

DETROIT DIESEL



Coolant Selections

For Engine Cooling Systems

COOLANT SELECTIONS

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GLOSSARY

The following describes terms used in this publication.

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, TMC RP-330 “Type A” propylene glycol or TMC RP-338 organic acid ethylene glycol.

NOTE:

“Type A” formulations are phosphate free.

TMC RP Specifications are published by:

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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

Contains all the necessary inhibitors to protect a diesel engine, and does not, therefore, require a pre-charge of SCA before its first use.

Initial-Fill Coolant

The coolant that is used in a new or rebuilt engine, or any time the cooling system is emptied and then refilled with new coolant.

NOAT

Nitrite Organic Acid Technology containing nitrite. This formulation recommended for on-highway applications and for C & I (construction and industrial) applications.

OAT

Organic Acid Technology: An inhibitor system based on organic acid inhibitors. This formulation is recommended for marine applications—Series 60, 2000 and 4000.

PPM

Parts per million.

SCA

Supplemental Coolant Additives: SCAs are used in a preventative maintenance program to prevent corrosion, cavitation, and the formation of deposits.

TMC

Technology and Maintenance Council of The American Trucking Association.

COOLANT FILL OPTIONS

The coolants recommended for use in Detroit engines are listed in Table 1. Refer to this publication for a complete explanation of their usage.

NOTICE:
Required specifications for water, ethylene glycol, propylene glycol, 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 Option	Product
40, 50, 55, 60, D700	Ethylene Glycol and Water + Corrosion Inhibitors ¹	DDC <i>POWER COOL</i>
	Commercial Equivalent of DDC <i>POWER COOL</i>	Fully Formulated TMC RP-329 Type A Antifreeze and Water
	Propylene Glycol and Water + Corrosion Inhibitors	Fully Formulated TMC RP330 Type A Antifreeze and Water
	Ethylene Glycol and Water + NOAT Inhibitors	DDC <i>POWER COOL</i> Plus
	Water Only + Corrosion Inhibitors ²	Water + DDC <i>POWER COOL</i> 3000
	Water Only + NOAT Inhibitors ²	Water + DDC <i>POWER COOL</i> Plus 6000
53, 71, 92	Ethylene Glycol and Water + Corrosion Inhibitors ¹	DDC <i>POWER COOL</i>
	Commercial Equivalent of DDC <i>POWER COOL</i>	Fully Formulated TMC RP-329 Type A Antifreeze and Water
	Propylene Glycol and Water + Corrosion Inhibitors	Fully Formulated TMC RP330 Type A Antifreeze and Water
	Ethylene Glycol and Water + NOAT Inhibitors	DDC <i>POWER COOL</i> Plus
	Water Only + Corrosion Inhibitors ²	Water + DDC <i>POWER COOL</i> 3000
	Water Only + OAT Inhibitors ²	Water + DDC <i>POWER COOL</i> Plus 6000
149, 2000, 4000 (Except 2000/4000 Marine)	Ethylene Glycol and Water + Corrosion Inhibitors ¹	Fully Formulated TMC RP-329 Type A Antifreeze and Water or DDC <i>POWER COOL</i> 3149 IEG Coolant
	Ethylene Glycol and Water + NOAT Inhibitors	DDC <i>POWER COOL</i> Plus
	Water Only + Corrosion Inhibitors	Water + DDC <i>POWER COOL</i> 3149
	Water Only + OAT Inhibitors ²	Water + DDC <i>POWER COOL</i> Plus 6000
60, 2000 & 4000 Marine	Ethylene Glycol and Water + OAT Inhibitors	DDC <i>POWER COOL</i> Plus Marine
	Water Only + OAT Inhibitors ²	Water + DDC <i>POWER COOL</i> Plus 6000

¹Preferred Coolant

²Water-only coolant systems offer no freeze protection and should not be used where ambient temperatures can fall to 32°F (0°C).

Table 1. Initial Fill Coolant Options

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 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 representative.

The coolant used in Detroit 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.

Corrosion inhibitor in conventional coolant provides the following protection:

Inhibitor	Protection
Azoles	Copper alloys
Borate	pH buffer
Silicate	Aluminum and solder
Nitrite	Cast iron corrosion and cavitation
Nitrate	Light alloys

Corrosion inhibitor in organic acid coolant provides the following protection:

Inhibitor	Protection
Azoles	Copper alloys
Carboxylic and dibasic acids	Corrosion protection for aluminum, solder, light alloys and cavitation/corrosion for cast iron

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 and have been proven harmful to Detroit engines.

