28-1

Ignition system, checking

General notes on ignition system

- *The battery should only be disconnected and reconnected when the ignition is turned off, since otherwise the Engine Control Module (ECM) can be damaged.*
- *The Engine Control Module (ECM) is equipped with an On Board Diagnostic (OBD)*
- *For the electric components to work properly, a voltage of at least 12.7 V is required.*
- *It is possible that the control module will recognize a malfunction and store a DTC during some tests. After completing all tests and repairs, DTC memory should therefore be checked and erased if necessary.*
- *If the engine only starts briefly and then turns off again after troubleshooting, repair or checking of the components, it may be that the immobilizer is blocking the Engine Control Module (ECM). DTC memory must then be checked and if necessary, control module must be adapted.*

28-2

Safety precautions

To reduce the risk of personal injury and/or damage to the fuel injection and ignition system, always observe the following:

- Do not touch or pull off ignition wires when engine is running or turning at starting RPM.
- Always switch ignition off before disconnecting or reconnecting wires for the injection and ignition system, including high voltage wiring and test leads.
- If engine is to be cranked at starting RPM without starting (e.g. for compression testing), disconnect connector from ignition coils and from fuel injectors.
- It is possible that the control module will recognize a malfunction and store a DTC during some tests. After completing all tests and repairs, DTC memory should therefore be checked and erased if necessary. Readiness code must be generated after DTC memory is erased ⇒ Page 01-82 .
- Always switch ignition off before cleaning engine.

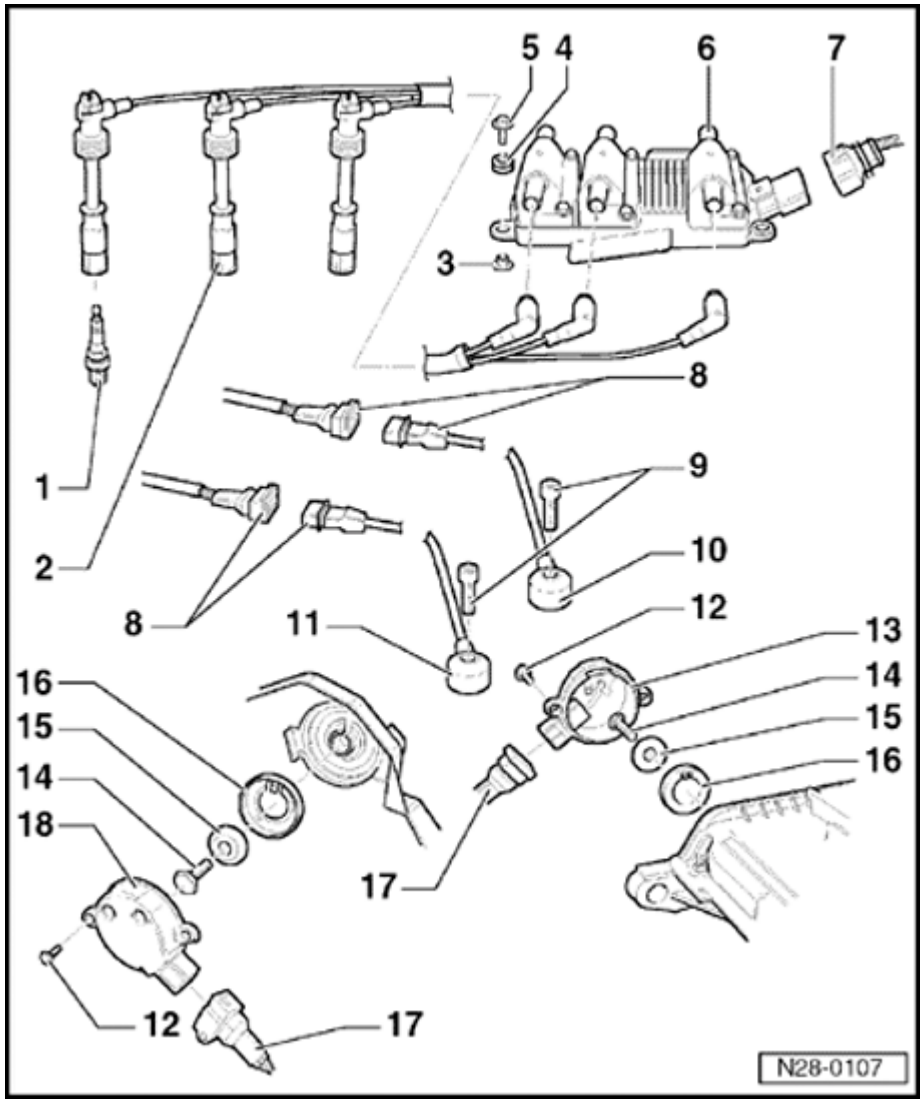
- The battery should only be disconnected and reconnected when the ignition is turned off, since otherwise the Engine Control Module (ECM) can be damaged.

28-3

Technical data, ignition

Engine identification	ATQ (2.8 L / 5V/ 147 kW-engine)
Idle speed Engine speed cannot be adjusted, it is regulated by idle stabilization	720 to 820 RPM (front wheel drive) 630 to 730 RPM (all wheel drive)
Engine speed (RPM) limitation via fuel injector shut-off	 about 6800 RPM
Ignition timing is determined in the control module It is not possible to adjust the ignition timing	
Ignition system	Dual-spark ignition system with three ignition coils
Spark plugs	Tightening torque 30 Nm.
Firing sequence	1-4-3-6-2-5

28-4



Ignition system components, removing and installing

1 - Spark plug, 30 Nm

- Remove and install with 3122 B

2 - Spark plug connectors with ignition wires

3 - Spacer sleeve

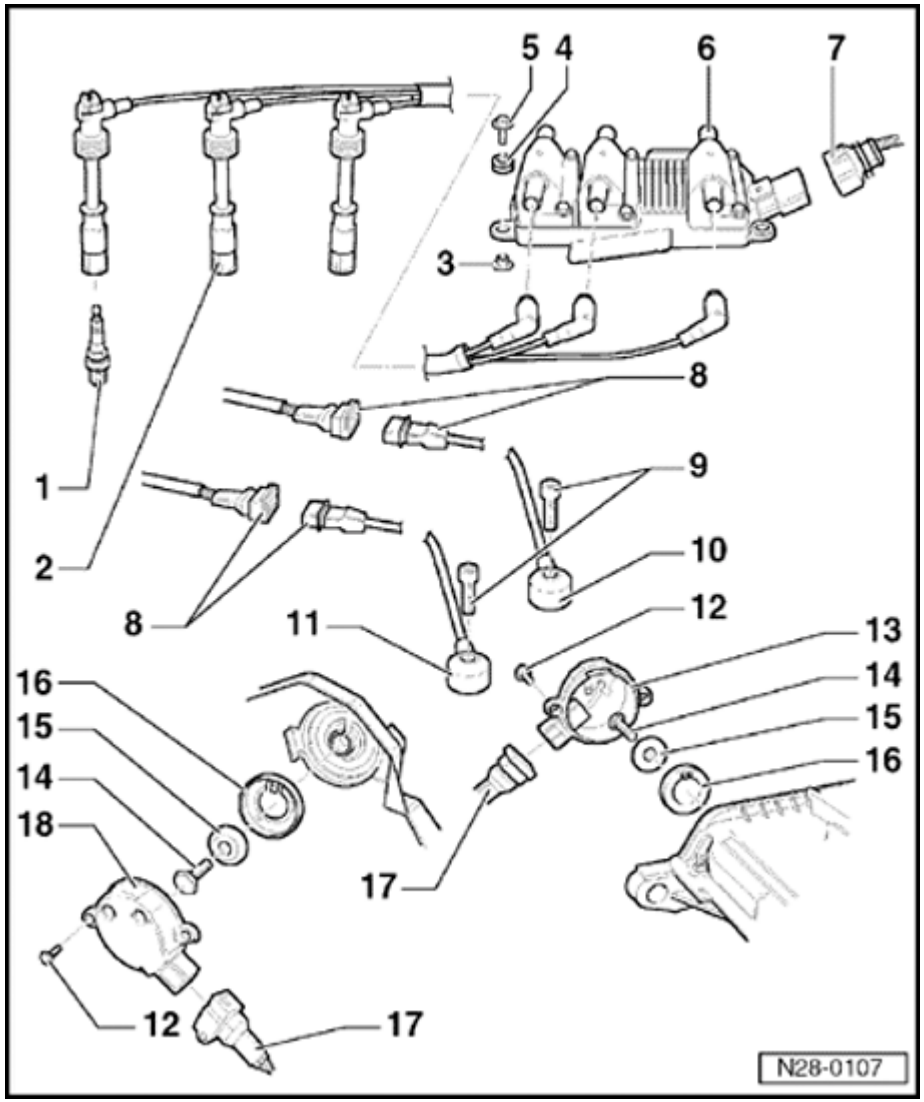
4 - Rubber grommet

5 - 10 Nm

6 - Ignition coils (-N-, -N128-, -N158-)

- With power output stage -N122-
- With marking for ignition wires, do not interchange

28-5



7 - 5-pin harness connector

- Black

8 - 3-pin harness connector

- Terminals are gold-plated

9 - 20 Nm

- Tightening torque affects function of Knock Sensor (KS)

