**ENGINE 157.9 in MODEL 212, 218**
**ENGINE 278.9 in MODEL 207, 212, 218**

**Function requirements for charging - general**
- Circuit 87 M (engine timing ON)
- Engine running

**Forced induction, general**
The cylinder charging efficiency is improved as a result of forced induction. This raises the engine torque and engine power.
The fuel quantity corresponding to the increased air mass is metered by the ME-SFI [ME] control unit (N3/10).
With forced induction, the flow energy of the exhaust gases is used to drive the turbocharger.
The turbochargers draw fresh air through the air filters into the compressor inlets, from where it passes through the compressor outlets in the charge air pipes to the charge air cooler.
Due to the high rotational speed of the compressor impellers and the resulting high volume flow rates, the intake air becomes compressed in the charge air pipes.
The compressed charge air flows via the charge air pipes upstream of the charge air cooler to the charge air cooler. This finally cools the air which was heated by the compression and leads it over the charge air pipe to the intake manifold.

**Forced induction function sequence**
The function sequence is divided into the following subfunctions:
- **Function sequence for boost pressure control**
- **Function sequence for charge air cooling**

**Function sequence for boost pressure control**
The boost pressure control occurs electropneumatically via the boost pressure control pressure transducer (Y31/5). The vacuum is generated by the mechanical vacuum pump attached to the engine. The pressure transducer is actuated dependent on the characteristics map and the load by the ME-SFI [ME] control unit for the purposes of boost pressure control. To do this the ME-SFI [ME] control unit evaluates the following sensors and functions of the engine timing system:
– charge air temperature sensor (B17/8)
– pressure sensor downstream of air filter, left cylinder bank (B28/4)
– pressure sensor downstream of air filter, right cylinder bank (B28/5)
– pressure sensor upstream throttle valve (B28/6), boost pressure
– pressure sensor downstream throttle valve (B28/7), intake manifold pressure
– accelerator pedal sensor (B37), load request made by driver
- crankshaft Hall sensor (B70), engine speed
– knock control, transmission overload protection, overheating protection

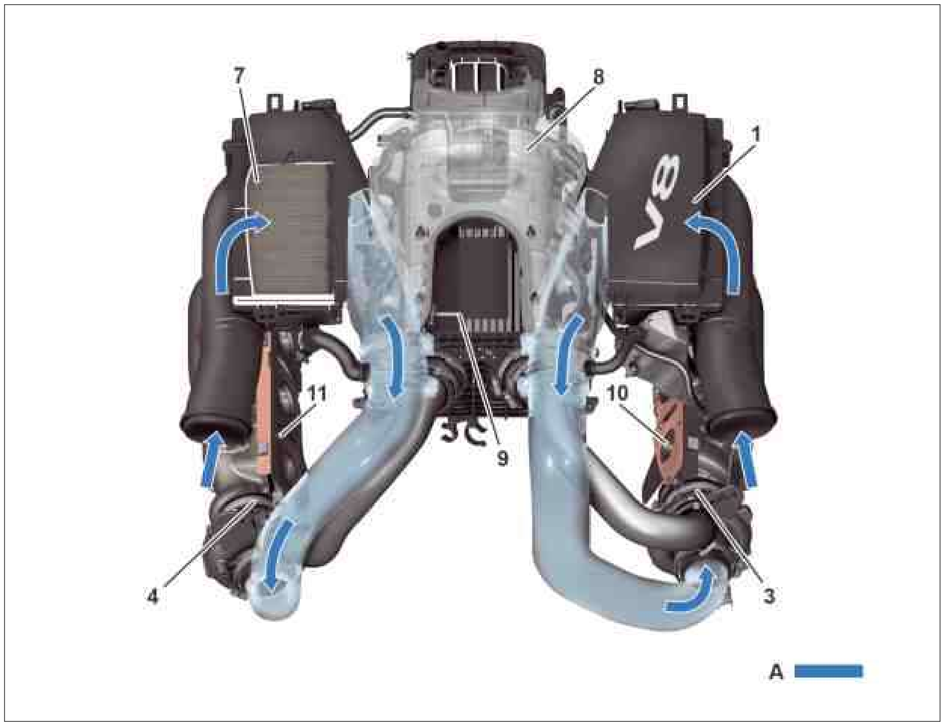
In full-load range, the maximum boost pressure is built up.
To reduce the boost pressure, the exhaust flows that drive the turbochargers are each redirected through bypasses by opening the boost pressure control flaps.
To do this the boost pressure regulator actuates the boost pressure control flap vacuum cell with vacuum from the vacuum pump. The vacuum cells react by closing the boost pressure control flaps over a rod, which close the bypasses. If there is no vacuum at the vacuum cells then the boost pressure control flaps and thus also the bypasses are opened.
The boost pressure control flaps therefore allow the exhaust flow to bypass the turbine wheels (bypass), thus controlling the boost pressure and limiting the turbine speed.
In this way the boost pressure can be adapted to the current load demand on the engine.
If there is leakage in the line between the vacuum pump and the vacuum cells then no build up of boost pressure is possible.
To monitor the current boost pressure, the pressure sensor upstream of the throttle valve sends the corresponding voltage signal to the ME-SFI [ME] control unit.
The pressure sensors downstream of the air filter serve to allow the ME-SFI [ME] control unit to monitor the charging.
The charge air temperature is detected in the charge air distributor by the intake air temperature sensor and transmitted to the ME-SFI [ME] control unit in the form of a voltage signal.

