

Workshop Manual OCTAVIA 1997 ➤

**2.0 l/85 kW Engine, Fuel Injection and Ignition
System**
Edition 02.00

Engine code	AEG	APK	AQY	AZH	AZJ				
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List of Supplements to Workshop Manual

OCTAVIA 1997 ➤

2,0 I/85 kW Engine, Fuel Injection and Ignition System

Edition 02.00

Supplement	Edition	Subject	Article Number
	02.00	Basic Edition	S00.5128.50.20
1	03.01	Supplement to basic edition (completely replaces the basic edition)	S00.5128.51.20
2	04.02	Changes for engine AZJ	S00.5128.52.20
3	01.04	Modifications in the Rep. Gr. 01 and 24	S00.5128.53.20

Table of Contents

01 – Self-diagnosis

Self-diagnosis I	01-1	page	1
- Properties of the self-diagnosis	01-1	page	1
- Technical data of self-diagnosis	01-1	page	1
- Connecting vehicle system tester -V.A.G 1552- and selecting the control unit for engine electronics	01-1	page	2
- Interrogating and erasing fault memory	01-1	page	4
Self-diagnosis II	01-2	page	1
- Fault table, fault codes 16485...17736	01-2	page	1
Self-diagnosis III	01-3	page	1
- Fault table, fault codes 17743...18101	01-3	page	1
Self-diagnosis IV	01-4	page	1
- Actuator diagnosis	01-4	page	1
- Readiness code	01-4	page	3
- Reading readiness code	01-4	page	4
- Generating readiness code	01-4	page	4
Self-diagnosis V	01-5	page	1
- Reading measured value blocks, display groups 000 to 029	01-5	page	1
Self-diagnosis VI	01-6	page	1
- Reading measured value block, display groups 030 to 062	01-6	page	1
Self-diagnosis VII	01-7	page	1
- Reading measured value blocks, display groups 066 to 126	01-7	page	1

24 – Fuel Formation, Injection

Repairing the injection system	24-1	page	1
- General Instructions	24-1	page	1
- Safety instructions	24-1	page	1
- Rules of cleanliness	24-1	page	2
- Individual components of system - Installation overview	24-1	page	2
- Removing and installing parts of the injection system	24-1	page	5
- Disassembling and assembling the air filter	24-1	page	8
- Disassembling and assembling bottom part of intake manifold	24-1	page	8
- Disassembling and assembling top part of intake manifold	24-1	page	10
- Disassembling and assembling fuel distributor with injectors	24-1	page	11
Testing components	24-2	page	1
- Testing cables with test box -V.A.G 1598/22- or -V.A.G 1598/31-	24-2	page	1
- Testing throttle valve control unit -J338-	24-2	page	1
- Testing accelerator pedal position sender	24-2	page	2
- Testing injected quantity and injectors for leaks	24-2	page	3
- Testing fuel pressure regulator and holding pressure	24-2	page	5
Check for proper operation	24-3	page	1
- Testing lambda probe -G39- and lambda control upstream of catalytic converter	24-3	page	1
- Testing lambda probe ageing upstream of catalytic converter -G39-	24-3	page	2
- Testing lambda probe -G130- and lambda control downstream of catalytic converter	24-3	page	4
Engine control unit	24-4	page	1

- Testing voltage supply for engine control unit	24-4	page	1
- Procedure if voltage supply interrupted	24-4	page	2
- Replacing engine control unit	24-4	page	3
- Code the engine control unit (AEG, APK, AQY)	24-4	page	4
- Deleting learned values from the engine control unit	24-4	page	5
- Adjusting the engine control unit to the throttle valve control unit	24-4	page	6
- Adjusting the kick-down function	24-4	page	7
Testing auxiliary signals	24-5	page	1
- Testing the speed signal	24-5	page	1
- Testing databus (CAN bus)	24-5	page	1
- Activating and deactivating cruise control system (CCS)	24-5	page	3

28 – Ignition System

Repairing the ignition system	28-1	page	1
- General notes on the ignition system	28-1	page	1
- Safety measures	28-1	page	1
- Removing and installing parts of the ignition system	28-1	page	2
- Testing camshaft position sensor -G40-	28-1	page	4

01 – Self-diagnosis

01-1 Self-diagnosis I

Properties of the self-diagnosis

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

If malfunctions occur in the monitored sensors or components, they are stored in the fault memory with indication of the fault type.

Faults which occur only occasionally (sporadically), are displayed as „SP“. Possible causes of sporadic faults are e.g. a loose contact or a momentary line interruption. If a sporadic fault no longer occurs within 40 warm-up phases (engine start at coolant temperature of less than 50°C - engine stop at more than 72 °C), it is automatically removed from the fault memory.

The stored faults can be read and erased using the vehicle system tester -V.A.G 1552-, -V.A.G 1551- or - V.A.S 5051- ⇒ **01-1** page 4.



Note

- ♦ *The following description only relates to vehicle system tester -V.A.G 1552- using the program card - 5.0-, or higher.*
- ♦ *If vehicle system tester -V.A.G 1551- with program card -8.0-, or a higher version, with integrated printer, or vehicle system tester -V.A.S 5051 - is used, slight differences are possible in the readouts in the display.*

Technical data of self-diagnosis

Engine code letters	AEG	APK	AQY	AZH	AZJ
System denomination	Motronic M5.9.2	Motronic M5.9.2	Motronic M5.9.2	Motronic ME 7.5	Motronic ME 7.5
Complies with EU-4	TIER-1	EU-2	EU-4/D4 (EU-3) ¹⁾	EU-4	EU-4
Lambda control	1 lambda probe	1 lambda probe	2 lambda probes	2 lambda probes	2 lambda probes
Knock control	2 knock sensors	2 knock sensors	2 knock sensors	2 knock sensors	2 knock sensors
Variable intake manifold length	no	no	no	no	yes
Camshaft adjustment	no	no	no	no	no
Secondary air system	no	no	yes	yes	yes

¹⁾ Standard D4 (EU-3) applicable only to models with automatic gearbox

Functions available when using the vehicle system tester -V.A.G 1552-

The preconditions for selecting the desired functions are given in the following table.

Operation		Precondition		
Function at vehicle system tester -V.A.G 1552-		Engine off, ignition switched on	Engine idling	Normal driving
01	Interrogating control unit version	yes	yes	yes
02	Interrogating fault memory	yes ¹⁾	yes	yes
03	Final control diagnosis	yes	no	no
04	Initiate basic setting ²⁾	yes	yes	yes / no ³⁾
05	Erasing fault memory	yes	yes	yes
06	Ending output	yes	yes	yes
07	Coding control unit	yes	no	no
08	Reading measured value block	yes	yes	yes
10	adjustment	yes	no	no
11	Login procedure	yes	yes / no ³⁾	no
15	Readiness code	yes	yes	yes

¹⁾ Only to be carried out with the ignition switched on and if the engine does not start (activate starter for at least 6 seconds).

²⁾ To be carried out after the following operations: replacing engine control unit, throttle valve control unit or engine, or disconnecting battery.

³⁾ For engines with engine code AZJ

Interrogating control unit version

The control unit version is displayed once the vehicle system tester -V.A.G 1552- is connected, the ignition switched on and the engine electronics control unit selected ⇒ **01-1** page 2.

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

Special tools, test and measuring equipment and auxiliary items required

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

Test conditions

- Fuses o.k.
- All electrical components such as headlights and rear window heater, must be switched off.
- If vehicle is equipped with air conditioning, this must be switched off.
- On vehicles with an automatic gearbox the selector lever must be in position „P“ or „N“.

- Battery voltage at least 11.5 V
- Earth connections between the engine (on clutch housing) and body (under battery) must be O.K.

Procedure

- Connect vehicle system tester -V.A.G 1552- with cable -V.A.G 1551/3, 3A, 3B oder 3C-.

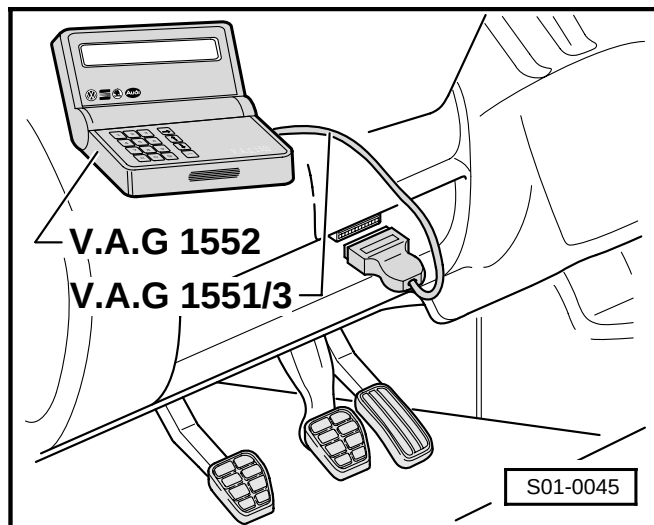
Once the vehicle system tester has been connected:

- Depending on the desired function you must: either switch on the ignition or start the engine ⇒ **01-1** page 2, table „Available functions“.



Note

- ♦ If no readout appears in the display, check the voltage supply for the diagnostic connector ⇒ fault finding in the „Current Flow Diagrams, Electrical Fault Finding and Fitting Locations“ binder.
- ♦ If the readout which appears in display does not match the procedure ⇒ Operating instructions for vehicle system tester.
- ♦ If „Error in data transmission“ is displayed because of an incorrect entry, unplug cable of vehicle system tester, plug in again and repeat all the steps.



Note

Operate the vehicle system tester by following the indication on the display:

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

The control unit identification appears in the display of the vehicle system tester (example):

```
06A906018 FH 2.0 1 R4/2V MOTR HS V03 ->
Coding 00011                               WSC 00000
```

- ♦ 06A906018 FH = Part No. of control unit (refer to Parts List for current control unit version)
- ♦ 2.0 I R4/2V = Displacement 2.0 l, 4-cyl. inline engine, 2 valves per cylinder
- ♦ MOTR = System designation (Motronic)
- ♦ HS = Manual gearbox, AT = Automatic gearbox
- ♦ V03 = Software version
- ♦ Coding 00011 = Code control unit, coding versions for engine control unit ⇒ Chap. 24-4
- ♦ WSC xxxxx = Workshop code from the vehicle system tester -V.A.G 1552- with which the last coding was performed



Note

- ♦ If the matching control unit version is not displayed, replace control unit ⇒ Chapter 24-4.
- ♦ Incorrect coding of the engine control unit results in:
- ♦ poor driveability (jerking when changing gears, load alteration shock etc.)
- ♦ Increase in fuel consumption

- ♦ Increase in pollution
- ♦ Storage of non-existent faults in fault memory
- ♦ Certain functions not being performed (lambda control, actuation of activated charcoal filter system, etc.)
- ♦ Reduction in life of automatic gearbox

If the code does not match the version of the vehicle:

- Check code of control unit ⇒ Chapter 24-4.

Interrogating and erasing fault memory

Special tools, test and measuring equipment and auxiliary items required

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

Procedure

- Connect vehicle system tester -V.A.G 1552-. Start engine and select address word 01 „Engine electronics“ ⇒ **01-1** page 2.

Only if engine does not start:

- Operate starter for about 6 seconds.

Do not switch ignition off.

- Enter function 02 „Interrogate fault memory“ and confirm entry with the  key.

The number of stored faults, or „No fault recognised“ appears in the display. ►

X faults detected!

If no fault is stored:

- Press  key.

If one or several faults are stored:

The stored faults are displayed in sequence.

- Rectify the faults displayed by referring to the fault table ⇒ Chapter 01-2, ⇒ Chapter 01-3.
- Enter function 05 „Erase fault memory“ and confirm entry with the  key. ►

Vehicle system test
Fault memory erased!

->



Note

The fault memory is not erased if the ignition is switched off between „Interrogating the fault memory“ and „Erasing the fault memory“.

- If the fault memory was erased, it is then necessary to re-generate the readiness code ⇒ Chapter 01-4.
- Select function 06 „End output“ and switch off ignition.

Automatic test sequence

When carrying out test and removal and installation operations, faults, such as connectors unplugged, may also

be detected by other control units. This is why you must conclude the self-diagnosis by interrogating and erasing the fault memories of all control units. Therefore it is necessary to:

- Enter 00 for address word „Automatic test sequence“ and confirm with the  key. Vehicle system tester -V.A.G 1552- transmits all the known address words one after the other.

If a control unit responds with its identification, the display will indicate the number of faults in the memory or „No fault detected“.

Any faults stored for one of the systems are displayed in sequence. Vehicle system tester -V.A.G 1552- then transmits the next address word.

The automatic test sequence has ended when the following read-out appears on the display: ►

Vehicle system test	HELP
Enter address word XX	

- Erase the fault memory and carry out test drive.
- Generate readiness code ⇒ Chapter 01-4.

Pay attention to safety precautions for test drives
⇒ Chapter 24-1.

During the test drive the following operating conditions must be fulfilled:

- Coolant temperature must rise to more than 80°C.
- In case of full load the speed should be increased beyond 3500 rpm.
- Once the specified temperature has been reached, the following operating states must be reached several times:

Idling

Partial load

Full load

Enrichment

Trailing throttle

- Once again interrogate the fault memory of all the control units using automatic test sequence.

If no fault is stored:

- Select function 06 „End output“ and switch off ignition.

01-2 Self-diagnosis II

Fault table, fault codes 16485...17736



Note

- ♦ The fault table is arranged according to the 5-digit fault code on the left.
- ♦ Faults related to the electronic throttle are indicated on the dash panel insert by the fault lamp for the electronic accelerator control „EPC warning lamp“.
- ♦ The SAE code which is displayed on the right next to the fault code (e.g.. P0107) can be ignored (at present only valid for USA).
- ♦ Explanations regarding fault types (e.g. „open circuit or short-circuit to earth“) ⇒ Operating instructions for the vehicle system tester.
- ♦ If parts are output as faulty: First of all, test all the cables and plug connections to these components as well as the earth cables of the system according to the current flow diagram. Replace the component only if this test does not reveal any fault. This applies in particular if the fault is shown as sporadic (SP).



Note

- ♦ 16486 = Fault denomination
- ♦ P0113 = next fault code (at present only applicable for USA)
- ♦ 035 = fault type as number
- ♦ air mass meter -G70- = current path or fault point defective
- ♦ Signal too small = designate fault type with text
- ♦ sporadically occurring fault = fault which does not occur often, e.g. loose contact

Readout on -V.A.G 1552 -		Rectifying fault
16485 Air mass meter -G70-	Implausible signal	– Read measured value block, display group 002 ⇒ Chapter 01-5 – Check wiring to meter -G70- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
16486 Air mass meter -G70-	Signal too low	– Testing the intake system for tightness (unmetered air) – Replace air filter element – Read measured value block, display group 002 ⇒ Chapter 01-5 – Remove short-circuit or line interruption ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations – Replace engine control unit ⇒ Chapter 24-4 – Test fuse 43
16487 Air mass meter -G70-	Signal too high	– Read measured value block, display group 002 ⇒ Chapter 01-5 – Test wiring ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations – Replace engine control unit ⇒ Chapter 24-4

Readout on -V.A.G 1552 -		Rectifying fault
16496 Intake air temperature sender -G42-	Signal too low	– Read measured value block, display group 004, display field 4 ⇒ Chapter 01-5 – Test wiring ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations – Replace engine control unit ⇒ Chapter 24-4
16497 Intake air temperature sender -G42-	Signal too high	
16500 Sender for the coolant temperature -G62-	Implausible signal	
16501 Sender for the coolant temperature -G62-	Signal too low	– Read measured value block, display group 001, display field 2 ⇒ Chapter 01-5 – Test coolant temperature sender ⇒ Chapter 24-1 – Check coolant regulator ⇒ 2.0 l/85 kW Engine, Mechanical Components; Rep. Gr. 19 – Replace engine control unit ⇒ Chapter 24-4
16502 Sender for the coolant temperature -G62-	Signal too high	
16504 Throttle valve potentiometer -G69-	Electrical fault in the circuit	
16505 Throttle valve potentiometer -G69-	Implausible signal	– Test throttle valve control unit ⇒ Chapter 24-2
16506 Throttle valve potentiometer -G69-	Signal too low	
16507 Throttle valve potentiometer -G69-	Signal too high	
16514 Bank 1 - probe 1	Electrical fault in the circuit	
16515 Bank 1 - probe 1	Voltage too low	– Testing lambda probe and lambda control upstream of catalytic converter ⇒ Chapter 24-3 – Test lambda probe ageing ⇒ Chapter 24-3
16516 Bank 1 - probe 1	Voltage too high	
16517 Bank 1 - probe 1	Signal too slow	
16518 Bank 1 - probe 1	No activity	
16519 Bank 1 - probe 1, heating circuit	Electrical fault	– Testing lambda probe heater upstream of catalytic converter ⇒ Chapter 24-3
16520 Bank 1 - probe 2	Electrical fault in the circuit	– Testing lambda probe and lambda control downstream of catalytic converter ⇒ Chapter 24-3
16521 Bank 1 - probe 2	Voltage too low	
16522 Bank 1 - probe 2	Voltage too high	
16523 Bank 1 - probe 2	Signal too slow	
16524 Bank 1 - probe 2	No activity	
16525 Bank 1 - probe 2, heating circuit	Electrical fault	– Test lambda probe heater downstream of catalytic converter ⇒ Chapter 24-3

Readout on -V.A.G 1552 -		Rectifying fault
16554 Bank 1, fuel metering system	Malfunction	– Test fuel pressure regulator and holding pressure ⇒ Chap. 24-2 – Test injectors ⇒ Chapter 01-4, Final control diagnosis
16555 Bank 1, fuel metering system	System too lean	– Test fuel delivery unit ⇒ 2.0 l/85 kW Engine, Mechanical Components; Rep. Gr. 20 – Inspect exhaust system for tightness ⇒ 2.0 l/85 kW Engine, Mechanical Components; Rep. Gr. 26 – Inspect tightness of the secondary air system ⇒ 2.0 l/85 kW Engine, Mechanical Components; Rep. Gr. 26 – Inspect vacuum lines for tightness – Test intake system for tightness
16556 Bank 1, fuel metering system	System too rich	– Test fuel pressure regulator and holding pressure ⇒ Chap. 24-2 – Test injected quantity ⇒ Chapter 24-2 – Test solenoid valve for activated charcoal filter ⇒ Chapter 01-4, final control diagnosis
16585 Injector cyl. 1 -N30-	Electrical fault in the circuit	– Test injectors ⇒ Chapter 01-4, Final control diagnosis
16586 Injector cyl. 2 -N31-	Electrical fault in the circuit	see fault code 16585
16587 Injector cyl. 3 -N32-	Electrical fault in the circuit	
16588 Injector cyl. 4 -N33-	Electrical fault in the circuit	
16603	Maximum engine speed exceeded	– Rectify any mechanical damage
16605 Angle sender 2 for TV drive -G188-	Implausible signal	– Test throttle valve control unit ⇒ Chapter 24-2
16606 Angle sender 2 for TV drive -G188-	Signal too low	
16607 Angle sender 2 for TV drive -G188-	Signal too high	
16610 Sender 1/2 for accelerator pedal position -G79- + -G185-	Implausible signal	– Test accelerator pedal position sender ⇒ Chapter 24-2
16611 Sender for accelerator pedal position -G79-	Signal too low	
16612 Sender for accelerator pedal position -G79-	Signal too high	
16614 Fuel pump relay -J17-	Electrical fault in the circuit	– Test fuel pump relay -J17- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
16645 Injector cyl. 1 -N30-	Short circuit to earth	– Test injectors ⇒ Chapter 01-4, Final control diagnosis
16646 Injector cyl. 1 -N30-	Short circuit to positive	

Readout on -V.A.G 1552 -		Rectifying fault
16648 Injector cyl. 2 -N31-	Short circuit to earth	see fault code 16645
16649 Injector cyl. 2 -N31-	Short circuit to positive	see fault code 16646
16651 Injector cyl. 3 -N32-	Short circuit to earth	see fault code 16645
16652 Injector cyl. 3 -N32-	Short circuit to positive	see fault code 16646
16654 Injector cyl. 4 -N33-	Short circuit to earth	see fault code 16645
16655 Injector cyl. 4 -N33-	Short circuit to positive	see fault code 16646
16684 Combustion misfiring detected		– Test injectors ⇒ Chapter 01-4, Final control diagnosis – Test ignition leads and spark plugs ⇒ Chapter 28-1 – Inspect ignition transformer ⇒ Chapter 28-1 – Read measured value block, display group 014 ⇒ Chapter 01-5
16685 Cyl. 1	Combustion misfiring detected	see fault code 16684
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	– Check engine speed sender -G28- ⇒ Chapter 24-1
16706 Engine speed sender -G28-	No signal	
16708 Knock control	Malfunction	– Inspecting knock sensors -G61- and -G66- ⇒ Chap. 28-1. – Read measured value block, display group 026 ⇒ Chap. 01-5
16711 Knock sensor 1 -G61-	Signal too low	
16712 Knock sensor 1 -G61-	Signal too high	
16716 Knock sensor 2 -G66-	Signal too low	
16717 Knock sensor 2 -G66-	Signal too high	
16724 Camshaft position/ crankshaft position sensor	Incorrect assignment	– Test camshaft position sensor -G40- ⇒ Chapter 28-1

Readout on -V.A.G 1552 -		Rectifying fault
16725 Camshaft position sensor ⇒ sender -G40-	Implausible signal	
16726 Camshaft position sensor ⇒ sender -G40-	Signal too low	
16727 Camshaft position sensor ⇒ sender -G40-	Signal too high	
16735 Ignition control cyl. 1	Malfunction	– Test ignition leads and spark plugs ⇒ Chapter 28-1 – Inspect ignition transformer ⇒ Chapter 28-1 – Read measured value block, display group 014 ⇒ Chapter 01-5
16736 Ignition control cyl. 2	Malfunction	
16737 Ignition control cyl. 3	Malfunction	
16738 Ignition control cyl. 4	Malfunction	
16795 Secondary air system	Flow rate incorrect	– Check secondary air pump ⇒ 2.0 I/85 kW Engine, Mechanical Components; Rep. Gr. 26 – Check secondary air pump ⇒ 2.0 I/85 kW Engine, Mechanical Components; Rep. Gr. 26 – Test combination valve ⇒ 2.0 I/85 kW Engine, Mechanical Components; Rep. Gr. 26 – Check secondary air injection valve ⇒ 2.0 I/85 kW Engine, Mechanical Components; Rep. Gr. 26 – Inspect hoses and connection pipes to individual components, and between components ⇒ 2.0 I/85 kW Engine, Mechanical Components; Rep. Gr. 26
16802 Secondary air pump relay -J299-	Malfunction	– Test the relay or the secondary air pump ⇒ Chapter 01-4, final control diagnosis
16804 Bank 1, catalytic converter system	Efficiency too low	– Generate readiness code ⇒ Chapter 01-4 – Check emission levels if the same faults are displayed ⇒ Inspection and Maintenance
16806 Bank 1, main catalytic converter	Efficiency too low	– Replace catalytic converter ⇒ 2.0 I/85 kW Engine, Mechanical Components; Rep. Gr. 26
16824 Tank ventilation system	Malfunction	– Test solenoid valve for activated charcoal filter ⇒ Chapter 01-4, final control diagnosis
16825 Tank ventilation system	Flow rate incorrect	– Inspect hoses and connection pipes from fuel tank up to injection rail ⇒ 2.0 I/85 kW Engine, Mechanical Components; Rep. Gr. 20
16885 Vehicle speed signal	Implausible signal	– Test vehicle speed signal ⇒ Chapter 24-5
16890 Idling control	Speed under nominal value	– Test throttle valve control unit ⇒ Chapter 24-2 – Replace intake air filter
16891 Idling control	Speed above nominal value	– Test throttle valve control unit ⇒ Chapter 24-2

Readout on -V.A.G 1552 -		Rectifying fault
16894 Idling speed switch -F60-	Malfunction	– Test throttle valve control unit ⇒ Chapter 24-2 – Replace engine control unit ⇒ Chapter 24-4
16897 Immobilizer	incorrect code number	– Adapt engine control unit to electronic immobiliser ⇒ Electrical System; Rep. Gr. 96.
16944 Voltage supply	Implausible signal	– Check wiring and plug connections according to the current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
16946 Voltage supply	Voltage too low	– Inspect engine control unit power supply ⇒ Chapter 24-4 – procedure if voltage interrupted ⇒ Chapter 24-4 – Test alternator and battery ⇒ Electrical System; Rep. Gr. 27
16947 Voltage supply	Voltage too high	– Inspect engine control unit power supply ⇒ Chapter 24-4 – Test alternator and battery ⇒ Electrical System; Rep. Gr. 27
16952 CCS switch -E45-	Implausible signal	– Read measured value block, display group 066 ⇒ Chapter 01-7
16955 Brake light switch -F	Implausible signal	– Read measured value block, display group 066 ⇒ Chapter 01-7 – Check wiring and plug connections according to the current flow diagram
16984 Databus drive	missing mes- sage	– Read measured value block, display groups 125 and 126 ⇒ Chapter 01-7 – Inspect databus ⇒ Chapter 24-5 – Perform automatic test sequence ⇒ Chapter 01-1
16985 Control unit defective		– Test earth cables according to current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations – Replace engine control unit ⇒ Chapter 24-4
16986 Control unit program- ming	Malfunction	– Check parts of the engine control unit and the gearbox control unit and replace the control unit if necessary
16988 Control unit defective		– Test earth cables according to current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations – Replace engine control unit ⇒ Chapter 24-4
16989 Control unit defective		
16990 Control unit defective		
17022 Throttle valve control unit -J338-	Implausible signal	– Test throttle valve control unit ⇒ Chapter 24-2
17026 Knock control	Control unit defective	– Replace engine control unit ⇒ Chapter 24-4
17069 Main relay ⇒ -J271-	Open circuit	– Test the power supply relay -J271- for the engine control unit ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
17070 Main relay ⇒ -J271-	Short circuit to earth	
17071 Main relay ⇒ -J271-	Short circuit to positive	

Readout on -V.A.G 1552 -		Rectifying fault
17510 Bank 1 - probe 1, heating circuit	Short circuit to positive	Testing lambda probe heater upstream of catalytic converter ⇒ Chapter 24-3
17511 Bank 1 - probe 1, heating circuit	Output too small	
17513 Bank 1 - probe 2, heating circuit	Short circuit to positive	Test lambda probe heater downstream of catalytic converter ⇒ Chapter 24-3
17519 Lambda control (Bench 1)	System too lean	Test lambda probe -G39- and lambda control upstream of catalytic converter ⇒ Chapter 24-3
17520 Lambda control (Bench 1)	System too rich	
17523 Bank 1 - probe 1, heating circuit	Short circuit to earth	Testing lambda probe heater upstream of catalytic converter ⇒ Chapter 24-3
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 ⇒ Chapter 24-3
17526 Bank 1 - probe 2, heating circuit	Open circuit	
17535 Bank 1, mixture adaptation (mult.)	System too rich	- Test fuel pressure regulator and holding pressure ⇒ Chap. 24-2 - Test injected quantity ⇒ Chapter 24-2 - Test solenoid valve for activated charcoal filter ⇒ Chapter 01-4, final control diagnosis
17536 Bank 1, mixture adaptation (mult.)	System too lean	- Test fuel pressure regulator and holding pressure ⇒ Chap. 24-2 - Test injected quantity ⇒ Chapter 24-2 - Test fuel delivery unit ⇒ 2.0 l/85 kW Engine, Mechanical Components; Rep. Gr. 20 - Test intake system for tightness - Inspect exhaust system for tightness ⇒ 2.0 l/85 kW Engine, Mechanical Components; Rep. Gr. 26 - Inspect tightness of the secondary air system ⇒ 2.0 l/85 kW Engine, Mechanical Components; Rep. Gr. 26 - Inspect vacuum lines for leaks
17549 Load detection	implausible value	- Test throttle valve control unit ⇒ Chapter 24-2 - Test accelerator pedal position sender ⇒ Chapter 24-2
17550 Load detection	Below limit	
17551 Load detection	Above limit	

