



Cooling System Product Guide

including Glossary of Coolant Terms and FAQ section

COOLANT



REAL™ Solutions.

Fleetguard Cooling System Maintenance Products

Heavy-duty diesel engines represent an extreme environment for a cooling system to perform well and protect the engine. In comparison to light-duty applications, cooling systems for heavy-duty applications experience an environment which is five to ten times more severe in terms of cooling system dynamics like heat rejection, flow rate, usage rate, and engine load factor (Table 1).

Heavy duty diesel engines must run up to five times as long as a light-duty engine, and the likelihood of rebuilding is much greater for the heavy-duty engine. With 40 percent of engine problems for heavy-duty applications being related to the performance of the cooling system, the importance of maintaining good cooling system performance cannot be ignored if maximum fleet reliability and reduced overall maintenance costs are to be achieved. A heavy duty coolant must be used for a heavy-duty application in order to achieve maximum engine reliability and lower overall operating costs.

Application	Heat rejecting through Cooling System (Kcal/hr)	Engine load Factor (%)	Usage rate (km/yr)	Engine life (km)
Light Duty	35,000	25	25,000	300,000
Heavy Duty	136,000	70	250,000	1,500,000

Table 1
Requirements for typical light-duty and heavy-duty engine

Heavy duty diesel engines are usually designed with wet cylinder liners that enable better heat rejection, but these liners are often sensitive to pitting from cavitation (see Figure 1).

When selecting the right coolant and cooling system maintenance program, it is critical to ensure that the coolant is designed with the chemistry needed to protect against liner pitting.

ES Compleat is the ideal coolant for heavy-duty applications because it contains the optimum balance of the key ingredients nitrite and molybdate to protect against liner pitting.

Light-duty coolants do not contain such protection (Figure 2).

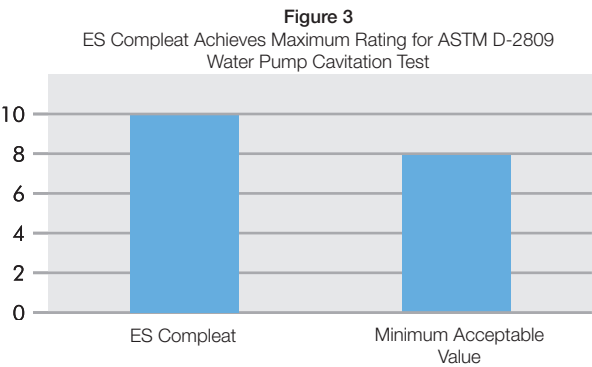
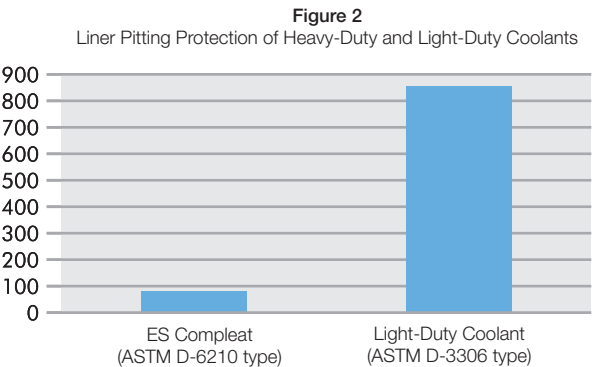
For heavy-duty systems the water pump must circulate up to 600 litres/min. to maintain the engine at a safe operating temperature.

ES Compleat is designed to prevent water pump cavitation and seal leakage.

ES Compleat achieves the maximum rating for the ASTM D-2809 water pump cavitation test (see Figure 3).



