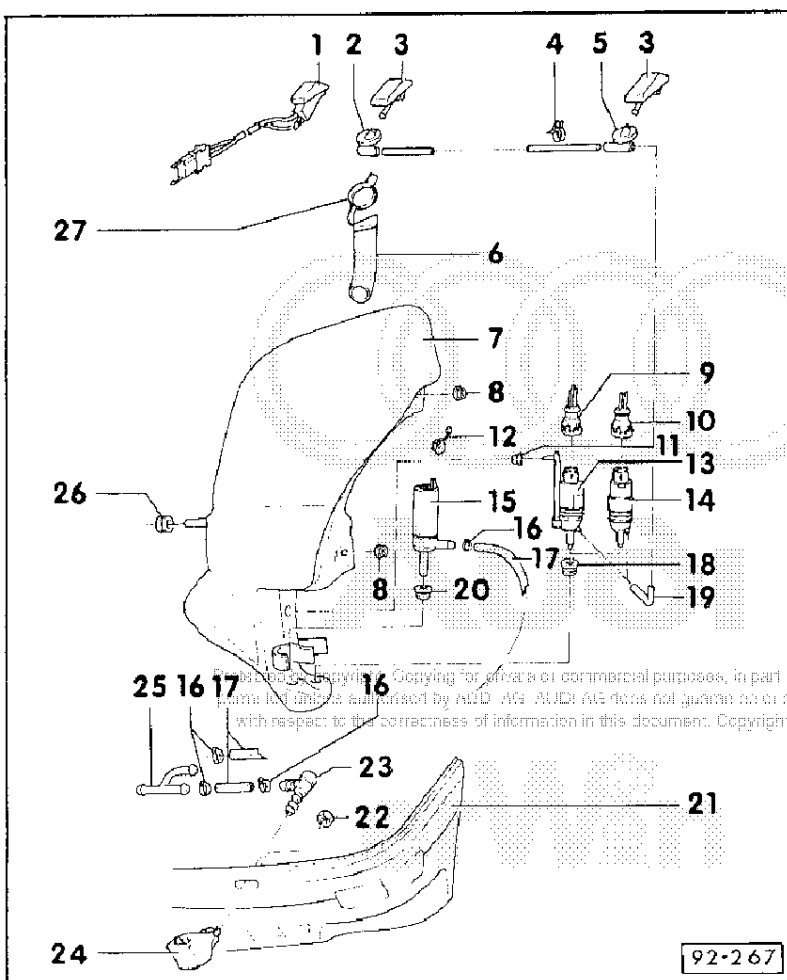
- ◆ for windscreen washing system
- ◆ Adjusting => Fig. 1
- ◆ Removing and installing => Page 92-17

2 - Connection socket, right

- ◆ Pull off connection before removing jet



92-7



3 - Jet

- ◆ for windscreen washing system
- ◆ Adjusting => Fig. 1
- ◆ Removing and installing => Page 92-17

4 - Retaining clip

5 - Connection socket, left

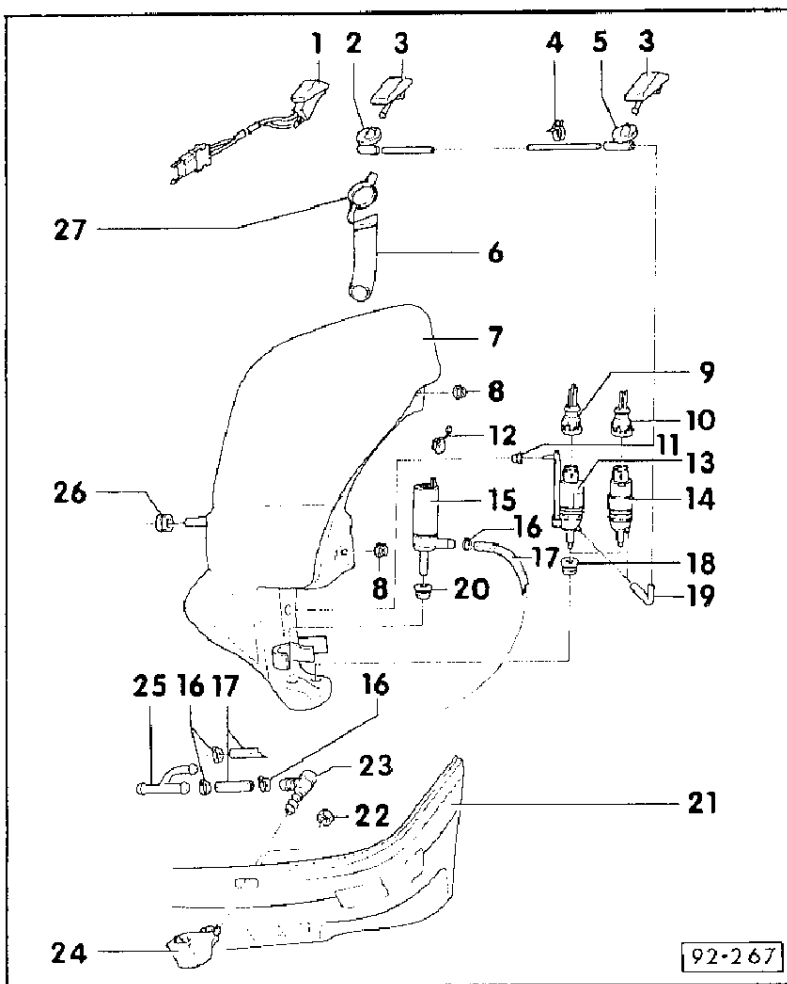
- ◆ Pull off connection before removing jet

6 - Filler neck

- ◆ Removing and installing => Page 92-16

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92-8

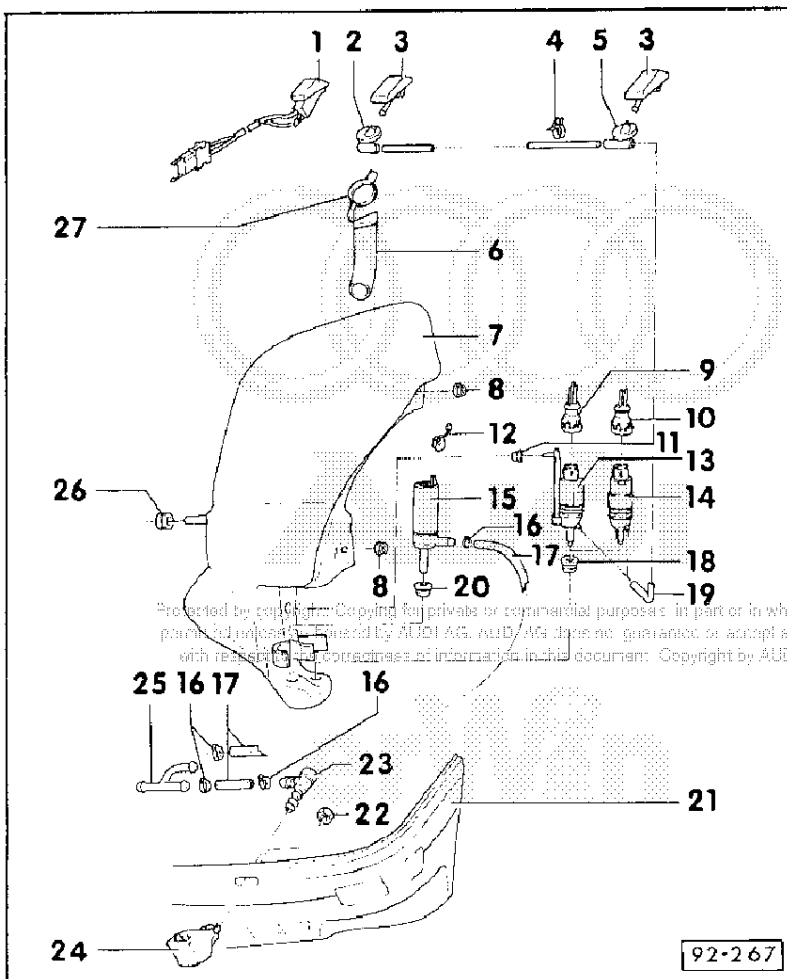


- 7 - Reservoir**
 - ◆ For windscreen washer system, capacity approx. 4.0 l
 - ◆ For windscreen and headlight washer system, capacity approx. 6.5 l
 - ◆ Removing and installing => Page 92-16

8 - Combination nut, 5 Nm

- 9 - Connector**
 - ◆ For windscreen washer system pump in vehicles with auto-check system

- 10 - Connector**
 - ◆ For windscreen washer system pump in vehicles with no auto-check system

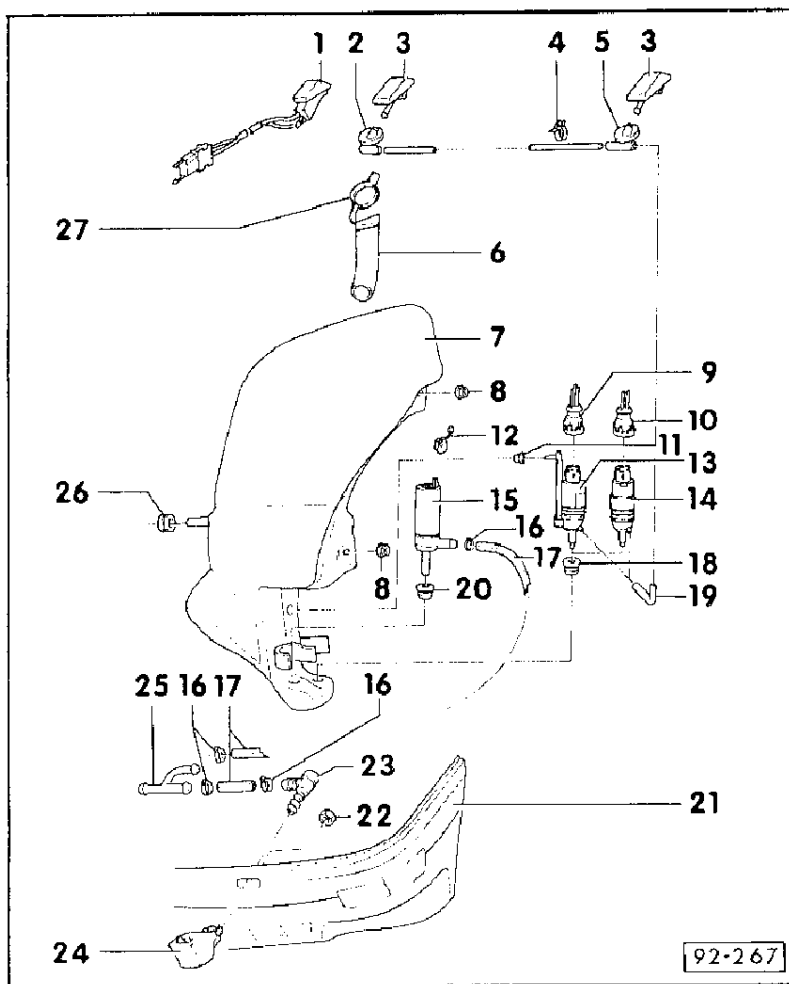


11 - Rubber grommet

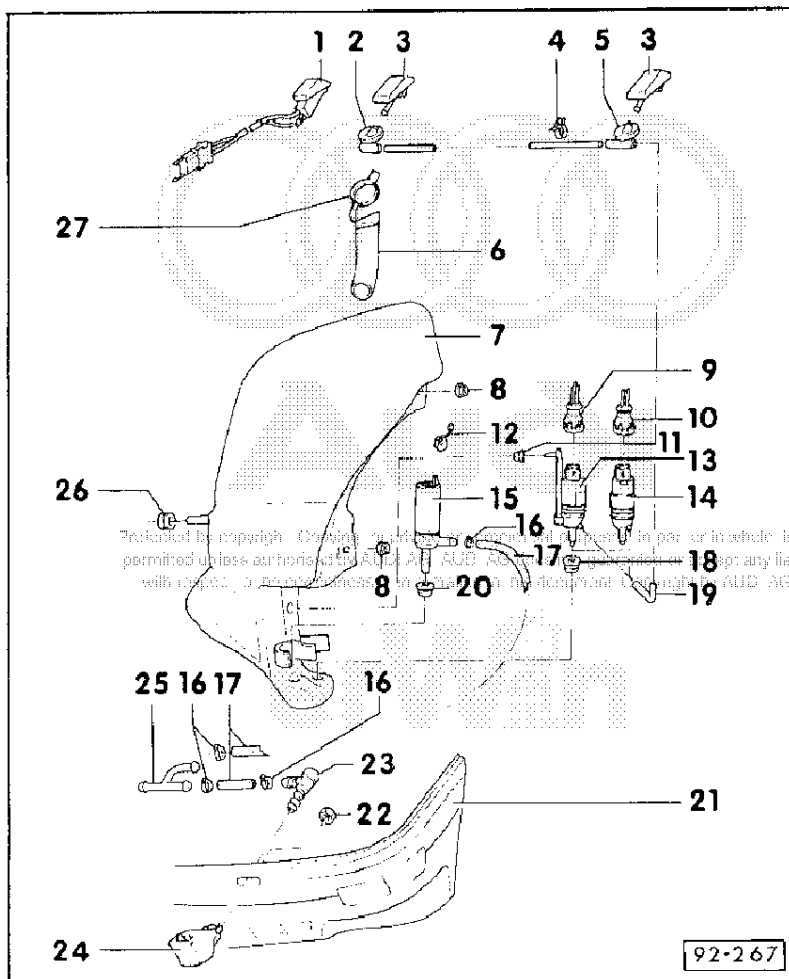
- 12 - Connector**
 - ◆ For headlight washer system pump
 - ◆ For windscreen washer system in vehicles with auto-check system

- 13 - Pump**
 - ◆ With integrated sensor
 - ◆ For windscreen washer system in vehicles with auto-check system
 - ◆ Removing and installing => Fig. 3 and Fig. 4

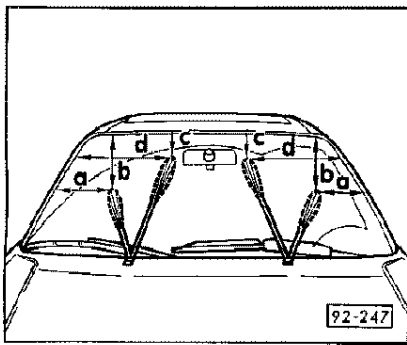
- 14 - Pump**
 - ◆ For windscreen washer system in vehicles with no auto-check system
 - ◆ Removing and installing => Fig. 4



- 15 - Pump
 - ◆ For headlight washer system
 - ◆ Removal and installation, see - Item 14-
- 16 - Hose clamp
 - ◆ Always replace
- 17 - Connecting hose
 - ◆ For headlight washer system
- 18 - Rubber grommet
- 19 - Angle piece
- 20 - Rubber grommet
- 21 - Bumper



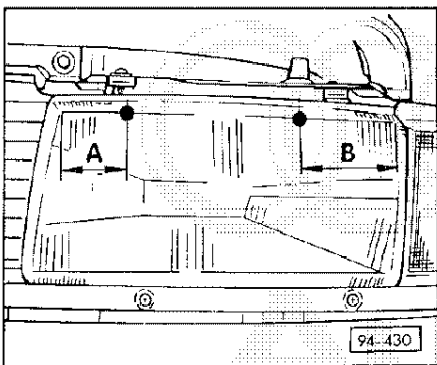
- 22 - Hexagon nut M6 - 2 Nm
 - ◆ Secure with sealing compound D 000 600
- 23 - Non-return valve
- 24 - Jet and holder assembly
 - ◆ Adjusting => Fig. 2
- 25 - Distributor piece
- 26 - Rubber grommet
- 27 - Cap



◀ Fig.1 Adjusting jets for windscreen washer system

Notes:

- ◆ Never use needles or other sharp objects, since these will damage the water ducts in the jet.
- ◆ If the water spray is irregular or cannot be set as specified, replace jet.
- Use special tool VW 3125 to set spray as follows:
 - a = 200 mm
 - b = 450 mm
 - c = 220 mm
 - d = 480 mm
- Tolerance ± 20 mm

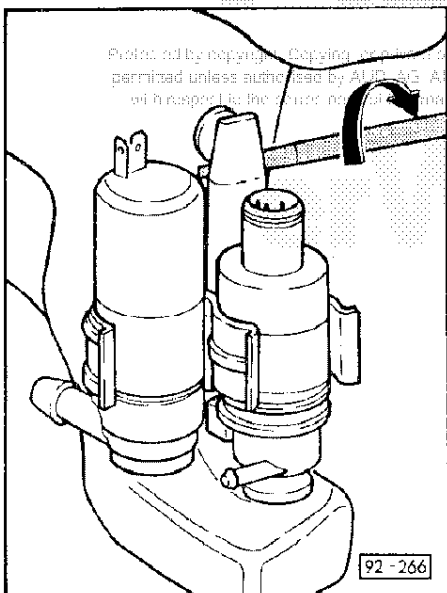


◀ Fig.2 Adjusting jets for headlight washer system

- Use special tool 3019 A to set spray at upper rim of headlight as follows:
 - ◆ A = 60 mm
 - ◆ B = 80 mm

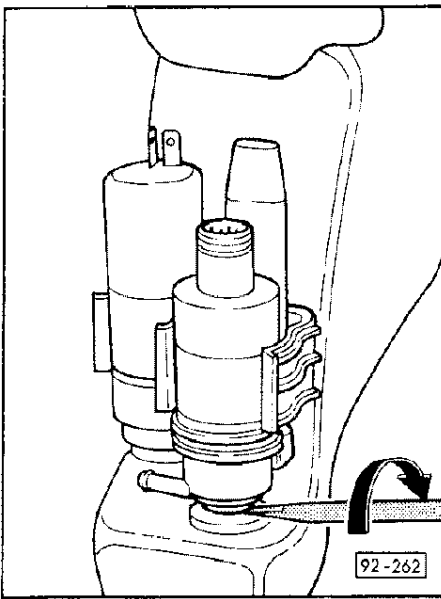
Note:

Dimensions also apply to dual headlights



◀ Fig.3 Removing warning contact for windscreen washer system water

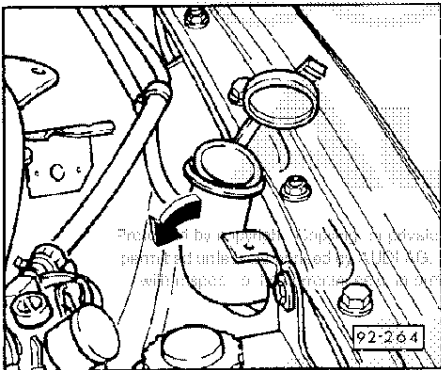
- Vehicles with auto-check system
 - Position screwdriver between reservoir and warning contact for windscreen washer system water and push warning contact out of rubber grommet by turning it.



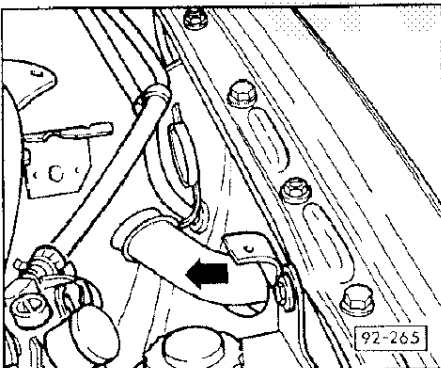
◀ Fig.4 Removing and installing pump for windscreen washer system

- Gently push pump forwards out of retaining clip
- Position screwdriver between reservoir and pump for windscreen washer system water and push pump out of rubber grommet by turning it.
- Pull pump for windscreen washer system upwards out of rubber grommet.

Removing and installing reservoir for windscreen and headlight washer system



- Unscrew coolant expansion reservoir and place to one side.
- ◀ - Turn filler neck so that it is facing downwards.

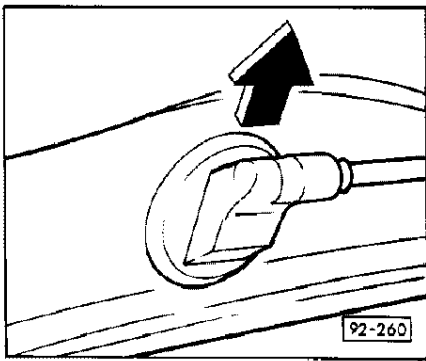


- ◀ - Pull filler neck out of mud guard lead-in and reservoir.
- Remove wheel housing liner
- = > General Body Repairs; Repair Group 63; Wheel housing liners; Removing and installing front wheel housing liner = >
- Remove strut
- Pull connector and connecting hoses from washing water pumps.
- Remove securing nuts (5 Nm)
- Carefully remove reservoir for windscreen and headlight washer system from wheel housing.

Removing and installing jets for windscreen washer system

Removal

- ◀ – Remove connection socket from jet by pulling backwards at an angle -arrow-.

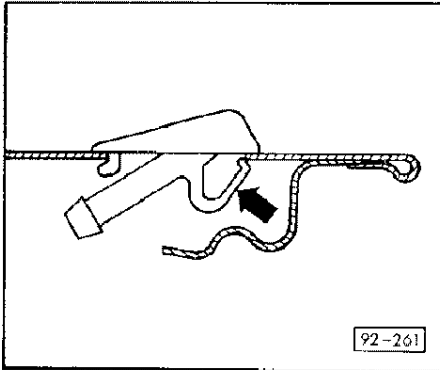


Non-heated jets:

- ◀ – Use medium-sized angled screwdriver to press back retaining lug -arrow- whilst pressing gently on connection piece.

Note:

Do not press screwdriver against bodywork panel.



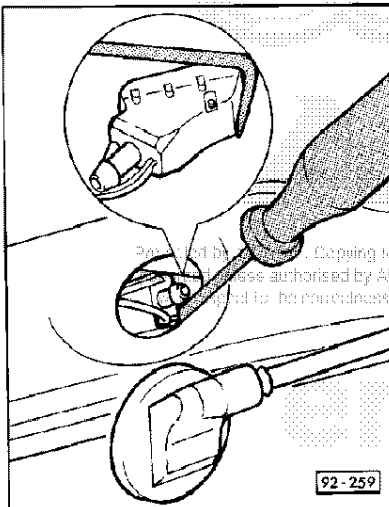
92-17

Heated jets:

- Pull off heating connector.
 - Connector location: Behind left foam bushing in bonnet
- ◀ – Use medium-sized angled screwdriver to press back retaining lug whilst pressing gently on connection piece.

Note:

Do not press screwdriver against bodywork panel.



All vehicles:

- Pull jet outwards out of bonnet.

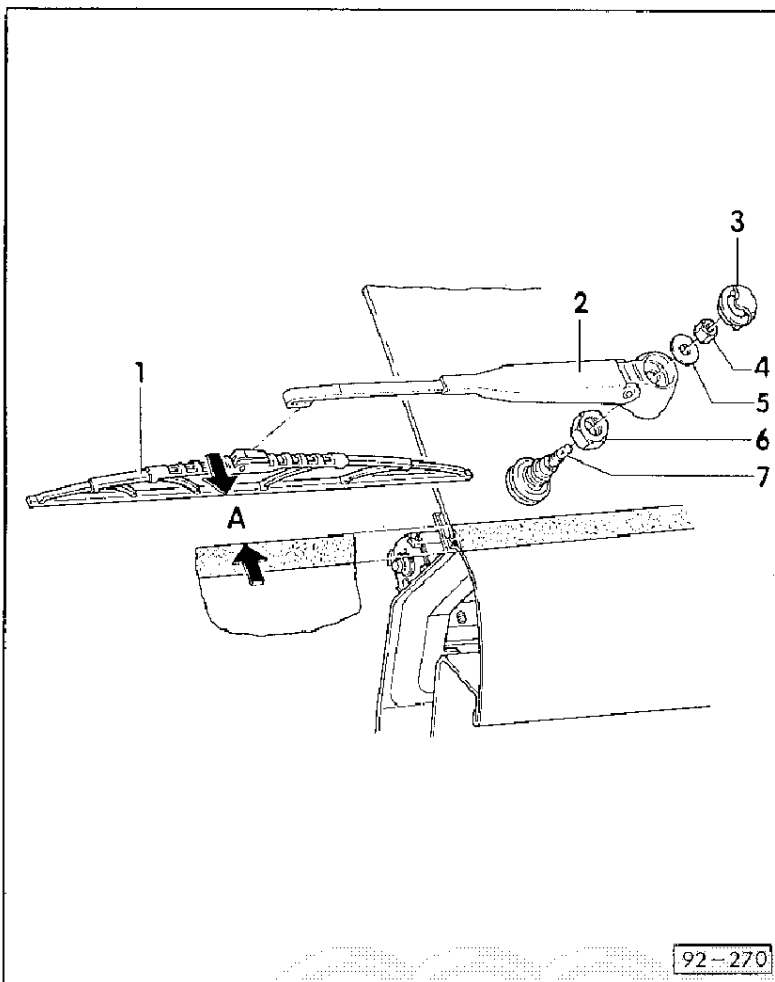
Installing

- Insert jet into bonnet from outside and push home until retaining lug engages.
- Attach connection socket.

92-18

Servicing rear window wiper system

Removing and installing rear window wiper arm



92-270

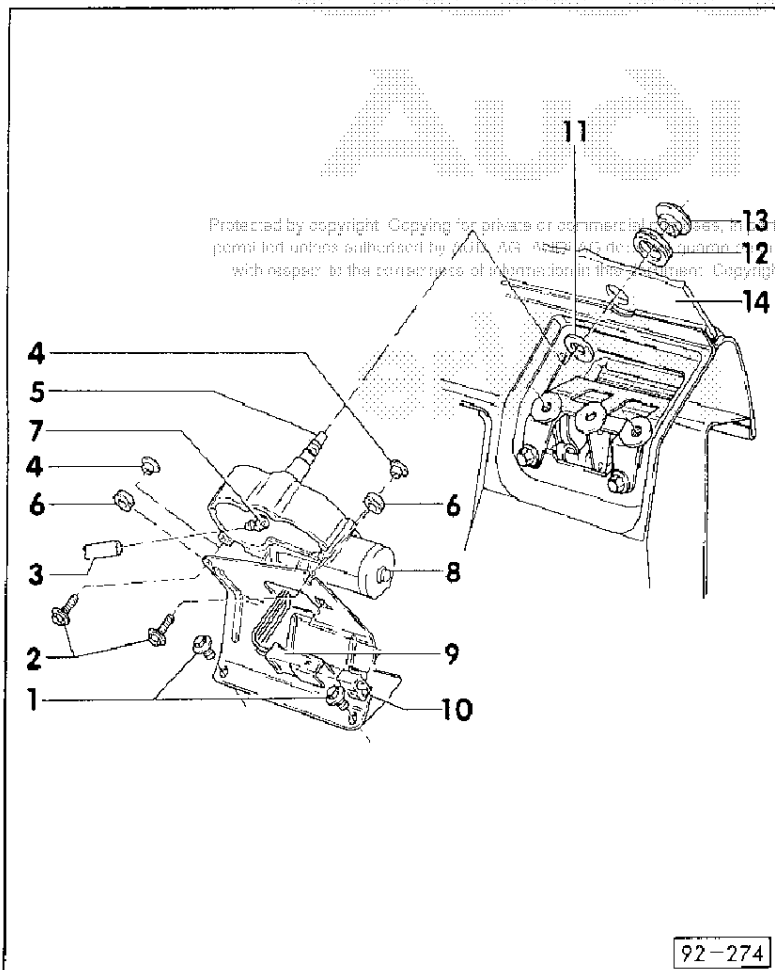
- 1 - Rear wiper blade
- 2 - Rear wiper arm
- 3 - Cap
- 4 - Securing nut - 16 Nm
- 5 - Spring lock washer
- 6 - Securing nut - 8 Nm
- 7 - Jet for rear window washer system

Note:

Setting for rear window wiper blade A = 40 mm from top edge of dotted pattern.

92-19

Removing and installing rear window wiper motor

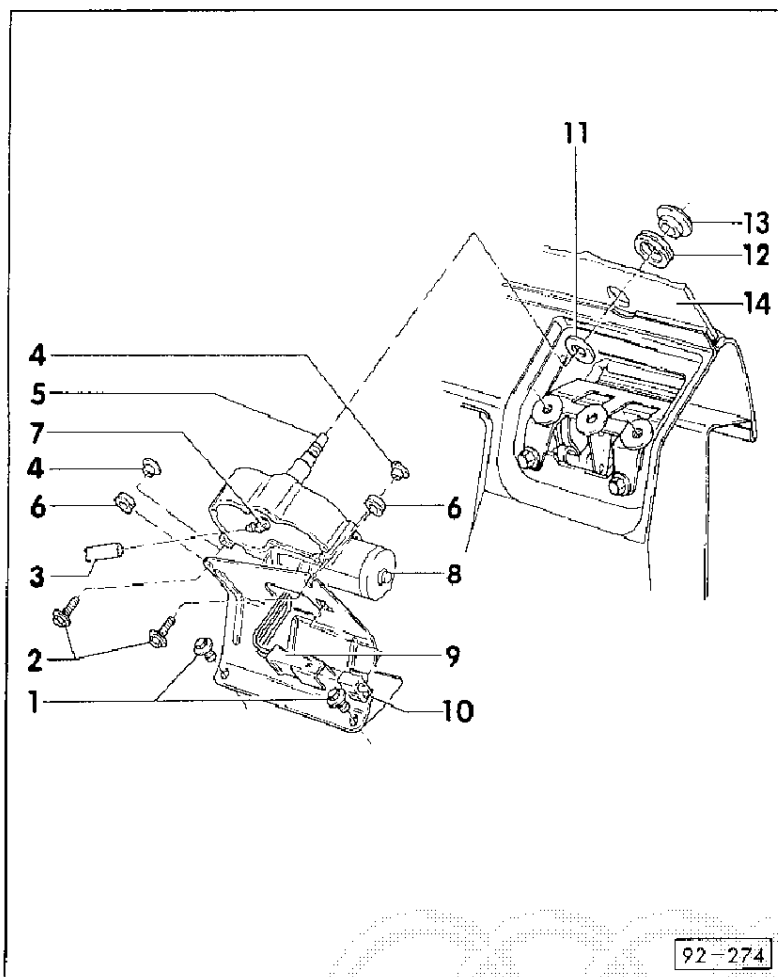


92-274

- Remove boot lid trim.
- => General Body Repairs, Interior; Repair Group 70; Trim Panels; Removing and installing boot trim (Avant) =>

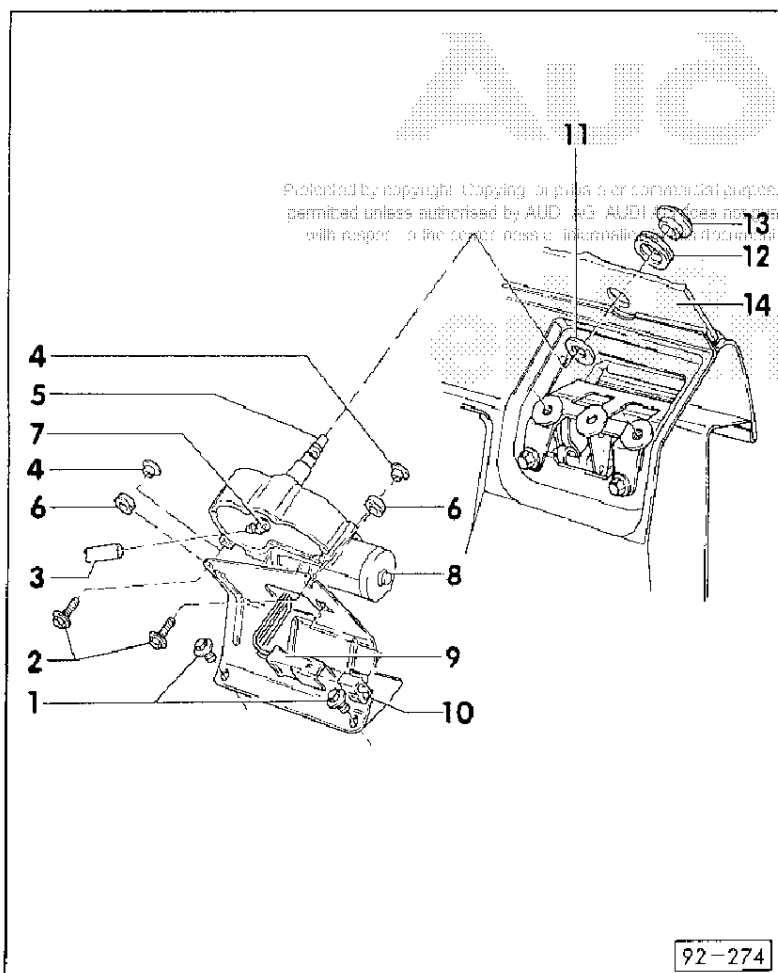
- 1 - Securing screw - 8 Nm
- 2 - Securing screw - 8 Nm
- 3 - Water hose
- 4 - Metal bushing
- 5 - Jet
 - ◆ Supplied as replacement part with -Item 7-

92-20



92-274

- 6 - Rubber grommet
- 7 - Connecting pipe
 - ◆ Supplied as replacement part with -Item 5-
- 8 - Rear window wiper motor
- 9 - Connector
- 10 - Retaining clip
- 11 - Plastic washer
- 12 - Rubber grommet
- 13 - Black metal bushing
- 14 - Rear window



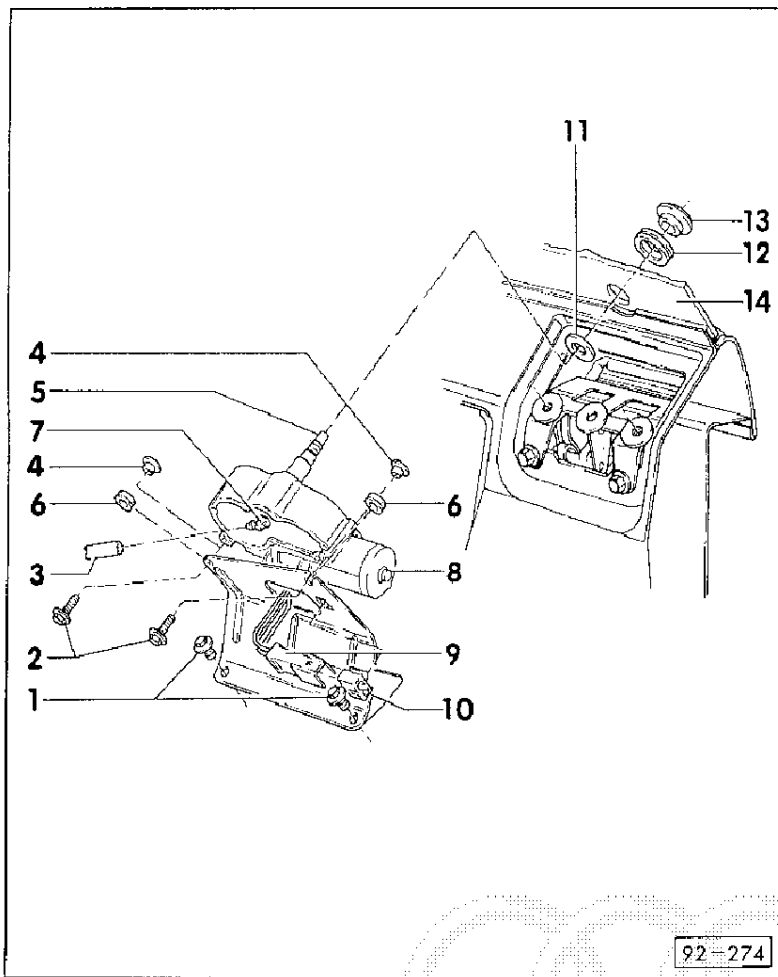
92-274

Removing, installing and adjusting jet for rear window washer system

Removal

Removing luggage compartment trim.

- => General Body Repairs, Interior; Repair Group 70; Trim Panels; Removing and installing boot trim (Avant) =>
- Remove cap for rear wiper arm => Page 92-19.
- Loosen clamps near connection pipe -Item 7-.
- Pull off water hose -Item 3-.



- Use universal pliers to carefully pull out connection pipe.
- Pull out jet -Item 5-

Installing

- First fit connection pipe and then jet.
- Counterhold at connection pipe when inserting jet. Connection pipe and jet must be firmly engaged.

Adjusting jet

- Use special tool VW 3125 to set spray to upper third of wiper area.

92-274

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Servicing headlights

Removing and installing headlights => Fig. 2, Page 94-6.

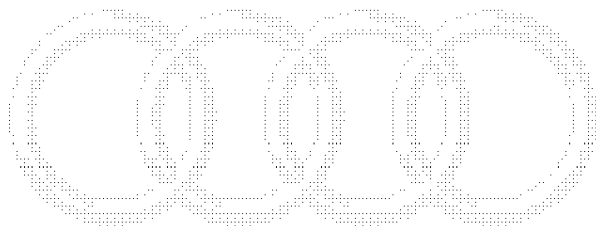
Removing and installing fog lamps => Fig. 3, Page 94-7 / Fig. 3, Page 94-15 (dual headlights).

Adjusting fog lamps => Fig. 3, Page 94-7 / Fig. 4, Page 94-15 (Dual headlights).

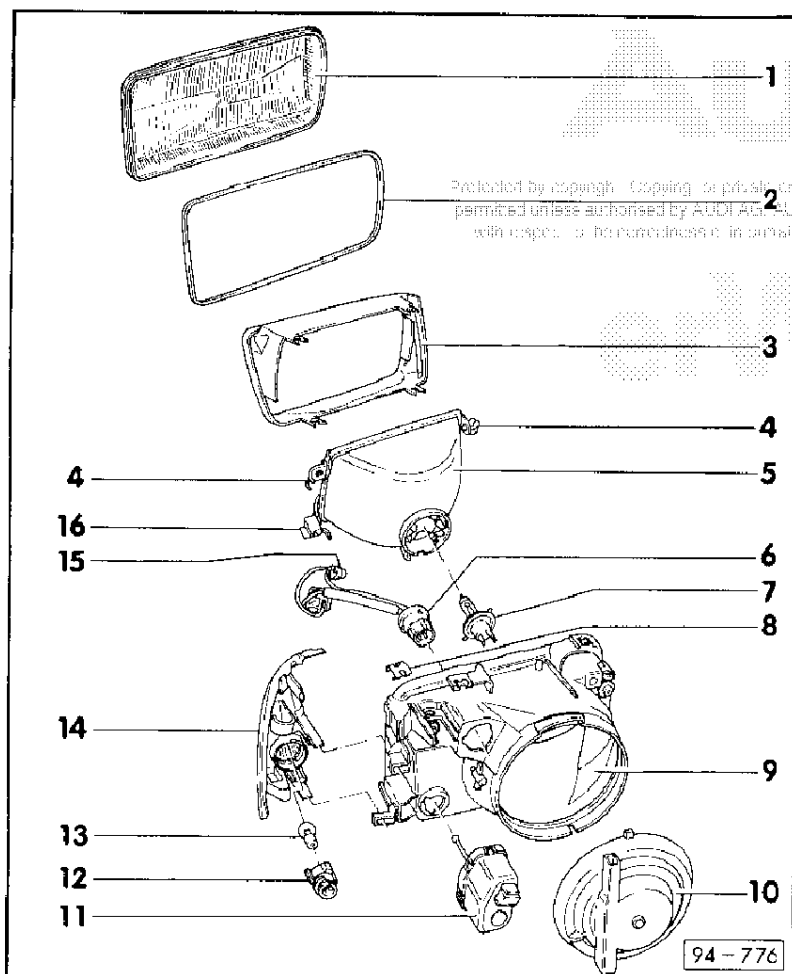
Adjusting jets for headlight washer system => Fig. 1, Page 92-13.

Notes:

- ◆ Always disconnect battery earth strap before working on electrical system.
- ◆ Re-adjust headlights after carrying out work which could affect their setting => Fig. 1, Page 94-5 and => "Maintenance"



94-1



Servicing headlights, 4- and 5-cylinder

1 - Lens

◆ Set aside carefully

2 - Seal

◆ Always renew

3 - Trim

◆ Unclip

4 - Locating piece

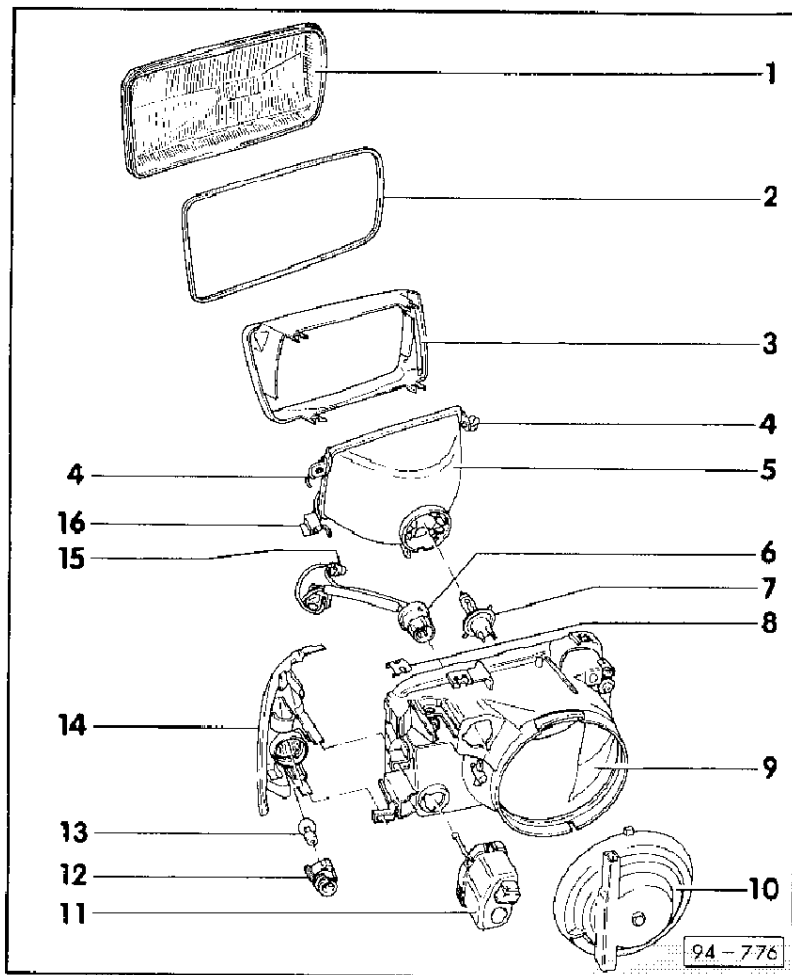
◆ Clipped into reflector (for headlight adjustment)

◆ Different versions on left and right

5 - Reflector

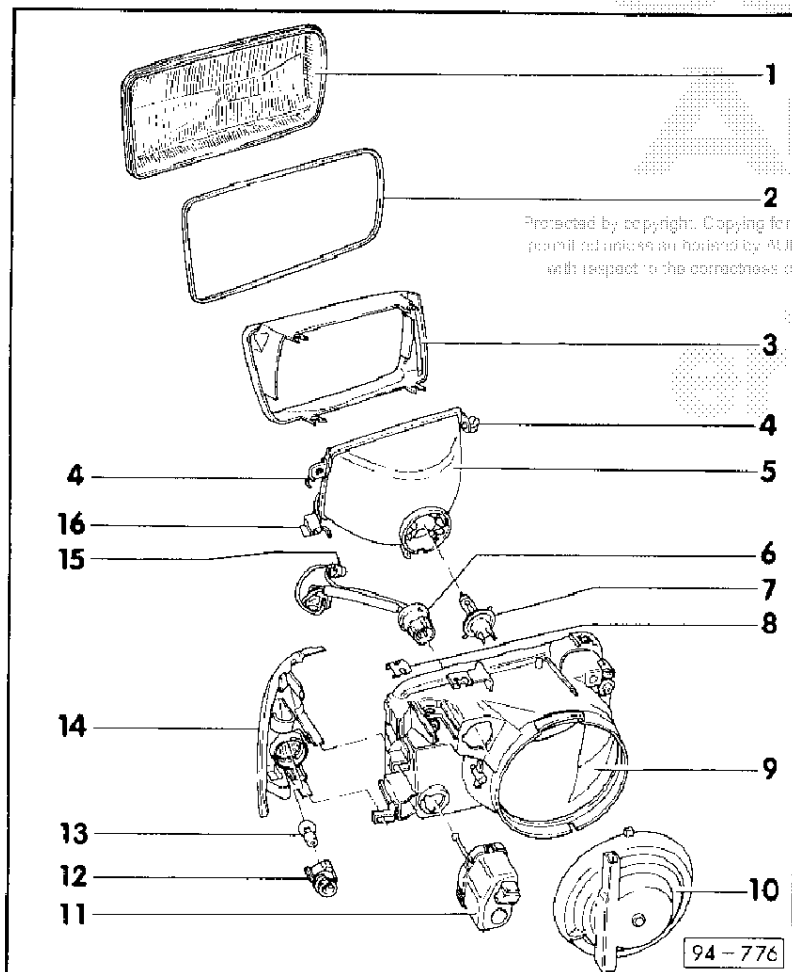
◆ Avoid touching reflective surface

94-2



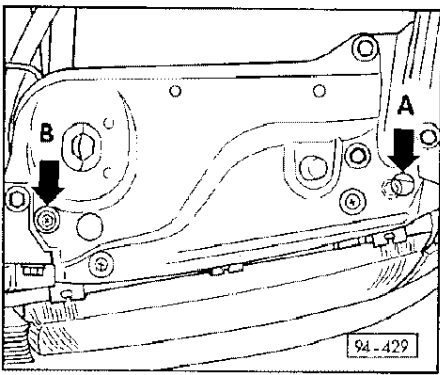
- 6 - Wiring loom
 - ◆ With plug housing and connector
- 7 - Dipped/main beam bulb
 - ◆ 12 V/60/55 W (H4)
- 8 - Retaining clip
 - ◆ 8x
 - ◆ Prise out carefully using screwdriver to remove
 - ◆ Press in by hand to install
- 9 - Headlight housing
- 10 - Cap
 - ◆ Marking: Note bayonet fitting

94-3



- 11 - Control motor for headlight range adjustment system
 - ◆ For vehicles with headlight range adjustment system
- 12 - Socket for turn signal indicator bulb
- 13 - Bulb for turn signal indicator
 - ◆ 12 V/21 W
- 14 - Turn-signal indicator
 - ◆ Removing and installing => Fig. 4
- 15 - Socket for side light bulb
- 16 - Locating piece
 - ◆ Clipped into reflector (for headlight range adjustment)

94-4



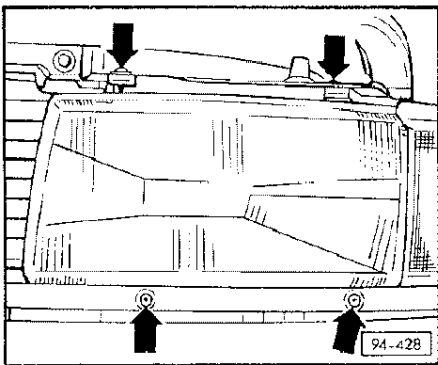
◀ **Fig.1 Adjusting headlight**

- Alter headlight setting by turning adjusting screws using recessed-head screwdriver or Allen key.
 - A - Height adjusting screw (towards outside of vehicle)
 - B - Lateral adjusting screw (towards inside of vehicle)

Note:

Make the adjustment using a headlight aiming device.

= > "Maintenance"



◀ **Fig.2 Removing and installing headlight**

Removal:

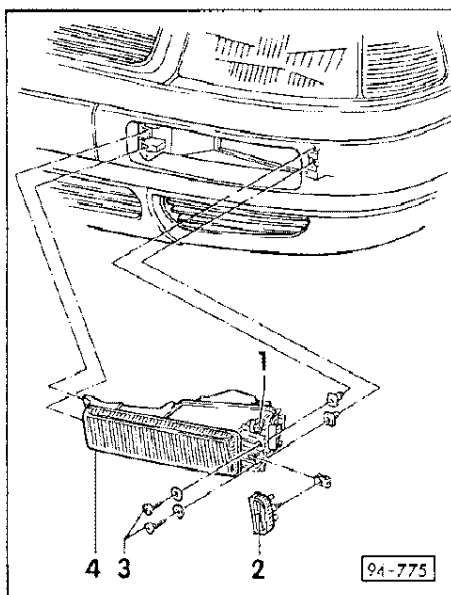
- Disengage cap at rear (bayonet socket) and set aside.
- Removing turn signal indicator => Fig. 4, Page 94-8.
- Remove plug.
- To avoid damage, mask bumper with tape beneath headlight.
- Unscrewing trim strip beneath headlight

= > General bodywork repairs; Repair group 50; Front bodywork; Removing and installing apron => 94-5. Copyright by AUDI AG.

- Remove headlight securing bolts - arrows -.
- Carefully remove headlight to front.

Installation:

- Insert headlight from front and align with bodywork contours; tighten the two upper securing bolts first.



◀ Fig.3 Removing, installing and adjusting fog lamp

Removal:

- Loosen screw -2- and remove trim.
- Loosen screws -3-, pull fog lamp -4- out of guide and remove to front.

Installation:

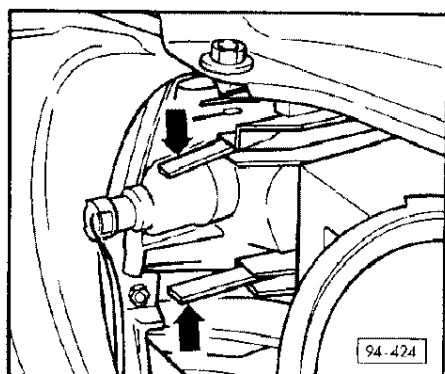
- Insert retaining lugs in guides and secure fog lamp using screws.
- Attach trim to fog lamp using screw.

Adjusting:

- Loosen screw -2- and remove trim.
- Use adjusting screw -1- to set fog lamp illumination direction to headlight adjusting device marking line.
- Attach trim to fog lamp using screw.

Note:

Fog lamps cannot be laterally adjusted.



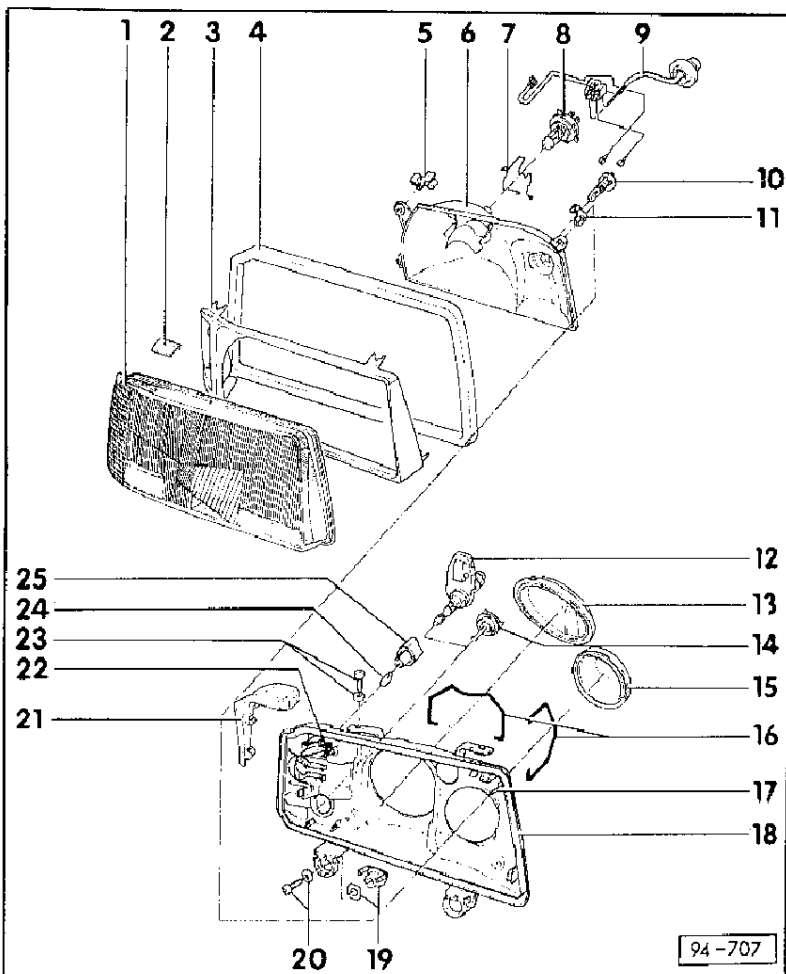
◀ Fig.4 Removing and installing turn-signal indicator

Note:

Turn-signal indicator can be taken out without removing headlight.

- Push in catches -arrows- and push out turn-signal indicator to front.
- Detach connector.
- Remove turn-signal indicator.

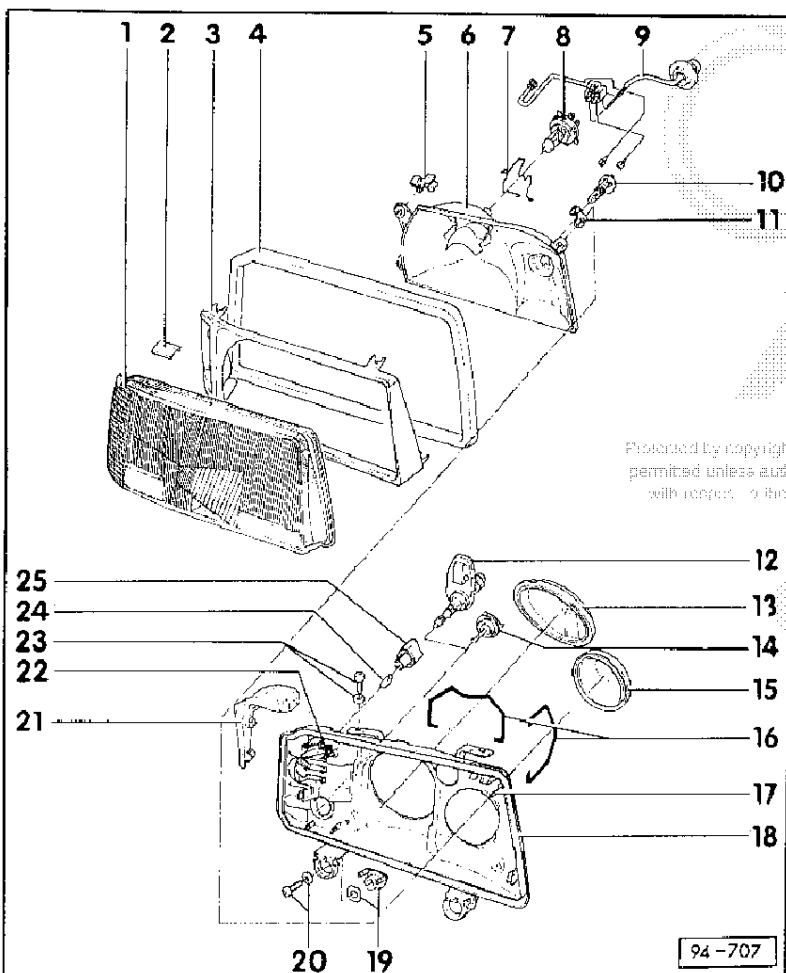
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Servicing dual headlights, 6-cylinder, S2

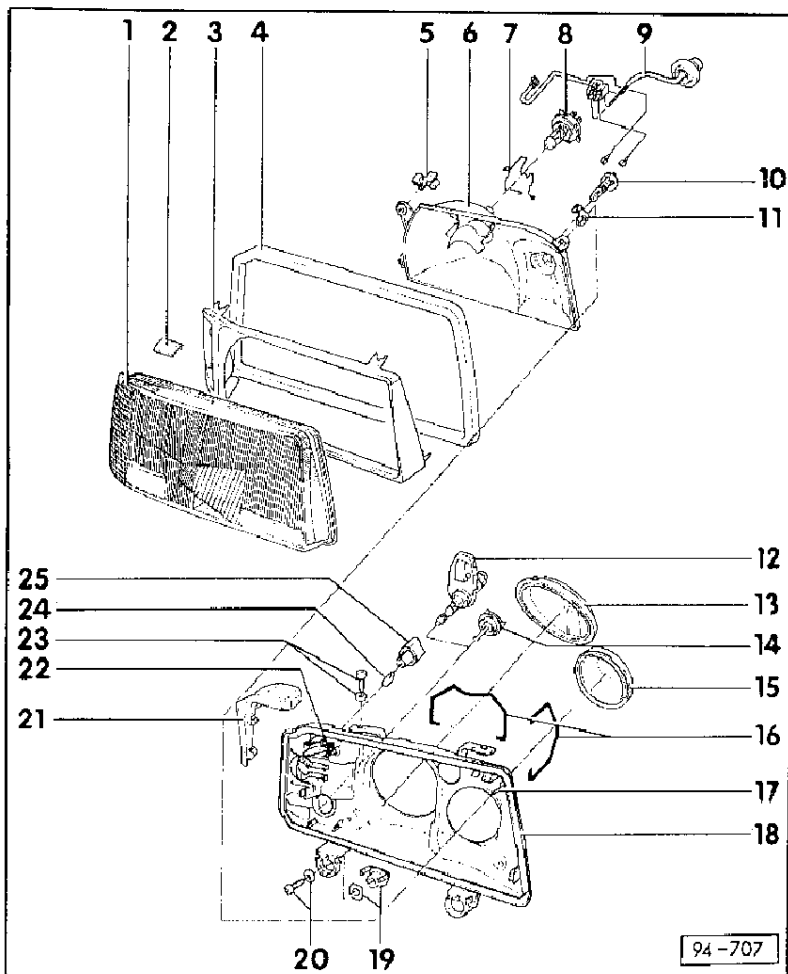
- 1 - Lens
 - ◆ Set aside carefully
- 2 - Retaining clip
 - ◆ 8x
 - ◆ Prise out carefully using screwdriver to remove
 - ◆ Press in by hand to install
- 3 - Trim
 - ◆ Unclip
- 4 - Seal
 - ◆ Always renew
- 5 - Locating piece
 - ◆ Clipped into reflector

94-9



- 6 - Reflector
 - ◆ Avoid touching reflective surface
- 7 - Retaining clip for bulb (H4)
 - ◆ Push off by hand
- 8 - Dipped/main beam bulb
 - ◆ 12 V/60/55 W (H4)
- 9 - Wiring loom
 - ◆ With plug housing and connector
- 10 - Bulb for main beam
 - ◆ 12 V/55 W (H1)
- 11 - Locating piece
 - ◆ Clipped into reflector

94-10



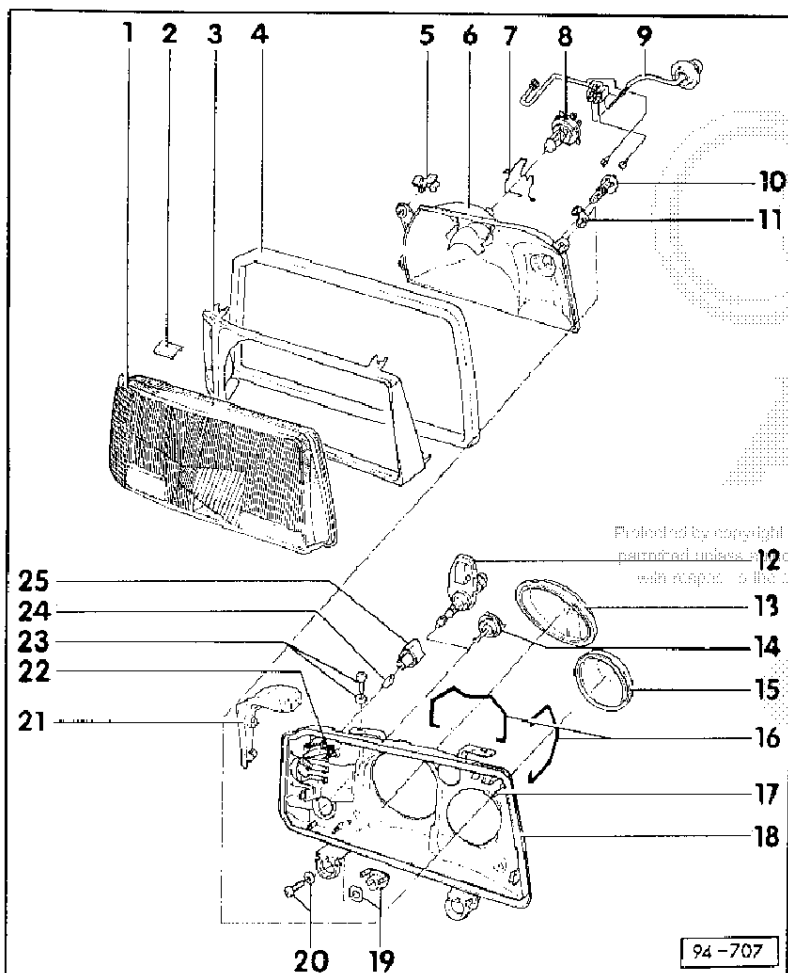
12 - Control motor for headlight range adjustment system
 ♦ For vehicles with headlight range adjustment system

13 - Cap (large)

14 - Locating piece for reflector
 ♦ Only for vehicles without headlight range adjustment system
 ♦ Right: release anti-clockwise
 ♦ Left: release clockwise

15 - Cap (small)

16 - Wire clip
 ♦ Prise off or push off by hand



17 - Lateral adjustment screw
 ♦ Flexibly mounted in housing
 ♦ Adjusting headlight => Fig. 1, Page 94-5.

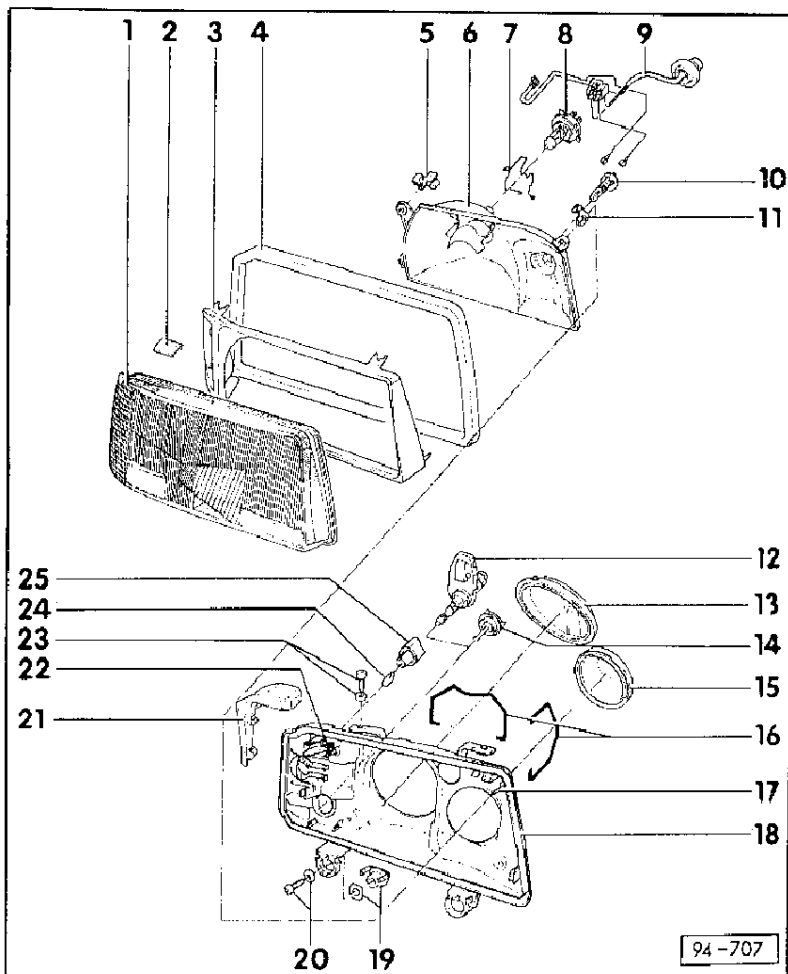
18 - Headlight housing
 ♦ Removing and installing headlight => Fig. 1.

19 - Fastener
 ♦ Clipped into headlight housing

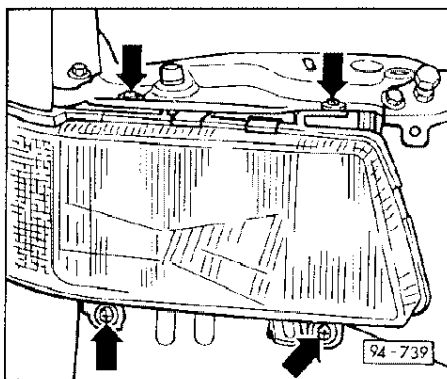
20 - Fastening screw
 ♦ With washer

21 - Rest
 ♦ Bonded to housing
 ♦ Must make flush contact

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- 22 - Height adjustment screw
 - ◆ Flexibly mounted in housing
 - ◆ Adjusting headlight => Fig. 1, Page 94-5.
- 23 - Fastening screw
 - ◆ With washer
- 24 - Side light bulb
 - ◆ 12 V/ 5 W (capless lamp)
- 25 - Socket for side light bulb



◀ **Fig.1 Removing and installing headlight**

Removal:

- Remove plug.
- To avoid damage, mask bumper with tape beneath headlight.
- Unscrewing trim strip beneath headlight
=> General bodywork repairs; Repair group 50; Front bodywork; Removing and installing apron =>
- Remove headlight securing bolts - arrows -.
- Carefully remove headlight to front.

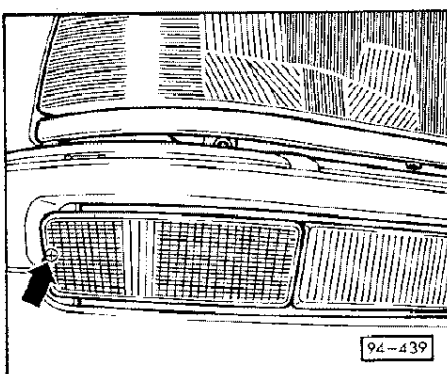
Installation:

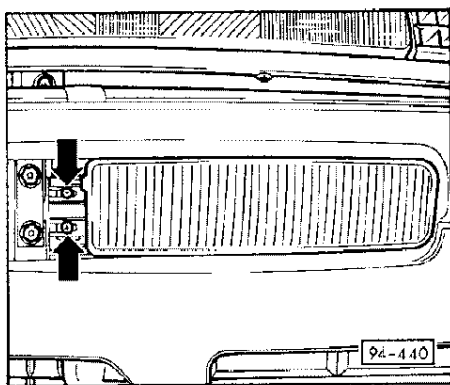
- Insert headlight from front and align with bodywork contours; tighten the two upper securing bolts first.

◀ **Fig.2 Removing and installing turn-signal indicator**

- Loosen screw -arrow- and remove turn-signal to front.

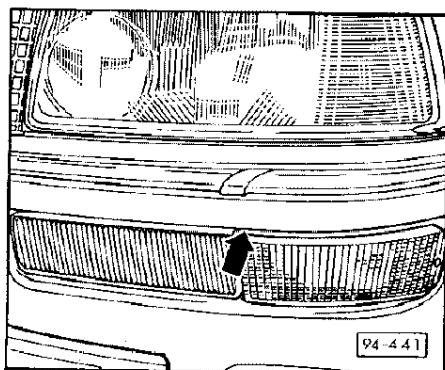
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◀ Fig.3 Removing and installing fog lamp

- Removing turn signal indicator => Fig. 2
- Loosen both screws -arrow- and remove fog lamp to front.

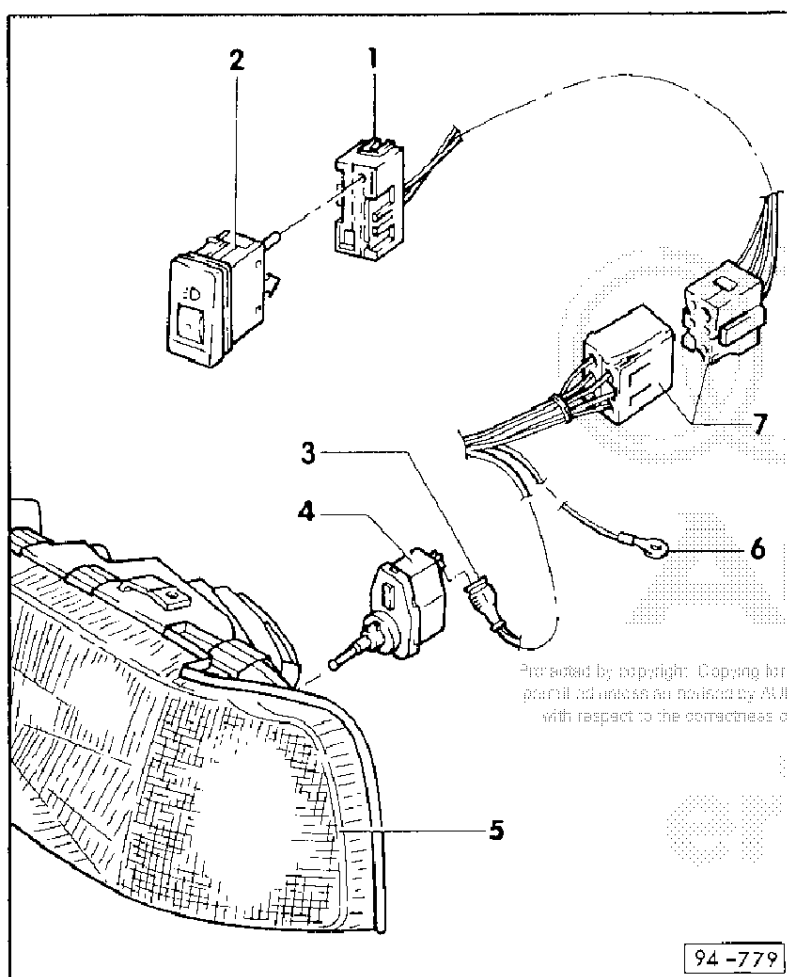


◀ Fig.4 Adjusting fog lamp

- Use adjusting screw -arrow- to set fog lamp illumination direction to headlight adjusting device marking line.

Notes:

- ◆ Adjustment can be made without removing turn signal indicator.
- ◆ Fog lamps cannot be laterally adjusted.



Servicing electrical headlight range adjustment

Note:

Troubleshooting/servicing
=> "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

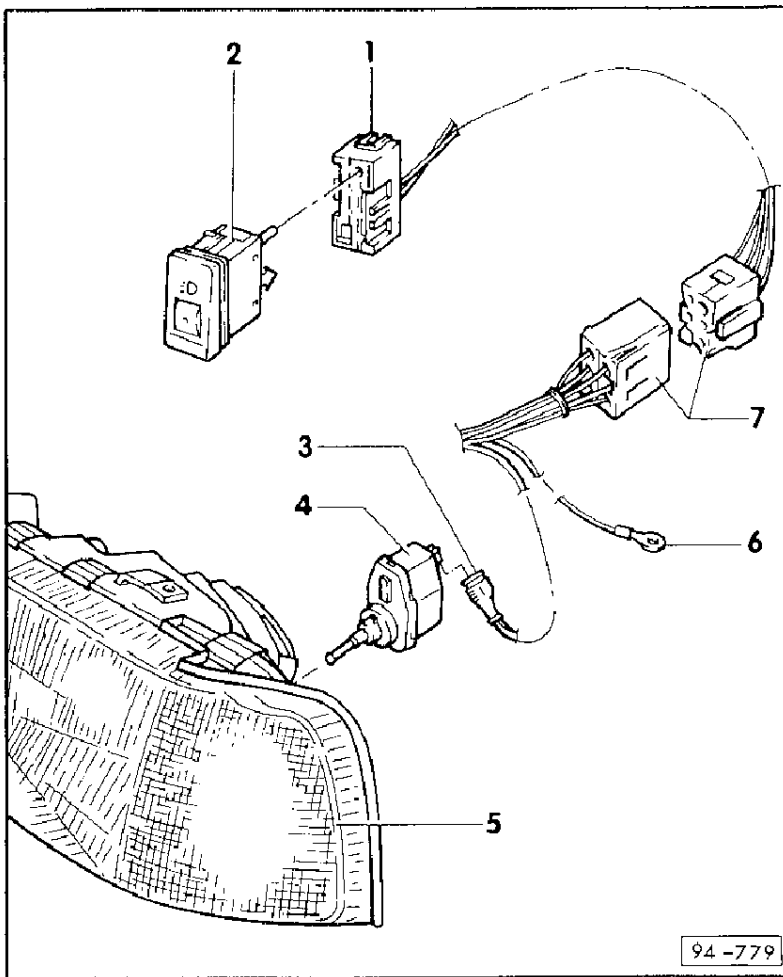
1 - Connector

- ◆ For headlight range control adjuster
- ◆ At instrument panel wiring loom

2 - Headlight range control adjuster (potentiometer) -E102

- ◆ Installed in centre console
- ◆ Carefully prise off using screwdriver

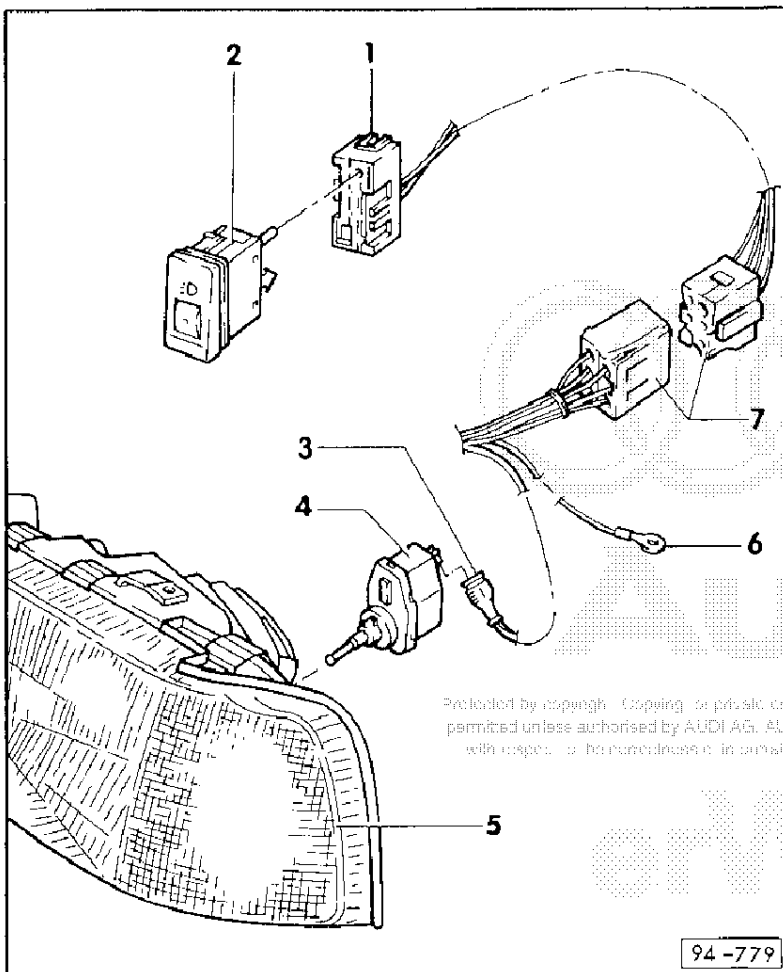
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3 - Connector for control motor
 ◆ Cavity assignment
 => "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

4 - Control motor -V48, -V49
 ◆ Removing and installing => Page 94-19
 ◆ Removing and installing dual headlights => Page 94-21

5 - Headlight housing
 ◆ Remove to take out control motor
 ◆ Removing and installing => Fig. 2, Page 94-6



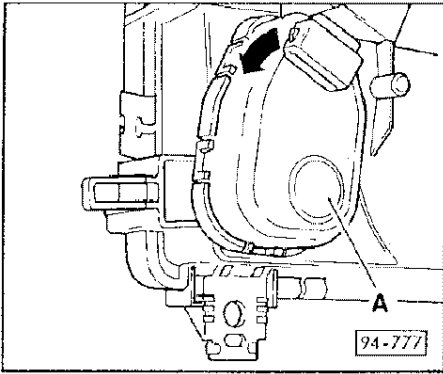
◆ Removing and installing dual headlights => Fig. 1, Page 94-14
 ◆ Adjusting headlight => Fig. 1, Page 94-5.

6 - Earthing point

7 - Connector
 ◆ Instrument panel/headlight range adjustment wiring loom

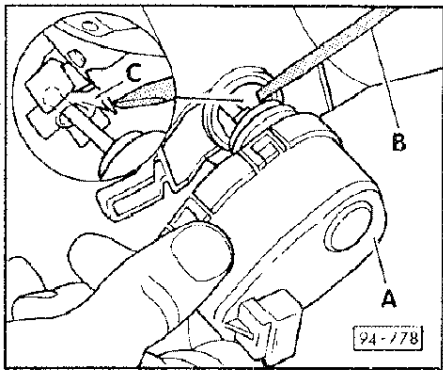
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Removing and installing control motor



Removal:

- Removing headlight => Fig. 2, Page 94-6.
- Release control motor -A- from support frame:
 - Turn control motor anticlockwise for left headlight.
 - Turn control motor clockwise for right headlight



- Lift up control motor -A- and insert narrow screwdriver -B- through rear headlight opening.
- Press back catch -C- and simultaneously pull out control motor to rear.

94-19

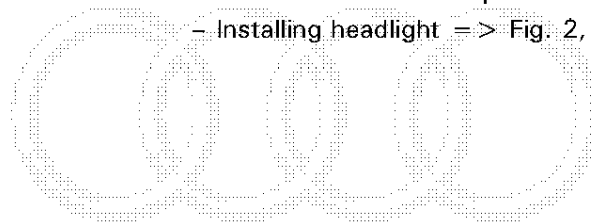
Installation:

- Release cap for two-filament lamp and remove.
- Push reflector upwards over twin filament lamp lead-in, insert operating arm with ball-head into reflector ball head mount and push in.

Note:

Avoid contact with inside of reflector.

- Lock control motor in position.
- Installing headlight => Fig. 2, Page 94-6.



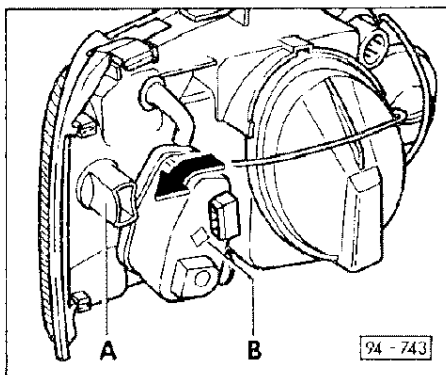
Audi

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erwin

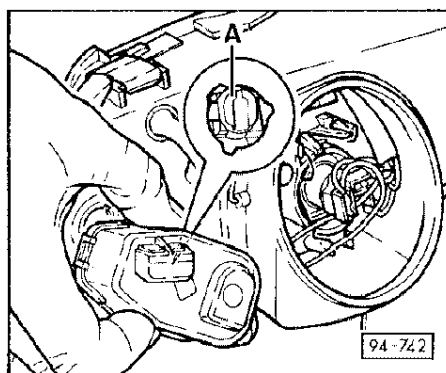
94-20

Removing and installing dual headlight control motor



Removal:

- Removing headlight => Fig. 1, Page 94-14.
- Remove side light socket -A-.
- Release control motor -B- from support frame:
 - Turn control motor anticlockwise for left headlight.
 - Turn control motor clockwise for right headlight



- Lift up control motor and push operating arm upwards out of ball-head mount-A- by tilting control motor.
- Pull out control motor to rear.

94-21

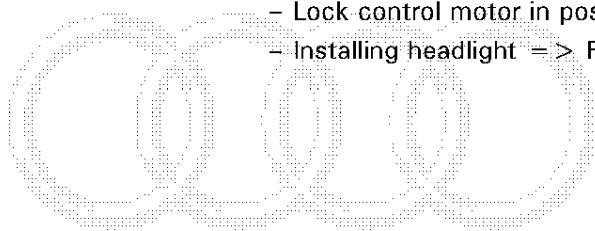
Installation:

- Release cap for two-filament lamp and remove.
- Push reflector upwards over twin filament lamp lead-in, insert operating arm with ball-head into reflector ball head mount and push in.

Note:

Avoid contact with inside of reflector.

- Lock control motor in position.
- Installing headlight => Fig. 1, Page 94-14.



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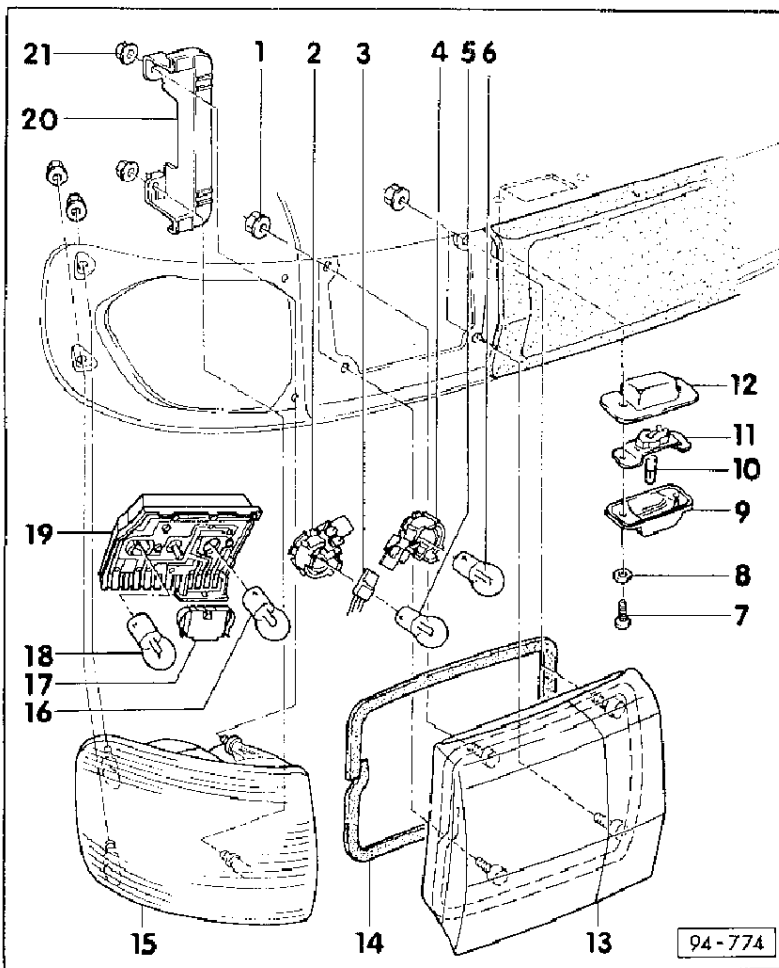
er/An

94-22

Servicing tail light

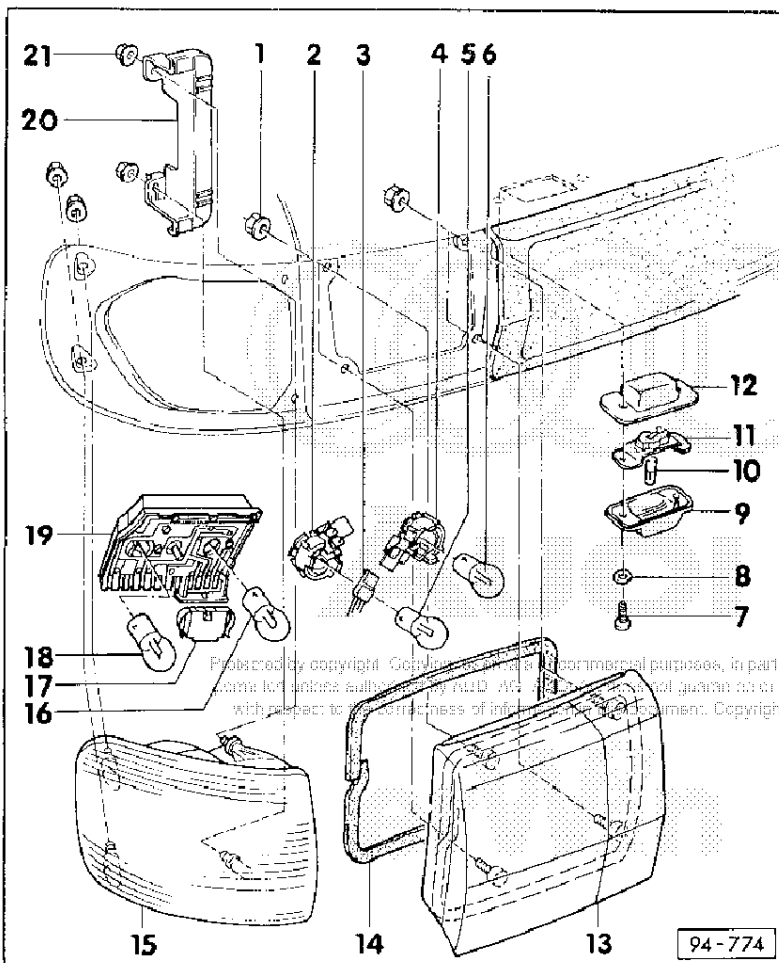
Note:

If a fog lamp is retrofitted, the relevant bulb holder and associated clear cover must also be retrofitted. Do not retrofit the fog lamp in the old clear cover.



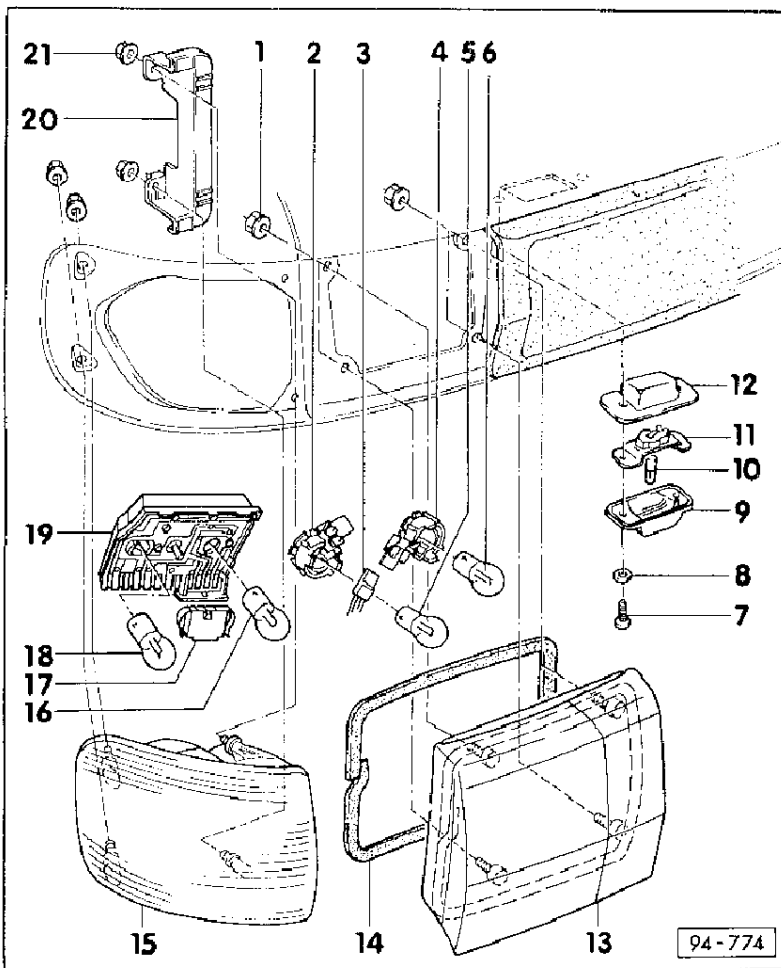
- 1 - Combination nut M5, 4 Nm
- 2 - Bulb holder for rear fog lamp
◆ Removing and installing => Fig. 2
- 3 - Connector with wiring loom
- 4 - Bulb holder for reversing light
◆ Removing and installing => Fig. 2

94-23

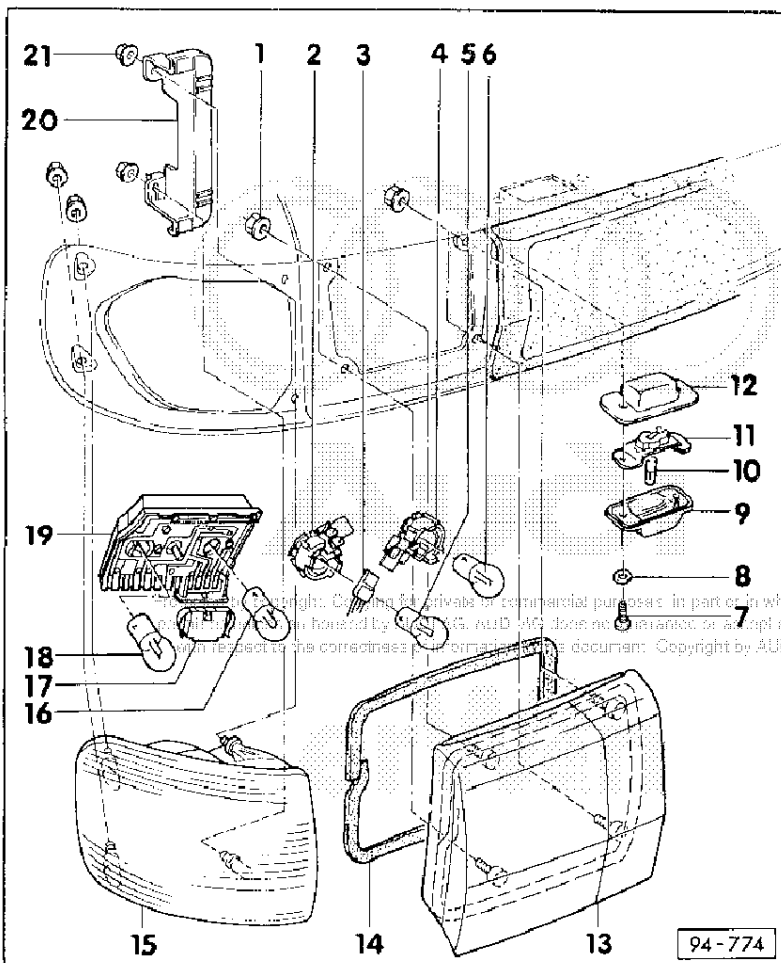


- 5 - Bulb for rear fog lamp
◆ 12 V/21 W
- 6 - Bulb for reversing light
◆ 12 V/21 W
- 7 - Self-tapping screw
- 8 - Seal
- 9 - Clear cover for number plate light
- 10 - Bulb for number plate light
◆ 12 V/4 W
- 11 - Bulb holder for number plate light

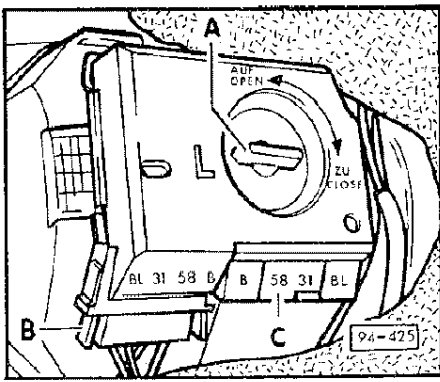
94-24



- 12 – Rubber seal
- 13 – Clear cover for reversing light and rear fog lamp
- 14 – Gasket
 - ◆ Always renew
- 15 – Clear cover for brake light, reversing light and turn-signal indicator
- 16 – Bulb for brake light and reversing light
 - ◆ 12 V/21/5 W
- 17 – Connector with wiring loom
- 18 – Bulb for turn signal indicator
 - ◆ 12 V/21 W



- 19 – Bulb holder for brake light, reversing light and turn-signal indicator
 - ◆ Removing and installing => Fig. 1
- 20 – Bracket for tail light
- 21 – Combination nut M5, 4 Nm

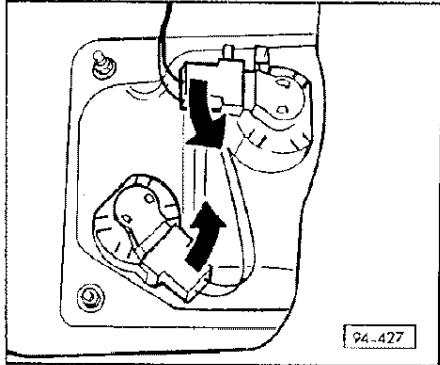


◀ Fig.1 Removing and installing bulb holder for brake light, reversing light and turn-signal indicator

- Turn catch -A- in direction of arrow.
- Pull off connector -B- and remove bulb holder.

Note:

Use connections -C- when retrofitting towing hitch.



◀ Fig.2 Removing and installing bulb holder for reversing light and rear fog lamp

- Turn bulb holder in direction of arrow and pull out.

Removing and installing steering column switch

Removal

Note:

Establish radio security code before disconnecting battery.

Vehicles without airbag:

- Detach battery earthing strap.
- Pull off steering wheel cover by hand:
 - Pull firmly on top half of cover to carefully detach it from mounting points; then remove bottom half using same procedure.
 - Push cover to one side and remove.
- Detach connector.

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Vehicles with airbag:

Pay attention to safety instructions

General airbag safety instructions:

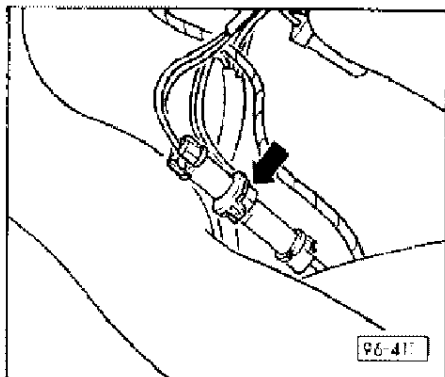
= > Chassis assembly work; Repair group 69; General safety instructions = >

● 1. Operation: Disconnect voltage supply

- Vehicles > 06.95: Detach battery earthing strap.

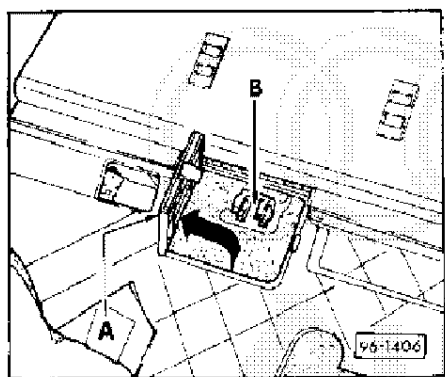
- Vehicles > 09.92: Remove compartment on driver's side.

= > General body repairs; Repair group 70; Dash panel, Removing driver's storage compartment = >



- ◀ - Detach 1-pin connector (red) for airbag power supply behind driver's side tray.

94-29



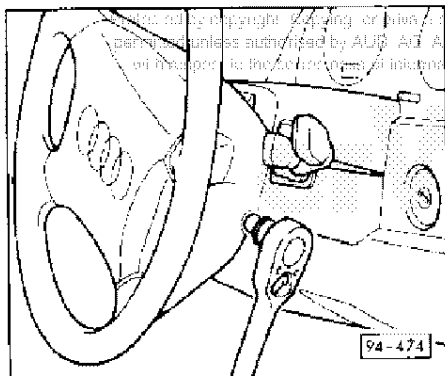
- ◀ - Vehicles 10.92 > 06.95: Open cover in driver's side tray - arrow A-.
- Remove 1-pin connector (red) for power supply from holder -B- and detach connector

Note:

The 1-pin connector for the airbag power supply was discontinued as of model year 1996.

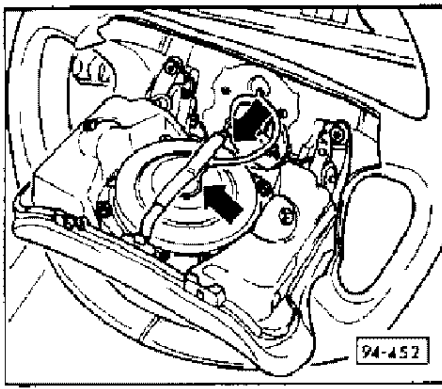
- Vehicles 07.95 > : Disconnect battery and cover negative terminal.

● 2. Operation: Remove airbag



- ◀ - Unscrew airbag unit on left and right of steering wheel from back of steering wheel using TORX insert T30.
- Carefully fold back airbag unit.

94-30



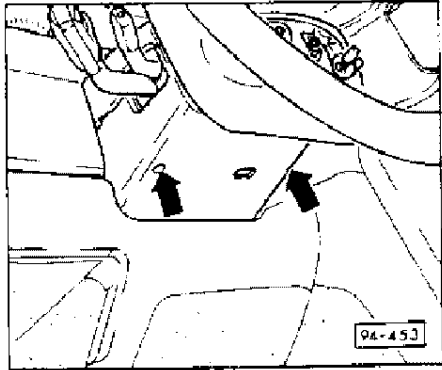
- ◀ – Detach airbag unit plug securing clip-top arrow- .
- Disconnect plug from airbag unit -bottom arrow- and remove airbag unit.

Note:

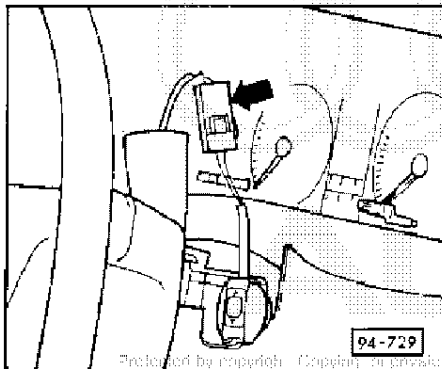
Set down airbag unit with impact cushion facing upwards.

- Move wheels to straightahead position to avoid damaging volute spring in steering wheel.

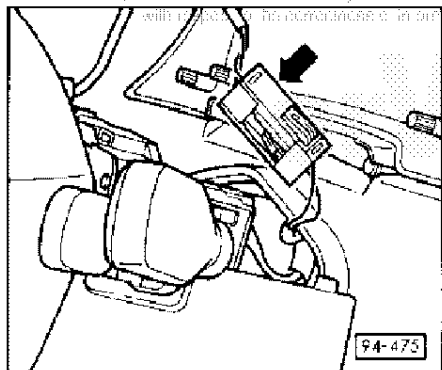
● 3. Operation: Detaching connector for volute spring



- ◀ – Remove the two screws -arrows- in the steering column switch upper trim.



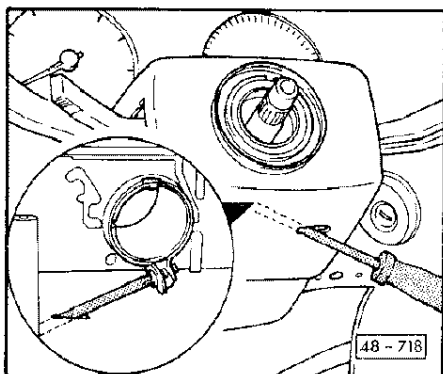
- ◀ – Vehicles > 06.93: Detach connector -arrow-.



- Vehicles 07.93 >: Pull airbag unit lead connector out of lower trim, gently pushing in lug in centre of lower connector section using a screwdriver and removing.
- ◀ – Detach connector -arrow-.

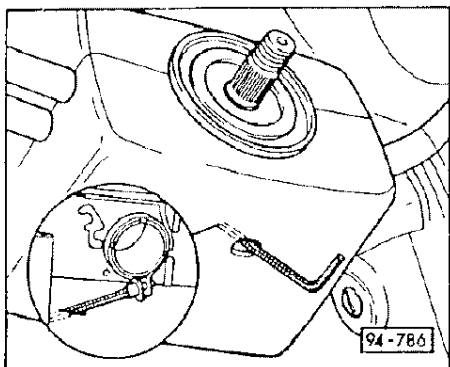
All vehicles:

Notes:



- ◆ Ensure that wheels are in a straightahead position before removing steering wheel.
- ◆ Prior to removal, it may be advisable to put a mark on the steering wheel and steering column using a felt-tipped pen so that the correct steering wheel position can be quickly and easily found during installation.
- Loosen securing nut on steering column and remove steering wheel (40 Nm).
- Loosen recessed-head screw for steering column switch clamp on underside.

Notes:



- ◆ The steering column switch clamp fastening screw has been changed from a recessed-head screw to a hexagon socket-head bolt (gradual introduction).
- ◆ Turn Allen key carefully to avoid scratching steering column switch trim.
- Loosen bolt for steering column switch clamp on underside using 4 mm Allen key (2.5 Nm).

- Remove all connector from steering column switch.
- Carefully remove steering column switch.

Installing

Note:

When mounting steering wheel, turn-signal stalk must be in zero position (driving straightahead) to avoid damaging the reset cam.

Vehicles with airbag:

On installation, first screw in airbag unit securing bolts by hand.

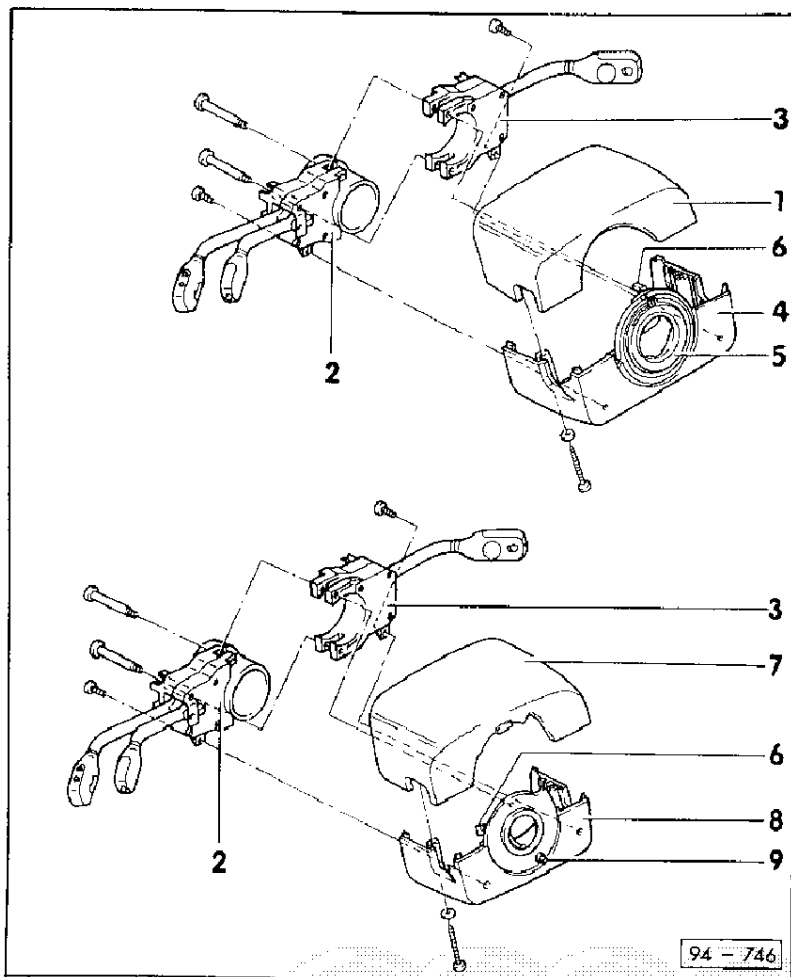
- Tighten right-hand bolt to 6 Nm, then tighten left-hand bolt to 6 Nm.

- Connect battery.

Warning

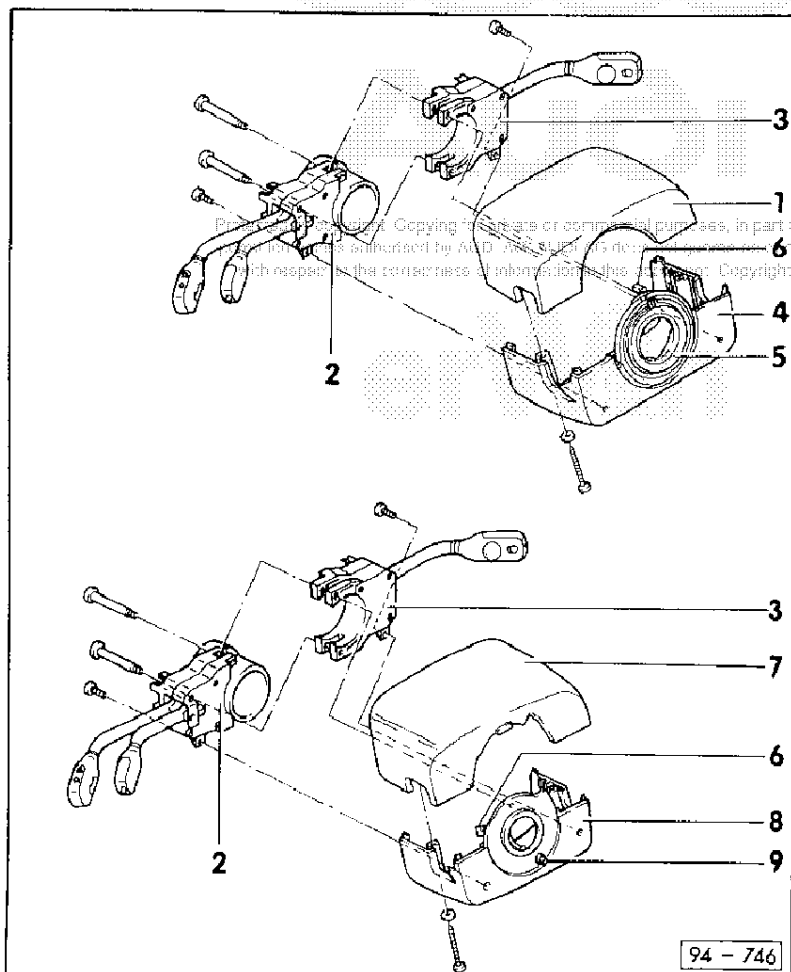
There must be no one in the vehicle when the battery is being connected.

Servicing steering column switch



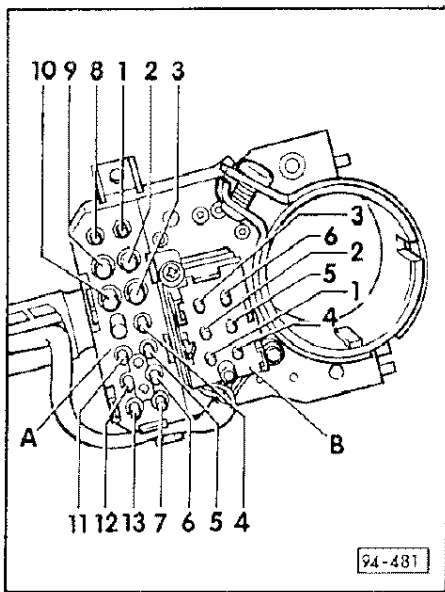
- 1 - Upper trim
 - ◆ For vehicles without airbag:
- 2 - Left switch
 - ◆ Light switch, turn-signal indicator switch, switch for manual dipping and headlight flasher, parking light and cruise control system
 - ◆ Connection assignment => Fig. 1, Fig. 2 and Fig. 3
- 3 - Right switch
 - ◆ Windscreen wiper switch, headlight washer system and on-board computer
 - ◆ Connection assignment => Fig. 4, Fig. 5 and Fig. 6

— 94-35 —



- 4 - Lower trim
 - ◆ For vehicles without airbag:
- 5 - Collector ring
 - ◆ Horn actuation
- 6 - Contact
 - ◆ For collector ring
 - ◆ Routing of wiring
 - => "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder
- 7 - Upper trim
 - ◆ For vehicles with airbag:
- 8 - Lower trim
 - ◆ For vehicles with airbag:
- 9 - Carbon brush
 - ◆ For vehicles with airbag:

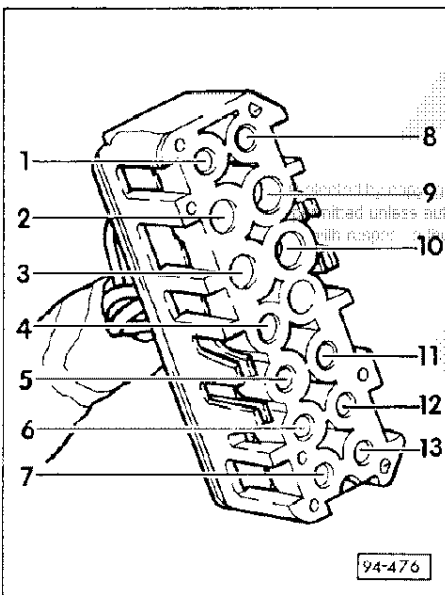
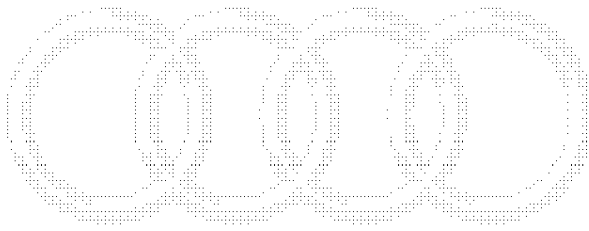
— 94-36 —



◀ Fig. 1 Connection assignment for light switch, turn-signal indicator switch, switch for manual dipping and headlamp flasher, parking light and cruise control system

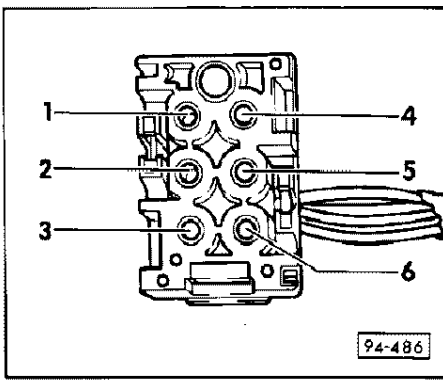
Notes:

- ◆ Assignment of 13-pin connector -A- => Fig. 2.
- ◆ Assignment of 6-pin connector -B- => Fig. 3.



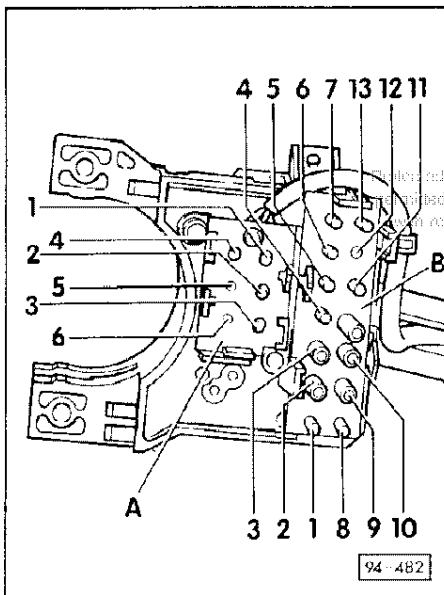
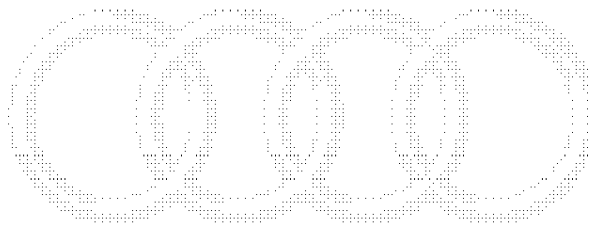
◀ Fig. 2 13-pin connector -A-

- 1 - Light switch, contact 1 (daytime/urban driving)
- 2 - Switch for manual dipping and headlight flasher, terminal 56a
- 3 - Light switch, terminal X
- 4 - Parking light switch, terminal PR
- 5 - Parking light switch, terminal PL
- 6 - Light switch and switch for manual dipping and headlamp flasher, terminal 30
- 7 - Switch for manual dipping and headlamp flasher, terminal 56b
- 8 - Switch for manual dipping and headlamp flasher, terminal 56
- 9 - Light switch, contact 9 (daytime/urban driving)
- 10 - Light switch, contact 10 (daytime/urban driving)
- 11 - Parking light switch, terminal P
- 12 - Light switch and switch for manual dipping and headlamp flasher, terminal 30
- 13 - Light switch, terminal 58



◀ Fig. 3 6-pin connector -B-, cruise control system

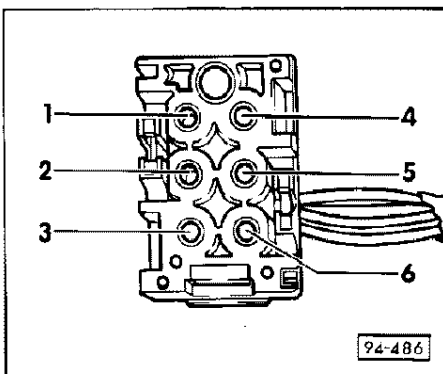
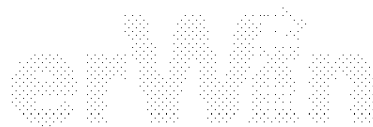
- 1 - Terminal 15
- 2 - On, activation and off (key-operated)
- 3 - Input from control unit, contact 3
- 4 - Switch-on and activation
- 5 - Activation
- 6 - Memory storage



◀ Fig.4 Connection assignment for windscreen wiper switch, headlight washer system and on-board computer

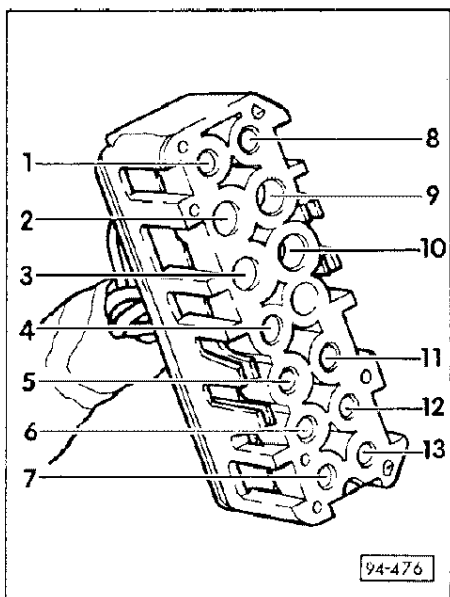
Notes:

- ◆ Assignment of 6-pin connector -A- => Fig. 5.
- ◆ Assignment of 13-pin connector -B- => Fig. 6.



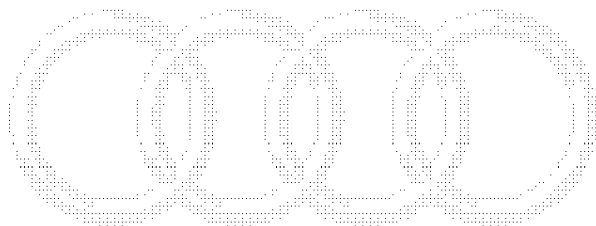
◀ Fig. 5 6-pin connector -A-

- 1 - On-board computer
- 2 - On-board computer reset
- 3 - On-board computer, right rocker
- 4 - On-board computer, left rocker
- 5 - Not used
- 9 - Not used



◀ Fig. 6 13-pin connector -B-

- 1 - Hazard warning switch, terminal L
- 2 - Windscreen wiper switch, terminal 53 a
- 3 - Windscreen wiper switch, terminal 53
- 4 - Windscreen wiper switch, terminal J
- 5 - Not used
- 6 - Windscreen wiper switch, terminal 53 c
- 7 - Hazard warning switch, terminal R
- 8 - Hazard warning switch, terminal 49 a
- 9 - Windscreen wiper switch, terminal 53 e
- 10 - Windscreen wiper switch, terminal 53 b
- 11 - Not used
- 12 - Not used
- 13 - Not used



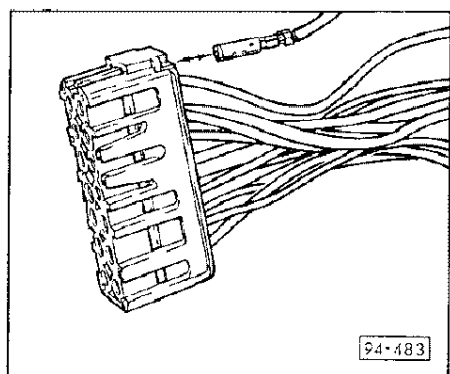
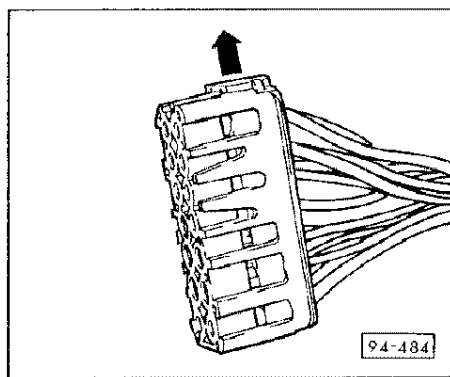
Replacing individual contacts in connectors

Notes:

- ◆ Never use extractor tool.
- ◆ Contact assignment => Page 94-37.
- ◆ Always use appropriate current flow diagram for troubleshooting.

=> "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

- Slide out plug catch by hand in direction of arrow as far as it will go.



- ◀ - Pull out and replace appropriate contact if necessary (damage, retrofitting or poor connection).
- To replace individual contacts, always use special tool 000 097 003 A or commercially available equivalent.
- Insert contact in appropriate cavity.
- Push home plug catch.

Removing and installing ignition switch

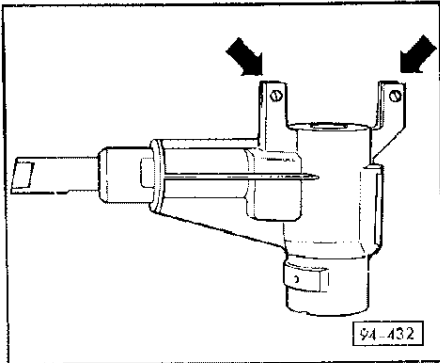
- Removing steering column switch => Page 94-28
- Removing dash insert => Page 90-8
- Connections at ignition/starter switch => Page 94-44.

Removal

Note:

For the sake of clarity, the illustration shows the steering column lock housing removed.

- Detach connector at ignition/starter switch.



- ◀ - Remove sealing compound from fastening screws -arrows-.
- Loosen screws.



94-43

- ◀ - Pull out ignition/starter switch in direction of arrow.

Installation:

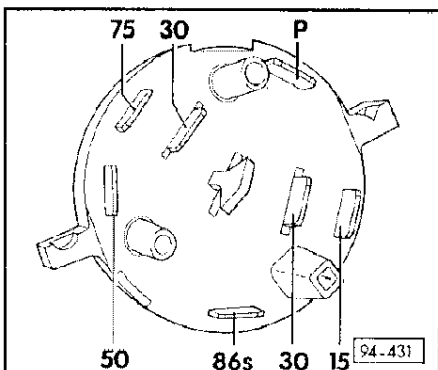
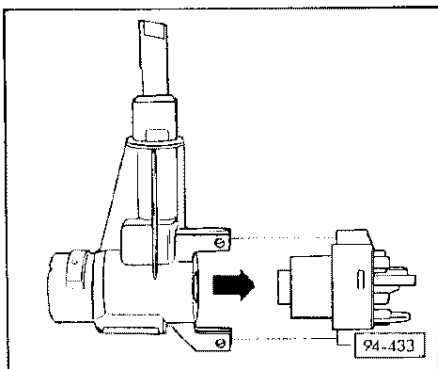
- Turn ignition key in ignition lock as far left as possible to "Ignition off" position.

- Push in ignition/starter switch as far as it will go.

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Tighten both fastening screws and seal with sealing compound.

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- ◀ Connections on ignition/starter switch

94-44

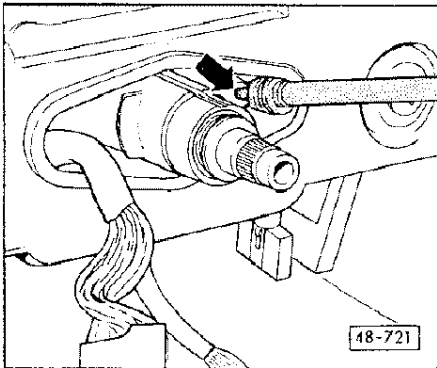
Removing and installing steering column lock switch with lock cylinder

Note:

If the lock cylinder has to be replaced in a vehicle fitted with an immobiliser, pay attention to reader coil replacement instructions => Page 96-55.

Removal

- Removing steering column switch =>Page 94-28
- Removing dash insert => Page 90-8
- Detach connector at ignition/starter switch.
- Pull off protective cap for steering column lock switch housing to front.

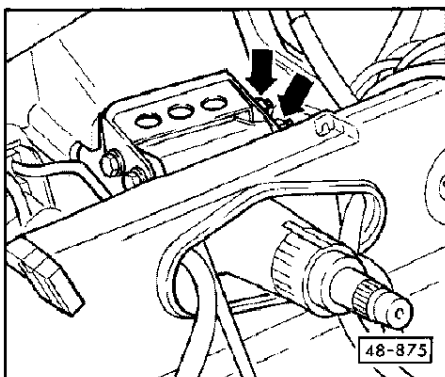


Vehicles with automatic gearbox:

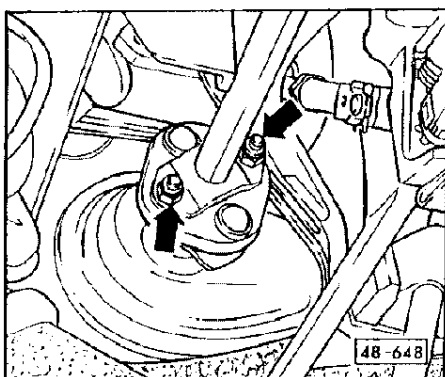
- Detaching cable for shift lock
=> Automatic Gearbox 01N; Repair Group 37; Servicing selector mechanism; Removing, installing and adjusting locking cable =>

All vehicles:

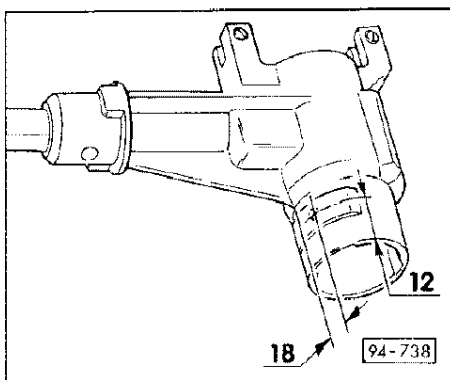
- Remove securing bolt -arrow- using TORX insert with end-face hole T 30 H.



- Loosen both nuts -arrows- at steering column mount and remove the through-bolts.
- Disconnect transponder coil wiring.



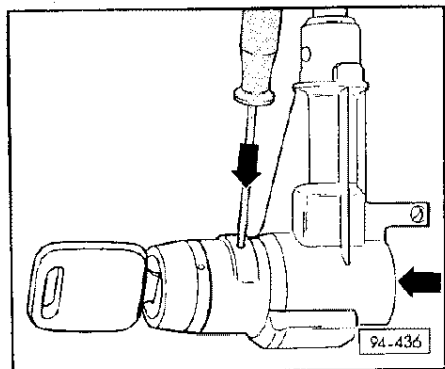
- Unscrew steering column from stop -arrows-.
- Use screwdriver to push steering column out of retainer stud bolts.
- Push down column tube until steering column lock housing can be removed.



- ◀ - Use 3 mm diameter drill to spot drill steering column lock housing as per the dimensions shown.

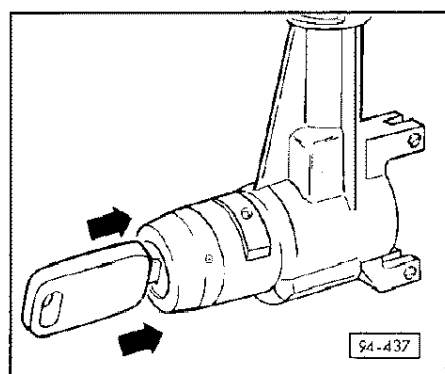
Warning

Proceed with caution when doing so in order to avoid damaging the lock cylinder. Drilling depth approx. 1.5 mm.



- ◀ - Insert ignition key into steering column lock.
- Remove ignition/starter switch => Page 94-43, so that it is possible to push on the pin end of the lock cylinder.
- Push out the lock cylinder -right arrow-; use makeshift mandrel to push rotating spring inwards -top arrow-.

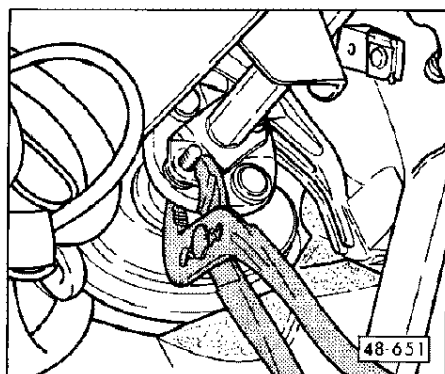
94-47



Installing

Note:

- ◀ *Renew all self locking nuts.*
- Set lock cylinder to "ignition off" position and insert in direction of arrow until retaining spring engages.
- Insert steering column lock housing at column tube; tighten TORX bolt to 7 Nm.
- Insert column tube into bracket.



- ◀ - Insert bolts in bracket and column tube; tighten new self-locking nuts to 35 Nm.
- ◀ - Release steering column lock so that steering column is free to turn.
- Press steering column onto disc coupling using multiple slip-joint pliers.
- Insert retainer into steering column; tighten new self-locking nuts to 25 Nm.
- Push protective cap for steering column lock onto column tube.
- Perform remaining installation operations in reverse order of removal.

94-48

Servicing switches in centre console

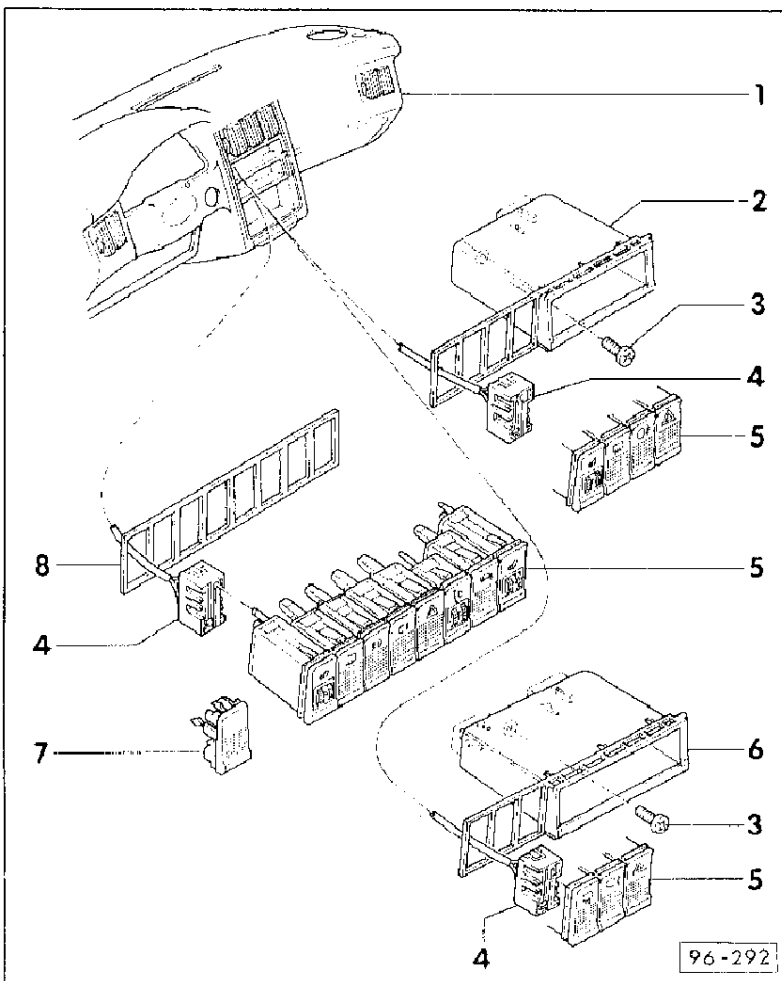
Notes:

- ◆ Plug connections that are not required can be clipped to the back of the tray.
- ◆ When retrofitting individual systems, replace switch holder -Item 6- with -Item 8-.
- ◆ Recesses that are not required must be sealed off using dummy covers -Item 7-.

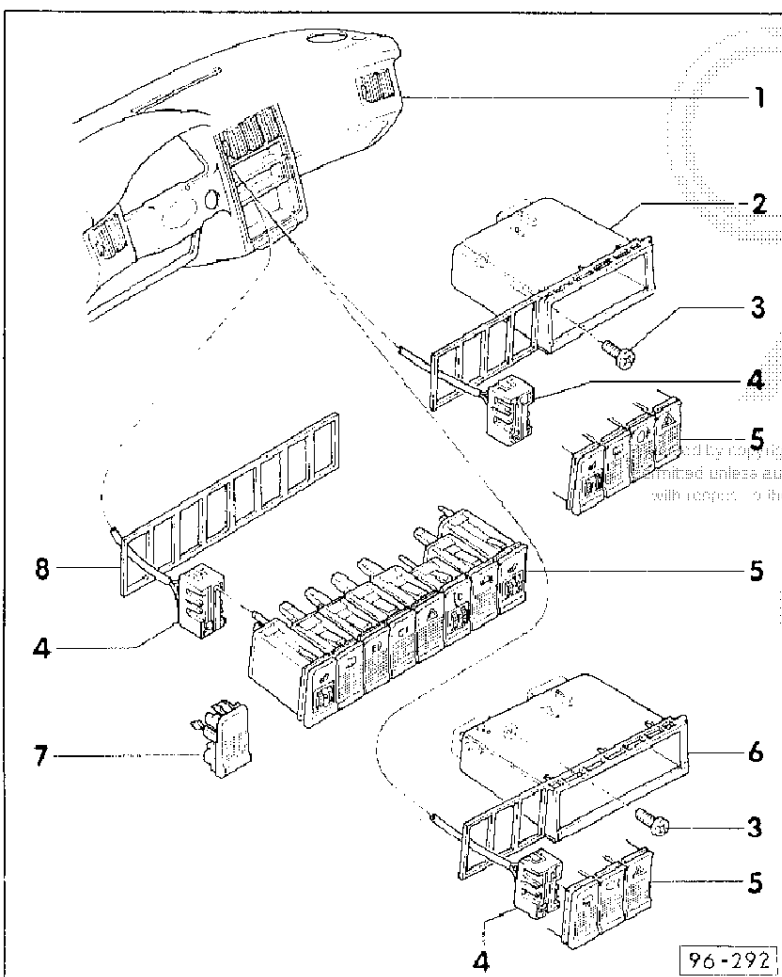
1 - Instrument panel

2 - Switch holder with small tray

- ◆ Remove all control switches to remove



96-1



3 - Fastening screw

4 - Connector with wiring loom

- ◆ Pull or prise off from switch
- ◆ Contact assignment

=> "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

5 - Pushbutton switch

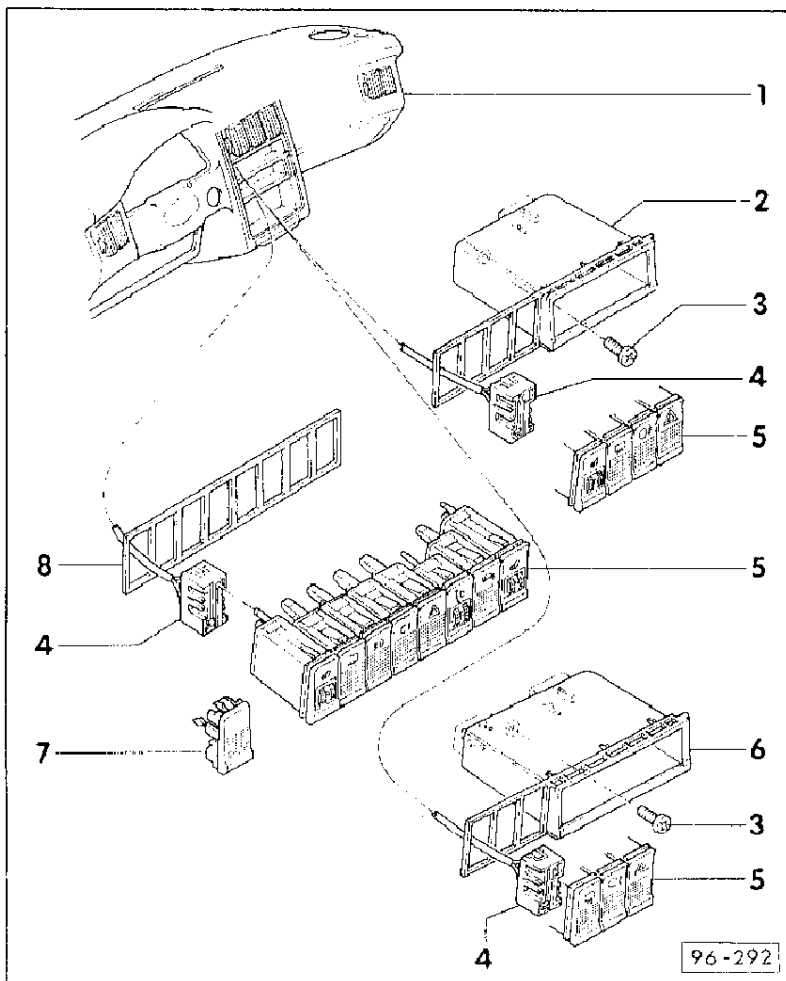
- ◆ Removing and installing => Page 96-4

- ◆ Replacing bulbs => Page 96-6

6 - Switch holder with large tray

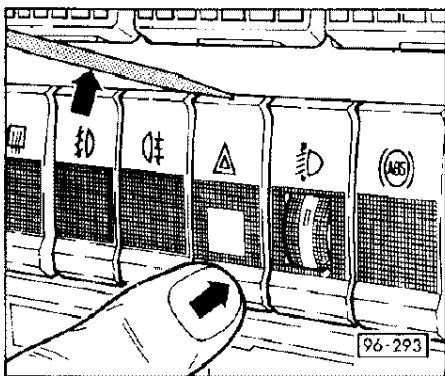
- ◆ Remove all pushbutton switches to remove

96-2



- 7 - Dummy cover
 - ◆ Used to seal off switch strip if not fully assigned
 - ◆ Prise off
- 8 - Switch holder with no tray
 - ◆ Remove all pushbutton switches to remove

Removing and installing pushbutton switches

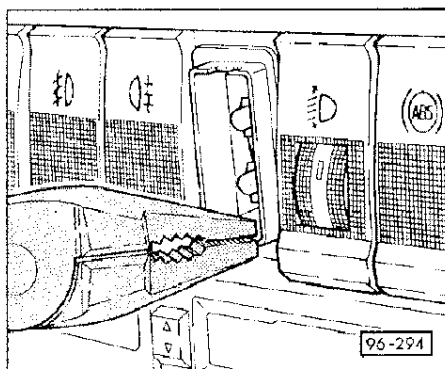


Note:

Radio does not have to be removed.

Removal:

- ◀ - Mask area above switches and front of radio using masking tape.
- Use small screwdriver to carefully prise off switch button from above whilst pressing against opposite side.



- ◀ - Pull switch forwards using universal or flat-nosed pliers.
 - **Prise or pull off connector.**
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Installation:

- Press button onto removed switch until it can be heard to engage.

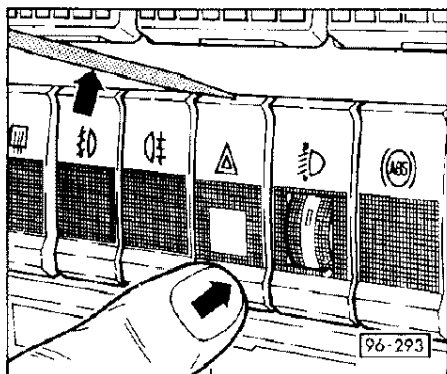
Note:

Considerable force is required to press the button onto the heated rear window switch, for example.

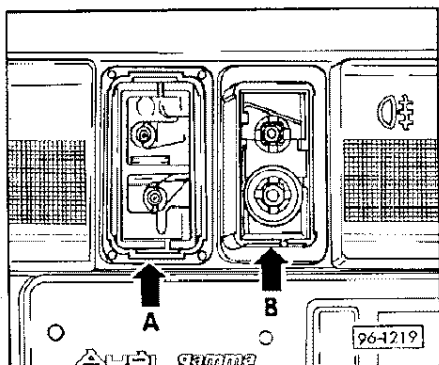
- Push on the connector and push switch back in again by hand.

96-5

Replacing bulbs in pushbutton switches



- Mask area above switches and front of radio using masking tape.
- Use small screwdriver to carefully prise off switch button from above whilst pressing against opposite side.

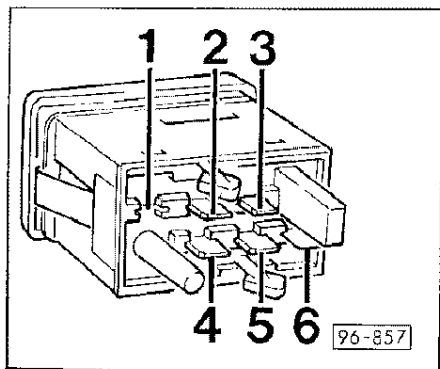


- A - Bulb replacement not possible
- B - Bulb replacement possible
- Extract bulb using pointed pliers or strong tweezers.
- Insert new bulb
- Use 2 W bulb for hazard warning switch.
- Use 0.8 W bulbs for all other switches.

96-6

Checking switch for electrically heated mirrors 07.92

>



- Remove switch.

Checking switching contact for mirror heating

- Actuate switch.

- Measure from pin 5 to pin 3 using hand-held multimeter V.A.G 1526.

- Specified value: approx. 0.5 Ω

- Integrated fuse or switching contact is defective if specified value not attained.

- Replace switch

Checking switching contact for rear window heating

- Actuate switch.

- Measure from pin 5 to pin 6 using hand-held multimeter V.A.G 1526.

- Specified value: approx. 0.5 Ω

- Switch is defective if specified value not attained.

- Replace switch

96-7

Vehicles with air conditioner:

Note:

In vehicles with AC, the rear window heating and the mirror heating are actuated electronically. These electronics are activated by pushbutton and heat the rear window and the mirrors for 10 minutes via pin 6 and pin 3 respectively.

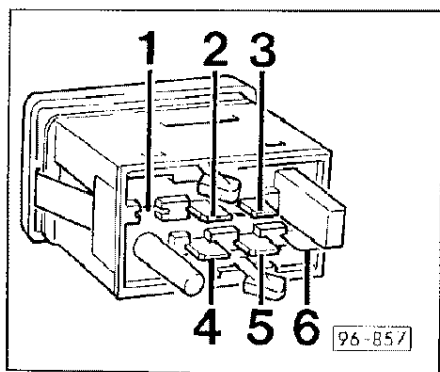
- Actuate switch.

- Measure from pin 6 to pin 3 using hand-held multimeter V.A.G 1526.

- Specified value: approx. 0.5 Ω

- Integrated fuse is defective if specified value not attained.

- Replace switch



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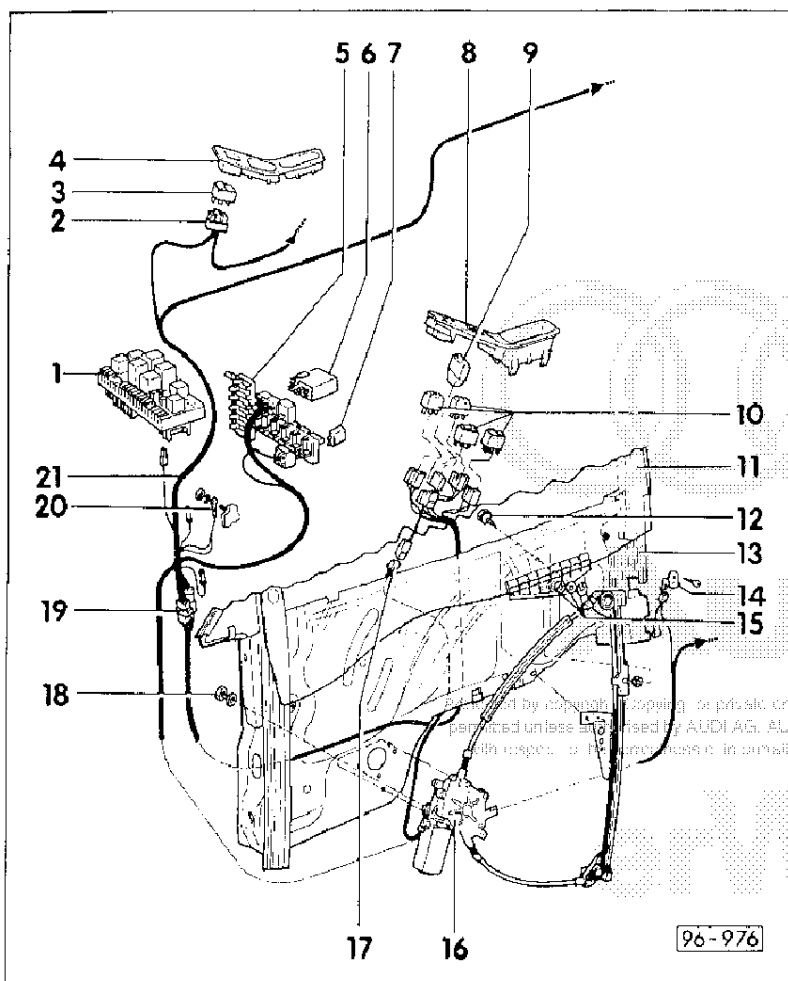
96-8

Electric window lifters

General notes:

- ◆ Consult appropriate current flow diagram and troubleshooting instructions during troubleshooting.
=> "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder
- ◆ Before removing the electric window lifter, always determine exactly whether the fault/damage is in the wiring, mechanical components or motor/gear unit.
- ◆ Removing and installing window lifter from/to door component carrier
=> General Body Repairs; Repair group 57; Front door; Removing window lifter and window from and installation on door component carrier =>
=> General Body Repairs; Repair group 58; Rear door; Removing window lifter and window from and installation on door component carrier =>
- ◆ Adjust top end stop after installing window lifter (mechanism) or entire door component carrier

96-9



Front electric window lifter – exploded view

1 – Relay plate with fuse box

- ◆ Relay position assignment
=> "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

2 – Connector for front right switch unit

- ◆ Removing and installing => Fig. 2

3 – Window lifter switch -E107

- ◆ Removing and installing => Fig. 3
- ◆ Checking => Fig. 4

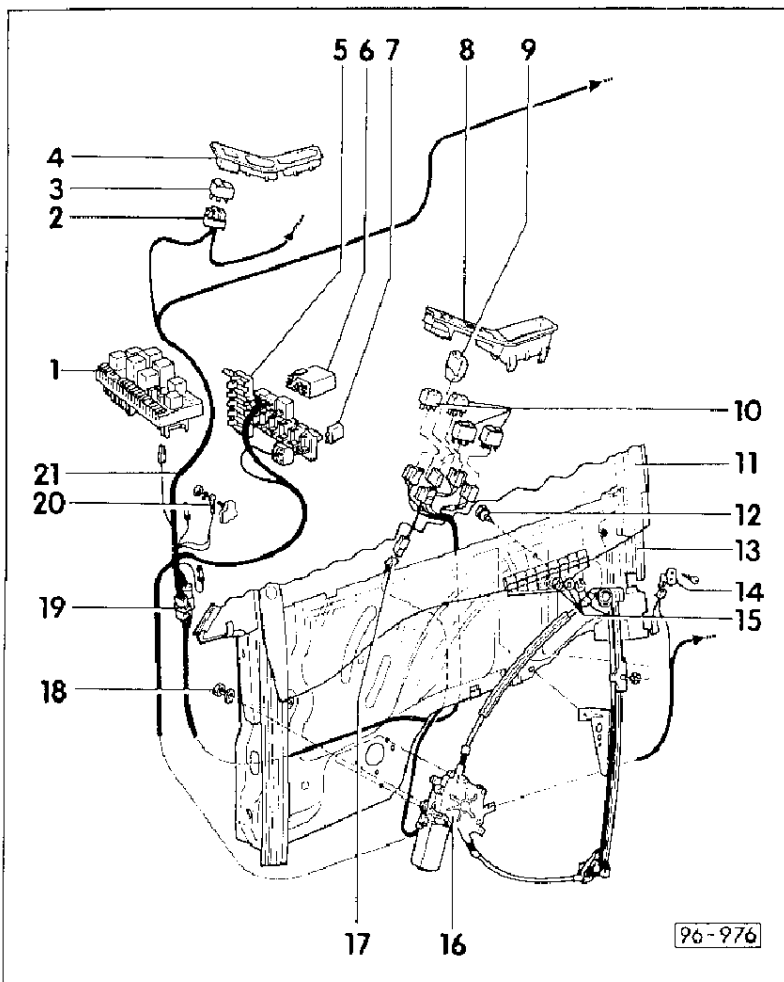
4 – Console

- ◆ Lift up to remove

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96-976

96-10

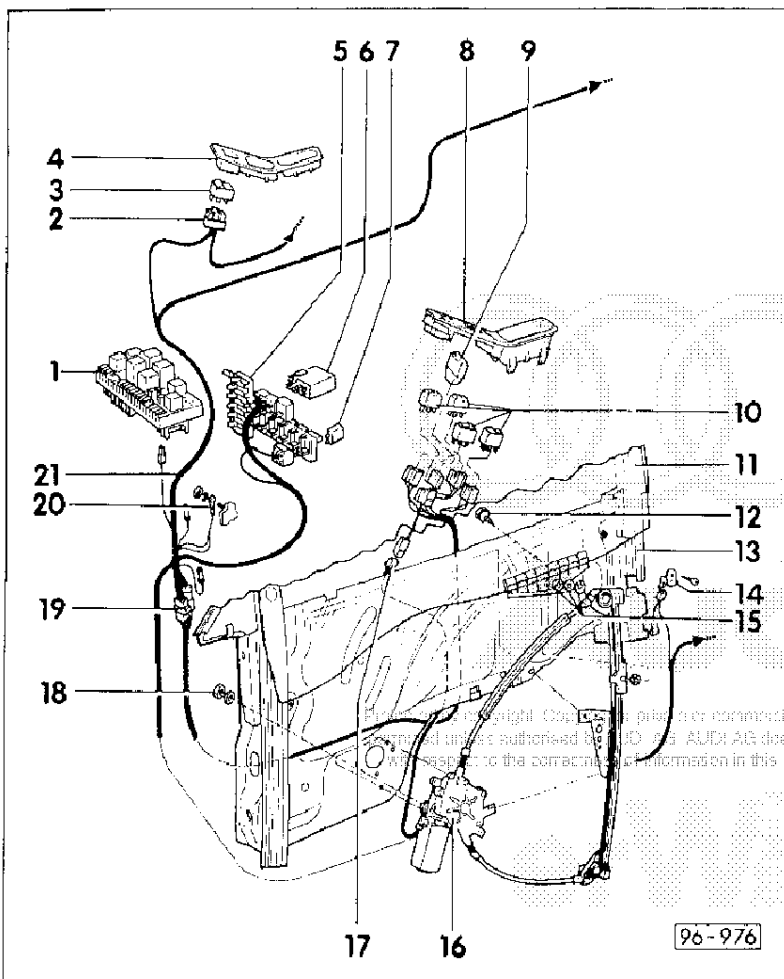


5 - Auxiliary relay carrier
 ◆ Adapter clipped to long side
 ◆ Relay position assignment
 => "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

6 - Window lifter control unit -J139
 ◆ Press catch upwards to remove
 ◆ Assignment
 => "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

7 - Thermo fuse 20 A
 ◆ Location => Fig. 1

8 - Console
 ◆ Lift up to remove



9 - Rear window lifter isolation switch -E39
 ◆ Only fitted with rear electric window lifters
 ◆ Removing and installing => Fig. 5

10 - Window lifter switches -E40, -E53, -E55, -E41
 ◆ Removing and installing => Fig. 3
 ◆ Checking => Fig. 4

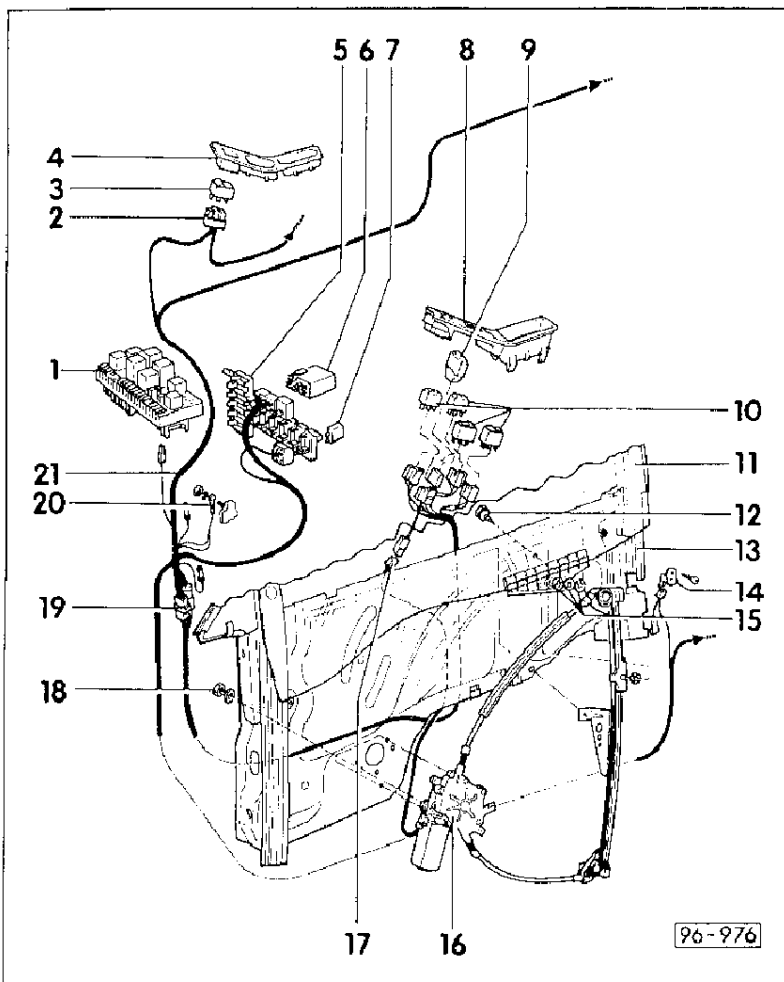
11 - Front left door window

12 - Fastening screw

13 - Door component carrier

14 - Driver's door contact switch -F2

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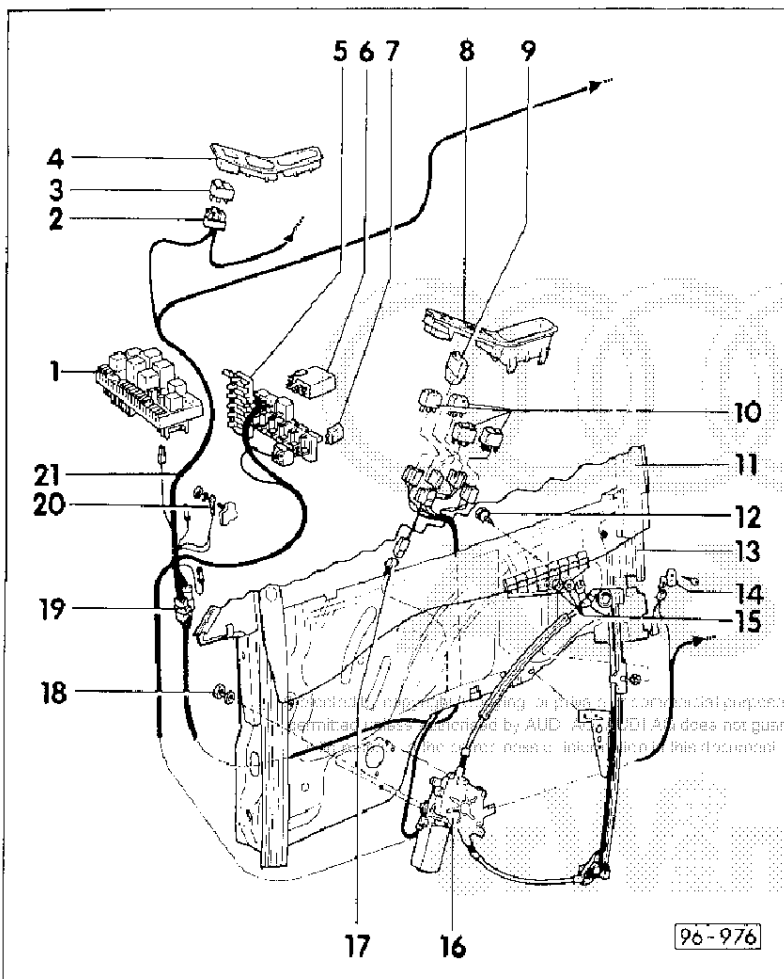


15 – Window fastening elements

16 – Window lifter motor, left -V14 with window lifter mechanism
 ♦ Ensure stress-free attachment by half-opening the window

17 – Connector for front left switch unit
 ♦ Removing and installing => Fig. 2
 ♦ Not directly attached to switch; connected to 2-pin plug housing of window lifter wiring loom.

