

Workshop Manual Audi A8 1994 ➤

TDI injection and glow plug system (6-cyl.)

Engine ID	AFB	AKE	AKN						
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Edition 12.2006

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List of Workshop Manual Repair GroupsList of Workshop Manual Repair Groups

Repair Group

- 01 - Self-diagnosis
- 23 - Mixture preparation - injection
- 28 - Glow plug system



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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

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01 – Self-diagnosis

1 Features of self-diagnosis

The diesel direct injection system control unit is equipped with a fault memory.

The engine control unit, after evaluating the information received, differentiates between more than 50 different faults ⇒ Fault table, ⇒ [page 6](#) and stores these until the contents of the fault memory are erased.

Faults which only occur sporadically are indicated as “sporadic fault” on the print out. These faults will be indicated on the display as “/SP”. The cause of sporadic faults can be e.g. a loose contact or an intermittent open circuit. If a sporadic fault does not occur again within 50 engine starts, it will be erased from the fault memory.

If faults affecting driveability are detected, the glow period warning lamp flashes.

The advantages of self-diagnosis can only be fully exploited by using the vehicle diagnostic, testing and information system - VAS 5051- or the vehicle diagnosis and service information system -VAS 5052- in operating mode “Rapid data transfer”.

The fault memory must be erased after the faults have been eliminated.

1.1 Connecting vehicle diagnosis and service information system -VAS 5052- and selecting engine electronics control unit

Special tools and workshop equipment required

- ◆ Vehicle diagnosis and service information system -VAS 5052-
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Test conditions

- The battery voltage must be at least 11.5 V.
- Fuses OK.
- Earth connections on engine and gearbox OK.
- Switch off air conditioner.
- On vehicles with automatic gearbox the selector lever must be in “P” or “N” position.

Procedure

- Connect vehicle diagnosis and service information system - VAS 5052- .



WARNING

- ◆ *Test equipment must always be secured on the rear seat and operated from that position by a second person.*
- ◆ *If test equipment and measuring instruments are operated from the front passenger's seat and the vehicle is involved in an accident, the person sitting in this seat could be seriously injured when the airbag is triggered.*

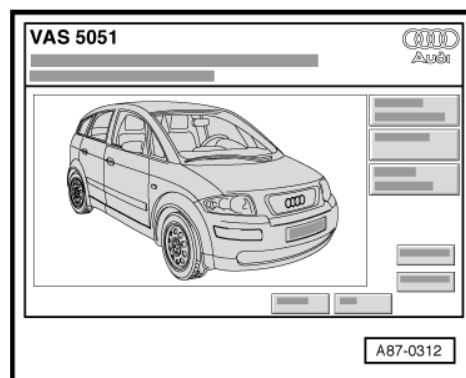
Depending on the function required:

- Switch on ignition or start engine.



Selecting operating mode:

- Select function “Vehicle self-diagnosis”.



Indicated on display:

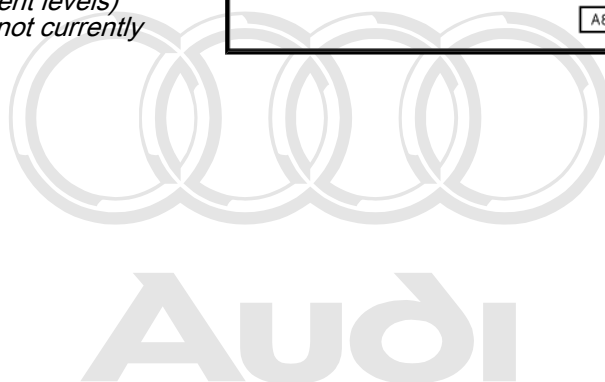
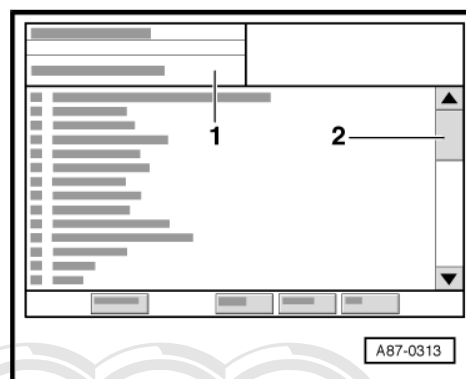
Selecting vehicle system:

- Select “Engine electronics” on display.



Note

- ◆ Vehicle system selection prompt appears in display zone -1-.
- ◆ “Scrolling” screen display with bar -2- permits display of vehicle systems (for all vehicle models and equipment levels) which are envisaged for self-diagnosis but are not currently visible on the screen.

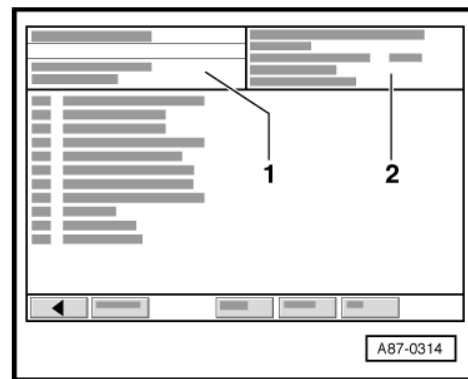


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Wait until "Select diagnosis function" appears in zone -1- on display.

The control unit identification and coding appear in display zone -2-, e.g.:

- | | |
|-------------------|--|
| ◆ 4D0 907 409.. | Control unit number (refer also to Parts catalogue) |
| ◆ 2.5 ltr. | Engine capacity |
| ◆ 4VT | 4-valve |
| ◆ EDC | Electronic Diesel Control |
| ◆ G or no display | Vehicle with or without cruise control |
| ◆ 000 | Control unit maps |
| ◆ AG | Automatic gearbox |
| ◆ SG | Manual gearbox |
| ◆ D00 | Data level (software version) of control unit |
| ◆ Coding 00012 | Coding of engine control unit |
| ◆ WSC 12345 | Dealership code of fault reader - V.A.G 1551- with which the last coding was performed |



If the coding does not correspond to the equipment in the vehicle:

- Check coding of diesel direct injection system control unit - J248- ⇒ [page 37](#) .

Selecting diagnostic function:

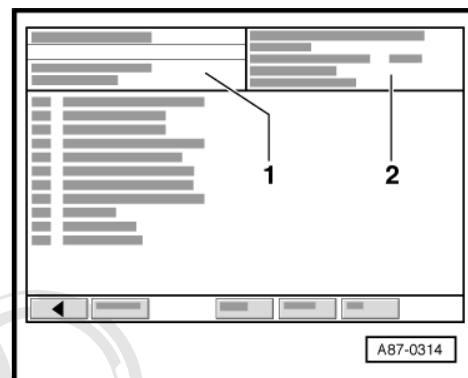
At this point all diagnostic functions are available.

- Select desired function on display.
- Refer to repair operations for further procedure.



Note

In the functions Basic setting and Reading measured value block, the display zones are shown from top to bottom.



2 Interrogating and erasing fault memory



Note

The fault memory must always be interrogated before being erased!

- Connect up the vehicle diagnosis and service information system -VAS 5052- and select vehicle system "Engine electronics". When doing this, the engine must be running at idling speed.

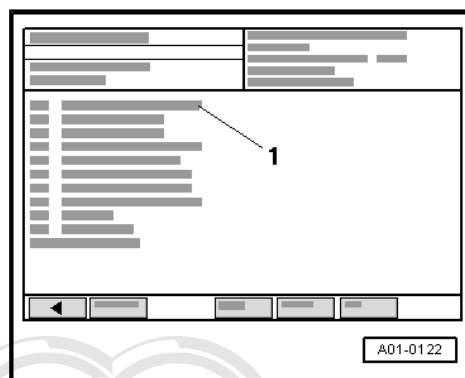


Note

If the engine does not start, turn the engine over for at least 5 seconds using the starter. After doing this, do NOT switch off the ignition.

Display on tester:

- From list -1-, select diagnostic function "Interrogate fault memory".



Display on tester:

1 - Content of fault memory:

r - 0 faults detected

- or

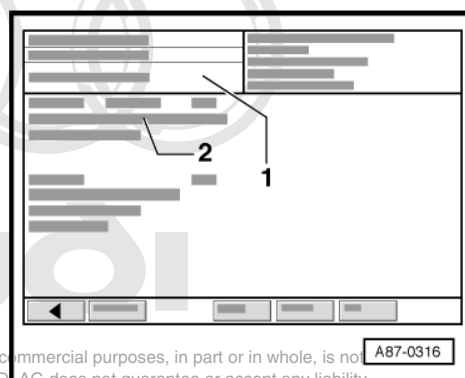
r - X faults detected

2 - Fault

r - Fault code

r - Fault location

r - Type of fault



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A - If faults are detected:

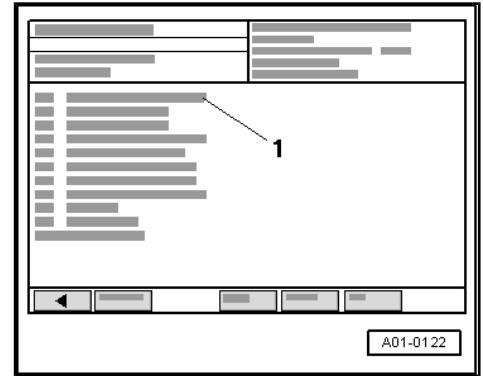
- Print out information on screen or self-diagnosis log.
- Terminate function "Interrogate fault memory" by touching ▸ button.

Display on tester:

- Eliminate fault(s) according to fault table ➔ [page 6](#) .
- Select diagnostic function “Interrogate fault memory” again in list and erase fault memory.
- Select diagnostic function “End output”.

B - If no faults are detected:

- Select diagnostic function “End output”.



2.1 Erasing fault memory



Note

If fault memory cannot be erased, interrogate fault memory again and eliminate fault.



Note

- ◆ *Fault memory interrogated.*
- ◆ *All faults eliminated.*

After interrogation of fault memory:

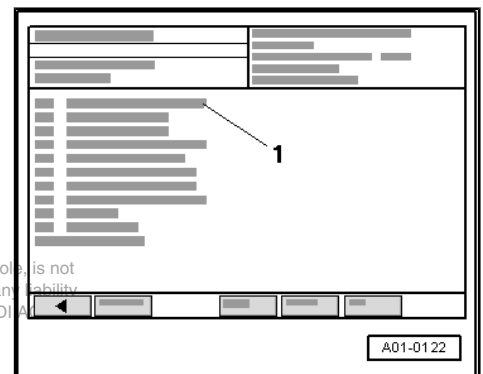
Display on tester:

- From list -1-, select diagnostic function “Erase fault memory”.
- After completion of repair work, interrogate the fault memory again and erase it as necessary.



Note

This has the effect of erasing any faults that may have been stored while carrying out repairs (e.g. as a result of unplugging connectors).



3 Fault table: fault codes 00513...00671



Note

- ◆ If faults occur in the monitored sensors or components, these are stored in the fault memory together with an indication of the type of fault.
- ◆ The fault table is arranged according to the 5-digit fault codes in the left-hand column.
- ◆ Sporadically occurring faults (temporary faults) will be indicated on the fault reader display as "SP".
- ◆ The components shown to be defective by the fault reader should not be replaced immediately. Start by using the current flow diagram to check the wiring and connectors to these components. Also test the earth connections using the current flow diagram. This is particularly important in the case of sporadic faults (indicated by the letters "SP" on the fault reader display).
- ◆ Erase fault memory after rectifying faults.

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00513 Engine speed sender -G28- Implausible signal	<p>Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.</p> <p>This fault message is stored if the sequence of pulses from the engine speed sender changes more rapidly than would be possible as a result of a change in engine speed.</p> <ul style="list-style-type: none"> ◆ Sender rotor on fly-wheel or sender pins on torque converter plate are damaged 	<ul style="list-style-type: none"> ◆ Glow period warning lamp flashes ◆ Loss of power (torque reduction) 	<ul style="list-style-type: none"> – Check sender rotor
	◆ -G28- defective		– Check engine speed sender ⇒ page 83
No signal	<p>This fault message is stored if the engine speed sender and the injector pump speed sender have registered different speeds.</p> <ul style="list-style-type: none"> ◆ -G28- defective ◆ Open circuit or short circuit in wiring 	<ul style="list-style-type: none"> ◆ Glow period warning lamp flashes ◆ Loss of power (torque reduction) 	– Check engine speed sender ⇒ page 83

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00519 Intake manifold pressure sender -G71- Short to positive	<p>This fault message is stored if the voltage of the signal from the intake manifold pressure sender is greater than 4.8 V.</p> <ul style="list-style-type: none"> ◆ Open circuit or short to positive in wiring ◆ -G71- defective 	<ul style="list-style-type: none"> ◆ Loss of power 	– Check intake manifold pressure sender ⇒ Rep. Gr. 21

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
Open circuit/short to earth	<p>This fault message is stored if the voltage of the signal from the intake manifold pressure sender is less than 0.68 V.</p> <ul style="list-style-type: none"> ◆ Open circuit or short to earth in wiring ◆ -G71- defective 	<ul style="list-style-type: none"> ◆ Loss of power 	<ul style="list-style-type: none"> – Check intake manifold pressure sender → Rep. Gr. 21

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00519 Intake manifold pressure sender -G71- Voltage supply	<p>This fault message is stored if the voltage supply to the intake manifold pressure sender is less than 4.92 V or greater than 5.03 V.</p> <ul style="list-style-type: none"> ◆ Open circuit or short circuit ◆ -G71- defective 	<ul style="list-style-type: none"> ◆ Loss of power 	<ul style="list-style-type: none"> – Check intake manifold pressure sender → Rep. Gr. 21
Implausible signal	<p>This fault message is stored if the difference between the ambient air pressure and the charge pressure is greater than 400 mbar for about 3 seconds at engine speeds lower than 1000 rpm.</p> <ul style="list-style-type: none"> ◆ Ice on G71 ◆ -G71- defective 	<ul style="list-style-type: none"> ◆ Loss of power 	<ul style="list-style-type: none"> – Check intake manifold pressure sender → Rep. Gr. 21

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00522 Coolant temperature sender -G62- Short to earth	<p>This fault message is stored if the voltage of the signal from the coolant temperature sender is less than 0.2 V.</p> <ul style="list-style-type: none"> ◆ -G62- defective ◆ Short to earth in wiring 	<ul style="list-style-type: none"> ◆ Black exhaust smoke when starting ◆ Glow period always approx. 20 seconds 	<ul style="list-style-type: none"> – Check coolant temperature sender ⇒ page 84
Open circuit/short to positive	<p>This fault message is stored if the voltage of the signal from the coolant temperature sender is greater than 4.95 V.</p> <ul style="list-style-type: none"> ◆ -G62- defective ◆ Open circuit or short to positive in wiring 	<ul style="list-style-type: none"> ◆ Black exhaust smoke when starting ◆ Glow period always approx. 20 seconds 	<ul style="list-style-type: none"> – Check coolant temperature sender ⇒ page 84

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00523 Intake air temperature sender -G42-			



Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
Short to earth	This fault message is stored if the voltage of the signal from the intake air temperature sender is less than 0.12 V. ♦ -G42- defective ♦ Short to earth in wiring	♦ Fixed substitute value	– Check intake air temperature sender ⇒ page 85
Open circuit/short to positive	This fault message is stored if the voltage of the signal from the intake air temperature sender is greater than 4.85 V. ♦ -G42- defective ♦ Open circuit or short to positive in wiring	♦ Fixed substitute value	– Check intake air temperature sender ⇒ page 85

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00532 Voltage supply Signal too low	This fault message is stored if the voltage supply at the engine control unit is less than 9 V for a period of 60 seconds. ♦ Battery discharged ♦ Faulty wiring connection to engine control unit	♦ Engine will not start ♦ Engine running problems, possibly including engine cut-out	– Check battery voltage – Check voltage supply for diesel direct injection system ⇒ page 79
No fault type identified	This fault message is stored if the engine control unit has an internal defect. ♦ Engine control unit defective	♦ Engine will not start	– Renew engine control unit ⇒ page 75
Implausible signal	This fault message is stored if the engine control unit does not receive a constant voltage supply when the ignition is switched on. ♦ Intermittent open circuit (loose contact)	♦ Engine will not start	– Check voltage supply for diesel direct injection system ⇒ page 79

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00532 Voltage supply Short to positive	This fault message is stored if the engine control unit has completed its self-test (sustained voltage phase) but the voltage supply has not been disconnected. (When the ignition is switched off the engine control unit continues to receive voltage for between 4 and 10 minutes. This is the self-test phase.) ♦ Diesel direct injection system relay defective (contacts sticking) ♦ Short to positive in wiring	♦ Battery discharges	– Check battery voltage – Check voltage supply for diesel direct injection system ⇒ page 79
Input open	This fault message is stored if the voltage supply to the engine control unit is cut during the self-test phase. (At the end of the self-test phase, i.e. after 4...10 minutes, the engine control unit shuts off the diesel direct injection system relay and thus cuts its own voltage supply)		

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
	<ul style="list-style-type: none"> ◆ Battery was disconnected within 10 minutes of switching off ignition ◆ Diesel direct injection system relay incorrectly connected 	<ul style="list-style-type: none"> ◆ Glow period warning lamp flashes 	<ul style="list-style-type: none"> - Erase fault memory - Check voltage supply for diesel direct injection system ⇒ page 79

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00534 Oil temperature sender -G8- Short to earth	<p>This fault message is stored if the voltage of the signal from the oil temperature sender is less than 0.2 V.</p> <ul style="list-style-type: none"> ◆ -G8- defective ◆ Short to earth in wiring 	<ul style="list-style-type: none"> ◆ Fixed substitute value ◆ Reduced power output (engine protection) 	<ul style="list-style-type: none"> - Rectify open circuit or short circuit ⇒ Current flow diagrams, Electrical fault finding and Fitting locations
Implausible signal	<p>This fault message is stored if the coolant temperature is greater than 70 °C but the oil temperature is less than -10 °C.</p> <ul style="list-style-type: none"> ◆ -G8- defective ◆ Open circuit or short to positive in wiring 	<ul style="list-style-type: none"> ◆ Fixed substitute value ◆ Reduced power output (engine protection) 	<ul style="list-style-type: none"> - Rectify open circuit or short circuit ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00539 Fuel temperature sender -G81- Signal outside tolerance	<p>This fault message is stored if the temperature of the fuel in the injection pump is greater than 100 °C.</p> <ul style="list-style-type: none"> ◆ Full throttle at extremely high outside temperature ◆ Blocked fuel filter or pipes 	<ul style="list-style-type: none"> ◆ Reduced power output (engine protection) 	<ul style="list-style-type: none"> - Allow vehicle to cool down - Check fuel system
Defective	<p>This fault message is stored if the temperature of the fuel in the injection pump is less than -50 °C or more than 150 °C.</p> <ul style="list-style-type: none"> ◆ -G81- defective 		<ul style="list-style-type: none"> - Renew injection pump ⇒ page 59

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00542 Needle lift sender - G80			



Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
Short to earth	This fault message is stored if the voltage of the signal from the needle lift sender is less than 0.03 V. ♦ -G80- defective ♦ Open circuit or short circuit	♦ Glow period warning lamp flashes	– Check needle lift sender ➔ page 84
Open circuit/short to positive	This fault message is stored if the voltage of the signal from the needle lift sender is greater than 2.12 V. ♦ -G80- defective ♦ Open circuit or short circuit	♦ Glow period warning lamp flashes	– Check needle lift sender ➔ page 84

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00546 Data wiring defective (Display blank)	This fault message is stored if interference occurs in the transmission of data between the engine control unit and the injection pump via the data wire, but transmission is not interrupted ♦ Data wire to injection pump defective ♦ Short in CAN bus	♦ Engine will not start ♦ Engine running problems, possibly including engine cut-out	– First interrogate all control units capable of CAN communication and eliminate all faults indicated – Read measured value block 18: voltage supply to injection pump in display zone 1 should be at least 10.5 Volt and the value of all bits in display zone 3 should be 0. – Test sequence continued in table on next page

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
			– Detach connector from injection pump and check pins for corrosion and correct seating. Re-attach connector and erase fault memory, then start engine and interrogate fault memory again. – Check CAN matching resistor in injection pump ➔ page 77 – Test sequence continued in table on next page

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
			<ul style="list-style-type: none"> Check data wiring between engine control unit and injection pump ⇒ page 77
No communication	<p>This fault message is stored if signal transmission along the data wiring between the engine control unit and the injection pump is interrupted.</p> <ul style="list-style-type: none"> CAN bus overloaded 		Trace open circuit in CAN bus between the various control units



Note

- ◆ If fault code "1318 - No communication" is stored in addition to fault code 00546, check production date of engine control unit.
- ◆ Due to an incorrect resistance value in the engine control unit, the engine will jolt or cut-out if the ambient temperature or sunlight intensity is very high. After parking the vehicle for approx. 1 hour in the shade, the faults can be erased and the engine will start.
- ◆ Check whether the production date is between 14.04.01 and 12.07.01 (the production date can be found on the sticker on the engine control unit). Renew the engine control unit if it was produced during this period and the two faults listed above are stored.

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00550 Injection commencement regulation Control difference	<p>Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.</p> <p>This fault message is stored if the actual crankshaft angle at the start of delivery differs from the specified angle by more than 3°. The specification is transmitted by the engine control unit to the injection pump. The comparison between specification and actual value is carried out in the injection pump.</p> <ul style="list-style-type: none"> Tank filled with petrol or biodiesel Water in fuel Air in fuel system Start of delivery not OK. 	<ul style="list-style-type: none"> Loss of power at high engine speeds Engine will not start easily Gearbox in emergency running mode Fault 00575 is stored 	<ul style="list-style-type: none"> Check tank for petrol or biodiesel; if this is the case: drain tank and fill with diesel, erase fault memory and perform road test, then interrogate fault memory again Check fuel supply and return lines for blockage or kinks Test sequence continued in table on next page



Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
			<ul style="list-style-type: none"> – Drain fuel filter ⇒ page 65 – Check fuel system for leaks ⇒ page 66 – Eliminate air in fuel system ⇒ page 63 – Check electrical fuel pump ⇒ Rep. Gr. 20 – Check injection timing control range ⇒ page 76 – Erase fault memory and perform road test, then interrogate fault memory again

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00550 Injection commencement regulation Regulating limit not reached Regulating limit exceeded	<p>This fault message is stored if the actual crankshaft angle at commencement of injection differs from the specified angle by more than 3°. The actual commencement of injection is transmitted by the needle lift sender to the engine control unit. The comparison between specification and actual value is carried out in the engine control unit.</p> <ul style="list-style-type: none"> ◆ Start of delivery not OK. ◆ Needle lift sender - G80- defective 	<ul style="list-style-type: none"> ◆ Loss of power at high engine speeds ◆ Gearbox in emergency running mode ◆ Jolting of engine 	<ul style="list-style-type: none"> – Check and adjust commencement of injection ⇒ page 67 – Check needle lift sender ⇒ page 84

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00550 Injection commencement regulation Implausible signal	<p>This fault message is stored if the injection timing control in the injection pump "jumps"</p>		

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
	<ul style="list-style-type: none"> ◆ Tank filled with petrol or biodiesel ◆ Fuel filter blocked ◆ Fuel lines kinked or clogged ◆ Air in fuel system 	<ul style="list-style-type: none"> ◆ Loss of power at high engine speeds ◆ Loud combustion noise ◆ Rattling noises in pump (injection timing control) ◆ Starting problems when engine is cold 	<ul style="list-style-type: none"> - Check tank for petrol or biodiesel; if this is the case: drain tank and fill with diesel, erase fault memory and perform road test, then interrogate fault memory again - Check fuel supply and return lines for blockage or kinks - Test sequence continued in table on next page

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
			<ul style="list-style-type: none"> - Drain fuel filter ⇒ page 65 - Check fuel system for leaks ⇒ page 66 - Eliminate air in fuel system ⇒ page 63 - Check electrical fuel pump ⇒ Rep. Gr. 20 - Erase fault memory and perform road test, then interrogate fault memory again

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00553 Air mass meter -G70- Implausible signal	<p>This fault message is stored if the intake air mass is less than 190 mg/stroke or greater than 1300 mg/stroke at an engine speed above 1300 rpm</p> <ul style="list-style-type: none"> ◆ Air cleaner blocked ◆ Vacuum hose system for exhaust gas recirculation incorrectly connected, or mechanical exhaust gas recirculation valve constantly open 	<ul style="list-style-type: none"> ◆ Rough idling, loss of power ◆ Fixed substitute value 	<ul style="list-style-type: none"> - Check intake system - Check vacuum hoses ⇒ Rep. Gr. 26 .
	<ul style="list-style-type: none"> ◆ Air mass meter defective 	<ul style="list-style-type: none"> ◆ Loss of power, jolting ◆ Fixed substitute value 	<ul style="list-style-type: none"> - Check air mass meter ⇒ page 86
Open circuit/short to earth	This fault message is stored if the voltage of the signal from the air mass meter is less than 0.16 V.		



Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
	<ul style="list-style-type: none"> ◆ Open circuit or short to earth in wiring ◆ -G70- defective 	<ul style="list-style-type: none"> ◆ Reduced power ◆ Fixed substitute value 	<ul style="list-style-type: none"> – Check air mass meter ⇒ page 86

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00553 Air mass meter -G70- Short to positive	<p>This fault message is stored if the voltage of the signal from the air mass meter is greater than 4.8 V</p> <ul style="list-style-type: none"> ◆ Open circuit or short to positive in wiring ◆ -G70- defective 	<ul style="list-style-type: none"> ◆ Reduced power ◆ Fixed substitute value 	<ul style="list-style-type: none"> – Check air mass meter ⇒ page 86
Voltage supply	<p>This fault message is stored if the voltage supply from the air mass meter is less than 4.91 V or greater than 5.03 V.</p> <ul style="list-style-type: none"> ◆ Open circuit or short circuit ◆ -G70- defective 	<ul style="list-style-type: none"> ◆ Reduced power ◆ Fixed substitute value 	<ul style="list-style-type: none"> – Check air mass meter ⇒ page 86

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00560 Exhaust gas recirculation, control difference Regulating limit not reached	<p>Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.</p> <p>This fault message is stored if the intake air mass is a certain amount less than specified air mass for approx. 10 seconds</p> <ul style="list-style-type: none"> ◆ Exhaust gas recirculation valve -N18- defective ◆ Hoses wrongly connected, blocked or leaking ◆ Mechanical EGR valve defective 	<ul style="list-style-type: none"> ◆ Reduced power ◆ Black exhaust smoke 	<ul style="list-style-type: none"> – Check exhaust gas recirculation system ⇒ Rep. Gr. 26
Regulating limit exceeded	<p>This fault message is stored if the intake air mass exceeds the specified air mass by a certain amount for approx. 10 seconds</p> <ul style="list-style-type: none"> ◆ Exhaust gas recirculation valve -N18- defective ◆ Hoses not connected, wrongly connected, blocked or leaking 		<ul style="list-style-type: none"> – Check exhaust gas recirculation system ⇒ Rep. Gr. 26

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00575			

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
Intake manifold pressure Regulating limit not reached	<p>This fault message is stored if the measured charge pressure is 800 mbar lower than the specified value for about 8 seconds above a certain engine speed and injection quantity.</p> <ul style="list-style-type: none"> ◆ Hoses not connected, wrongly connected, blocked or leaking ◆ Turbocharger defective 	<ul style="list-style-type: none"> ◆ Charge pressure too low ◆ Reduced power 	<ul style="list-style-type: none"> – Basic setting, block 11, refer to ➤ page 35 – Check charge pressure ➤ Rep. Gr. 21
Regulating limit exceeded	<p>This fault message is stored if the measured charge pressure is 200 mbar higher than the specified value for about 5 seconds above a certain engine speed and injection quantity.</p> <ul style="list-style-type: none"> ◆ Charge pressure control solenoid valve - N75- defective ◆ Turbocharger defective (charge pressure control mechanism sticking) 	<ul style="list-style-type: none"> ◆ Charge pressure too high ◆ Sudden loss of power ◆ Reduced power 	<ul style="list-style-type: none"> – Basic setting, block 11, refer to ➤ page 35 – Check charge pressure ➤ Rep. Gr. 21

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00625 Speed signal Implausible signal	<p>This fault message is stored if, for a period of about 10 seconds, the engine speed is greater than 2800 rpm, the injection quantity is greater than 22 mg/stroke and the measured road speed is less than 5 km/h.</p> <ul style="list-style-type: none"> ◆ Open circuit between speedometer sender - G22 and dash panel insert ◆ -G22- defective ◆ Speedometer -G21- defective ◆ Open circuit between dash panel insert and engine control unit 	<ul style="list-style-type: none"> ◆ Cruise control system not working ◆ Air conditioner not working ◆ Load change shocks 	<ul style="list-style-type: none"> – Check vehicle speed signal ➤ page 94 – Check speedometer sender ➤ Rep. Gr. 90
Signal too high	<p>This fault message is stored if the measured road speed is greater than 290 km/h.</p> <ul style="list-style-type: none"> ◆ Signal interference ◆ -G22- defective 	<ul style="list-style-type: none"> ◆ Cruise control system not working ◆ Load change shocks 	<ul style="list-style-type: none"> – Check vehicle speed signal ➤ page 94 – Check speedometer sender ➤ Rep. Gr. 90

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Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00626 Glow period warning lamp -K29-			



Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
Open circuit/short to earth	<p>This fault message is stored if the engine control unit fails to activate the glow period warning lamp and there is no voltage at the control unit input.</p> <ul style="list-style-type: none"> ◆ Open circuit in wiring ◆ Bulb defective 	<ul style="list-style-type: none"> ◆ Glow period warning lamp not working 	<ul style="list-style-type: none"> – Check glow period warning lamp ⇒ page 102
	<ul style="list-style-type: none"> ◆ Short to earth 	<ul style="list-style-type: none"> ◆ Glow period warning lamp permanently lit 	
Output does not sw./ short to pos.	<p>This fault message is stored if the engine control unit is activating the glow period warning lamp and too much current is flowing at the control unit input</p> <ul style="list-style-type: none"> ◆ Short to positive 	<ul style="list-style-type: none"> ◆ Glow period warning lamp not working 	<ul style="list-style-type: none"> – Check glow period warning lamp ⇒ page 102

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00628 Control element setting monitoring Implausible signal	<p>This fault message is stored if the engine control unit has sent a cut-out signal to the injection pump, the injection pump confirms receipt, but the engine keeps running</p> <ul style="list-style-type: none"> ◆ Injection pump defective 	<ul style="list-style-type: none"> ◆ Engine stops (safety cut-out) 	<ul style="list-style-type: none"> – Read measured value block 18, display zone 3; if 00100000 is displayed, check cut-out signal ⇒ page 77. – If 00000000 is displayed, erase fault memory, start engine and interrogate fault memory again. – If the cut-out signal (wiring connection) is okay and the fault code is stored again, renew injection pump ⇒ page 59

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00628 Control element setting monitoring Open circuit/short to earth	<p>This fault message is stored if the engine control unit has sent a cut-out signal to the injection pump but the injection pump has not received it</p> <ul style="list-style-type: none"> ◆ Open circuit or short to earth in wiring 	<ul style="list-style-type: none"> ◆ Engine cuts out (safety cut-out via data wire) 	<ul style="list-style-type: none"> – Check cut-out signal ⇒ page 77
00628 Control element setting monitoring Short to positive	<p>This fault message is stored if the injection pump has received a cut-out signal but no cut-out signal has been sent by the engine control unit.</p>		

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
	♦ Open circuit or short to positive in wiring	♦ Engine cuts out	– Check cut-out signal ⇒ page 77

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00667 Outside temperature signal Implausible signal	This fault message is stored, if the engine control unit does not receive an outside temperature signal ♦ Open circuit in wiring		– Check outside temperature signal ⇒ page 93

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Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00668 Vehicle voltage terminal 30 Voltage supply too low	This fault message is stored if the voltage supply to the injection pump is less than 6 V or greater than 24 V. ♦ Voltage supply to injection pump too low (battery discharged) ♦ Poor wiring connection to injection pump	♦ Engine will not start ♦ Engine running problems, possibly including engine cut-out	– Check battery voltage – Check voltage supply for diesel direct injection system ⇒ page 79
00671 CCS switch -E45- Undefined switch position	♦ E45 defective ♦ Open circuit or short circuit in wiring	♦ Cruise control system switched off	– Check cruise control system ⇒ Electrical system; Rep. Gr. 01 Checking cruise control system (CCS) - diesel engine

4 Fault table: fault codes 00741...65535



Note

- ◆ If faults occur in the monitored sensors or components, these are stored in the fault memory together with an indication of the type of fault.
- ◆ The fault table is arranged according to the 5-digit fault codes in the left-hand column.
- ◆ Sporadically occurring faults (intermittent faults) will be indicated on the -V.A.G 1551- display as "SP" (sporadic).
- ◆ The components shown to be defective by the fault reader should not be replaced immediately. Start by using the current flow diagram to check the wiring and connectors to these components. Also test the earth connections using the current flow diagram. This is particularly important in the case of sporadic faults (indicated by the letters "SP" on the fault reader display).
- ◆ Erase fault memory after rectifying faults.

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00741 Brake pedal monitoring Implausible signal	<p>This fault message is stored if the brake light switch signals "brake pedal pressed" but the brake pedal switch does not detect a pressed brake pedal, or vice versa</p> <ul style="list-style-type: none"> ◆ Both brake lights defective ◆ Fuse defective ◆ Switch incorrectly set ◆ Open circuit in wiring ◆ Brake light switch -F or brake pedal switch - F47- defective 	<ul style="list-style-type: none"> ◆ No throttle response at times, complete loss of power ◆ Glow period warning lamp flashes 	<ul style="list-style-type: none"> - Check brake light - Check fuse - Check brake light switch -F and brake pedal switch -F47- ⇒ page 89 - Adjust brake light switch ⇒ Brake system; Rep. Gr. 45

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00777 Accelerator pedal position sender -G79- Implausible signal	<p>This fault message is stored if the idling speed switch indicates that the engine is idling but the potentiometer indicates that the accelerator is depressed (or vice versa)</p> <ul style="list-style-type: none"> ◆ Open circuit in wiring ◆ -G79- defective 	<ul style="list-style-type: none"> ◆ Increased idling speed ◆ No throttle response 	<ul style="list-style-type: none"> - Check accelerator position sender ⇒ Rep. Gr. 20
Short to positive	This fault message is stored if the voltage of the signal from the accelerator position sender is greater than 4.7 V		

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
	<ul style="list-style-type: none"> ◆ Open circuit or short to positive in wiring ◆ -G79- defective 	<ul style="list-style-type: none"> ◆ Increased idling speed ◆ No throttle response 	<ul style="list-style-type: none"> – Check accelerator position sender ⇒ Rep. Gr. 20

Table continued on next page

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
00777 Accelerator pedal position sender -G79- Voltage supply	<p>This fault message is stored if the voltage supply to the accelerator position sender is less than 4.76 V or greater than 5.2 V</p> <ul style="list-style-type: none"> ◆ Open circuit or short circuit in wiring ◆ -G79- defective 	<ul style="list-style-type: none"> ◆ Increased idling speed ◆ No throttle response 	<ul style="list-style-type: none"> – Check accelerator position sender ⇒ Rep. Gr. 20

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01028 Blower relay -J323- Open circuit/short to earth	<p>This fault message is stored if the engine control unit fails to activate the radiator fan run-on control unit -J138 and there is no voltage at the control unit input.</p> <ul style="list-style-type: none"> ◆ Open circuit in wiring ◆ Relay defective 	<ul style="list-style-type: none"> ◆ No radiator fan run-on 	<ul style="list-style-type: none"> – Rectify open circuit or short circuit ⇒ Current flow diagrams, Electrical fault finding and Fitting locations
Output does not sw./ short to pos.	<p>This fault message is stored if the engine control unit activates the radiator fan run-on control unit -J138 and too much current is flowing at the control unit input</p> <ul style="list-style-type: none"> ◆ Short to positive 	<ul style="list-style-type: none"> ◆ Radiator fan runs continuously ◆ No radiator fan run-on 	<ul style="list-style-type: none"> – Rectify open circuit or short circuit ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01044 Control unit incorrectly coded	<p>This fault message is stored if the engine control unit has an invalid coding</p> <ul style="list-style-type: none"> ◆ Invalid control unit coding 	<ul style="list-style-type: none"> ◆ Glow period warning lamp flashes 	<ul style="list-style-type: none"> – Code control unit ⇒ page 37
01117 Load signal for alternator terminal DF			



Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
Implausible signal	<p>This fault message is stored if the load on the alternator remains at 0% for 10 minutes.</p> <ul style="list-style-type: none"> ◆ Open circuit in wiring 		<ul style="list-style-type: none"> – Rectify open circuit or short circuit ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

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Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01126 Engine speed signal Signal outside tolerance	<p>This fault message is stored if the impulses from the engine speed sender are not received by the injection pump within a specified period.</p> <ul style="list-style-type: none"> ◆ Start of delivery from injection pump incorrect ◆ Open circuit in wiring 	<ul style="list-style-type: none"> ◆ Engine will not start ◆ Engine cuts out 	<ul style="list-style-type: none"> – Check commencement of injection ⇒ page 67 – Check engine speed signal ⇒ page 82
No signal	<p>This fault message is stored if the injection pump is not receiving any impulses from the engine speed sender.</p> <ul style="list-style-type: none"> ◆ Open circuit in wiring ◆ Injection pump defective 	<ul style="list-style-type: none"> ◆ Engine will not start ◆ Engine cuts out 	<ul style="list-style-type: none"> – Check engine speed signal ⇒ page 82

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01180 Engine / AC compressor cut-off: electrical connection Short to positive	<p>This fault message is stored if there is too much current along the wiring from the air conditioner operating and display unit.</p> <ul style="list-style-type: none"> ◆ Short circuit in wiring 	<ul style="list-style-type: none"> ◆ Slower acceleration when air conditioner is on 	<ul style="list-style-type: none"> – Check AC compressor signal and AC compressor shut-off ⇒ page 92

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01259 Fuel pump relay -J17- Open circuit/short to earth	<p>This fault message is stored if the engine control unit fails to activate the fuel pump relay and there is no voltage at the control unit input.</p> <ul style="list-style-type: none"> ◆ Open circuit in wiring ◆ Short to earth 		<ul style="list-style-type: none"> – Check fuel pump relay ⇒ Rep. Gr. 20

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01259 Fuel pump relay -J17- Output does not sw./ short to pos.	This fault message is stored if the engine control unit activates the fuel pump relay and too much current is flowing at the control unit input. ♦ Short to positive	♦ Misfiring ♦ Engine cuts out	– Check fuel pump relay ⇒ Rep. Gr. 20

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01262 Charge pressure control solenoid valve - N75- Open circuit/short to earth	This fault message is stored if the engine control unit fails to activate the solenoid valve for boost pressure (charge pressure) control and there is no voltage at the control unit input. ♦ Open circuit in wiring ♦ Solenoid valve defective ♦ Short to earth	♦ Reduced power ♦ Charge pressure too low ♦ Reduced power ♦ Charge pressure too high	– Basic setting, block 11, refer to ⇒ page 35 – Check solenoid valve for charge pressure control ⇒ Rep. Gr. 21

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01262 Charge pressure control solenoid valve - N75- Output does not sw./ short to pos.	This fault message is stored if the engine control unit is activating the charge pressure control solenoid valve and too much current is flowing at the control unit input. ♦ Short to positive	♦ Reduced power ♦ Charge pressure too low	– Basic setting, block 11, refer to ⇒ page 35 – Check solenoid valve for charge pressure control ⇒ Rep. Gr. 21

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Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01265 Exhaust gas recirculation valve -N18- Open circuit/short to earth	This fault message is stored if the engine control unit does not activate the exhaust gas recirculation valve and there is no voltage at the control unit input		



Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
	<ul style="list-style-type: none"> ◆ Open circuit in wiring ◆ Solenoid valve defective 	<ul style="list-style-type: none"> ◆ No exhaust gas recirculation 	<ul style="list-style-type: none"> – Basic setting, block 3, refer to ⇒ page 35 – Check exhaust gas recirculation valve
	<ul style="list-style-type: none"> ◆ Short to earth 	<ul style="list-style-type: none"> ◆ Too much exhaust gas recirculation ◆ Reduced power, black exhaust smoke 	

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01265 Exhaust gas recirculation valve -N18- Output does not sw./ short to pos.	This fault message is stored if the engine control unit is activating the exhaust gas recirculation valve and too much current is flowing at the control unit input. <ul style="list-style-type: none"> ◆ Short to positive 		
	<ul style="list-style-type: none"> ◆ No exhaust gas recirculation 	<ul style="list-style-type: none"> – Basic setting, block 3, refer to ⇒ page 35 – Check exhaust gas recirculation valve ⇒ Rep. Gr. 26 	

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01266 Glow plug relay -J52 Open circuit/short to earth	<p>This fault message is stored if the engine control unit fails to activate the glow plug relay and there is no voltage at the control unit input.</p> <ul style="list-style-type: none">◆ Open circuit in wiring◆ Relay defective	<ul style="list-style-type: none">◆ Glow plug system not working	<ul style="list-style-type: none">– Rectify open circuit or short circuit ⇒ Current flow diagrams, Electrical fault finding and Fitting locations
	<ul style="list-style-type: none">◆ Short to earth	<ul style="list-style-type: none">◆ Glow plug system remains on constantly	
Output does not sw./ short to pos.	<p>This fault message is stored if the engine control unit is activating the glow plug relay and too much current is flowing at the control unit input.</p> <ul style="list-style-type: none">◆ Short to positive	<ul style="list-style-type: none">◆ Glow plug system not working	<ul style="list-style-type: none">– Rectify open circuit or short circuit ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01268 Metering adjuster - N146- Defective	This fault message is stored if the metering solenoid valve or the activation (in the injection pump) is defective		

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
	<ul style="list-style-type: none"> ◆ Metering adjuster defective ◆ Voltage supply to injection pump too low ◆ Fault entry relating to the CAN bus ◆ Sporadic short circuit in wiring harness 	<ul style="list-style-type: none"> ◆ Reduced power output (engine protection) ◆ Engine stops (safety cut-out) 	<ul style="list-style-type: none"> - Test sequence if engine does start: - Read measured value block 18, check that voltage in display zone 1 is at least 11 Volt and the value of all bits in display zone 3 must be 0. If both readings are as specified, erase fault memory and perform road test, then interrogate fault memory again. - Test sequence continued in table on next page

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Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01268 Metering adjuster - N146-			<ul style="list-style-type: none"> - Check data wiring between engine control unit and injection pump ⇒ page 77 - If 00000010 is indicated in display zone 3, renew injection pump ⇒ page 59 - Test sequence if engine does not start: - Select measured value block 18 (with ignition switched on) and check voltage supply in display zone 1: specification at least 11 Volt. - Test sequence continued in table on next page

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01268 Metering adjuster - N146-			



Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
			<ul style="list-style-type: none"> First interrogate all control units capable of CAN communication and eliminate all faults indicated Detach connector from injection pump and check pins for corrosion and correct seating. Re-attach connector and erase fault memory, then interrogate fault memory again. If the fault is entered again, renew injection pump ⇒ page 59

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01282 Variable intake manifold flap change-over valve -N239- Open circuit/short to earth	This fault message is stored if the engine control unit does not activate the change-over valve and there is no voltage at the control unit input ♦ Open circuit in wiring ♦ Change-over valve defective		<ul style="list-style-type: none"> Check intake manifold flap changeover valve ⇒ page 88
	♦ Short to earth	♦ Engine starts but cuts out again immediately	
Output does not sw./ short to pos.	This fault message is stored if the engine control unit is activating the changeover valve and excessive current is flowing at the control unit input ♦ Short to positive		<ul style="list-style-type: none"> Check intake manifold flap changeover valve ⇒ page 88

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01318 Injection pump control unit -J399- Defective			
No fault type identified	♦ Injection pump defective	♦ Reduced power output (engine protection) ♦ Engine stops (safety cut-out)	<ul style="list-style-type: none"> Fault 01126 Engine speed signal must not be stored (if it is stored, check signal using oscilloscope function) Renew injection pump ⇒ page 59
No signal			

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
Signal outside tolerance			
Signal too high			
Implausible signal			

Table continued on next page

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01318 Injection pump control unit -J399-			
No communication	<p>This fault message is stored if signal transmission along the data wiring between the engine control unit and the injection pump is interrupted.</p> <div style="display: flex; justify-content: space-between;"> <div> <p>◆ Open circuit in data wire to injection pump</p> </div> <div> <p>◆ Engine will not start</p> <p>◆ Engine cuts out</p> </div> <div> <ul style="list-style-type: none"> - Erase fault memory after performing compression test. - First interrogate all control units capable of CAN communication and eliminate all faults indicated - Read measured value block 18, check that voltage in display zone 1 is at least 10.5 Volt, charge battery if necessary, then erase fault memory and interrogate fault memory again. - Test sequence continued in table on next page </div> </div>		

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Table continued on next page

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
			<ul style="list-style-type: none"> - Detach connector from injection pump and check pins for corrosion and correct seating. Re-attach connector and erase fault memory, then interrogate fault memory again. - Check CAN matching resistor in injection pump ➔ page 77 - Check data wiring between engine control unit and injection pump ➔ page 77

**Note**

- ◆ Check production date of engine control unit if fault code "1318 - No communication" is stored in addition to fault code "00546".
- ◆ Due to an incorrect resistance value in the engine control unit, the engine will jolt or cut-out if the ambient temperature or sunlight intensity is very high. After parking the vehicle for approx. 1 hour in the shade, the faults can be erased and the engine will start.
- ◆ Check whether the production date is between 14.04.01 and 12.07.01 (the production date can be found on the sticker on the engine control unit). Renew the engine control unit if it was produced during this period and the faults listed above are stored.

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01375 Engine mounting valves stage 1 Open circuit/short to earth	<p>This fault message is stored if the engine control unit fails to activate the engine mounting valves and there is no voltage at the control unit input.</p> <ul style="list-style-type: none"> ◆ Open circuit in wiring ◆ Engine mounting - N144- or -N145 defective 	<ul style="list-style-type: none"> ◆ Electro-hydraulic engine mountings permanently hard 	<ul style="list-style-type: none"> - Rectify open circuit or short circuit
	<ul style="list-style-type: none"> ◆ Short to earth 	<ul style="list-style-type: none"> ◆ Electro-hydraulic engine mountings permanently soft 	<p>⇒ Current flow diagrams, Electrical fault finding and Fitting locations</p>
Output does not sw./ short to pos.	<p>This fault message is stored if the engine control unit is activating the engine mounting valves and too much current is flowing at the control unit input.</p> <ul style="list-style-type: none"> ◆ Short to positive 	<ul style="list-style-type: none"> ◆ Electro-hydraulic engine mountings permanently hard 	<ul style="list-style-type: none"> - Rectify open circuit or short circuit ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

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Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01376 Rev signal for injection pump Defective	<p>This fault message is stored if the speed sender in the injection pump is transmitting false signals or no signal at all.</p> <ul style="list-style-type: none"> ◆ Injection pump defective 	<ul style="list-style-type: none"> ◆ Engine stops (safety cut-out) 	<ul style="list-style-type: none"> - Renew injection pump ⇒ page 59

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01440 Fuel level signal			

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
Open circuit/short to positive	This fault message is stored if there is an open circuit or short to battery positive in the wiring to the instrument cluster. ♦ Open circuit or short to positive in wiring	♦ Glow period warning lamp flashes	– Check fuel level signal ⇒ page 95
Short to earth	This fault message is stored if there is a short to battery negative in the wiring to the instrument cluster. ♦ Short to earth in wiring	♦ Glow period warning lamp flashes	– Check fuel level signal ⇒ page 95

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Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01441 Low fuel level sender -G210- Open circuit/short to positive	This fault message is stored if the voltage of the signal from the sender for low fuel level is greater than 2.65 V. ♦ Open circuit or short to positive in wiring ♦ -G210- defective	♦ Glow period warning lamp flashes	– Check low level fuel sender ⇒ Rep. Gr. 20
Short to earth	This fault message is stored if the voltage of the signal from the sender for low fuel level is less than 0.5 V. ♦ Short to earth in wiring ♦ -G210- defective	♦ Glow period warning lamp flashes	– Check low level fuel sender ⇒ Rep. Gr. 20

Table continued on next page

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01441 Low fuel level sender -G210- Implausible signal	This fault message is stored if the sender for low fuel level indicates “no fuel” but the fuel level signal in the dash panel insert does not indicate that the tank needs filling. ♦ Baffle housing is not filled with fuel even though there is sufficient fuel in tank ♦ -G210- defective ♦ Fault in fuel level signal	♦ Glow period warning lamp flashes ♦ Engine cuts out due to air in fuel system	– Check fuel pump – Check that baffle housing is filled ⇒ Rep. Gr. 20 – Bleed fuel system ⇒ page 63 – Check fuel level signal ⇒ page 95

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01442			



Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
Misfiring due to lack of fuel	<p>This fault message is stored if the baffle housing in the tank is empty</p> <ul style="list-style-type: none"> Vehicle has been driven until tank is empty Baffle housing is not filled with fuel even though there is sufficient fuel in tank 	<ul style="list-style-type: none"> Fault "01441 Implausible signal" certainly not stored Misfiring Engine cuts out because vehicle has been driven until tank is empty Fault "01441 Implausible signal" stored Engine cuts out due to air in fuel system 	<ul style="list-style-type: none"> Put fuel in fuel tank Check fuel pump Check that baffle housing is filled ⇒ Rep. Gr. 20 Bleed fuel system ⇒ page 63

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01613 Fuel cooling pump relay Output does not sw./ short to pos.	<p>This fault message is stored if the engine control unit is activating the fuel cooling pump relay and too much current is flowing at the control unit input.</p> <ul style="list-style-type: none"> Short to positive 	<ul style="list-style-type: none"> Reduced power output 	<ul style="list-style-type: none"> Check wiring ⇒ Current flow diagrams, Electrical fault finding and Fitting locations
Open circuit/short to earth	<p>This fault message is stored if the engine control unit fails to activate the fuel cooling pump relay and there is no voltage at the control unit input.</p> <ul style="list-style-type: none"> Open circuit in wiring Short to earth Fuel cooling pump relay defective 	<ul style="list-style-type: none"> Reduced power output 	<ul style="list-style-type: none"> Check wiring ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01686 Radiator fan run-on control unit -J138- Open circuit/short to earth	<p>The fault message is stored if the engine control unit does not activate the radiator fan run-on control unit and there is no voltage at the control unit input</p> <ul style="list-style-type: none"> Open circuit in wiring Relay defective 	<ul style="list-style-type: none"> No radiator fan run-on 	<ul style="list-style-type: none"> Rectify open circuit or short circuit ⇒ Current flow diagrams, Electrical fault finding and Fitting locations
	<ul style="list-style-type: none"> Short to earth 	<ul style="list-style-type: none"> Radiator fan runs continuously 	

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
Output does not sw./ short to pos.	<p>This fault message is stored if the engine control unit activates the radiator fan run-on control unit and excessive current is flowing at the control unit input</p> <ul style="list-style-type: none"> ◆ Short to positive 	<ul style="list-style-type: none"> ◆ No radiator fan run-on 	<ul style="list-style-type: none"> – Rectify open circuit or short circuit ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

