28-1

Ignition system, checking

General notes on ignition system

- Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control module may be damaged.
- The engine control module is equipped with On Board Diagnostic (OBD).
- For trouble-free operation of the electrical components a voltage of at least 11.5 V is necessary.
- During some of the tests it is possible that the control module will detect and record a malfunction. The DTC memory must therefore be checked and if necessary erased when all tests and repair work have been completed.
- After completing troubleshooting, repairs or component tests, it is possible that the engine will start, run for a short period and then cut out. If this happens it may be that the immobilizer is blocking the engine control module. In such cases the DTC memory must be checked and if necessary the control module must be adapted.

28-2

Safety precautions

To prevent injuries to persons and/or damage to the fuel injection and ignition system, the following must be noted:

WARNING!

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

- ***DO NOT touch or disconnect ignition wiring when the engine is running or being turned at starter speed.***
- ***DO NOT operate the starter if fuel injectors are removed.***
- ***Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control module may be damaged.***
- ***The ignition must be switched off before connecting or disconnecting injection or ignition system wiring or tester cables.***
- ***In order to run the engine at starting speed***

without actually starting it (e.g. to test compression), disconnect the connectors from the output stages of the ignition coils and from all the fuel injectors. After completing the work, check and erase the DTC memory.

- ***The ignition must always be switched off when cleaning the engine.***

28-3

CAUTION!

Before disconnecting the battery:

- ***Stop the engine.***
- ***Be sure of proper radio code (for vehicles equipped with coded anti-theft radio).***

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

- ***Be sure the ignition is switched OFF.***
- ***Use correct adapters from VAG1594 connector test kit***

28-4

Technical data, ignition system

Engine code	APB
Engine idle RPM Not adjustable - controlled by Idle Air Control (IAC)	750 - 850 RPM
RPM limit ♦ Operates by closing throttle valve ♦ Operates by shutting off fuel injectors	approx. 6800 RPM
Ignition timing is determined by the control module. Ignition timing cannot be adjusted.	
Ignition system	Single-coil system with 6 ignition coils located above spark plug connectors and installed directly on spark plugs. The power output stages are located as separate components in air cleaner housing.
Spark plugs connectors	Resistance approx.: 2K Ohm
Firing order	1-4-3-6-2-5

28-5

Ignition coils, checking

Note:

Misfiring is recognized by the On Board Diagnostic (OBD). This means a non working cylinder is stored with the cylinder number in the DTC memory. This has an advantage in case of a malfunction the trouble shooting procedure can be started at a certain cylinder. Check the DTC memory of the Engine Control Module (ECM) before commencing trouble shooting.

Test conditions

- No DTCs stored relating to any of the fuel injectors

Determine a non working or misfiring cylinder as follows:

28-6

- With the engine running disconnect harness connectors in sequence from fuel injectors, and observe the engine performance.

or

- Compare spark plugs of all cylinders with each other and check for soot on the electrodes.

When the faulty cylinder has been identified:

- Connect hand-held multimeter (resistance measurement) to spark plug connector:

Note:

The spark plug connector can be disconnected from the ignition coil.

Specified value: approx.: 2K Ohm.

28-7

If specification is not obtained:

- Replace spark plug connector.

If specification is obtained:

- Exchange spark plug from faulty (misfiring) cylinder with one from another cylinder. Visually check spark plug for damage e.g.: cracks on ceramic body of spark plug.

- If malfunction (misfire) occurs now on other cylinder, replace spark plug.

If the malfunction remains at the same cylinder:

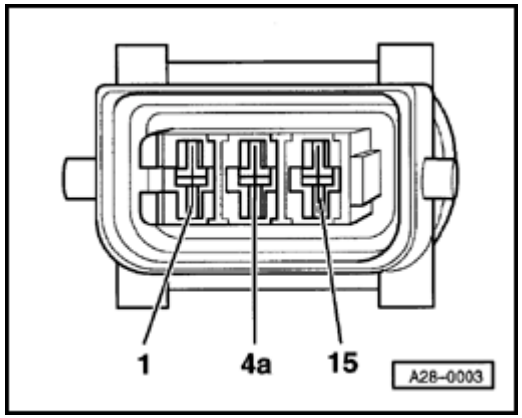
- Exchange ignition coil from faulty (misfiring) cylinder with one from another cylinder. Visually check ignition coil for damage (ignition coil could be cracked or bursted)

- If malfunction occurs now on other cylinder, replace ignition coil.

28-8

If malfunction remains at the same cylinder.

- Disconnect harness connector from ignition coil.



- Check Ground (GND) connection between socket 4a and engine Ground (GND) for open circuit and short circuit to B+.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- Repair any open/short circuit as necessary.

If the Ground (GND) connection is OK.

- Connect hand-held multimeter (voltage range) to terminal 15 of harness connector and Ground (GND).
- Disconnect harness connector from fuel injector of cylinder to be tested.
- Operate starter.

  Specified value: approx. battery voltage

28-9

If the specification is not obtained:

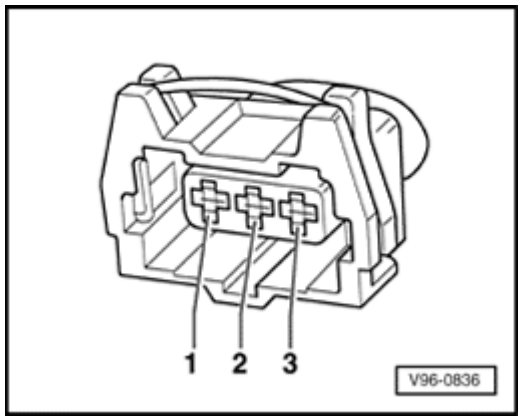
- Check wiring.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

If the specification is obtained:

- Disconnect 3-pin harness connectors on power output stages for ignition coils; component locations overview ⇒ Page 24-5 .

- Then connect diode test lamp to 3-pin connectors for both output stages.



