THE BLENDING OF ANTIFREEZE AND WATER

For many years glycol based products have been used for freeze up, boil over and corrosion protection in most vehicle's cooling systems. The majority of antifreezes in use today are based on ethylene glycol (EG), but propylene glycol (PG) products are becoming more common. Regardless of glycol type, antifreeze serves three main functions in a vehicle. These functions are heat transfer, corrosion protection and freeze - boil protection. This article will discuss each of these topics and explain how to achieve the best results from your antifreeze.

The reason a vehicle requires antifreeze at all is for heat transfer. As an internal combustion engine runs, it generates heat. This heat must be removed. When engines of this type were first designed they utilized water to remove heat. This worked well until winter when the water would freeze and ruin the engine. Originally methanol was added to the water to protect from freezing. The problem with this was that the methanol would boil over in the summer. To solve this problem glycol was added to the water and antifreeze was born.

The question of heat transfer is not as simple as it might seem. The amount of heat a fluid can carry varies greatly from fluid to fluid.

Water is an excellent conductor of heat. Glycols are not as good of heat conductors as water. As the concentration of glycol increases, the heat transfer ability of the mixture decreases. This change in heat transfer is not a problem. During engine and cooling system design the heat transfer ability of the coolant is taken into effect. What is important is not using a fluid that is outside the cooling system design parameters. Modern engines are designed to run with a glycol-water blend between 40% and 60% glycol. Using a coolant outside these limits will cause the engine to run at the wrong temperature. This change sacrifices engine performance and leads to other problems.

The second function of an antifreeze is to protect the metals in a vehicle's cooling system from corrosion. Antifreeze is able to perform this function by the addition of inhibitors. Inhibitor types vary depending on the type of antifreeze. Inhibitors can be of many different forms including organic and inorganic chemicals. One thing that is common with all inhibitors is that they are designed to work in a water solution. The addition of water "activates" the inhibitors, allowing them to protect the metals. For this reason it is important to always mix antifreeze with water in a vehicle's cooling system.

As the name implies the third main function of antifreeze is to protect the cooling system from freezing. The way to achieve maximum freeze protection differs between ethylene and propylene glycol. For ethylene glycol the maximum protection is at 67% ethylene glycol in water. A ethylene glycol solution of this concentration will freeze at -64°C (pure ethylene glycol freezes at -13°C). Propylene glycol does not freeze. It experiences a chemical phenomenon known as supercooling. For this reason there is no freezing point of pure PG. Due to the heat transfer and inhibitor activation reasons discussed above, PG antifreeze should also be maintained between 40% and 70% in water. Boil over protection with both glycols increases with glycol concentration.

As outlined above, antifreeze is an important component in any vehicle. No matter what type of vehicle you drive, maintaining the cooling system according to the manufacturer's recommendation is extremely important. Regardless of antifreeze type, using a solution of antifreeze and water is important to realize the maximum benefits for heat transfer, corrosion and freezing protection.