

# B46 Engine

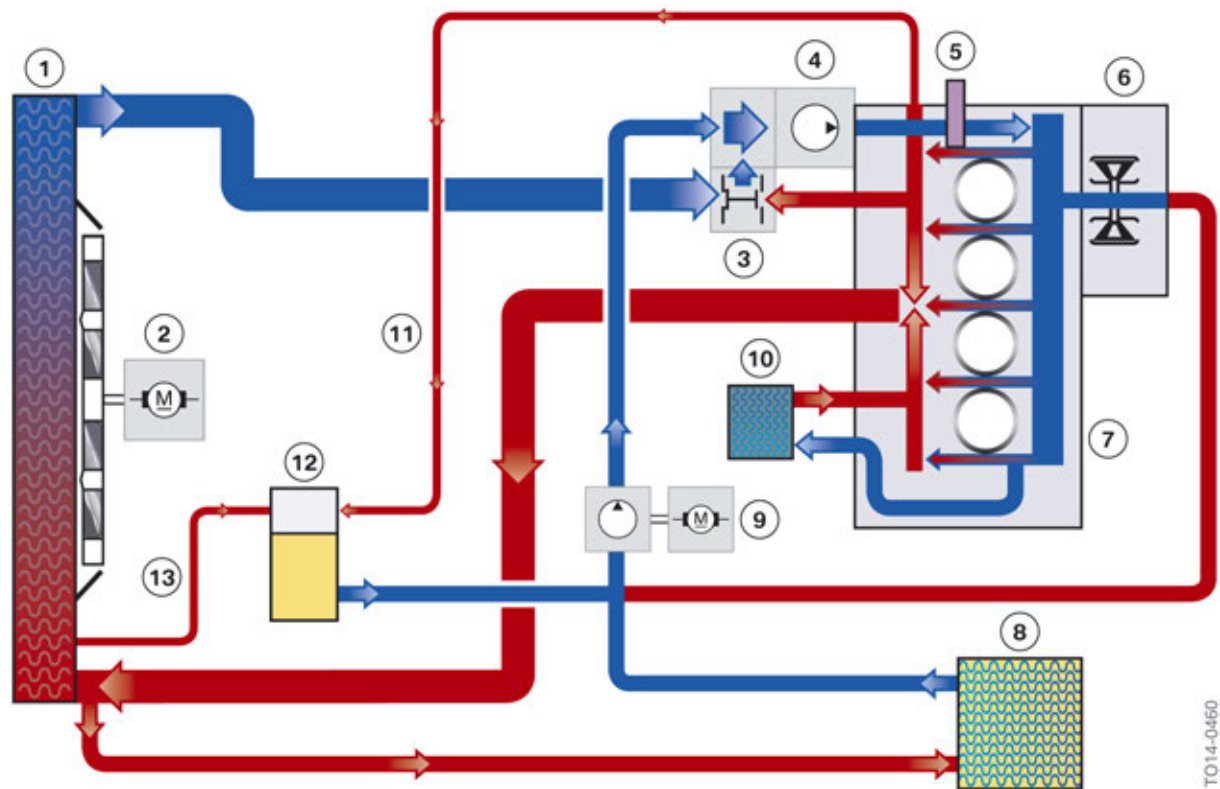
## 4. Cooling System

In order to protect the thermally loaded engine components, the engine oil and the transmission oil from overheating, they are cooled using coolant. A mechanical coolant pump circulates the coolant in the cooling circuit. The heat quantities introduced to the coolant are emitted to the ambient air again using a radiator. An electric fan assists the radiator output.

The coolant in the B46 engine is mainly circulated via a mechanical coolant pump. Several engines are also equipped with an electrical overrun pump which maintains a trickle of coolant to the bearing seat cooling system of the exhaust turbocharger.

The following graphics provide an overview of the different cooling circuits.

### 4.1. Cooling circuit, B46 engine



Cooling circuit, B46 engine

Index	Explanation
1	Radiator
2	Electric fan
3	Map thermostat
4	Coolant pump
5	Coolant temperature sensor
6	Coolant-cooled exhaust turbocharger
7	Engine housing

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Index	Explanation
8	Heat exchanger
9	Electric coolant pump (20 W)
10	Engine oil-to-coolant heat exchanger
11	Tank ventilation line from the cylinder head
12	Expansion tank
13	Ventilation line of the radiator

### 4.1.1. Special features

- Coolant-cooled exhaust turbocharger
- Mechanical coolant pump
- Electric coolant pump
- Characteristic map thermostat