DETROIT DIESEL ENGINE INITIAL FILL COOLANTS

Listed in Table 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 should be maintained according to procedures found in this publication. Refer to section titled "MAINTENANCE."

Ethylene Glycol / Water + SCA Inhibitor Propylene Glycol / Water + SCA Inhibitor

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

Do not use this type of coolant in Series 2000 and Series 4000 marine engines.

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

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

NOTE:

Fully formulated antifreeze does **not** require a dosage of SCA prior to initial use.

Mixing EG or PG Antifreeze and Water

If a concentrated Ethylene Glycol (EG) or Propylene Glycol (PG) antifreeze is purchased, mix the antifreeze with water meeting the required quality standards and fill the cooling system. Refer to section titled “Water Requirements.” If a pre-diluted, 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*.

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

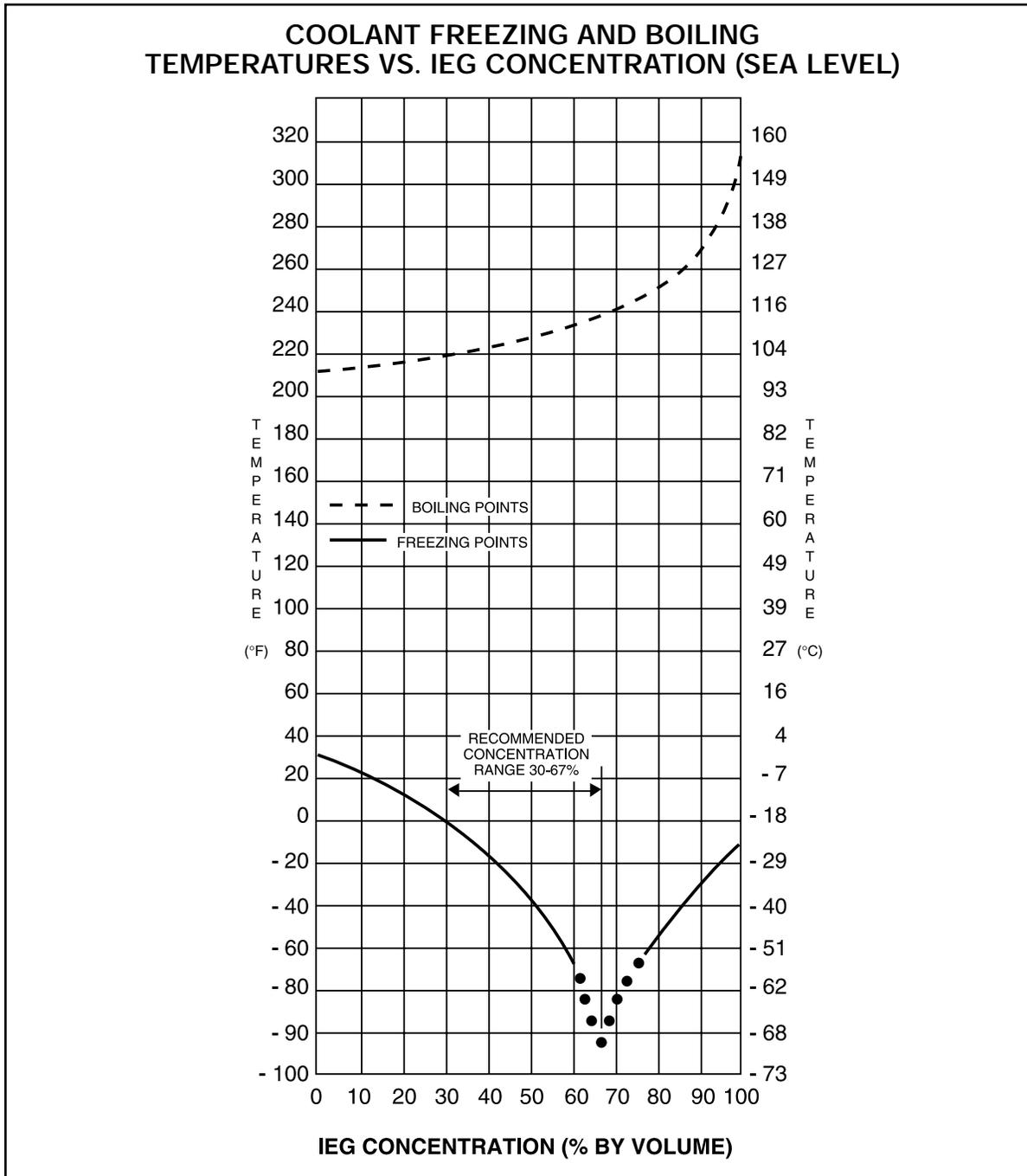


Figure 1. Coolant Freezing and Boiling Temperatures vs. Inhibited Ethylene Glycol (IEG) Concentration (Sea Level)

See Figure 2 for propylene glycol-based coolant concentration versus freezing and boiling temperatures.

