

## Cooling System and Electrolysis

Antifreeze is what protects the engine from overheating and the coolant from freezing. Corrosion inhibitor keeps the engine and cooling system components from corrosion. To provide these three benefits the antifreeze corrosion inhibitor must be used in the proper concentration and be in good condition.

Most engine manufacturers recommend using a 50/50 mixture of antifreeze and water in the cooling system for year-round operation. At this level of concentration most antifreeze will provide freezing protection down to -37 degrees Celsius and boilover protection up to 130 degrees Celsius depending on the pressure rating of the system. The higher the pressure rating of the system is the greater the boilover protection.

Higher concentrations of antifreeze can be used to extend both the freezing and boilover protection. At a maximum concentration of 70 percent antifreeze and 30 percent water most antifreeze will provide freezing protection down to -65 degrees Celsius and boilover protection to 136 degrees Celsius at maximum pressure rating.

Under no circumstances should a higher concentration of antifreeze be used in the cooling system. Antifreeze does not carry heat quite as efficiently as water so increasing the concentration of antifreeze beyond a maximum concentration of 70 percent can reduce the cooling capacity of the system and increase the danger of overheating. What's more straight antifreeze will not provide as much freezing protection as a mixture of antifreeze and water. Straight antifreeze freezes at -22 degrees C.

**Straight water should never be used in a cooling system.** Straight water freezes at 0 degrees Celsius and boils at 100 degrees Celsius. This is close to the normal operating temperature of many engines today and provides **no corrosion protection whatsoever**.

Most types of antifreeze are ethylene glycol which provides the freezing and boilover protection needed by all cooling systems. But ethylene glycol by itself does nothing to prevent corrosion inside the cooling system. For that job corrosion inhibiting chemicals are added to antifreeze.

In conventional antifreeze silicates phosphates and or borates are used in various combinations to form a protective coating on cooling system surfaces. This coating does an excellent job of preventing corrosion as long as it is intact.

But eventually heat and the combined effects of dissolved oxygen and minerals in the coolant deplete the inhibitors. And once the protection is gone electrolytic corrosion begins to accelerate very quickly. Aluminium parts such as radiators cylinder heads water pump and thermostat housings can be damaged by electrolytic attack as can the soldered joints and seams in copper and brass radiators and heater cores. Even rubber hoses can come under attack and fail from the inside out because of **electrolysis**.

Aluminium affected by electrolysis will corrode rapidly in the form of flakes. These flakes will suspend in the cooling system and eventually build up causing system failure. Cast iron engine components will corrode causing rust to enter the system contaminating the coolant and allowing the system to slowly destroy itself. Soldered joints will become pliable and produce leaks. Premature part failures overheating cavitation of cylinders and passages and deposit formation causing system failure are symptoms of or are caused by electrolysis.

**How can you test for electrolysis?**

The test is simple. Using a volt ohm meter digital is preferred connect the black or ground lead to the battery ground and lower the red or positive lead into the coolant in the radiator. Do not touch the filler neck sides or the tank. Any reading over 0.3 volts is indicative of excess current entering the cooling system.

To protect the cooling system against this kind of damage the coolant must be changed periodically. Most engine manufacturers recommend changing conventional corrosion inhibitor every 12 months for preventative maintenance. For best results follow the instructions provided by your supplier of corrosion inhibitor.