i The boost pressure control function can only be assessed if the "boost pressure control adapted" message is displayed with the Xentry diagnosis.
If the ME-SFI [ME] control unit or one of the turbochargers is replaced, a longer driving distance is required in certain operating conditions, in order to allow the ME-SFI [ME] control unit to perform the adaptation.

If the hose lines are leaky between the vacuum cells, boost pressure control pressure transducer and charge air cooler of the RH cylinder bank, a "boost pressure too high" fault is stored in the ME-SFI [ME] control unit. Quick load requirements below the basic charge pressure are controlled via the throttle valve actuator (M16/6).

**Shown: the flow pattern of the intake air**

| | |
|---|---|
| *1* | *Left air filter housing* |
| *3* | *Left turbocharger* |
| *4* | *Right turbocharger* |
| *7* | *Right air filter housing* |
| *8* | *Charge air distributor* |
| *9* | *Charge air cooler* |
| *10* | *Exhaust manifold on the left* |
| *11* | *Exhaust manifold on the right* |
| *A* | *Intake air* |

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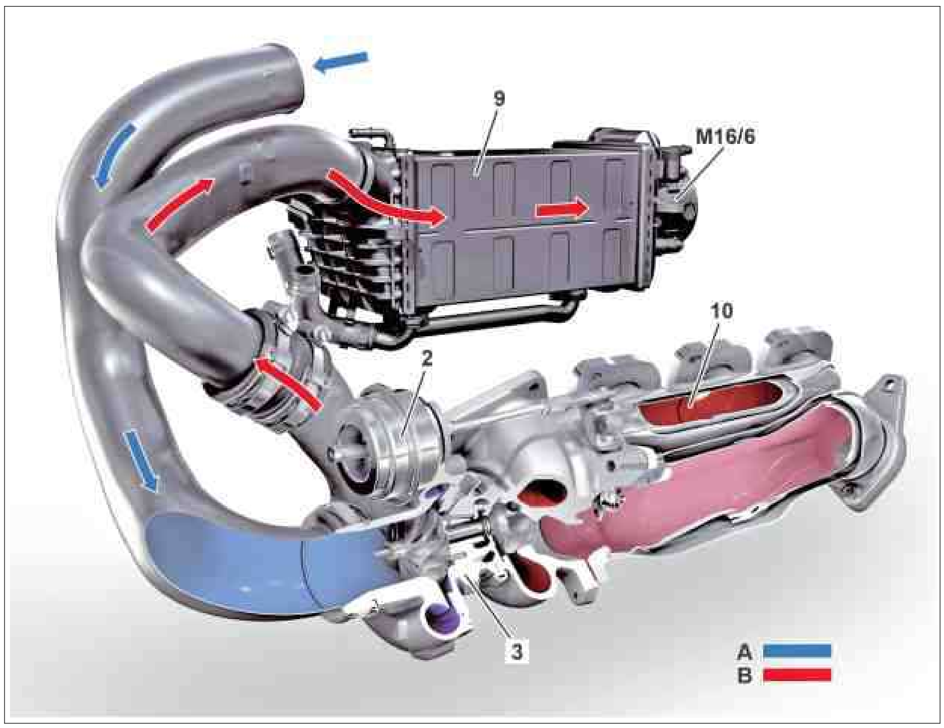
**Shown: flow pattern of the intake air/charge air**