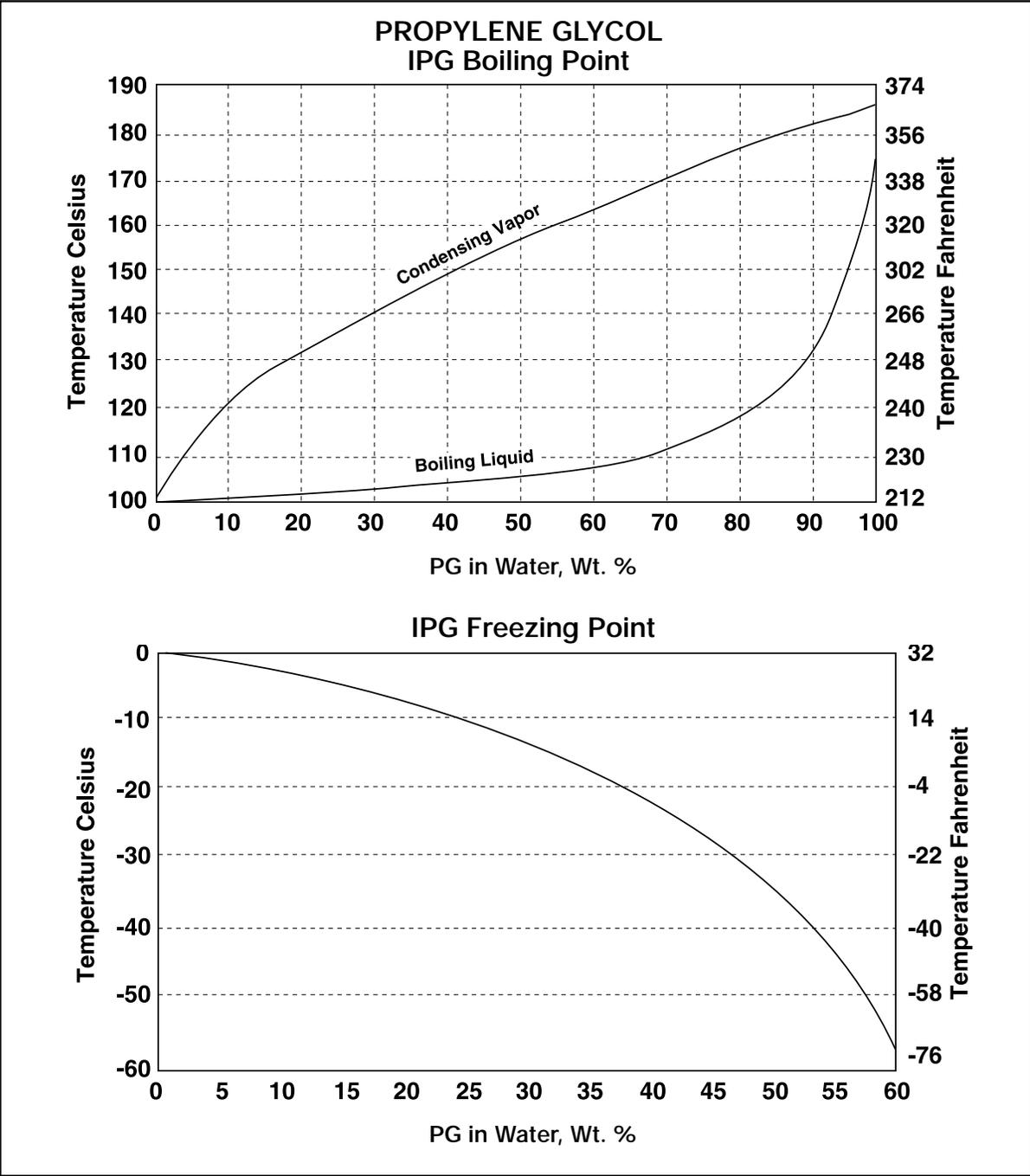


Figure 2. Coolant Freezing and Boiling Temperatures vs. Inhibited Propylene Glycol (IPG) Concentration (Sea Level)

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 2.

