Critical Warm Weather Maintenance For Engine Coolant In Heavy Duty Vehicles

Extreme seasonal heat requires attention to a heavy duty vehicle's engine cooling system and coolant concentration

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Fleet managers understand that effective engine cooling system maintenance is their frontline defense against summer's relentless heat. Engine coolant is the lifeblood of any heavy duty engine and it requires a proactive approach to testing and maintenance.

Introduction

The old saying goes: Be careful what you wish for. For many fleet managers who wished for one of the harshest winters on record to be over, the onset of summer heat brings with it some relief but also a new set of challenges.

Truck fleets that traverse the North American continent this summer, spanning regions from the North to the South and both coasts, know that one of the few constants among those thousands of miles of pavement will be stifling heat and oppressive humidity.

With the primary goal of delivering a contracted load from Point A to Point B, fleet managers know they cannot control the weather in any region or on any route. The best they can do is prepare their vehicles to withstand whatever the road throws at them.

It is easy to see that no matter where you are located you need to be prepared for the weather extremes that may occur.

Extreme heat puts extreme stress on a heavy duty truck and its engine. The primary source of protection from heat is an engine's antifreeze/coolant (AF/C). Fleet managers understand that effective engine cooling system maintenance is their frontline defense against summer's relentless heat, and it requires a proactive approach to testing and maintenance.

This white paper will look at the warm weather effects on the modern heavy duty engine and the challenges fleet managers must face in maintaining an effective engine cooling system that protects against boilover and damage to expensive metal and polymer engine components.

The Challenge

The engine cooling system controls the operating temperature of an engine, and today's heavy duty diesel engine runs hotter than ever. An engine running too hot or too cold will affect longevity and performance of oil and its viscosity, which can lead to increased wear and tear on the engine and negatively affect fuel efficiency.

Now that it is summer, how did that decision to add additional AF/C concentrate during the winter affect your summer heat protection? By increasing the percentage of concentrate during winter, heat exchange properties of the AF/C are compromised and can lead to engine component troubles in the summer.

A disproportionate ratio of AF/C to water in the mix can mean the heat exchange between the AF/C the engine cooling system will not be efficient, putting additional stress on the cooling system components that could lead to premature failure. This can also lead to additional stress on the other functional fluids under the hood, including engine oil as well as transmissions and power steering fluids. In some cases inhibitors can precipitate out and expose metal components of the engine to premature wear and potential failure. The modern heavy duty engine is equipped with a myriad of lightweight metal components such as heat exchangers, water pumps and EGR coolers, which are all impacted by higher operating temperatures.

Given these potential problems, OEM recommendations should always be consulted. A general recommendation of a 50/50 concentrate to water ratio will provide the system a boiling point up to 265° F. Above a 5,000-foot elevation, AF/C should be maintained at a 55-60% concentrate-to-water mixture to reduce the chance of boilover.

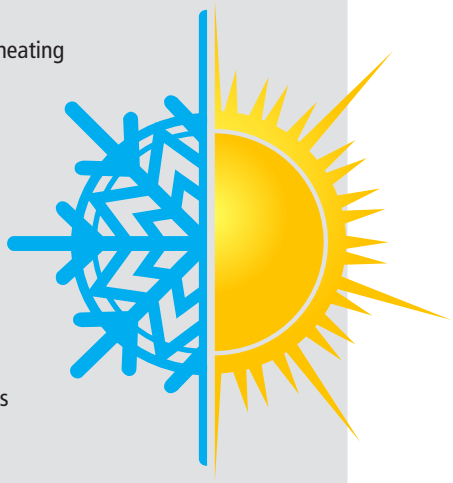
PROBLEMS CAUSED BY POOR ENGINE COOLING SYSTEM CONCENTRATION CONTROL

More than 70%

- Poor heat transfer and overheating
- Lower boiling point and higher freezing point
- Higher metal temperatures
- Additive precipitation
- Water pump leakage
- Slushing of AF/C

30% Or Less

- Lowered boiling point
- Increased incidence of liner pitting for heavy duty diesels
- Metal corrosion
- Raised freezing point

