ANTIFREEZE/COOLANT
PRODUCT TRAINING

FUNCTION OF COOLANTS

The cooling system controls temperatures of all metallic and non-metallic material, along with other engine fluids

To properly transfer heat, you must protect system components from corrosion, cavitation, and scale.

More than 40% of engine problems originate in the cooling system

Coolant selection and maintenance is key to the life of equipment.

CASTROL HD COOLANT OFFERING

Castrol Radicool Heavy Duty 50/50

- Conventional Technology

Castrol Radicool SF-O Extended Life 50/50

- Organic Acid Technology (OAT) Free of nitrites, amines, phosphates, silicates

Available Packaging

- 55 Gallon Drums

  Radicool Heavy Duty 50/50 and SF-O Extended Life 50/50
- 275 Gallon Totes

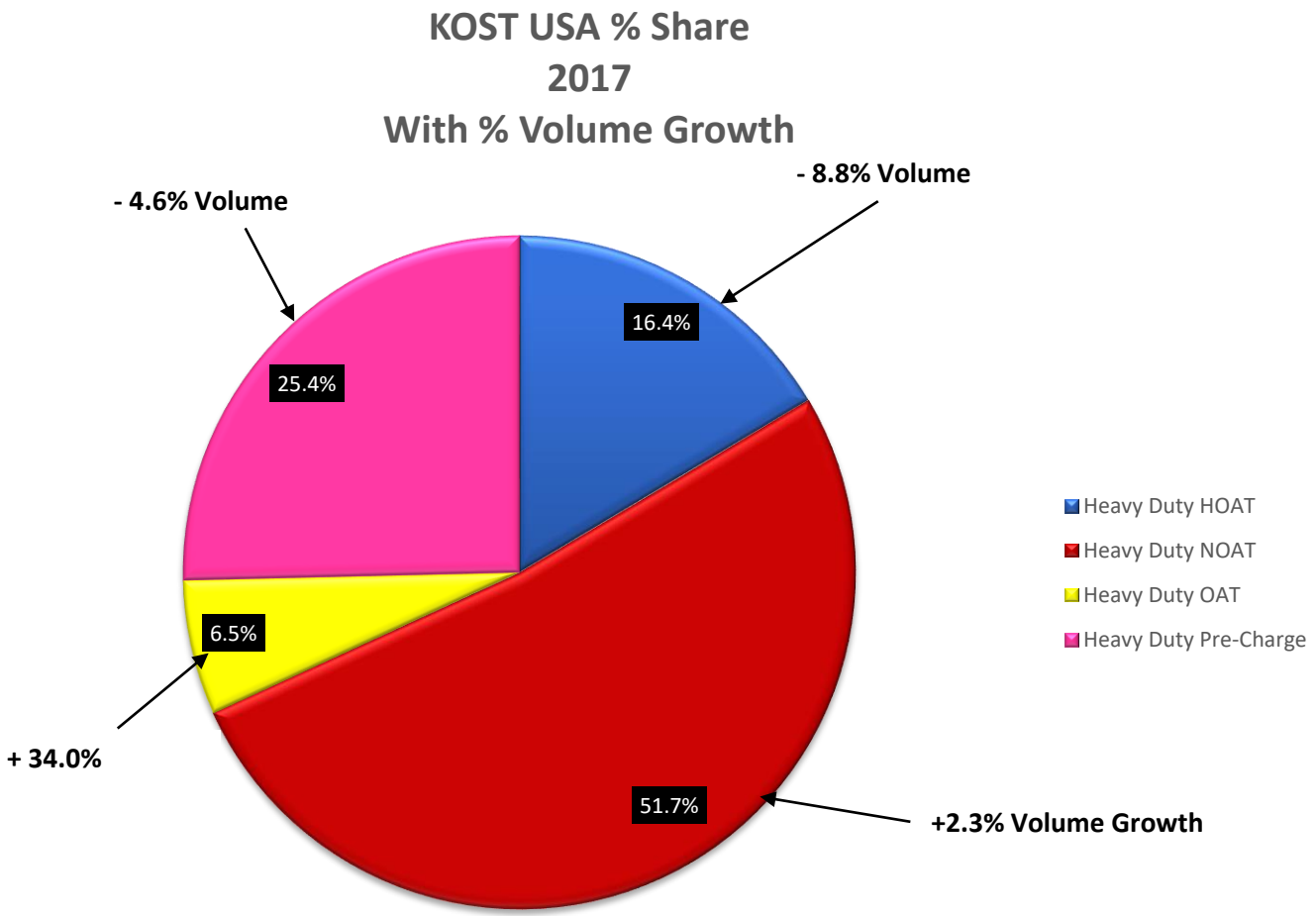
  Radicool SF-O Extended Life 50/50
- Bulk Shipments

