

8.2.1.1 Emission control systems

Validities

BMW i, BMW passenger cars, MINI passenger cars, Rolls-Royce passenger cars

Official method according to EG PTI:

Visual inspection

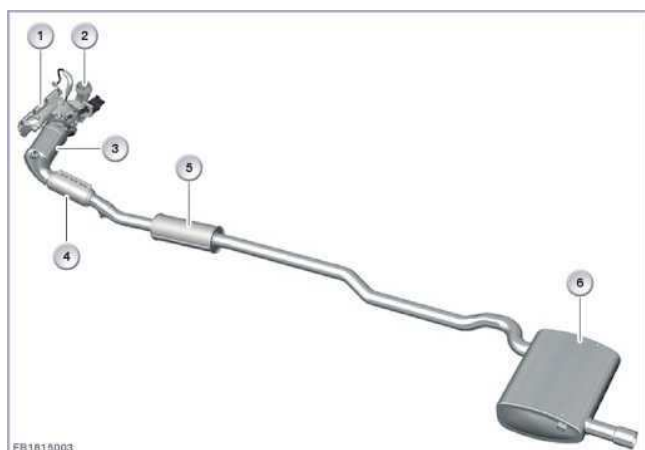
Fault determination according to EG PTI:

a)	The exhaust gas aftertreatment system installed by the manufacturer is missing, has been changed or it has evidently been damaged
b)	Leakages influencing emission measurement

Methods according to vehicle manufacturer:

System description

The engines form part of the so-called modular engines. Depending on the motorisation, different versions of the exhaust emission system are used. Apart from the exhaust manifolds and the exhaust turbochargers, the exhaust system has been designed very similarly for each modular engine. The exhaust emission systems essentially only differ in their varied volume and the number of exhaust tailpipes.



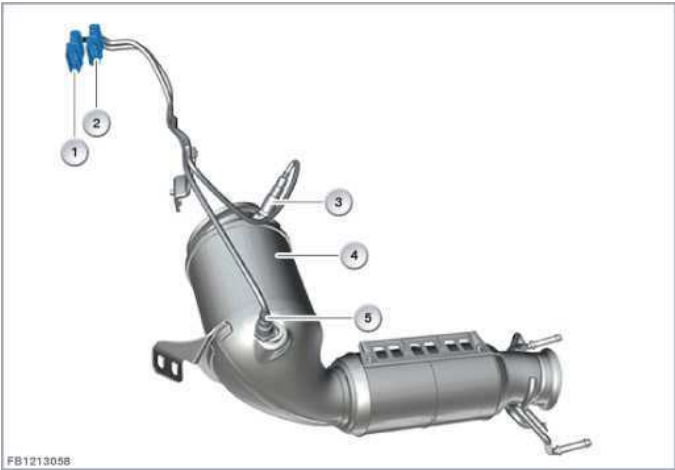
Exhaust emission system

Index	Explanation
1	Exhaust manifold
2	Exhaust turbocharger
3	Catalytic converter
4	Decoupling element
5	Centre silencer
6	Rear silencer

The 3-cylinder petrol engine is equipped with a water-cooled exhaust manifold made of aluminium. The 4-cylinder petrol engine and the 6-cylinder petrol engine feature an exhaust manifold made of cast steel. The 3, 4 and 6-cylinder petrol engines feature one bank each. In all engines, the exhaust manifold and the exhaust turbocharger housing have been designed as one cast part and for this reason, they cannot be renewed individually. Both the 8-cylinder petrol engine and the 12-cylinder engine have 2 cylinder banks. As a result, the engine features 2 exhaust turbochargers which have not been integrated into the exhaust manifold.

Apart from the 3-cylinder petrol engine, the exhaust turbochargers have been designed as twin-scroll exhaust turbochargers to enable a quicker and more direct response. The engines feature one oxidation catalytic converter near the engine per bank. The charging pressure per exhaust turbocharger is controlled using an electrical wastegate valve.