Figure 1





ES Compleat/ ES Extender

- Hybrid Lifetime Coolant with 250,000 km or 4000 Hours Service Intervals
- Best Liner Pitting, Scale and Corrosion Protection
- Easy Maintenance with ES Extender or Water Filter
- ES Extender Extends Coolant Life 250,000 km or 4000 Hours
- Meets ASTM 6210, TMC RP329 and Performance Specifications of all Major OEMs
- Available in Ethylene Glycol and Less Toxic Propylene Glycol Formulations

ES Compleat	EG Concentrate	*EG Premix	PG Concentrate	*PG Premix
5 l	CC2747M	CC2748M	CC2751M	CC2752M
20 l	CC2749M	CC2750M	CC2753M	CC2754M
208 l	CC2821M	CC2826M	CC2831M	CC2836M
1,000 l	CC2851M	CC2852M	CC2853M	CC2854M
bulk	CC2822M	CC2827M	CC2832M	CC2837M

* All PreMix part numbers are 50% glycol / 50% water (50/50) unless otherwise noted.

ES Extender	Part #
0,95 l	CC2840
18,9 l	CC2842
208 l	CC2841



Fleetcool™ OAT

- Extended service lifetime coolant with 500,000 km or 6,000 hour service intervals
- Optimizes cooling system performance and water pump life
- Superior deposit, scale, corrosion and erosion protection
- Meets ASTM D-3306, D-4985 performance requirements Performance Specifications of all Major OEMs

Fleetcool OAT	EG Concentrate	*EG Premix
5 l	CC36137M	CC36142M
20l	CC36138M	CC36143M
208l	CC36139M	CC36144M
1,000l	CC36140M	CC36145M
bulk	CC36141M	CC36146M

* All PreMix part numbers are 50% glycol / 50% water (50/50) unless otherwise noted.



Liquid Supplemental Coolant Additives (SCAs)

DCA2

- Standard Corrosion Protection Using Borate/Nitrite Based Inhibitor Package

DCA4

- Superior Liner Pitting, Scale & Corrosion Protection Using Phosphate/Molybdate Based Inhibitor Package

Units/size	DCA2™	DCA4™
5 / 0,5 l	DCA30L	DCA60L
20 / 1,9 l	DCA35L	DCA65L
200 / 18,9 l	DCA45L	DCA75L
2200 / 208 l	DCA50L	DCA80L

Coolant Filtration

Coolant filtration is proven to reduce wear and to maintain all cooling system components. Additionally, water filters can provide a convenient and reliable method for delivering supplemental coolant additives into the cooling system to improve performance and extend coolant service life.



Extended Service Water Filters

- Easy Maintenance every 12 months, 250,000 km or 4000 hours
- Patented Slow-Release Mechanism Replenishes Chemicals Depleted by Use
- StrataPore™ Multilayer Media Offers Superior Durability, Efficiency and Capacity
- Improved Mechanical Design for Increased Durability and Corrosion Resistance

Part #	Slow Release Coolant Additive	Thread Size
WF2121	15 units DCA 4	11/16-16 UN- 2B
WF2124	15 units DCA 4	3/4-20 UNEF- 2B
WF2128	15 units DCA 4	M16 X 1.5-6H INT
WF2126	8 units DCA 4	M36 X 2-6G INT
WF2131	15 units DCA 2	11/16-16 UN-2B
WF2133	15 units DCA 2	3/4-20 UNEF-2B
WF2138	15 units DCA 2	M16 X 1.5-6H INT
WF2136	15 units DCA 2	1-16 UN-2B

Part #	Extended Service Coolant Additive	Thread Size
WF2122	Non-Chemical	11/16-16 UN- 2B
WF2129	Non-Chemical	M16 X 1.5-6H INT
WF2134	Non-Chemical	3/4-20 UNEF- 2B
WF2123	Non-Chemical	11/16-16 UN- 2B
WF2130	Non-Chemical	M16 X 1.5-6H INT
WF2139	Non-Chemical	11/16-16 UN- 2B
WF2127	Non-Chemical	M36 X 2-6G INT
WF2137	Non-Chemical	1-16 UN-2B



Standard Service Water Filters

- For Use Up to 500 hours or 40,000 km
- Immediate Release SCA for Use with Any Coolant at Standard Service Interval
- High Quality Filtration for Efficient Removal of Harmful Contaminants

