

Index

Brake lines

- removing/installing 45.5

Combination relay

- removing/installing 45.6

Electronic control unit

- removing/installing 45.6

Front wheel speed sensors

- removing/installing 45.7

General repair notes

- cautions/warnings 45.2

Hydraulic modulator

- 2 wheel drive 45.3
- pressure testing 45.5
- removing/installing 45.5
- Quattro 45.4

Rear axle components

- removing/installing 45.9

Rear speed sensors

- disconnecting 45.10

Rear wiring harness retainer

- installing 45.12

Rear wheel speed sensor rotor

- pressing in 45.12

General repair notes

- cautions/warnings 45.13

Troubleshooting

- ABS 2-LED test procedure 45.14

CAUTION

- switch ignition **OFF** before connecting or disconnecting ABS control unit connector
- disconnect ABS control unit connector before using electrical welding equipment on the vehicle
- disconnect the battery connections before charging the battery or replacing the hydraulic modulator
- remove ABS control unit before drying paint repairs in an oven if temperatures will be above 85°C (185°F) for more than two hours
- do not use mini-spare tires on vehicles equipped with ABS. Use wheels and tires of matching size on ABS equipped vehicles
- do not drive the vehicle with the anti-lock brake tester connected

General repair notes

The complete testing procedure using the ABS 2-LED tester must be done after any repairs are made to the following:

- hydraulic modulator
- ABS control unit
- wheel speed sensors
- ABS wiring harness

It is also necessary to perform the test procedure if the brake lines or brake pressure regulators are replaced because of accident damage.

After repairs to the brake system that do not affect the anti-lock system components, do the following operational test of the ABS:

- switch ignition **ON**
 - ABS indicator light lights
- drive vehicle with differential locks **NOT** engaged at speed over 4 mph (6 km/h)
 - ABS indicator light must not light

Do this test after repairing/replacing the following components:

- brake pads and/or brake discs
- brake hoses
- brake servo or master cylinder
- brake cables and hand brake components

Note

During a final test drive, make sure that at least one controlled braking sequence is performed with the ABS **ON**.

Anti-Lock Brake System

CAUTION

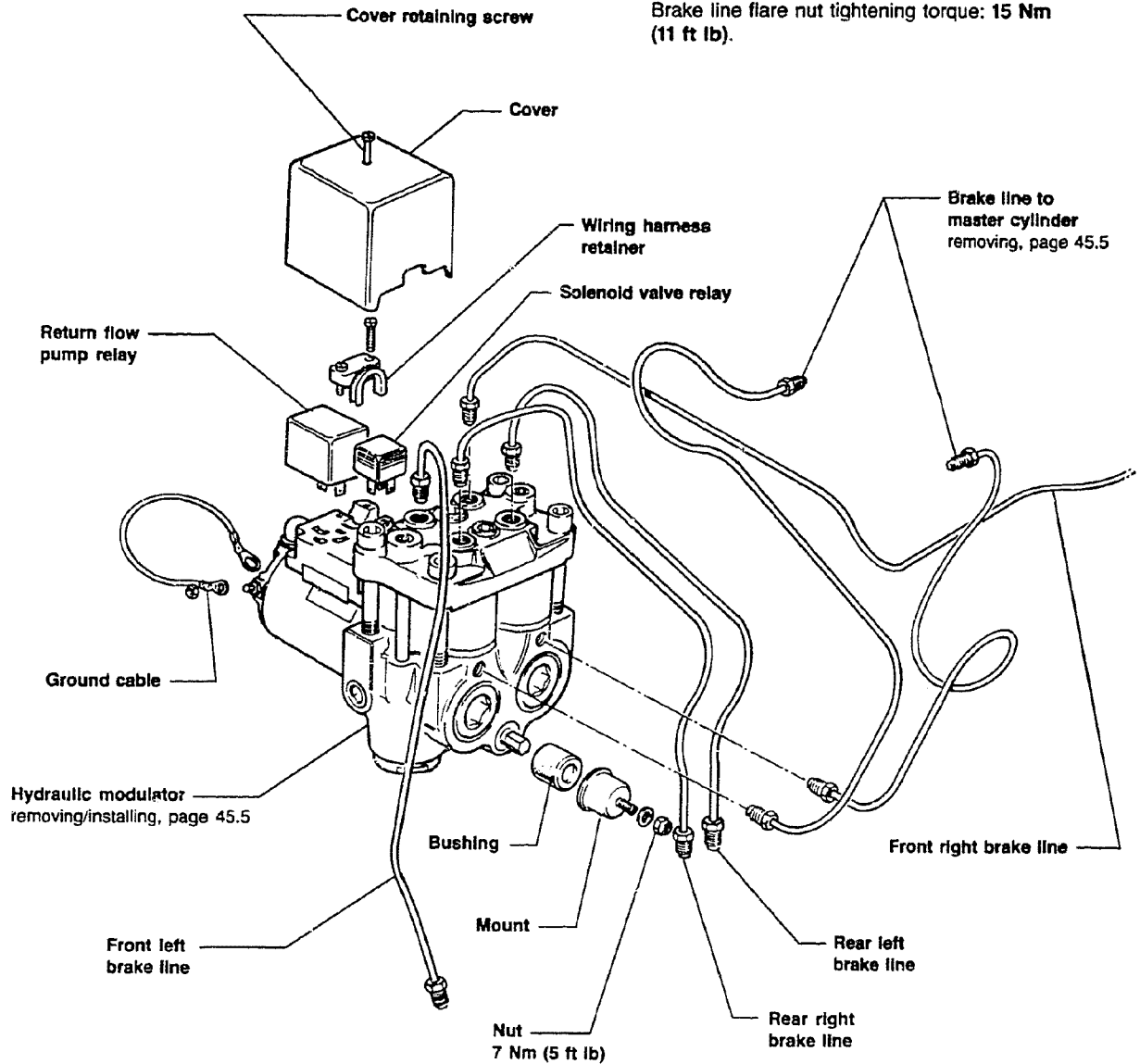
Do not repair hydraulic modulator except for replacing relays. If hydraulic modulator is defective it must be replaced.

CAUTION

Do not fabricate brake lines. Use only genuine Audi replacement parts when making repairs.

