

Workshop Manual OCTAVIA

**1.4-ltr./55 kW Engine, Motronic Fuel
Injection and Ignition System**

Supplement Overview for the Repair Manual **OCTAVIA**

Edition: 04.02

1.4 l/55 kW engine, Motronic Injection and Ignition System

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Supplement	Edition	Subject	Article Number
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1	04.02	Changes for the engine BCA	S00.5133.51.20
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General information on self-diagnosis

Features

The engine control unit (Motronic fuel injection and ignition system control unit -J220) is equipped with a fault memory.

If faults occur in the monitored sensors or components, these are stored in the fault memory with an indication of the type of fault.

Faults which occur only occasionally (sporadically), are also displayed with the prefix „/SP„. The cause of a sporadic fault may be, for example, a loose contact or a brief open circuit in the wiring. If a sporadic fault no longer occurs within 40 warming-up phases (engine start at less than 50 °C coolant temperature - engine switched off at more than 72 °C), it is erased from the fault memory.

The stored faults can be read with the vehicle system tester V.A.G 1552, V.A.G 1551 or VAS 5051 ⇒ page 01-6.

Notes:

- ◆ *The description which follows relates only to the vehicle system tester V.A.G 1552 using the programme card 5.0 or a higher version.*
- ◆ *Use of the fault reader V.A.G 1551 with programme card version 8.0 with integrated printer, or of the vehicle system tester VAS 5051, is similar although slight differences may exist in the readouts in the display.*

Technical data for the self-diagnosis

Engine identification characters	AXP, BCA
System designation	Motronic ME 7.5
Fulfils exhaust gas limit values according to	EU4
Lambda regulation	2 lambda probes
Knock control	1 knocking sensor
Variable intake manifold length	No
Camshaft adjustment	No
Secondary air system	No
Exhaust gas recycling system	Yes

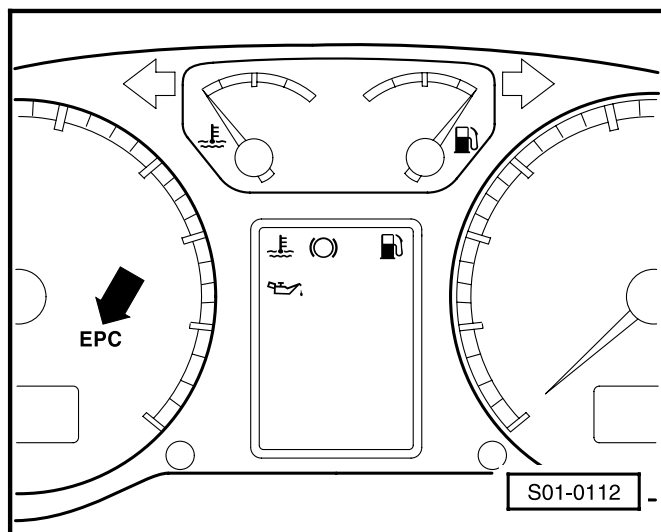
Selectable functions when using the vehicle system tester V.A.G 1551/1552

The conditions under which you can select the desired functions can be taken from the following table.

Function		Condition		
Function on the vehicle system tester		Engine stopped, ignition switched on	Engine running, idling	Vehicle running normally on the road
01	Ask about the control device version	Yes	Yes	Yes
02	Interrogate the fault memory	Yes ¹⁾	Yes	Yes
03	Actuator diagnosis	Yes	No	No
04	Initiate the basic setting ²⁾	Yes	Yes	Yes
05	Delete the fault memory	Yes	Yes	Yes
06	End output	Yes	Yes	Yes
07	Code the control device	Yes	No	No
08	Read the measuring block	Yes	Yes	Yes
15	Readiness code	Yes	Yes	Yes

¹⁾ Only undertake this when the ignition is switched on, when the engine does not start (actuate the starter motor beforehand for a minimum of 6 seconds)

²⁾ Must be undertaken after the following work has been done: engine control unit, replacing the throttle valve control unit or the engine or unclamping of the battery



Meaning of the EPC warning light (fault light for electronic throttle control) in the dash panel insert

„EPC“ is an abbreviation for **E**lectronic **P**ower **C**ontrol, which is sometimes also termed electronic throttle.

◀ Installation position of EPC warning light

After the ignition is switched on, the engine control unit checks all the components which are of importance for the operation of the EPC system.

Testing operation

- Switch ignition on,
the EPC warning light must come on.

If the EPC warning light does not come on when the ignition is switched on:

- Test dash panel insert
⇒ Electrical System; Repair Group 90.

If the EPC warning light comes on when the ignition is switched on:

- Start engine and run at idling speed.

If the EPC warning light does not go out:

- Interrogate fault memory of engine control unit ⇒ page 01-6.

Connecting vehicle system tester V.A.G 1552 and selecting engine electronics control unit

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Test conditions

- Fuses o.k. as specified in up-to-date current flow diagram.
- All electrical components such as lights and rear window heater, must be switched off.
- If vehicle is equipped with air conditioning, this must be switched off.
- Battery voltage at least 11.5 V.
- Earth connections between engine (at clutch housing) and body (below battery) o.k.

Procedure

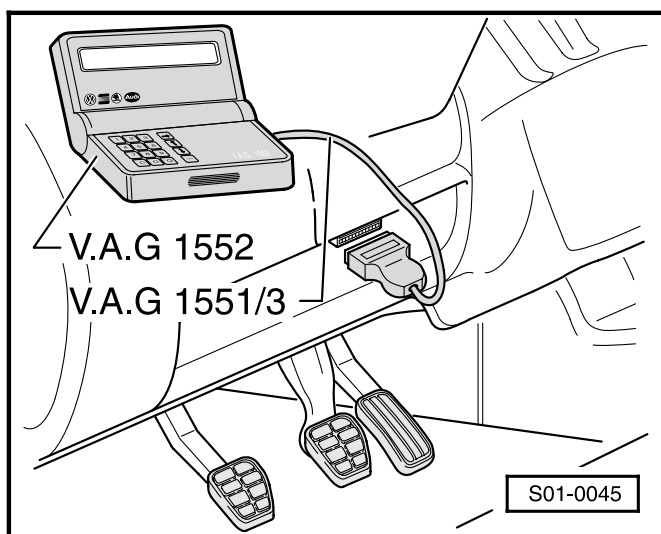
- ◀ - Connect the vehicle system tester V.A.G 1552.

After the vehicle system tester has been connected:

- Depending on the desired function, you have to: switch on ignition or start the engine
⇒ page 01-2, table of „Available Functions,,.

Notes:

- ◆ If no readout appears in the display, test voltage supply for diagnostic connector ⇒ *Fault Finding Programme in the binder „Current Flow Diagrams, Electrical Fault Finding and Fitting Locations,,.*
- ◆ If the readout in the display does not correspond to the procedure:
⇒ Operating instructions of vehicle system tester
- ◆ If „Data transmission error“ is displayed because of an incorrect entry, disconnect cable at fault reader, plug in again and repeat the steps.



Test of vehicle systems
Enter address word XX

HELP

◀ Readout in display:

036906032	ME 7.5.10	3257	→
Coding 00021		WSC 08686	

Note:

Operate the vehicle system tester in accordance with the readout which appears on the display.

- Enter address word 01 for „Engine electronics“ and confirm the entry with the key Q.

◀ The control unit identification and the coding appear in the display, e.g.:

- ◆ 036906032 = Part No. of control unit
(⇒ Parts List for current control unit version)
- ◆ ME 7.5.10 = System designation and version (Motronic)
- ◆ 3257 = Software version
- ◆ Coding 00021 = Coding of control unit, coding versions of engine control unit ⇒ page 24-30
- ◆ WSC xxxxx = Workshop code from V.A.G 1552 with which last coding was performed

Notes:

If the control unit version display does not match the vehicle, replace control unit ⇒ page 24-29.

Incorrect coding of the engine control unit results in:

- ◆ Poor performance (jerky gearshifts, load change jolts, etc.)
- ◆ Increased fuel consumption
- ◆ Increased emission levels
- ◆ Storage of non-existent faults in the fault memory
- ◆ Functions not being performed (lambda control, actuation of activated charcoal filter system, etc.)
- ◆ Reduction in life of automatic gearbox

If the coding does not agree with the version fitted to the vehicle:

- Check coding of control unit ⇒ page 24-30.
- Press the → key.

Test of vehicle systems Select function XX

HELP

◀ Readout in display:

- Workshop Manual for further procedure.

Interrogating and erasing fault memory

Special tools, testers and aids required

- ♦ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Procedure

- Connect vehicle system tester V.A.G 1552. Leave engine running and select the engine control unit with the „address word“ 01 ⇒ page 01-4.

Only if engine does not start:

- Operate starter for about 6 seconds and then do not switch off ignition.
- Enter function 02 for “Interrogate fault memory” and confirm the entry with the key Q.

X faults recognized!

◀ The number of stored faults or “No fault recognized!” appears in the display.

If no fault is stored:

- Press the → key.

If one or several faults are stored:

The stored faults are displayed one after the other.

- Rectify the faults displayed by referring to the fault table ⇒ page 01-8.
- Enter function 05 for „Erase fault memory“ and confirm the entry with the key Q.

Test of vehicle systems
Fault memory is erased!

→

◀ Readout in display:

Note:

If you have switched off the ignition between „Interrogating fault memory“ and „Erasing fault memory“, the fault memory is not erased.

- If the fault memory has been erased, it is then necessary to re-generate the readiness code ⇒ page 01-32.
- End output.

Automatic test sequence

When carrying out test and removal and installation work, it is possible that other control units detect faults, such as connectors unplugged. For this reason, it is necessary to interrogate and erase the fault memories of all the control units once the work is completed. To do this, you must:

- Press the key 0 twice for the address word "Automatic test sequence" and confirm the entry with the key Q. V.A.G 1552 thereupon sends all the known address words one after the other.

If the control unit answers with its identification, the number of stored faults or „No fault recognized“ appears in the display.

Any faults which are stored for a system are displayed one after the other. After this, V.A.G 1552 sends the next address word.

Test of vehicle systems
Enter address word XX

HELP

◀ The automatic test sequence is completed once the following readout appears in the display:

- Erase all the fault memories and then conduct a road test.

Observe the safety precautions applicable to a road test ⇒ page 24-2.

During this road test, the following operating conditions must be met:

- ◆ The coolant temperature must rise to more than 85 °C.
- ◆ Once this temperature is reached, the following operating states must be achieved several times:
 - Idling speed
 - Part throttle
 - Full throttle
 - Enrichment
 - Fuel shutoff on overrun
- ◆ Engine speed must be increased to more than 3500 rpm at full throttle.
- Once again interrogate the fault memories of all the control units with the „Automatic test sequence„.

If no fault is stored:

- End output and switch ignition on.

Fault table

Notes:

- ◆ The fault table is arranged in accordance with the 5-digit fault code which appears on the left.
- ◆ Explanations on fault types (e.g. „open circuit/short to earth„):
⇒ Operating instructions of vehicle system tester
- ◆ If components are shown as faulty:
First of all, test the cables and plug connections to these components as well as the earth cables of the system on the basis of the current flow diagram. Replace the component only if these tests do not reveal a fault. This applies in particular if faults are displayed as „occurring sporadically“ (SP).
- ◆ When testing earth cables, rectify any open circuit in wiring or short circuit according to the current flow diagram: Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder.

Explanations:

- ◆ 16497 = fault code
- ◆ Intake air temperature sender -G42 = faulty current path or fault location
- ◆ Signal too small = fault type as text
- ◆ Sporadically occurring fault = fault no longer present, e.g. loose contact
- ◆ When testing senders, injectors and other components of the fuel injection system, use the current flow diagrams binder.

Readout on V.A.G 1552	Rectifying fault
16490 Intake manifold pressure/air pressure ⇒ G71-/F96- implausible signal	- Test sender -G71
16491 Intake manifold pressure/air pressure ⇒ G71-/F96- signal too large	
16492 Intake manifold pressure/air pressure ⇒ G71-/F96- signal too small	
16496 Intake air temperature sender -G42 signal too small	- Test sender -G42
16497 Intake air temperature sender -G42 signal too large	
16500 Coolant temp. sender -G62 implausible signal	- Test sender -G62

Readout on V.A.G 1552	Rectifying fault
16501 Coolant temp. sender -G62 signal too small	- Test sender -G62 - Test coolant thermostat: ⇒ 1.4 l/55 kW Engine - Mechanical Components; Repair Group 19
16502 Coolant temp. sender -G62 signal too large	
16514 Bank 1 probe 1 electr. fault in circuit	- Test lambda probe heater upstream of catalytic converter ⇒ pae 24-24
16515 Bank 1 probe 1 voltage too small	- Test lambda probe and lambda probe control upstream of catalytic converter ⇒ page 24-24
16516 Bank 1 probe 1 voltage too large	
16517 Bank 1 probe 1 signal too slow	
16518 Bank 1 probe 1 no activity	- Test lambda probe and lambda probe control upstream of catalytic converter ⇒ page 24-24 - Test lambda probe heater upstream of catalytic converter ⇒ page 24-24
16519 Bank 1 probe 1, heating circuit electr. fault	

Readout on V.A.G 1552	Rectifying fault
16520 Bank 1 probe 2 electr. fault in circuit	- Test lambda probe and lambda probe control upstream of catalytic converter ⇒ page 24-25 - Test lambda probe heater upstream of catalytic converter ⇒ page 24-26
16521 Bank 1 probe 2 voltage too small	
16522 Bank 1 probe 2 voltage too large	
16523 Bank 1 probe 2 signal too slow	
16524 Bank 1 probe 2 no activity	
16525 Bank 1 probe 2, heating circuit electr. fault	
16554 Bank 1, fuel metering system malfunction	- Test fuel pressure regulator and pressure in system ⇒ page 24-19 - Test injectors ⇒ page 24-17 - Test fuel pump: ⇒ 1.4 l/55 kW Engine - Mechanical Components; Repair Group 20 - Inspect intake system for leaks ⇒ page 24-22 - Inspect vacuum lines for leaks
16555 Bank 1, fuel metering system system too lean	

Readout on V.A.G 1552	Rectifying fault
16556 Bank 1, fuel metering system system too rich	- Test fuel pressure regulator and pressure in system ⇒ page 24-19 - Test injectors ⇒ page 24-17 - Test activated charcoal filter solenoid valve ⇒ page 01-29, Final control diagnosis
16585 Injector cyl. 1 -N30 electr. fault in circuit	
16586 Injector cyl. 2 -N31 electr. fault in circuit	
16587 Injector cyl. 3 -N32 electr. fault in circuit	
16588 Injector cyl. 4 -N33 electr. fault in circuit	
16603 Maximum engine speed exceeded	- Inspect engine for mechanical damage and erase fault memory ⇒ page 01-6 - Test engine speed sender
16605 Angle sender 2 for TV drive -G188 implausible signal	- Test throttle valve control unit ⇒ page 24-16
16606 Angle sender 2 for TV drive -G188 signal too small	
16607 Angle sender 2 for TV drive -G188 signal too large	

Readout on V.A.G 1552	Rectifying fault
16610 Sender 1/2 for accelerator pedal position -G79+G185 implausible signal	- Test sender -G79
16611 Accelerator pedal position sender -G79 signal too small	
16612 Accelerator pedal position sender -G79 signal too large	
16645 Injector cyl. 1 -N30 short to earth	- Test injectors
16646 Injector cyl. 1 -N30 short to positive	
16648 Injector cyl. 2 -N31 short to earth	
16649 Injector cyl. 2 -N31 short to positive	
16651 Injector cyl. 3 -N32 short to earth	
16652 Injector cyl. 3 -N32 short to positive	

Readout on V.A.G 1552	Rectifying fault
16654 Injector cyl. 4 -N33 short to earth	- Test injectors
16655 Injector cyl. 4 -N33 short to positive	
16684 Combustion misfiring detected	- Test injectors - Test ignition cables and spark plugs ⇒ page 28-3 - Test ignition coil - Test combustion misfiring
16685 Cyl. 1 Combustion misfiring detected	
16686 Cyl. 2 Combustion misfiring detected	
16687 Cyl. 3 Combustion misfiring detected	
16688 Cyl. 4 Combustion misfiring detected	
16705 Engine speed sender -G28 implausible signal	
16706 Engine speed sender -G28 no signal	- Test sender -G28

Indicator on the V.A.G 1552	Fault removal
16711 Knocking sensor 1 -G61 Signal too small	- Check sender -G61
16712 Knocking sensor 1 -G61 Signal too large	
16725 Camshaft position sensor ⇒ Sender -G40 Implausible signal	- Check sender -G40 ⇒ Page 28-5
16726 Camshaft position sensor ⇒ Sender -G40 Signal too small	
16727 Camshaft position sensor ⇒ Sender -G40 Signal too large	
16791 Potentiometer for the exhaust gas recycling -G212 Signal too small	- Check the exhaust gas recycling ⇒ Page 01-29 Actuator diagnosis - Check sender -G212
16792 Potentiometer for the exhaust gas recycling -G212 Signal too large	
16804 Bank 1, the catalytic converter system Effect too weak	- Replace the catalytic converter ⇒ 1.4 l/55 kW engine mechanics; Rep. Size 26
16806 Bank 1, main catalytic converter Effect too weak	

Readout on V.A.G 1552	Rectifying fault
16824 Tank vent system malfunction	- Test -N80 ⇒ page 01-29, Final control diagnosis - Inspect hoses and connection pipes from fuel tank to throttle valve control unit ⇒ 1.4 l/55 kW Engine - Mechanical Components; Repair Group 20
16825 Tank vent system faulty flow	
16826 Tank vent system minor leak detected	- Inspect tank vent system
16839 Tank vent system major leak detected	
16885 Vehicle speed signal implausible signal	- Test vehicle speed signal ⇒ page 24-34
16944 Voltage supply implausible signal	- Test voltage supply to engine control unit ⇒ page 24-27 - Test alternator and battery: ⇒ Electrical System; Repair Group 27, Battery - Procedure in the case of voltage interruption ⇒ page 24-28
16946 Voltage supply voltage too small	
16947 Voltage supply voltage too large	
16955 Brake light switch -F implausible signal	- Test brake light switch and brake pedal switch
16985 Control unit defective	- Test earth cables according to current flow diagram - Replace engine control unit ⇒ page 24-29
16988 16989 16990	
Control unit defective	

Readout on V.A.G 1552	Rectifying fault
17510 Bank 1 probe 1, heating circuit short circuit to positive	- Test lambda probe heater upstream of catalytic converter ⇒ page 24-24 - Rectify short circuit according to current flow diagram
17513 Bank 1 probe 2, heating circuit short circuit to positive	- Test lambda probe heater downstream of catalytic converter ⇒ page 24-26
17519 Lambda control (bank 1) system too lean	Test lambda probe and lambda control upstream of catalytic converter ⇒ page 24-24
17520 Lambda control (bank 1) system too rich	
17521 Bank 1, probe 1 internal resistance too large	- Test lambda probe heater upstream of catalytic converter ⇒ page 24-24
17522 Bank 1, probe 2 internal resistance too large	- Test lambda probe heater downstream of catalytic converter ⇒ page 24-26
17523 Bank 1 probe 1, heating circuit short circuit to earth	- Test lambda probe heater upstream of catalytic converter ⇒ page 24-24
17524 Bank 1 probe 1, heating circuit open circuit	
17525 Bank 1 probe 2, heating circuit short circuit to earth	- Test lambda probe heater downstream of catalytic converter ⇒ page 24-26
17526 Bank 1 probe 1, heating circuit open circuit	

Readout on V.A.G 1552	Rectifying fault
17535 Bank 1, mixture adaptation (mult.) system too rich	- Test fuel pressure regulator and pressure in system ⇒ page 24-19 - Test injectors ⇒ page 24-17 - Test -N80 ⇒ page 01-29, Final control diagnosis
17536 Bank 1, mixture adaptation (mult.) system too lean	- Test fuel pressure regulator and pressure in system ⇒ page 24-19 - Test injectors ⇒ page 24-17 - Test fuel pump: ⇒ 1.4 I/55 kW Engine - Mechanical Components; Repair Group 20 - Test intake system for leaks ⇒ page 24-22 - Test exhaust system for leaks: ⇒ 1.4 I/55 kW Engine - Mechanical Components; Repair Group 26 - Test vacuum lines for leaks
17544 Bank 1, mixture adaptation (add.) system too lean	
17545 Bank 1, mixture adaptation (add.) system too rich	- Test fuel pressure regulator and pressure in system ⇒ page 24-19 - Test injectors ⇒ page 24-17 - Test -N80 ⇒ page 01-29, Final control diagnosis
17557 Lambda control bank 1 implausible control value	- Test lambda probe and lambda control upstream of catalytic converter ⇒ page 24-24
17559 Bank 1, mixture adaptation range 1 below lean limit	- Test fuel pressure regulator and pressure in system ⇒ page 24-19 - Test injectors ⇒ page 24-17 - Test fuel pump: ⇒ 1.4 I/55 kW Engine - Mechanical Components; Repair Group 20 - Test intake system for leaks ⇒ page 24-22 - Test exhaust system for leaks: ⇒ 1.4 I/55 kW Engine - Mechanical Components; Repair Group 26 - Test EGR valve: ⇒ 1.4 I/55 kW Engine - Mechanical Components; Repair Group 26 - Test tank vent system for leaks - Test lambda probe and lambda control upstream of catalytic converter ⇒ page 24-24 - Test lambda probe and lambda control downstream of catalytic converter ⇒ page 24-25
17560 Bank 1, mixture adaptation range 2 below lean limit	

Readout on V.A.G 1552	Rectifying fault
17563 Intake manifold pressure sender -G71 short circuit to positive	- Test sender -G71 - Test intake system for leaks ⇒ page 24-22
17564 Intake manifold pressure sender -G71 open/short circuit to earth	
17565 Intake manifold pressure sender -G71 supply voltage	
17566 Intake manifold pressure sender -G71 implausible signal	
17573 Bank 1, mixture adaptation range 1 rich limit exceeded	- Test fuel pressure regulator and pressure in system ⇒ page 24-19 - Test injectors ⇒ page 24-17 - Test fuel pump: ⇒ 1.4 l/55 kW Engine - Mechanical Components; Repair Group 20 - Test intake system for leaks ⇒ page 24-22 - Test exhaust system for leaks: ⇒ 1.4 l/55 kW Engine - Mechanical Components; Repair Group 26 - Test EGR valve: ⇒ 1.4 l/55 kW Engine - Mechanical Components; Repair Group 26 - Test tank vent system for leaks - Test lambda probe and lambda control upstream of catalytic converter ⇒ page 24-24 - Test lambda probe and lambda control downstream of catalytic converter ⇒ page 24-25
17574 Bank 1, mixture adaptation range 2 rich limit exceeded	
17579 Angle sender 2 for TV drive -G188 implausible signal	- Test throttle valve control unit ⇒ page 24-16
17580 Angle sender 2 for TV drive -G188 signal too small	
17581 Angle sender 2 for TV drive -G188 signal too large	
17584 Bank 1, lambda correction after cat control limit reached	- Test ageing of lambda probe upstream of catalytic converter - Test lambda probe and lambda control downstream of catalytic converter ⇒ page 24-25

