PM SENSOR

USER MANUAL

Table of content

For direct replacement of OE sensors

PM sensors

The new PM Sensor ensures Particulate Matter OBD monitor and can replace the OE sensor directly.

An essential part of modern trucks

A PM (Particulate Matter) sensor is typically a high-temperature device that measures the level of Particulate Matter slip in exhaust systems, which is strictly regulated by authorities in all parts of the world.

Thoroughly tested

All PM Sensor products match OE criteria and are calibrated and controlled at test facilities. Parts available for DAF, Iveco, MAN, Mercedes-Benz, Renault, Scania and Volvo. All products have a 1 year warranty.

Principle of operation

The sensing element is a ceramic chip (see Fig. 1) that consists of a heating circuit, IDE electrode and temperature measurement circuit.
The heating circuit is periodic heating regenerates sensor surface by burning soot layer off.
IDE electrode is to test the resistance between interdigital electrodes depends on soot adsorption.
Temperature measurement circuit is to test the temperature of probe.

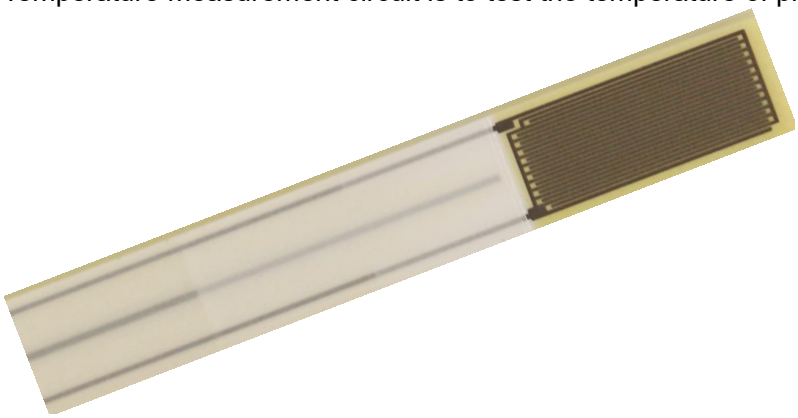


Figure 1. PM sensing element (chip)

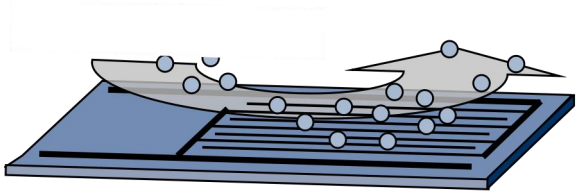


Figure 2. PM sensing element in longitudinal section view

The exhaust gas sensor for particulate matter PM-WXD consists of a probe (Figure 2) And its sensor control unit(SCU) Figure 3.
It is used to monitor the filtration Efficiency of a diesel particulate filter in the exhaust system of a diesel-engine Vehicle.
The sensing element of the PM-WXD is a planar ceramic element with Comb-shaped interdigital electrodes(IDE) on its surface, an integrated heater, and a PTC resistor for temperature measurement.
The PM-WXD measurement principle of Particulate matter(PM) is based on electric current between the comb-shaped Electrodes due to soot deposition. The response time Tr until this IDE-current exceeds A threshold is defined as the sensor signal.

Figure 3. Sensor circuit board

User Manual

The probe is designed for installation in a diesel exhaust gas system downstream of a ceramic wall-flow diesel particulate filter as shown in Figure 4. Water from outside the vehicle must not reach the probe inside the exhaust gas system. Therefore, a distance between mounting position of probe and exhaust gas outlet or other appropriate barriers has to be taken into account by the customer.

During REGENERATION the probe ceramic element is heated up quickly. Condensed water in the exhaust system could damage the hot ceramic element. The REGENERATION may be initiated only if the presence of condensed water in the exhaust gas system can be ruled out without a doubt.

In addition, the specified temperature limits must be met and condensates must be avoided. For early REGENERATION in the beginning of a MEASUREMENT phase, the probe mounting position and design must be selected in a way to minimize, or eliminate, condensed water on the exhaust gas side so that its contact with the probe is prevented.