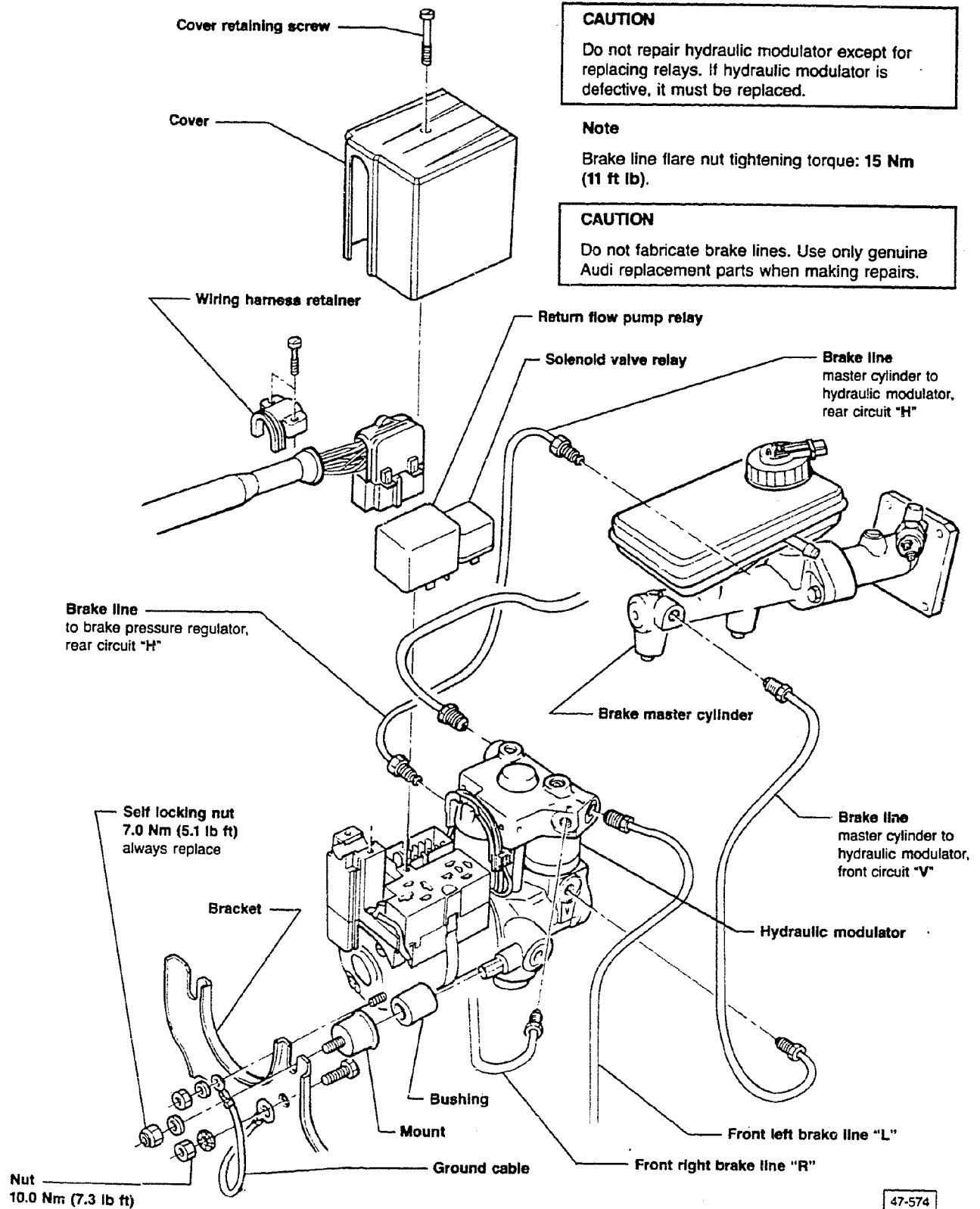
Note

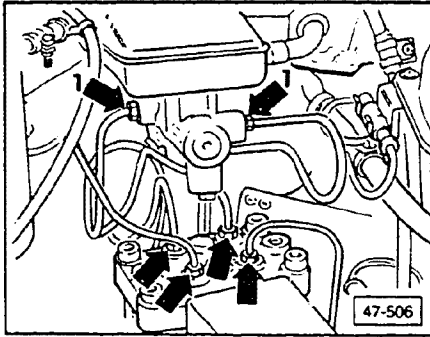
Brake line flare nut tightening torque: 15 Nm (11 ft lb).



47-495

Anti-Lock Brake System





Brake lines, removing/installing

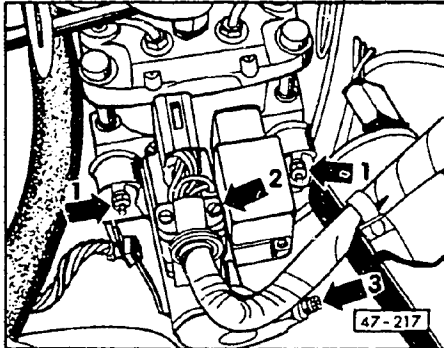
- remove lines 1
- remove all other lines (arrows)
 - 15 Nm (11 ft lb)

Hydraulic modulator, removing/installing

- 1 = modulator mounting
- 2 = wiring harness mounting
- 3 = ground strap mounting

CAUTION

Do not repair hydraulic modulator except for replacing relays. If hydraulic modulator is defective it must be replaced.



Hydraulic modulator, high and low pressure testing

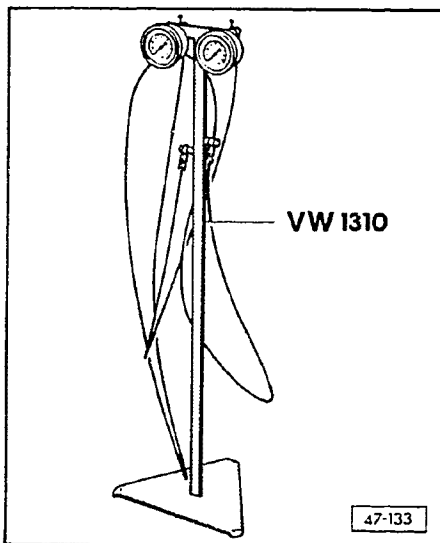
- remove one front wheel
- remove bleeder screw from caliper
- connect VW 1310 and bleed
- press brake pedal until pressure gauge reads 50.0 bar (725.0 psi)

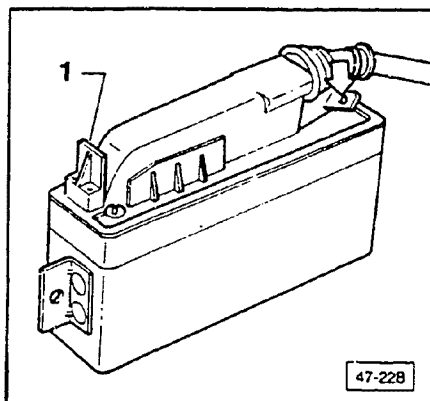
If pressure drops more than 4.0 bar (58.0 psi) in 45 seconds,

- replace hydraulic modulator
- press brake pedal until pressure gauge reads 6.0 bar (87.0 psi)

If pressure drops more than 1.0 bar (14.5 psi) in 3 minutes,

- replace hydraulic modulator





Electronic control unit, removing/installing

CAUTION

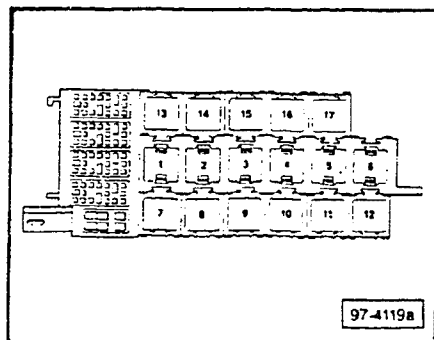
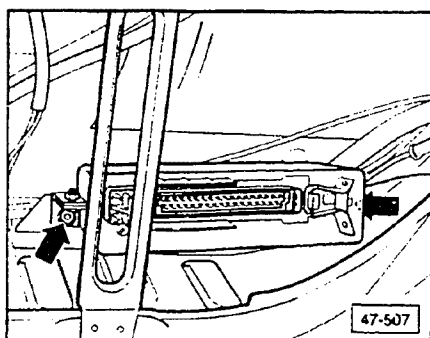
Switch ignition **OFF** before disconnecting or connecting control unit connector.

- press spring down (**arrow**)
- lift connector from control unit

Note

When installing control unit connector, engage tab on connector 1 and press connector against spring.

- remove rear seat cushion
- disconnect electrical connector
- remove control unit

