

Oil coolers for hydrodynamic retarders

General

Hydrodynamic retarders (working with liquids) are used in commercial vehicles in order to support the actual brake system as an almost wear-free hydrokinetic brake. The kinetic energy is turned into heat through the deceleration caused by the flow speed of the oil, and this must be transferred back to the cooling system via a heat exchanger (Fig.1). The use of the retarder is either activated by the driver or works automatically. The braking power reaches several hundred KW.



Figure 1

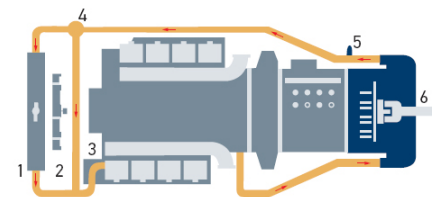
Function / Structure

Besides the service brake of a commercial vehicle, which usually is a friction brake subject to wear, vehicle manufacturers increasingly use additional, wear-free deceleration systems.

One design is the hydrodynamic retarder, which varies in the way in which it is installed or attached. There is a difference between external and internal retarders. External retarders can be freely positioned in the drive train area, while internal retarders are fully or partially integrated into the transmission. There are "inline" retarders (integrated into the drive train) and "offline" variants (flange-mounted on the side of the transmission).

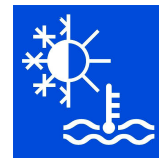
All variants have several common goals:

- Reduce vehicle speed
- Keep speed constant on a downward slope
- Minimise wear of the service brake
- Protect service brake against overload



Coolant circuit with retarder:

1. Radiator
2. Cooler fan
3. Coolant pump
4. Coolant thermostat
5. Coolant temperature sensor
6. Retarder with oil cooler (heat exchanger)



Hydrodynamic retarders (Fig. 2) usually work with oil (sometimes also with water) and possess an internal or external oil supply, which is moved by pressurised air towards a converter housing during braking. The housing consists of two opposing impellers. There is also a rotor, which is connected to the drive train of the vehicle, and a fixed stator. The rotor accelerates the oil flowing in. The shape of the rotor blades and the centrifugal force moves the oil to the stator, which decelerates the rotor and thus the drive shaft. The thermal energy thus created in the retarder heats the oil, which is then cooled down via an oil cooler (Fig. 3).

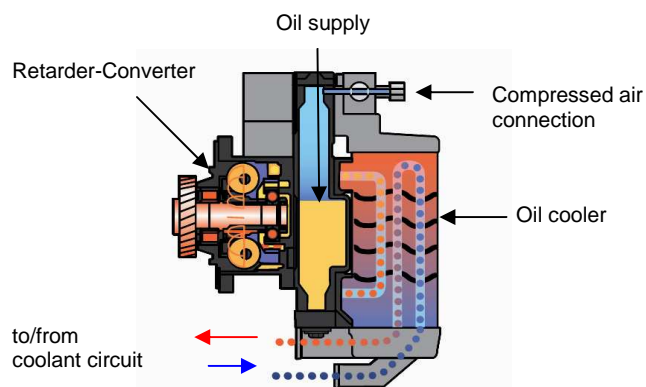
The oil cooler, which is made of solid aluminium or steel, is flange-mounted to the retarder and returns the heat it absorbs to the vehicle coolant circuit. In order to avoid exceeding the preset temperature limit, a temperature sensor for monitoring the coolant temperature is installed near the oil cooler. The sensor ensures that the retarder is reduced or switched off when the temperature limit is exceeded.



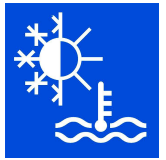
Figure 2



Figure 3



Retarder with attached oil cooler



Effects of a failure / Causes

A failure/defect of the retarder can manifest itself as follows:

- Loss of coolant
- Loss of oil
- Mixing of oil and water
- Total failure of the braking function

The following possibilities should be taken into account:

- Overheating of the cooling system due to lack of coolant, the wrong coolant or a wrong coolant mixture
- Overheating of the coolant through faulty handling (full deceleration of the vehicle at low engine speeds, choice of the wrong transmission gear) and the ensuing cavitation (forming of bubbles in the coolant due to high thermal loads) Figure 4
- Damage on seals, hose couplings
- Cross-section constrictions caused by dirt in the heat exchanger or the cooling system
- High or sudden thermal loads (temperature/pressure)
- Leaks inside the heat exchanger
- Failure of the temperature sensor (Fig. 5)

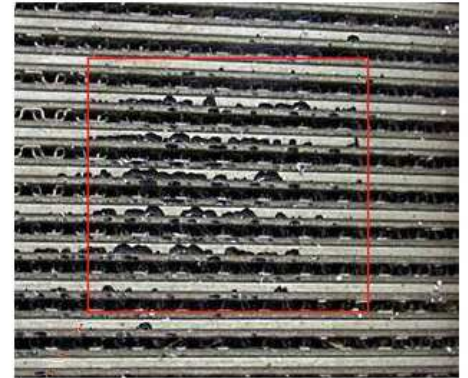


Figure 4

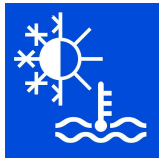


Figure 5

Troubleshooting / Indicators

The following steps should be followed during troubleshooting:

- Testing the coolant for fulfilling the vehicle manufacturer's requirements (type of coolant, mixture ratio)
- Checking the coolant level
- Checking the cooling system for leaks and



- contamination (oil, limestone, rust, insulating material)
- Check the coolant intake/outflow for cross-section constrictions
 - Check the heat exchanger for firm seating and cracks
 - Check electrical components (sensors)
 - Check the cooling system for the functioning of additional components (fan, thermostat, water pump, cover)

During the exchange of the oil cooler, the cooling system should be flushed and the retarder oil and the coolant be replaced. For flushing, the cooling system cleaner 8PE 351 225-841 may be used. Always observe any additional requirements by the specific vehicle manufacturer.