DETROIT DIESEL

Coolant Selections

For Engine Cooling Systems

TRADEMARK INFORMATION

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1 INTRODUCTION

This publication specifies the types of coolants, filters, and related maintenance intervals required for the diesel-fueled engines manufactured and marketed by Detroit Diesel®.

NOTE:
For Off-Highway engine lubricating oil, fuel, and coolant requirements, refer to MTU® Technical Publication, *Fluids and Lubricants, Specification*, A001061/32E. This bulletin is available from authorized MTU Detroit Diesel distributors.

Selection of the proper quality of coolant and filters in conjunction with required coolant and filter maintenance is required to achieve the long and trouble-free service which Detroit Diesel engines are designed to provide. Operation with improper coolant and filters may void the manufacturer's warranty.

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2 COOLANT FILL OPTIONS

The coolants recommended for use in Detroit Diesel engines are listed in Table 2-1. This publication will give a complete explanation of their use.

NOTICE:
Required specifications for water, Ethylene Glycol (EG), Propylene Glycol (PG), inhibitor packages, and inhibitor concentration are included in this publication. To avoid possible engine damage from inadequate or over-concentrated coolant, this publication should be read thoroughly before replacing coolant.

Engine Series	Coolant Fill Options	Product
40, 50, 60, MBE 900, MBE 4000	EG and Water + Conventional Corrosion Inhibitors *	Detroit Diesel *POWER COOL*®
	Commercial Equivalent of *POWER COOL*	Fully formulated TMC RP-329 "Type A" Antifreeze and Water
	PG and Water + Conventional Corrosion Inhibitors	Fully formulated TMC RP-330 "Type A" Antifreeze and Water
	EG and Water + Organic Acid Technology (OAT) Inhibitors	*POWER COOL* Plus
	Water Only + Conventional Corrosion Inhibitors †	Water + *POWER COOL* 3000
	Water Only + OAT Inhibitors †	Water + *POWER COOL* Plus 6000

* Preferred Coolant

† Water-only coolant systems offer no freeze protection and should not be used where ambient temperatures can fall to 32° F (0° C).

Table 2-1 Initial Fill Coolant Options

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3 COOLANTS FOR DETROIT DIESEL ENGINES

The intent of this bulletin is to provide the requirements, directions, and information required to ensure cooling system protection for Detroit Diesel engines. These recommendations are general rules and reflect years of experience, technology research, and product development. Specific concerns not covered by this publication should be addressed to your local Detroit Diesel representative. The coolant used in Detroit Diesel engines must meet the following basic requirements:

- □ Provide an adequate heat transfer medium.
- □ Protect against cavitation damage to both cylinder liners and water pumps.
- □ Provide a corrosion/erosion-resistant environment.
- □ Prevent formation of scale or sludge deposits.
- □ Be compatible with cooling system hose and seal materials.
- □ Provide adequate freeze protection.

The corrosion inhibitors in a conventional coolant provide the protections listed in Table 3-1.

Inhibitor	Protection
Azoles	Copper Alloys
Borate	pH Buffer
Silicate	Aluminum and Solder
Nitrite	Cast Iron Corrosion and Cavitation
Nitrate	Light Alloys

Table 3-1 Protection Provided by Inhibitors in Conventional Coolant

The corrosion inhibitors in Organic Acid Technology coolants provide the protections listed in Table 3-2.

NOTE:
Nitrated Organic Acid Technology (NOAT) coolants (containing Nitrite as an additive) are not recommended by Detroit Diesel.

Inhibitor	Protection
Azoles	Copper Alloys
Carboxylic Acids	Corrosion protection for aluminum, solder, light alloys
	Cavitation/corrosion protection for cast iron

Table 3-2 Protection Provided by Inhibitors in OAT Coolant

The rest of this bulletin will describe the requirements for the proper usage of the water, antifreeze, and corrosion inhibitors. It will also describe the coolants and additives that are not recommended by Detroit Diesel and have been proven harmful to Detroit Diesel engines.

3.1 DETROIT DIESEL ENGINE INITIAL FILL COOLANTS

Listed in Table 3-1 are the approved and preferred coolants for each engine series. This section details the proper formulation of these coolants. Once in use, **these coolants must be maintained** according to procedures found in this publication. Refer to section 3.3.

3.1.1 ETHYLENE GLYCOL / WATER + CONVENTIONAL CORROSION INHIBITOR, PROPYLENE GLYCOL / WATER + CONVENTIONAL CORROSION INHIBITOR

These products are available as Fully Formulated, Phosphate-Free, Extended Service Interval (ESI) coolants. They are commercially available from Detroit Diesel (recommended) and other manufacturers as either a concentrated antifreeze or as a pre-mixed antifreeze. The pre-mixed antifreeze is ready to use, while the concentrated coolant must be mixed with water prior to use. Refer to section 3.1.1.1.

Detroit Diesel *POWER COOL* Engine Coolant (P/N 23512138) is the preferred EG coolant as listed in Table 2-1. If other commercial brands of EG coolant are used, they must be equivalent to *POWER COOL*. Detroit Diesel does not market a Propylene Glycol (PG) coolant. If a PG coolant is used, it must also meet the following requirements:

- Fully formulated EG-based, low silicate antifreeze or coolant must meet TMC RP-329 “Type A” requirements.
- Fully formulated PG-based, low silicate antifreeze or coolant must meet TMC RP-330 “Type A” requirements.

NOTE:
Fully formulated antifreeze does not require a dosage of Supplemental Coolant Additive (SCA) prior to initial use.

3.1.1.1 Mixing Ethylene Glycol or Propylene Glycol Antifreeze and Water

If a concentrated EG or PG antifreeze is purchased, mix the antifreeze with water meeting the required quality standards and fill the cooling system. For water requirements, refer to section 3.1.5. If a prediluted, fully formulated coolant is purchased, simply fill the cooling system.

For best overall performance, a coolant consisting of 50% concentration of antifreeze (50% antifreeze, 50% water) is recommended. An antifreeze concentration of over 67% (67% antifreeze, 33% water) is **not recommended** due to poor heat transfer, reduced freeze protection (IEG only), and possible silicate dropout. An antifreeze concentration below 33% (33% antifreeze, 67% water) offers too little freeze and/or corrosion protection and is **not recommended**.