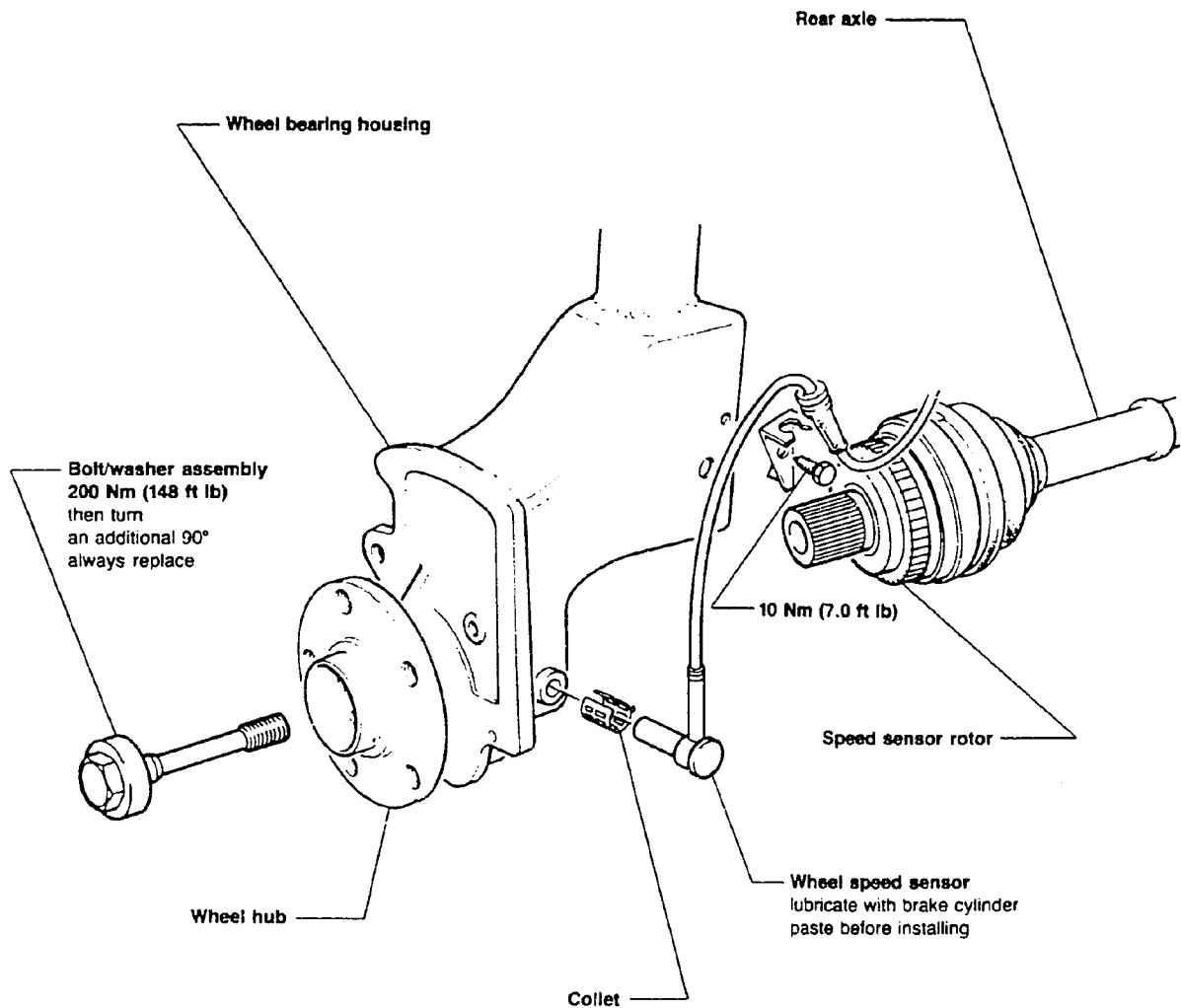


Combination relay, removing/installing

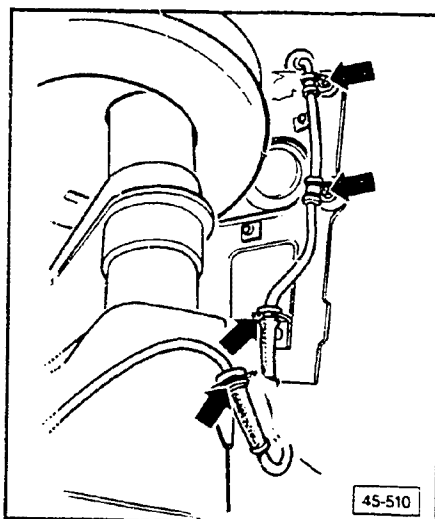
CAUTION

Switch ignition **OFF** before disconnecting or connecting control unit connector.

- switch ignition **OFF**
- remove combination relay from position 8 of auxiliary relay panel

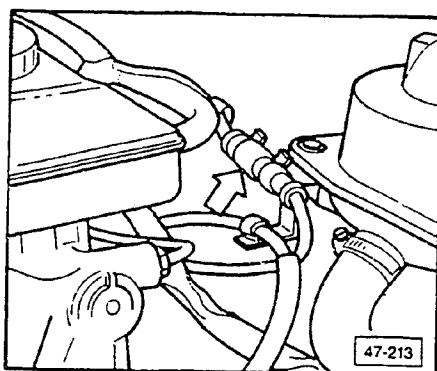


U 45-012



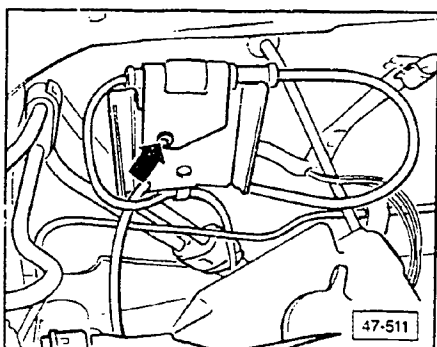
► **Front wheel speed sensor wiring harness, installing**

- install rubber grommets in retainers on bearing housing
- fasten cable clips to body (arrows)



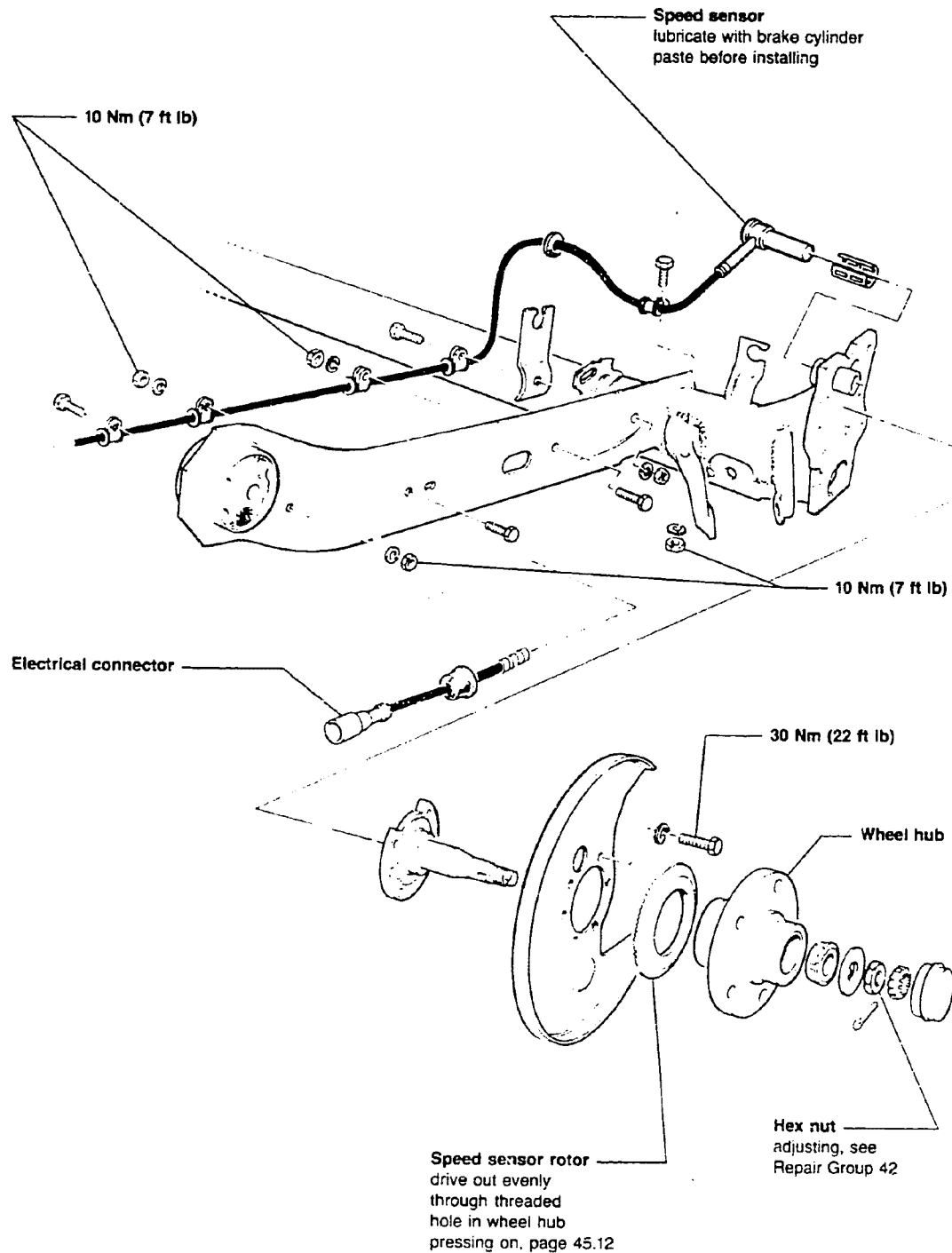
► **Left front wheel speed sensor connector, removing**