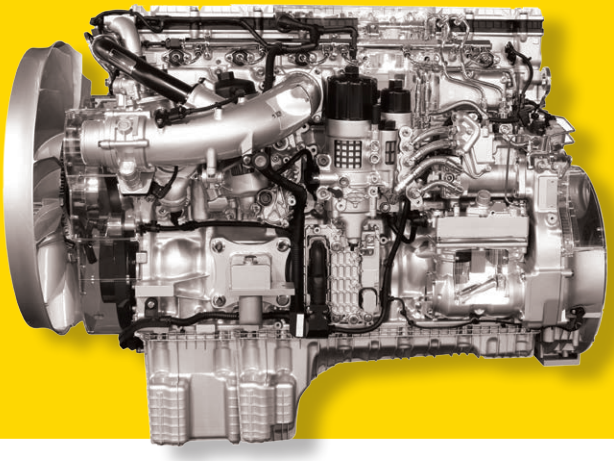


To optimize the performance of the specially blended inhibitors in an AF/C, it must be accurately diluted with a good quality water. Beware, water quality can vary depending on the source and timing throughout the year. In some locations it can be extremely difficult to find a water source that would meet the TMC and other industry recommendations.

Deionized, distilled and soft water all provide for the elimination of impurities within water that can cause problems when mixed into an engine's cooling system. Hard water should never be used in a cooling system due to its propensity to escalate scaling on metal engine components. Elements within water that cause especially dire cooling system consequences include:

THE MAJOR COMPONENTS THAT COULD POTENTIALLY BE AFFECTED BY INCORRECT ENGINE AF/C CONCENTRATIONS ARE:

- Radiator
- Heater Core
- Wet Sleeve Liner
- Coolant Pump
- Block
- Cylinder Head
- Thermostat
- DEF Valve



- Hoses
- Gaskets
- Oil Cooler
- Super Charger/ Turbo Cooler
- Sensors
- EGR Cooler
- Control Valve

- **Calcium & Magnesium:** Salts of calcium and magnesium carbonates adhere to metal compounds in hot heat exchangers causing scale build-up
- **Chloride:** Water contains chloride, which is corrosive to cooling system components, especially aluminum
- **Sulfate:** Water can contain sulfates, which contribute to general corrosion and/or scaling

Test strips can be used to test water quality including Hardness, pH and Chloride levels.

Measuring and maintaining the concentrate/water ratios within an engine cooling system can help ensure optimum engine operational efficiency. Ratios can be measured a number of ways including a hand-held refractometer, a hydrometer, or test strips. The challenge for the fleet manager is that these measurements only ascertain whether boil point and freeze point protection are correct; it does not indicate the level of inhibitor protection. Test strips are designed to test AF/C inhibitor levels in a vehicle's cooling system. Qualified independent testing laboratories are another option to determine the exact condition of an AF/C sample.

The primary focus when checking the engine AF/C quality in a heavy duty diesel engine is to guarantee the concentrate and water ratios are correct and will provide boilover protection. To avoid costly repairs, vehicle downtime and the loss of valuable revenue, invest in quality AF/C products and a AF/C maintenance program that protects your engine year round.

The Solution

Having the ability to proactively test an engine cooling system is imperative to making the right decisions for maintaining the correct levels of AF/C concentrations. By providing an easy way to test an engine cooling system, essential preventative maintenance can be convenient and highly accurate.

There are a number of ways to test your AF/C to ensure you are ready for any situation or condition. Prestone Command® offers a full line of AF/C testing methods. These testing options vary in complexity and scope, offering the ability to test a wide range of important variables from basic glycol concentration to far more complete methods that measure condition of the fluid and the ability of the AF/C to protect the engine from corrosion by measuring the level of inhibitors.

Prestone Command® Test Kits
Prestone Command® offers a complete fluid testing, training and consulting program to complement its trusted AF/C family. The Prestone Command® team has developed a practical, effective testing program that will assist in making informed maintenance decisions based on an effective AF/C analysis program. The data generated from the Prestone Command® program will remove the guesswork, risk and reactionary nature of any maintenance department and improve the bottom line. Prestone

From ethylene and propylene glycol concentration levels to visual inspection for rust and sediment presence, the new Prestone Command® line of AF/C tests provide convenience and user-friendly operation to determine key characteristics of AF/C conditions.