Boron	125-500 PPM
Nitrite	800-3200 PPM
Nitrate	200-750 PPM
Silicon	50-250 PPM
Phosphorous	0 PPM Max.
pH	8.0-11

Table 2. Fully Formulated Glycol Coolant Limits with TMC RP-329, RP-330, Chemistry Type A (50/50 Coolant/Water Mixture)

Recycled Antifreeze

Antifreeze or coolant recycled by reverse osmosis, distillation, and ion exchange, properly re-inhibited to meet TMC RP-329 “Type A” or RP-330 “Type A” 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.

Ethylene Glycol / Water + OAT / NOAT Inhibitor Propylene Glycol / Water + OAT / NOAT Inhibitor

Ethylene glycol and propylene glycol are also available with an Organic Acid Technology (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 (Extended Service Interval) coolant, not as an OAT coolant.

Detroit markets OAT-inhibited ethylene glycol coolants—DDC *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-DDC® OAT antifreeze is used, it must conform to TMC RP-338 specification. ***Do not add extender to new OAT antifreeze or coolant.***

Water Only + SCA 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-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 1. OAT inhibitors such as *POWER COOL* Plus 6000 are available for water-only systems. OAT inhibitor should be mixed at 7.5% by volume with water. A listing of *POWER COOL* products is provided at the end of this brochure. Refer to section titled “*POWER COOL* ENGINE PRODUCTS.”

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

Boron	125-500 PPM
Nitrite	800-3200 PPM
Nitrate	0-1000 PPM
Silicon	50-400 PPM
Phosphorous	0 PPM
pH	8-11.0

Table 3. *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). 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 elements matched with the cooling system capacity for water-only systems is provided at the end of this brochure.

NOTE:

In Series 2000®, 4000™, and 149 engines, use a mix of 3% *POWER COOL* 3149 silicate-free SCA and 3% *POWER COOL* 3000 in the coolant water. Use only OAT (*POWER COOL* Plus 6000 or *POWER COOL* Plus Marine) inhibitors in Series 60, Series 2000 and Series 4000 marine engines.

Non-marine water-only systems for Series 2000, Series 4000, and all Series 149 engines should be charged with 5% *POWER COOL* 3149. Listed in Table 4 are the coolant concentration requirements for these engines. Glycol (EG or PG)-based coolant in marine applications (Series 149, 2000 and 4000) may cause overheat problems if raw water temperature is above 80°F (27°C).

Boron	125-500 PPM
Nitrite	800-3200 PPM
Nitrate	0-1000 PPM
Silicon	0 PPM
Phosphorous	0 PPM
pH	8.0-11.0

Table 4. *POWER COOL* 3149 Coolant Concentration Limits

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 over-heating. If tap water is used, the mineral content in the water must be below the maximum allowable limits listed in Table 5.

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.

	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

*Limits currently under review

Table 5. Satisfactory Water Limits

See Figure 3 for the procedure for evaluating the quality of water.