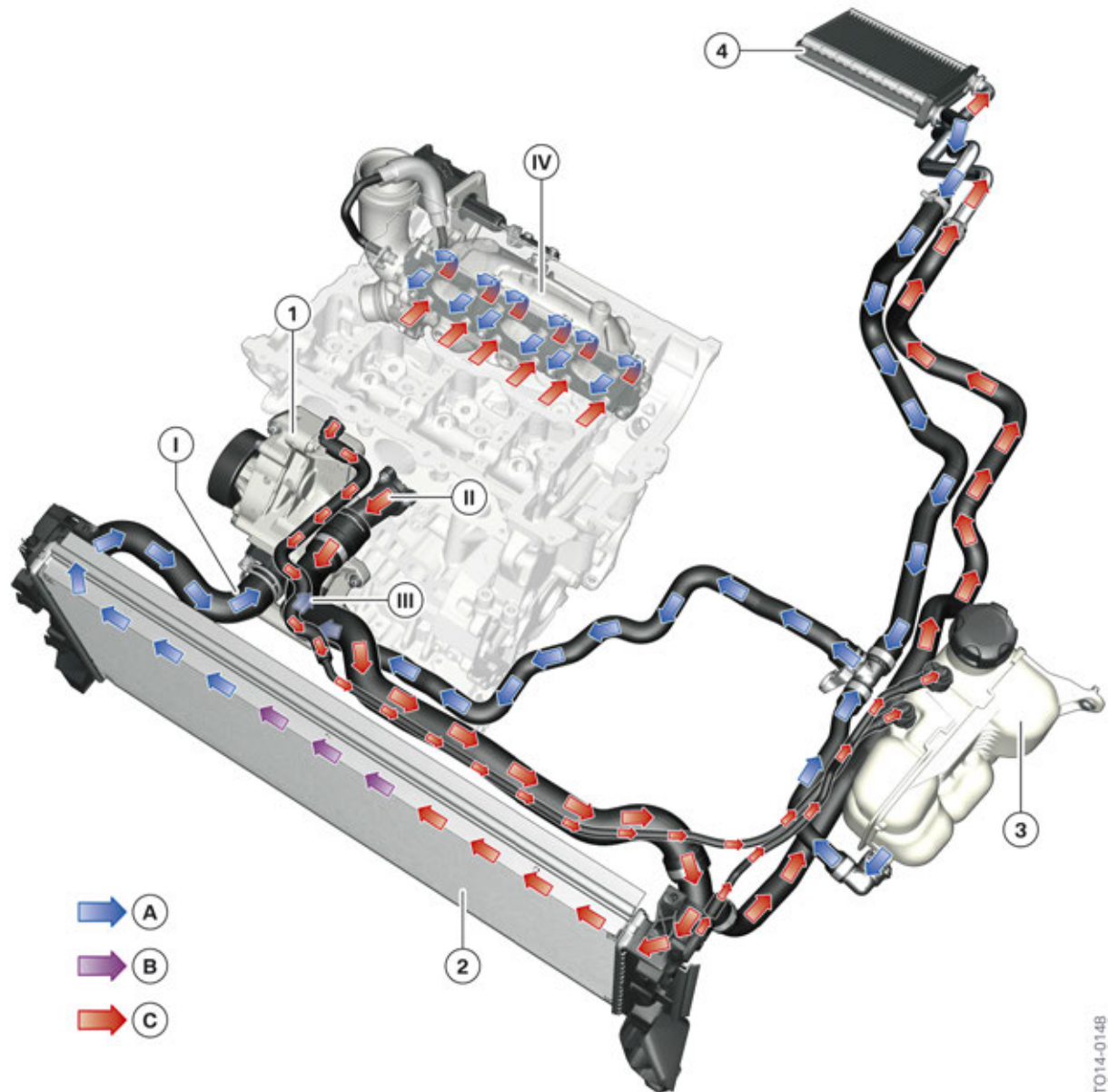
Due to the twin-scroll technology, the B46 engines are equipped with a steel manifold. 'Twin-scroll' means that the exhaust flows are routed via two separate channels to the exhaust turbocharger. The heat produced is absorbed by the coolant which is supplied via a coolant connection on the exhaust turbocharger. When the motor is not running, post-cooling of the exhaust turbocharger is possible with the assistance of an electric coolant pump (20 W). This prevents a build-up of heat in the area of the exhaust turbocharger.

For more in-depth explanations on the exhaust turbocharger, refer to the chapter Intake air and exhaust emission system.