  Radicool SF-O Extended Life 50/50 Tankers hold up to 5000 gallons

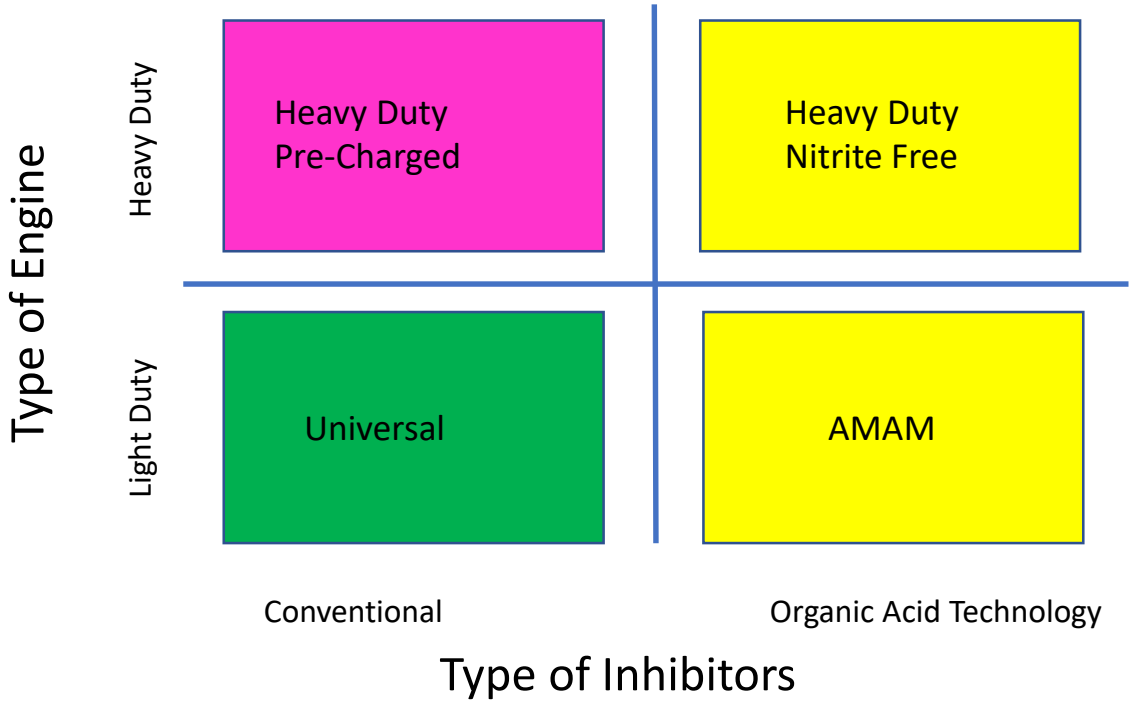
COOLANT TECHNOLOGIES

Product	Technology	Description
Conventional Green	Conventional	Designed for automotive applications or 'spin on' filters required for wet sleeve liners (diesel)
Conventional HD Pre-Charged	Conventional	Conventional technology with the initial charge of SCAs which must be maintained throughout service life at PM
OAT All Makes All Models	OAT	All makes, all models automotive and light-duty diesel (non wet sleeve liners)
DEX-COOL Type Orange for use in GM Cars and Trucks requiring DEX-COOL®*	OAT	All makes, all models automotive and light-duty diesel (non wet sleeve liners) *DEX-COOL® is a registered trademark of the General Motors Corporation.
NOAT HD Extended Life	NOAT	Nitrite + Molybdate (typically for CAT)
OAT Nitrite Free Extended Life	NAPS free	Free of nitrites, amines, phosphates, silicates

