

1.2 Engine 111

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Diagnosis - Diagnostic Trouble Code (DTC) Memory

Preliminary work: Engine Test, Adjustment, Engines, Volume 1

Note regarding diagnostic trouble code (DTC) readout:

The engine control module (N3/4) for the HFM-SFI system is equipped with diagnostic trouble code (DTC) memory. Malfunctions are recognized and stored as trouble codes and are distinguished as follows:

- Malfunctions which are constantly present,
- Malfunctions which occur longer than 3 seconds,
- Intermittent contact malfunctions which have occurred 5x during a trip.

The DTC memory remains active even if the vehicle's battery is disconnected.

Malfunctions which are no longer present, are automatically erased again after a maximum of 19 trips. A trip has occurred if:

- Vehicle speed > 2.5 mph (4 km/h),
- Engine speed >700 rpm,
- Engine shut off for 30 seconds.

The stored diagnostic trouble codes (DTCs) can be read at the data link connector (DTC readout) (X11/4) with the ignition switched "ON" or with the "engine running".

Diagnosis via an on-off ratio readout has been eliminated.

Note regarding mixture preparation self-adaptation:

The Lambda control system determines fuel injection duration precisely so 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,
- Contact resistance in MAF sensor,
- Defective diaphragm pressure regulator,
- Defective purge control valve,

the engine control module automatically performs a mixture adjustment. The degree of correction is calculated constantly and stored permanently. The self-adaptation is performed at idle and under partial load. Maximum correction towards rich or lean is 25%. After repair work is performed, the engine control module will automatically adapt itself again after approx. 10 trips. After eliminating a malfunction or after trial installation of an engine control module from another vehicle, the self-adaptation feature must be reset to its mean value (see "Resetting and Reactivating Engine Control Module Memory" 11/5).

Diagnosis - Diagnostic Trouble Code (DTC) Memory

Note regarding version coding on vehicles up to 02/94 (up to HHT Diagnosis Version 42):

The engine control module recognizes and stores the following equipment and/or version information during the vehicle's initial operation:

- Catalytic converter/non-catalytic converter,
- Manual/automatic transmission,
-  version.

After replacing the engine control module or after trial installation of an engine control module from another vehicle, the stored data must be erased and the recognition feature reactivated (see "Resetting and Reactivating Engine Control Module Memory" 11/5).

Initial programming of engine control module.

Prerequisite for initial programming process:

- Battery voltage ⇒ 11 Volt minimum
- Vehicle speed signal ⇒ V = 0
- Engine rpm signal ⇒ n = 0
- Transmission range ⇒ P/N = 1
- Idle speed contact closed ⇒ CTP = 1
(Caution: Vehicle can not be moved during initial programming process)
- Drive vehicle ⇒ V = > 5 km/h (3 mph)
(Only then will the transmission version be recognized).

Note regarding automatic recognition of the mechanical end stop of the closed throttle valve:

The mechanical end stop of the closed throttle valve at idle is determined by the ISC actuator and stored in the engine control module.

After replacement of the engine control module or the ISC actuator, the mechanical end stop of the throttle valve must be again determined and stored (see "Resetting and Reactivating Engine Control Module Memory" 11/5).

Note regarding version coding on vehicles starting 03/94 (as of HHT Diagnosis Version 45):

The engine control module is equipped with a version coding feature as of 03/94. The coding can only be performed with the Hand-Held Tester (automatically or manually, see Notes for HHT 11/4).

The following vehicle versions must be observed for coding:

- Vehicle model,
- Catalytic converter (TWC),
- Non-catalytic converter (non-TWC),
- 4 or 5-speed automatic transmission,
- Cruise control (CC),
- Acceleration slip regulation (ASR),
- Electronic traction system (ETS),
- Country version.

Diagnosis - Diagnostic Trouble Code (DTC) Memory

Notes regarding drive authorization system (DAS):

- Up to the end of model year 1995, a starter lock-out system is installed which interrupts circuit 50 to the starter.
- On vehicles starting model year 1996 (HHT Diagnosis Version 46), the RCL system is enhanced with a so-called drive authorization system, stage 2 (DAS).

The activation of the drive authorization system (DAS) is initiated by the RCL control module and transmitted to the engine control module via the CAN data bus.

After activation of the drive authorization system (DAS), the fuel injection system is rendered inoperative by the engine control module. The drive authorization system (DAS) can be activated or deactivated with the infrared remote control transmitter or the master key.

The engine control module and RCL control module are permanently locked with one another by an identification code. This identification code can not be erased (see HHT actual values "DAS" menu selection 3/6).

Therefore, trial installation of an engine control module or RCL control module from another vehicle is no longer possible.

CAUTION!

If a **new** engine control module is installed for test purposes only, a maximum of 40 engine starts can be performed before the control modules are **permanently** locked with one another. **After 40 engine starts, the engine control module can no longer be used in any other vehicle.**

Additionally, the code number and VIN must be entered (see HHT actual values "DAS", menu selection 3/6).

As of model year 1997, model 202 is equipped with an electronic ignition key. The electronic ignition key controls the activation/deactivation of the drive authorization system, stage 3, via the CAN data bus.

Diagnosis - Diagnostic Trouble Code (DTC) Memory**Notes for 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 values for coolant temperature, intake air temperature and air mass

In case of an open or short circuit, the actual value is immediately replaced by a substitute value which is very close to the actual value. Therefore, a fault can not be recognized clearly. A readout of the fault is possible only via the diagnostic trouble code (DTC) memory.

• Actual value for engine rpm

In case of the engine rpm's, the HHT display shows the closed throttle (idle) speed nominal value calculated by the control module on the left and on the right, the rpm actual value. Both values should differ from each other only slightly. The permissible tolerances are not yet known.

• Version coding with HHT starting 03/94 (up to HHT Diagnosis Identification 45).

- a) Before replacement of the engine control module, the existing code number must be read and stored with the HHT (menu selection 6 "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.
- c) When performing a trial installation of a control module with the same part number from another vehicle (up to model year 1995), but with a different code number, the following must be observed:
- Read and record code number from vehicle with complaint.
 - Exchange control modules.
 - Read and record code number from the exchanged control module.
 - Enter the code number from the original control module into the exchange control module.
 - Perform function test.
 - Before returning control module to other vehicle, enter recorded code number into exchange control module.
 - Exchange control modules.

Diagnosis - Diagnostic Trouble Code (DTC) Memory

Notes for HHT (continued)

- **Drive authorization system, stage 2, 2b, 3 (DAS)**
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 3/6).

Preparation for Test with Impulse Counter Scan Tool

Note:

The DTC memory readout, DTC memory clearing as well as resetting and reactivating the engine control module can be performed with the impulse counter scan tool only on vehicles up to HHT Diagnosis Version 46. On vehicles as of HHT Diagnosis Version 49, it is possible only with the HHT.

- Connect impulse counter scan tool to data link connector (X11/4) according to connection diagram.

Reading Diagnostic Trouble Code (DTC) Memory

- Ignition: **ON**
- Press start button for 2 to 4 seconds.
- Read and record DTC.
- Press start button again.
- Read and record DTC.
Repeat steps d) and e) until the first DTC reappears.

Clearing Diagnostic Trouble Code (DTC) Memory

- Press start button for 2 to 4 seconds (DTC appears).
- Press start button for 6 to 8 seconds, thereby clearing the previously displayed malfunction (DTC) from memory.
- Repeat steps a) and b) until the number "!" appears (no malfunctions stored).

Resetting and Reactivating Engine Control Module Memory

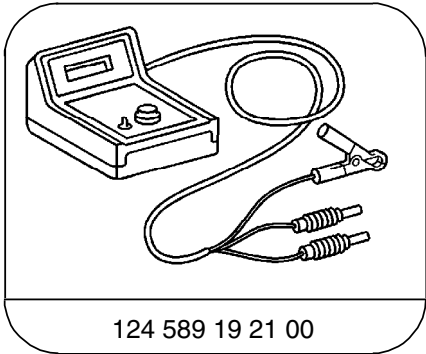
- Clear diagnostic trouble code (DTC) memory.
- After the number "!" appears, press start button for 6 to 8 seconds.
- Switch ignition **OFF** and wait a minimum of 2 seconds.
- Turn ignition **ON**, wait a minimum of 10 seconds and then start engine.

Note:

Control modules manufactured by Bosch up to 8/93, the start button must be pressed 5 to 6 seconds to clear the DTC memory and 8 to 9 seconds to reset and reactivate the engine control module memory.

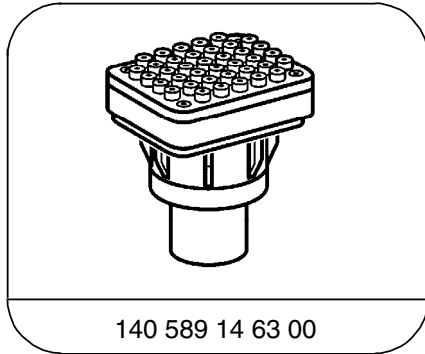
Diagnosis - Diagnostic Trouble Code (DTC) Memory

Special Tools



124 589 19 21 00

Pulse counter



140 589 14 63 00

Adapter



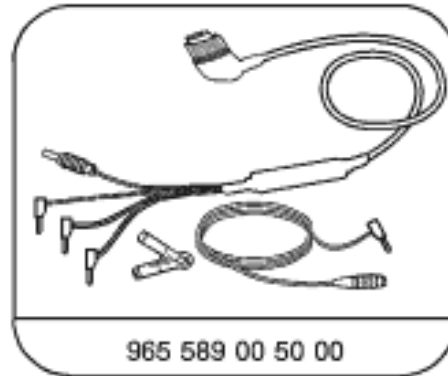
965 589 00 01 00

Hand-Held-Tester



965 589 00 40 00

Test cable



965 589 00 50 00

Adapter cable

Diagnosis - Diagnostic Trouble Code (DTC) Memory

Connection Diagram - Impulse Counter Scan Tool/Hand-Held Tester (HHT)
Model 202

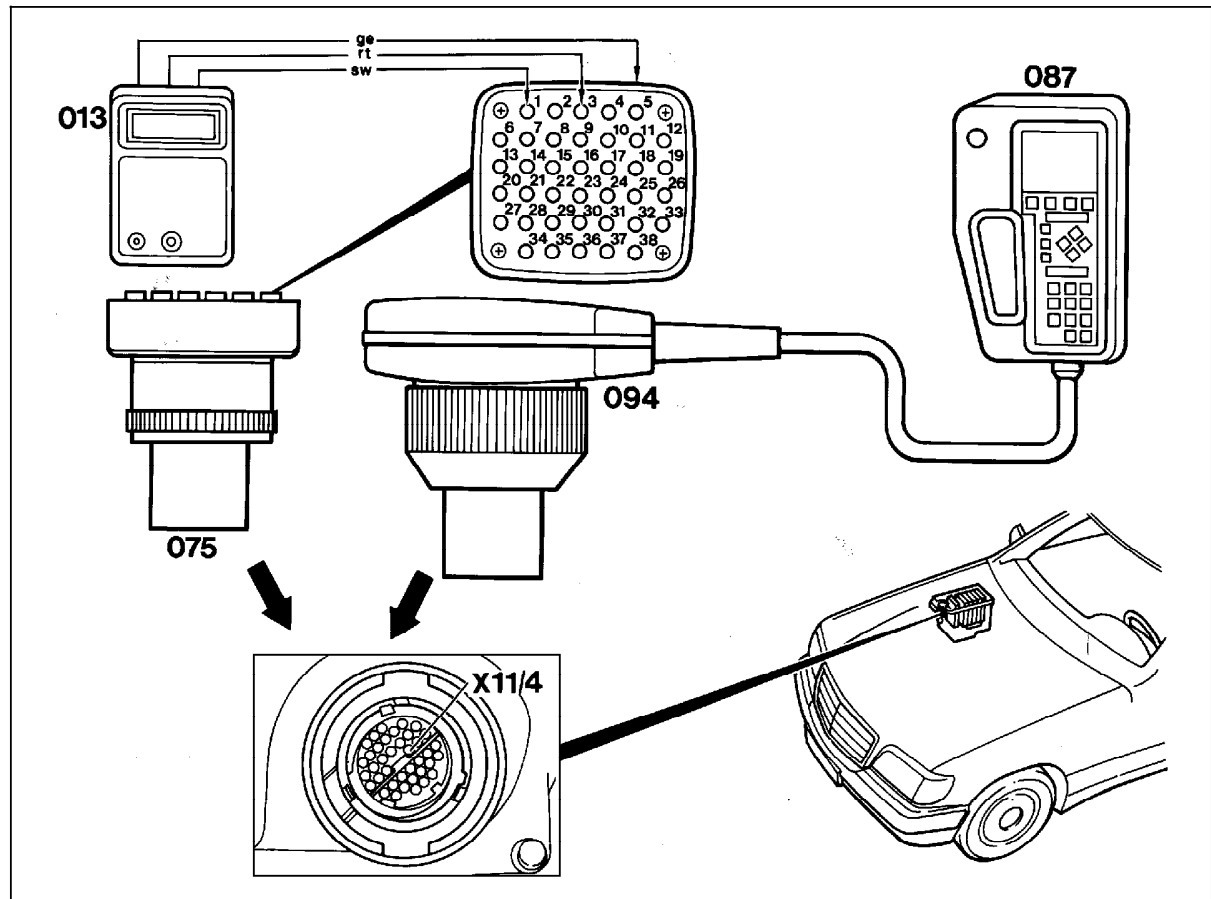
Note:
The DTC memory can be read with the impulse counter scan tool only on vehicles up to HHT diagnosis code 46. On vehicles starting HHT diagnosis code 49 it can be read only with the HHT.

Connect red wire of impulse counter scan tool to socket 3, black wire to socket 1, and connect yellow wire as follows:

| | |
|---------------------------------|-----------|
| Engine control module (HFM-SFI) | Socket 4 |
| Cruise control | Socket 7 |
| Rpm signal (TN output) | Socket 17 |
| Diagnostic module | Socket 19 |

Figure 1

- 013 Impulse counter scan tool (Hand-Held Tester 087 optional)
- 075 Impulse counter scan tool adapter
- 087 Hand-Held Tester (Impulse counter scan tool 013 optional)
- 094 Multiplexer
- X11/4 Data link connector (DTC readout)



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Diagnosis – Diagnostic Trouble Code (DTC) Memory

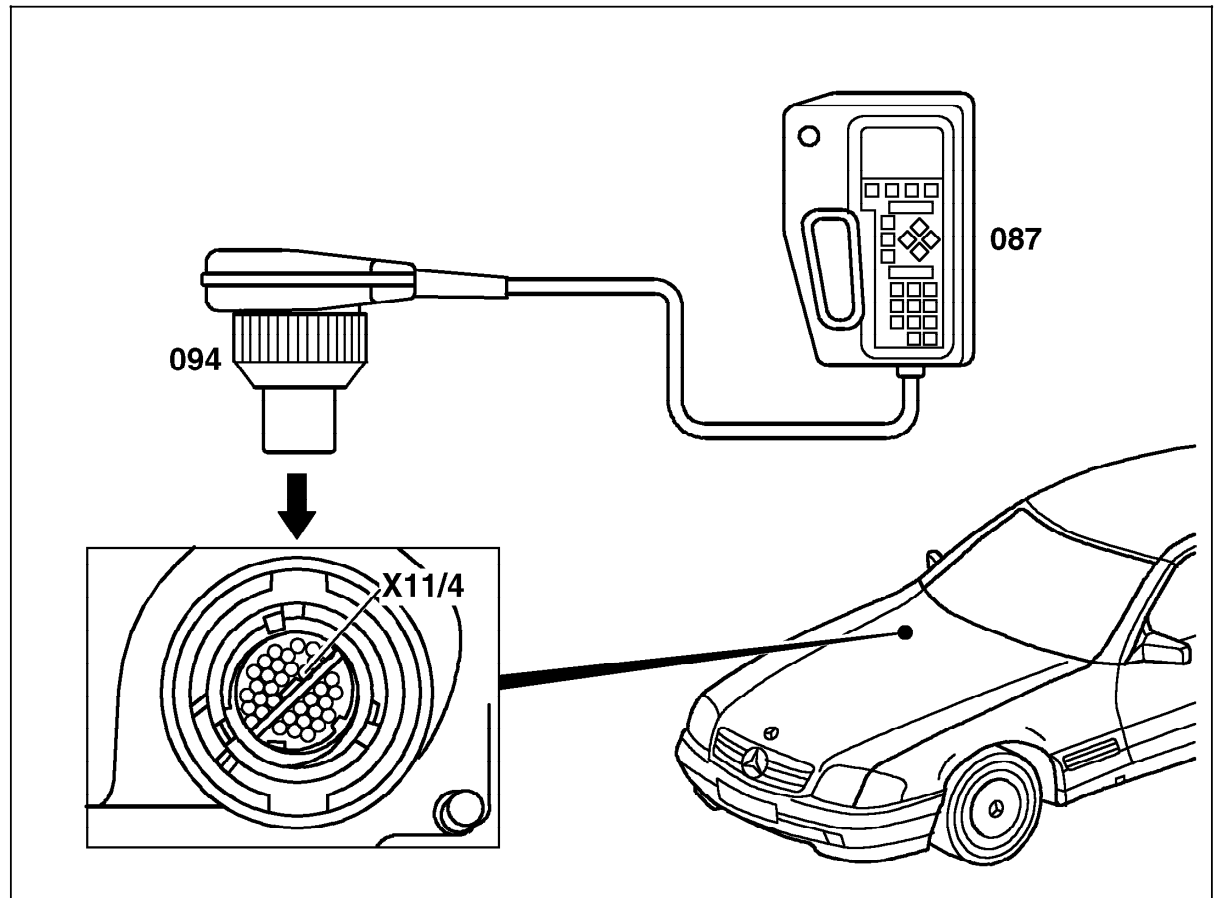
Connection Diagram - Hand-Held Tester (HHT)

1. Connect HHT with Multiplexer (094) attached to the data link connector X11/4.
2. Turn ignition: **ON**
3. According to the instructions in HHT display:
 - a) Readout DTC memory/erase
 - b) Readout actual values
 - c) Perform activations
 - d) Program control modules
4. Disconnect HHT.

Observe all system specific instructions listed in the "Preparation for test" section of each Test Program. Diagnostic Trouble Codes (DTC's) which have been stored due to testing or the disconnection of lines must be erased from the diagnostic trouble code memory at the end of testing.

Figure 1

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





P00.19-0411-06

1.2 HFM Sequential Multiport Fuel Injection/Ignition System (HFM-SFI)

Engine 111



Diagnosis – Diagnostic Trouble Code (DTC) Memory

| DTC  7) |  | Possible cause | Test step/Remedy ¹⁾ |
|---|---|--|--|
| 1 | – | No malfunction in system | – |
| 2 | 002 | ECT sensor (B11/3) short circuit | 23⇒ 9.0 |
| 2 | 003 | ECT sensor (B11/3) open circuit | 23⇒ 9.0 |
| 2 | 004 | ECT sensor (B11/3) implausible | 23⇒ 9.0 |
| 2 | 005 | ECT sensor (B11/3) intermittent contact | Contacts in connector of B11/3 or N3/4. |
| 3 | 006 | IAT sensor (B17) short circuit | 23⇒ 10.0 |
| 3 | 007 | IAT sensor (B17) open circuit | 23⇒ 10.0 |
| 3 | 008 | IAT sensor (B17) intermittent contact | Contacts in connector of B17 or N3/4. |
| 4 | 009 | Hot film MAF sensor (B2/5) air flow implausibly high | 23 ⇒ 4.0 – 5.3 Engine friction excessive. |
| 4 | 010 | Hot film MAF sensor (B2/5) open circuit | 23 ⇒ 4.0 – 5.3 |
| 5 | 011 | CTP switch (M16/6s1) throttle valve angle implausibly large | 25⇒ 4.0 |
| 5 | 012 | CTP switch (M16/6s1) air flow implausibly high | 25⇒ 4.0 |
| 5 | 013 | CTP switch (M16/6s1) intermittent contact | 25⇒ 4.0 |
| 6 | 014 | Throttle valve actual value potentiometer (M16/6r1) implausibly high | 25⇒ 3.0 |
| 6 | 015 | Throttle valve actual value potentiometer (M16/6r1) implausible | 25⇒ 3.0 |
| 6 | 016 | Throttle valve actual value potentiometer (M16/6r1) intermittent contact | 25⇒ 3.0 |

¹⁾ Observe Preparation for Test, see 22.

⁷⁾ Only possible up to end of model year 1995.



Diagnosis – Diagnostic Trouble Code (DTC) Memory

| DTC  7) |  | Possible cause | Test step/Remedy ¹⁾ |
|---|---|---|---|
| 7 | 017 | Drive actual value potentiometer (M16/6r2) implausibly high | 25 ⇒ 1.0, 2.0 |
| 7 | 018 | Drive actual value potentiometer (M16/6r2) implausibly low | 25 ⇒ 1.0, 2.0 |
| 7 | 019 | Drive actual value potentiometer (M16/6r2) intermittent contact | 25 ⇒ 1.0, 2.0 |
| 8 | 020 | ISC system at lower control stop | Intake air leak, throttle body binding. |
| 8 | 021 | ISC system at upper control stop | Intake air leak, throttle body binding. |
| | 022 | CC or EA indicates “limp-home” mode | Intake air leak, throttle body binding, adjust throttle linkage, erase DTC's in HFM-SFI control module. |
| 9 | 023 | O2S 1 (before TWC) (G3/2) sensor voltage too high | 23 ⇒ 13.0 |
| 9 | 024 | O2S 1 (before TWC) (G3/2) cold or open circuit | 23 ⇒ 13.0 |
| 9 | 025 | O2S 1 (before TWC) (G3/2) sensor voltage implausible | 23 ⇒ 13.0 |
| 10 | 026 | O2S 2 (after TWC) (G3/1) sensor voltage too high | 23 ⇒ 15.0 |
| 10 | 027 | O2S 2 (after TWC) (G3/1) cold or open circuit | 23 ⇒ 15.0 |
| 10 | 028 | O2S 2 (after TWC) (G3/1) sensor voltage implausible | 23 ⇒ 15.0 |
| 11 | 029 | O2S 1 (before TWC) heater (G3/2) current too low | 23 ⇒ 14.0 |
| 11 | 030 | O2S 1 (before TWC) heater (G3/2) current too high | 23 ⇒ 14.0 |
| 11 | 031 | O2S 1 (before TWC) heater (G3/2) short circuit | 23 ⇒ 14.0 |

1) Observe Preparation for Test, see 22.

7) Only possible up to end of model year 1995.



