## Lesson 3

### Service Functions via IDS (Integrated Diagnostic System)

**Parameter reset after renewing various components**

A parameter reset must be performed in the PCM (powertrain control module) after renewing the following components:

- DPF (diesel particulate filter)
- DPF differential pressure sensor

**Static regeneration**

This function must be executed if diagnosis reveals an overloaded DPF. Using this function, IDS initiates the active regeneration process without the vehicle having to be driven.

**Exhaust gas temperature overheating protection**

The exhaust gas temperature overheating protection is activated if the exhaust gas temperature in the oxidation catalytic converter exceeds approx. 790 °C (1,454 °F).

Overheating can result in the following faults, for example:

- Leaking fuel injector nozzles in one or more fuel injectors,
- leaks in the engine oil circuit at the intake or exhaust tract (for example caused by a leak at the TC (turbocharger)).

If the programmed exhaust gas temperature limit is exceeded, the exhaust gas temperature overheating protection limp-home mode is activated and the following measures are initiated by the PCM:

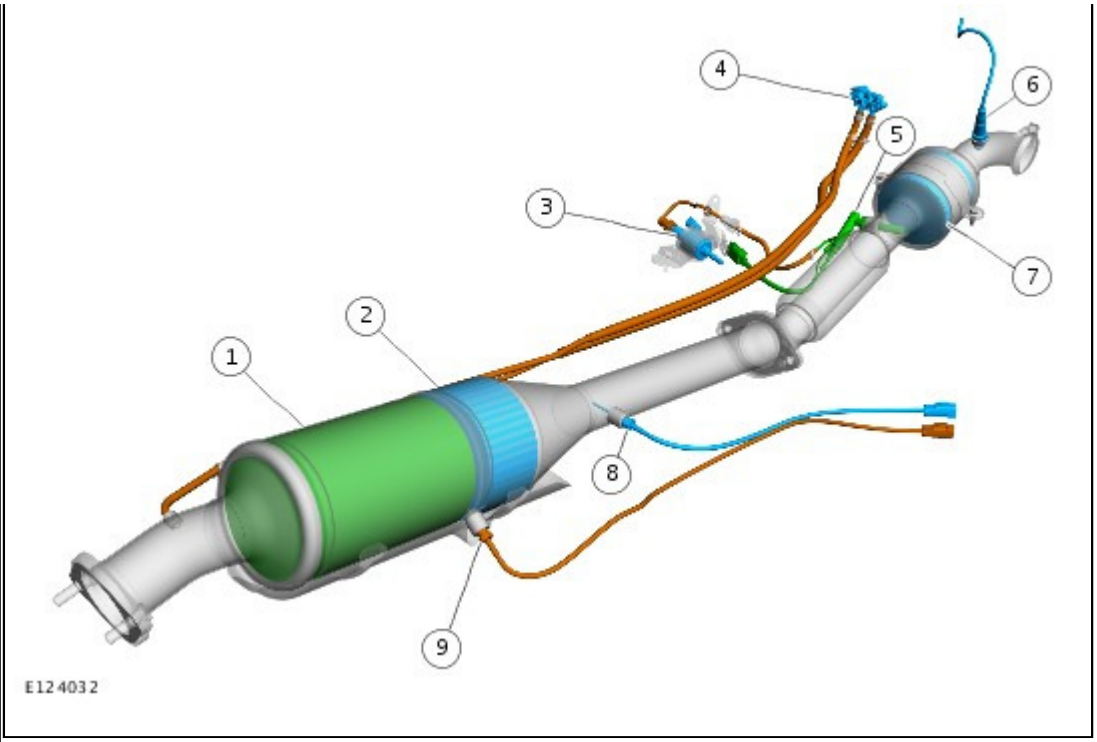
- The emissions warning indicator (MIL) and the malfunction indicator lamp are switched on and a text message is sent to the instrument cluster,
- the EGR (exhaust gas recirculation) system is switched off,
- the fuel pressure is reduced,
- the torque is reduced,
- juddering of the engine is initiated.

The PCM independently switches off the engine if this has not been done by the driver after a certain amount of time. The engine can then only be restarted once a certain amount of time has elapsed since it was switched off.

The exhaust gas temperature overheating protection limp-home mode is deactivated

- if a certain amount of time has elapsed since the engine was switched off or
- the exhaust gas temperature overheating protection **service function** was executed with IDS.