10 - Knock Sensor (KS) 2 -G66-

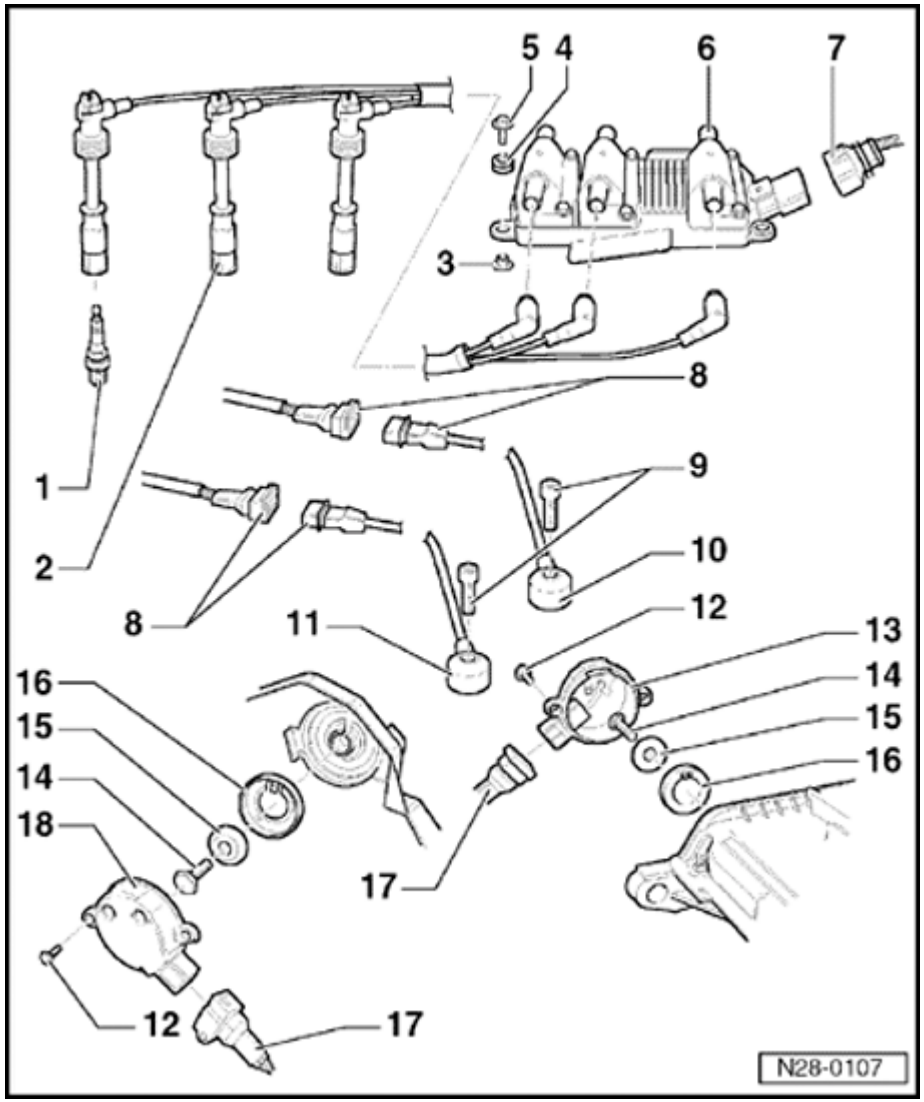
- Bank 2
- Terminals of sensor and connector are gold-plated

11 - Knock Sensor (KS) 1 -G61-

- Bank 1
- Terminals of sensor and connector are gold-plated

12 - 10 Nm

28-6



13 - Camshaft Position (CMP) sensor 2 -G40-

- Bank 2

14 - 25 Nm

15 - Washer

- Conical

16 - Face plate

- for Camshaft Position (CMP) sensor
- note position when installing

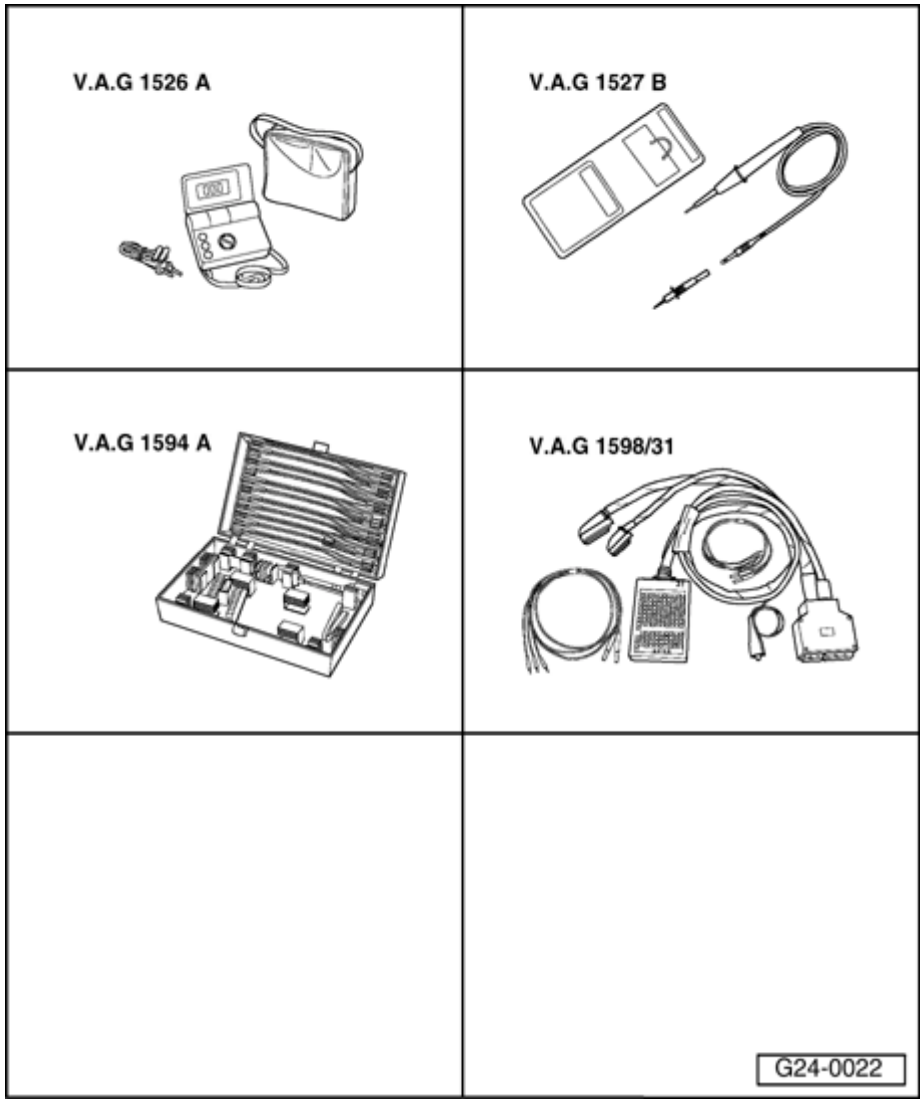
17 - 3-pin harness connector

- Black
- for Camshaft Position (CMP) sensor -G40- or -G163-

18 - Camshaft Position (CMP) sensor 2 -G163-

- Bank 1

28-7



Ignition coils, checking

Special Tools and Equipment

- VAG1526A
- VAG1527B
- VAG1594A
- VAG1598/31

28-8

Component location ⇒ Overview of Component Locations, page ⇒ Page 24-5

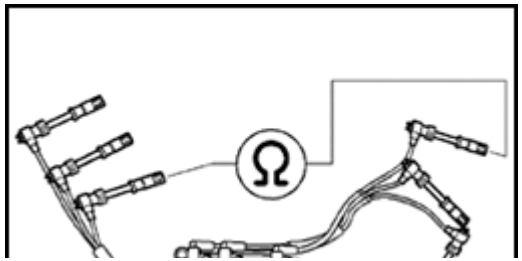
Notes:

- *Ignition coils and power output stage are a common part.*
- *Primary resistance of ignition coils cannot be measured.*
- *Secondary resistance must first be measured with the ignition wires connected to the ignition coils via the spark plug connectors of the corresponding cylinder (This measurement will include measurement of the shielded resistances of the ignition wires).*

- Disconnect 5-pin connector from ignition coils.

Check ignition coils (-N-, -N128- and -N158-)

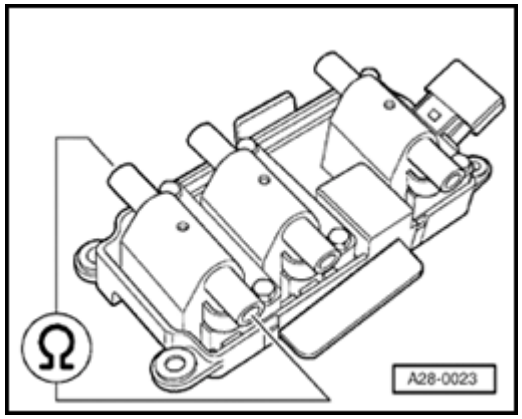
- Pull the ignition wires from the spark plugs.



- In order to perform a resistance measurement, connect multimeter between both spark plug connectors of the respective ignition circuit to be checked.
  - Specification: each 16 to 27 kΩ

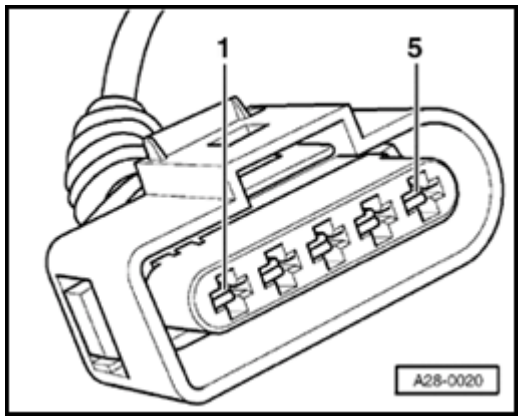
- If the specified values are not reached, disconnect ignition wires from ignition coils and perform a separate resistance measurement at the ignition wires and at the ignition coils.

28-9



- In order to perform a resistance measurement, connect multimeter between both ignition wire connectors connectors of the ignition coil to be checked.
  - Specification: 8 to 14 kΩ
- In order to perform a resistance measurement, connect multimeter between both ignition wire connectors connectors of the ignition wire to be checked.
  - Specification: 3 to 7 kΩ
- Replace faulty components if the specified values are not reached again.

28-10



Checking Ground (GND) supply of power output stage

- Connect VAG1527B voltage tester as follows:

Harness connector Terminal	Measure to
2	B+

♦ LED must light up.

If LED does not light up:

- Check the wire connection for open circuit:

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

- Repair open circuit if necessary.