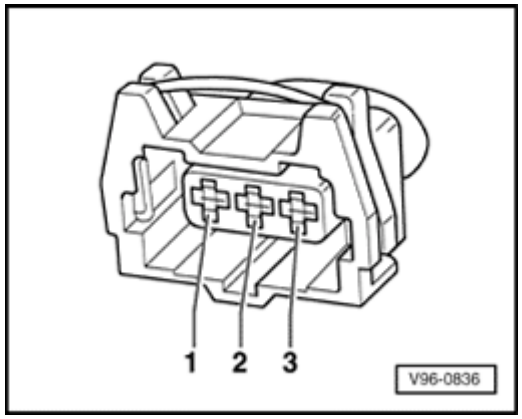
- Connect diode test lamp VAG1527 to following contacts on connectors for power output stages:

3-pin harness connector terminal	Specification (with starter activated)
1 + Ground (GND)	Diode test lamp should light up
2 + Ground (GND)	
3 + Ground (GND)	

If the specifications are not obtained:

- Switch ignition off.

28-10



Check the following wiring connections for open circuits and/or short to B+ or Ground (GND).

Black 3-pin connector on power output stage, terminal	3-pin connector on ignition coil, terminal
1	1 (cylinder 1)
2	1 (cylinder 2)
3	1 (cylinder 3)
Brown 3-pin connector on power output stage, terminal	**3-pin connector on ignition coil, terminal**
1	1 (cylinder 4)
2	1 (cylinder 5)
3	1 (cylinder 6)

- Eliminate any open/short circuit as necessary.

28-11

Power output stages for ignition coils, checking

Note:

- *Power Output Stage -N122 (black connector) activates the ignition coils for cylinder bank 1 (cylinders 1 to 3).*

- *Power Output Stage 2 -N192 (brown connector) activates the ignition coils for cylinder bank 2 (cylinders 4 to 6).*

Checking activation of power output stages

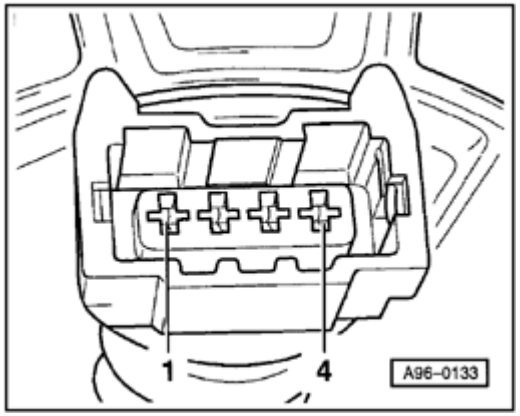
- Disconnect harness connectors from all six fuel injectors.

Note:

It is important to ensure that no fuel is injected during the test as this would damage the catalytic converter. The harness connectors on the fuel injectors must therefore be disconnected.

28-12

- Disconnect 4-pin harness connectors on power output stages Component locations overview, ⇒ Page 24-5 .



- Connect diode test lamp VAG1527 in turn to the following contacts on the two 4-pin connectors for the power output stages.
- Then, operate starter for a few seconds.

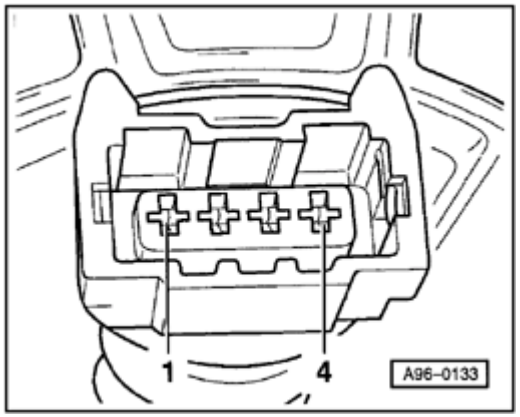
6-pin connector on wiring harness, terminal	Specification
1 + Ground (GND)	Diode test lamp should flash (brief impulse)
3 + Ground (GND)	
4 + Ground (GND)	

28-13

If the specifications are not obtained:

- Switch ignition off.

- Connect test box VAG 1598/31 to wiring harness for engine control module. Do not connect to the engine control module itself. ⇒ Page 24-20 .



The following wiring connections are to be checked for open circuits and/or short to B+ or Ground (GND).

Black 4-pin connector on wiring harness, terminal	VAG1598/31 test box, socket
1	94
3	110
4	102
Brown 4-pin connector on wiring harness, terminal	**VAG1598/31 test box, socket**
1	95
3	111
4	103

- Rectify any open/short circuit as necessary.

If no wiring malfunction is detected:

- Connect 4-pin connectors to power output stages.

- Disconnect 3-pin connectors from power output stages.

- Connect diode test lamp VAG1527 to battery (B+) and to one of the 3 terminals on power output stage.

- Operate starter for few seconds.

  The diode test lamp should flash.

- Carry out test with all 3 terminals on each of the 3-pin connectors for the power output stages.

  The diode test lamp should flash each time.

28-15

If the diode test lamp does not flash when testing one or more of the contacts:

Check the Ground (GND) connections for the power output stages as follows:

- Disconnect 4-pin harness connectors from power output stages.

- Connect diode test lamp VAG1527 to battery (B+) and terminal 2 of each of the 4-pin connectors in turn.

  The diode test lamp should light up.

- If diode test lamp does not light up, test for open circuit in wiring using wiring diagram.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

If the diode test lamp lights up:

- Replace power output stage.

Note:

Before installing new power output stage coat metal side with heat paste (part no. G 052 170 A1). The heat paste is used to prevent corrosion between the power output stage and the fastening point, it is also used to transfer heat from the power output stage.

CAUTION!

Part numbers are only for reference, always check with your parts department for latest information.

28-17

Intake Air Temperature (IAT) sensor - G42, checking

Location of sensor and connector ⇒ Page 24-5 .

- Connect vehicle diagnostic, testing and information system VAS 5051 or VAG1551 scan tool and select engine electronics control module by entering address word "01" ⇒ Page 01-9 . When doing this the ignition must be switched on.

Rapid data transfer HELP

Select Function XX

Indicated on display

- Press buttons -0- and -8- to select function "Read Measuring Value Block" and confirm entry with -Q- button.

