ENGINE 113.986
ENGINE 113.987
ENGINE 113.988 up to Model Year 8
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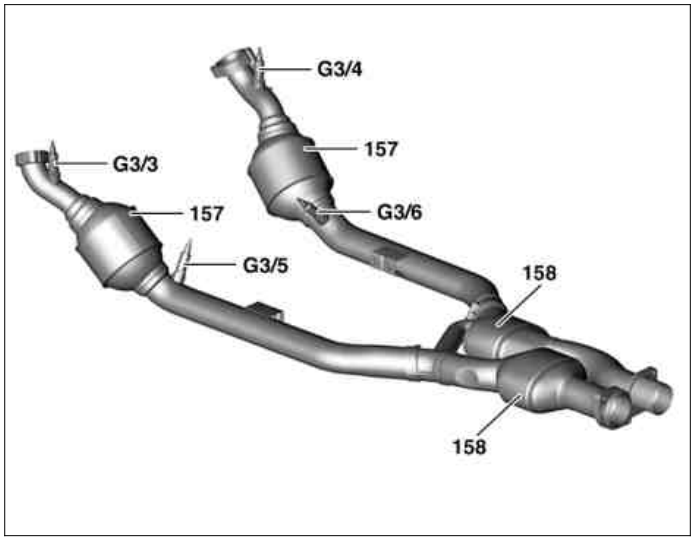
157 Firewall catalytic converter
158 Underfloor catalytic converter

G3/3 Left O2 sensor upstream of the TWC
G3/4 Right O2 sensor upstream of the TWC
G3/5 Left O2 sensor downstream TWC
G3/6 Right O2 sensor, downstream of TWC



P07.04-2161-11

Task

The O_2 sensors detect levels of residual oxygen in the exhaust and transmit corresponding voltage signals to the ME control unit (N3/10).

O_2 sensors upstream of the catalytic converter (control sensors):

- Lambda control
- Self adaptation of the mixture formation
- Function chain test

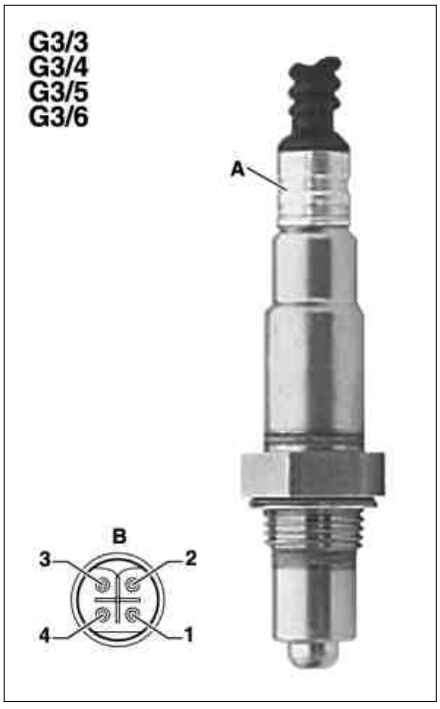
O_2 sensors downstream of the catalytic converter (master sensors):

- Two-sensor control
- Monitoring three way catalytic converter effect

Design

G3/3 Left O2 sensor upstream of TWC
G3/4 Right O2 sensor upstream of TWC
G3/5 Left O2 sensor downstream of TWC
G3/6 Right O2 sensor, downstream of TWC

A Connection cable (cast in)
B Connector (4-pin)
Pin 1 Sensor heater voltage
Pin 2 Sensor heater ground
Pin 3 O_2 sensor signal ground
Pin 4 sensor signal



P07.04-2258-03

The sensors used are potential-free insulated O_2 planar sensors.

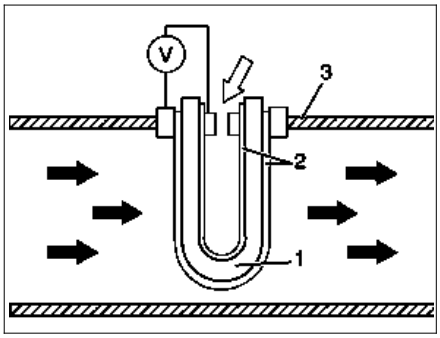
The active sensor ceramic consists of a gas-permeable ceramic body manufactured from zirconium dioxide. A protective tube with several slots protects the ceramic body from mechanical stresses and temperature jumps.

They are connected electrically by means of a 4-pin connector. The ground cable for the sensor signal is routed individually up to the ME control unit for each O_2 sensor.

