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NPG waterless coolant—*ready* for a million miles

Occasionally, *CCJ* has reported on the development of waterless engine cooling—the Evans Non-aqueous Propylene Glycol (NPG) system. Here's how it works, and what it's done for one owner operator who has 500,000 miles experience with this innovation.

According to Evans Cooling Systems, Sharon, Conn., www.evanscooling.com, the NPG system can improve virtually any engine's thermal efficiency and fuel economy, while offering superior liner-cavitation and system-corrosion protection.

Here's what makes the system different from conventional cooling systems.

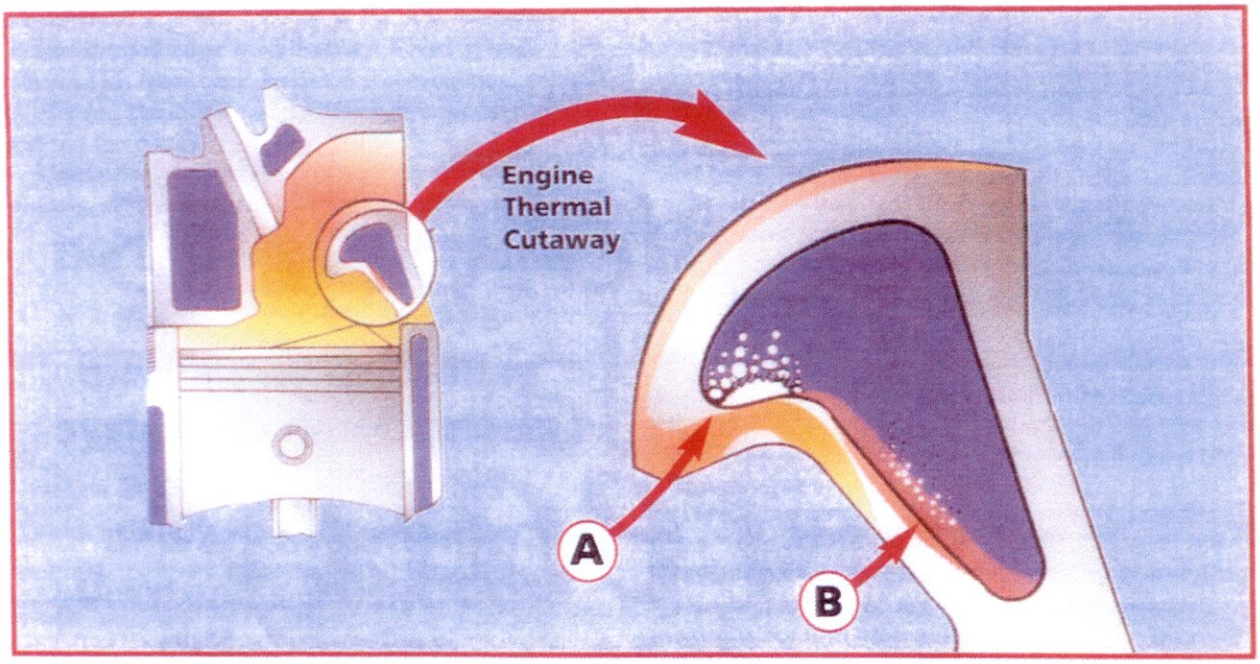
Liquid cooling is based on the fact that whatever is being cooled doesn't get appreciably hotter than the coolant it contacts. The coolant, in turn, can't get any hotter than its own boiling point.

You can demonstrate this principle for yourself by holding a flame under a paper cup filled with water. The water will eventually boil, but it won't get any hotter than its boiling point (212°F at sea level). As long as there's water in the cup, it won't burn, since paper's combustion temperature is over 400°F.

In an engine, localized boiling occurs in high-heat areas. This prevents engine metal from reaching fatal temperatures. It is important, however, that the vapor formed by localized boiling be quickly condensed by the surrounding coolant. The process is called nucleate boiling. When that doesn't happen, the vapor momentarily insulates the metal from the coolant. This inhibits heat transfer and causes dangerously high local metal temperatures, or hot spots.

The speed of condensation depends on the temperature differential (•T) between the vapor and surrounding coolant.

In a conventional cooling system, the bulk of the ethylene glycol/water mixture, which must be kept hot enough to run efficiently, is often precariously close to its boiling point. This slows condensation and increases the likelihood of engine-damaging,



Upper cylinder cutaway. Loss of nucleate boiling (A) shows vapor blanket as metal temperature exceeds thermal capabilities of water-based coolant. Sustained nucleate boiling with Evans NPG system (B) shows continuous heat transfer through uninterrupted metal-to-liquid contact.

vapor-induced hot spots and cavitation.