Diagnosis – Diagnostic Trouble Code (DTC) Memory

| DTC  ⁷⁾  | Possible cause | Test step/Remedy ¹⁾ |
|--|---|--|
| 12 032 | O2S 2 (after TWC) heater (G3/1) current too low | 23 ⇒ 16.0 |
| 12 033 | O2S 2 (after TWC) heater (G3/1) current too high | 23 ⇒ 16.0 |
| 12 034 | O2S 2 (after TWC) heater (G3/1) short circuit | 23 ⇒ 16.0 |
| 13 035 | O2S system operating at rich limit, mixture too lean | Intake air leak, fuel injectors, diaphragm pressure regulator. |
| 13 036 | O2S system operating at lean limit, mixture too rich | Intake air leak, fuel injectors, diaphragm pressure regulator. |
| 14 037 | Injector (Y62y1), cylinder 1 short circuit to plus | 23 ⇒ 18.0 |
| 14 038 | Injector (Y62y1), cylinder 1 open/short circuit to ground | 23 ⇒ 18.0 |
| 15 039 | Injector (Y62y2), cylinder 2 short circuit to plus | 23 ⇒ 19.0 |
| 15 040 | Injector (Y62y2), cylinder 2 open/short circuit to ground | 23 ⇒ 19.0 |
| 16 041 | Injector (Y62y3), cylinder 3 short circuit to plus | 23 ⇒ 20.0 |
| 16 042 | Injector (Y62y3), cylinder 3 open/short circuit to ground | 23 ⇒ 20.0 |
| 17 043 | Injector (Y62y4), cylinder 4 short circuit to plus | 23 ⇒ 21.0 |
| 17 044 | Injector (Y62y4), cylinder 4 open/short circuit to ground | 23 ⇒ 21.0 |
| 18 – 19 045 – 048 | Not used | - |

¹⁾ Observe Preparation for Test, see 22.

⁷⁾ Only possible up to end of model year 1995.



Diagnosis – Diagnostic Trouble Code (DTC) Memory

| DTC  ⁷⁾ |  | Possible cause | Test step/Remedy ¹⁾ |
|--|---|--|--|
| 20 | 049 | Self-adaptation at idle speed too rich | Intake air leak, fuel injectors, diaphragm pressure regulator, engine wear (reset self-adaptation following repair, see 11/5). |
| 20 | 050 | Self-adaptation at idle speed too lean | Intake air leak, fuel injectors, diaphragm pressure regulator, engine wear (reset self-adaptation following repair, see 11/5). |
| 20 | 051 | Self-adaptation at lower partial load too rich | Intake air leak, fuel injectors, diaphragm pressure regulator, engine wear (reset self-adaptation following repair, see 11/5). |
| 20 | 052 | Self-adaptation at lower partial load too lean | Intake air leak, fuel injectors, diaphragm pressure regulator, engine wear (reset self-adaptation following repair, see 11/5). |
| 20 | 053 | Self-adaptation at upper partial load too rich | Intake air leak, fuel injectors, diaphragm pressure regulator, engine wear (reset self-adaptation following repair, see 11/5). |
| 20 | 054 | Self-adaptation at upper partial load too lean | Intake air leak, fuel injectors, diaphragm pressure regulator, engine wear (reset self-adaptation following repair, see 11/5). |

¹⁾ Observe Preparation for Test, see 22.

⁷⁾ Only possible up to end of model year 1995.



Diagnosis – Diagnostic Trouble Code (DTC) Memory

| DTC  7) |  | Possible cause | Test step/Remedy ¹⁾ |
|---|---|--|--------------------------------|
| 21 | 061 – 063 | Not used | – |
| 22 | 055 | Ignition output 1 or ignition coil (T1/1) for cylinder 1 misfires | 24 ⇒ 4.0, 9.0, 11.0 and 13.0 |
| 22 | 056 | Ignition output 1 or ignition coil (T1/1) for cylinder 4 misfires | 24 ⇒ 4.0, 9.0, 11.0 and 13.0 |
| 22 | 057 | Ignition output 1 or ignition coil (T1/1) current value not obtained | 24 ⇒ 4.0, 9.0, 11.0 and 13.0 |
| 23 | 058 | Ignition output 2 or ignition coil (T1/2) for cylinder 2 misfires | 24 ⇒ 5.0, 10.0, 12.0 and 14.0 |
| 23 | 059 | Ignition output 2 or ignition coil (T1/2) for cylinder 3 misfires | 24 ⇒ 5.0, 10.0, 12.0 and 14.0 |
| 23 | 060 | Ignition output 2 or ignition coil (T1/2) current value not obtained | 24 ⇒ 5.0, 10.0, 12.0 and 14.0 |
| | 061 – 063 | Not used | – |
| 24 | 064 | CKP sensor (L5) signal not recognized/implausible | 24 ⇒ 6.0 |
| 24 | 065 | CKP sensor (L5) magnet is missing (segment control) CKP sensor (L5) tooth count on flywheel implausible | 24 ⇒ 6.0 |
| 24 | 066 | CKP sensor (L5) rpm implausibly high | 24 ⇒ 6.0 |
| 25 | 067 | CMP sensor (L5/1) not recognized/implausible (segment control) | 24 ⇒ 7.0 |
| 26 | 068 | Not used | – |
| 26 | 069 | Not used | – |
| 27 | 070 | TN-signal (rpm signal), short circuit to ground | 23 ⇒ 11.0 |

¹⁾ Observe Preparation for Test, see 22.

⁷⁾ Only possible up to end of model year 1995.



Diagnosis – Diagnostic Trouble Code (DTC) Memory

| DTC  ⁷⁾  | Possible cause | Test step/Remedy ¹⁾ |
|--|----------------|--|
| 27 | 071 | TN-signal (rpm signal), short circuit to plus |
| 28 | 072 | VSS, not recognized |
| 28 | 073 | VSS, implausible high |
| 29 | 074 – 075 | Not used |
| 30 | 076 | FP relay module (K27) open/short circuit |
| 31 | 077 | Not used |
| 31 | 078 | Not used |
| 32 | 079 | KS 1 (A16) open circuit |
| 32 | 080 | KS 2 (A16) open circuit |
| 33 | 081 | Maximum retard setting on at least one cylinder has been reached |
| 33 | 082 | Ignition angle deviation between the individual cylinders is > 6° CKA. |
| 34 | 083 | Knock control evaluation circuit in engine control module (N3/4) defective |
| 34 | 084 | Momentary fault in self-adaptation of closed throttle speed/partial load |
| 35 | 085 | AIR pump switchover valve (Y32) and/or AIR relay module (K17) |

¹⁾ Observe Preparation for Test, see 22.

⁷⁾ Only possible up to end of model year 1995.



Diagnosis – Diagnostic Trouble Code (DTC) Memory

| DTC  ⁷⁾  | Possible cause | Test step/Remedy ¹⁾ |
|--|--|--------------------------------|
| 36 086 | Purge control valve (Y58/1) open/short circuit | 23 ⇒ 25.0 – 26.0 |
| 36 087 | Purge control valve (Y58/1) short circuit to plus | 23 ⇒ 25.0 – 26.0 |
| 37 088 | Upshift delay switchover valve (Y3/3) open/short circuit | 23 ⇒ 29.0 |
| 38 089 | Adjustable camshaft timing solenoid (Y49) short circuit to plus | 23 ⇒ 27.0 – 28.0 |
| 38 090 | Adjustable camshaft timing solenoid (Y49) open/short circuit to ground | 23 ⇒ 27.0 – 28.0 |
| 39 091 | EGR switchover valve (Y27) short circuit to plus | 23 ⇒ 39.0 |
| 39 092 | EGR switchover valve (Y27) open/short circuit to ground | 23 ⇒ 39.0 |
| 40 093 – 096 | Not used | – |
| 41 097 | CAN communication from engine control module (N3/4) defective | 23 ⇒ 42.0 – 43 |
| | 098 – 099 | – |
| 42 100 | CAN communication from diagnostic module (OBD II) (N59/1) defective | 23 ⇒ 42.0 |
| 43 101 | Starter signal (circuit 50) not present | 23 ⇒ 7.0 |
| 44 102 | Not used | – |
| 44 103 | Not used | – |
| 45 – 46 104 – 106 | Not used | – |

¹⁾ Observe Preparation for Test, see 22.


⁷⁾ Only possible up to end of model year 1995.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

| DTC  7) |  | Possible cause | Test step/Remedy 1) |
|---|---|--|---|
| | 107 4) | Control of ignition coil preloading voltage exceeds limits | 24 ⇒ 11.1, Engine control module (N3/4). |
| 48 | 108 | O2S 2 (after TWC) heater relay module (K35) short circuit to plus | 23 ⇒ 17.0 |
| 48 | 109 | O2S 2 (after TWC) heater relay module (K35) open/short circuit to ground | 23 ⇒ 17.0 |
| 49 | 110 | Voltage supply circuit 87 U at engine control module (N3/4) implausible | 23 ⇒ 2.0 |
| 49 | 111 | Voltage supply circuit 87 U at engine control module (N3/4) low voltage | 23 ⇒ 2.0 |
| 50 | 112 | Engine control module (N3/4) | N3/4. |
| | 113 5) | Engine control module (N3/4) not coded | Code N3/4. |
| | 114 5) | Engine control module identification of N3/4 faulty | Code N3/4, if necessary, replace N3/4. |
| | 115 5) | Engine control module code bytes of N3/4 faulty | Code N3/4, if necessary, replace N3/4. |
| | 116 6) | CAN communication from RCL control module (N54) faulty | 23 ⇒ 41.1 |
| | 117 6) | Engine starts with RCL system locked | Incorrect operation, clear DTC memory. |
| | 118 | <i>Not applicable for U.S.A. version vehicles</i> | - |
| | 119 | <i>Not applicable for U.S.A. version vehicles</i> | - |
| | 120 | <i>Not applicable for U.S.A. version vehicles</i> | - |

- 1) Observe Preparation for Test, see 22.
- 4) As of 06/93
- 5) As of 01/94
- 6) As of model year 1996
- 7) Only possible up to end of model year 1995.


Diagnosis – Diagnostic Trouble Code (DTC) Memory

| DTC  7) | Possible cause | Test step/Remedy 1) |
|---|---|--|
| 123 | <i>Not applicable for U.S.A. version vehicles</i> | - |
| 124 | <i>Not applicable for U.S.A. version vehicles</i> | - |
| 125 126 | Engine control module (N3/4) | N3/4. |
| 127 | ISC and CC/ISC actuators interchanged | Replace actuator. |
| 128 129 | Engine control module (N3/4) | N3/4. |
| 130 | Drive actual value potentiometer (M16/6r2) | 25 ⇒ 2.0 |
| 131 132 | Engine control module (N3/4) | N3/4. |
| 133 | ISC actuator | Perform learning process on engine control module with HHT. If the fault is still present, replace actuator. |
| 134 | Engine control module (N3/4) | N3/4. |
| 135 | Voltage supply for actuator potentiometer | 25 ⇒ 1.0 |
| 136 | Drive actual value potentiometer (M16/6r2) | 25 ⇒ 2.0 |
| 137 | Engine control module (N3/4) | N3/4. |

1) Observe Preparation for Test, see 22.

7) Only possible up to end of model year 1995.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

| DTC  7) | Possible cause | Test step/Remedy 1) |
|---|--|--|
| 138 | ISC actuator | Perform learning process on engine control module with HHT. If the fault is still present, replace actuator. |
| 139 | Switch cruise control | 25 ⇒ 8.0 |
| 140 141 142 | Engine control module (N3/4) | N3/4. |
| 143 | Brake light switch | 25 ⇒ 11.0 |
| 144 | Engine control module (N3/4) | N3/4. |
| 145 | <i>Not applicable for U.S.A version vehicles</i> | - |
| 146 | <i>Not applicable for U.S.A version vehicles</i> | - |
| 147 | <i>Not applicable for U.S.A version vehicles</i> | - |
| 148 | <i>Not applicable for U.S.A version vehicles</i> | - |
| 149 | <i>Not applicable for U.S.A version vehicles</i> | - |
| 150 | <i>Not applicable for U.S.A version vehicles</i> | - |
| 151 | <i>Not applicable for U.S.A version vehicles</i> | - |
| 152 | <i>Not applicable for U.S.A version vehicles</i> | - |
| 153 | <i>Not applicable for U.S.A version vehicles</i> | - |


1) Observe Preparation for Test, see 22.

7) Only possible up to end of model year 1995.

1.2 HFM Sequential Multiport Fuel Injection/Ignition System (HFM-SFI)

Engine 111


Diagnosis – Diagnostic Trouble Code (DTC) Memory

| DTC  7) | Possible cause | Test step/Remedy ¹⁾ |
|---|--|--------------------------------|
| 154 | <i>Not applicable for U.S.A version vehicles</i> | - |
| 155 | <i>Not applicable for U.S.A version vehicles</i> | - |
| 156 157 | <i>Not applicable for U.S.A version vehicles</i> | - |
| 158 | <i>Not applicable for U.S.A version vehicles</i> | - |
| 159 | <i>Not applicable for U.S.A version vehicles</i> | - |
| 160 | <i>Not applicable for U.S.A version vehicles</i> | - |
| 161 | <i>Not applicable for U.S.A version vehicles</i> | - |
| 162 | <i>Not applicable for U.S.A version vehicles</i> | - |
| 163 | <i>Not applicable for U.S.A version vehicles</i> | - |
| 164 | <i>Not applicable for U.S.A version vehicles</i> | - |

1) Observe Preparation for Test, see 22.


7) Only possible up to end of model year 1995.

Diagnosis – Diagnostic Trouble Code (DTC) Memory OBD II

| DTC  | Possible cause | | Test step/Remedy ¹⁾ |
|--|--|--|--------------------------------|
| | SAE nomenclature | Explanation | |
| – | No malfunction in system | | |
| P0101 | Mass or volume air flow circuit range/performance problem | Hot film MAF sensor (B2/5) | 23⇒ 4.0 - 4.2 |
| P0105 | Manifold absolute pressure/barometric pressure circuit malfunction | MAP sensor (B5/2) | |
| P0111 | Intake air temperature circuit range performance problem | IAT sensor (sensor B17) | 23⇒ 10.0 |
| P0116 | Engine coolant temperature circuit range performance problem | ECT sensor (B11/3) | 23⇒ 8.0 |
| P0125 | Insufficient coolant temperature for closed loop control | ECT sensor (B11/3) | 23⇒ 8.0 |
| P0131 | O2S 1 circuit low voltage | O2S 1 (before TWC) (G3/2) Voltage too low | 23⇒ 13.0 |


¹⁾ Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory OBD II

| DTC  | Possible cause | | Test step/Remedy ¹⁾ |
|--|--|--|---|
| | SAE nomenclature | Explanation | |
| P0132 | O2S 1 circuit high voltage | O2S 1 (before TWC) (G3/2) Voltage too high | 23 ⇒ 13.0 |
| P0133 | O2S 1 circuit slow response | A O2S 1 (before TWC) (G3/2), ageing correction value exceeded B O2S 1 (before TWC) (G3/2), ageing time period too long | |
| P0134 | O2S 1 circuit no activity detected | O2S 1 (before TWC) (G3/2) | 23 ⇒ 13.0 |
| P0135 | O2S 1 heater circuit malfunction | O2S 1 heater (before TWC) (G3/2) | 23 ⇒ 14.0 |
| P0138 | O2S 2 circuit high voltage | O2S 2 (after TWC) (G3/1) Voltage too high | 23 ⇒ 15.0 |
| P0141 | O2S 2 heater circuit malfunction | O2S 2 heater (after TWC) (G3/1) | 23 ⇒ 16.0 |
| P0170 | Fuel trim malfunction | Self adaptation of fuel mixture at limit from engine control module (N3/4). | Intake air leak, injectors, diaphragm pressure regulator, engine wear. |
| P0200 | Injector circuit malfunction - cyl. 1 Injector circuit malfunction - cyl. 2 Injector circuit malfunction - cyl. 3 Injector circuit malfunction - cyl. 4 | Injector (Y62y1) – cylinder 1 Injector (Y62y2) – cylinder 2 Injector (Y62y3) – cylinder 3 Injector (Y62y4) – cylinder 4 | 23 ⇒ 18.0 23 ⇒ 19.0 23 ⇒ 20.0 23 ⇒ 21.0 |


¹⁾ Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory OBD II

| DTC  | Possible cause | | Test step/Remedy ¹⁾ |
|--|-----------------------------|---|--------------------------------|
| | SAE nomenclature | Explanation | |
| P0 300 | Random misfire detected | A Random misfire, several cylinders B Random misfire, TWC damaging | 24 ⇒ 11.0 – 14.1 |
| P0 301 | Cylinder 1 misfire detected | A Cylinder 1 misfire B Cylinder 1 misfire, TWC damaging | 24 ⇒ 11.0 – 14.1 |
| P0 302 | Cylinder 2 misfire detected | A Cylinder 2 misfire B Cylinder 2 misfire, TWC damaging | 24 ⇒ 11.0 – 14.1 |
| P0 303 | Cylinder 3 misfire detected | A Cylinder 3 misfire B Cylinder 3 misfire, TWC damaging | 24 ⇒ 11.0 – 14.1 |
| P0 304 | Cylinder 4 misfire detected | A Cylinder 4 misfire B Cylinder 4 misfire, TWC damaging | 24 ⇒ 11.0 – 14.1 |


¹⁾ Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory OBD II

| DTC  | Possible cause | | Test step/Remedy ¹⁾ |
|--|--|--|--------------------------------|
| | SAE nomenclature | Explanation | |
| P0 325 | Knock sensor 1 circuit malfunction | Knock control at limit KS 1 (A16) | |
| P0 326 | Knock sensor 1 circuit range/performance | KS 1 (A16) | |
| P0 327 | Knock sensor 1 circuit low input | KS 1 (A16) Signal implausible | |
| P0 335 | CKP sensor circuit malfunction | CKP sensor (L5) Tooth count implausible | 24 ⇒ 6.0 |
| P0 341 | CMP sensor circuit range/performance | CMP sensor (L5/1) | 24 ⇒ 7.0 |
| P0 400 | Exhaust gas recirculation flow malfunction | Exhaust gas recirculation malfunction (logic chain) | |
| P0 411 | Secondary air injection system incorrect flow detected | Secondary air injection system incorrect flow detected (logic chain) | |
| P0 412 | Secondary air injection system switching valve circuit malfunction | Air pump switchover valve (Y32) Air relay module (K17) | 23 ⇒ 38.0 23 ⇒ 38.1 |
| P0 420 | Catalyst system efficiency below threshold | Catalyst system efficiency below threshold (logic chain) | |
| P0 441 | Evaporative emission control system incorrect purge flow | EVAP not functioning properly (logic chain) | 23 ⇒ 25.0 - 26.0 |


¹⁾ Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory OBD II

| DTC  | Possible cause | | Test step/Remedy ¹⁾ |
|--|---|---|---|
| | SAE nomenclature | Explanation | |
| P0 443 | Evaporative emission control system purge control valve circuit malfunction | Purge control valve (Y58/1) | 23 ⇒ 25.0 - 26.0 |
| P0 500 | Vehicle speed sensor malfunction | VSS rear axle | 23 ⇒ 24.0 |
| P0 501 | Vehicle speed sensor range/performance | VSS signal malfunction Implausible high | 23 ⇒ 24.0 |
| P0 505 | Idle control system malfunction | Idle control system in "limp-home" mode | Intake air leak, throttle body binding, adjust throttle linkage, erase DTC's in control module |
| P0 507 | Idle control system rpm higher than expected | Idle control system valve at lower limit and engine speed is too high | 25 ⇒ 1.0 - 5.0 |
| P0 510 | Closed throttle position switch malfunction | Idle control system | 25 ⇒ 4.0 |


¹⁾ Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory OBD II

| DTC  | Possible cause | | Test step/Remedy ¹⁾ |
|--|--|---|--------------------------------|
| | SAE nomenclature | Explanation | |
| P0 600 | Serial communication link malfunction | CAN communication from diagnostic module OBDII (N59/1) defective | 23 ⇒ 42.0 |
| P1 131 | O2S 1 circuit short circuit | O2S 1 (before TWC) (G3/2) Short to voltage | |
| P1 132 | O2S 1: Oxygen sensor integration on rich or lean stop | O2S 1 (before TWC) (G3/2) Lambda integrator at limit | |
| P1 137 | O2S 2 circuit short circuit | O2S 2 (after TWC) (G3/2) Short to voltage | |
| P1 138 | O2S 2 operating condition | O2S 2 (after TWC) (G3/2) No signal/low voltage | |
| P1 170 | Short term fuel trim | Self adaptation of fuel mixture at limit from engine control module (N3/4). | |
| P1 335 | Engine speed signal TNA not received by diagnostic module | TNA-signal to diagnostic module missing | |
| P1 336 | Crankshaft sensor signal: Magnet coding on segment | CKP sensor (L5) magnet is missing (segment control) | 24 ⇒ 7.0 |
| P1 337 | Engine speed signal TNA not transmitted from engine control module | TNA-signal to diagnostic module implausible | 23 ⇒ 11.0 |
| P1 340 | CMP sensor monitoring signal from engine control module (HFM) (N3/4) | CMP sensor signal to diagnostic module implausible (camshaft signals not in sync) | 23 ⇒ 46.0 |

¹⁾ Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory OBD II

| DTC  | Possible cause | | Test step/Remedy ¹⁾ |
|--|--|---|--------------------------------|
| | SAE nomenclature | Explanation | |
| P1 341 | Camshaft timing adjuster without function | Camshaft timing adjuster without function (logic chain) | |
| P1 342 | Electrical activation of adjustable camshaft timing solenoid | Adjustable camshaft solenoid (Y49) | 23 ⇒ 27.0 - 28.0 |
| P1 400 | Electrical activation of the EGR switchover valve | EGR switchover valve (Y27/6) | 23 ⇒ 39.0 |
| P1 443 | Electrical activation of the purge flow switchover valve | Purge flow switchover valve malfunction (Y27/6), open circuit/short circuit | 23 ⇒ 39.0 |
| P1 444 | Pressure switchover without function | Pressure switchover valve malfunction (logic chain) | |
| P1 700 | Transmission upshift delay without function | Transmission upshift malfunction (logic chain) | |
| P1 701 | Electrical activation of upshift delay switchover valve (Y3/3) | Upshift delay switchover valve (Y3/3) open/short circuit | 23 ⇒ 29.0 |
| P1 740 | Full load information: Load implausible | Throttle valve actual value potentiometer (M16/6r1) implausibly high | 25 ⇒ 2.0 - 3.1 |
| P1 741 | Full load information: Throttle valve position implausible | Throttle valve actual value potentiometer (M16/6r1) implausible | 25 ⇒ 2.0 - 3.1 |
| P1 750 | Battery voltage too low | | |

¹⁾ Observe Preparation for Test, see 22.