18 – Securing nut

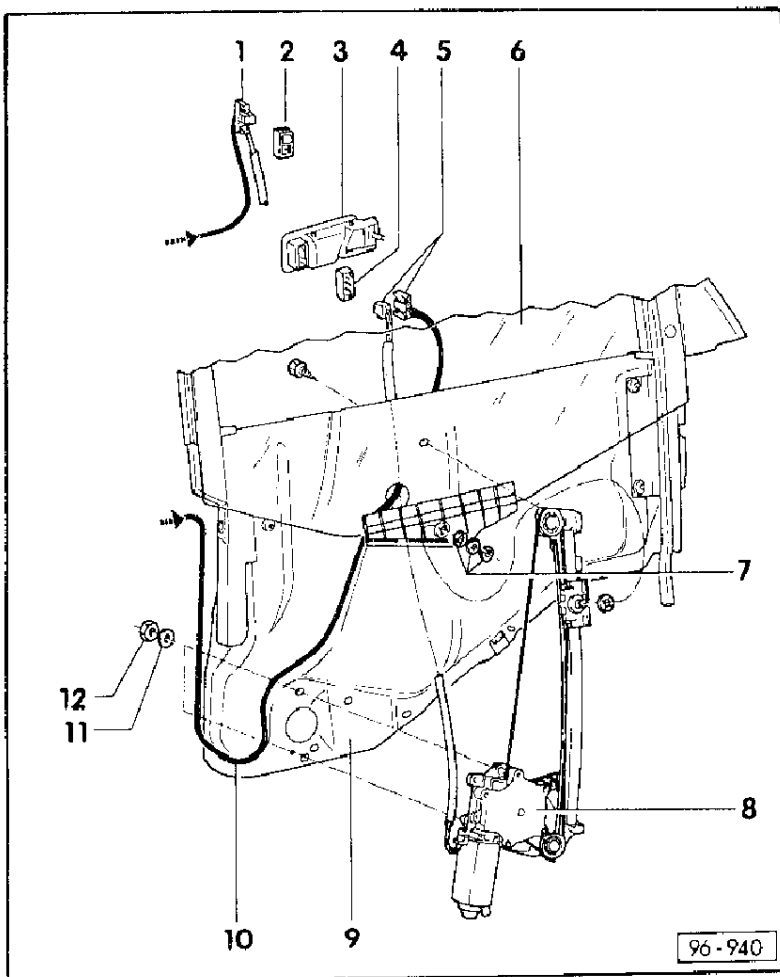


19 – Connectors
 ♦ Beneath instrument panel, on left

20 – Earth connection
 ♦ Screwed to inside of A pillar

21 – Wiring loom
 ♦ Wiring and contact assignment
 => "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

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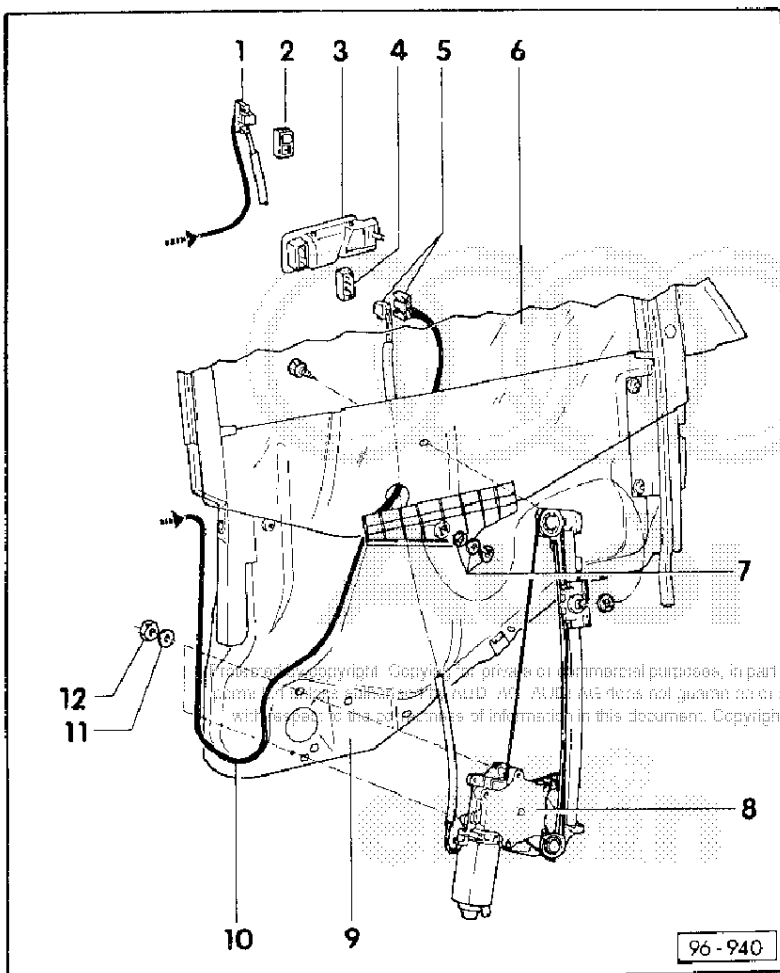
Rear electric window lifters – exploded view

Note:

The rear electric window lifter is an "open system" and must only be moved if bolted to the door component carrier. Otherwise the electric window lifter will be destroyed.

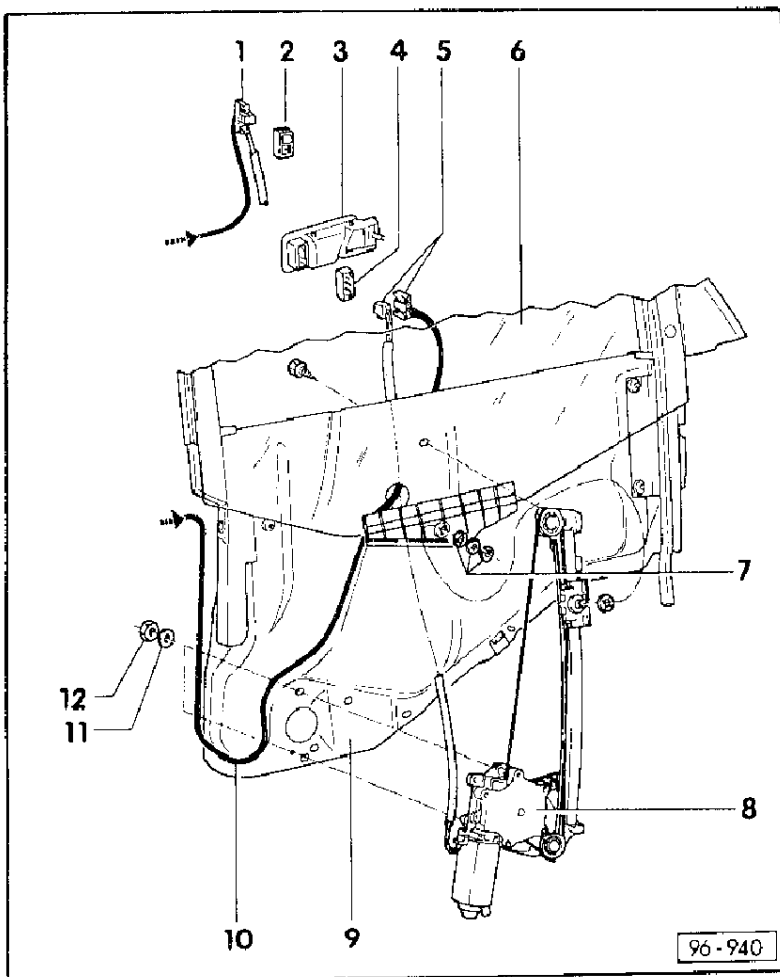
- 1 – Connector for right rear switch
 - ◆ Removing and installing => Fig. 2
- 2 – Rear right window lifter switch - E54
 - ◆ Removing and installing => Fig. 3
 - ◆ Checking => Fig. 4

———— 96-15 ————



- 3 – Inside door mechanism
 - ◆ Remove to take out switch
- 4 – Rear left window lifter switch - E52
 - ◆ Removing and installing => Fig. 3
 - ◆ Checking => Fig. 4
- 5 – Connector for left rear switch
 - ◆ Removing and installing => Fig. 2
- 6 – Rear left window
- 7 – Window fastening elements

———— 96-16 ————



8 – Rear left window lifter motor - V26 with window lifter mechanism
 ♦ Ensure stress-free attachment by half-opening the window

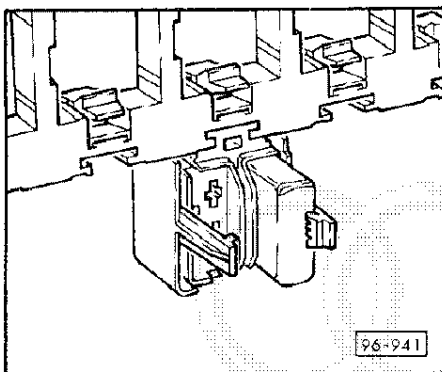
9 – Door component carrier

10 – Window lifter wiring loom
 ♦ Wiring and contact assignment

=> "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

11 – Washer

12 – Securing nut

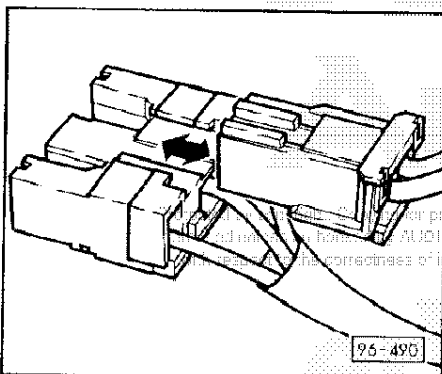


◀ Fig. 1 Thermo fuse location

♦ In auxiliary relay carrier on left beneath instrument panel.

♦ Relay position

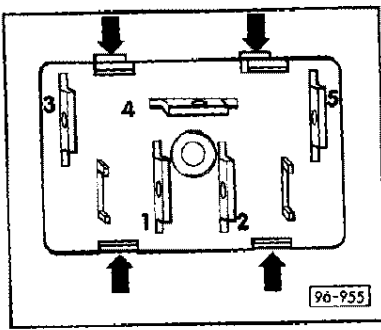
=> "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder



◀ Fig.2 Removing and installing connector for switch unit

– To remove, unclip 2-pin connector for electric window lifter from plug housing to rear by turning it sideways.

– To install, push 2-pin connector into 3-pin plug housing from rear until both engage.



◀ Fig.3 Removing and installing switch

Front door:

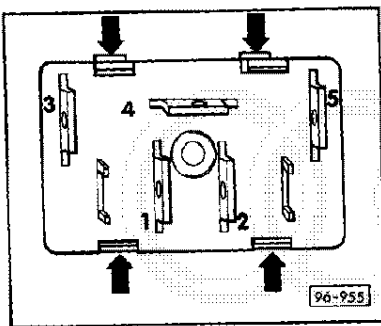
- 4- and 5-cyl. > 06.93: Place small screwdriver between door trim and console and prise out console together with switch unit.
- 4- and 5-cyl. 7.93 >, 6-cyl., S2: Removing door handle
=> General Body Repairs; Repair group 70; Door trim; Removing and installing front door trim (4 and 5-cyl. 7.93 >, 6-cyl., S2) =>
- Remove switch unit from door handle.

Rear door:

- Removing interior door handle
=> General body repairs; Repair group 70; Door trims; Removing and installing rear door trim =>

All vehicles:

- Remove plug.
- Use small screwdriver to prise long sides of switch -arrows- out of catch and push out switch.
- To install, push in switch until all retaining lugs engage.



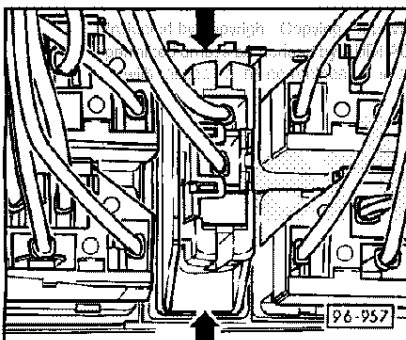
◀ Fig.4 Functional test of switch

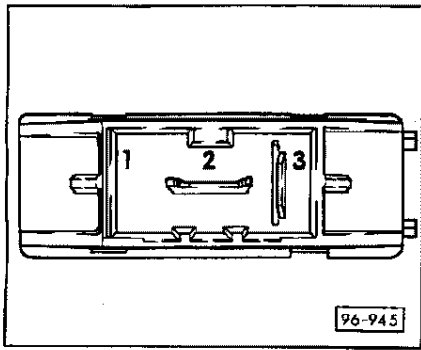
- Remove switch.
- Connect ohmmeter:

Contact	Test condition	Specified value
5 + 2	-	0 Ω
3 + 1	-	0 Ω
4 + 2	-	∞ Ω
4 + 2	Actuate switch "open"	0 Ω
4 + 1	-	∞ Ω
4 + 2	Actuate switch "close"	0 Ω

◀ Fig.5 Removing and installing locking switch for rear window lifter

- Position small screwdriver in recesses (arrows), press towards centre of switch and carefully push out the switch.





◀ Fig.6 Functional test of locking switch for rear window lifter

- Remove switch.
- Connect ohmmeter:

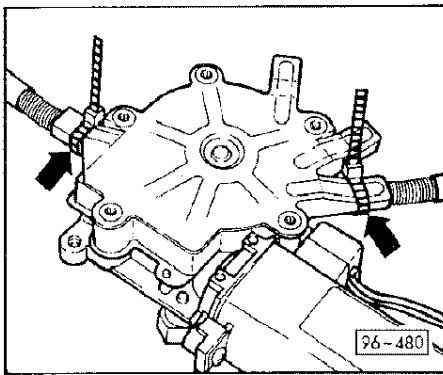
Contact	Test condition	Specified value
2 + 3	Button not pressed	$\infty \Omega$
2 + 3	Button pressed	0Ω

- Replace switch if the specified values not attained.

Dismantling and assembling electric window lifters

Notes:

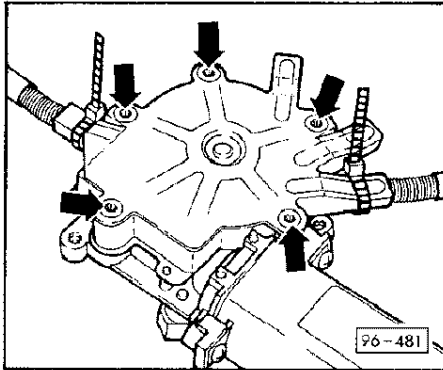
- ◆ The rear electric window lifter is an "open system" and must only be moved if bolted to the door component carrier. Otherwise the electric window lifter will be destroyed. The entire window lifter therefore has to be replaced if repairs are required.
 - ◆ Replacement of the motor/gear unit assembly is described in the following.
 - ◆ The mechanical section (linkage/cable) is replaced in the same way. The upper door stop must then be adjusted.
- = > General body repairs; Repair group 57; Front door; Door component carrier – exploded view = >
- = > General body repairs; Repair group 58; Rear door; Door component carrier – exploded view = >
- Removing window lifter from door component carrier
- = > General Body Repairs; Repair group 57; Front door; Removing window lifter and window from and installation on door component carrier = >
- = > General Body Repairs; Repair group 58; Rear door; Removing window lifter and window from and installation on door component carrier = >



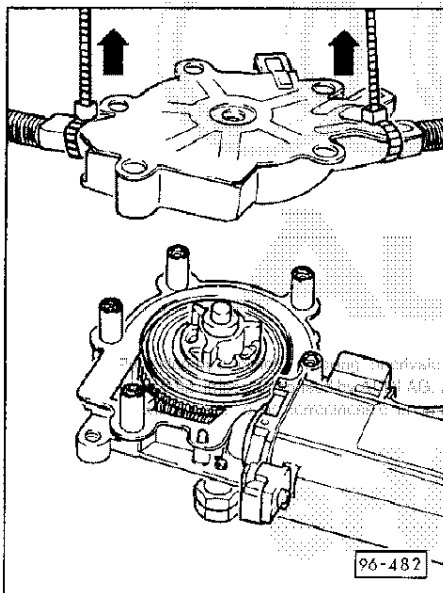
- ◀ - To secure in position, use cable ties to tightly connect metal housing cover and plastic cover at both cable exits -arrows-.

Note:

Both cable ties may be left in place throughout the entire sequence of repair operations, since servicing would otherwise be impossible.

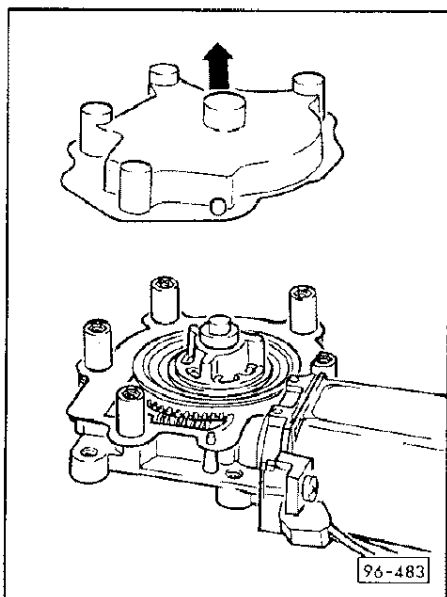


- ◀ - Completely unscrew and remove gear unit cover securing bolts -arrows-.



- ◀ - Pull cable reel from gear housing by hand in direction of arrow by tilting gently from side to side. Take care not to damage sealing surfaces.
- The 3 damper elements in the recesses may drop out - take care not to lose them.

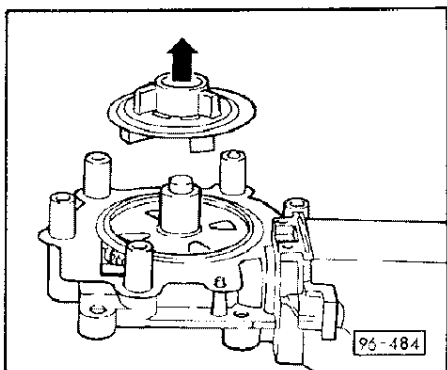
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- ◀ – Pull dust and transportation cover from new motor in direction of arrow.
- Ensure that flange seal and 3-winged retainer remain on gear housing.

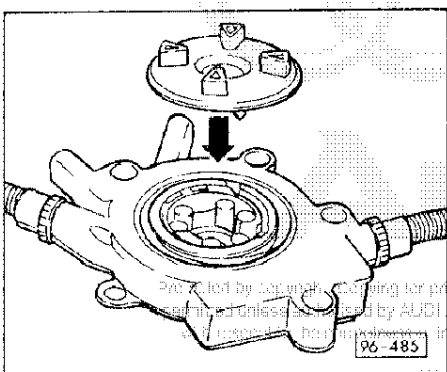
Note:

Surfaces/components that are coated with grease must not be allowed to come into contact with dust or dirt. Only original grease G 000 450 02 should be used for regreasing.



- ◀ – Pull 3-winged retainer off gear shaft of new motor in direction of arrow. Leave rubber moulding in gear housing.
- Check transmission components (rubber moulding, damping element) for damage, replace if necessary.

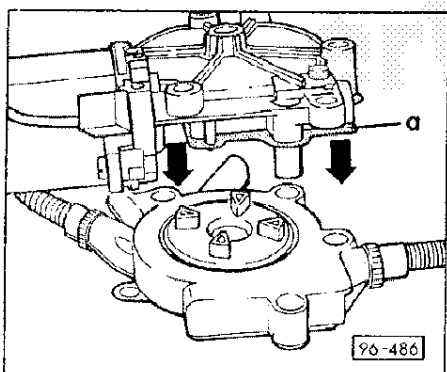
———— 96-25 ————



- ◀ – Insert 3-winged retainer in cable reel.

Note:

The 3 damping element must fit exactly into the cable reel recesses.

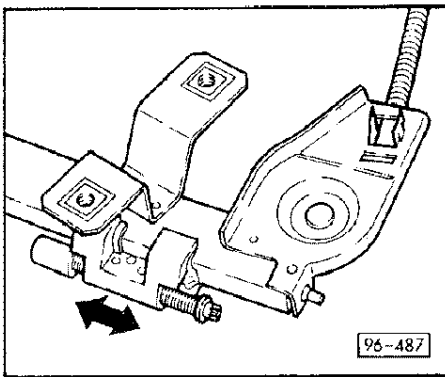


- ◀ – Attach window lifter motor to cable reel in direction of arrow.
- The 4 lugs of the 3-winged retainer must coincide with the recesses in the rubber moulding in the gear housing.

Note:

If applicable, coat flange seal -a- and gear wheel in gear housing with a thin film of grease to stop them falling out.

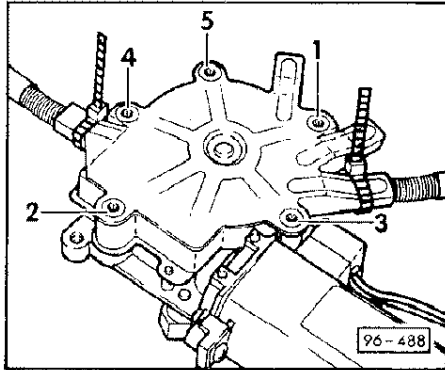
———— 96-26 ————



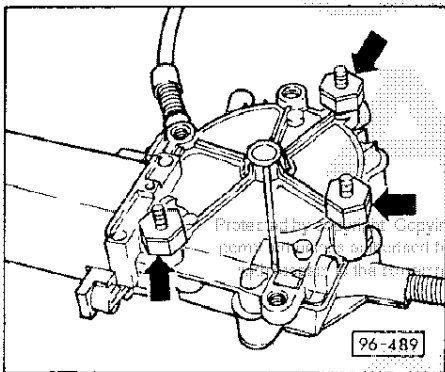
- ◀ - If gear housing cannot be properly attached to cable reel, shift driver -arrow- slightly to alter position of rubber moulding so that it engages.

Note:

Never turn adjusting screw for top stop.



- ◀ - Screw in securing bolts and tighten to 3 Nm in the order shown.



- ◀ - Unscrew bonded rubber bushes -arrows- from defective window lifter motor.
- Replace defective bonded rubber bushes.
- Fit bonded rubber bushes in new window lifter motor and tighten to 3 Nm.
- Test operation before installing in door component carrier.
- **To avoid scratching noise during operation, cut off protruding ends of subsequently attached cable ties.**

Electrically adjustable seats

Notes:

◆ Troubleshooting instructions

= > "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

◆ Assignment of pins in connectors

= > "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

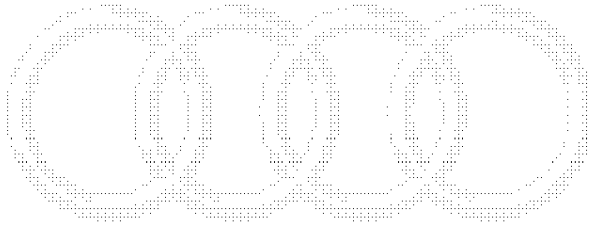
Removing seat

= > General Body Repairs; Repair Group 72; Front Seat; Removing and installing front seat = >

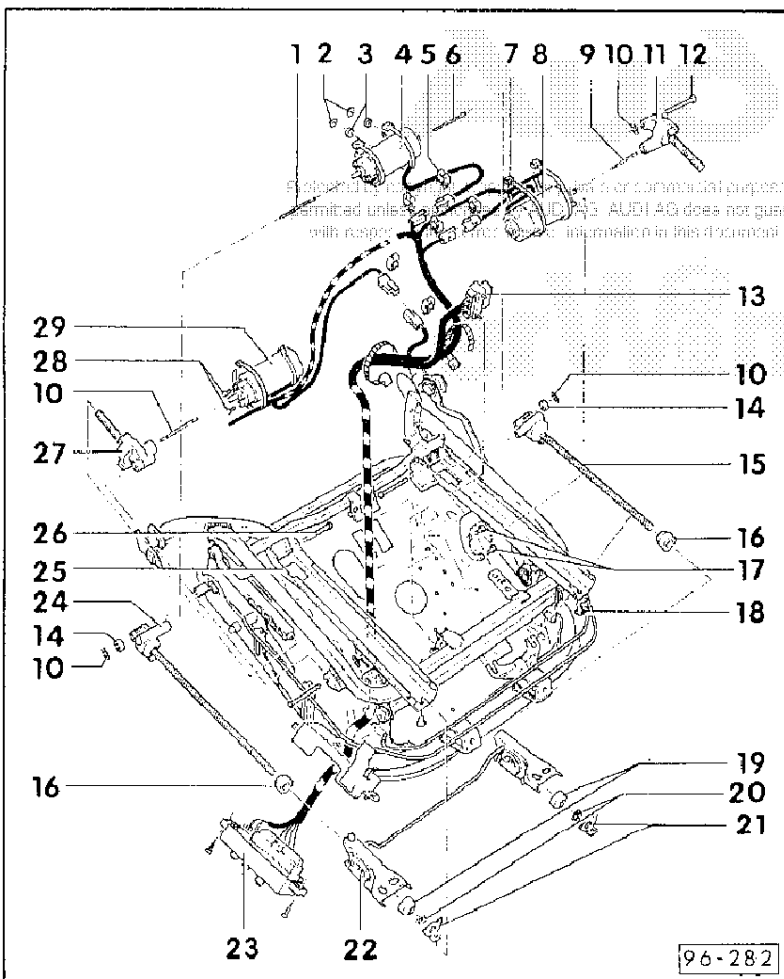
Removing backrest

= > General Body Repairs; Repair Group 72; Front Seat; Removing and installing backrest = >

Function test = > Page 96-42



96-29



Electrically adjustable seat – exploded view

1 – Left drive shaft

◆ For fore-and-aft adjustment

2 – Securing nut

3 – Grommet

4 – engine

◆ For fore-and-aft adjustment

◆ Removing and installing

= > Page 96-39

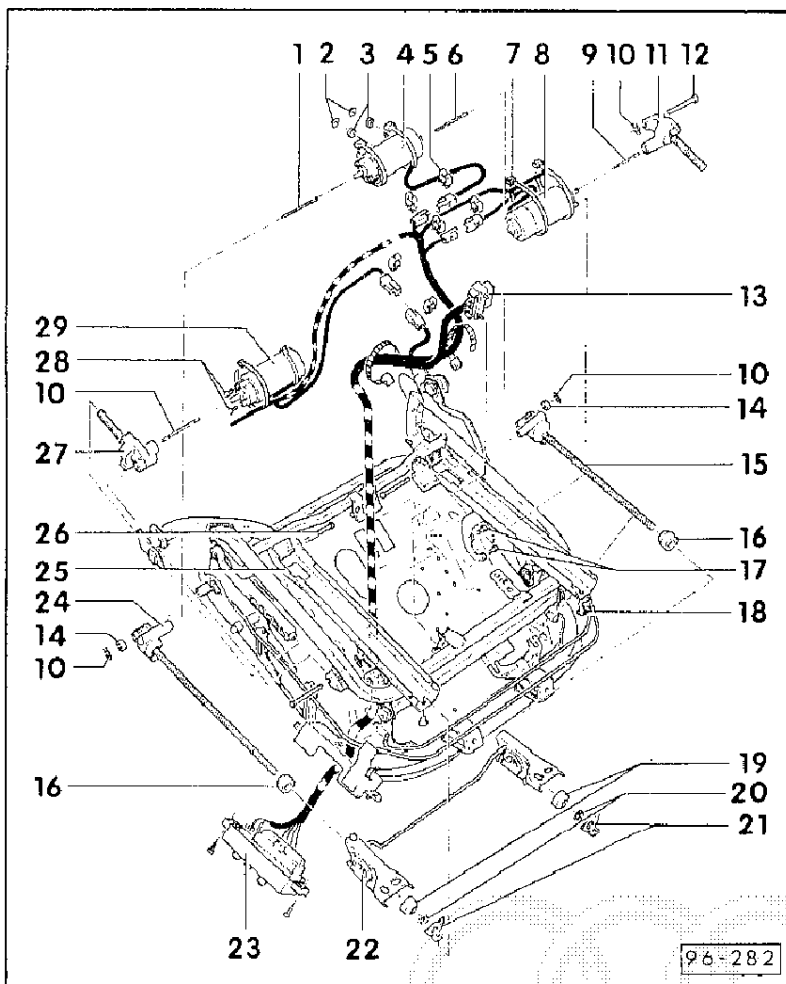
5 – Retaining clip

◆ For connector

6 – Right drive shaft

◆ For fore-and-aft adjustment

96-30



7 - Cable tie

8 - engine

- ◆ For front height adjustment
- ◆ Removing and installing => Page 96-38

9 - Drive shaft

- ◆ For adjuster

10 - Circlip

11 - Adjuster

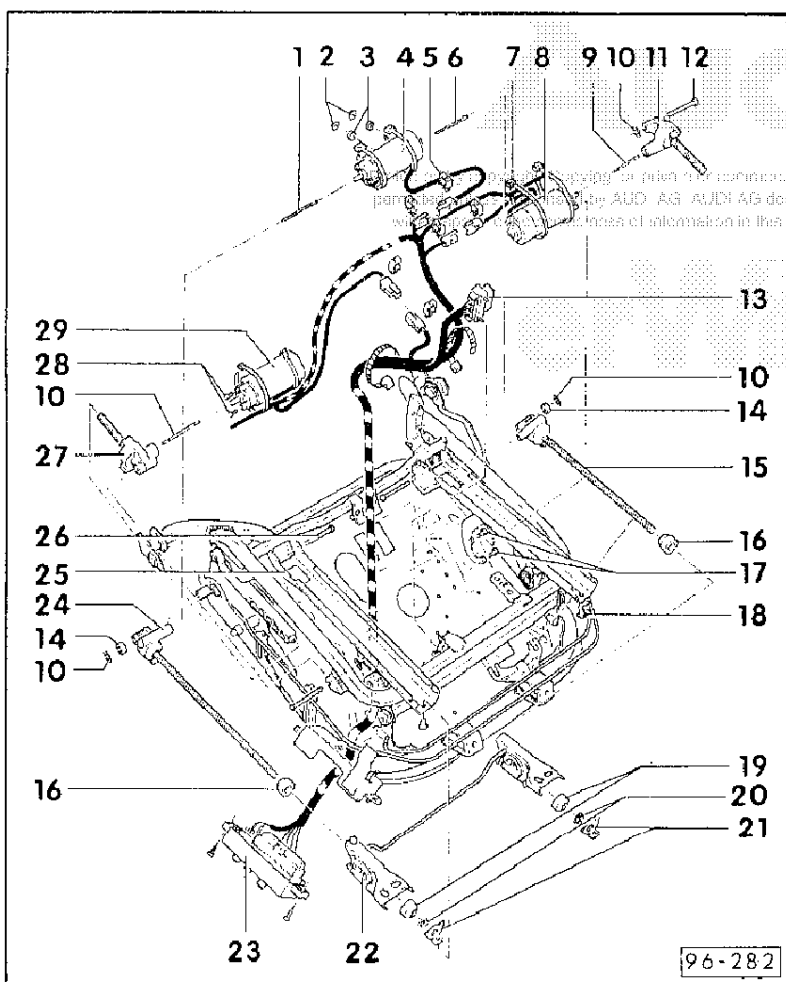
- ◆ For front height adjustment
- ◆ Removing and installing => Page 96-40

12 - Fastening pin

- ◆ For adjuster -item 11-

13 - Connector

- ◆ For wiring harness



14 - Shim

15 - Right adjuster

- ◆ For fore-and-aft adjustment
- ◆ Removing and installing => Page 96-40

16 - Rear rubber stop

- ◆ For rear height adjustment

17 - Securing bolts

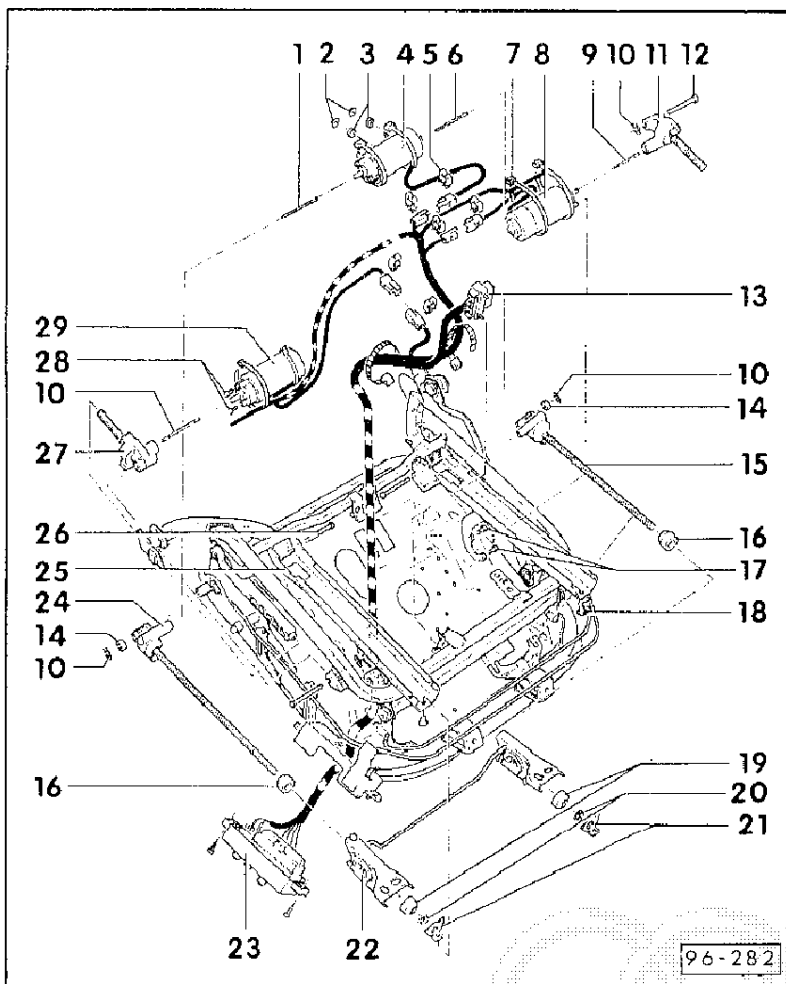
- ◆ For motor -item 8-

18 - Rivet

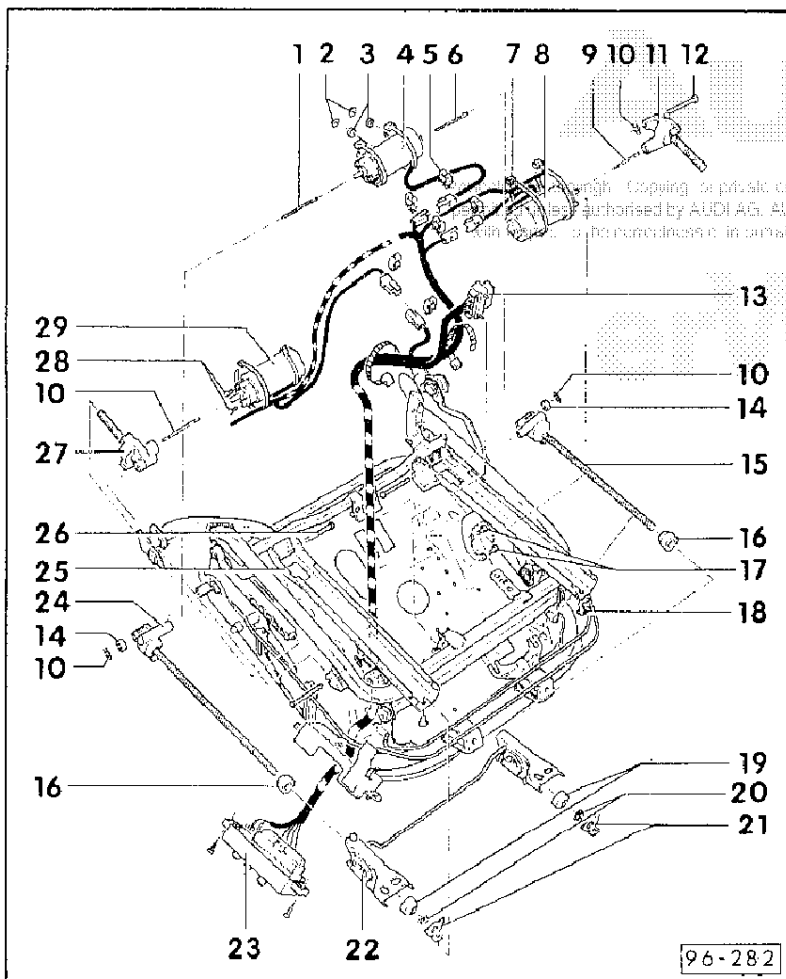
- ◆ For fastening spindle holder

19 - Front rubber stop

20 - Bush

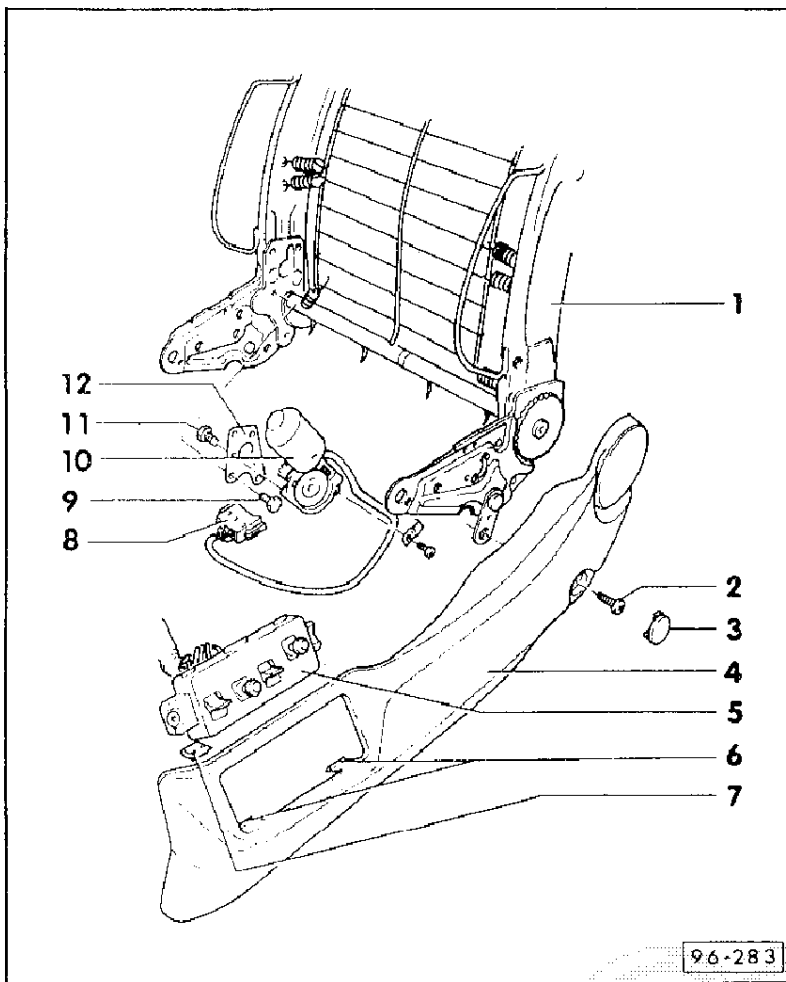


- 21 - Spindle holder
 - ◆ Removal: Grind off rivet and drive out
 - ◆ Installation: Secure using blind rivet or M5 screw
- 22 - Runners
 - ◆ Removing and installing adjuster with runners => Page 96-40
- 23 - Switch unit with wiring loom
 - ◆ Supplied as one unit, no individual replacement
 - ◆ Removing and installing => Page 96-37



- 24 - Left adjuster
 - ◆ For fore-and-aft adjustment
 - ◆ Removing and installing => Page 96-40
- 25 - Seat base frame
 - ◆ With runner guides
- 26 - Fastening pin
 - ◆ For adjuster
- 27 - Adjuster
 - ◆ For rear height adjustment
 - ◆ Removing and installing => Page 96-40
- 28 - Securing bolts
 - ◆ For motor -item 29-
- 29 - engine
 - ◆ For rear height adjustment
 - ◆ Removing and installing => Page 96-38

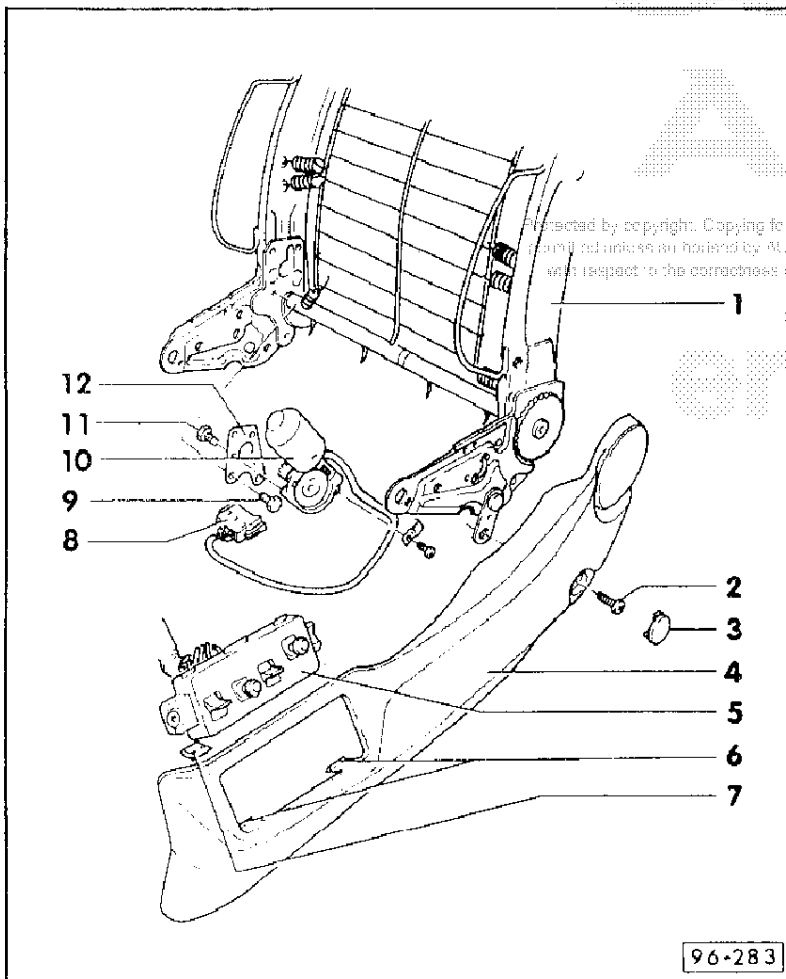
Electrically adjustable backrest – exploded view



- 1 – Seat back
- 2 – Fastening screw
 - ◆ For side trim
 - ◆ Screwed into stop pin for backrest
- 3 – Trim cap
 - ◆ Prise out
- 4 – Side trim
- 5 – Seat switch unit
 - ◆ Removing and installing => Page 96-37

96-283

96-35



- 6 – Catch for switch unit
 - ◆ Integrated into side trim
 - ◆ To remove, prise off clips carefully with screwdriver
- 7 – Retaining clip
 - ◆ Prise out before removing side trim
- 8 – Connector
- 9 – Fastening screw
- 10 – Backrest adjustment motor
 - ◆ Removing and installing => Page 96-41
- 11 – Fastening screw
- 12 – Retainer
 - ◆ For backrest adjustment

96-283

96-36

Removing and installing switch unit on seat

- Use small screwdriver to lever off fastening screw cap.
- Screw fastening screw out of backrest stop bolt.
- Prise of retainers
- Disengage side trim for seat from switch trim at seat frame and remove.
- Loosen the two fastening screws and remove switch unit.

Note:

Switch unit and wiring loom form a single unit and can only be replaced as a complete assembly.

96-37

Removing and installing front/rear seat height adjustment motor

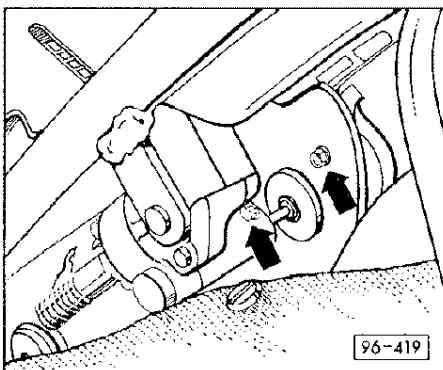
- Seat removed

Note:

If removal or installation work involves removing individual adjusters or detaching them from the drive shaft, ensure that the individual adjusters do not become bent.

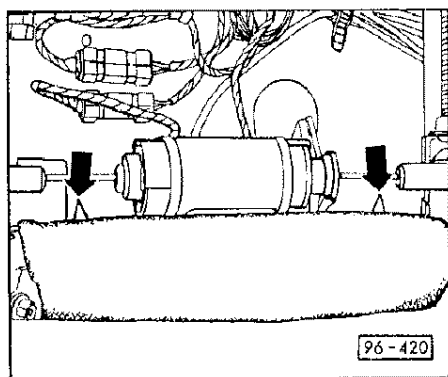
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- Remove motor securing bolts -arrows-.
- Pull drive shaft out of motor.
- Detach connector.

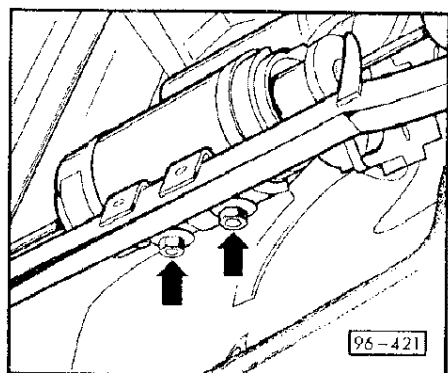


96-38

Removing and installing longitudinal adjustment motor



- Seat removed
- ◀ – Bend open clips for securing fabric -arrow- and detach fabric from rear cross member as required.



- ◀ – Remove both nuts arrows from motor at seat cross member.
- Pull drive shafts out of both end faces of motor.
- Detach connector.

96-39

Removing and installing front/rear height adjuster

- Seat removed
- Prise retaining ring from securing pin and pull out the pin.
- Pull drive shaft out of adjuster
- Screw adjuster with spindle out of holder by hand.

Removing and installing longitudinal adjuster

- Seat removed
- Grind off or drill out rivets for spindle holders on right and left at runner guide.
- Remove spindle holders and rubber buffers.

96-40

Removing and installing backrest adjustment motor

- Seat removed
- Backrest removed
- Detach fabric at bottom of backrest and carefully pull forward to the necessary extent.
- Remove hexagon bolts for motor bracket from backrest hinge.
- Unscrew bracket from motor.
- Pull off/unsolder motor connecting lead.

———— 96-41 ————

Functional test of electrically adjustable seats

- After repair work
- Installing seat
- = > General Body Repairs; Repair Group 72; Front Seat; Removing and installing front seat =>
- Use seat switches to move seat to all possible positions
- = > Owner's manual
- It must be possible to move the seat to all possible positions in accordance with switch setting.

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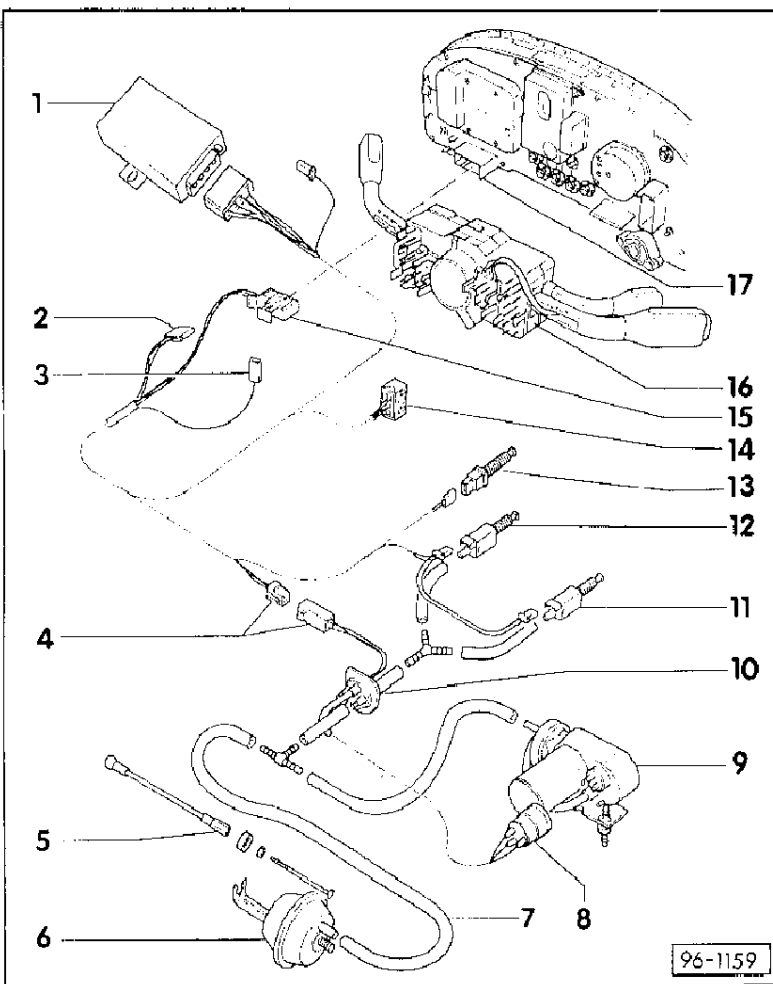
———— 96-42 ————

Servicing cruise control system

Notes:

◆ Checking vacuum system => Page 96-51.

◆ Troubleshooting
=> "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder



1 - Control unit

◆ Removing and installing => Fig. 1

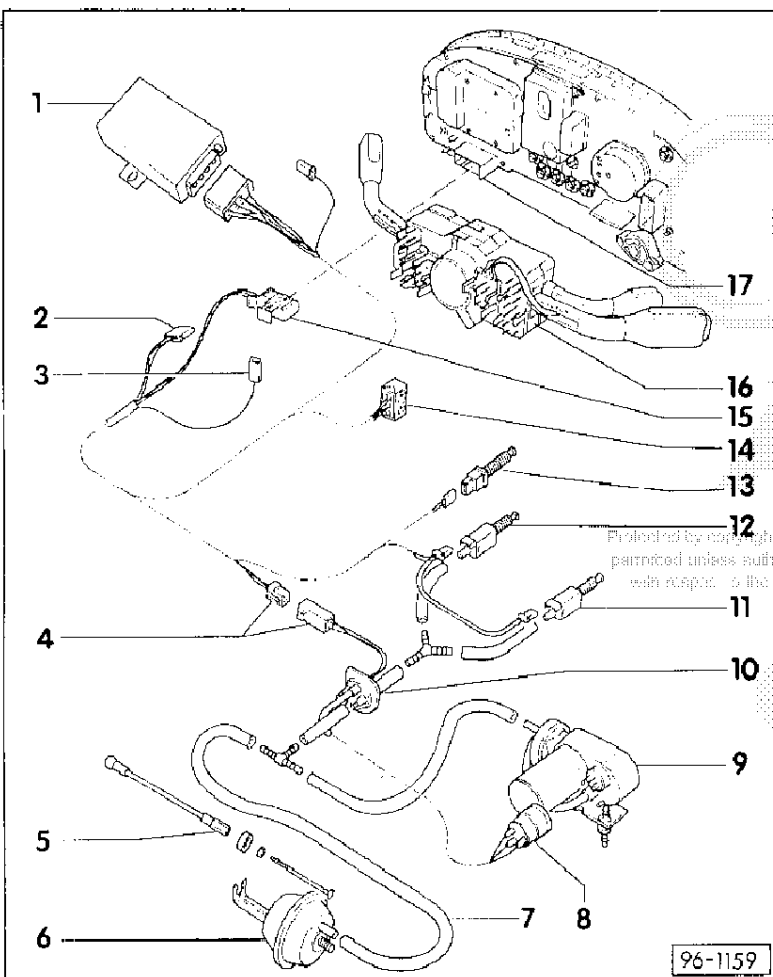
2 - Test connection with cable link

◆ Production only
◆ Automatic gearbox only

3 - Earth connection

◆ Beneath instrument panel

96-43



4 - 6-way connector

◆ Blue

5 - Linkage

◆ Adjusting, vehicles with petrol engine:

4/5-cyl.-engine => Fig. 2,

6-cyl.-engine => Fig. 3

6 - Actuator

◆ Removing and installing => Fig. 4

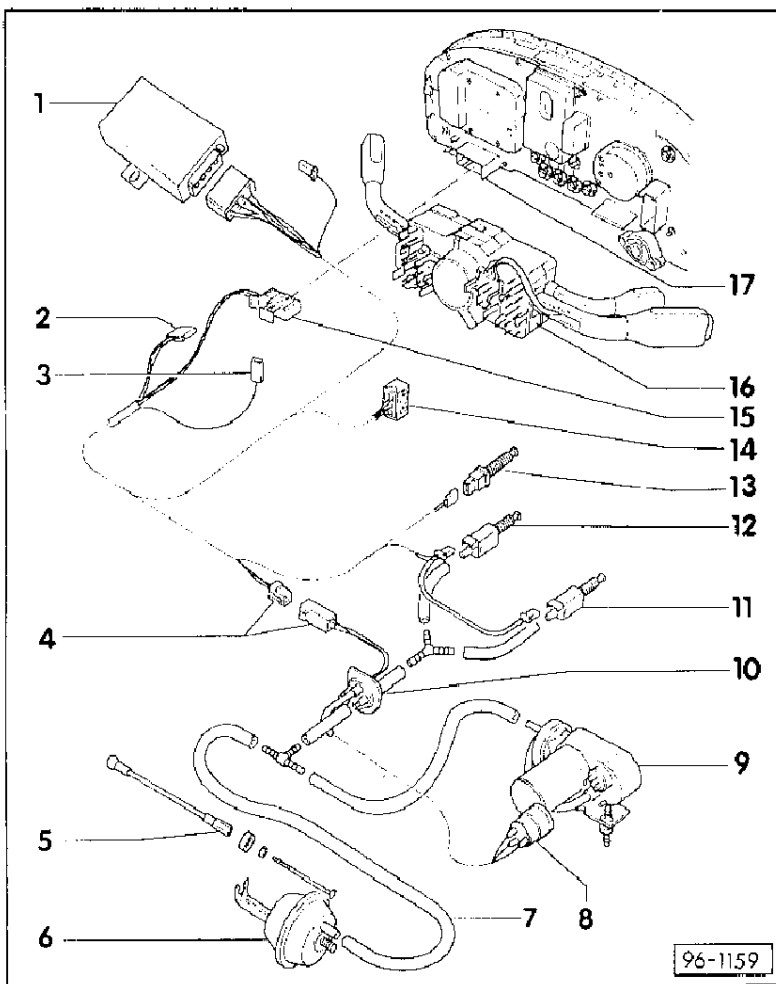
7 - Vacuum hose

◆ Remove to perform leak test
=> Page 96-51

8 - Connector

◆ For vacuum pump

96-44



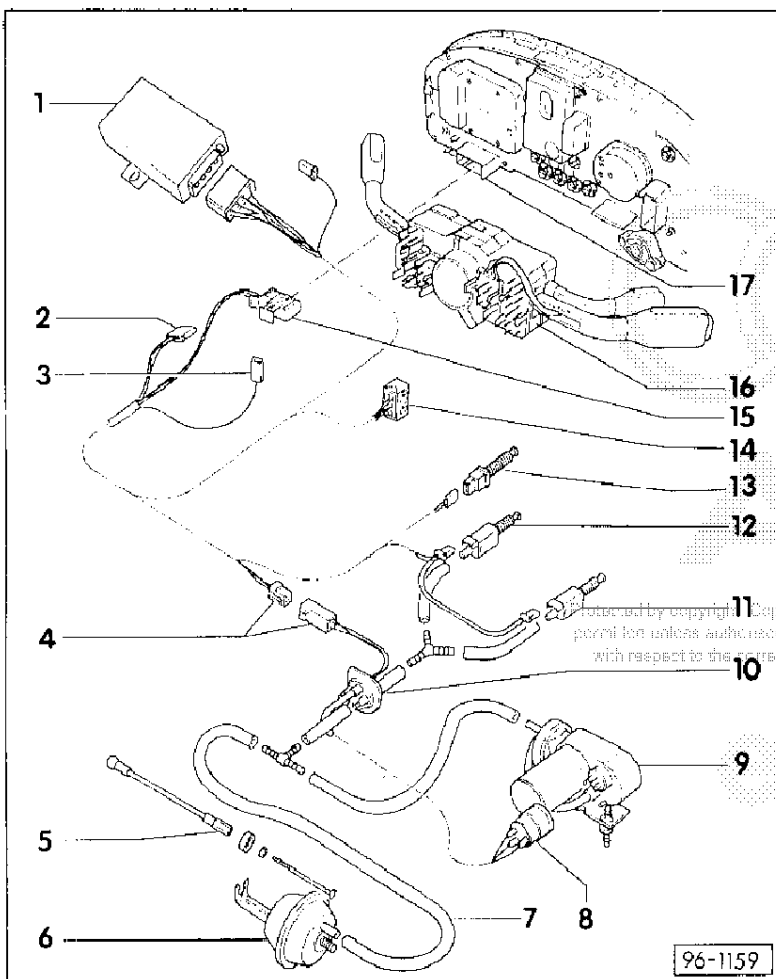
9 - Vacuum pump
 ◆ Removal and installation, vehicles with 4 and 5-cyl. engine => Fig. 5, vehicles with 6-cyl. engine => Fig. 6

10 - Rubber grommet

11 - Vent valve at clutch pedal
 ◆ Removing => Fig. 7
 ◆ Installing and adjusting => Fig. 8

12 - Vent valve
 ◆ At brake pedal
 ◆ Removing => Fig. 7
 ◆ Installing and adjusting => Fig. 8

13 - Brake light switch



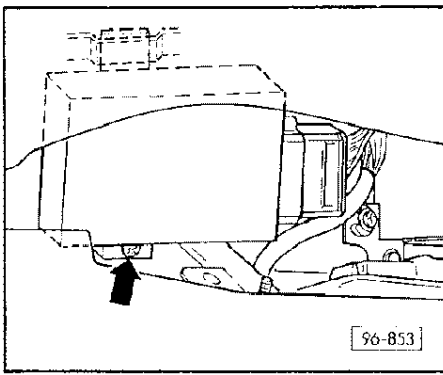
14 - 26-pin connector
 ◆ Black
 ◆ For cruise control switch

15 - 26-pin connector
 ◆ Blue
 ◆ For dash insert

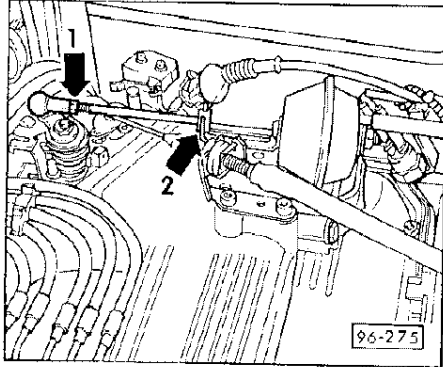
16 - Steering column switch with controls for CCS.
 ◆ Removing and installing => Page 94-28

17 - Dash panel insert
 ◆ Travel signal connection, blue connector, cavity 18

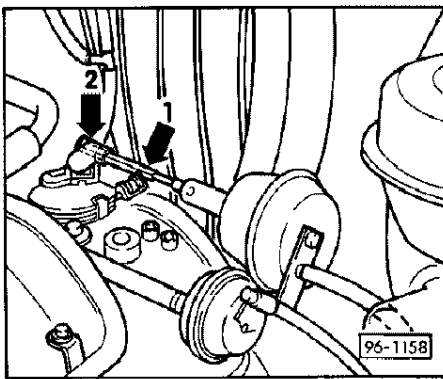
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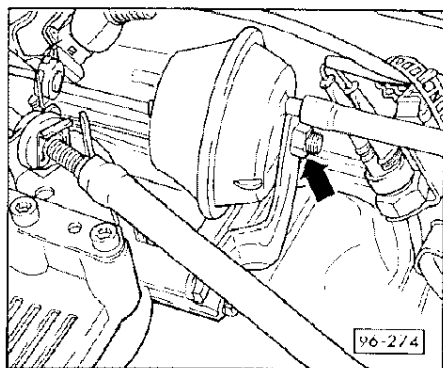
- ◀ **Fig.1 Removing and installing control unit**
- Removing glove compartment
 - = > Body Assembly Work; Repair Group 70; Dash Panel; Removing and installing glove compartment =>
 - Use recessed head screwdriver to detach control unit from back of instrument panel.
 - Remove control unit from retainer and unplug connector.



- ◀ **Fig.2 Adjusting linkage at actuator, vehicles with 4 and 5- cyl.-engine**
- Start engine.
 - Use nut -1- to adjust clearance between bushing and stop plate -2-.
 - Specified value: 0,5 ... 1 mm

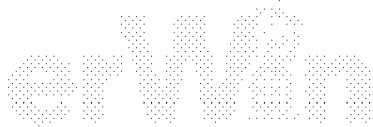


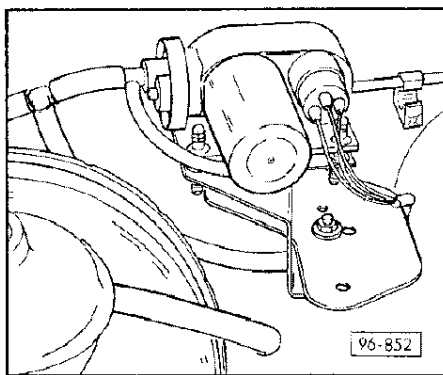
- ◀ **Fig.3 Adjusting linkage at actuator, vehicles with 6 – cyl.-engine**
- Start engine.
 - Use nut -1- to adjust clearance between bushing and stop plate -2-.
 - Specified value: 0.5 ... 1 mm



- ◀ **Fig.4 Removing and installing actuator**
- Unscrew linkage.
 - Pull off vacuum hose.
 - Unscrew actuator -arrow-from holder (25 Nm).

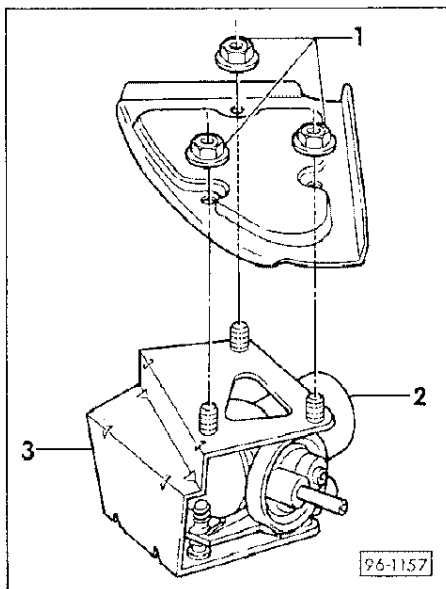
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◀ **Fig.5 Removing and installing vacuum pump, vehicles with 4 and 5-cyl. engine**

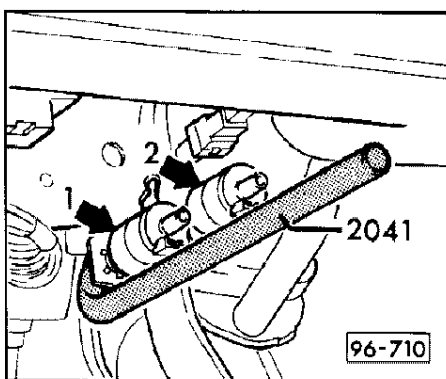
- Pull pump complete with rubber studs upwards out of bracket.



◀ **Fig.6 Removing and installing vacuum pump, vehicles with 6-cyl. engine**

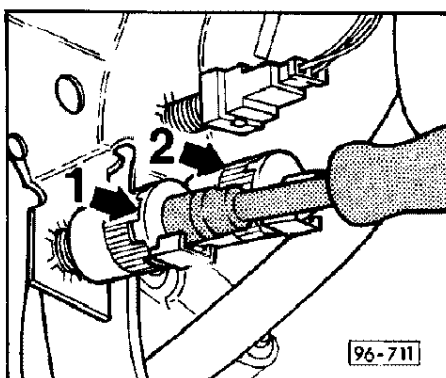
- Remove securing nuts -1- (3 Nm).
- Remove vacuum pump -2- with holder -3- from bracket.
- Pull off vacuum hose and connector; remove vacuum pump with holder from engine compartment.
- Pull vacuum pump complete with rubber studs upwards out of bracket; if necessary, position screwdriver between vacuum pump and bracket and prise out vacuum pump.

96-49



◀ **Fig.7 Removing vent valve at clutch pedal/brake pedal**

- Remove driver's side tray.
- = > General body repairs; Repair group 70; Dash panel, Removing driver's storage compartment = >
- Pull connector and vacuum hose off vent valve at clutch pedal -1-/brake pedal -2-.
- Use special tool 2041 to push vent valve out through bushing.



◀ **Fig.8 Installing and adjusting vent valve at clutch pedal/brake pedal**

- Place vent valve in position.
- Use 10 mm socket wrench to push home vent valve through bushing.
- To adjust vent valve, pull back clutch pedal -1-/ brake pedal -2- as far as it will go.

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er/en

96-50

Testing vacuum system for cruise control

- Pull vacuum hose off vacuum pump.
- Push in diaphragm in positioning element.
- Seal off end of detached hose.
 - If diaphragm at actuator remains pushed in and does not move, vacuum system is OK.
 - If diaphragm returns to original position, there is a leak in the system.

Possible cause of fault

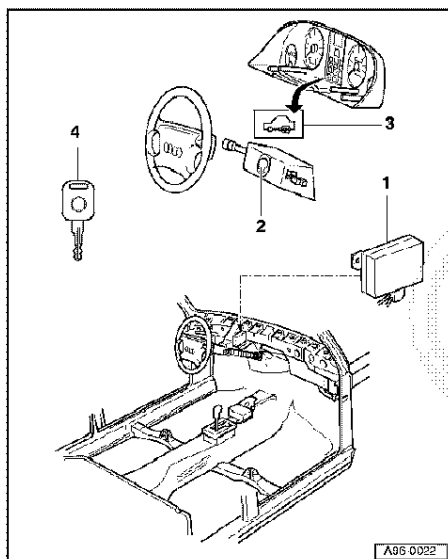
- ◆ Vent valve leaking or incorrectly set
- ◆ Actuator leaking
- ◆ Cracks in vacuum hoses

96-51

Servicing immobiliser

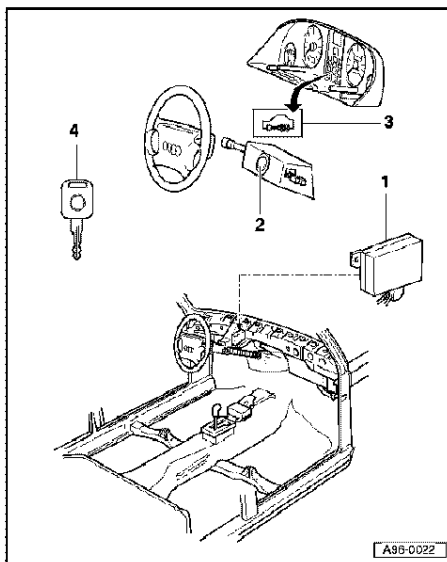
Overview

- 1 - Immobiliser control unit -J362
 - ◆ Removing and installing => Page 96-54
- 2 - Immobiliser reader coil -D2
 - ◆ Integrated into steering column lock
 - ◆ -D2 reads response code of transponder each time ignition is switched on
 - ◆ Removing and installing => Page 96-55



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96-52



3 – Immobiliser warning lamp -K117

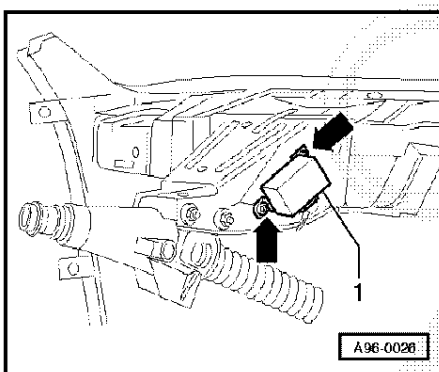
- ◆ -K117 comes on briefly when an authorised ignition key is used.
- ◆ -K117 flashes continuously if an unauthorised ignition key is used, or if a system fault occurs.
- ◆ Removing and installing => Page 90-11

4 – Transponder (reply storage memory)

- ◆ Integrated into ignition key
- ◆ Replace entire vehicle key if transponder defective.
- ◆ Make or order replacement key on basis of lock number.
- ◆ Perform vehicle key adaptation => Page 01-11.

Removing and installing immobiliser control unit

- Removing steering column switch => Page 94-28
- Removing dash panel insert => Page 90-8
- Remove driver's side tray.
- => General body repairs; Repair group 70; Dash panel, Removing driver's storage compartment =>



- Remove securing bolts -arrows- from immobiliser control unit -1- at steering mount on right, remove control unit.
- Detach multipin connector.

Notes:

- ◆ The engine control unit identifier is read in automatically when a new immobiliser control unit is installed.
- ◆ When installing an immobiliser control unit -J362 from another vehicle, engine control unit replacement adaptation must be carried out => Page 01-15.
- ◆ Vehicle key adaptation => Page 01-11 is then to be carried out.

Replacing reader coil -D2

Note:

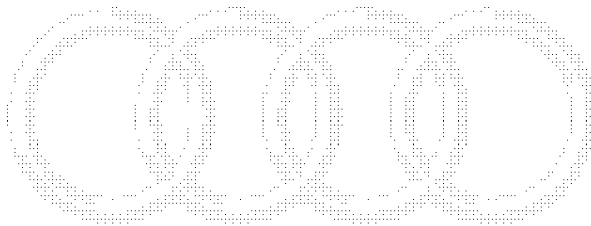
The reader coil can only be replaced in conjunction with the steering column lock.

- Removing steering column lock and lock cylinder => Page 94-45.
- Fit new steering column lock with any lock number. Do not perform door lock adaptation.

Note:

The customer will have to use two different keys for vehicle during the delivery period.

- Order new steering column lock with vehicle-specific lock number from Sales Centre/Importer.
- After delivery, replace steering column lock with the one with the vehicle-specific lock number.



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erwin

Relay plate

Removing and installing relay plate with fuse box

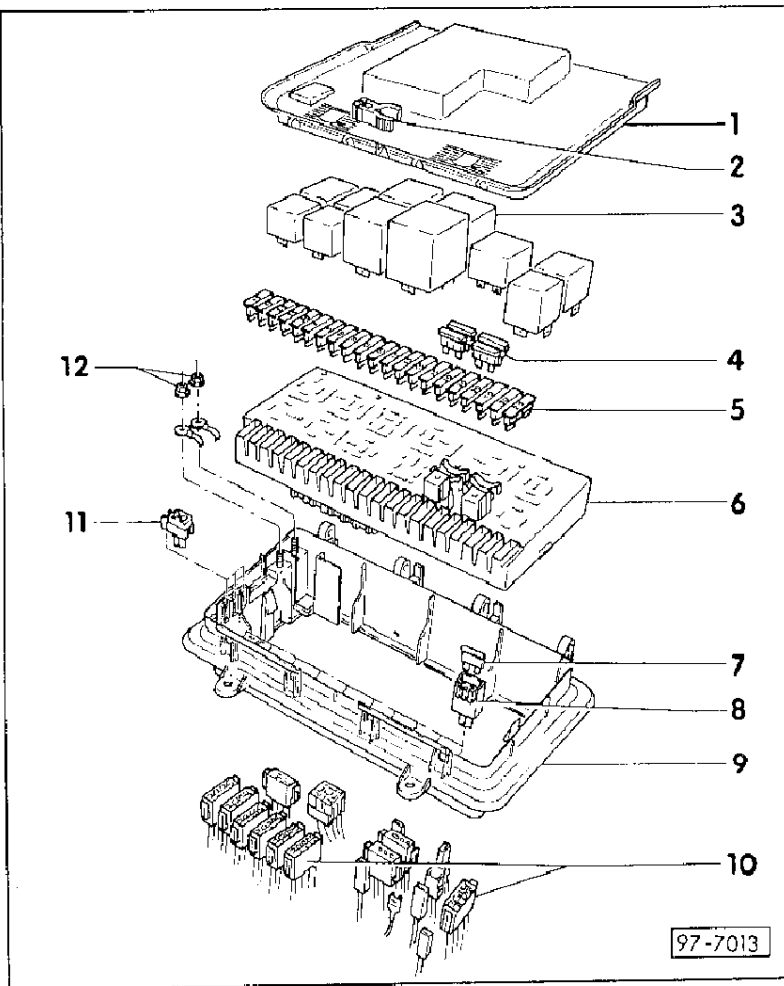
Note:

Relay assignment, fuse assignment and ratings, allocation of contact designations, assignment of self-diagnosis connectors

=> "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

1 - Cover

2 - Fuse assembly tool
◆ Attached to cover



97-1

3 - Relay

4 - Spare fuses

5 - Fuses

◆ Removing => Fig. 1

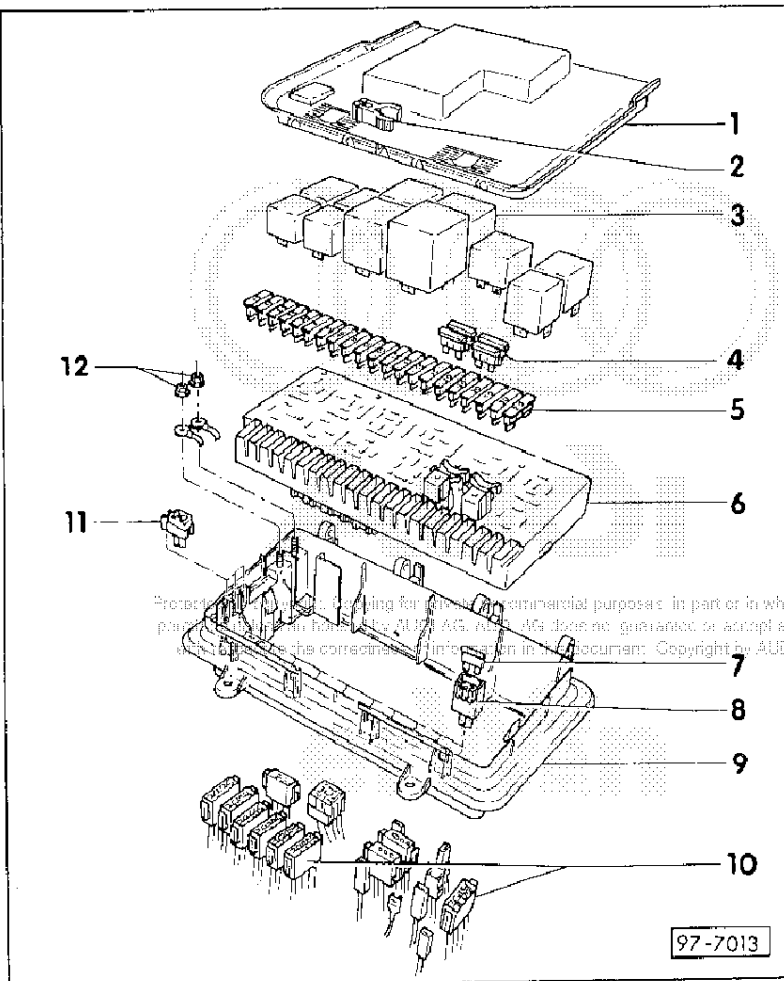
6 - Relay plate with fuse box

7 - Additional fuses

8 - Additional fuse adapter

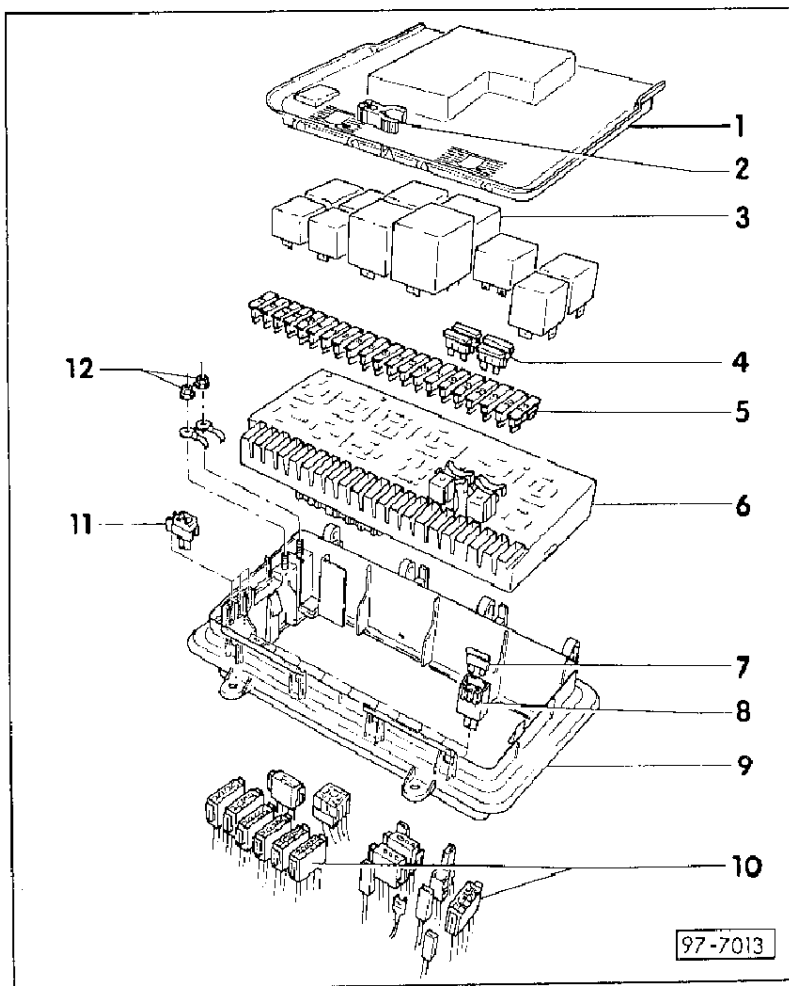
◆ Removing and installing =>
Page 97-5

9 - Housing

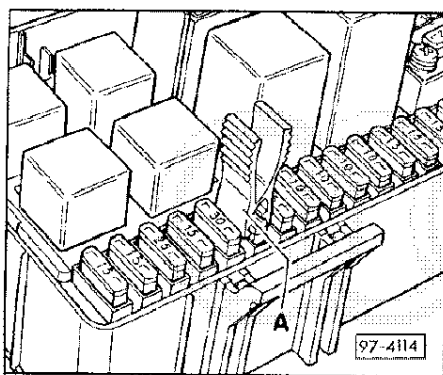


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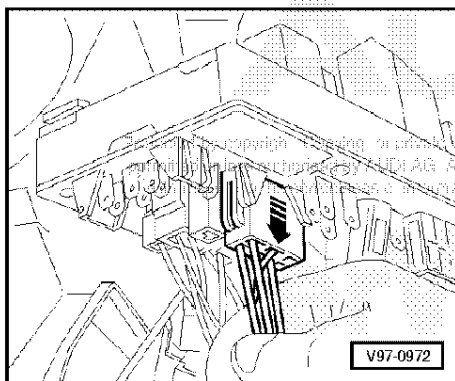
97-2



- 10 - Plug housing
 - ◆ Pulling off => Fig. 2
 - ◆ Assignment => Page 97-9
- 11 - Self-diagnosis connector
- 12 - Combination nut M5



- ◀ **Fig.1 Removing fuses**
 - A - Fuse assembly tool, attached to cover
 - Place tool over fuse and pull fuse out of holder.

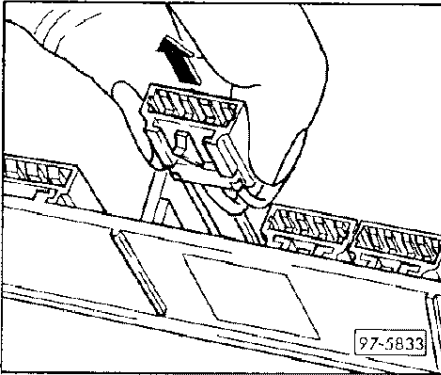
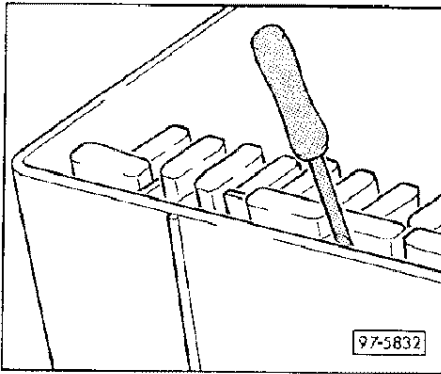


- ◀ **Fig.2 Pulling off plug housing**
 - To detach connectors, grip plug housings firmly and pull off.
 - If this is not possible, pull carefully on wiring loom as well.

Removing and installing additional fuse adapter

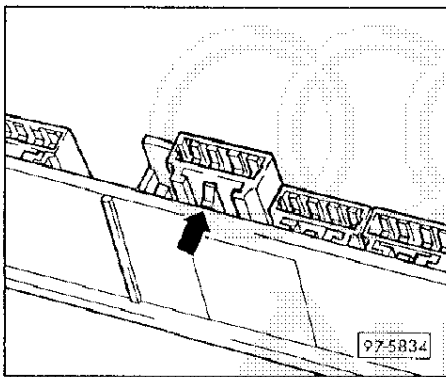
Removal:

- Lift cover for relay plate in plenum chamber and remove.
- Remove relay plate upwards; leave all connectors attached.
- ◀ - Pull out fuse.
- Press in catch using small screwdriver.



- ◀ - Pull additional fuse adapter off upwards.

97-5



Installation:

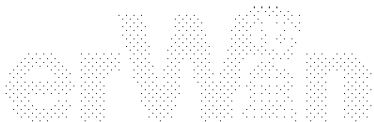
- Insert additional fuse adapter from top until catch -arrow- can be heard to engage.
- Push in fuse.
- Push in relay plate.

Note:

Take care not to crush any connecting leads when pushing in.

- Attach cover and make sure that it is properly closed (to prevent water from entering).

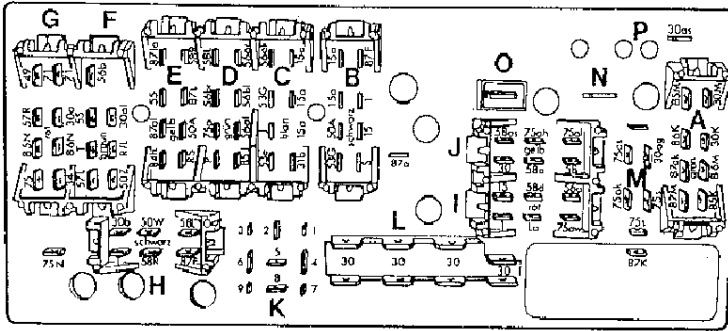
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97-6

Wiring loom connections

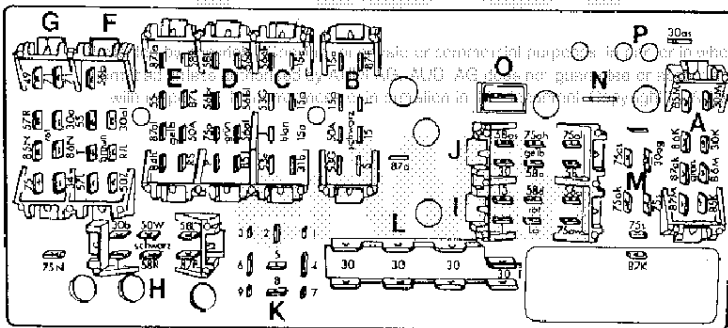
- A - Air conditioner
- B - Front right
- C - Instrument panel
- D - Front left
- E - Front left
- F - Instrument panel
- G - Instrument panel
- H - Rear
- I - Instrument panel
- J - Instrument panel



97-4117

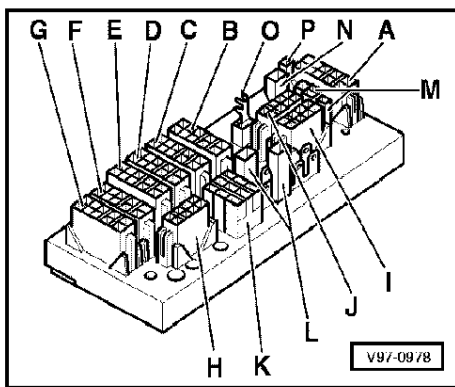
97-7

- K - Connection, relay position 3
- L - Single connector, terminal 30
- M - M-Options
- N - Output, glow-plug strip fuse
- O - Output, intake manifold preheating
- P - Output, fuse 20



97-4117

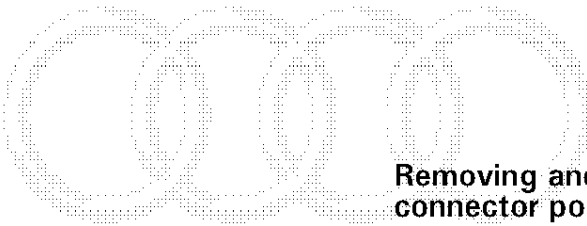
97-8



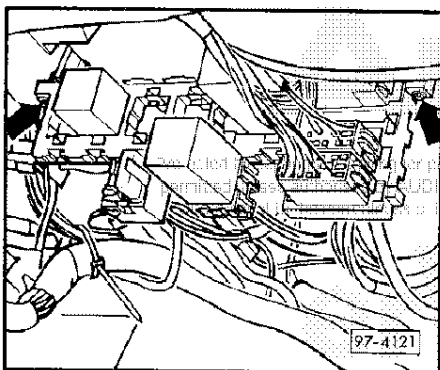
◀ Plug housing assignment

Terminal	Plug housing colour	Connection
A	Grey	8-pin
B	Black	8-pin
C	Blue	8-pin
D	green	8-pin
E	Yellow	8-pin
F	Brown	8-pin
G	red	8-pin
H	Black	6-pin
I	red	6-pin
J	Yellow	6-pin
K	Black	9-pin
L	Black	single
M	colourless	single ¹⁾
N	colourless	single
O	Black	single
P	red	single

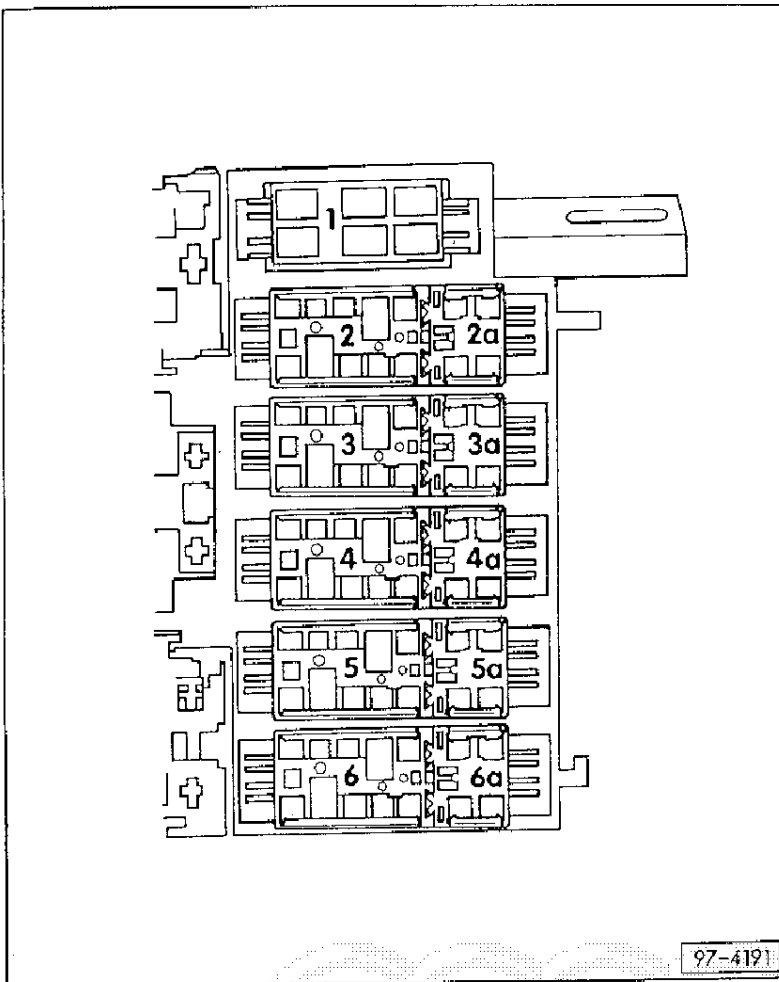
¹⁾ at contacts 75 ak, 75 as, 75 s, 30 ac, 30 az



Removing and installing auxiliary relay carrier with connector point



- Remove driver's side tray.
- = > General body repairs; Repair group 70; Dash panel, Removing driver's storage compartment = >
- Remove fastening screws -arrows- and pull relay carrier downwards;

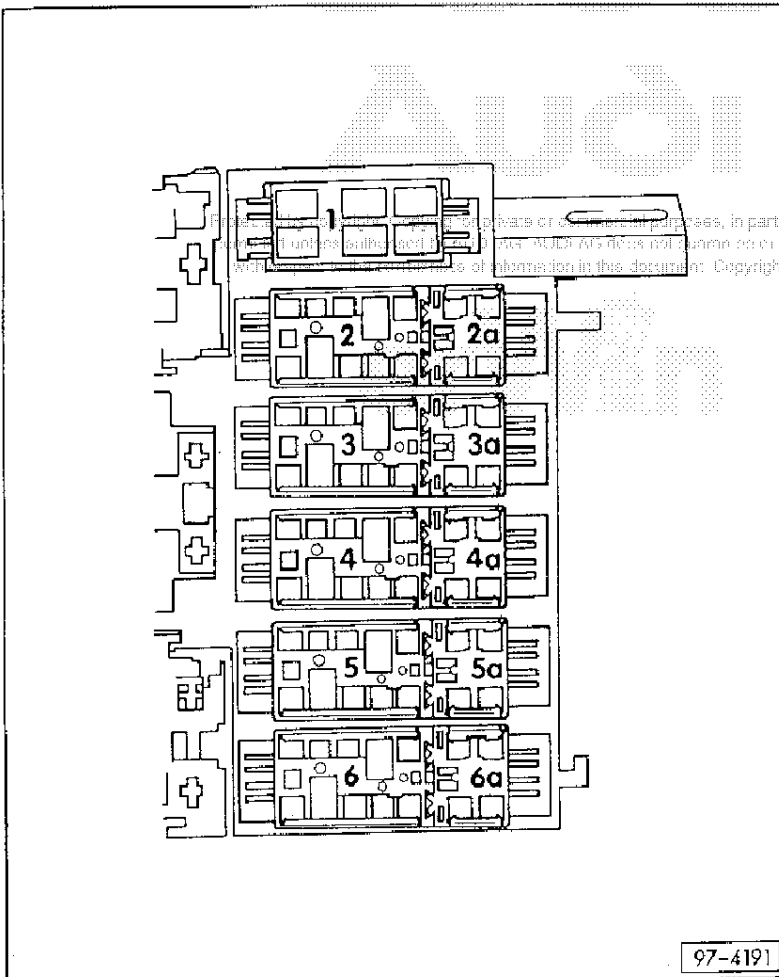


97-4191

Arrangement if connectors in connector point

Notes:

- ◆ Use appropriate current flow diagram.
- = > "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder
- ◆ If various wiring looms for options have not been fitted, there will be an empty housing at this point.
- 1 - Wiring loom, wiper motor (black)
- 2 - Wiring loom, automatic gearbox (green)
- 2a - Wiring loom, AC compressor (green)



97-4191

- 3 - Wiring loom, front left (yellow)
- 3a - Wiring loom, seat heating (yellow)
- 4 - Wiring loom, ABS (blue)
- 4a - Wiring loom, cruise control system (blue)
- 5 - Wiring loom, rear (brown)
- 5a - Wiring loom, door contact switch (brown)
- 6 - Wiring loom, front right (black)
- 6a - Wiring loom, front right (black)

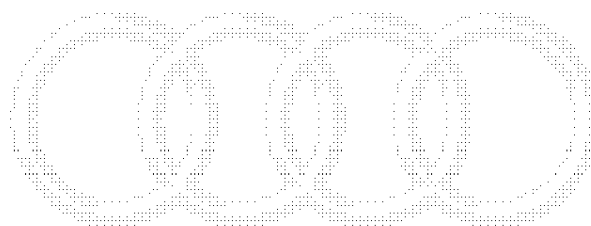
Workshop Manual

Audi 80 1992 ▶

***Booklet* 6-Speed Manual Gearbox
01E Four-Wheel Drive**

Edition 02.97

Gearbox code letters: CGR CRB



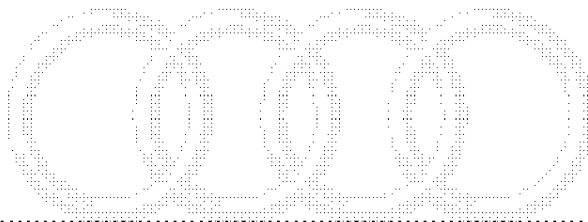
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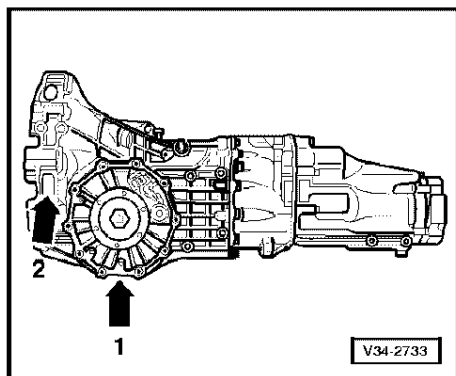
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Gearbox identification

The 6-speed manual gearbox 01E (four-wheel drive) is installed in Audi 80 S2 and Audi Avant RS2 models from 11.92.

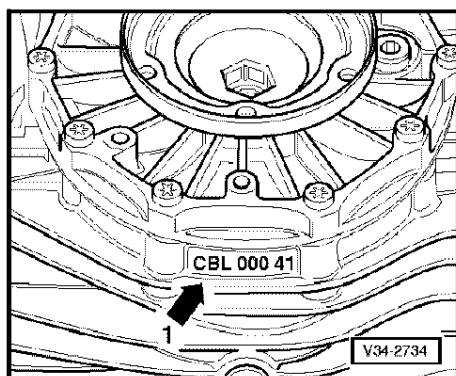
Allocation = > Page 00-3.



Location on gearbox

- ◆ Code letters and serial number -arrow 1-
- ◆ Manual gearbox 01E -arrow 2-

00-1



Code letters and gearbox consecutive serial number -arrow 1-

Example:

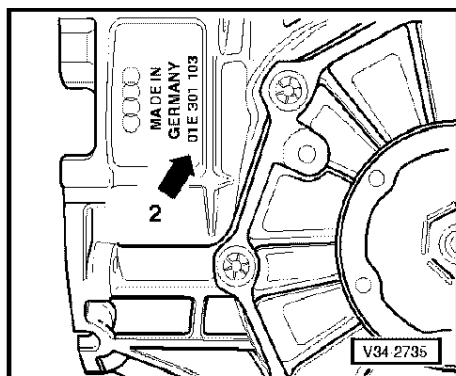
CBL	000 41
Code letters	Gearbox consecutive serial number

Additional information is related to production.

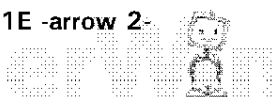
Note:

The gearbox code letters are also included on the vehicle data stickers.

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Manual gearbox 01E -arrow 2-



00-2

Code letters, allocation, ratios, capacities

Manual gearbox		6-speed 01E four-wheel drive	
Code letters		CGR ¹⁾	CRB
Manufactured	from	11.92	11.93
	to	12.95	12.95
Allocation	Model	Audi80 S2, Audi Avant RS2	Audi Avant RS2
	Engine	2.2 ltr – 169 kW 2.2 ltr – 232 kW	2.2 ltr – 232 kW
Ratios Z2:Z1 = i	Final drive	37 : 9 = 4.111	
	1st gear	28 : 8 = 3.500	
	2nd gear	34 : 18 = 1.889	
	3rd gear	33 : 25 = 1.320	
	4th gear	30 : 29 = 1.034	
	5th gear	30 : 35 = 0.857	
	6th gear	27 : 37 = 0.730	
	Reverse gear	38 : 11 = 3.455	

¹⁾ From 04.95 onwards (gearbox serial No.77644) the 1st speed gear and sliding gear are wider. At the same time the bearing plate was modified and the width of the cylinder roller bearing inner race was reduced.

00-3

Code letters	CGR ¹⁾	CRB
Speedometer	electronic	
Capacity	2.7 litres)	2.3 litres
Specification	Gear oil G 052 911 A SAE 75 W 90 (synthetic oil)	
Clutch mechanism	hydraulic	
Clutch plate dia.	240 mm	
Drive shaft flange	for triple roller joint	
Overall ratio i _{ov} in top gear	3.000	
Allocation: rear final drive (code letters)	AZE	

¹⁾ From 04.95 onwards (gearbox serial No.77644) the 1st speed gear and sliding gear are wider. At the same time the bearing plate was modified and the width of the cylinder roller bearing inner race was reduced.

²⁾ Capacity for Avant RS2: 2.3 litres

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00-4

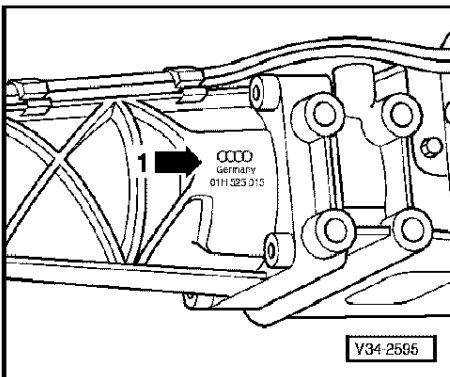
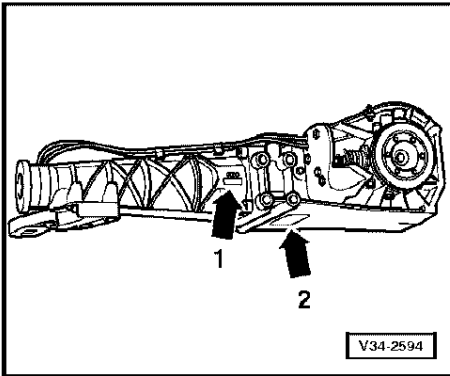
Identification of rear final drive

Final drive 01H is fitted in conjunction with manual gearbox 01E (four-wheel drive).

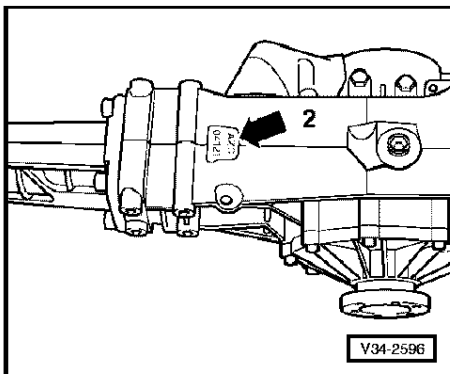
Allocation = > Page 00-7, Technical data.

Location on final drive

- ◆ Final drive 01H -arrow 1-
- ◆ Code letters and date of manufacture -arrow 2-



Final drive 01H -arrow 1-



Code letters and date of manufacture of rear final drive -arrow 2-

Example:	AZC	04	12	1
	Code letters	Day	Month	Year (1991)
				of manufacture

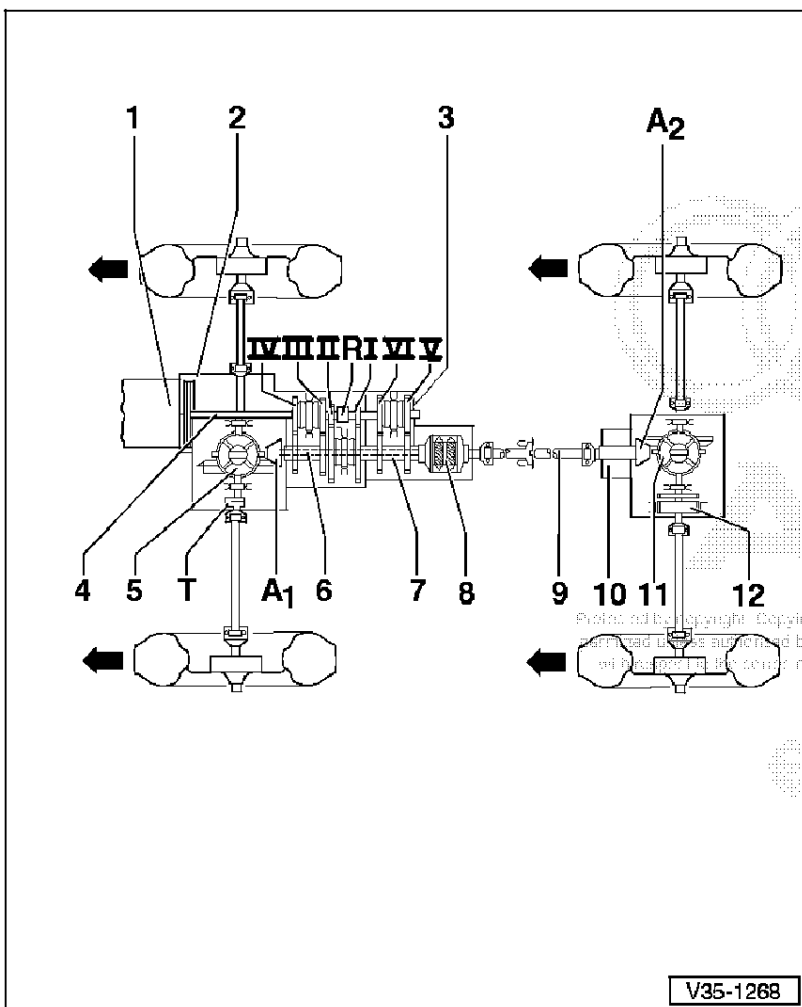
Note:

The code letters of the rear final drive are also given on the vehicle data stickers.

Code letters, allocation, ratios, capacities

Rear final drive		01H.1
Code letters		AZE
Manufactured	from to	11.92 12.95
Allocation	Model Engine	Audi 80 S2, Audi Avant RS2 2.2 ltr – 169 kW, 2.2 ltr – 232 kW
Ratio	Final drive	37 : 9 = 4.111
Capacity		1.3 litres
Specification		Gear oil GL 5 SAE 90 (MIL-L 2105 B)
Drive shaft flange dia.		108 mm
Allocation: manual gearbox (code letters)		CGR CRB

00-7



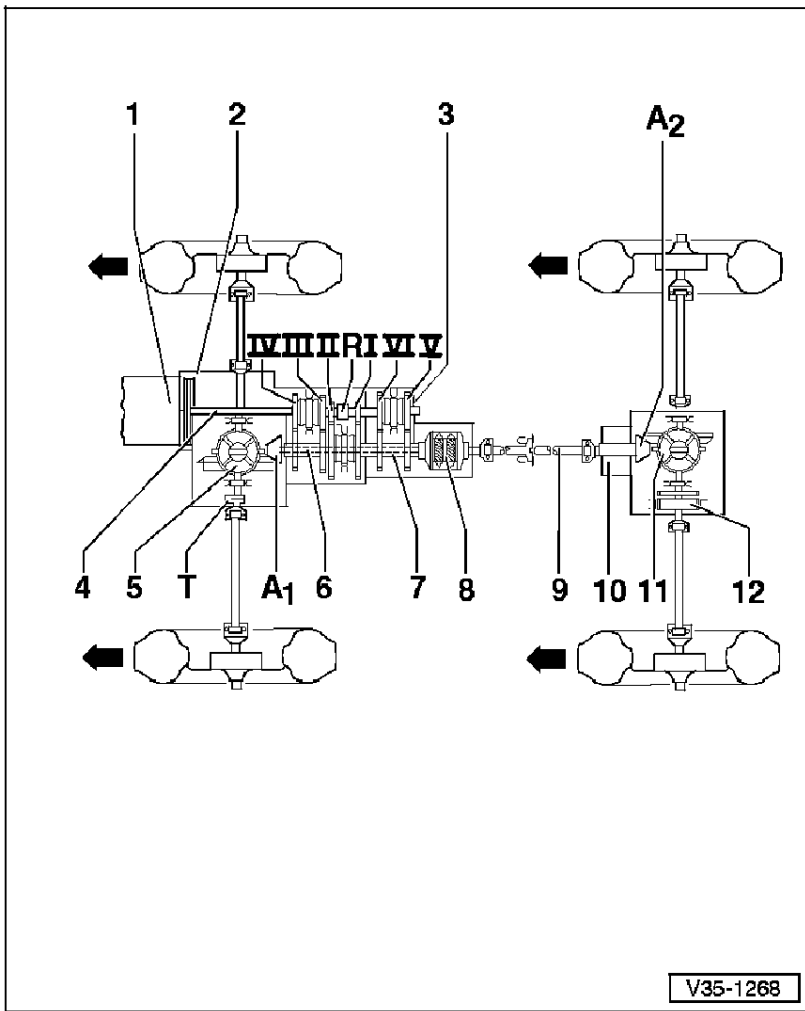
Transmission layout

- 1 – Engine
- 2 – Clutch
- 3 – Gearbox
- 4 – Input shaft (main shaft)
- 5 – Front differential
- 6 – Front drive pinion (output shaft)
- 7 – Hollow shaft
- 8 – Torsen differential

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00-8



9 – Propshaft

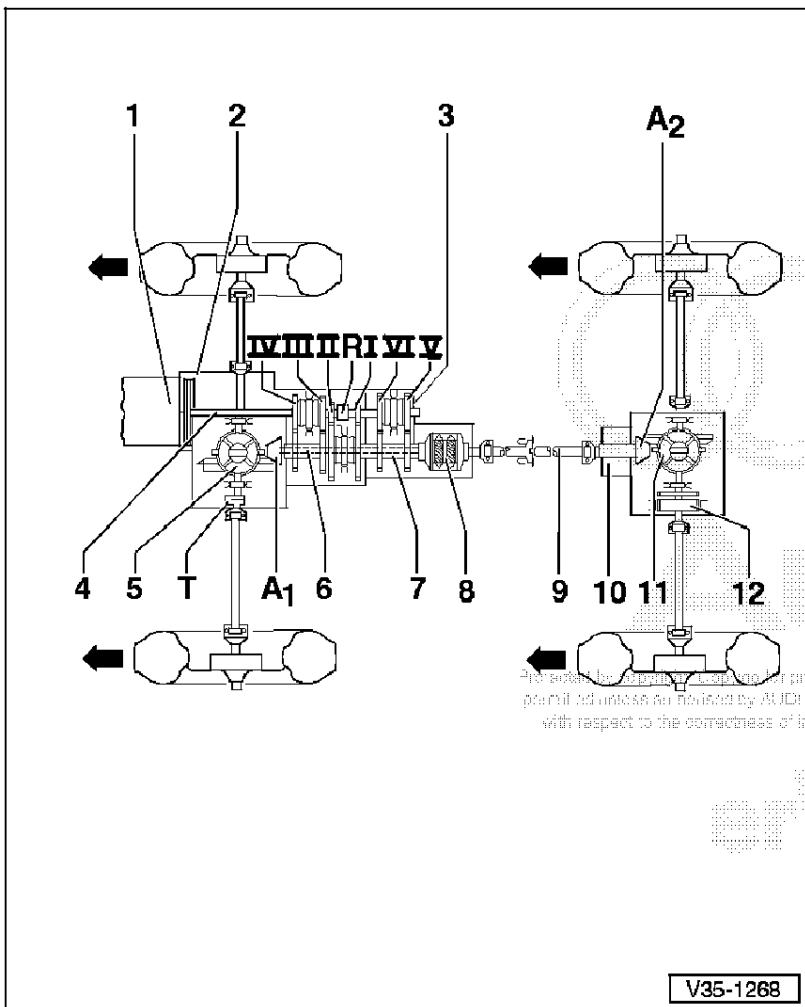
10 – Rear drive pinion

11 – Rear differential

12 – Differential lock

Note:

Arrows point in forward direction of travel.



– I - 1st gear

– II - 2nd gear

– III - 3rd gear

– IV - 4th gear

– V - 5th gear

– VI - 6th gear

– R - Reverse gear

– A1 - Front final drive

– A2 - Rear final drive

– T - Speedometer drive, electronic

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Notes on engine output/brake test and towing/tow starting

- ◆ Engine output and brake test
=> Special Information; Transmission; No. 8
- ◆ Tow-starting and towing
=> Booklet; Maintenance

00-11

Calculations

Calculating transmission ratios "i"

Transmission ratio

Transmission ratio = No. of teeth driven gear : No. of teeth drive gear

Ratios

iG = gear ratio
iA = axle ratio
iov = overall ratio

Formula

ZG2 : ZG1
ZA2 : ZA1
iG x iA

Example:

6th gear
Drive gear ZG1 = 37
Driven gear ZG2 = 27

Final drive
ZA1 = 9
ZA2 = 37

Calculating:

iA = $37 : 9 = 4.111$
iG = $27 : 37 = 0.730$
iov = $(27 : 37) \times (37 : 9) = 0.730 \times 4.111 = 3.000$

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00-12

Calculating speed "V"

V	=	n : iovxUA x 0.06
n	=	Engine speed (rpm)
iov	=	Overall ratio
UA	=	Dynamic rolling circumference of tyres (m)
V	=	Road speed (km/h)

Example:

$$V = 1000 : 3.000 \times 1.93 \times 0.06 = 39 \text{ km/h}$$

The road speed at an engine speed of 1000 rpm in 6th gear is 39 km/h.

Repair instructions

The maximum possible care and cleanliness and proper tools are essential to ensure satisfactory and successful gearbox repairs. The usual basic safety precautions also, naturally apply when carrying out vehicle repairs.

A number of generally applicable instructions for individual repair operations, which are otherwise mentioned at various points in the Workshop Manual, are summarized here. They apply to this Workshop Manual.

Special tools

For a complete list of special tools used in this Workshop Manual
=> Booklet; Special tools, Workshop equipment

Gearbox

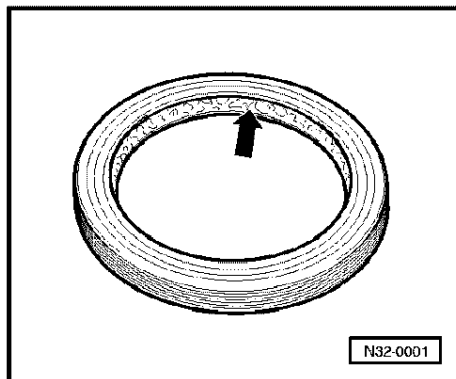
- ◆ When exchanging the manual gearbox or rear final drive, check oil level and top-up if necessary => Page 34-29 or Page 39-69.
- ◆ Capacities and specifications => from Page 00-3 or Page 00-7.



- ◆ Thoroughly clean all connections and the surrounding area before disconnecting.
- ◆ When installing gearbox, ensure dowel sleeves are correctly seated.

O-rings, seals, gaskets

- ◆ Always renew O-rings, seals and gaskets.
- ◆ After removing gaskets and seals, always inspect the contact surface on the housing or shaft for burrs resulting from removal or for other signs of damage.
- ◆ Thoroughly clean housing joint surfaces before assembling.
- ◆ Before installing radial shaft oil seals, lightly oil outer edge and fill space between sealing lips -arrow- with grease.
- ◆ The open side of the oil seals faces toward the side with fluid filling.
- ◆ When replacing oil seals, always vary the point at which the sealing lips make contact (use insertion depth tolerances).
- ◆ Lightly oil O-rings before installing; this prevents the rings being crushed when inserting.



- ◆ Check oil level after renewing gaskets and seals => Page 34-29 or 39-69.

Sealants

- ◆ Thoroughly clean housing joint surfaces before applying sealing paste.
- ◆ Apply sealing paste AMV 188 200 03 evenly and not too thick.
- ◆ Breather holes must remain free of sealing paste.

Locking elements

- ◆ Always renew circlips.
- ◆ Do not over-tension circlips.
- ◆ Circlips must be properly seated in the base of the groove.
- ◆ Always renew roll pins.

Note:

The roll pins for securing the selector fork/selector rail for 5th/6th gear must only be assembled or dismantled using the special tool => Page 34-67.



Nuts, bolts

- ◆ Loosen nuts or bolts, opposite to tightening sequence.
- ◆ Nuts and bolts which secure covers and housings should be slackened and tightened crosswise in stages if no tightening sequence is specified.
- ◆ The tightening torques stated apply to non-oiled nuts and bolts.
- ◆ Always renew self-locking nuts and bolts.
- ◆ The threads of bolts which are secured by a locking fluid should be cleaned with a wire brush. Then apply AMV 185 101 A1 when inserting.
- ◆ Threaded holes into which self-locking bolts or bolts coated with locking fluid are screwed, must be cleaned (e.g. tap). Otherwise there is a danger of bolts shearing when subsequently being removed.

00-17

Bearings

- ◆ Install needle bearings with the lettering on the bearing (the side with thicker metal) facing towards the drift or other tool used for installing.
- ◆ Mark needle bearings of 1st to 6th speed sliding gears when removing, this ensures that when installing, the same installation position can be guaranteed.
- ◆ Grease needle bearing for gearbox input shaft in rear of fly-wheel.
- ◆ Lubricate all bearings in gearbox housing with gear oil before installing.
- ◆ Heat inner races of taper roller bearings to approx. 100 °C before installing. Press in onto stop when installing so there is no axial clearance.
- ◆ Do not interchange the outer or inner races of bearings of the same size.
- ◆ Always replace the taper roller bearings on one shaft together and use new bearings from a single manufacturer.
- ◆ The taper roller bearings for the output shaft and the differential in the gearbox are low-friction bearings. Do not additionally oil new taper roller bearings when measuring friction torque. The bearings are pre-treated at the factory with a special type of oil for this purpose.

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00-18

Shims

- ◆ Use a micrometer to measure the shims at several points. Different tolerances make it possible to obtain the exact shim thickness required.
- ◆ Inspect for burrs and signs of damage. Install only shims which are in perfect condition.

Synchroniser rings

- ◆ Do not interchange synchroniser rings. When reusing always fit to the same gear.
- ◆ Check for wear, renew if necessary.
- ◆ Lubricate with gear oil before installing.

Gears, synchro-hubs, inner races for sliding gears

- ◆ Heat gears and synchro-hubs to approx. 100 °C before installing. Press in onto stop when installing so there is no axial clearance.
- ◆ Heat inner races for sliding gears to approx. 100 °C when installing.
- ◆ The temperature can be checked with Temperature tester V.A.G 1558.
- ◆ Observe installation position.

00-19

Sliding gears

- ◆ After installing, check 1st to 6th speed sliding gears for axial clearance of 0.15 ... 0.35 mm and check that they rotate freely.

Notes:

- ◆ In gearboxes with code letters CGR from serial No. 77644 onwards and in gearboxes with code letters CRB the 1st speed gear and sliding gear are wider. At the same time the bearing plate was modified and the width of the cylinder roller bearing inner race was reduced.
- ◆ Mixed installation of components belonging to the old and new versions in the same gearbox is not permissible.

Clutch mechanism

- ◆ When removing gearbox, remove clutch slave cylinder without disconnecting pipes.
- ◆ Do not depress clutch pedal after removing slave cylinder. Otherwise the piston will be pressed out of the slave cylinder.
- ◆ Do not cant clutch pressure plate, loosen and tighten in a diagonal sequence and in stages.
- ◆ To reduce odour caused by a burnt clutch, thoroughly clean the clutch bellhousing, the flywheel and the parts of the engine facing the gearbox.

00-20

Servicing clutch mechanism

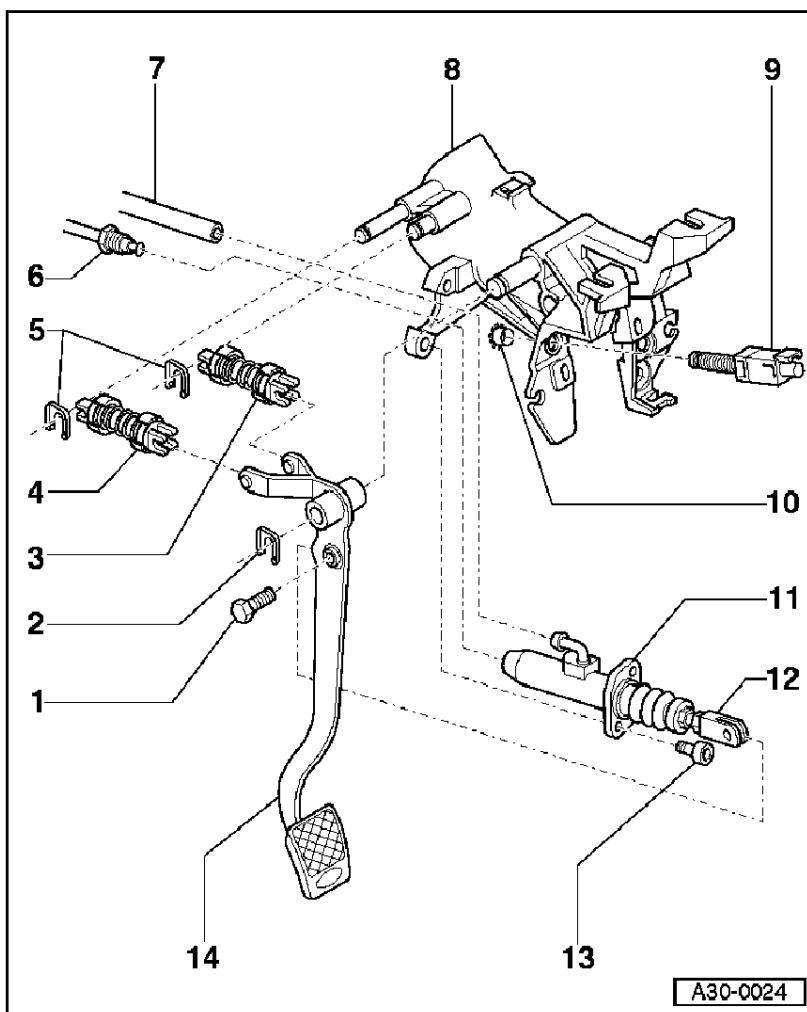
Assembly overview, pedal cluster

Notes:

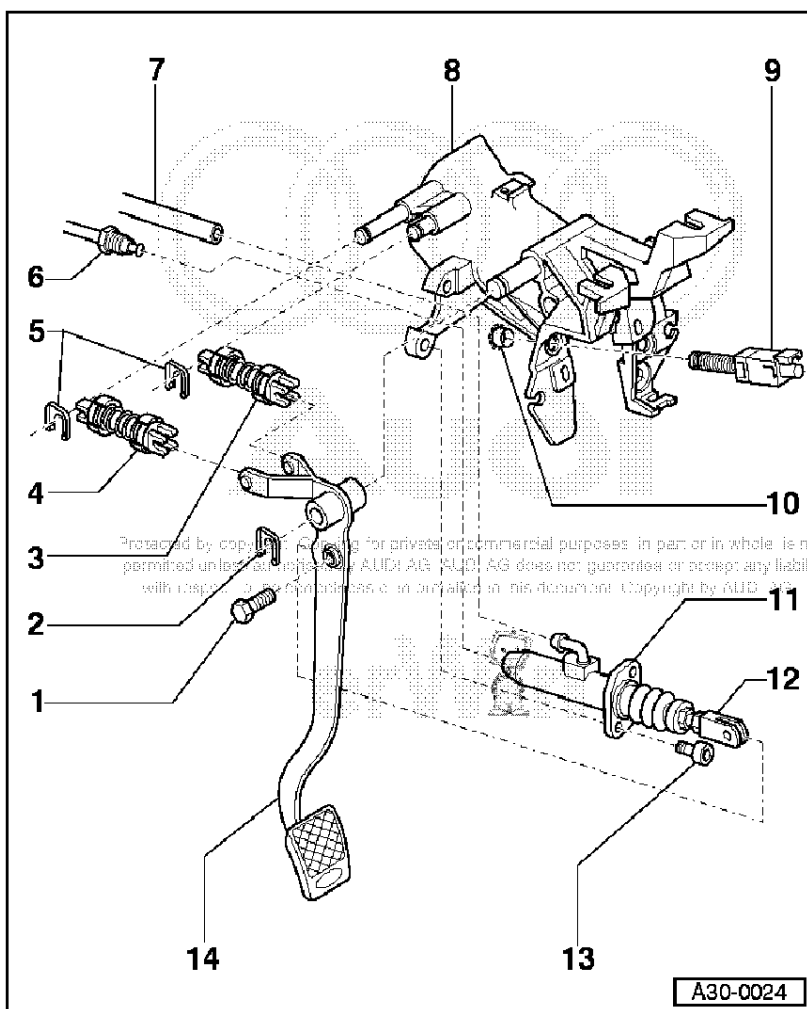
- ◆ Grease all bearing points with poly-carbamide grease G 052 142 A2 before assembling.
- ◆ The clutch pedal travel must not be restricted by additional floor coverings.

1 - Bolt - 25 Nm

- ◆ Self-locking
- ◆ Always renew
- ◆ Insert in clevis and screw into clutch pedal



30-1



2 - Securing clip

- ◆ Renew
- ◆ Fit onto pivot pin on pedal bracket

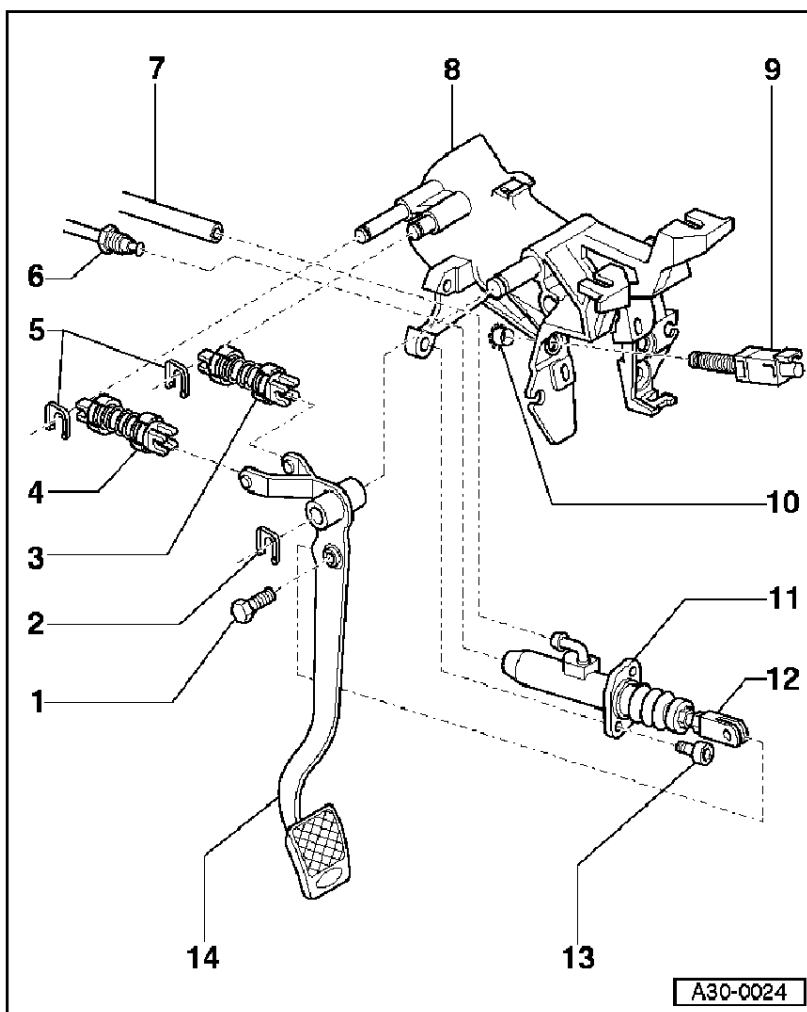
3 - Assister spring

- ◆ Identification: brown
- ◆ Installation position: goes towards centre tunnel
- ◆ Do not grease spring
- ◆ Only grease moving surfaces on pedal and pedal bracket
- ◆ Removing and installing => Fig. 3

4 - Over-centre spring

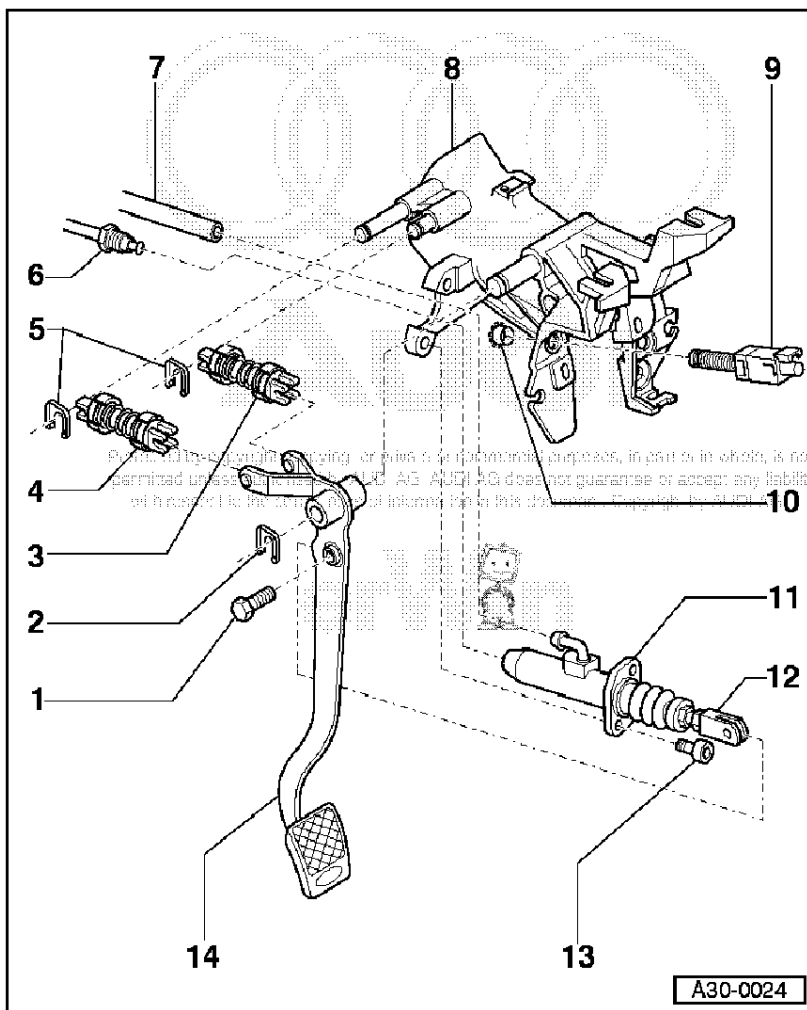
- ◆ Identification: red
- ◆ Installation position: goes towards outside of vehicle
- ◆ Do not grease spring
- ◆ Only grease moving surfaces on pedal and pedal bracket
- ◆ Removing and installing => Fig. 2

30-2



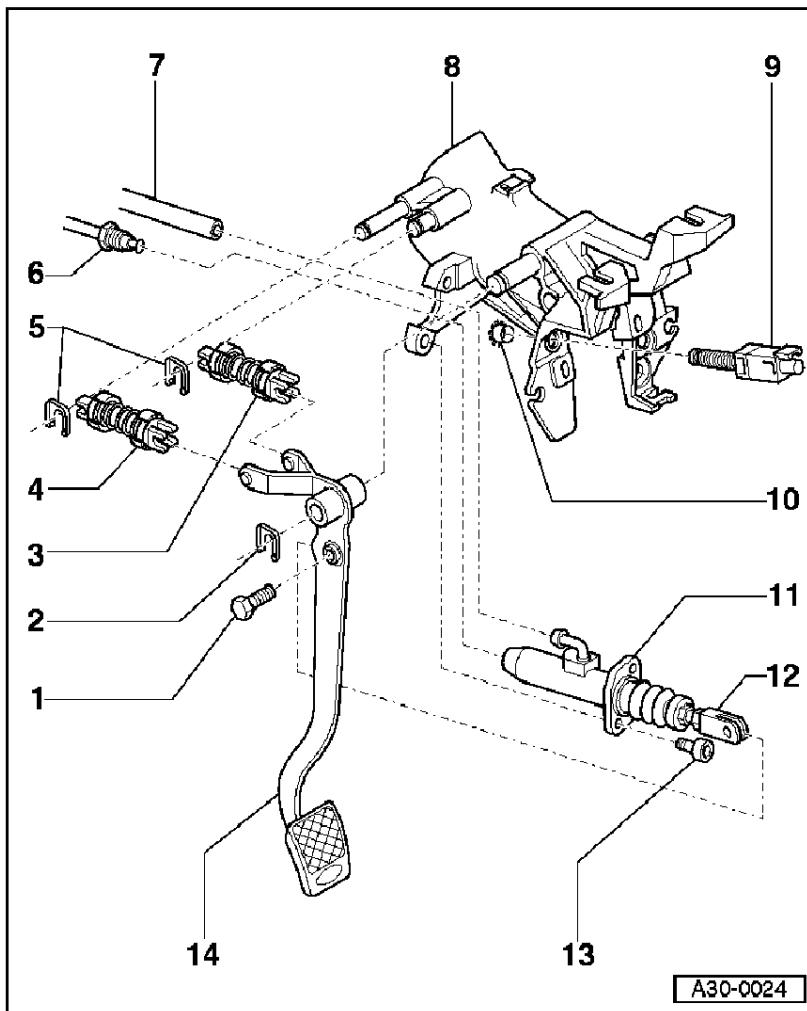
A30-0024

- 5 – Securing clip
 - ◆ Renew
- 6 – Pipe
 - ◆ For clutch master cylinder
 - ◆ Tighten nut on pipe connection to 15 Nm
- 7 – Supply hose
 - ◆ For master cylinder
 - ◆ Must not touch over-centre spring
 - ◆ Locate accordingly on pedal bracket and secure with cable clip
- 8 – Pedal bracket
 - ◆ Removing and installing
 => Running gear, Four-wheel drive; Repair group 46; Removing, installing and servicing pedal cluster for vehicles with 169 kW engine =>

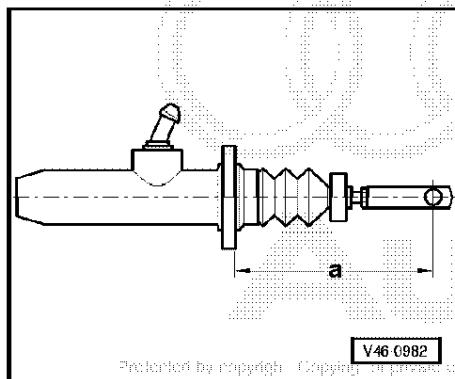


A30-0024

- 9 – Vent valve
 - ◆ For cruise control system
 - ◆ Renew
 - ◆ Press in valve after fitting clip
 - ◆ Adjust valve with clevis connected:
 - Depress clutch pedal
 - Press in vent valve onto stop
 - Pull back clutch pedal onto stop by hand
- 10 – Clip
 - ◆ Secures vent valve for cruise control
 - ◆ Using pliers, press into holes in pedal bracket as far as stop



- 11 - Master cylinder
 - ◆ Renew if leaking
- 12 - Clevis
 - ◆ Adjusting => Fig. 1
- 13 - Bolt - 20 Nm
- 14 - Clutch pedal
 - ◆ Is located in correct position by clevis adjustment
 - ◆ Can be renewed with pedal bracket installed in vehicle
 - ◆ Fit onto pivot pin on pedal bracket
 - ◆ Bearing bush cannot be replaced separately; pedal is supplied as replacement part with integral bush.



◀ **Fig.1 Adjusting clevis**

- Check distance -a- when master cylinder is renewed, and adjust as necessary.
 - When measuring, clevis must be at right angles to mounting surface of clutch master cylinder.
 - Distance a = 109.5 ± 0.5 mm
- To adjust, turn clevis.

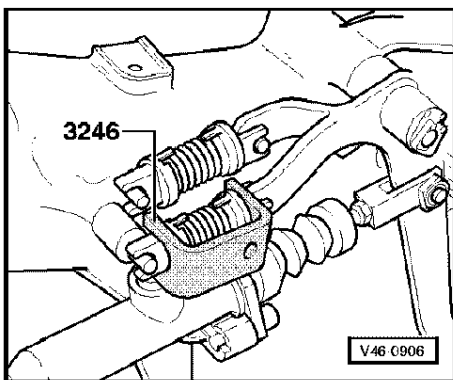
Notes:

If the clevis is correctly adjusted and the clutch pedal does not return properly by itself, this can be caused by the following:

- ◆ Air in hydraulic system.
- ◆ Pedal bearing or over-centre spring not moving freely.

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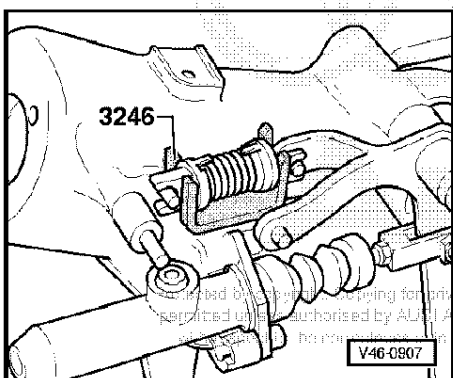
◀ Fig.2 Removing and installing over-centre spring

- Remove left-hand storage compartment
=> General body repairs; Repair group 70; Dash panel; Removing driver's side storage compartment =>
- Take securing clip off pivot pin.
- Slide installation clamp 3246 onto over-centre spring from the side.
- Depress clutch pedal and remove over-centre spring together with installation clamp.

Notes:

- ◆ Installation clamp 3246 is shown in the illustration with the pedal bracket removed.
- ◆ Before assembling, lubricate moving parts with G 052 142 A2 polycarbamide grease.

— 30-7 —



◀ Fig.3 Removing and installing assister spring

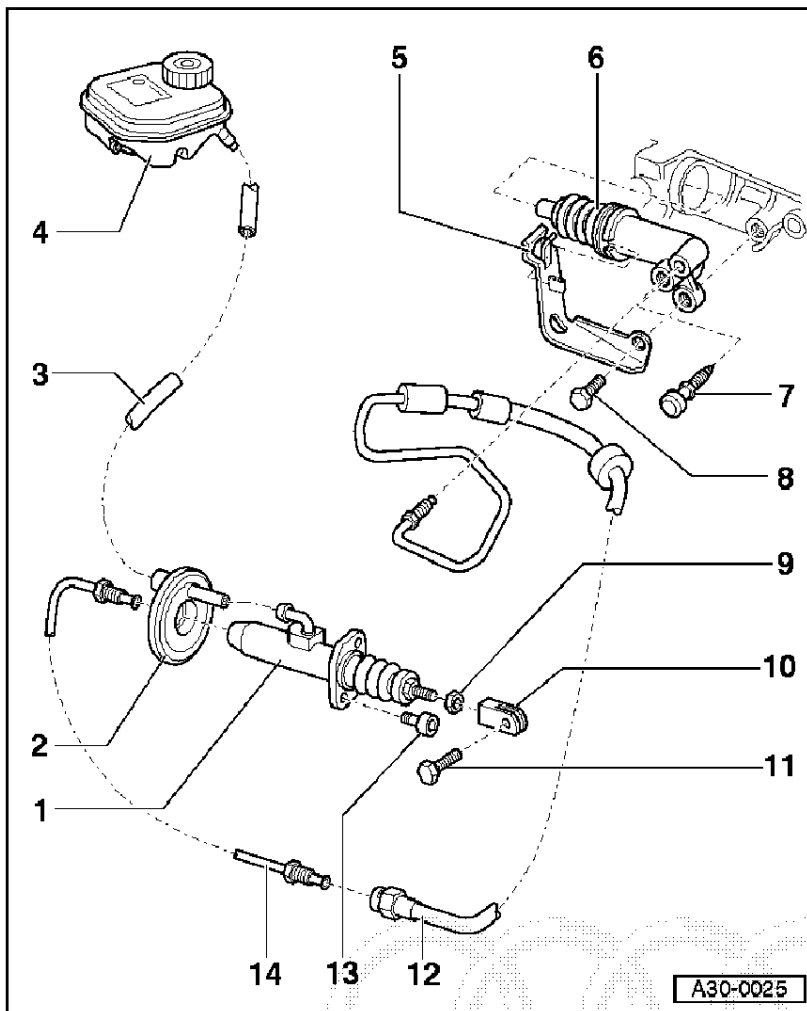
- Remove over-centre spring => Fig. 2.
- Take securing clip off pivot pin.
- With clutch pedal slightly depressed, slide installation clamp 3246 onto assister spring from below.
- Depress clutch pedal and remove assister spring together with installation clamp.

Notes:

- ◆ Installation clamp 3246 is shown in the illustration with the pedal bracket removed.
- ◆ Before assembling, lubricate moving parts with G 052 142 A2 polycarbamide grease.



— 30-8 —



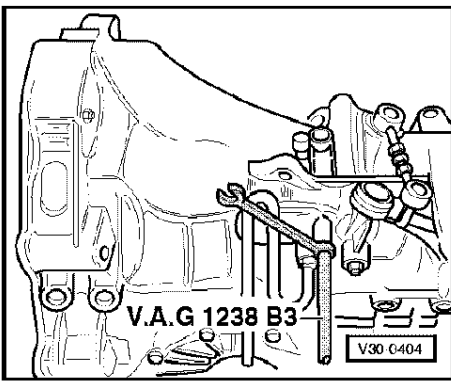
- 12 – Pressure hose
 - ◆ Tighten nut on pipe connection to 15 Nm
- 13 – Bolt – 20 Nm
- 14 – Pipe
 - ◆ For clutch master cylinder
 - ◆ Tighten nut on pipe connection to 15 Nm

Bleeding clutch system

Notes:

- ◆ The clutch system must be bled after performing work on hydraulic clutch mechanism.
- ◆ **Top-up brake fluid reservoir to "max." marking with brake fluid before bleeding clutch system.**
 - Bleed clutch system only with a brake bleeding unit.
 - Working pressure 2.5 bar
 - Use bleeder hose V.A.G 1238 B3 (670 mm long) for bleeding.
 - Connect bleeder hose to pressure hose of brake bleeding unit collector bottle.

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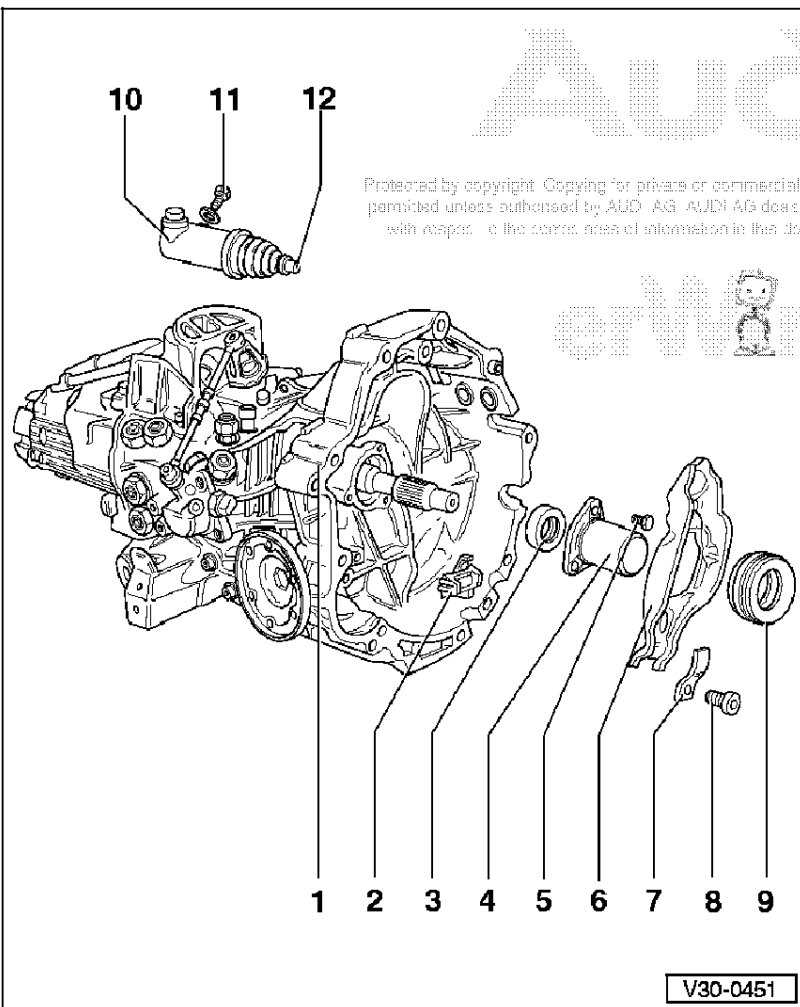


- ◀ - Fit ring spanner and hose V.A.G 1238 B3 onto bleed valve and open bleed valve.

Note:

Ensure bleeder hose is correctly fitted during bleeding operation.

- After completing bleeding operation, depress clutch pedal several times.
- Bleed system again if necessary.



