9.4 ENGINE 113

Diagnosis - Diagnostic Trouble Code (DTC) Memory

Preliminary work: . . . . . Engine Test, Adjustment, Engines (SMS, Job No. 07-1100)

⚠ WARNING!
Risk of severe injury when touching ignition parts which produce high voltages. Do not touch igntion components.
Persons with heart pacemakers are not to perform repairs on this type of ignition system..

Electronic ignition systems produce dangerous high voltages on both the primary circuit and the secondary (ignition) circuits. Due to the high voltages produced, contact with any of the voltage carrying components can be dangerous to your health (burns, heart palpatations, cardiac arrest etc).

- Igntion must be turned OFF prior to performing any repair work on the igntion system.
- Do not come in contact or remove with any of the ignition components while the engine is cranking or idling.
- Wear rubber soled shoes.
- Disconnect connectors for CKP sensor at sensor or control module.
- If repairs require that the ignition be turned on, then dangerous voltages will be present through out the entire ignition system.
- No exposed metal connectors or sending units may be installed in the ignition wires.

⚠ WARNING!
Risk of fatal injury from being pulled into rotating vehicle parts.
Do not reach into rotating parts.
Wear closed and tight-fitting work clothes.
Protect vicinity of rotating vehicle components from unauthorized access.

⚠ WARNING!
Risk of explosion from fuel igniting, risk of poisoning from inhaling and swallowing fuel as well as risk of injury to eyes and skin from contact with fuel.
No fire, sparks, exposed flames or smoking.
Pour fuels only into suitable and appropriately marked containers.
Wear protective clothing when handling fuel.
Possible hazards
Risk of explosion, poisoning and injury
Fuels are highly inflammable and toxic if inhaled. Fuel may cause skin damage. Contact with gasoline fuel, for example, removes the natural oils on the skin. Fuel vapors are explosive, invisible and spread out at floor level. They are toxic if inhaled and have a narcotic effect in high concentrations.

Protective measures/guidelines

- Pay attention to national safety regulations and provisions.
- No fire, sparks, exposed flames or smoking.
- Ensure that the place of work is adequately ventilated.
- Never drain or pour in fuels over assembly pits.
- Store drained fuel in suitable and sealed containers.
- Immediately eliminate any fuel spills which have been spilled out of the container.

Continued on next page:

Diagnosis - Diagnostic Trouble Code (DTC) Memory

Conducting work on a vehicle with exposed flame
(e.g. welding etc.)

- Prior to commencing such work, remove appropriate parts of the fuel system and seal open fuel lines with plugs.

First-aid measures

- Clean contaminated/exposed skin with water and soap.
- Change contaminated clothing as quickly as possible.
- If fuel gets into the eyes, rinse out eyes immediately with water, and contact a doctor, if necessary.

To Avoid Damage to the Ignition System

- To avoid damage to the engine control module, connect/disconnect the control module connectors only with the ignition: **OFF**.
- Circuit 1 of the ignition coil may not be shorted to ground, e.g. theft deterence.
- Only original equipment should be installed in the ignition system.
- Do not operate the ignition system at cranking speed unless the entire igntion harness is connected.
- Do not perform any tests (grounding of ignition cable 4 disconnecting a spark plug connector or pulling cable 4 out of the ignition coil) at cranking or idle speed.
- The high output side of the ignition system must carry at least 2 kΩ of load (spark plug connector).
- If assisting a disabled vehicle and it becomes necessary to perform an igntion spark test, perform this test only on one ignition/sark plug. Ensure a good ground connection to the spark plug.
- ME - SFI: the ignition system is to be turned OFF, when cranking engine to perform compression tests, additionally, it is necessary to disconnect connector 2 from the control module.

ⓘ Engine 120 has separate ignition and fuel injection system.

⚠
Readout via the impulse counter scan tool is not possible.

Note:
Symbol for emission related malfunctions which lead to the activation of the CHECK ENGINE MIL when a certain test cycle was performed and a fault was recognized.

Diagnosis - Diagnostic Trouble Code (DTC) Memory

Note regarding diagnostic trouble code (DTC) readout:
The engine control module (N3/10) for the ME-SFI system is equipped with diagnostic trouble code (DTC) memory. Malfunctions are recognized and stored as DTC's and are distinguished as follows:

- Malfunctions which are constantly present,
- Intermittent contact malfunctions which have occured during a trip and have been stored.

The DTC memory is erased when the vehicle's battery is disconnected.

Malfunctions which are no longer present, are automatically erased as follows:

- After three trips the "CHECK ENGINE" MIL goes out.
- After an additional 40 warm-up periods the DTC is automatically erased.
- "CHECK ENGINE" MIL is illuminated if the fault was stored on the previous driving-cycle.

A warm-up period or trip is defined as follows:

Warm-up period
- Engine coolant temperature at start < 35° C,
- Engine coolant temperature increases to > 70° C.

Trip
- Engine running for > 20 minutes,
- Engine oil temperature > – 7° C,
- Engine speed > 500 rpm,
- All emission related logic chain functions already there were checked during previous trips.

Driving-cycle (for a test) consists of:
- Engine start
- Completion of test,
- Shutting engine: OFF

The stored DTC's can be read at the data link connector (X11/4) **using the HHT only**, with the ignition switched "**ON**" or with the "engine running". Readout via an on-off ratio readout or impulse counter scan tool has been eliminated.

As required by law, the DTC's can be read out using the Generic Scan Tool, by connecting scan tool to the diagnostic connector (X11/4).

Diagnosis - Diagnostic Trouble Code (DTC) Memory

Note regarding mixture preparation self-adaptation:
The Lambda control system determines the fuel injection duration so precisely that the fuel/air ratio is kept constant at Lambda level 1 (equals 14.7 kg air to 1 kg fuel) under all operating conditions.
Should malfunctions occur in the form of:

- Intake air leaks,
- Injector wear or carbon build-up,
- Engine wear,
- Transition resistance in MAF sensor,
- Defective diaphragm pressure regulator,
- Defective purge control valve,

the engine control module (ME-SFI, 2.0) automatically performs a mixture adjustment.
The degree of correction is constantly calculated and permanently stored. The self-adaptation is performed additive at idle and multiplicative under partial load. The correction towards rich or lean is ± 1.0 milliseconds (injection duration) at idle and the factor 0.68 – 1.32 at partial load. After repair work is performed, the engine control module will automatically adapt itself again.

Note regarding drive authorization system (DAS 3):
Model Year 1998, models 202, 208 and 210
Vehicles with ME-SFI (ME 2.0) are equipped with DAS 3. DAS is activated from the DAS control module (N54/1) via the CAN data bus to the engine control module.
Upon activation of the DAS, the engine control module renders the fuel injection system inoperative. The activation or deactivation is accomplished only with the electronic ignition key. As soon as the electronic ignition key is inserted in the steering lock, the DAS control module receives a signal and activates the engine control via the CAN data bus.
The locking and unlocking of the vehicle, using the mechanical key has no effect on the DAS system.
The engine control module and the DAS control module are “married” to one another through identification codes. The identification codes can not be erased (see HHT nominal values “DAS”, menu selection 3/7).
Therefore, swapping the engine or RCL control module from one vehicle to another is not possible!

Diagnosis - Diagnostic Trouble Code (DTC) Memory

If an exchange engine control module is installed for test purposes, up to 40 start attempts can be performed before the engine and DAS control modules “marry” to one another. Prior to perfroming the first start, the engine control module must be version coded using the HHT. Additionally, the code number and VIN must be entered (see HHT nominal values “DAS”, menu selection 3/7).

Note regarding version coding:
The engine control module is equipped with a version coding feature. The coding must be performed with the Hand-Held Tester (automatically or manually, see Notes for HHT “Version coding“ 11/5) upon installation of a new control module.
The following vehicle version data must be determined for coding:

- Vehicle model,
- Engine
- Non-catalytic converter (non-TWC),
- Country version,
- 30 km/h limitation

Diagnosis - Diagnostic Trouble Code (DTC) Memory

Notes regarding automatic recognition of the mechanical end stop and wide open position of the throttle valve from the actuator:
The end stops of the throttle valve is determined by the actuator and stored in the engine control module.
After replacing the control module or actuator, the mechanical end stop and wide open position must again be determined and recorded.
Thereby allowing learned data to be erased with the HHT and new data to be learned. When the new engine control module is connected for the first time to circuit 30 (B+), the engine control module performs a self-adaptation of the actuator with the ignition "ON" (lower mechanical end stop).

Requirements for learning process:
- Selector lever in position P/N,
- Vehicle standing still,
- Engine off,
- Engine coolant temperature between 5° C and 100° C,
- Accelerator pedal not applied.

When all requirements are met, turn **ignition ON for at least 60 seconds**, then turn **ignition OFF for at least 10 seconds**.
The learned value is stored in memory, only after the first 10 start cycles, provided the voltage supply has not been interrupted. Should the battery be disconnected after the 9th start cycle, the re-learning process must be performed again.

Notes regarding VSS sensor adaption for rough running engine test:
After the replacement of the ME-SFI control module, CKP sensor (L5), starter ring gear or motor mount, a sensor adaption must be performed:
- Engine coolant temperature approx. > 70 ºC,
- Drive vehicle on road.

Vehicles up to 01/98:
- With selector lever in position 4: Increase engine rpm to approx. 2,500 rpm and then coast until engine rpm is approx. < 1,500 rpm.
- With selector lever in position 2: Increase engine rpm to approx. 6,100 rpm and then coast until engine rpm is approx. < 4,100 rpm. Again increase engine rpm to approx. 6,100 rpm and then coast until engine rpm is approx. < 3,000 rpm.
- Using the HHT, determine if VSS sensor adaption has taken place.

Vehicles as of 02/98:
- With selector lever in position 3: Increase engine rpm to approx. 2,100 rpm and then hold a 50% engine load for approx. 30 seconds.
- Using the HHT, determine if VSS sensor adaption has taken place.

Notes regarding performance/speedometer test:
Disconnecting the ESP/ASR/ETS/ABS control modules is not allowed. The engine control module and transmission control module rely on these modules to supply the VSS data via the CAN bus.

To disable the brake and engine regulation function of the ESP/ASR/ETS/ABS control modules:

Continued on 11/5

Diagnosis - Diagnostic Trouble Code (DTC) Memory

Notes regarding working with HHT:

A. Working without HHT
- Ignition: **OFF**.
- Connect HHT adapter to data link connector (X11/4).
- Bridge sockets 1 and 6.
- Engine: **Start** (BAS/ESP or BAS/ASR MIL must illuminate!).

B. Working with HHT
- Ignition: **OFF**.
- Disconnect front axle VSS sensor connector (BAS/ESP or BAS/ASR MIL must illuminate!).

When work is completed, reconnect VSS sensor connector and erase DTC's with HHT!

- **Fault search with HHT**
  Diagnostic trouble code (DTC) memory: Select "Current DTC's".
  If the actual condition changes, e.g. when wiggling a connector, the change is reported optically and acoustically so that troubleshooting can be performed directly with the HHT.

- **Loose connections**
  Loose connections are stored if they occur several times in a certain time period. Therefore, they can appear only as "Stored DTC's" and never as "Current DTC's".

- **Nominal values**
  All nominal values relative to the actual values shown on the HHT are listed in the Diagnostic Manual, Engines, Volume 1, section A.

- **Actual value for engine speed**
  For engine speed, the HHT display indicates the closed throttle speed (CTP) nominal value calculated by the control module on the left, and the rpm actual value on the right. Both values should differ from each other only slightly. Permissible tolerances are not yet determined.

- **Version coding with HHT**
  a) Before replacement of the engine control module, the existing code number must be read and stored with the HHT (menu selection 5 "Version coding"). After installation of the new control module, the previously read code number must be entered.

Note:
If returning a new control module to a PDC, the code number must be erased.

  b) If the code number can **not** be read, the vehicle equipment/version must be determined, the corresponding code number obtained from the Spare Parts Microfiche (group 54) and manually entered with the HHT.

- **Drive authorization system (DAS) X**
  Upon replacement the engine control module must be version coded using the HHT. Additionally, the code number and VIN must be entered (see HHT nominal values "DAS", menu selection 3/7).

Diagnosis - Diagnostic Trouble Code (DTC) Memory

Special Tools

965 589 00 01 00

Hand-Held-Tester

965 589 00 40 00

Test cable

Diagnosis - Diagnostic Trouble Code (DTC) Memory

Connection Diagram - Hand-Held Tester (HHT)

1 Connect HHT (087) with test cable (097) to data link connector (X11/4)

2. Ignition: **ON**

3. As per display in HHT:
   a) read out/erase DTC memory
   b) read out actual values
   c) perform activations
   d) program control modules

4. Disconnect HHT

Observe system specific notes, which are described in the beginning of each chapter. Erase all stored faults which come about when tests or simulations are performed, upon completion of the repairs.

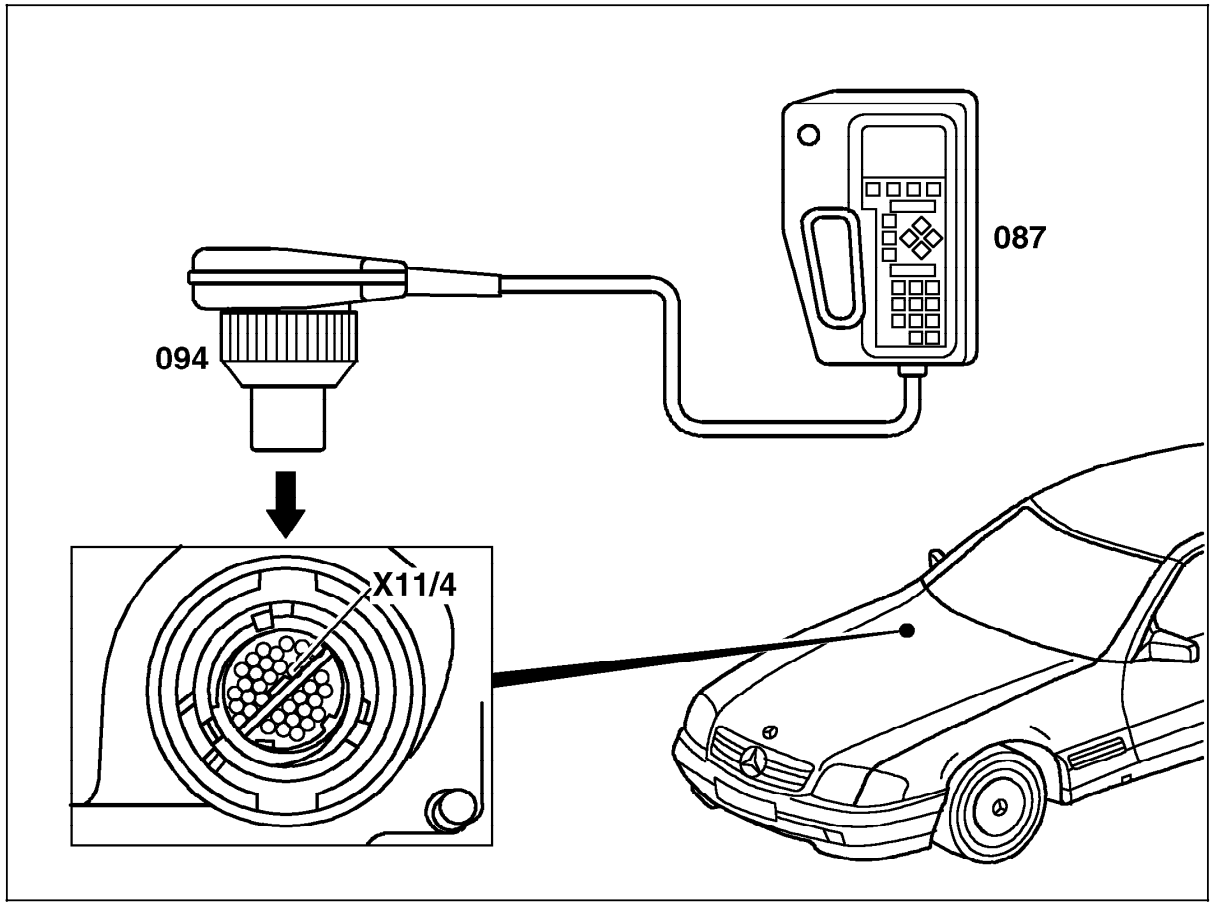

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Figure 1

087	Hand-Held Tester
094	Multiplexer cable
X11/4	Data link connector (DTC readout) (38-pole)

Diagnosis – Diagnostic Trouble Code (DTC) Memory

Prerequisites for readout of DTC memory

⚠ **WARNING!**

Risk of severe injury when touching ignition parts which produce high voltages. Do not touch igntion components.
Persons with heart pacemakers are not to perform repairs on this type of ignition system.

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Readout via the impulse counter scan tool is not possible.

Note:

Symbol for emission related malfunctions which lead to the activation of the CHECK ENGINE MIL when a certain test cycle was performed and a fault was recognized in the prior trip cycle. The CHECK ENGINE MIL will illuminate immediately if a "TWC damaging" misfire is found.

Preparation for Test:

1. Connect HHT with test cable to data link connector (X11/4), readout DTC fault codes.
2. Review 22,
3. Review 11, 21, 23, 24, 31, 33,
4. Perform Test and adjustment of engine, see DM, Engines, Vol. 1, section B, if necessary.
5. Ignition: **ON**

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC		Possible cause		Test step/Remedy [1]
		SAE nomenclature	Explanation	
–		No malfunction in system		In case of complaint, perform 23, 24, 25 or 26 in its entirety.
P0 100		MAF circuit malfunction	Hot film MAF sensor (B2/5) DTC description	23⇒ 4.0 11/27
P0 105	Only (USA), Vehicles with cylinder shut-off	MAP circuit malfunction	Pressure sensor (B28) DTC description	23⇒ 6.0 11/28
P0 110		IAT circuit malfunction	IAT sensor (in Hot film MAF sensor B2/5) DTC description	23⇒ 5.0 11/29
P0 115		ECT circuit malfunction	ECT sensor (B11/4) DTC description	23⇒ 8.0 11/30
P0 120		Throttle position circuit malfunction	Actual value potentiometer in EA/CC/ISC actuator (M16/6) DTC description	25⇒ 3.0 11/31
P0 130		O2S 1 circuit malfunction	A. O2S 1 (before TWC) (G3/4) B. O2S 1 (before TWC) (G3/4) voltage increase insufficient DTC description	23⇒ 11.0 11/32

[1] Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC	Possible cause		Test step/Remedy [1]
	SAE nomenclature	Explanation	
P0 133	O2S 1 circuit slow response	A O2S 1 (before TWC) (G3/4), ageing correction value exceeded B O2S 1 (before TWC) (G3/4), ageing time period too long C O2S 1 (before TWC) (G3/4), ageing O2S 1 sensor response too slow DTC description	23⇒ 11.0 11/33
P0 135	O2S 1 heater circuit malfunction	O2S 1 heater (before TWC) (G3/4) DTC description	23 ⇒ 13.0 11/35
P0 136 Only USA	O2S 2 circuit malfunction	O2S 2 (after TWC) (G3/6) DTC description	23 ⇒ 15.0 11/32
P0 140	O2S 2 heater circuit malfunction	Right O2S 2 (before TWC) (G3/4) DTC description	23⇒ 11.0 11/32
P0 141 Only USA	O2S 2 heater circuit malfunction	Right O2S 2 heater (after TWC) (G3/6) DTC description	23⇒ 17.0 11/35
P0 150	O2S 1 circuit malfunction	A O2S 1 (before TWC) (G3/3) B O2S 1 (before TWC) (G3/3), voltage increase too slow DTC description	23⇒ 10.0 11/32

[1] Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC	Possible cause		Test step/Remedy [1]
	SAE nomenclature	Explanation	
P0 153	O2S 1 circuit slow response	A O2S 1 (before TWC) (G3/3), ageing correction value exceeded B O2S 1 (before TWC) (G3/3), ageing time period too long C O2S 1 (before TWC) (G3/3), ageing O2S 1 sensor response too slow DTC description	23⇒ 10.0 11/33
P0 155	O2S 2 heater circuit malfunction	Left O2S 1 heater (before TWC) (G3/3) DTC description	23⇒ 12.0 11/35
P0 156 Only USA	O2S 2 circuit malfunction	Left O2S 2 (after TWC) (G3/5) DTC description	23⇒ 14.0 11/32
P0 160	O2S 2 heater circuit malfunction	Left O2S 2 (before TWC) (G3/5) DTC description	23⇒ 14.0 11/32
P0 161 Only USA	O2S 2 heater circuit malfunction	Right O2S 2 heater (after TWC) (G3/5) DTC description	23⇒ 16.0 11/35

[1] Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC	Possible cause		Test step/Remedy [1]
	SAE nomenclature	Explanation	
P0 170	Fuel trim malfunction	A Self adaptation of fuel mixture “partial load“, right cylinder bank, at limit from engine control module (N3/10). B Self adaptation of fuel mixture “CTP“, right cylinder bank, at limit from engine control module (N3/10). DTC description	Intake air leak, injectors, diaphragm pressure regulator, engine wear. 11/36
P0 173	Fuel trim malfunction	A Self adaptation of fuel mixture “partial load“, left cylinder bank, at limit from engine control module (N3/10). B Self adaptation of fuel mixture “CTP“, left cylinder bank, at limit from engine control module (N3/10). DTC description	Intake air leak, injectors, diaphragm pressure regulator, engine wear. 11/36
P0 201	Injector circuit malfunction - cyl. 1	Injector (Y62y1) – cylinder 1 DTC description	23⇒ 18.0 11/37
P0 202	Injector circuit malfunction - cyl. 2	Injector (Y62y2) – cylinder 2 DTC description	23⇒ 19.0 11/37
P0 203	Injector circuit malfunction - cyl. 3	Injector (Y62y3) – cylinder 3 DTC description	23 ⇒ 20.0 11/37

[1] Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC	Possible cause		Test step/Remedy [1]
	SAE nomenclature	Explanation	
P0 204	Injector circuit malfunction - cyl. 4	Injector (Y62y4) – cylinder 4 DTC description	23 ⇒ 21.0 11/37
P0 205	Injector circuit malfunction - cyl. 5	Injector (Y62y5) – cylinder 5 DTC description	23 ⇒ 22.0 11/37
P0 206	Injector circuit malfunction - cyl. 6	Injector (Y62y6) – cylinder 6 DTC description	23 ⇒ 23.0 11/37
P0 207	Injector circuit malfunction - cyl. 7	Injector (Y62y7) – cylinder 7 DTC description	23 ⇒ 24.0 11/37
P0 208	Injector circuit malfunction - cyl. 8	Injector (Y62y8) – cylinder 8 DTC description	23 ⇒ 25.0 11/37
P0 300	Random misfire detected	A Random misfire B Random misfire, TWC damaging DTC description	24 ⇒ 13.0 – 21.0 36 ⇒ 1.0 – 2.0 Compression pressure 11/39
P0 301	Cylinder 1 misfire detected	A Cylinder 1 misfire B Cylinder 1 misfire, TWC damaging DTC description	24 ⇒ 13.0 24 ⇒ 21.0 36 ⇒ 1.0 – 2.0 Compression pressure 11/39

[1] Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC	Possible cause		Test step/Remedy [1]
	SAE nomenclature	Explanation	
P0 302	Cylinder 2 misfire detected	A Cylinder 2 misfire B Cylinder 2 misfire, TWC damaging DTC description	24 ⇒ 14.0 24 ⇒ 21.0 36 ⇒ 1.0 – 2.0 Compression pressure 11/39
P0 303	Cylinder 3 misfire detected	A Cylinder 3 misfire B Cylinder 3 misfire, TWC damaging DTC description	24 ⇒ 15.0 24 ⇒ 21.0 36 ⇒ 1.0 – 2.0 Compression pressure 11/39
P0 304	Cylinder 4 misfire detected	A Cylinder 4 misfire B Cylinder 4 misfire, TWC damaging DTC description	24 ⇒ 16.0 24 ⇒ 21.0 36 ⇒ 1.0 – 2.0 Compression pressure 11/39
P0 305	Cylinder 5 misfire detected	A Cylinder 5 misfire B Cylinder 5 misfire, TWC damaging DTC description	24 ⇒ 17.0 24 ⇒ 21.0 36 ⇒ 1.0 – 2.0 Compression pressure 11/39
P0 306	Cylinder 6 misfire detected	A Cylinder 6 misfire B Cylinder 6 misfire, TWC damaging DTC description	24 ⇒ 18.0 24 ⇒ 21.0 36 ⇒ 1.0 – 2.0 Compression pressure 11/39

[1] Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC	Possible cause		Test step/Remedy [1]
	SAE nomenclature	Explanation	
P0 307	Cylinder 7 misfire detected	A Cylinder 7 misfire B Cylinder 7 misfire, TWC damaging DTC description	24 ⇒ 19.0 24 ⇒ 21.0 36 ⇒ 1.0 – 2.0 Compression pressure 11/39
P0 308	Cylinder 8 misfire detected	A Cylinder 8 misfire B Cylinder 8 misfire, TWC damaging DTC description	24 ⇒ 20.0 24 ⇒ 21.0 36 ⇒ 1.0 – 2.0 Compression pressure 11/39
P0 325	KS 1 circuit malfunction	Right KS 1 (A16g1) DTC description	Wiring, connector, A16g1 11/42
P0 330	KS 2 circuit malfunction	Left KS 2 (A16g2) DTC description	Wiring, connector, A16g2 11/42
P0 335	CKP sensor circuit malfunction	CKP sensor (L5) DTC description	24 ⇒ 11.0 11/42
P0 341	CMP sensor circuit range/performance	Camshaft Hall-effect sensor (B6/1) DTC description	24 ⇒ 12.0 11/43
P0 370	Angle deviation between camshaft and crankshaft	Angle deviation between camshaft and crankshaft.	Check basic adjustment of camshaft.

[1] Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC		Possible cause		Test step/Remedy [1]
		SAE nomenclature	Explanation	
P0 400		Exhaust gas recirculation flow malfunction	Exhaust gas recirculation malfunction (logic chain) DTC description	23 ⇒ 29.0 11/45
P0 410	Only USA	Air injection system malfunction	AIR system malfunction (logic chain) DTC description	23 ⇒ 26.0– 28.0 11/46
P0 422		TWC (right) efficiency below threshold	TWC efficiency below threshold DTC description	Replace right TWC 11/48
P0 432		TWC (left) efficiency below threshold	TWC efficiency below threshold DTC description	Replace left TWC 11/48
P0 440	Only USA	EVAP system malfunction	EVAP malfunction (logic chain) DTC description	23 ⇒ 32.0 – 33.0 11/50
P0 441	Only USA	EVAP system malfunction (leak) (logic chain)	Purge valve (Y58/1) (function) DTC description	23 ⇒ 31.0 – 32.0 11/50
P0 442	Only USA	EVAP system leak detected (small leak)	EVAP system, small leak DTC description	23 ⇒ 33.0 11/50
P0 443		EVAP system purge control valve circuit malfunction	Purge control valve (Y58/1) DTC description	23 ⇒ 31.0 11/54
P0 446	Only USA	EVAP system vent control malfunction	A. Activated charcoal canister shut-off valve (Y58/4) B. End stage activated charcoal canister shut-off valve (Y58/4) within N3/10 DTC description	23 ⇒ 34.0 – 35.0 N3/10 11/55

[1] Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC	Possible cause		Test step/Remedy [1]
	SAE nomenclature	Explanation	
P0 450 Only USA	EVAP system pressure sensor malfunction	A. Fuel tank pressure sensor (B4/3) electrical fault B. Fuel tank pressure sensor (B4/3) electrical fluctuations DTC description	23 ⇒ 35.0 Charcoal canister plugged. 11/56
P0 455 Only USA	EVAP system leak detected (large leak)	EVAP system, large leak Fuel tank pressure sensor (B4/3) (voltage supply) DTC description	23 ⇒ 33.0 23 ⇒ 35.0 11/50
P0 460	Fuel level sensor circuit low input	Fuel tank level too low	Read out instrument cluster memory.
P0 500	VSS sensor malfunction	A VSS left front B VSS left rear DTC description	Test ASR, ESP see DM, Chassis and Drivetrain, Vol. 3, 10.2 11/57
P0 507	ISC rpm higher than expected	Idle control system, unplausible DTC description	25 ⇒ 1.0 – 3.0 11/58
P0 560	System voltage malfunction	Voltage supply to engine control module (N3/10) DTC description	23 ⇒ 1.0 – 2.0 11/59
P0 520 (not USA)	Cylinder shut-off, oil pressure sensor	Engine with cylinder shut-off only	
P0 560	Voltage supply to control module ME	Voltage supply	23 ⇒ 1.0 – 2.0 11/59
P0 565	Cruise control switch	CC switch (S40)	25 ⇒ 1.0

[1] Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC	Possible cause		Test step/Remedy [1]
	SAE nomenclature	Explanation	
P0 600	Serial communication link malfunction	CAN bus from ESP/SPS control module (N47-5) DTC description	23 ⇒ 36.0 11/60
P0 604	Internal control module random Access memory (RAM) error	A Engine control module (N3/10) B Engine control module (N3/10)	(N3/10)
P0 605	Internal control module read only memory (ROM) error	Engine control module (N3/10)	(N3/10)
P0 700	Transmission control system malfunction Gear unplausi, transmission leak, Command sleeve stuck in pressure pos.	Read DTC memory of transmission control module. DTC description DTC description	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3 11/61 11/62
P0 702	Transmission control system electrical Voltage supply to solenoid valves	Read DTC memory of transmission control module. DTC description	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3 11/63
P0 715	Input/turbine speed sensor circuit malfunction RPM sensor voltage supply and function	Read DTC memory of transmission control module. DTC description	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3, 23 11/65

[1] Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC	Possible cause		Test step/Remedy [1]
	SAE nomenclature	Explanation	
P0 720	Output speed sensor circuit malfunction CAN fault recognition	Read DTC memory of transmission control module. DTC description	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3, 23 11/67
P0 730	Incorrect gear ratio Ratio comparison negative (numerous)	Read DTC memory of transmission control module. DTC description	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3, 23 11/68
P0 740	Torque converter clutch circuit malfunction	Read DTC memory of transmission control module. DTC description	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3, 23 11/69
P0 743	Torque converter clutch circuit electrical	Read DTC memory of transmission control module. DTC description	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3, 23 11/70
P0 748	Pressure control solenoid electrical Pressure control valve modulation press. Pressure control valve shift pressure	Read DTC memory of transmission control module. DTC description DTC description	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3, 23 11/71 11/72
P0 753	Shift solenoid A electrical 1-2/4-5 solenoid shift valve	Read DTC memory of transmission control module. DTC description	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3, 23 11/73
P0 758	Shift solenoid B electrical 2-3 solenoid shift valve	Read DTC memory of transmission control module. DTC description	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3, 23 11/74

[1] Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC	Possible cause		Test step/Remedy [1]
	SAE nomenclature	Explanation	
P0 763	Shift solenoid C electrical 3-4 solenoid shift valve	Read DTC memory of transmission control module. DTC description	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3, 23 11/75
P0 801	Engine/climate control electric cooling fan malfunction	Engine/climate control electric cooling fan (M4/3).	23 ⇒ 38.0
P0 802	Resonance intake mainfold switchover valve malfunction	Resonance intake mainfold switchover valve (Y22/6).	23 ⇒ 30.0
P0 809	Angle deviation between camshaft and crankshaft	Angle deviation between camshaft and crankshaft.	Check basic adjustment of camshaft.
P0 811	CAN from electronic ignition lock	CAN from electronic ignition lock.	23 ⇒ 36.0
P1 031	O2 sensors (G3/3, G3/4) reversed	O2 sensors (G3/3, G3/4) reversed.	Check proper connection of O2 sensors in ETM.
P1 177	Oil sensor	Oil sensor (level, temperature, quality)(B40), Oil temperature implausible.	23 ⇒ 37.0
P1 178	Oil sensor	Oil sensor (level, temperature, quality)(B40), Oil level implausible.	23 ⇒ 37.0
P1 179	Oil sensor	Oil sensor (level, temperature, quality)(B40), Oil quality implausible.	23 ⇒ 37.0
P1 180	Oil sensor	Oil sensor (level, temperature, quality)(B40), Oil temperature too high.	23 ⇒ 37.0

[1] Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC	Possible cause		Test step/Remedy [1]
	SAE nomenclature	Explanation	
P1 181	Engine/climate control electric cooling fan	Faulty	23 ⇒ 38.0
P1 183 (not USA)	Right hand cylinder bank shut-off (Y80)	Faulty	
P1 184 (not USA)	Left hand cylinder bank shut-off (Y81)	Faulty	
P1 185	Oil sensor	Oil sensor (level, temperature, quality)(B40), water in oil.	23 ⇒ 37.0
P1 186	Fuel safety shut-off recognized	EA/CC/ISC actuator (M16/6)	25 ⇒ 3.0 – 4.0, EA/CC/ISC actuator (M16/6) sticks or jammed, Check intake system for residue.
P1 225	Resonance intake mainfold switchover valve malfunction	Resonance intake mainfold switchover valve (Y22/6).	23 ⇒ 30.0
P1 233	EA/CC/ISC actuator (M16/6) icing problem	EA/CC/ISC actuator (M16/6) icing problem	Actuator
P1 355 (not USA)	Right hand cylinder bank shut-off (Y80)	Faulty	
P1 356 (not USA)	Left hand cylinder bank shut-off (Y81)	Faulty	
P1 357 (not USA)	Cylinder bank shut-off ON	Faulty	
P1 358 (not USA)	Cylinder bank shut-off OFF	Faulty	
P1 359 (not USA)	Cylinder bank shut-off OFF	Faulty	
P1 360 (not USA)	Cylinder bank shut-off OFF	Faulty	
P1 361 (not USA)	Cylinder bank shut-off OFF	Faulty	

[1] Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC		Possible cause		Test step/Remedy [1]
		SAE nomenclature	Explanation	
P1 366	(not USA)	Exhaust flap switchover valve	Faulty	
P1 380	(not USA)	Intake valve of cyl. does not with cylinder shut-off function	Faulty	
P1 386		Knock sensor control from ECM (N3/10) at end stop	Knock sensor regulation from engine control module (N3/10) at end stop, due to hardware problem. DTC description	1. Increased knock tendency due to bad fuel, carbon in combustion chamber or mechanical damage. 11/77
P1 400		EGR valve vacuum transducer	EGR valve vacuum transducer (Y31/1) faulty DTC description	23 ⇒ 29.0 11/78
P1 420	Only USA	AIR pump switchover valve	AIR pump switchover valve (Y32) DTC description	23 ⇒ 27.0 11/79
P1 453	Only USA	AIR relay module, AIR pump	Relay module, AIR pump (K40/4k3) in relay module (K40) DTC description	23 ⇒ 26.0 11/79
P1 491			Refrigerant pressure in A/C system too high	Check automatic A/C system.
P1 542		Pedal value sensor	Pedal value sensor (B37) DTC description	25 ⇒ 1.0 – 2.0 11/80

[1] Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC	Possible cause		Test step/Remedy [1]
	SAE nomenclature	Explanation	
P1 570	CAN signal from DAS control module to engine control module	A. Start attempted with "locked" DAS B. CAN signal from DAS control module (N54/1) to engine control module (N3/10) interrupted. C. Engine control module (ME-SFI) and DAS control module are not compatible.	User error, Check correct operation of DAS, see DM, Body and Accessories, Vol. 1, 4.9, 4.10 23 ⇒ 36.0 Check control modules and part no.
P1 580	EA/CC/ISC actuator	EA/CC/ISC actuator (M16/1) DTC description	25 ⇒ 3.0 – 4.0 11/81
P1 584	Stop lamp switch	Stop lamp switch (S9/1)	Test ETS, ASR see DM, Chassis & Drivetrain, Vol. 3, 10.2
P1 603	CAN from EIS		23 ⇒ 36.0
P1 605		Poor road/traction condition recognition signal (via comparison of VSS rpm signals.	Test ASR/ESP see DM, Chassis and Drivetrain, Vol. 3, section 10.2

[1] Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC	Possible cause		Test step/Remedy [1]
	SAE nomenclature	Explanation	
P1 642	Engine control module	Engine control module (N3/10) improperly version coded.	Check engine control module for correct version code.
P1 644		Transmission version can not be checked due to low voltage at transmission control module (N15/3).	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3
P1 666 (not USA)	Cylinder shut-off does not open with cylinder shut-off ON function	Faulty	
P1 681	Crashsignal unplausible		23/40
P1 747	CAN signal from ETC	A. CAN failure: Transmission protection malfunction from transmission control module (N15/3) B. CAN failure: Instrument cluster DTC description	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3 Test instrument cluster (A1), see DM, Body & Accessories, Vol. 1 11/60

[1] Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0100	Hot film MAF sensor (B2/5)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Limit signals, MAF (B2/5)
Magnitude: lower limit Lower threshold limit Upper threshold limit Test duration	At idle approx. 6-48 kg/h (1.3-1.8 V) min. 25kg/h, if throttle plate angle is greater than 5° approx. 50-1200 kg/h, ECM map based on engine rpm and throttle plate angle. approx. 5 sec. per limit.
Test pre-requisites	No fault in throttle plate adjustment

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0105	Pressure sensor (B28)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Limit values, Pressure sensor (B28)
Magnitude: lower limit Lower threshold limit Upper threshold limit Test duration	min -60 mbar, with engine rpm over 1300 rpm approx. 0 mbar, if throttle plate angle is greater than 80° approx. 500-1200 mbar, ECM map dependent on engoine rpm and throttle plate angle. approx. 5 sec. per limit.
Test pre-requisites	Lock time period of 30 seconds after start exceeded. No fault in the throttle plate angle.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0110	IAT sensor (in Hot film MAF sensor B2/5)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Limit values, IAT sensor
Lower threshold limit Upper threshold limit Test duration	Fault if signal is smaller than 0.1 V (> 300k Ω ,approx. -50°C) Fault if signal is greater than 4.93 V (< 92 Ω , approx. +150°C) approx. 1 sec.
Hint	With faults, the reserve value of +20°C is used. Should the signal become plausible, the signal from the IAT is subsequently used again.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0115	ECT sensor (B11/4)
Fault memory and activation of Check Engine (MIL)	Two in sequence driving-cycles with faults
Test frequency, test duration	Continuously
Tested signal or condition	Limit values, ECT sensor (B11/4)
Lower threshold limit Upper threshold limit Plausibility	Fault, if the resistancve is: > 80 k Ω (approx. - 39°C) Fault if the resistance is: < 45 Ω (approx. +170°C) The temperature raise is compared to a stored baseline value. Independent of start temperature and engine rpm, a value of +15°C after 120-1200 sec. must be attained.
i	With faults, the reserve value from the temperature base value is used. Should the signal become plausible, the signal from the ECT sensor is subsequently used again.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0120	Actual values-potentiometer in EA/CC/ISC actuator (M16/1)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Voltage supply, Actual values-potentiometer 1 or 2
Actual values potentiometer 1 Actual values potentiometer 2	Fault if: voltage is less than 0.275 V or is greater than 4.83 V Fault if: voltage is less than 0.176 V or is greater than 4.74 V

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0130	Right 02S 1 (before TWC)
DTC P0136	Right 02S 2 (after TWC) (only USA)
DTC P0140	Right 02S 1 (before TWC)
DTC P0150	Left 02S 2 (before TWC)
DTC P0156	Left 02S 2 (after TWC) (only USA)
DTC P0160	Left 02S 1 (before TWC)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	A. Limit values, 02 sensor signal B. Sensor status exchange
A. 02 sensor limit value signal Lower threshold limit value Upper threshold limit Test duration B. Sensor status exchange	 <-0.15V > 1.5 V approx. 5 sec. With 02 heater on (approx. 220sec.), the sensor signal does not remain in the voltage window (0.4-0.6V) for longer then 15 seconds.
Test pre-requisites	– engine rpm approx. 1000-2000 – engine load approx. 15-50% – catalytic converter temperature > 380°C – release Lambda regulation
i Also see: 11/78	Via testing, all electrical connection faults of the 02 sensors before and after the catalytic converters are recognized (harness open circuits and shorts/high ohmic valueshorts to ground or positive). • The 02 sensor signal wire has a high ohmic short circuit or limited voltage increase. • The 02 sensor signal wire has a open circuit. With a cold 02 sensor: a high ohmic short circuit to positive or a short to ground on control module ME (!) If the 02 sensor signal wire ground is shorted to positive, the control module ME will be destroyed.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0133 DTC P0153	Right 02S 1 (before TWC) Left 02S 2 (before TWC)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	A. Correction factor exceeded B. Time period too long
A. correction factor exceeded B. Time period too long Test duration	approx. ±1.2 sec. > 5 sec. (average value via 15 measurements) up to 190 sec.
Test pre-requisites	– engine rpm approx. 1000-2000 – engine load approx. 15-50% – catalytic converter temperature > 380°C – no faults with effective function of catalytic converter – no faults with 02 sensor heating

Continued

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0133 DTC P0153	Right 02S 1 (before TWC) Left 02S 2 (before TWC)
Test sequence	The engine control module determines the the mid value of Lambda. This value is compared to the stored value for optimal exhaust gas value. With numerous of excessive values, a correction value for the lambda regulation is determined. With the correction factor (value with a new 02 sensor approx 0) the aging of the 02 sensor before the catalytic converter is equalized within certain limits With exceeded values beyond the correction values, the 02 sensor before the catalytic converter must be replaced. Additionally, the timespan of the sensor before the catalytic converter is evaluated. If there is no 02 sensor condition interexchange, then the lambda regulation is not active and the two sensor regulation will not take place. With the 02 sensor signals after the catalytic converter, the effectiveness of the catalytic converter is monitored.
i Also see: 11/79	Time span for 02 sensor before catalytic converter too long: 02 sensor located after the catalytic converter is no longer monitored. Correction factor of the 02 sensor before the catalytic converter exceeded: the 02 sensor after the catalytic converter is to be further monitored. If a fault is for both the 02 sensor before and after the catalytic converter is recorded, then usually the 02 sensor behind the catalytic converter is faulty.