Ethylene glycol-based coolant concentrations versus freezing and boiling temperatures are listed in Table 3-3.

Ethylene Glycol Volume %	Freezing Point		Boiling Point	
	° F	° C	° F	° C
0	32	0	212.0	100.0
10	24.2	4.3	212.6	100.2
20	14.9	–9.5	215.1	101.7
25	9.3	–12.6	216.7	102.5
30	3.0	–16.1	218.2	103.4
35	–4.3	–20.2	219.8	104.3
40	–13.1	–25.0	221.4	105.2
45	–23.5	–30.9	223.1	106.1
50	–36.2	–37.9	225.1	107.2
55	–51.6	–46.5	227.4	108.4
60	–70.3	–56.8	230.5	110.1
65	< –70	< –60	234.5	112.2
70	NA	NA	239.9	115.2
80	NA	NA	256.4	124.2
90	NA	NA	284.0	139.6
100	NA	NA	327.7	164.0

Table 3-3 Coolant Freezing and Boiling Temperatures vs. IEG Concentration (Sea Level)

See Figure 3-1 for propylene glycol-based coolant concentration versus freezing and boiling temperatures.

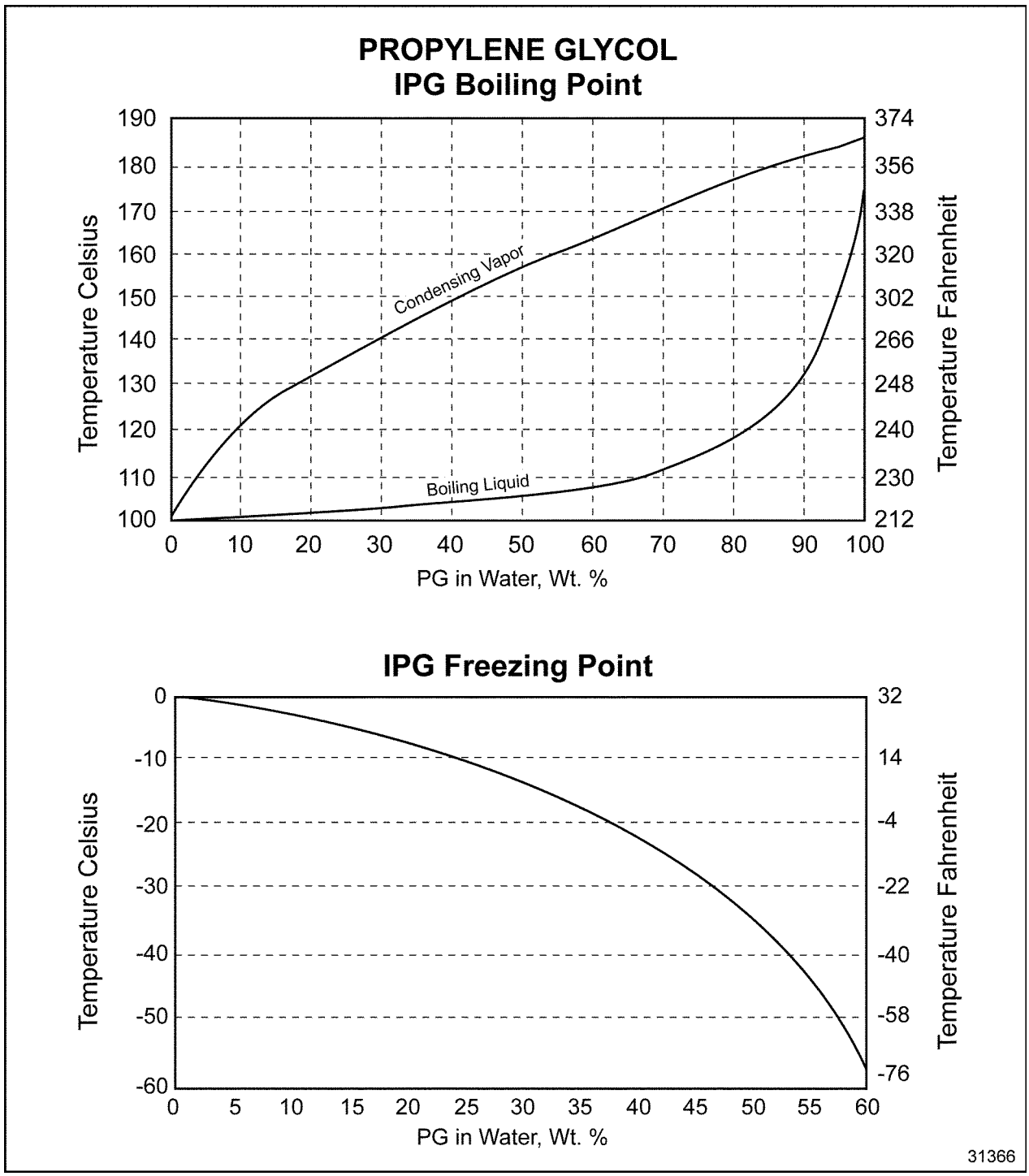

Figure 3-1 Coolant Freezing and Boiling Temperatures vs. Inhibited Propylene Glycol Concentration (Sea Level)

Always verify that the freeze point and nitrite concentration of the antifreeze/water mix are correct by using a *POWER Trac*® 3-Way Test Strip. If chemical analysis is used, elements in the coolant must fall within the limits listed in Table 3-4.

Element	Limit
Boron	125 – 500 PPM
Nitrite	900 – 3200 PPM
Nitrate	0 – 1000 PPM
Silicon	50 – 250 PPM
Phosphorous	0 PPM
pH	8.0 – 11

Table 3-4 Fully Formulated Glycol Coolant Limits with TMC RP-329 and TMC RP-330 Chemistry "Type A" (50/50 Coolant/Water Mixture)

3.1.1.2 Recycled Antifreeze

Antifreeze or coolant recycled by reverse osmosis, distillation, and ion exchange and properly re-inhibited to meet ASTM D6471 or D6472 requirements has been demonstrated to provide service equivalent to virgin antifreeze. Recycled antifreeze or coolants of these types are preferred. Other recycled coolants, especially coolants recycled through filtration processes, are **not recommended**.