Oxygen sensors

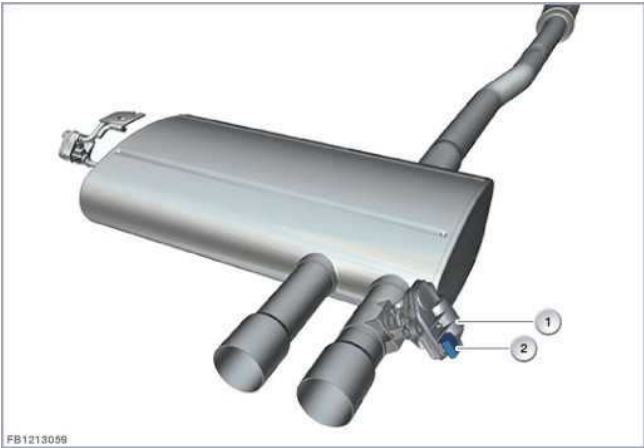


Index	Explanation
1	five-pin plug connection
2	five-pin plug connection
3	Oxygen sensor before catalytic converter
4	Catalytic-converter mounted close to the engine
5	Oxygen sensor after catalytic converter

The oxygen sensor consists of a ceramic coating made of zirconium dioxide (laminated). The heating element that has been inserted into the laminate quickly generates the required operating temperature of at minimum 750 °C. The oxygen sensor contains 2 cells, a measuring cell and a reference cell. The two cells are coated with electrode made of platinum.

It is possible to gradually measure an air/fuel ratio of between 0.65 and 2.5 using the oxygen sensor (constant characteristic curve). This oxygen sensor works with a lower heater output than a conventional oxygen sensor. In addition, this oxygen sensor is ready for operation more quickly. Current is applied at the measuring cell. Consequently O2 is pumped into the reference cell until a voltage of 450 mV has been established between the reference cell electrodes. The applied current at the measuring cell is the measured variable for the fuel-air ratio. This enables the oxygen sensor emissions control to set any desired air/fuel ratio in the combustion chamber.

Electrical exhaust flap (model-specific)



Index	Explanation
1	Electrical exhaust flap
2	five-pin plug connection

The exhaust control flap is driven via an axially arranged electric motor with integrated gearing and integrated electronics. The exhaust control flap is activated by the Digital Engine Electronics (pulse-width modulation). Input variables are:

- Engine speed
- Load
- Driving speed

The exhaust flap is integrated within the rear silencer. The exhaust flap reduces the noise level when the engine is idle and when the engine speed is close to idle. The exhaust flap guarantees active noise control and reduces the output by approximately 8 dB.

The electric exhaust control flap is connected via 4-pin plug connection. The drive for the electric exhaust control flap is supplied with terminal 15N.

The exhaust flap can be opened (10 % pulse width modulation) and closed (90 % pulse width modulation). The end positions are mechanical limit stops. Intermediate positions are not provided. The preferred position with a detected fault (for example failure of pulse-width modulated signal) or after having switched off the combustion engine is the open position.



TECHNICAL INFORMATION

The oxygen sensor requires ambient air within its interior in order to operate. The ambient air enters the interior via the plug connection through the cable. For this reason it is important to guard the plug connection against contamination from substances such as wax and sealants. When malfunctions occur in the lambda closed-loop control system the oxygen sensor's plug connection should always be checked. If necessary, the plug connection must be cleaned. Avoid all contact between the plug connection and contact spray, cleaning agents and solvents, as these substances could destroy the oxygen sensor.



TECHNICAL INFORMATION

If the exhaust flap is defective the exhaust system will emit a hissing noise at high engine speeds when it is closed. If the exhaust flap is defective and partially open a humming noise will be generated at idle.

Petrol particulate filter

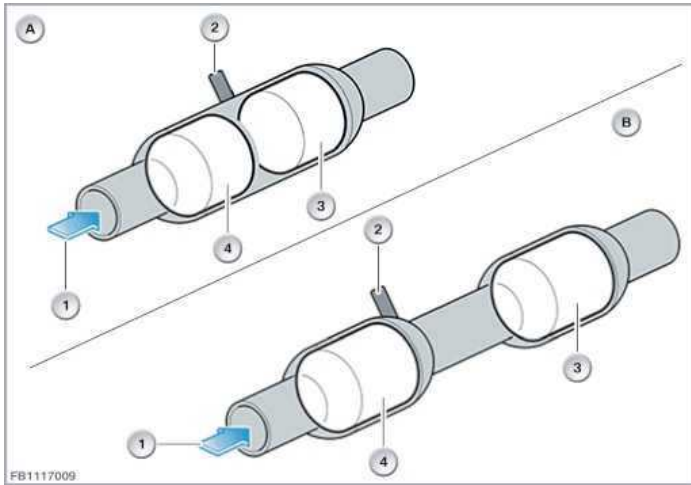
In the EURO 6c exhaust emissions legislation, the limit values of the particle mass (PM) and the particle number (PN) are even more strictly limited. The reason for this is that, in modern petrol engines with direct injection, the most homogeneous fuel-air mixture is created with intake pipe fuel injection. This means that more particles are created during combustion. In order to comply with the limit values, a petrol particulate filter is installed, among other things.