DTC P0135	Right 02S 1 (before TWC)
DTC P0141	Right 02S 2 (after TWC)
DTC P0155	Left 02S 1 (before TWC)
DTC P0161	Left 02S 2 (after TWC)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Calculated resistance value of the 02 sensor heating
Lower threshold limit Upper threshold limit	< 2.0 Ω (approx. 6 A at 12 V) > 10 Ω (approx. 1.2 A at 12 V)
Test pre-requisites	Engine runs 02 sensor heating ON and a heating time of 220 sec. has elapsed.
i	A fault code for sensor heating is also set, if the time period for the sensor signal suddenly lengthens by over 25 seconds.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0170 DTC P0173	Right cylinder bank Left cylinder bank
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, activation of Check Engine (MIL), after two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Limit values of self adaption of mixture formation
A. Limit threshold value for idle B. Limit threshold value for part load	approx. ± 1.0 ms (approx. 25% of injection time at idle) 0.7-1.3 factor
i	For the self adaption of the mixture formation to attain a new value, a drive time of approx. 30 minutes with lambda regulation is required. The coolant temperature at time of start must be < 60°C.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0201	Injector 1 (Y62y1)
DTC P0202	Injector 2 (Y62y2)
DTC P0203	Injector 3 (Y62y3)
DTC P0204	Injector 4 (Y62y4)
DTC P0205	Injector 5 (Y62y5)
DTC P0206	Injector 6 (Y62y6)
DTC P0207	Injector 7 (Y62y7)
DTC P0208	Injector 8 (Y62y8)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Test requirements: Battery voltage between 8 - 17 V	Voltage and amp supply to each indivdual injector
Limit threshold value: amps required Limit threshold value: voltage Wire has open circuit Test duration	> 4.2 A < 2.5 V no voltage at injector, approx. 4 - 8 volts at load free output of the engine control module ME approx. 5 sec.

Continued

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0201	Injector 1 (Y62y1)
DTC P0202	Injector 2 (Y62y2)
DTC P0203	Injector 3 (Y62y3)
DTC P0204	Injector 4 (Y62y4)
DTC P0205	Injector 5 (Y62y5)
DTC P0206	Injector 6 (Y62y6)
DTC P0207	Injector 7 (Y62y7)
DTC P0208	Injector 8 (Y62y8)
i	The activation of each indivdual injector is checked for harness opens and shorts to ground or positive. Shorts to ground and open circuits are recognized with a locked endstage, where else a short to positive is recognized with a conducting endstage. With a fault detected, the endstage is immediately no longer activated.
(!)	With a short to ground, the indivdual injector remains continuously open.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0300 DTC P0301 DTC P0302 DTC P0303 DTC P0304 DTC P0305 DTC P0306 DTC P0307 DTC P0308 DTC P0460 DTC P0462	Random misfire Misfire, cyl. 1 Misfire, cyl. 2 Misfire, cyl. 3 Misfire, cyl. 4 Misfire, cyl. 5 Misfire, cyl. 6 Misfire, cyl. 7 Misfire, cyl. 8 Fuel level in fuel tank too low Fuel level in fuel tank too low
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, activation of Check Engine (MIL), after two in sequence driving-cycles with faults A. Misfire (emissions limit) Activation of Check Engine (MIL), after two in sequence driving-cycles with faults B. TWC damaging Activation of Check Engine (MIL) (blinks), immediately
Test frequency	Continuously
Tested signal or condition	Count of recognized combustion misfires (recognition via uneven running engine evaluation)
Limit threshold values:	A. max. 20 combustion misfires within 1000 engine revolutions B. max. 4-35 combustion misfires within 200 engine revolutions (ECM map dependent of engine rpm and load i.e. 4 misfires at medium engine rpm and load, 35 misfires at idle w/o load)

Continued

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0300	Random misfire
DTC P0301	Misfire, cyl. 1
DTC P0302	Misfire, cyl. 2
DTC P0303	Misfire, cyl. 3
DTC P0304	Misfire, cyl. 4
DTC P0305	Misfire, cyl. 5
DTC P0306	Misfire, cyl. 6
DTC P0307	Misfire, cyl. 7
DTC P0308	Misfire, cyl. 8
DTC P0460	Fuel level in fuel tank too low
DTC P0462	Fuel level in fuel tank too low
Test pre-requisites	– engine rpm approx. 450-6000 rpm – engine rpm variation less than 1900/rpm per sec. – engine load variation < 50% per second – engine start undertaken less then 5 seconds ago – no ESP interaction – CKP sensor adaption in coast range has been accomplished – No uneven terrain recognized (via CAN from ASR/ESP control module, attained via comparison of VSS signals) – no faults from camshaft Hall-effect sensor (B6/1) – no injector shutoff

Continued

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0300	Random misfire
DTC P0301	Misfire, cyl. 1
DTC P0302	Misfire, cyl. 2
DTC P0303	Misfire, cyl. 3
DTC P0304	Misfire, cyl. 4
DTC P0305	Misfire, cyl. 5
DTC P0306	Misfire, cyl. 6
DTC P0307	Misfire, cyl. 7
DTC P0308	Misfire, cyl. 8
DTC P0460	Fuel level in fuel tank too low
DTC P0462	Fuel level in fuel tank too low
i	If too many misfires occurr in one cylinder, then that cylinder will be turned off (cylinder selective fuel shut-off). **Misfire due to ignition system faults:** If ignition does not occur, misfires will result. If there are faults stored in the ignition system, in addition to the misfire, start at the ignition system first. Max. rough running per cylinder is $3m^2$ if this value is exceeded, then proceeed as follows: 1. turn off one of the ignition circuits, using the SDS/HHT 2. Observe rough running of the affected cylinder: if the value has changed very little, (up to approx. $2m^2$, then the remaining ignition circuit is OK. If the value has changed considerably, (beyond $2m^2$ then the activated ignition circuit has a fault: spark plug, igntion lead or igntion coil. **Misfire due to fuel starvation:** With recognized misfires, with a low fuel level in the fuel tank the DTC codes P0460 and P0462 are set, thus this information indicates a misfire due to low fuel level in fuel tank. **Misfire due to additional causes:** Misfires can be caused by the fuel injection system, additional faults may be stored, mechanical faults of the engine must be considered as well.

Continued

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0325 DTC P0330	Right KS (A16g1) Left KS (A16g2)
Fault memory and activation of Check Engine (MIL)	Fault is immediately stored in memory Check Engine (MIL) is not activated
Test frequency	Continuously
Tested signal or condition	Knock sensor signal (in control module determined comparison via amplitude)
Lower threshold limit Upper threshold limit	approx. 0.10V approx. 4.98V
Test pre-requisites	– engine at operating temperature – engine rpm > 2000/rpm – engine load > 40% – knock regulation not active
i	With faults, a safety ignition timing retart setting on all cylinders.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0335	CKP sensor signal (L5)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	CKP sensor (L5) signal (flywheel tooth count)
Lower threshold limit Upper threshold limit Test duration	(60 -2 teeth) - 1 tooth 60 -2 teeth) + 1 tooth aprox. 5 sec.

DTC P0341	CMP sensor signal (B6/1)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	CMP sensor (B6/1)
Plausibility No signal: Count:	 within 2 engine revolutions the signal must change from 0 to 1 and from 1 to 0 max. of 1 signal changeover (1 to 0 and 0 to 1) per engine revolution

Continued..

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0341	CMP sensor signal (B6/1)
Test pre-requisites	– engine rpm 25-6000 – no faults from CKP sensor (L5)
i	To minimize damage to the catalytic converter, a missing signal from the Hall sensor or improper synchronization, results in fuel shutoff.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0400	EGR valve vacuum transducer (Y31/1)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	One per drive
Tested signal or condition	Intake manifold pressure
Limit threshold value Test duration	Vacuum in manifold must decrease by 38 mbar when exhaust gas recirculation flow is active approx. 2 sec.
Test pre-requisites	– no fault from EGR valve vacuum transducer (Y31/1) – no fault from pressure sensor (B28) – injector shut off is active – engine rpm approx. 900-1700 and constant – vehicle altitude location is under 8000 ft
i	If the requirement are met, then the intake manifold pressure is measured and subsequently the exhaust gas recirculation is briefly activated.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0410	Air injection system
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Once per driving cycle.
Tested signal or condition	Lambda regulation
Limit threshold value Test duration	Lambda regulation factor approx. +25% ("rich" - detent stop) approx. 10 sec.
Test pre-requisites	– engine at idle – vehicle stationary – air injection pump has been activated 1x after engine start – no faults with voltage supply to exhaust gas recirculation valve (Y31/1), air pump switchover valve (Y32) and electrical air pump (M33) – no faults with exhaust gas recirculation system – no faults with EA/CC/ISC actuator (M16/1) – no combustion misfires – no faults with 02 sensor before catalytic converter, aging – no faults with CAN Databus – self adaption of mixture formation not at limit values – outside air pressure over approx. 780 hPa (since the test will not be done above 8000 ft) – engine coolant temperature greater than 50°C – Lambda regulation released – A/C system OFF

Continued..

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0410	Air injection system
Test sequence	With the start of the logic chain, all functions for the self adaption of the mixture formation are locked. The exhaust gas recirculation valves are closed and the current lambda regulation factor is attained. There after air injection follows. The mixture must be leaned out. As a result, the lambda regulation factor reacts with an increase of approx. 25%.
i	If the requirements change during the test, the test is as a result stopped and is later restarted again.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0422 DTC P0432	TWC right efficiency TWC left efficiency
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Voltage relationship (amplitudes) between 02 sensors before catalytic converters and 02 sensors after catalytic converters
Limit threshold value Test duration	02 sensor signal after catalytic converter is max. 80% of 02 sensor signal before catalytic converter approx. 170 sec.
Test pre-requisites	– engine rpm 1050-2400 – engine load approx. 20% to 54% – catalytic converter temperature > 380˚C – lambda regulation released and lambda > 0.4 – no faults with 02 sensors (signal, heating, aging) – no combustion misfires

Continued

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0422 DTC P0432	TWC right efficiency (continued) TWC left efficiency
i	The catalytic converter is evaluated for its oxygen storing capability. Within the required engine rpm and load ranges many measurements need to be accomplished. The results are compared to a map and from there faults are recognized. The amplitude of the 02 sensors after the catalytic converters must be smaller then the amplitude of the 02 sensors before the catalytic converters. (Hint; if for example, a monolith was left out within the catalytic converter, then the 02 sensors signals both before and after the catalytic converters would be identical). If the fault codes for the catalytic converter and the 02 sensor before stored at the same time, then replace the 02 sensor before the catalytic converter first. If thereafter, no more catalytic converter fault is present, then the catalytic converter is slightly reducted in effectiveness, but does not need to be replaced.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0440	Evap. system malfunction
DTC P0441	Evap. system malfunction (purge valve function)
DTC P0442	Evap. system leak small
DTC P0455	Evap. system leak large
Fault memory Activation of Check Engine (MIL)	After completion of test duration and faults Two in sequence driving-cycles with faults
Test frequency	Once per drive-cycle
Tested signal or condition	Pressure values per fuel tank pressure sensor (B4/3)
Large leak test Small leak test Test duration	Vacuum of approx. 0.4 mbar per second is not attained. Loss of vacuum within closed system is 15% greater the achieved vacuum values during the large leak test above. approx. 30 sec

Continued

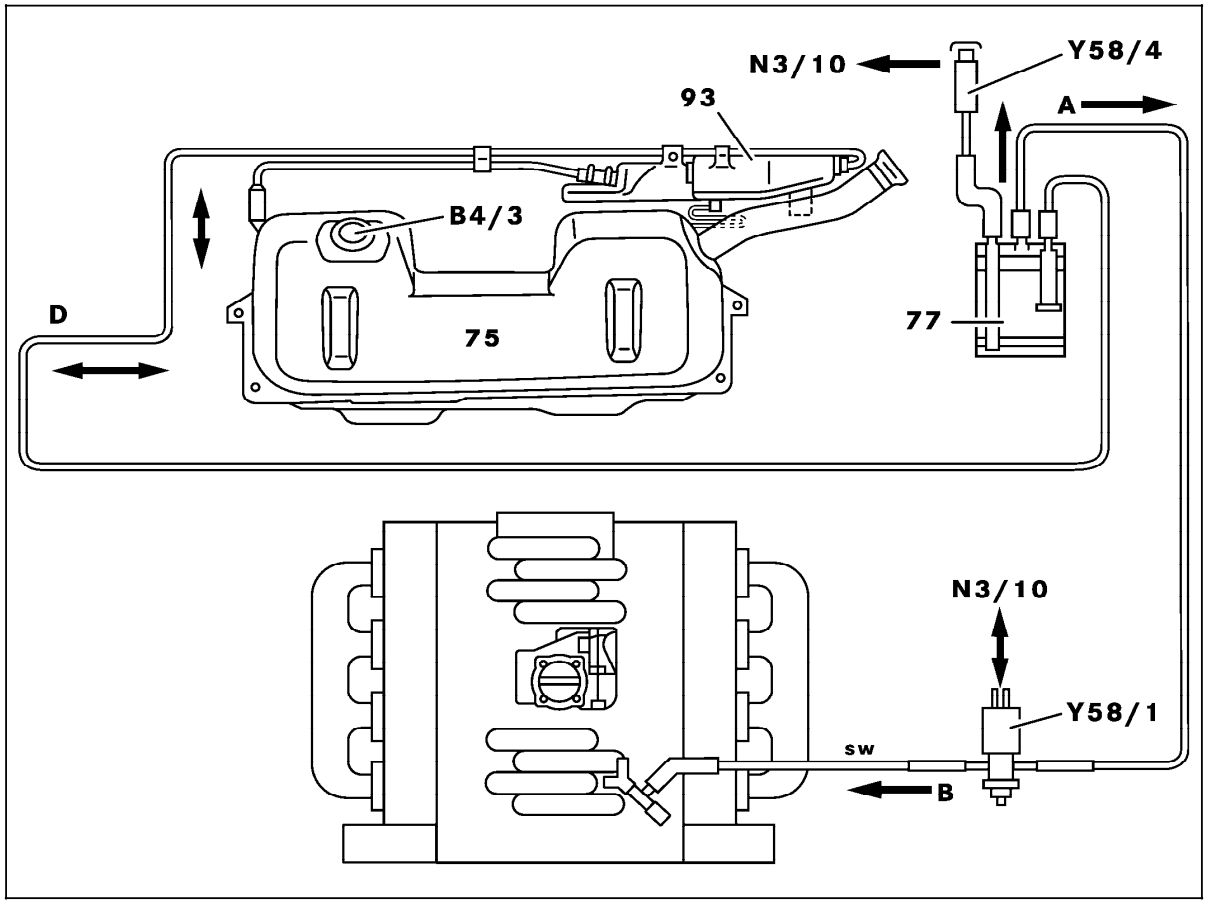
Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0440	Evap. system malfunction
DTC P0441	Evap. system malfunction, purge valve function
DTC P0442	Evap. system leak small
DTC P0455	Evap. system leak large
Test pre-requisites	– engine at idle – vehicle stationary – lock time of approx. 16 min. after engine start has elapsed – lambda regulation released – air injection is not active – outside air pressure over approx. 780 hPa (since the test will not be done above 8000 ft) – little saturation of activated charcoal cannister – lambda is > 0.9 during the testing – with a fuel tank level of <1/4 and > 3/4 only the large leak test is undertaken – if the fuel within the fuel tank sloshes greatly (large pressure variations), the fuel tank pressure sensor (B4/3) recognizes same and stops the test. – no fault at activated charcoal cannistershut-off valve (Y58/4) – no fault at fuel tank pressure sensor (B4/3) – no fault at fuel level sensor – no fault purge valve function (open/close)
i	The DTC P0455 is stored in memory, if the fuel tank pressure sensor (B4/3) is defective.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

Evaporative System
Engine 119 shown without On-board Refueling Vapor Recovery

The leak test for the EVAP system must detect leaks of 1mm in diameter. By law no fuel vapors are to be admitted to atmosphere.



P47.30-0284-06

Figure 1

75	Fuel tank
77	Actvated charcoal cannister
93	Fuel tank expansion reservoir
A	Activated charcoal cannister to purge valve hose
B	Purge valve to intake manifold hose
D	Fuel tank to activated charcoal cannister hose
B4/3	Fuel tank pressure sensor
N3/10	Engine control module (ME-SFI)
Y58/1	Purge control vlave
Y58/4	Activated charcoal canister shut-off valve

Function

The leak test (logic chain) is acomplished in two phases:

- Large leak test
- Small leak test

Continued...

Diagnosis – Diagnostic Trouble Code (DTC) Memory

Function (continued)

1. Large leak test

The activated charcoal cannister shut-off valve (Y58/4) is closed and the purge valve (Y58/1) is opened. As a result, the intake manifold vacuum reaches the fuel tank and is evaluated by the fuel tank pressure sensor (B4/3).
If no vacuum is established (i.e. approx. -4mbar within 10 seconds) a large leak is present (fuel tank cap open, loose hose connection etc.).

If the enginbe control module (N3/10) recognizes a large leak within the fuel system, the fuel reserve indicator lamp (A1e4) in the instrument cluster will blink as a result.

2. Small leak test

If the large leak test results in no fault then a small leak test is performed.
Once a vacuum of -7mbar is achieved, the purge control valve (Y58/1) is closed and the vacuum is evaluated for an additiuonal 30 seconds.
The vaccum must remain consistant during this time period. Should a leak be detected, then a fault is recognized.
After the test, the activated charcoal cannister shut-off valve (Y58/4) is opened.
The purge control valve (Y58/1) is checked for proper function via activation at the same time.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0443	Purge control valve (Y58/1)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Voltage or amps at purge control valve
Limit threshold values Short to ground Short to positive (+ 12 V) Open circuit Test duration	 Voltage < 4 V Amps > 4.2 A No voltage at purge control valve (approx. 4-8 V at output stage). approx. 1 second
i	The activation of the purge control valve is checked for harness opens and shorts to ground or positive. Shorts to ground and open circuits are recognized with a locked endstage, where else a short to positive is recognized with a conducting endstage. With a fault detected, the endstage is immediately no longer activated.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0446	Activated charcoal cannister shut-off valve (Y58/4)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Voltage supply at activated charcoal cannister shut-off valve (Y58/4)
Limit threshold values, voltage supply Short to ground Short to positive (+ 12 V) Open circuit Test duration	 Voltage < 4 V Amps > 4.2 A No voltage at purge control valve (approx. 4-8 V at output stage). approx. 1 second
i	The activation of the purge control valve is checked for harness opens and shorts to ground or positive. Shorts to ground and open circuits are recognized with a locked endstage, where else a short to positive is recognized with a conducting endstage. With a fault detected, the endstage is immediately no longer activated.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0450	Fuel tank pressure sensor (B4/3)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continual
Tested signal or condition	Fuel tank pressure sensor (B4/3) electrical fault Fuel tank pressure sensor (B4/3) signal flucuations
A Lower threshold limit Upper threshold limit Test duration **B** Signal sequence	 greater than 4.7 V (relates to approx. 35 mbar positive pressure) smaller than 0.1 V (relates to approx. -60 mbar vacuum) approx. 10 sec. The fuel tank pressure, with active recirculation can pusate at max. 2 mbar (0.1 V), otherwise the activated charcoal cannister maybe clogged.
Test pre-requisites	– engine at idle
i	The test is run independent of the evap. system leak test The sensor is tested for an electrical fault (short circuit, short to ground or positive). If the sensor voltage is below or above values, a fault is present. Base line for fuel tank pressure sensor: -50 mbar approx. 0.5 V; 0 mbar approx. 3.0 V; +30 mbar approx. 4.5 V. If the sensor is "hung",a constant signal yet plausible signal can be present. In this case, a large leak will be present in the evap. system.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0500	VSS signal
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults, stored in DTC memory Check Engine (MIL) is not activated (illuminated)
Test frequency	Continuously
Tested signal or condition	A VSS signal left front B VSS signal left rear
Limit threshold values Test duration Plausibility Test duration	After approx. 8 miles per hr vehicle speed, the VSS signals must be recognized approx. 5 sec. Requirement after approx. 25 miles per hr vehicle speed: VSS front minus VSS rear < ± 18 miles per hr approx. 30 sec.
Test pre-requisites	– engine rpm approx. 2500-4500 – engine load > 40% – transmission selector lever in D
i	The wheel speed (VSS signal) is recognized and evaluated via the ASR or ESP (G-wagen = ABS) control module. The ME-SFI control module receives the VSS signal via the CAN databus. Readout DTC memory (i.e. driving on dynometer) for ME-SFI and ASR or ME-SFI and ESP control modules [G-wagen = fault codes in ME and ABS control modules]).

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0507	ISC control system unplausible
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Engine rpm
Upper threshold limit value Lower threshold limit test duration	Nominal value + 200 rpm Nominal value - 100 rpm approx. 30 sec. If the activation of the actuator motor within actuator (via the ME control module) is performed, then the new value must be attained within 25 sec.
Test pre-requisites	– Engine temperature > 20° C – Climate control system: **OFF** – Vehicle stationary

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0520 (not USA)	Cylinder shut-off, oil pressure sensor
Fault memory and activation of Check Engine (MIL)	–
Test frequency	–
Tested signal or condition	–
Limit threshold value Test duration	–
Test pre-requisites	–

DTC P0560	Battery voltage at ME-SFI control module
Fault memory and activation of Check Engine (MIL)	Two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Battery voltage to control module ME
Limit threshold value Test duration	Voltage must be between approx. 8 V and 17.5 V approx. 5 sec.
Test pre-requisites	– Time period of 180 sec. has elapsed since start

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0600 DTC P1747	CAN bus from ASR/ESP control module CAN bus from ETC or instrument cluster
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	CAN communication
Test duration	approx. 15 sec.
i	The data transmission between the control modules is monitored via the CAN controller within the ME-SFI control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0700	Transmission control system malf. (gear ratio unplausible, transmission leak)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Monitor time and test frequency	Continuously
Tested signal or condition	Calculated gear ratios relationship out of tolerance
Acceptable gear ratios Test duration	–0.20 to 0.20 1st and 2nd gear –0.05 to 0.050 3rd gear –0.03 to 0.030 4th and 5th gear –0.02 to 0.20 Reverse gear approx. 2 sec.
Test pre-requisites	– engine rpm greater than 400 – output shaft rpm greater than 180 rpm (12 miles per hr) – no shift undertaken
Test sequence	If there is no shift undertaken, then the ETC control module recognizes the gear ratio relationship for the gear in use. If the acceptable gear ratio is out of tolerance or the gear recognition is unplausible, then the modulator pressure is adjusted to its highest value after approx. 5 seconds. Should the gear ratio remain out of tolerance or the gear recognition is unplausible then after 1 second a DTC is stored.
i	The calculated gear ratios are calculated from the following values: N2 rpm, N3 rpm and outputshaft rpm (via rear wheel VSS). Faults are noted by the ETC control module and sent via CAN data bus to the ME-SFI control module. DTC storage and activation of the CHECK ENGINE (MIL) occur via the ME-SFI control module. Readout additional DTC 51 from ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0700	Command valve sticks in pressure position
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Calculated gear ratio relationship out of tolerance
Acceptable gear ratios Test duration	–0.20 to 0.20 1st and 2nd gear –0.05 to 0.050 3rd gear –0.03 to 0.030 4th and 5th gear –0.02 to 0.20 Reverse gear approx. 2 sec.
Test pre-requisites	– engine rpm greater than 400 – output shaft rpm greater than 180 rpm (12 miles per hr) – no shift undertaken
Test sequence	After each shift procedure the shift pressure is reduced gradually. If the activated shift components drag after the pressure reduction, the command valve will bind in the shift phase (pressure) side. Shift components which drag will be recognized via the gear ratio relationship tolerances
i	The calculated gear ratios are calculated from the following values: N2 rpm, N3 rpm and outputshaft rpm (via rear wheel VSS). Faults are noted by the ETC control module and sent via CAN data bus to the ME-SFI control module. DTC storage and activation of the CHECK ENGINE (MIL) occur via the ME-SFI control module. Readout additional DTC 51, 52 from ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0702	Transmission control system malf. (electrical)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Faults within ETC control module – CAN data bus communication – Unacceptable version coding – Internal memory (RAM, ROM, EEPROM)
i	Faults are recognized via the ETC control module and are sent via the CAN data bus to the ME-SFI control module. DTC memory and activation of the CHECK ENGINE MIL are done via the ME-SFI control module. Readout additional DTCs 56–65 in ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0702	Voltage supply to solenoid valves
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Voltage supply to solenoid valves
Lower threshold limit value Upper threshold limit value	approx. 8.5 V (longer then approx. 0.1 sec.) approx. 15 V (longer then approx. 0.1 sec.)
Test sequence	The solenoid valves are supplied battery voltage vis the ETC control module. The difference in value between battery voltage and supplied battery voltage to the solenoid valves is monitored by the ETC control module.
i	Faults are recognized via the ETC control module and are sent via the CAN data bus to the ME-SFI control module. DTC memory and activation of the CHECK ENGINE MIL are done via the ME-SFI control module. Readout additional DTC in ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0715	RPM sensor function, voltage supply
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	– RPM sensor voltage supply – N2 rpm – N3 rpm
RPM sensor voltage supply Lower threshold limit value Upper threshold limit value N2, N3 rpm signals Test duration	 < 4.8 V > 7.2 V Signals recognized and plausible approx. 1 sec.
Test pre-requisites N2 rpm sensor	– engine rpm > 450 – right rear wheel rpm (VSS) > 250 – left rear wheel rpm (VSS) > 250 – 3rd or 4th gear recognized – output shaft rpm > 180 rpm (12 miles per hr) – no shift undertaken

Continued

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0715	RPM sensor function, voltage supply
Test sequence	After a predetermined engine and wheel rpm, the rpm sensor signals must be recognized. For the N3 rpm signal, 3rd or 4th gear must be engaged.
i	Faults are recognized via the ETC control module and are sent via the CAN data bus to the ME-SFI control module. DTC memory and activation of the CHECK ENGINE MIL are done via the ME-SFI control module. Readout additional DTC i1, i2, i3 in ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0720	CAN fault recognition
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Wheel rpm (VSS) is checked for plausibility via ETC control module which receives the signal via the ASR and ESP control modules via the CAN data bus
Test duration	approx. 1 sec.
i	Faults are recognized via the ETC control module and are sent via the CAN data bus to the ME-SFI control module. DTC memory and activation of the CHECK ENGINE MIL are done via the ME-SFI control module. Readout additional DTC (22, 23, 38) in ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0730	Transmission range comparison
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Comparison of known gear ratio and engaged gear (calculated gear ratio) is at least 6X negative
Test pre-requisites	– 2nd, 3rd, 4th or 5th gear recognized – engine rpm greater than 450 – output shaft rpm greater than 180 rpm (12 miles per hr) – no shift undertaken
i	The calculated gear ratios are calculated from the following values: N2 rpm, N3 rpm and outputshaft rpm (via rear wheel VSS). Faults are noted by the ETC control module and sent via CAN data bus to the ME-SFI control module. DTC storage and activation of the CHECK ENGINE (MIL) occur via the ME-SFI control module. Readout additional DTC (55) from ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0740	Torque converter lock-up clutch
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Friction value of torque converter lock-up clutch
Test sequence	The friction value is monitored via during torque converter lock-up by noting rpm differences. Should the values be out of tolerance numerous times, a DTC fault is noted.
i	Faults are recognized via the ETC control module and are sent via the CAN data bus to the ME-SFI control module. DTC memory and activation of the CHECK ENGINE MIL are done via the ME-SFI control module. Readout additional DTC 53 in ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0743	PWM solenoid valve (Y3/6y6)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	PWM solenoid valve engagement quality
Lower threshold limit value Upper threshold limit value Test duration	< 5 % > 94% 1 sec.
i	Faults are recognized via the ETC control module and are sent via the CAN data bus to the ME-SFI control module. DTC memory and activation of the CHECK ENGINE MIL are done via the ME-SFI control module. Readout additional DTC 5 in ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0748	Modulating pressure regulating solenoid valve (Y3/6y1)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Monitor time and test frequency	Continuously
Tested signal or condition	Activation of modulating pressure regulating solenoid valve
Limit values Short to ground Lower threshold limit value, voltage Upper threshold limit value, voltage Lower threshold limit value, amps Upper threshold limit value, amps Test duration	 < 0.4 V approx. 8.5 V approx. 15 V approx. 0.300 A approx. 0.700 A 1 sec.
i	Faults (open circuit, short or short within solenoid while activating) are recognized via the ETC control module and are sent via the CAN data bus to the ME-SFI control module. DTC memory and activation of the CHECK ENGINE MIL are done via the ME-SFI control module. Readout additional DTC Б in ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0748	Shift pressure regulating solenoid valve (Y3/6y2)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Activation of shift pressure regulating solenoid valve (Y3/6y2)
Limit values Short to ground Lower threshold limit value, voltage Upper threshold limit value, voltage Lower threshold limit value, amps Upper threshold limit value, amps Test duration	 < 0.4 V approx. 8.5 V approx. 15 V approx. 0.300 A approx. 0.700 A 1 sec.
i	Faults (open circuit, short or short within solenoid while activating) are recognized via the ETC control module and are sent via the CAN data bus to the ME-SFI control module. DTC memory and activation of the CHECK ENGINE MIL are done via the ME-SFI control module. Readout additional DTC 1 in ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0753	1-2/4-5shift solenoid valve (Y3/6y3)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Voltage supply to 1-2/4-5shift solenoid valve (Y3/6y3)
Limit values Lower threshold limit value, voltage Upper threshold limit value, voltage Test duration	 approx. 8.5 V approx. 15 V approx. 1 sec.
i	Faults (open circuit, short or short within solenoid while activating) are recognized via the ETC control module and are sent via the CAN data bus to the ME-SFI control module. DTC memory and activation of the CHECK ENGINE MIL are done via the ME-SFI control module. Readout additional DTC 2 in ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0758	2-3 shift solenoid valve (Y3/6y5)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Voltage supply to 2-3 shift solenoid valve (Y3/6y5)
Limit values Lower threshold limit value, voltage Upper threshold limit value, voltage Test duration	 approx. 8.5 V approx. 15 V approx. 1 sec.
i	Faults (open circuit, short or short within solenoid while activating) are recognized via the ETC control module and are sent via the CAN data bus to the ME-SFI control module. DTC memory and activation of the CHECK ENGINE MIL are done via the ME-SFI control module. Readout additional DTC ∃ in ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0763	3-4 shift solenoid valve (Y6/3y4)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Voltage supply to 3-4 shift solenoid valve (Y6/3y4)
Limit values Lower threshold limit value, voltage Upper threshold limit value, voltage Test duration	 approx. 8.5 V approx. 15 V approx. 1 sec.
i	Faults (open circuit, short or short within solenoid while activating) are recognized via the ETC control module and are sent via the CAN data bus to the ME-SFI control module. DTC memory and activation of the CHECK ENGINE MIL are done via the ME-SFI control module. Readout additional DTC 4 in ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P1183 (not USA)	Cylinder shut-off
DTC P1183 (not USA)	Cylinder shut-off
DTC P1355 (not USA)	Cylinder shut-off
DTC P1356 (not USA)	Cylinder shut-off
DTC P1357 (not USA)	Cylinder shut-off
DTC P1358 (not USA)	Cylinder shut-off
DTC P1359 (not USA)	Cylinder shut-off
DTC P1360 (not USA)	Cylinder shut-off
DTC P1361 (not USA)	Cylinder shut-off
DTC P1366 (not USA)	Cylinder shut-off
DTC P1380 (not USA)	Cylinder shut-off
Fault memory and activation of Check Engine (MIL)	–
Test frequency	–
Tested signal or condition	–
Limit threshold value Test duration	–
Test pre-requisites	–