Diagnosis – Complaint Related Diagnostic Chart

| Complaint/Problem | Possible cause | Test step/Remedy ¹⁾ |
|---|---|--|
| Engine starts poorly and accelerates poorly | Injector (Y62) control and injection time. Hot-film MAF sensor (B2/5). ECT sensor (B11/3). | 23 ⇒ 18.0 – 21.0 23 ⇒ 4.0 23 ⇒ 9.0 |
| Engine does not start | No voltage supply from overvoltage protection relay module (K1/2). CKP sensor (L5) defective. FP relay module (K27) defective. Fuel pumps defective. Injector (Y62) control and injection time. Malfunction of drive authorization system (DAS) in models as of model year 1996. | 23 ⇒ 1.0 – 3.0 24 ⇒ 6.0 23 ⇒ 6.0 34 ⇒ 2.0 23 ⇒ 18.0 – 21.0 Test see Diagnostic Manual, Body and Accessories, Vol. 1 (RCL) |
| Engine has uneven idle | Injector (Y62) control and injection time. EGR valve defective. | 23 ⇒ 18.0 – 21.0 23 ⇒ 40.0 |
| Engine has uneven idle and insufficient engine output | Camshaft timing adjustment defective. | 23 ⇒ 27.0 – 28.0 |

¹⁾ Observe Preparation for Test, see 22.

Electrical Test Program - Component Locations

Engine 111

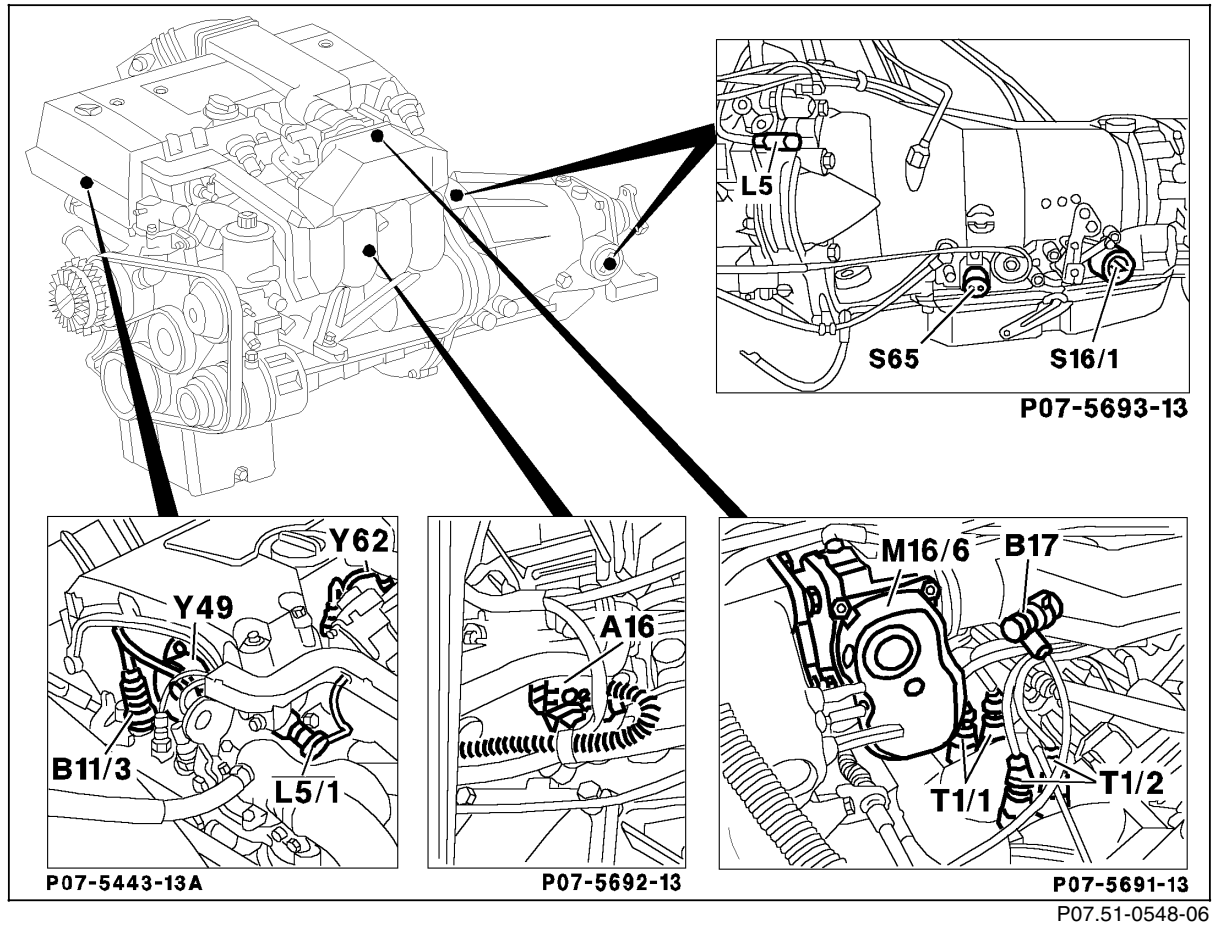


Figure 1

- A16 Knock sensors
- B11/3 ECT sensor
- B17 IAT sensor
- L5 CKP sensor
- L5/1 CMP sensor
- M16/6 ISC actuator
- S16/1 Starter lock-out/backup lamp switch
- T1/1 Ignition coil (cylinders 1 and 4)
- T1/2 Ignition coil (cylinders 2 and 3)
- Y49 Adjustable camshaft timing solenoid
- Y62 Injectors

Electrical Test Program - Component Locations

Engine 111

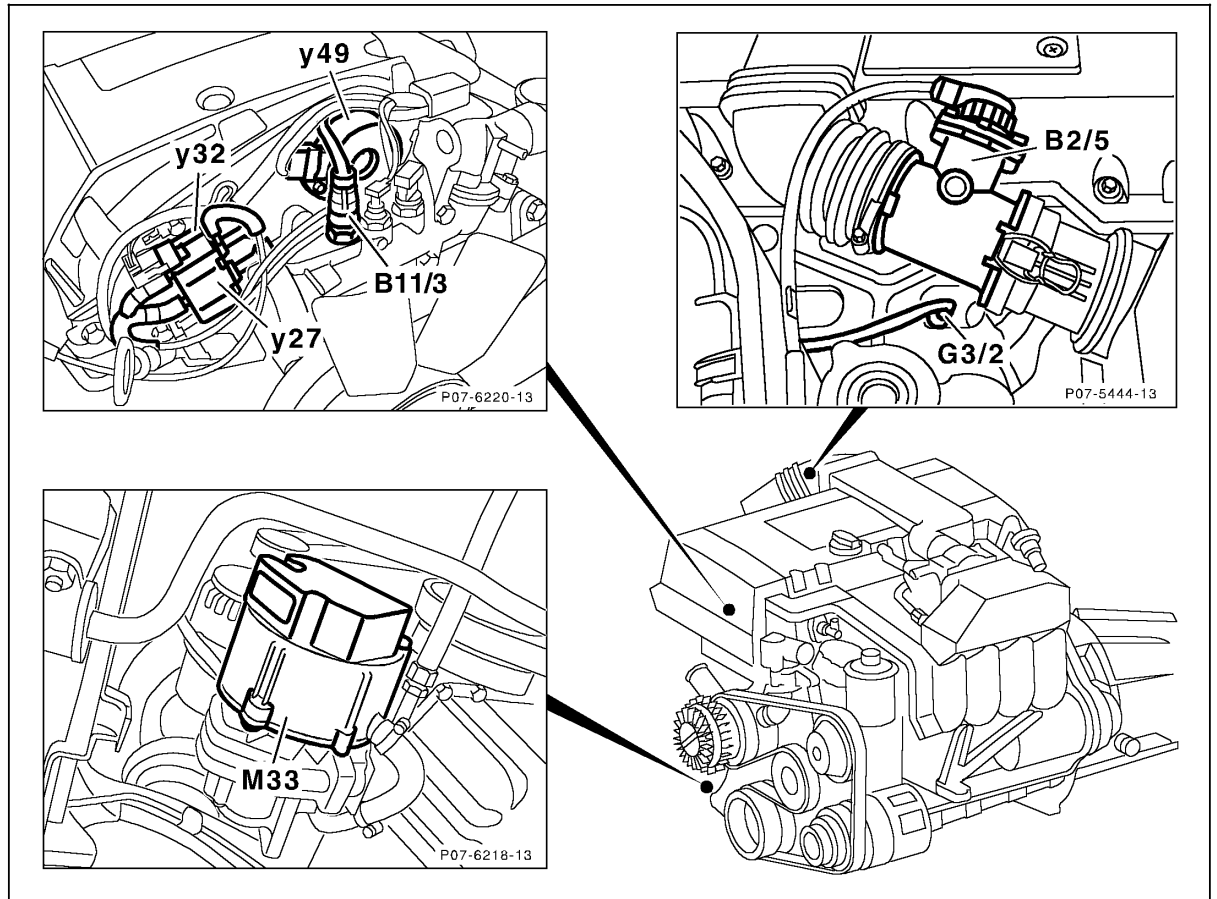


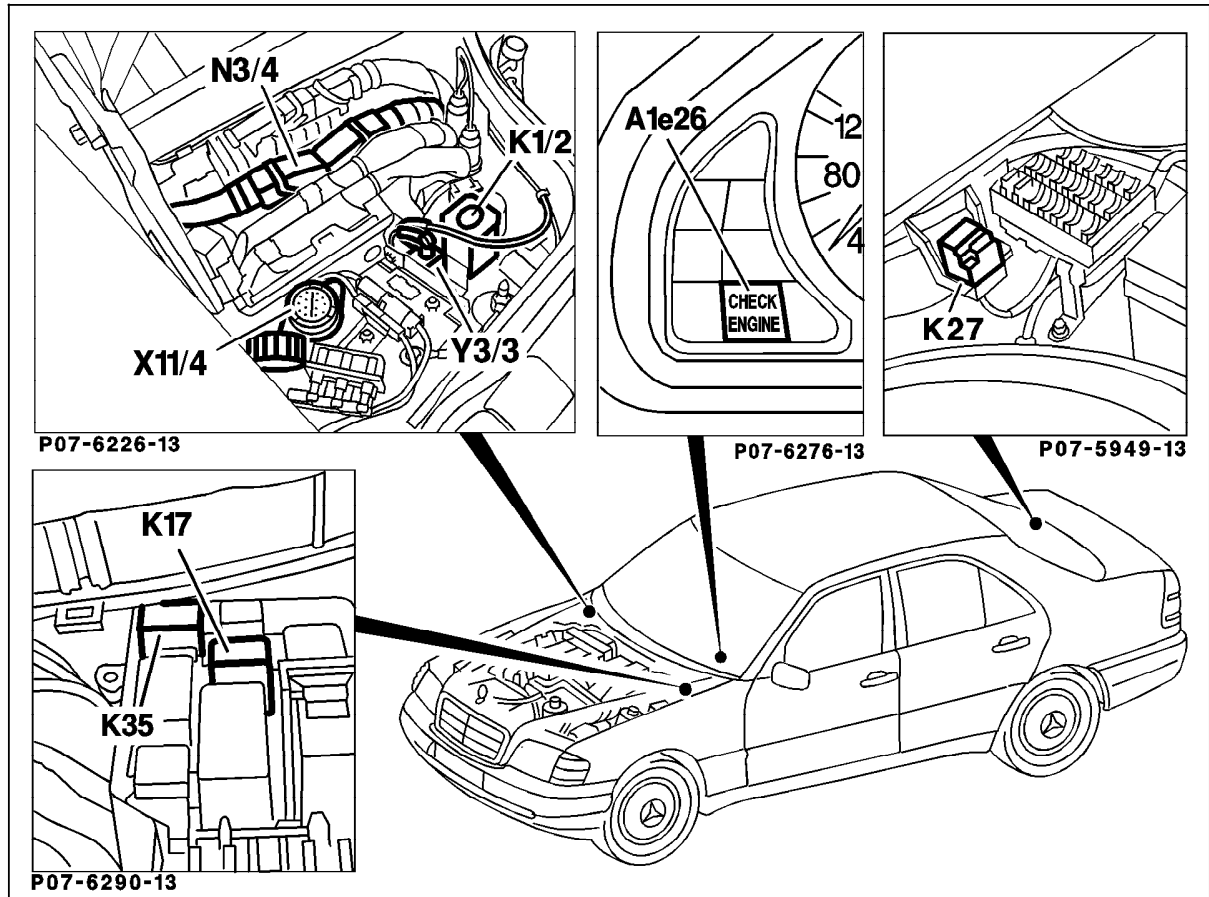
Figure 2

- B2/5 Hot film mass air flow sensor
- G3/2 O2S 1 (before TWC)
- M33 AIR pump
- Y27 EGR switchover valve
- Y32 AIR pump switchover valve

P07-51-0549-06

Electrical Test Program - Component Locations

Engine Compartment
Model 202



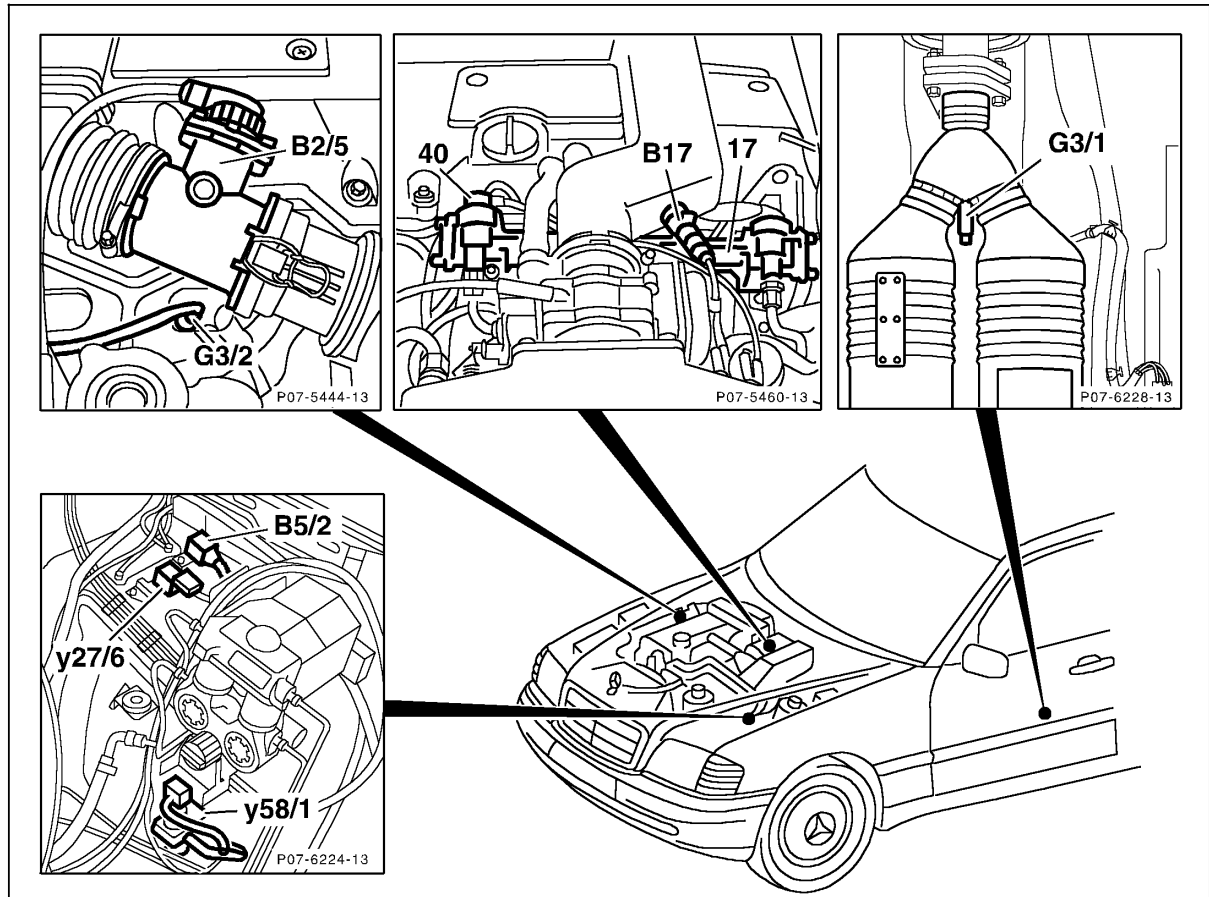
P07-6291-57

Figure 3

- A1e26 "CHECK ENGINE" MIL
- K1/2 Overvoltage protection relay module (9-pole)
- K17 AIR relay module
- K27 FP relay module
- K35 O2S 2 (after TWC) heater relay module
- N3/4 Engine control module (HFM-SFI)
- X11/4 Data link connector (DTC readout)
- Y3/3 Upshift delay switchover valve

Electrical Test Program - Component Locations

Engine Compartment
Model 202



P07.51-0552-06

Figure 4

- B5/2 DM pressure sensor
- B17 IAT sensor
- G3/1 O2S 2 (after TWC)
- G3/2 O2S 1 (before TWC)
- Y58/1 Purge control valve

Electrical Test Program - Component Locations

Engine Compartment
Model 202

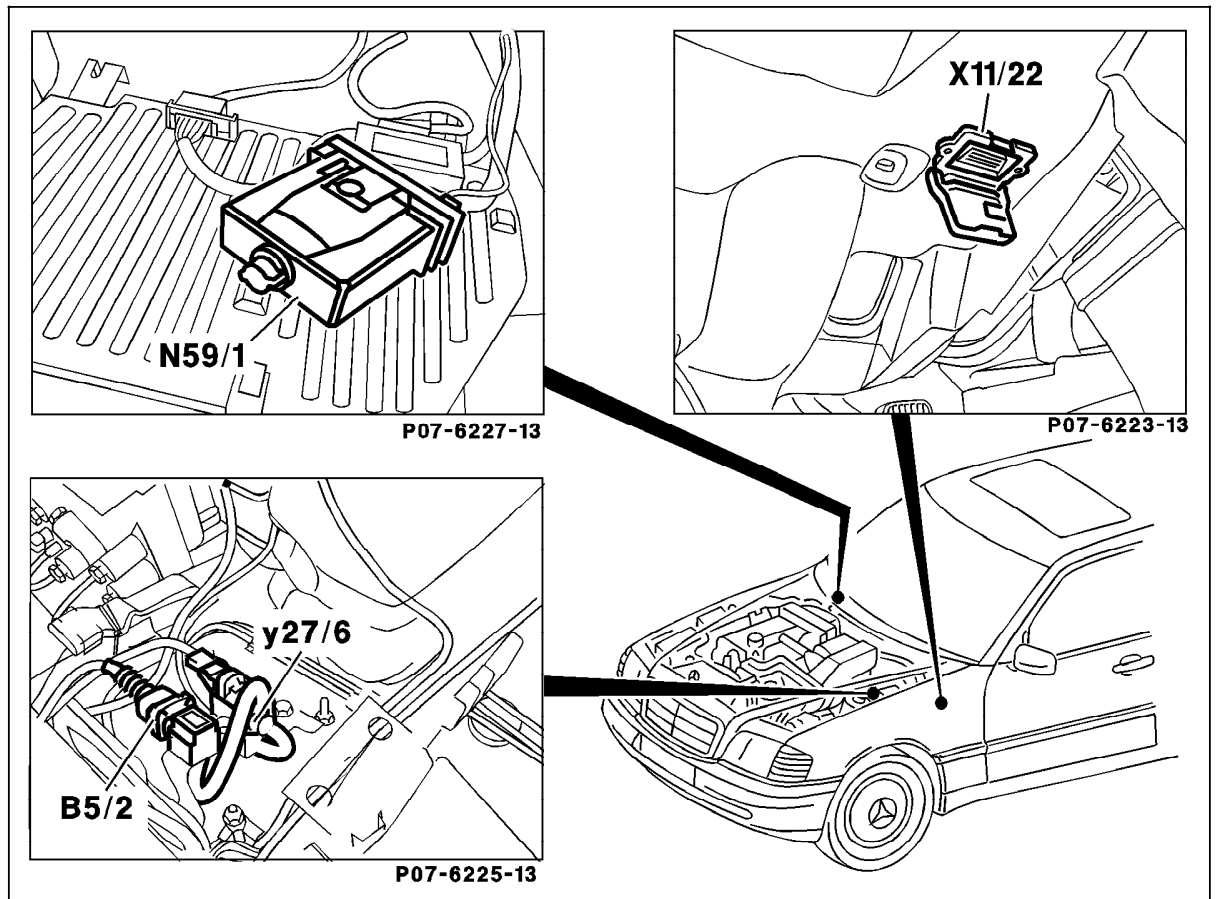


Figure 5

- B5/2 DM pressure sensor (HFM-SFI)
- N59/1 Diagnostic module (OBD II)
- X11/22 Diagnostic module (OBD II) generic scan tool connector
- Y27/6 Purge flow switchover valve

Electrical Test Program - Preparation for Test

Preliminary work:
 Diagnosis - Malfunction Memory 11

Preparation for Test

1. Ignition: **OFF**
2. Connect test cable with socket box to engine control module (N3/4) according to connection diagram.

- If installing an engine control module from another vehicle (only possible on vehicles without drive authorisation system (DAS) up to the end of model year 1995), the control module's memory must be erased and the control module must be reactivated, see 11/5.

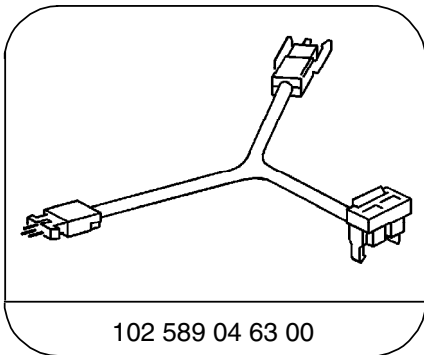
Electrical wiring diagrams, see Electrical Troubleshooting Manual.

Note regarding "Test Connection" column:

The numbers indicated in parentheses, for example, ⇒ 1.0 (1.23) signify:

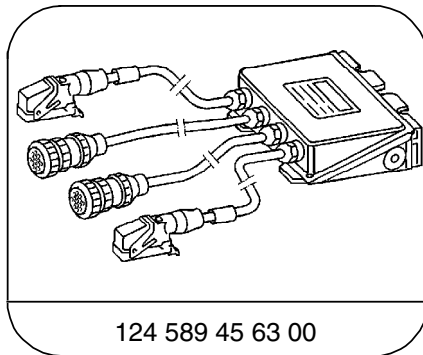
- 1= Connector 1 on wiring diagram,
- 23= Socket 23 on wiring diagram.