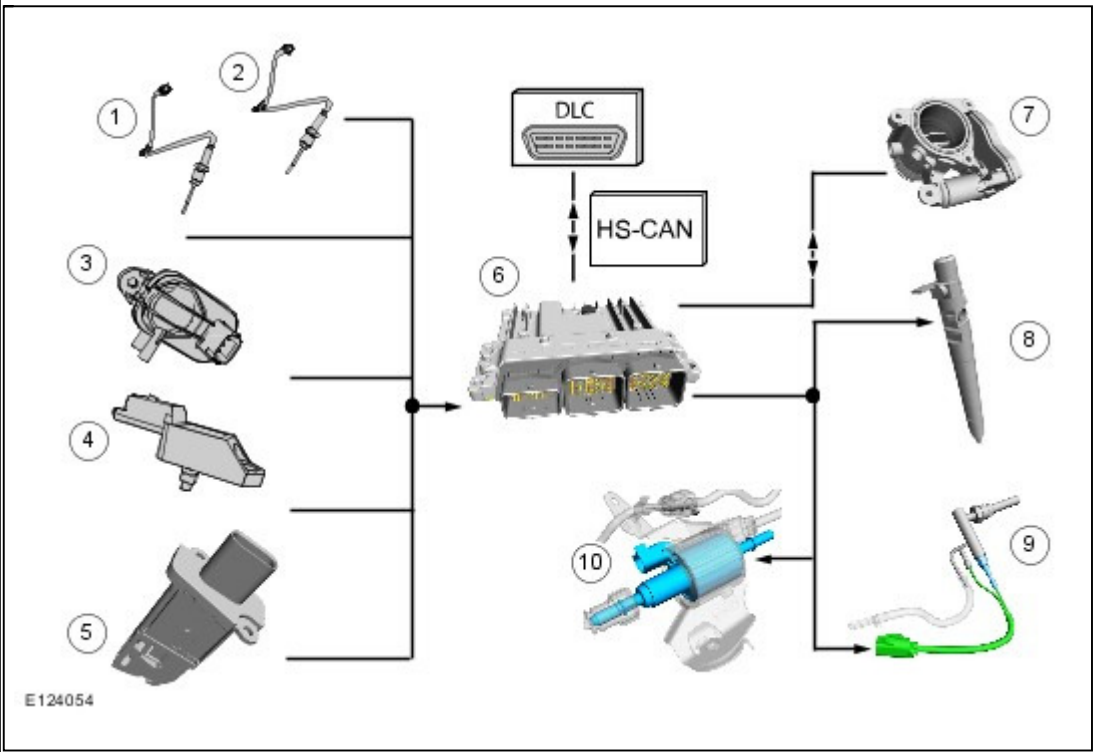
**Overview of the DPF**




1 DPF
2 Oxidation catalytic converter for DPF
3 Fuel vaporizer system fuel pump
4 Differential pressure sensor for DPF
5 Fuel vaporizer
6 HO2S (heated oxygen sensor)
7 Oxidation catalytic converter
8 Exhaust gas temperature sensor for oxidation catalytic converter for DPF
9 Exhaust gas temperature sensor for DPF

**System Control – DPF – Overview**

Example on the 2.2L Duratorq-TDCi (DW) diesel engine

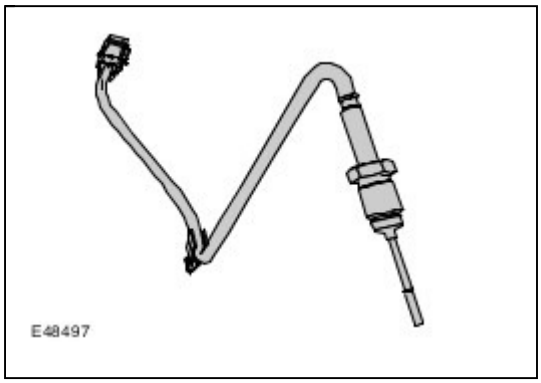


1 Exhaust gas temperature sensor for oxidation catalytic converter for DPF
2 Exhaust gas temperature sensor for DPF
3 Differential pressure sensor for DPF
4 MAPT (manifold absolute pressure and temperature) sensor
5 MAF (mass air flow) sensor
6 PCM
7 Electric intake manifold flap unit
8 Fuel injector
9 Fuel vaporizer
10 Fuel vaporizer system fuel pump

## Exhaust Gas Temperature Sensors

### Purpose and function

The exhaust gas temperature of at least 550 °C to 600 °C (1,022 °F to 1,112 °F) required for the oxidation of the **deposited** diesel particulates is detected by two exhaust temperature sensors and transmitted to the PCM.




