PMS Gasoline Injection and Ignition System

A. General

The sections which follow describe the differences compared to the HFM gasoline injection and ignition system.

The abbreviation PMS means:

P = pressure

M = engine

S = management

Features of PMS

- Engine load detected by pressure sensor in PMS control unit (N3/6)
- PMS control unit (N3/6) in left wheelhouse
- Resistance trimming coupling (R16/7) at PMS control unit
- No permanent fault memory
- Full or group injection
- No anti-knock control
- No camshaft adjustment
- Control of fuel evaporation control system with thermo-valve

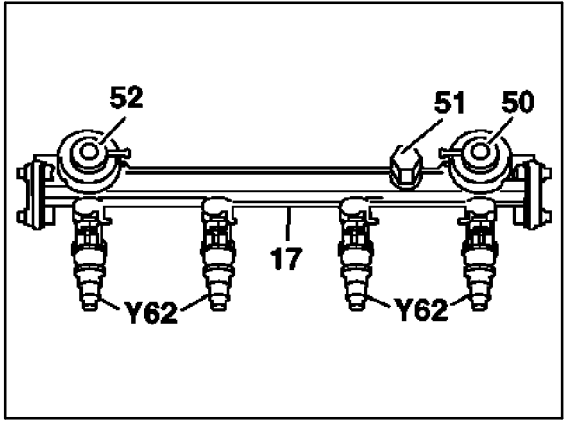
Principle differences

- PMS control unit (N3/6)
- Gasoline injection system function
- Ignition system function
- Idle speed control function
- Influencing parameters for controlling gasoline injection and ignition system (PMS)
- Function diagram of vacuum supply
- Fuel evaporation control system

B. Fuel supply

Fuel rail (17)
The fuel rail supplies the fuel to the injection valves and is positioned above the intake manifold.
It is used for housing:

- Injection valves (Y62)
- Diaphragm pressure regulator (50)
- Diaphragm pressure damper (52)
- Pressure measurement connection (51)
- Fuel feed fitting with strainer
- Fuel return fitting



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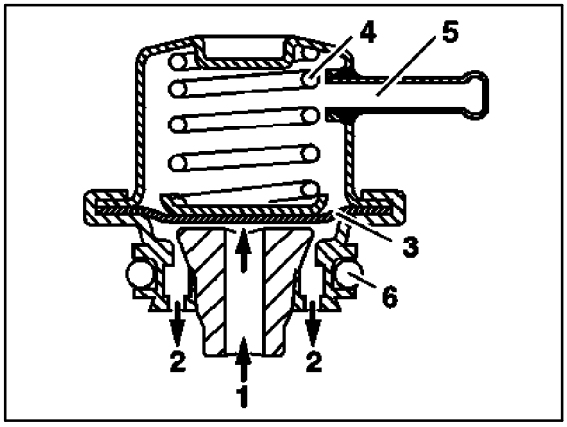
Diaphragm pressure damper (52)
The diaphragm (3) is able to act against the force of the compression spring (4) if pressure peaks occur in the fuel rail. This makes it possible to reduce pressure vibrations in the fuel feed pipe and in the fuel rail and thus prevents pulsation noises.



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1 Fuel feed
2 To fuel rail
3 Diaphragm
4 Compression spring
5 Air inlet connection
6 Seal

C. Functions in the control unit

a) Anti-jerk function (MG only)

The ignition angle is briefly retarded after a load change in order to prevent a sudden surge in engine speed or tendency to jerk in 1st gear.

b) Idle speed control

Idle speed is controlled by the LLR actuator (M16/6) which is operated by the PMS control unit (N3/6) to alter the throttle valve position.

The ignition angle can be retarded or advanced by up to 8° CA in order to assist the idle speed control.

Note

Intervention by altering the ignition angle reacts more rapidly than adjusting the throttle valve (idle speed control).

Idle speeds 1)

Coolant temperature	MG, AG (selector lever position P/N)	AG (selector lever in Drive position)
- 20°C	1000 7 50 rpm	800 7 50 rpm
- 0°C	950 7 50 rpm	720 7 50 rpm
+ 20°C	850 7 50 rpm	680 7 50 rpm
+ 60°C	780 7 50 rpm	650 7 50 rpm
> 80°C	750 7 50 rpm	650 7 50 rpm

1) Can be read about 30 seconds after start.

Catalytic converter heating speed

Engine speed is increased briefly each time the engine is started to allow the catalytic converter to reach its operating temperature more rapidly. The increase in engine speed is dependent on the coolant temperature at starting. Engine speed is increased within a coolant temperature range from +10 up to +80 °C.