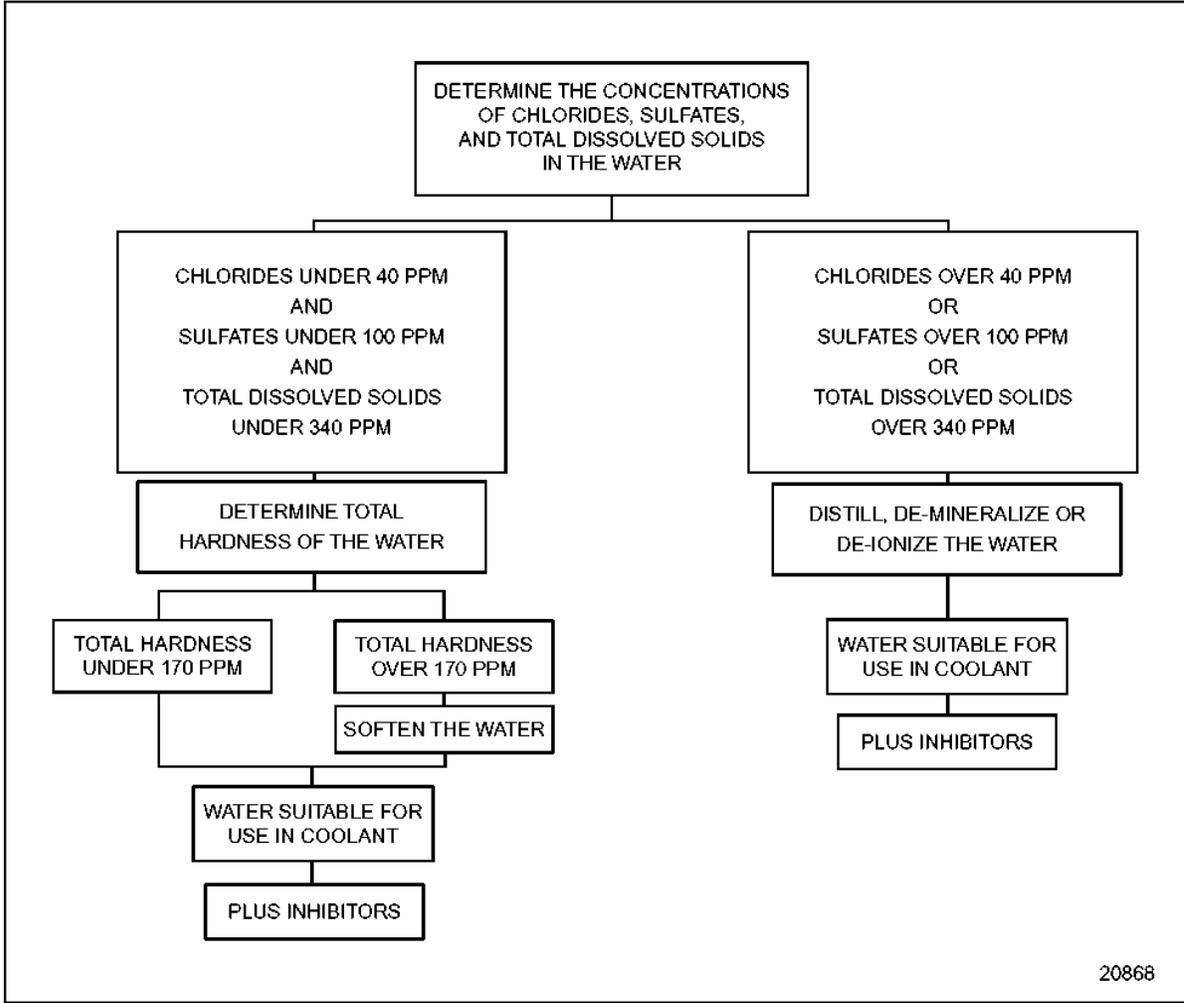


Figure 3. Procedure for Evaluating Water

COOLANTS NOT RECOMMENDED

The following describes the types of coolants not recommended for use in Detroit engines:

- All antifreezes and coolants containing phosphorous** should be avoided. 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 engines.
- Methyl alcohol-based antifreeze** must not be used in Detroit engines because of its effect on the non-metallic components of the cooling system and its low boiling point.
- Methoxy propanol-based antifreeze** must not be used in Detroit 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 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.

ADDITIVES NOT RECOMMENDED

The following describes the types of additives not recommended for use in Detroit engines:

Soluble Oils

- Soluble oil additives are not approved for use in Detroit 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 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 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.

MAINTENANCE

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

Topping Off Coolant

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

Supplemental Coolant Additives For Fully Formulated Coolant

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 **POWER COOL** maintenance products are recommended for use in all Detroit 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 6 with a *Power Trac 3-Way Test Strip*.

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
Industrial, Marine, Generator Set, and all other Applications	200 Hours (300 Hours for Series 149) or yearly, whichever comes first

This table does not apply to organic acid technology-based inhibitor systems.

Table 6. Required IEG and IPG Coolant Inhibitor Test Intervals for Traditional Nitrite-based SCA

Listed in Table 7 and listed in Table 8 are concentration limits. Additional SCA *must* be added to the coolant when it becomes depleted, as indicated by a nitrite concentration of 800 PPM or less. *If the nitrite concentration is greater than 800 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. In this case the EG or PG should contain no inhibitors, and should conform to ASTM D4985 or ASTM D5223. This will dilute the over-concentrated inhibitors.

Boron	125-500 PPM
Nitrite	800-3200 PPM
Nitrate	0-750 PPM
Silicon	50-400 PPM
Phosphate	0 PPM
pH	8.0-11.0

Table 7. POWER COOL 3000 Coolant Concentration Limits (5% POWER COOL 3000, 95% water)

Boron	125-500 PPM
Nitrite	1200-3200 PPM
Nitrate	0-750 PPM
Silicon	0 PPM
Phosphate	0 PPM
pH	8.0-11.0

Table 8. POWER COOL 3149 Coolant Concentration Limits

Silicate-Free SCAs for Series 149, 2000 and 4000 Construction and Industrial Engines

The high thermal gradients experienced by coolants in high *horsepower* construction and industrial engines causes silicates to drop-out if maintained with traditional SCAs. This drop-out accumulates in the radiator tubes, reducing heat transfer and overheating the engine. For this reason, Detroit Diesel has developed an SCA package that is formulated without silicates. The DDC-formulated package is **POWER COOL 3149 Silicate-Free SCA**. The **POWER COOL 3149** should be mixed at 5% by volume with water, or 1 quart to 5 gallons of water. **Series 149, 2000 and 4000 C and I engines should be initially charged with conventional SCAs (such as POWER COOL 3000) at initial fill, but should be maintained with the silicate-free SCA.**

NOTICE:

Phosphate-based inhibitor packages should not be used. Overheating and water pump seal failures will result if used.