Overview:

Index	Explanation
1	Petrol particulate filter

The petrol particulate filter is installed behind the catalytic converter instead of the centre silencer. In future vehicles, it will also be possible to install the petrol particulate filter near the engine together in one housing with the catalytic converter.



Mounting orientation:

Index	Explanation
A	Petrol particulate filter near the engine in the catalytic converter
B	Petrol particulate filter near the engine instead of the centre silencer
1	Exhaust mass flow
2	Exhaust gas pressure sensor connection
3	Petrol particulate filter
4	Catalytic converter

The mounting orientation of the exhaust gas pressure sensor must be checked for unique identification. If the exhaust gas pressure sensor is at the output of the catalytic converter, then the petrol particulate filter is installed far from the engine in the vehicle underbody instead of the centre silencer. If the exhaust gas pressure sensor is located in the centre of the catalytic converter housing, then the petrol particulate filter is installed close to the engine.

A mounting orientation of the petrol particulate filter near the engine benefits regeneration (erosion of soot) since it is easier to reach the necessary exhaust temperatures.

Exhaust gas pressure sensor:

Index	Explanation
1	Exhaust gas pressure sensor
2	Ambient pressure measuring connection
3	Measuring connection before petrol particulate filter
4	three-pin plug connection

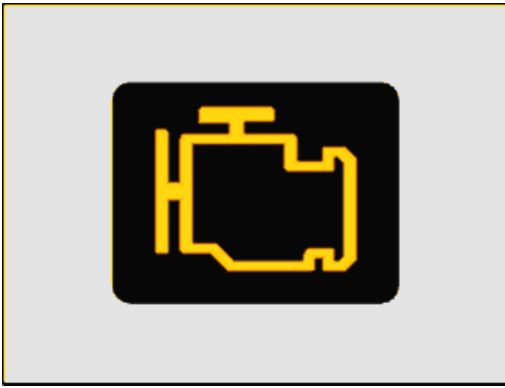


Unlike in diesel engines the differential pressure in petrol engines is not measured upstream and downstream of the microfilter. Instead, with petrol engines, the exhaust gas pressure sensor measures the exhaust gas pressure before the petrol particulate filter as well as the ambient pressure.

The Digital Motor Electronics (DME) calculates the exhaust mass flow using the signals of the exhaust gas pressure sensor and other signals such as the air mass. A value for the exhaust gas pressure after the petrol particulate filter is determined using the calculation of the exhaust mass flow in combination with the measured ambient pressure. The calculated differential pressure before and after the petrol particulate filter gives information on the load status of the petrol particulate filter. The Digital Motor Electronics (DME) activates regeneration when the permitted load status is exceeded.

Malfunction indicator lamp

The malfunction indicator lamp is also called as "Check engine light" in some countries.



Activation in fault states

The malfunction indicator lamp is activated if an exhaust-related fault is detected in two consecutive driving cycles. The associated BMW fault code then receives the fault detail "fault is currently activating a warning light". If a fault disappears again, the fault memory remains stored for 40 driving cycles. The malfunction indicator lamp is deactivated again if the fault does not occur for three successive driving cycles. In this case, the fault detail for the associated BMW fault code changes back to "fault does not currently activate any warning light".

Activation without fault status

In the conditions listed below, the malfunction indicator lamp is also active. These conditions do not represent a fault status, however. Troubleshooting is therefore not necessary in these conditions.

- During the pre-drive check, i.e. for some seconds directly after activating driving readiness.
- If exclusively terminal 15 is switched on without driving readiness and/or without having started the engine.