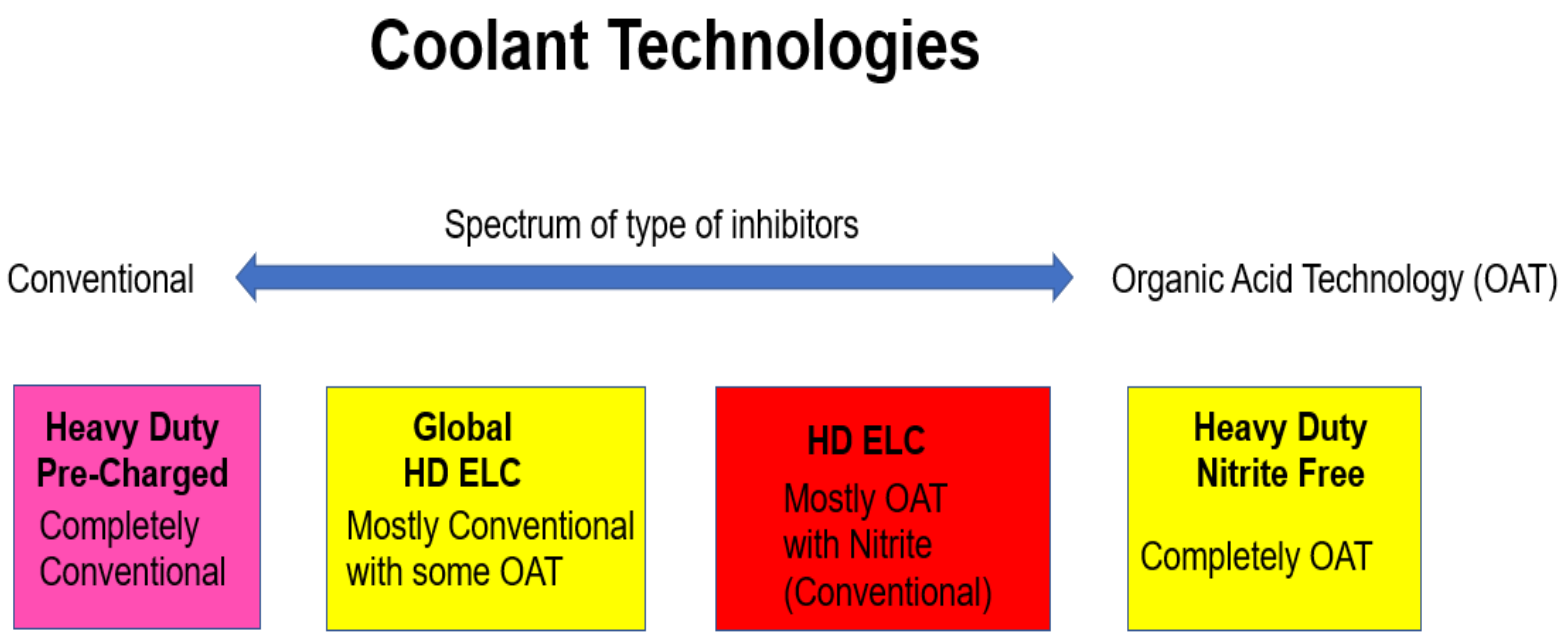
HEAVY DUTY ANTIFREEZE TRENDS UNIT SHARE BY SEGMENT



COOLANT TECHNOLOGIES



COOLANT TECHNOLOGIES

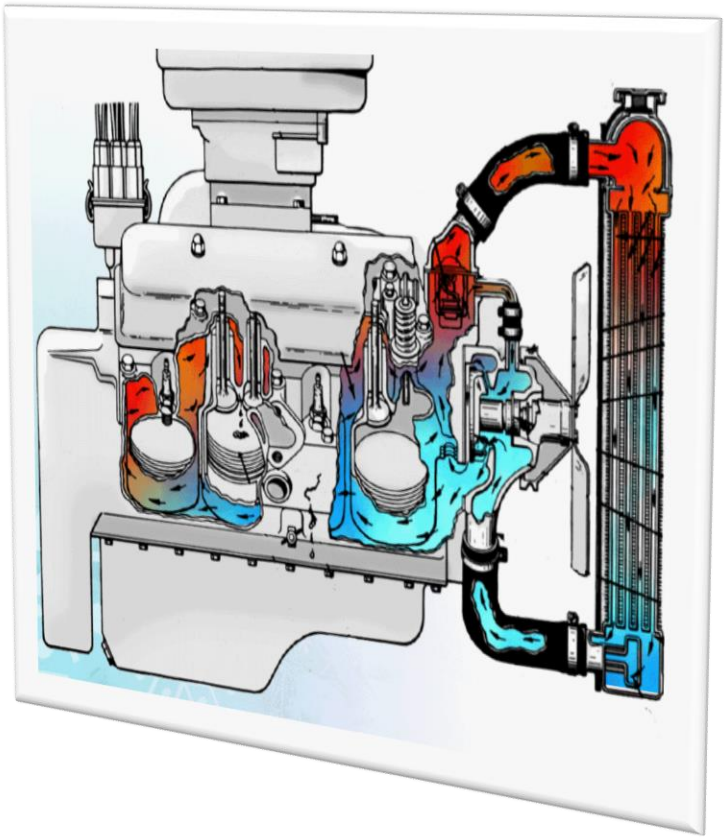


GLYCOLS

- EG and PG assist in heat transfer and reduce the surface tension of the fluid.
- Increase boil point and reduce freeze point.
- 95% of the fluid is glycol in 100% / 47% in pre-mix.
- Ethylene glycol is the most commonly used raw material making up the majority of fluids today.
- Propylene glycol usage is growing because of environmental and renewable aspects. Typically, however, the costs are higher.

COOLANT REQUIREMENTS

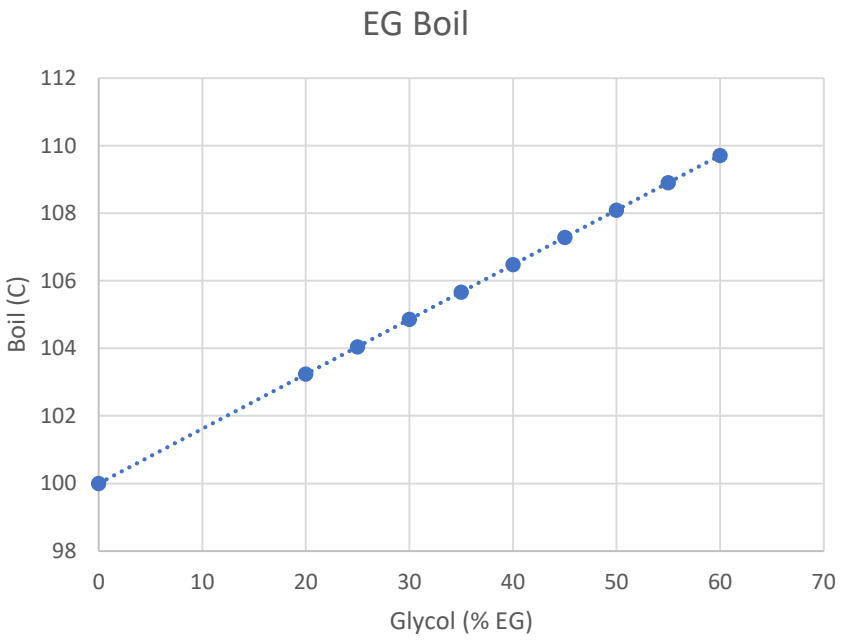
1. Provide engine material protection
2. Facilitate effective heat exchange
3. Provide freeze and boil protection