Read Measuring Value Block HELP

Input Display Group Number XXX

Indicated on display

- Press buttons -0-, -0- and -4- to select Display Group 4 and confirm entry with -Q- button.

Read Measuring Value Block 4 →

1 2 3 4

Indicated on display: (1...4 = display fields)

- Check display value for intake air temperature sensor (display field 4):

28-18

	Display fields			
	1	2	3	4
Display Group 004: Intake air temperature with engine idling				
Display	xxxx rpm	xx.xxx V	xxx.x °C	**xxx.x °C**
Indicates	Engine speed	Battery voltage	Coolant temperature	**Intake air temperature**
Work range	min.: 750 RPM max.: 6800 RPM	min.:10.000 V max.: 15.000 V	min.: -48.0 °C max.: 143.0 °C	**min.: -48.0 °C** **max.: 143.0 °C**
Specified value	xxxx RPM	12.000...15.000 V	80.0...110.0 °C	**Between ambient temp. and 120 °C** [1)]

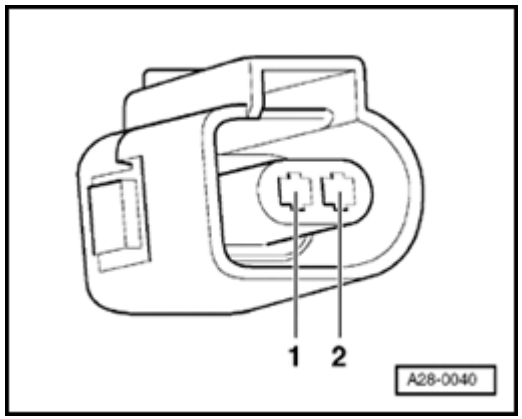
1) If there is a large difference between the temperature displayed and the ambient temperature at the sensor, check the sensor and sensor wiring for contact resistance and open circuit.

28-19

Checking wiring:

- Switch ignition off.

- Connect test box VAG1598/31 to wiring harness for engine control module. Do not connect to the engine control module itself. ⇒ Page 24-20 .



- Check for open circuit in wiring between test box and 2 pin harness connector using wiring diagram.

  Specified value: max. 1.5 Ω

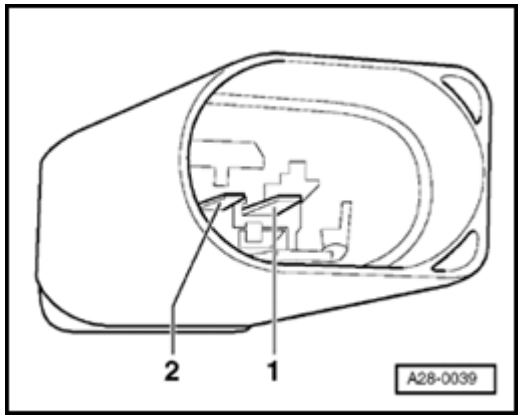
Terminal on 2-pin harness connector	Contact on control module connector or test box
1	85
2	108

- Check wiring for short circuits to each other between contacts 1 and 2 on 2-pin connector. Also test for short circuits to B+ or Ground (GND).

28-20

If no malfunction in wire is detected:

Checking sender



- Measure resistance between contacts 1 (signal) and 2 (Ground GND)) on connector for Intake Air Temperature (IAT) sensor -G42.

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

- If value does not match the specification, replace intake air temperature sensor.
- In order to install a new sensor, the intake manifold must first be removed ⇒ Page 24-15 .

28-21

Engine Speed (RPM) sensor -G28, checking

Note:

- *The engine speed sender is a combined speed sender and reference mark sender. Without a signal from the Engine Speed (RPM) sensor -G28 the engine cannot be started. If the signal from the Engine Speed (RPM) sensor -G28 fails while the engine is running, the engine will cut out immediately.*

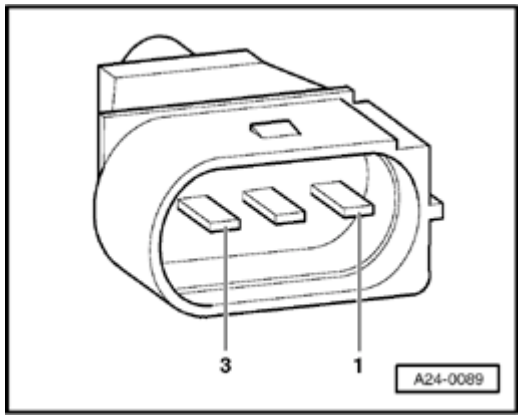
Checking Engine Speed (RPM) sensor

Component location of sensor and connector ⇒ Page 24-5 .

- Before carrying out test, make sure that sensor is correctly installed and firmly seated.

- Disconnect harness connector for Engine Speed (RPM) sensor (grey connector).

28-22



- Connect multimeter (Fluke 83 or equivalent) (resistance test range) to terminals 2 and 3 on connector for engine speed sensor using test lead from VAG1594 connector test kit.

  Specified value: approx. 730 - 1000 ohm

Notes:

- *The resistance value for the engine speed sensor is based on a temperature of 20° C.*
- *The resistance increases as the temperature rises.*

If the specification is not attained:

- Replace engine speed sensor.

If the specification is attained:

- Connect multimeter (Fluke 83 or equivalent) (resistance test range) between terminals 2 and 1 (Ground (GND)) and between terminals 3 and 1 (Ground (GND)).

  Specified value: R Ω (infinite Ohms / open circuit) in each test

If the specification is not attained:

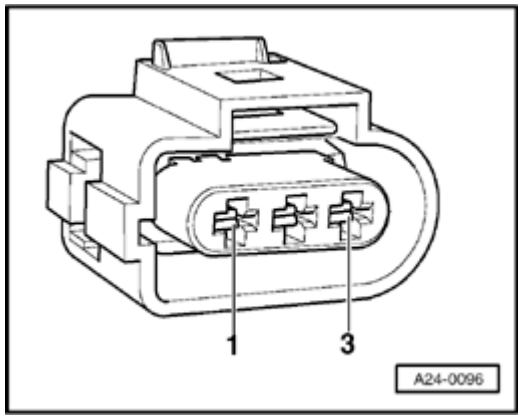
- Replace Engine Speed (RPM) sensor.