Servicing clutch release mechanism

1 - Gearbox

2 - Intermediate piece

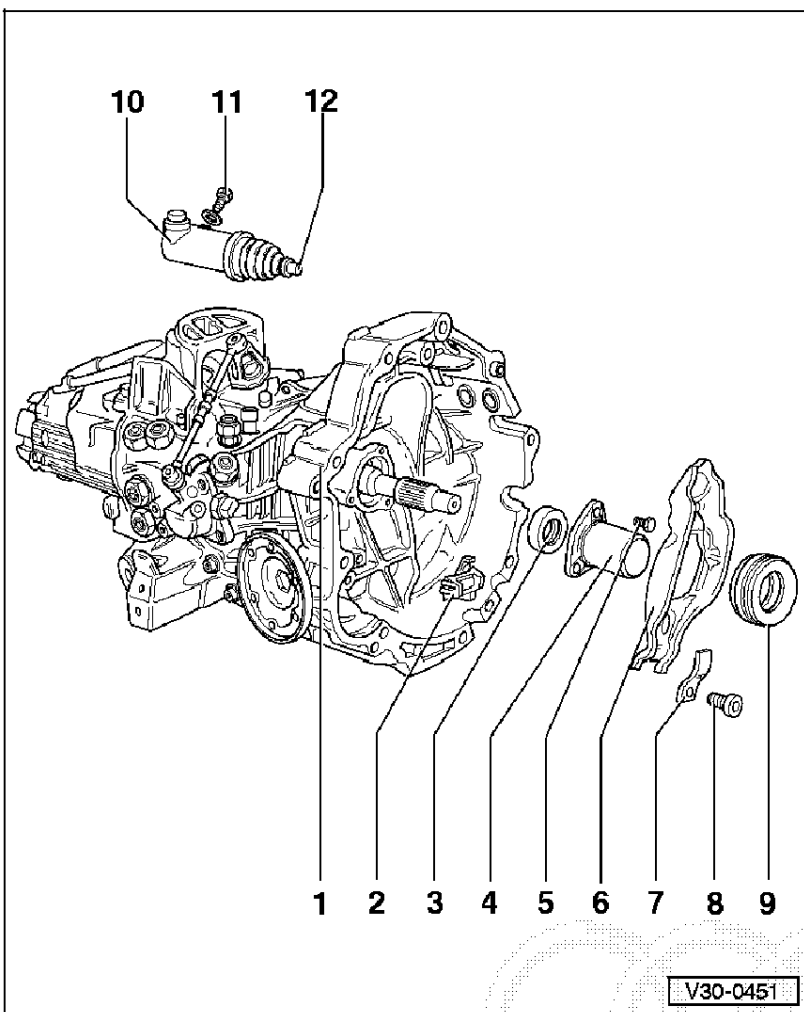
3 - Shaft seal

- ◆ For input shaft
- ◆ Removing => Fig. 1
- ◆ Installing => Fig. 2
- ◆ Pressed in to a depth of 3.5 mm at the factory
- ◆ Press in to a depth of 4.5 mm for service replacement

4 - Guide sleeve

5 - Bolt - 15 Nm

- ◆ Qty. 3



6 - Clutch release lever

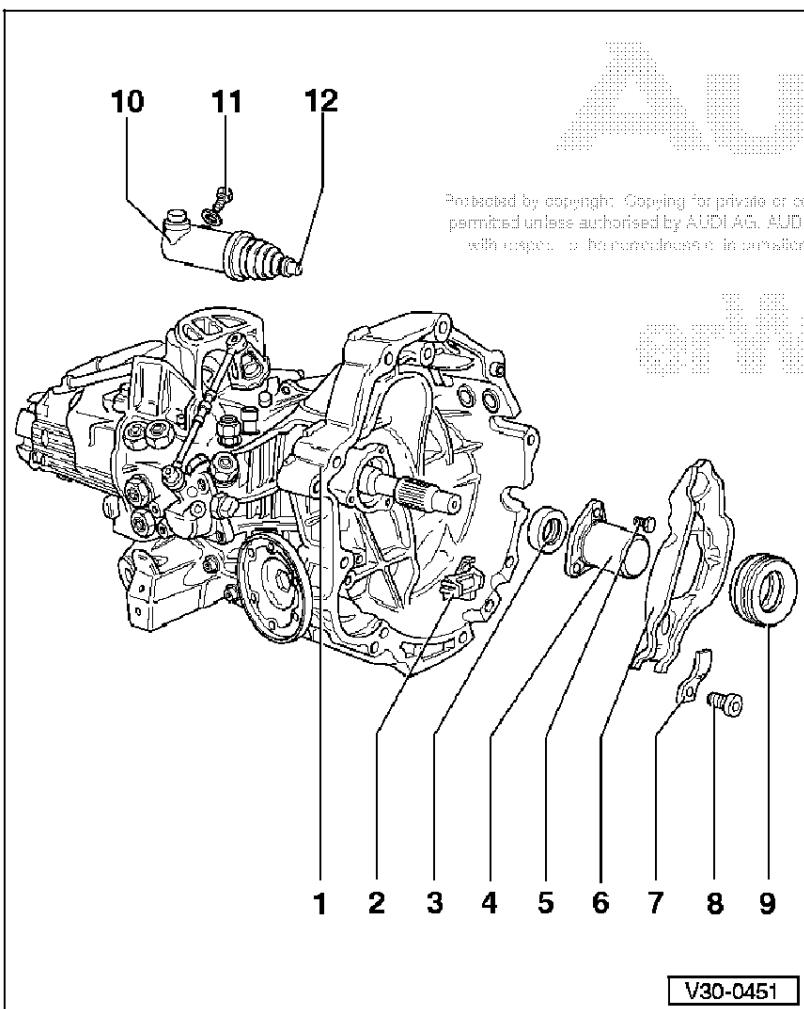
- ◆ Must engage in the lugs in intermediate piece when installed => Fig. 3
- ◆ Before installing, coat clutch slave cylinder push rod contact surface with a thin layer of copper grease, e.g. 381 351 TE

7 - Leaf spring

8 - Bolt - 25 Nm

9 - Release bearing

- ◆ Do not wash out, wipe clean only
- ◆ Renew noisy bearings
- ◆ Fit bearing onto release lever turned approx. 45° to installation position and engage by turning into position



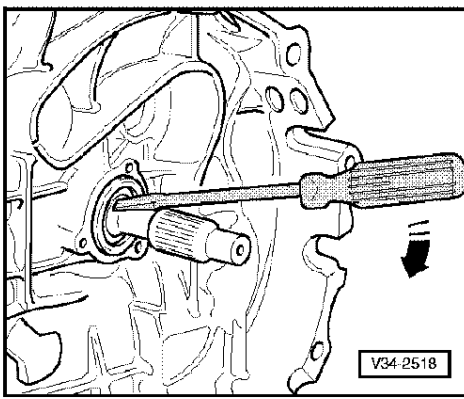
10 - Clutch slave cylinder

- ◆ Bleeding clutch system => Page 30-12
- ◆ Removing and installing => Page 30-19
- ◆ When installing, push on until the securing bolt can be fitted
- ◆ To aid installation, the securing bolt with pointed end listed in parts catalogue may be used

11 - Bolt - 25 Nm

- ◆ Renew

12 - Push rod

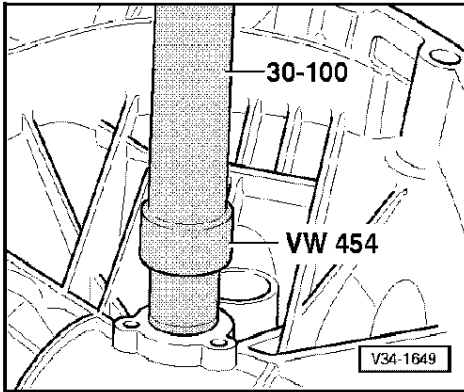


◀ **Fig.1 Removing shaft seal for input shaft**

- Lever seal out carefully with a screwdriver.

Note:

Do not damage contact surface of shaft seal on input shaft.



◀ **Fig.2 Installing shaft seal for input shaft**

- Pack space between sealing lip and dust lip of new seal for input shaft with multi-purpose grease.
- Fit a thin protective hose tightly over input shaft splines.
- Drive on seal for input shaft.
 - Pressing-in depth: 4.5 mm
- Remove protective hose.

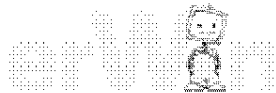
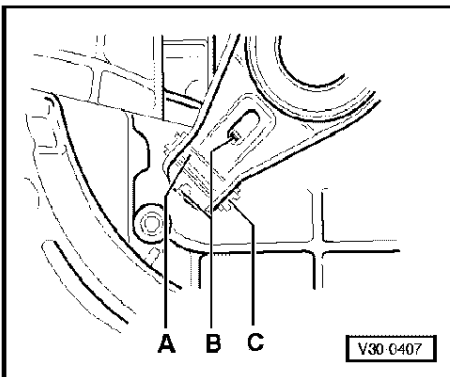


30-17

◀ **Fig.3 Installing clutch release lever**

- Fit clutch release lever -A- in intermediate piece -C-, and engage in position (retainer -B- will become visible).
- Insert leaf spring (-item 7-, Page 30-15) and tighten retaining bolt (-item 8-, Page 30-15) to 25 Nm.

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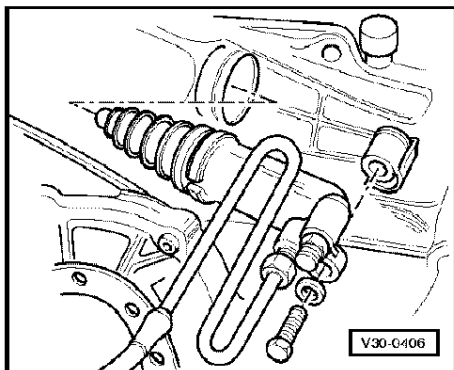
Removing and installing clutch slave cylinder

Removing

- Remove selector rod => Page 34-9.
- Disconnect hose/pipe assembly going to clutch slave cylinder at the connection point provided.

Note:

Plug hose connection with dust cap for bleeder valve.



- Unscrew retaining bolt for clutch slave cylinder, pull slave cylinder towards the rear and guide out of gearbox housing from the side.

Installing

Installation is carried out in the reverse order, when doing this note the following:

- When inserting the clutch slave cylinder into the mounting hole of the gearbox housing, keep it as far as possible in line with the direction of operation of the push rod.

30-19

Notes:

- ◆ If the clutch slave cylinder is inserted off-line there is a danger that the push rod will be guided past the clutch release lever.
- ◆ Pre-tension the clutch slave cylinder far enough for the securing bolt to be easily inserted.
- ◆ Always renew securing bolt. To aid installation, the securing bolt with pointed end listed in parts catalogue may be used.
- Bleed clutch system => page 30-12.

Adjust gear selector mechanism => Page 34-12

Tightening torques

Component	Nm
Clutch slave cylinder to gearbox	22 ¹⁾
Rear selector rod to gear stick	23

¹⁾ Self-locking bolt, always renew

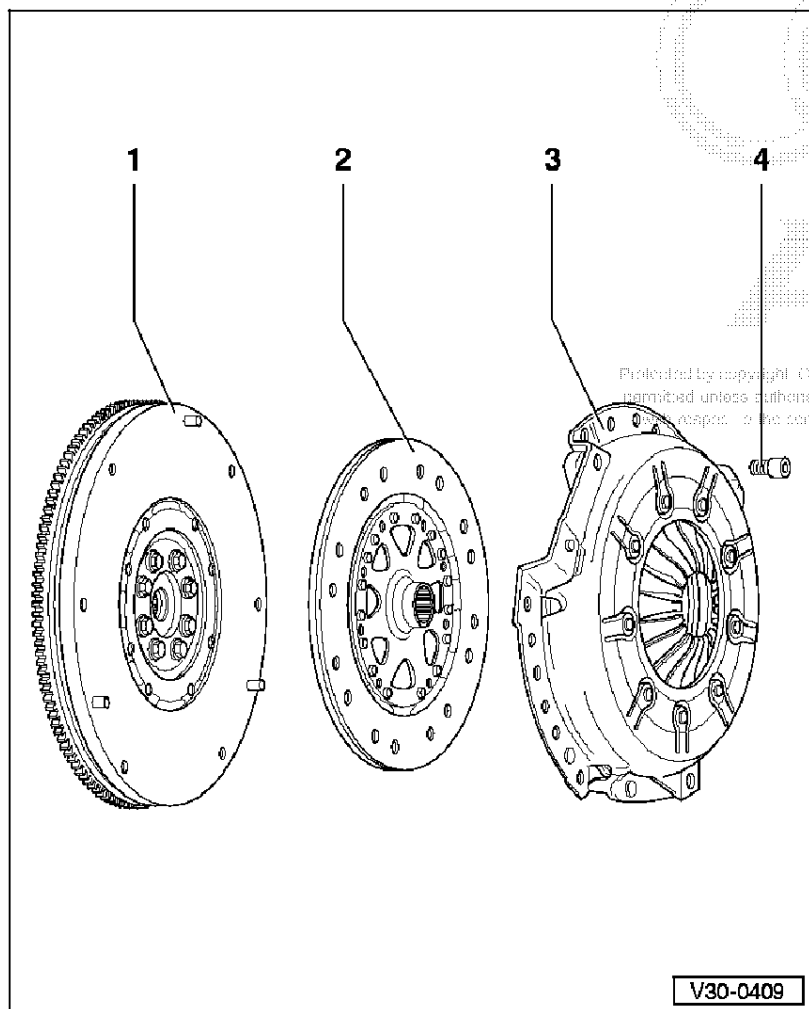
30-20

Servicing clutch

Notes:

- ◆ Before renewing the clutch plate and pressure plate
=> Fault-finding No. 9 – Defects on the clutch and clutch mechanism
- ◆ Replace clutch plates and pressure plates with damaged or loose rivets.
- ◆ Clean input shaft splines and (in the case of used clutch plates) the hub splines. Remove corrosion and apply only a very thin coating of grease G 000 100 to the splines. Then move clutch plate to and fro on input shaft until hub moves freely on shaft. Excess grease must be removed.
- ◆ Pressure plates have an anti-corrosion coating and are greased. Only the contact surface may be cleaned, otherwise the service life of the clutch will be considerably reduced.
- ◆ If the clutch has burnt out, thoroughly clean the bellhousing, flywheel and parts of the engine facing the gearbox to reduce the smell of burnt linings.

30-21



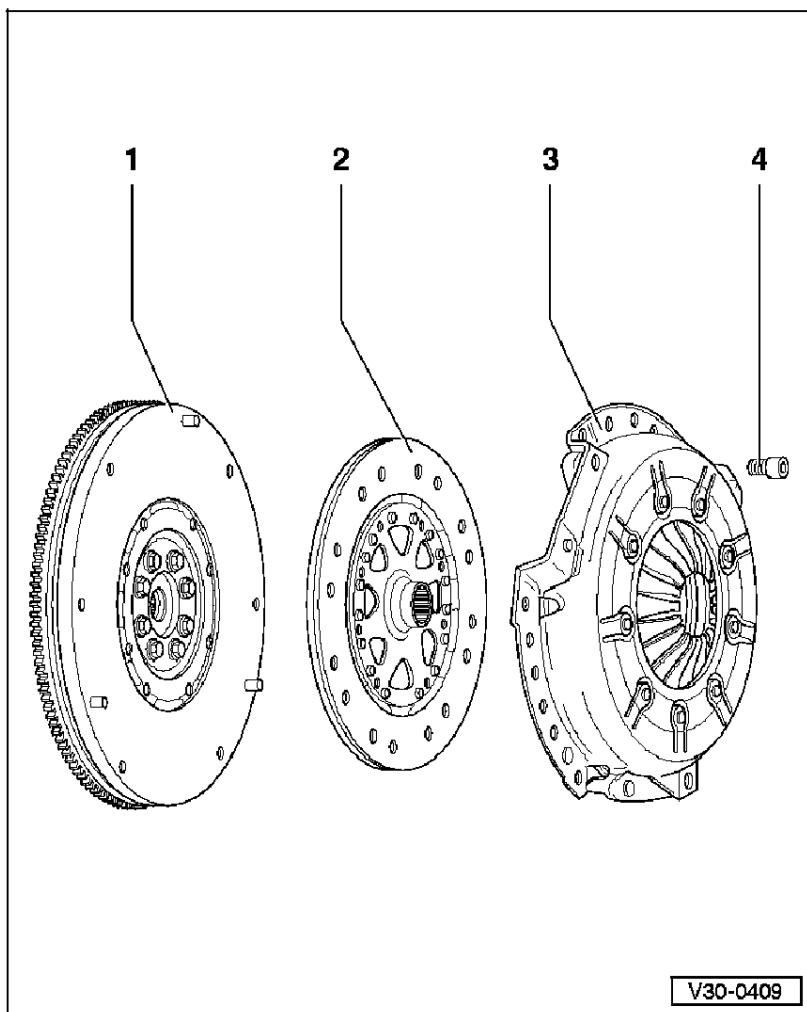
– Remove gearbox to work on clutch
=> page 34-16.

1 - Flywheel

- ◆ Ensure centring pins are tightly seated
- ◆ Contact surface for clutch lining must be free of grooves, oil and grease
- ◆ Removing and installing
- ◆ Removing and installing needle bearing in flywheel

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30-22



2 - Clutch plate

- ◆ Installation position: longer side of hub towards pressure plate and gearbox
- ◆ Centring => Fig. 1
- ◆ Do not grease
- ◆ => Notes
- ◆ Clutch plate diameter => from page 00-3

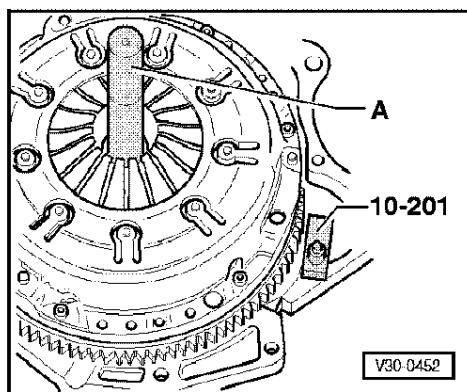
3 - Pressure plate

- ◆ Removing and installing => Fig. 1
- ◆ Checking ends of diaphragm spring => Fig. 2
- ◆ Checking spring connection and riveted fastenings => Fig. 3

4 - Bolt - 25 Nm

- ◆ Tighten in stages and diagonally

30-23



◀ Fig.1 Removing and installing clutch

- Loosen and tighten bolts in stages and diagonally - 25 Nm.
- Reverse position of counter-hold tool 10-201 when removing.
- A - Centring mandrel 3176

Notes:

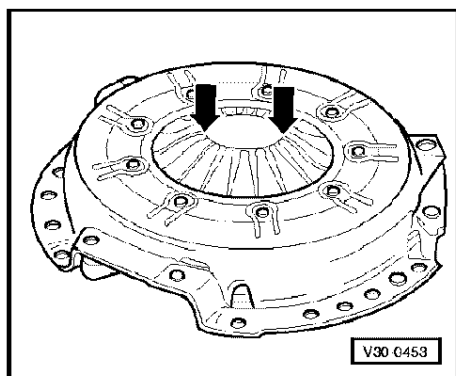
- ◆ Clutch lining and contact surface of pressure plate must make full contact with flywheel before securing bolts are inserted.
- ◆ Tighten securing bolts uniformly and in diagonal sequence to avoid damaging centring holes in pressure plate and centring pins on flywheel.

◀ Fig.2 Checking ends of diaphragm spring

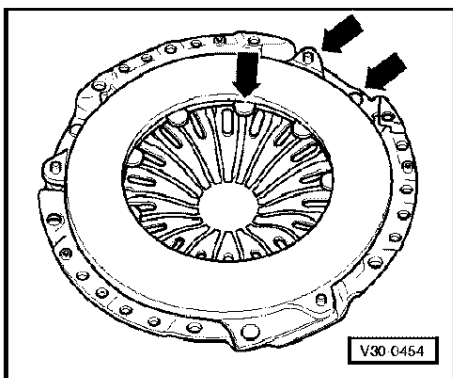
- ◆ Wear up to half the thickness of the diaphragm spring is permitted

Note:

When performing repairs always match up clutch pressure plate and clutch plate by checking engine code (see parts catalogue).



30-24



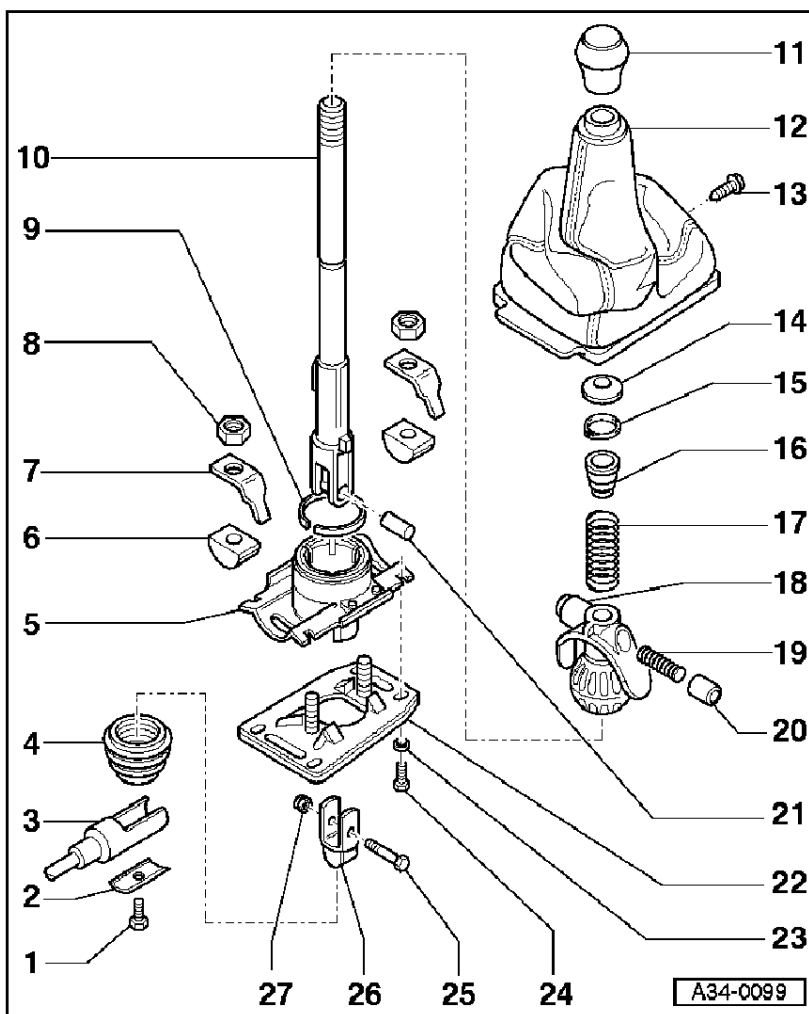
◀ Fig.3 Checking spring connection and riveted fastenings

- Check spring connection between pressure plate and cover for cracks and make sure rivet fastenings are seated tightly.
- Renew clutches with damaged springs or loose riveted fastenings -arrows-.



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Servicing selector mechanism

Removing and installing gear stick

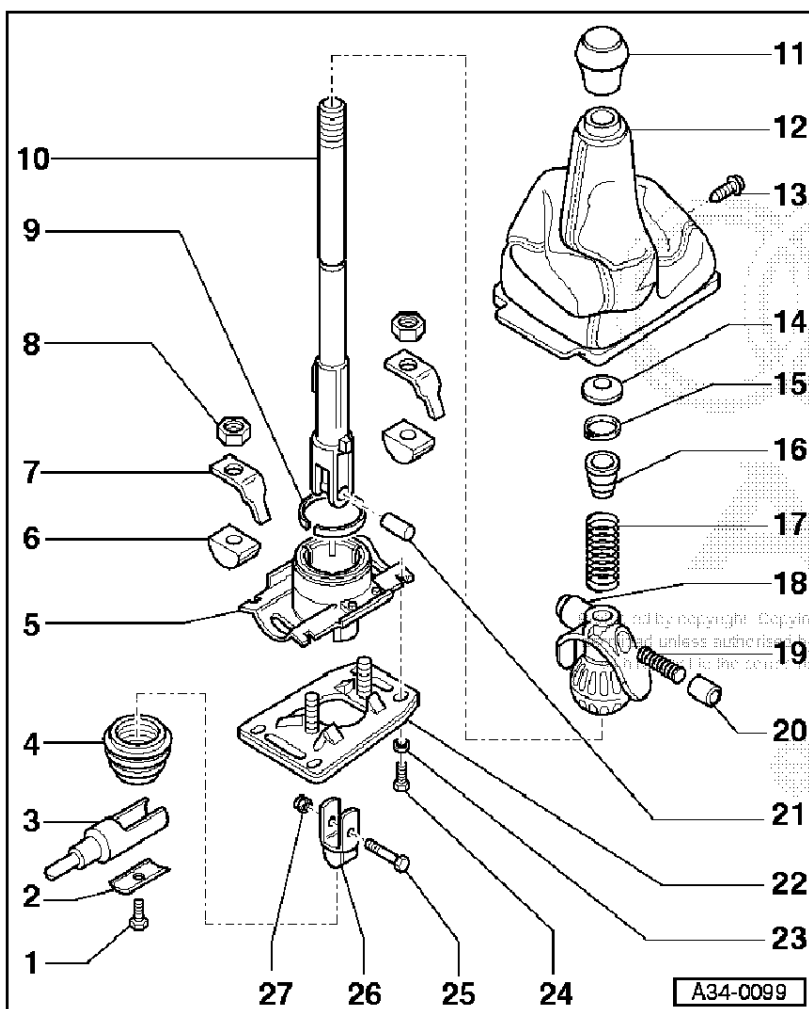
Note:

*Adjusting selector mechanism
=> Page 34-12.*

- 1 - Bolt, 23 Nm
 - ◆ On joint
 - ◆ Self-locking
 - ◆ Renew
 - ◆ Clean threads in selector fork with tap

2 - Clamp

3 - Rear selector rod



4 - Sealing collar

- ◆ Engage in gear stick mounting and selector fork

5 - Ball housing

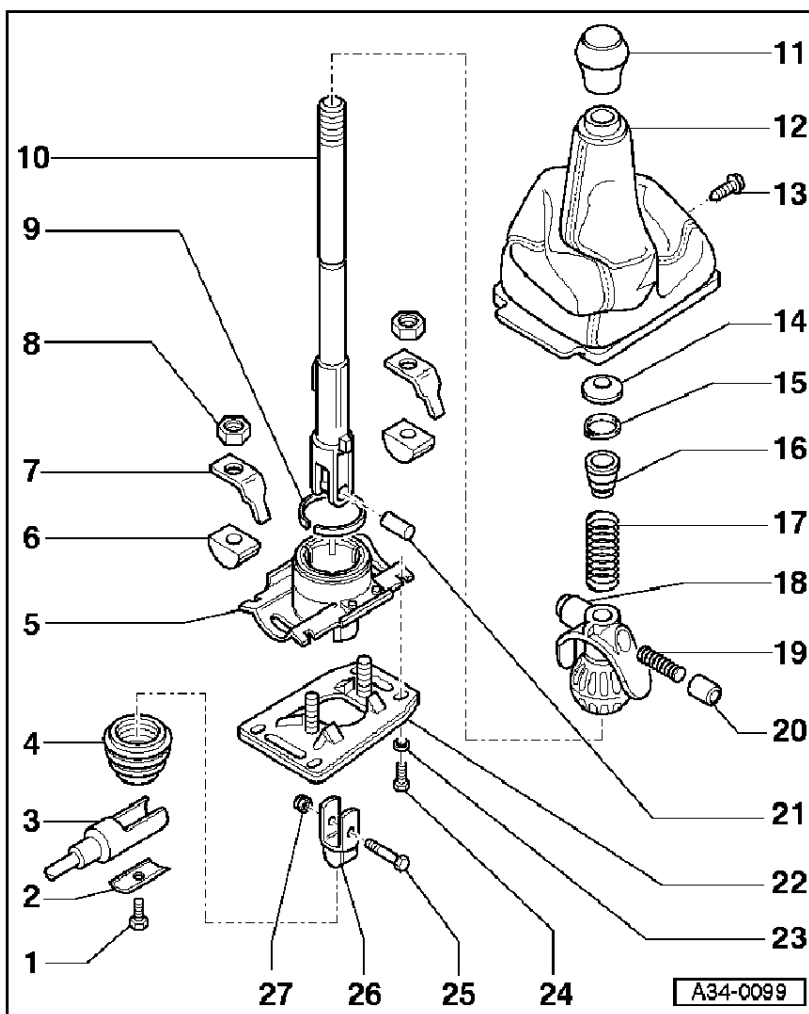
- ◆ Limit pieces for ball stop on left and right sides must be engaged
- ◆ Installation position: reverse detent faces left
- ◆ Lubricate with G 052 142 A2 polycarbamide grease

6 - Connector

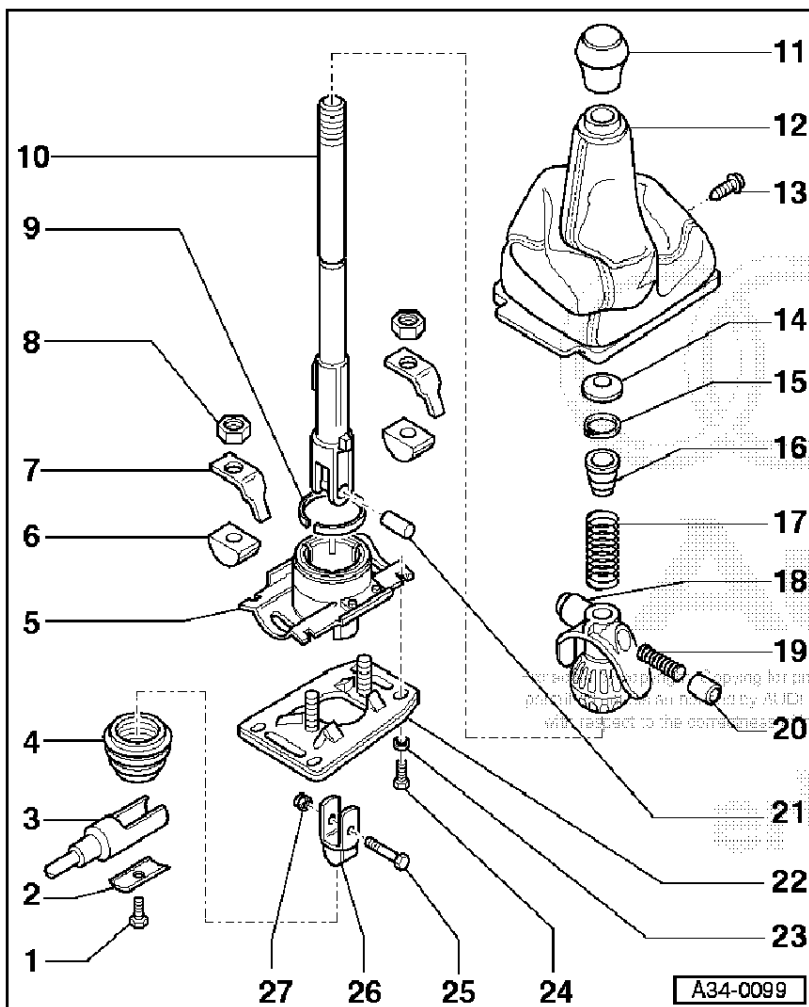
7 - Leaf spring

8 - Nut - 25 Nm

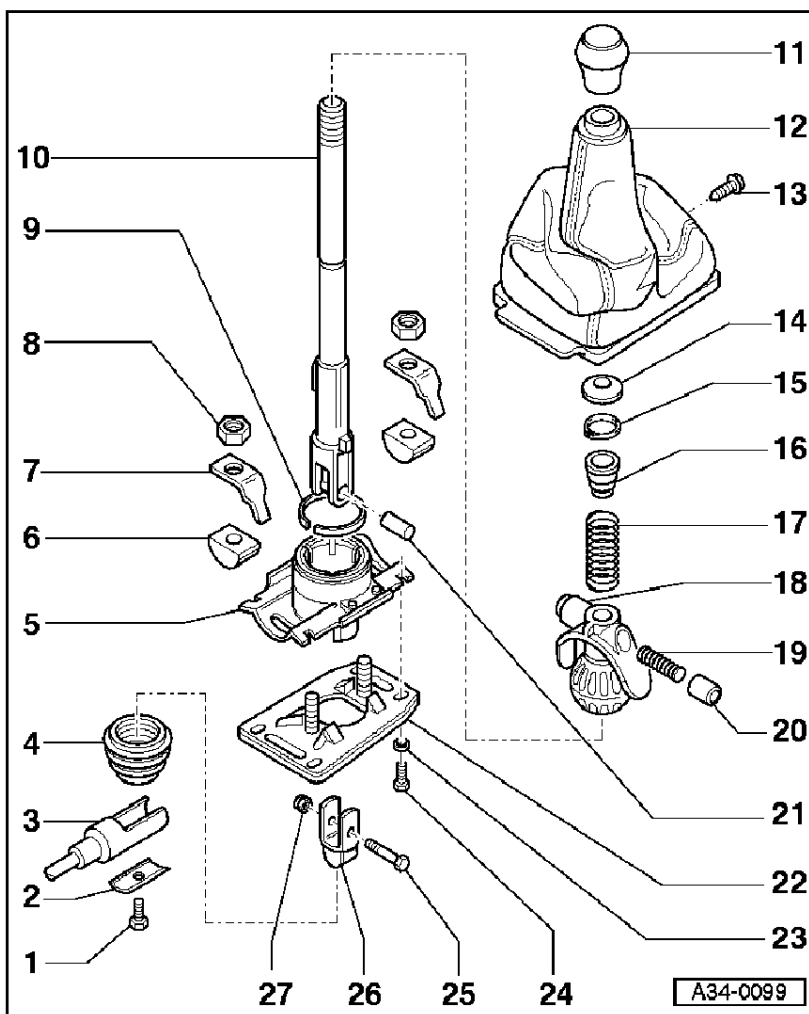
- ◆ Secures ball housing to gear stick mounting



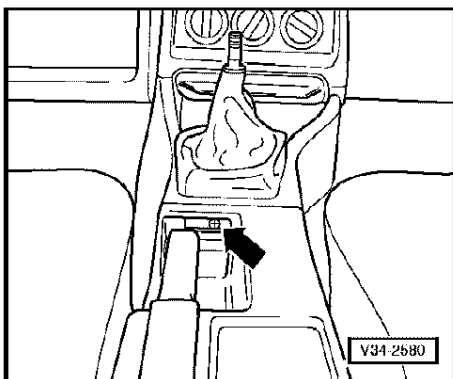
- 9 - Circlip
 - ◆ Renew
 - ◆ Installation position: rounded side towards ball housing
 - ◆ Remove before taking out ball stop -Item 18-
- 10 - Gear stick
 - ◆ Can only be inserted in ball housing in one position
 - ◆ Lubricate area around bottom drilling with G 052 142 A2 polycarbamide grease
- 11 - Gear stick knob
- 12 - Gear stick cover
 - ◆ Removing => Fig. 1
- 13 - Bolt
 - ◆ For cover
- 14 - Rubber cap
- 15 - Circlip
 - ◆ Do not open out too far when fitting



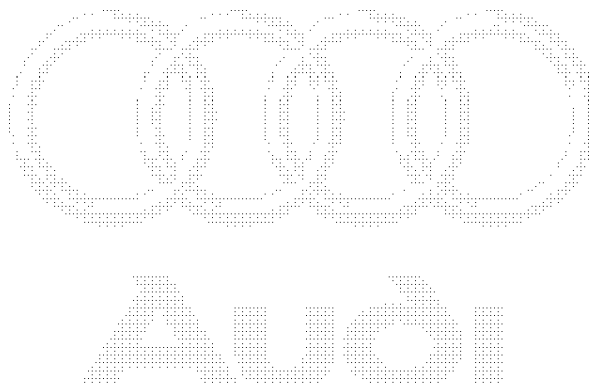
- 16 - Spacer bush
- 17 - Spring
- 18 - Ball stop
 - ◆ Insert spring and spacer bush in the ball stop and assemble on the gear stick so that the spring and bush are on the right.
 - ◆ Install ball stop before fitting circlip -Item 9-
 - ◆ Lubricate ball with G 052 142 A2 polycarbamide grease
- 19 - Spring
- 20 - Bush
 - ◆ Installation position: rounded part towards gear stick
 - ◆ Lubricate with G.052 142 A2 polycarbamide grease



- 21 - Spacer tube
◆ Lubricate with G 052 142 A2 polycarbamide grease
- 22 - Gear stick mounting
◆ Apply AKD 512 000 05 sealant between gear stick mounting and floor panel
- 23 - Washer
- 24 - Bolt - 10 Nm
◆ Secures gear stick mounting
- 25 - Bolt
◆ Secures selector fork
- 26 - Selector fork
◆ Lubricate with G 052 142 A2 polycarbamide grease
- 27 - Nut - 10 Nm
◆ Secures selector fork



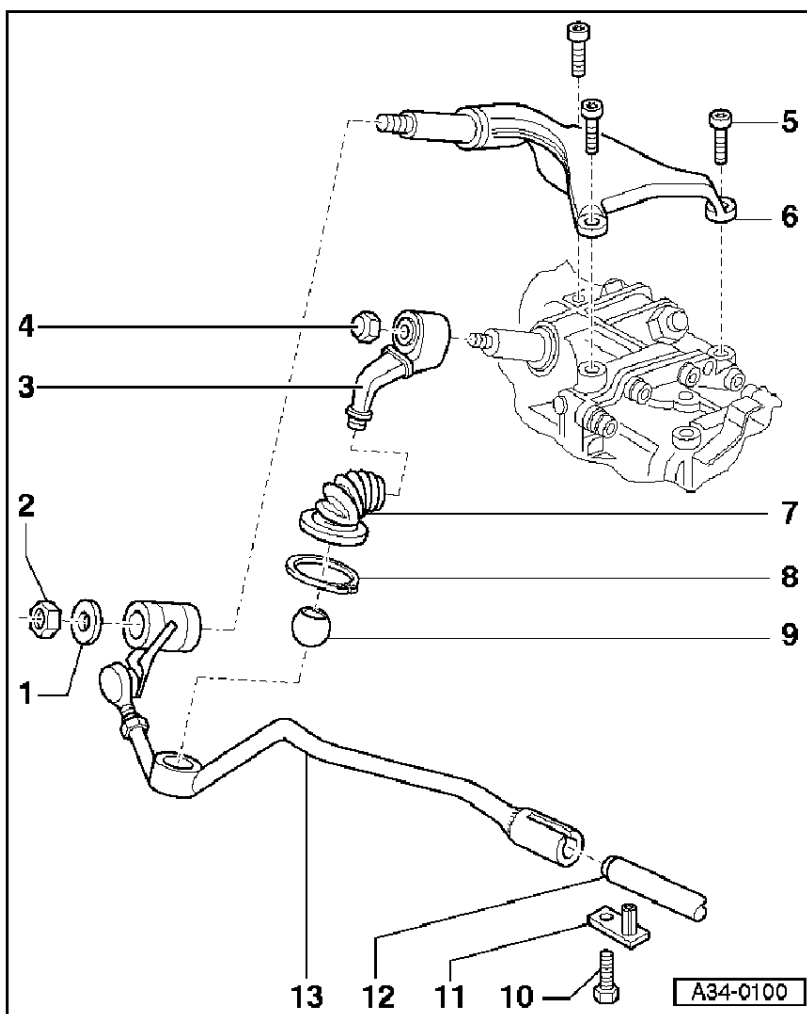
- ◀ **Fig.1 Removing gear stick cover**
- Unscrew gear stick knob.
 - Detach cap on centre console.
 - Remove screw -arrow- for cover.
 - Lift off the cover.



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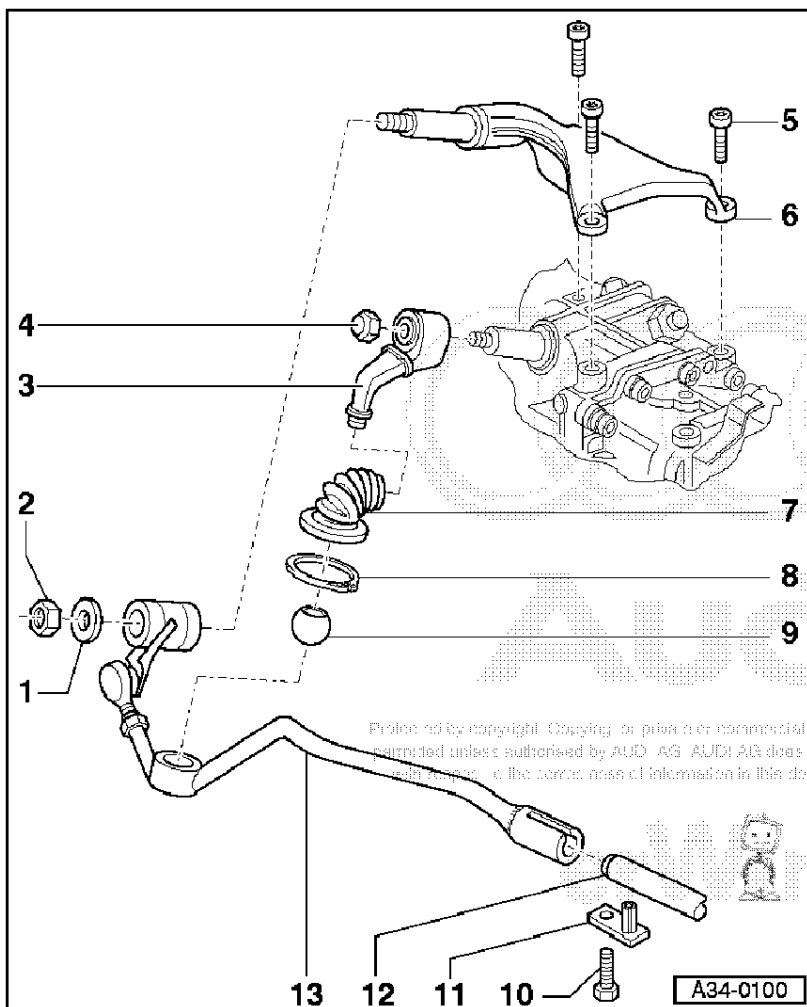


Removing and installing selector rod – assembly overview



- 1 – Washer
- 2 – Nut – 10 Nm
 - ◆ Self-locking
 - ◆ Renew
- 3 – Gear selector lever
- 4 – Cap nut – 23 Nm
- 5 – Cheese-head bolt – 35 Nm
- 6 – Support bracket
- 7 – Sealing collar
- 8 – Securing ring
 - ◆ For sealing collar

34-7



- 9 – Ball
 - ◆ For selector joint
 - ◆ Secure to gear selector lever. Tightening torque: 40 Nm
- 10 – Bolt – 23 Nm
- 11 – Clamp
- 12 – Rear selector rod
- 13 – Front selector rod

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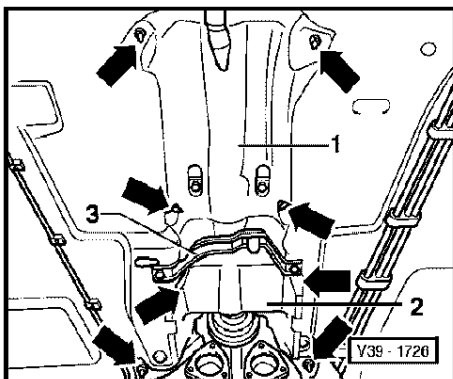
34-8

Removing and installing selector rod

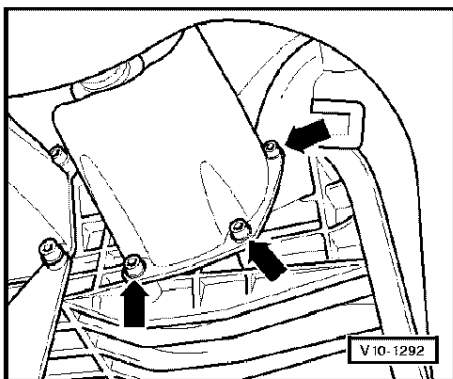
- Gearbox installed

Removing

- Remove exhaust system parts behind catalytic converters
=> Avant RS2; Repair group 26; Removing and installing parts of exhaust system
- Remove heat shields -1- and -2- -arrows.
- Unbolt cross member -3- below propshaft.
- Remove propshaft => Page 39-59.



- Remove left-hand catalytic converter:
=> Avant RS2; Repair group 26; Removing and installing parts of exhaust system =>
- Remove heat shield for left drive shaft -arrows-.
- Remove noise insulation above left drive shaft.



34-9

- Remove left gearbox support.
- Unscrew nut for front selector rod at support bracket.
- Unscrew cap nut for gear selector lever.

- Unbolt tunnel support -arrows-.
- Remove bolt -1- for rear selector rod -2- at base of gear stick.

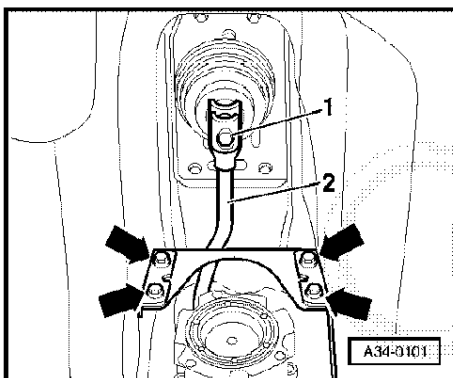
Installing

Installation is carried out in the reverse order, when doing this note the following:

- Adjusting selector mechanism => Page 34-12.

Tightening torques

Component	Nm
Tunnel support to body	23
Front selector rod to support bracket	10
Gear selector lever to gearbox	23
Rear selector rod to gear stick	23
Gearbox support to subframe	40
Gearbox support to gearbox	40



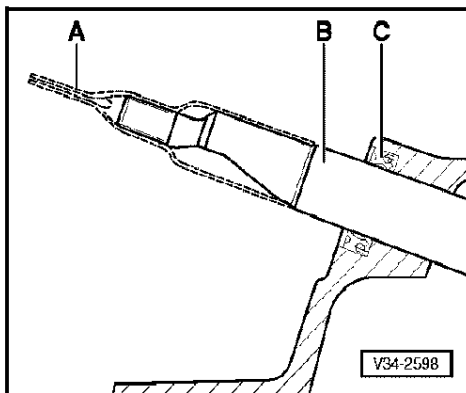
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34-10

Renewing shaft seal for selector shaft

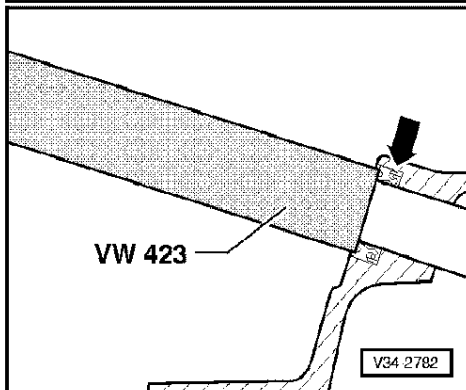
- Gearbox removed but not dismantled



- ◀ – Carefully lever out shaft seal -C- with a small screwdriver.
- Slide assembly sleeve -A-, Part No. 01E 311 120, over selector shaft -B-.

Notes:

- ◆ Lightly oil outside circumference of seal.
- ◆ Pack space between sealing lip and dust lip with multipurpose grease.
- ◆ Always use fitting sleeve to install shaft seal.



- ◀ – Drive new shaft seal -arrow- into housing onto stop with press piece VW 423.

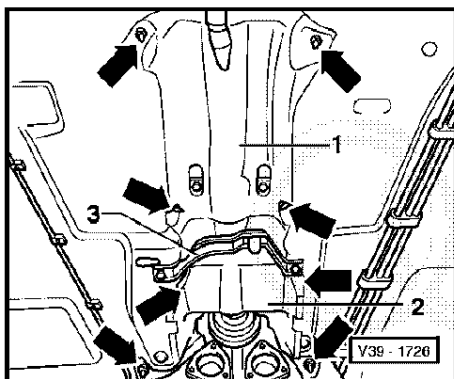
— 34-11 —

Adjusting and checking selector mechanism

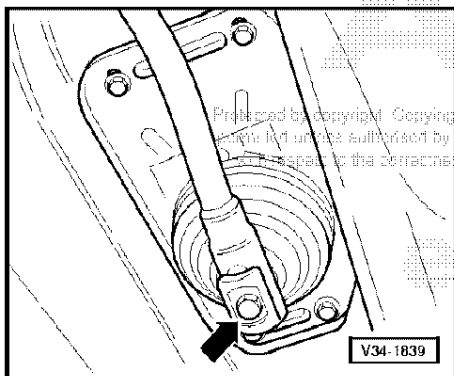
- Gearbox in neutral.

Adjusting gear stick

- Remove exhaust system parts behind catalytic converters
=> Avant RS2; Repair group26; Removing and installing parts of exhaust system
- ◀ – Remove heat shield -2- -arrows-.
- Remove gear stick knob and gear stick cover.



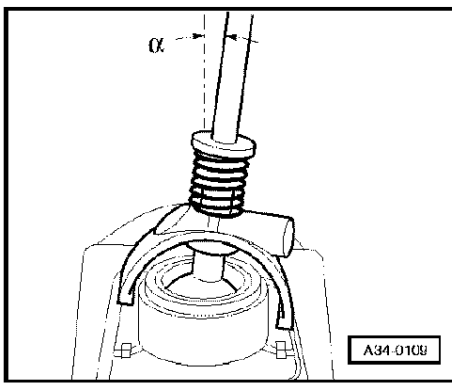
- ◀ – Slacken securing bolt -arrow- for selector rod.



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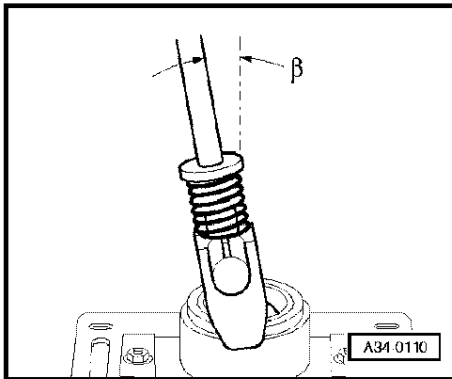
— 34-12 —



- Adjust gear stick as follows:
 - Gear stick at an angle of 5° to the right (angle α)

Note:

The illustration shows the gear stick from behind (looking towards the front of the vehicle).



- Gear stick at an angle of 7° to the rear (angle β)

Note:

The illustration shows the gear stick from the right.

- Hold gear stick in this position (second mechanic required).
- Tighten selector rod bolt below vehicle to 23 Nm.

Note:

The gear stick must remain in the same position while the bolt is being tightened.

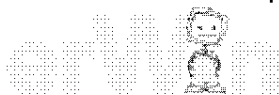
Checking gear stick setting

- Check operation of 1st and 2nd gear stop.
- Engage 2nd gear and push gear stick to the left against the stop.
- Reduce pressure on gear stick until it moves back to pressure point.
 - Spring-back measured at gear stick knob: 3 ... 5 mm
- Check that all gears can be engaged.
- Check operation of reverse gear lock.
 - It must be possible to move the gear stick, without pushing and without force, forwards from the reverse gear lock to the 3rd/4th gear plane

● If the gear stick setting is incorrect it can be adjusted as follows:

- Slacken bolts for ball housing.
- With gear stick pressed downwards, move it to the left as far as the reverse gear stop in the gearbox, and hold it in this position.
- Push the ball housing to the right against the gear stick.

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- Hold gear stick in this position and tighten ball housing bolts.
 - Install gear stick cover and knob.
 - Align exhaust system free of stress
- = > Avant RS2; Repair group 26; Aligning exhaust system free of stress = >

Removing and installing gearbox

Special tools, testers and auxiliary items required:

- ◆ Engine support bracket 10-222 A
- ◆ Gearbox support 3282
- ◆ Adjustment plate 3282/12
- ◆ Gearbox jack V.A.G 1383 A

Removing

Note:

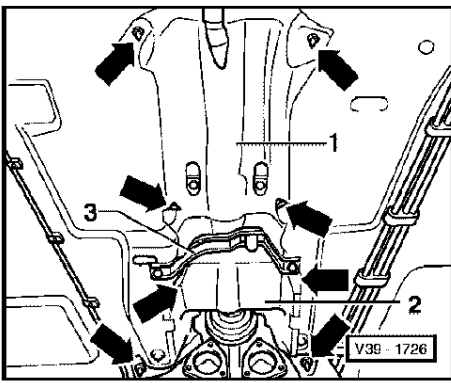
Obtain anti-theft code for radio before disconnecting the battery.

- Remove battery cover.
- Disconnect battery earth strap.
- Remove air cleaner housing cover with air mass meter.
- Detach lower section of air cleaner housing.

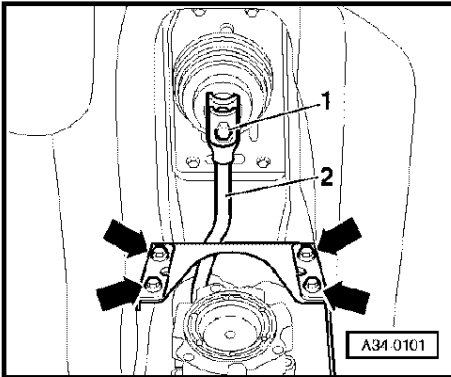
- Remove noise insulation below engine compartment and unbolt noise insulation bracket.

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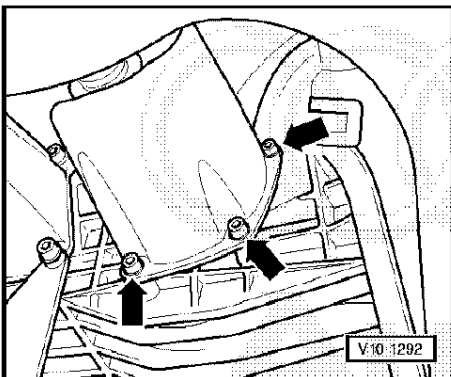




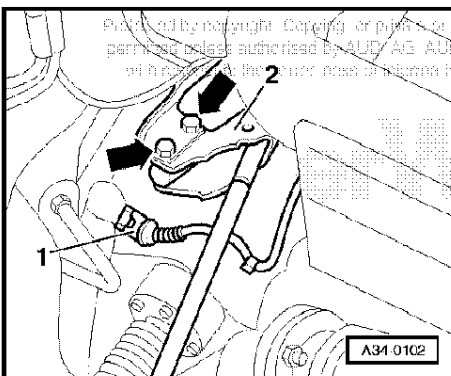
- Unbolt exhaust system with catalytic converters from front exhaust pipe and remove
- ◀ => Avant RS2; Repair group 26; Removing and installing parts of exhaust system =>
- Unbolt heat shields -1- and -2- -arrows-.
- Unbolt cross member -3- below propshaft.
- Remove propshaft => Page 39-59.



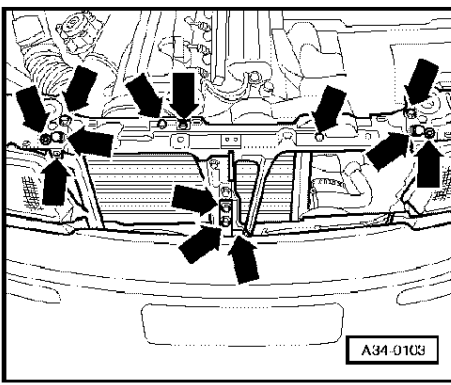
- ◀ - Unbolt tunnel support -arrows-.
- Unscrew bolt -1- for rear selector rod -2- at base of gear stick.
- Unbolt selector rod from gearbox => Page 34-9 and remove.



- ◀ - Remove noise insulation covers above left and right drive shafts.
- Remove left and right heat shields for drive shafts -arrows-.
- Remove right drive shaft; unbolt left drive shaft at gearbox, move clear to the rear and tie up
- ◀ => Running gear, Four-wheel drive; Repair group 40; Removing and installing suspension strut and drive shaft =>
- Pull connector off speedometer sender above left drive shaft flange and move wiring clear.



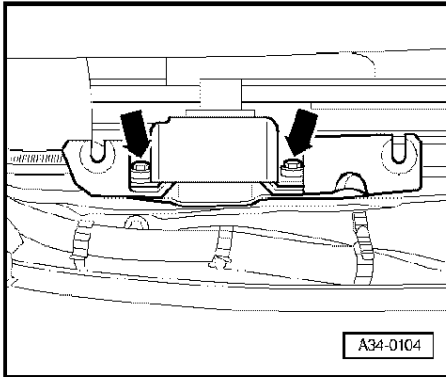
- ◀ - Unplug connector -1- for reversing light switch and move wiring clear.
- Unscrew bottom nuts on actuator for track rods -2-.
- Pull out bolts -arrows-.
- Press actuator with track rods upwards.
- Unscrew engine/gearbox securing bolts accessible from above.
- Press bracket for coolant pipe upwards.



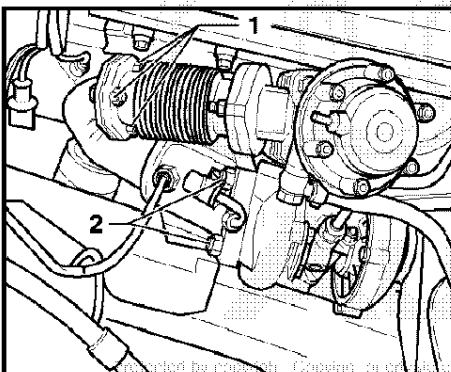
- ◀ - Remove lock carrier support:
 - Slacken bolts -arrows-.
 - Detach radiator air cowls.
 - Using a small screwdriver, unclip bonnet lock cable from retainers.
- Slacken bottom nuts on auxiliary radiator two turns and place auxiliary radiator on bumper without opening connections.

Note:

Cover the bumper to prevent damage.



- ◀ - Unbolt stop for torque reaction support -arrows-.



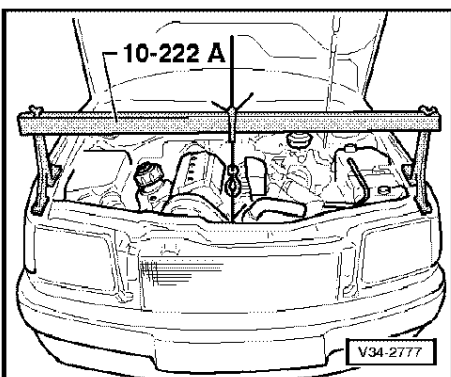
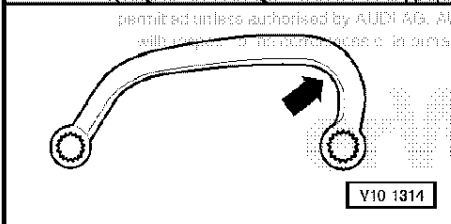
- ◀ - Unplug connector for lambda probe and move wiring clear.
- Unbolt three bolted mountings -1- on corrugated pipe.
- Unscrew 4 nuts -2- on flange between turbocharger and front exhaust pipe.

Notes:

◆ To loosen the bottom rear nut on the flange between the turbocharger and the front exhaust pipe, bend a flat ring spanner (15 mm AF) to the required shape -arrow in lower part of illustration-.

◆ The other nuts on the flange (turbocharger/front exhaust pipe) are 17 mm AF.

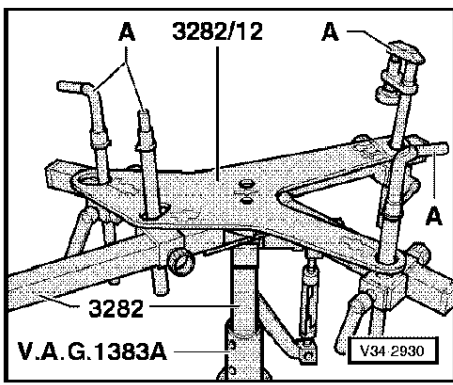
Remove the front exhaust pipe from underneath.



- ◀ - Set up engine support bracket 10-222 A and take up weight of engine by turning spindle.

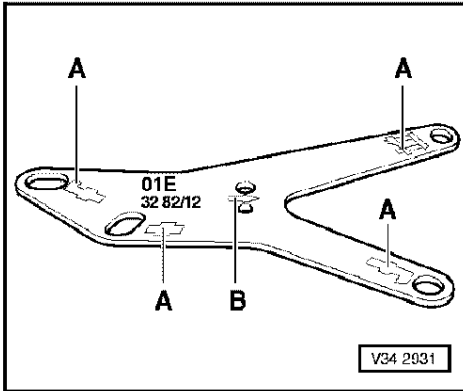
Note:

Do not place support bracket 10-222 A on headlights.



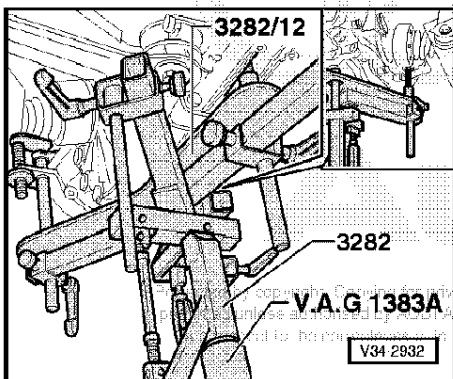
- ◀ – Prepare gearbox support 3282 for removing manual gearbox 01E (four-wheel drive) with adjustment plate 3282/12, and place support on gearbox jack V.A.G 1383 A.

– A - Attachments

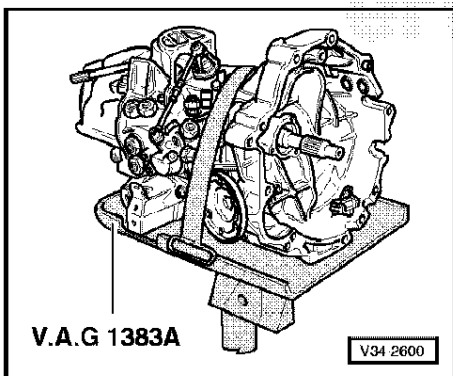


Notes:

- ◀ ♦ The positions for the attachments are indicated by symbols (-A-). Arrow -B- points in the direction of travel.
- ♦ Adjustment plate 3282/12 can only be fitted in one position.
- ♦ The elongated holes in adjustment plate 3282/12 allow for different versions of the gearbox housing and gearbox cover.

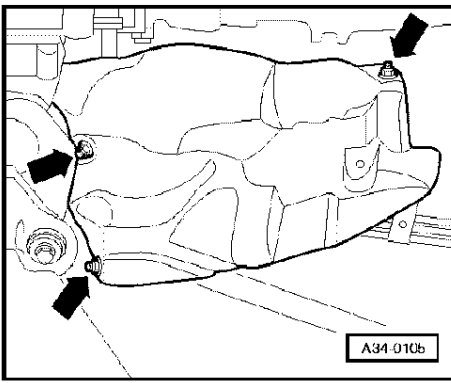


- ◀ – Run gearbox jack V.A.G 1383 A with gearbox support 3282 in under the gearbox and take up the weight of the gearbox.
- Secure gearbox to gearbox support 3282.

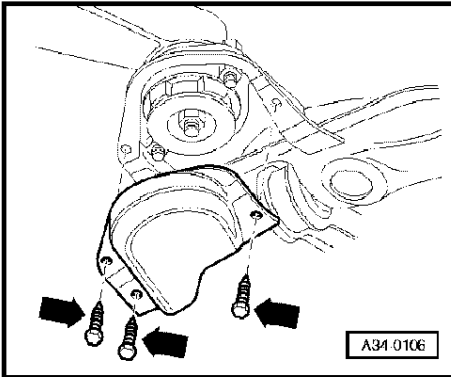


Note:

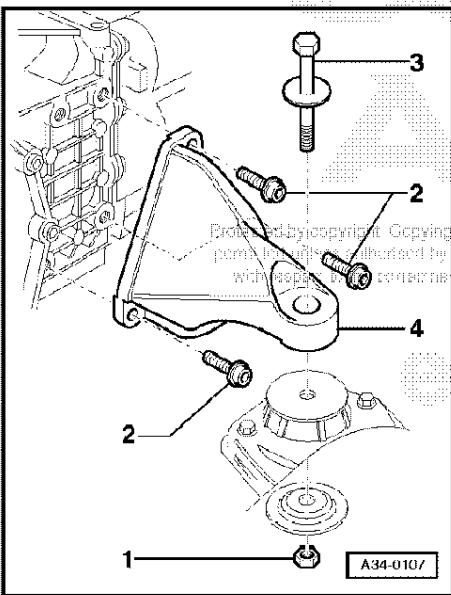
- ◀ *If gearbox support 3282 is not available, the gearbox can be removed and installed using gearbox jack V.A.G 1383 A.*
- Support gearbox with gearbox jack V.A.G 1383 A.



- ◀ - Remove heat shield on right-hand side of tunnel -arrows-.



- ◀ - Remove heat shields for left and right bonded rubber mountings -arrows-.



- ◀ - Remove nuts and bolts -1 - 3- for gearbox support on left -4- and right; remove gearbox supports.

Note:

Illustration shows left gearbox support from above.

- Unbolt bottom engine/gearbox securing bolts => Page 34-27.

- Place starter motor on subframe and secure with wire to prevent it dropping.

- Lower gearbox jack; at the same time engine support 10-222 A must be readjusted to take up weight (second mechanic required, using a step ladder).

- Lower gearbox slightly until the slave cylinder is just accessible.

Note:

When lowering gearbox ensure hydraulic pipe/hose to slave cylinder is not damaged.

- Remove clutch slave cylinder => Page 30-19. Do not disconnect pipe.

Note:

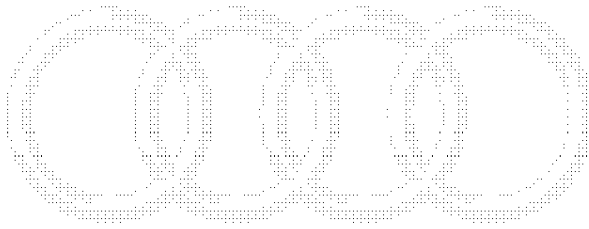
Do not depress clutch pedal after removing slave cylinder.

- Remove cable holder and cables for procon-ten from gearbox => General body repairs; Repair group 68; Repairing procon-ten system, left-hand drive ▶ 06.94 ▶ 06.94"; =>
- Press gearbox off dowel sleeves and carefully lower with V.A.G 1383 A.
- Lower gearbox completely.

Installing

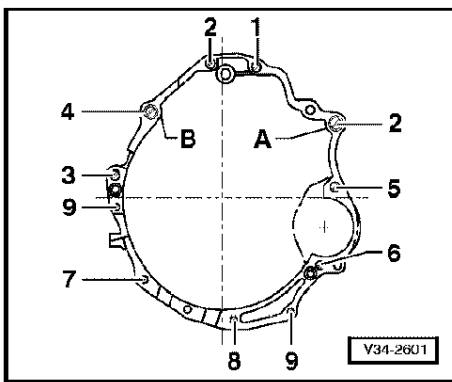
Installation is carried out in the reverse order, when doing this note the following:

- Before installation it is important to use a tap to clean out the locking fluid left in the threads in the propshaft drive flanges on the gearbox and rear final drive and in the thread of the clutch slave cylinder mounting.



- Check whether dowel sleeves for aligning gearbox with engine are in the gearbox flange. Insert if necessary => Page 34-27.
- Renew gaskets at propshaft mountings => Page 39-58 and drive shaft mountings.
- Install propshaft => Page 39-61 and adjust => Page 39-65.
- **Ensure adequate clearance between front exhaust pipe and subframe, and align exhaust system free of stress**
=> Avant RS2; Repair group 26; Aligning exhaust system free of stress =>
- Check oil level in gearbox => Page 34-29.
- Install clutch slave cylinder => Page 30-19.
- Adjust selector mechanism => Page 34-12.

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Tightening torques

Engine/gearbox mountings

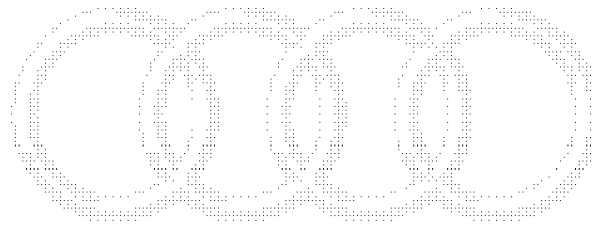
Item No.	Bolt	Qty	Nm
1	M12 x 67	1	65
2	M12 x 80	2	65
3	M12 x 80	1	65
4	M12 x 110	1	65
5	M12 x 110	1	65
6	M10 x 135	1	45
7	M10 x 50	1	45
8	M10 x 45	1	45
9 ¹⁾	M8 x 40	2	25

¹⁾ Tightening torque for M10 x 45 bolt: 45 Nm

A and B are centring sleeves

Note:

When installing an exchange gearbox with the newer type of gearbox housing, it may be necessary to fit an M10 bolt in place of the M8 bolt near the sump. To do this, drill out the hole in the sump to 11.5 mm dia. Use the M10 bolt specified in the Parts List: tightening torque 45 Nm.



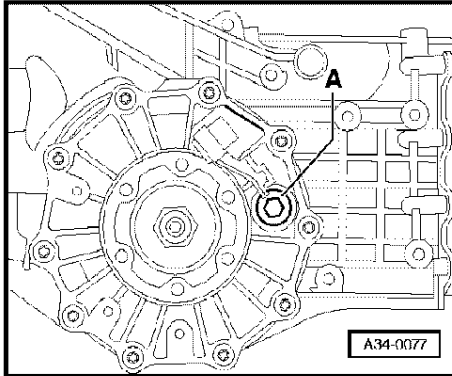
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Component		Nm
Clutch slave cylinder to gearbox		25
Gearbox support to subframe		40
Gearbox support to gearbox		40
Drive shaft to flange shaft	M10	80
Heat shield for drive shaft		25
Torque reaction support to body		40
Clamp on front selector rod to rear selector rod		23
Propshaft to gearbox and final drive	M8	55
Propshaft centre bearing to body		23
Propshaft heat shield to gearbox		25
Tunnel support to body		23

Checking oil level in gearbox

Notes:

- ◆ When checking the oil level in the gearbox, the vehicle should be standing on a perfectly horizontal surface. An inspection pit or a 4-post lifting platform is ideal.
- ◆ The prescribed oil level is to be adhered to exactly; the gearbox reacts very sensitively to over-filling.



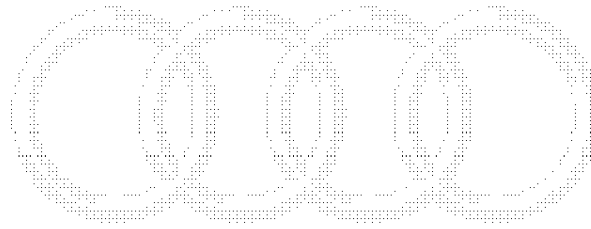
- ◀ – To check gearbox oil level, unscrew oil filler plug -A- (behind flange shaft).
- Check oil level with a suitable tool (such as a length of wire bent to shape).

Audi 80 S2:

- Specification: oil level 7 mm below bottom edge of oil filler hole.

Audi Avant RS2:

- Specification: oil level 16 mm below bottom edge of oil filler hole.



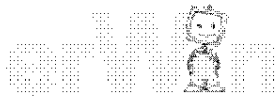
34-29

- Top up gear oil if necessary. Specification => Page 00-3.
- Fit oil filler plug.

Tightening torque

Component	Nm
Oil filler plug	40

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34-30

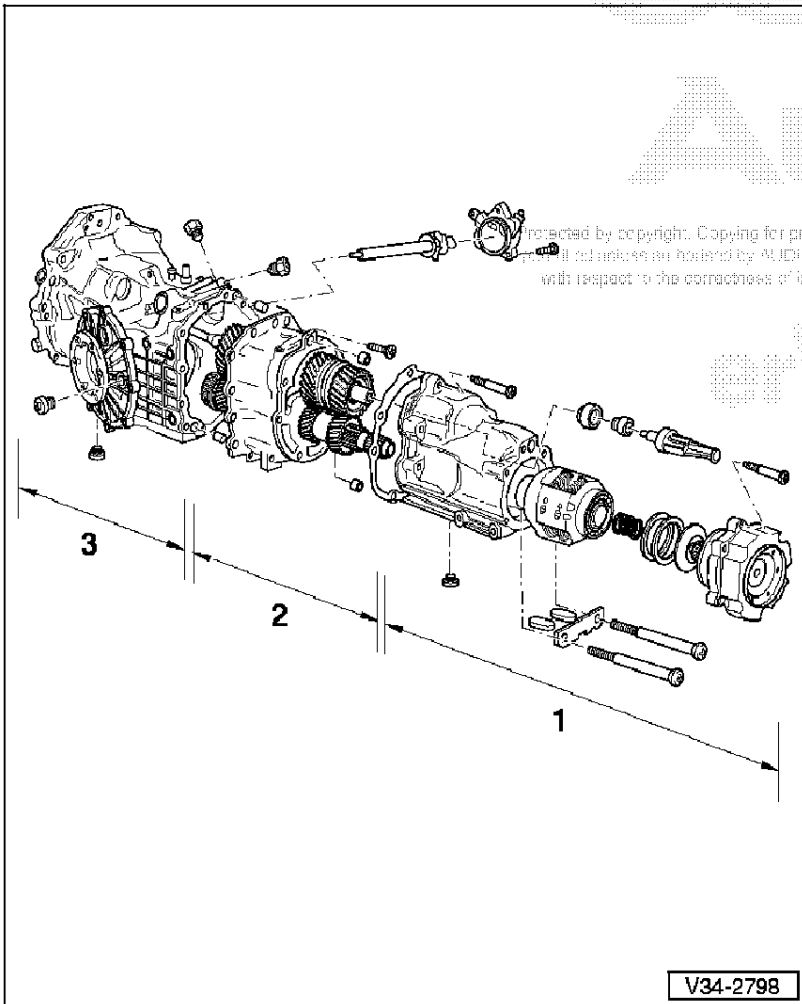
Dismantling and assembling gearbox

Work sequence => Page 34-46.

Notes:

- ◆ In gearboxes with code letters CGR from serial No.77644 onwards and in gearboxes with code letters CRB the 1st speed gear => Page 35-13 and 1st speed sliding gear => Page 35-33 are wider. At the same time the bearing plate was modified => Page 34-100, the width of the cylinder roller bearing inner race was reduced => Page 35-13 and the installation depth for the cylinder roller bearing was changed => Page 34-108.
- ◆ Mixed installation of components belonging to old and new versions is not permissible.

34-31



V34-2798

1 - Bearing housing, Torsen differential and end cover

- ◆ Removing and installing
=> Page 34-33

2 - Gearbox and selector shaft

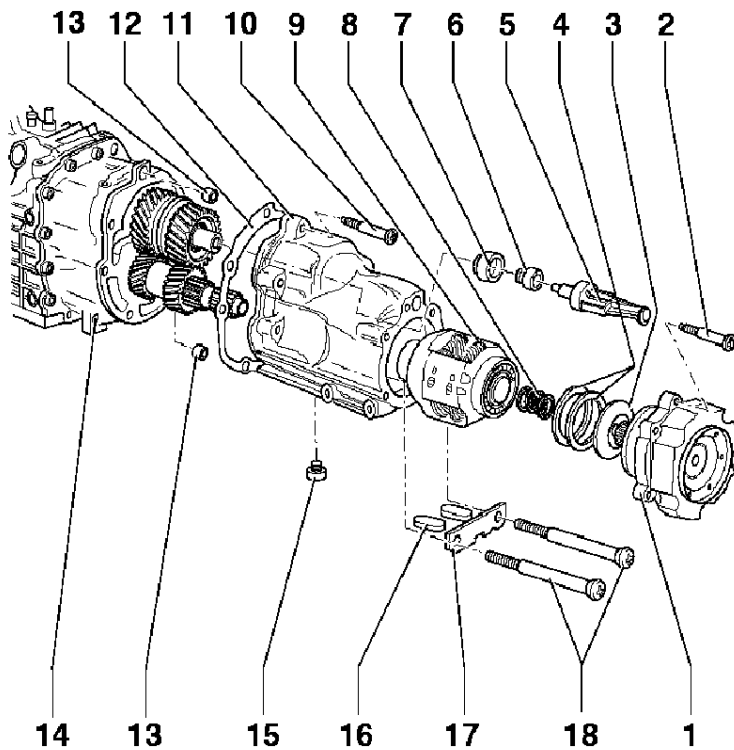
- ◆ Removing and installing
=> Page 34-36

3 - Differential

- ◆ Removing and installing
=> Page 39-13

34-32

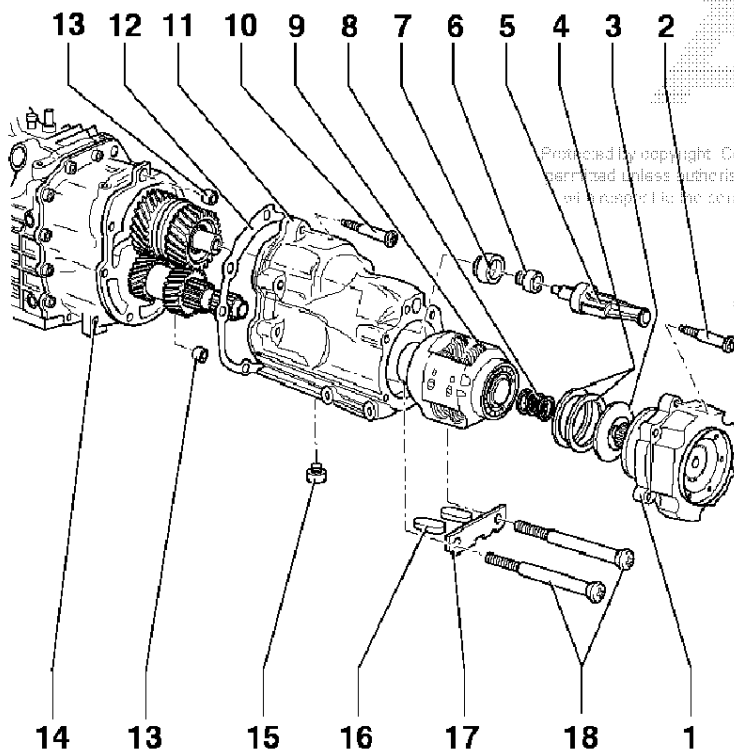
Removing and installing bearing housing, Torsen differential and end cover



V34-2819

- 1 - Bearing housing
 - ◆ Dismantling and assembling =>Page 34-79
- 2 - Bolt - 25 Nm
 - ◆ Qty. 6
- 3 - Dished spring
 - ◆ Installation position: larger diameter (concave side) faces shims
- 4 - Washer
 - ◆ Qty. 2 or 3
 - ◆ Re-determining shims =>Page 34-75
- 5 - Oil collector
 - ◆ Dismantling and assembling =>Page 34-73
 - ◆ Removing =>Page 34-48
 - ◆ Installing =>Page 34-74

34-33



V34-2819

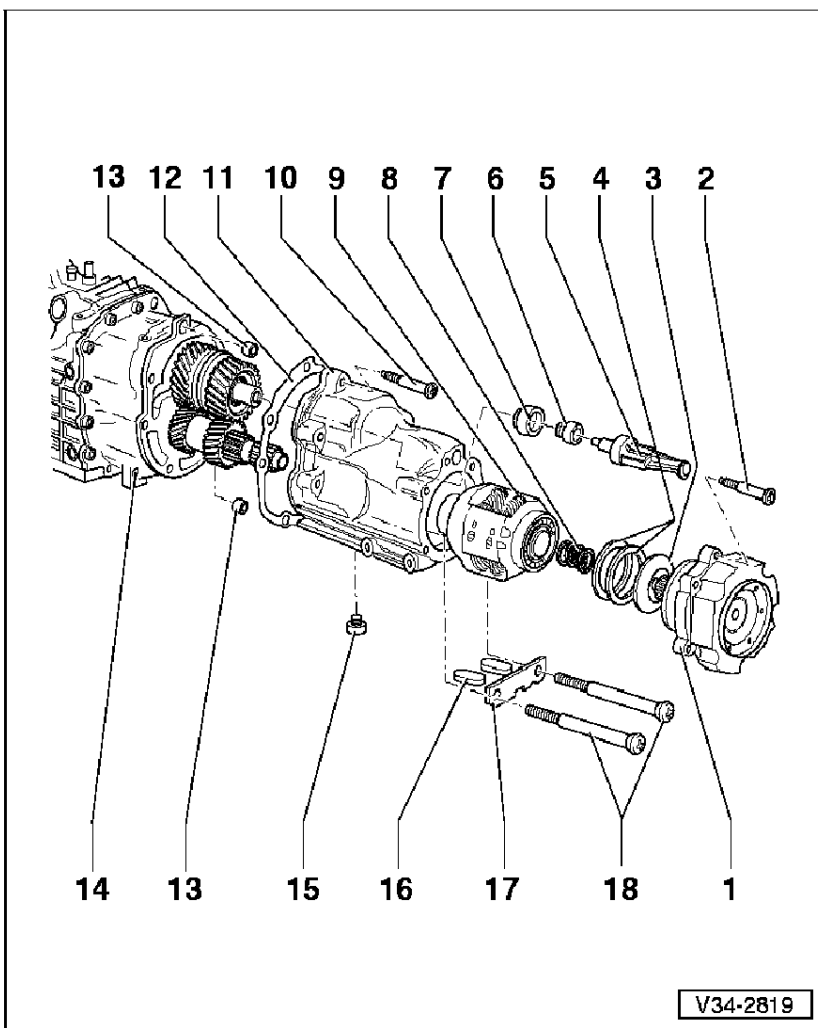
- 6 - Multi-point socket head bolt - 150 Nm
 - ◆ Removing =>Page 34-50
 - ◆ Installing =>Page 34-73

- 7 - 2nd inner race for taper roller bearing for input shaft
 - ◆ Removing =>Page 34-51
 - ◆ Installing =>Page 34-72

- 8 - Spring
- 9 - Torsen differential
 - ◆ Can be serviced only by manufacturer
 - ◆ Servicing bearings for Torsen differential =>Page 34-87

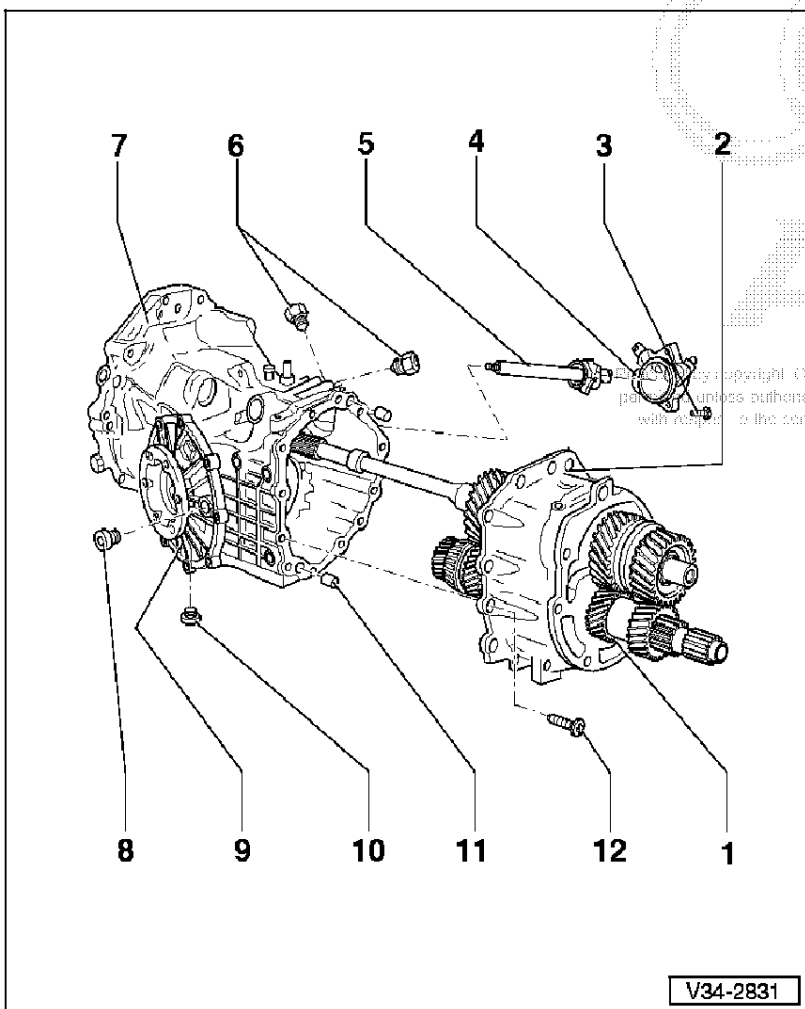
- 10 - Bolt - 25 Nm
 - ◆ Qty. 5
- 11 - End cover
 - ◆ Servicing =>Page 34-92

34-34



V34-2819

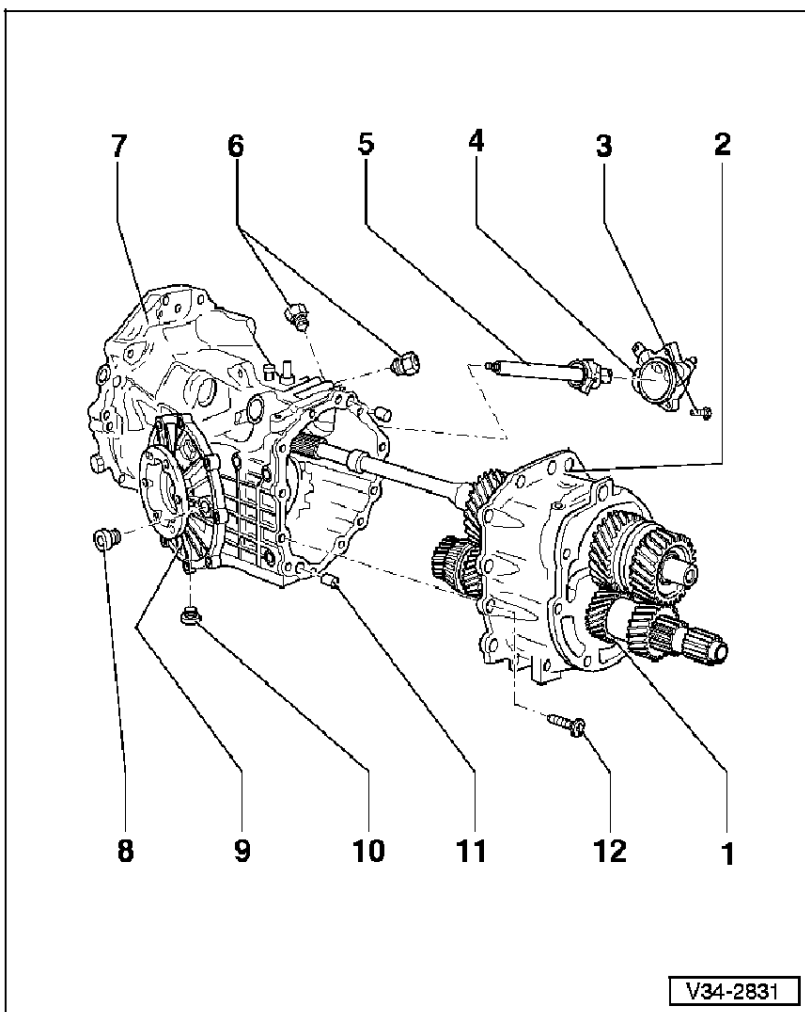
- 12 - Gasket
 - ◆ Renew
- 13 - Dowel sleeve
 - ◆ Qty. 2
- 14 - Gearbox
 - ◆ Removing and installing
=>Page 34-16
- 15 - Oil drain plug - 40 Nm
- 16 - Magnet
 - ◆ Qty. 2
 - ◆ Clean
- 17 - Support plate
 - ◆ Installation position: lugs face magnets
- 18 - Bolt - 25 Nm
 - ◆ Qty. 2



V34-2831

Removing and installing gearbox and selector shaft

- 1 - 5th and 6th gear
 - ◆ Gearbox remains flanged to gearbox housing
 - ◆ Removing and installing
=>Page 34-39
- 2 - Bearing plate (complete)
 - ◆ Modified bearing plate in CGR gearbox from serial No. 77644 and in CRB gearbox
 - ◆ Removing and installing input shaft, drive pinion, hollow shaft and internal selector mechanism =>Page 34-43
- 3 - Bolt - 25 Nm
 - ◆ Qty. 3
 - ◆ Inserted with sealing paste AMV 188 200 03



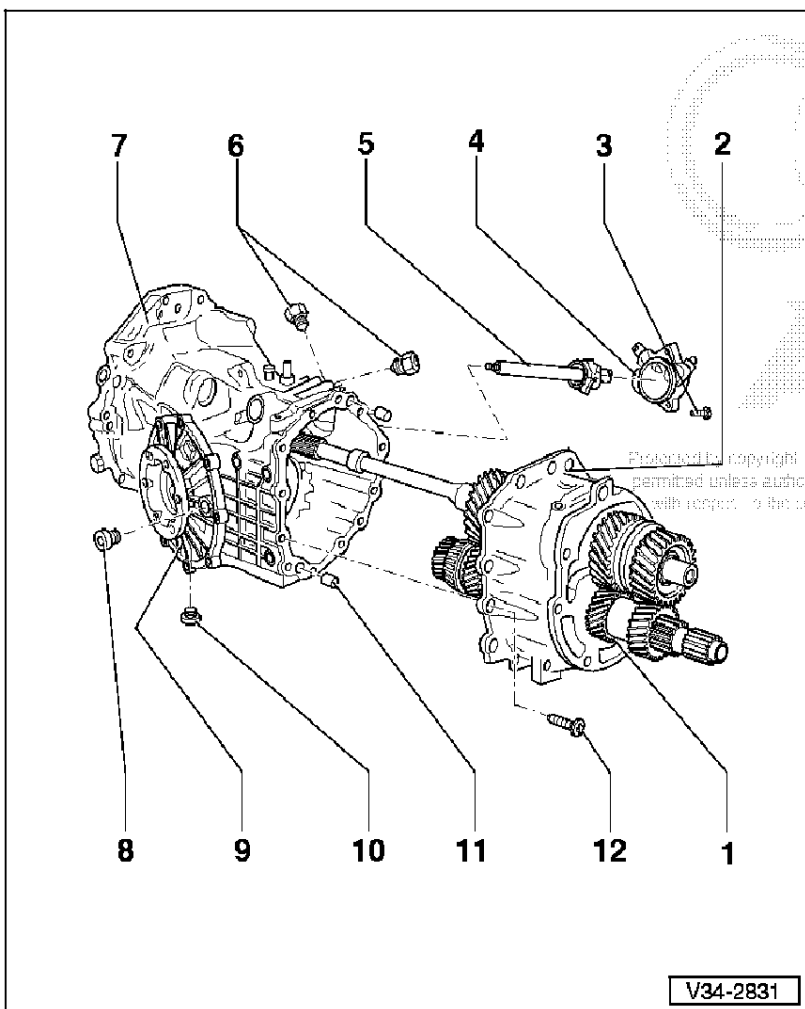
- 4 - Cover for selector shaft**
 ◆ Removing =>Page 34-49
 ◆ Installing =>Page 34-75

- 5 - Selector shaft complete**
 ◆ Removing =>Page 34-49
 ◆ Installing =>Page 34-75
 ◆ Dismantling and assembling
 =>Page 34-129

- 6 - Locking bolt**
 ◆ For aluminium bolt: 50 Nm
 ◆ For steel bolt: 70 Nm
 ◆ Mark installation positions of
 aluminium bolts and steel
 bolts; do not interchange

- 7 - Gearbox housing**
 ◆ Servicing =>Page 34-114

- 8 - Oil filler plug - 40 Nm**



- 9 - Differential**
 ◆ Removing and installing
 =>Page 39-13

- 10 - Oil drain plug - 40 Nm**

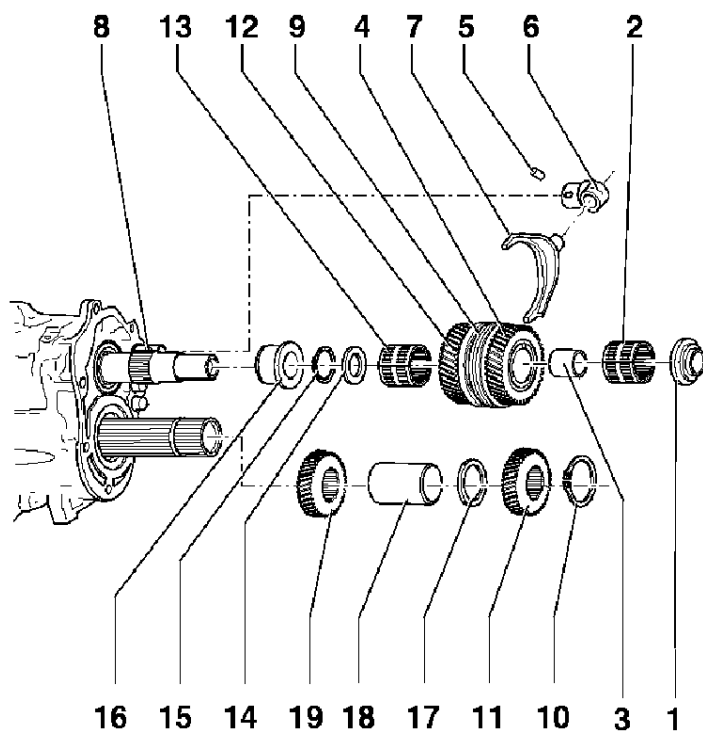
- 11 - Dowel sleeves**
 ◆ Qty. 2

- 12 - Bolt - 25 Nm**
 ◆ Qty. 12

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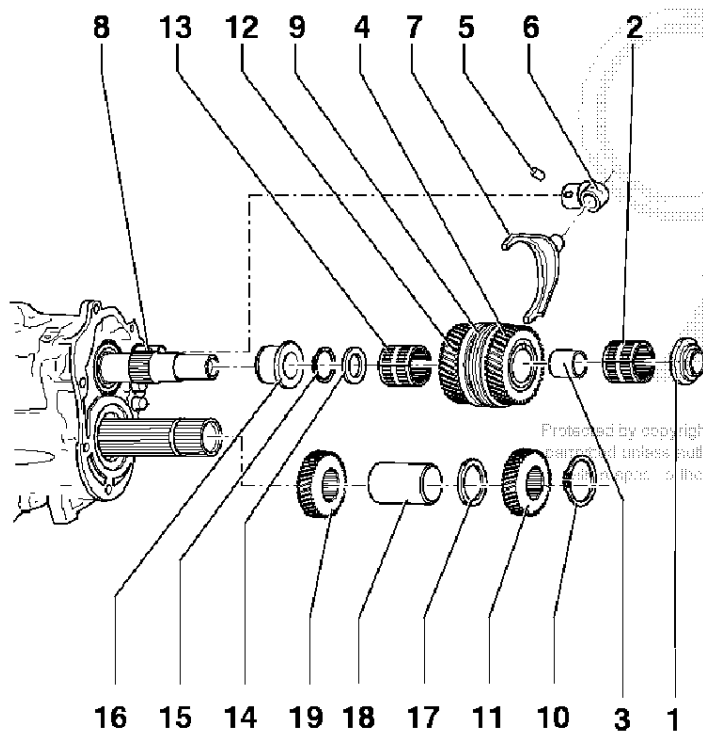
Removing and installing 5th and 6th gear



- 1 - 1st inner race for taper roller bearing for input shaft
 - ◆ Pulling off =>Page 34-51
 - ◆ Installing =>Page 34-71
- 2 - Needle bearing for 5th gear
- 3 - Inner race for 5th speed sliding gear
 - ◆ Pulling off =>Page 34-54
 - ◆ Driving on =>Page 34-71
- 4 - 5th speed sliding gear
 - ◆ Pulling off =>Page 34-51
 - ◆ Installing =>Page 34-71
- 5 - Roll pin
 - ◆ Pressing out =>Page 34-52
 - ◆ Pressing in =>Page 34-67

V34-2881

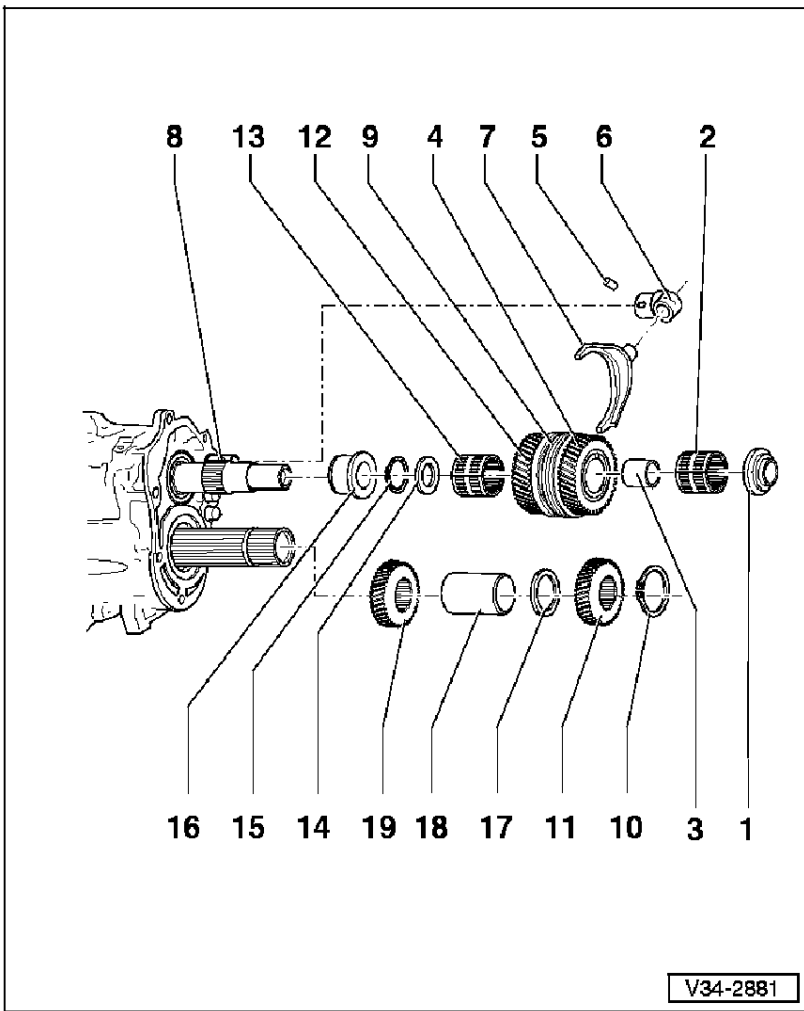
34-39



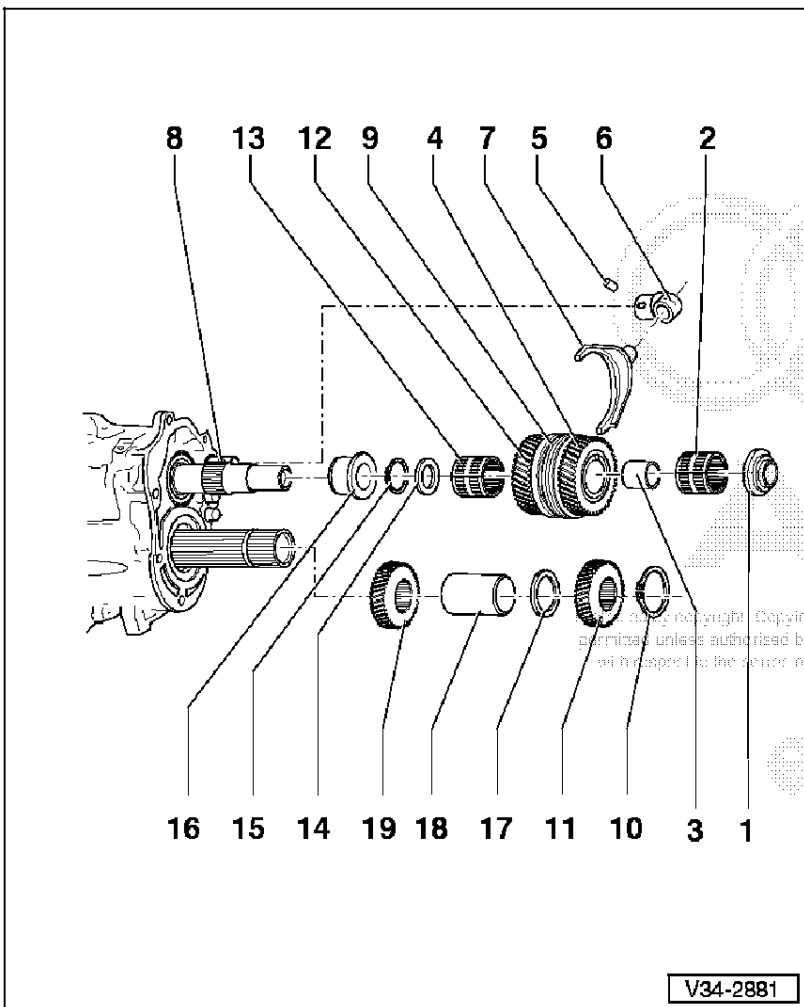
- 6 - Follower
 - ◆ Only renew complete with selector rod for 5th and 6th gear -item 8-
 - ◆ Pulling off =>Page 34-53
 - ◆ Fitting =>Page 34-67
- 7 - Selector fork for 5th and 6th gear
 - ◆ Can be renewed individually
- 8 - Selector rod for 5th and 6th gear
 - ◆ Only renew complete with follower -item 6-
 - ◆ Removing =>Page 34-52
 - ◆ Installing =>Page 34-62
- 9 - Locking collar, synchro-ring, synchro-hub for 5th and 6th gear
 - ◆ Removing =>Page 34-53
 - ◆ Installing =>Page 34-66

V34-2881

34-40



- 10 - Circlip
 - ◆ Re-determining =>Page 34-70
- 11 - 5th speed gear
 - ◆ Pulling off =>Page 34-52
 - ◆ Pressing on =>Page 34-69
- 12 - 6th speed sliding gear
 - ◆ Pull off together with synchro-hub and inner race for 5th gear =>Page 34-54
- 13 - Needle bearing for 6th gear
- 14 - Thrust washer for needle bearing for 6th gear
 - ◆ Installation position: grooves face circlip, smooth face contact surface towards needle bearing
- 15 - Circlip



- 16 - Inner race for cylinder roller bearing
 - ◆ Take off by hand =>Page 34-55
 - ◆ Width is changed in CGR gearbox from serial No. 77644 and in CRB gearbox. Allocation => Fig. 8, Page 35-13
- 17 - Shim
 - ◆ Re-determining thickness =>Page 34-68
- 18 - Spacer sleeve
 - ◆ Length 39.6 mm
- 19 - 6th speed gear
 - ◆ To press off, remove bearing plate =>Page 34-55
 - ◆ Pressing off =>Page 34-58
 - ◆ Pressing on =>Page 34-59

Removing and installing input shaft, drive pinion, hollow shaft and internal selector mechanism from bearing plate

1 - Bearing plate

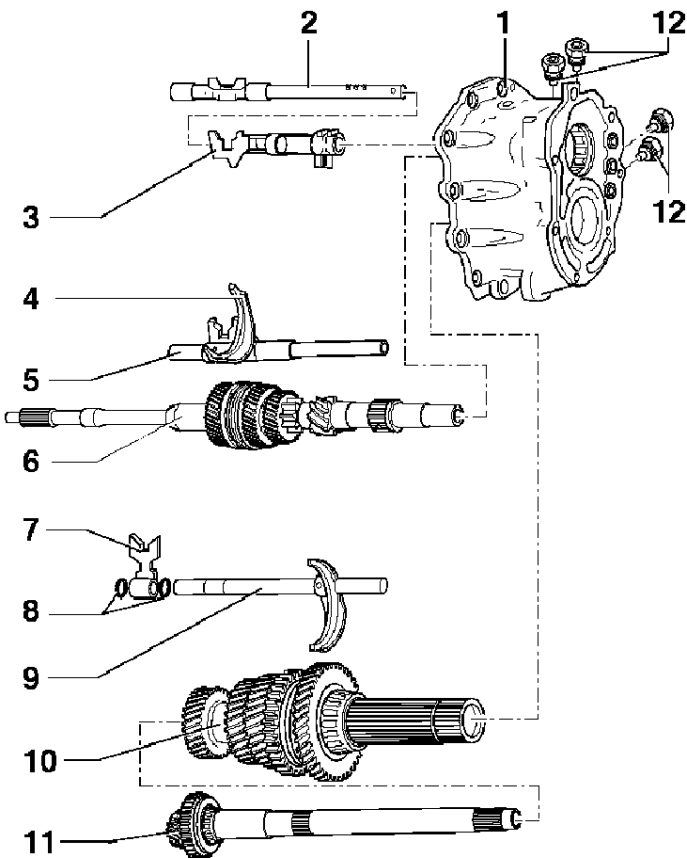
- ◆ Modified bearing plate in CGR gearbox from serial No. 77644 and in CRB gearbox
- ◆ Servicing => Page 34-100

2 - Selector rod for 5th and 6th gear

- ◆ Only renew complete with follower for 5th and 6th gear => Page 34-40

3 - Follower for reverse gear

- ◆ Pulling out ball sleeve => Fig. 4, Page 34-106
- ◆ Driving in ball sleeve => Fig. 5, Page 34-107



V34-2867

34-43

4 - Selector fork for 3rd and 4th gear

- ◆ Can be replaced individually
- ◆ Installation position: rib towards follower

5 - Selector rod for 3rd and 4th gear

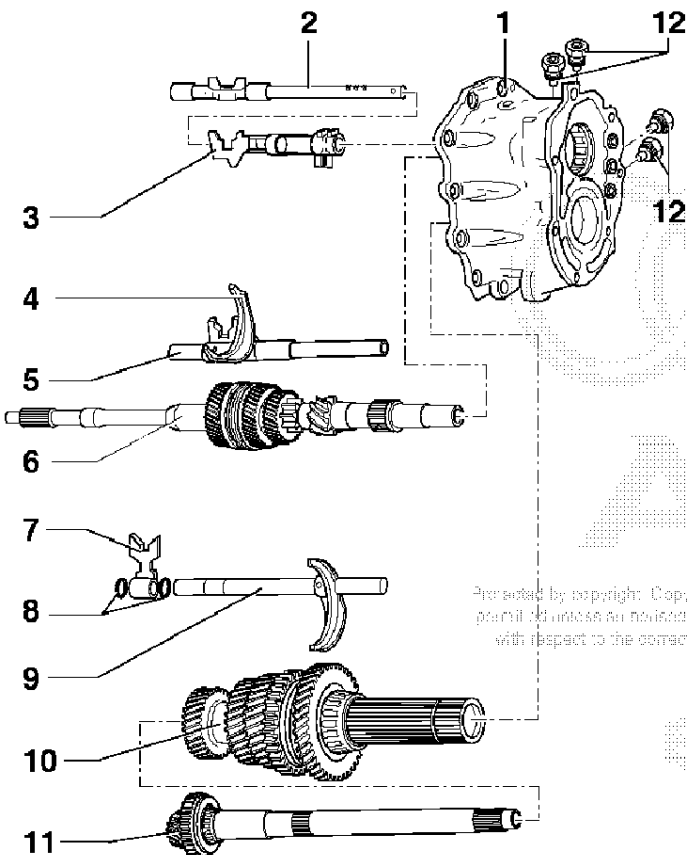
- ◆ Only renew complete with follower for 3rd and 4th gear

6 - Input shaft

- ◆ Wider 1st speed gear fitted in CGR gearbox from serial No. 77644 and in CRB gearbox => Fig. 8, Page 35-13
- ◆ Dismantling and assembling => Page 35-1

7 - Follower for 1st and 2nd gear

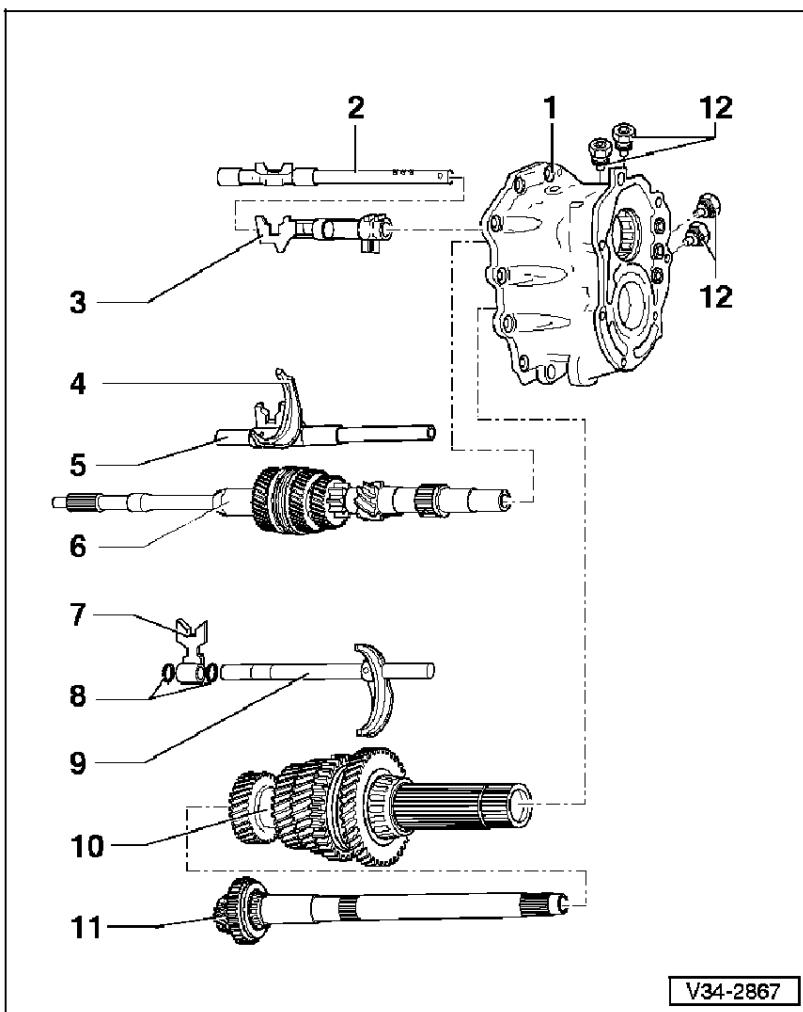
- ◆ Can be replaced individually



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V34-2867

34-44

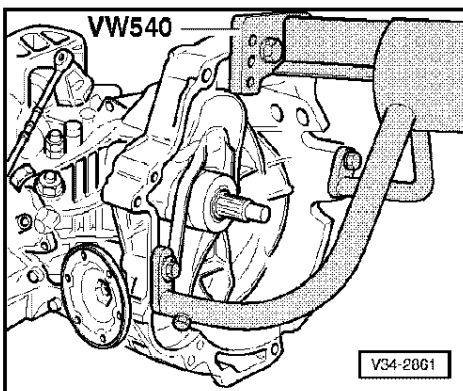


- 8 - Circlip
 - ◆ Qty. 2
- 9 - Selector rod for 1st and 2nd gear
 - ◆ Only renew together with selector fork for 1st and 2nd gear (secured together by means of a pin)
- 10 - Hollow shaft
 - ◆ Dismantling and assembling => Page 35-14
- 11 - Drive pinion
 - ◆ Dismantling and assembling => Page 35-14
- 12 - Locking bolts
 - ◆ Qty. 4
 - ◆ For aluminium bolt: 50 Nm
 - ◆ For steel bolt: 70 Nm
 - ◆ Mark installation positions of aluminium bolts and steel bolts; do not interchange

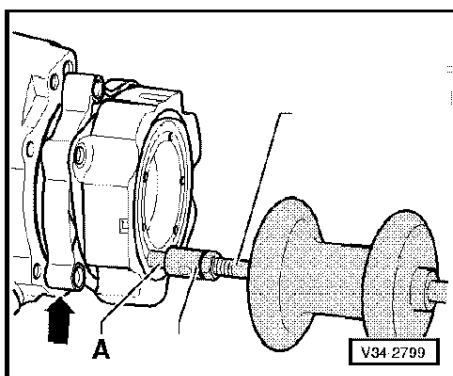
34-45

Removing and installing bearing housing, Torsen differential, end cover, internal selector mechanism, input shaft, drive pinion and hollow shaft – assembly sequence

Removing



- ◀ - Secure gearbox in assembly stand VW 540.
- Place a drip tray underneath, drain gearbox oil (2 oil drain plugs).
- Remove release bearing, clutch release lever and guide sleeve => Page 30-14.
- Unbolt cable grab for procon-ten system
=> General body repairs; Repair group 68; Repairing procon-ten system, left-hand drive ▶ 06.94 ▶ 06.94"; =>



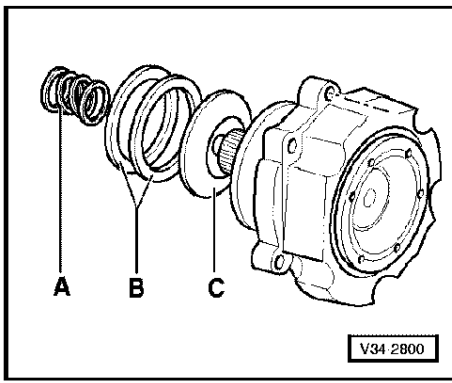
- ◀ - Unbolt bearing housing -arrow- and pull off.

A - M8/M10 stud

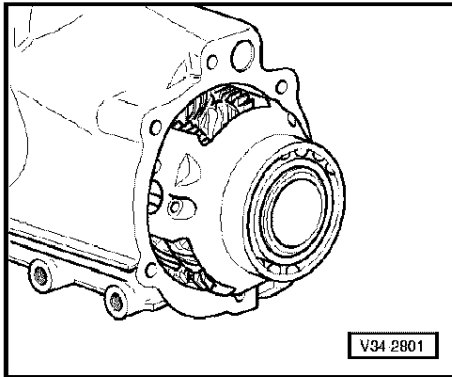
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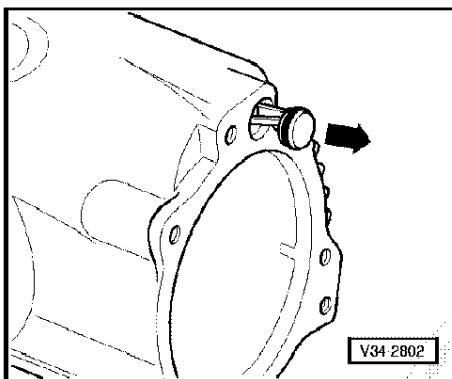
34-46



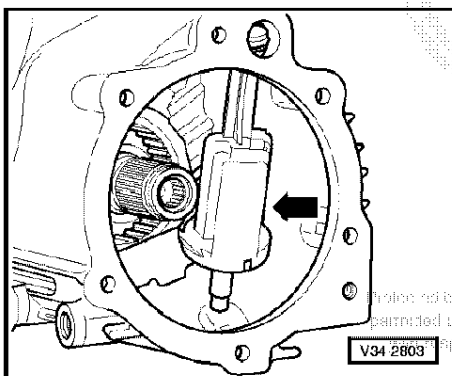
- ◀ When pulling off, the bearing housing is pressed slightly off the end cover by the spring -A-.
- When removing the bearing housing, note position of spring plate -C-:
 - Outer diameter (concave side) towards shims
- Remove shims -B-, note thickness re-determine if necessary
=> Page 34-75.



- ◀ - Pull Torsen differential out of end cover.



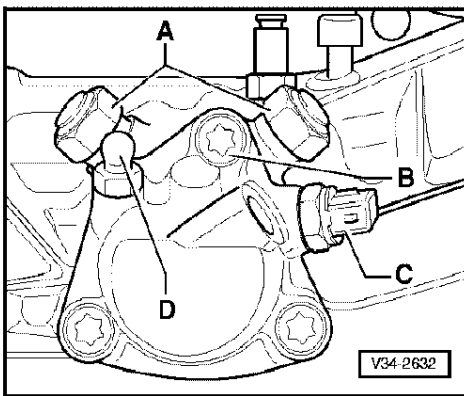
- ◀ - Pull oil collector out of end cover -arrow- until it moves freely.



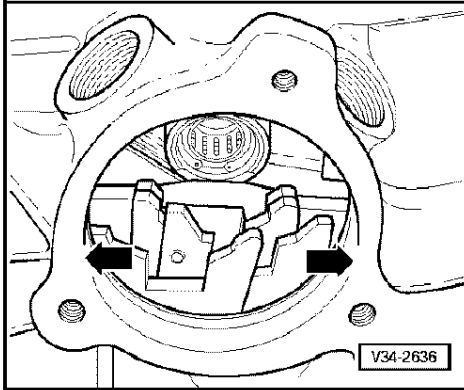
- ◀ - Swing oil collector -arrow- down and guide out through hole in end cover.
- Remove oil collector.

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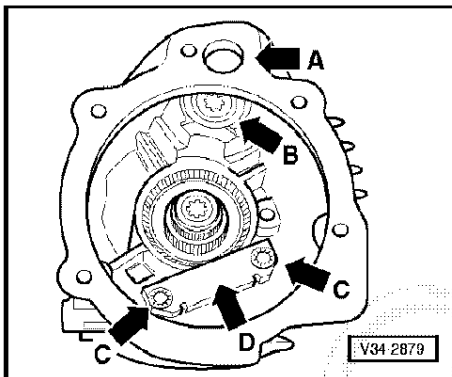




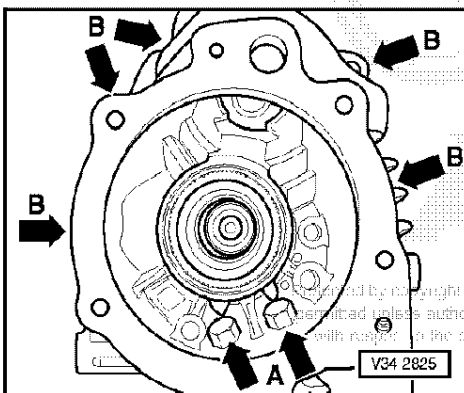
- ◀ - Remove locking bolts -A- for selector shaft from gearbox housing.
- Mark installation positions of aluminium bolts and steel bolts; do not interchange.
- Remove 3 bolts -B- for cover for selector shaft, take off cover.
- Pull out selector shaft.



- ◀ - Lock input shaft by engaging 2 gears (e.g. reverse and 2nd gear) do this by moving 2 selector plates -arrows-.



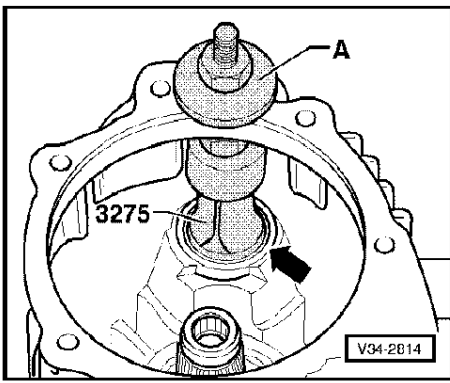
- ◀ - Loosen and unscrew multi-point socket head bolt -arrow B- in input shaft through hole -arrow A- in end cover.
- Remove 2 securing bolts -arrow C- for end cover for gearbox at supporting plate for needle bearings -arrow D-.
- Take out supporting plate.



- ◀ - Remove the 2 magnets -arrows A- and clean.
- Loosen the 5 bolts -arrows B- for securing end cover for gearbox and remove.

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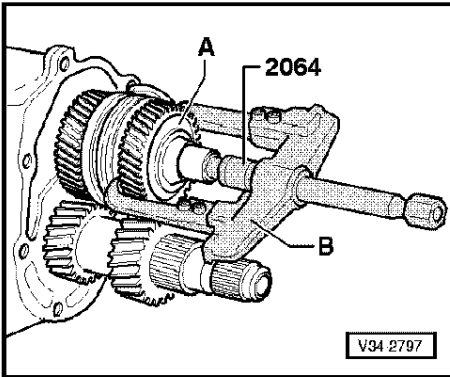
- ◀ - Pull 2nd inner race for ball bearing for input shaft.

_ A - Washer

Note:

The internal extractor 3275 grips the circumferential groove of the inner race -arrow- during the pulling operation.

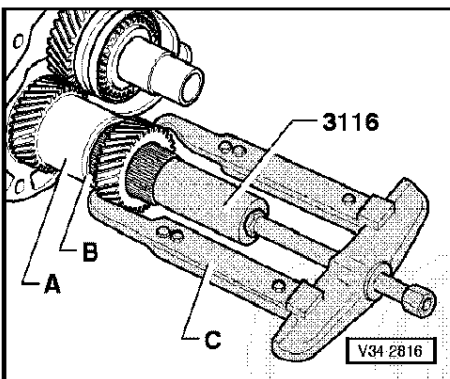
- Take off end cover together with end cover/bearing plate gasket.
- Pull dowel sleeves out of bearing plate.



- ◀ - Pull off 5th speed sliding gear with spring together with 1st inner race -A- for ball bearing for input shaft.

_ B - Two arm puller, e.g. Kukko 20/10

- Take off 5th gear synchro-ring.
- Take off circlip for 5th speed gear.



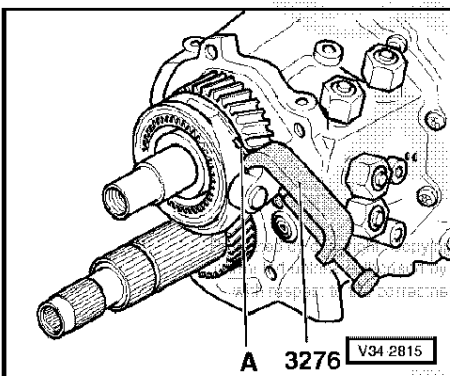
- ◀ - Pull off 5th speed gear, to do this, block hollow shaft by engaging 2 gears => Page 34-49.

Note:

Use only hexagon bolt of tensioning sleeve 3116, length 50 mm.

_ C - Two arm puller, e.g. Kukko 20/10 with 200 mm long puller arms

- Remove shim -B- for 5th speed gear, note thickness and re-determine if necessary => Page 34-68.
- Take off spacer sleeve -A-.



- ◀ - Press out roll pin -A- for selector fork for 5th and 6th gear.

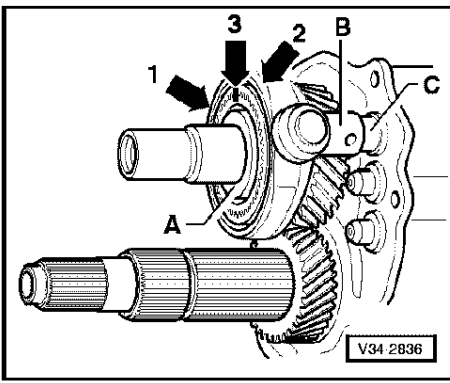
Note:

Do not drive out roll pin, otherwise selector rod bearing will be damaged.

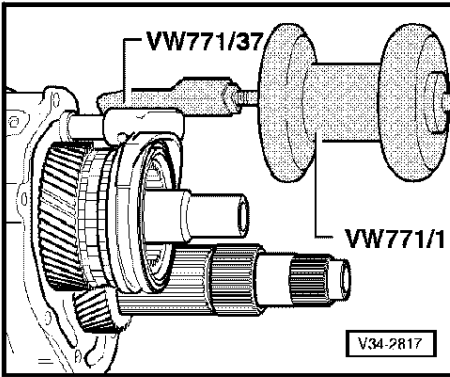
- Pull selector rod on follower together with selector fork for 5th and 6th gear and locking collar as far as possible away from bearing plate (until stop is felt).

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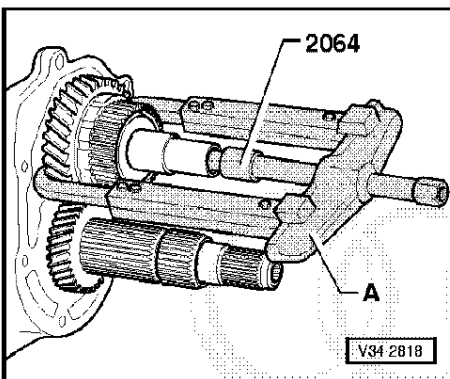




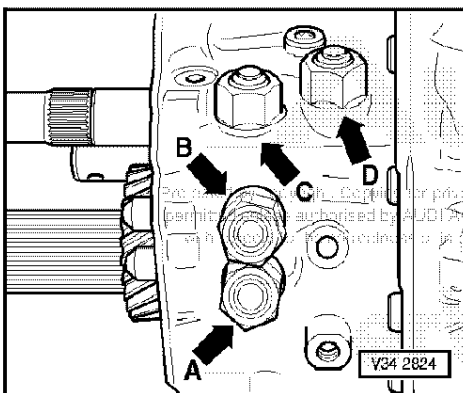
- ◀ - Mark installation position -arrow 3- of locking collar for 5th and 6th gear -arrow 1- and synchro-hub -A- (paired).



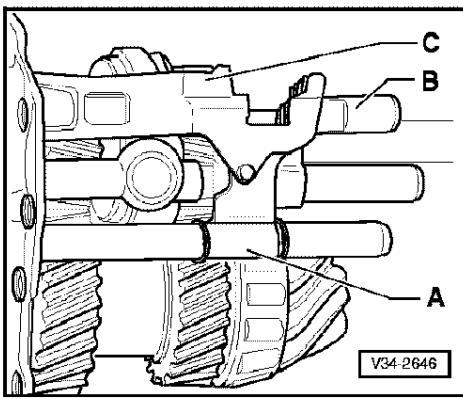
- ◀ - Pull follower together with selector fork and locking collar off selector rod.



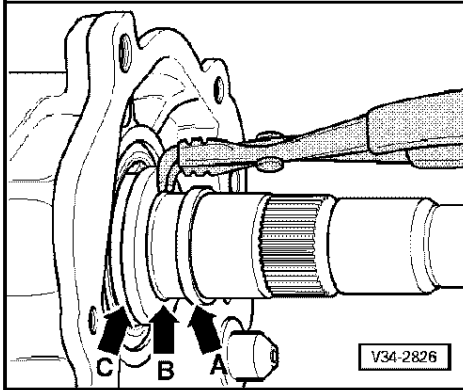
- ◀ - Pull off 6th speed sliding gear, synchro-ring for 6th gear, synchro-hub for 5th and 6th speed gears and inner race for 5th speed sliding gear.
- A - Two arm puller, e.g. Kukko 20/10 with 200 mm long hooks



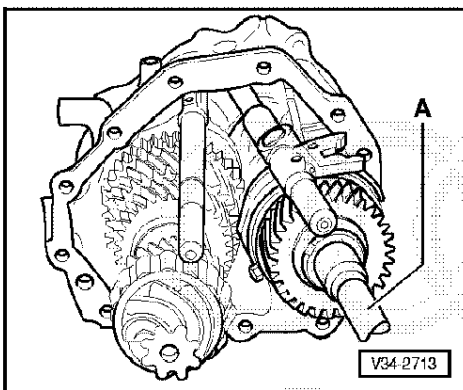
- ◀ - Unscrew selector rod locking bolts.
- A - 1st and 2nd gear
- B - 3rd and 4th gear
- C - 5th and 6th gear
- D - Reverse gear
- Mark fitting locations of aluminium and steel bolts. (Bolts must not be interchanged when installing.)
- Drive out dowel sleeves on bearing plate and remove bearing plate from gearbox housing.
- Secure drive pinion relative to hollow shaft (e.g. with hose clip) to prevent it falling out.



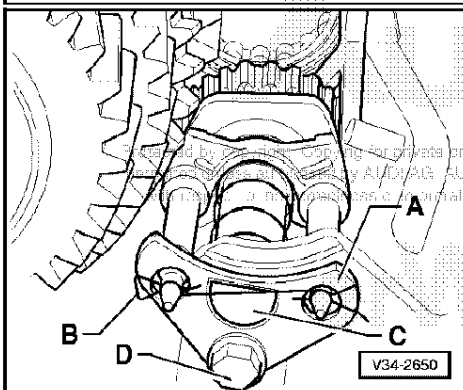
- ◀ - Separate bearing plate with input shaft, with drive pinion and hollow shaft and with inner selector mechanism from gearbox housing.
- Remove circlip from selector rod for 1st and 2nd gear and take off follower -A-.
- Pull out selector rod -B- for 5th and 6th gear.
- Remove follower -C- for reverse gear.



- ◀ - Pull thrust washer -arrow A- for needle bearing for 6th gear off shaft.
- Use right-angled circlip pliers to remove circlip -arrow B- for inner race for cylinder roller bearing.
- Take out inner race -arrow C- for cylinder roller bearing (not a press fit).



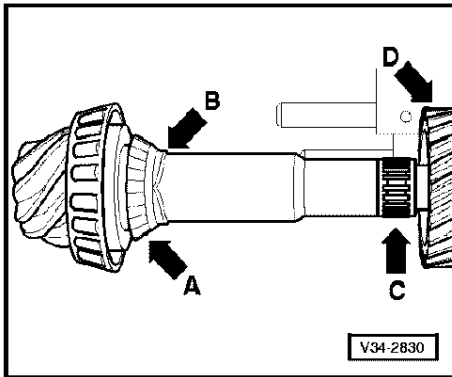
- ◀ - Take input shaft -A- with selector rod and selector fork for 3rd and 4th gear out at an angle from bearing plate.



- ◀ - Unscrew hexagon bolt -D-, take off spring clasp -B- and retaining plate -A-, pull out shaft -C- for reverse idler gear.
- Take out spring, synchro-ring and reverse idler gear.
- Take off relay lever for reverse gear.
- Removing and installing reverse gear => Page 34-102.

Notes:

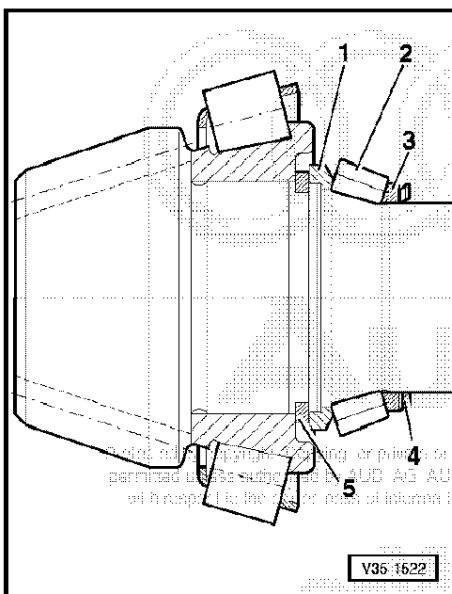
- ◆ Drive pinion and hollow shaft can be removed complete if the 6th speed gear can be easily levered off.
- ◆ If it is necessary to press off the 6th speed gear, the drive pinion must be pulled out of the hollow shaft.
- Remove drive pinion circlip.



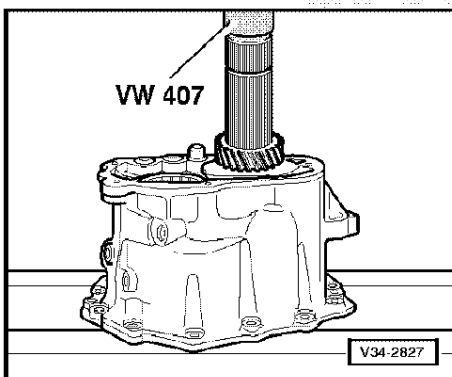
- ◀ - Pull drive pinion out of hollow shaft -D-, when doing this catch the taper rollers -A- (Qty. 23).
- Take off corrugated spring -B- and needle ring -C-.

Note:

Carefully protect bearings from dirt, clean if necessary.



- ◀ - Check bearing to ensure it is complete:
 - 1 - Flange ring (tapered contact surface to tapered rollers)
 - 2 - Tapered rollers (Qty. 23) with larger diameter facing towards drive pinion head
 - 3 - Support ring (tapered contact surface to tapered rollers)
 - 4 - Corrugated spring
 - 5 - Circlip for tapered roller bearing for drive pinion



- ◀ - Press off 6th speed gear.

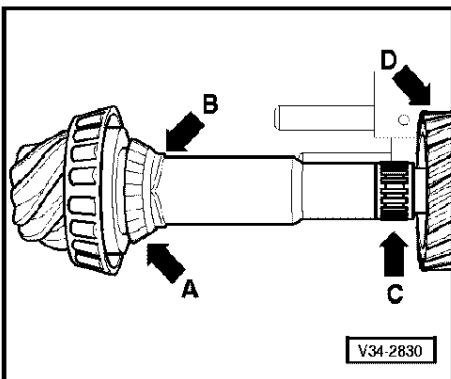
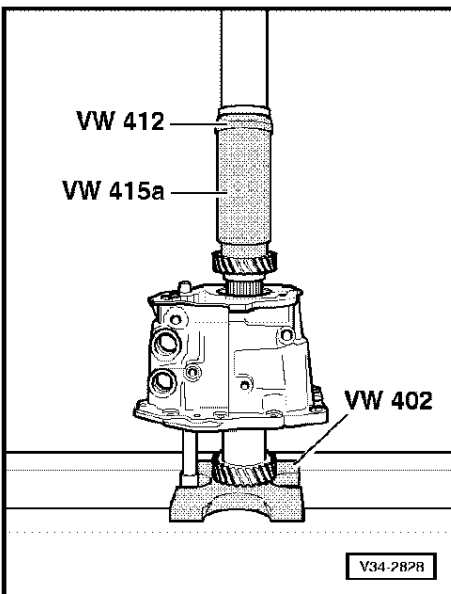
Note:

Because of the type of fit, it may be possible to press gear off easily.

- Take hollow shaft or drive pinion and hollow shaft with selector rod and selector fork for 1st and 2nd gear out of the bearing plate.

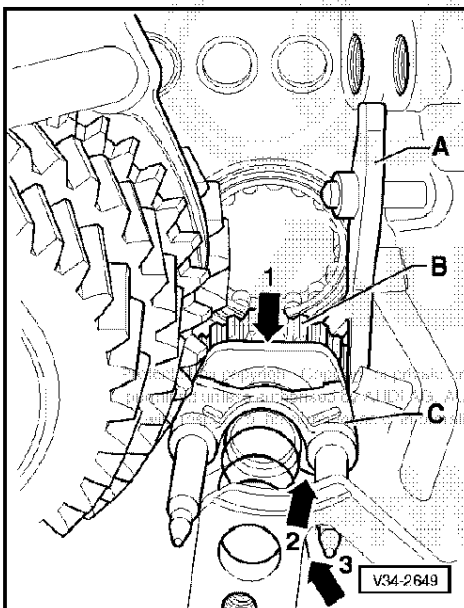
Installing

- ◀ - Fit hollow shaft with selector fork and selector rod for 1st and 2nd gear (without follower) into bearing plate.
- Heat 6th gear to approx. 120 °C and fit on.
 - Installation position: shoulder towards taper roller bearing
- Press onto stop; ensure there is no play.
- Grease drive pinion/hollow shaft taper roller bearing with multi-purpose grease before inserting.
 - Allocation =>Page 34-58



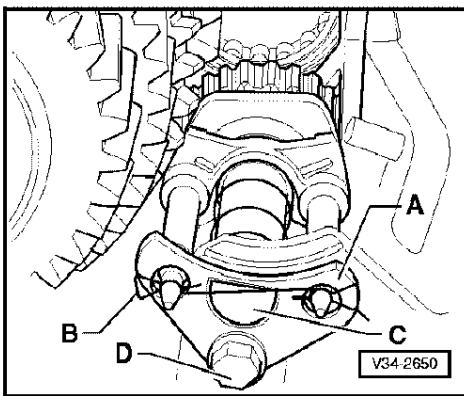
- ◀ - A - Flange ring, tapered rollers (Qty. 23), and support ring
- B - Corrugated spring
- C - Needle ring
- D - Hollow shaft
- Oil needle bearing well.
- Insert drive pinion into hollow shaft and secure with hose clip to prevent it slipping out.

34-59

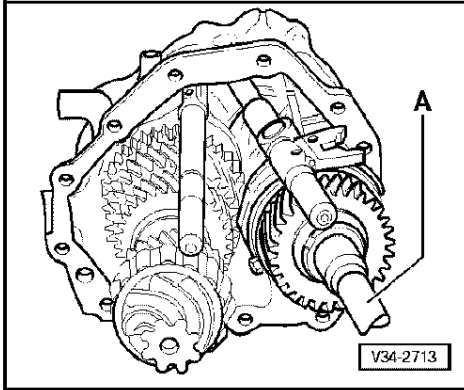


- ◀ - Fit relay lever -A- for reverse gear onto bolt for relay lever. Watch position of pin when doing this (limits relay lever travel to synchro-ring).
- Insert sliding gear -B- and engage relay lever with groove on sliding gear.
- Insert synchro-ring -C-.
 - Installation position: position flat on circumference of synchro-ring towards input shaft (not as yet fitted) -arrow 1-
- Insert spring.
 - Installation position: hook single angled end into recess on synchro-ring -arrow 2-. Turn double angled end anti-clockwise and hook into opening in bearing plate -arrow 3-

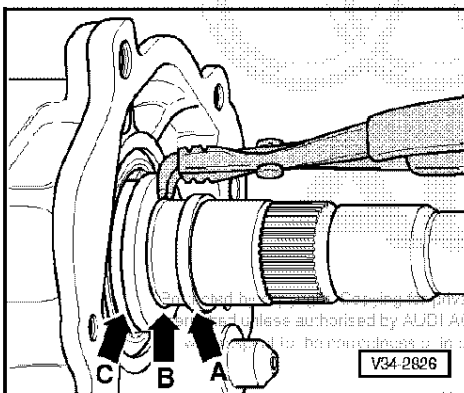
34-60



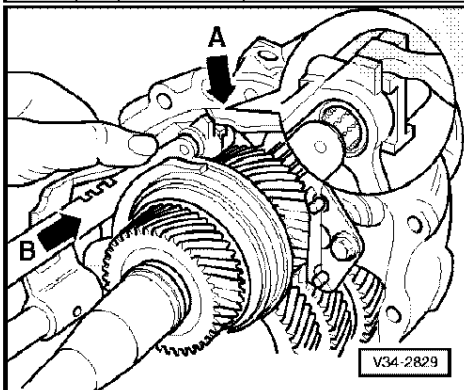
- ◀ – Insert shaft -C-.
- Fit retaining plate -A-.
 - Installation position: chamfers of holes for locking pins of the synchro-ring face bearing plate
- Insert spring clasp -B- into locking pins of the synchro-ring.
- Renew self-locking nut -D- and tighten to 25 Nm.



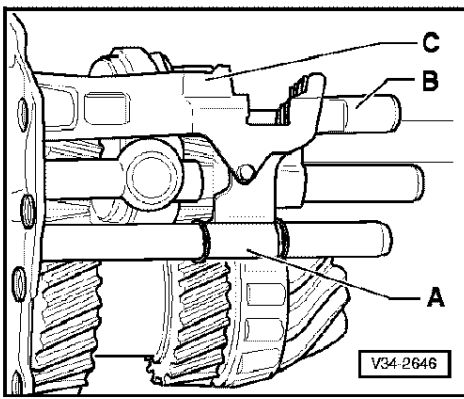
- ◀ – Slide input shaft -A- with selector rod and selector fork for 3rd and 4th gear at an angle into the bearing plate.
 - Selector fork installation position: rib towards follower
- = > Page 34-44



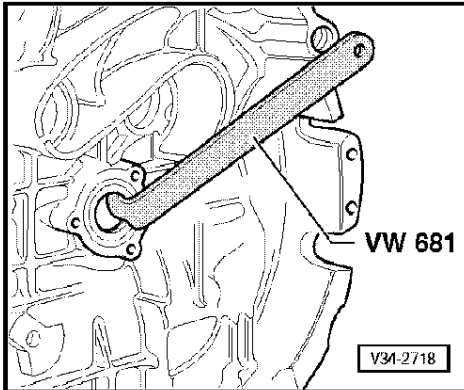
- ◀ – Slide inner race -arrow C- for cylinder roller bearing onto main shaft at flange for end cover (clearance fit).
- Fit circlip -arrow B- using right-angled circlip pliers.



- Engage recess in follower for reverse gear with the free end of relay lever -arrow A-.
- Slide selector rod for 5th and 6th through follower for reverse gear in direction of -arrow B-.



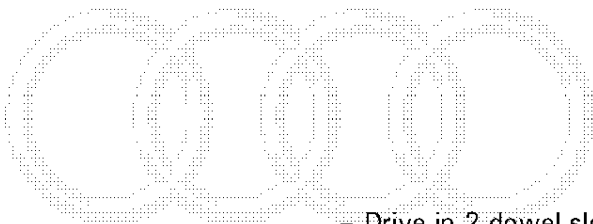
- ◀ - Slide follower -A- for 1st and 2nd gear onto selector rod and secure with circlips.
- Oil all bearings of input shaft and drive pinion/hollow shaft in gearbox housing and bearing flange as well as the selector rods with gear oil.



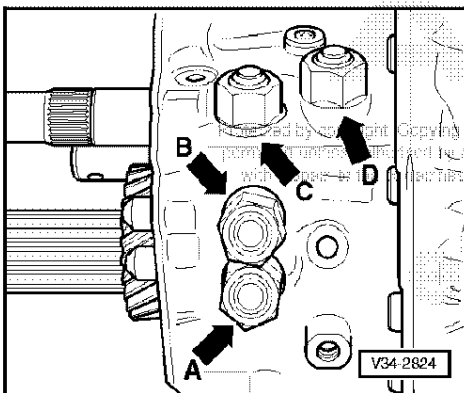
- ◀ - Lever used seal for input shaft carefully out of gearbox housing with VW 681.
- Coat sealing surfaces between bearing plate and gearbox housing with sealing paste AMV 188 200 03.
- Insert complete bearing plate into gearbox housing.

Note:

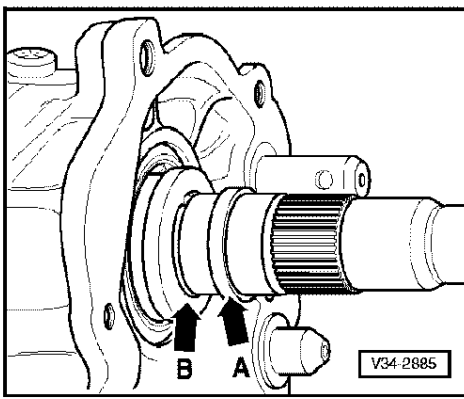
When inserting the complete bearing plate, ensure that the selector rods align with their mounting points.



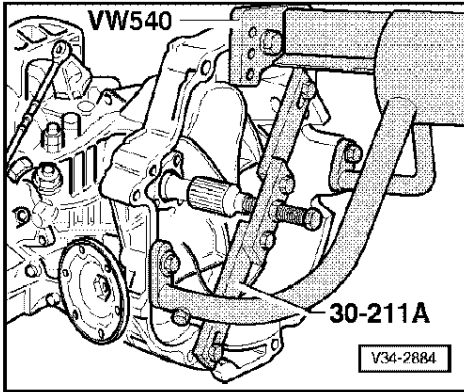
- Drive in 2 dowel sleeves for bearing flange/gearbox housing.
- Tighten 12 bolts using diagonal sequence.



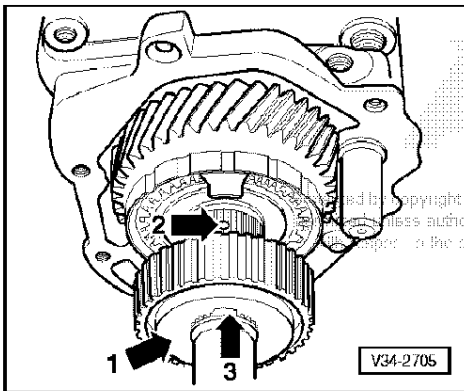
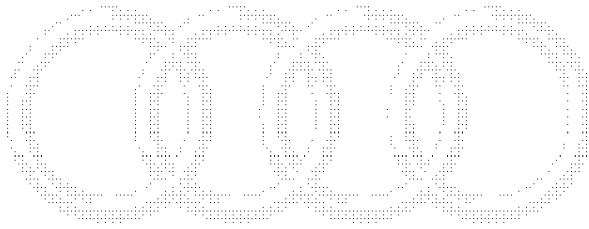
- ◀ - Screw in locking bolts for selector rods.
 - A - 1st and 2nd gear
 - B - 3rd and 4th gear
 - C - 5th and 6th gear
 - D - Reverse gear
- Aluminium and steel bolts must not be interchanged when installing.
- Tightening torques:
 - for aluminium locking bolts – 50 Nm
 - for steel locking bolts – 70 Nm



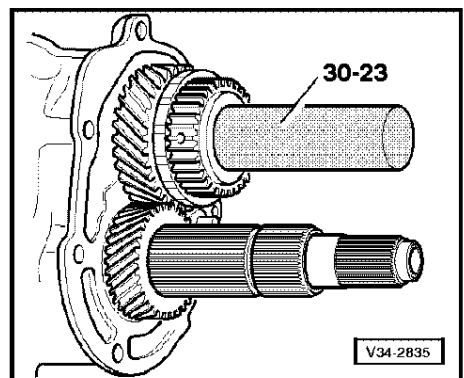
- ◀ - Fit thrust washer -arrow A- for needle bearing for 6th speed gear.
 - Installation position: shoulder towards circlip -arrow B-, smooth contact surface to shaft end
- Oil needle bearing for 6th speed sliding gear with gear oil and fit.
- Slide on 6th speed sliding gear with spring and synchro-ring.
 - Synchro-ring installation position: the lugs of the synchro-ring engage into the recesses below in the sliding gear



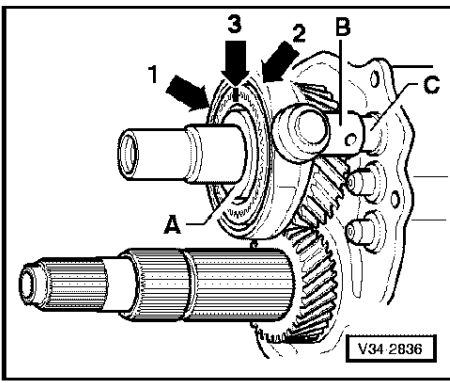
- ◀ - Support input shaft with support bridge 30-211 A.



- ◀ Installation position of synchro-hub for 5th and 6th gear:
 - ◆ Side with projecting face -arrow 1- faces shaft end
 - ◆ The oil drilling of the input shaft -arrow 2- and the oil groove of the synchro-hub -arrow 3- are in line



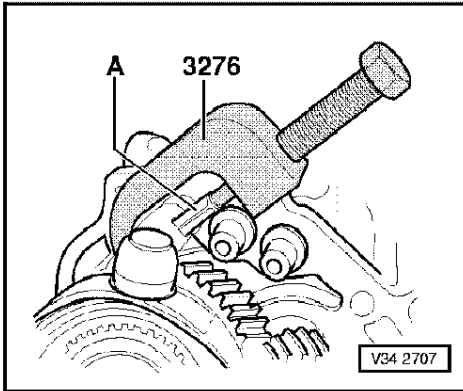
- ◀ - Heat synchro-hub for 5th and 6th gear to approx. 100 °C, fit and drive on; ensure there is no play.
- Check 6th speed sliding gear for axial play.



- ◀ - Line up markings -arrow 3- on paired synchro-hub -A- and locking collar for 5th and 6th gear -arrow 1-.
- Fit locking collar -arrow 1- with selector fork -arrow 2- onto synchro-hub -A- as well as follower for 5th and 6th gear -B- onto selector rod -C- at the same time.

Notes:

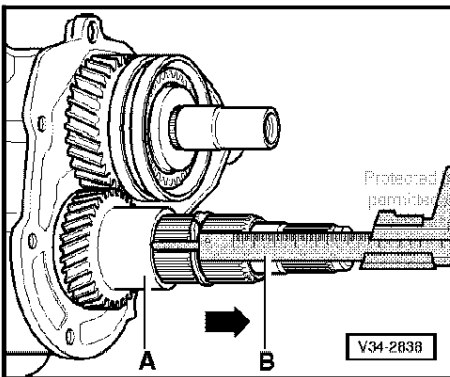
- ◆ Selector fork rib -arrow 2- must face towards shaft end.
- ◆ When sliding follower onto selector rod for 5th and 6th gear remember holes for roll pin.



- ◀ - Press in roll pin -A- flush.

Note:

Do not drive in roll pin, otherwise selector rod mounting will be damaged.



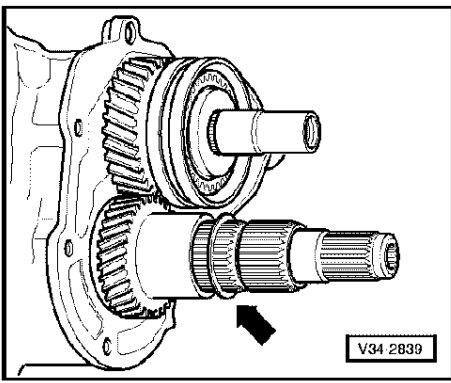
- ◀ - Re-determining shim for 5th speed gear:
 - Fit spacer sleeve -A- (length 39.6 mm) onto hollow shaft.
 - When fitting circlip, push in direction of arrow onto stop.
 - Measure distance between sleeve and fitted circlip with depth gauge -B-.

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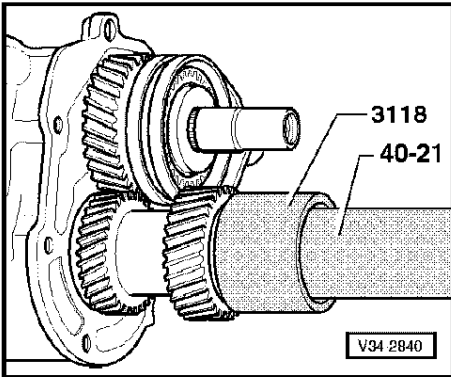
- Determine shim from table. Part numbers = > Parts catalogue

The following shims are available:

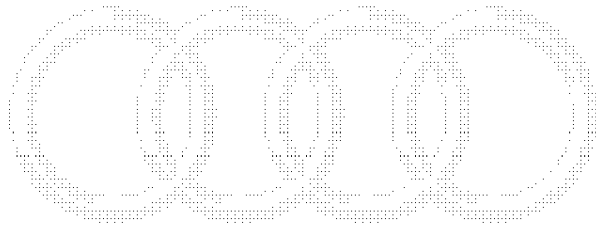
Measured range (mm)	Shim thickness (mm)
31.01 ... 31.11	1.05
31.11 ... 31.21	1.15
31.21 ... 31.31	1.25
31.31 ... 31.41	1.35



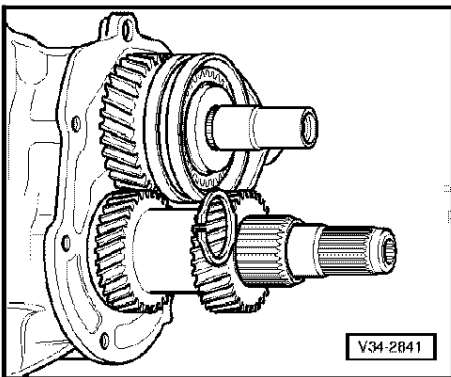
- ◀ - Fit shim selected -arrow- onto hollow shaft.