- remove electrical connector from retainer and unplug

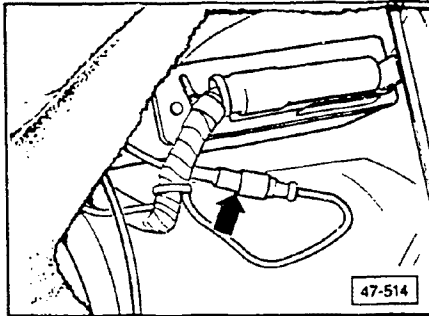


► **Right front wheel speed sensor connector, removing**

- remove windshield washer fluid reservoir
- unbolt bracket
- remove electrical connector from bracket
- unplug connector

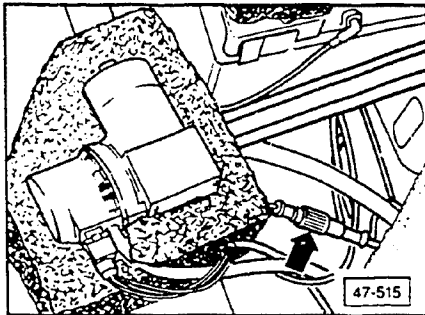


45-001



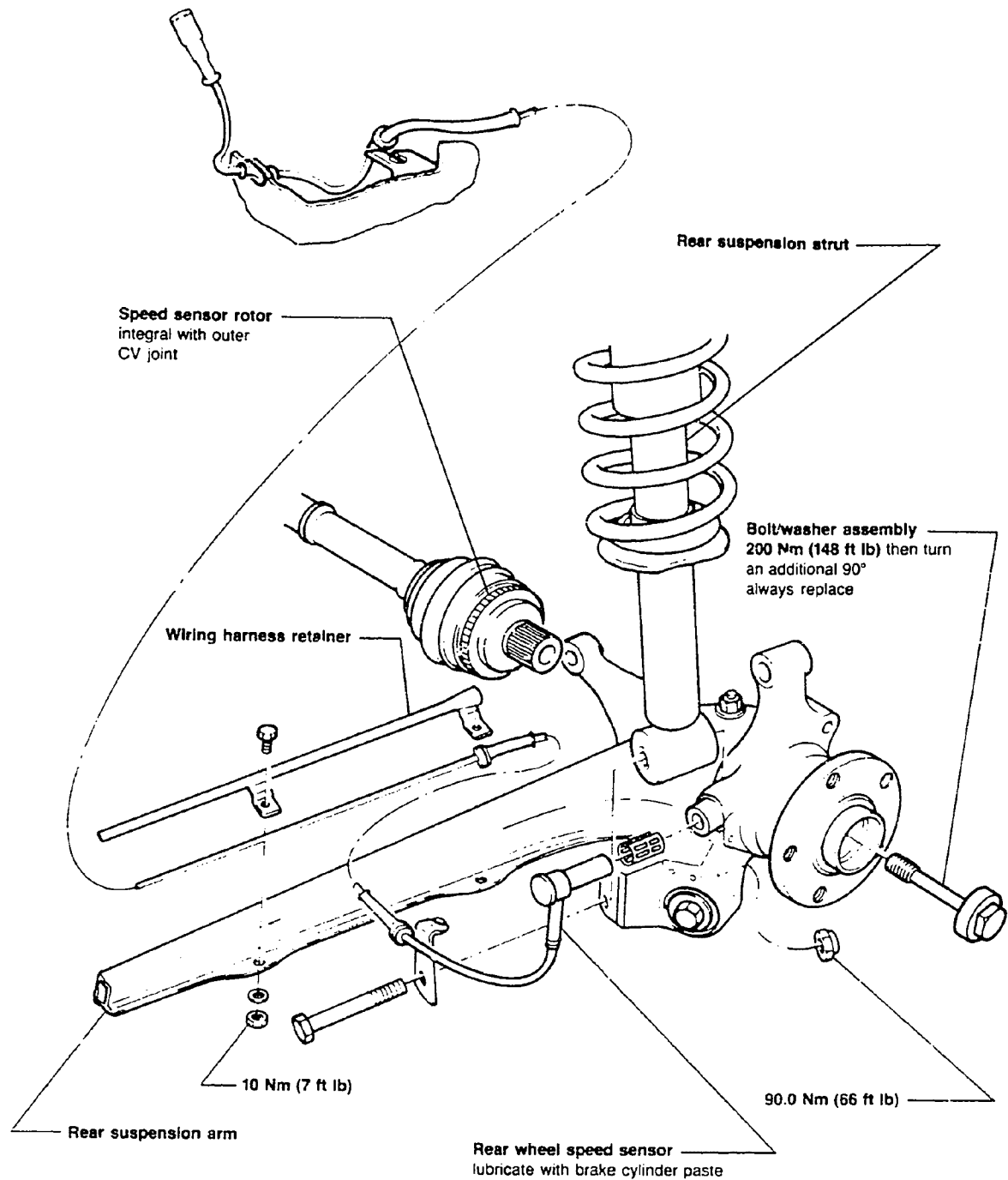
▶ **Left rear speed sensor connector, disconnecting**

Connector (arrow) located near ABS control unit under rear seat.

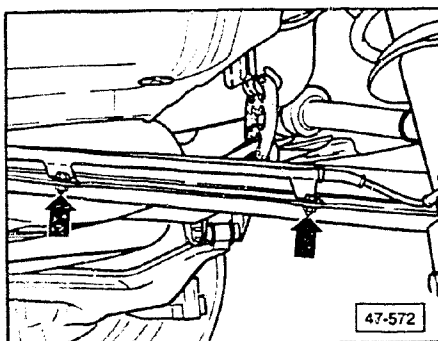


▶ **Right rear speed sensor connector, disconnecting**

Connector (arrow) located near central locking system pump.



45-010

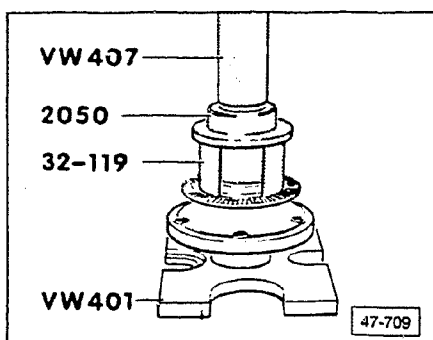


▶ Rear wiring harness retainer, installing

- install wires in retainer and tighten bolts (arrows)

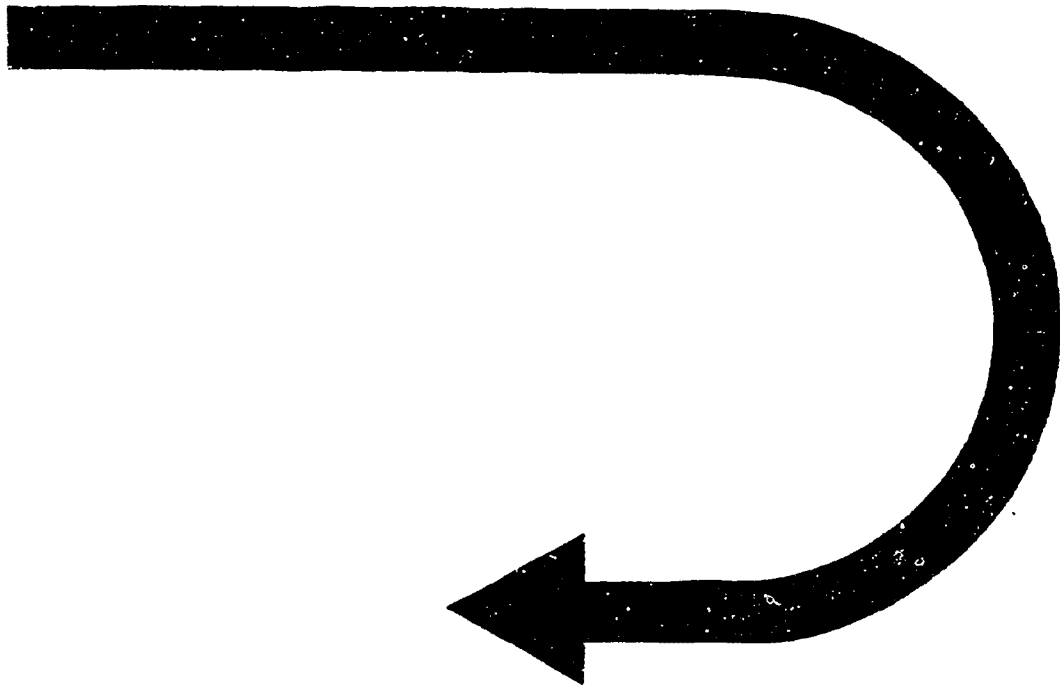
CAUTION

Do not pinch wires when routing.