3.1.2 ETHYLENE GLYCOL / WATER + OAT INHIBITOR, PROPYLENE GLYCOL / WATER + OAT INHIBITOR

EG and PG are also available with an OAT corrosion inhibitor package. These coolants require less maintenance over the useful life of the engine. The cooling system should either be equipped with a "**blank**" coolant filter or the coolant filter and piping may be omitted from the system.

OAT fully formulated antifreezes are available as concentrated and pre-mixed. Concentrated antifreezes should be mixed at 50% (50% antifreeze/50% water). **OAT coolants should not be mixed with conventional coolants.** If OAT and conventional coolants are mixed, no damage will result, but the long-life advantages of the OAT coolant will be lost. In this event, the coolant should be maintained as a fully formulated ESI coolant, not as an OAT coolant.

Detroit Diesel markets OAT-inhibited EG coolants – *POWER COOL* Plus and *POWER COOL* Plus Marine (30% glycol, 70% water). *POWER COOL* Plus coolants contain all of the required inhibitors. If a non-Detroit Diesel OAT antifreeze is used, it must conform to TMC RP-338 specification. **Do not add extender to new OAT antifreeze or coolant.**

3.1.3 WATER ONLY + SUPPLEMENTAL COOLANT ADDITIVE (TRADITIONAL/CONVENTIONAL), WATER ONLY + OAT INHIBITOR

In warm climates where freeze protection is not required, water only with corrosion inhibitors is approved for use. Water-only systems need to be treated with the proper dosage of corrosion inhibitors. Detroit Diesel-approved conventional SCA or OAT corrosion inhibitors must be added to the water to provide required corrosion and cavitation erosion protection. Initial fill options are listed in Table 2-1. OAT inhibitors such as *POWER COOL* Plus 6000 are available for water-only systems. OAT inhibitor should be mixed at 7.5% – 10% by volume with water. Refer to section 4 for a listing of *POWER COOL* products.

Conventional SCA (*POWER COOL* 3000) can also be used to protect the engine. Listed in Table 3-5 are *POWER COOL* 3000 coolant concentration limits.

Element	Limit
Boron	125 – 500 PPM
Nitrite	900 – 3200 PPM
Nitrate	0 – 1000 PPM
Silicon	50 – 250 PPM
Phosphorous	0 PPM
pH	8.0 – 11.0

Table 3-5 *POWER COOL* 3000 Coolant Concentration Limits (5% *POWER COOL* 3000, 95% Water)

POWER COOL 3000 SCA inhibitors should be mixed at 5% by volume with water (1 quart per 5 gallons of water[1 liter per 20 liters of water]). These additions can be made by adding liquid SCAs available in a variety of sizes. Coolant filters are also available for different cooling system capacities. These filters release the proper amount of SCA at initial fill. A listing of coolant filter elements matched with the cooling system capacity for water-only systems is listed in Table 4-13.

3.1.4 SUPPLEMENTAL COOLANT ADDITIVES FOR FULLY FORMULATED COOLANT (CONVENTIONAL COOLANT FORMULATIONS ONLY)

The concentrations of some inhibitors will gradually deplete during normal engine operation. SCAs replenish the protection for cooling system components. The coolant must be maintained with the proper concentration of SCA. Detroit Diesel *POWER COOL* maintenance products are recommended for use in all Detroit Diesel engines.

The proper application of SCA will provide:

- □ pH Control
- □ Restored inhibitor levels to prevent corrosion
- □ Water softening to deter formation of mineral deposits

- □ Cavitation protection to protect internal engine surfaces exposed to coolant

Check the nitrite concentration at the regular intervals listed in Table 3-6 with a *POWER Trac* 3-Way Test Strip. Test strip part numbers are listed in Table 4-11.

Service Application	Inhibitor Test Interval
On-Highway Trucks and Motor Coaches	20,000 Miles (32,000 Kilometers)
City Transit Coaches, Pick-Up and Delivery, Short Trip, and Emergency Vehicles	6,000 Miles (9,600 Kilometers) or three months, whichever comes first

NOTE: This table does not apply to OAT-based inhibitor systems.

Table 3-6 Required IEG and IPG Coolant Inhibitor Test Intervals for Traditional Nitrite-Based Supplemental Coolant Additive

Additional SCA must be added to the coolant when it becomes depleted, as indicated by a nitrite concentration of 900 PPM or less. If the nitrite concentration is greater than 900 PPM, do not add additional SCA. If the nitrite concentration is above 3200 PPM, the system is over-inhibited. The system should be partially drained and filled with a 50/50 mix of water and EG or PG.

3.1.5 WATER REQUIREMENTS

Distilled or de-ionized water, which eliminates the adverse effects of minerals in tap water, is preferred. High levels of dissolved chlorides, sulfates, magnesium, and calcium in some tap water causes scale deposits, sludge deposits and/or corrosion. These deposits have been shown to result in water pump failures and poor heat transfer, resulting in overheating. If tap water is used, the mineral content in the water must be below the maximum allowable limits listed in Table 3-7.

NOTICE:

Do not add additional SCA to new, fully formulated antifreeze or coolant. This can result in drop-out and/or the formation of deposits.

Mineral	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 3-7 Satisfactory Mineral Limits — Make-Up Water Only

See Figure 3-2 for the procedure to evaluate the quality of water. It is the owner's responsibility to ensure conformance.

