Repair Manual
100/S4/A6/S6 1992 ▶

2.8 Liter V6 (MMS 100/200)
Fuel Injection & Ignition

Edition 06.95 W42 013 195 102

Technical Service Communications

Audi

Repair Manual
100/S4/A6/S6

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List of Repair Manual Repair Groups

100/S4/A6/S6

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2.8 Liter V6 Fuel Injection & Ignition (MMS 100/200)

When filing a new Technical Bulletin enter the Bulletin No. in the adjacent column. When using the Repair Manual you can then see at a glance whether Bulletins have been published for that particular Repair Group. In addition, safety precautions must be observed when working on motor vehicles.

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Audi

Repair Manual

100/S4/A6/S6

1992 ▶

This repair manual contains information published for use in the repair and servicing of the 1992 and later Audi 100, A6, S4 and S6 models imported into the USA and Canada.

CAUTION!

Before attempting any work on an Audi sold in the USA or Canada, first determine whether the service or repair procedure you wish to use is applicable to USA or Canada models. The use of procedures and specifications that are not intended for use in connection with USA or Canadian Audi models may endanger the safety of persons servicing the vehicle or be detrimental to the safe operation of the vehicle.

Part numbers mentioned in these procedures are for reference only. Always check with your authorized Audi retailer to verify part numbers.

Note:

This booklet supersedes the following for coverage of MMS 100 and MMS 200 engine management systems:

- microfiche Repair Manual, *100/S4/A6/S6 From 1992* (Oct. 1, 1994): Fiche 2 of 19 (W42-544-192-F2), Repair Groups 24 and 28
- Troubleshooting binder, *Using VAG 1551 and VAG 1598*, section *100/C4 D2*

Printed in the United States of America

Introduction

This repair manual booklet covers the 2.8 Liter V6 fuel injection and ignition systems MMS 100 and MMS 200, Repair Groups 01, 24 and 28.

It supersedes coverage of these systems in Repair Groups 24 and 28 of the Oct. 1, 1994 microfiche Repair Manual, *100/S4/A6/S6 From 1992*, Fiche 2 of 19 (W42-544-192-F2), and in the *100/C4 D2* section in the troubleshooting binder *Using VAG 1551 and VAG 1598*.

Important!

The contents of this manual have been and will continue to be updated by Technical Bulletins. This manual has been updated to include information from Technical Bulletins available at the time of printing that specifically cover changes or additions to repair procedures and specifications, but Technical Bulletins covering other important information, and those that have been created since the printing of this manual, are not included. Before using this manual, be sure to look up the latest Technical Bulletins on OTIS, paper or microfiche.

Please read these WARNINGS and CAUTIONS before proceeding with maintenance and repair work.

- If you lack the skills, tools and equipment, or a suitable workshop for any procedure described in this manual, we suggest you leave such repairs to an authorized Audi retailer or other qualified shop. We especially urge you to consult an authorized Audi retailer before beginning repairs on any vehicle that may still be covered wholly or in part by any of the extensive warranties issued by Audi.

- Audi is constantly improving its vehicles and sometimes these changes, both in parts and specifications, are made applicable to earlier models. Therefore, part numbers listed in this manual are for reference only. Always check with your authorized Audi retailer parts department for the latest information.

- Never work under a lifted vehicle unless it is solidly supported on stands designed for the purpose. Do not support a vehicle on cinder blocks, hollow tiles or other props that may crumble under continuous load. Never work under a vehicle that is supported solely by a jack. Never work under the vehicle while the engine is running.

- If you are going to work under a vehicle on the ground, make sure that the ground is level. Block the wheels to keep the vehicle from rolling. Disconnect the battery negative terminal (ground strap) to prevent others from starting the vehicle while you are under it.

- Never run the engine unless the work area is well ventilated. Carbon monoxide (CO) kills.

- Tie long hair behind your head. Do not wear a necktie, a scarf, loose clothing, or a necklace when you work near machine tools or running engines. If your hair, clothing, or jewelry were to get caught in the machinery, severe injury could result.

- Illuminate the work area adequately but safely. Use a portable safety light for working inside or under the vehicle. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

- Finger rings should be removed so that they cannot cause electrical shorts, get caught in running machinery, or be crushed by heavy parts.

- Disconnect the battery negative terminal (ground strap) whenever you work on the fuel system or the electrical system. Do not smoke or work near heaters or other fire hazards. Keep an approved fire extinguisher handy.

- Any time the battery has been disconnected on an automatic transmission vehicle, it will be necessary to reestablish Transmission Control Module (TCM) basic settings using the VAG 1551 Scan Tool (ST).

- For vehicles equipped with an anti-theft radio, be sure of the correct radio activation code before disconnecting the battery or removing the radio. If the wrong code is entered when power is restored, the radio may lock up and become inoperable, even if the correct code is used in a later attempt.

- Do not attempt to work on your vehicle if you do not feel well. You increase the danger of injury to yourself and others if you are tired, upset or have taken medicine or any other substance that may impair you or keep you from being fully alert.

- Always observe good workshop practices. Wear goggles when you operate machine tools or work with battery acid. Wear goggles, gloves and other protective clothing whenever the job requires working with harmful substances.

- Do not re-use any fasteners that are worn or deformed in normal use. Many fasteners are designed to be used only once and become unreliable and may fail when used a second time. This includes, but is not limited to, nuts, bolts, washers, self-locking nuts or bolts, circlips, cotter pins. Always follow recommendations made in this publication. Always replace these fasteners with new parts.

- Friction materials such as brake pads and clutch discs may contain asbestos fibers. Do not create dust by grinding, sanding, or by cleaning with compressed air. Avoid breathing asbestos fibers and asbestos dust. Breathing asbestos can cause serious diseases such as asbestosis or cancer, and may result in death.

Please read these WARNINGS and CAUTIONS before proceeding with maintenance and repair work.

- Catch draining fuel, oil or brake fluid in suitable containers. Do not use empty food or beverage containers that might mislead someone into drinking from them. Store flammable fluids away from fire hazards. Wipe up spills at once, but do not store the oily rags, which can ignite and burn spontaneously.

- Keep sparks, lighted matches, and open flame away from the top of the battery. If escaping hydrogen gas is ignited, it will ignite gas trapped in the cells and cause the battery to explode.

- The air-conditioning (A/C) system is filled with a chemical refrigerant that is hazardous. The A/C system should be serviced only by trained automotive service technicians using approved refrigerant recovery/recycling equipment, trained in related safety precautions, and familiar with regulations governing the discharging and disposal of automotive chemical refrigerants.

- Do not expose any part of the A/C system to high temperatures such as open flame. Excessive heat will increase system pressure and may cause the system to burst.

- Some of the vehicles covered by this manual are equipped with a supplemental restraint system (SRS), that automatically deploys an airbag in the event of a frontal impact. The airbag is operated by an explosive device. Handled improperly or without adequate safeguards, it can be accidently activated and cause serious personal injury. To guard against personal injury or airbag system failure, only trained Audi Service technicians should test, disassemble or service the airbag system.

- Never use a test light to conduct electrical tests of the airbag system. The system must only be tested by trained Audi Service technicians using the VAG 1551 Scan Tool (ST) or an approved equivalent. The airbag unit must never be electrically tested while it is not installed in the vehicle.

- Before starting a job, make certain that you have all the necessary tools and parts on hand. Read all the instructions thoroughly, do not attempt shortcuts. Use tools that are appropriate to the work and use only replacement parts meeting Audi specifications. Makeshift tools, parts and procedures will not make good repairs.

- Use pneumatic and electric tools only to loosen threaded parts and fasteners. Never use these tools to tighten fasteners, especially on light alloy parts. Always use a torque wrench to tighten fasteners to the tightening torque listed.

- Be mindful of the environment and ecology. Before you drain the crankcase, find out the proper way to dispose of the oil. Do not pour oil onto the ground, down a drain, or into a stream, pond, or lake. Consult local ordinances that govern the disposal of wastes.

- Before doing any electrical welding on vehicles equipped with anti-lock brakes (ABS), disconnect the battery negative terminal (ground strap) and the ABS Control Module connector.

- When boost-charging the battery, first remove the fuses for the Engine Control Module (ECM), the Transmission Control Module (TCM), the ABS Control Module, and the On-Board computer. In cases where one or more of these components is not separately fused, disconnect the Control Module connector(s).

- Do not quick-charge the battery (for boost starting) for longer than one minute, and do not exceed 16.5 volts at the battery with the boosting cables attached. Wait at least one minute before boosting the battery a second time.

- Some aerosol tire inflators are highly flammable. Be extremely cautious when repairing a tire that may have been inflated using an aerosol tire inflator. Keep sparks, open flame or other sources of ignition away from the tire repair area. Inflate and deflate the tire at least four times before breaking the bead from the rim. Completely remove the tire from the rim before attempting any repair.

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24 Multiport fuel injection

28 Ignition system

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On Board Diagnostic system, Engine Control Module (ECM)

Functions and features described in this Repair Group apply to the following ECMs:

- 4A0 906 266 A (MMS 100)
- 4A0 906 266 AA (MMS 200)
- 4A0 906 266 AB (MMS 200)
- 8A0 906 266 A (MMS 200)

Component locations ⇒ Repair Group 24

After signal evaluation, the Engine Control Module (ECM) differentiates between 44 different malfunctions, see Diagnostic Trouble Code (DTC) table starting on page 01-14.

When malfunctions occur they are stored in DTC memory until the DTC memory content is erased.

Technical data

♦ Permanent memory	**YES**
Data output modes:	
♦ Rapid data transfer mode	**YES**
♦ Blink code output at Malfunction Indicator Lamp (MIL)	**YES**
Function 01: Check Control Module Versions	**YES**
Function 02: Check DTC Memory	**YES**
Function 03: Output Diagnostic Test Mode (DTM)	**YES**
Function 04: Basic Setting	**YES**
Function 05: Erase DTC Memory	**YES**
Function 06: End Output	**YES**
Function 07: Code Control Module	NO
Function 08: Read Measuring Value Block	**YES**
Function 09: Read Individual Measuring Value	**YES**
Function 10: Adaptation	NO

On Board Diagnostic system overview

- The On Board Diagnostic capabilities are only accessible by using the VAG 1551 Scan Tool (ST).
- Only "Rapid data transfer" operating mode 1 of the VAG 1551 scan tool is described in this Repair Group.
- Check DTC Memory function 02 should be carried out with the engine running if possible.
- Output Diagnostic Test Mode (DTM) function 03 can only be carried out with the engine not running and the ignition switched on.

Malfunction recognition and repair

- A malfunction that is is present for a specified time is stored as a static malfunction. If after a specified time the condition no longer exists, it is defined as a sporadic malfunction and identified with an "SP" in the display. The evaluation repeats continuously. If a sporadic malfunction does not reoccur within the next 50 engine starts, it is automatically erased.
- In the California version, malfunctions that affect the exhaust and emission control are also displayed by illuminating the Malfunction Indicator Lamp (MIL) in the instrument cluster.
- Each time the ignition is switched on, the MIL must light up and then go out after the engine starts. If the MIL does not light up when the ignition is switched on, bridge the Data Link Connector (DLC) terminals using jumpers from the VW 1594 connector test kit. The MIL must remain lit for as long as the terminals are bridged. If not, or if the MIL does not go out, check DTC memory or use the wiring diagram to determine the cause of the malfunction and repair as necessary.
- If the Engine Control Module (ECM) is disconnected, the voltage supply is interrupted and DTC memory will be erased.

If a malfunction recognized by On Board Diagnostic is repaired:

- Erase DTC memory.
- Switch engine off and restart.
- Test drive the vehicle.
- Initiate the automatic test sequence using address word 00.

Ground (GND) connections, checking

Requirements

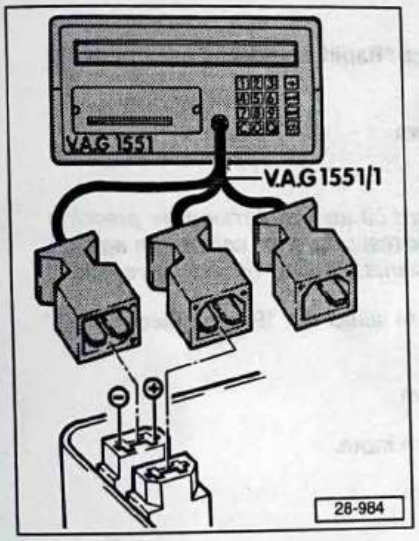
- Fuses 14, 17, 19 in passenger side footwell OK
- Circuit breakers for engine (black, brown, red, and yellow holders) in passenger side footwell OK
- Fuel pump relay OK

Note:

Before checking DTC memory (function 02), initiate the Output Diagnostic Test Mode (function 03), Basic Setting function 04 and Read Measuring Value Block function 08.

Before testing performance or replacing components, check the following ground connections for corrosion or damage, and repair or replace as necessary.

- *Ground attachment points on the intake manifold and right engine mount ⇒ Repair Group 24, multiport fuel injection system component layout.*
- *Battery GND strap; Repair or replace as necessary.*



VAG 1551 Scan Tool (ST), connecting

Requirements:

- Fuses 14, 17 and 19 in passenger side footwell OK
- Fuel Pump (FP) relay OK

Note:

DTC memory cannot be erased until AFTER it has been read.

– Connect VAG 1551 scan tool to Data Link Connectors (DLC) in fuse/relay box (in water plenum) using diagnostic cable VAG 1551/1 as follows.

– Remove cover from fuse/relay box in water plenum.

– Connect black scan tool connector to black DLC.

VAG On Board Diagnostic HELP 1 – Rapid data transfer
VAG On Board Diagnostic HELP 2 – Blink code output

◄ Indicated on display[1)]

[1)] Two displays appear alternately.

If there is NO display:

– Check voltage supply to black DLC.

– Connect white adapter cable connector to white/brown DLC.

Blue connector is not used.

Note:

- *Press the HELP button on the VAG 1551 scan tool to obtain additional operating notes.*
- *Press the → button to step through the program sequence.*

Functions

DTC memory reading and erasing (functions 02 and 05):

- Check with engine idling. If engine will not start: crank engine for a minimum of 5 seconds, do not switch ignition off after cranking.

Output Diagnostic Test Mode (function 03):

- Switch ignition ON, but do not start engine.

Basic Setting (function 04):

- Let engine idle or switch ignition on.

Read Measuring Value Block (function 08):

- Let engine run and/or switch ignition ON.

– Press PRINT button to switch on printer.

• LED in button must light up

– Press -1- button to select "Rapid data transfer" operating mode 1.

Rapid data transfer HELP Insert address word XX

◄ Display will appear as shown

Note:

After inserting address word 00 and confirming by pressing the -Q- button, an automatic test sequence will be run against the DTC memory for all systems present within that vehicle.

– Press buttons -0- and -1- to select the "Engine Electronics" address word 01.

Rapid data transfer Q 01 – Engine Electronics

◄ Display will appear as shown

– Press -Q- button to confirm input.

Rapid data transfer Scan Tool sends address word 01

◄ Display will appear as shown

Rapid data transfer HELP Control module does not answer

◄ If "Control module does not answer" appears in the display:

– Press HELP button to print list of possible causes.

– Check DLC wiring ⇒ page 01-73.

– Check for faulty ECM (DTC 65535) ⇒ DTC table, page 01-42.

After eliminating the possible cause:

– Re–insert "Engine Electronics" address word 01.

– Press -Q- button to confirm input.

Rapid data transfer Error in communications link	◄	If "Error in communications link" appears in the display:
		– Disconnect rapid data transfer wire between various systems. Refer to DTC 65535 in DTC chart ⇒ page 01-42.
Rapid data transfer HELP L wire not switching to Ground	◄	If any of these four displays appear:
Rapid data transfer HELP L wire not switching to B+		– Press HELP button to print list of possible causes.
Rapid data transfer HELP K wire not switching to Ground		
Rapid data transfer HELP K wire not switching to B+		
		After eliminating the possible cause(s):
		– Re–insert "Engine Electronics" address word 01.
		– Press -Q- button to confirm input.
4A0906266A 2.8l V6 MPI 2 valve DOB Coding 1111	◄	If ECM identification and coding are displayed as shown, coding breakdown is as follows:
		♦ ECM identification: 4A0 906 266 A (example)
		♦ Engine displacement: 2.8 liter
		♦ Engine design: V6

♦ Fuel injection system: MPI = Multi-Point Injection

♦ Number of valves per cylinder: 2 valves

♦ ECM hardware and software version: DOB (factory use only)

♦ Coding: 1111 (table ⇒ page 01-58)

Note:

If the correct ECM identification corresponding to the vehicle is not displayed after coding, replace the ECM ⇒ page 01-79.

Incorrect coding of the ECM leads to:

♦ Driveability complaints (e.g. jerky shifting, load change jolts)

♦ Increased fuel consumption

♦ Exhaust emissions out of specification

♦ Decrease in transmission life

♦ Storage in DTC memory of malfunctions that do not exist

♦ Some functions may become inoperative (oxygen sensor control, EVAP canister purge regulator valve activation, etc.)

♦ Maximum road speed not attained (speed limiter activated)

– Press → button.

Rapid data transfer HELP Select function XX	◄	Display will appear as shown
		Note:
		Press the HELP button to print a list of possible functions.

Diagnostic Trouble Code (DTC) memory, checking and erasing

- Connect VAG 1551 scan tool and step through program sequence until "Select function XX" is displayed ⇒ page 01-6.

Function 02 – Check DTC Memory

Rapid data transfer HELP Select function XX

◄ Display will appear as shown

Note:

DTC memory cannot be erased until AFTER it has been read.

- Press -0- and -2- to select "Check DTC Memory" function 02.

Rapid data transfer Q 02 – Check DTC Memory

◄ Display will appear as shown

- Press -Q- button to confirm input.

X DTC recognized

◄ Display will appear as shown, indicating the number of stored malfunctions, or "No DTC recognized" will be displayed.

- Repair any malfunctions as necessary using DTC troubleshooting table, starting on page 01-14.

No DTC recognized

◄ - When display appears as shown, press → button.

Note:

- *If the printer is switched ON, stored malfunctions are displayed and printed out one after the other.*
- *If the printer is switched OFF, press the → button to display the next code.*

Function 05 – Erase DTC Memory

Rapid data transfer HELP Select function XX

◄ Display will appear as shown

- Press -0- and -5- buttons to select function 05 "Erase DTC memory".

Rapid data transfer Q 05 – Erase DTC Memory

◄ Display will appear as shown

Attention! DTC Memory is not interrogated

◄ If "DTC Memory is not interrogated" is displayed:

- Follow sequence of operations precisely, first check DTC memory.

Note:

If the ignition was switched off or the engine speed has exceeded 2500 RPM between checking DTC memory and erasing DTC memory, DTC memory WILL NOT BE erased.

Rapid data transfer DTC Memory is erased

◄ If the display appears as shown:

- Press → button.

Rapid data transfer HELP Select function XX

◄ Display will appear as shown

- Repair any malfunctions as necessary using DTC troubleshooting tables.
- Check and erase DTC memory (to ensure that any DTC generated by connecting and disconnecting various component harness connectors are erased).

- Carry out a road test lasting at least 5 minutes.
- Press -0- button twice to insert "Automatic Test Sequence" address word 00.

Note:

- *After inserting address word 00, the DTC memory for all systems having rapid data transfer are checked.*
- *On automatic transmission vehicles, if one of the Transmission Control Module (TCM) harness connectors was disconnected while repairing a malfunction; the display "Engine/ Trans.Electrical Connection interruption" is stored in the TCM and must be erased.*

Diagnostic Trouble Code (DTC) table

- All of the possible malfunctions that can be recognized by the Engine Control Module (ECM) -J192- and then displayed and printed by the VAG 1551 Scan Tool (ST) are listed in the following tables by DTC in ascending numerical order.
- If malfunctions occur intermittently, or if the DTC memory was not erased after a malfunction has been eliminated, these malfunctions will be displayed as "Sporadic malfunctions" by VAG 1551.
- If malfunction components are indicated, first check the wiring for continuity or short circuits using the wiring diagrams before replacing those components.
- Before eliminating malfunctions or replacing components, check the ECM ground connections by testing terminals 1, 2, 3 and 16 of connector D (must be between 0 and 0.5 ohms). Check the ground points on the engine for corrosion or damage, and check the fuel pump relay (⇒ Repair Group 24).
- The 5-digit DTC and the 4-digit blink code are only visible together when printed on the VAG 1551 scan tool printer.

VAG 1551 scan tool printer display DTC	Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
00000	4444				
No DTC recognized		—	—	—	—
00000	0000				
Display ends		—	—	—	—
00281	1231	X			
Vehicle Speed Sensor–G68 No signal [1]			♦ Vehicle Speed Sensor (VSS) -G68- faulty ♦ Wiring harness between -G68- and speedometer -G21- ♦ Speedometer -G21- faulty ♦ Wiring connection between instrument cluster and ECM -J192- ♦ ECM faulty	♦ Engine dies while decelerating ♦ Load change jolt	⇒ *Electrical Wiring Diagrams, Troubleshooting and Component Locations* binder – Read individual measuring value, channel 15 ⇒ page 01-65 – Check speedometer signal ⇒ Repair Group 24

[1] This malfunction type is displayed in addition to the component.

♦ If the malfunction displayed as DTC 00281 is displayed, first check whether the speedometer display is OK. Disregard scan tool display if speed reading is faulty!

♦ The "No signal" malfunction is set as soon as no pulse is received for longer than 21 seconds at engine speeds over 3000 RPM and engine load higher than idle.

VAG 1551 scan tool printer display DTC	Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
00513	2111	X			
Engine Speed Sensor –G28 No signal [1]			♦ Debris on Engine Speed (RPM) sensor -G28- ♦ Sensor -G28- holding socket loose ♦ Distance from -G28- to flywheel ring gear greater than 1.2 mm (3/64 in.) ♦ Broken teeth on flywheel ring gear ♦ Open circuit between 3-pin connector in engine compartment and -G28- ♦ Open circuit between ECM -J192- and -G28- ♦ Short circuit between connector C terminals 1, 2, 3, and -J192- and/or shielding or ground ♦ Open circuit in -G28- shielding	♦ Engine does not start ♦ Ignition misfires ♦ Engine dies	– In basic setting, read display field 3 ⇒ page 01-47 – Check RPM sensor -G28- ⇒ Repair Group 28 – Repair short or open circuit using wiring diagram
			♦ 3-pin connector from -G28- and -G4- connected in reverse ♦ Sensor -G28- faulty ♦ Input for -G28- in -J192- faulty (ECM -J192- faulty)	♦ Engine does not start	– Connect -G4- and -G28- connectors correctly

[1] This malfunction type is displayed in addition to the component.

♦ If the "No signal" malfunction is recognized when engine is cranking, there will be no ignition or fuel injection.

VAG 1551 scan tool printer display DTC	Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
00514	2112	X			
Crankshaft Pos.Sensor –G4			♦ Crankshaft Position (CKP) sensor -G4- loose ♦ Distance from -G4- to crankshaft counterweight greater than1.3 mm (0.051 in.)	♦ Malfunction before engine start: engine does not start	– Check CKP sensor -G4- ⇒ Repair Group 28
No signal [1]			♦ Open circuit in wiring between 3-pin connector in engine compartment and -G4- ♦ Short circuit between connector C terminals 4, 5, 6 and ECM -J192- and/or shield on ground	♦ Malfunction after start: malfunction stored	– Repair short or open circuit using wiring diagram
Mechanical malfunction [1]			♦ Open circuit in wiring in -G4- shielding ♦ Input for -G4- in -J192- faulty (ECM -J192- faulty)		– Replace CKP sensor -G4- – Replace ECM -J192-
			♦ 3-pin plug connector of -G4- and engine speed sensor -G28- transposed in engine compartment	♦ Engine does not start	– Connect 3-pin connectors of -G4- and -G28- correctly

[1] One of these malfunction types is displayed in addition to the component.

♦ A starting time of 2 seconds is required to recognize the "No signal" malfunction type

♦ The "Mechanical malfunction" malfunction is displayed if -G4- and -G28- are transposed

VAG 1551 scan tool printer display DTC	Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
00515	2113	X			
Camshaft Pos.Sensor –G40			♦ Supply voltage for Camshaft Position (CMP) sensor -G40- from ECM -J192- ♦ Open circuit in signal wire to -J192- and/or short to ground of signal wire connector C terminals 7, 8, 9. ♦ Open circuit in between 3-pin connector in engine compartment and -J192- ♦ Assignment of groove on crankshaft counterweight (CKP sensor -G4- not OK) ♦ -G40- faulty ♦ Input for -G4- in -J192- faulty (ECM -J192- faulty)	♦ Engine has no power at Wide Open Throttle (WOT) ♦ Measured emission values not OK ♦ High fuel consumption	– Check CMP sensor -G40- ⇒ Repair Group 28 – Repair short or open circuit using wiring diagram
Short circuit to Ground [1]					
Open/Short circuit to B+ [1]					
			♦ Cam timing off		– Check cam timing ⇒ Repair Manual, *2.8 Liter V6 General, Engine*, Repair Group 15

[1] One of these malfunction types is displayed in addition to the component.

♦ The "Open/Short circuit to B+" malfunction is set if the camshaft position sensor signal is high longer than 5 sec. with the engine running.

♦ The "Short circuit to Ground" malfunction is set as soon as the camshaft position sensor signal is low longer than 5 sec. with the engine running.

VAG 1551 scan tool printer display DTC	Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
00516	2121	X			
Closed Throttle Pos.Switch–F60			♦ Adjust Closed Throttle Position (CTP) switch -F60- ♦ Throttle valve sticking ♦ Floor mat presses on accelerator pedal ♦ Accelerator pedal cable adjustment ♦ Open circuit in wiring to connector A, terminal 9 of ECM -J192- ♦ Input for -F60- in -J192- faulty ♦ Connector A terminal 9 of ECM -J192- has short circuit to ground ♦ Moisture in throttle connector		– In basic setting, read display fields 7 and 10 ⇒ page 01-47 and/or – Check CTP switch -F60- ⇒ Repair Group 24 – Adjust accelerator pedal cable ⇒ Repair Group 20 – Repair open circuit and/or short circuit in wiring using wiring diagram
Short circuit to Ground [1]					
Open/Short circuit to B+ [1]					

[1] One of these malfunction types is displayed in addition to the component.

♦ The "Short circuit to Ground" malfunction is set as soon as the throttle opening is greater than 7° and the CTP switch is closed longer than 1 sec.

♦ The "Open/Short circuit to B+" malfunction is set if the CTP switch has not been recognized as closed at least once as soon as the engine has been started and there has been a 10 minute drive under 62 mph.

VAG 1551 scan tool printer display DTC	Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
00518	2212	X			
Throttle Pos.Sensor –G69			♦ Open circuit in wiring between Throttle Position (TP) sensor -G69- and ECM -J192- ♦ Short circuit to positive (B+) or ground in -G69- or in wiring connection between -G69- and -J192- ♦ -G69- faulty ♦ ECM -J192- faulty ♦ Dampness and/or corrosion at -G69- harness connector ♦ TP sensor incorrectly adjusted	♦ Lack of power and driveability problems	– In basic setting, read display field 10 ⇒ page 01-47 – Check TP sensor -G69- ⇒ Repair Group 24
Open/short circuit to Ground [1]					
Incorrect signal [1]					

[1] One of these malfunction types is displayed in addition to the component.

♦ The "Open/short circuit to Ground" malfunction is set as soon as the signal voltage is lower than 100 mV for longer than 1 second.

♦ The "Incorrect signal" malfunction is set as soon as a TP sensor signal voltage of over 0.72 volts (corresponds to a throttle opening of more than 7°) is recognized (closed throttle position switch closed).

♦ The "Open/Short circuit to B+" malfunction is set as soon as the signal voltage is greater than 4.9 volts for longer than 1 second.

♦ The "Signal too low" malfunction is set as soon as the TP sensor signal voltage is less than 0.96 volts (corresponds to a throttle opening of less that 12°) for longer than 1 second with an engine coolant temperature over 70°C (158°F), engine speed between 1500 RPM and 3500 RPM and average engine load (as sensed by the MAF sensor)

VAG 1551 scan tool printer display DTC / Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
00521 2242 CO Fuel Trim Potentiometer –G74 Open/Short circuit to B+ [1]	X	♦ Auxiliary fuse 27 faulty ♦ Open circuit between CO Fuel Trim (FT) potentiometer -G74- and ECM -J192- ♦ Short to positive (B+) in -G74- and/ or in the wiring connection between -G74- and ECM -J192-	♦ Hard to drive away ♦ Takes gas poorly, CO cannot be adjusted	– Check CO FT potentiometer -G74- ⇒ Repair Group 24 – In basic setting, read display fields 8 and 9 ⇒ page 01-51

[1] This malfunction type is displayed in addition to the component.

VAG 1551 scan tool printer display DTC / Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
00522 2312 Engine Coolant Temp.Sensor –G62 Short circuit to Ground [1] Open/Short circuit to B+ [1]	X	♦ Short circuit to ground ♦ Moisture in Engine Coolant Temperature (ECT) sensor -G62- harness connector ♦ Open circuit between -G62- and ECM -J192- ♦ High resistance between -G62- and -J192- ♦ -G62- faulty ♦ Input from -G62- in -J192- faulty (ECM -J192- faulty)	♦ Cold start problems at very low temperatures ♦ Driving problems when warmed up	– In basic setting, read display field 1 ⇒ page 01-51

[1] One of these malfunction types is displayed in addition to the component.

♦ The "Short circuit to Ground" malfunction is set as soon as the signal voltage is under 0.10 volt (corresponds to an ECT over 20°C or 68°F)

♦ The "Open/Short circuit to B+" malfunction is set as soon as the signal voltage is over 4.94 volts (corresponds to an ECT of under 50°C or 122°F)

♦ The "Incorrect signal" malfunction is set if the ECT is under 55°C (131°F) when the engine starts, but 18 minutes later the temperature has still not risen above 70°C (158°F).

VAG 1551 scan tool printer display DTC	Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
00524	2142	X			
Knock Sensor 1–G61 No signal [1]			♦ Knock Sensor (KS) 1 -G61- loose or connector corroded ♦ Open circuit or short circuit in wiring between -G61- and ECM -J192- ♦ Short circuit between -G61- and ground or to shielding ♦ -G61- faulty ♦ Input for -G61- in -J192- faulty (ECM -J192- faulty)	♦ High fuel consumption ♦ Lack of power ♦ Jerky, loss of power (like misfiring)	♦ Tightening torque: 20 Nm (15 ft lb) – Repair open or short circuit in wiring using wiring diagram

[1] This malfunction type is displayed in addition to the component.

♦ The "No signal" malfunction is set if KS 1 output voltage is too low with an engine coolant temperature over 20°C (68°F) and engine speed greater than 3500 RPM.

♦ The ignition timing is then retarded by 12° (crankshaft) in the knock affected range of the ignition map.

VAG 1551 scan tool printer display DTC	Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
00525	2342	X			
Heated Oxygen Sensor –G39 No signal [1] Short circuit to B+ [1] Short circuit to Ground [1]			♦ Open circuit in wiring to ECM -J192- ♦ Probe heater faulty ♦ Auxiliary fuse no. 28 (probe heater) faulty ♦ Resistance heater in probe faulty ♦ Probe heater wiring ♦ Short to ground in signal wire ♦ Signal wire has short to shielding ♦ Heated Oxygen Sensor (HO2S) probe faulty (dirty)	♦ Exhaust emissions out of spec ♦ Oxygen sensor (O2S) control goes into open loop	– Repair open circuit in wiring – Check O2S control ⇒ Repair Group 24 – In basic setting, read display field 8 ⇒ page 01-47 and/ or – Read individual measuring values, channels 00, 01, 02 and 03 ⇒ page 01-65

[1] One of these malfunction types is displayed in addition to the component.

♦ Heated Oxygen Sensor (HO2S) -G39- = oxygen sensor probe 1

♦ The "No signal" malfunction is set if 5 minutes after the engine is started, signal voltage lies between 370 and 430 mV for longer than 4 seconds, under normal engine operation and with engine temperature over 80°C (176°F)

♦ The "Short circuit to B+" malfunction is set when signal voltage exceeds 2 volts under normal operation.

♦ The "Short circuit to Ground" malfunction is set when signal voltage is lower than 350 mV 5 minutes after the engine starts under normal engine operation and with an engine temperature over 22°C (72°F).

♦ The "Incorrect signal" malfunction is set if 60 seconds after control start the difference between min. and max. signal voltage is less than 400 mV with engine idling and engine coolant temperature over 80°C (176°F).

VAG 1551 scan tool printer display DTC / Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
00531 2233 Mass Air Flow Sensor Ref.Voltage Open/Short circuit to B+ [1]	X	♦ Open circuit between ECM -J192- connector A, terminals 5 and 2 ♦ Short circuit between ECM -J192- connector A, terminals 5 and 2 and positive (B+)		– In basic setting, read display field 2 ⇒ page 01-47 – Repair open or short circuit in wiring using wiring diagram

[1] This malfunction type is displayed in addition to the component.

♦ If the malfunction displayed as DTC 00531 is recognized by the ECM, a replacement value of 0.020 volts is displayed ⇒ "Read Individual Measuring Value" function 09, channel 05.

♦ The "Open/Short circuit to B+" malfunction is recognized as soon as the signal voltage is over 1 volt

VAG 1551 scan tool printer display DTC / Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
00532 2234 Supply Voltage (B+) Signal too low [1]	X	♦ Supply voltage greater than 16 volts ♦ Generator (GEN) faulty ♦ Overvoltage spike because of a starting aid	♦ Damage to ECM -J192-	– Check voltage – Check battery charge status – Check supply voltage of ECM ⇒ Repair Group 28
		♦ Poor ground connection to ECM -J192- ♦ Battery discharged ♦ Current draw (with ignition switched off)	♦ Voltage less than 6 volts ♦ Engine does not run	– Read individual measuring value, channel 14 ⇒ page 01-65

[1] This malfunction type is displayed in addition to the component.

♦ If a malfunction is displayed as sporadic, disregard the display. This malfunction can be generated and stored if the engine idles for a long time with many electrical consumers switched ON and the battery discharged.

♦ The "Signal too low" malfunction is set as soon as the supply voltage falls below 10.08 volts for longer than 1 second (the ECM will not operate below 6.5 volts!)

VAG 1551 scan tool printer display DTC / Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
00535 2141 First Knock Sensor Control limit exceeded [1]	X	♦ Poor fuel quality (under 95 RON) ♦ Knock sensor (KS) 1 -G61- loose (affects cylinders 1, 2 and 3) ♦ Abnormal engine running noises (attached components loose) ♦ Open circuit in wiring in shielding of KS 1 -G61- ♦ Knock regulation module in ECM -J192- faulty (ECM -J192- faulty)	♦ Slight loss of power ♦ Slight increase in fuel consumption ♦ Max. speed too low ♦ Engine runs rough	– Fill tank with fuel having at least 95 RON – Tighten KS 1 to 20 Nm (15 ft lb) – Repair open circuit using wiring diagram – Replace ECM -J192-

[1] This malfunction type is displayed in addition to the component.

♦ The "Control limit exceeded" malfunction is set when the ignition timing has to be completely retarded for longer than 5 seconds.

VAG 1551 scan tool printer display DTC / Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
00536 2143 Second Knock Sensor Control limit exceeded [1]	X	♦ Poor fuel quality (under 95 RON) ♦ Knock sensor (KS) 2 -G66- loose (affects cylinders 4, 5 and 6) ♦ Abnormal engine running noises (attached components loose) ♦ Open circuit in wiring in shielding of KS 2 -G66- ♦ Knock regulation module in ECM -J192- faulty (ECM -J192- faulty)	♦ Slight loss of power ♦ Slight increase in fuel consumption ♦ Max. speed too low ♦ Engine runs rough	– Fill tank with fuel having at least 95 RON – Tighten KS 2 to 20 Nm (15 ft lb) – Repair open circuit using wiring diagram – Replace ECM -J192-

[1] This malfunction type is displayed in addition to the component.

♦ The "Control limit exceeded" malfunction is set when the ignition timing has to be completely retarded for longer than 5 seconds.

VAG 1551 scan tool printer display DTC	Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
00537	2341	X			
Oxygen Sensor Control Control limit exceeded [1] Control limit not reached [1]			♦ Auxiliary fuse 28 faulty ♦ Fuel tank empty (10 liter minimum) ♦ Fuel system pressure too low ♦ Fuel system pressure too high ♦ Malfunction of spark plugs, spark plug connectors, ignition wires ♦ Intake air leak to MAF sensor -G70- ♦ Leak in exhaust system before Three Way Catalytic Converter (TWC) ♦ Oxygen Sensor (O2S) faulty ♦ EVAP canister purge regulator valve -N80- sticks	♦ CO before three way catalyst is less than 3% ♦ Increased fuel consumption ♦ Black smoke ♦ Spark plug fouling ♦ CO before three way catalyst is greater than 1%	– Fill fuel tank – In basic setting, display field 8 ⇒ page 01-47 and/or – Individual measuring value, channels 00, 01, 02, and 03 ⇒ page 01-65 – Repair leak – Check O2S control – Check EVAP canister purge regulator valve -N80- ⇒ Repair Group 24

[1] One of these malfunction types is displayed in addition to the component.

♦ O2S control for cylinders 1, 2, and 3

♦ The "Control limit exceeded" malfunction is set as soon as the probe voltage is less than 300 mV for longer than 2 minutes with an engine coolant temperature over 80°C (176°F) in the control range

♦ The "Control limit not reached" malfunction is set as soon as the probe voltage is greater than 600 mV for longer than 2 minutes with an engine coolant temperature over 80°C (176°F) in the control range

VAG 1551 scan tool printer display DTC	Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
00540	2144	X			
Knock Sensor 2–G66 No signal [1]			♦ Knock Sensor (KS) 2 -G66- loose or connector corroded ♦ Open circuit or short circuit in wiring between -G66- and ECM -J192- ♦ Short circuit between -G66- and ground or to shielding ♦ -G66- faulty ♦ Input for -G66- in -J192- faulty (ECM -J192- faulty)	♦ High fuel consumption ♦ Lack of power ♦ Jerky, loss of power (misfiring)	♦ Tightening torque: 20 Nm (11–18 ft lb) – Repair open or short circuit in wiring using wiring diagram

[1] This malfunction type is displayed in addition to the component.

♦ The "No signal" malfunction is set if KS output voltage is too low (engine coolant temperature over 68°F and engine speed greater than 3500 RPM)

♦ The ignition timing is then retarded by 12° (crankshaft) in the knocking areas of the ignition map

VAG 1551 scan tool printer display DTC	Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
00554	2331	X			
Oxygen Sensor Control II Control limit exceeded [1] Control limit not reached [1]			♦ Auxiliary fuse 28 faulty ♦ Fuel tank empty (10 liter minimum) ♦ Fuel system pressure too low ♦ Malfunction of spark plugs, spark plug connectors, ignition wires ♦ Air leak downstream to MAF sensor -G70- ♦ Leak in exhaust system before Three Way Catalytic Converter (TWC) ♦ Oxygen Sensor (O2S) faulty ♦ EVAP canister purge regulator valve -N80- sticks	♦ CO before three way catalyst is less than 3% ♦ Increased fuel consumption ♦ Black smoke ♦ Spark plug fouling ♦ CO before three way catalyst is greater than 1%	– Fill fuel tank – In basic setting, display field 8 ⇒ page 01-47 and/or – Read individual measuring value, channels 00, 01, 02, and 03 ⇒ page 01-65 – Repair leak – Check O2S control – Check EVAP canister purge regulator valve -N80- ⇒ Repair Group 24

[1] One of these malfunction types is displayed in addition to the component.

- O2S control for cylinders 4, 5, and 6
- The "Control limit exceeded" malfunction is set as soon as probe voltage is less than 300 mV for longer than 2 minutes with an engine coolant temperature over 80°C (176°F) in the control range
- The "Control limit not reached" malfunction is set as soon as the probe voltage is greater than 600 mV for longer than 2 minutes with an engine coolant temperature over 80°C (176°F) in the control range.

VAG 1551 scan tool printer display DTC	Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
00553	2324	X			
Mass Air Flow Sensor –G70 Short circuit to B+ [1] Open/short circuit to Ground [1]			♦ Auxiliary fuse 27 faulty ♦ Open circuit in wiring between Mass Air Flow (MAF) sensor -G70- and ECM -J192- ♦ Voltage supply to -G70- interrupted and/or ground short ♦ Short to positive (B+) or GND in -G70- and/or in the wiring connection between -G70- and -J192- ♦ MAF sensor -G70- faulty ♦ Input for -G70- in -J192- faulty (ECM -J192- faulty)	♦ Goes to limp home mode ♦ Takes gas poorly ♦ Lack of power ♦ Sometimes engine dies after start or during fuel shut-off phase	– Check MAF sensor -G70- ⇒ Repair Group 24

[1] One of these malfunction types is displayed in addition to the component.

- If malfunction is displayed as sporadic, disregard display.
- The "Short circuit to B+" malfunction is recognized if the signal voltage exceeds 5 volts with an engine speed less than 2000 RPM
- The "Open/short circuit to Ground" malfunction is recognized if the signal voltage is under 0.3 volts with an engine speed less than 2000 RPM

VAG 1551 scan tool printer display DTC	Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
00555	2332	X			
Heated Oxygen Sensor II -G108 No signal [1] Short circuit to B+ [1] Short circuit to Ground [1]			♦ Open circuit in wiring to ECM -J192- ♦ Probe heater does not work ♦ Auxiliary fuse 28 (O2S heater) faulty ♦ Heater resistance faulty ♦ Probe heater wiring ♦ Short circuit to ground in signal wire ♦ Signal wire has short circuit to shielding ♦ Heated Oxygen Sensor (HO2S) 2 probe faulty (dirty)	♦ Exhaust emissions out of spec ♦ Oxygen sensor control goes into open loop	– Repair open circuit in wiring – Check O2S control ⇒ Repair Group 24 – In basic setting, read display field 8 ⇒ page 01-47 and/ or – Read individual measuring values, channels 000, 001, 002 and 003 ⇒ page 01-65

[1] One of these malfunction types is displayed in addition to the component.