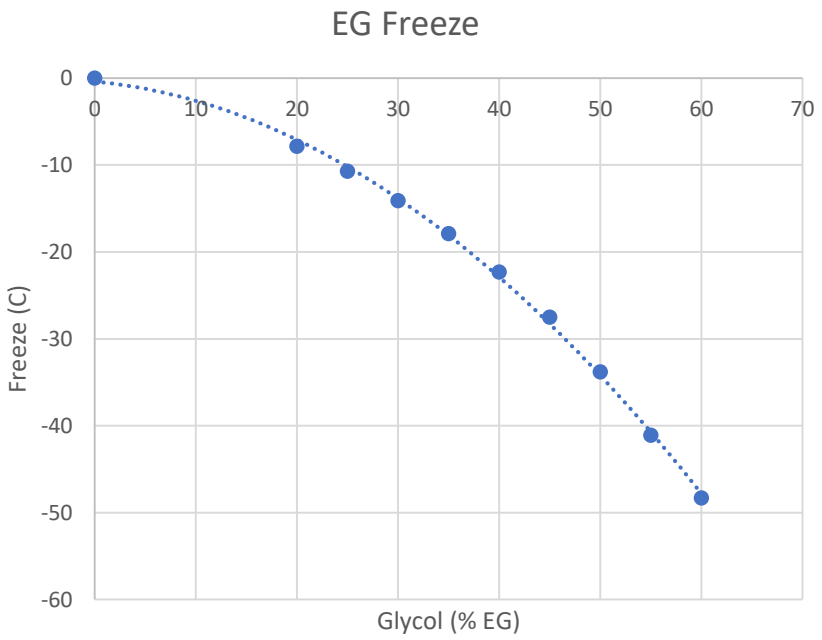


COOLANT COMPOSITION

2		3		1
Water	+	Glycol	+	Additives
• Transfers heat to radiator		• Lowers freeze point		• Provides corrosion protection
		• Raises boiling point		• Liner pitting protection
		• Transfers heat to radiator		• Scaling protection
		• Reduces water surface tension		

FREEZE / BOIL POINT





INHIBITORS

Conventional/Inorganic

"Plating"

Typically focused protection

Borates – Iron
Phosphate – Iron

Organic Acid (OAT)

"Cleaning"

Broad based corrosion protection

2-EHA
Benzoic
Sebacic

Heavy Duty

Cavitation protection

Nitrite
Molybdate

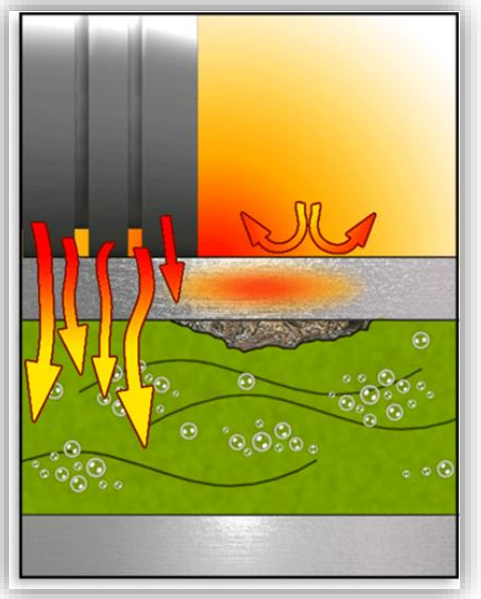
Other

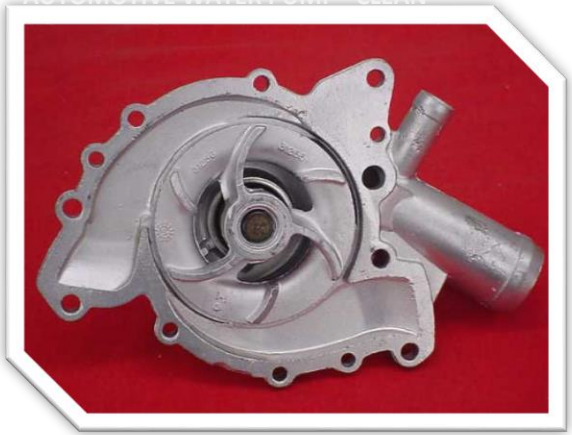
Azoles

Anti-scale

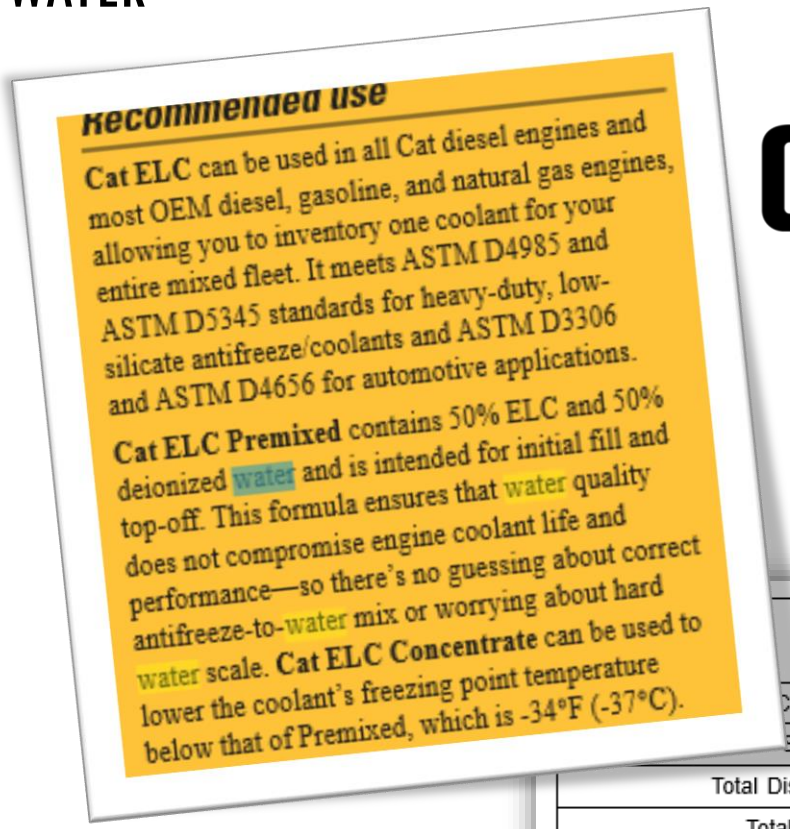
Tolyltriazole
Benzotriazole
Bayhibit
Carbosperse