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P1386	Knock sensor control in N3/10
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, fault is stored immediately Check Engine (MIL) is not activated (illuminated)
Test frequency	After each deactivation of the knock sensor control
Tested signal or condition	Hardware test of knock sensor control
Test pre-requisites	– engine at operating temperature – engine load is decreasing (deactivate knock sensor control)
i	Fault must appear at least 10 times.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC	P1400 EGR valve vacuum transducer (Y31/1)
DTC P1400	EGR valve vacuum transducer (Y31/1)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Voltage/amps check at EGR valve vacuum transducer (Y31/1)
Limit threshold values Short to ground Short to positive Open circuit	 approx. < 2.5 Volts approx. > 4.2 Amps no voltage at EGR valve vacuum transducer (Y31/1), (approx. 4-8 V at output side of control module ME).
Test pre-requisites	– Battery voltage at 8-17.1 Volts
i	Tested are shorts and open circuits (shorts to ground and to positive). Shorts to ground and open circuits are recognized with a locked endstage, where else a short to positive is recognized with a conducting endstage. With a fault the endstage is no longer activated.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P1420 DTC P1453	AIR pump switchover valve (Y32) AIR relay module, AIR pump
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Via the amp measurement of each endstage, the voltage supply of the relay air pump in relay module (K40) and AIR pump switchover valve (Y32) are evaluated.
Limit threshold values	Air injection: **OFF**: max. of 3 volts are allowed at the output side. Air injection: **ON**: a min. of 9 volts must be at the output side.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P1542	Pedal value sensor (B37)
Fault memory and activation of Check Engine (MIL)	faults are stored immediately, the Check Engine (MIL) is not activated.
Test frequency	Continuously
Tested signal or condition	Voltage signal 1 and 2 are compared
Difference at idle Difference at full load Plausibility Test duration	Fault, if the voltage difference is > 8 % (up to a 60% angle change of the pedal value sensor). Fault, if the voltage difference is > 25 % (beyond the 60% angle change of the pedal value sensor). For Comparison: signal 2 is multiplied 2X approx. 30 sec.
Test pre-requisites	– the lock time after start of 60 seconds has elapsed.
i	With the production start up of engine 112 and 113, a pedal sensor with Hall sensors has been phased in. Comparison of throttle plate angle to air mass value and pedal value sensor must be plausible.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P1580	EA/CC/ISC actuator (M16/1)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Voltage comparison of actual values potentiometer 1 and actual values potentiometer 2
Plausibility	– Voltage difference can be up to 1° of the throttle plate angle. – Comparison of throttle plate angle to air mass value and pedal value sensor must be plausible.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P1666 (not USA)	Cylinder shut-off
Fault memory and activation of Check Engine (MIL)	–
Test frequency	–
Tested signal or condition	–
Plausibility	–

Diagnosis – Diagnostic Trouble Code (DTC) Memory

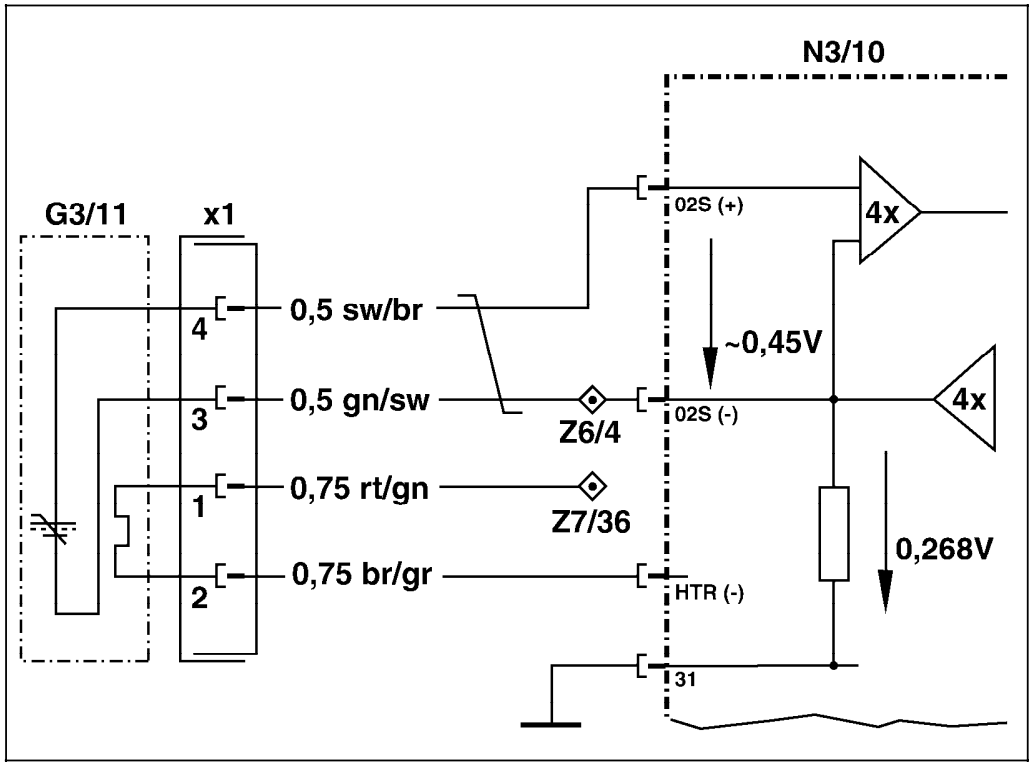
Figure 1

02 sensor voltage as shown on engine 137

G/3 Sensor signal sensitivity ok
X1 Connector
1 Circuit 78 Sensor heating
2 Sensor heating ground
3 Sensor signal ground
4 Sensor signal (approx. 0.45 V at λ = 1 and 02 sensor at operating temperature.

N3/10 control module ME
4X measurement amplifier for sensor signal and sensor ground evaluation switching
0.268 V opposite voltage based on ground circuit 31

Z6/4 Connector socket sensor signal ground
(4 02 senosrs, engine 137 only)
Z7/36 Connector socket circuit 87



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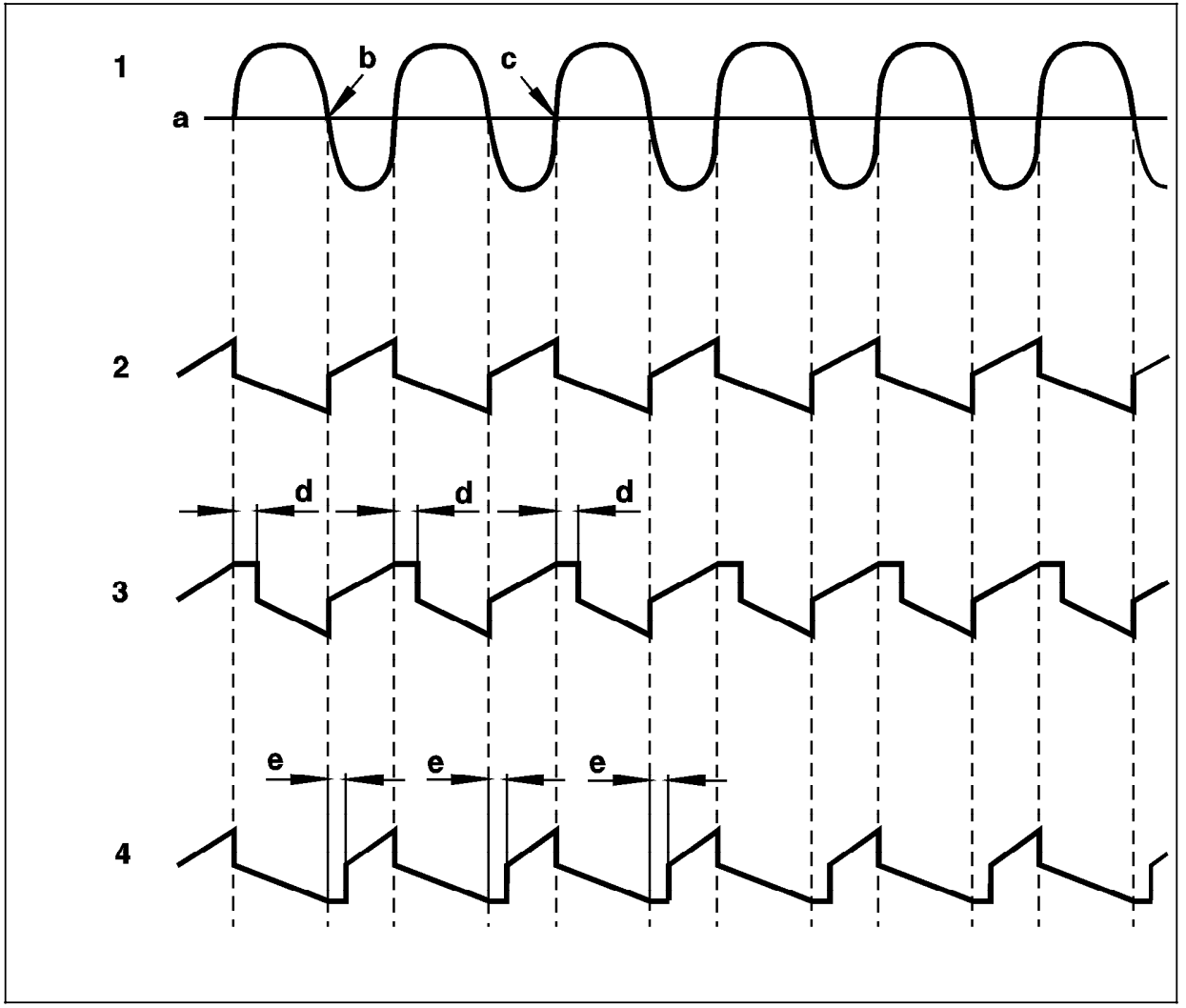
Diagnosis – Diagnostic Trouble Code (DTC) Memory



P07.61-0383-06

Figure 2
Two 02 sensor regulation

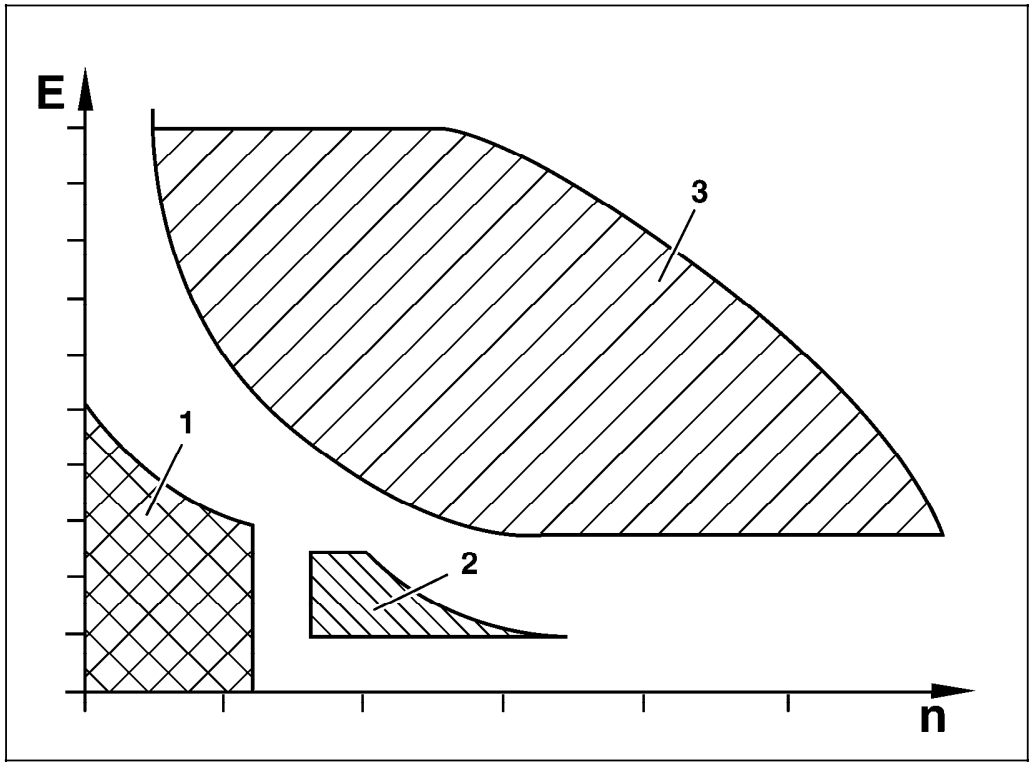
1 02 sensor signal before CAT.
a Voltage peak for Rich - lean changeover (B) or
Lean - rich changeover (c)

2 Lambda regulation without correction

3 Lambda regulation with correction (d), time delay (+TV) towards Rich

4 Lambda regulation with correction (e), time delay (+TV) towards Lean

Diagnosis – Diagnostic Trouble Code (DTC) Memory



P07.61-2529-11

Figure 3
Fuel mixture - self adaption

1 Idle range
2 Range between idle and part load
3 Part load range

E Injection amount
n Engine rpm

Diagnosis – Diagnostic Trouble Code (DTC) Memory

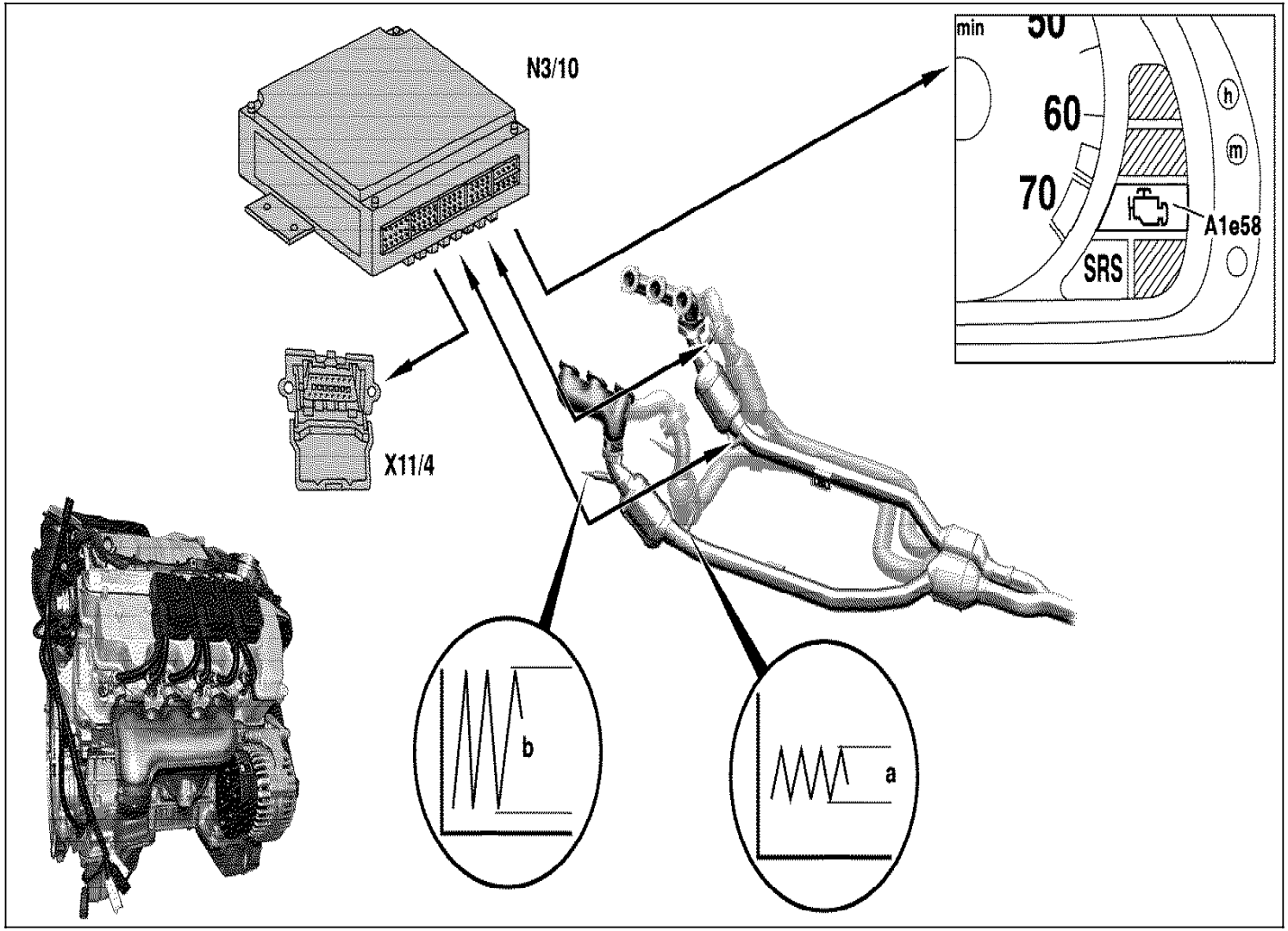


Figure 4

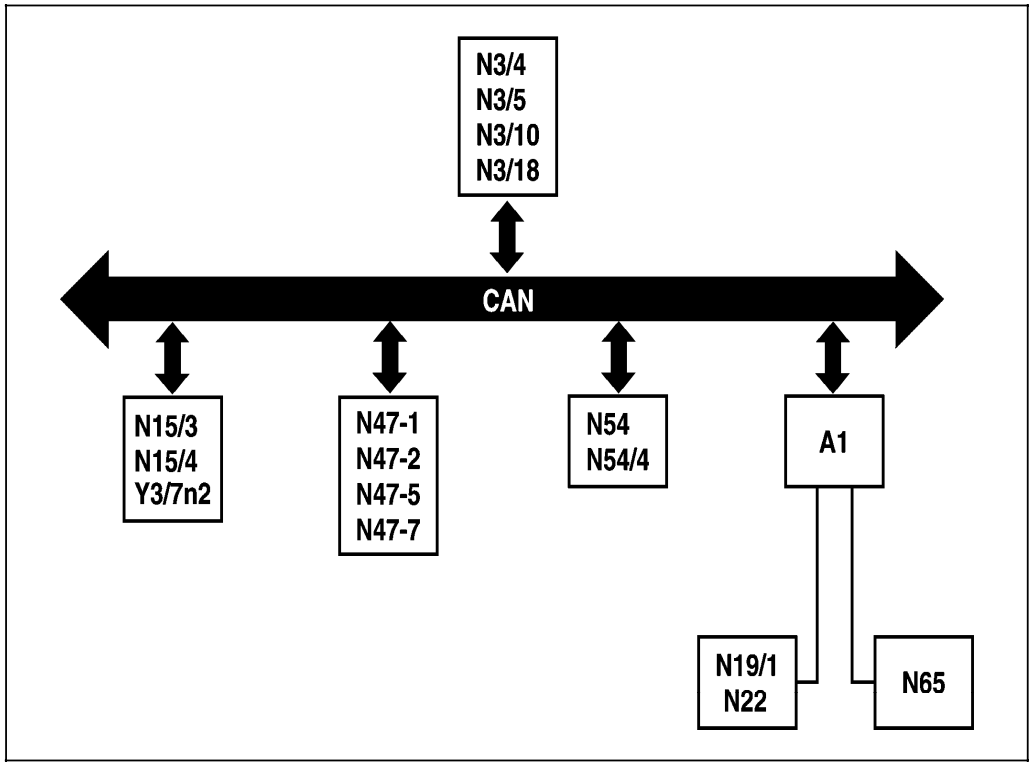
Engine 112 (not (USA)) **shown**

A1e58	Engine diagnostic indicator lamp
N3/10	Control module ME
X11/4	Data link connector (DTC readout
a	Amplitude of 02 sensor signal after CAT
b	Amplitude of 02 sensor signal before CAT

P49.10-2116-09

Diagnosis – Diagnostic Trouble Code (DTC) Memory

Figure 5
Engine CAN data bus
Models 129, 140, 163, 170, 202, 203, 208 210



P54.18-2146-75

A1	Instrument cluster
N3/4	Engine control module (HFM-SFI)
N3/5	Engine maangement monolith control module (not USA)
N3/10	Engine control module (ME-SFI)
N15/3	ETC control module
N15/4	Automatic clutch control module (not USA)
N19/1	A/C pushbutton control module
N22	AAC control unit and module
N47-1	ASR/SPS control module
N47-2	ETS/SPS control module
N47-5	ESP/BAS control module
N47-7	ABS control module
N54	RCL control module
N54/4	DAS radio frequency/infrared control module
N65	Pulse module (traction systems, HCS,ATA, AAC)
Y3/7n2	FWD control module (not USA)

Diagnosis – Complaint Related Diagnostic Chart – Injection/Ignition

⚠ **WARNING!**
Risk of severe injury when touching ignition parts which produce high voltages. Do not touch igntion components.
Persons with heart pacemakers are not to perform repairs on this type of ignition system..

Electronic ignition systems produce dangerous high voltages on both the primary circuit and the secondary (ignition) circuits. Due to the high voltages produced, contact with any of the voltage carrying components can be dangerous to your health (burns, heart palpatations, cardiac arrest etc).

- Igntion must be turned OFF prior to performing any repair work on the igntion system.
- Do not come in contact or remove with any of the ignition components while the engine is cranking or idling.
- Wear rubber soled shoes.
- Disconnect connectors for CKP sensor at sensor or control module.
- If repairs require that the ignition be turned on, then dangerous voltages will be present through out the entire ignition system.
- No exposed metal connectors or sending units may be installed in the ignition wires.

⚠ **WARNING!**
Risk of fatal injury from being pulled into rotating vehicle parts.
Do not reach into rotating parts.
Wear closed and tight-fitting work clothes.
Protect vicinity of rotating vehicle components from unauthorized access.

⚠ **WARNING!**
Risk of explosion from fuel igniting, risk of poisoning from inhaling and swallowing fuel as well as risk of injury to eyes and skin from contact with fuel.
No fire, sparks, exposed flames or smoking.
Pour fuels only into suitable and appropriately marked containers.
Wear protective clothing when handling fuel.

Possible hazards

Risk of explosion, poisoning and injury

Fuels are highly inflammable and toxic if inhaled. Fuel may cause skin damage. Contact with gasoline fuel, for example, removes the natural oils on the skin. Fuel vapors are explosive, invisible and spread out at floor level. They are toxic if inhaled and have a narcotic effect in high concentrations.

Protective measures/guidelines

- Pay attention to national safety regulations and provisions.
- No fire, sparks, exposed flames or smoking.
- Ensure that the place of work is adequately ventilated.
- Never drain or pour in fuels over assembly pits.
- Store drained fuel in suitable and sealed containers.
- Immediately eliminate any fuel spills which have been spilled out of the container.

Continued on next page:

Diagnosis – Complaint Related Diagnostic Chart – Injection/Ignition

Conducting work on a vehicle with exposed flame
(e.g. welding etc.)

- Prior to commencing such work, remove appropriate parts of the fuel system and seal open fuel lines with plugs.

First-aid measures

- Clean contaminated/exposed skin with water and soap.
- Change contaminated clothing as quickly as possible.
- If fuel gets into the eyes, rinse out eyes immediately with water, and contact a doctor, if necessary.

To Avoid Damage to the Ignition System

- To avoid damage to the engine control module, connect/disconnect the control module connectors only with the ignition: **OFF**.
- Circuit 1 of the ignition coil may not be shorted to ground, e.g. theft deterence.
- Only original equipment should be installed in the ignition system.
- Do not operate the ignition system at cranking speed unless the entire igntion harness is connected.
- Do not perform any tests (grounding of ignition cable 4 disconnecting a spark plug connector or pulling cable 4 out of the ignition coil) at cranking or idle speed.
- The high output side of the ignition system must carry at least 2 kΩ of load (spark plug connector).
- If assisting a disabled vehicle and it becomes necessary to perform an igntion spark test, perform this test only on one ignition/sark plug. Ensure a good ground connection to the spark plug.
- ME - SFI: the ignition system is to be turned OFF, when cranking engine to perform compression tests, additionally, it is necessary to disconnect connector 2 from the control module.

Engine 120 has separate ignition and fuel injection system.

⚠
Readout via the impulse counter scan tool is not possible.

Note:
Symbol for emission related malfunctions which lead to the activation of the CHECK ENGINE MIL when a certain test cycle was performed and a fault was recognized.

Diagnosis – Complaint Related Diagnostic Chart – Injection/Ignition

⚠ WARNING!

Risk of severe injury when touching ignition parts which produce high voltages. Do not touch ignition components.
Persons with heart pacemakers are not to perform repairs on this type of ignition system.

Preparation for Test:

1. Review 11, 21, 22, 23, 24, 31, 33,

Complaint/Problem	Possible cause	Test step/Remedy [1]	Actual value Engine test Menu item
Engine starts and accelerates poorly when cold	Injector (Y62) activation and injection duration. Hot film MAF sensor (B2/5). ECT sensor (B11/4). Ignition voltage too low. Intake air leak.	23 ⇒ 18.0 – 25.0 23 ⇒ 4.0 23 ⇒ 8.0 24 ⇒ 21.0 Remedy air leak.	3/11 2/11 4/11 – –
Engine does not start	Voltage supply from engine control module (N3/10) is missing. Malfunction of drive authorization system (DAS) . Fuel pumps defective. No compression due to high oil pressure. Ignition voltage too low.	23 ⇒ 1.0 – 3.0 23 ⇒ 36.0 34 ⇒ 2.0 Check compression and oil pressure. 24 ⇒ 21.0	– DAS 1/1 – – –
Engine has uneven idle	Injector (Y62) activation and injection duration. Intake air leak.	23 ⇒ 1.0 – 2.0 Remedy air leak.	3/11 –

[1] Observe Preparation for Test, see 22.

Diagnosis – Complaint Related Diagnostic Chart – Injection/Ignition

Complaint/Problem	Possible cause	Test step/Remedy [1]	Actual value Engine test Menu item
Engine has insufficient output	TWC flow restricted.	Check exhaust back pressure, see DM, Engines, Vol. 1, section A, “Engine Output“	–
	O2S 1 (G3/3 or G3/4) (before TWC).	23 ⇒ 10.0 – 13.0	8/11
	ECT sensor (B11/4).	23 ⇒ 8.0	4/11
	Hot film MAF sensor (B2/5).	23 ⇒ 4.0	2/11
	Resonance intake manifold does not function	23 ⇒ 30.0	–
	Knock control at adjustment stop	Knock sensors	2/11
Engine runs unevenly (shakes)	Injector (Y62) activation and injection duration.	23 ⇒ 18.0 – 25.0	3/11
	Injector leaking, spray pattern.	36 ⇒ 1.0– 2.0	–
	O2S 1 (G3/3 or G3/4) (before TWC).	23 ⇒ 10.0 – 13.0	8/11
	Ignition voltage too low.	24 ⇒ 21.0	–
	Compression on one or more cylinders too low.	Check compression.	–
	Intake air leak.	Remedy air leak.	–
	Exhaust gas recirculation valve sticks/leaks	Replace valve	–
Engine runs unevenly (misfiring)	Ignition voltage too low.	24 ⇒ 21.0	–
	Hot film MAF sensor (B2/5).	23 ⇒ 4.0	2/11
Engine surges after cold start	Intake air leak.	Remedy air leak.	–
Transition failure during warm-up	ECT sensor (B11/4).	23 ⇒ 8.0	4/11
	Hot film MAF sensor (B2/5).	23 ⇒ 4.0	2/11
	Intake air leak.	Remedy air leak.	–
Transition failure when warm or increased fuel consumption	O2S 1 (G3/3 or G3/4) (before TWC).	23 ⇒ 10.0 – 13.0	8/11
	Purge control valve (Y58/1) stuck in open position.	23 ⇒ 31.0 – 32.0	4/11

[1] Observe Preparation for Test, see 22.

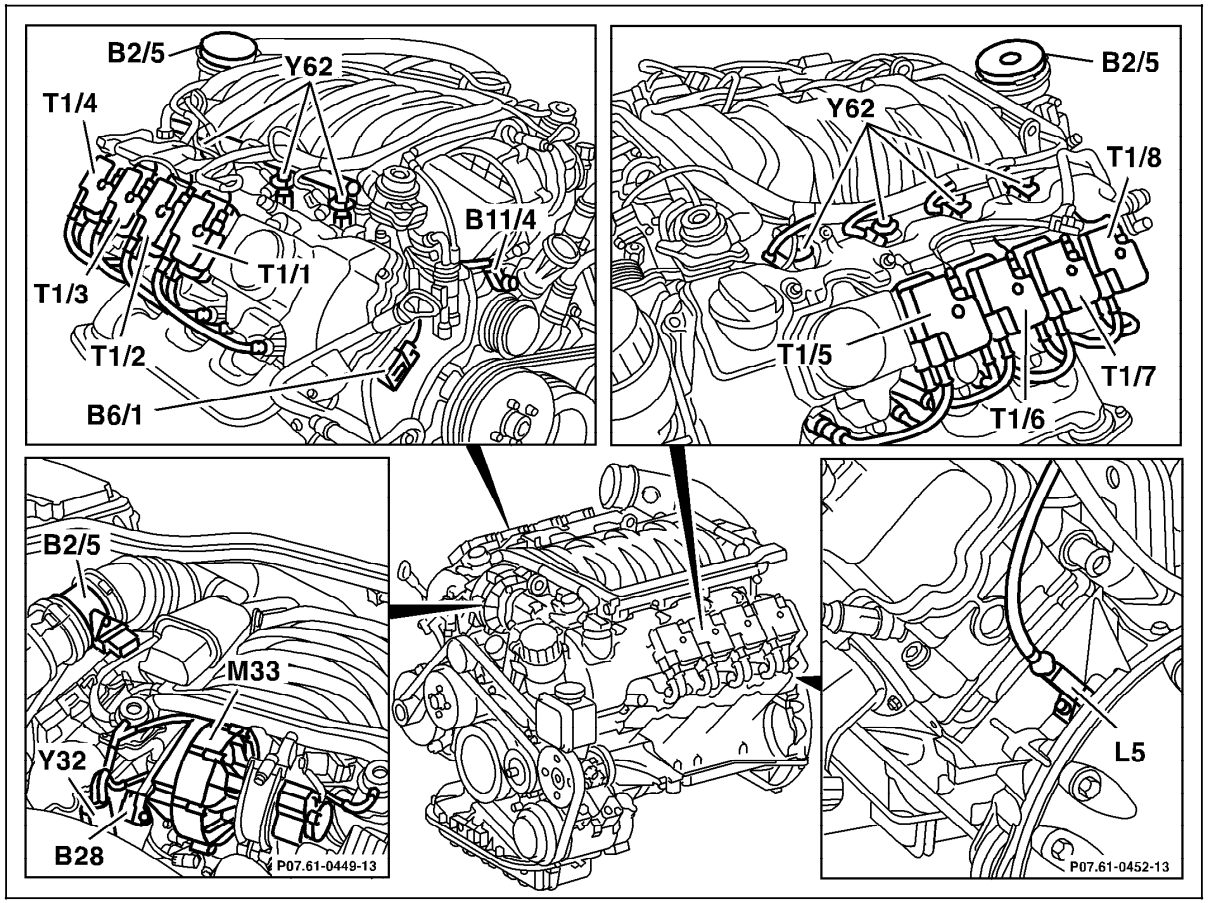
Diagnosis – Complaint Related Diagnostic Chart – Injection/Ignition

Complaint/Problem	Possible cause	Test step/Remedy [1]	Actual value Engine test Menu item
Engine bucks, jerks	Hot film MAF sensor (B2/5). Ignition voltage too low. O2S 1 (G3/3 or G3/4) (before TWC).	23 ⇒ 4.0 24 ⇒ 21.0 23 ⇒ 10.0 – 13.0	2/11 – 8/11
EA is in “limp-home” mode	Nominal value potentiometer in pedal value sensor (B37). EA/CC/ISC actuator actual value potentiometer.	25 ⇒ 1.0 – 2.0 25 ⇒ 3.0	5/11 5/11

[1] Observe Preparation for Test, see 22.