- ◀ - Heat 5th speed gear to approx. 120 °C, fit and drive onto stop free of play.
 - Installation position: shoulder towards spacer sleeve



———— 34-69 ————



- ◀ - Re-determining circlip for 5th speed gear:
 - Determine the thickest circlip that can still just be fitted.
 - Determine circlip from table. Part numbers
- = > Parts catalogue

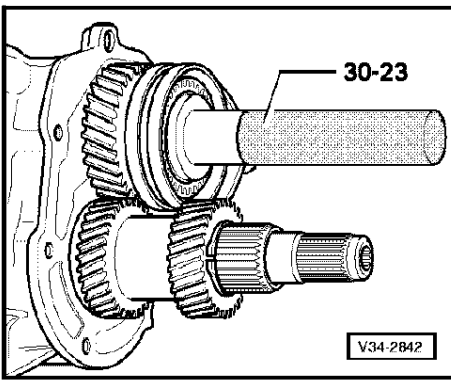
The following circlips are available:

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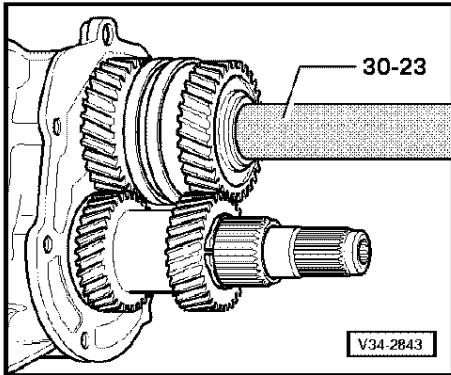
Circlip thickness (mm)		
2.32	2.40	2.48
2.34	2.42	2.50
2.36	2.44	
2.38	2.46	

- Fit circlip.

———— 34-70 ————



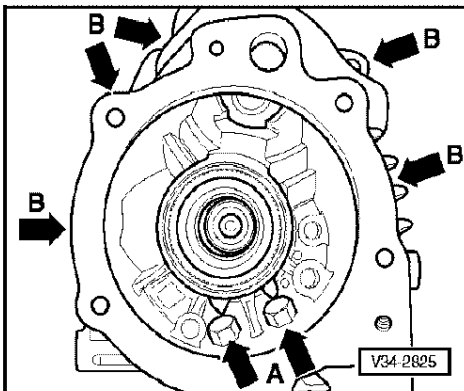
- ◀ - Drive on inner race for 5th speed sliding gear free of axial play.
- Oil needle bearing with gear oil and fit.
- Place synchro-ring for 5th gear in locking collar.
- Slide on 5th speed sliding gear with spring.



- ◀ - Heat 1st inner race for ball bearing for input shaft to approx. 100 °C, fit onto input shaft and drive onto stop; ensure there is no play.
- Check 5th speed sliding gear for axial clearance.
 - Permissible axial clearance: 0.15 ... 0.35 mm
- Insert dowel sleeves into bearing plate.
- Fit new gasket for end cover.



34-71



- ◀ - Fit end cover and insert securing bolts -arrows B-.

Note:

Do not tighten bolts.

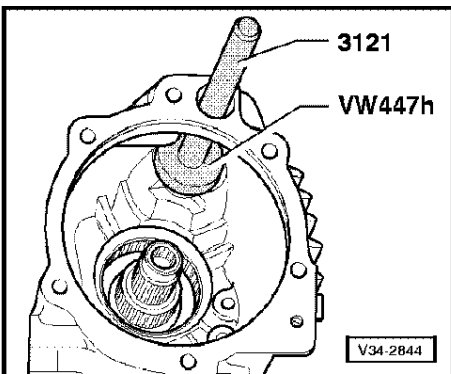
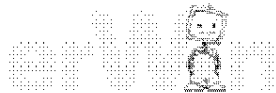
- Clean the two magnets -arrows A- and insert.

- Fit support plate and tighten hand tight.

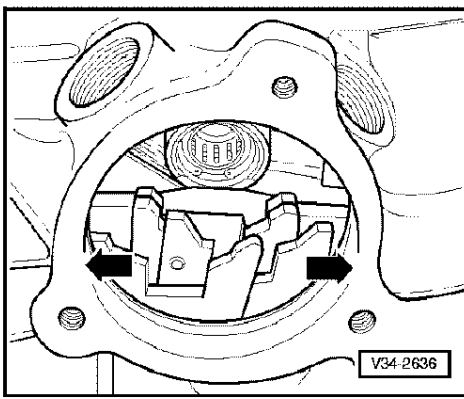
- Installation position: Lugs towards magnets

Protected by copyright. Copying for private or commercial purposes in part or in whole is not permitted. Tighten bolts for end cover using diagonal sequence with respect to the correctness of information in this document. Copyright by AUDI AG

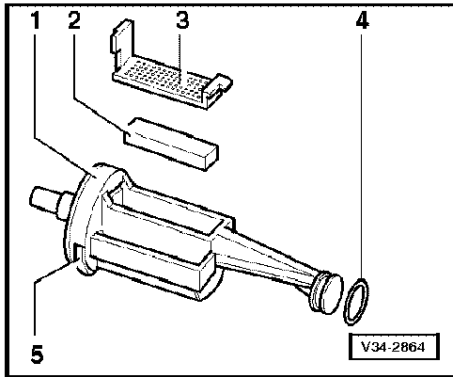
- Tighten bolts for end cover using diagonal sequence.



- ◀ - Oil 2nd inner race and with ball contact surface facing towards input shaft ball bearing, drive onto input shaft through hole in end cover.
- Remove support bridge 30-211 A.

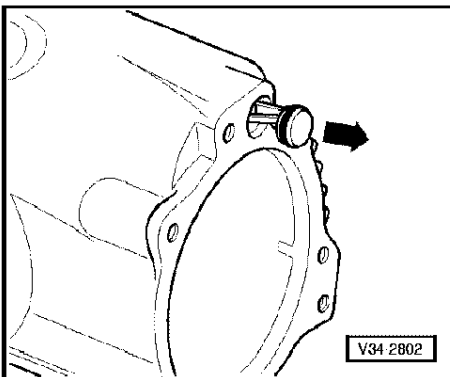


- ◀ - Lock input shaft by engaging 2 gears (e.g. reverse and 2nd gear), do this by moving two selector plates -arrows-.
- Tighten multi-point socket head bolt to 150 Nm.



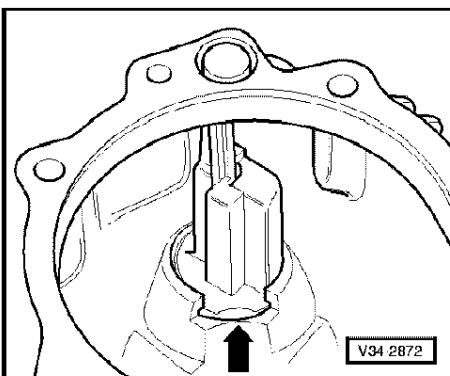
- ◀ - Unclip cover -3- for oil collector from oil collector -1- at longer end with a screwdriver and remove magnet -2-.
- 4 - O-ring
- 5 - Positioning segment
- Clean oil collector.
- Assemble oil collector.

34-73



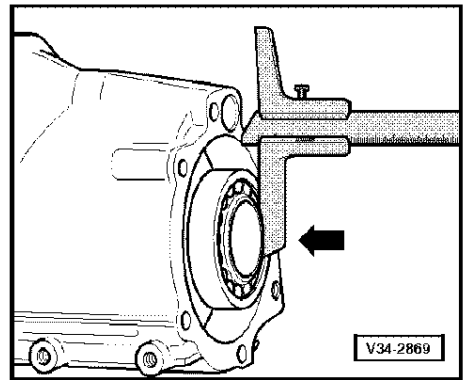
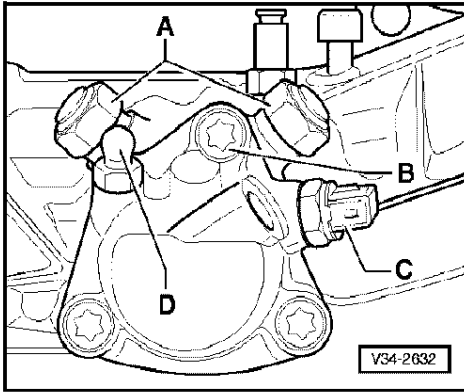
- ◀ - Guide oil collector from interior of end cover with support arm leading through the hole of the end cover -arrow-, until the O-ring can be fitted from outside onto the oil collector.
- Lightly oil new O-ring and fit.

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- Insert oil tube of oil collector into input shaft.
- ◀ - Turn oil collector until the positioning segment is located in the machined recess of the end cover -arrow-.
- Press in oil collector onto stop.
- Slide assembly sleeve, Part No. 01E 311 120, onto selector shaft.
- Check neutral position of followers.
 - Selector gates must align

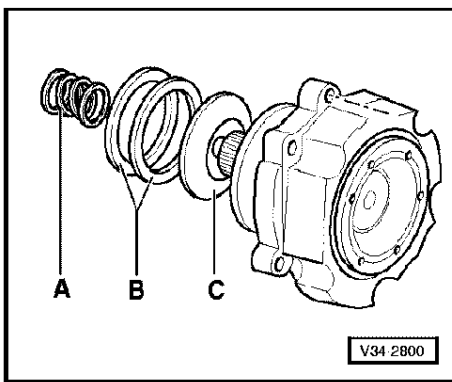
34-74



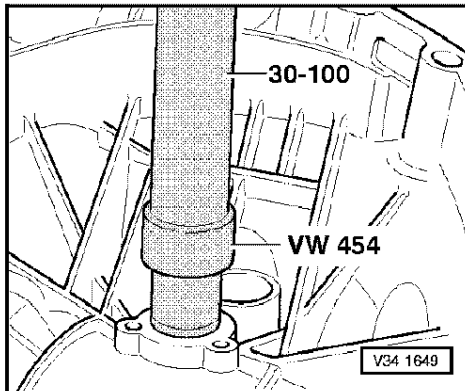
- Install complete selector shaft.
- ◀ - Screw locking bolts -A- for selector shaft into gearbox housing.
- Aluminium and steel bolts must not be interchanged when installing.
 - Tightening torques:
 - for aluminium locking bolts – 50 Nm
 - for steel locking bolts – 70 Nm
- Lightly oil new O-ring for cover for selector shaft and fit.
- Fit cover for selector shaft.
- Coat bolts -B- (Qty. 3) with sealing paste AMV 188 200 03 before installing and tighten.
- ◀ - Slide Torsen differential onto splines of hollow shaft.
- Press Torsen differential in direction of arrow, and measure distance between top edge of the bolted end cover and front edge of outer race of ball bearing for Torsen differential.
- Determine required shim(s) from following table. Part numbers => Parts catalogue

The following shims are available:

Measured range mm	Qty.	Shim thickness (mm)
7.05 ... 7.30	1	1.65
	1	1.45
	1	1.20
7.30 ... 7.55	1	1.65
	1	1.45
	1	0.95
7.55 ... 7.80	1	1.65
	1	1.45
	1	0.70
7.80 ... 8.05	1	1.65
	1	1.45
	1	0.45
8.05 ... 8.25	2	1.65
8.25 ... 8.50	1	1.65
	1	1.45
8.50 ... 8.75	1	1.65
	1	1.20
8.75 ... 9.00	1	1.65
	1	0.95
9.00 ... 9.25	1	1.65
	1	0.70
9.25 ... 9.50	1	1.65
	1	0.45



- ◀ - Insert spring plate -C- into bearing housing.
 - Installation position: larger diameter (concave side) towards the shims.
- Fit shims -B- as determined in table.
- Fit spring -A- to end of flange shaft.
- Lightly oil new O-ring for bearing housing and fit.
- Oil small needle bearing in drive pinion.
- Insert complete bearing housing and pull home evenly.
- Tighten bearing housing using diagonal sequence.



- ◀ - Fill space between sealing lip and dust lip of new seal for input shaft with multi-purpose grease.
- Pull a thin protective hose tightly onto splines of input shaft.
- Drive on seal for input shaft.
 - Installation depth: 4.5 mm
- Remove protective hose.

———— 34-77 ————

- Install release bearing, clutch release lever and guide sleeve
=> from Page 30-14.
- Check that gearbox can be shifted through all gears.
- Fit connecting rod.
- Install cable grab for procon-ten
=> General body repairs; Repair group 68; Repairing procon-ten system, left-hand drive ▶ 06:94 ▶ 06:94"; =>
- Check oil level in gearbox => Page 34-29.

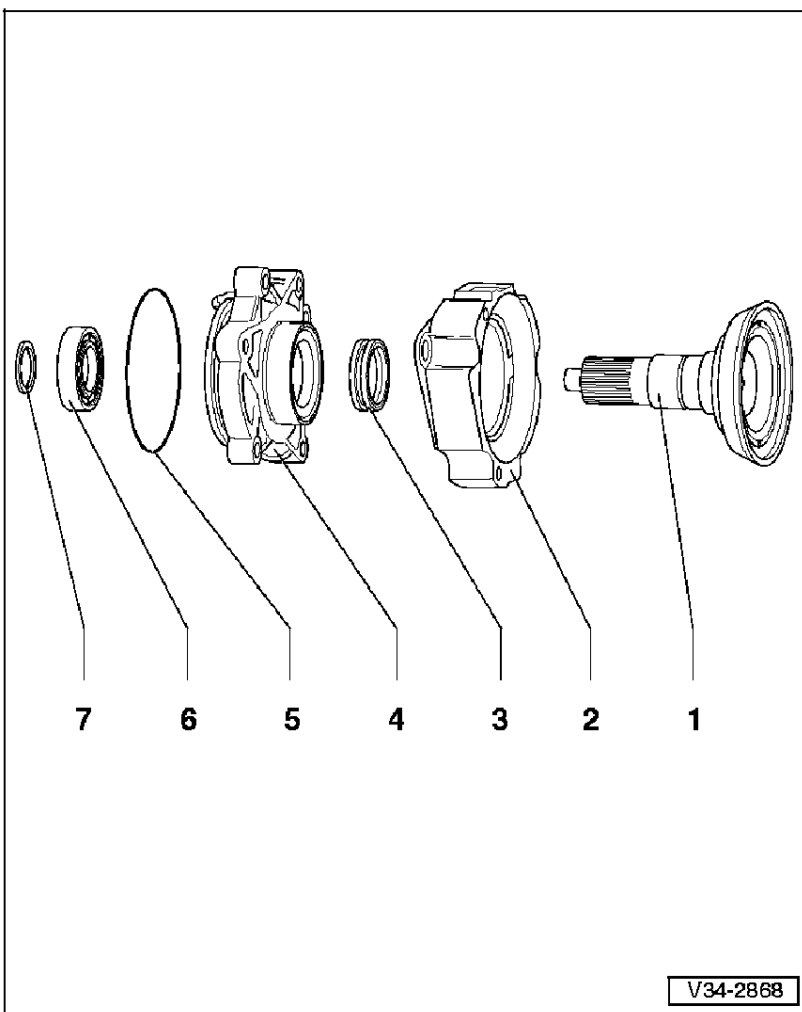
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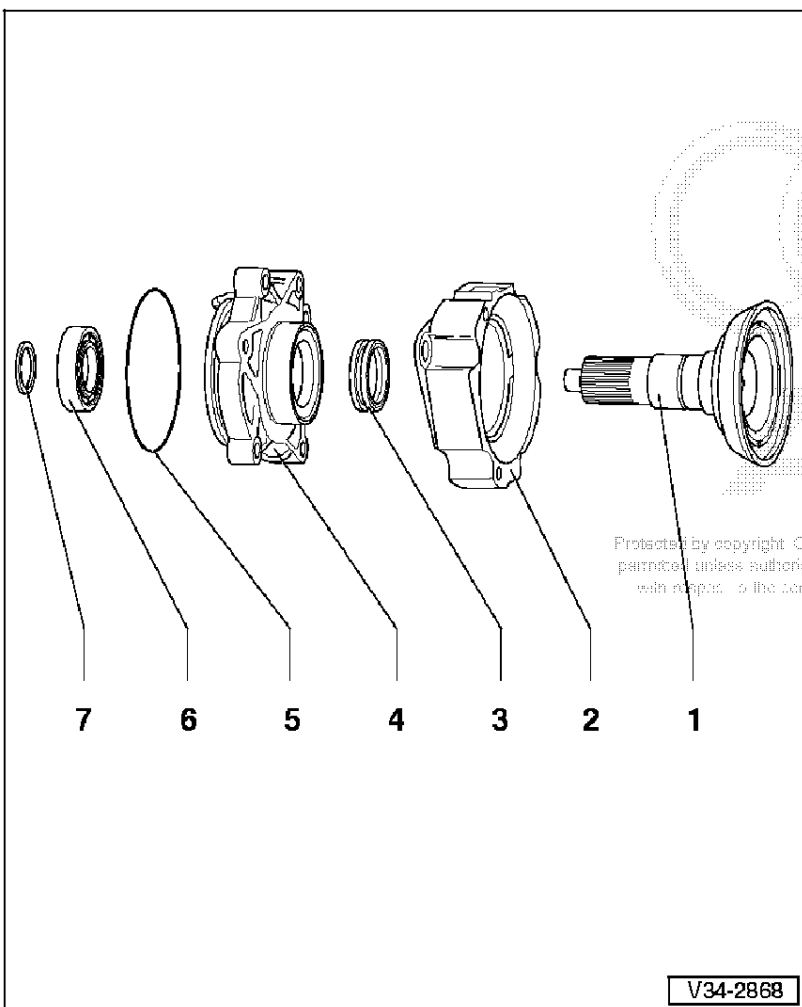
———— 34-78 ————

Dismantling and assembling bearing housing



- 1 - Flange shaft
 - ◆ Pressing out => Fig. 1
 - ◆ Pressing in => Fig. 2
- 2 - Balance weight
 - ◆ Pressing off => Fig. 3
 - ◆ Pressing on => Fig. 4
- 3 - Seal
 - ◆ Pulling out => Fig. 5
 - ◆ Preparing for installation => Fig. 6
 - ◆ Driving in => Fig. 7
- 4 - Bearing housing

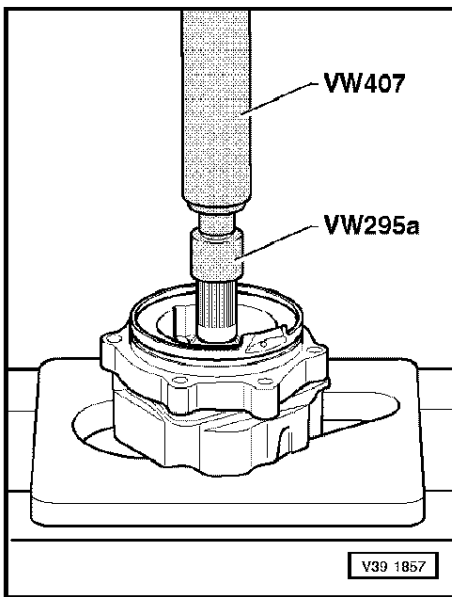
34-79



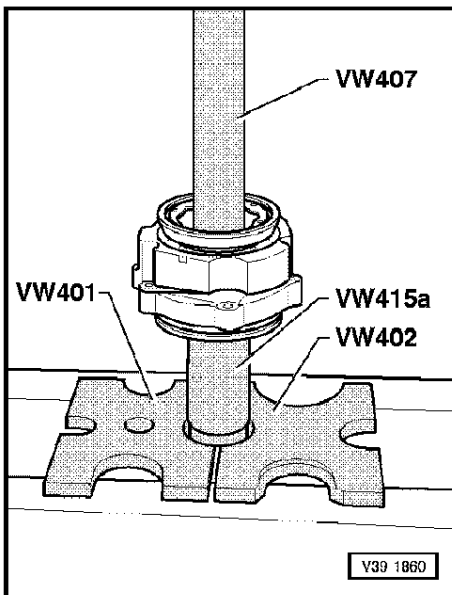
- 5 - O-ring
 - ◆ Always renew
 - ◆ Lightly oil before installing
- 6 - Ball bearing for flange shaft
 - ◆ Pressing off => Fig. 8
 - ◆ Pressing in => Fig. 9
- 7 - Circlip

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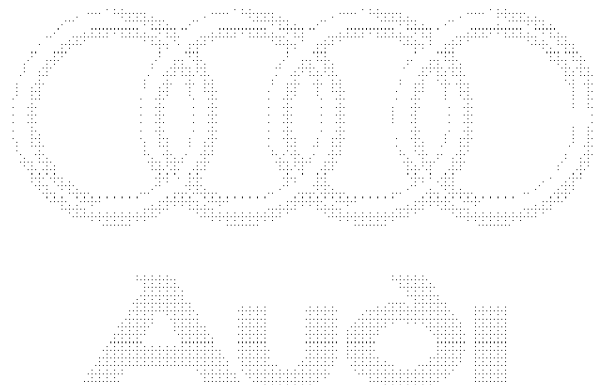
34-80



◀ Fig.1 Pressing out flange shaft
 – Before pressing out flange shaft remove circlip.

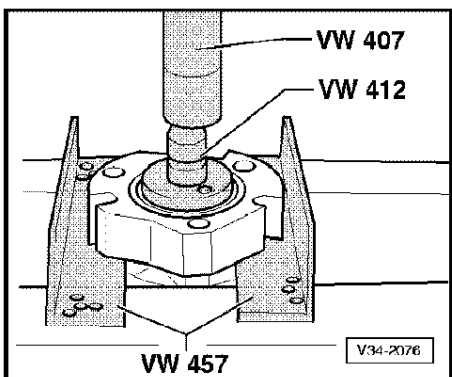


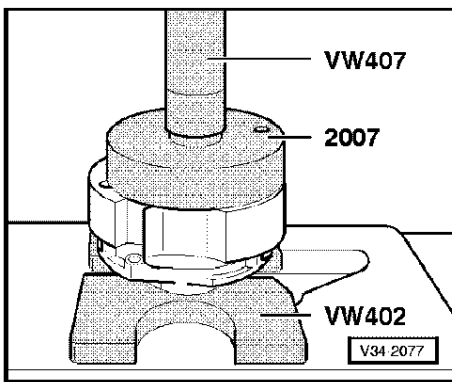
◀ Fig.2 Pressing in flange shaft
 – Before pressing in flange shaft, press on balance weight => Fig. 4.
 – Fit circlip.



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◀ Fig.3 Pressing off balance weight

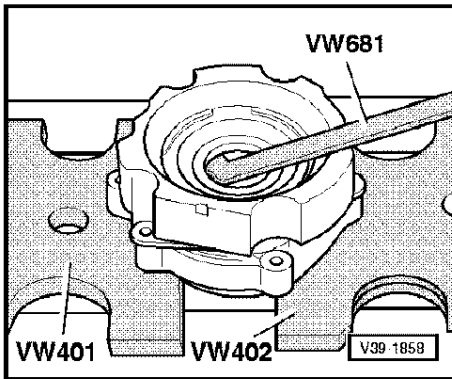




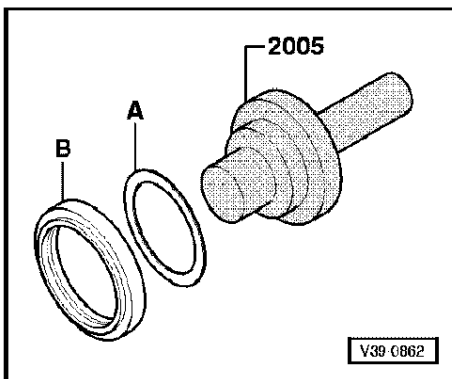
◀ Fig.4 Pressing on balance weight

Note:

Note position of holes.



◀ Fig.5 Pulling out seal



◀ Fig.6 Preparing seal for installation

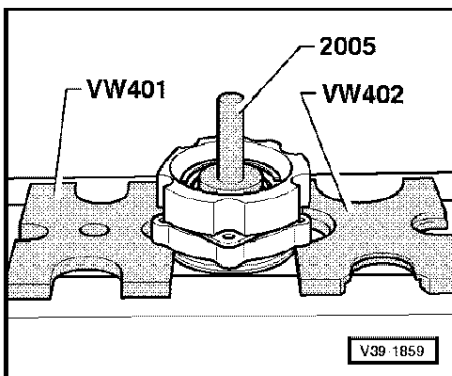
— A - Shim Part No. 016 311 391 B (1.7 mm thick)

— B - Seal

– Fill space between sealing and dust lips with multipurpose grease.

– Fit shim and seal onto tool one after the other.

– Installation position: open side of seal towards bearing housing



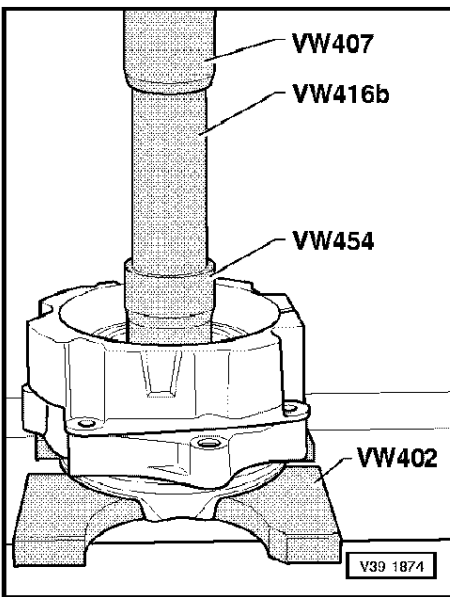
◀ Fig.7 Driving in seal

– Remove shim.

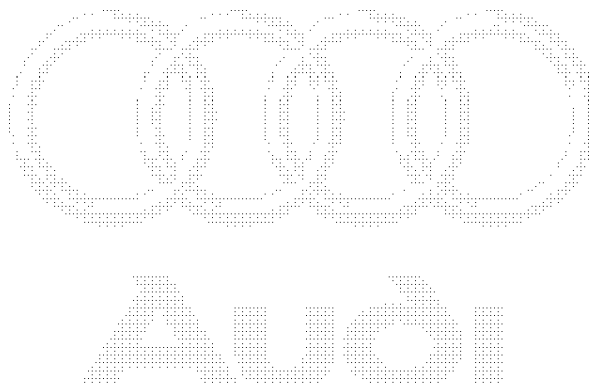
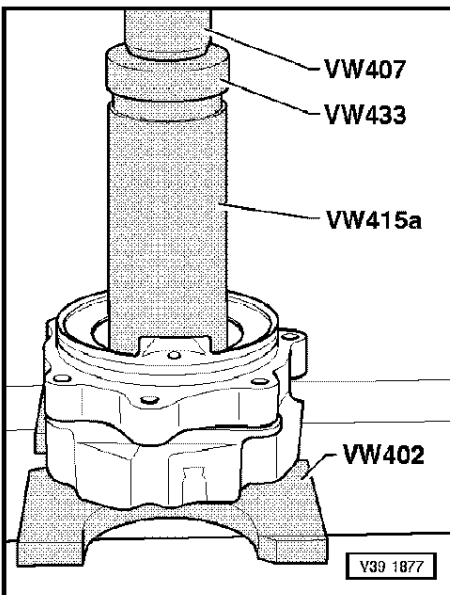
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◀ Fig.8 Pressing out ball bearing for flange shaft



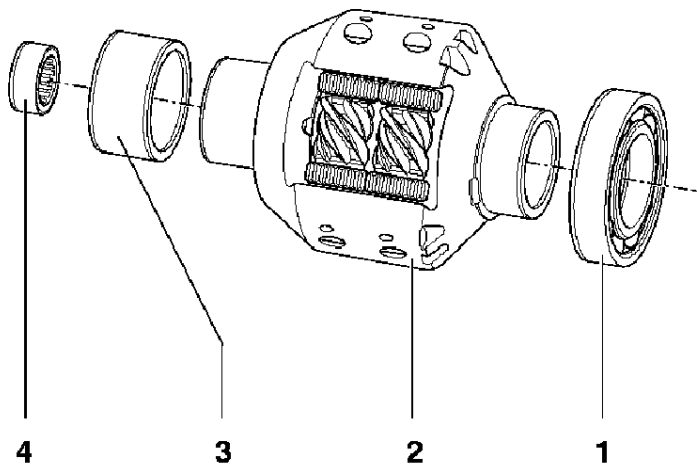
◀ Fig.9 Pressing in ball bearing for flange shaft



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Servicing bearings for Torsen differential



V35-1411

1 – Ball bearing for Torsen differential

- ◆ Pressing off => Fig. 1
- ◆ Pressing on => Fig. 2

2 – Torsen differential

- ◆ Can only be serviced by manufacturer

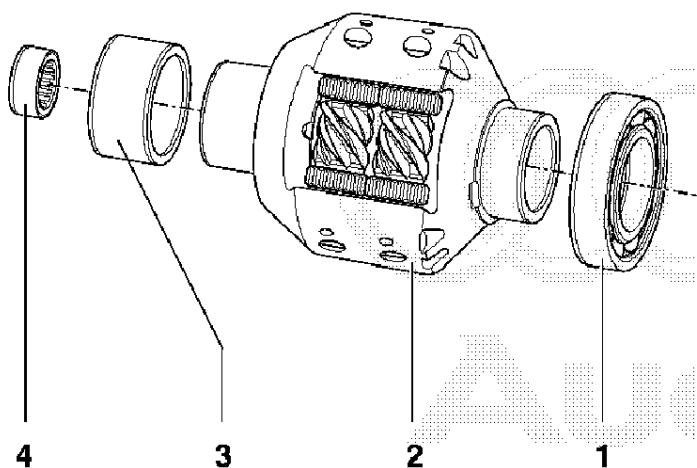
3 – Inner race for needle bearing for Torsen differential

- ◆ Pulling off => Fig. 3
- ◆ Pressing on => Fig. 4

4 – Needle bearing for drive pinion/Torsen differential

- ◆ Pulling out => Fig. 5
- ◆ Pressing in => Fig. 6

34-87



V35-1411

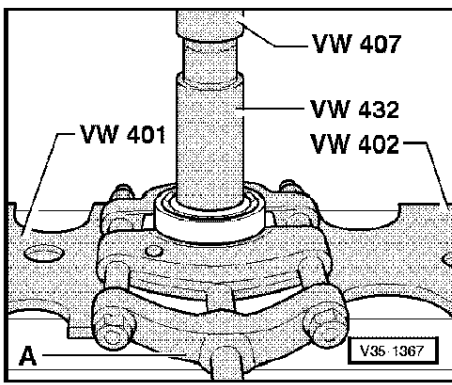
Note:

The shims for the Torsen differential must be re-determined after replacing the following parts =>Page 34-75:

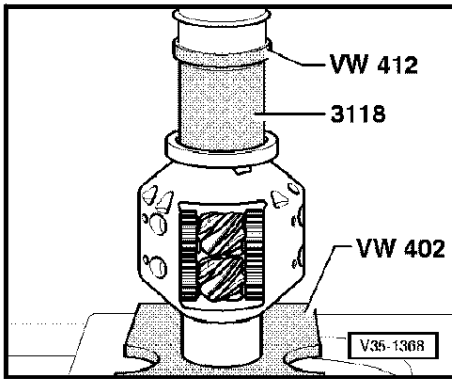
- ◆ End cover
- ◆ Inner race for needle bearing
- ◆ Torsen differential
- ◆ Ball bearing for Torsen differential

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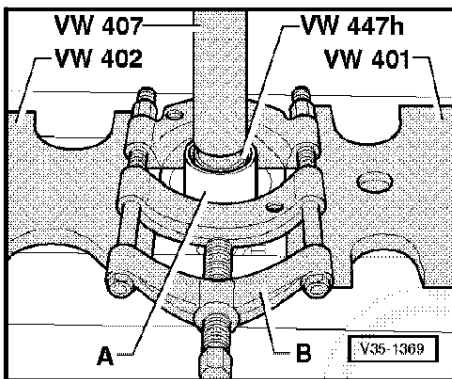
34-88



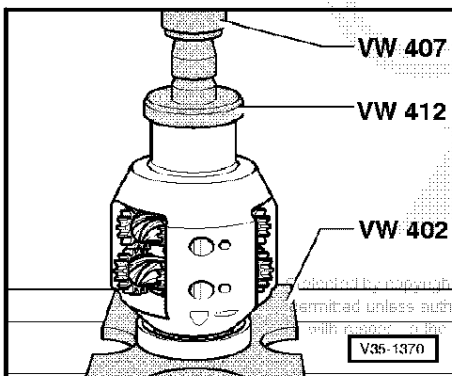
◀ Fig.1 Pressing off ball bearing for Torsen differential
 _ A - Separating device 22 ... 115 mm, e.g. Kukko 17/2



◀ Fig.2 Pressing on ball bearing for Torsen differential
 ♦ Press piece 3118 with shoulder towards press tool VW 412



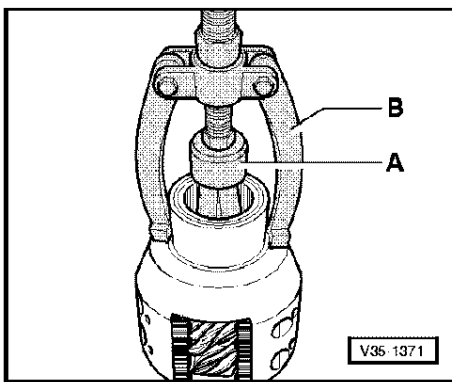
◀ Fig.3 Pulling off inner race for needle bearing for Torsen differential
 _ A - Inner race
 _ B - Separating device 22 ... 115 mm, e.g. Kukko 17/2



◀ Fig.4 Pressing on inner race for needle bearing for Torsen differential

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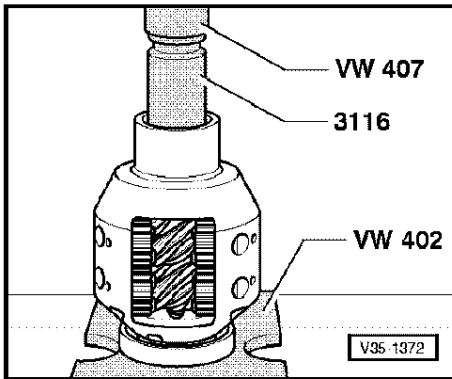




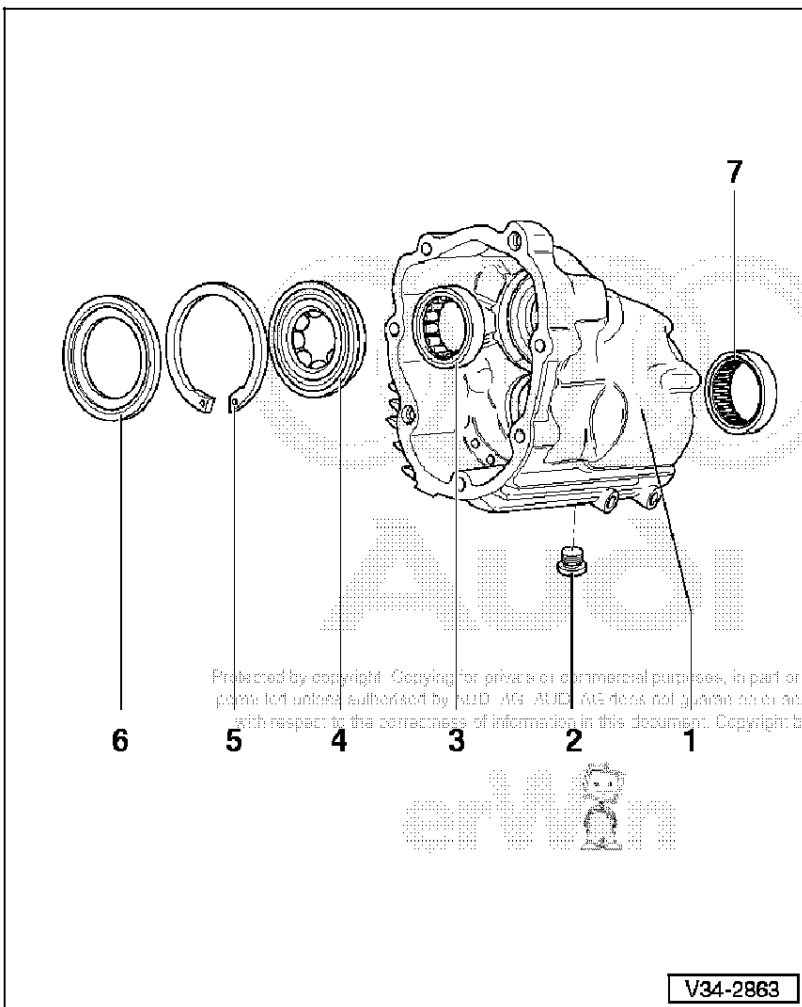
◀ Fig.5 Pulling out needle bearing for drive pinion/Torsen differential

_ A - Internal puller 30 ... 37 mm, e.g. Kukko 21/5

_ B - Counter support, e.g. Kukko 22/1



◀ Fig.6 Pressing in needle bearing for drive pinion/Torsen differential



Servicing end cover

1 – End cover

◆ If renewed:

- Re-determine thickness of circlip -item 5-
- Re-determining shims for Torsen differential => Page 34-75.

2 – Oil drain plug – 40 Nm

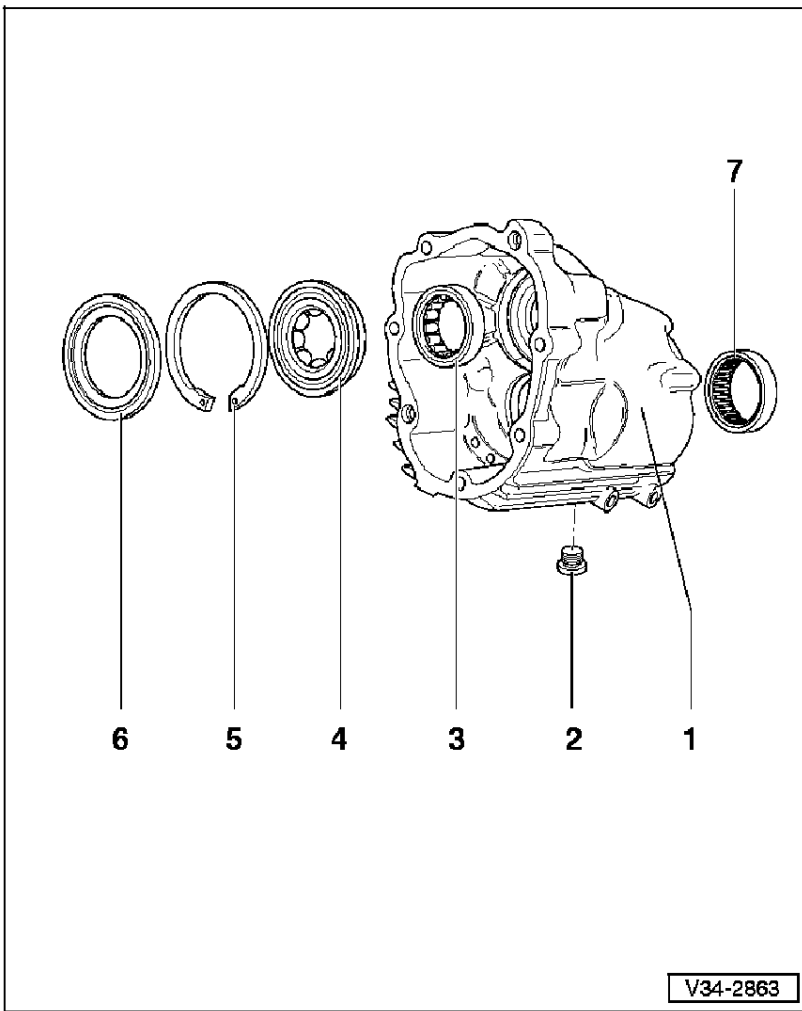
3 – Cylinder roller bearing for input shaft

- ◆ Pulling out => Fig. 1
- ◆ Pressing in flush => Fig. 2

4 – Ball bearing for input shaft

- ◆ Removing => Fig. 3
- ◆ Installing => Fig. 4
- ◆ If renewed, re-determine thickness of circlip -item 5-

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5 - Circlip

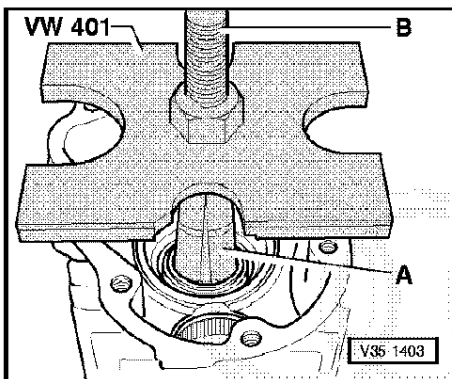
- ◆ Re-determine thickness
=> Page 34-96
- ◆ Installing => Fig. 4

6 - Baffle plate

- ◆ Renew
- ◆ Removing => Fig. 3
- ◆ Installing and peening in position when replacing ball bearing for input shaft => Fig. 5
- ◆ Installing and peening in position when replacing end cover => Fig. 6

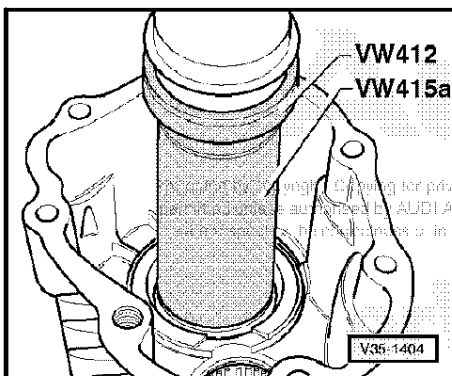
7 - Needle bearing for Torsen differential

- ◆ Pulling out => Fig.
- ◆ Driving in => Fig. 8



◀ **Fig.1 Pulling cylinder roller bearing for input shaft out of end cover**

- _ A - Internal puller 37 ... 46 mm, e.g. Kukko 21/6
- _ B - Spindle from counter support Kukko 22/2

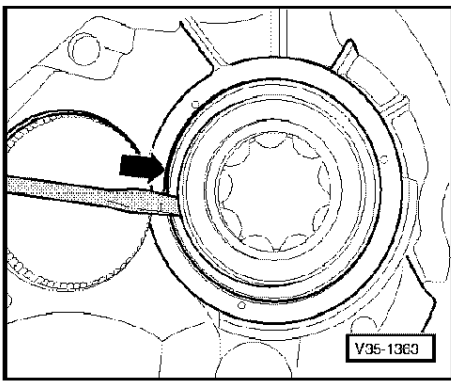


◀ **Fig.2 Pressing cylinder roller bearing for input shaft flush into end cover**

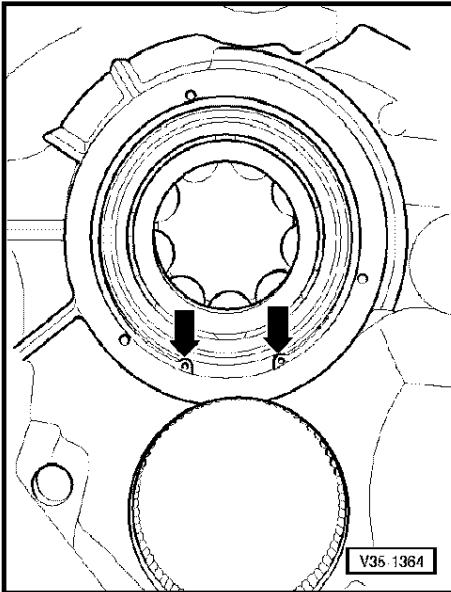
- ◆ Tube VW 415a with shoulder towards press tool VW 412

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- ◀ **Fig.3 Removing ball bearing for input shaft from end cover**
- Position screwdriver as illustrated, drive into baffle plate -arrow- and lever out.
 - Remove circlip.
 - Take out bearing, remove peening indentations if necessary.



- ◀ **Fig.4 Installing ball bearing for input shaft in end cover**
- Installation position of circlip:
- ◆ Ends of circlip -arrows-, point towards needle bearing
- Note:**
- The thickness of the circlip must be re-determined if the bearing or the end cover are replaced.*

- Determining circlip for ball bearing for input shaft:
 - Press ball bearing outer race onto stop.
 - Determine the thickest circlip that can still just be fitted.
 - Axial play: max. 0.08 mm
 - Determine circlip from table. Part numbers

=> Parts catalogue

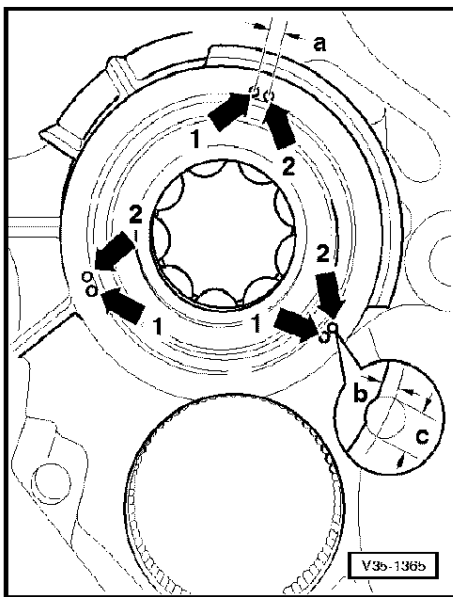
The following circlips are available:

Circlip thickness (mm)	
2.55	2.65
2.60	2.70

- Fit circlip.

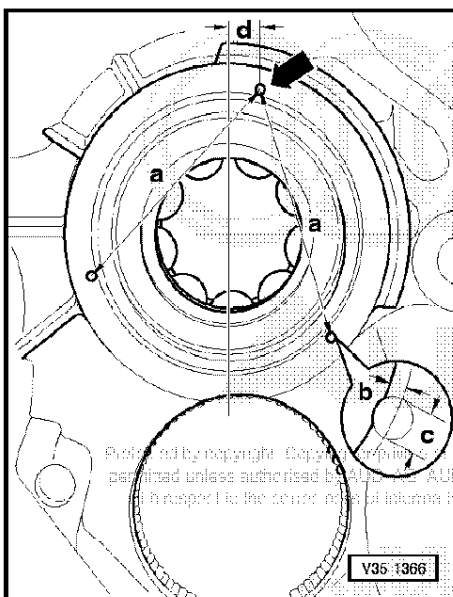
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◀ **Fig.5 Peening baffle plate in position when renewing ball bearing for input shaft**

- Use a blunt punch with a ball shaped end (ball diameter 5 mm) to peen in position.
- Insert baffle plate.
- First peen at points marked with -arrows 1-.
- Then peen at points marked with -arrows 2- at distance -a- from first position.
 - Dimension a = 5 mm
- Observe position and diameter of peening positions:
 - Dimension b = 2 mm
 - Dimension c = 3 mm



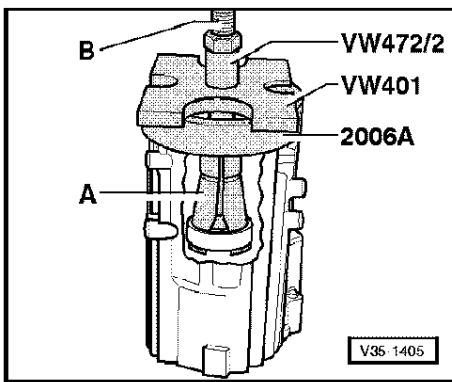
◀ **Fig.6 Peening baffle plate in position when renewing end cover**

- Use a blunt punch with a ball shaped end (ball diameter 5 mm) to peen in position.
- Insert baffle plate.
- Peen in first peening point -arrow- at distance -d- from the centre line of the two shafts.
 - Dimension d = 10 mm
- Observe position and diameter of peening positions.
 - Dimension b = 2 mm
 - Dimension c = 3 mm
- Peen in second and third peening points in same manner at distance -a-.

Dimension a = 70 mm

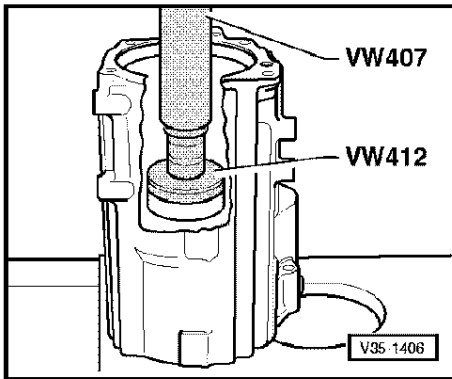
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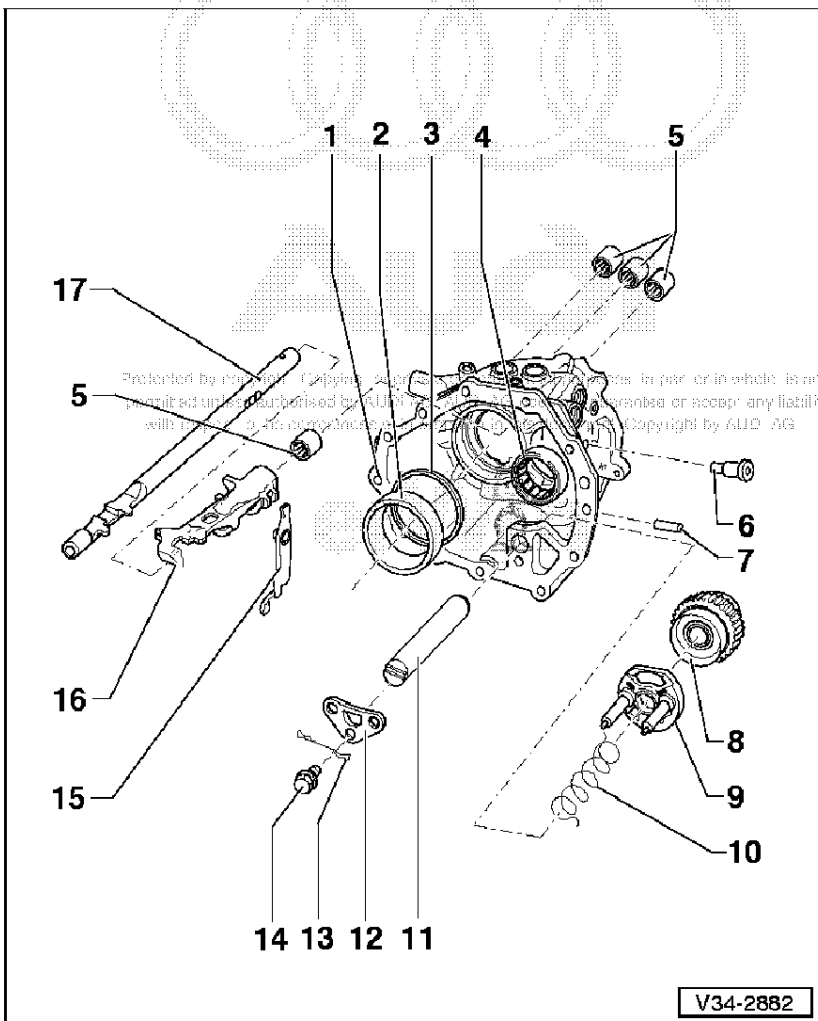
◀ Fig.7 Pulling needle bearing for Torsen differential out from end cover

- _ A - Internal puller 46 ... 58 mm, e.g. Kukko 21/7
- _ B - Spindle from counter support Kukko 22/2



◀ Fig.8 Driving needle bearing for Torsen differential flush into end cover

- Fit press plate VW 412 onto bearing with shoulder facing up.



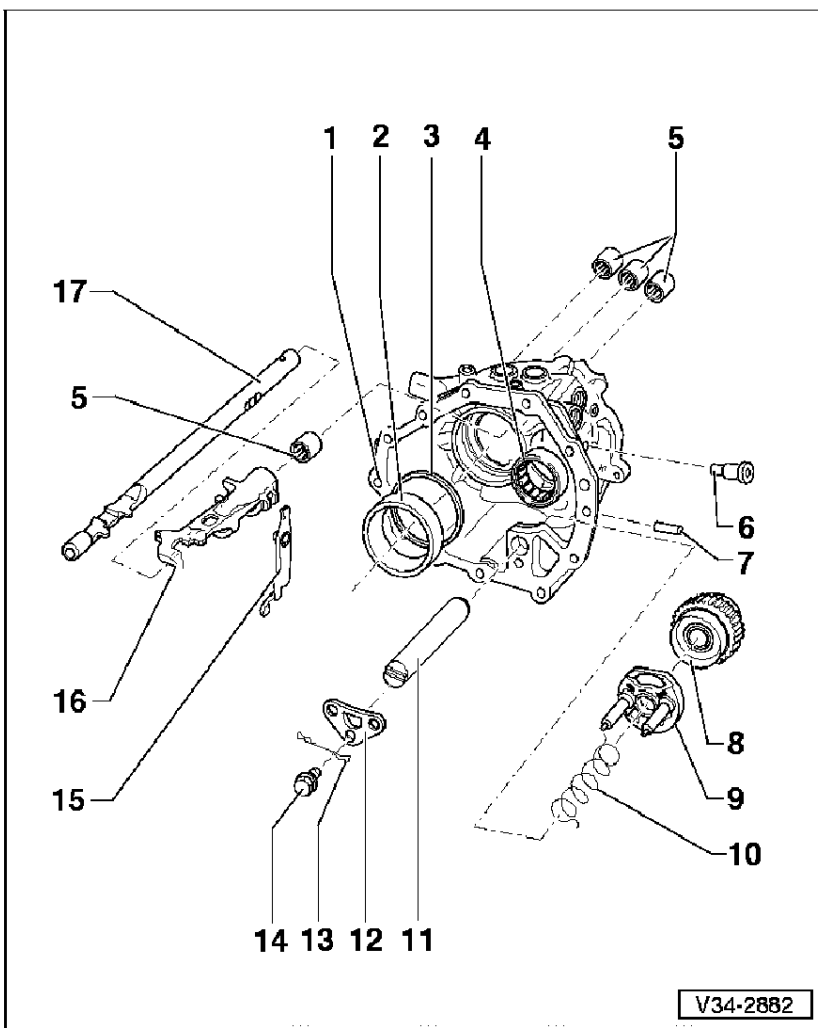
Servicing bearing plate

Notes:

- ◆ In gearboxes with code letters CGR from serial No.77644onwardsand in gearboxes with code letters CRB the 1st speed gear and 1st speed sliding gear are wider. At the same time the bearing plate -Item 1- was modified and the width of the cylinder roller bearing inner race was reduced.
- ◆ Mixed installation of components belonging to old and new versions is not permissible.

1 - Bearing plate

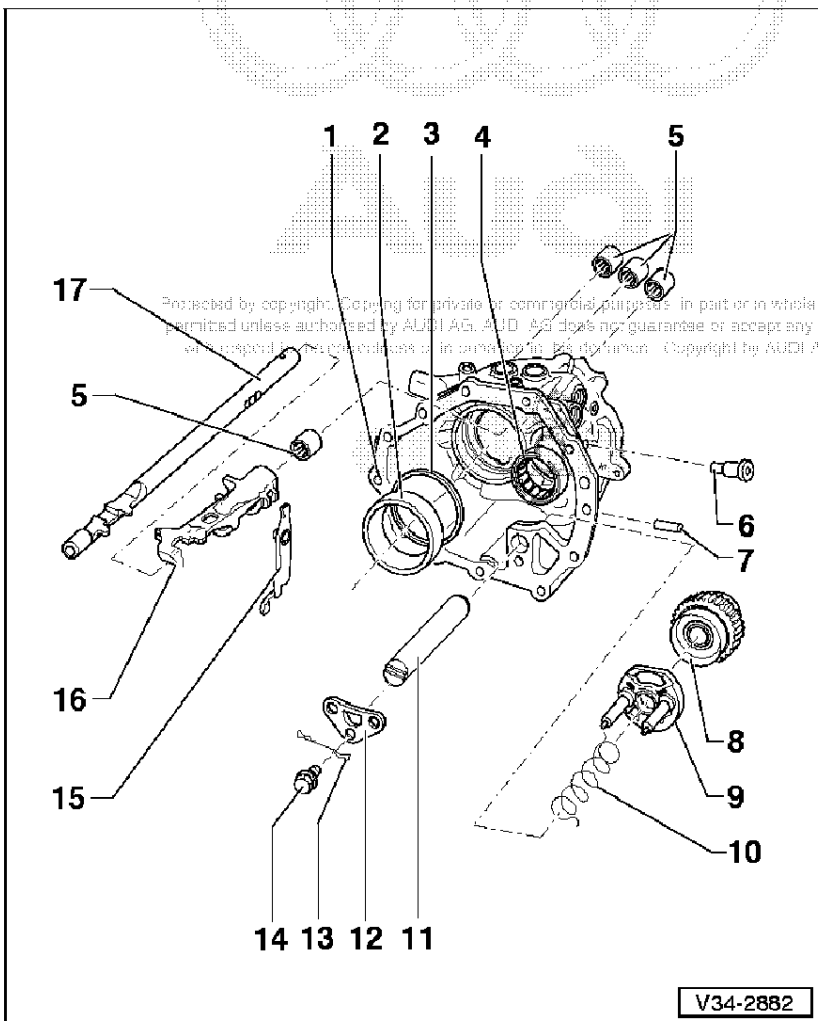
- ◆ If replacing, re-determine shim "S4"
- ◆ Provided with machined surface for identification in CGR gearbox from serial No. 77644 and in CRB gearbox => Fig. 1



- 2 - Outer race for taper roller bearing for drive pinion
 - ◆ Driving out => Page 35-32
 - ◆ Pressing in => Page 35-32
 - ◆ If replacing, re-determine shim "S4"

- 3 - Shim "S4"
 - ◆ Adjustment overview => Page 39-34
 - ◆ Re-determining => Page 34-109

- 4 - Cylinder roller bearing for input shaft
 - ◆ Pressing out => Fig. 6
 - ◆ Pressing in => Fig. 7
 - ◆ Insertion depth is altered in CGR gearbox from serial No. 77644 and in CRB gearbox
 - ◆ Measuring insertion depth => Fig. 8



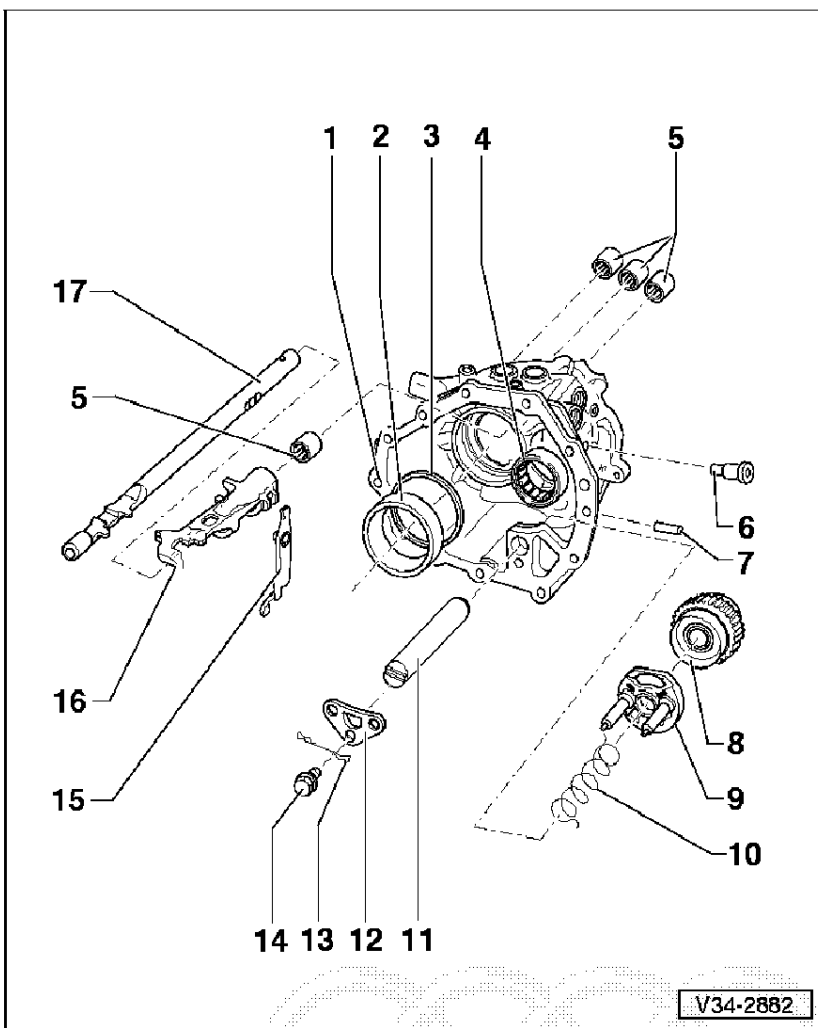
- 5 - Ball sleeve
 - ◆ For selector rods
 - ◆ Removing and installing => Fig. 2
 - ◆ Renew

- 6 - Bolt - 35 Nm
 - ◆ For relay lever

- 7 - Dowel pin (7 x 28)
 - ◆ Press in flush

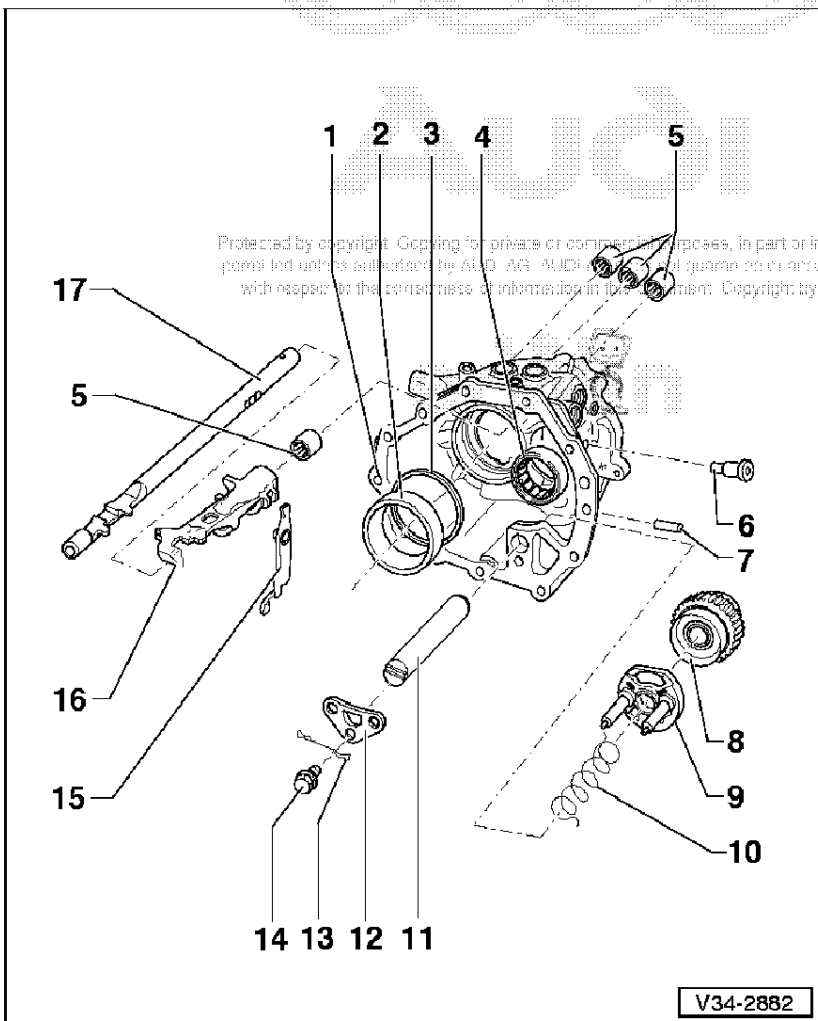
- 8 - Sliding gear for reverse gear

- 9 - Synchro-ring for reverse gear
 - ◆ With locking pins
 - ◆ Checking for wear => Fig. 3
 - ◆ Installation position: position flat on synchro-ring circumference to face input shaft => Page 34-60



V34-2882

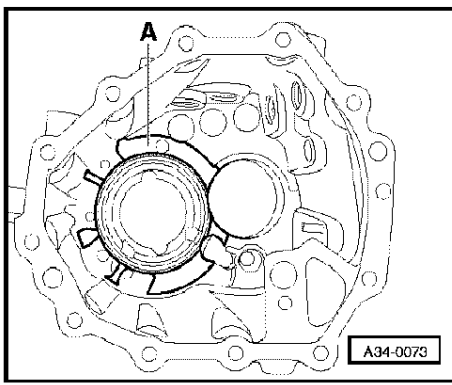
- 10 – Spring
 - ◆ Installation position: hook single angled end into recess on synchro-ring. Turn double angled end anti-clockwise and insert into opening on bearing plate.
- 11 – Shaft for reverse sliding gear
- 12 – Retaining plate
 - ◆ Installation position: the chamfers of the holes for the locking pins of the synchro-ring towards bearing plate
 - => Page 34-61



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V34-2882

- 13 – Spring clasp
- 14 – Bolt – 25 Nm
 - ◆ Self-locking
 - ◆ Renew
- 15 – Relay lever for reverse gear
- 16 – Follower for reverse gear
 - ◆ Pulling out ball sleeve => Fig. 4
 - ◆ Driving in ball sleeve => Fig. 5
- 17 – Selector rod for 5th and 6th gear
 - ◆ Renew only complete with follower => Page 34-40

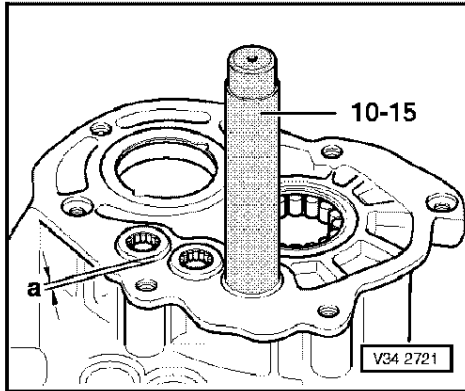


◀ **Fig.1 Bearing plate with machined surface for identification**

_ A - Machined surface for identification

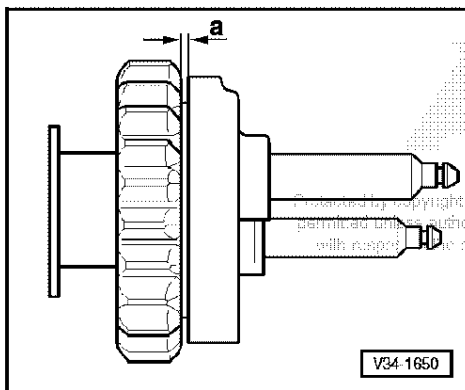
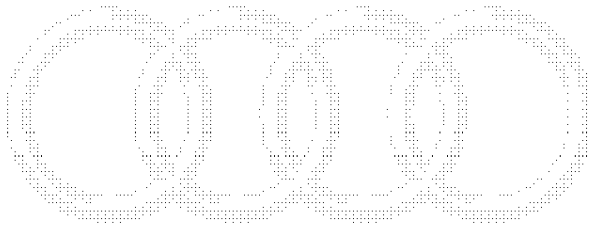
◆ In gearboxes with code letters CGR from serial No. 77644 onwards and in gearboxes with code letters CRB the 1st speed gear and 1st speed sliding gear are wider. At the same time the bearing plate was provided with a machined surface for identification and the width of the cylinder roller bearing inner race was reduced.

◆ Mixed installation of components belonging to old and new versions is not permissible.



◀ **Fig.2 Driving selector rod ball sleeves in and out**

◆ Insertion depth $a = 2.5 \text{ mm}$



◀ **Fig.3 Checking synchro-ring for wear**

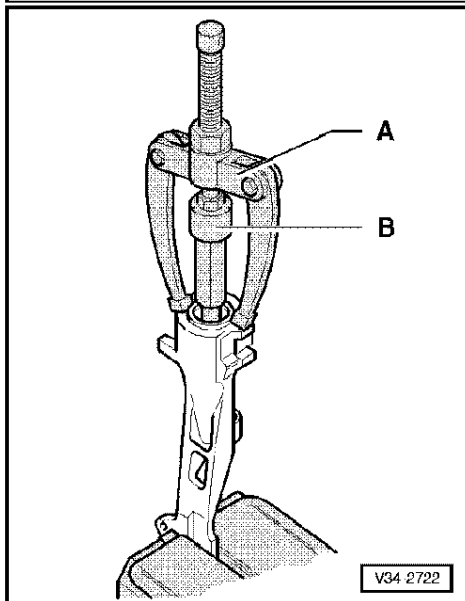
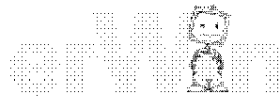
- Press synchro-ring onto cone of the gear.

- Measure gap "a" with a feeler gauge:

- Dimension, new: $0.75 \dots 2.3 \text{ mm}$

- Wear limit: 0.2 mm

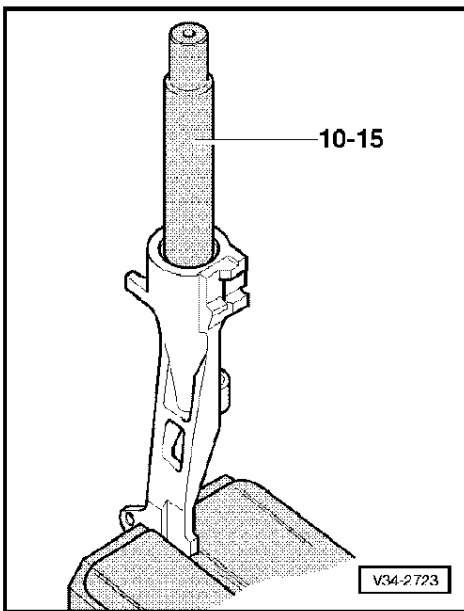
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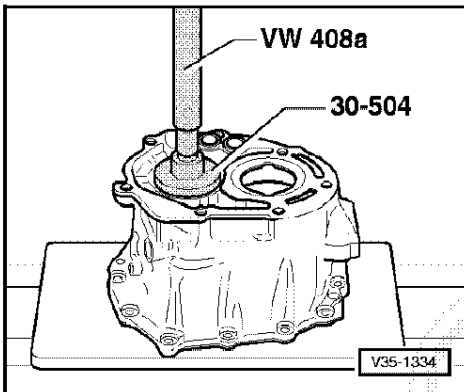
◀ **Fig.4 Pulling ball sleeve out of follower for reverse gear**

_ A - Counter support, e.g. Kukko 22/1

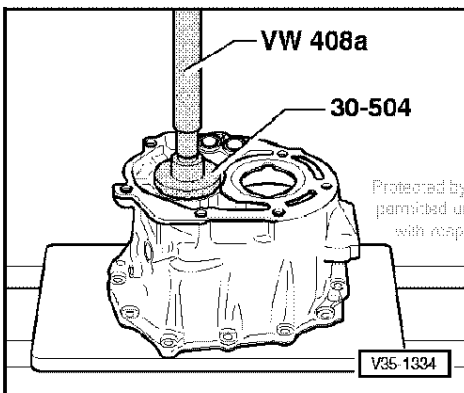
_ B - Internal puller $18.5 \dots 23.5 \text{ mm}$, e.g. Kukko 21/3



◀ Fig.5 Driving ball sleeve flush into follower for reverse gear



◀ Fig.6 Pressing cylinder roller bearing for input shaft out of bearing plate

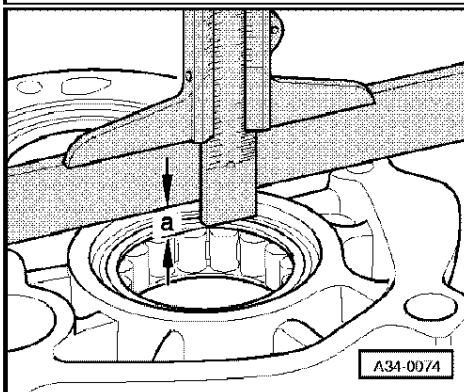
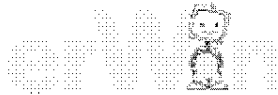


◀ Fig.7 Pressing cylinder roller bearing for input shaft into bearing plate

Insertion depth depends on serial number of gearbox.

- Measuring insertion depth => Fig. 8.

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◀ Fig.8 Measuring insertion depth of cylinder roller bearing for input shaft

Insertion depth -a- depends on serial number of gearbox:

◆ CGR gearbox up to serial number 77643:

_ a = 9 mm

◆ CGR gearbox from serial number 77644 onwards and CRB gearbox:

_ a = 7 mm

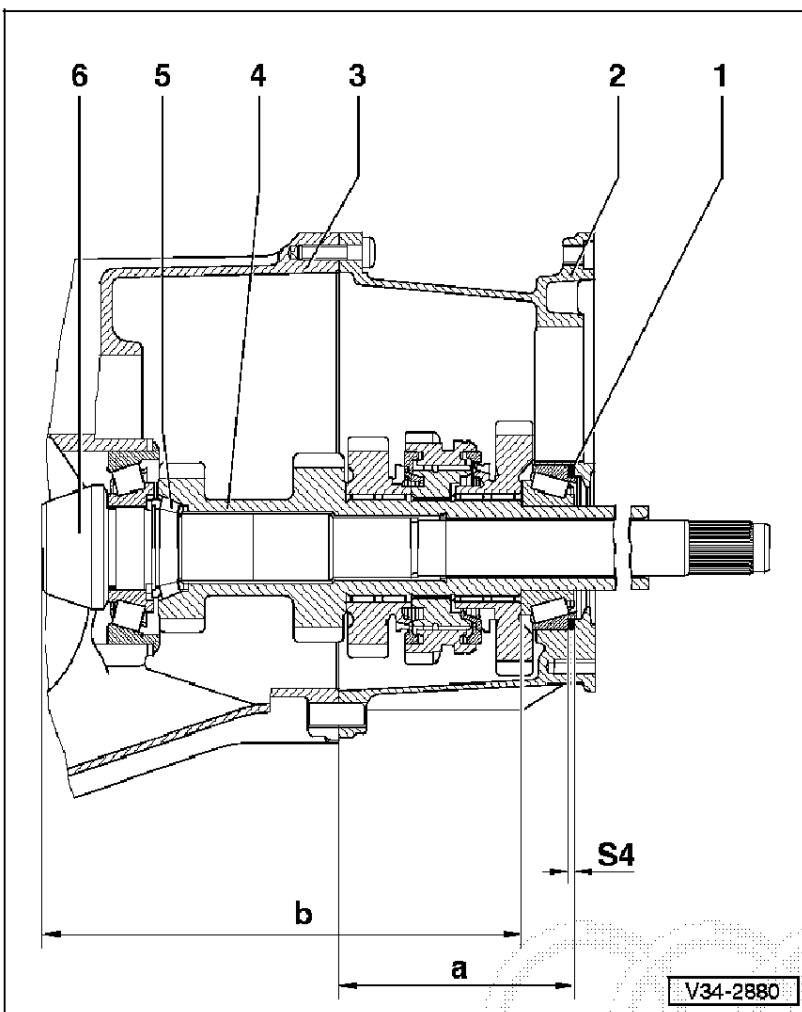
Re-determining shim "S4"

This adjustment is necessary when renewing following components:

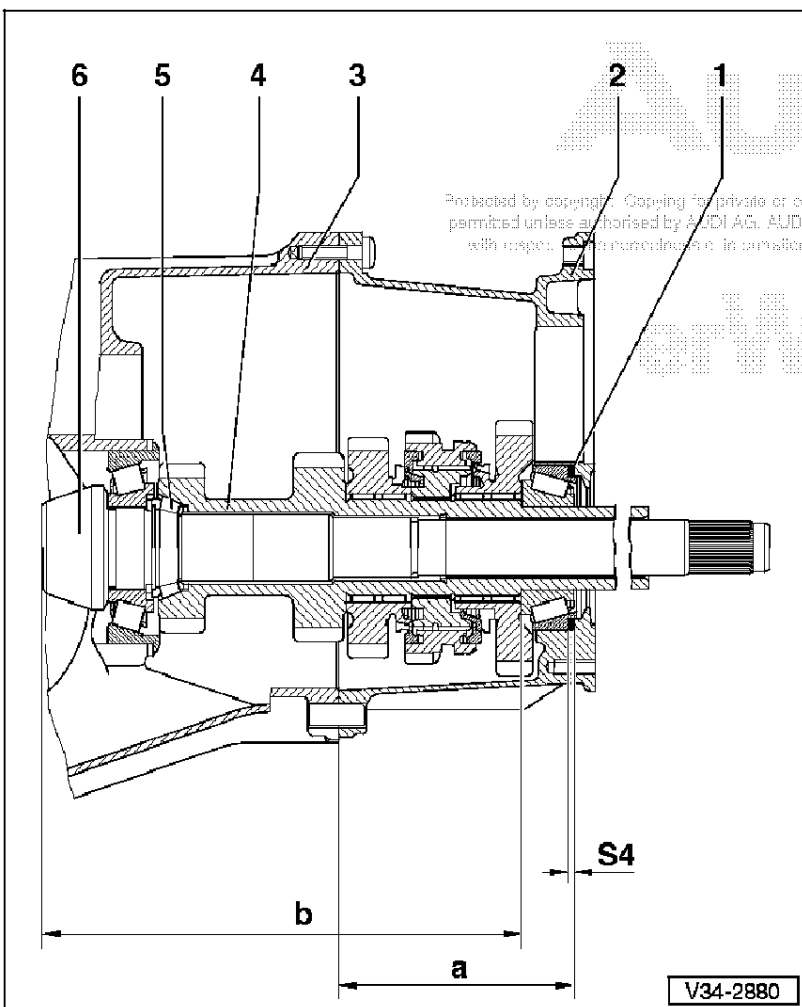
- ◆ Bearing plate => Page 34-111
- ◆ Hollow shaft => Page 34-112

This adjustment re-creates the preload of the taper rollers for the drive pinion and hollow shaft.

- 1 - Shim "S4"
- 2 - Bearing plate
- 3 - Gearbox housing
- 4 - Hollow shaft



34-109



- 5 - Drive pinion/hollow shaft taper roller bearing

- 6 - Drive pinion

- a - Bearing plate housing depth

- b - Dimension from drive pinion head to contact shoulder of taper roller bearing on hollow shaft

- Taper roller bearing (drive pinion/hollow shaft) preloaded to 10 Nm

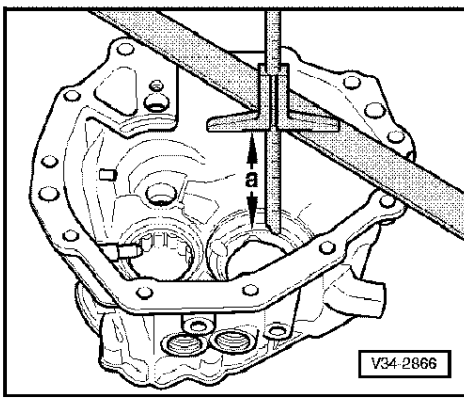
- S4 - Thickness of shim "S4"

Note:

When replacing the drive pinion (final drive set), observe adjustment overview

=> Page 39-34.

34-110



Determining shim when replacing bearing plate

- Use a depth gauge which is accurate to within at least 5/100 mm.
- Measure difference of depth "a" on old and new bearing plates

Example:

Depth "a" old bearing plate	124.40 mm
Depth "a" new bearing plate	124.65 mm
= Difference	0.25 mm

- If the new bearing plate is deeper, install a thicker "S4" shim.
- If the old bearing plate is deeper, install a thinner "S4" shim.

Example:

Previous "S4" shim	0.95 mm
+ Difference	0.25 mm
= New "S4" shim	1.20 mm

Available shims => Table Page 34-113.



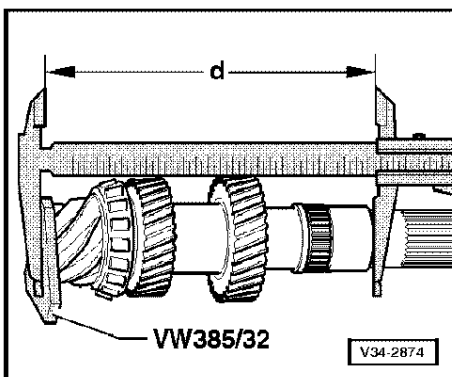
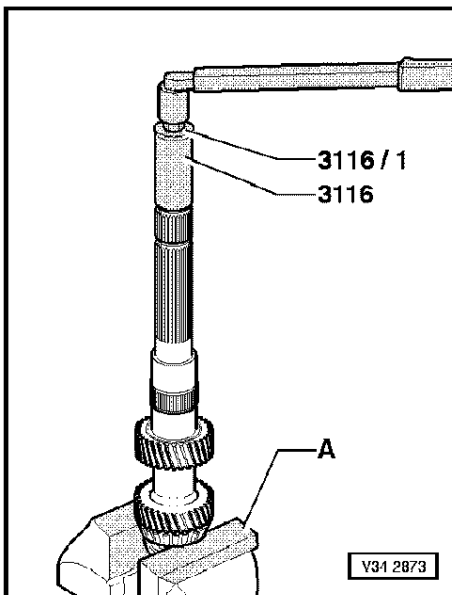
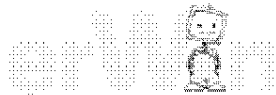
34-111

Determining shim when replacing hollow shaft

- Use a caliper gauge which is accurate to within at least 5/100 mm.
- Tighten tensioning sleeve to exactly 10 Nm.

_ A - Vice clamps

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- Fit end measuring plate VW 385/32 onto drive pinion head and measure dimension "d".

_ Example: 248.50 mm

_ Example: 248.50 mm

- Install new hollow shaft and measure dimension "d" again.

_ Example: 248.70 mm

34-112

- Determine difference:

Dimension "d", old hollow shaft	248.50 mm
Dimension "d", new hollow shaft	248.70 mm
= Difference	0.20 mm

- Install a correspondingly thinner shim "S4" if dimension "d" of new hollow shaft is greater.

- Install a correspondingly thicker shim "S4" if dimension "d" of new hollow shaft is less.

- Determine shim(s) from table: part numbers

= > Parts catalogue

Available shims for "S4"

Shim thickness (mm) ¹⁾		
0.45	0.65	0.85
0.50	0.70	0.90
0.55	0.75	
0.60	0.80	

¹⁾ Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

34-113

Servicing gearbox housing

Notes:

◆ Refer to general repair instructions
=> Page 00-14.

◆ Adjustments are required when replacing components marked ¹⁾
=> adjustment overview Page 39-34.

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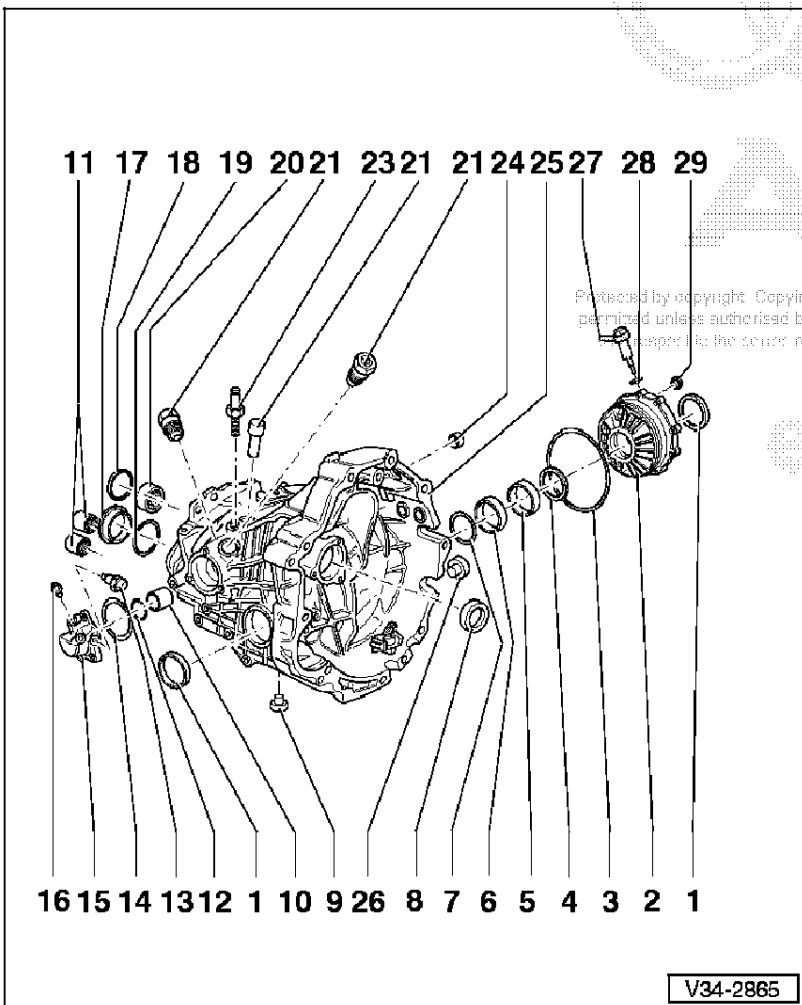
1 - Seal

- ◆ For flange shaft
- ◆ Pulling out => Fig. 1
- ◆ Driving in => Fig. 2
- ◆ Fill space between sealing lips with multi-purpose grease
- ◆ Renewing with gearbox installed
=> Page 39-1

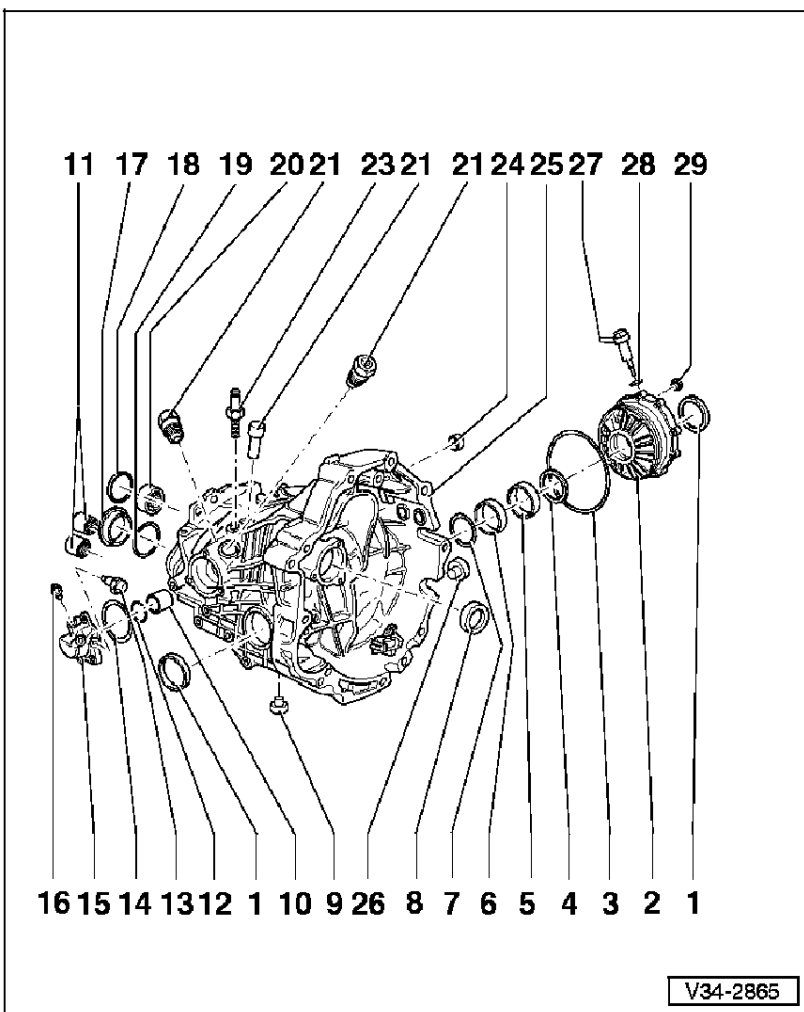
2 - Final drive cover ¹⁾

3 - O-ring

- ◆ For final drive cover
- ◆ Renew



34-114



4 - Shim "S1"

- ◆ Note thickness
- ◆ Adjustment overview => Page 39-34

5 - Outer race for large taper roller bearing ¹⁾

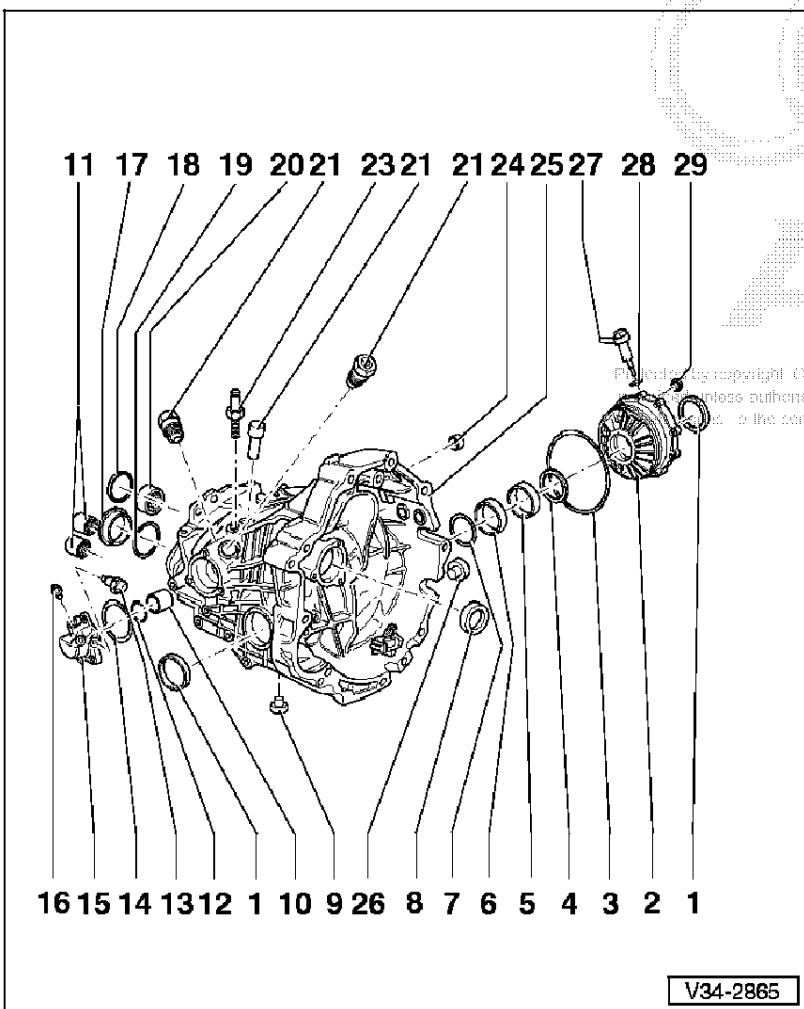
- ◆ For differential
- ◆ Driving out and driving in => Page 39-29

6 - Outer race for small taper roller bearing ¹⁾

- ◆ For differential
- ◆ Driving out and driving in => Page 39-28

7 - Shim "S2"

- ◆ Note thickness
- ◆ Adjustment overview => Page 39-34



8 - Seal

- ◆ For input shaft
- ◆ Levering out => Fig. 3
- ◆ Driving in => Fig. 5
- ◆ Always renew when removing input shaft
- ◆ Renewing when gearbox is not dismantled => Fig. 4 and Fig. 5

9 - Oil drain plug - 40 Nm

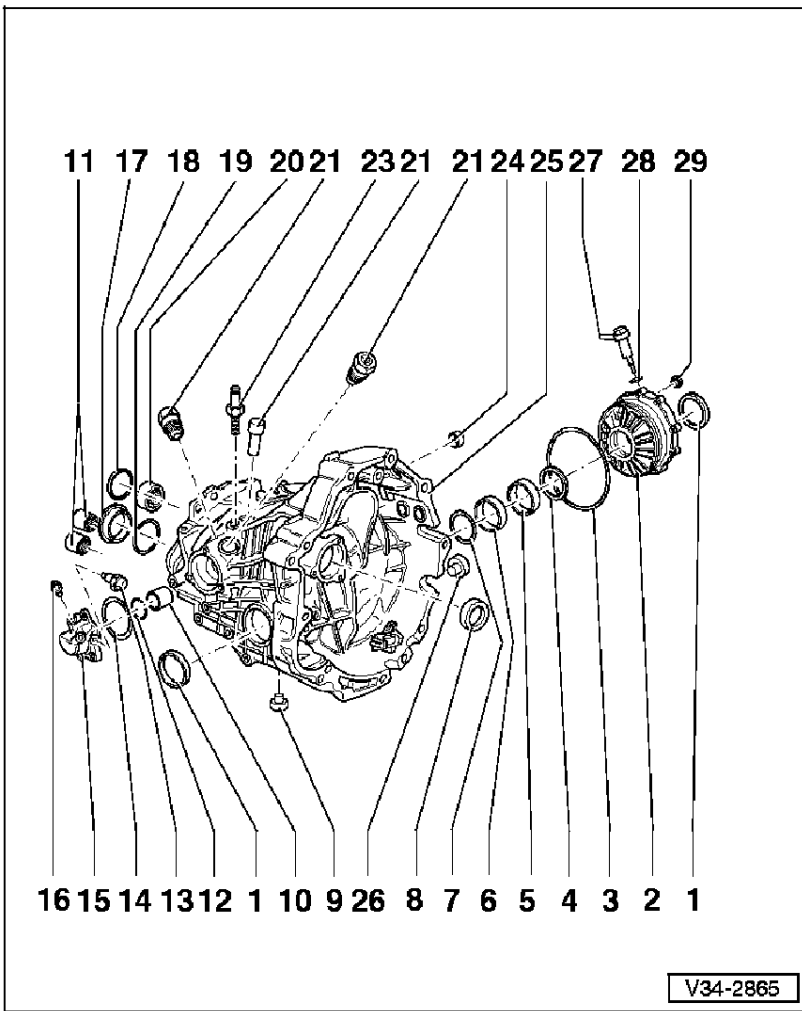
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10 - Ball sleeve

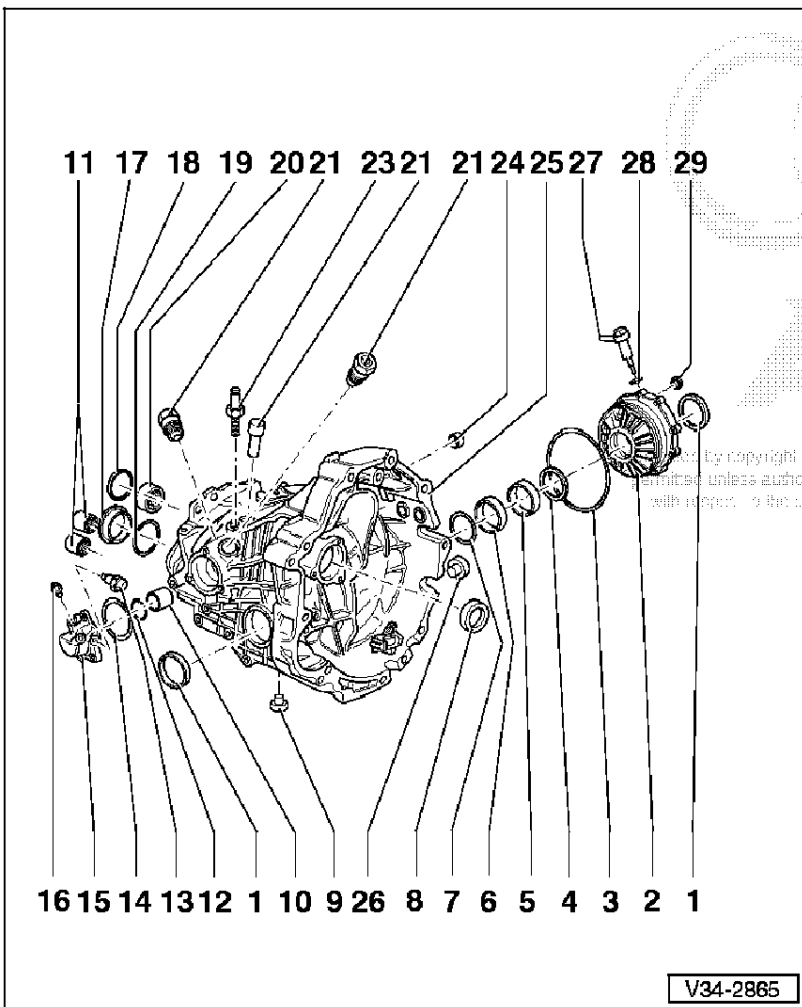
- ◆ For selector shaft
- ◆ Renew
- ◆ Pulling out => Fig. 6
- ◆ Driving in => Fig. 7

11 - Ball sleeves

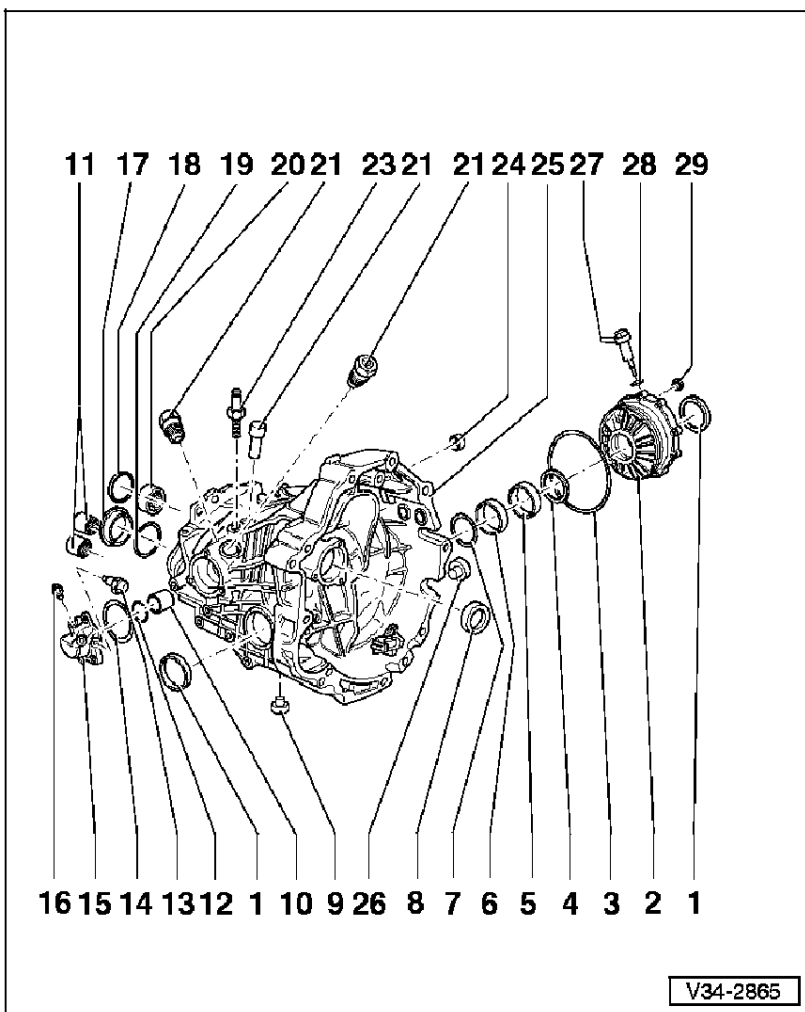
- ◆ For selector shafts
- ◆ Renew
- ◆ Pulling out, as -item 10-, => Fig. 6
- ◆ Driving in, as -item 10-, => Fig. 7



- 12 – Circlip
 - ◆ Installation position: eyes facing up
- 13 – Switch for reversing lights – 20 Nm
- 14 – O-ring
 - ◆ For cover for selector shaft
 - ◆ Renew
- 15 – Cover for selector shaft
 - ◆ Removing =>Page 34-49
 - ◆ Installing =>Page 34-75
- 16 – Ball stud – 20 Nm
 - ◆ For connecting rod
- 17 – Outer race for large taper roller bearing ¹⁾
 - ◆ For drive pinion
 - ◆ Pulling out =>Fig. 1, Page 35-22
 - ◆ Pressing in => Fig. 2, Page 35-22 and Fig. 3, Page 35-23



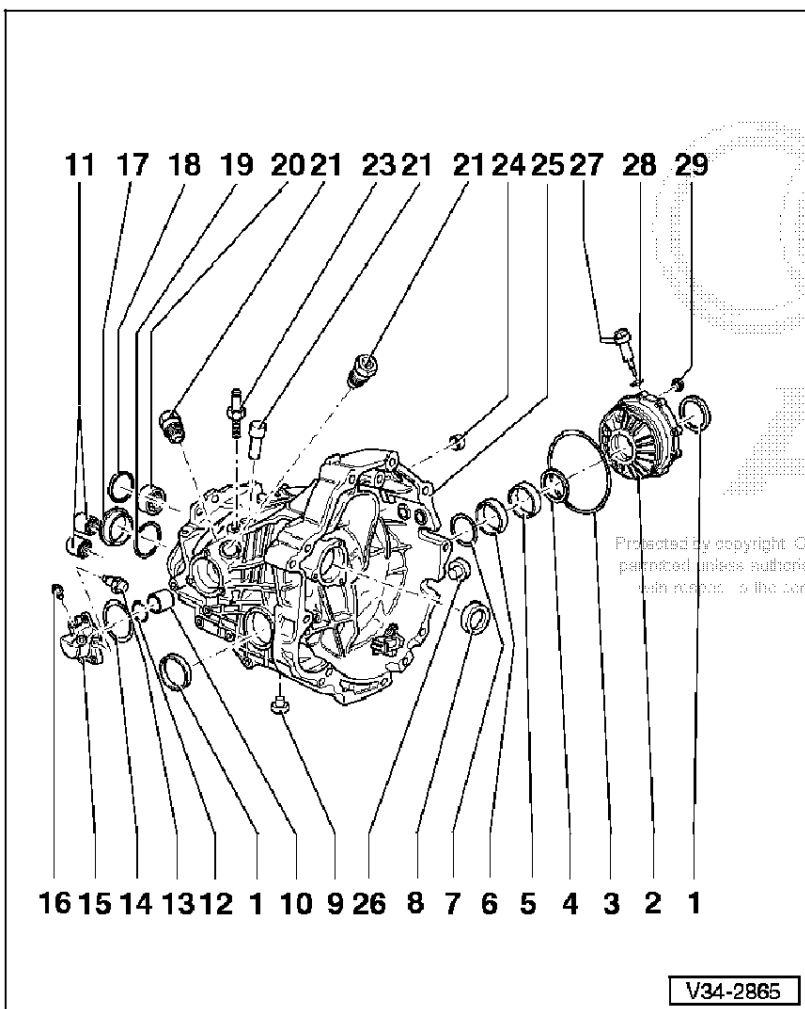
- 18 – Circlip
 - ◆ Removing =>Fig. 15
- 19 – Shim "S3"
 - ◆ Note thickness
 - ◆ Adjustment overview => Page 39-34
- 20 – Needle bearing
 - ◆ For input shaft
 - ◆ Pulling out => Fig. 12
 - ◆ Driving in => Fig. 13
 - ◆ Measuring insertion depth => Fig. 14
- 21 – Locking bolt
 - ◆ For selector shaft
 - ◆ Removing =>Page 34-49
 - ◆ Installing =>Page 34-75
 - ◆ Tightening torques:
 - For aluminium bolt: 50 Nm
 - For steel bolt: 70 Nm
- 22 – Trunion bolt – 40 Nm
 - ◆ For push rod



- 23 - Breather**
 - ◆ Insertion depth of sleeve => Fig. 11
 - ◆ Clip cap on
- 24 - Seal for selector shaft**
 - ◆ Can be renewed when gearbox is removed but not dismantled
 - ◆ Renew
 - ◆ Pulling out => Fig. 8
 - ◆ Driving in => Fig. 9
 - ◆ Always use assembly sleeve for installing => Fig. 10

25 - Gearbox housing¹⁾

- 26 - Magnet**
 - ◆ Clean
 - ◆ When renewing gearbox housing drive in with e.g. press tool VW 408 A



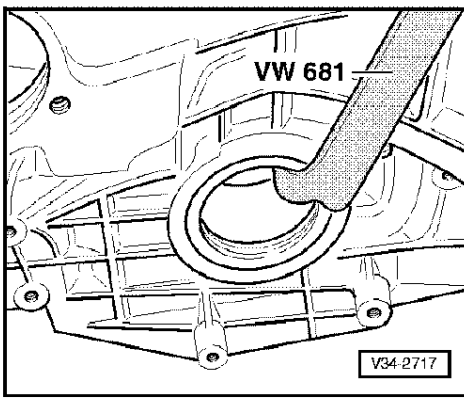
- 27 - Sender for speedometer -G22**
 - ◆ Renewing => Page 39-3

- 28 - O-ring**
 - ◆ Renew

29 - Oil filler plug - 40 Nm

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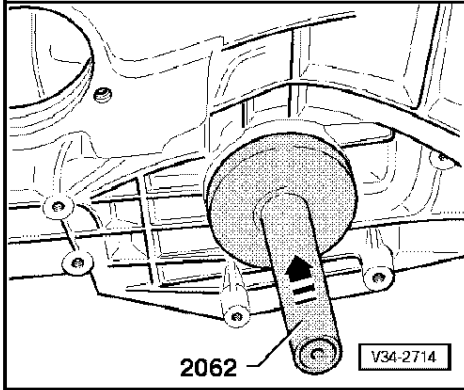




◀ Fig.1 Pulling out seal for flange shaft

Notes:

- ◆ Illustrated, removing oil seal on right-hand side.
- ◆ Procedure for removing oil seal on left and right-hand sides is identical.

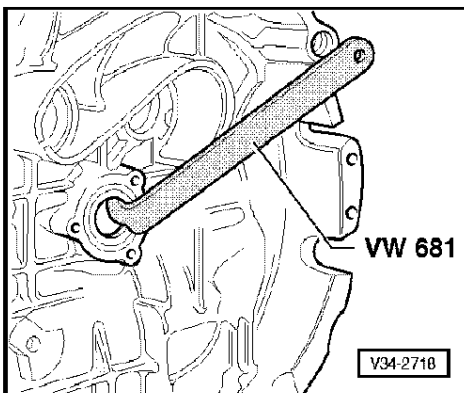


◀ Fig.2 Driving in seal for flange shaft

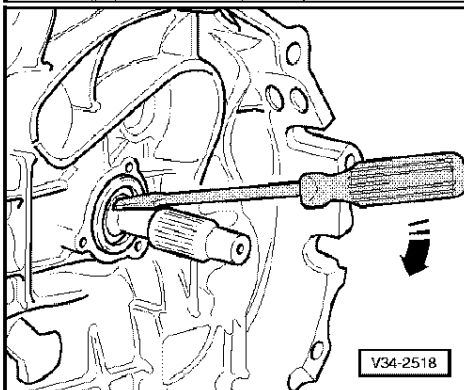
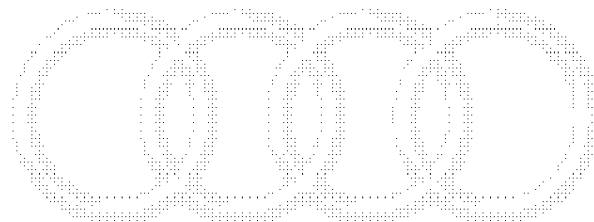
- ◆ Insertion depth: 6.5 mm

Notes:

- ◆ Illustrated, installing oil seal on right-hand side.
- ◆ Procedure for installing oil seal on left and right-hand sides is identical.



◀ Fig.3 Levering out seal for input shaft when gearbox is dismantled
– Lever out seal carefully with VW 681.



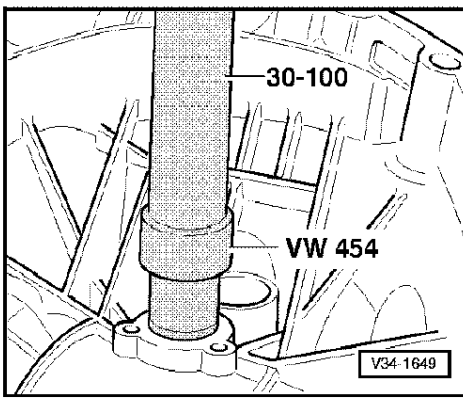
◀ Fig.4 Removing seal for input shaft when gearbox is not dismantled
– Lever out seal carefully with a screwdriver.

Note:

Do not damage bearing surface on input shaft for shaft seal.

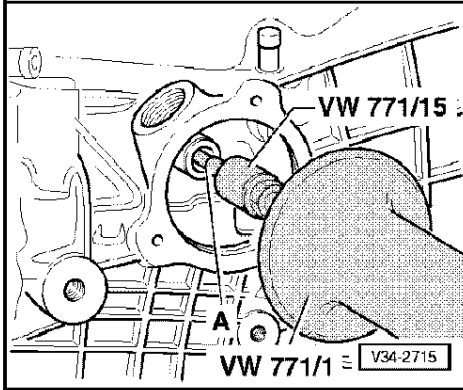
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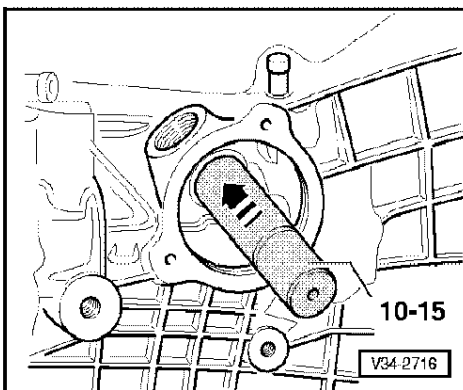
◀ **Fig.5 Driving in seal for input shaft**

- Fill space between sealing lip and dust lip of new seal for input shaft with multi-purpose grease.
- Fit a thin protective hose tightly over splines of input shaft.
- Drive in seal for input shaft.
 - Insertion depth: 4.5 mm
- Remove protective hose.



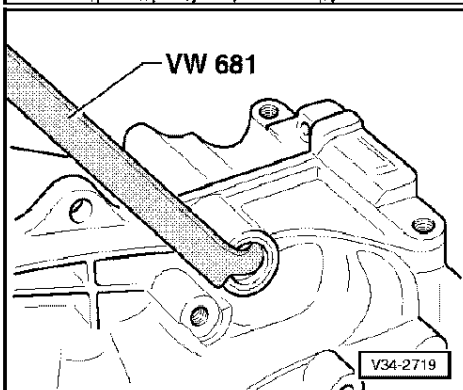
◀ **Fig.6 Pulling out ball sleeve**

- Remove circlip.
- A - Internal puller 14.5 ... 18.5 mm, e.g. Kukko 21/2



◀ **Fig.7 Driving in ball sleeve**

- Drive in onto stop.



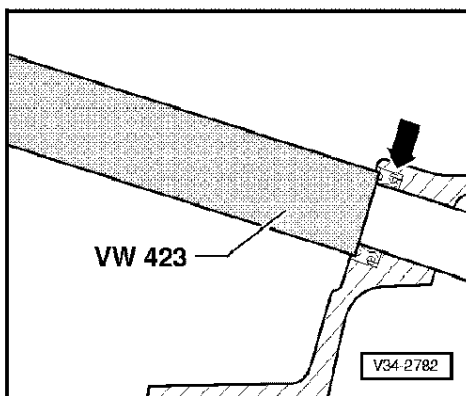
◀ **Fig.8 Pulling out seal for selector shaft**

Note:

With gearbox removed but not dismantled, carefully lever out seal without damaging the shaft with a screwdriver.

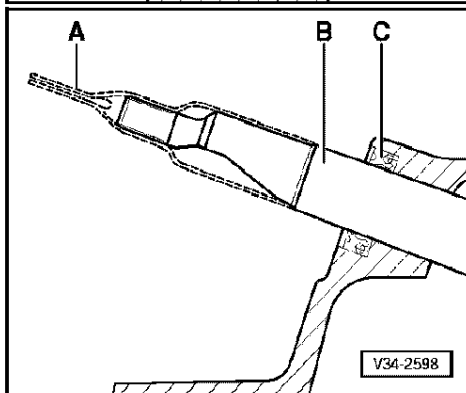
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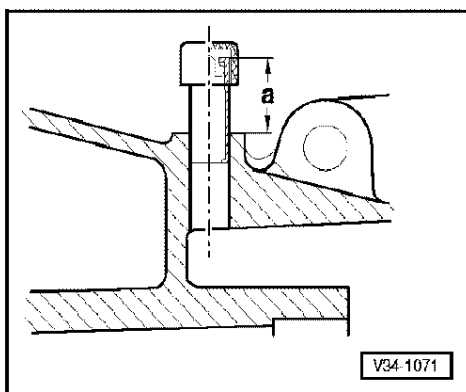
◀ Fig.9 Driving in seal for selector shaft

- Selector shaft installed or removed
- Fill space between sealing lip and dust lip with multi purpose grease.
- Pull assembly sleeve onto selector shaft => Fig. 10.
- Drive seal into housing onto stop.



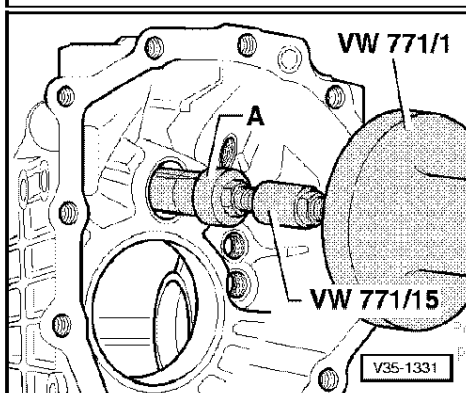
◀ Fig.10 Installing seal and selector shaft with assembly sleeve

- To avoid damaging the seal -C- always use assembly sleeve -A- , Part No. 01E 311 120, to install seal or selector shaft.



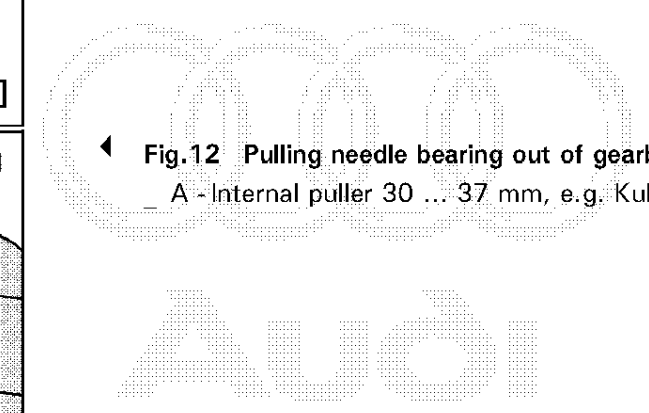
◀ Fig.11 Insertion depth of breather sleeve

- ◆ Dimension a = 21 mm



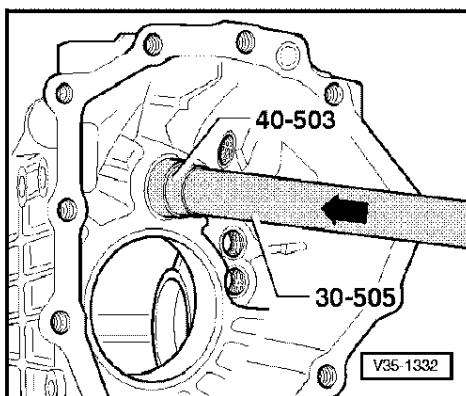
◀ Fig.12 Pulling needle bearing out of gearbox housing

- A - Internal puller 30 ... 37 mm, e.g. Kukko 21/5

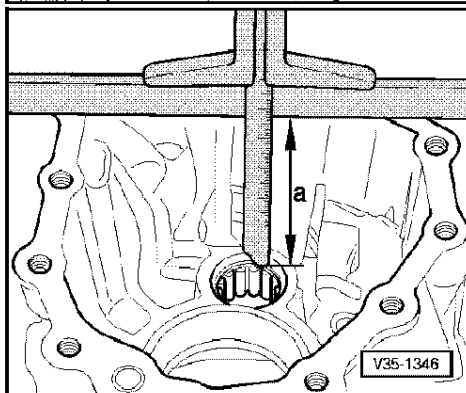


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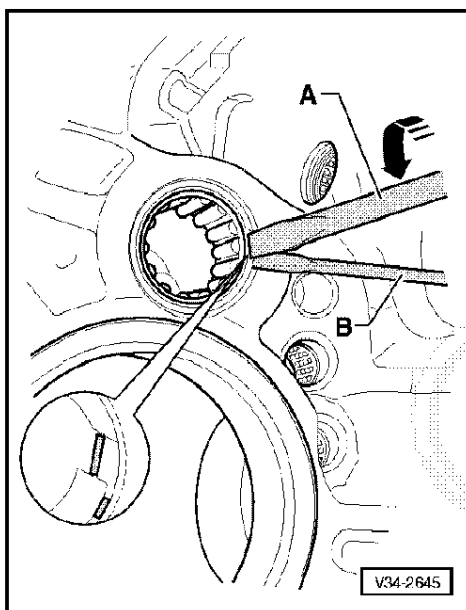


- ◀ **Fig.13 Driving needle bearing into gearbox housing**
 - ◆ Installation position: inscription on bearing faces tool
 - ◆ Insertion depth => Fig. 14

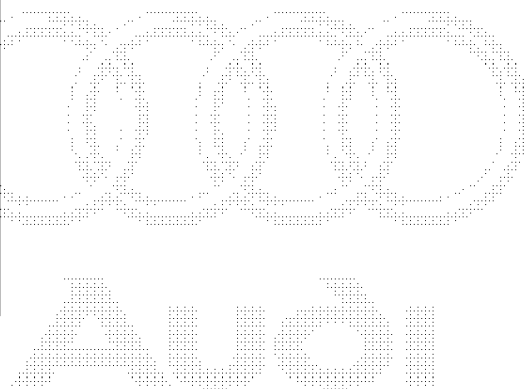


- ◀ **Fig.14 Insertion depth of needle bearing**
 - ◆ Dimension a = 105 mm

———— 34-127 ————



- ◀ **Fig.15 Removing circlip**
 - Lift circlip out of the groove by turning one end of the circlip with a screwdriver -A-.
 - Secure this end with a screwdriver -B-.
 - Lever circlip out further by repositioning screwdriver -A-.

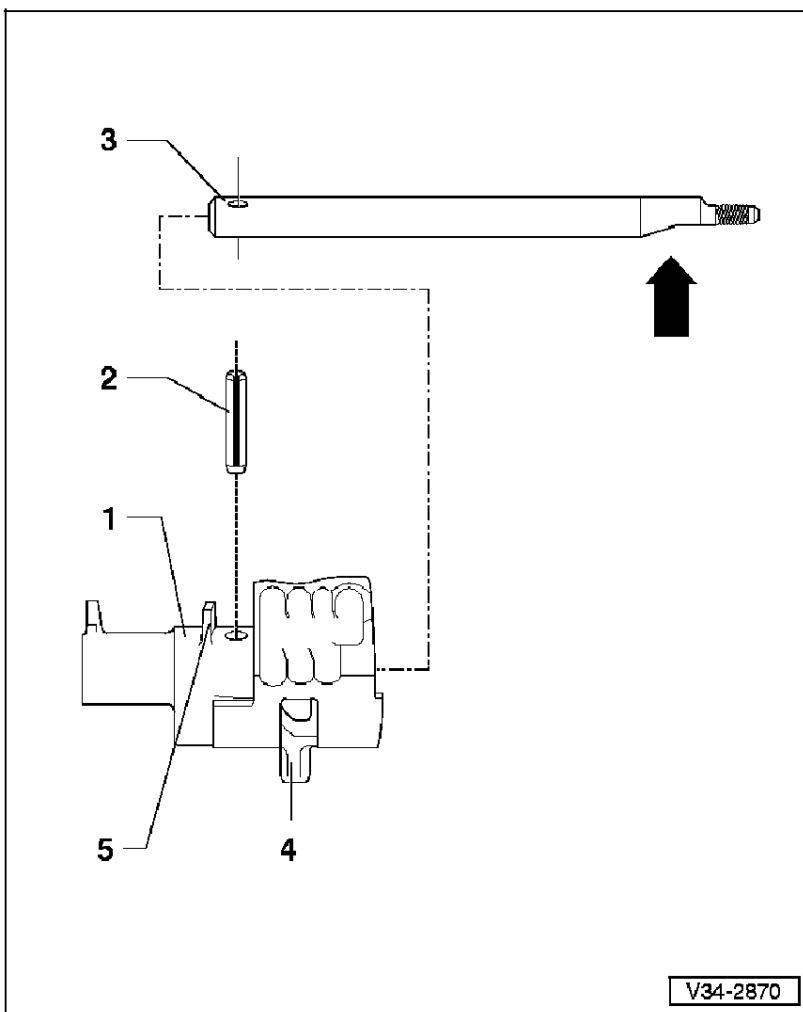


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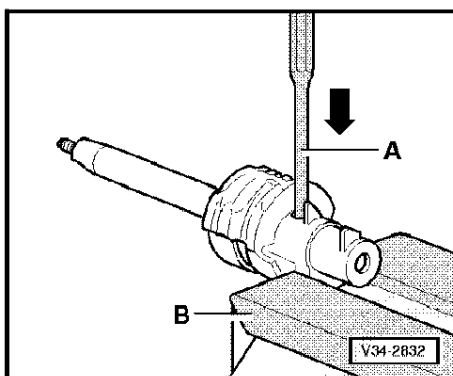
———— 34-128 ————

Dismantling and assembling selector shaft complete

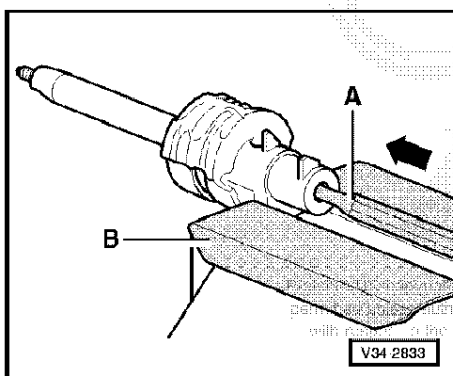


- 1 - Selector cylinder
- 2 - Roll pin
 - ◆ Driving out and driving in flush => Fig. 1
- 3 - Selector shaft
 - ◆ Driving out => Fig. 2
 - ◆ Driving in => Fig. 3
 - ◆ Installation position: flat (arrow) and selector finger -item 4- face in same direction
- 4 - Selector finger
 - ◆ Observe installation position to -item 3-
- 5 - Cam for reversing light switch

34-129



◀ Fig.1 Driving out and driving in roll pin flush
 _ A - Drift
 _ B - Vice clamps

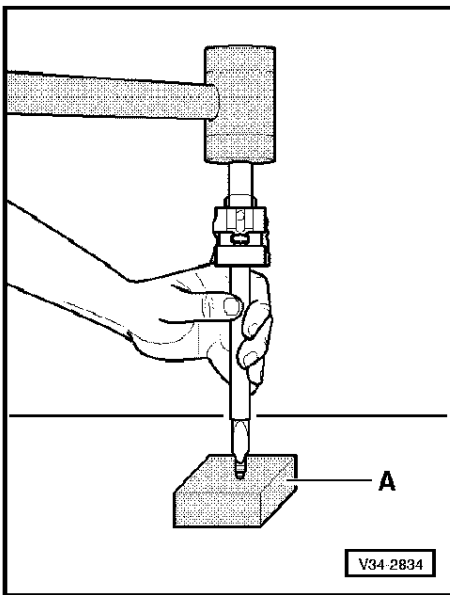


◀ Fig.2 Driving out selector shaft
 _ A - Drift
 _ B - Vice clamps

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34-130

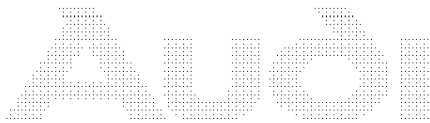
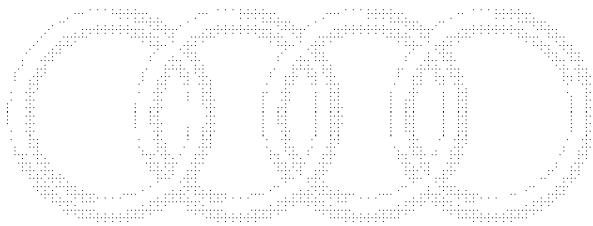


◀ Fig.3 Driving in selector shaft

_ A - Wooden block

Notes:

- ◆ Bring holes into alignment.
- ◆ Flat on selector shaft and selector finger point in same direction.



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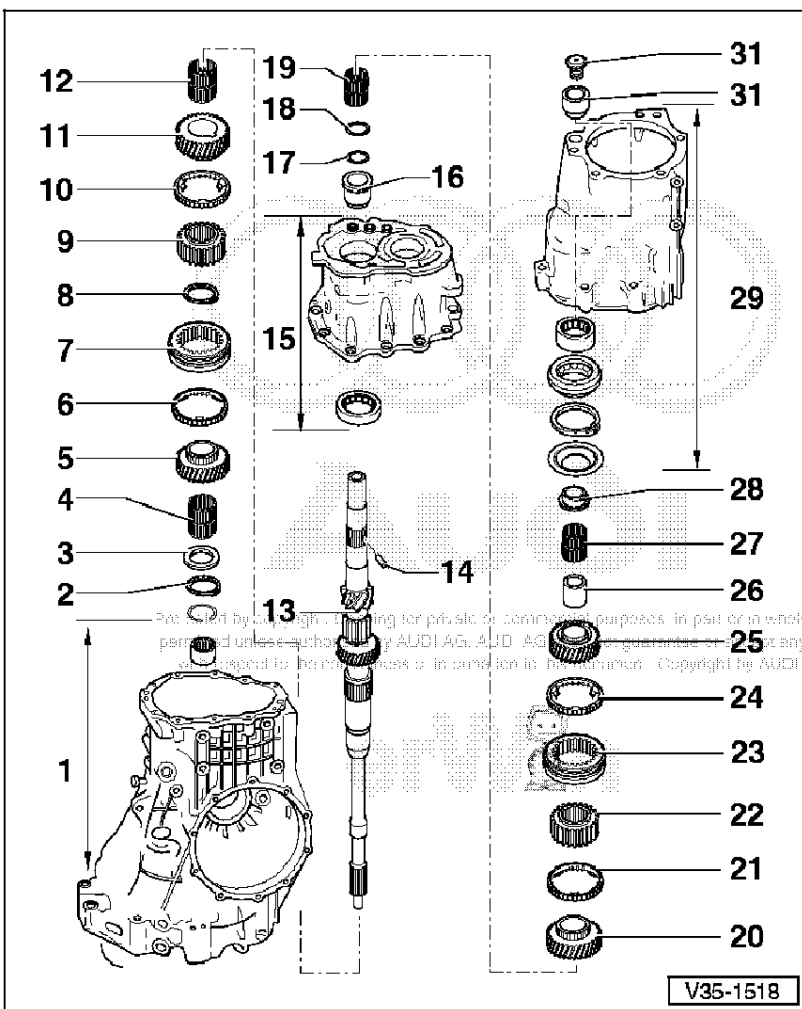
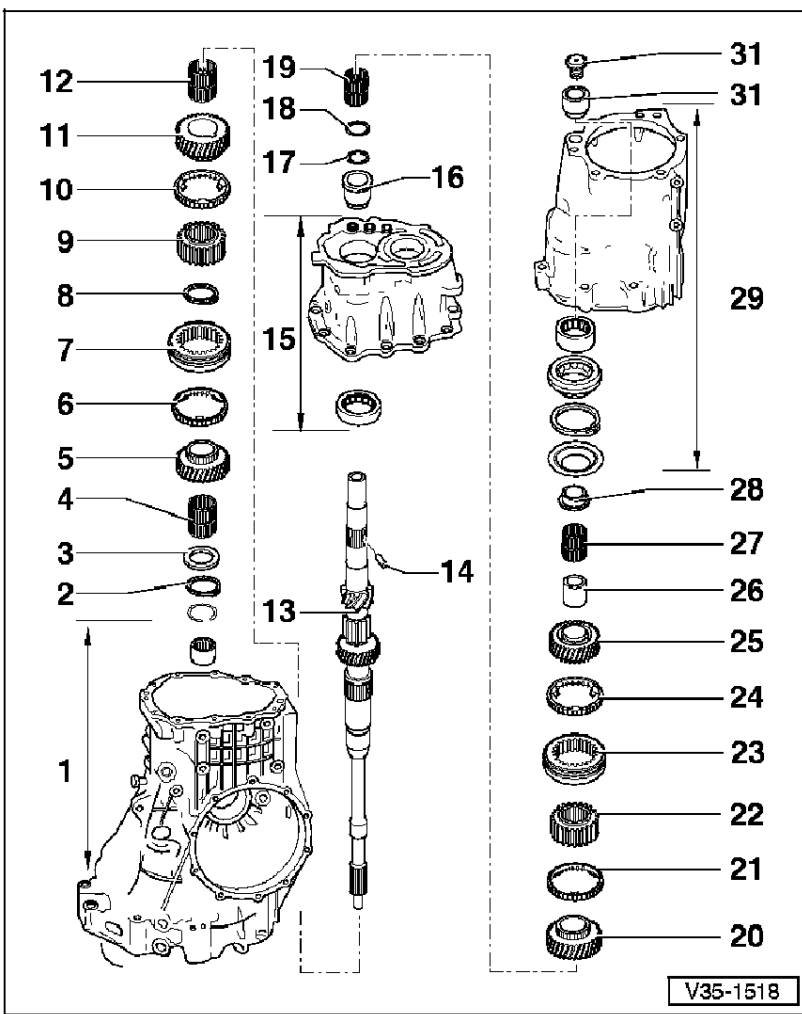


Dismantling and assembling input shaft

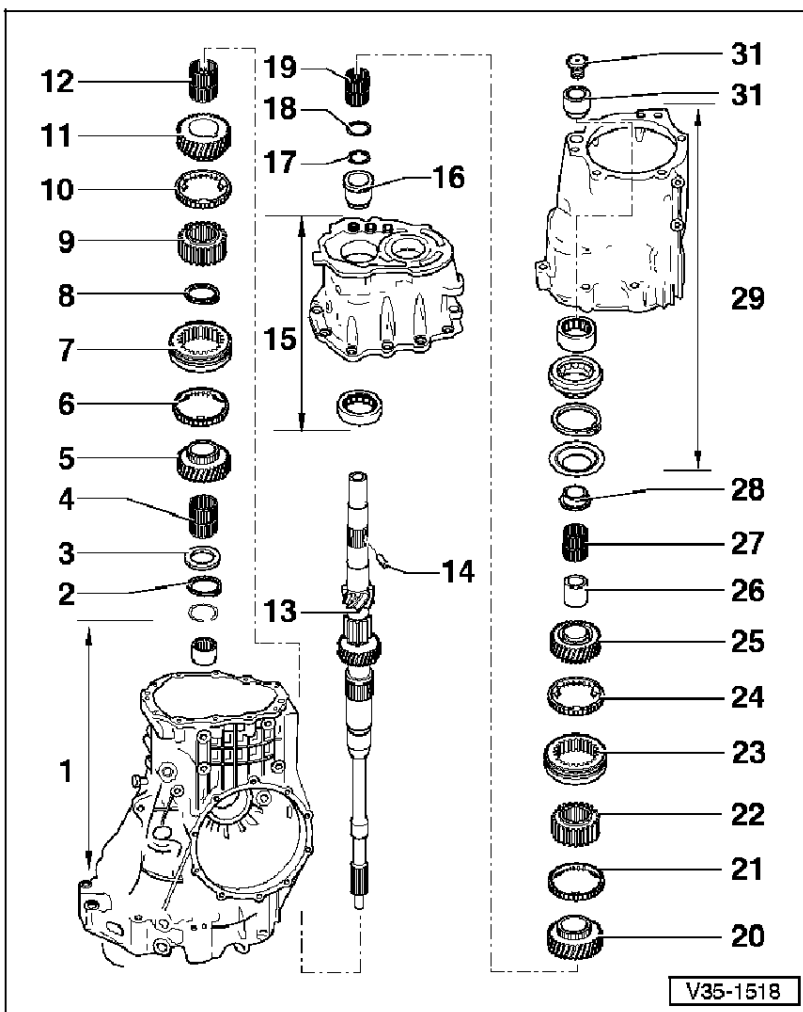
Notes:

- ◆ When installing new gears, refer to => Technical data, Page 00-3.
- ◆ In gearboxes with code letters CGR from serial No.77644 onwards and in gearboxes with code letters CRB a wider 1st speed gear (on input shaft -Item 13-) and a wider 1st speed sliding gear are fitted. At the same time the bearing plate -Item 15- was modified and the width of the cylinder roller bearing inner race -Item 16- was reduced.
- ◆ Mixed installation of components belonging to old and new versions is not permissible.

- 1 - Gearbox housing
 - ◆ Servicing => Page 34-114



- 2 - Circlip
- 3 - Thrust washer
- 4 - Needle bearing for 4th gear
 - ◆ Mark before removing
 - ◆ Do not interchange with needle bearing for 3rd gear
 - ◆ Oil with gear oil before installing
- 5 - 4th speed sliding gear
 - ◆ Before installing, insert spring => Fig. 1
 - ◆ After installing, check axial clearance with a feeler gauge (0.15 ... 0.35 mm)
- 6 - Synchro-ring for 4th gear
 - ◆ Checking for wear => Fig. 2

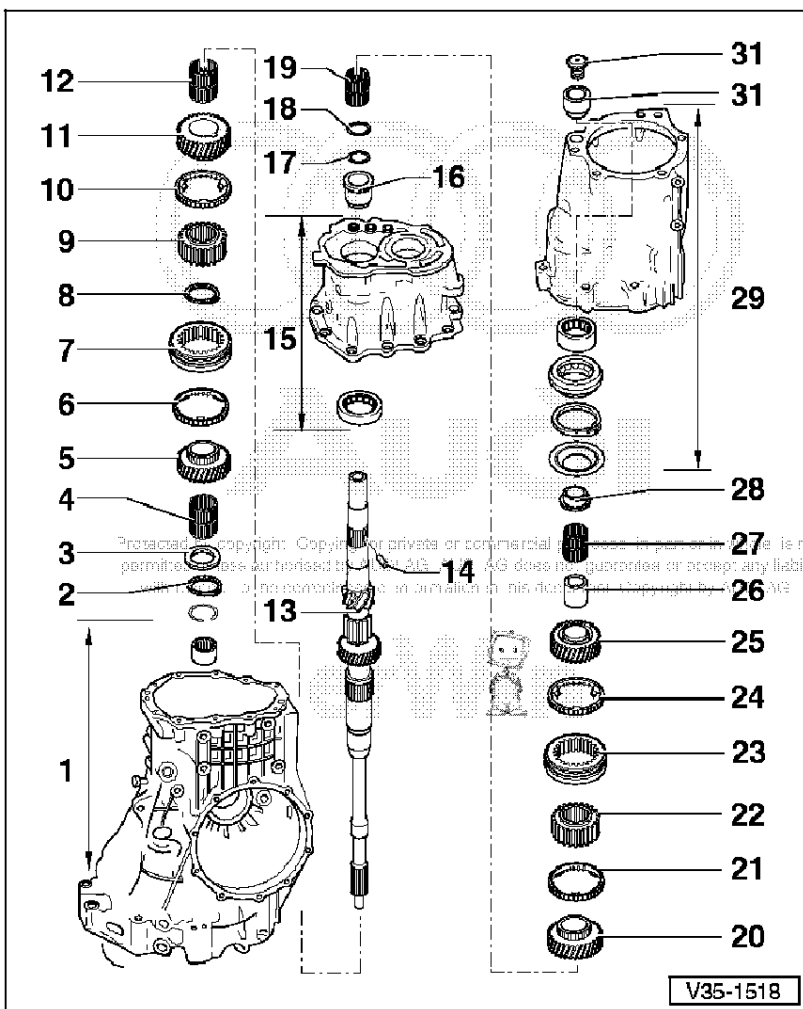


7 - Locking collar
 ◆ Paired with synchro-hub
 ◆ Mark before removing => Page 34-53

8 - Circlip
 ◆ Re-determine thickness when renewing synchro-hub => Fig. 3
 ◆ Installation position: ends align with groove of synchro-hub

9 - Synchro-hub for 3rd and 4th gear
 ◆ Pressing off => Fig. 4
 ◆ Installation position: => Fig. 5
 ◆ Pressing on => Fig. 6

10 - Synchro-ring for 3rd gear
 ◆ Coated with molybdenum
 ◆ Checking for wear => Fig. 2

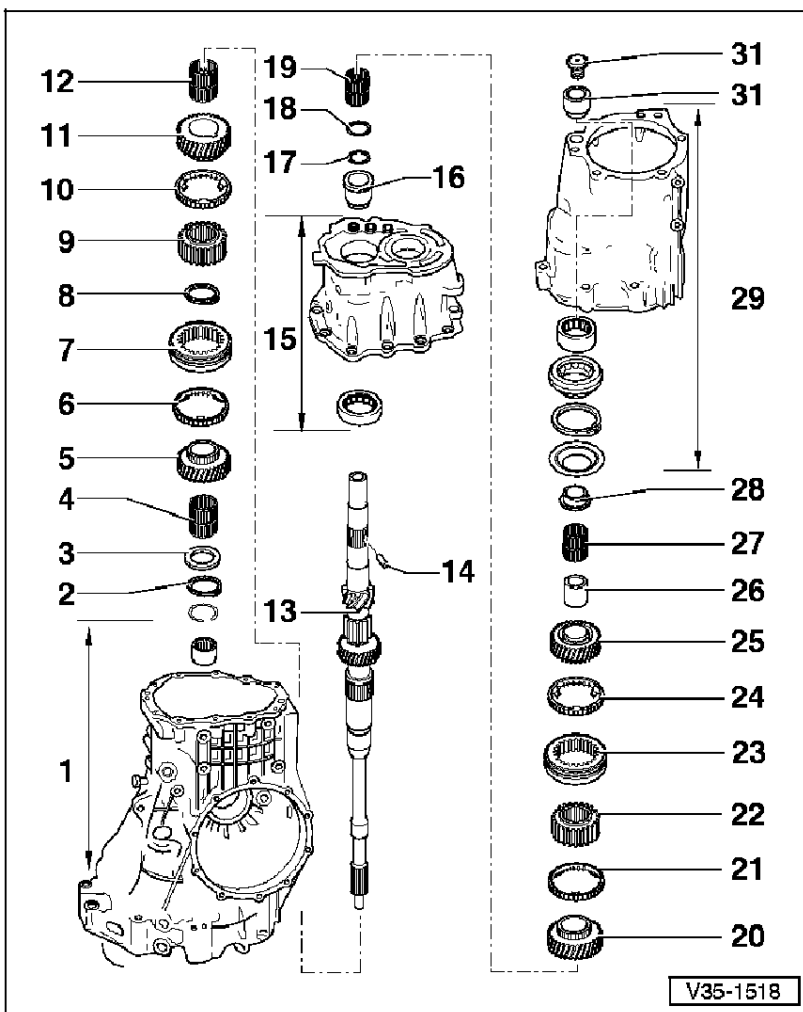


11 - 3rd speed sliding gear
 ◆ Before installing, insert spring => Fig. 1
 ◆ After pressing on -item 9-, check axial clearance with a feeler gauge (0.15 ... 0.35 mm)

12 - Needle bearing for 3rd gear
 ◆ Mark before removing
 ◆ Do not interchange with needle bearing for 4th gear
 ◆ Oil with gear oil before installing

13 - Input shaft
 ◆ With wider 1st speed gear in CGR gearbox from serial No. 77644 and in CRB gearbox: allocation => Fig. 8

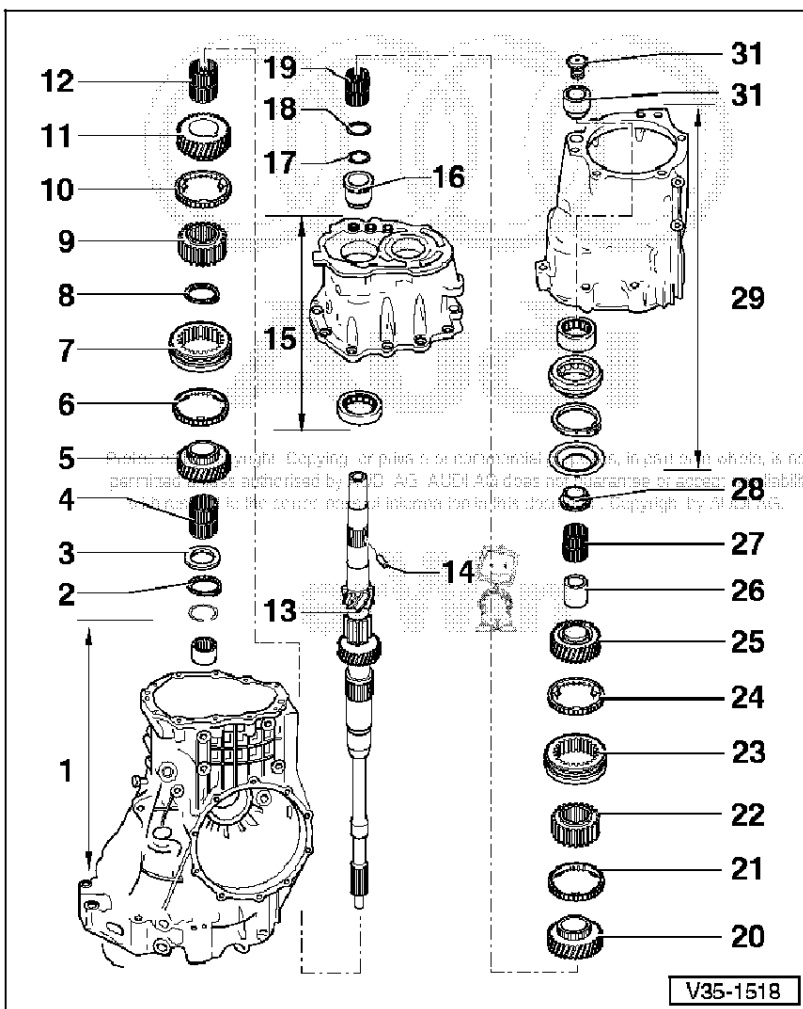
14 - Spring pin
 ◆ Drive in when renewing input shaft
 => Fig. 7



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- 15 - Bearing plate
 - ◆ Servicing => Page 34-100
 - ◆ With machined surface for identification in CGR gearbox from serial No. 77644 and in CRB gearbox => Fig. 1, Page 34-105
- 16 - Inner race for cylinder roller bearing
 - ◆ Altered width in CGR gearbox from serial No. 77644 and in CRB gearbox: allocation => Fig. 8
 - ◆ Take off and fit by hand
- 17 - Circlip
- 18 - Thrust washer for needle bearing for 6th gear
 - ◆ Installation position: shoulder towards circlip, smooth contact surface towards needle bearing => Page 34-65

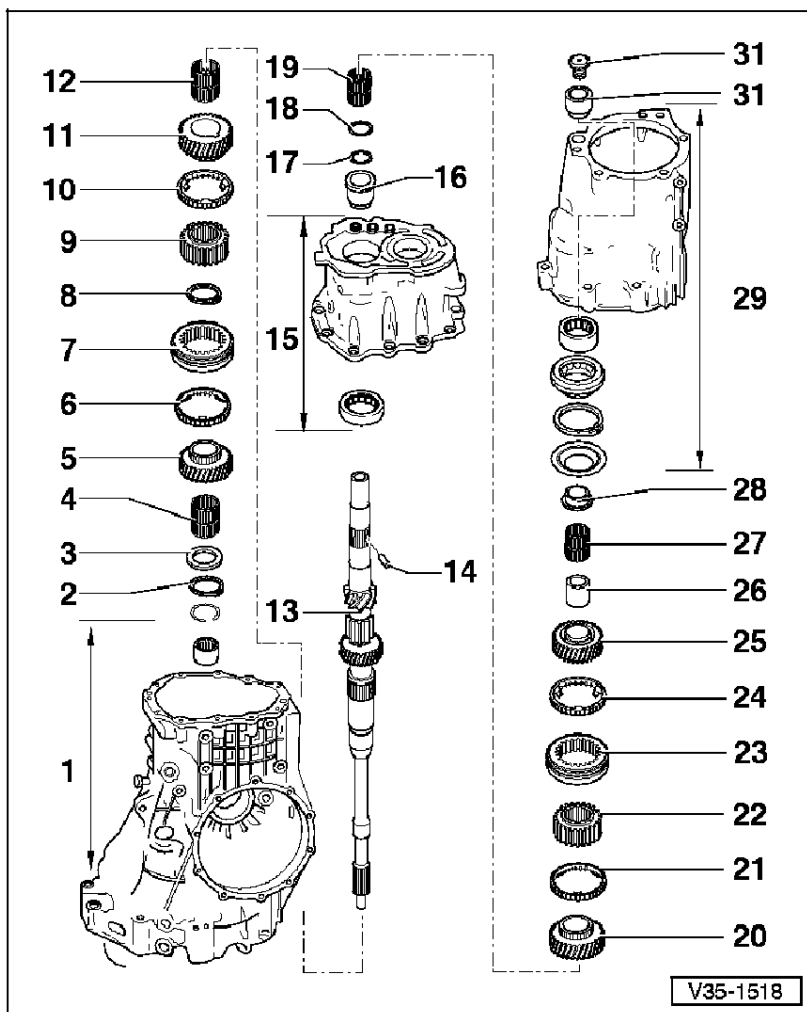
35-5



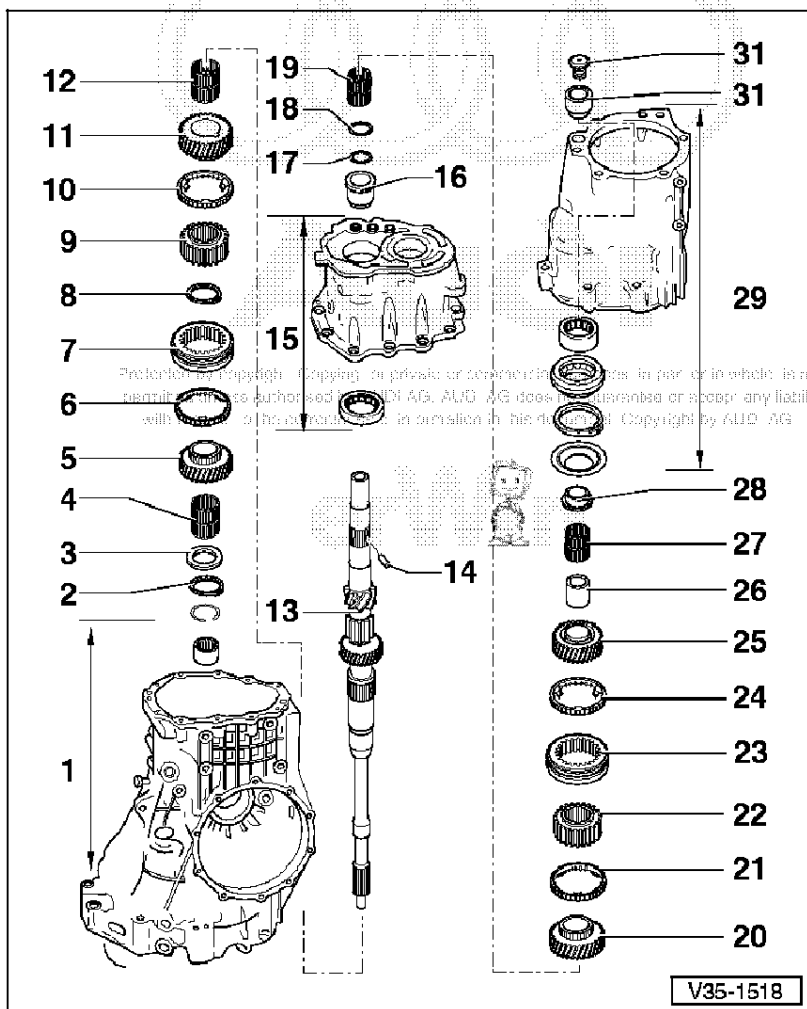
V35-1518

- 19 - Needle bearing for 6th gear
 - ◆ Oil with gear oil before installing
- 20 - 6th speed sliding gear
 - ◆ Before installing, insert spring => Fig. 1
 - ◆ After installing, check axial clearance with a feeler gauge (0.15 ... 0.35 mm)
- 21 - Synchro-ring for 6th gear
 - ◆ Checking for wear => Fig. 2
- 22 - Synchro-hub for 5th and 6th gear
 - ◆ Pulling off => Page 34-54
 - ◆ Driving on => Page 34-66
 - ◆ Installation position: projecting hub towards 5th speed sliding gear

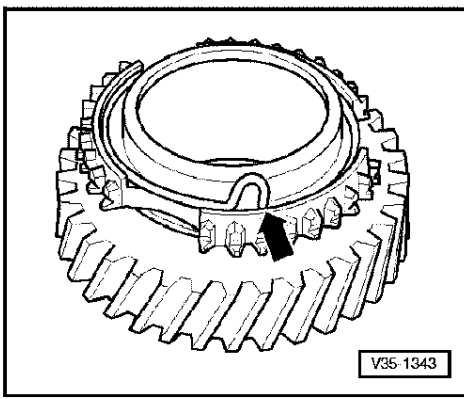
35-6



- 23 - Locking collar
 - ◆ Paired with synchro-hub
 - ◆ Mark before removing => Page 34-53
- 24 - Synchro-ring for 5th gear
 - ◆ Checking for wear => Fig. 2
- 25 - 5th speed sliding gear
 - ◆ Before installing, insert spring => Fig. 1
 - ◆ After installing, check axial clearance => Page 34-71
- 26 - Inner race for 5th speed sliding gear
 - ◆ Pulling off => Page 34-54
 - ◆ Driving on => Page 34-71

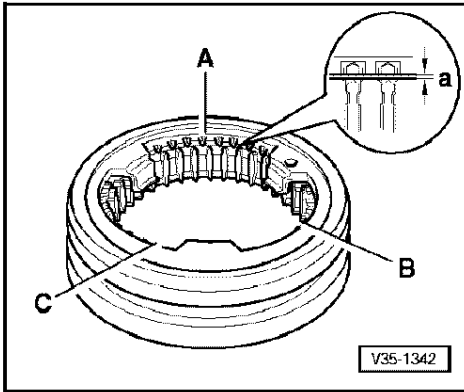


- 27 - Needle bearing for 5th gear
 - ◆ Oil with gear oil before installing
- 28 - 1st inner race for tapered roller bearing for input shaft
 - ◆ Pulling off => Page 34-51
 - ◆ Driving on => Page 34-71
- 29 - End cover
 - ◆ Servicing => Page 34-92
- 30 - 2nd inner race for tapered roller bearing for input shaft
 - ◆ Pulling off => Page 34-51
 - ◆ Driving on => Page 34-72
- 31 - Multi-point socket head bolt - 150 Nm
 - ◆ Loosening and tightening => Page 34-50



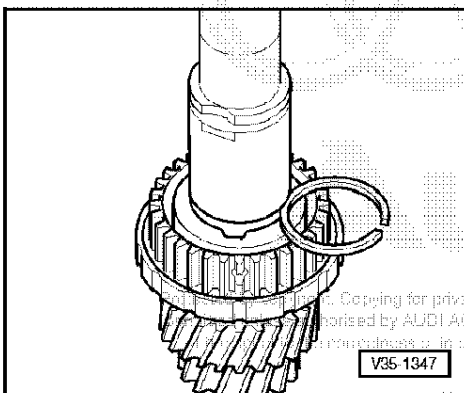
◀ Fig.1 Inserting spring in sliding gear

- Insert spring -arrow- in sliding gear, hook angled end into hole.