## Differential Pressure Sensor for DPF

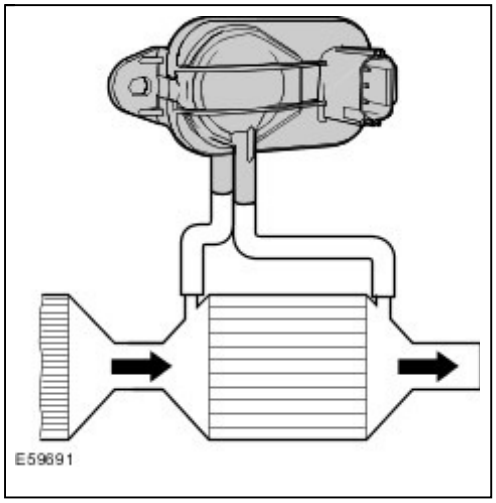
### Purpose and function

The differential pressure sensor for the diesel particulate filter measures the current exhaust gas pressure upstream and downstream of the DPF in the exhaust gas flow.

The soot particles and ash collected in the DPF result in a change in pressure in the exhaust gas stream upstream and downstream of the DPF. The change in pressure is used by the PCM as an input parameter for determining soot load.

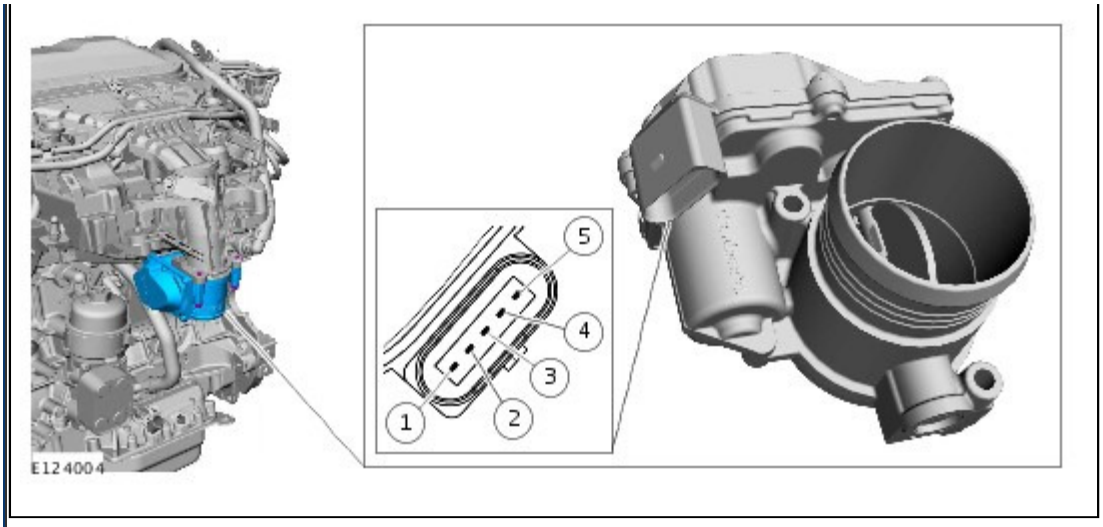
For this purpose, there is a pipe connection upstream and downstream of the particulate filter.

In addition, the diesel particulate filter differential pressure sensor is **used for fault diagnosis**.




## Intake Manifold Flap Unit

### Purpose and function




1 Position sensor reference voltage (approx. 5 V)
2 Position sensor output signal
3 Position sensor ground
4 DC (direct current) actuator motor ground
5 DC actuator motor voltage supply

The intake manifold flap is partially closed as required during the **active** regeneration process. This helps to increase the exhaust gas temperature.

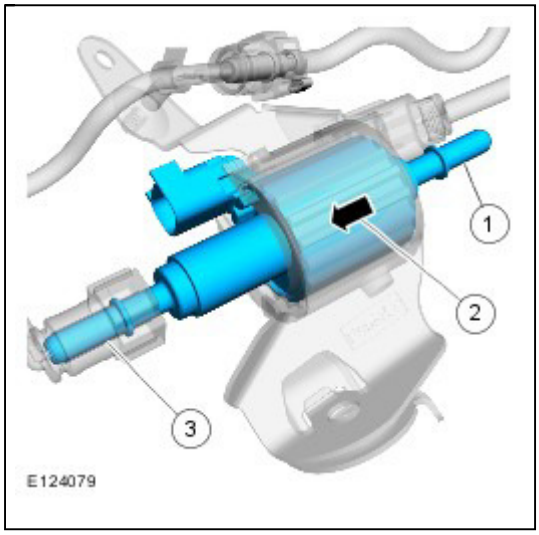
## Fuel Vaporizer System Fuel Pump

### Purpose and function

The fuel pump for the fuel vaporizer system is a reciprocating piston pump. The pump stroke is generated electromagnetically.