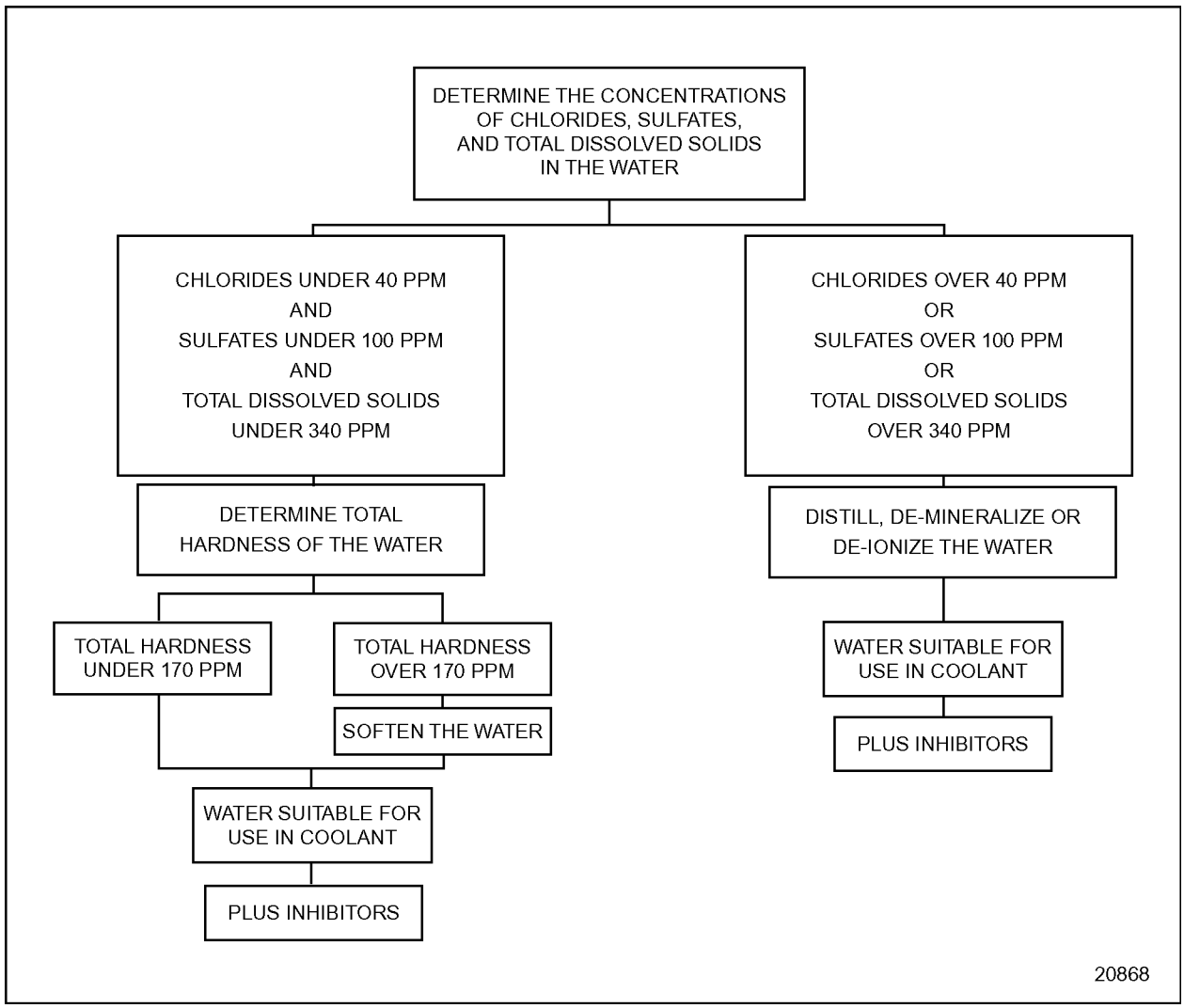

Figure 3-2 Procedure for Evaluating Water

3.2 COOLANTS AND ADDITIVES NOT RECOMMENDED

This section describes the coolants and additives **not recommended** for use in Detroit Diesel engines.

3.2.1 COOLANTS NOT RECOMMENDED

The following coolants should not be used in Detroit Diesel engines:

- **All antifreezes and coolant containing phosphorous are not recommended.** Drop-out, overheating, and water pump seal failures can result from use of coolant or inhibitor packages based on phosphate.
- **Automotive type coolants** generally contain high levels of phosphate and silicate, offer no liner pitting protection, and are not suitable for use in Detroit Diesel engines.
- **Methyl alcohol-based antifreeze** must not be used in Detroit Diesel engines because of its effect on the nonmetallic components of the cooling system and its low boiling point.
- **Methoxy propanol-based antifreeze** must not be used in Detroit Diesel engines because it is not compatible with fluoroelastomer seals found in the cooling system.
- **Glycol-based coolants formulated for Heating/Ventilation/Air Conditioning (HVAC)** should not be used in Detroit Diesel engines. These coolants generally contain high levels of phosphates, which will form deposits on hot internal engine surfaces, reduce heat transfer, and cause water pump seal leaks.
- **Organic acid inhibited containing nitrite** should not be used because this technology has been proven to be deferential to aluminum components within the cooling system circuit.

3.2.2 NON-FORMULATED ADDITIVES NOT RECOMMENDED

The following additives should not be used in Detroit Diesel engines:

- **Soluble Oils:** Soluble oil additives are not approved for use in Detroit Diesel engine cooling systems. A small amount of oil adversely affects heat transfer. For example, a 1.25% concentration of soluble oil increases the fire deck temperature 6%. A 2.50% concentration increases the fire deck temperature 15%. The use of soluble oil additives may result in engine overheating and/or failure.
- **Chromates:** Chromate additives are not approved for use in Detroit Diesel engine cooling systems. Chromate additives can form chromium hydroxide, commonly called “green slime.” This, in turn, can result in engine damage due to poor heat transfer. Cooling systems operated with a chromate-inhibited coolant must be chemically cleaned with ***POWER COOL*** **Twin Pack** cooling system cleaner/conditioner (or equivalent sulfamic acid/sodium carbonate cleaner) and flushed. *POWER COOL* cleaners are listed in Table 4-10.

- **Nitrited Organic Acid Coolant:** Nitrite as an additive in a Nitrited Organic Acid Technology (NOAT) coolant has been proven to be detrimental to some aluminum components within the cooling system circuit. In addition, it can then negate the proper function of certain engine sensor capabilities and thus result in engine damage. It is important to understand the difference between the benefit of nitrite as an additive to a Traditional/Conventional coolant versus the detriment to an OAT coolant. Nitrite in a Traditional/Conventional coolant does not have an adverse effect on aluminum components.
- **Phosphate Inhibitors:** Phosphate has tendency to form deposits on surfaces transferring high heat which ultimately affect cooling capabilities. Phosphate deposits on water pump seals will result in coolant leakage across seal faces.

