Inspection Essentials For Cold Weather Antifreeze/Coolant Maintenance In Heavy Duty Vehicles

Maintaining a heavy duty diesel engine during extreme winter cold temperatures requires attention to the condition of your vehicle's cooling system and concentration of AF/C

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Introduction

Throughout the North American regional trucking markets, increasing cargo volumes are projected to grow by as much as 24% over the next 10 years, and overall revenue increases are forecasted to jump by as much as 66% by the year 2022. This growth will continue to strain fleet managers' resources as they grapple with increasing their capacity and uptime.

For the modern day fleet manager, trucks on the road equate to revenue growth while those in the shop minimize margins and put additional, unnecessary stress on the remaining operational equipment. For the North American market, winter is an especially crucial time for fleet managers and maintenance professionals who understand the importance of preparing a heavy duty engine for the brutal temperatures subjected by winter's frigid wrath.

In order to keep the fleet running and on the road, it is important to recognize that there is no seasonable approach for HD cooling system maintenance. Coolant in the vehicle must be in compliance with TMC recommendations and must be maintained in accordance with TMS scheduling.

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Summer Thinking and Winter Consequences

During the summer, when someone realizes the coolant level is low in their cooling system, it may seem to make sense to put a jug of water in the system to 'top off' when the correct fluid is not available. In the winter, the opposite approach might be taken by adding a jug or two of AF/C concentrate, when freezing is the primary concern. While these apparently common-sense fixes may not scream 'bad idea' at the time — they could prove detrimental to the 'health' of the entire engine.

It is essential to stick to your usual recommended maintenance schedule and practices as winter weather puts strains on your engine. Don't let summer thinking get you stuck on the winter road. The functions of AF/C are far more complex than simple freeze and overheating protection.The newest technologies in today's AF/C provide a layered approach to controlling engine temperatures as well as protecting engine components from premature damage and excessive corrosion.

The primary functions of heavy duty antifreeze/ coolant are:

- Efficient heat transfer, transporting engine heat to control critical metal temperatures
- Maintain optimum engine temperature for fuel and lubrication efficiency
- Increase the cooling index to help prevent boilover and overheating failure
- Provide freezing protection to the very lowest temperature encountered
- Provide effective corrosion protection or corrosion inhibition for all cooling system metals through a wide range of temperatures

If the cooling system is unable to satisfy the essential requirements put on it by the heavy duty engine, the vehicle's horsepower, fuel efficiency, emissions and overall durability may be compromised. Selecting the highest quality AF/C products and replenishing at the recommended interval will ensure operating efficiency and optimal performance. Controlling as many variables and keeping trucks on the road directly affect the bottom line of any operation and these are some of the highest priorities for fleet managers.

The Challenge

While the threat of winter season freezing may appear on the surface to be the primary concern for AF/C, inhibitor effectiveness is also a primary function for an effective coolant.

In addition to protection from excessive heat and cold temperatures, properly formulated coolant protects a long list of engine cooling system metals and components from corrosion and failures.

Testing the coolant concentration (mixture of glycol, water and inhibitors) is an important part of winter engine management.

Water and water-glycol mixture alone are naturally corrosive, coolant manufacturers add inorganic and/or organic salts and other chemicals, known as corrosion inhibitors, to the glycol/ water mixture in order to prevent the cooling system components from corroding.

While the very best coolants will protect a heavy duty engine from freezing up in cold temperatures, they also actively fight metal corrosion within the engine. Corrosion, rust in particular, can degrade the effectiveness of an cooling system, negatively affecting performance and putting the long-term 'health' of the engine at risk. Given the multitude of metals making up any heavy duty engine, it is important to understand the need for inhibitors in the coolant to fight rust and different types of corrosion across all the metal surfaces. The correct mixture of coolant with the proper amount and type of inhibitors will guard against corrosion.

Recommended testing for levels of coolant is essential for protecting a heavy duty engine. If the glycol concentration is too rich or too low, not only can freezing and boilover protection become a problem, but the correct level of inhibitors necessary to protect the essential engine components can become a matter of concern.