To avoid the formation of condensation, quick heating of the exhaust gas system in the area upstream of the mounting position of probe as well as in the complete threaded area must be ensured. To avoid condensation collecting upstream of the mounting position, the probe should be mounted in an inclined section of the exhaust gas system if possible. Indentations, pockets, protrusions, separating edges, flexible tubes, etc. upstream and in case of returning water also downstream of the mounting position of probe shall be avoided.

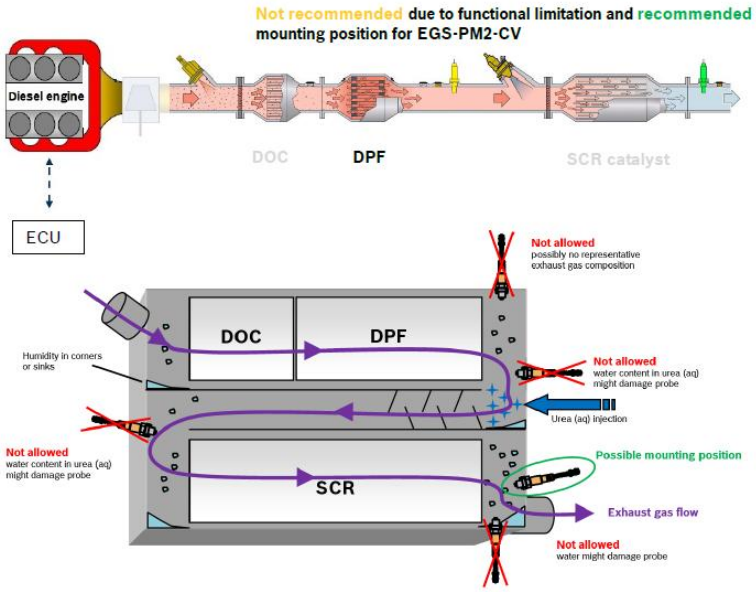


Figure 4. Typical exhaust gas system layouts for PM snesor

For illustration some examples for **not** recommended and recommended mounting positions are added

a) The probe is installed behind or in case of returning water in front of a position where water can collect, e.g. a siphon tube, a sink, indentations, pockets, protrusions, separating edges, flexible tubes. High amounts of condensation water can be collected here or can return from there. This installation is not recommended.
b) Water downstream of the mounting position can return to the mounting position caused by force of gravity. This installation is not recommended.
c) In horizontal exhaust gas tube, only a thin water film is expected.
d) Tube junction where the water film can tear off and build water droplets. The probe orientation to-wards exhaust gas flow is undefined. This installation is not recommended.
e) The probe is installed in a tube connection, outside of the main exhaust gas stream. The installation point will be heated up slowly. Exhaust gas flow direction is undefined. This installation is not recommended.
f) In vertical exhaust gas tube only a thin water film is expected upstream of the mounting position. Downstream of the mounting position returning water is expected. Therefore, appropriate barriers have to be taken into account, e.g. drip rail or drain.
g) Escape of condensation water from the DPF or SCR must be respected. Also probe orientation towards exhaust gas flow cannot be met. This installation is not recommended.
h) Installation of the probe into the tube behind the DPF or SCR. Especially in the lower part of the DPF or SCR a lot of water can be collected. A sufficient safety margin must be respected regarding dew-point release.
i) In complex exhaust gas systems.