Electrical Test Program – Component Locations

Components on engine
Model 129



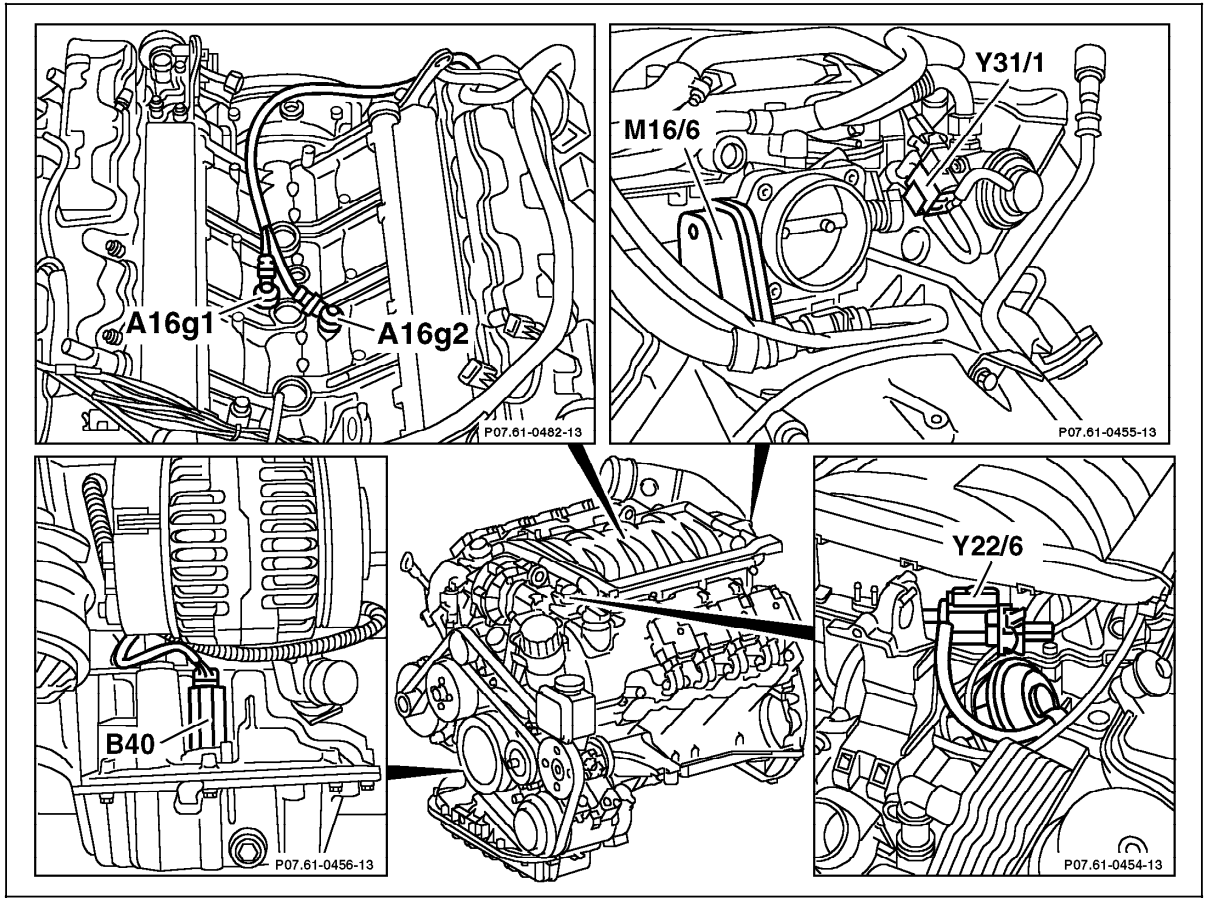
P07.61-2014-06

Figure 1

B2/5	Hot film MAF sensor
B6/1	Camshaft Hall-effect sensor
B11/4	ECT sensor
B28	Pressure sensor (only USA)
L5	CKP sensor
M33	AIR pump (only USA)
T1/1	Ignition coil 1
T1/2	Ignition coil 2
T1/3	Ignition coil 3
T1/4	Ignition coil 4
T1/5	Ignition coil 5
T1/6	Ignition coil 6
T1/7	Ignition coil 7
T1/8	Ignition coil 8
Y32	Air pump switchover valve (only USA)
Y62	Injectors

Electrical Test Program – Component Locations

Components on engine
Model 129



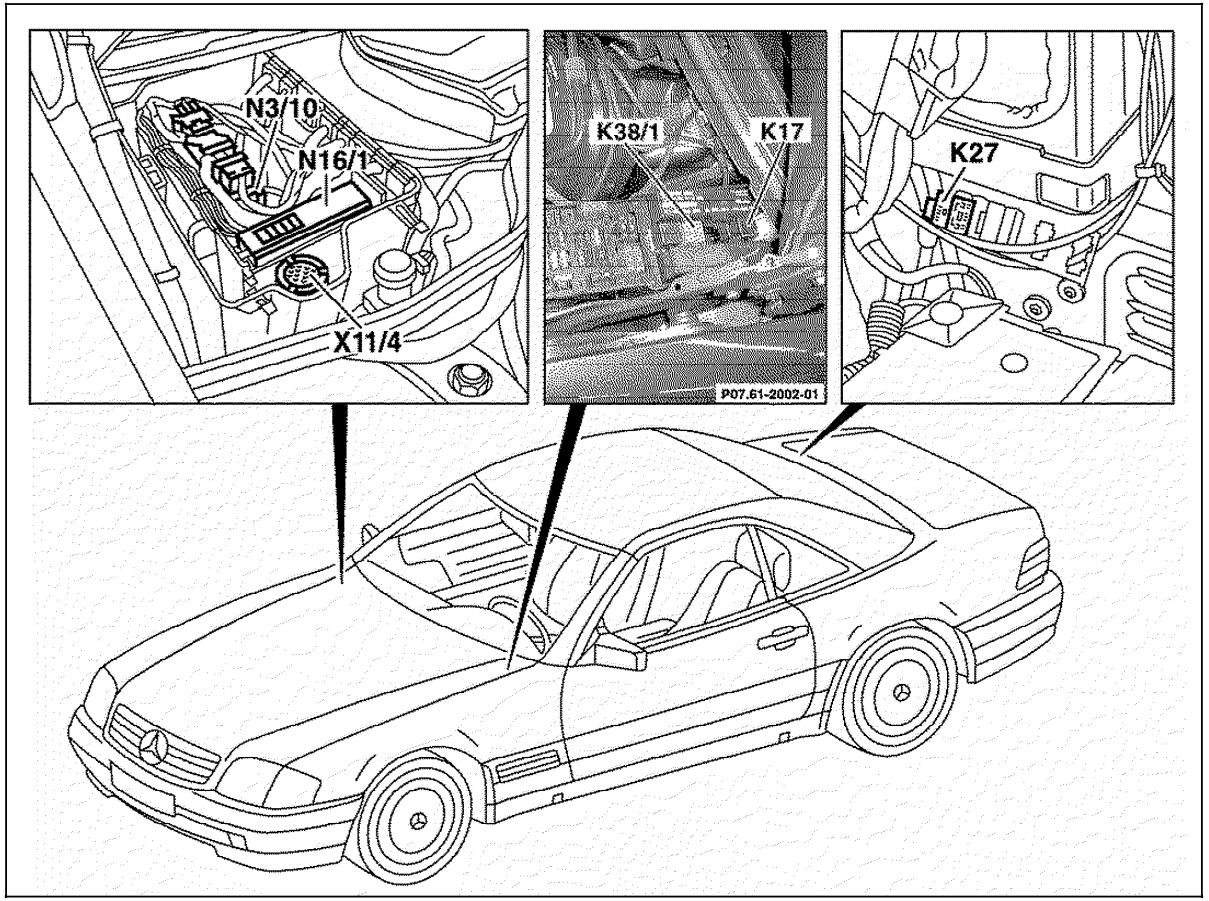
P07.61-0554-06

Figure 2

A16g1	KS 1 (right side of engine)
A16g2	KS 2 (left side of engine)
M16/6	EA/CC/ISC actuator
Y22/6	Resonance intake mainfold switchover valve
Y31/1	EGR valve vacuum transducer
B40	Oil sensor (level/temperature/quality)

Electrical Test Program – Component Locations

Engine Compartment
Model 129



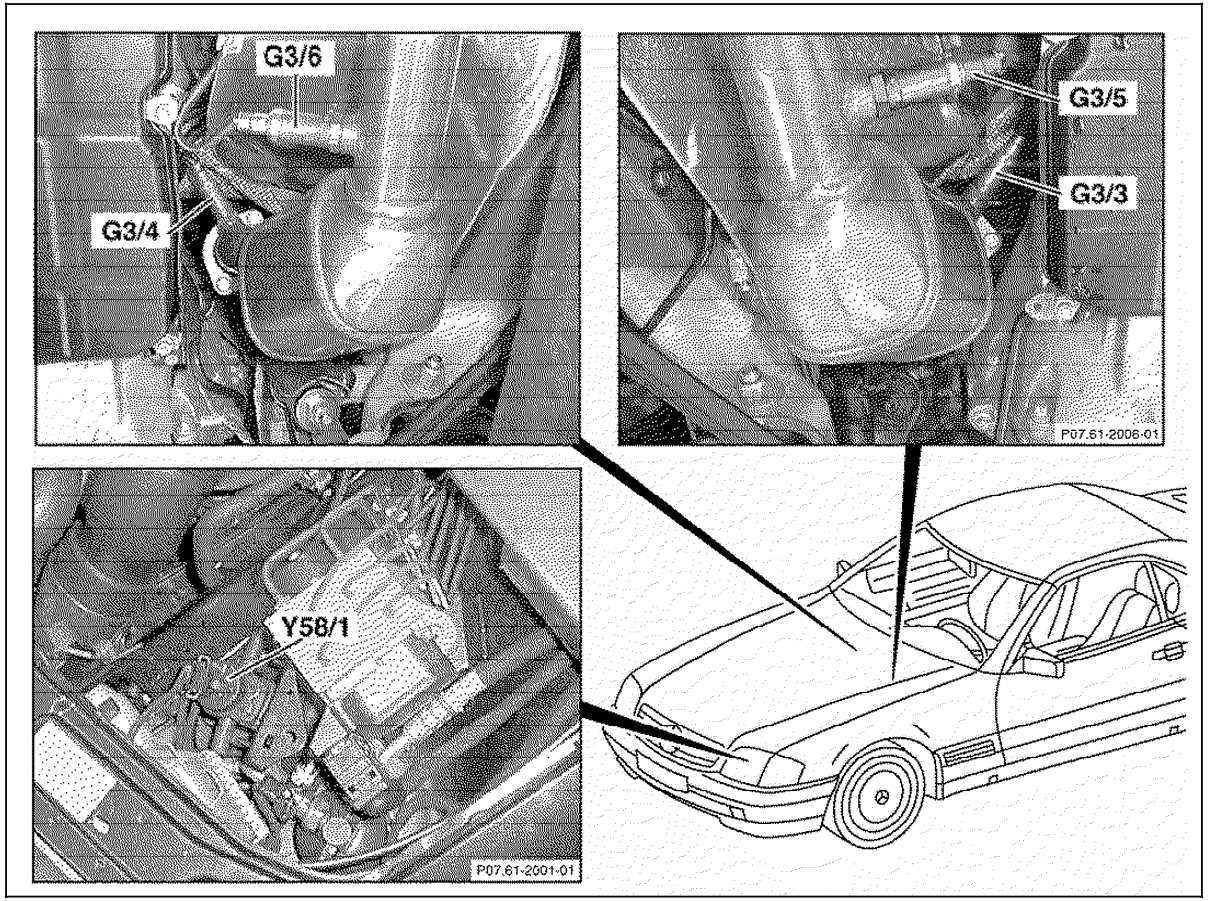
P07.61-2027-06

Figure 3

K17	AIR relay module (only USA)
K27	FP relay module
K38/1	Starter lock-out relay module
N3/10	Engine control module (ME-SFI)
N16/1	Base module (BM)
X11/4	Data link connector (DTC readout)

Electrical Test Program – Component Locations

Engine Compartment
Model 129



P07.61-2010-06

Figure 4

G3/3 Left O2S 1 (before TWC)
G3/4 Right O2S 1 (before TWC)
G3/5 Left O2S 2 (after TWC) (only USA)
G3/6 Right O2S 2 (after TWC) (only USA)
Y58/1 Purge control valve

Electrical Test Program – Component Locations

Engine Compartment
Model 129

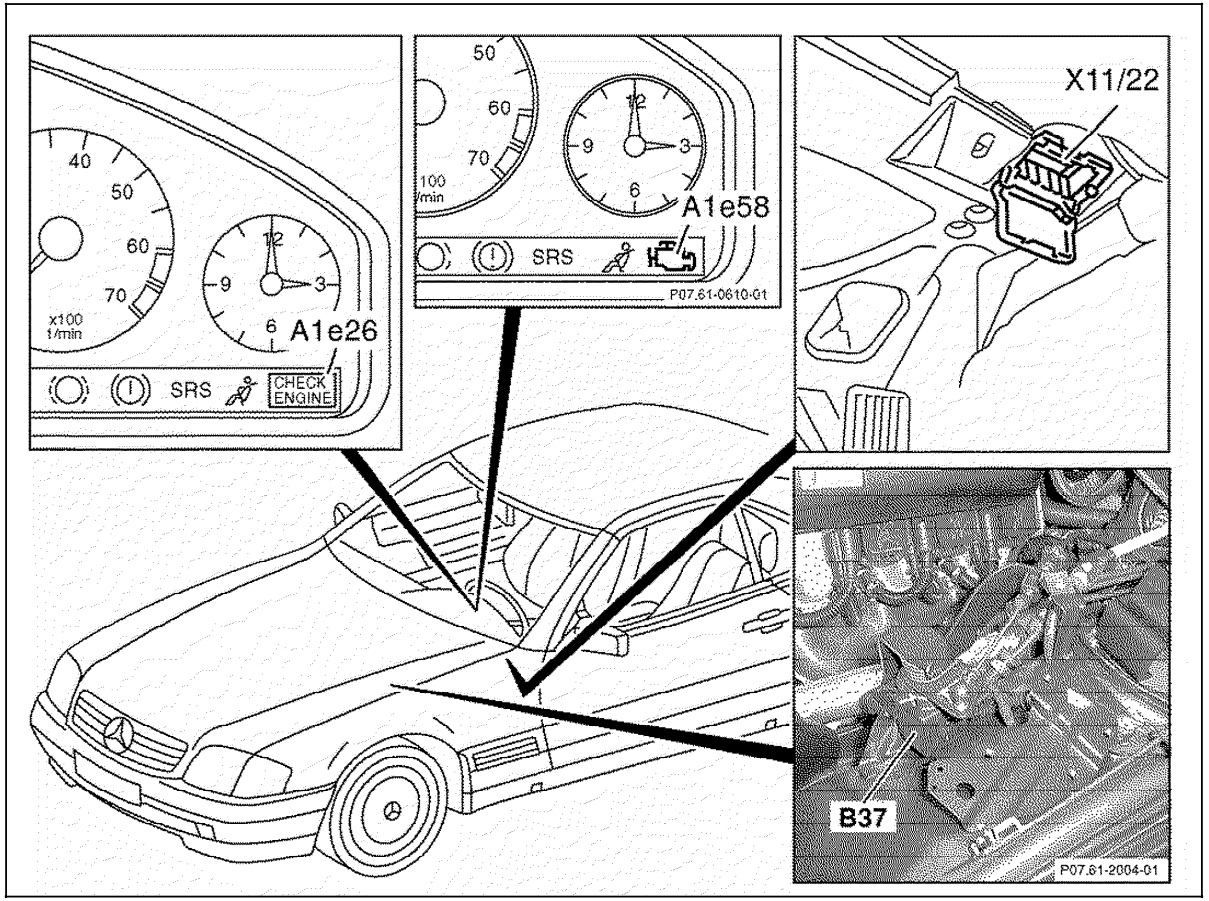


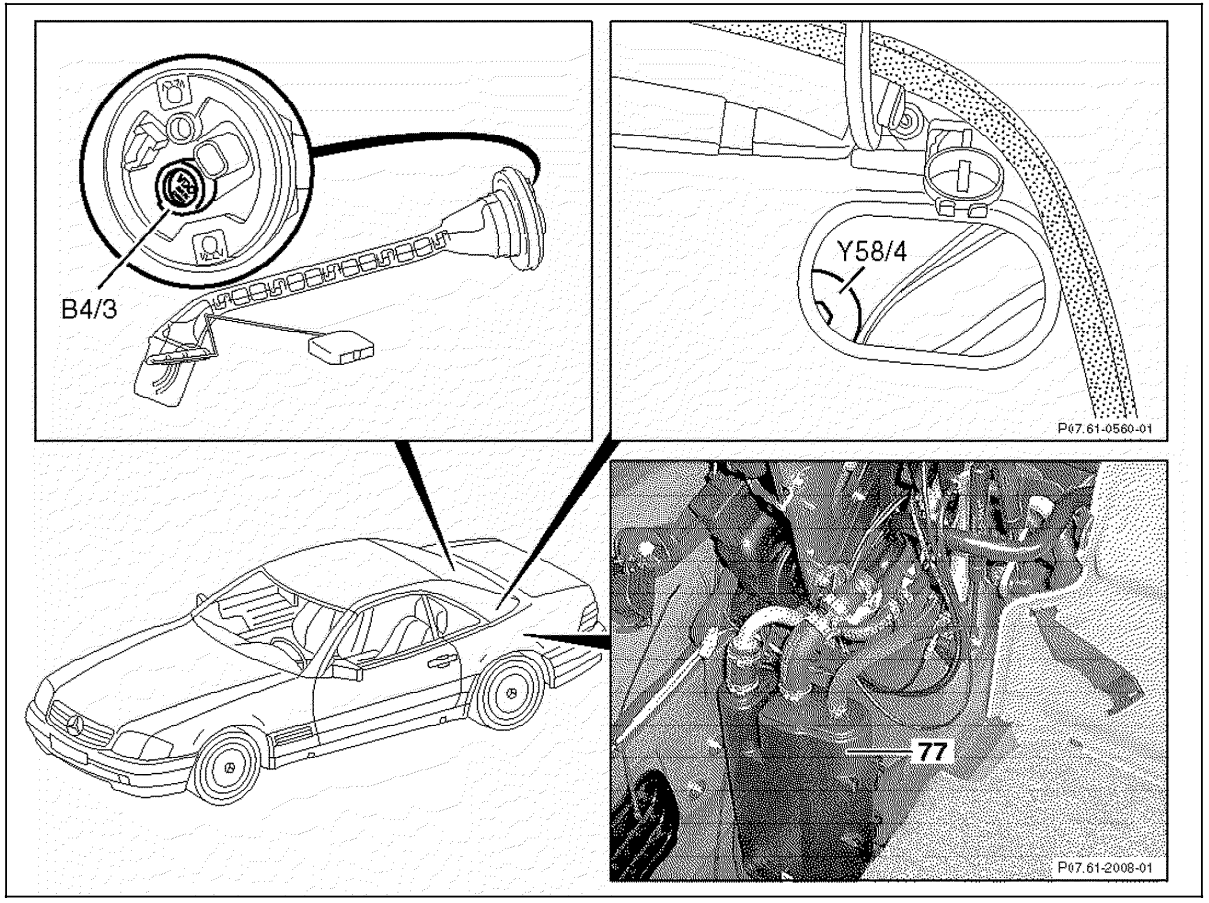
Figure 5

A1e26 "CHECK ENGINE" MIL (only USA)
A1e58 Engine diagnostics indicator lamp (only USA)
B37 Pedal value sensor
X11/22 Diagnostic module (OBDII) generic scan tool connector

P07.61-2011-06

Electrical Test Program – Component Locations

Trunk
Model 129



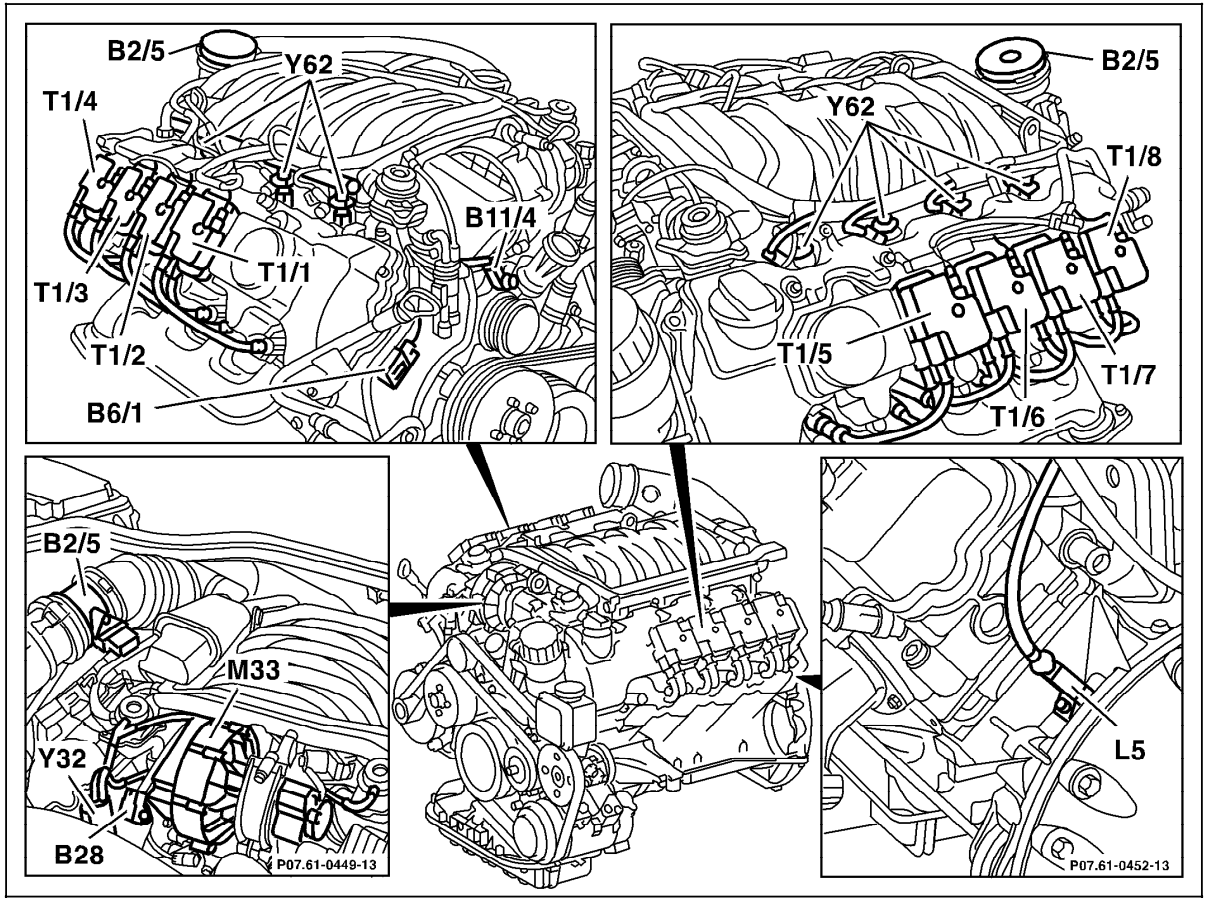
P07.61-2012-06

Figure 6

B4/3	Fuel tank pressure sensor (only USA)
Y58/4	Activated charcoal canister shut-off valve (only USA)
77	Activated charcoal canister

Electrical Test Program – Component Locations

Components on engine
Model 163



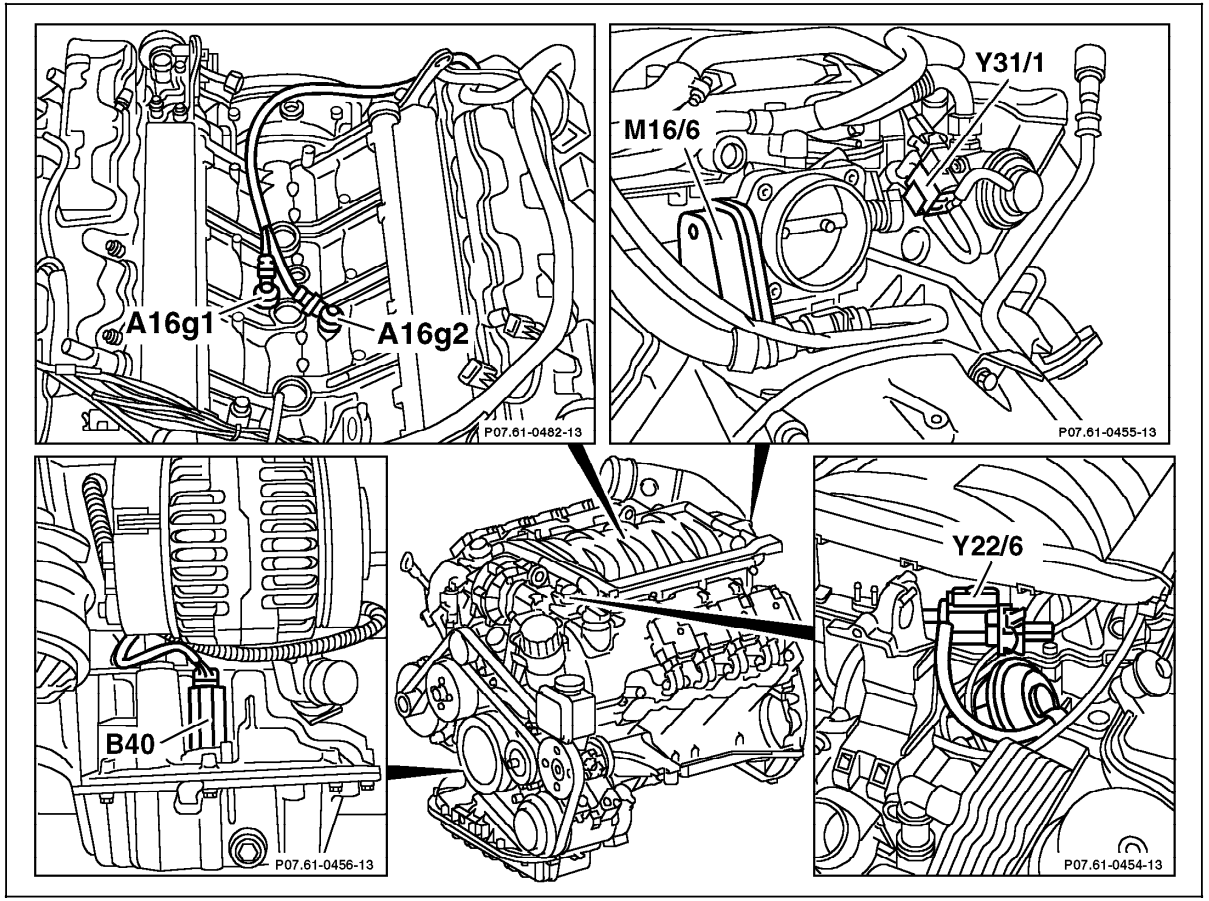
P07.61-2014-06

Figure 7

B2/5	Hot film MAF sensor
B6/1	Camshaft Hall-effect sensor
B11/4	ECT sensor
B28	Pressure sensor (only USA)
L5	CKP sensor
M33	AIR pump (only USA)
T1/1	Ignition coil 1
T1/2	Ignition coil 2
T1/3	Ignition coil 3
T1/4	Ignition coil 4
T1/5	Ignition coil 5
T1/6	Ignition coil 6
T1/7	Ignition coil 7
T1/8	Ignition coil 8
Y32	Air pump switchover valve (only USA)
Y62	Injectors

Electrical Test Program – Component Locations

Components on engine
Model 163



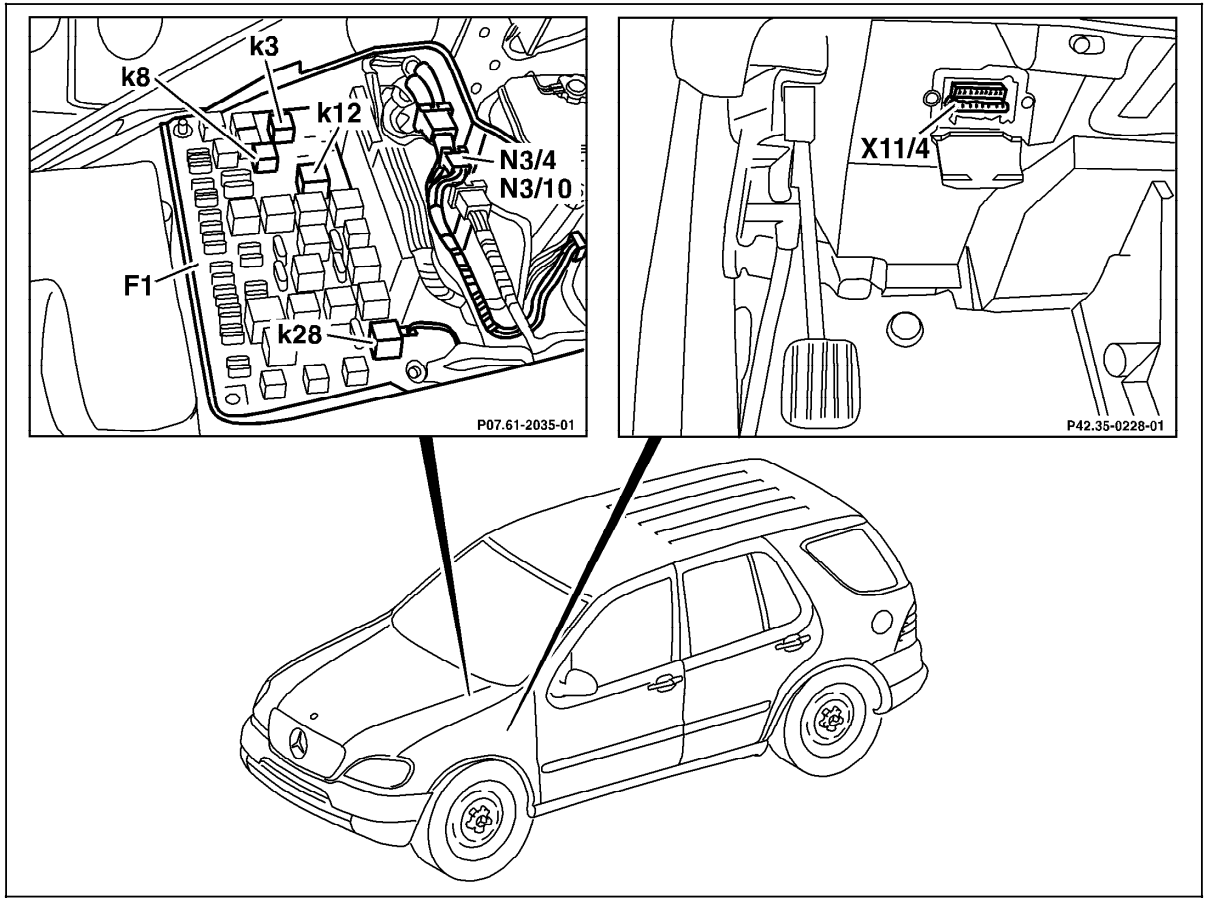
P07.61-0554-06

Figure 8

A16g1	KS 1 (right side of engine)
A16g2	KS 2 (left side of engine)
M16/6	EA/CC/ISC actuator
Y22/6	Resonance intake mainfold switchover valve
Y31/1	EGR valve vacuum transducer
B40	Oil sensor (level/temperature/quality)

Electrical Test Program – Component Locations

Components in engine compartment
Model 163



P07.61-2029-06

Figure 9

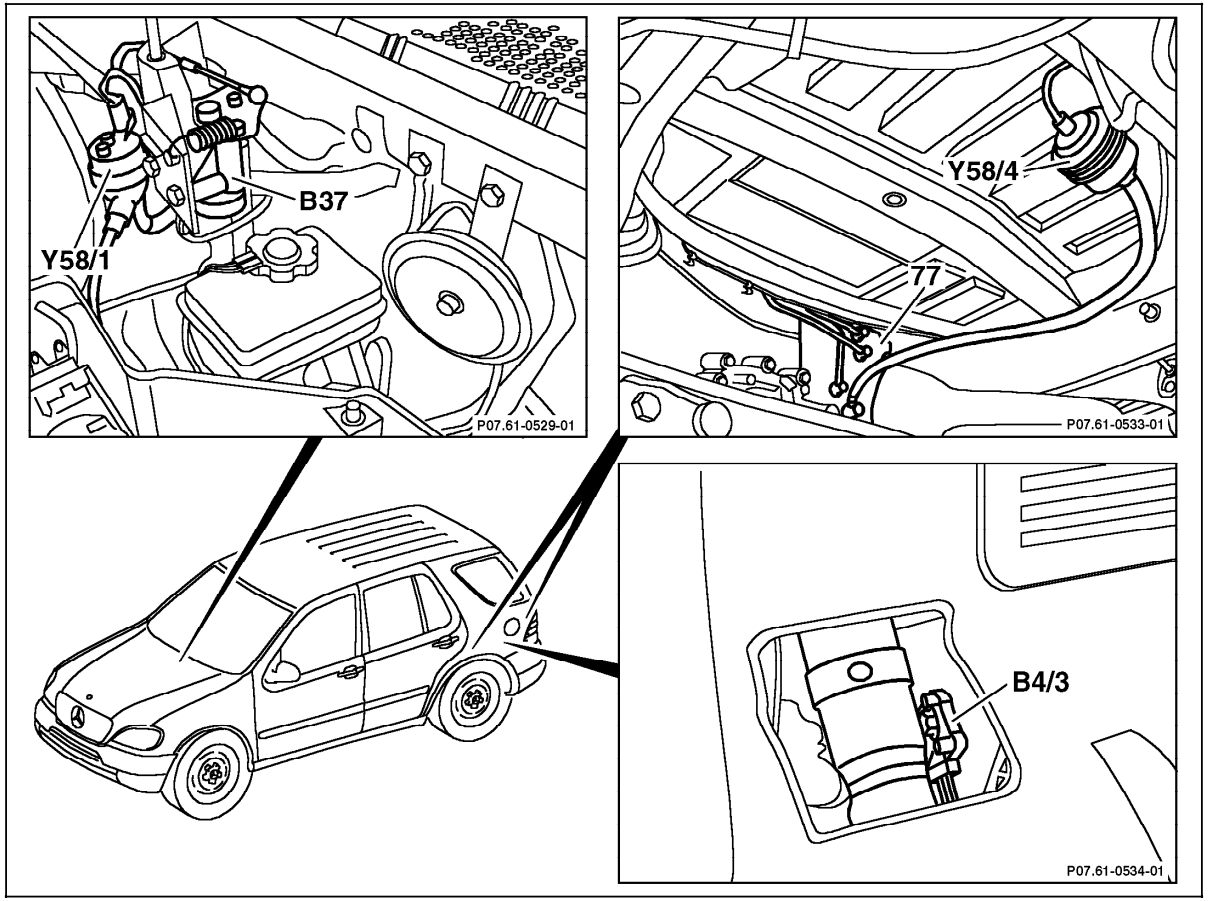
F1 Fuse and relay box with:
k3 Fuel pump relay
k8 Starter relay
k12 Circuit 15 relay
k28 Secondary air injection pump relay (only USA)

N3/10 Engine control module (ME-SFI)

X11/4 Data link connector (DTC readout)

Electrical Test Program – Component Locations

Model 163



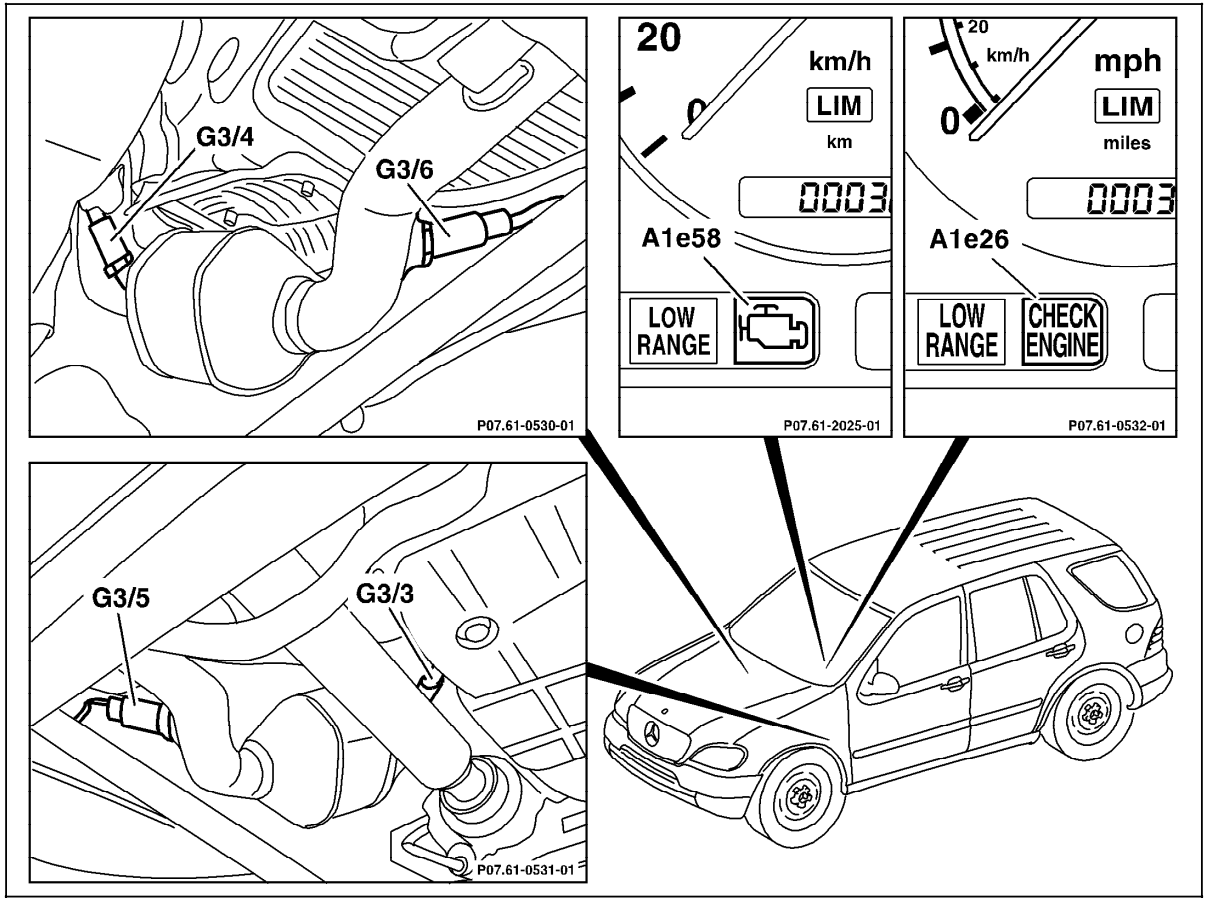
P07.61-0545-06

Figure 10

B4/3	Fuel tank pressure sensor (only USA)
B37	Pedal value sensor
Y58/1	Purge control valve
Y58/4	Activated charcoal canister shut-off valve (only USA)
77	Activated charcoal canister

Electrical Test Program – Component Locations

Model 163



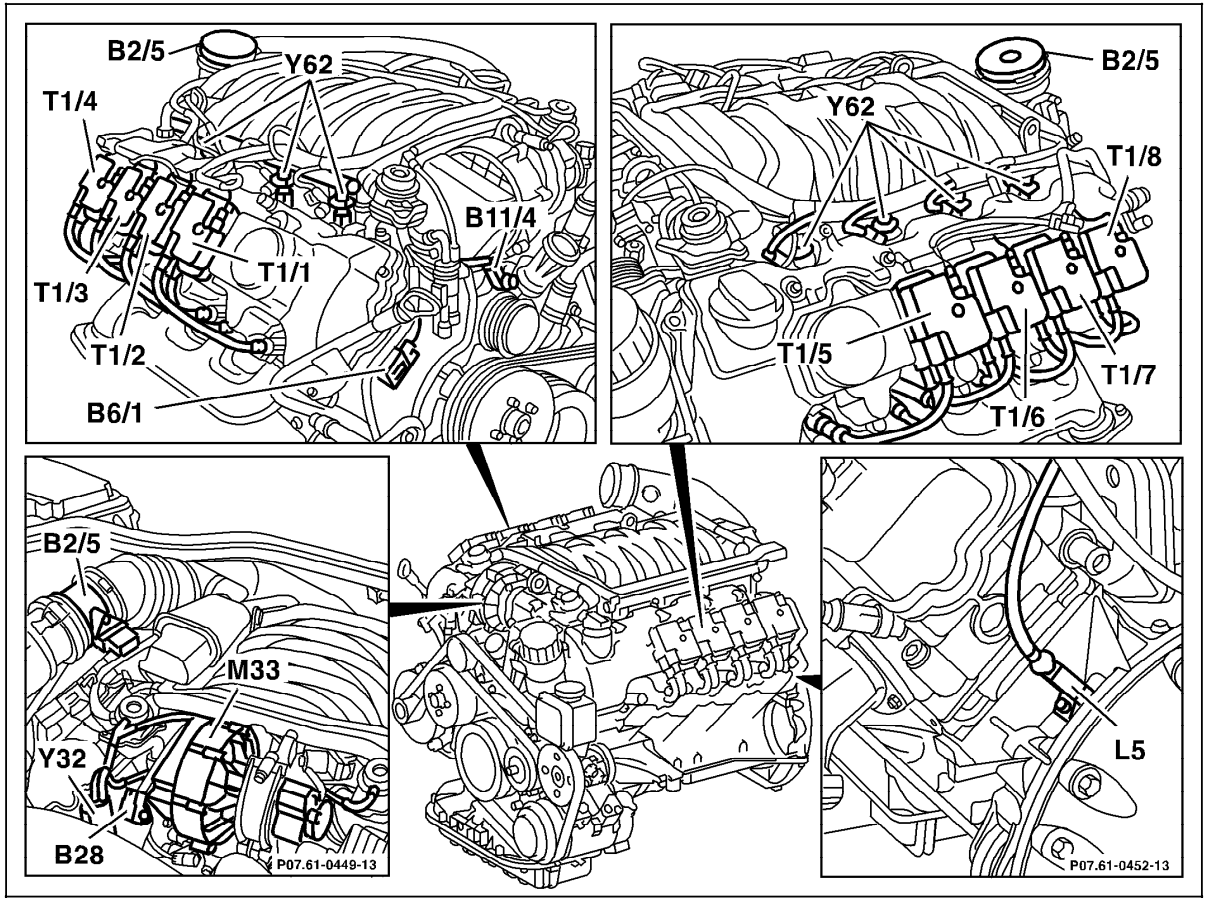
P07.61-2028-06

Figure 11

A1e26 "CHECK ENGINE" MIL (only USA)
A1e58 Engine diagnostics indicator lamp (only USA)
G3/3 Left O2S 1 (before TWC)
G3/4 Right O2S 1 (before TWC)
G3/5 Left O2S 2 (after TWC) (only USA)
G3/6 Right O2S 2 (after TWC) (only USA)