Special Tools



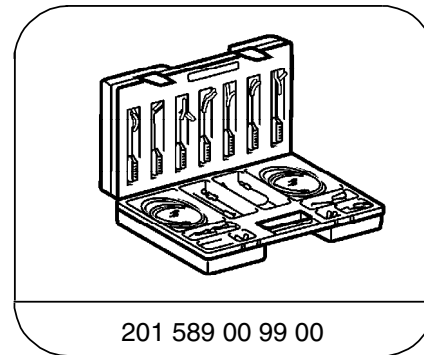
102 589 04 63 00

Test cable



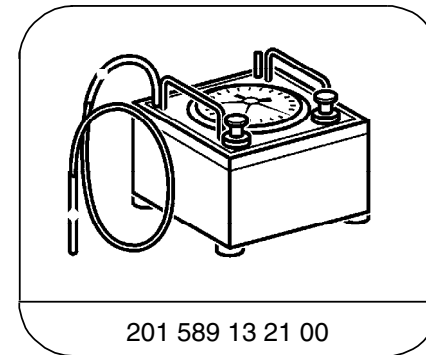
124 589 45 63 00

82-pin test cable CAN



201 589 00 99 00

Electrical connecting set

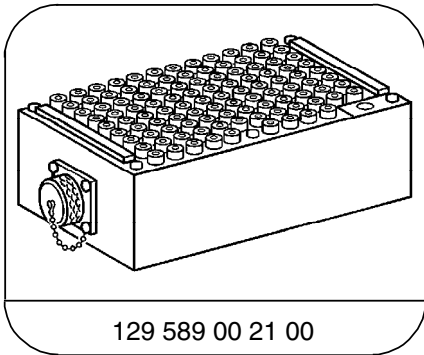


201 589 13 21 00

Tester

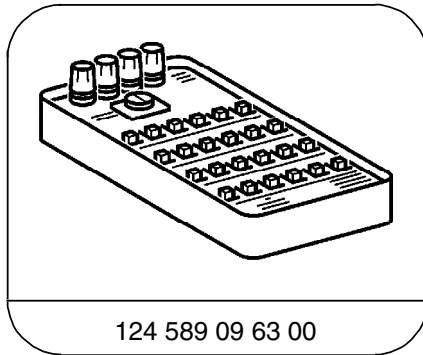
Electrical Test Program - Preparation for Test

Special Tools



129 589 00 21 00

126-pin socket box



124 589 09 63 00

Ohm decade

Conventional tools, test equipment

| Description | Brand, model, etc. |
|-------------------------------|---|
| Multimeter ¹⁾ | Fluke models 23, 83, 85, 87 |
| Engine analyzer ¹⁾ | Bear DACE (Model 40-960) Hermann Model D960S Sun MEA-1500MB |

¹⁾ Available through the MBUSA Standard Equipment Program.

Electrical Test Program - Preparation for Test

WARNING!

Conductive parts of the ignition system are under high voltage. Never touch conductive parts when the ignition is switched on, when the engine is being "turned over" manually or with the starter, or when the engine is running.

Persons with heart pacemakers should never perform work on the ignition system.

Electronic ignition systems operate in a dangerously high voltage range on the low voltage side (primary circuit) as well as on the high voltage side (secondary circuit). Due to the high voltages in electronic ignition systems contact with parts or terminals under power can be dangerous.

Always switch off the ignition when working on the ignition system, e.g.:

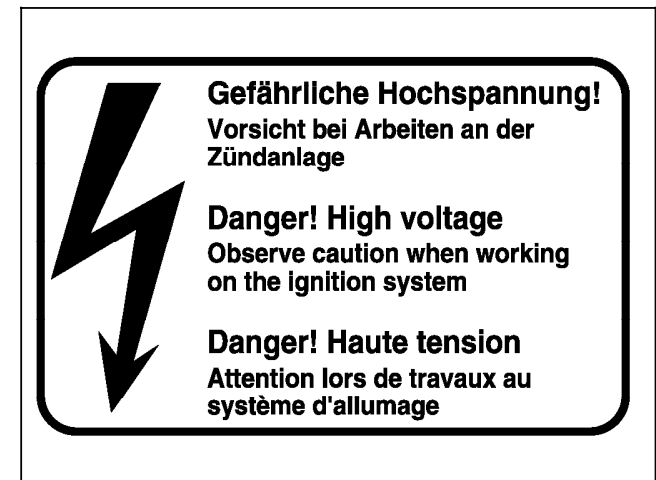
- Replacing ignition system components

- Connecting engine test instruments
- Connecting removed assemblies for testing on test benches

If it is necessary to switch on the ignition for work on the ignition system, observe safety precautions, dangerously high voltage is present in the entire ignition system.

Ensure that the engine and ignition are turned off when connecting/disconnecting equipment such as voltage signal pick-up on respective ignition cables and trigger pick-up on cylinder 1.

See Service Microfiche System (SMS), Repair Instructions, group 15 for further safety precautions.



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Electrical Test Program - Preparation for Test

Notes for avoiding damage to ignition systems during testing:

- To avoid damage to the control module, disconnect and connect control module connectors with the ignition switched **off**.
- Do not connect a test lamp to circuit 1 or 15 of ignition coil.
- Terminal 1 of the ignition coils must not be short-circuited to ground, e.g. anti-theft protection.
- Install only original ignition system components.
- Do not operate the ignition system at cranking speed unless the ignition wires are fully connected.
- The following ignition tests should **not** be performed with engine cranking or with the engine running: holding secondary coil wire at a distance to ground, disconnecting a spark plug connector, or pulling secondary coil wire out of the ignition coil(s).
- Each high-voltage circuit must have a load of at least 2 k Ω (plug connector).
- On the separate ignition coil tests, the ignition coil must not be loaded above 28 kV to avoid damaging the ignition coil.
- If engine cuts out when using engine analyzer during cylinder balance test, do not perform further testing with that type of engine analyzer.
- If it is necessary to check the ignition spark following a breakdown, check with spark plug connected to one of the secondary ignition wires. Ensure that the spark plug is well grounded.
- When working at cranking speed, e.g. checking compression, switch off ignition and:
On engine with HFM-SFI/ME-SFI fuel injection and ignition system, disconnect connector "2" on control module.

Electrical Test Program - Preparation for Test

Connection Diagram - Socket Box Model 202

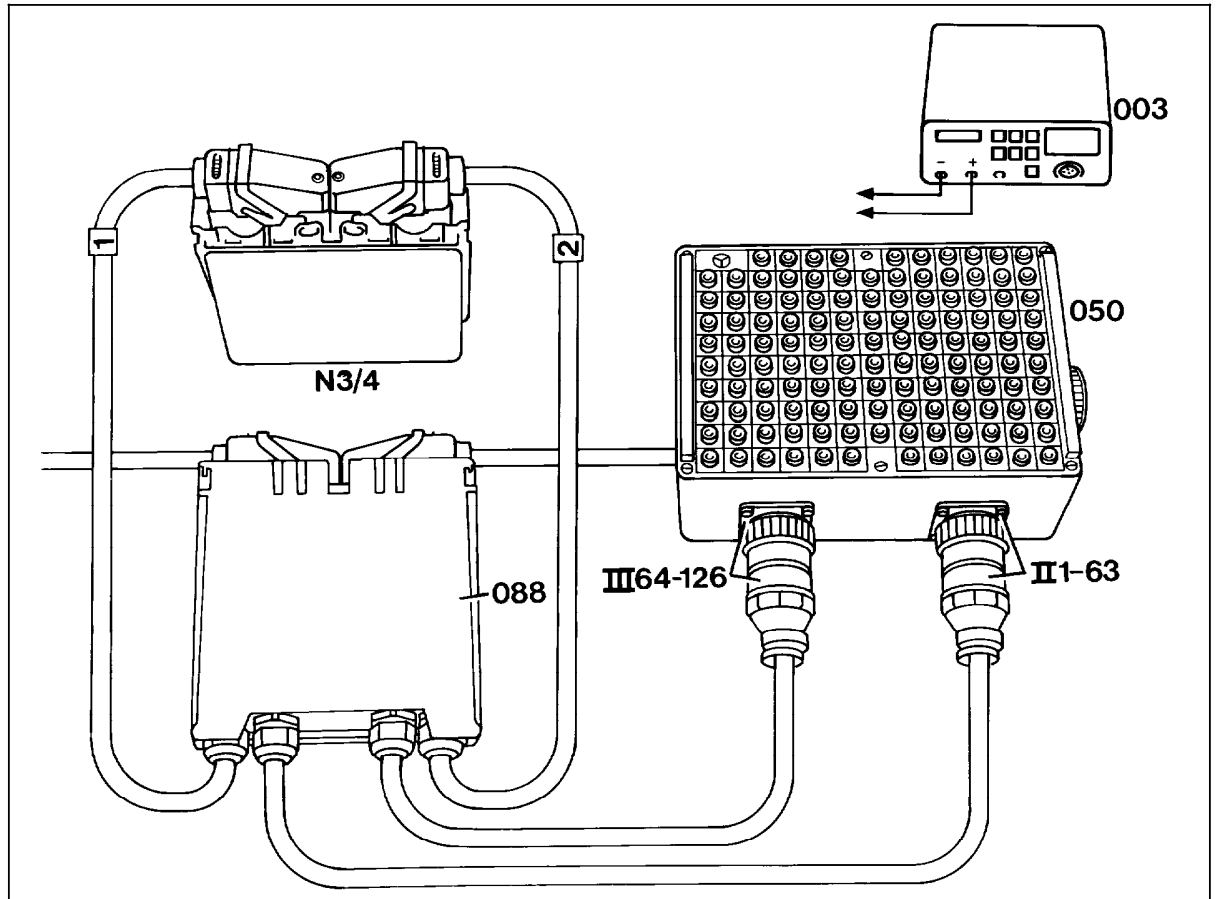


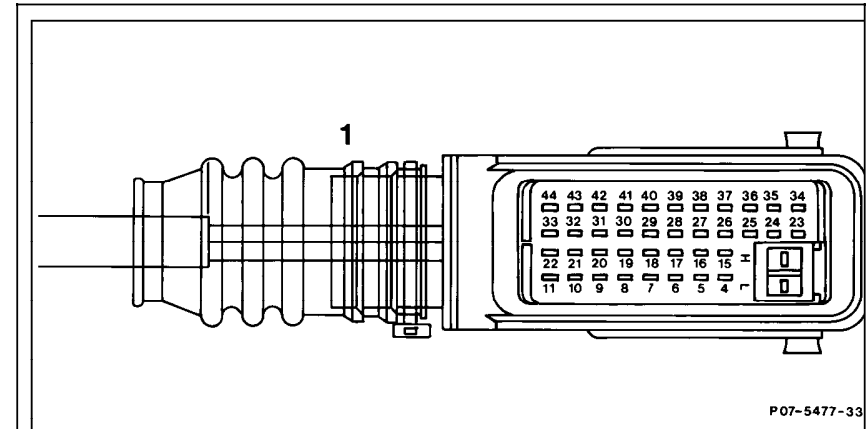
Figure 1

- 003 Multimeter
- 050 Socket box (126-pole)
- 088 Test cable
- N3/4 Engine control module (HFM-SFI)

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Electrical Test Program – Preparation for Test

Layout Engine Control Module Connector “1” – Interior



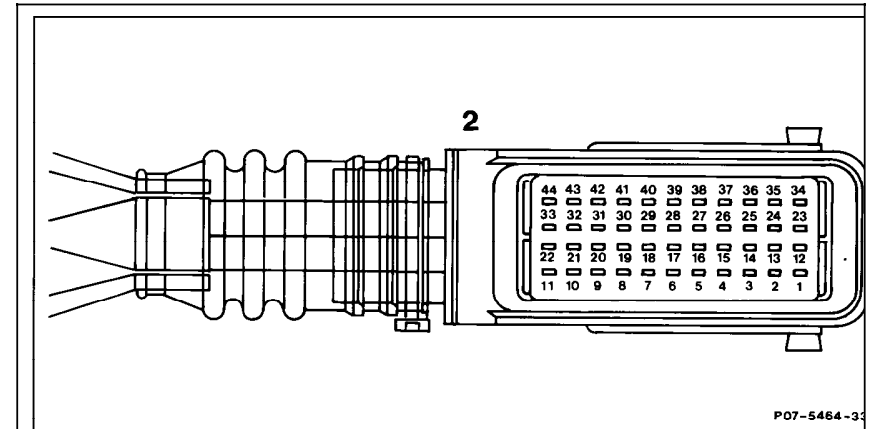
P07-5477-33
P07-5477-33

Figure 2

| | | | | | |
|---------|---|----|---|----|---|
| 1 – 3 | Not used | 23 | Not used | 40 | Voltage supply (circuit 30) |
| 4 | Brake switch (to end of M.Y. 1996) | 24 | O2S 2 (after TWC) ground | 41 | O2S 2 (after TWC) heater current |
| 5 | Bridged with socket 6 | 25 | O2S 2 (after TWC) signal | 42 | Transmission upshift delay switchover valve |
| 6 | Bridged with socket 5 | 26 | O2S 2 (after TWC) wire insulation | 43 | Purge switchover valve |
| 7 | Cooling fan control for climate control | 27 | Voltage supply, circuit 87 | 44 | Ground for Lambda signal |
| 8 | VSS from ABS control module (N30) | 28 | Not used | L | CAN (-) |
| 9 | Not used | 29 | FP relay module | | Controller area network (Engine control module (HFM-SFI), RCL control module [as of M.Y. 1996], diagnostic module [OBD II]) |
| 10 | Not used | 30 | O2S 1 heater | H | CAN (+) |
| 11 | A/C compressor engagement signal | 31 | O2S 2 (after TWC) heater relay module | | Controller area network (Engine control module (HFM-SFI), RCL control module [as of M.Y. 1996], diagnostic module [OBD II]) |
| 12 – 14 | Not used | 32 | Electronics ground (W16/6), (component compartment - right) | | |
| 15 | O2S 1 (before TWC) signal | 33 | Output ground (W16/4), (component compartment - right) | | |
| 16 | O2S 2 (after TWC) signal | 34 | O2S 1 (before TWC) ground | | |
| 17 | CMP output signal | 35 | O2S 1 (before TWC) signal | | |
| 18 | TN-signal (engine rpm output signal) | 36 | O2S 1 (before TWC) wire insulation | | |
| 19 | Diagnostic wire | 37 | Not used | | |
| 20 | Starter lock-out and backup lamp switch (transmission range P/N recognition) (automatic only) | 38 | Not used | | |
| 21 | Starter signal, circuit 50 | 39 | Voltage supply (circuit 87) | | |
| 22 | Recognition signal cruise control ON | | | | |

Electrical Test Program – Preparation for Test

Layout
 Engine Control Module Connector “2” – Engine
 Compartment


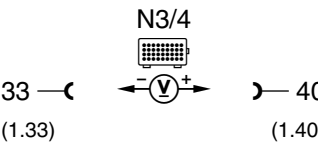
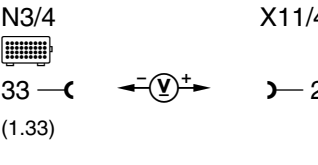
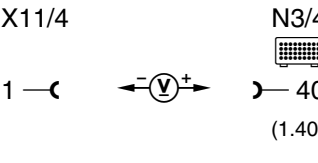


P07-5464-33
 P07-5464-33

Figure 3

| | | | | | |
|----|---|----|---|----|---|
| 1 | Adjustable camshaft timing solenoid | 20 | Not used | 38 | Not used |
| 2 | Injector 4 | 21 | Ignition coil T1/1 (terminal 1) to end of M.Y. 1995 | 39 | ISC actuator (throttle body actual value potentiometer) |
| 3 | Not used | | Ignition coil T1/2 (terminal 1) as of M.Y. 1996 | 40 | KS 1 ground |
| 4 | ISC actuator (motor voltage supply) | 22 | Electronics ground (W16/6) | 41 | KS 1 signal |
| 5 | MAF sensor signal | 23 | Injector 1 | 42 | Not used |
| 6 | ISC actuator (potentiometer ground) | 24 | Injector 2 | 43 | Not used |
| 7 | ISC actuator (actual value potentiometer) | 25 | EGR switchover valve | 44 | Not used |
| 8 | CMP sensor signal | 26 | ISC actuator (motor ground) | | |
| 9 | Ignition coil T1/2 (terminal 1) to end of M.Y. 1995 | 27 | MAF sensor signal ground | | |
| | Ignition coil T1/1 (terminal 1) as of M.Y. 1996 | 28 | ECT sensor ground | | |
| 10 | Not used | 29 | CKP sensor ground | | |
| 11 | Not used | 30 | CKP sensor signal | | |
| 12 | Injector 3 | 31 | Not used | | |
| 13 | Not used | 32 | Not used | | |
| 14 | Actuator air flap/air filter | 33 | Not used | | |
| 15 | AIR pump relay module | 34 | ISC actuator (CTP contact) | | |
| 16 | Not used | 35 | Not used | | |
| 17 | Voltage supply mass air flow sensor | 36 | ECT sensor | | |
| 18 | ISC actuator (potentiometer voltage supply) | 37 | IAT sensor | | |
| 19 | CMP sensor ground | | | | |

Electrical Test Program – Sequential Multiport Fuel Injection System Test

| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|-----|---|---|--|----------------------|---------------|--|
| 1.0 | | Engine control module (HFM-SFI) (N3/4) Voltage supply Circuit 30 |  | Ignition: OFF | 11 – 14 V | ⇒ 1.1 |
| 1.1 | | Ground wire |  | Ignition: ON | 11 – 14 V | Ground wire, Ground (output ground - component compartment - right) - W16/4, ⇒ 1.2 |
| 1.2 | | Voltage supply Circuit 30 |  | Ignition: OFF | 11 – 14 V | Wire to terminal block X4/22. |

Electrical Test Program – Sequential Multiport Fuel Injection System Test

| ⇒ | | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|-----|--|---|--|---------------------|---------------|---|
| 2.0 | | Engine control module (HFM-SFI) (N3/4) Voltage supply Circuit 87 | N3/4 32 —()— 39 (1.32) (1.39) | Ignition: ON | 11 – 14 V | ⇒ 2.1 |
| 2.1 | | Electronics ground | N3/4 32 —()— 2 (1.32) | Ignition: ON | 11 – 14 V | Wire, Ground (electronics ground - component compartment - right) - [W16/6] ⇒ 2.2 |
| 2.2 | | Voltage supply Circuit 87 | X11/4 1 —()— 39 (1.39) | Ignition: ON | 11 – 14 V | Wires, Overvoltage protection relay module (K1/2), Ignition/starter switch (S2/1). |
| 3.0 | | Engine control module (HFM-SFI) (N3/4) Voltage supply Circuit 87 | N3/4 66 —()— 27 (2.22) (1.27) | Ignition: ON | 11 – 14 V | Wiring, Fuse, K1/2, ⇒ 3.1. |
| 3.1 | | Electronics ground | N3/4 66 —()— 2 (2.22) | Ignition: ON | 11 – 14 V | W16/6. |

Electrical Test Program – Sequential Multiport Fuel Injection System Test


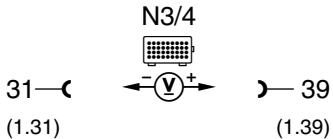
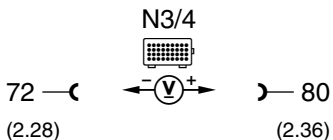
| ⇒ | | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|-----|--|--|--|---|--|--|
| 4.0 | | Hot film MAF sensor (B2/5) with 4-pole connector Voltage at hot film | N3/4 71 —(C) ←(V)→ —(D) 49 (2.27) (2.5) | Engine: at Idle Engine coolant temperature >70°C | 0.8 – 1.1 V ²⁾ | Wiring, ⇒ 4.1, ⇒ 4.2, Intake air leak, B2/5. |
| 4.1 | | Hot film MAF sensor (B2/5) Voltage supply | N3/4 71 —(C) ←(V)→ —(D) 39 (2.27) (1.39) | Ignition: ON | 11 – 14 V | Wiring, N3/4. |
| 4.2 | | Ground for hot film MAF sensor (B2/5) | N3/4 66 —(C) ←(Q)→ —(D) 71 (2.22) (2.27) | Ignition: OFF Disconnect connector 2 on N3/4. | < 20 Ω | Ground wire. |
| 5.0 | | Hot film MAF sensor (B2/5) with 5-pole connector Voltage at hot film | N3/4 71 —(C) ←(V)→ —(D) 49 (2.27) (2.17) | Ignition: ON Engine: at Idle Engine coolant temperature >70°C | 0.9 – 1.1 V ²⁾ 1.3 – 1.7 V | Wiring, ⇒ 5.1, Intake air leak, B2/5 |
| 5.1 | | Hot film MAF sensor (B2/5) Voltage supply | N3/4 66 —(C) ←(V)→ —(D) 61 (2.22) (2.17) | Ignition: ON | 4.7 – 5.2 V | Wiring, N3/4 ⇒ 5.2, |

²⁾ Voltage increases with increasing rpm.