- ♦ Oxygen sensor probe -G108- = Heated Oxygen sensor (H02S) 2
- ♦ The "No signal" malfunction is set if, 5 minutes after engine start, signal voltage is between 370 and 430 mV for more than 4 seconds under normal engine operation, with coolant temperature over 80°C (176°F).
- ♦ The "Short circuit to B+" is set when signal voltage exceeds 2 volts under normal operation.
- ♦ The "Short circuit to Ground" malfunction is set if signal voltage is lower than 350 mV five minutes after engine start, under normal engine operation and engine coolant temperature over 22°C (72°F).
- ♦ The "Incorrect signal" malfunction is set if 60 seconds after control start the difference between min. and max. signal voltage is less than 400 mV with engine idling and engine coolant temperature over 80°C (176°F).

VAG 1551 scan tool printer display DTC	Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
00560	2411	X			
EGR System Mechanical malfunction [1] Incorrect signal [1]			♦ Vacuum hoses pulled off or kinked ♦ EGR temperature sensor -G98- faulty ♦ EGR valve ♦ Auxiliary fuse 28 faulty ♦ EGR vacuum regulator solenoid valve -N18- faulty ♦ Open circuit in wiring between -G98-, EGR vacuum regulator valve -N121-, and ECM -J192-	♦ Poor idle, poor starting performance ♦ Bucking	– Check EGR system ⇒ Repair Group 24 – Read individual measuring value, channel 10 ⇒ page 01-68

[1] One of these malfunction types is displayed in addition to the component.

- ♦ Recognition conditions for malfunction type "Incorrect signal" (-N18- continuously closed) is engine temperature over 60°C (140°F), a throttle opening under 35° with a vehicle speed between 45 and 65 mph, an engine speed between 1500 and 3000 RPM, and average engine load.
- ♦ The "Mechanical malfunction" (-N18- continuously open) malfunction is set as soon as the measured EGR temperature increase is greater than 60°C (140°F) during cold start 10°–30°C (50°–86°F) and with a 35°C (95°F) engine coolant temperature.

Way to check if Valve + tempsensor Working (Read measuring Block.) @ check EGR Temp sensor - goes up with Vacuum on EGR Valve

– When applying Vacuum to EGR Valve – the Engine should Run rough + temp on EGR temp Sensor Should Rise on measuring Block 01-34

VAG 1551 scan tool printer display DTC	Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
00585	2411	X	♦ Short circuit to ground in EGR temperature sensor -G98- and/or in the wiring connection between -G98- and ECM -J192- ♦ Open circuit in wiring		– Read individual measuring value, channel 10 ⇒ page 01-68 – Check -G98- ⇒ Repair Group 24 – Repair open or short circuit in wiring using wiring diagram
EGR Temp.Sensor–G98					
Short circuit to Ground [1]					

[1] This malfunction type is displayed in addition to the component.

♦ The "Short circuit to Ground" malfunction is set as soon as a temperature signal in excess of 200°C (392°F) is received for longer than 3 seconds after the start of an engine whose temperature is 30°C (86°F) or lower.

VAG 1551 scan tool printer display DTC	Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
00609	4332	X	♦ Short to positive (B+) or ground in the ignition output stage and/or wiring connection between ECM -J192- and power output stage -N122- ♦ ECM -J192- faulty	♦ Engine does not start ♦ Loss of power ♦ Engine runs rough	– Repair open or short circuit in wiring using wiring diagram – Check power output stage -N122- ⇒ Repair Group 28 – Replace ECM
Ignition Output 1					
00610	4332	X			
Ignition Output 2					
00611	4332	X			
Ignition Output 3					
Open/Short circuit to B+ [1]					
Const.output/short circuit to Ground					

[1] One of these malfunction types is displayed in addition to the component

♦ The power output stage is not integrated in the ECM -J192-, it is a separate component mounted on the fire wall next to the ignition coil.

VAG 1551 scan tool printer display DTC	Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
01247	4343	X			
EVAP Canister Purge Regulator Valve–N80 Short circuit to B+ [1] Open/short circuit to Ground [1]			♦ Short circuit to positive (B+) in EVAP canister purge regulator valve -N80- or between -N80- and ECM -J192- ♦ Short circuit to ground in -N80- or between -N80- and ECM -J192- ♦ Auxiliary fuse 28 faulty ♦ Open circuit in wiring ♦ ECM -J192- faulty	♦ Poor transition performance in partial load range ♦ Fuel odors may be present	– Check EVAP canister purge regulator valve -N80- ⇒ Repair Group 24 – Replace ECM -J192-

[1] One of these malfunction types is displayed in addition to the component

VAG 1551 scan tool printer display DTC	Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
01249	4411	X			
Injector,Cyl.1–N30			♦ Circuit breaker (red) faulty ♦ Short to ground ♦ Open circuit in wiring ♦ Short circuit to positive (B+) on connector and/or fuel injector	♦ Engine running rough ♦ Engine stalling	– Check fuel injectors ⇒ Repair Group 24
01250	4412	X			
Injector,Cyl.2–N31					
01251	4413	X			
Injector,Cyl.3–N32					
Short circuit to B+ [1]			♦ ECM -J192- faulty		– Replace ECM -J192-
Open/short circuit to Ground [1]					

[1] One of these malfunction types is displayed in addition to the component

VAG 1551 scan tool printer display DTC	Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
01252	4414	X	♦ ECM -J192- faulty	♦ Engine running rough ♦ Engine stalling	– Replace ECM -J192-
Injector,Cyl.4–N33					
01253	4421	X			
Injector,Cyl.5–N83					
01254	4422	X			
Injector,Cyl.6–N84					
Short circuit to B+ 1)					
Open/short circuit to Ground 1)					

1) One of these malfunction types is displayed in addition to the component

VAG 1551 scan tool printer display DTC	Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
01257	4431	X			
Idle Air Control Valve–N71			♦ Short circuit to positive (B+) in Idle Air Control (IAC) valve -N71- and/or in the wiring connection between -N71- and ECM -J192-	♦ Engine speed deviates from spec at engine operating temperature ♦ Engine may die when cold ♦ Engine idle hunts	– Check IAC valve -N71- ⇒ Repair Group 24
Short circuit to B+ 1)			♦ Short circuit to ground in -N71- and ECM -J192- ♦ Open circuit in wiring ♦ Large air leak ♦ IAC valve -N71- mechanically faulty ♦ Secondary throttle valve does not close		– In basic setting, read display fields 2, 4, 5,and 6 ⇒ page 01-47
Short circuit to Ground 1)					
Mechanical malfunction 1)					

1) One of these malfunction types is displayed in addition to the component.

VAG 1551 scan tool printer display DTC	Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
01265	4412	X			
EGR Vacuum Regulator Solenoid Valve–N18 Short circuit to B+ [1] Open/short circuit to Ground [1]			♦ Short circuit to ground in EGR vacuum regulator solenoid valve -N18- or ♦ Open circuit in the wiring connection between -N18- and ECM -J192-	♦ Uneven idle	– Read individual measuring value, channel 09, page 01-65 – Check EGR vacuum regulator solenoid valve -N18- – Repair Group 24 – Repair open or short circuit in wiring using wiring diagram – Replace ECM -J192-

[1] One of these malfunction types is displayed in addition to the component

♦ Recognition conditions for malfunction type "Const.output/short circuit to B+" is an engine speed between 1000 and 3500 RPM and average engine load

♦ Recognition conditions for malfunction type "Open/short circuit to Ground" is an engine speed below 900 RPM and low engine load

VAG 1551 scan tool printer display DTC	Blink code	MIL (lamp)	Possible cause	Possible effects	Corrective steps
65535	1111	X			
Control Module Malfunctioning			♦ Ground connections to ECM -J192- connector D terminals 1, 2, 3, and 16 ♦ ECM faulty	♦ Engine does not start	– Check GND connection using wiring diagram – Replace ECM

The malfunction type "Control Module Malfunctioning" is set when malfunctions are recognized in the ROM, RAM or EEPROM.

Output Diagnostic Test Mode (DTM) (VAG 1551 function 03)

The following components are checked via the output Diagnostic Test Mode:

- Fuel Pump (FP) relay -J17-
- Idle Air Control (IAC) valve -N71-
- Intake manifold change-over valve -N156-
- EVAP canister purge regulator valve -N80-
- EGR vacuum regulator solenoid valve -N18-

Note:

- *Only "Rapid data transfer" operating mode 1 of the VAG 1551 scan tool is described in this Repair Group.*
- *The output DTM can only be carried out with the ignition switched ON and the engine NOT running.*
- *The output DTM is interrupted if the engine is started or a rotary pulse is recognized.*
- *During output DTM, the individual components are activated until the → button is used to switch to the next component or the output DTM is ended.*
- *The components are checked by listening for sounds of activation, and/or by touching.*
- *If the output DTM is to be repeated without running the engine, switch OFF the ignition for approx. 20 seconds.*

– Connect VAG 1551 scan tool and step through program sequence until "Select function XX" is displayed ⇒ page 01-6.

Rapid data transfer HELP Select function XX

◄ Display will appear as shown

Note:

After pressing the HELP button, a list of possible functions is printed out.

– Press buttons -0- and -3- to select "Output Diagnostic Test Mode" function 03.

Rapid data transfer Q 03 – Output Diagnostic Test Mode

◄ Display will appear as shown

– Press -Q- button to confirm input.

Output diagnostic test mode Fuel Pump Relay–J17

◄ Display will appear as shown

- Fuel Pump (FP) relay must activate audibly (click)
- Fuel pump must run
- Must be able to hear sound of fuel flowing through fuel pressure regulator

If the fuel pump relay does not activate, check relay activation ⇒ Repair Group 24.

– Press → button.

Output diagnostic test mode Idle Air Control Valve–N71	◄	Display will appear as shown

♦ The Idle Air Control (IAC) valve is activated (clicks) until the next DTM component is selected by pressing the → button.

If the IAC valve does not click, check the IAC valve -N71- ⇒ Repair Group 24.

– Press → button.

Output diagnostic test mode Intake Manifold Changeover Valve–N156	◄	Display will appear as shown

♦ The intake manifold change-over valve is activated (clicks) until the next DTM component is selected by pressing the → button.

If the valve does not click, check the intake manifold change-over valve -N156- ⇒ Repair Group 24.

– Press → button.

Output diagnostic test mode EVAP Canister Purge Regulator Valve–N80	◄	Display will appear as shown

♦ The EVAP canister purge regulator valve is activated (clicks) until the next DTM component is selected by pressing the → button.

If the valve does not click, check the EVAP canister purge regulator valve -N80- ⇒ Repair Group 24.

– Press → button.

Output diagnostic test mode EGR Vacuum Regulator Solenoid Valve-N18	◄	Display will appear as shown

♦ The EGR vacuum regulator solenoid valve is activated (clicks) until the next DTM component is selected by pressing the → button.

If the valve does not click, check the EGR vacuum regulator solenoid valve -N18- ⇒ Repair Group 24.

– Press → button.

Rapid data transfer HELP Select function XX	◄	Display will appear as shown

Note:

Switch the ignition OFF for approx. 20 seconds before re–selecting function 03 (Output Diagnostic Test Mode).

Engine Basic Setting (VAG 1551 scan tool function 04)

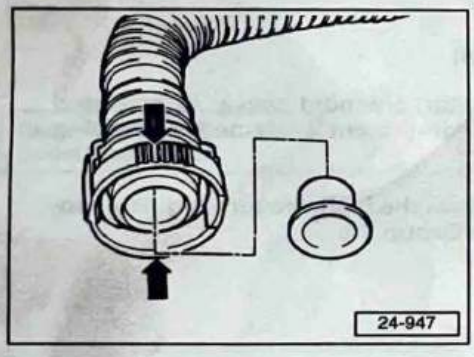
Note:

When "Basic Setting" function 04 is initiated, the ECM establishes the following conditions:

- *Idle Speed Control (ISC) system adjustment of ignition timing point is blocked*
- *A constant ignition timing angle of 12° is set*
- *The EVAP canister purge regulator valve remains in the closed position*
- *A/C compressor is switched OFF*
- *The EGR valve remains in the closed position*
- *Dynamic Engine Coolant Temperature (ECT) sensor signal is ignored; the ECM assumes a constant value of 176°F (80°C)*

Requirements

- Engine Coolant Temperature (ECT) 185°F (85°C) minimum
- All electrical consumers switched OFF
- A/C switched OFF; Fan speed "minus" button in A/C control head pressed repeatedly until all displays are erased
- Automatic transmission selector lever in P or N position



– Disconnect positive crankcase ventilation hoses from cylinder head covers and plug with round stock of appropriate diameter.

◄ ***Note:***

- *To remove each of the positive crankcase ventilation hoses, press together the oval outer ring at the points indicated (arrows) and disconnect the line.*
- *To plug the crankcase ventilation hoses, use plastic plugs as shown. These plugs are often used in packaging to cover hose connections in new and replacement parts assemblies.*

– Check and erase DTC memory ⇒ page 01-11.

– After checking and erasing DTC memory, start engine and let idle.

Rapid data transfer Q 04 – Basic Setting

◄ Display will appear as shown

Note:

After pressing the HELP button, a list of possible functions is printed out.

– Press buttons -0- and -4- to select "Basic Setting" function 04.

Basic setting HELP Input display group number XXX

◄ Display will appear as shown

– Press -Q- button to confirm input.

Note:

Press the HELP button for the procedure describing input of display group numbers.

– Press -0- button three times to select display group 000.

– Press -Q- button to confirm input.

System in basic setting 1 2 3 4 5 6 7 8 9 10

◀ Display will appear as shown

Note:

- *For an explanation of the values in the various display fields ⇒ page 01-50.*
- *The values that appear in display fields 1 through 10 are displayed in decimals. Refer to the description column on page 01-50 for conversion to physical units.*
- *The most recent display on the scan tool can be printed by switching on the printer. A printout can be obtained as often as desired by pressing the PRINT button.*

When specified values are obtained in all display fields:

– Press → button.

Rapid data transfer Select function XX HELP

◀ Display will appear as shown

– Press buttons -0- and -6- to select "End Output" function 06.

Rapid data transfer 06 – End Output Q

◀ Display will appear as shown

– Press -Q- button to confirm input.

Rapid data transfer Insert address word XX HELP

◀ Display will appear as shown

Key to display fields 1 through 10

Display field	Specified value	Corresponds to measurement	Description and conversion to physical values
1	135–160	185°–230°F (85°–110°C)	Momentary Engine Coolant Temperature (ECT): display minus 50 = ___°C
2	150–165	1.50–1.65 V	Mass Air Flow (MAF) sensor output voltage display: 100 = 1 V
3	28–32	700–800 RPM	Momentary Engine Speed (RPM): display x 25 = ___RPM
4	0–10 or 240–255	—	Learning value of Idle Speed Control (ISC); with manual transmission during idle, or automatic transmission with selector lever position P or N (average value = 0)
5	0–10 or 240–255	—	Learning value of Idle Speed Control (ISC); with automatic transmission selector lever in position D, 1, 2, 3, or R (average = 0); Manual transmission: 0 is always displayed
6	126–130	—	Feedback for idle speed control system (average = 128)
7	20	—	Shift inputs
8	120–136	—	Oxygen Sensor (O2S) control (average = 128) both cylinder banks
9	65–90	—	CO adjusting value (average = 75)
10	50–100	250–500 mV	Throttle Position (TP) sensor learning value: display x 5 = ___mV

Note:

If the values displayed do not correspond to the specified values ⇒ following test table.

Basic settings function 04 – troubleshooting table

Display field	VAG 1551 display	Possible cause	Corrective steps
1	Greater than 160 or Less than 135	♦ Engine Coolant Temperature (ECT) sensor -G62- faulty ♦ Wiring from ECT sensor to ECM -J192- faulty	– Check DTC memory ⇒ page 01-11 – Check -G62- ⇒ Repair Group 28
2	Less than 150	♦ Excessive air leakage between intake manifold and Mass Air Flow (MAF) sensor	– Eliminate cause
	Greater than 165	♦ Electrical consumers switched ON, steering wheel at full lock, automatic transmission selector lever in D, 1, 2, 3 or R ♦ Above causes of malfunction not given	– Switch off all electric consumers, turn steering wheel to center position, move selector lever to P or N – Read individual measuring values from channel 5 (⇒ page 01-65) and deduct from higher measuring value 2. If the result lies within the tolerance range, then the higher measuring value 2 can be ignored ***Note:*** *If the measuring value from individual measuring value channel 5 is greater than 4, check the ground connection for the MAF sensor -G70- using the wiring diagram.*

Display field	VAG 1551 display	Possible cause	Corrective steps
3	Greater than 32	♦ Closed Throttle Position (CTP) switch faulty	– See display field 7, page 01-57 – Check CTP switch ⇒ Repair Group 24
		♦ Excessive intake air leakage	– Eliminate cause
		♦ Idle Air Control (IAC) valve -N71- seized or not moving freely	– Check using Output DTM ⇒ page 01-43
	Less than 28	♦ IAC valve -N71- sticks or hard to move ♦ CTP switch faulty	– See display field 7, page 01-57 – Check using Output DTM ⇒ page 01-43 – Check CTP switch ⇒ Repair Group 24
4	Greater than 10	♦ Electrical consumers ON, steering wheel at full lock	– Switch all electrical consumers off – Turn steering wheel to center position, after 1 minute the display must change
	Less than 240	♦ Large air leak in the area of the intake manifold ♦ Throttle stop adjustment not OK.	– Repair cause

Display field	VAG 1551 display	Possible cause	Corrective steps
5	Deviates from tolerance range	Vehicles with automatic transmission only: ♦ Value in display field 4 deviates from specified value. If value in display field 4 is in tolerance range and value in display field 5 is out of tolerance, move selector lever to D and observe idle for approx. 1 minute. If the display stays outside of tolerance range, the transmission is hard to move.	– See display field 4 – Check transmission

Notes on display fields 4 and 5:

- *A display value from 0 to 10 shows a greater learning value than in the basic setting (IAC valve is further open). A display value from 255 to 240 shows a smaller learning value than in the basic setting (IAC valve is further closed). In the basic setting, this display value is 0.*
- *In older engines, there can be a deviation in the learning values because of contamination of IAC valve -N71-. Permitted deviation in older engines with manual transmission: 0–18*
- *Vehicles with automatic transmission and a vacuum pump should be retro-fitted with a vacuum booster ⇒ page 24-97.*

Display field	VAG 1551 display	Possible cause	Corrective steps
6	Deviating from tolerance range	♦ Values in display fields 4 and 5 deviate from the specified values. If values in display fields 4 and 5 are within the tolerances, no further measures are necessary. If values in display fields 4 and 5 exceed the tolerance range:	– See display fields 4 and 5. – Check DTC memory ⇒ page 01-11
		♦ If there are no stored malfunctions in DTC memory, and component tolerance range of 240–255 in display fields 4 and 5 is exceeded: excessive intake air leakage entering the intake manifold by means other than the IAC valve -N71-	– Eliminate cause
7	Greater or less than 20	♦ Electrical consumers switched on, steering wheel at full lock position ♦ Large intake air leak in the area of the intake manifold	– Switch A/C off, press "minus" button in A/C control head pressed until all displays are erased, or check AC compressor cut-off ⇒ Repair Group 24
		♦ Throttle stop not OK.	– Check CTP switch ⇒ Repair Group 24.
		♦ Automatic transmission selector lever not in P or N	– Move selector lever to P or N, or check wiring between engine and transmission control modules using wiring diagram.

Display field	VAG 1551 display	Possible cause	Corrective steps
8	Outside tolerance range	♦ Displayed value less than 128: engine too rich; Effect: Oxygen Sensor (O2S) control creates lean situation ♦ Displayed value greater than 128: engine too lean; Effect: O2S control creates rich situation ♦ Positive crankcase ventilation hoses on cylinder head covers not pulled off and plugged ⇒ page 01-48	– Wait 30 sec. until the display has stabilized after that set to 128 ± 2 with CO Fuel Trim (FT) potentiometer ⇒ Repair Group 24 ***Note:*** *If no stable oxygen sensor value can be reached while adjusting, read individual measuring values from channels 2 and 3 and check the control behavior of the two oxygen sensors. In this process, the display values must in part drop below 30 and exceed 60. Otherwise, check oxygen sensor heating and oxygen sensor probe.*
9	Outside tolerance range	♦ Value in display field 8 outside tolerance range.	– See display field 8
	Greater than 90	♦ Faulty fuel injector providing inconsistent fuel injection quantities ♦ Spark plug faulty	– Check fuel injectors – Check injection quantity of fuel injectors and check for leaks ⇒ Repair Group 24 – Check spark plugs
	Less than 65	♦ Engine oil thinning ♦ Varying fuel injection quantity ♦ MAF sensor -G70- inoperative	– Check injection quantity of fuel injectors and check for leaks ⇒ Repair Group 24 – Check DTC memory ⇒ page 01-11

Display field	VAG 1551 display	Possible cause	Corrective steps
10	Deviating from tolerance range	♦ Value in display field 7 deviating from tolerance range	– See display field 7. – Check DTC memory
		♦ Poor ground connection on intake manifold	– Check ECM Grounds ⇒ Repair Group 24, and re–start
		♦ CTP switch or Throttle Position (TP) sensor incorrectly adjusted	– Check TP sensor ⇒ Repair Group 24 – Read individual test value in channel 11 ⇒ page 01-68 ***Note:*** *If the difference between values in display field 10 (display x 5 = mV) and test value of display field 11 (display x 20 = mV) is greater than ±40 mV, check the CTP switch. If OK, check the TP sensor ⇒ Repair Group 24.* – Then check and adjust TP sensor, briefly accelerate at wide open throttle; Test value in channel 09 (⇒ page 01-68) should be greater than 175

Basic settings function 04 – breakdown of possible malfunctions (display field 7)

Display	Air conditioner	A/C compressor	Closed Throttle Position (CTP) switch	Manual trans. — Automatic trans. selector lever in P or N	Automatic trans. selector lever in D, 1, 2, 3 or R
00	Off	Off	Open	No	Yes
04	Off	Off	Open	Yes	No
16	Off	Off	Closed	No	Yes
20	Off	Off	Closed	Yes	No
32	Off	On	Open	No	Yes
36	Off	On	Open	Yes	No
48	Off	On	Closed	No	Yes
52	Off	On	Closed	Yes	No
64	On	Off	Open	No	Yes
68	On	Off	Open	Yes	No
80	On	Off	Closed	No	Yes
84	On	Off	Closed	Yes	No
96	On	On	Open	No	Yes
100	On	On	Open	Yes	No
112	On	On	Closed	No	Yes
116	On	On	Closed	Yes	No

Code Control Module (VAG 1551 function 07)

- The VAG 1551 scan tool must display a four-digit code during Control Module identification.

The factory performs ECM coding in the wiring harness at connectors B and C of the ECM.

The first three digits are coded via terminals 14, 16 and 19 of connector B and the fourth digit via terminal 9 of connector C.

If one of these terminals is connected to ground a zero is displayed; if this terminal is not occupied (open), a 1 is displayed in the appropriate position of the code.

Example

Coding	1	1	1	1
Connector	B	B	B	C
Terminal	14	16	19	9

- If VAG 1551 scan tool does not display appropriate coding for vehicle (⇒ page 01-59), check ECM terminal assignment using wiring diagram.
- If incorrect terminal assignment is determined, correctly install terminals in connectors B or C using wiring diagram.
- If terminal assignments are correct, replace ECM.

ECM coding table – equipment combinations

Coding	Vehicle equipped with:	Vehicle NOT equipped with:
1010	Manual transmission	EGR
1111	Manual transmission, EGR	EGR temperature sensor
1011	California version with manual transmission, EGR and EGR temperature sensor	—
1110	ECE version	Heated Oxygen Sensors (HO2S), EVAP canister purge regulator valve, EGR
0010	Front wheel drive and automatic transmission	EGR
0111	Front wheel drive and automatic transmission	EGR temperature sensor
0011	California version with front wheel drive and automatic transmission, EGR and EGR temperature sensor	—
0110	ECE version with front wheel drive and automatic transmission	HO2S, EVAP canister purge regulator valve, EGR

Coding	Vehicle equipped with:	Vehicle NOT equipped with:
1000	Quattro with automatic transmission	EGR
1101	Quattro with automatic transmission, EGR	EGR temperature sensor
1001	California version quattro with automatic transmission, EGR and EGR temperature sensor	—
1100	ECE version quattro with automatic transmission	Heated Oxygen Sensors (HO2S), EVAP canister purge regulator valve, EGR
0000 0001 0100 0101	DTC coding	—

Read Measuring Value Block (VAG 1551 function 08)

Requirements

- Engine temperature 85°C (185°F) minimum
- A/C switched ON
- When using function 08, only the values in display field 7 are used to check the A/C auxiliary signal (idle speed boost) and/ or to check the A/C compressor shut-off (⇒ Repair Group 24).
- When using function 08, no CO adjustment can be made using the CO Fuel Trim (FT) potentiometer.
- The two positive crankcase ventilation hoses on the cylinder head covers must not be disconnected when using the "Read Measuring Value Block" function.

– Connect the VAG 1551 scan tool and operate until display shows "Select function XX" ⇒ page 01-6.

Rapid data transfer HELP Select function XX

◄ Display will appear as shown

Note:

Press the HELP button to print a list of possible functions.

– Press buttons -0- and -8- to select "Read Measuring Value Block" function 08.

Rapid data transfer Q 08 – Read Measuring Value Block

◄ Display will appear as shown

– Press -Q- button to confirm input.

Rapid data transfer HELP Input display group number XXX

◄ Display will appear as shown

Note:

Press the HELP button to print the procedure for entering the display group number.

– Press -0- button three times to select display group 000.

– Press -Q- button to confirm input.

Read measuring value block 1 2 3 4 5 6 7 8 9 10

◄ Display will appear as shown

Note:

- *Values and specifications in each display field are identical to those for "Basic Setting" function 04 ⇒ page 01-50.*
- *Display fields 1 to 6 and 8 to 10 (all except display field 7) should be ignored when in "Read Measuring Value Block" function 08.*
- *See page 01-64 for an explanation of the values that appear in display field 7.*
- *Press the PRINT button to print the current display.*
- *The display will print as often as the PRINT button is pressed.*

If values are as specified for all display fields:

– Press → button.

Rapid data transfer Selection function XX	HELP

◄ Display will appear as shown

– Press buttons -0- and -6- to select "End Output" function 06.

Rapid data transfer 06 – End Output	Q

◄ Display will appear as shown

– Press -Q- button to confirm input.

"Basic Settings" function 04 – breakdown of possible malfunctions (display field 7)

Display	Air conditioner	A/C compressor	Closed Throttle Position (CTP) switch	Manual trans. — Automatic trans. selector lever in P or N	Automatic trans. selector lever in D, 1, 2, 3 or R
00	Off	Off	Open	No	Yes
04	Off	Off	Open	Yes	No
16	Off	Off	Closed	No	Yes
20	Off	Off	Closed	Yes	No
32	Off	On	Open	No	Yes
36	Off	On	Open	Yes	No
48	Off	On	Closed	No	Yes
52	Off	On	Closed	Yes	No
64	On	Off	Open	No	Yes
68	On	Off	Open	Yes	No
80	On	Off	Closed	No	Yes
84	On	Off	Closed	Yes	No
96	On	On	Open	No	Yes
100	On	On	Open	Yes	No
112	On	On	Closed	No	Yes
116	On	On	Closed	Yes	No

Read Individual Measuring Value (VAG 1551 function 09)

Requirements

- Check DTC memory ⇒ page 01-11.
- Carry out basic setting ⇒ page 01-47.
- Start engine and let idle after checking DTC memory.

Rapid data transfer HELP Select function XX

◀ Display will appear as shown

– Press buttons -0- and -9- to select "Read Individual Measuring Value" function 09.

Rapid data transfer Q 09 – Read Individual Measuring Value

◀ Display will appear as shown

– Press -Q- button to confirm input.

Read individual measuring value Insert channel number XX

◀ Display will appear as shown

– Enter appropriate channel number ⇒ page 01-67.

Channel 01 is used to demonstrate the input sequence.

Note:

Before checking channel numbers 00 and 01, disconnect the EVAP canister purge regulator valve harness connector (then check and erase DTC memory).

Read individual measuring value Q Enter channel number 01

◀ Display will appear as shown

– Press -Q- button to confirm input.

Read individual measuring value Channel 01 Measuring Value 128

◀ Display will appear as shown

Note:

- *Press the PRINT button to print the current display.*
- *The current display will be printed as many times as the PRINT button is pressed.*
- *For a description of measuring values for different channels ⇒ test table, page 01-68.*

– Press -C- button.

Read individual measuring value Enter channel number XX

◀ Display will appear as shown

– Enter desired channel number ⇒ page 01-67.

Note:

Repeat the procedures as described starting on page 01-65.

– Press → button to exit function 09.

Rapid data transfer HELP Select function XX

◀ Display will appear as shown

"Read Individual Measuring Values" function 09 – channel numbers

Note:

Disconnect EVAP canister purge regulator valve connector before checking channels 00 and 01.

00 - Oxygen Sensor (O2S) control factor for Cyl. 1–3

01 - O2S control factor for Cyl. 4–6

02 - O2S 1 output voltage

03 - O2S 2 output voltage

04 - Injection time, Cyl. 1–3

05 - Mass Air Flow (MAF) sensor ground voltage loss

06 - Duty cycle (control) for EVAP canister purge regulator valve -N80-

07 - Duty cycle (control) for Idle Air Control (IAC) valve -N71-

08 - Current regulation for IAC valve -N71-

09 - Throttle valve angle

10 - EGR temperature (via EGR temperature sensor -G98-)

11 - Throttle Position (TP) sensor -G69- output voltage

14 - ECM battery positive voltage supply (B+)

15 - Current road speed

WARNING!

Channel numbers 4 and 15 must be read by a second person during the test drive.

"Read Individual Measuring Values" function 09 test table

Channel number	Designation	VAG 1551 display (specified values)	Corrective steps in case of deviations
00	Oxygen Sensor (O2S) control factor for Cyl. 1–3 (disconnect EVAP canister purge regulator valve -N80- connector)	♦ Average value: 128 ♦ Tolerance range: 120–136	– Adjust CO ⇒ Repair Group 24
01	O2S control factor for Cyl. 4–6 (disconnect EVAP -N80- connector)		
02	Output voltage, HO2S 1	♦ Display value must at times exceed 60 or drop below 30; display must fluctuate (display value x 10 = mV)	– Check HO2S 1 and/or 2 ⇒ Repair Group 24 – Check wiring using wiring diagram – Check DTC memory ⇒ page 01-11
03	Output voltage, HO2S 2 Bank 2		
04	Injection time, Cyl. 1–3	♦ Tolerance range: 0–255 (display value x 0.128 = ms)	– For functional testing only
05	Mass Air Flow (MAF) sensor ground voltage loss	♦ Tolerance range: 0–4 (display value x 10 = mV)	– Check MAF sensor -G70- ground using wiring diagram

Channel number	Designation	VAG 1551 display (specified values)	Corrective steps in case of deviations
06	Duty cycle (control) for EVAP canister purge regulator valve -N80-	♦ Tolerance range: 0 (fully open) – 255 (fully closed) (display value ÷ 255 = duty cycle in %)	– Check EVAP canister purge regulator valve -N80- ⇒ Repair Group 24 ***Note:*** *During "Basic Setting" function 04 the EVAP canister purge regulator valve -N80- is closed.*
07	Duty cycle (control) for Idle Air Control (IAC) valve -N71-	♦ Average value 128 ♦ Tolerance range: 0 (fully open) – 255 (fully closed) (display value ÷ 255 = duty cycle in %)	– Check IAC valve -N71- ⇒ Repair Group 24
08	Current regulation for IAC valve -N71-	——	– Not for service use (ECM internal calculation value)
09	Throttle valve angle	♦ Display value at idle: 0 With brief activation of throttle: greater than 175 (display value x 0.405 = ∠°)	– Check and adjust TP sensor -G69- ⇒ Repair Group 24
10	EGR temperature (EGR temperature sensor -G98-)	___°C	– Check EGR temperature sensor -G98- ⇒ Repair Group 24 ***Note:*** *During "Basic Setting" function 04 the EGR valve -N18- is closed.*

Channel number	Designation	VAG 1551 display (specified values)	Corrective steps in case of deviations
11	Throttle Position (TP) sensor -G69- output voltage	♦ Average value at idle 19 ♦ Tolerance range 12–25 (display value x 20 = mV)	– Check TP sensor -G69- and adjust if necessary
12	Ignition map switching	♦ Less than 128 = map 1 (ignition timing basic map) ♦ Greater than 128 – map 2 (ignition timing map with reduced ignition angles)	***Note:*** *If ignition map 2 is selected:* ♦ *Poor fuel quality (less than 95 RON)* ♦ *Abnormal engine noises (attached assembly loose)* ♦ *Engine damage (oil combustion because of damaged pistons)*
13	Ignition timing with knock regulation and with idle speed control (ISC) (average for all cylinders)	♦ ____ display value x 1.333 = ignition timing point in crankshaft degrees	***Note:*** ♦ *ISC active only with Closed Throttle Position (CTP) switch closed.* ♦ *Knock regulation starting with an active load greater than 40%.*
14	ECM battery positive voltage (B+) supply	♦ Tolerance range 132 – 182 (display value x 0.08 = volts)	– Check voltage supply using wiring diagram
15	Momentary vehicle road speed	♦ Momentary vehicle road speed in km/h	– Check Vehicle Speed Sensor (VSS) -G22-

VAG 1598 test box, connecting

CAUTION!

- ***VAG 1598 Test box must not be connected to the vehicle at the same time as the VAG 1551 scan tool.***
- ***Wait 30 seconds after switching off ignition before disconnecting ECM harness connectors.***
- ***Disconnecting the ECM harness connectors will interrupt the power supply to the ECM memory which in turn erases the DTC memory.***

– Switch ignition OFF.

– Remove ECM ⇒ page 01-79.

– Connect VAG 1598/11 or 1598/12 adapter cable between ECM and ECM harness connector.

– Connect the VAG 1598 test box to the desired ECM connector using the appropriate adapter cable.

Note:

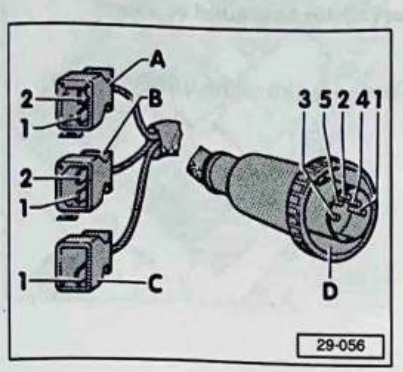
The test box socket numbering is identical to the ECM terminal assignments EXCEPT when the VAG 1598/11 adapter is connected ⇒ page 01-72.

VAG 1598 test box terminal assignments

Note:

- *Terminal numbers for connectors A and B (using adapter cable VAG 1598/11) is not identical to the numbering of the test box sockets.*
- *Terminal numbers for connector C (adapter cable VAG 1587/11) are identical to the test box socket numbers.*
- *Terminal numbers for connector D (adapter cable VAG 1598/12) are identical to the test box socket numbers.*

ECM connector A	VAG 1598 socket number	ECM Connector B	VAG 1598 socket number	ECM Connector C	VAG 1598 socket number
1	41	1	21	1	1
2	42	2	22	2	2
3	43	3	23	3	3
4	44	4	24	4	4
5	45	5	25	5	5
6	46	6	26	6	6
7	47	7	27	7	7
8	48	8	28	8	8
9	49	9	29	9	9
10	50	10	30	10	10
11	51	11	31	11	11
12	52	12	32	12	12
		13	33	13	13
		14	34	14	14
		15	35	15	15
		16	36	16	16
		17	37		
		18	38		
		19	39		
		20	40		



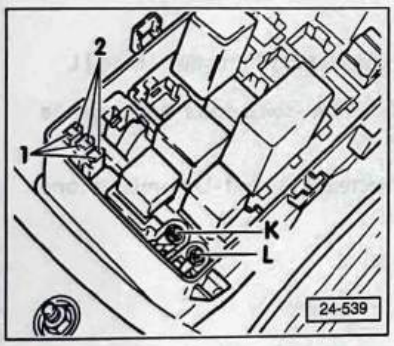
Data Link Connector (DLC) wiring, checking

Checking VAG 1551/1 adapter for continuity

Vehicle side connector/terminal		Instrument side Connector -D- contact	
Black -A-	1	3	Ground (GND)
	2	2	Battery Positive (B+)
White -B-	1	4	L wire
	2	1	K wire
Blue -C-	1	5	Malfunction Indicator Lamp wire

Checking voltage supply for black DLC

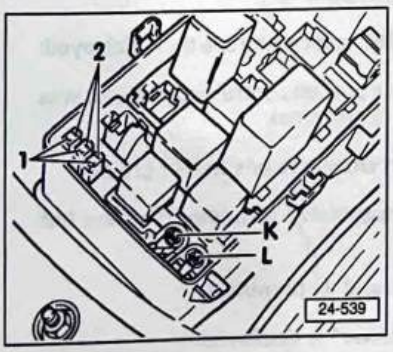
Terminal 1	to Ground (GND)
Terminal 2	Battery positive voltage (B+) (terminal 30 via fuse 19)



Checking wiring between white DLC and ECM

Note:

- *For electrical checking, use multimeter (Fluke 83 or equivalent), VW 1594 connector test kit, VAG 1598 test box and VAG 1598/11 adapter.*
- *The wiring between the "white" DLC and the ECM is connected to the K and L terminals located in the fuse/relay panel. All other vehicle systems with the "Rapid data transfer" mode are also connected to these terminals.*
- *DLC connectors and "K" and "L" wiring junctions are in relay station 1 located in the plenum tray.*



– Switch ignition OFF.

– Connect VAG 1598 test box and VAG 1598/11 adapter to ECM wiring harness ⇒ page 01-71.

White DLC terminal	Wiring junction	ECM connector C terminal	VAG 1598 and 1598/11 test box socket
1	L	13	13
2	K	12	12

Checking white DLC for short circuit to ground or short circuit to positive (B+)

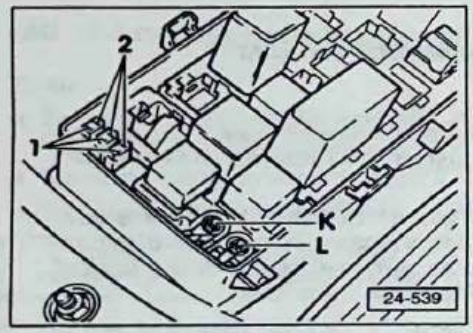
Rapid data transfer Error in communication link
Rapid data transfer HELP L wire not switching to Ground
Rapid data transfer HELP L wire not switching to B+
Rapid data transfer HELP K wire not switching to Ground
Rapid data transfer HELP K wire not switching to B+

◄ Only if the displays on this page are shown on VAG 1551:

– Switch ignition OFF.

Note:

- *Wiring between the white DLC and the control modules is connected via terminals K and L in the fuse/relay panel, see the wiring diagram for additional information.*
- *For wire colors and other vehicle systems connected to the white DLC, see the wiring diagram for additional information.*
- *Other vehicle systems could be connected to the K and L terminals or to terminal K only; see the wiring diagram for additional information.*



Wires of DIFFERENT colors connected to junctions K and L

– Using wiring diagram, determine wire color between the white DLC and Motronic ECM.

◄ – Disconnect each wire connected to -K- and -L- terminals (one at a time).

Each time a wire is disconnected:

– Start engine and let idle

– Press buttons -0- and -1- to insert "Engine Electronics" address word 01.
⇒ page 01–07 for additional information.

If control module identification and coding are then displayed:

– Check wiring connections from last control module that was disconnected from -K- or -L- terminal.

If there are no open or short circuits to positive or ground:

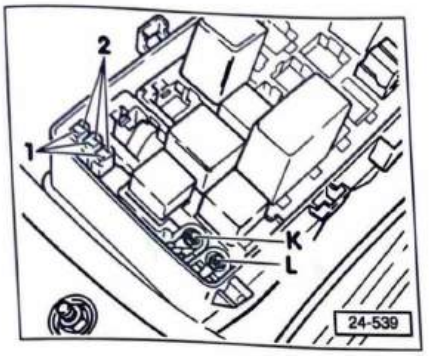
– Replace control module associated with wire that was last disconnected.

– Reconnect all wires to -K- and -L- terminals.

If "Control unit does not answer" is displayed:

– Check wiring to Motronic ECM for open circuit.

Using wiring diagram, repair or replace as necessary



Several wires with SAME colors connected to junctions K and L

◄ – Disconnect all wires at K and L terminals.

– Connect VAG 1598 test box using adapter VAG 1598/11 ⇒ page 01-71.

– Using multimeter (Fluke 83 or equivalent) and VW 1594 connector test kit, identify ECM connecting wires and reconnect them to K and L terminals.

White DLC terminal	Wiring junction	ECM connector C terminal	VAG 1598 and 1598/11 test box socket
1	L	13	13
2	K	12	12

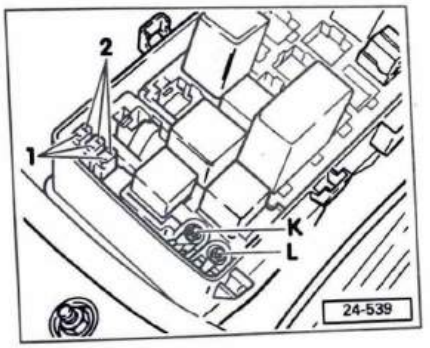
– Press buttons -0- and -1- to insert "Engine Electronics" address word 01.
⇒ page 01–07 for additional information.

If the Motronic ECM identification and coding are again NOT displayed:

– Replace Motronic ECM.

– Reconnect all wires to the -K- and -L- connectors.

– Check DTC memory again.



If the ECM identification and coding are displayed:

♦ Malfunction is not with the ECM.