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Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
01695 Fuel temperature sender 2 -G248- Short to earth	<p>This fault message is stored if the voltage of the signal from the sender 2 for fuel temperature is less than 4.1 V.</p> <ul style="list-style-type: none"> ◆ Short to earth ◆ Fuel temperature sender 2 defective 	<ul style="list-style-type: none"> ◆ No noticeable effects 	<ul style="list-style-type: none"> – Check wiring ⇒ Current flow diagrams, Electrical fault finding and Fitting locations
Open circuit/short to positive	<p>This fault message is stored if the voltage of the signal from the sender 2 for fuel temperature is greater than 4.7 V.</p> <ul style="list-style-type: none"> ◆ Open circuit in wiring ◆ Short to positive 	<ul style="list-style-type: none"> ◆ No noticeable effects 	<ul style="list-style-type: none"> – Check wiring ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
17583 P1175 Pilot injection shut off	<p>This fault message is stored if the pilot injection is shut off due to implausible values</p> <ul style="list-style-type: none"> ◆ Tank filled with petrol or biodiesel ◆ Water in fuel ◆ Fuel pressure too low ◆ Fuel return pipe damaged ◆ Internal mechanical fault in injection pump 	<ul style="list-style-type: none"> ◆ Loud engine noise 	<ul style="list-style-type: none"> – Check tank for petrol or biodiesel; if this is the case: drain tank and fill with diesel, erase fault memory and perform road test, then interrogate fault memory again – Drain fuel filter ⇒ page 65 – Check fuel return pipe for blockage or kinks – Test sequence continued in table on next page

Table continued on next page



Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
			<ul style="list-style-type: none"> – Renew flow restrictor¹⁾ in return pipe – Read measured value block 18 and check that voltage in display zone 1 is at least 11 Volt and the value of all bits in display zone 3 is 0. If both readings are as specified, erase fault memory and perform road test, then interrogate fault memory again. Renew injection pump if the same fault is stored again ➔ page 59

1) The flow restrictor is integrated in the banjo bolt of the return pipe. If the banjo bolt (Bosch parts number 1 467 445 003) is already fitted, the injection pump must be renewed ➔ [page 59](#)

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
17931 P1523 Crash signal from airbag CU Implausible signal	<p>This fault message is stored if the wiring to the airbag control unit is defective</p> <ul style="list-style-type: none"> ◆ Open circuit or short circuit in wiring 		<ul style="list-style-type: none"> – Check crash signal ➔ perform final control diagnosis in airbag CU – Check wiring ➔ Current flow diagrams, Electrical fault finding and Fitting locations
17978 P1570 Engine control unit Blocked	<p>This fault message is stored if the ignition was switched on but the engine control unit did not receive a starting signal from the immobilizer.</p> <ul style="list-style-type: none"> ◆ Attempted tampering ◆ Immobilizer not adapted ◆ Immobilizer defective 	<ul style="list-style-type: none"> ◆ Engine starts but cuts out again immediately 	<ul style="list-style-type: none"> – Check electronic immobilizer ➔ Rep. Gr. 96

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Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
18017 P1609 Crash deactivation triggered	<p>This fault message is stored if the engine control unit is notified by the airbag control unit that the airbag has triggered.</p> <ul style="list-style-type: none"> ◆ Final control diagnosis in airbag CU performed ◆ Accident involving airbag activation 	<ul style="list-style-type: none"> ◆ Engine cuts out 	<ul style="list-style-type: none"> – Erase fault memory

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
18033 P1625 Drive train data bus Implausible message from gearbox CU	This fault message is stored if there is interference in the transmission of data between the engine control unit and the gearbox control unit via the data wire. ◆ Open circuit in wiring to gearbox control unit	◆ Gearbox in emergency running mode	– Check wiring ⇒ Current flow diagrams, Electrical fault finding and Fitting locations
18034 P1626 Drive train data bus No message from gearbox CU	This fault message is stored if there is interference in the transmission of data between the engine control unit and the gearbox control unit via the data wire. ◆ Open circuit in wiring to gearbox control unit	◆ Gearbox in emergency running mode	– Check CAN bus ⇒ page 96

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
18044 P1636 Drive train data bus No message from airbag CU	This fault message is stored if interference occurs in the transmission of data between the engine control unit and the airbag control unit via the data wire. ◆ Open circuit in wiring to airbag control unit		– Check CAN bus ⇒ page 96
18056 P1648 Drive train data bus Hardware defective	This fault message is stored if the information exchange between all control units via CAN bus is no longer possible. ◆ Open circuit in wiring or short to earth or positive	◆ Engine running problems	– Check CAN bus ⇒ page 96

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
18057 P1649 Drive train data bus No message from ABS CU	This fault message is stored if interference occurs in the transmission of data between the engine control unit and the ABS control unit via the data wire. ◆ Open circuit in wiring to ABS control unit	◆ Traction control (ASR) warning lamp lights up ◆ ASR not working	– Check CAN bus ⇒ page 96
18058 P1650 Drive train data bus No message from dash panel insert	This fault message is stored if interference occurs in the transmission of data between the engine control unit and the dash panel insert via the data wire.		

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Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
	<ul style="list-style-type: none"> ♦ Open circuit in wiring to dash panel insert 		<ul style="list-style-type: none"> – Check adaption for drive train data bus in dash panel insert. ⇒ Electrical system; Rep. Gr. 01 – Check CAN bus ⇒ page 96

Output on printer of - V.A.G 1551-	Possible cause of fault	Possible effects	Fault remedy
18062 P1654 Please interrogate fault memory of combi-instrument	<ul style="list-style-type: none"> ♦ Fault in instrument cluster (dash panel insert) 		<ul style="list-style-type: none"> – Determine cause of fault in instrument cluster and eliminate
18259 P1851 Drive train data bus No message from ABS CU	<p>This fault message is stored if interference occurs in the transmission of data between the engine control unit and the ABS control unit via the data wire.</p> <ul style="list-style-type: none"> ♦ Open circuit in wiring to ABS control unit 	<ul style="list-style-type: none"> ♦ Traction control (ASR) warning lamp lights up ♦ ASR not working 	<ul style="list-style-type: none"> – Check wiring ⇒ Current flow diagrams, Electrical fault finding and Fitting locations
65535 Control unit defective	<ul style="list-style-type: none"> ♦ Internal fault in control unit 	<ul style="list-style-type: none"> ♦ Engine running problems ♦ Engine cuts out 	<ul style="list-style-type: none"> – Renew engine control unit ⇒ page 75

5 Final control diagnosis



Note

- ◆ *During the final control diagnosis, individual control elements continue to be activated until the test programme is advanced to the next control element by pressing the  key.*
- ◆ *The control elements can be checked either by listening for audible clicks, etc. or by touching the component.*
- ◆ *If the final control diagnosis is to be repeated without first starting the engine briefly, switch off the ignition for approx. 20 seconds.*

1. Glow plug relay -J52-
 2. Glow period warning lamp -K29-
 3. Radiator fan run-on control unit -J138- or blower relay -J323-
- Connect vehicle diagnosis and service information system - VAS 5052- and select engine electronics control unit by entering "address word" 01. When doing this, the ignition must be switched on.



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Checking glow plug relay -J52- :

Specification: the glow plug relay should click.

While the relay is being switched on and off, this can also be observed as the interior light becomes brighter and darker due to the current draw of the glow plugs.

If the glow plug relay does not click:

- Check glow plug relay: ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

Checking glow period warning lamp -K29- :

The warning lamp should flash.

If the warning lamp does not flash:

- Check glow period warning lamp ⇒ [page 102](#)

Checking radiator fan run-on control unit -J138- or blower relay -J323- :

The radiator fan should start running and stop again every 5 seconds.

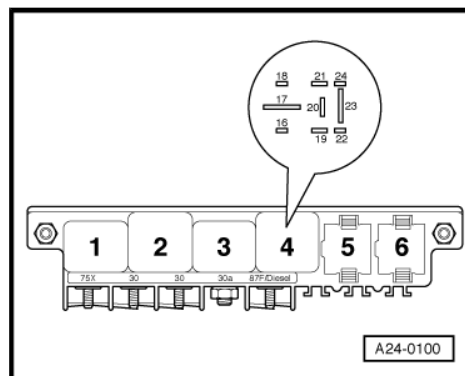


Note

- ◆ *The radiator fan may also be activated by the thermoswitch, automatic gearbox or air conditioner if the temperature reaches a certain level. When performing final control diagnosis, make sure activation does not take place for any of these reasons.*
- ◆ *If necessary, allow the engine to cool down.*

If the radiator fan is not activated:

- Check radiator fan activation ⇒ Rep. Gr. 19 .
- Check radiator fan run-on control unit -J138- or blower relay -J323- ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.



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6 Basic setting

Test conditions

- Coolant temperature at least 80 °C
- Electrical equipment switched off (radiator fan must not run during the test).
- Air conditioner switched off.
- Selector lever in position P or N.

Test sequence

- Connect up the vehicle diagnosis and service information system -VAS 5052- and select vehicle system "Engine electronics". When doing this, the ignition must be switched on.

Or, depending on desired operation:

- Start engine.
- Select diagnostic function "Basic setting".
- Enter the required display group number (3 figures) and confirm entry.

Example:

- Enter "003" for "display group number 003" and confirm.

Display group 03 at idling speed

This display group is used for checking the exhaust gas recirculation. The exhaust gas recirculation valve -N18- is alternately opened and closed for 10 seconds. Check exhaust gas recirculation system ⇒ Rep. Gr. 26

System in basic setting 3 →				▼ Indicated on display
1000 rpm	EGR active	169 mg/H	0 %	
				Duty cycle (activation) of EGR valve
				Intake air mass
				Exhaust gas recirculation valve -N18- open
Engine speed				

System in basic setting 3 →				▼ Indicated on display
1000 rpm	EGR n.active	415 mg/H	100 %	
				Duty cycle (activation) of EGR valve
				Intake air mass
				Exhaust gas recirculation valve -N18- closed
Engine speed				

Display group 04 at idling speed

This display group is used for checking injection timing control. The injection timing control is moved between the "advanced" and "retarded" positions every 10 seconds.



System in basic setting 4 →				▾ Indicated on display
850 rpm	Ad- vanced	15.4° BTDC	29 %	
Duty cycle (activation) of commencement of injection valve				
Commencement of injection: at least 12° BTDC is okay				
Commencement of injection valve -N108- is activated until specification of at least 12° BTDC is achieved				
Engine speed				

System in basic setting 4 →				▾ Indicated on display
850 rpm	Retarded	1.2° ATDC	100 %	
Duty cycle (activation) of commencement of injection valve				
Commencement of injection between 4° ATDC and 0° ATDC is okay				
Commencement of injection valve -N108- open				
Engine speed				

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Display group 11 at idling speed

This display group is used for checking the charge pressure (boost pressure) control. The charge pressure control solenoid valve -N75- is opened and closed alternately for periods of 10 seconds. Checking charge pressure control ⇒ Rep. Gr. 21 .

System in basic setting 11 →				▾ Indicated on display
1000 rpm	On	1040 mbar	100 %	
Activation of charge pressure control solenoid valve -N75-				
Charge pressure				
Charge pressure control solenoid valve -N75- open				
Engine speed				

System in basic setting 11 →				▾ Indicated on display
1000 rpm	Off	979 mbar	0 %	
Activation of charge pressure control solenoid valve -N75-				
Charge pressure				
Charge pressure control solenoid valve -N75- closed				
Engine speed				

7 Coding diesel direct injection system control unit -J248-

If the appropriate code for the vehicle is not displayed or if the control unit has been renewed, the control unit must be coded as follows.

- Connect up the vehicle diagnosis and service information system -VAS 5052- and select vehicle system “Engine electronics”. When doing this, the ignition must be switched on.
- Select diagnostic function “Coding control unit” from list.
- Enter control unit coding via key pad as specified in coding table

Make up the code number according to the following example:

Audi A8	00
Not used	0
Emission standard EU III D	1
Front-wheel drive and manual gearbox	2
Code number	00 0 1 2

Coding versions for diesel direct injection system control unit - J248-

Vehicle type	Not used	Country/emissions	Gearbox
00 = Audi A8	0 = Display “0”	0 = EU II	0 = ---
01 = ---	1 = ---	1 = EU III D	1 = Automatic gearbox, front-wheel drive with/without ESP
02 = ---	2 = ---	2 = ---	2 = Manual gearbox front-wheel drive with/without ESP
03 = ---	3 = ---	3 =	3 = Manual gearbox four-wheel drive without ESP
04 =	4 = ---	4 = ---	4 = Automatic gearbox four-wheel drive without ESP
05 = ---	5 = ---	5 = ---	5 = Manual gearbox four-wheel drive with ESP
06 = ---	6 = ---	6 = ---	6 = Automatic gearbox four-wheel drive with ESP

Enter new code after replacing the following engine control units:

Engine control unit, old version	Engine control unit, new version	Code:	Model
4D0 907 401 B	4D0 907 401 N <small>Protected by copyright. Copying for private or commercial purposes, in part or in full, is permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright © 2006 AUDI AG.</small>	00301	Automatic gearbox with front-wheel drive
		00402	Manual gearbox with front-wheel drive
		00504	Automatic gearbox with four-wheel drive without ESP
4D0 907 401 C	4D0 907 401 M	00312	Manual gearbox with front-wheel drive



Engine control unit, old version	Engine control unit, new version	Code:	Model
4D0 907 401 G	4D0 907 401 N	00001	Automatic gearbox with front-wheel drive
		00102	Manual gearbox with front-wheel drive
		00204	Automatic gearbox with four-wheel drive without ESP

Enter new code after replacing the following engine control units:

Engine control unit, old version	Engine control unit, new version	Code:	Model
4D0 907 401 H	4D0 907 401 M	00001	Automatic gearbox with front-wheel drive
		00102	Manual gearbox with front-wheel drive
4D0 907 401 J	4D0 907 401 M	00206	Automatic gearbox with four-wheel drive and ESP

**Note**

The abbreviation "ESP" stands for Electronic Stabilisation Program

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8 Reading measured value block

Note the following if testers and measuring instruments have to be used during a road test:



WARNING

- ◆ *Test equipment must always be secured on the rear seat and operated from that position by a second person.*
- ◆ *If test equipment and measuring instruments are operated from the front passenger's seat and the vehicle is involved in an accident, the person sitting in this seat could be seriously injured when the airbag is triggered.*

Test conditions

- Electrical equipment switched off (radiator fan must not run during the test).
- Air conditioner switched off.
- Selector lever in P or N position

Test sequence

- Connect up the vehicle diagnosis and service information system -VAS 5052- and select vehicle system "Engine electronics". When doing this, the ignition must be switched on.

Or, depending on desired operation:

- Start engine.
- Select diagnostic function "Read measured value block".
- Enter the required display group number (3 figures) and confirm entry.



Note

The choice of display group number depends on which functions and components are to be tested.

8.1 List of display groups

Display group number	Indicated on display	Designation
00	Read measured value block 0	1 = Engine speed
General vehicle check	1 2 3 4 5 6 7 8 9 10	2 = Commencement of injection 3 = Accelerator pedal position 4 = Injection quantity 5 = Intake manifold pressure (charge pressure) 6 = Atmospheric pressure (ambient air pressure) 7 = Coolant temperature 8 = Intake air temperature 9 = Fuel temperature 1 = Intake air mass 0



Display group number	Indicated on display	Designation
01 Injection quantity	Read measured value block 1 1 2 3 4	1 = Engine speed 2 = Injection quantity 3 = Activation time of metering solenoid valve 4 = Coolant temperature

Display group number	Indicated on display	Designation
02 Idling speed	Read measured value block 2 1 2 3 4	1 = Engine speed 2 = Accelerator pedal position 3 = Operating status: <ul style="list-style-type: none"> X X X X 1 A/C compressor switched on X X X 1 X Ignore X X 1 X X Idling speed switch closed X 1 X X X Kickdown switch closed 1 X X X X Idling speed increased because: <ul style="list-style-type: none"> • Required by air conditioner • Accelerator and brake application detected • System fault detected 4 = Coolant temperature

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Display group number	Indicated on display	Designation
03 Exhaust gas recirculation	Read measured value block 3 1 2 3 4	1 = Engine speed 2 = Intake air mass (specified) 3 = Intake air mass (actual) 4 = Duty cycle (activation) of exhaust gas recirculation valve - N18-
04 Commencement of injection	Read measured value block 4 1 2 3 4	1 = Engine speed 2 = Commencement of injection (specified) 3 = Commencement of injection (actual) 4 = Duty cycle (activation) of commencement of injection valve -N108-
05 Start conditions	Read measured value block 5 1 2 3 4	1 = Engine speed 2 = Injection quantity for starting (recorded from last start) 3 = Commencement of injection 4 = Coolant temperature

Display group number	Indicated on display	Designation
06 Switch positions	Read measured value block 6 1 2 3 4	<p>1 = Vehicle speed</p> <p>2 = Brake pedal monitoring:</p> <p style="margin-left: 40px;">X X 1 Brake light switch -F closed</p> <p style="margin-left: 40px;">X 1 X Brake pedal switch -F47- open</p> <p style="margin-left: 40px;">1 X X Clutch pedal switch -F36- open (display on vehicles with manual gearbox only)</p> <p>3 = Cruise control system (CCS) operating unit:</p> <p style="margin-left: 40px;">X X X X X 1 CCS switched on</p> <p style="margin-left: 40px;">X X X X 1 X CCS off with memory</p> <p style="margin-left: 40px;">X X X 1 X X Speed reduction</p> <p style="margin-left: 40px;">X X 1 X X X Resume/accelerate</p> <p style="margin-left: 40px;">X 1 X X X X Brake pedal depressed</p> <p style="margin-left: 40px;">1 X X X X X Clutch pedal pressed (display on vehicles with manual gearbox only)</p>

Display group number	Indicated on display	Designation
06 Switch positions	Read measured value block 6 1 2 3 4	<p>4 = Operating status of cruise control system (CCS):</p> <p style="margin-left: 40px;">0 Control unit with cruise control system switched off</p> <p style="margin-left: 40px;">1 Cruise control system switched on</p> <p style="margin-left: 40px;">2 Accelerate</p> <p style="margin-left: 40px;">4 Decelerate</p> <p style="margin-left: 40px;">8 Resume</p> <p style="margin-left: 40px;">1 6 Brake pedal depressed</p> <p style="margin-left: 40px;">3 2 Maintain speed</p> <p style="margin-left: 40px;">6 4 Ignore</p> <p style="margin-left: 40px;">1 2 8 Ignore</p> <p style="margin-left: 40px;">2 5 5 Control unit without CCS function</p>

Display group number	Indicated on display	Designation
07 Temperatures	Read measured value block 7 1 2 3 4	<p>1 = Fuel temperature</p> <p>2 = Oil temperature</p> <p>3 = Intake air temperature</p> <p>4 = Coolant temperature</p>
08 Injection quantity limitation	Read measured value block 8 1 2 3 4	<p>1 = Engine speed</p> <p>2 = Desired injection quantity (driver input via accelerator pedal)</p>



Display group number	Indicated on display	Designation
		3 = Injection quantity limitation via engine speed (torque limitation) 4 = Injection quantity limitation based on intake air mass (avoidance of exhaust smoke)
09 Injection quantity limitation	Read measured value block 9 1 2 3 4	1 = Desired injection quantity (driver input via accelerator pedal) 2 = Injection quantity limitation by automatic gearbox during gearshift 3 = Injection quantity determined by overrun torque limitation (MSR) 4 = Injection quantity limitation by traction control system

Display group number	Indicated on display	Designation
10 Air quantities	Read measured value block 10 1 2 3 4	1 = Intake air mass 2 = Atmospheric pressure (ambient air pressure) 3 = Intake manifold pressure (charge pressure) 4 = Accelerator pedal position
11 Charge pressure control	Read measured value block 11 1 2 3 4	1 = Engine speed 2 = Charge pressure (specified) 3 = Charge pressure (actual) 4 = Duty cycle (activation) of charge pressure control solenoid valve -N75-
12 Glow plug system	Read measured value block 12 1 2 3 4	1 = (Ignore) 2 = Glow period (in seconds) 3 = Voltage supply at control unit 4 = Coolant temperature

Display group number	Indicated on display	Designation
13 Smooth idling regulation	Read measured value block 13 1 2 3 4	1 = Difference between injection quantities for cylinders 3 and 2 2 = Difference between injection quantities for cylinders 1 and 2 3 = No display 4 = No display
14 Smooth idling regulation	Read measured value block 14 1 2 3 4	1 = No display 2 = Difference between injection quantities for cylinders 6 and 2 3 = Difference between injection quantities for cylinders 4 and 2

Display group number	Indicated on display	Designation
		4 = Difference between injection quantities for cylinders 5 and 2
15 Fuel consumption	Read measured value block 15 1 2 3 4	1 = Engine speed 2 = Injection quantity (actual) 3 = Fuel consumption 4 = Desired injection quantity (driver input via accelerator pedal)

Display group number	Indicated on display	Designation
16 Not used	Read measured value block 16	No display
17 Not used	Read measured value block 17	No display
18	Read measured value block 18 1 2 3 4	1 = Voltage supply to injection pump 2 = Voltage supply at engine control unit 3 = Signals from injection pump X X X X X X 1 Constant current to metering solenoid valve X X X X X X 1 X Metering solenoid valve defective X X X X X 1 X X Injection pump speed sender defective X X X X 1 X X X Injection timing control defective X X X 1 X X X X Commencement of injection not detected X X 1 X X X X X Cut-out signal has been set X 1 X X X X X X Engine speed not registered 1 X X X X X X X Data wiring defective

Display group number	Indicated on display	Designation
18	Read measured value block 18 1 2 3 4	4 = Evaluation of pulses from engine speed sender. The injection pump expects the pulses in specific phases, alternately inside and outside a phase 0 0 0 0 One pulse outside the phase, one pulse within the phase = okay X X X 1 No pulses outside the phase X X 1 X Several pulses outside the phase X 1 X X No pulses within the phase 1 X X X Several pulses within the phase
19 Start conditions (stored)	Read measured value block 19 1 2 3 4	1 = Engine speed 2 = Start of delivery 3 = Activation time of metering solenoid valve 4 = Fuel temperature


Note

Display group number 18: is only displayed on engine control units with a certain data level.

Display group number	Indicated on display	Designation
20 Supplementary heater	Read measured value block 20 1 2 3 4	1 = Ambient temperature 2 = Fuel consumption of supplementary heater 3 = Supplementary heater switched off due to: X X X 1 Engine speed less than 600 rpm X X 1 X Engine start within last 10 seconds X 1 X X No request to engine control unit (e.g. ECON button pressed) 1 X X X Ambient temperature above +5 °C 4 = Coolant temperature

Display group number	Indicated on display	Designation
21 Fuel level	Read measured value block 21 1 2 3 4	1 = Status of fuel level check 1 0 0 Low fuel level sender: Tank empty 0 1 0 Low fuel level sender: Tank almost empty 0 0 1 Warning signal from dash panel insert: fill up 2 = Status of injection system 1 0 0 0 Engine cut out, no more fuel 0 1 0 0 Engine starts but cuts out again because not enough fuel in tank 0 0 1 0 Engine will not start because no fuel in tank 0 0 0 1 Engine misfiring (intentional) 0 0 0 1 Preparation for shut-down 3 = Fuel pump activated: 1 0 When engine is running 0 1 For about 6 seconds after switching on ignition 4 = Status of fuel level check 1 Switched off because of system fault

Display group number	Indicated on display	Designation
25 Injection pump	Read measured value block 25 1 2 3 4 5	1 = Data level 2 = Injection pump number (see also Parts catalogue) 3 = Software version

Display group number	Indicated on display	Designation
		4 = Serial No. 5 = Production date
125 Drive train data bus	Read measured value block 125 1 2 3 4	1 = Gearbox control unit 2 = ABS control unit 3 = Instrument cluster 4 = Airbag control unit

8.2 Readout specifications for general vehicle check

8.2.1 Display group 00 at idling speed (engine warm, coolant temperature not below +85 °C)

Read measured value block 0 →										Indicated on display	
34	72	0	16	97	20	59	19	12	54		
					8		1	7			
										Intake air mass: 50...70 okay	
										• If outside tolerance ⇒ Display group 03, ⇒ page 52	
										Fuel temperature: no specification	
										Intake manifold temperature: no specification	
										Coolant temperature: 80...45 okay	
										• > 80: run engine till warm	
										Ambient air pressure: no specification	
										Charge pressure: ignore	
										Injection quantity: 10...30 okay	
										• If outside tolerance ⇒ Display group 01, ⇒ page 47	
										Accelerator pedal position: 0	
										Commencement of injection: 51...88 okay	
										• If outside tolerance ⇒ Display group 04, ⇒ page 48	
										Idling speed: 32...36 okay	
										• If outside tolerance ⇒ Display group 02, ⇒ page 50	

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8.2.2 Display group 00 at full throttle (test drive in 3rd or 4th gear, coolant temperature not below +85 °C) on engine code AFB, AKN



WARNING

Secure fault reader to rear seat and operate from this position. When doing this, always observe the relevant safety precautions ⇒ [page 57](#).

Read measured value block 0 →										▾ Indicated on display
15	14	25	12	20	20	59	19	12	21	
6	7	5	4	8	8		1	9	1	
										Intake air mass: greater than 185 okay
										• < 185: ⇒ Display group 10
										Fuel temperature: no specification
										Intake manifold temperature: no specification
										Coolant temperature: 80...45 okay
										• > 80: run engine till warm
										Ambient air pressure: ignore
										Charge pressure: 187...215 okay
										• If outside tolerance ⇒ Display group 11, ⇒ page 55
										Injection quantity: 113...127 (injection quantity at full throttle) okay
										• If outside tolerance ⇒ interrogate fault memory, ⇒ page 4
										Accelerator pedal: 255 (fully depressed)
										Commencement of injection: greater than 115 OK
										• If outside tolerance ⇒ Display group 04, ⇒ page 48
										Engine speed: 140...170 (do not exceed 4000 rpm; engine speed is governed)

8.2.3 Display group 00 at full throttle (test drive in 3rd or 4th gear, coolant temperature not below +85 °C) on engine code AKE



WARNING

Secure fault reader to rear seat and operate from this position. When doing this, always observe the relevant safety precautions ⇒ [page 57](#).