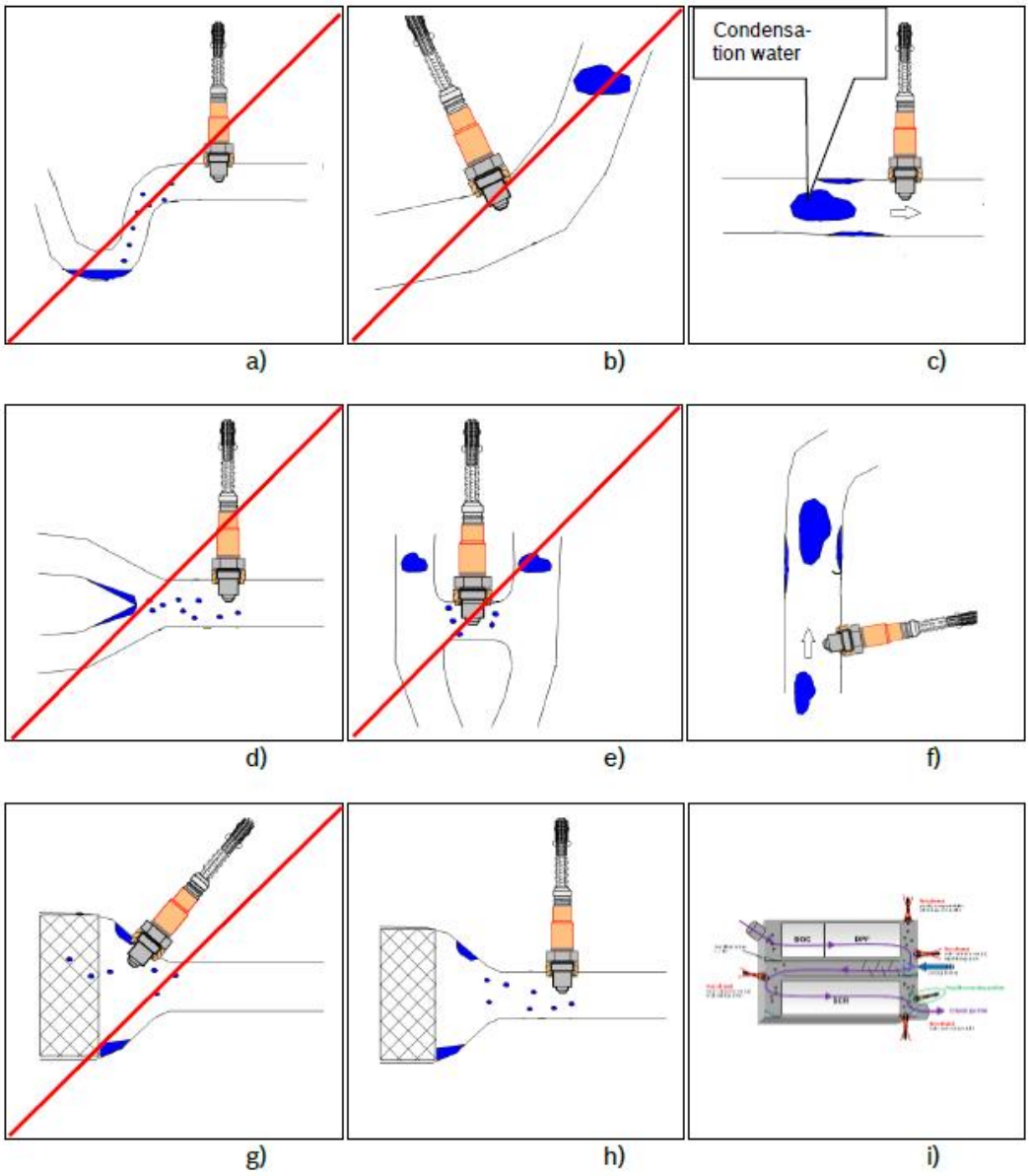
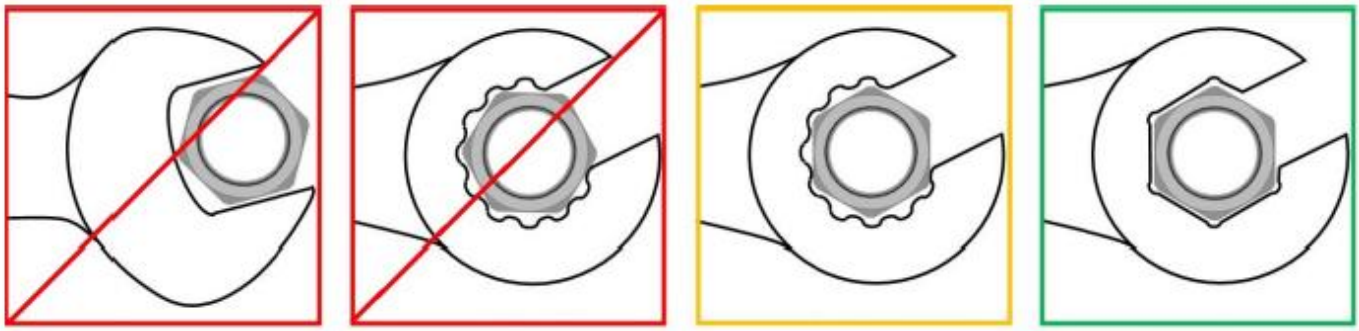


Figure 5. Not recommended and recommended mounting positions

In case of replacement of the probe, a flare nut wrench with single inner hexagon, according to DIN 3118 – 24 S, is strongly recommended (figure 6d). The inner hexagon has to grip the retaining screw at a minimum of 5 corners (figure 6c and figure 6d).