Readout on -V.A.G 1552 -		Rectifying fault
17553 Air mass meter -G70-	Short circuit to positive	– Read measured value block, display group 002 ⇒ Chapter 01-5 – Check wiring to meter -G70- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
17557 Lambda control (Bench 1)	implausible control value	– Test lambda probe -G39- and lambda control upstream of catalytic converter ⇒ Chapter 24-3
17559 Bank 1, mixture adaptation range 1	Below lean-ness limit	– Testing the intake system for tightness (unmetered air) – Inspect tightness of the secondary air system ⇒ 2.0 l/85 kW Engine, Mechanical Components; Rep. Gr. 26 – Test fuel pressure regulator and holding pressure ⇒ Chap. 24-2 – Test injected quantity ⇒ Chapter 24-2 – Test fuel delivery unit ⇒ 2.0 l/85 kW Engine, Mechanical Components; Rep. Gr. 20
17560 Bank 1, mixture adaptation range 2	Below lean-ness limit	
17573 Bank 1, mixture adaptation range 1	Above rich-ness limit	
17574 Bank 1, mixture adaptation range 2	Above rich-ness limit	– Test fuel pressure regulator and holding pressure ⇒ Chap. 24-2 – Test injected quantity ⇒ Chapter 24-2 – Test solenoid valve for activated charcoal filter ⇒ Chapter 01-4, final control diagnosis
17579 Angle sender 2 for TV drive -G188-	Implausible signal	– Check angle sender in measured value block, display group 060 ⇒ Chapter 01-6 – Test throttle valve control unit ⇒ Chapter 24-2
17580 Angle sender 2 for TV drive -G188-	Signal too low	
17581 Angle sender 2 for TV drive -G188-	Signal too high	
17584 Bank1, lambda correction according to catalytic converter	Regulating limit reached	– Test lambda probe ageing -G39- upstream of catalytic converter ⇒ Chapter 24-3 – Test lambda probe -G130- and lambda control downstream of catalytic converter ⇒ Chapter 24-3
17586 Linear lambda probe/ pump current	Open circuit	– Test lambda probe -G39- and lambda control upstream of catalytic converter ⇒ Chapter 24-3
17587 Linear lambda probe/ pump current	Short circuit to earth	
17588 Linear lambda probe/ pump current	Short circuit to positive	
17589 Linear lambda probe/ reference voltage	Open circuit	
17590 Linear lambda probe/ reference voltage	Short circuit to earth	
17591 Linear lambda probe/ reference voltage	Short circuit to positive	

Readout on -V.A.G 1552 -		Rectifying fault
17592 Linear lambda probe/ combined earth cable	Open circuit	
17593 Linear lambda probe/ combined earth cable	Short circuit to earth	
17594 Linear lambda probe/ combined earth cable	Short circuit to positive	
17606 Bank 1 - probe 2, heat- ing circuit	Electrical fault	– Test lambda probe -G130- and lambda control downstream of cata- lytic converter ⇒ Chapter 24-3
17621 Injector cyl. 1 -N30-	Short circuit to positive	– Test injectors ⇒ Chapter 01-4, Final control diagnosis
17622 Injector cyl. 2 -N31-	Short circuit to positive	see fault code 17621
17623 Injector cyl. 3 -N32-	Short circuit to positive	
17624 Injector cyl. 4 -N33-	Short circuit to positive	
17633 Injector cyl. 1 -N30-	Short circuit to earth	– Test injectors ⇒ Chapter 01-4, Final control diagnosis
17634 Injector cyl. 2 -N31-	Short circuit to earth	see fault code 17633
17635 Injector cyl. 3 -N32-	Short circuit to earth	
17636 Injector cyl. 4 -N33-	Short circuit to earth	
17645 Injector cyl. 1 -N30-	Open circuit	– Test injectors ⇒ Chapter 01-4, Final control diagnosis – Test fuse 32
17646 Injector cyl. 2 -N31-	Open circuit	see fault code 17645
17647 Injector cyl. 3 -N32-	Open circuit	
17648 Injector cyl. 4 -N33-	Open circuit	
17704 Cooling system	Fault	– Test coolant temperature sender ⇒ Chapter 24-1 – Check coolant regulator ⇒ 2.0 l/85 kW Engine, Mechanical Compo- nents; Rep. Gr. 19
17708 Combustion misfiring detected	Reason: Fuel shortage	– Refuel – Test signal from fuel gauge sender – Test wiring between engine control unit and dash panel insert accord- ing to current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations

Readout on -V.A.G 1552 -		Rectifying fault
17733 Knock control Cyl. 1	Regulating limit reached	– Inspecting knock sensors -G61- and -G66 - ⇒ Chap. 28-1. – Read measured value block, display group 026 ⇒ Chap. 01-5 – Eliminate abnormal engine running noises (loose ancillaries, bracket or bolt bent) – Slacken knock sensors and then tighten again to 20 Nm – Change type of fuel
17734 Knock control Cyl. 2	Regulating limit reached	see fault code 17733
17735 Knock control Cyl. 3	Regulating limit reached	
17736 Knock control Cyl. 4	Regulating limit reached	

**Note**

- ♦ *re fault codes 16505 and 16506:*
- ♦ *As soon as one of these faults is detected, the engine control unit uses a substitute value which is generated from the engine speed and the inducted air mass.*

01-3 Self-diagnosis III

Fault table, fault codes 17743...18101

Readout on -V.A.G 1552-		Rectifying fault
17743 Engine torque monitoring 2	Regulating limit exceeded	– Inspect vacuum lines for tightness – Inspect intake system for leaks – Test coolant temperature sender ⇒ Chapter 24-1 – Test intake manifold temperature sender ⇒ Chap. 24-1 – Read measured value block, display group 002 ⇒ Chapter 01-5
17744 Engine torque monitoring	Regulating limit exceeded	
17748 Camshaft position/ crankshaft position sensor	Incorrect assignment	
17763 Ignition control cyl. 1	Open circuit	– Inspect ignition transformer ⇒ Chapter 28-1
17764 Ignition control cyl. 1	Short circuit to positive	
17765 Ignition control cyl. 1	Short circuit to earth	
17766 Ignition control cyl. 2	Open circuit	
17767 Ignition control cyl. 2	Short circuit to positive	
17768 Ignition control cyl. 2	Short circuit to earth	
17769 Ignition control cyl. 3	Open circuit	– Test ignition coil ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
17770 Ignition control cyl. 3	Short circuit to positive	
17771 Ignition control cyl. 3	Short circuit to earth	
17772 Ignition control cyl. 4	Open circuit	
17773 Ignition control cyl. 4	Short circuit to positive	
17774 Ignition control cyl. 4	Short circuit to earth	
17794 Control unit defective		– Replace engine control unit ⇒ Chapter 24-4 – Test earth cables according to current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
17795 Control unit defective		
17796 Control unit defective		
17818 Tank ventilation valve -N80-	Short circuit to positive	– Test solenoid valve for activated charcoal filter ⇒ Chapter 01-4, final control diagnosis

Readout on -V.A.G 1552-		Rectifying fault
17828 Secondary air injection valve -N112-	Electrical fault in the circuit	– Test secondary air injection valve ⇒ Chapter 01-4, Final control diagnosis
17829 Secondary air injection valve -N112-	Short circuit to earth	
17830 Secondary air injection valve -N112-	Short circuit to positive	
17832 Bank 1, secondary air system	Leak detected	
17833 Tank ventilation valve -N80-	Short circuit to earth	– Test solenoid valve for activated charcoal filter ⇒ Chapter 01-4, final control diagnosis
17834 Tank ventilation valve -N80-	Open circuit	– Test solenoid valve for activated charcoal filter ⇒ Chapter 01-4, final control diagnosis – Test fuse 43
17841 Secondary air pump re- lay -J299-	Open circuit	– Test the relay or the secondary air pump ⇒ Chapter 01-4, final control diagnosis
17842 Secondary air pump re- lay -J299-	Short circuit to positive	
17843 Secondary air pump re- lay -J299-	Short circuit to earth	
17858 Secondary air system	Short circuit to positive	
17859 Secondary air system	Short circuit to earth	
17860 Secondary air system	Open circuit	
17908 Fuel pump relay -J17-	Electrical fault in the circuit	– Test fuel pump relay -J17- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
17909 Fuel pump relay -J17-	Short circuit to earth	
17910 Fuel pump relay -J17-	Short circuit to positive	
17920 Valve for variable in- take manifold changeo- ver -N156-	Short circuit to positive	– Check wiring and plug connections according to the current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
17921 2nd valve for variable intake manifold changeover -N261-	Short circuit to positive	
17922 2nd valve for variable intake manifold changeover -N261-	Short circuit to earth	

Readout on -V.A.G 1552-		Rectifying fault
17923 Valve for variable in- take manifold changeo- ver -N156-	Short circuit to earth	
17924 Valve for variable in- take manifold changeo- ver -N156-	Open circuit	
17925 Main relay ⇒ -J271-	Electrical fault in the circuit	– Test the power supply relay for Motronic -J271- ⇒ Current Flow Dia- grams, Electrical Fault Finding and Fitting Locations
17926 Main relay ⇒ -J271-	Short circuit to positive	
17928 2nd valve for variable intake manifold changeover-N261-	Open circuit	– Check wiring and plug connections according to the current flow dia- gram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
17931 Crash signal from air- bag CU	Implausible signal	– Test airbag ⇒ Body Work; Rep. Gr. 01
17947 Clutch pedal switch -F36-	Implausible signal	– Test clutch pedal switch – Read measured value block, display group 066 ⇒ Chapter 01-7
17949 Fuel pump relay --	Open circuit	– Test fuel pump relay -J17- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
17950 Angle sender for TV drive -G187- ¹⁾	Implausible signal	– Test throttle valve control unit ⇒ Chapter 24-2
17951 Angle sender for TV drive -G187- ²⁾	Signal too low	– Test throttle valve control unit ⇒ Chapter 24-2
17952 Angle sender for TV drive -G187- ²⁾	Signal too high	
17953 Throttle valve control	Malfunction	
17966 Throttle valve drive -G186- ¹⁾	Electrical fault in the circuit	
17967 Throttle valve control unit -J338- ¹⁾	Incorrect ba- sic setting	– Adapt engine control unit to throttle valve control unit ⇒ Chapter 24-4
17968 Maximum engine speed exceeded		– Inspect engine for mechanical damage and erase fault memory ⇒ Chapter 01-1 – Check engine speed sender -G28- ⇒ Chapter 24-1
17972 Throttle valve control unit -J338-	Undervoltage on basic set- ting	– Inspect generator and battery voltage, charge battery ⇒ Electrical System; Rep. Gr. 27
17973 Throttle valve control unit -J338-	Bottom limit not reached	– Inspect throttle valve for damage and dirt – Test throttle valve control unit ⇒ Chapter 24-2
17976 Throttle valve control unit -J338-	Mechanical fault	

Readout on -V.A.G 1552-		Rectifying fault
17977 CCS switch -E45-	Implausible signal	– Check cruise control system (CCS) in the measured value block, display group 066 ⇒ Chapter 01-7
17978 Engine control unit inhibited		– Adapt engine control unit to electronic immobiliser ⇒ Electrical System; Rep. Gr. 96.
17987 Throttle valve control unit -J338-	Adaptation was not initiated	– Adapt engine control unit to throttle valve control unit ⇒ Chapter 24-4 – Test throttle valve control unit ⇒ Chapter 24-2
17988 Throttle valve drive, bank 1	Malfunction	– Test throttle valve control unit ⇒ Chapter 24-2
17990 Idling control	Adaption limit reached	– Inspect vacuum lines for tightness – Test intake system for tightness – Inspect exhaust system for tightness ⇒ 2.0 l/85 kW Engine, Mechanical Components; Rep. Gr. 26 – Inspect tightness of the secondary air system ⇒ 2.0 l/85 kW Engine, Mechanical Components; Rep. Gr. 26 – Test fuel pressure regulator and holding pressure ⇒ Chap. 24-2 – Test injected quantity ⇒ Chapter 24-2 – Test solenoid valve for activated charcoal filter ⇒ Chapter 01-4, final control diagnosis
18010 Voltage supply tml. 30	Voltage too low	– Inspect generator and battery voltage, charge battery ⇒ Electrical System; Rep. Gr. 27
18011 Control unit defective		– Replace engine control unit ⇒ Chapter 24-4 – Test earth cables according to current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
18014 Poor road info/engine spec. torque from ABS CU	Electrical fault in the circuit	– Read out fault memory of ABS control unit ⇒ Chassis; Rep. Gr. 45 – Inspect databus ⇒ Chapter 24-5
18017 Crash disconnect activated		– Interrogate fault memory of airbag control unit and erase ⇒ Body Work; Rep. Gr. 01
18018 Control unit defective		– Replace engine control unit ⇒ Chapter 24-4 – Test earth cables according to current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
18020 Engine control unit	Incorrectly coded	– Code engine control unit ⇒ Chapter 24-4
18034 Databus drive	Missing message from gearbox CU	– Test databus cables ⇒ Chapter 24-5
18038 Sender for accelerator pedal position -G79-	Signal too low	– Test accelerator pedal position sender ⇒ Chapter 24-2
18039 Sender for accelerator pedal position -G79-	Signal too high	

Readout on -V.A.G 1552-		Rectifying fault
18041 Sender 2 for accelerator pedal position -G185-	Signal too low	
18042 Sender 2 for accelerator pedal position -G185-	Signal too high	
18044 Databus drive	Missing message from airbag CU	– Inspect databus ⇒ Chapter 24-5
18047 Sender 1/2 for accelerator pedal position -G79- + -G185-	Implausible signal	– Test accelerator pedal position sender ⇒ Chapter 24-2
18048 Control unit defective		– Replace engine control unit ⇒ Chapter 24-4 – Test earth cables according to current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
18056 Databus drive	defective	– Inspect databus ⇒ Chapter 24-5
18057 Databus drive	Missing message from ABS CU	– Inspect databus ⇒ Chapter 24-5 – Interrogate fault memories of all control units (automatic test sequence) ⇒ Chap. 01-1
18058 Databus drive	Missing message from combiinstrument	
18089 Control unit programming	Programming not ended	– Replace engine control unit ⇒ Chapter 24-4
18090 Databus drive	implausible message from ABS CU	– Inspect databus ⇒ Chapter 24-5
18091 Databus drive	implausible message from airbag-SG	
18099 Self-diagnosis fault lamp -K83-	Open circuit	– Check self-diagnosis fault lamp -K83- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
18100 Self-diagnosis fault lamp -K83-	Short circuit to earth	
18101 Self-diagnosis fault lamp -K83-	Short circuit to positive	
19667 Exhaust gas - bank 1 - probe 1	Heating feedback	– Test lambda probe -G39- and lambda control upstream of catalytic converter ⇒ Chapter 24-3
19722 Bank 1 - probe 1	Internal resistance implausible	– Test lambda probe -G39- and lambda control upstream of catalytic converter ⇒ Chapter 24-3

1) Throttle valve drive (electronic power control) -G186- is also known as throttle valve positioner (for intake manifold) -V60-.

2) Angle sensor for throttle valve drive (electronic power control) -G187- is also known as throttle valve position sender -G127-.

**Note**

- ♦ *regarding fault code 17978:*
- ♦ *The immobilizer control unit is located in the dash panel insert and cannot be replaced individually.*
- ♦ *When attempting to start with a non-adapted key a static fault is stored in the memory. If a subsequent start attempt occurs with an adapted key the fault is changed to a sporadic fault.*

01-4 Self-diagnosis IV

Actuator diagnosis

With the actuator diagnosis the following parts are activated in the sequence indicated:

- 1 - Injector cyl. 1 -N30-
- 2 - Injector cyl. 2 -N31-
- 3 - Injector cyl. 3 -N32-
- 4 - Injector cyl. 4 -N33-
- 5 - Activated charcoal filter system solenoid valve 1 -N80-

For engines with engine code AZH

- 6 - Secondary air pump relay -J299-

For engines with engine code AQY

- 6 - Secondary air injection valve -N112 -
- 7 - Secondary air pump relay -J299-

For engines with engine code AZJ

- 1 - Activated charcoal filter system solenoid valve 1 -N80-
- 2 - Secondary air pump relay -J299-
- 3 - Injector cyl. 1 -N30-
- 4 - Injector cyl. 3 -N32-
- 5 - Injector cyl. 4 -N33-
- 6 - Injector cyl. 2 -N31-

Special tools, test and measuring equipment and auxiliary items required

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

Test condition

- Fuses o.k.



Note

- ♦ *The final control diagnosis takes place for the individual engine code according to the above-mentioned order.*
- ♦ *The actuator diagnosis can only be carried out when the engine is not running and the ignition is switched on.*
- ♦ *The final control diagnosis is interrupted if the engine is started or if an engine speed pulse is detected.*
- ♦ *During the actuator diagnosis the individual actuators remain activated until the next actuator is selected by pressing key .*
- ♦ *The actuators are tested acoustically or by touch.*

- ♦ Before repeating final control diagnosis without briefly running the engine in-between, switch the ignition off for about 2 seconds.
- ♦ The electric fuel delivery unit runs during the entire final control diagnosis.
- ♦ Final control diagnosis is aborted after 10 minutes.

Procedure

- Connect vehicle system tester -V.A.G 1552-. Switch ignition on and select address word 01 „Engine electronics“ ⇒ Chap. 01-1.
- Enter the function 03 „Final control diagnosis“ and confirm entry using the  key.

Actuate injectors -N30- to -N33-:

Readout on display:



Actuator diagnosis	->
Injector cyl. 1 N30	



Note

The fuel delivery unit must run and the fuel flow must be audible at the fuel pressure regulator. If the fuel delivery unit does not run, test actuation ⇒ 2.0 l/85 kW Engine, Mechanical Components; Rep. Gr. 20.

- Open throttle valve. After the idling speed switch opens, the cylinder injector closes five times.
- The next injector is operated by pressing the  button. (Procedure can also be performed without testing the relevant injector.)
- Test all the injectors one after the other in this way.

If one of the injectors is not actuated (does not click):

- Test injectors and cable connections for an open circuit, short circuit to earth and to positive ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations.

Activating solenoid valve for activated charcoal filter -N80-:

- Press  key. The activated charcoal filter solenoid valve must continue clicking audibly until the next control element is actuated by pressing the  key.



Actuator diagnosis	->
Activated charcoal filter solenoid valve N80	

The valve clicks, but there is nevertheless probably a fault (the valve does not open, or does not close):

- Detach hose from activated charcoal filter solenoid valve.
- Fit an auxiliary hose onto the free connection of the valve.
- Blow into this hose during final control diagnosis.

The valve must open and close.

If the solenoid valve does not click:

- Test activated charcoal filter solenoid valve -N80- and cable connections for open circuit, short circuit to earth and to positive ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations.

Actuate secondary air inlet valve -N112-:

- Press  key. The secondary air inlet valve must continue clicking until the next control element is actuated by pressing the  key.

Actuator diagnosis	->
Secondary air inlet valve N112	

If the valve does not click:

- Testing secondary air injection valve.

Actuate secondary air pump relay -J299-:

- Press  key. The secondary air pump relay -J299- is controlled by the motor for the secondary air pump. It continues running at intervals until the  key is pressed.

Actuator diagnosis	->
Secondary air pump relay J299	

If the secondary air pump motor -V101 - does not run at intervals:

- Testing secondary air pump motor ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations.
- Enter function 06 „End output“ and switch ignition off.



Note

The ignition must be switched off after final control diagnosis is ended. 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

For engines with engine codes AQY, AZH, AZJ

Operation

The readiness code is an 8-digit numerical code that provides information on the status of the emission-relevant diagnosis.

Diagnoses in normal operation are performed at regular intervals. If repairs have been done on a system relevant for the exhaust gas it is recommended to generate the readiness code as this guarantees that these systems operate according to the specifications. If a fault is detected during diagnosis, it is then stored in the fault memory.

If diagnosis of a system has been performed (e.g. of the secondary air system), the appropriate code number position is set from 1 to 0.

Readiness code 00000000 means that the individual diagnoses have been successfully performed.

Readiness Code is erased after the fault memory is erased or if the power supply is interrupted.

Reading readiness code

Special tools, test and measuring equipment and auxiliary items required

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

Procedure

- Connect vehicle system tester -V.A.G 1552-, switch ignition on and enter address word 01 „Engine electronics“ ⇒ Chapter 01-1.
- Enter function 15 „Readiness code“ and confirm the entry with the  key.

The following readout must appear in the display after successfully completing all the diagnoses:

Specified value: 00000000

► **Readiness code**
00000000 - Test complete

- Press  key.
- Enter function 06 „End output“ and switch ignition off.

One of the diagnoses has not been successfully performed, e.g.:

► **Readiness code**
00101101 - Test not complete

- Press  key.
- Generate readiness code ⇒ **01-4** page 4.

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

The readiness code is only generated when all display positions are at „0“								Diagnosis function
1	2	3	4	5	6	7	8	
							0	Catalytic converter
						0		Catalytic converter heater (no diagnosis at present/always „0“)
					0			Activated charcoal filter system (tank ventilation system)
				0				Secondary air system
			0					Air conditioning system (no diagnosis at present/always „0“)
		0						Lambda probes
	0							Lambda probe heater (no diagnosis at present/always „0“)
0								Exhaust gas recirculation (not fitted/always „0“)

Generating readiness code

Special tools, test and measuring equipment and auxiliary items required

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

Test conditions

- Vehicle stopped
- On vehicles with an automatic gearbox the selector lever must be in position „P“ or „N“
- All electrical components such as headlights and rear window heater, must be switched off.
- Intake air temperature less than 60 °C measured value block 004, display field 4 ⇒ Chapter 01-5
- Coolant temperature at least 80 °C measured value block 004, display field 3 ⇒ Chapter 01-5

Procedure

- Connect vehicle system tester -V.A.G 1552-, switch ignition on and enter address word 01 „Engine electronics“ ⇒ Chapter 01-1.



Note

It is essential to carry out the individual steps in the correct order, otherwise the readiness code cannot be successfully generated.

1. step: Interrogating fault memory

Readout on display:

Vehicle system test
Select function XX

HELP

- Enter function 02 „Interrogate fault memory“ and confirm entry with **Q** key.

The number of stored faults or „No fault recognised“ appears in the display.

X No fault recognised!

If a fault is stored in the memory:

- Rectify the faults displayed by referring to the fault table $\Rightarrow$ Chapter 01-2, $\Rightarrow$ Chapter 01-3.

If no fault is stored:

- Press  key.

2. step: Erasing fault memory

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

Vehicle system test
Select function XX

HELP



Note

Readiness code is erased each time the fault memory is erased.

Readout on display:

▶

Vehicle system test
Fault memory erased!

->



Note

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

3. step: Adapting throttle valve control unit to engine control unit

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

For engines with engine code AQY



System in basic setting 60				->
xx ∠°	x.x V	Idling	ADP runs	

- Display field 3:

Specified value: Idling

For engines with engine codes AZH, AZJ



System in basic setting 60				->
xx %	xx %	8	ADP runs	

- Display field 3:

Specified value: 0...8

Continued for all engines

- Display field 4:

Specified value: ADP runs, ADP o.k.

- End adjustment only after 30 seconds have passed by pressing the key.

If one of the above messages appears:

- Check throttle valve control unit -J338-.

4. step: Diagnosis of secondary air injection system

- Start engine and run in idle.



Note

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

- Select function 04 „Initiate basic setting“ and display group 077.

After initiating diagnosis of engine control unit the message in display field 4 changes from „Test OFF“ to „Test ON“.

Read-out on the display for engines with engine code:

AQY, AZH



System in basic setting 77				->
xxx.x °C	xx.x %	Test ON		

AZJ



System in basic setting 77				->
780/min	x.x g/s	x.x g/s	Test ON	

- Leave engine idling until the following readout appears in display field 4:

Specification „Syst. o.k.“

If the message is not displayed:

- Interrogate fault memory ⇒ Chapter 01-1.

If the message is displayed:

5. step: Diagnosis of activated charcoal filter system (tank vent system)

- Enter display group 070.

After initiating diagnosis of engine control unit the message in display field 4 changes from „Test OFF“ to „Test ON“.

Read-out on the display for engines with engine code:**AQY**

System in basic setting 70				->
xx.x %	x.x %	xx.x g/s	Test ON	

AZH, AZJ

System in basic setting 70				->
xx.x %	-	x.x %	xx.x %	Test ON

- Leave engine idling until the following readout appears in display field 4:

Specified value: „TVV o.k.“

If this message is not displayed:

- Interrogate fault memory ⇒ Chapter 01-1.

If this message is displayed:

- Press key.

6. step: Testing operating state of lambda control

Lambda control can only be tested at a catalytic converter temperature of more than 352 °C.

To achieve this, engine speed must be increased for several minutes to 2800...3200 rpm. Read off the catalytic converter temperature in measured value block 034.

- Select function 08 „Read measured value block“ and display group 034.
- Set engine speed to 2800...3200 rpm until the catalytic converter temperature in display field 2 is more than 352°C.



Reading measured value block 34				->
3000 rpm	352 °C	xx.xx s	Text	

**Note**

This may take a few minutes.

- Press key.
- Enter display group 030.
- Check operating state of lambda control upstream of catalytic converter (display field 1):



Reading measured value block 30				->
111		110		

Specified value: 111

- Check operating state of lambda control downstream of catalytic converter (display field 2):

Specified value: 110 meaning ⇒ **01-4** page 8

**Note**

- ♦ *The first position in the 3-digit numerical block fluctuates initially between 0 and 1 (lambda probe heater OFF and ON).*
- ♦ *Bits in display field 2 are only set to value 1 once the lambda probe downstream of the catalytic converter is heated up. The catalytic converter temperature must be more than 352 °C.*
- ♦ *The lambda control of lambda probe downstream of catalyst is not active without engine load and the third position in display field 2 indicates 0.*

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

1	2	3	Meaning if display position
		1	Lambda control active
	1		Lambda probe operational
1			Lambda probe heater switched on

If the specified values are not reached:

- Interrogate fault memory ⇒ Chapter 01-1.

If the specified values are reached:

- Press  key.

7. step: Diagnosis of lambda probe ageing (monitoring period)

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

For engines with engine code AQY

- Maintain engine speed at 2200...2800 rpm until message in display field 4 changes from „Test OFF“ to „Test ON“.

System in basic setting 34				->
2800 rpm	352 °C	2.2 s	Test ON	

For engines with engine code AZH

- Press down the brake pedal.
- Engine speed is increased and the readout in display field 4 switches from „Test OFF“ to „Test ON“.

System in basic setting 34				->
2300 rpm	352 °C	1,78	Test OFF	

For engines with engine code AZJ

- Depress brake pedal and accelerator simultaneously.
- Engine speed is increased and the readout in display field 4 switches from „Test OFF“ to „Test ON“.

System in basic setting 34				->
2300 rpm	352 °C	1.78	Test OFF	

Continued for all engines

Catalytic converter temperature in display field 2 must be at least 352 °C.

**Note**

If the message does not change to „Test ON“, vary engine speed.

For engines with engine code AQY

- Check period in display field 3.

Specified value: max. 2.2 s

For engines with engine codes AZH, AZJ

- Check the dynamic factor in display field 3.

Specified value: min. 0.70

Continued for all engines

- Maintain the increased engine speed.

Specification in display field 4: "B1-S1 o.k."

If the specified values are not reached:

- Interrogate fault memory ⇒ Chapter 01-1.

If the specified values are reached:

8. step: Diagnosis of catalytic converter



Note

This diagnosis is only ended once the diagnosis of the lambda probe ageing has been successfully completed.

- Enter display group 046.

For engines with engine codes AQY, AZH

- Increase engine speed to 2800...3200 rpm until the readout in display field 4 changes from „Test OFF“ to „Test ON“.

Catalytic converter temperature in display field 2 must be at least 352 °C. ►

System in basic setting 46				->
3000 rpm	352 °C	0.55	Test OFF	

- Check amplitude ratio in display field 3.

Specified value: max. 0.55

- Maintain the increased engine speed.

Specification in display field 4: „Cat B1 o.k.“

For engines with engine code AZJ

- Depress brake pedal and accelerator simultaneously.
- Engine speed is increased and the readout in display field 4 switches from „Test OFF“ to „Test ON“.