▶ Rear wheel speed sensor rotor, pressing in

CONTINUED IN THE
BEGINNING OF NEXT ROW



Anti-Lock Brake System

CAUTION

- switch ignition **OFF** before connecting or disconnecting ABS control unit connector
- disconnect ABS control unit connector before using electrical welding equipment on the vehicle
- disconnect the battery connections before charging the battery or replacing the hydraulic modulator
- remove ABS control unit before drying paint repairs in an oven if temperatures will be above 85°C (185°F) for more than two hours
- do not use mini-spare tires on vehicles equipped with ABS. Use wheels and tires of matching size on ABS equipped vehicles
- do not drive the vehicle with the anti-lock brake tester connected

General repair notes

The complete testing procedure using the ABS 2-LED Tester must be done after any repairs are made to the following:

- hydraulic modulator
- ABS control unit
- wheel speed sensors
- ABS wiring harness

It is also necessary to perform the test procedure if the brake lines or brake pressure regulators are replaced because of accident damage.

After repairs to the brake system that do not affect the anti-lock system components, do the following operational test of the ABS:

- switch ignition **ON**
 - ABS indicator light lights
- drive vehicle with differential locks **NOT** engaged at speed over 4 mph (6 km/h)
 - ABS indicator light must not light

Do this test after repairing/replacing the following components:

- brake pads and/or brake discs
- brake hoses
- brake servo or master cylinder
- brake cables and hand brake components

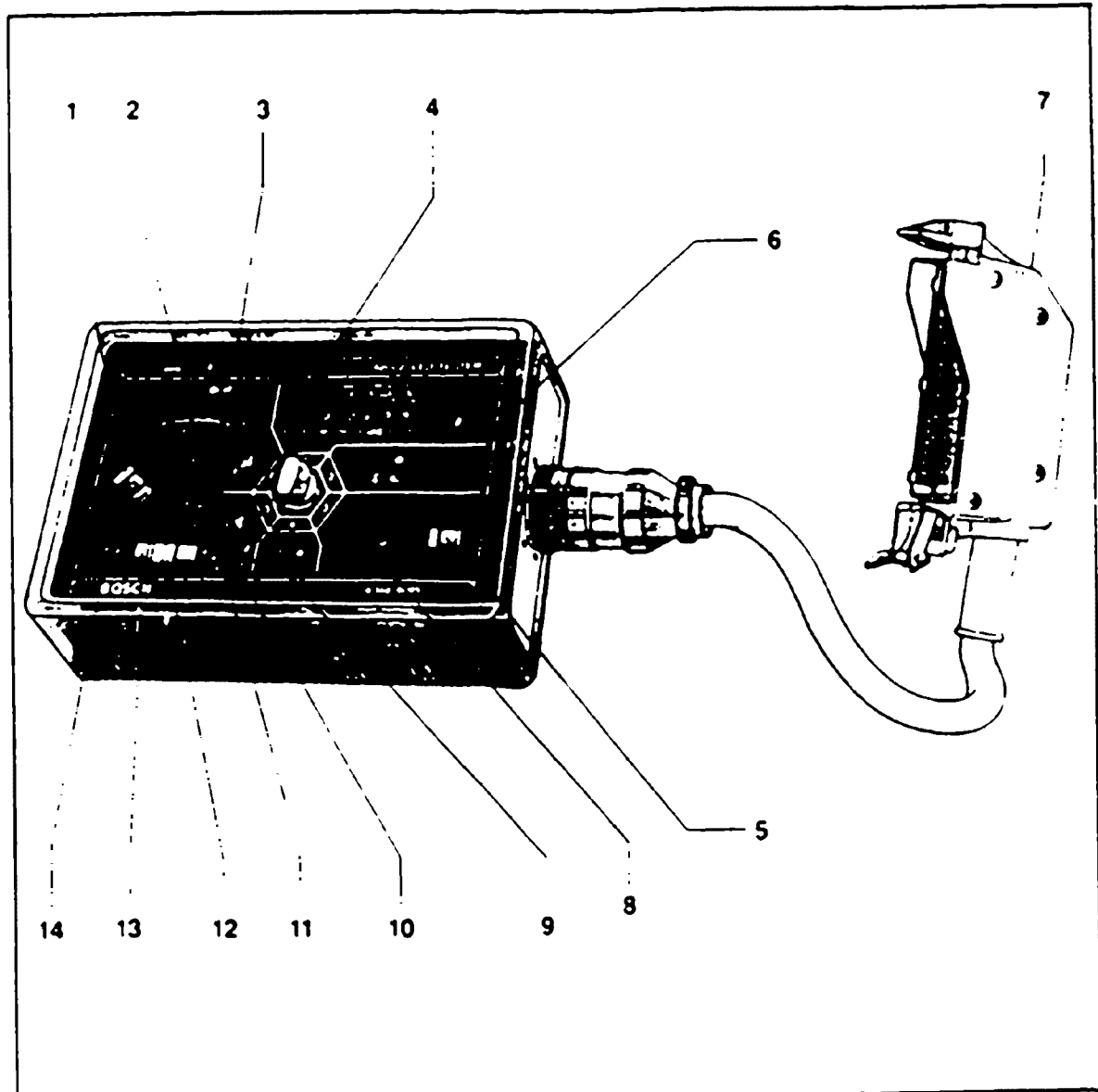
Note

During a final test drive, make sure that at least one controlled braking sequence is performed with the ABS **ON**.

THIS FRAME INTENTIONALLY LEFT

BLANK

Anti-Lock Braking System



The Bosch ABS 2 LED-Tester will check the following:

- hydraulic modulator and relays
- wheel speed sensors
- warning light
- cable harness connectors
- brake light switch signal
- alternator signal

The tester is not designed to check the electronic control unit.

Note

Certain steps of the test sequence require two technicians.

1 — Rotary switch

used during program switch positions #5 and #6 to select the solenoid wheel to be tested

2 — Analog gauge

used to check the operation of the selected wheel speed sensor

3 — LED

indicator for battery voltage

4 — 7 LEDs

indicate the condition of ground connections, warning light diode, internal resistance of solenoid valves, OFF position of solenoid valve relay

Anti-Lock Braking System

- 5 — **Push button**
used to operate return pump
- 6 — **2 LEDS**
monitor alternator connections and brake light switch connections
- 7 — **Adapter plug**
for connecting the tester to the ABS wiring harness in the vehicle
- 8 — **LED**
that monitors return pump operation
- 9 — **2 LEDs**
(Not Applicable)
- 10 — **LED**
monitors the ON position of the solenoid valve relay
- 11 — **LED**
indicates current availability for the pressure hold check of the selected solenoid valve
- 12 — **Pushbutton**
used during functional check of selected solenoid valve (pressure hold)
- 13 — **Pushbutton**
used during functional check of selected solenoid valve (pressure reduction)
- 14 — **LED**
indicates current availability for the pressure reduction check of the selected solenoid valves