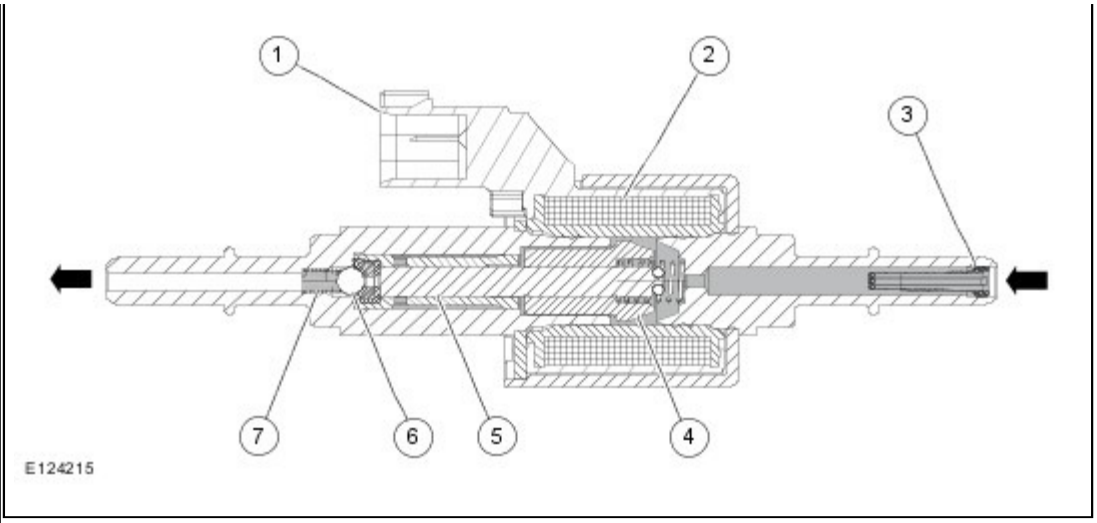
One side of the fuel pump is connected to the fuel return of the common rail system via a fuel line.

The other side is connected to the evaporator core chamber of the fuel vaporizer.




1 Connection for fuel line from the fuel tank
2 Direction of fuel flow
3 Connection for the fuel line to the fuel vaporizer