It is strongly recommended to use a tool with wave profile and spared corners to avoid damaging the hexagon corners of the retaining screw. The usage of a flare nut wrench with double inner hexagon, is unfavorable due to the lower robustness of the tool (figure 6b and figure 6c) and the risk of gripping the screw only at 4 corners (figure 6b). An engineer's wrench, like described in DIN 894/895 (figure 6a), is unsuitable for a retaining screw, because it grips the screw only at two corners. Gripping the screw at less than 5 corners increases the risk of deforming the hexagon while applying the demounting torque and therefore increases the risk that the probe cannot be demounted.



The neck and the retaining screw of the PM must match together in order to fulfill their mechanical sealing function together. Therefore the coefficients of thermal expansion shall be equal. To obtain an indication of matching materials it can be checked whether the neck is non-magnetic as it should be - e.g. by using a magnet.

If tests in vehicles or workshops shall be performed, please take care of:

• Do not heat the sensor locally by flame burner or similar workshop tools

• Keep fluids away from the sensor like AdBlue®, oil, fuel, grease, sealants etc.

• Only on screw-in thread a special high temperature resistant grease (Castrol Molub-Alloy Paste MF [previously called Castrol Optimol Paste MF] or Bostik Never Seez Regular Grade) is allowed

• Only a small amount of grease is recommended: 40mg ± 10mg; comparable in size to a peppercorn

• Apply grease to the thread only. Do not apply the grease on the sealing surface or at the connector

• Probe, cable and its individual calibrated SCU must not be separated

Then following tests can be done as a first check of the sensor:

• Visual inspection for mechanical damage

Troubleshoot

Before replacing the old PM sensor it is important to understand why it failed. Possible reasons for failures are listed below:

- Excessive soot/ash content in exhaust gas. The sensor head will be black.
- Contaminated exhaust gasses. Engine oil contamination is a common issue indicating worn out engine components.
- Lacking or excessive supply voltage due to short circuit, sudden voltage spikes or external power source.
- Direct contact with condensate during operation.

It is important to fix any of the listed issues before installing a new PM sensor otherwise the risk of repeated damage remains. If the freshly installed sensor is not recognized or does not function, please use a multimeter to see if the power supply is within 9-36 Volts (12V nominal) at the sensor connector. Please also make sure that you follow any instructions regarding PM sensor replacement issued by the manufacturer of your vehicle.

Warranty

Please make sure that all the issues from troubleshoot section have been repaired before installing GAONENG product. If evidence of any of the issues listed under troubleshoot section will be detected during warranty investigation, the claim will be rejected. Likewise, the sensor body and wiring must not bear visible signs of damage in order for the warranty to be valid. If the sensor thread or nut has sustained damage, it is evidence of excessive force that can potentially lead to failure

Figure 10. Damaged sensor thread and nut

If there are considerable stains of soot/ash on the sensor head. it is evidence of a damaged DPF or poorly calibrated engine operation. The sensor chip in this case is easily damaged therefore warranty becomes void

Figure 11. soot/ash on the sensor head

Figure 12. Urea on the sensor head

Damaged wire protector is evidence of poor handling (see Figure 13) that can result in damaged wiring. In order for the warranty to be valid there must be no signs of wire damage.

Figure 13. Damaged wire protector.

Figure 14.wiring connects to the sensor head

The area where wiring connects to the sensor head is most critical and prone to connection loss if treated poorly (see Figure 14). In case of damage, the warranty will not be valid.

Do not attempt to wash or submerge the sensor. Do not use any spraying agents. Store in dry environment only. If evidence of water will be found in the sensor head, or any chemical traces will be found on the product, the warranty will be void.