Electrical Test Program – Component Locations

Components on engine
Model 208



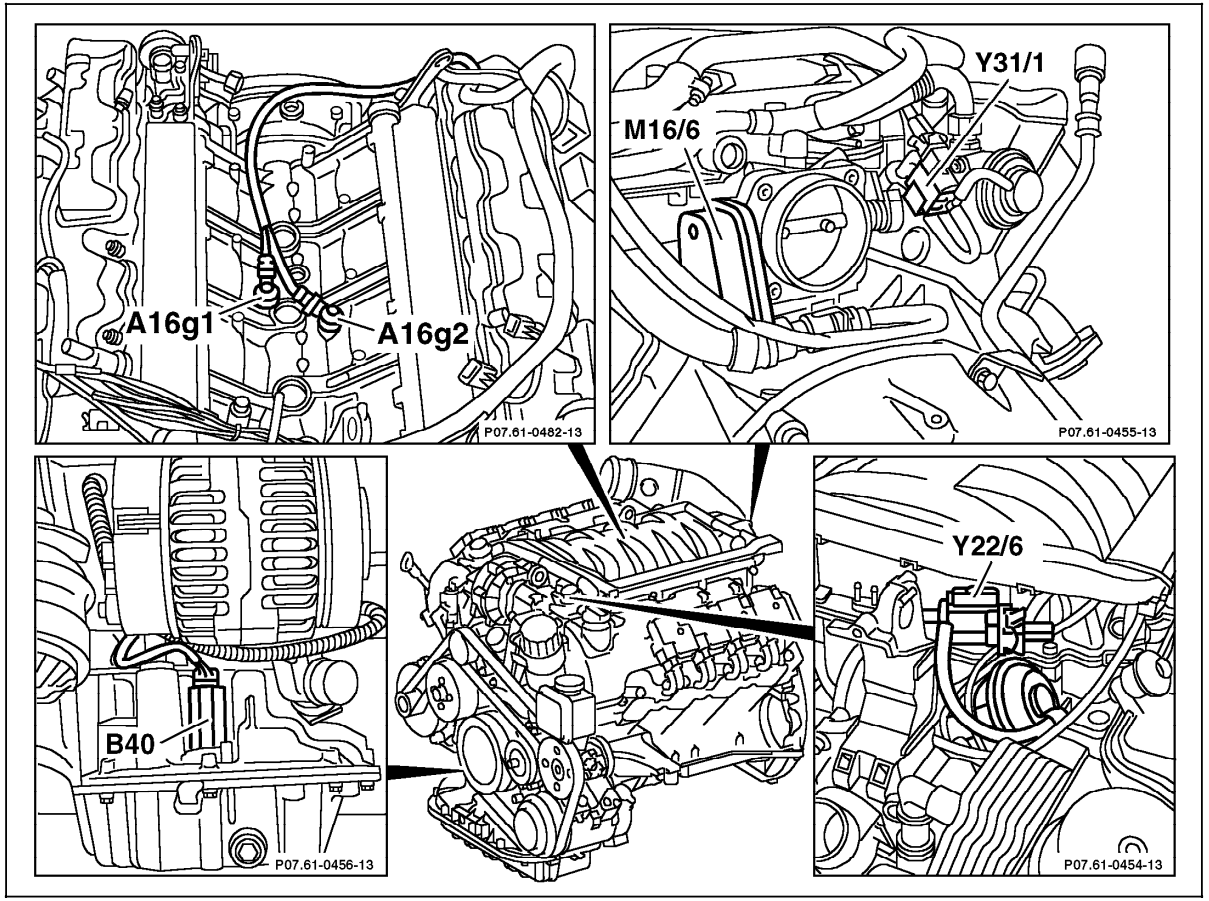
P07.61-2014-06

Figure 12

B2/5	Hot film MAF sensor
B6/1	Camshaft Hall-effect sensor
B11/4	ECT sensor
B28	Pressure sensor (only USA)
L5	CKP sensor
M33	AIR pump (only USA)
T1/1	Ignition coil 1
T1/2	Ignition coil 2
T1/3	Ignition coil 3
T1/4	Ignition coil 4
T1/5	Ignition coil 5
T1/6	Ignition coil 6
T1/7	Ignition coil 7
T1/8	Ignition coil 8
Y32	Air pump switchover valve (only USA)
Y62	Injectors

Electrical Test Program – Component Locations

Components on engine
Model 208



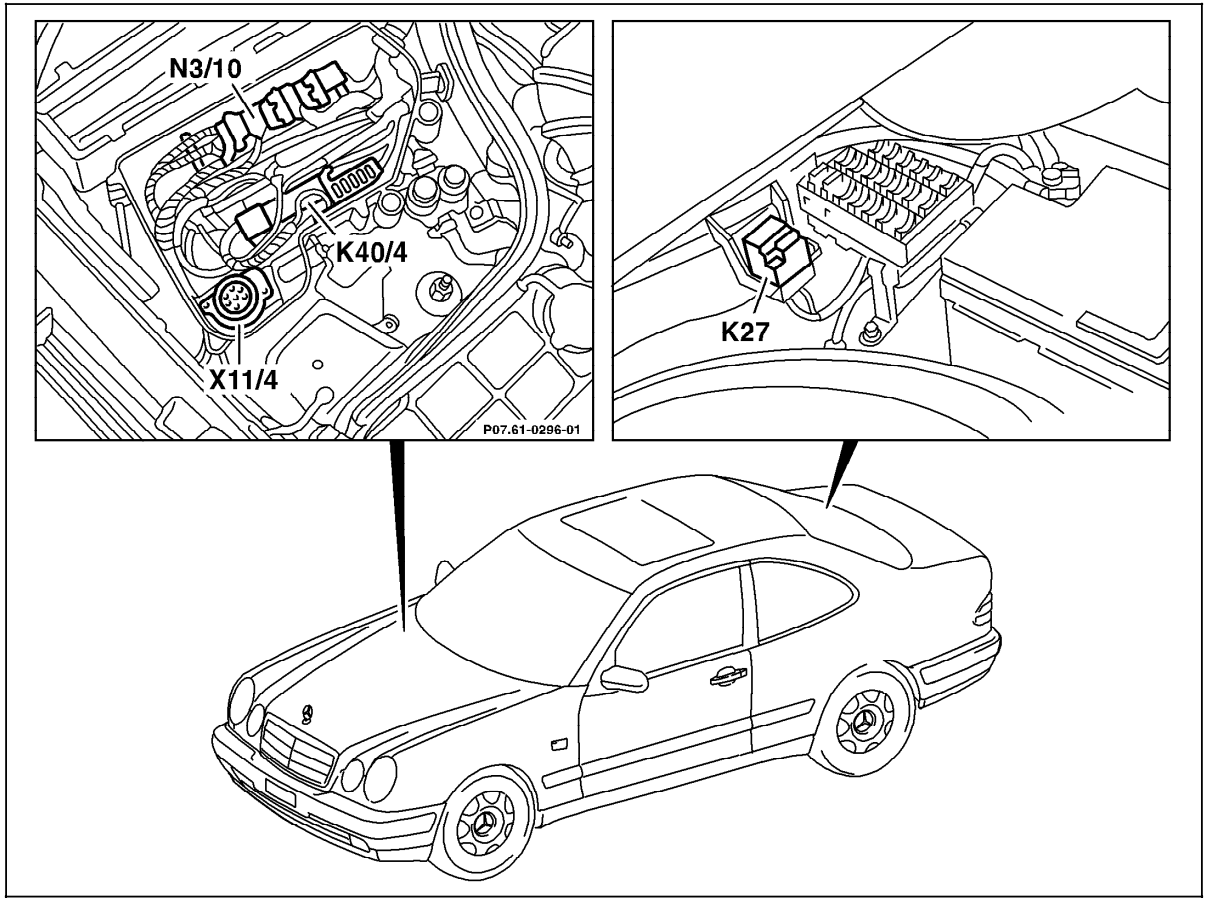
P07.61-0554-06

Figure 13

A16g1	KS 1 (right side of engine)
A16g2	KS 2 (left side of engine)
M16/6	EA/CC/ISC actuator
Y22/6	Resonance intake mainfold switchover valve
Y31/1	EGR valve vacuum transducer
B40	Oil sensor (level/temperature/quality)

Electrical Test Program – Component Locations

Model 208



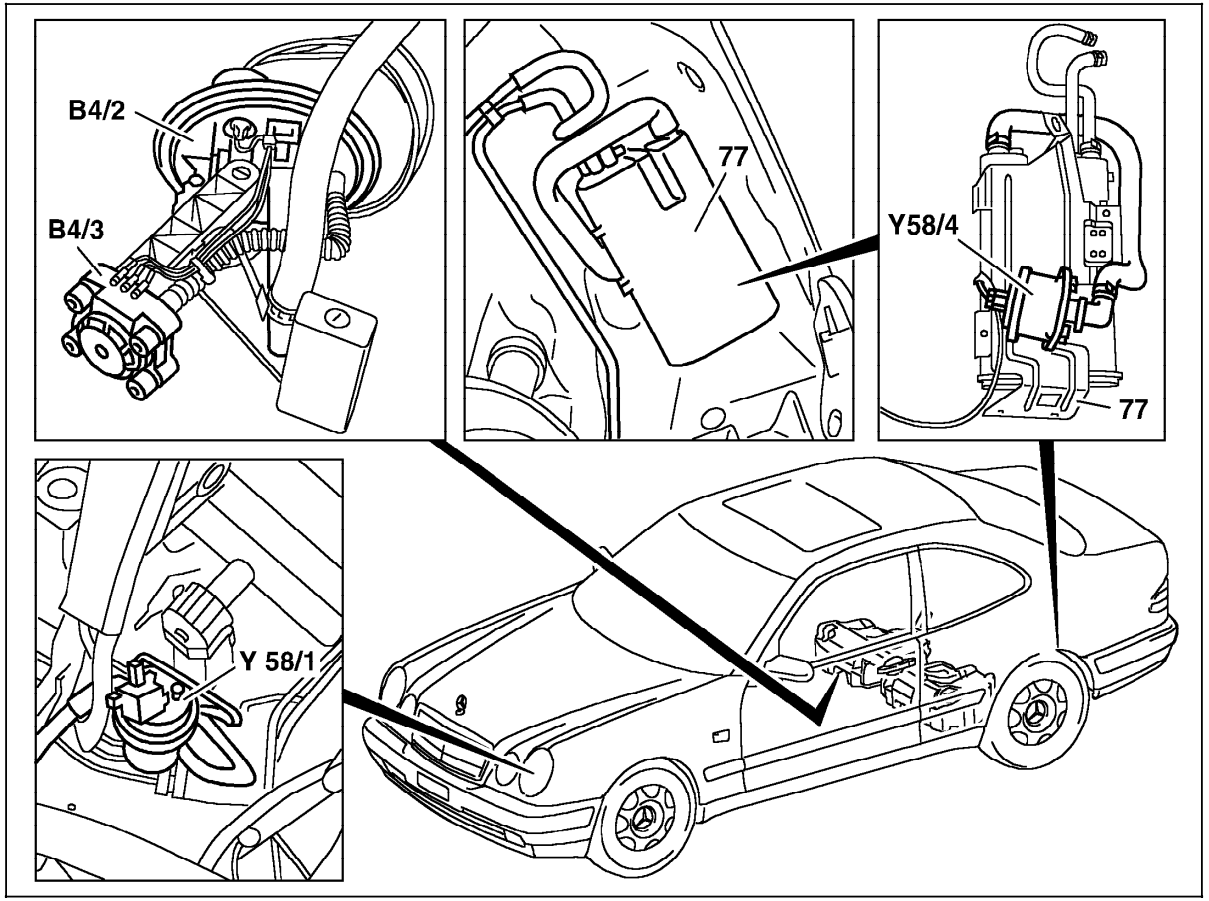
P07.61-2030-06

Figure 14

K27 FP relay module
K40/4 Passenger-side fuse and relay module box
N3/10 Engine control module (ME-SFI)
X11/4 Data link connector (DTC readout)

Electrical Test Program – Component Locations

Model 208



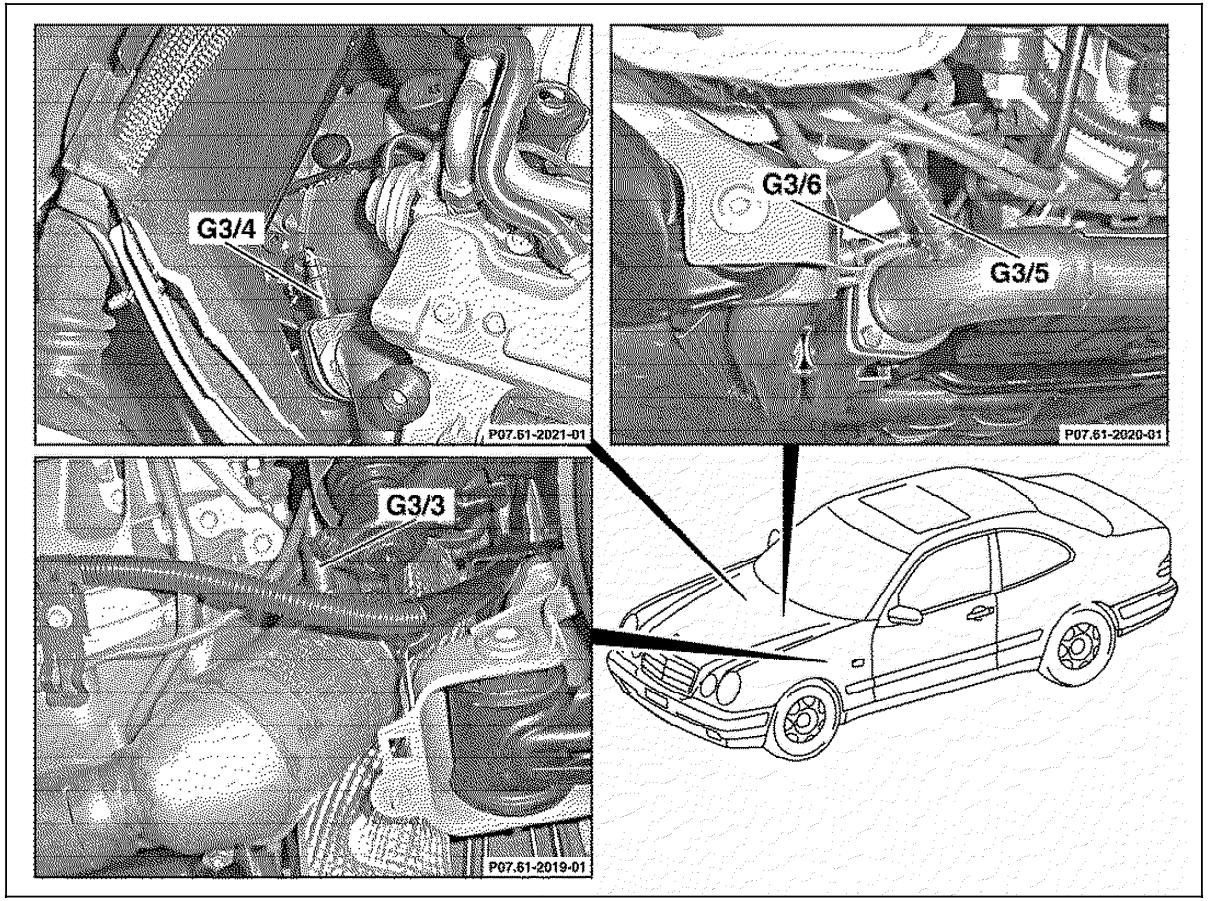
P07.61-2032-06

Figure 15

B4/2	Right fuel level sensor
B4/3	Fuel tank pressure sensor (only USA)
Y58/1	Purge valve
Y58/4	Activated charcoal canister shut-off valve (only USA)
77	Activated charcoal canister

Electrical Test Program – Component Locations

Model 208



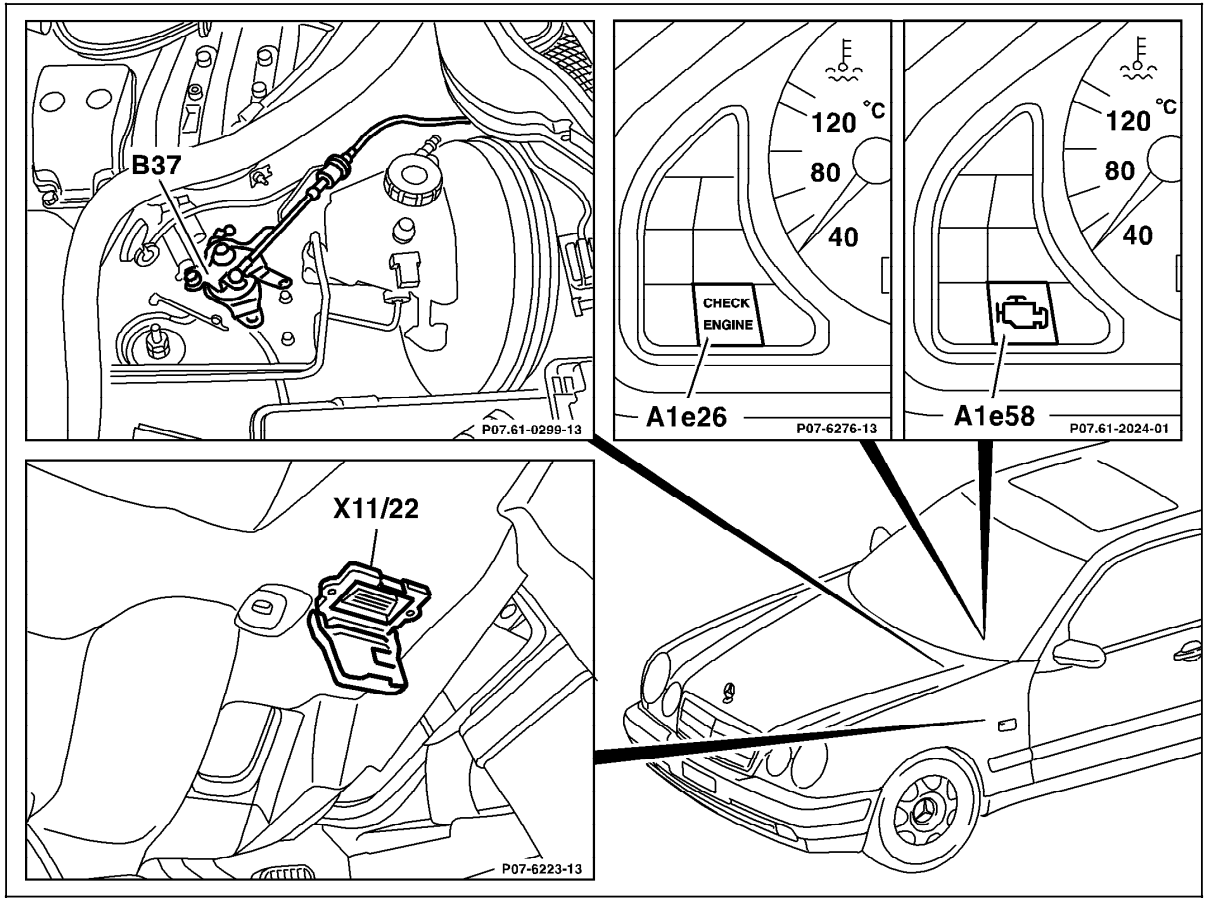
P07.61-2033-06

Figure 16

G3/3 Left O2S 1 (before TWC)
G3/4 Right O2S 1 (before TWC)
G3/5 Left O2S 2 (after TWC) (only USA)
G3/6 Right O2S 2 (after TWC) (only USA)
Y58/1 Purge control valve

Electrical Test Program – Component Locations

Model 208



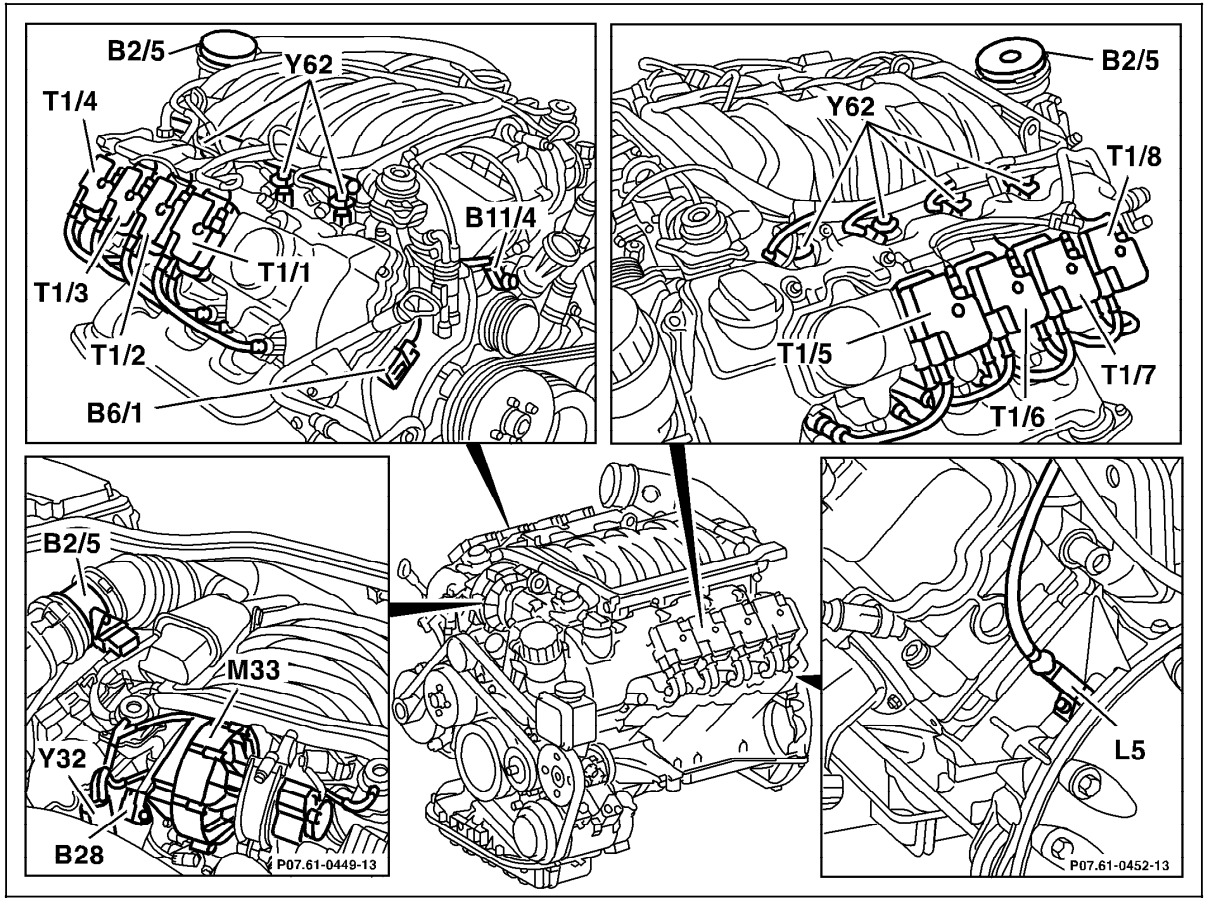
P07.61-2031-06

Figure 17

A1e26 "CHECK ENGINE" MIL (only USA)
A1e58 Engine diagnostics indicator lamp (not USA)
B37 Pedal value sensor
X11/22 Diagnostic module (OBDII) generic scan tool connector

Electrical Test Program – Component Locations

Components on engine
Model 210



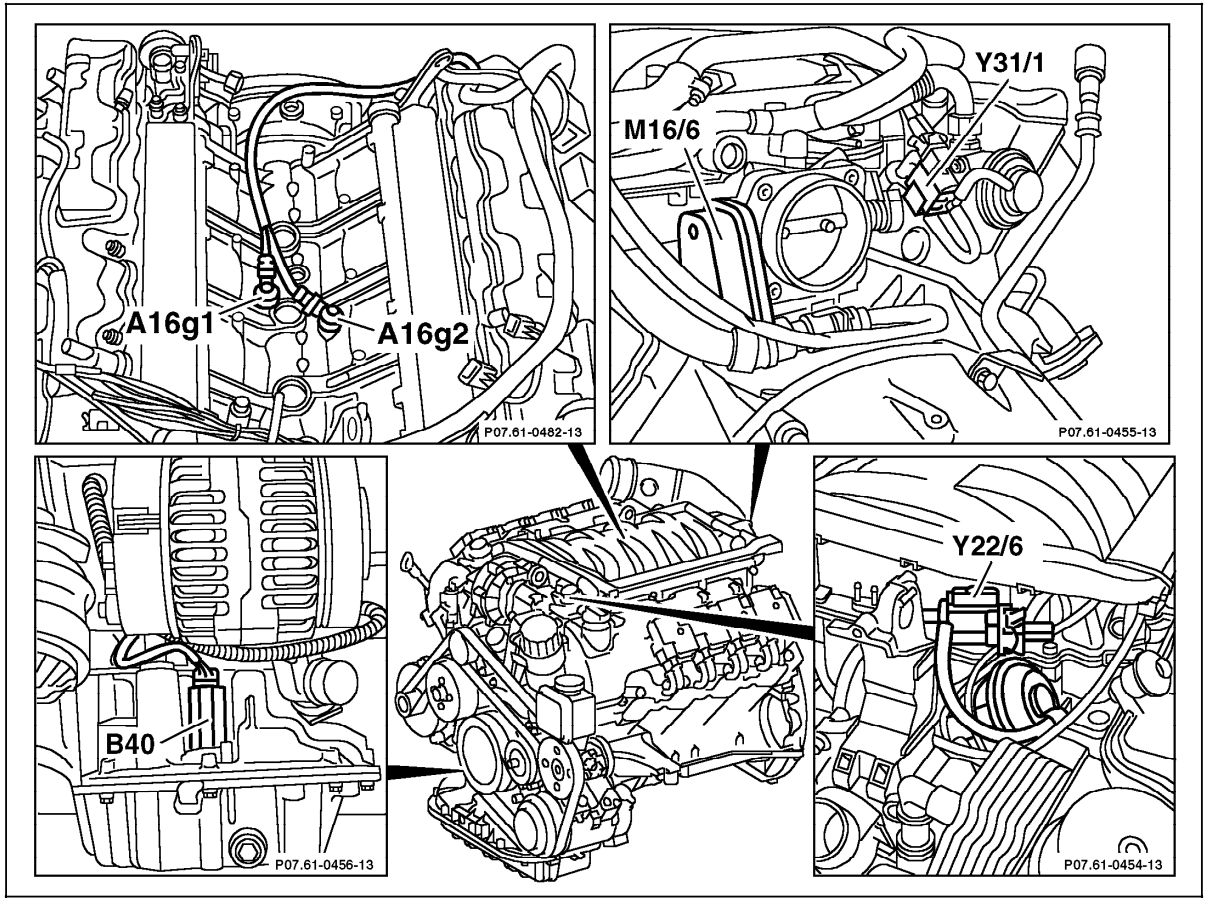
P07.61-2014-06

Figure 18

B2/5	Hot film MAF sensor
B6/1	Camshaft Hall-effect sensor
B11/4	ECT sensor
B28	Pressure sensor (only USA)
L5	CKP sensor
M33	AIR pump (only USA)
T1/1	Ignition coil 1
T1/2	Ignition coil 2
T1/3	Ignition coil 3
T1/4	Ignition coil 4
T1/5	Ignition coil 5
T1/6	Ignition coil 6
T1/7	Ignition coil 7
T1/8	Ignition coil 8
Y32	Air pump switchover valve (only USA)
Y62	Injectors

Electrical Test Program – Component Locations

Components on engine
Model 210



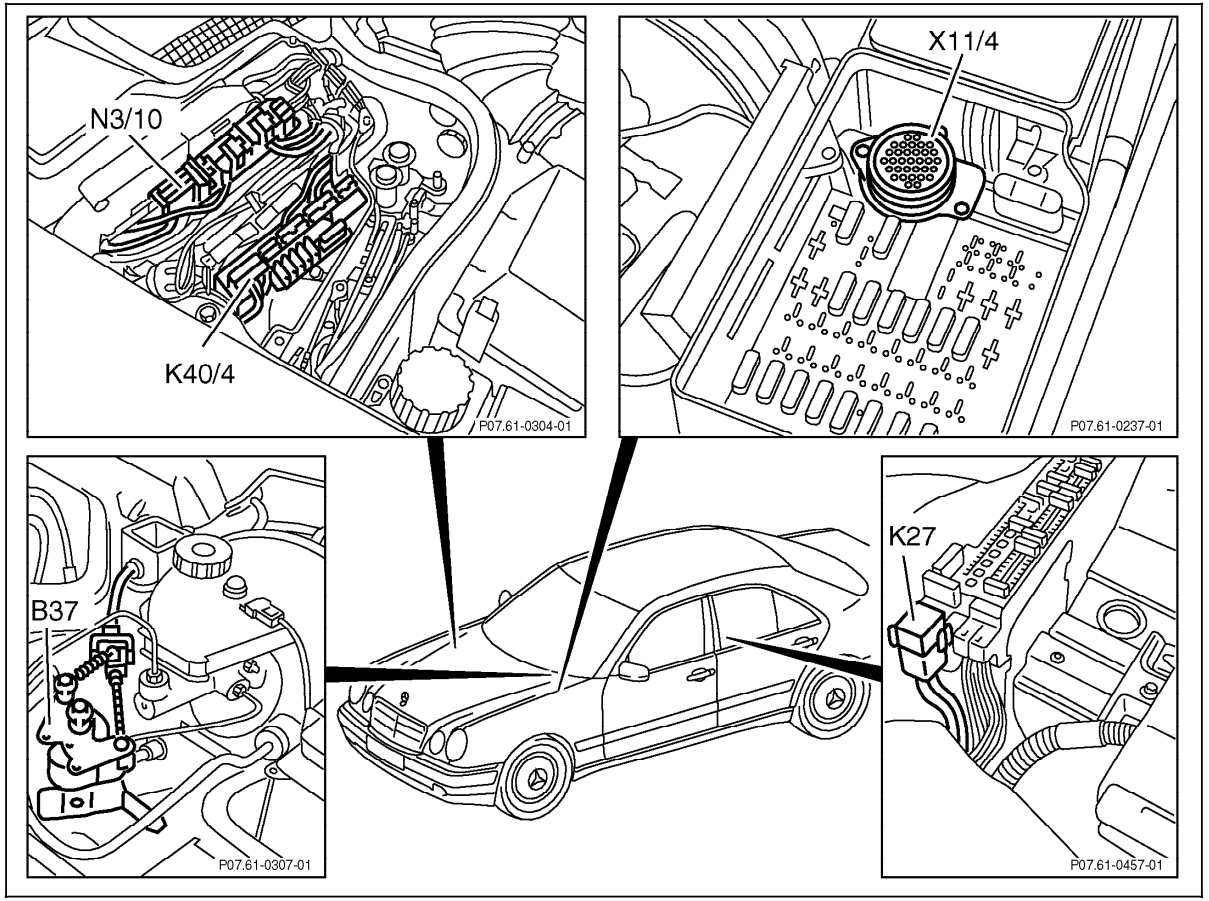
P07.61-0554-06

Figure 19

A16g1 KS 1 (right side of engine)
A16g2 KS 2 (left side of engine)
M16/6 EA/CC/ISC actuator
Y22/6 Resonance intake mainfold switchover valve
Y31/1 EGR valve vacuum transducer
B40 Oil sensor (level/temperature/quality)

Electrical Test Program – Component Locations

Model 210



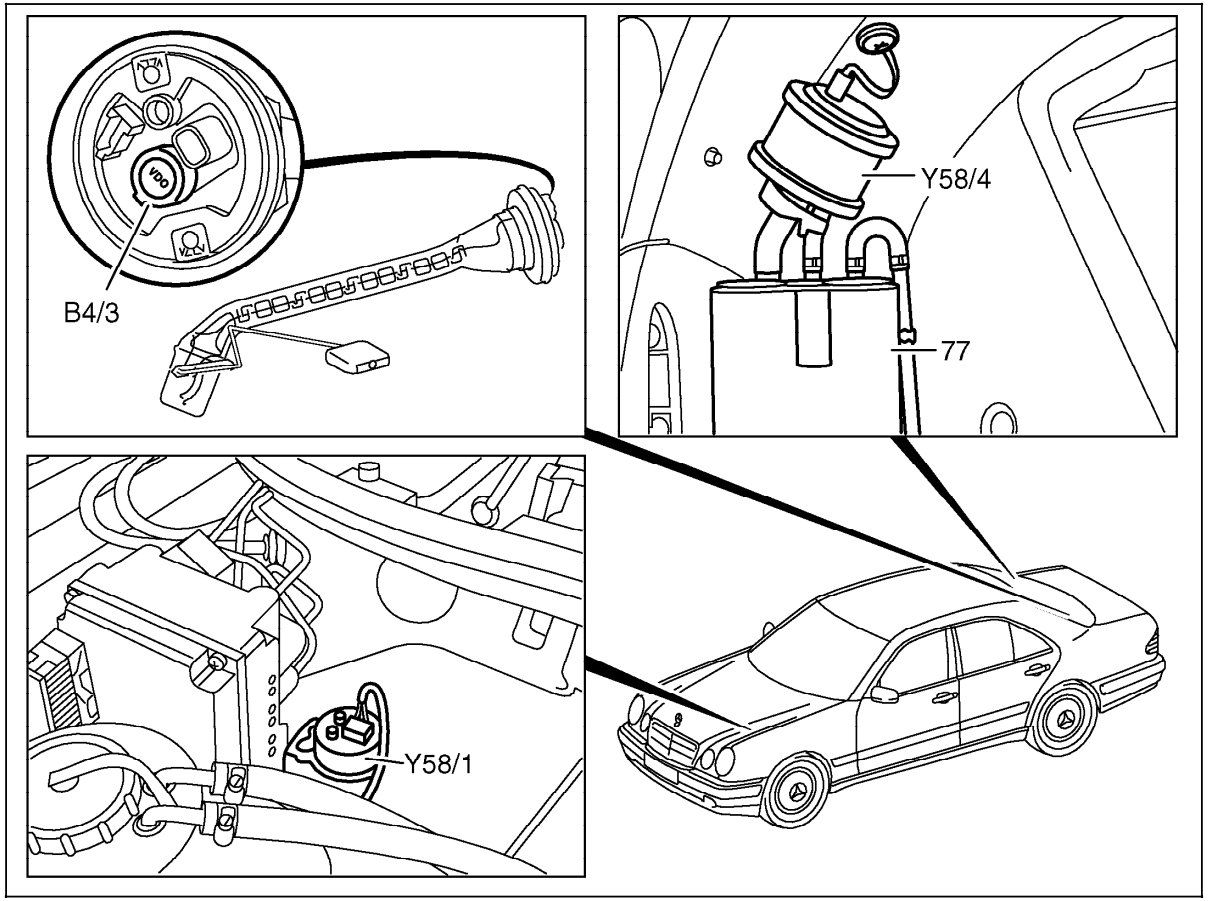
P07.61-0461-06

Figure 20

B37 Pedal value sensor
K27 FP relay module
K40/4 Passenger-side fuse and relay module box
N3/10 Engine control module (ME-SFI)
X11/4 Data link connector (DTC readout)