| | |
|---|---|
| *2* | *Vacuum cell (boost pressure control flap)* |
| *3* | *Left turbocharger* |
| *9* | *Charge air cooler* |
| *10* | *Exhaust manifold on the left* |
| *M16/6* | *Throttle valve actuator* |
| *A* | *Intake air* |
| *B* | *Charge air (uncooled)* |

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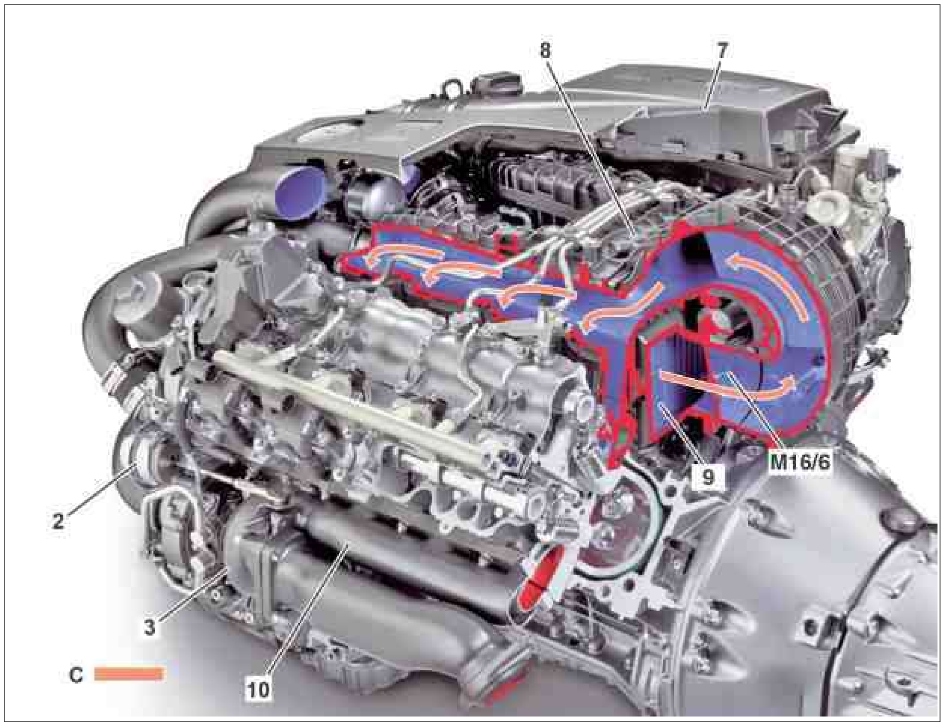
**Shown: flow pattern of the charge air**

| | |
|---|---|
| *2* | *Vacuum cell (boost pressure control flap)* |
| *3* | *Left turbocharger* |
| *7* | *Right air filter housing* |
| *8* | *Charge air distributor* |
| *9* | *Charge air cooler* |
| *10* | *Exhaust manifold on the left* |
| *M16/6* | *Throttle valve actuator* |
| *C* | *Charge air (cooled)* |