Coolant start temperature		KAT heating speed
eg. +20 °C	MG, AG (selector lever position P, N)	950 7 50 rpm
	AG (selector lever in Drive position)	750 7 50 rpm

c) Intake air temperature correction

The ignition timing point is retarded by the HFM control unit as a function of the intake air temperature and "load" (engine speed and air mass).

Example

Ignition angle correction values

Intake air temperature °C	Ignition angle correction in °CA
+ 75	- 4
+ 50	- 3
+ 30	7 0
+ 20	+1.5
+ 10	+ 3
- 20	+ 4

Pinging protection

Ignition angle correction values

Coolant temperature °C	Ignition angle correction 1) in °CA
+120	- 4.0
+110	- 3.0
+100	- 1.5

1) Dependent on engine load and speed

Note

The ignition angle correction values of the intake air and coolant temperature are added together, ie. 110 °C coolant temperature and 50 °C intake air temperature result in a maximum retardation of 6.5° CA at full load.

Catalytic converter heating

Ignition angle retarded when engine idling up to about
2° CA before TDC.

d) Diagnosis/Fault storage

All the inputs/outputs are checked for plausibility when the car is operating. Faults detected are stored in the fault memory. The PMS control unit (N3/6) distinguishes in fault output:

- Faults which exist at that moment
- Faults which exist over a certain period
- Brief open circuits (loose contact) which have occurred more than 5 times during a journey

A journey for the PMS control unit (N3/6) exists if:

- road speed >4 km/h
- engine speed >700 rpm
- ignition **"OFF"** >30 seconds

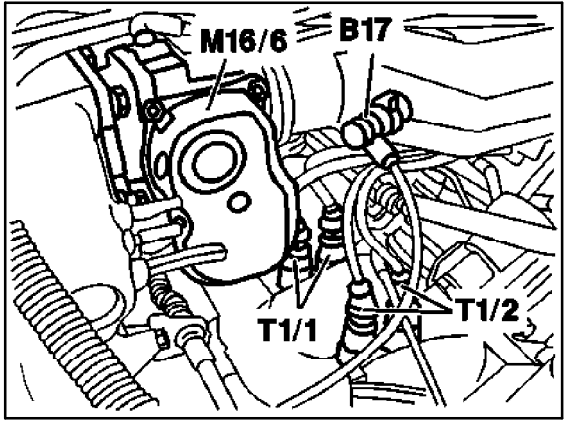
The faults remain stored when ignition **"OFF",** although they are erased if the car battery is disconnected. Faults are automatically erased in the fault memory if the fault no longer occurs within 19 successive journeys. If, for example, a fault again occurs after 6 fault-free journeys, a further 19 successive journeys are required before the fault is automatically erased.

The stored faults can be read and erased at the test coupling for diagnosis (X11/4) contact 8 with:

- Hand-held tester (HHT)
- Pulse counter

e) Automatic recognition of mechanical end stop of closed throttle valve

It is necessary for the PMS control unit (N3/6) to recognize the mechanical end stop of the closed throttle valve to ensure proper operation of the idle speed control. Recognition is performed with ignition **"ON"** (90 seconds, selector lever in P/N). When the throttle valve is pulled to the end stop by the servomotor integrated in the LLR actuator (M16/6), the PMS control unit (N3/6) detects, through the increase in current of the servo motor, in conjunction with the actual value potentiometer (throttle valve angle), the mechanical end stop and stores this value.



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M16/6 Idle speed control actuator
B17 Intake air temperature sensor
T1/1 Twin-spark ignition coil 1 and 4
T1/2 Twin-spark ignition coil 2 and 3