28-11

Checking voltage supply to ignition coils

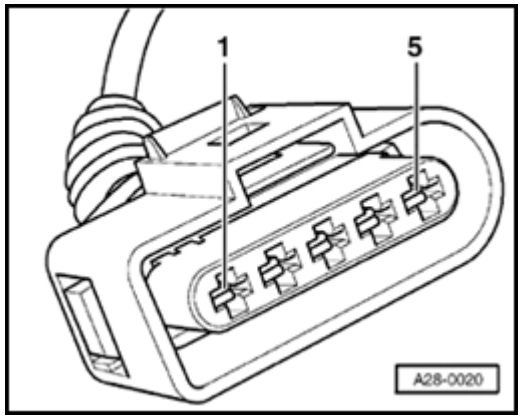
Note:

Voltage is supplied to ignition coils via Fuel Pump (FP) relay.

Test requirement:

- Fuse for ignition coils OK

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*



- Connect VAG1527B voltage tester as follows:

Harness connector Terminal	Measure to
1	Engine Ground (GND)

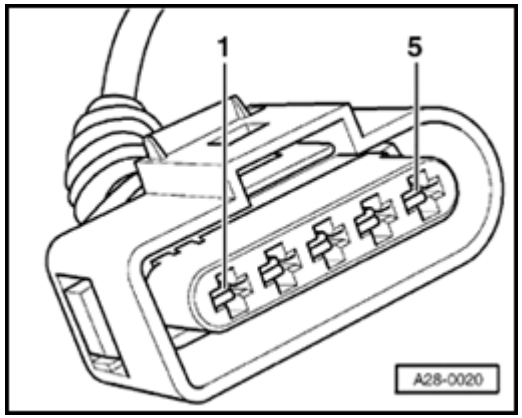
- Operate starter.
  - ♦ LED must light up.

If LED does not light up:

- Check the wire connection for open circuit:

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

- Repair open circuit if necessary.



Checking activation

- Disconnect connectors from all six fuel injectors. (afterward check DTC memory)

- Connect VAG1527B voltage tester as follows:

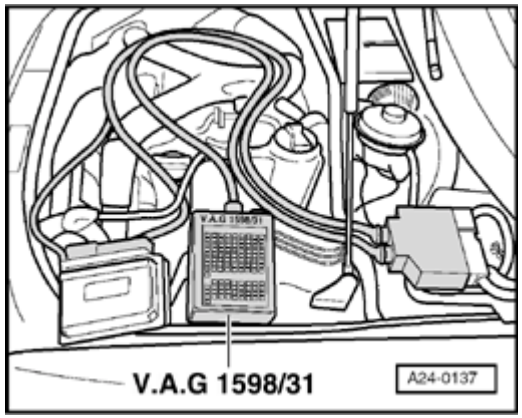
Harness connector Terminal	Measure to
3	Engine Ground (GND)
4	Engine Ground (GND)
5	Engine Ground (GND)

- Operate starter for a few seconds.
  - ♦ LED must blink (brief blink signal).

If specified values are not obtained:

- Switch ignition off.
- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

28-13



- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:

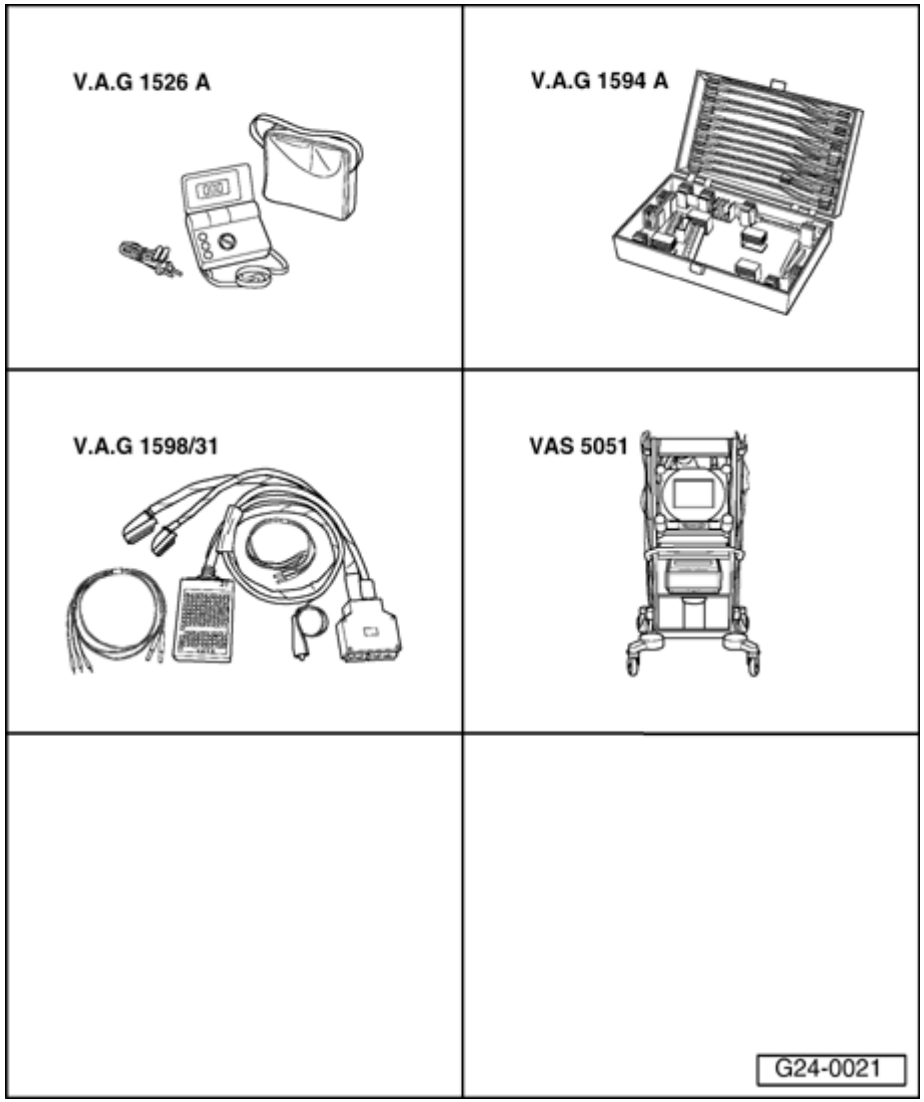
Harness connector Terminal	VAG1598/31 test box Socket
3	102
4	103
5	94

- Repair open circuit or short circuit if necessary.

If no malfunctions are found in wires:

- Replace Engine Control Module (ECM) ⇒ Page 24-21 .

28-14



Intake Air Temperature (IAT) sensor -G42-, checking

Special Tools and Equipment

- VAG1526A
- VAG1594A
- VAG1598/31
- VAS5051 with VAG5051/1

- or

- VAG1551 with VAG1551/3B

28-15

Component location ⇒ Overview of Component Locations, page ⇒ Page 24-5

Test sequence

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

  Ignition must remain switched on for this.

Rapid data transfer **HELP** **Select function XX**	When indicated on display: - Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.
Read Measuring Value Block **Q** **Input display group number XXX**	When indicated on display: - Press buttons -0-, -0- and -4- to select "display group number 004" and press -Q- button to confirm input.
Read Measuring Value Block 4 → **1 2 3 4**	Indicated on display: - Check specified value for Intake Air Temperature (IAT) sensor in display field 4:

28-16

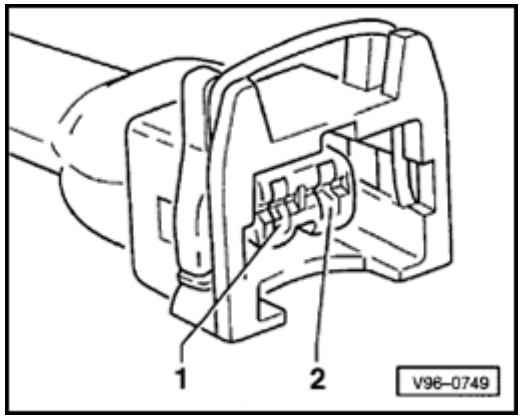
	Display fields			
	1	2	3	4
Display group 004: Intake Air Temperature (IAT), engine at idle				
Display	xxxx/min	xx.xxx volts	xxx.x °C	**xxx.x °C**
Indicated	Engine speed (RPM)	Battery voltage	Coolant temperature	**Intake Air Temperature (IAT)**
Functional range	630 to 6800 RPM	10.000 to 15.000 V	-48.0 to 143.0 °C	**-48.0 to 143.0 °C**
Specified value	xxxx/min	12.000 to 15.000 V	80.0 to 110.0 °C	**From ambient temperature up to 120 °C** [1)]

1) Approximate values: While driving, up to 24 °C above ambient temperature. If heated while standing, up to 120 °C is possible.

28-17

Checking wire connections

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .



- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:

Harness connector Terminal	VAG1598/31 test box Socket
1	85
2	108

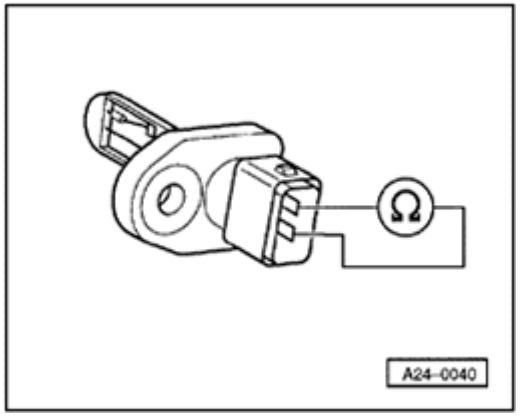
- Check both wires to each other for short circuit.
- Repair open circuit or short circuit if necessary.

28-18

If no malfunctions are found in wire:

Check sensor:

- Disconnect connector from Intake Air Temperature (IAT) sensor.



- Connect multimeter at sensor for resistance measurement.