Part #	Immediate Release Coolant Additive	Thread Size
WF2093	5 units DCA4	11/16-16 UN- 2B
WF2070	2 units DCA4	11/16-16 UN- 2B
WF2071	4 units DCA4	11/16-16 UN- 2B
WF2072	6 units DCA4	11/16-16 UN- 2B
WF2073	8 units DCA4	11/16-16 UN- 2B
WF2087	9 units DCA4	11/16-16 UN- 2B
WF2151	4 units DCA4	11/16-16 UN- 2B
WF2015	8 units DCA4	3/4-20 UNEF- 2B
WF2074	12 units DCA4	5.43 (137.92)
WF2075	15 units DCA4	11/16-16 UN- 2B
WF2076	23 units DCA4	11/16-16 UN- 2B
WF2083	4 units DCA4	3/4-20 UNF-2B
WF2104	15 units DCA4	11/16-16 UN- 2B
WF2106	4 units DCA4	11/16-16 UN- 2B

Part #	Immediate Release Coolant Additive	Thread Size
WF2108	8 units DCA4	M16 X 1.5-6H INT
WF2022	11 units DCA4	1-16 UN-2B
WF2082	6 units DCA4	1-16 UN-2B
WF2051	4 units DCA2	11/16-16 UN- 2B
WF2088	6 units DCA2	11/16-16 UN- 2B
WF2054	15 units DCA2	11/16-16 UN- 2B
WF2144	12 units DCA2	11/16-16 UN- 2B
WF2096	4 units DCA2	M16 X 1.5-6H INT
WF2145	18 units DCA2	11/16-16 UN- 2B
WF2053	8 units DCA2	11/16-16 UN- 2B
WF2055	23 units DCA2	11/16-16 UN- 2B
WF2091	14 units DCA2	11/16-16 UN- 2B
WF2056	34 units DCA2	11/16-16 UN- 2B



Non-Chemical Filters

- For Use Up to 500 hours or 25,000 miles (40,000 km)
- High Quality Filtration for Efficient Removal of Harmful Contaminants

Part #	Thread Size
WF2077	11/16-16 UN- 2B
WF2078	3/4-20 UNF-2B
WF2101	11/16-16 UN- 2B

Part #	Thread Size
WF2109	M16 X 1.5-6H INT
WF2084	11/16-16 UN- 2B
WF2107	11/16-16 UN- 2B



Filter Head Assembly

- Head Assembly for Installation on Engines without Water Filtration Capability
- Assemblies Provide Everything Needed to Achieve Benefits of Coolant Filtration

Part #*	Description	Style	Port Size	Thread Size
204163 S	Water Filter Spin-On Head	Aluminum	3/8" NPT	11/16-16 UN- 2B
215617 S	Dual Water Filter Spin-On Heads	Aluminum	1/2" NPT	11/16-16 UN- 2B
256535 S	Filter Head Mounting Bracket	N/A	N/A	N/A
257715 S	Water Filter Head (204163 S) and Mounting Bracket Assembly	Aluminum Head	3/8" NPT	11/16-16 UN- 2B
3904378 S	Severe Duty Water Filter Head	Steel (thread)	3/8" NPT	11/16-16 UN- 2B

* Severe Duty Filter Head is recommended for most applications.

Coolant Testing

Every good cooling system maintenance program should include regular coolant testing to determine if the proper level of protection is present or if contaminants exist. A good coolant testing program eliminates guesswork and allows the cooling system to maintain peak performance.

Note: for correct results coolant should ideally be at room temperature (20°C).



3-Way™ SCA/Freeze Point Strips

- Easy to Use Test Strips Measure Freeze Point and Molybdate/Nitrite
- Measures Protection against Liner Pitting, Corrosion and Coolant Dilution
- Results in 45 – 75 Seconds

50/ bottle	CC2602M
25 x 4-pack	CC2602AM



4-Way Coolant Test Strips

- Easy to Use Test Strips for Organic Acid Technology (OAT) Coolant
- Measures pH, Nitrite, Molybdate and the freezepoint
- Detects coolant dilution, contamination and indicates if service is required
- Results in 45 – 75 Seconds