Catalytic converter temperature in display field 2 must be at least 352 °C. ►

System in basic setting 46				->
2300 rpm	352 °C	1.00	Test OFF	

- Maintain the increased engine speed.

Specification in display field 4: „Cat B1 o.k.“

- Check the effect of the catalytic converter in display field 3:

Specified value: min. 1.00

Continued for all engines



Note

The catalytic converter diagnosis only takes 100 seconds. If no result is shown within 150 seconds change the engine speed.

- Enter function 06 „End output“ and confirm entry with key.

If the specified values are not reached:

- Interrogate fault memory ⇒ Chapter 01-1.

If the specified values are reached:

9. step: Reading readiness code

- Read readiness code ⇒ **01-4** page 4.

01-5 Self-diagnosis V

Reading measured value blocks, display groups 000 to 029

Display group 001 - Basic function

• Engine idling						
Read measured value block 1 →				← Readout on display		
xxxx rpm	xx.x °C	xx.x %	xxxxxx xxxxxxxx			
1	2	3	4	← Display fields	Specification	Analysis
				Operating conditions	111111 1x111111 ¹⁾²⁾	⇒ 01-5 page 2
				Lambda controller upstream of catalytic converter	-10.0...10.0 %	⇒ 01-5 page 2
				Coolant temperature	80.0..110.0 °C	⇒ 01-5 page 2
				Engine speed (idling speed)	740..820 rpm 790..890 rpm ²⁾ 730...830 rpm ¹⁾	⇒ 01-5 page 1

¹⁾ For engines with engine code AZJ

²⁾ For engines with engine code AZH



Note

- ♦ Re display field 3:
- ♦ Readout must fluctuate around zero. If zero is always displayed, the lambda control has switched from closed-loop to open-loop control because of a fault in the lambda control. Interrogate fault memory ⇒ Chapter 01-1.
- ♦ Operating state of lambda control ⇒ display group 099, display field 4 ⇒ Chapter 01-7.

Analysis of display group 001, display field 1 - engine speed (idling speed)

Display -V.A.G 1552 -	Rectifying fault
less than 740 rpm less than 790 rpm ¹⁾ less than 730 rpm ²⁾	– Test throttle valve control unit ⇒ Chapter 24-2 – Inspect intake system for leaks
greater than 820 rpm greater than 890 rpm ¹⁾ greater than 830 rpm ²⁾	– Interrogate fault memory ⇒ Chapter 01-1 – Inspect intake system for leaks – Test throttle valve control unit ⇒ Chapter 24-2

¹⁾ For engines with engine code AZH

²⁾ For engines with engine code AZJ

Analysis of display group 001, display field 2 - coolant temperature

Display -V.A.G 1552 -	Rectifying fault
less than 80 °C	– Conduct test drive if necessary – Test coolant temperature sender ⇒ Chapter 24-1
greater than 110 °C	– Clean radiator – Test function of the radiator fan – Test coolant thermostat, replace if necessary ⇒ 2.0 l/85 kW Engine - Mechanical Components; Rep. Gr. 19 – Test coolant temperature sender ⇒ Chapter 24-1

Analysis of display group 001, display field 3 - lambda controller upstream of catalytic converter

Display -V.A.G 1552 -	Rectifying fault
Signal outside tolerance	– Wait 30 seconds until readout has stabilised – Inspect intake system for leaks – Test injectors ⇒ Chapter 01-4 – Check lambda learned values in display group 032 ⇒ Chapter 01-6

Analysis of display group 001, display field 4 - operating states

For engines with engine codes AEG, APK, AQY

1	2	3	4	5	6	Meaning if display position
					1	Coolant temperature more than 80 °C
				1		Speed below 2000 rpm
			1			Throttle valve closed
		1				Lambda regulation OK
	1					Operating state - idling
1						AC compressor disconnected

For engines with engine codes AQY, AZJ

1	2	3	4	5	6	7	8	Meaning if display position
							1	Coolant temperature more than 80 °C
							1	Speed below 2000 rpm
					1			Throttle valve closed
				1				Lambda regulation OK
			1					Operating state - idling
		1						AC compressor disconnected
	x							No meaning
1								No fault detected by self-diagnosis

Display group 002, basic function - air mass meter

• Engine idling						
Read measured value block 2 →				← Readout on display		
xxxx rpm	xxx %	x.xx ms	x.x g/s			
1	2	3	4	← Display fields	Specification	Analysis
				Drawn in air mass	2.0...5.0 g/s	⇒ 01-5 page 4
				Injection period	2.00...5.50 ms	⇒ 01-5 page 4
				Engine load	15...35 % 10.0...25.0 % ¹⁾	⇒ 01-5 page 3
				Engine speed (idling speed)	—	⇒ 01-5 page 1

¹⁾ For engines with engine codes AZH, AZJ

**Note**

- ♦ *Re display field 4:*
- ♦ *What is displayed is the inducted air mass which is determined by the air mass meter.*
- ♦ *If a fault is detected at the air mass meter by the engine control unit, the substitute value of the throttle valve potentiometer in g/s is displayed.*
- ♦ *In the emergency mode resulting from a fault at the throttle valve control unit, the engine runs without idling speed stabilisation at a higher idling speed which is dependent on the throttle valve position in an emergency mode position (approx. 1100..0.3000 rpm). Air mass flow approx. 4.5...5.5 g/s.*

Analysis of display group 002, display field 2 - engine load

Display -V.A.G 1552 -	Rectifying fault
smaller than 15% smaller than 10 % ¹⁾	♦ Smaller value can only occur in overrun
greater than 35% greater than 25% ¹⁾	— Test injectors ⇒ Chapter 01-4, Final control diagnosis — If necessary, replace spark plugs — Disconnect electric consumer — Turn steering wheel into middle position — Move selector lever into position „P“ or „N“ (automatic gearbox) — Test air mass meter — Test throttle valve control unit ⇒ Chapter 24-2

¹⁾ For engines with engine codes AQY, AZJ

**Note**

- ♦ The maximum engine load decreases approximately 10 % for each 1000 m above mean sea level.
- ♦ The maximum engine load decreases by up to 10 % at high temperatures.
- ♦ The following readouts must be reached when driving at full throttle: at 4000 rpm approx. 78 %, at 6000 rpm approx. 75 %.

Analysis of display group 002, display field 3 - injection time

Display -V.A.G 1552 -	Rectifying fault
less than 2.00 ms	– Test drive without full load for at least 10 minutes – Test activated charcoal filter solenoid valve ⇒ Chapter 01-4 – Test injected quantity ⇒ Chapter 24-2 – Test fuel pressure regulator ⇒ Chapter 24-2
greater than 5.50 ms	– Eliminate increased load (air conditioning, power steering etc.)

Analysis of display group 002, display field 4 - inducted air mass

Display -V.A.G 1552 -	Rectifying fault
less than 2.0 g/s	– Eliminate unmetered air
greater than 5.0 g/s	– Move selector lever into position „P“ or „N“ ¹⁾ – Eliminate load (air conditioning, power steering etc.)

¹⁾ For models with an automatic gearbox

Display group 003, basic function - air mass meter

• Engine idling						
Read measured value block 3 →				← Readout on display		
xxxx rpm	x.x g/s	x.x ∠° xxx.x % ¹⁾	xx.x ° BTDC			
1	2	3	4	← Display fields	Specification	Analysis
				Ignition angle	0...120.0 ° BTDC	—
				Throttle valve angle	0...6.0 ∠° 0.2...5.0 % ¹⁾	⇒ 01-5 page 5
				Drawn in air mass	2.0...5.0 g/s	⇒ 01-5 page 4
				Engine speed (idling speed)	—	⇒ 01-5 page 1

¹⁾ For engines with engine codes AZH, AZJ

Analysis of display group 003, display field 3 - throttle valve angle

Display -V.A.G 1552 -	Rectifying fault
greater than 6 $\angle^\circ$ 5.0 % ¹⁾	- Adapt engine control unit to throttle valve control unit $\Rightarrow$ Chapter 24-4 - Interrogate fault memory $\Rightarrow$ Chapter 01-1 - Test throttle valve control unit $\Rightarrow$ Chapter 24-2 - Adjust cable of accelerator pedal $\Rightarrow$ 2.0 l/85 kW Engine - Mechanical Components; Rep. Gr. 20

¹⁾ For engines with engine codes AQY, AZJ

**Note**

Readout when accelerator pedal fully depressed is 80...90 $\angle^\circ$ (90...100 %) ¹⁾.

Display group 004 - basic function

• Engine idling						
Read measured value block 4 $\rightarrow$				$\leftarrow$ Readout on display		
xxxx rpm	xx.xxx V	xxx.x $^\circ\text{C}$	xxx.x $^\circ\text{C}$			
1	2	3	4	$\leftarrow$ Display fields	Specification	Analysis
				Intake manifold temperature	-40.0...140.0 $^\circ\text{C}$	$\Rightarrow$ 01-5 page 6
				Coolant temperature	80.0...110.0 $^\circ\text{C}$	$\Rightarrow$ 01-5 page 2
				Supply voltage of the engine control unit	11.5...14.5 V	$\Rightarrow$ 01-5 page 6
				Engine speed (idling speed)	—	$\Rightarrow$ 01-5 page 1

**Note**

If 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 (start temperature - substitute value) when the engine is started. The temperature then rises according to a model sequence stored in the control unit. Once the engine has reached normal operating temperature a fixed substitute value is displayed after a certain time. This fixed substitute value depends on the intake air temperature.

**Note**

The readout must be higher than the temperature of the ambient air.

Analysis of display group 004, display field 2 - supply voltage to the engine control unit

Display -V.A.G 1552 -	Rectifying fault
less than 11.5 V	– Test generator and battery voltage, charge battery ⇒ Electrical System; Rep. Gr. 27 – Increase engine speed slightly for a few minutes and switch off additional consumers – Test supply voltage of engine control unit ⇒ Chapter 24-4 – Eliminate current consumption
greater than 14.5 V	– Test voltage, replace voltage regulator if necessary – Interrogate fault memory ⇒ Chapter 01-1

Analysis of display group 004, display field 4 - intake air temperature

Display -V.A.G 1552 -	Rectifying fault
approx. 140.0 °C	– Test intake air temperature sender -G42 - ⇒ Chapter 24-1
approx. -40 °C	
approx. 140 °C (readout appears only for a short time and then jumps to 19.5 °C)	

Display group 005 - basic function

• Engine idling						
Read measured value block 5 →				← Readout on display		
xxxx rpm	xxx.x %	xxx km/h	Text			
1	2	3	4	← Display fields	Specification	Analysis
				Operating state (idling, part load, full load, enrichment, overrun)	Idling	—
				Vehicle speed	0 km/h	—
				Engine load	10...35 % 10,0...25,0 % ¹⁾	⇒ 01-5 page 3
				Engine speed (idling speed)	—	⇒ 01-5 page 1

¹⁾ For engines with engine codes AQY, AZJ

**Note**

Test speed signal ⇒ Chapter 24-5

Display group 006 - basic function

• Engine idling						
Read measured value block 6 → xxxx rpm xxx.x % xxx.x °C xx.x %				← Readout on display		
1	2	3	4	← Display fields	Specification	Analysis
				Level correction factor	—	—
				Intake manifold temperature	-40..0.140.0 °C	—
				Engine load	15...35 % 10,0...25,0 % ¹⁾	⇒ 01-5 page 3
				Engine speed (idling speed)	—	⇒ 01-5 page 1

¹⁾ For engines with engine codes AQY, AZJ

**Note**

- ◆ Re display field 2:
- ◆ The maximum engine load decreases approximately 10 % for each 1000 m above mean sea level.
- ◆ The maximum engine load decreases by up to 10 % at high temperatures.
- ◆ The following readouts must be reached when driving at full throttle: at 4000 rpm approx. 78 %, at 6000 rpm approx. 75 %.

**Note**

- ◆ Re display field 3:
- ◆ Specification is a random temperature within the temperature range. The readout must be higher than the temperature of the ambient air.

Display group 010 ignition

• Engine idling						
Read measured value block 10 → xxxx rpm xxx % x ∠° xx.x° xx.x % ¹⁾ BTDC				← Readout on display		
1	2	3	4	← Display fields	Specification	Analysis
				Ignition angle	0...12 ° BTDC	—
				Throttle valve angle	0...6 ∠° 0.2...5.0 % ¹⁾	⇒ 01-5 page 5
				Engine load	15...35 % 10.0...25.0 % ¹⁾	⇒ 01-5 page 3
				Engine speed (idling speed)	—	⇒ 01-5 page 1

¹⁾ For engines with engine codes AZH, AZJ

Display group 014, ignition-misfiring detection

• Engine idling						
Read measured value block 14 →				← Readout on display		
xxxx rpm	xx %	xxx	Text			
1	2	3	4	← Display fields	Specification	Analysis
				Status of misfiring detection (activated, not activated)	activated	—
Total of ignition misfirings					0...5	⇒ 01-5 page 8
Engine load					15...35 % 10...25 % ¹⁾	⇒ 01-5 page 3
Engine speed (idling speed)					—	⇒ 01-5 page 1

¹⁾ For engines with engine codes AZH, AZJ

Analysis of display group 014, display field 3 - total of ignition misfirings

Display -V.A.G 1552 -	Rectifying fault
greater than 5	– Inspect ignition transformer ⇒ Chapter 28-1 – Test spark plugs and ignition cable guide with termination – Test injectors ⇒ Chapter 01-4, Final control diagnosis – Check fuel level in tank

Display group 014, ignition-ignition misfiring 1...3 (engines with engine codes AQY, AZH, AZJ)

• Driving						
Read measured value block 15 →				← Readout on display		
x	x	x	Text			
1	2	3	4	← Display fields	Specification	Analysis
				Status of misfiring detection (activated, not activated)	activated	—
Ignition misfiring cylinder 3					0	⇒ 01-5 page 9
Ignition misfiring cylinder 2					0	⇒ 01-5 page 9
Ignition misfiring cylinder 1					0	⇒ 01-5 page 9

Display group 016, ignition-ignition misfiring 4 (engines with engine codes AQY, AZH, AZJ)

• Normal driving						
Read measured value block 16 →				⇐ Readout on display		
x	-	-	Text			
1	2	3	4	⇐ Display fields	Specification	Analysis
			Status of misfiring detection (activated, not activated)		activated	—
					—	—
					—	—
			Ignition misfiring cylinder 4		0	⇒ 01-5 page 9

Analysis of display groups 015 and 016, display fields 1, 2 and 3

Display -V.A.G 1552 -	Possible cause of fault	Rectifying fault
greater than 0	♦ Spark plug defective ♦ Ignition cable closure defect ♦ Ignition coil defective	– Test spark plugs and spark cables with closure ⇒ Chapter 28-1 – Test ignition coil ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
	♦ Injection valve defective	– Test injectors ⇒ Chapter 01-4, Final control diagnosis – Test injected quantity and tightness ⇒ Chapter 24-2
	♦ Unmetered air	– Inspect intake system for leaks
	♦ Engine damaged mechanically	– Testing compression pressure ⇒ 2.0 l/85 kW Engine - Mechanical Components; Rep. Gr. 15

Display group 020, ignition-knocking control (for engines with engine codes AZH, AZJ)

• Normal driving						
Read measured value block 20 →				⇐ Readout on display		
xx.x °CA	xx.x °CA	xx.x °CA	xx.x °CA			
1	2	3	4	⇐ Display fields	Specification	Analysis
			Ignition angle relief cylinder 4 through knock control		0.0..0.12.0 °CA	
			Ignition angle relief cylinder 3 through knock control		0.0..0.12.0 °CA	
			Ignition angle relief cylinder 2 through knock control		0.0..0.12.0 °CA	
			Ignition angle relief cylinder 1 through knock control		0.0..0.12.0 °CA	

**Note**

At idling speed the displayed value is 0.0 °CA

Display group 022, ignition - knock control

• Normal driving				← Readout on display		
Read measured value block 22 →						
xxxx rpm	xxx.x %	xx.x °CA	xx.x °CA			
1	2	3	4	← Display fields	Specification	Analysis
				Ignition angle relief cylinder 2 through knock control	0...15.0 °CA 0...12.0 °CA ¹⁾	⇒ 01-5 page 11
				Ignition angle relief cylinder 1 through knock control	0...15.0 °CA 0...12.0 °CA ¹⁾	⇒ 01-5 page 11
Engine load					0,0...100,0 %	—
Engine speed					730..0.6800 rpm	—

¹⁾ For engines with engine codes AZH, AZJ

Display group 023, ignition - knock control

• Normal driving				← Readout on display		
Read measured value block 23 →						
xxxx rpm	xxx.x %	xx.x °CA	xx.x °CA			
1	2	3	4	← Display fields	Specification	Analysis
				Ignition angle relief cylinder 4 through knock control	0...15.0 °CA 0...12.0 °CA ¹⁾	⇒ 01-5 page 11
				Ignition angle relief cylinder 3 through knock control	0...15.0 °CA 0...12.0 °CA ¹⁾	⇒ 01-5 page 11
Engine load					0...100 %	—
Engine speed					730...6800 rpm	—

¹⁾ For engines with engine codes AZH, AZJ

**Note**

- ♦ Knock control active from an engine load of more than 40 %.
- ♦ If an engine load of 40 % is exceeded, the current retardation of the ignition angles are displayed. If the engine load was not reached, the values last used are displayed.
- ♦ If knocking can be heard without any retardation of the ignition angle detectable, increase engine speed for 5 seconds to more than 3500 rpm in order to activate the knock sensor fault detection (for self-diagnosis).

Analysis of display groups 022/023, display fields 3 and 4 - ignition angle retardation

Display -V.A.G 1552 -	Rectifying fault
all cylinders greater than 15 °CA all cylinders greater than 12.0 °CA ¹⁾	— Test knock sensors -G61- and -G66- — Slacken knock sensor and tighten again to 20 Nm — Tighten up loose parts — Change type of fuel
one cylinder differs significantly from the others	— Test knock sensors -G61- and -G66 - — Testing compression pressure ⇒ 2.0 l/85 kW Engine - Mechanical Components; Rep. Gr. 15 — Tighten up loose parts

¹⁾ For engines with engine codes AZH, AZJ

Display group 026, ignition - knock sensors

• Normal driving						
Read measured value block 26 →				← Readout on display		
x.xxx V	x.xxx V	x.xxx V	x.xxx V			
1	2	3	4	← Display fields	Specification	Analysis
				Knock sensor voltage signal cyl. 4	0.400..2.000 V	—
				Knock sensor voltage signal cyl. 3	0.400..2.000 V	—
				Knock sensor voltage signal cyl. 2	0.400...2.000 V	—
				Knock sensor voltage signal cyl. 1	0.400...2.000 V	—

**Note**

- ♦ If no fault is found when checking the knock sensor, wiring and plug connections, check the ancillary components or the engine for damage - see display groups 014 and 015.
- ♦ At higher engine speeds the readout of the knock sensor voltage signal may be as much as 5.1 V.
- ♦ If a difference of more than 50 % exists between the smallest and largest knock sensor signal, the cause may be corrosion at the plug connection.

Display group 028, ignition - testing knock sensor (for engines with engine code AZH, AZJ)

• Normal driving						
Read measured value block 28 →				← Readout on display		
xxxx rpm	xxx.x %	xxx.x °C	Text			
1	2	3	4	← Display fields	Specification	Analysis
				Test knock sensor (Test OFF, Test ON / system OK, system not OK)	Syst. ok	—
				Coolant temperature	80.0...110.0 °C	⇒ 01-5 page 2
				Engine load	40,0...100,0 %	—
				Engine speed	2500...6800 rpm 3000...6500 rpm ¹⁾	—

¹⁾ For engines with engine code AZJ

01-6 Self-diagnosis VI

Reading measured value block, display groups 030 to 062

Display group 030 - lambda control

- Engine idling - Catalytic converter temperature at least 352 °C (display group 034, display field 2)						
Read measured value block 30 →				← Readout on display		
xxx	xxx					
1	2	3	4	← Display field	Specification	Analysis
		Status of lambda control downstream of catalytic converter ¹⁾			110	⇒ 01-6 page 1
		Status of lambda control upstream of catalytic converter			111	⇒ 01-6 page 1

¹⁾ For engines with engine codes AQY, AZH, AZJ



Note

The first position in the 3-digit numerical block fluctuates initially between 0 and 1 (lambda probe heater off and on).



Note

- ♦ regarding display field 2
- ♦ The third position of the display number changes to 1 under load.

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

1	1	1	Meaning, if display positions = 1
			Lambda control active
			Lambda probe operational
			Lambda probe heater switched on

Display group 031, lambda control - lambda values upstream of catalytic converter

• Engine idling						
Read measured value block 31 →				← Readout on display		
x.xxxx	x.xxxx	—	—			
1	2	3	4	← Display field	Specification	Analysis
					—	—
					—	—
Lambda nominal value - Bank 1					0,9900...1,0100	—
Lambda actual value - Bank 1					0,9900...1,0100	—

Display group 032, lambda control - lambda learned values

• Engine idling						
Read measured value block 32 →				← Readout on display		
xx.x %	xx.x %	—	—			
1	2	3	4	← Display field	Specification	Analysis
					—	—
					—	—
Lambda learned value at part load upstream of catalytic converter (multiplicative)					-10,0...10,0 %	⇒ 01-6 page 5
Lambda learned value at idling speed upstream of catalytic converter (additive)					-10,0...10,0 %	⇒ 01-6 page 5



Note

- ♦ Re display fields 1 and 2:
- ♦ Low readouts indicate that the engine is running too rich and the lambda control therefore produces a leaner mixture.
- ♦ High readouts mean that the engine is running too lean and the lambda control therefore produces a richer mixture.
- ♦ If the control unit is dead all initialisation values are reset.
- ♦ Condition for part load learning. Coolant temperature at least 75 °C, intake air temperature max. 90 °C, driving mode.

- ♦ *add = additive - The effect of the fault (e.g. unmetered air) becomes increasingly less as engine speed rises. In the case of an additive initialisation value the injection period is changed by a fixed rate. This rate is independent of the basic injection period.*
- ♦ *mul = multiplicative - The effect of the fault (e.g. faulty injector) becomes greater as engine speed rises. The multiplicative learned value is a percentage change in the injection period. This change is dependent on the basic injection period.*

Display group 033, lambda control upstream of catalytic converter - lambda control values

• Engine idling						
Read measured value block 33 →				← Readout on display		
xx.x %	x.xxx V	—	—			
1	2	3	4	← Display field	Specification	Analysis
					—	—
					—	—
		Lambda probe voltage upstream of catalytic converter			0.00...10.00 V 1.40...1.60 V ¹⁾	⇒ 01-6 page 5
		Lambda control before catalyst			-10,0...10,0 %	⇒ 01-6 page 5

¹⁾ for engines with engine codes AZH, AZJ



Note

- ♦ *Re display field 1:*
- ♦ *Readout must fluctuate around zero. If zero is always displayed, the lambda control has switched from closed-loop to open-loop control because of a fault in the lambda control. Interrogate fault memory
⇒ Chapter 01-1.*

For engines with engine codes AEG, APK, AQY



Note

- ♦ *Voltage signal „Mixture rich (low level of residual oxygen)“ is at approx. 0.7...1.0 V.*
- ♦ *Voltage signal „Mixture lean (high level of residual oxygen)“ is at approx. 0.0...0.3 V.*
- ♦ *A voltage jump from 0.7...1.0 V to 0.0...0.3 V or vice versa takes place at the 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.*

- ♦ The readout must in some cases be less than 0.3 V and in some cases more than 0.6 V. The readout below 0.45 V indicates a lean mixture while above 0.45 V indicates a rich mixture.
- ♦ At idling speed, the lambda probe voltage upstream of the catalytic converter must fluctuate between a rich and leaner mixture. The lambda probe voltage downstream of the catalytic converter should indicate a constant rich or lean mixture. If the voltage also fluctuates downstream of the catalytic converter, either the catalytic converter is faulty (⇒ Read measured value block 046 ⇒ **01-6** page 10) or the probes have been wrongly connected (irregular engine running). Lambda control varies between -15...15 %.

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

A: Lambda probe voltage high

rich mixture (fuel surplus or air shortage)

high CO value

B: Lambda probe voltage low

lean mixture (fuel shortage or air surplus)

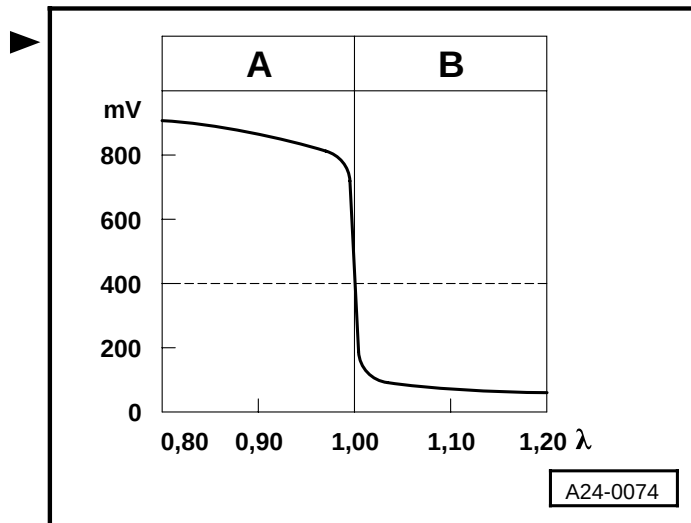
low CO value

For engines with engine codes AZH, AZJ



Note

- ♦ Re display field 2:
- ♦ Voltage signal „Mixture rich“ (low level of residual oxygen) is at approx. 0.13...1.50 V
- ♦ Voltage signal „Mixture rich“ (high level of residual oxygen) is at approx. 1.50...4.80 V



Analysis of display groups 032 and 033, display fields 1 and 2 - lambda learned values

Readout on -V.A.G 1552 -	Rectifying fault
low learned values	– Disappears after driving on motorway or changing oil – Test injectors ⇒ Chapter 01-4, Final control diagnosis – Test fuel pressure regulator and holding pressure ⇒ Chap. 24-2 – Test solenoid valve for activated charcoal filter ⇒ Chapter 01-4, final control diagnosis – Test air mass meter – Testing lambda probe heater upstream of catalytic converter ⇒ Chapter 24-3
high learned values	– Test intake system for tightness – Test injected quantity ⇒ Chapter 24-2 – Test air mass meter – Test fuel pressure regulator and holding pressure ⇒ Chap. 24-2 – Test the exhaust manifold ⇒ 2.0 l/85 kW Engine, Mechanical Components; Rep. Gr. 26 – Testing lambda probe heater upstream of catalytic converter ⇒ Chapter 24-3

Analysis of display group 033, display field 2 - lambda probe voltage upstream of catalytic converter

Display field: 1	Rectifying fault
constant 0.00...0.30 (0.00...1.50 V) ¹⁾ possibly constant 0.70...1.00 V (1.50...4.80 V) ¹⁾	– Testing the intake system for tightness (unmetered air) – Inspect the spark plugs ⇒ Inspection and Maintenance – Test fuel pressure regulator and holding pressure ⇒ Chap. 24-2 – Test injectors ⇒ Chapter 01-4, Final control diagnosis – Test coolant temperature sender ⇒ Chapter 24-1 – Testing lambda probe heater upstream of catalytic converter ⇒ Chapter 24-3 – Testing lambda probe and lambda control upstream of catalytic converter ⇒ Chapter 24-3
constant 1,00 V (greater than 4,80 V) ¹⁾	– Testing lambda probe heater upstream of catalytic converter ⇒ Chapter 24-3 – Testing lambda probe and lambda control upstream of catalytic converter ⇒ Chapter 24-3
constant 0.40...0.50 V (1.40...1.60 V) ¹⁾	
constant 0.00 V (less than 0.13 V) ¹⁾	

¹⁾ for engines with engine codes AZH, AZJ

Display group 034, lambda control - diagnosis of lambda probe upstream of catalytic converter (for engines with the engine codes AQY)

- Vehicle stationary, engine running at fast idling - Control unit in function 04 - initiate basic setting			
System in basic setting 34 →			
xxxx rpm	xxx.x °C	x.x s	Text
1	2	3	4
← Readout on display			
← Display field			
Specification			
Analysis			
Results of a test of lambda probe ageing upstream of catalytic converter (Test OFF/Test ON/B1 S1 OK/B1S1 not OK)			
B1 S1 OK			
—			
Period of lambda probe upstream of catalytic converter			
max. 2.2 s			
—			
Catalytic converter temperature			
min. 352 °C			
—			
Engine speed			
2200...2800 rpm			
—			



Note

- ♦ Re display field 3:
- ♦ The period indicates the time between two jumps (e.g. rich - lean - rich mixture) and is thus a measure of the status of the lambda probe ageing. If the specified time is exceeded, the following appears in display field 4: B1-S1 not OK

Display group 034, lambda control - diagnosis of lambda probe upstream of catalytic converter (for engines with the engine codes AZH, AZJ)

- Control unit in function 04 - initiate basic setting - AZH: Vehicle stationary, brake pedal depressed, engine running at fast idling - AZJ: Vehicle stationary, brake and accelerator pedal depressed simultaneously, engine running at fast idling			
System in basic setting 34 →			
xxxx rpm	xxx.x °C	xx.xx	Text
1	2	3	4
← Readout on display			
← Display field			
Specification			
Analysis			
Results of a test of lambda probe ageing upstream of catalytic converter (Test OFF/Test ON/B1 S1 OK/B1 S1 not OK)			
B1 S1 OK			
—			
dynamic factor			
do not observe min. 0.70 ¹⁾			
—			
Catalytic converter temperature			
min. 352 °C			
—			
Engine speed			
1300...2600 rpm about 2300 rpm ¹⁾			
—			

¹⁾ for engines with engine code AZJ

**Note**

- ♦ Re display field 3:
- ♦ The dynamic factor is the measure of the status of the lambda probe ageing. The lower the dynamic factor the more advanced the lambda probe ageing.