Anti-Lock Brake System

Program switch positions	Test of:	Additional steps:	Desired result:	If desired result is not obtained, go to page:
During Entire Test	Power supply	■ switch ignition ON	● LED stays lit 	45.19
1	Grounds Warning light diode Solenoid valves internal resistance Solenoid valve relay OFF position	■ switch ignition ON	5000 and 5000 Turbo (2 wheel drive) ● all seven LEDs stay lit 5000 Quattro (4 wheel drive) ● six LEDs stay lit (all LEDs except the one inside the dashed lines)	45.20 & 45.21
2	Alternator voltage Stop lamp switch	■ switch ignition ON ■ start engine, let engine idle ■ switch ignition ON ■ operate brake pedal	● LED lights up  ● LED goes out  ● LED lights up  ● LED goes out each time brake pedal is depressed 	45.24
3	Return pump motor relay Return pump	■ ignition ON ■ depress pushbutton   ■ release pushbutton	● LED lights up  ● the pump motor runs  ● LED  continues to stay lit for a few seconds after the pushbutton is released	45.25
4	Longitudinal acceleration sensor aL (only on vehicles so equipped)	■ switch ignition ON	● LED lights up 	● acceleration sensor defective ■ replace

Anti-Lock Brake System

Program switch positions	Test of:	Additional steps:	Desired result:	If desired result is not obtained, go to page:
5	Relay for solenoid valves Solenoid valve maintain pressure function (Requires 2 people) Solenoid valve reduce pressure function (Requires 2 people) The LED surrounded by the dashed line IS NOT used during Position #5 when testing the 5000 Quattro 3 channel system (4 wheel drive)	■ switch ignition ON ■ lift vehicle ■ put the transmission in neutral with the handbrake released ■ set the wheel selector switch to the wheel to be tested first ■ depress P - pushbutton and hold ■ depress brake pedal ■ release P - pushbutton while keeping brake pedal depressed Do not release the brake pedal ■ depress P - pushbutton while keeping the brake pedal depressed ■ release P - pushbutton while keeping the brake pedal depressed ■ release brake pedal in between each wheel being tested Note Each channel must be tested separately and consecutively	● LED  lights up and must stay lit constantly as long as program switch is in position #5 ● LED P - lights up ● LED P stays lit test wheel should now be able to be rotated by hand using second person ● LED P goes out and the test wheel locks up and cannot be rotated ● LED P  Lights Up Test wheel should now be able to rotate by hand using second person ● LED P  goes out and the test wheel locks up and cannot be rotated	45 27

Note

Vehicle wheels must be off the ground to perform steps 5 and 6. Carry out all testing consecutively for each wheel.

Anti-Lock Brake System

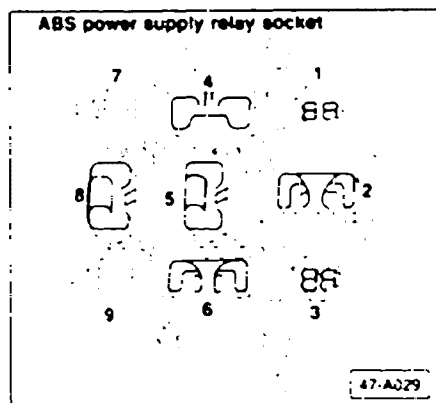
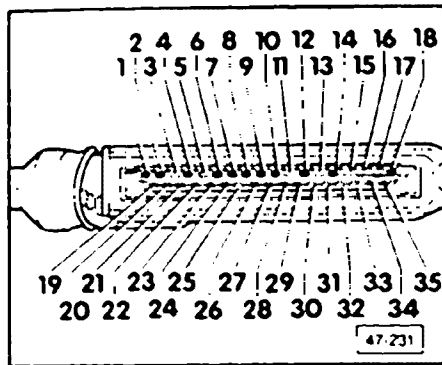
Program switch positions	Test of:	Additional steps:	Desired result:	If desired result is not obtained, go to page:
6	Wheel Speed Sensors The LED surrounded by the dashed line IS used during Position #6 when testing any Audi ABS system	■ put the transmission in neutral with the handbrake released ■ set the wheel selector switch to the wheel to be tested first Note When testing the driven axle, the wheel NOT being tested must be held still.	■ turn the wheel by hand until the LED above the analog gauge lights up without flickering (speed approximately 1 revolution per second). The reading must be greater than 0.8 and approx. equal to each of the other three sensors.	45.28 - 45.29

Final check:

- assemble system
- start engine; anti-lock indicator light in vehicle must go out
- while the engine is running, acutate switch for anti-lock; indicator light in vehicle must come on
- switch off engine and start it again; anti-lock indicator light must go out
- drive vehicle at a speed above 20 mph (30 kph); anti-lock indicator must not come on
- if the center and/or rear differential lock is engaged, the ABS indicator light must come on (5000 Quattro only)

If the ABS system does not function properly at the conclusion of the test procedure, replace the control unit and test drive the vehicle.

Anti-Lock Brake System



LED   not lit

- check these first
 - battery is fully charged
 - fuses #3 and #12 on the fuse relay panel are OK
 - fuse on top of the anti-lock power supply relay is OK

- check for continuity between terminal 20 on the ABS control unit connector and ground at battery ground strap

- switch ignition OFF

- check continuity of the wire between terminal 10 of the ABS control unit connector and ground

- check for battery voltage between terminals 1 and 10 of ABS control unit plug
 - approximately battery voltage

If NOT OK,

- remove anti-lock power supply relay
- check for battery voltage between contacts 2 and 4 and contacts 5 and 4

If NOT OK,

- repair wiring

- connect voltmeter between contacts 8 and 4

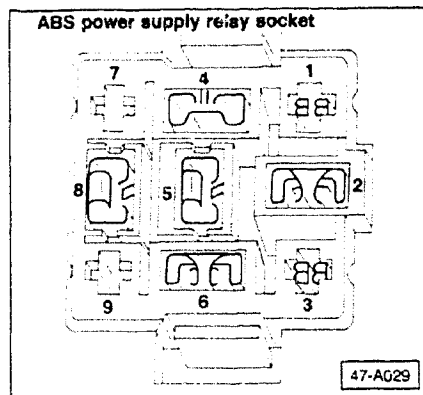
- press and hold the anti-lock switch
 - approximately battery voltage

If NOT OK,

- repair wiring or replace ABS switch and recheck

more

Anti-Lock Brake System

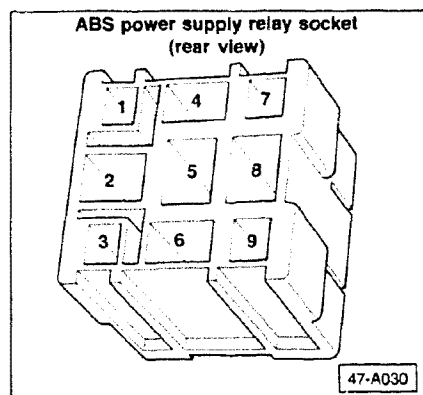


LED not in
(on Quattro models)

- connect voltmeter between contacts 1 and 5 of power supply relay socket
- lock rear differential
 - approximately battery voltage
- unlock rear differential
 - 0.0 volts

If **NOT OK**

- repair wiring or replace differential lock switch
- install ABS power supply relay



- check for voltage between contacts 6 and 4 on back of relay socket
 - approximately battery voltage

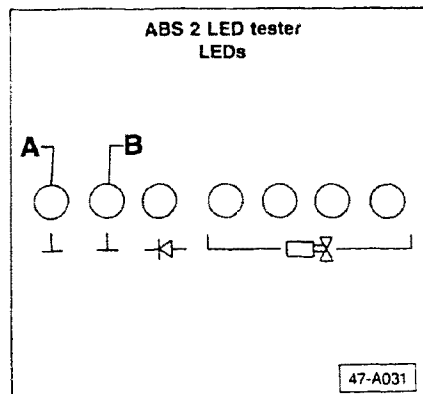
If **NOT OK**

- replace ABS power supply relay and recheck

LED does not light (tester in 'Position 1')

Note

Weaker illumination of an LED indicates a contact resistance in the corresponding current path.