Readout on V.A.G 1552	Rectifying fault
17604 Bank 1 probe 1, heating circuit electr. fault	- Test lambda probe heater upstream of catalytic converter ⇒ page 24-24
17606 Bank 1 probe 2, heating circuit electr. fault	
17609 Injector cyl. 1 -N30 electr. fault in circuit	- Test injectors
17610 Injector cyl. 2 -N31 electr. fault in circuit	
17611 Injector cyl. 3 -N32 electr. fault in circuit	
17612 Injector cyl. 4 -N33 electr. fault in circuit	
17621 Injector cyl. 1 -N30 short to positive	- Test injectors

Readout on V.A.G 1552	Rectifying fault
17622 Injector cyl. 2 -N31 short to positive	- Test injectors
17623 Injector cyl. 3 -N32 short to positive	
17624 Injector cyl. 4 -N33 short to positive	
17633 Injector cyl. 1 -N30 short to earth	- Test injectors
17634 Injector cyl. 2 -N31 short to earth	
17635 Injector cyl. 3 -N32 short to earth	
17636 Injector cyl. 4 -N33 short to earth	
17645 Injector cyl. 1 -N30 open circuit	- Test injectors
17646 Injector cyl. 2 -N31 open circuit	
17647 Injector cyl. 3 -N32 open circuit	

Readout on V.A.G 1552	Rectifying fault
17648 Injector cyl. 4 -N33 open circuit	- Test injectors
17658 Fuel level too low	- Refuel vehicle
17733 Knock control cyl. 1 control limit reached	- Change type of fuel - Test knock sensor - Eliminate abnormal engine running noises (loose ancillaries, bent brackets or bolt) - Test cables and plug connections according to current flow diagram - Slacken knock sensor and then tighten again to 20 Nm
17734 Knock control cyl. 2 control limit reached	
17735 Knock control cyl. 3 control limit reached	
17736 Knock control cyl. 4 control limit reached	
17745 Bank 1, camshaft pos. sensor ⇒ -G163 short to earth	- Test Hall sender -G40 ⇒ page 28-4
17746 Bank 1, camshaft pos. sensor ⇒ -G163 open/short to positive	
17748 Camshaft pos./crankshaft pos. sens. incorrectly assigned	- Test sender -G28 - Test Hall sender ⇒ page 28-4

Readout on V.A.G 1552	Rectifying fault
17749 Ignition output 1 short to earth	- Test ignition transformer
17751 Ignition output 2 short to earth	
17794 17795 17796 Control unit defective	- Test earth connections according to current flow diagram - Replace engine control unit ⇒ page 24-29
17801 Ignition output 1 electr. fault in circuit	- Test ignition transformer
17802 Ignition output 2 electr. fault in circuit	
17808 EGR valve -N18 electr. fault in circuit	- Test valve -N80 ⇒ page 01-29, Final control diagnosis
17809 EGR valve -N18 short to earth	
17810 EGR valve -N18 short to positive	
17811 Exhaust gas recirculation system control difference	

Readout on V.A.G 1552	Rectifying fault
17812 Exhaust gas recirculation system basic setting not performed	- Test valve -N18 ⇒ page 01-29, Final control diagnosis
17817 Tank vent valve -N80 electr. fault in circuit	
17818 Tank vent valve -N80 short to positive	
17833 Tank vent valve -N80 short to earth	
17834 Tank vent valve -N80 open circuit	- Test valve -N80 ⇒ page 01-29, Final control diagnosis - Test fuse 43
17847 EGR potentiometer -G212 fault in basic setting	- Test valve -N18 ⇒ page 01-29, Final control diagnosis
17848 EGR valve -N18 open circuit	
17850 EGR potentiometer -G212 signal too large	
17851 EGR potentiometer -G212 signal too small	
17852 EGR potentiometer -G212 implausible signal	

Readout on V.A.G 1552	Rectifying fault
17908 Fuel pump relay -J17 electr. fault in circuit	- Test -J17
17909 Fuel pump relay -J17 short to earth	
17910 Fuel pump relay -J17 short to positive	
17931 Crash signal from airbag ECU implausible signal	- Test airbag ⇒ Body Fitting Work; Repair Group 01
17947 Clutch pedal switch -F36 implausible signal	- Test switch -F36
17949 Fuel pump relay -J17 open circuit	- Test relay -J17
17950 Angle sender for TV drive -G187¹⁾ implausible signal	- Test throttle valve control unit ⇒ page 24-16 - Replace engine control unit -J220 ⇒ page 24-29
17951 Angle sensor for TV drive -G187¹⁾ signal too small	- Test throttle valve control unit ⇒ page 24-16
17952 Angle sensor for TV drive -G187¹⁾ signal too large	
17953 Throttle valve actuation malfunction	

Readout on V.A.G 1552	Rectifying fault
17966 Throttle valve drive -G186²⁾ electr. fault in circuit	- Test throttle valve control unit ⇒ page 24-16
17967 Throttle valve control unit -J338 fault in basic setting	- Adapt engine control unit to throttle valve control unit ⇒ page 24-32
17968 Maximum engine speed exceeded	- Inspect engine for mechanical damage and erase fault memory ⇒ page 01-6
17972 Throttle valve control unit -J338 voltage drop in basic setting	- Test battery voltage, charge if necessary - Adapt engine control unit to the throttle valve control unit ⇒ page 24-32
17973 Throttle valve control unit -J338 lower stop is not reached	- Inspect throttle valve for damage or dirt - Test throttle valve control unit ⇒ page 24-16
17976 Throttle valve control unit -J338 mechanical fault	
17977 CCS switch -E45 implausible signal	- Test cruise control system - Read measured value block 66 ⇒ page 01-65
17978 Engine control unit inhibited	- Adapt engine control unit to electronic immobiliser ⇒ Electrical System; Repair Group 96 - Test immobiliser ⇒ Electrical System; Repair Group 96
17987 Throttle valve control unit -J338 adaptation not started	- Adapt engine control unit to throttle valve control unit ⇒ page 24-32 - Test throttle valve control unit ⇒ page 24-16

Readout on V.A.G 1552	Rectifying fault
18008 Voltage supply tml. 15 voltage too small	- Test supply voltage of engine control unit ⇒ page 24-27 - Carry out procedure if interruption to supply voltage ⇒ page 24-28 - Test fuse
18010 Voltage supply tml. 30 voltage too small	
18011 18012 Control unit defective	- Replace engine control unit -J220 ⇒ page 24-29
18017 Crash shutoff was activated	Test airbag system ⇒ Body Fitting Work; Repair Group 01
18018 Control unit defective	- Test earth cables according to current flow diagram - Replace engine control unit ⇒ page 24-29
18034 Drive databus missing message from gearbox ECU	- Test databus ⇒ page 24-35
18038 Accelerator pedal position sender -G79 signal too small	- Test sender -G79
18039 Accelerator pedal position sender -G79 signal too large	

Readout on V.A.G 1552	Rectifying fault
18041 Sender 2 for accelerator pedal position -G185 signal too large	- Test sender -G185
18042 Sender 2 for accelerator pedal position -G185 signal too large	
18044 Drive databus missing message from airbag ECU	- Test databus ⇒ page 24-35 - Test airbag control unit ⇒ Body Fitting Work; Repair Group 01
18047 Sender 1/2 for accelerator pedal position -G79+G185 implausible signal	- Test accelerator pedal position sender
18048 Control unit defective	- Replace engine control unit -J220 ⇒ page 24-29 - Test earth cables according to current flow diagram
18056 Drive databus defective	- Test databus lines ⇒ page 24-35
18057 Drive databus missing message from ABS ECU	
18058 Drive databus missing message from combiinstrument	
18062 Read fault memory of combiinstrument	- Self-diagnosis of control unit for combiinstrument ⇒ Electrical System; Repair Group 90

Readout on V.A.G 1552	Rectifying fault
18084 EPC fault light -K132 electr. fault in circuit	- Test EPC fault light ⇒ page 01-3
18085 EPC fault light -K132 short to positive	
18086 EPC fault light -K132 short to earth	
18087 EPC fault light -K132 open circuit	
18090 Drive databus missing message from ABS ECU	- Test databus ⇒ page 24-35
18261 Drive databus implausible message from ABS ECU	- Test databus ⇒ page 24-35 - Test ABS control unit ⇒ Running Gear; Antilock Brake System

1) Angle sender -1- for throttle valve drive (electronic power control) -G187 is also known as the throttle valve control unit sender -G127.

2) Throttle valve drive (electronic power control) -G186 is also known as throttle valve positioner (of intake manifold).

Note on fault code 17978:

◆ *The immobiliser control unit is installed in the dash panel insert and can therefore not be replaced separately.*

◆ *If an attempt is made to start the engine with a non-adapted key, a static fault is stored. During the subsequent start of the engine with an adapted key, the fault is converted into a sporadic fault.*

Final control diagnosis

Notes:

- ◆ *Final control diagnosis can only be carried out when the engine is not running and the ignition is switched on.*
- ◆ *Final control diagnosis is interrupted if the engine is started or if an engine speed pulse is registered.*
- ◆ *During final control diagnosis the individual control elements continue to be operated until the test programme is switched to the next control element by pressing the → key.*
- ◆ *The control elements are checked audibly or by touching.*
- ◆ *Before repeating final control diagnosis without briefly running the engine in-between, switch the ignition off for about 20 seconds.*
- ◆ *The electric fuel pump runs during the entire final control diagnosis.*
- ◆ *Final control diagnosis is ended after 10 minutes.*

With final control diagnosis the following components are operated in the order stated:

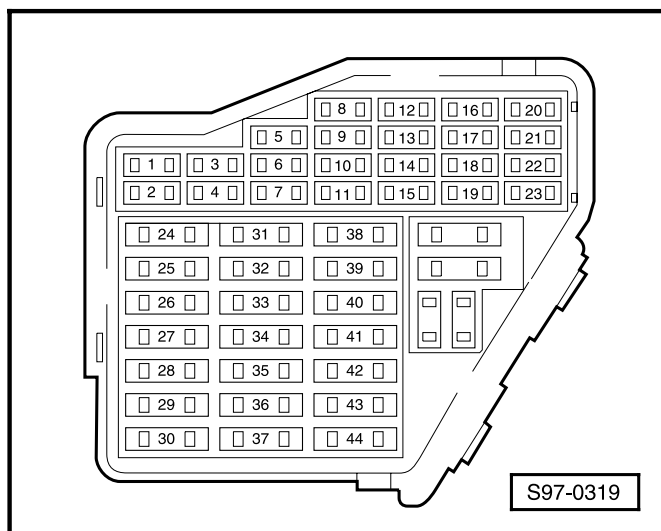
- 1 - Solenoid valve 1 for activated charcoal filter -N80
- 2 - EGR valve -N18

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Test conditions

- Fuses 7, 29, 34 and 43 must be o.k.
- Battery voltage at least 11.5 V
- All electrical components such as lights and rear window heater, must be switched off.



- On vehicles fitted with air conditioning, the air conditioning must be switched off.
- There must not be any faults stored in the fault memory; rectify any faults present and erase fault memory ⇒ page 01-6; Interrogating and erasing fault memory.

Procedure

- Connect vehicle system tester V.A.G 1552 and select address word 01 „Engine electronics,“. The ignition must be switched on for this step.
- Enter function 03 „Final control diagnosis“ and confirm entry with the key Q.

Actuating activated charcoal filter solenoid valve -N80:

- Press → key.

Final control diagnosis →
Activated charcoal filter solenoid valve -N80

◀ Readout in display:

The activated charcoal filter solenoid valve must be heard to continue clicking until the next control element is actuated by pressing the → key.

- If the solenoid valve is not actuated (does not click), test activated charcoal filter solenoid valve.

On/off ratio (actuation) of EGR valve -N18:

- Press → key.

Final control diagnosis →
EGR valve -N18

◀ Readout in display:

EGR valve -N18 (inlet of engine compartment at cylinder head) must be heard to click.

If the solenoid valve does not click, Test EGR valve -N18.

Note:

After final control diagnosis is ended, the ignition must be switched off. If the ignition is not switched off before the engine is next started, the engine will not start as the injectors and the ignition transformer are not operated.

Readiness code

Function

The readiness code is an 8-digit numerical code which indicates the status of the diagnoses which are of relevance for exhaust emissions.

If the diagnosis for a system (e.g. secondary air injection system) has been successfully completed, the corresponding place of the numerical code is set from 1 to 0.

The readiness code 00000000 means that the individual diagnoses are successfully completed.

The diagnoses are carried out in regular intervals during normal driving. After completing repairs to an exhaust-relevant system, it is recommended to generate the readiness code as this then ensures that these systems operate in accordance with specification. If during a diagnosis a fault is detected, this is entered in the fault memory.

The readiness code is erased each time the fault memory is erased, or if the power supply is interrupted.

Reading readiness code

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A or 3B

Procedure

- Connect vehicle system tester V.A.G 1552, switch the ignition on and select the address word 01 „Engine electronics“ ⇒ page 01-4.
- Enter function 15 „Readiness code“ and confirm the entry with the key Q.

Once all the diagnoses have been successfully completed, the following readout must appear in the display:

Readiness code
00000000 - Test complete

◀ Readout in display:

- ◆ 00000000: meaning ⇒ page 01-32
- End output and switch ignition off.

Readiness code
00101101 - Test not complete 0010000

◀ Readout in display:

One of the existing diagnoses was not successfully completed:

- Press the → key.

- Generate the readiness code
⇒ page 01-32.

Meaning of the 8-digit numerical block of the readiness code

The readiness code is only generated if all the readout places are 0									
1	2	3	4	5	6	7	8	Diagnosis function	
							0	Catalytic converter	
						0		Catalytic converter heater (no diagnosis at present/always „0„)	
					0			Activated charcoal filter system (fuel tank ventilation system)	
				0				Secondary air injection system	
			0					Catalytic converter heating (no diagnosis at present/always „0„)	
		0						Lambda probe	
	0							Lambda probe heater	
0								Exhaust gas recirculation system	

Generating readiness code

The readiness code must be re-generated if the fault memory of the engine control unit was erased, or if the power supply of the vehicle was interrupted.

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A or 3B

Test conditions

- Vehicle stationary.
- On vehicles fitted with automatic gearbox, selector lever in position „P“ or „N„.
- All electrical components such as lights and rear window heater, must be switched off.
- Coolant temperature must be at least 80 °C
⇒ Measured value block 004, display zone 3.
- Intake air temperature less than 60 °C
⇒ Measured value block 004, display zone 4.

Procedure

- Connect vehicle system tester V.A.G 1552, switch the ignition on and select address word 01 „Engine electronics“ ⇒ page 01-4.

Note:

It is essential to follow the order of the steps otherwise the readiness code cannot be successfully generated.

Step 1: Interrogating fault memory

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

- Press keys 0 and 2 for the function „Interrogate fault memory“ and confirm the entry with the key Q.

X faults recognized!

◀ The number of stored faults or „no fault recognized!“ appears in the display.

If a fault is stored:

- Rectify the fault or faults by referring to the fault table ⇒ page 01-8.

If no fault is stored:

- Press the → key.

Step 2: Erasing fault memory

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

- Enter function 05 for „Erase fault memory“ and confirm the entry with the key Q.

Note:

The readiness code is reset or cancelled each time the fault memory is erased.

Test of vehicle systems
Fault memory is erased!

→

◀ Readout in display:

Note:

If you have switched off the ignition between „Interrogating fault memory“ and „Erasing fault memory“, the fault memory is not erased.

- Press the → key.

Step 3: Adaptation of throttle valve control unit to engine control unit

- Select function 04 for „Initiate basic setting“ and select display group 060.

System in basic setting			60	→
14 %	85 %	8	ADP runs	

◀ Check readouts in display zones 3 and 4:

Display zone 3: 0...8

Display zone 4: ADP runs, ADP o.k.

- Wait at least 30 seconds before ending adaptation by pressing the → key.

If the readout does not appear as described:

- Test throttle valve control unit
⇒ page 24-16.

Step 4: Diagnosis of lambda probe ageing

- Start engine running and run at idling speed.
- Select function 08 „Read measured value block“ and display group 030.

Read measured value block		30	→
111	111		

◀ Check operating state of lambda control upstream of catalytic converter (display zone 1):
Specification: 111

- Check operating state of lambda control downstream of catalytic converter (display zone 2):
Specification: 111

Notes:

This procedure may take a few minutes.

- ♦ *The first place in the 3-digit numerical block changes between 0 and 1 (lambda probe heater off and on).*
- ♦ *A 0 or 1 may be displayed alternately in the 3-digit numerical block for the lambda control operating state.*
- ♦ *Readout in display zones 1 and 2 is not set to value 1 until the catalytic converter temperature is more than 400 °C (⇒ display group 34, display zone 2).*
- ♦ *The third place in display zone 2 changes for a short time from 0 to 1 (the specification is reached as a result).*

If the specification is not reached:

- Interrogate fault memory ⇒ page 01-6.

If the specification is reached:

- Select function 04 „Initiate basic setting“ and display group 034.

System in basic setting 34				→
720 rpm	400.0 °C	1.19	Test OFF	

◀ Readout in display:

- Depress brake pedal and hold.

Engine speed is increased by the engine control unit to 1100...1400 rpm.

- Run engine at higher speed until the readout in display zone 4 switches from „Test OFF“ to „Test ON„. Catalytic converter temperature in display zone 2 must be at least 400 °C.

Note:

This process may take a few minutes.

- Check period duration of lambda probe upstream of catalytic converter in display zone 3.
Specification 0.7...2.00.
- Continue running engine at increased speed.
Specification in display zone 4: B1-S1 o.k.

If none of the above messages appears:

- Interrogate fault memory ⇒ page 01-6.

If the above messages appear:

- Press key C.

Increased engine speed changes to idling speed.

Step 5: Diagnosis of lambda control system

- Enter code number of display group 037 and confirm entry with the key Q.

System in basic setting 37				→
19.5 %	0.435 V	0.000	Test ON	

◀ Readout in display:

- Depress brake pedal and hold.

Engine speed is increased by the engine control unit to 1100...1400 rpm.

- Run engine at increased speed until „Syst. o.k.“ appears in display zone 4.

If none of the messages described above appears:

- Interrogate fault memory ⇒ page 01-6.

If the messages described above appear:

- Press → key.

Increased engine speed changes to idling speed

Step 6: Diagnosis of catalytic converter

Note:

This diagnosis is only successfully completed if no fault is present in the previous diagnosis for the lambda probe ageing.

Enter code number of display group 046 and confirm the entry with the key Q.

System in basic setting 46	→
720 rpm 400.0 °C 0.25 Test OFF	

◀ Readout in display:

- Depress brake pedal and hold.
Engine speed is increased by the engine control unit to 1100...1400 rpm.
- Run engine at increased speed until the readout in display zone 4 switches from „Test OFF“ to „Test runs„. Catalytic converter temperature in display zone 2 must be at least 400 °C.
- Check period duration of lambda probe upstream of catalytic converter in display zone 3.
Specification: max. 0.50.
- Continue running engine at increased speed.
Specification in display zone 4: CatB1 o.k.

If none of the messages described above appears:

- Interrogate fault memory ⇒ page 01-6.

If the messages described above appear:

- Press the → key.

Increased engine speed changes to idling speed.

Step 7: Diagnosis of activated charcoal filter system (tank vent system)

Note:

The engine must not be switched off during the entire procedure.

- Select function 04 „Initiate basic setting“ and display group 070.

System in basic setting 70			→
0.0 %	0.0 %	Test OFF	

◀ After the engine control diagnosis is started, the message in display zone 4 switches from „Test OFF“ to „Test ON„.

- Continue running engine at idling speed until the specification „TVV o.k.“ appears in the display zone.

If the message described does not appear:

- Interrogate fault memory ⇒ page 01-6.

If the message described appears:

- Press → key.

Step 8: Diagnosis of exhaust gas recirculation system

Test of vehicle systems	HELP
Select function XX	

◀ Readout in display:

- Select function 08 „Read measured value block“ and display group 075.

Measured value block	75	→
0 mbar 0 mbar 0 mbar	Test OFF	

◀ Readout in display:

- Drive the car a short distance (about 3...4 min).

Engine speed must reach at least 1800...3600 rpm, coolant temperature must be greater than 70 °C.

- Take foot quickly off accelerator to produce deceleration mode.
- Readout in display zone 4 jumps from „Test OFF“ to „Test ON„.

Braking phase must last about 8 seconds.

- Check readout in display zone 4.
Specification: Syst. o.k.

If the message described is not displayed:

- Repeat braking phase several times.

If the message described again does not appear:

- Interrogate fault memory ⇒ page 01-6.

If the message described appears:

- Press → key.

Step 9: Reading out readiness code

- Interrogate fault memory ⇒ page 01-31.

Reading measured value block

Safety precautions

Pay attention to the following points if it is necessary to operate test and measuring equipment during a road test:

- ◆ Always attach the test and measuring equipment to the rear seat and have it operated from that point by a second person.
- ◆ If the test and measuring equipment is operated from the front passenger seat, the person sitting in that seat may suffer injuries in the event of an accident in which the front passenger airbag is deployed.

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Test conditions

- All electrical components such as lights and rear window heater, switched off.
- If vehicles equipped with air conditioning, it must be switched off.
- There must not be any fault stored in the fault memory ⇒ page 01-6.
- Coolant temperature must be at least 80 °C ⇒ Measured value block 004, display zone 3.

Procedure

- Connect vehicle system tester V.A.G 1552. Start engine and select the address word 01 „Engine electronics“ ⇒ page 01-4.
- Select function 08 „Read measured value block“ and confirm the entry with the key Q.
- Select desired display group number ⇒ from page 01-40.

Note:

Proceed as follows to switch into another display group:

Switching into display group	V.A.G 1552	V.A.G 1551
higher	Press ↑ key	Press key 3
lower	Press ↓ key	Press key 1
skip	Press key C	Press key C

- For further procedure ⇒ Repair descriptions.
- If the specifications for all display zones are achieved, press → key.
- End output and switch ignition off.