– Switch ignition OFF.

◄ – Disconnect each wire connected to -K- and -L- terminals (one at a time).

– Using wiring diagram, properly reconnect each wire to -L- and -K- connectors.

Each time a wire is disconnected:

– Start engine and let idle.

– Press buttons -0- and -1- to insert "Engine Electronics" address word 01.

If control module identification and coding are then displayed:

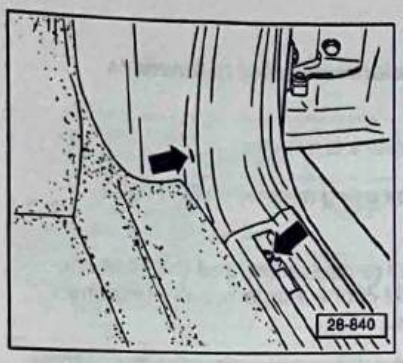
– Switch ignition OFF.

– Reconnect wiring from control module last disconnected from -K- and -L- terminals.

If the control module and identification are not displayed:

– Replace control module associated with wire that was last disconnected.

– Reconnect all wires to -K- and -L- terminals.



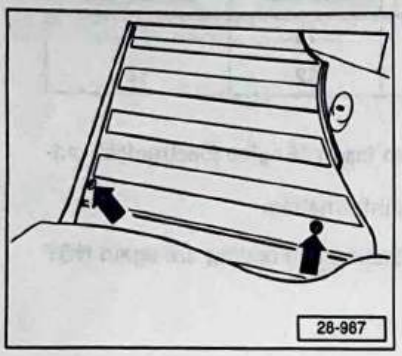
Engine Control Module (ECM), removing and installing

Removing

- Switch ignition OFF.

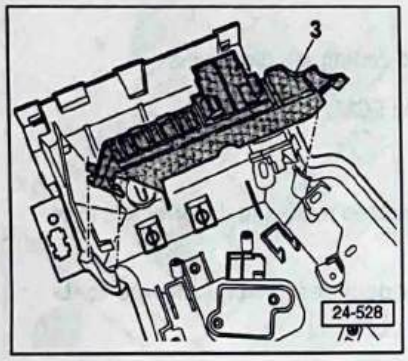
◄ - Remove trim cover from lower right A-pillar.

- Push back carpet in right front footwell.



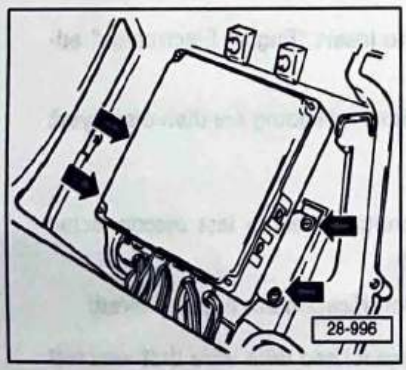
◄ - Remove screws (arrows) from electronics box cover.

- Carefully pull off upper and lower electronics box covers.



◄ - Carefully remove brace -3- along with attached parts.

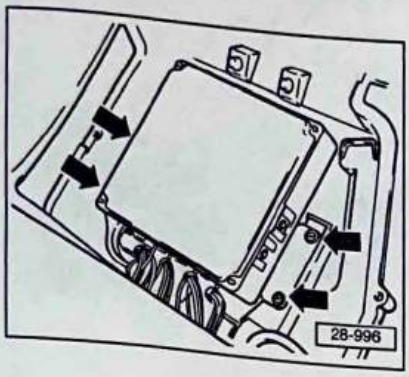
- Remove fasteners securing ECM to mounting bracket.



- Remove ECM from electronics box and disconnect.

CAUTION!

BEFORE disconnecting the ECM harness connector, switch the ignition OFF and WAIT at least 30 seconds. Failure to do so may damage the ECM.



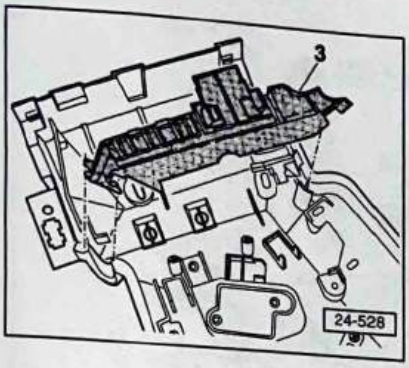
Installing

- Make sure that ignition is switched OFF.

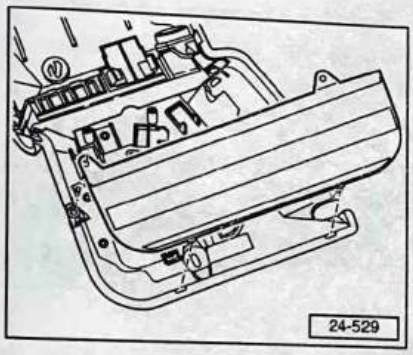
CAUTION!
DO NOT connect Motronic ECM with ignition switched ON.

- Connect ECM harness connector to ECM.

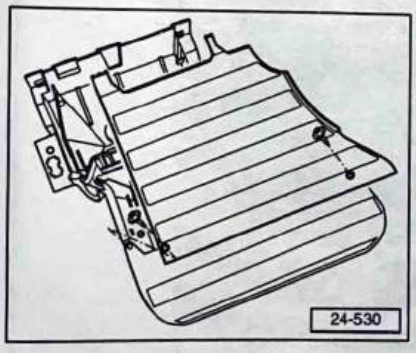
◄ - Mount ECM onto bracket in electronics box.



◄ - Install brace -3-.

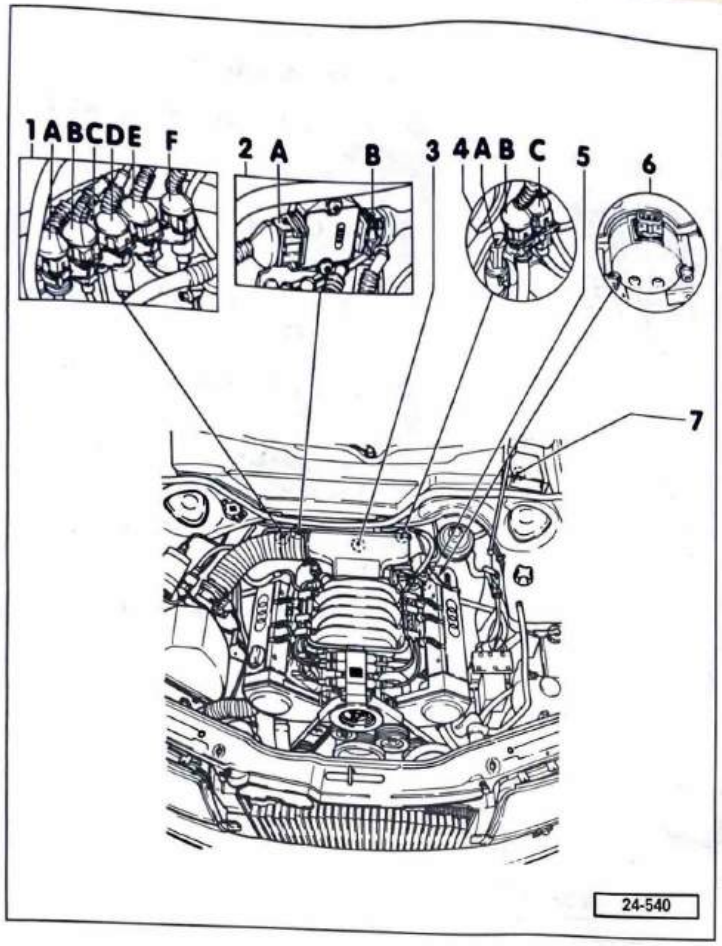


◄ - Install lower cover into both openings of electronics box and engage.



◄ - Carefully hook upper cover into both openings of electronics box.

- Fasten both covers together.
- Cover electronics box again with carpet.
- Reinstall A-pillar trim cover.



Multiport fuel injection and ignition system, component layout

— **Engine Control Module (ECM) -J192-**
- Not shown
- Located in passenger-side footwell, in electronics box under carpeting ⇒ Repair Group 01

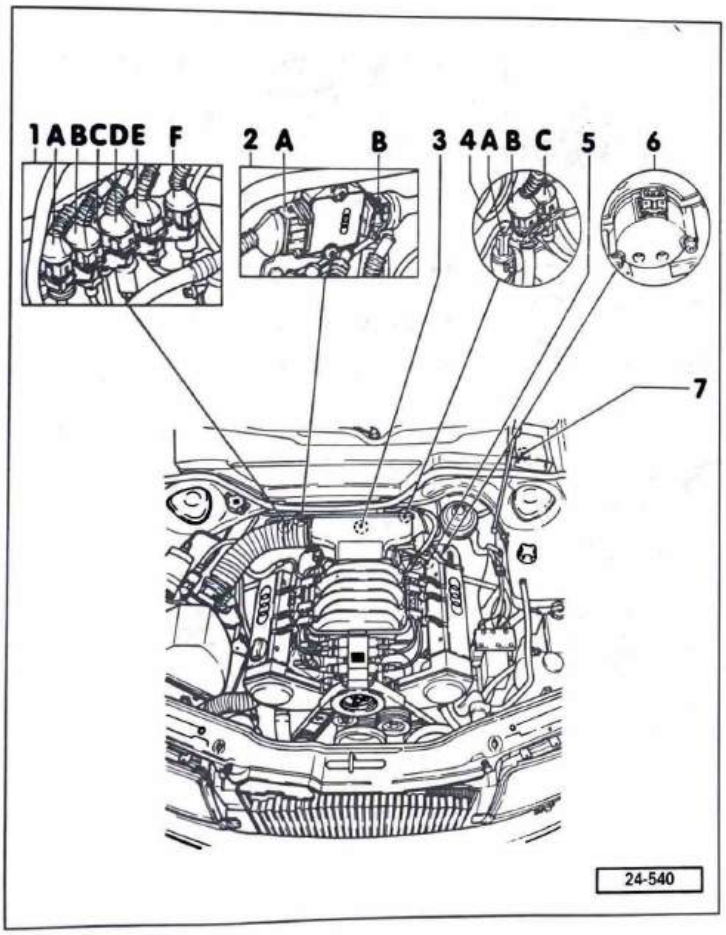
1 - Harness connectors:

A - For Oxygen Sensor (O2S) heater -Z19-
- Heater for heated oxygen sensor -G39-, right bank
- Black 2-pin connector

B - For Ignition coils
- Battery positive voltage (B+) supply
- White connector

C - For Heated Oxygen Sensor (HO2S) -G39-
- Signal wire
- Under connector holder on bulkhead

D - For Knock Sensor (KS) 1 -G61-
- Blue connector



E - For Engine Speed (RPM) sensor -G28-
- Gray connector

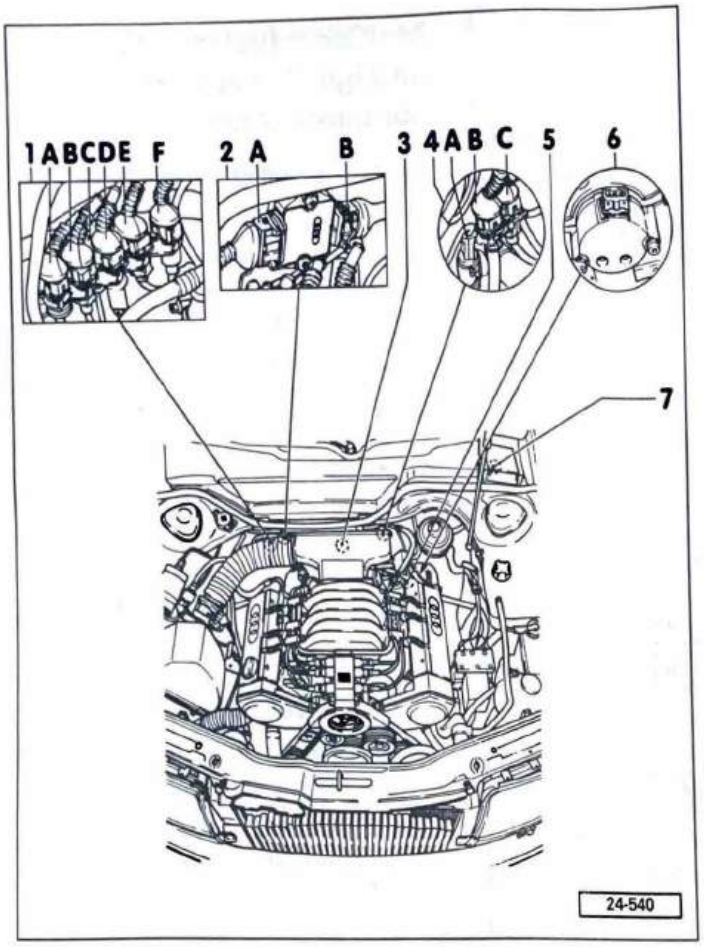
F - For Crankshaft Position (CKP) sensor -G4-
- Black connector

2 - Power output stage -N122-
- For ignition coils

A - Signal wires
- From Engine Control Module (ECM)
- Brown 4-pin connector

B - Ignition coil primary circuit connections

3 - Throttle Position (TP) sensor -G69-
- With integrated Closed Throttle Position (CTP) switch -F60-



4 - Harness connectors:

A - For Heated Oxygen Sensor 2 -G108-
- Signal wire

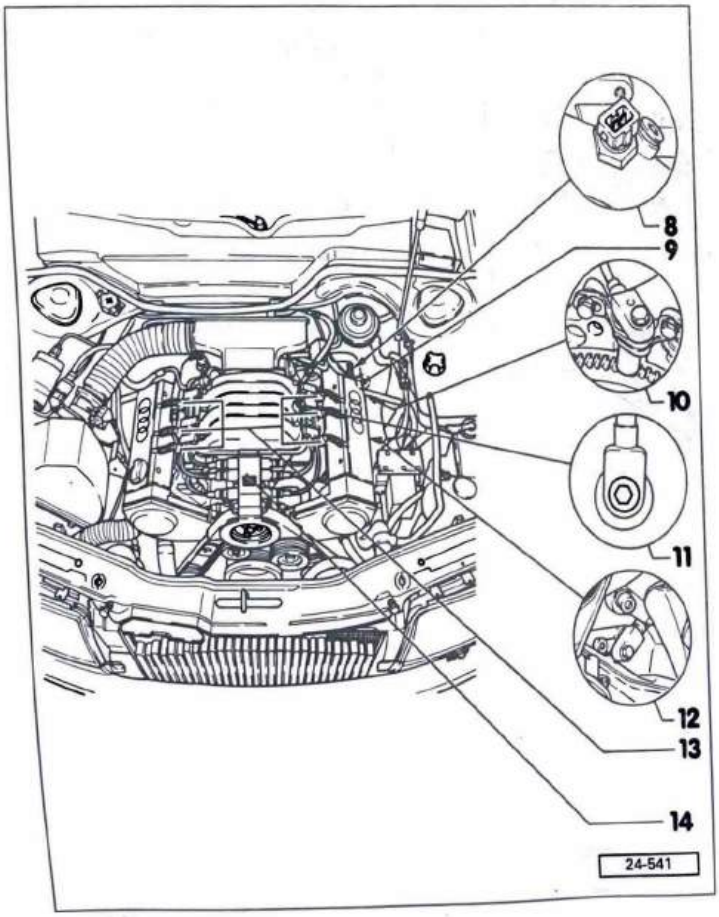
B - For Oxygen Sensor (O2S) 2 heater -Z28-
- Heater for heated oxygen sensor 2 -G108-, left bank
- Black 2-pin connector

C - For Knock Sensor (KS) 2 -G66-
- Blue connector

5 - EGR temperature sensor -G98-
- US vehicles only

6 - Camshaft Position (CMP) sensor -G40-

7 - Data Link Connector (DLC)



8 - Engine Coolant Temperature (ECT) sensor -G62-
- In coolant line behind cylinder head

9 - Heated Oxygen Sensor (HO2S) 2 -G108-

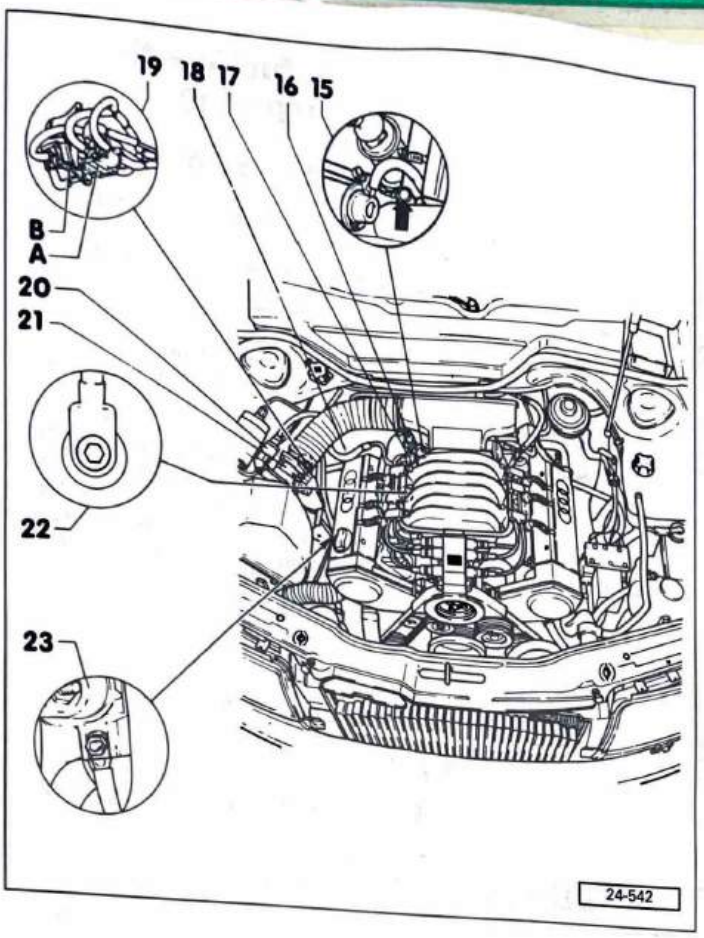
10 - Engine Speed (RPM) sensor -G28-

11 - Knock Sensor (KS) 2 -G66-

12 - Crankshaft Position (CKP) sensor -G4-
- Reference mark on left-hand side of cylinder block

13 - Fuel Injectors

14 - Ignition coils
- Ignition coil 1 -N-
- Ignition coil 2 -N128-
- Ignition coil 3 -N158-



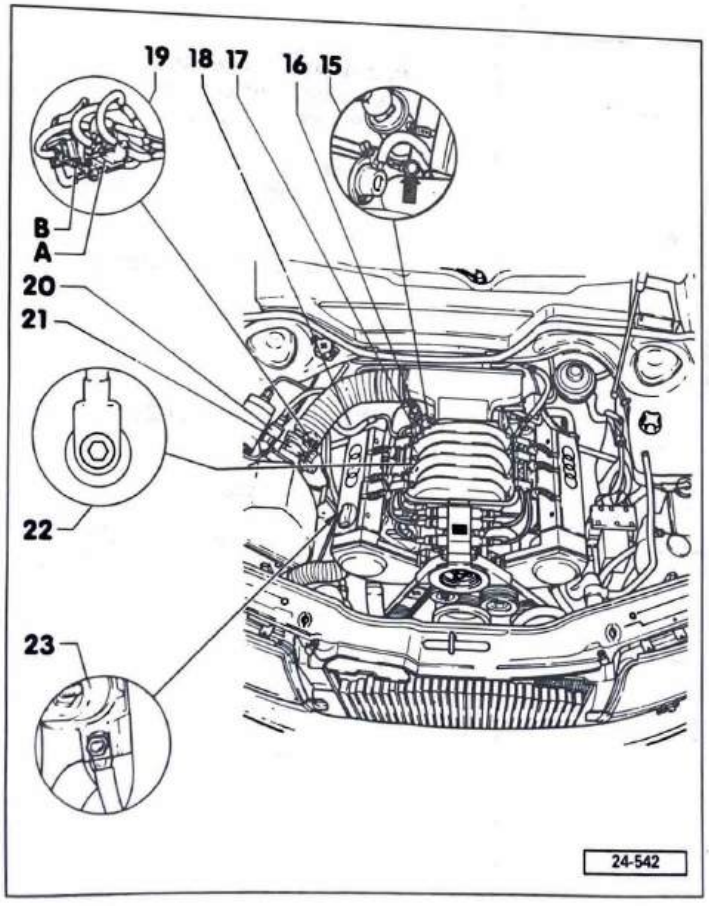
15 - Ground (GND) connection
- On intake manifold

16 - Idle Air Control (IAC) valve -N71-

17 - Fuel pressure regulator

18 - Heated Oxygen Sensor (HO2S) -G39-

19 - Mass Air Flow (MAF) sensor -G70-
- With CO Fuel Trim (FT) potentiometer



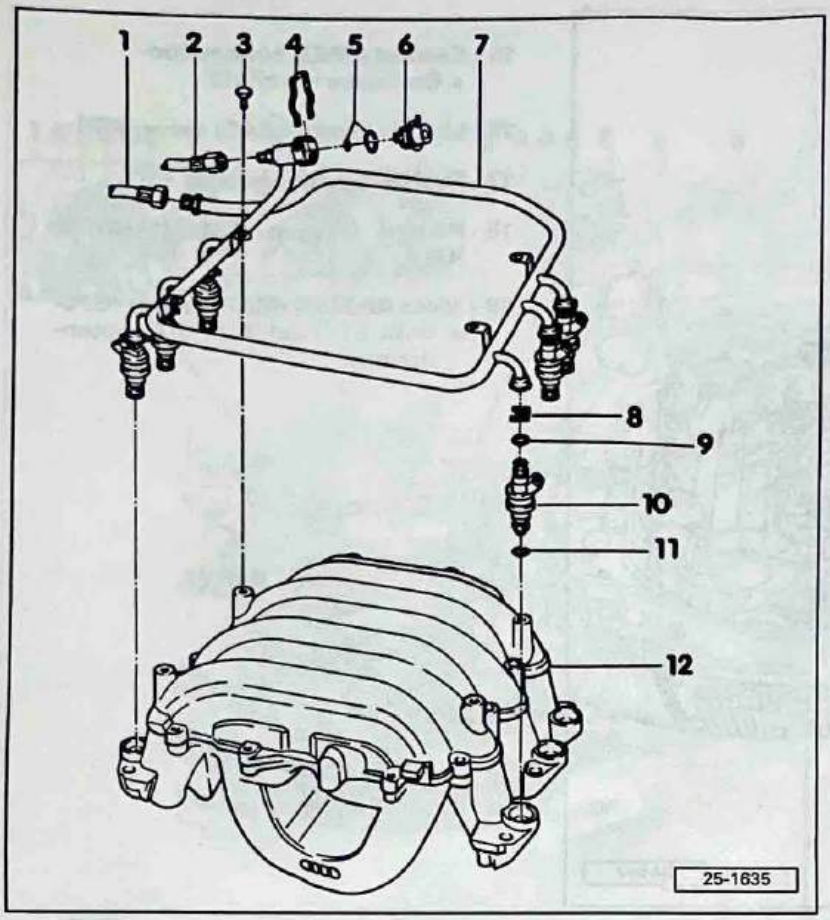
20 - EVAP canister purge regulator-valve -N80-

21 - A - EGR vacuum regulator solenoid valve -N18-

B - Intake manifold change-over valve -N156-

22 - Knock Sensor (KS) 1 -G61-

23 - Ground (GND) connection
- On right engine mount



Multiport fuel injection system, repairing

Fuel injector assembly

Rules of cleanliness ⇒ page 24-12

Safety precautions ⇒ page 24-13

CAUTION!
Seals must always be replaced.

Note:

Check Diagnostic Trouble Code (DTC) memory and check functions using the output Diagnostic Test Mode (DTM) before starting repair work on the fuel injection system ⇒ Repair Group 01.

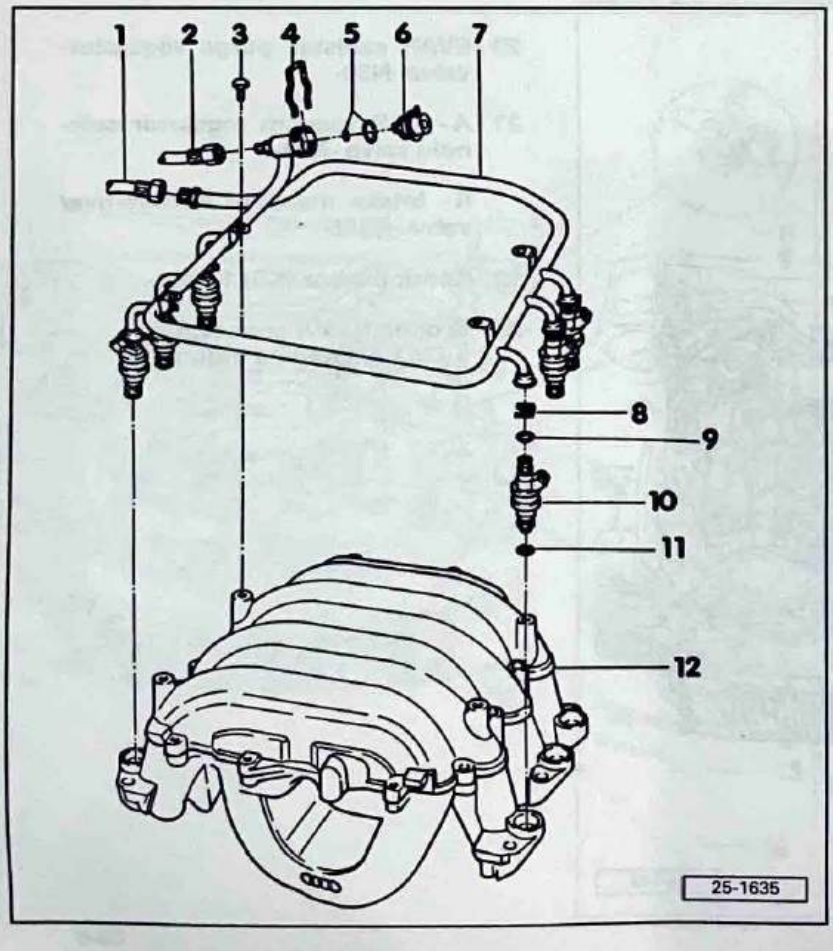
1 - Fuel supply line
- 25 Nm (18 ft lb)

2 - Fuel return line
- 25 Nm (18 ft lb)

3 - 10 Nm (7 ft lb)

4 - Clamp for fuel pressure regulator

5 - Seals
- Always replace



6 - Fuel pressure regulator
- Checking system and residual pressure ⇒ page 24-15

7 - Fuel rail
- Also serves as retainer for fuel injectors

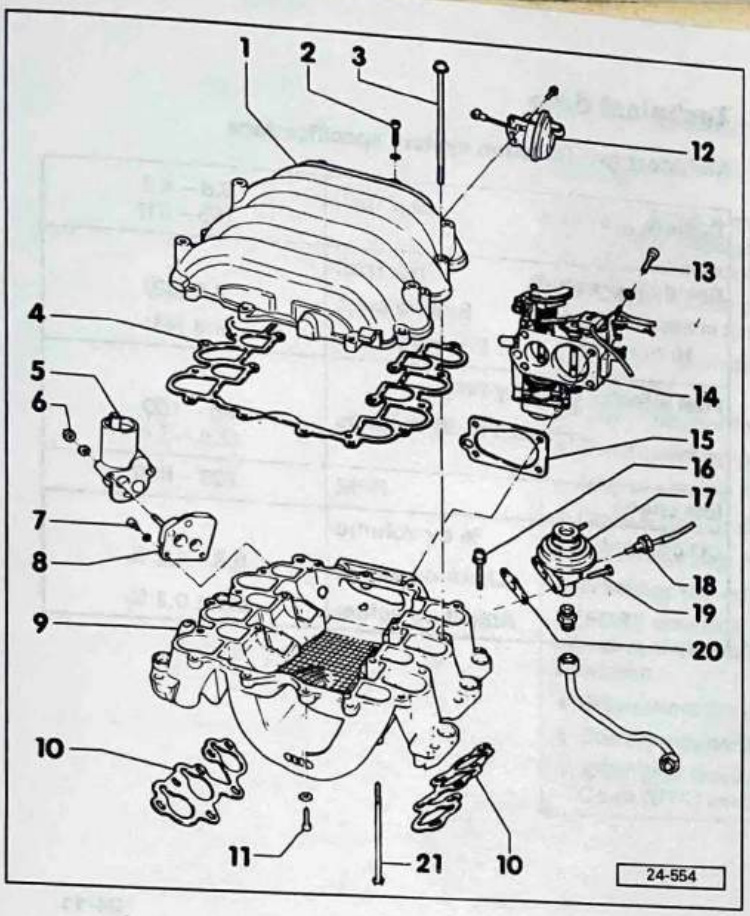
8 - Safety clamp for fuel injector

9 - Seal
- Always replace

10 - Injectors
- Checking ⇒ page 24-24

11 - Seal
- Always replace

12 - Compound intake manifold



Intake manifold assembly

Rules of cleanliness ⇒ page 24-12

Safety precautions ⇒ page 24-13

CAUTION!
Seals must always be replaced.

Note:

Check Diagnostic Trouble Code (DTC) memory and check functions using the output Diagnostic Test Mode (DTM) before starting repairs work on the fuel injection system ⇒ Repair Group 01.

1 - Intake manifold upper section

2 - 10 Nm (7 ft lb)

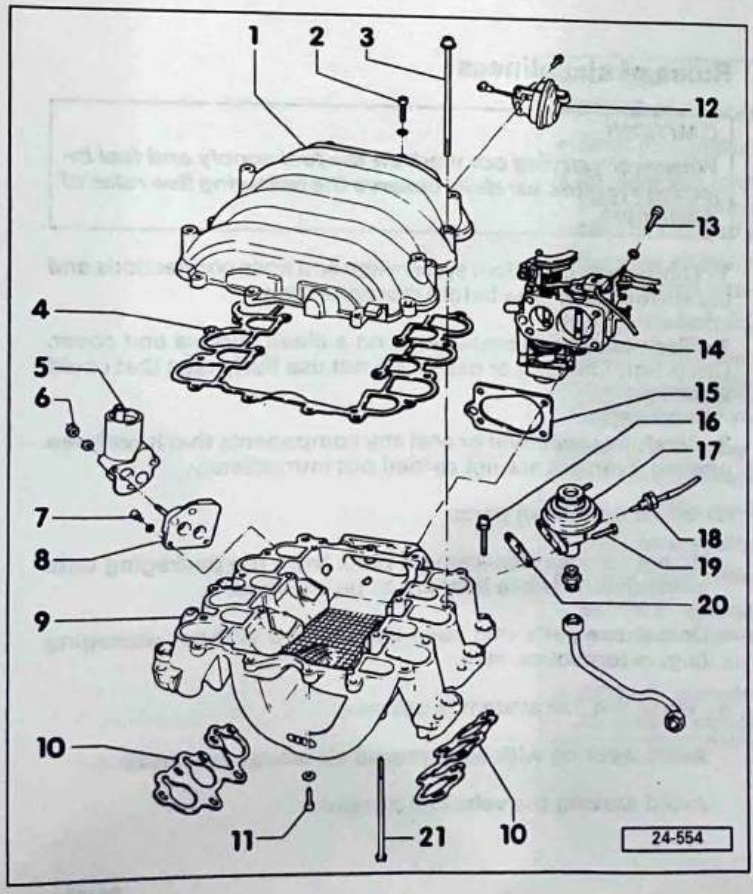
3 - 20 Nm (15 ft lb)

4 - Seal
- Always replace

5 - Idle Air Control (IAC) valve -N71-
- Checking ⇒ page 24-33

6 - 10 Nm (7 ft lb)

7 - 6 Nm (53 in lb)



8 - Flange

9 - Intake manifold, lower section

10 - Gasket
- Always replace

11 - 10 Nm (7 ft lb)

12 - Vacuum unit

13 - 20 Nm (15 ft lb)

14 - Throttle Body (TB)

15 - Gasket
- Always replace

16 - 20 Nm (15 ft lb)

17 - EGR vacuum regulator solenoid valve

18 - EGR temperature sensor -G98-
- On EGR vacuum regulator solenoid valve

19 - 10 Nm (7 ft lb)

20 - Gasket
- Always replace

21 - 10 Nm (7 ft lb)

Technical data

Multiport fuel injection system specifications

System pressure	bar (psi)	3.8 – 4.2 (55 – 61)
Residual pressure	bar (psi)	
Minimum after 10 minutes	Engine cold:	2.2 (32)
	Engine warm:	3.0 (44)
Fuel injector delivery rate		
	ml (oz.) in 30 seconds	85 – 100 (2.9 – 3.4)
Idle speed	RPM	700 – 800
CO content	% by volume	
	Checking value:	0.3 – 1.2 %
	Adjusting value:	0.7 ± 0.2 %

Rules of cleanliness

CAUTION!

Whenever carrying out work on the fuel supply and fuel injection systems, carefully observe the following five rules of cleanliness.

1 - Thoroughly clean fuel system line and hose connections and the surrounding area before disconnecting.

2 - Place removed components on a clean surface and cover. Use plastic sheeting or paper. Do not use fluffy rags that could leave lint!

3 - Carefully cover over or seal any components that have been opened if repairs are not carried out immediately.

4 - Install only clean parts:

Do not remove replacement parts from the packaging until immediately before they are to be installed.

Do not use parts that have been stored without packaging (e.g. in toolboxes, etc.).

5 - When the fuel system is opened:

Avoid working with compressed air whenever possible.

Avoid moving the vehicle if possible.

Safety measures

WARNING!

Be alert when working on or near the engine. High ignition secondary voltage can cause serious personal injury and damage vehicle components.

- ***DO NOT touch or disconnect ignition system wires when the engine is running or being cranked at starting RPM.***
- ***DO NOT operate the starter if the fuel injectors have been removed.***

Be sure the ignition is switched OFF, when:

- ***Disconnecting ignition wires***
- ***Disconnecting fuel injection system wiring***
- ***Connecting or disconnecting test equipment leads***
- ***Disconnecting the battery***
- ***Washing the engine or engine compartment.***

BEFORE cranking the engine at starting RPM (such as for compression testing) disable the ignition and fuel injection systems:

- ***Disconnect the ignition coil power output stage.***
- ***Disconnect harness connectors from all fuel injectors.***
- ***After the work is completed, erase Diagnostic Trouble Code (DTC) memory.***

CAUTION!

BEFORE disconnecting the battery:

- ***Stop the engine.***
- ***Be sure the ignition is switched OFF (also applies when connecting the battery). Failure to do so may damage the Engine Control Module (ECM).***
- ***Be sure of the proper radio code (for vehicles equipped with coded anti-theft radio).***

Be sure the battery negative (–) cable is disconnected, when:

- ***Working on the electrical system***
- ***Resistance (spot) welding or electric arc welding anywhere on the vehicle.***

When connecting and disconnecting electrical test equipment (LED voltage tester, multimeter, etc.):

- ***Be sure the ignition is switched OFF.***
- ***Use correct adapters from the VW 1594 connector test kit.***

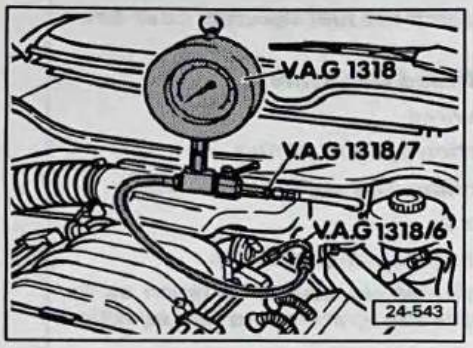
For any work affecting the Engine Control Module (ECM):

- ***BEFORE disconnecting the ECM harness connector, switch the ignition OFF and WAIT at least 20 seconds. Failure to do so may damage the ECM.***
- ***DO NOT connect any outside voltage source to stimulate an output signal at the ECM.***

Fuel system pressure and residual pressure, checking

Test conditions

- Fuse 17 -S17- OK
- Fuel filter OK
- Battery fully charged (12 volts minimum)



Checking system pressure

◄ – Connect VAG 1318 pressure tester between fuel supply line and fuel rail.

Lever on pressure tester should be in "open" position.

– Disconnect vacuum hose from fuel pressure regulator to intake manifold at fuel pressure regulator, and plug hose.

Note:

Replace the fuel pressure regulator if fuel runs out of the vacuum connection during the pressure test that follows.

– Activate fuel pump relay -J17- using ECM output Diagnostic Test Mode ⇒ Repair Group 01.

- Fuel pump must run

If NOT:

– Check fuel pump.
⇒ Repair Manual, *2.8 Liter V6 General, Engine*, Repair Group 20.

– With fuel pump running, check fuel pressure on gauge.

Specification: 3.8–4.2 bar (55–70 psi)

If the specified pressure is not obtained:

– Replace fuel pressure regulator and repeat pressure test.

If the specified pressure is still not obtained:

– Check fuel pump and fuel supply line for damage (e.g. crushed or pinched sections) and replace if necessary.

If the specified pressure is exceeded:

– Check fuel return line for damage (e.g. crushed or pinched sections) and replace if necessary.

CAUTION!

Excessive fuel pressure may rupture the fuel pressure regulator diaphragm. This may cause fuel to enter the engine via the vacuum hose.

Note:

During subsequent testing, the engine should not run for an unnecessarily long time with the vacuum hose disconnected. The increased fuel pressure will cause mixture enrichment, which in turn may cause Oxygen Sensor (O2S) control limits to be exceeded, and a malfunction to be registered and stored.

- Start engine and let idle (this automatically interrupts output diagnostic test mode).
- Switch electrical consumers (A/C, etc.) off.
- Connect vacuum hose to fuel pressure regulator and observe pressure drop on pressure gauge.

• Fuel pressure should drop by about 0.5 bar (7 psi) after connecting the vacuum hose.

If NOT, perform the following tests:

- Check vacuum hose for leaks (cracks, damage).
- Check passage of vacuum connection on intake manifold by disconnecting hose on fuel pressure regulator and blowing through it.

If there is no leak and the vacuum connection is not blocked:

- Replace fuel pressure regulator.

Checking residual pressure

Residual pressure 10 minutes after switching off the engine (minimum pressure):

♦ Cold engine: 2.2 bar (32 psi)

♦ Warm engine: 3.0 bar (44 psi)

Note:

Higher pressure for a warm engine is normal, and is the result of thermal expansion of the fuel.

If residual pressure is not OK, perform following tests:

- Check pressure tester connections for leaks.
- Check fuel lines for leaks.
- Check fuel pump check valve.
⇒ Repair Manual, *2.8 Liter V6 General, Engine*, Repair Group 20.
- Check fuel injectors for leaks ⇒ page 24-28.

If there are no leaks and the fuel pump check valve is OK:

- Replace fuel pressure regulator.
- Repeat residual pressure test.

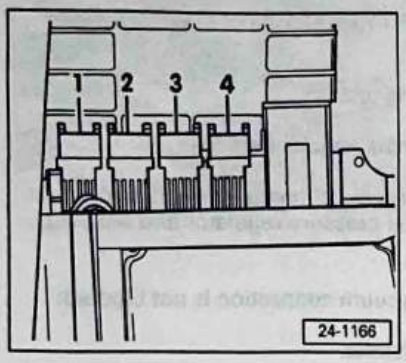
Fuel Pump (FP) relay, checking

Checking function

Note:

The fuel pump relay is located in the fuse/relay panel, on the left side under the instrument panel.

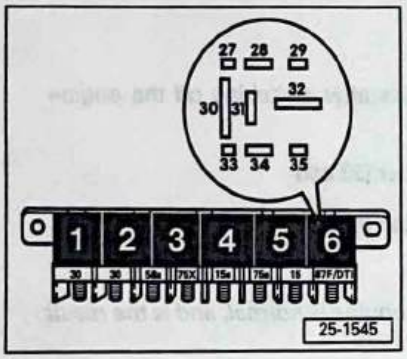
- Remove shelf in left front footwell.
- Remove lower right A-pillar trim.
- Fold back carpet in right front footwell.
- Remove cover from electronics box.



◄ - Remove HO2S circuit breaker -2- (-S73- in brown holder) and injector valve circuit breaker -3- (-S72- in red holder).

- Remove fuse 17 from fuse holder.
- Connect VAG 1527B voltage tester between Ground (GND) and one terminal for fuse 17, using adapter cables from VW 1594 connector test kit.
- Operate starter briefly.

- Fuel pump relay must be activated (can be felt and heard)
- LED tester must light up



If fuel pump relay is NOT activated:

- Check activation of fuel pump relay ⇒ page 24-22

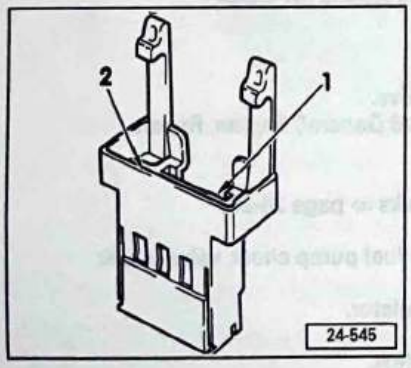
If LED tester does NOT light up:

- Repeat test on other terminal for fuse 17.

If LED tester still does NOT light up:

◄ - Check wiring connection for continuity between fuse 17 and terminal 30 at relay position 6 per wiring diagram.

- Repair open circuit in wiring, if necessary.



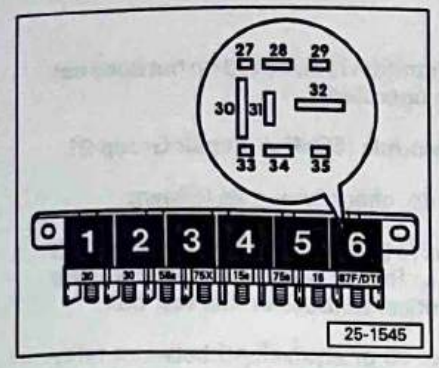
◄ - Connect LED tester between GND and to terminal 1 of holder for injector valve circuit breaker -S72- (red holder ⇒ page 24-19).