◀ Fig.2 Checking synchro-ring for wear

- Press synchro-ring into locking collar and measure gap "a" with a feeler gauge at positions -A-, -B- and -C-.
- Add together results and divide by three.
 - The figure calculated must not be less than 0.5 mm



◀ Fig.3 Re-determining thickness of circlip

- Press synchro-hub onto stop.

Note:

Note installation position when pressing on => Fig. 5.

- Determine the thickest circlip that can still just be fitted.

Note:

The opening of the circlip must align with the groove in the synchro-hub.

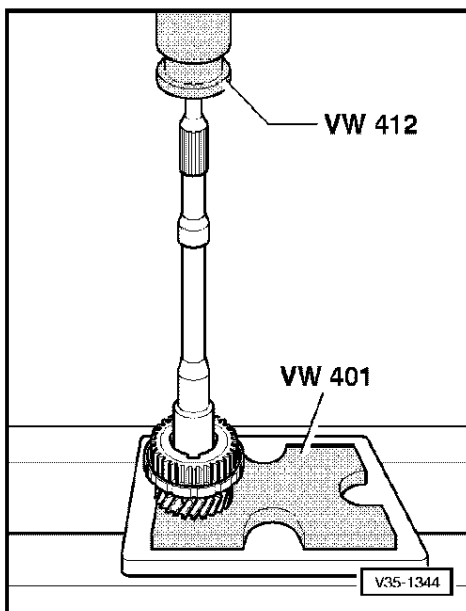
- Determine circlip from table. Part No.

= > Parts catalogue

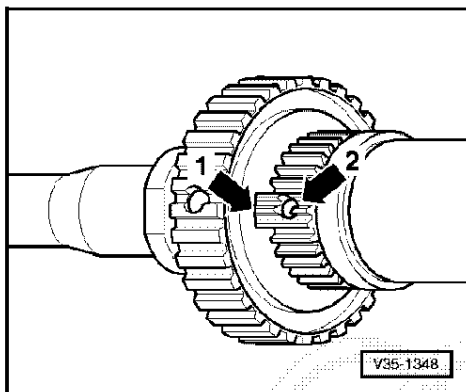
Circlips available

Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	2.05

- Fit circlip.

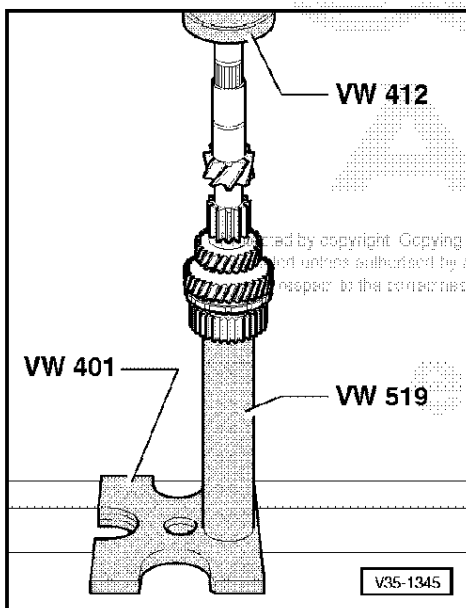


◀ Fig.4 Pressing off synchro-hub for 3rd and 4th gear



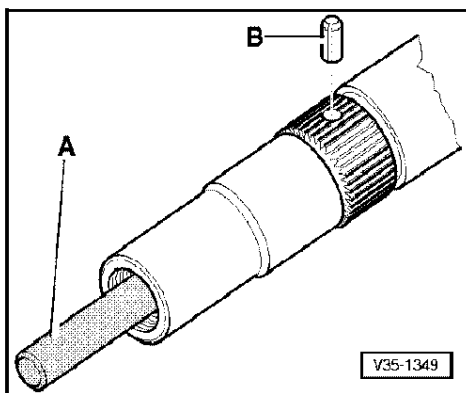
◀ Fig.5 Synchro-hub installation position

- ◆ Oil groove in synchro hub -arrow 1- must align with oil drilling - arrow 2- in input shaft



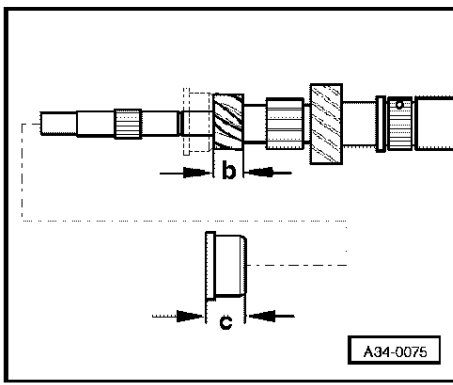
◀ Fig.6 Pressing on synchro-hub for 3rd and 4th gear

- Heat synchro-hub to approx. 100 °C, fit and press home.
- Fit circlip.



◀ Fig.7 Driving spring pin into input shaft

- Guide a 9 mm diameter drift -A- into oil drilling and drive spring pin -B- in until it touches drift.



◀ **Fig.8 Allocation of 1st speed gear and cylinder roller bearing inner race**

In the CGR gearbox from serial No. 77644 onwards and in the CRB gearbox 1st speed gear is wider and the cylinder roller bearing inner race is modified to match.

_ b - Width of 1st speed gear

_ c - Width of cylinder roller bearing inner race

Allocation:

◆ CGR gearbox up to serial number 77643:

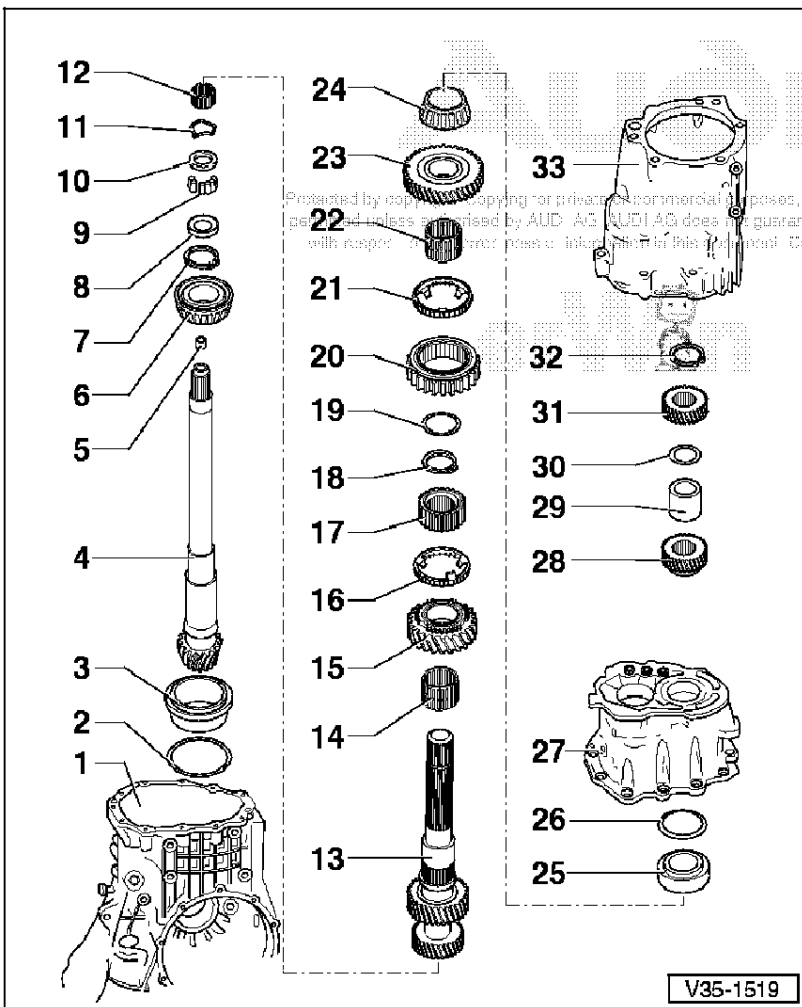
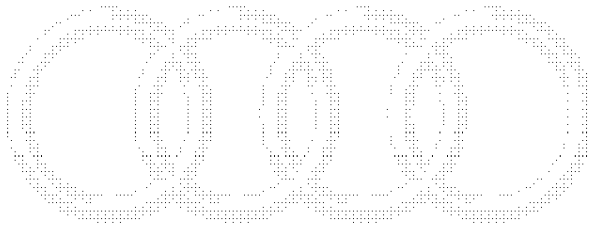
_ b = 22 mm

_ c = 28 mm

◆ CGR gearbox from serial number 77644 onwards and CRB gearbox:

_ b = 26 mm

_ c = 24 mm



Dismantling and assembling drive pinion and hollow shaft

Notes:

◆ When installing new gears or final drive set => Technical data, Page 00-3.

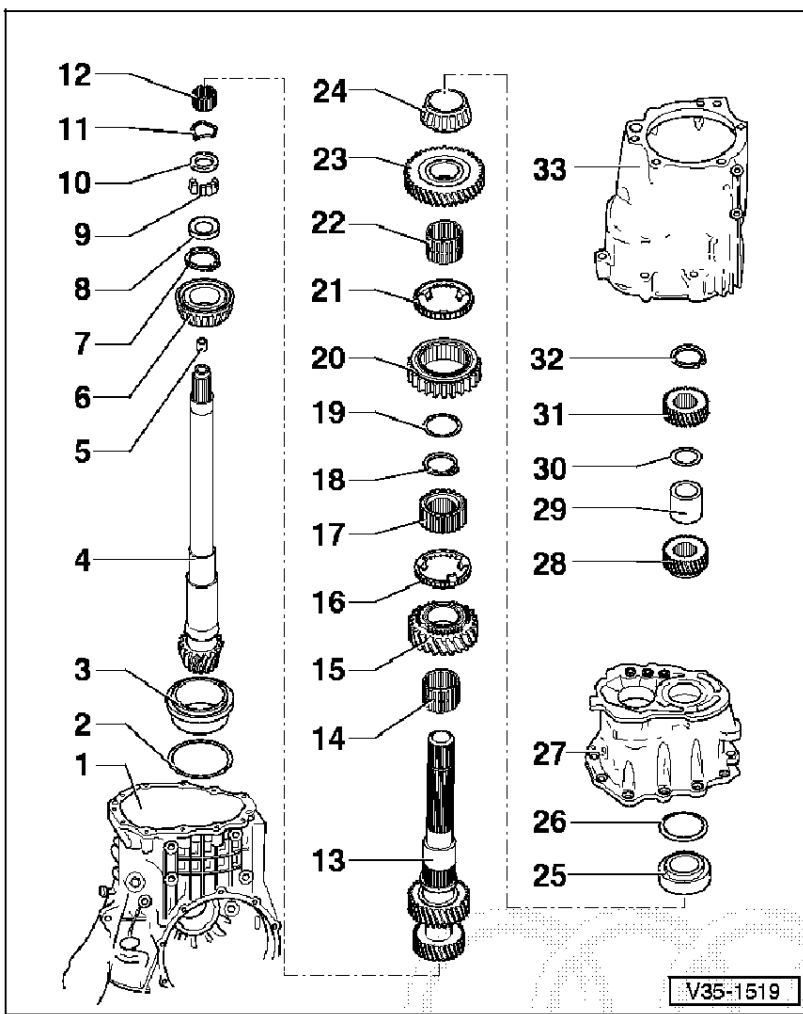
◆ Adjustments are required when renewing components marked ¹⁾ => Adjustment overview, Page 39-34.

1 - Gearbox housing

◆ Servicing => Page 34-114

2 - Shim "S3"

◆ Adjustment overview => Page 39-34



3 - Outer race for large taper roller bearing¹⁾

◆ Pulling out => Fig. 1

◆ Pressing in => Fig. 2 and Fig. 3

4 - Drive pinion¹⁾

◆ Paired with crown wheel (final drive set)

5 - Needle bearing for flange shaft/drive pinion

◆ Pulling out => Fig. 4

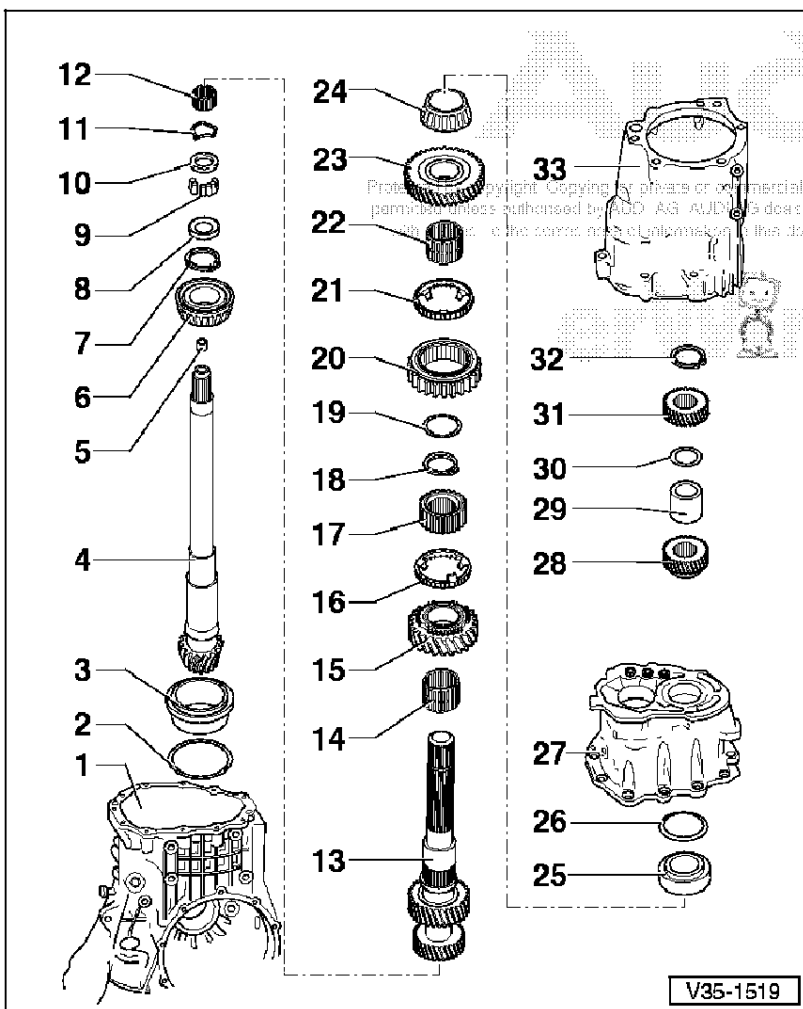
◆ Driving in => Fig. 5

6 - Inner race for large taper roller bearing¹⁾

◆ Pressing off => Fig. 6

◆ Pressing on => Fig. 7

◆ Low friction bearing; do not oil when measuring frictional torque



7 - Circlip

◆ Re-determining => Fig. 8

8 - Flange ring

◆ Installation position => Page

34-58

9 - Tapered rollers

◆ Qty. 23

◆ Installation position => Page 34-58

10 - Support ring

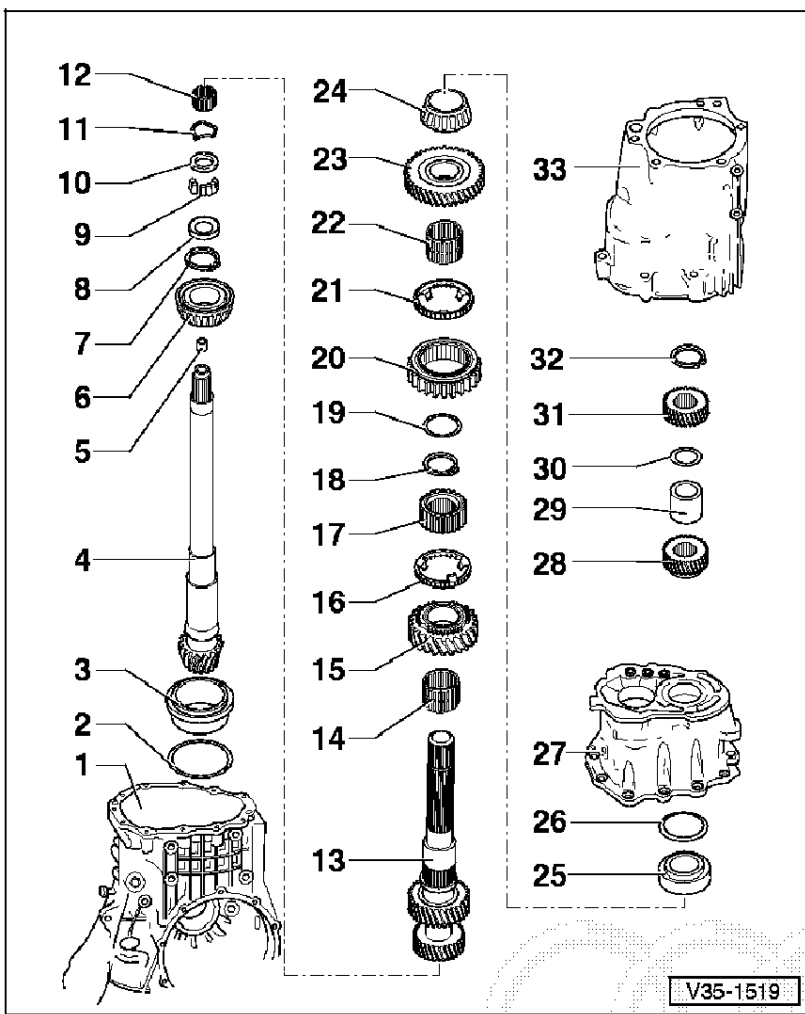
◆ Installation position => Page 34-58

11 - Corrugated spring

12 - Needle bearing for drive pinion/hollow shaft

◆ Oil before installing

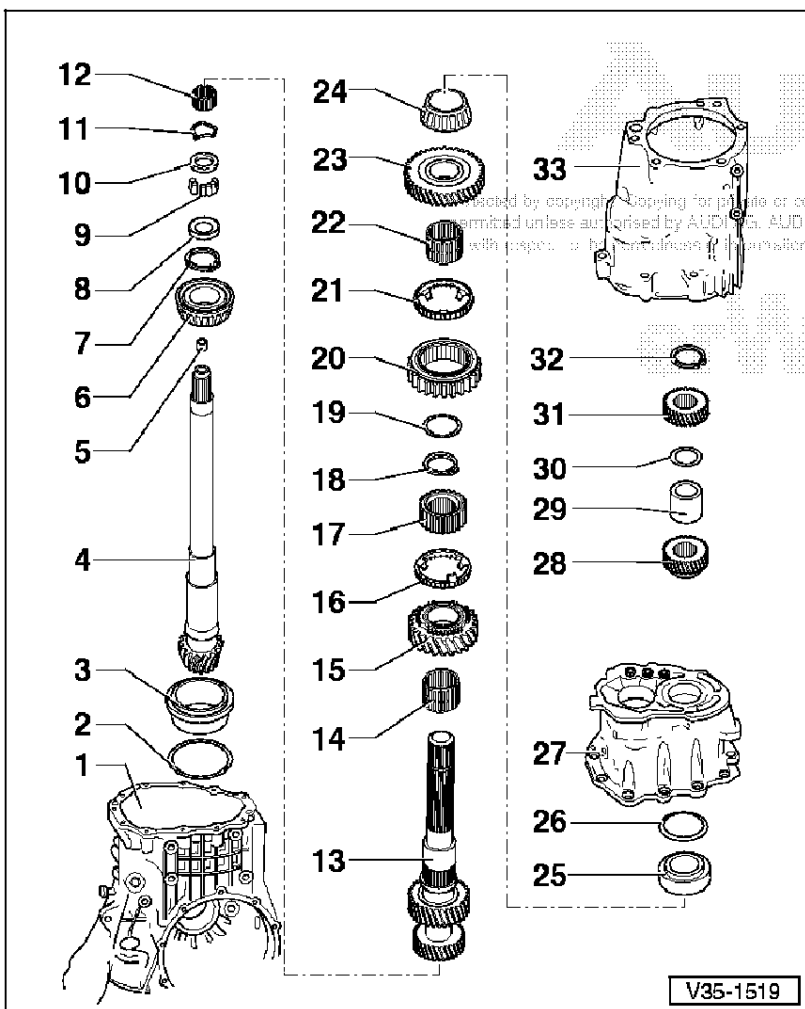
13 - Hollow shaft with 3rd and 4th speed gears¹⁾



14 - Needle bearing for 2nd speed sliding gear
 ◆ Split
 ◆ Oil with gear oil before installing

15 - 2nd speed sliding gear
 ◆ Pressing off => Fig. 12
 ◆ Before installing, fit spring and slide needle bearing onto hollow shaft
 ◆ After installing, check axial clearance with a feeler gauge (0.15 ... 0.35 mm)

16 - Synchro-ring for 2nd gear
 ◆ Coated with Molybdenum
 ◆ Checking for wear => Fig. 2, Page 35-9



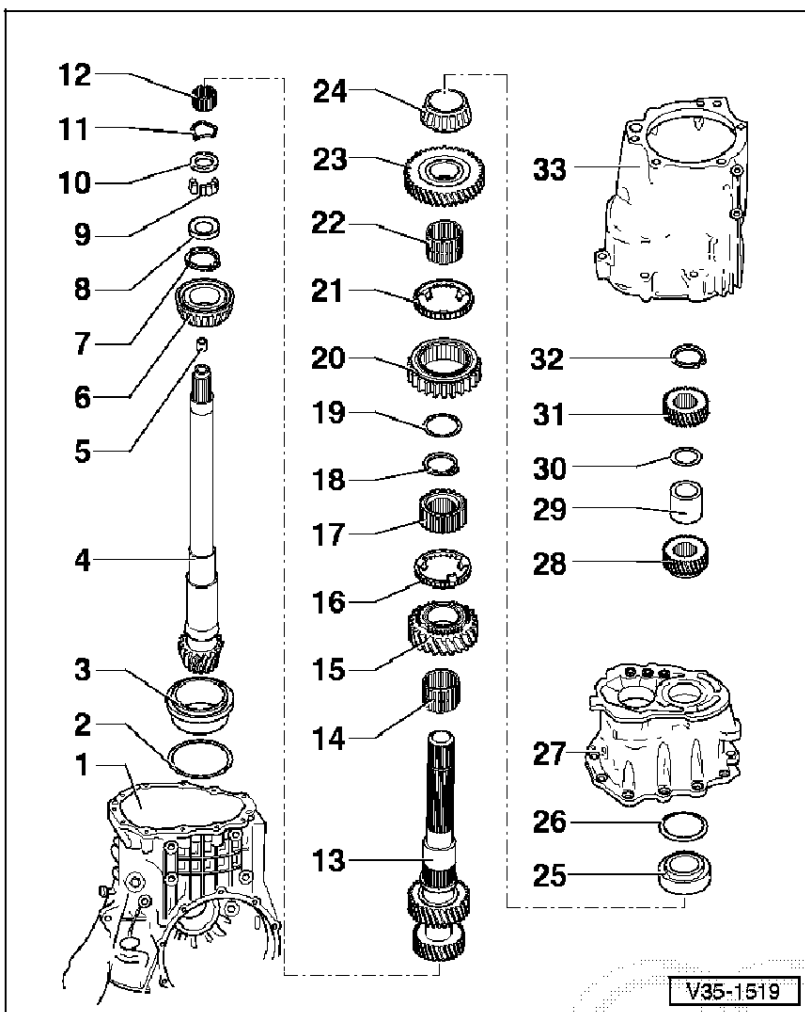
17 - Synchro-hub for 1st and 2nd gear
 ◆ Pressing off => Fig. 12
 ◆ Pressing on => Fig. 13
 ◆ Installation position: flush hub towards 2nd speed sliding gear

18 - Circlip
 ◆ Removing and installing => Fig. 11
 ◆ Re-determining => Fig. 8

19 - Washer
 ◆ Removing and installing => Fig. 11

20 - Locking collar for 1st and 2nd gear
 ◆ Installation position: splines for reverse gear towards synchro-ring for 2nd gear

21 - Synchro-ring for 1st gear
 ◆ Checking for wear => Fig. 2, Page 35-9



22 - Needle bearing for 1st speed sliding gear

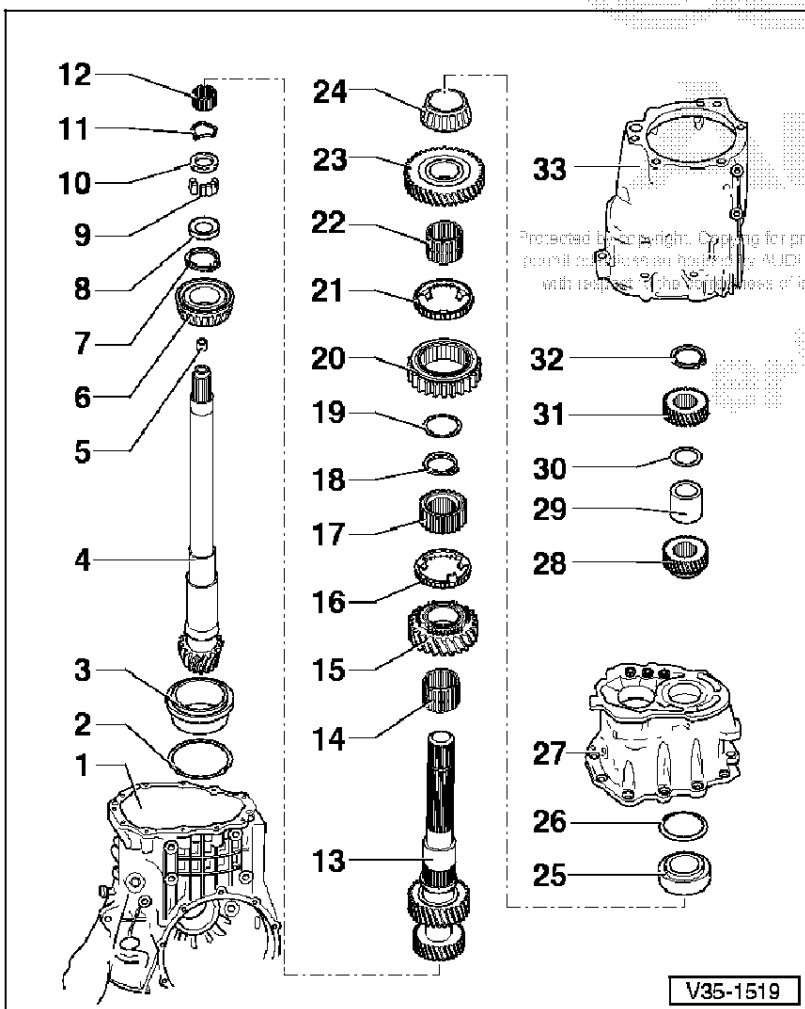
- ◆ Oil with gear oil before installing

23 - 1st speed sliding gear

- ◆ In CGR gearbox from serial No. 77644 and in CRB gearbox 1st speed sliding gear is wider => Fig. 17
- ◆ Before installing, insert spring => Fig. 1, Page 35-9
- ◆ After pressing on -item 24-, check axial clearance

24 - Inner race for small taper roller bearing ¹⁾

- ◆ Pressing off => Fig. 9
- ◆ Pressing on => Fig. 10
- ◆ Low friction bearing; do not oil when measuring frictional torque



25 - Outer race for small taper roller bearing ¹⁾

- ◆ Driving out => Fig. 15
- ◆ Pressing in => Fig. 16

26 - Shim "S4"

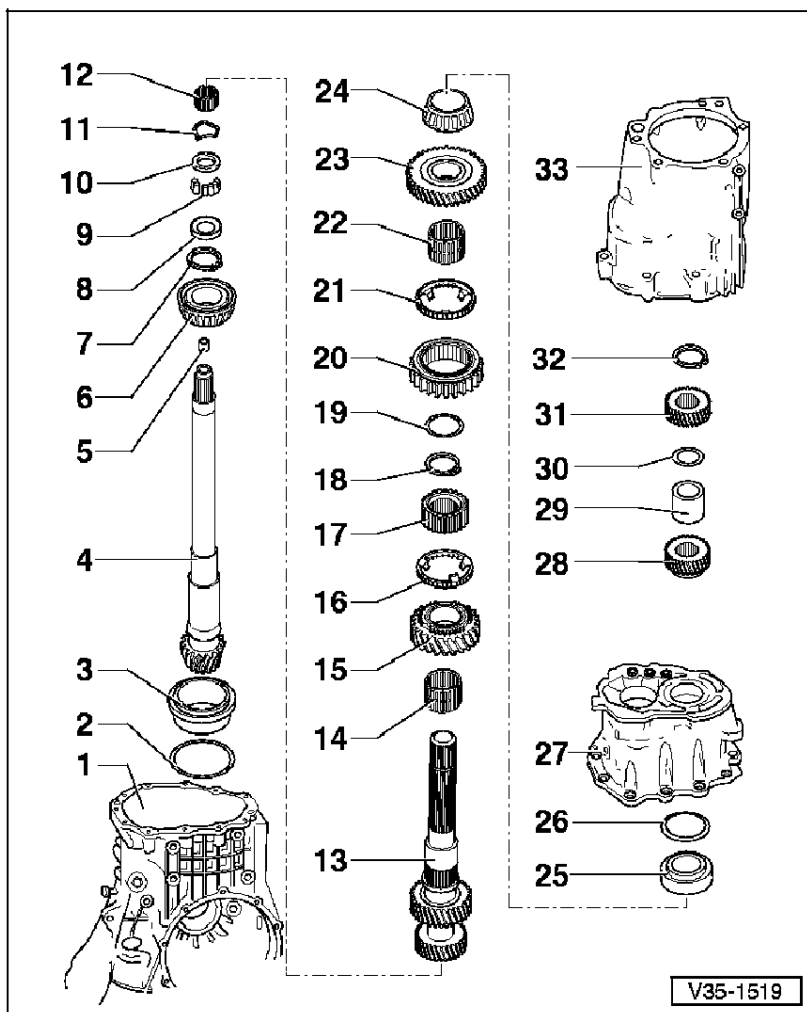
- ◆ Adjustment overview => Page 39-34

27 - Bearing plate ¹⁾

- ◆ Modified bearing plate with machined surface for identification in CGR gearbox from serial No. 77644 and in CRB gearbox => Fig. 1, Page 34-105
- ◆ Servicing => Page 34-100

28 - 6th gear wheel

- ◆ Pressing off => Page 34-58
- ◆ Pressing on => Page 34-59
- ◆ Installation position: shoulder towards inner race for small taper roller bearing



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29 - Spacer sleeve

30 - Shim

◆ Re-determining => Page 34-68

31 - 5th gear wheel

◆ Pulling off => Page 34-52
◆ Driving on => Page 34-69

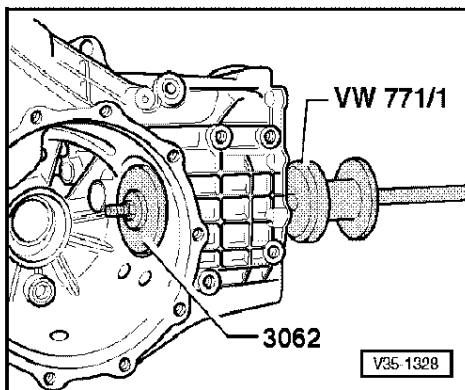
32 - Circlip for 5th gear wheel

◆ Re-determining => Page 34-70

33 - End cover

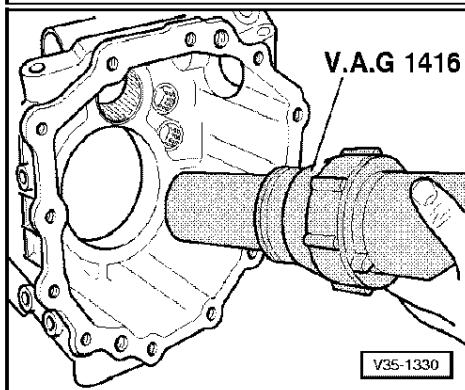
◆ Servicing => Page 34-92

35-21



V35-1328

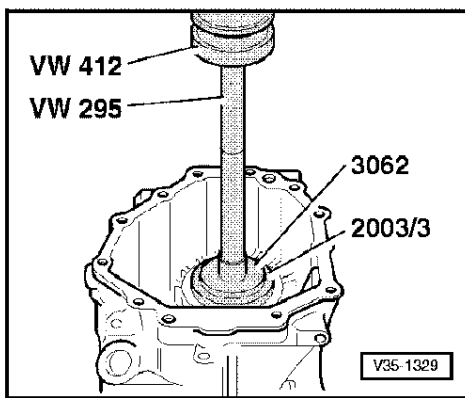
◀ Fig.1 Pulling out outer race for large taper roller bearing
◆ Stepped side of thrust pad 3062 rests against the outer race



V35-1330

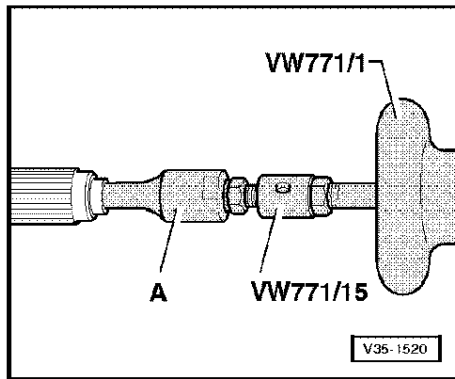
◀ Fig.2 Heating gearbox housing to insert the outer race for large taper roller bearing
- Heat gearbox housing in area of bearing seat for approx. 15 minutes, to approx. 100 °C, with a hot air blower.

35-22



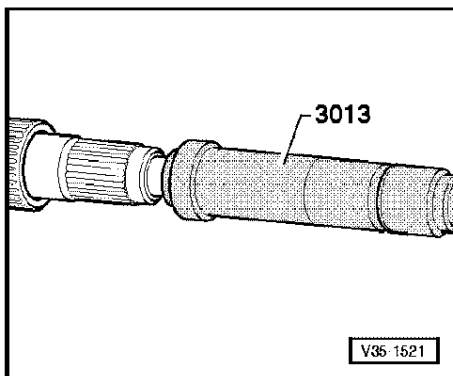
◀ Fig.3 Inserting outer race for large taper roller bearing in gearbox housing and pressing home

- Insert outer race only after heating gearbox housing and press home for 1 ... 2 minutes under a repair press until a heat exchange has taken place.

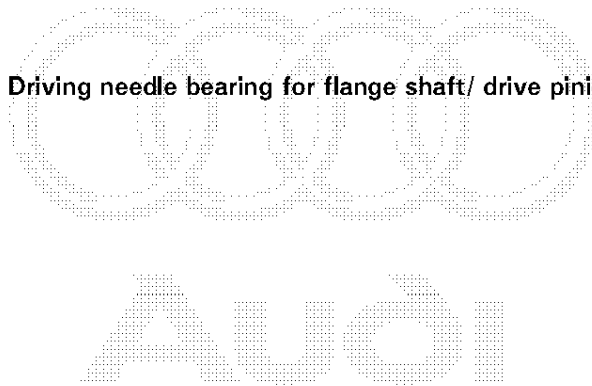


◀ Fig.4 Pulling out needle bearing for flange shaft/drive pinion

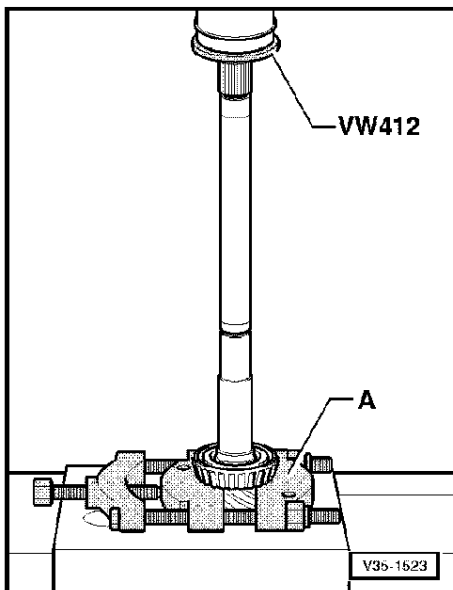
- _ A - Internal puller 12 ... 14.5 mm, e.g. Kukko 21/1



◀ Fig.5 Driving needle bearing for flange shaft/ drive pinion in flush



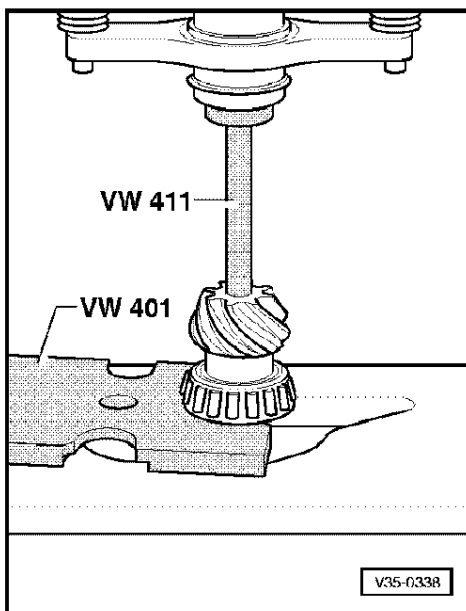
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◀ Fig.6 Pressing off inner race for large taper roller bearing

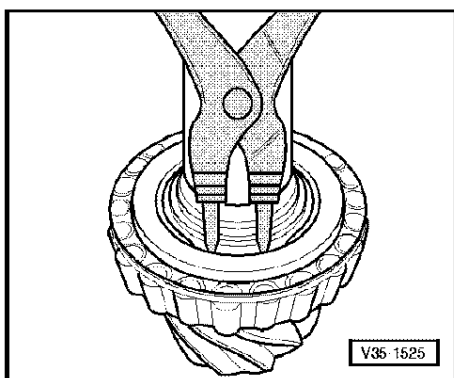
- _ A - Separating device 22 ... 115 mm, e.g. Kukko 17/2

◆ Bearing is destroyed when pressing off



◀ Fig.7 Pressing on inner race for large taper roller bearing

- Heat inner race to approx. 100 °C and fit.
- Press home ensuring there is no axial play.



◀ Fig.8 Determining circlip for large taper roller bearing for drive pinion

- Determine the thickest circlip that can still just be fitted.
 - Determine circlip from table. Part numbers
- = > Parts catalogue

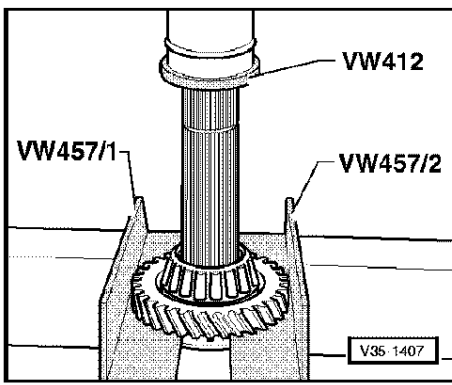
The following circlips are available:

Circlip thickness (mm)		
2.34	2.40	2.46
2.36	2.42	2.48
2.38	2.44	

- Fit circlip.

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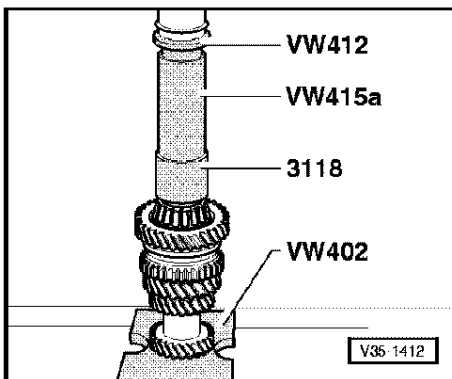




◀ Fig.9 Pressing off inner race of small taper roller bearing for drive pinion together with 1st speed sliding gear

Note:

Do not press off together with 1st and 2nd gear synchro-hub and 2nd speed sliding gear.



◀ Fig.10 Pressing on inner race for small taper roller bearing for drive pinion together with 1st speed sliding gear

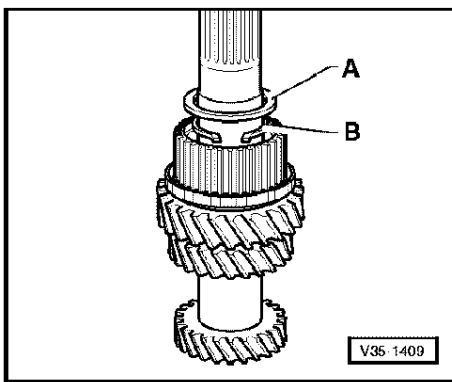
- Install circlip, shim for 1st speed sliding gear, synchro-ring for 1st speed, and 1st speed sliding gear with spring and needle bearing.
- Heat inner race to approx. 100 °C and fit.
- Press home ensuring there is no axial play.

Notes:

- ◆ With shoulder of thrust piece 3118 facing downwards, press only onto bearing inner race.
- ◆ Position stepped shoulder of tube VW.415 A facing up towards press tool VW.412.
- ◆ After pressing on, check axial clearance of 1st speed sliding gear.

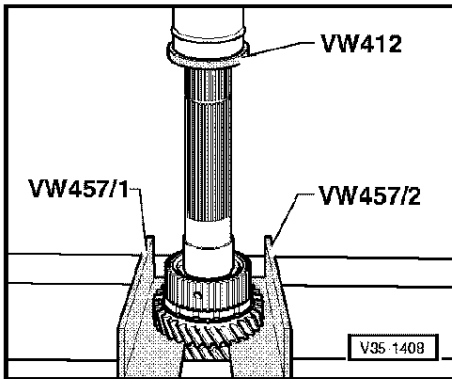
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◀ Fig.11 Removing and installing circlip for synchro-hub and shim for 1st speed sliding gear

- Removing, take off shim -A- then circlip -B-.
- Installing, fit circlip -B- then shim -A-.

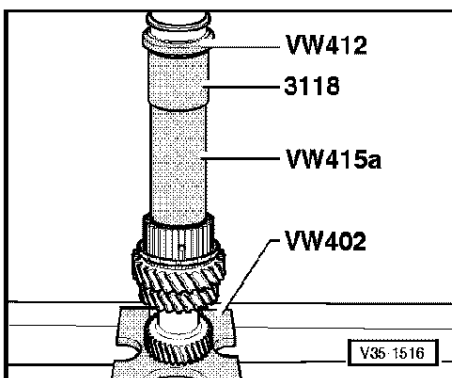


◀ Fig.12 Pressing off 2nd speed sliding gear with synchro-hub for 1st and 2nd gear

- Take off locking collar for 1st and 2nd gear and synchro-ring for 1st gear.
- Remove shim and circlip for synchro-hub
- Press off 2nd speed sliding gear together with synchro-hub for 1st and 2nd gear.

Note:

Do not press off together with 1st speed sliding gear and inner race for small taper roller bearing.



◀ Fig.13 Fitting 2nd speed sliding gear, pressing on synchro-hub for 1st and 2nd gear

- Install needle bearing (split), sliding gear with spring and synchro-ring for 2nd gear.
- Oil needle bearing.
- Heat synchro-hub to approx. 100 °C and fit.
- Press home ensuring there is no axial play.

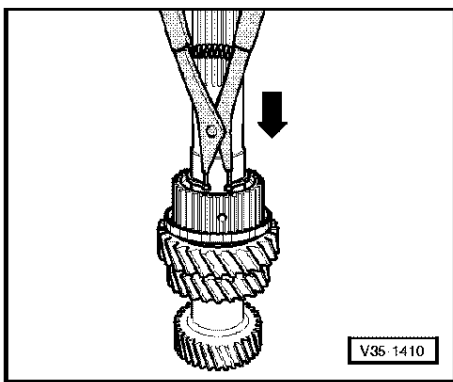
Notes:

- ◆ Position tube VW 415 a with shoulder towards synchro-hub.
- ◆ Position thrust pad 3118 with stepped shoulder towards press tool VW 412.



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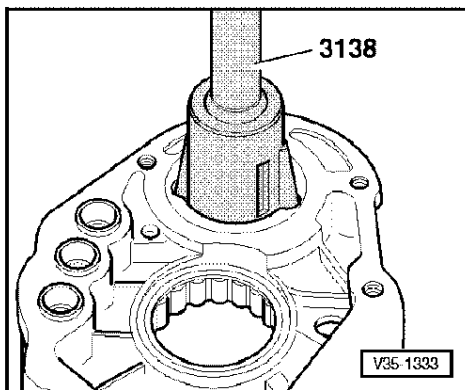
◀ **Fig.14 Determining thickness of circlip for synchro-hub for 1st and 2nd gear**

- Determine the thickest circlip that can still just be fitted.
- Determine circlip from table. Part No.
- = > Parts catalogue

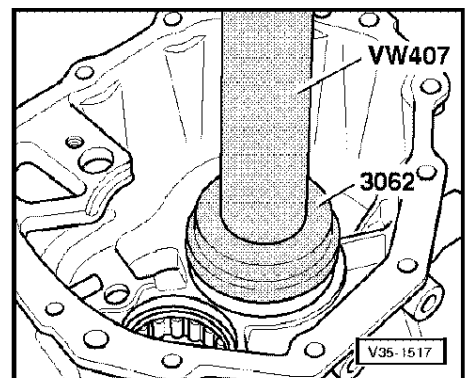
The following circlips are available:

Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	

- Fit circlip in direction of arrow onto synchro-hub.



◀ **Fig.15 Driving out outer race for small taper roller bearing**

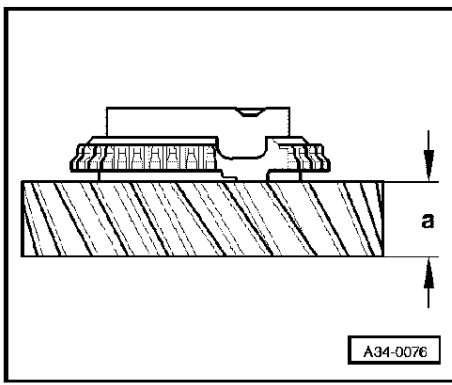


◀ **Fig.16 Pressing in outer race for small taper roller bearing**

- Insert shim "S4" into bearing flange behind bearing seat.
- Position stepped shoulder of thrust pad 3062 towards press tool VW 407.
- Press outer race for small taper roller bearing onto stop.

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◀ **Fig.17 Width of 1st speed sliding gear**

The CGR gearbox from serial No. 77644 and the CRB gearbox have a wider 1st speed sliding gear to match the wider 1st speed gear.

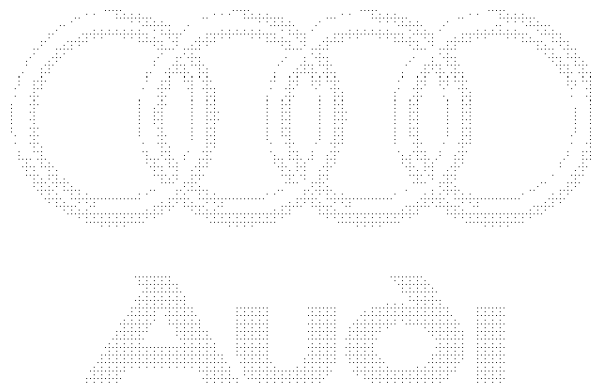
Allocation:

- ◆ CGR gearbox up to serial No. 77643: 1st speed sliding gear with smaller width

_ a = 18 mm

- ◆ CGR gearbox from serial No. 77644 and CRB gearbox: 1st speed sliding gear with larger width

_ a = 22 mm



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Renewing seal for flange shaft

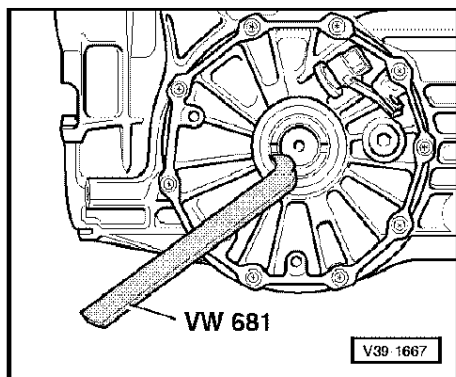
- Gearbox installed

Notes:

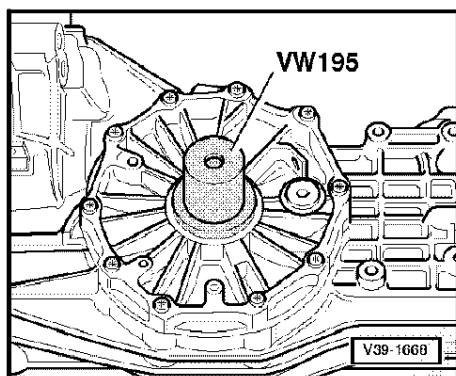
- ◆ Illustrated, removing and installing oil seal on left-hand side.
- ◆ Procedure for removing oil seal on left and right-hand sides is identical.

Removing

- Remove heat shield.
- Disconnect drive shaft.
- Place a drip tray underneath.
- Remove flange shaft, secure with a drift to prevent it turning.
- Pull seal out with lever VW 681.



39-1



Installing

- Fill space between sealing and dust lips with multipurpose grease.
- Lightly oil outer circumference of seal.
- Drive in seal for flange shaft.
 - Insertion depth: 6.5 mm
- Install flange shaft and drive shaft.

Tightening torques

Component	Nm
Flange shaft to gearbox	10 + 90° ¹⁾
Drive shaft to flange shaft	80

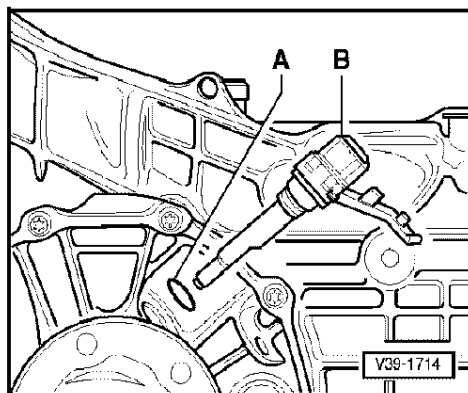
¹⁾ 90° = 1/4turn

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39-2

Removing and installing speedometer sender - G22 and drive wheel for speedometer sender

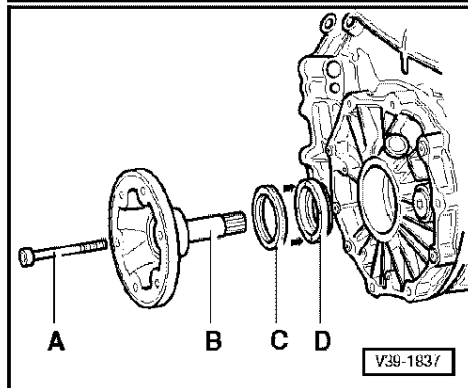


- Gearbox installed

Removing and installing speedometer sender - G22

- ◀ – Pull connector off sender -B-.
- Press sender retainer down, turn and pull out sender.
- Renew O-ring -A-.

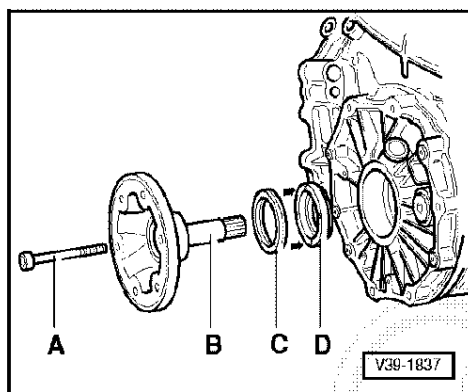
Removing and installing drive wheel for speedometer sender -G22



Removing:

- ◀ – Detach drive shaft from left flange shaft -B-.
- Unscrew bolt -A-. Secure flange shaft with a drift to prevent it turning.
- Remove flange shaft and seal -C-.

39-3



- ◀ – Using a screwdriver, lever out drive wheel for speedometer sender -D- on alternate sides at the follower lugs -arrows-.

Installing:

- Install drive wheel for speedometer sender so that the follower lugs -arrows- face toward the seal.

Note:

Fit the drive wheel carefully onto the differential, making sure that it is kept straight. Do not use force; the drive wheel can break easily.

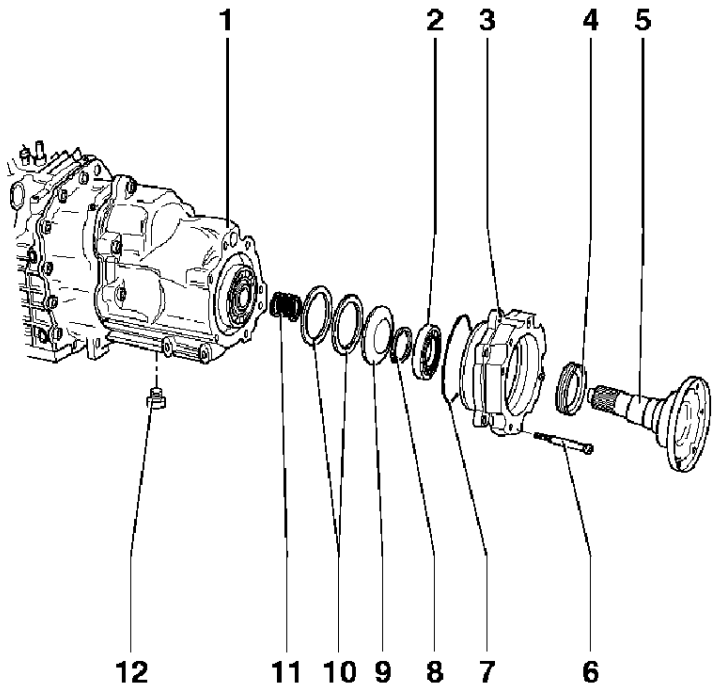
- Follower lugs engage in differential housing grooves.
- Renew seal for flange shaft and install flange shaft => Page 39-1.
- Top up oil in gearbox and check oil level => Page 34-29.

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39-4

Renewing seal and grooved ball bearing for flange for propshaft on gearbox

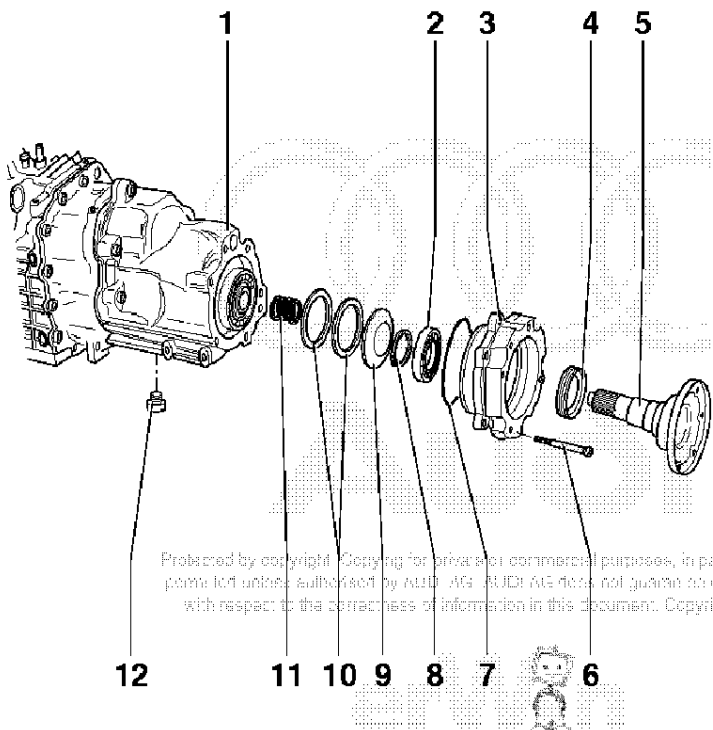


V39-1873

● Gearbox installed

- 1 - Gearbox
- 2 - Grooved ball bearing
- 3 - Bearing housing on balance weight
- 4 - Seal
 - ◆ Driving in => Page 39-11
- 5 - Flange shaft

39-5



V39-1873

- 6 - Bolt - 25 Nm
 - ◆ Qty. 6
- 7 - O-ring
 - ◆ Renew
- 8 - Circlip
- 9 - Spring plate
 - ◆ Mark installation position when removing: larger diameter (concave side) towards shims -item 10
- 10 - Shims
- 11 - Spring
- 12 - Oil drain plug - 40 Nm

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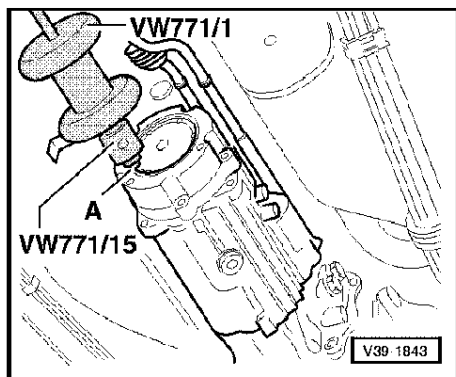
39-6

Removing

- Disconnect propshaft at the front => Page 39-59 and tie-up on selector linkage.
- Place a drip tray underneath.
- Unscrew rear oil drain plug (on end cover) and drain gearbox oil.
- Unscrew securing bolts for bearing housing.

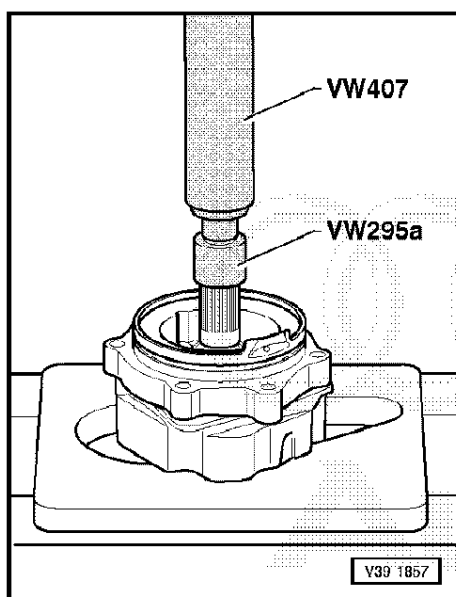
Note:

Bearing housing is pressed slightly off end cover by coil spring when securing bolts are loosened.

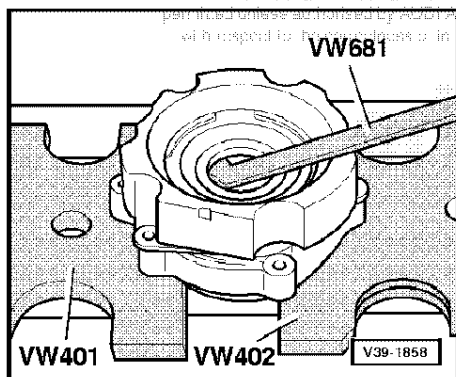


- ◀ - Pull flange shaft together with bearing housing and balance weight off end cover.
 - A - M8/M10 stud
- Take off bearing housing.

39-7

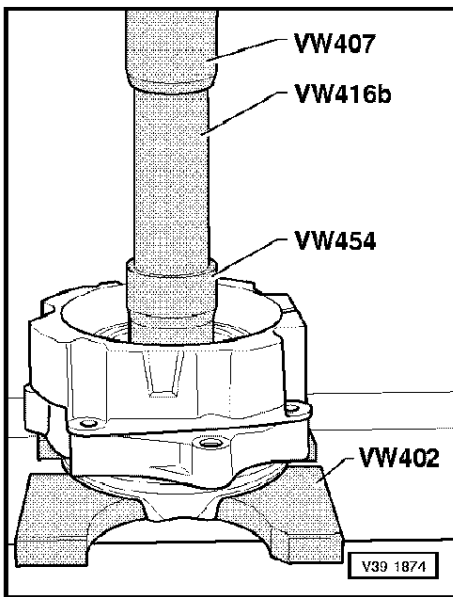


- ◀ - Take circlip off flange shaft.
- Press out flange shaft.

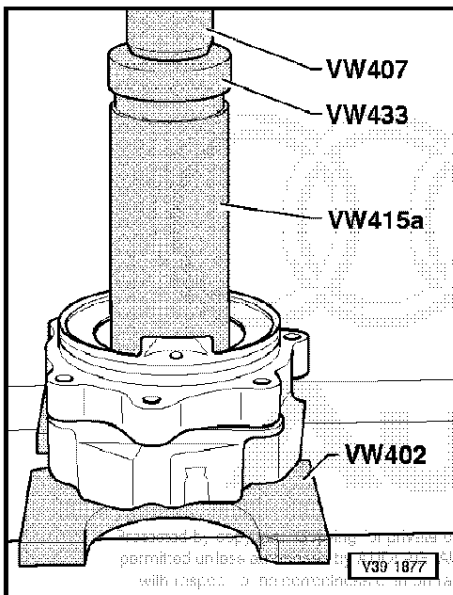


- ◀ - Pull out seal for flange shaft.
- Thoroughly clean seal seat.

39-8



◀ – Press out grooved ball bearing.

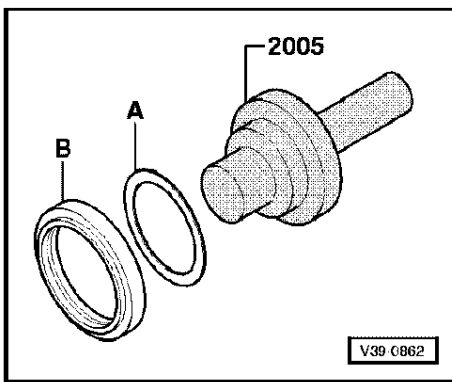


◀ **Installing**

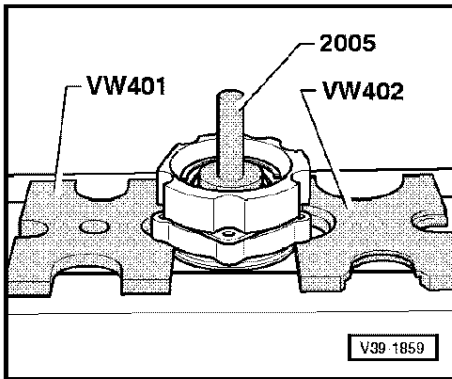
– Press grooved ball bearing into bearing housing.

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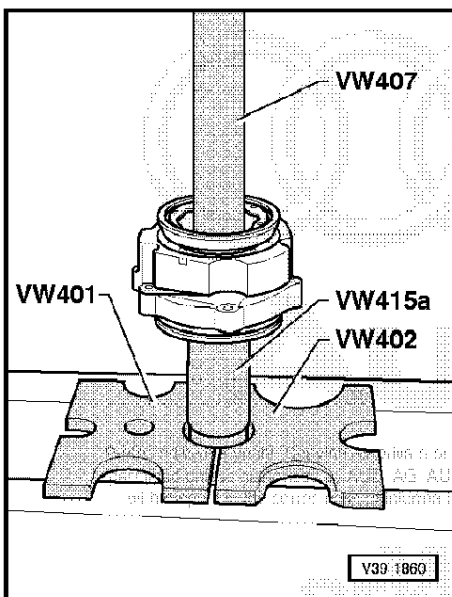




- ◀ - Lightly oil outer circumference of seal -B-.
- Fill space between sealing lips with grease.
- Fit seal with shim -A-, Part No. 016 311 391 B (1.7 mm thick) onto punch 2005.
 - Installation position: open side of seal towards gearbox



- ◀ - Drive in seal for flange shaft.
- Remove shim after driving in.



- ◀ - Press in flange shaft.
- Fit circlip onto flange shaft.
- Lightly oil O-ring and fit into bearing housing groove.
- Insert spring plate and shims into bearing housing.
 - Installation position: => Page 39-6
- Slide coil spring onto flange shaft.
- Tighten securing bolts for bearing housing in diagonal sequence and in stages.
- Bolt on propshaft =>Page 39-61.
- Top up oil in gearbox and check oil level => Page 34-29.

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Removing and installing differential

Note:

Removing and installing is also possible with gearbox installed in vehicle.

1 - Bolt - 10 Nm + 1/4turn (90°) further

2 - Flange shaft

◆ When removing, secure with a drift to prevent it turning

3 - Bolt - 25 Nm

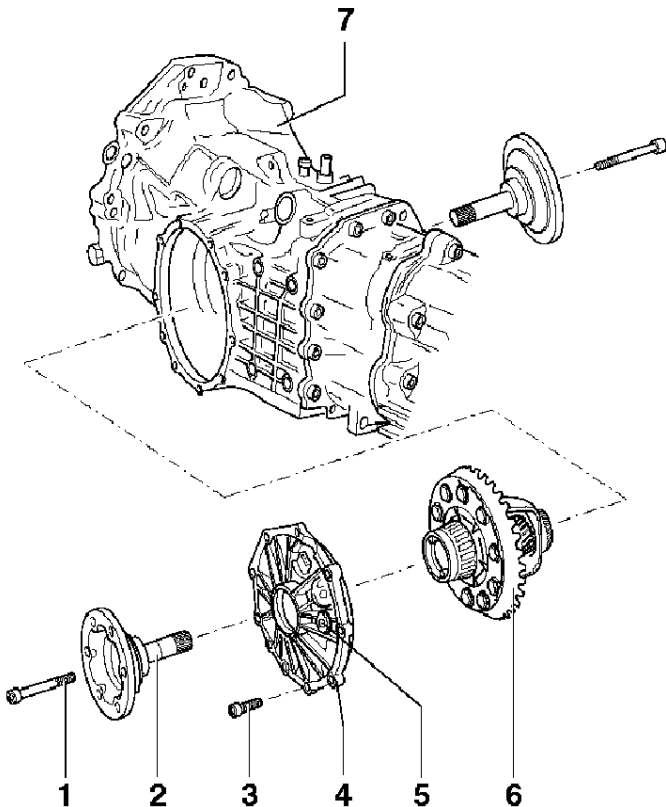
◆ Qty. 10

4 - Cover for final drive

◆ Removing and installing drive wheel for speedometer sender -G22

=> Page 39-3

◆ If renewed: adjust crown wheel => Page 39-47



V34-2860

39-13

5 - Oil filler plug - 40 Nm

◆ Checking oil level in gearbox
=> Page 34-29

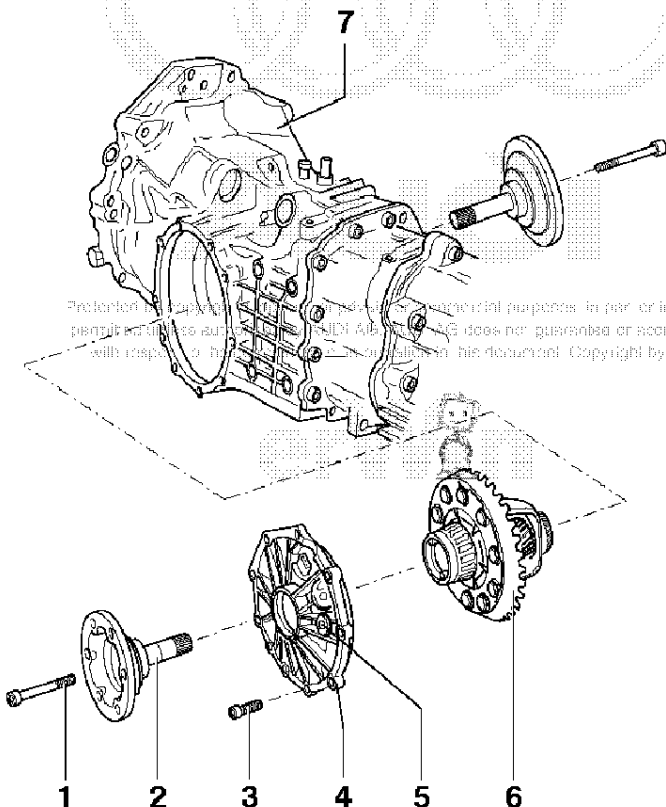
6 - Differential

◆ Dismantling and assembling
=> Page 39-15

◆ If renewed: adjust crown wheel
=> Page 39-47

7 - Gearbox housing

◆ Servicing => Page 34-114



V34-2860

39-14

Dismantling and assembling differential

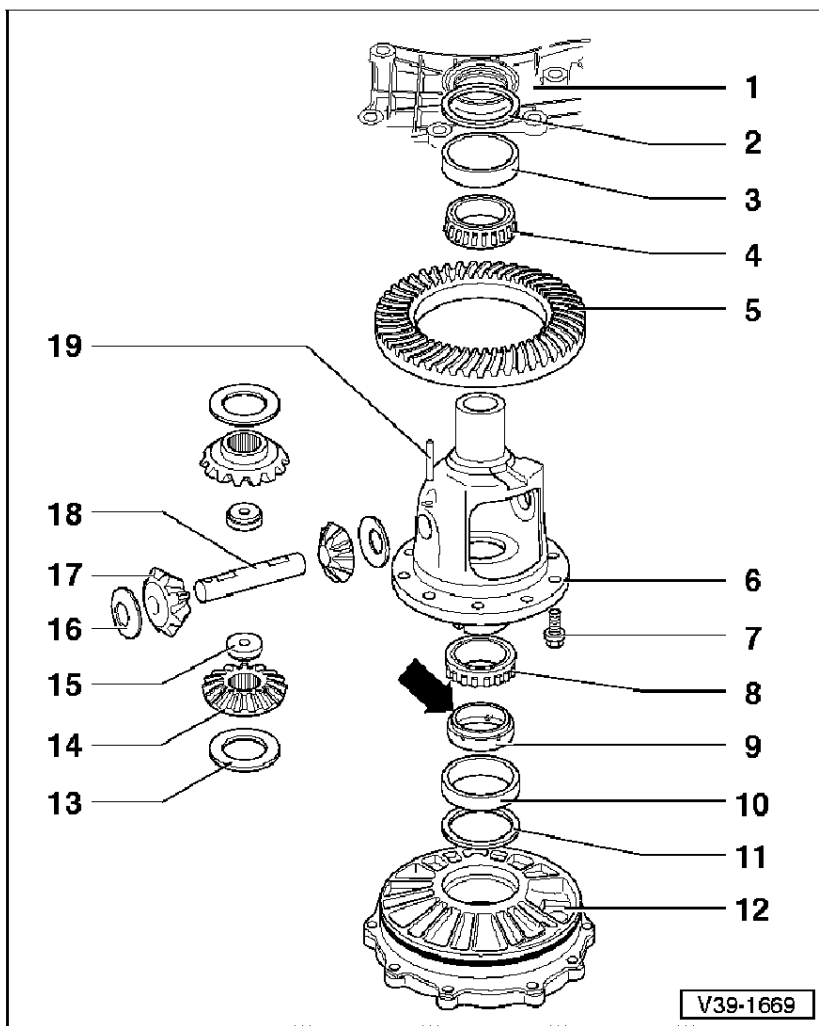
Notes:

- ◆ Removing and installing differential => Page 39-13.
- ◆ Adjustments are required when replacing components marked 1) => adjustment overview Page 39-34.

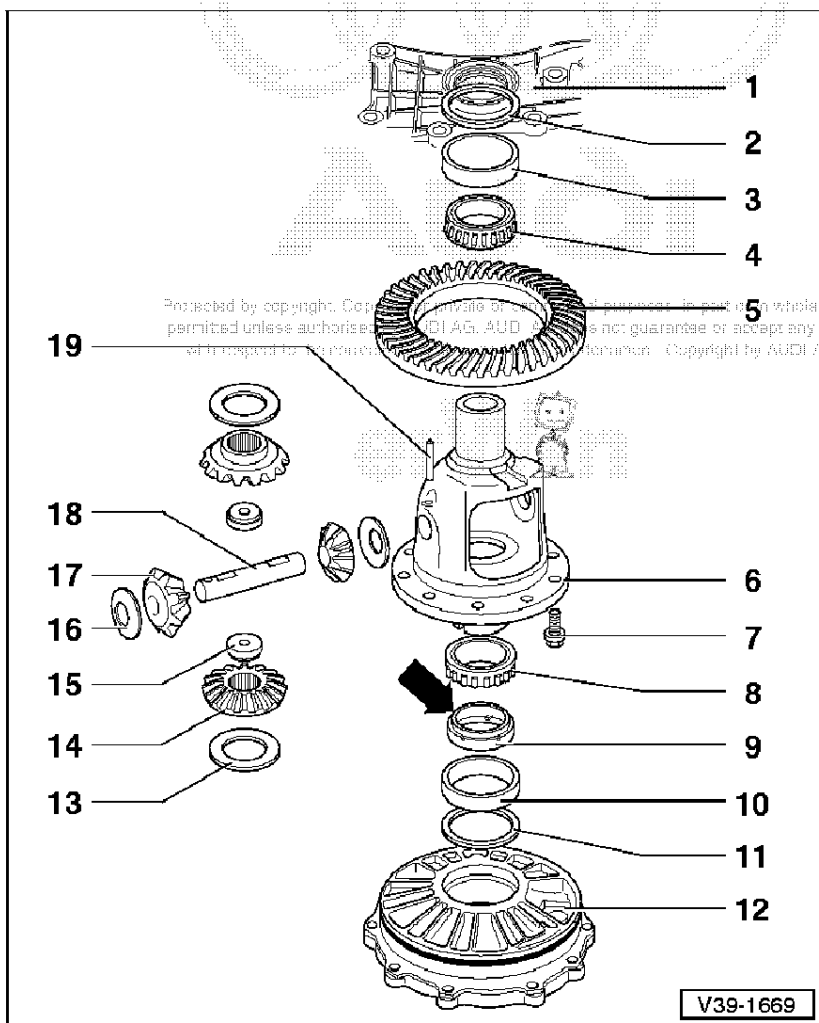
1 - Gearbox housing ¹⁾

2 - Shim "S2"

- ◆ Note thickness
- ◆ Adjustment overview => Page 39-34



39-15



3 - Outer race for small taper roller bearing ¹⁾

- ◆ Driving out => Fig. 9
- ◆ Driving in => Fig. 10

4 - Inner race for small taper roller bearing ¹⁾

- ◆ Pulling out => Fig. 1
- ◆ Pressing in => Fig. 3

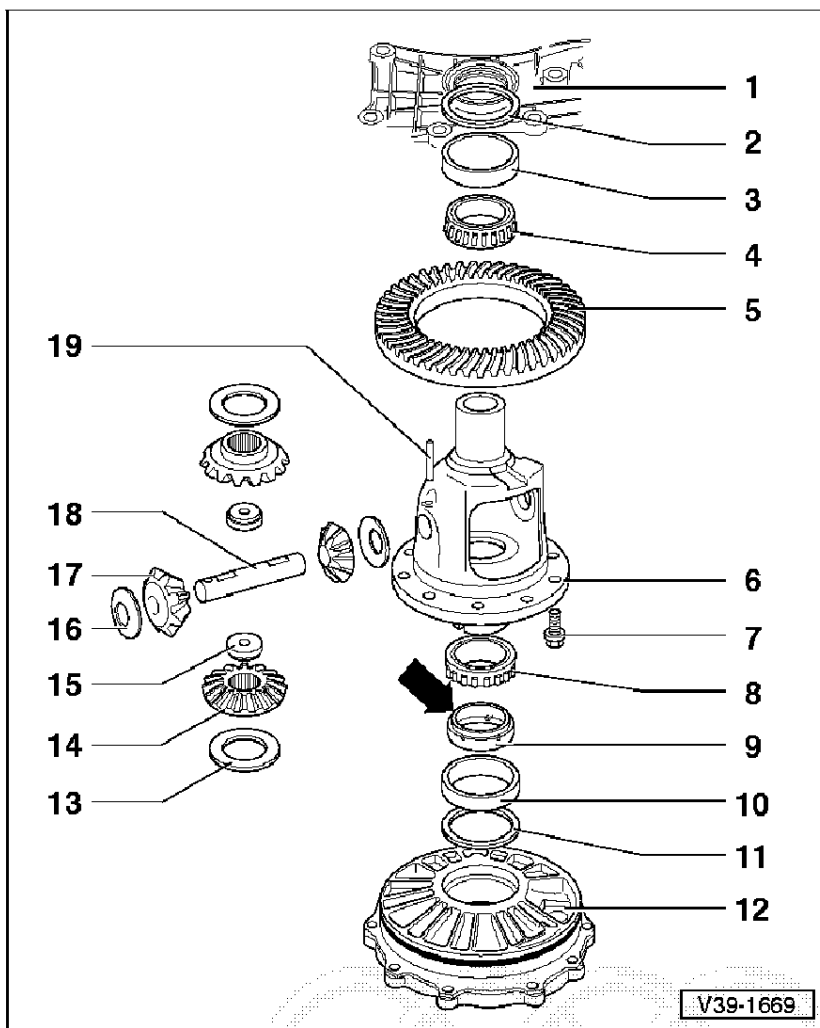
- ◆ Low friction bearing; do not oil when measuring frictional torque

5 - Crown wheel ¹⁾

- ◆ Paired with drive pinion (final drive set)
- ◆ Removing => Fig. 5
- ◆ Installing => Fig. 6

6 - Differential housing ¹⁾

39-16



7 - Crown wheel bolt - 60 Nm + 45° further

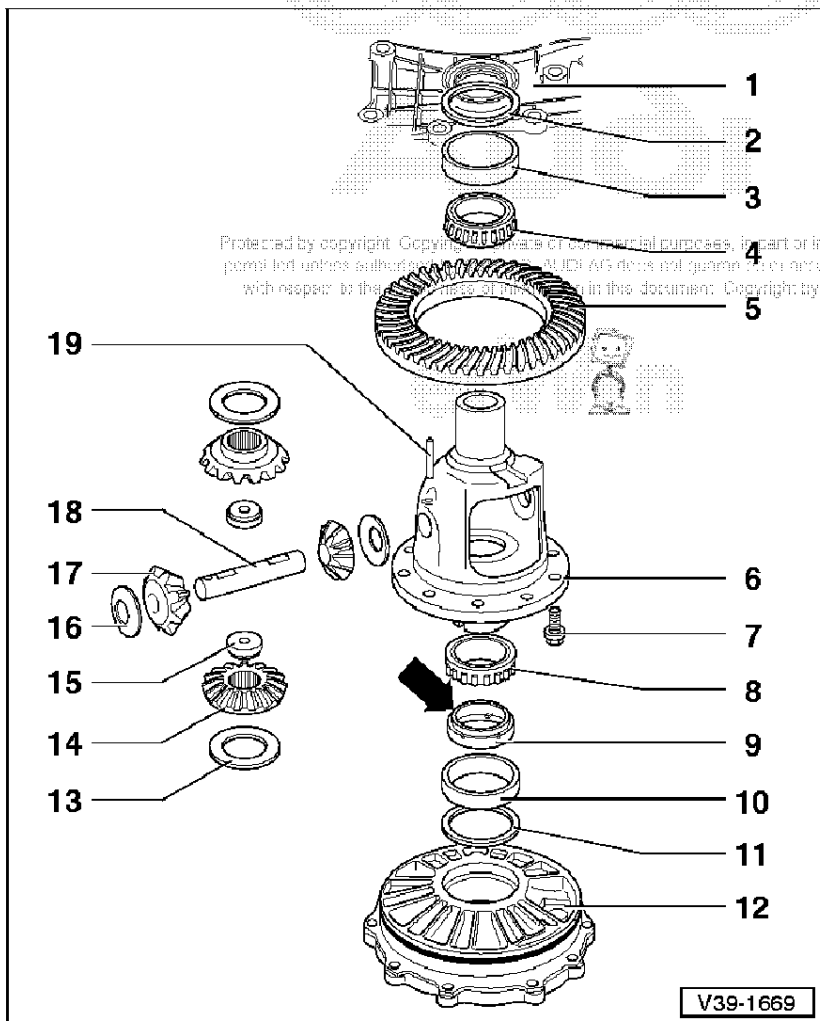
- ◆ Always renew
- ◆ Use only genuine bolts

8 - Inner race for large taper roller bearing ¹⁾

- ◆ Pulling off => Fig. 2
- ◆ Pressing on => Fig. 4
- ◆ Low friction bearing; do not oil when measuring frictional torque

9 - Drive wheel

- ◆ For speedometer sender
- ◆ Removing and installing => Page 39-3
- ◆ Fit the drive wheel carefully onto the differential, making sure that it is kept straight. Do not use force; the drive wheel can break easily
- ◆ Installation position: shoulder - arrow- towards differential



10 - Outer race for large taper roller bearing ¹⁾

- ◆ Driving out => Fig. 11
- ◆ Driving in => Fig. 12

11 - Shim "S1"

- ◆ Note thickness
- ◆ Adjustment overview => Page 39-34

12 - Cover for final drive ¹⁾

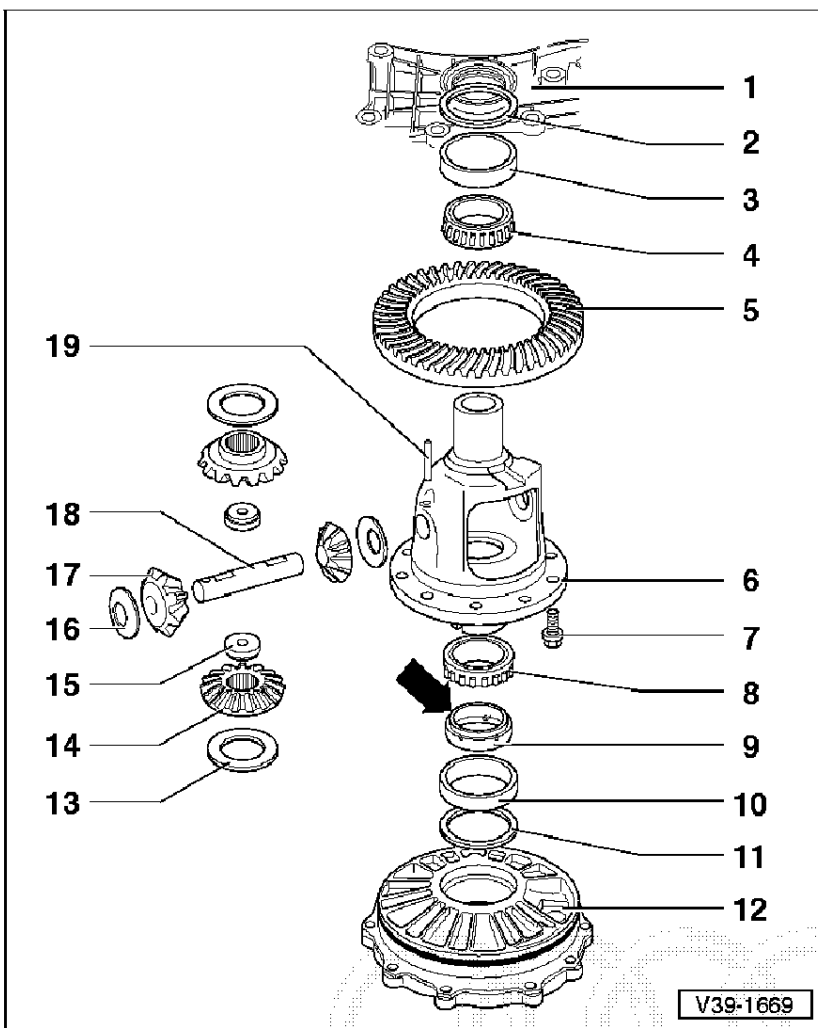
- ◆ With O-ring
- ◆ Renew O-ring
- ◆ Oil O-ring before installing

13 - Shims

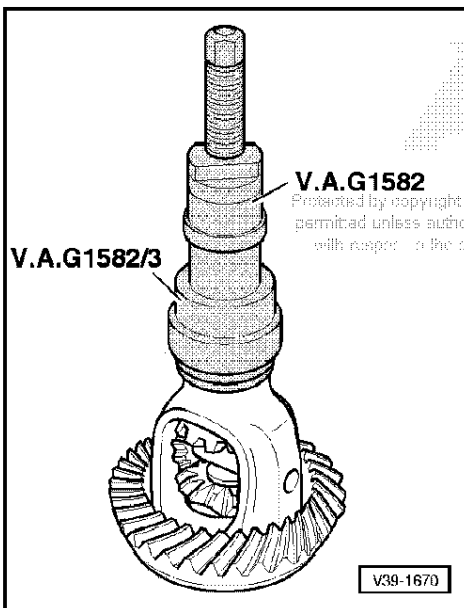
- ◆ Re-determining thickness => Fig. 8

14 - Sun wheels

- ◆ Adjusting => Fig. 8

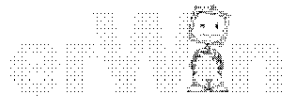


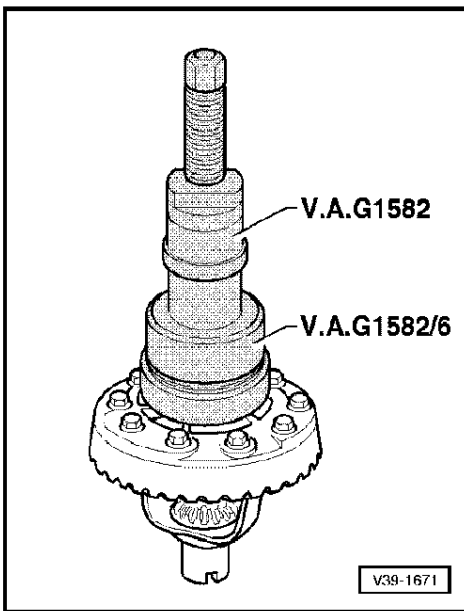
- 15 – Threaded piece
- 16 – Thrust washer
◆ Check for cracks and chipping
- 17 – Planet wheels
◆ Installing => Fig. 7
- 18 – Shaft for planet wheels
◆ Drive out with drift after removing spring pin
◆ Before driving in, align thrust washers
- 19 – Spring pin
◆ Drive in flush



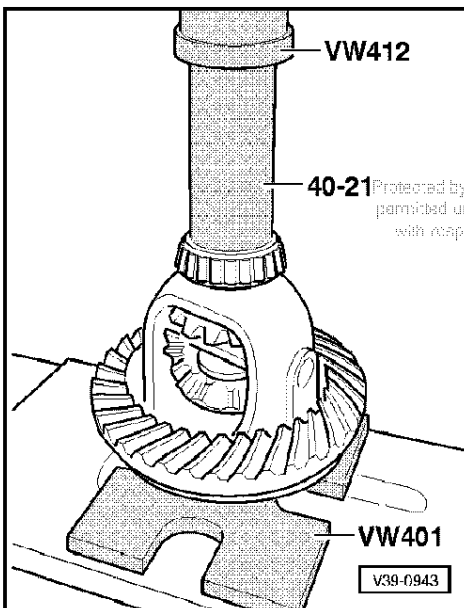
◀ **Fig.1 Pulling inner race for small taper roller bearing out of housing**
 – Fit thrust plate 40-105 before fitting puller.

V.A.G1582
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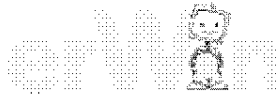


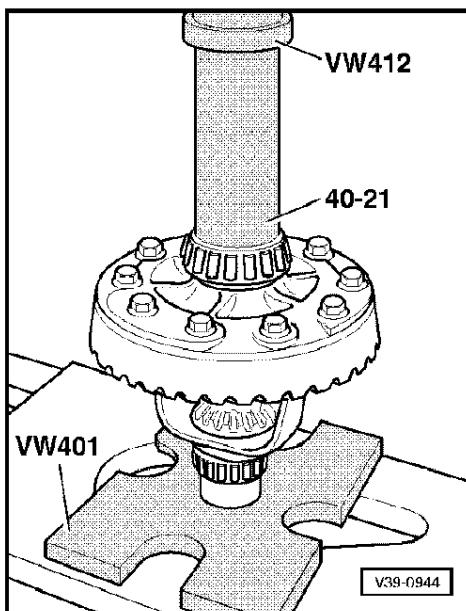
◀ **Fig.2 Pulling inner race for large taper roller bearing off housing**
 – Fit thrust plate 40-105 before fitting puller.



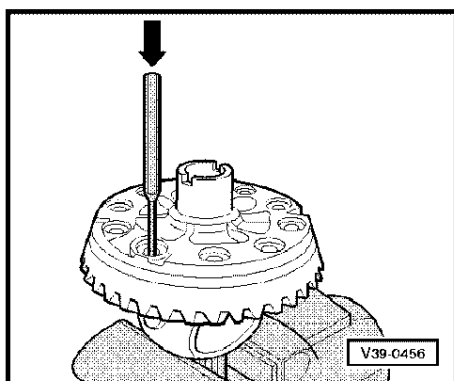
◀ **Fig.3 Pressing on inner race for small taper roller bearing**
 – Heat bearing to approx. 100 °C, fit in position and press home.

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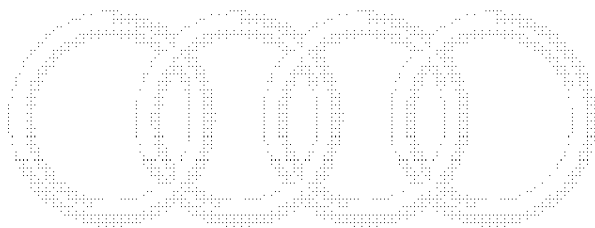




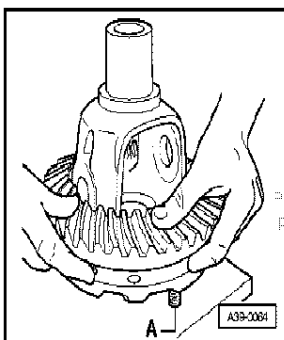
◀ Fig.4 Pressing on inner race for large taper roller bearing
 – Heat bearing to approx. 100 °C, fit in position and press home.



◀ Fig.5 Driving crown wheel off housing



39-23



◀ Fig.6 Installing crown wheel
 – Use 2 centring pins -A- (local manufacture) as a guide.

Caution

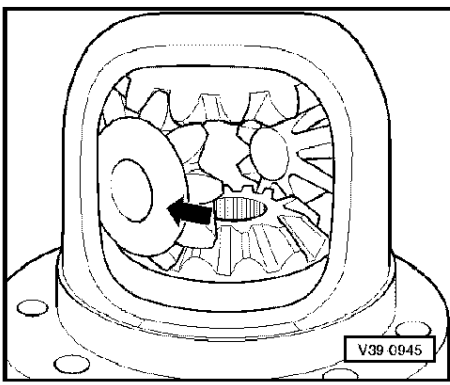
Wear protective gloves.

Heat crown wheel to approx. 100 °C and install.

Allow the crown wheel to cool off slightly before inserting the bolts. Then tighten to specified torque.



39-24



◀ **Fig.7 Installing planet wheels and sun wheels**

- Carefully lever out drive wheel for speedometer sender with a screwdriver.
- Insert thrust washers for planet wheels with a small amount of grease.
- Insert sun wheels with selected shims => Fig. 8.
- Insert planet wheels spaced 180° apart and rotate into place - arrow-.
- Insert threaded pieces.
 - Installation position: stepped shoulder towards sun wheels
- Locate thrust washers and planet wheels so that they align with the holes.
- Drive in shaft for planet wheels into final position and secure.



39-25

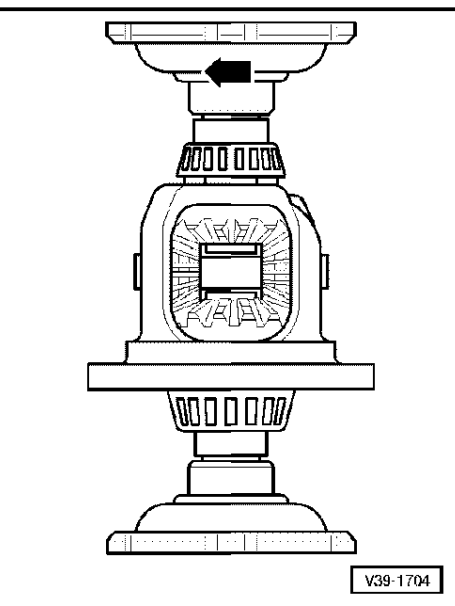
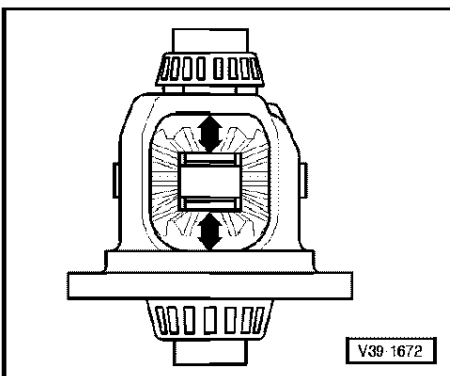
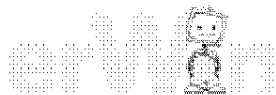
◀ **Fig.8 Adjusting planet wheels and sun wheels**

- Insert sun wheels with thinnest shims (0.5 mm).
- Insert planet wheels with thrust washers and press in shaft.

Note:

Do not now interchange bevel gears and thrust washers!

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- Press planet wheels outwards and check play of sun wheels by hand -arrows-.
- Adjust play by inserting an appropriate shim => Page 39-27.
 - Specification: max. 0.10 mm

◀ **Note:**

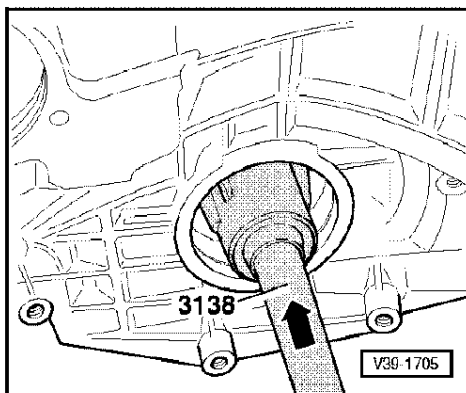
The adjustment is also correct if no further play is perceptible, although it is still possible to rotate the differential bevel gears - arrow-.

- Determine shim from table. Part numbers

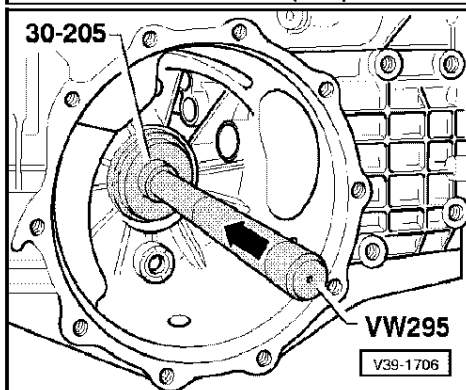
= > Parts catalogue

The following shims are available:

Shim thickness (mm)		
0.50	0.70	0.90
0.60	0.80	1.00

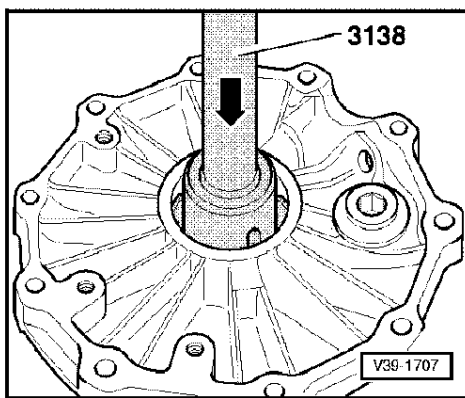


◀ Fig.9 Driving outer race for small taper roller bearing out of gear-box housing



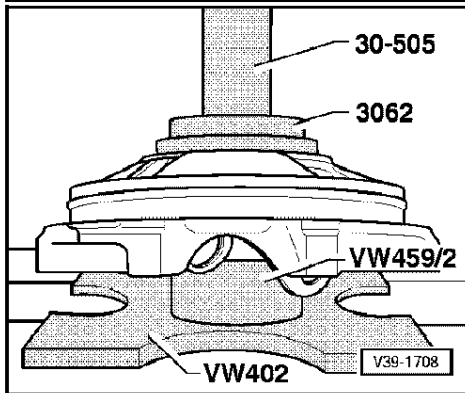
◀ Fig.10 Driving outer race for small taper roller bearing into gear-box housing

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◀ Fig.11 Driving outer race for large taper roller bearing out of cover

– Use suitable base, e.g. VW 470 with recess towards cover.



◀ Fig.12 Driving outer race for large taper roller bearing into cover

Adjusting drive pinion and crown wheel

General notes:

- ◆ Careful adjustment of the drive pinion and crown wheel is important for the service life and smooth running of the final drive. For this reason, the drive pinion and crown wheel are matched together during manufacture, and checked to ensure a good mesh pattern and quiet running in both directions of rotation. The position of quietest running is found by moving the drive pinion in an axial direction and at the same time lifting the crown wheel out of the zero-play mesh position by the amount necessary to maintain the backlash within the specified tolerance.
- ◆ The object of the adjustment is to reproduce the setting for quietest possible running, as obtained on the test machine in production.
- ◆ The deviation (tolerance) "r", which is related to the master gauge "Ro", is measured for the final drive sets supplied as replacement parts and marked on the outer circumference of the crown wheel. The final drive set (drive pinion and crown wheel) may only be replaced together as a matched pair.
- ◆ Observe the general repair instructions for taper roller bearings and shims.
- ◆ The frictional torque measurement is only used as a final check to make sure that the adjustment is correct.

Adjusting and marking of gear sets

1 - Identification "0937" signifies Oerlikon gear set with a ratio of 37:9.

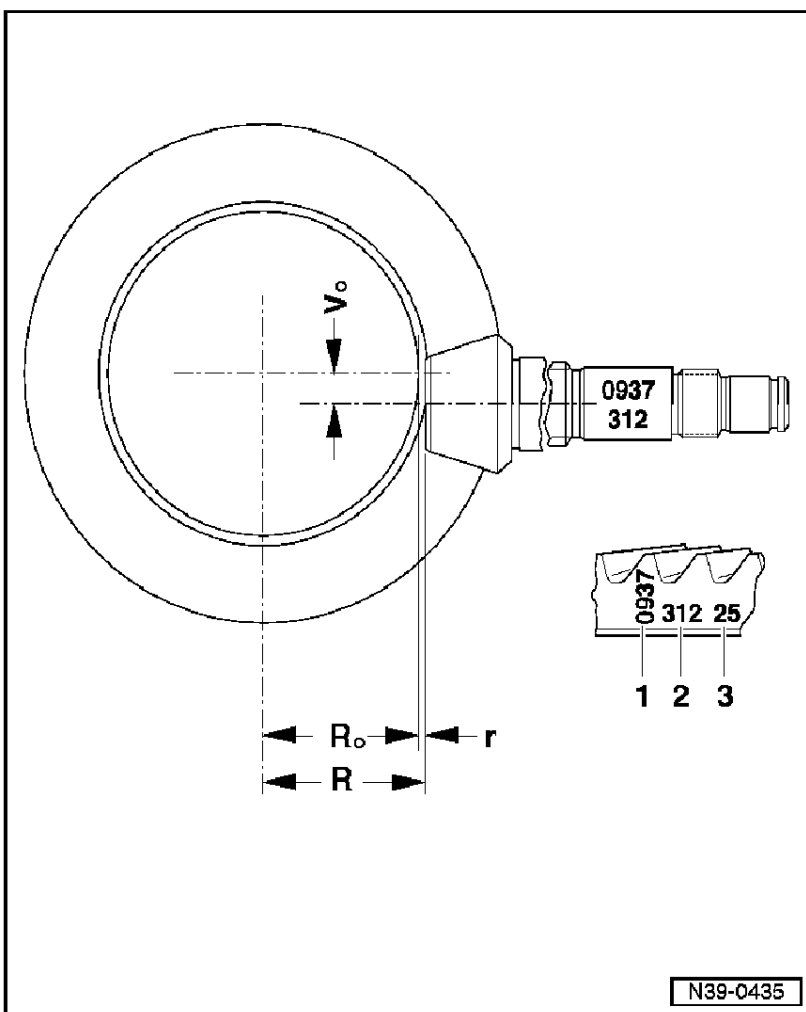
2 - Pairing number (312) of final drive set.

3 - Deviation (tolerance) "r" is based on the test machine master gauge used in the production. The deviation "r" is always given in 1/100 mm. Example: "25" signifies

$$r = 0.25 \text{ mm}$$

- R_0 - Length of master gauge used on test machine

$$R_0 = 59.65 \text{ mm}$$

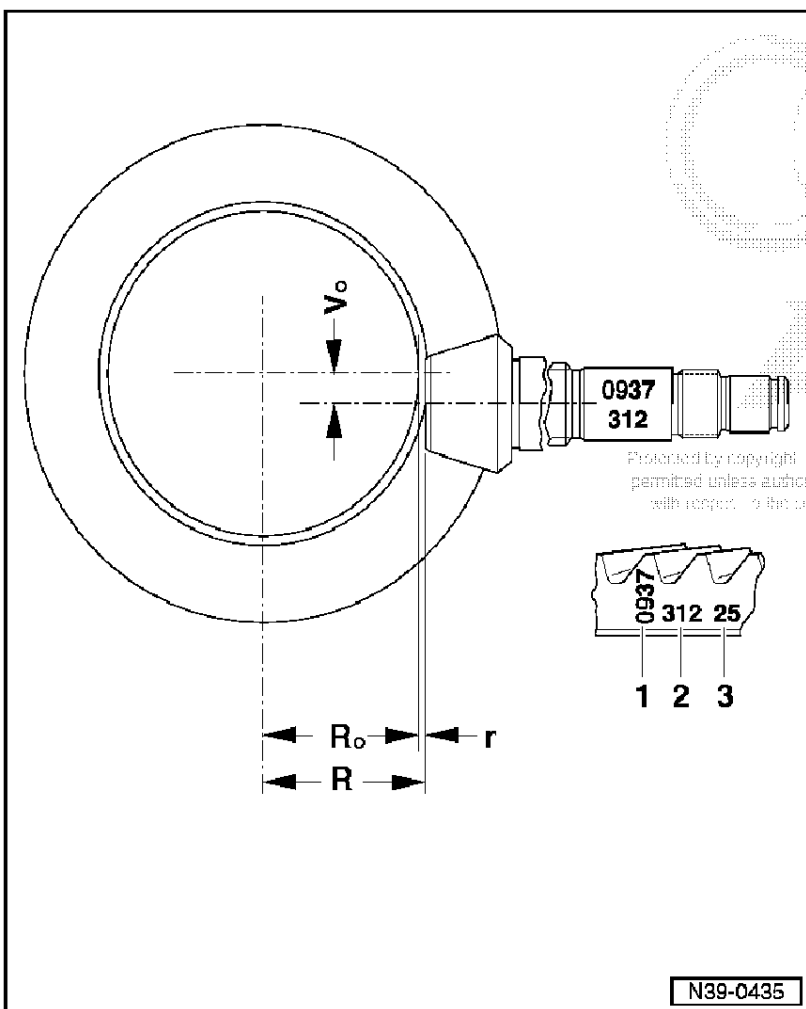


39-31

- R - Actual distance between crown wheel axis and face of drive pinion at point with quietest running for this gear set

$$R = R_0 + r$$

- V_o - Hypoid offset



39-32

Recommended sequence for readjusting final drive set

The following sequence of work is recommended to save time when the drive pinion and crown wheel have to be adjusted:

- 1.) Determine total shim thickness "Stotal" for "S1" + "S2" (sets preload for taper roller bearings for differential) => from Page 39-47.
- 2.) Determine total shim thickness "Stotal" for "S3" + "S4" (sets preload for taper roller bearings for drive pinion) => from Page 39-36.
- 3.) Distribute total shim thickness "Stotal" for "S3" + "S4" so that the distance from centre of crown wheel to face of drive pinion is the same as distance "R" which was determined during production => from Page 39-42.
- 4.) Distribute total shim thickness "Stotal" for "S1" + "S2" so that the specified backlash between crown wheel and drive pinion is maintained => from Page 39-54.

Note:

Overview of components and shims => Page 39-35.

Adjustment overview

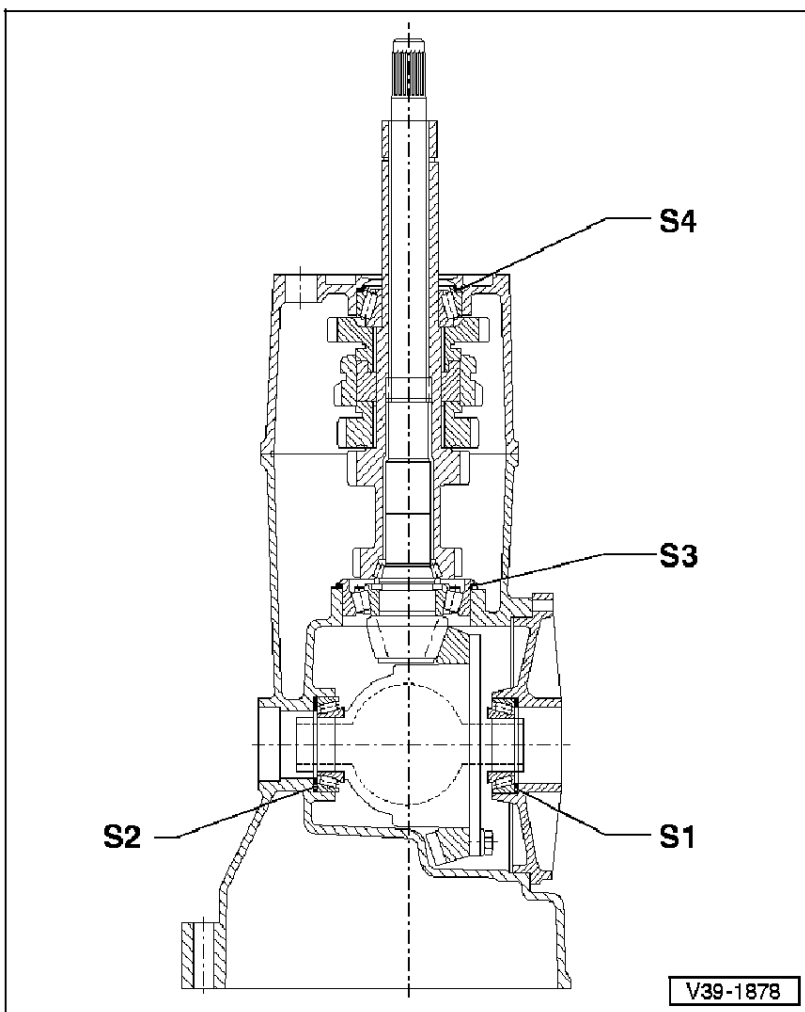
Note:

If repairs have been carried out to the gearbox, it is only necessary to adjust the drive pinion, crown wheel or final drive set if components have been renewed which have a direct effect on the adjustment of the final drive. Refer to the following table to avoid unnecessary adjustments:

Parts renewed: ▼	to be adjusted:			
	Crown wheel "S1" + "S2" ¹⁾ => Page 39-47	Drive pinion "S3" + "S4" ¹⁾ via deviation "r" => Page 39-36	Drive pinion "S4" ¹⁾ => Page 34-109	Backlash Check => Page 39-52
Gearbox housing	X	X		X
Bearing plate			X	X
Differential housing	X			X
Taper roller bearing for drive pinion		X		X
Taper roller bearing for differential	X			X
Final drive set ²⁾	X	X		X
Hollow shaft			X	X
Cover for differential	X			X

¹⁾ Shims; installation position => Page 39-35.

²⁾ Drive pinion and crown wheel; only renew together.



Position of shims

Note:

Adjustment overview when renewing individual components of gearbox => Page 39-34.

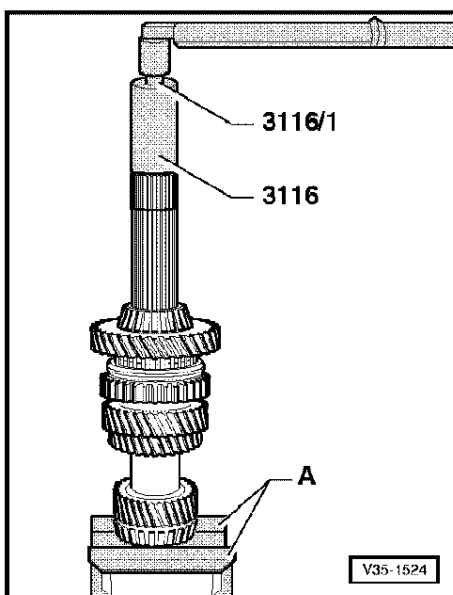
- S1 - Adjustment shim for crown wheel in cover for differential
- S2 - Adjustment shim for crown wheel in gearbox housing
- S3 - Adjustment shim for drive pinion in gearbox housing
- S4 - Adjustment shim for drive pinion in bearing plate

Adjusting drive pinion

(Adjusting drive pinion and hollow shaft)

Repairs after which the drive pinion must be adjusted => table on Page 39-34.

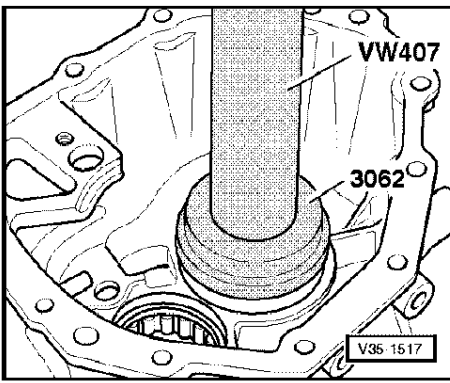
Determining total shim thickness "Stotal" for shims "S3" + "S4"
(Setting preload of taper roller bearing for drive pinion with hollow shaft)



● Differential removed

- Clamp drive pinion in a vice using clamps -A-
- Insert taper rollers with grease, assemble drive pinion and hollow shaft.
- Turn hollow shaft against drive pinion five turns in both directions so that the taper roller bearings settle.
- Preload drive pinion/hollow shaft to 10 Nm, hold hollow shaft when doing this.

Insert outer race for taper roller bearing for drive pinion into gearbox housing without shims => Fig. 2, Page 35-22 and Fig. 3, Page 35-23.

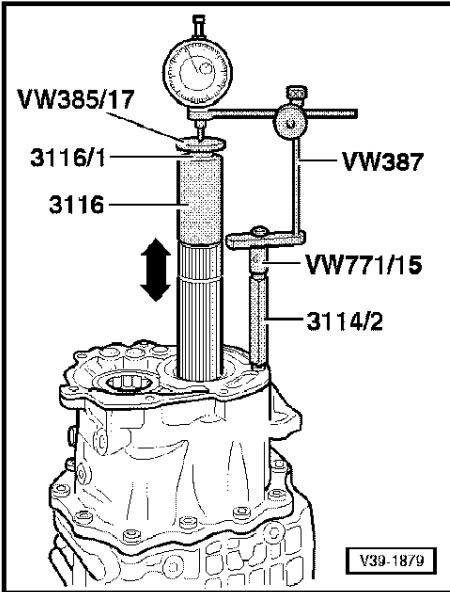


- ◀ – Insert outer race for taper roller bearing for drive pinion with shim "S4*" (1.0 mm thick) into bearing plate.

Note:

For measurement purposes a shim "S4" of 1.0 mm is initially inserted which is designated "S4" After determining measurement "e" "S4*" will be replaced by the correct shim "S4".*

- Insert completely assembled drive pinion in gearbox housing.



- Fit bearing plate with dowel sleeves and tighten to 25 Nm.
- ◀ – Turn drive pinion with hollow shaft five turns in both directions so that the taper roller bearings settle.
- Assemble measuring equipment, use a 30 mm dial gauge extension.
- Set dial gauge (3 mm measuring range) to "0" with 2 mm preload.

Note:

The tip of the dial gauge must be positioned on centre of drive pinion.

- Lift drive pinion, without turning, and read off play on dial gauge.

– Measurement in example: 0.90 mm

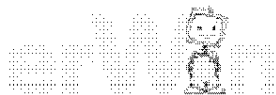
Note:

If the measurement has to be repeated, the drive pinion with hollow shaft must be turned 5 turns in each direction to settle the taper roller bearings. Set dial gauge again to "0" with 2 mm preload.

Formula:		
"Stotal"	=	"S4*" + measurement + bearing preload

Example:		
Inserted shim "S4*"		1.00 mm
+ Measured value (example)		0.90 mm
+ Bearing preload (constant)		0.15 mm
= Total shim thickness "Stotal" for "S3" + "S4"		2.05 mm

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Determining thickness of shim "S3"

Formula:	
"S3" =	"Stotal" - "S4"

Example:

Total shim thickness "Stotal" for "S3" + "S4"	2.05 mm
- Inserted shim "S4"	1.00 mm
= Thickness of shim "S3"	1.05 mm

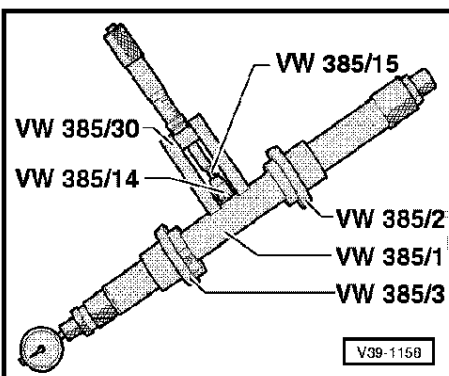
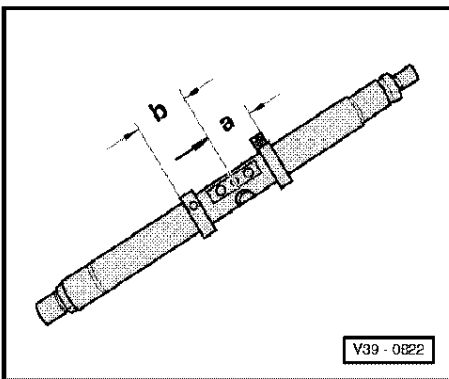
- Remove outer race for taper roller bearing, insert shim "S3" into gearbox housing and install outer race again => Fig. 2, Page 35-22 and Fig. 3, Page 35-23.
- Insert completely assembled drive pinion into gearbox housing again.
- Fit bearing plate with dowel sleeves and tighten securing bolts to 25 Nm.
- Turn drive pinion with hollow shaft five turns in both directions to settle the taper roller bearing.

Determining measurement "e"

Note:

- Measurement "e" is required to determine the final shim thickness of "S3" and "S4".

- Set adjustment rings of universal mandrel VW 385/1 to the following measurements:
 - Dimension a = 65 mm
 - Dimension b = 55 mm



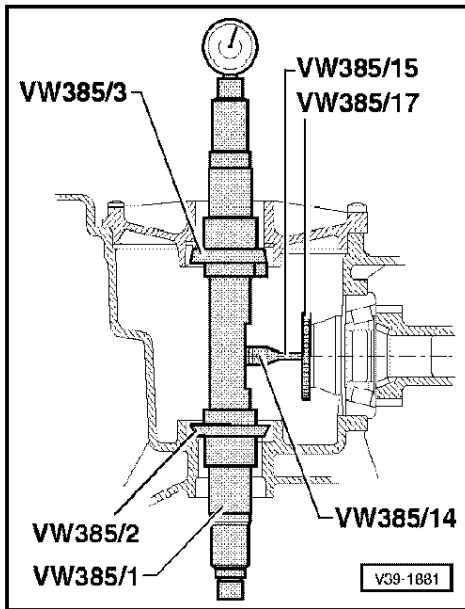
- Assemble universal mandrel VW 385/1 as illustrated:
 - Dial gauge extension VW 385/15, 9.3 mm long
 - Master gauge VW 385/30
- Set master gauge VW 385/30 to $R_o = 59.65$ mm and fit onto mandrel.
- Set dial gauge (3 mm measuring range) to "0" with 2 mm preload.

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Note:

The gauge VW 385/27 can also be used in place of the master gauge VW 385/30 ($R_o = 59.65 \text{ mm}$).



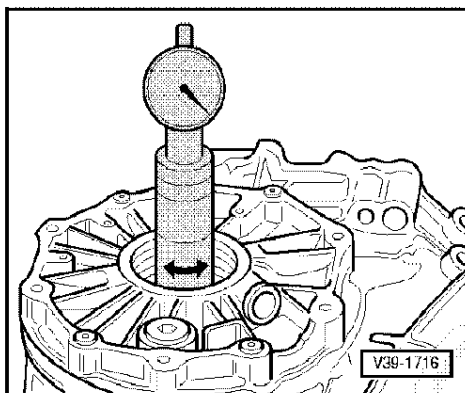
- ◀ Arrangement of measuring equipment when determining dimension "e"

- Place end measuring plate VW 385/17 onto drive pinion head.

Note:

Ensure plate contact surface fits exactly and is free of oil.

- Take master gauge off mandrel.
- Insert mandrel into gearbox housing.
 - The centring disc 385/3 faces towards cover for final drive
- Fit cover for final drive and tighten 4 bolts to 25 Nm.
- Using the adjustable ring, pull 2nd centring disc VW 385/2 out as far as possible so that the mandrel can still just be turned by hand.



- ◀ – Turn mandrel until the dial gauge plunger tip touches the end measuring plate on drive pinion head, then measure maximum deflection (return point).

- Measurement in following example: "e" = 0.16 mm (in red scale)

Determining thickness of shim "S3"

Formula:

$$\text{"S3"} = \text{"S3*"} + \text{"r"} + \text{"e"}$$

("e" in black scale)

or

$$\text{"S3"} = \text{"S3*"} + \text{"r"} - \text{"e"}$$

("e" in red scale)

Notes:

- ◆ The deviation "r" related to the master gauge "Ro" is measured for the final drive sets supplied as replacement parts and inscribed on outer circumference of crown wheel.
- ◆ If measurements are obtained on red scale then subtract value "e".
- ◆ If measurements are obtained on black scale then add value "e".

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Example:		
	Inserted shim "S3"	1.05 mm
	+ Deviation "r"	0.38 mm
-	Determined "e" (in red scale)	0.16 mm
	= Thickness of shim "S3"	1.27 mm

- Determine shim(s) from table. Part numbers
- = > Parts catalogue

The following shims are available for "S3"

Shim thickness (mm) ¹⁾		
0.45	0.60	0.75
0.50	0.65	
0.55	0.70	

¹⁾ Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

Determining thickness of shim "S4"

Formula:
"S4" = "Stotal" - "S3"

Example:		
	Total shim thickness "Stotal" for "S3" + "S4"	2.05 mm
-	Thickness of shim "S3"	1.27 mm
	= Thickness of shim "S4"	0.78 mm

- Determine shim(s) from table. Part numbers
- = > Parts catalogue

The following shims are available for "S4"

Shim thickness (mm) ¹⁾		
0.45	0.65	0.85
0.50	0.70	0.90
0.55	0.75	
0.60	0.80	

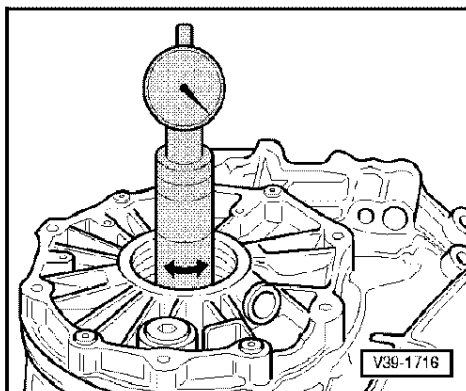
¹⁾ Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

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Performing check measurement

Checking dimension "r"



- Install drive pinion with determined shims "S3" and "S4" and turn 5 turns in both directions.
- Insert universal mandrel, => "determining measurement 'e'" on Page 39-40 and perform check measurement.
- Read off dial gauge anti-clockwise (red scale).
 - If the shims have been correctly selected, the deviation "r" (marked on outer circumference of crown wheel) must be shown – within a tolerance of ± 0.04 mm

Note:

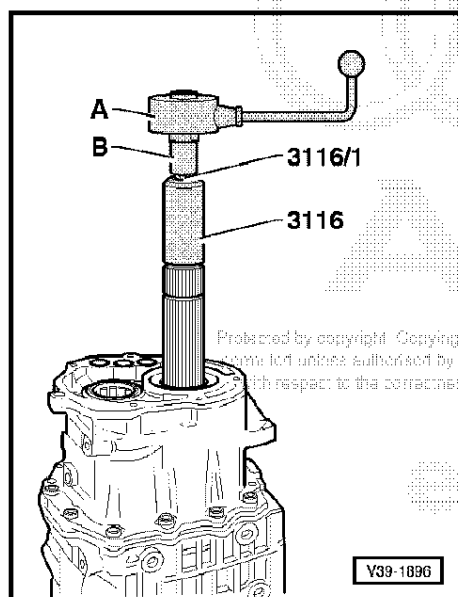
Then, (after removing universal mandrel) check again that the dial gauge, with master gauge VW 385/30 in place, indicates "0" with 2 mm preload, otherwise correct adjustments.

39-45

Measuring frictional torque (check)

Notes:

- ◆ Drive pinion/hollow shaft tapered roller bearings are low friction bearings. Therefore the frictional torque has only a limited use as a check. Correct adjustment is only possible by determining the total shim thickness "Stotal".
- ◆ Do not additionally oil new tapered roller bearing to perform the frictional torque measurement. These bearings have already been treated with a special oil by the manufacturer.



- Fit torque gauge 0 ... 600 Ncm -A- onto drive pinion.
- B - Socket
- Insert tensioning sleeve 3116.

Frictional torque specification:

New bearings	Used bearings
80 ... 150 Ncm	30 ... 60 Ncm

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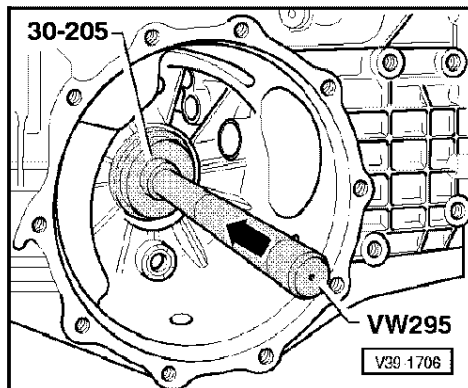
39-46

Adjusting crown wheel

(Adjusting differential)

Repairs after which the crown wheel must be adjusted => Page 39-34.

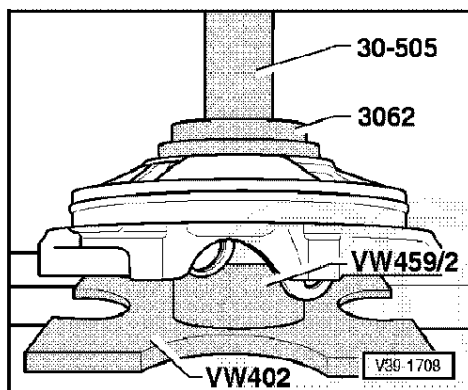
Determining total shim thickness "Stotal" for shims "S1" + "S2"
(Setting preload of taper roller bearing for differential)



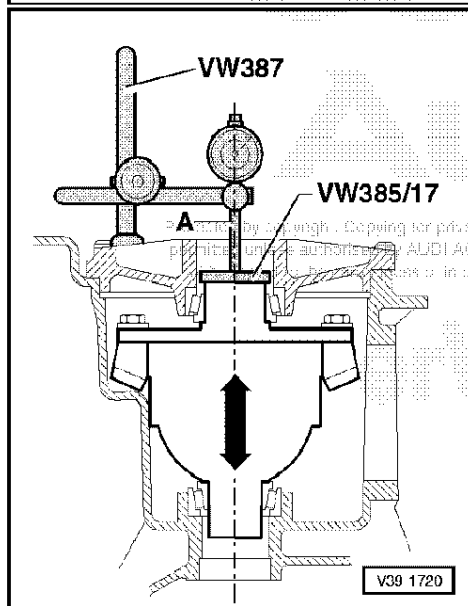
- Drive pinion removed
- Remove seal and outer races of both taper roller bearings for differential.
- ◀ - Remove shims => Page 39-15.
- Drive outer race for taper roller bearing with shim "S2" into gearbox housing. For measurement purposes an "S2*" shim 1.20 mm thick (2 shims of 0.60 mm) is used.

Note:

For measurement purposes a shim "S2" of 1.20 mm is initially inserted which is designated "S2*" in the following. After determining backlash, "S2*" will be replaced by the correct shim "S2".



- ◀ - Press outer race for taper roller bearing without shim "S1" into cover for differential.
- Insert differential without drive wheel for speedometer sender - G22 into gearbox housing. The crown wheel is positioned on the left-hand side (same side as cover for final drive).
- Install cover for differential with 4 bolts (25 Nm).
- Position gearbox so that the cover for differential faces up.



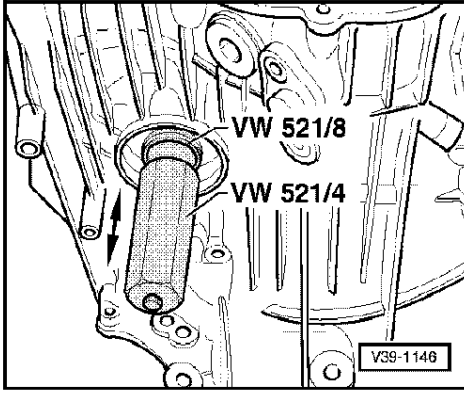
- Turn differential 5 turns in both directions so that the taper roller bearings settle.
- ◀ - Assemble measuring equipment, use a 30 mm dial gauge extension.
- Set dial gauge (3 mm measuring range) -A- to "0" with 2 mm preload.

Note:

The tip of the dial gauge must be positioned on centre of differential.

- Lift differential, without turning, and read off play on dial gauge.

● Measurement in following example: 0.62 mm.



Notes:

- ◆ Secure special tools VW 521/4 and VW 521/8 on right of differential (gearbox side) to lift differential.
- ◆ If the measurement has to be repeated, the drive pinion with hollow shaft must be turned 5 turns in each direction first to settle the taper roller bearings.

Formula:
"Stotal" = **"S2*"** + measurement + bearing preload

Example:	
Inserted shim(s) "S2*"	1.20 mm
+ Measured value	0.62 mm
+ Bearing preload (constant)	0.25 mm
= Total shim thickness "Stotal" for "S1" + "S2"	2.07 mm

Determining thickness of shim "S1*"

Notes:

- ◆ The preliminary adjustment shim "S1*" will be replaced with the final shim "S1" after determining the backlash.
- ◆ The total shim thickness "Stotal" remains unchanged.

Formula:
"S1*" = **"Stotal"** - **"S2*"**

Example:	
Total shim thickness "Stotal" for "S1" + "S2"	2.07 mm
- Inserted shim(s) "S2*"	1.20 mm
= Thickness of shim "S1*"	0.87 mm

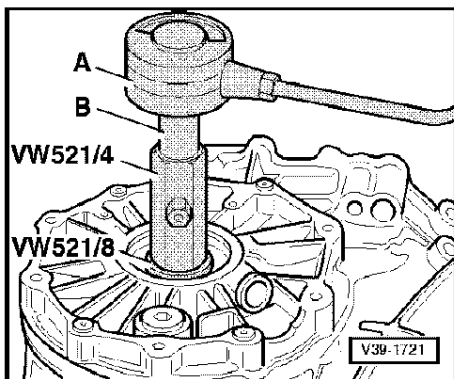
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Measuring frictional torque (check)

Notes:

- ◆ Differential tapered roller bearings are low friction bearings. Therefore the frictional torque only has a limited use as a check. Correct adjustment is only possible by determining the total shim thickness "Stotal".
- ◆ Do not additionally oil new taper roller bearings for frictional torque measurement. The bearings have already been treated with a special oil by the manufacturer.
- Drive pinion removed



- ◀ - Fit torque gauge 0 ... 600 Ncm -A- onto differential.
- _ B - Socket
- Read off frictional torque.

Frictional torque specifications:

New bearings	Used bearings
200 ... 350 Ncm	30 ... 50 Ncm

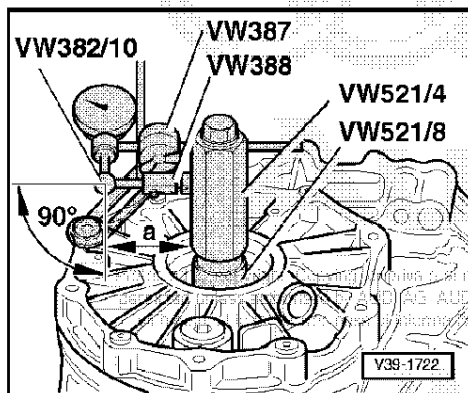
Note:

If the final drive set (drive pinion and crown wheel) is being adjusted, perform the adjustment of the drive pinion now and check the adjustment => Page 39-36.

Measuring backlash

(Position of crown wheel in gearbox housing)

- Drive pinion with shims "S3" and "S4" installed
- Install differential.
- Turn the differential 5 turns in each direction to settle the taper roller bearings.
- Secure dial gauge retainer VW 387 onto housing.
- Insert adjustment device VW 521/4 and VW 521/8 for crown wheel.
- Fit dial gauge with dial gauge extension VW 382/10 (6 mm flat).



Set measuring lever VW 388 to dimension a = 79 mm.

- Determine play between the teeth flanks as follows:
 - Turn crown wheel until it makes contact with a tooth flank (end of backlash travel).
 - Set dial gauge to "0" with 2 mm preload.
 - Turn crown wheel back until lying against an opposite tooth flank (backlash).

- Read off backlash and note value.
- Turn crown wheel through 90° and repeat measurements a further 3 times.

Note:

If the individual measurements differ by more than 0.06 mm from each other, the installation of the crown wheel or the final drive set itself is not correct. Check installation, replace final drive set if necessary.

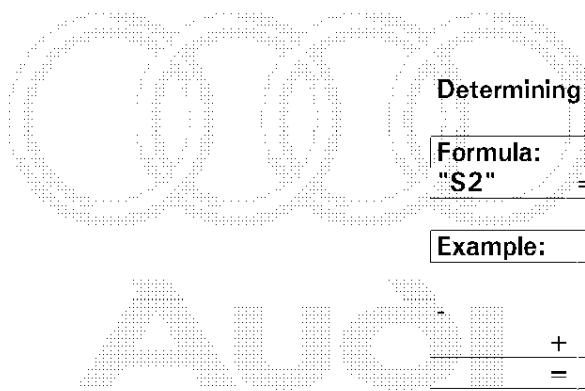
Determining average backlash

- Add the four measured values together and divide by four.

Example:

1st measurement	0.49 mm
+ 2nd measurement	0.48 mm
+ 3rd measurement	0.50 mm
+ 4th measurement	0.49 mm
= Sum of measured values	1.96 mm

- Result: The average backlash is 1.96 / 4 = 0.49 mm



Determining thickness of shim "S2"

Formula:

$$"S2" = "S2*" - \text{backlash} + \text{lift}$$

Example:

Inserted shim "S2*"	1.20 mm
- Average backlash	0.49 mm
+ Lift (constant)	0.15 mm
= Thickness of shim "S2"	0.86 mm

- Determine shim(s) from table. Part numbers

= > **Parts catalogue**

The following shims are available for "S2"

Shim thickness (mm) ¹⁾		
0.45	0.65	0.85
0.50	0.70	0.90
0.55	0.75	
0.60	0.80	

¹⁾ Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

Determining thickness of shim "S1"

Formula:

$$\text{"S1"} = \text{"Stotal"} - \text{"S2"}$$

Example:

	Total shim thickness "Stotal" for "S1" + "S2"	2.07 mm
-	Thickness of shim "S2"	0.86 mm
=	Thickness of shim "S1"	1.21 mm

- Determine shim(s) from table. Part numbers

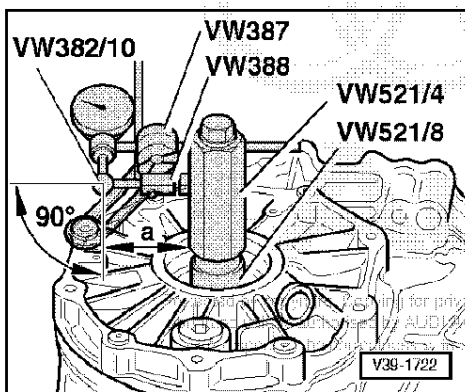
= > Parts catalogue

The following shims are available for "S1"

Shim thickness (mm) ¹⁾		
0.45	0.65	0.85
0.50	0.70	0.90
0.55	0.75	
0.60	0.80	

¹⁾ Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

39-55



Performing check measurement

- After installing shims "S1" and "S2", turn differential 5 turns in both directions so that the taper roller bearings settle.
- Measure backlash four times on circumference.
 - Specifications: 0.12 ... 0.22 mm

Notes:

- ◆ If the backlash lies outside the tolerances, the adjustments must be repeated. But the total shim thickness "Stotal" must remain the same.
- ◆ The individual measurements must not differ by more than 0.06 mm from each other.

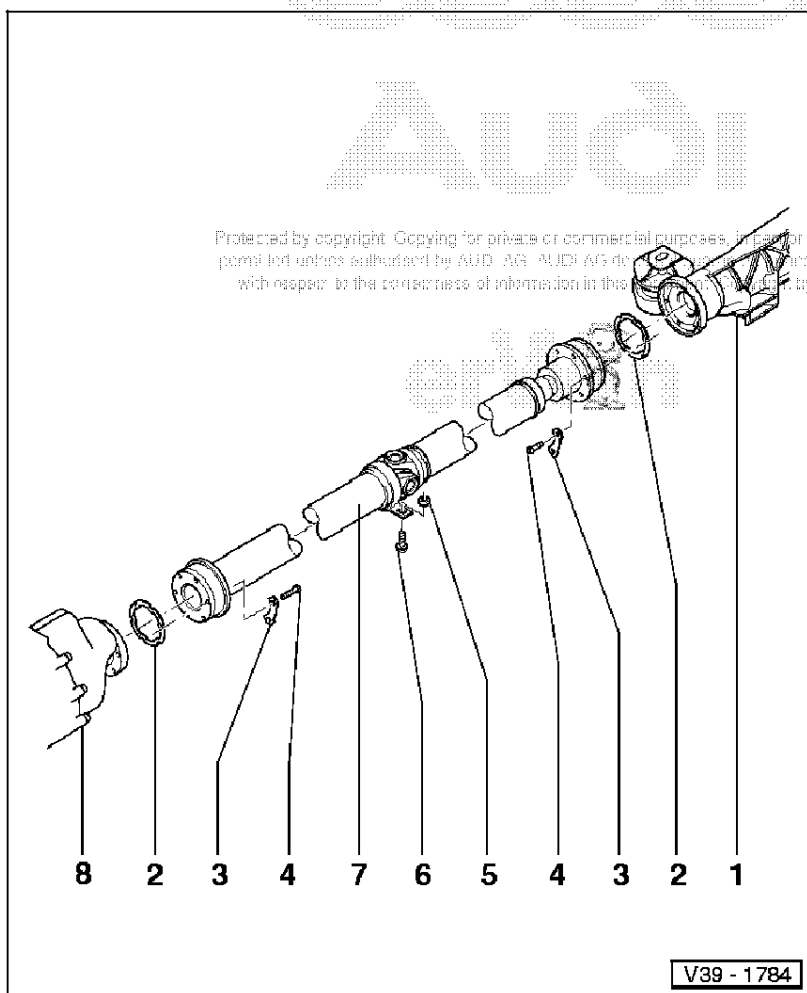
39-56

Servicing propshaft

Notes:

- ◆ Do not bend the propshaft more than 25 ° at the central joint, otherwise the universal joint will be damaged.
- ◆ Only store and transport propshaft in extended position.
- ◆ Observe General instructions =>Page 00-14.
- ◆ No repair work can be carried out on the propshaft with the exception of removing, installing and adjusting.
- ◆ If the propshaft is only detached at the gearbox or from rear final drive then the propshaft is to be tied-up or supported at the constant velocity joint.
- ◆ Work on the propshaft should be carried out on a vehicle hoist.
- ◆ If complaints are received (noises, vibrations), it is essential to check whether correct adjustment of the propshaft rectifies the fault before replacing the propshaft.

39-57



1 - Rear final drive

2 - Gasket

- ◆ Renew
- ◆ Pull off backing foil, and stick self-adhesive side of gasket to flange shaft.
- ◆ Remove grease from flange shaft

3 - Packing plate

4 - Bolts - 55 Nm

- ◆ Self-locking
- ◆ Renew

5 - Shims

- ◆ Adjusting propshaft => Page 39-65

6 - Bolt - 20 Nm

7 - Propshaft

- ◆ Adjusting => Page 39-65

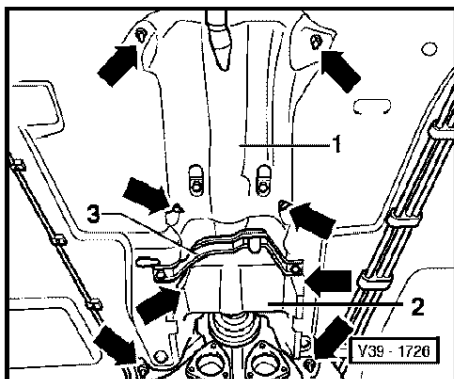
8 - Gearbox

39-58

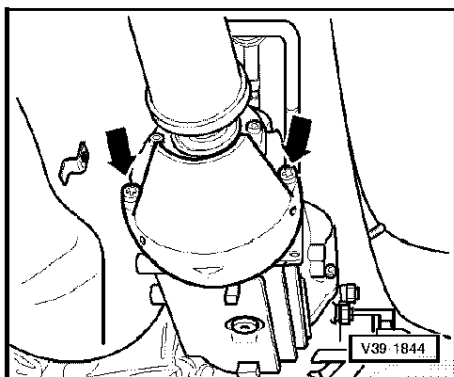
Removing and installing propshaft

Removing

- Observe notes => Page 39-57.
- Remove parts of exhaust system behind catalytic converters
=> Avant RS2; Repair group 26; Removing and installing parts of exhaust system =>
- Remove head shields -1- and -2- -arrows-.
- Unbolt cross member -3- below propshaft.



- Remove heat shield for propshaft from cover for Torsen differential -arrows-.



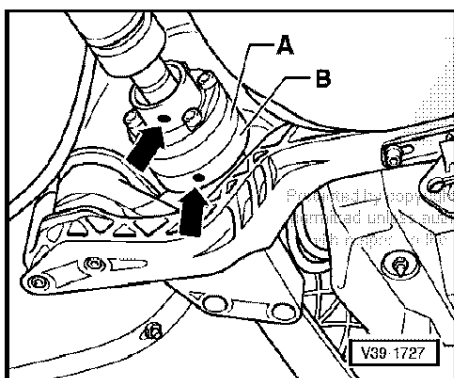
39-59

- Check whether there is a factory marking (paint spots -arrows-) on the propshaft flange and the flange on the rear final drive. If not, mark the position of the propshaft flange -A- in relation to the rear final drive -arrow B- with paint.

Note:

Only mark if the same propshaft is to be reinstalled.

- Slacken securing bolts on both propshaft flanges.

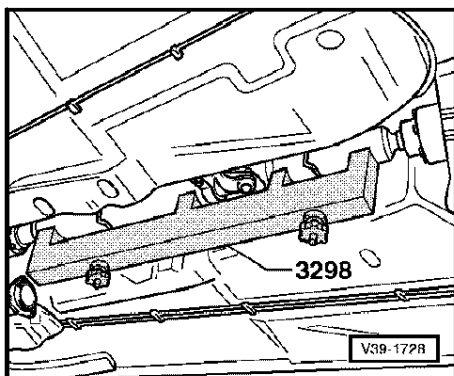


- Attach assembly tool 3298 and tighten plastic nuts.

Note:

Never fit assembly tool onto balance plates.

- Loosen bolts securing centre propshaft mounting to body.
- Remove securing bolts and shims from centre mounting.
- Slide propshaft together towards rear final drive. The constant velocity joints move along their axes.



39-60

– Guide out propshaft with assembly tool past rear final drive.

Note:

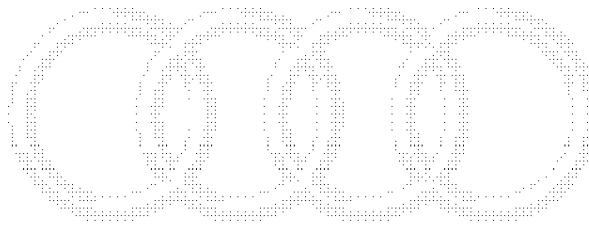
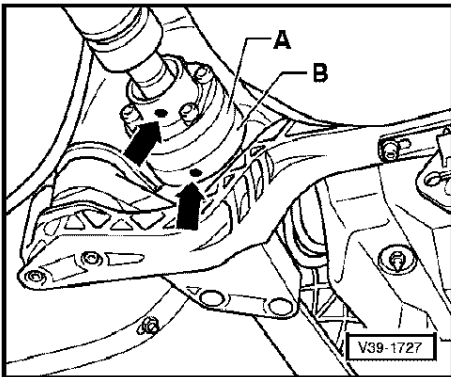
Only transport and store propshaft in extended position.

Installing

Installation is carried out in the reverse order, when doing this note the following points:

Notes:

- ◆ To prevent imbalance, the flanges on the propshaft -A- and on the rear final drive -B- must be installed so that the factory markings (or the markings made on removal) are in alignment - arrows-.
- ◆ If a new propshaft is being installed and the factory marking on the rear final drive flange is no longer visible, the radial run-out on the rear final drive flange must be measured => Page 39-63, and the paint marking on the propshaft must then be aligned with the new marking on the flange.
- ◆ Renew gaskets on flange shafts (pull off backing foil and stick gasket onto flange). The surface must be free of grease.



◆ After removing the propshaft, it is important to clean any remaining locking compound out of the threads in the flange shafts on the gearbox and rear final drive. If this is neglected, the new bolts can seize when they are screwed in and shear off later if they have to be removed.

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◆ The threaded holes can be cleaned with a thread tap.

◆ Renew propshaft bolts (self-locking).

– Adjust propshaft after installing => Page 39-65.

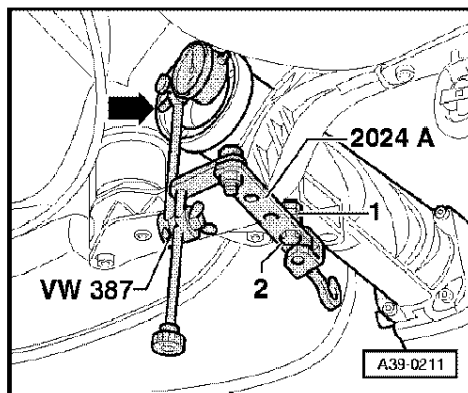
Tightening torques

Component	Nm
Propshaft to gearbox (output flange) M8	55
Propshaft to final drive (input flange) M8	55
Centre propshaft mounting to body	20
Propshaft heat shield to gearbox	25
Cross member to body	25
Catalytic converter to front exhaust pipe	25

Measuring radial run-out at flange shaft of rear final drive

Notes:

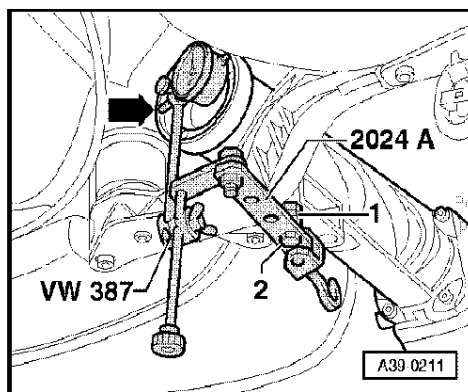
- ◆ The radial run-out must always be measured when the thrust tube is removed. Remove old paint marking and make new marking.
- ◆ If a new propshaft is being installed and the marking on the flange shaft of the rear final drive is no longer visible, the point of maximum radial run-out must be measured with a dial gauge and marked with paint.
- ◆ The paint marking on the propshaft is then brought into alignment with this paint marking = >Page 39-61.



- ◆ The radial run-out can be measured when rear final drive is installed but the propshaft must be disconnected at rear final drive. Observe notes = >Page 39-57.
 - Remove bolt on front left of rear final drive support.
 - Remove bar from lifting appliance 2024 A and secure it to the free hole with an M10 x 85 mm bolt -2-. Use approx. 5 M12 nuts -1- as spacers.
 - Secure dial gauge bracket VW 387 to the bar when it is secured in position.



