



# CHARGE AIR COOLERS INTERCOOLERS

NRF has over 80 years of experience in the design and production of Radiators, Radiator cores, Charge Air Coolers, Oil Coolers and Air Conditioning components as an OEM and aftermarket manufacturer. NRF covers the full spectrum of heat transfer products with over 8.000 individual parts which can be delivered on a same day / next morning basis.

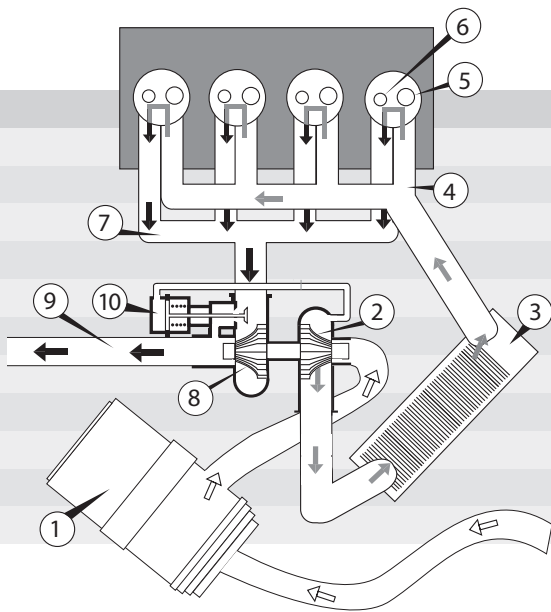


**NRF offers a broad range of Charge Air Coolers for:**

- ◆ Passenger Cars
- ◆ Trucks and delivery Vehicles
- ◆ Buses
- ◆ Agricultural tractors and Industrial Applications

Besides providing OE products, or products of OEM quality and performance, an experienced NRF staff is available to you in every European country.

Strong engineering and technical support is available when required.



- 1 Air Filter
- 2 Compressor wheel Turbocharger
- 3 Charge Air Cooler
- 4 Intake manifold
- 5 Inlet Valve
- 6 Exhaust Valve
- 7 Exhaust manifold
- 8 Turbine wheel Turbocharger
- 9 Exhaust Pipe
- 10 Bypass Valve

### The Charge Air Cooler

Regardless what kind of Turbocharger, supercharged engines need cooling of the hot, compressed air. The inlet temperature of Charge Air Coolers frequently reaches 150 degrees Celsius and on trucks as high as 220 degrees. The air pressure reaches 1.5 bars on automotive applications and well over 2 bars in trucks or industrial use.

Since the mid 80's, a charge air cooler is used to cool the hot compressed induction air, entering the intake manifold of the engine. The lower air temperature means Volume reduction of the air supplied to the engine. Due to the increased density more air can enter the combustion chamber of the cylinders and more Fuel can be injected, resulting in more power with the same cylinder dimensions. It increases the engines efficiency. This is the so called "supercharging".

This also effects a longer durability of the combustion parts. The lower the air temperature of the compressed air, the more efficient the engine burns the fuel. A positive side effect: If the supercharging is not used for more power, the engine will consume less fuel and produce less exhaust emissions.

### The Technology

In the automotive sector, mainly the air-to-air cooled Charge Air Coolers are used. Charge Air Coolers basically consist of three main components: Manifolds on each in- and outlet side

and in between the core, that consist of air-tubes and fins. This design allows a large cooling surface. To maximize the internal cooling surface, the air-tubes have additional separation walls. The cores are made of brazed aluminium. On heavy duty applications like trucks, the manifolds are also made of aluminum and welded to the cooler core. They are mainly manufactured in permanent mold castings. On passenger cars plastic manifolds of Polyamide material are most sufficient. They save cost and weight.

### Failure mode / Source of failure

A cooling system is only as good as the materials used. High temperatures and pressure wear out the materials. Hoses and connections get porous and leaky after a while. Frequent maintenance is always recommendable. But also stone collision, poor crash repairs, too tight hose connections, dirt and salt residue can negatively affect the Charge Air Cooler function. An incorrect function is one part, an engine defect the other worse case. To prevent engine damage you must always check/clean the engine air intake manifold for metal and dirt particles, before installing the new Charge Air Cooler.



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