Read measured value block 0 →										▾ Indicated on display
15	14	25	13	20	20	59	19	12	21	
6	7	5	2	8	8		1	9	1	
										Intake air mass: greater than 200 okay
										• < 200: ⇒ Display Group 10

							Fuel temperature: no specification
							Intake manifold temperature: no specification
							Coolant temperature: 80...45 okay
							• > 80: run engine till warm
							Ambient air pressure: ignore
							Charge pressure: 200...230 okay
							• If outside tolerance ⇒ Display group 11, ⇒ page 55
							Injection quantity: 130...150 (injection quantity at full throttle) okay
							• If outside tolerance ⇒ interrogate fault memory, ⇒ page 4
							Accelerator pedal: 255 (fully depressed)
							Commencement of injection: greater than 120 OK
							• If outside tolerance ⇒ Display group 04, ⇒ page 48
							Engine speed: 140...170 (do not exceed 4000 rpm; engine speed is governed)

8.3 Readout specifications for injection pump

8.3.1 Display group 19 in case of attempted start (only if engine does not start)

Read measured value block 19 →				Indicated on display
310 rpm	0.7° BTDC	35.7 °CA	14.3° C	
				Fuel temperature
				Activation time of metering solenoid valve
				• Readout value increases in periodic jumps: okay (injection pump working)
				• 0 °CA: metering control closed, starting speed too low, see display zone 1 ⇒ Interrogate fault memory, ⇒ page 4
				Start of delivery
				• 2.0° ATDC...4.7° BTDC: okay
				• Retarded more than 2.0° ATDC: start of delivery retarded too far ⇒ check commencement of injection, ⇒ page 67
				Starting speed
				• Less than 200 rpm and coolant temperature above 40 °C: starter speed too low, injection pump is not activated, battery weak, starter defective



Note

If all values are OK, but engine does not start: air in fuel system, injectors stuck open.

8.3.2 Display group 01 at idling speed (engine warm, coolant temperature not below +85 °C)

Read measured value block 1	→	Indicated on display
-----------------------------	---	----------------------

800 rpm	5.6 mg/H	20.7 °CA	87.3 °C	
				Coolant temperature <ul style="list-style-type: none"> • 85...105 °C: okay • < 85 °C: ⇒ run engine till warm
				Activation time of metering solenoid valve <ul style="list-style-type: none"> • 15...25° CA: okay • less than 15° CA: injection pump too rich ⇒ fit a new injection pump • Greater than 25 °CA: engine under load ⇒ Switch off load, injection pump too lean ⇒ renew injection pump
				Injection quantity <ul style="list-style-type: none"> • 3.0...8.0 mg/stroke: okay • Less than 3.0 mg/H (mg/stroke): injection pump too rich ⇒ fit a new injection pump • Greater than 8.0 mg/stroke: engine under load ⇒ Switch off load, injection pump too lean ⇒ renew injection pump
				Engine speed <ul style="list-style-type: none"> • 740...840 rpm okay

8.3.3 Display group 04 at idling speed (engine warm, coolant temperature not below +85 °C)

Read measured value block 4				→	Indicated on display
800 rpm	2.0° ATDC	1.6° ATDC	73 %		
					Duty cycle (activation) of commencement of injection valve <ul style="list-style-type: none"> • No specification
					Current commencement of injection <ul style="list-style-type: none"> • 2° ATDC...3° BTDC: okay • Retarded more than 2° ATDC: commencement of injection valve defective <ul style="list-style-type: none"> Injection pump retarded much too far ⇒ check injection timing control range, ⇒ page 76 • Advanced more than 3° BTDC: engine too cold ⇒ run engine till warm <ul style="list-style-type: none"> Injection pump set too advanced commencement of injection defective ⇒ check injection timing control range, ⇒ page 76
					Commencement of injection specified by control unit <ul style="list-style-type: none"> • 2° ATDC...3° BTDC: okay
					Engine speed <ul style="list-style-type: none"> • 740...840 rpm okay

8.3.4 Display group 04 at full throttle (test drive in 3rd or 4th gear, coolant temper-

**ature not below +85 °C) Engine code
 AFB, AKN**



WARNING

*Secure fault reader to rear seat and operate from this position.
 When doing this, always observe the relevant safety precautions ➔ [page 57](#).*

Read measured value block 4				→	▼ Indicated on display
4160 rpm	11.8° BTDC	14.2° BTDC	32 %		
					Duty cycle (activation) of commencement of injection valve
					• No specification
					Current commencement of injection
					• If as specified in display zone 2 (tolerance ±2°): okay
					• If outside tolerance: start of delivery from injection pump incorrect
					⇒ Check commencement of injection, ➔ page 67
					injection timing control blocked
					commencement of injection valve defective
					⇒ check injection timing control range, ➔ page 76
					Commencement of injection specified by control unit
					• 8...12° BTDC: okay
					Engine speed
					• 3800...4200 rpm okay

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**8.3.5 Display group 04 at full throttle (test
 drive in 3rd or 4th gear, coolant temper-
 ature not below +85 °C) on engine code
 AKE**



WARNING

*Secure fault reader to rear seat and operate from this position.
 When doing this, always observe the relevant safety precautions ➔ [page 57](#).*

Read measured value block 4				→	▼ Indicated on display
4160 rpm	12.8° BTDC	14.2° BTDC	32 %		
					Duty cycle (activation) of commencement of injection valve
					• No specification

		Current commencement of injection
		• If as specified in display zone 2 (tolerance $\pm 2^\circ$): okay
		• If outside tolerance: start of delivery from injection pump incorrect
		⇒ Check commencement of injection, ⇒ page 67
		injection timing control blocked
		commencement of injection valve defective
		⇒ check injection timing control range, ⇒ page 76
		Commencement of injection specified by control unit
		• 10...14° BTDC: okay
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Engine speed		
		• 3800...4200 rpm okay

8.4 Readout specifications for engine idling speed

8.4.1 Display group 02 at idling speed (engine warm, coolant temperature not below +85 °C)

Read measured value block 2		→	Indicated on display
800 rpm	0.0 %	0 01 00	88.4 °C
		Coolant temperature	
		• 85...100 °C: okay	
		• < 85 °C: ⇒ run engine till warm	
		Operating status	
		• 0 01 00: okay (idling speed switch closed)	
		• 1 01 10: air conditioning system signal ⇒ switch off air conditioner	
		Accelerator and brake application detected ⇒ check brake pedal switch	
		auxiliary heater on ⇒ run engine till warm	
		• 1 01 11: air conditioning system signal ⇒ switch off air conditioner	
		Accelerator pedal position	
		• 0.0 %: okay	
		• > 0.0 %: accelerator pedal position sender incorrectly set or defective ⇒ adjust	
Engine speed			
		• 740...840 rpm okay	

8.4.2 Display group 13 at idling speed

Read measured value block 13		→	Indicated on display
0.82 mg/	-0.12 mg/		
H	H		
		No display	
		No display	

- Difference between injection quantities for cylinders 3/1 and cylinder 2
- -1.5 mg/H...+1.5 mg/H (mg/stroke) okay
- Readouts in all display zones too high: cylinder 2 strong
- Readouts in all display zones too low: cylinder 2 weak

- Difference between injection quantities for cylinder 1 and cylinder 2
- -1.5 mg/H...+1.5 mg/H (mg/stroke) okay
 - > +1.5 mg/H: cylinder 1 weak
 - < -1.5 mg/H: cylinder 1 strong

- Difference between injection quantities for cylinder 3 and cylinder 2
- -1.5 mg/H...+1.5 mg/H (mg/stroke) okay
 - > +1.5 mg/H: cylinder 3 weak
 - < -1.5 mg/H: cylinder 3 strong

8.4.3 Display group 14 at idling speed

Read measured value block 14 →			▼ Indicated on display
0.79 mg/ H	0.37 mg/ H	-0.15 mg/ H	
			<ul style="list-style-type: none"> – Difference between injection quantities for cylinders 6/4/5 and cylinder 2 • -1.5 mg/H...+1.5 mg/H (mg/stroke) okay • Readouts in all display zones too high: cylinder 2 strong • Readouts in all display zones too low: cylinder 2 weak
			<p>Difference between injection quantities for cylinder 5 and cylinder 2</p> <ul style="list-style-type: none"> • -1.5 mg/H...+1.5 mg/H (mg/stroke) okay • > +1.5 mg/H: cylinder 5 weak • < -1.5 mg/H: cylinder 5 strong
			<p>Difference between injection quantities for cylinder 4 and cylinder 2</p> <ul style="list-style-type: none"> • -1.5 mg/H...+1.5 mg/H (mg/stroke) okay • > +1.5 mg/H: cylinder 4 weak • < -1.5 mg/H: cylinder 4 strong
			<p>Difference between injection quantities for cylinder 6 and cylinder 2</p> <ul style="list-style-type: none"> • -1.5 mg/H...+1.5 mg/H (mg/stroke) okay • > +1.5 mg/H: cylinder 6 weak • < -1.5 mg/H: cylinder 6 strong
			No display

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Note

- ◆
- ◆ *The injection system is equipped with an idling speed smooth running control function. The system is able to detect differences in the performance of the individual cylinders (component tolerances, nozzle output, compression etc.) and compensate by adjusting the injection quantities accordingly at idling speed.*
- ◆ *Differences in cylinder performance at idling speed are detected by the engine speed sender, which sends the control unit six signals per crankshaft revolution. If the signals are being sent at uniform intervals, this means that all cylinders are performing equally. If one cylinder is weaker, the crankshaft will take longer for its next 120 ° revolution. Conversely a more powerful cylinder will accelerate the crankshaft so that less time is needed for the 120 ° revolution.*
- ◆ *If the control unit detects a difference, the injection quantity for the relevant cylinder is immediately increased or decreased as required until the engine runs evenly again.*
- ◆ *The measured value block shows the differences between the injection quantities of the individual cylinders and the injection quantity of No. 2 cylinder. In each case the difference represents the quantity required to ensure an even engine idling speed.*
- ◆ *+... mg/H: The relevant cylinder is less powerful than No. 2 cylinder and is therefore supplied with more fuel.*
- ◆ *-... mg/H: The relevant cylinder is more powerful than No. 2 cylinder and is therefore supplied with less fuel.*
- ◆ *Display groups 13 and 14 indicate the deviations in injection quantity for cylinder banks 1 and 2 respectively. If there is a considerable difference between the injection quantities for the cylinder banks, check: Toothed belt tension, tensioning roller and timing.*

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8.5 Readout specifications for exhaust gas recirculation

8.5.1 Display group 03 at idling speed (engine warm, coolant temperature not below +85 °C)

Read measured value block 3			→	Indicated on display
800 rpm	215 mg/H	211 mg/H	54 %	
				Duty cycle (activation) of EGR valve
				• No specification

		<p>Intake air mass</p> <ul style="list-style-type: none"> • If as specified in display zone 2 (tolerance ± 20 mg/H (mg/stroke)): okay • Intake air mass less than specified: unmetered air in intake tract <p>Excessive exhaust gas recirculation \Rightarrow check</p> <ul style="list-style-type: none"> • Excessive air mass: exhaust gas recirculation less than specified \Rightarrow check <p>If engine has been running for 10 min. at idling speed \Rightarrow Briefly press accelerator</p> <ul style="list-style-type: none"> • Constant readout: substitute value \Rightarrow interrogate fault memory
		<p>Air mass specified by control unit</p> <ul style="list-style-type: none"> • 180...270 mg/H (mg/stroke): okay • Above 270 mg/H (mg/stroke): engine too cold \Rightarrow run engine till warm <p>Injection quantity too high \Rightarrow Readout specifications for injection pump</p> <p>Intake air temperature very high (display group 7 zone 3) \Rightarrow adjustment not possible</p>
	Engine speed	<ul style="list-style-type: none"> • 740...840 rpm okay

8.6 Readout specifications for temperature senders

8.6.1 Display group 07 with ignition switched on (engine cold)

Read measured value block 7				→	Indicated on display
15.4 °C	16.5 °C	15.9 °C	16.7 °C		
					Coolant temperature (at coolant temperature sender - G62-)
					Intake air temperature (at intake air temperature sender - G42-)
					Oil temperature (at oil temperature sender - G8-)
					Fuel temperature (at fuel temperature sender - G81-)



Note

- ◆ No specifications can be given for temperature values.
- ◆ When the engine is cold, the temperatures of the fuel, intake air, oil and coolant must be approximately the same as the ambient temperature. If one of the temperature readings is noticeably different, test the relevant sender.

8.7 Readout specifications for engine power output

8.7.1 Display group 08 at full throttle (test drive in 3rd or 4th gear, coolant temper-

ature not below +85 °C) Engine code
AFB, AKN



WARNING

*Secure fault reader to rear seat and operate from this position.
When doing this, always observe the relevant safety precautions ⇒ [page 57](#).*

Read measured value block 8 →				▾ Indicated on display
3490 rpm	43.6 mg/ H	38.5 mg/ H	42.9 mg/ H	
				Injection quantity limitation according to intake air mass detected greater than 41 mg/H (mg/stroke): okay <ul style="list-style-type: none"> • Less than 41 mg/stroke: Inadequate air mass detected ⇒ Check air mass meter, ⇒ page 86 Exhaust gas recirculation at full throttle
				Injection quantity limitation according to engine speed (torque limitation) 37...40 mg/H: okay <ul style="list-style-type: none"> • < 37 mg/H: engine speed too high or too low • > 40 mg/H: injection quantity increased as a result of tuning
				Desired injection quantity (accelerator pedal position) greater than 41 mg/H (mg/stroke): okay <ul style="list-style-type: none"> • Less than 41 mg/H: accelerator pedal not fully depressed, incorrectly adjusted or defective ⇒ check
Engine speed 2800...3500 rpm: OK				

8.7.2 Display group 08 and 10 at full throttle (test drive in 3rd or 4th gear, coolant temperature not below +85 °C) on engine code AKE



WARNING

*Secure fault reader to rear seat and operate from this position.
When doing this, always observe the relevant safety precautions ⇒ [page 57](#).*


Read measured value block 8 →				▾ Indicated on display
3490 rpm	66.1 mg/ H	45.5 mg/ H	50.9 mg/ H	
				Injection quantity limitation according to intake air mass detected greater than 48 mg/H (mg/stroke): okay <ul style="list-style-type: none"> • Less than 48 mg/stroke: Inadequate air mass detected ⇒ Check air mass meter, ⇒ page 86 Exhaust gas recirculation at full throttle

		<p>Injection quantity limitation according to engine speed (torque limitation) 42...47 mg/H: okay</p> <ul style="list-style-type: none"> • < 42 mg/H: engine speed too high or too low • > 47 mg/H: injection quantity increased as a result of tuning
		<p>Desired injection quantity (accelerator pedal position) greater than 50 mg/H (mg/stroke): okay</p> <ul style="list-style-type: none"> • Less than 50 mg/H: accelerator pedal not fully depressed, incorrectly adjusted or defective ⇒ check
Engine speed 2800...3500 rpm: OK		

Read measured value block 10	→	Indicated on display
832 mg/H 1030 mbar 2070 mbar	100 %	
		<p>Accelerator pedal position: 100 % okay</p> <ul style="list-style-type: none"> • less than 100 %: Accelerator pedal not fully pressed down, accelerator position sender -G79- incorrectly set or defective ⇒ Check
		<p>Current charge pressure: 1900...2300 mbar: OK Outside tolerance: Charge pressure control defective ⇒ Display group 11, ⇒ page 55</p>
		Current atmospheric pressure: No specification
		<p>Intake air mass: > 750 mg/H (mg/stroke) okay</p> <ul style="list-style-type: none"> • Less than 750 mg/H: engine speed less than 2000 rpm or above 4000 rpm, charge pressure too low ⇒ observe display zone 3, air leak between air mass meter and turbocharger, air mass meter defective

8.8 Readout specifications for charge pressure control

8.8.1 Display group 11 at full throttle (test drive in 3rd and 4th gear, coolant temperature not below +85 °C)



WARNING

Secure fault reader to rear seat and operate from this position. When doing this, always observe the relevant safety precautions ⇒ [page 57](#).

Read measured value block 11	→	Indicated on display
3340 rpm 2121 mbar 2121 mbar	42 %	
		Duty cycle (activation) of charge pressure control solenoid valve -N75-



		<p>Current charge pressure</p> <ul style="list-style-type: none">• If as specified in display zone 2 (tolerance ± 100 mbar): okay• Charge pressure too low: no charge pressure control \Rightarrow check• Excessive charge pressure: Charge pressure control solenoid valve -N75- sticking <p>Charge pressure control pressure hose disconnected or clogged Linkage seized on turbocharger, vacuum unit defective \Rightarrow Check charge pressure</p>
		<p>Charge pressure specified by control unit</p> <ul style="list-style-type: none">• 1900...2300 mbar okay
		<p>Engine speed 2900...4000 rpm: OK</p>



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23 – Mixture preparation - injection

1 Servicing diesel direct injection system

1.1 Safety precautions

Note the following if testers and measuring instruments have to be used during a road test:



WARNING

- ◆ ***Test equipment must always be secured on the rear seat and operated from that position by a second person.***
- ◆ ***If test equipment and measuring instruments are operated from the front passenger's seat and the vehicle is involved in an accident, the person sitting in this seat could be seriously injured when the airbag is triggered.***

To avoid injury and/or damage to the injection and glow plug system, note the following:

- ◆ Switch off the ignition before connecting or disconnecting injection or glow plug system wiring or tester cables.
- ◆ If the engine is to be turned at starter speed without starting, e.g. when checking compression, detach connector from injection pump.



WARNING

Before disconnecting battery, obtain radio code for radios equipped with anti-theft coding.

Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.

1.2 Rules for cleanliness

When working on the fuel supply/injection system, pay careful attention to the following "5 rules":

- ◆ Thoroughly clean all unions and surrounding areas before disconnecting.
- ◆ Place parts that have been removed on a clean surface and cover them over. Use only lint-free cloths.
- ◆ Carefully cover or seal open components if repairs cannot be carried out immediately.
- ◆ Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have been stored loose (e.g. in tool boxes etc.).
- ◆ When the system is open: Do not work with compressed air if this can be avoided. Do not move the vehicle unless absolutely necessary.

- ◆ Also ensure that no diesel fuel comes into contact with the coolant hoses. Should this occur, the hoses must be cleaned immediately. Damaged hoses must be renewed.

1.3 Overview of fitting locations

Components A to E are not shown on the exploded view.

1 - Electronics box in plenum chamber

- ☐ Diesel direct injection system control unit - J248- with altitude sensor -F96-
- ☐ Diesel direct injection system relay -J322-
- ☐ Fuses for glow plugs

2 - Injector with needle lift sender -G80-

- ☐ Injector for No. 3 cylinder

3 - Solenoid valve for charge pressure control -N75-

4 - Exhaust gas recirculation valve -N18-

5 - Connector

- ☐ 2-pin
- ☐ For needle lift sender - G80-

6 - Connector

- ☐ 3-pin
- ☐ For engine speed sender -G28-

7 - Oil temperature sender - G8-

8 - Intake manifold flap with vacuum unit

- ☐ Change-over valve for intake manifold flap - N239- is located on ABS/EDL hydraulic unit

9 - Intake manifold pressure sender -G71-

10 - Engine speed sender -G28-

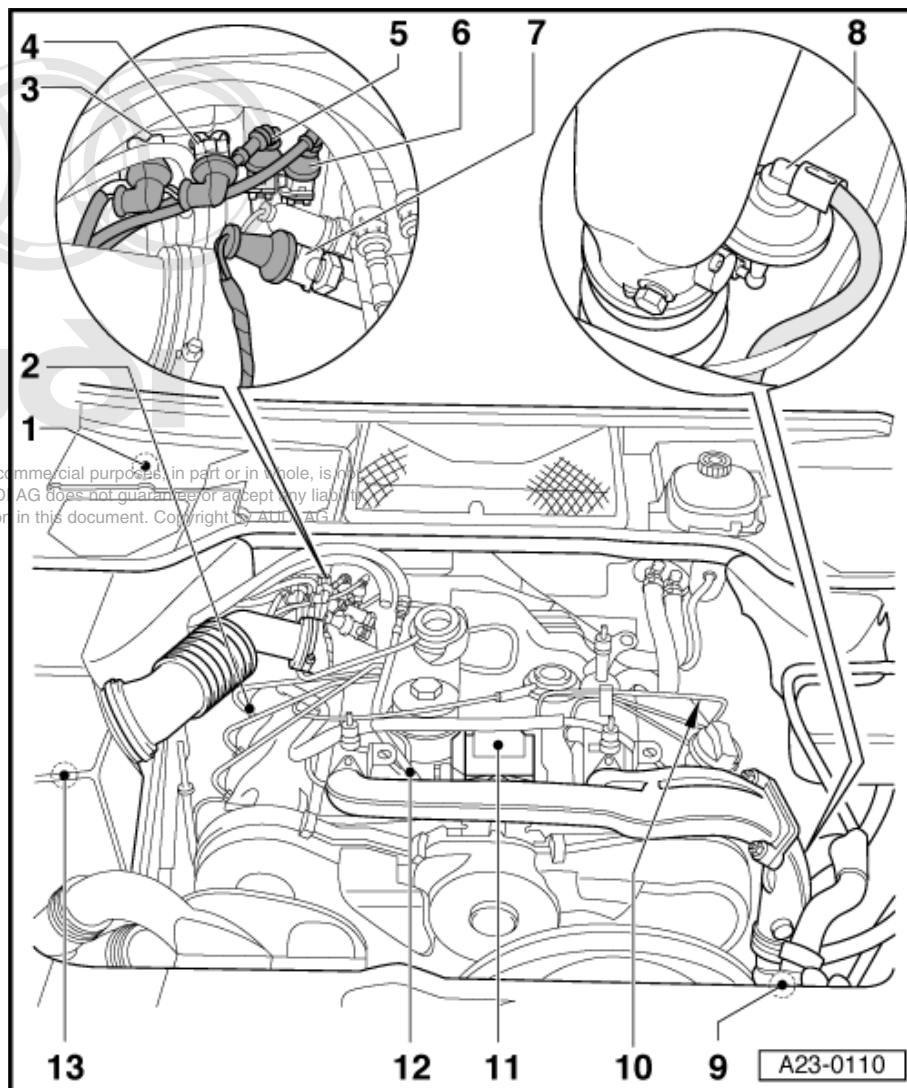
11 - Injection pump

- ☐ With injection pump control unit
- ☐ With metering adjuster solenoid valve
- ☐ With injection pump speed sender
- ☐ With commencement of injection valve
- ☐ With fuel temperature sender

12 - Coolant temperature sender -G62-

13 - Air mass meter -G70- with intake air temperature sender -G42-

- ☐ In air cleaner housing (top section)



A - Brake light switch -F- and brake pedal switch -F47-

- ☐ In footwell on brake pedal
- ☐ Combined in one unit

B - Accelerator position sender -G79-

- ☐ In footwell on accelerator pedal

C - Glow plug relay -J52-

- ☐ Micro-central electrics in electronics box in passenger's footwell, relay position 4

D - Fuel pump relay -J17-

- ☐ Relay carrier in electronics box in passenger's footwell, relay position 2

E - Diesel direct injection system relay -J322-

- ☐ Relay and fuse holder in electronics box in plenum chamber, relay position 4

1.4 Removing and installing injection pump

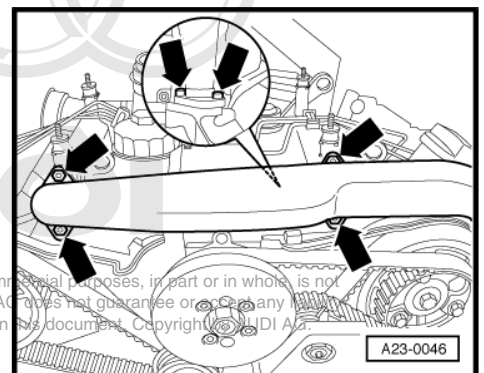
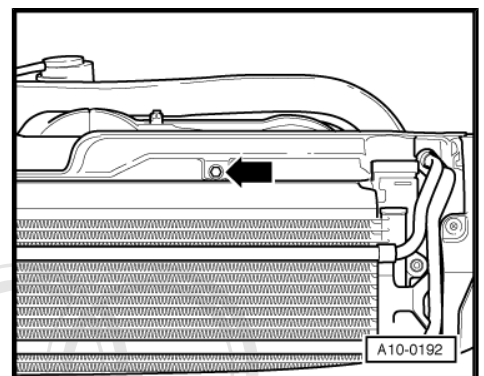


Note

- ◆ *For security reasons, in all vehicles as from the 2002 model year the injection pump is integrated in the immobiliser system.*
- ◆ *When an injection pump has been renewed, it must be re-adapted to the immobiliser (same adaption as when replacing the engine control unit), otherwise the engine will not start.*
- ◆ *Removing injection pump*

Removing injection pump

- Remove toothed belt covers (front left and right).
- Remove viscous fan.
- Remove air duct for viscous fan.
- Remove front engine cover panel.
- Remove front section of intake manifold.
- Open oil filler cap.



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- Turn engine until the marking “- OT -” (TDC) is visible on camshaft.

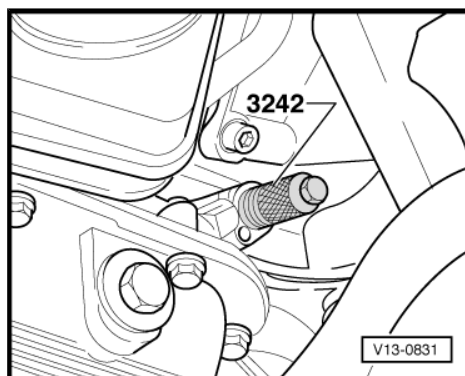
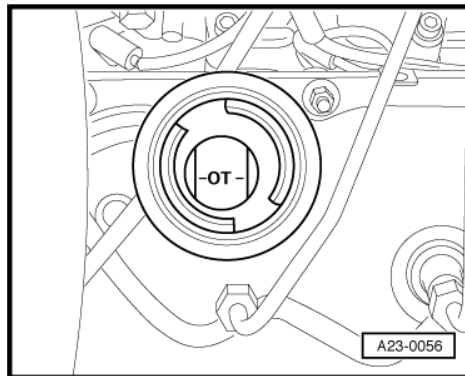
**Note**

Turn over the engine at the central bolt on the crankshaft.