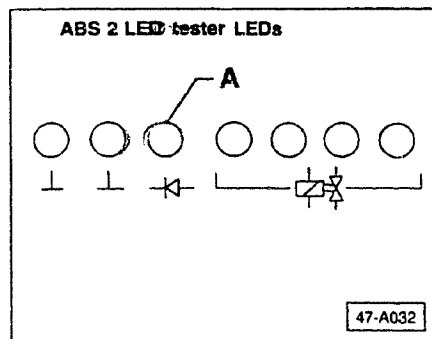


- check for continuity between terminal 34 of ABS control unit plug and ground connection at battery ground strap (LED A)
- check for continuity between terminal 10 of ABS control unit plug and ground connection at battery ground strap (LED B)

If **NOT OK**

- repair wiring as necessary

Anti-Lock Brake System



LED  **does not light**
(tester in 'Position 1')

- check continuity between terminal 32 of ABS control unit connector and terminal 12 of black hydraulic modulator connector (LED A)

If **NOT OK**,

- repair wiring as necessary
- check for continuity between terminal 20 of ABS control unit connector and ground connection at battery ground strap

If **NOT OK**,

- repair wiring as necessary

Note

If terminal 20 is disconnected, the battery LED will not be lit.

- check for defective ABS ON/OFF switch
- check for defective ABS ON/OFF switch wiring
- check ABS warning light bulb
- check warning light bulb diode

ABS warning light bulb diode, checking

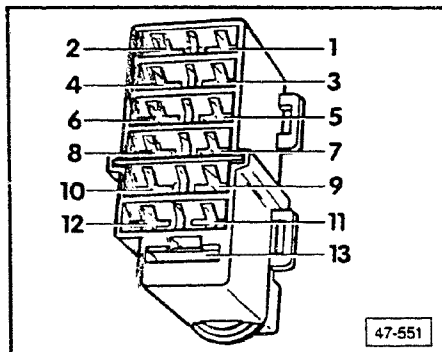
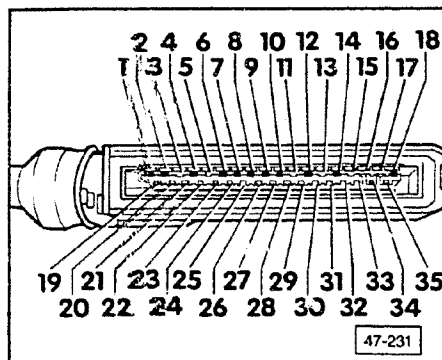
- check continuity between terminal 10 of black hydraulic modulator connector and terminal 29 of the ABS control unit plug

If **NOT OK**,

- repair wiring as necessary
- measure for continuity and contact resistance both ways between male terminals 10 and 12 in the socket on top of the hydraulic modulator
 - ohmmeter must indicate continuity (K ohm reading) in one direction and no continuity in the other direction

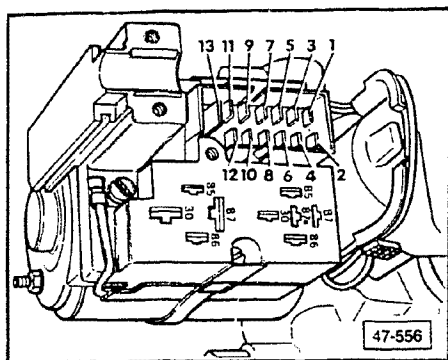
Note

The diode is not replaceable. The hydraulic modulator must be replaced as a unit.



Black hydraulic modulator connector

Anti-Lock Brake System



All  LEDs and  LED do not light up (tester in 'Position 1')

Solenoid valve relay, checking

- switch ignition **OFF**
- remove solenoid valve relay from hydraulic modulator
- measure continuity between terminals **87a** and **30**
 - 0 ohm
- measure resistance between terminals **85** and **86** of solenoid valve relay
 - approximately 70 to 120 ohms
- remove black connector from top of hydraulic modulator
- check for continuity between terminal **8** on connector and ground
- check for continuity between male terminal **8** of hydraulic modulator and terminal **87a** of the solenoid valve relay socket
- check for continuity between terminal **12** of the black hydraulic modulator connector and contact **32** of the ABS control unit connector

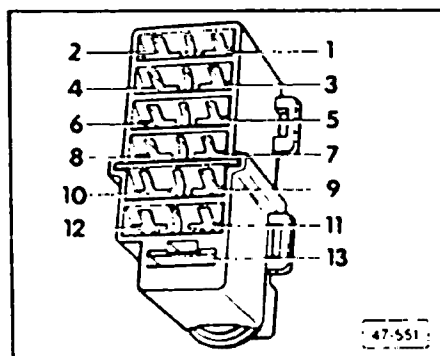
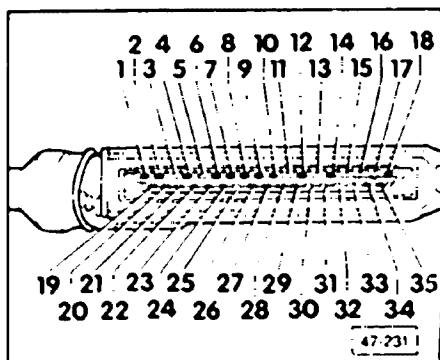
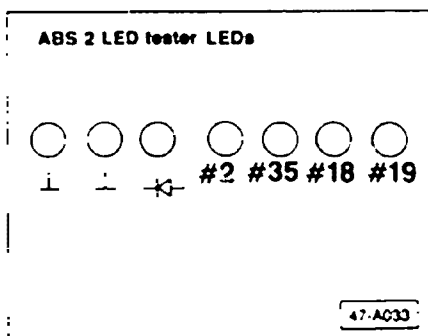
If **NOT OK**

- repair wiring as necessary

If the above checks are **OK** and **LEDs DO NOT** light,

- replace solenoid valve relay

Anti-Lock Brake System



All  LED does not light
(tester in 'Position 1')

#2 LED out

- check for continuity between terminal 2 on ABS control unit connector and terminal 3 on black hydraulic modulator connector

If NOT OK,

- repair wiring as necessary

#35 LED out

- check for continuity between terminal 35 on ABS control unit connector and terminal 5 on the black hydraulic modulator connector

If NOT OK,

- repair wiring as necessary

#13 LED out

- check for continuity between terminal 18 of ABS control unit connector and terminal 7 on the black hydraulic modulator connector

#19 LED out

(on 2-wheel drive models only)

- check for continuity between terminal 19 on ABS control unit connector and terminal 1 on black hydraulic modulator connector

If NOT OK,

- repair wiring as necessary

**LED  does not light
(tester in 'Position 2')**

- check for continuity between terminal 61 on back of the alternator and terminal 15 of the ABS control unit connector

If **NOT OK**,

- repair wiring as necessary

LED  does not go out when engine is started

- check alternator output

LED  does not light

- check for continuity between brake light switch terminal and terminal 25 on ABS control unit connector

If **NOT OK**,

- repair wiring as necessary

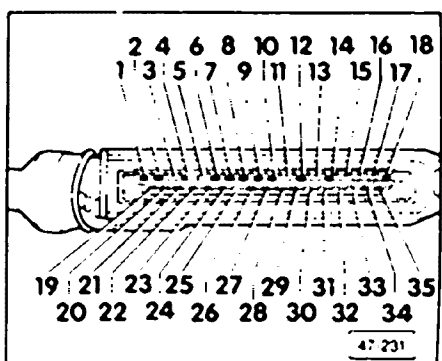
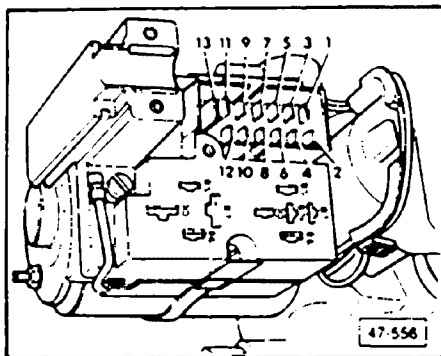
OR

- check for short circuit in brake light switch

LED  does not go out when brake pedal is depressed

- check brake light switch adjustment
- check mechanical function of brake light switch

Anti-Lock Brake System



ABS return pump does not run (tester in 'Position 3')