SCALE, CAVITATION, HARD WATER DEPOSITS





WATER



Recommended Use

Cat ELC can be used in all Cat diesel engines and most OEM diesel, gasoline, and natural gas engines, allowing you to inventory one coolant for your entire mixed fleet. It meets ASTM D4985 and ASTM D5345 standards for heavy-duty, low-silicate antifreeze/coolants and ASTM D3306 and ASTM D4656 for automotive applications.

Cat ELC Premixed contains 50% ELC and 50% deionized water and is intended for initial fill and top-off. This formula ensures that water quality does not compromise engine coolant life and performance—so there's no guessing about correct antifreeze-to-water mix or worrying about hard water scale. **Cat ELC Concentrate** can be used to lower the coolant's freezing point temperature below that of Premixed, which is -34°F (-37°C).

CAT

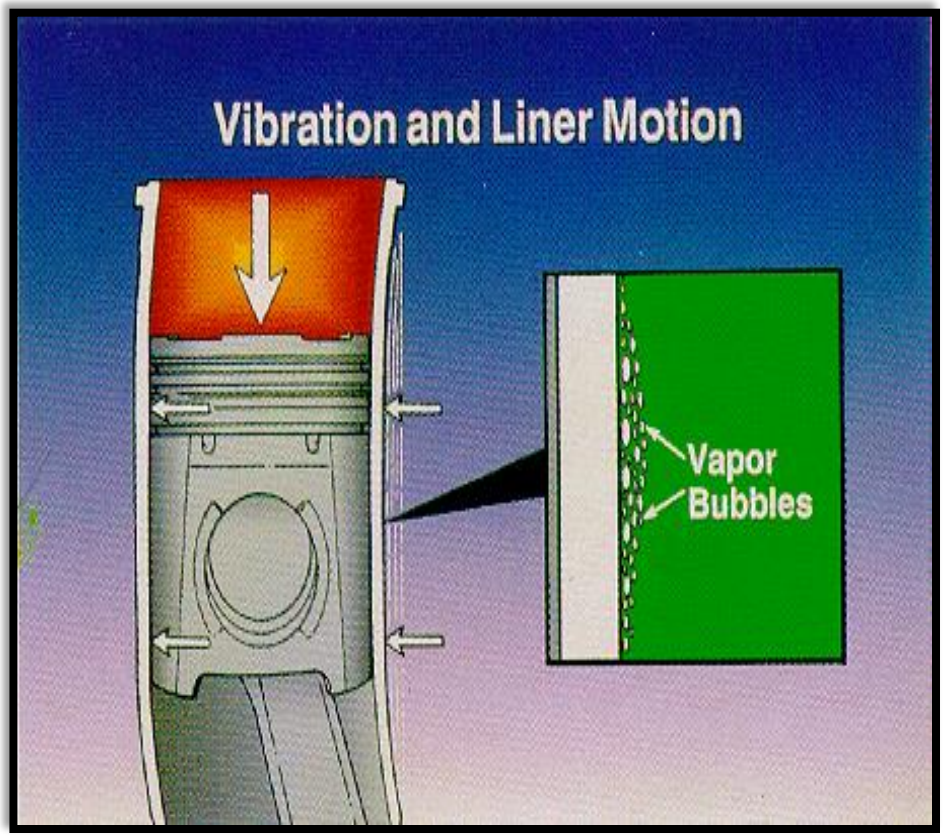
DETROIT
DEMAND PERFORMANCE

	Maximum Allowable	
	Parts per Million	Grains per Gallon
Chlorides	40	2.5
Sulfates	100	5.8
Total Dissolved Solids	340	20
Total Hardness Magnesium & Calcium	170	10

Table 4-8 Satisfactory Water Limits — Make-up Only

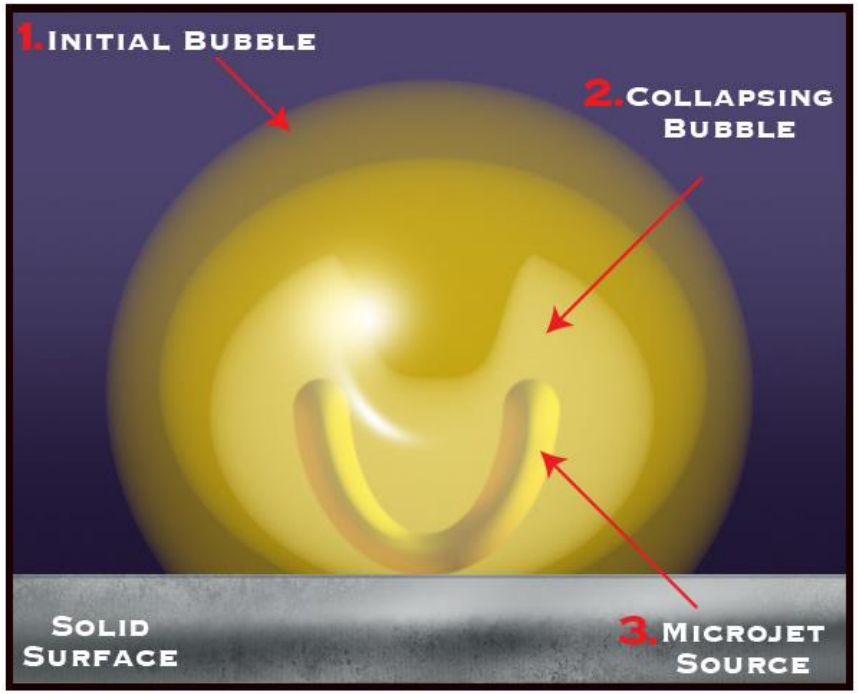
See Figure 4-2 for the procedure for evaluating the quality of water.