Specified values

Temperature °C	Resistance kΩ
-20	approx. 13.8
0	approx. 5.5
20	approx. 2.4
40	approx. 1.1
60	approx. 0.6

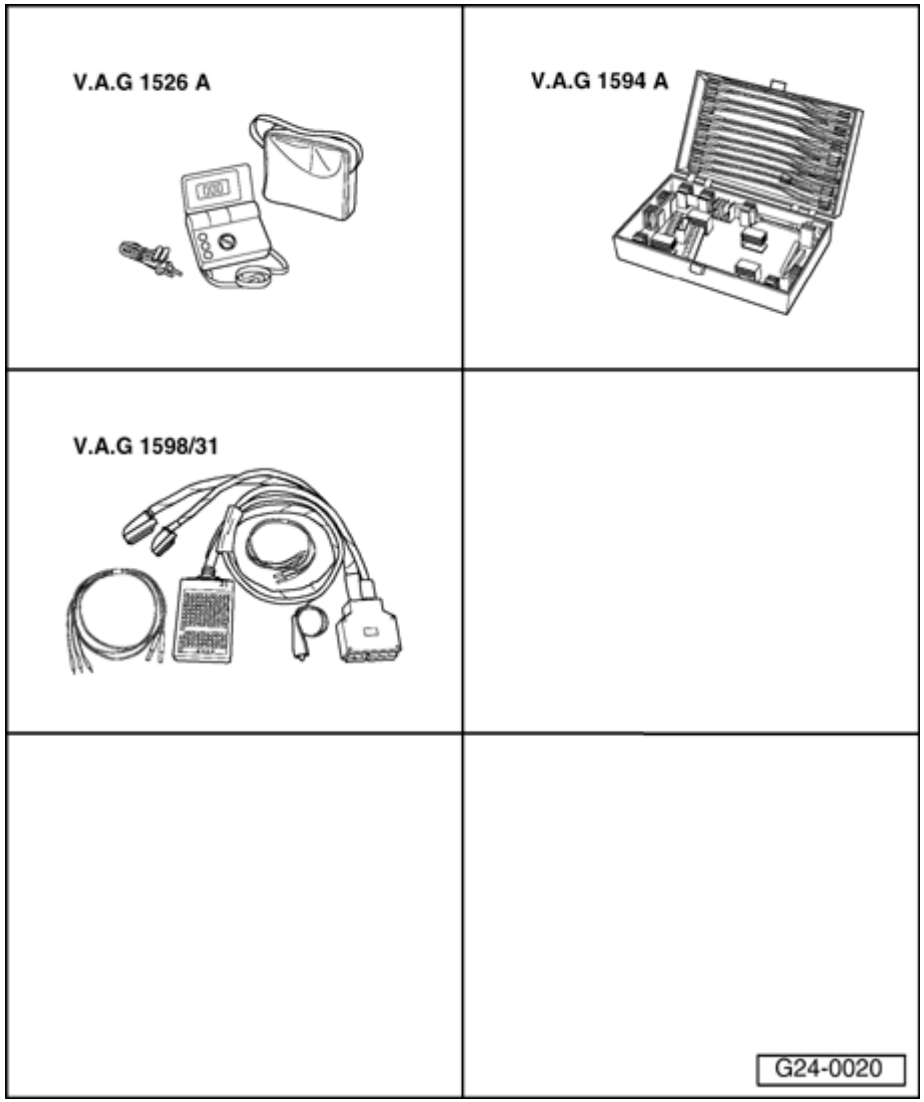
Example:

If air temperature is in a range from 0 °C to 20 °C, the resistance value must be between 5 kΩ and 2.4 kΩ

If specified value is not obtained:

- Replace Intake Air Temperature (IAT) sensor.

28-19



Engine speed (RPM) sensor -G28-, checking

Special Tools and Equipment

- VAG1526A
- VAG1594A
- VAG1598/31

28-20

Component location ⇒ Overview of Component Locations, page ⇒ Page 24-5

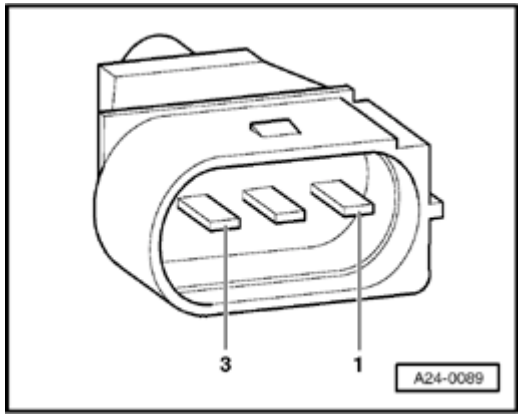
Note:

The engine speed (RPM) sensor detects RPM and reference marks. The engine cannot be started without a signal from the engine speed (RPM) sensor -G28-. If the engine speed (RPM) sensor -G28- signal fails while the engine is running, the engine will stop immediately.

Test sequence

- Before performing test, check sensor for proper installation and proper fitting.

- Disconnect harness connector for the engine speed (RPM) sensor (identification: gray harness connector).



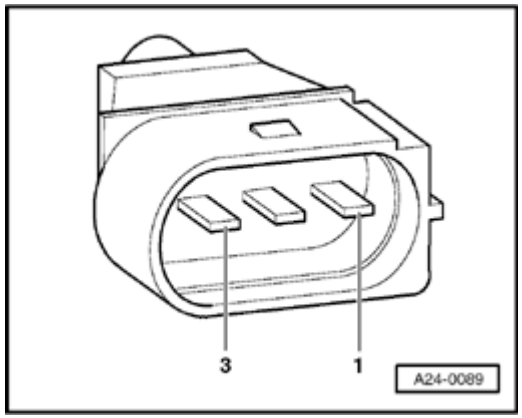
- Connect multimeter between terminal 2 and 3 for resistance measurement.

  - Specification: 730 to 1000 Ω

Note:

Resistance value of the engine speed (RPM) sensor is based on a temperature of 20 °C. Resistance increases as temperature increases.

28-21



If specified value is not obtained:

- Replace engine speed (RPM) sensor.

If specified value is obtained:

- Connect multimeter to terminals 2 and 1 (shielding) and to terminals 3 and 1 (shielding) for resistance measurement.
  - ♦ Specification: each ∞ Ω (no continuity)

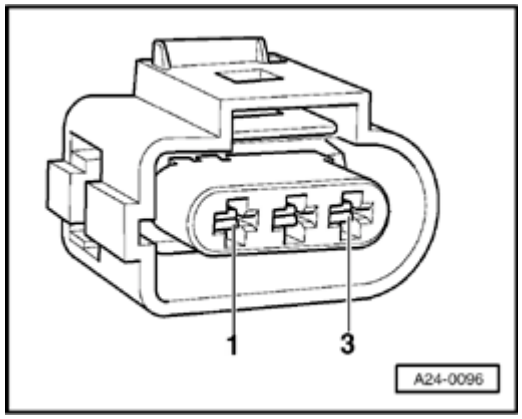
If specified value is not obtained:

- Replace engine speed (RPM) sensor.

If specified value is obtained:

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

28-22



- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:

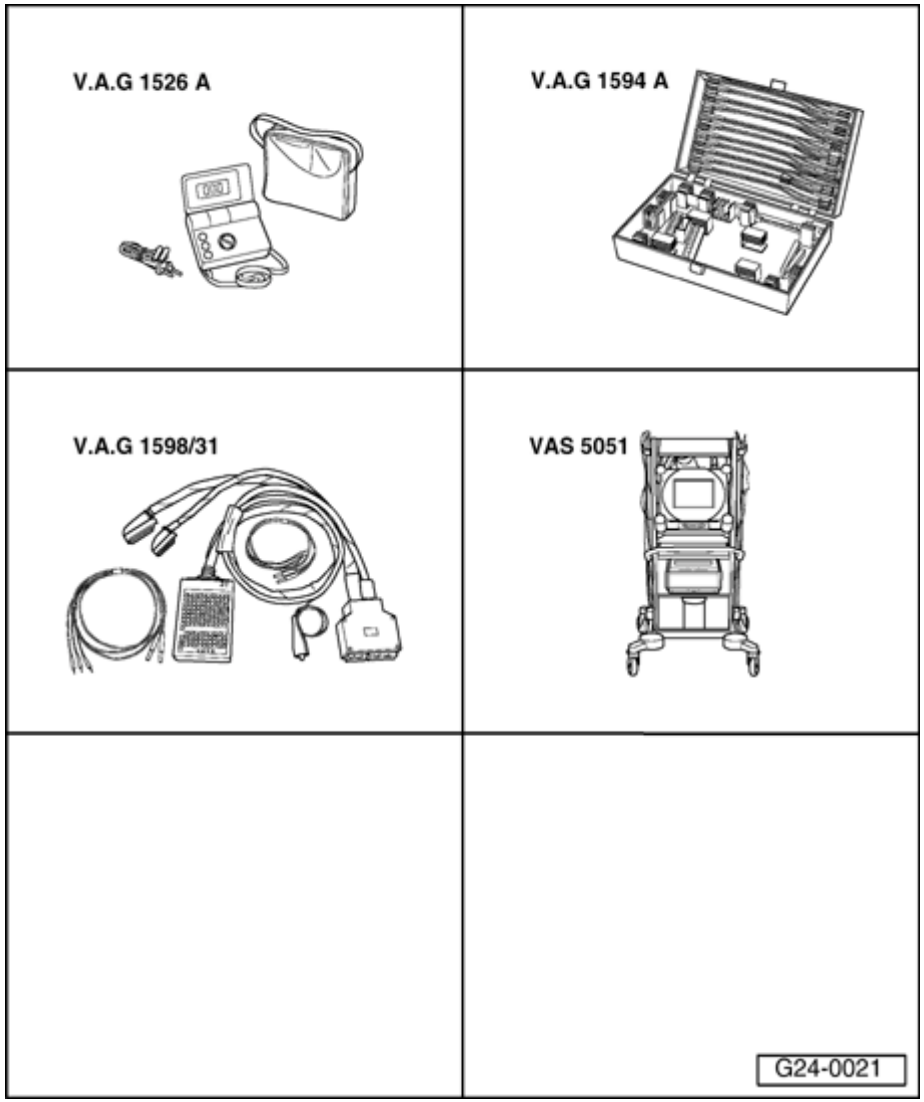
Harness connector Terminal	VAG1598/31 test box Socket
1 (shielding)	108
2 (Ground -GND-)	90
3 (signal)	82

- Repair open circuit or short circuit if necessary.

If no malfunctions are found in wires:

- Replace Engine Control Module (ECM) ⇒ Page 24-21 .

