TECHNICAL INFORMATION

EXHAUST GAS PRESSURE SENSOR

The exhaust gas pressure sensor measures the pressure difference between gas in the intake and the outtake of the particulate filter. The outtake may be directly set to ambient pressure depending on the model.

This sensor is another element in the pollution regulation systems for diesel engines imposed by European emissions regulation.

The sensor can be found in two different systems:
- Diesel Particulate Filter Systems with no additive (DPF)(*figure 1)*.
- Diesel Particulate Filter Systems with additive (FAP)(*figure 2)*.

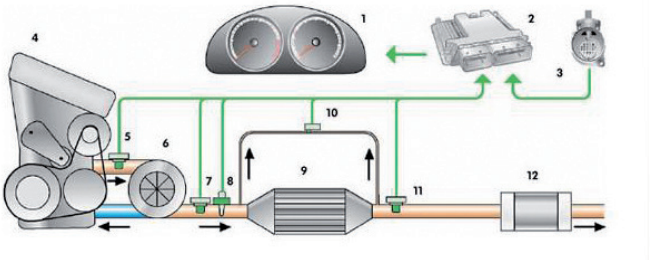


Figure 1. DPF
1- Dashboard control unit.
2- Engine control unit.
3- Mass airflow sensor.
4- Diesel engine.
5- Turbo compressor temperature sensor.
6- Turbo compressor.
7- Particulate filter temperature sensor.
8- Lambda sensor.
9- Particulate filter.
10- Exhaust gas pressure sensor 1.
11- Post-particulate filter temperature sensor.
12- Muffler.

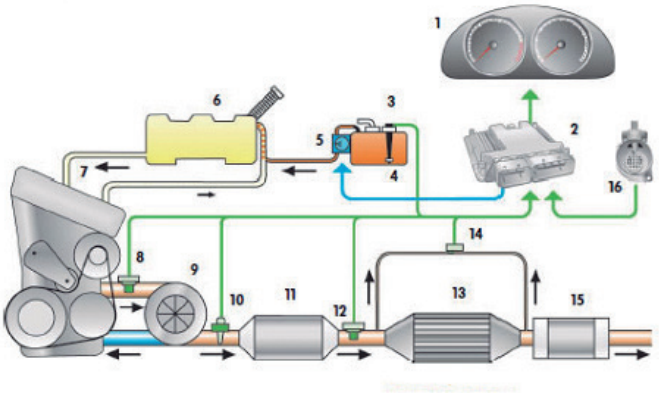


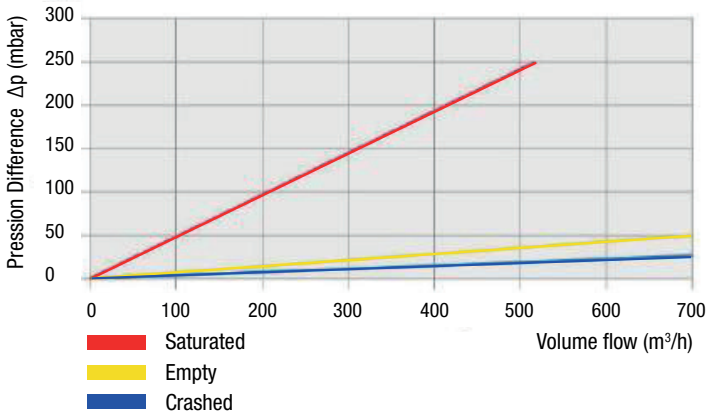
Figure 2. FAP
1- Dashboard control unit.
2- Engine control unit.
3- Additive tank.
4- Additive level sensor.
5- Additive pump.
6- Fuel tank.
7- Diesel engine.
8- Turbo compressor temperature sensor.
9- Turbo compressor.
10- Lambda sensor.
11- Oxidation catalytic converter.
12- Particulate filter temperature sensor.
13- Particulate filter.
14- Exhaust gas pressure sensor 1.
15- Muffler.
16- Mass airflow sensor.

The difference between the two systems is on how the filter is regenerated after saturation:

On DPF regeneration is done regularly by increasing exhaust gas temperature. This is achieved by a post injection process with crankshaft at 35º after Top Dead Point. This way the Filter temperature gets up to 600ºC, where soot is burnt.

On FAP regeneration is done regularly by mixing an additive in the oil. The additive lowers the soot burning point down to 300-350 ºC, where soot is burnt. This cycle repeats every 500-700km (varies upon driving style) and lasts from 5 to 10 minutes.

