

Air supply

The 4-cylinder N12 petrol engine is a naturally aspirated engine with Valvetronic (see also chapter 'Valvetronic').

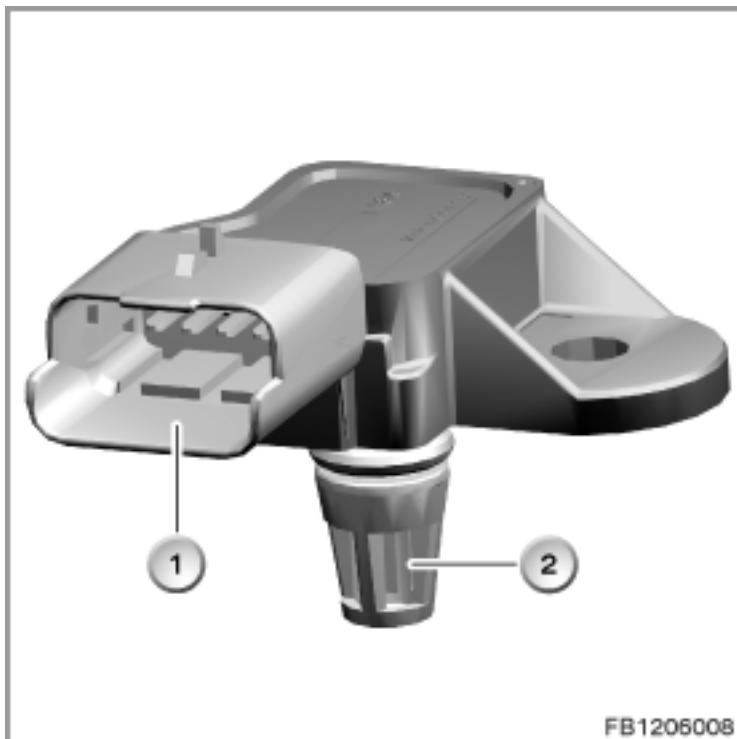
The intake strokes of the pistons create periodic pressure waves in the intake pipe. These pressure waves travel along the inlet pipe and are reflected by the closed inlet valves. The fact that the length of the intake pipe is precisely geared to the timing of the valves has the following effect: shortly before the intake valve closes, a pressure peak of the reflected air wave reaches the intake valve. This has a supercharging effect which pumps a higher proportion of fresh air into the cylinder.

Brief description of components

The following components are described for the air supply:

Intake temperature and differential pressure sensor

The intake temperature and differential pressure sensor are located on the air collector for intake air. The sensor delivers the temperature and differential pressure of the air in the intake system to the DME control unit.



Index	Explanation	Index	Explanation
-------	-------------	-------	-------------

1	4-pin plug-in connection	2	Intake temperature and charge-air pressure sensor
---	--------------------------	---	---

The air pressure reaches the evaluation element through a bore hole on the outside of the sensor. The air intake pressure affects the opposite side, enabling the sensor to detect the differential pressure. The sensor is supplied with 5 Volts and earth by the DME. The information of the differential pressure is sent to the DME across a signal cable.