28-23



Engine Coolant Temperature (ECT) sensor -G62-, checking

Special Tools and Equipment

- VAG1526A
- VAG1594A
- VAG1598/31
- VAS5051 with VAG5051/1

- or

- VAG1551 with VAG1551/3B

Component location ⇒ Overview of Component Locations, page ⇒ Page 24-5

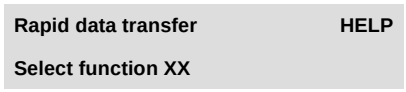
Test requirement:

- Engine cold

Test sequence

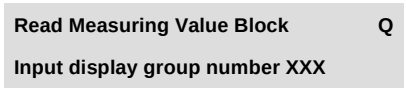
- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

  Engine must run at idle for this.



When indicated on display:

- Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.



When indicated on display:

- Press buttons -0-, -0- and -4- to select "display group number 004" and press -Q- button to confirm input.

Indicated on display:

- Check indication in display field 3.

28-25

	Display fields			
	1	2	3	4
Display group 004: Coolant temperature, engine at idle				
Display	xxxx/min	xx.xxx V	**xxx.x °C**	xxx.x °C
Indicated	Engine speed (RPM)	Battery voltage	**Coolant temperature**	Intake Air Temperature (IAT)
Functional range	630 to 6800 RPM	10.000 to 15.000 V	**-48.0 to 143.0 °C**	-48.0 to 143.0 °C
Specified value	xxxx/min	12.000 to 15.000 V	**Temperature value must rise evenly**	From ambient temperature up to 120 °C

If display field 3 does not have a realistic indication:

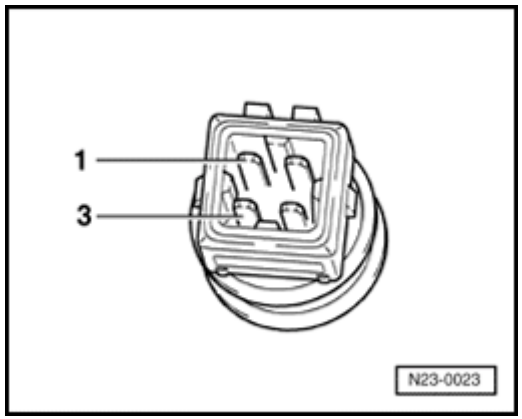
Note:

Intake air hose between Mass Air Flow (MAF) sensor and intake air elbow must be removed in order to be able to reach the coolant temperature sensor.

- Disconnect connector at coolant temperature sensor.

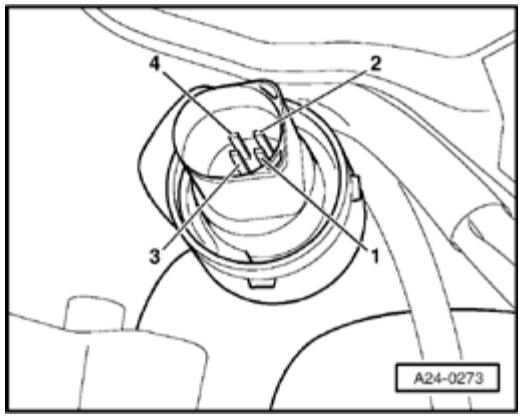
28-26

Coolant temperature sensor with square connector:



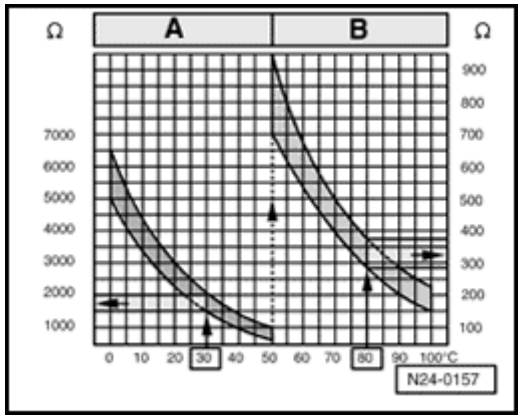
- Connect multimeter between terminal 1 and 3 of connector for resistance measurement.

Coolant temperature sensor with oval connector:



- Connect multimeter between terminal 3 and 4 of connector for resistance measurement.

28-27



All models

Range A shows the resistance values for the temperature range from 0-50 °C, and range B shows the values for the temperature range from 50-100 °C.

Read-out examples:

- 30 °C corresponds to a resistance of 1500 to 2000 Ω
- 80 °C corresponds to a resistance of 275 to 375 Ω

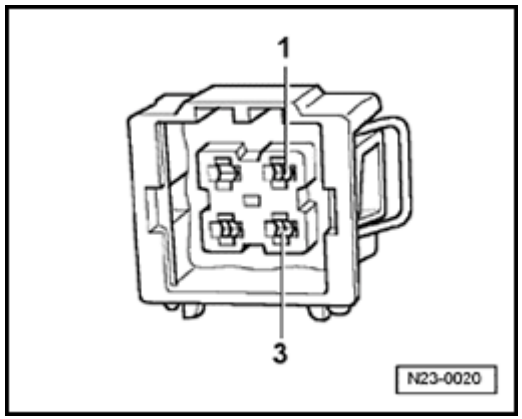
If specified value is not obtained:

- Replace coolant temperature sensor.

If specified value is obtained:

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

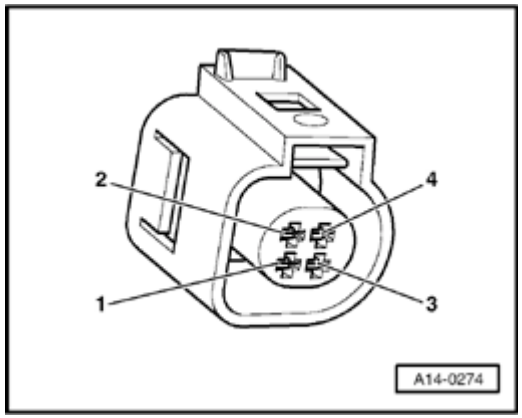
28-28



Coolant temperature sensor with square connector:

- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:

Harness connector Terminal	VAG1598/31 test box Socket
1 (signal)	93
3	108



Coolant temperature sensor with oval connector:

- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:

Harness connector Terminal	VAG1598/31 test box Socket
3	108
4 (signal)	93

28-29

All models

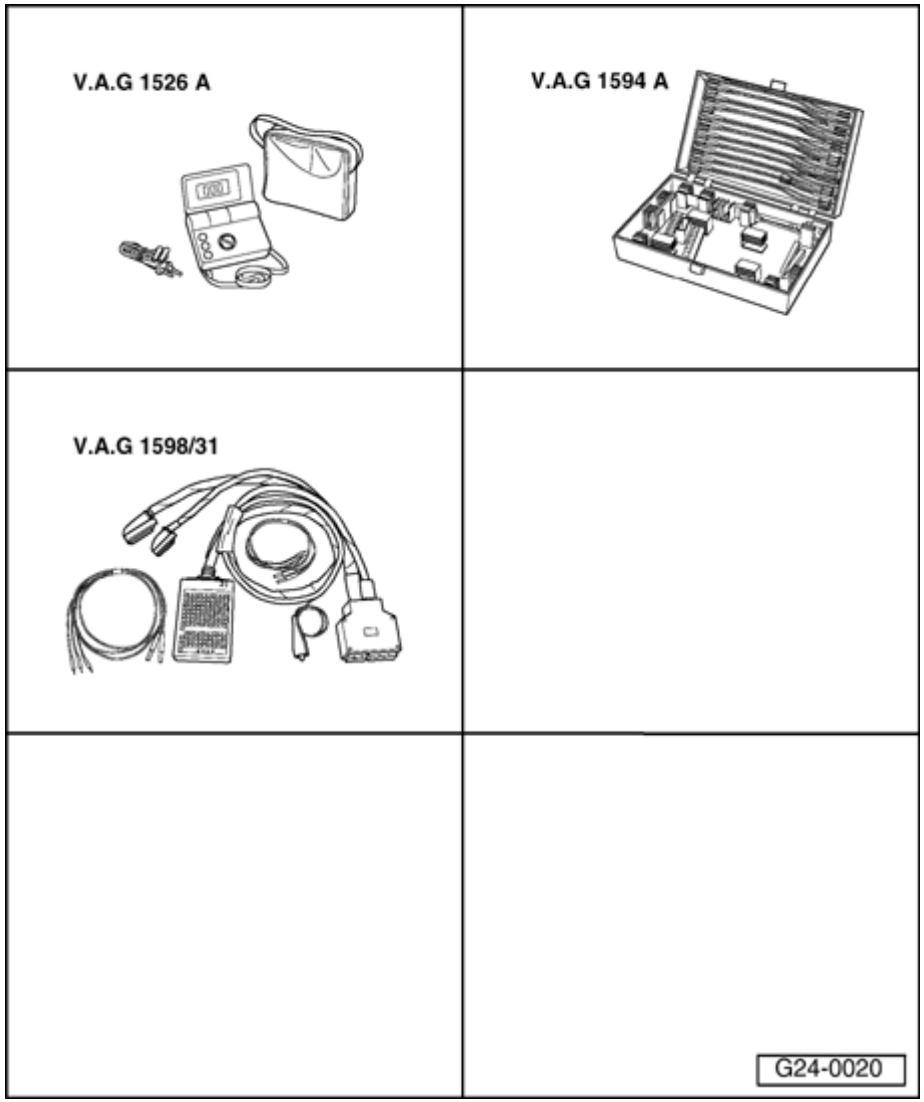
- Check both wires to each other for short circuit.

- Repair open circuit or short circuit if necessary.

If no malfunctions are found in wires:

- Replace Engine Control Module (ECM) ⇒ Page 24-21 .

28-30



Voltage supply for control module, checking

Special Tools and Equipment

- VAG1526A
- VAG1594A
- VAG1598/31

28-31

Test requirements:

- Fuse for Engine Control Module (ECM) OK

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

- Battery voltage at least 12.7 V

- Generator OK

Test sequence

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

- Switch ignition on.

