What You Should Know about Recycled Engine Coolant / Antifreeze

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There is not a one of us that has not been effected or knows someone that has been effected by the economic crisis, downturn, recession or whatever catch phrase that is being used this week in an effort to try and keep us from focusing on one reality that we all are aware of; "the cupboards are bare" in the words of old Mother Hubbard. This TechTip topic for many of us as individuals may not be a big deal but is certainly getting a lot of attention in the world of fleets, and even the OE's "recycled engine coolant/anti-freeze". We as individuals have a major impact as well but it is on the disposal side.

Recycled engine coolant/anti-freeze is a relatively new and emergent industry that got its start in the late 80's. Why? The result of passed federal government regulations that materials containing lead levels of more than 5.0 ppm as hazardous; a category that most used engine coolant fell into. You now had equipment and vehicle maintenance facilities looking for methods by which to comply and reduce the cost of their new hazardous waste disposal cost, and preserve the environment. This demand to reduce hazardous wastes and related costs created opportunities for many different companies and groups to develop and market effective means to recycle used engine coolants. Since ethylene and propylene glycol are economically recoverable components in engine coolants, many different ways were developed to separate out the contaminants from the ethylene or propylene glycol. The various processes included simple filtration, ultra-filtration, chemical precipitation and filtration, reverse osmosis, ion-exchange, and distillation.

As this young market developed and entrepreneurial opportunities presented themselves several technologies developed, clearly many were producing inexpensive and poor quality recycled engine coolants while others provided higher quality recycled engine coolants. This led to significant, and understandable, concern from OEMs and state regulatory bodies. Without industry standards, there was inevitably going to be a clash between engine manufacturers and recycled coolant providers with warranties and responsibility.

- *Antifreeze/engine coolant is the most neglected fluid in the vehicle.*
- *Cooling system neglect is cited as the principal reason for premature engine and transmission failure.*
- *Cooling system failure is the most common cause of mechanical breakdown on the road.*
- *A national survey found that 7 out of 10 vehicles contain rust and scale and two thirds of more than 8,000 cooling system repair jobs were performed on an emergency basis.*
- *Just 1/16th of an inch of mineral deposits on 1 inch of cast iron reduces heat dissipation by 40%.*

While ASTM (American Society for Testing and Materials) was in the process of developing industry standards, OEMs such as General Motors, Ford, Chrysler, Caterpillar, and Cummins developed proprietary standards in

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response to the demand of the field. After developing these standards, they issued company- or process-specific approvals. Testing and approval programs varied in intensity, however; they were primarily based around virgin engine coolant requirements. Interestingly enough, standards for pre-mixed coolant where in the mix as well. With many bi-metal, or all aluminum engines, inundated with electronics throughout, the worst potential enemy to your engine coolant could very well be the **water** that you use for your 50/50 mixture. Listed below are a few of the issues with the water out of your garden hose.

- *Calcium and Magnesium – Calcium and magnesium salts form scale on hot heat exchange surfaces. Scale impedes heat transfer and causes localized hot spots that result in engine overheating and component failure.*
- *Chloride and Chlorine – All municipal water supplies contain chloride and chlorine. Chloride is very corrosive to all cooling system metals, especially aluminum. Chlorine forms additional chlorides in the cooling system.*
- *Sulfate – All municipal water also contains sulfate that contributes to general corrosion and scale formation.*
- *Oxygen – Deionized water doesn't taste good due to the lack of oxygen and certain minerals. Tap water, however, is full of oxygen and other minerals making it suitable for drinking and aquariums. Oxygen contributes to metal corrosion and depletion of inhibitors. Water with low oxygen is preferred for engine coolant.*

If that isn't bad enough even if correct water is being used you have mixing mistakes - Cooling system problems can also be caused by improper dilution of the coolant/antifreeze with water. These problems include:

- *Improper ratio of concentrate to water*
- *Not stirring thoroughly to mix the water and concentrate*
- *Mixing the concentrate and water in a dirty container*
- *Pouring the concentrate and water into the radiator without first mixing them*

Resulting damage of poor coolant maintenance and/or poor water quality

So if you have used water from your garden hose to mix your coolant, you are overdue for cooling system maintenance deposits have been building up. Maybe you already have had the radiator rodded out,

unfortunately, the engine block and heads have the same deposits. A quick acid flush (which can attack copper, aluminum, and brass) will NOT remove what took years and tens of thousands of miles to build up. So you can see how you could actually be better off to use pre-mixed antifreeze and keep the cooling system clean in the first place. The other issue with using water from your garden hose is that is has a detrimental effect on additive package in your coolant to keep the system clean and free from corrosion, insure long life of the seals and maximize the cooling capability.