Reading measured value blocks, display groups 001...009

Display group 001 - Basic functions

• Engine idling						
Read measured value block 1 →				◀ Readout in display		
xxxx rpm	xx.x °C	xx.x %	xxxxxxx			
1	2	3	4	◀ Display zones	Specification	Analysis
				Setting conditions	1x111111	⇒ page 01-41
				Lambda controller upstream cat	-25.5...25.0 %	—
				Coolant temperature	80.0...110.0 °C	⇒ page 01-44
				Engine speed (idling speed)	650...850 rpm	⇒ page 01-40

Analysis of display group 001, display zone 1 - Engine speed (idling speed)

Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
less than specification	♦ Throttle valve control unit jamming or faulty ♦ Large quantity of unmetered air (cannot be compensated by idling speed stabilisation)	- Test throttle valve control unit ⇒ page 24-16 - Test idling speed - Inspect intake system for leaks ⇒ page 24-22
greater than specification	♦ Throttle valve control unit jamming or faulty ♦ Large quantity of unmetered air (cannot be compensated by idling speed stabilisation)	- Interrogate fault memory ⇒ page 01-6 - Inspect intake system for leaks ⇒ page 24-22 - Test throttle valve control unit ⇒ page 24-16 - Test idling speed

Analysis of indicator group 001, indicator field 4 - setting conditions

1	2	3	4	5	6	7	8	Meaning, when display position - 1
							1	The coolant temperature must exceed 80 °C
						1		The engine speed is below 2000 r.p.m.
					1			The throttle valve is closed
				1				Lambda regulation in order
			1					Idling speed established
		1						Air-conditioning unit compressor switched off
	x							Not used
1								No fault recognised by the self-diagnostic function

Display group 002 - Basic functions - Air mass meter

• Engine idling						
Read measured value block 2 →				◀ Readout in display		
xxxx rpm	xxx.x %	x.xx ms	xxx mbar			
1	2	3	4	◀ Display zones	Specification	Analysis
				Intake manifold pressure	250...500 mbar	⇒ page 01-42
				Injection time	2.0...7.0 ms	⇒ page 01-42
				Engine load	12.0...40.0 %	⇒ page 01-46
				Engine speed (idling speed)	—	⇒ page 01-40

Analysis of display group 002, display zone 3 - Injection time

Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
less than 2.0 ms	♦ High quantity of fuel out of activated charcoal filter system ♦ Incorrect injectors with larger flow installed ♦ Fuel pressure too high	- Test solenoid valve for activated charcoal filter ⇒ page 01-29, Final control diagnosis - Test quantity injected - Test fuel pressure regulator ⇒ page 24-19
greater than 7.0 ms	♦ Increased engine load caused by electrical components, AC, gear engaged or power steering at full lock	- Eliminate increased load (AC, power steering etc.)

Analysis of display group 002, display zone 4 - Intake manifold pressure

Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
less than 250 mbar	♦ Large quantity of unmetered air between intake manifold and air mass meter	- Eliminate unmetered air - Test intake air pressure sender -G71
greater than 500 mbar	♦ Additional load from ancillaries	- Eliminate load (AC, power steering etc.) - Test intake air pressure sender -G71

Display group 003 - Basic functions - Air mass meter

• Engine idling						
Read measured value block 3 →				◀ Readout in display		
xxxx rpm	xxx mbar	xxx.x %	xx.x° BTDC			
1	2	3	4	◀ Display zones	Specification	Analysis
				Ignition angle	-5.0...10.0° BZDC	—
				Throttle valve angle (potentiometer 1 -G187)	0.2...5.0 %	⇒ page 01-46
				Intake manifold pressure	250...500 mbar	⇒ page 01-42
Engine speed (idling speed)					—	⇒ page 01-40

Note on display zone 3:

Readout when accelerator pedal fully depressed is approx. 100 %.

Display group 004 - Basic functions

• Engine idling						
Read measured value block 4 →				◀ Readout in display		
xxxx rpm	xx.xxx V	xxx.x °C	xxx.x °C			
1	2	3	4	◀ Display zones	Specification	Analysis
				Intake air temperature	-30.0...120.0 °C	⇒ page 01-45
				Coolant temperature	80.0...110.0 °C	⇒ page 01-44
				Supply voltage of engine control unit	11.500...15.000 V	⇒ page 01-44
Engine speed (idling speed)					—	⇒ page 01-40

Note on display zone 3:

As soon as a fault relating to the coolant temperature sender -G62 is stored in the fault memory, the engine control unit uses the intake air temperature as a substitute value for starting the engine. The temperature then rises in line with a model curve stored in the control module. After a certain time, a fixed substitute value is displayed for an engine at operating temperature. This fixed substitute value is, in turn, dependent on the intake air temperature.

Note on display zone 4:

The readout should be greater than the ambient temperature.

Analysis of display group 004, display zone 2 - Supply voltage of engine control unit

Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
less than 11.500 V	◆ Alternator faulty, battery severely discharged ◆ Battery subjected to high loads just after start because of high charge current and ancillaries ◆ Contact resistance in power supply or in earth connection for engine control unit ◆ Current drain although ignition off	- Test alternator and battery voltage, charge battery: ⇒ Electrical System; Repair Group 27; Battery - Increase engine speed slightly for a few minutes and switch off ancillaries - Test voltage supply of engine control unit ⇒ page 24-27 - Eliminate current drain
greater than 15.000 V	◆ Voltage regulator at alternator faulty ◆ Excess voltage caused by jump-starting or quick-charger	- Test voltage, replace regulator if necessary - Interrogate fault memory ⇒ page 01-6

Analysis of display group 004, display zone 3 - Coolant temperature

Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
less than 80 °C	◆ Engine too cold ◆ Coolant temperature sender or cable connection to engine control unit faulty ◆ Coolant thermostat faulty	- Conduct road test if necessary - Test coolant temperature sender - Test coolant thermostat, replace if necessary ⇒ 1.4 l/55 kW Engine - Mechanical Components; Repair Group 19
greater than 110 °C	◆ Radiator soiled ◆ Radiator fan not operating ◆ Coolant thermostat faulty ◆ Coolant temperature sender or cable connection to engine control unit faulty	- Clean radiator - Test operation of radiator fan - Test coolant thermostat, replace if necessary ⇒ 1.4 l/55 kW Engine - Mechanical Components; Repair Group 19 - Test coolant temperature sender
constant -40 °C	◆ Open circuit in wiring or short circuit to positive	- Test coolant temperature sender
constant 120 °C	◆ Short circuit to earth	

Analysis of display group 004, display zone 4 - Intake air temperature

Note:

- ♦ Use only gold-plated contacts for repairing the contacts in the plug connection of the sender.

Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
constant -40 °C	♦ Open circuit in wiring or short circuit to positive	- Test intake air temperature sender -G42
constant 129 °C	♦ Short circuit to earth	

Display group 005 - Basic functions

• Engine idling						
Read measured value block 5 →				◀ Readout in display		
xxxx rpm	xxx.x %	xxx km/h	Text			
1	2	3	4	◀ Display zones	Specification	Analysis
				Operating state (idling, part load, full load, enrichment, overrun)	Idling	—
				Vehicle speed	0 km/h	—
				Engine load	12.0...40.0 %	⇒ page 01-46
				Engine speed (idling speed)	—	⇒ page 01-40

Display group 006 - Basic functions

• Engine idling						
Read measured value block 6 →				◀ Readout in display		
xxxx rpm	xxx.x %	xxx.x °C	xx.x %			
1	2	3	4	◀ Display zones	Specification	Analysis
				Altitude correction factor	-50.0...20.0 %	—
				Intake air temperature	-30.0...120.0 °C	⇒ page 01-45
				Engine load	12.0...40.0 %	⇒ page 01-46
				Engine speed (idling speed)	—	⇒ page 01-40

Note on display zone 3:

The entire temperature range is stated as a specification. The readout must be above the ambient temperature.

Reading measured value blocks, display groups 010...029

Display group 010 - Ignition

• Engine idling						
Read measured value block 10 →				◀ Readout in display		
xxxx rpm	xxx.x %	xxx.x %	xx.x° BTDC			
1	2	3	4	◀ Display zones	Specification	Analysis
				Ignition angle	-5.0...10.0° BTDC	—
				Throttle valve angle (potentiometer 1 -G187)	0.2...5.0 %	⇒ page 01-46
				Engine load	12.0...40.0 %	⇒ page 01-46
				Engine speed (idling speed)	—	⇒ page 01-40

Note on display zone 3:

Readout when accelerator pedal fully depressed is approx. 100 %.

Analysis of display group 010, display zone 2 - Engine load

Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
less than 12.0 %	♦ Smaller readouts occur only in fuel shutoff on overrun	
greater than 40.0 %	♦ Poor idling (not running on all cylinders) ♦ Electrical components on ♦ Steering wheel at full lock ♦ Throttle valve control unit faulty	- Test injectors - Replace spark plugs if necessary - Switch off electrical components - Turn steering wheel into straightahead position - Test throttle valve control unit ⇒ page 24-16

Analysis of display group 010, display zone 3 - Throttle valve angle, potentiometer 1

Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
greater than 5 %	♦ Engine control unit not adapted to throttle valve control unit ♦ Throttle valve potentiometer in throttle valve control unit faulty ♦ Throttle valve jamming	- Adapt engine control unit to throttle valve control unit ⇒ page 24-32 - Interrogate fault memory ⇒ page 01-6 - Test throttle valve control unit ⇒ page 24-16 - Eliminate cause

Display group 014, ignition - Misfiring detection

• Driving						
Read measured value block 14 →				◀ Readout in display		
xxxx rpm	xxx.x %	xxx	Text			
1	2	3	4	◀ Display zones	Specification	Analysis
				Misfiring detection status (activated, deactivated)	activated	—
Total of ignition misfirings					0	⇒ page 01-47
Engine load					12.0...100.0 %	—
Engine speed (idling speed)					650...5700 rpm	—

Analysis of display group 014, display zone 3 - Total of ignition misfirings

Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
greater than 0	◆ Spark plug faulty ◆ Ignition cable termination faulty ◆ Ignition coil faulty ◆ Power output stages for ignition coil faulty	- Test spark plugs and ignition cable with termination - Test ignition coil
	◆ Injector faulty	- Test injectors

Display group 015, ignition - Cylinder misfiring 1...3

• Driving						
Read measured value block 15 →				◀ Readout in display		
xxx	xxx	xxx	Text			
1	2	3	4	◀ Display zones	Specification	Analysis
				Misfiring detection status (activated, deactivated)	activated	—
Ignition misfiring cylinder 3					0	⇒ page 01-48
Ignition misfiring cylinder 2					0	⇒ page 01-48
Ignition misfiring cylinder 1					0	⇒ page 01-48

Analysis of display group 015, display zones 1...3 - Ignition misfiring, and display group 016, display zone 1 - Ignition misfiring cylinders 1...4

Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
greater than 0	◆ Spark plug faulty ◆ Ignition cable termination faulty ◆ Ignition coil faulty ◆ Power output stages for ignition coil faulty	- Test spark plugs and ignition cable with termination - Test ignition coil
	◆ Injector faulty	- Test injectors

Display group 016, ignition - Ignition misfiring 4

• Driving						
Read measured value block 16				◀ Readout in display		
xxx	-	-	Text			
1	2	3	4	Display zones	Specification	Analysis
				Misfiring detection status (activated, deactivated)	activated	—
					—	—
					—	—
Ignition misfiring cylinder 4					0	⇒ page 01-48

Display group 020, ignition - Knock control

• Driving						
Read measured value block 20 →				◀ Readout in display		
xx.x °CA	xx.x °CA	xx.x °CA	xx.x °CA			
1	2	3	4	◀ Display zones	Specification	Analysis
				Ignition angle retardation in cylinder 4 by knock control	0.0...12.0 °CA	⇒ page 01-49
				Ignition angle retardation in cylinder 3 by knock control	0.0...12.0 °CA	⇒ page 01-49
				Ignition angle retardation in cylinder 2 by knock control	0.0...12.0 °CA	⇒ page 01-49
				Ignition angle retardation in cylinder 1 by knock control	0.0...12.0 °CA	⇒ page 01-49

Note on display zones 1...4:

- ♦ The readout in the idling speed range is 0.0 °CA.

Analysis of display group 020, display zones 1...4 - Ignition angle retardation

Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
all cylinders greater than 12.0 °CA	♦ Knock sensor faulty	- Test knock sensor
	♦ Plug connection corroded	
	♦ Knock sensor not correctly tightened	- Slacken knock sensor and tighten again to 20 Nm
	♦ Engine components loose	- Tighten loose components
	♦ Poor quality fuel	- Change type of fuel
one cylinder differs significantly from the others	♦ Plug connection corroded	- Test knock sensor
	♦ Engine damaged	- Test compression: ⇒ 1.4 l/55 kW Engine - Mechanical Components; Repair Group 15
	♦ Engine components loose	- Tighten loose components

Display group 022, ignition - Knock control

• Driving						
Read measured value block 22 →				◀ Readout in display		
xxxx rpm	xxx.x %	xx.x °CA	xx.x °CA			
1	2	3	4	◀ Display zones	Specification	Analysis
				Ignition angle retardation cylinder 2 by knock control	0.0...12.0 °CA	⇒ page 01-51
				Ignition angle retardation cylinder 1 by knock control	0.0...12.0 °CA	⇒ page 01-51
Engine load					15.0...100.0 %	—
Engine speed (idling speed)					650...5700 rpm	—

Note on display zones 3 and 4:

- ♦ The readout in the idling speed range is 0.0 °CA.

Display group 023, ignition - Knock control

• Driving						
Read measured value block 23 →				◀ Readout in display		
xxxx rpm	xxx.x %	xx.x °CA	xx.x °CA			
1	2	3	4	◀ Display zones	Specification	Analysis
				Ignition angle retardation cylinder 4 by knock control	0.0...12.0 °CA	⇒ page 01-51
				Ignition angle retardation cylinder 3 by knock control	0.0...12.0 °CA	⇒ page 01-51
Engine load					15.0...100.0 %	—
Engine speed (idling speed)					650...5700 rpm	—

Note on display zones 3 and 4:

- ♦ The readout in the idling speed range is 0.0 °CA.

Analysis of display groups 022/023, display zones 3 and 4 - Ignition angle retardation

Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
all cylinders greater than 12.0 °CA	♦ Knock sensor faulty	- Test knock sensor
	♦ Plug connection corroded	
	♦ Knock sensor incorrectly tightened	- Slacken knock sensor and tighten again to 20 Nm
	♦ Engine components loose	- Tighten loose components
	♦ Poor quality fuel	- Change grade of fuel
one cylinder differs significantly from the others	♦ Plug connection corroded	- Test knock sensor
	♦ Engine damage	- Test compression: ⇒ 1.4 l/55 kW Engin - Mechanical Components; Repair Group 15
	♦ Engine components loose	- Tighten loose components

Display group 028, ignition - Knock sensor

• Driving • Control unit in function 04 „Initiate basic setting,„							
System in basic setting 28 →				◀ Readout in display			
xxxx rpm	xxx.x %	xxx.x °C	Text				
1	2	3	4	◀ Display zones	Specification	Analysis	
				Result of knock sensor test (Test ON/Test OFF/Syst. o.k./Syst. n.o.k.)	Syst. o.k.	—	
				Coolant temperature	40.0...110.0 °C	⇒ page 01-44	
				Engine load	15.0...100.0 %	—	
				Engine speed	2200...5700 rpm	—	

Reading measured value blocks, display groups 030...049, 099 - Lambda control

Display group 030 - Lambda control

• Engine idling						
Read measured value block 30 →				◀ Readout in display		
xxx	xxx					
1	2	3	4	◀ Display zones	Specification	Analysis
					—	—
					—	—
				Status of lambda control downstream of catalytic converter		
				• Catalytic converter temperature at least 400.0 °C (display group 034, display zone 2)		
					111	⇒ page 01-52
				Status of lambda control upstream of catalytic converter		
					111	⇒ page 01-52

Notes:

- ♦ The first digit in the 3-digit numerical block switches temporarily between 01 and 1 (lambda probe heater off and on).
- ♦ A 0 or 1 may be displayed alternately for the status of the lambda control in the 3-digit numerical block.
- ♦ Readout in display zones 1 and 2 are not set to the value 1 until the catalytic converter temperature is more than 400 °C (⇒ display group 34, display zone 2).

Meaning of the 3-digit numerical block in display zones 1 and 2:

1	2	3	Meaning if readouts = 1
		1	Lambda control active
	1		Lambda probe operational
1			Lambda probe heater on

Display group 032, lambda control - Lambda learned values

• Engine idling						
Read measured value block 32 →				◀ Readout in display		
xx.x %		xx.x %				
1	2	3	4	◀ Display zones	Specification	Analysis
					—	—
					—	—
Lambda learned value at part load (multiplicative)					-10.0...10.0 %	⇒ page 01-54
Lambda learned value at idling speed (additive)					-10.0...10.0 %	⇒ page 01-54

Notes on display zones 1 and 2:

- ♦ Low values indicate that the engine is running too rich and for this reason the lambda control produces a leaner mixture.
- ♦ High values mean that the engine is running too lean and the lambda control therefore produces a richer mixture.
- ♦ All the learned values are reset if the control unit is de-energized.
- ♦ add = additive - The fault (e.g. unmetered air) always has a far less pronounced effect as engine speed rises. In the case of the additive learned value the injection time is altered by a fixed amount. The amount is not dependent on the basic injection time.
- ♦ mul = multiplicative - The fault (e.g. faulty injector) has an increasingly pronounced effect as engine speed rises. In the case of the multiplicative learned value this is a percentage change in the injection time. This change is dependent on the basic injection time.
- ♦ Learning conditions for idling speed. Coolant temperature at least 80 °C, intake air temperature max. 90 °C.
- ♦ Learning conditions for part load. Coolant temperature at least 80 °C, intake air temperature max. 90 °C.

Analysis of display group 032, display zones 1 and 2 - Lambda learned values

Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
low lambda learned values	◆ Low lambda idling learned values with normal lambda part throttle learned values: oil dilution (high level of fuel in oil) possible ◆ Injector leaking ◆ Fuel pressure too high ◆ Solenoid valve for activated charcoal filter constantly open ◆ Lambda probe heater faulty or lambda probe dirty	- Disappears after driving on motorway or changing oil - Test injectors - Test fuel pressure regulator and holding pressure ⇒ page 24-19 - Test solenoid valve for activated charcoal filter ⇒ page 01-29, Final control diagnosis - Test lambda probe heater
high lambda learned values	◆ High lambda idling learned values with less high lambda part throttle learned values: unmetered air possible in intake manifold area ◆ Injector leaking ◆ Fuel pressure too low ◆ Unmetered air at the manifold gasket ◆ Lambda probe heater faulty or lambda probe dirty	- Inspect intake system for leaks ⇒ page 24-22 - Test injected quantity - Test fuel pressure regulator and holding pressure ⇒ page 24-19 - Rectify cause - Test lambda probe heater

Display group 033, lambda control - Lambda learned values

• Engine idling						
Read measured value block 33 →				◀ Readout in display		
xx.x %		x.xxx V				
1	2	3	4	◀ Display zones	Specification	Analysis
					—	—
					—	—
Lambda probe voltage upstream of catalytic converter					1.4...1.6 V	—
Lambda controller upstream of catalytic converter					-25.0...25.0 %	—

Note on display zone 1:

- ♦ The readout must vary around 0. If a constant 0 is displayed, the lambda control has switched from closed-loop to open-loop control because there is a fault in the lambda control system. Interrogate fault memory ⇒ page 01-6.

Display group 034, lambda control - Diagnosis of lambda probe upstream of catalytic converter

- Control unit in function 04 „Initiate basic setting„ - Brake pedal operated - Vehicle stationary, engine running at fast idling speed						
Read measured value block 34 →				◀ Readout in display		
xxxx rpm	xxx.x °C	x.xx	Text			
1	2	3	4	◀ Display zones	Specification	Analysis
				Result of ageing test of lambda probe upstream of catalytic converter (test OFF/test ON/B1-S1 o.k./B1-S1 n.o.k.)	B1-S1 ok	—
				Period of lambda probe upstream of catalytic converter	0.7...2.00	—
				Catalytic converter temperature	at least 400.0 °C	—
				Engine speed	1100...1400 rpm	—

Note on display zone 2:

- ♦ Value calculated from engine speed and engine load.

Note on display zones 3 and 4:

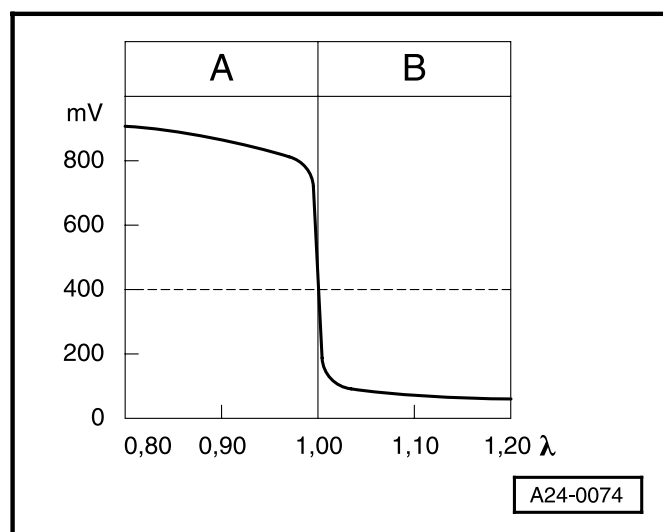
The period indicates the time between two voltage jumps (e.g. rich - lean - rich) of the lambda probe and is thus a measure for the state of ageing of the lambda probe. If the specified period is exceeded, B1-S1 n.o.k. appears in the display zone 4.

Display group 036, lambda control - Readiness downstream of catalytic converter

Engine idling						
Read measured value block 36 →				◀ Readout in display		
x.xxx V	xxx.x °C	x.xx	Text			
1	2	3	4	◀ Display zones	Specification	Analysis
				Test lambda probe downstream of catalytic converter (Test OFF/Test ON/B1-S2 ok/B1-S2 nok)	B1-S2 ok	—
				Specification lambda probe downstream of catalytic converter	—	—
				Catalytic converter temperature	at least 400,0 °C	—
				Lambda probe voltage downstream of catalytic converter	0.000...1.000 V	⇒ page 01-57

Note on display zone 1:

- ◆ The voltage signal „rich mixture (low level of residual oxygen)“ is at approx. 0.700...0.900 V.
- ◆ The voltage signal „lean mixture (large level of residual oxygen)“ is at approx. 0.000...0.300 V.
- ◆ A voltage jump from 0.700...0.900 V to 0.000...0.300 V and vice versa takes place at transition from „rich“ to „lean“ and vice versa ($\lambda = 1.0$).
- ◆ In view of the steep voltage jump, the lambda control is not able to maintain constant the ideal mixture composition which corresponds to $\lambda = 1.0$. The control constantly fluctuates back and forward between the „slightly too lean“ and „slightly too rich“ states.
- ◆ Control value difference between rich and lean mixture is approx. 0.630 V.



◀ **Voltage of 4-pin lambda probe U_{λ} in mV**

A: Lambda probe voltage high

- ◆ rich mixture (fuel excess or air deficiency)
- ◆ high CO level

B: Lambda probe voltage low

- ◆ lean mixture (fuel deficiency or air excess)
- ◆ low CO level

Analysis of display group 036, display zone 1 - Lambda probe voltage, lambda probe downstream of catalytic converter

Display zone: 1	Possible cause of fault	Rectifying fault
constant 1.085 V	◆ Short circuit to positive caused by: Lambda probe Lambda probe cable Earth cable Engine control unit	- Test lambda probe voltage downstream of catalytic converter ⇒ page 24-25 - Test lambda probe cable downstream of catalytic converter ⇒ page 24-25
constant 0.400...0.500 V	◆ Open circuit in wiring caused by: Lambda probe Lambda probe cable Earth cable Engine control unit	
constant 0.000 V	◆ Short circuit to earth caused by: Lambda probe Lambda probe cable Earth cable Engine control unit	

Display group 037, lambda control - Readiness downstream of catalytic converter

- Engine idling - Control unit in function 04 „Initiate basic setting„						
System in basic setting 37 →				◀ Readout in display		
xxx %	x.xxx V	xxx.xxx	Text			
1	2	3	4	◀ Display zones	Specification	Analysis
				Test lambda probe (Test ON/Test OFF, Syst. ok/Syst. nok)	Syst. ok	—
				Ignore	—	—
				Lambda probe voltage downstream of catalytic converter	0.000...1.000 V	⇒ page 01-57
				Engine load	12.0...40.0 %	⇒ page 01-46

Display group 041, lambda control - Lambda probe heater

Engine idling						
Read measured value block 41 →				◀ Readout in display		
-	Text	-	Text			
1	2	3	4	◀ Display zones	Specification	Analysis
				Lambda probe heater downstream of catalytic converter	Htg. a.C. OFF Htg. a.C. ON	—
					—	—
				Lambda probe heater upstream of catalytic converter	Htg. b.C. OFF Htg. b.C. ON	—
					—	—

Note:

Depending on operating state of the engine, the lambda probe heaters are switched on or off, in other words the readouts in display zones 2 and 4 may either be Htg.b.(a.)C.ON or alternately Htg.b.(a.)C.ON/Htg.b.(a.)C.OFF.