LINER PITTING

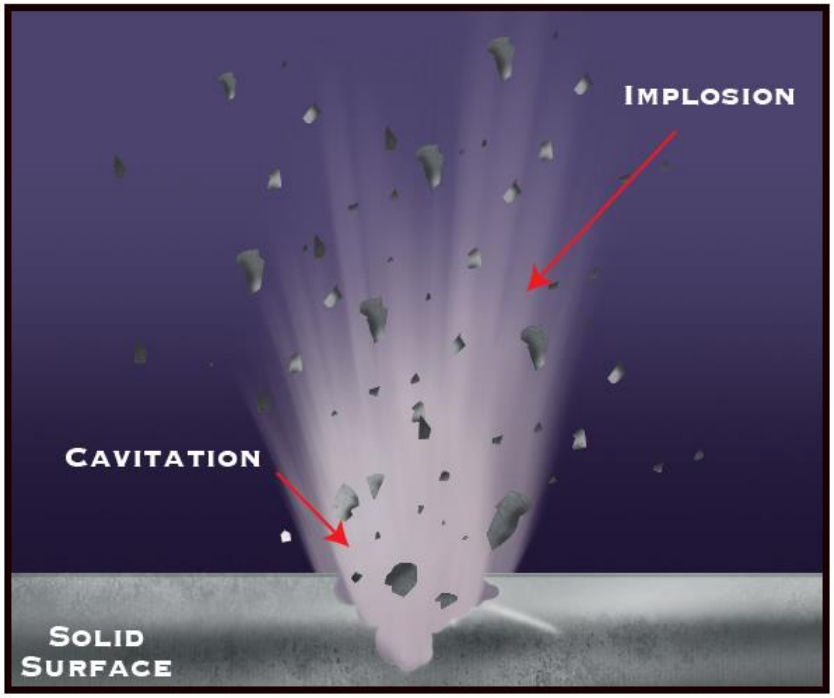


- Shockwave cavitation's explosion is measured at 15,000-20,000 PSI.
- The ONLY way to avoid these cavitation's are to use coolants with the proper additives to prevent this catastrophic occurrence.

CAVITATION



Collapsing Bubble



Implosion / Cavitation Bubble

Cavitation's are rapid formations of air entrapped in a fluid that compress under pressure.
High pressures will cause the collapsing bubble to implode and increase wear and reduce system efficiency.