The major components that could potentially be affected by incorrect engine coolant concentrations are:

- Radiator
- Heater Core
- Wet Sleeve Liner
- Coolant Pump
- Block
- Cylinder Head
- Thermostat
- Hoses
- Gaskets
- Oil Cooler
- Super charger/ Turbo Cooler
- Sensors
- EGR Valve
- Control Valve

The engine's cooling system is exactly that — a system. It relies on all the components within its group to maintain effective operation. When you consider how the components in a modern-day heavy duty engine cooling system are reliant on each other for effective and safe operation, it is not hard to recognize the importance of testing AF/C, which could negatively affect one component and lead to problems with other components throughout the system.

Aside from the components, the metal surfaces that make up the entire engine can be negatively affected by incorrectly managed levels of coolant. The typical cooling system metals that can be affected are: cast iron, steel, cast aluminum, aluminum alloys, brass, copper, and solder CAB flux.

If glycol concentrations are not monitored and start to drop, you begin to lose freeze point protection that may be necessary for the region in which your truck fleet needs to operate. As the coolant concentration starts to dip below 30%, there will be little-to-no protection from cold weather temperature extremes and the potential of damaging a cooling system component or head/block cracking can become more prevalent.

With the seemingly innocuous decision to merely add water to a cooling system, an understandably instinctive decision based on a premise that water cools surfaces, a heavy duty cooling system can incur significant corrosion from that unintended dilution as well as a loss of nitrite/corrosion protection, leading to an increased incidence of liner pitting.

Likewise, when the good-intentioned act of adding that extra couple of gallons of concentrate in the winter because coolant water was frozen, especially doing this a couple of times, will lead to the spiking of the glycol levels. When glycol levels exceed 70%, it can leaves an engine with virtually no extreme temperature protection and it can create the potential slushing of coolant, where the liquid becomes semi-liquid. When AF/C becomes 'slushy' it can lead to water pump leaks as the pump strains to move the thickened coolant. While most coolants will protect a heavy duty engine from freezing up in cold temperatures, they also need to actively fight metal corrosion within the engine cooling system.

Corrosion, rust in particular, can degrade the effectiveness of a cooling system, by generating deposits in heat exchangers and negatively impacting the performance of the radiator to remove heat from the system.

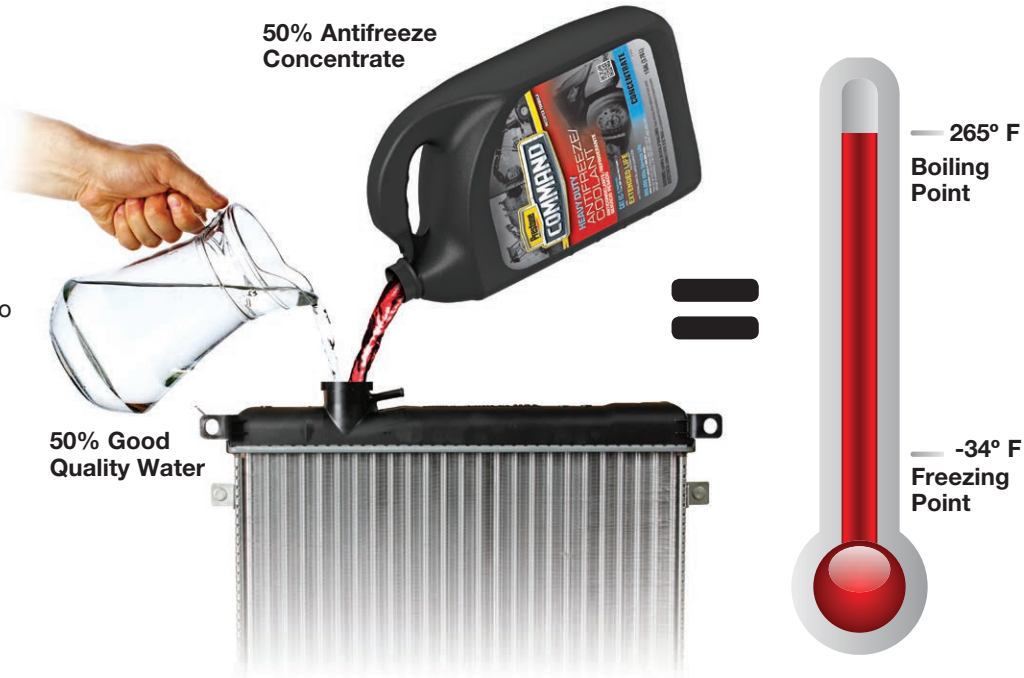
Fleet owners running in extreme cold conditions might decide to push the glycol levels to the upper limits, 70% max, for optimum freeze point protection. Extreme care at these concentrate levels must be exhibited when warm temperatures approach and the coolant concentrate needs to be rebalanced to recommended concentrations of 50% to optimize the heat transfer properties of the coolant (the ability to keep the vehicle from overheating).