The filter saturation level is controlled 1) by the exhaust gas pressure sensor, 2) by the temperature sensors placed before and after the filter and 3) by the intake mass airflow sensor.



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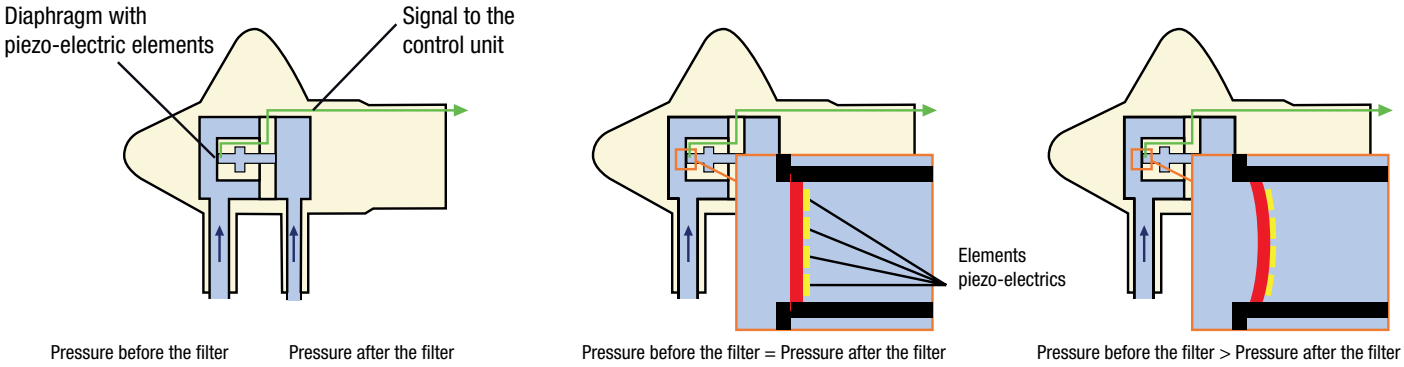
The exhaust gas pressure sensors need to operate in critical assembly conditions, and need to be operative in a range of temperatures from -40 to +130 ºC. They also have to be hydrocarbon resistant.
In order to achieve this, **FAE** performs the following intensive homologations tests:

- Cyclic operation at high and low pressures in extreme environmental conditions.
- Vibration and shock resistance.
- Over pressure operation at high and low temperatures.
- Humidity and temperature endurance.
- Thermal shock from -40 to +150ºC.

All of our sensors are tested against leakage and for precise output voltage performance.

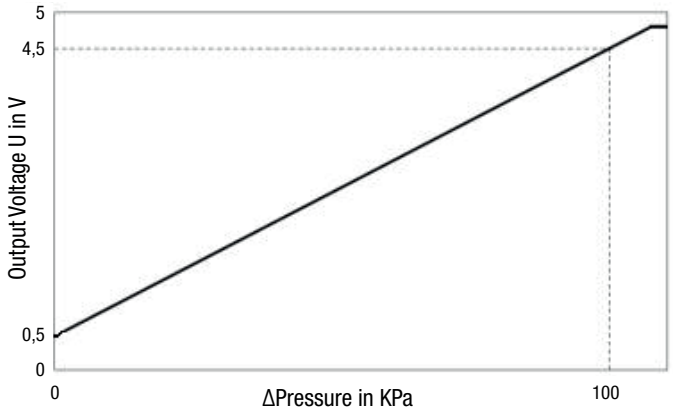
SENSING ELEMENT

The sensing element of the exhaust gas pressure sensor is a piezoresistive in a wheatstone bridge configuration. This sensor is basically changing its electrical resistance upon mechanical deformation of the membrane.



The sensing element is integrated in a MEMS die including amplification, thermal compensation and signal conditioning. The embedded digital electronics allows programming of the output signal from 0 to 5 V.
The die is assembled on a ceramic circuit and the electrical connection is made by wire bonding. The whole system is protected by a receptacle and a silicone gel. The electronic is made by using hybrid technology and is handled in clean ESD protected room to protect it from unwanted electrical discharges.

The exhaust pressure sensor output is linear and depends on the pressure difference between input and output. This relationship can be expressed with the following formula:



$Vout = S*\Delta P+Of$ whereas: Vout: Output voltage (V).
S: Sensitivity.
ΔP: Pressure difference between.
filter input and output (kPa).
Of: Offset.