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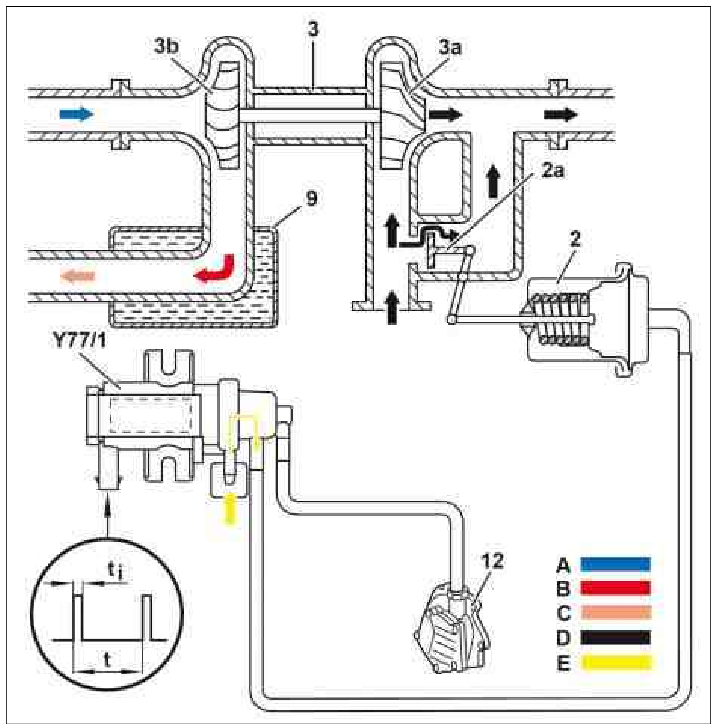
**Shown: boost pressure control shown with a duty cycle of ($t_i$) <5%**

| | |
|---|---|
| *2* | *Vacuum cell (boost pressure control flap)* |
| *2a* | *Boost pressure control flap* |
| *3* | *Left turbocharger* |
| *3a* | *Turbine wheel* |
| *3b* | *Compressor impeller* |
| *9* | *Charge air cooler* |
| *12* | *Mechanical vacuum pump* |
| *Y31/5* | *Boost pressure control pressure transducer* |
| *A* | *Intake air* |
| *B* | *Charge air (uncooled)* |
| *C* | *Charge air (cooled)* |
| *D* | *Exhaust* |
| *E* | *Atmospheric pressure (atmospheres)* |
| *t* | *Time* |
| *$t_i$* | *Duty cycle* |

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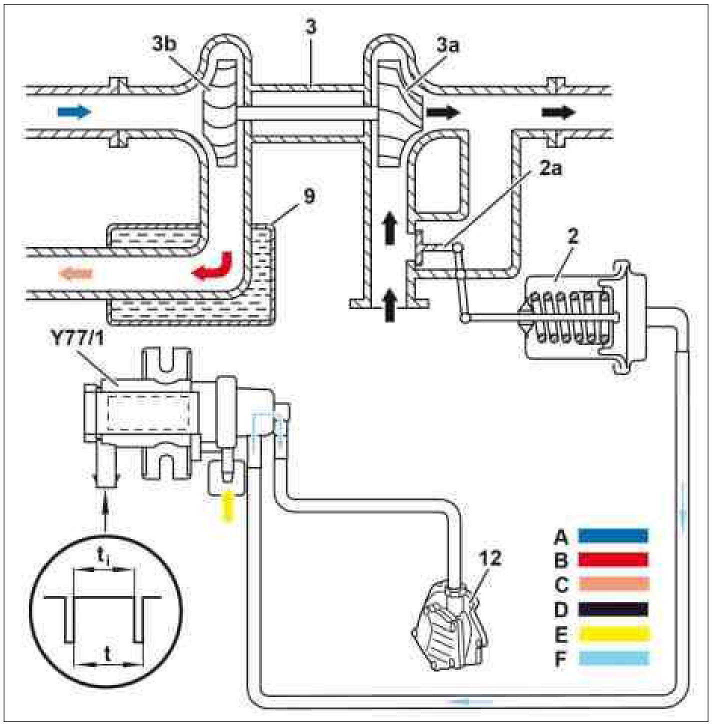
**Shown: boost pressure control shown with a duty cycle of ($t_i$) >5%**

| | |
|---|---|
| *2* | *Vacuum cell (boost pressure control flap)* |
| *2a* | *Boost pressure control flap* |
| *3* | *Left turbocharger* |
| *3a* | *Turbine wheel* |
| *3b* | *Compressor impeller* |
| *9* | *Charge air cooler* |
| *12* | *Mechanical vacuum pump* |
| *Y31/5* | *Boost pressure control pressure transducer* |
| *A* | *Intake air* |
| *B* | *Charge air (uncooled)* |
| *C* | *Charge air (cooled)* |
| *D* | *Exhaust* |
| *E* | *Atmospheric pressure (atmospheres)* |
| *F* | *Vacuum* |
| *t* | *Time* |
| *$t_i$* | *Duty cycle* |