If the specification is attained:

- Check wiring between sensor connector and engine control module as

follows:

28-23



- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .

- Test continuity of screening (shielded wire) between contact 1 on engine speed sender connector and socket 108 on test box.

Specified value: max. 1 Ω.

- Test continuity of negative wire from contact 2 on sender connector to socket 90 on test box.

Specified value: max. 1 Ω.

- Test continuity of signal wire from contact 3 on sender connector to socket 82 on test box.

Specified value: max. 1 Ω.

28-24

If the values are not as specified:

- Rectify short or open circuit in wiring between sender connector and control module connector.

Terminal on sensor connector	Terminal on control module connector
1	108
2	90
3	82

- If no open circuits or short circuits are identified, replace Engine Control Module (ECM) ⇒ Page 24-24 .

28-25

Engine Coolant Temperature (ECT) sensor -G62, checking

Note:

Component location of coolant temperature sensor ⇒ Page 24-5 .

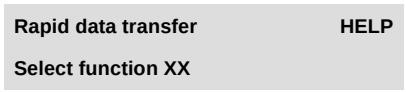
Test conditions

- Engine cold

- Connect vehicle diagnostic, testing and information system VAS 5051 or VAG1551 scan tool to vehicle and select engine electronics control module by entering address word "01" ⇒ Page 01-9 .

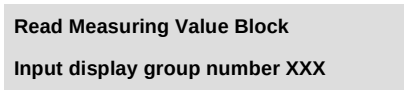
  When doing this the engine must be at idle.

28-26



Indicated on display

- Press buttons -0- and -8- to select function "Read Measuring Value Block" and confirm entry with -Q- button.



Indicated on display

- Press buttons -0-, -0- and -4- to select Display Group 4 and confirm entry with -Q- button.

Indicated on display

- Check readout for coolant temperature sender in display field 3.

28-27

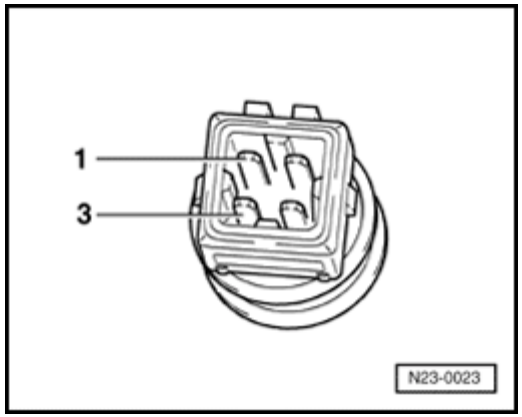
	Display fields			
	1	2	3	4
Display Group 004: Coolant temperature with engine idle				
Display	xxxx RPM	xx.xxx V	**xxx.x °C**	xxx.x °C
Indicates	Engine speed RPM	Battery voltage	**Coolant temperature**	Intake air temperature
Specified value	XXXX RPM	12.000...14.500 V	**Temperature must increase evenly**	Ambient temperature until 120 °C

28-28

If display field 3 does not display a realistic value:

- Disconnect harness connector from coolant temperature sensor.

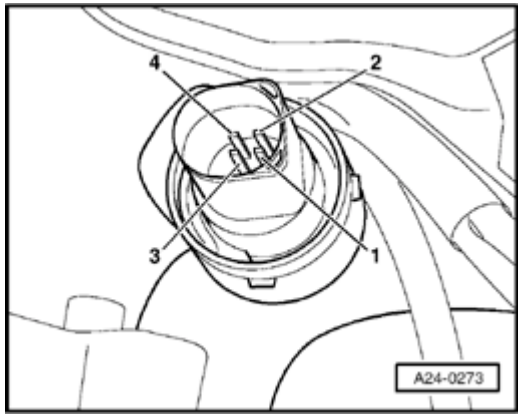
Coolant temperature sensor with square connector:



- Connect multi-meter (resistance measurement) between terminals 1 and 3 of sensor.

28-29

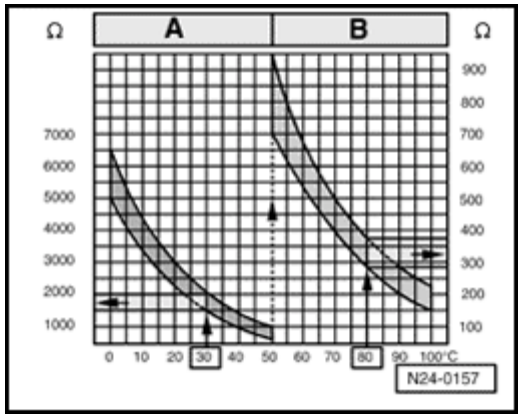
Coolant temperature sensor with oval connector:



- Connect multi-meter (resistance measurement) between terminals 3 and 4 of sensor.

All:

Scale A shows resistance values for temperature range 0 - 50 ° C and scale B the values for temperature range 50 - 100 ° C.



Examples:

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

If value does not match the specification:

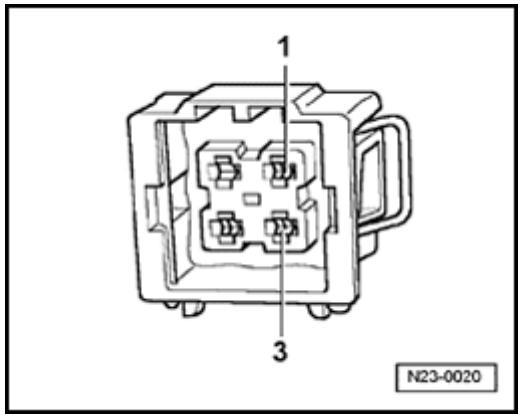
- Replace coolant temperature sensor.

28-30

If the value does match the specification:

- Connect test box VAG1598/31 to wiring harness for engine control module. Do not connect to the engine control module itself. ⇒ Page 24-20 .