Electrical Test Program – Sequential Multiport Fuel Injection System Test

| ⇒ | | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|-----|--|--|---|---|-------------------------|--|
| 5.2 | | Ground for hot film MAF sensor (B2/5) | B2/5 3 — — 4 | Disconnect connector on B2/5 and measure directly at sockets 3 and 4. Ignition: ON | 4.7 – 5.2 V | Fuse, Wiring, ⇒ 5.3, |
| 5.3 | | Voltage supply | N3/4 66 — — 2 (2.44) (2) | Disconnect connector on B2/5 and place positive lead directly on socket 2 (rt/bl). Ignition: ON | 11 – 14 V | Fuse, Wiring, Relay module (K40) |
| 6.0 | | FP relay module (K27) Control signal | N3/4 32 — — 29 (1.32) (1.29) | Engine: Start | 6 – 14 V while cranking | ⇒ 6.1, N3/4. |
| 6.1 | | Current draw | N3/4 29 — — 39 (1.29) (1.39) | Ignition: ON | 0.1 – 0.3 A | Wiring, FP relay module (K27). |
| 7.0 | | Starter signal Circuit 50 | N3/4 32 — — 21 (1.32) (1.21) | Engine: Start | 6 – 14 V while cranking | Wiring, Ignition/starter switch (S2/1), Starter lock-out system. |

Electrical Test Program – Sequential Multiport Fuel Injection System Test

| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy | | | | | | | | | | | | | | | | | | | | | | |
|-----|---|--------------------------------------|---|---|---|--|---|----|-----|----|-----|----|-----|----|-----|----|-----|----|-----|----|-----|----|-----|-----|-----|--|------|--|
| 8.0 | | Starter relay im pulse module | <p>N3/4</p>  | <p>Engine coolant temperature >20°C</p> <p>Turn ignition switch briefly to position 2.</p> | 6 – 14 V (or approx. 5 second duration if engine does not start) | Ignition switch, Wiring, Pulse module (N65). Engine control module N3/4 | | | | | | | | | | | | | | | | | | | | | | |
| 9.0 | <p>002</p> <p>003</p> <p>004</p> <p>005</p> | ECT sensor (B11/3) Voltage | <p>N3/4</p>  | Ignition: ON | <table border="0"> <tr> <td>°C</td> <td>V</td> </tr> <tr> <td>20</td> <td>3.5</td> </tr> <tr> <td>30</td> <td>3.1</td> </tr> <tr> <td>40</td> <td>2.7</td> </tr> <tr> <td>50</td> <td>2.3</td> </tr> <tr> <td>60</td> <td>1.9</td> </tr> <tr> <td>70</td> <td>1.5</td> </tr> <tr> <td>80</td> <td>1.2</td> </tr> <tr> <td>90</td> <td>1.0</td> </tr> <tr> <td>100</td> <td>0.8</td> </tr> <tr> <td></td> <td>±5 %</td> </tr> </table> | °C | V | 20 | 3.5 | 30 | 3.1 | 40 | 2.7 | 50 | 2.3 | 60 | 1.9 | 70 | 1.5 | 80 | 1.2 | 90 | 1.0 | 100 | 0.8 | | ±5 % | ⇒ 9.1, Wiring, Engine control module (N3/4). |
| °C | V | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | 3.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | 3.1 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40 | 2.7 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50 | 2.3 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 60 | 1.9 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 70 | 1.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 80 | 1.2 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 90 | 1.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 100 | 0.8 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ±5 % | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Electrical Test Program – Sequential Multiport Fuel Injection System Test

| ⇒ | | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy | | | | | | | | | | | | | | | | | | | | |
|------|-------------------|-------------------------------------|-----------------|---|---|-----------------------|---|----|------|----|------|----|------|----|-----|----|-----|----|-----|------|-----|--|-----|------|--|----------------|
| 9.1 | | Resistance (B11/3) | <p>N3/4</p> | Ignition: OFF Unplug connector 2 on N3/4. | <table border="1"> <tr> <th>°C</th> <th>Ω</th> </tr> <tr> <td>20</td> <td>2500</td> </tr> <tr> <td>30</td> <td>1700</td> </tr> <tr> <td>40</td> <td>1170</td> </tr> <tr> <td>50</td> <td>830</td> </tr> <tr> <td>60</td> <td>600</td> </tr> <tr> <td>70</td> <td>435</td> </tr> <tr> <td>80</td> <td>325</td> </tr> <tr> <td>90</td> <td>245</td> </tr> <tr> <td colspan="2">±5 %</td> </tr> </table> | °C | Ω | 20 | 2500 | 30 | 1700 | 40 | 1170 | 50 | 830 | 60 | 600 | 70 | 435 | 80 | 325 | 90 | 245 | ±5 % | | Wiring, B11/3. |
| °C | Ω | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | 2500 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | 1700 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40 | 1170 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50 | 830 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 60 | 600 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 70 | 435 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 80 | 325 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 90 | 245 | | | | | | | | | | | | | | | | | | | | | | | | | |
| ±5 % | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10.0 | 006 007 008 | IAT sensor (B17), (B2/5) Voltage | <p>N3/4</p> | Ignition: ON | <table border="1"> <tr> <th>°C</th> <th>V</th> </tr> <tr> <td>10</td> <td>3.2</td> </tr> <tr> <td>20</td> <td>2.6</td> </tr> <tr> <td>30</td> <td>2.1</td> </tr> <tr> <td>40</td> <td>1.6</td> </tr> <tr> <td>50</td> <td>1.2</td> </tr> <tr> <td>60</td> <td>0.9</td> </tr> <tr> <td colspan="2">±5 %</td> </tr> </table> | °C | V | 10 | 3.2 | 20 | 2.6 | 30 | 2.1 | 40 | 1.6 | 50 | 1.2 | 60 | 0.9 | ±5 % | | ⇒ 10.1, Engine control module (N3/4). | | | | |
| °C | V | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | 3.2 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | 2.6 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | 2.1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40 | 1.6 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50 | 1.2 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 60 | 0.9 | | | | | | | | | | | | | | | | | | | | | | | | | |
| ±5 % | | | | | | | | | | | | | | | | | | | | | | | | | | |


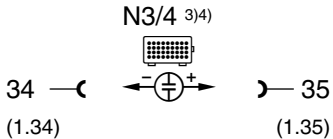
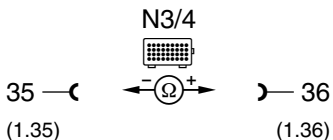
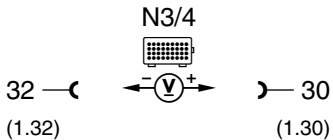
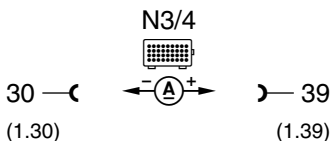
Electrical Test Program – Sequential Multiport Fuel Injection System Test

| ⇒ | | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy | | | | | | | | | | | | | | | | |
|------|------|---|---|---|--|---|---|----|------|----|------|----|------|----|------|----|------|----|------|--|------|----------------------|
| 10.1 | | Resistance | <p>N3/4</p> <p>72 — (2.28) 81 — (2.37)</p> | Ignition: OFF Unplug connector 2 on N3/4. | <table border="0"> <tr> <td>°C</td> <td>Ω</td> </tr> <tr> <td>10</td> <td>9670</td> </tr> <tr> <td>20</td> <td>6060</td> </tr> <tr> <td>30</td> <td>3900</td> </tr> <tr> <td>40</td> <td>2600</td> </tr> <tr> <td>50</td> <td>1760</td> </tr> <tr> <td>60</td> <td>1220</td> </tr> <tr> <td></td> <td>±5 %</td> </tr> </table> | °C | Ω | 10 | 9670 | 20 | 6060 | 30 | 3900 | 40 | 2600 | 50 | 1760 | 60 | 1220 | | ±5 % | Wiring, B17, B2/5 |
| °C | Ω | | | | | | | | | | | | | | | | | | | | | |
| 10 | 9670 | | | | | | | | | | | | | | | | | | | | | |
| 20 | 6060 | | | | | | | | | | | | | | | | | | | | | |
| 30 | 3900 | | | | | | | | | | | | | | | | | | | | | |
| 40 | 2600 | | | | | | | | | | | | | | | | | | | | | |
| 50 | 1760 | | | | | | | | | | | | | | | | | | | | | |
| 60 | 1220 | | | | | | | | | | | | | | | | | | | | | |
| | ±5 % | | | | | | | | | | | | | | | | | | | | | |
| 11.0 | | TN-signal output (engine rpm output signal) Engine control module (N3/4) | <p>N3/4 ³⁾</p> <p>32 — (1.32) 18 — (1.18)</p> <p>N3/4 ⁴⁾</p> <p>32 — (1.32) 18 — (1.18)</p> | Engine: Start or Engine: at Idle | <p>Signal, see Figure 1.</p> <p>5 – 7.5 V</p> | Wiring, CKP sensor (L5) Engine control module (N3/4). | | | | | | | | | | | | | | | | |
| 12.0 | | Non-USA vehicles only. Continue to next test step. | | | | | | | | | | | | | | | | | | | | |
| 12.1 | | Non-USA vehicles only. Continue to next test step. | | | | | | | | | | | | | | | | | | | | |

3) Test with oscilloscope.

4) Test with multimeter only if oscilloscope is not available.


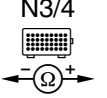
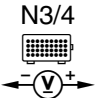
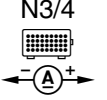
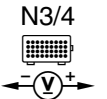
Electrical Test Program – Sequential Multiport Fuel Injection System Test

| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|------|---|--|---|--|--|---|
| 13.0 | 023 024 025 | O2S 1 (before TWC) (G3/2) O2S 1 signal | N3/4 ³⁾⁴⁾  | Engine: at Idle and at operating temperature > 80 °C let engine run for a minimum of 2 minutes. | Oscillates between -0.2 and +1.0 V by more than 0.3 Figure 14 | Wiring, O2S 1 (G3/2), ⇒ 13.1, ⇒ 14.0 |
| 13.1 | | Insulation, O2S 1 wire | N3/4  | Ignition: OFF Unplug connector 1 on N3/4. | >20 kΩ | Wiring. |
| 14.0 | 029 030 031 | O2S 1 (before TWC) (G3/2) O2S 1 heater Control signal | N3/4  | Engine: at Idle and at operating temperature > 80 °C let engine run for a minimum of 2 minutes. | 11 – 14 V or voltage changes between 1 – 14 V | Engine control module (N3/4), ⇒ 14.1 |
| 14.1 | | Current draw | N3/4  | Ignition: ON | 0.6 – 3.4 A | Wiring, O2S 1 (G3/2). |


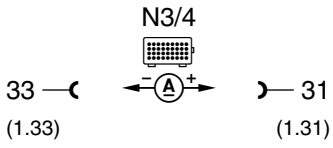

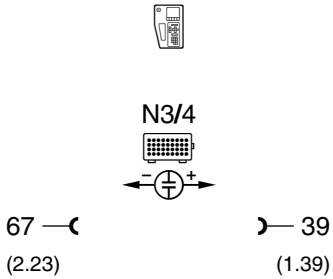
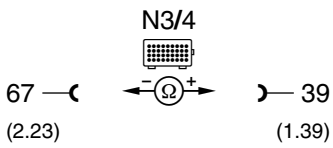
3) Test with oscilloscope.

4) Test with multimeter only if oscilloscope is not available.







Electrical Test Program – Sequential Multiport Fuel Injection System Test

| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|------|---|--|---|--|---------------|--|
| 15.1 | 029 030 031 | Insulation, O2S 2 wire | <p>N3/4</p>  <p>25 — (1.25) 26 — (1.26)</p> | Ignition: OFF Unplug connector 1 on N3/4. | >20 kΩ | Wiring. |
| 16.0 | 032 033 034 | O2S 2 (after TWC) (G3/1) O2S 2 heater Control signal | <p>N3/4</p>  <p>32 — (1.32) 41 — (1.41)</p> | Engine: at Idle and at operating temperature > 80 °C let engine run for a minimum of 2 minutes. | 11 – 14 V | ⇒ 16.1, Engine control module (N3/4). |
| 16.1 | | Current draw | <p>N3/4</p>  <p>41 — (1.41) 39 — (1.39)</p> | Ignition: ON | 0.6 – 3.4 A | Wiring, O2S 2 (after TWC) heater relay module (K35) O2S 2 (G3/1). |
| 17.0 | 108 109 | O2S 2 (after TWC) heater relay module (K35) Control signal | <p>N3/4</p>  <p>31 — (1.31) 27 — (1.27)</p> | Disconnect ECT sensor (B11/3) and simulate 2.5 kΩ at sockets 1 and 2 with resistance substitution unit. Engine: at Idle | 11 – 14 V | ⇒ 17.1, N3/4. |





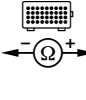
Electrical Test Program – Sequential Multiport Fuel Injection System Test

| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|------|---|---|---|--|---|--|
| 17.1 | | Current draw |  <p>33 — (1.33) 31 — (1.31)</p> | Ignition: ON | 0.1 – 0.3 A | Wiring, K35. |
| 18.0 |  | Injector (Y62y1) Control and injection time |  <p>67 — (2.23) 39 — (1.39)</p> | ECT approx. 20 °C at start → ECT approx. 80 °C at idle → accelerate briefly → | Injection time: approx. 8 ms approx. 3 – 5 ms approx. 17 ms (see signals, Figures 2 and 3) | ⇒ 18.1, N3/4. Further possible causes: ECT sensor (B11/3), IAT sensor (B17), O2S 1 (G3/2). |
| 18.1 | | Resistance |  <p>67 — (2.23) 39 — (1.39)</p> | Ignition: OFF Connector 2 on engine control module unplugged. | 14 – 17 Ω | Wiring, Y62y1. |







Electrical Test Program – Sequential Multiport Fuel Injection System Test

| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|------|--|---|--|---|---|--|
| 19.0 |   | Injector (Y62y2) Control and injection time |   68 —┘ (2.24) ┘— 39 (1.39) | ECT approx. 20 °C at start → ECT approx. 80 °C at idle → accelerate briefly → | Injection time: approx. 8 ms approx. 3 – 5 ms approx. 17 ms (see signals, Figures 2 and 3) | ⇒ 19.1, N3/4. Further possible causes: ECT sensor (B11/3), IAT sensor (B17), O2S 1 (G3/2). |
| 19.1 | | Resistance |  68 —┘ (2.24) ┘— 39 (1.39) | Ignition: OFF Connector 2 on engine control module unplugged. | 14 – 17 Ω | Wiring, Y62y2. |


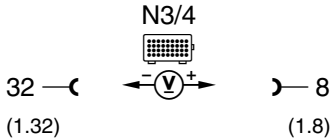
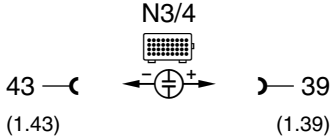
Electrical Test Program – Sequential Multiport Fuel Injection System Test

| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|------|---|---|--|---|---|--|
| 20.0 |  041 042 | Injector (Y62y3) Control and injection time |  N3/4  56 —┘ (2.12) ┘— 39 (1.39) | ECT approx. 20 °C at start → ECT approx. 80 °C at idle → accelerate briefly → | Injection time: approx. 8 ms approx. 3 – 5 ms approx. 17 ms (see signals, Figures 2 and 3) | ⇒ 20.1, N3/4. Further possible causes: ECT sensor (B11/3), IAT sensor (B17), O2S 1 (G3/2). |
| 20.1 | | Resistance | N3/4  56 —┘ (2.12) ┘— 39 (1.39) | Ignition: OFF Connector 2 on engine control module unplugged. | 14 – 17 Ω | Wiring, Y62y3. |


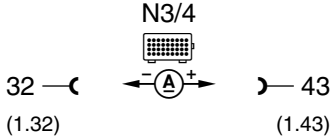
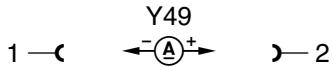
Electrical Test Program – Sequential Multiport Fuel Injection System Test

| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|------|--|---|---|---|---|--|
| 21.0 |   | Injector (Y62y4) Control and injection time |   46 —┘ (2.2) ┘— 39 (1.39) | ECT approx. 20 °C at start → ECT approx. 80 °C at idle → accelerate briefly → | Injection time: approx. 8 ms approx. 3 – 5 ms approx. 17 ms (see signals, Figures 2 and 3) | ⇒ 21.1, N3/4. Further possible causes: ECT sensor (B11/3), IAT sensor (B17), O2S 1 (G3/2). |
| 21.1 | | Resistance |  46 —┘ (2.2) ┘— 39 (1.39) | Ignition: OFF Connector 2 on engine control module unplugged. | 14 – 17 Ω | Wiring, Y62y4. |

Electrical Test Program – Sequential Multiport Fuel Injection System Test

| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|------|---|---|--|---|--|--|
| 22.0 | 068 069 | Non-USA vehicles only. <i>Continue to next test step.</i> | | | | |
| 22.1 | | Non-USA vehicles only. <i>Continue to next test step.</i> | | | | |
| 23.0 | 077 078 | Non-USA vehicles only. <i>Continue to next test step.</i> | | | | |
| 23.1 | | Non-USA vehicles only. <i>Continue to next test step.</i> | | | | |
| 24.0 | 072 073 | Vehicle speed signal (VSS) ABS control module | <p>N3/4</p>  <p>32 — (1.32) — 8 (1.8)</p> | Raise rear of vehicle. Ignition: ON Turn one rear wheel by hand. | >3 V | Wire from ABS control module to engine control module (N3/4), Rear axle VSS sensor (L6) (Test, see SMS, Brakes - ABS). |
| 25.0 | 086 087 | Purge control valve (Y58/1) Control signal | <p>N3/4</p>  <p>43 — (1.43) — 39 (1.39)</p> | Engine: at Idle and at operating temperature. | After approx. 1 min, purge control valve (Y58/1, Figure 5) must cycle noticeably (signal, see Figure 4). | ⇒ 25.1, ⇒ 26.0, N3/4. |


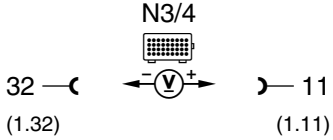
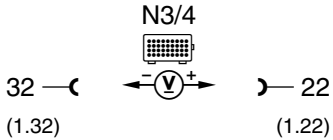
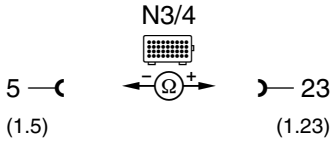
Electrical Test Program – Sequential Multiport Fuel Injection System Test

| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|------|---|--|--|---|---------------------------------------|--|
| 25.1 | 086 087 | Current draw |  | Ignition: ON | 0.2 – 0.3 A | Fuse, Wiring, Y58/1. |
| 26.0 | | Purge control valve (Y58/1) Vacuum control | | Note to test connection: Connect vacuum tester to Y58/1 (Figure 5), connection (A). Engine: at Idle and at operating temperature. | After approx. 1 minute, > 400 mbar | Vacuum lines, Y58/1. |
| 27.0 | 089 090 | Adjustable camshaft timing solenoid (Y49) Current draw |  | Note to test connection: Connect test cable (102 589 04 63 00) to solenoid. Engine: at Idle and accelerate engine briefly. | 1 – 1.5 A, | ⇒ 28.0, Engine control module (N3/4). |
| 27.1 | | Non-USA vehicles only. Continue to next step. | | | | |

Electrical Test Program – Sequential Multiport Fuel Injection System Test




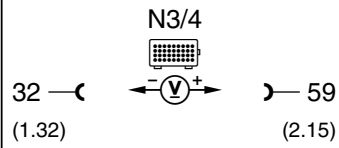
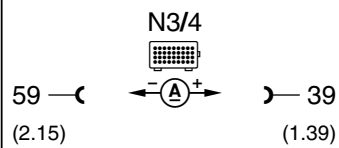

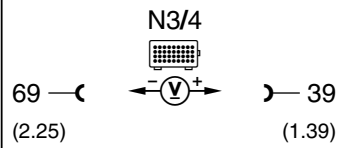
| ⇒ | | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|------|--|--|--|--|---------------------------------|--|
| 27.2 | | Non-USA vehicles only. Continue to next step. | | | | |
| 27.3 | | Non-USA vehicles only. Continue to next step. | | | | |
| 28.0 | | Adjustable camshaft timing solenoid Mechanical operation | <p>N3/4 </p> <p>45 (2.1) ← → 66 (2.22)</p> | Engine: at Idle Bridge socket box sockets for maximum of 10 seconds. | Engine runs unevenly or stalls. | Mechanical camshaft adjustment (see SMS, Engine 111, Job No. 05–2160). |
| 29.0 | | Upshift delay switchover valve (Y3/3) Current draw | <p>N3/4 </p> <p>42 (1.42) ← → 39 (1.39)</p> | Ignition: ON | 0.4 – 0.6 A | Wiring, Y3/3, ⇒ 30.0. |
| 30.0 | | Pneumatic upshift delay Vacuum control and sealing | <p>N3/4 </p> <p>42 (1.42) ← → 39 (1.39)</p> | Note to test connection: Connect vacuum tester to upshift delay switchover valve (Y3/3) according to Figure 6. Engine: at Idle | > 400 mbar | Vacuum lines, Y3/3. |

Electrical Test Program – Sequential Multiport Fuel Injection System Test


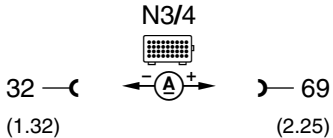
| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|------|---|---|---|---|-----------------------|---|
| 31.0 | | A/C compressor engagement signal |  | Engine: at Idle A/C system: ON | 11 – 14 V | Wiring, A/C pushbutton control module (N22). |
| 32.0 | | Cruise control ON recognition |  | Test condition ⁵⁾ Cruise control switch: Accelerate OFF or apply brake pedal | 11 – 14 V <1 V | Wiring, Cruise control switch (S40). |
| 33.0 | | Non-USA vehicles only. Continue to next test step. | | | | |
| 34.0 | | Non-USA vehicles only. Continue to next test step. | | | | |
| 35.0 | | Transmission range 2/3 recognition |  | Ignition: OFF Unplug connector 1 on engine control module (N3/4). Transmission range: D→ 2 – 3→ | >20 kΩ <1 Ω | Wiring, Starter lock-out/backup lamp switch (S16/1). |

⁵⁾ Drive vehicle above 25 mph (40 km/h) on dynamometer.




