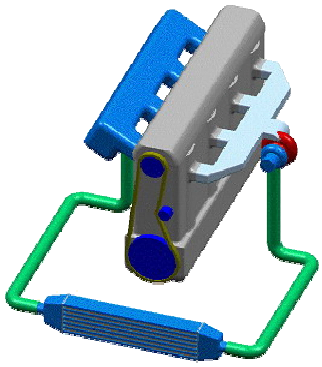


Intercoolers

General points

Increase in power over the whole speed range, low fuel consumption, improved engine efficiency, reduction of emission values, less thermal stress for the engine - there are numerous reasons to cool the combustion air of supercharged engines with intercoolers. Basically, a distinction must be made between two types of cooling. Direct charge air cooling, where an intercooler is installed in the vehicle front-end area and is cooled by environmental air (wind blast), and indirect charge air cooling, where coolant flows through the intercooler and discharges heat.

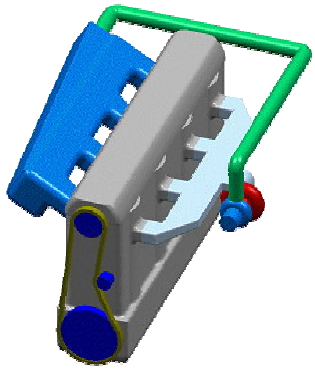
Structure/function



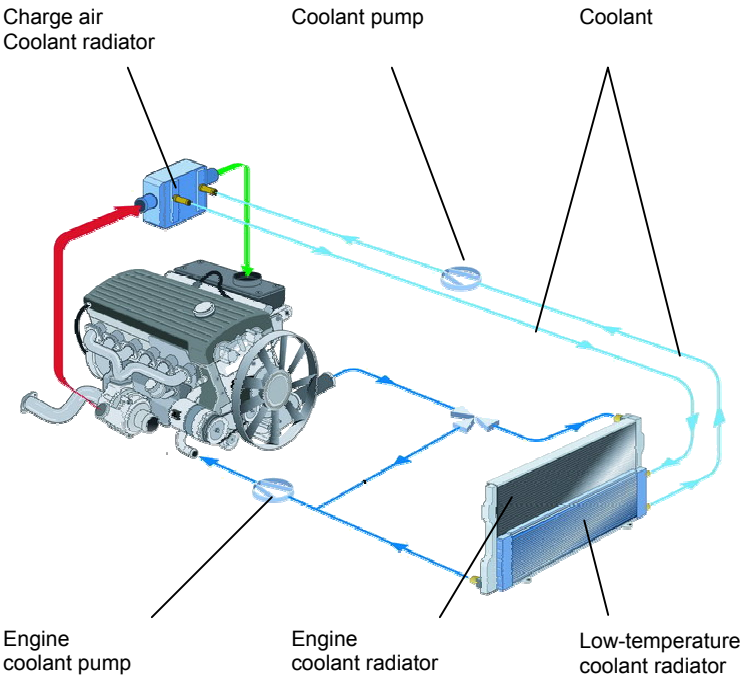
Direct charge air cooling

In terms of structural design, the intercooler corresponds to the coolant radiator. In the case of an intercooler, the medium to be cooled down is not coolant, but rather compressed hot air (up to 150 °C) coming from the turbocharger. Basically, heat can be withdrawn from the charge air by outside air or the engine coolant. The charge air enters the intercooler and, in the case of direct charge air cooling, has the wind blast flow through it and has cooled down by the time it reaches the engine intake tract. In the case of a coolant-cooled intercooler, the cooler can be installed in almost any position, with the smaller design volume representing a great advantage. Thus, for example, in the case of indirect charge air cooling, the coolant-cooled intercooler and the intake tract can form one unit. Without an additional cooling circuit, however, the charge air can only be reduced to near the coolant temperature.

With the aid of a separate intercooler coolant circuit independent of the engine coolant circuit, the efficiency of the engine can be further increased by increasing the air density. A low-temperature coolant radiator and a charge air coolant radiator are integrated in this circuit. The waste heat from the charge air is first transferred to the coolant and then dissipated to the environmental air in the low-temperature coolant radiator. The low-temperature radiator is housed in the vehicle front-end. Since the low-temperature radiator requires significantly less space than a conventional air-cooled intercooler, this solution creates free space in the front-end. In addition, the voluminous charge air lines are no longer required.



Indirect charge air cooling/ intake manifold with integrated intercooler



Effects of failure

A faulty intercooler can become noticeable as follows:

- Poor engine performance
- Loss of coolant (in the case of coolant-cooled intercooler)
- Increased pollutant emission
- Increased fuel consumption

The following can be considered as possible causes:

- Damaged or blocked hose/coolant connections
- Loss of coolant or secondary air due to leaks
- Outer damage (caused by gravel throw, accident)
- Reduced air flow (dirt)
- Lack of heat exchange due to inner soiling (corrosion, sealing agent, limescale deposits)
- Failure of the coolant pump (in the case of low-temperature coolant radiators)

Troubleshooting

Test steps towards recognising faults:

- Check coolant level
- Check coolant for soiling/discolouring and anti-freeze content
- Watch out for external damage and soiling
- Check system components and connection elements (hose connections) for leaks
- Check coolant pump
- Check fans and auxiliary fans
- Check the flow rate (blockage due to foreign materials, corrosion)