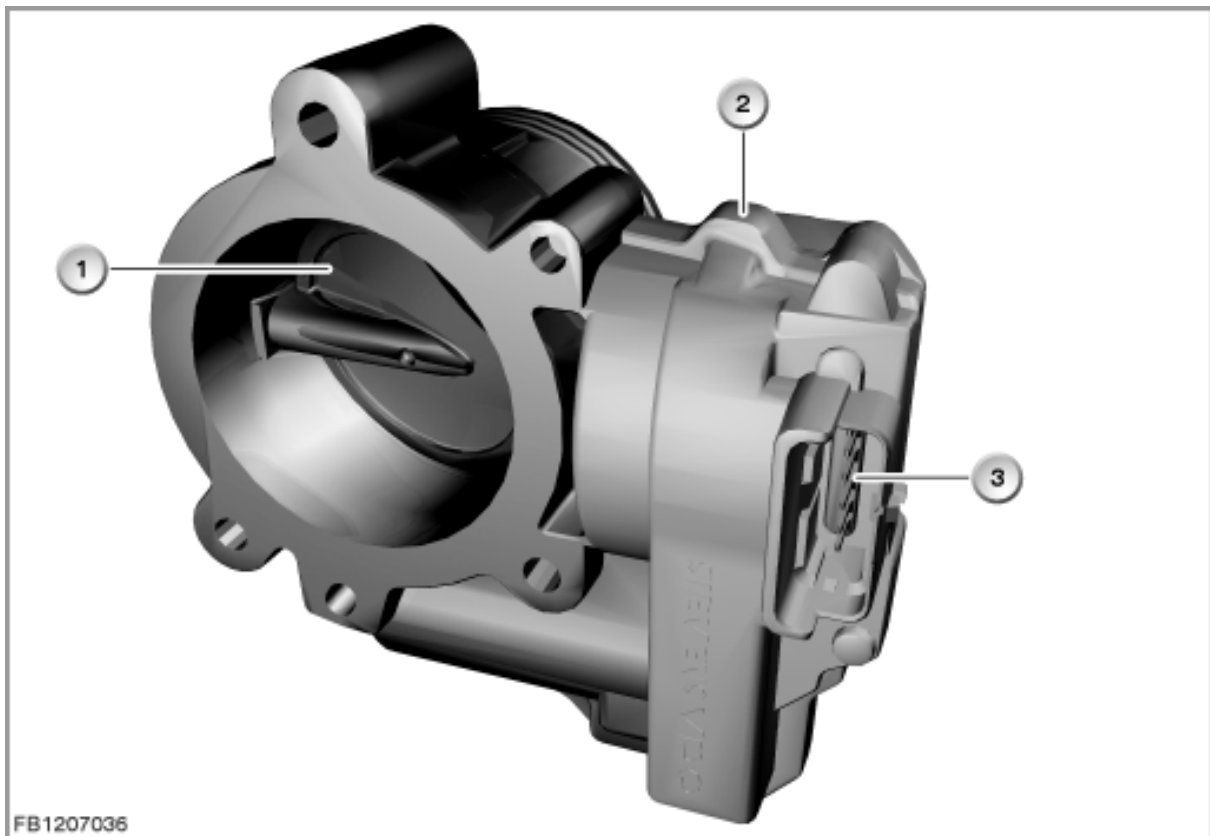
The signal for evaluation of differential pressure fluctuates depending on the pressure. The measuring range of approx. 0.5 to 4.5 Volts corresponds to a differential pressure of 20 kPa (0.2 bar) to 250 kPa (2.5 bar).

The DME control unit uses the sensor signal to calibrate the position of the throttle valve.

Throttle-valve actuator

The throttle-valve actuator is secured to the air collector for intake air.

The DME control unit calculates the position of the throttle valve: from the position of the accelerator pedal as well as the torque request from other control units. The position of the throttle valve is monitored in the throttle-valve actuator without contact by 2 Hall sensors. The throttle-valve actuator is electrically opened or closed by the DME control unit.