8.2.1.2 Gaseous emissions

Validities

BMW i, BMW passenger cars, MINI passenger cars, Rolls-Royce passenger cars

Official method according to EG PTI:

— In vehicles up to emission categories Euro 5 and Euro V (7): Measurement with the help of one of the exhaust gas analysis unit 1 conforming to the regulations or reading out the on-board diagnosis system. The exhaust-gas test is basically performed using the exhaust emissions. The member states may allow the use of the on-board diagnosis system based on a equivalence assessment and in consideration of the relevant type approval regulations, in which the recommendations of the vehicle manufacturer and other requirements must be observed.

— In vehicles from emission categories Euro 6 and Euro VI (8): measure using an emission analysis device¹ that meets the specifications or read out the on-board diagnosis system while taking into account the manufacturer's recommendations and other requirements¹. No measurements are carried out in two-stroke engines.

Fault determination according to EG PTI:

a)	Exhaust gas exceeds the specific values as per manufacturer specifications
b)	Or (if there is no corresponding data available) the carbon monoxide emissions exceed i) — 4.5 % or — 3.5 % in vehicles without modern exhaust gas aftertreatment system, depending on the first registration or initial operation date as per specifications ¹ ; ii) in vehicles with modern exhaust gas aftertreatment system — when the engine is idling: 0.5 %, — at increased idle speed: 0.3 % or — when the engine is idling: 0.3 % (7), — at increased idle speed: 0.2 %, depending on the first registration or initial operation date as per specifications ¹ .
c)	Oxygen sensor coefficient outside the range 1 ± 0.03 or not in compliance with manufacturer specifications
d)	On-board diagnosis system (OBD) shows significant fault.

8.2.2.1 Emission control devices

Validities

BMW i, BMW passenger cars, MINI passenger cars, Rolls-Royce passenger cars

Official method according to EG PTI:

Visual inspection

Fault determination according to EG PTI:

a)	The exhaust gas aftertreatment system installed by the manufacturer is missing or it has evidently been damaged.
b)	Leakages influencing emission measurement

Methods according to vehicle manufacturer:

Diesel particulate filter

In order to comply with required particle emissions as per EURO5 and EURO6 exhaust emissions legislation all BMW diesel vehicles have been equipped with a diesel particulate filter.

The filter housing of the filter contains the oxidation catalytic converter and the actual diesel particulate filter. The oxidation catalytic converter is mounted upstream of the diesel particulate filter.



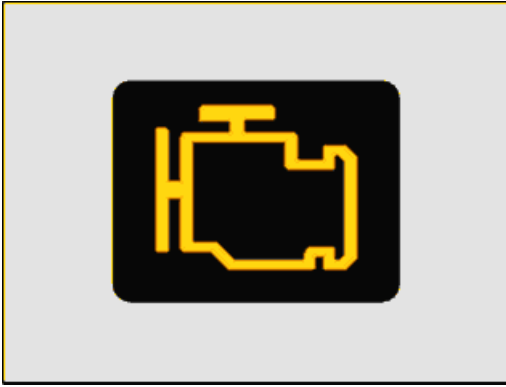
Index	Explanation
1	Oxygen sensor before catalytic converter
2	Exhaust temperature sensor upstream of catalytic converter
3	three-pin plug connection
4	Differential pressure sensor microfilter
5	two-pin plug connection
6	two-pin plug connection
7	two-pin plug connection
8	two-pin plug connection



Index	Explanation
1	Exhaust-gas temperature sensor after catalytic converter
2	Oxygen sensor after catalytic converter
3	five-pin plug connection

Malfunction indicator lamp

The malfunction indicator lamp is also called as "Check engine light" in some countries.



Activation in fault states

The malfunction indicator lamp is activated if an exhaust-related fault is detected in two consecutive driving cycles. The associated BMW fault code then receives the fault detail "fault is currently activating a warning light". If a fault disappears again, the fault memory remains stored for 40 driving cycles. The malfunction indicator lamp is deactivated again if the fault does not occur for three successive driving cycles. In this case, the fault detail for the associated BMW fault code changes back to "fault does not currently activate any warning light".

Activation without fault status

In the conditions listed below, the malfunction indicator lamp is also active. These conditions do not represent a fault status, however. Troubleshooting is therefore not necessary in these conditions.

- During the pre-drive check, i.e. for some seconds directly after activating driving readiness.
- If exclusively terminal 15 is switched on without driving readiness and/or without having started the engine.