Display group 036, lambda control - operational readiness downstream of catalytic converter (for engines with engine codes AQY, AZJ)

• AQY: Engine idling, engine at idling speed • AZJ: Control unit in function 04 - initiate basic setting • AZJ: Vehicle stationary, brake and accelerator pedal depressed simultaneously, engine running at fast idling			
Read measured value block 36 →			
x.xxx V	Text	—	—
1	2	3	4
← Readout on display			
← Display field			
Specification			
Analysis			
—			
—			
Test lambda probe downstream of catalytic converter (Test OFF/Test ON/B1-S2 not OK)			
B1 S2 o.k.			
—			
Lambda probe voltage downstream of catalytic converter			
0.00...1.00 V			
⇒ 01-6 page 8			

Display group 036, lambda control - operational readiness downstream of catalytic converter (for engines with engine codes AZH)

• Vehicle stationary, brake pedal depressed, engine running at fast idling • Control unit in function 04 - initiate basic setting			
Read measured value block 36 →			
x.xxx V	xxx.x °C	xx.xx	Text
1	2	3	4
← Readout on display			
← Display field			
Specification			
Analysis			
—			
Test lambda probe downstream of catalytic converter (Test OFF/Test ON/B1-S2 not OK)			
B1 S2 o.k.			
—			
No meaning			
—			
Catalytic converter temperature			
min. 350 °C			
—			
Lambda probe voltage downstream of catalytic converter			
0.00...1.00 V			
⇒ 01-6 page 8			

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

Display field: 1	Rectifying fault
constant 0.00...0.30 V possibly constant 0.70...1.00 V	– Testing the intake system for tightness (unmetered air) – Inspect the spark plugs ⇒ Inspection and Maintenance – Test fuel pressure regulator and holding pressure ⇒ Chap. 24-2 – Test injectors ⇒ Chapter 01-4, Final control diagnosis – Test coolant temperature sender ⇒ Chapter 24-1 – Test tank ventilation ⇒ Chapter 01-4, Final control diagnosis – Test lambda probe heater downstream of catalytic converter ⇒ Chapter 24-3 – Testing lambda probe and lambda control downstream of catalytic converter ⇒ Chapter 24-3
between 1.00 1.10 V ¹⁾	– Test lambda probe heater downstream of catalytic converter ⇒ Chapter 24-3 – Testing lambda probe and lambda control downstream of catalytic converter ⇒ Chapter 24-3
constant 0.40 ...0.50 V	
constant 0.00 V	

¹⁾ For engines with engine code AZH

Display group 037, lambda control - operational readiness downstream of catalytic converter (for engines with engine codes AEG, APK, AQY)

• Engine idling • Control unit in function 04 - initiate basic setting						
System in basic setting 37 →				← Readout on display		
xxx.x %	x.xxx V	xxxx ms	Text	← Display field	Specification	Analysis
1	2	3	4	Test lambda probe downstream of catalytic converter (B1 S2 OFF/B1 S2 ON/B1 S2 OK/B1 S2 not OK) Waiting time of lambda control upstream of catalytic converter Lambda probe voltage downstream of catalytic converter Engine load	B1 S2 o.k.	—
					-1200...1200 ms	—
					0.00...1.00 V	⇒ 01-6 page 8
					15...35 %	—

**Note**

- ◆ Re display field 3:
- ◆ If the readout rises above 200 ms, there is a leak in the exhaust system.

Display group 037, lambda control - operational readiness downstream of catalytic converter (for engines with engine codes AZH, AZJ)

- Engine idling - Control unit in function 04 - initiate basic setting						
System in basic setting 37 →				← Readout on display		
xxx.x %	x.xxx V	x.xxx	Text			
1	2	3	4	← Display field	Specification	Analysis
				Test lambda probe downstream of catalytic converter (Test ON / Test OFF, System OK / System not OK)	System OK	—
				Waiting time of lambda control upstream of catalytic converter	—	—
				Lambda probe voltage downstream of catalytic converter	0.00...1.00 V	⇒ 01-6 page 8
				Engine load	10,0...25,0 %	—

Display group 041, lambda control - resistance of lambda probe heater

Engine idling						
Read measured value block 41 →				← Readout on display		
xx.x Ω	Text	xx.x Ω	Text			
1	2	3	4	← Display field	Specification	Analysis
				Lambda probe heating downstream of catalytic converter	Htg dC.OFF Htg dC.ON	—
				Resistance lambda probe heating downstream of catalytic converter	6,4...47,5 Ω ¹⁾	—
				Lambda probe heating upstream of catalytic converter	Htg.uC.OFF Htg.uC.ON	—
				Resistance of lambda probe heating upstream of catalytic converter	6,4...47,5 Ω ¹⁾	—

¹⁾ for engines with engine codes AEG, APK, AQY

**Note**

Depending on the operating state of the engine the lambda probe heaters are switched on or off, i.e. the readouts in display field 2 and 4 may show either Htg.u(d)C.ON or Htg.u(d)C.OFF.

Display group 046, lambda control - catalytic converter diagnosis (for engines with engine code AEG, APK, AQY, AZH)

- Vehicle stationary, engine running at fast idling - Control unit in function 04 - initiate basic setting						
System in basic setting 46 →				← Readout on display		
xxxx rpm	xxx.x °C	x.xx	Text	← Display field	Specification	Analysis
1	2	3	4	Test result of the catalytic conversion (Test OFF / Test ON / Cat B1 OK / Cat B1 not OK)		
				Amplitude ratio Value of the catalytic converter conversion		
				Catalytic converter temperature		
				Engine speed		

¹⁾ For engines with engine code AZH

Display group 046, lambda control - catalytic converter diagnosis (for engines with engine code AZJ)

- Vehicle stationary, brake and accelerator pedal depressed simultaneously, engine running at fast idling - Control unit in function 04 - initiate basic setting						
System in basic setting 46 →				← Readout on display		
xxxx rpm	xxx.x °C	x.xx	Text	← Display field	Specification	Analysis
1	2	3	4	Test result of the catalytic conversion (Test OFF / Test ON / Cat B1 OK / Cat B1 not OK)		
				Effect of the catalytic converter		
				Catalytic converter temperature		
				Engine speed		

**Note**

- ◆ Re display field 3:
- ◆ The indicated value for the new catalytic converters should be above 5.00.

Display group 050, engine speed control - operating states

• Engine idling						
Read measured value block 50 →				← Readout on display		
xxxx rpm	xxxx rpm	Text	Text			
1	2	3	4	← Display field	Specification	Analysis
				Operating condition air conditioning compressor ON/OFF	Compr. ON or Compr. OFF	—
				Operating state of air conditioning	A/C High or A/C Low	—
				Engine speed (idling speed - specified value)	780 rpm 840 rpm ¹⁾	—
				Engine speed (idling speed)	—	⇒ Chapter 01-5 display group 001, display field 1

¹⁾ For engines with engine code AZH

**Note**

- ◆ Re display field 2:
- ◆ What is displayed is the specification for the engine speed which is fixed by the engine control unit (internal computed value in control unit). In exceptional cases the idling speed can be adjusted. The idling speed when a gear is engaged is then changed automatically.

**Note**

- ◆ Re display field 3:
- ◆ A/C High = air conditioning switched on to high heating or cooling capacity
- ◆ A/C Low = air conditioning not switched on

**Note**

- ◆ Re display field 4:
- ◆ On vehicles not fitted with air conditioning the indication „Compr. OFF“ is always displayed.

Display group 054, engine speed control - operating states

- Engine idling - Driving¹⁾						
Read measured value block 54 →				← Readout on display		
xxxx rpm	Text	xxx ∠° xxx.x % ¹⁾	xxx ∠° xxx.x % ¹⁾			
1	2	3	4	← Display field	Specification	Analysis
				Throttle valve positioner angle	— 0...100 % ¹⁾	—
				Throttle valve angle	0...6 ∠° 0...100 % ¹⁾	⇒ Chapter 01-5, display group 003, display field 3
				Operating state (idling, part load, full load, enrichment, overrun)	Idling — ¹⁾	—
				Engine speed	—	⇒ Chapter 01-5, display group 022, display field 1

¹⁾ for engines with engine codes AZH, AZJ

Display group 055, engine speed control - idling speed stabilisation

Engine idling						
Read measured value block 55 →				← Readout on display		
xxxx rpm	x.xx g/s xx.xx % ¹⁾	x.xx g/s xx.xx % ¹⁾	xxxx xxxxx ¹⁾			
1	2	3	4	← Display field	Specification	Analysis
				Operating conditions	xxxx xxxxx ¹⁾	⇒ 01-6 page 13
				Initialisation value idling regulator	-1.50...1.50 g/s -10.0...10.0 % ¹⁾	—
				Idling regulator	-2.00...2.00 g/s ²⁾ -10.0...10.0 % ¹⁾	—
				Engine speed (idling speed)	—	⇒ Chap. 01-5, display group 001, display field 1

¹⁾ for engines with engine codes AZH, AZJ

²⁾ On a new engine the value is in the positive region because of the higher friction, on a run-in engine it is in the negative region.



Note

- ♦ Re display field 3:¹⁾
- ♦ The display shows to what extent the idling stabilizer has „disinitialised“ from the constructively given mean value. On a new engine the value is in the positive region because of the higher friction, on a run-in engine it is in the negative region.

Meaning of the numerical block display field 4, operating conditions

For engines with engine codes AEG, APK, AQY

1	2	3	4	Meaning if display position
			1	Air conditioning compressor on
		1		Gear engaged, selector lever in 1/2/3/R/D (automatic gearbox)
	1			Air conditioning switched on
1				No meaning

For engines with engine codes AZH, AZJ

1	2	3	4	5	Meaning if display position
				1	Air conditioning compressor on
			1		Gear engaged, selector lever in 1/2/3/R/D (automatic gearbox)
		1			Air conditioning switched on
	1				No meaning
1					No meaning

Display group 056, engine speed control - idling speed stabilisation

• Engine idling						
Read measured value block 56 → xxxx rpm xxxx rpm xx.xx g/s xxxx xx.x % ¹⁾ xxxxx ¹⁾				← Readout on display		
1	2	3	4	← Display field	Specification	Analysis
				Operating conditions	xxxx xxxxx ¹⁾	⇒ 01-6 page 13
				Idling regulator	-2.00...2.00 g/s -10.0...10.0 % ¹⁾	—
				Engine speed (idling speed - specified value)	780 rpm 840 rpm ²⁾	—
				Engine speed (idling speed)	—	⇒ Chap. 01-5, display group 001, display field 1

¹⁾ for engines with engine codes AZH, AZJ

²⁾ For engines with engine code AZH

Display group 060 - adjustment of the throttle valve control unit

- Ignition switched on, engine switched off - Control unit in function 04 - initiate basic setting			
System in basic setting 60 →		← Readout on display	
x ∠° xxx % ¹⁾	xx.x V xxx % ¹⁾	Text x ¹⁾	Text
1	2	3	4
		← Display field	
		Specification	
		Analysis	
		Adaption state (ADP runs, ADP o.k. or ADP ERROR)	
		ADP o.k.	
		—	
		Engine operating state	
		Idling	
		0...8 ¹⁾	
		—	
		Throttle valve positioner sender -G127 - Throttle valve angle - Potentiometer 2 -G188- ¹⁾	
		0.0...5.0 V 97...3 % ¹⁾	
		—	
		Throttle valve angle Throttle valve angle - Potentiometer 1 -G187- ¹⁾	
		0...6 ∠° 3...97 % ¹⁾	
		⇒ Chapter 01-5, display group 003, display field 3	

¹⁾ for engines with engine codes AZH, AZJ



Note

- When display group 060 is selected in function 04 „Initiate basic setting“, the engine control unit is adapted to the throttle valve control unit. This adaption must be performed if another throttle valve control unit (or the complete engine), or another engine control unit, has been installed.
- Carry out the adaptation of throttle valve control unit with the ignition switched on.
- If the voltage supply has been interrupted (battery disconnected), it is also necessary to carry out adaption ⇒ Chap. 24-4.

Display group 061 - engine speed control, E-gas (for engines with the engine codes AZH, AZJ)

Driving			
Read measured value block 61 →		← Readout on display	
xxxx rpm	xx.xxx V	xxx.x %	xxxxx
1	2	3	4
		← Display field	
		Specification	
		Analysis	
		Operating conditions	
		xxxxx	
		⇒ 01-6 page 13	
		Actuate throttle valve drive -G186-	
		0,0...100,0 %	
		—	
		Supply voltage of the engine control unit	
		13.50...14.50 V ¹⁾	
		—	
		Engine speed	
		—	
		⇒ Chapter 01-5, display group 022, display field 1	

¹⁾ for engines with engine code AZJ

Display group 062 - engine speed control, E-gas (for engines with the engine codes AZH, AZJ)

• Ignition on						
Read measured value block 62 →				← Readout on display		
xxx %	xxx %	xxx %	xxx %			
1	2	3	4	← Display field	Specification	Analysis
				Sender 2 for accelerator pedal position -G185-	3...48 % 4...50 % ¹⁾	—
				Sender 1 for accelerator pedal position -G79-	6...96 % 12...97 % ¹⁾	—
				Throttle valve angle potentiometer -G188 -	97...3 %	—
				Throttle valve angle potentiometer -G187-	3...97 %	—

¹⁾ for engines with engine code AZJ

01-7 Self-diagnosis VII

Reading measured value blocks, display groups 066 to 126

Display group 066 - cruise control system (only models with CCS)

• Engine idling						
Read measured value block 66 →				← Readout on display		
xxx km/h	xxxx	xxx km/h	xxxx			
	xxxxxxx ¹⁾		xxxxxxx ¹⁾			
1	2	3	4	← Display fields	Specification	Analysis
				CCS switch position	0000 0000xxxx ¹⁾	⇒ 01-7 page 2
				Specified vehicle speed (value last stored by CCS)	x km/h	—
				Brake pedal, clutch pedal and CCS position	1000 0000xxxx ¹⁾	⇒ 01-7 page 1
				Vehicle speed	0 km/h	—

¹⁾ For engines with engine code AZJ

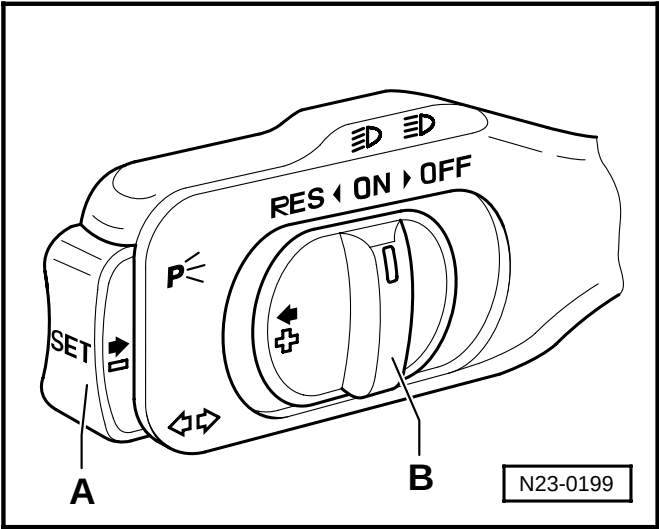
Meaning of 4-digit numerical block, display field 2, brake and clutch pedal switch, CCS switch

1	2	3	4	Meaning if display position
			1	Brake pedal depressed (brake light switch)
		1		Brake pedal depressed (brake pedal switch)
	1			Clutch operated, if necessary depress brake pedal if automatic gearbox fitted
1				CCS actuated

For engines with engine code AZJ

1	2	3	4	5	6	7	8	Meaning if display position
							1	Brake pedal depressed (brake light switch)
						1		Brake pedal depressed (brake pedal switch)
					1			Clutch operated, if necessary depress brake pedal if automatic gearbox fitted
			1					CCS actuated
		0						No meaning
	0							
	0							
0								

Meaning of 4-digit numerical block, display field 4, CCS switch



1	2	3	4	Meaning if display position
			1	CCS sliding switch in OFF position (only if closed)
		1		CCS sliding switch in OFF position (closes or closed)
	1			CCS pushbutton SET operated
1				CCS sliding switch in RES position

For engines with engine code AZJ

1	2	3	4	5	6	7	8	Meaning if display position
				0	0	0	0	CCS sliding switch -B- in the OFF position (interlocked)
				0	0	0	1	CCS sliding switch -B- in the OFF position (before operating point)
				0	1	1	1	CCS pushbutton SET operated
				1	0	1	1	CCS sliding switch -B- in RES position
				0	0	1	1	Switch -B- to ON
0000								No meaning

Display group 070 - exhaust gas reduction - diagnosis of activated charcoal filter system

• Engine idling • Coolant temperature at least 60 °C (display group 77, display field 1) • Control unit in function 04 - initiate basic setting						
System in basic setting 70 →				← Readout on display		
xxx.x %	xx.x %	x.xx g/s	Text			
		xx.x % ¹⁾				
1	2	3	4	← Display fields	Specification	Analysis
				Result of diagnosis (Test ON / Test OFF or TVV OK / TVV not OK)	TVV o.k.	—
				Idling speed controller variation during TVV diagnosis	0...0.33 g/s do not observe ¹⁾	—
				Lambda controller variation during TVV diagnosis	-7,8...7,8 % Ignore ¹⁾	—
				On/off ratio of activated charcoal filter solenoid valve	0,0...100,0 %	—

¹⁾ For engines with engine codes AQY, AZJ

**Note**

TVV means Tank Vent Valve (activated charcoal filter solenoid valve). Diagnosis can only be initiated once each time the engine is started.

**Note**

- ♦ Re display field 2:
- ♦ Lambda regulator variation in negative range: activated charcoal filter full.
- ♦ Lambda regulator variation in positive range: activated charcoal filter empty.

Display group 077, exhaust reduction - diagnosis of secondary air system (for engines with engine identification characters AQY, AZH, AZJ)

- Engine idling - Control unit in function 04 - initiate basic setting			
System in basic setting 77 →			
xxx.x °C xxxx/min ¹⁾	xx.x % xx.x g/s ¹⁾	xx.x g/s	Text
1	2	3	4
← Readout on display			
← Display fields			
Specification			
Analysis			
Result of diagnosis (Test ON / Test OFF, system OK / system not OK)			
Syst. ok			
—			
Ignore			
xx.x g/s ¹⁾			
—			
Lambda regulator variation during diagnosis air mass ¹⁾			
max. 25.0 % 1.0...10.0 g/s ¹⁾			
—			
Coolant temperature			
80...110 °C			
—			
⇒ Chapter 01-5, display group 001			

¹⁾ For engines with engine code AZJ

Display group 099 - lambda control - operating state of lambda control (for engines with engine code AQY)

- Engine idling - Control unit in function 04 - initiate basic setting, lambda control switched off - Control unit in function 08 - read measured value block, lambda control switched on			
Read measured value block 99 →			
xxxx rpm	xx.x °C	xx.x %	Text
1	2	3	4
← Readout on display			
← Display fields			
Specification			
Analysis			
Operating state of lambda control			
Control I OFF or control I ON			
—			
Lambda controller upstream of catalytic converter			
-10,0...10,0 %			
⇒ Chap. 01-5, display group 001, display field 3			
Coolant temperature			
80.0...110.0 °C			
⇒ Chap. 01-5, display group 001, display field 2			
Engine speed (idling speed)			
—			
⇒ Chap. 01-5, display group 001, display field 1			


Note

For defined fault finding the lambda control is switched off when selected in display group 099 in „Initiate basic setting“ and switched on in „Read measured value block“. The lambda control is automatically operated again when quitting function 04 „Initiate basic setting“.

Display group 100 - readiness code (for engines with engine identification characters AQY, AZH, AZJ)

• Engine idling						
Read measured value block 100 →				← Readout on display		
xxxxxxx	xxx.x °C	xxxx s	xxxxxxx			
1	2	3	4	← Display fields	Specification	Analysis
				Diagnosis status	—	—
				Time since engine start	—	—
				Coolant temperature	80.0..0.110.0 °C	⇒ Chap. 01-5, display group 001, display field 2
Readiness code					00000000	⇒ 01-7 page 5

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

1	2	3	4	5	6	7	8	Function of diagnosis
							0	Catalytic converter
						0		Catalytic converter heater (no diagnosis at present/always „0“)
					0			Activated charcoal filter (tank vent system)
				0				Secondary air system
			0					Air conditioning system (no diagnosis at present/always „0“)
		0						Lambda probes
	0							Lambda probe heater (no diagnosis at present/always „0“)
0								Exhaust gas recirculation (not fitted/always „0“)

**Note**

Readiness code is only generated if a 0 is shown at all places

Display group 107 - lambda regulation (for engines with engine identification characters AZH, AZJ)

- Engine idling - Control unit in function 04 - initiate basic setting						
System in basic setting 107 →				← Readout on display		
xxxx rpm	xx.x %	Text				
1	2	3	4	← Display fields	Specification	Analysis
				Result of diagnosis (Test ON / Test OFF, system OK / system not.OK)	System OK	—
					—	—
Lambda controller upstream of catalytic converter					-10,0...10,0 %	⇒ Chapter 01-6, display group 003, display field 1
Engine speed (idling speed)					—	⇒ Chap. 01-5, display group 001, display field 1

Display group 120 - traction control system -TCS- (for engines with engine identification characters AZH, AZJ)

Driveability						
Read measured value block 120 →				← Readout on display		
xxxx rpm	xxx Nm	xxx Nm	Text			
1	2	3	4	← Display fields	Specification	Analysis
				Status	TCS active / TCS n. active	—
Actual engine load					0...260 Nm	—
Nominal engine load					0..0.399 Nm	—
Engine speed					—	⇒ Chapter 01-5, display group 022, display field 1

Display group 122 - automatic gearbox

• Driveability						
Read measured value block 122 →				← Readout on display		
xxxx rpm	xxx Nm	xxx Nm	Text			
1	2	3	4	← Display fields	Specification	Analysis
				Status (engaged/not engaged)	Text	—
Actual engine load					0...260 Nm	—
Specified gearbox load					0..0.399 Nm	—
Engine speed					—	⇒ Chapter 01-5, display group 022, display field 1

Display group 125 - communication, databus messages

• Engine idling						
Read measured value block 125 →				← Readout on display		
Text	Text	Text	—			
1	2	3	4	← Display fields	Specification	Analysis
					—	—
Status of combiinstrument					Combi 1	—
Status ABS					ABS 1	—
Status of the automatic gearbox					Gearbox 1 ¹⁾	—

¹⁾ For engines with engine identification characters AZJ with automatic gearbox

Display group 126 - communication, databus messages

• Engine idling						
Read measured value block 126 →				← Readout on display		
—	—	Text	—			
1	2	3	4	← Display fields	Specification	Analysis
					—	—
Status airbag					Airbag 1	—
					—	—
					—	—

Analysis of display groups 125 and 126

Display -V.A.G 1552 -	Possible cause of fault	Rectifying fault
0 instead of 1	♦ CAB-BUS wiring defective ♦ CAN-BUS databus not used - control unit ♦ CAB-BUS databus defective - control unit	– Perform automatic test sequence on all error memories ⇒ Chapter 01-4

24 – Fuel Formation, Injection

24-1 Repairing the injection system

General Instructions

Special instructions regarding ignition system ⇒ Chapter 28-1.

- ♦ The engine control unit is equipped with a self-diagnosis system. Before commencing repairs and also for fault finding, first of all interrogate the fault memory. Also check the vacuum hoses and connections (unmetered air).
- ♦ Fuel lines must be secured only with spring strap clips. The use of clamp-type or screw-type clips is not allowed.
- ♦ Switch off the ignition before disconnecting and connecting the battery, as this may damage the 4AV control unit.
- ♦ Components marked with an * are checked by self-diagnosis ⇒ Chapter 01-1.
- ♦ Components marked with ** can be checked by final control diagnosis ⇒ Chap. 01-4.
- ♦ A minimum voltage of 11.5 V is required for perfect functioning of the electrical components.
- ♦ Do not use sealants containing silicone. Silicone particles are not combusted in the engine and damage the lambda probe.
- ♦ Certain inspections may cause the control unit to detect and store a fault. For this reason, after completing all the inspections and repairs, once again interrogate the fault memory, and erase it if necessary ⇒ Chapter 01-1.

Safety precautions ⇒ **24-1** page 1.

Cleanliness rules ⇒ **24-1** page 2.

Safety instructions



WARNING!

The fuel system is under pressure! Place a cloth around the connecting point before releasing hose connections or when opening the system. Then release pressure by carefully detaching.

Observe the following points to prevent injury to persons and/or damage to the injection and ignition system:

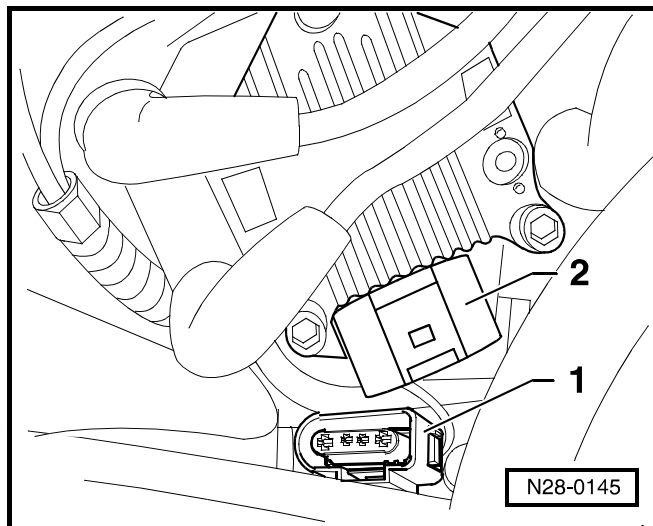
- ♦ Do not touch or remove ignition leads with the engine running or at start speed.
- ♦ Do not disconnect or connect cables of the fuel injection and ignition system, also not cables of test equipment, unless the ignition is switched off.

If test and measuring devices are required during test drives observe the following:

- ◆ Always secure the test and measuring devices on the rear seat and have a second person operate them there.
- ◆ If the test and measuring devices are operated from the passenger seat the passenger could be injured by the release of the passenger airbag in the event of an accident.

If the engine must be operated at start speed without the engine starting:

- Unplug 4-pin connector -1- from ignition transformer -2-.