39-63



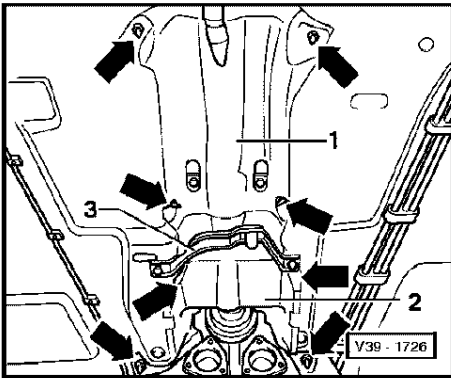
- ◆ - Apply dial gauge to ground surface on rim of flange -arrow- and set to "0" with a preload of 1 mm.
- Turn differential via both rear wheels (left and right flange shafts) until the flange on the rear final drive completes one rotation.

Make a paint marking at the point of greatest radial run-out on the outside of the flange (= greatest distance from axis of rotation).

- Remove old marks on flange.
- Install propshaft = >Page 39-61.

39-64

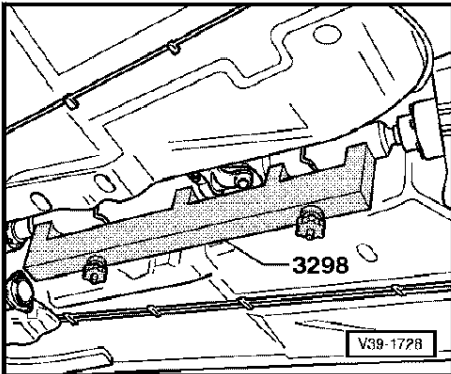
Adjusting propshaft



Adjustments should be carried out with care, because a badly adjusted propshaft is often the cause of vibration and droning.

- Remove parts of exhaust system behind catalytic converters
=> Avant RS2; Repair group 26; Removing and installing parts of exhaust system =>

- Remove heat shields -1- and -2- -arrows-.
- Unbolt cross member -3- below propshaft.

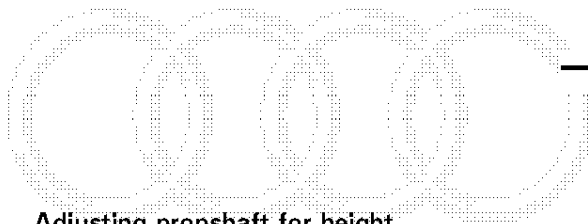


- Attach assembly tool 3298 and tighten plastic nuts.

Note:

Never fit assembly tool onto balance plates.

- Loosen bolts securing centre propshaft mounting to body.
- Remove securing bolts and shims from centre mounting.



39-65

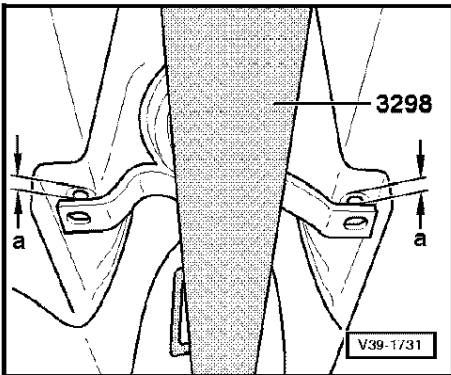
Adjusting propshaft for height

- Align centre propshaft mounting so that the dimension -a- on left-hand side is the same as dimension -a- on right-hand side.
- Measure dimension -a-.
- Select shim according to table. Part numbers

=> Parts catalogue

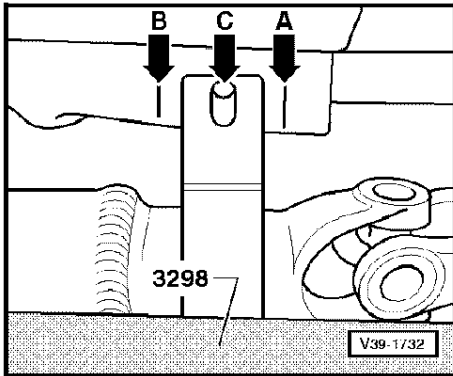
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The following shims are available:



Dimension -a- (mm)	Shim thickness (mm)
0 ... 3.0	-
3.1 ... 5.0	2
5.1 ... 7.0	4
7.1 ... 9.0	6
9.1 ... 11.0	8
11.1 ... 13.0	10

Aligning propshaft longitudinally



- ◀ – Slide propshaft with assembly tool towards the rear as far as it will go.
 - Mark position of centre mounting on body -arrow A-.
 - Slide propshaft with assembly tool forwards.
 - Mark position of centre mounting on body -arrow B-.
 - Align propshaft -arrow C-.
 - The centre mounting must be positioned centrally between the markings -A- and -B-.
 - Install securing bolts for propshaft centre mounting with previously selected shims and tighten bolts.
 - Remove assembly tool.
 - Align exhaust system free of stress
- = > Avant RS2; Repair group 26; Aligning exhaust system free of stress = >

39-67

Tightening torques

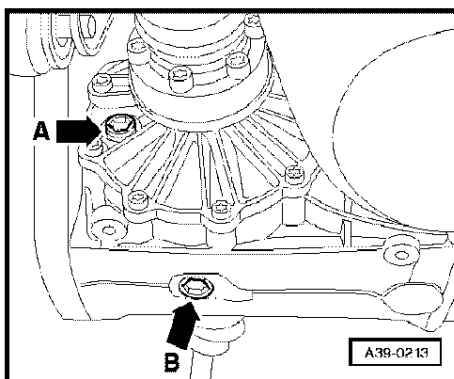
Component	Nm
Centre propshaft mounting to body	20
Cross member to body	25

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39-68

Checking oil level in rear final drive

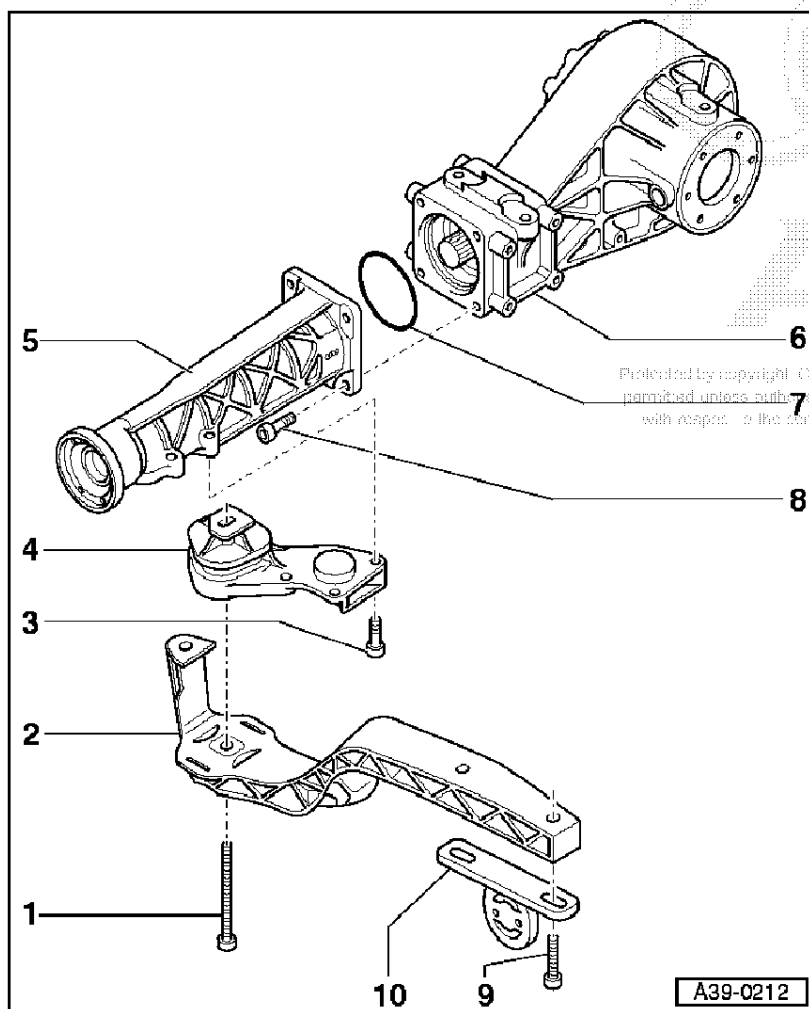


- ◀ - Remove oil filler plug -arrow A- to check gear oil.
 - Specification: oil level up to lower edge of filler hole
- Top-up gear oil if necessary. Specification => Page 00-7.
- Fit oil filler plug.

Tightening torque

Component	Nm
Oil filler plug	25

39-69



Removing and installing thrust tube

Assembly overview

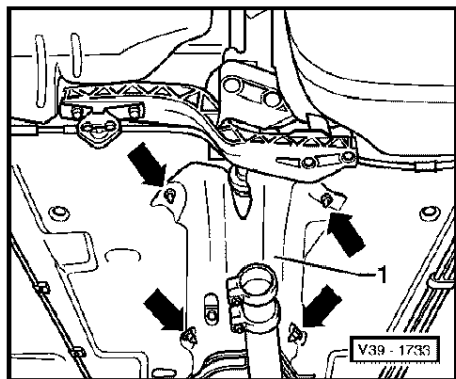
- 1 - Bolt - 40 Nm
- 2 - Front cross member
- 3 - Bolt - 40 Nm
- 4 - Final drive support
- 5 - Thrust tube
- 6 - Rear final drive housing
- 7 - O-ring
- 8 - Bolt - 35 Nm
- 9 - Bolt - 20 Nm
- 10 - Bracket
 - ◆ For exhaust system

39-70

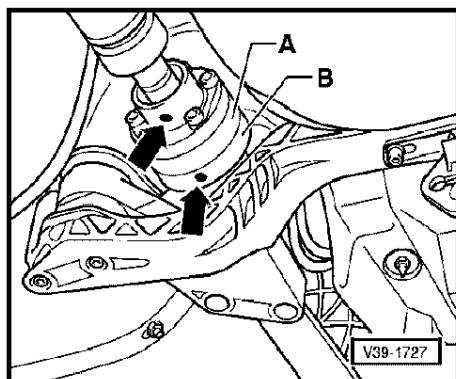
Removing and installing thrust tube

Removing

- Rear final drive installed

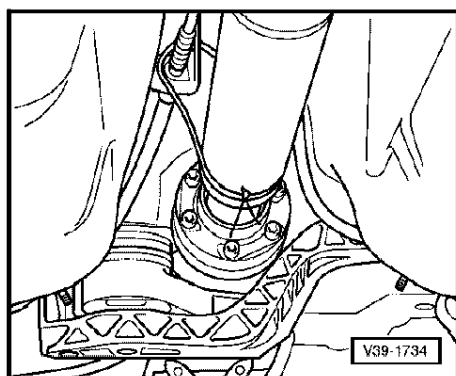


- Place oil tray underneath and drain off gear oil.
- Remove parts of exhaust system behind front exhaust pipe
- ◀ => Avant RS2; Repair group26; Removing and installing parts of exhaust system
- Remove heat shield -1- -arrows-.
- Remove heat shield next to rear final drive.



- ◀ - Check whether there is a factory marking (paint spot) on the propshaft. If not, mark the position of the propshaft flange -A- in relation to the rear final drive -arrow B- with paint.
- Unscrew bolts from propshaft flange.

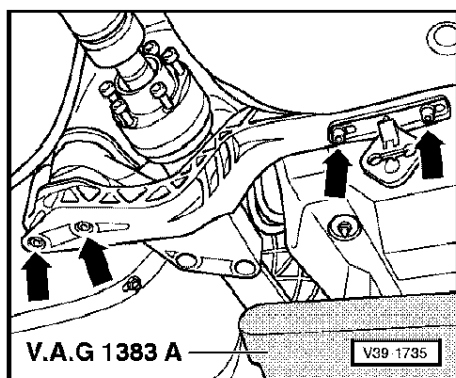
39-71



- ◀ - Secure propshaft to handbrake cable bracket with wire.

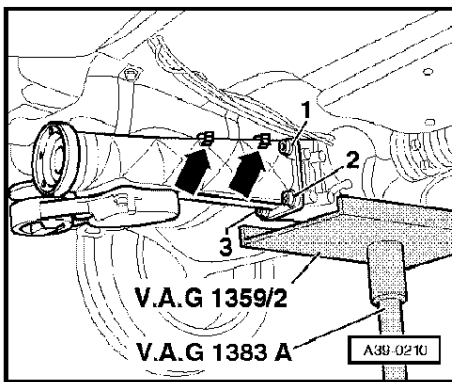
Note:

If it is not possible to push the propshaft up and off the flange, lower the final drive before tying up the propshaft. When lowering the final drive, prevent the propshaft from dropping down, and do not bend the centre joint further than the maximum angle permitted => Notes on Page 39-57.



- ◀ - Support final drive with gearbox jack V.A.G 1383 A.
- Unscrew bolts -arrows- on front cross member for rear final drive.
- Detach front cross member.

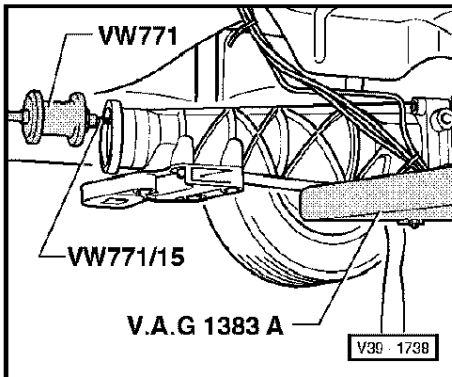
39-72



- ◀ – Unclip electrical wiring and hoses for differential lock actuator at clips -arrows-.
- Lower final drive about 10 cm.
- Remove 4 bolts for thrust tube -1 ... 3-.

Note:

Fourth bolt not shown in illustration.



- ◀ – Pull off flange shaft with thrust tube.

Installing

Installation is carried out in the reverse order, when doing this note the following:

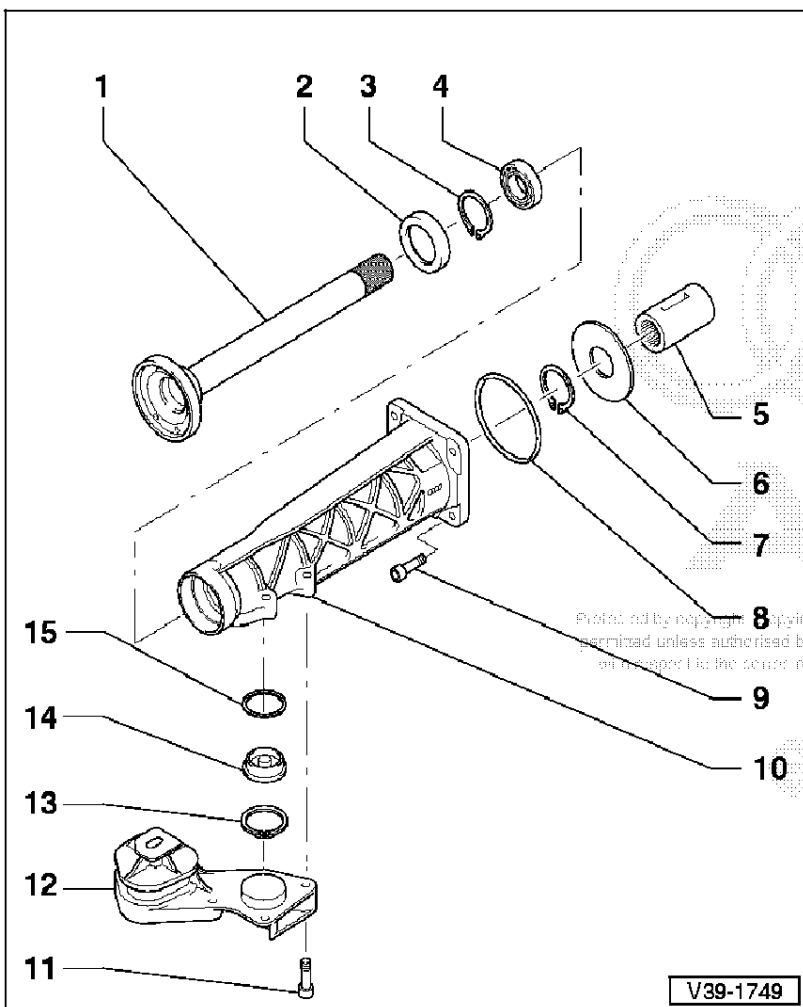
Notes:

- ◆ After removing the propshaft, it is important to clean any remaining locking compound out of the threads in the flange shafts on the gearbox and rear final drive. If this is neglected, the new bolts can seize when they are screwed in and shear off later if they have to be removed.
- ◆ The threaded holes can be cleaned with a thread tap.
- ◆ Renew gasket between propshaft and drive flange (pull off backing foil and stick gasket onto flange shaft). Surface must be free of grease.
- ◆ Renew propshaft bolts (self-locking).
 - If there is a factory marking on the propshaft, measure radial run-out at flange on final drive => Page 39-63 and bring marking on propshaft into alignment with new marking on flange.
 - Align exhaust system free of stress
 - => Avant RS2; Repair group 26; Aligning exhaust system free of stress =>

- Top up gear oil in rear final drive and check oil level => Page 39-69.

Tightening torques

Component	Nm
Thrust tube to rear final drive	35
Propshaft to final drive (input flange) M8	55
Front cross member for rear final drive to body M10	40
Front cross member for rear final drive with ex- haust bracket to body M8	20
Oil filler plug	25
Double clamp for exhaust pipe	40



Dismantling and assembling thrust tube – assembly overview

Note:

Removing and installing thrust tube
=> Page 39-70.

1 - Flange shaft

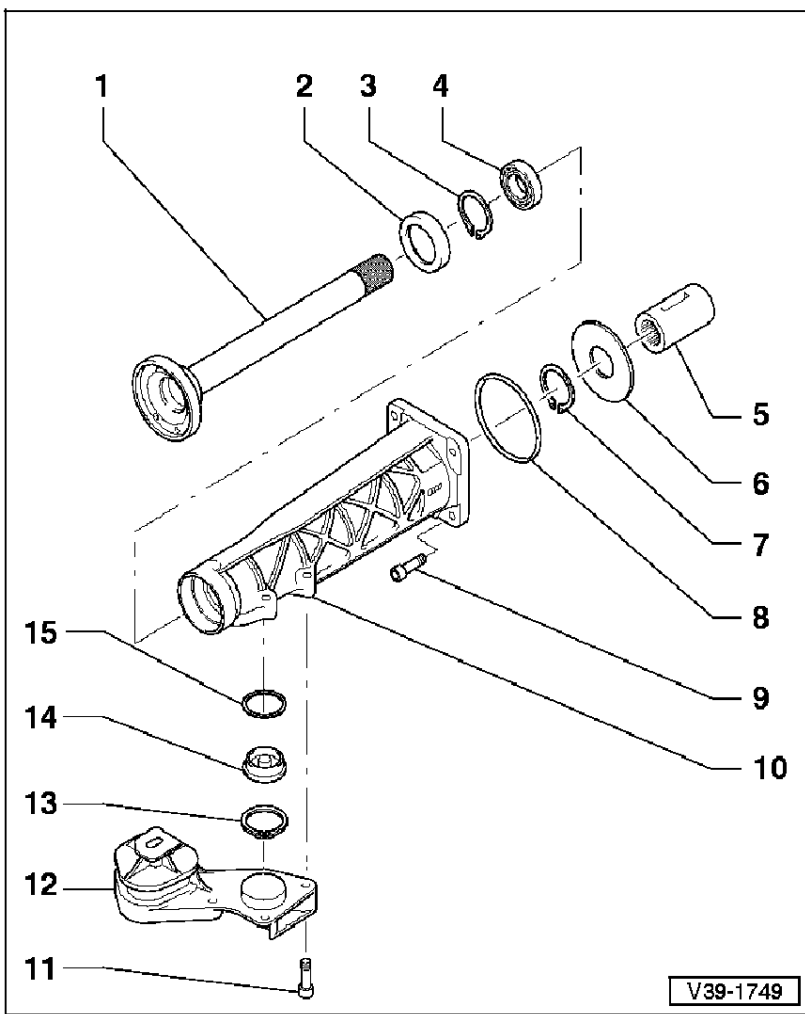
- ◆ Removing => Page 39-80
- ◆ When installing flange shaft, circlip -Item 7- must be inserted through opening in housing at the same time => Page 39-84

2 - Seal

- ◆ Prising off => Page 39-81
- ◆ Driving in => Page 39-83

3 - Circlip

- ◆ Removing => Page 39-81



4 - Grooved ball bearing for flange shaft

◆ Pulling out => Page 39-82

5 - Sleeve

◆ Pulling off => Page 39-79

◆ Pressing on => Page 39-84

6 - Baffle plate

◆ Only press out if damaged

◆ Installing => Page 39-82

7 - Circlip

◆ To remove flange shaft, open out circlip => Page 39-80

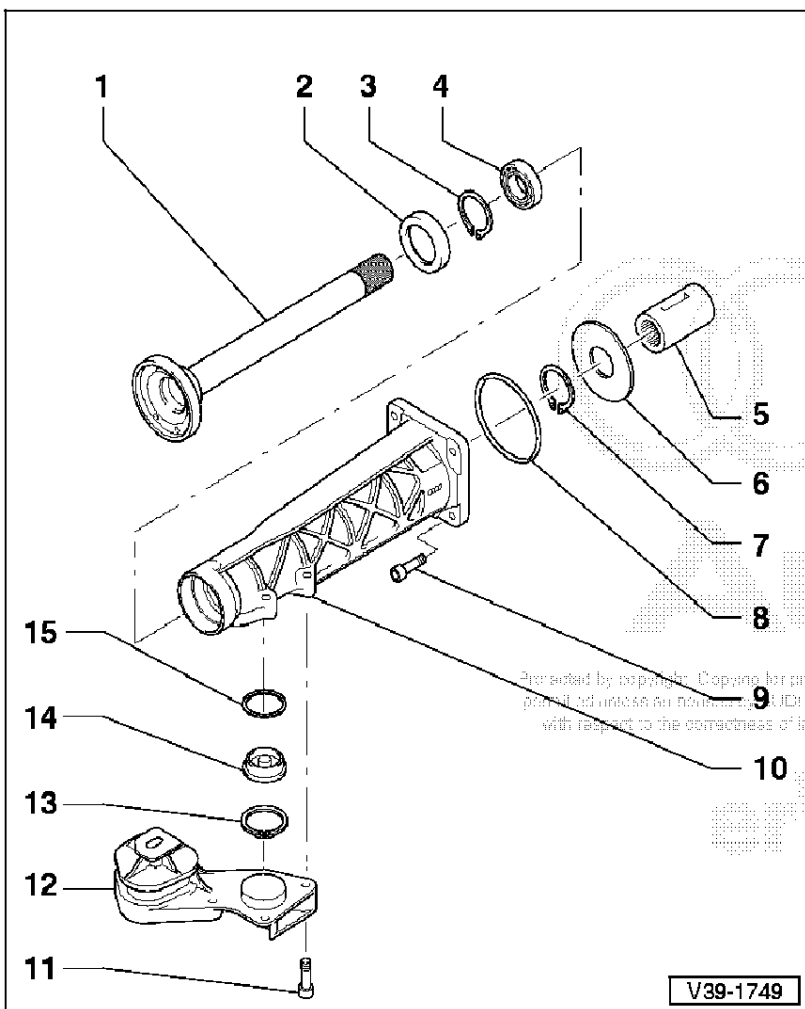
8 - O-ring

◆ Renew

9 - Bolt - 35 Nm

◆ Secures thrust tube to rear final drive housing

39-77



10 - Thrust tube

11 - Bolt - 40 Nm

◆ Secures final drive support to thrust tube

12 - Final drive support

13 - Circlip

14 - Cover cap

◆ Removing => Page 39-79

15 - O-ring

◆ Renew

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39-78

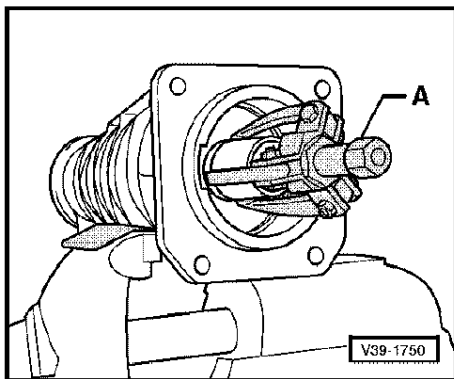
Dismantling and assembling thrust tube

Note:

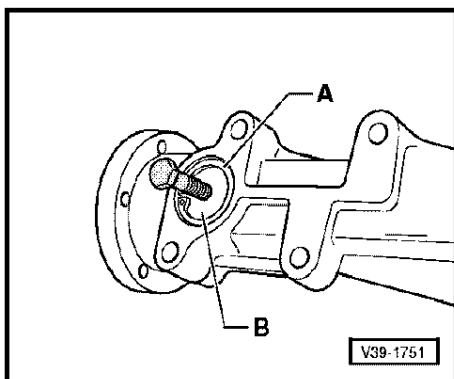
Removing and installing thrust tube => Page 39-70.

Dismantling

- ◀ – Clamp thrust tube in vice (use soft jaws).
- Pull off sleeve.
- A - Internal puller 30 ... 37 mm, e.g. Kukko 21/5
- Detach final drive support.

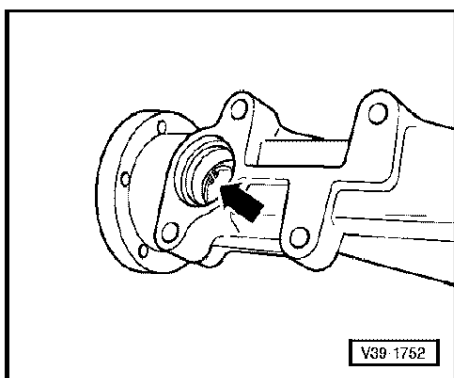


- ◀ – Remove circlip -A-.
- Screw M8 bolt into thread in cover cap -B- and pull out cover cap.

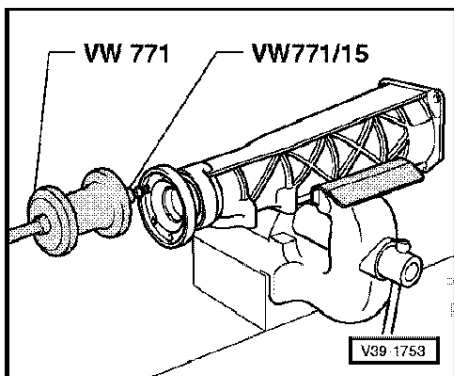


39-79

- ◀ – Open out circlip -arrow- on flange shaft and push circlip towards splines.



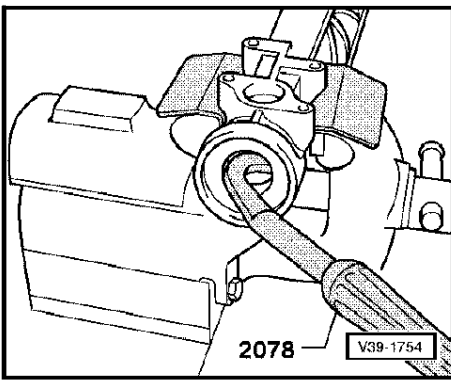
- ◀ – Remove flange shaft.
- Take circlip out of thrust tube.



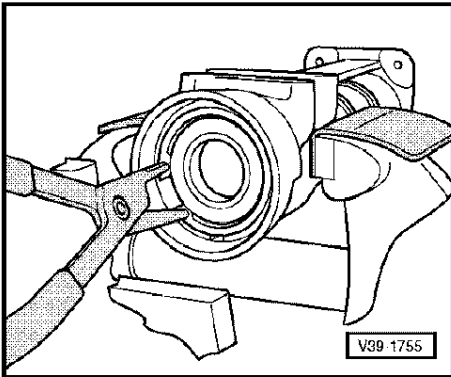
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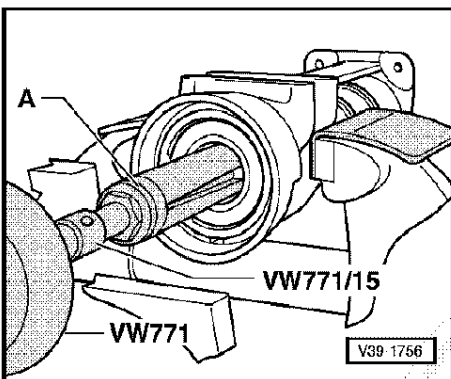
39-80



- ◀ - Prise out seal.



- ◀ - Remove circlip.

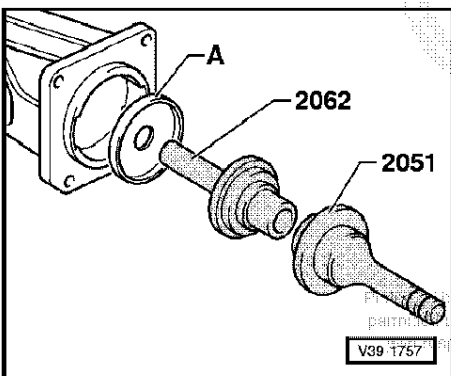


- ◀ - Pull out grooved ball bearing for flange shaft.
_ A - Internal puller 30 ... 37 mm, e.g. Kukko 21/5

Note:

The bearing will be damaged when it is removed.

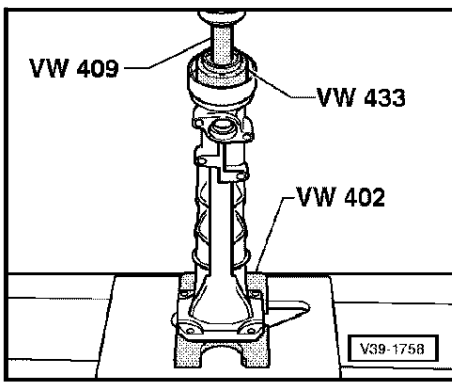
Only if baffle plate is damaged:



- ◀ - If baffle plate is damaged, press it out with flange shaft.
- To install, drive in baffle plate -A- onto stop.

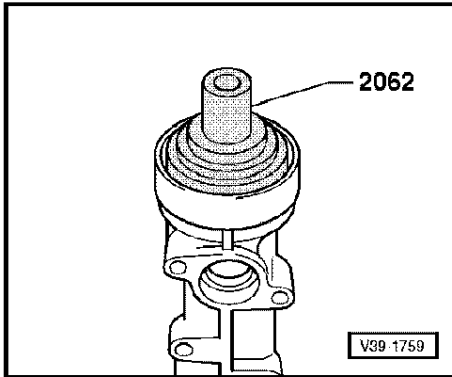
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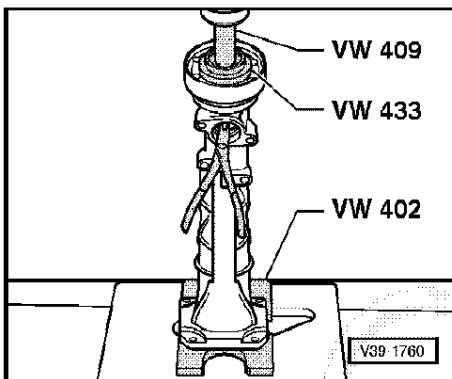
Assembling

- ◀ – Press grooved ball bearing into thrust tube.
- Fit outer circlip.

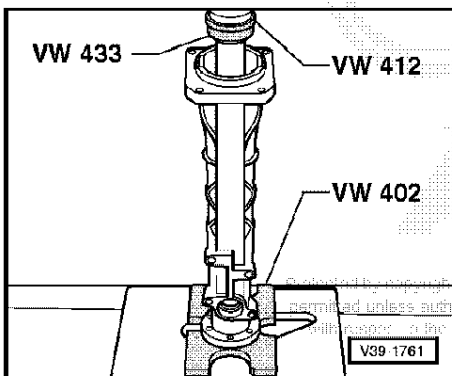


- ◀ – Pack space between sealing lip and dust lip of seal with multi-purpose grease.
- Drive in seal onto stop.

39-83



- ◀ – Insert inner circlip in thrust tube and hold in position with pliers; press in flange shaft.
- Fit circlip in groove.



- ◀ – Press sleeve onto flange shaft as far as stop.
- Install cover cap with seal.
- Fit circlip.
- Install final drive support.
- Fit O-ring on thrust tube.

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39-84

Removing and installing oil seals for flange shafts

- Rear final drive installed

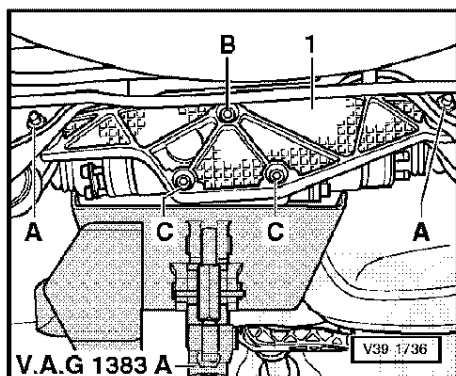
Note:

The procedure is identical for left and right-hand seals.

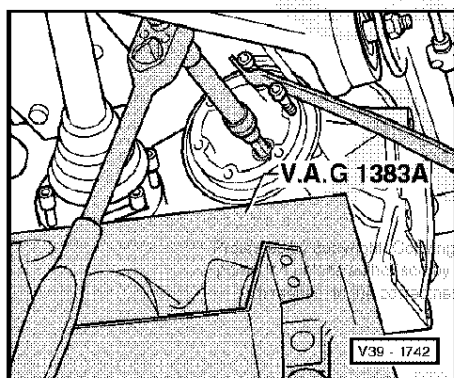
Removing

- Remove parts of exhaust system behind front exhaust pipe
=> Avant RS2; Repair group 26; Removing and installing parts of exhaust system
- Place oil tray underneath and drain off about 0.5 litres of gear oil.
- Remove heat shield next to rear final drive.
- Unclip electrical wiring and hoses for differential lock actuator.
- Support rear final drive with gearbox jack V.A.G 1383 A.
- Unbolt left and right drive shafts from rear final drive and tie up
=> Running gear, Four-wheel drive; Repair group 42; Removing and installing drive shaft =>

39-85



- ◀ - Unscrew bolts from rear cross member -1-:
 - A - Cross member to subframe
 - B - Cross member to rear final drive
 - C - Cross member to rear final drive
- Push cross member towards the left and take it out downwards to the right.
- Lower final drive slightly on gearbox jack.

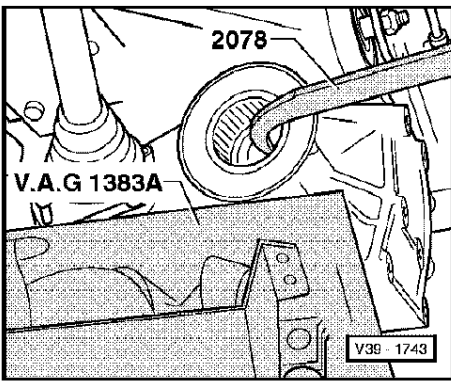


- ◀ - Remove flange shaft. To loosen the securing bolt, screw two bolts into the flange shaft and counter-hold with a lever.
- Pull out flange shaft using the bolts already screwed in.

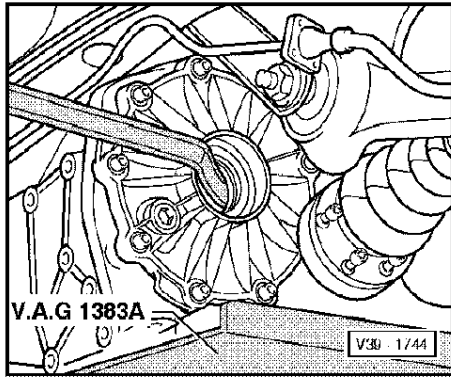
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39-86



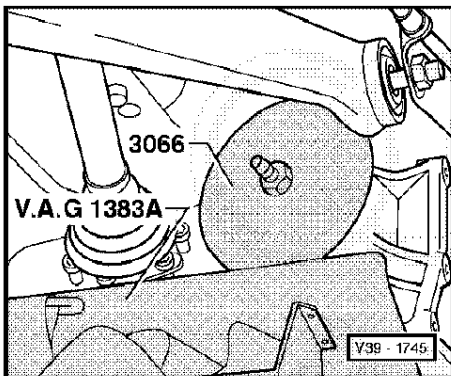
- ◀ - Prise out oil seal for left flange shaft using special tool 2078.



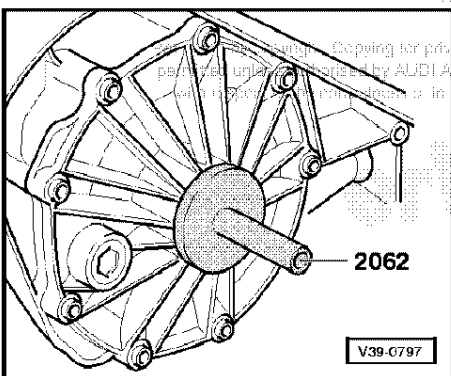
- ◀ - Lever out oil seal for right flange shaft using a suitable lever.

Installing

Installation is carried out in the reverse order, when doing this note the following:



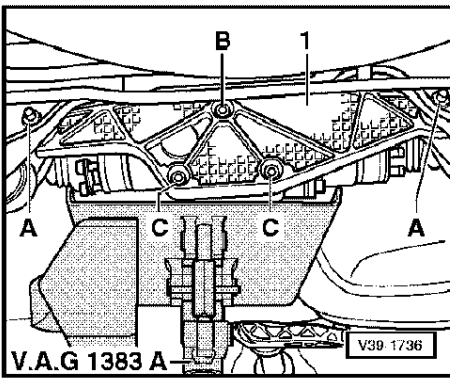
- Clean seat for oil seal.
- Moisten outer circumference of seal with gear oil.
- ◀ - Fill space between sealing lip and dust lip with multi-purpose grease.
- Using assembly tool 3066 with thrust plate, pull in oil seal for left flange shaft onto stop by turning hexagon nut.



- ◀ - Drive in oil seal for right flange shaft onto stop with mandrel 2062, ensuring that seal is kept straight.

Bolt on drive shaft

= > Running gear, Four-wheel drive; Repair group 42; Removing and installing drive shaft = >



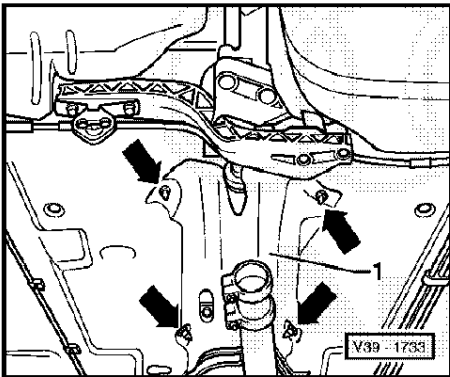
- ◀ - When installing rear cross member -1-, tighten bolts in the sequence -A-, -B-, -C-.
- Align exhaust system free of stress
- = > Avant RS2; Repair group 26; Aligning exhaust system free of stress = >
- Top up gear oil in rear final drive and check oil level = > Page 39-69.

Tightening torques

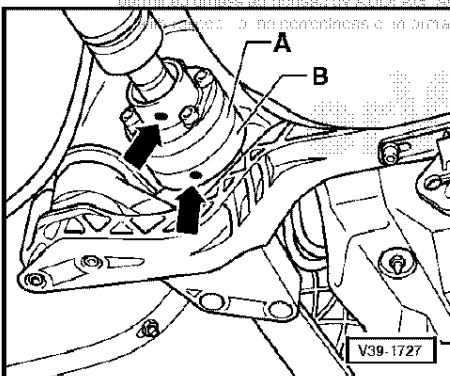
Component	Nm
Rear cross member for rear final drive to subframe	50
Rear cross member to rear final drive	55
Drive shaft to rear final drive M10	80

Removing and installing rear final drive

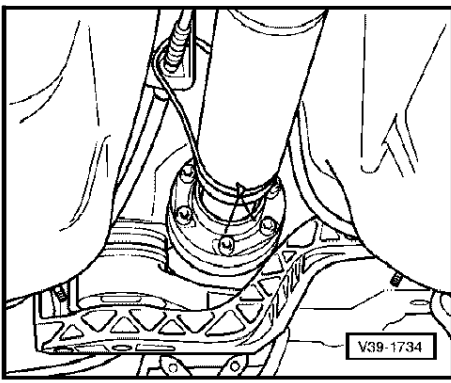
Removing



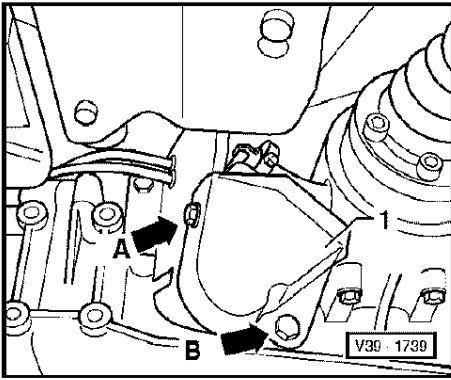
- Remove parts of exhaust system behind the front exhaust pipe
- = > Avant RS2; Repair group 26; Removing and installing parts of exhaust system = >
- Remove heat shield -1- -arrows-.
- Remove heat shield next to the rear final drive.



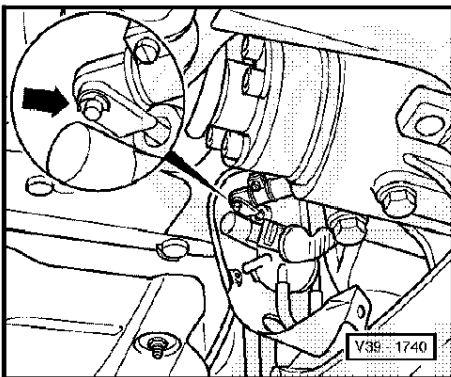
- Check whether there is a factory marking (paint spots -arrows-) on the propshaft flange and the flange on the rear final drive. If not, mark the position of the propshaft flange -A- in relation to the rear final drive -arrow B- with paint.
- Slacken bolts on propshaft flange.



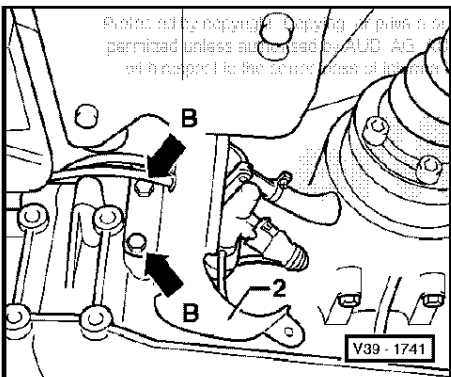
- ◀ - Tie up propshaft to handbrake cable bracket with wire.



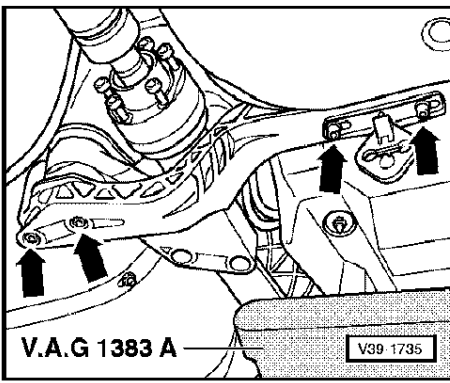
- ◀ - Unbolt heat shield -1- for differential lock actuator -arrows A and B-.



- ◀ - Using a screwdriver, prise off circlip -arrow- on connection between differential lock actuator and differential lock.
- Take out connecting pin from above.

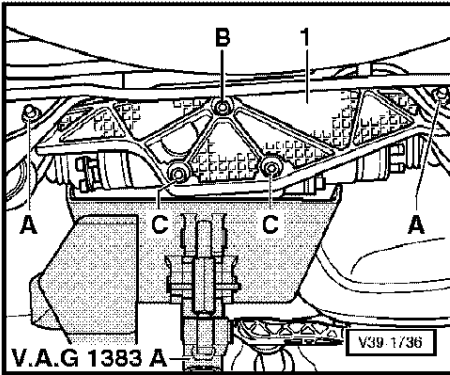


- ◀ - Unclip electrical wiring and hoses for differential lock actuator.
- Unbolt bracket -2- for vacuum unit and switch for differential lock on rear final drive -arrow B-.
- Move bracket clear to the side with wiring and hoses connected, and tie up with wire.



- Unbolt left and right drive shafts from rear final drive and tie up
=> Running gear, Four-wheel drive; Repair group42; Removing and installing drive shaft

- ◀ - Support final drive with gearbox jack V.A.G 1383 A.
- Unscrew bolts -arrows- on front cross member for rear final drive.
- Detach front cross member.



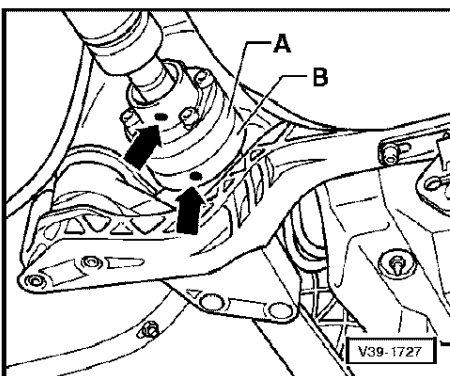
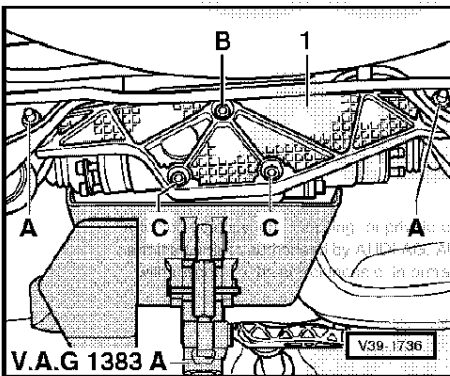
- ◀ - Unscrew bolts from rear cross member -1-:
 - _ A - Cross member to body
 - _ B - Cross member to rear final drive
 - _ C - Cross member to rear final drive
- Push cross member towards the left and take it out downwards to the right.
- Lower final drive on gearbox jack.

Installing

Installation is carried out in the reverse order, when doing this note the following:

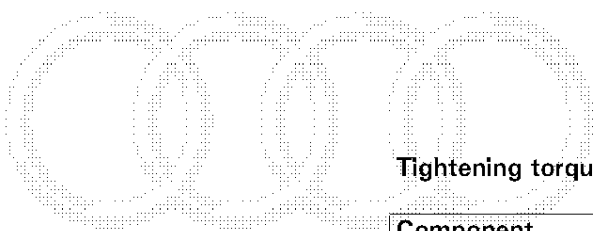
- ◀ - When installing rear cross member -1-, tighten bolts in the sequence -A-, -B-, -C-.

Notes:



- ◀ ♦ To prevent imbalance, the flanges on the propshaft -A- and on the rear final drive -B- must be installed so that the paint markings are in alignment -arrows-.
- ♦ Renew gasket between propshaft and flange on rear final drive (pull off backing foil and stick gasket onto flange shaft). The surface must be free of grease.

- ◆ After detaching the propshaft, it is important to clean the remaining locking compound out of the threads in the flange shaft on the rear final drive. If this is neglected, the new bolts can seize when they are screwed in and shear off later if they have to be removed.
- ◆ The threads can be cleaned with a thread tap.
- ◆ Renew propshaft bolts (self-locking).
 - Align exhaust system free of stress
 - = > Avant RS2; Repair group 26; Aligning exhaust system free of stress = >
 - Top up gear oil in rear final drive and check oil level = > Page 39-69.



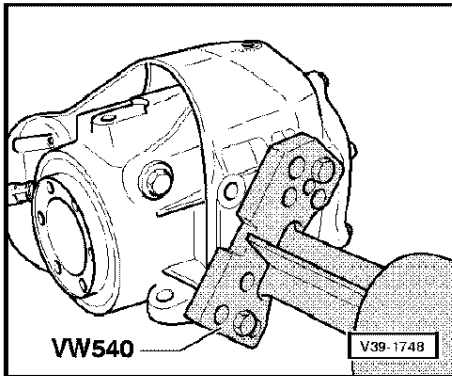
Tightening torques

Component	Nm
Propshaft to final drive (input flange) M8	55
Front cross member for rear final drive to body M10	40
Front cross member for rear final drive with bracket for exhaust system to body M8	20
Rear cross member for rear final drive to subframe M10	50
Rear cross member to rear final drive M10	55
Drive shaft to rear final drive M10	80
Heat shield for differential lock actuator to bracket M6	10
Bracket for vacuum unit to rear final drive M8	25

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Securing rear final drive to repair stand



- ◀ – Secure complete rear final drive on a repair stand with bracket VW 540.

39-97

Dismantling and assembling rear final drive

Assembly overview

Notes:

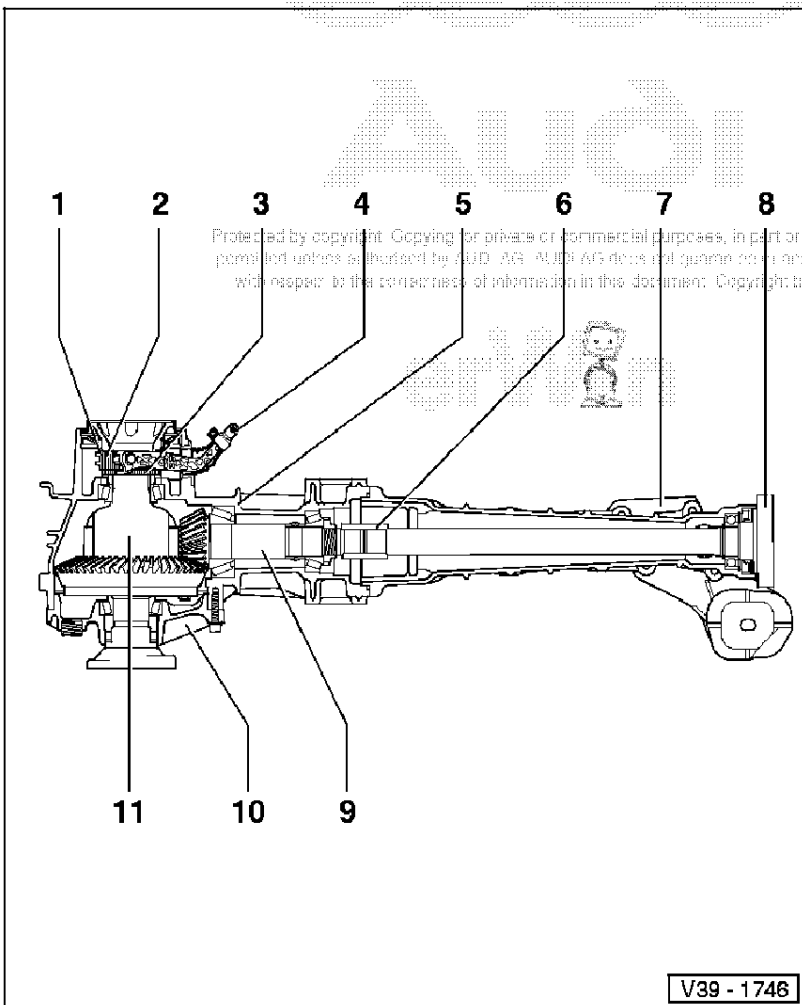
- ◆ Removing thrust tube from rear final drive with final drive installed => Page 39-71.
- ◆ Removing thrust tube from rear final drive with final drive removed => Page 39-100.

1 – Locking collar

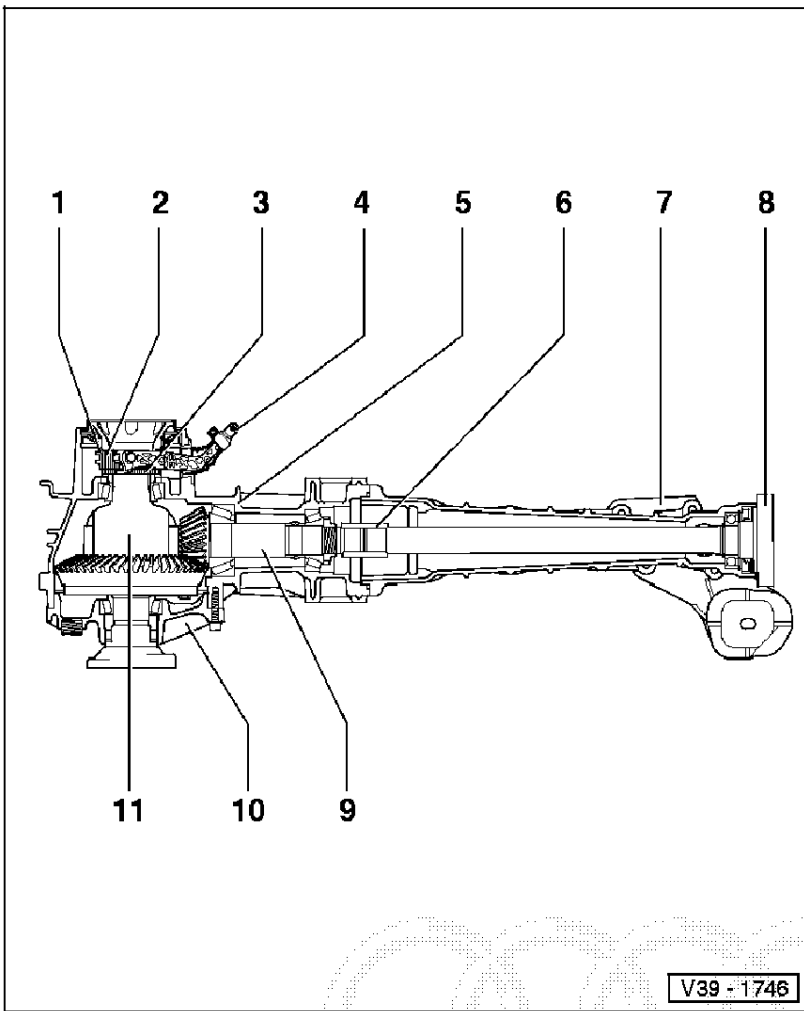
2 – Synchro-hub

3 – Clutch body for differential lock

4 – Selector fork



39-98



5 – Final drive housing

6 – Sleeve

7 – Final drive support

8 – Flange shaft

◆ Removing => Page 39-80

9 – Drive pinion

◆ Paired with crown wheel

◆ Removing and installing

=> Page 39-121

10 – Cover for final drive

11 – Differential with crown wheel

◆ Must be removed before dismantling drive pinion

◆ Crown wheel is mated to drive pinion

◆ Removing and installing

=> Page 39-101

◆ Dismantling and assembling

=> Page 39-109

39-99

Removing thrust tube from rear final drive

● Rear final drive removed

– Secure rear final drive to repair stand => Page 39-97.

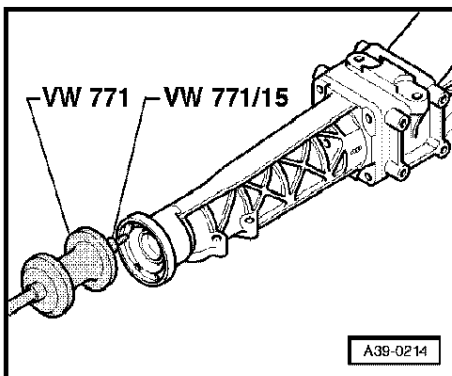
– Place drip tray underneath to collect oil.

– Drain gear oil.

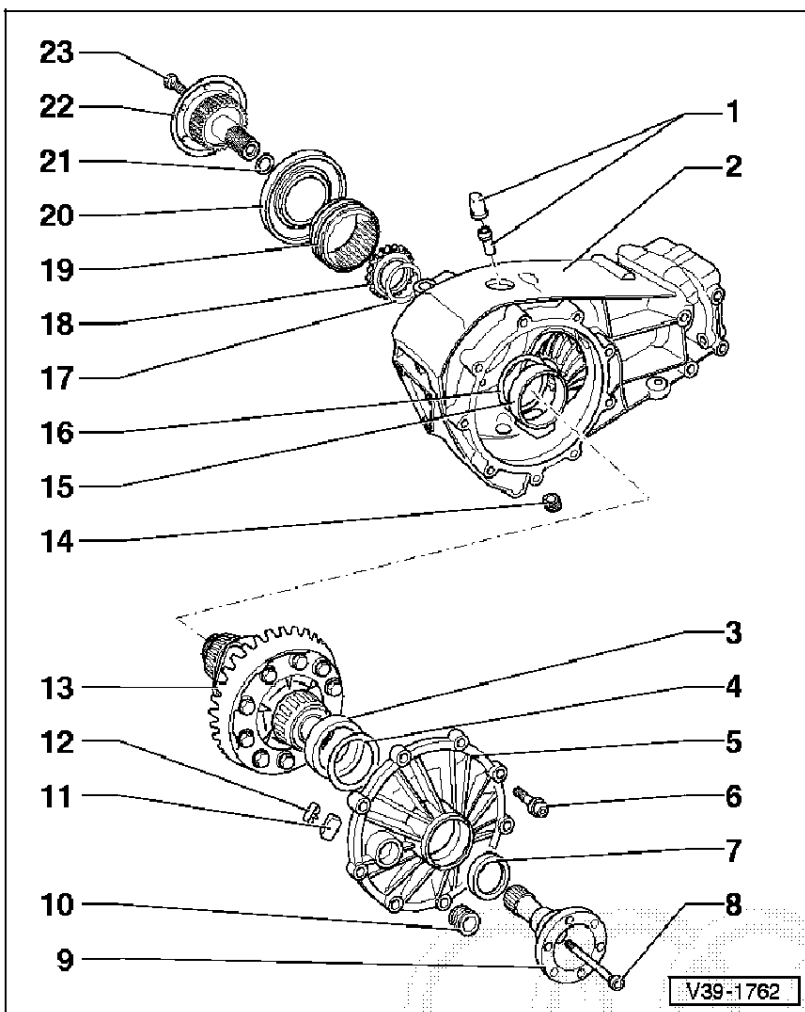
– Remove bolts securing the thrust tube to the rear final drive housing.

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– Pull off thrust tube with flange shaft ; when doing this, support thrust tube.



39-100



Removing and installing differential

Notes:

- ◆ Secure final drive on a repair stand => Page 39-97.
- ◆ General repair instructions => Page 00-14.
- ◆ Adjustments are required when replacing components marked ¹⁾ => adjustment overview Page 39-149.

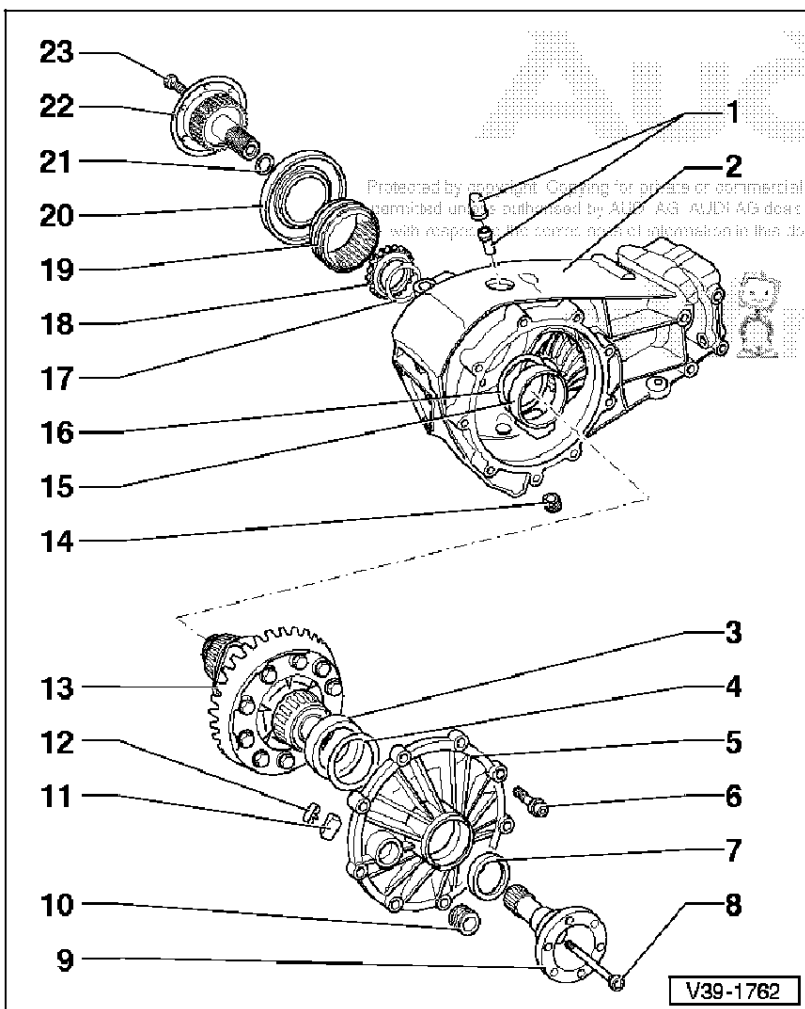
1 - Breather

- ◆ Insertion depth => Fig. 1

2 - Final drive housing¹⁾

- ◆ With drive pinion
- ◆ Removing and installing drive pinion => Page 39-121

39-101



3 - Outer race for large taper roller bearing¹⁾

- ◆ Removing and driving in => Fig. 9 and Fig. 10, Page 39-119

4 - Shim "S1"

- ◆ Note thickness
- ◆ Adjustment overview => Page 39-149

5 - Cover for final drive¹⁾

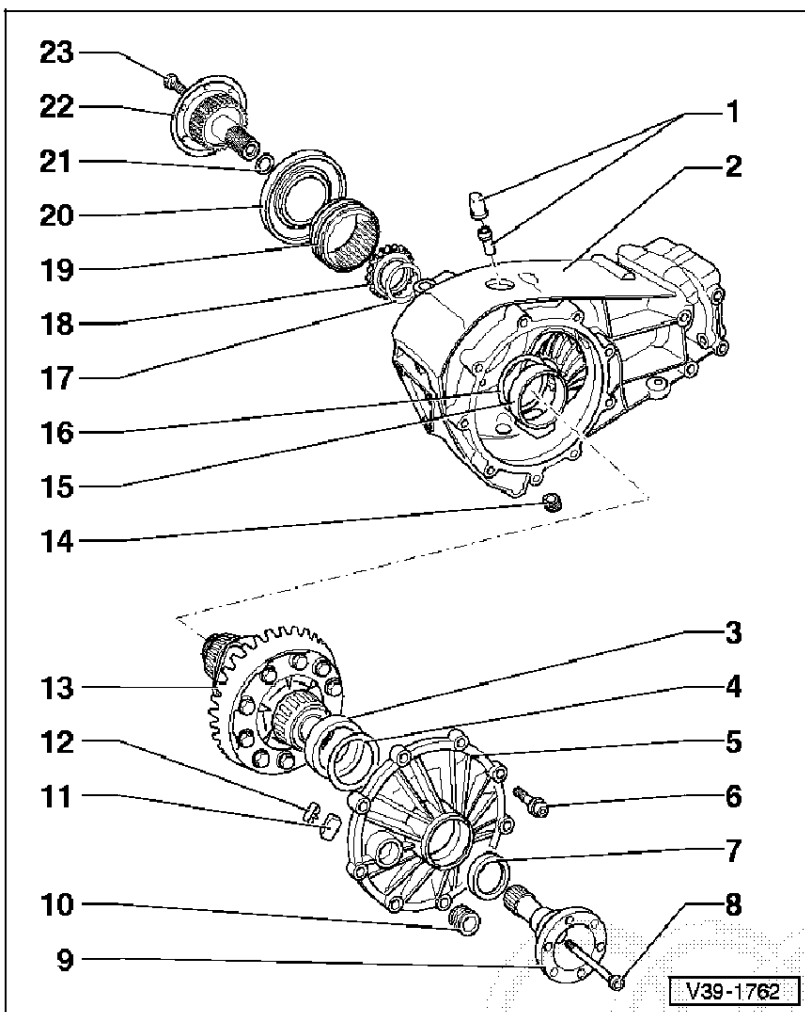
- ◆ Seal with sealing paste AMV 188 200 03
- ◆ Installation position: magnet towards the bottom

6 - Bolt - 25 Nm

7 - Seal, right

- ◆ Removing => Page 39-87
- ◆ Drive in with 2062 as far as stop => Page 39-88

39-102



8 - Taper head bolt M8 - 10 Nm
+ 1/4turn (90°) further

9 - Flange shaft, right
◆ Removing => Page 39-107

10 - Oil filler plug- 25Nm

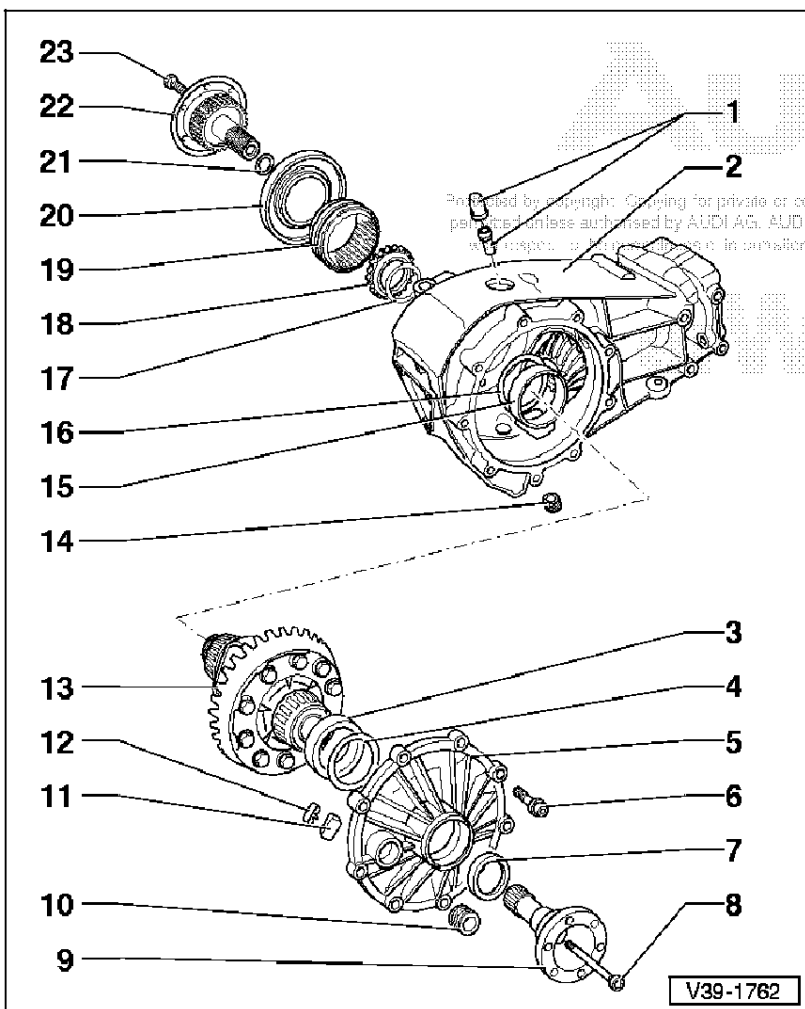
11 - Magnet
◆ Installation position => Fig. 2

12 - Clip for magnet
◆ Installation position => Fig. 2
◆ Always renew

13 - Differential with crown wheel ¹⁾
◆ Removing => Page 39-107
◆ Dismantling and assembling
=> Page 39-109

14 - Oil drain plug - 25 Nm

39-103



15 - Outer race for small taper roller bearing ¹⁾
◆ Driving out and driving in =>
Fig. 11 and Fig. 12, Page 39-120

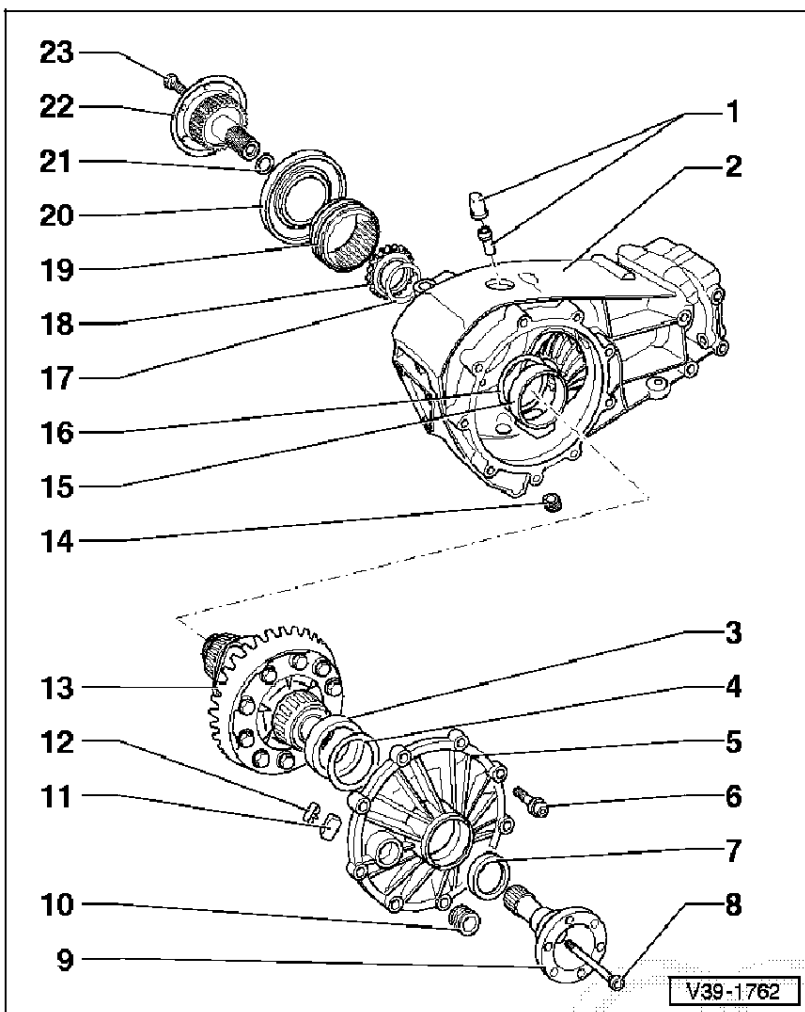
16 - Shim "S2"
◆ Note thickness
◆ Adjustment overview => Page 39-149

17 - Shim for clutch body
◆ Determining thickness
=> Fig. 2, Page 39-142

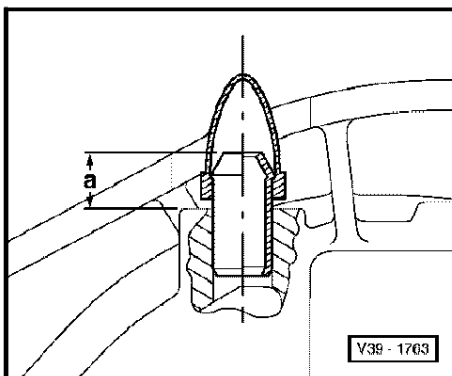
18 - Clutch body for differential lock
◆ Installation position
=> Fig. 1, Page 39-142

19 - Locking collar
◆ Installation position: shoulder
towards clutch body
◆ Remove and install together
with selector fork

39-104

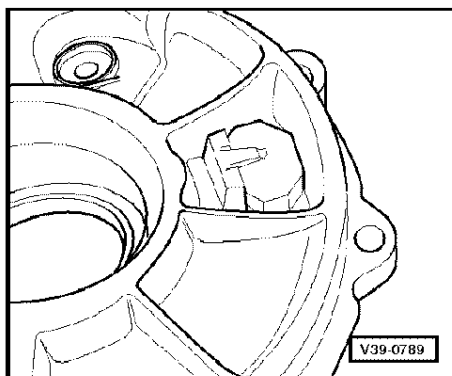
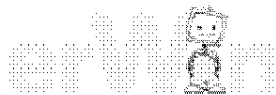


- 20 - Seal, left
 - ◆ Removing => Page 39-87
 - ◆ Drive in with 3066 as far as stop
 - => Page 39-88
- 21 - Shim for flange shaft
 - ◆ Take care not to lose shim when dismantling
 - ◆ Determining thickness => Page 39-143
 - ◆ Adjustment overview => Page 39-149
- 22 - Flange shaft, left
 - ◆ Removing => Page 39-107
 - ◆ Adjusting => Page 39-143
- 23 - Taper head bolt M8 - 10 Nm + 1/4turn (90°) further

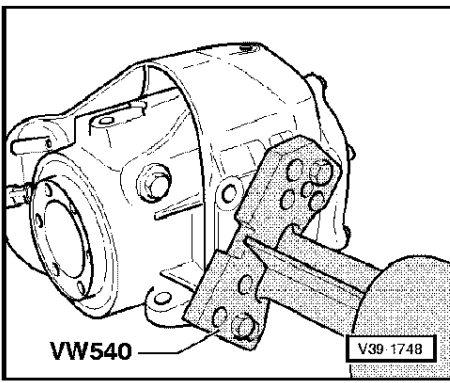


◀ Fig.1 Insertion depth for breather sleeve
 ◆ Distance a = 11 mm

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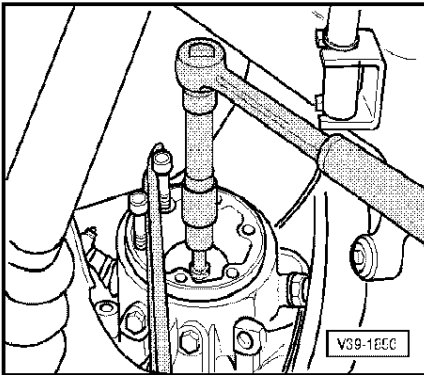


◀ Fig.2 Installation position of magnet
 - Always fit new clip when performing repairs.



Removing

- Rear final drive removed
- ◀ – Secure complete rear final drive on a repair stand with bracket VW 540.
- Place drip tray underneath to collect oil.
- Drain gear oil.



- ◀ – Remove left and right-hand flange shafts.
- To loosen the securing bolt, screw two bolts into the flange shaft and counter-hold with a lever.
- Mark flange shafts (left and right) and pull out.
- Remove clutch body for differential lock => Page 39-136. Selector fork and locking collar remain in final drive.
- Unscrew securing bolts from cover for final drive.
- Take cover for final drive off axle housing and remove differential.

39-107

Installing

Install in reverse order.

- Insert differential.
- Clean sealing surface and coat with sealing paste AMV 188 200 03.
- Fit final drive cover on axle housing and tighten bolts in diagonal sequence.
- Install clutch body for differential lock with correct shim => from Page 39-136.
- Fill space between sealing and dust lips with multipurpose grease.
- Fit flange shafts and tighten.

Note:

A shim is fitted between differential and right flange shaft.

- Top-up gear oil in rear final drive and check oil level => Page 39-69.

39-108

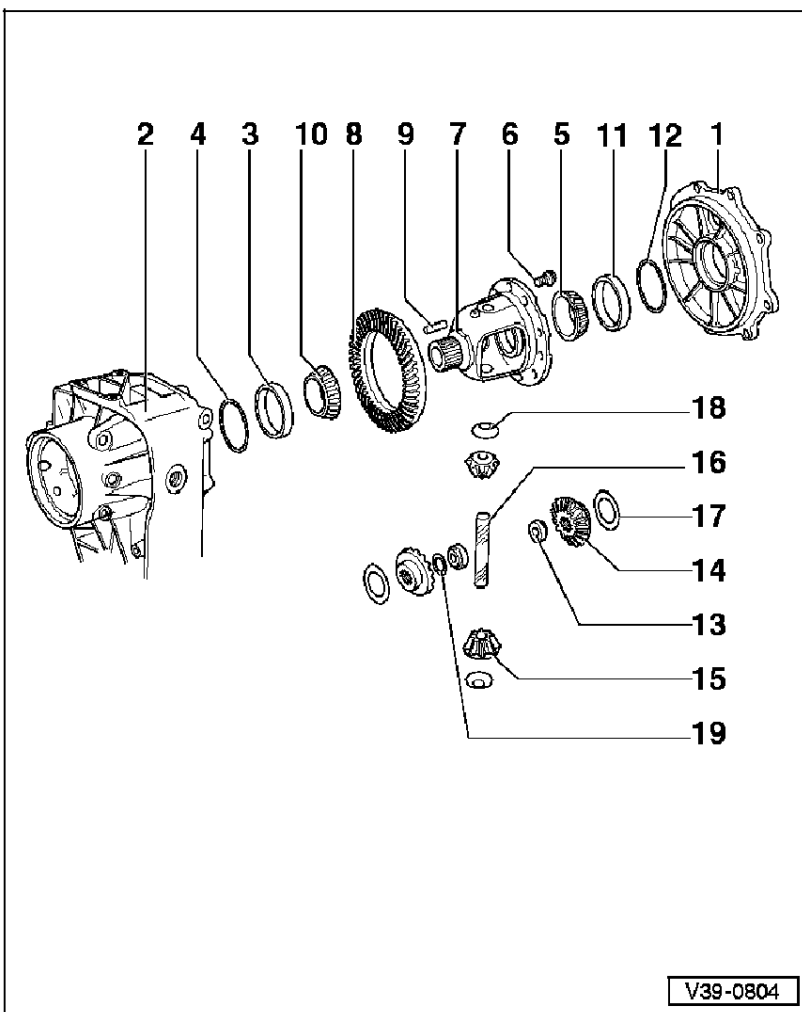
Dismantling and assembling differential

Notes:

- ◆ General repair instructions => Page 00-14.
- ◆ Replace both taper roller bearings of the differential together. Use same make if possible.
- ◆ Adjustments are required when replacing components marked ¹⁾ => adjustment overview Page 39-149.

1 - Cover for final drive ¹⁾

2 - Final drive housing ¹⁾



V39-0804

39-109

3 - Outer race for large taper roller bearing ¹⁾

- ◆ Driving out => Fig. 9
- ◆ Driving in => Fig. 10

4 - Shim "S2"

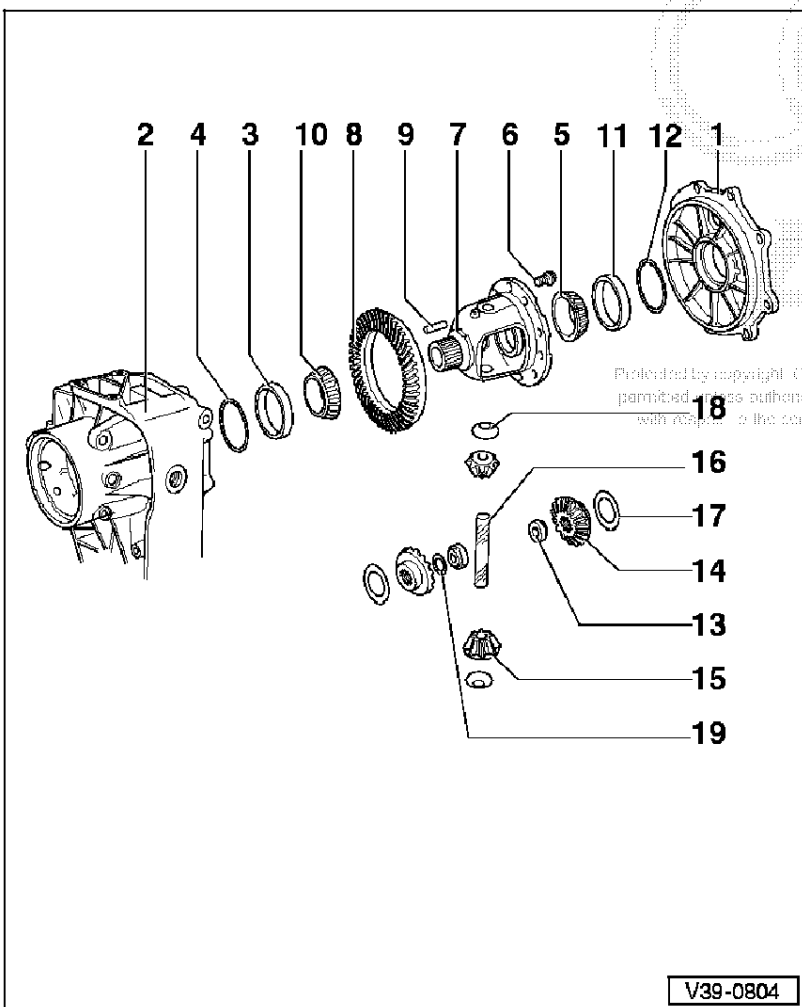
- ◆ Note thickness
- ◆ Adjustment overview => Page 39-149

5 - Inner race for small taper roller bearing ¹⁾

- ◆ Pulling out => Fig. 2
- ◆ Pressing on => Fig. 4

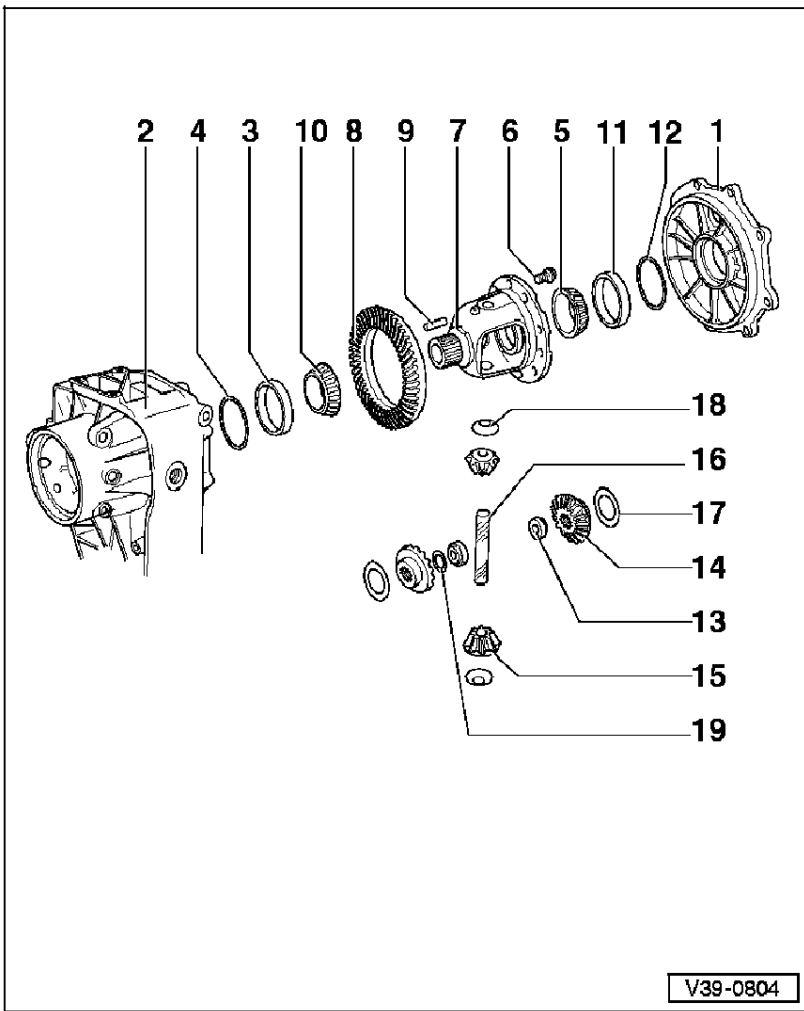
6 - Crown wheel bolt

- ◆ Renew
- ◆ Use only genuine bolts
- ◆ Counter hold, then tighten using diagonal sequence to 60 Nm and then turn 45° further



V39-0804

39-110



V39-0804

7 - Differential housing ¹⁾

8 - Crown wheel ¹⁾

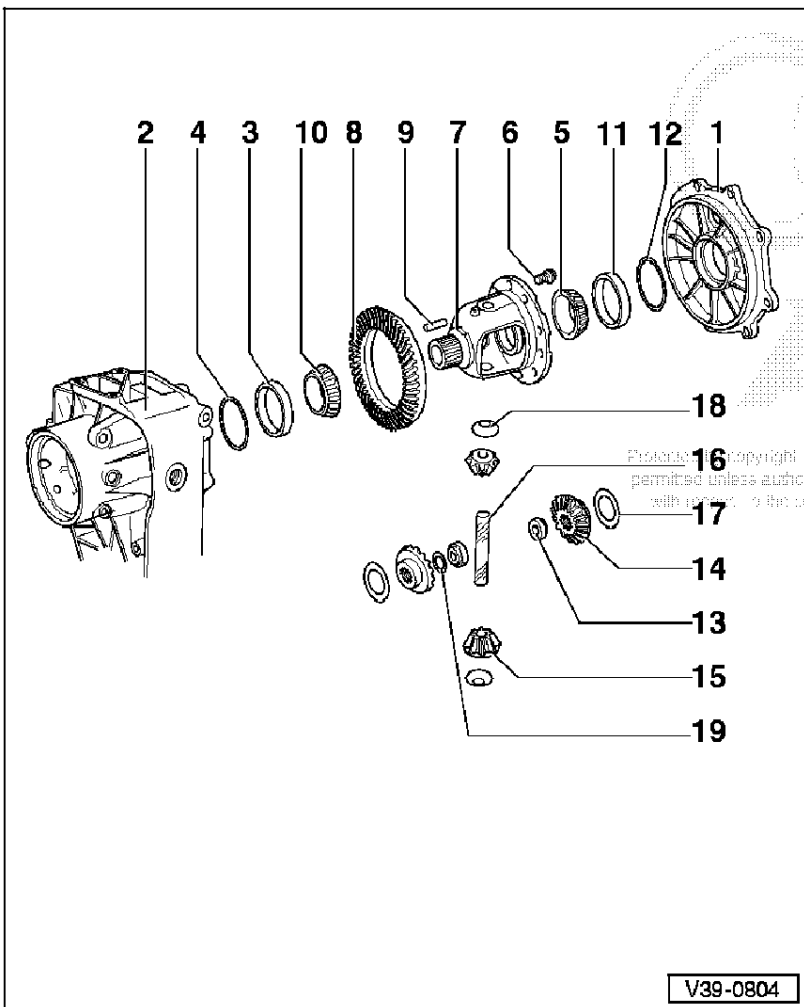
- ◆ Paired with drive pinion (final drive set)
- ◆ Drive off differential housing with a drift => Fig. 5
- ◆ Installing => Fig. 6
- ◆ Heat crown wheel to 100 °C when installing

9 - Spring pin

- ◆ Drive in flush

10 - Inner race for large taper roller bearing ¹⁾

- ◆ Pulling off => Fig. 1
- ◆ Pressing in => Fig. 3



V39-0804

11 - Outer race for small taper roller bearing ¹⁾

- ◆ Driving out => Fig. 11
- ◆ Driving in => Fig. 12

12 - Shim "S1"

- ◆ Note thickness
- ◆ Adjustment overview => Page 39-149

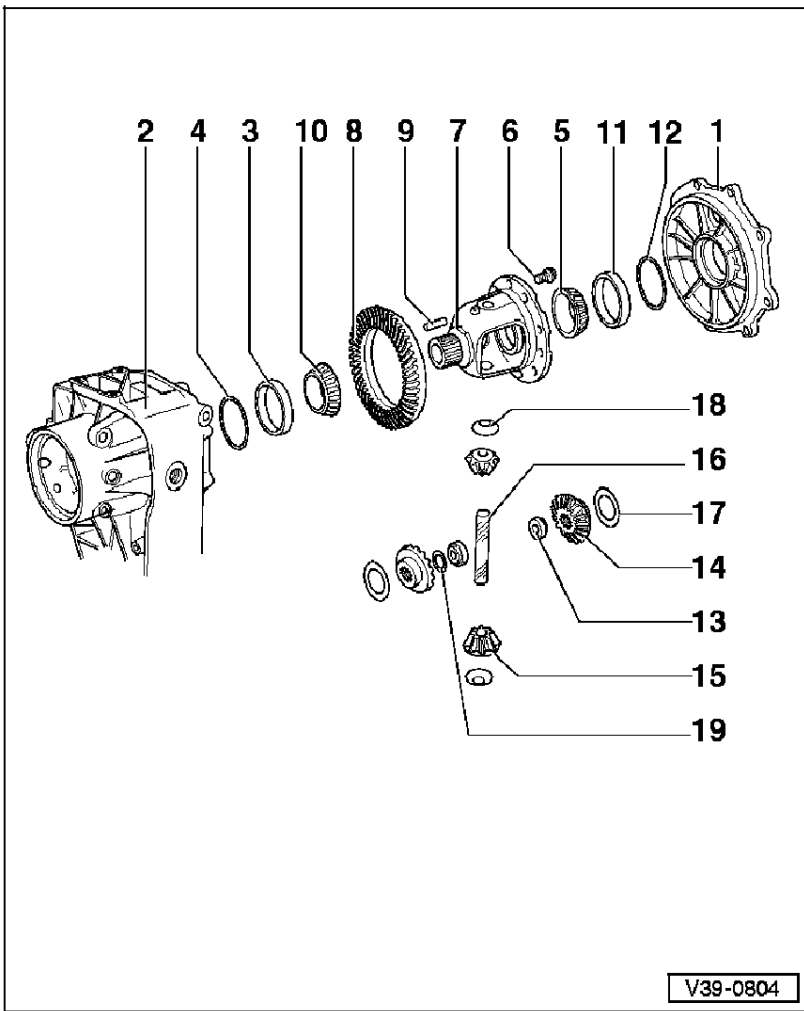
13 - Threaded piece

14 - Sun wheels

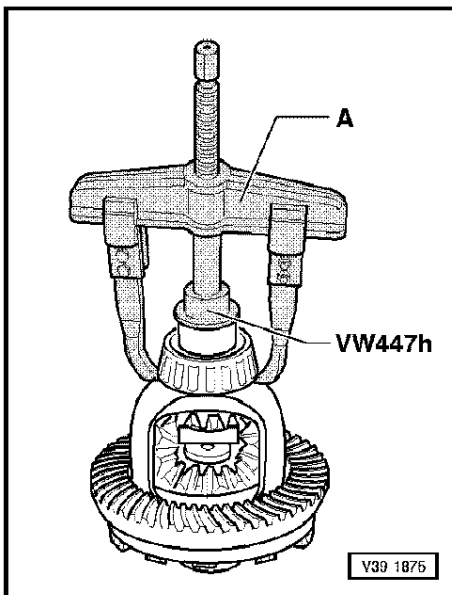
- ◆ Installing => Fig. 7
- ◆ Adjusting => Fig. 8

15 - Planet wheels

- ◆ Installing => Fig. 7



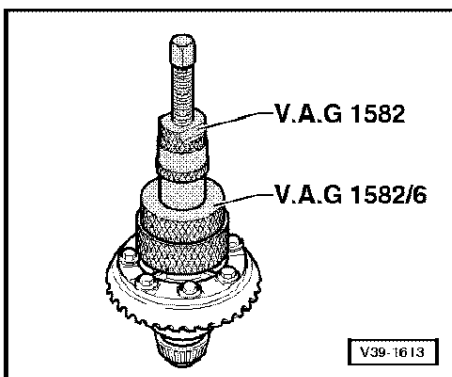
- 16 – Shaft for planet wheels**
 - ◆ Drive out with a drift
 - ◆ Drive in carefully so that the thrust washers are not damaged
 - ◆ Secure with spring pin
- 17 – Shim**
 - ◆ Re-determining thickness => Fig. 8
- 18 – Thrust washer**
 - ◆ Check for cracks and chipping
- 19 – Shim for flange shaft**
 - ◆ Take care not to lose shim when dismantling
 - ◆ Determining thickness => Page 39-143
 - ◆ Adjustment overview => Page 39-149



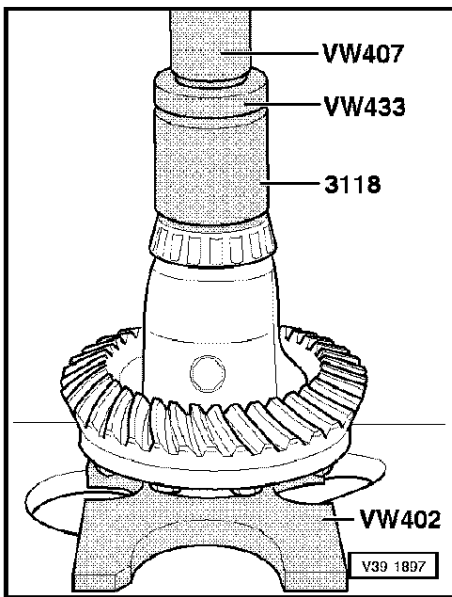
◀ **Fig.1 Pulling off inner race for large taper roller bearing**
 – Before applying puller, fit thrust plate VW 447 h on differential housing.
 – A - Two-arm puller, e.g. Kukko 20/10



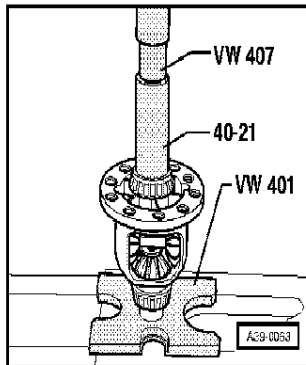
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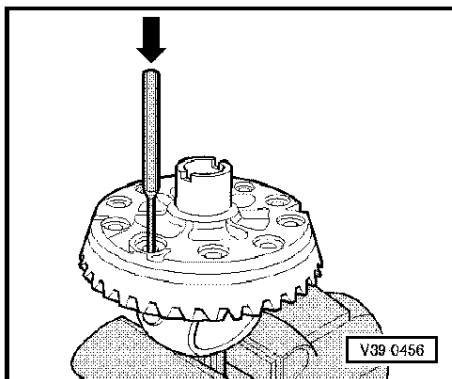
◀ **Fig.2 Pulling off inner race for small taper roller bearing**
 – Fit thrust plate 40-105 onto differential housing before fitting puller.



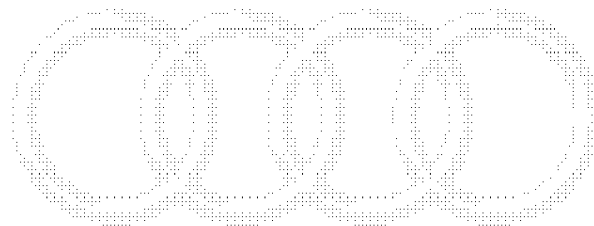
◀ Fig.3 Pressing on inner race for large taper roller bearing
 – Heat bearing to approx. 100 °C, fit in position and press home.



◀ Fig.4 Pressing on inner race for small taper roller bearing
 – Heat bearing to approx. 100 °C, fit in position and press home.



◀ Fig.5 Driving crown wheel off housing



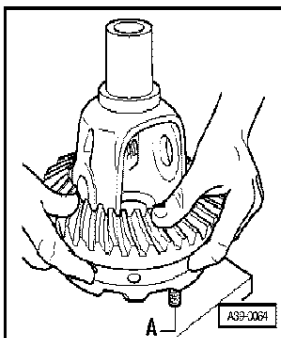
◀ Fig.6 Installing crown wheel
 – Use 2 centring pins -A- (local manufacture) as a guide.

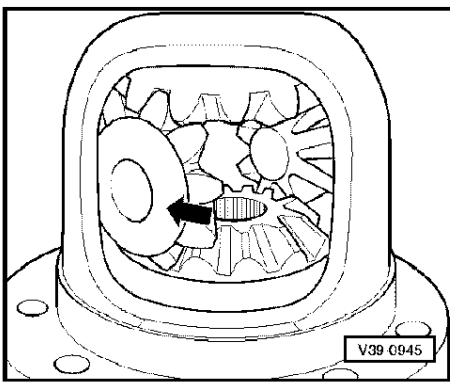
Caution

Wear protective gloves.

– Heat crown wheel to approx. 100 °C and install.

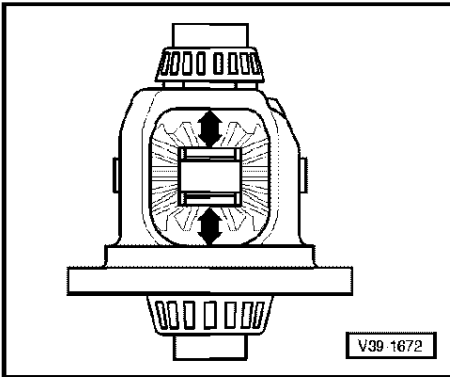
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◀ Fig.7 Installing differential bevel gears

- Insert sun wheels with correct shims => Fig. 8.
- Insert planet wheels spaced 180° apart (stick thrust washers on with a small amount of grease) and rotate into position - arrow-.
- Locate thrust washers and planet wheels so they are aligned with the holes.
- Insert threaded pieces.
- Drive in shaft for planet wheels into final position and secure.



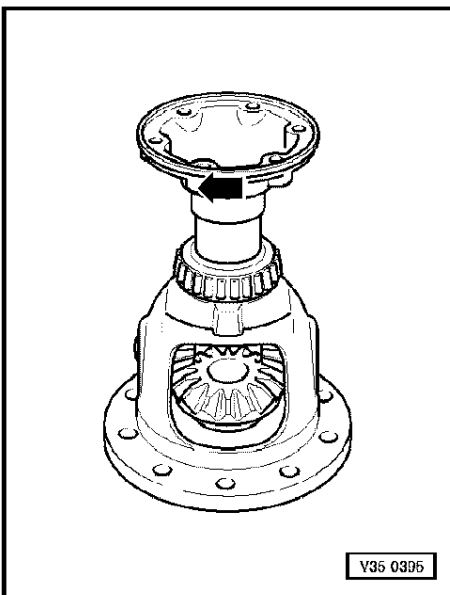
◀ Fig.8 Adjusting differential bevel gears

- Insert sun wheels with thinnest shims (0.5 mm).
- Insert planet wheels with thrust washers and press in shaft.

Note:

Do not now interchange bevel gears and thrust washers.

- Press planet wheels outwards and check play of sun wheels by hand -arrows-.



- Adjust play by inserting an appropriate shim.
 - Specification: max. 0.10 mm

◀ **Note:**

The adjustment is also correct if no further play is perceptible, although it is still possible to rotate the differential bevel gears - arrow-.

- Determine shim from table. Part numbers => Parts catalogue

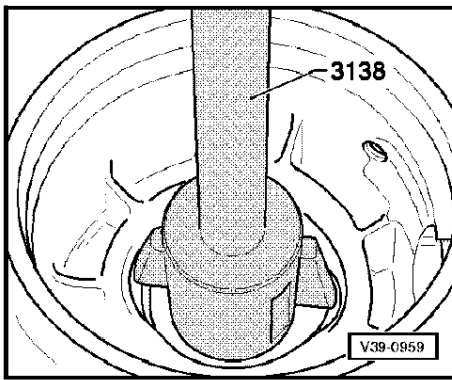
The following shims are available:

Shim thickness (mm)		
0.50	0.70	0.90
0.60	0.80	1.00

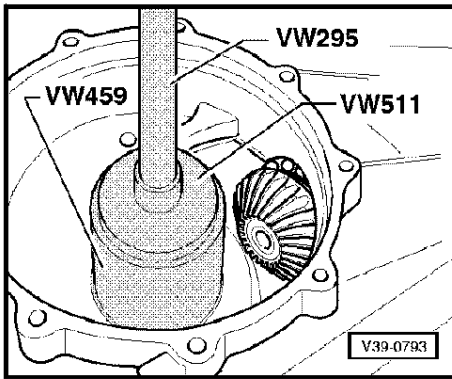


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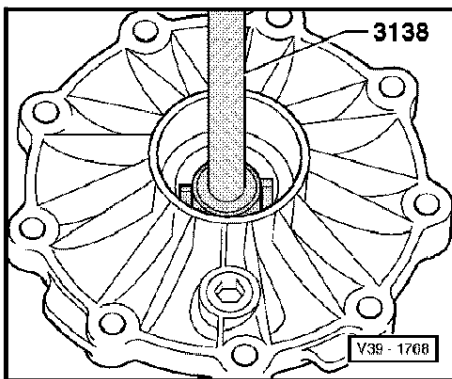




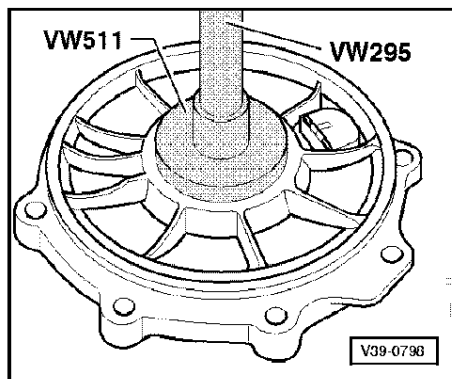
◀ **Fig.9 Driving outer race for large taper roller bearing out of final drive housing**
 – After removing check shims for damage.



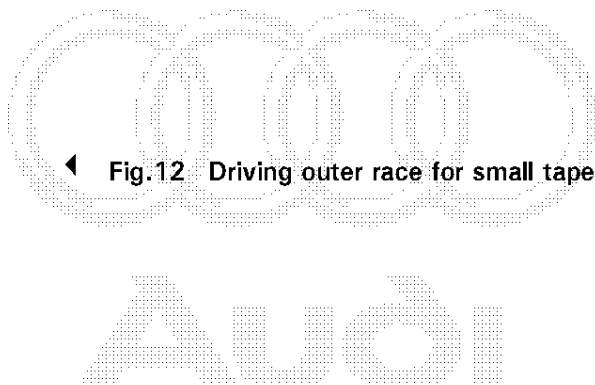
◀ **Fig.10 Driving outer race for large taper roller bearing into final drive housing**
 – Position outer race using VW 295 and light even blows with a hammer.
 – Then drive in onto stop as shown in illustration.



◀ **Fig.11 Driving outer race for small taper roller bearing out of cover**
 – After removing check shims for damage.



◀ **Fig.12 Driving outer race for small taper roller bearing into cover**



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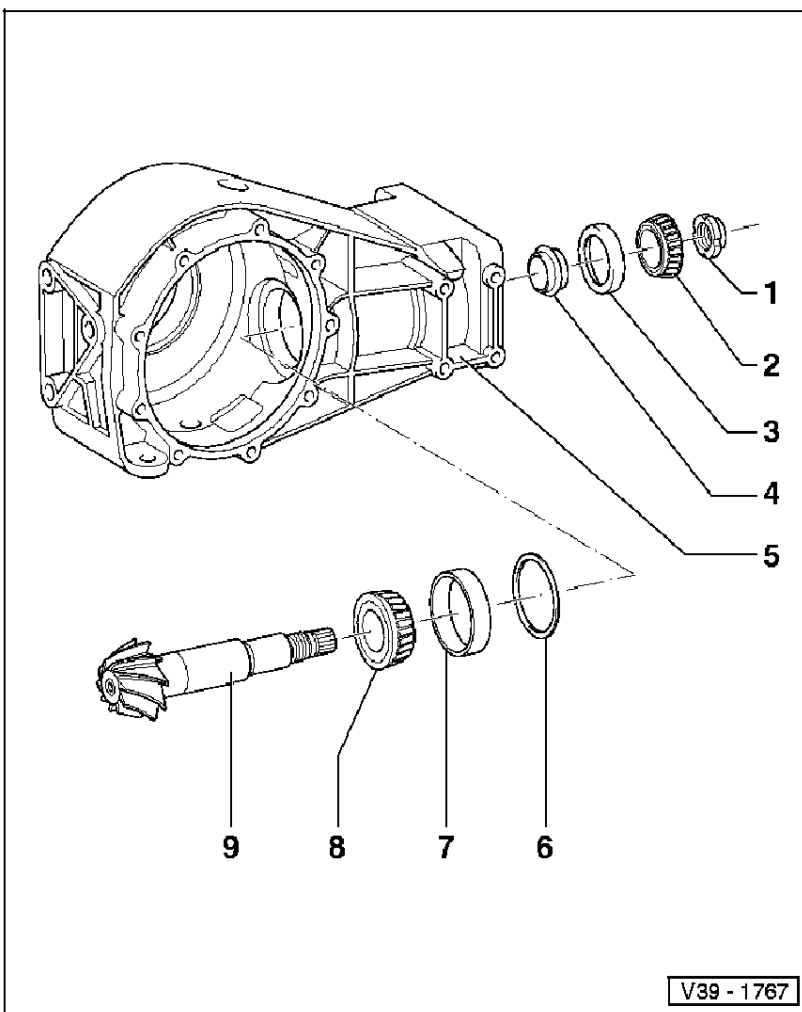
Removing and installing drive pinion

Notes:

- ◆ General repair instructions => Page 00-14.
- ◆ Secure final drive on a repair stand => Page 39-97.
- ◆ Renew both taper roller bearings together. Use bearings made by same manufacturer if possible.
- ◆ Removing differential => Page 39-101.
- ◆ Adjustments are required when replacing components marked¹⁾ => Adjustment overview, Page 39-149.

1 - Drive pinion nut

- ◆ Slackening => Fig. 1 and Fig. 2
- ◆ Tightening => Fig. 11
- ◆ Measuring frictional torque => Fig. 12
- ◆ Locking => Fig. 13



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2 - Inner race for small taper roller bearing¹⁾

- ◆ Pressing out drive pinion => Fig. 3
- ◆ Installing => Fig. 10

3 - Outer race for small taper roller bearing¹⁾

- ◆ Pulling out => Fig. 4
- ◆ Pressing in => Fig. 9

4 - Spacer sleeve¹⁾

- ◆ Renew

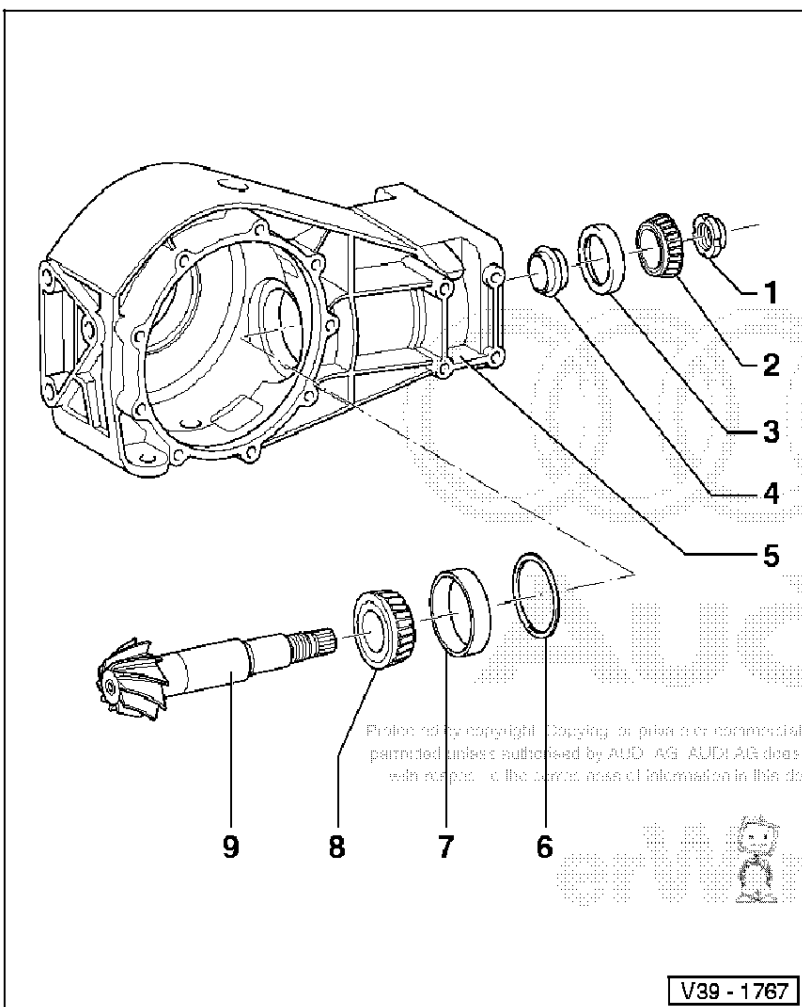
5 - Final drive housing¹⁾

6 - Shim "S3"

- ◆ Note thickness
- ◆ Adjustment overview => Page 39-149

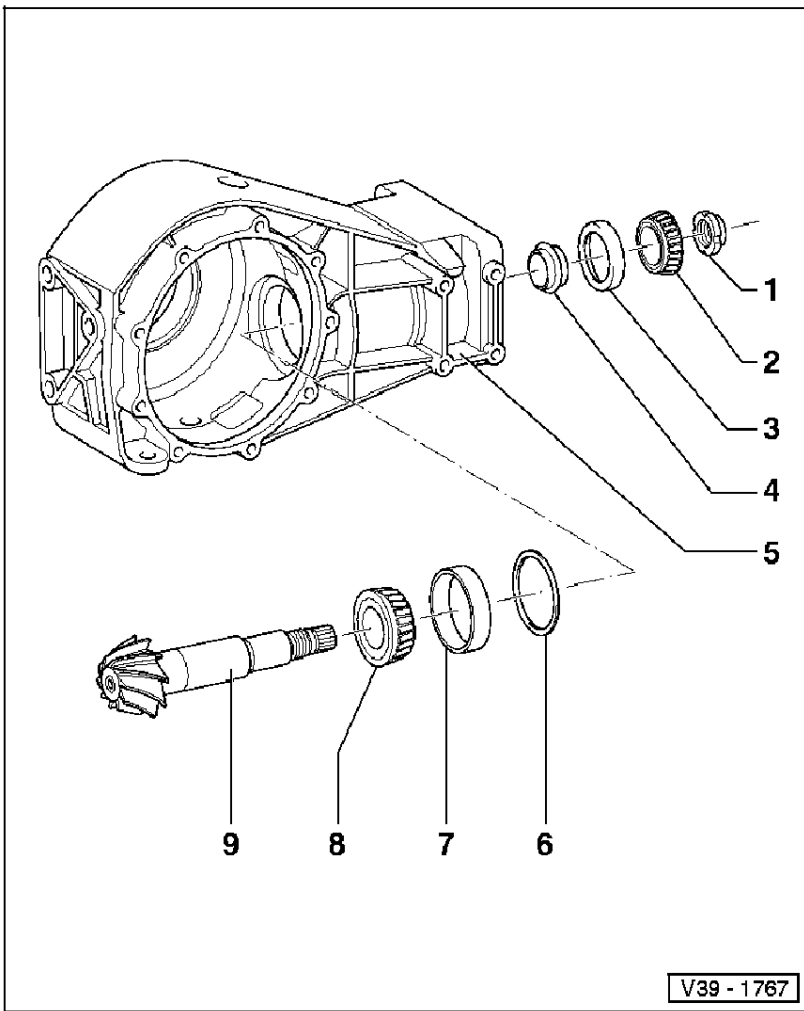
7 - Outer race for large taper roller bearing¹⁾

- ◆ Driving out => Fig. 5
- ◆ Pulling in => Fig. 8



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8 – Inner race for large taper roller bearing ¹⁾

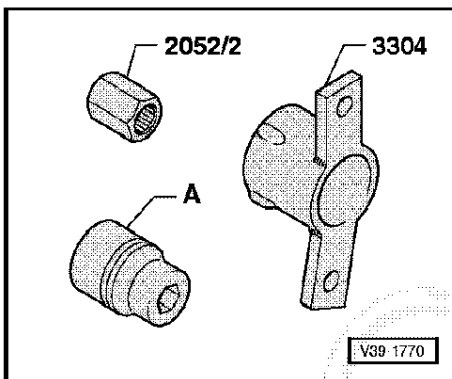
◆ Pressing off => Fig. 6

◆ Pressing on => Fig. 7

9 – Drive pinion ¹⁾

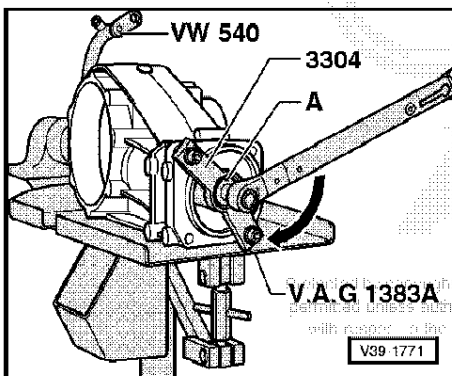
◆ Paired with crown wheel

◆ Replace only in conjunction with crown wheel



◀ **Fig.1 Tools for slacking and tightening drive pinion nut**

_ A - Socket (32 mm)

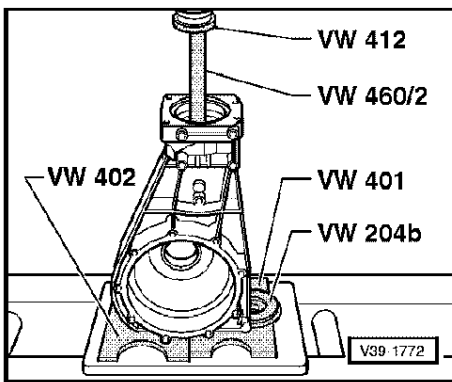


◀ **Fig.2 Slacking drive pinion nut**

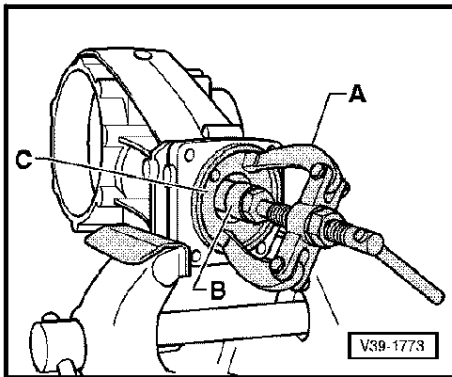
The final drive must be adequately supported (e.g. with V. A. G 1383 A) when slacking the drive pinion nut; otherwise the threaded holes in the housing can be damaged.

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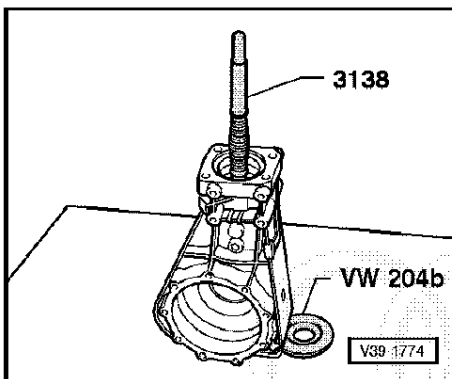




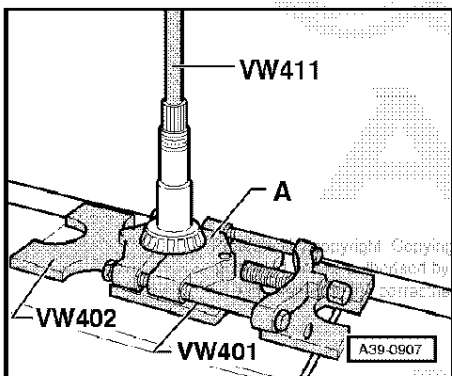
◀ Fig.3 Pressing drive pinion out of inner race for small taper roller bearing



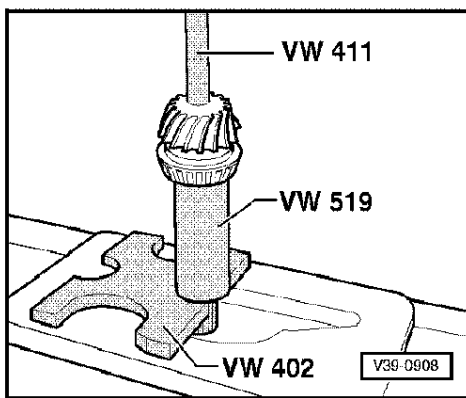
◀ Fig.4 Pulling out outer race for small taper roller bearing
 _ A - Counter support, e.g. Kukko 22/1
 _ B - Internal puller 46 ... 58 mm, e.g. Kukko 21/7
 _ C - Assembly ring 10-9



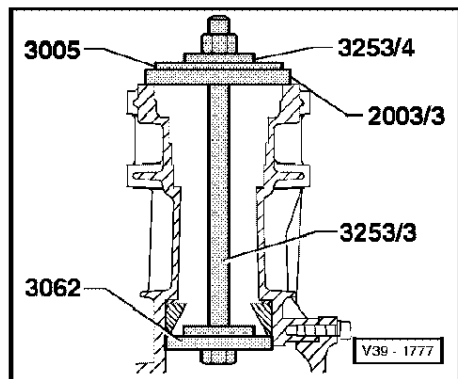
◀ Fig.5 Driving out outer race for large taper roller bearing
 - After removing check shims for damage.



◀ Fig.6 Pressing inner race for large taper roller bearing off drive pinion
 _ A - Separating device 22 ... 115 mm, e.g. Kukko 17/2



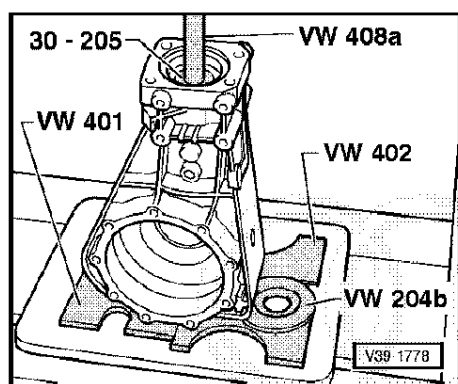
- ◀ **Fig.7 Pressing inner race for large taper roller bearing onto drive pinion**
 – Heat bearing to approx. 100 °C, fit in position and press home.



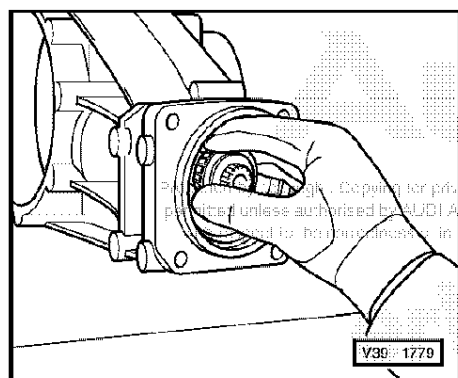
- ◀ **Fig.8 Pulling in outer race for large taper roller bearing**
 – Insert predetermined shim "S3" for drive pinion => Page 39-149.

Note:

Marking "Oben" (top) on thrust plate 3253/4 faces towards nut on fitting appliance.



- ◀ **Fig.9 Pressing in outer race for small taper roller bearing**
 – Oil outer race
 – Before pressing in, locate outer race in position with VW 295 and 30-205.



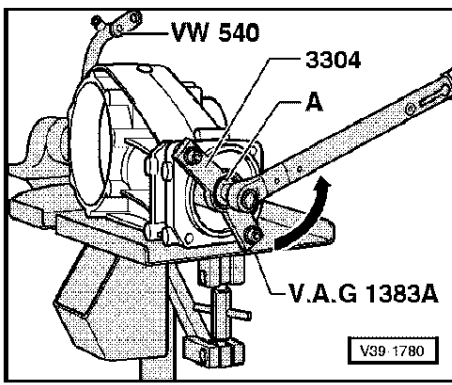
- ◀ **Fig.10 Fitting inner race for small taper roller bearing onto drive pinion**

- Insert drive pinion with new spacer sleeve.

Caution:

Wear protective gloves.

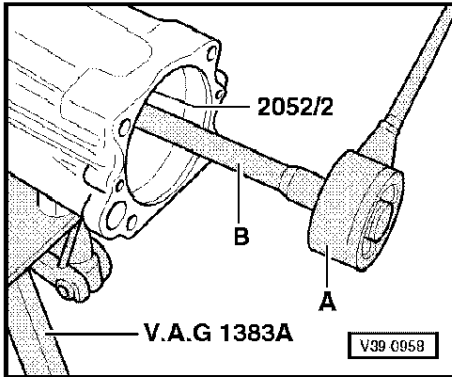
- Heat inner race for small taper roller bearing to approx. 100°C.
 – Press drive pinion upwards and fit bearing onto drive pinion as far as stop.



◀ Fig.11 Tightening drive pinion nut and setting frictional torque

Notes:

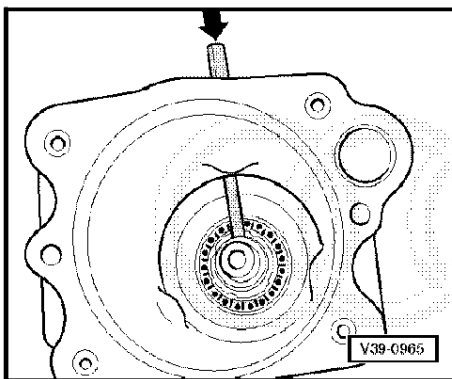
- ◆ Only increase tightening torque slowly and read-off frictional torque frequently. If the specified frictional torque is exceeded, the spacer sleeve must be replaced and the adjustment repeated. It is not possible to reuse a spacer sleeve that has been excessively compressed.
- ◆ The final drive must be supported (e.g. with V.A.G 1383 A) when tightening the drive pinion nut, otherwise the threaded holes in the housing will be damaged.



◀ Fig.12 Measuring frictional torque

- _ A - Torque gauge, commercially available, 0 ... 600 Ncm
- _ B - Socket (32 mm)
- The following frictional torques should be set:

New bearings	Used bearings
250 ... 300 Ncm	30 ... 60 Ncm



◀ Fig.13 Locking drive pinion nut

- Peen drive pinion nut with punch.

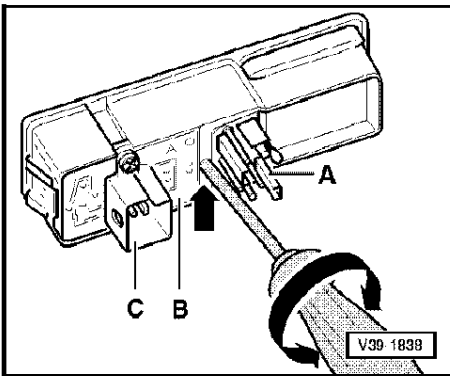


Servicing differential lock actuator

Removing and installing switch for differential lock

Notes:

- ◆ The switch for the differential lock is fitted in a trim panel in the centre console.
- ◆ Checking function of switch for differential lock
 - = > Current flow diagrams, electrical fault-finding and fitting locations binder; Model year 1992 >; Fault-finding programme No. 36
 - Carefully lever switch with trim panel out of centre console.
 - Disconnect wiring.
- ◀ - Insert a small screwdriver between switch -A- and conductor plate -B- -arrow-.
- Prise switch out of front catch by turning screwdriver.
- Take switch out of trim panel.
- Conductor plate -B- can be removed from trim panel together with plug housing -C-.



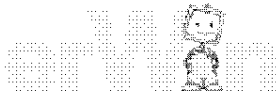
39-131

Routing hoses and pipes

Notes:

- ◆ Hoses and pipes are supplied as replacement parts in one colour only. When installing, cut hose or pipe to length and mark with a piece of adhesive tape of the appropriate colour (or identify with a written marking).
- ◆ Position and length of hoses and pipes:
 - = > Parts catalogue

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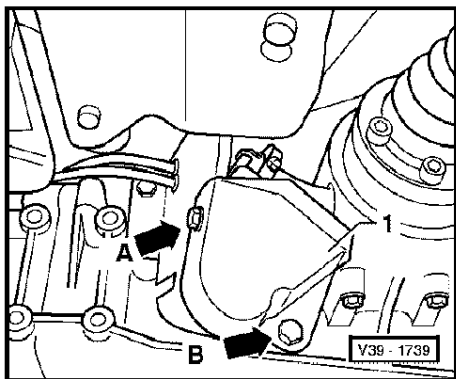
39-132

Removing and installing vacuum element

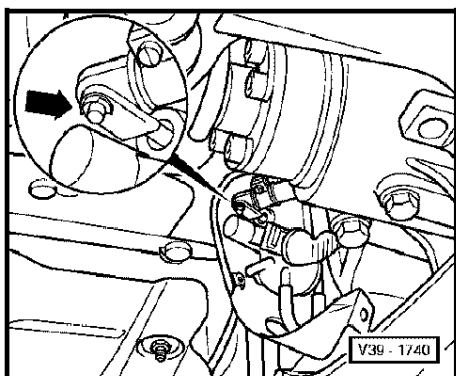
- Final drive installed

Removing

- Slacken double clamp and disconnect exhaust system
=> Avant RS2; Repair group 26; Removing parts of exhaust system =>
- Disengage main silencer and rear silencer from mountings.
- Unbolt heat shield -1- for differential lock actuator -arrows A and B-.

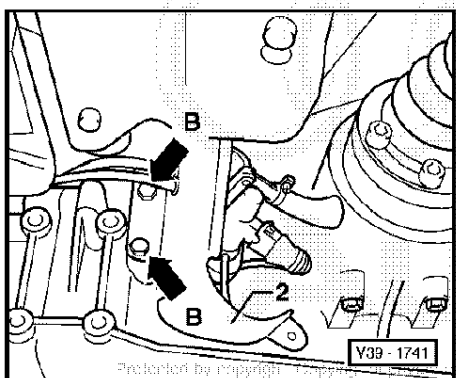


- Use a screwdriver to lever off circlip from connection between differential lock actuator and differential lock.
- Take out connecting pin from above.
- Unclip electrical wiring and hoses for differential lock actuator.



39-133

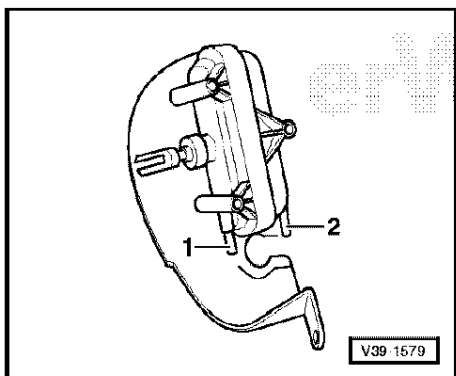
- Unbolt bracket -2- for vacuum unit and switch for differential lock on rear final drive -arrows B-.
- Pull vacuum hoses off vacuum unit – note colour coding.
- Unbolt vacuum unit from console.



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Installing

- Note colour coding of vacuum hoses:
 - Yellow hose to connection -1-
 - Blue hose to connection -2-
- Adjust clevis on vacuum unit
=> Page 39-139.

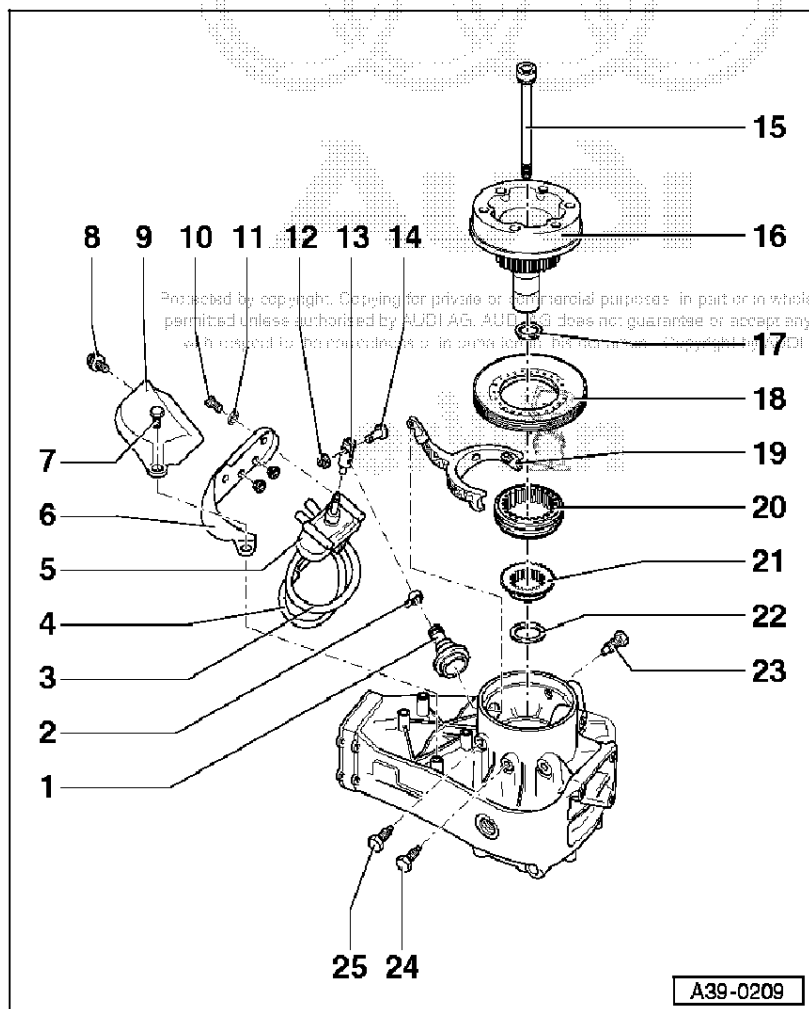


39-134

Tightening torques

Component	Nm
Heat shield for differential lock actuator to bracket M6	10
Bracket for vacuum unit to rear final drive M8	25
Vacuum unit to bracket M5	2.5
Double clamp on exhaust system	40

39-135

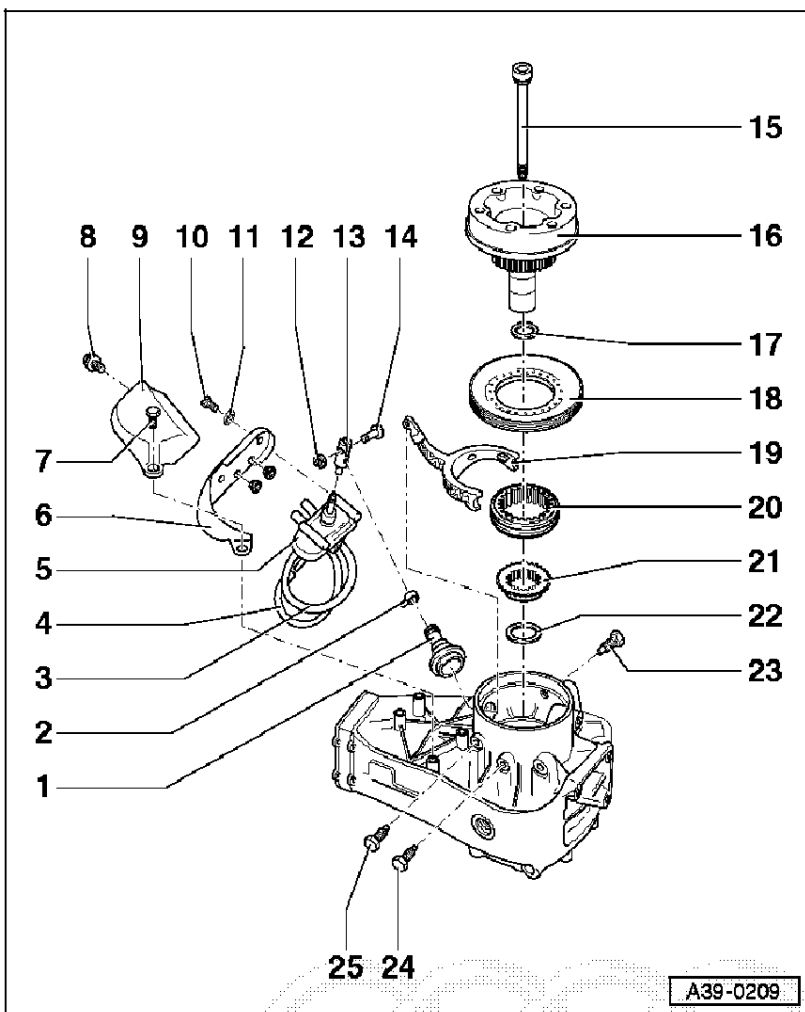


Dismantling and assembling differential lock

Notes:

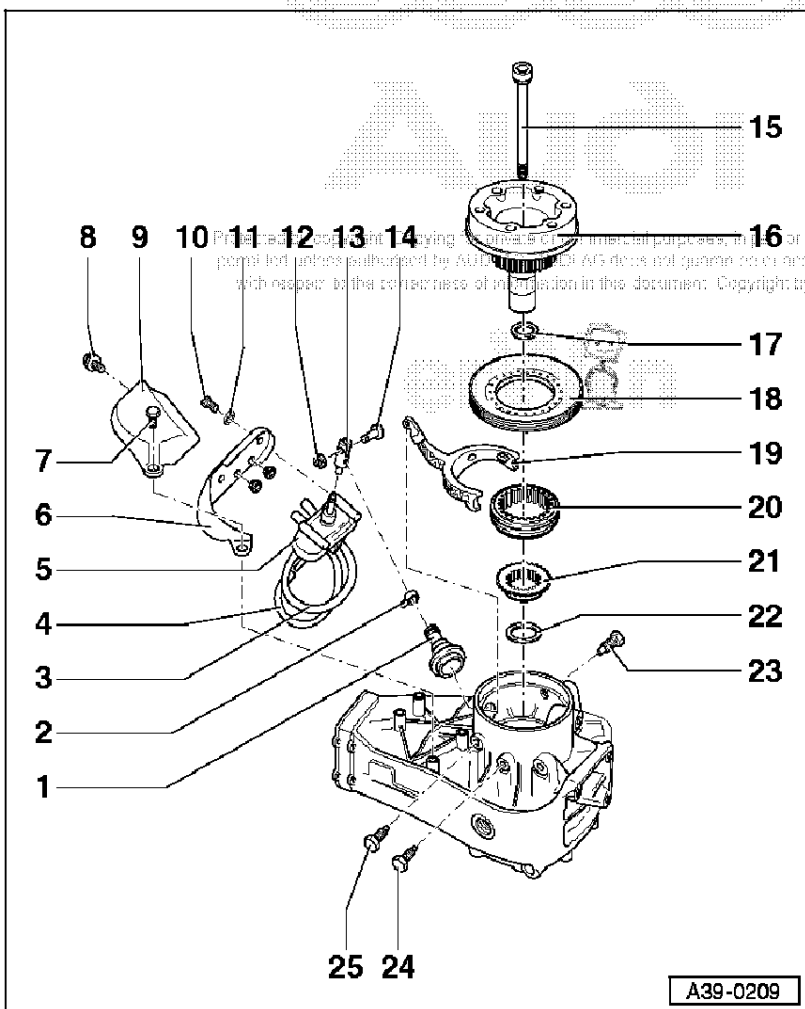
- ◆ Can be dismantled with final drive installed
- ◆ The differential lock in the rear final drive can be engaged at speeds up to 25 km/h via a control unit. It is disengaged automatically at speeds above 25 km/h.
- ◆ Fault-finding for the differential lock
=> Current flow diagrams, fault-finding and fitting locations binder; model year 1992 >; Fault-finding programme No. 36

39-136



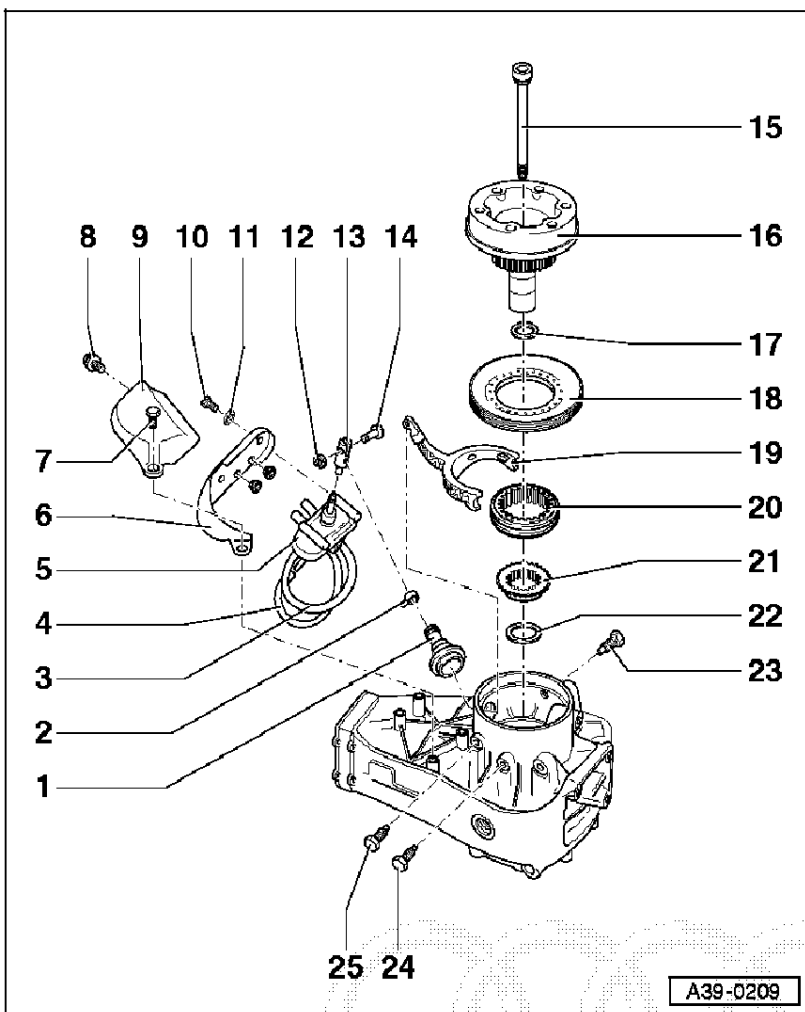
- 1 - **Boot**
 - ◆ To remove and install, remove bracket with vacuum element
=>Page 39-133
- 2 - **Clamp**
 - ◆ Secures boot to selector fork
- 3 - **Vacuum hose (yellow)**
 - ◆ Fit onto outer connection on vacuum unit
- 4 - **Vacuum hose (blue)**
 - ◆ Fit onto inner connection on vacuum unit
- 5 - **Vacuum unit**
 - ◆ Removing and installing
=>Page 39-133

A39-0209



- 6 - **Bracket**
 - ◆ For vacuum unit
- 7 - **Bolt - 10 Nm**
- 8 - **Bolt - 10 Nm**
- 9 - **Heat shield**
- 10 - **Bolt - 3.5 Nm**
 - ◆ Qty. 3
 - ◆ With corrugated washer
 - ◆ Secures vacuum unit to bracket
- 11 - **Grommet**
 - ◆ Qty. 2
- 12 - **Circlip**
 - ◆ Fit onto pin

A39-0209



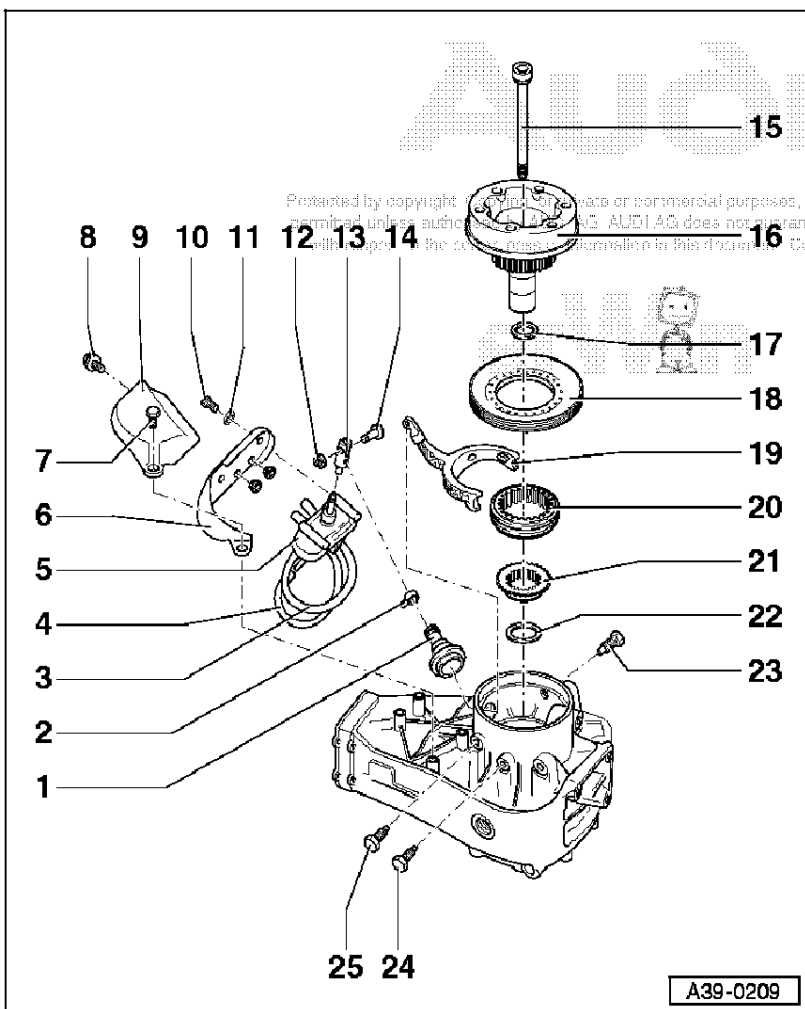
13 - Clevis

- ◆ Adjusting
- Final drive must be fully assembled
- Remove pin from selector fork
- Turn clevis so that operating travel of vacuum element moves selector fork all the way to its two end positions (trunnion bolt -Item 24- serves as the stop).

14 - Pin

- 15 - Taper head bolt - 10 Nm + 1/4turn (90°) further**

16 - Flange shaft, left



17 - Shim for flange shaft

- ◆ Take care not to lose shim when dismantling
- ◆ Determining thickness =>Page 39-143

18 - Seal

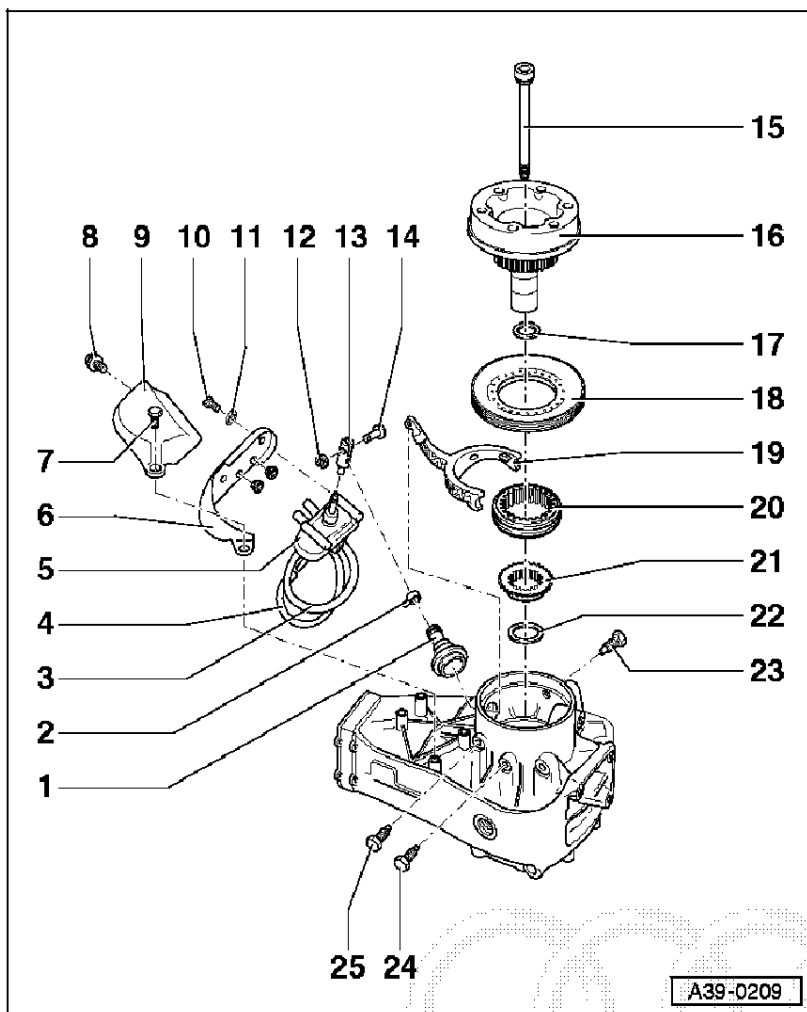
- ◆ Always renew
- ◆ Removing and installing =>Page 39-85

19 - Selector fork

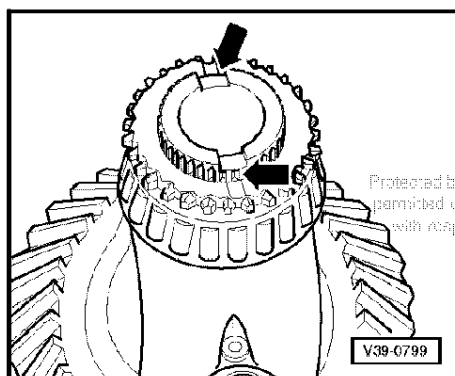
- ◆ Remove and install together with locking collar

20 - Locking collar

- ◆ Installation position: shoulder faces towards clutch body
- ◆ Remove and install together with selector fork



- 21 – Clutch body for differential lock
◆ Installation position = > Fig. 1
- 22 – Shim for clutch body
◆ Determining thickness = > Fig. 2
- 23 – Trunnion bolt – 35 Nm
◆ Guide for selector fork
- 24 – Trunnion bolt – 35 Nm
◆ Stop for selector fork
- 25 – Trunnion bolt – 35 Nm
◆ Guide for selector fork



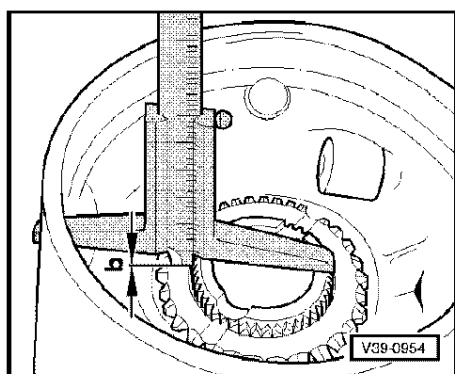
◀ Fig.1 Installation position of clutch body

Note:

Shown in illustration with differential removed.

Oil grooves -arrows- on differential and clutch body must be aligned.

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◀ Fig.2 Determining thickness of shim

- Measure distance -b-.
- Select required shim from table. Part numbers = > Parts catalogue

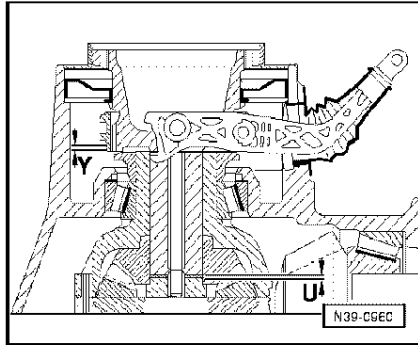
Distance -b-	Shim thickness (mm)
0.00 ... 4.10	no shim
4.11 ... 4.40	0.3
4.41 ... 4.70	0.6
4.71 ... 4.90	0.9

Adjusting left flange shaft

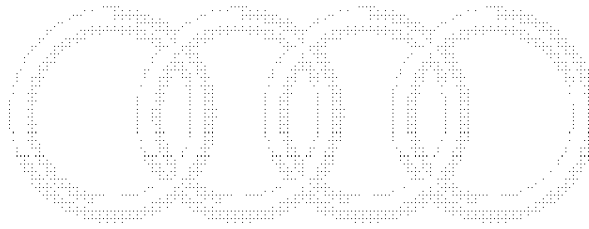
Notes:

- ◆ This adjustment is only required if the left flange shaft, the differential housing or the differential bevel gears are being replaced.
- ◆ The purpose of the adjustment is to obtain a clearance (-Y-) of 0.2 ... 0.5 mm between flange shaft and differential housing. This is necessary to ensure free running and reliable operation of the differential lock.