Electrical Test Program – Component Locations

Engine compartment
Model 210



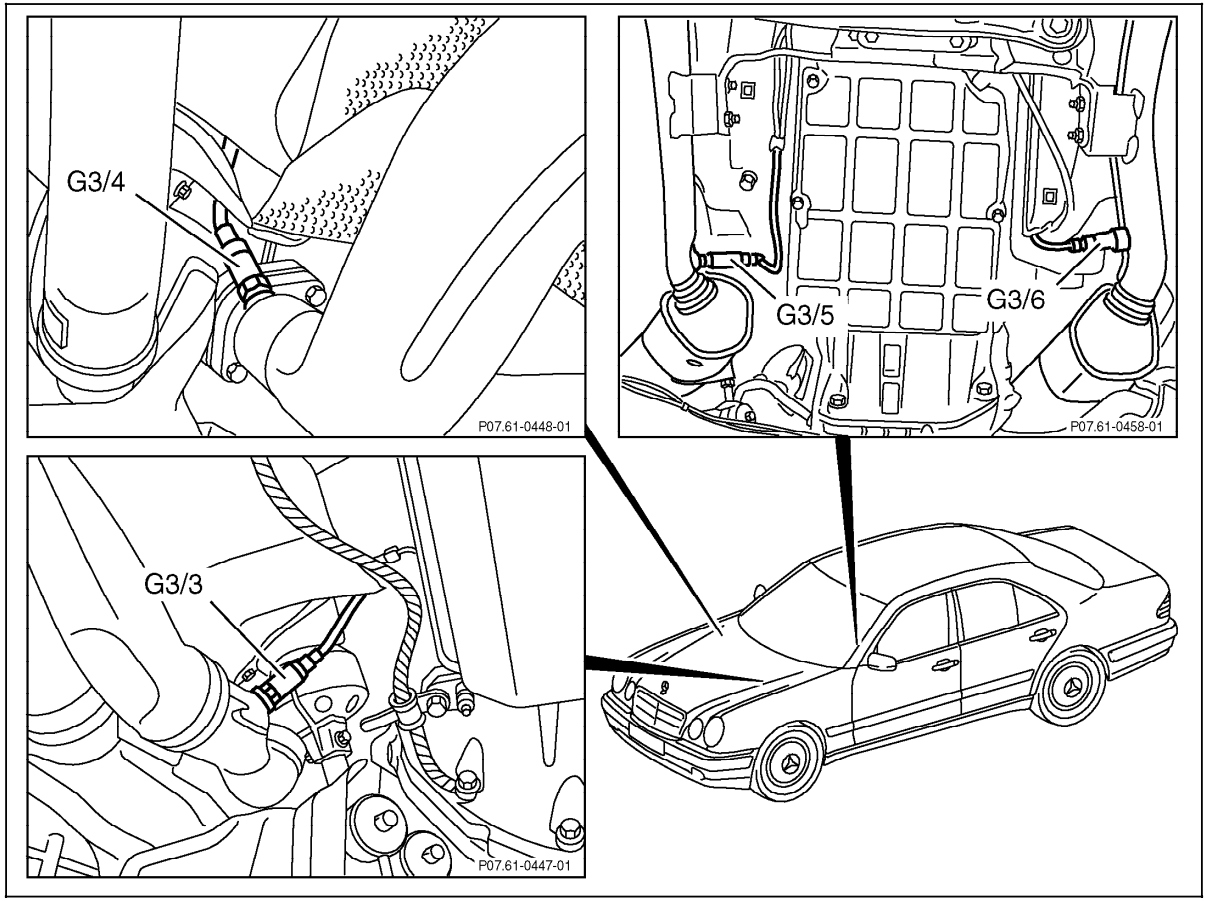
P07.61-0288-06

Figure 21

B4/3	Fuel tank pressure sensor
Y58/1	Purge control valve
Y58/4	Activated charcoal canister shut-off valve
77	Activated charcoal canister

Electrical Test Program – Component Locations

Engine compartment
Model 210



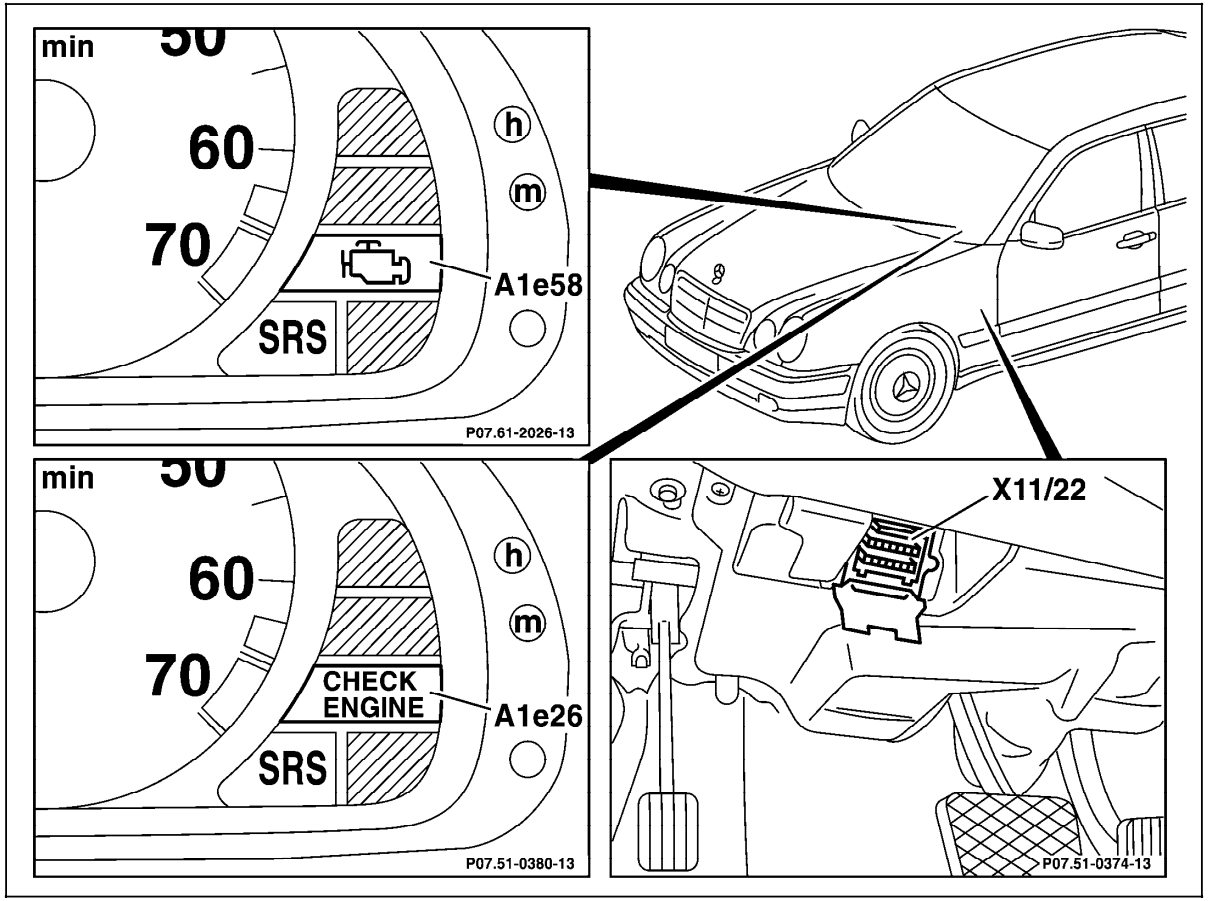
P07.61-0462-06

Figure 22

G3/3 Left 02S 1 (left, before TWC)
G3/4 Right 02S 1 (right, before TWC)
G3/5 Left 02S 2 (left, after TWC) (only USA)
G3/6 Right 02s 2 (right, after TWC) (only USA)

Electrical Test Program – Component Locations

Passenger compartment
Models 210



P07.61-2034-06

Figure 23

A1e26 "CHECK ENGINE " MIL (only USA)
A1e58 Engine diagnostics indicator lamp (only USA)
X11/22 Diagnostic module (OBD II) generic scan tool connector

Electrical Test Program – Preparation for Test

⚠ **WARNING!**
Risk of severe injury when touching ignition parts which produce high voltages. Do not touch ignition components.
Persons with heart pacemakers are not to perform repairs on this type of ignition system.

1. Review 11, 21, 22, 23, 24, 31, 33, 35, 36,
2. Review section 0,
3. Connect HHT and readout DTC memory, see 11,
4. Ignition: **OFF**
5. Connect test cable with socket box to engine control module (N3/10).

Connector with red marking is not required at this time since the engine control module has presently no function installed for it. When disconnecting the connectors on the engine control module remove center connector (D) first, when reconnecting connectors install center connector (D) last.

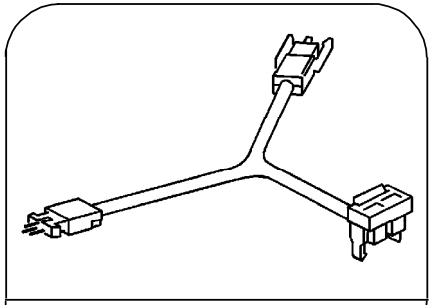
Note:
The test program is divided into four sections:
23 SFI Test
24 Ignition System Test
25 EA System Test
26 CC System Test

New Model designation:
Model 463 = G-Wagen

Note regarding "Test Connection" column:
The numbers indicated in parentheses, for example, ⇒ 1.0 (2A) signify:
2 = Socket 2 on wiring diagram.
A = Connector A on wiring diagram,

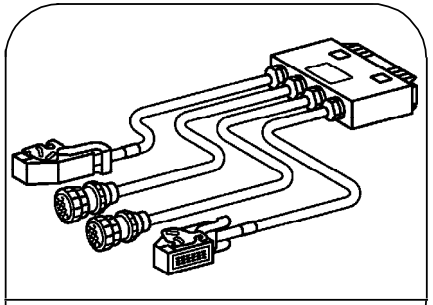
Electrical Test Program – Preparation for Test

Special Tools



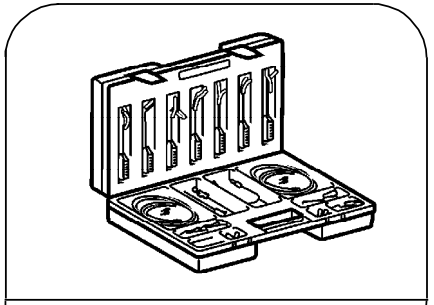
102 589 04 63 00

Test cable



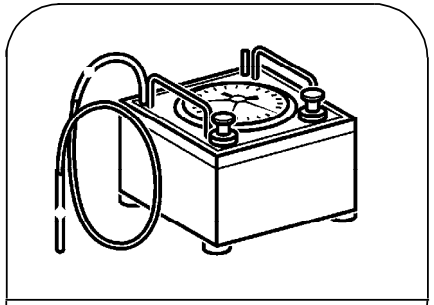
140 589 46 63 00

Test cable, 117-pin



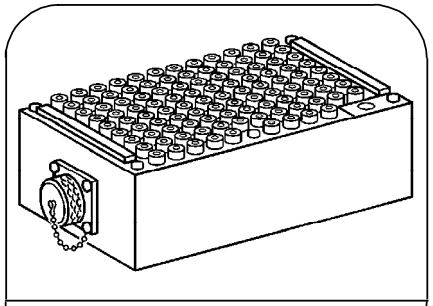
201 589 00 99 00

Electrical connecting set



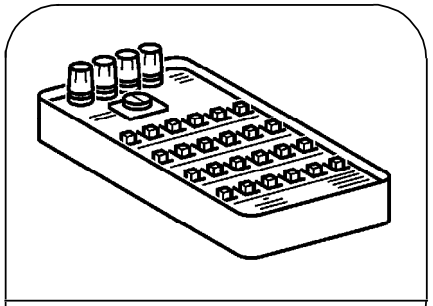
201 589 13 21 00

Tester



129 589 00 21 00

126-pin socket box



124 589 09 63 00

Ohm decade

Test equipment; See MBUSA Standard Service Equipment Program

Description	Brand, model, etc.
Digital multimeter	Fluke models 23, 77 III, 83, 85, 87
Engine analyzer	Bear DACE Herman Electronics

Electrical Test Program – Preparation for Test

⚠ **WARNING!**
Persons with heart pacemakers are not to perform repairs on this type of ignition system.

Electronic ignition systems produce dangerous high voltages on both the primary circuit and the secondary (ignition) circuits. Due to the high voltages produced, contact with any of the voltage carrying components can be dangerous to your health (burns, heart palpatations, cardiac arrest etc).

- Igntion must be turned OFF prior to performing any repair work on the igntion system.
- Do not come in contact or remove with any of the ignition components while the engine is cranking or idling.
- Wear rubber soled shoes.
- Disconnect connectors for CKP sensor at sensor or control module.
- If repairs require that the ignition be turned on, then dangerous voltages will be present through out the entire ignition system.
- No exposed metal connectors or sending units may be installed in the ignition wires.

P15.11-0001-01

Electrical Test Program – Preparation for Test

To Avoid Damage to the Ignition System

- To avoid damage to the engine control module, connect/disconnect the control module connectors only with the ignition: **OFF**.
- Circuit 1 of the ignition coil may not be shorted to ground, e.g. theft deterence.
- Only original equipment should be installed in the ignition system.
- Do not operate the ignition system at cranking speed unless the entire igntion harness is connected.
- Do not perform any tests (grounding of ignition cable 4 disconnecting a spark plug connector or pulling cable 4 out of the ignition coil) at cranking or idle speed.
- The high output side of the ignition system must carry at least 2 kΩ of load (spark plug connector).
- To avoid damaging the ignition coils during individual testing, do not load the coil with more than 28 kV.
- If assisting a disabled vehicle and it becomes necessary to perform an igntion spark test, perform this test only on one ignition/sark plug. Ensure a good ground connection to the spark plug.
- ME - SFI: the ignition system is to be turned OFF, when cranking engine to perform compression tests, additionally, it is necessary to disconnect connector 2 from the control module.
- CFI/LH-SFI: disconnect connector(s) on DI control module for CKP sensor (L5).
- CFI/LH-SFI: The DI control module, which is mounted on the wheel arch, is coated with a heat absorbing paste to enhance the transfer of heat, therefore do not remove the foil strip, since this has no effect on the heat transfer.

i Engine 120 has separate ignition and fuel injection system

Using Test Equipment

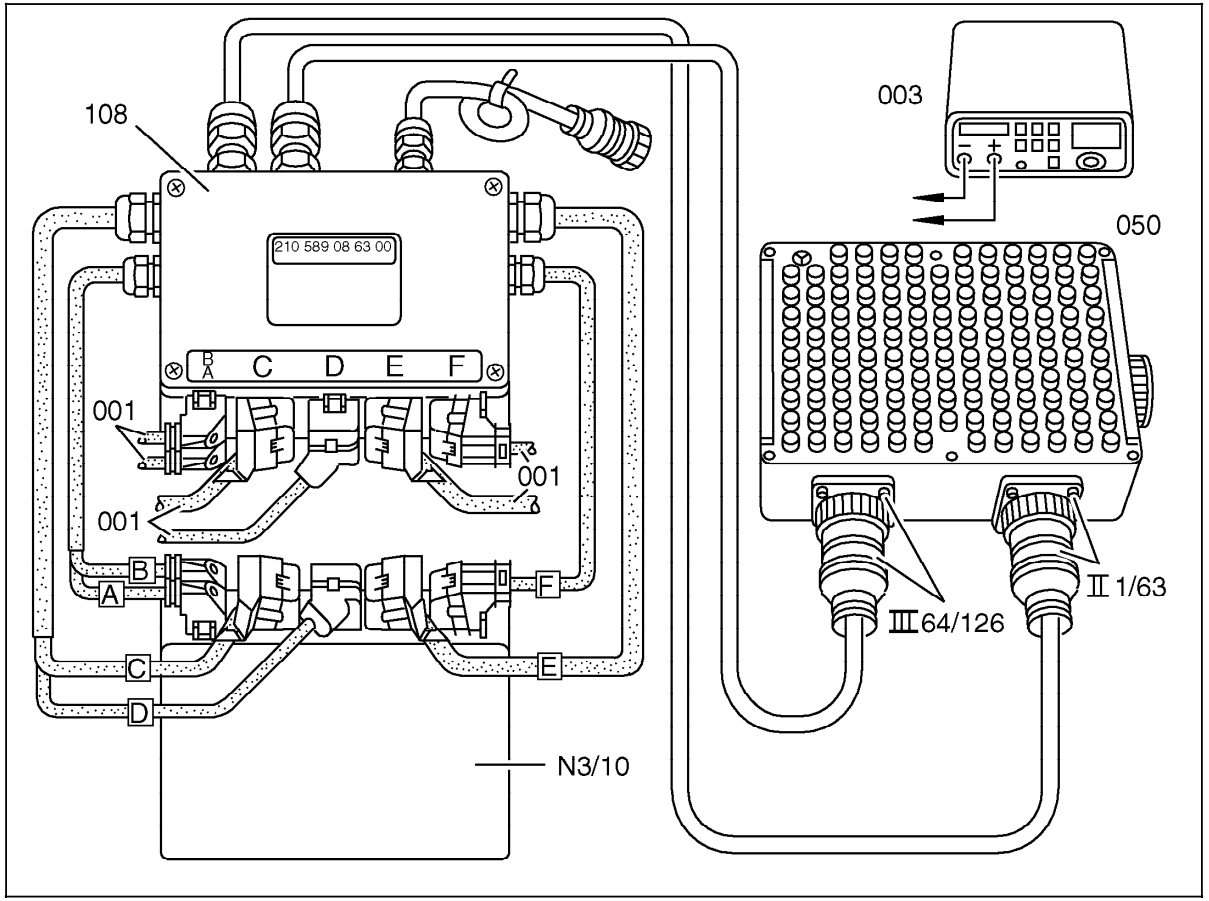
- **Ensure that the engine and ignition are OFF when connecting/ disconnecting test equipment to a coil.**
- **Connect the secondary voltage measuring equipment on the corresponding secondary ignition lead only when engine is stopped and ignition is OFF.**
- **If the circuit breaker is activated (power balance test), and the engine stalls, then the test procedure with this tester cannot be performed.**
- **Do not connect a test lamp to circuit 1 or 15 of the ignition coil.**

Electrical Test Program – Preparation for Test

Connection Diagram - Socket Box

Note:
When disconnecting the connectors on the engine control module remove center connector (D) first, when reconnecting connectors install center connector (D) last.

⚠
Connector with red marking is not required at this time since the engine control module has presently no function installed for it.



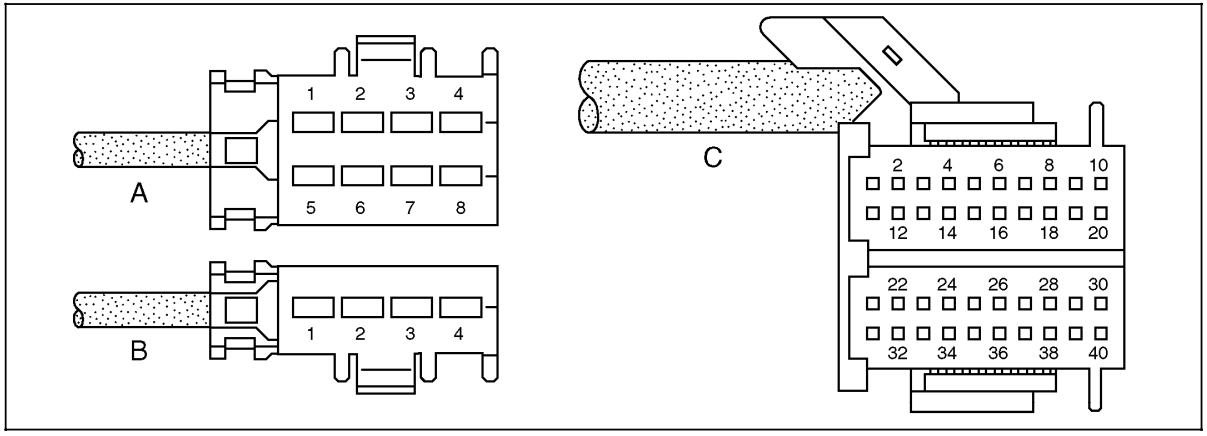
P07.61-0267-06

Figure 1

001	Engine control module connectors
003	Digital multimeter
050	Socket box (126-pole)
108	Test cable
N3/10	Engine control module (ME-SFI)
A-F	Connectors
II1/63	Connectors, socket box
III63/126	Connectors, socket box

Electrical Test Program – Preparation for Test

Connector Layout - Engine Control Module



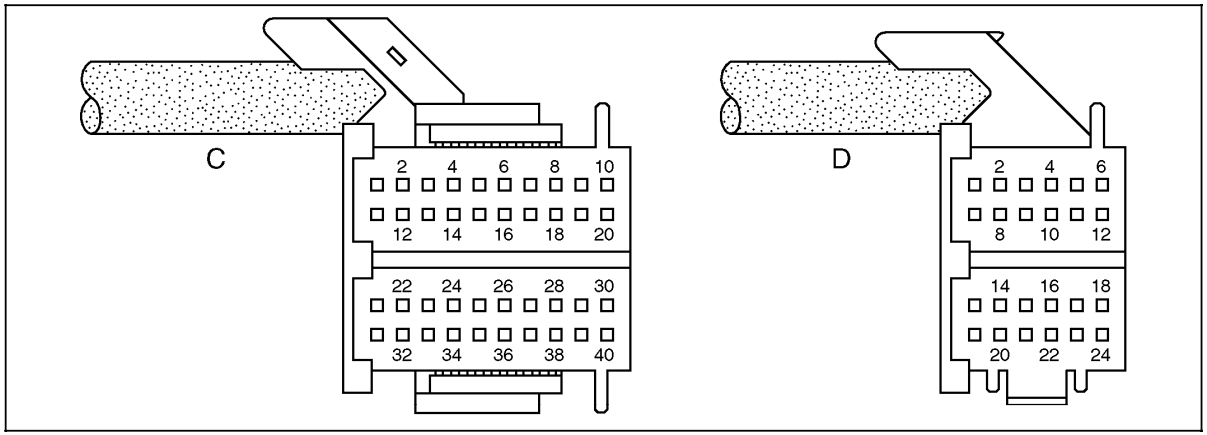
P07.61-0251-04

Figure 2

1A	Left O2S 1 heater (before TWC)
2A	Voltage supply (circuit 87), fused
3A	Ground Model 129: (control module box/module box) (W27) Model 163: (component compartment) (W16) Model 208/210: (electronics ground - component compartment - right) (W16/6)
4A	–
5A	Right O2S 1 heater (right, before TWC)
6A	Engine/climate control electric cooling fan control
7A	Ground Model 129: (control module box/module box) (W27) Model 208/210: (electronics ground - component compartment - right) (W16/6)
8A	Ground Model 129: (control module box/module box) (W27) Model 208/210: (electronics ground - component compartment - right) (W16/6)
1B	Right O2S 2 heater (right, after TWC) (only USA)
2B	Left O2S 2 heater (left, after TWC) (only USA)
3B	Diagnosis connection (data link connector)
4B	Voltage supply (circuit 30)
1C – 20C	–
21C	Purge control valve
22C	Pedal value sensor (+ nominal value potentiometer 1)
23C	Pedal value sensor (– nominal value potentiometer 1)
24C	Pedal value sensor (nominal value potentiometer 1 wiper)
25C	Pedal value sensor (nominal value potentiometer 2 wiper)
26C	Pedal value sensor (– nominal value potentiometer 2)
27C	Pedal value sensor (+ nominal value potentiometer 2)
28C	AIR pump relay module (only USA)
29C	FP relay module (K27)
30C	–
31C	Right O2S 1 ground (right, before TWC)
32C	Right O2S 1 signal (right, before TWC)
33C	Left O2S 1 signal (left, before TWC)
34C	Left O2S 1 ground (left, before TWC)
35C-37C	–

Electrical Test Program – Preparation for Test

Connector Layout - Engine Control Module



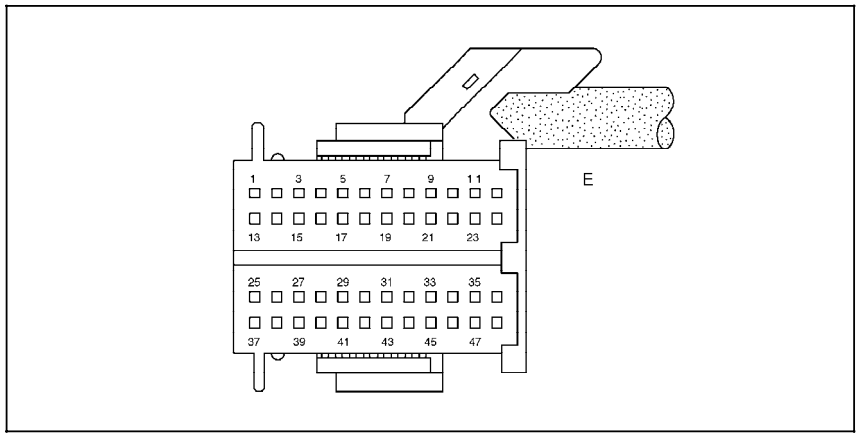
P07.61-0252-04

Figure 3

38C	Datalink connector (engine rpm signal)
39C	Data link connector (ME-SFI DTC's)
40C	Signal (circuit 50)
1D	FP relay module (K27)
2D	Activated charcoal canister shut-off valve (only USA)
3D	Starter relay
4D	Ground, fuel tank pressure sensor (only USA)
5D	Signal, fuel tank pressure sensor (only USA)
6D	Voltage supply 5 V for fuel tank pressure sensor (only USA)
7D	Right O2S 2 ground (right, after TWC) (only USA)
8D	Right O2S 2 signal (right, after TWC) (only USA)
9D	Left O2S 2 signal (left, after TWC) (only USA)
10D	Left O2S 2 ground (left, after TWC) (only USA)
11D	CAN data bus "H"
12D	CAN data bus "L"
13D	Variable speed limit regulation (without DAS 3 only)
14D-15D	–
16D	Crash-Signal (as of 06/98)
17D-18D	–
19D	P/N recognition with AT
20D	CC switch (accelerate/set) (without DAS 3 only)
21D	CC switch (decelerate/set) (without DAS 3 only)
22D	CC switch (resume) (without DAS 3 only)
23D	CC switch (control contact) (without DAS 3 only)
24D	CC switch (off) (without DAS 3 only)

Electrical Test Program – Preparation for Test

Connector Layout - Connector 1, interior for ME-SFI control module



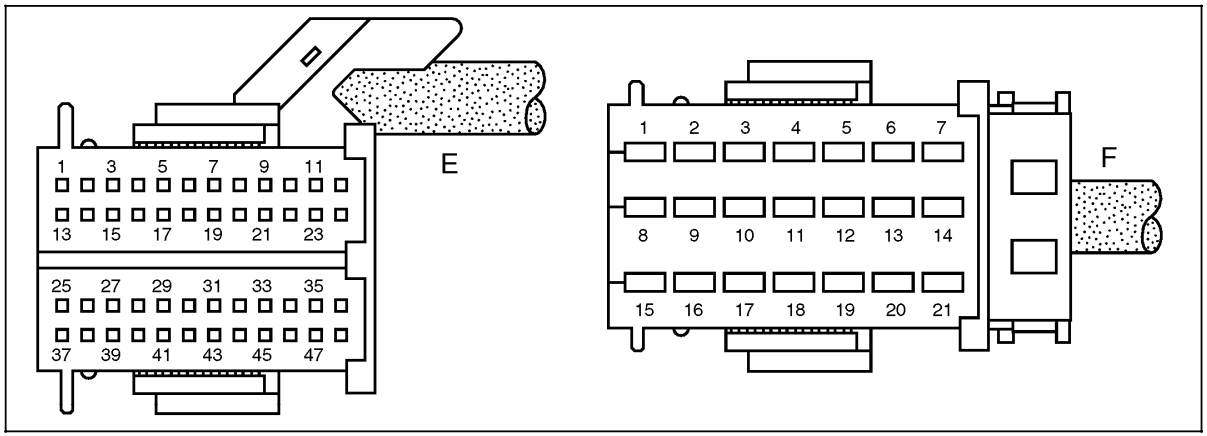
P07.61-0253-05

Figure 4

1E	Injector cyl. 6
2E	Injector cyl. 3
3E	Injector cyl. 7
4E	Injector cyl. 8
5E	EGR switchover valve
6E – 9E	–
10E	AIR pump switchover valve (only USA)
11E	–
12E	Resonance intake manifold switchover valve
13E	Injector cyl. 4
14E	Injector cyl. 2
15E	Voltage supply 5 V, oil sensor (level/temperature/quality)
16E	Ground for oil sensor (level/temperature/quality)
17E	Signal for oil sensor (level/temperature/quality)
18E – 20E	–
21E	Signal for oil pressure switch
22E	Voltage supply 5 V, pressure sensor (only USA)
23E	Pressure sensor signal (only USA)
24E	Pressure sensor ground (only USA)
25E	Injector cyl. 1
26E	Injector cyl. 5
27E	AIR pump relay in relay module (only USA)
28E	ECT sensor ground
29E	ECT sensor signal
30E	–
31E	EA/CC/ISC actuator (actual value potentiometer 1 wiper)
32E	EA/CC/ISC actuator (actual value potentiometer ground)
33E	Actual value potentiometer voltage supply
34E	EA/CC/ISC actuator (actual value potentiometer 2 wiper)
35E – 36E	–
37E	CKP sensor ground
38E	CKP sensor signal
39E	Camshaft Hall-effect sensor ground
40E	Camshaft Hall-effect sensor signal

Electrical Test Program – Preparation for Test

Connector Layout - Engine Control Module



P07.61-0254-04

Figure 5

33E	Actual value potentiometer voltage supply	1F	EA/CC/ISC actuator (–)	15F	Ground
34E	EA/CC/ISC actuator (actual value potentiometer 2 wiper)	2F	EA/CC/ISC actuator (+)		Model 129: (control module box/module box) (W27)
35E – 36E	–	3F	–		Model 163: (component compartment) (W16)
37E	CKP sensor ground	4F	Ignition coil T1/3 b cyl. 3		Model 208/210: (electronics ground - component compartment - right) (W16/6)
38E	CKP sensor signal	5F	Ignition coil T1/3 a cyl. 3	16F	Ignition coil T1/6, b cyl. 6
39E	Camshaft Hall-effect sensor ground	6F	Ignition coil T1/4 a cyl. 4	17F	Ignition coil T1/6, a cyl. 6
40E	Camshaft Hall-effect sensor signal	7F	Ignition coil T1/4 b cyl. 4	18F	Ignition coil T1/2, b cyl. 2
41E	KS 1 ground (right side of engine)	8F	Ground	19F	Ignition coil T1/2, a cyl. 2
42E	KS 1 signal (right side of engine)		Model 129: (control module box/module box) (W27)	20F	Ignition coil T1/1, a cyl. 1
43E	KS 2 ground (left side of engine)		Model 163: (component compartment) (W16)	21F	Ignition coil T1/1, b cyl. 1
44E	KS 2 signal (left side of engine)		Model 208/210: (electronics ground - component compartment - right) (W16/6)		
45E	IAT sensor (in hot film MAF sensor)	9F	Ignition coil T1/8 b cyl. 8		
46E	Hot film MAF sensor voltage supply 5 V	10F	Ignition coil T1/8 a cyl. 8		
47E	Hot film MAF sensor signal	11F	Ignition coil T1/7 b cyl. 7		
48E	Hot film MAF sensor ground	12F	Ignition coil T1/7 a cyl. 7		
		13F	Ignition coil T1/5 a cyl. 5		
		12F	Ignition coil T1/5 b cyl. 5		

Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
1.0	P0 560	**Engine control module (ME-SFI) (N3/10)** Voltage supply Circuit 30 U	N3/10 3 (3A) — V — 12 (4B)	Ignition: **ON**	11 – 14 V	⇒ 1.1 ⇒ 1.2
1.1		Ground wire, Output ground	N3/10 3 (3A) — V — X11/4 2 7 (7A) — V — X11/4 2 112 (8F) — V — X11/4 2 119 (15F) — V — X11/4 2	Ignition: **ON**	11 – 14 V	Wiring, **Model 208/210:** (electronics ground - component compartment - right) (W16/6) **Model 129:** (control module box/module box) (W27) **Model 163:** (component compartment) (W16) ⇒ 1.2 **Model 463:** Ground: right A-pillar (W29/2), ground bracket - control module box (W27)
1.2		Voltage supply Circuit 30	N3/10 X11/4 1 — V — 12 (4B)	Ignition: **ON**	11 – 14 V	Wiring, Passenger-side fuse and relay module (K40/4), Fuse box (F1), Base module (BM) (N16/1).

Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
2.0	P0 560	**Engine control module (ME-SFI) (N3/10)** Voltage supply Circuit 87	N3/10 8 (8A) — 2 (2A)	Ignition: **ON**	11 – 14 V	⇒ 2.1 – 2.2
2.1		Electronics ground	N3/10 8 (8A) — X11/4 — 2	Ignition: **ON**	11 – 14 V	Wiring, **Model 208/210:** (electronics ground - component compartment - right) (W16/6), **Model 129:** (control module box/module box) (W27), **Model 163:** (component compartment) (W16) **Model 463:** Ground: right A-pillar (W29/2)
2.2		Voltage supply Circuit 87	N3/10 X11/4 1 — 2 (2A)	Ignition: **ON** Model 163: connect 16-pole test cable to socket 4 Ignition: **OFF**	11 – 14 V < 1 V	Wiring, Passenger-side fuse and relay module (K40/4), Fuse box (F1), Base module (BM) (N16/1).

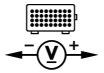
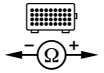
Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
3.0		**Starter relay** **Model 208/210:** In passenger-side fuse and relay module box (K40/4k2) **Model 163:** F1k8 **Model 129** Starter lock-out relay module K38/1 Activation **Model 463:** in relay module (K40) Activation	N3/10 35 (3D) 2 (2A)	ECT temperature > 20 ° C Ignition/starter switch (S2/1): position 3 (start position): crank engine **briefly**	11 – 14 V or if engine does not start in approx. 5 seconds.	⇒ 1.1, Engine control module (N3/10)
3.1		Starter signal circuit 50	N3/10 8 (8A) 32 (40C)	Engine: **Start**	11 – 14 V while starting.	Wiring, Ignition/starter switch (S2/1)
4.0	P0 100	**Hot film MAF sensor (B2/5)** Hot film signal	N3/10 104 (48E) 103 (47E)	Ignition: **ON** Engine: **at Idle** Engine coolant temperature >70°C	0.9 – 1.1 V 1.3 – 1.7 V Increasing rpm, increasing voltage.	⇒ 4.1 – 4.3, Wiring, Air intake system leak, B2/5

Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
4.1		Hot film MAF sensor (B2/5) Voltage supply 5 V	N3/10 104 (48E) — V — B2/5 — 4	Disconnect MAF sensor (B2/5) connector and measure directly on socket 4 (brown/yellow). Ignition: **ON**	4.7 – 5.2 V	Wiring, N3/10
4.2		Ground wire for hot film MAF sensor (B2/5)	B2/5 3 — V — N3/10 102 (46E)	Disconnect MAF sensor (B2/5) connector and measure directly on socket 3 (brown). Ignition: **ON**	4.7 – 5.2 V	Wiring.
4.3		Hot film MAF sensor (B2/5) Voltage supply 12 V	N3/10 104 (48E) — V — B2/5 2 (2)	Disconnect MAF sensor (B2/5) connector and connect plus of voltmeter to socket 2 (red/blue). Ignition: **ON**	11 – 14 V	Wiring, Passenger-side fuse and relay module (K40/4), Fuse box (F1), Base module (BM) (N16/1).

Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
5.0	P0 110	**IAT sensor in hot film MAF sensor (B2/5)** Voltage	N3/10  104 (48E) — 101 (45E)	Ignition: **ON**	°C V 10 3.1 20 2.7 30 2.2 40 1.8 50 1.4 60 1.1 ± 5%	⇒ 5.1 N3/10
5.1		IAT sensor Resistance	N3/10  104 (48E) — 101 (45E)	Ignition: **OFF** Disconnect connector **E** on engine control module (N3/10).	°C Ω 10 3600 20 2420 30 1660 40 1170 50 850 60 600 ± 5%	Wiring, B2/5

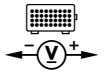
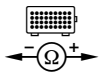
Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
6.0	P0 105	**Only** (USA) **Pressure sensor (B28)** Sensor signal	N3/10 80 (24E) — V — 79 (23E)	Connect vacuum tester to B28, using the Y-connector. Ignition: **ON** Engine: **at Idle**	 > 3.5 V < 2 V and vacuum climbs to > 500 mbar.	Vacuum line, Wiring, B28, N3/10
		Pressure sensor (B28) Voltage supply	N3/10 80 (24E) — V — 78 (22E)	Ignition: **ON**	4.7 – 5.3 V	

Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
7.0		**FP relay module (K27)** Activation	N3/10 21 (29C) — (V) — 2 (2A)	Ignition: **ON** Engine: **Start**	11 – 14 V for approx. 1 sec. The activation of the FP occurs only once after ignition "ON". For the next activation, the engine must have run briefly.	Fuse, Wiring, K27 or, N3/10
		Current draw (K27) Model 463: K40k1	N3/10 8 (8A) — (A) — 21 (29C)	Ignition: **ON**	0.1 – 0.3 A	

Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
8.0	P0 115	**ECT sensor (B11/4)** Voltage	N3/10  84 (28E) — 85 (29E)	Ignition: **ON**	°C V 20 3.4 30 2.9 40 2.4 50 1.9 60 1.5 70 1.2 80 0.9 90 0.7 100 0.5 ±5 %	⇒ 8.1, N3/10
8.1		Resistance (B11/4)	N3/10  84 (28E) — 85 (29E)	Ignition: **OFF** Disconnect connector **E** on engine control module (N3/10).	°C Ω 20 3090 30 2000 40 1330 50 900 60 630 70 440 80 320 90 230 100 170 ±5 %	Wiring, ⇒ 8.2

Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
8.2		ECT sensor (B11/4) Resistance	B11/4 1 ◄–Ω+► 2	Disconnect connector on ECT sensor (B11/4).	°C Ω 20 3090 30 2000 40 1330 50 900 60 630 70 440 80 320 90 230 100 170 ±5 %	B11/4
9.0		**Engine control module (N3/10)** TN-signal output	N3/10 8 (8A) ◄–⏚+► (38C) 30	Test with oscilloscope. Engine: **Start** or Engine: **at Idle**	Signal: see Figure 2.	Wiring, N3/10
			N3/10 8 (8A) ◄–V+► (38C) 30	Test with multimeter only if oscilloscope is not available.	7.5 – 9.0 V	
10.0	P0 150 P0 153 P0 160	**Left O2S 1 (before TWC) (G3/3)** O2S signal	N3/10 26 (34C) ◄–V+► (33C) 25	ECT > 80 ° C, run engine at idle for at least two minutes.	Fluctuates from – 0.2 V to + 1.0 V, by more than 0.3 V	⇒ 12.0, Wiring, G3/3

Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
11.0	P0 130 P0 133 P0 140	**Right O2S 1 (before TWC) (G3/4)** O2S signal	N3/10 23 (31C) — V — 24 (32C)	ECT > 80 ° C, run engine at idle for at least two minutes.	Fluctuates from – 0.2 V to + 1.0 V, by more than 0.3 V	⇒ 13.0, Wiring, G3/4
12.0	P0 155	**Left O2S 1 (before TWC) (G3/3)** O2S heater Activation	N3/10 1 (1A) — V — 2 (2A)	Engine: **at Idle** ECT > 80° C, run engine at idle for at least 2 minutes.	11 – 14 V	Fuse, Wiring, G3/3, N3/10
		O2S 1 (G3/3) Current draw	N3/10 3 (3A) — A — 1 (1A)	Disconnect connector **A** on engine control module N3/10 Ignition: **ON**	1.5 – 4.5 A	

Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
13.0	P0 135	**Right O2S 1** **(before TWC) (G3/4)** O2S heater Activation	N3/10 5 (5A) — (V) — 2 (2A)	Engine: **at Idle** ECT > 80° C, run engine at idle for at least 2 minutes.	11 – 14 V	Fuse, Wiring, G3/4, N3/10
		O2S 2 (G3/4) Current draw	N3/10 3 (3A) — (A) — 5 (5A)	Disconnect connector **A** on engine control module N3/10 Ignition: **ON**	1.5 – 4.5 A	
14.0	P0 156 P0 160	**Only** (USA) **Left O2S 2** **(after TWC) (G3/5)** O2S signal	N3/10 42 (10D) — (V) — 41 (9D)	ECT > 80° C, run engine at 2000-3000 rpm for approx. 2 minutes. Engine: **at Idle**	The range of 450mV to 550mV, must be attained or not attained within 1 minute.	⇒ 16.0, Wiring, G3/5, N3/10
			N3/10 3 (3A) — 66 (10E)	Bridge sockets on socket box.	Air pump runs. Voltage changes within 60 seconds to < 40 mV	
			3 (3A) — 20 (28C)			

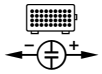
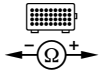
Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
15.0	P0 136	**Only** (USA) **Right O2S 2** **(after TWC) (G3/6)** O2S signal	N3/10 39 (7D) — (V) — 40 (8D)	ECT > 80° C, run engine at 2000-3000 rpm for approx. 2 minutes. Engine: **at Idle**	The range of 450mV to 550mV, must be attained or not attained within 1 minute.	⇒ 17.0, Wiring, G3/6, N3/10
			N3/10 3 (3A) — 66 (10E) 3 (3A) — 20 (28C)	Bridge sockets on socket box.	Air pump runs. Voltage changes within 60 seconds to < 40 mV	
16.0	P0 161	**Only** (USA) **Left O2S 2** **(after TWC) (G3/5)** O2S heater Activation	N3/10 10 (2B) — (V) — 2 (2A)	Engine: **at Idle** ECT > 80° C, run engine at idle for at least 2 minutes.	11 – 14 V or voltage fluctuates between 1 – 14 V.	Fuses, Wiring, G3/5, N3/10
		O2S 2 (G3/5) Current draw	N3/10 3 (3A) — (A) — 10 (2B)	Disconnect connector **B** on engine control module N3/10 Ignition: **ON**	1.5 – 4.5 A	

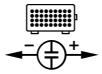
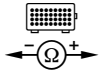
Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
17.0	P0 141	**Only** (USA) **Right O2S 2** **(after TWC) (G3/6)** O2S heater Activation	N3/10 9 (1B) — (V) — 2 (2A)	Engine: **at Idle** ECT > 80° C, run engine at idle for at least 2 minutes.	11 – 14 V or voltage fluctuates between 1 – 14 V.	Fuses, Wiring, G3/6, N3/10
		O2S 2 (G3/6) Current draw	N3/10 3 (3A) — (A) — 9 (1B)	Disconnect connector **B** on engine control module Ignition: **ON**	1.5 – 4.5 A	
18.0	P0 201	**Injector (Y62y1)** Activation and injection time	N3/10 81 (25E) — (⏚) — 2 (2A)	**ECT approx. 20° C** at start: **ECT approx. 80° C** at idle: accelerate briefly:	Injection time: approx. 8 ms approx. 3 – 5 ms approx. 14 ms (signal: see 3 and 4)	Fuses, Wiring, Y62y1, N3/10, ECT sensor (B11/4), IAT sensor in hot film MAF sensor (B2/5), O2S 1 (G3/3 or G3/4).
		Resistance (Y62y1)	N3/10 81 (25E) — (Ω) — 2 (2A)	Ignition: **OFF**	14 – 18 Ω	

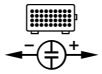
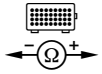
Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
19.0	P0 202	**Injector (Y62y2)** Activation and injection time	N3/10  70 (14E) — 2 (2A)	**ECT approx. 20° C** at start: **ECT approx. 80° C** at idle: accelerate briefly:	Injection time: approx. 8 ms approx. 3 – 5 ms approx. 14 ms (signal: see Figures 3 and 4)	Fuses, Wiring, Y62y2, N3/10, ECT sensor (B11/4), IAT sensor in hot film MAF sensor (B2/5), O2S 1 (G3/3 or G3/4).
		Resistance (Y62y2)	N3/10  70 (14E) — 2 (2A)	Ignition: **OFF**	14 – 18 Ω	

Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
20.0	P0 203	**Injector (Y62y3)** Activation and injection time	N3/10  58 (2E) — 2 (2A)	**ECT approx. 20° C** at start: **ECT approx. 80° C** at idle: accelerate briefly:	Injection time: approx. 8 ms approx. 3 – 5 ms approx. 14 ms (signal: see Figures 3 and 4)	Fuses, Wiring, Y62y3, N3/10, ECT sensor (B11/4), IAT sensor in hot film MAF sensor (B2/5), O2S 1 (G3/3 or G3/4).
		Resistance (Y62y3)	N3/10  58 (2E) — 2 (2A)	Ignition: **OFF**	14 – 18 Ω	

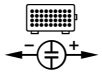
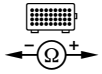
Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
21.0	P0 204	**Injector (Y62y4)** Activation and injection time	N3/10  69 (13E) — 2 (2A)	**ECT approx. 20° C** at start: **ECT approx. 80° C** at idle: accelerate briefly:	Injection time: approx. 8 ms approx. 3 – 5 ms approx. 14 ms (signal: see Figures 3 and 4)	Fuses, Wiring, Y62y4, N3/10, ECT sensor (B11/4), IAT sensor in hot film MAF sensor (B2/5), O2S 1 (G3/3 or G3/4).
		Resistance (Y62y4)	N3/10  69 (13E) — 2 (2A)	Ignition: **OFF**	14 – 18 Ω	

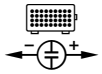
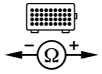
Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
22.0	P0 205	**Injector (Y62y5)** Activation and injection time	N3/10 82 (26E) — 2 (2A)	**ECT approx. 20° C** at start: **ECT approx. 80° C** at idle: accelerate briefly:	Injection time: approx. 8 ms approx. 3 – 5 ms approx. 14 ms (signal see Figures 3 and 4)	Fuses, Wiring, Y62y5, N3/10, ECT sensor (B11/4), IAT sensor in hot film MAF sensor (B2/5), O2S 1 (G3/3 or G3/4).
		Resistance (Y62y5)	N3/10 82 (26E) — 2 (2A)	Ignition: **OFF**	14 – 18 Ω	

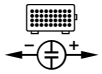
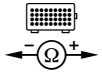
Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
23.0	P0 206	**Injector (Y62y6)** Activation and injection time	N3/10  57 (1E) — 2 (2A)	**ECT approx. 20° C** at start: **ECT approx. 80° C** at idle: accelerate briefly:	Injection time: approx. 8 ms approx. 3 – 5 ms approx. 14 ms (signal: see Figures 3 and 4)	Fuses, Wiring, Y62y6, N3/10, ECT sensor (B11/4), IAT sensor in hot film MAF sensor (B2/5), O2S 1 (G3/3 or G3/4).
		Resistance (Y62y6)	N3/10  57 (1E) — 2 (2A)	Ignition: **OFF**	14 – 18 Ω	

Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
24.0	P0 207	**Injector (Y62y7)** Activation and injection time	N3/10  59 (3E) — 2 (2A)	**ECT approx. 20° C** at start: **ECT approx. 80° C** at idle: accelerate briefly:	Injection time: approx. 8 ms approx. 3 – 5 ms approx. 14 ms (signal: see Figures 3 and 4)	Wiring, Y62y7, N3/10, ECT sensor (B11/4), IAT sensor in hot film MAF sensor (B2/5), O2S 1 (G3/3 or G3/4)
		Resistance (Y62y7)	N3/10  59 (3E) — 2 (2A)	Ignition: **OFF**	14 – 18 Ω	

Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
25.0	P0 208	**Injector (Y62y8)** Activation and injection time	N3/10  60 (4E) — 2 (2A)	**ECT approx. 20° C** at start: **ECT approx. 80° C** at idle: accelerate briefly:	Injection time: approx. 8 ms approx. 3 – 5 ms approx. 14 ms (signal: see Figures 3 and 4)	Wiring, Y62y8, N3/10, ECT sensor (B11/4), IAT sensor in hot film MAF sensor (B2/5), O2S 1 (G3/3 or G3/4).
		Resistance (Y62y8)	N3/10  60 (4E) — 2 (2A)	Ignition: **OFF**	14 – 18 Ω	

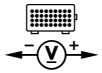
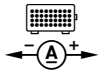
Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
26.0	P1 453	Only USA Possible air injection **AIR relay module (K17)** **in Passenger-side fuse and relay module** **box (K40/4)** **Model 129** **AIR relay module (K17)** Activation	N3/10 20 (28C) — (V) — 2 (2A)	Disconnect ECT sensor (B11/4) connector. Simulate 2.5 kΩ resistance at sockets 1 and 2 with resistance substitution unit. Engine: **at Idle**	11 – 14 V for approx. two minutes **and** AIR pump runs.	Fuses, Wiring, K17, K40/4, F1k28, N3/10
		Current draw (K40/4), (K17), or (F1k28)	N3/10 3 (3A) — (A) — 20 (28C)	Ignition: **ON**	0.1 – 0.3 A	
27.0	P1 420	Only USA **AIR pump switchover valve (Y32)** Activation	N3/10 66 (10E) — (V) — 2 (2A)	Disconnect ECT sensor (B11/4) connector. Simulate 2.5 kΩ resistance at sockets 1 and 2 with resistance substitution unit. Engine: **at Idle**	11 – 14 V for approx. two minutes **and** AIR pump runs.	Fuses, Wiring, Y32, N3/10
		Current draw (Y32)	N3/10 3 (3A) — (A) — 66 (10E)	Ignition: **ON**	0.3 – 0.5 A	

Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
28.0	P0 410	**Only** (USA) **AIR system** (logic chain)	N3/10 23 (31C) — V — 24 (32C) N3/10 3 (3A) — 66 (10E) 3 (3A) — 20 (28C)	**Note:** The O2S 1 signal before TWC is measured. With ETC > 80°C run engine at idle for at least 2 minutes. Bridge sockets on socket box	The O2S voltage oscillates in the area of –0.2 V and +1.0 V AIR pump runs. Voltage changes to < 100 mV within 20 seconds	Y32 binding, AIR combi valve, AIR pump no output.

Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
29.0	P0 400 P1 400	**EGR valve vacuum transducer (Y31/1)** Activation and vacuum control	N3/10  61 (5E) — 2 (2A)	**Note to test connection:** Connect vacuum tester to EGR valve vacuum transducer, after removing the MAF sensor with air box.		Fuses, Wiring, N3/10, Y31/1
				Engine: **at idle** ETC > 60°C	< 1 V and < 10 mbar vacuum.	
				Vehicle at approx. 3000/rpm while on dynamometer	1 – 7 V and 80 – 220 mbar vacuum.	
		Current draw (Y31/1)	N3/10  3 (3A) — 61 (5E)	Ignition: **ON**	0.3 – 0.5 A	

Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
30.0	P0 802	**Resonance intake manifold switchover valve (Y22/6)** Activation	N3/10 68 (12E) — 2 (2A)	Engine: **Start** Engine: **at idle** Engine: accelerate briefly to > approx. 3900 rpm	< 1 V 9 – 14 V and vacuum applied to valve.	Wiring, Y22/6, N3/10
		Current draw (Y22/6)	N3/10 3 (3A) — 68 (12E)	Ignition: **ON**	0.3 – 0.5 A	
31.0	P0 441 P0 443	**Purge control valve (Y58/1)** Activation	N3/10 13 (21C) — 2 (2A)	Engine: **at Idle** and at operating temperature.	After approx. 2 minutes, purge control valve (Y58/1) must noticeably cycle, Signal: see Figure 5.	⇒ 32.0, Fuses, Wiring, Y58/1, N3/10
		Current draw (Y58/1)	N3/10 3 (3A) — 13 (21C)	Ignition: **ON**	0.3 – 0.5 A	

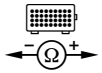
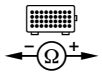
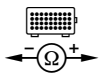
Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
32.0	P0 440 P0 441 P0 446	**Purge control valve (Y58/1)** Vacuum control		Connect vacuum tester to purge control valve (Y58/1) between purge line to charcoal canister. Engine at operating temperature and at idle.	After approx. 2 minute, > 50 mbar and needle oscillates, Y58/1 must cycle.	Vacuum line, Y58/1
33.0	P0 440 P0 442 P0 455 P00446	**Only** (USA) **Purge system** Leaks Activated charcoal canister shut-off valve (Y58/4) activated	N3/10 3 (3A) — 34 (2D)	Disconnect purge line (A) to charcoal canister on purge control valve (Y58/1). Connect vacuum tester to purge line. Ignition: **ON** Apply approx. 25 mbar of vacuum.	After approx. 1 minute, < 5 mbar vacuum loss.	Fuel tank cap, Purge line to charcoal canister, Purge line from charcoal canister to Y58/4, Charcoal canister, Y58/4, Y58/1, Fuel tank pressure sensor (B4/3).

Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
34.0	P0 446	**Only** (USA) **Activated charcoal canister shut-off valve (Y58/4)** Current draw	N3/10 3 (3A) — (A) — 34 (2D)	Ignition: **ON**	0.5 – 0.9 A	Fuse, Wiring, Y58/4
35.0	P0 450 P0 455 P0 446	**Only** (USA) **Fuel tank pressure sensor (B4/3)** Sender signal	N3/10 36 (4D) — (V) — 37 (5D)	Disconnect purge line (A) to charcoal canister on purge control valve (Y58/1). Connect vacuum tester to purge line.		⇒ 35.1, Wiring, Vacuum line, Charcoal canister plugged, B4/3
		Activated charcoal canister shut-off valve (Y58/4) activated	N3/10 3 (3A) — 34 (2D)	Ignition: **ON**	> 2.9 V	
				Apply approx. 25 mbar of vacuum.	< 2.3 V	
35.1		**Only** (USA) Fuel tank pressure sensor (B4/3) Voltage supply	N3/10 36 (4D) — (V) — 38 (6D)	Ignition: **ON**	4.7 – 5.3 V	N3/10

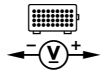
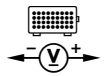
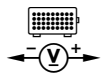
Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
36.0	P0 600 P0 811 P1 570 P1 603 P1 747	**CAN data bus**	N3/10  43 (11D) — 44 (12D)	Ignition: **OFF**	55 – 65 Ω	⇒ 36.1 ⇒ 36.2 Data line.
36.1		CAN element in EIS electronic ignition switch (N73), DAS radio frequency/infrared control module (N54/4), Instrument cluster (A1), DAS control module (N54/1) Resistance	N3/10  43 (11D) — 44 (12D)	Ignition: **OFF** Disconnect connector **D** from engine control module N3/10.	115 – 125 Ω	Wiring, **Model 208/210:** N73 **Model 129:** DAS radio frequency/infrared control module (N54/4), **Model 163:** Instrument cluster (A1) **Model 463:** DAS control module (N54/1)
36.2		CAN element in engine control module (N3/10) Resistance	N3/10  43 (11D) — 44 (12D)	Ignition: **OFF** Disconnect connector **D** from test cable and reconnect connector **D** to N3/10	115 – 125 Ω	N3/10

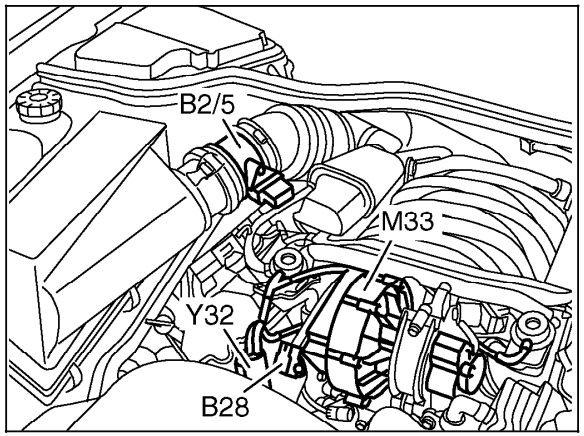
Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
37.0	P1 177 P1 178 P1 179 P1 180 P1 185	**Oil sensor (level/ temperature/quality) (B40)**	N3/10 72 (16E) — 73 (17E) N3/10 72 (16E) — 73 (17E)	Test with oscilloscope. Range: 2V Duration: 50ms Test with multimeter only if oscilloscope is not available. Ignition: **ON**	Signal: see Figure 6 0.3 – 3 V, voltage jumps	⇒ 37.1, oil level, oil quality, wiring, B40
37.1		Voltage supply (B40)	N3/10 72 (16E) — 71 (15E)	Ignition: **ON**	4.7 – 5.3 V	N3/10

Electrical Test Program – Sequential Multiport Fuel Injection System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
38.0	P0 801 P1 181	**With engine/climate control electric cooling fan only** **Engine/climate control electric cooling fan control module (N76)** Activation	N3/10  3 (3A) 6 (6A)	Engine: **at idle** ECT< 70° C Ignition: **ON** A/C: **ON** ECT > 85° C	 1 – 1.9 V and cooling fan is stationary. 2 – 4 V and cooling fan runs. between 2.5 – 12.5 V and cooling fan speed is based on activation.	Wiring, N76, N3/10
39.0		**Diagnosis line** Activation	N3/10  3 (3A) 31 (39C)	Ignition: **ON**	11 – 14 V	Wiring, N3/10
40.0	P1 681	**Vehicles as of 06/98** **Crash signal**	N3/10  8 (8A) 48 (16D)	Ignition: **ON**	<1 V	Wiring, Readout DTC memory.

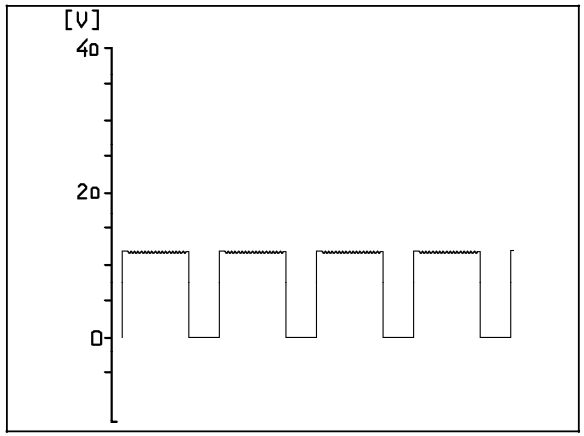
Electrical Test Program – Sequential Multiport Fuel Injection System Test



P07.61-0449-01

Figure 1

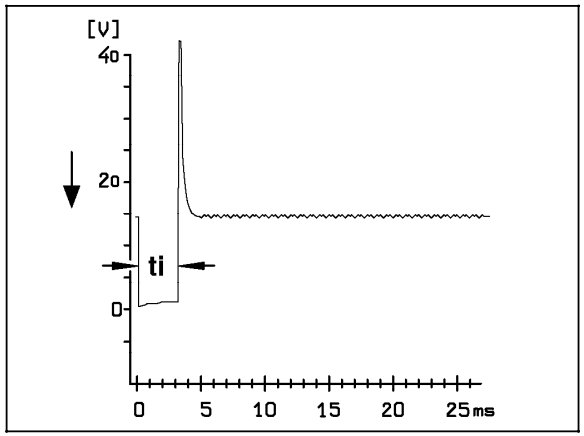
B28 Pressure sensor only (USA)



P07.61-0537-01

Figure 2

TN signal

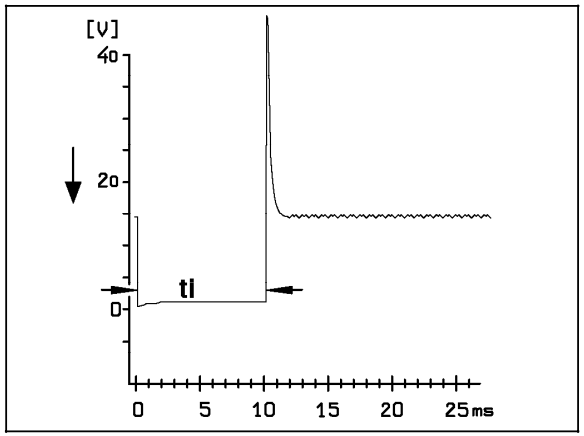


P07.61-0538-01

Figure 3

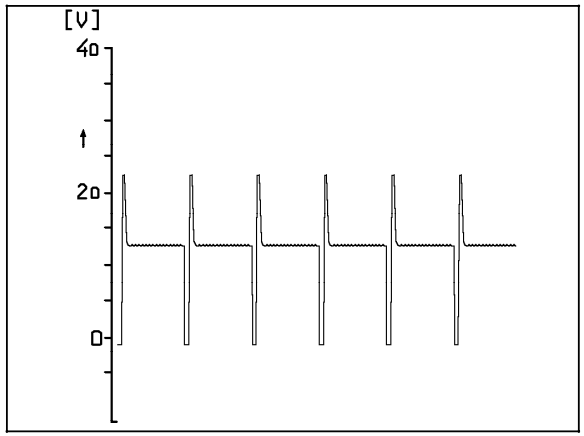
Injection duration “ti” at CTP

Electrical Test Program – Sequential Multiport Fuel Injection System Test



P07.61-0539-01

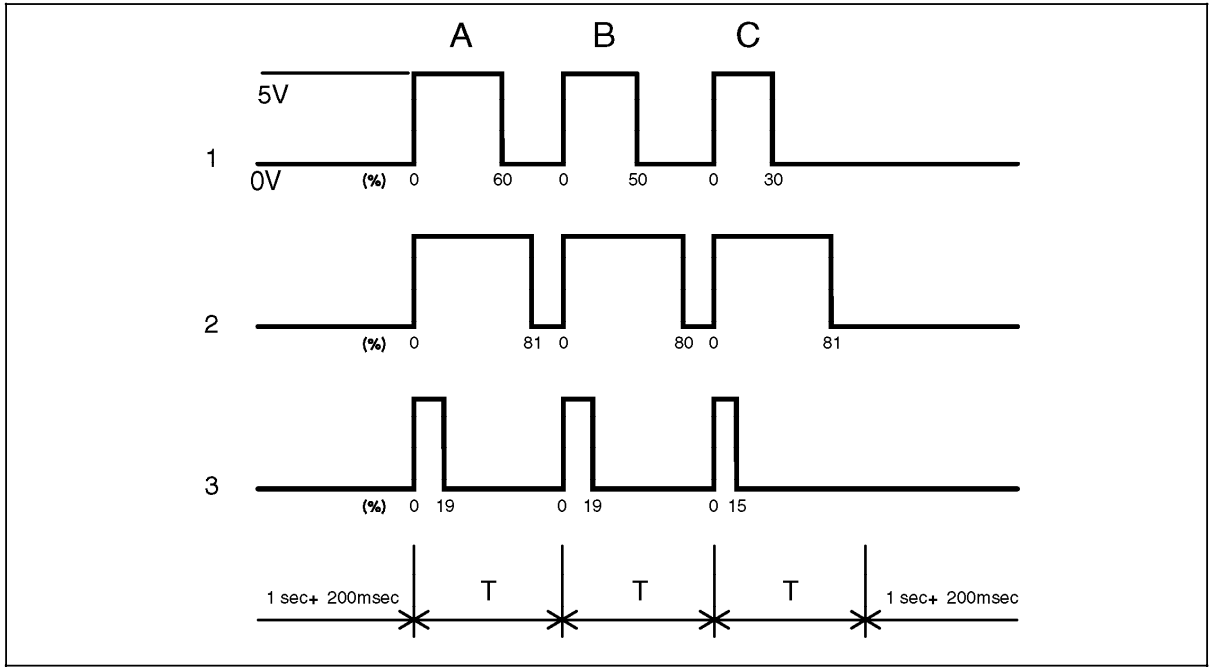
Figure 4
Injection duration “ti” at WOT



P07.61-0540-01

Figure 5
Model 129
Y58/1 Purge control valve

Electrical Test Program – Sequential Multiport Fuel Injection System Test



P07.61-0445-05

Figure 6

Oil Sensor (B40) Signal Survey

1 Sensor signal sensitivity ok
2 Sensor signal sensitivity > 80%
- A Oil temperature > +160° C
- B Oil level > 80mm
- C Oil quality good

3 Sensor signal sensitivity < 20%
- A Oil temperature < -40° C
- B Oil level < 0 mm
- C Oil quality poor

Electrical Test Program – Ignition System Test

⚠ WARNING!
Risk of severe injury when touching ignition parts which produce high voltages. Do not touch ignition components.
Persons with heart pacemakers are not to perform repairs on this type of ignition system.

Preparation for Test:
1. Review section 0,
2. Review 11, 21, 22 entirely,
3. Readout DTC memory,
4. Ignition: **OFF,**
5. Connect test cable with socket box to N3/10.

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
1.0	P0 560	**Engine control module (N3/10)** Voltage supply circuit 30	N3/10 3 (3A) — V — 12 (4B)	Ignition: **ON**	11 – 14 V	⇒ 1.1 – 1.2
1.1		Ground wire	N3/10 3 (3A) — V — X11/4 2 7 (7A) — V — X11/4 2 112 (8F) — V — X11/4 2 119 (15F) — V — X11/4 2	Ignition: **ON**	11 – 14 V	Wiring, **Model 208/210:** (electronics ground - component compartment - right) (W16/6), **Model 163:** (component compartment) (W16), **Model 129:** (control module box/module box) (W27). Model 463: Ground, right A-pillar (w29/2), Ground, bracket control module (W27).

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
1.2		Voltage supply circuit 30	X11/4 1 — ◄ (V) ► N3/10 — 12 (4B)	Ignition: **ON** Model 163: Connect 16-pole test cable to socket 4.	11 – 14 V	Wiring, Passenger-side fuse and relay module box (K40/4). Fuse box (F1), Base module (BM) (N16/1).
2.0	P0 560	**Engine control module (N3/10)** Voltage supply circuit 87	N3/10 8 — ◄ (V) ► — 2 (8A) (2A)	Ignition: **ON**	11 – 14 V	⇒ 2.1 – 2.2
2.1		Electronics ground	N3/10 8 — ◄ (V) ► X11/4 — 2 (8A)	Ignition: **ON**	11 – 14 V	Wiring, **Model 208/210:** (electronics ground - component compartment - right) (W16/6), **Model 163:** (component compartment) (W16), **Model 129:** (control module box/module box) (W27). **Model 463:** Ground, right A-pillar (W29/2)
2.2		Voltage supply circuit 87	X11/4 1 — ◄ (V) ► N3/10 — 2 (2A)	Ignition: **ON** Model 163: Connect 16-pole test Ignition: **OFF**	11 – 14 V < 1 V	Wiring, Passenger-side fuse and relay module box (K40/4). Fuse box (F1), Base module (BM) (N16/1), (F1f22)

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
3.0		**Ignition coil (T1/1)** Cylinder 1 Voltage supply Primary coil a Voltage supply Primary coil b	N3/10 3 (3A) — (V) — 124 (20F) N3/10 3 (3A) — (V) — 125 (21F)	Ignition: **ON**	11 – 14 V	Wiring, Fuses: **Model 208/210:** Fuse, ignition coils (K40/4f6), **Model 129:** Fuse 34 (F1f34), **Model 163:** Fuse 26 (F1f26), Ignition coil (T1/1). **Model 463:** Fuse F1f25 Ignition coil (T1/1).
4.0		**Ignition coil (T1/2)** Cylinder 2 Voltage supply Primary coil a Voltage supply Primary coil b	N3/10 3 (3A) — (V) — 123 (19F) N3/10 3 (3A) — (V) — 122 (18F)	Ignition: **ON**	11 – 14 V	Wiring, Fuses: **Model 208/210:** Fuse, ignition coils (K40/4f6), **Model 129:** Fuse 34 (F1f34), **Model 163:** Fuse 26 (F1f26), Ignition coil (T1/2), **Model 463:** Fuse F1f25 Ignition coil (T1/2).

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
5.0		**Ignition coil (T1/3)** Cylinder 3 Voltage supply Primary coil a Voltage supply Primary coil b	N3/10 3 (3A) — V — 109 (5F) N3/10 3 (3A) — V — 108 (4F)	Ignition: **ON**	11 – 14 V	Wiring, Fuses: **Model 208/210:** Fuse, ignition coils (K40/4f6), **Model 129:** Fuse 34 (F1f34), **Model 163:** Fuse 26 (F1f26), Ignition coil (T1/3), **Model 463:** Fuse F1f25 Ignition coil (T1/3).
6.0		**Ignition coil (T1/4)** Cylinder 4 Voltage supply Primary coil a Voltage supply Primary coil b	N3/10 3 (3A) — V — 110 (6F) N3/10 3 (3A) — V — 111 (7F)	Ignition: **ON**	11 – 14 V	Wiring, Fuses: **Model 208/210:** Fuse, ignition coils (K40/4f6), **Model 129:** Fuse 34 (F1f34), **Model 163:** Fuse 26 (F1f26), Ignition coil (T1/4) **Model 463:** Fuse F1f25 Ignition coil (T1/4).

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
7.0		**Ignition coil (T1/5)** Cylinder 5 Voltage supply Primary coil a Voltage supply Primary coil b	N3/10 3 (3A) — (V) — 117 (13F) N3/10 3 (3A) — (V) — 118 (14F)	Ignition: **ON**	11 – 14 V	Wiring, Fuses: **Model 208/210:** Fuse, ignition coils (K40/4f6), **Model 129:** Fuse 34 (F1f34), **Model 163:** Fuse 26 (F1f26), Ignition coil (T1/5), **Model 463:** Fuse F1f25 Ignition coil (T1/5).
8.0		**Ignition coil (T1/6)** Cylinder 6 Voltage supply Primary coil a Voltage supply Primary coil b	N3/10 3 (3A) — (V) — 121 (17F) N3/10 3 (3A) — (V) — 120 (16F)	Ignition: **ON**	11 – 14 V	Wiring, Fuses: **Model 208/210:** Fuse, ignition coils (K40/4f6), **Model 129:** Fuse 34 (F1f34), **Model 163:** Fuse 26 (F1f26), Ignition coil (T1/6), **Model 463:** Fuse F1f25 Ignition coil (T1/6).

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
9.0		**Ignition coil (T1/7)** Cylinder 7 Voltage supply Primary coil a Voltage supply Primary coil b	N3/10 3 (3A) — V — 116 (12F) N3/10 3 (3A) — V — 115 (11F)	Ignition: **ON**	11 – 14 V	Wiring, Fuses: **Model 208/210:** Fuse, ignition coils (K40/4f6), **Model 129:** Fuse 34 (F1f34), **Model 163:** Fuse 26 (F1f26), Ignition coil (T1/7), **Model 463:** Fuse F1f25 Ignition coil (T1/7).
10.0		**Ignition coil (T1/8)** Cylinder 8 Voltage supply Primary coil a Voltage supply Primary coil b	N3/10 3 (3A) — V — 114 (10F) N3/10 3 (3A) — V — 113 (9F)	Ignition: **ON**	11 – 14 V	Wiring, Fuses: **Model 208/210:** Fuse, ignition coils (K40/4f6), **Model 129:** Fuse 34 (F1f34), **Model 163:** Fuse 26 (F1f26), Ignition coil (T1/8), **Model 463:** Fuse F1f25 Ignition coil (T1/8).

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
11.0	P0 335	**CKP sensor (L5)**		Test with oscilloscope. Starter: **Crank**	Signal: see Figure 1 and 3.	⇒ 11.1, Teeth on starter ring gear.
		Signal	N3/10 93 (37E) — 94 (38E)	Engine: **at Idle**		
				Test with multimeter only if oscilloscope is unavailable.		
		Voltage	N3/10 93 (37E) — 94 (38E)	Starter: **Crank**	> 2.0 V	
				Engine: **at Idle**	> 5 V Voltage increases with increasing rpm.	
11.1		Resistance of CKP sensor (L5)	N3/10 93 (37E) — 94 (38E)	Ignition: **OFF** Unplug connector **E** on engine control module (N3/10).	(at 20°C): 600 – 1200 Ω	Wiring, L5

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
12.0	P0 341	**Camshaft Hall-effect sensor (B6/1)** Hall-effect signal	N3/10 95 (39E) — 96 (40E)	Test with oscilloscope. Engine: **at Idle**	Signal: see Figure 2 and 3.	⇒ 12.1, Wiring, B6/1
		Voltage	N3/10 96 (40E) — 2 (2A)	Test with multimeter only if oscilloscope is unavailable. Engine: **at Idle**	1.2 – 2.2 V Value changes.	
12.1		Voltage supply to camshaft Hall-effect sensor (B6/1)	B6/1 1 — 3	Ignition: **ON** Disconnect connector from Hall-effect sensor (B6/1) and test directly on sockets 1 (brown/green) and 3 (red/blue) of connector.	11 – 14 V	Wiring.

