Water Quality in Engine Coolant

Category: Coolants
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Introduction:

Penray frequently is asked to recommend practices relative to water selection for the blending of engine coolant. ASTM publishes the following recommendation, and a discussion follows.

ASTM Water Quality Recommendation (from D-4985):

	ppm (max.)	Grains Per Gallon (max.)
Chlorides	40	2.5
Sulfates	100	5.8
Total Dissolved Solids	310	20
Total Hardness (calcium and magnesium)	170	10

Discussion:

Engine coolant is a mixture of antifreeze and water, usually 50% each. ASTM specs require the antifreeze be formulated so that when it is mixed with water at 50%, the freeze point is no higher than -34°F (-37°C). A great deal of work and expense goes into the formulation of quality antifreeze. Reputable companies use high quality ethylene glycol, and purchase deionized water and chemicals that are certified to be low in contaminants, such as chloride, to blend the anti corrosion properties into the finished product. Frequently, the effort seems somewhat wasted when the end user indiscriminately uses water unsuitable for engine coolant to blend with the antifreeze.

Probably the poorest choice of blending water is well water. The minerals, when introduced into engine coolant are the source of several concerns.

Calcium: combines in engine coolant to form scale on hot heat exchange surfaces. Scale is an efficient insulator, and the result is localized engine overheating that can cause component failure.

Magnesium: Magnesium also can form scale, creating localized overheating and warped engine heads. It is the second of the two components (with calcium) measured to determine the degree of "water hardness". Water that contains calcium and magnesium is defined as "hard"; the concentration of the two chemicals combined determines the level of hardness.

Silicate: In water, silicate would be detected as the result of sand, not sodium silicate inhibitor. Sand is frequently found in cooling systems, and is associated with premature wear due to abrasion in various areas of the cooling system.

Chloride: Municipal drinking water most often is, in fact, acceptable for engine coolant. A water test can determine the quality of municipal water. Nevertheless, most municipal waters contain chlorine, resulting in the formation of chlorides in the coolant. Chlorides are aggressive to aluminum.

Oxygen: Anyone who has tried deionized water knows it tastes nasty. This is due to its lack of oxygen. Oxygen contributes tremendously to metal corrosion and depletion of inhibitors. City water is full of oxygen making it suitable for drinking and keeping pet fish. Water with low oxygen levels is preferable for coolant.

Therefore, the argument for distilled or deionized water is made on the basis that such water contains fewer reactive chemicals, resulting in optimum coolant life and performance. It is also true that Penray antifreeze chemistry is formulated with certain safeguard additives chosen to address typical city water. This is another "good - better - best" choice; relating city water, shop blending DI water, and prediluted coolant from a blending plant representing the three quality choices. No one recommends using well water for engine coolant.