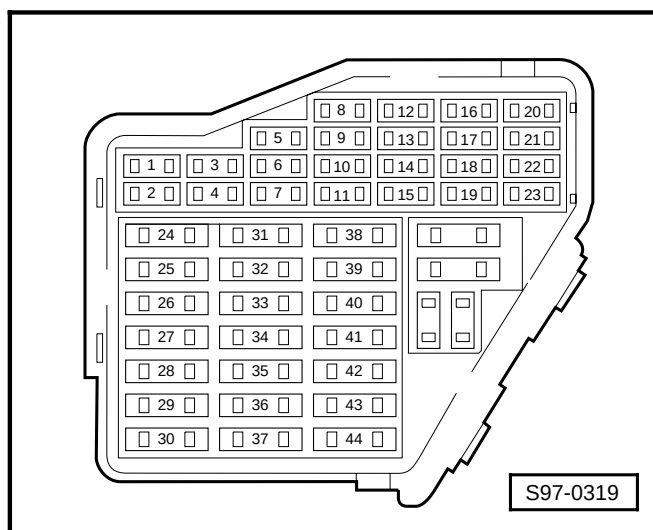


- Remove fuse 28 for the fuel delivery unit.

Rules of cleanliness

Pay careful attention to the following five rules for cleanliness when working on the fuel supply or fuel injection system:

- ◆ Thoroughly clean the connection points and their surroundings before releasing.
- ◆ Place removed parts on a clean surface and cover. Do not use fuzzy cloths!
- ◆ Carefully cover or close opened components if the repair is not completed immediately.
- ◆ Only install clean parts: Remove spare parts from their wrapping immediately before fitting. Do not use any parts which have been stored unwrapped (e.g. in tool boxes etc.).
- ◆ When the system is open: Avoid using compressed air. Avoid moving the vehicle.



Individual components of system - Installation overview

For engines with engine identification characters AEG, APK, AQY, AZH

1 - Activated charcoal filter solenoid valve -N80-^{*/**}

- ☐ Activated charcoal filter
⇒ 2.0 I/85 kW Engine, Mechanical Components; Rep. Gr. 20

2 - Plug connection for lambda probe upstream of catalytic converter

- ☐ for engines with engine identification characters AEG, APK, AQY - 4-pin
- ☐ for engines with engine code AZH - 6-pin
- ☐ driver side on right

3 - Plug connection for lambda probe downstream of catalytic converter

- ☐ for engines with engine codes AQY, AZH
- ☐ 4-pin
- ☐ driver side on right

4 - Throttle valve control unit -J338 - ***5 - Engine control unit -J220-***

- ☐ below the water box cover

6 - Combination valve

- ☐ for engines with engine codes AQY, AZH

7 - Sender for coolant temperature -G62-*

- ☐ resistances ⇒ Fig. 1 in **24-1** page 10

8 - Secondary air injection valve -N112 -^{*/**}

- ☐ only engines with engine codes AQY, AZH ➤ 07.2000
- ☐ valve internal resistance 25...45 Ω
- ☐ Secondary air pump ⇒ 2.0 I/85 kW Engine, Mechanical Components; Rep. Gr. 26

9 - Relay carrier

- ☐ only engines with engine codes AQY, AZH
- ☐ the secondary air pump relay is also located here -J299-
- ☐ the Motronic current supply relay is also located here -J271-

10 - Air mass meter -G70-* with intake air temperature sender -G42-***11 - Injectors -N30-...-N33-^{*/**}**

- ☐ ⇒ item 8 in **24-1** page 9

12 - Secondary air pump -V101-

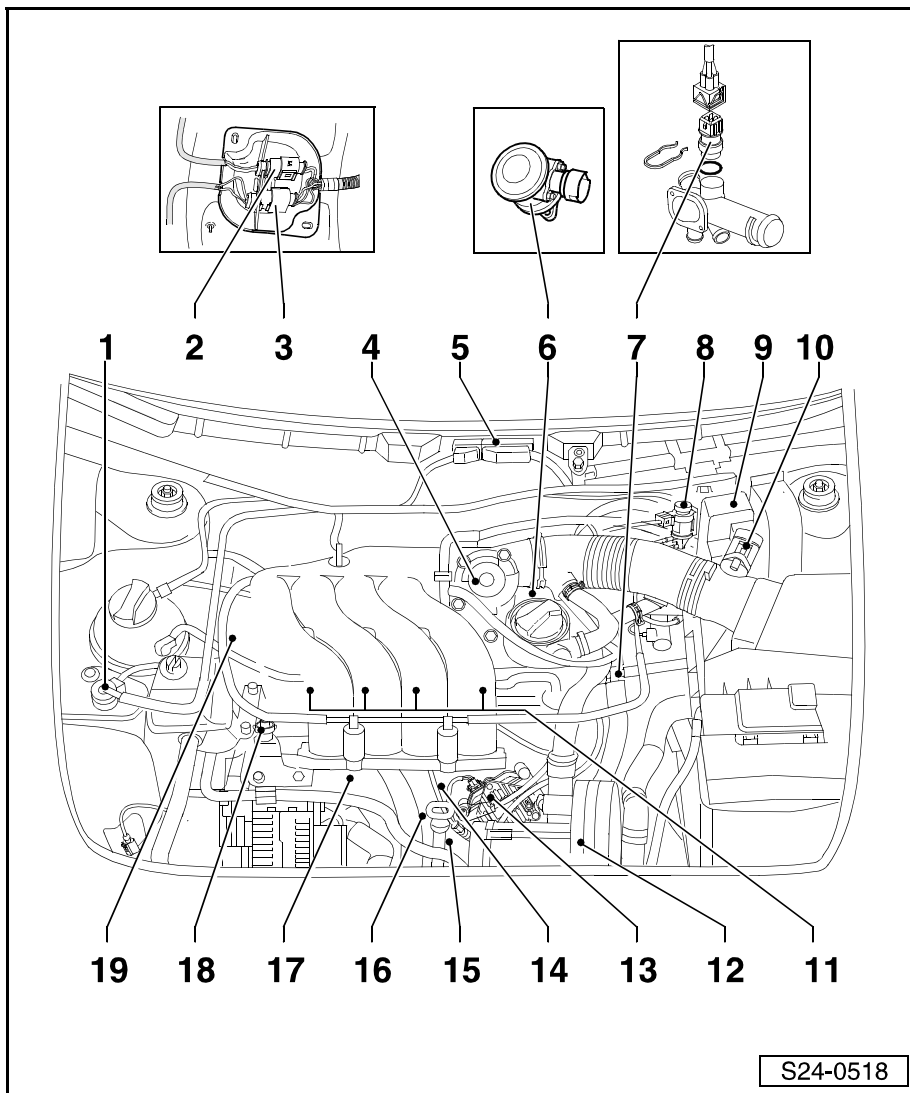
- ☐ only engines with engine codes AQY, AZH
- ☐ Secondary air pump ⇒ 2.0 I/85 kW Engine, Mechanical Components; Rep. Gr. 26

13 - Ignition transformer *

- ☐ with power output stage -N122-
- ☐ with ignition coils -N-, -N128-
- ☐ inspect ⇒ Chapter 28-1

14 - Knock sensor 2 -G66-***15 - Engine speed sender -G28 - ***

- ☐ inductive pickup
- ☐ Fitting location: under the oil filter in the cylinder block



☐ ⇒ item 17 in **24-1** page 7

16 - 3-pin plug connection

☐ for the engine speed sender -G28- grey

17 - Knock sensor 1 -G61-*

18 - Fuel pressure regulator

19 - Camshaft position sensor -G40 -*

☐ inspect ⇒ Chapter 28-1

For engines with engine code AZJ

1 - Activated charcoal filter solenoid valve -N80-*/**

☐ Activated charcoal filter
⇒ 2.0 l/85 kW Engine, Mechanical Components;
Rep. Gr. 20

2 - Return-flow line

☐ secure with spring strap clip

3 - Feed line

☐ secure with spring strap clip

4 - Camshaft position sensor -G40-*

5 - Valve for variable intake manifold changeover -N156-

6 - Top part of intake manifold

☐ disassembling and assembling ⇒ **24-1** page 10

7 - Bottom part of intake manifold

☐ disassembling and assembling ⇒ **24-1** page 8

8 - 81-pin plug connection

☐ insert and remove plug when the ignition is switched off
☐ unlock for removing

9 - Engine control unit -J220-*

☐ below the water box cover

10 - 40-pin plug connection

☐ insert and remove plug when the ignition is switched off
☐ unlock for removing

11 - Throttle valve control unit -J338 -*

12 - Combination valve

☐ Secondary air pump ⇒ 2.0 l/85 kW Engine, Mechanical Components; Rep. Gr. 26

13 - Relay carrier

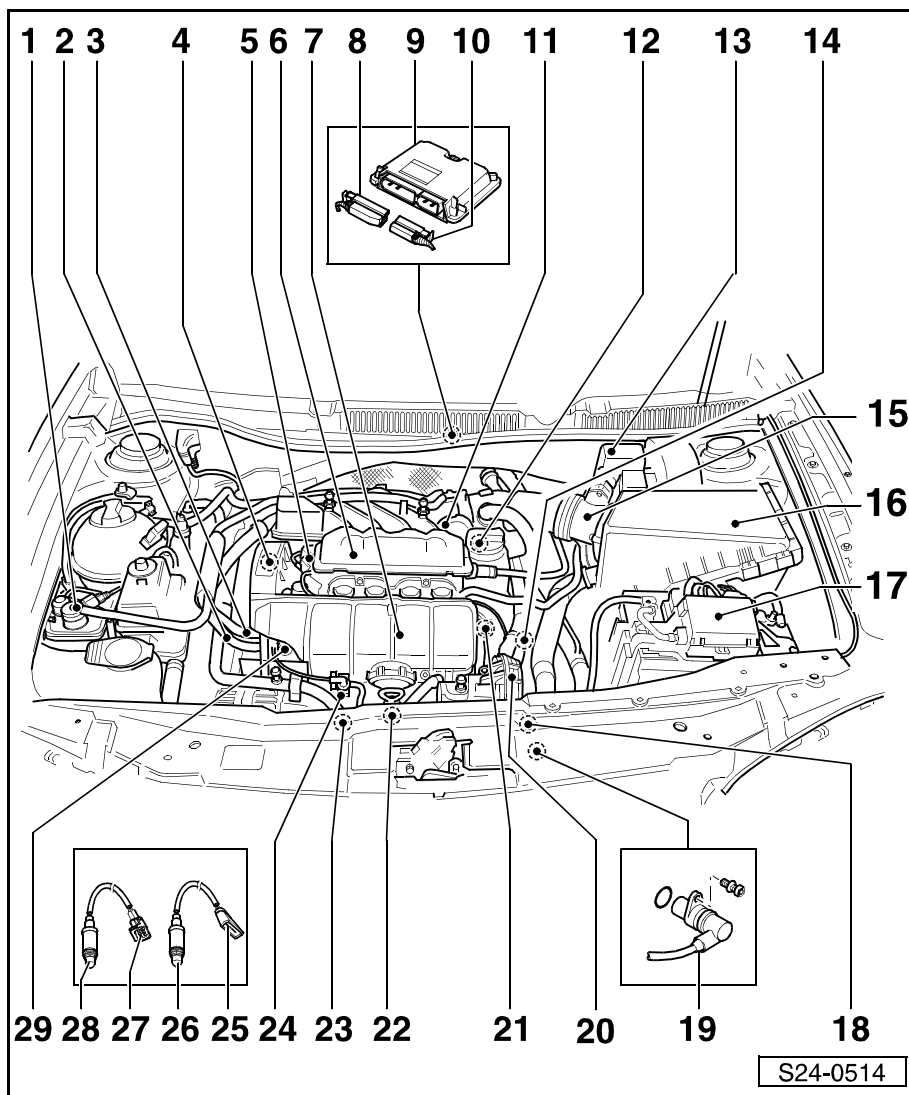
☐ the secondary air pump relay -J299- and the Motronic current supply relay -J271- is also located here

14 - Sender for coolant temperature -G62-*

☐ resistances ⇒ Fig. 1 in **24-1** page 10
☐ with coolant temperature gauge sensor -G2-
☐ before removing, reduce pressure in cooling system if necessary

15 - Air mass meter -G70-* with intake air temperature sender -G42-*

16 - Air filter



S24-0514

- ☐ disassembling and assembling ⇒ **24-1** page 8

17 - Main fuse box

18 - ignition coil with power output stage (- N70-, -N127-, -N291-, -N292-)

19 - Engine speed sender -G28 -*

- ☐ inductive pickup
- ☐ Fitting location: under the oil filter in the cylinder block
- ☐ ⇒ item 17 in **24-1** page 7

20 - Secondary air pump -V101-

- ☐ Secondary air pump ⇒ 2.0 l/85 kW Engine, Mechanical Components; Rep. Gr. 26

21 - Injectors -N30-...-N33-*/**

- ☐ ⇒ item 8 in **24-1** page 9
- ☐ with air ring

22 - Knock sensor 2 -G66-*

23 - Knock sensor 1 -G61-*

24 - Valve 2 for variable intake manifold changeover -N261-

25 - Plug connection for lambda probe downstream of catalytic converter

- ☐ 4-pin
- ☐ driver side on right

26 - Lambda probe after catalyst -G130 -*, 50 Nm

- ☐ Fitting location: in exhaust pipe downstream of catalytic converter
- ☐ coat only thread with hot bolt paste „G052 112 A3“; the hot bolt paste must not get into the slots of the probe body
- ☐ Testing lambda probe and lambda control downstream of catalytic converter ⇒ Chapter 24-3

27 - Plug connection for lambda probe upstream of catalytic converter

- ☐ 6-pin
- ☐ driver side on right

28 - Lambda probe upstream of catalytic converter -G39-*, 50 Nm

- ☐ Fitting location: in the 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
- ☐ Testing lambda probe and lambda control upstream of catalytic converter ⇒ Chapter 24-3
- ☐ Test lambda probe ageing upstream of catalytic converter ⇒ Chapter 24-3

29 - Fuel pressure regulator

- ☐ Test fuel pressure regulator and holding pressure ⇒ Chap. 24-2

Removing and installing parts of the injection system

For engines with engine identification characters
AEG, APK, AQY, AZH

1 - Top part of intake manifold**2 - from activated charcoal filter solenoid valve -N80-**

- ☐ Activated charcoal filter
⇒ 2.0 l/85 kW Engine, Mechanical Components;
Rep. Gr. 20

3 - Plug connection

- ☐ for engines with engine identification characters AEG, APK, AQY - 52-pin
- ☐ for engines with engine code AZH - 81-pin
- ☐ insert and remove plug when the ignition is switched off
- ☐ unlock for removing

4 - Engine control unit -J220-*

- ☐ Fitting location: in plenum chamber
- ☐ testing voltage supply
⇒ Chapter 24-4
- ☐ procedure if voltage interrupted ⇒ Chapter 24-4
- ☐ replacing ⇒ Chapter 24-4

5 - Plug connection

- ☐ for engines with engine identification characters AEG, APK, AQY - 28-pin
- ☐ for engines with engine code AZH - 40-pin
- ☐ insert and remove plug when the ignition is switched off
- ☐ unlock for removing

6 - Secondary air injection valve -N112 -

- ☐ only engines with engine codes AQY, AZH ➤ 07.2000

7 - Air filter

- ☐ disassembling and assembling ⇒ **24-1** page 8

8 - 10 Nm**9 - to air guide pipe**

- ☐ to injectors with air ring

10 - Air intake hose

- ☐ only engines with engine codes AQY, AZH
- ☐ to secondary air pump -V101-

11 - 6 Nm**12 - Connector**

- ☐ 4-pin
- ☐ to coolant temperature sender -G62-

13 - Sender for coolant temperature -G62-*

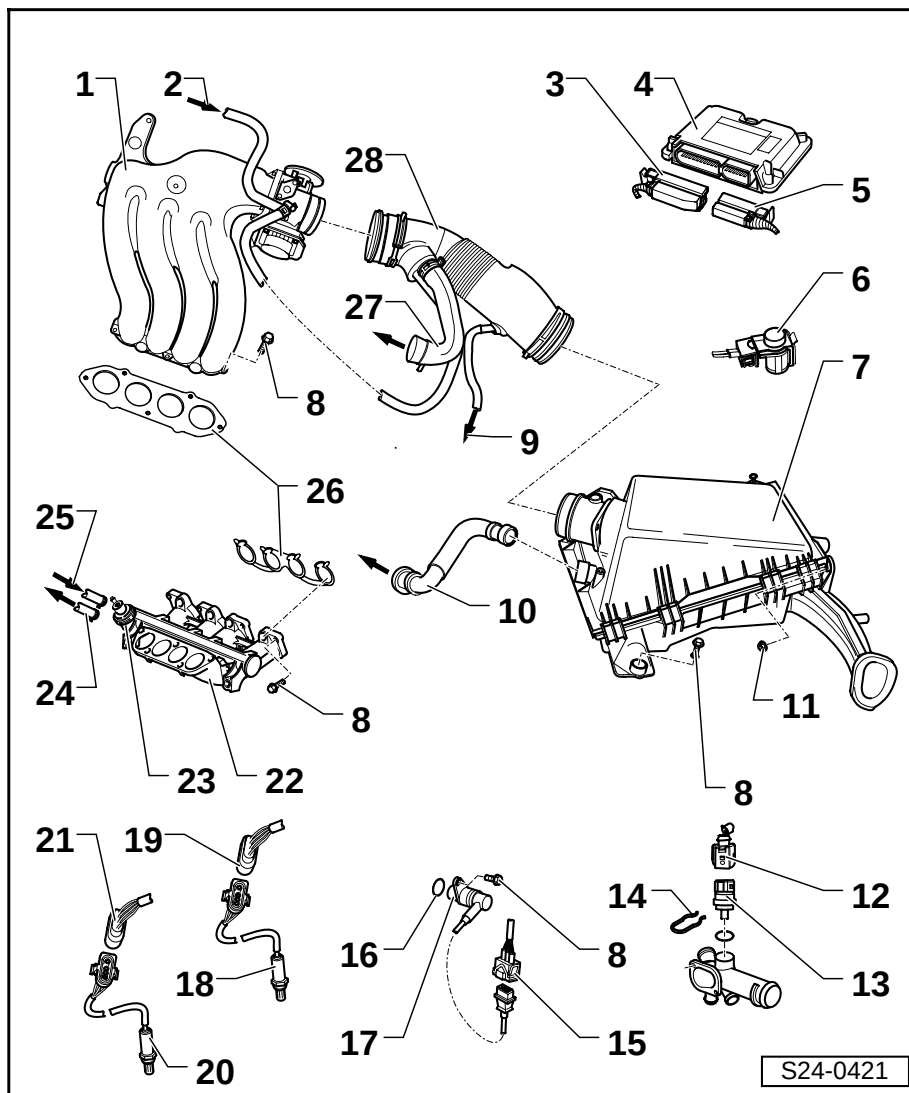
- ☐ with coolant temperature gauge sensor -G2-
- ☐ before removing, reduce pressure in cooling system if necessary
- ☐ resistances ⇒ Fig. 1 in **24-1** page 10

14 - Retaining clip

- ☐ check tightness

15 - 3-pin connector

- ☐ grey



- ☐ for engine speed sender -G28 -

16 - O-ring

- ☐ replace if damaged

17 - Engine speed sender -G28 - *

- ☐ resistance between contacts 480...1000 Ω

18 - Lambda probe after catalyst -G130 -*, 50 Nm

- ☐ Fitting location: in exhaust pipe downstream of catalytic converter
- ☐ only engines with engine codes AQY, AZH
- ☐ Testing lambda probe and lambda control downstream of catalytic converter ⇒ Chapter 24-3

19 - Plug connection for lambda probe downstream of catalytic converter

- ☐ only engines with engine codes AQY, AZH
- ☐ 4-pin
- ☐ Brown
- ☐ for lambda probe downstream of catalytic converter -G130- and lambda probe heater downstream of catalytic converter -Z29-
- ☐ Fitting location ⇒ item 3 in **24-1** page 3

20 - Lambda probe upstream of catalytic converter -G39-*, 50 Nm

- ☐ Fitting location: in the 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
- ☐ Power supply of probe heating via fuel pump relay -J17-
- ☐ Testing lambda probe and lambda control upstream of catalytic converter ⇒ Chapter 24-3
- ☐ Test lambda probe ageing upstream of catalytic converter ⇒ Chapter 24-3

21 - Plug connection for lambda probe upstream of catalytic converter

- ☐ for engines with engine identification characters AEG, APK, AQY - 4-pin
- ☐ for engines with engine code AZH - 6-pin
- ☐ black
- ☐ for lambda probe -G39- upstream of catalytic converter and lambda probe heater upstream of catalytic converter -Z19-
- ☐ Fitting location ⇒ item 2 in **24-1** page 3

22 - Bottom part of intake manifold

- ☐ disassembling and assembling ⇒ **24-1** page 8

23 - Fuel rail with injection valves

- ☐ disassemble and assemble bottom part of intake manifold ⇒ **24-1** page 8

24 - Fuel return-flow line

- ☐ blue
- ☐ secure with spring strap clamps
- ☐ Check fitting position
- ☐ to fuel delivery unit in fuel tank ⇒ 2.0 l/85 kW Engine, Mechanical Components; Rep. Gr. 20

25 - Fuel feed line

- ☐ black
- ☐ from fuel filter ⇒ 2.0 l/85 Engine, Mechanical Components; Rep. Gr. 20

26 - Gasket

- ☐ replace if damaged
- ☐ Check fitting position

27 - To crankcase vent valve**28 - Air intake hose**

Disassembling and assembling the air filter

- 1 - Air mass meter -G70-* with intake air temperature sender -G42-***

☐ -G42- resistances ⇒ Fig. 1 in **24-1** page 10

- 2 - Gasket ring**

☐ replace if damaged

- 3 - Air filter top part**

- 4 - 6 Nm**

- 5 - Air deflector**

☐ in air filter top part

- 6 - Filter insert**

- 7 - 10 Nm**

- 8 - Air filter bottom part**

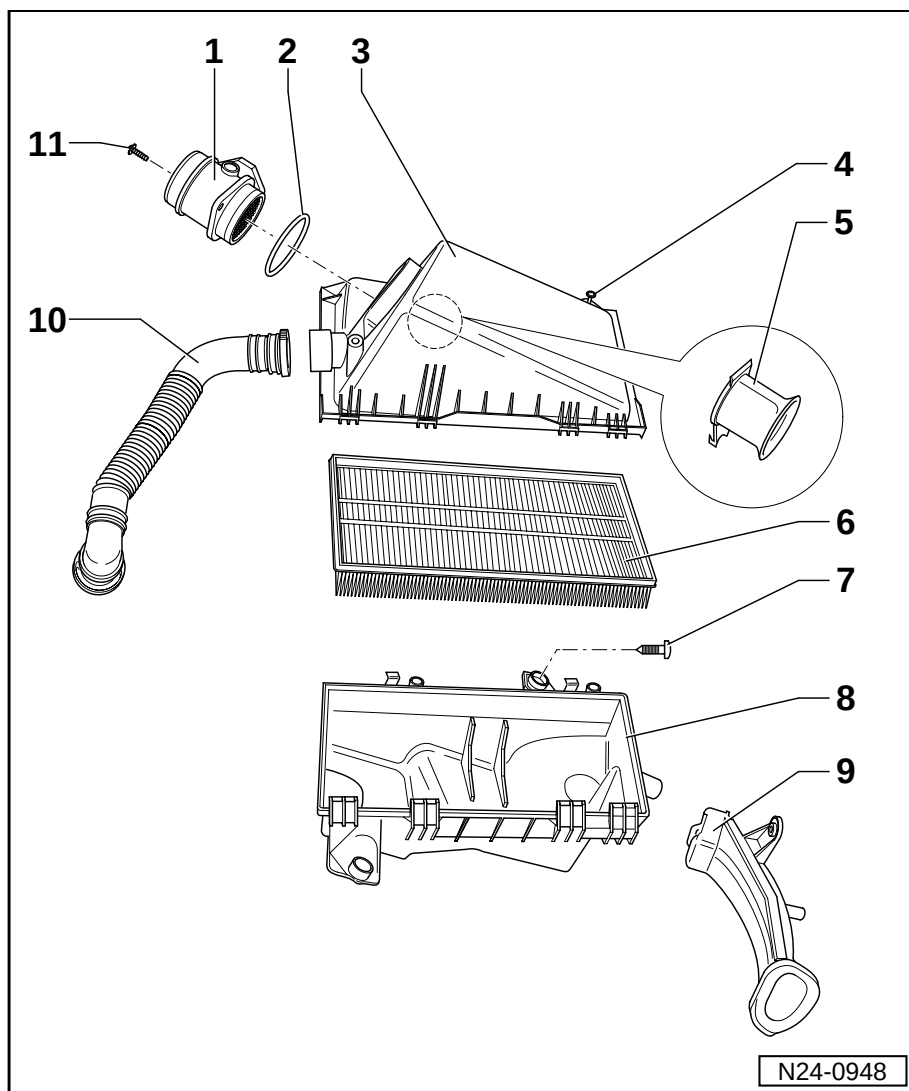
- 9 - Air deflector**

- 10 - Air intake hose**

☐ For engines with engine identification characters AQY, AZH, AZJ

☐ to secondary air pump

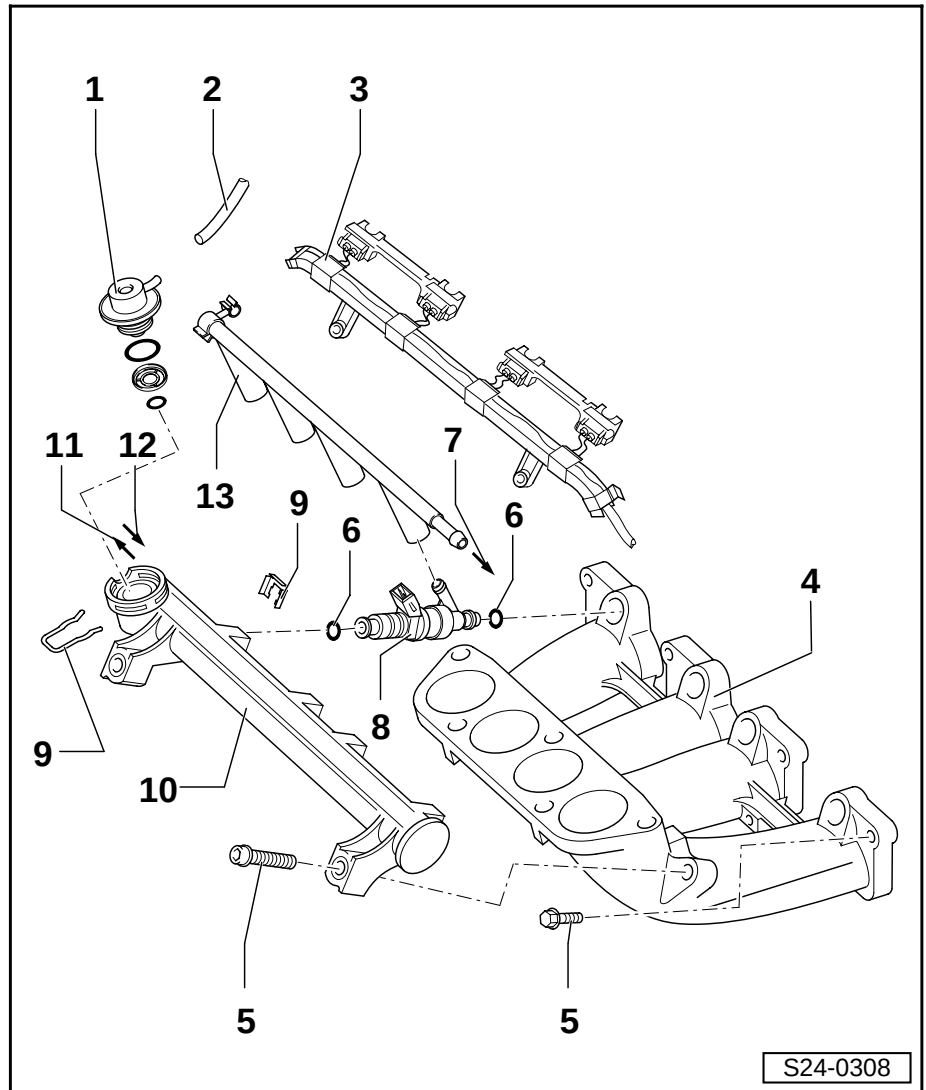
- 11 - 6 Nm**



Disassembling and assembling bottom part of intake manifold

For engines with engine identification characters
AEG, APK, AQY, AZH

- 1 - Fuel pressure regulator**
 - ☐ Test fuel pressure regulator and holding pressure
⇒ Chap. 24-2
- 2 - Vacuum hose**
 - ☐ to top part of the intake manifold
- 3 - Cable rail**
 - ☐ for connector for injection valves -N30-...-N33-
- 4 - Bottom part of intake manifold**
- 5 - 10 Nm**
- 6 - O-ring**
 - ☐ replace
 - ☐ before fitting moisten lightly with clean engine oil
- 7 - To intake hose**
- 8 - Injector -N30-...-N33-^{*/**}**
 - ☐ Air flushing
 - ☐ resistance 14.0...17.0 Ω (at 20 °C)
- 9 - Retaining clip**
 - ☐ check tightness
- 10 - Fuel distributor**
- 11 - Fuel return-flow line**
- 12 - Fuel feed line**
- 13 - Air guide pipe**
 - ☐ to air flushing of the injector