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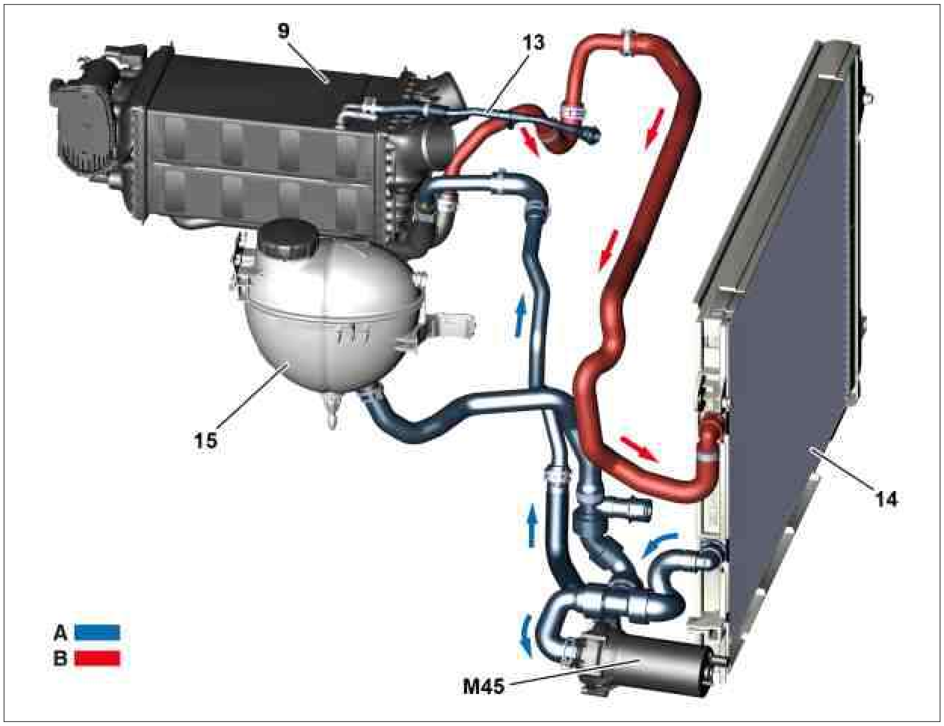
**Function sequence for charge air cooling**
Through charge air cooling the charge air temperature is kept < 60°C (for engine 278) or < 65°C (for engine 157) for a 20°C ambient temperature.
The cooled air downstream of the charge air coolers has a higher density. This increases the cylinder charge, and therefore engine performance. The tendency to knock is also reduced and also the tendency to generate nitrogen oxide (NOx) is reduced by low exhaust temperatures.
Both cylinder banks are fitted with a common water/charge air cooler. The water/charge air cooler is attached to the low temperature cooling circuit with the low-temperature cooler and the coolant circulation pump (M45).
The circulation pump is actuated through the charge air cooler circulation pump relay (K60) by the ME-SFI [ME] control unit (N3/10), once the charge air temperature is >35°C.
If the charge air temperature falls below 25°C, the coolant circulation pump is switched off again.
The charge air temperature is detected in the intake manifold by the charge air temperature sensor and sent to the ME-SFI control unit as a voltage signal.

ℹ Only open the cap on the low-temperature coolant circuit when the charge air temperature is increased (lack of power) and the engine is cold.
The coolant must reach up to the cap.

**Shown: charge air cooler coolant circuit**

| | |
|---|---|
| *9* | *Charge air cooler* |
| *13* | *Vent line* |
| *14* | *Low-pressure cooler* |
| *15* | *Expansion reservoir* |
| *M45* | *Coolant circulation pump* |
| *A* | *Coolant feed* |
| *B* | *Coolant return flow* |

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| | | | |
|---|---|---|---|
| | Electrical function schematic for charging | MODEL 207<br>MODEL 212<br>Model 218 | PE09.00-P-2050-97EAI<br>PE09.00-P-2050-97DAK<br>PE09.00-P-2050-97XAC |
| | Overview of system components for gasoline injection and ignition system with direct injection | ENGINE 157.9 in MODEL 212, 218<br>ENGINE 278.9 in MODEL 207, 212, 218 | GF07.70-P-9998MM |