Functional principle

1 Sensor ceramic
2 Electrodes at boundary surfaces
3 Exhaust pipe

Arrows black: exhaust gases
white: outside air



P07.61-0403-01

Function

The sensor ceramic is conductive for oxygen ions from approx. 300°C. If the oxygen concentration on both sides of the sensor ceramic differs, a voltage is produced at the boundary surfaces as a result of the particular properties of the sensor ceramic (Nernst voltage). This Nernst voltage produces the O_2 sensor signal which is a measure of the residual oxygen in the exhaust gas.

The analysis circuit for the O_2 sensor signal (in the ME control unit) produces a so-called sensor backvoltage of about 450 mV on the O_2 sensor.

If the O_2 sensor is cold, the sensor internal resistance is so high that the O_2 sensor voltage is initially the same as the back voltage irrespective of the mixture composition.

i

The backvoltage at the ME control unit can be measured to the ground for the O_2 sensor signal when the O_2 sensor is disconnected.

O_2 sensor heater

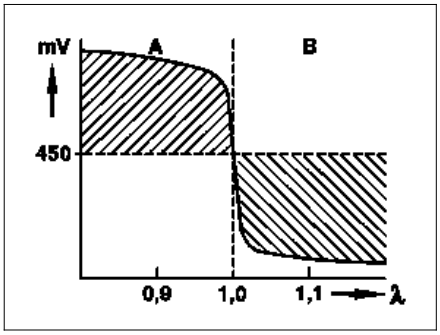
The O_2 sensors are heated in order to rapidly warm up the sensor ceramic to operating temperature. The sensor heater is actuated by the ME control unit over a ground signal. The current in the cold state is increased approximately by a factor of 4.

The sensor heater is switched off at coolant temperatures below approx. 20°C and at high engine speeds in order to avoid overheating (thermal shock).

O_2 sensor voltage

A *Rich mixture*
B *Lean mixture*
λ *Lambda (fuel-air ratio)*

The O_2 sensor signal experiences a steep voltage jump at the transition from a rich to a lean mixture (λ=1). This property is utilized for the lambda closed-loop control.



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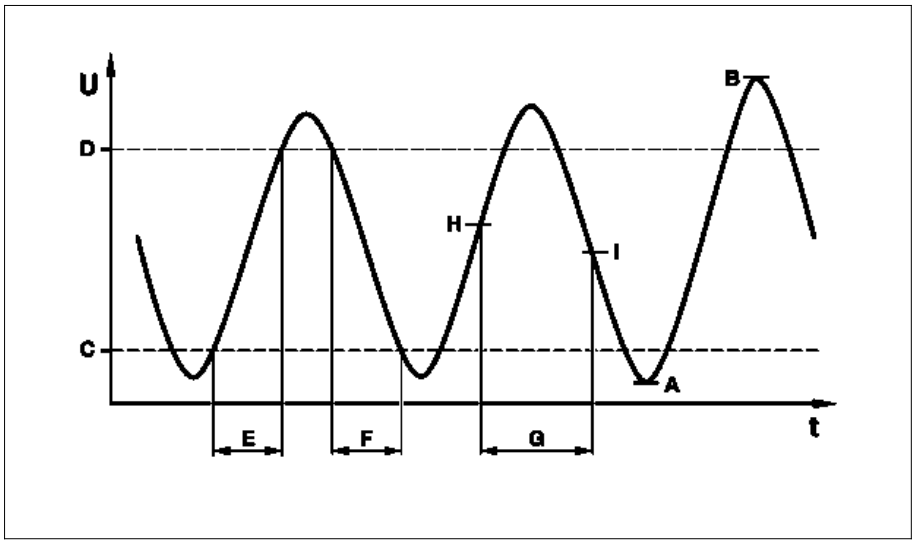
Curve of the O_2 sensor voltage (shown schematically)

A *Minimum sensor voltage (lean mixture)*
B *Maximum sensor voltage (rich mixture)*
C *Lower limit value for time measurement*
D *Upper limit value for time measurement*
E *Duration of sensor state change for rich-lean transition*
F *Duration of sensor state change for rich-lean transition*
G *Duration between sensor state change*
H *Threshold for rich range (e.g. greater than 475 mV)*
I *Threshold for lean range (e.g. less than 425 mV)*
U *Sensor voltage in mV*

t *Time in ms*



P07.04-2121-05

Faults on the O_2 sensor can be detected by means of the O_2 sensor signal.

Defined limit values must be maintained for the O_2 sensor voltage, the cycle duration and the sensor status change.