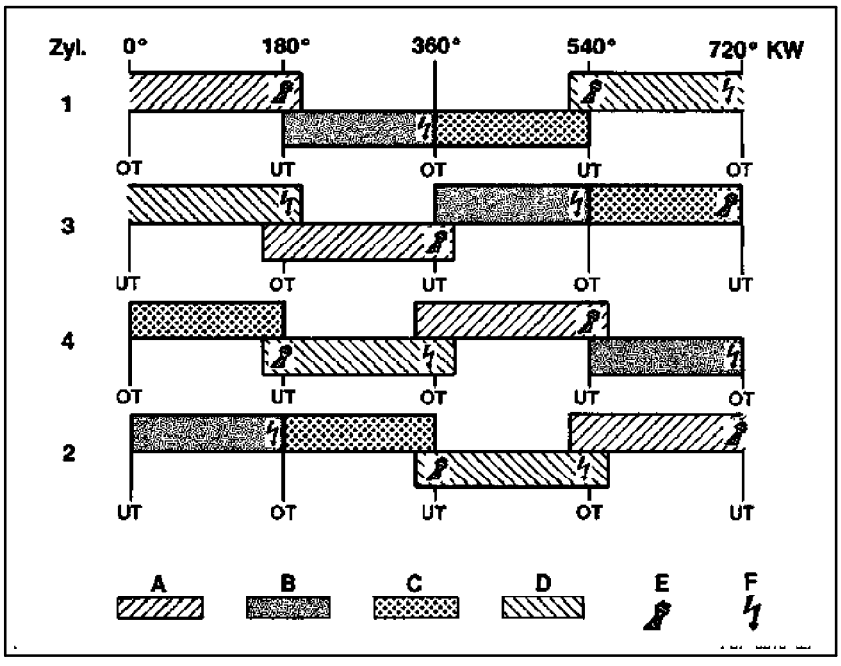
D. Mixture formation

a) Actuation of fuel metering in different operating states

Full injection

The four fuel injection valves inject fuel simultaneously every 180° crank angle when the engine is started up to 600 rpm, and also when accelerating.

Group injection



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PMS fuel injection and ignition diagram, >600 rpm

A Induction stroke
B Compression stroke
C Combustion stroke
D Exhaust stroke
E Fuel injection
F Ignition

Once engine speed is >600 rpm, two fuel injection valves always inject fuel simultaneously (cylinders 1 and 4 or 2 and 3). Fuel is always injected at BDC so that the fuel is injected into the cylinder either after being stored upstream (inlet valve closed) or directly (inlet valve open).

The PMS control unit calculates the injection time in line with the operating state of the engine. The quantity of fuel injected is determined by the opening time of the injection valves.

The injection time ranges from 1.5 to 130 milliseconds, and is dependent on engine load, engine speed and temperature.

Base quantity injected

The map of the base injection quantity in the PMS control unit is influenced in accordance with the operating state by:

- intake manifold pressure
- engine speed
- coolant temperature
- intake air temperature
- CO potentiometer (without KAT)
- resistance trimming coupling version for PMS control unit

Deceleration fuel shutoff

Operates if, for example, the following conditions are met at a coolant temperature of about 80 °C:

- Engine speed higher than deceleration speed threshold
  Manual transmission >1700 rpm
  Automatic transmission >1950 rpm
- Idle speed contact closed
- Cruise control "OFF"

Once engine speed drops below the resumption speed of about 1100 rpm, deceleration fuel shutoff is cancelled and fuel injection is re-activated on a groupwise basis.

Governing maximum engine speed

Injection	Engine speed
Off	>6200 rpm
On	<6170 rpm

Drive train protection

Maximum engine speed is governed to 5650 rpm by shutting off the fuel to avoid the propeller shaft speed in 5th gear at top speed rising to an excessive extent, eg. when driving downhill.

Whether 5th gear is engaged is recognized in the PMS control unit by comparing road speed to engine speed.

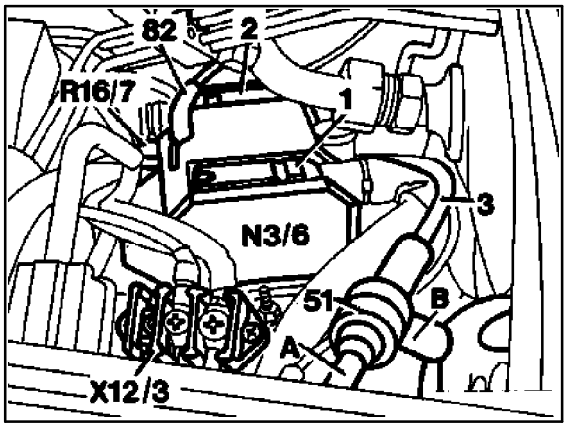
Altitude correction

The correction of the injection time is performed as a function of the barometric pressure and engine speed. The barometric pressure is detected by the pressure sensor in the PMS control unit.

E. Influencing parameters for control

a) Engine load recognition by intake manifold pressure sensor in PMS control unit

Engine load recognition as an essential control parameter for the PMS gasoline injection and ignition system is performed by analyzing the absolute intake manifold pressure by means of a pressure sensor in the PMS control unit (N3/6).



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Function

4 piezo resistors, which are interlinked by means of a bridge circuit, are located on an IC sensor chip, which is designed as a diaphragm.