Display group 046, lambda control - Diagnosis of catalytic converter

- Control unit in function 04 „Initiate basic setting,, - Brake pedal operated - Vehicle stationary, engine running at fast idling speed			
System in basic setting 46 →			
xxxx rpm	xxxx °C	x.xx	Text
1	2	3	4
◀ Readout in display			
◀ Display zones			
Result of catalyst ageing test (Test OFF/Test ON/Cat B1 ok/Cat B1 nok)			
Amplitude ratio			
Catalytic converter temperature			
Engine speed			
		Specification	Analysis
		Cat B1 ok	—
		0.00...0.50	—
		min. 400.0 °C	—
		1100...1400 rpm	—

Display group 099, lambda control - Operating state of lambda control

- Engine idling - Control unit in function 04 - Initiate basic setting, lambda control off - Control unit in function 08 - Read measured value block, lambda control on			
Read measured value block 99 →			
xxxx rpm	xxx.x °C	xx.x %	Text
1	2	3	4
◀ Readout in display			
◀ Display zones			
Operating state of lambda control of lambda probe upstream of catalytic converter			
Lambda controller upstream of catalytic converter			
Coolant temperature			
Engine speed (idling speed)			
		Specification	Analysis
		λ ctrl. OFF or λ ctrl. ON	—
		-25.0...25.0 %	—
		80...110 °C	⇒ page 01-44
		—	⇒ page 01-40

Note on display group 099:

- ♦ For defined fault finding, the lambda control is switched off when display group 099 is selected under „Initiate basic setting,, or is switched on when selected under „Read measured value block,,. The lambda control is automatically active again when function 04 „Basic setting“ is quit.

Reading measured value blocks, display groups 050...069

Display group 050, engine speed limiting - Operating states

• Engine idling						
Read measured value block 50 →				◀ Readout in display		
xxxx rpm	xxxx rpm	Text	Text			
1	2	3	4	◀ Display zones	Specification	Analysis
				Operating state AC compressor ON/OFF	Compr. ON or Compr. OFF	—
				Operating state of AC	A/C High or A/C Low	—
				Engine speed (specified idling speed)	750 rpm	—
				Engine speed (idling speed)	—	⇒ page 01-40

Note on display zone 2:

What is displayed is the specified engine speed set by the engine control unit (value computed in control unit).

Note on display zone 3:

A/C High = air conditioning demands high heating or cooling capacity

A/C Low = air conditioning not switched on

Notes on display zone 4:

- ♦ On models not fitted with air conditioning „Compr. OFF“ is always displayed.
- ♦ Test signal from and to AC compressor.
- ♦ If accelerator pedal is depressed suddenly, the readout in display zone 4 must jump from „on“ to „off“ for a few seconds (AC compressor switched off when vehicle accelerates).

Display group 054, limiting engine speed - Operating states

• Driving						
Read measured value block 54 →				◀ Readout in display		
xxxx rpm	Text	xxx.x %	xxx.x %			
1	2	3	4	◀ Display zones	Specification	Analysis
				Throttle valve angle positioner (potentiometer 1 -G187)	0.0...100.0 %	—
				Sender 1 for accelerator pedal position -G79	0.0...100.0 %	—
				Operating state (idling, part load, full load, enrichment, overrun)	—	—
				Engine speed (idling speed)	650...850 rpm	⇒ page 01-40

Display group 055, limiting engine speed - Idling speed stabilisation

• Engine idling						
Read measured value block 55 →				◀ Readout in display		
xxxx rpm	xx.x %	xx.x %	xxxxx			
1	2	3	4	◀ Display zones	Specification	Analysis
				Operating states	xxxxx	⇒ page 01-62
				Learned value of idling speed controller		
				AC on	-8.0...8.0 %	
				AC off	-5.0...5.0 %	—
				Idling speed controller	-10.0...10.0 %	—
				Engine speed (idling speed)	—	⇒ page 01-40

Note on display zone 3:

The readout for a new engine is in the positive range because of the higher friction and once the engine is running in it is in the negative range.

Meaning of the 4-digit numerical block

Meaning if readout = 1					
1	2	3	4	5	Meaning
				1	AC compressor switched on
			x		Ignore
		1			AC switched on
	x				Ignore
x					Ignore

Display group 056, engine speed control - Idling speed stabilisation

• Engine idling						
Read measured value block 56 →				◀ Readout in display		
xxxx rpm	xxxx rpm	xx.x %	xxxxx			
1	2	3	4	◀ Display zones	Specification	Analysis
				Operating states	xxxxx	⇒ page 01-62
				Idling speed controller	-10.0...10.0 %	—
				Engine speed (specified idling speed)	750 rpm	—
				Engine speed (idling speed)	—	⇒ page 01-40

Note on display zone 2:

What is displayed is the specified engine speed which is set by the engine control unit (computed internally by control unit).

Display group 060, engine speed control - Adapting electronic throttle system¹⁾

- Ignition on, engine not running - Control unit in function 04 „Initiate basic setting,,						
System in basic setting 60 →				◀ Readout in display		
xx %	xx %	x	Text			
1	2	3	4	◀ Display zones	Specification	Analysis
				Adaptation state (ADP runs, ADP o.k. or ADP ERROR)	ADP. o.k.	—
				Learning steps counter	0...8	—
				Throttle valve angle (potentiometer 2 -G188)	90...10 %	—
				Throttle valve angle (potentiometer 1 -G187)	10...90 %	—

¹⁾ Adapting engine control unit to throttle valve control unit ⇒ page 24-32.

Notes on display group 060:

- Adaptation of the throttle valve control unit is performed with the ignition switched on.
- If display group 060 is selected in function 04 „Initiate basic setting,, the engine control unit is adapted to the throttle valve control unit. This adaptation must always be performed if another throttle valve control unit (or complete different engine) or another engine control unit has been installed.
- If the voltage supply was interrupted (battery disconnected), it is also necessary to carry out adaptation ⇒ page 24-28, Procedure after interruption of voltage supply.

Display group 061, engine speed control - Electronic throttle system

Driving						
Read measured value block 61 →				◀ Readout in display		
xxxx rpm	-	xxx.x %	xxxxx			
1	2	3	4	◀ Display zones	Specification	Analysis
				Operating states	xxxxx	⇒ page 01-62
				Throttle valve angle (potentiometer 1 -G187)	0.0...100.0 %	—
					—	—
				Engine speed	650...5700 rpm	—

Display group 062, engine speed control - Electronic throttle system

Notes:

- ◆ The reason why the readout in display zone 1 rises as a percentage and the readout in display zone 2, in contrast, drops, is because of the contra-synchronism of the potentiometers (angle sensors) in the throttle valve control unit.
- ◆ This means that the voltage tap of the one angle sensor moves in the direction of 5 V. (The more the throttle valve is open, the greater is the voltage; the percentage readout rises).
- ◆ The voltage tap of angle sensor 2 moves away from 5 V in the direction of 0 V. (The more the throttle valve is open, the less is the voltage; the percentage readout drops).
- ◆ The engine control unit converts the voltage values of the accelerator pedal sensors into a percentage (related to 5 V). Supply voltage of 5 V equals 100 %.
- ◆ The readout displayed in display zone 3 must always be approximately twice as much as the readout in display zone 4.

• Ignition on, engine not running						
Read measured value block 62 →				◀ Readout in display		
xx %	xx %	xx %	xx %			
1	2	3	4	◀ Display zones	Specification	Analysis
				Sender 2 for accelerator pedal position -G185	4...49 %	—
				Sender 1 for accelerator pedal position -G79	12...97 %	—
				Throttle valve angle (potentiometer 2 -G188)	90...10 %	—
				Throttle valve angle (potentiometer 1 -G187)	10...90 %	—

Display group 066 - Brake and clutch pedal switch

• Engine idling						
Read measured value block 66 →				◀ Readout in display		
km/h	xxxx	km/h	xxxx			
1	2	3	4	◀ Display zones	Specification	Analysis
				CCS switch position ¹⁾	0000	—
				Specified vehicle speed (speed last stored by CCS)	—	—
				Switch position of brake, clutch and CCS	0000	⇒ page 01-65
				Vehicle speed (actual)	0 km/h	—

Meaning of the digits in the 4-digit readout, display zone 2, switch for brake, clutch and CCS

1	1	1	1	Meaning
				Brake depressed (brake light switch)
				Brake depressed (brake pedal switch)
				Clutch depressed
				CCS activated ¹⁾

¹⁾ Not available at present

- ◆ Test clutch pedal switch.
- ◆ Test brake pedal and brake pedal switch.

Reading measured value blocks, display groups 070...079

Display group 070, exhaust reduction - Diagnosis of activated charcoal filter system

• Engine idling • Coolant temperature at least 80 °C • Control unit in function 04 „Initiate basic setting„						
System in basic setting 70 →				◀ Readout in display		
xx.x %	xx.x %	-	Text			
1	2	3	4	◀ Display zones	Specification	Analysis
				Result of diagnosis (Test ON/Test OFF or TVV ok/TVV nok)	TVV ok	—
						—
Lambda controller variation during TVV diagnosis					< 5 %	—
Actuate activated charcoal filter solenoid valve					0.0...99.0 %	—

Note:

TVV means tank vent valve (solenoid valve for activated charcoal filter system). Diagnosis can only be initiated once for each engine start.

Note on display zone 2:

- ♦ The readout must not be greater than 5 % during the diagnosis.

Display group 074, exhaust gas recirculation

• Ignition switched on • Control unit in function 04 „Initiate basic setting„						
System in basic setting 74 →				◀ Readout in display		
x.xxx V	x.xxx V	x.xxx V	Text			
1	2	3	4	◀ Display zones	Specification	Analysis
					ADP. o.k.	—
Current potentiometer voltage					0.300...4.600 V	—
100 % position					2.900...4.600 V	—
0 position (basic setting)					0.300...1.300 V	—

Note:

Adaptation must always be performed if another EGR valve or engine control unit is installed.

Display group 075, exhaust gas recirculation diagnosis

• Driving						
Read measured value block 75 →				◀ Readout in display		
xxx mbar	xxx mbar	xxx mbar	Text			
1	2	3	4	◀ Display zones	Specification	Analysis
				Result of test: Test ON/Test OFF/Syst. ok/Syst. nok	Syst. ok	—
Intake manifold pressure difference					—	—
Rapid compensation jump during diagnosis					—	—
Intake manifold pressure					—	—

Reading measured value block, display group 100

Display group 100 - Readiness code

• Engine idling						
Read measured value block 100 →				◀ Readout in display		
xxxxxxx	xxx.x °C	xxx.x s	xxxxxxx			
1	2	3	4	◀ Display zones	Specification	Analysis
				Diagnosis status	—	—
Time since engine start					—	—
Coolant temperature					80.0...110.0 °C	⇒ page 01-44
Readiness code					00000000	⇒ page 01-68

Meaning of 8-digit numerical block for readiness code, display zone 1

The readiness code is generated only if all readouts are 0									
1	2	3	4	5	6	7	8	Diagnosis function	
							0	Catalytic converter	
						0		Catalytic converter heater (no diagnosis at present/always „0„)	
					0			Activated charcoal filter system (tank vent system)	
				0				Secondary air system (no diagnosis at present/always „0„)	
			0					Air conditioning (no diagnosis at present/always „0„)	
		0						Lambda probes	
	0							Lambda probe heater	
0								Exhaust gas recirculation	

Servicing fuel injection system

General information

General information on ignition system ⇒ page 28-1, Servicing ignition system.

- ◆ *The engine control unit is equipped with self-diagnosis. The first step before commencing repairs and also fault finding, is to interrogate the fault memory. Likewise, also inspect the vacuum hoses and connections (for unmetered air).*
- ◆ *Fuel hoses in the engine compartment must be secured only using spring strap clamps. The use of collar clamps or screw-type clamps is not permitted.*
- ◆ *Always switch off the ignition before disconnecting and re-connecting the battery otherwise the engine control unit may be damaged.*
- ◆ *Components marked with * are tested by self-diagnosis ⇒ page 01-6, Interrogating and erasing fault memory.*
- ◆ *Components marked with ** can be tested with the final control diagnosis ⇒ page 01-29.*
- ◆ *A voltage of at least 11.5 V is required for proper operation of the electrical components.*
- ◆ *Do not use any sealants containing silicone. Traces of silicone elements inducted by the engine, are not combusted in the engine and damage the lambda probe.*
- ◆ *When conducting certain tests it is possible that a fault is detected by the control unit and is stored. For this reason, after completing all the tests and repair work, interrogate the fault memory and erase it, if necessary ⇒ page 01-6, Interrogating and erasing fault memory.*

Safety precautions ⇒ page 24-2.

Rules for cleanliness ⇒ page 24-3.

Technical data ⇒ page 24-3.

Testing operating states of the engine ⇒ page 01-45, display group 005.

Safety measures

Note!

The fuel system is pressurised! Place cleaning cloths around the connections before loosening hose connections or opening test connections. Then let the pressure out carefully by pulling off slowly.

The following points should be observed in order to avoid injury to persons and/or destruction of the injection and ignition system:

- ◆ Do not touch or remove ignition leads while the engine is running or at start speed.
- ◆ Only remove or attach lines to the injection and ignition system and also the measuring device lines when the ignition is switched off.

Please observe the following if it becomes necessary to use checking and testing equipment when undertaking a test drive:

- ◆ The checking and testing equipment are always to be fixed to the rear seat and also to be operated from there by a second person.
- ◆ If the checking and testing equipment were also operated from the front passenger seat then the person there could suffer injury from the airbag if a crash occurred.

When the engine should be run at the starter speed without firing:

For engines with engine identification characters AXP

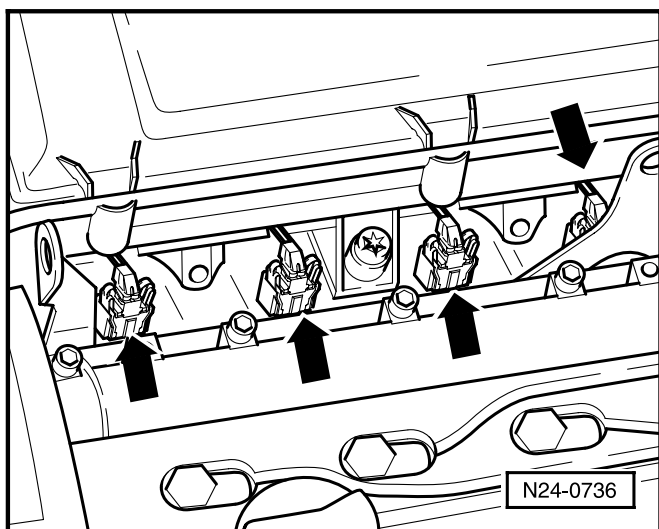
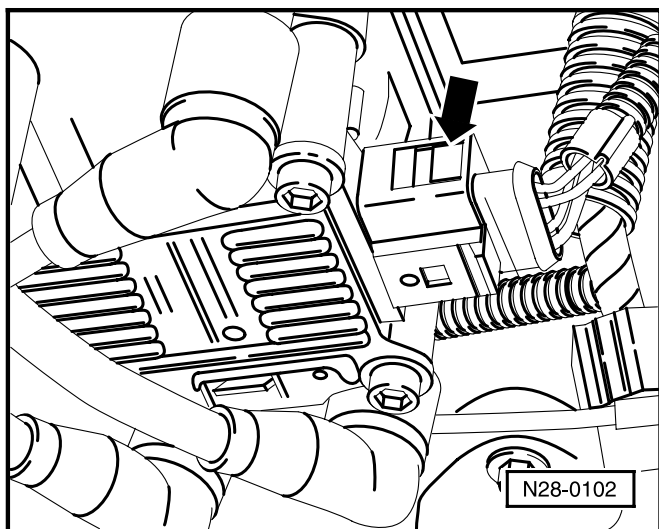
- ◀ - pull out the 4-pin connecting plug from the ignition transformer -arrow-

For engines with engine identification characters BCA

- pull out all ignition coils using extractor T10094.

For all engines

- ◀ - pull out the connecting plug on the injection valve -arrows-

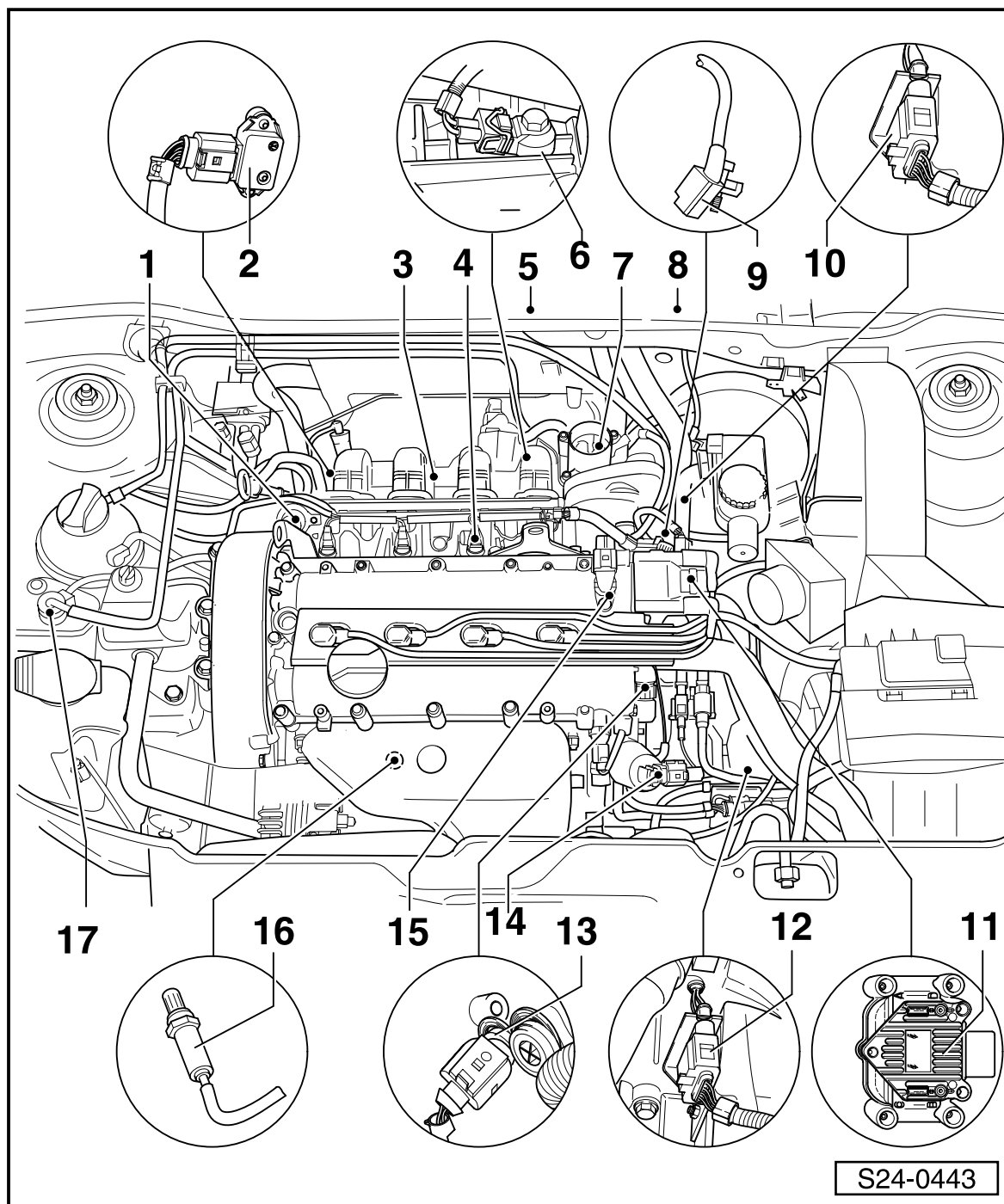


Rules for cleanliness

Pay careful attention to the following „5 rules“ for cleanliness when carrying out work on the fuel supply and injection system:

- ◆ Thoroughly clean connection points and the surrounding area before disconnecting.
- ◆ Place removed parts down onto a clean surface and cover over. Do not use fluffing cloths!
- ◆ Carefully cover over or seal opened components if repairs are not carried out immediately.
- ◆ Install only clean parts:
Do not remove replacement parts from their wrapping until just before installing.
Do not use parts which have been stored unwrapped (e.g. in tool boxes etc.).
- ◆ If the system is opened:
Avoid working with compressed air, if possible.
Avoid moving the vehicle, if possible.

