Smooth running values and misfire detection

For troubleshooting purposes, the smooth running values of the individual cylinders are displayed. Rough running can only be evaluated when the engine is at idle. The engine temperature and load influence the values. For this reason, limit values always apply to defined operation conditions:

- Engine at regular operating temperature
- Auxiliary loads off, e.g. air-conditioning system, heated rear window

Conclusions can be drawn on the combustion quality of individual cylinders through evaluation of the crankshaft acceleration (measured by crankshaft sensor). Individual cylinders with a bad combustion performance are pinpointed. Random fluctuations in the smooth-running value of individual cylinders can only be detected through close observation of the value.

Where the engine's combustion is theoretically uniform, the smooth running values are 0 (averaged across all cylinders).

There are a number of different reasons for increased smooth-running values (e.g. misfiring, excess air, mixture deviations, malfunctions in the fuel supply system, insufficient compression pressure). It is therefore not possible to state precise control limits.

The engine speed is measured at the increment gear with the assistance of the crankshaft sensor.

As well as recording the engine speed, smooth running of the engine (= misfire detection) is monitored.

For misfire detection, the increment gear in the DME control unit is split into 4 segments according to the ignition interval (between 2 ignitions). The period duration of the individual segments is measured by the DME control unit and "statically" evaluated. The maximum permissible values for irregular operation are stored (as a function of engine speed, load and engine temperature).

If these values are exceeded for a specific number of combustion cycles, a fault code memory entry is stored where a faulty cylinder has been detected.

Poor-road-surface detection

The poor-road-surface detection detects poor-road operation on bad surfaces (stony surfaces, gravel or potholes) by means of the communicated wheel acceleration.

With poor-road-surface detection, a fault is stored and the misfire detection briefly suppressed.
This is necessary as vibrations in the drive train caused by poor-road surfaces can cause errors in the misfire detection.

Conversely, the effect of poor-road-surface detection may also be delayed (only takes effect once misfiring has been mistakenly identified). In this case, an incorrect diagnosis of combustion misfiring is identified with the assistance of the poor-road-surface detection.

Lambda adaptation

Lambda adaptation serves to compensate for component tolerances and effects of ageing which affect the mixture. Factors such as unmetered air and fuel delivery pressure also affect lambda adaptation (partial compensation). For these reasons, it is not possible to give exact control limits for a fault.

The following differences are made in lambda adaptation:

- Additional mixture adaptation
- Multiplicative mixture adaptation

Additional mixture adaptation works at idling speed and in the range close to idling speed. Its influence decreases with increasing engine speed. An important factor is, for example, unmetered air.

Multiplicative mixture adaptation works across the entire map. An important factor is, for example, the fuel delivery pressure.

Catalytic converter system test

The catalytic converter has the ability to store oxygen. The oxygen stored in the lean range is used either partially or wholly in the rich range. Ageing and environmental influences reduce the ability of the catalytic converter to store oxygen. As this happens, the degree to which hydrocarbons are converted is also reduced. According to legal requirements, hydrocarbon emissions must not exceed a certain limit. The ability of the catalytic converter to store oxygen is therefore also a way of monitoring the observation of emissions limits.

During the system test, rich exhaust gas flows through the catalytic converter. Rich exhaust gas is low in oxygen. This means that the amount of oxygen stored in the catalytic converter is reduced. After this, lean exhaust gas flows through the catalytic converter. Lean exhaust gas is rich in oxygen. This means that the amount of oxygen stored in the catalytic converter is increased. When the catalytic converter's capacity for storing oxygen has been reached, the oxygen content in the exhaust gas downstream of the catalytic converter increases again.

The system test measures when the capacity for storing oxygen has been reached. The catalytic converter is better, the more oxygen it can absorb.