3.3 MAINTENANCE

This section describes procedures needed for maintaining the recommended coolant level and proper concentration.

3.3.1 TOPPING OFF COOLANT

The coolant level should be checked at each maintenance interval. If topping off is needed, add coolant which is identical to the initial-fill coolant.

3.3.2 COOLANT MAINTENANCE INTERVALS

Recommended coolant maintenance intervals are listed in Table 3-8.

Coolant	Interval – Whichever Comes First	Action
Conventional Detroit Diesel *POWER COOL* Antifreeze/Water	20,000 Miles (32,000 Km), 3 Months, or 500 Hours	Test nitrite concentration with test strip. Add SCA or dilute coolant as needed.
	300,000 Miles (480,000 Km) or 2 Years	Drain and clean system. Refill with new coolant.
EG Antifreeze/Water + Conventional Corrosion Inhibitor	20,000 Miles (32,000 Km), 3 Months, or 500 Hours	Test nitrite concentration with test strip. Add SCA or dilute coolant as needed.
	300,000 Miles (480,000 Km) or 2 Years	Drain and clean system. Refill with new coolant.
PG Antifreeze/Water + Conventional Corrosion Inhibitor	20,000 Miles (32,000 Km), 3 Months, or 500 Hours	Test nitrite concentration with test strip. Add SCA or dilute coolant as needed.
	Engine Overhaul	Drain and clean system. Refill with new coolant.
EG Antifreeze/Water + OAT Inhibitor	Test at 1 year.	Laboratory test inhibitor concentration annually
	300,000 Miles (480,000 Km), 2 Years, or 10,000 Hours	Add *POWER COOL* Plus Extender
	600,000 Miles (960,000 Km), 4 Years, or Engine Overhaul	Drain and clean system. Refill with new coolant.
PG Antifreeze/Water + OAT Inhibitor	Test at 1 year.	Laboratory test inhibitor concentration annually
	300,000 Miles (480,000 Km), 2 Years, or 10,000 Hours	Add *POWER COOL* Plus Extender
	600,000 Miles (960,000 Km), 4 Years, or Engine Overhaul	Drain and clean system. Refill with new coolant.
Water Only + Conventional Corrosion Inhibitor	20,000 Miles (32,000 Km), 3 Months, or 500 Hours	Test nitrite concentration with test strip. Add SCA or dilute coolant as needed.
	Engine Overhaul	Drain and clean system. Refill with new coolant.
Water Only + OAT Inhibitor	300,000 Miles (480,000 Km), 2 Years, or 10,000 Hours	Add *POWER COOL* Plus Extender
	600,000 Miles (960,000 Km), 4 Years, or Engine Overhaul	Drain and clean system. Refill with new coolant.

NOTE: The recommended organic acid inhibitor concentration varies depending upon producer. Check producer specification for specific recommended levels.

Table 3-8 Coolant Maintenance Intervals

3.3.3 SUPPLEMENTAL COOLANT ADDITIVE TEST PROCEDURES

Nitrite concentration is an indication of the overall coolant inhibitor concentration in non-OAT formulations. These coolants must be tested for nitrite concentration at the regular intervals as listed in Table 3-8. *POWER Trac* 3-Way Test Strips (or equivalent) are recommended. Nitrite levels must be within the ranges listed in Table 3-5.

Use Detroit Diesel *POWER Trac* 3-Way Coolant Test Strips to measure nitrite and glycol concentrations. Cavitation/corrosion protection is indicated on the strip by the level of nitrite concentration. Freeze/boil-over protection is determined by glycol concentration. Test strip part numbers are listed in Table 4-11.

Use the test strips as follows:

1. Dip the strip into coolant for one second. Remove and shake briskly to eliminate excess fluid.
2. Immediately compare end pad (% Glycol) to the color chart on the container.
3. Sixty seconds (one minute) after dipping, compare the nitrite pad.
4. Color change of additive indicator (middle pad) indicates the presence of inhibitor that is **not approved** by Detroit Diesel.

For best results, make the tests while the coolant is between 50°–140° F (10.0° – 60° C). Wait at least 60 seconds, but not longer than 75 seconds before reading the nitrite level. Promptly replace and tighten container cap after each use. Discard unused strips if they have turned light pink or tan.

A factory coolant analysis program is available through authorized Detroit Diesel service outlets. Coolant test products are listed in Table 4-11. To verify coolant acceptability, submit a sample for coolant analysis every two (2) years, 300,000 miles, or 10,000 operating hours, whichever comes first.

NOTICE:
Failure to properly maintain coolant with SCA can result in damage to the cooling system and its related components. Conversely, over-concentration of SCA inhibitor can result in water pump seal leaks and poor heat transfer, leading to engine damage. Always maintain concentrations at recommended levels. **Do not use traditional SCAs with OAT coolant.**

3.3.4 NEED-RELEASE COOLANT FILTERS (NOT AVAILABLE IN OAT APPLICATIONS)

Spin-on coolant filters are available for Series 50 and 60 engines. Membranes in the filters release SCAs before the coolant approaches a corrosive condition, protecting the engine from corrosion. The need-release elements release the SCA charge as needed, as opposed to the maintenance SCA elements, which instantaneously release the SCA charge. Need-release coolant filter elements should be replaced after 1 year, 120,000 miles (192,000 km), or 2,000 operating hours, whichever comes first.

3.3.5 DROP-OUT

Excessive amounts of some inhibitors in the engine coolant can cause a gel or crystalline deposit that reduces heat transfer and coolant flow. The deposit, called "drop-out," takes the color of the coolant when wet, but appears as a white or gray powder when dry. It can pick up solid particles in the coolant and become gritty, causing excessive wear of water pump seals and other cooling system components. The wet gel can be removed by using a nonacid (alkali) type heavy-duty cleaner such as Detroit Diesel *POWER COOL* On-Line Cleaner (sodium nitrite/sodium tetraborate). Cooling system cleaner part numbers are listed in Table 4-10. If the gel is allowed to dry, it is necessary to disassemble the engine and clean it with a caustic solution or physically clean individual components.