While a 50/50 mix of ethylene glycol and water boils at 225°F (unpressurized), straight propylene glycol boils at 369°F. Therefore, it can be cooled to a temperature well below its boiling point, and still keep an engine's temperature in an efficient (hot) operating range.

Vapor formed by localized boiling is quickly condensed by the (relatively) much cooler bulk coolant. This, along with NPG's lower surface tension and vapor pressure, minimizes liquid displacement and keeps liquid coolant in constant contact with jacket metal.

The whole process can actually increase performance and fuel economy, says Evans, since a hotter engine, within material limits, is a more efficient engine.

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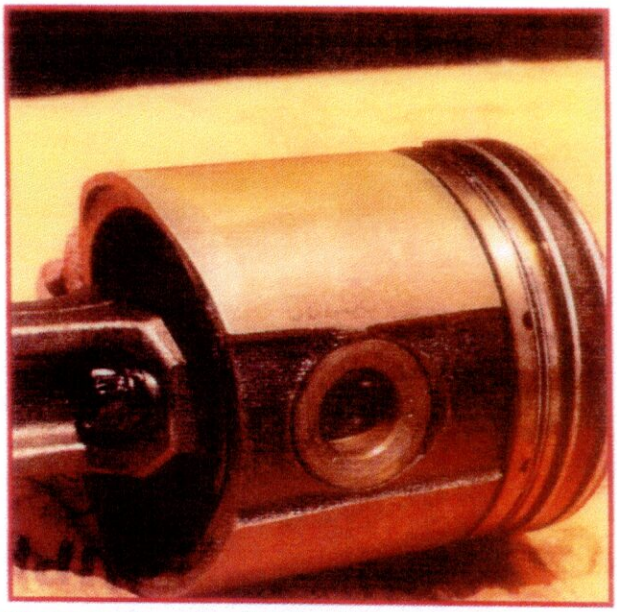
Another plus is that the Evans system runs at reduced pressure, so system leakage is less likely. And silicates, which are added to conventional coolants to prevent aluminum corrosion that occurs in the presence of water, are unnecessary, since the Evans system contains no water.

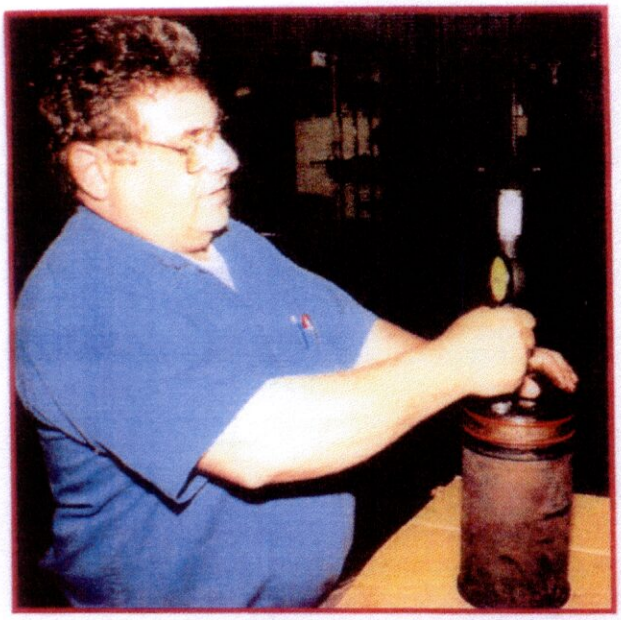
Finally, propylene glycol is non-toxic, at least out of the bottle. But beware—any coolant can become toxic if it absorbs lead from a radiator.

Trial by miles

Joe Umstead, a driver with North American Van Lines, was having a problem with his coolant. Additive dropout had plugged his radiator and oil cooler. Asking around, he



Almost spotless after 500,000 miles—and obviously devoid of overheating damage—this piston from Umstead's Freightliner still shows the original Detroit Diesel part number printed on its side.



Evans' diesel fleet rep Al Improta uses a dial bore gauge to measure cylinder taper on cylinder liners removed from the Detroit Diesel Series 60 after 500,000 miles. "Every cylinder was within original OEM specifications," he observes.

found that he had added too much supplemental coolant additive (SCA). After reading an article in a trucking magazine, discussing the concept of non-aqueous coolant, he contacted Evans. He liked what he heard, and thought the coolant might address the problems he was having.