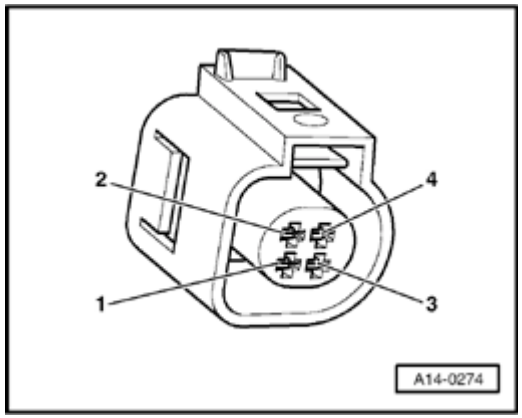
Coolant temperature sensor with square connector:



- Check following wiring connections for open circuits and short circuits to B+ or Ground (GND)

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

Coolant temperature sensor with oval connector:



- Check following wiring connections for open circuits and short circuits to B+ or Ground (GND)

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

28-31

All:

- Check wiring for short circuit to each other.
- If necessary eliminate open circuit or short circuit.

If no malfunction is identified in the wiring:

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

28-32

Control module voltage supply, checking

Test requirements:

- Fuse for Engine Control Module (ECM) OK

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- Battery voltage at least 11 V

- Generator OK

- Connect test box VAG1598/31 to wiring harness for engine control module. Do not connect to the engine control module itself. ⇒ Page 24-20 .

- Switch ignition on.

Note:

- *The B+ voltage supply for the engine control module comes via terminal 3 (terminal 15) and terminal 62 (terminal 30).*

- *The Ground (GND) connection for the engine control module is via terminals 1 and 2.*

28-33

- Connect hand-held multimeter VAG1526 (voltage measurement range) to the following contacts on the test box:

Contact	Specification
3 + 2	approx. battery voltage
3 + 1	approx. battery voltage
62 + 2	approx. battery voltage

If the specifications are not obtained:

- Check wiring.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

28-34

Knock sensor control limit, checking

If the malfunction message "Knock control regulation reached" is recorded in the DTC memory the following tests must be carried out. See also measuring value blocks 20, 21, 22, 23 and 24 ⇒ Page 28-35

	Possible cause of malfunction	Corrective action
Malfunction message relating to all cylinders or malfunction message relating to all cylinders in one bank	♦ Poor fuel quality	- Change to higher quality fuel (see Owner's Manual)
	♦ Incorrect tightening torque on knock sensor	- Loosen knock sensor, then tighten to 20 Nm (15 ft lb)
	♦ Knock sensor faulty	- Check knock sensor ⇒ Page 28-41 .
	♦ Corrosion on connector	
	♦ Loose components on engine	- Secure loose components
Malfunction message relating to one cylinder	♦ Mechanical engine damage	- Check compression pressure
	♦ Loose components on engine	- Secure loose components

28-35

Measuring value blocks for ignition timing angle retard

Display Group 20 -Ignition- Knock control						
• Driving mode						
Read measuring value block 20 →				◀ Indicated on display		
xx.x ° KW	xx.x ° KW	xx.x ° KW	xx.x ° KW			
1	2	3	4	◀ Display fields	**Specified value**	**Evaluation**
				Ignition timing retard via knock control: cylinder 4	0...12 ° KW (crankshaft angle)	⇒ Page 28-40
				Ignition timing retard via knock control: cylinder 3	0...12 ° KW (crankshaft angle)	⇒ Page 28-40
				Ignition timing retard via knock control: cylinder 2	0...12 ° KW (crankshaft angle)	⇒ Page 28-40
				Ignition timing retard via knock control: cylinder 1	0...12 ° KW (crankshaft angle)	⇒ Page 28-40

Note:

The displayed digit values in display fields 1 to 4 reflects the actual "ignition timing retard" via knock control from the individual cylinders. The ignition timing retard occurs via ° KW (crankshaft angle).

28-36

Display Group 21 -Ignition- Knock control						
• Driving mode						
Read measuring value block 21 →				◀ Indicated on display		
xx.x ° KW	xx.x ° KW					
1	2	3	4	◀ Display fields	**Specified value**	**Evaluation**
				Ignition timing retard via knock control: cylinder 6	0...12 ° KW (crankshaft angle)	⇒ Page 28-40
				Ignition timing retard via knock control: cylinder 5	0...12 ° KW (crankshaft angle)	⇒ Page 28-40

Note:

The displayed digit values in display fields 1 and 2 reflects the actual "ignition timing retard" via knock control from the individual cylinders. The ignition timing retard occurs via ° KW (crankshaft angle).

28-37

Display Group 22 -Ignition- Knock control						
• Driving mode						
Read measuring value block 22 →				◀ Indicated on display		
xx.x RPM	x.x %	xx.x ° KW	xx.x ° KW			
1	2	3	4	◀ Display fields	**Specified value**	**Evaluation**
				Ignition timing retard via knock control: cylinder 2	0...12 ° KW (crankshaft angle)	⇒ Page 28-40
				Ignition timing retard via knock control: cylinder 1	0...12 ° KW (crankshaft angle)	⇒ Page 28-40
		Engine load			15 - 175 %	
	Engine speed RPM				750 - 6800 RPM	

Note:

The displayed digit values in display fields 3 and 4 reflects the actual "ignition timing retard" via knock control from cylinders 1 and 2. The ignition timing retard occurs via ° KW (crankshaft angle).

28-38

Display Group 23 -Ignition- Knock control						
• Driving mode						
Read measuring value block 23 →				◀ Indicated on display		
xx.x RPM	x.x %	xx.x ° KW	xx.x ° KW			
1	2	3	4	◀ Display fields	**Specified value**	**Evaluation**
				Ignition timing retard via knock control: cylinder 4	0...12 ° KW (crankshaft angle)	⇒ Page 28-40
				Ignition timing retard via knock control: cylinder 3	0...12 ° KW (crankshaft angle)	⇒ Page 28-40
		Engine load			15 - 175 %	
	Engine speed RPM				750 - 6800 RPM	

Note:

The displayed digit values in display fields 3 and 4 reflects the actual "ignition timing retard" via knock control from cylinders 3 and 4. The ignition timing retard occurs via ° KW (crankshaft angle).