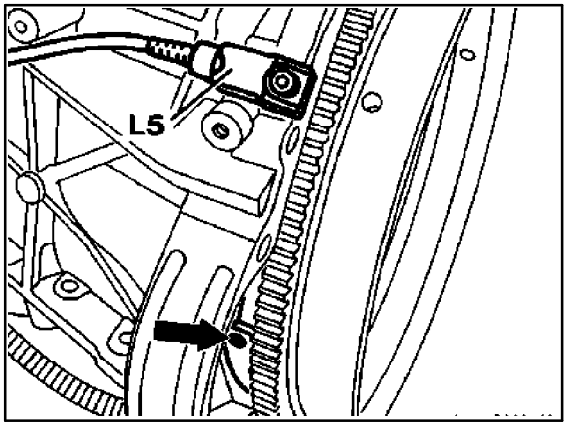
If the shape of the diaphragm is altered as a result of the intake manifold vacuum, the piezo resistors change their resistance. The change in the voltage level which occurs as a result is used by the PMS control unit as an operand for engine load.

Emergency running properties

In the event that the intake manifold pressure sensor for detecting engine load in the PMS control unit should fail, the injection time is calculated as a subsitute from a map using the throttle valve angle and engine speed. The throttle valve angle is detected in this case by the throttle valve actual value potentiometer (M16/6r1) in the LLR actuator (M16/6) and passed to the PMS control unit.

Ignition circuit recognition, allocation to injection valve groups

The signal from the magnet at the flywheel segment (arrow) is required for this purpose. When a signal is output via the crankshaft position sensor (L5), the ignition circuit for cylinders 2 and 3 is recognized, the pistons of these cylinders are in this case in TDC. Firing is performed in both cylinders simultaneously. The pistons of cylinders 1 and 4 are in BDC, fuel is injected simultaneously into cylinders 1 and 4 (group injection).



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b) Intake air/coolant temperature

The ignition angle is retarded at load as a function of the intake air and coolant temperature in order to prevent any tendency for the engine to knock at increased intake air and coolant temperatures.

Ignition angle retarded:

- Intake air temperature >35 °C
- Coolant temperature >105 °C

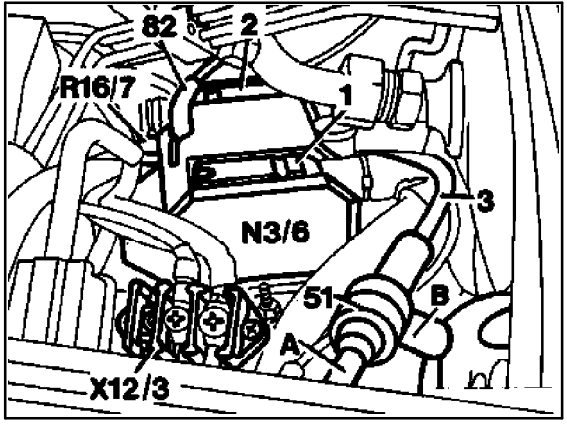
Note

The values of the ignition angle retardation of intake air and coolant temperature are added together.

c) Adaptation of fuel injection and ignition maps with resistance trimming coupling

The resistance trimming coupling (R16/7) is used for adapting the ignition and fuel injection maps in the PMS control unit.

7 resistance trimming couplings are available for adaptation.



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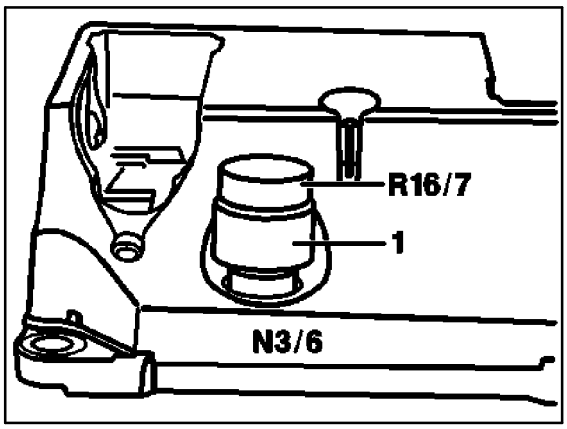
Resistance trimming coupling (A) (AUS)

This resistance trimming coupling (R16/7) retards the ignition timing point by 3° CA compared to the base version.

In the case of the national version (A) the resistance trimming coupling is equipped with anti-tamper lock (1).



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d) Battery voltage and voltage supply

Permanent voltage exists via terminal 30 and supplies the electronics such as:

- Memory
- Microprocessor

The following control unit output stages are supplied with voltage via terminal 15u (unfused) when the ignition is on:

- Fuel pump relay actuation
- Oxygen sensor heater
- Partial intake manifold preheating (PSV)