



Ethylene Glycol Antifreeze Coolant in Natural Gas Engines: Understanding Degradation and Extending Coolant Life

Introduction

In the oil and gas industry, stationary natural gas engines are vital for powering compressors in upstream, midstream, and processing applications. These engines operate under extreme thermal conditions, so maintaining the correct coolant chemistry is essential for ensuring reliable operation and minimizing maintenance costs. Ethylene glycol-based antifreeze coolant, combined with corrosion inhibitors and additives, is the standard fluid used to manage engine temperature. However, under certain conditions, this coolant can degrade—turning black and forming damaging residues on internal components.

This article outlines how ethylene glycol-based coolants degrade in natural gas engines, the consequences, and how operators can monitor and extend their life coolant.

What Causes Coolant Degradation?

In high-temperature zones of the engine, particularly near the piston liner, ethylene glycol can break down due to localized overheating. This thermal stress can lead to:

- Oxidation of ethylene glycol produces organic acids such as glycolic and formic acid.
- Catalyzed polymerization involves partially degraded glycol forming longer-chain compounds, which results in viscous, sticky residues.
- Formation of black deposits, commonly resulting from carbon-like polymer degradation products and interactions with dissolved metal ions or contaminants.

These residues often deposit on the hottest surfaces, including cylinder liners and heat exchangers, leading to heat transfer loss, under-deposit corrosion, and eventual component failure.

Why Coolant Monitoring and Management Is Essential

When antifreeze coolant turns black, it is a visible indicator of thermal and chemical breakdown. Continuing to run an engine with degraded coolant leads to:

- Plugged coolant passages.
- Decreased heat transfer efficiency.
- Accelerated corrosion and erosion of engine components.
- Costly downtime and repairs—sometimes requiring complete engine rebuilds.

Given these risks, managing coolant quality is not optional—it's a core part of engine reliability management.

Best Practices to Extend Coolant Life

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1. Use High-Quality Coolant

Always begin with a premium ethylene glycol-based coolant designed for heavy-duty engines. Make sure it has a strong inhibitor package that includes organic acid technology (OAT) or hybrid organic acid technology (HOAT), which resist degradation at high temperatures.

2. Control Coolant Chemistry

Maintain the proper glycol-to-water ratio (usually 50/50). Using deionized or distilled water prevents the introduction of minerals that catalyze breakdown. Avoid topping off with untreated water.

3. Monitor Inhibitor Levels

Test the coolant after every 1,000 hours of engine operation. Key tests include pH levels, reserve alkalinity, and inhibitor concentration. Many coolants allow re-inhibition using additive packages—by following the manufacturer's guidelines.

4. Watch for Early Warning Signs

A cloudy appearance, color changes (especially to dark brown or black), or a sweet, burnt odor are early indicators of degradation. These signs warrant immediate testing.

5. Flush and Replace When Needed

If contamination or degradation is severe, it is essential to flush the coolant system with a chemical cleaner, followed by fresh coolant. Reusing degraded coolant is not advised.

6. Maintain Proper Operating Conditions

Engine tuning, proper thermostat function, and clean radiator cores all help minimize hot-spot formation that speeds up glycol breakdown.

Conclusion

The proper selection, testing, and management of ethylene glycol-based antifreeze coolant are essential for the reliable operation of natural gas engines used in compressor service. Coolant degradation—indicated by black residue and thermal breakdown—can lead to severe engine damage and costly downtime. However, operators can significantly extend the life of the coolant and protect critical engine components by following industry best practices and implementing a structured coolant monitoring program.

Choose Chem Advances' AdvanceGuard products and service programs to extend the life of your antifreeze/coolant.

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