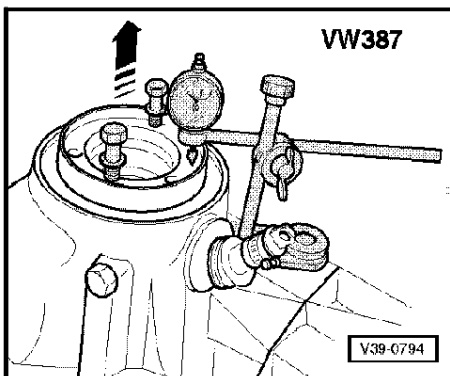
Determining shim "u"



- ◀ - Measure clearance -y- between flange shaft and differential housing as follows:



39-143



- ◀ - Secure dial gauge to rear final drive with universal dial gauge bracket VW 387.
- Press flange shaft in towards differential. Apply dial gauge to flange shaft and set to "0" with 1 mm preload.
- Pull out flange shaft in direction of arrow, and read off the clearance indicated.
- If clearance is too small, install correspondingly thicker shims; if clearance is too large, install correspondingly thinner shims.
- Select required shims from table. Part numbers = > Parts catalogue

Available shims

Shim thickness (mm)		
0.3	0.6	0.9

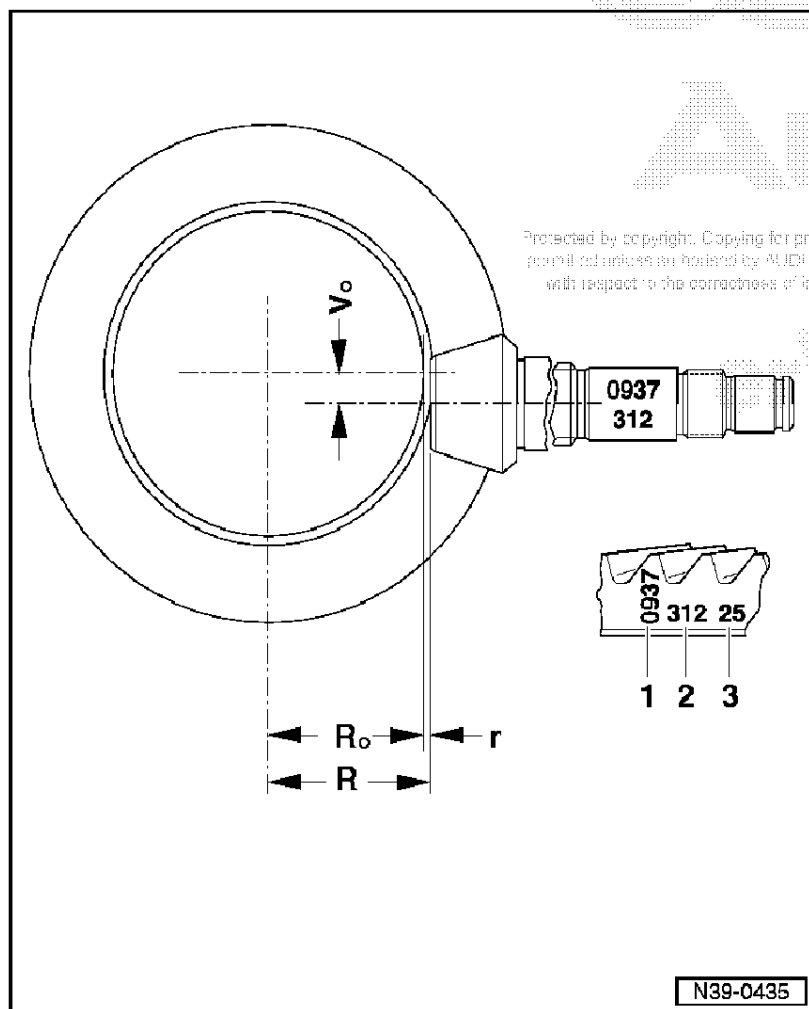
39-144

Adjusting drive pinion and crown wheel

General notes:

- ◆ Careful adjustment of the drive pinion and crown wheel is important for the service life and smooth running of the final drive. For this reason, the drive pinion and crown wheel are matched together during manufacture, and checked to ensure a good mesh pattern and quiet running in both directions of rotation. The position of quietest running is found by moving the drive pinion in an axial direction and at the same time lifting the crown wheel out of the zero-play mesh position by the amount necessary to maintain the backlash within the specified tolerance.
- ◆ The object of the adjustment is to reproduce the setting for quietest possible running, as obtained on the test machine in production.
- ◆ The deviation (tolerance) "r", which is related to the master gauge "Ro" is measured for the final drive sets supplied as replacement parts and marked on the outer circumference of the crown wheel. The final drive set (drive pinion and crown wheel) may only be replaced together as a matched pair.
- ◆ Observe the general repair instructions for taper roller bearings and shims.

39-145



Adjusting and marking of gear sets

1 – Identification "0937" signifies Oerlikon gear set with a ratio of 37:9.

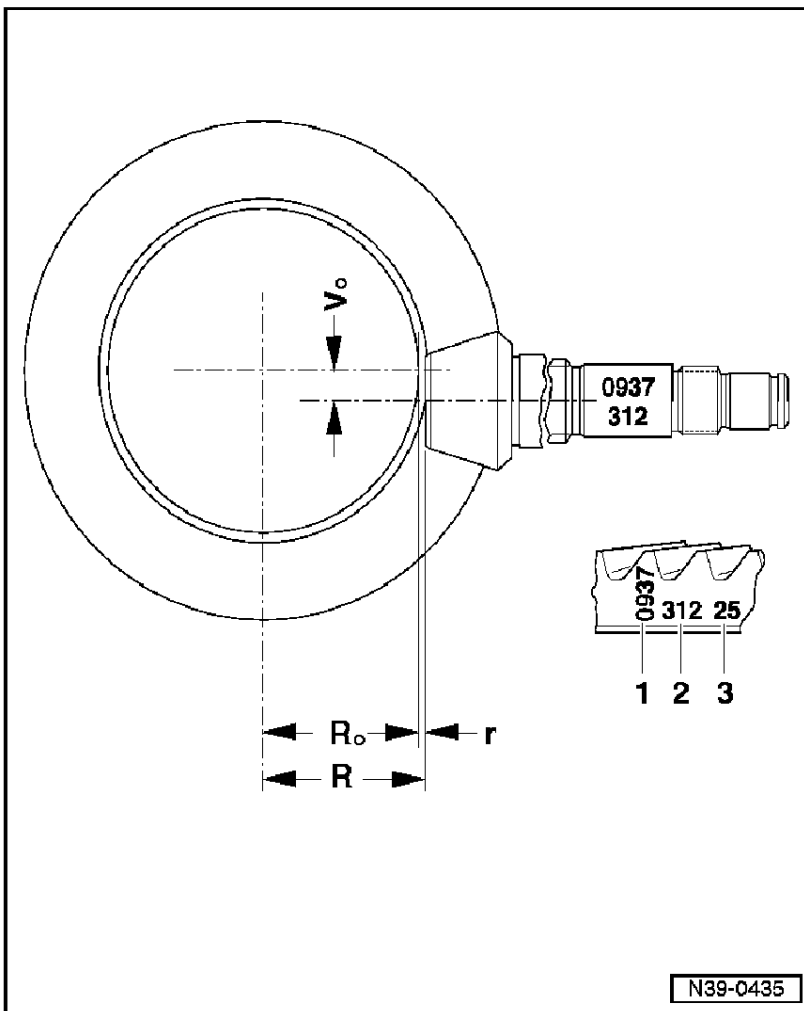
2 – Pairing number (312) of final drive set.

3 – Deviation (tolerance) "r" is based on the test machine master gauge used in the production. The deviation "r" is always given in 1/100 mm. Example: "25" signifies

$$r = 0.25 \text{ mm}$$

– Ro - Length of master gauge used on test machine
Ro = 53.15 mm

39-146



- R - Actual distance between centre axis of crown wheel and face of drive pinion at the point of quietest running for this particular gear set.
 $R = R_o + r$
- Vo - Hypoid offset

Recommended sequence for readjusting final drive set

The following work sequence is recommended to save time when the drive pinion and crown wheel have to be adjusted:

- 1.) Determine total shim thickness "Stotal" for "S1" + "S2" for the specified preload for taper roller bearings for differential.
- 2.) Determine total shim thickness "S3" to reproduce the installation position for the drive pinion determined on the test machine in production.
- 3.) Distribute total shim thickness "Stotal" for "S1" + "S2" so that the specified backlash exists between crown wheel and drive pinion.

Note:

Overview of components and shims => Page 39-150.

Adjustment overview

Note:

If repairs have been carried out on the final drive it is only necessary to adjust the drive pinion or final drive set if components have been renewed which have a direct effect on the adjustments of the final drive. Refer to the following table to avoid unnecessary adjustments:

Part renewed: ▼	to be adjusted:			
	Crown wheel "S1" + "S2" ¹⁾ => Page 39-162	Drive pinion "S3" ¹⁾ via deviation "r" => Page 39-151	Backlash 0.12 ... 0.22 mm => Page 39-167	Left flange shaft => Page 39-143
Final drive housing	X	X	X	
Differential housing	X		X	X
Taper roller bearing for drive pinion		X	X	
Taper roller bearings for differential	X		X	
Final drive set ²⁾	X	X	X	
Cover for final drive	X		X	
Flange shaft				X
Differential bevel gears				X

¹⁾ Shims; installation position => Page 39-150.

²⁾ Drive pinion and crown wheel; only renew together.

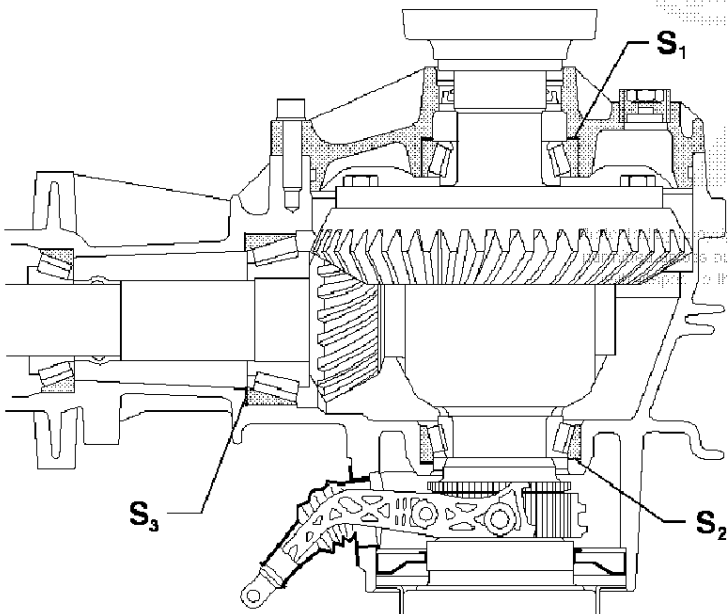
39-149

Position of shims

Note:

Adjustment overview when renewing individual components of final drive => Page 39-149.

- S1 - Adjustment shim for crown wheel in cover for final drive
- S2 - Adjustment shim for crown wheel in final drive housing
- S3 - Adjustment shim for drive pinion in final drive housing



V39-0850

39-150

Adjusting drive pinion

Notes:

- ◆ Before adjusting drive pinion, adjust crown wheel (determine total shim thickness "Stotal" for shims "S1" + "S2" => Page 39-162.
- ◆ Re-adjustment of the drive pinion is only necessary if the final drive set, taper roller bearing for drive pinion or housing for final drive is replaced => Page 39-149.

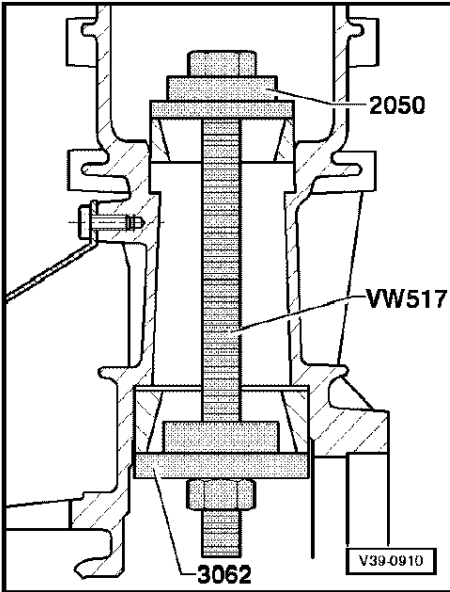
Determine thickness of shim "S3"

(Setting preload of taper roller bearings for drive pinion)

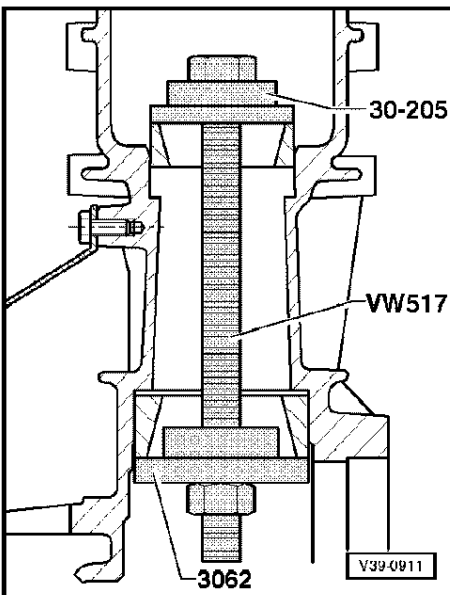
- Secure final drive on a repair stand.
- Pull outer race for large taper roller bearing into housing without shim.

Note:

Thoroughly oil bearing race and bearing seat in housing.



39-151



- Pull outer race for small taper roller bearing into housing.

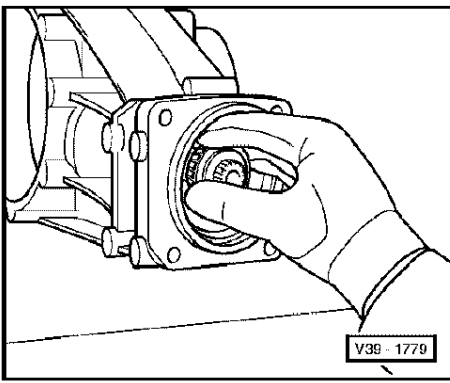
Note:

Thoroughly oil bearing race and bearing seat in housing.

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39-152



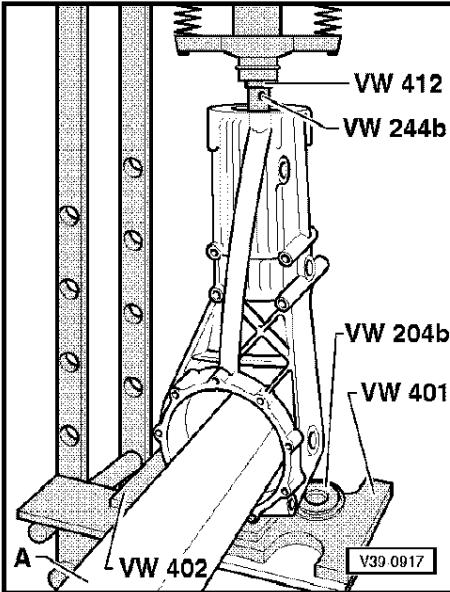
- ◀ – Insert drive pinion without spacer sleeve.
- Heat inner race for taper roller bearing to approx. 100 °C and fit onto drive pinion.

Caution

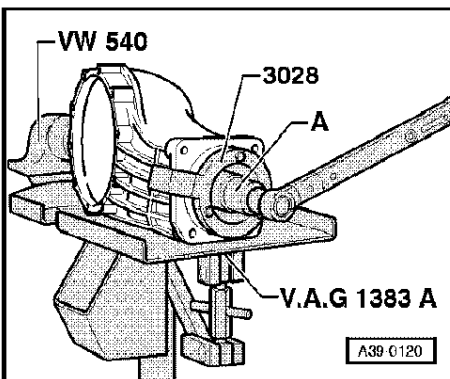
Wear protective gloves.

Note:

Only install spacer sleeve for final frictional torque measurement (after determining shim "S3").



- ◀ – Press taper roller bearing fully home.
- A - Wooden block used to support drive pinion

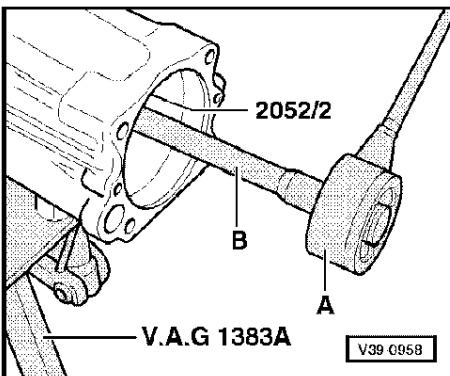


- ◀ – Tighten drive pinion nut until the following friction torque is obtained.

New bearings	Used bearings
250 ... 300 Ncm	30 ... 60 Ncm

Note:

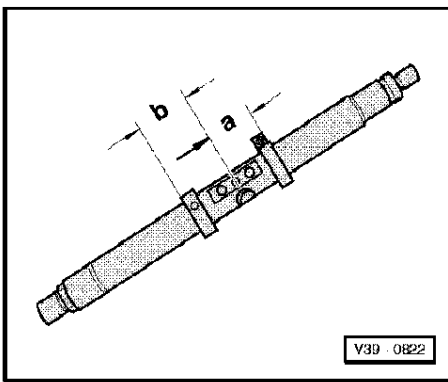
The final drive must be supported (e.g. with V.A.G 1383 A) when tightening the drive pinion nut otherwise the threaded holes in the housing will be damaged.



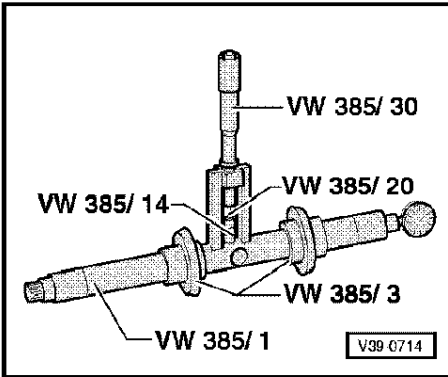
- ◀ – A - Torque gauge, commercially available, 0 ... 600 Ncm
- B - Extension with 32 mm socket

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- ◀ - Set adjustment ring of universal mandrel VW 385/1.
 - Distance "a" = 75 mm
- Set sliding adjustment ring.
 - Distance "b" = 35 mm

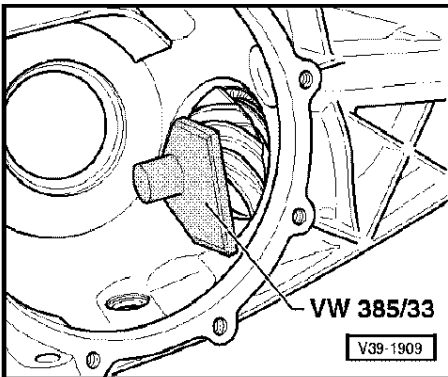


- ◀ - Assemble universal mandrel as illustrated:
 - Dial gauge extension VW 385/20 = 3 mm long
- Set universal master gauge VW 385/30.
 - $R_o = 53.15$ mm
- Set dial gauge (3 mm measuring range) to "0" with 2 mm pre-load.

— 39-155 —

Note:

Before performing following measurements turn drive pinion at least five turns in both directions, so that the taper roller bearings settle. Otherwise a false reading will be obtained.

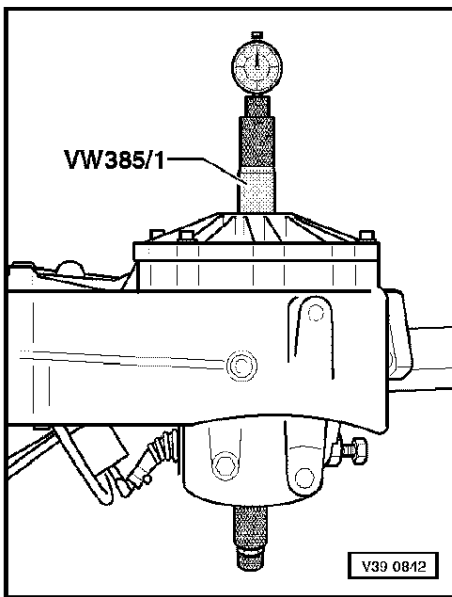


- ◀ - Place end measuring plate VW 385/33 onto drive pinion head.
- Remove master gauge VW 385/30 and insert mandrel into housing.
 - The centring disc 385/3 faces towards cover for final drive
- Fit cover for final drive and tighten 4 bolts.
- Using the adjustable ring, move 2nd centring disc out as far as possible so that the mandrel can still just be turned by hand.

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— 39-156 —



Determining dimension "e"

- Turn mandrel until the dial gauge point touches the end measuring plate on drive pinion head, then measure maximum deflection (return point). The measured value is dimension "e" (in red scale).
- Measurement in following example: "e" = 1.60 mm

Note:

Dimension "e" is required to determine thickness of shim "S3".

- After removing universal mandrel, check once again whether the dial gauge reads "0" with 2 mm preload when master gauge VW 385/30 is in place – otherwise repeat the measurement.

Determining shim thickness "S3"

Formula:

$$\begin{aligned}
 \text{"S3"} &= \text{"e"} - \text{"r"} \\
 e &= \text{Measured value} \Rightarrow \text{Page 39-157} \\
 r &= \text{Deviation (tolerance): marked on crown wheel in 1/100 mm}
 \end{aligned}$$

Example:

	Determined value "e"	1.60 mm
-	Deviation "r"	0.42 mm
=	Thickness of shim "S3"	1.18 mm

- Determine shim(s) from table. Part numbers
- = > Parts catalogue

The following shims are available for "S3"

Shim thickness (mm) ¹⁾		
0.95	1.15	1.35
1.00	1.20	1.45
1.05	1.25	1.50
1.10	1.30	1.55

¹⁾ Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

- Remove universal mandrel.



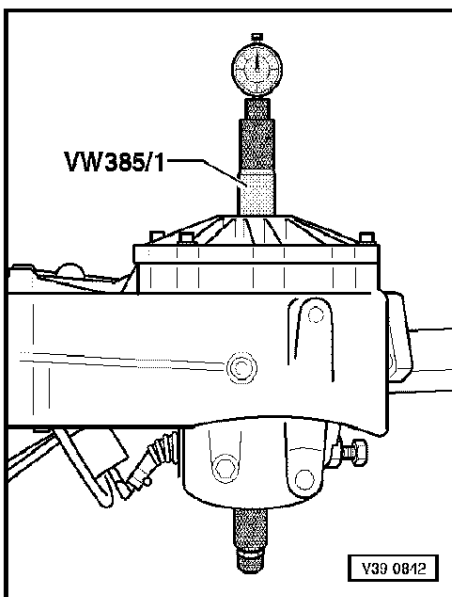
- Remove drive pinion and outer race for large taper roller bearing and reinstall with determined shim(s) and spacer sleeve => Page 39-121.
- Insert inner race for small taper roller bearing and tighten drive pinion nut until specified frictional torque is achieved => Page 39-121.

Note:

Increase tightening torque slowly and check friction torque at regular intervals. If the specified friction torque is exceeded, the spacer sleeve must be renewed. A spacer sleeve which has been compressed too far cannot be reused.

- Set to following frictional torques:

New bearings	Used bearings
250 ... 300 Ncm	30 ... 60 Ncm



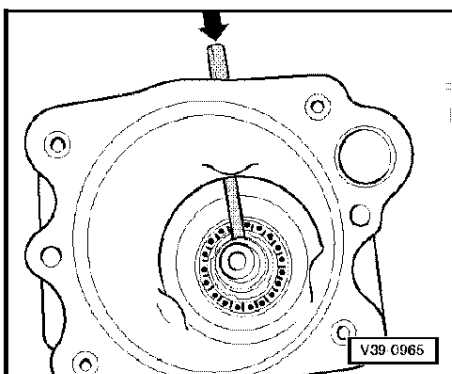
Performing check measurement

Checking dimension "r"

- ◀ - Turn drive pinion at least 5 turns in both directions.
- ◀ - Insert universal mandrel and perform check measurement.
 - If the shims have been correctly selected, the dial gauge should now show the value of "r" as marked on the crown wheel, reading anti-clockwise in the red scale, within a tolerance of ± 0.04 mm.

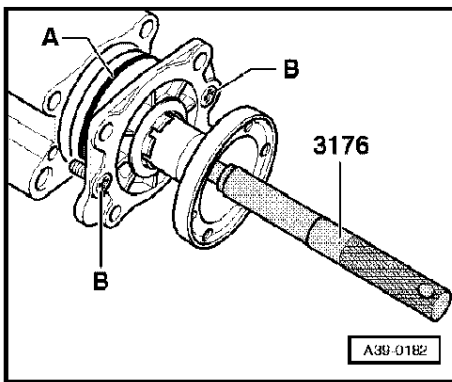


- ◀ - Peen drive pinion nut by applying a punch through the oil drain hole.



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- ◀ – Renew O-ring -A- in cover.
- Install flange for propshaft and cover for final drive.
- Drive in flange shaft with drift 3176.
- Tighten 2 countersunk bolts -B- for cover to 25 Nm.
- Measure radial run-out at flange for propshaft and mark accordingly => Page 39-63.

Adjusting crown wheel

(Adjusting differential)

Repairs after which the crown wheel must be adjusted

=> Page 39-149.

Determining total shim thickness "Stotal" for shims "S1" + "S2"
(Setting preload of taper roller bearing for differential)

● Drive pinion removed or crown wheel dismantled from differential housing

– Remove seal and left and right differential outer races for taper roller bearings and take out shims => Page 39-119 and 39-120.

– Drive left outer race for taper roller bearing for differential (housing side) with shim "S2" into final drive housing => Page 39-119. For measurement purposes an "S2*" shim 1.00 mm thick (2 shims, 1 of 0.80 mm and 1 of 0.20 mm).

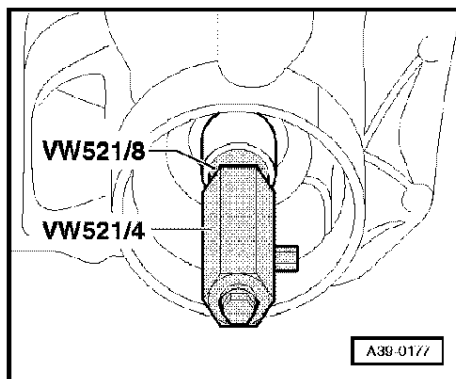
Note:

For measurement purposes a shim "S2" of 1.0 mm is initially inserted which will be designated "S2" in the following. After determining the backlash "S2*" will be replaced by the correct "S2".*

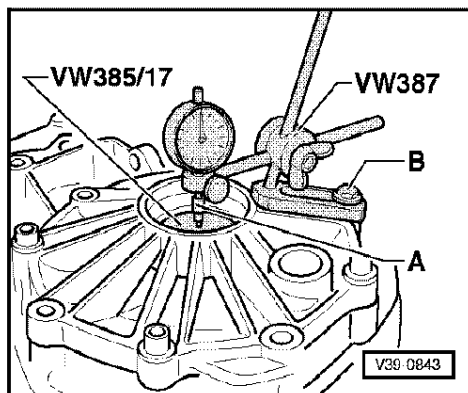
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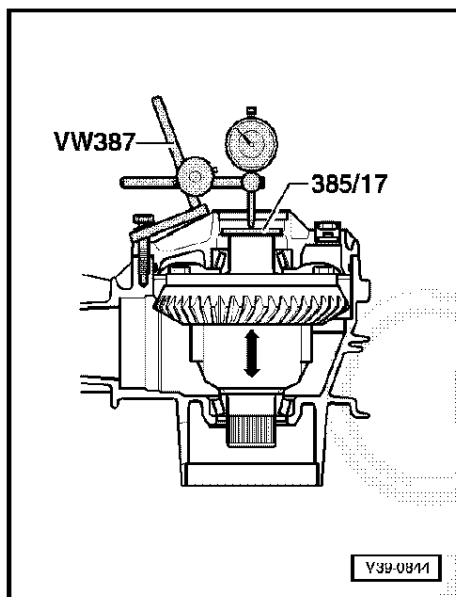
- Drive outer race for right-hand taper roller bearing for differential (cover side) without shim in onto stop => Page 39-120.



- Insert differential into housing. The crown wheel is positioned on the right side (cover side).
- ◀ - Fit cover and tighten bolts to 25 Nm.
- Install special tools VW 521/4 and 521/8 onto housing side in differential housing.
- Turn cover side of differential housing upwards.
- Turn differential 5 turns in both directions to settle the taper roller bearing.



- Place measuring plate VW 385/17 onto differential.
- ◀ - Assemble measuring tools.
 - _ A - Dial gauge extension approx. 30 mm long
 - _ B - Hexagon bolt M8 x 45
- Set dial gauge extension onto centre of plate.
- Set dial gauge (3 mm measuring range) to "0" with 1 mm pre-load.



- ◀ - Lift differential without turning; read off play on dial gauge and note.
 - Measurement in following example: 0.50 mm

Note:

If the measurement has to be repeated, the differential must be turned five turns in each direction again so that the taper roller bearings settle.

Formula:

$$\text{"Stotal"} = \text{"S2*"} + \text{measurement} + \text{bearing preload}$$

Example:

Inserted shim(s) "S2*"	1.00 mm
+ Measured value	0.50 mm
+ Bearing preload (constant)	0.30 mm
= Total shim thickness "Stotal" for shims "S1" + "S2"	1.80 mm



Determining thickness of shim "S1"

Notes:

- ◆ The preliminary adjustment shim "S1*" will be replaced with the final shim "S1" after determining the backlash.
- ◆ The total shim thickness "Stotal" remains unchanged.

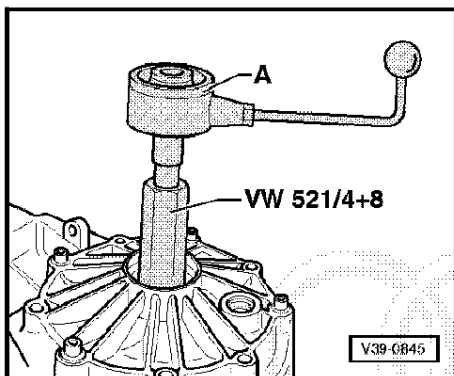
Formula:

$$\text{"S1*"} = \text{"Stotal"} - \text{"S2*"}$$

Example:

	Total shim thickness "Stotal" for shims "S1" + "S2"	1.80 mm
-	Inserted shim(s) "S2*"	1.00 mm
=	Thickness of shim "S1*"	0.80 mm

- Determine shim(s) from table => Page 39-170.



Measuring frictional torque (check)

- Drive pinion removed
- Differential fitted with shims "S1*" and "S2*"
 - Fit torque gauge 0 ... 600 Ncm -A- onto differential.
 - Read off frictional torque.

Frictional torque specifications:

New bearings	Used bearings
250 ... 300 Ncm	30 ... 60 Ncm

Note:

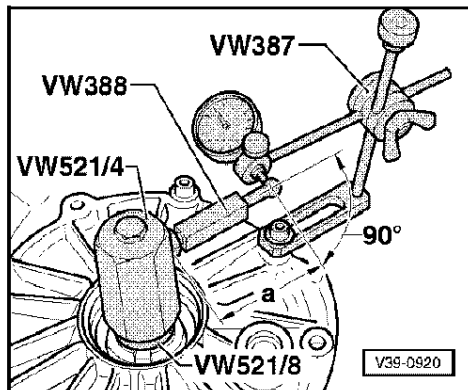
If the final drive set (drive pinion and crown wheel) is being re-adjusted, the adjustment of the drive pinion should be performed now, and the adjustment checked => Page 39-151.



Adjusting backlash

(Positioning crown wheel in final drive housing)

- Drive pinion with shim "S3" installed
- Differential with shims "S1*" + "S2*" installed
- Insert differential in final drive housing, install cover and tighten all bolts to 25 Nm.



- Turn differential 5 turns in both directions to settle the taper roller bearings.
- Assemble measuring equipment.
- Use dial gauge extension VW 382/10 (6 mm flat).
- Set measuring lever VW 388 to dimension "a" = 60 mm.
- Determine play between the teeth flanks as follows:
 - Turn crown wheel until it makes contact with a tooth flank (end of backlash travel).
 - Set dial gauge to "0" with 1 mm preload.

39-167

- Turn crown wheel back until lying against an opposite tooth flank (backlash).
- Read off backlash and note value.
- Turn crown wheel through 90° and repeat measurements a further 3 times.

Note:

If the individual measurements differ by more than 0.06 mm from each other, the installation of the crown wheel or the final drive set itself is not correct. Check installation, replace final drive set if necessary.

Determining average backlash

Example:

1st measurement	0.28 mm
+ 2nd measurement	0.30 mm
+ 3rd measurement	0.30 mm
+ 4th measurement	0.28 mm
= Sum of measured values	1.16 mm

- **Result:** The average backlash is $1.16 / 4 = 0.29$ mm

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39-168

Determining thickness of shim "S2"

Formula:

$$\text{"S2"} = \text{"S2*" - backlash + lift}$$

Example:

	Inserted shim "S2*"	1.00 mm
-	Average backlash	0.29 mm
+	Lift (constant)	0.15 mm
=	Thickness of shim "S2"	0.86 mm

- Determine shim from table. Part numbers

= > Parts catalogue

The following shims are available for "S2"

Shim thickness (mm) ¹⁾		
0.15	0.60	1.50
0.20	0.65	1.65
0.25	0.80	
0.55	1.35	

¹⁾ Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

39-169

Determining thickness of shim "S1"

Formula:

$$\text{"S1"} = \text{"Stotal"} - \text{"S2"}$$

Example:

	Total shim thickness "Stotal" for "S1" + "S2"	1.80 mm
-	Thickness of shim "S2"	0.86 mm
=	Thickness of shim "S1"	0.94 mm

- Determine shim(s) from table. Part numbers

= > Parts catalogue

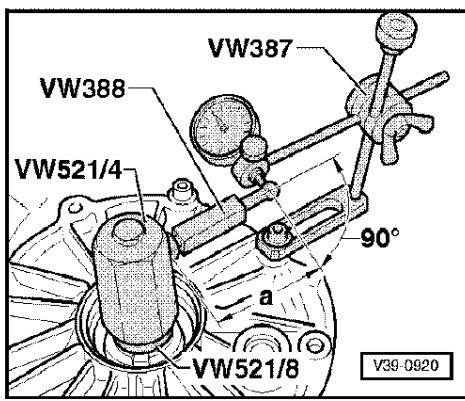
The following shims are available for "S1"

Shim thickness (mm) ¹⁾		
0.15	0.50	1.50
0.20	0.80	
0.25	1.00	

¹⁾ Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

39-170



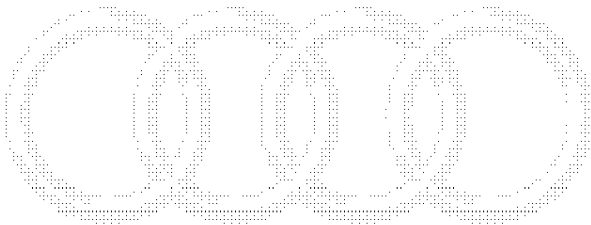


◀ **Performing check measurement**

- Drive pinion with shim "S3" installed
- Differential with shims "S1" + "S2" installed
 - Turn differential 5 turns in both directions so that the taper roller bearings settle.
 - Measure backlash four times on circumference.
 - Specifications: 0.12 ... 0.22 mm

Notes:

- ◆ If the backlash lies outside the tolerances, the adjustments must be repeated, but the total shim thickness "Stotal" must remain unchanged.
- ◆ The individual measurements must not differ by more than 0.06 mm from each other.



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Workshop Manual Audi 80 1992 ►

Engine code	ABY				
Booklet	Motronic Fuel Injection and Ignition System (5-Cylinder) Edition 09.92				

Edition 09.92

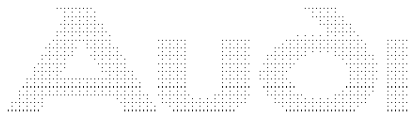


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28 Ignition system	Page
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- Technical data of ignition system	28- 4
- Safety precautions regarding Motronic system	28- 6
- Testing ignition coils, spark plug connectors and power output stage	28- 8
- Testing ignition timing sender	28-13
- Testing engine speed sender	28-15
- Testing intake air temperature sender	28-18
- Replacing intake air temperature sender	28-20
- Testing coolant temperature sender	28-21
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- Testing knock sensors	28-25
- Testing Hall sender	28-27
- Basic setting of Hall sender	28-29



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Self-diagnosis of Motronic system

Technical data of self-diagnosis:

Memory	
• Permanent memory	yes
• Volatile memory	no
Data output	
• Rapid data transfer	yes
• Additional flash code output at CARB lamp	no
Final control diagnosis	yes
Engine basic setting	yes
Reading measured value block	yes
Reading individual measured values	no
Fitting locations of components	⇒ Repair Group 24

The Motronic control unit (-J220) features self-diagnosis. If faults occur in the monitored sensors or components, these are stored in the fault memory with an indication of the type of fault. Faults which occur sporadically are additionally identified as such.

01-1

The Motronic control unit analyses the information and distinguishes between different types of faults ⇒ Fault table page 01-12, and stores these until the contents of the fault memory are erased or after not more than 50 engine starts.

In addition, the Motronic control unit is equipped with final control diagnosis for 8 control elements ⇒ page 01-44.

Notes:

- *Final control diagnosis can only be performed when the engine is not running.*
- *By contrast, the fault memory should be interrogated, if possible, with the engine running.*

The possibilities of self-diagnosis can only be utilized with the fault reader V.A.G. 1551.

In Repair Group 01 only operating mode 1 with V.A.G 1551 is described.

Note regarding fault recognition:

If a fault condition exists for longer than a certain time, the fault is stored as a static fault. If the fault condition no longer exists for a certain time, the fault is classified as a sporadic fault. This procedure is repeated constantly.

01-2

- Conversion of a fault from a static to a sporadic fault is only done if the fault no longer exists for a certain time.
- If the fault no longer occurs within the next 50 engine starts, this sporadic fault is automatically erased.

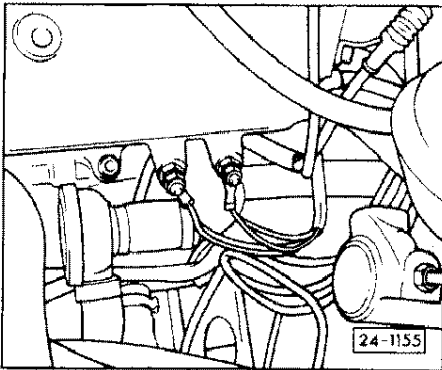
Test requirements

- Fuse 21 in order.
- Fuel pump relay in order.

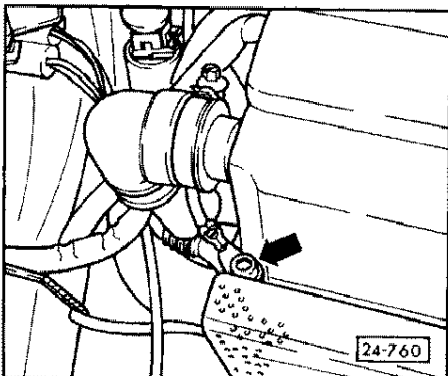
Checking engine earth connections

Before interrogating the fault memory, performing final control diagnosis, testing wiring and replacing components, check the following earth connections for signs of corrosion and poor connection, repair if necessary:

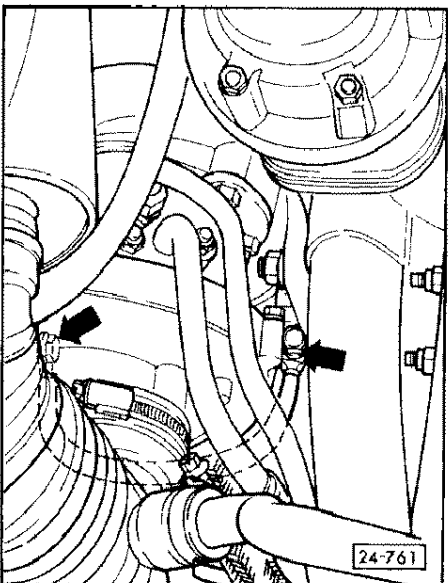
- ▶ • Power earth cable (thick cables)
- ▶ • Electronic earth cable (thin cables)



01-3

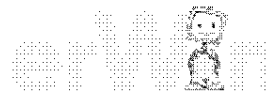


- ▶ • Earth connection for ignition coils at rear right of cylinder head cover.

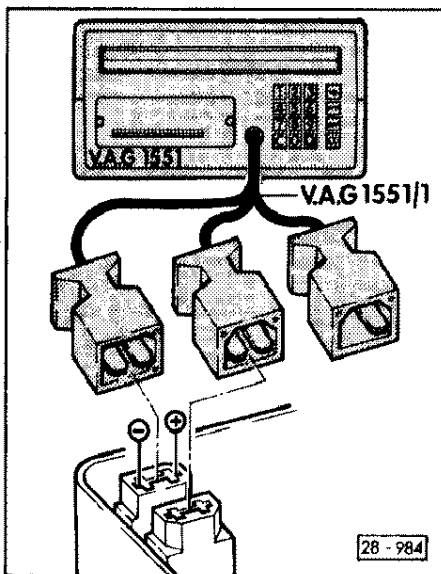


- ▶ • Attachment points of earth cable between engine and right side member.

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01-4



V.A.G self-diagnosis HELP
 1 – Rapid data transfer*
 2 – Flash code output*

Interrogating and erasing fault memory

Test requirements:

- Fuses –S28 and –S24 for engine in auxiliary fuse carrier in order.
- Fuse –S21 in order.
- Fuel pump relay in order.

Note:

The fault memory cannot be erased until after it has been interrogated.

- ◀ – Connect fault reader with diagnostic cable V.A.G 1551/1 to the diagnostic sockets in the electrical centre as follows:
 - Remove cover from the electrical centre in the plenum chamber.
 - **Black** connector to "**black**" diagnostic socket.
 - **White** connector to "**white**" diagnostic socket.
 - **Blue** connector is not required.
- ◀ Readout in display:
 - * appears alternately
 - If no readout appears in the display, test voltage supply for black diagnostic socket ⇒ page 01–69.

01–5

Notes:

- *Additional operating information can be retrieved by pressing the HELP key of V.A.G 1551.*
- *The → key is used for advancing within the programme.*
- Run engine, otherwise crank engine with starter for at least 5 seconds **without** then switching off the ignition.
- Switch on printer with the Print key (indicator lamp in the key lights up).
- Press key 1 for the "Rapid data transfer" mode.

Rapid data transfer HELP
 Enter address word XX

- ◀ Readout in display:

Note:

After entering the address word 00 and confirming with the key Q, an automatic test run is performed (interrogation of fault memories of all systems with data transfer).

- Press keys 0 and 1.
 (The address word "Engine electronics" is entered with 01).

Rapid data transfer Q
 01 – Engine electronics

- ◀ Readout in display:

- Confirm entry with the key Q.

Rapid data transfer
 Tester sends address word 01

- ◀ Readout in display:

01–6

Rapid data transfer HELP
Control unit does not answer!

- ◀ If the following appears in the display:
 - A list of the possible causes of faults can be printed out by pressing the HELP key.

Notes:

- Test cable connection of "white" diagnostic socket ⇒ page 01-69.
- Control unit faulty ⇒ Fault table, page 01-12 under fault code 65535.
- Test voltage supply of Motronic control unit ⇒ Repair Group 28.

Rapid data transfer
Fault in communication buildup

- ◀ If the following appears in the display:

Notes:

- On vehicles with several systems with "Rapid data transfer" self-diagnosis, separate cable connection between the individual systems ⇒ page 01-68.
- Vehicles only with faulty Motronic control unit ⇒ Fault table, page 01-12 under fault code 65535.

Rapid data transfer HELP
L wire not switching to earth

- ◀ If one of the 4 faults appears in the display:
 - A list of the possible causes of faults can be printed out by pressing the HELP key.

01-7

Rapid data transfer HELP
L wire not switching to positive

or

Notes:

- Test cable connection of diagnostic sockets ⇒ page 01-69.

Rapid data transfer HELP
K wire not switching to earth

or

- On vehicles with several systems with "Rapid data transfer" self-diagnosis, separate cable connection between the individual systems ⇒ page 01-69.
- Vehicles only with control unit for diesel direct injection system ⇒ Fault table, page 01-12 under fault code 65535.

Rapid data transfer HELP
K wire not switching to positive

- After rectifying the possible causes of faults, once again enter the address word 01 for "Engine electronics" and confirm with the key Q.

895 907551 2.21 R5 MOTR. RHV HS D01
Coding 01

- ◀ The control unit identification appears in the display.

- Explanation of display: Interrogating control unit version with V.A.G 1551 ⇒ page 01-86.

- Press → key.

01-8

Rapid data transfer HELP
Select function XX

◀ Readout in display:

Note:

A list of the possible causes of faults is printed out after pressing the HELP key.

- Press keys 0 and 2.
(The function "Interrogate fault memory" is selected with 02).

Rapid data transfer Q
02 – Interrogate fault memory

◀ Readout in display:

- Confirm entry with the key Q.

X faults recognized!
Readout in display:

◀ The number of stored faults or "No fault recognized" appears in the display.

Notes:

or

- If the printer is switched on, the stored faults are displayed and printed out one after the other.
- If the printer is switched off, the → key must be pressed in order to display the next fault.
- Fault code 00513 engine speed sender is not always output with ignition on and engine running. This fault display should be ignored in this state. The fault should be heeded after an unsuccessful attempt at starting (engine does not start) without then switching off the ignition.

No fault recognized!

- After displaying and printing out the last fault, press → key.

Note:

If a complaint exists and has not been recognized by self-diagnosis, perform further fault finding on the basis of the fault table from the "Fault Finding Engine" binder.

Rapid data transfer HELP
Select function XX

◀ Readout in display:

- Press keys 0 and 5.
(The fault memory is erased with 05).

Rapid data transfer Q
05 – Erase fault memory

◀ Readout in display:

- Confirm entries with the key Q.

Important!
Fault memory was not interrogated.

◀ If the following appears in the display:

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If, for example, the ignition was switched off or the engine left running between interrogating and erasing fault memory, the fault memory is then not erased.

- Adhere precisely to the sequence of operations, i.e. first of all interrogate fault memory.

Rapid data transfer
Fault memory is erased!

← Readout in display:

- Press → key.

Rapid data transfer HELP
Select function XX

← Readout in display:

- Rectify faults printed out on the basis of the fault table ⇒ page 01-12.
- Interrogate and erase fault memory (this ensures that faults which were stored during rectification of faults, e.g. as a result of unplugging connectors, are erased).
- Perform a road test lasting at least 5 minutes.
- Once again interrogate the fault memory as a check.

Notes:

- After entering the address word 00, the fault memories of all the systems with rapid data transfer are interrogated.
- If on vehicles with "automatic gearbox" the connector was unplugged from the Motronic control unit when rectifying a fault, the fault "Engine/Gearbox electrical connection interruption" is stored in the gearbox control unit and should be erased.

01-11

Fault table

- All the possible faults which can be recognized by the Motronic control unit—J220 are listed below according to the fault code. Existing faults are printed out with the fault code (5-digit) and flash code (4-digit) only if the printer of V.A.G 1551 is switched on.
- Only the fault code is listed in the fault table.
- If faults occur only occasionally or if the fault memory was not erased after rectifying faults, such faults are also displayed as "sporadic faults". In this case, an "SP" appears on the right of the display of V.A.G 1551.
- If faulty components are found, additionally test the wiring to the components for short circuit and open circuit on the basis of the current flow diagram.
- Before rectifying faults or replacing components, test the earth connections of the Motronic control unit—J220 at contacts 10, 14, 19 and 24 (specification max. 1.0 Ω) and also check the earthpoints at the engine for signs of corrosion and damage, test fuel pump relay ⇒ Repair Group 24.
- Faults may be stored in the fault memory as a result of unplugging connectors from electronic components with the ignition switched on. For this reason, do not unplug connectors at electronic components unless the ignition is switched off.
- After rectifying faults and erasing the fault memory, check the basic setting of the engine with V.A.G 1551, perform a road test and, after the road test, once again interrogate the fault memory and also re-check the basic setting.

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01-12

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
00000 No fault recognized	If a complaint exists: Fault not recognized by self-diagnosis.	_____	Continue fault finding on basis of fault table, "Fault Finding Engine" binder.
00000 End of output	_____	_____	_____
00281 Road speed sender -G68 * No signal	<ul style="list-style-type: none"> - Open circuit in wiring or short circuit from contact 50 at -J220 to speedometer -G21 in dash panel insert. - Speedometer sender -G22 faulty. - Speedometer -G21 faulty. 	<ul style="list-style-type: none"> - A/C compressor does not cut out in 1st gear at full load. - Engine speed briefly drops below idling speed when disengaging clutch in overrun phase. - Engine speed limited to 5300 rpm (only with USA coding!). 	<ul style="list-style-type: none"> - Test road speed signal ⇒ Repair Group 24. - After repairing, perform brief road test.

* This readout appears in addition to the relevant component.

01-13

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
00513 Engine speed sender -G28 * Implausible signal * No signal * Mechanical fault	<ul style="list-style-type: none"> - Metal swarf on -G28. - Base of -G28 loose. - Clearance from -G28 to ring gear of flywheel greater than 1.2 mm. - Teeth at ring gear of flywheel broken off. - Open circuit in wiring between 3-pin connector in engine compartment and -G28. - Open circuit in wiring between -J220 and -G28. - Short circuit between contact 47 at -J220 and screening or engine earth. - Open circuit in screening of -G28. - 3-pin plug connection of -G28 and -G4 in engine compartment mixed up. - -G28 faulty. - Input for -G28 in -J220 faulty (-J220 faulty). 	<ul style="list-style-type: none"> - Engine does not start. - Misfiring. - Engine cuts out. - Engine does not start. 	<ul style="list-style-type: none"> - Test -G28 ⇒ Repair Group 28. - Rectify short circuit and open circuit according to current flow diagram. - Plug in connectors at -G4, -G28 correctly.

* One of these readouts appears in addition to the relevant component.

01-14

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
00514 Ignition timing sender -G4 * No signal	<ul style="list-style-type: none"> - Base of -G4 loose. - Clearance from -G4 to pin of flywheel greater than 1.2 mm. - Pin on flywheel bent or broken off. - Open circuit in wiring between 3-pin connector in engine compartment and -G4. - Open circuit in wiring between -J220 and -G4. - Short circuit between contact 49 at -J220 and screening or engine earth. - Open circuit of screening of -G4. - 3-pin plug connection of -G4 and -G28 in engine compartment mixed up. - -G4 faulty. - Input for -G4 in -J220 faulty (-J220 faulty). 	<ul style="list-style-type: none"> - Fault prior to engine start or attempt at starting: engine does not start. - Fault after engine start: engine continues running in emergency mode. - Engine does not start. 	<ul style="list-style-type: none"> - Test -G4 ⇒ Repair Group 28. - Rectify short circuit or open circuit according to current flow diagram.

* This readout appears in addition to the relevant component.

01-15

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
00515 Hall sender -G40 * Open circuit/short circuit to positive * Signal to positive * Short circuit to earth * Signal to earth * Mechanical fault * Fault in basic setting	<ul style="list-style-type: none"> - No supply voltage for -G40 from -J220. - No earth for -G40. - Open circuit in signal wire to -J220 or short to earth of signal wire. - Short circuit between contacts 8 and 12 at -J220. - Open circuit in wiring between 3-pin plug connection in engine compartment and -J220. - Position of pin of -G4. - -G40 faulty. - Input for -G40 in -J220 faulty (-J220 faulty). - Toothed belt jumped off. - Basic setting of Hall sender - Pin of ignition timing sender -G4 bent or broken off. 	<ul style="list-style-type: none"> - Engine does not start. - Poor performance. 	<ul style="list-style-type: none"> - Test -G40 ⇒ Repair Group 28. - Rectify short circuit and open circuit on basis of current flow diagram. - Check toothed belt (camshaft setting) ⇒ Repair Group 15. - Test -G40 ⇒ Repair Group 28. - Basic setting of Hall sender ⇒ Repair Group 28. - Check pin of -G4 ⇒ Repair Group 28.

* One of these readouts appears in addition to the relevant component.

Note regarding fault code 00515:

If the fault appears as a sporadic fault, ignore fault display!

01-16

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
00516 Idling speed switch -F60 * Open circuit/short circuit to positive * Short circuit to earth	<ul style="list-style-type: none"> - Setting of -F60. - Throttle valve jamming. - Closing damper jamming or incorrectly set. - Footmat pressing on accelerator pedal. - Accelerator cable adjustment. - Open circuit in wiring between -F60 and -J220. - Input for -F60 in -J220 faulty (-J220 faulty). - Cable from -F60 to -J220 has short to earth. - Moisture in throttle valve connector. 	<ul style="list-style-type: none"> - Idle speed control moves to open-loop control. - A/C compressor is switched off. - Idling speed not within specified range. 	<ul style="list-style-type: none"> - Test F60 and adjust ⇒ Repair Group 24. - Check closing damper ⇒ Repair Group 20. - Adjust throttle cable ⇒ Repair Group 20. - Rectify open circuit in wiring on basis of current flow diagram. - Rectify short circuit.

* One of these readouts appears in addition to the relevant component.

01-17

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
00518 Throttle valve potentiometer -G69 * Open circuit/short circuit to positive * Signal too large * Short circuit to earth * Signal too small * Implausible signal	<ul style="list-style-type: none"> - Open circuit or short circuit to positive in -G69 or in cable connection between -G69 and -J220. - Short circuit to earth in -G69 or in cable connection between -G69 and -J220. - G69 faulty. - J220 faulty. - Moisture or corrosion in plug connection at -G69. 	<ul style="list-style-type: none"> - Boost pressure is not reached. - Poor performance. 	<ul style="list-style-type: none"> - Test G69 ⇒ Repair Group 24.

* One of these readouts appears in addition to the relevant component.

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01-18

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
00519 Intake manifold pressure sender -G71 <ul style="list-style-type: none"> * Signal too small * Signal too large * Control difference 	<ul style="list-style-type: none"> - Vacuum line from intake manifold to -J220 interrupted, blocked, kinked, crimped. - Liquid separator in hose line from intake manifold to -J220 full of liquid. - Blow-off valve faulty. - Solenoid valve for boost pressure limiter -N75 faulty. - Pressure sensor in Motronic control unit -J220 faulty. - Turbocharger faulty. 	<ul style="list-style-type: none"> - Poor performance. 	<ul style="list-style-type: none"> - Check/drain vacuum lines of liquid separator. - Test solenoid valve for boost pressure limiter -N75 ⇒ Repair Group 24. - Test turbocharger ⇒ Repair Group 20.

* One of these readouts appears in addition to the component.

01-19

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
00522 Coolant temperature sender -G62 <ul style="list-style-type: none"> * Short circuit to earth * Open circuit/short circuit to positive 	<ul style="list-style-type: none"> - Short circuit to earth. - Moisture in connector of -G62. - Open circuit between -G62 and -J220. - Contact resistances between -G62 and -J220. - -G62 faulty. - Input of -G62 in -J220 faulty (-J220 faulty). 	<ul style="list-style-type: none"> - Cold starting problems at very low temperatures. - Driving faults in warming-up phase 	<ul style="list-style-type: none"> - Test -G62 ⇒ Repair Group 28.

* One of these readouts appears in addition to the relevant component.

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01-20

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
00524 Intake air temperature sender -G42 * Short circuit to earth * Open circuit/short circuit to positive	<ul style="list-style-type: none"> - Short circuit to earth. - Open circuit in wiring between -G42 and -J220. - -G42 faulty. - Input of -G42 in -J220 faulty (-J220 faulty). 	<ul style="list-style-type: none"> - Possible driving faults in warming-up phase at low temperatures. 	<ul style="list-style-type: none"> - Test -G42 ⇒ Repair Group 28.

* One of these readouts appears in addition to the relevant component.

01-21

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
00524 Knock sensor 1 -G61 * No signal	<ul style="list-style-type: none"> - Corrosion in connector. - -G61 loose. - Open circuit in wiring or short circuit between -G61 and -J220. - Short circuit between -G61 and earth or to screening. - -G61 faulty. - Input for -G61 in -J220 faulty (-J220 faulty). 	<ul style="list-style-type: none"> - High fuel consumption. - Poor performance. - Boost pressure is not reached. 	<ul style="list-style-type: none"> - Repair contacts. - Tightening torque 20 Nm. - Rectify open circuit or short circuit.

* This readout appears in addition to the relevant component.

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01-22

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
00525 Lambda probe –G39 * Short circuit to positive * No signal * Short circuit to earth	<ul style="list-style-type: none"> - Open circuit in wiring to –J220. - Probe heater not operating. - Fuse –S25 (probe heater) faulty. - Heating resistor in probe faulty. - Wiring of probe heater. - Short circuit of signal wire to earth. - Short circuit of signal wire to screening. - Fuel tank empty, at least 10 ltr. - Fuel system pressure. - Failure of spark plugs, ignition coils and ignition output stages. - Ingress of air to –G70. - Leak in exhaust system up to catalyst. - Faulty lambda probe. - Open circuit in earth cable to contact 10, –J220 to engine block. 	<ul style="list-style-type: none"> - Exhaust not in order. - Increased fuel consumption. - Formation of black smoke. - Spark plugs soot up. - Lambda control moves to open-loop control. 	<ul style="list-style-type: none"> - Rectify open circuit in wiring. - Test lambda probe heater ⇒ Repair Group 24. - Basic setting of engine with V.A.G 1551 ⇒ page 01–50.

* One of these readouts appears in addition to the relevant component.

01–23

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
00528 Allitude sender –F69 * Open circuit/short circuit to positive * Short circuit to earth	<ul style="list-style-type: none"> - Short circuit to positive in –F96 or in cable connection between –F96 and –J220. - Short circuit to earth in –F96 or in cable connection between –F96 and –J220. - –F96 faulty. - Input for –F96 in –J220 faulty (–J220 faulty). 	<ul style="list-style-type: none"> - Poor performance. - Boost pressure is not reached. 	<ul style="list-style-type: none"> - Test –F96 ⇒ Repair Group 24. - Test boost pressure ⇒ Repair Group 21.

* One of these readouts appears in addition to the relevant component.

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01–24

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
00532 Supply voltage • Signal too large • Signal too small	<ul style="list-style-type: none"> - Supply voltage greater than 16 V. - Alternator faulty. - Starting with two series-connected batteries. - Poor earth connection to -J220. - Battery discharged. - Current drain with ignition off. 	<ul style="list-style-type: none"> - -J220 destroyed. - Idling speed not within specified range. - Voltage below 6 volts. - Engine not running. 	<ul style="list-style-type: none"> - Test voltage. - Check battery charge state. - Test voltage supply ⇒ Repair Group 28.

* One of these readouts appears in addition to the relevant component.

Note regarding fault code 00532:

This fault may be stored if the engine is operated for a lengthy period at idling speed with a large number of electrical consumers switched on and the battery is severely discharged.

01-25

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
00533 Idle speed control • Adaptation limit exceeded • Adaptation limit not reached	<ul style="list-style-type: none"> - Idling speed stabilization valve -N71 sticking. - Air mass meter -G70 characteristic curve shifted. - Contact resistance at connector of -N71. - -N71 sticking in open position. - -G70 characteristic curve shifted. - Ingress of air between -G70 and -N71. - Throttle valve potentiometer -G69 incorrectly set. - Throttle valve body jamming. 	<ul style="list-style-type: none"> - Idling speed too low. - Idling speed too high. - Engine vibrating. - Poor throttle response. - Irregular idling (surging). 	<ul style="list-style-type: none"> - Test -N7 ⇒ Repair Group 24. - Test -G70 ⇒ Repair Group 24. - Rectify leak. - Test -G69 and adjust ⇒ Repair Group 24. - Test throttle valve body, replace if necessary.

* One of these readouts appears in addition to the relevant component.

01-26

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
00537 Lambda control * Control limit exceeded * Control limit not reached	<ul style="list-style-type: none"> - Fuel tank empty, at least 10 ltr. - Fuel system pressure too low. - Failure of spark plugs, ignition coils and ignition output stages. - Ingress of air to air mass meter -G70. - Leak in exhaust system up to catalyst. - Lambda probe faulty. - Fuel system pressure too high. 	<ul style="list-style-type: none"> - CO upstream of catalyst less than 0.3 %. - Formation of black smoke. - Spark plugs sooted. - CO upstream of CAT greater than 1 %. 	<ul style="list-style-type: none"> - Fill up fuel tank. - Rectify leak. - Test lambda probe ⇒ Repair Group 24. - Test fuel system pressure ⇒ Repair Group 24. - Check hose connection intake manifold/pressure regulator (fuel shut-off valve on overrun). - Check fuel return line for fouling, kinking and damage.

* One of these readouts appears in addition to the relevant component.

01-27

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
00540 Knock sensor 2 -G66 * No signal	<ul style="list-style-type: none"> - Corrosion in connector. - -G66 loose. - Open circuit in wiring or short circuit between -G66 and -J220. - Short circuit between -G66 and earth or to screening. - -G66 faulty. - Input for -G66 in -J220 faulty (-J220 faulty). 	<ul style="list-style-type: none"> - High fuel consumption. - Poor performance. - Boost pressure is not reached. 	<ul style="list-style-type: none"> - Repair contacts. - Tightening torque 20 Nm. - Rectify open circuit in wiring and short circuit.

* This readout appears in addition to the relevant component.

01-28

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
00543 Engine speed to maximum exceeded * Signal too large	– Engine overrevs (switching fault).	– Possible engine damage.	_____

* This readout appears in addition to the relevant component.

Note regarding fault code 00543:

Engine speed to maximum exceeded is stored as a fault if engine speed of 7200 rpm is exceeded. This engine speed can only be exceeded if the engine has been overrevved as a result of an operating fault (incorrect switching).



01-29

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
00544 Boost pressure to maximum exceeded * Implausible signal * Signal too large	– Ingress of air downstream of turbocharger. – Blow-off valve faulty. – Solenoid valve for boost pressure limiter –N75 faulty. – Leak in vacuum line from intake manifold to –J220; vacuum line dropped off. – Pressure sensor in Motronic control unit –J220 faulty.	– Hard misfiring at full load. – Boost pressure too high. – Severe boost pressure fluctuations at full load.	– Check connections. – Test blow-off valve ⇒ Repair Group 21. – Test solenoid valve for boost pressure limiter –N75 ⇒ Repair Group 24. – Test boost pressure ⇒ Repair Group 21.

* One of these readouts appears in addition to the relevant component.

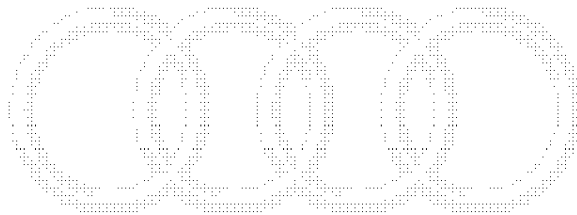
01-30

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
00545 Engine/gearbox electrical connection * Short circuit to earth	– Signal wire from gearbox control unit to –J220 has short circuit to earth.	– Hard gearshifts.	– Test cable connections to gearbox control unit (signal for gearshift) ⇒ Repair Group 24.

* This readout appears in addition to the relevant component.

Note:

This fault is only relevant to vehicles with automatic gearbox.



01-31

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
00553 Air mass meter –G70 * Signal too large * Signal too small	– Open circuit in wiring between –G70 and –J220. – Voltage supply to –G70 interrupted or short to earth. – Short to earth of signal wire to –J220. – Short circuit of signal wire to –J220. – –G70 faulty. – Input for –G70 in –J220 faulty (–J220 faulty).	– Slight handling faults.	– Test –G70 ⇒ Repair Group 24.

* One of these readouts appears in addition to the relevant component.

01-32

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
00561 Mixture adaptation * Adaptation limit (multiplicative) exceeded * Adaptation limit (multiplicative) not reached * Adaptation limit (additive) exceeded * Adaptation limit (additive) not reached	<ul style="list-style-type: none"> - Fuel system pressure too low or too high. - Failure of spark plugs, ignition coils and ignition output stages. - Ingress of air to -G70. - Leak in exhaust system up to catalyst. - Incorrect signal from air mass meter -G70. 	<ul style="list-style-type: none"> - Increased fuel consumption. - Formation of black smoke. - Spark plugs sooted up. 	<ul style="list-style-type: none"> - Fill fuel tank. - Rectify leak. - Test fuel system pressure ⇒ Repair Group 24. - Test -G70 ⇒ Repair Group 24.

* One of these readouts appears in addition to the relevant component.



01-33

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
00577 Knock control cylinder 1 00578 Knock control cylinder 2 00579 Knock control cylinder 3 * Control limit exceeded	<ul style="list-style-type: none"> - Poor quality fuel, less than 91 RON. - Open circuit in signal wire from engine speed sender -G28 or ignition timing sender -G4 (loose contact, sporadic fault) or signal wire wrongly connected. - Abnormal engine noises (ancillaries loose). - Open circuit in screening of -G61. - Injector fouled. 	<ul style="list-style-type: none"> - High fuel consumption. - Poor performance. - Maximum speed is not reached. - Boost pressure reduction. 	<ul style="list-style-type: none"> - Replace -J220. - Fill up with fuel of at least 91 RON. - Test -G28 and -G4 ⇒ Repair Group 28. - Rectify open circuit. - Replace injector.

* This readout appears in addition to the relevant component.

Note:

The knock control retards the ignition angle always only for the cylinder indicated.

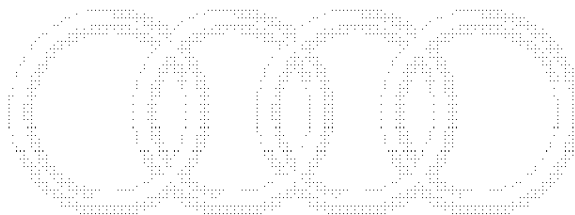
01-34

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
00580 Knock control cylinder 4 00581 Knock control cylinder 5 * Control limit exceeded	<ul style="list-style-type: none"> - Poor quality fuel, less than 91 RON. - Open circuit in signal wire from engine speed sender -G28 or ignition timing sender -G4 (loose contact, sporadic fault) or signal wire wrongly connected. - Abnormal engine noises (ancillaries loose). - Open circuit in screening of -G66. - Injector fouled. 	<ul style="list-style-type: none"> - High fuel consumption. - Poor performance. - Maximum speed is not reached. - Boost pressure reduction. 	<ul style="list-style-type: none"> - Replace -J220. - Fill up with fuel of at least 91 RON. - Test signal wire from -G28 and -G4 according to CFD ⇒ Repair Group 28. - Rectify open circuit. - Replace injector.

* This readout appears in addition to the relevant component.

Note:

The knock control retards the ignition angle always only for the cylinder indicated.



01-35

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
01247 Solenoid valve 1 for activated charcoal filter -N80 * Short circuit to positive * Open circuit/short circuit to earth	<ul style="list-style-type: none"> - Short circuit to positive in -N80 or in the cable connection between -N80 and -J220. - Short circuit to earth in -N80 or in the cable connection between -N80 and -J220. - Thermofuse -S75 faulty. - Open circuit in wiring. 	<ul style="list-style-type: none"> - Short circuit to positive in -N80 or in the cable connection between -N80 and -J220. - Short circuit to earth in -N80 or in the cable connection between -N80 and -J220. - Thermofuse -S75 faulty. - Open circuit in wiring. 	<ul style="list-style-type: none"> - Test -N80 ⇒ Repair Group 24.

* One of these readouts appears in addition to the component.

01-36

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
01249 Injector cylinder 1 -N30 * Open circuit/short circuit to earth * Short circuit to positive	- Short circuit to earth. - Open circuit in wiring. - Fuse -S28 faulty. - Short circuit to positive at connector or in injector.	- Engine does not run smoothly.	- Test injectors ⇒ Repair Group 24.

* One of these readouts appears in addition to the component.



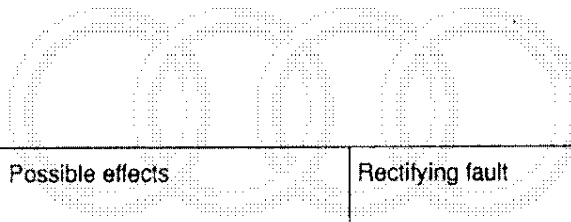
01-37

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
01250 Injector cylinder 2 -N31 * Open circuit/short circuit to earth * Short circuit to positive	- Short circuit to earth. - Open circuit in wiring. - Fuse -S28 faulty. - Short circuit to positive at connector or at injector.	- Engine does not run smoothly.	- Test injectors ⇒ Repair Group 24.

* One of these readouts appears in addition to the component.

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
01251 Injector cylinder 3 – N32 * Open circuit/short circuit to earth * Short circuit to positive	– Short circuit to earth. – Open circuit in wiring. – Fuse –S28 faulty. – Short circuit to positive at connector or in injector.	– Engine does not run smoothly.	– Test injectors ⇒ Repair Group 24.

* One of these readouts appears in addition to the component.



01-39

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
01252 Injector cylinder 4 – N33 * Open circuit/short circuit to earth * Short circuit to positive	– Short circuit to earth. – Open circuit in wiring. – Fuse –S28 faulty. – Short circuit to positive at connector or in injector.	– Engine does not run smoothly.	– Test injectors ⇒ Repair Group 24.

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* One of these readouts appears in addition to the component.



01-40

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
01253 Injector cylinder 5-N83 * Open circuit/short circuit to earth * Short circuit to positive	<ul style="list-style-type: none"> - Short circuit to earth. - Open circuit in wiring. - Fuse -S28 faulty. - Short circuit to positive at connector or in injector. 	<ul style="list-style-type: none"> - Engine does not run smoothly. 	<ul style="list-style-type: none"> - Test injectors ⇒ Repair Group 24.

* One of these readouts appears in addition to the component.

01-41

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
01257 Idling speed stabilization valve-N71 * Short circuit to positive * Open circuit/short circuit to earth	<ul style="list-style-type: none"> - Short circuit to positive in -N71 or in cable connection between -N71 and contact 4 of -J220. - Short circuit to earth in -N71 or in cable connection between -N71 and -J220. - Fuse -S24 faulty. - Open circuit in wiring. 	<ul style="list-style-type: none"> - At engine operating temperature idling speed differs from specification. - With cold engine, engine may cut out. - In emergency running mode, idling speed 1100 - 1200 rpm when engine warm. - A/C compressor cuts out when idling. - Irregular idling speed. 	<ul style="list-style-type: none"> - Test -N71 ⇒ Repair Group 24.

* This readout appears in addition to the relevant component.

01-42

Output at printer of V.A.G 1551	Possible causes of fault	Possible effects	Rectifying fault
01262 Solenoid valve for boost pressure limiter -N75 • Short circuit to positive • Open circuit/short circuit to earth	- Short circuit to positive in -N75 or in cable connection between -N75 and contact 23 of -J220. - Short circuit to earth in -N75 or in cable connection between -N75 and -J220. - Fuse -S24 faulty. - Open circuit in wiring.	- Boost pressure too high. - Boost pressure too low. - Hard misfiring at full load because of "Boost pressure to max. exceeded, implausible signal" fault.	- Test -N75 ⇒ Repair Group 24.
65535 Control unit faulty	- Earth connection to -J220, contacts 10, 14, 19 and 24. - Control unit faulty.	- Engine does not start. - With ignition on, no voltage at contact 37 of -J220.	- Test earth connection according to current flow diagram.

- One of these readouts appears in addition to the component.

01-43

Final control diagnosis with fault reader V.A.G 1551

Test requirements:

- Fuses -S24, -S27 and -S28 in auxiliary fuse carrier in order.
- Fuse -S21 in order.
- Fuel pump relay in order.
- Control unit connected without test adapter V.A.G 1598/5 and test box V.A.G 1598.

Note:

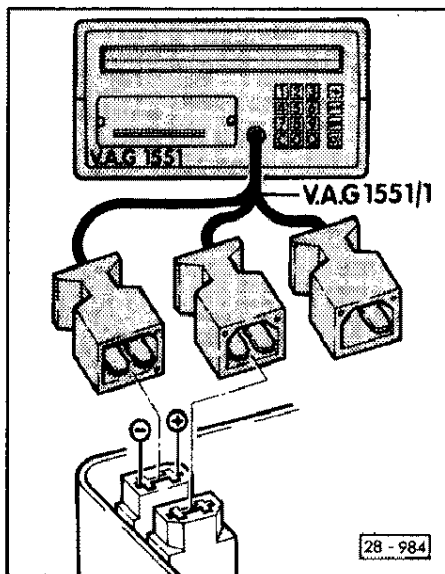
During the final control diagnosis, all the injectors, the idling speed stabilization valve, the activated charcoal filter solenoid valve and boost pressure limiter solenoid valve are checked audibly or by touching. The injectors are each actuated for only 2 ms 5 times. Avoid background noises when conducting the audible check of the injectors as the switching noise (clicking) of the injectors is very quiet and brief.

The final control diagnosis is aborted if the engine is started or if an engine speed pulse is detected.

Actuating sequence of final control diagnosis:

Injector cylinder 1 -N30
 Injector cylinder 2 -N31
 Injector cylinder 4 -N33
 Injector cylinder 5 -N83
 Injector cylinder 3 -N32
 Idling speed stabilization valve -N71
 Solenoid valve 1 for activated charcoal filter -N80
 Solenoid valve for boost pressure limiter -N75

01-44



V.A.G self-diagnosis 1 - Rapid data transfer* 2 - Flash code output*	HELP
--	------

- ▶ - Connect fault reader with diagnostic cable V.A.G 1551/1 to the diagnostic sockets in the electrical centre as follows:
- Remove cover from the electrical centre in the plenum chamber.
- Black connector to "black" diagnostic socket.

- ▶ Readout in display:
 - * appears alternately
 - If no readout appears in the display, test voltage supply for black diagnostic socket ⇒ page 01-69.
- White connector to "white" diagnostic socket.
- Blue connector is not required.

01-45

Rapid data transfer Enter address word XX	HELP
--	------

- Switch on ignition.
- Switch on printer with the Print key (indicator lamp in key lights up).
- Press key 1 for "Rapid data transfer" mode.
- ▶ Readout in display:
 - Press keys 0 and 1.
(The address word "Engine electronics" is entered with 01).

Rapid data transfer 01 - Engine electronics	Q
--	---


- ▶ Readout in display:
 - Confirm entry with the key Q.

Rapid data transfer Tester sends address word 01	
---	--

- ▶ Readout in display:

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Rapid data transfer Control unit does not answer!	HELP
--	------

- ▶ If the following appears in the display:
 
 - ⇒ page 01-5 and 01-7.

01-46

Final control diagnosis
Solenoid valve 1 for activated charcoal filter
-N80

◀ Readout in display:

This valve continues to be operated (clicks) until the programme is advanced to the next control element by pressing the → key.

Final control diagnosis
Solenoid valve for boost pressure limiter
-N75

◀ Readout in display:

This valve continues to be operated until the programme is advanced to the next control element by pressing the → key.

Rapid data transfer HELP
Select function XX

◀ Readout in display:

- If function 03 = Final control diagnosis is once again selected after this, the final control diagnosis can be repeated. If one of the valves does not click, test valve or actuation ⇒ Repair Group 24.

01-49

Basic setting of engine with V.A.G 1551

Notes:

- The basic setting is performed with the engine running.
- During the basic setting the Motronic control unit performs the following function:

- ACF valve is closed.

- The values appear either in display group 00 as a block of ten or in display group 01 as a block of four.
- The display as a block of four also includes the physical dimension (e.g. rpm or °C).

Requirements:

- Engine temperature at least 85 °C.
- All electrical components switched off.
- Air conditioner switched off.

- Perform a road test lasting at least 5 minutes, if possible, including a stop at traffic lights.

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- Interrogate and erase fault memory ⇒ page 01-5.

- Continue running engine at idling speed after interrogating and erasing fault memory and do not depress accelerator pedal.

01-50

Rapid data transfer HELP
Select function XX

◀ Readout in display:

Note:

A list of the possible functions is printed out after pressing the HELP key.

- Press keys 0 and 4.
(The function "Initiate basic setting" is selected with 04).

Function is unknown or cannot be carried out at the moment

◀ If the following readout appears in the display:

Notes:

- Interrogate control unit version ⇒ page 01-86.
- Requirements on page 01-44 are not met.

Rapid data transfer Q
04 – Initiate basic setting

◀ Readout in display:

- Confirm entry with the key Q.

Initiate basic setting HELP
Enter display group number XX

◀ Readout in display:

Note:

The procedure for entering the display group number is printed out after pressing the HELP key.

01-51

List of display groups

Display group number	Readout in display field
00	System in basic setting 1 2 3 4 5 6 7 8 9 10
01	1 = Engine speed 2 = Coolant temperature 3 = Lambda control 4 = Ignition angle

Note:

The display group should be selected depending on the type of fault which exists.

- Select desired display group number according to the list of display groups and confirm entry with the key Q.

Display group number 00:

- Press key 0 twice.
(*System in basic setting" is selected with 00).

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◀ Readout in display:

- Confirm entry with the key Q.

Initiate basic setting Q
Enter display group number 00

01-52

System in basic setting									
1	2	3	4	5	6	7	8	9	10

◀ Readout in display:

- Wait at least 5 seconds before comparing readouts in the display fields with the explanation ⇒ page 01-56.

Notes:

- The figures which are displayed in display fields 1 to 10 are shown as decimals. The conversions into physical values, to the extent necessary, are listed in the column "equals measured value" ⇒ page 01-56.
- After performing a road test and interrogating the fault memory, compare the readout in display field 9 with the specification ⇒ page 01-56 within the next 5 minutes. If the engine runs at idling speed for a longer period, the specification may be exceeded without a fault actually existing.
- The readout in display field 10 represents the ignition angle calculated by the control unit -J220.
- When the printer is switched on, the current display is printed out on the report log.
- The current display is printed out again each time the **Print** is pressed.
- Before selecting further display groups, press the key **C**.
- After selecting another display group, the printer must once again be switched on in each case.

01-53

Display group number 01:

Note:

If the display group 00 (or 02) has been selected beforehand and the programme then advanced with the → key or the **C** key pressed twice, the function "04 Initiate basic setting" must first of all again be selected.

- Press keys 0 and 1.
(The function "Display group number 01" is selected with 01).

Initiate basic setting	Q
Enter display group number 01	

◀ Readout in display:

- Confirm entry with the key **Q**.

System in basic setting				1
1	2	3	4	

◀ Display fields in display:

Notes:

- In the case of display group numbers 01 and 02, the respective display group number appears in the display **without the 0** in the case of the display "System in basic setting".
- In the case of display group number 00, **only "System in basic setting" appears in the display. Description of individual displays in the display fields ⇒ page 01-56.**
- Before selecting further display groups, press key **C**.

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01-54

Display group number 02:
 The procedure for display group 02 is identical to display group 01.
 Display group 02 does not contain any information of use for the Service Department.

Note:

When retrieving a display group number from 03 to 99, the values of display group 02 are always displayed.

01-55

Explanation of the readouts in display fields 1 to 10

Display field	Readout specifications*	equals measured value	Designation	Remarks
1	184 ... 215	85° ... 105°C	Coolant temperature	Requirement for all other displays/ specifications
2	20 ... 24		Engine load	With air conditioner off, without electrical components
3	77 ... 83	770 ... 830 rpm	Engine speed	With air conditioner off, without electrical components
4	121 ... 135		Idling stabilization working range	Air volume change as the result of -N71
5	70 ... 125		Idling stabilization characteristic curve zero point	Internal computation value
6	123 ... 137		Idling speed stabilization load adaptation	Air volume change as the result of -N71
7	41 ... 61		Idling speed stabilization characteristic curve control	Internal computation value
8	123 ... 133		Lambda control	after about 1,5 minutes
9	100 ... 150		Learning value for lambda control	If readout is high, once again perform road test
10	35 ... 37	8 ... 12° BTDC	Ignition angle when idling	Ignition angle calculated by -J220

Note:

If the values displayed do not correspond to the specifications, check whether air conditioner is switched off. If air conditioner is switched off ⇒ Test table, page 01-55.

01-56

Test table for display group 00:

The tests which require to be performed if the display/specifications are not achieved are listed in the table.

Note:

Before performing the tests, ensure that the air conditioner and A/C compressor are switched off.

Display field	Readout on V.A.G 1551	Cause of fault	Rectifying fault
1	greater than 215	Coolant temperature sender -G62 Radiator fan not operating	- Test -G62 ⇒ Repair Group 28. - Interrogate fault memory ⇒ page 01-5.
1	less than 184	Coolant thermostal Coolant temperature sender -G62	- Test coolant thermostal ⇒ Repair Group 19. - Test -G62 ⇒ Repair Group 28. - Interrogate fault memory ⇒ page 01-5.
2	greater than 24	Air conditioner switched on Electrical components switched on A/C compressor running although air conditioner switched off Air mass meter -G70 Central hydraulics pump Ingress of air between turbocharger and throttle valve	- Switch off air conditioner. - Switch off electrical components. - Test air conditioner ⇒ Repair Group 87. - Test -G70 ⇒ Repair Group 24. - Test central hydraulics pump ⇒ Repair Group 48. - Determine cause of ingress of air.

* One of these readouts appears in addition to the component.

Display field	Readout on V.A.G 1551	Cause of fault	Rectifying fault
2	less than 20	Ingress of air between air mass meter -G70 and turbocharger Ingress of air downstream of throttle valve Vacuum hose has dropped off Leak in crankcase ventilation Fuel tank ventilation Solenoid valve 1 for activated charcoal filter jamming Air mass meter -G70	- Determine cause for ingress of air. - Determine cause for ingress of air. - Check vacuum system. - Check crankcase for leaks. - Check fuel ventilation system ⇒ Repair Group 24. - Perform final control diagnosis ⇒ page 01-44. - Test -G70 ⇒ Repair Group 24.
3	greater than 83	Idling speed stabilization valve -N71 at bottom control stop Ingress of air downstream of throttle valve Vacuum hoses dropped off (rear of intake manifold ⇒ Repair Group 24) Air conditioner not switched off A/C compressor control signal supplied although compressor is switched off Idling speed stabilization valve faulty	- Briefly blip throttle 4 times at intervals of 15 seconds. - Rectify cause for ingress of air. - Switch off air conditioner. - Test air conditioner ⇒ Repair Group 87. - Perform final control diagnosis ⇒ page 01-44. Note: If air conditioner has high capacity demand (cooling or heating) idling speed is increased to 880 rpm (readout 88).

Display field	Readout on V.A.G 1551	Cause of fault	Rectifying fault
3	less than 77	Idling speed stabilization valve -N71 jamming Idling speed stabilization valve -N71	- Test -N71 ⇒ Repair Group 24. - Perform final control diagnosis ⇒ page 01-44.
4	less than 121	Ingress of air downstream of throttle valve Idling speed stabilization valve -N71 jamming	- Rectify cause for ingress of air. - Test -N71 ⇒ Repair Group 24.
4	greater than 135	A/C compressor running although air conditioner off Charge state of battery	- Test air conditioner ⇒ Repair Group 87. - Check charge state.
5	less than 70	Idling speed stabilization valve -N71 jamming Throttle valve potentiometer -G69 incorrectly set	- Test -N71 ⇒ Repair Group 24. - Adjust -G69 ⇒ Repair Group 24.
5	greater than 125	Leak between throttle valve/intake manifold or air flow meter and turbocharger (in vacuum circuit) Idling speed stabilization valve -N71	- Rectify cause. - Test -N71 ⇒ Repair Group 24.
6	not between 123 - 137	Control for idling speed stabilization valve -N71 Throttle valve potentiometer -G69 incorrectly set Ingress of air	- Briefly blip throttle and check readout, readout must be between 123 and 137. - Adjust -G69 ⇒ Repair Group 24. - Determine cause.

01-59

Display field	Readout on V.A.G 1551	Cause of fault	Rectifying fault
7	less than 41 greater than 61	Idling speed stabilization valve -N71 Ingress of air	- Test -N71 ⇒ Repair Group 24. - Determine cause of fault.
8	constant 128	Fuel supply too low Lambda probe faulty Lambda probe heater faulty	- At least 10 ltr. of fuel in tank. - Test lambda probe and lambda control ⇒ Repair Group 24.
8	not between 123 and 133	Lambda adaptation not yet completed Lambda probe Ingress of air downstream of air mass meter -G70 Fuel system pressure Leak in exhaust system	- After disconnecting battery or control unit or replacing control unit, run warm engine at idling speed for at least 10 minutes. - Check specification display field 9. - Test lambda control ⇒ Repair Group 24. - Rectify cause of fault. - Test system pressure ⇒ Repair Group 24. - Check ⇒ Repair Group 26.
8	jumps	Fuel supply too low Loose contact in lambda probe signal cable Lambda probe heater faulty	- At least 10 ltr. of fuel in tank. - Test lambda probe and lambda control ⇒ Repair Group 24.

01-60

Display field	Readout on V.A.G 1551	Cause of fault	Rectifying fault
9	less than 100	Fuel system pressure too high Air mass meter –G70 Lambda probe Ingress of air between turbocharger and throttle valve	<ul style="list-style-type: none"> – Test system pressure ⇒ Repair Group 24. – Test –G70 ⇒ Repair Group 24. – Test lambda control ⇒ Repair Group 24. – Determine cause of fault.
9	greater than 150	Fuel system Fuel supply too low Ingress of air between air mass meter and turbocharger or in intake manifold	<ul style="list-style-type: none"> – At least 10 ltr. of fuel in tank. Rectify cause for ingress of air.
10	greater than 37	Idling speed stabilization valve –N71	<ul style="list-style-type: none"> – Perform final control diagnosis ⇒ page 01–44. – Test –N71 ⇒ Repair Group 24. – Test –F60 ⇒ Repair Group 24. – Coolant temperature too low (check display field 1).
10	less than 35	Idling speed stabilization valve –N71 Idling speed switch –F60	<ul style="list-style-type: none"> – Perform final control diagnosis ⇒ page 01–44. – Test –N71 ⇒ Repair Group 24. – Test idling speed switch –F60.

01–61

Explanation of readouts for display group 01:

Display field	Readout specifications	Designation	Remarks
1	770 ... 830 rpm	Engine speed	With the air conditioner off, without electrical components
2	85 ... 105°C	Coolant temperature	Requirement for all other displays/ specifications
3	0.96 ... 1.04	Lambda control	after about 1.5 minutes
4	8 ... 12° BTDC	Ignition angle at idling speed	Ignition angle calculated by –J220

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01–62

Test table for display group 01:

The test required if the readout/specifications are not reached are listed in the table.

Note:

Prior to the tests, ensure that the air conditioner and compressor are switched off.

Display field	Readout on V.A.G 1551	Cause of fault	Rectifying fault
1	greater than 830	Idling speed stabilization valve -N71 at bottom control stop Ingress of air downstream of throttle valve Vacuum hoses dropped off (rear of intake manifold ⇒ Repair Group 24) Air conditioner not switched off A/C compressor control signal supplied although compressor is switched off Idling speed stabilization valve jamming	<ul style="list-style-type: none"> - Briefly blip throttle 4 times at intervals of 15 seconds. - Rectify cause for ingress of air. - Switch off air conditioner. - Test air conditioner ⇒ Repair Group 87. - Perform final control diagnosis ⇒ page 01-44.
1	less than 770	Idling speed stabilization valve -N71 jamming Idling speed stabilization valve -N71	<ul style="list-style-type: none"> - Test -N71 ⇒ Repair Group 24. - Perform final control diagnosis ⇒ page 01-44.
2	greater than 105°C	Coolant temperature sender -G62 Radiator fan not operating	<ul style="list-style-type: none"> - Test -G62 ⇒ Repair Group 28. - Interrogate fault memory ⇒ page 01-5.
2	less than 85°C	Coolant thermostat Coolant temperature sender -G62	<ul style="list-style-type: none"> - Test coolant thermostat ⇒ Repair Group 19. - Test -G62 ⇒ Repair Group 28. - Rectify fault memory ⇒ page 01-5.

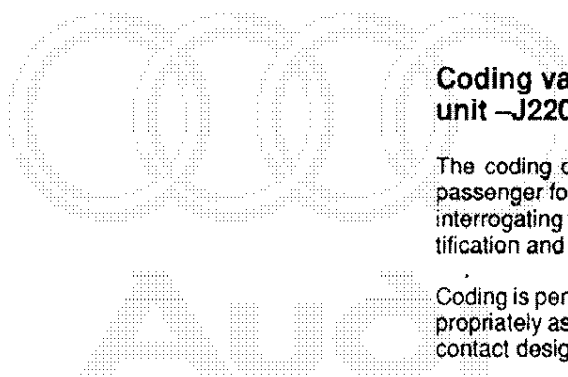
01-63

Display field	Readout on V.A.G 1551	Cause of fault	Rectifying fault
3	constant 1.0	Fuel supply too low Lambda probe faulty Lambda probe heater faulty	<ul style="list-style-type: none"> - At least 10 ltr. of fuel in tank. - Test lambda probe and lambda control ⇒ Repair Group 24.
3	not between 0.96 and 1.04	Lambda adaptation not yet completed Lambda probe Ingress of air downstream of air mass meter -G70 Fuel system pressure Leak in exhaust system	<ul style="list-style-type: none"> - After disconnecting battery or control unit or replacing control unit, run warm engine at idling speed for at least 10 minutes. - Check display group 02, display field 2. - Test lambda control ⇒ Repair Group 24. - Rectify cause of fault. - Test system pressure ⇒ Repair Group 24. - Check ⇒ Repair Group 26.
3	jumps	Fuel supply too low Loose contact in lambda probe signal cable Lambda probe heater faulty	<ul style="list-style-type: none"> - At least 10 ltr. of fuel in tank. - Test lambda probe and lambda control ⇒ Repair Group 24.

01-64

Display field	Readout on V.A.G 1551	Cause of fault	Rectifying fault
4	greater than 12° BTDC	Idling speed stabilization valve –N71 Idling speed switch –F60	<ul style="list-style-type: none"> – Perform final control diagnosis ⇒ page 01–44. – Test –N71 ⇒ Repair Group 24. – Test –F60 ⇒ Repair Group 24.
4	less than 8° BTDC	Idling speed stabilization valve –N71	<ul style="list-style-type: none"> – Perform final control diagnosis ⇒ page 01–44. – Test –N71 ⇒ Repair Group 24.

01–65



Coding variants of Motronic control unit –J220

The coding connector is located in the right front passenger footwell in the area of the A pillar. When interrogating the fault memory, the control unit identification and the coding are displayed.

Coding is performed at the coding connector by appropriately assigning the contacts 1, 2, 3 and 4. The contact designation is stamped on the connector.

At present there are only the codings 1 and 4.

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Coding 1: (applies to European countries)

This coding does not contain any speed limit.



All the contacts of the coding connector with this coding are open.

Coding 4: (applies to USA and Canada)

With this coding vehicle speed is limited to 210 km/h. Contact 1 in the coding connector is connected to contact 4. Consequently, contact 38 of the Motronic control unit –J220 is connected to earth.

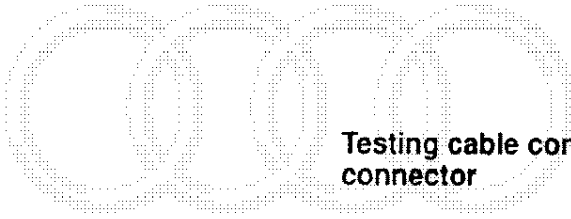
– If the correct coding is not displayed, test cable connection for coding connector ⇒ page 01–68.

01–66

Important !

Removing the coding connector alters the coding from 1 to 4 and thus cancels the vehicle speed limit. This modification is only permissible if tyres which are approved for a higher speed (in excess of 210 km/h) are fitted (see also Owner's Manual).

01-67



Testing cable connection of coding connector

The following test can only be performed if the correct coding is not displayed when interrogating the control unit version.

- Connect test box V.A.G 1598 with adapter cable 1598-5 to the wiring harness running to the Motronic control unit ⇒ page 01-78 (the connector at the control unit is not plugged in).

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- Test the following wiring for short circuit to positive or to earth on the basis of the current flow diagram.

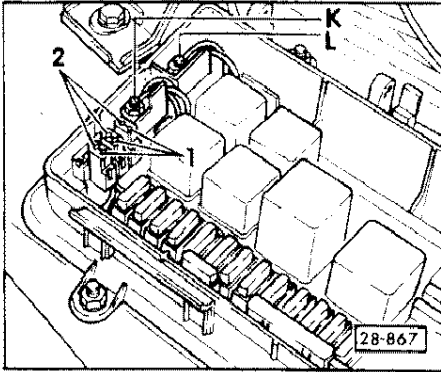


Contact at coding connector	V.A.G 1598 socket control unit	Connector for Motronic
-----------------------------	--------------------------------	------------------------

1	38	38
2	39	39
3	12	12
4	30	30

- Rectify any short circuit.

01-68



Testing cable connection of diagnostic sockets

- The diagnostic sockets and the cable junctions "K" and "L" are located in the electrical centre in the left of the plenum chamber.

Testing voltage supply for "black" diagnostic socket

- Contact 2 connected to earth
- Contact 1 positive (terminal 30 protected by fuse 21)

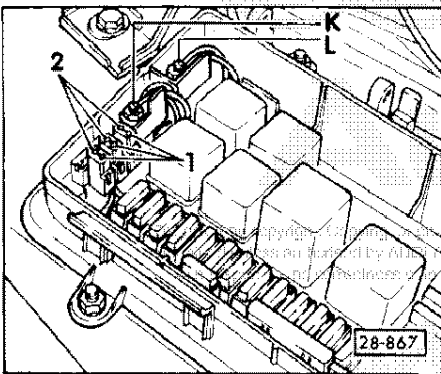
Testing cable connection from "white" diagnostic connector to Motronic control unit

- Switch off ignition.
- Connect test box V.A.G 1598 with adapter cable 1598-5 only to the wiring harness of the Motronic control unit ⇒ page 01-78.

Notes:

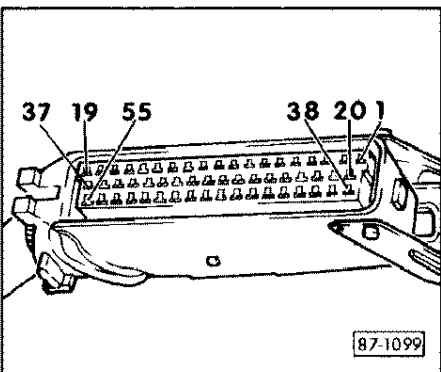
- The cable connection between the "white" diagnostic socket and the Motronic control unit runs via the cable junctions K and L in the electrical centre.
- All other vehicle systems with "Rapid data transfer" self-diagnosis are connected via these two cable junctions ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations Binder.
- Test cable connection for open circuit in wiring, short circuit to positive or negative.

01-69



Diagnostic socket contact	Cable junction	V.A.G 1598 with V.A.G 1598-5 socket
2	L	13
1	K	55

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- Contact assignment at connector for control unit –J220 (the contact assignment is identical to the socket assignment of the test box V.A.G 1598).

01-70

Testing cable connection of "white" diagnostic socket for short circuit to positive or earth

Rapid data transfer
Fault in communication build-up

or

Rapid data transfer HELP
L wire not switching to earth

or

Rapid data transfer HELP
L wire not switching to positive

or

Rapid data transfer HELP
K wire not switching to earth

or

Rapid data transfer HELP
K wire not switching to positive

➤ Only if one of the following appears in the display of V.A.G 1551:

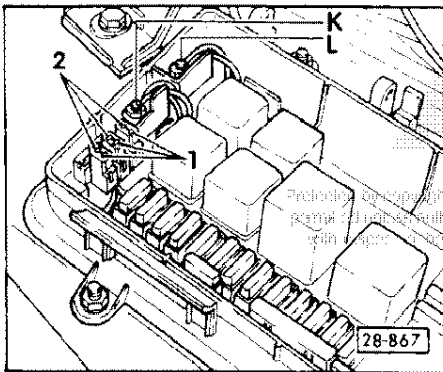
– Switch off ignition.

Notes:

- The cable connection between the "white" diagnostic socket and the Motronic control unit J220 runs via the cable junctions K and L in the electrical centre ⇒ Current flow diagram.
- For colour of cables and other vehicle systems connected to the "white" diagnostic socket ⇒ Current flow diagram, Electrical fault finding and Fitting locations binder.
- Other vehicle systems may be connected both to cable junctions K and L or only to cable junction K ⇒ Current flow diagram or Additional current flow diagrams.



01-71



A – Only if cables of different cable colours are connected to the cable junctions

➤ – Determine colour of cables between "white" diagnostic socket and Motronic control unit on the basis of current flow diagram.

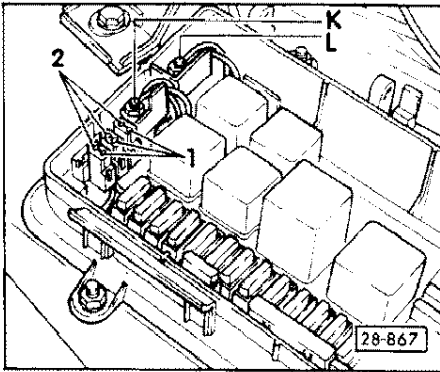
– Separate all the cable connections of the other vehicle systems with "Rapid data transfer" self-diagnosis one after the other from the cable junctions K and L.

– After each cable connection to a vehicle system has been separated, run engine at idling speed and once again enter address word "01 – Engine electronics" ⇒ page 01-5.

– If the control unit identification and coding then appear in the display, test cable connection to the control unit last separated on the basis of CFD. If no open circuit in the wiring, short circuit to positive or to earth is found, replace the control unit last separated and re-connect all the cables to the cable junctions K and L.

– If "Control unit does not answer" is displayed, there is an open circuit in the cable connection to the Motronic control unit.

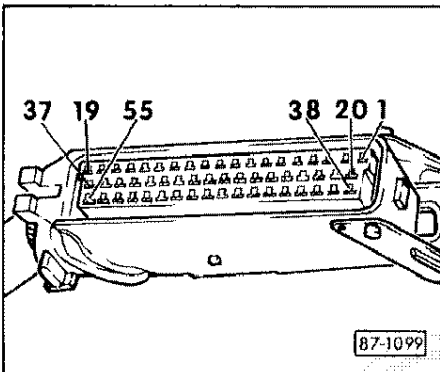
01-72



B – Only if several cables with the same cable colours are connected to the cable junctions

- ◀ – Separate all the cables from the cable junctions K and L.
- Connect test box V.A.G 1598 with adapter cable V.A.G 1598-5 ⇒ page 01-78.
- Use hand-held multimeter V.A.G 1526 and adapter cable set V.A.G 1594 to determine the cable connections to the Motronic control unit and re-connect to the cable junctions K and L.

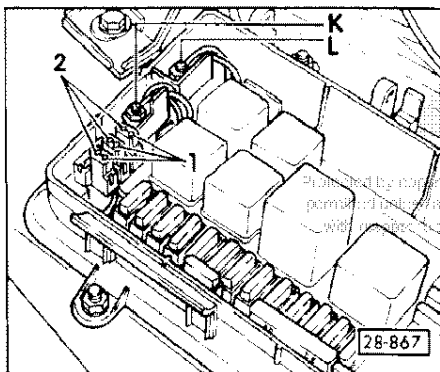
"White" diagnostic socket contact	Cable junction	V.A.G 1598 socket
2	L	13
1	K	55



- ◀ Contact assignment at the connector for Motronic control unit –J220 (the contact assignment is identical to the socket assignment of the test box V.A.G 1598).

- Run engine at idling speed and once again enter address word "01 – Engine electronics" ⇒ page 01-5.
- If the control unit identification and coding do **not** then again appear in the display, replace Motronic control unit and reconnect all the cables to the cable junctions K and L and repeat interrogation of fault memory.

01-73



- If the control unit identification and coding appear in the display, the fault is not at the Motronic control unit.

– Switch off ignition.

- ◀ – Determine one after the other all the cable connections between the control units and the cable junctions K and L, as described for the Motronic control unit, and connect one after the other to the cable junctions K and L on the basis of the current flow diagram or additional current flow diagram.

- After re-establishing each cable connection to the vehicle system, run engine at idling speed and once again enter address word "01 – Engine electronics" ⇒ page 01-5.

- If the control unit identification and coding are displayed, switch off ignition.

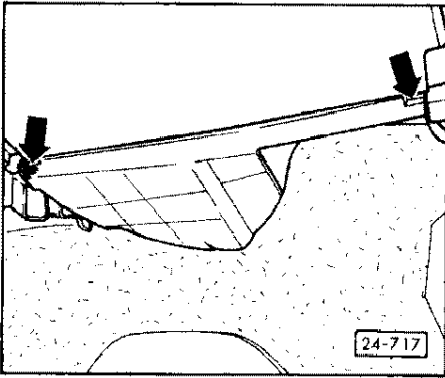
- Determine cable connection of the next control unit to the cable junctions K and L and re-create.

- If the control unit identification and coding are not displayed, replace the control unit last connected and re-establish all the cable connections.

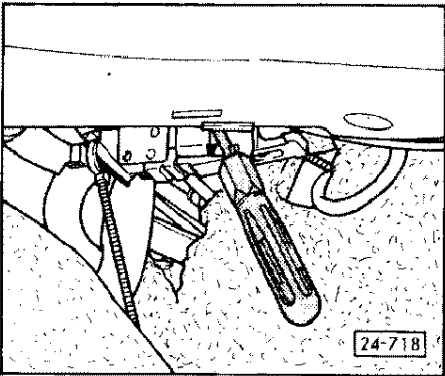
01-74

Removing and installing Motronic control unit

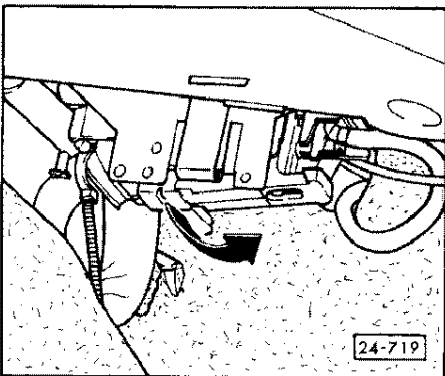
- Switch off ignition.
- ← - Remove cover below glove box.



- Turn back carpet below the Motronic control unit.
- ← - Insert screwdriver next to the retaining clip between carrier plate of Motronic control unit and plastic shaft.
- Turn screwdriver slightly, if necessary, in order to release the catches on the carrier plate above the clip from the recess of the plastic shaft.
- Pull control unit down slightly and remove screwdriver.



- Pull control unit down 3 ... 4 cm. In this position the control unit locks in a second catch (service position).

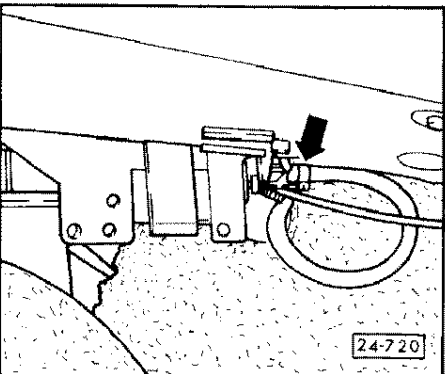


- ← - Wait at least 30 seconds after switching off the ignition before releasing and unplugging connector from the Motronic control unit.
In this position the test box V.A.G 1598 can be connected with adapter cable V.A.G 1598-5 to the Motronic control unit or to the engine wiring harness for measurement and test purposes. The vacuum line remains connected.

Note:

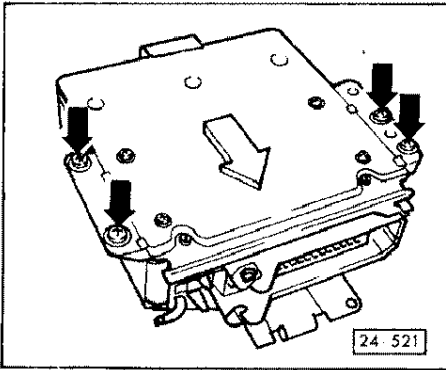
The further operations only require to be performed if the Motronic control unit has to be removed completely.

- ← - Remove hose clip at the pressure line and detach vacuum line.
- Release catch with screwdriver, as described on the previous page and carefully pull control unit down out of the shaft. On vehicles with air conditioner, the condensation water drain hose must be carefully pushed to the side when performing this step far enough to avoid the side flange of the control unit damaging the drain hose (detach hose, if necessary).



01-75

01-76



Note:

The vacuum line must not be damaged when removing the control unit.

- ← Unscrew Motronic control unit from the carrier plate.

- The Motronic control unit is installed in the reverse order by analogy.

Note:

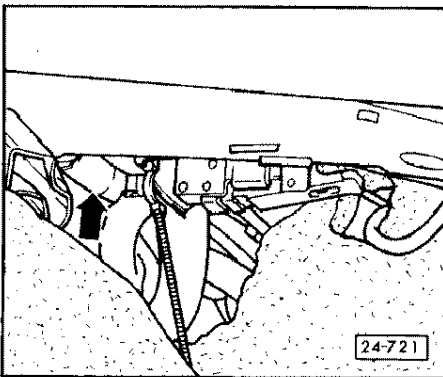
- When installing, ensure the vacuum line is laid free of kinks.
- The vacuum line runs from the Motronic control unit to the moisture separator located on pillar A on the left and from the moisture separator on to the engine compartment.

Important !

The connector on Motronic control unit must not be unplugged or plugged in unless the ignition is switched off.

Note:

- ← Before installing the cover below the glove box, check whether condensation water hose on vehicles with air conditioner (arrow) is fitted on.



01-77

Connecting test box V.A.G 1598

Notes:

- The test box V.A.G 1598 must not be connected during the diagnosis with the fault reader V.A.G 1551.
 - Wait at least 30 seconds after switching off the ignition before unplugging the connector from the Motronic control unit.
 - Unplugging the connector from the Motronic control unit also separates the continuous positive power supply and thus erases the fault memory and the learning value memory.
- Switch off ignition.
 - Remove Motronic control unit ⇒ page 01-75.
 - Connect adapter cable V.A.G 1598-5 between Motronic control unit and engine wiring harness.

01-78

Reading measured value block with V.A.G 1551

Notes:

- Perform Reading measured value block with engine running.
- In contrast to the basic setting, the solenoid valve for the activated charcoal filter is not permanently closed during reading measured value block.
- The readout of the values may either appear in the display group 00 as a block of ten or in the display groups 01 to 09 as a block of four.
- The physical dimension (e.g. rpm or °C) also appears together with the display as a block of four.

Requirements:

- Engine temperature at least 85°C
 - All electrical components switched off.
 - Air conditioner switched off. Press and hold minus button in the control display unit of the air conditioner until all the readouts on the displays are cancelled.
 - Move selector lever to position P or N.
- Interrogate and erase fault memory ⇒ page 01–5.
- Continue running engine at idling speed after interrogating fault memory and erasing fault memory.

Rapid data transfer HELP
Select function XX

Readout in display:

Note:

A list of the possible functions is printed out after pressing the HELP key.

- Press keys 0 and 8.
(The function "Read measured value block" is selected with 08).

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◀ If the following appears in the display:

Notes:

- Interrogate control unit version ⇒ page 01–86.
- Requirements on page 01–79 are not met.

Function is not known or cannot be carried out at the moment

Rapid data transfer Q
08 – Read measured value block

◀ Readout in display:

- Confirm entry with the key Q.

◀ Readout in display:

Note:

The procedure for entering the display group number is printed out after pressing the HELP key.

Read measured value block HELP
Enter display group number XX

List of display groups

Display group number	Readout in display field
00	Read measured value block → 1 2 3 4 5 6 7 8 9 10
01	1 = Engine speed 2 = Coolant temperature 3 = Lambda control 4 = Ignition angle
02	1 = Engine speed 2 = Injection time 3 = Vehicle voltage 4 = Altitude
03	1 = Engine speed 2 = Engine load 3 = Throttle valve angle 4 = Intake manifold temperature
04	1 = Engine speed 2 = Engine load 3 = Vehicle speed 4 = Switch positions
05	1 = Engine speed 2 = Idling speed stabilization characteristic curve zero point 3 = Idling speed stabilization duty cycle 4 = Switch positions

01-81

Display group number	Readout in display field
07	1 = Idling speed stabilization working range 2 = Idling speed stabilization characteristic curve zero point 3 = Idling speed stabilization characteristic curve control 4 = Idling speed stabilization load adaptation

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Notes:

- Display groups 06, 08 and 09 do not contain any information of use for the Service Department.
 - The display group should be selected depending on the type of fault which exists.
- Select desired display group number according to the list of display groups and confirm with the key Q.

01-82

Display group number 00:

- Press key 0 twice.
(“Read measured value block” is selected with 00).

Read measured value block Q
Enter display group number 00

◀ Readout in display:

- Confirm entry with the key Q.

Read measured value block
1 2 3 4 5 6 7 8 9 10

◀ Readout in display:

Notes:

- Explanation of the individual displays in the display fields is identical to the basic setting function ⇒ page 01–50.
- If the printer is switched on, the current display is printed out on the log.
- Each time the **Print** key is pressed, the current display is again printed out.
- Press key **C** before selecting further display groups.
- After selecting another display group, the printer must once again be switched on.

01–83

Display group numbers 01 to 09:

Notes:

- The **C** key must be pressed each time to move forward to a different display group.
- If the **→** key is used for moving forward or if the **C** key is inadvertently pressed twice, the function “08 Read measured value block” must first of all be selected again.
- The explanation of the individual displays as well as the indication of the specifications is given in the respective test description in which the values for the test are used (Repair Group 24 and 28).
- The displays in the display groups 01 to 05 and 07 described are not all used in Repair Groups 24 and 28.
- The example only describes selecting display group 01. The other display groups should be selected in the same manner.



01–84

- Press keys 0 and 1.
(Function "Display group number 01" is selected with 01).

Read measured value block	Q
Enter display group number 01	

◀ Readout in display:

- Confirm entry with the key Q.

Read measured value block	1
1 2 3	4

◀ Display fields in the display:

Notes:

- In the case of display group number 00, **only** "Read measured value block" appears in the display.
- In the case of display group numbers 01 to 09, the respective display group number **without the 0** appears in the display together with "Read measured value block".

01-85

Interrogating control unit version with V.A.G 1551

- Interrogate fault memory ⇒ page 01-5.

Rapid data transfer	HELP
Select function XX	

◀ Readout in display:

- Press keys 0 and 1.
(The function "Interrogate control unit version" is selected with 01).

Rapid data transfer	Q
01 - Interrogate control unit version	

◀ Readout in display:

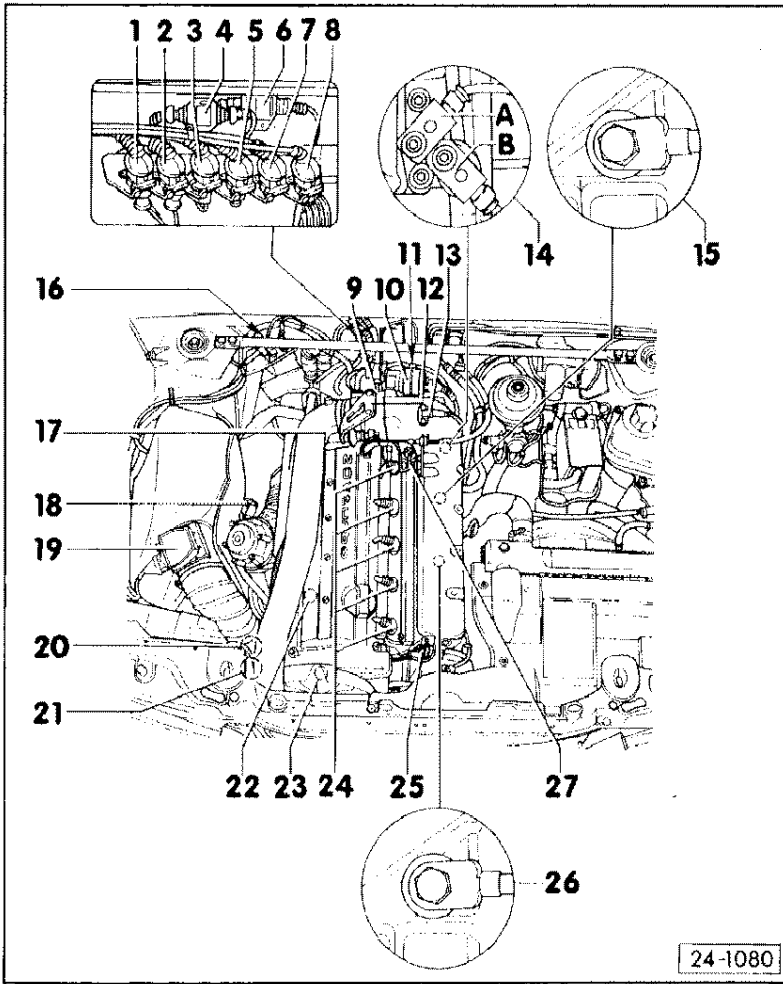
- Confirm entry with the key Q.

8959077551A 2.2l R5 MOTR:	
RHV HS D01	
Coding 1	

◀ Readout in display:

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- This display contains the following information:**
- Control unit identification (895 907 551 A, for current control unit version ⇒ Part programme).
 - Cubic capacity of engine (2.2 ltr.)
 - Type of engine (in-line engine, 5-cylinders)
 - Injection system (MOTRONIC)
 - Ignition system version (distributorless ignition)
 - Gearbox version (HS = manual gearbox or AT = automatic gearbox)
 - Software version of control unit (D., only for vehicle manufacturer)
 - Coding ⇒ Coding variants of Motronic control unit, page 01-66.

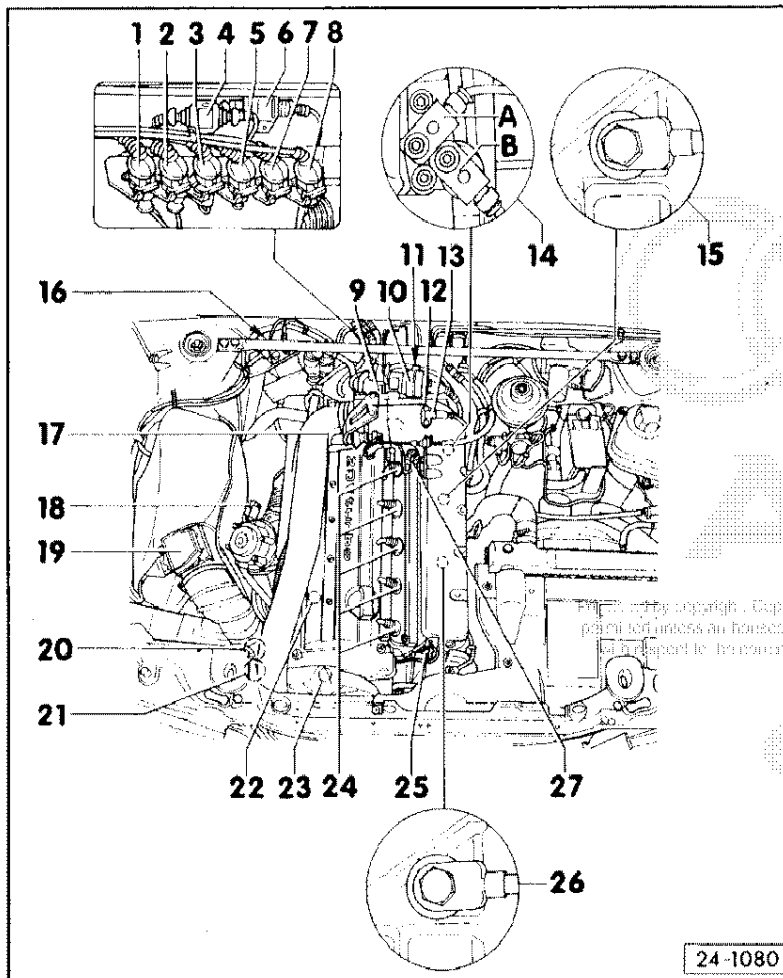
01-86



Motronic components

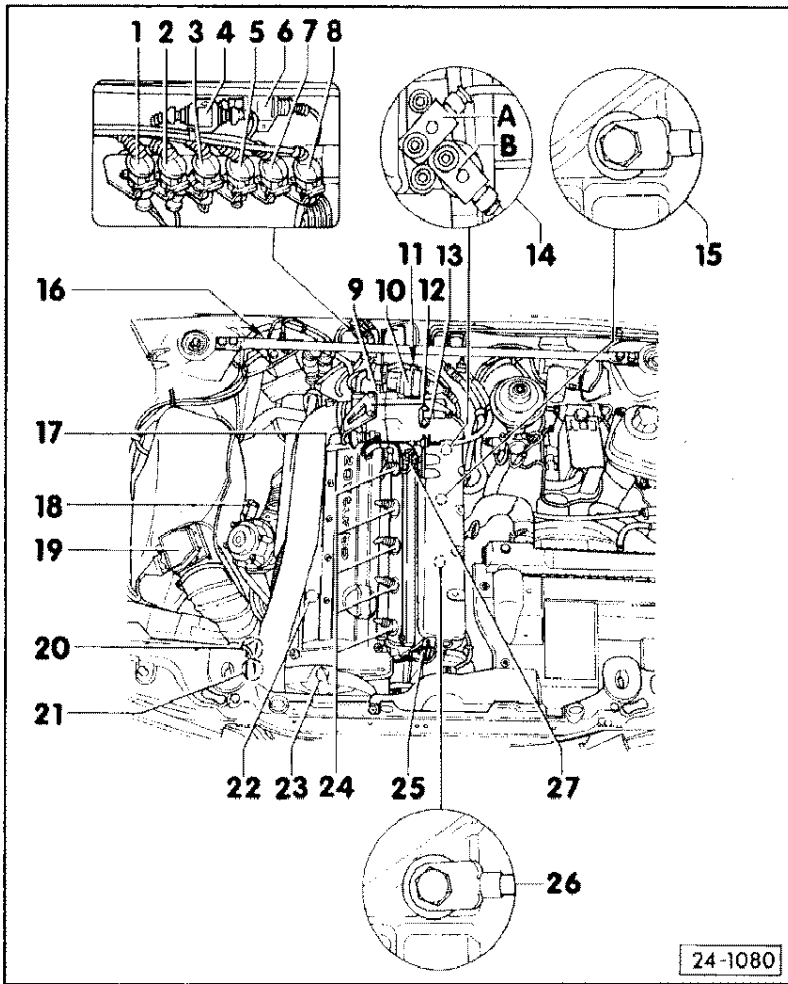
- 1 – Plug connection, cylinders 4 and 5 (N 163 and N 164)
(white plug connection)
- 2 – Plug connection, cylinders 1, 2 and 3 (N, N 128 and N 158)
(white plug connection)
- 3 – Plug connection for sender, knock sensor I front –G61
(blue plug connection)
- 4 – Power output stage I –N122
(actuation for cylinders 1, 2 and 3)
- 5 – Plug connection for sender, knock sensor II rear –G66
(green plug connection)
- 6 – Power output stage II –N127
(actuation for cylinders 4 and 5)
- 7 – Plug connection for engine speed sender –G28
(grey plug connection)
- 8 – Plug connection for ignition timing sender –G4
(reference mark sender, black plug connection)

24-1



- 9 – Throttle valve potentiometer –G69
(with integral idling speed switch)
- 10 – Idling speed stabilization valve –N71
• Testing ⇒ page 24-28
- 11 – Solenoid valve for activated charcoal filter –N80
• Testing ⇒ page 24-37
- 12 – Throttle valve body
- 13 – Intake air temperature sender –G42
• Testing ⇒ page 28-18
- 14 – A – Ignition timing sender –G4
(reference mark sender, black plug connection)
• Testing ⇒ page 28-13
B – Engine speed sender –G28
(grey plug connection)
• Testing ⇒ page 28-15
- 15 – Knock sensor II rear –G66
- 16 – Plug connection for lambda probe
Lambda probe heater –Z19
(two-pin black plug connection)
Lambda probe –G39
(one-pin signal wire)
- 17 – Coolant temperature sender –G62
(at rear right of cylinder head)
• Testing ⇒ page 28-21

24-2



- 18 – Lambda probe –G39
• Testing ⇒ page 24–33
- 19 – Air mass meter –G70
• Testing ⇒ page 24–58
- 20 – Overrun shut-off valve
• Testing ⇒ Repair Group 21
- 21 – Solenoid valve for boost pressure limiting –N75
• Testing ⇒ page 24–41
- 22 – Ignition coils –N, N128, N158, N163, N164
• Testing ⇒ page 28–12
- 23 – Hall sender –G40
• Testing ⇒ page 28–27
• Basic setting ⇒ page 28–30
- 24 – Injectors
• Testing ⇒ page 24–19
- 25 – Plug connection for Hall sender –G40
- 26 – Knock sensor | front –G61
- 27 – Fuel pressure regulator
• Testing system and holding pressure ⇒ page 24–11

Technical data

System pressure (in bar gauge) with engine running (idling):	
without vacuum:	4.0 ... 4.2
with vacuum:	3.4 ... 3.7
Holding pressure 10 minutes (minimum pressure in bar)	
Engine cold:	3.5
Engine hot:	3.8
Injectors	
Quantity injected ml/30 s	150 ... 170
Idle speed test*	
Speed in rpm	800 ± 30
CO content % by vol.	0.70 ± 0.20

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* Pay attention to test requirements ⇒ page 24–26

Rules for cleanliness

Note:

Carefully observe the following "5 rules" for cleanliness when performing work on the fuel supply/fuel injection system.

- 1 – Thoroughly clean connection points and surrounding area before disconnecting.
- 2 – Place removed parts down on a clean surface and cover over. Use sheeting or paper. Do not use fluffing cloth!
- 3 – Carefully cover over or seal opened components if repairs are not performed immediately.
- 4 – Install only clean parts.
 - Do not remove replacement parts from their wrapping until just before installing.
 - Do not use parts which have been stored unwrapped (e.g. in tool boxes etc.).
- 5 – When the system is open:
 - Avoid working with compressed air if possible.
 - Avoid moving vehicle if possible.

24-5

Safety precautions

Pay attention to the following points when performing work on vehicles with Motronic system to avoid injuries to persons and/or damage to the Motronic control unit:

Notes:

- *Before disconnecting the battery, determine the coding of radios equipped with anti-theft coding.*
- *Do not disconnect or connect the battery unless the ignition is **switched off** otherwise the Motronic control unit may be damaged.*
- *Wait at least 30 seconds after switching off the ignition before unplugging the connector from the Motronic control unit otherwise the Motronic control unit may be damaged.*
- *Do not disconnect cables of the ignition system unless the ignition is switched off.*
- *Do not connect or disconnect cables of test equipment unless the ignition is switched off.*

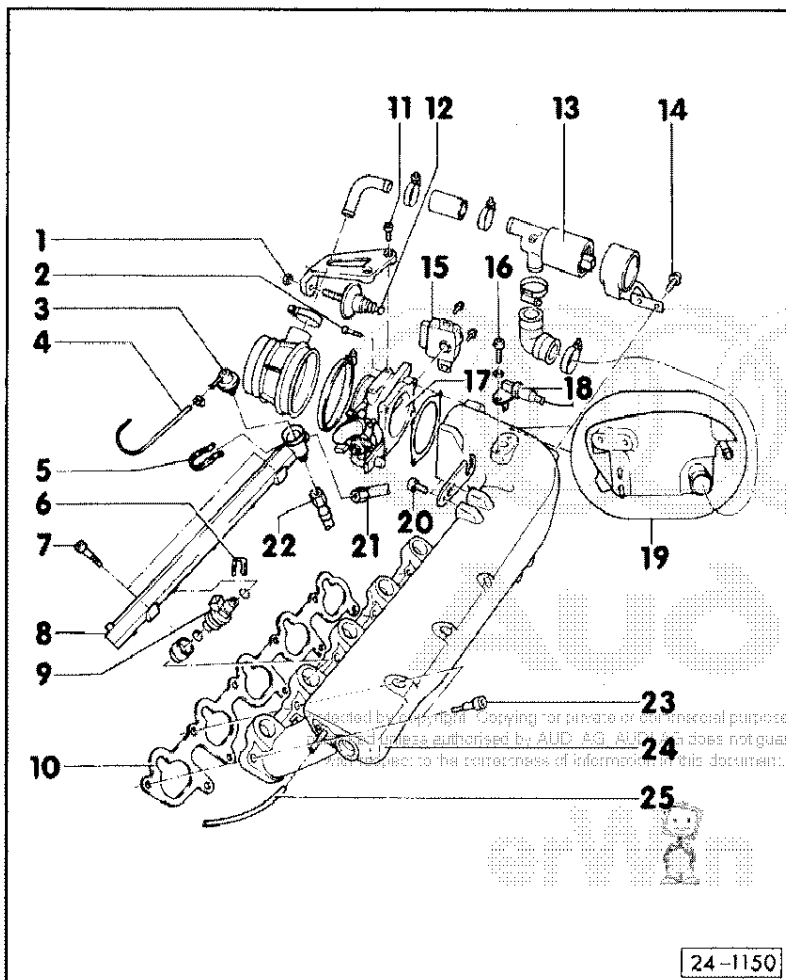
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24-6

- To operate the engine at starting speed (e.g. for testing compression pressure, testing Motronic system), unplug the three-pin connectors from the power output stages of the ignition coil and also the connectors of all five injectors.
- Do not disconnect the battery when the engine is running.
- Do not apply voltage to the control unit for simulating output signals.
- Do not operate starter when the injectors are removed.

24-7



Servicing Motronic injection system

Notes:

- Before performing repair work on the injection system, interrogate fault memory and perform final control diagnosis.
- Always fit new seals and gaskets.
- Interrogating fault memory ⇒ Repair Group 01.
- Final control diagnosis ⇒ Repair Group 01.

1 – 10 Nm

2 – 10 Nm

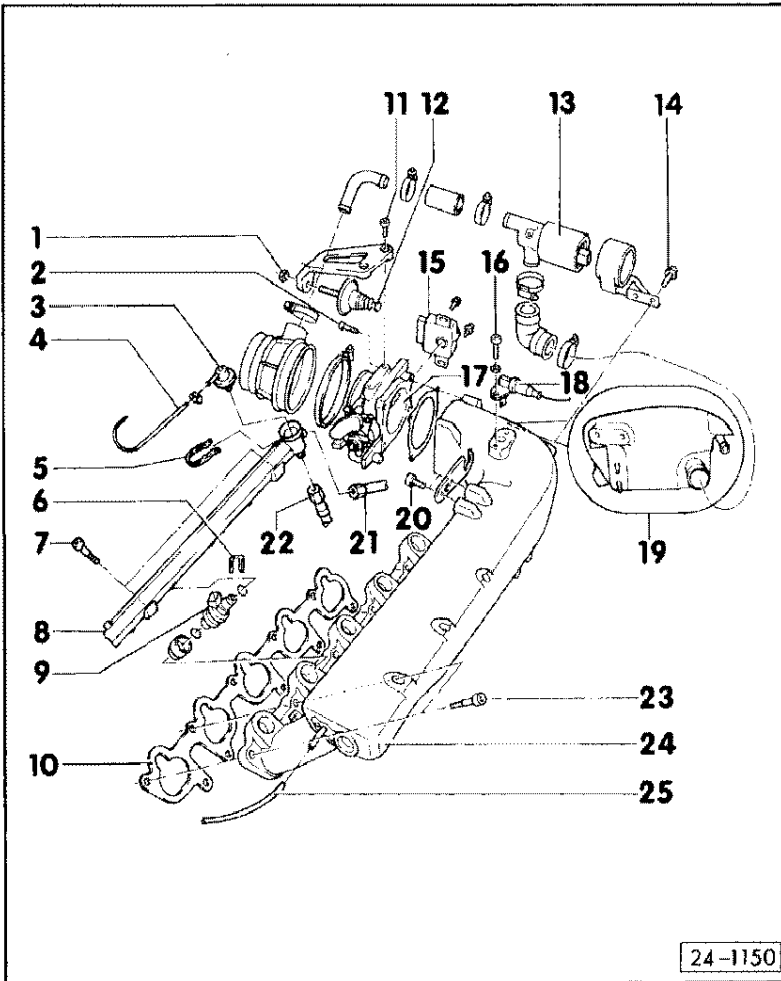
3 – Fuel pressure regulator

4 – Control pressure line from intake manifold (connection Item 19)

5 – Securing clip for fuel pressure regulator

6 – Securing clip for injectors

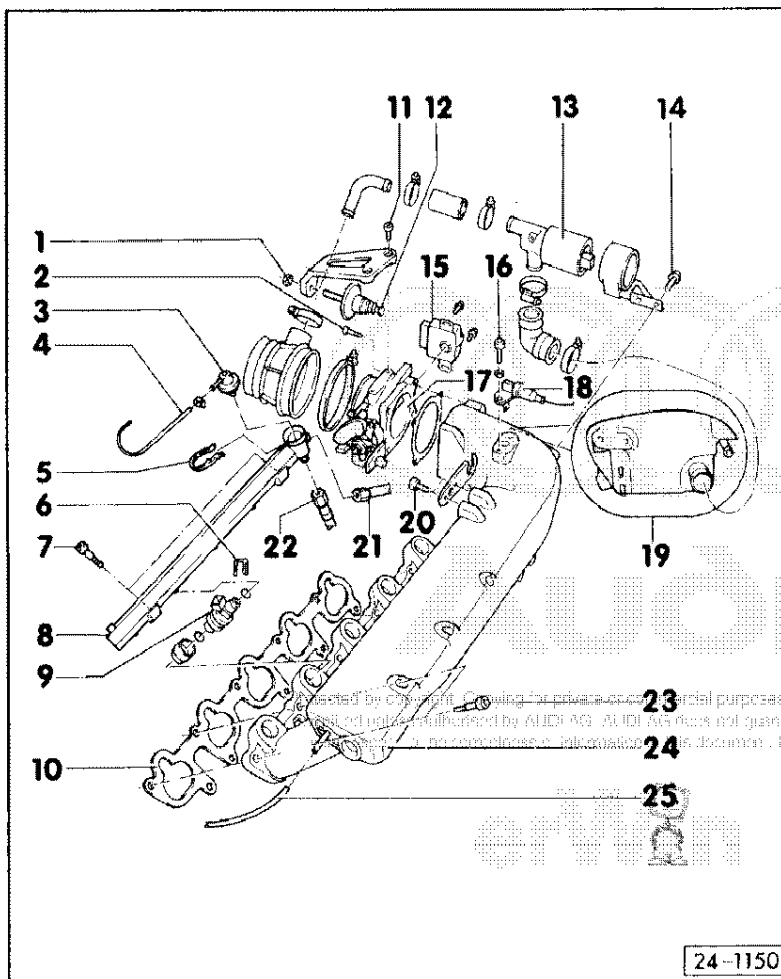
7 – 10 Nm



- 8 – Fuel manifold
- 9 – Injector
 - When removing, replace bottom and top O-ring of injector
- 10 – Gasket
- 11 – 10 Nm
- 12 – Closing damper
 - Checking and adjusting
⇒ Repair Group 20
- 13 – Idling speed stabilization valve –N71
 - Testing ⇒ page 24–28
- 14 – 10 Nm
- 15 – Throttle valve potentiometer –G69 (idling switch integrated)
 - Testing ⇒ page 24–53
- 16 – 10 Nm
- 17 – Throttle valve body
- 18 – Intake air temperature sender –G42
 - Testing ⇒ page 28–18
- 19 – Pressure connections
 - Page 24–81

24-1150

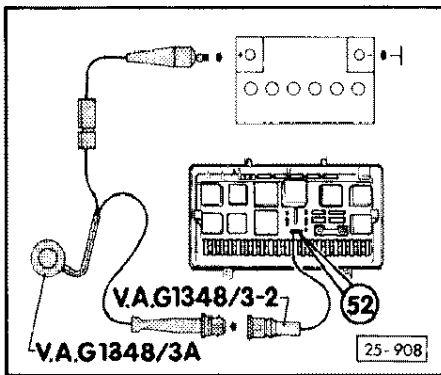
24-9



- 21 – Fuel feed pipe
- 22 – Fuel return pipe (25 Nm)
- 23 – 25 Nm
- 24 – Intake manifold
- 25 – Vacuum connection for overrun shut-off valve

24-1150

24-10



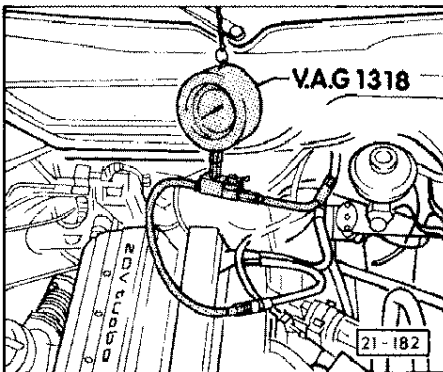
Testing system pressure and holding pressure

Test requirements:

- Fuse 13 in relay plate intact with fuse holder
- Fuel filter in proper condition
- Battery fully charged (min. 12 V)

Testing system pressure

- Remove fuel pump relay from the relay plate (relay position 10).
- ← - Connect remote control V.A.G 1348/3A with adapter cable V.A.G 1348/3-2 to contact 52 and to battery positive.



- Detach vacuum line from fuel pressure regulator.
- ← - Install pressure measuring device V.A.G 1318 with adapters 1318/11, 1318/13 and 1318/15 into the fuel feed pipe, as shown in the illustration, and move lever at pressure measuring device to "open" position - feed pipe ⇒ page 24-10.

24-11

Note:

If fuel flows out at the vacuum connection of pressure regulator during the subsequent pressure test, replace pressure regulator.

- Briefly operate remote control - fuel pump must run.
- If the fuel pump does not run, test fuel pump ⇒ Repair Group 20.
- Continue operating remote control until the pressure no longer builds up.

Specifications:

- 4.0 ... 4.2 bar with pump running
- 3.5 ... 3.7 bar immediately after switching off fuel pump

Note:

If no fuel pressure is built up, check whether the fuel feed and return pipes have been wrongly connected.

- If the specification is not achieved, test fuel pump (Repair Group 20) and check fuel feed pipe for leaks or damage (e.g. crimping points in area of vehicle floor), replace if necessary.

If the specification is again not achieved, replace pressure regulator and repeat pressure test.

If the specification is exceeded, check return pipe for damage (e.g. crimping points in area of vehicle floor) and check flow, replace if necessary.

Note:

Excessive fuel pressure may cause the diaphragm of the pressure regulator to tear, allowing fuel to pass along the vacuum line into the engine (risk of explosion).

- Remove remote control and re-insert fuel pump relay into relay position 10.

Note:

During the subsequent test, the engine must not run unnecessarily long with the vacuum hose detached as the fuel/air mixture will be enriched as a result of the higher fuel pressure, which may cause the lambda control limits to be exceeded and a fault to be stored.

- Run engine at idling speed.
- Switch off all electrical components (air conditioner etc.).
- Fit intake manifold pressure connection onto pressure regulator and observe pressure drop at pressure gauge.
- When the vacuum hose is fitted on, the fuel pressure must drop by about 0.5 bar. If this pressure change does not occur, perform the following checks:
 - Check vacuum hose for signs of leaks (split, damage).
 - Check whether vacuum connection at intake manifold is blocked; to do this detach hose at pressure regulator and blow into hose.

24-13

- If no leak exists and the vacuum connection is not blocked, replace pressure regulator.

Testing holding pressure

- Holding pressure 10 minutes after switching off engine (minimum pressure)

cold engine: 3.5 bar
hot engine: 3.8 bar

Note:

The pressure rise when the engine is hot is normal as a result of the expansion of the fuel.

- If the holding pressure is not reached, perform the following checks:
 - Check connections of pressure measuring device for leaks.
 - Check fuel pipes for leaks.
 - Check non-return valve in electric fuel pump (⇒ Repair Group 20).
 - Check injectors for leaks ⇒ page 24-23.
- If no leaks exist and if the non-return valve in the electric fuel pump is operating properly, replace pressure regulator and repeat holding pressure test.
- After testing system and holding pressure, interrogate fault memory and erase ⇒ Repair Group 01.

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24-14

Testing fuel pump relay and actuation

Testing fuel pump relay –J17

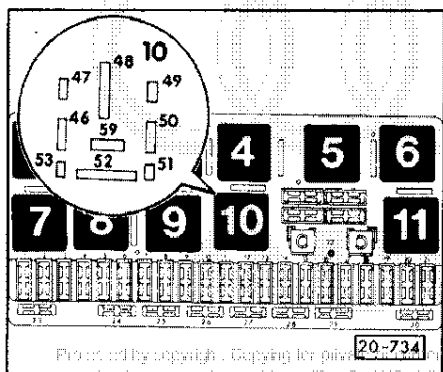
- Remove fuses 13, 24, 25 and 28. Connect diode test lamp V.A.G 1527 between earth and rear contact for fuse 13.
- Briefly operate starter.
- Specification: Fuel pump relay must pick up, diode test lamp must light up.
- If the fuel pump relay does not pick up (can be felt and heard), test actuation ⇒ page 24–17.
- If the diode test lamp does not light up, test cable connection ⇒ page 24–16.
- Connect diode test lamp to earth and **one after the other** between the left contacts of the fuses 24, 25 and 28.
- Briefly operate starter.
- Specification: Diode test lamp must light up.
- If the diode test lamp does not light up or if it lights up as soon as the ignition is switched on, connect diode test lamp to the right-hand contact of the respective fuse and repeat test.

24–15

- Specification: Diode test lamp must light up.
- If the diode test lamp again does not light up, test cable connection ⇒ below.
- If the diode test lamp lights up, re-insert fuses 13, 24, 25 and 28.

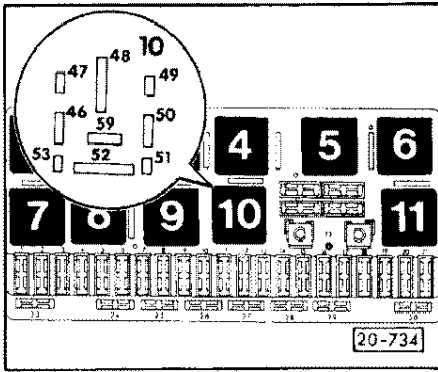
B – Testing cable connections

- Ignition switched off.
- Remove fuel pump relay –J17 from the relay plate, relay position 10.
- Test cable connections between fuse 13 and contact 52, fuse 25 and contact 52, fuse 24 and contact 59 and also between fuse 28 and contact 59 of the relay position 10 for open circuit with digital multimeter V.A.G 1526.
- Specification: max. 0.5 ohms
- If the specification is not achieved, rectify open circuit in wiring on basis of current flow diagram.
- If no open circuit in the wiring is found, test actuation of fuel pump relay ⇒ next page.
- If actuation is in order, replace fuel pump relay.



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24–16

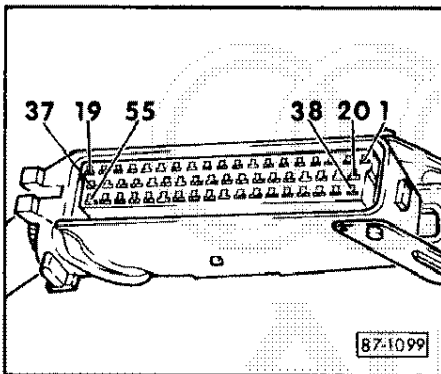


C – Testing actuation of fuel pump relay

- ◀ – Remove fuel pump relay ~J17 from the relay plate, relay position 10.
- Switch on ignition.
- ◀ – Connect hand-held multimeter V.A.G 1526 with auxiliary cables from V.A.G 1594 one after the other between contacts 46 and 50 and also 48 and 50 of the relay base.
- Specification: approx. 12 volts.
- If the specifications are not achieved, rectify open circuit in wiring on basis of current flow diagram.
- Connect diode test lamp V.A.G 1527 to contacts 46 and 47.
- When the ignition is switched on, the diode test lamp must light up weakly and become brighter when the starter is operated.
- If the diode test lamp lights up weakly when the ignition is switched on but does not become brighter when the starter is operated, replace Motronic control unit.
- If the diode test lamp does not light up, test wiring as follows:

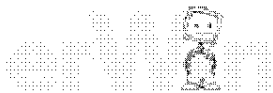
Connect test box V.A.G 1598 with adapter cable 1598/5 **only** to the wiring harness to the Motronic control unit ⇒ page 01–77.

24–17



- ◀ – Test cable from contact 47 at relay position 10 to socket 3 of the test box for open circuit.
- Specification: max. 1.0 Ω
- If the specification is not achieved, rectify open circuit between contact 47 at relay base and contact 3 of the connector at the control unit on the basis of the CFD.
- If no open circuit exists and the diode test lamp does not light up, replace control unit.
- Re-insert fuses 13, 24, 25 and 28 as the case may be.

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Testing injectors

- Perform final control diagnosis ⇒ Repair Group 01.
- If none of the injectors clicks, test actuation of injectors.
- If one or several injectors do not click, first of all perform electrical test of injectors ⇒ below.
If the injectors are electrically in order, connect replacement injector as a test and repeat final control diagnosis. If this injector does not click, replace faulty injector.

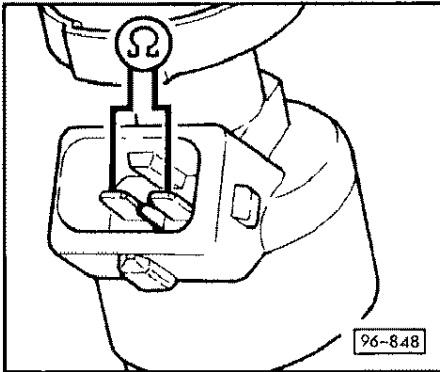
Note:

Only a genuine injector for 5-cylinder Motronic system may be used for this test.

- If the injectors do not click although they are in order, test actuation of the injectors.

Performing electrical test of injectors

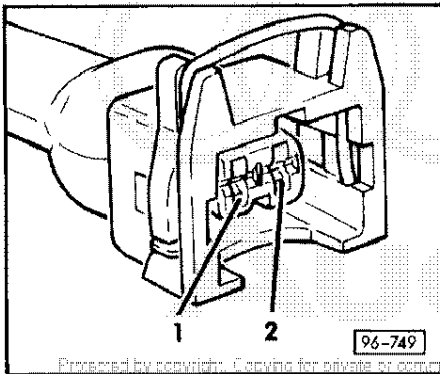
- Unplug connector at the injector to be tested.
- ◀ - Connect hand-held multimeter V.A.G 1526 to the particular injector.
- Specification: 15 ... 17 Ω
- If the specification is not achieved, replace appropriate injector.



24-19

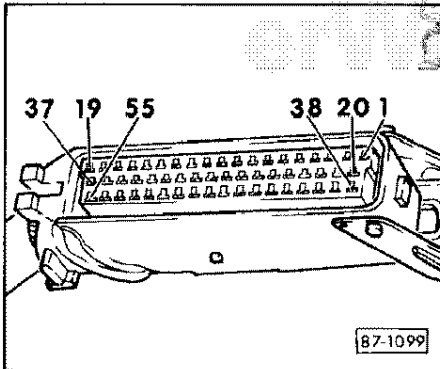
Testing actuation of injectors

- Unplug connector at the injector to be tested.
- Remove fuse 28, test fuse 27.
- ◀ - Connect diode test lamp V.A.G 1527 to contact 2 of the connector and to engine earth.
- Switch on ignition, diode test lamp must light up.
- If the diode test lamp does not light up, connect test box V.A.G 1598 with adapter cable 1598/5 to the Motronic control unit (⇒ Repair Group 01).

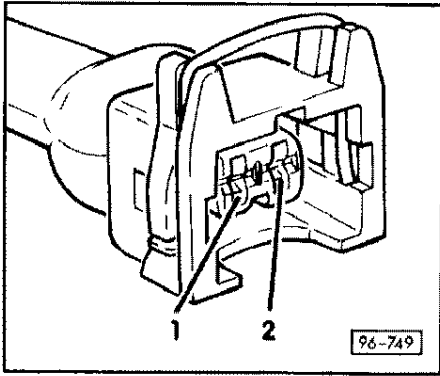


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- Connect diode test lamp V.A.G 1527 to earth (socket 19) and to socket 37 of the test box.
- Switch on ignition, diode test lamp must light up.
- ◀ - If the diode test lamp does not light up, determine open circuit between contact 37 of the connector at the Motronic control unit and contact 2 of the connector at the respective injector on the basis of the current flow diagram, and rectify.
- If the diode test lamp does not light up, replace Motronic control unit.



24-20



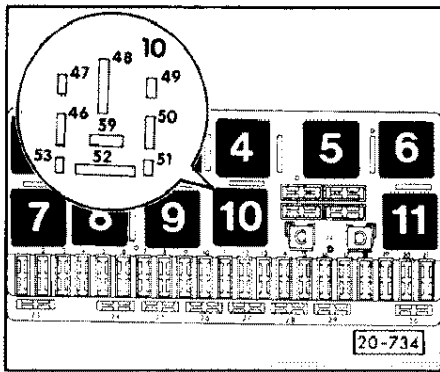
- ▶ - Insert fuse 28.
- Connect diode test lamp V.A.G 1527 to contact 2 of the connector at the injector and to engine earth.

- Switch on ignition and operate starter for a few seconds.

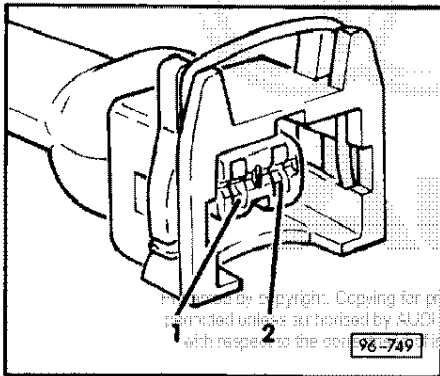
- The diode test lamp must light up when the ignition is switched on and during starting.

- If the diode test lamp goes out when the starter is operated, perform the following tests:

- Test fuse 28.
- Test cable from contact 1 of the respective connector at the injector to fuse 28 for open circuit with ohmmeter on the basis of the CFD.
- ▶ • Test cable from fuse 28 to the fuel pump relay ~J17 (relay position 10), contact 59 for open circuit on the basis of the CFD.
- Test fuel pump relay and, if necessary, actuation of fuel pump relay ⇒ page 24-15.



24-21



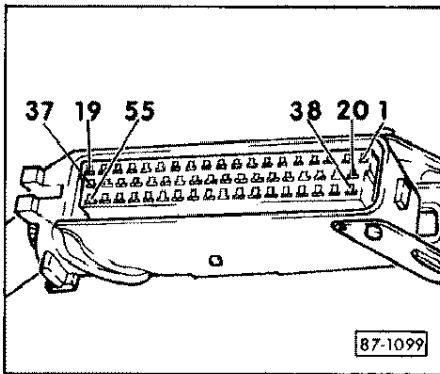
▶ - Connect diode test lamp V.A.G 1527 to contacts 1 and 2 of the connector at the injector being tested.

- Initiate final control diagnosis (⇒ Repair Group 01). When the injector being tested is actuated, the diode test lamp must briefly flash (max. 5 times).

- If the diode test lamp does not light up or shows a steady light, connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 to the wiring harness to the Motronic control unit ⇒ Repair Group 01 (the connector at the control unit is not plugged in).

▶ Test the following cables for open circuit or short to earth with ohmmeter on the basis of the CFD:

Injector cylinder	Between contacts at injector	and socket of test box
1	2	36
2	2	17
3	2	34
4	2	35
5	2	16



- – Rectify any open circuit between the respective contact of the connector at the Motronic control unit and contact 2 of the connector at the respective injector.
- Rectify any short to earth.
- If neither an open circuit nor a short to earth exists, replace Motronic control unit.

Testing quantity of fuel injected and leaktightness of injectors

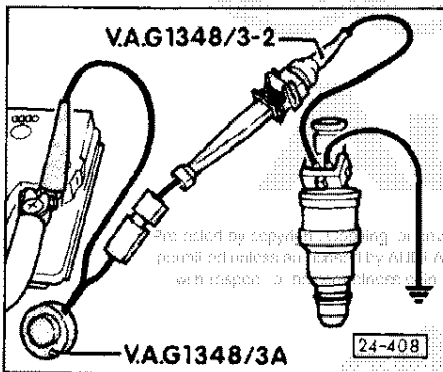
Test requirement:

- System pressure in order.
- Detach pressure line from fuel pressure regulator.
- Unplug connectors from the injectors.
- Unscrew fuel manifold and pull up and out complete together with the injectors.

Note:

When installing, ensure that the O-rings on the injectors are not damaged. Replace O-rings and moisten lightly with clean engine oil.

24-23



- Connect one contact of the injector being tested to engine earth with test cables and crocodile clamp from V.A.G 1594.
- – Connect second contact of the injector to positive with remove control V.A.G 1348/3A, adapter cable V.A.G 1348/3-2 and auxiliary cable.

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- Connect test box V.A.G 1598 with adapter cable 1598/5 to the Motronic control unit ⇒ Repair Group 01.
- Switch on ignition.
- Connect socket 3 and socket 10 of the test box with test cable and removable fuse (BA) (this activates the electric fuel pump).
- Check injectors for leaks (visual inspection). When fuel pump is running, only 1 to 2 drops per minute must flow out of each injector.

If the fuel loss is greater:

- Switch off ignition and replace leaking injector.