Note:

- *The plus voltage supply for the Engine Control Module (ECM) travels via connector terminal 3 (terminal 15) and connector terminal 62 (terminal 30).*

- *Ground (GND) supply of the Engine Control*

Module (ECM) travels via connector terminal 1 and terminal 2.

28-32

- Connect multimeter for voltage measurement as follows:

VAG1598/31 test box Socket	Measure to
1	B+
2	B+
62	Engine Ground (GND)

- Specification: approx. battery voltage

- Connect multimeter for voltage measurement as follows:

VAG1598/31 test box Socket	Measure to
3	Engine Ground (GND)

- Switch ignition on.

- Specification: approx. battery voltage

If specified values are not obtained:

- Check wire connections.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

28-33

Knock recognition control stop, checking

The following tests must be performed when a DTC is stored that relates to "knock recognition control limit reached".

	Possible cause	Corrective action
DTC for all cylinders or DTC for all cylinders in one row	♦ Poor fuel quality	- Change fuel quality (see operating instructions)
	♦ Knock sensor tightened to incorrect torque	- Loosen knock sensors and tighten to 20 Nm
	♦ Knock sensor faulty	- Check knock sensors ⇒ Page 28-41
	♦ Corrosion at harness connector	
	♦ Engine accessories loose	- Secure engine accessories
DTC for one Cylinder	♦ Engine damage	- Check compression pressure
	♦ Engine accessories loose	- Secure engine accessories

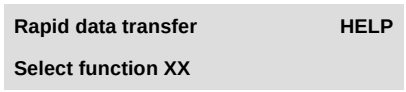
- Also check ignition angle retardation of the individual cylinders ⇒ Page 28-34 .

28-34

Check ignition angle retardation of the individual cylinders

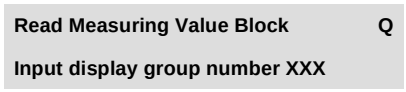
- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

Engine must run at idle for this.



When indicated on display:

- Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.



When indicated on display:

- Press buttons -0-, -2- and -0- to select "display group number 020" and press -Q- button to confirm input.

When indicated on display:

- Check indication in all display fields.

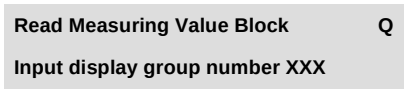
28-35

	Display fields			
	1	2	3	4
Display group 020: Ignition -knock control in driving operation				
Display	**xx.x ° KW**	**xx.x ° KW**	**xx.x ° KW**	**xx.x ° KW**
Indicated	**Ignition angle retardation cylinder 1 via knock control Knock sensor control**	**Ignition angle retardation cylinder 2 via knock control Knock sensor control**	**Ignition angle retardation cylinder 3 via knock control Knock sensor control**	**Ignition angle retardation cylinder 4 via knock control Knock sensor control**
Specified value	**0 to 12 ° KW**	**0 to 12 ° KW**	**0 to 12 ° KW**	**0 to 12 ° KW**
Notes	Evaluation ⇒ Page 28-40			

Note:

The number values indicated in display fields 1 to 4 represent actual ignition angle retardation via knock control of the individual cylinders. Ignition angle retardation occurs in ° KW (crankshaft degrees) toward retardation.

- Press -C- button.



When indicated on display:

- Press buttons -0-, -2- and -1- to select "display group number 021" and press -Q- button to confirm input.

When indicated on display:

- Check indication in display field 1 and 2.

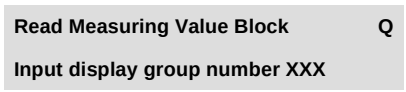
28-36

	Display fields			
	1	2	3	4
Display group 021: Ignition -knock control in driving operation				
Display	**xx.x ° KW**	**xx.x ° KW**		
Indicated	**Ignition angle retardation cylinder 5 via knock control Knock sensor control**	**Ignition angle retardation cylinder 6 via knock control Knock sensor control**		
Specified value	**0 to 12 ° KW**	**0 to 12 ° KW**		
Notes	Evaluation ⇒ Page 28-40			

Note:

The number values indicated in display fields 1 and 2 represent actual ignition angle retardation via knock control of the individual cylinders. Ignition angle retardation occurs in ° KW (crankshaft degrees) toward retardation.

- Press -C- button.



When indicated on display:

- Press buttons -0-, -2- and -2- to select "display group number 022" and press -Q- button to confirm input.

When indicated on display:

- Check indications in display field 3 and 4.

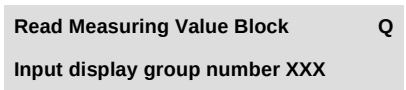
28-37

	Display fields			
	1	2	3	4
Display group 022: Ignition -knock control in driving operation				
Display	xxxx/min	xxx.x %	**xx.x ° KW**	**xx.x ° KW**
Indicated	Engine speed (RPM)	Engine load	**Ignition angle retardation cylinder 1 via knock control Knock sensor control**	**Ignition angle retardation cylinder 2 via knock control Knock sensor control**
Specified value	xxxx/min	12 to 100 %	**0 to 12 ° KW**	**0 to 12 ° KW**
Notes			Evaluation ⇒ Page 28-40	

Note:

The number values indicated in display fields 3 and 4 represent actual ignition angle retardation via knock control of cylinders 1 and 2. Ignition angle retardation occurs in ° KW (crankshaft degrees) toward retardation.

- Press -C- button.



When indicated on display:

- Press buttons -0-, -2- and -3- to select "display group number 023" and press -Q- button to confirm input.

When indicated on display:

- Check indications in display field 3 and 4.

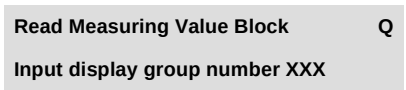
28-38

	Display fields			
	1	2	3	4
Display group 023: Ignition -knock control in driving operation				
Display	xxxx/min	xxx.x %	**xx.x ° KW**	**xx.x ° KW**
Indicated	Engine speed (RPM)	Engine load	**Ignition angle retardation cylinder 3 via knock control Knock sensor control**	**Ignition angle retardation cylinder 4 via knock control Knock sensor control**
Specified value	xxxx/min	12 to 100 %	**0 to 12 ° KW**	**0 to 12 ° KW**
Notes			Evaluation ⇒ Page 28-40	

Note:

The number values indicated in display fields 3 and 4 represent actual ignition angle retardation via knock control of cylinders 3 and 4. Ignition angle retardation occurs in ° KW (crankshaft degrees) toward retardation.

- Press -C- button.



When indicated on display:

- Press buttons -0-, -2- and -4- to select "display group number 024" and press -Q- button to confirm input.

When indicated on display:

- Check indications in display field 3 and 4.

28-39

	Display fields			
	1	2	3	4
Display group 024: Ignition -knock control in driving operation				
Display	xxxx/min	xxx.x %	**xx.x ° KW**	**xx.x ° KW**
Indicated	Engine speed (RPM)	Engine load	**Ignition angle retardation cylinder 5 via knock control Knock sensor control**	**Ignition angle retardation cylinder 6 via knock control Knock sensor control**
Specified value	xxxx/min	12 to 100 %	**0 to 12 ° KW**	**0 to 12 ° KW**
Notes			Evaluation ⇒ Page 28-40	

Note:

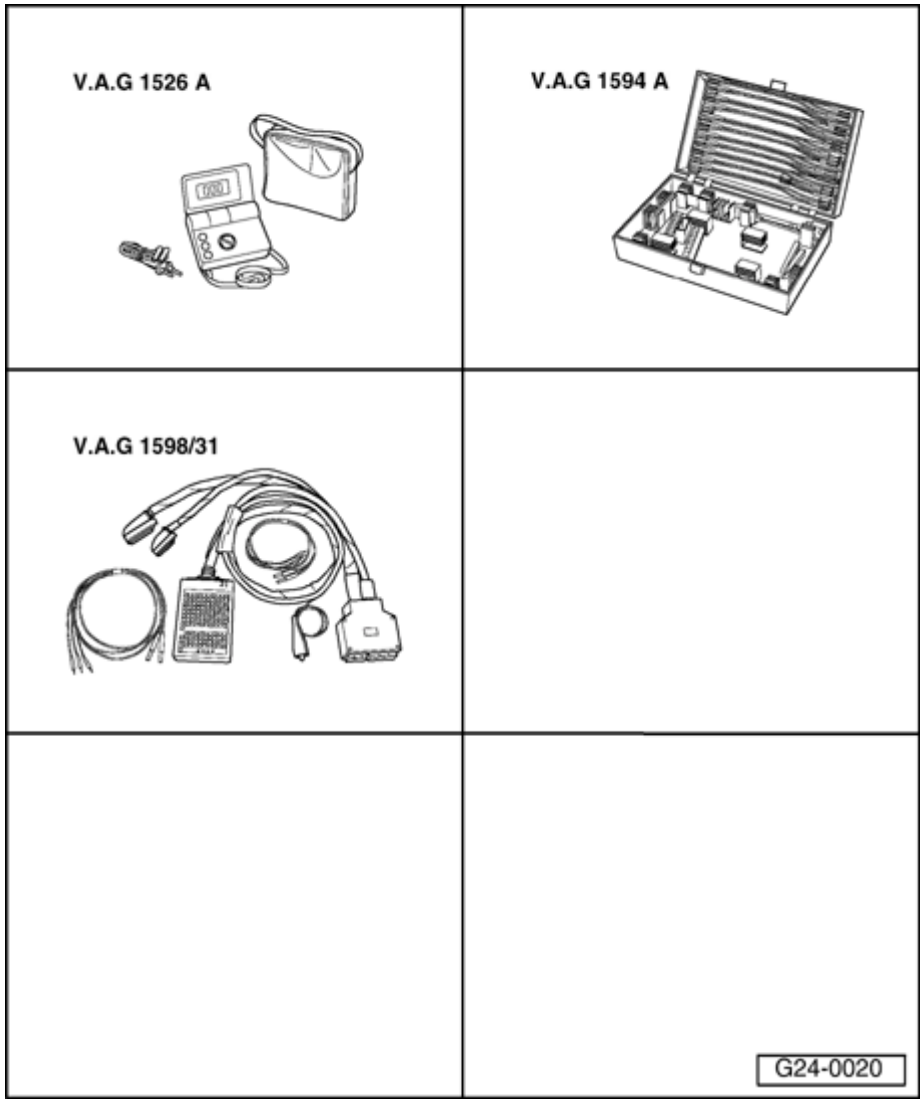
The number values indicated in display fields 3 and 4 represent actual ignition angle retardation via knock control of cylinders 5 and 6. Ignition angle retardation occurs in ° KW (crankshaft degrees) toward retardation.