3.3.6 COOLANT EXTENDER INHIBITOR ADDITIVE FOR OAT COOLANT

The inhibitors in OAT coolant must also be maintained, but less often than traditional SCA-type coolants. The concentrations of some inhibitors will gradually deplete during normal engine operation. Fleet testing has determined the rate of depletion of these inhibitors. Using this data, an extender package was developed which should be added to the coolant at 0.6% by volume at 300,000 miles (480,000 km), 2 years, or 10,000 hours, whichever comes first. A properly maintained OAT-inhibited coolant will last 4 years, 600,000 miles (960,000 km), or to engine overhaul, whichever comes first, at which time the coolant should be drained. This dosage should be added to the water-only and the glycol systems at the same interval.

NOTE:
Do not use traditional SCAs in OAT coolant, and do not use OAT extender in traditional coolants.

3.3.7 DETROIT DIESEL COOLING SYSTEM MAINTENANCE PRODUCTS

Detroit Diesel *POWER COOL* SCAs are water-soluble chemical compounds. These products are available in coolant filter elements, liquid packages, and in fully formulated *POWER COOL* antifreeze.

3.3.7.1 Coolant Filter Elements

Replaceable coolant filter elements (spin-on canisters) are available in various sizes suitable for cooling systems of varying capacity. Selection of the proper element size is vital when pre-charging nonfully formulated coolant at initial fill and at maintenance intervals.

A fully formulated antifreeze must NOT have SCA added at initial fill. **Do not use** SCA-containing filters with OAT antifreeze or coolant.

The need for maintenance elements is determined by the results of the nitrite concentration test performed at each cooling system service interval in systems using traditional/conventional formulations. **Do not automatically install maintenance elements at maintenance intervals unless the nitrite concentration level falls below 900 ppm.**

3.3.7.2 Liquid Supplemental Coolant Additive

POWER COOL 3000 SCA is more compatible with hard water than *POWER COOL* 2000 SCA.

3.3.7.3 Cleaners

Use *POWER COOL* Liquid On-Line Cleaner for light deposits. Use *POWER COOL* Dry Chemical Cleaner/Conditioner for heavy deposits or scale.

3.3.8 SUMMARY OF COOLANT RECOMMENDATIONS

Observe the following recommendations for proper coolant maintenance:

WARNING:

HOT COOLANT

To avoid scalding from the expulsion of hot coolant, never remove the cooling system pressure cap while the engine is at operating temperature. Wear adequate protective clothing (face shield, rubber gloves, apron, and boots). Remove the cap slowly to relieve pressure.

- □ Always maintain the engine coolant to meet Detroit Diesel specifications.
- □ Always “top off” the system with the same coolant being used.
- □ Only use water that meets Detroit Diesel specifications listed in Table 3-9. Distilled, demineralized (reverse osmosis) or de-ionized water is preferred.

Mineral	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 3-9 Satisfactory Mineral Limits – Make-Up Water Only

- □ Include the proper dosage of inhibitors in the coolant at initial fill for all Detroit Diesel engines. This dosage is usually included in the fully formulated antifreeze used, but it may need to be added if water alone is used or if less than 50% antifreeze is used. The user is urged to refer to the full text of this publication to determine the proper dosage. Mixing of different manufacturers' technologies (brands) could cause cooling system problems.

- Maintain the inhibitor at the prescribed concentration. Test the nitrite concentration by using a titration kit or Detroit Diesel *POWER Trac* 3-Way Coolant Test Strips. Add SCA only if the nitrite concentration is below 900 PPM.
- Do not use another manufacturer's test kit to measure the SCA concentration of a Detroit Diesel Maintenance Product.
- Pre-mix coolant makeup solutions to the proper concentration before adding to the cooling system.
- Do not use automotive coolants.
- Where freeze/boil over protection is required, use only antifreeze that meets TMC RP-329 (EG) “Type A” or TMC RP-330 (PG) “Type A” specifications or OAT.
- Always maintain coolant at the proper level.
- Use the following guidelines on Coolant Life:
  - **Antifreeze/Water Coolant:** A properly maintained cooling system, filled with phosphate-free coolant consisting of a 50/50 mix of antifreeze and water per TMC RP-329 “Type A” or TMC RP-330 “Type A” can be operated to the limits recommended. The proper maintenance involves periodic evaluation using *POWER Trac* 3-Way Test Strips and the addition of an SCA as needed as indicated by the test strip. To verify coolant acceptability, submit a sample for coolant analysis every two (2) years, 300,000 miles (480,000 km), or 10,000 operating hours, whichever comes first. Submit the sample in a Detroit Diesel *POWER Trac* Coolant Test Bottle. Coolant test and analysis products are listed in Table 4-11. Refer to section 4 for part numbers.
  - **OAT Coolant:** A properly maintained OAT coolant may be operated four (4) years or 600,000 miles (960,000 km), whichever comes first. At this time, the system **must** be completely drained and refilled. OAT Coolants require the addition of an extender at 300,000 miles (480,000 km) or 10,000 hours, whichever comes first. Use one pint of extender for every 20 gallons of coolant (1:160 ratio).
- Do not use the following in Detroit Diesel engine cooling systems:
  - Soluble Oil
  - High Silicate, Automotive Type Antifreeze
  - Chromate SCA
  - Methoxy Propanol-Based Coolant
  - Methyl Alcohol-Based Coolant
  - Sealer Additives or Coolant Containing Sealer Additives
  - HVAC Coolant
  - Phosphate Coolants
  - Water with Total Hardness above 170 PPM

3.4 WARRANTY INFORMATION

3.4.1 DEFECTS

The engine warranty offered by Detroit Diesel covers engine repairs to correct any malfunction occurring during the warranty period resulting from defects in material or workmanship.

3.4.2 MAINTENANCE

Detroit Diesel is not responsible for the cost of maintenance or repairs due to the lack of performance of required maintenance services as recommended by Detroit Diesel, or the failure to use fuel, oil, lubricants, or coolant meeting Detroit Diesel-recommended specifications. Performance of the required maintenance and use of the proper fuel, lubricating oil, and coolant are the responsibility of the owner. For full details, refer to the Engine Operator's Guide for your engine. Operator's guides are available from authorized Detroit Diesel distributors.