The cooling system consists of a radiator, water pump, hoses, fan(s), heater, thermostat and engine coolant. The cooling system removes excess heat from the engine block and heads, keeps the engine operating at its most efficient temperature, and gets the engine up to the correct temperature as soon as possible after starting. Ideally, the cooling system keeps the engine running at its most efficient temperature no matter what the operating conditions are.

Environmental issues require cleaner burning engines. Engine manufacturers have raised engine operating temperatures in order to reduce exhaust emissions and improve fuel economy. Today's engines run on the borderline of overheating, with in-cylinder combustion temperatures around 2,000 °F.

As fuel is burned in the engine, about one-third of the energy in the fuel is converted to kinetic energy for moving the vehicle. Another third goes out the exhaust pipe and the remaining third is removed by the cooling system. If no cooling were provided, metal parts would melt and the pistons would seize. The engine coolant must have indirect contact with the combustion chamber, the cylinder walls, and the valve seats and guides. As the engine coolant circulates through the engine, it picks up heat from the engine. The coolant releases this heat as it passes through the radiator.

Worldwide, over 400 million gallons of antifreeze concentrate are sold each year. After the typical 50% dilution with water, this yields about 800 million gallons of engine coolant. Between 25 and 50% of this volume ends up improperly in the environment, and dumping by consumers is a major cause of this pollution. Approximately 90% is mixed with wastewater, treated, then discarded to surface waters. Improperly disposed antifreeze can have devastating effects. Antifreeze has a sweet taste that small children and animals can find attractive. If ingested, antifreeze affects the central nervous system and can cause death. A couple of states in the US require the addition of a bittering agent to make antifreeze less tasty to children and animals. Every year about 10,000 cats and dogs are victims of accidental poisoning by ingestion of antifreeze. Governments are imposing more regulations concerning antifreeze management. This means more antifreeze will be collected for beneficial reuse/recycling. Proper cooling system maintenance and good recycling practices can mitigate the harmful effects of antifreeze on our environment.

Antifreezes differ in more than color. Antifreeze is made using ethylene glycol or propylene glycol. Antifreeze producers use a number of different corrosion inhibitor packages (with descriptions such as heavy duty conventional with SCA, low silicate conventional without SCA (Supplemental Coolant Additives), OAT (Organic Acid Inhibitors), and hybrid OAT). Antifreezes can be the same color but use different inhibitor packages. Each unique antifreeze chemistry formulation performs differently. The vast majority of recycled antifreeze in the USA does not meet these standards. If you want to verify that the recycled coolant that you are purchasing is correct verify that you have D 6471, Specification for Recycled Prediluted Aqueous Glycol Base Engine Coolant

Light-Duty Service; and D 6472, Specification for Recycled Glycol Base Engine Coolant Concentrate for Automobiles and Light-Duty Service. "Light duty" antifreeze is intended primarily for gasoline-engine passenger car applications. "Heavy duty" antifreeze is intended for diesel engines in both on- and off-highway applications. Diesel engines in heavy-duty truck and construction equipment have more severe corrosion prevention requirements than gasoline-engines in passenger cars and therefore require more corrosion inhibitors. Using "light duty" antifreeze in an over-the-road tractor will cause cooling system problems unless an SCA in proper amount is added to the antifreeze.

Heavy Duty is a bit more complicated and manufacturer specific however the following chart should help determine if you have a product that meets the engine requirements.

ASTM D-3306	John Deere 8650-5	EMD M.I. 1748E
ASTM D-4985	MACK	Ford New Holland 9-86
ASTM D-6210	Navistar	Freightliner 48-22880
Case Corp. MS1710	PACCAR	GM 1825
Caterpillar	SAE 1941	GM 1899
Cummins S/B 3666132	Thermo-King	Volvo GM
Detroit Diesel 7SE298	TMC RP 329	Waukesha 4-1974D

US government specification CID-A-A-52624 covers requirements for ethylene glycol and propylene glycol antifreeze and allows three different concentrations: 100%, 60%, and 50%. CID-A-A-52624 requires the antifreeze "to be suitable for use in all administrative vehicles, construction and material handling vehicles and equipment, and military ground combat and tactical vehicles and equipment." The US government encourages the use of recycled antifreeze.

The last thought that I leave you with is this; if you have a recycled coolant that has not gone through the process of removing corrosive chloride salts, then you do not have a product that you are going to want to use. They are the hardest product to remove from recycled coolant but the one that can cause the most damage. Recycled coolant is a great way to be environmentally friendly and easy way for all of use individually and corporately to be "Green" with little or no effort, just make sure that you have a product that meets the standards and it is every bit as good as a virgin coolant and in some cases even better.

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