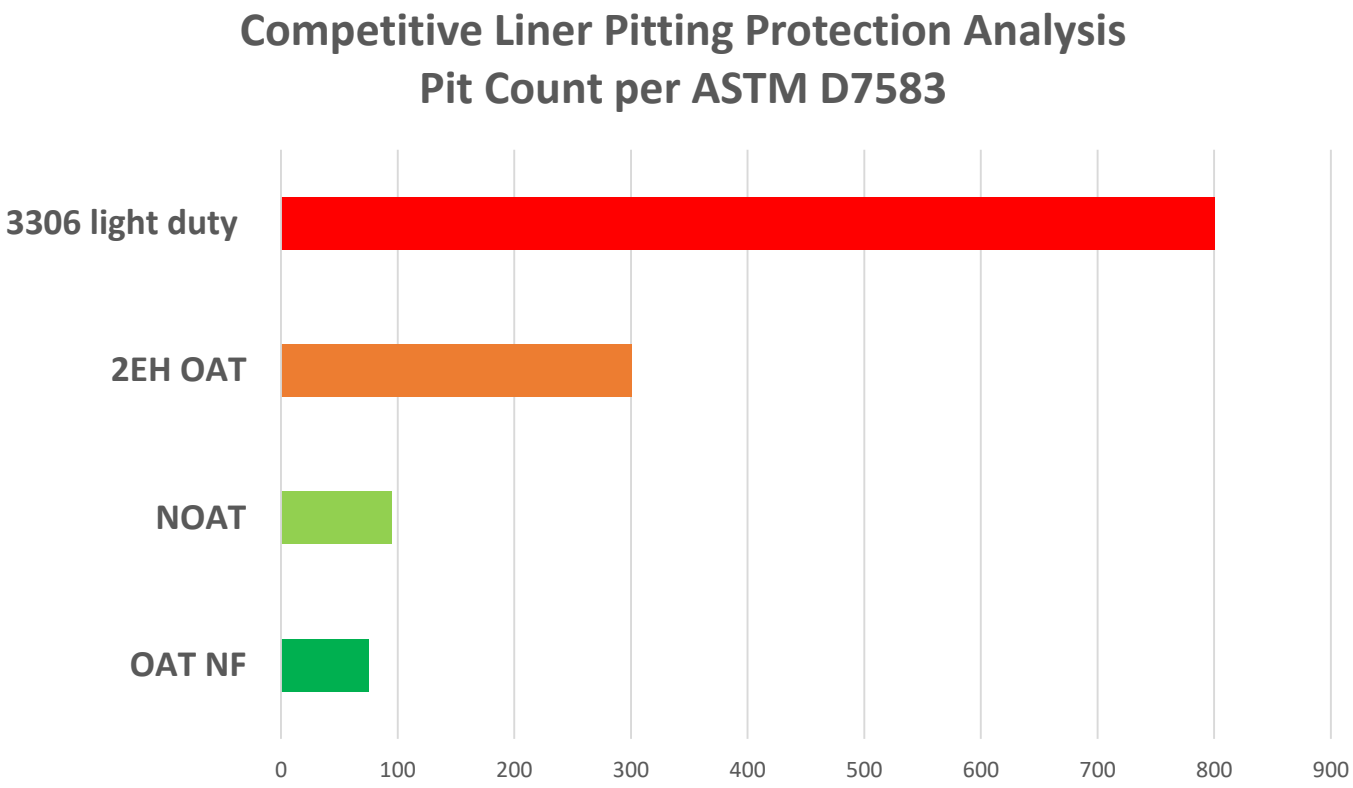
COMMON ISSUES – LINER PITTING

Liner Pitting

Coolants that are not properly formulated may not protect liners from cavitation in heavy duty applications.

This is a very expensive engine overhaul.

COMPETITIVE LINER PITTING PROTECTION ANALYSIS



ADDITIVE PROTECTION

Proper additives form a hard surface on the liner, creating a film, shielding the metal from the effects of bubble implosion and subsequent pitting.

COMMON ISSUES – ADDITIVE DROP OUT

Additive Drop Out

Additives can become unstable due to contamination, poor formulation, or over addition of SCAs.

Water pump leaking from seals and weep holes, overheating from scale build-up, plugged radiator tubes.

COMMON ISSUES – CORROSION

Corrosion

Corrosion of brass, solder, copper and aluminum.

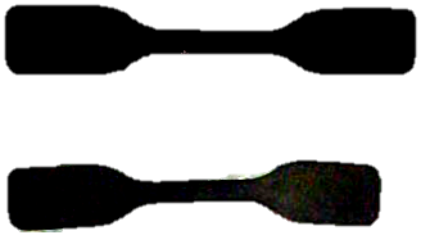
Degradation

Premature degradation of coolant life and ability to protect internal engine components, along with freeze and boiling point protection.

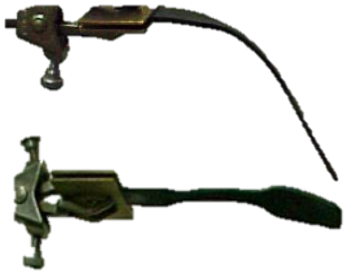
WHAT CAN GO WRONG

LEAKS THROUGHOUT THE SYSTEM DUE TO ELASTOMER COMPATIBILITY

Some additives have a negative impact on elastomers used in some applications



Shrinkage



Loss of flexibility

CONVENTIONAL COOLANT ADDITIVES

- Conventional fluids are typically comprised of inorganic metals that create a strong plating film
- Inorganic Acids are chemicals that don't contain carbon atoms
- Some Conventional Inhibitors are more soluble in water
- They are fast acting, cover all parts of cooling system equally, but deplete quickly, and have short lived protection
- Over a period of extended usage of a conventional coolant, (Universal Green or HD Pre-Charge), issues in a cooling system can be masked by their ability to plate the system
- Nitrites, Nitrates, Silicates, Phosphates, Borates are common Inorganic inhibitors

RADICOOL HEAVY DUTY

- Designed for ALL diesel engine applications where conventional fluids are acceptable.
- Conventional formula, initial charge of SCAs
- SCAs need to be checked and added in order to protect against pitting in diesel engines at every PM
- Identified by ASTM D 6210 & TMC RP 329
- Phosphate-free formula
- Service life can vary based on maintenance practices.

RADICOOL HEAVY DUTY

- Contains nitrites for superior wet sleeve liner cavitation protection.
- Provides freeze and boil-over protection.
- Designed for heavy duty applications, yet can be used in automotive applications where conventional technology coolants are acceptable.
- Phosphate-free with low silicates.
- Effective, long-term corrosion protection for steel, solder, copper, iron, brass and aluminum.
- Compatible with all major American brands of conventional coolants, with and without the addition of SCAs.
- Appropriate for use in on- and off road diesel engines, as well as in stationary engine applications where a conventional pre-charged coolant is required.

RADICOOL SF-O EXTENDED LIFE

- Designed for ALL diesel engine applications
- OAT Nitrite-Free formulation
- Identified by specifications CAT EC-1, ASTM D 6210 & TMC RP 338
- Purpose of this product is to provide diesel engine protection over very long service intervals and hide poor maintenance practices
- Service life can be up to 1,000,000+ miles without an extender
- Compatible with all other brands of ELC coolants in the market (NOAT and Nitrite-Free)

RADICOOL SF-O EXTENDED LIFE

- Extended service life of 1,000,000 miles or 20,000 hours of use.
- Free of phosphates, silicate, nitrites, amines, and borates.
- Offers excellent wet sleeve liner cavitation protection.
- Contains better heat transfer properties than conventional coolants requiring SCAs.
- Eliminates maintenance with no SCAs required.
- Provides freeze and boil over protection.
- Extended life corrosion protection for steel, solder, copper, iron, brass and aluminum.
- High-quality inhibitor system, nonharmful to hoses, plastics or gaskets.
- Compatible with all major American brands of coolant technologies including conventional and Organic Acid Technology (OAT).