For engines with engine code AZJ

- 1 - Fuel rail with injection valves
- 2 - Vacuum hose
 - ☐ to top part of the intake manifold
- 3 - Cable rail
- 4 - O-ring
 - ☐ replace if damaged
- 5 - Bottom part of intake manifold
 - ☐ with variable intake manifold changeover
- 6 - to the vacuum setting element
 - ☐ at the rear side of the intake manifold - lower part
- 7 - 3 Nm
- 8 - Valve 2 for variable intake manifold changeover -N261-
- 9 - 5 Nm
- 10 - Washer
- 11 - 25 Nm
- 12 - from the top part of the intake manifold
- 13 - Gasket ring
 - ☐ replace

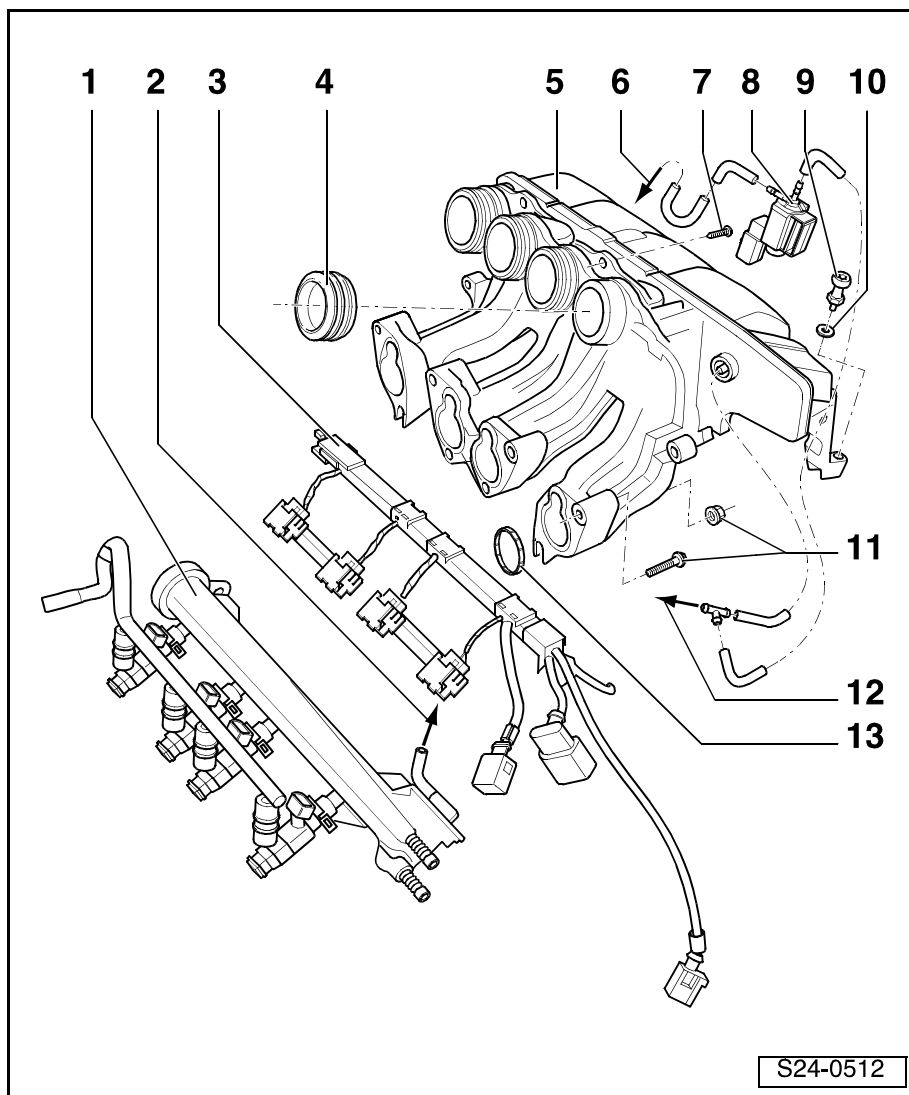


Fig. 1: resistances

Chart applies to:

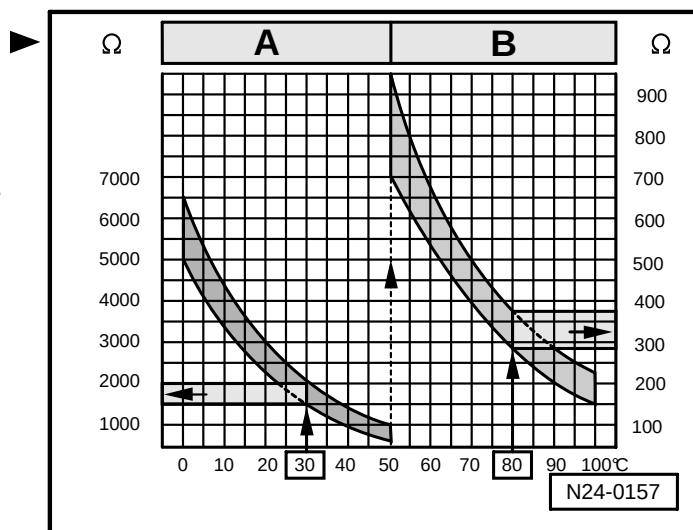
- ◆ Coolant temperature sender -G62 - at contacts 3 + 4.
- ◆ Intake air temperature sender -G42- at contacts 1 + 3.

The diagram is divided into two temperature ranges:

- A - from 0 to 50°C
- B - from 50 to 105°C

Read out examples:

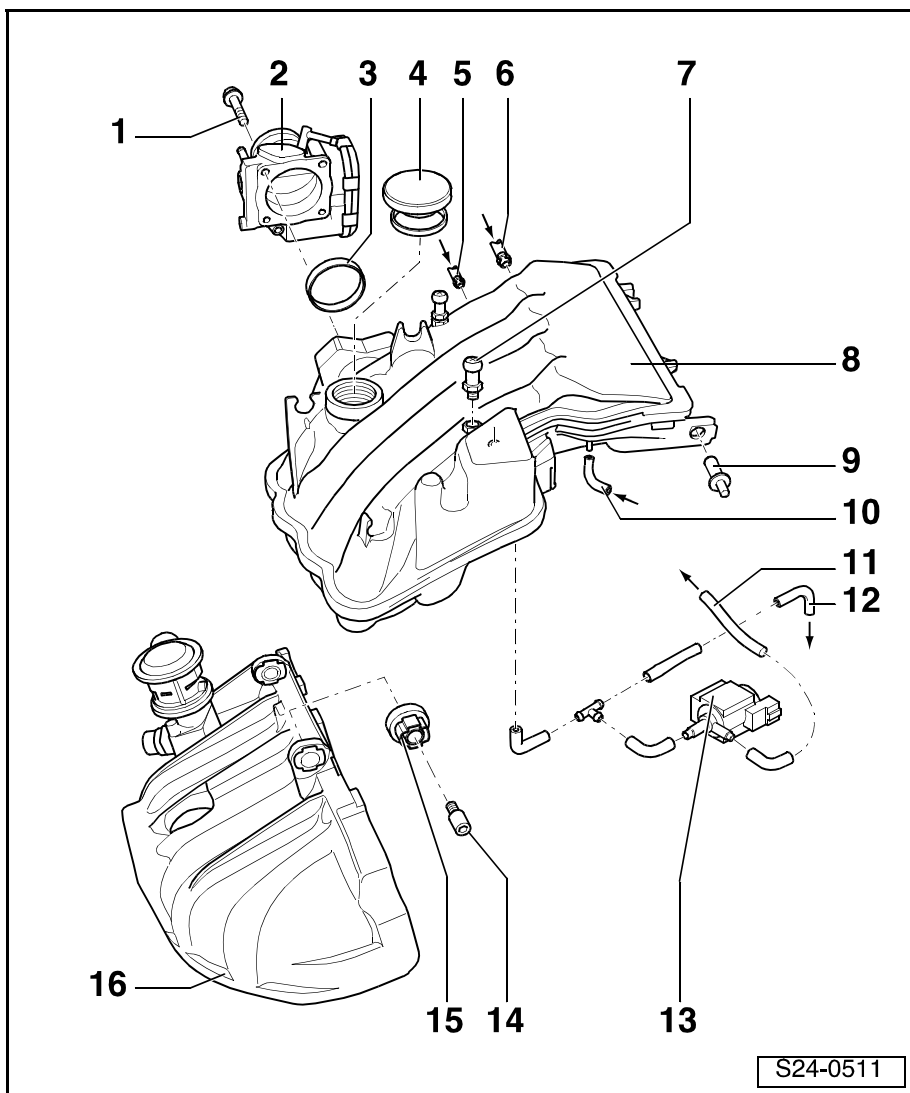
- ◆ For a temperature of 30°C the specification is 1500...2000 Ω
- ◆ For a temperature of 80°C the specification is 275...375 Ω



Disassembling and assembling top part of intake manifold

For engines with engine code AZJ

- 1 - 8 Nm
- 2 - Throttle valve control unit
-J338 -*
- 3 - Gasket ring
☐ replace if damaged
- 4 - Pressure relief valve
☐ protects intake manifold from
damage if excess pressure
exists
- 5 - Vacuum hose
☐ from the suction hose
- 6 - To the brake servo unit
- 7 - 5 Nm
- 8 - Top part of intake manifold
☐ with variable intake manifold
changeover
- 9 - Body-bound rivet
- 10 - Vacuum hose
☐ from the fuel pressure regu-
lator
- 11 - to the vacuum setting element
☐ on the underside of the upper
part of the intake manifold
- 12 - to the T union
- 13 - Valve for variable intake man-
ifold changeover -N156-
- 14 - 8 Nm
- 15 - Rubber bush
- 16 - Heat shield with intake mani-
fold cover

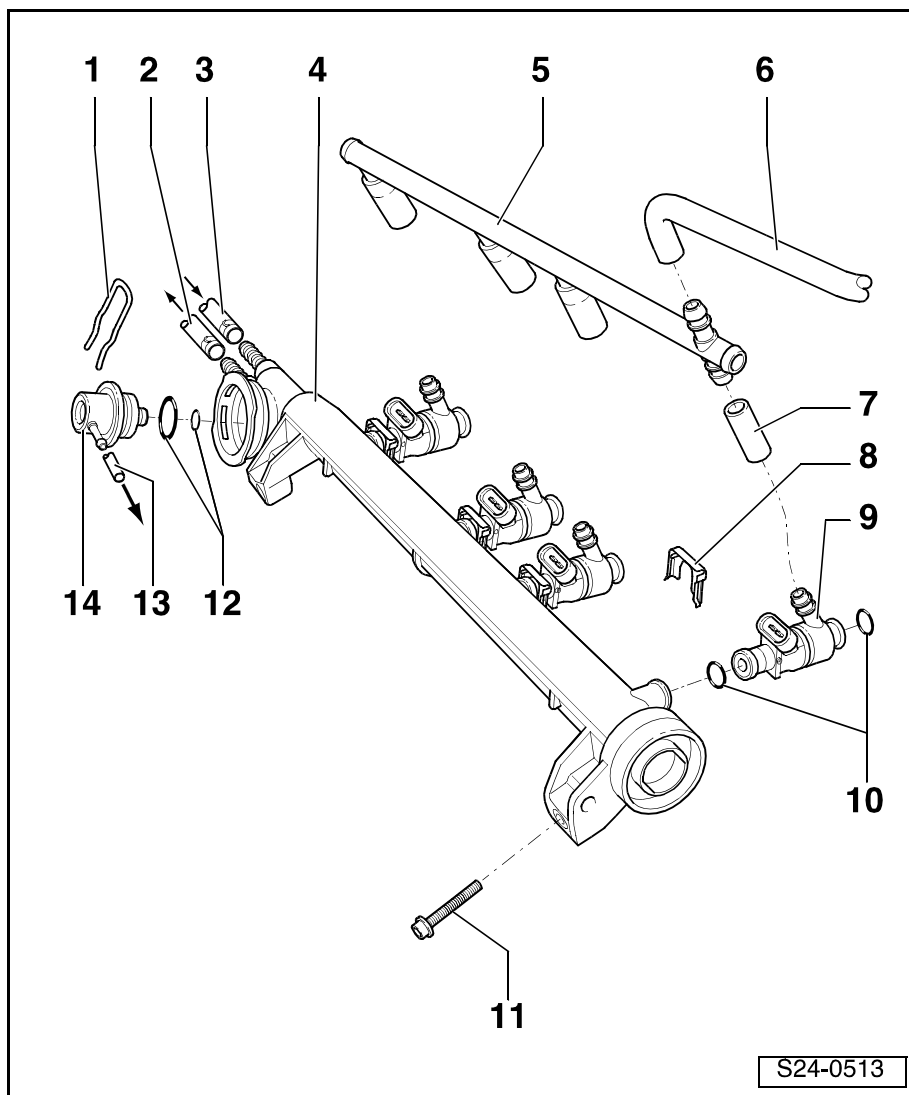


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Disassembling and assembling fuel distributor with injectors

For engines with engine code AZJ

- 1 - Retaining clip**
 - ☐ check for firm seating
- 2 - Connection return-flow line**
 - ☐ blue or marked in blue
 - ☐ secure with spring strap clip
 - ☐ check for firm seating
 - ☐ to fuel delivery unit in fuel tank
- 3 - Connection feed line**
 - ☐ black with a white marking
 - ☐ secure with spring strap clip
 - ☐ check for firm seating
 - ☐ from fuel filter
- 4 - Fuel distributor**
- 5 - Air guide pipe**
- 6 - To intake hose**
- 7 - Air guide hose**
 - ☐ to air flushing of the injector
- 8 - Retaining clip**
 - ☐ check tight connection of injectors in fuel rail
- 9 - Injector (-N30-...-N33-).**
 - ☐ Air flushing
 - ☐ resistance 14.0...17.0 Ω (at 20 °C)
- 10 - O-ring**
 - ☐ replace
 - ☐ before fitting moisten lightly with clean engine oil
- 11 - 8 Nm**
- 12 - O-ring**
 - ☐ replace
- 13 - Vacuum hose**
 - ☐ to top part of the intake manifold
- 14 - Fuel pressure regulator**
 - ☐ Test fuel pressure regulator and holding pressure ⇒ Chap. 24-2



24-2 Testing components

Testing cables with test box -V.A.G 1598/22- or -V.A.G 1598/31-

Special tools, test and measuring equipment and auxiliary items required

- ♦ Test box -V.A.G 1598/22- or - V.A.G 1598/31-



Note

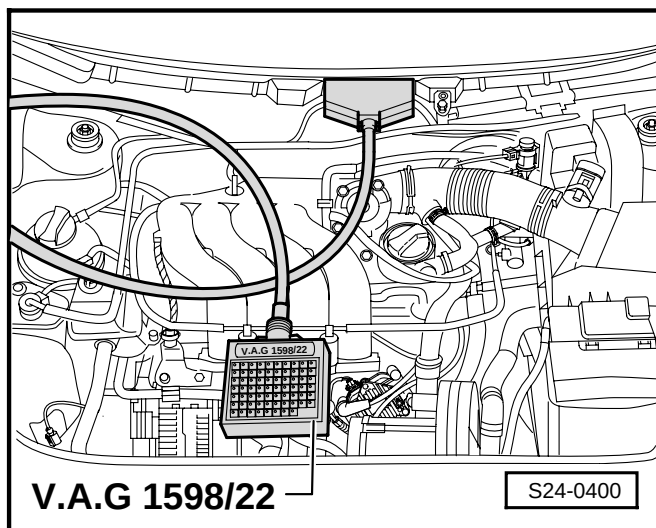
- ♦ Use adapter cables from adapter cable set for connecting the test equipment to the test box.
- ♦ The contact numbers of the connector of the engine control unit and the socket numbers of the test box agree.

Procedure

- Switch off ignition.
- Unscrew windscreen wipers and cooling water tank cover ➔ Body Work; Rep. Gr. 66.
- Release the connector catches and unplug the engine control unit connectors.

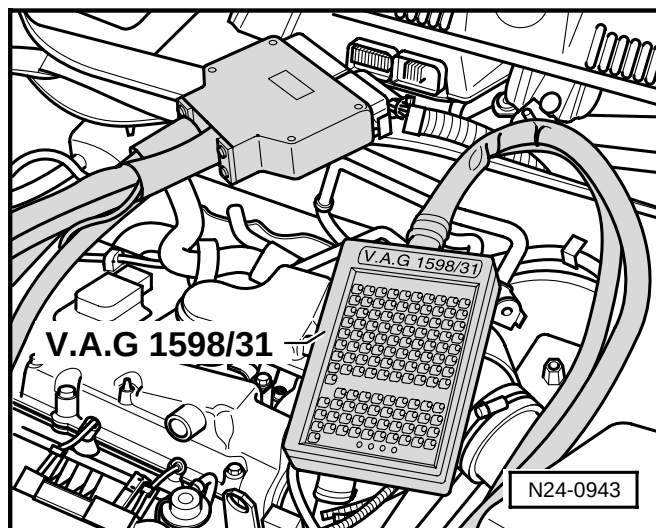
For engines with engine codes AEG, APK, AQY

- Connect test box -V.A.G 1598/22- to connector of wiring loom. ➔
- Perform test as described in the relevant repair sequences.



For engines with engine codes AZH, AZJ

- Connect test box -V.A.G 1598/31- to connector of wiring loom. The earth clip of the test box must be connected to the negative battery terminal. ➔
- Whether the engine control unit remains connected to the test box or not, is described in the relevant test procedures.



Testing throttle valve control unit -J338-



Note

If the throttle valve control unit is replaced, it is then essential to adapt this new control unit to the engine control unit ➔ Chapter 24-4.

Special tools, test and measuring equipment and auxiliary items required

- ♦ Handheld multimeter, e.g. -V.A.G 1526 A oder B-
- ♦ Measuring tool set, e.g. -V.A.G 1594 A, B oder C-

Test conditions

- Throttle valve must be in the idling position.
- Throttle cable must be correctly set, inspecting ⇒ 2.0 l/85 kW Engine, Mechanical Components; Rep. Gr. 20
- On vehicles with an automatic gearbox the selector lever must be in position „P“ or „N“.
- If vehicle is equipped with air conditioning, this must be switched off.
- If the vehicle is equipped with cruise control, it must be correctly set.

Testing throttle valve drive -V60-

Test sequence

- Unplug connector from throttle valve control unit.
- Measure resistance of throttle valve positioner between the following contacts:

For engines with engine codes AEG, APK, AQY

Models with CCS: Contact 7 + 8

Models without CCS: Contact 1 + 2

For engines with engine codes AZH, AZJ

Contact 3 + 5

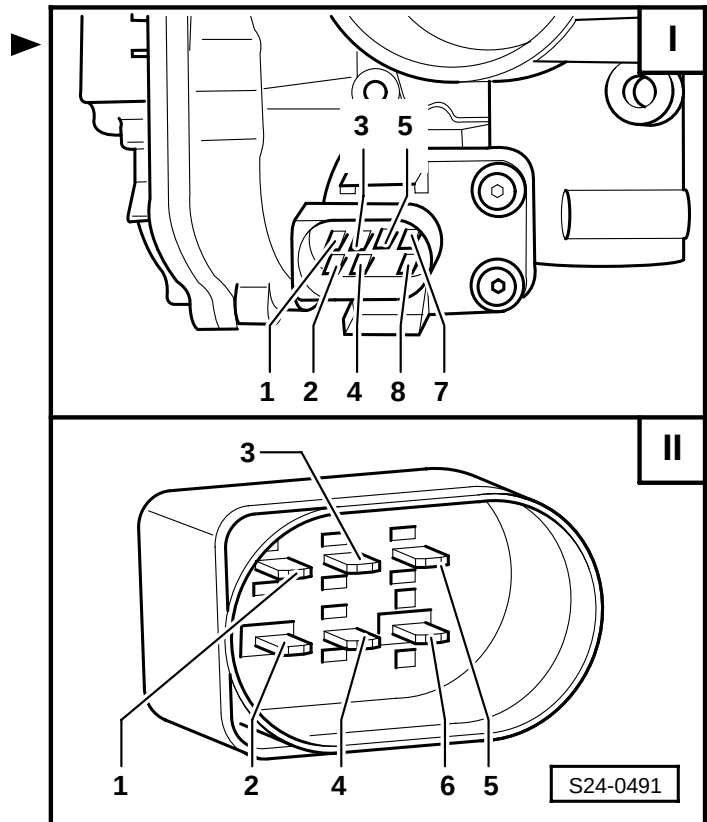
Specified value: 1...5 Ω

If the specified value is reached:

- Test voltage supply and cables to throttle valve control unit ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations.

If the specified value is not reached:

- Replace throttle valve control unit -J338-.
- Adapt engine control unit to throttle valve control unit ⇒ Chapter 24-4.



Testing accelerator pedal position sender

For engines with engine codes AZH, AZJ

Special tools, test and measuring equipment and auxiliary items required

- ♦ Handheld multimeter, e.g. -V.A.G 1526 A oder B-
- ♦ Measuring tool set, e.g. -V.A.G 1594 A, B oder C-

Operation

The two accelerator pedal position senders -G79- and -G185- are located at the accelerator pedal and pass on

the driver input to the engine control unit completely independently of each other (when accelerator is depressed). Both senders are located in a housing.

Test condition

- Battery voltage at least 11.5 V.

Testing voltage supply and cables to engine control unit

- Remove bottom part of dash panel on left ⇒ Body Work; Rep. Gr. 70.
- Separate the 6-pin plug connection of the accelerator pedal position sender.
- Switch on ignition.
- Connect the multimeter for voltage measurement to the following contacts of the connector: ➤

Contact 1 + earth

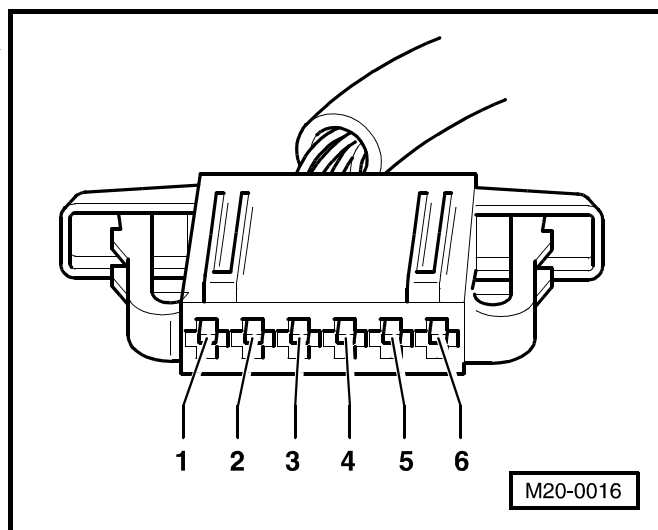
Contact 1 + 5

Contact 2 + earth

Contact 2 + 3

Specified value: min. 4.5 V

- If the specified values are not reached:
- Test cables to accelerator pedal position sender for open circuit or short circuit to earth or to positive ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations



If the lines are not found to be faulty:

- Replace accelerator pedal position sender.

Testing injected quantity and injectors for leaks

Special tools, test and measuring equipment and auxiliary items required

- ♦ Remote control, e.g. -V.A.G 1348/3A-
- ♦ Adapter, e.g. -V.A.G 1348/3-2-
- ♦ Measuring glasses, e.g. -V.A.G 1602-
- ♦ Measuring tool set, e.g. -V.A.G 1594 A, B oder C-

Test condition

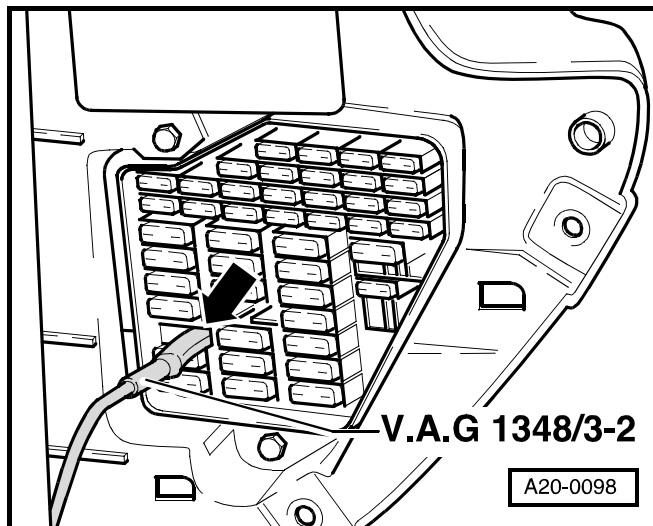
- The fuel pressure must be OK, test ⇒ **24-2** page 5
- Fuel pump relay -J17- OK
- Fuel temperature 15...20°C.
- Ambient temperature.
- The fuel used for testing must conform to the valid standards.

Test sequence

- Remove the fuel rail with injection valves from the intake manifold (the fuel hoses remain connected) ⇒ Chapter 24-1.
- Detach air guide pipe for air flushing of the injectors
- Detach vacuum hose from fuel pressure regulator.
- Lift fuel rail together with injectors off intake manifold and support.

Check tightness

- Connect adapter cable with adapter -V.A.G 1348/3-2- to fuse socket no. 28 -arrow-.



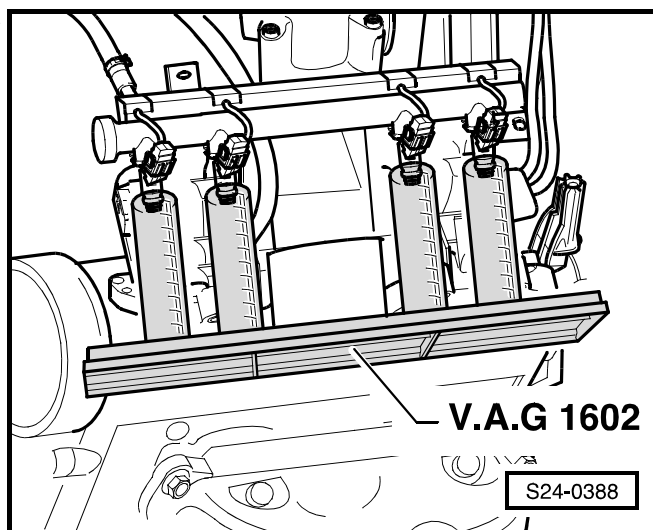
- Hold the injectors in the measuring glasses.
- Connect alligator clip to battery positive (+).

The fuel delivery unit must start running.

- Test the tightness of the injectors (visual inspection). With the fuel delivery unit running, only 1 to 2 drops a minute should drip out at each valve.

If the fuel loss is greater than this:

- Switch off the voltage supply of the fuel delivery unit and replace the leaking injection valve.



Note

Always fit new seals.