Proper AF/C Mixture Needed To Ensure Freeze And Boilover Protection

Antifreeze/Coolant (Ethylene Glycol Base) and good quality water* are mixed at a 50/50 ratio to lower the freeze point of the cooling system to -34° F (-37° C) and raise the boiling point of the system to 265° F (129° C), pressure measured with use of 15-lb pressure cap.

Above 5000 ft elevation antifreeze/ coolant concentration should be maintained at a 55-60% antifreeze/ coolant to water mixture to reduce the chance of boilover. Refer to OEM specifications for more information.

*per ASTM and TMC recommendations



Regardless of any seasonal climate, the well-intentioned addition of water alone to a cooling system can seriously undermine the effectiveness of AF/C's ability to protect an engine from excessive temperatures and potential corrosion of cooling system components.

Excessive levels of glycol, and relative low levels of water, create a poor heat transfer environment that will encourage higher under-hood temperatures, overall cooling system fatigue and potential engine overheating and failure.

Those excessive levels of glycol, and relative low levels of water, create a poor heat transfer environment that will encourage engine overheating, while insufficient water percentages can also compromise corrosion additive effectiveness. Once those corrosion-protecting elements drop out of the coolant, engines become susceptible to corrosion and overall cooling system fatigue can set in.

The Solution

Having the ability to proactively initiate testing on any engine cooling system is imperative to making the right decisions for maintaining the correct levels of coolant concentrations. By providing an easy way to test a cooling system, essential preventative maintenance need not be put off out of mere inconvenience.

There are a number of ways to test your coolant to ensure you are ready for any situation or condition. These testing options vary in complexity and scope, but they do offer 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 coolant 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 antifreeze/coolant family. The Prestone Command team has developed a practical, effective testing program that will assist in making informed maintenance decisions based on an effective coolant 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 Command offers three different test kits to meet the various challenges equipment might encounter.

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

Prestone Command® Test Kits

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

Specifically-Designed Test Strips will assist in determining pH, glycol concentration and allows you to check for:

- Water Quality
- Nitrite and Molybdate Levels
- Nitrite Levels
- Corrosion inhibitor (Organic Acid) Levels

Prestone Command® Hand-Held Refractometer

- Measures concentration and freezing temperature of ethylene and propylene glycol-based coolants
- Easy-to-use, customer-friendly portability that provides a wide-range measurement
- Provides a dual scale and temperature compensation

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Colin Dilley, Ph.D, is the Director of Technology for Prestone Products Corporation. Colin can be reached at (203) 731-8110 or Colin.Dilley@Prestone.com. Prestone Products Corporation manufactures and markets Prestone® antifreeze/coolant and related products. For more than 85 years, the Prestone name has provided customers with high-quality products, including one of the leading brands of antifreeze/coolant. The company's heavy duty division is headquartered in Lake Forest, IL, and recently launched its Prestone Command® brand of products specifically engineered for the most demanding heavy duty on-road and off-road applications. You can find more at www.prestonecommand.com.

SOURCES:

**1: GENCO American Trucking Association (ATA) Transportation Forecast, U.S. Freight transportation forecast*

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ANYWHERE. ANYTIME. ANY ENGINE.™