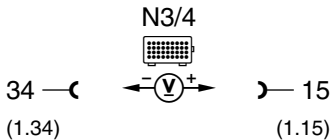
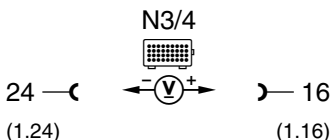
Electrical Test Program – Sequential Multiport Fuel Injection System Test

| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|------|---|--|---|---|--|-----------------------------------|
| 36.0 |  | Non-USA vehicles only. Continue to next test step. | | | | |
| 37.0 | | Non-USA vehicles only. Continue to next test step. | | | | |
| 37.1 | | Non-USA vehicles only. Continue to next test step. | | | | |
| 38.0 |  | AIR pump switchover valve (Y32) and/or AIR relay module (K17) |  | Disconnect ECT sensor (B11/3) and simulate 2.5 kΩ at sockets 1 and 2 with resistance substitution unit, Engine: at Idle | 11 - 14 V for approx. 2 minutes and AIR pump runs. | N3/4. |
| 38.1 | | Current draw |  | Ignition: ON | 0.4 – 0.7 A | Wires, Y32, K17. |
| 39.0 |  | EGR switchover valve (Y27) Vacuum control |  | Engine: at Idle Engine coolant temperature > 60 °C Briefly apply full throttle. | 11 – 14V | ⇒ 39.1, N3/4, ⇒ 40.0 – 41.0 |


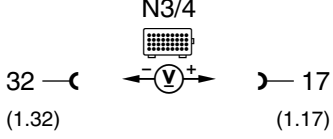
Electrical Test Program – Sequential Multiport Fuel Injection System Test

| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|------|---|---|---|---|--|-------------------------------------|
| 39.1 | | Current draw |  | Ignition: ON | 0.3-0.5 A | Fuse, Wiring, Y27. |
| 40.0 | | EGR switchover valve (Y27) Vacuum control | | Note to test connection: Connect vacuum tester to the EGR valve (Figure 7). Engine control module (N3/4) plugged in. Engine: Start and run at > 3000 rpm. | > 400 mbar | Vacuum lines, EGR valve, Y27. |
| 41.0 | | EGR valve Mechanical test | | Note to test connection: Connect vacuum tester to the EGR valve (Figure 11). Engine: at Idle Apply 500 mbar vacuum with vacuum tester. Engine: OFF Apply 500 mbar vacuum with vacuum tester and pull off vacuum line. | Engine runs unevenly EGR valve closes audibly | EGR valve. |

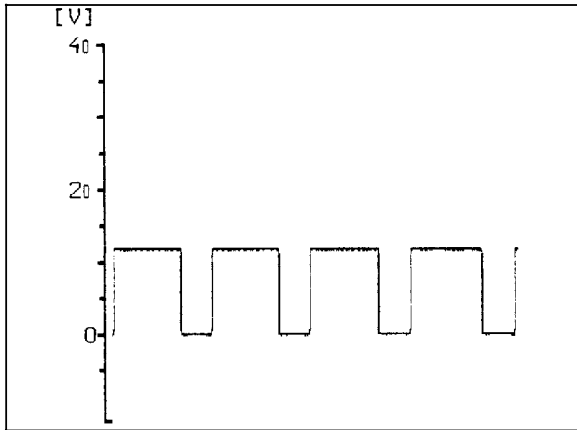
Electrical Test Program – Sequential Multiport Fuel Injection System Test

| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|------|---|---|---|---|--|-----------------------|
| 43.0 |  | CAN element in engine control module (N3/4) Resistance |  | Ignition: OFF Unplug connector 1 on N3/4 and measure resistance directly at engine control module (Figure 12) | 55 – 65 Ω | N3/4. |
| 44.0 | | O2S 1 (before TWC) (G3/2) O2S signal for Diagnostic Module (OBD II) (N59/1) |  | Engine: at Idle and at operating temperature > 80 °C. Allow engine to run for a minimum of 2 minutes. | Oscillates in range between -0.2 and +1.0 V by more than 0.3 V | Wiring, N3/4. |
| 45.0 | | O2S 2 (after TWC) (G3/1) O2S signal for Diagnostic Module (OBD II) (N59/1) |  | At operating temperature > 80 °C start engine and run at 2000 – 3000 rpm for a minimum of 3 minutes. Accelerate briefly. | 450 mV constant. Voltage fluctuates. Voltage fluctuates by >100 mV | Wiring, N3/4. |

Electrical Test Program – Sequential Multiport Fuel Injection Test

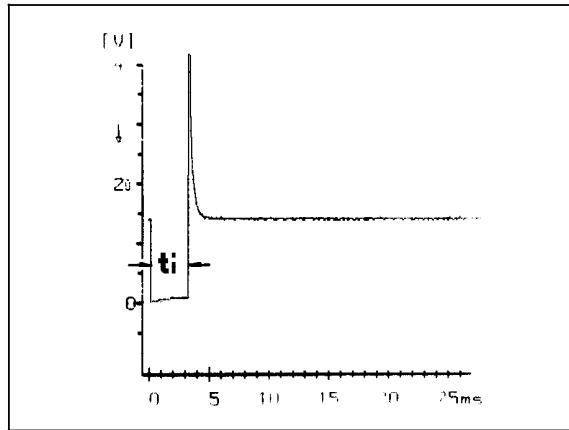
| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|------|---|---|---|------------------------|---------------|-----------------------|
| 46.0 | | CMP sensor (L5/1) Signal for Diagnostic Module (OBD II) (N59/1) | <p style="text-align: center;">N3/4</p>  | Engine: at Idle | 9.5 – 10.5 V | Wiring, N3/4. |
| 47.0 | 118 | Non-USA vehicles only. Continue to next test step. | | | | |
| 48.0 | 119 | Non-USA vehicles only. Continue to next test step. | | | | |
| 48.1 | 123 124 | Non-USA vehicles only. Continue to next test step. | | | | |
| 49.0 | 123 124 | Non-USA vehicles only. Continue to next test step. | | | | |
| 50.0 | | Non-USA vehicles only. Continue to next test step. | | | | |
| 51.0 | 153 154 | Non-USA vehicles only. Continue to next test step. | | | | |

Electrical Test Program – Sequential Multiport Fuel Injection System Test



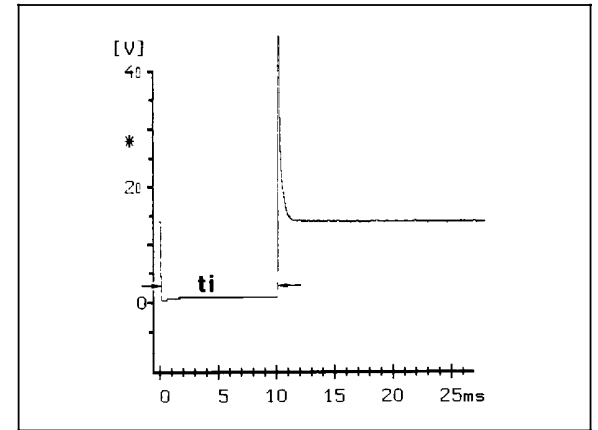
P15-0370-13

Figure 1
TN signal (engine rpm)



P07-0699-13

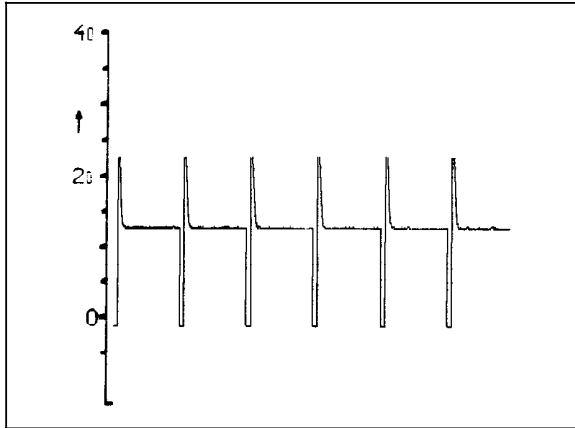
Figure 2
Injection time signal "ti" of injectors at idle speed



P07-0700-13

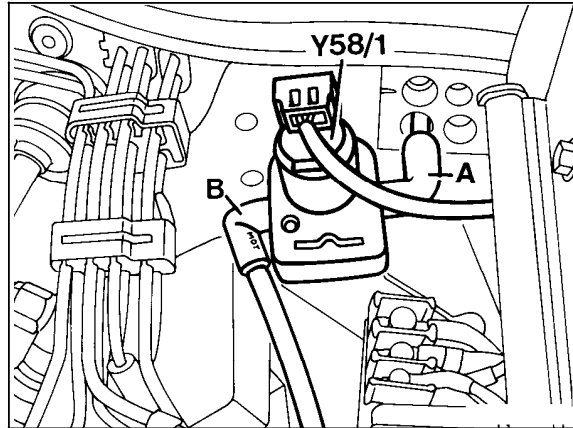
Figure 3
Injection time signal "ti" of injectors when briefly accelerating

Electrical Test Program – Sequential Multiport Fuel Injection System Test



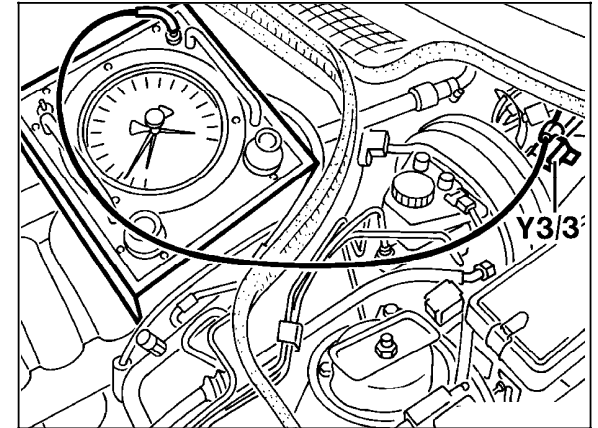
P07-5330-13

Figure 4
Purge control valve signal



P07-5455-13

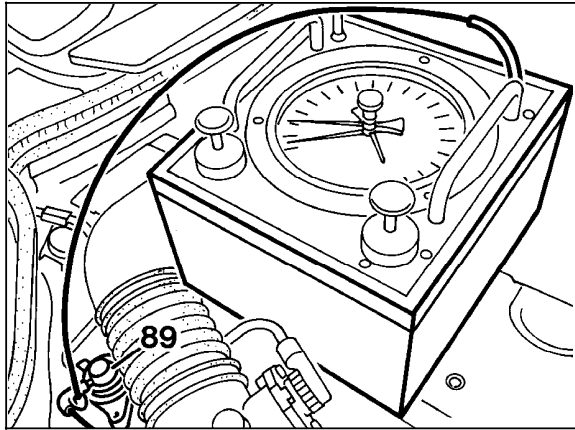
Figure 5
Y58/1 Purge control valve
A Line to charcoal canister
B Line to engine



P07-5735-13

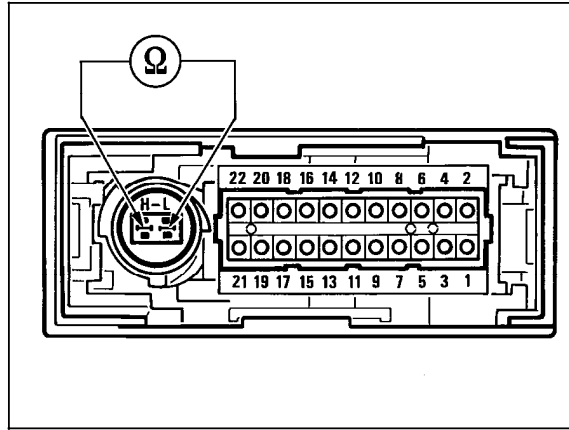
Figure 6
Y3/3 Upshift delay switchover valve

Electrical Test Program – Sequential Multiport Fuel Injection System Test



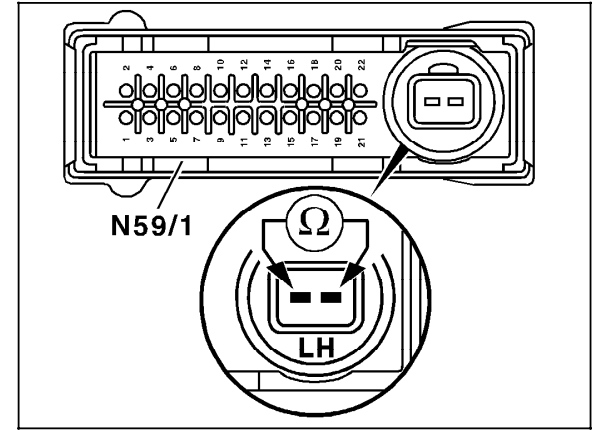
P07-5733-13

Figure 7
89 EGR valve



P07-5787-13

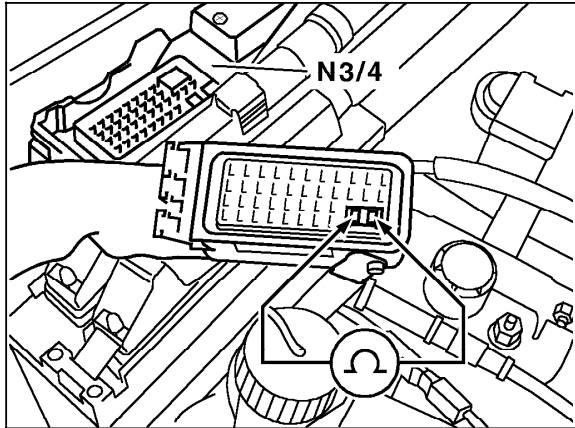
Figure 8
Serial data bus (CAN)



P07.51-0554-01

Figure 9
Serial data bus (CAN)
N59/1 Diagnostic Module (OBD II)

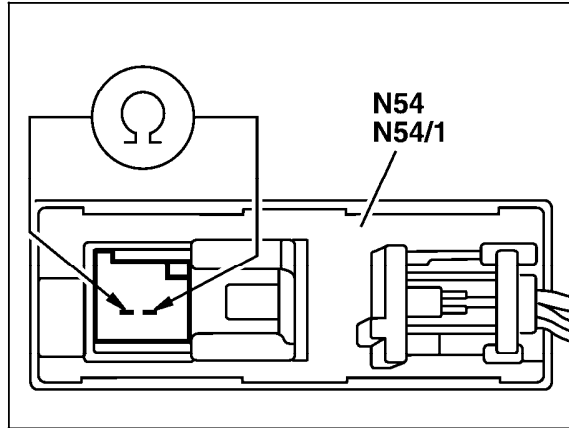
Electrical Test Program – Sequential Multiport Fuel Injection System Test



P07.51-0555-01

Figure 10

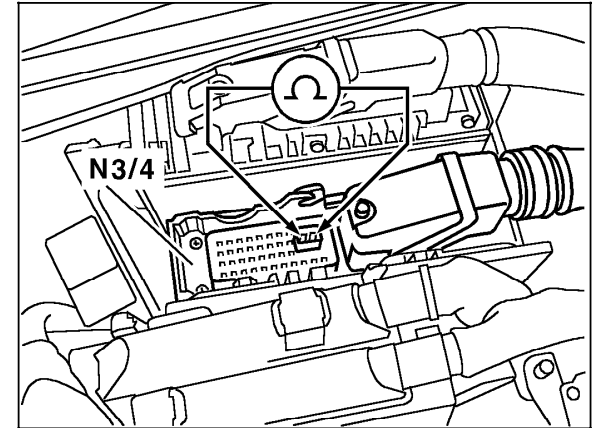
N3/4 Engine control module (HFM-SFI)



P07.51-0426-13

Figure 11

N54 RCL control module



P07.51-0556-01

Figure 12

N3/4 Engine control module (HFM-SFI)

Electrical Test Program – Sequential Multiport Fuel Injection System Test

Function diagram, purge system monitoring/pressure switchover

- 3 Intake manifold
- 75 Fuel tank
- 76 Vent valve
- 77 Charcoal canister
- B5/2 Diagnostic pressure sensor
- N3/4 Engine control module
- N59/1 Diagnostic module (OBDII)
- Y27/6 Purge-flow switchover valve
- Y58/1 Purge switchover valve
- a Barometric pressure

With voltage applied to the purge-flow switchover valve (Y27/6), the diagnostic pressure sensor is connected to the purge switchover valve (Y58/1).

With no voltage applied to the purge-flow switchover valve (Y27/6), the diagnostic pressure sensor is connected to the intake manifold (3).

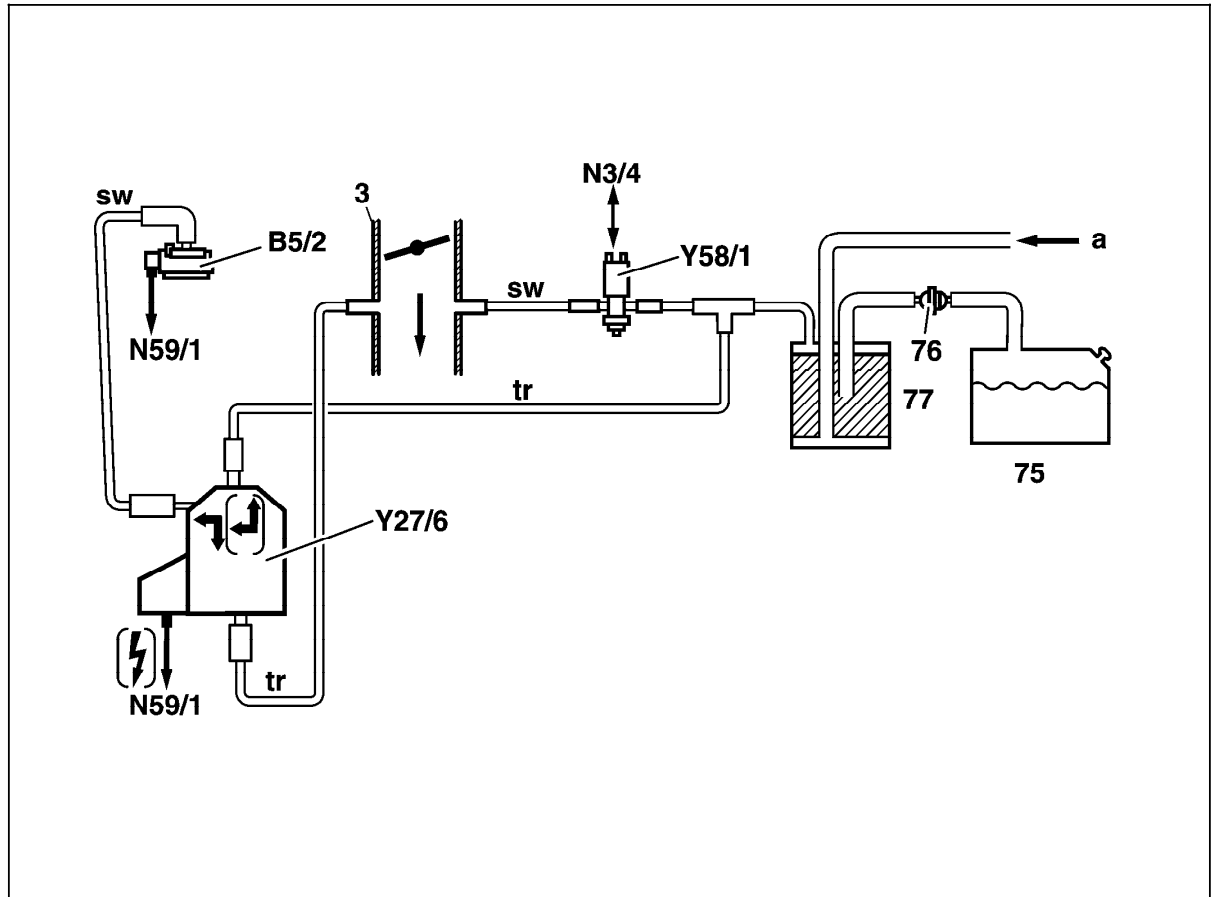


Figure 13

P47.30-2021-05

Electrical Test Program – Sequential Multiport Fuel Injection System Test

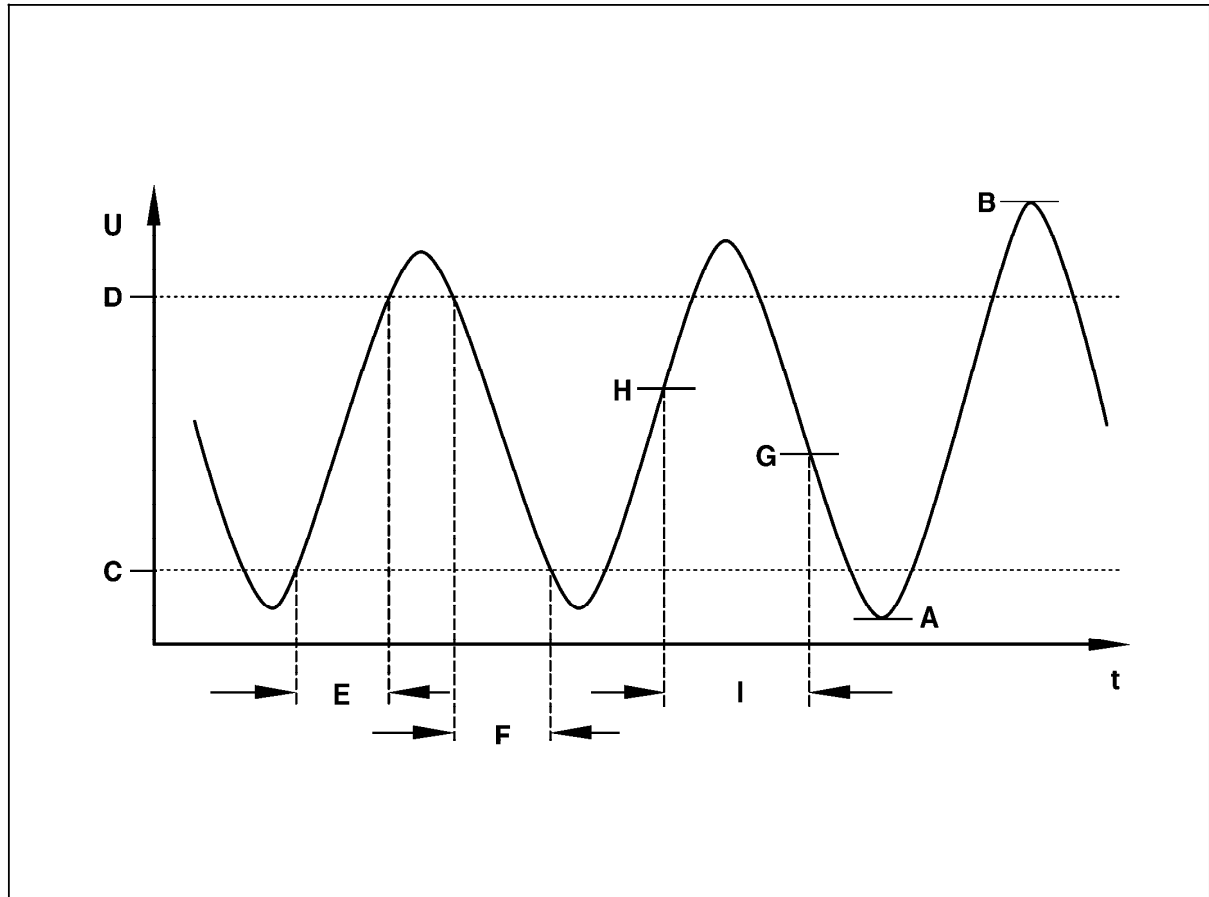
O2S signal

- A minimum sensor voltage
- B maximum sensor voltage
- C lower limit for time measurement (E,F)
- D upper limit for time measurement (E,F)
- E time from lean to rich
- F time from rich to lean
- G predetermined threshold for lean range (≤ 425 mV)
- H predetermined threshold for rich range (≥ 425 mV)
- I total time of one regulating period
- U = voltage
- t = time

At an engine speed of approximately 2500 rpm following conditions must be met:

- A greater than approximately 100 mV
- B smaller than approximately 1280 mV
- C greater than 200 mV
- D smaller than 700 mV
- E smaller than approximately 20 ms
- F smaller than approximately 20 ms
- G smaller than 425 mV
- H greater than 475 mV
- I smaller than approximately 700 ms


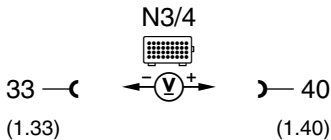
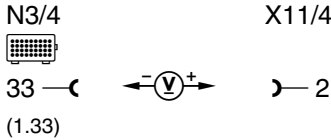
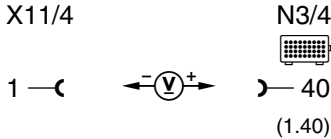
Test O2S (G3/1, G3/2) using an oscilloscope. Connect at test connector (X11/22) on diagnostic module.