28-40

Evaluation display groups 020/021/022/023/024 - ignition angle retardation

Indicated on display	Possible cause	Corrective action
All cylinders more than 12 ° KW	♦ Knock sensor faulty	- Check knock sensor ⇒ Page 28-41
	♦ Harness connector corroded	
	♦ Knock sensor incorrect tightening torque	- Loosen knock sensors and tighten to 20 Nm
	♦ Engine accessories loose	- Secure engine accessories
	♦ Poor fuel quality	- Change fuel quality (see operating instructions)
One cylinder deviates significantly from the others	♦ Harness connector corroded	- Check knock sensor ⇒ Page 28-41
	♦ Engine damage	- Check compression pressure: ⇒ Repair Manual, Engine Mechanical, Repair Group 15
	♦ Engine accessories loose	- Secure engine accessories

28-41



Knock sensors, checking

Special Tools and Equipment

- VAG1526A
- VAG1594A
- VAG1598/31

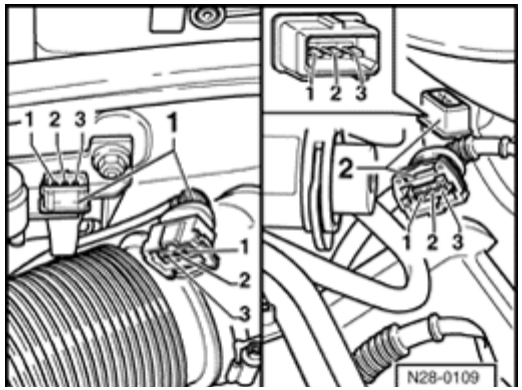
28-42

Component location ⇒ Overview of Component Locations, page ⇒ Page 24-5

Notes:

- *Knock Sensor (KS) 1 -G61- and Knock Sensor (KS) 2 -G66- themselves cannot be electrically tested.*
- *Use only gold-plated terminals when servicing harness connector for knock sensors.*
- *For the knock sensors to function properly, it is important that tightening torque be exactly 20 Nm.*
- *Check harness connector from knock sensor to wiring harness for corrosion.*

Check knock sensors

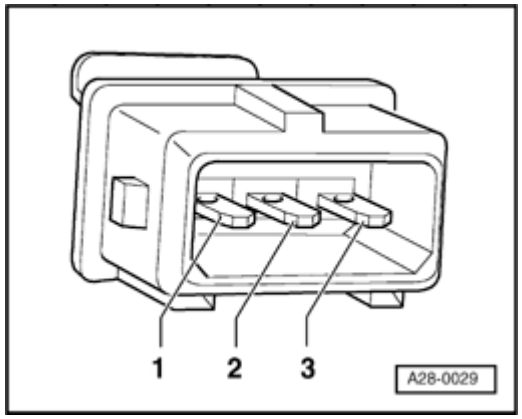


- Disconnect the harness connector of the relevant knock sensor in engine compartment.

Note:

Coolant reservoir screws must be removed and coolant reservoir must be placed to side in order to access harness connector for knock sensor for bank 2. The coolant hoses can remain connected.

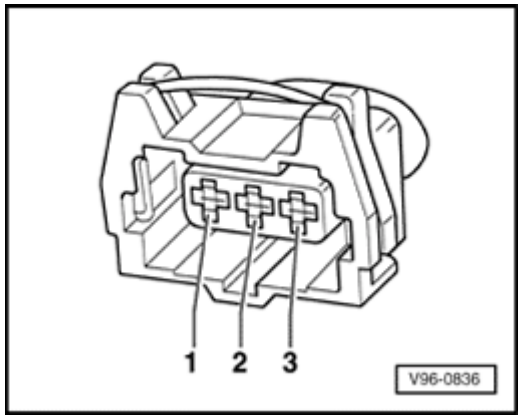
28-43



- Check all three terminals at knock sensor connector for short circuit to each other (terminal 1+2, 1+3, 2+3).
  - Specification: ∞ Ω (no continuity) - the wires must not have any connection to each other.
- If there is no connection , replace knock sensor.
- If no short circuit is detected, check knock sensor wires:

Check wires from knock sensors to Engine Control Module (ECM).

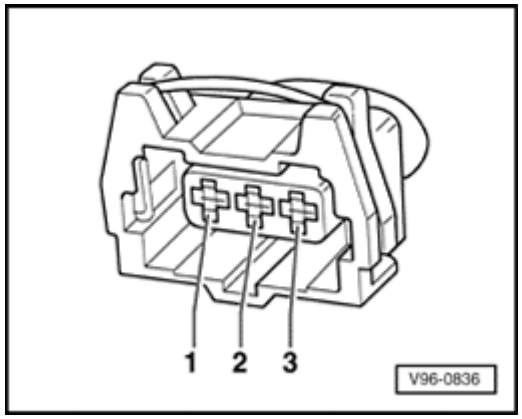
- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .
- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:



Knock Sensor (KS) 1 -G61-

Harness connector Terminal	VAG1598/31 test box Socket
1 (signal)	106
2 (Ground -GND-)	99
3 (shielding)	108

28-44

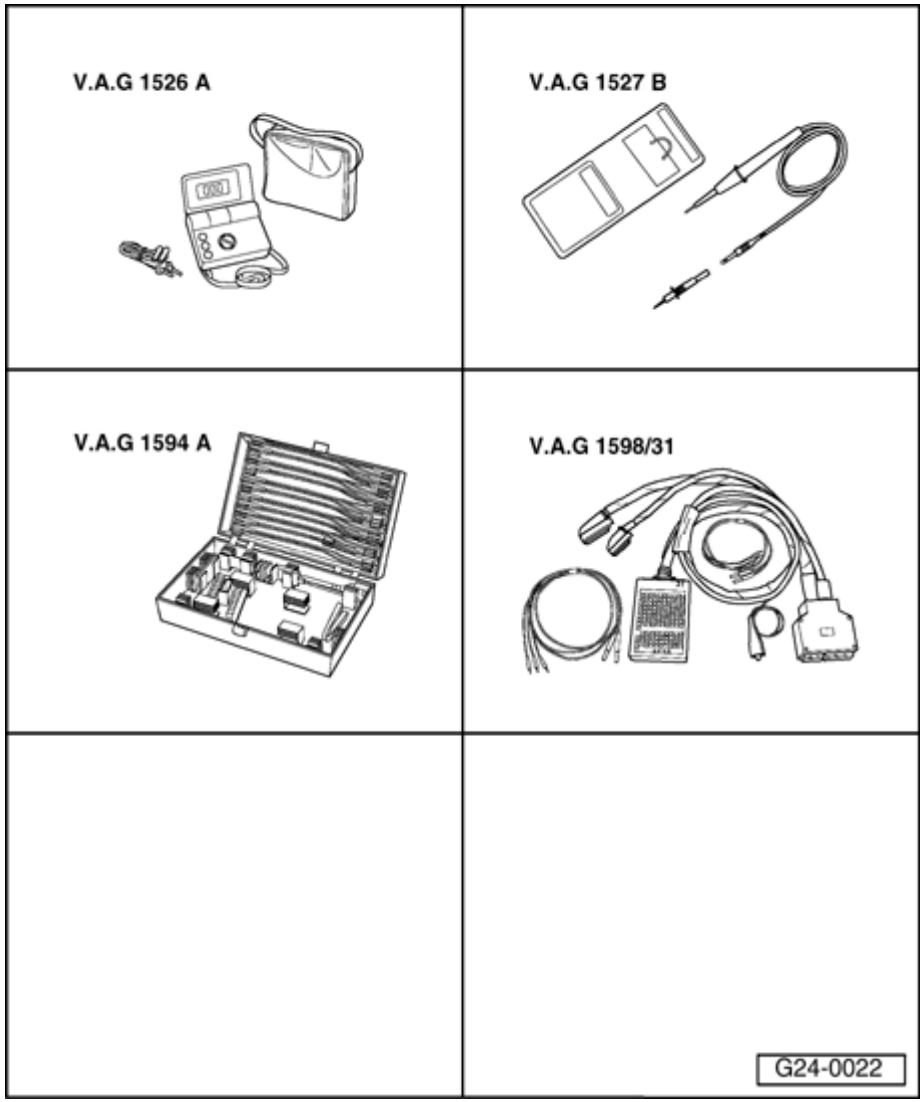


Knock Sensor (KS) 2 -G66-

Harness connector Terminal	VAG1598/31 test box Socket
1 (signal)	107
2 (Ground -GND-)	99
3 (shielding)	108

- Repair open circuit or short circuit if necessary.

28-45



Camshaft Position (CMP) sensor, checking

Special Tools and Equipment

- VAG1526A
- VAG1527B
- VAG1594A
- VAG1598/31

28-46

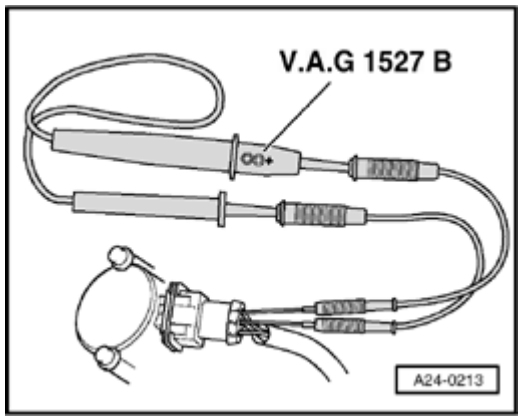
Component location ⇒ Overview of Component Locations, page ⇒ Page 24-5

Notes:

- *Camshaft Position (CMP) Sensor -G40- is located at rear of left cylinder block (bank 2).*
- *Camshaft Position (CMP) Sensor 2 -G163- is located at front of right cylinder block (bank 1).*

Checking activation

- Slide back rubber grommet at connector of the respective Camshaft Position (CMP) Sensor (connector remains connected to Camshaft Position (CMP) Sensor).