- Unscrew plug for TDC marking in crankcase.

The crankshaft is provided with a TDC drilling, which can be felt directly below the plug.

- Screw locking pin -3242- into threaded hole where plug has been removed, and tighten.

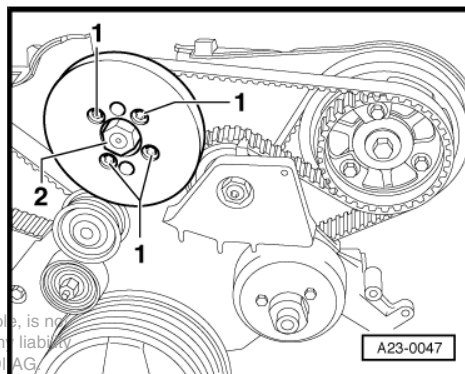


- Remove vibration damper on injection pump sprocket (bolts -1-).

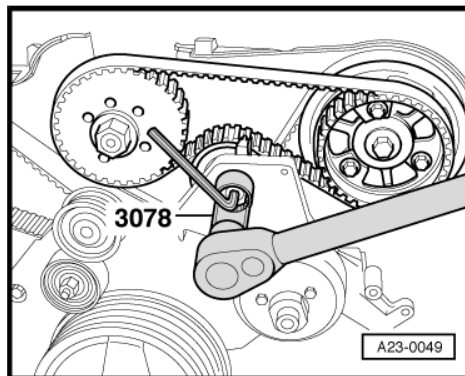
**Note**

Do NOT loosen nut -2- for injection pump sprocket. Otherwise this would alter the basic setting of the injection pump. The setting cannot be re-adjusted with workshop equipment.

- Mark direction of rotation of toothed belt. The belt can break if it rotates in the opposite direction when refitted.



- Slacken toothed belt tensioner and take off toothed belt.
- Unplug connector from injection pump.
- Disconnect fuel supply and return pipes from injection pump.
- Cover open connections with a clean cloth.
- Disconnect injector pipes from injectors using open ring spanner -3078-.



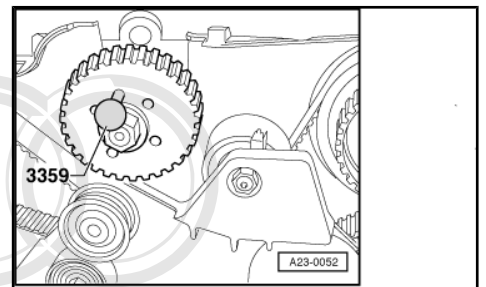
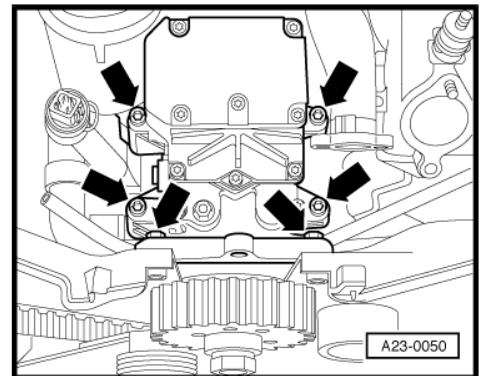
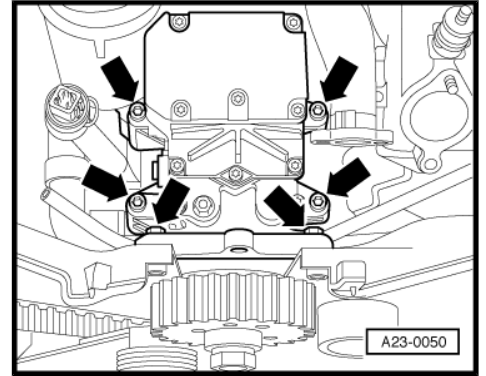
- Unscrew injection pump mountings.
- Lift out injection pump together with injector pipes.
- Mark injector pipes according to cylinders.
- Disconnect injector pipes with ring spanner -3035- .

Installing injection pump

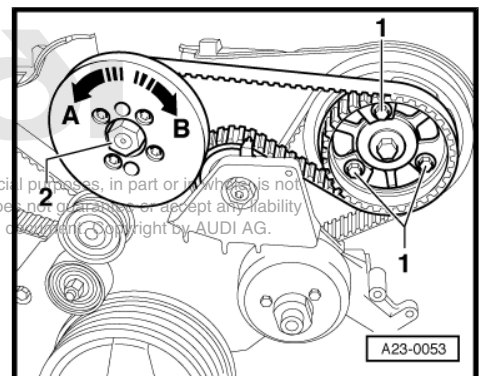
- Mount injection pump on engine and bolt it in place.
- ◆ Tightening torque: bolts on crankcase: 20 Nm
- ◆ Tightening torque: bolts on toothed belt cover: 10 Nm
- Install the injector pipes one by one, working from bottom to top, and tighten with torque wrench -V.A.G 1331- and 17 mm open ring spanner insert (e.g. Stahlwille 733/10).
- ◆ Tightening torque: 30 Nm

Note

- ◆ *Incorrect assembly will distort the taper seats of the pipe unions.*
 - ◆ *When tightening the connections, make sure the injector pipes are not twisted or under tension.*
 - ◆ *Secure the retaining clips on the injector pipes in their original positions and without tension.*
- Lock injection pump sprocket with diesel injection pump locking pin -3359- .



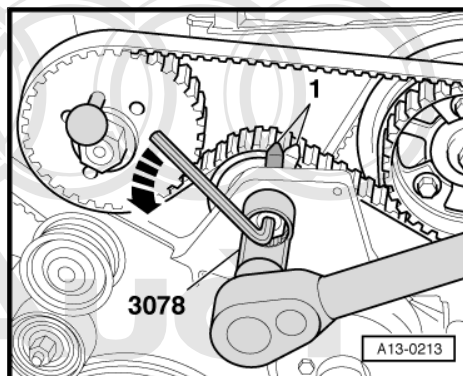
- Slacken camshaft sprocket -1- and align centrally in longitudinal holes.
- Fit toothed belt. Pay attention to the direction of rotation as marked upon removal.



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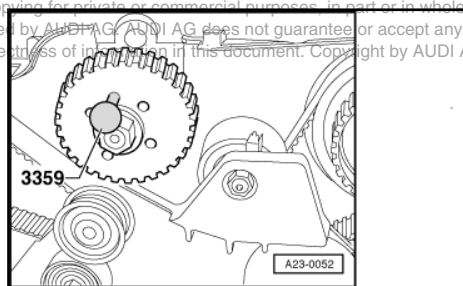


- Tension toothed belt. To do so, turn Allen key anti-clockwise until markings -1- are in line, then tighten securing nut.
- ◆ Tightening torque: 36 Nm
- Tighten bolts at camshaft sprocket.
- ◆ Tightening torque: 20 Nm

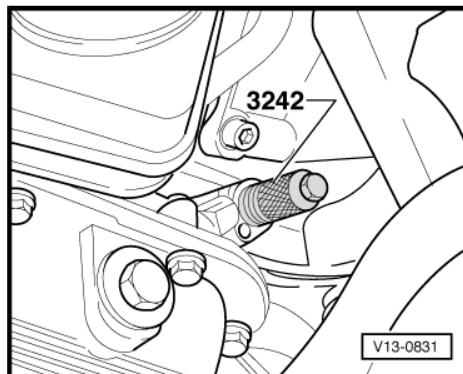


- Remove diesel injection pump locking pin -3359-

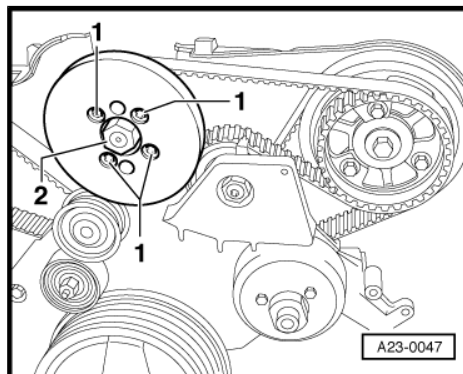
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- Remove locking pin -3242- .
- Turn crankshaft two rotations in normal direction of rotation until it is set to TDC of No. 3 cylinder again.
- Recheck markings at toothed belt tensioner. Correct toothed belt tension as necessary.



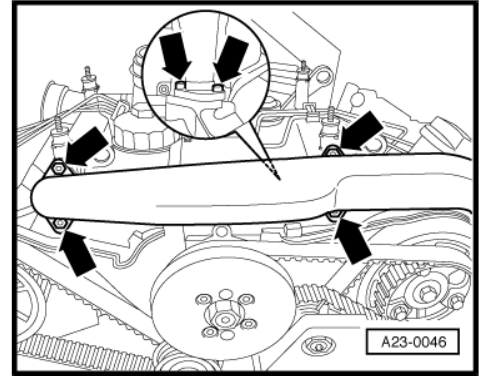
- Install vibration damper on injection pump sprocket (bolts -1-).
- ◆ Tightening torque: 20 Nm



- Install front section of intake manifold.
- ◆ Tightening torque: 10 Nm
- Fit connector to injection pump.
- Connect fuel pipes.

After installing the injection pump, the following steps must be performed:

- Additional step for vehicles as from model year 2002
 ⇒ [page 63](#) .
- Bleed fuel system, otherwise engine will not start
 ⇒ [page 63](#) .
- Dynamically check and adjust commencement of injection
 ⇒ [page 67](#) .



1.4.1 Additional step for vehicles as from model year 2002:

- The new injection pump must be adapted to the immobiliser (otherwise engine will not start).

For this purpose, use vehicle diagnosis and service information system -VAS 5052- .

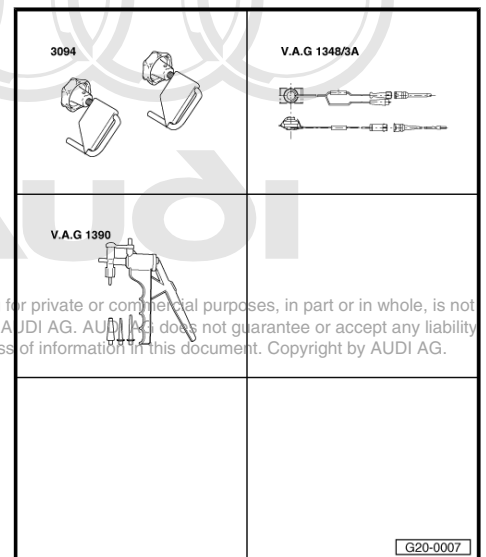
Using the “Guided Fault Finding” function, select “Go to” button, “Function/component selection”, “Powertrain”, “corresponding engine code”, “23 Mixture preparation - injection”, “Electrical component”, “J248 23 CU for diesel direct injection system” and “Adapting injection pump to immobiliser”.

- Install toothed belt cover.

1.5 Bleeding fuel system

Special tools and workshop equipment required

- ◆ Hose clamps for hoses up to 25 mm -3094-
- ◆ -V.A.G 1348/3A- with -V.A.G 1348/3-2-
- ◆ -V.A.G 1390- with -V.A.G 1390/1-



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WARNING

- ◆ *When bleeding the fuel system, make sure the inner section of the baffle housing (capacity approx. 0.5 litres) is constantly filled with fuel.*
- ◆ *When the engine is not running (electric fuel pump off), the inner section of the baffle housing will only stay full if the tank is more than $\frac{1}{3}$ full.*
- ◆ *So if the fuel tank is less than $\frac{1}{3}$ full, follow the procedure outlined below.*

Procedure when fuel tank less than $\frac{1}{3}$ full

If you do not want to put more fuel in the tank because of tests that will be required later, the following method can be used to keep the inner section of the baffle housing full of fuel while bleeding the system:

- Open cover of fuse box.
- Pull out fuse No. 1 from fuse holder 4 (blue).
- Connect remote control -V.A.G 1348/3A- with adapter cable -V.A.G 1348/3-2- to right-hand terminal of fuse socket No. 1 fuse carrier 4 (blue).
- Connect crocodile clamp to vehicle battery (positive).
- Keep remote control switch pressed while bleeding fuel system; fuel pump should run audibly.

Bleeding

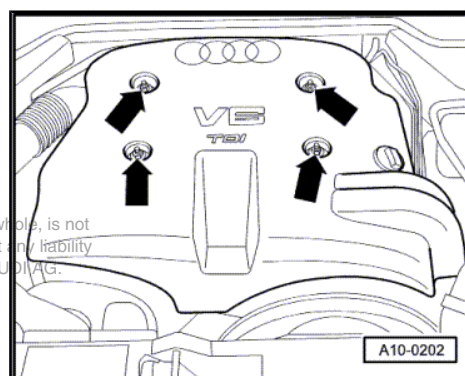
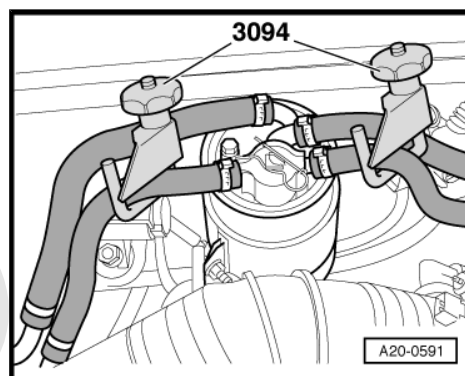
- Using hose clamps up to Ø 25 mm -3094-, clamp off fuel return line at the following points:

- ◆ Between filter and fuel tank
- ◆ Between filter and injection pump

If it has not already been done:

- Detach caps on engine cover panel.

- Unbolt and remove engine cover panel -arrows-.



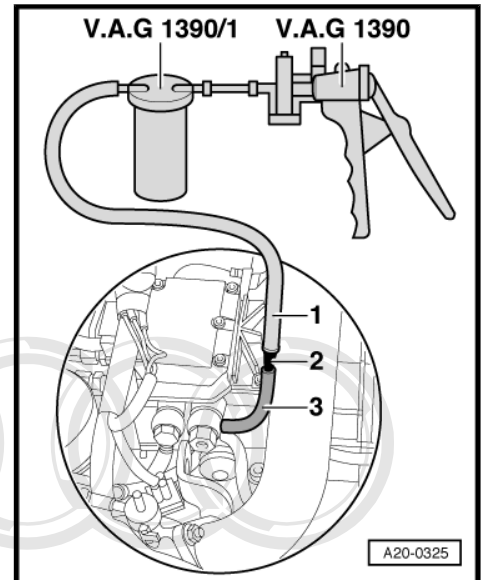
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- Disconnect return hose for injectors of right cylinder bank at injection pump.
- Connect a short length of hose -3- to the free hose connection on the injection pump.
- Insert a suitable adapter -2- from -V.A.G 1390/1- into the short length of hose.
- Connect hose -1- between adapter and bleeder container - V.A.G 1390/1- .
- Operate hand pump and fill bleeder container three times in this way.



WARNING

Empty the bleeder container before it becomes full. No fluid must be allowed to enter the hand-operated vacuum pump.



Note

Air bubbles may still be visible in the hose even after the bleeder container has been filled 3 times.

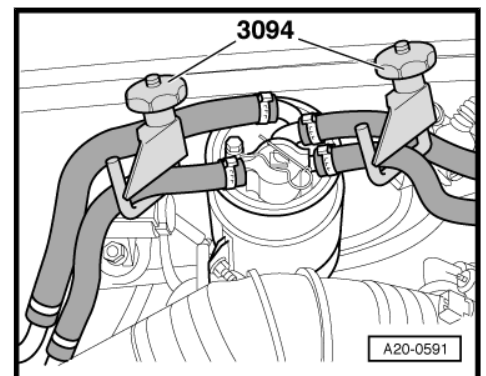
- Re-connect return hose to injection pump.
- Remove hose clamps up to Ø 25 mm -3094- from return line.
- If the fuse was removed, fit fuse 1 back onto fuse carrier 4 (blue).
- Start engine and check fuel system for leaks (visual check).

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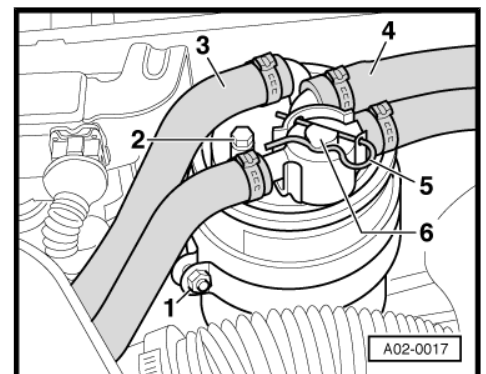
WARNING

Do not prolong attempted starting for more than 15 seconds. If engine does not start, repeat bleeding procedure.



1.6 Draining fuel filter

- Unscrew bleeder screw -2- at fuel filter (bleeder connection is open)





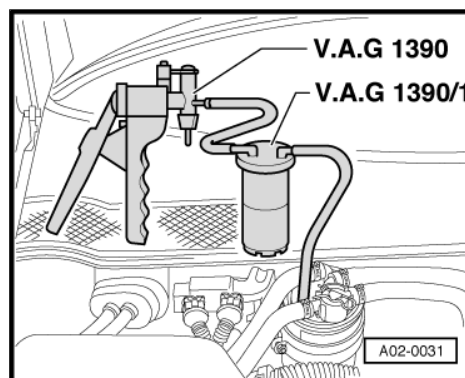
- Connect hand-operated vacuum pump -V.A.G 1390/1- to bleeder connection at fuel filter -arrow-.
- Operate hand pump until approx. 100 cm³ of fluid is drawn out of fuel filter.



WARNING

No fluid must be allowed to enter the hand-operated vacuum pump.

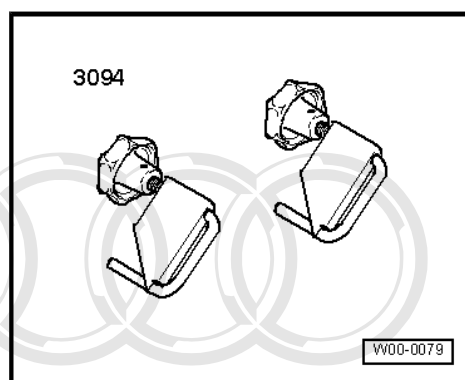
- Start engine and check fuel system for leaks (visual check)
⇒ [page 66](#) .



1.7 Checking fuel system for leaks

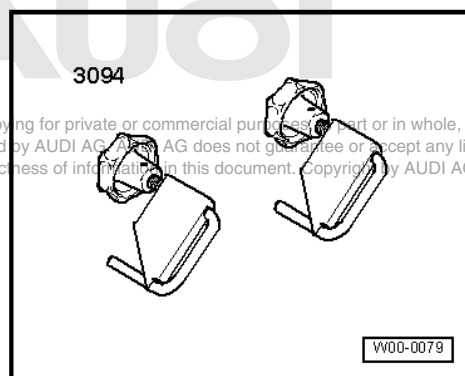
A leaking fuel system can cause:

- ◆ Foam build-up or air bubbles in the supply pipe
- ◆ Lack of power, misfiring
- ◆ Starting problems

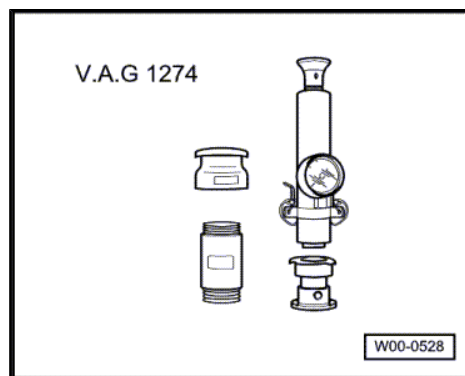


Special tools and workshop equipment required

- ◆ Hose clamps for hoses up to 25 mm -3094-

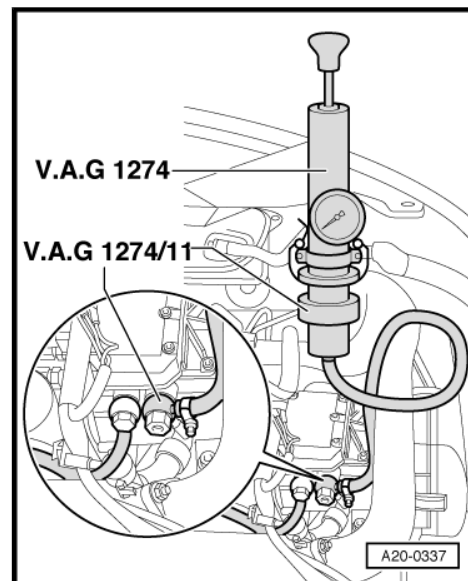


- ◆ Cooling system tester -V.A.G 1274-

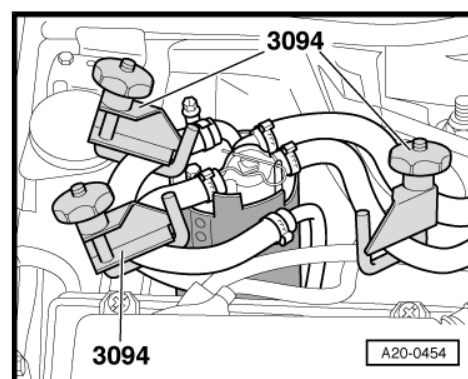


- ◆ Adapter -V.A.G 1274/11-

- Attach adapter -V.A.G 1274/11- to cooling system tester - V.A.G 1274- .
- Unscrew fuel return line at injection pump and connect up hose of adapter -V.A.G 1274/11- in its place.



- Fit hose clamps up to Ø 25 mm -3094- at the following points:
 - ◆ Supply hose behind fuel filter
 - ◆ Return hose behind fuel filter
 - ◆ Return hose from injection pump



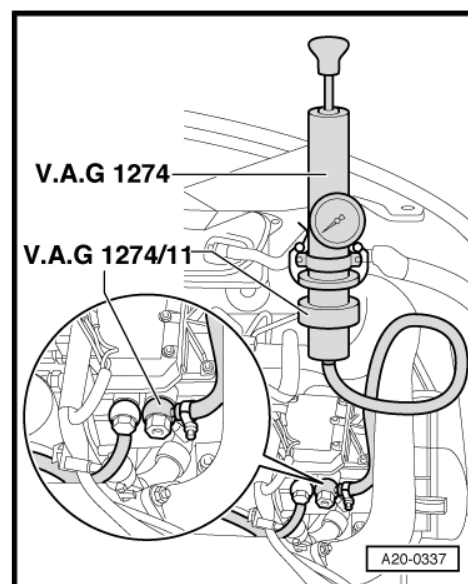
- Use hand pump on tester to create a pressure of 1.0 ... 1.5 bar.
- If pressure drops constantly, locate leak and eliminate fault.

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Note

By moving the hose clamps from the filter to the fuel tank connections it is also possible to check the fuel hoses at the same time.

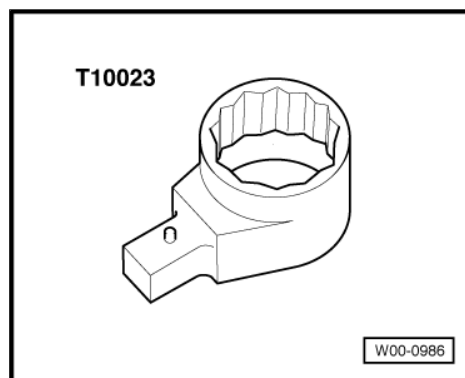


1.8 Dynamically checking and adjusting commencement of injection

Special tools and workshop equipment required



◆ -T10023- Insert tool

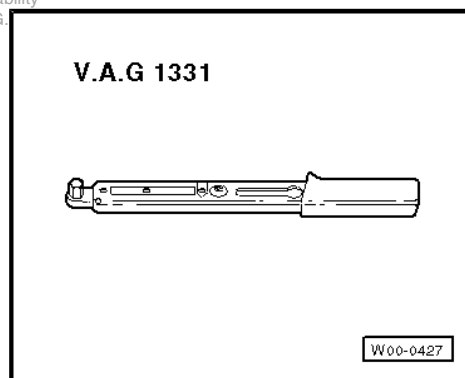


◆ Fault reader -V.A.G 1551- or vehicle system tester -

V.A.G 1552- with cable -V.A.G 1551/3-

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◆ -V.A.G 1331- Torque wrench (5...50 Nm)



Note

The commencement of injection must always be checked after renewing the toothed belt or loosening the injection pump bolts or toothed belt sprockets, and adjusted if necessary.

- Start engine.
- Read measured value block, Display group 07, engine running at idling speed.
- Check readout in display zone 4 (coolant temperature).

◆ Specification: at least 85 °C

Do not continue the test until the coolant has reached the specified temperature.

- Start basic setting function, Display group 04, engine running at idling speed.
- Check display in display zone 4.

◆ Specification: 100%

- Observe display in display zone 2.

◆ Specification: "retarded"

- Check display in display zone 3.

◆ Specification: 2° ATDC ± 2°

If the readout does not match the specification, adjust the commencement of injection (injection timing) ⇒ [page 69](#) .

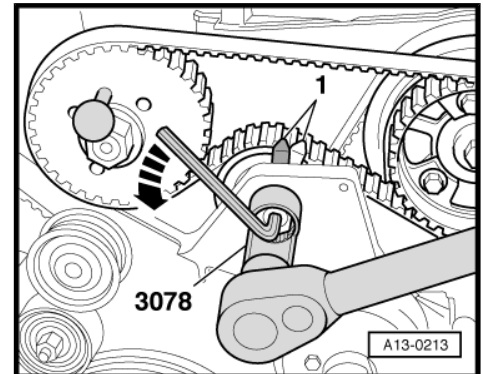
1.9 Adjusting commencement of injection

- Remove toothed belt covers (front left and right).
- Check toothed belt tension.