P07.51-2050-05

Figure 14


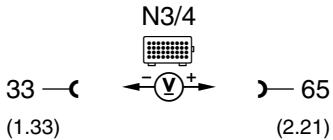
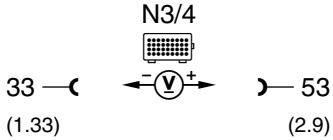
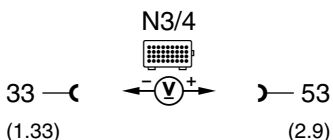
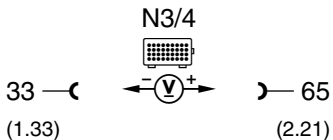
Electrical Test Program – Ignition System Test

| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|-----|---|---|---|----------------------|---------------|---|
| 1.0 | | Engine control module (N3/4) Voltage supply, circuit 30 |  | Ignition: ON | 11 – 14 V | ⇒ 1.1 |
| 1.1 | | Ground wire |  | Ignition: ON | 11 – 14 V | Wiring, Ground, component compartment - right (W16/4), ⇒ 1.2 |
| 1.2 | | Voltage supply, circuit 30 |  | Ignition: OFF | 11 – 14 V | Wire to terminal block X4/22, |

Electrical Test Program – Ignition System Test

| ⇒ | | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|-----|--|--|---|---------------------|---------------|---|
| 2.0 | | Engine control module (N3/4) Voltage supply, circuit 87U | <p>32 — (1.32) N3/4 — 39 (1.39)</p> | Ignition: ON | 11 – 14 V | ⇒ 2.1 |
| 2.1 | | Electronics ground | <p>32 — (1.32) N3/4 — 2</p> | Ignition: ON | 11 – 14 V | Wiring, Electronics ground, component compartment - right (W16/6), ⇒ 2.2 |
| 2.2 | | Voltage supply, circuit 87 | <p>1 — (1.39) X11/4 — 39 (1.39)</p> | Ignition: ON | 11 – 14 V | Wiring, Overvoltage protection relay module (K1/2), Ignition/starter switch (S2/1). |

Electrical Test Program – Ignition System Test

| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|-----|---|--|--|--|------------------------|--|
| 4.0 | 055 056 057 | Ignition coil (T1/1) Voltage supply Up to end of M.Y. 1995 As of M.Y. 1996 |   | Ignition: ON Starter: Crank | 11 – 14 V > 6 V | Wire to T1/1, Ignition coil T1/1, Engine control module (N3/4). Fuse, Ignition coil T1/1, Engine control module (N3/4). |
| 5.0 | 058 059 060 | Ignition coil (T1/2) Voltage supply Up to end of M.Y. 1995 As of M.Y. 1996 |   | Ignition: ON Starter: Crank | 11 – 14 V > 6 V | Wire to T1/2, Ignition coil T1/2, Engine control module (N3/4). Fuse, Ignition coil T1/2, Engine control module (N3/4). |

Electrical Test Program – Ignition System Test

| ⇒ | | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|-----|-------------------|---|---|---|---|--|
| 6.0 | 064 065 066 | CKP sensor (L5) and magnet for CKP sensor on flexplate segment | <p>N3/4 ²⁾</p> <p>73 —((2.29) —) 74 (2.30)</p> <p>N3/4 ³⁾</p> <p>73 —((2.29) —) 74 (2.30)</p> | <p>Starter: Crank</p> <p>Starter: Crank</p> <p>Engine: at Idle</p> | <p>Signal, see Figure 1</p> <p>> 0.4 V</p> <p>> 1 V ⁴⁾</p> | <p>⇒ 6.1, Segments (magnets) on starter ring gear.</p> |
| 6.1 | | Resistance of L5 | <p>N3/4</p> <p>73 —((2.29) —) 74 (2.30)</p> | <p>Ignition: OFF</p> <p>Unplug connector 2 on engine control module (N3/4).</p> | 700 – 1400 Ω | <p>Wiring, ⇒ 6.2</p> |
| 6.2 | | Insulation of L5 | <p>N3/4</p> <p>32 —((1.32) —) 74 (2.30)</p> | <p>Ignition: OFF</p> <p>Unplug connector 2 on engine control module (N3/4).</p> | > 20 kΩ | L5. |

2) Test with oscilloscope.

3) Test with multimeter only if oscilloscope is unavailable.

4) Voltage increases with increasing rpm.

Electrical Test Program – Ignition System Test


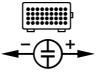
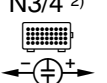
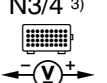
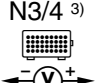
| ⇒ | | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|-----|--|--------------------------|---|---|--|---|
| 7.0 | | CMP sensor (L5/1) | <p>N3/4 ²⁾</p> <p>63 — (2.19) 52 (2.8)</p> <p>N3/4 ³⁾</p> <p>63 — (2.19) 52 (2.8)</p> | <p>Engine: at Idle</p> <p>Engine: at Idle</p> | <p>Signal, see Figure 3.</p> <p>> 0.2 V ⁴⁾</p> | <p>⇒ 7.1, Check distance between sensor (L5/1) and pickup (Refer to SMS, Engine 111, Engine Combustion, Job No. 15-2143).</p> |
| 7.1 | | Resistance of L5/1 | <p>N3/4</p> <p>63 — (2.19) 52 (2.8)</p> | <p>Ignition: OFF Unplug connector 2 on engine control module (N3/4).</p> | 900 – 1600 Ω | Wiring, ⇒ 7.2 |
| 7.2 | | Insulation of L5/1 | <p>N3/4</p> <p>32 — (1.32) 52 (2.8)</p> | <p>Ignition: OFF Unplug connector 2 on engine control module (N3/4).</p> | > 20 kΩ | L5/1. |

2) Test with oscilloscope.

3) Test with multimeter only if oscilloscope is unavailable.

4) Voltage increases with increasing rpm.





Electrical Test Program – Ignition System Test

| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|-----|---|---|---|--|------------------------------------|---|
| 8.0 | 067 | Non-U.S.A vehicles only. Continue to next step | | | | |
| 8.1 | | Non-U.S.A vehicles only. Continue to next step | | | | |
| 9.0 | 055 056 057 | Closure duration for ignition coil (T1/1) Up to end of M.Y. 1995 As of M.Y. 1996 | <p>N3/4 ²⁾</p>  <p>65 — (2.21) 39 — (1.39)</p> <p>N3/4 ²⁾</p>  <p>53 — (2.9) 39 — (1.39)</p> | <p>Starter: Crank</p> <p>Engine: at Idle</p> | <p>20 - 100 ms</p> <p>4 – 6 ms</p> | <p>⇒ 6.0, Engine control module (N3/4).</p> |
| 9.1 | | Testing with multimeter: T1/1 Up to end of M.Y. 1995 | <p>N3/4 ³⁾</p>  <p>65 — (2.21) 39 — (1.39)</p> <p>N3/4 ³⁾</p>  <p>53 — (2.9) 39 — (1.39)</p> | <p>Ignition: ON</p> <p>Starter: Crank</p> | <p>0 V</p> <p>0.3 – 0.5 V</p> | <p>T1/1, < 0.3 V: Open circuit in wire from T1/1 to N3/4, > 0.5 V: T1/1.</p> |

²⁾ Test with oscilloscope.

³⁾ Test with multimeter only if oscilloscope is unavailable.




Electrical Test Program – Ignition System Test

| ⇒ | | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|------|-------------------|--|--|--|------------------------------------|--|
| 10.0 | 058 059 060 | <p>Closure duration for ignition coil (T1/2)</p> <p>Up to end of M.Y. 1995</p> <p>As of M.Y. 1996</p> | <p>N3/4</p>  <p>53 — 39 (2.9) (1.39)</p> <p>N3/4</p>  <p>65 — 39 (2.21) (1.39)</p> | <p>Starter: Crank</p> <p>Engine: at Idle</p> | <p>20 - 100 ms</p> <p>4 - 6 ms</p> | <p>⇒ 6.0, Engine control module (N3/4).</p> |
| 10.1 | | <p>Testing with multimeter: T1/2</p> <p>Up to end of M.Y. 1995</p> <p>As of M.Y. 1996</p> | <p>N3/4</p>  <p>53 — 39 (2.9) (1.39)</p> <p>N3/4</p>  <p>65 — 39 (2.21) (1.39)</p> | <p>Ignition: ON</p> <p>Starter: Crank</p> | <p>0 V</p> <p>0.3 - 0.5 V</p> | <p>T1/2, < 0.3 V: Open circuit in wire from T1/2 to N3/4, > 0.5 V: T1/2.</p> |

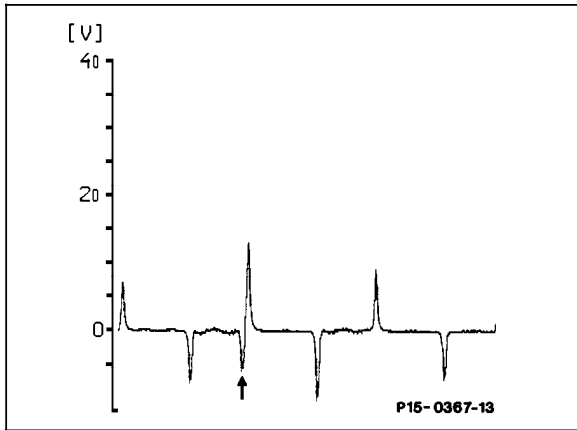
Electrical Test Program – Ignition System Test

| ⇒ | | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|------|-------------------|--|-----------------|---|---------------|---|
| 12.0 | 058 059 060 | Primary voltage of ignition coil (T1/2) for cylinder no. 2 and 3 Up to end of M.Y. 1995 As of M.Y. 1996 | | Note to Test connection: Primary pattern, measurement range 400 V, duration 100%, voltage signal pick-up connected to T1/2. Starter: Crank | 200 – 350 V | ⇒ 11.1, Engine control module (N3/4). |
| 13.0 | 055 056 057 | Firing voltage of ignition coil (T1/1) for cylinder no. 1 and 4 | | Note to Test connection: Secondary pattern, measurement range 20 kV, duration 100%, voltage signal pick-up connected to ignition coil (T1/1). Starter: Crank | 8 – 30 kV | ⇒ 13.1, Spark plug cables, Spark plug connector, Spark plugs, N3/4. |
| 13.1 | | Secondary winding of T1/1 | | Unplug both ignition cables on T1/1. | 5.2 – 8.5 kΩ | T1/1. |

Electrical Test Program – Ignition System Test

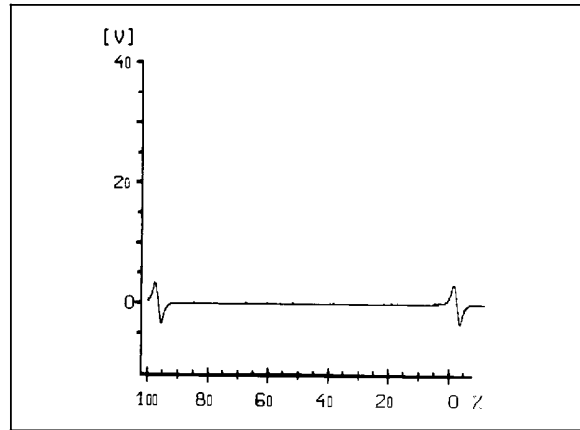
| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|------|---|--|---|---|---------------|---|
| 14.0 | 058 059 060 | Firing voltage of ignition coil (T1/2) for cylinder no. 2 and 3 | Engine analyzer  | Note to Test connection: Secondary pattern, measurement range 20 kV, duration 100%, voltage signal pick-up connected to ignition coil (T1/2). Starter: Crank | 8 – 30 kV | ⇒ 14.1, Spark plug cables, Spark plug connector, Spark plugs, Engine control module (N3/4). |
| 14.1 | | Secondary winding of T1/2 | ter. 4a  ter. 4b | Unplug both ignition cables on T1/2. | 5.2 – 8.5 kΩ | T1/2. |

Electrical Test Program – Ignition System Test



P15-0367-13


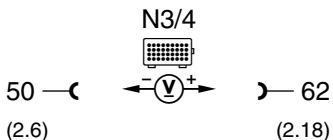
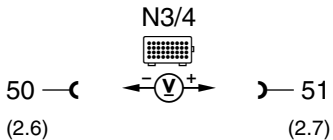
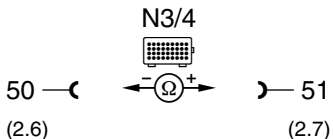
Figure 1
CKP sensor (L5) signal




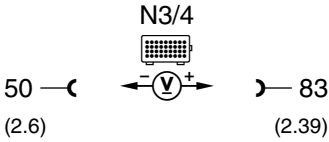
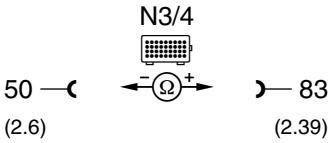
P15-5093-13

Figure 2
CMP sensor (L5/1) signal


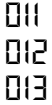

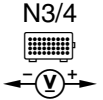
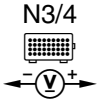
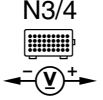
Electrical Test Program – Idle Speed Control (ISC) Test

| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|-----|---|---|--|---|---------------|---|
| 1.0 | 017 018 019 135 | ISC actuator (M16/6) Voltage supply |  | Ignition: ON | 4.7 - 5.3 V | Wiring, M16/6, Engine control module (N3/4), ⇒ 2.0 |
| 2.0 | 017 018 019 130 136 | Drive actual value potentiometer (M16/6r2) |  | Engine: at Idle | 3.0 - 4.2 V | ⇒ 2.1, N3/4. |
| 2.1 | | Resistance (M16/6r2) |  | Ignition: OFF Unplug connector 2 from engine control module (N3/4). | 0.5 - 1.6 kΩ | Wiring, M16/6 |


Electrical Test Program – Idle Speed Control (ISC) Test

| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|-----|---|--|---|--|--|---|
| 3.0 | 014 015 016 | Throttle valve actual value potentiometer (M16/6r1) |  | Ignition: ON CTP (idle) WOT (full throttle) | Voltage changes continuously up to wide open throttle position >4 V <1 V | ⇒ 3.1, Engine control module (N3/4). |
| 3.1 | | Resistance (M16/6r1) |  | Ignition: OFF Unplug connector 2 from engine control module (N3/4). CTP (idle) WOT (full throttle) | 1.0 - 3.0 kΩ 0.5 - 2.2 kΩ | Wiring, ISC actuator (M16/6). |

Electrical Test Program – Idle Speed Control (ISC) Test

| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|-----|---|--|---|---|--|--|
| 4.0 |  | CTP switch (M16/6s1) | <p>N3/4</p>  <p>66 — 66 (2.22) 78 — 78 (2.34)</p> | Ignition: ON CTP (idle) Accelerator pedal depressed | <3 V >10 V | Wiring, M16/6s1, ⇒ 5.0 Engine control module (N3/4) |
| 5.0 | | Actuator motor (M16/6m1) Control signal | <p>N3/4</p>  <p>48 — 48 (2.4) 70 — 70 (2.26)</p> | Engine: at Idle | Voltage changes continuously between 1.2 - 3.2 V | Wiring, Engine control module (N3/4), M16/6m1 |
| 6.0 | | Starter lock-out/backup lamp switch (S16/1) Recognition of park/neutral (P/N) position | <p>N3/4</p>  <p>20 — 20 (1.20) 39 — 39 (1.39)</p> | Ignition: ON Selector lever position P/N → R, D, 3, 2 → | 11 - 14 V <1 V | Wiring, S16/1. |
| 7.0 | | A/C compressor engagement signal Voltage | <p>N3/4</p>  <p>32 — 32 (1.32) 11 — 11 (1.11)</p> | Engine: at Idle A/C system: ON | <1 V 9 - 14 V | Wiring, A/C pushbutton control module (N22). |

Electrical Test Program – Idle Speed Control (ISC) Test

| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy |
|------|---|---|-----------------|----------------|---------------|-----------------------|
| 8.0 | 139 | Non-USA vehicles only. Continue to next test step. | | | | |
| 8.1 | 163 164 | Non-USA vehicles only. Continue to next test step. | | | | |
| 9.0 | 120 121 | Non-USA vehicles only. Continue to next test step. | | | | |
| 10.0 | | Non-USA vehicles only. Continue to next test step. | | | | |
| 11.0 | 143 | Non-USA vehicles only. Continue to next test step. | | | | |

Electrical Test Program – Idle Speed Control (ISC) Test

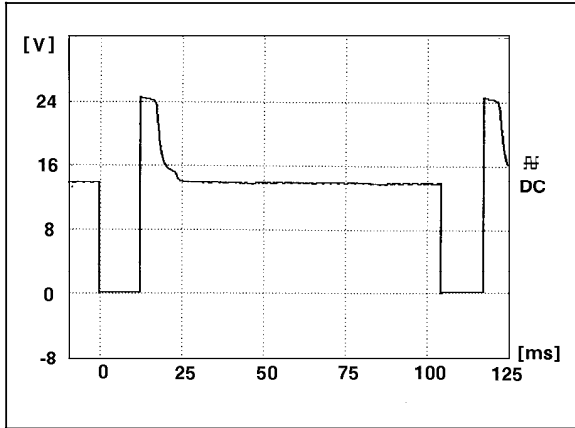


Figure 1
Actuator motor control signal without consumers

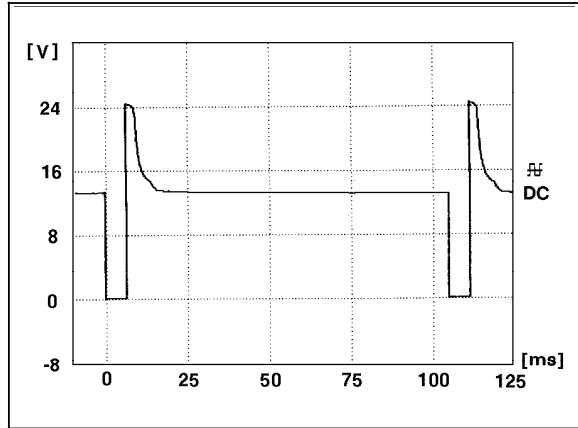


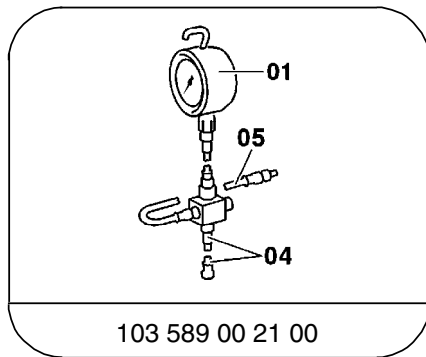
Figure 2
Actuator motor control signal with consumers

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

Preparation for Test

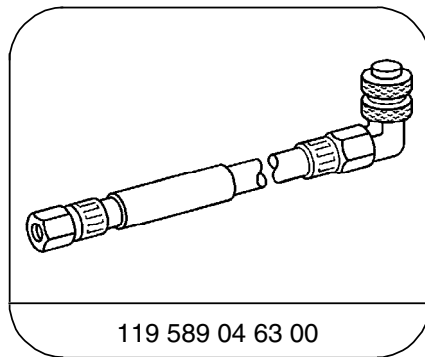
- Connect pressure gauge to test connection.
- After completing test, using measurement glass (055), release fuel pressure and allow residual fuel to drain into glass (see Figure 1).

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 - Pressure Gauge/
Pressure Hose

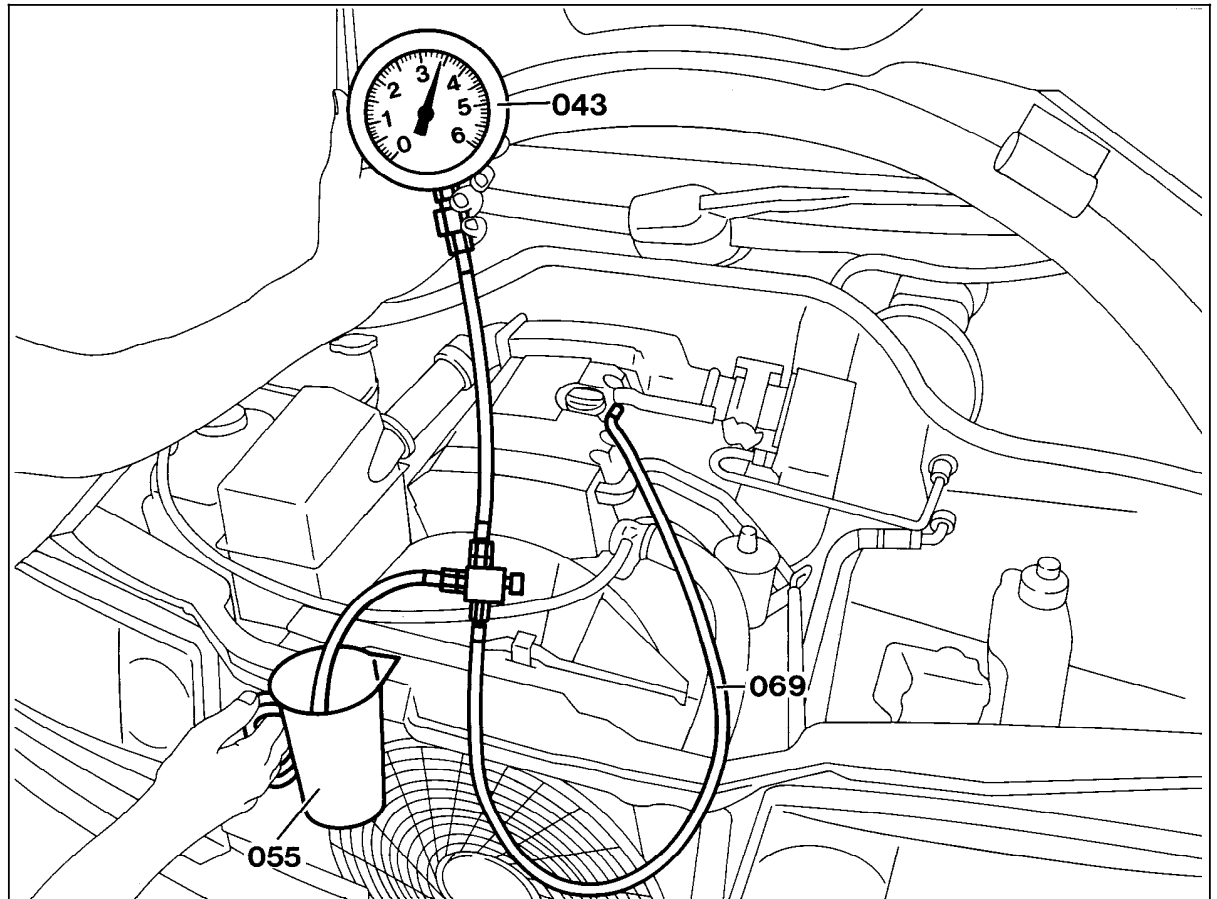


Figure 1

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

P07-5793-57

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

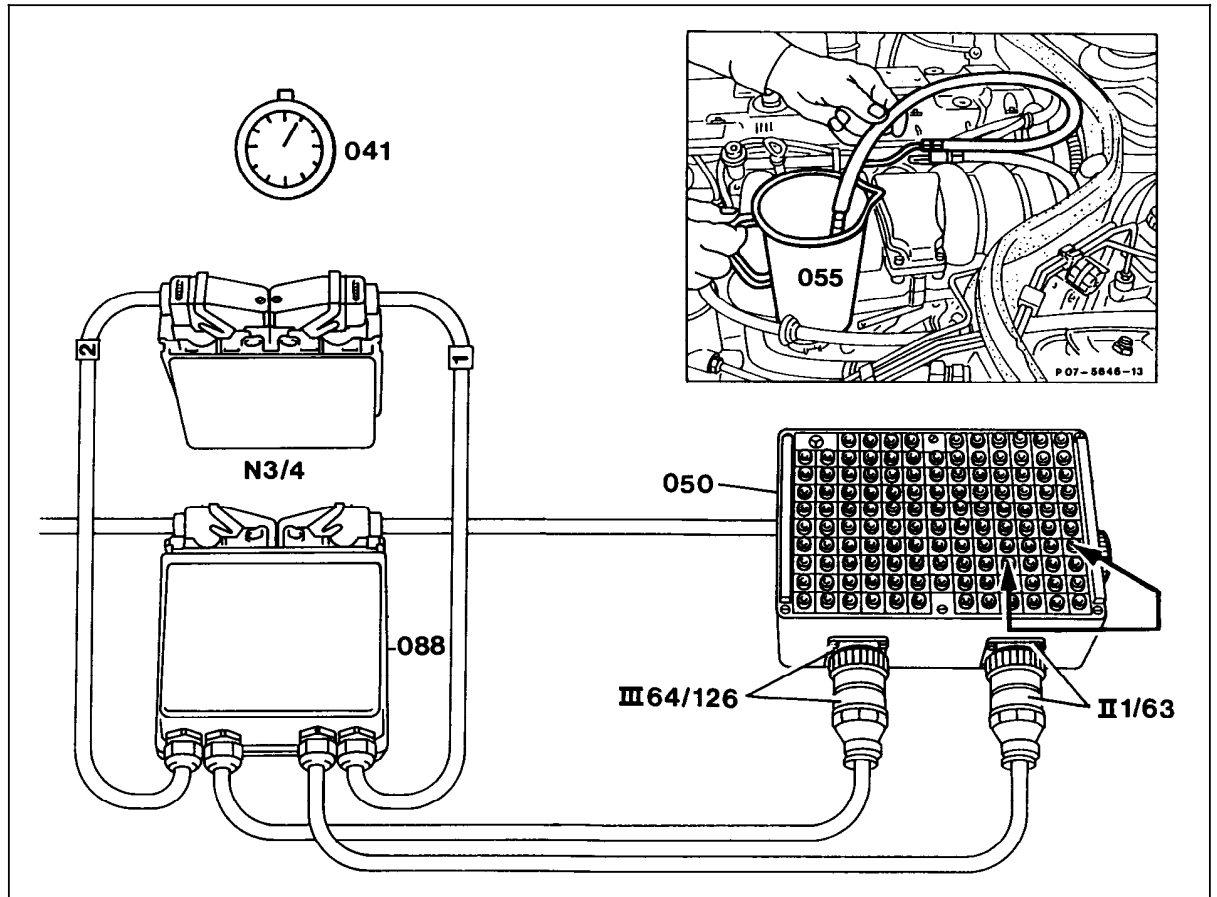
| Test step DTC | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy ¹⁾ |
|------------------|---|--|---|----------------------------|--|
| ⇒ 1.0 | Fuel pressure at idle (with vacuum) | Pressure gauge connected to test connection. | Engine: at Idle Valve on pressure gauge closed. | 3.2 – 3.6 bar | Check fuel pumps 33, Replace diaphragm pressure regulator. |
| ⇒ 2.0 | Fuel pressure at idle (without vacuum) | Pressure gauge connected to test connection. | Engine: at Idle Disconnect vacuum hose from diaphragm pressure regulator. | 3.7 – 4.2 bar | Replace diaphragm pressure regulator. |
| ⇒ 3.0 | Fuel system leakage | Pressure gauge connected to test connection. | Shut off engine. 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, Replace diaphragm pressure regulator or O-rings on diaphragm pressure regulator. |

¹⁾ Observe Preparation for Test, see 22.

