Differential Pressure Sensors – monitoring the particle filter

Exhaust differential pressure sensors monitor the full-flow particle filter in modern diesel engines. As part of reducing pollutants, the differential pressure sensor is indispensable for detecting the load and therefore determining the intervals for regular regeneration.

A downstream particle filter with sensoring is increasingly being installed in gasoline engines with direct injection, in order to comply with the legally required limit values. The sensor is usually installed on the front wall and connected to two vacuum hoses with different diameters (cannot be mixed up) via a measuring pipe before and after the particle filter.

The filter itself represents a flow resistance that changes as the load increases. The sensor contains a membrane with piezo elements on which the corresponding exhaust gas pressures act. With a low load, the pressure in front of and behind the filter is almost the same. As the load increases, the exhaust gas pressure in front of the filter increases. Since the level of the differential pressure changes depending on the engine load, the air mass sensor is also included in the calculation by the engine control unit.

Determining the correct causes of errors

If the engine control unit recognizes a defective pressure sensor as an error, it is very important to identify and eliminate the cause of the failure during the inspection by the workshop. If this does not happen, the customer often has a legitimate complaint. Here are some examples from practice.

The most common cause of failure is **damage to the tubing** between the sensor and filter. In modern vehicles, the hoses are rarely completely visible or easily accessible!

The tubing can be damaged by animal bites or, with advancing age, become porous, leaky and soft, so that it may contract and block the flow completely under slight negative pressure.

Blockages in the forward lines due to **residue** are also not uncommon. The deposits also cause problems for the sensor, causing the membrane to stick and thus display increased values even before the engine is running. The most common cause of this is a **carbonized EGR module**, which in older vehicle types does not yet have a position sensor and is therefore not recognized as a fault by the engine control unit.

Since the **air mass sensor** is also providing values to the calculations done by the engine control unit, an undetected defect may also exist here; the differential pressure sensor may therefore be incorrectly reported as being faulty.

If the vehicle has a high mileage and the **interval for changing the particle filter** has not been adhered to, you cannot avoid replacing it.

Since each regeneration produces ash that cannot be burned, this leads to clogging of the filter. The amount of ash is calculated by the engine control unit and in some cases differs significantly from the actual value. The reasons for this are **oil combustion residues** caused by mechanical errors in the crank mechanism or an **increased sulfur content in the fuel**.

Once the cause of the failure has been identified and eliminated, the sensor can be replaced. To do this, it is almost always necessary to perform a new **calibration** of the differential pressure sensor with the ECU.

Since the failure of the sensor is not always immediately recognized by the engine control unit, a **forced regeneration cycle** should be carried out before handing over the vehicle back to the customer, thus making sure the filter is clean.

GEBE

IKA Industrie- und Kraftfahrzeugausrüstung GmbH

Humboldtstraße 8
53639 Königswinter

www.ika-germany.de
sales@ika-germany.de

Electronics for the Exhaust Tract