- Connect VAG1527B voltage tester between sockets 2 (CMP sensor signal) and 1 (B+).

Note:

Connector socket numbers are shown on the rear side of the connector.

- Operate starter for a few seconds.
  - LED must blink briefly at every second engine rotation.

28-47

Note:

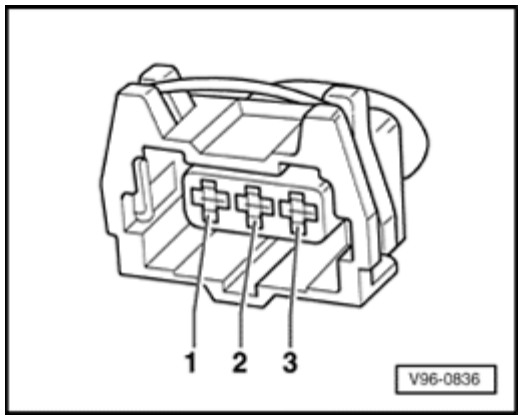
Voltage testers do not go out completely during low current pick-up between activations by the ECM, but rather continue to glow a little and then get significantly brighter during activation.

If LED does not blink:

Checking voltage supply

- Disconnect connector at respective Camshaft Position (CMP) sensor.

- Switch ignition on.

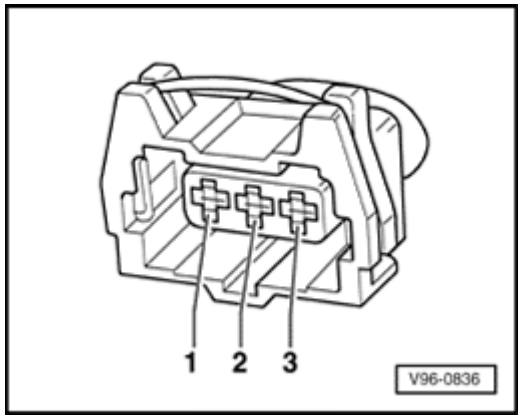


- Connect multimeter for voltage measurement as follows:

Harness connector Terminal	Measure to
1	Engine Ground (GND)

♦ Specification: about 5 V

28-48



Checking signal wire

- Connect multimeter for voltage measurement as follows:

Harness connector Terminal	Measure to
2	Engine Ground (GND)

♦ Specification: approx. battery voltage

Checking Ground (GND) wire

- Connect multimeter for voltage measurement as follows:

Harness connector Terminal	Measure to
3	B+

♦ Specification: approx. battery voltage

- Repair open circuit or short circuit if necessary.

If all specified values are being reached and the LED does not blink (measured between terminal 1 and 2 with starter and connector connected):

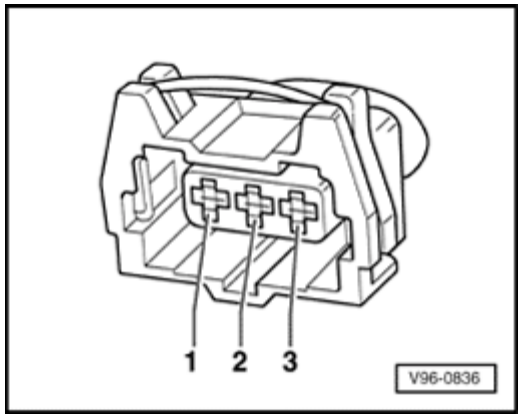
- Replace respective Camshaft Position (CMP) sensor.

28-49

If specified values are not obtained:

Checking wire connections between Camshaft Position (CMP) sensor and Engine Control Module (ECM)

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .



- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:

Camshaft Position (CMP) Sensor 2 -G40- (bank 2)

Harness connector Terminal	VAG1598/31 test box Socket
1 (B+)	98
2 (signal)	86
3 (Ground -GND-)	108

Camshaft Position (CMP) Sensor 2 -G163- (bank 1)

Harness connector Terminal	VAG1598/31 test box Socket
1 (B+)	98

2 (signal)	87
3 (Ground -GND-)	108

28-50

- Repair open circuit or short circuit if necessary.

- If, after erasing DTC memory for the sake of the test, a DTC relating to the Camshaft Position (CMP) sensor (hall sensor) is indicated again, even though all previous tests were OK, the following malfunction is possible:

  - Shutter wheel for Camshaft Position (CMP) sensor is not aligned properly.

Check phase position of Camshaft Position (CMP) sensor

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

  Engine must run at idle for this.

Rapid data transfer **HELP**

Select function XX

➢ When indicated on display:

- Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.

Read Measuring Value Block **Q**

Input display group number XXX

➢ When indicated on display:

- Press buttons -0-, -9- and -3- to select "display group number 093" and press -Q- button to confirm input.

When indicated on display:

- Check specified values of Camshaft Position (CMP) sensor

28-51

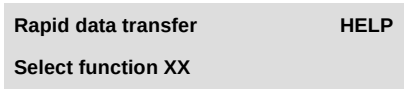
	Display fields			
	1	2	3	4
Display group 093: Phase position of Camshaft Position (CMP) sensor bank 1 and bank 2 with engine at idle.				
Display	xxx /min	xx %	**° KW**	**° KW**
Indicated	Engine speed	Engine load	**Phase position Bank 1**	**Phase position Bank 2**
Functional range	630 to 6800 RPM	12 to 100 %	**-20 to 15 ° KW**	**-20 to 15 ° KW**
Specified value	720 to 820 RPM 1) 630 to 730 RPM 2)	12 to 26 %	**-20 to 15 ° KW**	**-20 to 15 ° KW**
Notes			**If specified values are not reached, unscrew Camshaft Position (CMP) sensor and check whether shutter wheel is mounted properly at camshaft (if mounted improperly, locking lug will get squished when mounting bolt is tightened).** - Also check engine timing ⇒ Repair Manual, Engine, Mechanical, Repair Group 13, removing and installing toothed belt	

1) Front Wheel Drive Vehicles

2) All-Wheel Drive Vehicles

If specified values are obtained:

- Press → button.



Indicated on display (function selection):

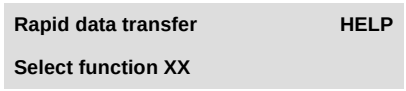
28-52

Misfire recognition, checking

Test sequence

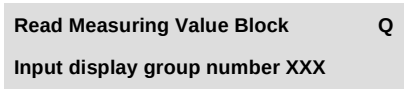
- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

Engine must run at idle for this.



When indicated on display:

- Press buttons -0- and -8- to select "Read measuring value block" function 08. Press -Q- button to confirm input.



When indicated on display:

- Press buttons -0-, -1- and -4- to select "display group number 014" and press -Q- button to confirm input.

When indicated on display:

- Check misfire recognition in display fields 3 and 4.

28-53

	Display fields			
	1	2	3	4
Display group 014: Misfire recognition				
Display	xxxx/min	xxx %	**xxx**	**---**
Indicated	Engine speed (RPM)	Load	**Number of combustion misfires**	**Misfire recognition**
Functional range	670 to 6800 RPM	12 to 100 %		**activated** **locked**
Specified value	720 to 820 RPM [1)] 630 to 730 RPM [2)]	12 to 26 %	**0 to 12**	**activated**
Notes			**If the specified value is exceeded: Check combustion misfires of the individual cylinders ⇒ Page 28-54**	

1) Front Wheel Drive Vehicles

2) All-Wheel Drive Vehicles

If specified value is obtained:

- Press → button.

Rapid data transfer HELP

Indicated on display (function selection):

Select function XX

28-54

Check misfire recognition of the individual cylinders.

- Press -C- button.

Read Measuring Value Block Q

Input display group number XXX

When indicated on display:

- Press buttons -0-, -1- and -5- to select "display group number 015" and press -Q- button to confirm input.

Read Measuring Value Block 15 →

1 2 3 4

When indicated on display:

- Check misfire recognition in display fields 1 to 4.

	Display fields			
	1	2	3	4
Display group 015: Misfire recognition of cylinders 1, 2 and 3				
Display	**xxx**	**xxx**	**xxx**	**---**
Indicated	**Number of combustion misfires, cylinder 1**	**Number of combustion misfires, cylinder 2**	**Number of combustion misfires, cylinder 3**	**Misfire recognition**
Functional range				**activated** **locked**
Specified value	**0 to 15**	**0 to 15**	**0 to 15**	**activated**
Notes	**If the specified value is exceeded: Evaluation ⇒ Page 28-56**			**---**

28-55

- Press -C- button.

Read Measuring Value Block Q

Input display group number XXX

When indicated on display:

- Press buttons -0-, -1- and -4- to select "display group number 014" and press -Q- button to confirm input.

Read Measuring Value Block 16 →

1 2 3 4

When indicated on display:

- Check misfire recognition in display fields 1 to 4.

	Display fields			
	1	2	3	4
Display group 016: Misfire recognition of cylinders 4, 5 and 6				
Display	**xxx**	**xxx**	**xxx**	**---**
Indicated	**Number of combustion misfires, cylinder 4**	**Number of combustion misfires, cylinder 5**	**Number of combustion misfires, cylinder 6**	**Misfire recognition**
Functional range				**activated** **locked**
Specified value	**0 to 15**	**0 to 15**	**0 to 15**	**activated**
Notes	**If the specified value is exceeded: Evaluation ⇒ Page 28-56**			**---**

28-56

Evaluation display group 014, display field 3 and display group 015 and 016, display fields 1, 2 and 3

Indicated on display	Possible cause	Corrective action
greater than 15	♦ spark plug defective ♦ spark plug connector defective ♦ Ignition coil or power output stage faulty	- Check spark plugs and ignition wires with connectors. - Check ignition coils and power output stages ⇒ Page 28-7
	♦ Fuel injector faulty	- Check fuel injectors ⇒ Page 24-36
	♦ Poor compression of one or more cylinders	- Check compression pressure: ⇒ Repair Manual, Engine Mechanical, Repair Group 15