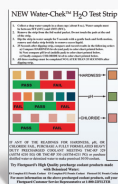
20 Single strips/Box	CC8997M
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QuikChek™ Coolant Quality Strips

- Easy to Use Test Strips Measure Levels of pH, Sulfate and Chloride for Overall Coolant Quality
- Minimizes Unnecessary Draining of Coolant still within Specifications
- Results in 45 – 75 Seconds

10 strips/Bottle	CC2718
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Water-Chek™ 3-Way Strips

- Easy to Use Test Strips Measure pH, Chloride and Hardness
- Determines if Coolant Make-Up Water Meets OEM, TMC and ASTM specifications
- Results in 45 – 75 Seconds

100 Single strips/Box	CC2609
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Refractometer

- Determines the Freeze Point Protection for Coolants
- More Accurate than Test Strips or Float-Type Hydrometers
- Durable Storage Case Included

Ethylene Glycol or Propylene Glycol*

CC2806*

* displays Fahrenheit only



Monitor-C™ Laboratory Testing – Coolant Analysis

- Expert Laboratory Analysis with On-line Reporting, Results in 24 Hours
- Measures Molybdate, Nitrate, pH, Hardness, Chloride, Sulfates, Corrosion Products (iron, lead, etc), and Silicates
- Tests for Freeze/Antifreeze Points, TDS and Buffers

Standard Kit

CC2700

Cooling System Cleaners

Cummins Filtration offers two types of cleaners to keep your cooling system in top condition. Both Restore™ and Restore Plus™ remove contaminants without harming metal surfaces, gaskets, hoses or plastic parts. They are also approved by Cummins® as the preferred product for cleaning contaminated cooling systems under warranty maintenance.



Restore™

- Alkaline-Based Cleaner
- Most Effective Cooling System Oil/Fuel Contamination-Cleaning Agent on Market
- 10 Times More Effective than Automotive Distributor Detergent Powders
- Safe for Use in Aluminum Radiators and Heaters
- Removes Silicate Gel

Restore

3,8 l	CC2601
18,9 l	CC2611
208 l	CC2612



Restore Plus™

- Mild Acid-Based Chelating Cleaner
- Safely Removes Rust, Corrosion, Scale, and Solder Bloom – Without Disassembling your Cooling System

Restore Plus

3,8 l	CC2638
208 l	CC2637

Frequently Asked Questions

What is the cavitation?

Cavitation is the formation of bubbles in the liquid coolant, which appear depending on coolant composition and the thermodynamic conditions of temperature and pressure.

What is the difference between cavitation associated with liner pitting and cavitation associated with the water pump?

Cavitation occurs depending on the thermodynamic conditions encountered. For cavitation associated with liner pitting bubbles appear as a result of high frequency vibration due to movement of the piston. These bubbles implode against the liner surface and cause pitting. Water pump cavitation is the result of bubbles formed in the inlet coolant of the pump and imploding on the pump impeller.

What is slow chemical release technology?

Slow chemical release technology is Fleetguard's patented technology that enables the slow release of coolant inhibitors into cooling system by coating of the inhibitors with a non-soluble material. The chemicals are released over time into the cooling system by diffusion.

What is diffusion?

The tendency of matter to move from areas of high concentration to areas of low concentration.

With cooling system removing one third of the total heat from combustion, what happens to the remaining two thirds?

Roughly one third of the heat of combustion is removed through the cooling system. Another third is removed through exhaust and general heat loss. The remaining third is converted to useful work.

What is scaling and what causes it?

Build up of calcium and/or magnesium on the cooling system components. Scaling is directly related to poor water quality.

Why do I need to check my tap water quality?

Proper water quality is important for the performance of the cooling system. Engine manufacturers follow these limits for water used in cooling system: Calcium and magnesium below 170 ppm; Chloride below 40 ppm; Sulfur below 100 ppm. If make up water does not meet these guidelines then ES Compleat in premix form is recommended.

Can I leave Restore/Restore Plus in the cooling system overnight?