- Use On Board Diagnostic (OBD) output diagnostic test mode to activate fuel pump relay -J17- ⇒ Repair Group 01.

- Fuel pump relay must be activated
- LED tester must light up

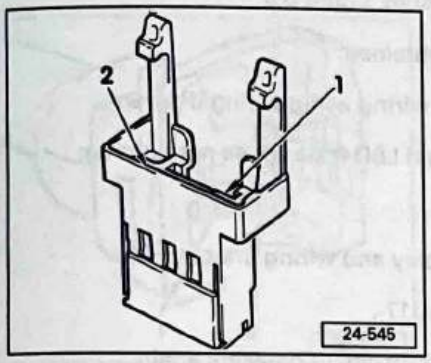
If LED tester does not light up:

- Repeat test on circuit breaker holder terminal 2.



If LED tester does not light up:

◄ – Check wiring connection from circuit breaker to terminal 30 on relay location 6 for continuity per wiring diagram. Repair open circuit in wiring if necessary.



◄ – Connect LED tester between GND and to terminal 1 of holder for HO2S circuit breaker -S73- (brown holder ⇒ page 24-19).

– Use On Board Diagnostic (OBD) output diagnostic test mode to activate fuel pump relay -J17- ⇒ Repair Group 01.

- Fuel pump relay must be activated
- LED tester must light up

If LED tester does not light up:

– Repeat test on circuit breaker holder terminal 2.

If LED tester does not light up again:

– Check wiring for continuity from circuit breaker holder and terminal 31 at relay position 6, according to wiring diagram.

– Repair open circuit in wiring if necessary.

Checking battery positive voltage (B+) for fuel pump relay

– Switch ignition on.

– Connect multimeter (Fluke 83 or equivalent) to measure voltage at fuel pump relay panel sockets:

♦ Sockets 28 (positive) and 34

♦ Sockets 32 (B+) and 34

Specified value: approx. 12 volts

– Switch ignition off.

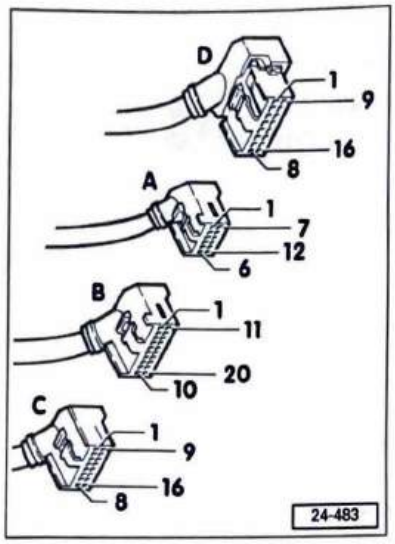
If the specified values are not obtained:

– Eliminate open circuits in wiring using wiring diagram.

Checking activation of fuel pump relay

– Connect VAG 1527B voltage tester to relay sockets 28 and 29.

- Ignition on: LED must light up brightly for approx. 1 sec., then stay dimly lit
- Starter operated: LED must become visibly brighter



If LED lights up dimly when ignition is switched on but does not get brighter when starter is operated:

- Replace Engine Control Module (ECM) ⇒ Repair Group 01.

If LED tester does not light up, check wiring as follows:

◄ - Connect VAG 1598 test box to ECM wiring harness using VAG 1598/12 adaptor harness ⇒ Repair Group 01. The numbers of the connectors are identical to those on the test box.

- Connect multimeter (Fluke 83 or equivalent) between relay socket 29 and test box socket 15 and check for open circuit.

  Specified reading: maximum 1 ohm (Ω)

If specified reading is not obtained:

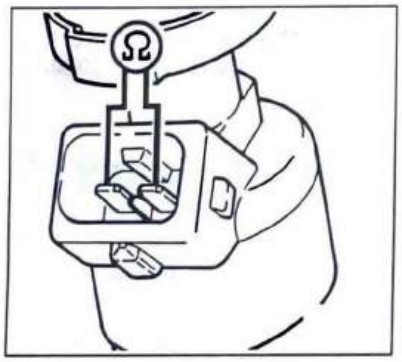
- Eliminate open circuit in wiring using wiring diagram.

If there is no open circuit and LED tester does not light up:

- Replace ECM.

If activation of fuel pump relay and wiring are both OK:

- Replace fuel pump relay -J17-.
- Replace fuse no. 17 and both circuit breakers again.



Fuel injectors, checking

Checking electrical resistance

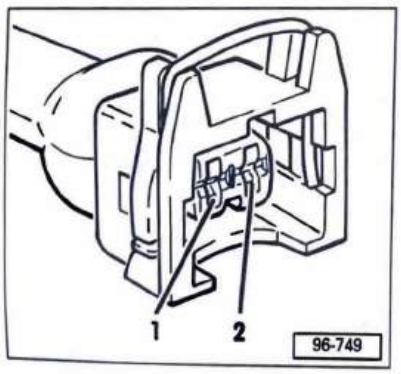
- Disconnect harness connector from fuel injector to be tested.

◄ - Measure resistance of fuel injector.

Specification:	Bosch	15.0–17.0 Ω
	Siemens	13.5–14.5 Ω

If the specified value is not obtained:

- Replace fuel injector.



Checking battery positive voltage (B+) for fuel injectors

- Fuel pump relay OK
- Activation of fuel pump relay OK
- Injector valve circuit breaker -S72- OK (red holder in electronics box in passenger side footwell ⇒ page 24-19)

- Disconnect harness connector from fuel injector to be tested.

◄ - Connect VAG 1527B voltage tester between connector terminal 2 and Ground (GND).

- Use On Board Diagnostic (OBD) output diagnostic test mode to activate fuel pump relay -J17- ⇒ Repair Group 01.

- LED must light up

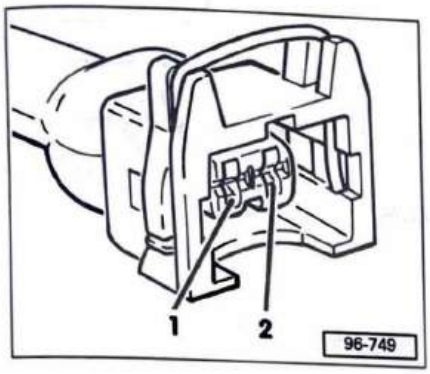
If the LED does not light up:

- Check wiring connection for continuity between connector terminal 2 and circuit breaker -S72- (red holder in electronics box in passenger side footwell) according to wiring diagram.

  Repair if necessary.

If the LED lights up:

- Check activation of fuel injectors.



Checking activation of fuel injectors

- Disconnect harness connector on fuel injector to be tested.

- Connect LED tester to connector terminal 1 and to battery positive (B+), or jumper to positive (B+) using cable from VW1594 connector test kit.

- Operate starter briefly (the engine can also turn over).

- LED must blink

If the LED does not blink:

- Check wiring and connections between connector terminal 1 (for fuel injector being tested) and ECM as follows:

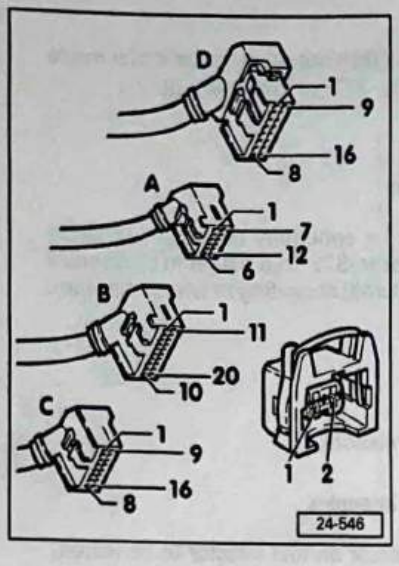
- Connect VAG 1598 test box with VAG 1598/12 adapter harness on wiring harness to ECM ⇒ Repair Group 01.

  Harness connector is not connected to ECM.

- Check control wire for continuity between fuel injector connector terminal 1 (in engine compartment) and test box.

Fuel injector	Fuel injector connector terminal	Test box socket
1	1	4
2	1	5
3	1	6
4	1	9
5	1	10
6	1	13

Specified value: maximum 1 ohm (Ω)



◄ – If necessary, eliminate break or short circuit in wiring between terminal 1 of fuel injector being tested, and corresponding terminal at ECM connector -D-.

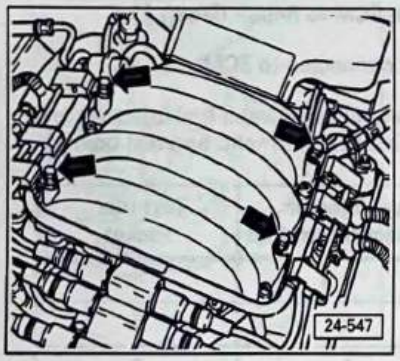
Terminal 1 on fuel injector connector for cylinder number:	Terminal on ECM connector D
1	4
2	5
3	6
4	9
5	10
6	13

If, in the previous test above, the LED does not flash for any of the fuel injectors:

– Check voltage supply for ECM ⇒ Repair Group 28.

If voltage supply is OK:

– Replace ECM.



Fuel injector leakage, checking

- System fuel pressure OK.

– Remove intake air duct between Mass Air Flow (MAF) sensor and engine cover.

– Disconnect and lay aside ignition cables to permit removal of fuel rail.

– Disconnect harness connectors from fuel injectors.

◄ – Disconnect fuel rail from intake manifold.

– Disconnect vacuum hose from fuel pressure regulator.

– Lift fuel rail with fuel injectors off intake manifold and support.

– Use On Board Diagnostic (OBD) output diagnostic test mode to activate fuel pump relay -J17- ⇒ Repair Group 01.

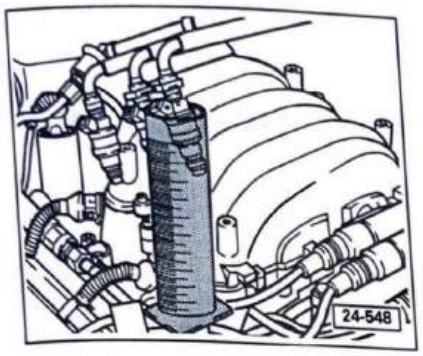
- Fuel pump should run

– Visually check fuel injectors for leaks.

- With fuel pump running, no more than 1 to 2 drops of fuel per minute may be discharged from each fuel injector.

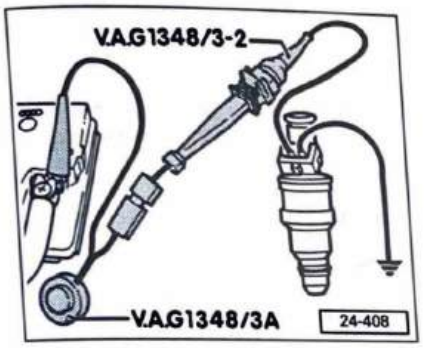
If fuel leakage is greater:

– Switch ignition off and replace leaking fuel injector and seals.



Fuel injection delivery rate, checking

◄ – Place fuel injector to be tested in measuring beaker from VAG 1602 fuel analyzer.



◄ – Connect one terminal from fuel injector to be tested to GND using test harness and clip from VW 1594 connector test kit.

– Connect second terminal of fuel injector to B+ using remote control VAG 1348/3 A, adapter harness VAG 1348/3–2 or equivalent, and a test harness.

– Operate remote control VAG 1348/3 A for 30 seconds.

– When all three fuel injectors from one cylinder bank have been activated, place measuring beakers on a level surface.

Specified quantity per fuel injector: 85–100 ml

If the measured quantity of one or more of the fuel injectors is greater or less than the specified value:

– Replace faulty fuel injector(s).

To complete the test:

– Repeat test on fuel injectors in second bank of cylinders.

If measured values of all fuel injectors are greater or less than specified value:

– Check system pressure ⇒ page 24-15.

– Install fuel injectors in the reverse order of removal.

– Replace O-rings for all fuel injectors and moisten slightly with clean engine oil.

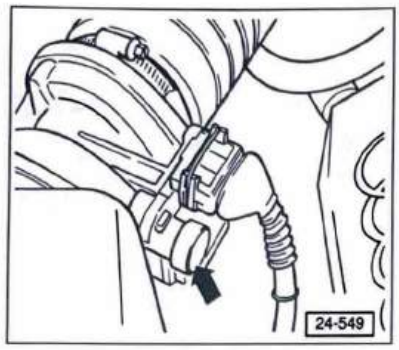
– Slide fuel injectors vertically and in correct positions into fuel rail and secure with clamps.

– Install fuel rail with secured fuel injectors onto manifold and press in uniformly.

Idle speed and CO content, checking

Note:

- *Idle speed cannot be adjusted.*
- *Idle speed is checked during the On Board Diagnostic (OBD) "Basic Setting" function 04.*
- *The CO content is influenced by oxygen sensor control.*



- Using VAG 1551 scan tool, establish display of engine basic settings ⇒ Repair Group 01.

◄ - If value in display field 8 is outside specifications, remove cap and pry out plastic plug (arrow).

- Adjust CO content during engine basic setting function by turning CO Fuel Trim (FT) adjustment screw until displayed value = 128.

Note:

The displayed value will not change immediately after turning the CO fuel trim adjustment screw, but after a slight time delay.

- Connect CO tester Sun 75 (or EPA-approved equivalent) to right CO tap tube according to operating instructions.
- Check CO content reading on tester.

  Specification: 0.3–1.2% by volume

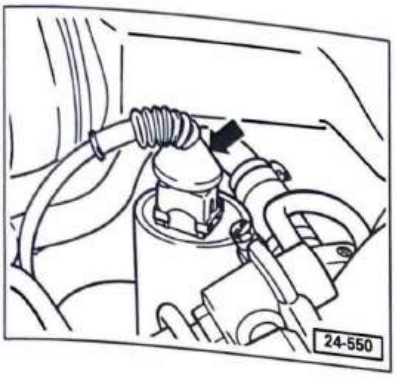
- Repeat CO content test on left CO tap tube.

If the CO content is less than 0.3% by volume even though the value displayed on VAG 1551 is correct:

- Eliminate leak in area of CO tap tube or test connection to VAG 1363.

If the CO content is greater than 1.2% by volume:

- Eliminate leak in exhaust system between engine and heated oxygen sensor.
- Install new plug on CO fuel trim adjustment screw, and press on new cap.



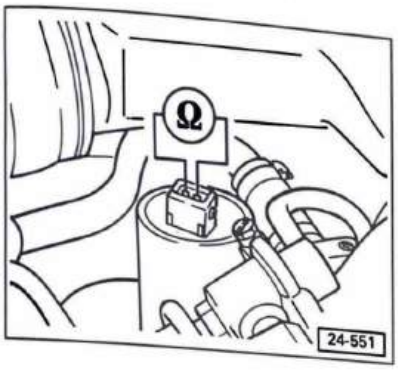
Idle Air Control (IAC) valve, checking

Note:

For function testing of the idle air control valve, also see Repair Group 01, engine "Basic Setting" function 04, display field 4.

Electrical check

◄ – Disconnect harness connector from IAC valve.



◄ – Measure resistance on IAC valve.

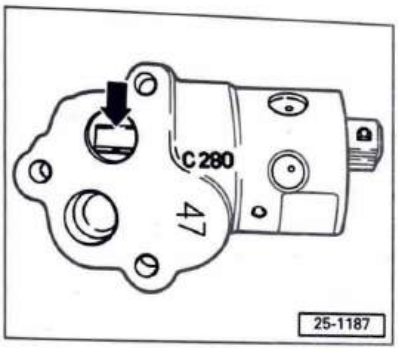
Specified value: 7–11 ohms (Ω)

If specified values are not obtained:

– Replace IAC valve.

Note:

At room temperature, the resistance lies lower in the tolerance range; with the engine warmed to operating temperature, it is higher in the tolerance range.



Mechanical check

– Remove idle air control valve.

◄ – Check rotary slide valve (arrow) for signs of scoring (by visual inspection).

> ***CAUTION!***
>
> ***When checking free movement, do not move the rotary slide valve with a screwdriver or other tool.***

– Re-connect harness connector to removed valve.

– Switch ignition on.

– Use On Board Diagnostic (OBD) output Diagnostic Test Mode (DTM) to activate idle air control valve ⇒ Repair Group 01.

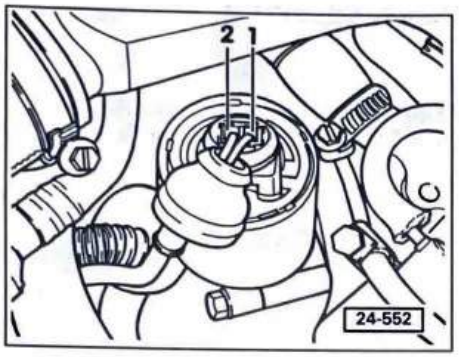
– Check whether rotary slide valve runs properly from stop to stop.

If there are signs of scoring that impair free movement, or if the rotary slide does not move freely (sticks, runs slowly or does not run up to both stops):

– Replace idle air control valve.

– If there is no valve activation during output DTM:

– Check IAC valve activation (page 24-35).



Checking idle air control valve activation

- Electrical check OK.

– Push back boot from harness connector (stays connected).

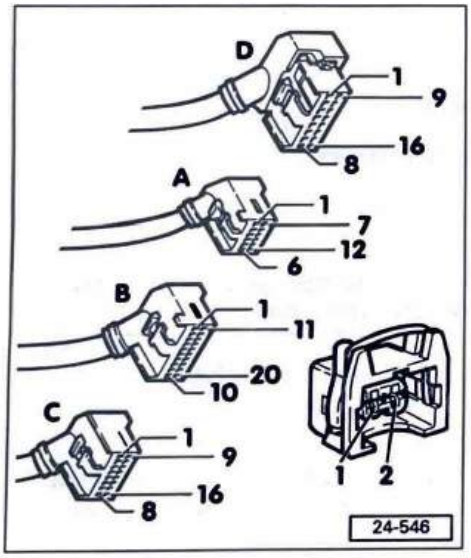
– Use On Board Diagnostic (OBD) output Diagnostic Test Mode (DTM) to activate idle air control valve ⇒ Repair Group 01.

◄ – Connect VAG 1527B voltage tester between harness connector terminal 1 and Ground (GND).

- LED must blink

– Connect VAG 1527B voltage tester between harness connector terminal 2 and battery positive (B+).

- LED must light up



If specified results are not obtained:

◄ – Check for open circuit or short circuit between valve harness connector and ECM connector -D-.

IAC valve connector terminal	Terminal on ECM connector D
1	11
2	7

– Eliminate wiring break or short circuit as necessary.

If wiring is OK and activation fails:

– Replace ECM.

If activation and wiring is OK and there is still no valve reaction:

– Replace mechanically seized valve.

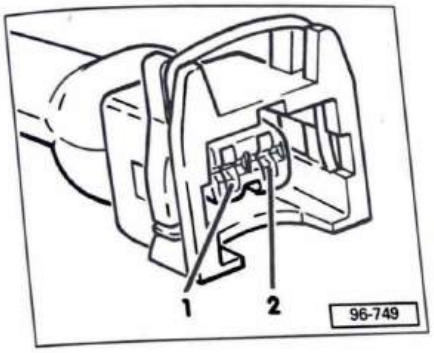
Heated Oxygen Sensor (H02S) system, checking

Note:

For functional testing of the oxygen sensor, see also Repair Group 01, engine "Basic Setting" function 04, display field 8.

CAUTION!

- ***DO NOT USE SILICONE SPRAYS, SEALERS, CLEANERS, ETC. near the intake area. Traces of silicone components drawn into the engine are not burned during combustion and can damage the oxygen sensor.***
- ***DO NOT use contact sprays or similar materials in the area of the oxygen sensor connection, since these lead to corrosion damage in the oxygen sensor.***



Checking Oxygen Sensor (O2S) heating

- Disconnect heated oxygen sensor harness connector on right or left cylinder bank (location ⇒ page 24-1).

◄ - Connect multimeter (Fluke 83 or equivalent) between connector terminals 1, Ground (GND), and 2, positive (B+).

- Start engine and let idle.

Specified value: approx. 12–14 volts

If specified values are not obtained:

- Check HO2S circuit breaker -S73- (brown holder in electronics box, passenger side footwell).
- Check continuity in wiring from connector terminal 2 to circuit breaker using wiring diagram.

Specified reading: maximum 0.5 ohms (Ω)

- Check continuity in wiring from connector terminal 1 to GND.

Specified reading: maximum 0.5 ohms (Ω)

- Check fuel pump relay ⇒ page 24-19.

If the specified reading is obtained:

- Connect additional test harness VAG 1315 A/1 into 2-pin HO2S connector.
- Switch multimeter to 10 amp (DC) measuring range and connect (connect test harness to 10 amp connector).
- Run engine.

Specified reading: 0.5–3.0 amps (Current decreases as sensor temperature increases).

If specified reading is not obtained:

- Replace oxygen sensor.

Checking Oxygen Sensor (O2S) control

- Disconnect harness connector for oxygen sensor signal wire (locations: ⇒ page 24-1).

- Connect multimeter between oxygen sensor signal wire and GND.

  Specified value: ∞ ohms (Ω) (no continuity)

If specified values are not obtained:

- Replace HO2S.

If specified value is obtained:

- Switch multimeter to 2 volt measuring range and connect between signal wire connector of wiring harness to ECM and GND.

- Switch ignition on.

  Specified value: 400 ± 50 mV

If specified values are not obtained, check wiring to ECM:

- Switch ignition OFF.

- Connect VAG 1598 test box on ECM wiring harness using VAG 1598/11 adapter harness ⇒ Repair Group 01.

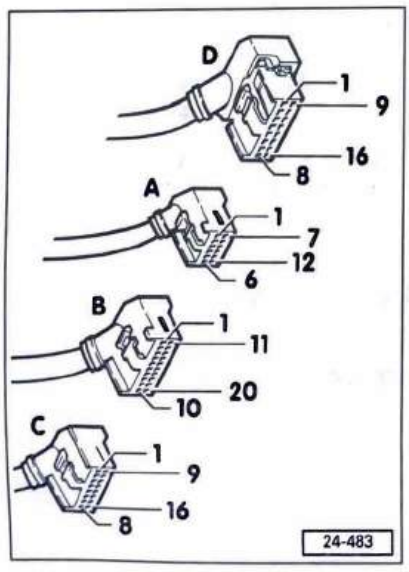
  (Adapter harness for ECM is not connected.)

- Check for continuity between H02S -G39- signal wire and test box socket 50.

  Specified value: max. 1 ohm (Ω)

- Check for continuity between H02S 2 -G108- signal wire and test box socket 48.

  Specified value: max. 1 ohm (Ω)



If specified values are not obtained:

◄ - Repair open or short circuit in wiring connection between connector in engine compartment and terminal 50 and/or 48 of ECM connector A according to wiring diagrams.

If there is no malfunction in wiring connection:

- Replace ECM ⇒ Repair Group 01.

Heated Oxygen Sensor (HO2S), removing and installing

Removing

- Disconnect heated oxygen sensor harness connectors (for locations ⇒ page 24-1).
- Remove cable tie.
- Remove oxygen sensor.

Installing

Note:

- *Cable ties must always be re-installed at the original locations when installing the sensor to help prevent contact between the sensor wiring and the exhaust system.*
- *Coat the threads of the oxygen sensor with an anti-seize compound. Do not allow compound to enter the slots in the body of the sensor.*

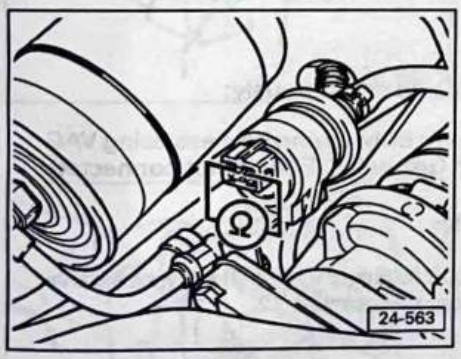
Tightening torque: 50 Nm (37 ft lb)

EVAP canister purge regulator valve, checking

Note:

For functional testing of EVAP canister purge regulator valve activation, see also Repair Group 01, "Read Individual Measuring Value" function 09, channel 06.

Installation location ⇒ page 24-6



Electrical check

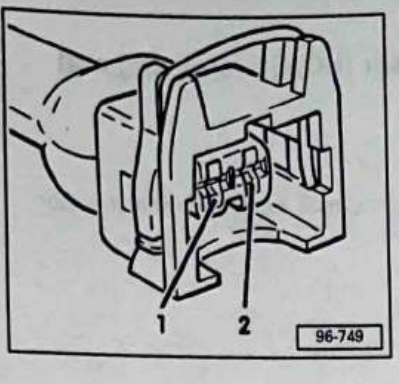
- Disconnect harness connector on EVAP canister purge regulator valve.

◄ - Measure valve resistance.

Specified value: 20–28 ohms (Ω)

If specified values are not obtained:

- Replace EVAP canister purge regulator valve.



Checking battery positive voltage (B+) supply

- Disconnect harness connector on valve.

◄ - Connect VAG 1527B voltage tester between connector terminal 1 and Ground (GND) using cable from VW 1594 test kit.

- Use On Board Diagnostic (OBD) output diagnostic test mode (DTM) to activate fuel pump relay -J17- ⇒ Repair Group 01.

• LED must light up

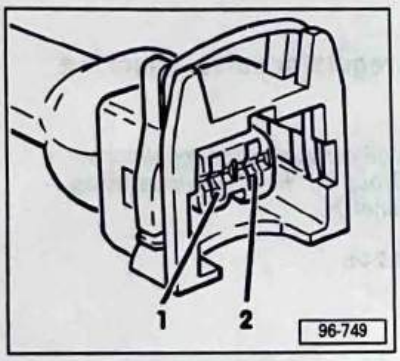
If LED does not light up, perform following tests:

- Check HO2S circuit breaker -S73- (brown holder in electronics box, passenger side footwell)

- Check continuity in wiring from terminal 1 of connector on EVAP canister purge regulator valve to circuit breaker using wiring diagram.

  Specified reading: maximum 0.5 ohms (Ω)

- Check fuel pump relay and activation ⇒ page 24-19.



Checking EVAP canister purge regulator valve activation

◄ - Connect VAG 1527B voltage tester to EVAP canister purge regulator valve connector terminals 1 and 2 using adapters from VW 1594 connector test kit.

- Use output Diagnostic Test Mode (DTM) to activate EVAP canister purge regulator valve ⇒ Repair Group 01.

• LED must blink

If LED does not blink or lights up continuously:

- Connect VAG 1598 test box to ECM wiring harness using VAG 1598/12 adapter ⇒ Repair Group 01. ECM is not connected.

If LED lights up continuously:

- Check wiring for short circuit to Ground (GND) between valve connector terminal 2 to test box socket 12.

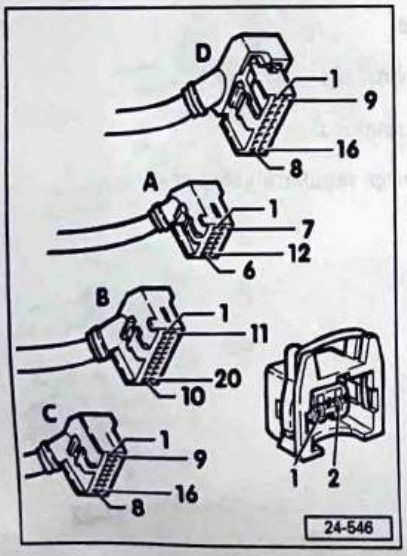
If LED does not blink:

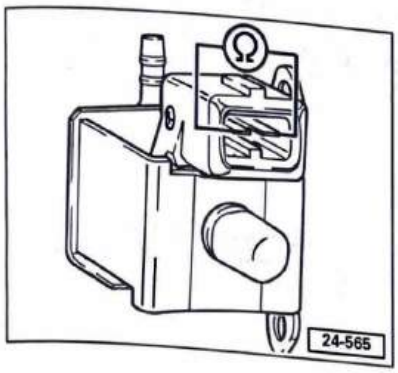
- Check wiring for continuity between connector terminal 2 and test box socket 12.

  Specified reading: maximum 1.0 ohm (Ω)

◄ - If necessary, eliminate open circuit or short circuit to GND between EVAP canister purge regulator valve connector terminal 2 and ECM connector -D- terminal 1.

If there is no open circuit or short circuit, replace ECM.





Intake manifold change-over valve, checking

Installation location ⇒ page 24-6.

Electrical check

- Disconnect harness connector on intake manifold change-over valve -N156-.

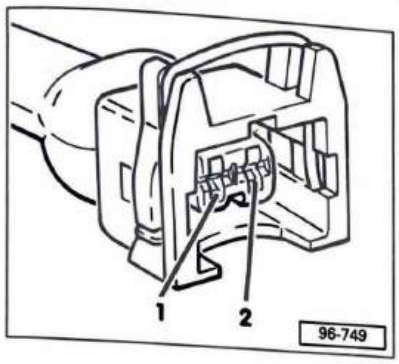
◄

- Measure valve resistance.

  Specified value: 25–35 ohms (Ω)

If specified value is not obtained:

- Replace intake manifold change-over valve.



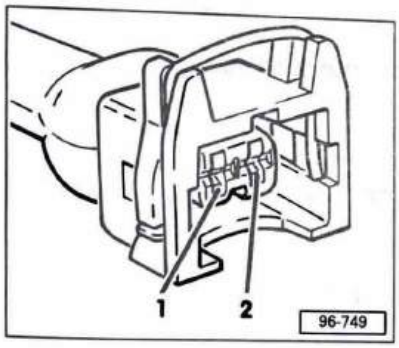
Checking battery positive voltage (B+) supply

- Disconnect harness connector on intake manifold change-over valve.

◄

- Connect VAG 1527B voltage tester between harness connector terminal 1 (positive) and Ground (GND) using adapter from VW 1594 connector test kit.
- Use On Board Diagnostic (OBD) output diagnostic test mode (DTM) to activate fuel pump relay -J17- ⇒ Repair Group 01.

• LED must light up



If LED does not light up:

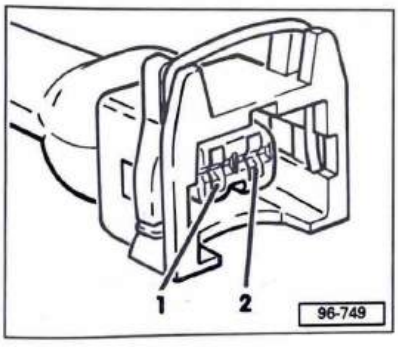
- Check HO2S circuit breaker -S73- (brown holder in electronics box, passenger side footwell).

◄

- Check wiring for continuity between valve harness connector terminal 1 and circuit breaker using wiring diagram.

  Specified reading: 0.5 ohms (Ω)

- Check fuel pump relay and activation ⇒ page 24-19.



Checking intake manifold change-over valve activation

◄

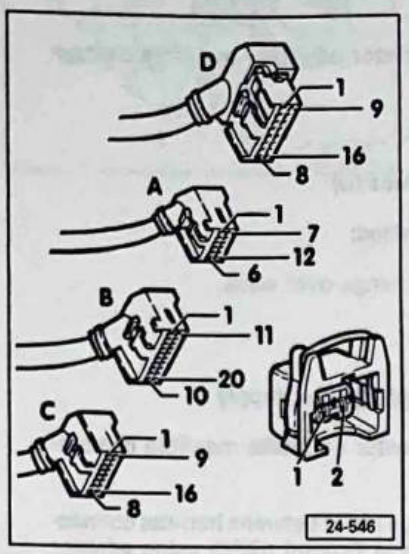
- Connect VAG 1527B voltage tester across terminals 1 and 2 of intake manifold change-over valve connector using adapter from VW 1594 connector test kit.
- Use output Diagnostic Test Mode (DTM) to activate intake manifold change-over valve ⇒ Repair Group 01.

• LED must blink when intake manifold change-over valve is activated.

If LED does not blink or lights up continuously:

- Connect VAG 1598 test box to ECM wiring harness for using adapter harness VAG 1598/11 ⇒ Repair Group 01.

  (Adapter harness for ECM is not connected.)



If LED lights up continuously:

- Check wiring for short circuit to GND between intake manifold change-over valve connector terminal 2 and test box socket 3.

If LED does not blink:

- Check wiring for continuity between intake manifold change-over valve connector terminal 2 and test box socket 3.

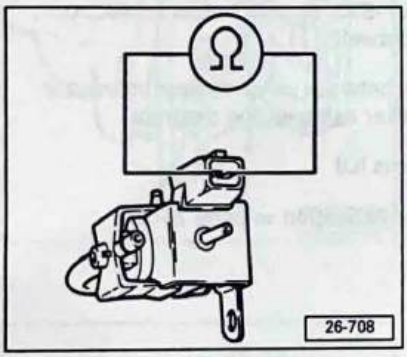
  Specified reading: maximum 1.0 ohm (Ω)

◄ - If necessary, eliminate short circuit to GND or wiring break between intake manifold change-over valve connector terminal 2 and terminal 3 of ECM connector C.

If there is no wiring break or short circuit:

- Replace ECM.

EGR vacuum regulator solenoid valve, checking



Note:

For functional testing of the EGR system ⇒ Repair Group 01.

Checking resistance

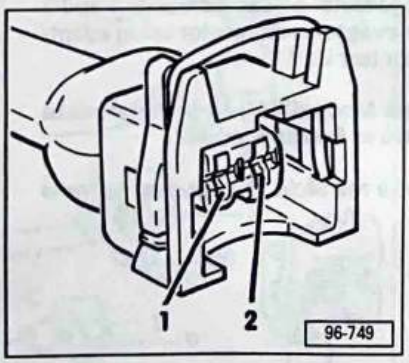
- Disconnect harness connector on EGR vacuum regulator solenoid valve.

◄ - Measure valve resistance.

  Specified value: 25–35 ohms (Ω)

If specified value is not obtained:

- Replace EGR vacuum regulator solenoid valve.



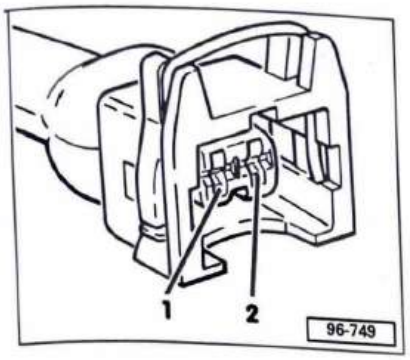
Checking battery positive voltage (B+) supply

- Disconnect harness connector on EGR vacuum regulator solenoid valve.

◄ - Connect VAG 1527B voltage tester between terminal 1 (positive) and Ground (GND) using adapter from VW 1594 test kit.

- Use On Board Diagnostic (OBD) output diagnostic test mode (DTM) to activate fuel pump relay -J17- ⇒ Repair Group 01.

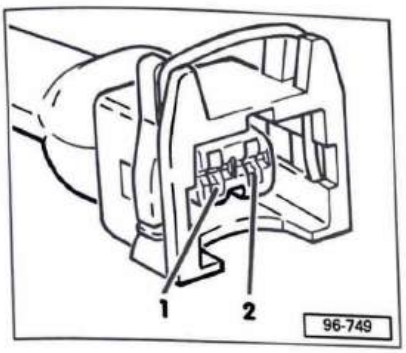
- LED must light up



If LED does not light up:

- Check HO2S circuit breaker -S73- (brown holder in electronics box, passenger side footwell).
- Check wiring for continuity between EGR vacuum regulator solenoid valve connector terminal 1 and circuit breaker using wiring diagram.

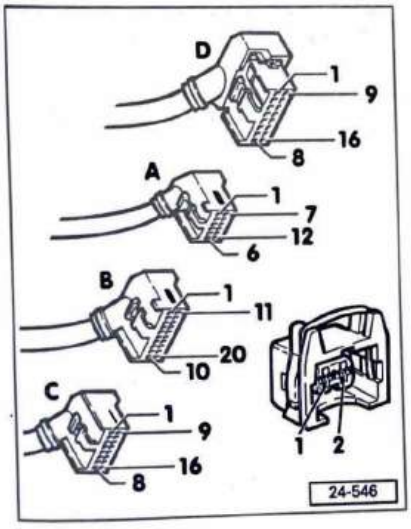
  Specified reading: 0.5 ohms (Ω)
- Check fuel pump relay and activation ⇒ page 24-19.



Checking EGR vacuum regulator solenoid valve activation

- Connect VAG 1527B voltage tester to EGR vacuum regulator solenoid valve connector terminals 1 and 2, using adapter from VW 1594 connector test kit.
- Use output Diagnostic Test Mode (DTM) to activate EGR vacuum regulator solenoid valve ⇒ Repair Group 01.

• LED must blink



If LED does not blink or lights up continuously:

- Connect VAG 1598 test box to wiring harness for ECM using adapter harness VAG 1598/12 ⇒ Repair Group 01. (The ECM is not connected).

If LED lights up continuously:

- Check wiring for short circuit to Ground between EGR vacuum regulator solenoid valve connector terminal 2 and test box socket 14.

If LED does not blink:

- Check wiring for continuity between EGR vacuum regulator solenoid valve connector terminal 2 and test box socket 14.

  Specified reading: maximum 1.0 ohm (Ω)
- If necessary, eliminate short circuit or wiring break between EGR vacuum regulator solenoid valve connector terminal 2 and terminal 14 of ECM connector -D-.

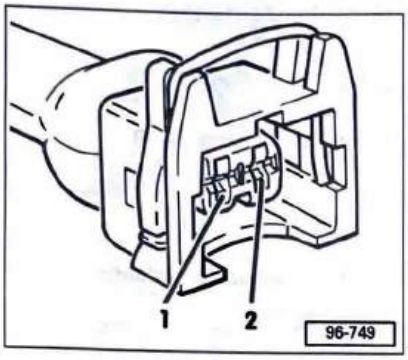
If there is no wiring break or short circuit:

- Replace ECM.

EGR temperature sensor, checking

Note:

- *Also see Repair Group 01, "Read Individual Measuring Value" function 09, channel 10.*
- *Installation location ⇒ page 24-10.*

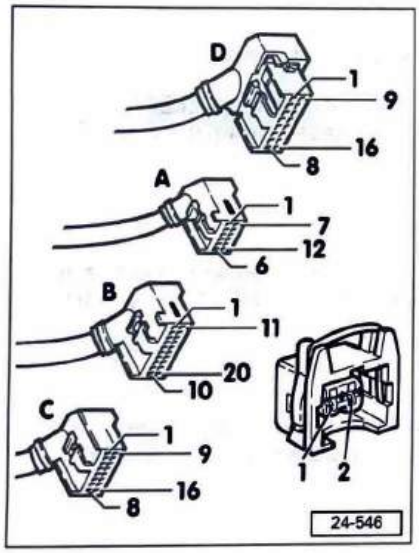


- Disconnect harness connector from EGR temperature sensor -G98-.

◄ - Connect multimeter (Fluke 83 or equivalent) for voltage measurement between two connector terminals using jumper wire from VW 1594 connector test kit.

- Switch ignition on.

  Specified value: 4.5–5.0 volts



If specified values are not obtained:

◄ - Locate break in wiring between EGR temperature sensor connector terminal 1 and terminal 7 of ECM connector B, as well as between connector terminal 2 and Ground (GND) according to wiring diagram, and repair as necessary.

Note:

Use only gold-plated terminals to repair terminals at the EGR temperature sensor connector.

If the specified reading is obtained:

- Disconnect multimeter and test harness from connector.
- Switch ignition off.
- Remove EGR temperature sensor -G98- from EGR valve.
- Switch multimeter to 200 kΩ resistance range and connect meter between EGR temperature sensor terminals using test harness.
- Place EGR temperature sensor in boiling water, 80°–100°C (176°–212°F), and measure resistance.

• Resistance value must change

If the resistance value does not change:

- Replace EGR temperature sensor.

Closed Throttle Position (CTP) switch, checking and adjusting

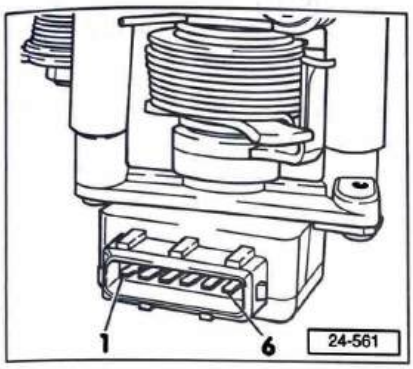
Note:

- *For functional testing of the CTP switch, see also Repair Group 01, "Read Measuring Value Block" function 08, display field 7.*
- *The CTP switch is an integral part of the Throttle Position (TP) sensor.*
- *Location of TP sensor ⇒ page 24-1.*

Test condition

- Adjustment of accelerator pedal cable OK

⇒ Repair Manual, *2.8 Liter V6, General, Engine*, Repair Group 20.



Electrical check

- Remove noise damper.
- Disconnect harness connector on throttle body.
- Switch multimeter (Fluke 83 or equivalent) to resistance range (Ω) and connect across terminals 4 and 6 using jumper cables from VW 1594 connector test kit.

  Specified value: 0 ohms (Ω) (continuity)

- Operate accelerator pedal to open throttle slightly.

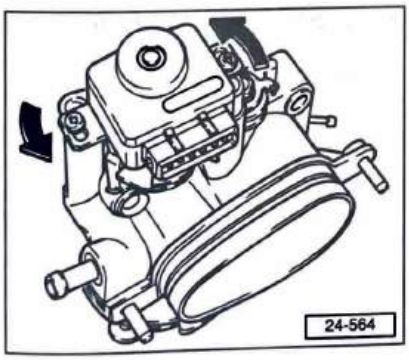
  Specified value: ∞ ohms (Ω) (no continuity)

If specified value is not obtained, or is only obtained after the throttle is opened more:

- Adjust CTP switch.