28-39

Display Group 24 -Ignition- Knock control						
• Driving mode						
Read measuring value block 24 →				◀ Indicated on display		
xx.x RPM	x.x %	xx.x ° KW	xx.x ° KW			
1	2	3	4	◀ Display fields	**Specified value**	**Evaluation**
				Ignition timing retard via knock control: cylinder 6	0...12 ° KW (crankshaft angle)	⇒ Page 28-40
				Ignition timing retard via knock control: cylinder 5	0...12 ° KW (crankshaft angle)	⇒ Page 28-40
		Engine load			15 - 175 %	
	Engine speed RPM				750 - 6800 RPM	

Note:

The displayed digit values in display fields 3 and 4 reflects the actual "ignition timing retard" via knock control from cylinders 5 and 6. The ignition timing retard occurs via ° KW (crankshaft angle).

28-40

Evaluation display groups 20/21/22/23/24, - Ignition timing angle retard

Indicated on display	Malfunction cause	Corrective action
All cylinders greater than 12 ° KW	♦ Knock sensor faulty	- Check knock sensor ⇒ Page 28-41 .
	♦ Corroded connection	
	♦ Knock sensor incorrect tightening torque	- Loosen and tighten knock sensor with 20 Nm (15 ft lb)
	♦ Components on engine loose	- Tighten components
	♦ Low fuel grade	- Change fuel grade
One cylinder deviates clearly from others	♦ Corroded connection	- Check knock sensor ⇒ Page 28-41 .
	♦ Engine damage	- Check compression pressure: ⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 15, Cylinder head removing, check compression pressure*
	♦ Components on engine loose	- Tighten components

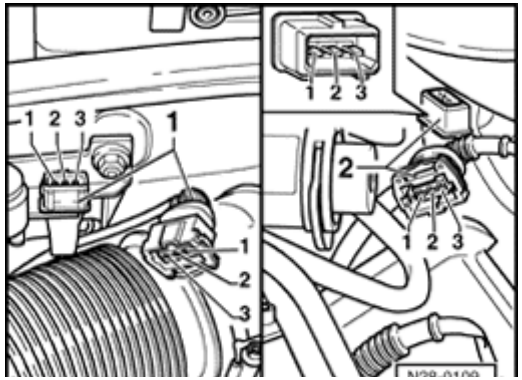
28-41

Knock Sensor (KS) 1 -G61 and Knock Sensor (KS) 2 -G66, checking

Notes:

- *It is not possible to carry out an electrical test of the knock sensors themselves.*
- *To ensure that the knock sensors function properly it is important to keep exactly to the specified tightening torque of 20 Nm (15 ft lb)*
- *Use only gold-plated terminals when repairing the terminals in the plug connectors for the knock sensors.*
- *Check for corrosion in connection between knock sensor and wiring harness.*

Checking knock sensors



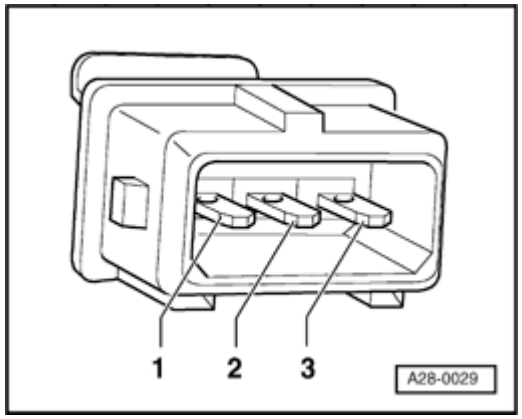
- Disconnect harness connector for relevant knock sensor in engine compartment.

Note:

- *Component location overview* ⇒ *Page 24-5* .
- *In order to reach the connector for the knock sensor for cylinder bank 2, first remove the bolts securing the coolant reservoir and move the*

coolant reservoir to one side. Coolant hoses remain attached.

28-42



- Check for short circuits between all three terminals in knock sensor connector (terminals 1 + 2, 1 + 3 and 2 + 3).

  Specified value: There must be no contact between the wires (infinite Ω).

If there is a connection between the terminals.

- Replace knock sensor.

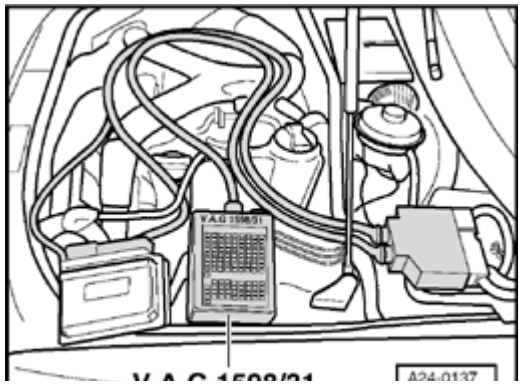
Notes:

- *In order to reach the knock sensors, first remove the air duct ⇒ Page 24-43 .*
- *Use special tool 3247 to remove the knock sensors.*

If there is no short circuit

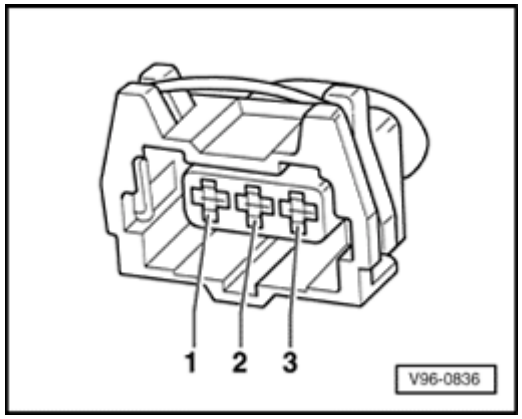
- Check wiring for knock sensors.

Checking wiring between knock sensors and engine control module

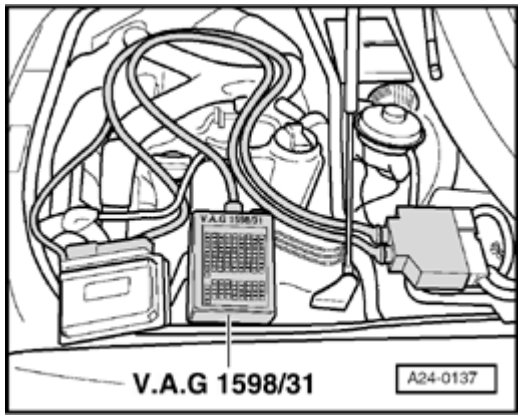


- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .

28-43



- Check wiring connection from relevant sensor connector to...



- ....Engine Control Module (ECM) for open circuit and/or short to B+ or Ground (GND).

28-44

Knock Sensor (KS) 1 -G61 (Bank 1)	
3-pin connector on wiring harness, socket	**VAG1598/31 test box, socket**
1 (Ground (GND))	99
2 (signal)	106
3 (shielded)	108
Knock sensor (KS) 2 -G66 (Bank 2)	
3-pin connector on wiring harness, socket	**VAG1598/31 test box, socket**
1 (Ground (GND))	99
2 (signal)	107
3 (shielded)	108

Resistance in wiring: max. 1.5 ohm

- Repair any open/short circuit as necessary.

28-45

Camshaft Position (CMP) sensor 1 -G40 and Camshaft Position (CMP) sensor 2 - G163, checking

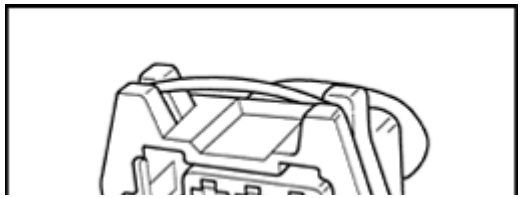
Notes:

- *Component locations of Hall sensors* ⇒ *Page 24-5* .
- *The Camshaft Position (CMP) Sensor 1 -G40 is located at the rear of the right-hand cylinder head (Bank 1).*
- *The Camshaft Position (CMP) Sensor 2 -G163 is located at the front of the left-hand cylinder head (Bank 2).*

Checking activation of Hall sensor (camshaft position sensor)

Use test leads VAG1594 connector test kit when carrying out the following tests.

- Push back rubber grommet on relevant Hall sensor connector.



- Connect VAG1527 diode test lamp to terminals 1 and 2 of hall sensor connector from behind (without disconnecting connector from hall sensor).

Note:

The connector terminals are numbered on the back of the connector.

- Operate starter for few seconds.

The diode test lamp should blink briefly once every two engine revolutions.

Note:

Diode test lamps with a low current draw continue to glow faintly between impulses from the engine control module (rather than going out completely) and become much brighter when receiving an impulse.

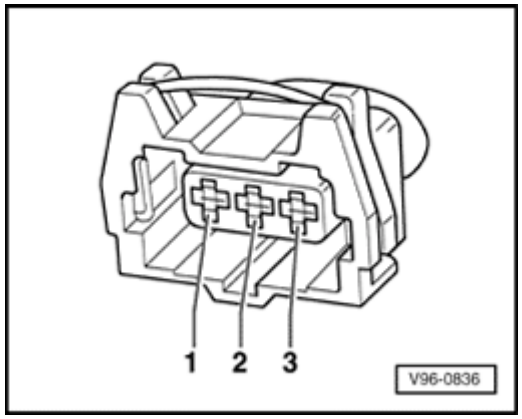
If the diode test lamp does not flash, test the voltage supply.

Checking voltage supply for Hall sensor

- Disconnect harness connector from relevant Hall sensor.

- Switch ignition on.

28-47



- Connect multimeter (Fluke 83 or equivalent) (voltage measurement range) between engine Ground (GND) and socket 1 of connector.

  Specified value: approx. 5 V

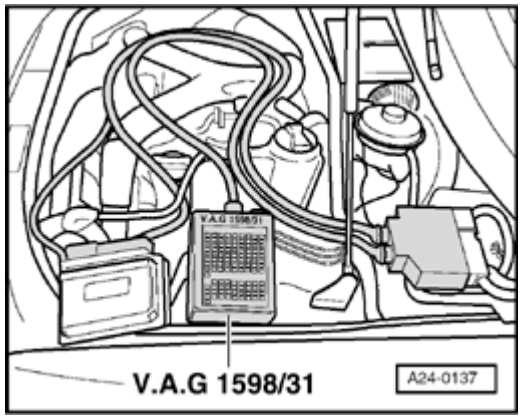
Checking signal wire for Hall sensor

- Connect multimeter (Fluke 83 or equivalent) (voltage measurement range) between engine Ground (GND) and socket 2 of relevant connector.

  Specified value: approx. battery voltage

Checking Ground (GND) wire for Hall sensor:

- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .



- Connect multimeter (Fluke 83 or equivalent) (resistance measurement range) between socket 3 on connector and engine Ground (GND).

  Specified value: Continuity

  Resistance in wiring: max. 1.5 Ohms

28-48

If all specifications are reached but the diode test lamp does not flash (measurement taken between terminals 1 and 2 without unplugging connector and while operating starter):

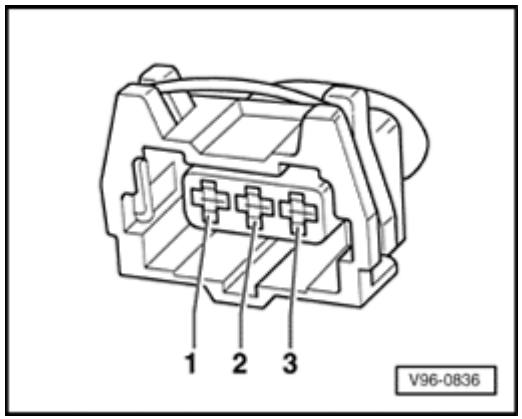
- Replace relevant Hall sensor.

If specifications are obtained:

- Check wiring.

Checking wiring between hall sensor and engine control module

- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .



- Check wiring connection from Hall sensor to engine control module for open circuit and/or short circuit to B+ or Ground (GND).