4 *POWER COOL* ENGINE PRODUCTS

POWER COOL engine products are available from authorized Detroit Diesel distributors and dealers. Listed in Table 4-1 are *POWER COOL* fully formulated Inhibited Ethylene Glycol (IEG) coolant products.

Coolant Type	Part Number	Description
Concentrated	23512138	One Gallon Jug – 6 Per Case
	23512139	55 Gallon Drum
	23529295	330 Gallon Tote
	23512140	Bulk Delivery – 1,000 Gallon Minimum
Pre-Blended 50:50	23528203	One Gallon Jug – 6 Per Case
	23518918	55 Gallon Drum
	23528544	330 Gallon Tote
	23513503	Bulk Delivery – 1,000 Gallon Minimum

Table 4-1 *POWER COOL* Fully Formulated IEG Coolant

Listed in Table 4-2 are *POWER COOL* Latin American coolant products.

Coolant Type	Part Number	Description
Pre-Blended 67:33	23524737	1 Gallon Jug (6 Per Case)
	23524923	55 Gallon Drum
	23524924	Bulk Delivery – 1,000 Gallon Minimum

Table 4-2 *POWER COOL* Latin American Coolant

Listed in Table 4-3 are *POWER COOL* 2000 Supplemental Coolant Additive (SCA) products.

Coolant Type	Part Number	Description
For *POWER COOL* IEG Coolant	23507858	Pint Bottle – 12 Per Case
	23507859	Half Gallon Jug – 6 Per Case
	23507860	5 Gallon Pail
	23507861	55 Gallon Drum

Table 4-3 *POWER COOL* 2000 Supplemental Coolant Additive

Listed in Table 4-4 are *POWER COOL* 3000 SCA products.

Coolant Type	Part Number	Description
For *POWER COOL* IEG Coolant	23507854	Pint Bottle – 12 Per Case
	23507855	Half Gallon Jug – 6 Per Case
	23507856	5 Gallon Pail
	23507857	55 Gallon Drum

Table 4-4 *POWER COOL* 3000 Supplemental Coolant Additive

Listed in Table 4-5 are *POWER COOL* 3000 SCA filters.

Coolant Type	Part Number	Description
For *POWER COOL* IEG Coolant	23507545	4 Ounce (1 Pint Equivalent)
	23508425	8 Ounce (2 Pint Equivalent)
	23508426	12 Ounce (3 Pint Equivalent)
	23507189	16 Ounce (4 Pint Equivalent)
	23508427	32 Ounce (8 Pint Equivalent)
	23508428	53 Ounce (13 Pint Equivalent)

Table 4-5 *POWER COOL* 3000 Supplemental Coolant Additive Filters

Listed in Table 4-6 are *POWER COOL* SCA need-release filters.

Coolant Type	Part Number	Description
For *POWER COOL* IEG Coolant	23516488	For 0 – 8 Gal Systems
	23516489	For 8 – 20 Gal Systems

Table 4-6 *POWER COOL* Supplemental Coolant Additive Need-Release Filters

Listed in Table 4-7 are *POWER COOL* Plus extended life OAT coolant products.

Coolant Type	Part Number	Description
Concentrated	23519397	One Gallon Jug – 6 Per Case
	23519394	55 Gallon Drum
	23519395	Bulk Delivery – 2,000 Gallon Minimum
Pre-Blended 50:50	23519396	One Gallon Jug – 6 Per Case
	23519398	55 Gallon Drum
	23519399	Bulk Delivery – 2,000 Gallon Minimum

Table 4-7 *POWER COOL* Plus Extended Life OAT Coolant

Listed in Table 4-8 is the *POWER COOL* Plus extender product.

Coolant Type	Part Number	Description
For *POWER COOL* Plus OAT Coolant	23519400	One Quart Bottle – 6 Per Case

Table 4-8 *POWER COOL* Plus Extender for Use with *POWER COOL* Plus OAT Coolant

Listed in Table 4-9 are *POWER COOL* Plus 6000 OAT inhibitor products for water-only systems.

Coolant Type	Part Number	Description
Water Only	23522127	One Gallon Jug – 6 Per Case
	23522128	5 Gallon Pail

Table 4-9 *POWER COOL* Plus 6000 OAT Inhibitor for Water-Only Systems

Listed in Table 4-10 are *POWER COOL* cooling system cleaners products.

Coolant Type	Part Number	Description
Line Cleaner	200164	One-Half Gallon Jug – 6 Per Case
	200105	5 Gallon Pail
	200155	55 Gallon Drum
Twin pack	201549	Twin pack – 2 Per Case

Table 4-10 *POWER COOL* Cooling System Cleaners

Listed in Table 4-11 are the *POWER Trac* coolant testing and analysis products.

Application	Part Number	Description
Indicates Nitrite, Molybdate, and Glycol Levels	23519401	3-Way Coolant Test Strips (Single Foil Packs)
Indicates Nitrite, Molybdate, and Glycol Levels	23519402	3-Way Coolant Test Strips (Bottle of 50)
Indicates Nitrite, Molybdate and Glycol Levels	23522774	3-Way Coolant Test Strips (Bottle of 10)
Complete Coolant Analysis	23516921	Coolant Analysis Bottle (Carton of 6)
Organic Coolant Analysis	23523398	Laboratory Coolant Analysis

Table 4-11 *POWER Trac* Coolant Testing and Analysis Products

Listed in Table 4-12 are the coolant inhibitor element size requirements.

Cooling System Capacity	Filters Only*		Liquid Only
	Filter Quantity	Part Number	Number of Pints†
1 – 4 gal (4 – 17 L)	1	23507545	1/4 – 1
5 – 8 gal (18 – 32 L)	1	23508425	1/4 – 2
9 – 12 gal (33 – 47 L)	1	23508426	2-1/4 – 3
13 – 16 gal (48 – 60 L)	1	23507189	3-1/4 – 4
24 – 32 gal (90 – 120 L)	1	23508427	6 – 8
47 – 52 gal (178 – 197 L)	1	23508428	11-3/4 – 13
50 – 75 gal (190 – 284 L)	2	23508427	12-1/2 – 18-3/4
75 – 100 gal (285 – 378 L)	2	23508428	18-3/4 – 25
100 – 125 gal (379 – 373 L)	2	23508428	25 – 31-1/4
125 – 150 gal (374 – 368 L)	2	23508428	31-1/4 – 37-1/2

* Not necessary if *POWER COOL* coolant is used (already pre-charged)
† *POWER COOL* 3000 part numbers are listed in Table 4-4 and Table 4-5.