No. Maximum time to allow Restore/ Restore Plus in the cooling system is 3 hours. Prolonged exposure can cause damage to elastomers and soft metals.

What does the condemnation test tell me about the coolant?

The condemnation test, provided by the Quik Chek 3-Way Coolant Quality Test Kit, is a go no-go test regarding the quality of the coolant. If the answer is negative, then the cooling system must be drained and new coolant added. The test measures the pH, chloride, and sulfate levels. Recommended to test coolant for condemnation once per year.

Why are freeze point and nitrite level in my coolant so important?

Measuring the freeze point, molybdate and nitrate level in your engine's cooling system is absolutely essential for protection against liner pitting, corrosion and coolant dilution.

How quickly does inhibitor inside a water filter dissolve into the coolant?

This will depend on the type of filter used. For DCA4 filters (ex: WF2070) the inhibitor exists as pellets inside the water filter. Immediately upon installation and exposure to coolant the DCA4 pellets dissolve into the coolant. For ES system filters (ex: WF2121), the inhibitor is coated with a non-soluble material which enables the slow release of inhibitors over the service interval.

Does maintaining with ES Compleat cost more than using a light-duty coolant pre-charged with coolant additives?

No. Although individual circumstances vary, use of light-duty coolant often requires frequent draining and refilling of cooling system whereas ES Compleat can be used for many years. Overall maintenance costs associated with cooling system are less for ES Compleat than for light-duty pre-charged with coolant additives since coolant chemistry is better maintained over time.

If I fill my system with ES Compleat, do I need to add any other product?

No. ES Compleat is a fully-formulated heavy duty coolant. Therefore, it contains all ingredients for a heavy-duty cooling system. If you are using an ES Compleat premix you simply add this to the clean system. For ES Compleat concentrate, de-ionized water should be added in the to make the premix.

How can I see if my cooling system is contaminated?

For severely contaminated systems, this can probably be seen by visual inspecting a coolant sample. Also, if in doubt about quality of coolant, use Fleetguard coolant test kits to determine over quality.

Does ES Compleat also contain antifreeze?

Yes, ES Compleat contains either ethylene glycol or propylene glycol as antifreeze.

What happens if I use a light-duty coolant in a heavy -duty application?

The overall reliability and durability of the engine will be reduced. LD coolants do not contain the specific HD inhibitors that are required in order to fully protect the cooling system from corrosion, cavitation, scale build up and oil fouling etc. This will result in problems such as overheating, leakage due to corrosion and even cavitation.

How do I clean my cooling system?

Drain down the existing coolant and flush with clean water. Use Restore (for oil fouling or silicate gel) or Restore Plus (for corrosion or scale) at 10 to 15% dilution for up to 3 hours at working temperature. Always follow the instructions carefully. Allow to cool, drain down and then flush several times with clean water before filling system with ES Compleat.

Have a technical question about a Cummins Filtration product? From filtration and exhaust systems to coolant products, we can answer your most pressing maintenance questions.

Coolant Product Glossary

Antifreeze: A formula with ethylene glycol or propylene glycol base that contains supplemental coolant additives (SCAs) and/or Organic Acids to prevent corrosion, foaming and other damage to cooling system components. It must be mixed with water before it is used! The most common mixture is 50% each.

ASTM: American Society for Testing of Materials (www.astm.org), the most important standards-setting organization in the world, publishes specifications most commonly cited, ASTM D-3306 for cars and ASTM D-6210 (new) and ASTM D-4985 (old) for trucks.

Borate: A pH buffer used in some antifreezes and SCAs (supplemental coolant additives) to maintain the pH of coolant as it ages.

Carboxylates: Organic acids that have the chemical fragment COOH in the molecule. In orange coolant, such as GM DEXCOOL[®], some of the anti-rust inhibitors are from this chemical family.

Charge: To charge or pre-charge a heavy-duty coolant, add 3% SCA to a 50% low silicate ASTM 4985 specification antifreeze and 50% water mix. In water, 6% SCA is usually the pre-charge dose.

Coolant: The fluid formulation in the cooling system, usually half antifreeze and half water.