COMMON COOLANT SPECIFICATIONS

Nitrites become less common:

- OEM developments mean engines with harsher conditions – leads to faster oxidation of nitrite
- Europe has taken the lead on amine and nitrite-free fluids due to environmental concerns

ASTM D6210 – Heavy Duty Specification

- Past requirement: 1200ppm nitrite, or 780ppm total of nitrite + molybdate
- Current (2010): Allows for a performance test for nitrite-free coolants: ASTM D7583 - John Deere Cavitation Test
- D6210 cavitation protection can be met with chemical OR performance requirements

CAT EC-1

- ASTM D6210 + nitrites

TMC RP 329

- Virtually identical to ASTM D6210

ASTM D3306 – Light Duty Specification

- Applies to coolants produced from virgin glycol (specifications D6471 and D6472 are used for coolants produced from recycled glycol; OEMs typically only accept coolants produced from virgin glycol)

Cummins CES 14603

RADICOOL HEAVY DUTY – SPECIFICATIONS

Specification	Radicool Heavy Duty
ASTM D3306	Meets Specification
Low Silicate	Meets Specification
ASTM D6210	Meets Specification
CAT DEAC/ NGEC	Works in / Suitable
Chrysler MS-7170	Works in / Suitable
Cummins CES 14603	Works in / Suitable
Detroit Diesel 7SE298	Works in / Suitable
Ford ESE-M97B44-A	Works in / Suitable
Freighliner 48-22680	Works in / Suitable
GM 1825M	Works in / Suitable
GM 1899M	Works in / Suitable
John Deere JDM H24A	Works in / Suitable
John Deere JDM H24B, C	Works in / Suitable
Mack GS17004	Works in / Suitable
MTU 5048	Works in / Suitable
Navistar CEMS B-1 Type II	Works in / Suitable
Perkins (CAT)	Works in / Suitable
TMC RP 329	Meets Specification
Volvo -GM Heavy Truck	Works in / Suitable

RADICOOL SF-O - SPECIFICATIONS

Specification	Radicool SF-O
ASTM D3306	Meets Specification
ASTM D6210	Meets Specification
ASTM DA7583	Meets Specification
Behr Radiator	Works in / Suitable
Caterpillar EC-1	Works in / Suitable
Cummins (Diesel/NG) CES 14603	Meets Specification
Daimler DBL 7700.00	Works in / Suitable
Daimler MS-7170	Works in / Suitable
Detroit Diesel 93K217	Meets Specification
Ford (light/medium) WSS-M97B44-D	Works in / Suitable
GM (ligh/medium) GMW3420	Works in / Suitable
International	See Navistar
John Deere JDS-G135	Meets Specification
Komatsu KES 07 892	Works in / Suitable
Mack GS17004	Works in / Suitable
MAN 324 Type SNF	Meets Specification
Mercedes Benz 325.3	Works in / Suitable
MTU 5048	Works in / Suitable
Navistar CEMS B-1 Type IIIA	Meets Specification
Paccar CS0185	Meets Specification
TMC RP 338A	Meets Specification
Volvo / Mack 20774185	Meets performance requirement / Works in / Suitable

MARKET & OEM TRENDS

- OEM Factory Fill almost exclusively OAT extended life fluids (exception: customer requests for conventional pre-charged coolants).
- OEMs recommend the use of OAT extended life coolants more and more in the after market, specifically nitrite free (both auto and HD).
- Movement toward one globally accepted coolant by all OEMs, again nitrite-free.
- ASTM standards are developed, altered, and pushed by the OEMs.
- Development of OAT (HD) with other technologies outside of 2 EHA.
- Global cooperation, OEM mergers, etc.

COOLANT RECYCLING

- Coolant Recyclers have a variety of ways to “clean up” used glycol but the consistency of those companies will always be in question. The incoming streams of glycol are inconsistent, and the process to recycle may be as well.
- OEMs stand up and say no!
- Leave behind chemistry that will hinder the performance of the fluid.
- No aftermarket support – laboratory, testing, and expertise.
- What are the risks of making a mistake with a partner who may not support your distributor (insurance, etc.)?
- If you think you may be competing or using a recycled coolant, KOST USA can test the fluid and uncover the facts.

LOW PRICE ALTERNATIVE

Industry chemical engineers state that all recycled coolants need to meet the standards found in the specification ASTM 1177

- Most recycled coolants on the market today DO NOT meet that standard.
- The cost is substantially higher to produce a recycled coolant that meets the ASTM standard than it does to produce a new coolant with the same ASTM standards.

Coolants require chloride levels to be at 25 ppm – Recycled coolants are typically 400+ ppm

- This causes unstable pH levels in the antifreeze/coolant, which leads to inconsistent and poor formulations.
- When you invest thousands of dollars on an automobile, truck or a piece of heavy duty equipment, why would you want to save a dollar or two on antifreeze that would most likely damage your engine?

40% OF ALL ENGINE FAILURES ORIGINATE IN THE ENGINES COOLING SYSTEM

REALLY?

This is the only time you should be choosing your coolant colors!