Note:

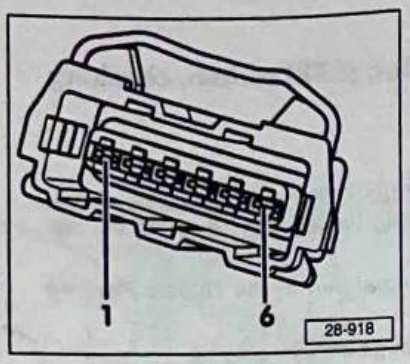
When installing the noise insulation, make sure noise insulation fits tightly on throttle body to prevent air leaks. Check the output voltage of the Mass Air Flow (MAF) sensor to be sure % Repair Group 01, "Basic Setting" function 04, display field 2.



Adjusting CTP switch

- Remove throttle body.
- Loosen both screws on throttle position sensor (arrows).
- Turn throttle position sensor in direction of arrow until stop is perceptible. Do not move throttle valve while turning TP sensor.
- Tighten throttle position sensor in this position.
- Check CTP switch again ⇒ page 24-53.
- Install throttle body and adjust accelerator pedal cable.

⇒ Repair Manual, *2.8 Liter V6 General, Engine*, Repair Group 20.



Checking wiring between ECM and CTP switch

◄ Terminal assignments for CTP switch and throttle position sensor connector.

- Connect VAG 1598 test box with adapter harness VAG 1598/11 to ECM wiring harness ⇒ Repair Group 01.

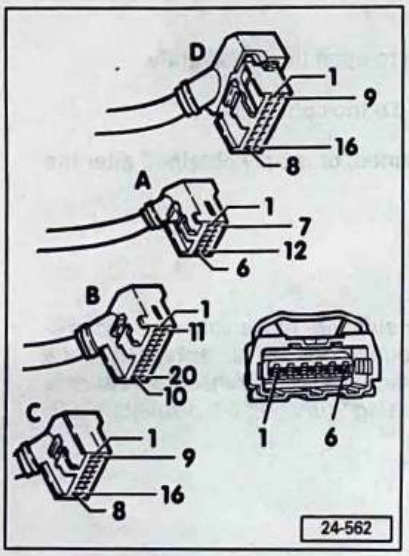
  (Adapter harness for ECM is not connected.)

- Check wiring for continuity and/or short circuit to positive (B+) between throttle position sensor connector Ground (GND) terminal 4 and GND connection on right engine compartment wiring harness.

  Specified value: maximum 1 ohm (Ω)

- Check wiring for open circuit or short circuit to ground between throttle position sensor connector terminal 6 and test box socket 49.

  Specified reading: maximum 1 ohm (Ω)



If specified values are not obtained:

◄ - Determine open and/or short circuit in wiring harness between 6-pin TP sensor connector in engine compartment and ECM connector A according to wiring diagram, and repair.

6-pin connector	ECM connector -A- or engine Ground
6	9
4	Ground (GND)

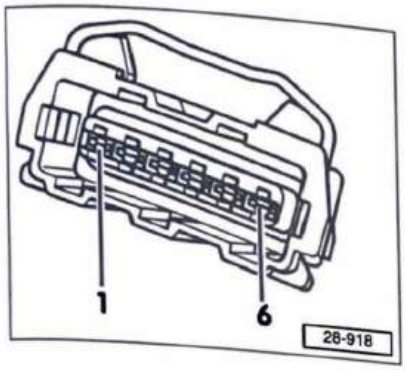
Note:

Use only gold-plated terminals to replace terminals on the TP sensor connector.

Throttle Position (TP) sensor, checking and adjusting

Note:

- *For functional testing of the TP sensor, see also Repair Group 01, "Basic Setting" function 04, display field 10.*
- *Installation location of throttle position sensor ⇒ page 24-1.*



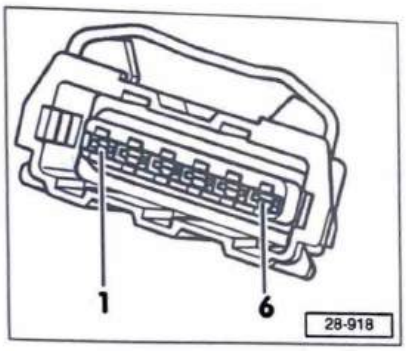
Checking battery positive voltage (B+) supply

- Disconnect harness connector from throttle position sensor.
- Switch ignition on.
- Connect multimeter to measure voltage between terminals 1 (positive) and 2 (Ground); then between terminals 1 (positive) and 3 (signal wire).

  Specified values: 4.5–5.5 volts (in each case)

If specified value is obtained:

- Check resistance of throttle position sensor ⇒ page 24-60.



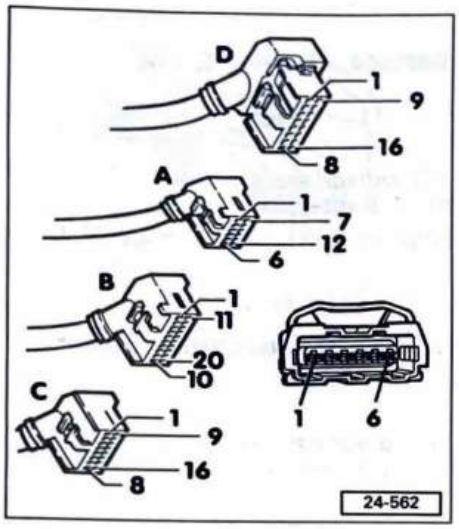
- If one of the specified values is not obtained, check wiring to ECM as follows:
- Connect VAG 1598 test box with VAG 1598/11 adapter harness to ECM ⇒ Repair Group 01.

  (Adapter harness for ECM is not connected.)
- Test for continuity between throttle position sensor Ground terminal 2 and test box socket 45.

  Specified value: maximum 1 ohm (Ω)
- Test for continuity between throttle position sensor positive terminal 1 and test box socket 46.

  Specified value: maximum 1 ohm (Ω)
- Test for continuity between throttle position sensor signal wire terminal 3 and test box socket 47.

  Specified value: maximum 1 ohm (Ω)



If specifications are not achieved:

- Determine open and/or short circuit in wiring harness between 6-pin TP sensor connector in engine compartment and ECM connector -A- according to wiring diagram, and repair as necessary.

6-pin connector	ECM connector -A-
1	6
3	7
2	Ground (GND)

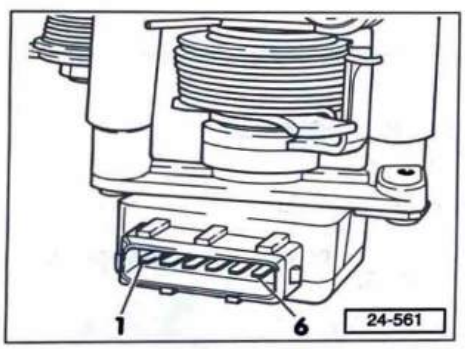
Note:

Use only gold-plated terminals for repairing terminals in the terminal connector for throttle position sensor.

- Check and erase Diagnostic Trouble Code (DTC) memory ⇒ Repair Group 01.

If there is no malfunction in wiring harness or connections:

- Replace ECM ⇒ page 01-79.



Checking TP sensor resistance

- Disconnect harness connector at throttle position sensor.
- Connect multimeter (Fluke 83 or equivalent) to terminals 1 and 2.

  Specified value: 1500–2600 ohms (Ω)

- Connect multimeter to terminals 2 and 3.

  Closed throttle position: approx. 750–1300 ohms (Ω)

- Slowly operate accelerator pedal fully.

  Wide open throttle: maximum 3600 ohms (Ω)

If either specification is not achieved:

- Replace throttle position sensor.
- Check and erase Diagnostic Trouble Code (DTC) memory ⇒ Repair Group 01.

Adjusting TP sensor

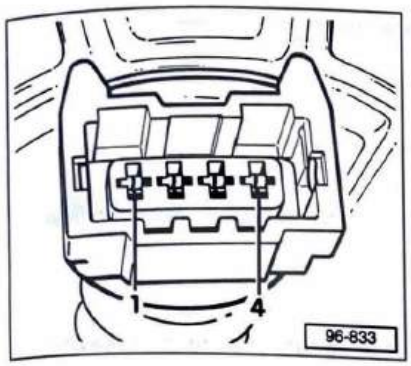
If the setting of the closed throttle position switch is adjusted, the throttle position sensor is automatically adjusted as well.

Adjusting closed throttle position switch ⇒ page 24-54.

Mass Air Flow (MAF) sensor and CO Fuel Trim (FT) potentiometer, checking

Location ⇒ page 24-5, item -19-

- MAF sensor circuit breaker -S74- OK (location: black holder in electronics box, passenger side footwell)



Checking battery positive voltage (B+) supply

- Disconnect harness connector from MAF sensor.
- Connect multimeter (Fluke 83 or equivalent) between terminals 2 and 3 using adapters from VW 1594 connector test kit.
- Switch ignition on.

  Specified reading: approx. 12–14 volts

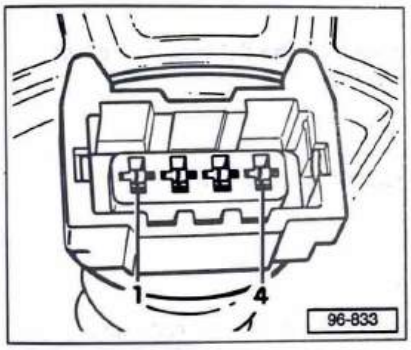
If the specified reading is not obtained:

- Check MAF sensor circuit breaker -S74- (black holder in electronics box, passenger side footwell).
- Check continuity between connector terminal 3 and circuit breaker using wiring diagram.

  Specified reading: maximum 0.5 ohms (Ω)

- Check continuity between terminal 2 and Ground (GND)

  Specified reading: maximum 0.5 ohms (Ω)



Checking signal wires

- Connect VAG 1598 test box with VAG 1598/11 adapter harness to wiring harness to ECM ⇒ see Repair Group 01.

  (Adapter harness for ECM is not connected.)

- Check for continuity between ground wire from MAF sensor connector terminal 2 and test box socket 45.

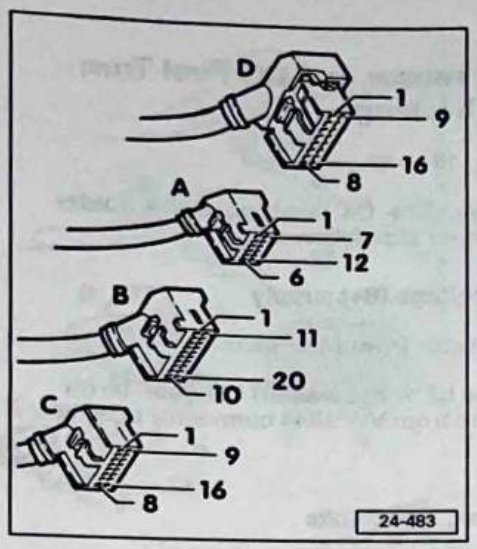
  Specified value: maximum 1 ohm (Ω)

- Check continuity of signal wire for MAF sensor between connector terminal 1 and test box socket 42.

  Specified value: maximum 1 ohm (Ω)

- Check continuity of signal wire (for CO fuel trim potentiometer) between MAF sensor connector terminal 4 and test box socket 41.

  Specified value: maximum 1 ohm (Ω)



- If specified values are not obtained:

- Repair break in wiring and/or short between MAF sensor connector and ECM connector A.

MAF sensor connector	ECM connector -A-
1	2
2	5
4	1

Note:

Use only gold-plated terminals when replacing mass air flow sensor connector terminals.

Checking function

- Push back protective boot on MAF sensor connector (leaving sensor connected).

Note:

The connector terminals are marked accordingly on the back of the connector.

- Switch ignition on.

- Connect multimeter (Fluke 83 or equivalent) between connector terminals 2 and 4 using adapter cables from VW 1594 connector test kit.

  Specified reading: approx. 1.0–7.5 volts

If the specified value is not obtained, the CO fuel trim potentiometer in the mass air flow sensor is faulty:

- Replace mass air flow sensor.

- Connect multimeter between terminals 2 and 1.

- Switch ignition on.

  Specification: 0.3–1.1 volts

- Run engine, switch off all electrical consumers (radiator cooling fan must not run) and alternate engine speed continuously between idle speed and 4000 RPM.

  Specified reading: voltage alternating between 1.5 and maximum 3.4 volts depending on engine speed.

If the specified values are not obtained:

- Replace mass air flow sensor.

Intake manifold change-over function, checking

Carry out this test only when there are performance complaints. The change-over of the intake manifold from long to short intake path occurs at approx. 4000 RPM.

Checking function

- Increase engine speed to over 4000 RPM.

- Vacuum unit for intake manifold change-over valve must operate (location: on left rear of compound intake manifold)

If the change-over does not occur, perform the following tests:

- Use On Board Diagnostic (OBD) output diagnostic test mode (DTM) to activate fuel pump relay -J17- ⇒ Repair Group 01.

- Check operation of intake manifold change-over valve during On Board Diagnostic (OBD) output diagnostic test mode (DTM) ⇒ Repair Group 01. If necessary check valve and actuation ⇒ page 24-45.

- Check to make sure vacuum reservoir and lines are free of leaks and restrictions ⇒ page 24-67.

- Check vacuum hoses for correct connection ⇒ page 24-87.

- Check mechanical action of intake manifold change-over valve for ease of movement (operate rods by hand).

- Switch ignition off.

- Disconnect vacuum hoses from intake manifold change-over valve vacuum unit.

- Connect hand pump US 8026 to vacuum unit.

- Operate hand pump to apply vacuum, and observe change-over process.

- Check vacuum unit for leaks.

- The vacuum unit must not return to its original position as long as vacuum is maintained.

- If necessary, replace vacuum unit.

If no malfunctions were determined in the previous tests:

- Disconnect harness connector from valve and connect valve terminals to battery positive voltage (B+) and Ground (–) using adapter cables from VW 1594 connector test kit (if necessary, remove valve).

- Valve must be clear (detach vacuum lines and blow through)

- If necessary, replace intake manifold change-over valve.

Checking vacuum system

- Let engine idle 2–3 minutes (to fill vacuum reservoir).
- Switch ignition off.
- Disconnect harness connector (2-pin) from intake manifold change-over valve.
- Connect one terminal of valve to Ground (GND) using harness and clip from VW 1594 connector test kit.
- Connect second terminal of valve to battery positive voltage (B+) using remote control VAG 1348/3A, adapter harness VAG 1348/32 and adapter cable.
- Operate remote control VAG 1348/3A approx. 2–3 minutes.

• Vacuum unit must remain activated

A/C compressor ON signal, checking

The A/C compressor ON signal increases the basic value for the Idle Air Control (IAC) valve, ensuring that idle speed remains in the center of the control map range.

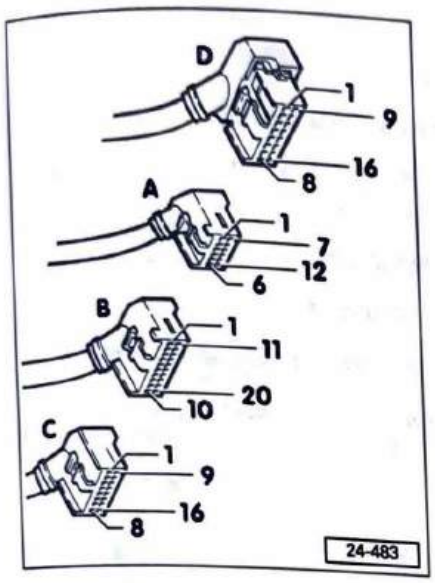
- Initiate engine "Basic Setting" function 04 with VAG 1551 scan tool ⇒ Repair Group 01.
- Switch A/C on (press A/C button on manual A/C, or press "AUTO", "HI" temperature and "HI" blower speed buttons on automatic systems).

• The value in display field 7 must increase by at least 64 when the A/C is switched on.

If the displayed value does not change:

- Switch ignition off.
- Connect VAG 1598 test box to ECM using adapter harness VAG 1598/11 ⇒ Repair Group 01.
- Connect VAG 1527B voltage tester between test box sockets 11 and 45 (Ground).
- Switch ignition on.
- Switch A/C on, as described above.

• LED must light up



If LED does not light up:

- Disconnect harness connector -C- from ECM.

If LED now lights up:

- Replace ECM.

If LED does not light up:

- Check continuity of wiring and/or short circuit using wiring diagram as follows:

For manual A/C:

- Check wiring connection between ECM harness connector C terminal 11 and A/C switch -E30-.

For automatic A/C:

- Check wiring harness between ECM connector C terminal 11 and A/C control head -E87-.

- If wiring is not faulty, check the A/C system.
⇒ Repair Manual, *Heating & Air Conditioning*, Repair Group 87

A/C compressor cut-out, checking

During acceleration from a stop and from low speed, the A/C compressor is switched off for approx. 12 seconds. If the accelerator pedal is released sooner, the time decreases to a minimum of 3 seconds.

Test conditions

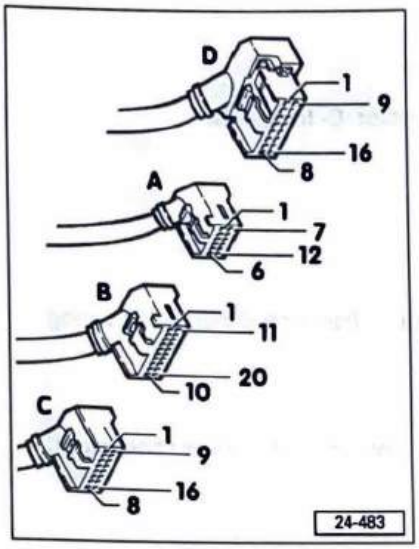
- A/C function OK
- No codes stored in DTC memory
- Vehicle at room temperature, i.e. warmer than 15°C (59°F)

- Start engine and let idle.
- Switch A/C on (manual A/C) or, with automatic A/C, press buttons "AUTO", temperature "LO" and blower speed "HI."

- Compressor symbol must light up
- A/C compressor must run

- Using VAG 1551 scan tool, initiate "Basic Setting" function 04, display group 000 ⇒ Repair Group 01.

- A/C compressor must stop (check visually)



If A/C compressor does not stop:

- Switch A/C off, let engine continue to idle.
- Using VAG 1551 scan tool, initiate "Read Measuring Value Block" function 08 ⇒ Repair Group 01.
- Switch A/C on as described above.

"116" should be shown in display field 7.

◄ If "116" is not displayed, these malfunctions are possible:

- Closed throttle position switch not connected (throttle linkage does not return completely to closed throttle position)
- A/C settings incorrect
- Automatic transmission drive range selected

If "116" is not displayed and none of the malfunctions listed above are detected:

- Check continuity of wiring and/or short circuit using wiring diagram as follows:

For manual A/C:

- Check wiring between ECM connector C terminal 10 and A/C clutch control module -J153-.

For automatic A/C:

- Check wiring between ECM connector C terminal 10 and A/C control head -E87-.
- If no malfunctions are found in wiring, check A/C
⇒ Repair Manual *Heating & Air Conditioning*, Repair Group 87

If "116" is displayed:

- Briefly accelerate fully (quickly).

- The displayed value must briefly drop to 68 and rise again to 84 after accelerator pedal is released
- "116" must be displayed again several seconds later

If the values change as described:

- Check whether compressor is switched off when depressing accelerator pedal suddenly (visual inspection).
- If the compressor is not switched off:
- Check A/C.
⇒ Repair Manual *Heating & Air Conditioning*, Repair Group 87

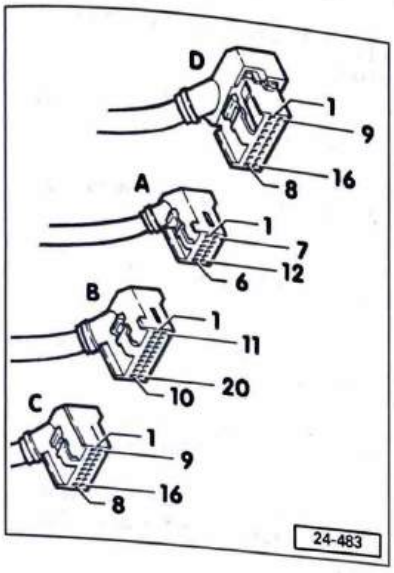
If the values do not change as described:

- Replace ECM.

Tachometer activation, checking

Note:

- *Carry out this test only if the tachometer in the instrument cluster does not produce a reading.*
- *The tachometer is activated by the Engine Control Module (ECM).*



- Connect VAG 1598 test box to ECM using VAG 1598/11 adapter harness ⇒ Repair Group 01.
- Check engine speed with VAG 1367 tester according to operating instructions. The signal wire (green terminal) is connected to test box socket 30 (use VW 1594 connector test kit).
- Start engine and let idle.

• Engine RPM must be displayed on VAG 1367

If YES:

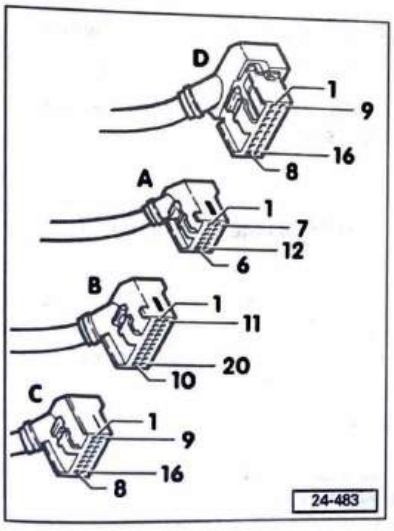
- Switch ignition off and remove instrument cluster and automatic Transmission Control Module (TCM) -J217-.

◄ - Check wiring harness for continuity between ECM connector B terminal 10 and instrument cluster, as well as TCM -J217-, using wiring diagram.

- If there is no open circuit, eliminate malfunction in instrument cluster, see wiring diagrams and/or check TCM -J217- ⇒ Repair Manual, *Automatic Transmission 097/01F/01K.*

If engine RPM is NOT displayed:

- Stop engine (switch ignition off), remove instrument cluster and TCM -J217- in succession and disconnect harness connectors one after another.
- Start engine and let idle.
- If engine RPM now displayed on VAG 1367, malfunction is in instrument cluster. See wiring diagrams, and/or check TCM -J217- ⇒ Repair Manual, *Automatic Transmission 097/01F/01K.*



◄ If engine RPM is still not displayed on VAG 1367:

- Check wiring for short circuit to positive or short circuit to ground between ECM connector B, terminal 10 and instrument cluster, as well as TCM -J217- using wiring diagram.

If there is no short circuit, but engine speed (RPM) is not displayed:

- Replace ECM ⇒ Repair Group 01.

Board computer activation (fuel consumption display), checking

Note:

Carry out this test only if a missing or incorrect consumption signal is determined from the board computer test.

- Connect VAG 1598 test box to ECM using VAG 1598/11 adapter harness ⇒ Repair Group 01.

- Connect multimeter (Fluke 83 or equivalent) between test box sockets 45 (GND) and 31 (signal).

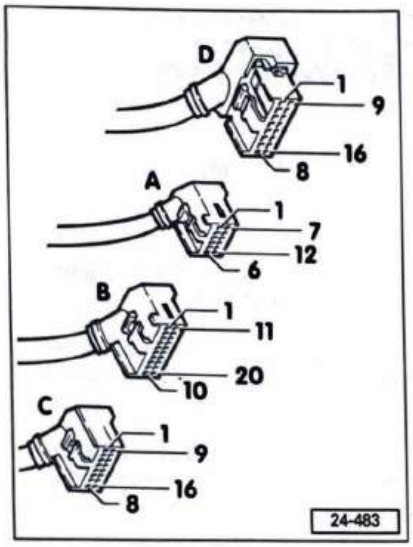
- Start engine and alternate speed continuously between 1000 and 4000 RPM.

  Specified reading: approx. 0.3–6.0 volts (depending on engine speed).

If the specified values are obtained even though the board computer does not display a fuel consumption value:

- Stop engine (switch ignition off) and remove instrument cluster and Transmission Control Module (TCM) -J217-.

- Check continuity in wiring between ECM connector B terminal 11 and black 10-pin board computer connector, as well as TCM -J217-, using wiring diagram.



- If wiring is OK, eliminate malfunction in instrument cluster and/or display unit for board computer. See wiring diagrams and/or check TCM -J217- ⇒ Repair Manual, *Automatic Transmission 097/01F/01K.*

If specified values are not obtained:

- Stop engine (switch ignition off) and remove instrument cluster and/or TCM -J217- in succession.

- Disconnect black 10-pin board computer connector, and connector for TCM -J217- in succession.

- Start engine and let idle.

  Specified value: approx. 0.3–0.6 volts (depending on engine speed).

- If specified values are obtained now, board computer and/or TCM -J217- has a malfunction. See wiring diagrams and/or check TCM ⇒ Repair Manual, *Automatic Transmission 097/01F/01K*

If specified values are still not obtained:

- Check wiring for short circuit to positive or short circuit to Ground (GND) between ECM and 10-pin connector, as well as connector of TCM -J217-, using the wiring diagram.

If there is no short circuit, but the specified values are still not obtained:

- Replace Engine Control Module (ECM).

Vehicle speed signal, checking

- Speed display in instrument cluster OK

– Switch ignition on.

Note:

See Repair Group 01, "Read Individual Measuring Value" function 09, channel 15

– Lift left front of vehicle until wheel is raised off of floor.

– Rotate left front wheel by hand.

- Speed must be displayed on VAG 1551 scan tool

If NO speed is displayed:

– Switch ignition off and connect VAG 1598 test box with VAG 1598/11 adapter harness to ECM ⇒ Repair Group 01.

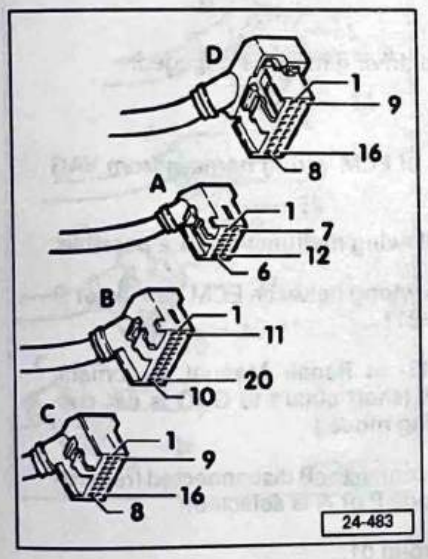
(Adapter harness for ECM connector B is not connected.)

– Connect VAG 1527B voltage tester across test box sockets 29 (signal) and 40 (positive).

– Switch ignition on.

- LED lights up at approx. half light intensity

– Turn left front wheel by hand.



- LED lights up brighter and begins blinking

If LED does not light up and blink:

– Check wiring for continuity between test box socket 29 and instrument cluster, using wiring diagram.

◄ – If necessary, eliminate break in wiring between ECM connector B terminal 9 and instrument cluster.

– If wiring is OK, continue troubleshooting ⇒ "Vehicle Speed Signal" in Audi *Electrical Troubleshooting Manual.*

If LED lights up and blinks:

– Switch ignition off and connect connector -B- of VAG 1598/11 adapter harness to ECM.

– If necessary, re-connect LED voltage tester to test box sockets 29 (signal) and 40 (positive).

– Switch ignition on.

- LED must light up at approx. half light intensity

– Turn left front wheel slowly by hand.

- LED must light up brighter and begin blinking

If NOT, even though no malfunction was found with connector -B- not connected to ECM:

– Replace ECM.

Wiring connections to Transmission Control Module (TCM), checking

Checking input signal for selector lever position

By using this signal, idle speed is reduced by about 50 RPM when a driving mode is selected.

- Engine Control Module (ECM) coding OK ⇒ Repair Group 01

– Switch ignition on.

– Using VAG 1551 scan tool, initiate "Read Measuring Value Block" function 08 ⇒ Repair Group 01.

- The value in display field 7 must decrease by 4 when a driving mode is selected.

– Press → button.

– Press -0- and -6- buttons to select "End Output" function 06.

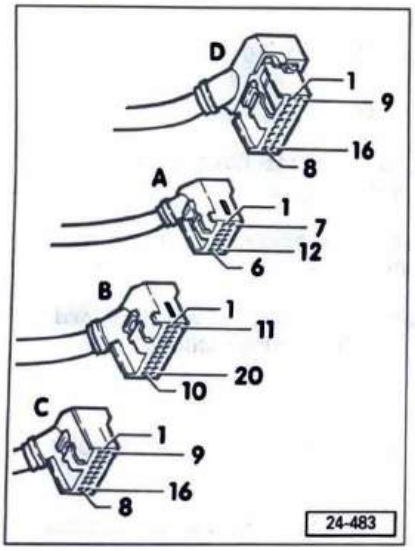
– Press -Q- button to confirm input.

If the display does not change even though coding is correct:

– Connect VAG 1598 test box with VAG 1598/11 adapter harness to ECM ⇒ Repair Group 01.

- Connector D of wiring harness must be connected to ECM.

– Connect VAG 1527B voltage tester to test box sockets 32 and 45 (Ground).



– Switch ignition on.

- LED must light up when a driving mode is engaged.

If LED does not light up:

◄ – Disconnect connector -B- of ECM wiring harness from VAG 1598/11 adapter harness.

If LED lights up now, the following malfunctions are possible:

♦ Short to Ground (GND) in wiring between ECM connector B terminal 12 and to TCM -J217-.

♦ Malfunction in TCM -J217- ⇒ Repair Manual, *Automatic Transmission 097/01F/01K* (short circuit to GND is not corrected by selecting a driving mode.)

If LED does not light up with connector B disconnected (regardless of whether a driving mode P or N is selected):

– Replace ECM ⇒ Repair Group 01.

If LED lights up when connector B is connected and does not go out when selecting a gear, these malfunctions are possible:

♦ Break in wiring between ECM connector B terminal 12 and TCM -J217-.

♦ Malfunction in TCM -J217- (no short circuit to GND in P or N).

– If necessary, check and repair wiring using wiring diagram and check TCM or shift lock solenoid.

Checking input signal for shifting

This signal retards the ignition timing briefly while changing gear in order to reduce shift force.

> ***WARNING!***
>
> ***This test can be carried out only during a road test with help from a second technician.***

- Engine Control Module (ECM) coding OK ⇒ Repair Group 01, *Code Control Module*

– Read measuring value block (VAG 1551 function 08), display group 000 during the road test ⇒ Repair Group 01.

- Value in display field 7 must be briefly increased by 2 while shifting

If the display does not change even though coding is correct, perform following tests on a stationary vehicle:

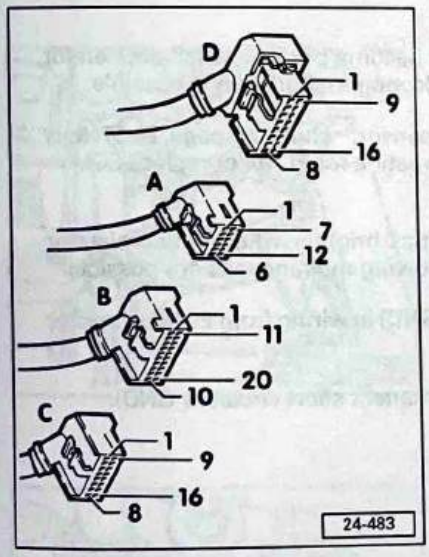
– Connect VAG 1598 test box to ECM using VAG 1598/11 adapter harness ⇒ Repair Group 01.

- Connector D of wiring harness must be connected to ECM

– Connect VAG 1527B voltage tester to test box sockets 33 and 45 (Ground).

– Switch ignition on.

- LED must light up



If LED does NOT light up:

– Separate ECM harness connector B from VAG 1598/11.

If LED now lights up, the following malfunctions are possible:

◄ ♦ Short circuit to Ground (GND) in wiring between ECM connector B terminal 13 and TCM.

♦ Malfunction in TCM (permanent short circuit to GND)

If LED does NOT light up when connector -B- is disconnected:

– Replace ECM ⇒ Repair Group 01.

If LED lights up when connector -B- re-connected:

– Bridge test box sockets 33 and 45 for approx. 2 to 3 seconds.

- Value in display field 7 must be briefly increased by 2

If the display does NOT change:

– Replace ECM ⇒ Repair Group 01.

If the value in display field 7 changes, the following malfunctions are possible:

♦ Open circuit between ECM connector B terminal 13 and TCM.

♦ Malfunction in TCM (no short circuit to GND when shifting).

– If necessary, check and repair wiring break using wiring diagram, or check TCM.

Throttle Position (TP) sensor output signal, checking

This signal is also used as a load signal for other control modules (e.g. automatic transmission). Carry out this test only if the output signal is actually used for applications other than the engine control module.

- Connect VAG 1598 test box with VAG 1598/11 adapter harness to ECM ⇒ Repair Group 01.

• Connector D of wiring harness must be connected to ECM

- Connect VAG 1527B voltage tester between test box sockets 28 and 45.

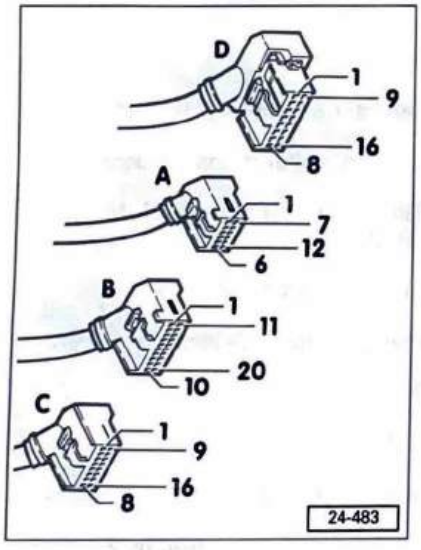
- Switch ignition on.

• LED must light up weakly in closed throttle position, and become brighter when accelerator pedal is depressed.

If LED does not light up and does not become brighter:

- Disconnect connector -B- of ECM wiring harness from VAG 1598/11 adapter harness.

  Connector B from VAG 1598/11 remains connected to ECM.



If LED does not light up or become brighter when accelerator pedal is depressed, the following malfunction is possible:

♦ Faulty throttle position sensor; check ⇒ page 24-57 (this means lack of input information for ECM), or replace ECM ⇒ Repair Group 01.

If LED lights up and becomes brighter when the accelerator pedal is depressed, the following malfunctions are possible:

◄

♦ Short circuit to Ground (GND) in wiring from ECM connector terminal 8 to TCM.

♦ Malfunction in TCM (permanent short circuit to GND).

Kickdown switch, checking and adjusting

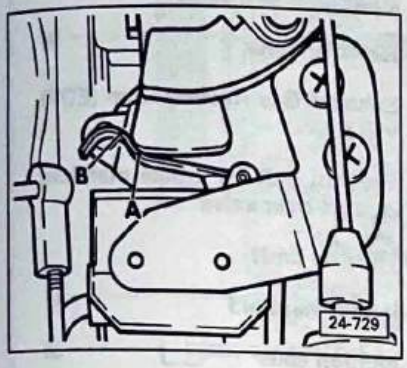
Location: on throttle body assembly ⇒ page 24-10.

Checking kickdown switch ⇒ Repair Manual, *Automatic Transmission 097/01F/01K*, Repair Group 01.

Checking function

- Remove noise insulation.
- Disconnect 2-pin kickdown switch connector.
- Connect multimeter (Fluke 83 or equivalent) to kickdown switch connector terminals 1 and 2 using adapter cables from VW 1594 connector test kit.

  Specified value: infinite ohms (∞Ω)

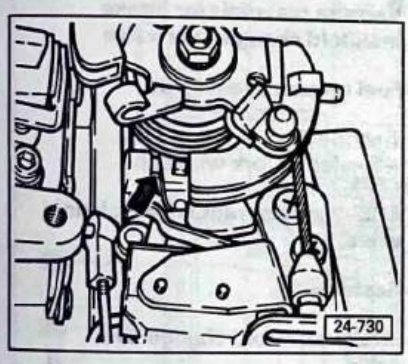


◄ - Slowly depress accelerator pedal.

- Kickdown switch must be switched between points A and B.

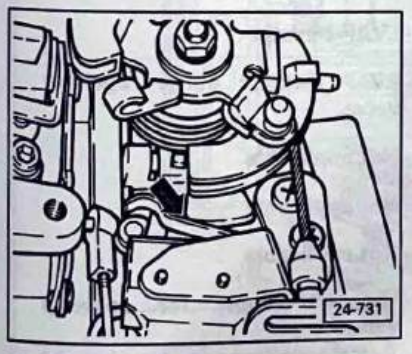
  Specified value: 0 ohms (Ω)

If switching point of the kickdown switch does not lie within range between A and B, adjust kickdown switch as follows:



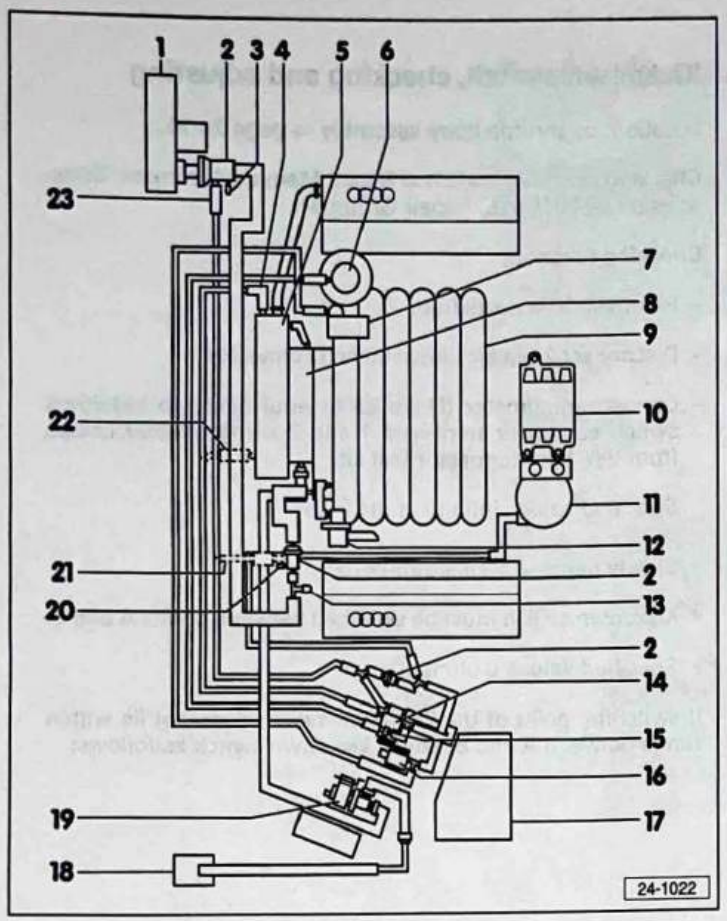
- Loosen kickdown switch mounting screws.

◄ - Press throttle lever by hand against wide open throttle stop (arrow).



◄ - Adjust kickdown switch so that kickdown switch lever rests on throttle cam (arrow).

- Tighten mounting screws and secure with paint seal.



Vacuum system, connection diagrams

Manual transmission vehicles with EVAP system and Exhaust Gas Recirculation (EGR)

1 - Vacuum brake booster

2 - Check valve

3 - Vacuum connection for A/C and/or differential lock

4 - Vent line from Exhaust Gas Recirculation (EGR) valve

5 - Noise damper

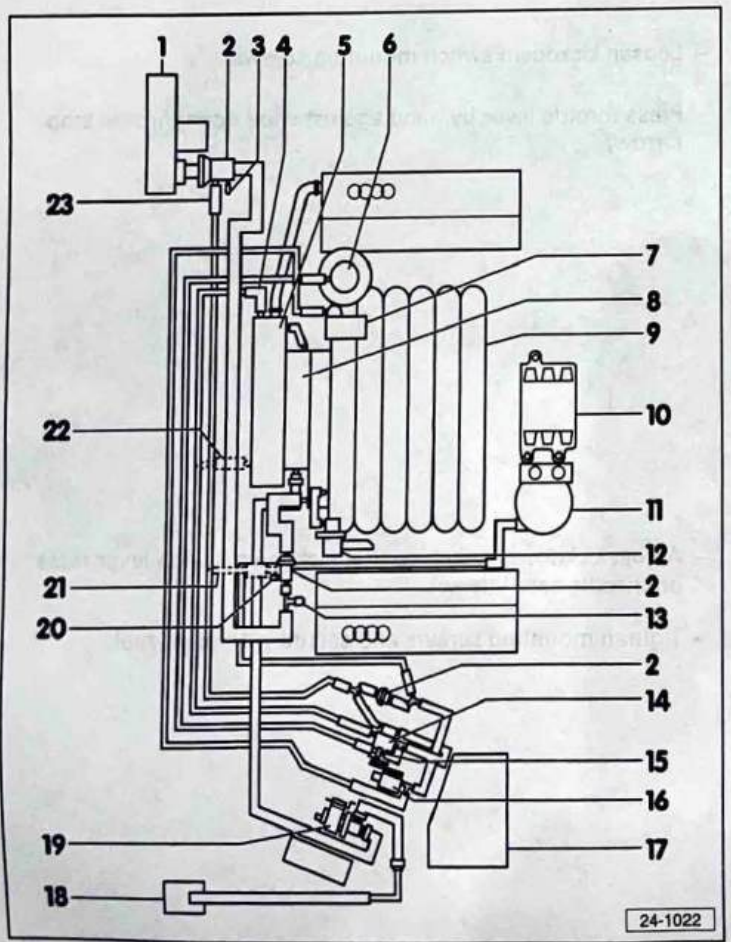
6 - Exhaust Gas Recirculation (EGR) valve

7 - Vacuum unit for intake manifold change-over valve

8 - Throttle body

9 - Intake manifold

10 - Ignition coils



11 - Vacuum reservoir for intake manifold change-over valve

12 - Fuel pressure regulator

13 - T-connector
♦ Sealed at fork with cap

14 - EGR vacuum regulator solenoid valve

15 - Restrictor

16 - Intake manifold change-over valve

17 - Air cleaner

18 - EVAP canister

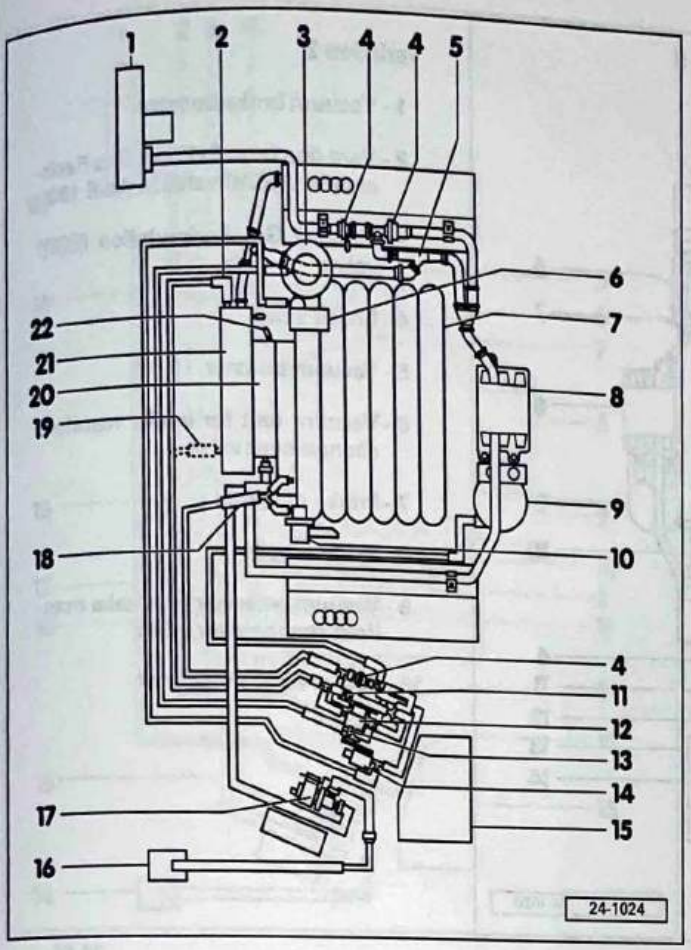
19 - EVAP canister purge regulator valve

20 - Not applicable

21 - Not applicable

22 - Not applicable

23 - Vacuum supply for solenoid valves



Automatic transmission vehicles with EVAP system and EGR

On automatic transmission vehicles with EVAP and EGR there are two system variations. Also ⇒ page 24-91.