The installed position of individual components of engines with the engine identification characters AXP



1 - Fuel flow regulator

2 - Sender for the intake manifold pressure (G71) with the sender for the intake manifold temperature (G42)
 ♦ Nominal resistance ⇒ Page 24-14

3 - Intake manifold

4 - Injection valve (N30 .. N33)

5 - Engine control unit

(Motronic control unit - J220)

♦ Below the plenum chamber cover

6 - Knocking sensor 1 (G61)

♦ ⇒ Page 28-3, position 6

7 - Throttle valve control unit (J338)

8 - Earth connection

9 - Engine speed sender (G28)

- ◆ fitting location: at inlet side of cylinder block
- ◆ ⇒ page 24-7, item 14

10 - 3-pin plug connection

- ◆ grey, for engine speed sender (G28)

11 - Ignition transformer (N152)

- ◆ with marking for ignition cables, do not mix up
- ◆ ⇒ page 28-3, item 2

12 - 6-pin plug connection

- ◆ black
- ◆ for lambda probe and lambda probe heater

13 - Coolant temperature sender (G62)

- ◆ with coolant temperature gauge sender (G2)
- ◆ testing ⇒ page 24-14

14 - EGR valve (N18) with EGR potentiometer (G212)**15 - Hall sender (G40)**

- ◆ ⇒ page 28-3, item 9

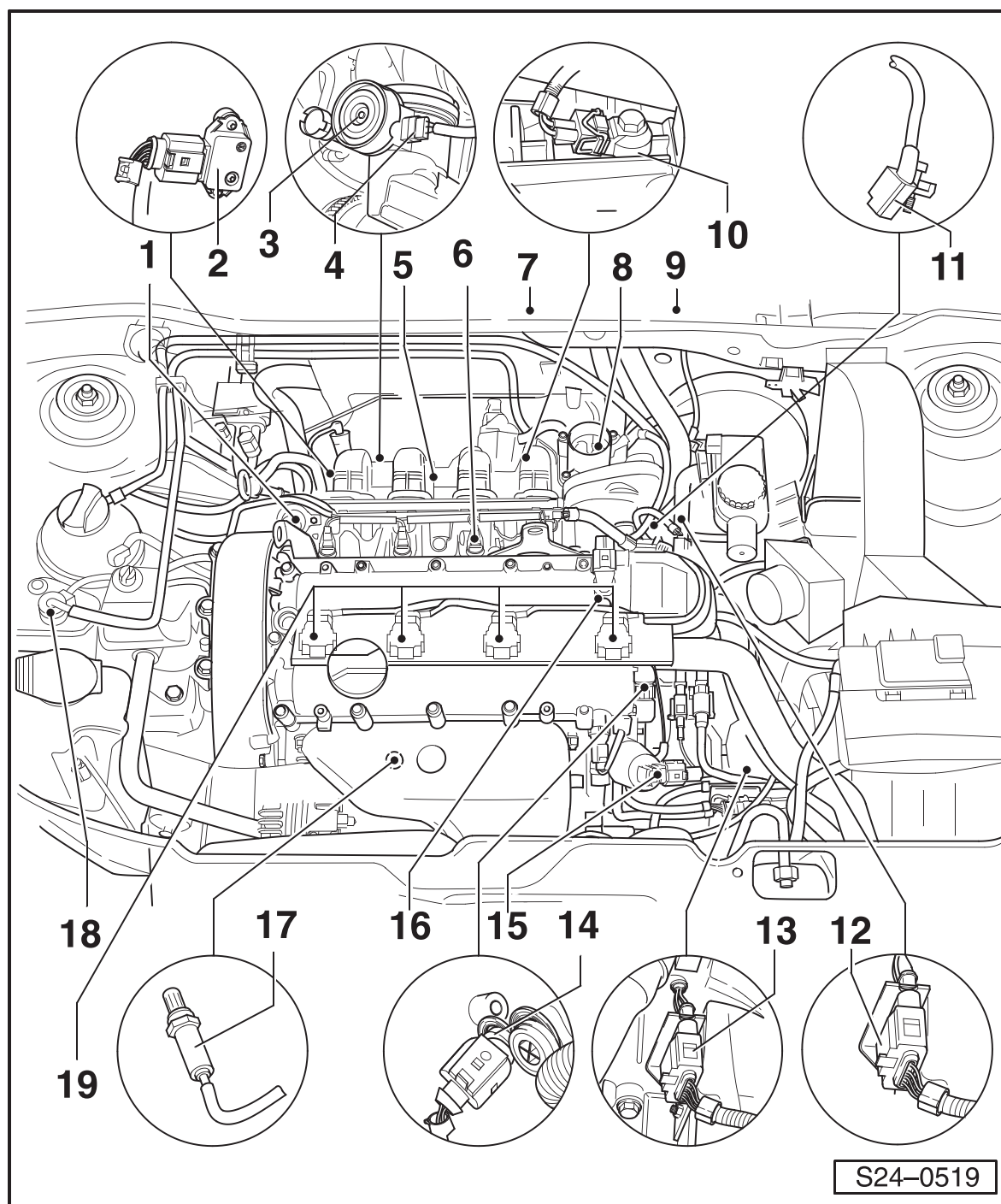
16 - Lambda probe upstream of catalytic converter (G39), 50 Nm, lambda probe downstream of catalytic converter (G130), 50 Nm

- ◆ fitting location: lambda probe upstream of catalyst, in exhaust manifold; lambda probe downstream of catalyst, behind main catalytic converter

17 - Activated charcoal filter solenoid valve (N80)

- ◆ activated charcoal filter:
⇒ 1.4 l/55 kW Engine - Mechanical Components; Repair Group 20

The installed position of individual components of engines with the engine identification characters BCA



S24-0519

1 - Fuel flow regulator

2 - Sender for the intake manifold pressure (G71) with the sender for the intake manifold temperature (G42)
 ♦ Nominal resistance ⇒ Page 24-14

3 - PCV valve
 ♦ For venting air from the crankcase

4 - Heating for the crankcase venting (N79)

5 - Intake manifold

6 - Injection valve (N30 ... N33)

7 - Engine control unit
 (Motronic control unit -J220)
 ♦ Below the plenum chamber cover

8 - Throttle valve control unit (J338)

9 - Earth connection (N79)

10 - Knocking sensor 1 (G61)

- ◆ ⇒ page 28-5 Position 4

11 - Sender for the engine speed (G28)

- ◆ installed location: the cylinder block on the suction side
- ◆ ⇒ page 24-7 Position 14

12 - 3-pin plug connector

- ◆ grey for the sender for the engine speed (G28)

13 - 6-pin plug connector

- ◆ black
- ◆ for the lambda probe and lambda probe heating

14 - Sender for the coolant temperature (G62)

- ◆ with coolant temperature indicator (G2)
- ◆ checking ⇒ page 24-14

15 - Valve for the exhaust gas recycling (N18) with a potentiometer for exhaust gas recycling (G212)**16 - Hall sender (G40)**

- ◆ ⇒ page 28-5 Position 7

17 - Lambda probe before the catalytic converter (G39), 50 Nm, lambda probe after the catalytic converter (G130), 50 Nm

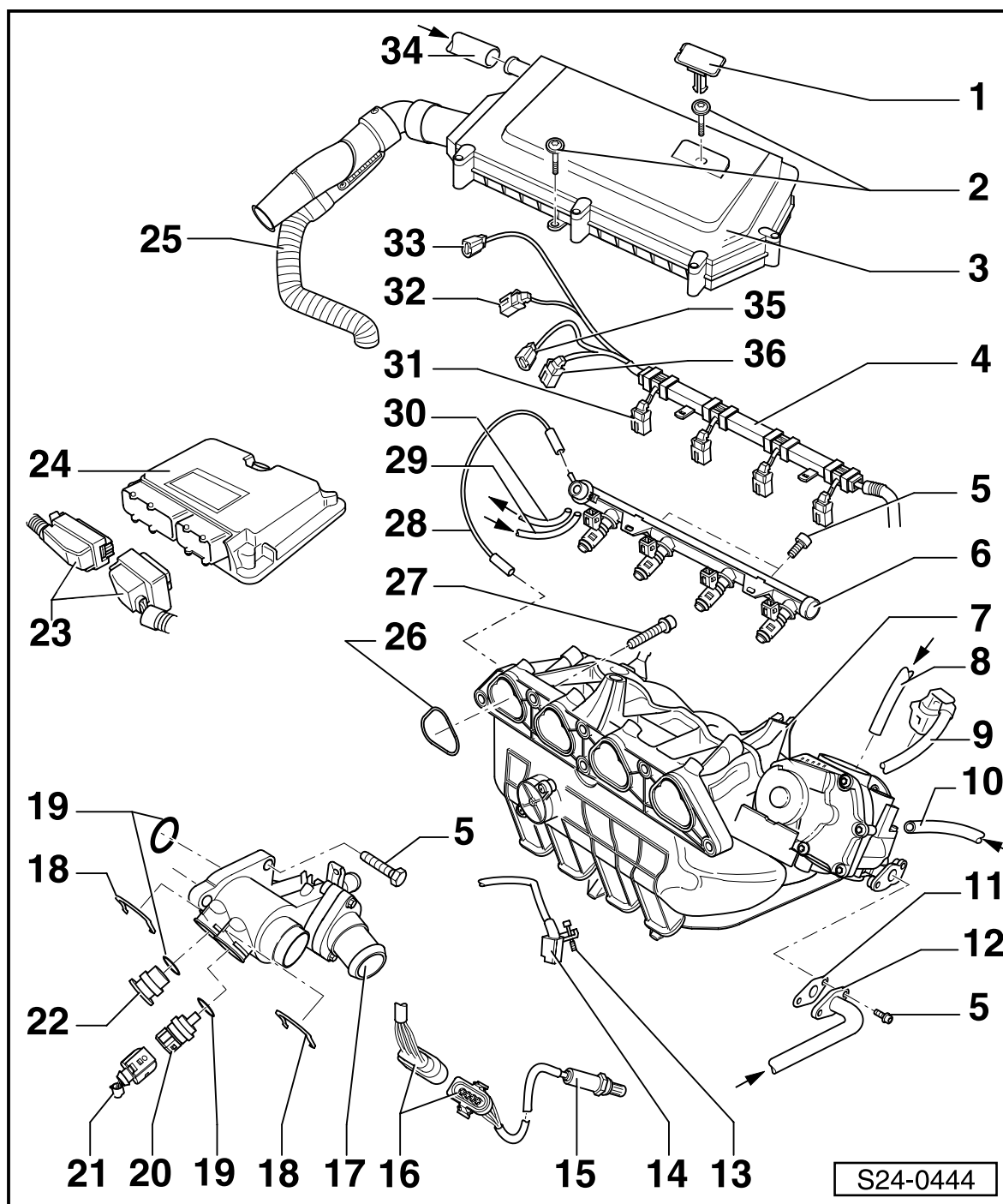
- ◆ Installed location: lambda probe before the catalytic converter in exhaust manifold, lambda probe after the catalytic converter behind the main catalytic converter

18 - Solenoid valve for the activated charcoal container (N80)

- ◆ activated charcoal container:
⇒ 1.4/55 kW engine - mechanics; Rep. Gr. 20

19 - Ignition coils with power transformer (N70, N127, N291 and N292)

Removing and installing parts of fuel injection system



1 - Plug

2 - 3 Nm

3 - Air filter

- ♦ disassembling and assembling
⇒ page 24-13

4 - Cable duct

- ♦ clipped onto fuel rail

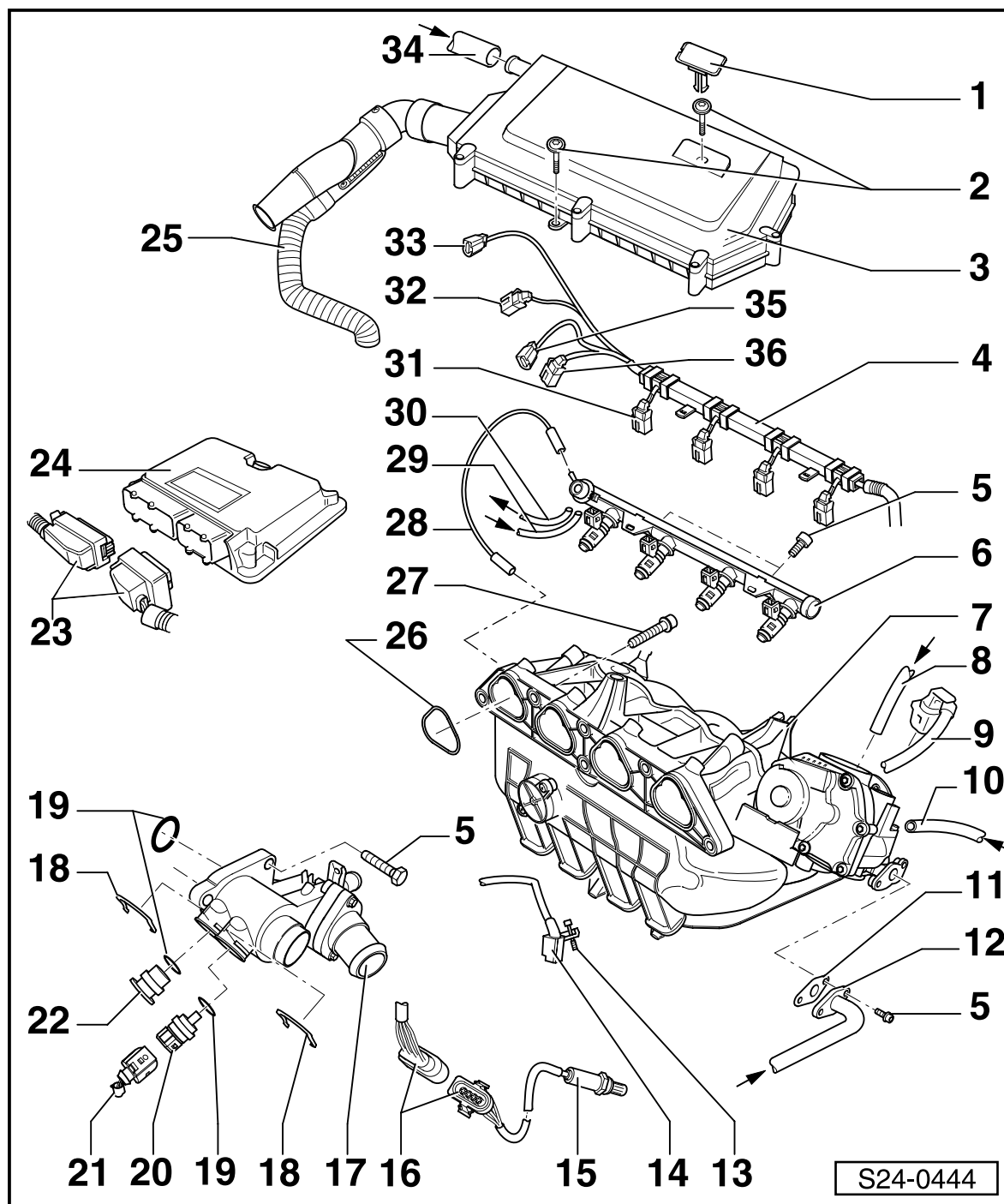
5 - 10 Nm

6 - Fuel rail with injectors

- ♦ disassembling and assembling bottom part of intake manifold ⇒ page 24-9

7 - Intake manifold

- ♦ disassembling and assembling
⇒ page 24-9



8 - From activated charcoal filter solenoid valve (N80)
 ♦ activated charcoal filter system
 ⇒ 1.4 I/55 kW Engine - Mechanical Components; Repair Group 20

9 - 6-pin plug connection
 ♦ black
 ♦ for throttle valve control unit (J338)
 ♦ contacts gold-plated

10 - From brake servo unit

11 - Gasket
 ♦ replace

12 - Connection pipe
 ♦ to EGR valve

13 - 5 Nm

14 - Engine speed sender (G28)
 ♦ testing ⇒ page 01-40

15 - Lambda probe upstream of catalytic converter (G39), 50 Nm

- ◆ fitting location: in exhaust manifold
- ◆ coat only thread with hot bolt paste „G052 112 A3“; the hot bolt paste must not get into the slots of the probe body
- ◆ voltage for probe heater supplied through fuel pump relay (J17)
- ◆ testing heater of lambda probe upstream of catalytic converter ⇒ page 24-24
- ◆ testing lambda probe and lambda control upstream of catalytic converter ⇒ page 24-24
- ◆ testing lambda probe ageing 1 ⇒ page 01-56

16 - 6-pin plug connection

- ◆ black
- ◆ for lambda probe and lambda probe heater upstream of catalytic converter

17 - Coolant thermostat housing**18 - Retaining clip**

- ◆ ensure tightly fitted

19 - O-ring

- ◆ replace if damaged

20 - Coolant temperature sender (G62)

- ◆ with coolant temperature gauge sender (G2)
- ◆ testing ⇒ page 01-43
- ◆ before removing, release pressure from cooling system
- ◆ resistances ⇒ page 24-14, Fig. 1

21 - Connector

- ◆ 4-pin
- ◆ for coolant temperature sender (G62)

22 - Plug

- ◆ before removing, release pressure from cooling system

23 - Connector

- ◆ unplug or plug in connector only when ignition switched off
- ◆ unlock for removing

24 - Engine control unit*

(Motronic control unit -J220)

- ◆ fitting location: in plenum chamber
- ◆ testing voltage supply ⇒ page 24-27
- ◆ procedure if interruption to voltage ⇒ page 24-28
- ◆ replacing ⇒ page 24-29

25 - Warm air intake**26 - Gasket**

- ◆ replace

27 - 20 Nm**28 - Vacuum hose****29 - Fuel feed line**

- ◆ white
- ◆ secure with spring strap clips
- ◆ ensure tightly fitted
- ◆ from fuel filter:

⇒ 1.4 l/55 kW Engine - Mechanical Components; Repair Group 20

30 - Fuel return-flow line

- ◆ blue
- ◆ secure with spring strap clamps
- ◆ pay attention to fitting location
- ◆ to fuel pump in fuel tank:

⇒ 1.4 l/55 kW Engine - Mechanical Components; Repair Group 20

31 - Connector, 2-pin

- ◆ black
- ◆ for injectors (N30...N33)

32 - Connector, 3-pin

- ◆ black
- ◆ fr engine speed sender (G28)

33 - Connector, 3-pin

- ◆ black
- ◆ for oil temperature/oil level sender (G266)

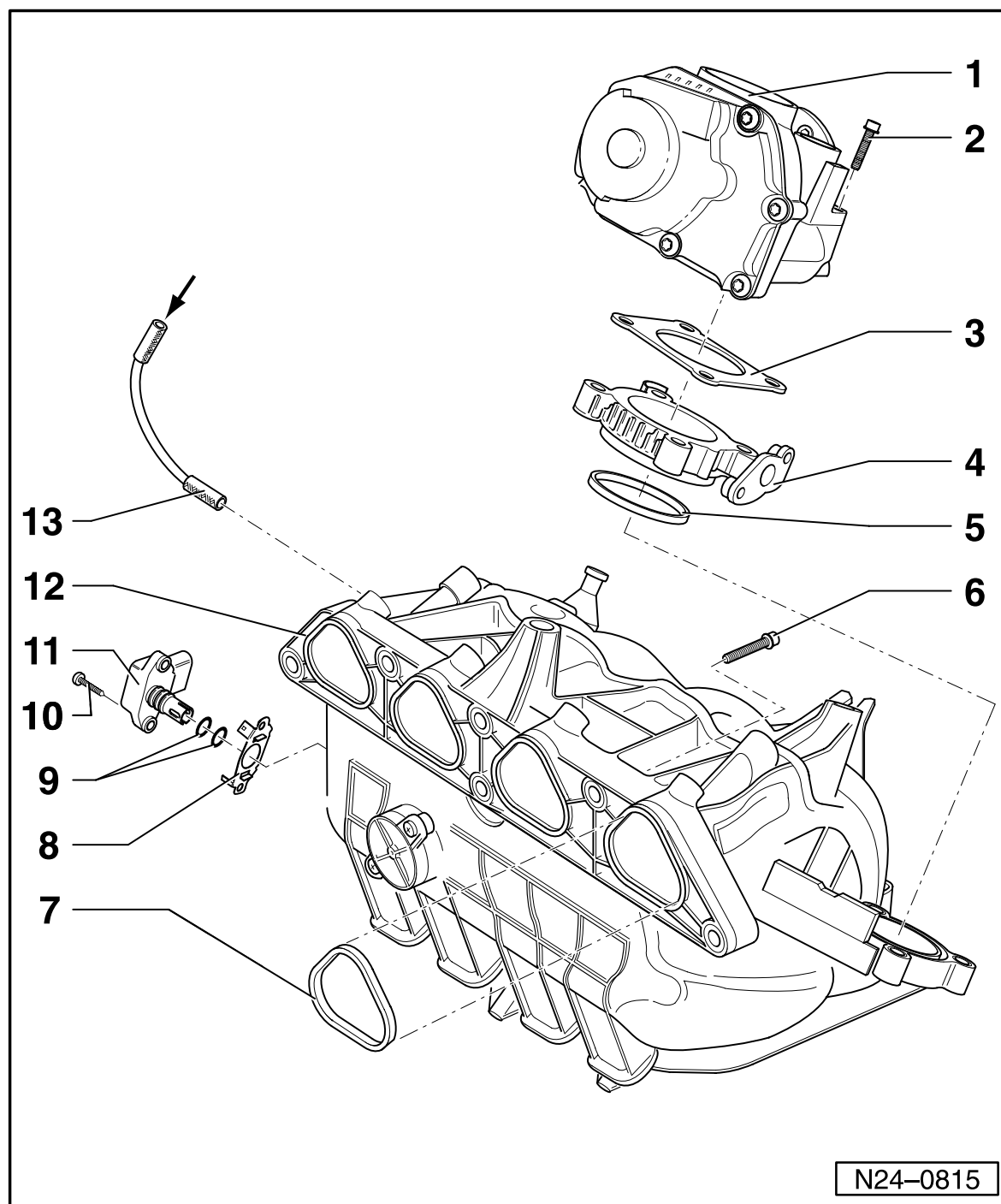
34 - Crankcase ventilation hose**35 - Connector, 2-pin**

- ◆ black
- ◆ for knock sensor 1 (G61)

36 - Connector, 4-pin

- ◆ black
- ◆ for intake manifold pressure and intake manifold temperature sender

Disassembling and assembling intake manifold

**1 - Throttle valve control unit**

- ♦ testing ⇒ page 24-16
- ♦ if replaced, adapt engine control unit
⇒ page 24-32

2 - 10 Nm**3 - Gasket**

- ♦ replace

4 - Inlet connection**5 - Seal**

- ♦ replace if damaged

6 - 20 Nm**7 - Seal**

- ♦ replace

8 - Guide plate

- ◆ ensure correctly installed
- ◆ replace if damaged

9 - O-ring

- ◆ replace if damaged

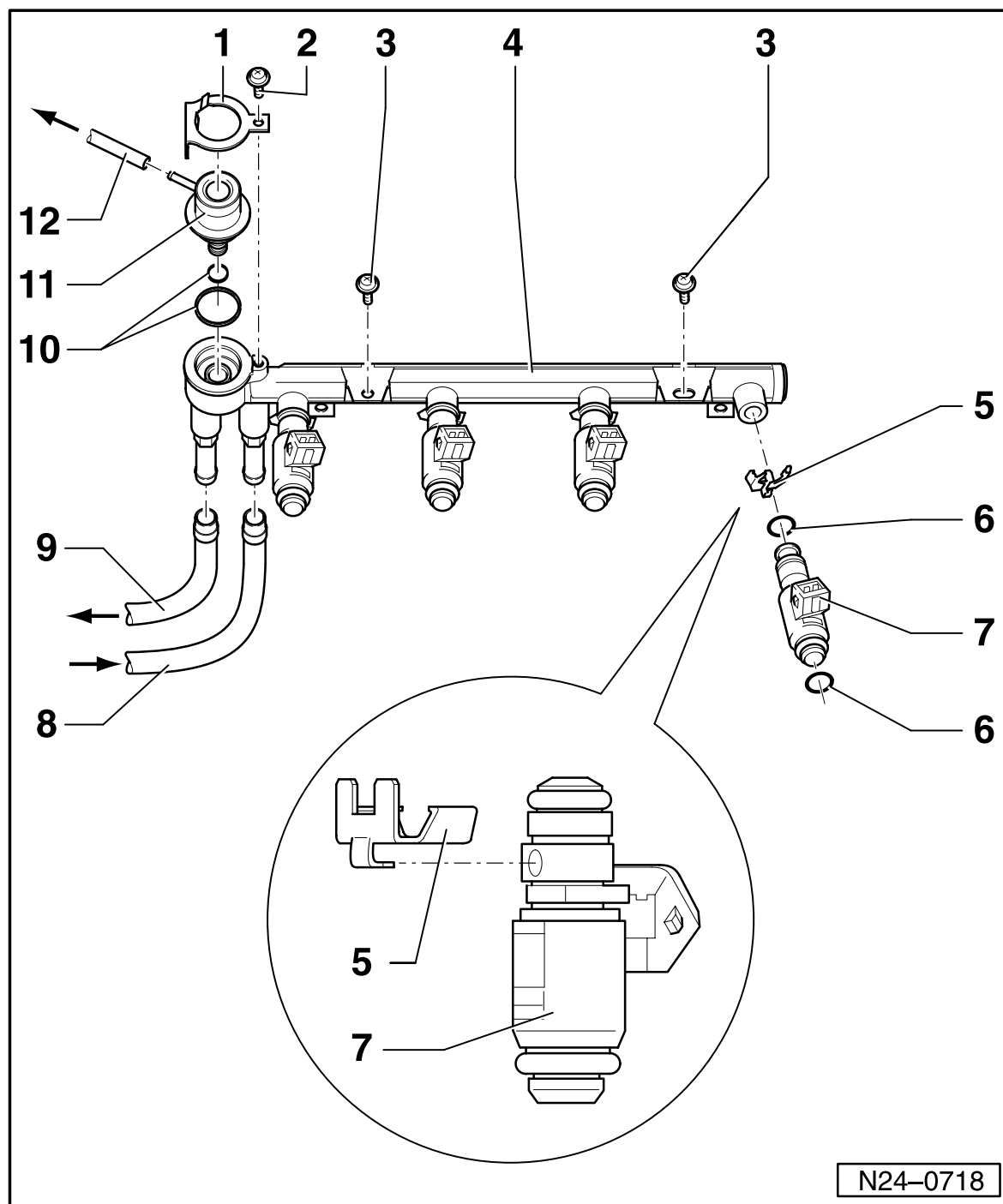
10 - 3 Nm**11 - Intake manifold pressure sender (G71) with intake manifold temperature sender (G42)**