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## 4. Cooling System

### 4.2. System overview, vehicle



Vehicle cooling circuit, B38 engine

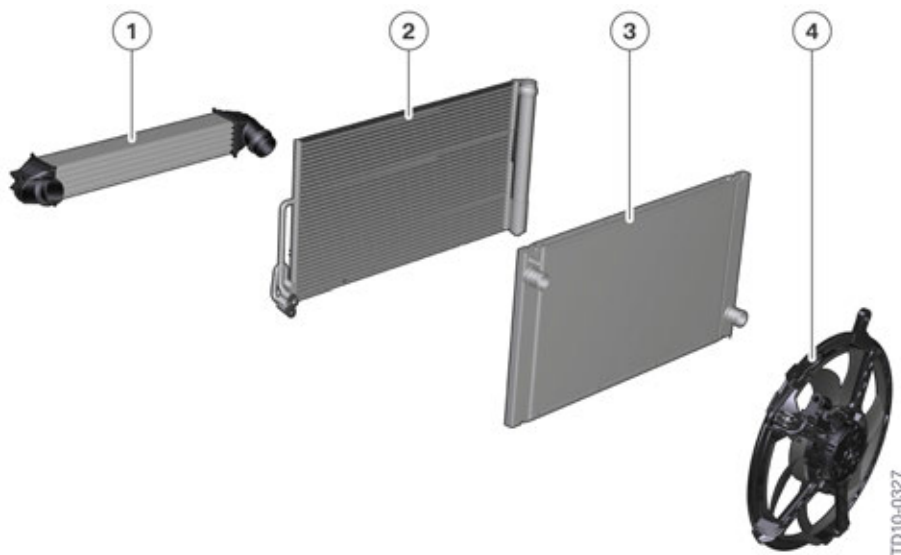
Index	Explanation
A	Coolant cooled down
B	Coolant warmed up
C	Coolant heated up
I	Cooled coolant to coolant pump
II	Heated coolant from engine to radiator
III	Cooled coolant to thermostat

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## 4. Cooling System

Index	Explanation
IV	Coolant flow via exhaust turbocharger
1	Coolant pump
2	Radiator
3	Expansion tank
4	Heat exchanger