Variation 1

1 - Vacuum brake booster

2 - Vent line from EGR solenoid valve

3 - Exhaust Gas Recirculation (EGR) valve

4 - Check valve

5 - Vacuum booster

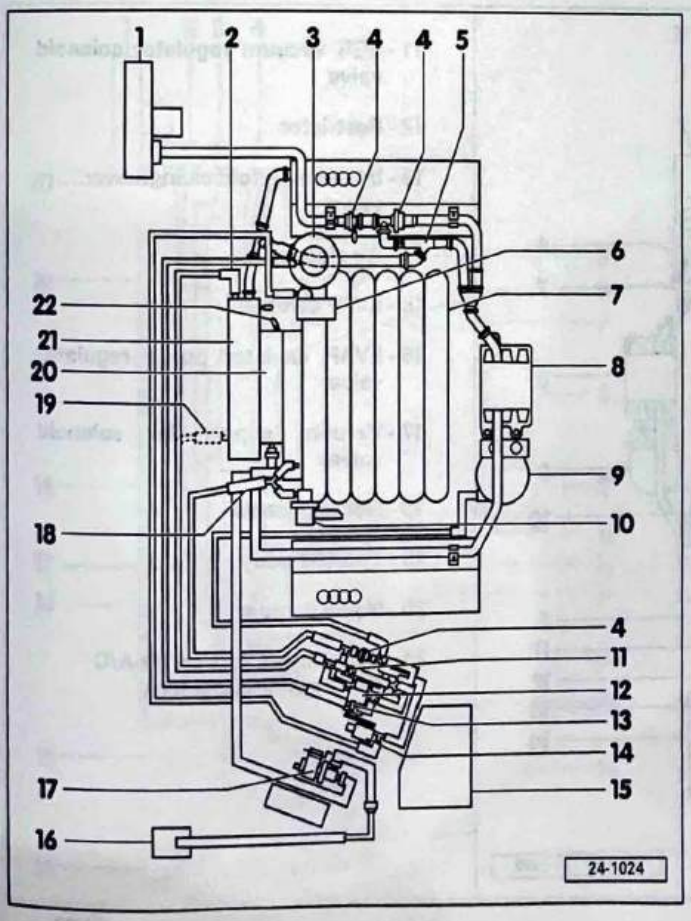
6 - Vacuum unit for intake manifold change-over

7 - Intake manifold

8 - Ignition coils

9 - Vacuum reservoir for intake manifold change-over valve

10 - Fuel pressure regulator



11 - Restrictor 1

12 - EGR vacuum regulator solenoid valve

13 - Restrictor 2

14 - Solenoid valve for intake manifold change-over valve

15 - Air cleaner

16 - EVAP canister

17 - EVAP canister purge regulator valve

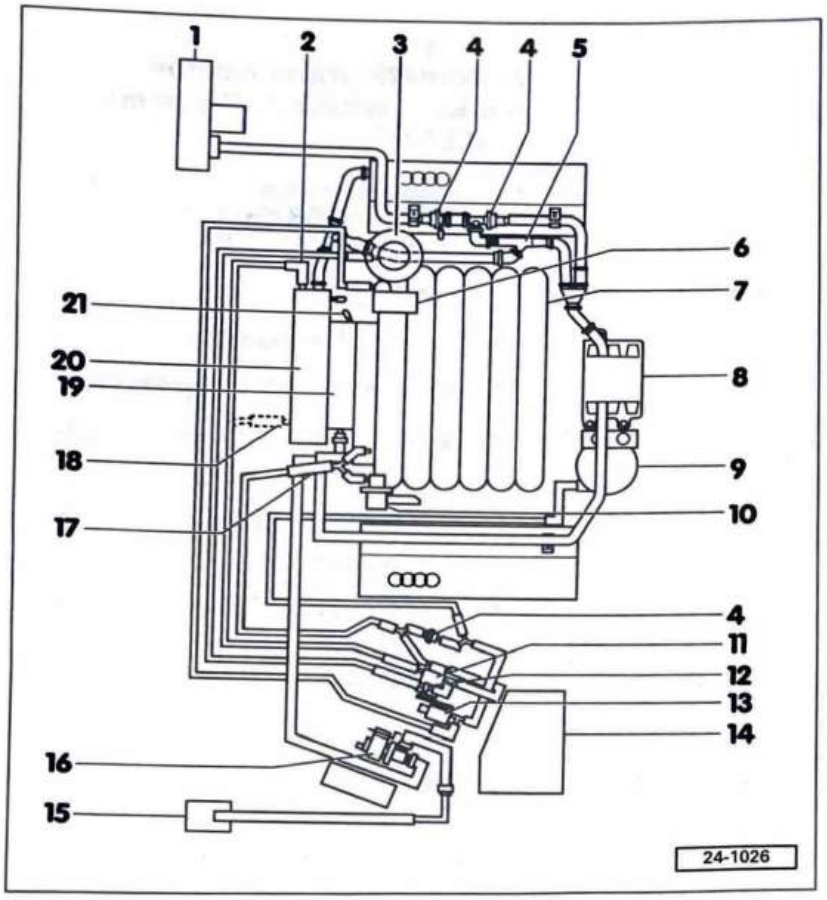
18 - Vacuum supply for solenoid valves

19 - Vent line from EGR vacuum regulator solenoid valve

20 - Throttle body

21 - Noise damper

22 - Vacuum connection for A/C and/or differential lock



Variation 2

1 - Vacuum brake booster

2 - Vent line from Exhaust Gas Recirculation (EGR) valve in Audi 100

3 - Exhaust Gas Recirculation (EGR) valve

4 - Check valve

5 - Vacuum booster

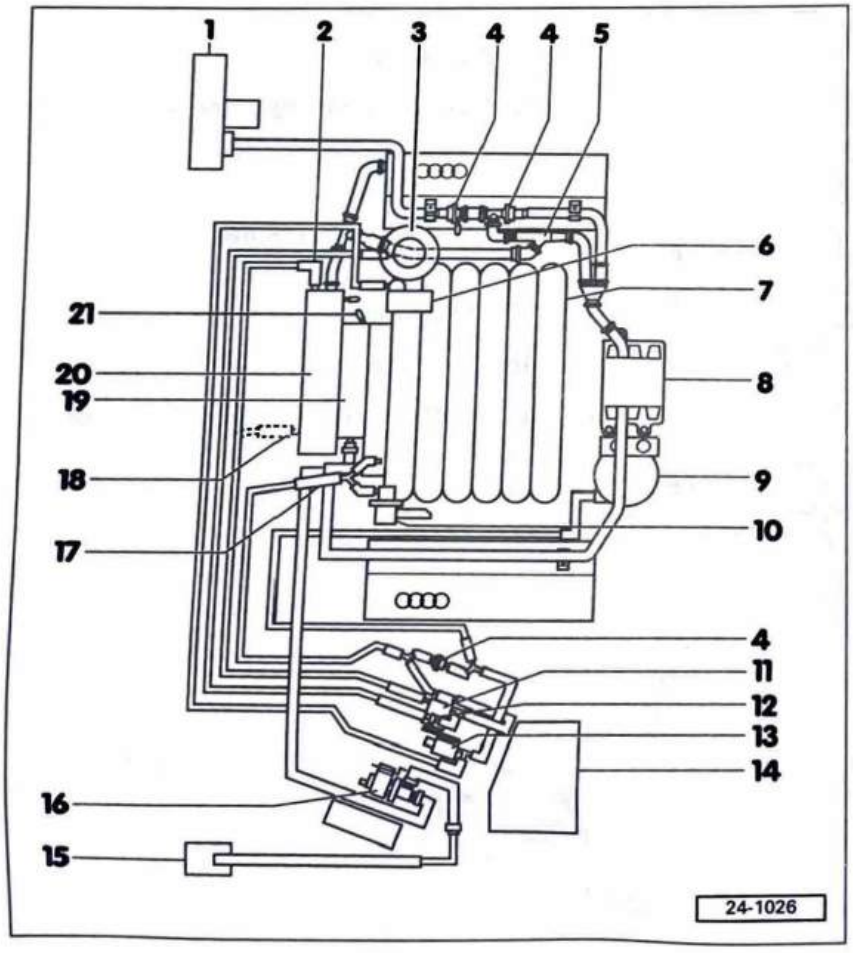
6 - Vacuum unit for intake manifold change-over valve

7 - Intake manifold

8 - Ignition coils

9 - Vacuum reservoir for intake manifold change-over valve

10 - Fuel pressure regulator



11 - EGR vacuum regulator solenoid valve

12 - Restrictor

13 - Intake manifold change-over valve

14 - Air cleaner

15 - EVAP canister

16 - EVAP canister purge regulator valve

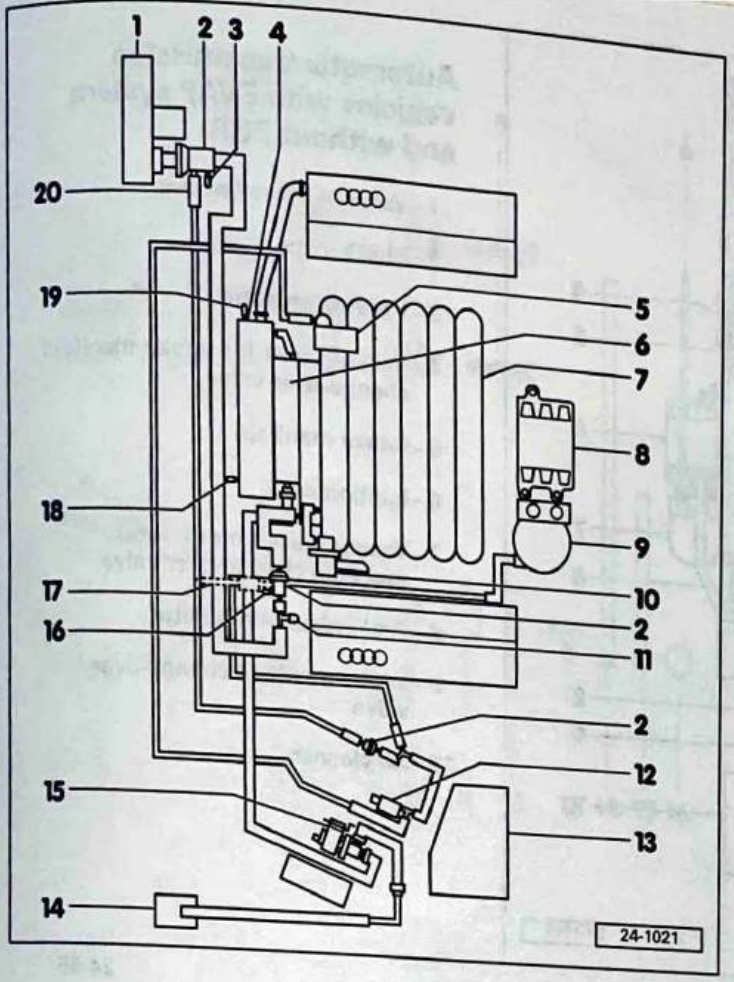
17 - Vacuum supply for solenoid valves

18 - Not applicable

19 - Throttle body

20 - Noise damper

21 - Vacuum connection for A/C and/or differential lock



Manual transmission vehicles with EVAP system, and without EGR

1 - Vacuum brake booster

2 - Check valve

3 - Vacuum connection for A/C and/or differential lock

4 - Noise damper

5 - Vacuum unit for intake manifold change-over valve

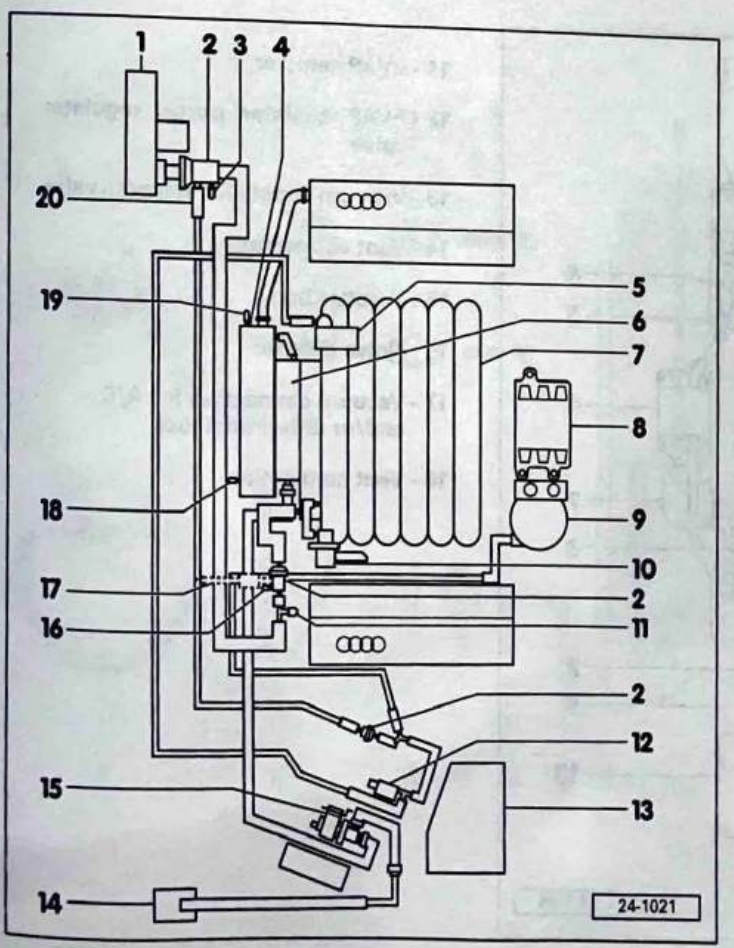
6 - Throttle body

7 - Intake manifold

8 - Ignition coils

9 - Vacuum reservoir for intake manifold change-over valve

10 - Fuel pressure regulator



11 - T-connector
- ♦ Connected at fork with sealing caps

12 - Intake manifold change-over valve

13 - Air cleaner

14 - EVAP canister

15 - EVAP canister purge regulator valve

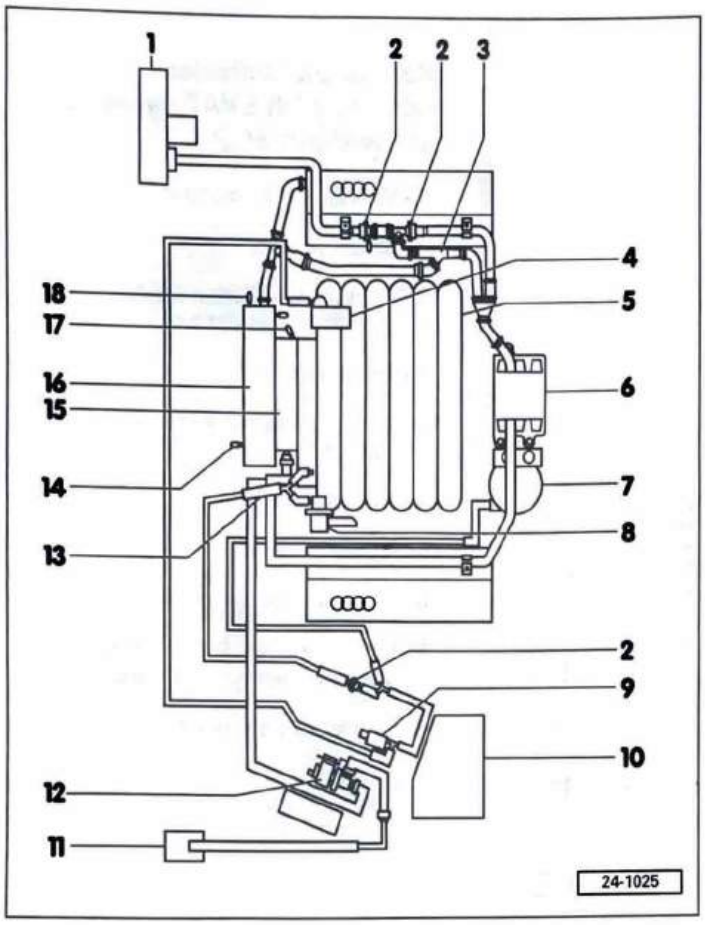
16 - Not applicable

17 - Not applicable

18 - Not applicable

19 - Not applicable

20 - Vacuum supply for solenoid valves



Automatic transmission vehicles with EVAP system and without EGR

1 - Vacuum brake booster

2 - Check valve

3 - Vacuum amplifier

4 - Vacuum unit for intake manifold change-over valve

5 - Intake manifold

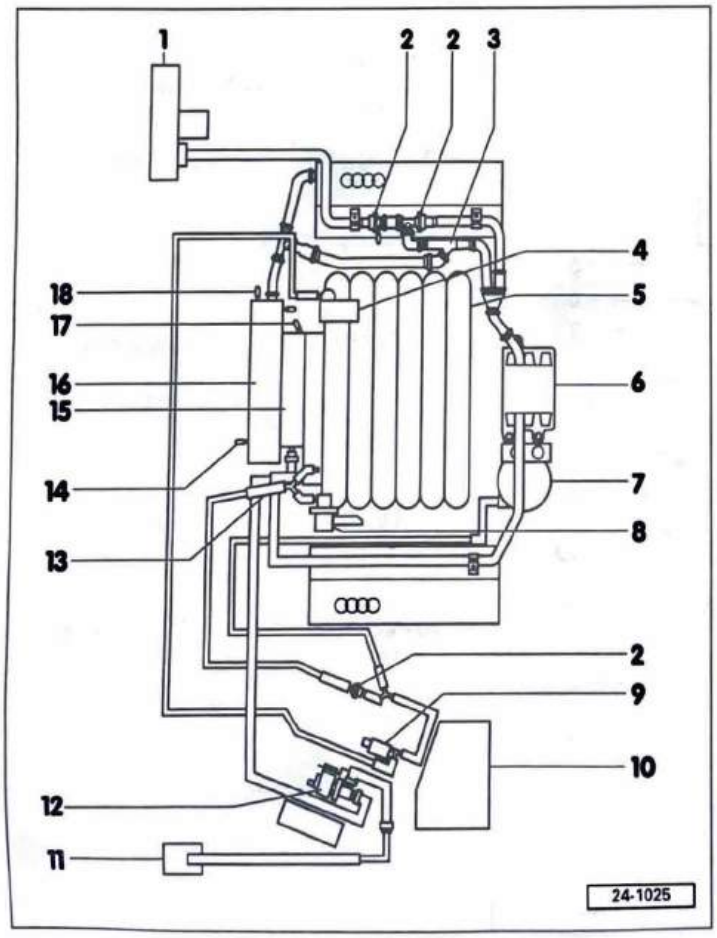
6 - Ignition coils

7 - Vacuum reservoir for intake manifold change-over valve

8 - Fuel pressure regulator

9 - Intake manifold change-over valve

10 - Air cleaner



11 - EVAP canister

12 - EVAP canister purge regulator valve

13 - Vacuum supply for solenoid valve

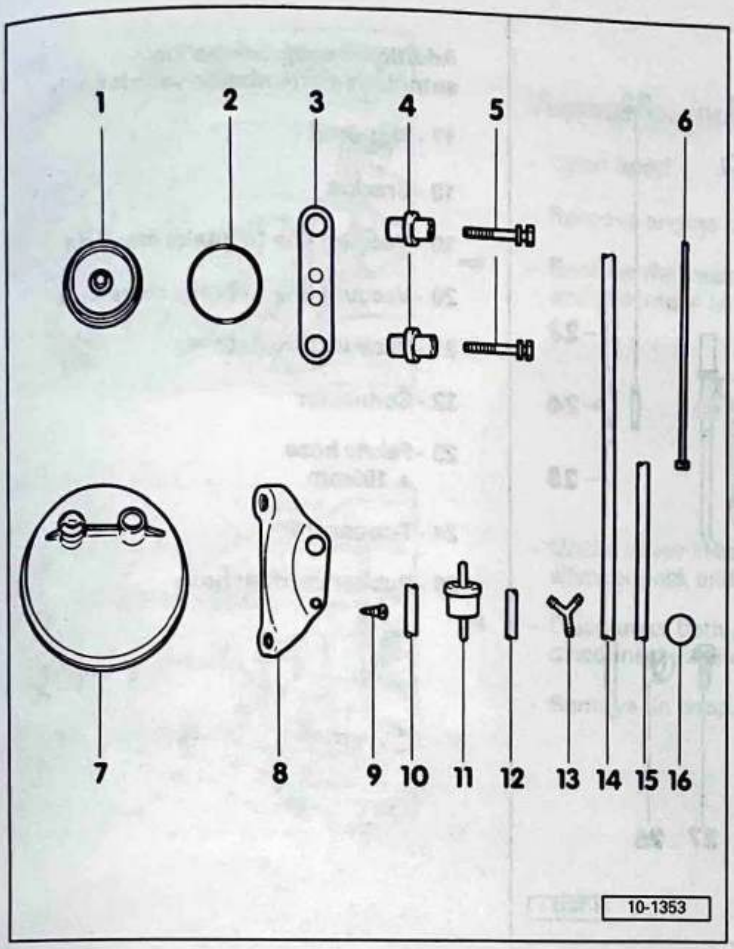
14 - Vent connection

15 - Throttle body

16 - Noise damper

17 - Vacuum connection for A/C and/or differential lock

18 - Vent connection



Vacuum system modification, replacing vacuum pump with vacuum booster

The following three parts are not shown in the illustration:

- Oil filter
- Oil pan gasket, lower section
- Oil pan drain plug seal

1 - Plug

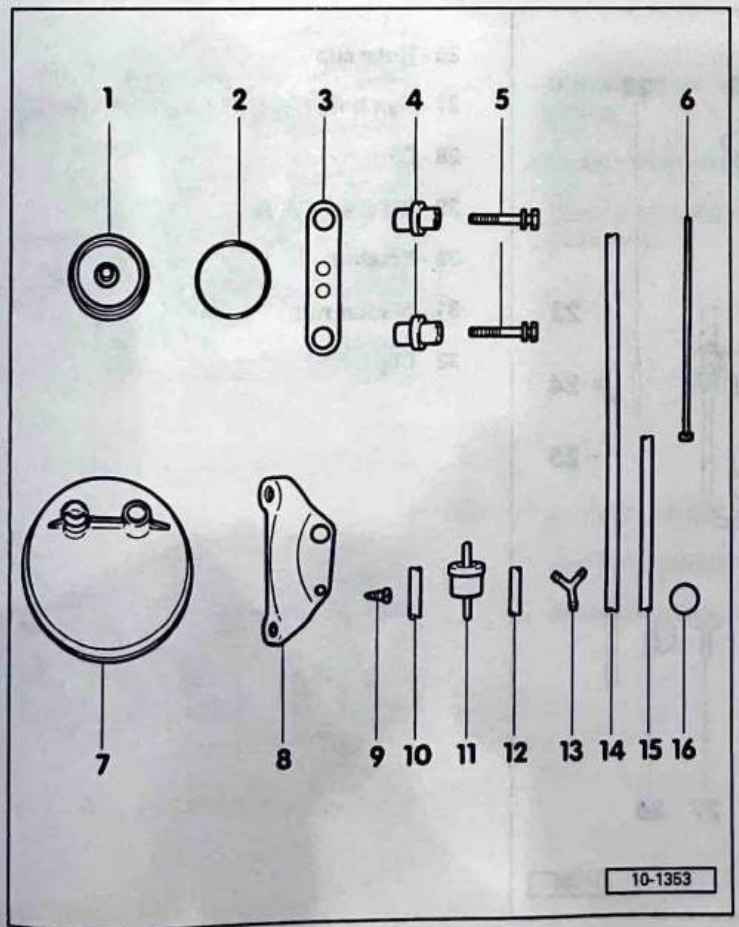
2 - O-ring

3 - Retaining plate

4 - Sleeves

5 - Bolts

6 - Tie wrap



7 - Vacuum damper

8 - Vacuum damper mounting bracket

9 - Self-tapping screw

10 - Vacuum hose
- 30mm

11 - Check valve

12 - Vacuum hose
- 30mm

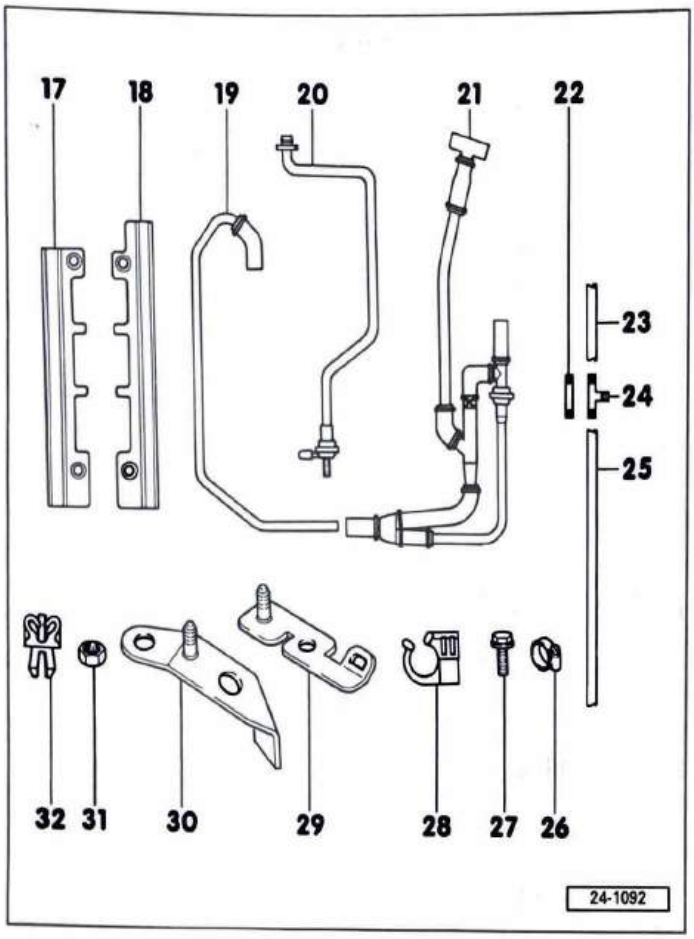
13 - Y-connector

14 - Fabric hose
- 770 mm

15 - Vacuum hose
- 115 mm

16 - Cap
- 2.9mm diameter

Cap
- 4.0 mm diameter



Additional components for automatic transmission vehicles only

17 - Not used

18 - Bracket

19 - Vacuum line to intake manifold

20 - Vacuum line to brake servo unit

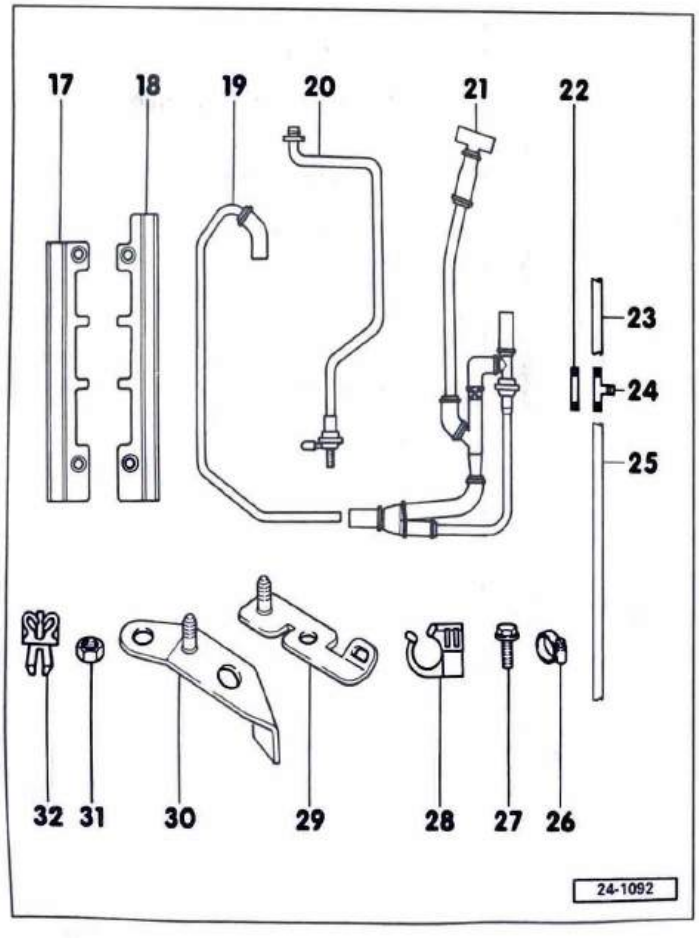
21 - Vacuum booster

22 - Connector

23 - Fabric hose
♦ 100mm

24 - T-connector

25 - Rubber vacuum hose



26 - Hose clip

27 - Hex bolt

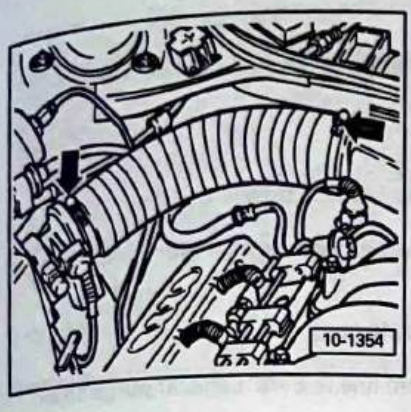
28 - Clip

29 - Bracket

30 - Bracket

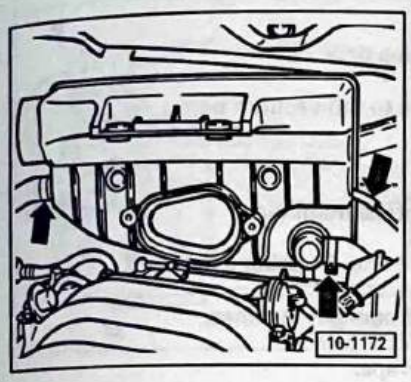
31 - M8 flat nut

32 - Clip

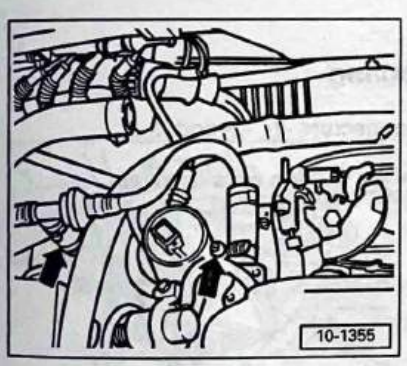


Vacuum pump, removing

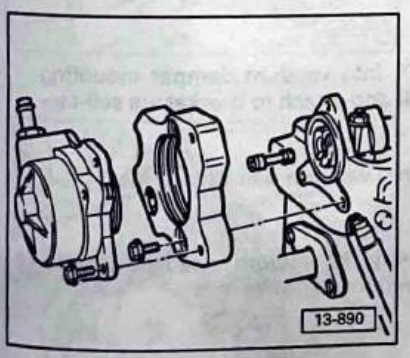
- Open hood.
- Remove engine cover (if installed).
- ◄ Remove the intake air duct between the mass air flow sensor and the intake air silencer.



- Unclip cover at intake air silencer, unscrew both bolts, push silencer back and lift upward.
- ◄ Disconnect both positive crankcase ventilation hoses, then disconnect vacuum hose (arrows) and remove.
- Remove tie wrap if necessary.

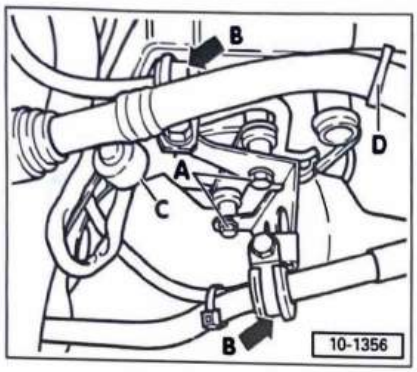


- Disconnect vacuum line at intake manifold and vacuum pump.
- Loosen clips and disconnect fuel line.
- Loosen clips and disconnect line to EVAP canister purge solenoid valve.



- ◄ Remove vacuum pump.
- Remove pump piston from camshaft.
- Detach intermediate flange.

Blanking plug, installing (in place of vacuum pump)



◄ – Install plug -1- with O-ring -2- (⇒ page 24-97) into cylinder head (in place of vacuum pump). Press-in by hand.

– Screw retaining plate, sleeves and brackets for hoses into threaded holes -A-.

Tightening torque: 7 ft lb (10 Nm)

– Attach fuel line and vacuum line to EVAP canister purge solenoid valve using clips -B-.

Manual transmission vehicles only

– Remove the vacuum hose to the vacuum pump.

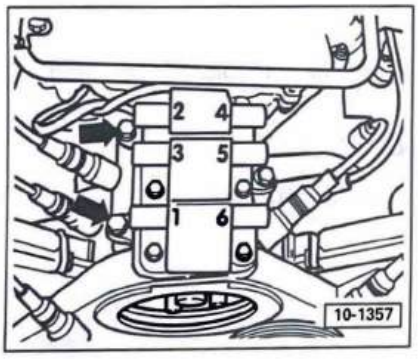
– Press on cap -C-.

– Attach vacuum hose to intake manifold.

– Attach vacuum line to fuel line -D- using a tie-wrap.

– Install the air silencer and connect the lines.

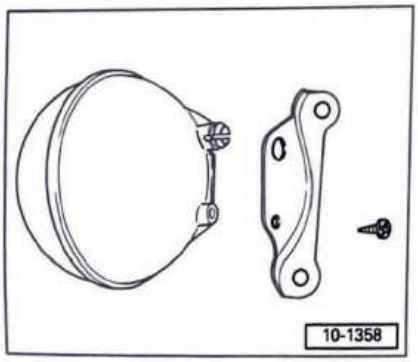
– Replace any broken tie-wraps.



Vacuum damper, installing

◄ – Disconnect ignition coil connectors -1-, -2- and -3-.

– Remove mounting screws for ignition coils (arrows).

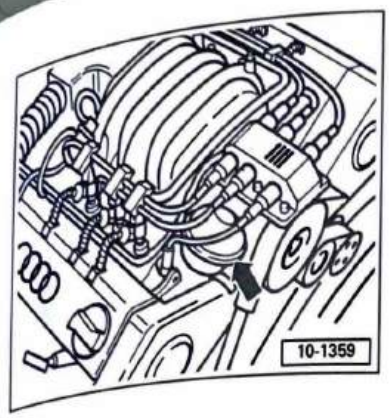


◄ – Snap vacuum damper -7- into vacuum damper mounting bracket -8- (⇒ page 24-98) and attach to bracket via self-tapping screw.

– Attach fabric hose -14- onto vacuum damper.

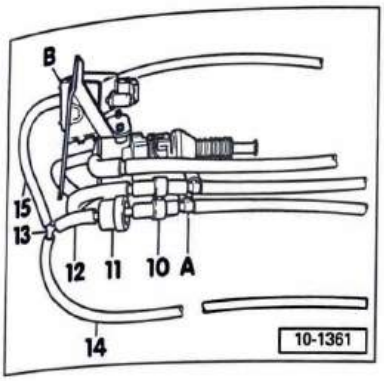
Note

Before installing this assembly, the vacuum hose below the intake manifold must be routed towards the rear.



◄ – Install vacuum damper assembly with vacuum hose attached.

– Reconnect the ignition coils.



– Connect the vacuum supply lines in the direction of the solenoid valve.

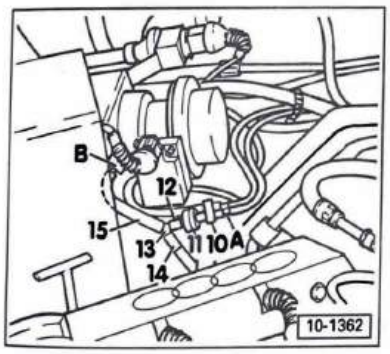
Note

The vacuum supply line for the EVAP canister purge solenoid valve is connected to the power brake servo check valve.

Vehicles with EGR

◄ – Remove the vacuum line to the change-over valve solenoid -B- behind branch -A-

Vehicles without EGR



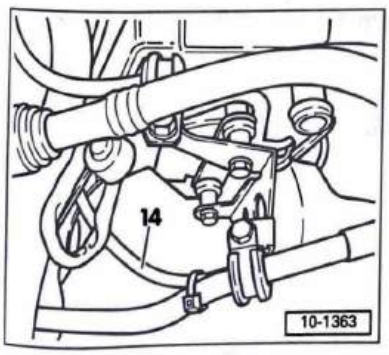
– Disconnect the vacuum line from the manifold change-over valve solenoid.

– First, connect the vacuum lines to components -10-, -11-, -12-, -13- and -15-.

Note

Make that the check valve is correctly installed. The blue connection on the valve faces the Y-connector, which is attached to the vacuum damper with vacuum line.

◄ – Attach the previously assembled vacuum hose to branch -A-. Note that branch -A- is not installed on vehicles without EGR.



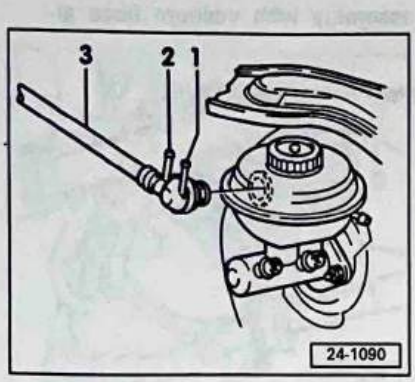
◄ – Attach vacuum hose -14- to EVAP canister hose using a tie-wrap.

Manual transmission vehicles only

– Install air guide hose between mass air flow sensor and intake manifold.

– Compare installation with vacuum diagram to ensure that the routing is correct.

Vacuum booster, installing

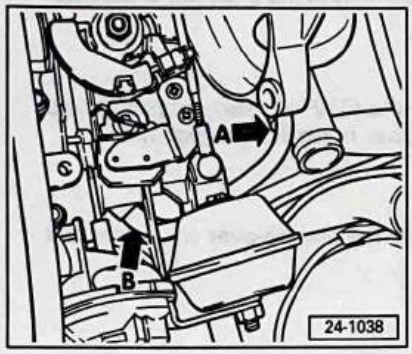


ONLY for vehicles with automatic transmission

◄ – Disconnect vacuum supply -1- (for solenoid valves) from the brake servo.

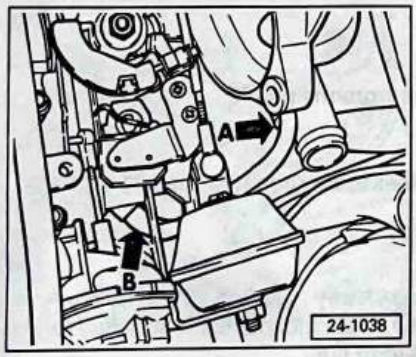
– Disconnect vacuum supply -2- for the A/C and/or differential lock (if installed).

– Remove vacuum line -3-.



◄ – Remove the vacuum line between air cleaner -A- and throttle body -B-.

– Plug the open connection at air silencer -A- with cap (2.9 mm diameter).



◄ – (If installed) attach the vacuum hose for the A/ C and/or differential lock to the connection at throttle body -B-.

Vehicles with A/ C

– Attach, rubber hose -25-, intermediate piece -22- and fabric hose -23- (⇒ page 24-99) together and connect as follows: fabric hose to throttle body and rubber hose to A/ C check valve.