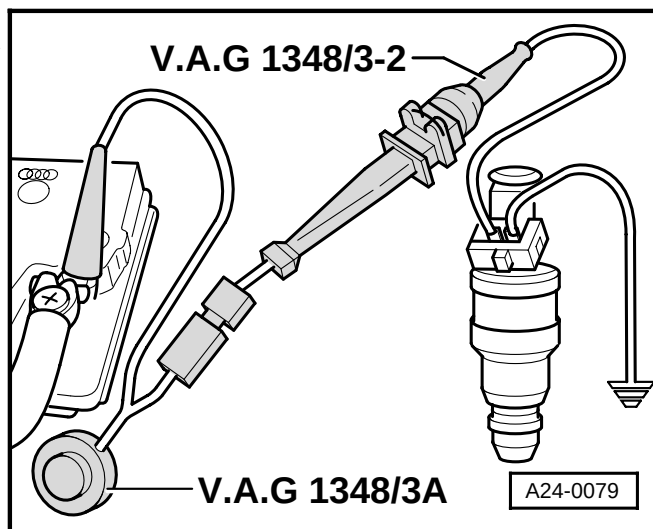
Testing fuel injected quantity

- Insert the injectors to be tested in the measuring glasses.
- Connect one contact of injector to the battery earth.
- Connect the second contact of the injector to the remote control.
- Connect terminal to battery positive (+).
- Connect battery positive (+) and fuse socket No. 28 with adapter cable and adapter -V.A.G 1348/3-2-.

The fuel delivery unit must start running.

- Operate remote control for 30 seconds.
- Repeat test at the other injectors. Always use a new measuring glass.
- Once all the injectors have been driven, position the graduated measuring glasses on an even base.
- Switch off voltage supply of fuel delivery unit.
- Compare the individual quantities of fuel injected.

Specified value: 88...98 ml per valve.



If the measurement obtained for one or several injectors is not within the specification:

- Replace the faulty injector.



Note

When testing the injection rate also check the jet formation. The jet must be the same for all valves.

The injectors are installed in the reverse order.

Pay attention to the following:

- ♦ Replace the O-rings and all the injectors and moisten lightly with clean engine oil.
- ♦ Insert injectors vertically and into the correct position in the fuel rail and secure with retaining clips.

Testing fuel pressure regulator and holding pressure

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

Special tools, test and measuring equipment and auxiliary items required

- ♦ Pressure gauge appliance e.g. -V.A.G 1318-
- ♦ Adapter, e.g. -V.A.G 1318/10-
- ♦ Adapter, e.g. -V.A.G 1318/11-
- ♦ Adapter, e.g. -V.A.G 1318/16-

Test condition

- Delivery rate of fuel delivery unit o.k., testing ⇒ 2.0 l/85 kW Engine, Mechanical Components; Rep. Gr. 20

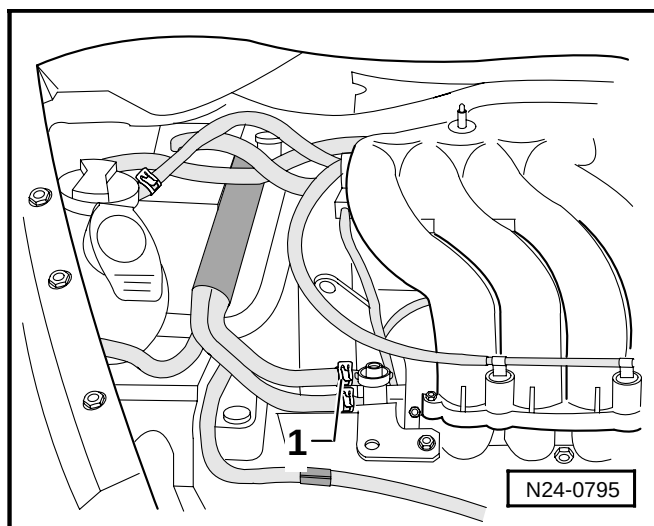
Test sequence



WARNING!

The fuel system is under pressure! Place a cloth around the connecting point before releasing hose connections or when opening the system. Then release pressure by carefully detaching.

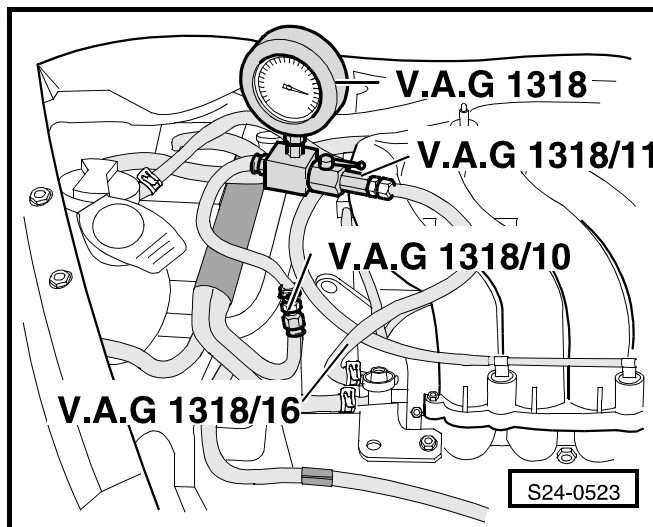
- Pull off the fuel feed line -1- and gather residual fuel in a cloth. ►



- Connect up the pressure measuring device.
- Open shut-off cock of the pressure measuring device. Lever points in direction of flow.
- Start engine and run in idle.
- Measure fuel pressure.

Specified value: approx. 0.25 MPa (2.5 bar)

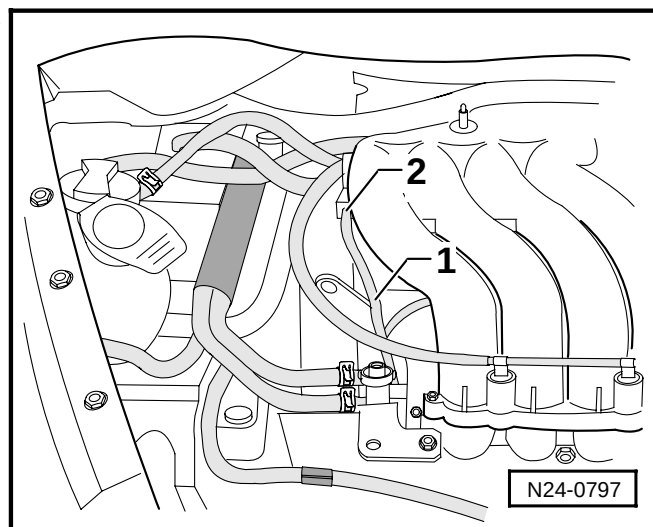
If the specified value is reached:



- Detach vacuum hose -1- from connection -2-.
- The fuel pressure must rise to approx. 0.3 MPa (3.0 bar).

- Switch off ignition.
- Test for leaks and holding pressure. Observe pressure drop at gauge. A pressure of at least 0.2 MPa (2.0 bar) must be indicated on the gauge after 10 minutes.

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

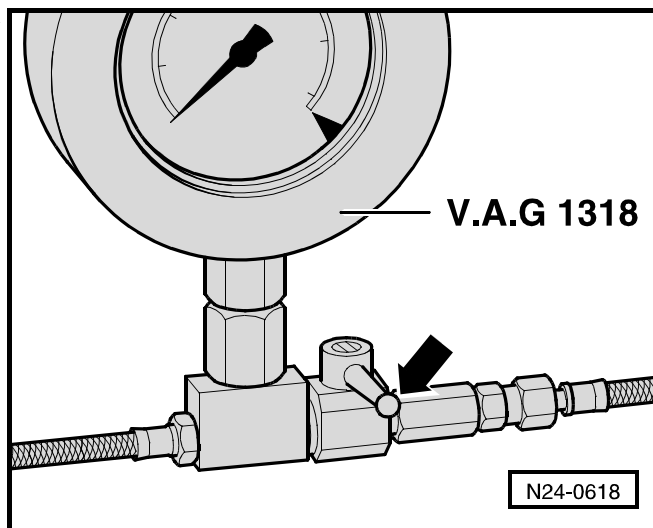


- Start engine and run in idle.
- After the pressure has been built up, switch ignition off. At the same time close the shut-off cock of the pressure measuring device (lever at right angles to direction of flow of fuel -arrow-).
- Observe pressure drop at gauge.

If the pressure again drops:

- Test non-return valve of fuel delivery unit ⇒ 2.0 l/85 kW Engine, Mechanical Components; Rep. Gr. 20

If the pressure does not drop:



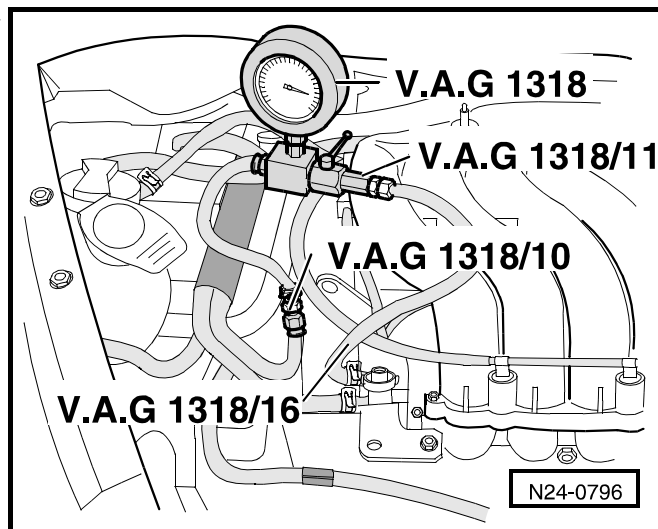
- Open shut-off cock of pressure measuring device -V.A.G 1318- (lever in direction of flow of fuel).
- Start engine and run in idle.
- After the pressure has been built up, switch ignition off. Press together the return-flow hose at the same time.

If the pressure does not drop:

- Replace fuel pressure regulator.

If the pressure drops:

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

**Note**

Before taking off the pressure measuring device, place cleaning cloths around the loose hoses of the feed line.

24-3 Check for proper operation

Testing lambda probe -G39- and lambda control upstream of catalytic converter

Special tools, test and measuring equipment and auxiliary items required

- ◆ Handheld multimeter, e.g. -V.A.G 1526 A oder B-
- ◆ Measuring tool set, e.g. -V.A.G 1594 A, B oder C-

Test conditions

- Fuse 43 must be o.k.
- Battery voltage at least 11.5 V.
- The fuel pump relay must be OK.

Test sequence

- Connect vehicle system tester -V.A.G 1552-. Start engine and select the address word 01 „Engine electronics“ ⇒ Chapter 01-1.

For engines with the engine identification characters AEG, APK

- Check display groups 030, 031, 032, 033 and 041 ⇒ Chapter 01-6.

For engines with engine codes AQY, AZH, AZJ

- Check display groups 030, 031, 032, 033, 034, 036, 041 and 107 ⇒ Chapter 01-6 and 01-7.

If the specified values are not reached:

For engines with engine codes AEG, APK, AQY

- Test resistance of heating element between the contacts 1 + 2.

For engines with engine codes AZH, AZJ

- Test resistance of heating element between the contacts 3 + 4.

Continued for all engines



Note

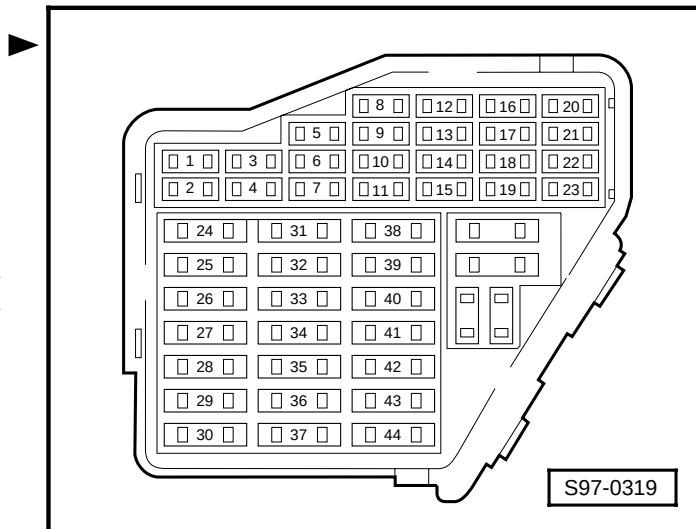
At ambient temperature the resistance of the heating element should be approx. 1...5 Ω. The resistance increases considerably even if the temperature rises only slightly.

- Test voltage supply of heater and cables to -Z19-.

If the specified resistance is reached and the voltage supply for heater and cables to -Z19- is o.k.

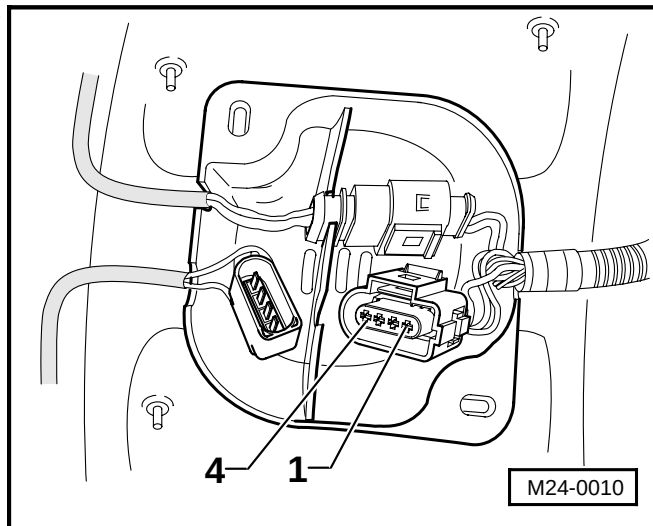
- Start engine.

For engines with engine codes AEG, APK, AQY



- Use handheld multimeter to measure voltage between the contacts 3 and 4 of connector at the wiring loom. ➤

For engines with engine codes AZH, AZJ



- Use handheld multimeter to measure voltage between the contacts 1 and 5 of connector -2- at the wiring loom. ➤

Continued for all engines

Specified value: 0.40...0.50 V.

- Switch off ignition.

If the specified values are reached:

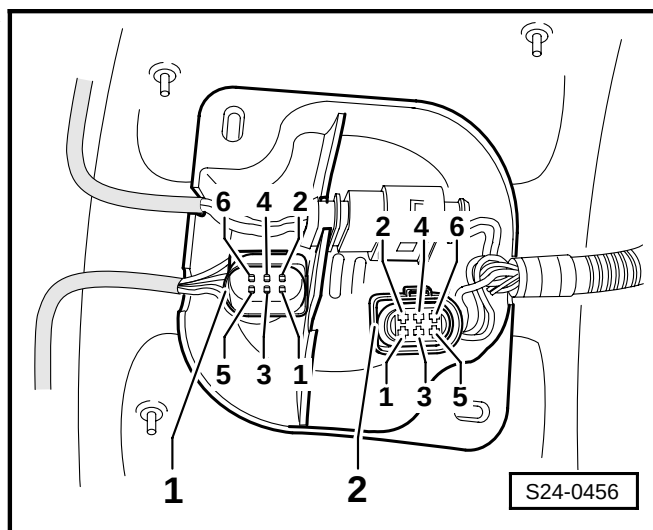
- Replace lambda probe -G39-.

If the specified values are not reached:

- Test cables between engine control unit and connector of lambda probe ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations

If the cable is not found to be faulty:

- Replace engine control unit ⇒ Chapter 24-4.



Testing lambda probe ageing upstream of catalytic converter -G39-

For engines with engine codes AQY, AZH, AZJ

Special tools, test and measuring equipment and auxiliary items required

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

Test condition

- Coolant temperature at least 80°C ⇒ measured value block 004, display field 3 ⇒ Chapter 01-5.

Check for proper operation

- Connect vehicle system tester -V.A.G 1552-. Start engine and select the address word 01 „Engine electronics“ ⇒ Chapter 01-1.

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

For engines with engine code AQY

- Increase and maintain engine speed at 2200...2800 rpm until the readout in display field 4 changes from „Test OFF“ to „Test ON“.

System in basic setting 34				->
2800 rpm	355 °C	2.20 s	Test ON	

For engines with engine code AZH

- Press down the brake pedal.
- Engine speed is increased and the readout in display field 4 switches from „Test OFF“ to „Test ON“.

System in basic setting 34				34	->
2400 rpm	355 °C	0.70	Test OFF		

For engines with engine code AZJ

- Depress brake pedal and accelerator simultaneously.
- Engine speed is increased and the readout in display field 4 switches from „Test OFF“ to „Test ON“.

System in basic setting 34				->
2300 rpm	352 °C	1.78	Test OFF	

Continued for all engines



Note

- ♦ *This may take a few minutes.*
- ♦ *Catalytic converter temperature in display field 2 must be at least 352 °C.*

For engines with engine code AQY

- Check period in display field 3:

Specified value: max. 2.20 s

- Maintain engine speed at 2200...2800 rpm until the readout in display field 4 shows "B1 S1 OK".

For engines with engine codes AZH, AZJ

- Check the dynamic factor in display field 3.

Specified value: min. 0.70

- Maintain the increased engine speed until the readout in display field 4 shows "B1 S1 OK".

Continued for all engines

If the specified values are not reached:

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

Pay attention to safety precautions during the test drive
⇒ Chap. 24-1.

If the specified value is again not reached:

- Replace lambda probe upstream of the catalyst
-G39-.

Testing lambda probe -G130- and lambda control downstream of catalytic converter

Only engines with engine identification characters AQY, AZH, AZJ

Special tools, test and measuring equipment and auxiliary items required

- ◆ Handheld multimeter, e.g. -V.A.G 1526 A oder B-
- ◆ Measuring tool set, e.g. -V.A.G 1594 A, B oder C-

Test conditions

- Fuse 43 must be o.k.
- Battery voltage at least 11.5 V.
- The fuel pump relay must be OK.
- Coolant temperature at least 80°C ⇒ measured value block 004, display field 3 ⇒ Chapter 01-5.

Test sequence

- Check display groups 030, 031, 036, 037 and 041 ⇒ Chapter 01-6.

If the specified values are not reached:

- Test resistance of heating element between the contacts 1 + 2, voltage supply for heater and cables to -Z29- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations.



Note

At ambient temperature the resistance of the heating element should be approx. 1...5 Ω. The resistance increases considerably even if the temperature rises only slightly.

If the specified resistance is reached and voltage supply and cables to -Z29- are o.k.

- Use handheld multimeter to measure voltage between the contacts 3 and 4 of connector at the wiring loom.
- Start engine.

Specified value: 0.40...0.50 V

- Switch off ignition.

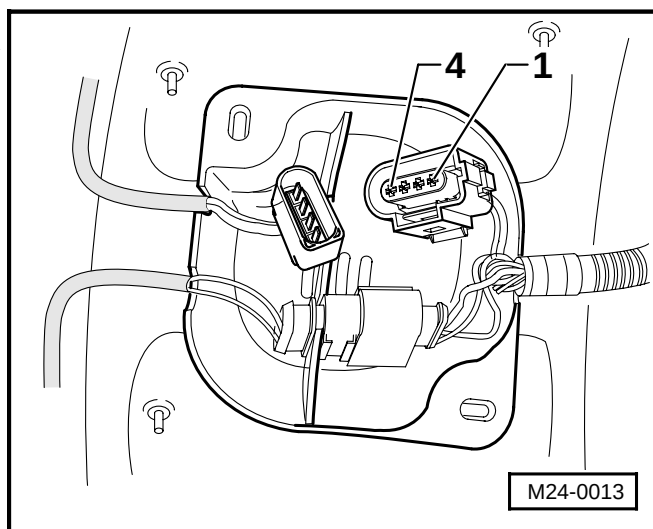
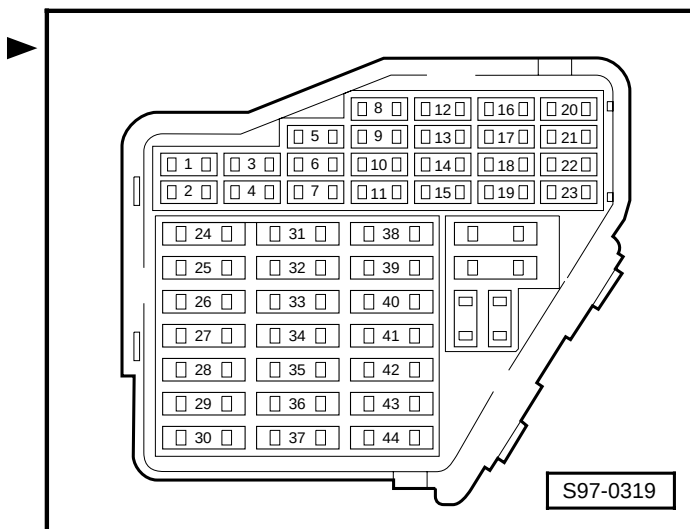
If the specified value is reached:

- Replace lambda probe after catalyst -G130-.

If the specified value is not reached:

- Test cables to lambda probe -G130- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations.

If the cable is not found to be faulty:



- Replace engine control unit ⇒ Chapter 24-4.

24-4 Engine control unit

The engine control unit controls the fuel injection system, lambda control, ignition system, knock control, fuel tank ventilation, governing of engine speed by injectors, and fuel pump relay, as well as self-diagnosis.

Testing voltage supply for engine control unit

Special tools, test and measuring equipment and auxiliary items required

- ◆ Vehicle system tester -V.A.G 1552- with cable
-V.A.G 1551/3, 3A, 3B oder 3C-
- ◆ Test box -V.A.G 1598/22- or - V.A.G 1598/31-
- ◆ Handheld multimeter, e.g. -V.A.G 1526 A-
- ◆ Measuring tool set, e.g. -V.A.G 1594 A-

Test conditions

- Fuses 10 and 29 must be o.k.
- Battery voltage at least 11.5 V
- All electrical components such as headlights and rear window heater, must be switched off.
- If vehicle is equipped with air conditioning, this must be switched off.
- On vehicles with an automatic gearbox the selector lever must be in position „P“ or „N“.
- Alternator o.k., test ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations.

Test sequence

- Connect vehicle system tester -V.A.G 1552-. Start engine and select address word 01 „Engine electronics“ ⇒ Chapter 01-1.
- Select function 08 „Read measured value block“ and display group number 004.

Analysis of display group 004 ⇒ Chapter 01-5.

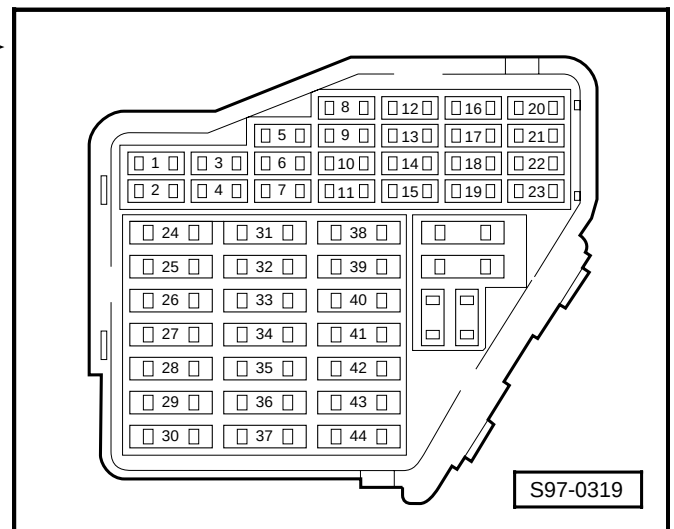
Testing voltage supply, terminal 30

For engines with engine codes AEG, APK, AQY

- Connect test box -V.A.G 1598/22- to wiring loom to engine control unit ⇒ Chapter 24-2.
- Use multimeter to measure voltage supply between sockets 2 + 3 of test box.

For engines with engine codes AZH, AZJ

- Connect test box -V.A.G 1598/31- to wiring loom to engine control unit ⇒ Chapter 24-2. The engine control unit is not connected.



- Use multimeter to measure voltage supply between sockets 1 +62 of test box.

Continued for all engines

Specified value: at least 11.5 V

If the specified value is not reached:

- Test cables to the micro-electrical centre according to the current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations.

Testing voltage supply, terminal 15

For engines with engine codes AEG, APK, AQY

- Connect test box -V.A.G 1598/22- to wiring loom to engine control unit ⇒ Chapter 24-2.
- Use multimeter to measure voltage supply between sockets 1 +2 of test box.

For engines with engine codes AZH, AZJ

- Connect test box -V.A.G 1598/31- to wiring loom to engine control unit ⇒ Chapter 24-2. The engine control unit is not connected here.
- Use multimeter to measure voltage supply between sockets 1 + 3 of test box.

Continued for all engines

- Switch on ignition.

Specified value: at least 11.5 V

If the specified value is not reached:

- Test cables to the micro-electrical centre according to the current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations.

Procedure if voltage supply interrupted

If the voltage supply is interrupted, all the learned values of the engine control unit, and possibly also the basic settings, are erased. Depending on the mileage which the vehicle has driven, this may result in considerable driveability problems.

Special tools, test and measuring equipment and auxiliary items required

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

Procedure

Carry out the following steps if the voltage supply has been interrupted:

- Switch ignition on for at least 10 seconds.
- Switch off ignition.
- Adapt engine control unit to throttle valve control unit
⇒ **24-4** page 6.
- Generate readiness code ⇒ Chapter 01-4.
- Conduct a lengthy test drive.

Pay attention to safety precautions during the test drive
⇒ Chapter 24-1.

During the test drive the following operating conditions must be fulfilled:

- ♦ The coolant temperature should rise beyond 80°C.
- ♦ Once this temperature is reached the following operating conditions must be reached a number of times: idling, part load, full load, enrichment, overrun.
- ♦ In case of full load the speed should be increased beyond 3500 rpm.

Replacing engine control unit

Special tools, test and measuring equipment and auxiliary items required

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

Procedure

- Connect vehicle system tester -V.A.G 1552-. Switch ignition on and select address word 01 „Engine electronics“ ⇒ Chapter 01-1.

The engine control unit identification and the coding are shown on the display, e.g.:

06A906018 FH 2.01 R4/2V MOTR HS V03 ->
Coding 00011 WSC 00000

- Enter engine control unit identification.
- Select function 06 „End output“ and switch ignition off.

Removing

- Unscrew windscreen wipers and remove cover of plenum chamber ⇒ Body work; Rep. Gr. 66.
- Release the connector catches and unplug the engine control unit connectors.
- Use a screwdriver to push the catch of the fixture to the side and pull the engine control unit forward.

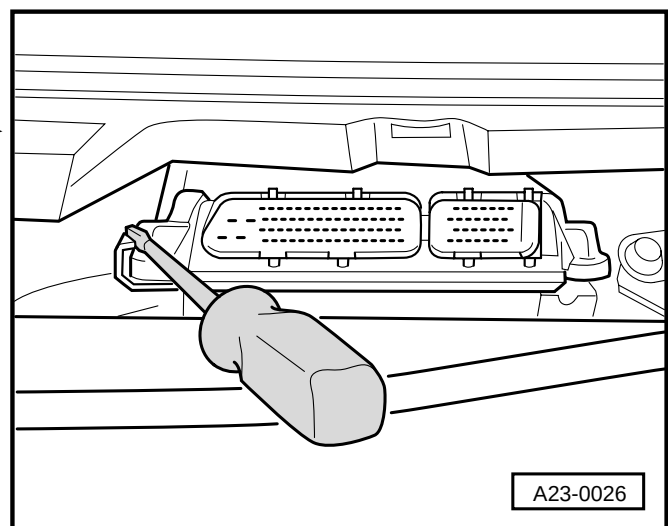
Installing

Installation undertaken in the reverse order.



Note

- ♦ After installing the engine control unit, carry out the following steps:
- ♦ Code engine control unit ⇒ **24-4** page 4.



- ♦ Adapt engine control unit to throttle valve control unit
⇒ **24-4** page 6.
- ♦ Adapt engine electronics control unit to immobiliser
⇒ Electrical System; Rep. Gr. 96
- ♦ Activate CCS ⇒ Chapter 24-5.
- ♦ Adjust the kick-down function for vehicles with an automatic gearbox ⇒ **24-4** page 7.
- ♦ Generate readiness code ⇒ Chapter 01-4 (for engines with engine codes AQY, AZH, AZJ).

Code the engine control unit (AEG, APK, AQY)

If the code matching the vehicle is not displayed or if the control unit has been replaced, it is then necessary to code the engine control unit as follows.



Note

The engine control unit is not coded for engines with the engine codes AZH and AZJ.