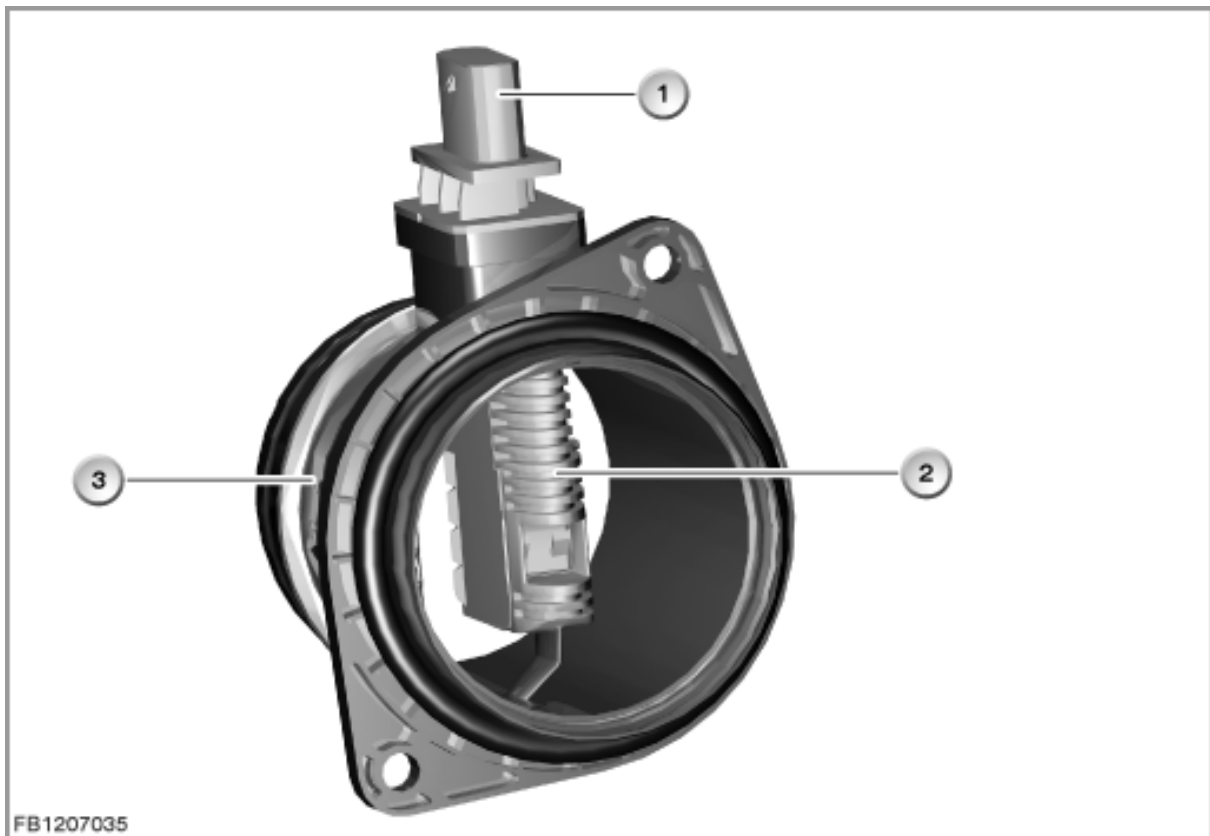
Index	Explanation	Index	Explanation
1	Throttle valve	2	Throttle-valve actuator
3	6-pin plug-in connection		

The throttle-valve actuator is supplied with 5 Volts and earth by the DME. Two data lines ensure a redundant information signal of the throttle-valve position to the DME.

Hot-film air-mass sensor, only US version

The hot-film air-mass sensor is used in the US version. This increases the accuracy of the load identification. The measure is necessary due to exhaust emissions legislation. The signal of the intake air temperature sensor in the HFM is not used.

The hot-film air-mass sensor is behind the intake muffler.



Index	Explanation	Index	Explanation
1	4-pin plug-in connection	2	Hot-film air mass meter
3	Housing		

System functions

The following system function is described for the air supply system:

Calculation of the air mass

The air mass that is taken in is no longer measured directly with the mass air flow sensor, rather it is calculated by the DME. A filling calculation (filling model) has been programmed in the DME for this calculation. The following signals are included in this calculation:

- VANOS setting (load identification)
- Intake-air temperature (correction of air density)
- Engine speed (cylinder fill levels)

- Air intake pressure (correction for choke action)
- Ambient pressure (air density divided by altitude correction)

The air mass calculated in this way is synchronised with:

- Signal of the oxygen sensor (fuel-air ratio)
- Fuel injection period (volume of fuel)

If necessary, the calculated air mass is corrected. In the event of failure of the oxygen sensor, a fault is entered in the fault code memory of the DME (plausibility check of the air mass). In this case, there is no adjustment of the calculated air mass.