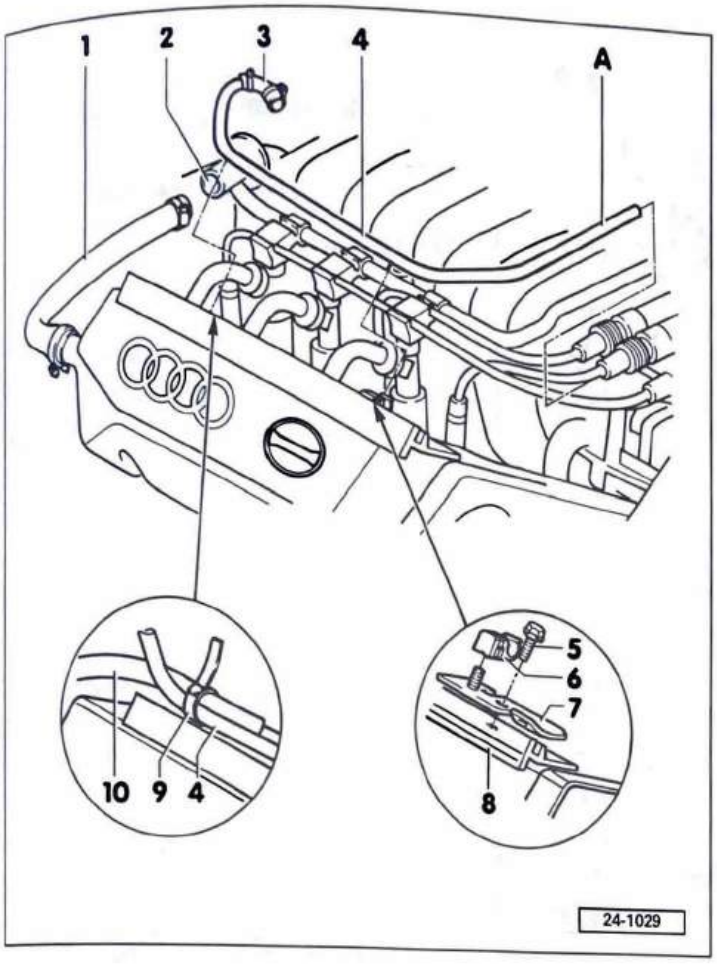
Vehicles with all-wheel drive

– Route the existing vacuum line (free of stress) to connector on throttle body.

Vehicles with A/C and all-wheel drive

– Attach rubber hose -25-, T-connector -24- and fabric hose -23- (⇒ page 24-99) and connect as follows: fabric hose to throttle body, rubber hose to A/C and differential lock to T-connector.

– If neither A/C nor differential lock is fitted, seal the connection at throttle body -B- using cap (2.9 mm diameter).



Vacuum line, installing

A - Connection to pre-assembled vacuum booster
- Between middle and rear ignition coils

1 - Positive crankcase ventilation breather hose, right

2 - Fuel pressure regulator

3 - Intake manifold hose connection

4 - Vacuum line

5 - 10 Nm (7 ft lb)

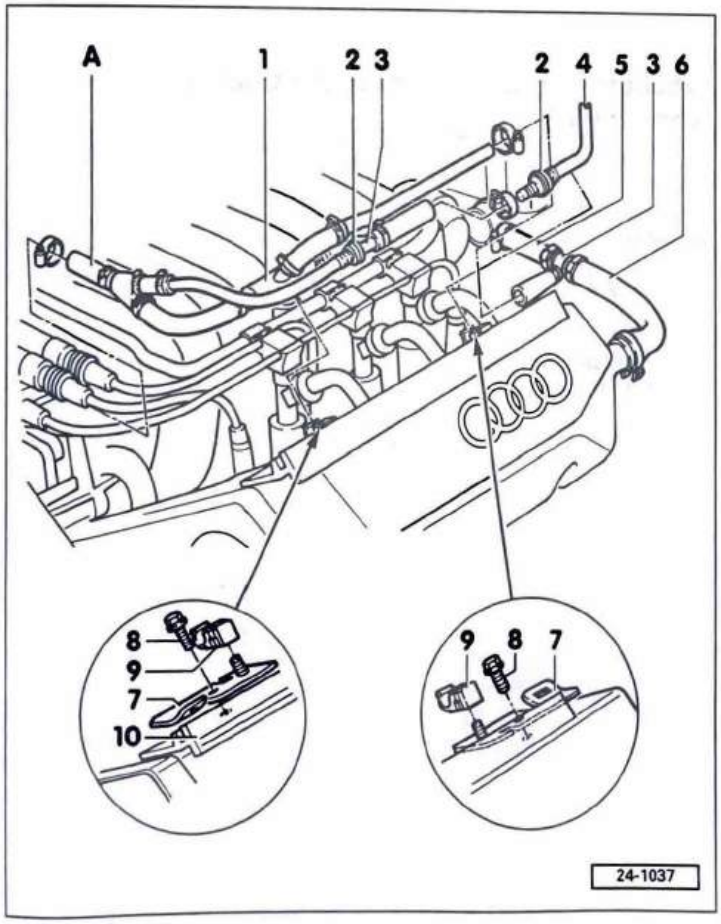
6 - Clip
- To hold vacuum line in place

7 - Bracket

8 - Connection rail

9 - Cable strap
- After tightening, cut off excess strap

10 - Pressure line



Vacuum booster (pre-assembled), installing

A - Connection to vacuum pipe
- Between middle and rear ignition coils

1 - Vacuum booster

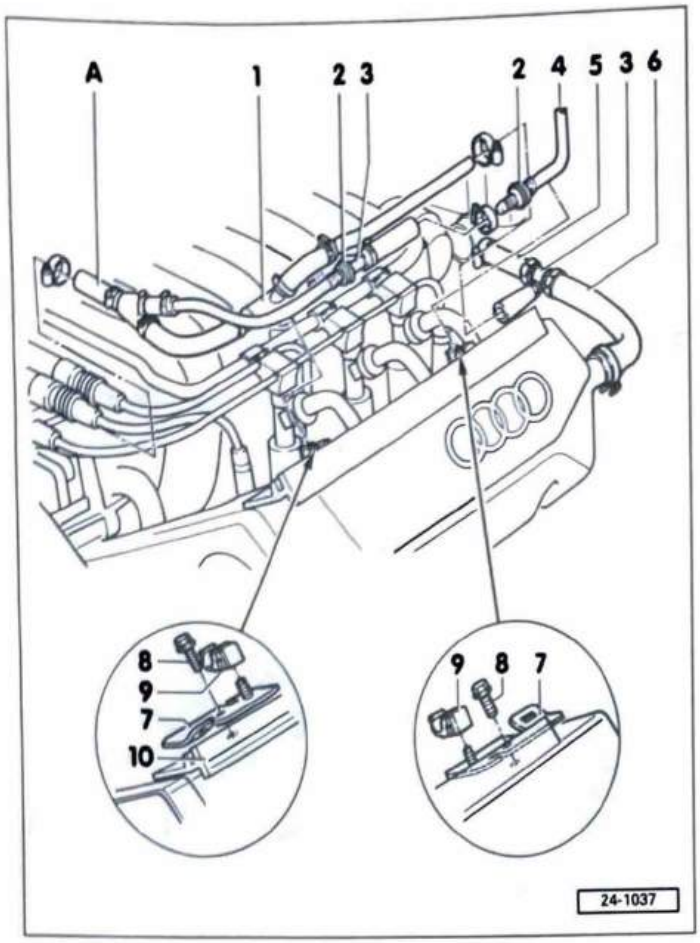
2 - Check valve
- Arrow must point toward connection -A-

3 - T-piece

4 - Vacuum line to vacuum brake booster
- Attach with bracket and clip to brake master cylinders ⇒ diagrams starting page 24-87

5 - Positive crankcase ventilation breather to air cleaner
- Starting from air cleaner side of existing hose, cut hose at 62mm and then at 20 mm

6 - Positive crankcase ventilation breather to cylinder head cover
- Use section of existing hose

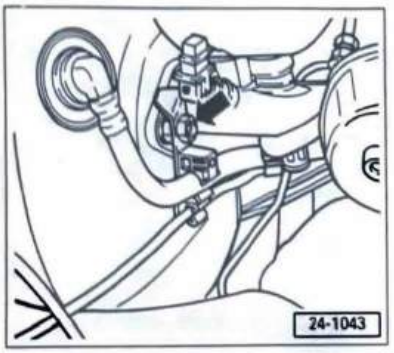


7 - Bracket

8 - 10 Nm (7ft lb)

9 - Clip
♦ To hold vacuum line in place

10 - Connection rail

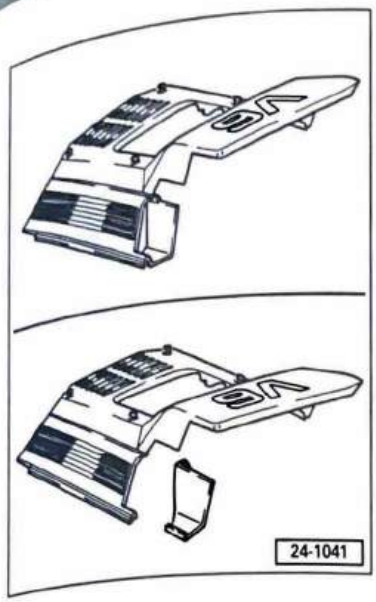


Vacuum line to vacuum brake booster, connecting

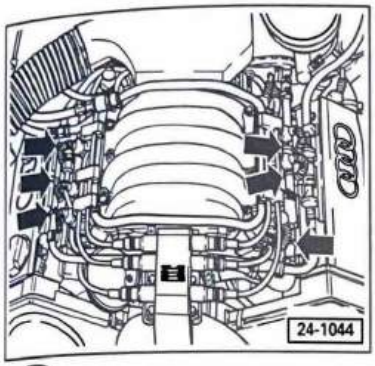
◄ ***Note***

Do not remove the nut from the brake master cylinder. The bracket is attached with an additional nut.

- Tightly screw bracket -30- to threaded bolt with flat nut -31- (⇒ page 24-99).
- Attach vacuum line to vacuum brake booster -20- using clip -28- at bracket -30- (⇒ page 24-99).
- Attach brake line to bracket -30- with clip -32- (⇒ page 24-99).



- Cut out portion of engine cover as shown.

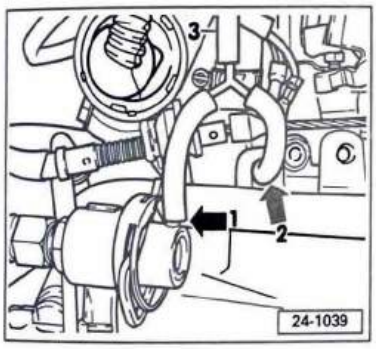


- If the vehicle has no engine cover, attach lines to the fuel injectors (for each one) behind the rubber grommet using a tie-wrap at the vacuum line.

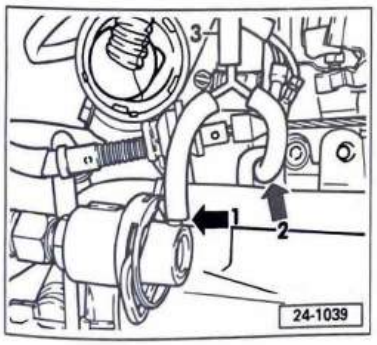
Note

Install the rubber grommets facing down so that the end of the grommet is no longer visible.

Solenoid valve vacuum supply, connecting



- Remove vacuum line between fuel pressure regulator -1- and intake manifold -2-, and cut vacuum line at point -1- to a length of 40 mm (1.57 in.).
- Fit both pieces onto Y-connector and re-attach to fuel pressure regulator and intake manifold.
- Route vacuum supply line (for solenoid valves) that was disconnected from vacuum brake booster check valve, and connect to Y-connector near fuel pressure regulator.

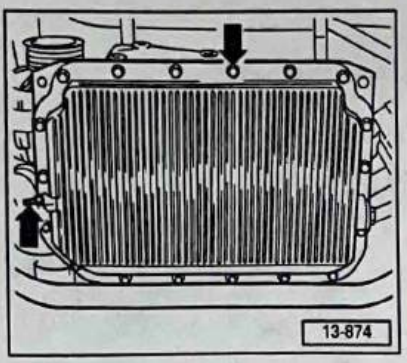


- Attach vacuum supply lines for solenoid valves -3- onto third port of Y-connector.

Note

Route the vacuum line so that it does not interfere with the throttle body.

- Secure vacuum line into position using tie-wrap
- Make final comparison of entire installation using vacuum diagram. Installation must agree with diagram.



Oil pan cleaning

- Drain engine oil.
- Always replace drain plug seal.

◄ - Detach lines from bracket (arrows).

- Remove lower section of oil pan and thoroughly clean.
- Oil rubber seal and replace oil filter

  Tightening torque: 20 Nm (15 ft lb)

- Re-install lower section of oil pan using new gasket.

  Tightening torque: 10 Nm (7 ft lb)

- Re-attach lines to brackets
- Fill engine with fresh oil.

CAUTION!

Do NOT overfill the engine. The oil level must not be above the Max. mark on the dipstick, or there is the possibility of damaging the three way catalytic convertor.

Driving performance, troubleshooting

Table 1 (⇒ page 24-117)

Possible causes of malfunctions according to frequency:

●	Frequent	○	Seldom
◔	Less Frequent	—	Not cause of malfunction

Table 2 (⇒ page 24-119)

Corrective measures and/or technical background for driving performance complaints.

Note:

VAG 1551 scan tool should be used for basically all driving performance complaints.

Test requirements

- Mechanical basic setting OK
- Initiate automatic test sequence (VAG 1551, address word 00)
- Check and erase DTC memory, switch ignition off and restart, test drive for at least 5 minutes. During test drive, accelerator pedal must be pushed down completely once and vehicle operated briefly at greater than 4000 rpm. Check DTC memory again and repair malfunctions as necessary.
- Measurements during test drive must be carried out by a second technician.
- Use the information that follows to eliminate driving performance malfunctions.

Table 1

(Explanations ⇒ Table 2)

Complaint \ Possible cause	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Engine stalls sporadically	●	●		○		○							○								
Engine stalls again immediately after starting	●	○																			
Engine stalls after Drive position engaged on vehicles with automatic transmission	●																				
Rough idle, fluctuates irregularly	●	○	○			—	○	○	—	○	○										
Rough idle, fluctuates regularly (surges)	●	○		○		○				○											
Idle speed too high	○			○	○					○											
Idle speed vibrations can be felt in car	—		—										—							○	○
Vibrations at 1800 rpm	—		—										—							○	○
Engine misfires during warm-up			●		○			○	○			●				●					
Engine constantly misfires	○	●						●	○		○						○				

24-117

(Explanations ⇒ Table 2)

Complaint \ Possible cause	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Engine has poor throttle response/acceleration		●	●		○	○	○						—			○					
Engine misfires sporadically			○		○	○							○								
Engine misfires close to idle speed range		○	●																		
Engine misfires when cold					○					○											
Engine stalls or does not start			—				○			○	●	—	○	●	○						
Engine has poor performance			○	—	○	○	○	○	○			○	○					●	○		
Fuel consumption too high	—	●	○	—	○	○	○						—						○		
Smell of sulphur from exhaust system			○																●		
(only US vehicles) Engine Malfunction Indicator Lamp comes on	●		●		●								●								
Problems starting engine	—	○	—	—	—	—	○	○		○		—		○			○				

24-118

Table 2

Index no.	Possible Cause	Corrective measures/Technical background
1	♦ Idle Air Control (IAC) valve -N71- sticks, is hard to move or does not operate	♦ Failures because of contamination in the intake manifold; because of this, IAC valve rotary slide valve surface scratches possible. ♦ Cleaning with compressed air unsuccessful. ♦ When removed or disconnected, only limp home slot can be seen. The control edge lies on the opposite side. ♦ The limp home slot of IAC valve -N71- must not be widened by tools inserted from the outside. ♦ The visible surface of the rotary slide valve must not be machined mechanically. ♦ Check IAC valve ⇒ page 24–34 (internal resistance: 7–10 ohms)
2	♦ Intake air leaks	♦ Leaks in the hoses of crankcase, IAC valve, vacuum lines, EGR, EVAP canister, etc. ♦ System is sensitive to air leaks, especially if not constant. Air leaks that are constantly present are compensated within the control limits by the adaptive system. Check hoses and connections for leaks and tight fit. ♦ If there is uneven idle, vacuum hoses may be transposed. – Correct possible transposed vacuum hoses according to vacuum diagram. – Checking with VAG 1551, function 04 and 08 ⇒ Repair Group 01 ***Note:*** *Do not exceed max. engine speed of 2500 rpm, otherwise the VAG 1551 scan tool will be switched into function 04 "Basic Setting" in initial setting.*

Index no.	Possible Cause	Corrective measures/Technical background
3	♦ Heated Oxygen Sensor (HO2S) -G39- and/or -G108- and/or Oxygen Sensor (O2S) heater -Z19- and/or -Z28- faulty	♦ Oxygen sensor probe reacts very sensitively to contamination. The use of silicone and contact spray causes deposits on the probe which make the control behavior become slow. Thus they are stored only occasionally in the DTC memory since control is still within tolerance limits but too slow for optimum driving performance. ♦ Deposits on the probe also develop because of increased oil consumption and/or frequent cold starts. (Please note on complaint report.) – Check oxygen sensor control with VAG 1551 ⇒ Repair Group 01, functions 04, 08 and 09. – Check oxygen sensor probe heating and oxygen sensor probe ⇒ page 24-37 – Use scan tool "Read Individual Measuring Value" function 09, channels 02 and 03 ⇒ Repair Group 01. The display values must fluctuate between the upper and lower value. The fluctuation between upper and lower display value must become faster with increasing engine speed and load. Very slow fluctuation causes lean bucking and delayed control behavior in idle and partial load range. – If there is misfiring and bucking, the influence of the oxygen sensor probe is especially high, with continuous lean condition, i.e. oxygen sensor value continuously rich (high voltage, i.e. using VAG 1551 "Read Individual Measuring Value" function 09, channels 02 and 03 continuously or frequently over 60). Take test drive with VAG 1551, driving malfunctions must disappear without heated oxygen sensor probes (signal wire disconnected).

Index no.	Possible Cause	Corrective measures/Technical background
4	♦ Throttle Body (TB) faulty	♦ Air leak at stage 2 leads to incorrect learned values. DTC 01257 (IAC valve) can be stored, read DTC memory. ♦ Malfunction in the ECM or mass air flow sensor is unlikely. ♦ Difficult to recognize with On Board Diagnostic, since usually there is no constant air leak value. – Perform basic setting of the engine ⇒ Repair Group 01. – Using VAG 1551 "Basic Setting" function 04, display fields 4 and 5, check whether specified values lie in the lower or upper limit range. If the values lie outside or very close to the tolerance limit, see Repair Group 01. ♦ Throttle Body can only be checked visually for sticking, e.g. after removal.
5	♦ Throttle Position (TP) sensor -G69- and Closed Throttle Position (CTP) switch simultaneously faulty	♦ No acceleration enrichment. ♦ Throttle position sensor incorrectly adjusted, has tolerance problem and/or break in wiring on resistor area (misfiring/bucking, poor throttle response). ♦ Throttle position sensor remains continuously on wide open throttle. (Fuel consumption too high) – Read DTC memory and check "Read Individual Measuring Value" function 09, channel 11 as well as "Read Measuring Value Block" function 08, display field 7 ⇒ Repair Group 01. With continuous accelerator pedal movement/throttle opening this value must also increase continuously. – Check wiring connector.

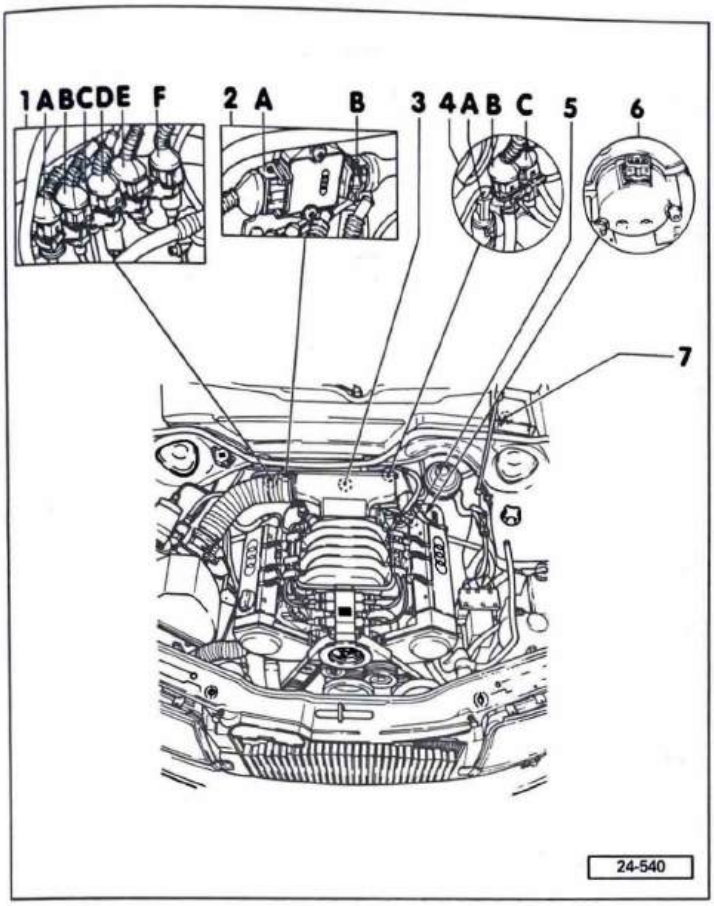
Index no.	Possible Cause	Corrective measures/Technical background
6	♦ Mass Air Flow (MAF) sensor -G70- faulty, connector fell off, break in wiring	♦ Temperature compensation is not OK (cannot be checked, replace -G70- as a test). ♦ Ground (GND) not OK. – Read DTC memory with VAG 1551 and repair malfunctions ⇒ Repair Group 01. ♦ Dynamic problems can occur with -G70- (part no. without index A). – Using VAG 1551 "Read Individual Measuring Value" function 09, channel 5: if display is greater than 5 or fluctuates there is a loose connection. – Check GND connection between ECM and mass air flow sensor connector ⇒ Repair Groups 24 and 28.
7	♦ Fuel injectors leak and/or spray pattern faulty because of dirt and tolerance problems	♦ Fuel gets into combustion chamber. Even injectors with slight leaks generally lead to poor cold start because of fuel that has leaked into intake channel. This can lead to pinging during starting and in a short time to poor throttle response during first acceleration (low fuel pressure). – Checking: let engine warm up at least 10 min. and then shut engine off. Separate and remove fuel distributor rail including injectors without separating supply and return lines. If bubbles/drops can be seen on the valve tip, replace affected injectors. Avoid replacing all injectors! – Check injection quantity ⇒ page 24-29. – Carefully install O-rings (before installing, lubricate O-rings with engine oil) ⇒ page 24-29.

Index no.	Possible Cause	Corrective measures/Technical background
8	♦ Spark plugs fouled from frequent cold starts, high oil consumption or oil overfill	♦ Spark plugs damaged during installation. ♦ Spark plug connector loose and/or disruptive discharge. – Check spark plugs ⇒ Repair Group 28.
9	♦ Ignition coil -N-, -N128-, -N158- faulty	♦ Power output stage connector loose and/or loose contact. ♦ Ignition cable oxidized, defective or not correctly connected. – Check power output stage for ignition system and/or check ignition coils ⇒ Repair Group 28.
10	♦ Engine Coolant Temperature (ECT) sensor -G62- out of tolerance	♦ This results in a function of the oxygen sensor control. Engine too rich or too lean. – Check resistance ⇒ Repair Group 28. Check to see whether values displayed are realistic using VAG 1551 "Basic Setting" function 04, display field 1 ⇒ Repair Group 1.
11	♦ Engine speed (RPM) sensor -G28- and/or wiring faulty	– Checking ⇒ Repair Group 28. – Check engine speed sensor and starter ring gear for damage. To do so, remove starter and turn engine by hand.

Index no.	Possible Cause	Corrective measures/Technical background
12	♦ Knock Sensor (KS) 1 -G61-, Knock Sensor (KS) 2 -G66-, faulty	♦ A single lurch because of lack of resistance in knock sensor – Additional resistor in wiring harness can help as customer service solution. – Starting 2/91, VIN 4A MN 039 997 resistor (1MΩ) in the knock sensor wiring in the engine compartment wiring harness connector between pins 1 and 2. Starting 1/92, VIN 4A MN 080 000, resistor (1MΩ) in the knock sensor between pins 1 and 2. – If there is audible knocking without DTC recognized by OBD and without ignition timing retarded by the knock control: use "Read Individual Measuring Value" function 09, channel 13 to check resistor (1MΩ) in the knock sensor wiring. ♦ Ignition timing retarded by knock regulation. – Check "Read Individual Measuring Value" function 09, channels 12 and 13 for current ignition map and timing angle ⇒ Repair Group 01. – If the value on channel 12 is greater than or equal to 128, the injection is in ignition map II. Ignition map II stands for fuel with low octane rating lower than 95 RON. Another cause is possible noises from loud auxiliary assemblies that are recognized as knock signals. Channel 13 values multiplied by 1.33 gives the current average ignition timing angle over all cylinders in crankshaft degrees.
13	♦ Engine Control Module (ECM) -J192-, faulty and/or Ground (GND) connection NOT OK	♦ Contact problems on connector. ♦ No DTC with VAG 1551 possible. – DTC memory displays ECM faulty. Check GND connections and connectors for contact problems. – Check ECM version ⇒ Repair Group 01. – Before replacing ECM, disconnect harness connector and reconnect. Repeat test.

Index no.	Possible Cause	Corrective measures/Technical background
14	♦ Camshaft Position (CMP) sensor -G40- faulty	♦ Camshaft position sensor will be damaged by creeping camshaft seal. – Install sealing ring dry (⇒ Repair Group 28). ♦ Camshaft position sensor connector terminal pushed back. – Check camshaft position sensor and harness connection ⇒ Repair Group 28.
15	♦ Crankshaft Position (CKP) sensor -G4- faulty	♦ Engine does not start. ♦ Failure when driving has no effect since engine continues to run from engine speed signal. – Check CKP sensor -G4- ⇒ Repair Group 28.
16	♦ Intake valves have carbon deposits because of insufficient additives	♦ Use fuel additive G 001 700 03. ♦ Use specified fuel quality with sufficient additive.
17	♦ Fuel pressure regulator and/or check valve for fuel pump faulty	♦ Using VAG 1551, check oxygen sensor control ⇒ Repair Group 01, "Read Measuring Value Block" function 08, display field 8. ♦ Fuel supply from electrical fuel pump too low. – Check supply quantity. ⇒ Repair Manual, *2.8 Liter V6 General, Engine*, Repair Group 20 – Check system and holding pressure ⇒ page 24-15. ♦ The fuel pressure must not be exceeded, even under actual operating conditions (test drive). – Check fuel pump check valve. ⇒ Repair Manual, *2.8 Liter V6 General, Engine*, Repair Group 20
18	♦ Intake manifold NOT OK, especially over 4000 RPM	– Check function of intake manifold change-over valve ⇒ page 24-65. – Check vacuum hoses for leaks and correct routing according to vacuum diagram ⇒ page 24-87.

Index no.	Possible Cause	Corrective measures/Technical background
19	♦ a) Three Way Catalytic Converter (TWC) melted ♦ b) Sulfur odor after shutting off engine	♦ a) Check exhaust gas back-pressure at CO tap tube with greater than 0.3 bar excess pressure (1.3 bar absolute pressure) at 2000 rpm. Ask customer whether the vehicle has been towed or jump started. Read DTC memory and check injection and ignition systems and engine electronics. ***CAUTION!*** ***Even driving the tank empty with misfiring over a short stretch (approx. 200 meters) can lead to thermal damage on the Three Way Catalytic Converter because of uncontrolled combustion.*** ♦ b) Rational: Sulfur odor (H_2S) results from sulfur oxide (SO) that is stored in the Three Way Catalytic Convertor as sulfate after slightly lean operation (e.g. idle or fast acceleration). During rich engine operation, the sulfate is reduced by hydrogen (H_2) in the exhaust to hydrogen sulfide (H_2S) (sulfur odor). The odor is dependent on the brand and origin of the fuel. This dissipates with increasing service life by aging at approx. 10,000 km. Replacing the Three Way Catalytic Converter makes it worse.
20	♦ Exhaust system	♦ Tolerance and resonance problems. ♦ In vehicles with automatic transmission, failure of front pipe insolated by air slot. – Adjust exhaust system (For further information, see Repair Manual) ⇒ Repair Manual, *2.8 Liter V6 General, Engine*, Repair Group 26
21	♦ Torque arm	♦ On some vehicles, adjusting the torque arm can help.



Motronic fuel injection and ignition system, component layout

— **Engine Control Module (ECM) -J192-**
- Not shown
- Located in passenger-side footwell, in electronics box under carpeting ⇒ Repair Group 01

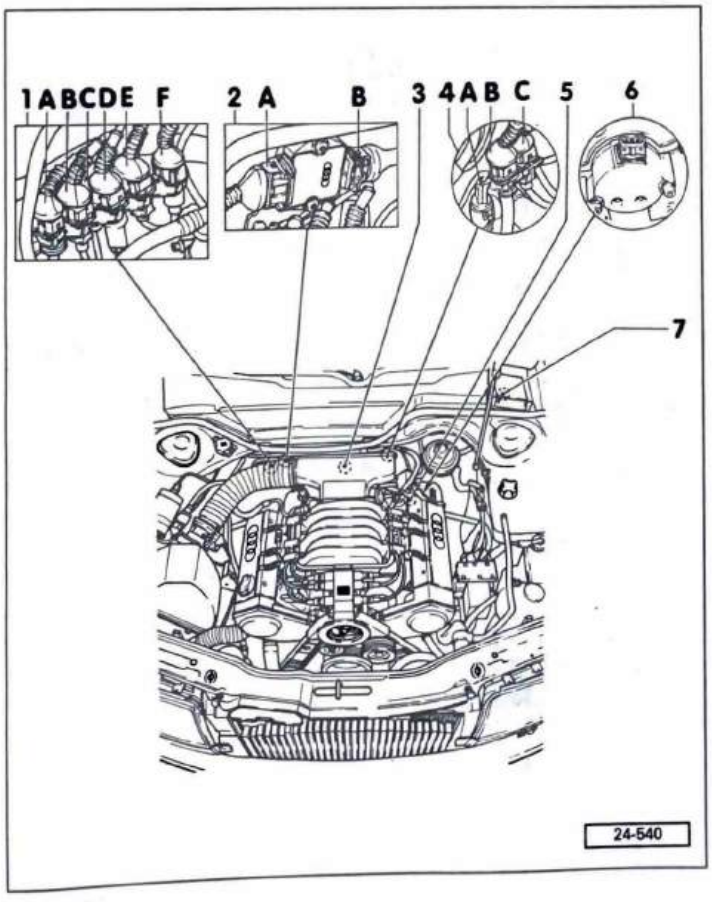
1 - Harness connectors for:

A - For Oxygen Sensor (O2S) heater -Z19-
- Heater for heated oxygen sensor -G39-, right bank
- Black 2-pin connector

B - For Ignition coils
- Battery positive voltage (B+) supply
- White connector

C - For Heated Oxygen Sensor (HO2S) -G39-
- Signal wire
- Under connector holder on bulkhead

D - For Knock Sensor (KS) 1 -G61-
- Blue connector



E - For Engine Speed (RPM) sensor -G28-
- Gray connector

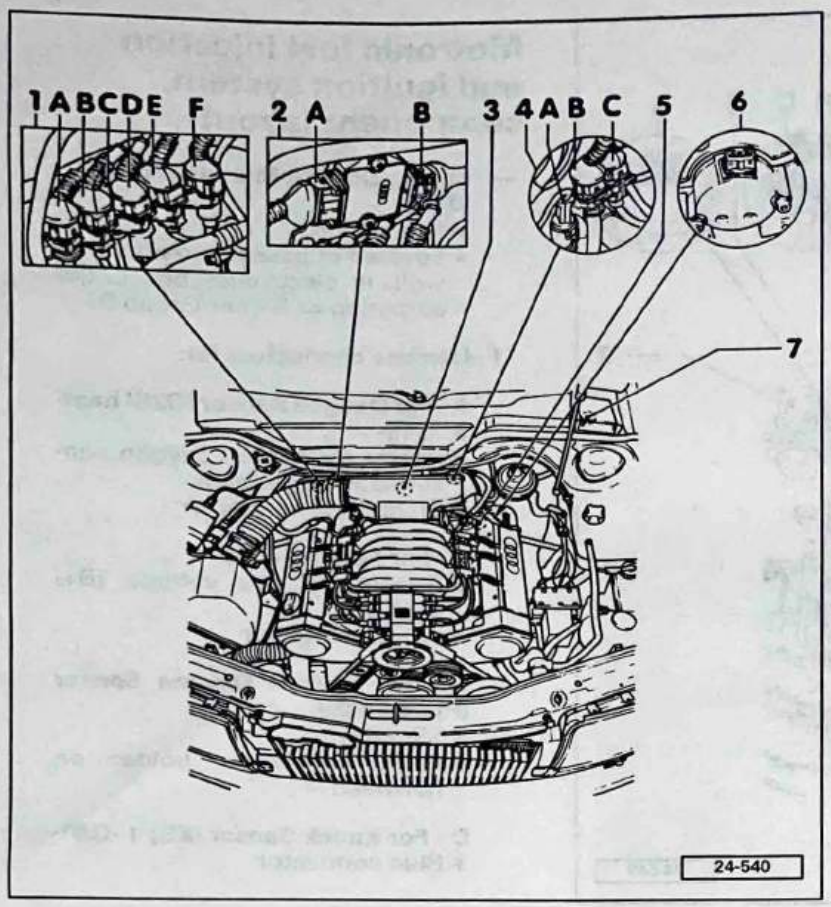
F - For Crankshaft Position (CKP) sensor -G4-
- Black connector

2 - Power Output Stage -N122-
- For ignition coils

A - Signal wires
- From Engine Control Module (ECM)
- Brown 4-pin connector

B - Ignition coil primary circuit connections

3 - Throttle Position (TP) sensor -G69-
- With integrated Closed Throttle Position (CTP) switch -F60-



4 - Connectors for:

A - For Heated Oxygen Sensor 2 -G108-
- Signal wire

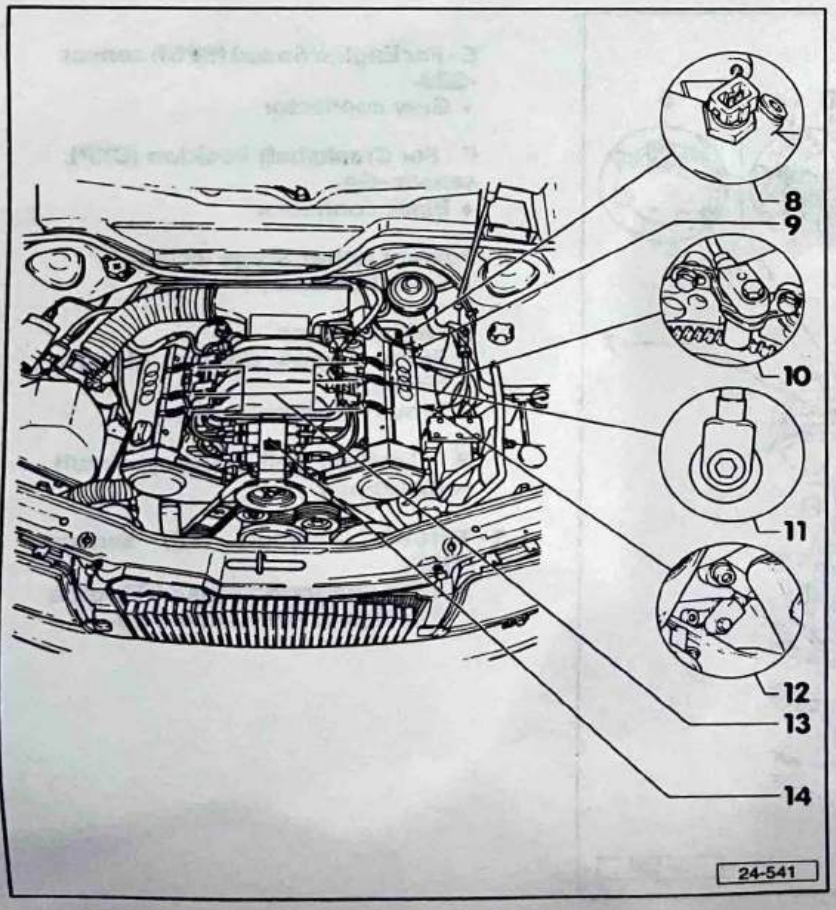
B - For Oxygen Sensor (O2S) 2 heater -Z28-
- Heater for heated oxygen sensor 2 -G108-, left bank
- Black 2-pin connector

C - For Knock Sensor (KS) 2 -G66-
- Blue connector

5 - EGR temperature sensor -G98-
- US vehicles only

6 - Camshaft Position (CMP) sensor -G40-

7 - Data Link Connector (DLC)



8 - Engine Coolant Temperature (ECT) sensor -G62-
- In coolant line behind cylinder head

9 - Heated Oxygen Sensor (H02S) 2 -G108-

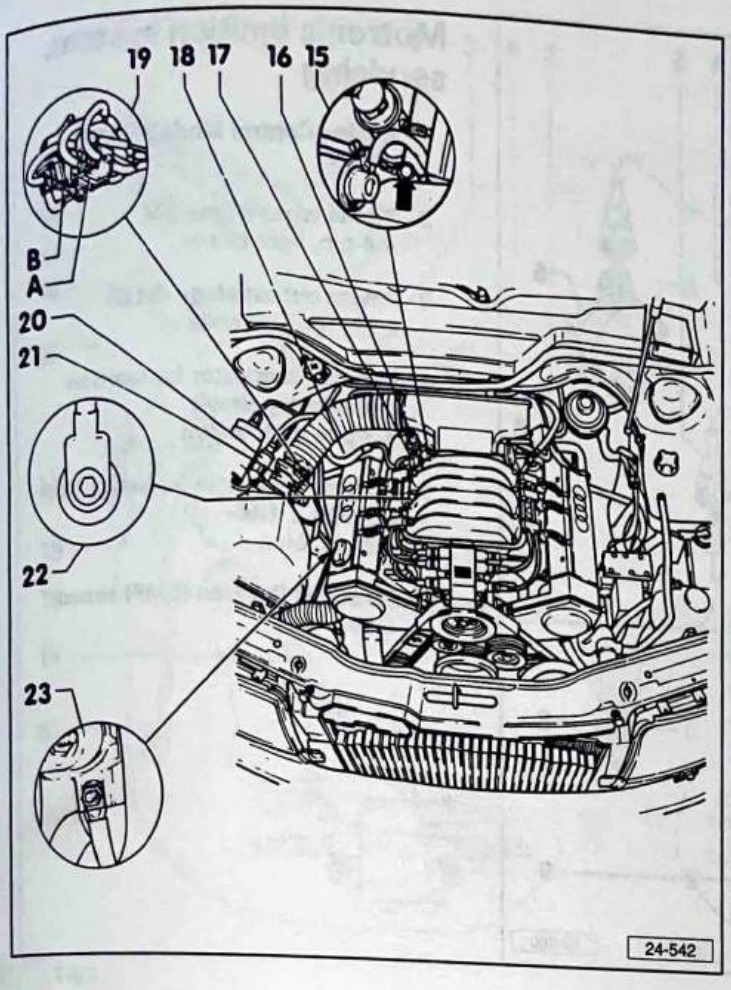
10 - Engine Speed (RPM) sensor -G28-

11 - Knock Sensor (KS) 2 -G66-

12 - Crankshaft Position (CKP) sensor -G4-
- Reference mark on left hand side of cylinder block

13 - Fuel Injectors

14 - Ignition coils
- Ignition coil 1 -N-
- Ignition coil 2 -N128-
- Ignition coil 3 -N158-



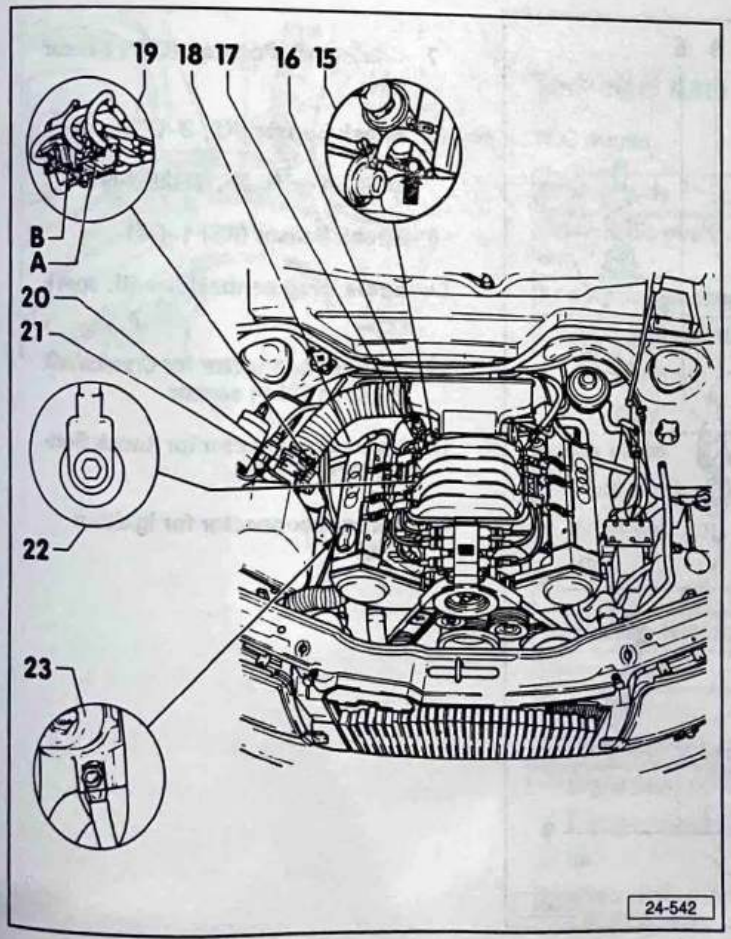
15 - Ground (GND) connection
♦ On intake manifold