Coolant Maintenance

Coolant	Interval – Whichever Comes First	Action
DDC <i>POWER COOL</i> 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.
Ethylene Glycol Antifreeze/Water + SCA 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.
	250,000 miles (400,000 km) or 2 years	Drain and clean system. Replace with new coolant
Propylene Glycol Antifreeze/ Water + SCA 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. Replace with new coolant.
Ethylene Glycol Antifreeze/ Water + OAT Inhibitor	300,000 miles (480,000 km) 2 years or 10,000 hours	Add <i>POWER COOL</i> Plus Extender.
	600,000 miles (960,000 km) 4 years or Engine overhaul	Drain and clean system. Replace with new coolant.
Propylene Glycol Antifreeze/ Water + OAT Inhibitor	300,000 miles (480,000 km) 2 years or 10,000 hours	Add <i>POWER COOL</i> Plus Extender.
	600,000 miles (960,000 km) 4 years or Engine overhaul	Drain and clean system. Replace with new coolant.
WATER ONLY + SCA 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. Replace with new coolant.
WATER ONLY + OAT Inhibitor	300,000 miles (480,000 km) 2 years or 10,000 hours	Add <i>POWER COOL</i> Plus Extender.
	600,000 miles (960,000 km) 4 years or engine overhaul	Drain and clean system. Replace with new coolant.

Table 9. Coolant Maintenance Intervals

SCA Test Procedures

Nitrite concentration is an indication of the overall coolant inhibitor concentration in non-OAT formulations. Coolant must be tested for nitrite concentration at the regular intervals listed in Table 9. *Power Trac* 3-Way Test Strips (or equivalent) are recommended. Nitrite levels must be within the ranges listed in Table 7 and listed in Table 8.

Use Detroit *Power Trac* 3-Way Coolant Test Strips to measure nitrite and glycol concentrations. Refer to section titled “*POWER COOL ENGINE PRODUCTS*” for part numbers. Cavitation/corrosion protection is indicated on the strip by the level of nitrite concentration. Freeze/Boil-over protection is determined by glycol concentration.

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.

For best results make the tests while the coolant is between 50°-140°F (10.0°-60°C). Wait at least 60, 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 service outlets. Refer to section titled “*POWER COOL ENGINE PRODUCTS*” for part numbers. To verify coolant acceptability, submit a sample for coolant analysis every three (3) years, 300,000 miles, or 6,000 operating hours, whichever comes first.

NOTICE:
<p>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. <i>Do not use traditional SCAs with NOAT coolant.</i></p>

NEED RELEASE COOLANT FILTERS (Not Available in OAT/NOAT 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 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.

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 non-acid (alkali) type heavy-duty cleaner such as Detroit *POWER COOL* On-Line Cleaner (sodium nitrite/sodium tetraborate). Refer to section titled “*POWER COOL* ENGINE PRODUCTS” for part numbers. 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.

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.

DETROIT DIESEL COOLING SYSTEM MAINTENANCE PRODUCTS

Detroit *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.

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 non-fully formulated coolant (i.e. water) 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 800 ppm.*

Liquid SCA

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

Cleaners

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

SUMMARY OF COOLANT RECOMMENDATIONS

Observe the following recommendations for proper coolant maintenance:

 CAUTION:
<p>To avoid possible personal injury (scalding, eye injury) from the hot coolant, never remove the cooling system fill (pressure) cap while coolant is hot. The system may be under pressure. Remove the cap <i>slowly</i> and only when coolant is at ambient temperature.</p>

1. Always maintain the engine coolant to meet Detroit specifications.
2. Always “top off” the system with the same coolant being used.
3. Only use water that meets Detroit specifications listed in Table 10. Distilled, de-mineralized (reverse osmosis) or de-ionized water is preferred.