- Switch on ignition.
- Insert injector being tested into a measuring glass from tester for injected quantity V.A.G 1602.
- Operate remote control V.A.G 1348/3 A for 30 seconds.
- After all five injectors have been operated, switch off ignition and place measuring glasses on a flat surface.

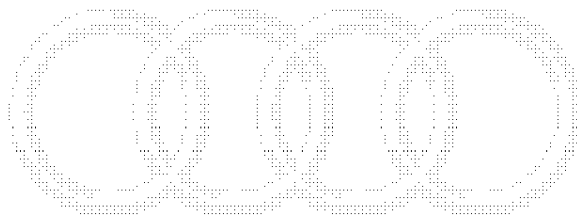
Specification: 150 ... 170 ml

If the quantity measured for one or several injectors is less or more than the specification:

- Replace faulty injector.

Note:

After removing the injectors, always replace the top and bottom O-rings.



Testing idling speed and CO content

Testing idling speed

Note:

The idling speed cannot be adjusted.

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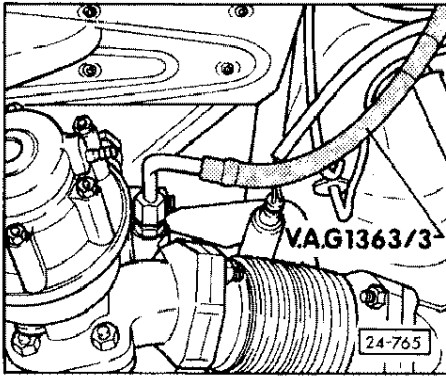
Test requirements:

- Interrogate fault memory (Repair Group 01).
- Engine warm, engine temperature at least 85°C.
- Throttle valve in idle position.
- All electrical components switched off.
- Air conditioner switched off.
- Pressure measuring device not connected.

Note:

The radiator fan must not cut in during the test.

- Run engine at idling speed.
- Basic setting of engine, select display group 01 ⇒ Repair Group 01.
- The reading in display field 1 must be between 770 and 830 rpm.
- If the specification is not achieved, perform the following tests, as described in Repair Group 01:
 - Once again interrogate fault memory.
 - Perform final control diagnosis.
 - Check possible causes of fault according to test table for basic setting of engine and rectify as necessary.



Testing CO content

Note:

The CO content cannot be adjusted.

Test requirements:

- Engine warm, oil temperature at least 85°C.
- Throttle valve in idle position.
- All electrical components switched off.
- Air conditioner switched off.
- Pressure measuring device not connected.
- Crankcase ventilation remains fitted on.
- Interrogate fault memory (Repair Group 01).

- ◀ – Connect CO tester V.A.G 1363 with hose adapter V.A.G 1363/3 to the CO sampling pipe next to the lambda probe according to the operating instructions.

– Run engine at idling speed.

– Specification: 0.5 ... 0.9 % by vol.

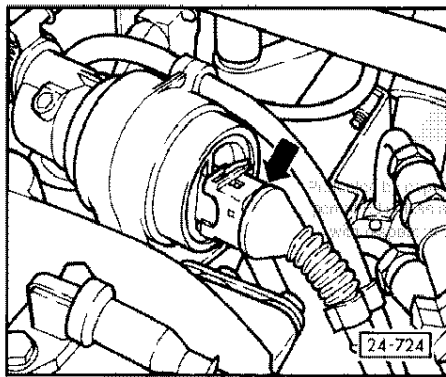
– If the specification is not achieved, check whether all spark plugs are operating properly.

Note:

Failure of a spark plug causes a sharp rise in the CO content.

– If the specification is not achieved, perform the following test ⇒ Repair Group 01:

- Once again interrogate fault memory.
- Perform final control diagnosis.
- Check basic setting values (display group 01, display field 3).

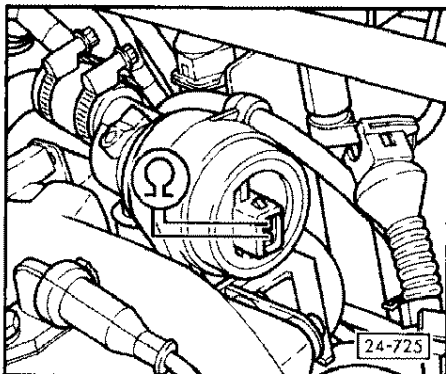


Testing idling speed stabilization

Performing electrical test of idling speed stabilization valve –N71

- ◀ – Unplug connector from the idling speed stabilization valve.

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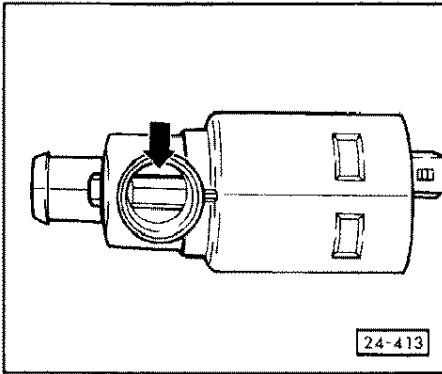
- ◀ – Connect hand-held multimeter V.A.G 1526 with auxiliary cables from V.A.G 1594 for resistance measurement to the idling stabilization valve.

Specification: 7 ... 11 Ω

– If the specification is not achieved, replace valve

Note:

At room temperature the resistance is in the lower tolerance range, when engine is at normal operating temperature it is in the upper tolerance range.



Performing mechanical test of idling speed stabilization valve

- Remove idling speed stabilization valve.
- ◀ - Check rotary slide for signs of rubbing (visual check).

Note:

Do not attempt to move rotary slide with screwdriver or other tools in order to check its ease of movement.

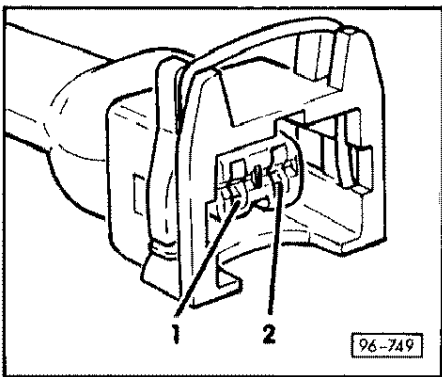
- Plug in connector at removed valve.
- Initiate final control diagnosis (Repair Group 01) and actuate idling speed stabilization valve.
- Check whether the rotary slide runs properly from stop to stop.
- If signs of rubbing are present which impair ease of movement or if the rotary slide does not operate freely (sticks, runs sluggishly or does not reach the stops), replace valve.

Testing actuation of idling speed stabilization valve

- Unplug connector from the idling speed stabilization valve.



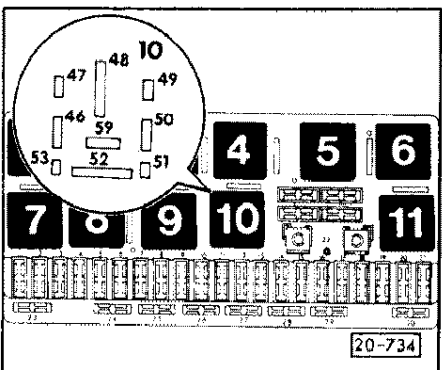
24-29



- ◀ - Connect diode test lamp V.A.G 1527 with test cable from adapter cable set V.A.G 1594 to contact 1 of the connector and to engine earth.

- Operate starter for a few seconds; the diode test lamp must light up when this is done. If the diode test lamp does not light up, perform the following tests:

- Test fuses -S24 and -S28
- Test cable from contact 1 of connector at idling speed stabilization valve to fuse -S24 for open circuit on the basis of the CFD. Specification max. 0.5 Ω.



- ◀ • Test cable from fuse -S24 to the fuel pump relay -J17 (relay position 10), contact 59, for open circuit on the basis of the CFD. Specification max. 0.5 Ω.
- Test actuation of the fuel pump relay ⇒ page 24-15.

- Reconnect diode test lamp to the connector as described above.

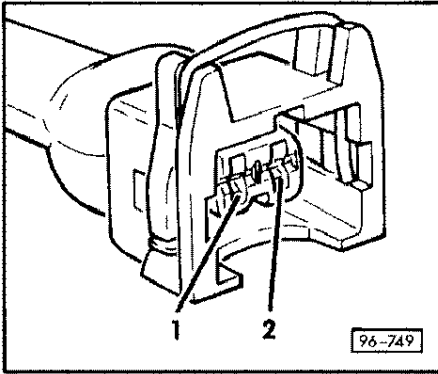
- Initiate final control diagnosis (Repair Group 01).

- Diode test lamp must light up.

Note:

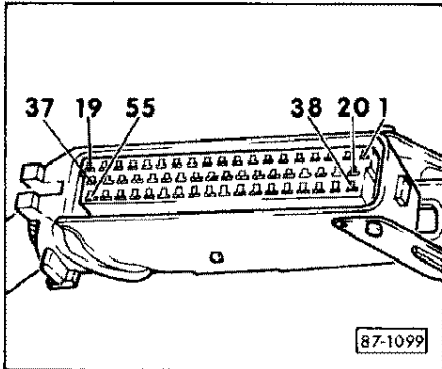
Irrespective of which actuator is selected, positive must exist at contact 1 of the connector.

24-30



- If the diode test lamp does not light up, connect test box V.A.G 1598 with adapter cable 1598/5 **only** to the wiring harness to the Motronic control unit → Repair Group 01.

◀ - Test cable from contact 1 of the connector of the idling speed stabilization valve to socket 37 of the test box for open circuit on the basis of CFD ...

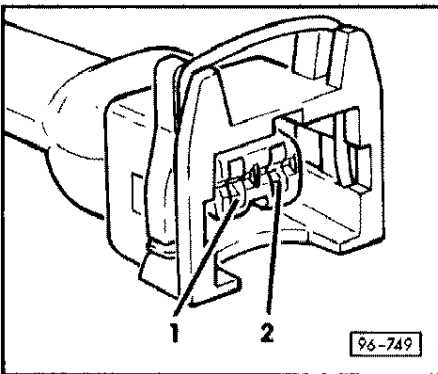
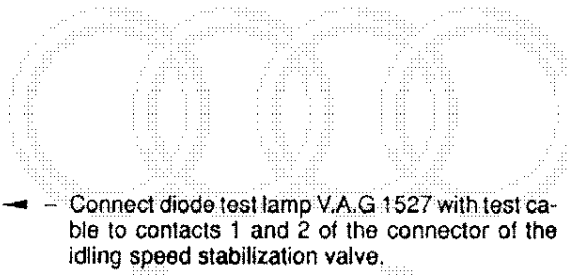


◀ - ... and rectify any open circuit between contact 37 of the connector at the control unit and contact 1 of the connector at the idling speed stabilization valve.

- If no open circuit exists, replace control unit.

- Remove test box V.A.G 1598 and adapter cable V.A.G 1598/5.

- Connect Motronic control unit to vehicle wiring harness.



◀ - Connect diode test lamp V.A.G 1527 with test cable to contacts 1 and 2 of the connector of the idling speed stabilization valve.

- Initiate final control diagnosis (Repair Group 01). When the idling speed stabilization valve is operated, the diode test lamp must flash (diode test lamps with very low current consumption become only slightly brighter and darker, but do not go out).

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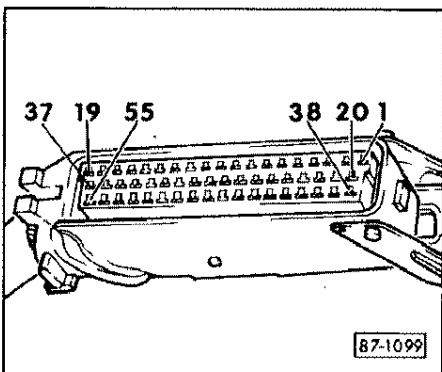
- If the diode test lamp does not flash or if it shows a steady light, connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 **only** to the wiring harness to the Motronic control unit → Repair Group 01.

- If the diode test lamp shows a steady light, test cable from contact 2 of connector at the idling speed stabilization valve to socket 4 of the test box for short to earth.

- If the diode test lamp does not flash, test cable from contact 2 of the connector at the idling speed stabilization valve to socket 4 of the test box for open circuit.

◀ - Rectify any short to earth or open circuit between contact 2 of the connector at the idling speed stabilization valve and contact 4 of the connector at the Motronic control unit.

- If there is neither an open circuit nor a short to earth in the cable, replace control unit.

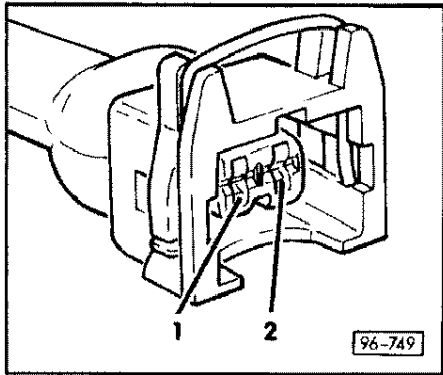
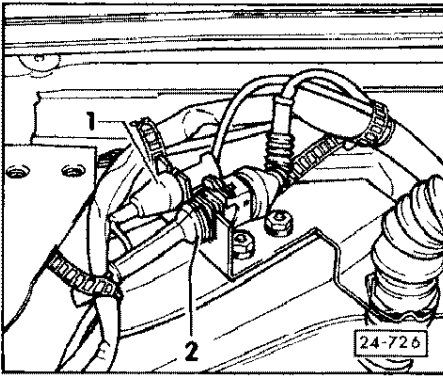


Testing lambda probe –G39 and lambda control

Testing lambda probe heater –Z19

The plug connection for the heater of the lambda probe is located in the rear of the engine compartment ⇒ also page 24-1, item 2.

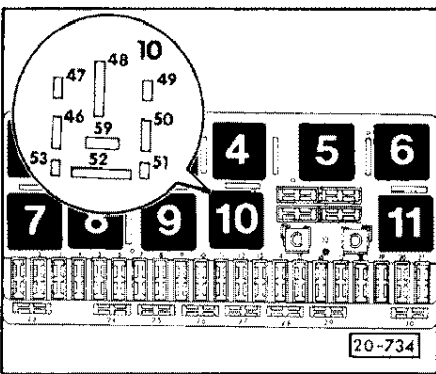
- ▶ – Separate plug connection (2).



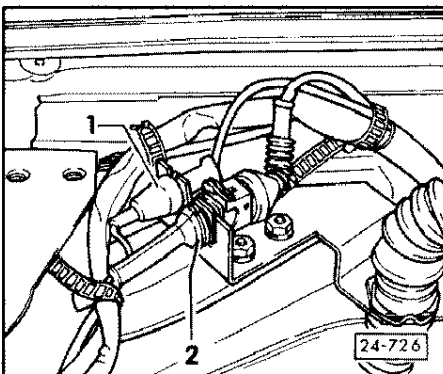
- ▶ – Connect hand-held multimeter V.A.G 1526 with auxiliary cables from V.A.G 1594 for voltage measurement between contacts 1 and 2 of the connector.
- Run engine.
- Specification: approx. 12 ... 14 volts.
- If the specification is not achieved, perform the following steps marked with a dot:
 - Test fuse 25.
 - Test cable from contact 2 to fuse 25 for open circuit on the basis of the CFD. Specification max. 0.5 Ω (check pin assignment if necessary).
 - Test cable from contact 1 to engine earth for open circuit. Specification max. 0.5 Ω.

24-33

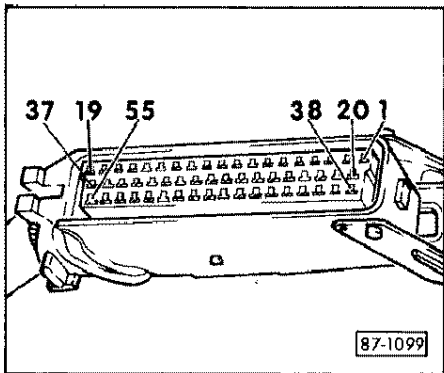
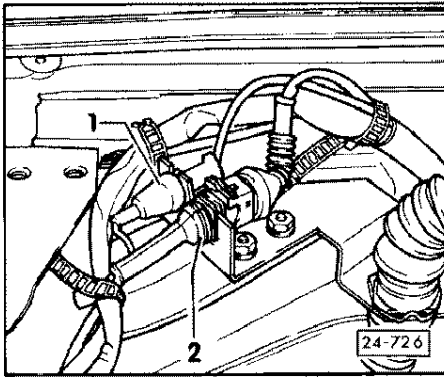
- ▶ • Test cable from fuse 25 to fuel pump relay –J17 (replay position 10), contact 52, for open circuit on the basis of the CFD. Specification max. 0.5 Ω.



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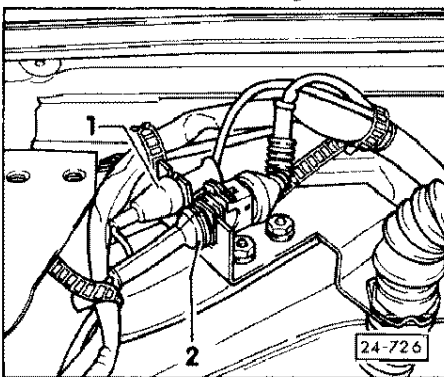
- ▶ – If no open circuit exists, connect additional test cable V.A.G 1315A/1 into plug connection (2) and to 10A test input of the hand-held multimeter V.A.G 1526.
- Run engine.
- Specification: 0.5 ... 3.0 A (the current decreases as the probe heats up).
- If the specification is not achieved, replace lambda probe.



Testing actuation of lambda probe (-G39)

- ◀ - Separate plug connection (1) (lambda signal wire).
- Connect hand-held multimeter V.A.G 1526 with auxiliary cables from V.A.G 1594 for voltage measurement between connector of the wiring harness to the Motronic control unit and engine earth.
- Switch on ignition.
- Specification: 450 ± 50 mV.
- If the specification is not achieved, connect test box V.A.G 1598 with adapter cable 1598/5 **only** to the wiring harness to the Motronic control unit \Rightarrow Repair Group 01.
- ◀ - Test cable from the connector in the engine compartment to socket 28 of the test box for open circuit on the basis of the CFD. Specification max. 1.0Ω . Rectify any open circuit between the connector in the engine compartment and contact 28 of the connector at the control unit.
- Test earth connection between engine housing and socket 10 of the test box with ohmmeter for open circuit according to CFD. Specification max. 1.0Ω . Rectify any open circuit.
- To test operation of lambda control, check basic setting of engine \Rightarrow Repair Group 01.
The readout in display field 8 must not be at a constant 128, but must fluctuate between 123 and 133.

24-35



Removing and installing lambda probe -G39

The plug connections for the lambda probe are located in the rear right of the engine compartment \Rightarrow also page 24-1, item 2.

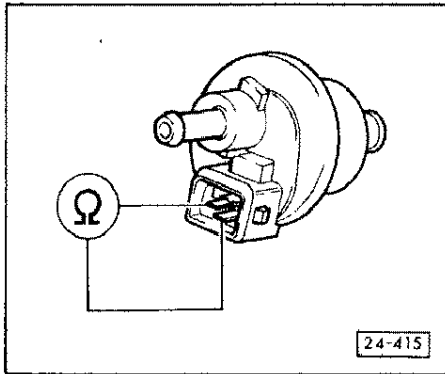
- ◀ - Separate both plug connections.
- Open cable straps.
- Unscrew lambda probe (fitting location and tightening torque \Rightarrow Repair Group 26).

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When installing the lambda probe, pay attention to the following points:

- It is important that the cable straps are carefully re-attached in order to prevent the probe cable touching the exhaust pipe.
- The thread of the lambda probe is coated with installation paste.
This paste must not get onto the slot of the probe.

24-36



Testing solenoid valve I for activated charcoal filter –N80

The solenoid valve for the activated charcoal filter is located behind the engine between cylinder head and bulkhead.

Performing electrical test of solenoid valve I for activated charcoal filter

– Unplug connector at the solenoid valve.

- ◀ – Connect hand-held multimeter V.A.G 1526 with auxiliary cables from V.A.G 1594 for resistance measurement to the solenoid valve.

Specification: 40 ... 50 Ω

– If the specification is not achieved, replace valve.

Testing actuation of solenoid valve

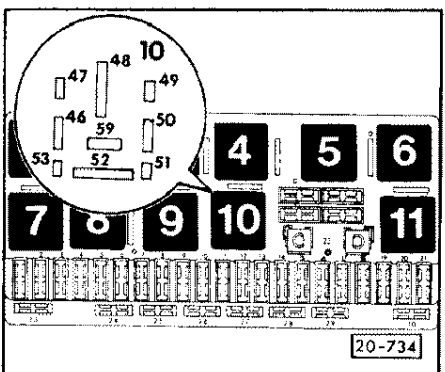
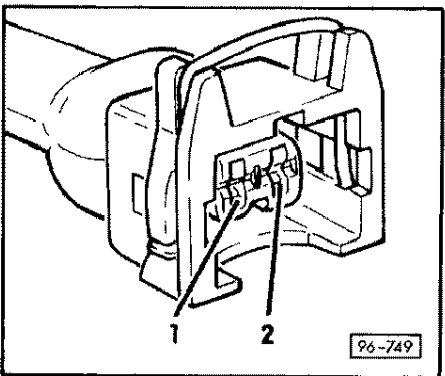
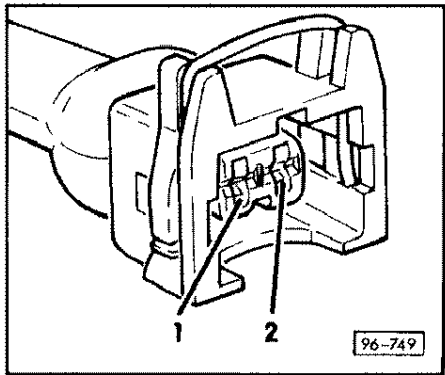
– Unplug connector at the solenoid valve.

- ◀ – Connect diode test lamp V.A.G 1527 with test cable from adapter cable set V.A.G 1594 to contact 2 of the connector and to engine earth.

– Operate starter for a few seconds; the diode test lamp must light up when this is done.

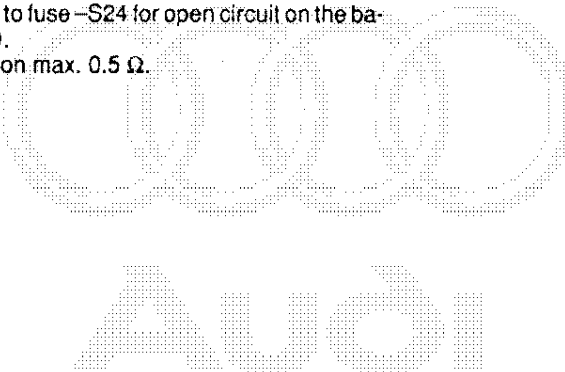
– If the diode test lamp does not light up, perform the following tests identified with a dot:

- Test fuses 24 and 28.



24-37

- ◀ • Test cable from contact 2 of the connector at the ACF valve to fuse –S24 for open circuit on the basis of CFD. Specification max. 0.5 Ω.



- ◀ • Test cable from fuse 24 to the fuel pump relay –J17 (relay position 10) contact 59 for open circuit on the basis of the CFD. Specification max. 0.5 Ω.

- Test actuation of the fuel pump relay ⇒ page 24-15.

– Re-connect diode test lamp, as described on page 24-37.

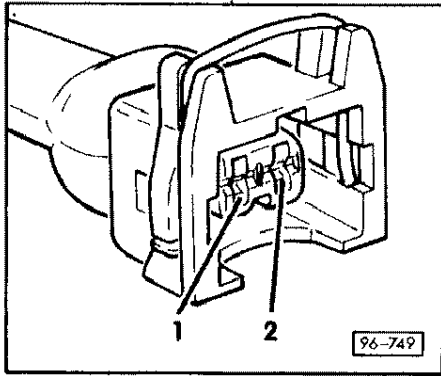
– Initiate final control diagnosis (Repair Group 01).

– Diode test lamp must light up.

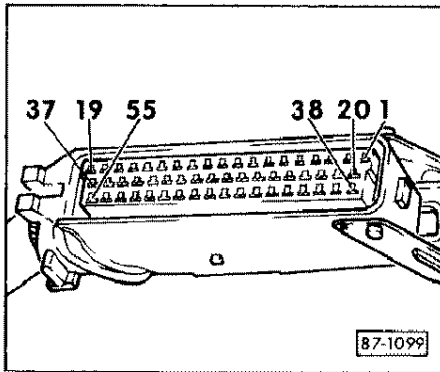
Note:

Irrespective of which actuator is selected, positive must exist at contact 2 of the connector at the solenoid valve.

24-38

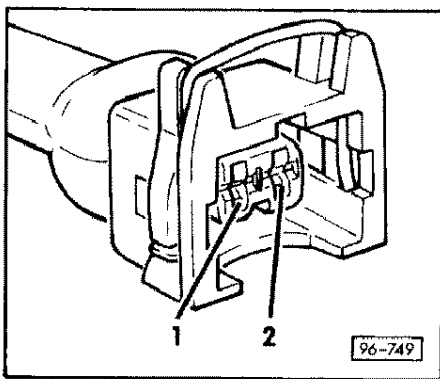


- If the diode test lamp does not light up, connect test box V.A.G 1598 with adapter cable 1598/5 **only** to the wiring harness to the Motronic control unit ⇒ Repair Group 01.
- ▶ - Test cable from contact 2 of the connector at the solenoid valve to socket 37 of the test box for open circuit on the basis of the CFD. Specification max. 1.0 Ω.

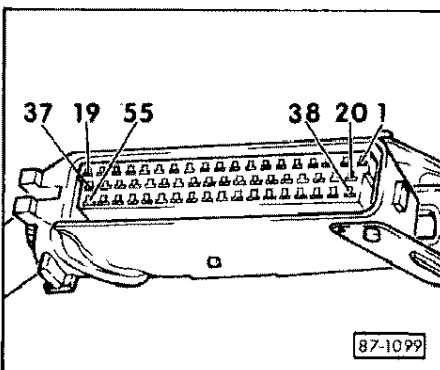


- ▶ - Rectify any open circuit between contact 37 of the connector at the control unit and contact 2 of the connector at the solenoid valve for the activated charcoal filter.
- If no open circuit exists, replace control unit.
- Remove test box V.A.G 1598 and adapter cable V.A.G 1598/5.
- Connect Motronic control unit to vehicle wiring harness.

24-39

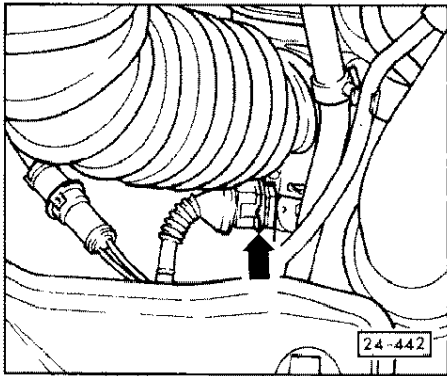


- ▶ - Connect diode test lamp V.A.G 1527 with test cable to contacts 1 and 2 of the connector at the ACF valve.
- Initiate final control diagnosis (Repair Group 01). When the solenoid valve is operated, the diode test lamp must flash.
- If the diode test lamp does not flash or if it shows a steady light, connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 **only** to the wiring harness to the Motronic control unit ⇒ Repair Group 01.



- If the diode test lamp shows a steady light, test cable from contact 1 of the connector at the ACF valve to socket 5 of the test box for short to earth.
- If the diode test lamp does not flash, test cable from contact 1 of the connector at the ACF valve to socket 5 of the test box for open circuit. Specification max. 1.0 Ω.
- ▶ - Rectify any short to earth or open circuit between contact 1 of the connector at the solenoid valve and contact 5 of the connector at the Motronic control unit.
- If neither an open circuit nor a short to earth exists in the cable, replace control unit.

24-40



Testing solenoid valve for boost pressure limiting –N75

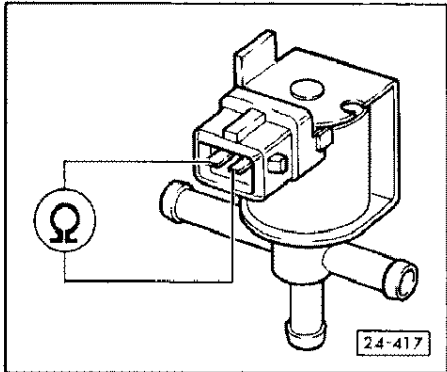
The solenoid valve for boost pressure limiting is located in front of the turbocharger (behind the right headlamp).

The solenoid valve for boost pressure limiting controls the control pressure of the blow-off valve and thus the boost pressure.

If the solenoid valve is not energized (e.g. connector unplugged), the boost pressure is lowered.

Performing electrical test of solenoid valve for boost pressure limiting

- ◀ – Unplug connector at the boost pressure limiter solenoid valve.

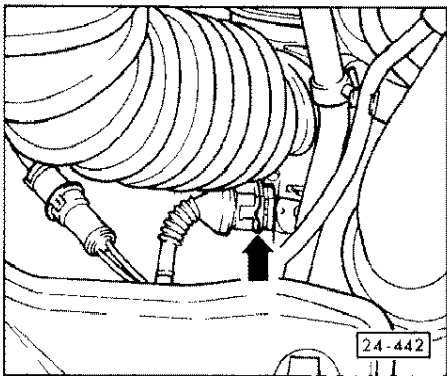


- ◀ – Connect hand-held multimeter V.A.G 1526 with auxiliary cables from V.A.G 1594 for resistance measurement to the solenoid valve for boost pressure limiting.

Specification: 25 ... 35 Ω.

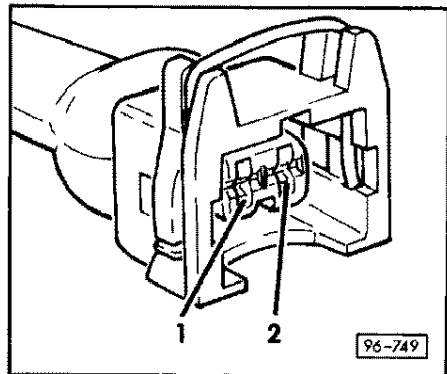
- If the specification is not achieved, replace valve.

24-41



Testing actuation of solenoid valve for boost pressure limiting

- ◀ – Unplug connector at the solenoid valve for boost pressure limiting.



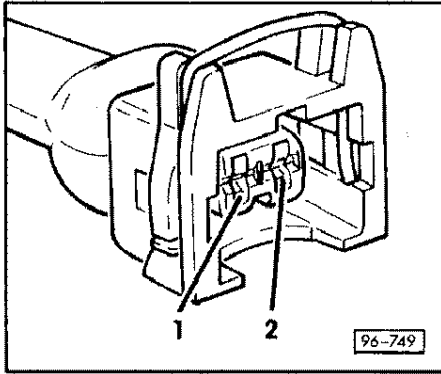
- ◀ – Connect diode test lamp V.A.G 1527 with test cable from adapter cable set V.A.G 1594 to contact 1 of the connector and to engine earth.

– Operate starter for a few seconds; the diode test lamp must light up when this is done.

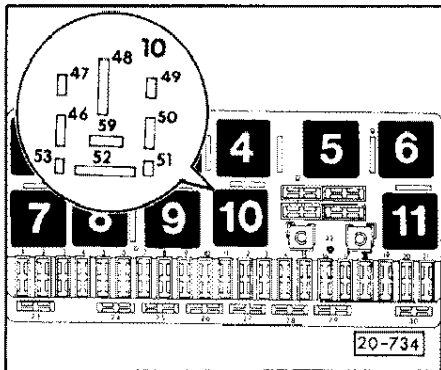
- If the diode test lamp does not light up, perform the following tests marked with a dot:

- Test fuses 24 and 28.

24-42



- Test cable from contact 1 of the connector at the solenoid valve for boost pressure limiting to fuse 24 for open circuit on the basis of the CFD. Specification max. 0.5 Ω.

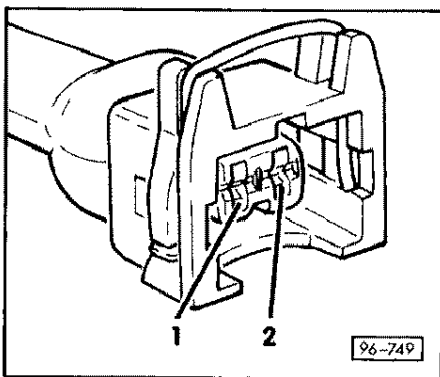


- Test cable from fuse 24 to the fuel pump relay ~J17 (relay position 10) contact 59 for open circuit on the basis of the CFD. Specification max. 0.5 Ω.
- Test actuation of the fuel pump relay ⇒ page 24-15.
- Re-connect diode test lamp, as described on page 24-42.
- Initiate final control diagnosis (Repair Group 01).
- Diode test lamp must light up.

Note:

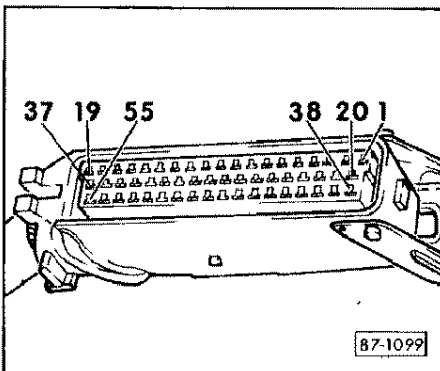
Irrespective of which actuator is selected, positive must exist at contact 1 of the connector at the solenoid valve for boost pressure limiting.

24-43



- If the diode test lamp does not light up, connect test box V.A.G 1598 with adapter cable 1598/5 only to the wiring harness to the Motronic control unit ⇒ Repair Group 01.

- Test cable from contact 1 of the connector at the solenoid valve for boost pressure limiting to socket 37 of the test box for open circuit on the basis of the CFD. Specification max. 1.0 Ω.



- Rectify any open circuit between contact 37 of the connector at the control unit and contact 1 of the connector at the solenoid valve for boost pressure limiting.

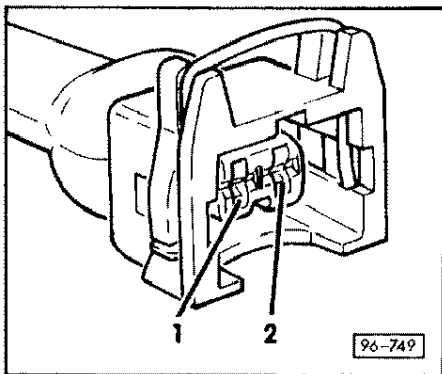
- If no open circuit exists, replace control unit.

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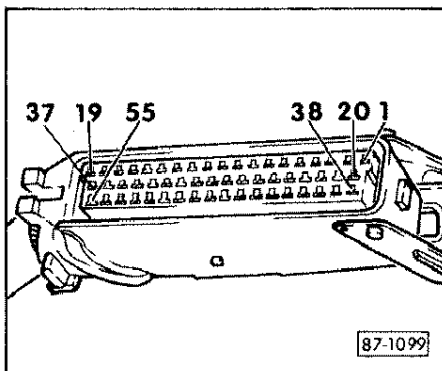
- Remove test box V.A.G 1598 and adapter cable V.A.G 1598/5.

- Connect Motronic control unit to vehicle wiring harness.

24-44



- - Connect diode test lamp V.A.G 1527 with test cable to contacts 1 and 2 of the connector at the solenoid valve for boost pressure limiting.
- Initiate final control diagnosis (Repair Group 01). When the solenoid valve is operated, the diode test lamp must flash.
- If the diode test lamp does not flash or if it shows a steady light, connect test box V.A.G 1598 with adapter cable 1598/5 only to the wiring harness to the Motronic control unit ⇒ Repair Group 01.



- If the diode test lamp shows a steady light, test cable from contact 2 of the connector at the solenoid valve for boost pressure limiting to socket 23 of the test box for short to earth.
- If the diode test lamp does not flash, test cable from contact 2 of the connector at the solenoid valve to socket 23 of the test box for open circuit. Specification max. 1.0 Ω.
- - Rectify any short to earth or open circuit between contact 2 of the connector at the solenoid valve and contact 23 of the connector at the Motronic control unit.
- If no open circuit or short to earth exists in the cable, replace control unit.

24-45

Testing and adjusting idling speed switch

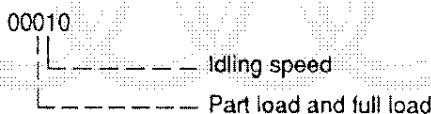
The idling speed switch is located in the throttle valve potentiometer.

- Fitting location of throttle valve potentiometer ⇒ page 24-1.

Testing operation of idling speed or part load detection of Motronic control unit with V.A.G 1551

- Read measured value block and select display group 04 ⇒ Repair Group 01.

- Check readout in display field 4:



- When the accelerator pedal is depressed (pedal travel several mm) the part load/full load display must jump from 0 to 1 and the idling speed display from 1 to 0.

- If this change in the display does not occur until the pedal has been depressed further, adjust idling speed switch ⇒ page 24-48.

- If the display does not jump, test idling speed switch and cable connection.

- If the part load/full load display is already at 1 and the idling speed display at 0 before the accelerator pedal is depressed, adjust idling speed switch.

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Read measured value block				4
840 rpm	41 %	4 km/h	00010	

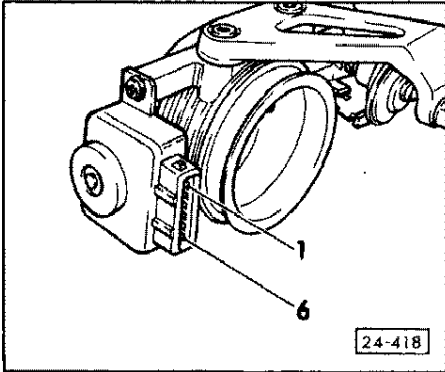
24-46

- If the fault cannot be rectified by adjusting the switch, test idling speed switch and cable connection.

Testing idling speed switch

Test requirements:

- Throttle adjustment in order ⇒ Repair Group 20.
- Throttle pedal mechanism and throttle cable operate easily.
- Adjustment of linkage for cruise control system in order.
- Throttle valve body operates easily, closes properly.
- Closing damper and adjustment in order.



- Unplug connector at the throttle valve potentiometer.

- ▶ - Connect hand-held multimeter V.A.G 1526 with auxiliary cables from V.A.G 1594 for resistance measurement to contacts 4 and 6.

Specification: zero ohms (continuity).

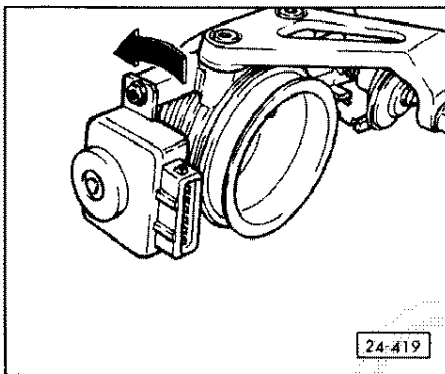
- Operate throttle valve slightly.

Specification: infinite ohms (no continuity).

If the specification is not achieved or if the specification is not achieved until the throttle valve is opened further, adjust idling speed switch.

- If the specification is still not achieved after adjusting the idling speed switch, replace throttle valve potentiometer.

24-47



Adjusting idling speed switch

- Slacken both screws of the throttle valve potentiometer.
- ▶ - Turn throttle valve potentiometer in direction of arrow until a stop is felt. The throttle valve (throttle mechanism) must not be moved when performing this step.
- Tighten throttle valve potentiometer in this position.
- Once again test idling speed switch.

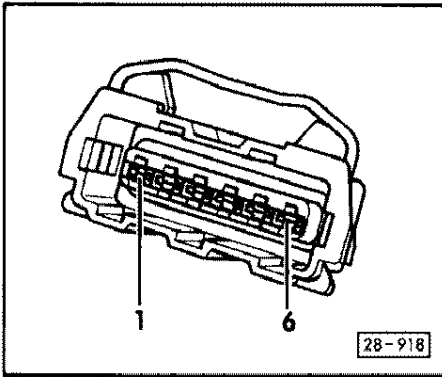
Testing wiring between idling speed switch and Motronic control unit

- Connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 **only** to the wiring harness to the Motronic control unit ⇒ Repair Group 01.
- Unplug connector from the throttle valve potentiometer.

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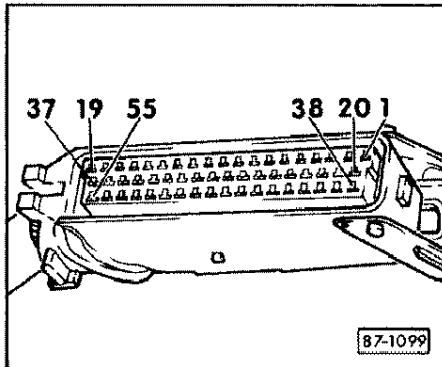
24-48



- ▲ – Test the following cables for open circuit or short circuit on the basis of the CFD:

Connector contact	V.A.G 1598 socket
4	19
6	52

Specification: max. 1.0 Ω.



- ▲ – Rectify any open circuit or short circuit on the basis of the current flow diagram.

Note:

Only gold-plated contacts may be used for repairing contacts in the connector of the throttle valve potentiometer.

Testing and adjusting throttle valve potentiometer –G69

- Fitting location of throttle valve potentiometer ⇒ page 24-1.

Test requirement:

- Accelerator cable correctly set.

– Switch off ignition.

– Read measured value block (do not run engine at idling speed) and select display group 03 ⇒ Repair Group 01.

– Check readout in display field 3:

- Throttle valve closed (accelerator pedal not depressed)
Specification: 5 ... 10°
- Throttle valve fully open (accelerator pedal fully de-pressed)
Specification: 90 ... 102°

Notes:

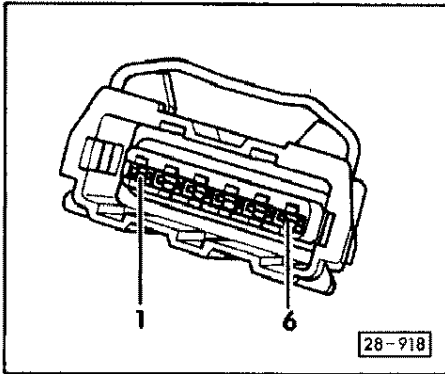
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- Readouts below 5° indicate a short circuit in the cable connection or in the throttle valve potentiometer.
- Readouts of more than 102° indicate an open circuit in the wiring or an open circuit in the throttle valve potentiometer.

– If the specifications are not achieved, adjust throttle valve potentiometer ⇒ page 24-54.

- If the specifications are not achieved although the setting is in order, perform the following tests:
 - Test voltage supply.
 - Test cable connection.
 - Test resistance of throttle valve potentiometer.

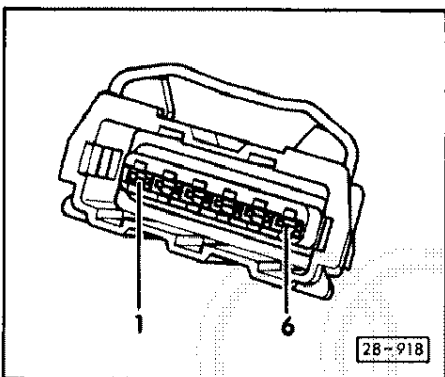
Testing voltage supply



- Unplug connector at the throttle valve potentiometer.
- Switch on ignition.
- ◀ - Connect hand-held multimeter V.A.G 1526 with auxiliary cables from V.A.G 1594 for voltage measurement in turn between contacts 1 and 2 and also 2 and 3.
- Specification: 4.5 ... 5.5 volts in each case.
- If the specifications are achieved, test resistance of the throttle valve potentiometer ⇒ page 24-53.
- If one of the specifications is not achieved, test wiring to the Motronic control unit and the Motronic control unit.

24-51

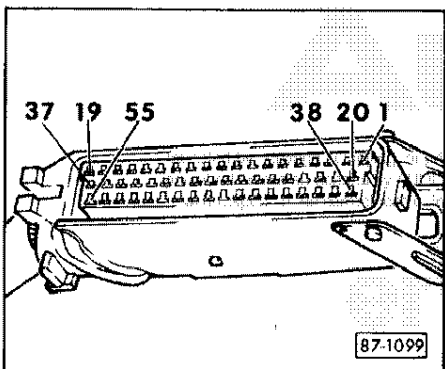
Testing cable connection



- Switch off ignition.
- Connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 **only** to the wiring harness to the Motronic control unit ⇒ Repair Group 01.
- ◀ - Test the following cables for open circuit or short circuit on the basis of the CFD:

Connector contactsocket	V.A.G 1598
1	12
2	30
3	53

Specification: max. 1.0 Ω.



- ◀ - Rectify any open circuit or short circuit on the basis of the current flow diagram.

Note:

Only gold-plated contacts may be used for repairing contacts in the connector of the throttle valve potentiometer.

24-52

- Connect adapter cable V.A.G 1598-5 to the Motronic control unit.
- Switch on ignition.
- Connect hand-held multimeter V.A.G 1526 in turn between sockets 12 and 30 and also 30 and 53.

Specification: 4.5 ... 5.5 volts in each case.

- If one of the specifications is not achieved, replace Motronic control unit.

Testing resistance of throttle valve potentiometer

- ◀ Connect hand-held multimeter V.A.G 1526 with auxiliary cables from V.A.G 1594 for resistance measurement to contacts 1 and 2.

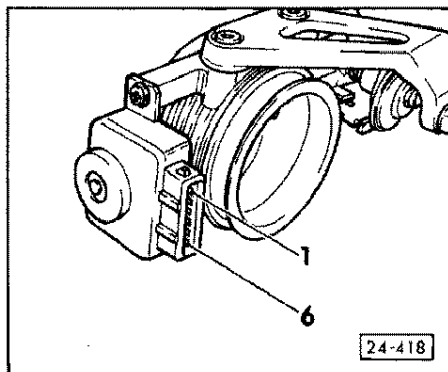
Specification: 1.5 ... 2.6 k Ω .

- Connect hand-held multimeter to contacts 2 and 3.

Specification in idle speed position:
approx. 0.75 ... 1.3 k Ω .

- Slowly move throttle valve lever into end position (full throttle position). When this is done, the resistance must rise to a max. of 3.6 k Ω .

- If one of the specifications is not achieved, replace throttle valve potentiometer.



24-53

Adjusting throttle valve potentiometer

The throttle valve potentiometer is also adjusted when the idling speed switch is adjusted.

Adjusting idling speed switch \Rightarrow page 24-48.

Testing altitude sender

- ◀ The altitude sender is located in the footwell on the front passenger's side below the trim in a recess of pillar A.

- Read measured value block and select display group 02 \Rightarrow Repair Group 01.

- Check readout in display field 4.

The current atmospheric pressure in mbar is indicated.

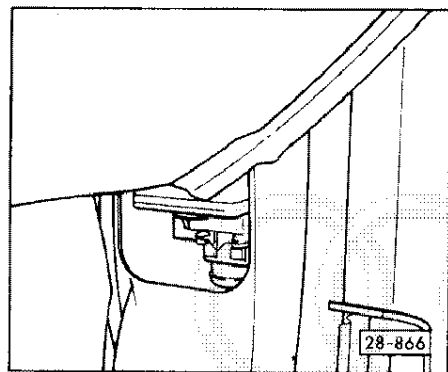
Notes:

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- The current atmospheric pressure is dependent on altitude and weather-related pressure fluctuations.

- The atmospheric pressure at mean sea level in normal weather conditions is approx. 1013 mbar and decreases by approx. 100 mbar for each 1000 m altitude.

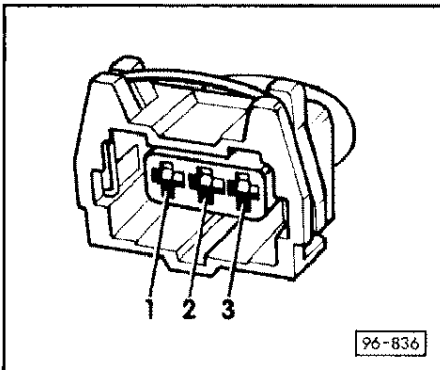
- Weather-related pressure fluctuations as a rule amount to less than ± 50 mbar (with the exception of extreme weather conditions and tropical countries).



24-54

- If a constant 968 mbar is indicated in place of the actual atmospheric pressure or if the readout differs so greatly from the figure which would be normal on the basis of the altitude and weather conditions, test voltage supply of altitude sender and cable connection.
- If the altitude sender fails, a substitute altitude of approx. 3000 m is assumed by the control unit and a constant 968 mbar displayed.

After rectifying the fault, it is classified as a sporadic fault and normal control is resumed.



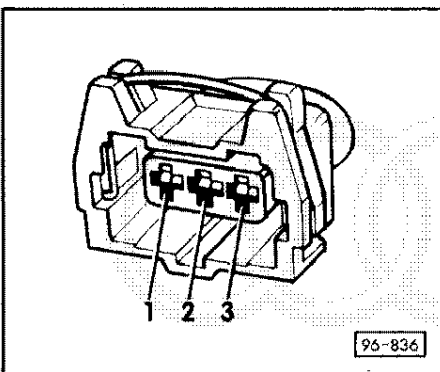
Testing voltage supply of altitude sender

- Unplug connector from altitude sender.
- Switch on ignition.
- ▶ - Connect hand-held multimeter V.A.G 1526 with auxiliary cables from V.A.G 1594 for voltage measurement in turn between contacts 1 and 3 and also 2 and 3.

Specification: 4.5 ... 5.5 volts in each case.

- If the specifications are achieved, replace altitude sender.

24-55



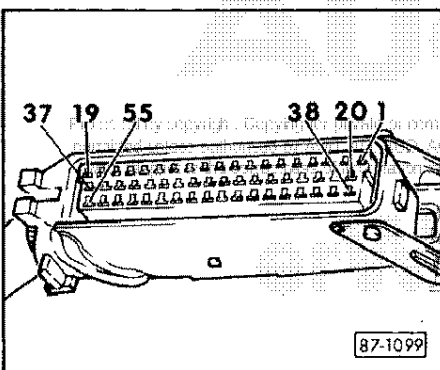
- If one of the specifications is not achieved, test wiring to Motronic control unit and also Motronic control unit as follows:

Testing cable connection of altitude sender

- Switch off ignition.
- Connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 **only** to the wiring harness to the Motronic control unit ⇒ Repair Group 01.
- ▶ - Test the following cables for open circuit or short circuit on the basis of the CFD:

Connector contactsocket	V.A.G 1598
1	9
2	12
3	30

Specification: max. 1.0 Ω.



- ▶ - Rectify any open circuit or short circuit on the basis of the current flow diagram.

24-56

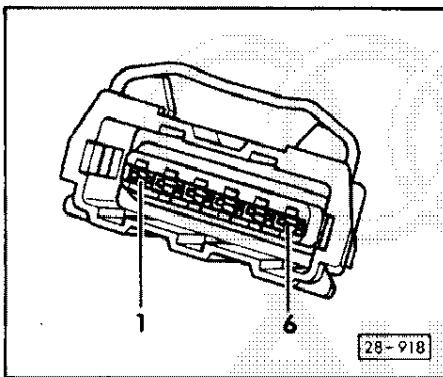
- Connect adapter cable V.A.G 1598/5 to the Motronic control unit.
- Switch on ignition.
- Connect hand-held multimeter V.A.G 1526 in turn between sockets 12 and 30 and also 9 and 30.

Specifications:

Sockets 12 and 30: 4.5 ... 5.5 volts
Sockets 9 and 30: 0.5 ... 5.0 volts

- If one of the specifications is not achieved, replace Motronic control unit.

24-57



Testing air mass meter -G70

- Fitting location of air mass meter -G70 ⇒ page 24-2.

Note:

The wire grille and the hot wire of the air mass meter must not be touched.

- Unplug connector from the air mass meter.
- ← Connect diode test lamp V.A.G 1527 between contact 1 of the connector and the positive contact of the battery.

The diode test lamp must light up.

If the diode test lamp does not light up, determine open circuit in wiring on the basis of the CFD and rectify.

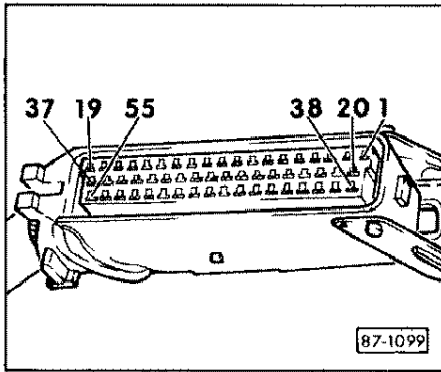
- Connect diode test lamp V.A.G 1527 between contact 5 of the connector and the air mass meter and engine earth.

- Switch on ignition.
- The diode test lamp must light up.
- If the diode test lamp does not light up, connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 to the Motronic control unit ⇒ Repair Group 01.

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24-58

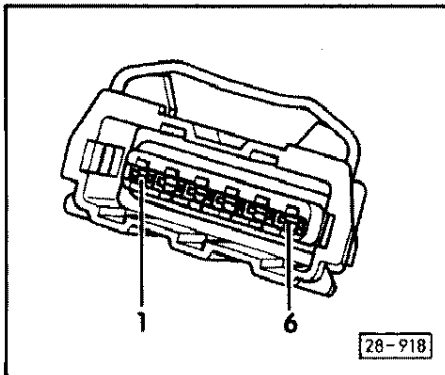


– Connect diode test lamp V.A.G 1527 to earth (socket 19) and to socket 37 of the test box.

– Switch on ignition, diode test lamp must light up.

◀ – If the diode test lamp now lights up, determine open circuit between contact 37 of the connector at the control unit and contact 5 of the connector at the air mass meter on the basis of the CFD and rectify.

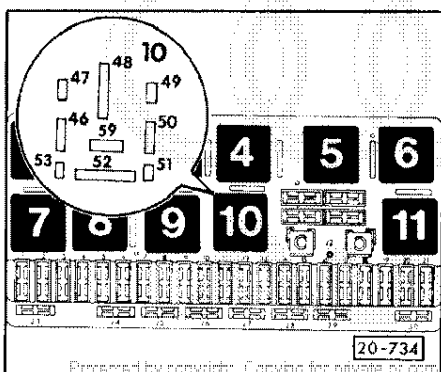
– If the diode test lamp does not light up, replace control unit.



◀ – Connect diode test lamp to contact 5 of the connector at the air mass meter and to engine earth.

– Switch on ignition and operate starter for a few seconds.

24-59



– The diode test lamp must light up when the ignition is switched on and during starting.

– If the diode test lamp goes out when the starter is operated, perform the following tests:

- Test fuse –S28.
- Test cable from contact 5 of the connector at the air mass meter to fuse –S28 for open circuit on the basis of the CFD. Specification max. 0.5 Ω.
- Test cable from fuse –S28 to the fuel pump relay –J17 (relay position 10) contact 59 for open circuit on the basis of the CFD. Specification max. 0.5 Ω.

◀ Test fuel pump relay and, if necessary, actuation of fuel pump relay ⇒ page 24-15.

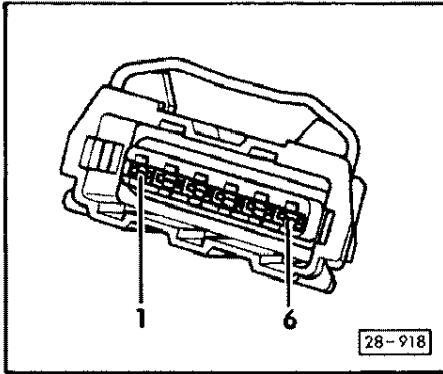
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Testing signal wires

– Connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 only to the wiring harness to the Motronic control unit ⇒ Repair Group 01.

– Unplug connector at the air mass meter.

24-60



- Test the following cables for open circuit or short circuit:

From connector at air mass meter, contact	To socket of test box
2	26
3	7
4	25

Specification: max. 1.0 Ω.

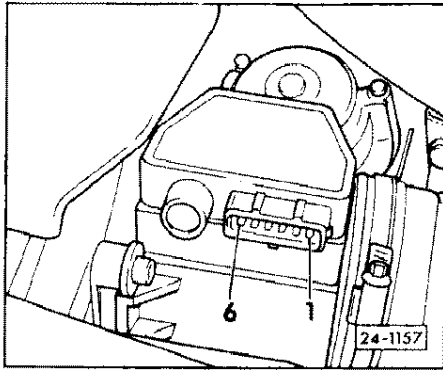
- Rectify any open circuit or short circuit.

Note:

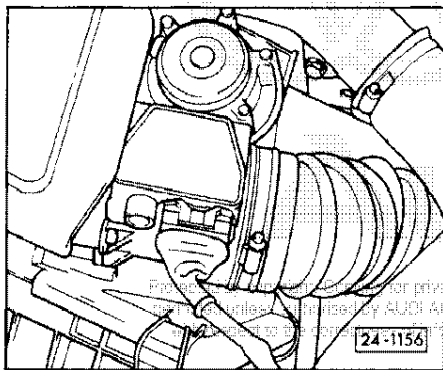
Only gold-plated contacts may be used for repairing contacts in the connector of the air mass meter.

Testing operation of air mass meter

- Unplug connector at the air mass meter.
- Connect hand-held multimeter V.A.G 1526 with auxiliary cables from V.A.G 1594 for resistance measurement to contacts 1 and 2 of the air mass meter and note resistance.
- Unplug test cables at the air mass meter and short-circuit.



24-61



- The reading now displayed must agree with the noted reading (what is measured is the earth bridge in the air mass meter). The reading corresponds to the internal resistance of the test cables.
- If the readings differ by more than 0.1 Ω from each other, replace air mass meter.
- Plug in connector at air mass meter and push back rubber grommet.

Connect hand-held multimeter V.A.G 1526 with auxiliary cables from V.A.G 1594 for voltage measurement at contacts 1 and 3.



Switch on ignition.
Specification approx. 1.2 V ... 1.5 V.



Run engine at idling speed.
Specification approx. 2.5 V.

- Briefly increase engine speed (blip throttle).
Specification: Clear rise in voltage to approx. 3 ... 5 V.
- If the specifications are not achieved, replace air mass meter.

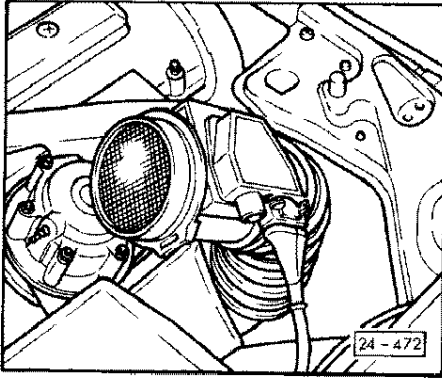
Testing cleaning operation of air mass meter

The cleaning operation is performed about 4 seconds after switching off the engine and takes about 1 second.

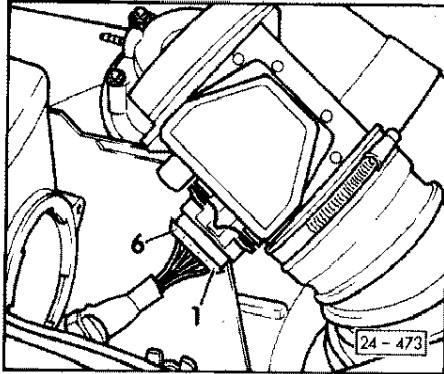
The cleaning operation is only performed under the following preconditions:

- Coolant temperature above 60°C.
- Engine speed above 2000 rpm.
- Signal wires in order.
- Fuse -S28 in order.

24-62



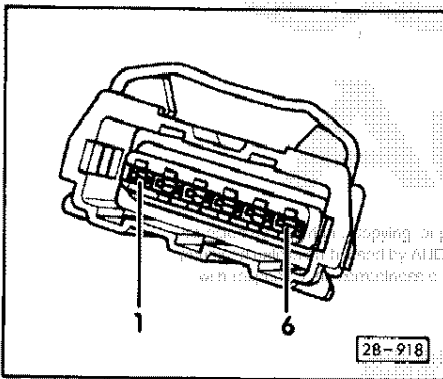
- ◀ – Unscrew air mass meter from air cleaner housing and pull forward sufficiently so that the cleaning operation can be observed (the connector remains plugged in and the intake hose connected).
- Run engine and increase engine speed to more than 2000 rpm.
- Switch off engine and observe cleaning operation (the hot wire glows for about 1 second).
- If no cleaning operation is performed, push back rubber grommet at connector of air mass meter (the connector remains plugged into the air mass meter).



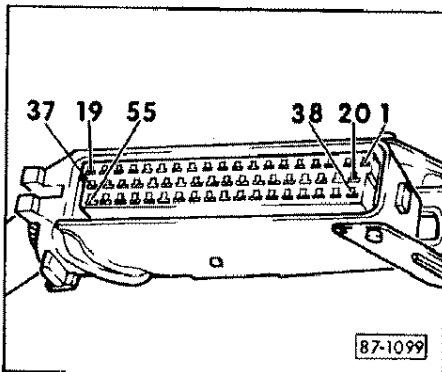
- ◀ – Connect diode test lamp V.A.G 1527 to contacts 1 and 4.
- Repeat test sequence and observe diode test lamp. The diode test lamp must light up during the cleaning operation.
- If the diode test lamp lights up, replace air mass meter.
- If the diode test lamp does not light up, connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 to the Motronic control unit ⇒ Repair Group 01.

- Connect diode test lamp to socket 26 (earth) and to socket 25.

24-63



- Repeat test sequence and observe diode test lamp. The diode test lamp must light up during the cleaning operation.
- If the diode test lamp does not light up, replace control unit.
- ◀ – If the diode test lamp lights up, test cable between contact 4 of connector at air mass meter and socket 25 of the test box for continuity with an ohmmeter, specification max. 0.5 Ω, and also test for short to earth.



- ◀ – Rectify any short circuit or open circuit between contact 4 of the connector at the air mass meter and contact 25 of the connector at the Motronic control unit.

Testing air conditioner auxiliary signal and compressor cutoff

This signal from the air conditioner raises the pilot control value for idling speed stabilization when the air conditioner compressor is switched on so that idling speed stabilization remains in the mid-range of the control field.

When accelerating from a standing start and from a low speed, the Motronic control unit supplies this signal to earth and thus briefly switches off the air conditioner compressor.

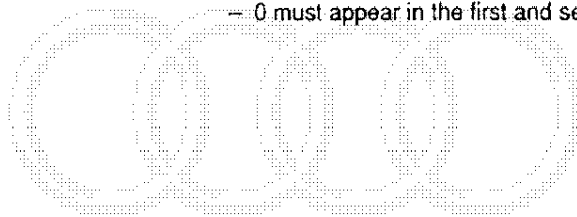
Test requirements:

- Air conditioner operating properly.
 - No fault stored in fault memory.
 - Vehicle at room temperature (warmer than +15°C).
- Run engine at idling speed (air conditioner switched off).
- Read measured value block and select display group ⇒ Repair Group 01.
- Check readout in display field 4.

Note:

The third (middle) position of the five-digit display is not assigned.

- 0 must appear in the first and second positions.



24-65

Notes:

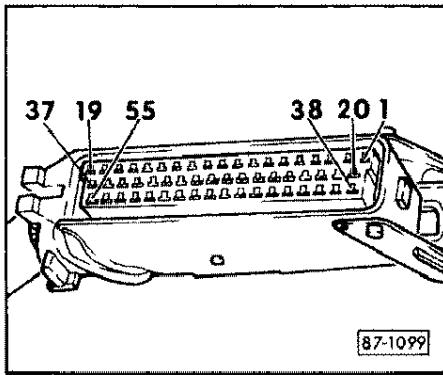
- *The first position indicates whether the air conditioner compressor is switched on.*
- *The second position indicates whether the air conditioner is switched on.*

Protected by copyright. Copying, or prior or concurrent publication, in part or in whole, is not permitted without the authorized by V.A.G. Switch on air conditioner.

with respect to the conditions of use. (Lowest temperature and fastest blower speed).

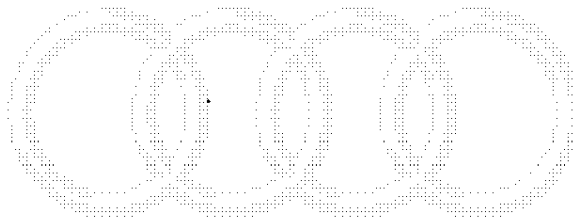
- The readout in the first and second positions must jump from 0 to 1.
- Fully depress accelerator pedal rapidly and release again (brief blip of throttle).
When the accelerator pedal is depressed, the readout of the first position must jump for a few seconds from 1 to 0.
- If the readout does not change as described, connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 to the Motronic control unit ⇒ Repair Group 01.
- Connect diode test lamp V.A.G 1527 to socket 6 (signal) and to socket 19 (earth).
- Run engine at idling speed.
- Switch on air conditioner (lowest temperature and fastest blower speed).

24-66



Specifications:

- The diode test lamp must light up after 1 ... 6 seconds.
- Fully depress accelerator pedal rapidly and release again (brief blip of throttle). When the accelerator pedal is depressed, the diode test lamp must go out for a few seconds.
- If the specifications are not achieved, switch off engine and wait at least 30 seconds before unplugging the connector of the adapter cable V.A.G 1598/5 from the Motronic control unit.
- ◀ - Test cable connection from contact 6 at the connector for Motronic control unit (socket 6 of the test box) to the air conditioner for open circuit or short circuit on the basis of the CFD.
- If there is no fault in the cable connection, check operation of the control unit for the magnetic clutch -J153 or of the control and display unit -E87.
- If the control unit for the magnetic clutch or for the control and display unit is operating properly, replace Motronic control unit.



Testing air conditioner auxiliary signal for increasing engine speed

This signal from the air conditioner raises the idling speed of the engine by about 80 rpm if increased output is required from the heating or cooling system.

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Test requirements:

- Air conditioner operating properly.
- No fault stored in fault memory.
- Vehicle at room temperature (warmer than +15°C).
- Run engine at idling speed (air conditioner switched off).
- Read measured value block and select display group 05 ⇒ Repair Group 01.
- Check readout in display field 4.

Note:

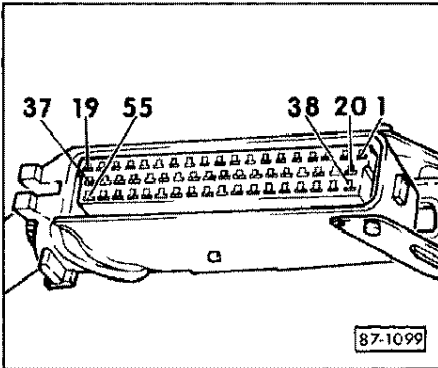
The third (middle) position of the five-digit display is not assigned.

- 0 must appear in the first and second positions.

Notes:

- The first position indicates whether the air conditioner compressor is switched on.
- The second position indicates whether the air conditioner is switched on.
- Switch on air conditioner. (Lowest temperature and fastest blower speed).

- The readout in the first and second positions must jump from 0 to 1.
- If the readout does not change as described, connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 to the Motronic control unit ⇒ Repair Group 01.
- Connect diode test lamp V.A.G 1527 to socket 41 (signal) and to socket 19 (earth).
- Run engine at idling speed.
- Switch on air conditioner (lowest temperature and fastest blower speed).
- When the air conditioner compressor switches on, the diode test lamp must light up (idling speed also increases).



- If the diode test lamp does not light up, switch off engine and wait at least 30 seconds before unplugging the connector of the adapter cable V.A.G 1598/5 from the Motronic control unit.
- ◀ Test cable connection from contact 41 at the connector for Motronic control unit (socket 41 at the test box) to the air conditioner switch -E30 or to the control and display unit -E87 for open circuit or short circuit on the basis of the CFD.
- If there is no fault in the cable connection, check operation of the air conditioner.
- If the air conditioner is operating properly, replace Motronic control unit.

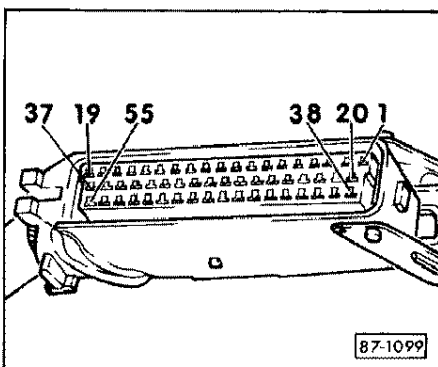
24-69

Testing actuation of on-board computer for fuel consumption display

Note:

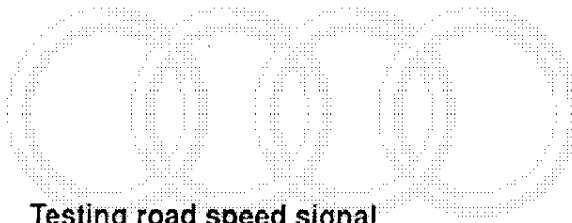
Perform the following test only if a missing or incorrect fuel consumption signal is determined when testing the on-board computer.

- Connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 to the Motronic control unit ⇒ Repair Group 01.
- Connect voltmeter between socket 19 (earth) and socket 31 (signal).
- Run engine and vary engine speed continuously between 1000 rpm and 4000 rpm.
- Specification: approx. 0.3 ... 10 volts (corresponding to engine speed).
- If the specification is achieved although the on-board computer does not indicate a consumption reading, switch off engine and remove dash panel insert.
- ◀ Test cable connection between Motronic control unit (contact 31 or socket 31 at test box, respectively) and black 10-pin connector of the on-board computer for open circuit on the basis of the CFD.



24-70

- If no open circuit exists, the fault is in the dash panel insert ⇒ Workshop Manual "Electrical System".
- If the specification is not achieved, switch off engine and remove dash panel insert.
- Unplug black 10-pin connector at the on-board computer.
- Run engine.
- Specification: approx. 0.3 ... 10 volts (corresponding to engine speed).
- If the specification is now achieved, there is a fault at the on-board computer.
- If the specification is not achieved, test cable connection between Motronic control unit and 10-pin connector for short circuit to positive or to earth on the basis of the CFD.
- If the specification is not achieved although no short circuit exists, replace Motronic control unit.



24-71

Testing road speed signal

The road speed signal is required for the following functions:

- Gear detection for switching off air conditioner compressor when accelerating in first gear.
- Switching idling speed stabilization over from closed-loop control to open-loop control above 6 km/h.
- Torque converter protection for automatic gearbox – below 20 km/h the stall speed is lowered after 2 seconds to 2900 rpm.
- Speed limit of 210 km/h for vehicles with comfort tyres and for vehicles for USA and Canada.

Notes:

- If the road speed signal fails, engine speed is limited at full load to 5320 rpm after 4 seconds.
- The fault "00281, Road speed sender –G68 no signal" is not stored in the fault memory until it exists and an engine speed of 4000 rpm has been maintained or exceeded at full load for at least 4 seconds.
- Perform road test and read measured value block (select display group 04) ⇒ Repair Group 01.
 - Have a second person operate V.A.G 1551!
- Check readout in display field 3.

Note:

4 km/h is always displayed if the vehicle is stationary.

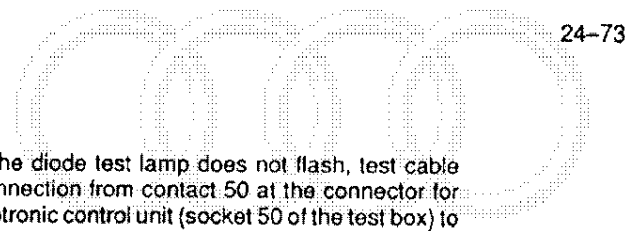
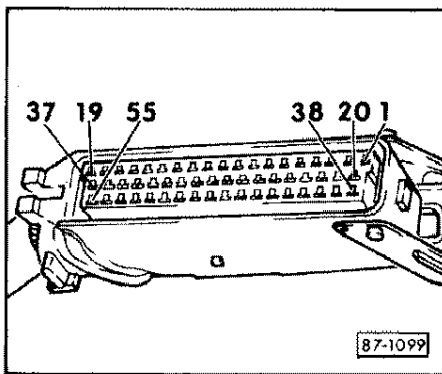
24-72

- The road speed must be displayed if vehicle speed exceeds 4 km/h.

Note:

The road speed is displayed in steps of two. Intermediate figures cannot be displayed.

- If the road speed is not displayed, raise vehicle at front left until the wheel is clear off the ground.
- Connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 to the Motronic control unit ⇒ Repair Group 01.
- Connect diode test lamp to socket 18 (positive) and to socket 50 (signal).
- Switch on ignition.
- Rotate left front wheel by hand. When this is done, the diode test lamp must flash (very short flash signal).
- If the diode test lamp does not flash, switch off ignition and wait at least 30 seconds before unplugging the connector of the adapter cable V.A.G 1598/5 from the Motronic control unit.
- Switch on ignition.
- Rotate left front wheel by hand. When this is done, the diode test lamp must flash.
- If the diode test lamp now flashes, replace Motronic control unit.



- ← If the diode test lamp does not flash, test cable connection from contact 50 at the connector for Motronic control unit (socket 50 of the test box) to the dash panel insert for open circuit or short circuit on the basis of the CFD.
- If no fault exists in the cable connection, continue fault finding with the fault finding programme "Testing road speed signal" in the Current flow diagram, Electrical fault finding and Fitting locations binder.

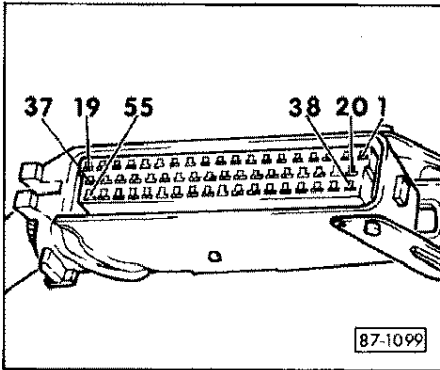
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Testing actuation of tachometer

Notes:

- Perform the following test only if no engine speed is displayed at the tachometer in the dash panel insert.
- The tachometer in the dash panel insert is actuated by the Motronic control unit.



- Connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 to the Motronic control unit ⇒ Repair Group 01.

- Connect tester V.A.G 1367 for measuring engine speed as specified in the operating instructions. The signal wire (green terminal) is connected to socket 40 of the test box (use adapter cable set V.A.G 1594).

- Run engine at idling speed.

- Specification: Engine speed is displayed.

- If the engine speed is displayed on V.A.G 1367, switch off engine and remove dash panel insert.

- ◀ - Test cable connection between Motronic control unit (contact 40 or socket 40 at the test box, respectively) and dash panel insert for open circuit on the basis of the CFD.

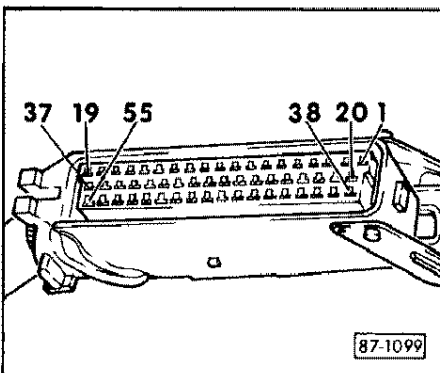
24-75

- If no open circuit exists, rectify fault in dash panel insert ⇒ Workshop Manual "Electrical System".

- If the engine speed is not displayed on V.A.G 1367, switch off engine, remove dash panel insert and unplug the green 26-pin connector.

- Run engine at idling speed.

- If engine speed is now displayed on V.A.G 1367, the fault is in the dash panel insert ⇒ Workshop Manual "Electrical System".



- ◀ - If engine speed is not displayed on V.A.G 1367, test cable connection between Motronic control unit (contact 40 or socket 40 at test box, respectively) and dash panel insert for short circuit to positive or to negative on the basis of the CFD.

- If the engine speed is not displayed although no short circuit exists, replace Motronic control unit.

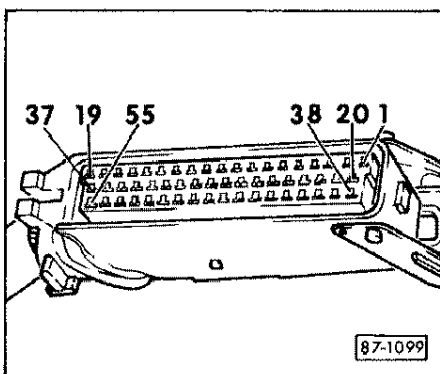
24-76

Testing output signal for throttle valve position

This signal can be used as a load signal for other components (e.g. automatic gearbox). The test must only be performed if the signal is actually used for another component. At present this signal is output but is not used.

- Connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 to the Motronic control unit ⇒ Repair Group 01.
- Connect diode test lamp V.A.G 1527 to socket 19 (earth) and to socket 54 (signal).
- Run engine at idling speed.
- The diode test lamp must light up with a weak light and become brighter when the accelerator pedal is depressed.
- If the diode test lamp does not light up or does not become brighter when the accelerator pedal is depressed, the following fault may exist:
 - Throttle valve potentiometer faulty, testing ⇒ page 24-50 (no input information exists for this for the Motronic control unit) or replace Motronic control unit.

24-77



- If the diode test lamp lights up and becomes brighter when the accelerator pedal is depressed, the following faults may exist:
 - Short to earth in the cable from contact 54 of the connector at the Motronic control unit to the connector at the gearbox control unit.
 - Fault in gearbox control unit (constant short to earth).

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24-78

Testing auxillary signal for reducing boost pressure when engine hot

- Perform the following test only if an insufficient boost pressure is determined when testing the boost pressure!

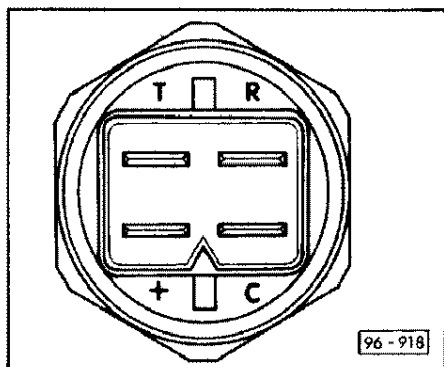
Note:

This signal switches off the boost pressure control if engine temperature is too high and results in the boost pressure being lowered below 1.5 bar.

The boost pressure control is switched off if the engine temperature rises above approx. 118°C. Once the engine temperature has again dropped below approx. 113°C, the boost pressure control is restored.

- If the boost pressure is too low and the engine is too hot, test the signal at the Motronic control unit, contact 46.
- Connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 to the Motronic control unit and to the wiring harness ⇒ Repair Group 01.
- Measure with hand-held multimeter V.A.G 1526 between socket 13 (earth) and socket 46 (signal) during the test of the turbocharger and blow-off valve (Mechanics, Repair Group 21).

24-79



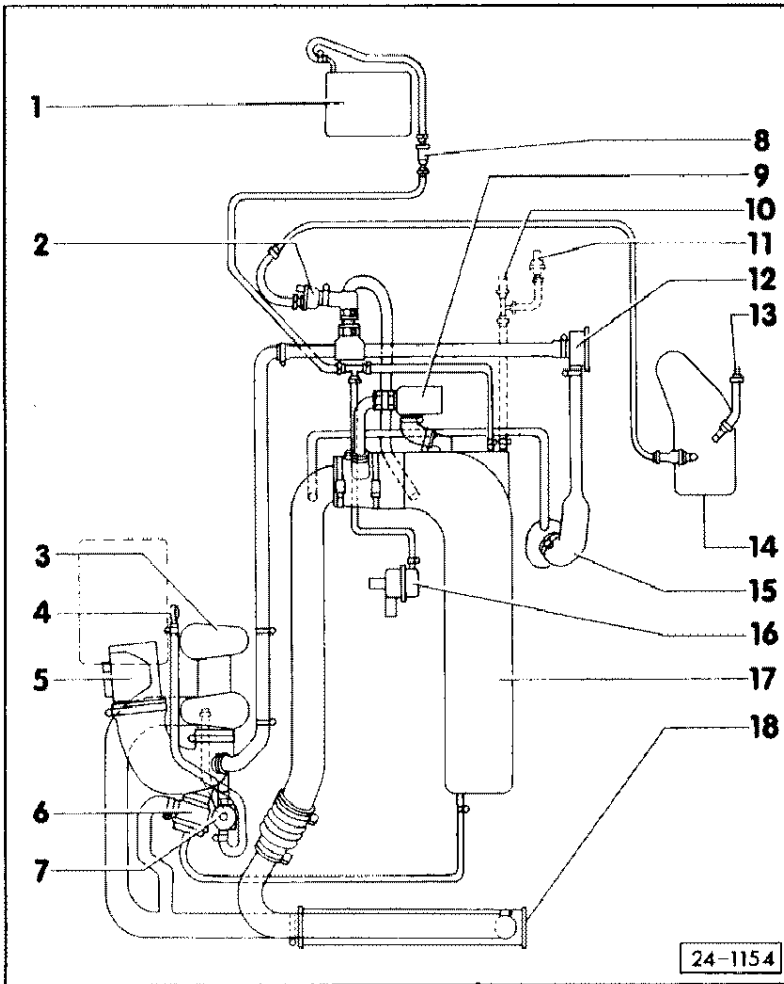
Voltage at Motronic ECU contact 46	Boost pressure control	Engine temperature
greater than 2 V	active	less than about 113°C
less than 2 V	inactive (boost pressure reduced)	greater than about 118°C

- If the boost pressure is too low and the engine is not too hot, test electronic thermostich -F76 (is located in water manifold below intake manifold).

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24-80

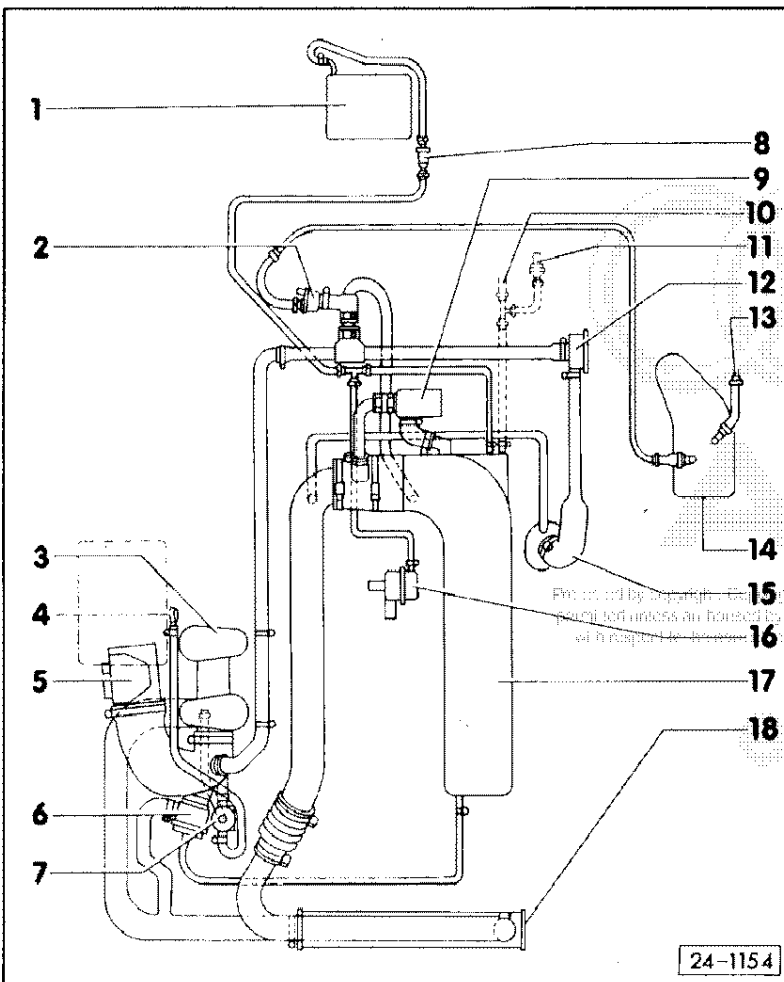


Pressure connections

- 1 – Motronic control unit
 - Fitting location: behind cover below glove box
- 2 – Solenoid valve for activated charcoal filter
- 3 – Turbocharger
- 4 – To blow-off valve
- 5 – Air mass meter
- 6 – Overrun shut-off valve
 - The overrun shut-off valve reduces the boost pressure on overrun
- 7 – Solenoid valve for boost pressure limiting
- 8 – Liquid separator
- 9 – Idling speed stabilization valve

24-1154

24-81

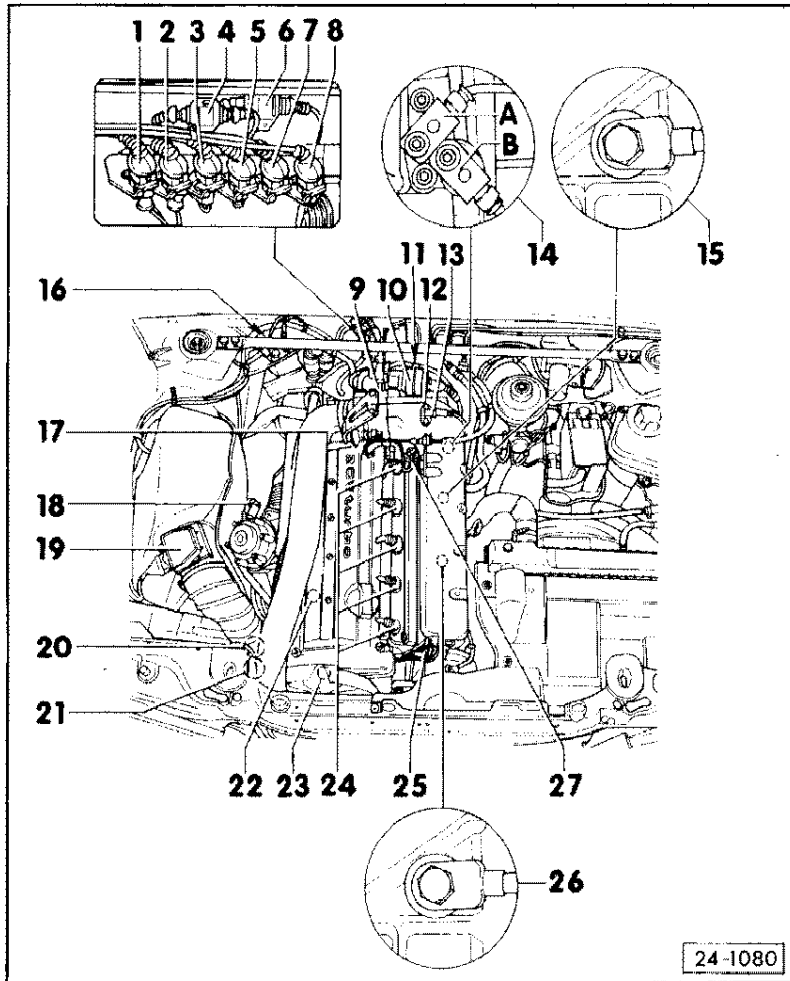


- 10 – Connection for differential lock
- 11 – Connection for air conditioner (only on vehicles with air conditioner)
- 12 – Pressure control valve for crankcase ventilation
- 13 – From fuel tank
- 14 – Activated charcoal filter
- 15 – Crankcase ventilation
- 16 – Fuel pressure regulator
- 17 – Manifold
- 18 – Charge air cooler

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24-1154

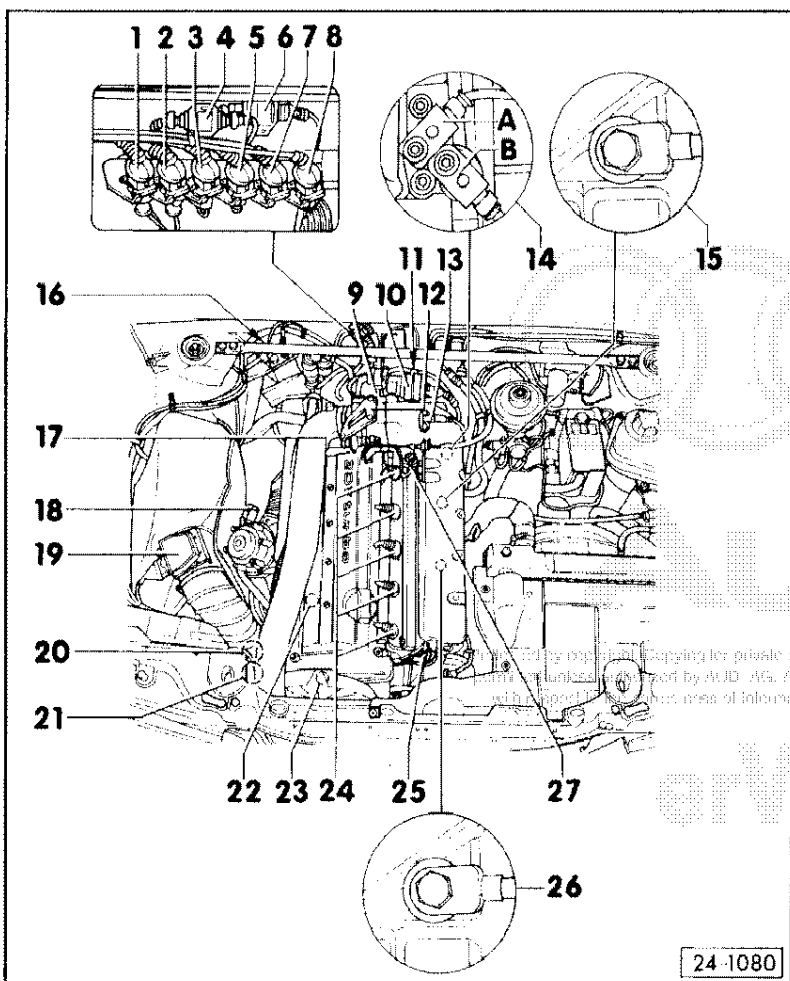
24-82



Motronic components

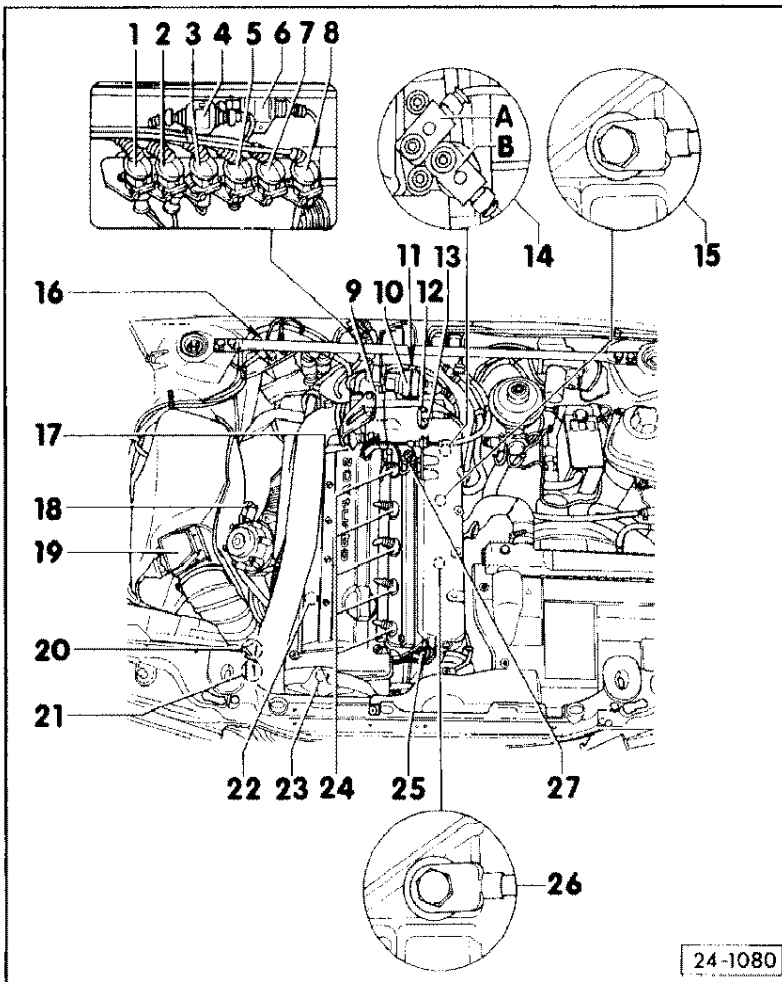
- 1 – Plug connection, cylinders 4 and 5 (N 163 and N 164) (white plug connection)
- 2 – Plug connection, cylinders 1, 2 and 3 (N, N 128 and N 158) (white plug connection)
- 3 – Plug connection for sender, knock sensor I front –G61 (blue plug connection)
- 4 – Power output stage I –N122 (actuation for cylinders 1, 2 and 3)
- 5 – Plug connection for sender, knock sensor II rear –G66 (green plug connection)
- 6 – Power output stage II –N127 (actuation for cylinders 4 and 5)
- 7 – Plug connection for engine speed sender –G28 (grey plug connection)
- 8 – Plug connection for ignition timing sender –G4 (reference mark sender, black plug connection)

28-1



- 9 – Throttle valve potentiometer –G69 (with integral idling speed switch)
- 10 – Idling speed stabilization valve –N71
 - Testing ⇒ page 24–28
- 11 – Solenoid valve for activated charcoal filter –N80
 - Testing ⇒ page 24–37
- 12 – Throttle valve body
- 13 – Intake air temperature sender –G42
 - Testing ⇒ page 28–18
- 14 – A – Ignition timing sender –G4 (reference mark sender, black plug connection)
 - Testing ⇒ page 28–13
- B – Engine speed sender –G28 (grey plug connection)
 - Testing ⇒ page 28–15
- 15 – Knock sensor II rear –G66
- 16 – Plug connection for lambda probe
 Lambda probe heater –Z19 (two-pin black plug connection)
 Lambda probe –G39 (one-pin signal wire)
- 17 – Coolant temperature sender –G62 (at rear right of cylinder head)
 - Testing ⇒ page 28–21

28-2



- 18 – Lambda probe –G39
 - Testing ⇒ page 24–33
- 19 – Air mass meter –G70
 - Testing ⇒ page 24–58
- 20 – Overrun shut-off valve
 - Testing ⇒ Repair Group 21
- 21 – Solenoid valve for boost pressure limiting –N75
 - Testing ⇒ page 24–41
- 22 – Ignition coils –N, N128, N158, N163, N164
 - Testing ⇒ page 28–12
- 23 – Hall sender –G40
 - Testing ⇒ page 28–27
 - Basic setting ⇒ page 28–30
- 24 – Injectors
 - Testing ⇒ page 24–19
- 25 – Plug connection for Hall sender –G40
- 26 – Knock sensor I front –G61
- 27 – Fuel pressure regulator
 - Testing system and holding pressure ⇒ page 24–11

28–3

Technical data ignition

Engine code letters	ABY	
Ignition timing sender**	Resistance kΩ	approx. 1.0
Engine speed sender***	Resistance kΩ	approx. 1.0
** – Testing ignition timing sender ⇒ page 28–13 *** – Testing engine speed sender ⇒ page 28–15		
Important!		
<ul style="list-style-type: none"> • The ignition timing is determined in the control unit. • It is not possible to adjust the ignition timing point. 		

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Spark plugs (tightening torque 30 Nm)	* Part No.N 101 000 016 AA		
	* Bosch F 5 DPO R		
Electrode gap	mm	0.6 + 0.1	
Firing order	1-2-4-5-3		
Engine speed limited by Motronic system			
	Governed speed	rpm	7200 ± 40
Spark plug connector			
	Resistance	kΩ	5.0

* Current data ⇒ Emissions and idling test binder.

28-5

Safety precautions regarding Motronic system

Pay attention to the following points when performing work on vehicles with Motronic system to avoid injuries to persons and/or damage to the Motronic control unit:

Notes:

- Before disconnecting the battery, determine the coding of radios equipped with anti-theft coding.
- Do not disconnect or connect the battery unless the ignition is switched off otherwise the Motronic control unit may be damaged.
- Wait at least 30 seconds after switching off the ignition before unplugging the connector from the Motronic control unit otherwise the Motronic control unit may be damaged.
- Do not disconnect cables of the ignition system unless the ignition is switched off.
- Do not connect or disconnect cables of test equipment unless the ignition is switched off.

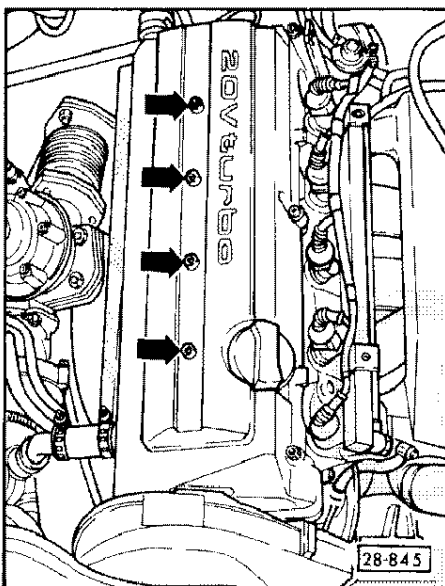
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28-6

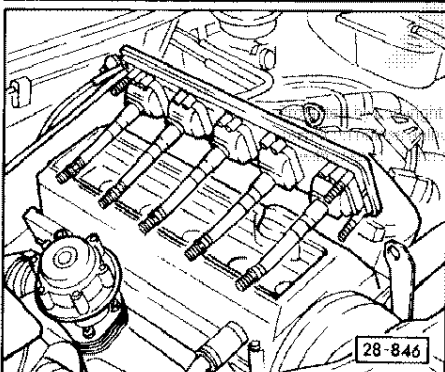
- To operate the engine at starting speed (e.g. for testing compression pressure, testing Motronic system), unplug the three-pin connectors from the power output stages of the ignition coil and also the connectors of all five injectors.
- Do not disconnect the battery when the engine is running.
- Do not apply voltage to the control unit for simulating output signals.
- Do not operate starter when the injectors are removed.

28-7



Testing ignition coils, spark plug connectors and power output stages

- ← Unscrew ignition coil carrier.
- Unscrew spark plugs.
- Unplug connectors from all five injectors.



- ← Insert spark plugs in the spark plug connectors (use new spark plugs if necessary) and place ignition coils down onto the cylinder head cover as shown in the illustration.
- Operate starter and check formation of spark at the spark plugs.

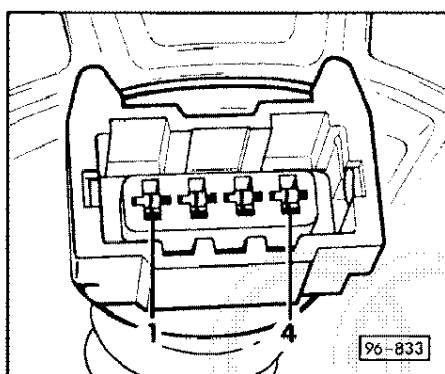
Important!

Do not touch ignition coil holder and spark plugs during the test – risk of high-voltage shock.

28-8

- If one or several spark plugs does not properly spark, repeat test with other spark plugs.
- If the spark is again not properly generated, unplug appropriate spark plug connector.
- Measure resistance of spark plug connector with hand-held multimeter V.A.G 1526.
Specification: approx. 5 k Ω .
- If the specification is not achieved, replace spark plug connector.
- If the specification is achieved, test voltage supply of the ignition coils \Rightarrow page 28-12.
- If the voltage supply is in order, test actuation of the power output stages.
- If the actuation of the power output stages is in order and the fault occurs only at one or at a few spark plugs, switch over both power output stages as a test and repeat test of ignition sparks.
- If the fault now occurs at different spark plugs, replace faulty power output stage.

28-9



- If the fault again occurs at the same spark plugs, replace appropriate ignition coil.

Testing actuation of power output stages -N122 and -N127

Fitting location \Rightarrow page 28-1.

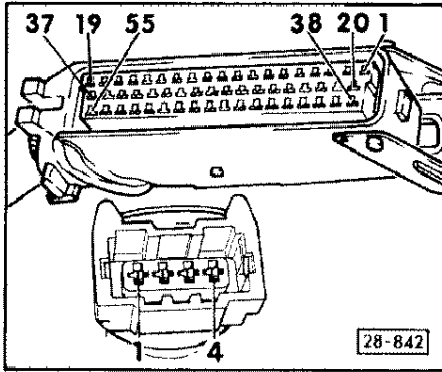
- Unplug both four-pin connectors from the power output stages.
- Connect diode test lamp V.A.G 1527 between battery positive and contact 2 (earth) of the connector for the right-hand power output stage - diode test lamp must light up.
- Connect diode test lamp V.A.G 1527 between battery positive and contact 2 (earth) of the connector for the left-hand power output stage - diode test lamp must light up.
- If the diode test lamp does not light up during one or both tests, test cable connection on basis of CFD, rectify any open circuit.

Unplug connectors from all five injectors.

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28-10



- Connect diode test lamp between engine earth and in turn contact 1, 3 and 4 of the connector for the left-hand power output stage and also to contacts 3 and 4 of the connector for the right-hand power output stage.
 - Operate starter each time for a few seconds. When this is done, the diode test lamp must flash.
 - If the diode test lamp does not flash, connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 **only to the wiring harness** to the Motronic control unit ⇒ Repair Group 01.
- ▶ - Test the following cables for open circuit or short circuit on the basis of the CFD:

Connector for left-hand power output stage	V.A.G 1598 socket	Connector at Motronic control unit
1	23	23
3	2	2
4	1	1

Connector for left-hand power output stage	V.A.G 1598 socket	Connector at Motronic control unit
3	21	21
4	20	20

28-11

- Rectify any open circuit or short circuit.
- If neither an open circuit nor a short circuit is found and the diode test lamp does not flash, replace Motronic control unit.

Testing voltage supply for ignition coils -N, -N128, -N158, -N163 and -N164

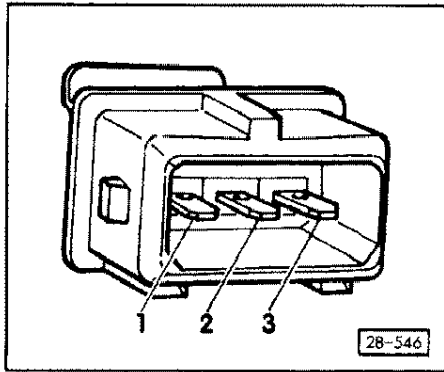
Fitting location of plug connections ⇒ page 28-1, items 1 to 8.

- Separate both plug connections (white) at the connector holder.
- Connect diode test lamp V.A.G 1527 between engine earth and in turn all six contacts of the two three-pin connectors.
- Specification: Diode test lamp must light up each time.

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If the specifications are not achieved, test cable connection on the basis of CFD and repair, if necessary.



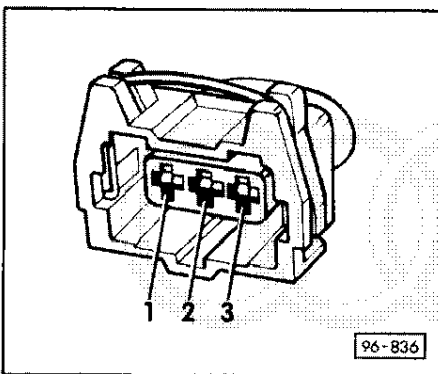


Testing Ignition timing sender –G4

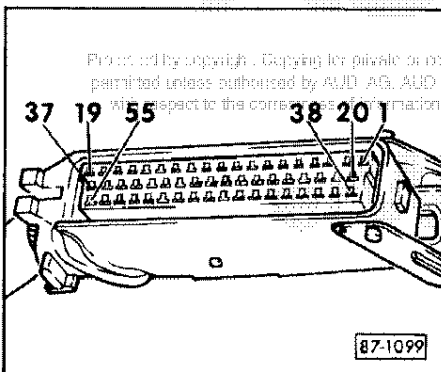
Fitting location of sender and of plug connection ⇒ page 28-1.

- Separate plug connection of ignition timing sender (identification: black plug connection).
 - ▶ - Connect hand-held multimeter V.A.G 1526 with auxiliary cables from V.A.G 1594 for resistance measurement to contacts 1 and 2.
 - Specification: approx. 1 kΩ.
 - If the specification is not achieved, replace ignition timing sender.
 - If the specification is achieved, connect hand-held multimeter to contacts 1 and 3 and also to contacts 2 and 3.
- Specification: infinite ohms (no continuity) in each case.
- If the specification is not achieved, replace ignition timing sender.
 - If the specification is achieved, test cables between sender coupling and Motronic control unit as follows:

28-13



- Connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 only to the wiring harness to the Motronic control unit ⇒ Repair Group 01.
- ▶ - Test the following cables for open circuit or short circuit to each other on the basis of the CFD:
 - From sender coupling contact 1 to socket 48.
 - From sender coupling contact 2 to socket 47.
 - From sender coupling contact 3 to socket 19 (earth).



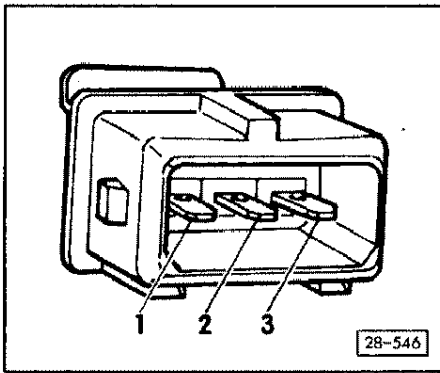
- ▶ - Rectify any open circuit or short circuit in the cables between sender coupling and the connector for the Motronic control unit, contacts 47/48 and 19.
- If no fault has been found up to this point, check pin for sender at ring gear:
The holder with ignition timing point sender and engine speed sender must be removed in order to inspect the pin.
- Crank engine sufficiently until the pin appears in the opening.

28-14

- Check condition of pin (damaged/bent) and check that it is tight; replace flywheel if necessary.
- If no fault has been found during all the tests so far, replace Motronic control unit.

Testing engine speed sender –G28

Fitting location of sender and of plug connection ⇒ page 28-1.

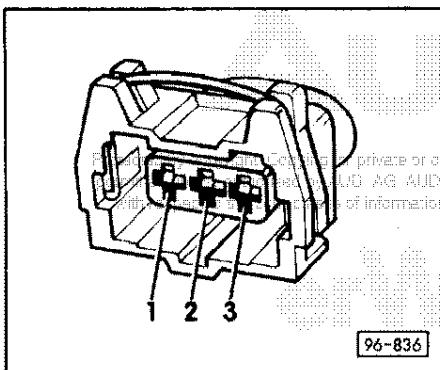


- Separate plug connection of engine speed sender (identification: grey plug connection).
- ◀ - Connect hand-held multimeter V.A.G 1526 with auxiliary cables from V.A.G 1594 for resistance measurement to contacts 1 and 2.
- Specification: approx. 1 kΩ.
- If the specification is not achieved, replace engine speed sender.
- If the specification is achieved, connect ohmmeter to contacts 1 and 3 and also to contacts 2 and 3.

28-15

Specification: infinite ohms (no continuity) in each case.

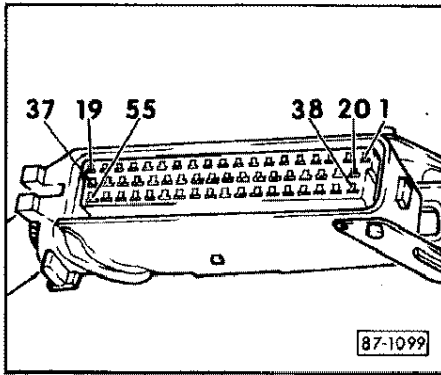
- If the specification is not achieved, replace engine speed sender.
- If the specification is achieved, test cables between sender coupling and Motronic control unit as follows:
- Connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 **only** to the wiring harness to the Motronic control unit ⇒ Repair Group 01.



Test the following cables for open circuit or short circuit to each other on the basis of the CFD:

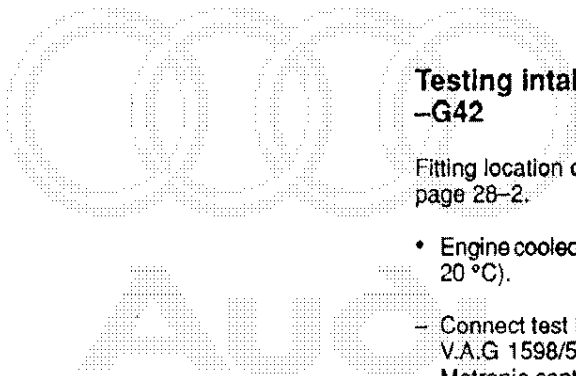
- From sender coupling contact 1 to socket 48.
- From sender coupling contact 2 to socket 49.
- From sender coupling contact 3 to socket 19 (earth).

28-16



- ▶ – Rectify any open circuit or short circuit in the cables between sender coupling and the connector for Motronic control unit (contacts 48/49 and 19).
- If no fault has been found up to this point, check the teeth of the starter ring gear:
The holder with engine speed sender and ignition timing point sender must be removed in order to examine the teeth.
- Slowly crank engine and check concentricity of ring gear and also check whether teeth broken off or damaged; replace flywheel if necessary.
- If no fault has been found in all the tests so far, replace Motronic control unit.

28-17



Testing intake air temperature sender -G42

Fitting location of intake air temperature sender ⇒ page 28-2.

- Engine cooled down to room temperature (approx. 20 °C).
- Connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 **only** to the wiring harness to the Motronic control unit ⇒ Repair Group 01.
- Connect hand-held multimeter V.A.G 1526 with auxiliary cables from V.A.G 1594 for resistance measurement to sockets 30 and 44.
- Specification: 450 ... 650 Ω.
- If the specification is not achieved, push back rubber grommet on intake air temperature sender.
- Connect hand-held multimeter between the two contacts of the sender.
- Specification: approx. 450 ... 650 Ω.
- If the specification is not achieved, replace intake air temperature sender.
- If the specification is achieved, test wiring between sender and control unit as follows:
- Connect hand-held multimeter to socket 30 of the test box and in turn to the two contacts of the sender.

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28-18

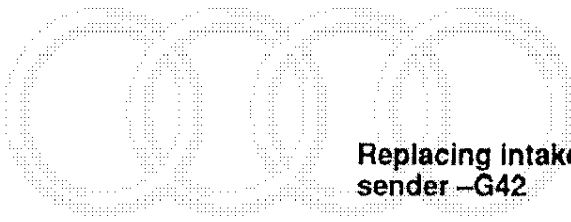
- Specification: approx. 0 Ω (continuity) or approx. 450 ... 650 Ω .
- This test should be repeated at socket 44 of the test box.
- If the specifications are not achieved, rectify open circuit in wiring or short circuit on the basis of the CFD.
- Read measured value block and select display group 03 \Rightarrow Repair Group 01.
- Check readout in display field 4.
The intake air temperature is displayed in $^{\circ}\text{C}$.

Note:

If the engine has cooled down to room temperature, the intake air temperature is approximately in the range of the ambient temperature immediately after starting.

- If the intake air temperature displayed appears implausible relative to the ambient temperature, test cable connection for short circuit to each other and also for short circuit to other cables (shunt).

28-19



Replacing intake air temperature sender –G42

- Unscrew intake air temperature sender.
- Push back rubber grommet on intake air temperature sender.
- Cut off cables at sender and pull off rubber grommet.

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- Fit on new rubber grommet, fit shrink hoses onto both cables.



- Attach cable shoes to the bared cable ends and fit on at sender.

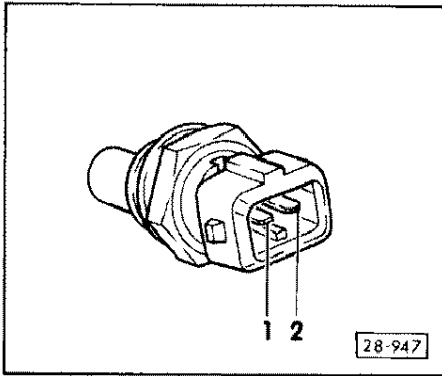
- Carefully solder both cable shoes to the sender (sender must not become too hot).

Note:

Do not allow any soldering metal to flow beyond the cable shoe into the strand of the cable otherwise there is a risk of a fracture point.

- Push shrink-fit hoses over the soldered points and heat.
- Fit on rubber grommet and install sender.

28-20



Testing coolant temperature sender -G62

Fitting location of coolant temperature sender ⇒
page 28-2.

- Engine cooled down to room temperature (approx. 20 °C)
- Unplug connector at the coolant temperature sender.

◀ - Connect hand-held multimeter V.A.G 1526 with auxiliary cables from V.A.G 1594 for resistance measurement to contacts 1 and 2 of the sender.

- Specification: approx. 1.5 ... 3.0 kΩ.

- If the specification is not achieved, replace sender.

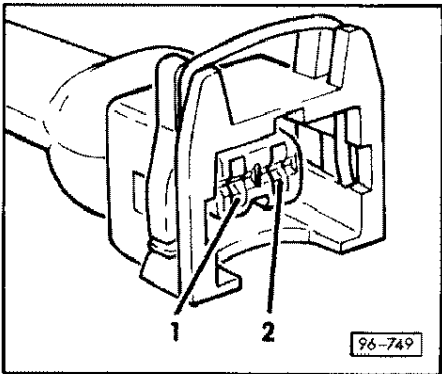
- If the specification is achieved, test wiring from sender to Motronic control unit as follows:

◀ - Connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 **only** to the wiring harness to the Motronic control unit ⇒ Repair Group 01.

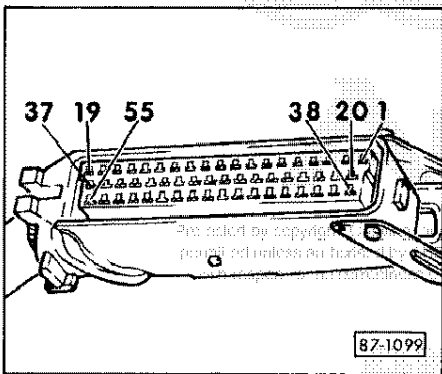
◀ - Test cable from socket 45 to contact 1 of the connector at the coolant temperature sender for open circuit. Specification max. 1.0 Ω.

- Test cable from socket 30 to contact 2 of the connector at the coolant temperature sender for open circuit. Specification max. 1.0 Ω.

- Test both cables for short circuit to each other.



28-21



◀ - Determine any short circuit or open circuit in the wiring between the connector at the sender and the connector at the Motronic control unit (contact 30 and 45) on the basis of the CFD and rectify.

Testing signal for coolant temperature

Notes:

- The coolant temperature sender is a temperature-dependent resistor. If, for example, the sender signal is falsified as the result of moisture in a plug connection (same effect as resistor connected in parallel), this falsification may still be within a range which is not detected by the control unit.
- If a fault regarding the coolant temperature sender is stored, a substitute value derived from the intake air temperature sender is displayed in the measured value block for a time determined by the control unit.

After this time has elapsed, a substitute value for an engine at normal operating temperature is assumed.

- Interrogate fault memory and erase ⇒ Repair Group 01.
- Read measured value block and select display group 01 ⇒ Repair Group 01.
- Check readout in display field 2.
The coolant temperature is displayed in °C.

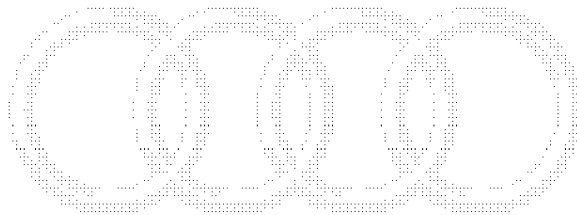
Notes:

If the engine has cooled down to room temperature, the coolant temperature is approximately within the range of the ambient temperature immediately after starting and rises as the engine heats up.

- If the coolant temperature displayed appears implausible relative to the ambient temperature or to the initial heating up of the engine although no fault is stored, test cable connection for short circuit to each other and also for short circuit to other cables (shunt, e.g. as a result of moisture in plug connections).
- If no fault has been found during the tests up to this point, install another coolant temperature sender as a check.
- If the fault still occurs after installing a different sender, replace Motronic control unit.

Testing voltage supply of Motronic control unit

- Test fuse -S27 in the auxiliary fuse carrier.
- Connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 **only** to the wiring harness to the Motronic control unit ⇒ Repair Group 01.
- Connect diode test lamp V.A.G 1527 to socket 18 (continuous positive) and in turn to the sockets 10, 14, 19 and 24 (earth connections).
- The diode test lamp must light up in each case.
- If the diode test lamp does not light up, rectify open circuit in wiring on basis of CFD.

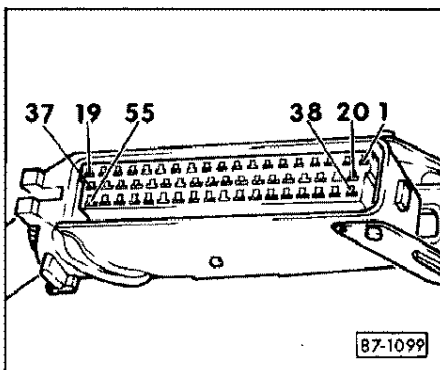


28-23

- Connect Motronic control unit to the adapter cable V.A.G 1598/5.
- Remove fuse -S28 (auxiliary fuse holder).
- Connect diode test lamp V.A.G 1527 to earth (socket 19) and to socket 37 of the test box.
- Switch on ignition, diode test lamp must light up.
- If the diode test lamp does not light up, replace Motronic control unit.
- Insert fuse -S28.

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- If the diode test lamp lights up, operate starter for a few seconds.
- The diode test lamp must light up when the ignition is switched on and during starting.
- ◀ - If the diode test lamp goes out when the starter is operated, perform the following tests:
 - Test fuse -S28.
 - Test cable from contact 37 to fuse -S28 for open circuit on the basis of the CFD.
 - Test cable from fuse -S28 to the fuel pump relay -J17 (relay position 10) contact 31 for open circuit on the basis of the CFD.
 - Test fuel pump relay and, if necessary, actuation of fuel pump relay ⇒ Repair Group 24.



28-24

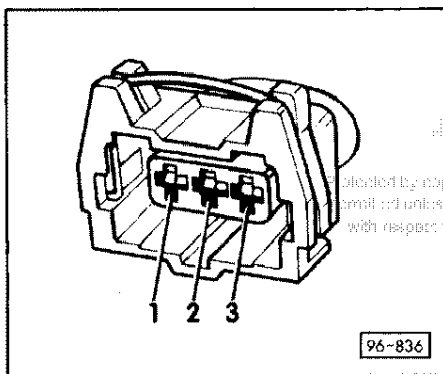
Testing knock sensors –G61 and –G66

Notes:

- The knock sensors themselves cannot be tested electrically.
 - Interrogate fault memory ⇒ Repair Group 01.
 - It is important to adhere exactly to the tightening torque of 20 Nm if the knock sensors are to operate properly.
 - Check plug connection from knock sensor to wiring harness for signs of corrosion.
- Connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 **only** to the wiring harness to the Motronic control unit ⇒ Repair Group 01.
- Separate plug connections of the two knock sensors in the engine compartment (fitting location of plug connections ⇒ page 28–1).



28–25



- Test the following cables for open circuit or short circuit to each other on the basis of the CFD:

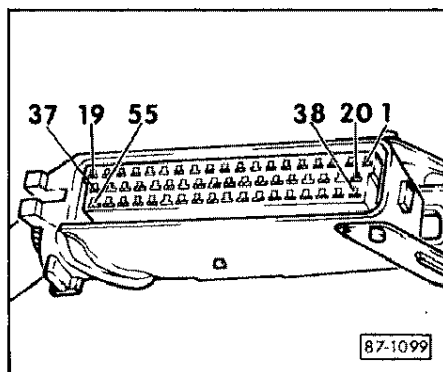
–G61 (front):

- From brown sensor coupling, contact 1 to socket 11 (signal wire).
- From brown sensor coupling, contact 2 to socket 30 (sensor earth connection to control unit).
- From brown sensor coupling, contact 3 to socket 19 (screening at earth).

–G66 (rear):

- From green sensor coupling, contact 1 to socket 29 (signal wire).
- From green sensor coupling, contact 2 to socket 30 (sensor earth connection to control unit).
- From green sensor coupling, contact 3 to socket 19 (screening at earth).

- Continuity – specification max. 1.0 Ω.
Short circuit – specification approx. 1 MΩ to infinite ohms.



- Rectify any open circuit or short circuit in the cables between the respective sensor coupling and the connector at the Motronic control unit, contacts 11/29, 30, 19.

Note:

Use only gold-plated contacts for repairing contacts in the connectors of the knock sensor.

- If a fault is displayed for the respective knock sensor although the cable connection is in order, replace knock sensor.

28–26

Testing Hall sender –G40

The Hall sender is located at the front of the cylinder head behind the camshaft sprocket ⇒ page 28–3, item 23.

– Connect test box V.A.G 1598 with adapter cable V.A.G 1598/5 to the Motronic control unit (⇒ Repair Group 01).

– Connect diode test lamp V.A.G 1527 to sockets 8 and 12.

– Operate starter for a few seconds.

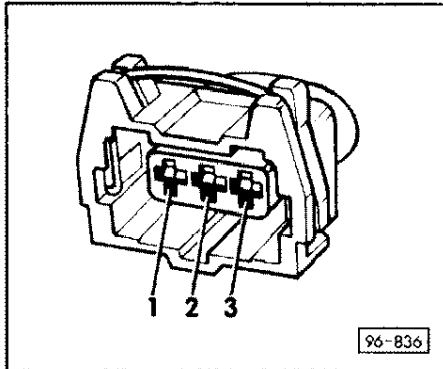
– The diode test lamp must flash briefly during each second engine revolution.

– If the diode test lamp does not flash, switch off ignition and unplug three-pin connector for Hall sender in front of intake manifold ⇒ page 28–3, item 25.

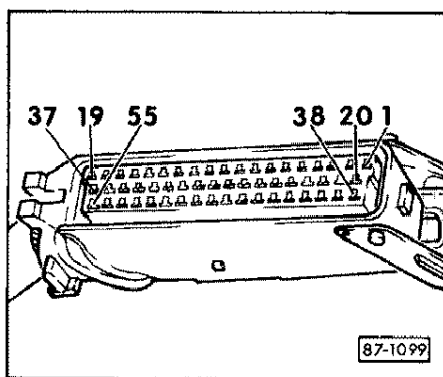
▶ – Test the following cables for open circuit or short circuit to each other on the basis of the CFD:

- From Hall sender connector, contact 1 to socket 12
- From Hall sender connector, contact 2 to socket 8
- From Hall sender connector, contact 3 to socket 19

– Continuity – specification max. 0.5 Ω.
Short circuit – specification infinite ohms.



28–27



▶ – Rectify any open circuit or short circuit in the cables between the Hall sender connector and the connector for the Motronic control unit (contacts 12, 8 and 19).

– If neither an open circuit nor a short circuit exists, switch on ignition.

– Connect hand-held multimeter V.A.G 1526 with auxiliary cables from V.A.G 1594 for voltage measurement to sockets 12 and 19.

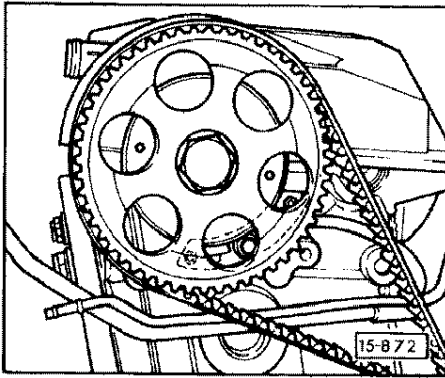
– Specification: 4.5 ... 5.5 volts.

– Connect hand-held multimeter V.A.G 1526 to sockets 8 and 19.

– Specification: 4.3 ... 5.2 volts.

– If the specifications are not achieved, replace Motronic control unit.

– If the specifications are achieved, replace Hall sender (Removing and installing Hall sender ⇒ Basic setting of Hall sender, page 28–30).



Basic setting of Hall sender

Note:

- ◀ *The Hall sender is located behind the camshaft sprocket. It is set by being attached to the cylinder head.*
- The Hall sender and the camshaft sprocket should only be checked for signs of mechanical damage.
- Installing and removing Hall sender ⇒ Repair Group 13 (Mechanics).

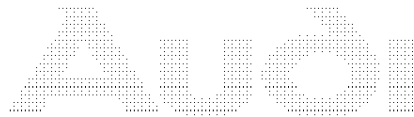


28-29

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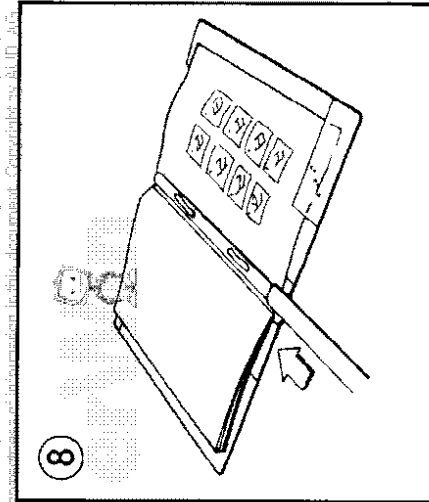
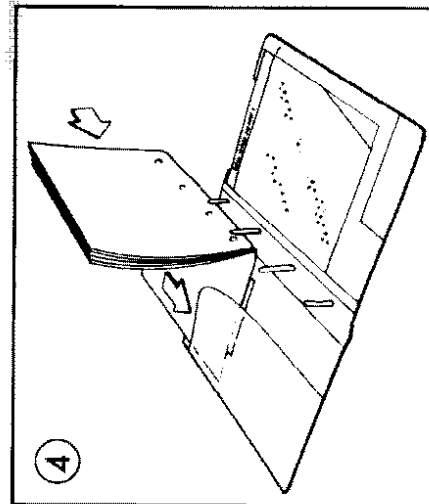
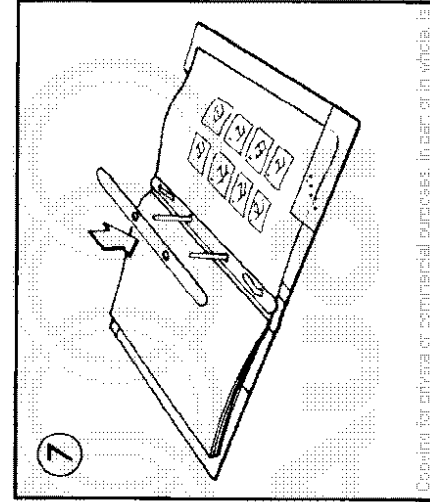
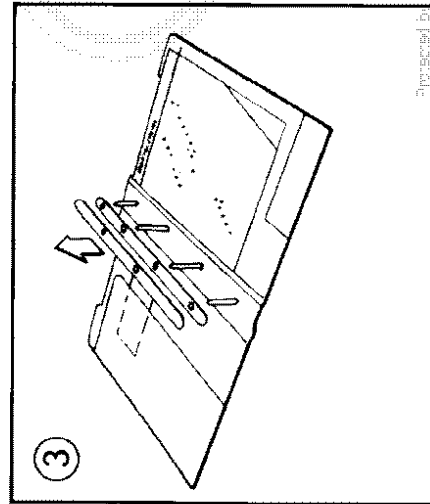
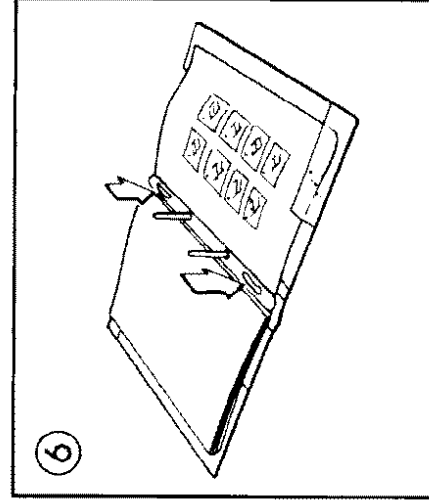
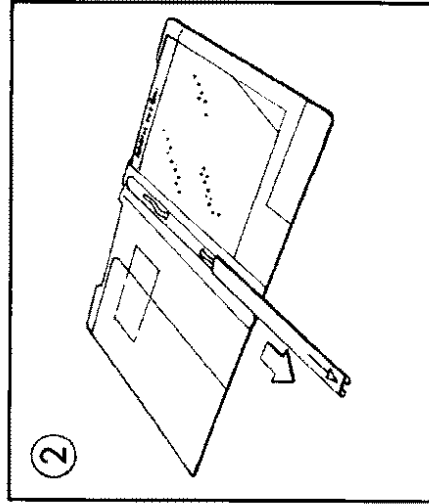
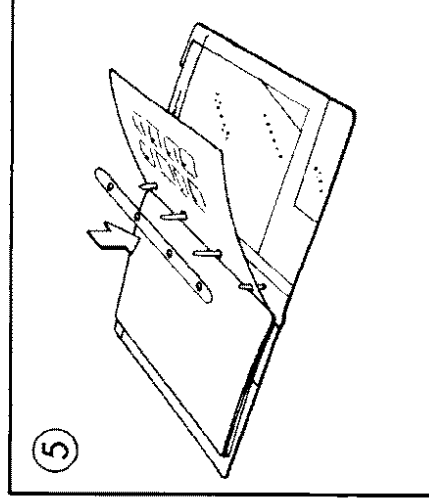
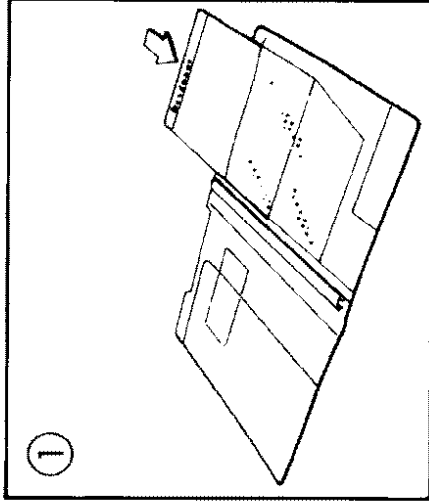
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Service.

Technical Bulletin to Workshop Manual

Audi 80 1992 >

Engine code letters	ABY									
Booklet Motronic fuel injection and ignition system (5 cylinder) Edition 09/92										

Enter in Repair Group list

Repair Group 01

Bulletin No. **1**

Affected: Vehicles with control unit, part number 895 907 551A*

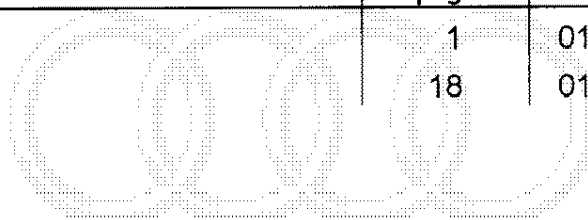
* see "Interrogating control unit version"

Subject

New control unit:

A new control unit with extended self-diagnosis functions has been introduced in production. This bulletin contains the main technical changes, which also apply to Audi 100 1991 > vehicles with engine code letters "AAN".

Contents	Bulletin page	Booklet from page
- Reading measuring value block	1	01-18
- Basic setting of engine	18	01-50



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Reading measuring value block

Test requirements:

- Engine oil temperature at least 80°C.
- All electrical equipment switched off.
- Air conditioner switched off. Keep pressing "-" button on operating and display unit of air conditioner until all displays go out.
- Selector lever at "P" or "N".
- Interrogate and erase fault memory, see repair group 01.
- Leave engine running at idle speed.

Rapid data transfer Select function XX	HELP
---	------

< Readout in display

Note :

A list of available functions is printed out if the HELP button is pressed.

1

- Press buttons 0 and 8.
(This selects function 08 "Read measuring value block".)

Rapid data transfer 08 - Read measuring value block	Q
--	---

< Readout in display

- Confirm entry with Q button.

Read measuring value block Enter display group number	HELP XX
--	------------

< Readout in display

- Enter required display group number (00..09) - a list of the display groups with specified display readings is given on page 4.

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- The measured values in display group number 00 are given in decimal form.
- Display group number 01 is taken as an example here to demonstrate the procedure.
- Press buttons 0 and 1.
(To select "display group number 01").

Read measuring value block	Q
Enter display group number	01

- < Readout in display
- Confirm entry with Q button.

Read measuring value block	1
1 2 3 4	4

- < Readout in display

Notes:

- The current information in the display is printed out every time the PRINT button is pressed.
- Press "C" before selecting another display group.
- Press button →.

Rapid data transfer	HELP
Select function XX	

- < Readout in display

List of display groups

Display group number	Readout in display	Designation
00	Read measuring value block 0 1 2 3 4 5 6 7 8 9 10	See basic setting, repair group 01
01	Read measuring value block 1 1 2 3 4	1 = Engine speed 2 = Coolant temperature 3 = Lambda control value for air/fuel mixture 4 = Ignition timing
02	Read measuring value block 2 1 2 3 4	1 = Engine speed 2 = Duration of injection 3 = Supply voltage at control unit 4 = Atmospheric pressure
03	Read measuring value block 3 1 2 3 4	1 = Engine speed 2 = Engine load 3 = Throttle valve angle 4 = Intake manifold temperature
04	Read measuring value block 4 1 2 3 4	1 = Engine speed 2 = Engine load 3 = Road speed 4 = Operating condition: XXXX1 Overrun cut-off XXX1X Idle switch closed XX1XX Part throttle and full throttle X1XXX Disregard display 1XXXX Disregard display

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Display group number	Display readout	Designation
05	Read measuring value block 1 2 3 4	5 1 = Engine speed 4 2 = Self-adaptive value 1 of operating curve of idling speed stabilisation valve -N71 3 3 = Duty cycle of control signal for -N71 4 = Operating condition: XX X1 Gear engaged (automatic gearbox only) XX 1X Engine torque reduction (for gearshift: vehicles with automatic gearbox) X1 XX Increased idling speed (air conditioner requires higher heating or cooling output) 1X XX Air conditioner compressor on
06	Read measuring value block 1 2 3 4	6 1 = Control value for air/fuel mixture (lambda control value) 4 2 = Self-adaptive value, air/fuel mixture (lambda self-adaptive value) at idle speed with fuel tank vent function inactive ¹⁾ 3 = Self-adaptive value, air/fuel mixture (lambda self-adaptive value) at idle speed or part throttle and fuel tank vent function active ²⁾ 4 = Self-adaptive value, air/fuel mixture (lambda self-adaptive value) at part throttle with fuel tank vent function inactive ¹⁾ 1) Solenoid valve 1 for active carbon filter -N80 remains closed for a period of 1 min 2) Pulsed operation of solenoid valve 1 for active carbon filter -N80 for a period of 6 min

5

Display group number	Display readout	Designation
07	Read measuring value block 1 2 3 4	7 1 = Control value for idling speed stabilisation 4 2 = Self-adaptive value 1 of operating curve of idling speed stabilisation valve -N71 3 3 = Self-adaptive value 2 of operating curve of idling speed stabilisation valve -N71 4 = Self-adaptive value of idling speed stabilisation (basic air requirement) - with air conditioner compressor off - with no gear engaged (automatics)
08	Read measuring value block 1 2 3 4	8 1 = Self-adaptive value of idling speed stabilisation (basic air requirement) 4 - with air conditioner compressor off - with no gear engaged (automatics) 2 = Self-adaptive value of idling speed stabilisation (basic air requirement) - with air conditioner compressor on - with no gear engaged (automatics) 3 = Self-adaptive value of idling speed stabilisation (basic air requirement) - with air conditioner compressor off - with gear engaged (automatics) 4 = Self-adaptive value of idling speed stabilisation (basic air requirement) - with air conditioner compressor on - with gear engaged (automatics)
09 (and 10 ... 99)	Read measuring value block 1 2 3 4	9 1 = Engine speed 4 2 = Internal processing value for duration of injection (engine load signal) 3 = Duty cycle of control signal for solenoid valve 1 for active carbon filter -N80 4 = Self-adaptive value, air/fuel mixture (lambda self-adaptive value) at idle speed or part throttle with tank vent function active (pulsed operation of solenoid valve 1 for active carbon filter -N80 for a period of 6 min)

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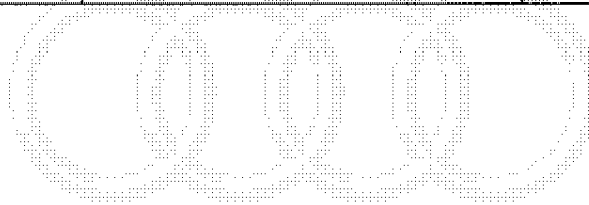


Display group number 01

Display field	Display on V.A.G 1551	Cause of fault	Remedy
1	760...840 rpm	OK	
	higher than 840 rpm	Idling speed stabilisation valve -N71 at bottom end of control range Air leaks downstream of throttle Vacuum hoses have become disconnected Air conditioner not switched off Air conditioner compressor switching signal is present although compressor is switched off Idling speed stabilisation valve defective	- Accelerate engine briefly 4 times at intervals of 15 seconds. - Rectify cause of air leak. - Switch off air conditioner. - Check air conditioner - see repair group 87
	less than 760 rpm	Idling speed stabilisation valve -N71 sticking or defective	- Perform final control diagnosis - see repair group 01 - Check -N71 - see repair group 24
2	85 ... 105 ° C	OK	
	higher than 105 ° C	Sender for coolant temperature -G62 defective Radiator fan not working	- Check -G62 - see repair group 28
	less than 85 ° C	Sender for coolant temperature -G62 defective Thermostat defective	- Check -G62 - see repair group 28

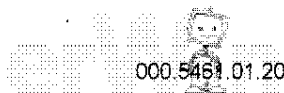
7

Display field	Display on V.A.G 1551	Cause of fault	Remedy
3	disregard display	Can only be tested with "System in basic setting 1", display field 3	
4	8 ... 12 ° before TDC	OK	
	greater than 12 ° before TDC	Idling speed stabilisation valve -N71 defective Idle switch -F60 defective	- Perform final control diagnosis - see repair group 01 - Check -N71 - see repair group 24 - Check -F60 - see repair group 24
	less than 8 ° before TDC	Idling speed stabilisation valve -N71 defective	- Perform final control diagnosis - see repair group 01 - Check -N71 - see repair group 24



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Display group number 02

Display field	Display on V.A.G 1551	Cause of fault	Remedy
1	760...840 rpm	Display group number 01, display field 1	
2	disregard display		
3	12.5 ... 14.5 V	OK	
	greater than 14.5 V	Voltage regulator defective	- Check voltage regulator - see repair group 90
	less than 12.5 V	Battery discharged Voltage regulator defective Voltage drop in wiring to Motronic control unit	- Check battery voltage - Check voltage regulator - see repair group 90 - Check wiring connections according to current flow diagram
4	... mbar	Compare reading with barometer (e.g. turbocharger tester V.A.G 1397/A) : the readings must be approximately the same.	- Check altitude sender -F96 - see repair group 24.

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Display group number 03

Display field	Display on V.A.G 1551	Cause of fault	Remedy
1	760...840 rpm	See display group number 01, display field 1	
2	26 ... 35 %	OK	
	greater than 35 %	Air conditioner switched on Electrical equipment switched on Air conditioner compressor is running, even though air conditioner is switched off Air mass meter -G70 defective Central hydraulic pump defective Air leaks between turbocharger and throttle valve	- Switch off air conditioner. - Switch off electrical equipment. - Check air conditioner - see repair group 87. - Check -G70 - see repair group 24. - Check central hydraulic pump - see repair group 48. - Repair leaks.
	less than 26 %	Air leaks between air mass meter -G70 and turbocharger or downstream of throttle valve Vacuum hose come off Crankcase breather leaking Tank vent system Solenoid valve 1 for active carbon filter sticking Air mass meter -G70	- Repair leaks - Check vacuum system - Check crankcase breather - Check tank vent system - Perform final control diagnosis - see repair group 01 - Check -G70 - see repair group 24

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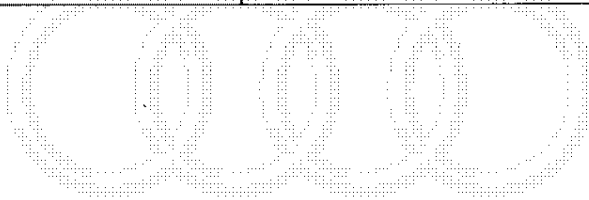
10

Display field	Display on V.A.G 1551	Cause of fault	Remedy
3	5 ... 10 <°	OK	
3	greater than 10 <°	Throttle valve potentiometer -G69 defective or incorrectly adjusted Throttle cable incorrectly adjusted Throttle valve sticking	- Check throttle valve potentiometer -G69 - see repair group 24 - Adjust throttle cable - see repair group 20 - Check throttle valve
	less than 5 <°	Throttle valve potentiometer -G69 defective or incorrectly adjusted	- Check throttle valve potentiometer -G69 - see repair group 24
4	... ° C	No specified value: depends on ambient temperature	

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Display group number 04

Display field	Display on V.A.G 1551	Cause of fault	Remedy
1	760...840 rpm	See display group number 01, display field 1	
2	26 ... 35 %	See display group number 03, display field 2	
3	4 km/h	OK (a constant speed of 4 km/h is displayed at speeds below 4 km/h)	
4	00010	OK (only in idle condition)	
	00000	Idle switch -F60 defective	- Check -F60 - see repair group 24



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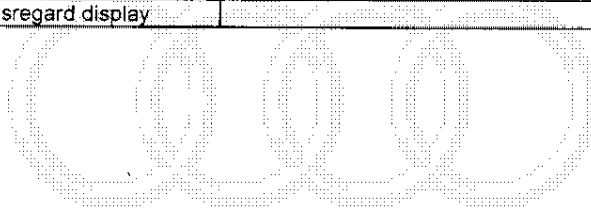
Display group number 05

Display field	Display on V.A.G 1551	Cause of fault	Remedy
1	770...830 rpm	OK (displayed in steps of 10 rpm)	
	greater than 830 or less than 770 rpm	See display group number 01, display field 1	
2	70 ... 125	OK	
	less than 70	Idling speed stabilisation valve -N71 sticking or defective Throttle valve potentiometer -G69 defective or incorrectly adjusted	- Check -N71 - see repair group 24 - Check throttle valve potentiometer -G69 - see repair group 24
	greater than 125	Air leaks between air mass meter -G70 and turbocharger or downstream of throttle valve Idling speed stabilisation valve -N71 defective	- Repair leaks - Check -N71 - see repair group 24
3	disregard display		
4	00 00	OK (only with air conditioner switched off and no gear selected - automatics)	

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Display group number 06

Display field	Display on V.A.G 1551	Cause of fault	Remedy
1	disregard display	Value can only be checked with "System in basic setting 2", display field 1	
2	0.79 ... 1.20	See "System in basic setting 2", display field 2	
3	disregard display		
4	disregard display		



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Display group number 07

Display field	Display on V.A.G 1551	Cause of fault	Remedy
1	121 ... 140	OK	
	less than 121	Air leaks downstream of throttle valve Idling speed stabilisation valve -N71 sticking or defective	- Repair leaks. - Check -N71 - see repair group 24.
	greater than 140	Air conditioner compressor is running although air conditioner is switched off Battery discharged	- Check air conditioner - see repair group 87. - Check battery voltage.
2	70 ... 125	OK	
	less than 70 or greater than 125	See display group number 05, display field 2	
3	41 ... 61	OK	
	less than 41 or greater than 61	Idling speed stabilisation valve -N71 defective Air leaks	- Check -N71 - see repair group 24. - Repair leaks.
4	123 ... 137	OK	
	less than 123 or greater than 137	Control function for idling speed stabilisation valve -N71 Throttle valve potentiometer -G69 incorrectly adjusted Air leaks	- Accelerate engine briefly and watch display; display must be between 123 and 137. - Adjust -G69 - see repair group 24. - Repair leaks.

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Display group number 09 (and 10 ... 99)

Display field	Display on V.A.G 1551	Cause of fault	Remedy
1	770 ... 830 rpm	OK (displayed in steps of 10 rpm)	
	greater than 830 rpm or less than 770 rpm	See display group number 01, display field 1	
2	1.0 ... 1.3 ms	OK	
	less than 1.0 ms	Air leaks between air mass meter -G70 and turbocharger or downstream of throttle valve Vacuum hose come off Crankcase breather leaking Tank vent system Solenoid valve 1 for active carbon filter sticking Air mass meter -G70	- Repair leaks. - Check vacuum system. - Check crankcase breather. - Check tank vent system. - Perform final control diagnosis -see repair group 01. - Check -G70 - see repair group 24
	greater than 1.3 ms	Air conditioner switched on Electrical equipment switched on Air conditioner compressor is running although air conditioner is switched off Air mass meter -G70 defective Central hydraulic pump defective Air leaks between turbocharger and throttle valve	- Switch off air conditioner. - Switch off electrical equipment. - Check air conditioner - see repair group 87 - Check -G70 - see repair group 24 - Check central hydraulic pump - see repair group 48 - Repair leaks

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Display field	Display on V.A.G 1551	Cause of fault	Remedy
3	0 ... 7 %	OK (tank vent function active for 6 min)	
	constant 0 %	OK (tank vent function inactive for 1 min)	
	greater than 7 %	See display group number 02, display fields 1 and 2	
	constant 0 %	System error	- Interrogate fault memory
4	disregard display		

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Basic setting of engine

The Motronic control unit performs the following functions during the basic setting:

- Solenoid valve 1 for active carbon filter -N80 is closed.
- Self-adaptive function of lambda mixture control and idle speed stabilisation are not influenced by active carbon filter system.

Requirements:

- Engine temperature at least 85° C.
- All electrical equipment switched off.
- Air conditioner switched off. Keep pressing "-" key on operating and display unit of air conditioner until **all displays go out**.
- Set selector lever to "P" or "N".
- Road test vehicle for at least 5 minutes, if possible without stopping at traffic lights, etc.

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- Press buttons 0 and 6.
(06 selects function "End output".)

Rapid data transfer 06 - End output	Q
--	---

< Readout in display

- Confirm entry with Q button.

Rapid data transfer Enter address word XX	HELP
--	------

< Readout in display

Display group number 01

Display field	Display on V.A.G 1551	Cause of fault	Remedy
1	770...830 rpm	OK	See "Read measuring value block 5", display field 1
2	85 ... 105 ° C	OK	See "Read measuring value block 1", display field 2

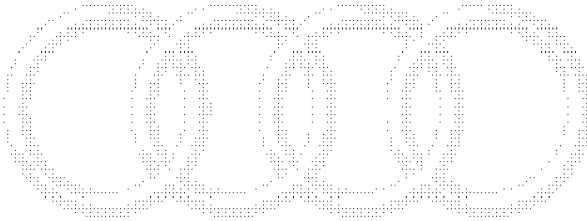
21

Display field	Display on V.A.G 1551	Cause of fault	Remedy
3	0.96 ... 1.04	OK	
	constant 1.0	Insufficient fuel Lambda probe defective Lambda probe heating defective	- At least 10 litres of fuel in tank. - Check lambda probe and lambda control function - see repair group 24.
	less than 0.96 or greater than 1.04	Lambda self-adaptive function not yet completed Lambda probe Air leaks downstream of air mass meter -G70 Fuel system pressure Leaks in exhaust system	- Run engine at idle speed for at least 10 minutes at operating temperature after power supply to control unit is interrupted (terminal 30). - See display group 02, display field 2 - Repair leaks. - Check system pressure - see repair group 24. - Check for leaks - see repair group 26.
	display fluctuates irregularly	Insufficient fuel Loose contact in lambda probe signal wire Lambda probe heating defective	- At least 10 litres of fuel in tank. - Check lambda probe and lambda control function - see repair group 24.
4	8 ... 12° before TDC	OK	See "Read measuring value block 1", display field 4

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Display group number 02 (and 03 ... 99)

Display field	Display on V.A.G 1551	Cause of fault	Remedy
1	0.96...1.04	See display group number 01, display field 3	
2	0.78...1.17	OK	
	less than 0.78	Fuel system pressure too high Air mass meter -G70 defective Lambda probe defective Air leaks between turbocharger and throttle assembly	<ul style="list-style-type: none"> - Check system pressure - see repair group 24. - Check -G70 - see repair group 24. - Check lambda control function - see repair group 24. - Repair leaks.
	greater than 1.17	Fuel system Insufficient fuel Air leaks between air mass meter and turbocharger or in intake manifold	<ul style="list-style-type: none"> - Check fuel system - see repair group 20 - At least 10 litres of fuel in tank. - Repair leaks.
3	disregard display		
4	disregard display		



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