- ◆ testing intake manifold temperature sender ⇒ page 01-43
- ◆ specified resistance ⇒ page 24-14, Fig. 2
- ◆ testing intake manifold pressure sender ⇒ page 01-42

12 - Intake manifold**13 - Vacuum hose**

- ◆ from fuel pressure regulator

Disassembling and assembling fuel rail with injectors

**1 - Metal holder**

- ◆ ensure correctly installed
- ◆ replace if damaged

2 - 5 Nm**3 - 10 Nm****4 - Fuel rail****5 - Retaining clip**

- ◆ ensure correctly installed at injector and at fuel rail

6 - O-ring

- ◆ replace
- ◆ before installing, moisten slightly with clean engine oil

7 - Injector (N30...N33)

- ◆ testing ⇒ page 24-17
- ◆ desired resistance: 12...17 Ω (resistance increases by about 4...6 Ω when engine reaches operating temperature)

N24-0718

8 - Fuel feed line

- ◆ white
- ◆ secure with spring strap clips
- ◆ ensure tightly installed
- ◆ from fuel filter:

⇒ 1.4 I/55 kW Engine - Mechanical Components; Repair Group 20

9 - Fuel return-flow line

- ◆ blue
- ◆ secure with spring strap clips
- ◆ pay attention to fitting location
- ◆ to fuel pump in fuel tank:

⇒ 1.4 I/55 kW Engine - Mechanical Components; Repair Group 20

10 - O-ring

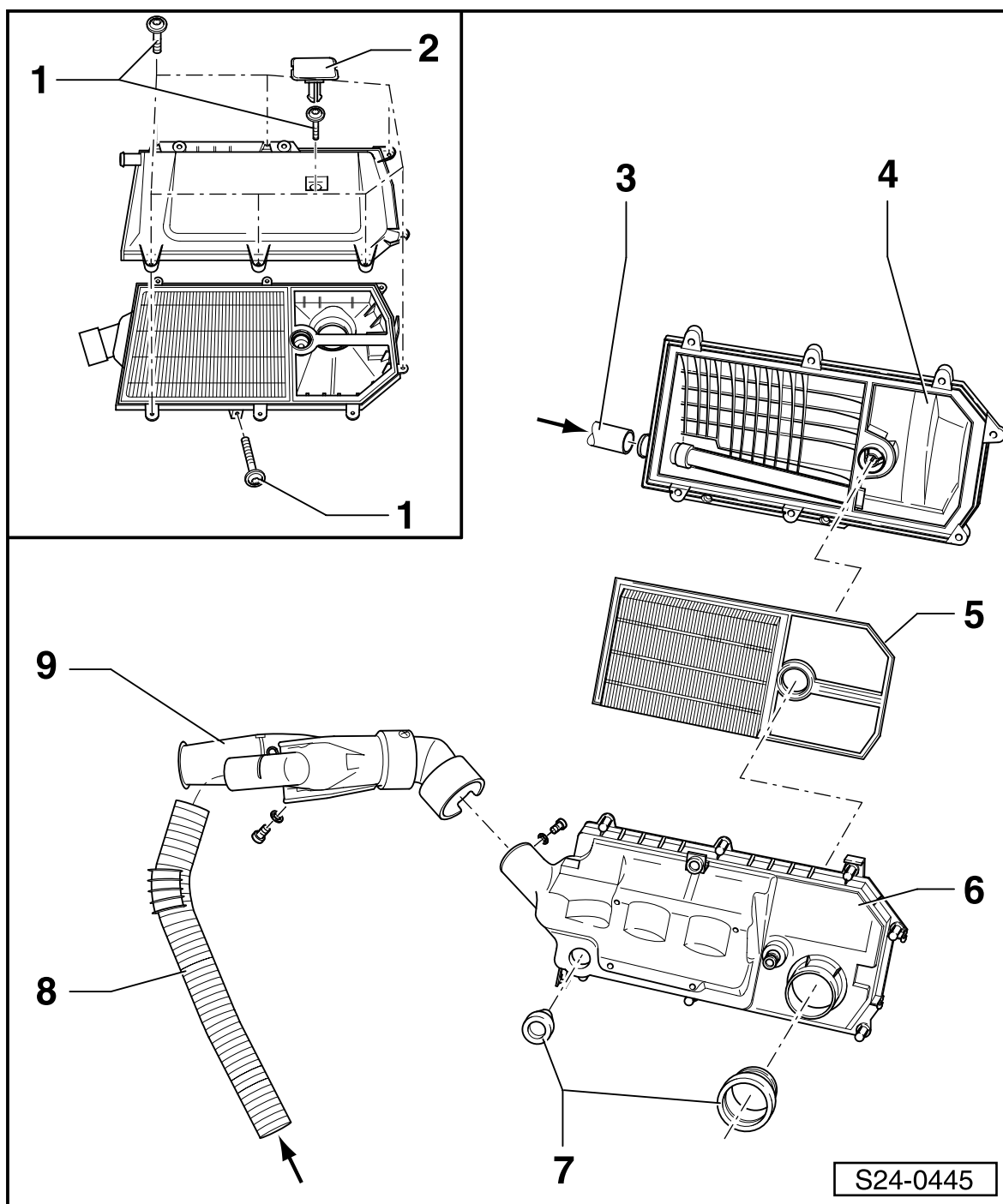
- ◆ replace if damaged

11 - Fuel pressure regulator

- ◆ testing fuel pressure regulator and holding pressure ⇒ page 24-19

12 - Vacuum hose

Disassembling and assembling air filter



1 - 3 Nm

2 - Plug

3 - Crankcase ventilation hose

4 - Top part of air filter

5 - Filter element

6 - Bottom part of air filter

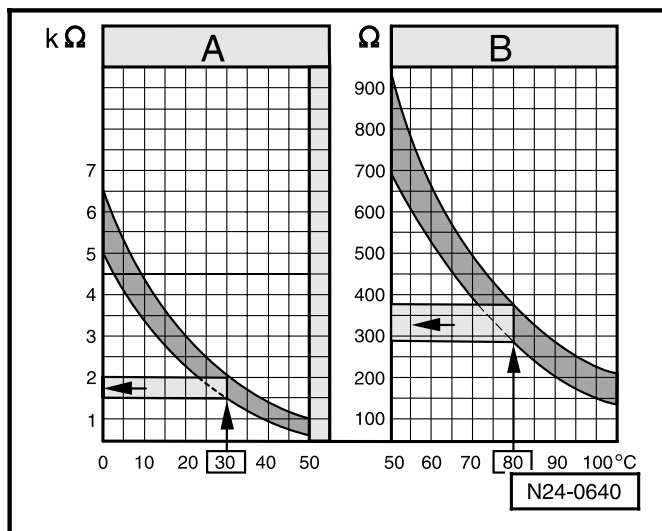
7 - Seal

- ♦ ensure tightly installed
- ♦ replace if damaged

8 - Warm air intake

- ♦ to warm air baffle at exhaust manifold

9 - Inlet connection with control flap



◀ **Fig. 1 Resistances for coolant temperature sender (G62)**

The chart is splitted to two temperature ranges:

A - from 0...50 °C

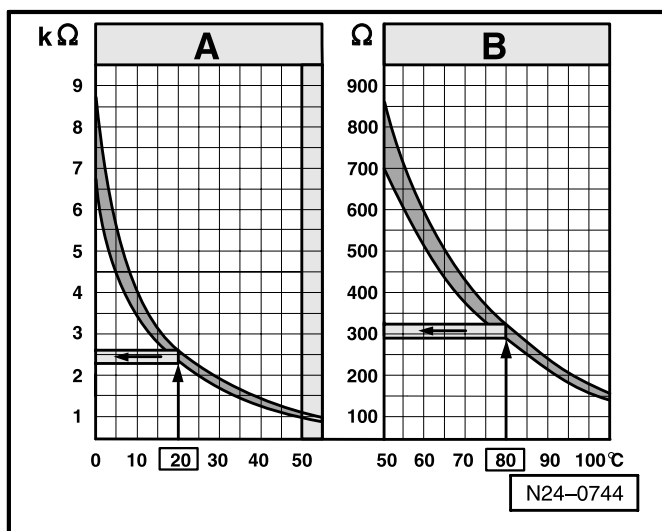
B - from 50...105 °C

Examples:

♦ 30 °C is within range A, equals a resistance of 1.5...2.0 kΩ

♦ 80 °C is within range B, equals a resistance of 275...375 Ω

- Connect multimeter for resistance measurement to contacts 3 + 4 of the coolant temperature sender.



◀ **Fig. 2 Resistances for intake manifold temperature sender (G42)**

The chart is splitted to two temperature ranges:

A - from 0...50 °C

B - from 50...105 °C

Examples:

♦ 20 °C is within range A, equals a resistance of 2.3...2.6 kΩ

♦ 80 °C is within range B, equals a resistance of 290...330 Ω

- Connect multimeter for resistance measurement to contacts 1 + 2 of the intake manifold temperature sender.

Testing components

Testing wiring with test box V.A.G 1598/22

Special tools, testers and aids required

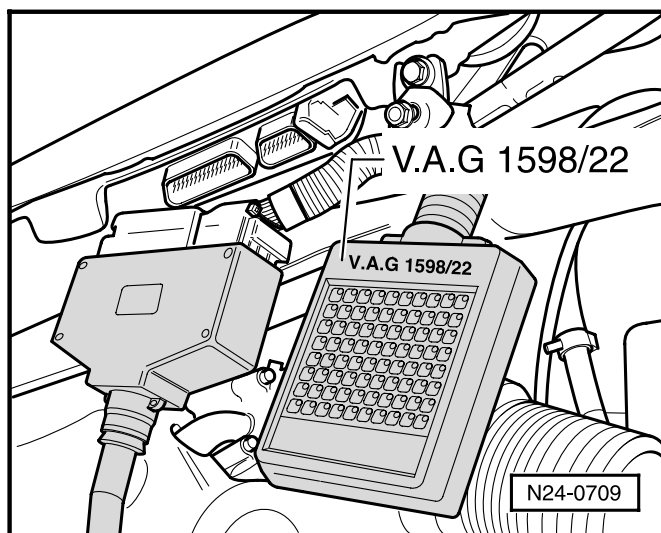
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Adapter cable set, e.g. V.A.G 1594 A

Notes:

- ◆ *Use adapter cables from adapter cable set for connecting the testers to the test box.*
- ◆ *The contact numbers of the connector and the socket numbers of the test box V.A.G 1598/22 are identical.*

Procedure

- Switch ignition off.
- Unscrew windscreen wipers and remove cover of plenum chamber.
⇒ Body Fitting Work; Repair Group 66
- Release the connector locks and unplug the engine control unit connectors.
- ◀ - Connect test box to connector of wiring loom.
- Carry out the test as described in the particular repair procedures.



Testing throttle valve control unit (J338)

Components of throttle valve control unit -J338-: throttle valve drive -G186-, angle sender 1 for throttle valve drive -G187- and angle sender 2 for throttle valve drive -G188-.

Note:

If the throttle valve control unit is replaced, it is then essential to adapt the new control unit to the engine control unit ⇒ page 24-32.

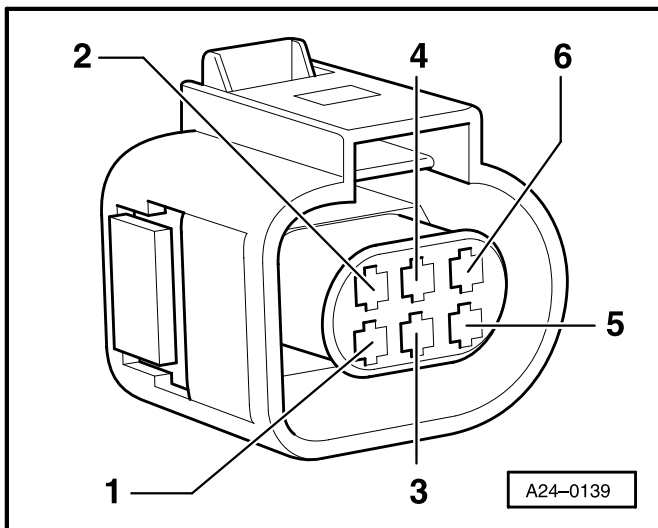
Special tools, testers and aids required

- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Adapter cable set, e.g. V.A.G 1594 A

Test conditions

- Throttle valve must neither be damaged nor dirty.
- Coolant temperature at least 80 °C.
- Battery voltage at least 11.5 V.

Test procedure



- ◀ - Measure resistance of throttle valve drive between contacts 3 + 5.
Specification: 1.0...5.0 Ω

If the specification is not achieved:

- Replace throttle valve control unit (J338).

If the specification is achieved:

- Test voltage supply and cables to throttle valve control unit.

If the voltage supply and cables of the throttle valve control unit are o.k.:

- Replace engine control unit ⇒ page 24-29.

Testing jet formation and tightness of the injection nozzles

Required special tools, testing and measuring equipment as well auxiliary devices and material

- ◆ torque wrench
- ◆ adapter cable set, e.g. V.A.G 1594 A
- ◆ digital potentiometer, e.g. V.A.G 1630
- ◆ measuring glasses, e.g. V.A.G 1602

Testing conditions

- the fuel pressure must be OK, check it
⇒ page 24-19.

Testing sequence

- remove the engine cover

For engines with the engine identification characters AXP

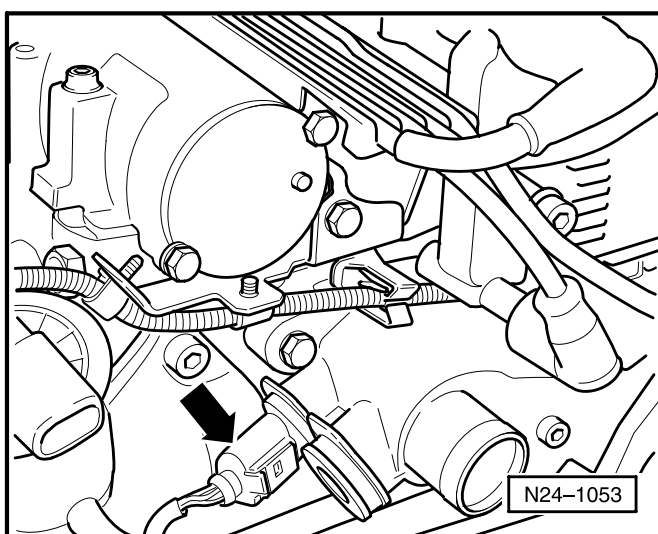
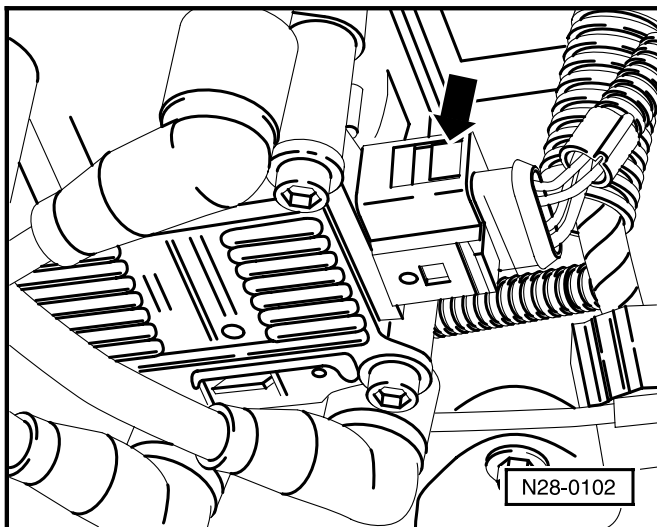
- ◀ - pull out the 4-pin connector -arrow- from the ignition transformer.

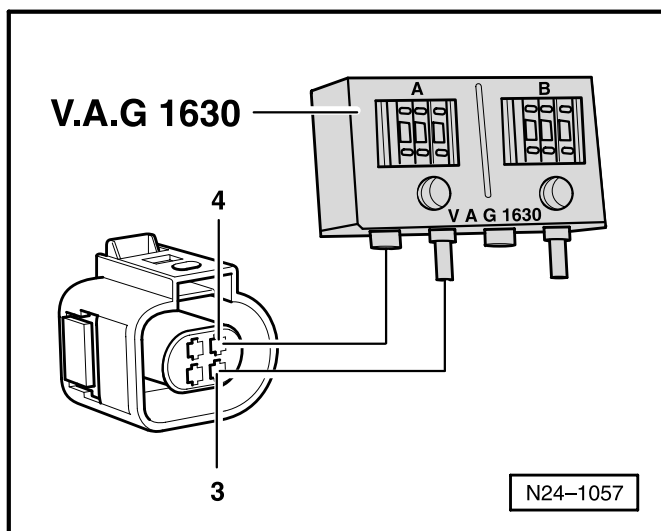
For engines with the engine identification characters BCA

- pull out all ignition transformers using the extractor T10094.

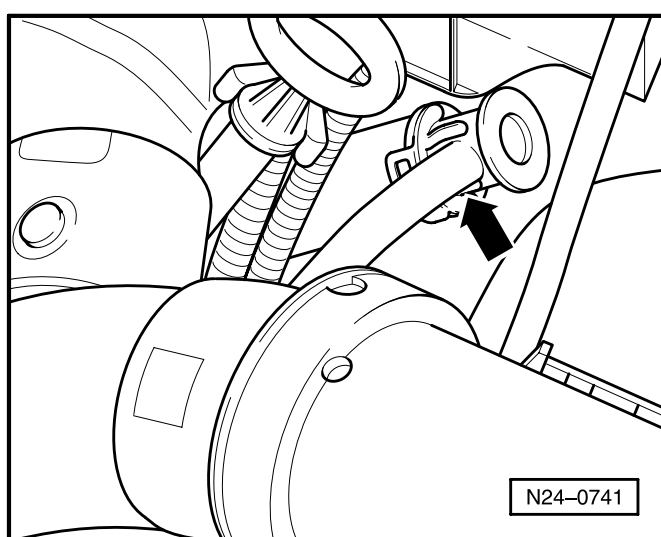
For all engines

- ◀ - pull out the 4-pin connector from the sender of the coolant temperature (G62) -arrow-.

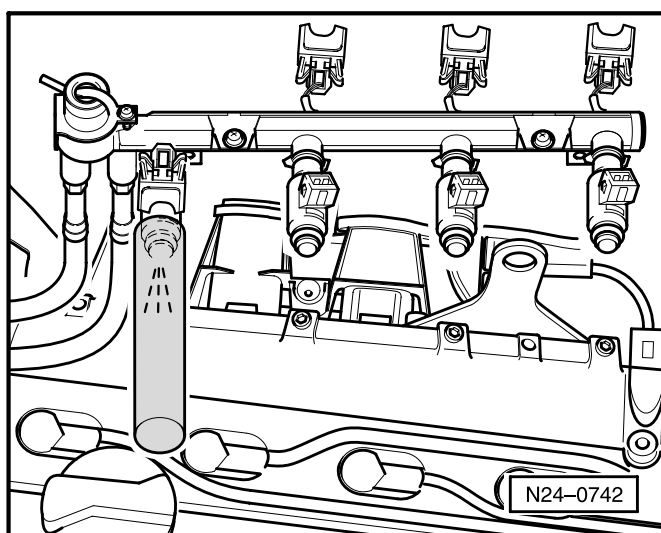




- ◀ - Connect digital potentiometer to contacts 3 + 4 of the connector and set the connected side to 15 k Ω .



- ◀ - Detach vacuum hose from fuel pressure regulator -arrow-.
- Detach wiring loom of the injectors at fuel rail.
- Remove fuel rail complete with all injectors from camshaft housing (the fuel hoses remain connected) $\Rightarrow$ page 24-11.



- ◀ - Hold a measuring vessel below the injector to be tested and unplug the connectors from the remaining injectors.
- Have a second person operate the starter. The injector must eject in a pulsating spray.
- Repeat the test at the other injectors. When doing this, ensure that only the injector being tested is connected.
- To conclude, inspect the injectors for leaks. Not more than 2 drops a minute must drip out.

If the fuel loss is greater:

- Switch ignition off.
- Replace the faulty injector $\Rightarrow$ page 24-4, item 4.

Install the injectors in the reverse order. Pay attention to the following points:

- ◆ Replace the O-rings at all the injectors and moisten lightly with clean engine oil.
- ◆ Insert injectors vertically into the fuel rail and into the correct position, and secure with retaining clips.
- ◆ Place fuel rail with secured injectors into camshaft housing and press in evenly.

Testing fuel pressure regulator and holding pressure

The fuel pressure regulator regulates the fuel pressure in line with the intake manifold pressure.

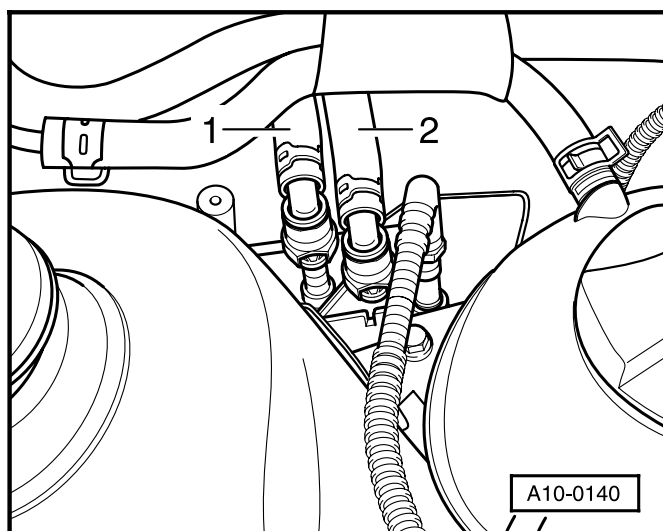
The specification for this test depends on the operating pressure of the fuel pump. Fuel pump pressure is approx. 3.0 bar (0.3 MPa).