Technical data

- Supply voltage.....5 V ±0.5 V.
- Temperature range.....-20 a 130ºC (inside tolerance).
- Max and Min Temperatures.....-40 a 150ºC.
- Response time (t 10/90).....1.5 ms.
- Max Pressure.....±400kPa (30ºC for 5s).

All these figures are common for all **FAE** exhaust gas pressure sensors. Every part has its specific working curve and tolerances.

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SENSOR COMPONENTS

The exhaust pressure sensor is built with the following components (*figure 3*):

1- Sensing element: Electronic circuit over ceramics board.
2- Body: Molded with PBT+30GF, contains all the parts and has two air intakes.
3- Pins: Tin soldered by automated operation.
4- Lid: To grant air tightness.

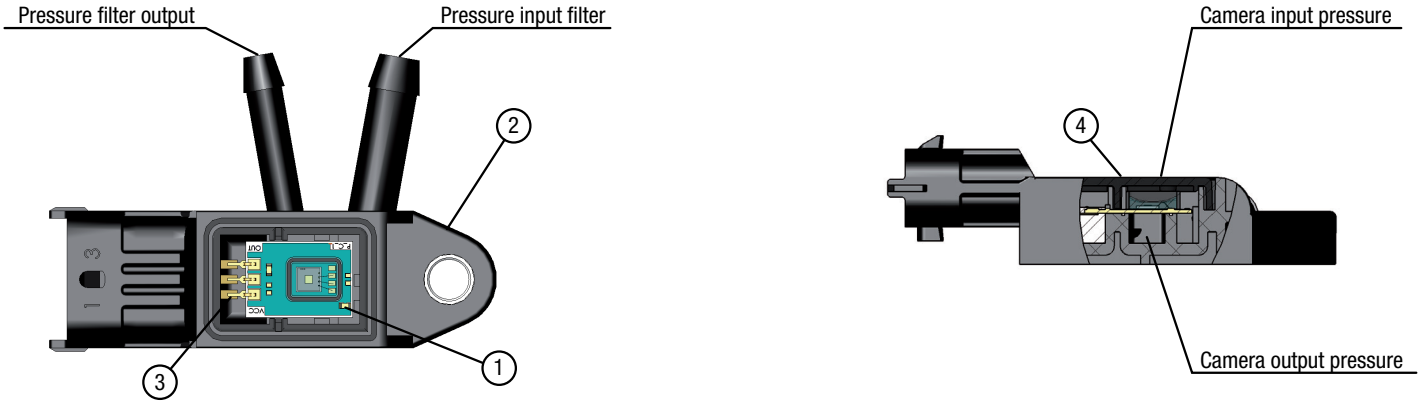
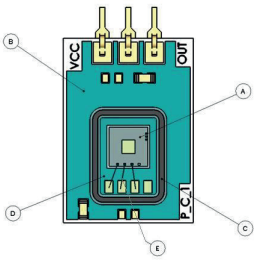


Figure 3

In the sensing element:



A- Electronic circuit.
B- Ceramics substrate.
C- Die protector.
D- Silicon resin (to protect the electronics).
E- Bonding.

ASSEMBLY INSTRUCTIONS

- Power off the vehicle.
- Locate the sensor (following the pipes coming out of the particulate filter).
- Disconnect pressure pipes (input and output).
- Disconnect sensor connector.
- Extract fixation screws or whatever the holding mechanism is.
- Install replacement sensor.
- Connect pipes and electrical connector.

VISUAL INSPECTION / FAILURE CAUSES

Sensor body, connector and wiring must be in good condition. Check for bumps, cracks or housing damage.
Visual inspection can help but it is not enough to determine if the sensor is operating well.

Failure causes can be:

- Breaks, pores or cracks in the pipes.
- Wear signs in the connector or wirings.
- Damage of the sensing element causing bad pressure readings.
- Air leakage in the sensor.
- Wear in the joints between the sensor and the pipes.

Malfunction of the sensor can cause any of the following symptoms:

- Unnecessary filter regenerations.
- Power losses if the sensor is not detecting the filter saturation level.
- Dashboard light for Particulate filter (or preheating in some models) and blinking light for pre-heating.
- Reduction of filter lifespan due to unnecessary regenerations.
- Increase in oil consumption.
- Increase in pollution levels.