Engine Coolants: Selection and Maintenance

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Coolant Basics

Coolant, also known as antifreeze, serves two major purposes: modulating temperature (through the transfer of heat) and protecting components against corrosion. In a heavy-duty diesel engine, for example, only one-third of the total energy produced is put towards propelling the vehicle; one-third of the energy is removed through the vehicle's exhaust as heat energy; the final third of the heat energy produced is removed by the engine coolant. This is important because overheating can cause the engine and oil to rapidly degrade.

Water is the best means of heat transfer, and glycol is often added to provide freeze and boil-over protection. While glycol reduces the heat transfer capabilities of water, it is often necessary for most climates and applications.

Engine coolant base fluids are usually made up of a 50/50 mix of ethylene glycol and water, but in some applications, other base fluids may be used, such as propylene glycol mixtures or deionized water and corrosion protection additives. Other ingredients may include antifoam agents, corrosion inhibitors, dyes and other additives.

Coolant Selection

There are three primary groups into which coolants fall:

Group 1 – Inorganic Additive Technology (IAT)

These are glycol-based coolants traditionally used in vehicle engines. These coolants are typically green with silicate and/or phosphate corrosion inhibitors and are effective at inhibiting corrosion on iron and aluminum surfaces. These coolants can often be called conventional or fully formulated coolants.

While effective, the corrosion inhibitors found in this group of coolants have short lifespans, and failure to maintain and replace the fluid leads to component failure.

Group 2 – Organic Additive Technology (OAT)

The coolants in this group are formulated with organic additive technology (OAT) and typically contain 2-ethylhexanoic-acid (2-EHA) or other organic acids, replacing the short-lived silicates or phosphates. These are often referred to as extended life coolants (ELC). These OAT corrosion inhibitors in these coolants last much longer than the additives in Group 1.

Group 3 – Hybrid Additive Technology (HOAT)

This group encompasses hybrid OAT coolants. These coolants contain OAT and have some silicate, borate, phosphate, nitrate, nitrate, or molybdate.

Nitrate-free Coolants

For the sake of efficiency, Original Equipment Manufacturers (OEMs) have begun to manufacture equipment utilizing aluminum components (radiators, heater cores, oil coolers, etc.). Aluminum has many benefits: it's a cheaper material than those previously used in the construction of these components, it effectively dissipates heat, and it reduces total machine weight.

However, there is a downside to all these aluminum components, and some nitrited coolants are not compatible with the metal. Nitrite can react with Aluminum to form Ammonia, which increases the pH which causes corrosion and degradation to elastomers. In response to these issues, many OEMs call for nitrite-free coolants to be used with machines containing aluminum components.

Extended Life Coolants

Extended Life Coolants (ELC) provide many benefits, especially for operations that require the maintenance of large fleets. However, the achievement of these benefits comes only when the engine cooling systems are properly maintained. These benefits include:

Improved Heat Transfer
Based on field and lab data, ELCs typically have improved heat transfer rates of 12%-13% compared to conventional, or fully formulated coolants, which contain Inorganic additives.

Extended Pump Life
Silicates can cause abrasive wear to the front seals of water pumps. Implementing silicate-free coolants can extend pump life (by as much as four times).

Engine Coolant Maintenance

The best maintenance practice is to know the specification of the coolant required for each machine and to use the correct coolant for top-offs.

Preventative maintenance measures that can be taken include the use of a refractometer to measure the coolant's glycol/water ratio. Maintaining the correct ratio ensures that the proper corrosion inhibitor levels are present and freeze protection is in place. This is also a good time to check the coolant's pH level and ensure there is no visible debris or oil contamination in the coolant.

Additionally, the cooling system itself should be regularly inspected to confirm it is full and operating properly. Low coolant levels can be blamed for many issues, including rapid corrosion. Low coolant levels can also affect the system's pressure — lower pressures than required can cause the coolant to boil.

Coolants using the same type of additive chemistry are generally compatible. However, not all coolants of the same type are made equal. Mixing coolants with different additive chemistries may reduce the effectiveness of the corrosion protection. It is recommended to continue using the same additive chemistry rather than mixing coolants in service.

When it comes to maintaining fleets, most operations have a robust engine oil maintenance program — coolants should also be given attention. An easy way to implement coolant maintenance into a lubrication program is to check the coolant at the same intervals as the regularly scheduled oil checks.