The marks must be aligned.

If the marks are not aligned:

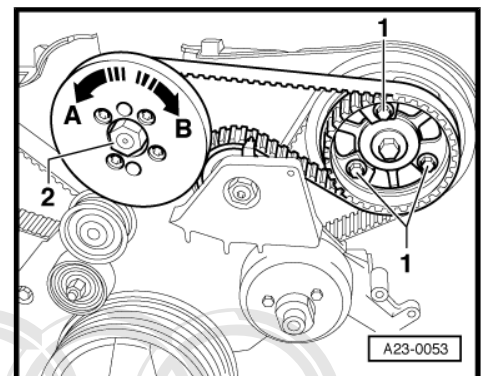
- Tension toothed belt.
- Slacken nut on belt tensioner using socket, 22 mm -3078- .
- Turn Allen key anti-clockwise until markings -1- are in line, then tighten nut.
- ◆ Tightening torque: 36 Nm



- Slacken camshaft sprocket securing bolts -1-.
- Position ring spanner (22 mm) on pump shaft -2- and turn slightly as follows:

A - Turn pump shaft in direction A to retard commencement of injection

B - Turn pump shaft in direction B to advance commencement of injection



Note

Do NOT loosen nut -2- for injection pump sprocket. Otherwise this would alter the basic setting of the injection pump. The setting cannot be re-adjusted with workshop equipment.

- Tighten bolts -1- at camshaft sprocket.
- ◆ Tightening torque: 20 Nm
- Check commencement of injection again and compare with the specification ⇒ [page 67](#) .

If commencement of injection is outside specified range:

- Correct setting on injection pump sprocket.
- Install toothed belt cover.

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1.10 Checking injectors

- Start engine.
- Read measured value block, Display group 13 (cylinders 1 and 2), engine running at idling speed.
- ◆ Specification: -1.50 mg/H...+1.50 mg/H (milligrams per stroke)
- Read measured value block, Display group 14 (cylinders 4, 5, 6), engine running at idling speed.



- ◆ Specification: $-1.50 \text{ mg/H} \dots +1.50 \text{ mg/H}$ (milligrams per stroke)
- If one or more of the values is outside the tolerance, swap round the injectors (except the injector for cylinder 3).
- If the values for all the cylinders of one cylinder bank are noticeably outside the tolerance range, check the toothed belt tension and tensioning roller ⇒ Rep. Gr. 15.

**Note**

The injector for cylinder 3 contains the needle lift sender.

- If the fault moves along with the injector, fit a new injector ⇒ [page 71](#).
- If the fault remains on the same cylinder, check the compression.

1.10.1 Checking spray pattern and checking for leaks

Check injectors using injector tester -V.A.G 1322- and pressure pipe -V.A.G 1322/2-.

**WARNING**

When testing injectors, ensure that the jet of fuel does not contact the hands as the high pressure will cause the fuel to penetrate the skin and may cause severe injuries.

- Pressure gauge switched on
- Move pump lever down slowly. Read off injection pressure when injector opens. If the pressure does not match the specification, fit a new injector.

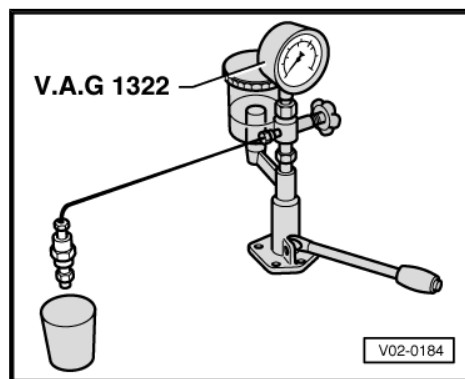
New injectors	200 ... 235 bar
Wear limit	170 bar

Checking for leaks

- Pressure gauge switched on
- Move pump lever down slowly and maintain a pressure of approx. 150 bar for 10 seconds. There should be no fuel leakage from the injector nozzle.
- Renew injector if leaking.

**Note**

- ◆ *This engine is equipped with dual spring injectors. The fuel is therefore injected in 2 stages.*
- ◆ *If a fault occurs with this type of injector, the injector must be renewed as it is not possible to adjust the pressure setting or repair faults.*



1.11 Removing and installing injectors



Note

*Removing injector together with needle lift sender -G80-
 ⇒ [page 72](#)*

Defective injectors can cause the following faults:

- Loss of power
- Excessive black exhaust smoke
- Excessive blue smoke when starting from cold
- High fuel consumption
- Engine overheating
- Knocking in one or more cylinders
- Misfiring

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Removing

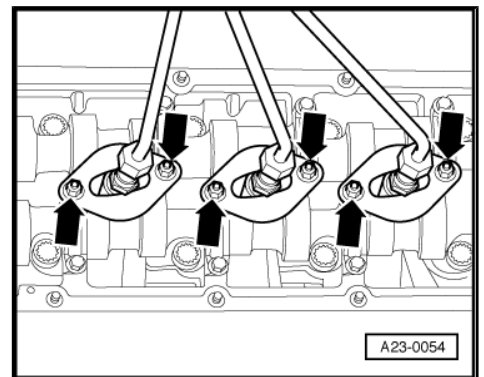
- Remove cylinder head cover ⇒ Rep. Gr. 15 .
- Remove retainers from injectors and pull out injectors upwards.

If one of the cams prevents the injector from being withdrawn (vehicles with manual gearbox):

- Engage 4th gear and push the vehicle forwards slightly.

If one of the cams prevents the injector from being withdrawn (vehicles with automatic gearbox):

- Refit all the retainers onto the injectors and tighten the nuts by hand.
- Unplug connector from injection pump.



WARNING

Before operating the starter, make sure that all the injectors are secured with their retainers and that the injection pump connector is detached.

- Operate the starter briefly.

Installing



Note

Always renew copper seals between cylinder head and injectors.

- Install injectors. Ensure that injectors are seated correctly.
- Fit retainer.
- ◆ Tightening torque: 10 Nm
- Install cylinder head cover ⇒ Rep. Gr. 15 .

1.12 Removing and installing injector with needle lift sender -G80-

Removing

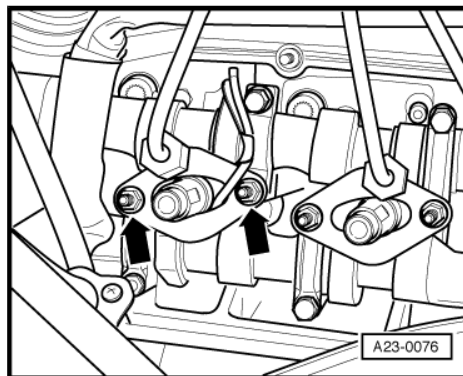
- Remove cylinder head cover (right-side) ⇒ Rep. Gr. 15 .
- Unplug connector for needle lift sender -G80- (brown connector on bulkhead).
- Slacken the two nuts on retainer for injector in No. 3 cylinder.
- Pull out injector together with needle lift sender -G80- .

If one of the cams prevents the injector from being withdrawn (vehicles with manual gearbox):

- Engage 4th gear and push the vehicle forwards slightly.

If one of the cams prevents the injector from being withdrawn (vehicles with automatic gearbox):

- Screw retainer back onto injector again.
- Unplug connector from injection pump.



WARNING

Before operating the starter, make sure that all the injectors are secured with their retainers and that the injection pump connector is detached.

- Operate the starter briefly.
- Remove copper seal (between injector and cylinder head) from cylinder head.

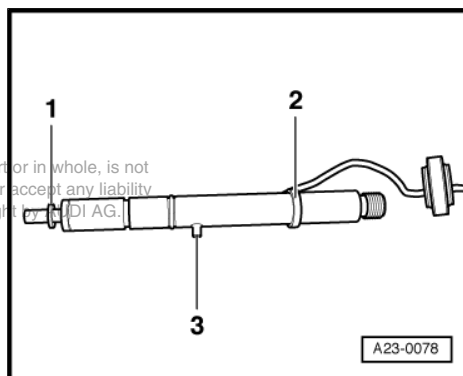


Note

The copper seal must always be renewed.

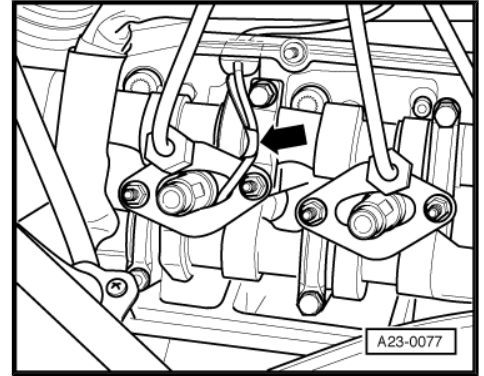
Installing

- Install new injector with collar -2- and new copper seal -1-.
- When installing injector, make sure that locating pin -3- fits into groove in cylinder head.



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- Guide injector wire through retainer.
- Secure retainer.
- ◆ Tightening torque: 10 Nm



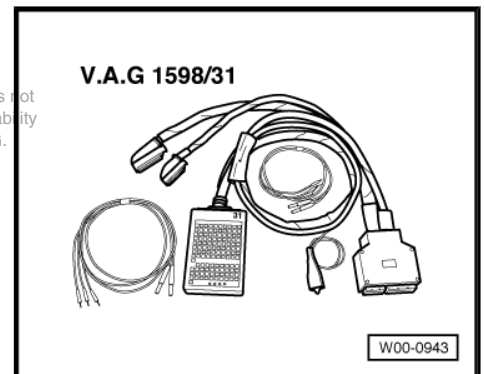
- Run electrical wire along metal channel in camshaft bearing -arrow-.
- Fit semi-circular rubber seal on wire into cut-out provided in top of cylinder head.



Note

Do not slide the semi-circular rubber seal along the wire (the seal is bonded to the wire to ensure proper sealing).

- Re-install cylinder head cover (right-side) ⇒ Rep. Gr. 15 .

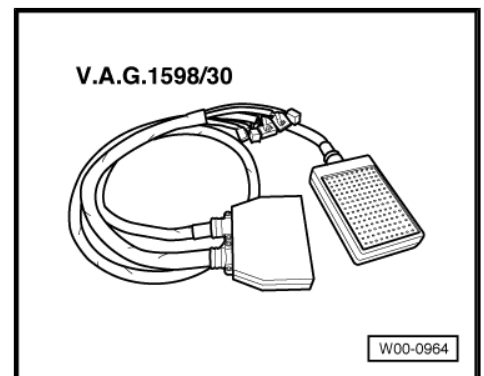


1.13 Wiring and component check with adapter -V.A.G 1598/30- or -V.A.G 1598/31-



Note

- ◆ *The test adapters (test boxes) are designed so that they can be connected to the wiring harness for the engine control unit and to the engine control unit itself at the same time.*
- ◆ *The advantage of this is that the electronic engine control system remains fully functional when the test adapter is connected (for example, for measuring signals when the engine is running).*
- ◆ *The relevant test procedure will state whether it is necessary to also connect the engine control unit to the test adapter.*
- ◆ *Always use auxiliary measuring set -V.A.G 1594C- to connect test equipment (e.g. voltage tester -V.A.G 1527B-, hand-held multimeter -V.A.G 1526C- etc.).*

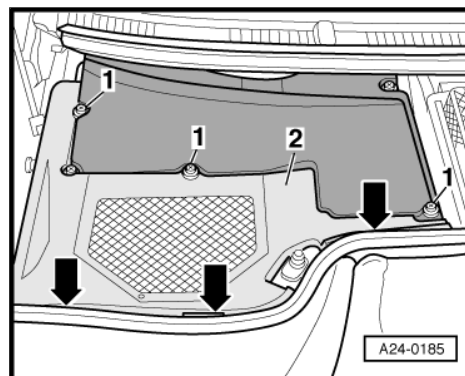


WARNING

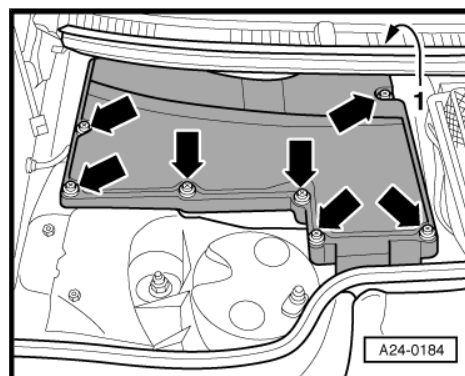
To prevent damage to the electronic components, select appropriate measuring range before connecting the measuring cables and observe the test requirements.

- Switch off ignition.

- Slacken off cross-head bolts -1- at electronics box in plenum chamber.
- Unclip plenum chamber cover -2- at front of bulkhead -arrows-.
- Detach plenum chamber cover.



- Prise out cover -1- in cowl panel trim and slacken off rear cross-head bolt -arrow- at rear right.
- Slacken off the remaining cross-head bolts -arrows-.
- Detach cover of electronics box in plenum chamber.



- Remove bolt -arrow-.
- Disengage retainer.

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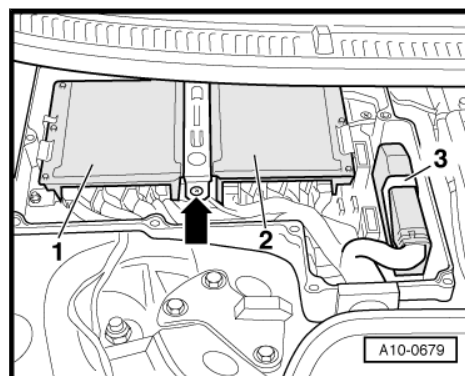
Remove engine control unit:

Depending on the type of control unit installed:

- Connect test adapter -V.A.G 1598/30- to wiring harness connector. The instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test adapter.
- Connect test adapter -V.A.G 1598/31- to wiring harness connector. The earth clip on the test adapter must be connected to the negative battery terminal. The instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test adapter.
- Carry out test as described in appropriate repair procedures.

Perform the following after reconnecting engine control unit:

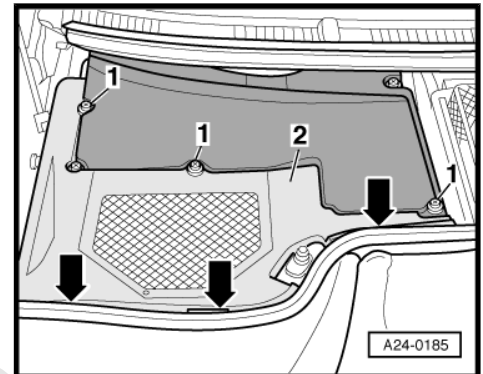
- Interrogate and, if necessary, erase fault memory. ⇒ Vehicle diagnostic, testing and information system VAS 5051



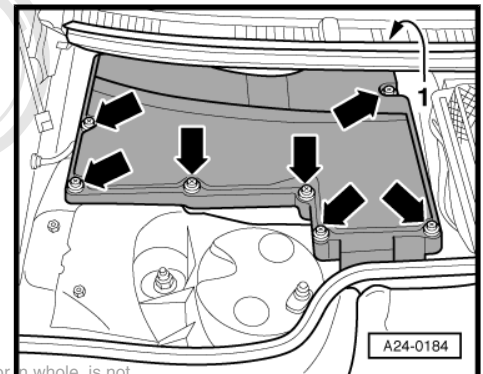
1.14 Renewing diesel direct injection system control unit -J248-

Removing

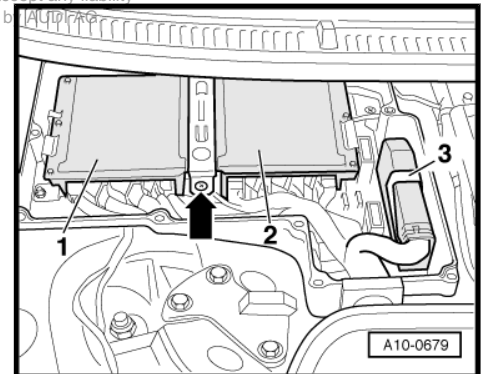
- Slacken off cross-head bolts -1- at electronics box in plenum chamber.
- Unclip plenum chamber cover -2- at front of bulkhead -arrows-.
- Detach plenum chamber cover.



- Prise out cover -1- in cowl panel trim and slacken off rear cross-head bolt -arrow- at rear right.
- Slacken off the remaining cross-head bolts -arrows-.
- Detach cover of electronics box in plenum chamber.



- Remove bolt -arrow-.
- Disengage retainer.
- Release connectors on diesel direct injection system control unit -J248- and unplug connectors.
- Take out old diesel direct injection system control unit -J248- and install new control unit.



Installing

Installation is performed in the reverse sequence.

- Perform coding of new diesel direct injection system control unit -J248- ➔ [page 37](#).
- Adapt immobilizer to diesel direct injection system control unit -J248- via "Guided Fault Finding or Guided Functions" (otherwise vehicle will not start).
- On vehicles fitted with cruise control (can be seen from steering column switch), this must be activated in the engine control unit.
- Interrogate fault memory and erase as necessary.

2 Checking injection pump

2.1 Identification of injection pump

- Read measured value block, display group 25, ignition on and engine stopped.

◆ 003	Data level
◆ 059130105A	Injection pump number (see also Parts catalogue)
◆ C062.1.V41	Software version
◆ 123456	Serial No.
◆ 769	Production date



Note

If display shows "Function unknown or cannot be executed at the moment": switch ignition off and back on again.

2.2 Checking injection timing control range

Test condition

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2.2.1 Test condition

- There must not be any faults stored relating to needle lift sender -G80-. If a fault is stored, you must first check the needle lift sender. Renew if defective.
- Start engine.
- Coolant temperature must be at least 85°C.
- Start basic setting function, Display group 04, engine running at idling speed.

The commencement of injection valve is alternately opened and closed for 10 seconds at a time.

- Check readouts in display zones 2 and 3.

Display zone 2	Display zone 3	Possible cause of fault
Advanced	Above 12.0° BTDC	• Okay - injection timing is sufficiently advanced
	Less than 12.0° BTDC	• Start of delivery not OK.
Retarded	Less than 0° BTDC	• Okay - injection timing is sufficiently retarded
	Above 0° BTDC	• Start of delivery not OK.

If the specifications are not obtained by the injection timing control:

- Check tank for petrol or biodiesel; if this is the case: drain tank and fill with diesel, erase fault memory and perform road test, then interrogate fault memory again
- Check and adjust commencement of injection ➔ [page 67](#)
- Drain fuel filter ➔ [page 65](#)
- Check fuel system for leaks ➔ [page 66](#)
- Eliminate air in fuel system ➔ [page 63](#)
- Interrogate and, if necessary, erase fault memory. Perform road test and repeat test.

If the specification is not obtained for a second time, renew injection pump ➔ [page 59](#)

2.3 Checking data wire between engine control unit and injection pump

The engine control unit and injection pump are linked via a CAN bus. The CAN bus consists of two data wires which transfer information (e.g. injection quantity, fuel temperature).

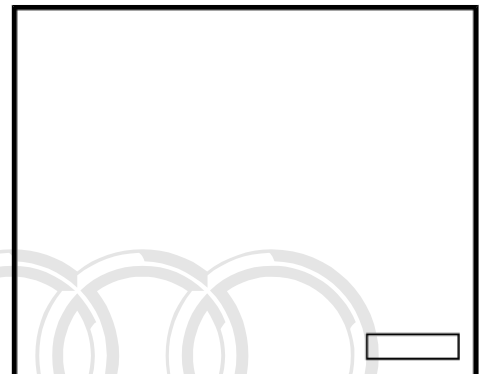
- Unplug connector from injection pump.
- Connect test adapter -V.A.G 1598/30- or -V.A.G 1598/31- to wiring harness for engine control unit. Do not connect engine control unit ➔ [page 73](#).

Test the following wiring connections for open circuits and short to positive or negative.

9-pin connector, contact	-V.A.G 1598/30-, socket	-V.A.G 1598/31-, socket
1	3/44	83
2	3/45	82

Resistance in wiring: max. 1.5 Ω

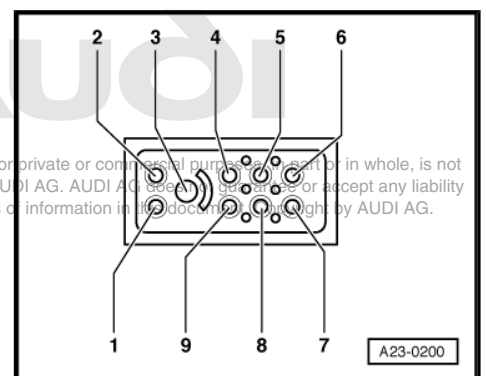
- Rectify open circuit or short circuit in wiring as necessary
 ➔ Current flow diagrams, Electrical fault finding and Fitting locations.



2.4 Checking CAN matching resistor

- Unplug connector from injection pump.
- Measure resistance of matching resistor for injection pump between contact 1 (CAN Low) and contact 2 (CAN High).
- ◆ Specification: 110 to 130 Ohm
- If the specification for the matching resistor is not obtained, renew injection pump.

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2.5 Checking cut-out signal

The cut-out signal switches off the engine. It is transmitted by the engine control unit to the injection pump along a separate wire in the following cases:

- ◆ When the driver switches off the ignition.



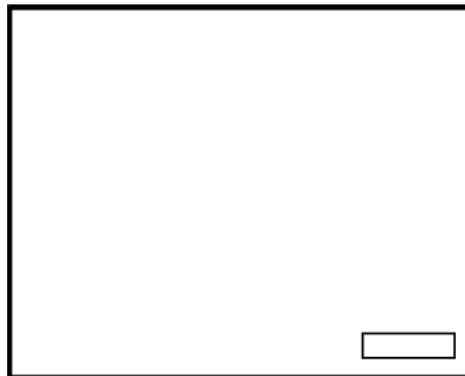
- ◆ If the engine control unit detects a fault and has to switch off the engine as a precaution
- Unplug connector from injection pump.
- Connect test adapter -V.A.G 1598/30- or -V.A.G 1598/31- to wiring harness for engine control unit. Do not connect engine control unit ⇒ [page 73](#) .

Test the following wiring connections for open circuits and short to positive or negative.

9-pin connector, con- tact	-V.A.G 1598/30- , socket	-V.A.G 1598/31- , socket
5	3/21	114

Resistance in wiring: max. 1.5 Ω

- Rectify open circuit or short circuit in wiring as necessary
⇒ Current flow diagrams, Electrical fault finding and Fitting locations.



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3 Checking control unit input values

3.1 Checking voltage supply for diesel direct injection system

The injection system receives its power supply via the diesel direct injection system relay -J322- .

To enable the diesel direct injection system relay -J322- to close, there must be voltage (terminal 15) at the diesel direct injection system control unit. In other words, the diesel direct injection system relay -J322- can only receive an earth connection (via the diesel direct injection system control unit) when voltage is applied to the control unit via terminal 15.

Test condition

- Battery voltage OK

Checking voltage supply (terminal 15)

- Connect test adapter -V.A.G 1598/30- or -V.A.G 1598/31- to wiring harness for engine control unit. Do not connect engine control unit ➔ [page 73](#) .
- Switch on ignition.
- Connect multimeter (voltage test range) between the following contacts on the test adapter:

-V.A.G 1598/30- , socket	-V.A.G 1598/31- , socket	Specification
4/26 + earth	37 + earth	approx. battery voltage

If specification is not obtained:

- Check the wiring ➔ Current flow diagrams, Electrical fault finding and Fitting locations.

Checking earth switching for diesel direct injection system relay -J322-

Test condition

- Battery voltage OK
- Terminal 15 voltage supply OK
- Open electronics box in plenum chamber.
- Switch on ignition.

Specification: diesel direct injection system relay -J322- should pick up. (Relay is located in relay and fuse holder in electronics box in plenum chamber, relay position 4).



Note

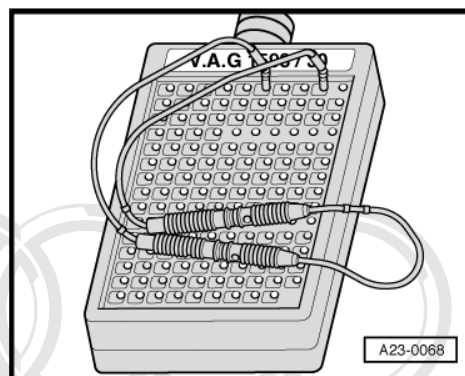
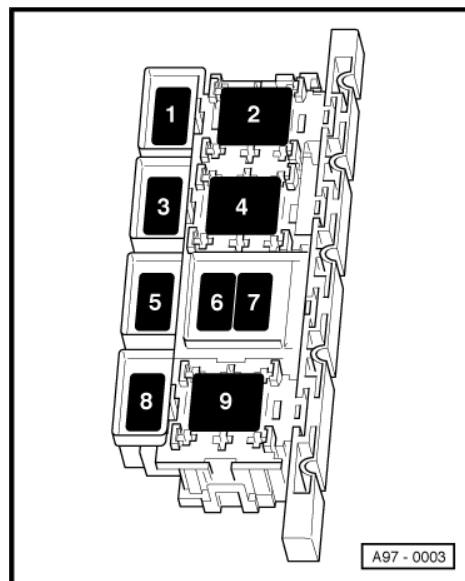
The clicking of the relay is difficult to hear and is therefore best checked by touching the relay.

If the relay does not pick up:

- Connect test adapter -V.A.G 1598/30- or -V.A.G 1598/31- to wiring harness for engine control unit. Do not connect engine control unit ➔ [page 73](#) .

- Using a test lead from auxiliary measuring set -V.A.G 1594C-, connect together the following sockets on the test adapter.