Command® offers three different test kits to meet the various challenges heavy duty engine AF/C may encounter. Detailed analysis provides a snapshot of what is happening with AF/C inside your equipment. It can tell you the condition of the fluid and identify component wear and contamination in engines so that you can:

- Safely extend drain intervals and equipment life
- Maximize asset reliability
- Minimize downtime (catch minor problems before they become major failures)

Prestone Command® Test Kit Description

AFC100-TK2	Designed for analysis of conventional low silicate heavy duty (IAT) coolants
AFC110-TK3	Designed for analysis of IAT and organic acids heavy duty (NOAT, OAT, HOAT) coolants
AFC110-TK5	Designed for Advanced Coolant Condition Monitoring for all coolant technologies

Prestone Command® Test Strips
Three specifically-designed Test Strips to assist in determining pH, glycol concentration and the ability to check for:

- AFC210 - Water Quality Test Strips - Hardness/pH/Chloride
- AFC220 - IAT (SCA-Charged) Antifreeze/Coolant Test Strips - Nitrite/Freeze Point/pH
- AFC240 - ELC (NOAT, OAT) Antifreeze/Coolant Test Strips - Freeze Point/Inhibitors/Nitrite/pH

Prestone Command® Hand-Held Refractometer
- Measures concentration and freezing temperature of ethylene and propylene glycol-based AF/C
- Easy-to-use, customer-friendly portability, providing a wide-range measurement
- Provides a dual-scale and temperature compensation

The Prestone Command® Testing Kits provide data on key components within heavy duty AF/C samples as well as a professional analysis that will flag critical values that require immediate attention.

Comments	Suggest flushing this system with water that meets specifications and install new recommended coolant; Copper is at a SEVERE level, copper can attack the other metals in the cooling system; The pH level is marginal; Resample in 60 days; The CARBOXYLIC ACID Pass/Fail test is NOT APPLICABLE for the COMPONENT TYPE and/or FLUID information provided.

	Sample Information							Corrosion Metals (ppm)								Contaminants (ppm)		Corrosion Inhibitors (ppm)				Carrier Salts (ppm/10)	
Sample #	Date Sampled	Date Received	Coolant Time mi	Unit Time mi	Coolant Change	SCA Added gal	Filter Change	Iron	Aluminum	Copper	Lead	Tin	Silver	Zinc	Titanium	Calcium	Magnesium	Silicon	Phosphates	Boron	Molybdenum	Sodium	Potassium
1	N/A	12-Nov-2009	18330	174830	No		Unk	1	0	6	1	0	0	0		2	0	74	1950	268	227	264	203
2	02-Dec-2010	16-Dec-2010	297000	297000	Unk		Unk	2	0	9	1	0	0	1		2	0	81	3505	270	318	325	309
3	08-Sep-2011	26-Sep-2011	16580	374880	No		No	3	0	5	2	0	0	0		0	0	72	3431	165	190	255	272
4	05-Mar-2013	18-Mar-2013	108347	488477	No	0	No	1	0	**19**	0	0	0	0									

"Hightlighted" numbers denote test results the analyst has **flagged** because they exceed pre-set warning parameters and warrant closer examination or require action.

Obtaining quality samples of AF/C for testing is crucial to receiving the most accurate data analysis.

Conclusion

The heat of spring and summer will create harsh conditions and challenges to fleets across North America. Regularly scheduled maintenance throughout the lifetime of a heavy duty vehicle can keep it running for a very long time. Maintenance is the key to optimal engine cooling system operation, and fleet owners must monitor their AF/C to ensure the concentrate remains at a safe ratio and the inhibitor levels are in the appropriate range.

Fleet owners should use a high-quality AF/C and additives from reputable suppliers to meet their needs. Do not rely on unknown sources of engine AF/C, which can provide the fleet operator with marginal protection and may create problems with new heavy duty vehicles. When in question, rely on the engine manufacturers' and trade associations' (like TMC, ASTM and EMA) recommendations for best practices relating to engine AF/C.

For more than 85 years, Prestone has made a steadfast commitment to develop and produce a full line of AF/C in the USA that deliver the highest quality and performance on the market. With an historical focus on research and development, Prestone continues to provide quality AF/C and products that reflect its commitment to the highest standards.

About the Author:

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