16 - Idle Air Control (IAC) valve -N71-

17 - Fuel pressure regulator

18 - Heated Oxygen Sensor (HO2S) -G39-

19 - Mass Air Flow (MAF) sensor -G70-
♦ With CO fuel trim potentiometer



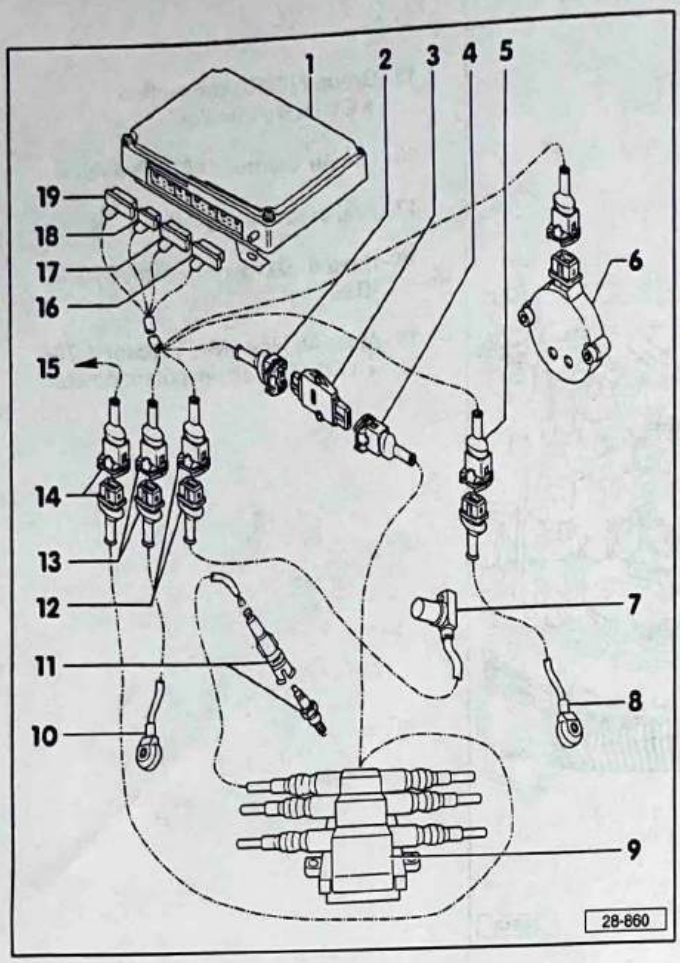
20 - EVAP canister purge regulator valve -N80-

21 - A - EGR vacuum regulator solenoid valve -N18-

B - Intake manifold change-over valve -N156-

22 - Knock Sensor (KS) 1 -G61-

23 - Ground (GND) connection
♦ On right engine mount



Motronic ignition system, servicing

1 - Engine Control Module (ECM) -J192-

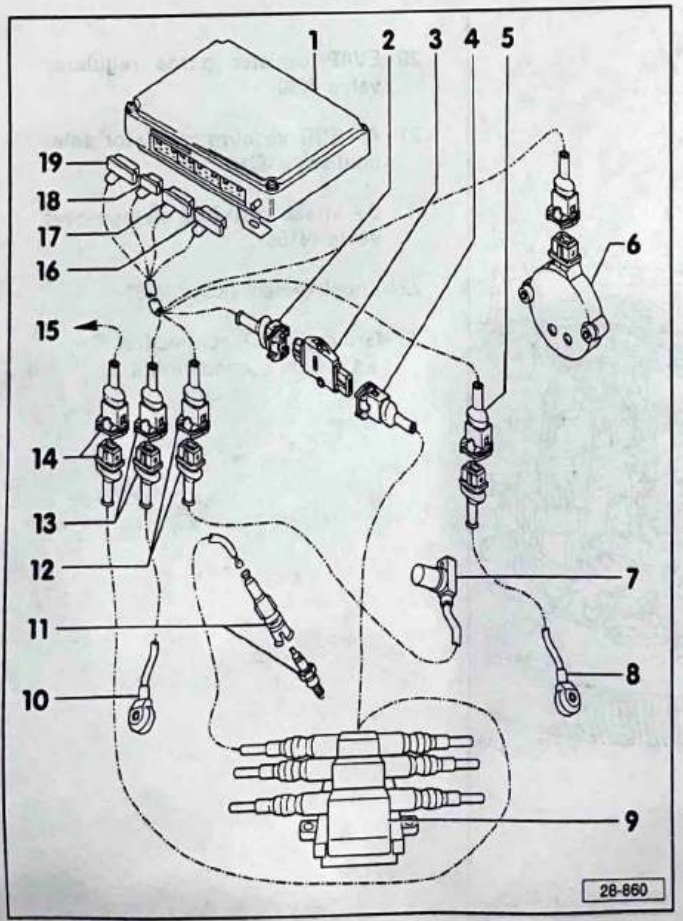
2 - Signal wires from ECM
♦ 4-pin, light brown

3 - Power output stage -N122-
♦ For ignition coils

4 - Harness connector for ignition coil primary circuit
♦ 3-pin, dark brown

5 - Harness connector for Knock Sensor (KS) 2 -G66-
♦ 3-pin, blue

6 - Camshaft Position (CMP) sensor -G40-



7 - Crankshaft Position (CKP) sensor -G4-

8 - Knock Sensor (KS) 2 -G66-

9 - Ignition coils -N-, -N128-, -N158-

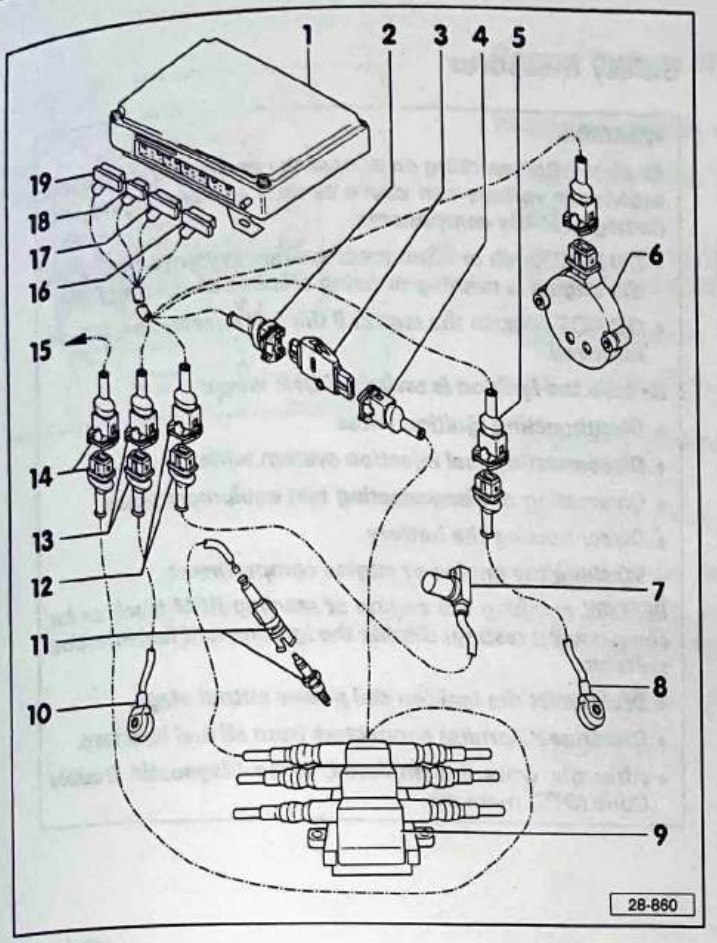
10 - Knock Sensor (KS) 1 -G61-

11 - Spark plug connector with spark plug

12 - Harness connector for Crankshaft Position (CKP) sensor

13 - Harness connector for Knock Sensor (KS) 1 -G61-

14 - Harness connector for ignition coils



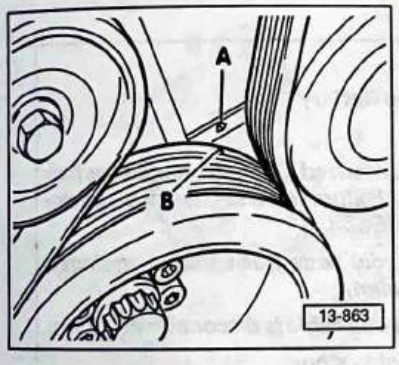
15 - To circuit breaker -S64-
- In electronics box, passenger side footwell, yellow holder

16 - ECM connector C
- 16-pin, brown

17 - ECM connector B
- 20-pin, red

18 - ECM connector A
- 12-pin, black

19 - ECM connector D
- 16-pin, black



Technical data

◄ TDC marks

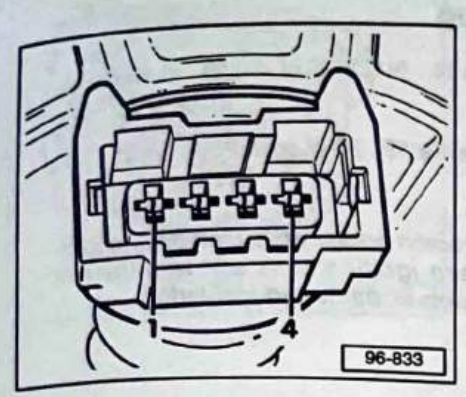
Engine code		AAH
Crankshaft position sensor [1]	Resistance – kΩ	approx. 1.0
Engine speed sensor [2]	Resistance – kΩ	approx. 1.0
Ignition coil resistance	kΩ	
Secondary		9–14
Primary		approx. 0.5–1.2
Spark plugs		
Part number		101 000 033 AA
NGK part no.		BKUR 6 ET–10
Gap	mm (in.)	1.0 ± 0.1 (0.039 ± 0.004)
Tightening torque		30 Nm (22 ft lb)
Firing order		1-4-3-6-2-5
RPM limit		
Fuel injector cut-off	RPM	6500

[1] Crankshaft position sensor, checking ⇒ page 28-18

[2] Engine speed sensor, checking ⇒ page 28-21

Note:

Ignition timing cannot be adjusted. Timing is determined by the ECM ignition map.



Power output stage, checking

Installation location ⇒ page 28-2

- Disconnect 4-pin harness connector from power output stage.

◄

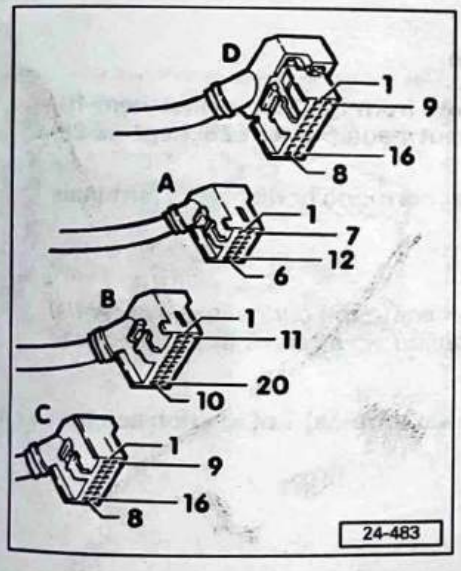
- Connect VAG 1527B voltage tester between battery positive (B+) and connector terminal 2 (GND).

• LED must light up

If LED does not light up:

- Check wiring using wiring diagram and if necessary, repair open circuit.
- Disconnect harness connectors from all six fuel injectors.
- Switch ignition on.
- Connect VAG 1527B voltage tester between GND and power output stage connector terminals 1, 3 and 4 in sequence.
- Operate starter several seconds each time.

• LED must blink



If LED does NOT blink:

- Connect VAG 1598 text box with VAG 1598/11 adapter to ECM wiring harness only.

  (Adapter harness is not connected to ECM.)
- Check for continuity or short circuit in wiring to ECM using wiring diagram.
- If applicable, eliminate open circuit or short circuit in wiring between 4-pin power output stage connector, and ECM connector -B-.

Ignition coil with power output stage terminal	ECM connector B terminal
1	15
3	18
4	17

If there is no open circuit or short circuit:

- Replace ECM.

If LED blinks, the wiring is OK.

If Diagnostic Trouble Codes 00609/00610/00611 (Ignition Output 1/2/3) are displayed by the On Board Diagnostic program:

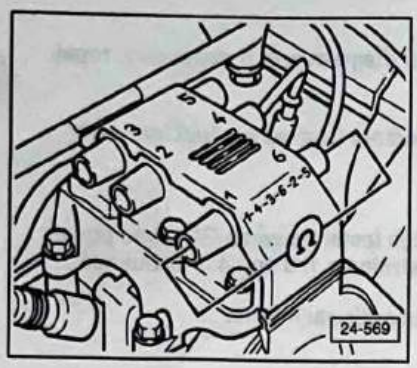
- Replace power output stage -N122-.

Ignition coils, checking

- Location of ignition coils N, -N128- and -N158- ⇒ Item 14, page 28-4.
- Connector locations ⇒ Items 1B, 2B (pages 28-1, 28-2)

Note:

Check connecting wires between power output stage and ignition coils as well as between ignition coils and terminals in connector blocks for corrosion or damaged insulation.



◄ **Checking secondary resistance**

– Disconnect ignition wires from ignition coils.

– Connect multimeter (Fluke 83 or equivalent) between both ignition wiring connections of ignition coil being tested.

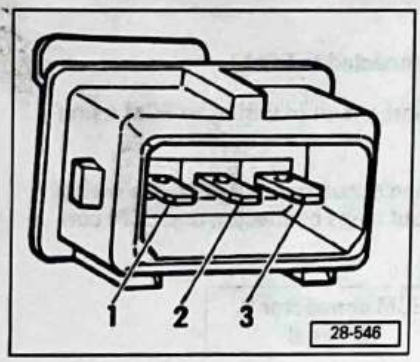
Specified reading: 9–14 kΩ each

If specified value is not obtained on any one ignition coil:

– Replace ignition coil.

Checking primary resistance

– Disconnect 3-pin connectors from ignition coil (⇒ item 1B, page 28-1) and power output stage (⇒ item 2B, page 28-2).

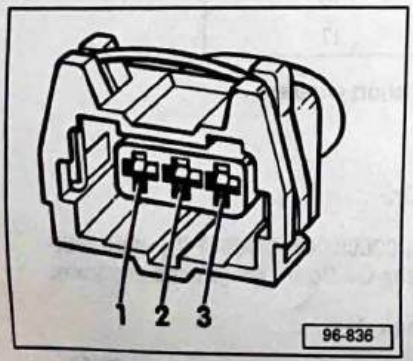


– Check connectors for loose, corroded or displaced terminals and repair as necessary.

Note:

The correct terminal assignment in the connector is essential since positive voltage is supplied via all three terminals to the ignition coils.

◄ – Connect multimeter between terminal 1 of ignition coil harness connector ...



◄ – ... and terminal 1 of power output stage harness connector.

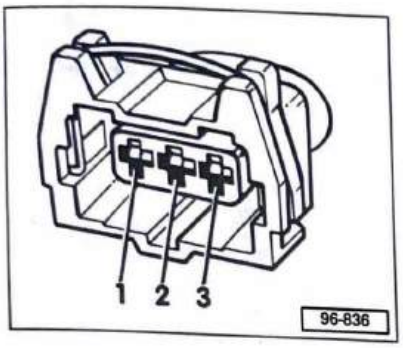
Specified value: 0.5–1.0 ohm (Ω) for each coil

– Repeat test for corresponding connector terminals 2 and 3.

• Specified value must be obtained for all three measurements

If specified values are not obtained:

– Replace ignition coil.



Checking battery positive voltage (B+) supply for ignition coils

- Circuit breaker -S64- must be OK (yellow holder in electronics box, passenger side footwell)

– Disconnect white harness connector at connector holder (on engine bulkhead) ⇒ Item 1B, page 28-1.

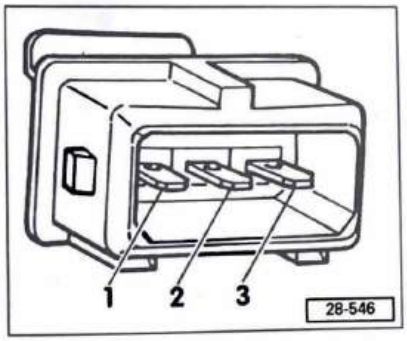
– Switch ignition on.

◄ – Connect VAG 1527B voltage tester between Ground (GND) and all three terminals of connector in sequence.

- LED must light up each time

If LED does NOT light up:

– Check for open circuit using wiring diagram and repair as necessary.



Crankshaft Position (CKP) sensor, checking

Location of sensor and harness connector ⇒ page 28-1

– Check that sensor is tight (properly torqued).

– Disconnect black CKP sensor harness connector.

◄ – Connect multimeter (Fluke 83 or equivalent) to harness connector terminals 1 and 2 (in connector holder) with adapter cable from VW 1594 connector test kit.

Specified value: approx. 1 kΩ

If specified values are not obtained:

– Replace CKP sensor.

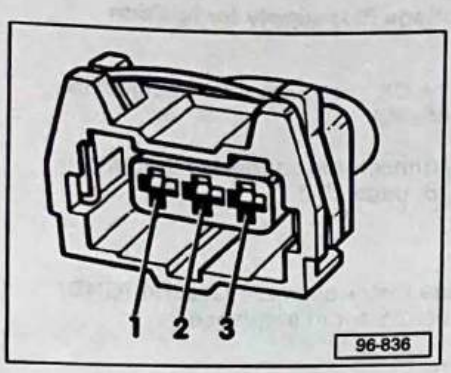
If specified value is obtained:

– Connect multimeter first between terminals 1 and 3 (GND) and then between terminals 2 and 3 (GND).

Specified value: infinite ohms in each case (no continuity).

If specified values are not obtained:

– Replace CKP sensor.



If specified value is obtained, check wiring between sensor harness connector and Engine Control Module (ECM) as follows:

- Connect VAG 1598 test box with VAG 1598/11 adapter harness to ECM wiring harness ⇒ Repair Group 01.

  (Adapter harness is not connected to ECM.)

- Check for continuity and/or short circuit using wiring diagram.

◄ - Check shielding by checking for continuity between sensor connector terminal 3 and GND.

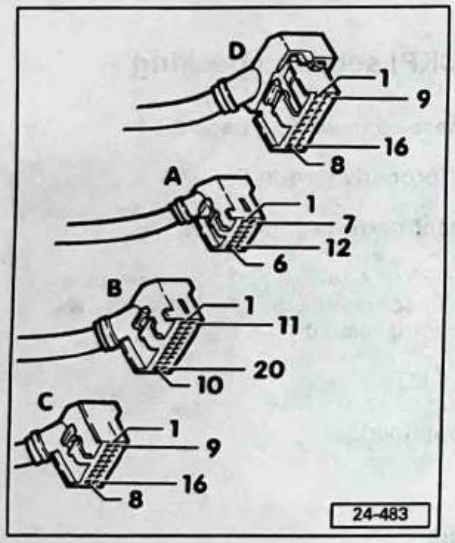
  Specified value: maximum 1 ohm (Ω)

- Check wiring for continuity between sensor connector terminal 1 and test box socket 5.

  Specified value: maximum 1 ohm (Ω)

- Check signal wire for continuity between sensor connector terminal 2 and test box socket 4.

  Specified value: maximum 1 ohm (Ω)



◄ If specified values are not obtained:

- Repair short and/or break in wiring between sensor connector and ECM connector -C- and/or Ground (GND).

CKP sensor connector terminal	ECM connector C
1	5
2	4
3	Ground

If no malfunction can be determined:

- Replace ECM ⇒ see Repair Group 01.

Engine Speed (RPM) sensor, checking and adjusting

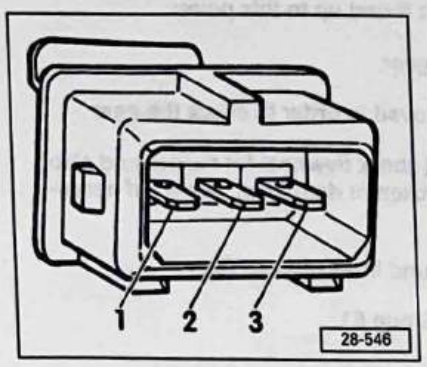
Note:

For functional testing of engine speed sensor, see Repair Group 01, "Basic Setting" function 04, display field 3.

Location of sensor and connector ⇒ page 28-1.

- Check that sensor is installed correctly.

- Disconnect gray harness connector.



◄ - Connect multimeter (Fluke 83 or equivalent) to terminals 1 and 2 of connector in connector station, using adapter cable VW 1594 connector test kit.

Specified value: approx. 1 kΩ

If specified value is NOT obtained:

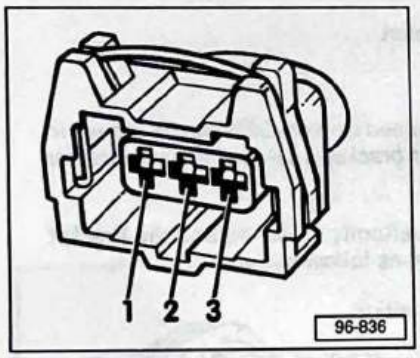
- Replace engine speed sensor.

If specified value is obtained:

- Connect multimeter to terminals 1 and 3 (Ground) and to terminals 2 and 3 (Ground).

Specified value: Infinite ohms in each case (no continuity).

If specified values are not obtained:



- Replace engine speed sensor.

If specified value is obtained, check wiring between sensor connector and ECM as follows:

- Connect VAG 1598 test box with VAG 1598/11 adapter harness to ECM wiring harness ⇒ Repair Group 01.

(Adapter harness is not connected to ECM.)

◄ - Check shielding by checking for continuity between sensor connector terminal 3 and GND.

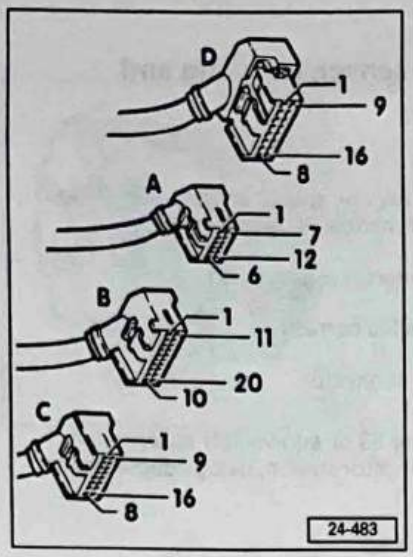
Specified value: maximum 1 ohm (Ω)

- Check GND wire for continuity between sensor connector terminal 1 and test box socket 1.

Specified value: maximum 1 ohm (Ω)

- Check signal wire for continuity between sensor connector terminal 2 and test box socket 2.

Specified value: maximum 1 ohm (Ω)



◄ – If specified values are not obtained, eliminate short circuit or break in wiring between RPM sensor connector and ECM connector -C-.

Sensor connector terminal	ECM connector C
1	5
2	4
3	Ground (GND)

If no malfunction has been found up to this point:

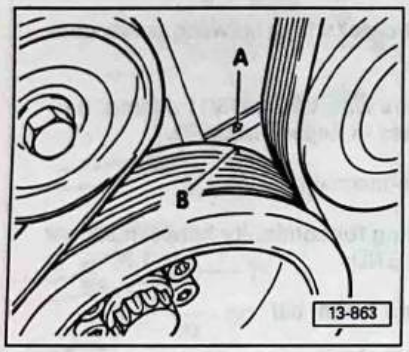
– Inspect teeth on starter gear.

• The starter must be removed in order to check the gear

– Crank engine slowly and check flywheel for runout and also whether any teeth are broken or damaged; replace if necessary.

– If no malfunction was found in all tests so far:

– Replace ECM ⇒ Repair Group 01.



Adjusting RPM sensor bracket

Note:

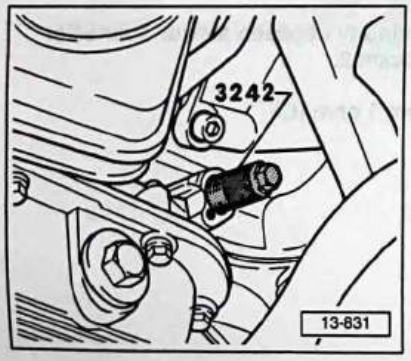
The bracket for the engine speed sensor -G28- can be moved in the slots. The position of the bracket is set by the manufacturer and must not be altered.

If the bolts have been inadvertently loosened and the bracket thus moved, it should be set as follows:

◄ – Turn crankshaft to TDC position.

– Remove Crankshaft Position (CKP) sensor -G4-.

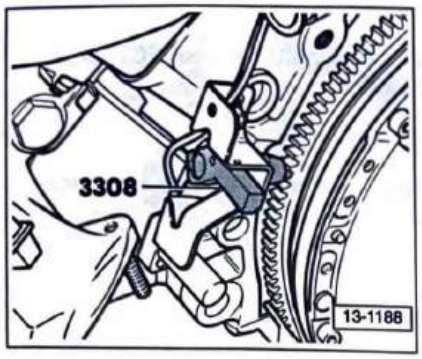
Hole in crankshaft for TDC can be seen or felt through CKP sensor hole.



◄ – Insert crankshaft fixture 3242 into hole of removed CKP sensor -G4- and tighten slightly.

– Remove engine speed sensor (remove heat shield first).

– Loosen bracket.



◄ – Insert adjusting tool 3308 in place of engine speed sensor (must engage in ring gear).

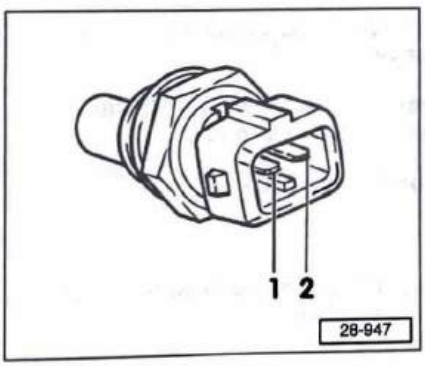
– Tighten bracket.

– Install engine speed sensor (install heat shield).

Engine Coolant Temperature (ECT) sensor, checking

Note:

- *For functional testing of the ECT sensor, starting with ECM 4A0 906 266 A see also "Read Measuring Value Block" function 08, display field 1.*
- *For installation position of ECT sensor ⇒ page 28-4.*



– Disconnect ECT sensor harness connector.

◄ – Check resistance between terminals 1 and 2 of sensor.

Specified values:

- At approx. 20°C coolant temperature, approx. 2.5 kΩ
- At approx. 80°C coolant temperature, approx. 330 ohm

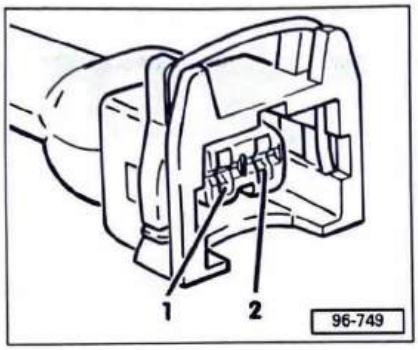
If specified values are not obtained:

– Replace ECT sensor.

If specified value is obtained, check wiring from sensor to ECM as follows:

– Connect VAG 1598 test box with VAG 1598/11 adapter harness to ECM wiring harness ⇒ Repair Group 01.

(Adapter harness is not connected to ECM.)



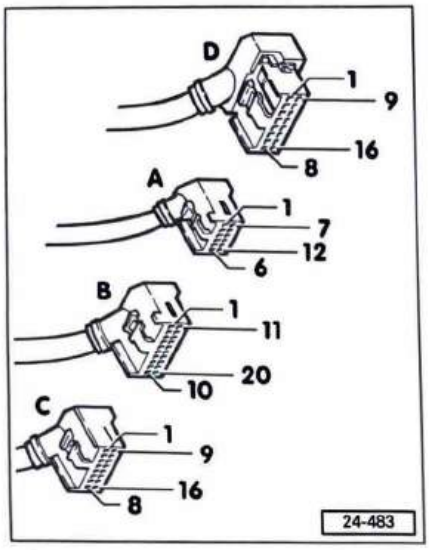
◄ – Check Ground (GND) wire for continuity between ECT sensor connector terminal 2 and GND.

Specified value: maximum 1 ohm (Ω)

– Check signal wire for continuity between ECT sensor connector terminal 1 and test box socket 15.

Specified value: maximum 1 ohm (Ω)

– Check both wires for short to each other.



If specified values are not obtained:

◄ – Repair short and/or break in wiring between ECT sensor and ECM connector -C- and/or GND.

ECT sensor connector terminal	ECM connector C terminal
1	15
2	Ground (GND)

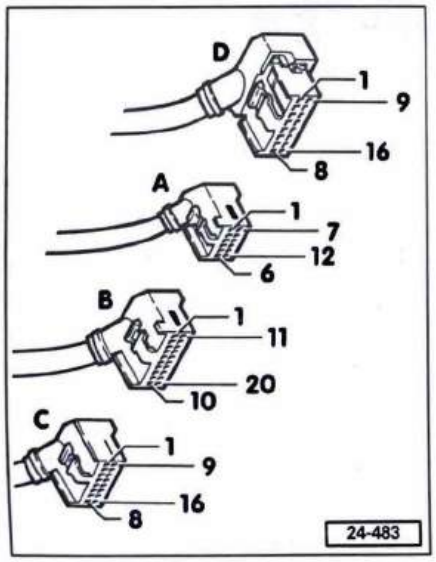
If there is no short or break in wiring, and ECT sensor is OK:

– Replace ECM ⇒ see Repair Group 01.

Engine Control Module (ECM) voltage supply, checking

Note:

To check the ECM voltage supply, starting with ECM 4A0 906 266 A, see also Repair Group 01, "Read Individual Measuring Value" function 09, channel 14.



- Circuit breaker -S64- must be OK (yellow holder in electronic box in passenger side footwell).

– Connect VAG 1598 test box with VAG 1598/12 adapter harness to ECM wiring harness ⇒ Repair Group 01.

(Adapter harness is not connected to ECM.)

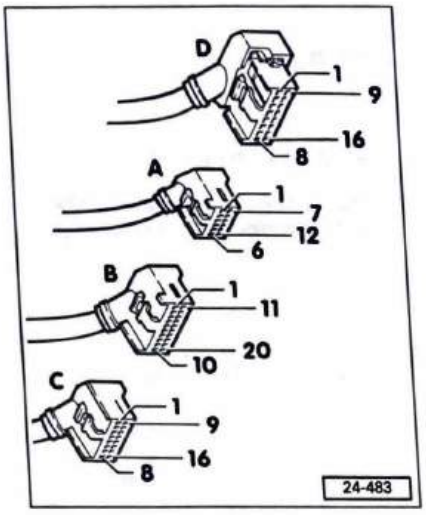
– Switch ignition on.

– Connect VAG 1527B voltage tester between test box socket 8 (B+ via ignition) and Ground (GND).

- LED must light up

If LED does NOT light up:

◄ – Check for break in wiring according to wiring diagram and repair if necessary.



– Connect VAG 1527B voltage tester to test box socket 8 (B+ supply via ignition) and successively to sockets 1, 2, 3 and 16 (Ground connections).

• LED must light up in each case

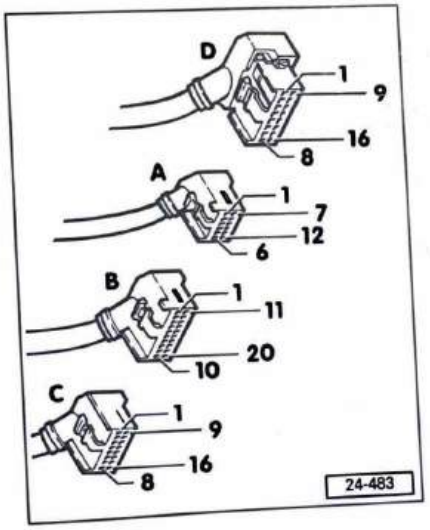
If LED does not light up:

◄ – Check wiring between intake manifold GND point and connector -D- using wiring diagram.

Test box socket	ECM connector D terminal
1	1
2	2
3	3
16	16

– Switch ignition off.

28-29



– Connect VAG 1598 test box with VAG 1598/11 adapter harness to ECM wiring harness ⇒ Repair Group 01.

(Adapter harness is not connected to ECM.)

– Connect VAG 1527B voltage tester between test box socket 40 (permanent B+) and Ground (GND).

• LED must light up.

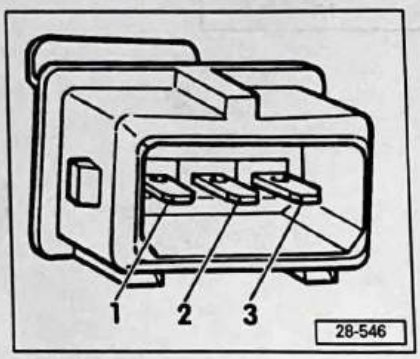
If LED does NOT light up:

◄ – Check wiring connection between ECM connector -B- terminal 20 and central electric panel according to wiring diagram.

Knock Sensors (KS), checking

Note:

- *See also Repair Group 24, driving performance.*
- *The knock sensors themselves cannot be checked electrically (Check Diagnostic Trouble Code memory ⇒ Repair Group 01).*
- *Remove and install with insert 3247.*
- *Exact compliance with the tightening torque of 20 Nm (15 ft lb) is critical for satisfactory function of the knock sensors.*
- *Check harness connection for corrosion.*
- *Use only gold terminals to repair knock sensor harness connectors.*

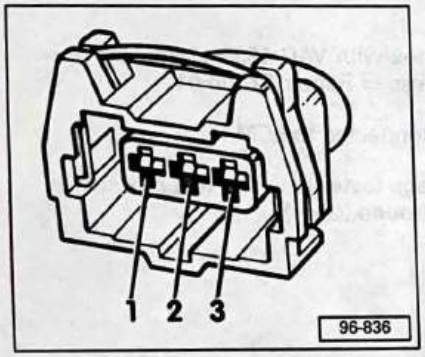


Checking knock sensor wiring

- Separate knock sensor harness connectors in engine compartment. (location ⇒ page 28-1).

◄ - Check all three terminals at each knock sensor connector for short circuit to each other.

- If a connection exists, replace knock sensor.



Checking wiring from knock sensors to ECM

- Connect VAG 1598 test box with VAG 1598/11 adapter harness to ECM wiring harness ⇒ Repair Group 01.
- Check wiring between sensor and ECM for open circuit or short circuit using wiring diagram.

◄ Terminal assignment of connector:

1 - Signal wire
2 - Ground
3 - Shield

- Check knock sensor 1 -G61- signal wire for continuity between terminal 2 of connector in engine compartment and test box socket 21.

  Specified value: maximum 1 ohm (Ω)

- Check knock sensor 1 -G61- Ground wire for continuity between terminal 1 of connector in engine compartment and test box socket 22.

  Specified value: maximum 1 ohm (Ω)

- Check knock sensor 1 -G61- shielding for continuity between terminal 3 of connector in engine compartment and test box socket 23.

  Specified value: maximum 1 ohm (Ω)

- Check knock sensor 2 -G66- signal wire for continuity between terminal 2 of connector in engine compartment and test box socket 24.

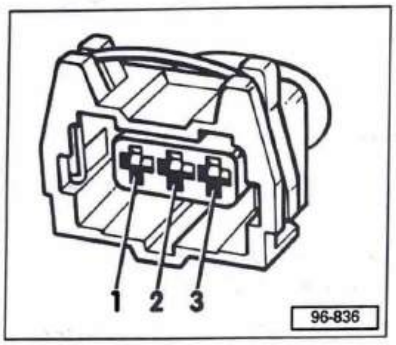
  Specified value: maximum 1 ohm (Ω)

- Check knock sensor 2 -G66- Ground wire for continuity between terminal 1 of connector in engine compartment and test box socket 25.

  Specified value: maximum 1 ohm (Ω)

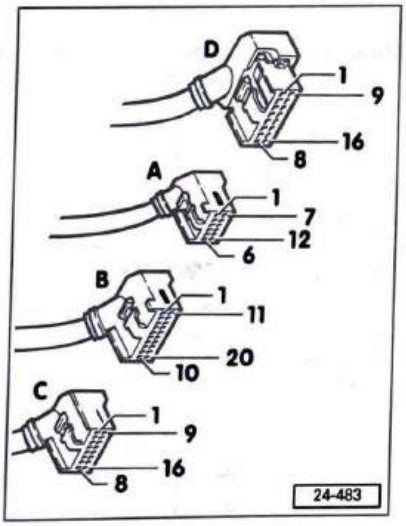
- Check knock sensor 2 -G66- shielding for continuity between terminal 3 of connector in engine compartment and test box socket 26.

  Specified value: maximum 1 ohm (Ω)



If specified values are not obtained:

- Repair break in wiring and/or short circuit between sensor connector and ECM connector B.



◄ Knock sensor 1 (right cyl. bank):

Blue sensor connector terminal	ECM connector B terminal
1 (signal)	2
2 (Ground)	1
3 (shield)	3

Knock sensor 2 (left cyl. bank):

Blue sensor connector terminal	ECM connector B terminal
1 (signal)	5
2 (Ground)	4
3 (shield)	6

Camshaft Position (CMP) sensor, checking

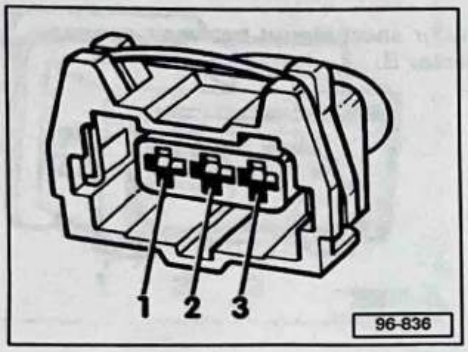
Location: back of left cylinder head ⇒ page 28-3.

Checking battery positive voltage (B+) supply

- Connect VAG 1598 test box and VAG 1598/11 adapter harness on ECM and wiring harness (⇒ Repair Group 01).
- Connect multimeter (Fluke 83 or equivalent) between test box socket 7 (positive) and Ground (GND).
- Switch ignition on.

  Specified value: minimum 9 volts
- Connect multimeter to socket 45 (GND) and socket 7 (positive).

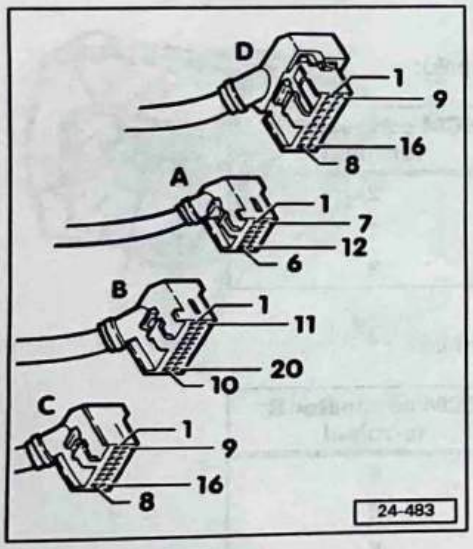
  Specified value: minimum 9 volts



If one of the specified values is not obtained:

◄ - Connect VAG 1598 test box and VAG 1598/11 adapter harness to engine wiring harness only.
- Check wiring between CMP sensor and ECM for continuity and/or short circuit according to wiring diagram.
- Check for continuity of GND wire from CMP sensor connector terminal 3 to GND.

  Specified value: maximum 1 Ω



- Check positive wire from terminal 1 of CMP sensor connector to test box socket 7 for continuity.

  Specified value: maximum 1 Ω
- Check both wires for short to each other.

If one specified value is not obtained:

◄ - Repair break in wiring and/or short between CMP sensor connector and ECM connector -C-.

CMP sensor connector terminal	ECM connector C terminal
1 (B+)	7
2 (GND)	(GND)

If there is neither break in wiring nor short circuit:

- Replace ECM ⇒ Repair Group 01.

Checking function

Note:

For functional testing of CMP sensor, disconnect 4-pin connector from power output stage, then check DTC memory.

- Voltage supply of CMP sensor OK, checking ⇒ page 28-35.

- Connect VAG 1598 test box and VAG 1598/11 adapter harness to ECM wiring harness (⇒ Repair Group 01).

- Connect VAG 1527B voltage tester between test box sockets 8 (CMP sensor signal) and 46 (positive).

- Operate starter a few seconds.

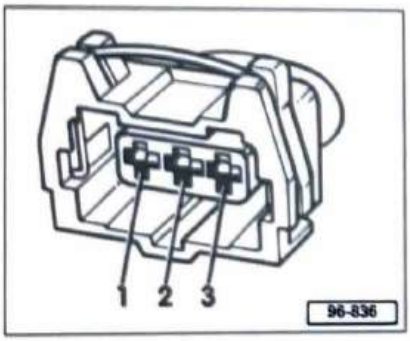
- LED must blink at each second engine revolution

If LED does not blink:

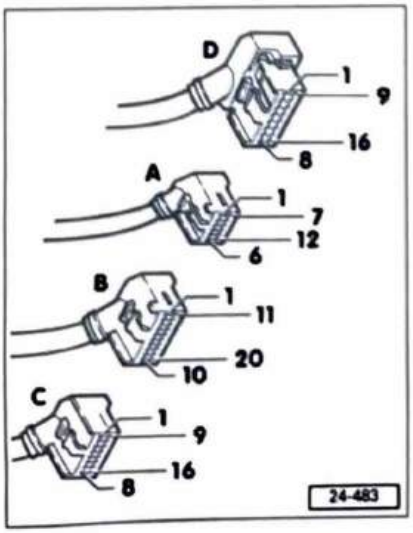
- Switch ignition off and disconnect 3-pin connector on CMP sensor.

- Check signal wire for continuity from CMP sensor connector terminal 2 to test box socket 8.

  Specified value: maximum 1 Ω



◄ - If specified values are not obtained, repair short and/or open circuit in wiring between CMP sensor connector and ...



◄ - ... ECM connector -C-.

CMP sensor connector terminal	ECM connector C terminal
2 (signal)	8

- If there is no open or short circuit, connect multimeter between test box sockets 8 and 45 (Ground).

  Specified value: minimum 4.0 volts

If specified values are not obtained:

- Replace ECM.

If specified values are obtained:

- Replace CMP sensor.