	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

*Limits currently under review

Table 10. Satisfactory Water Limits

4. The proper dosage of inhibitors *must* be included in the coolant at initial fill for all Detroit Diesel engines. This dosage is usually included in the fully formulated antifreeze used, or it may need to be added if water alone 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.
5. Maintain the inhibitor at the prescribed concentration. Test the nitrite concentration by using a titration kit or Detroit *Power Trac 3-Way Coolant Test Strips*. Add SCA only if the nitrite concentration is below 800 PPM. *Do not use Power Trac 3-Way Test Strips or SCA in NOAT coolant.*

NOTE:

If nitrite concentration exceeds 3,200 PPM, the coolant *must* be drained and replaced with new coolant. A thorough cleaning of the cooling system may be required.

6. Do not use another manufacturer's test kit to measure the SCA concentration of Detroit Maintenance Products.
7. Pre-mix coolant makeup solutions to the proper concentration before adding to the cooling system.
8. Do not mix OAT/NOAT and other coolants in the same cooling system.
9. Do not use automotive coolants or coolants with phosphates in excess of recommended limits.
10. 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.
11. Always maintain coolant at the proper level.
12. Coolant Life:
 - 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 until first overhaul. The proper maintenance involves periodic evaluation using *Power Trac 3-Way Test Strips* and the addition of SCA as needed, as indicated by the test strip. To verify coolant acceptability, submit a sample for coolant analysis every three (3) years, 300,000 miles (480,000 km), or 10,000 operating hours, whichever comes first. Submit the sample in a DDC *Power Trac Coolant Test Bottle*. Refer to section titled "*POWER COOL ENGINE PRODUCTS*" for part numbers.
 - OAT Coolant: A properly maintained OAT coolant may be operated 6 years, 600,000 miles (960,000 km) or 10,000 operating hours, 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).
13. Do not use the following in Detroit engine cooling systems:
 - Soluble oil
 - High silicate, automotive type antifreeze
 - Chromate SCA
 - Methoxy propanol-base coolant
 - Methyl alcohol-base coolant
 - Sealer additives or coolant containing sealer additives
 - HVAC coolant
 - Phosphate coolants
 - Water with total hardness above 170 PPM.
 - Nitrite inhibitors in Series 60, 2000 and 4000 marine engines.

WARRANTY INFORMATION

Defects

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

Maintenance

Detroit Corporation is not responsible for the cost of maintenance or repairs due to the lack of performance of required maintenance services as recommended by Detroit, or the failure to use fuel, oil, lubricants, or *coolant* meeting DDC-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 distributors.

POWER COOL ENGINE PRODUCTS

Listed in Table 11 are *POWER COOL* fully formulated IEG coolant product descriptions.

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

Table 11. *POWER COOL* Fully Formulated IEG Coolant

Listed in Table 12 are *POWER COOL* Plus Marine product descriptions.

Coolant Type	Part Number	Description
30% Glycol - 70% Water	23524676	55 Gallon Drum
	23524677	5 Gallon Pail

Table 12. *POWER COOL* Plus Marine Fully Formulated IEG Coolant

Listed in Table 13 are *POWER COOL* 2000 SCA product descriptions.

Coolant Type	Part Number	Description
For <i>POWER COOL</i> IEG Coolant	23507858	Pint Bottle - 12 Per Case
	23507859	Half Gallon Jug - 6 Per Case
	23507860	5 Gallon Pail
	23507861	55 Gallon Drum

Table 13. *POWER COOL* 2000 Supplemental Coolant Additive

Listed in Table 14 are *POWER COOL* 3000 SCA product descriptions.

Coolant Type	Part Number	Description
For <i>POWER COOL</i> IEG Coolant	23507854	Pint Bottle - 12 Per Case
	23507855	Half Gallon Jug - 6 Per Case
	23507856	5 Gallon Pail
	23507857	55 Gallon Drum

Table 14. *POWER COOL* 3000 Supplemental Coolant Additive

Listed in Table 15 are *POWER COOL* 3000 SCA filter descriptions.

Coolant Type	Part Number	Description
For <i>POWER COOL</i> 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 15. *POWER COOL* 3000 Supplemental Coolant Additive Filters

Listed in Table 16 are *POWER COOL* supplemental additive need release coolant filter descriptions.

Coolant Type	Part Number	Description
For <i>POWER COOL</i> IEG Coolant	23516488	For 0-8 Gallon Systems
	23516489	For 8-20 Gallon Systems

Table 16. *POWER COOL* Supplemental Coolant Additive Need Release Filters

Listed in Table 17 are *POWER COOL* 3149 SCA product descriptions.

Coolant Type	Part Number	Description
For <i>POWER COOL</i> IEG Coolant	23518072	1 Gallon Jug - 6 Per Case
	23518073	5 Gallon Pail
	23518074	55 Gallon Drum

Table 17. *POWER COOL* 3149 Supplemental Coolant Additive

Listed in Table 18 are *POWER COOL* 3149 SCA filter descriptions.