Hydraulic Test Program - Preparation for Test (Fuel Pump Test)

Connection Diagram - Delivery Test

- Connect socket box to engine control module (N3/4).



P07-5707-57

Figure 1

- 003 Multimeter
- 041 Stop watch
- 050 Socket box (126-pole)
- 055 Measuring glass
- 088 Test cable

Hydraulic Test Program - Preparation for Test (Fuel Pump Test)

Connection Diagram - Fuel Pump Pressure Test
(Vehicles with 2 fuel pumps)

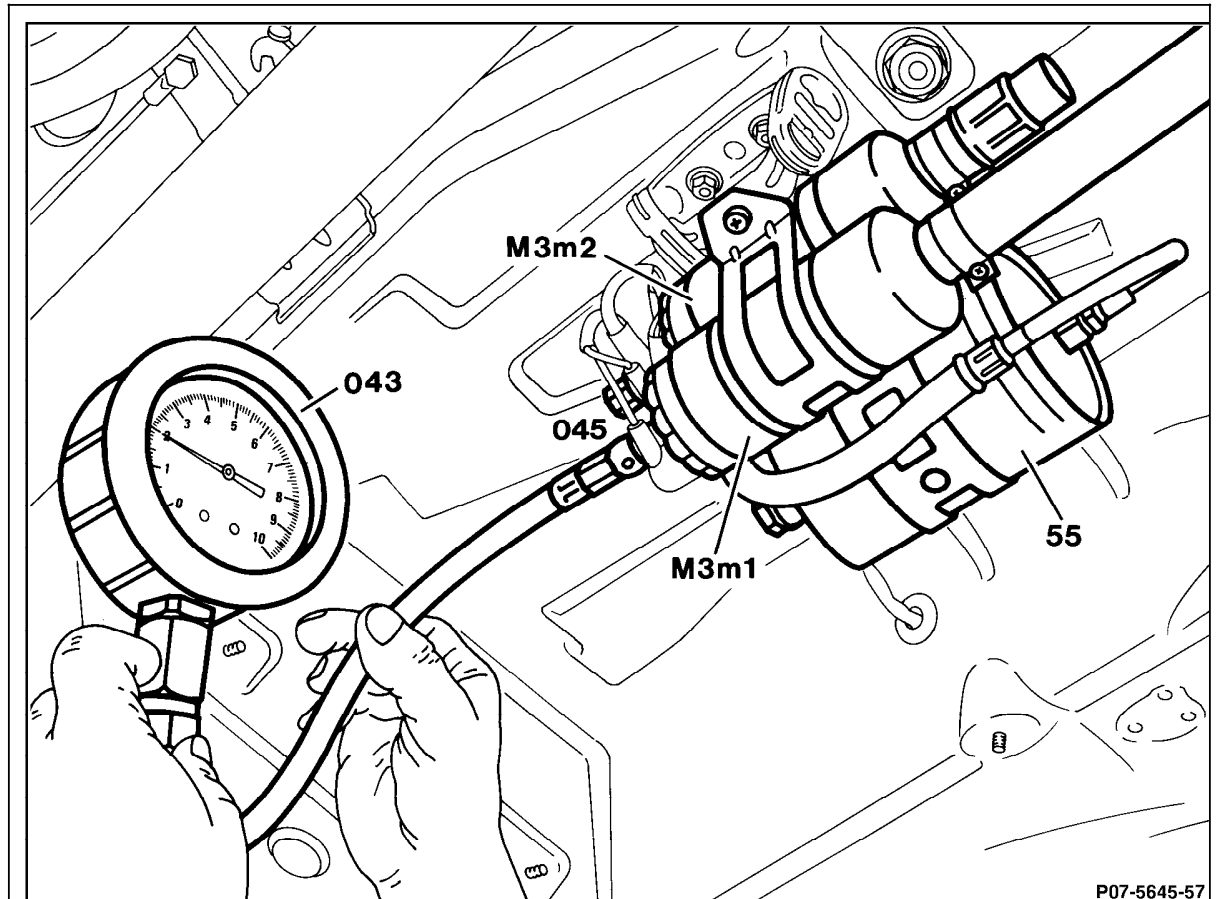


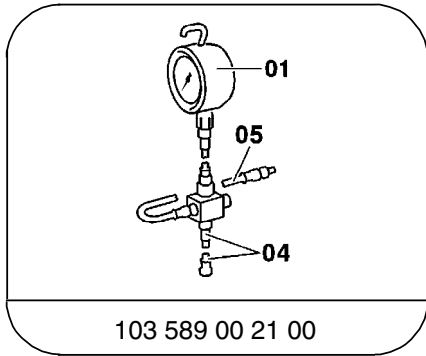
Figure 2

- 043 Pressure gauge, part no. 103 589 00 21 00
- 045 Adaptor, part no. 103 589 02 63 00
- 55 Fuel filter
- M3m1 Fuel pump 1
- M3m2 Fuel pump 2

P07-5645-57
P07-5645-57

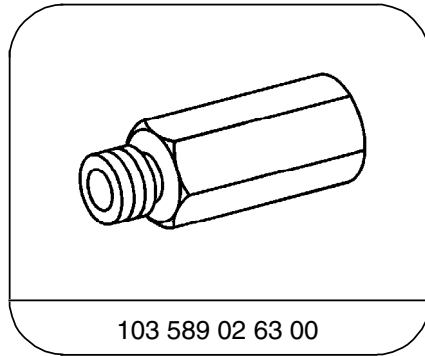
Hydraulic Test Program - Preparation for Test (Fuel Pump Test)

Special Tools



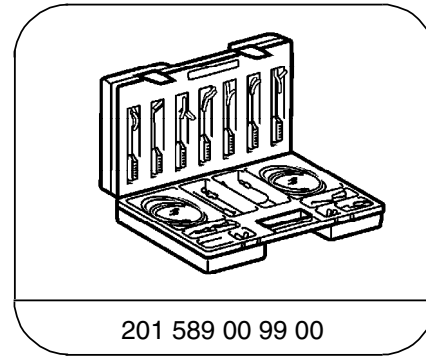
103 589 00 21 00

Tester



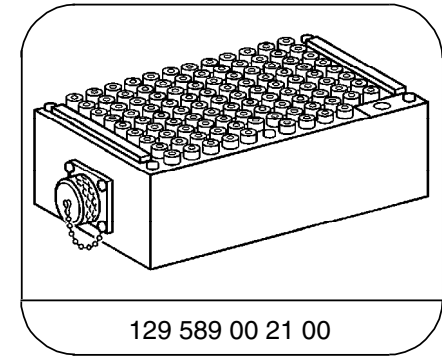
103 589 02 63 00

Adapter



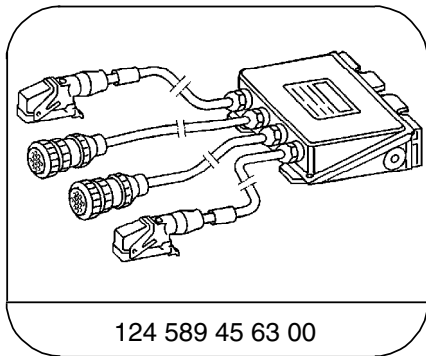
201 589 00 99 00

Electrical connecting set



129 589 00 21 00

126-pin socket box



124 589 45 63 00







82-pin test cable CAN

Equipment

| | |
|-----------------------------------|----------------------------|
| Fuel hose (500 mm, 20 in) | local purchase |
| Measuring glass (1 liter minimum) | local purchase |
| Stop watch | local purchase |
| Multimeter ¹⁾ | Fluke Model 23, 83, 85, 87 |

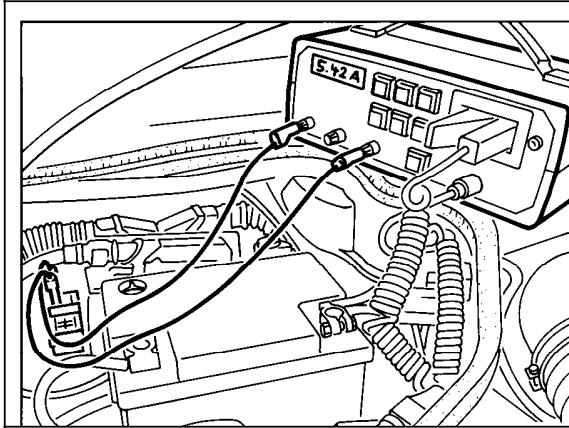
¹⁾ Available through the MBUSA Standard Equipment Program.

Electrical Test Program – Test

| ⇒ |  | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy ¹⁾ |
|-----|---|--|---|---|--------------------------------|--|
| 1.0 | | Fuel pumps Delivery capacity |   29 (1.29) 39 (1.39) | Connect special tool fitting, part no. 000 589 01 91 00, and fuel hose to diaphragm pressure regulator instead of fuel return line. Place other end of fuel hose in measuring glass. Ignition: ON | 1 liter after max. 35 seconds. | Check fuel lines for restrictions (kinks and dents). Replace fuel filter, ⇒ 2.0, ⇒ 3.0. |
| 2.0 | | Fuel pumps Current draw Connected to sockets 1 and 3 (Figure 1). |  | Unplug FP relay module and connect Amperemeter to socket 1 and 3. Ignition: ON | 5 – 9 A | Fuel pump 1 or 2. Note: If current draw > 12 A, also replace FP relay module. |
| 3.0 | | Fuel pressure after fuel pump 1 Only on vehicles with 2 fuel pumps |   29 (1.29) 39 (1.39) | Unscrew cap on fuel pump 1 (M3m1). Connect adaptor (045) and pressure gauge (043). Ignition: ON Read fuel pressure. Disconnect pressure gauge (043) and adaptor (045) and check for leaks. | 1 – 3 bar | Fuel pressure <1 bar: Voltage at fuel pump 1 < 11 V, Replace fuel pump 1 (M3m1). Fuel pressure >3 bar: Voltage at fuel pump 2 < 11 V, Replace fuel pump 2 (M3m2). |

¹⁾ Observe Preparation for Test, see 22.

Hydraulic Test Program - Test (Fuel Pump Test)



P07-5736-13

Figure 1

Hydraulic Test Program - Preparation for Test (Injector Test)

Preparation for Test

1. Connect socket box to engine control module (N3/4).
2. Unplug 2-pole connectors on injectors.
3. Remove fuel rail with injectors, thereby **not** disconnecting the fuel feed and return lines.
4. Connect self-made harness (048) one after another to each injector.
5. Hold each injector one after another in measuring glass.

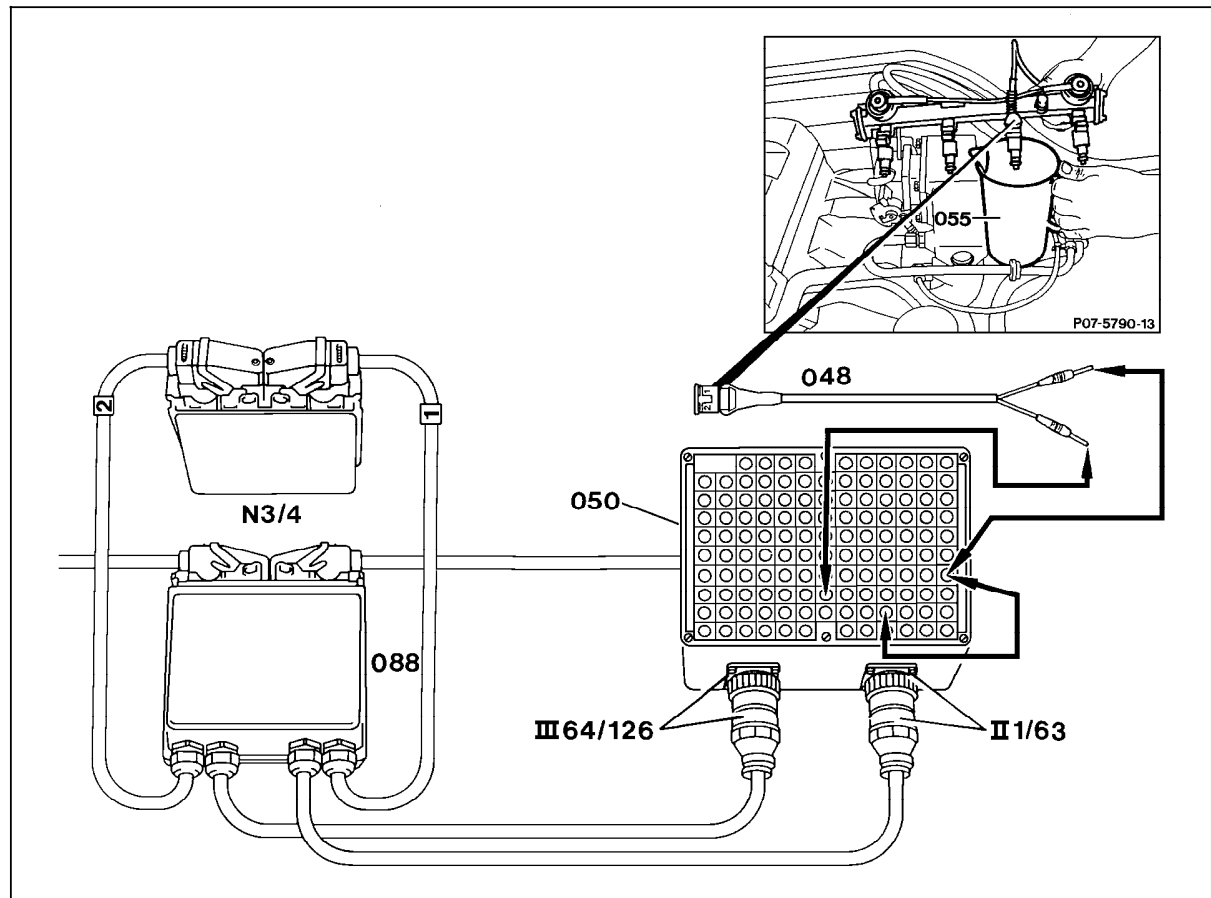


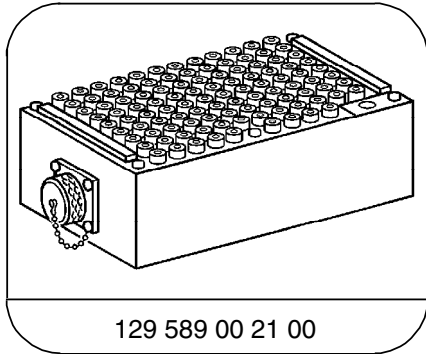
Figure 1

- N3/4 Engine control module (HFM-SFI)
- 048 Self-made harness
- 050 Socket box (126-pole)
- 055 Measuring glass
- 088 Test cable

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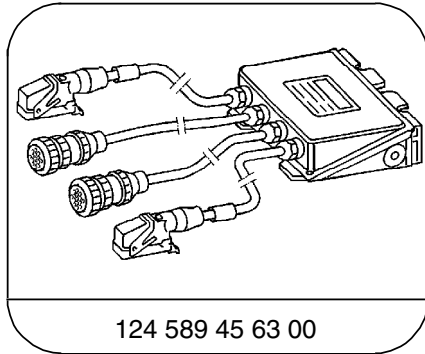
Hydraulic Test Program - Preparation for Test (Injector Test)

Special Tools



129 589 00 21 00

126-pin socket box



124 589 45 63 00

82-pin test cable CAN

Equipment

| | |
|-----------------------------------|----------------|
| Measuring glass (1 liter minimum) | local purchase |
|-----------------------------------|----------------|

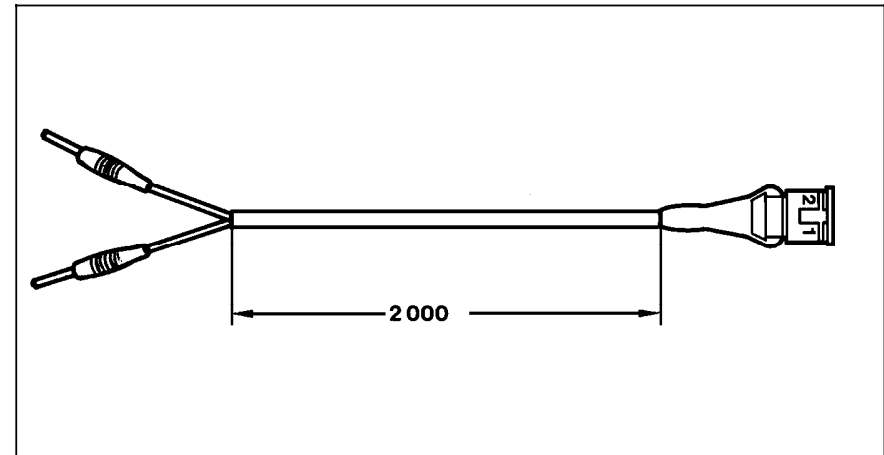
Hydraulic Test Program - Preparation for Test (Injector Test)

Self-made Tool

Test harness consisting of:

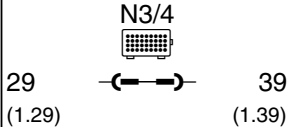
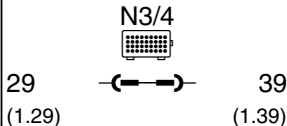
- 1X Connector 140 545 35 28
- 2X Contact spring 004 545 56 26
- 1X Banana plug (red)
- 1X Banana plug (black)
- 2.2 m Wire (red, 1.5 mm dia.)
- 2.2 m Wire (brown, 1.5 mm dia.)
- 2 m Harness tubing (6 mm dia.)

Connector layout
Position 1 = red
Position 2 = brown



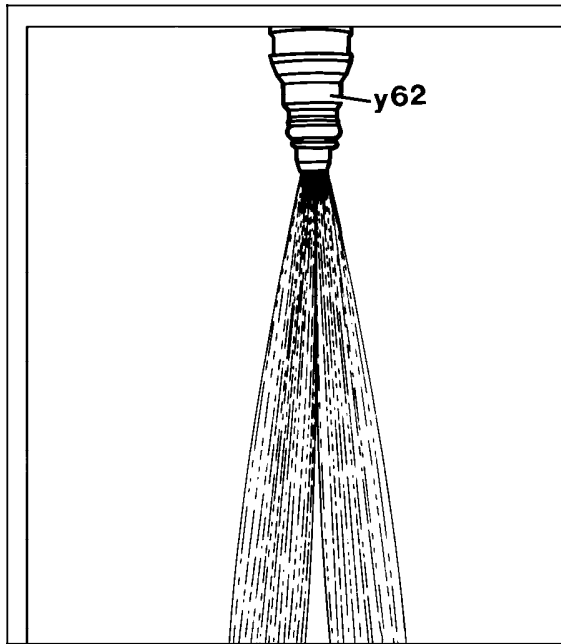
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Hydraulic Test Program - Test (Injector Test)

| Test step DTC | Test scope | Test connection | Test condition | Nominal value | Possible cause/Remedy ¹⁾ |
|------------------|--|---|--|--|-------------------------------------|
| ⇒ 1.0 | Injectors Leakage test | <p>N3/4</p>  <p>29 (1.29) 39 (1.39)</p> | Fuel rail and fuel injectors removed. Ignition: ON | Fuel injectors must not drip. | Replace dripping injectors, ⇒ 2.0 |
| ⇒ 2.0 | Injectors Operation and spray pattern test | <p>N3/4</p>  <p>29 (1.29) 39 (1.39)</p> | 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 32 (-) and 39 (+). | Fuel injectors must spray evenly (Figure 1). | Replace defective injectors. |

¹⁾ Observe Preparation for Test, see 22.

Hydraulic Test Program - Test (Injector Test)



P07-5475-15

Figure 1

Y62 Injector
Acceptable injector spray pattern.