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
13.0	P0 300 P0 301	**Primary voltage** Ignition coil (T1/1), Cylinder 1 Primary circuit a	N3/10 124 (20F) — 2 (2A)	**Test connection Note:** Individual primary pattern Range: 40 V Duration: 5 millisec. Starter: **Crank**	200 – 350 V	⇒ 13.1
		Primary circuit b	N3/10 125 (21F) — 2 (2A)			
13.1		Primary winding of T1/1 Primary circuit a and b	N3/10 124 (20F) — 125 (21F)	Ignition: **OFF**	0.9 – 1.6 Ω The resistance of a single coil at 20° C is approx. 0.6 Ω.	Wiring, T1/1
14.0	P0 300 P0 302	**Primary voltage** Ignition coil (T1/2), Cylinder 2 Primary circuit a	N3/10 123 (17F) — 2 (2A)	**Test connection Note:** Individual primary pattern Range: 40 V Duration: 5 millisec. Starter: **Crank**	200 – 350 V	⇒ 14.1
		Primary circuit b	N3/10 122 (18F) — 2 (2A)			

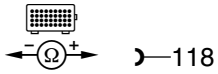
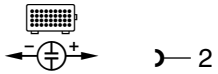
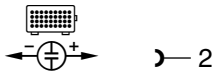
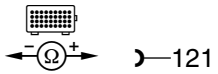
Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
14.1		Primary winding of T1/2 Primary circuit a and b	N3/10 122 (18F) — Ω — 123 (19F)	Ignition: **OFF**	0.9 – 1.6 Ω The resistance of a single coil at 20° C is approx. 0.6 Ω.	Wiring, T1/2
15.0	P0 300 P0 303	**Primary voltage** Ignition coil (T1/3), Cylinder 3 Primary circuit a	N3/10 109 (5F) — ⏚ — 2 (2A)	**Test connection Note:** Individual primary pattern Range 40 V Duration 5 millisec.	200 – 350 V	⇒ 15.1
		Primary circuit b	N3/10 108 (4F) — ⏚ — 2 (2A)	Starter: **Crank**		
15.1		Primary winding of T1/3 Primary circuit a and b	N3/10 108 (4F) — Ω — 109 (5F)	Ignition: **OFF**	0.9 – 1.6 Ω The resistance of a single coil at 20° C is approx. 0.6 Ω.	Wiring, T1/3

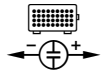
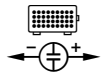
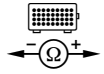
Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
16.0	P0 300 P0 304	**Primary voltage** Ignition coil (T1/4), Cylinder 4 Primary circuit a	N3/10 110 (6F) — 2 (2A)	**Test connection Note:** Individual primary pattern Range: 40 V Duration: 5 millisec.	200 – 350 V	⇒ 16.1
		Primary circuit b	N3/10 111 (7F) — 2 (2A)	Starter: **Crank**		
16.1		Primary winding of T1/4 Primary circuit a and b	N3/10 110 (6F) — 111 (7F)	Ignition: **OFF**	0.9 – 1.6 Ω The resistance of a single coil at 20° C is approx. 0.6 Ω.	Wiring, T1/4
17.0	P0 300 P0 305	**Primary voltage** Ignition coil (T1/5), Cylinder 5 Primary circuit a	N3/10 117 (13F) — 2 (2A)	**Test connection Note:** Individual primary pattern Range: 40 V Duration: 5 millisec.	200 – 350 V	⇒ 17.1
		Primary circuit b	N3/10 118 (14F) — 2 (2A)	Starter: **Crank**		

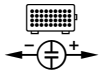
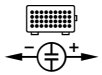
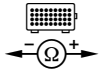
Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
17.1		Primary winding of T1/5 Primary circuit a and b	N3/10  117 (13F) — 118 (14F)	Ignition: **OFF**	0.9 – 1.6 Ω The resistance of a single coil at 20° C is approx. 0.6 Ω.	Wiring, T1/5
18.0	P0 300 P0 306	**Primary voltage** Ignition coil (T1/6), Cylinder 6 Primary circuit a Primary circuit b	N3/10  121 (17F) — 2 (2A) N3/10  120 (16F) — 2 (2A)	**Test connection Note:** Individual primary pattern Range: 40 V Duration: 5 millisec. Starter: **Crank**	200 – 350 V	⇒ 18.1
18.1		Primary winding of T1/6 Primary circuit a and b	N3/10  120 (16F) — 121 (17F)	Ignition: **OFF**	0.9 – 1.6 Ω The resistance of a single coil at 20° C is approx. 0.6 Ω.	Wiring, T1/6

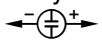
Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
19.0	P0 300 P0 307	**Primary voltage** Ignition coil (T1/7), Cylinder 7 Primary circuit a	N3/10  116 (12F) — 2 (2A)	**Test connection Note:** Individual primary pattern Range: 40 V Duration: 5 millisec. Starter: **Crank**	200 – 350 V	⇒ 19.1
		Primary circuit b	N3/10  115 (11F) — 2 (2A)			
19.1		Primary winding of T1/7 Primary circuit a and b	N3/10  115 (11F) — 116 (12F)	Ignition: **OFF**	0.9 – 1.6 Ω The resistance of a single coil at 20° C is approx. 0.6 Ω.	Wiring, T1/7

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
20.0	P0 300 P0 308	**Primary voltage** Ignition coil (T1/8), Cylinder 8 Primary circuit a	N3/10  114 (10F) — 2 (2A)	**Test connection Note:** Individual primary pattern Range: 40 V Duration: 5 millisec. Starter: **Crank**	200 – 350 V	⇒ 20.1
		Primary circuit b	N3/10  113 (9F) — 2 (2A)			
20.1		Primary winding of T1/6 Primary circuit a and b	N3/10  113 (9F) — 114 (10F)	Ignition: **OFF**	0.9 – 1.6 Ω The resistance of a single coil at 20° C is approx. 0.6 Ω.	Wiring, T1/8

Electrical Test Program – Ignition System Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
21.0	P0 300 P0 301 P0 302 P0 303 P0 304 P0 305 P0 306 P0 307 P0 308	**Firing voltage** Ignition coil (T1/1) to (T1/8)	Engine analyzer 	**Test connection Note:** Individual secondary pattern. Range: 20 kV Duration: 100% Connect kV pick-ups successively to T1/1 through T1/8. Starter: **Crank**	8 – 20 kV The resistance of the secondary winding can not be measured due to an installed diode.	Spark plugs, N3/10

Electrical Test Program – Ignition System Test

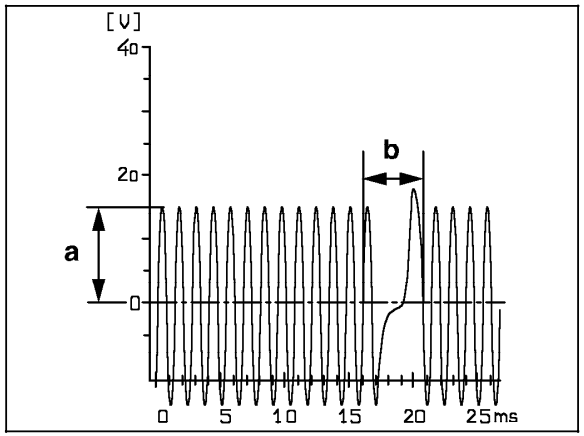


Figure 1

CKP sensor (L5) signal, shown at idle

b=2 missing teeth for cylinder 1 recognition

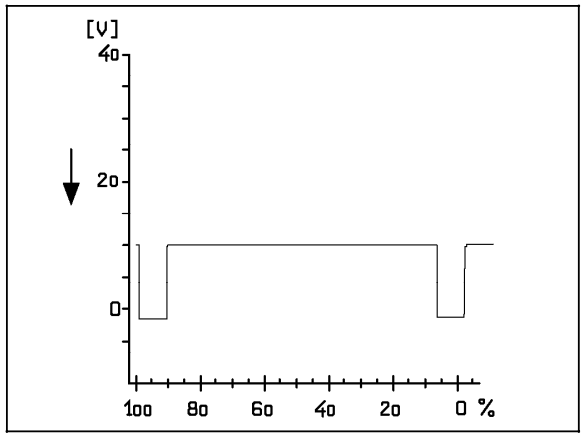
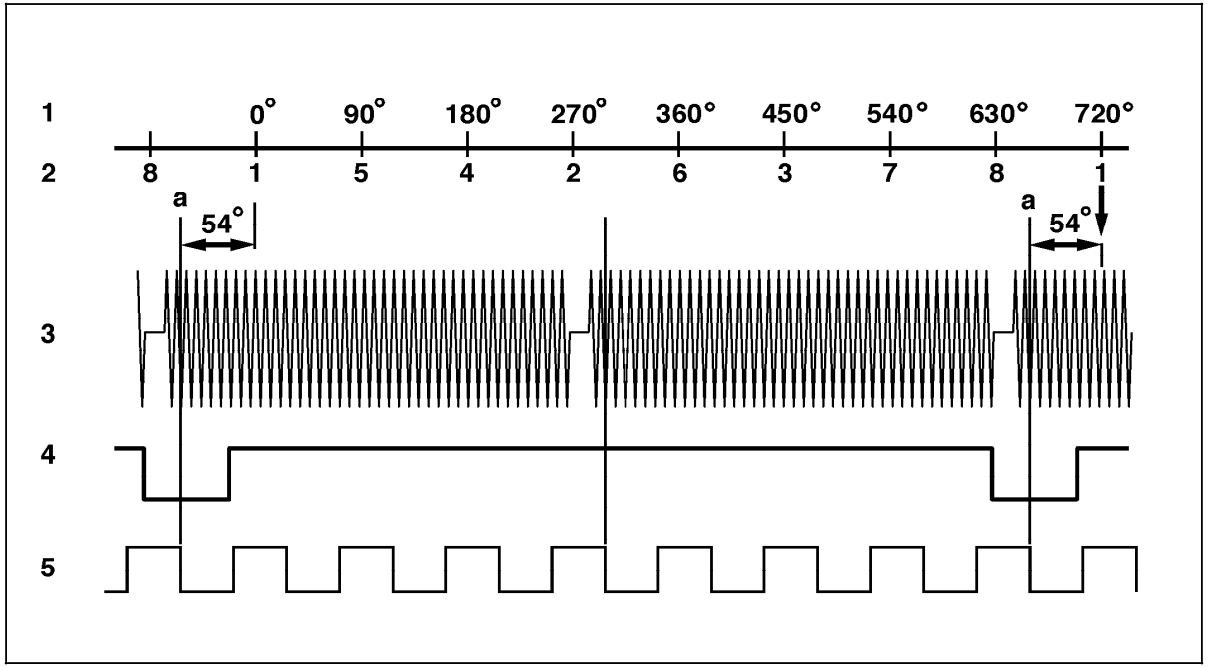


Figure 2

Camshaft Hall-effect sensor (B6/1) signal

Electrical Test Program – Ignition System Test

Signal survey



P07.61-0334-05

Figure 3

1 Crank angle (CKA)
2 Cylinder
3 CKP sensor (L5) signal
4 Camshaft Hall-effect sensor (B6/1) signal
5 Engine rpm signal TNA

Electrical Test Program – Electronic Accelerator (EA) Test

⚠ WARNING!
Risk of severe injury when touching ignition parts which produce high voltages. Do not touch ignition components.
Persons with heart pacemakers are not to perform repairs on this type of ignition system.

Preparation for Test:
1. Review section 0,
2. Review 22 entirely,
3. Ignition: **OFF,**
4. Connect test cable with socket box to N3/10.

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
1.0	P1 542 P0 507	**Pedal value sensor (B37)** Signal Nominal value potentiometer 1	N3/10 15 (23C) — V — 16 (24C)	Ignition: **ON** Accelerator pedal position: CTP WOT with kick-down	 0.2 – 0.5 V 4.3 – 4.8 V	⇒ 1.1, Wiring, B37
1.1		Voltage supply Nominal value potentiometer 2	N3/10 15 (23C) — V — 14 (22C)	Ignition: **ON**	4.75 – 5.25 V	Wiring, N3/10
2.0	P1 542 P0 507	**Pedal value sensor (B37)** Signal Nominal value potentiometer 2	N3/10 18 (26C) — V — 17 (25C)	Ignition: **ON** Accelerator pedal position: CTP WOT with kick-down	 0.1 – 0.4 V 2.1 – 2.5 V	Wiring, B37

Electrical Test Program – Electronic Accelerator (EA) Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
3.0	P0 507 P0 120 P1 186 P1 580	**EA/CC/ISC actuator (M16/6)** Signal Actual value potentiometer 1	N3/10 88 (32E) — V — 87 (31E)	Ignition: **ON** Accelerator pedal position: CTP WOT or kick-down	 4.0 – 4.6 V < CTP value	⇒ 3.1, Wiring, M16/6
		Actual value potentiometer 2	N3/10 88 (32E) — V — 90 (34E)	Accelerator pedal position: CTP WOT or kick-down	 0.3 – 0.9 V > CTP value	
3.1		Voltage supply Actual value potentiometers 1 and 2	N3/10 88 (32E) — V — 89 (33E)	Ignition: **ON**	4.75 – 5.25 V	Wiring, N3/10

Electrical Test Program – Electronic Accelerator (EA) Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
4.0	P1 1186 P1 580	**EA/CC/ISC actuator (M16/6)** Activation of actuator motor	N3/10 105 (1F) — V — 106 (2F)	Ignition: **ON** Engine: **at Idle** ECT > 70 °C	0.8 – 2.3 V 1.0 – 2.5 V Value oscillates.	Wiring, M16/6, N3/10
		Actuator motor resistance	N3/10 105 (1F) — Ω — 106 (2F)	Ignition: **OFF**	< 10 Ω	
5.0		**With AT only** **P/N recognition**	N3/10 51 (19D) — V — 2 (2A)	Ignition: **ON** Selector lever position: P/N R, D, 4, 3, 2, 1	 11 – 14 V < 2.0 V	Wiring, Test ETC, see DM, Chassis & Drivetrain, Vol. 1.

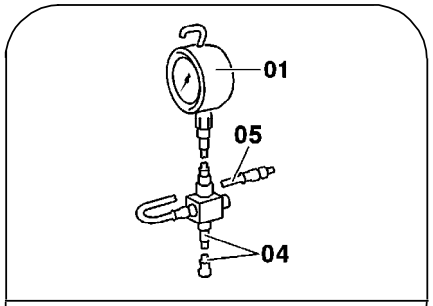
Hydraulic Test Program – Preparation for Test (Fuel System Pressure and Internal Leakage Test)

Operation No. of Text description and Time Allowance 07-1402

Preparation for Test

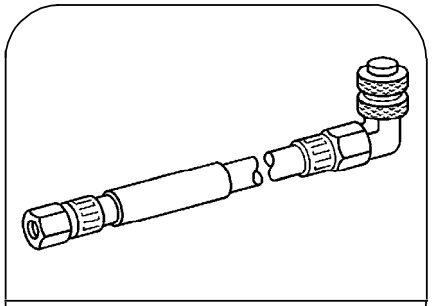
1. Review 11, 21, 22, 23, 24, 31, 33,
2. Review section 0,
3. Connect pressure gauge to test connection.
4. After completing test, using measurement glass (055), release fuel pressure and allow residual fuel to drain into glass (see Figure 1).

Special Tools



103 589 00 21 00

Tester

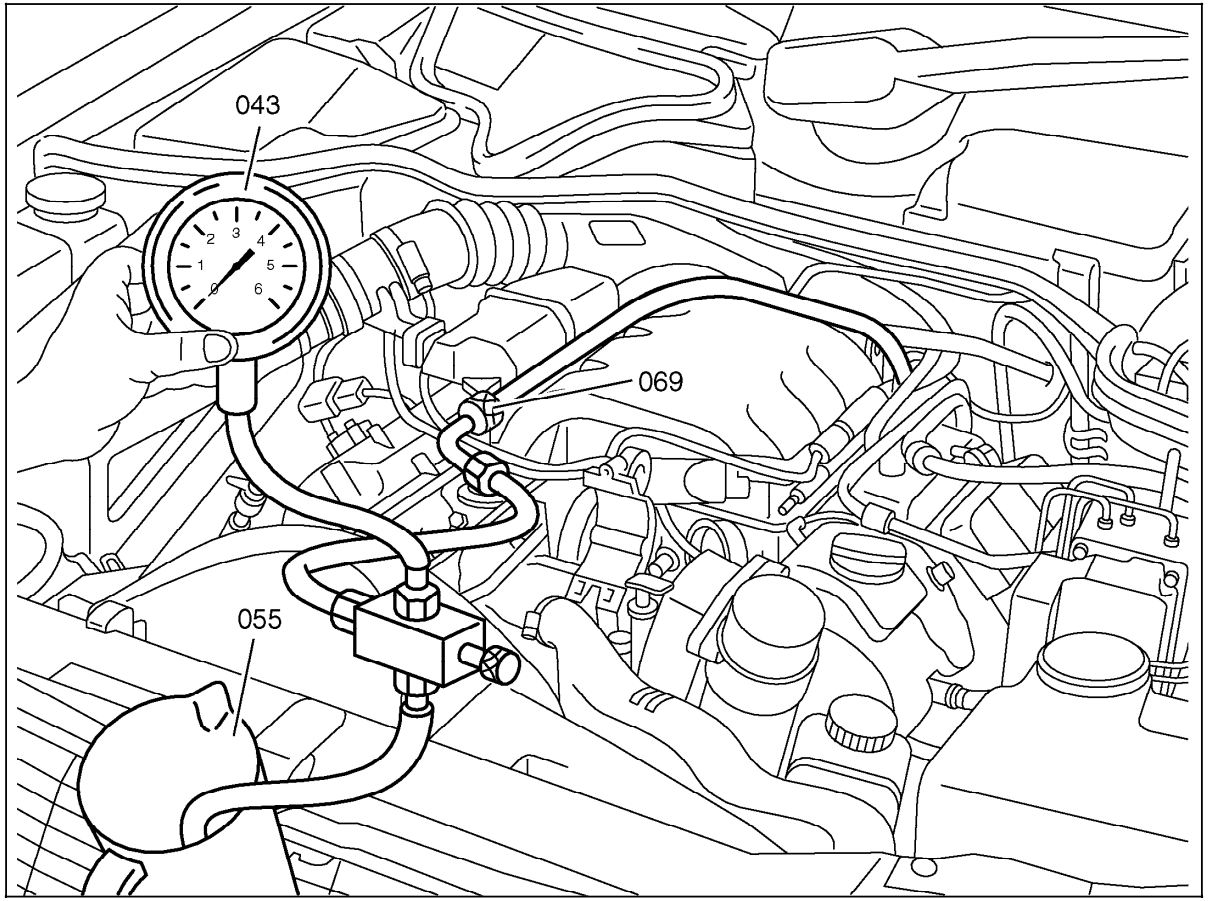


119 589 04 63 00

Pressure hose

Hydraulic Test Program – Preparation for Test (Fuel System Pressure and Internal Leakage Test)

Connection Diagram



P07.61-0446-06

Figure 1

043 Pressure gauge, part no. 103 589 00 21 00
055 Measuring glass
069 Pressure hose, part no. 119 589 04 63 00

Hydraulic Test Program – Test (Fuel System Pressure and Internal Leakage Test)

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
1.0		**Fuel pressure at idle (with vacuum)**	Pressure gauge connected to test connection.	Engine: **at Idle**	3.7 – 4.2 bar	⇒ 1.0, ⇒ 2.0, Diaphragm pressure regulator.
2.0		**Fuel system internal leakage test**	Pressure gauge connected to test connection.	Engine: **OFF** After 30 minutes	> 3.0 bar > 2.5 bar	If the pressure drops quickly: Replace check valve in fuel pumps. If the pressure drops slowly: check injectors 36, ⇒ 1.0, ⇒ 2.0, Replace diaphragm pressure.

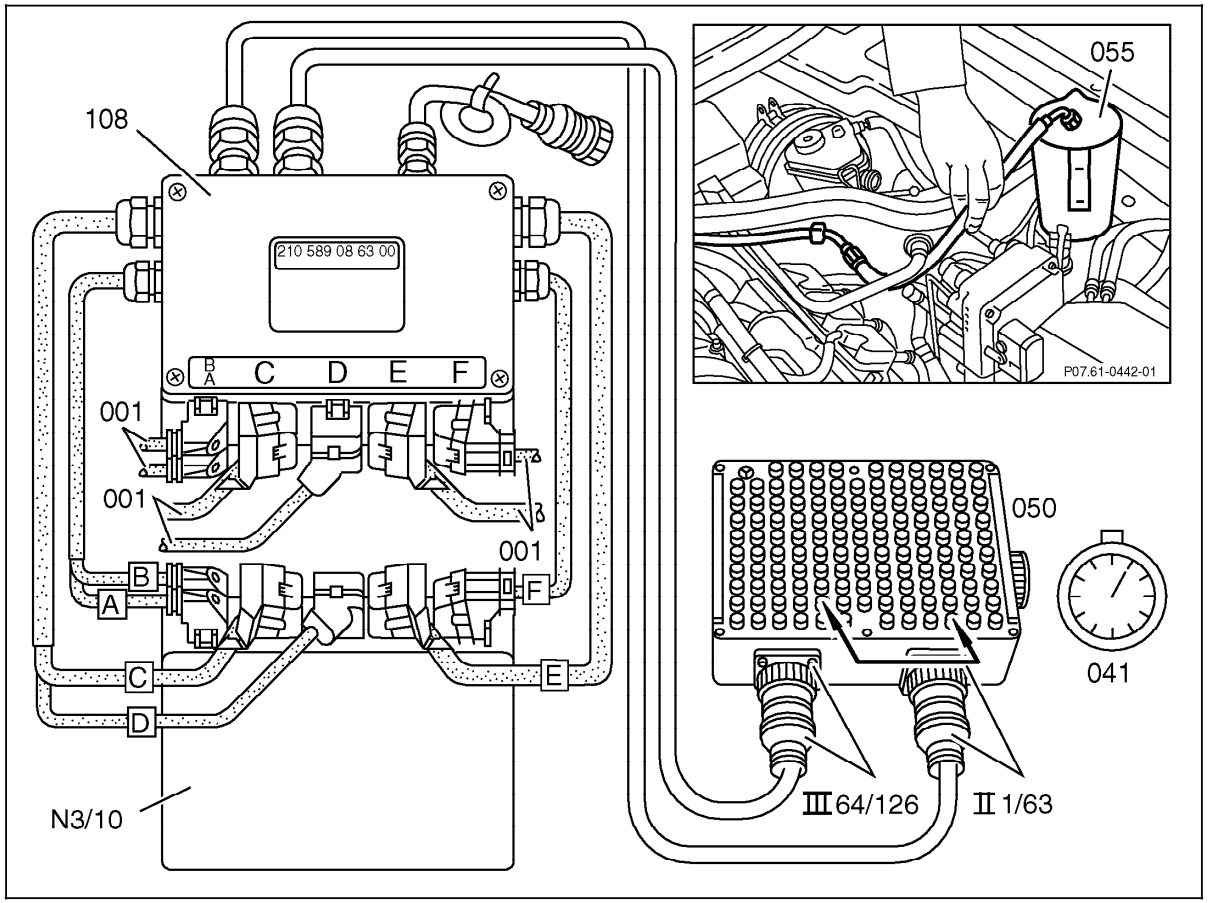
Hydraulic Test Program – Preparation forTest (Fuel Pump Test)

Connection Diagram – Delivery Test

- Connect socket box tester to engine control module (N3/10)

Note:
When disconnecting the connectors on the engine control module remove center connector (D) first, when reconnecting connectors install center connector (D) last.

Figure 1

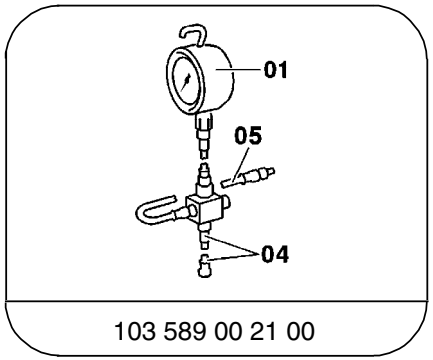


P07.61-0465-06

001	Engine control module connectors A–F
041	Stop watch
050	Socket box tester, 126 pole
055	Measuring glass
108	Test cable
N3/10	Engine control module (ME-SFI)
A - F	Connectors
II1/63	Connectors, socket box
III64/126	Coonnectors, socket box

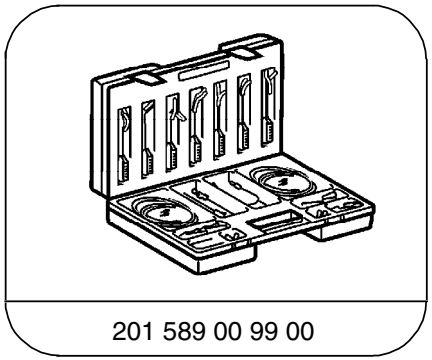
Hydraulic Test Program – Preparation forTest (Fuel Pump Test)

Special Tools



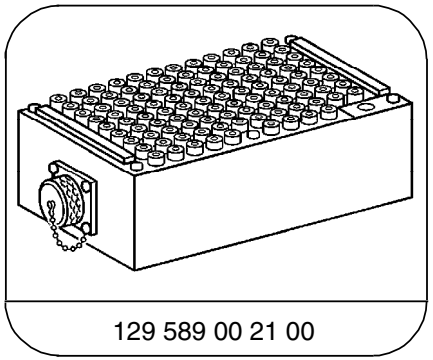
103 589 00 21 00

Tester



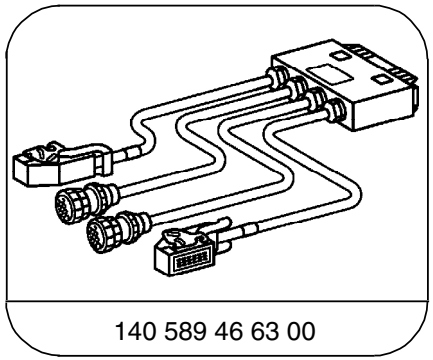
201 589 00 99 00

Electrical connecting set



129 589 00 21 00

126-pin socket box



140 589 46 63 00

Test cable, 117-pin

Conventional tools, test equipment

Description	Brand, model, etc.
Multimeter [1)]	Fluke models 23, 83, 85, 87
Stop watch	Local purchase
Measuring glass (1 liter minimum)	Local purchase

1) Available through the MBUSA Standard Equipment Program.

Hydraulic Test Program – Test (Fuel Pump Test)

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy [1]
1.0		**Fuel pump** Delivery capacity	N3/10 3 (3A) — 21 (29C)	Disconnect fuel return hose from fuel line and place end in measuring glass. Ignition: **ON**	1 liter of fuel within 35 seconds.	Check fuel lines for restrictions (kinks and dents). Replace fuel filter or fuel pressure regulator, check current draw (2.0 below).
2.0		**Fuel pumps** Current draw		Remove FP relay module (K27), located under right rear seat, connect multimeter on sockets 2 and 8. Ignition: **ON**	 4 – 9 A	Fuel pump.

[1] Observe Preparation for Test, see 33.

Hydraulic Test Program – Preparation for Test (Injector Test)

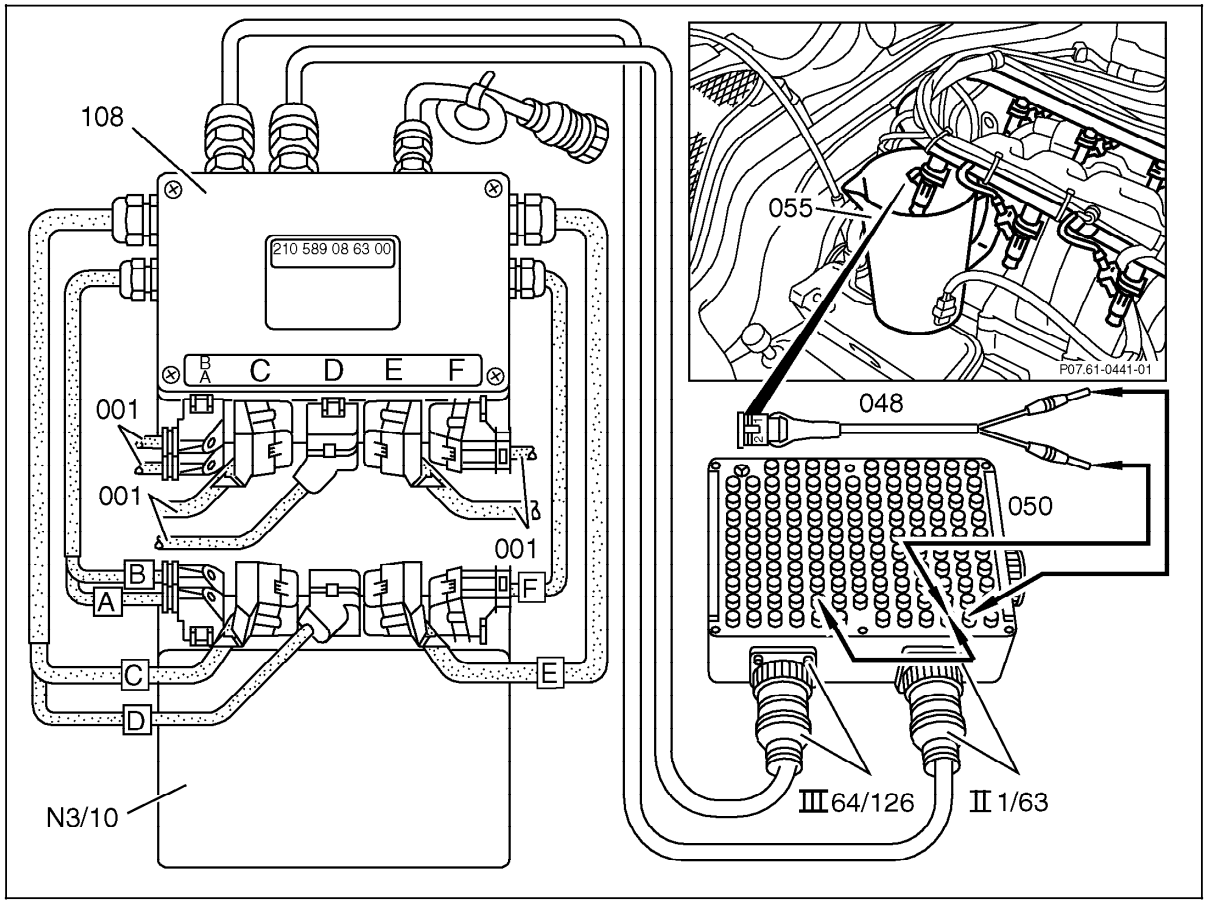
Preparation for Test

1. Review section 0,
2. Review 11, 21, 22, 23, 24, 31, 33,
3. Connect socket box tester to engine control module (N3/10).
4. Disconnect 2-pole connectors on injectors.
5. Remove fuel rail with injectors, thereby **not** disconnecting the fuel feed and return lines.
6. Connect self-made harness (048), see 35/3, to each injector one after another.
7. Hold each injector in measuring glass one after another.

i

When disconnecting the connectors on the engine control module remove center connector (D) first, when reconnecting connectors install center connector (D) last.

Figure 1

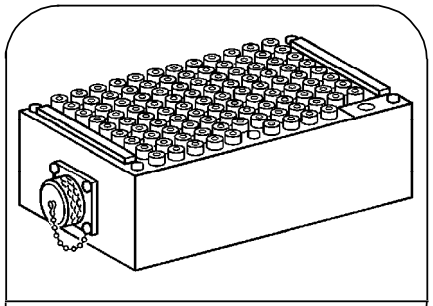


P07.61-0464-06

001	Engine control module connectors A–F
048	Self made harness
050	Socket box tester, 126 pole
055	Measuring glass
108	Test cable
N3/10	Engine control module (ME-SFI)
A - F	Connectors
II1/63	Connectors, socket box
III64/126	Connectors, socket box

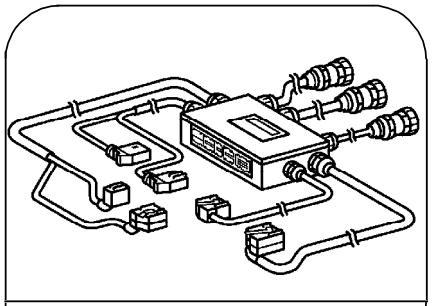
Hydraulic Test Program – Preparation for Test (Injector Test)

Special Tools



129 589 00 21 00

126-pin socket box



210 589 08 63 00

145-pin test cable

Conventional tools, test equipment

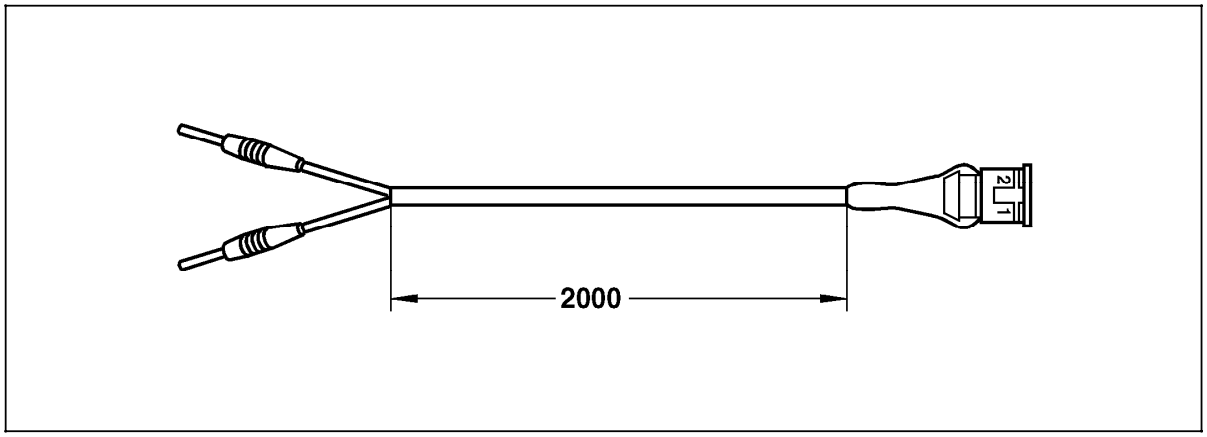
Description	Brand, model, etc.
Measuring glass (1 liter minimum)	Local purchase

Hydraulic Test Program – Preparation for Test (Injector Test)

Self made harness

Consists of:

1x	Connector (140 545 35 28)
2x	Contact spring (004 545 56 26)
1x	Banana plug (red)
1x	Banana plug (black)
2.2m	Wire (red, 1.5 mm)
2.2m	Wire (brown, 1.5 mm)
2.2m	Harness tubing (6mm diameter)



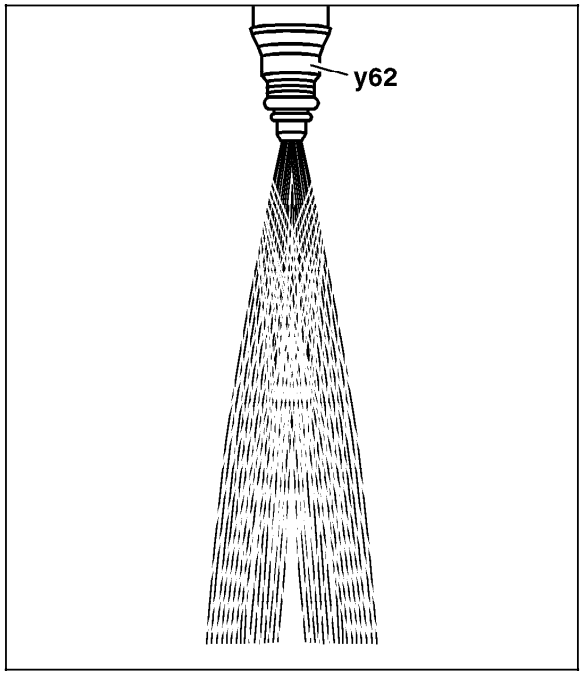
Connector layout
1=red
2=brown

P07.61-0541-10

Hydraulic Test Program – Test (Injector Test)

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
1.0		**Injectors** Leakage test	N3/10 3 (3A) — 21 (29C)	Fuel rail and fuel injectors removed. Ignition: **ON**	Injectors must not drip.	⇒ 2.0, Replace any dripping injectors.
2.0		**Injectors** Operation and spray pattern test	N3/10 3 (3A) — 21 (29C)	Ignition: **ON** Hold each injector (one after another) into a container and, using the self-made test harness, manually activate the injector by connecting harness banana plugs to socket box sockets 3 (–) and 2 (+).	Injectors must spray evenly (Figure 1).	Replace defective injectors.

Hydraulic Test Program – Test (Injector Test)



P07.61-0542-02

Figure 1

Y62 Injector
Correct spray pattern