-V.A.G 1598/30-, socket	-V.A.G 1598/31-, socket
1/09 + 1/06	18 + 4



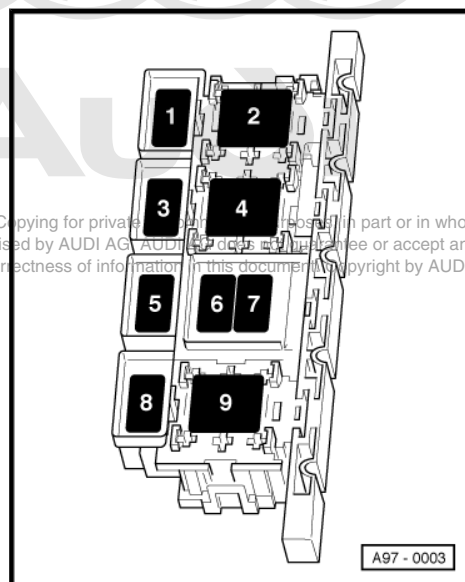
Specification: diesel direct injection system relay -J322- should pick up. (Relay is located in relay and fuse holder in electronics box in plenum chamber, relay position 4).

If the relay picks up now, but not when the control unit is connected:

- Renew diesel direct injection system control unit -J248- ➔ [page 75](#) .

If the relay does not pick up:

- Switch off ignition.



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- Unplug diesel direct injection system relay -J322- from relay socket (relay position 4 on relay and fuse holder in electronics box in plenum chamber).

Test the following wiring connections for open circuits and short to positive or negative.

Electronics box, relay socket 4, contact	-V.A.G 1598/30- , socket	-V.A.G 1598/31- , socket
⇒ Current flow diagrams, Electrical fault finding and Fitting locations	1/09	18

- Rectify open circuit or short circuit in wiring as necessary
 ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

Checking voltage supply (terminal 30)

Test condition

- Battery voltage OK
- Terminal 15 voltage supply OK
- Switched earth connection for diesel direct injection system relay -J322- okay
- Switch off ignition.
- Unplug diesel direct injection system relay -J322- from relay socket (relay position 4 on relay and fuse holder in electronics box in plenum chamber).
- Connect multimeter to measure voltage at following contacts of relay socket.

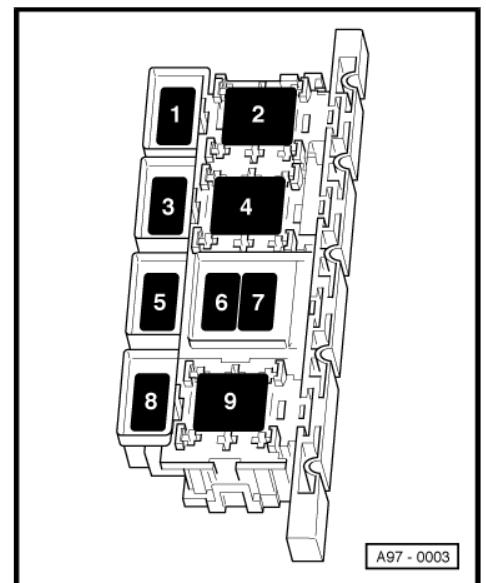
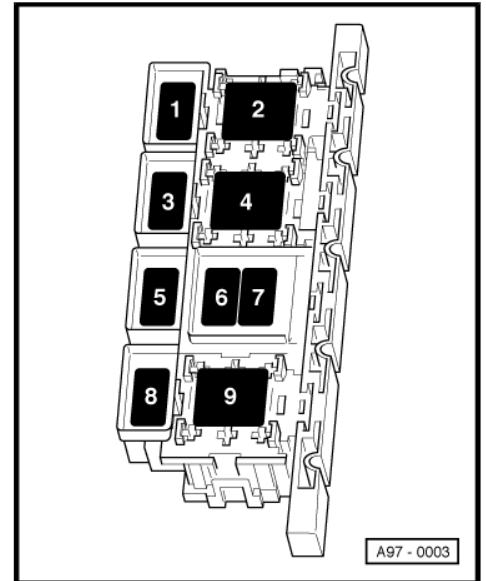
Electronics box, relay socket 4, contact	Specification
2 + earth	approx. battery voltage

If specification is not obtained:

- Check the wiring ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

If specification is obtained:

- Refit relay in relay socket (relay position 4 on relay and fuse carrier in electronics box in plenum chamber).
- Unplug connector from injection pump.
- Connect test adapter -V.A.G 1598/30- or -V.A.G 1598/31- to wiring harness for engine control unit. Do not connect engine control unit ⇒ [page 73](#) .





- Using a test lead from auxiliary measuring set -V.A.G 1594C-, connect together the following sockets on the test adapter.

-V.A.G 1598/30-, socket	-V.A.G 1598/31-, socket
1/09 + 1/06	18 + 4

- Connect multimeter (voltage test range) between the following contacts on the test adapter:

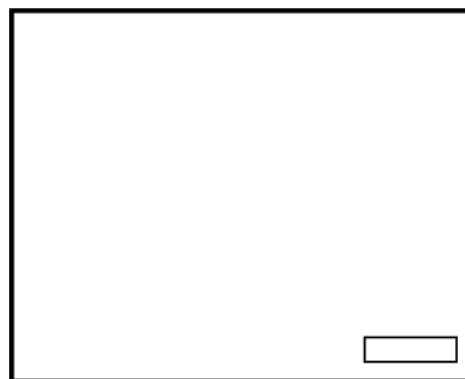
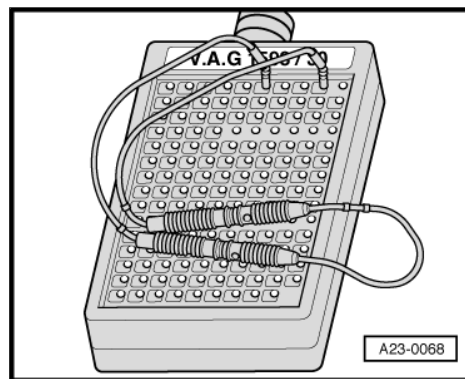
-V.A.G 1598/30-, socket	-V.A.G 1598/31-, socket	Specification
1/01 + 1/04	1 + 4	approx. battery voltage
1/01 + 1/05	1 + 5	approx. battery voltage
1/01 + 1/06	2 + 4	approx. battery voltage
1/08 + 1/04	2 + 5	approx. battery voltage
1/08 + 1/05		approx. battery voltage
1/08 + 1/06		approx. battery voltage

- Connect hand-held multimeter to measure voltage on connector for injection pump to following contacts of wiring harness. (Test leads remain connected).

9-pin connector on wiring harness, contact	Specification
7 + 6	approx. battery voltage

If specification is not obtained:

- Check the wiring ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.



3.2 Checking engine speed signal

The engine speed signal is generated in the engine speed sender -G28-. This sender supplies both the speed information and the position of the crankshaft to the engine control unit.

The injection pump also requires a constant signal indicating the crankshaft position in order to regulate the injection timing. The signal from the engine control unit is therefore passed on to the injection pump along a separate wire.

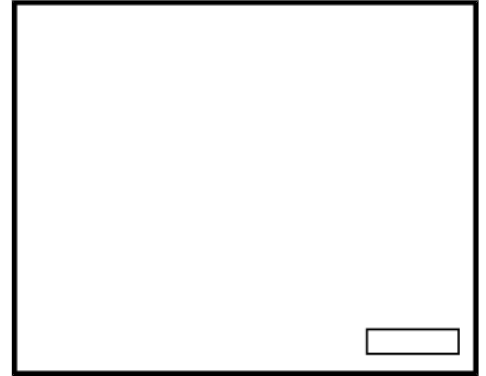
- Unplug connector from injection pump.
- Connect test adapter -V.A.G 1598/30- or -V.A.G 1598/31- to wiring harness for engine control unit. Do not connect engine control unit ⇒ [page 73](#).

Test the following wiring connections for open circuits and short to positive or negative.

9-pin connector, contact	-V.A.G 1598/30-, socket	-V.A.G 1598/31-, socket
8	3/07	93

Resistance in wiring: max. 1.5 Ω

- Rectify open circuit or short circuit in wiring as necessary
 ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.



3.3 Checking engine speed sender -G28-

The engine speed sender -G28- is both a speed sender and a reference mark sender. If it fails the engine will run with reduced power (torque limitation).

On vehicles with manual gearbox the engine speed sender -G28- registers six notches in the flywheel.

On vehicles with automatic gearbox it registers six metal pins on the torque converter plate.

Because the sender employs a different scanning method in each case (notches on vehicles with manual gearbox and pins on automatics), the form of the signal is inverted.

However, to ensure that the signal received by the engine control unit is always in the same form, the engine speed senders on vehicles with manual gearbox are wired the opposite way round compared with those used on automatics.

- Switch off ignition.
- Disconnect sender connector ⇒ Fitting locations overview
 ⇒ [page 58](#).
- Connect hand-held multimeter to measure resistance at contacts 3 and 2 of connection to sender.

Specification: approx. 1 kΩ

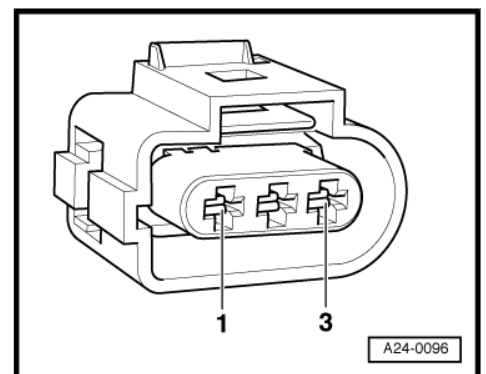
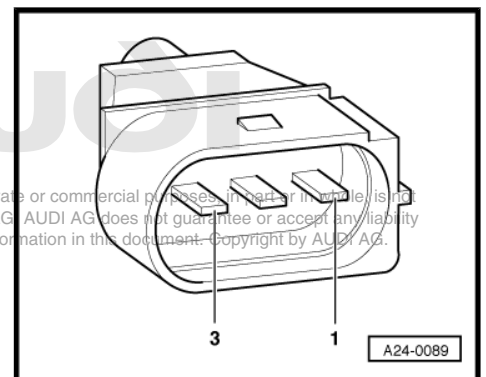
If specification is not obtained:

- Renew engine speed sender -G28-.

If specification is obtained:

- Connect test adapter -V.A.G 1598/30- or -V.A.G 1598/31- to wiring harness for engine control unit. Do not connect engine control unit ⇒ [page 73](#).

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Test the following wiring connections for open circuits and short to positive or negative.

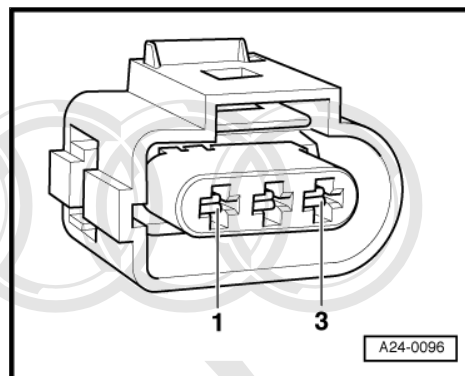
Vehicles with manual gearbox:

3-pin connector, contact	-V.A.G 1598/30-, socket	-V.A.G 1598/31-, socket
1	1/04	4
2	3/06	110
3	3/31	102

Vehicles with automatic gearbox:

3-pin connector, contact	-V.A.G 1598/30-, socket	-V.A.G 1598/31-, socket
1	1/04	4
2	3/31	102
3	3/06	110

- Rectify open circuit or short circuit in wiring as necessary
⇒ Current flow diagrams, Electrical fault finding and Fitting locations.



3.4 Checking needle lift sender -G80-

The needle lift sender signal is used to determine the commencement of injection. If it fails the commencement of injection switches to open-loop control (according to engine speed and engine load). During normal operation the commencement of injection is controlled by a closed-loop function (according to engine speed, engine load and temperature).

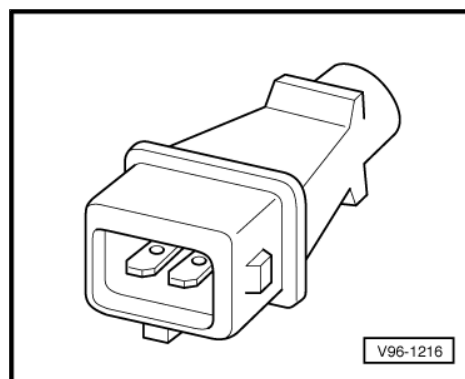
- Switch off ignition.
- Unplug connector from needle lift sender -G80- ⇒ Fitting locations overview ⇒ [page 58](#).
- Connect hand-held multimeter to measure resistance at contacts of connection to needle lift sender -G80-.
- ◆ Specification: 90...120 Ω (when the engine is hot the resistance may be up to 20 Ω higher)

If specification is not obtained:

- Renew injector for cylinder 3 with needle lift sender -G80- ⇒ [page 72](#).

If specification is obtained:

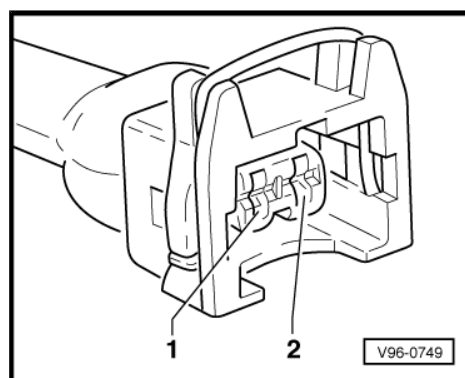
- Connect test adapter -V.A.G 1598/30- or -V.A.G 1598/31- to wiring harness for engine control unit. Do not connect engine control unit ⇒ [page 73](#).



Test the following wiring connections for open circuits and short to positive or negative.

2-pin connector, contact	-V.A.G 1598/30-, socket	-V.A.G 1598/31-, socket
1	1/05	109
2	3/18	101

- Rectify open circuit or short circuit in wiring as necessary
⇒ Current flow diagrams, Electrical fault finding and Fitting locations.



3.5 Checking coolant temperature sender -G62-

- Start engine.
- Read measured value block, Display group 07, engine idling when cold.
- Check readout in display zone 4 (coolant temperature).

- ◆ Specification: The temperature reading should increase at a uniform rate.

The fuel temperature is displayed as a substitute when there is a fault.

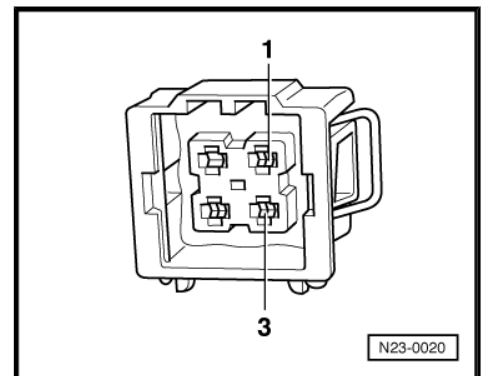
If an implausible value is displayed in display zone 4, or if the fuel temperature is displayed as a substitute value:

- Switch off ignition.
- Disconnect sender connector ⇒ Fitting locations overview ⇒ [page 58](#) .
- Connect test adapter -V.A.G 1598/30- or -V.A.G 1598/31- to wiring harness for engine control unit. Do not connect engine control unit ⇒ [page 73](#) .

Test the following wiring connections for open circuits and short to positive or negative.

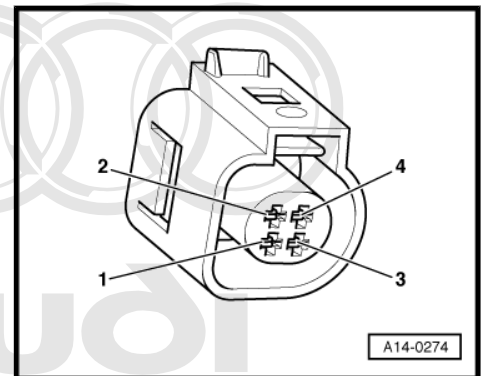
Vehicles with the connector shown on illustration:

4-pin connector, contact	-V.A.G 1598/30- , socket	-V.A.G 1598/31- , socket
1	3/32	104
3	3/28	112



Vehicles with the connector shown on illustration:

4-pin connector, contact	-V.A.G 1598/30- , socket	-V.A.G 1598/31- , socket
3	3/28	112
4	3/32	104



- Rectify open circuit or short circuit in wiring as necessary ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

If no faults are found in the wiring:

- Renew coolant temperature sender -G62-

3.6 Checking intake air temperature sender -G42-

- Switch on ignition.
- Read measured value block, Display group 07, engine not running and cold.
- Observe display in display zone 3. If the wiring to the sender has an open circuit, a substitute value of 60 °C will be displayed.

If the wiring to the sender has an open circuit, a substitute value of approx. 60 °C will be displayed.

If an implausible value or a substitute value of approx. 60 °C is displayed:

- Disconnect sender connector ⇒ Fitting locations overview ⇒ [page 58](#) .

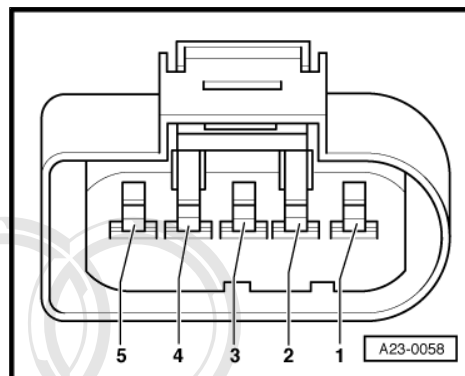
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- Unplug connector from air mass meter -G70- ⇒ Fitting locations overview ⇒ [page 58](#) .
- Connect test adapter -V.A.G 1598/30- or -V.A.G 1598/31- to wiring harness for engine control unit. Do not connect engine control unit ⇒ [page 73](#) .

Test the following wiring connections for open circuits and short to positive or negative.

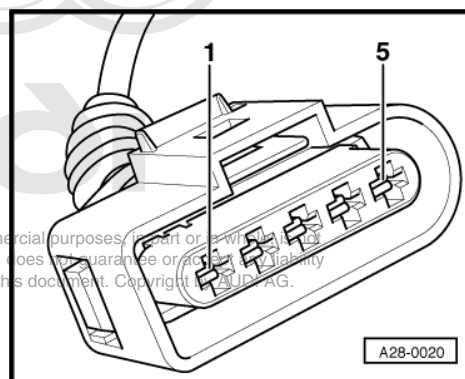
Vehicles with the connector shown on illustration:

5-pin connector, contact	-V.A.G 1598/30- , socket	-V.A.G 1598/31- , socket
1	3/29	73
3	3/03	49



Vehicles with the connector shown on illustration:

5-pin connector, contact	-V.A.G 1598/30- , socket	-V.A.G 1598/31- , socket
3	-	49
5	-	73



- Rectify open circuit or short circuit in wiring as necessary ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

Renew coolant temperature sender -G62- if no wiring fault is detected.

3.7 Checking air mass meter -G70-

The signal from the air mass meter is required by the control unit to calculate the required injection quantity and to control the exhaust gas recirculation. The weaker the signal from the air mass meter -G70- , the less fuel can be injected.

- Start engine.
- Read measured value block, Display group 10, engine idling.
- Observe display in display zone 1.
- ◆ Specification: 180...250 mg/stroke

If specification is not obtained:

- Check exhaust gas recirculation system ⇒ Rep. Gr. 26

If specification is obtained:

- Perform test drive.



WARNING

- ◆ *Test equipment must always be secured on the rear seat and operated from that position by a second person.*
- ◆ *If test equipment and measuring instruments are operated from the front passenger's seat and the vehicle is involved in an accident, the person sitting in this seat could be seriously injured when the airbag is triggered.*

- Place the vehicle in third gear or set selector lever to position 2 and accelerate at full throttle from 2000 rpm (without kick-down). Observe the rev counter.
- At approx. 3000 rpm (the accelerator pedal must be fully depressed at this moment in time):
- ◆ Specification in display zone 4: 100 % (accelerator pedal position)
- ◆ Specification in display zone 3: 1900...2300 mbar (charge pressure)

If reading does not match specification in display zone 3:

- Check charge pressure ⇒ Rep. Gr. 21.
- ◆ Specification in display zone 1: above 750 mg/H (mass of air drawn in).

If reading does not match specification in display zone 1:

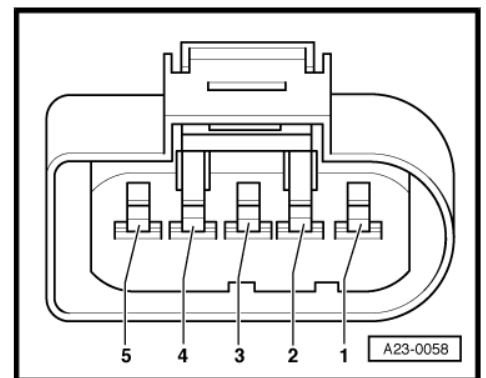
- Renew air mass meter -G70- .

If display zone 1 shows a constant value (fixed substitute value):

- Switch off ignition.
- Unplug connector for air mass meter ⇒ Fitting locations overview ⇒ [page 58](#) .
- Switch on ignition.
- Connect multimeter to measure voltage at following contacts of connector.

Vehicles with the connector shown on illustration:

5-pin connector on wiring harness, contact	Specification
2 + earth	Battery voltage
2 + 3	Battery voltage
4 + earth	approx. 5 V
4 + 3	approx. 5 V



Vehicles with the connector shown on illustration:

5-pin connector on wiring harness, contact	Specification
2 + earth	Battery voltage
2 + 3	Battery voltage
1 + earth	approx. 5 V
1 + 3	approx. 5 V

⇒ Current flow diagrams, Electrical fault finding and Fitting locations

If the specifications are not obtained:

- Connect test adapter -V.A.G 1598/30- or -V.A.G 1598/31- to wiring harness for engine control unit. Do not connect engine control unit ⇒ [page 73](#) .

Test the following wiring connections for open circuits and short to positive or negative.

Vehicles with the connector shown on illustration:

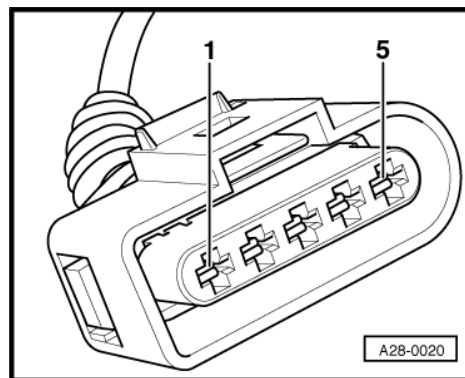
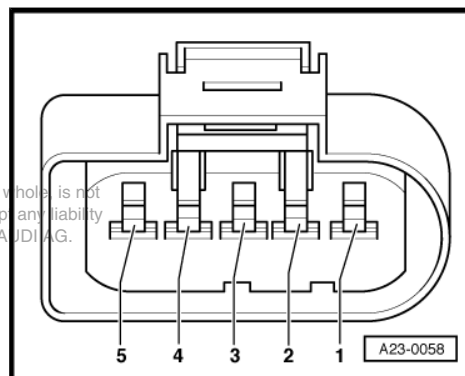
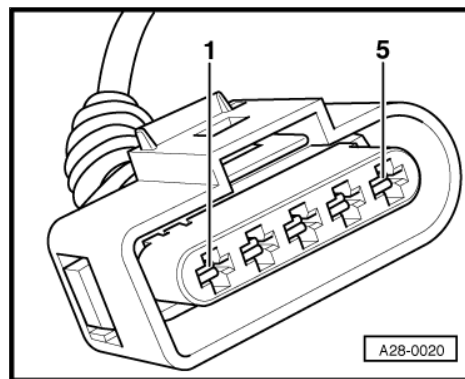
5-pin connector, contact	-V.A.G 1598/30-, socket	-V.A.G 1598/31-, socket
2	To diesel direct injection system relay - J322-	
3	3/03	49
4	3/01	30
5	3/02	68

- Rectify open circuit or short circuit in wiring as necessary
⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

Vehicles with the connector shown on illustration:

5-pin connector, contact	-V.A.G 1598/30-, socket	-V.A.G 1598/31-, socket
1		30
2	To diesel direct injection system relay - J322-	
3		49
4		68

- Rectify open circuit or short circuit in wiring as necessary
⇒ Current flow diagrams, Electrical fault finding and Fitting locations.



3.8 Checking variable intake manifold flap changeover valve -N239-

- Start engine.

- Watch linkage rod for intake manifold flap while a second mechanic switches off the engine.
- When the engine is switched off, the intake manifold flap should close and remain closed for 1 or 2 seconds.

Measure resistance if intake manifold flap does not close as described.

- Unplug connector from intake manifold flap changeover valve -N239- ➔ Fitting locations overview ➔ [page 58](#).
- Connect hand-held multimeter to measure resistance on intake manifold changeover valve -N239-.

◆ Specification: 30...40 Ω

If specification is not obtained:

- Renew intake manifold flap changeover valve -N239-.

If reading matches specification, perform voltage measurement.

Checking voltage supply to intake manifold flap changeover valve -N239-

- Connect hand-held multimeter (voltage measurement range) between earth and contact 2 on the connector.
- Switch on ignition.

Specification: approx. battery voltage

If specification is not obtained:

- Check voltage supply using current flow diagram ➔ Current flow diagrams, Electrical fault finding and Fitting locations.

If the specification is obtained, check wiring to diesel direct injection system control unit -J248-.

