CAT® Power Systems

TECH TIPS

Cooling System

Cooling System Function

During operation, all internal combustion engines generate heat. This heat is caused by fuel combustion. The cooling system must remove enough of this heat to keep the engine at a correct operating temperature but not so much heat that the engine runs cold. In addition, in some applications, the cooling system must also remove heat from other sources, such as retarder coolers, engine coolers, hydraulic oil coolers, torque converters or aftercoolers.

The cooling system has a direct effect on the operation and service life of the engine. If the cooling system is not the correct size, does not have good maintenance, or is not operated correctly, the result can be overheating or overcooling. Since overheating or overcooling can shorten engine service life or result in poor engine performance, it is very important that the cause of any problem in the cooling system be found and corrected immediately.

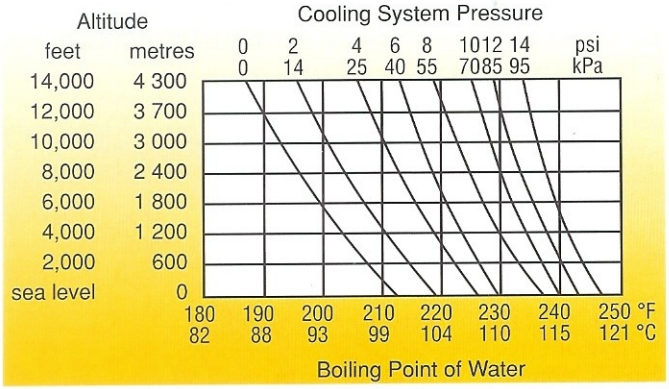
Cooling System Temperature During Operation

The amount of heat transfer in the radiator from the coolant to the air is directly related to the difference between coolant and air temperature. An increase in this temperature differential will increase the heat transfer. Normally, the design of a cooling system will permit operation at a temperature that is high enough for a good heat transfer, but low enough to prevent coolant boiling.

There are three factors that can change the temperature at which coolant will boil. These factors are:

1. The amount and type of antifreeze in the coolant
2. The pressure at which the cooling system operates.
3. The altitude at which the cooling system operates.

Increasing the pressure at which the cooling system operates raises the boiling point of the coolant. For this reason, most cooling systems are designed to operate under pressure. The amount of pressure is controlled by a valve in the radiator cap or the pressure relief valve. The higher the altitude, the lower the boiling point of the coolant. The illustration shows how the altitude and pressure at which the cooling system operates affect the temperature at which the coolant boils. This chart is for water with no antifreeze.



Cooling System Maintenance

Coolant generally consists of water combined with corrosion inhibitors or water combined with antifreeze and corrosion inhibitors. The correct selection has a direct effect on the efficiency and/or service life of both the cooling system and the engine.

Coolant

Coolant must be able to transfer heat from hot engine components to a radiator or heat exchanger where the heat is dissipated. To do this job correctly, coolant must have the following characteristics:

Heat Transfer

Heat transfer describes the tendency of heat to move from a hot area to a cooler area. Rate of heat transfer is measured by the specific heat properties of a given liquid. In coolant, the rate of heat transfer also depends on the temperature difference between the outside air and the coolant itself, plus the conductive properties of the material that surrounds the coolant.

Protection Against Freezing of the Coolant

The best protection against coolant freezing is the correct mixture ratio of the Coolant. Use the correct mixture of ethylene glycol and water or the correct mixture ratio of methoxy propanol and water as Coolant. The most common antifreezes that are available use ethylene glycol to provide freeze protection.

Corrosion Resistance

The coolant must prevent formation of rust and pits in the engine and other components. Since all waters can cause corrosion, water alone is not a good coolant. Both distilled water and softened water are unacceptably corrosive when corrosion inhibitors are not added.

Scale and Deposits

The general characteristics of the water used as a coolant determine scale and deposit formations. It is impossible to inhibit "poor" water completely so as to make it usable as a coolant mixture. The water must be pretreated.

Compatibility

The coolant must not damage seals, hoses, or any of the materials used in the construction of cooling systems such as copper, aluminium and steel. Inhibitors in antifreeze and Cooling System Conditioners are designed to protect these materials.

Non-foaming

The coolant used in a system must not foam or make sludge, which can damage the cooling system.

Sediment

The coolant must be clear and not have mud or an oil residue in it.