Special tools, testers and aids required

- ◆ Pressure measuring device, e.g. V.A.G 1318
- ◆ Adapter, e.g. 1318/10
- ◆ Adapter, e.g. 1318/11
- ◆ Adapter, e.g. 1318/16
- ◆ Pliers for spring strap clips

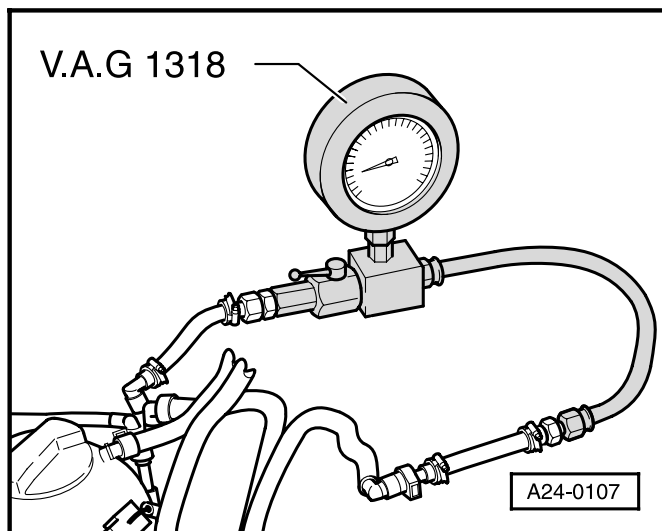
Test procedure

- Remove fuse 28 for fuel pump from the fuse holder.
- Remove engine trim panel.
- ◀ - Detach fuel feed line -1- and collect fuel which flows out with cloths.



Warning!

Fuel system is pressurized! Before slackening hose connections or opening test connections, place cleaning cloths around the connection point. Then, release pressure by detaching carefully.



- ◀ - Connect pressure measuring device to fuel feed line.
- Open shut-off cock of pressure measuring device. Lever points in direction of flow.
- Insert fuse 28 for fuel pump into the fuse holder.
- Start engine and run at idling speed.
- Measure fuel pressure. Specification: approx. 0.25 MPa (2.5 bar).

If the specification is achieved:

- ◀ - Detach the vacuum hose -arrow- from the fuel pressure regulator. The fuel pressure must rise to approx. 0.3 MPa (3.0 bar).
- Switch ignition off.

If the specification is not achieved:

- Test delivery of fuel pump
⇒ 1.4 l/55 kW Engine - Mechanical Components; Repair Group 20

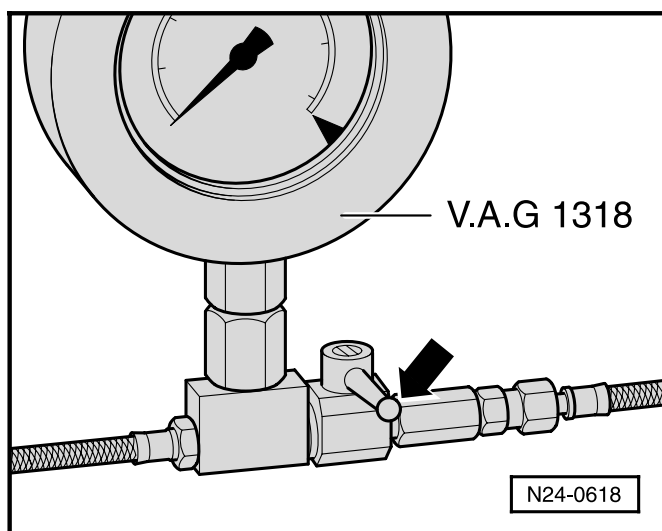
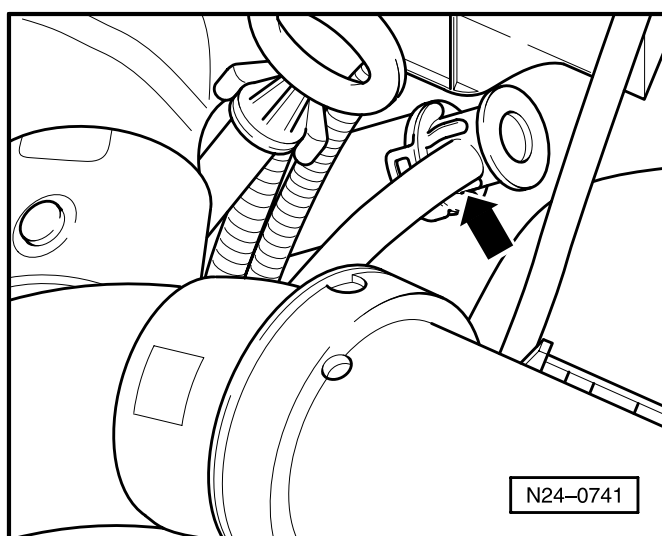
If the specification is achieved:

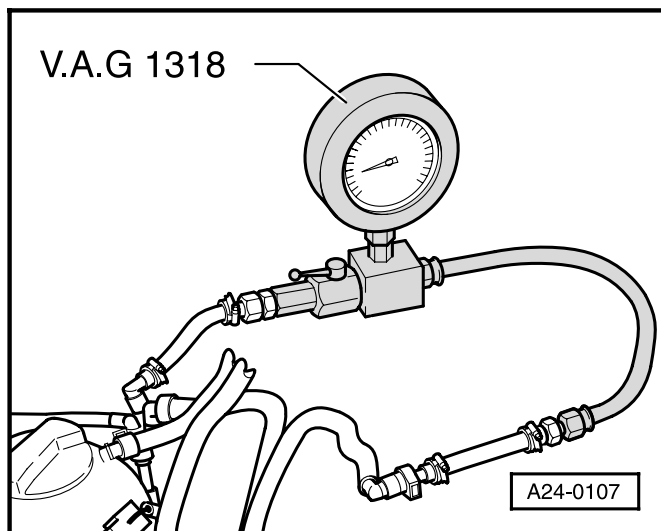
- Test leaktightness and holding pressure. To do this, observe pressure drop at the gauge. The pressure gauge must still indicate at least 0.2 MPa (2.0 bar) after 10 minutes.

If the holding pressure drops below 0.2 MPa (2 bar):

- Start engine and run at idling speed.
- ◀ - After the pressure has built up, switch ignition off. At the same time, close the shut-off cock at the pressure measuring device (lever at right angles to direction of flow -arrow-).
- Observe pressure drop at gauge.

If the pressure does not drop:

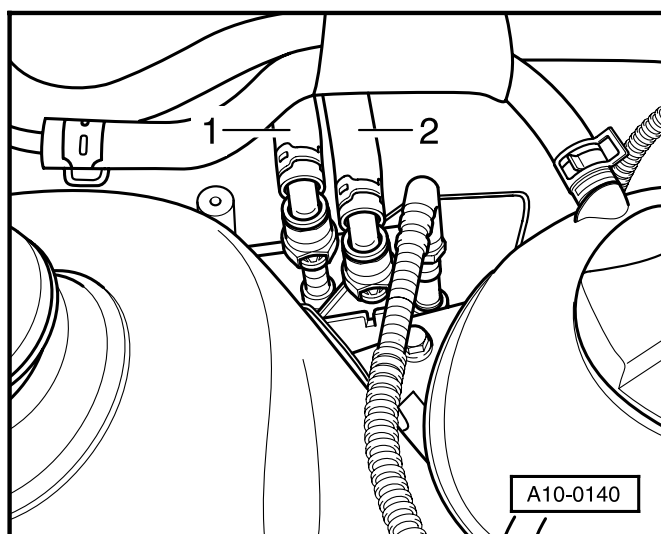




- Test non-return valve of fuel pump.
- ⇒ 1.4 l/55 kW Engine - Mechanical Components; Repair Group 20

If the pressure again drops:

- ◀ - Open shut-off cock of pressure measuring device (lever pointing in direction of flow).
- Start engine and run at idling speed.



- ◀ - After the pressure has built up, switch the ignition off. At the same time firmly compress return-flow hose -2- (with blue marking).

If the pressure does not drop:

- Replace fuel pressure regulator
- ⇒ page 24-11, item 11.

If the pressure again drops:

- Inspect connections, O-rings at fuel rail and at injectors for leaks.
- Inspect pressure measuring device for leaks.

Note:

Before disconnecting the pressure measuring device, place cleaning cloth again around the loose hoses of the feed line.

Testing intake system for leaks (unmetered air)

Notes:

- ◆ *The leak detection spray is inducted with the unmetered air as a result of the vacuum in the intake system. The leak detection spray reduces the ignition performance of the mixture. This results in a drop in engine speed and in a change in the lambda probe value.*
- ◆ *It is essential to observe the safety precautions stated on the can.*

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C
- ◆ Engine leak detection spray G 001 800 A1

Test condition

- Coolant temperature at least 80 °C ⇒ Read measured value block 004, display zone 3.

Test procedure

- Connect vehicle system tester V.A.G 1552. Start engine and select address word 01 „Engine electronics“ ⇒ page 01-4.
- Select function 08 „Read measured value block“ and display group 001.

Read measured value block 1				→
780 rpm	90 °C	5.0 %	00111111	

◀ Check in display zone 2 whether the coolant temperature is more than 80 °C.

- Observe lambda control in display zone 3 and engine speed in display zone 1.
- Spray the parts of the intake system systematically with engine leak detection spray.

If the engine speed drops or if the lambda control value displayed becomes greater:

- End output and switch ignition off.
- Inspect sprayed point of intake system for leaks and rectify any leak.

Testing intake air preheater

Special tools, testers and aids required

- ◆ Refrigerant spray

Testing control flap

- Remove air filter.
- Check position of control flap.
- ◆ If temperature more than +23 °C, flap must seal off warm air connection.
- ◆ If temperature less than +10 °C, flap opens the warm air connection.

Note:

The operation of the thermocouple can be easily tested by spraying with refrigerant spray.

Testing operation

Testing lambda probe and lambda control upstream of catalytic converter

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C
- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Adapter cable set, e.g. V.A.G 1594 A

Test conditions

- Fuse 43 must be in proper order.
- Battery voltage at least 11.5 V.
- No leak in exhaust system between catalytic converter and cylinder head.
- Coolant temperature at least 80 °C ⇒ Read measured value block 004, display zone 3.

Testing operation

- Check display groups 030, 032, 033 and 034 ⇒ page 01-52.

If the specifications are not achieved:

- Conduct a road test in order to eliminate any residues on the lambda probe, and repeat the test.

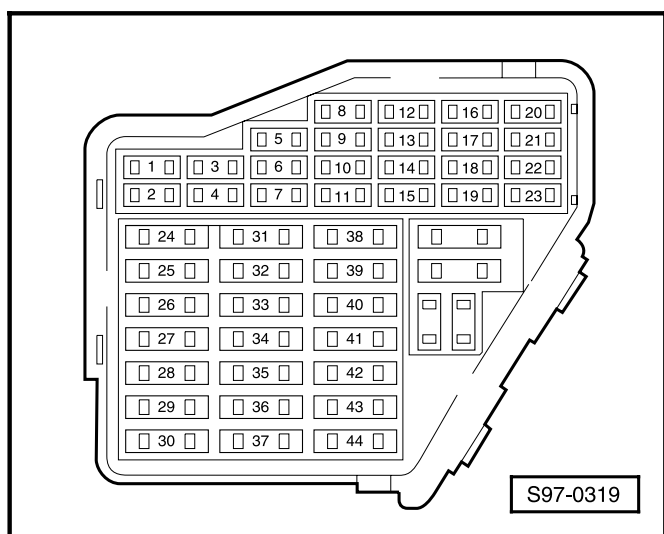
If the specification in the display is also not achieved after a road test:

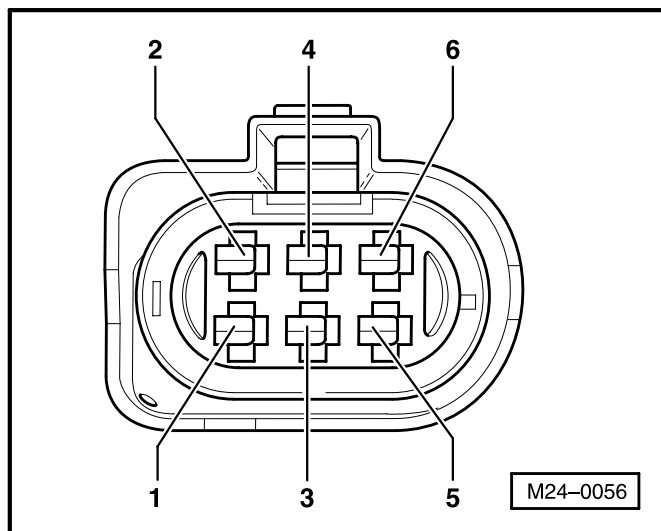
Testing heater

- Read measured value block, display group 041 ⇒ page 01-58.

If the specifications are not achieved:

- Test resistance of voltage supply for heater, and also cables to -Z19 (specified resistance 1...5 Ω)
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations.





Testing basic voltage

- Separate the 6-pin plug connection to the lambda probe upstream of catalytic converter (G39).
- ◀ - Set multimeter for voltage measurement and connect to contacts 1 + 5 of connector at wiring loom to control unit.
- Start engine and measure basic voltage
Specification: 0.400...0.500 V
- Switch ignition off.

If the specification is not achieved:

- Test cable of lambda probe upstream of catalytic converter
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations.

If the specification is achieved:

- Replace lambda probe upstream of catalytic converter (G39).

Testing lambda probe and lambda control downstream of catalytic converter

- ◆ *Use only gold-plated contacts for repairing contacts 3 and 4 in the plug connection of the lambda probe.*

Special tools, testers and aids required

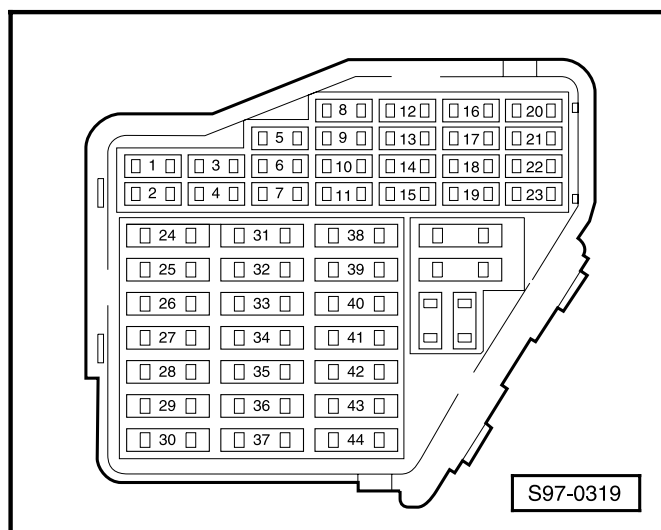
- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C
- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Adapter cable set, e.g. V.A.G 1594 A

Test conditions

- ◀ ● Fuse 43 must be in proper order.
- Battery voltage at least 11.5 V.
- No leak in exhaust system between catalytic converter and cylinder head.
- Coolant temperature at least 80 °C ⇒ Read measured value block 004, display zone 3.

Testing operation

- Check display groups 030, 036 and 037
⇒ page 01-52.



If the specifications are not achieved:

- Conduct a road test in order to eliminate any residues on the lambda probe, and repeat the test.

If the specification in the display is also not achieved after a road test:

Testing heater

- Read measured value block, display group 041 ⇒ page 01-58.

If the specifications are not achieved:

- Test resistance of voltage supply for heater, and also cables to -Z29 (specified resistance 1...5 Ω)
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations.

Testing basic voltage

- ◀ - Separate the 4-pin plug connection to the lambda probe downstream of catalytic converter (G130) -arrow-.

- ◀ - Set multimeter for voltage measurement and connect to contacts 3 + 4 of connector at wiring loom to control unit.

- Start engine and measure basic voltage
Specification: 0.400...0.500 V

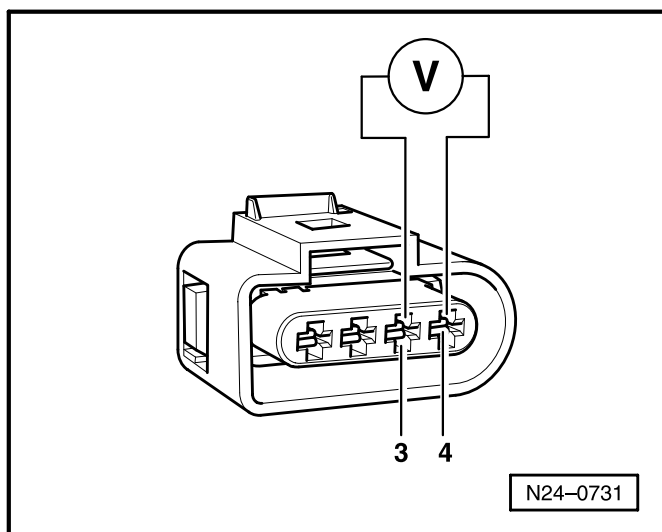
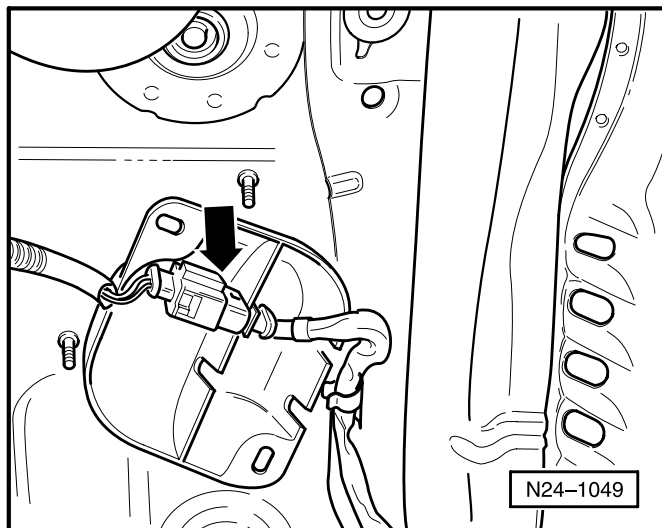
- Switch ignition off.

If the specification is not achieved:

- Test cable of lambda probe downstream of catalytic converter
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations.

If the specification is achieved:

- Replace lambda probe downstream of catalytic converter (G130).

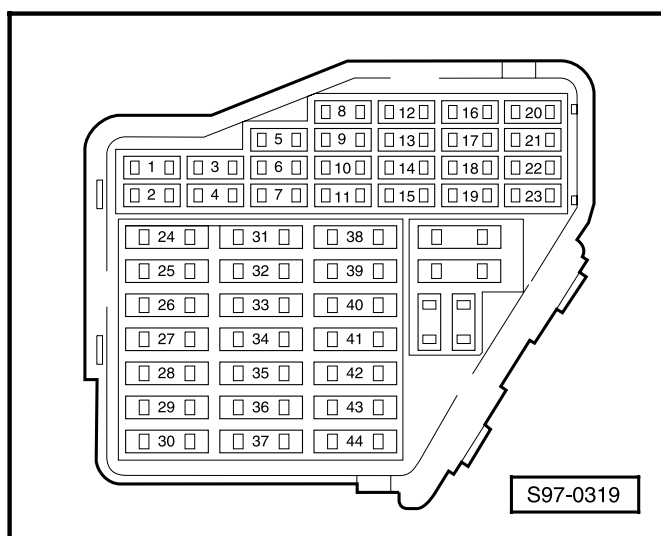


Engine control unit

Testing voltage supply for engine control unit

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Adapter cable set, e.g. V.A.G 1594 A



Test conditions

- Fuses 10 and 29 must be in proper order.
- Earth connections between engine and body must be in proper order.
- Earth connections in water channel must be in proper order.
- Battery voltage at least 11.5 V.
- All electrical components, such as lights and rear window heater, must be switched off.
- If vehicle is equipped with air conditioning, system must be switched off.
- Generator o.k., testing:
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations.

Test procedure

- Connect vehicle system tester V.A.G 1552. Start engine and select address word 01 „Engine electronics“ ⇒ page 01-4.
- Select function 08 „Read measured value block“ and display group number 004.

Read measured value block 4 →
800 rpm **13.580 V** 84.0 °C 29.0 °C

◀ Test battery voltage (display zone 2).

Specification: at least 11.5 V

- End output and switch ignition off.

If the specification is not achieved:

- Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-15.

Testing voltage supply, terminal 30

- Use multimeter to measure voltage supply between sockets 2 + 15 and 15 + 28 of test box.

Specification: at least 11.5 V.

If the specification is not achieved:

- Test cable connections to microelectrical centre according to current flow diagram:
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations.

Testing voltage supply, terminal 15

- Use multimeter to measure voltage supply between sockets 2 + 27 and 27 + 28 of test box.

- Switch ignition on.
Specification: at least 11.5 V.

If the specification is not achieved:

- Test cable connections to microelectrical centre according to current flow diagram:
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations.

Procedure in the event of interruption to voltage supply

If the voltage supply is interrupted, all the learned values of the engine control unit, and any basic setting values are erased. Depending on the mileage of the vehicle, this can result in considerable vehicle performance problems.

Special tools, testers and aids required

- ♦ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Procedure

If the voltage supply was interrupted, it is then necessary to carry out the following steps:

- Switch ignition on for at least 10 s.

- Switch ignition off.
- Adapt engine control unit to the throttle valve control unit ⇒ page 24-32.
- Test idling speed ⇒ page 01-62.
- Conduct a lengthy road test until the vehicle performance problems have been rectified.

During the road test, pay attention to safety precautions ⇒ page 24-2.

During the road test, it is necessary to achieve the following operating conditions:

- ◆ Coolant temperature must rise to more than 80 °C.
- ◆ Once this temperature is reached, the following operating states must be achieved several times
 - Idling speed
 - Part throttle
 - Full throttle
 - Fuel shutoff on overrun.
- ◆ At full throttle, engine speed must increase to more than 3500 rpm.
- Read readiness code ⇒ page 01-31.

Replacing engine control unit

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Removing

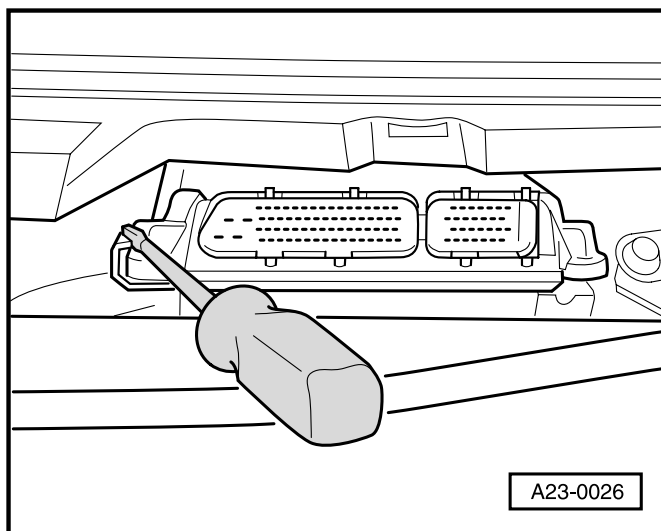
- Enter the control unit identification and thus also the coding of the previous control unit as follows:
- Connect vehicle system tester V.A.G 1552. Switch ignition on and enter address word 01 „Engine electronics“ ⇒ page 01-4.