Fuel pump for fuel vaporizer system in rest state

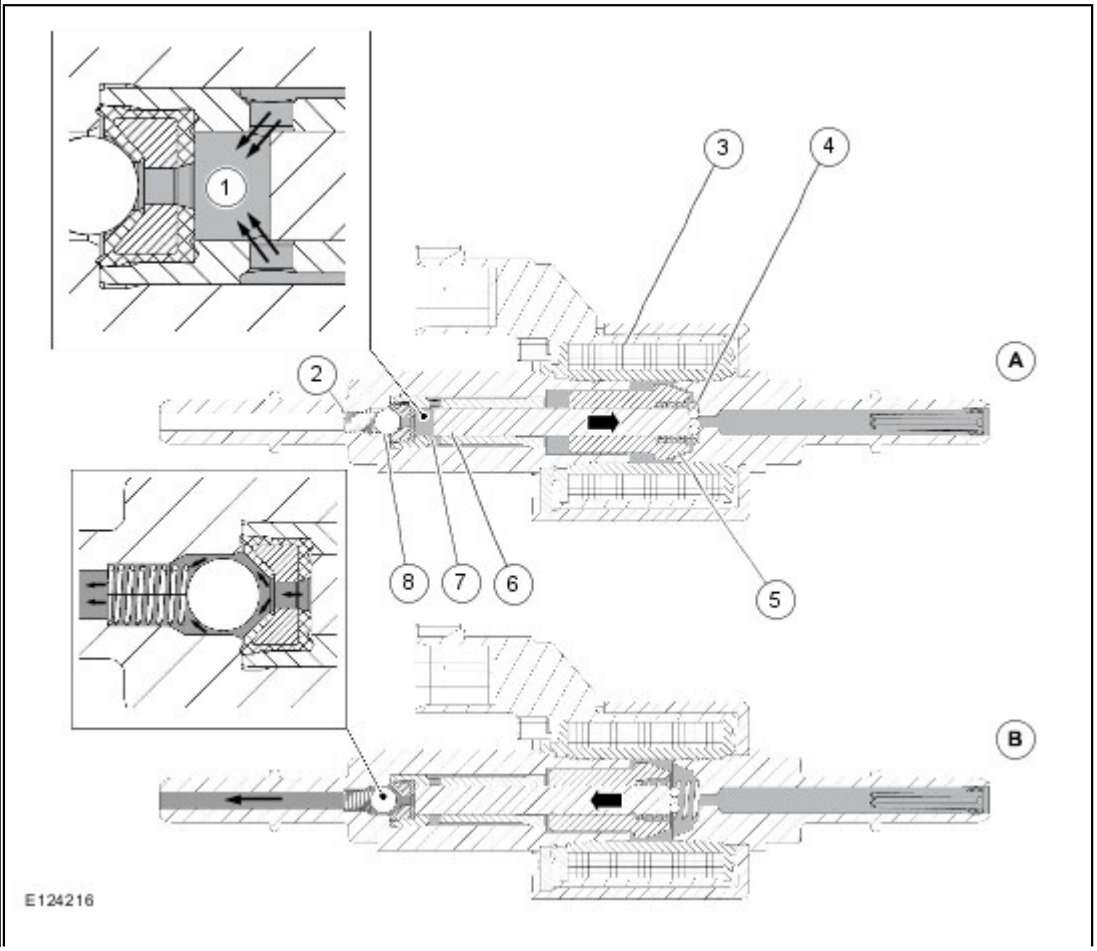



1 Electrical connector
2 Coil
3 Fine screen in the fuel inlet
4 Solenoid armature
5 Plunger
6 Valve ball
7 Compression spring for valve ball

All cavities are always filled with fuel (grey shadow effect).

In rest state (the coil is not actuated by the PCM), the valve ball is pressed into its seat by the spring force of the compression spring. This means that no fuel can reach the fuel vaporizer.

Function



A Fuel intake
B Fuel delivery
1 Pressure chamber
2 Compression spring for valve ball
3 Coil
4 Compressed spring for solenoid armature
5 Solenoid armature
6 Plunger
7 Annular channel
8 Valve ball

When the solenoid coil is energized, the solenoid armature pulls the reciprocating piston against the solenoid armature compression spring to the right.

The reciprocating piston opens an annular channel during this process. The movement of the reciprocating piston to the **right draws** fuel into the pressure chamber via the annular channel.

The PCM de-energizes the coil again for **fuel delivery**.

The reciprocating piston is then pushed to the **left** by the compression spring of the solenoid armature.

Once the end of the reciprocating piston has completely sealed the annular channel, the reciprocating piston starts building up pressure in the pressure chamber.

The valve ball opens as soon as the fuel pressure in the pressure chamber has exceeded the spring force of the valve ball compression spring. The fuel from the pressure chamber is then forced into the fuel line to the fuel vaporizer.

The PCM actuates the fuel pump with a permanently defined frequency. As a result the process keeps repeating.

The frequency with which the fuel pump is actuated depends on the operating state of the engine. It can be from 2 Hz (at idle) to 14 Hz (during acceleration).