- switch ignition **OFF**
- remove ABS return pump relay
- check for continuity between terminal 11 of the black hydraulic modulator connector and terminal 28 of the ABS control unit connector
- check for continuity between terminal 9 of the black hydraulic modulator connector and terminal 14 of the ABS control unit connector
- check for continuity between terminal 2 of the black hydraulic modulator connector and terminal 1 of the ABS control unit connector
- check for continuity between positive terminal on return pump motor and male terminal 9 on top of the hydraulic modulator
- switch ignition **ON**
- check voltage of terminal 2 and terminal 13 of the black hydraulic modulator connector
 - approximately battery voltage

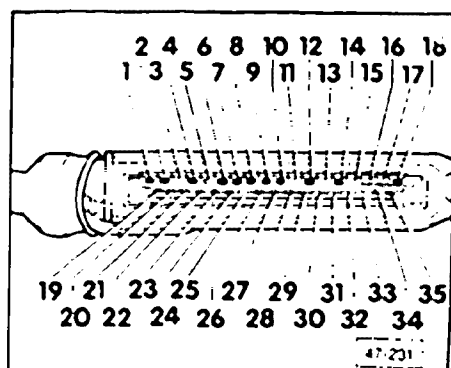
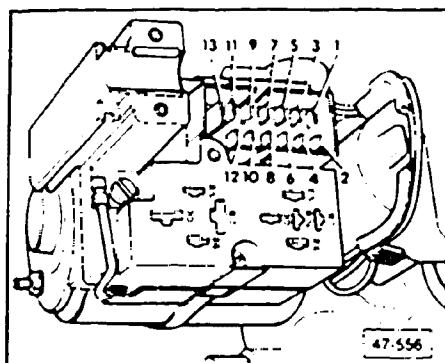
If **NOT OK**,

- repair wiring as necessary

If all of above checks are correct and the return pump does not run,

- replace the return pump relay

Anti-Lock Brake System



ABS return pump does not run
(return pump relay is OK,
(tester in 'Position 3')

- switch ignition **OFF**
- remove black hydraulic modulator connector
- check for continuity between male terminal **11** in the hydraulic modulator socket and terminal **85** in the return pump relay socket
- check for continuity between male terminal **13** in the hydraulic modulator socket and terminal **87** in the return pump relay socket
- check for continuity between male terminal **11** in the hydraulic modulator socket and terminal **28** of the ABS control unit connector

If **NOT OK**,

- repair wiring as necessary

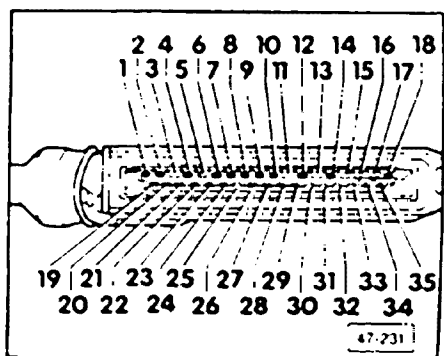
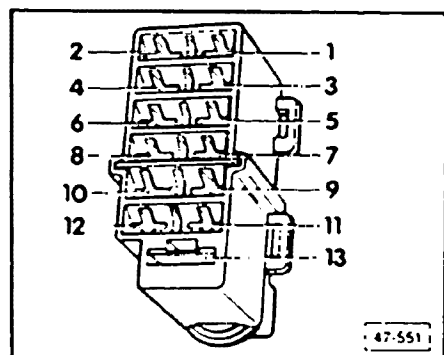
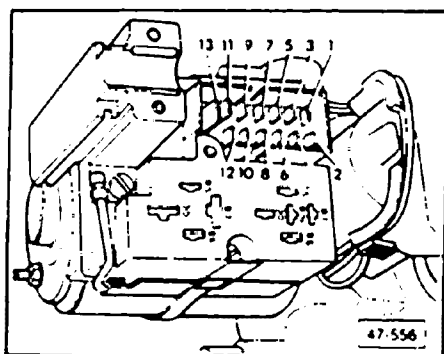
If all of the above checks are correct and the return pump does not run,

- replace the hydraulic modulator

LED  **does not light**
(tester in 'Position 5')

- check solenoid valve relay page (ABS book page 14)

Anti-Lock Brake System



**Solenoid valves do not work
(solenoid valve relay is OK)
(tester in 'Position 5')**

- switch ignition **OFF**
- remove black hydraulic modulator connector
- measure voltage at terminal 4
 - approximately battery voltage
- check for continuity between male terminal 4 in hydraulic modulator socket and terminal 87 in the socket for the solenoid valve relay
- check for continuity between male terminal 6 in hydraulic modulator socket and terminal 85 in the socket for the solenoid valve relay
- check for continuity between terminal 86 in the socket for the solenoid valve relay and terminal 86 in the socket for the return pump relay
- check for continuity between terminal 86 in the solenoid valve relay socket and male terminal 2 in the socket on top of hydraulic modulator
- check for continuity between terminal 6 of black hydraulic modulator connector and terminal 27 of ABS control unit connector
- switch ignition **ON**
- measure voltage at terminal 2 of black hydraulic modulator connector
 - approximately battery voltage

If NOT OK,

- repair wiring as necessary

If all of above checks are correct and the solenoids do not function,

- replace hydraulic modulator

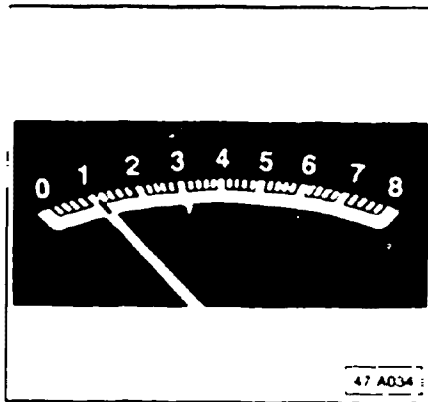
Anti-Lock Brake System

Wrong solenoid valve operates (tester in 'Position 5')

- check for proper connections of brake lines to hydraulic modulator
- using Wiring Diagram, check for proper wiring between hydraulic modulator and the ABS control unit

LED   flashes off and on
(selector in 'Position 6')

Wheel tested is being turned too fast or too slow.



Sensor signal on test meter is not above minimum value

- check for excessive air gap between wheel speed sensor and ring gear
- check for loose or defective ring gear
- check for excessive wheel bearing play

Anti-Lock Brake System

No response from selected sensor (tester in 'Position 6')

- switch ignition OFF
- disconnect wheel speed sensor connector of sensor to be tested

Note

Front sensor plug connectors are located under the front hood near the shock towers. Rear sensor plug connectors are located under the rear seat cushion.

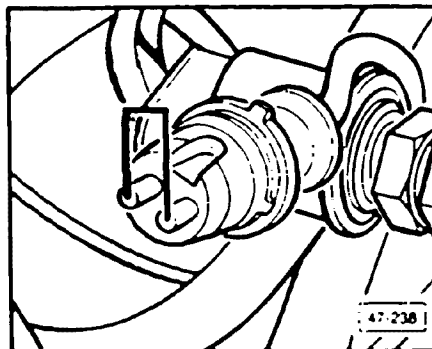
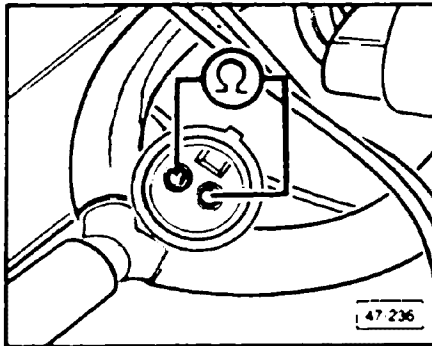
- connector ohmmeter to female terminals
measure resistance of speed sensor
 - 0.8K ohms to 1.8K ohms

If NOT OK

- replace wheel speed sensor

If OK,

- check for continuity between wheel speed sensor and ABS control unit connector



- bridge the male terminals of the wheel speed sensor connector
- remove ABS control unit connector
- check for continuity between wheel speed sensor you bridged and corresponding terminals of ABS control unit connector

if NOT OK,

- repair wiring as necessary