Table 4-12 Coolant Inhibitor Element Size Requirements – Initial Fill Dosage for IEG or IPG Plus Water Coolant Mixtures

Listed in Table 4-13 are the coolant inhibitor element/liquid size requirements for water-only systems.

Cooling System Capacity	Filters Only			Liquid Only
	Filter Quantity	Part Number	Additional SCA Required	Number of Pints or Quarts Needed†
3 Gal (11 L)	1	23507545	None	2 Pints
4 Gal (15 L)	2	23507545	None	2 Pints
5 Gal (20 L)	1	23508425	None	3 Pints
7 Gal (26 L)	1	23508426	None	4 Pints
10 Gal (38 L)	1	23507189	None	5 Pints
15 Gal (57 L)	2	23508426	None	8 Pints
20 Gal (76 L)	1	23508427	None	10 Pints
25 Gal (95 L)	1	23508427	None	13 Pints
30 Gal (114 L)	1	23508427	None	15 Pints
35 Gal (132 L)	1	23508427	None	18 Pints
40 Gal (151 L)	2	23508427	None	2-1/2 Quarts
50 Gal (189 L)	2	23508427	None	3-1/8 Quarts
60 Gal (227 L)	1	23508428	None	3-3/4 Quarts
70 Gal (265 L)	2	23508428	None	4-3/8 Quarts
85 Gal (322 L)	2	23508428	1 Gal *	5-3/8 Quarts
100 Gal (378 L)	2	23508428	2 Gal *	6-1/4 Quarts
125 Gal (374 L)	2	23508428	3-1/4 Gal *	7-7/8 Quarts
150 Gal (368 L)	2	23508428	5 Gal *	9-3/8 Quarts

* Use *POWER COOL* 2000 and 3000 liquid SCA, or equivalent.

† *POWER COOL* 2000 part numbers are listed in Table 4-3. *POWER COOL* 3000 part numbers arelisted in Table 4-4 and Table 4-5.

Table 4-13 Coolant Inhibitor Element Size Requirements – Initial Dosage for Water-Only Systems

Listed in Table 4-14 are coolant inhibitor element maintenance dosage requirements.

Cooling System Capacity	Filters Only		Liquid Only
	Filter Quantity	Part Number	Number of Pints *
1 – 4 Gal (4 – 17 L)	1	23507545	1/4
5 – 8 Gal (18 – 32 L)	1	23507545	1/4 – 1/2
9 – 12 Gal (33 – 47 L)	1	23507545	1/2 – 3/4
13 – 16 Gal (48 – 60 L)	1	23507545	3/4 – 1
24 – 32 Gal (90 – 120 L)	1	23508425	1-1/2 – 2
47 – 52 Gal (178 – 197 L)	1	23508426	3 – 3-1/4
50 – 75 Gal (190 – 284 L)	2	23508426	3 1/4 – 4-3/4
75 – 100 Gal (285 – 378 L)	2	23507189	4-3/4 – 6-1/4
100 – 125 Gal (379 – 373 L)	2	23507189	6-1/4 – 7-3/4
125 – 150 (374 – 368 L)	2	23508427	7-3/4 – 9-1/4

* *POWER COOL* 2000 part numbers are listed in Table 4-3.

NOTE: Water-only coolant systems offer no freeze protection and should not be used where ambient temperatures can fall to 32° F (0° C).

Table 4-14 Coolant Inhibitor Element Size Requirements – Maintenance Dosage for IEG, IPG, Pre-Charged, and Water-Only Coolant Mixtures

Need-release coolant filters are listed in Table 4-15 .

Cooling System Capacity	Filter Quantity	Part Number *	Number of Pints†
0 – 8 Gal (0 – 30 L)	1	23516488	N/A
8 – 20 Gal (31 – 88 L)	1	23516489	N/A

* Need-Release Filters: Use only per specific engine operator's guide instructions.
† *POWER COOL* 2000 part numbers are listed in Table 4-3.

Table 4-15 Need-Release Filters

APPENDIX A: LIST OF ACRONYMS

Acronym	Term
EG	Ethylene Glycol
ESI	Extended Service Interval
IEG	Inhibited Ethylene Glycol
IPG	Inhibited Propylene Glycol
NOAT	Nitrited Organic Acid Technology
OAT	Organic Acid Technology
PG	Propylene Glycol
PPM	Parts Per Million
SCA	Supplemental Coolant Additive
TMC	Technology and Maintenance Council

GLOSSARY

Antifreeze	Ethylene Glycol or Propylene Glycol containing a corrosion inhibitor package and meeting an appropriate heavy-duty specification, i.e. TMC RP-329 “Type A” ethylene glycol or TMC RP 330 “Type A” propylene glycol. A conventional coolant is considered one covered under TMC RP-329 and TMC RP-330.
Coolant	The fluid mixture circulating in the engine cooling system, typically a mixture of 50% water and 50% antifreeze
Drop-Out	Precipitated sludge or deposit formation in or on cooling system components
Fully Formulated Antifreeze	Antifreeze that contains all the necessary inhibitors to protect a diesel engine and does not, therefore, require a pre-charge of Supplemental Coolant Additive before its first use
Organic Acid Technology	An inhibitor system based on organic acid inhibitors
Initial-Fill Coolant	The coolant that is used in a new or rebuilt engine, or used any time the cooling system is emptied and then refilled with new coolant
Supplemental Coolant Additive	An additive used in a preventive maintenance program to prevent corrosion, cavitation, and the formation of deposits
Technology and Maintenance Council	Part of the American Trucking Association
TMC RP-329 **TMC RP-330**	Specifications published by The Maintenance Council (“Type A” formulations are phosphate free.)

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