8.2.2.2 Exhaust gas opacity vehicles, vehicles registered or in operation prior to 01.01.1980 are excluded

Validities

BMW i, BMW passenger cars, MINI passenger cars, Rolls-Royce passenger cars

Official method according to EG PTI:

— In vehicles up to emission categories Euro 5 and Euro V (7): measurement of the exhaust gas opacity during acceleration (without load) from idle to cutoff speed, whereby the gear selector lever must be in neutral interval stage and the clutch must not be pressed, or read out OBD. As a rule, the exhaust-gas test is carried out by checking the exhaust gases. Member states may permit the use of OBD on the basis of an equal assessment. However, recommendations by the vehicle manufacturer must be taken into account.

— In vehicles from emission categories Euro 6 and Euro VI (8): measurement of the exhaust gas opacity during acceleration (without load) from idle to cutoff speed, whereby the gear selector lever must be in neutral interval stage and the clutch must not be pressed, or read out OBD while taking into account the manufacturer recommendations and other requirements¹

Vehicle preheating/precooling: 1. Vehicles can be checked without preheating/precooling. However, for reasons of safety the engine must be at operating temperature and in correct mechanical condition².

Preheating/precooling requirements: i) The engine has fully reached operating temperature, i.e. an engine oil temperature of at minimum 80°C or the usual operating temperature (if this value is lower) is measured using a measuring tube sensor or the engine block temperature measured using an infrared radiation sensor has reached at minimum this value. If the value cannot be measured in this way as a result of the vehicle configuration, the normal engine operating temperature can be determined using a different method, e.g. by starting up the engine fan. ii) The exhaust emission system is flushed after a minimum of three non-loaded acceleration cycles from idle speed to cutoff speed or with an equivalent procedure.

Checking process: 1. The engine and a potentially installed exhaust turbocharger must have reached idle speed prior to starting the non-loaded acceleration cycle. With heavy diesel engines it is necessary to wait for a minimum of 10 seconds after having released the accelerator pedal for this purpose. 2. In order to initiate the non-loaded acceleration cycle it is necessary to quickly and constantly press the accelerator pedal (within less than one second), yet it must not be forcefully pressed fully down so the injection pump reaches the maximum delivery rate. 3. During each non-loaded acceleration cycle the engine must reach the cutoff speed or in vehicles with automatic transmission the speed specified by the manufacturer or, if this data is not available, two thirds of the cutoff speed before the accelerator pedal is released. For instance, this can be checked by monitoring the engine speed or by pressing the accelerator pedal for long enough, i.e. in M 2, M 3, N 2 and N 3 class vehicles the period of time from having initially pressed the accelerator pedal to releasing it must be at minimum two seconds. 4. The check must exclusively be assessed as a fail if the arithmetic mean of at minimum three non-loaded acceleration cycles exceeds the limit value. When calculating this value, measurements that significantly deviate from the average measured value or the result of other statistical calculations that take into account the spread of measurements can be ignored. Member states can limit the number of test cycles to be carried out. 5. Member states can assess vehicle checks as fails where measured values significantly exceed the limit values after fewer than three non-loaded acceleration cycles or after the flushing cycles to avoid unnecessary checks. Member states can also assess vehicle checks as passes where measured values are significantly below the limit values after fewer than three non-loaded acceleration cycles or after the flushing cycles to avoid unnecessary checks.

Fault determination according to EG PTI:

a)	In vehicles that are initially registered or put into operation after the date specified in the regulations ¹ : exhaust gas opacity exceeds the value stated on the manufacturer label on the vehicle
b)	If this information is not available or the use of reference values has not been specified in the regulations ¹ : — Naturally aspirated engines: 2.5 m–1, — Engines with turbocharger: 3.0 m–1, — In vehicles specified as per relevant regulations ¹ or initially registered or put into operation after the date stated in said regulations: 1.5 m–1 (9) or 0.7 m–1 (10)

Clean diesel particulate filter

1 Clean diesel particulate filter



TECHNICAL INFORMATION

The training video illustrates the methodology for cleaning the diesel particulate filter.

The training video does not replace the repair instructions.

The training video is not subject to the update service.

No liability can be accepted for printing or other faults.

Subject to changes of a technical nature

- Follow repair instructions!