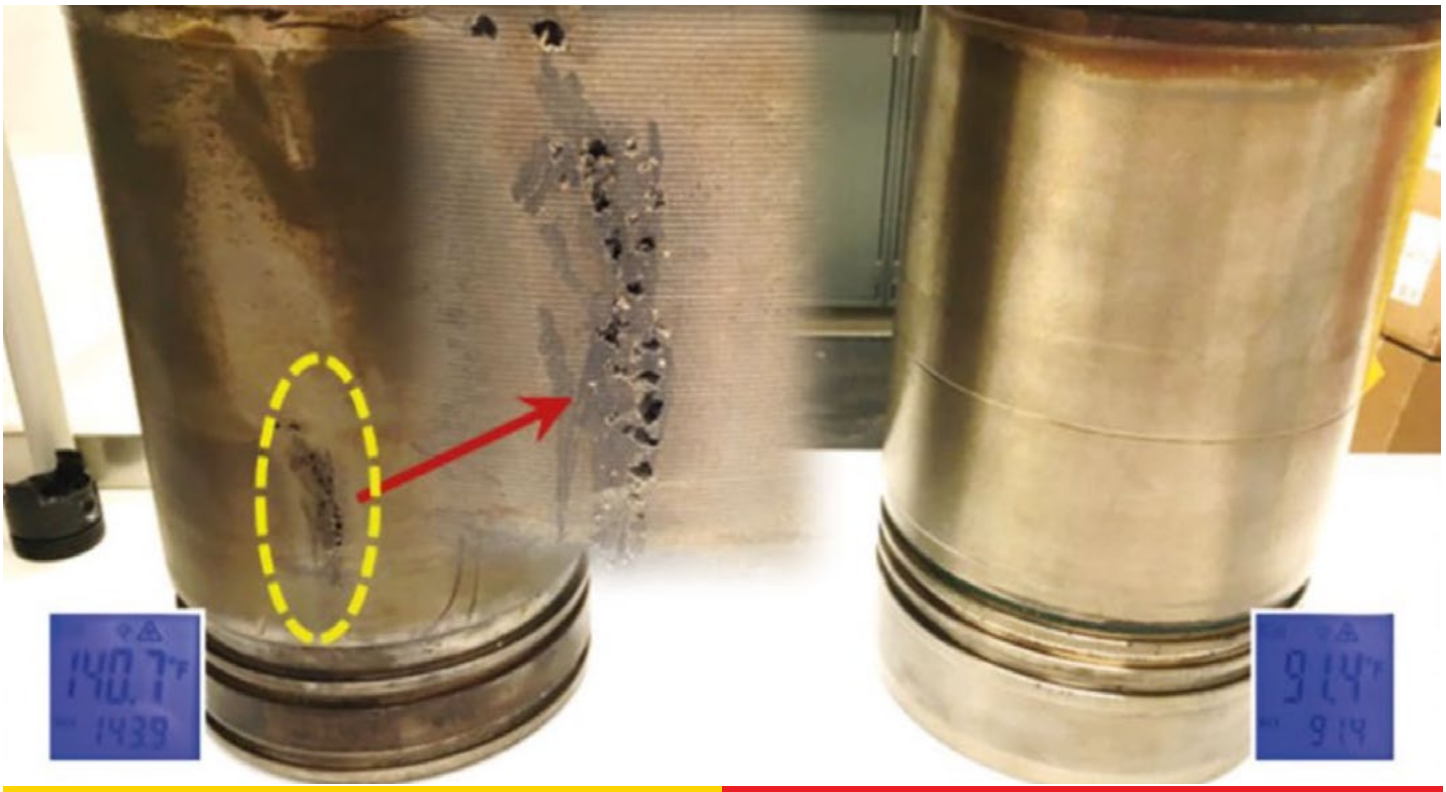
Coolants can be sampled and analyzed too — just like lubricating oils. pH imbalances or other chronic issues may call for analysis.

Meet the Challenges

Shell ROTELLA® Extended Life Coolant Nitrite Free (ELC NF) has a proven track record of extending the operating lifespans of medium and heavy-duty diesel, gasoline, LNG, and natural gas engines and vehicles. The formulation provides improved protection of aluminum components and meets many of the newest OEM standards.

When compared to conventional coolants, Shell ROTELLA® Extended Life Coolant Nitrite Free (ELC NF) has some key benefits, which include:

- **Superior heat transfer**
- **Extended life capabilities**
- **Compatible with other Extended Life Coolants**
- **No Supplemental Coolant Additives (SCA) or Extender use is required**
- **Excellent cavitation and corrosion protection**



CONVENTIONAL COOLANT
Engine running after 316,716 miles

ROTELLA ELC NF
Engine running after 349,195 miles

Shell ROTELLA® ELC Nitrite Free

One of Shell's most advanced coolants, Shell ROTELLA ELC™ Nitrite-Free, is formulated to meet more severe operational conditions of modern, hotter-running engines. This is particularly important for new emission engines, especially those with EGR.

Learn more about Shell at shell.us or shell.com.