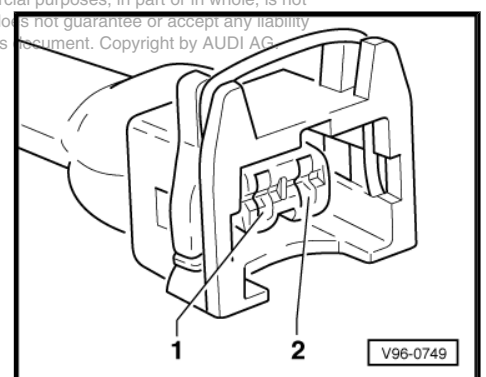
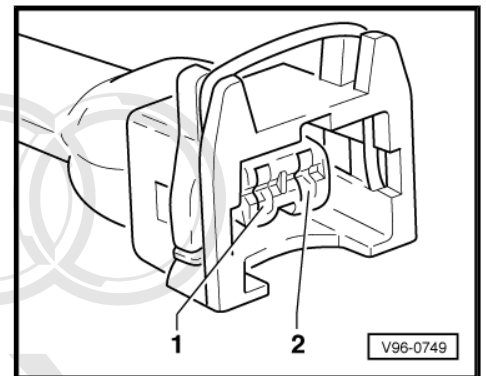
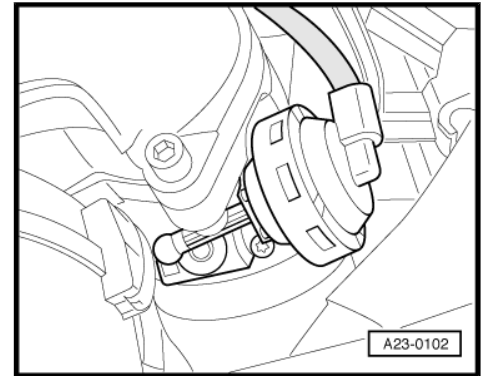
Checking wiring connection

- Connect test adapter -V.A.G 1598/30- or -V.A.G 1598/31- to wiring harness for engine control unit. Do not connect engine control unit ➔ [page 73](#).

Check the following wiring connections for open circuits and shorts to positive or earth:

2-pin connector, contact	-V.A.G 1598/30-, socket	-V.A.G 1598/31-, socket
1	2/20	81

- Rectify open circuit or short circuit in wiring as necessary ➔ Current flow diagrams, Electrical fault finding and Fitting locations.



3.9 Checking brake light switch -F- and brake pedal switch -F47-

As the injection system operates with an accelerator pedal sender (potentiometer) which could be defective, the engine speed is regulated for safety reasons when the brake is pressed. To do this the control unit requires signals from the brake light switch and also the brake pedal switch. This means that, if the brake is operated while the accelerator is held constantly depressed, the engine is immediately governed down to idling speed. Incorrect switch settings may lead to undesired regulating action.



- Start engine.
- Read measured value block, Display group 06, engine idling.
- Observe display in display zone 2.
- ◆ Specification: 0 0 0
- Slowly press brake.
- ◆ Specification: 0 1 1. Both displays should switch from 0 to 1
- Allow brake pedal to return slowly to rest position.
- ◆ Specification: 0 0 0. Both displays should switch back from 1 to 0.

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If one or both of the displays does not change from 0 to 1:

- Connect test adapter -V.A.G 1598/30- or -V.A.G 1598/31- to wiring harness for engine control unit. Do not connect engine control unit ⇒ [page 73](#) .

Test the following wiring connections for open circuits and short to positive or negative.

Switch on brake pedal, contact	-V.A.G 1598/30- , socket	-V.A.G 1598/31- , socket
⇒ Current flow diagrams, Electrical fault finding and Fitting locations	4/24	32
⇒ Current flow diagrams, Electrical fault finding and Fitting locations	4/31	65

Resistance in wiring: max. 1.5 Ω

- Rectify open circuit or short circuit in wiring as necessary
⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

3.10 Checking clutch pedal switch -F36-

This signal is used to prevent engine speed fluctuations and load change jolts when the clutch is disengaged. The signal is also required for the cruise control system.

- Switch on ignition.
- Read measured value block, Display group 06, engine not running
- Check display in display zone 2.
- ◆ Specification: 0 0 0
- Depress the clutch pedal.
- ◆
- ◆ Specification: 1 0 0. The display should change from 0 to 1.
- Allow clutch pedal to return slowly to its normal position.
- ◆ Specification: 0 0 0. The display should change from 1 to 0.

If specification is not obtained:

- Connect test adapter -V.A.G 1598/30- or -V.A.G 1598/31- to wiring harness for engine control unit. Do not connect engine control unit ⇒ [page 73](#) .

Test the following wiring connections for open circuits and short to positive or negative.

Switch on clutch pedal, contact	-V.A.G 1598/30- , socket	-V.A.G 1598/31- , socket
⇒ Current flow diagrams, Electrical fault finding and Fitting locations	4/23	66

Resistance in wiring: max. 1.5 Ω

- Rectify open circuit or short circuit in wiring as necessary
 ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

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4 Checking auxiliary signals

4.1 Checking AC compressor signal and AC compressor shut-off

The air conditioner compressor signal informs the engine control unit that the air conditioner compressor is to be switched on in 140 ms.

The engine control unit can send a signal via the same wire to shut off the air conditioner compressor.

The engine control unit will shut off the air conditioner compressor in the following cases:

- ◆ Heavy acceleration from low speeds (control unit detects angle change at accelerator pedal position sender and receives road speed signal)
- ◆ In emergency running mode (back-up)
- ◆ If the coolant temperature rises above 120 °C
- ◆ For about 6 seconds after every engine start

Test conditions

- Air conditioner OK
- Rear window heating switched off.
- **No faults stored in fault memory**
- Start the engine (operating temperature).
- Read measured value block, Display group 02, engine idling.
- Check display in display zone 3.
- ◆ Specification: 0 01 00 (no air conditioner compressor signal)
- Switch on air conditioner, press the “Auto” key and select the lowest temperature.
- Check display in display zone 3.
- ◆ Specification: 0 01 01 (air conditioner compressor signal)

If specification is not obtained:

- Connect test adapter -V.A.G 1598/30- or -V.A.G 1598/31- to wiring harness for engine control unit. Do not connect engine control unit ⇒ [page 73](#) .

Test the following wiring connections for open circuits and short to positive or negative.

-V.A.G 1598/30- , socket	-V.A.G 1598/31- , socket	Air conditioner operating and display unit, contact
4/19	29	⇒ Current flow diagrams, Electrical fault finding and Fitting locations

- Rectify open circuit or short circuit in wiring as necessary
⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

4.2 Checking air conditioner signal

The air conditioner system signal informs the engine control unit that the air conditioner requires a higher idling speed to provide the desired passenger compartment temperature (both when cooling and heating).



Note

The increase in idling speed resulting from the air conditioner signal depends on the control unit version and is not activated in all vehicles.

- Start the engine (operating temperature).
- Read measured value block, Display group 02, engine idling.
- Switch on air conditioner, press the “Auto” key and select the lowest temperature.
- Check display in display zone 3.
- ◆ Specification: 1 01 01 (air conditioner compressor signal)

If specification is not obtained:

- Connect test adapter -V.A.G 1598/30- or -V.A.G 1598/31- to wiring harness for engine control unit. Do not connect engine control unit ➔ [page 73](#) .

Test the following wiring connections for open circuits and short to positive or negative.

-V.A.G 1598/30- , socket	-V.A.G 1598/31- , socket	Air conditioner operating and display unit, contact
4/39	34	➔ Current flow diagrams, Electrical fault finding and Fitting locations

- Rectify open circuit or short circuit in wiring as necessary
➔ Current flow diagrams, Electrical fault finding and Fitting locations.

4.3 Checking outside temperature signal

The signal is transmitted to the engine control unit either by the air conditioning system or the instrument cluster.

This test applies only to vehicles up to and including model year 1999. From model year 2000 onwards, the signal is transmitted via the CAN bus.

- Read measured value block, Display group 20, engine not running
- Observe display in display zone 1.
- ◆ Specification: the value in the display should be approximately the same as the ambient temperature indicated on the dash panel insert and the actual ambient temperature

If no realistic readout is displayed:

- Connect test adapter -V.A.G 1598/30- to wiring harness for engine control unit ➔ [page 73](#) .

Test the following wiring connections for open circuits and short to positive or negative.

Test adapter - V.A.G 1598/30-, socket	Air conditioner operating and display unit, contact
4/33	⇒ Current flow diagrams, Electrical fault finding and Fitting locations

- Rectify open circuit or short circuit in wiring as necessary
⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

4.4 Checking road speed signal

The speed signal is required to ensure that the air conditioner compressor is switched off when accelerating. It is also required for the cruise control system and to ensure smoother driving (jolt damping).

Test condition

- Speedometer OK; check
- Read measured value block, Display group 20, engine idling.
- Perform test drive.



WARNING

Secure fault reader to rear seat and operate from this position. When doing this, always observe the relevant safety precautions ⇒ [page 57](#).

- Observe display in display zone 1.
- ◆ The display should show the current vehicle speed (compare against speedometer)

If specification is not obtained:

- Connect test adapter -V.A.G 1598/30- or -V.A.G 1598/31- to wiring harness for engine control unit. Do not connect engine control unit ⇒ [page 73](#).

Test the following wiring connections for open circuits and short to positive or negative.

-V.A.G 1598/30-, socket	-V.A.G 1598/31-, socket	Instrument cluster, contact
4/22	20	⇒ Current flow diagrams, Electrical fault finding and Fitting locations

- Rectify open circuit or short circuit in wiring as necessary
⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

If no fault in wire is detected:

- Establish which electrical “consumers” (e.g. radio, automatic gearbox, air conditioner etc.) are using the speed signal, disconnect them one by one from the dash panel insert, then keep repeating the test until the cause of the problem has been identified.

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4.5 Checking engine speed signal

The engine speed signal is required for the rev counter, air conditioner and automatic gearbox.

However, since the signal cannot be read in the form in which it is generated by the engine speed sender -G28-, it has to be processed by the engine control unit.

This test applies only to vehicles up to and including model year 1999. From model year 2000 onwards, the signal is transmitted via the CAN bus.

Determine engine speed signal as follows:

- Connect vehicle diagnosis and service information system - VAS 5052- or fault reader -V.A.G 1551- and select engine electronics control unit by entering “address word” 01. When doing this, the ignition must be switched on.
- Test all control units for a missing rpm signal via the “Automatic test sequence”.

No faults relating to a missing “engine speed signal” should be stored in any of the control units.

If one of the control units indicates a fault:

- Check for open circuit or short circuit between engine control unit and the control unit concerned ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

4.6 Checking fuel consumption signal

This signal is required for the fuel consumption indicator in the dash panel insert.

This test applies only to vehicles up to and including model year 1999. From model year 2000 onwards, the signal is transmitted via the CAN bus.

If the dash panel insert shows an incorrect fuel consumption rate:

- Adjust the fuel consumption indicator so that it shows the actual fuel consumption rate ⇒ Electrical system; Rep. Gr. 01 ..

If the dash panel insert does not show any fuel consumption rate:

- Connect test adapter -V.A.G 1598/30- to wiring harness for engine control unit ⇒ [page 73](#) .

Test the following wiring connections for open circuits and short to positive or negative.

Test adapter - V.A.G 1598/30- , socket	Dash panel insert, contact
4/18	⇒ Current flow diagrams, Electrical fault finding and Fitting locations

- Rectify open circuit or short circuit in wiring as necessary ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

4.7 Checking fuel level signal

When the fuel pump symbol on the dash panel insert lights up (telling the driver to fill up the fuel tank), a fuel level signal is sent to the engine control unit. The engine control unit processes the fuel level signal and also the signal from the low fuel level sender -G210- so that it can switch off the engine if the fuel tank runs dry.

This test applies only to vehicles up to and including model year 1999. From model year 2000 onwards, the signal is transmitted via the CAN bus.

- Connect test adapter -V.A.G 1598/30- to wiring harness for engine control unit ⇒ [page 73](#) .



Test the following wiring connections for open circuits and short to positive or negative.

Test adapter - V.A.G 1598/30- , socket	Dash panel insert, contact
2/17	⇒ Current flow diagrams, Electrical fault finding and Fitting locations

- Rectify open circuit or short circuit in wiring as necessary
⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

4.8 Checking data wire (CAN bus) between several control units



Note

- ◆ *The exchange of data between the various control units employs a data bus.*
- ◆ *The term "CAN data bus" refers to a system for transmitting and distributing data.*
- ◆ *The wires which connect the control units and convey the data between them are called data wires.*
- ◆ *Data are transmitted serially along these data wires to the connected control units (e.g. engine speed, accelerator pedal position).*

Checking bus system

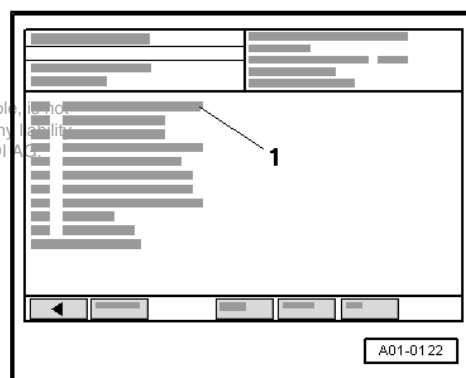
If the fault table indicates that the data exchange between the engine control unit and control units with CAN capability should be tested.

- Check that multi-pin connectors for control units are properly seated.
- Connect up the vehicle diagnostic and service information system -VAS 5052- and select the engine electronics control unit. Engine must be idling.

Display on tester:

- From list -1- select diagnostic function "Read measured value block".

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Display on tester:

1 - Enter display group (highest possible entry = 255)



Note

Measured value blocks 125 and 126 indicate the drive train CAN bus users.

- Use keypad -2- to enter "125" for "Display group number 125" and confirm by touching the  key.

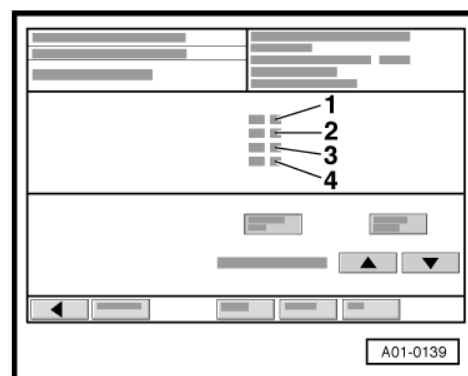
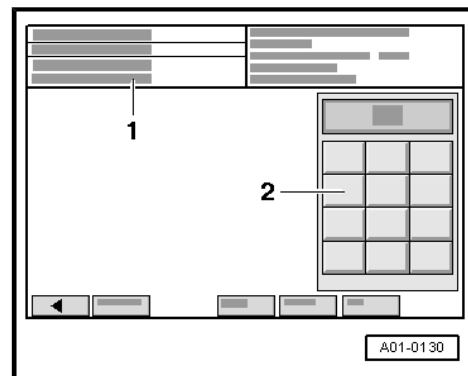
Display on tester:

- Check displays in zones -1- to -4-. The display shows the control units capable of CAN communication with the engine control unit:
- ◆ No display: Control unit without CAN capability
- ◆ Display 1: Control unit with CAN capability is data bus user
- ◆ Display 0: Control unit with CAN capability is not data bus user
- Perform the same check for display group number 126.
- Terminate "Read measured value block" function.

Display on tester:

- Select diagnosis function "End output" from the menu -1-.

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Display on tester:

- From list -1-, select diagnosis function “00 - Interrogating fault memory - Entire system”.
- ◆ Fault memories of all vehicle systems with self-diagnosis capability are interrogated

When a control unit answers with its identification the number of stored faults appears on the display or “No fault recognised”.

Any stored system faults are displayed consecutively.

If a fault relating to “Drive train data bus...” or “...CAN bus” is displayed:

- Check whether vehicle has been fitted with correct engine control unit and other control units with CAN capability (part no. and code).

If the correct versions are installed:

- Check that multi-pin connectors for control units are properly seated.

If multi-pin connectors are properly attached:

- Check CAN bus system.

Communication takes place between three or more control units by way of a “two-wire bus system”.

- Evaluate faults stored in control units.



Note

This will help to trace a fault in the wiring.

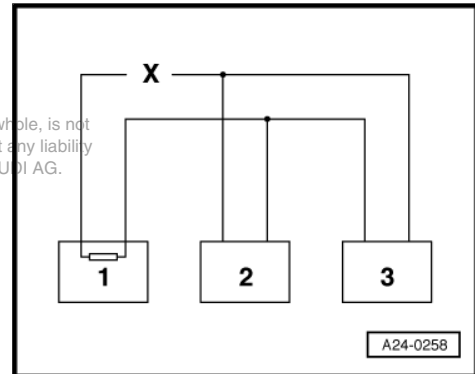
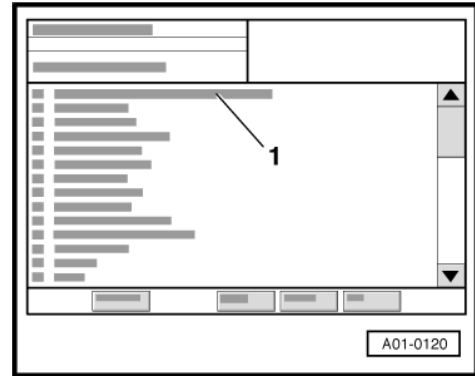
Example 1:

The faults entered in the fault memories indicate that there is no connection between control unit 1 and control units 2 and 3.

Control unit	Faults entered in fault memory:
1	<ul style="list-style-type: none"> ◆ No message from control unit 2 ◆ No message from control unit 3
2	<ul style="list-style-type: none"> ◆ No message from control unit 1
3	<ul style="list-style-type: none"> ◆ No message from control unit 1

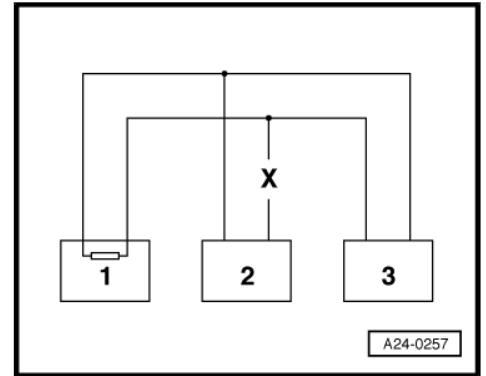
- Switch off ignition.
- Disconnect the control units linked by the bus wires and check for open circuit in one of the bus wires ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Renew control unit 1 if no faults are found in the bus wires.

Example 2:



The faults entered in the fault memories indicate that there is no connection between control unit 2 and control units 1 and 3.

Control unit	Faults entered in fault memory:
1	◆ No message from control unit 2
2	◆ No message from control unit 1 ◆ No message from control unit 3
3	◆ No message from control unit 2

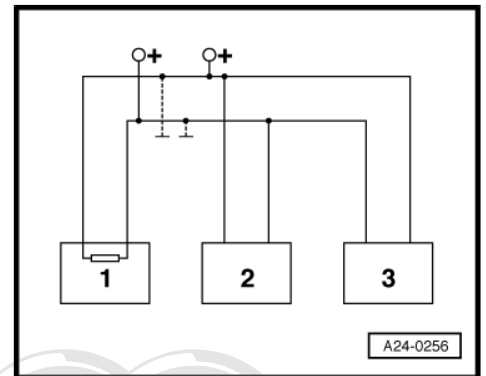


- Switch off ignition.
- Disconnect the control units linked by the bus wires and check for open circuit in one of the bus wires ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Renew control unit 2 if no faults are found in the bus wires.

Example 3:

The faults stored in the fault memories indicate that none of the control units can transmit or receive.

Control unit	Faults entered in fault memory:
1	◆ Drive train data bus defective
2	◆ Drive train data bus defective
3	◆ Drive train data bus defective



- Switch off ignition.
- Disconnect the control units linked by the bus wires and check the bus wires for short to positive and earth ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

If the cause of the fault “Drive train data bus defective” cannot be found in the data bus wires, check whether one of the control units is causing the fault.



Note

Vehicle diagnosis and service information system -VAS 5052- connected and vehicle self-diagnosis selected

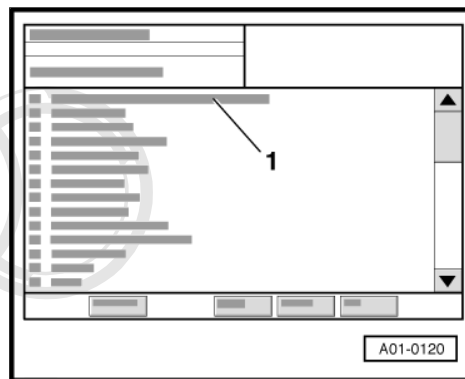
At this stage all the control units which communicate via the CAN data bus are disconnected. Ignition is switched off.

- Connect one of the control units.
- Switch on ignition.



Display on tester:

- From list -1- select relevant vehicle system.
- Interrogate and erase fault memory of control unit just connected.
- Select diagnosis function "End output" from the menu -1-.
- Switch ignition off and on again.
- Leave ignition switched on for 10 seconds. Then use fault reader to read out fault memory of control unit just connected.
- If the fault "Drive train data bus defective" is now indicated, replace the control unit which has just been connected.
- If the fault "Drive train data bus defective" is not indicated, connect the next control unit, and repeat the above procedure.



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28 – Glow plug system

1 Checking glow plug system

1.1 Checking operation

- Detach glow plug connectors from glow plugs.
- Connect hand-held multimeter (voltage test range) between engine earth and one of the glow plug connectors.
- Start final control diagnosis and activate glow plug relay -J52-
⇒ [page 33](#) .
- ◆ Specification: approx. battery voltage (every 5 seconds)

If specification is not obtained:

- Rectify open circuit or short circuit in wiring as necessary
⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

1.2 Checking glow plugs

- Battery voltage at least 11.5 V
- Switch off ignition.
- Detach glow plug connectors from glow plugs.
- Connect voltage tester -V.A.G 1527B- to battery (+) and place on each glow plug in turn.
- ◆ If diode lights up: glow plug OK.
- ◆ If diode does not light up: fit a new glow plug ⇒ [page 101](#) .

1.3 Removing and installing glow plugs

Special tools and workshop equipment required

- ◆ U/J extension and socket, 10 mm -3220-

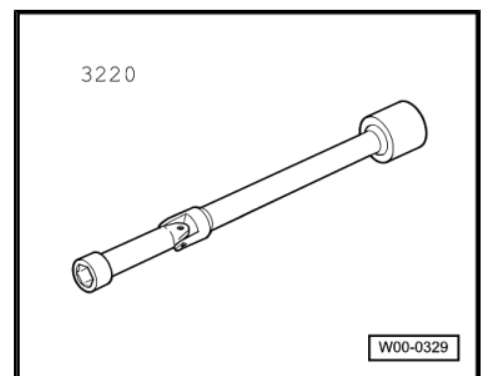


Removing

- Switch off ignition.

- Detach glow plug connectors from glow plugs.

- Clean glow plug openings in cylinder head; make sure no dirt gets into cylinder.



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Note

- ◆ *Cleaning procedure:*
- ◆ *Use a vacuum cleaner to remove coarse dirt.*
- ◆ *Spray brake cleaner or suitable cleaning agent into glow plug apertures, let it work in briefly, and blow out with compressed air.*
- ◆ *Then clean the glow plug openings using a cloth moistened with oil.*
- To slacken the glow plugs use special tool U/J extension and socket, 10 mm -3220-

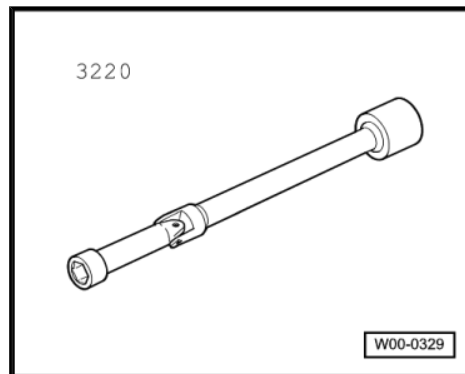
Installing



Note

Before installing, coat threads of glow plugs with high-temperature paste ⇒ Parts catalogue , servicing materials.

- To tighten the glow plugs use special tool U/J extension and socket, 10 mm -3220- with a suitable torque wrench.
- ◆ Tightening torque: 18 Nm
- Attach glow plug connectors correctly and make sure they are securely fitted.



1.4 Checking glow period warning lamp - K29-

This test applies only to vehicles up to and including model year 1999. From model year 2000 onwards, the signal is transmitted via the CAN bus.

Test condition:

- ◆ Glow period warning lamp -K29- in dash panel insert OK ⇒ Electrical system; Rep. Gr. 90

Test sequence

- Start final control diagnosis and activate glow period warning lamp -K29- .
- ◆ Specification: the glow period warning lamp -K29- should flash.
- Complete final control diagnosis.
- Switch off ignition.

If the glow period warning lamp -K29- does not flash during the final control diagnosis:

- Check bulb for glow period warning lamp -K29- in dash panel insert ⇒ Electrical system; Rep. Gr. 90 .

If the bulb in the dash panel insert is OK, check wiring connections:

- Connect test adapter V.A.G 1598/30 to wiring harness for engine control unit ⇒ [page 73](#) .

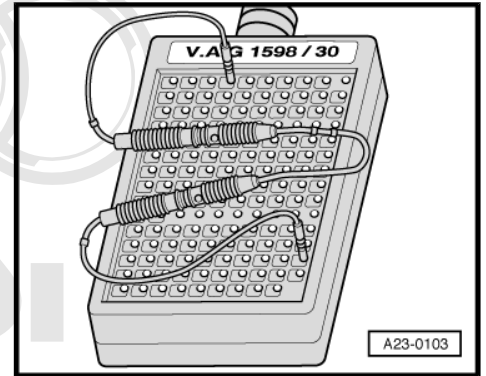
- Using a test lead from adapter set -V.A.G 1594C- , connect together sockets 1/04 and 4/30 on the test adapter.
- Switch on ignition.
- ◆ Specification: the glow period warning lamp -K29- should light up.

If the glow period warning lamp -K29- does not light up:

- Check for open circuit and short to positive or earth in the following wiring connections ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Rectify open circuit or short circuit in wiring as necessary.

If the glow period warning lamp -K29- lights up at this stage, but not during the final control diagnosis:

- Renew diesel direct injection system control unit -J248-
⇒ [page 75](#) .



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