03006032	ME 7.5.10
Coding 00031	

2853	→
WSC 00000	

◀ The engine control unit identification and the coding appear in the display (example):

- Note the engine control unit identification.
- End output and switch ignition off.



- Unscrew windscreen wipers and remove cover of plenum chamber.
⇒ Body Fitting Work; Repair Group 66
- Release the connector locks and unplug control unit connectors.
- ◀ - Push away the stops and pull engine control unit forward.

Installing

Installation is carried out in the reverse order; pay attention to the following points:

- Adapt engine control unit to throttle valve control unit ⇒ page 24-32.
- Adapt exhaust gas recirculation potentiometer:
- Select function 04 „Initiate basic setting“ and display group 074.

System in basic setting 74				→
0.960 V	4.100 V	3.060 V	ADP. o.k.	

- ◀ - Observe readouts in display zone 4:
Specification: ADP. o.k.
- Conclude adaptation by pressing the → key.
- Adapt engine control unit to electronic immobiliser
⇒ Electrical System; Repair Group 96.
- Interrogate fault memory, rectify any faults and erase fault memory ⇒ page 01-6.
- Test idling speed ⇒ page 01-62.
- Read readiness code ⇒ page 01-31.

Coding engine control unit

Notes:

- ◆ *During control unit identification a 5-digit code must always be displayed.*
- ◆ *If the code displayed does not correspond to the vehicle, or if the control unit has been replaced, it is then necessary to code the control unit as follows.*

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Procedure

- Connect vehicle system tester V.A.G 1552. Switch ignition on and enter address word 01 „Engine electronics“ ⇒ page 01-4.
- Select function 07 „Code control unit“ and confirm the entry with the key Q.

Code control unit Enter code number XXXXX	Q (0-32000)
--	----------------

◀ Enter code number by referring to the table of codes, and confirm the entry with the key Q.

Table of codes:

Code number	for vehicles fitted with
00001	Manual gearbox
00011	Manual gearbox with ABS (ESP, EDL, TCS)
00021	Manual gearbox with airbag
00031	Manual gearbox with ABS (ESP, EDL, TCS) and airbag

036906032 ME 7.5.10 Coding 00031	2853 → WSC 00000
-------------------------------------	---------------------

◀ The engine control unit identification and the code appear in the display (example):

Function is unknown or cannot be carried out at the moment.	→
---	---

◀ If the approved code number was not entered, this readout appears in the display.

- End output and switch ignition off.

Notes:

The Motronic control unit does not use the code entered and which appears in the display until after the ignition has been switched off once for at least 15 s. Incorrect coding results in:

- ◆ *Vehicle performance problems (jerky gear changes, load change jolts etc.)*
- ◆ *Increased fuel consumption*
- ◆ *Increased emission levels*
- ◆ *Storage of non-existent faults in fault memory*
- ◆ *Functions not being performed (lambda control, actuation of activated charcoal filter system, etc.)*
- ◆ *Traction control system on FWD vehicles not operating (TCS/ASR warning light on)*

Adapting engine control unit to throttle valve control unit

As a result of the adaptation, the engine control unit learns various positions of the throttle valve when the ignition is switched on and the engine is not running. These positions are stored in the engine control unit. The feedback signals of the throttle valve position are provided by the two angle sensors for the throttle valve drive.

Adaptation must be performed if:

- ◆ the voltage supply has been interrupted
- ◆ the throttle valve control unit has been replaced
- ◆ the engine control unit has been replaced
- ◆ another throttle valve control unit has been installed as a result of installing a different engine.

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Test conditions

- Ignition on, engine not running.
- There must not be any fault stored in the fault memory ⇒ page 01-6, Interrogating fault memory.
- Battery voltage at least 11.5 V.
- If vehicle is equipped with air conditioning, this system must be switched off.
- All electrical components such as lights and rear window heater, must be switched off.
- Throttle valve control unit must be in idle speed position.
- Throttle valve must not be dirty.
- Coolant temperature at least 5...80 °C
⇒ Read measured value block 004, display zone 3.

Procedure

- Connect vehicle system tester V.A.G 1552. Switch ignition on and enter address word 01 „Engine electronics“ ⇒ page 01-4.
- Select function 04 „Initiate basic setting“ and display group 060.

After pressing the key Q, the throttle valve positioner is first of all de-energized.

System in basic setting 60				→
14 %	85 %	8	ADP o.k.	

- ◀ Check the specifications for the throttle valve control unit in display zones 3 and 4
- Specification in display zone 3: 8
- Specification in display zone 4:
- ADP runs
- ADP o.k.

If the specifications are achieved:

Adaptation has been successfully completed.

- Wait at least 30 s before ending adaptation by pressing the → key.
- End output.

In order to store the values:

- Switch ignition off.

Notes:

If the basic setting is aborted by the engine control unit, this may be for the following reasons:

- ♦ *the throttle valve is not able to reach the mechanical idle speed stop because of dirt, e.g. oil carbon deposits, or because of a mechanical fault.*
- ♦ *the battery voltage is too low.*
- ♦ *the throttle valve control unit or the cable connection is faulty, test ⇒ page 24-16.*

After an aborted basic setting, the fault is stored in the fault memory. The next time the ignition is switched on, the basic setting is automatically repeated.

Testing additional signals

Testing vehicle speed signal

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C
- ◆ Test box V.A.G 1598/22
- ◆ Diode test lamp, e.g. V.A.G 1527 B
- ◆ Adapter cable set, e.g. V.A.G 1594 A

Test conditions

- Battery voltage at least 11.5 V.
- Speedometer in proper order. Testing speedometer:
⇒ Electrical System; Repair Group 90
- No fault stored in the fault memory ⇒ page 01-6, Interrogating fault memory.

Test procedure

- Read measured value block and display group 005.

If the vehicle speed is not indicated or if the readout does not drop as the vehicle slows down:

- Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-15.
- Connect diode test lamp between socket 27 and socket 5.
- Switch ignition on.
- Raise vehicle at left front.
- Rotate front wheel.
Diode test lamp must flash (very short flashing signal).

Note:

The right front wheel must not be rotated during this step.

If the diode test lamp does not flash:

- Test cable connections to speedometer, and also to speedometer sender if necessary.

⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations.

Testing databus (CAN bus)

- Refer to the appropriate current flow diagrams to determine which control units are connected to the drive databus (CAN; Controller Area Network).
- Check the plug connections of all the connected control units to ensure they are tight.
- Connect vehicle system tester V.A.G 1552 and enter function 00 „Automatic test sequence“.

Before testing the communication line, determine whether there is any operational fault at the connected control units.

Special tools, testers and aids required

- ◆ Test box V.A.G 1598/21
- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Adapter cable set, e.g. V.A.G 1594

Test conditions

- A fault has been detected at the databus by the self-diagnosis.

Test procedure

- ◀ - Connect test box V.A.G 1598/21 -1- to the wiring loom of the ABS control unit -2-.
- Test terminating resistance in engine control unit.
- Measure resistance between sockets 10 + 11 of test box.

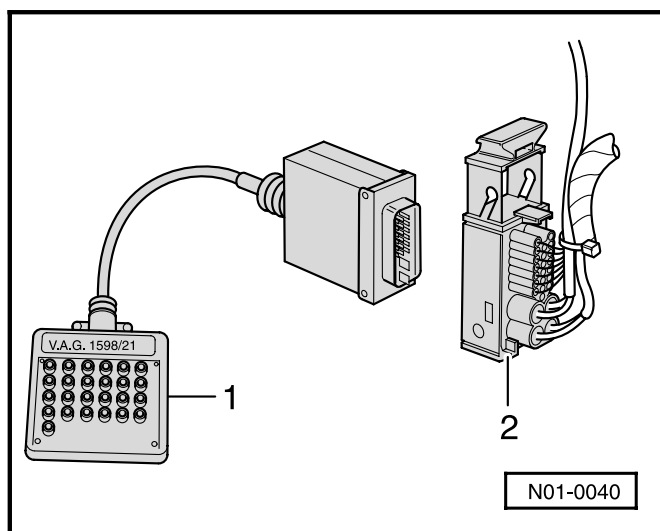
Specification: 60...72 kΩ.

If the measurement obtained is not within the specified range:

- Replace engine control unit ⇒ page 24-29.

If the measurement obtained is within the specified range:

- Test databus
- ⇒ Electrical System; Repair Group 90.



Servicing ignition system

General information on ignition system

- ◆ *This section deals specifically only with the components related to the ignition system. For the other components of the fuel injection and ignition system ⇒ from page 24-4.*
- ◆ *Do not disconnect and connect the battery unless the ignition is switched off otherwise the engine control unit may be damaged.*
- ◆ *The engine control unit is equipped with self-diagnosis.*
- ◆ *Components marked with * are tested by the self-diagnosis ⇒ page 01-6, Interrogating and erasing fault memory.*
- ◆ *A voltage of at least 11.5 V is required for proper operation of the electrical components.*
- ◆ *Before commencing repairs and fault finding, interrogate fault memory ⇒ page 01-6, Interrogating and erasing fault memory.*
- ◆ *When conducting certain tests, it is possible that the control unit will detect and store a fault. For this reason, after completing all the tests and repair work, interrogate the fault memories and erase if necessary ⇒ page 01-6, Interrogating and erasing fault memory.*
- ◆ *If the engine starts only for a short time and then cuts out again after conducting fault finding, repairs or tests of components, the reason for this may be that the immobiliser is inhibiting the engine control unit. In such a case, it is necessary to interrogate the fault memory and to adapt the control unit ⇒ page 24-32.*

Safety precautions ⇒ page 28-1.

Test data, spark plugs ⇒ Inspection and Maintenance.

Safety precautions

Pay attention to the following points in order to avoid injuries to persons and/or damage to the fuel injection and ignition system:

- ◆ *Do not touch or disconnect ignition cables when the engine is running or operating at starting speed.*
- ◆ *Do not disconnect or connect cables of the fuel injection and ignition system - also not cables of test equipment - unless the ignition is switched off.*

Please observe the following if it becomes necessary to use checking and testing equipment when undertaking a test drive:

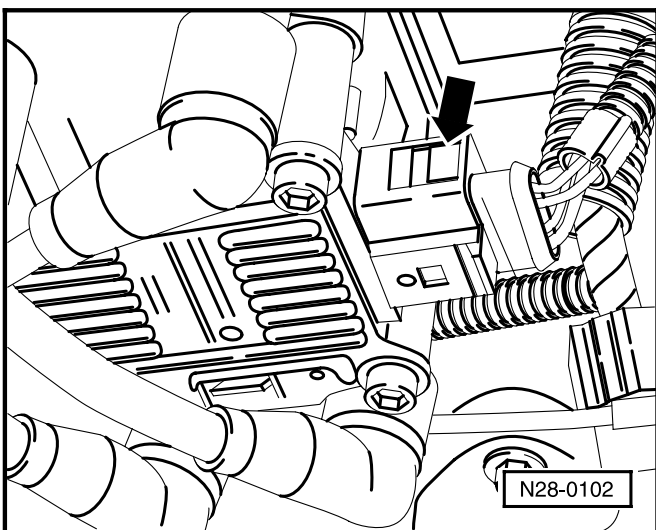
- ◆ The checking and testing equipment are always to be fixed to the rear seat and also to be operated from there by a second person.

If the checking and testing equipment were also operated from the front passenger seat then the person there could suffer injury from the airbag if a crash occurred.

- ◆ When the engine should be run at the starter speed without firing:

For engines with engine identification characters AXP

- ◀ - pull out the 4-pin connecting plug from the ignition transformer -arrow-.

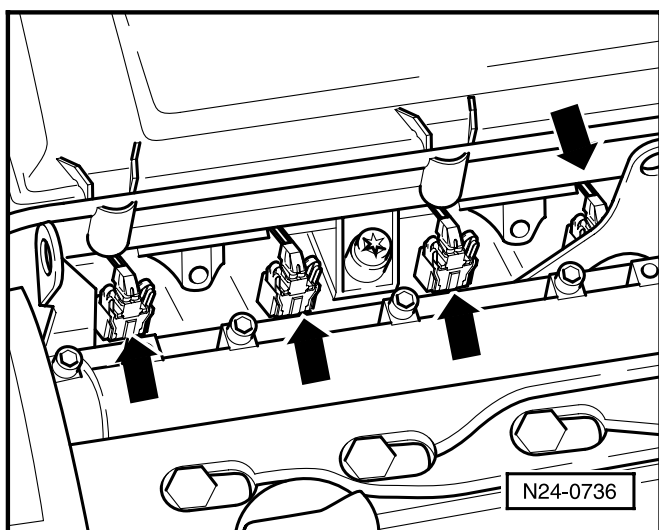


For engines with engine identification characters BCA

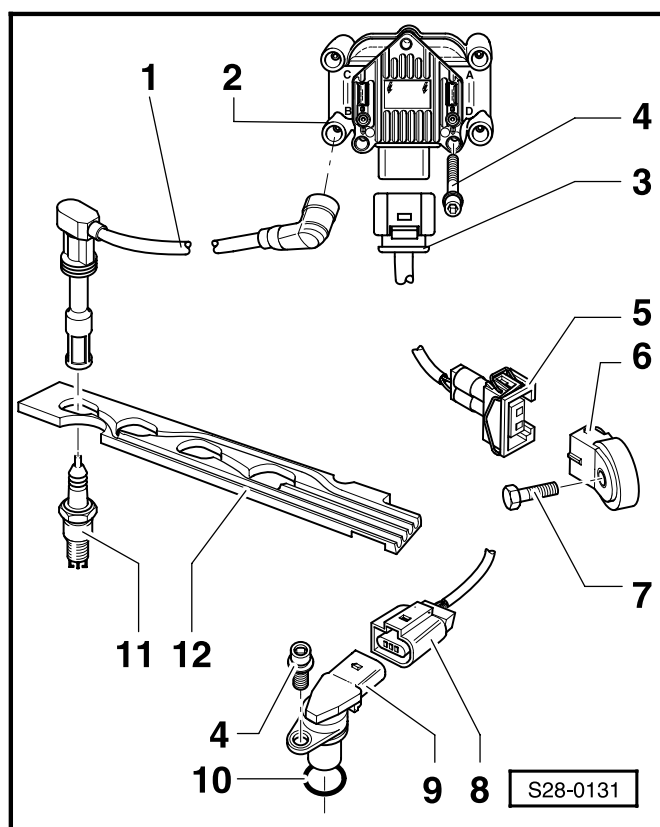
- pull out all ignition coils using extractor T10094.

For all engines

- ◀ - pull out the connecting plug on the injection valve -arrows-



Removing and installing parts of the engines with engine identification characters AXP



1 - Ignition lead

- ◆ with shielded plug and spark-plug
- ◆ resistance 4.8 .. 7.2 kΩ

2 - Ignition transformer (N152)

- ◆ with identification for the ignition leads:
A = Cylinder 1
B = Cylinder 2
C = Cylinder 3
D = Cylinder 4
- ◆ checking ⇒ page 28-4, Figure 1
- ◆ Installed location ⇒ page 24-5

3 - Connector

- ◆ black, 4-pin
- ◆ for the ignition transformer (N152)

4 - 10 Nm

5 - Connector

- ◆ black, 2-pin
- ◆ for the knocking sensor 1 (G61)
- ◆ contacts gold-plated

6 - Knocking sensor 1 (G61)*

- ◆ contact from the sensor and the connector, gold-plated
- ◆ installed location ⇒ page 24-4

7 - 20 Nm

- ◆ the tightening torque has an influence on the function of the knocking sensor

8 - Connector

- ◆ black, 3-pin
- ◆ for the hall sender (G40)

9 - Hall sender (G40)*

- ◆ checking ⇒ Page 28-6
- ◆ installed location ⇒ page 24-5

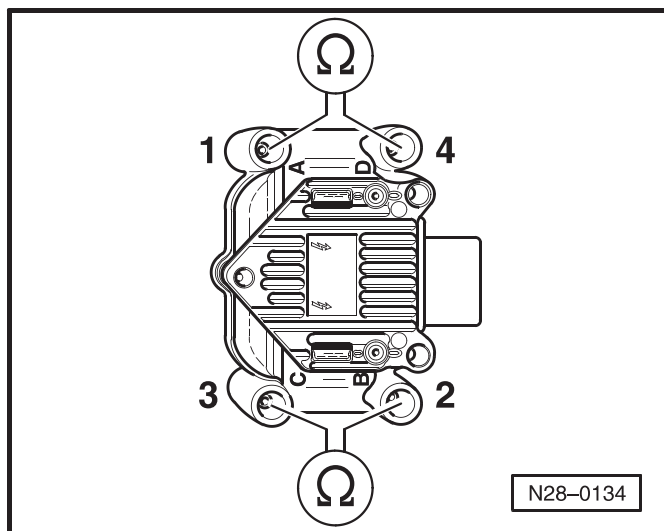
10 - O-ring

- ◆ replace when damaged

11 - Spark plug, 20 to 30 Nm

- ◆ removing and installing using a special spark plug wrench (e.g. 3122 B)
- ◆ type and change interval ⇒ Injection and Maintenance

12 - Ignition cable strip holder



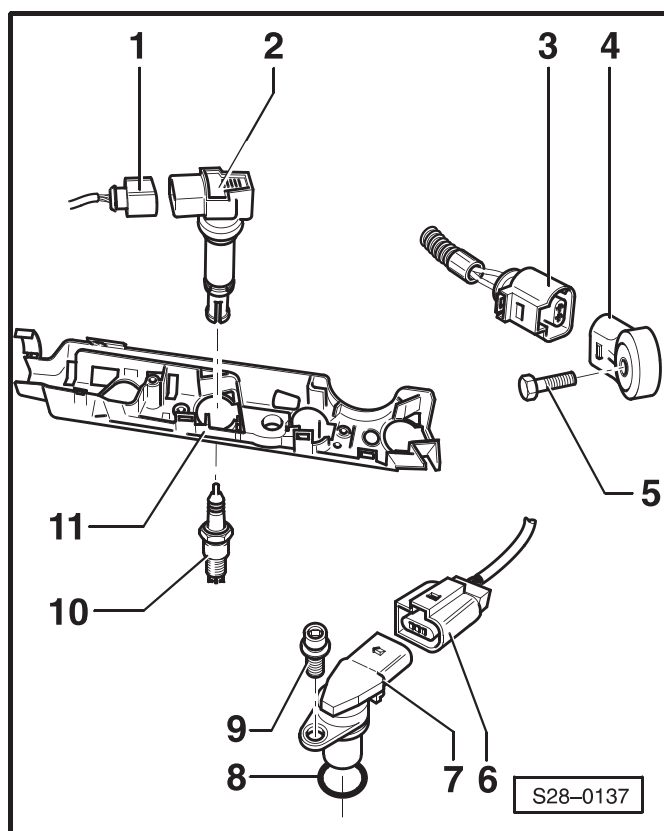
◀ **Figure 1 Checking the secondary resistances**

- check the secondary resistances on the terminal between cylinders 1 + 4 and cylinders 2 + 3
Nominal value 4.0 .. 6.0 k Ω (at 20 °C).

If the nominal value is not achieved:

- replace the ignition transformer (N152).

Removing and installing parts of the engines with engine identification characters BCA



1 - Connector

- ◆ black, 4-pin

2 - Ignition coils with power transformer (N70, N127, N291 and N292)

- ◆ remove and install using an extractor -T10094-

3 - Connector

- ◆ black, 2-pin
- ◆ for the knocking sensor 1 (G61)
- ◆ contacts gold-plated

4 - Knocking sensor 1 (G61)*

- ◆ contact from the sensor and the connector, gold-plated
- ◆ installed location ⇒ page 24-5.2

5 - 20 Nm

- ◆ the tightening torque has an influence on the function of the knocking sensor

6 - Connector

- ◆ black, 3-pin
- ◆ for the hall sender (G40)

7 - Hall sender (G40)*

- ◆ checking ⇒ page 28-6
- ◆ installed location ⇒ page 24-5.2

8 - O-ring

- ◆ replace when damaged

9 - 10 Nm

10 - Spark plug, 20 to 30 Nm

- ◆ removing and installing using a special spark plug wrench (e.g. 3122 B)
- ◆ type and change interval ⇒ Injection and Maintenance

11 - Holder

Checking components and functions

Checking the hall sender (G40)

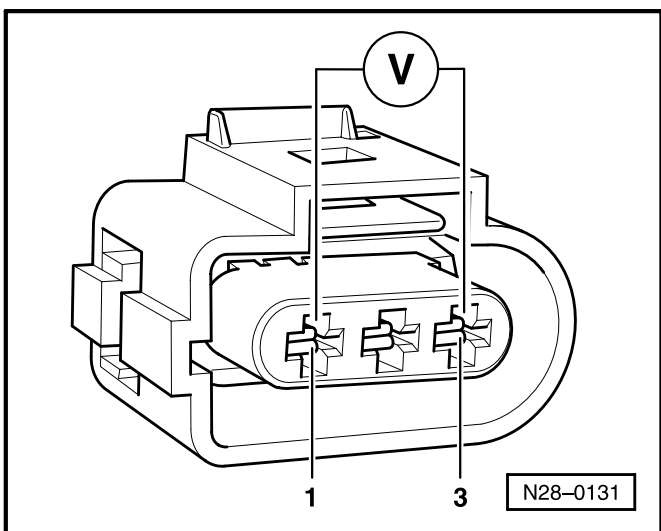
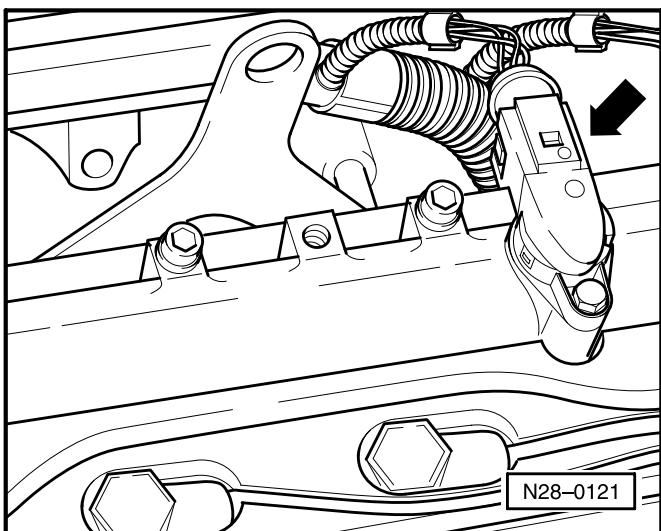
Required special tools, testing and measuring equipment as well auxiliary devices and material

- ◆ testing box V.A.G 1598/22
- ◆ hand multimeter, e.g. V.A.G 1526 A
- ◆ adapter cable set, e.g. V.A.G 1594 A

Testing conditions

- ◆ battery voltage at least 11.5 volts.

Testing sequence



- ◀ - pull out the 3-pin plug from the hall sender -arrows-

- ◀ - connect up the hand multimeter for voltage measurement to contact 1 (plus) and 3 (earth) of the plug.

- switch on the ignition:
Nominal value: at least 4.5 volts
- switch off the ignition:

If the nominal value is not reached:

- check the cable connections to the sender according to the current flow plan
⇒ Current flow plans, Fault Detection Electrics, Installed Locations