28-49

Camshaft Position (CMP) Sensor 2 -G163 (Bank 2)	
3-pin connector on wiring harness, socket	**VAG1598/31 test box, socket**
1 (B+)	98
2 (signal)	86
3 (Ground (GND))	108
Camshaft Position (CMP) Sensor 1 -G40 (Bank 1)	
3-pin connector on wiring harness, socket	**VAG1598/31 test box, socket**
1 (positive)	98
2 (signal)	87
3 (Ground (GND))	108

Resistance in wiring: max. 1.5 ohm

- Repair any open/short circuit as necessary.

28-50

If all the test results so far have been OK but a malfunction related to the camshaft position sensor (Hall sensor) is displayed again after erasing the DTC memory as a test measure, the following might be the cause:

- Rotor ring (trigger wheel) for camshaft position sensor (Hall sensor) misaligned; test phase position.

Checking phase position of Hall sensor

- Connect vehicle diagnostic, testing and information system VAS5051 or VAG1551 scan tool and select engine electronics control module by entering address word "01" ⇒ Page 01-9 . When doing this the engine must be idling.

Rapid data transfer HELP **Select function XX**	Indicated on display

- Press buttons -0- and -8- to select function "Read Measuring Value Block" and confirm entry with -Q- button.

Read Measuring Value Block **Input display group number XXX**	Indicated on display:

- Press buttons -0-, -9- and -3- to select "Display Group 093" and confirm entry with -Q- button.

28-51

Indicated on display

- Check specified display values for Hall sensors.

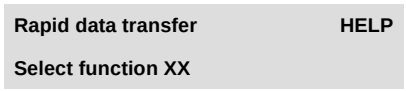
	Display fields			
	1	2	3	4
Display Group 093: Phase positions of Hall sensors (Bank 1 and Bank 2) with engine idling				
Display	xxx RPM	xx %	**0 ± 6 ° KW**	**0 ± 6 ° KW**
Indicates	Engine speed (RPM)	Engine load	**Phase position** **Bank 1**	**Phase position** **Bank 2**
Work range	min.: 750 RPM max.: 6800 RPM	min.: 15 % max.: 175 %	**-20.3 to 14.8 ° KW**	**-20.3 to 14.8 ° KW**
Specified value	750 - 850 RPM		**0 ± 6 ° KW**	**0 ± 6 ° KW**
Note			**If readouts do not match specifications, unbolt Hall sensor and check whether rotor ring is properly mounted on camshaft. If it is incorrectly mounted, the locating lug will be flattened when the securing bolt is tightened. Also check valve timing.** ⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 13, Crankcase ventilation, Ribbed belt removing and installing, Timing belt removing and installing*	

28-52

Misfire recognition, checking

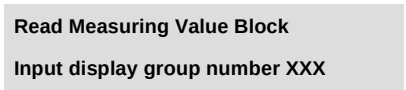
Test sequence

- Connect vehicle diagnostic, testing and information system VAS5051 or VAG1551 scan tool and select engine electronics control module by entering address word "01" ⇒ Page 01-9 . When doing this the engine must be at idle.



Indicated on display

- Press buttons -0- and -8- to select function "Read Measuring Value Block" and confirm entry with -Q- button.



Indicated on display

- Press buttons -0-, -1- and -4- to select "Display Group 014" and confirm entry with -Q- button.

Indicated on display

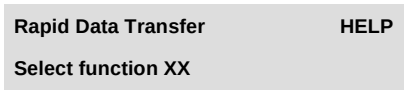
- Check misfire recognition.

28-53

	Display fields			
	1	2	3	4
Display Group 014: Misfire recognition				
Display	xxx / RPM	xxx %	**xxx**	**---**
Indicated	Engine speed (RPM)	Load	**Sum of misfire**	**Misfire recognition**
Work range	min.: 750 / RPM max.: 6800 /RPM	min.: 0 max.: 100		**activated** **locked**
Specified value	650 - 720 / RPM	15.0 - 22.0 %	**0 - 15**	**activated**
Note	---	---	**If specified value is not reached: Evaluation display field 3 ⇒ Page 28-54 see also page ⇒ Page 28-55**	**---**

If specified value is reached:

- Press →button.



Indicated on display (select function)

28-54

Evaluation display group 014, display field 3

Display field: 3	Possible cause	Corrective action
greater 15	♦ Spark plug faulty ♦ Spark plug connector faulty ♦ Ignition coil or power output stage faulty	- Check spark plug and ignition cable with connector - Check ignition coil ⇒ Page 28-5 . - Check power output stages ⇒ Page 28-11
	♦ Fuel injector faulty ♦ Check compression of one or more cylinder weak	- Check fuel injectors ⇒ Page 24-39 - Check compression pressure

28-55

The following measuring value blocks display misfiring of individual cylinders:

	Display fields			
	1	2	3	4
Display Group 015: Misfire recognition from cylinder 1, 2 and 3				
Display	**xxx**	**xxx**	**xxx**	**---**
Indicates	**Amount of misfires cylinder 1**	**Amount of misfires cylinder 2**	**Amount of misfires cylinder 3**	Misfire recognition
Work range				activated locked
Specified value	**0...15**	**0...15**	**0...15**	activated
Note			**If specification is obtained: Evaluation ⇒ Page 28-57 .**	**---**

28-56

	Display fields			
	1	2	3	4
Display Group 015: Misfire recognition from cylinder 4, 5 and 6				
Display	**xxx**	**xxx**	**xxx**	**---**
Indicates	**Amount of misfires cylinder 4**	**Amount of misfires cylinder 5**	**Amount of misfires cylinder 6**	Misfire recognition
Work range				activated locked
Specified value	**0...15**	**0...15**	**0...15**	activated
Note			**If specification is obtained: Evaluation ⇒ Page 28-57 .**	**---**

28-57

Evaluation display groups 015 and 016

Display field: 1,2 and 3 from measuring value block 15 and 16	Possible cause	Corrective action
greater 15	♦ Spark plug faulty ♦ Spark plug connector faulty ♦ Ignition coil or power output stage faulty	- Check spark plug and ignition cable with connector - Check ignition coil ⇒ Page 28-5 . - Check power output stages ⇒ Page 28-11
	♦ Fuel injector faulty ♦ Check compression of one or more cylinder weak	- Check fuel injectors ⇒ Page 24-39 - Check compression pressure