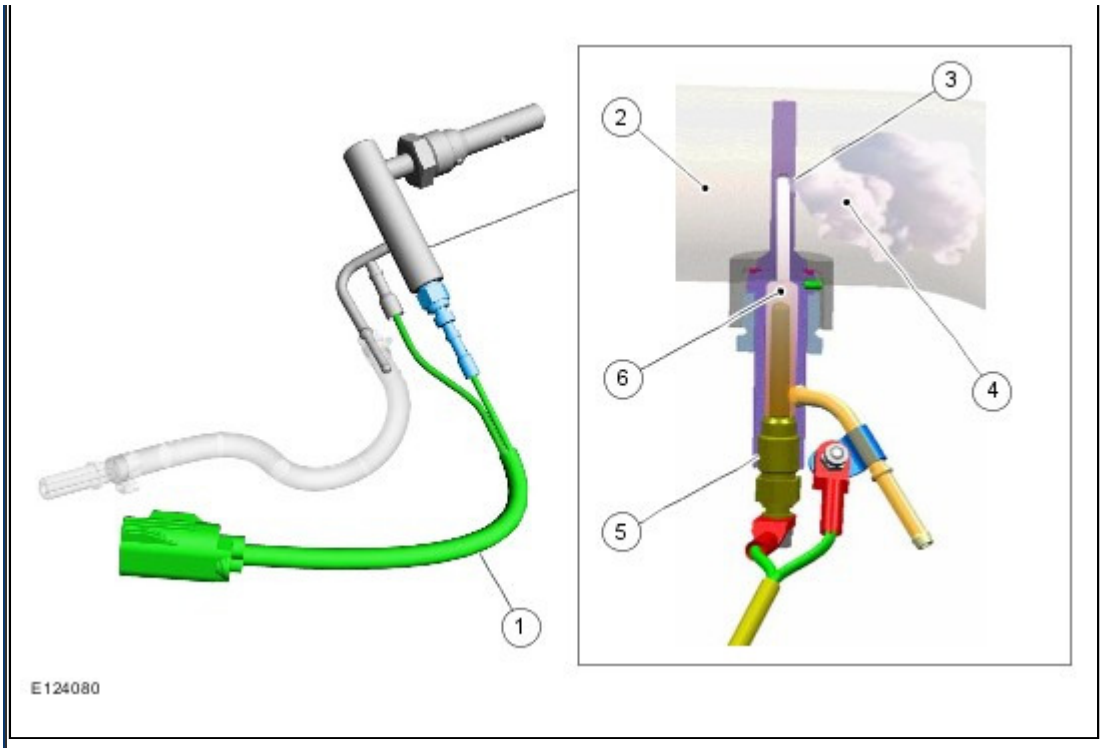
The pump delivers fuel to the fuel vaporizer for the duration of the regeneration process.

**Effects of faults**

If the pump is defective, active regeneration can no longer be carried out. The result is an overloaded through to a blocked DPF.

## Fuel Vaporizer

**Purpose and function**




1 Electrical connection for glow plug for fuel vaporizer
2 Exhaust pipe
3 Fuel outlet bore
4 Fuel vapor
5 Glow plug
6 Fuel vaporizer chamber

At the start of the regeneration process, the glow plug in the fuel vaporizer is actuated by the PCM.

A few seconds later, the fuel vaporizer system fuel pump delivers fuel to the fuel vaporizer chamber.

The delivered fuel flows past the heated glow plug, vaporizing in the process. The vaporized fuel then flows into the exhaust tract via the outlet bore.

The fuel is admitted into the fuel vaporizer chamber at a pressure of less than 2 bar.

NOTE: For the **active** regeneration process, the exhaust gas temperature must be at least 350 °C (662 °C) so that the fuel vaporized by the fuel vaporizer can effectively react in the second oxidation catalytic converter. This minimum exhaust gas temperature is, however, not always attained depending on the engine's operating condition. It can therefore still be necessary to increase the exhaust gas temperature by means of internal engine measures.

**Notes on the Oil Change Interval**

With frequent journeys in the lower part load range, the maximum number of existing measures must usually be taken to attain the exhaust gas temperature necessary for an active regeneration.

The intervals between the individual regeneration processes are then also shorter, so that the maximum number of available measures have to be taken more often.

The use of a fuel vaporizer means that the number of second post-injections, which greatly dilute the oil, can be **largely** reduced during active regeneration of the DPF.

It can nevertheless happen that in **extreme cases**, an oil change must be carried out ahead of schedule due to falling oil quality.

An **oil quality calculation strategy** has been implemented in the PCM software to detect excessively diluted engine oil.

**Frequent journeys at low vehicle speeds:**

- In urban traffic, for example, all available measures must be taken to achieve the exhaust gas temperature required to initiate active regeneration of the DPF. These measures include post-injections.
- Journeys of this type also lead to increased diesel particulate emissions and thus faster saturation of the DPF. This shortens the regeneration intervals and the post-injections are used with corresponding frequency.

The oil quality calculation strategy calculates the oil quality of the engine oil taking into consideration the measures for increasing the exhaust gas temperature during the regeneration processes.

If the PCM detects excessively diluted engine oil on the basis of the calculation, an appropriate text message in the instrument cluster indicates that the engine oil needs to be changed.

NOTE: After **each oil change**, the parameters for the oil quality calculation strategy must be reset (see the current workshop literature for further instructions).