Coolant Filter: A filter through which coolant flows and widely used as delivery device for SCA chemicals. Care is necessary to ensure the proper application, containing the proper chemical dose, is used. Extended life, slow release coolant filters are now used with extended life coolants.

Deionised (DI) Water: Water purified by deionization. It is chemically pure and contains no calcium, magnesium, chloride or sulfate as found in many tap waters. It is recommended as the make-up for coolant, especially extended service coolants.

Esters: A chemical family found in some recycled antifreezes. These chemicals quickly deplete the inhibitor package, acidify the coolant and cause catastrophic cooling system failure in remarkably short periods of time.

Ethylene Glycol: The most common antifreeze base. At 50% in water, EG antifreeze provides freeze protection to -34° F. EG can be harmful if ingested.

Freeze Point: The point where ice crystals begin to form in coolant as stated by ASTM method D 1177.

Fully Formulated: This term describes the new heavy-duty coolants that contain all chemicals necessary to protect diesel as well as automotive cooling systems. The ASTM specification for fully formulated coolant, ASTM D-6210, requires simultaneous compliance with all of the previous automotive and heavy-duty specifications. Therefore, this is a true universal antifreeze specification and may be used in any system.

Hybrid Coolant: Coolant made with a chemical additive package that contains a combination of organic acids and conventional corrosion inhibitors.

Molybdate: In the Fleetguard DCA-4, SCA, and coolant technology, a component to prevent cylinder liner cavitation and protect hard and soft metals from corrosion.

Nitrate: A general anti-corrosion additive that is especially effective in protecting aluminum and solder.

Nitrite: Additive present in all good SCAs and fully formulated antifreezes (ASTM spec D-6210) that is the most important additive for preventing cylinder liner cavitation.

Organic acid: A large family of chemicals usually used to refer in antifreeze discussions to carboxylate inhibitors (see carboxylates).

OAT: Organic Acid Technology coolant.

pH: A scale that indicates the acidity or alkalinity of a fluid or solution. The scale runs from 0 to 14 with values below 7 being acidic and those above 7 being alkaline. Antifreeze/coolant and SCA solutions run in the alkaline to mildly alkaline range of 7.5 to 11.0. A coolant or SCA solution will become unstable if the pH drops too much with use. Minimum acceptable pH depends on the type of coolant. Rapid additive depletion/precipitation and corrosion is likely once the coolant pH falls below the lower limit.

Phosphate: A pH buffer used in many coolants. Detroit Diesel[®] does not recommend phosphated coolants.

Pre-charged: A term to describe antifreeze that contains SCA. It is now obsolete; the term fully formulated is preferred.

Propylene Glycol: An alternative, slightly more expensive antifreeze base fluid that is environmentally friendlier than ethylene glycol due to its lower toxicity. Provides excellent corrosion protection.

Reserve Alkalinity: The ability of a coolant to resist aging as reflected by the amount of hydrochloric acid required to put the pH down to 5.5 in an ASTM test.

SCA: An acronym for supplemental coolant additive which is a chemical package added to coolant either as a liquid, powder or charge inside a filter to fortify the coolant's anticorrosive and other desirable properties. SCAs that meet the ASTM SCA specification are strongly preferred for maximum protection.

Silicate: The best protection against aluminum corrosion. However, silicate has limited solubility in coolant and is often associated with radiator plugging in poorly formulated coolants or SCAs. High quality coolants contain silicate stabilizers.

Silicate stabilizer: A chemical used in the best coolants and SCAs to prevent silicate drop-out, which may cause problems.

Specific Conductance: A coolant's ability to resist carrying an electrical current between dissimilar metals. Excessive levels can be due to improper source water, high metal corrosion or over-treatment with SCAs.

Total Dissolved Solids: A measure of the total amount of additives, make-up water minerals, and contaminants in a coolant.

Total Hardness: A calculation of calcium carbonate and magnesium carbonate - an indication of scale deposit formation. ASTM, TMC, and OEM specifications are based on Total Hardness.



**For more information, visit
cumminsfiltration.com**

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