### 4.3. Cooling module



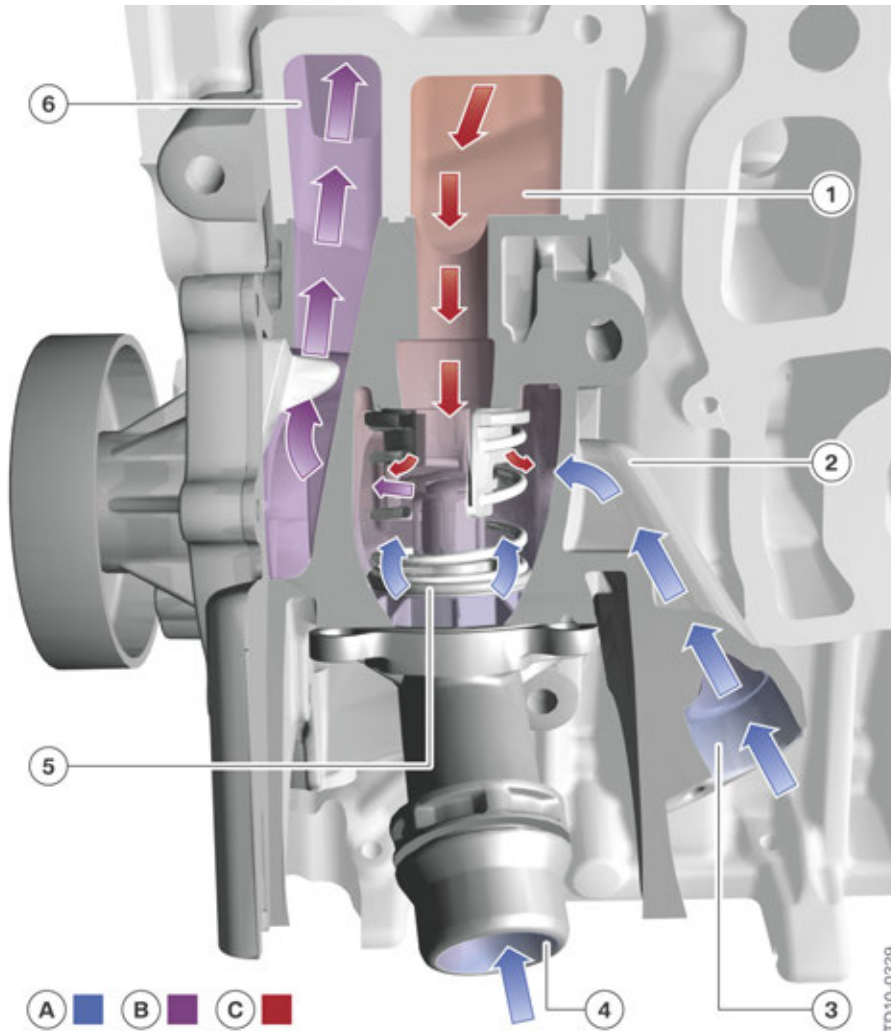
Cooling module

Index	Explanation
1	Charge air cooler
2	A/C condenser
3	Radiator
4	Electric fan

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### 4.4. Coolant pump



Coolant pump with characteristic map thermostat

Index	Explanation
A	Cooled coolant
B	Warmed coolant
C	Heated coolant
1	Coolant duct from the crankcase
2	supporting component carrier
3	Inlet from expansion tank and heat exchanger
4	Feed from radiator
5	Map thermostat
6	Coolant duct to the crankcase

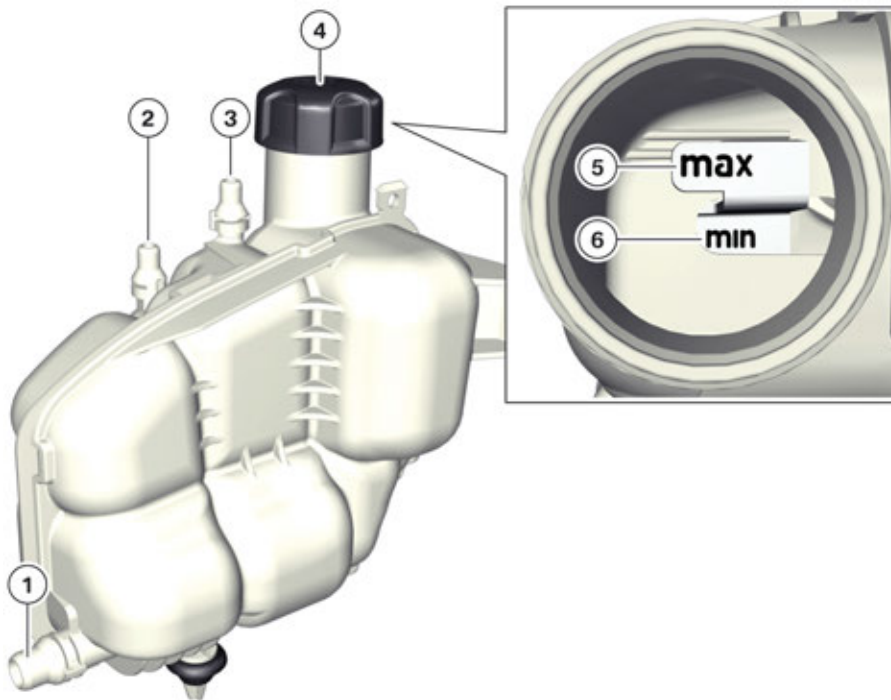
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The coolant pump forms one unit with the characteristic map thermostat. The coolant pump housing is made from the aluminium alloy ALSi9Cu3, the impeller and the thermostat cover are made of plastic.

The Digital Motor Electronics controls the cooling circuit via a map-controlled thermostat.

### 4.5. Expansion tank



Expansion tank

Index	Explanation
1	Coolant line, coolant expansion tank output
2	Tank ventilation line from the cylinder head
3	Ventilation line of the radiator
4	Sealing cap
5	Visible filling level indicator "Maximum"
6	Visible filling level indicator "Minimum"

The expansion tank is used as a reservoir for the coolant. The expansion tank ensures that there is always a sufficient quantity of coolant available in the cooling circuit.

In the sealing cap there is a pressure relief valve which restricts the pressure in the system.

The sealing cap must never be opened when the engine is hot. The reason for this is not just the risk of burning. In higher areas of the cooling circuit, such as the cylinder head, gas bubbles may form as a result of the loss of pressure. Sufficient heat dissipation is no longer guaranteed at these points. This would result in overheating.

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There is a visible filling level indicator in the expansion tank. The filling level can be read when the tank is open. The filling level should be between maximum and minimum for correct filling.

### 4.6. Coolant

The familiar coolant with a silicone base is used. The coolant is not subject to a change interval. The filling is designed for the entire service life of the engine. For work which requires an opening of the cooling circuit the coolant must be replaced. The precise procedure for ventilating the cooling circuit can be found in the current repair instructions.



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The cooling system must only be filled with BMW-approved coolant. If the wrong coolant is used, damage to the coolant pumps, coolant hoses, radiators and cylinder head gasket may subtly creep in.

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