Replacing his old truck with a new Freightliner in 1991, he decided he would try to get his truck to go for a million miles, and figured this new technology might help. So he contacted Evans again, and they arranged to ship some of their experimental fluid to his Freightliner truck dealer.

An over-the-road owner operator leased to North American Van Lines and running all 48 contiguous states, Umstead has a cabover Freightliner that's powered by a 12.7-liter Series 60 Detroit Diesel, rated at 400 hp @ 1800 rpm. The engine is mated to a Meritor RMO-13-1450 transmission, and Meritor SQ-100 tandem rear axles at a 3.42 ratio. The rig runs on Bridgestone M747 385/65R22.5 tires, and pulls a 48-ft x 102-in. x 13.6-ft Kentucky furniture trailer.

Ten years and half a million miles later, Umstead firmly believes he made the right decision.

Umstead's Freightliner dealer installed new, 215° thermostats and a 230° fan cut-in switch, removed all the water and antifreeze from the Detroit Diesel Series 60's cooling system, flushed the system, and replaced the ethylene glycol and water coolant mix with the proper quantity of the new Evans non-aqueous coolant—no water, just coolant.

And now, 10 years and half a million miles later, Umstead firmly believes he made the right decision. And he is confident he will achieve his goal of a million miles—and then some.

The waterless coolant reportedly allows his engine to operate at 215°-230° with no significant cavitation or electrolysis; and lets him run with low pressure in the cooling system, which saves hoses, the water pump, and other components, and the system simply won't boil over. Umstead says the coolant provides improved fuel mileage (by allowing the engine to run hotter), and never needs flushing, replenishing, or additives.

Umstead claims he improved his mileage by at least 1 mpg. "I have averaged 7.43 mpg over the road," he says. "It put two or three thousand dollars in my pocket every year, and it was great to drive.

"I could pull an 8° incline without a hint of boilover. I had total confidence in the truck. I just drove the heck out of it, essentially without touching the cooling system for over nine years."

After 500,000 miles, cylinder liners from Umstead's Freightliner showed less than 5% cavitation. This small amount was judged to be caused by air in the cooling system, plus 16,000 miles run with water/ethylene glycol in the cooling system.

Air compressor wreaks havoc

Umstead's good fortune was suddenly interrupted this past year when his air compressor, which is liquid-cooled, began pumping air into the cooling system, which interfered with engine cooling and caused the engine to suddenly begin to run excessively hot.

Umstead took the truck to a Detroit Diesel dealer in Denver, who ultimately diagnosed the air compressor as the culprit. But the dealer was totally unfamiliar with

waterless coolant, and appalled at the high temperature thermostat and other modifications. Before giving Umstead his truck back, he put in a conventional mixture of ethylene glycol and water, and a conventional thermostat and fan clutch.

Umstead was back on the road, but his wallet was complaining, depleted by new, unwanted parts costs and a lot of labor. And he was running the "wrong" coolant.

The service center found no appreciable mechanical or cooling system deterioration due to electrolysis and/or cavitation in Umstead's 500,000+ mile engine.

It was 16,000 miles later, and he was still running ethylene glycol and water, when Umstead got back to his home base in Virginia and called Evans for help. Evans agreed to help return the truck to NPG cooling, and convinced Umstead to let a professional service center tear down the entire engine to see what was what—at Evans' expense.

Evans also sent Al Improta, its heavy duty diesel fleet rep, to make certain the engine was reassembled to OEM specs.

"Like new" inside

The service center found no appreciable mechanical or cooling system deterioration due to electrolysis and/or cavitation in Umstead's 500,000+ mile engine. Pistons and cylinder liners were removed, checked, and found to be in like-new condition.

Thorough inspection of the engine showed that the original components (pistons, cylinder liners, crankshaft, and camshaft) all measured up to OEM tolerances for a new engine in use for a short period of time and still under warranty, according to Umstead and Improta.

The original pistons, cylinder liners, and NPG cooling system were re-installed, the engine was buttoned up, and Umstead went back on the road. "They did install new piston rings for insurance," says Umstead, "not because they were worn, but with the engine torn down, it would have been negligent not to.

"It runs perfectly, over every hard grade in the U.S. When I got back to Denver and explained the whole situation to the Detroit Diesel dealer there, he was quite interested and now supports the Evans system in my truck.

"If I get a new truck tomorrow, the first thing I'll do is switch over to waterless cooling." □

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