Special tools, test and measuring equipment and auxiliary items required

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

Procedure

- Connect vehicle system tester -V.A.G 1552-. Switch ignition on and select address word 01 „Engine electronics“ ⇒ Chapter 01-1.
- Enter function 11 „Login procedure“.
- Enter code number 01283 and confirm with  key.

Readout on display:



Vehicle system test
Select function XX

HELP

- Enter function 07 „Code control unit“ and confirm with  key.
- Enter code number by referring to table of codes and confirm entry with .

Table of codes:

for vehicles with	Code number	
	up to 04.00	from 05.00
Manual gearbox	00001	00001
Gearbox with ABS	00011	00011
Gearbox with airbag	00001	00021
Gearbox with ABS and airbag	00011	00031
Automatic gearbox	00003	00003
Automatic gearbox with ABS	00013	00013
Automatic gearbox with airbag	00003	00023
Automatic gearbox with ABS and airbag	00013	00033

The engine control unit identification and the coding are shown on the display, e.g.:

06A906018 FH 2.0 1 R4/2V MOTR HS V03 ->
Coding 00011 WSC 00000

If the approved code number was not entered, this read-out appears in the display.

Function unknown or ->
cannot be carried out at the moment

— Select function 06 „End output“ and switch ignition off.

**Note**

- ◆ The control unit Motronic stores the entered and displayed coding only after the ignition has been switched off for at least 15 seconds. Incorrect coding results in:
 - ◆ poor driveability (jerking when changing gears, load alteration shock etc.)
 - ◆ Increase in fuel consumption
 - ◆ Increase in pollution
 - ◆ Storage of non-existent faults in fault memory
 - ◆ Certain functions not being performed (lambda control, actuation of activated charcoal filter system, etc.)
 - ◆ Reduction in life of automatic gearbox

Deleting learned values from the engine control unit

For engines with engine code AZJ

The learned values from the engine control unit must be deleted when replacing the injectors or the lambda probes in order to avoid any possible vehicle operating problems.

Special tools, test and measuring equipment and auxiliary items required

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

Procedure

- Connect vehicle system tester -V.A.G 1552-. Switch ignition on and select address word 01 „Engine electronics“ ⇒ Chapter 01-1.
- Enter function 10 „Adaptation“ and confirm entry with the  key.

Readout on display:



adjustment
Enter channel number XX

- Enter 01 for channel 0 and confirm entry with key .

Readout on display:



Adaptation Q
Erase initialisation values?

- Confirm the read-out on display with .

Readout on display:



Adaptation ->
Initialisation values erased

- Confirm the adaptation/adjustment with .
- Adapt engine control unit to throttle valve control unit ⇒ **24-4** page 6.

Adjusting the engine control unit to the throttle valve control unit

When the engine control unit is adapted to the throttle valve control unit -J338- the engine control unit learns the stop positions of the throttle valve control unit when ignition is on and the engine switched off.

Adjustment must be performed if:

- ♦ the voltage supply has been interrupted
- ♦ the control unit has been replaced
- ♦ the throttle valve control unit was replaced
- ♦ if another engine or another throttle valve control unit was installed

Special tools, test and measuring equipment and auxiliary items required

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

Test conditions

- There must not be any faults present in the fault memory ⇒ Chapter 01-1.
- Battery voltage at least 11.5 V
- All electrical components such as headlights and rear window heater, must be switched off.
- If vehicle is equipped with air conditioning, this must be switched off.
- Throttle valve must be in the idling position.
- If the vehicle is equipped with cruise control, it must be correctly set.

Procedure

- Connect vehicle system tester -V.A.G 1552-. Switch ignition on and select address word 01 „Engine electronics“ ⇒ Chapter 01-1.
- Select function 04 „Initiate basic setting“ and display group 060.
- Observe display field 4:

Specified value: „ADP runs“

For engines with engine codes AEG, APK, AQY



System in basic setting	60	->
3 ∠° 70.9 % Idling	ADP runs	

For engines with engine codes AQY, AZJ



System in basic setting	60	->
15% 84% 6	ADP runs	



Note

- ♦ After display group 060 has been confirmed, adaption is initiated and the throttle valve drive moves into the min., max. and several intermediate positions. Each throttle valve angle is stored by the throttle valve control unit. This procedure takes up to 10 seconds. After this, the throttle valve remains in the start position for a short time and then closes.

- ♦ Specified value: „ADP. o.k.“

For engines with engine codes AEG, APK, AQY



System in basic setting	60	->
3 ∠° 70.9 % Idling	ADP o.k.	

For engines with engine codes AQY, AZJ



System in basic setting	60	->
23% 61% 8	ADP o.k.	



Note

- ♦ If the basic setting of the throttle valve control unit is interrupted, the reasons for this may be:
- ♦ The throttle valve does not reach the mechanical idling limit due to dirt, e.g. carbon deposits or an incorrectly adjusted throttle control cable.
- ♦ The battery voltage is too low.
- ♦ The throttle valve control unit or the cable connection is faulty, test ⇒ Chapter 24-2.
- ♦ The fault is entered in the fault memory „17973“ after the basic setting has been aborted. When the ignition is switched on again the basic setting is automatically performed again.

- Select function 06 „End output“ and switch off ignition.

Adjusting the kick-down function

The vehicles with an automatic gearbox must have their kick-down function adjusted after replacing the accelerator pedal or the engine control unit.

Test conditions

- Ignition switched on, engine switched off

Procedure

- Connect vehicle system tester -V.A.G 1552-. Switch ignition on and select address word 01 „Engine electronics“ ⇒ Chapter 01-1.
- Select function 04 „Initiate basic setting“ and display group 063.

Press down the accelerator pedal to the stop and hold it there. ►

System in basic setting	63	->
14 %	85 %	kick-down ADP OK

- Read off the indicated value in display block 4.

Specified value: „ADP. o.k.“



Note

The message „Kickdown ADP running“ will be displayed during the adjustment work. The message „ADP OK“ will be displayed once the adjustment has been completed successfully appears in display field 4.

- Select function 06 „End output“ and switch ignition off.

If the specified value is not reached:

- Check the throttle cable setting ⇒ 2.0 I/85 kW Engine
- Mechanical Components; Rep. Gr. 20.

24-5 Testing auxiliary signals

Testing the speed signal

Special tools, test and measuring equipment and auxiliary items required

- ◆ Test box -V.A.G 1598/22- or - 1598/31-
- ◆ Diode test lamp, e.g. -V.A.G 1527 B-
- ◆ Measuring tool set, e.g. -V.A.G 1594 A-

Test conditions

- Battery voltage at least 11.5 V.
- Speedometer must be OK. Test speedometer
⇒ Electrical System; Rep. Gr. 90.
- Test speed signal in the measured value block, display group 005

For engines with engine codes AEG, APK, AQY

- Connect test box -V.A.G 1598/22- to wiring loom to engine control unit ⇒ Chapter 24-2.
- Connect diode test lamp to sockets 2 and 20 of the test box.

For engines with engine codes AQY, AZJ

- Connect test box -V.A.G 1598/31- to wiring loom to engine control unit ⇒ Chapter 24-2. The engine control unit is not connected.
- Connect diode test lamp to sockets 1 and 54 of the test box.

Continued for all engines

- Switch on ignition.
- Raise vehicle at front left.
- Rotate front left wheel and observe diode test lamp.

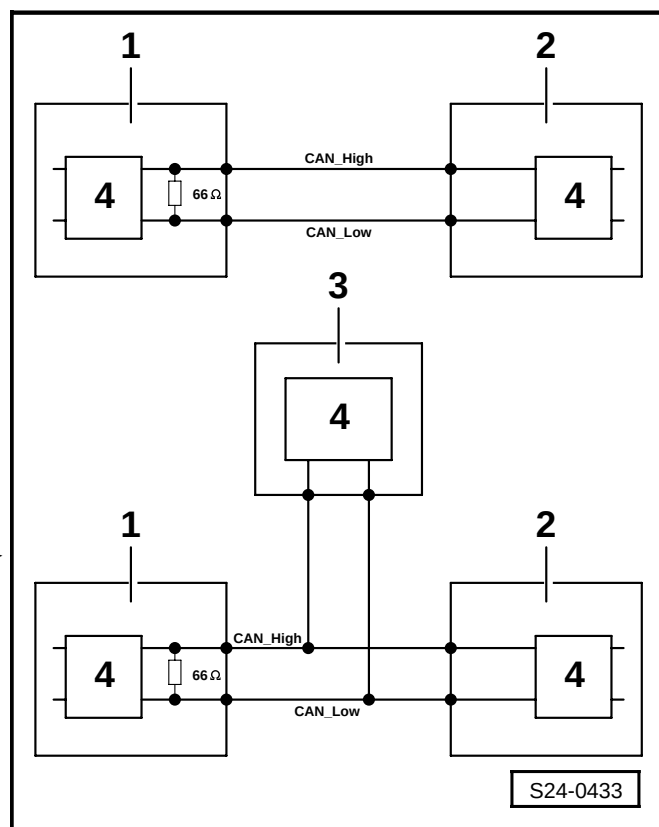
Specified value: The LED must flicker

If the LED does not flash:

- Test cables to the speedometer and to the speedometer sender ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations.

Testing databus (CAN bus)

- 1 - Engine control unit
- ◆ fitting location: in plenum chamber
- 2 - ABS control unit
- ◆ fitting location: at hydraulic unit in left of engine compartment



3 - Automatic gearbox control unit

- ♦ fitting location: in plenum chamber

4 - Databus driver

- ♦ Part of control unit

Operation

The engine control unit -1- communicates with the ABS control unit -2- and the gearbox control unit -3- over the CAN databus.

These control units are interlinked by a databus line (CAN High and CAN Low) and exchange information (messages).

If information is not received over the databus this is detected both by the engine control unit as well as by other control units as a fault (e.g. by the ABS control unit).

A terminating resistance of 66 Ω is required for the CAN databus to operate properly. Such a resistance is integrated in the engine control unit.

For further information $\Rightarrow$ Self-study Programme No. 24; CAN databus.

Special tools, test and measuring equipment and auxiliary items required

- ♦ Handheld multimeter, e.g. -V.A.G 1526 A-
- ♦ Measuring tool set, e.g. -V.A.G 1594 A-

For engines with engine codes AEG, APK, AQY

For vehicles with ABS

- ♦ Test box -V.A.G 1598/21-

For vehicles with ABS+ESP

- ♦ Test box -V.A.G 1598/33-

For engines with engine codes AZH, AZJ

Test box -V.A.G 1598/31-

Test condition

- If a fault in the databus line is stored in the fault memory, interrogate fault memory $\Rightarrow$ Page 01-1.

Test sequence

- Switch off ignition.

For engines with engine codes AEG, APK, AQY

- Remove air filter.
- Separate plug connections of control units with CAN databus $\Rightarrow$ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations.
- Connect test box -V.A.G 1598/21- or -V.A.G 1598/33- to ABS wiring loom.

- Test the central terminating resistor in the engine control unit:
- Measure the resistance between sockets 10 + 11 (ABS) or 11 +15 (ABS + ESP) at the test box:

Specified value: 60...72 Ω

If the resistance is not within the specified range:

- Test wiring, rectify any faults in the CAN databus line
⇒ Electrical System; Rep. Gr. 90.

If the resistance is not within the specified range and the CAN databus line is OK

- Replace engine control unit ⇒ Chapter 24-4.

For engines with engine codes AQY, AZJ

- Unlock connector at control unit and unplug.
- Connect the -V.A.G 1598/31- to the engine control unit. The wiring loom of the control unit is not connected for this test.
- Test the central terminating resistor in the engine control unit.
- Carry out a resistance measurement for this purpose between sockets 58 and 60 of the test box.

Specified value: 60...72 Ω

If the resistance value is not within the nominal value range:

- Replace engine control unit ⇒ Chapter 24-4.

If the resistance value is within the nominal value range:

- Test CAN databus ⇒ Electrical System; Rep. Gr. 90

Activating and deactivating cruise control system (CCS)

For engines with engine codes AZH, AZJ

Special tools, test and measuring equipment and auxiliary items required

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

Test conditions

- There must not be any faults present in the fault memory ⇒ Chapter 01-1.

Test sequence

- Connect vehicle system tester -V.A.G 1552-. Switch ignition on and select address word 01 „Engine electronics“ ⇒ Chapter 01-1.

Readout on display, e.g.:

06A906032BL 2.0 1 R4/2V G	3530 ->
Coding 00071	WSC XXXXX

If „2.0 I R4/2V G“ is displayed, CCS is activated.

Readout on display, e.g.:



06A906032BL 2.0 I R4/2V	3530 ->
Coding 00071	WSC XXXXX

If „2.0 I R4/2V G“ is displayed, the CCS is not activated.

- Press key and select function 11 „Login procedure“.



Login procedure
Enter code number XXXXX

Enter code number by referring to the table below and confirm entry with key.

Code number	Cruise control system (CCS)
11463	The cruise control system (CCS) is actuated
16167	Cruise control system (CCS) is deactivated

- Select function 06 „End output“ and switch ignition off.

Conduct a test drive as an operational check after the CCS has been actuated.

28 – Ignition System

28-1 Repairing the ignition system

General notes on the ignition system

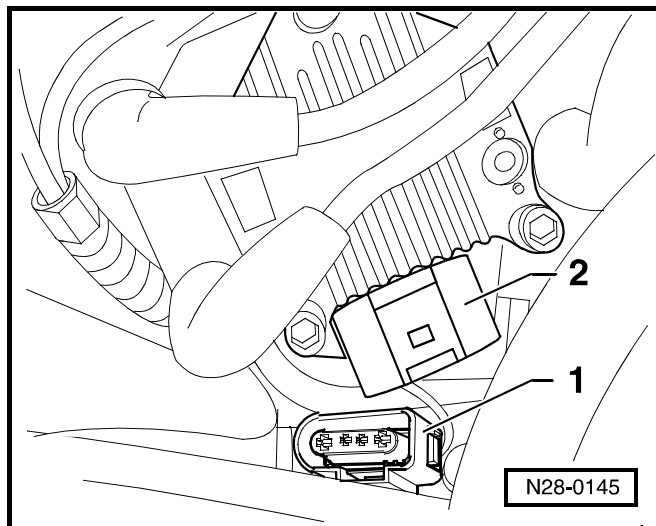
- ◆ This section deals specifically with the components relating to the ignition system. The other components of the fuel injection and ignition system ⇒ Chapter 24-1 and following.
- ◆ Switch off the ignition before disconnecting and connecting the battery, as this may damage the 4AV control unit.
- ◆ The engine control unit is equipped with a self-diagnosis system.
- ◆ Components marked with an * are checked by self-diagnosis ⇒ Chapter 01-4.
- ◆ A minimum voltage of 11.5 V is required for perfect functioning of the electrical components.
- ◆ Certain inspections may cause the control unit to detect and store a fault. That is why it is necessary to interrogate and erase the fault memory after completing all test and repair work ⇒ Chapter 01-1.

Safety measures ⇒ **28-1** page 1.

Safety measures

Observe the following points to prevent injury to persons and/or damage to the injection and ignition system:

- ◆ Do not touch or remove ignition leads with the engine running or at start 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.
 - ◆ If the engine must be operated at start speed without the engine starting:
- Unplug the 4-pin connector -1- from the ignition transformer -2-.



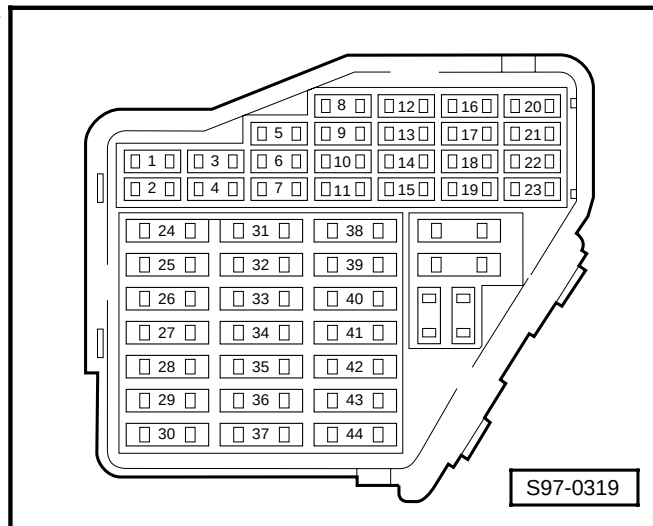
- Remove fuse 28 for the fuel pump.

If test and measuring devices are required during test drives observe the following:

- ♦ Attach test and measuring equipment always on the rear seat and have them operated from there by a second person.
- ♦ If the test and measuring devices are operated from the passenger seat the passenger could be injured by the release of the passenger airbag in the event of an accident.

Removing and installing parts of the ignition system

For engines with engine identification characters AEG, APK, AQY, AZH



1 - Ignition lead

- ☐ with shielded plug and spark-plug

2 - Spark plug, 20-30 Nm

- ☐ use spark plug wrench (e.g. - 3122 B-) for removing and installing
- ☐ type and electrode gap
⇒ Inspection and Maintenance; Rep. Gr. 02

3 - 20 Nm

- ☐ The tightening torque influences the knock sensor function

4 - Knock sensor 2 -G66-*

- ☐ contacts of sensor and of connector gold-plated

5 - 3-pin plug connection

- ☐ contacts gold-plated
- ☐ black for knock sensor 1 -G61-
- ☐ brown for knock sensor 2 -G66-

6 - Knock sensor 1 -G61-*

- ☐ contacts of sensor and of connector gold-plated

7 - Camshaft position sensor -G40-*

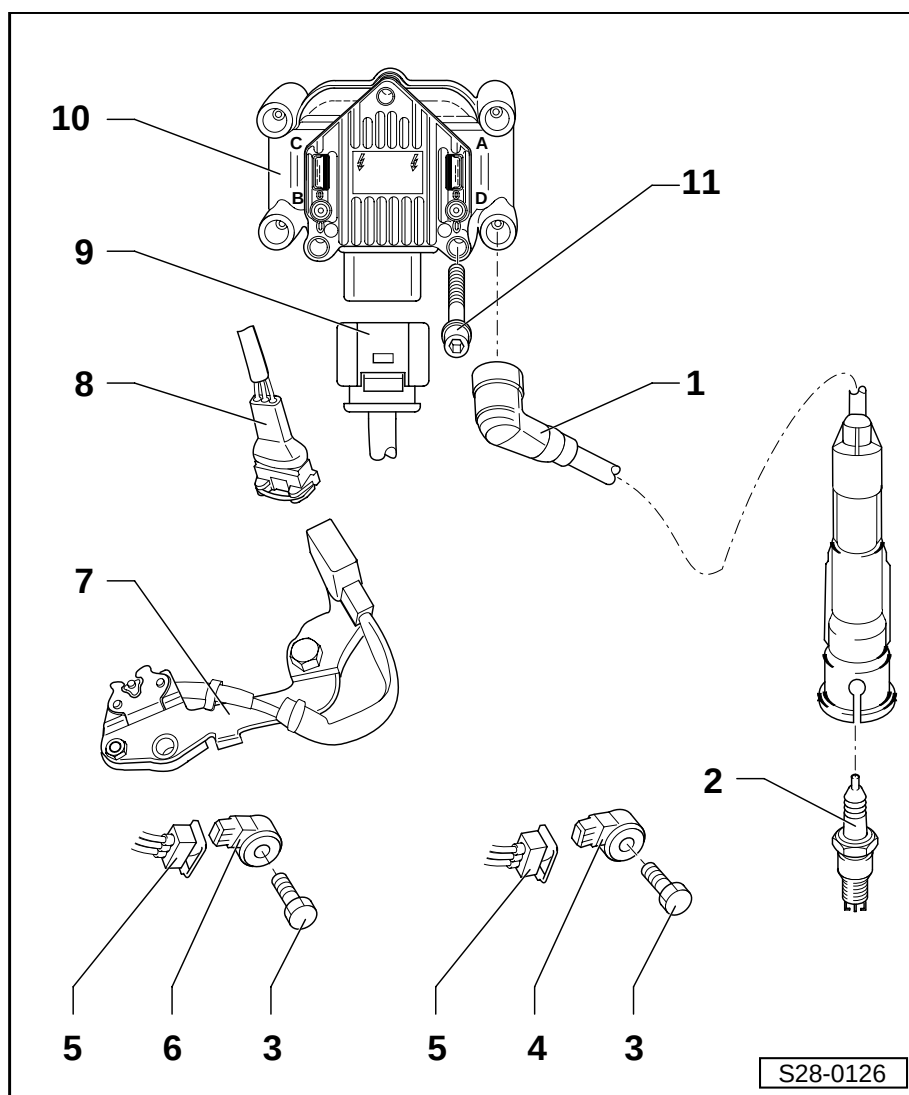
- ☐ check ⇒ **28-1** page 5

8 - Plug connection

- ☐ black, 3 pin
- ☐ for camshaft position sensor -G40-

9 - Plug connection

- ☐ for ignition transformer
- ☐ black, 4 pin



10 - Ignition transformer (N, N128)

☐ with identification for ignition leads:

A = Cylinder 1

B = Cylinder 2

C = Cylinder 3

D = Cylinder 4

☐ with power output stage -N122-

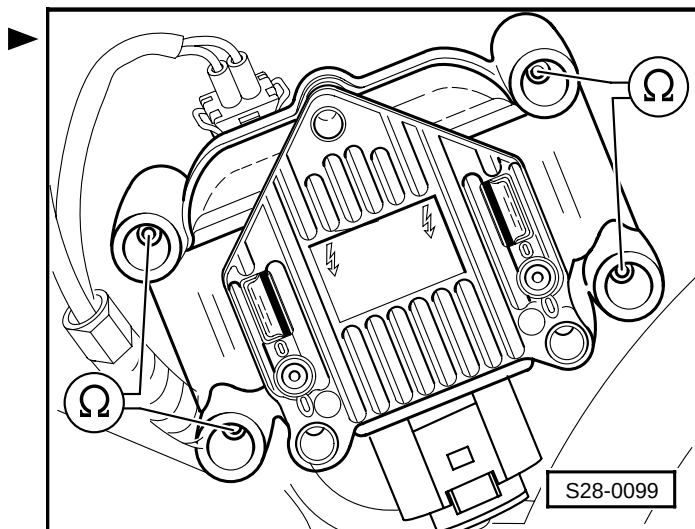
☐ resistances $\Rightarrow$ Fig. 1 in **28-1** page 3

11 - 10 Nm

Fig. 1: Resistances of ignition coils

Specified value: 4...6 k Ω .

For engines with engine code AZJ



1 - Ignition lead

- ☐ 4...8 kΩ
- ☐ with shielded plug and spark-plug

2 - ignition coil with power output stage (- N70-, - N127-, -N291-, -N292-)

- ☐ with identification for ignition leads:

A = Cylinder 1

B = Cylinder 2

C = Cylinder 3

D = Cylinder 4

3 - 10 Nm**4 - 6-pin plug connection****5 - Knock sensor 1 -G61-***

- ☐ contacts of sensor and of connector gold-plated

6 - 2-pin plug connection

- ☐ for knock sensor 1 -G61-
- ☐ contacts gold-plated
- ☐ do not interchange

7 - Knock sensor 2 -G66-*

- ☐ contacts of sensor and of connector gold-plated
- ☐ next to the ignition coil

8 - 2-pin plug connection

- ☐ for knock sensor 2 -G66-
- ☐ contacts gold-plated
- ☐ do not interchange

9 - 20 Nm

- ☐ The tightening torque influences the knock sensor function

10 - Spark-plug, 25 Nm

- ☐ use spark plug wrench (e.g. - 3122 B-) for removing and installing
- ☐ type and electrode gap ⇒ Inspection and Maintenance; Rep. Gr. 02
- ☐ to remove and install, unplug the connector for the outer injectors

11 - Plug connection

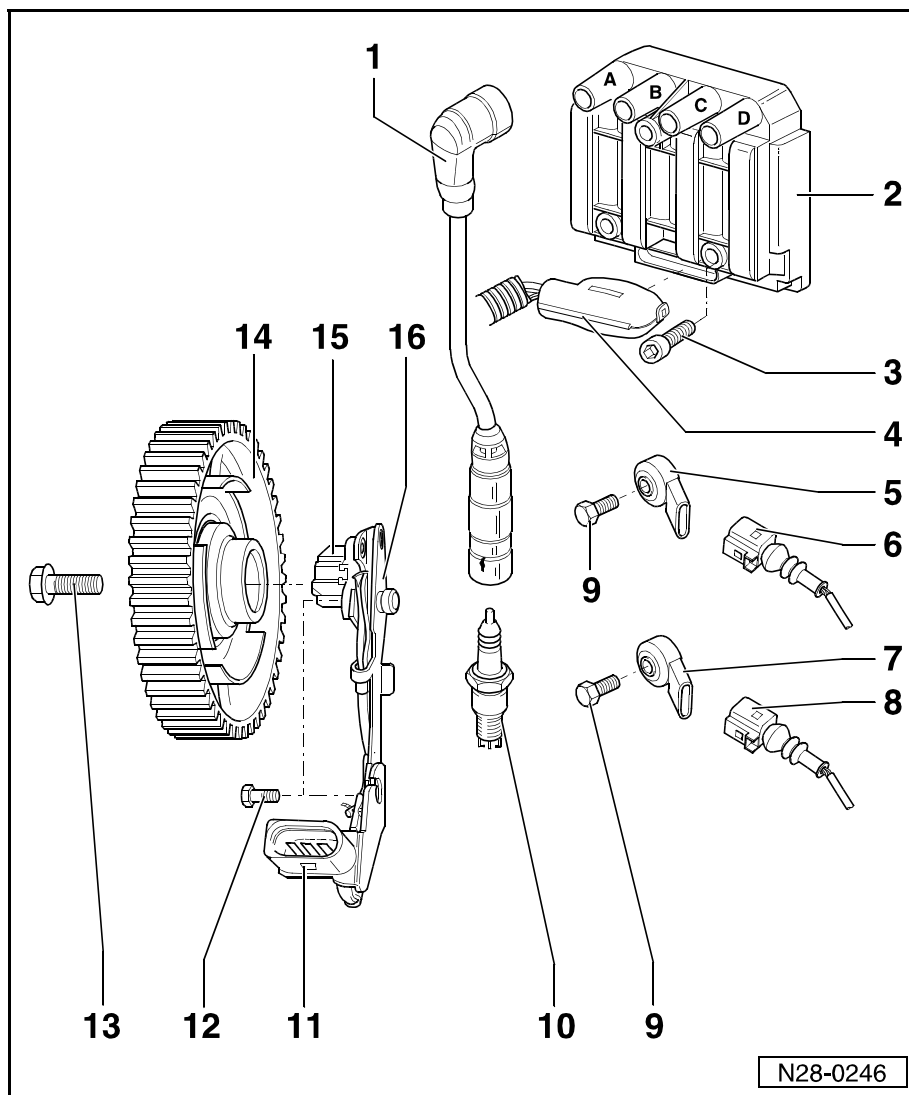
- ☐ contacts gold-plated
- ☐ 3-pin

12 - 10 Nm**13 - 100 Nm****14 - Camshaft sprocket**

- ☐ with sensor rotor for the Hall sensor -G40-

15 - Camshaft position sensor -G40 -***16 - Bracket**

- ☐ for the camshaft position sensor



Testing camshaft position sensor -G40-

Special tools, test and measuring equipment and auxiliary items required

- ◆ Handheld multimeter, e.g. -V.A.G 1526 A-
- ◆ Measuring tool set, e.g. -V.A.G 1594 A-

Test conditions

- Battery voltage 11.5 V

Test sequence

- Unplug 3-pin connector -1- at camshaft position sensor -2-. ►
- Connect handheld multimeter for voltage measurement to contacts 1 + 3 of connector -1-.
- Switch on ignition.

Specified value: at least 4.5 V

- Switch off ignition.

Continued for all engines

- Test the cables also for short circuit with each other
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations.

If no fault is found in the cables and the specified voltage was measured between contacts 1 + 3:

- Replace camshaft position sensor -G40-.

If no fault is found in the wiring and the specified voltage was not measured between contacts 1 + 3:

- Replace engine control unit ⇒ Chapter 24-4.