Coolant Type	Part Number	Description
For <i>POWER COOL</i> IEG Coolant	23518069	4 Ounce Maintenance
	23518070	32 Ounce Pre-Charge
	23518071	53 Ounce Pre-Charge

Table 18. *POWER COOL* 3149 Supplemental Coolant Additive Filters

Listed in Table 19 are *POWER COOL* Plus extended life OAT coolant product descriptions.

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 19. *POWER COOL* Plus Extended Life OAT Coolant

Listed in Table 20 is the *POWER COOL* Plus extender product description.

Coolant Type	Part Number	Description
For <i>POWER COOL</i> Plus	23519400	One Quart Bottle - 6 Per Case

Table 20. *POWER COOL* Plus Extender for use with *POWER COOL* Plus OAT Coolant

Listed in Table 21 are *POWER COOL* Plus 6000 OAT inhibitor product descriptions.

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

Table 21. *POWER COOL* Plus 6000 OAT Inhibitor for Water-Only Systems

Listed in Table 22 are *POWER COOL* cooling system cleaner product descriptions.

Coolant Type	Part Number	Description
On-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 22. *POWER COOL* Cooling System Cleaners

Listed in Table 23 are the *POWER Trac* coolant testing, analysis products and descriptions.

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 23. *Power Trac* Coolant Testing and Analysis Products

Listed in Table 24 are the coolant inhibitor element size requirements.

Cooling System Capacity (Gallons)	Filters Only#		Liquid Only
	Filter Quantity	Part Number	Number of Pints*
1-4	1	23507545	1/4 - 1
5-8	1	23508425	1-1/4 - 2
9-12	1	23508426	2-1/4 - 3
13-16	1	23507189	3-1/4 - 4
24-32	1	23508427	6 - 8
47-52	1	23508428	11-3/4 - 13
50-75	2	23508427	12-1/2 - 18-3/4
75-100	2	23508428	18-3/4 - 25
100-125	2	23508428	25 - 31-1/4
125-150	2	23508428	31-1/4 - 37-1/2

#Not necessary if *POWER COOL* coolant is used (already pre-charged).

*Listed in Table 14 and listed in Table 15 are *POWER COOL* 3000 part numbers.

Table 24. Coolant Inhibitor Element Size Requirements – Initial Fill Dosage for IEG or IPG Plus Water Coolant Mixtures

Listed in Table 25 are the coolant inhibitor element size requirements.

Cooling System Capacity (Gallons)	Filters Only			Liquid Only
	Filter Quantity	Part Number	Additional SCA Required	Number of Pints or Quarts Needed*
3	1	23507545	None	2 Pints
4	2	23507545	None	2 Pints
5	1	23508425	None	3 Pints
7	1	23508426	None	4 Pints
10	1	23507189	None	5 Pints
15	2	23508426	None	8 Pints
20	1	23508427	None	10 Pints
25	1	23508427	None	13 Pints
-	1	23507545	-	-
30	1	23508427	None	15 Pints
-	1	23508426	-	-
35	1	23508427	None	18 Pints
-	1	23507189	-	-
40	2	23508427	None	2-1/2 Quarts
50	2	23508427	None	3-1/8 Quarts
60	1	23508428	None	3-3/4 Quarts
-	1	23508427	-	-
70	2	23508428	None	4-3/8 Quarts
85	2	23508428	1 Gallon**	5-3/8 Quarts
100	2	23508428	2 Gallons**	6-1/4 Quarts
125	2	23508428	3-1/4 Gallons**	7-7/8 Quarts
150	2	23508428	5 Gallons**	9-3/8 Quarts

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

*Listed in Table 13 are *POWER COOL* 2000 part numbers. Listed in Table 14 and listed in Table 15 are *POWER COOL* 3000 part numbers.

Table 25. Coolant Inhibitor Element Size Requirements – Initial Dosage for Water-Only Systems

Listed in Table 26 are the coolant inhibitor element size requirements.

Cooling System Capacity (Gallons)	Filters Only		Liquid Only
	Filter Quantity	Part Number	Number of Pints*
1-4	1	23507545	1/4
5-8	1	23507545	1/4 - 1/2
9-12	1	23507545	1/2 - 3/4
13-16	1	23507545	3/4 - 1
24-32	1	23508425	1-1/2 - 2
47-52	1	23508426	3 - 3-1/4
50-75	2	23508426	3-1/4 - 4-3/4
75-100	2	23507189	4-3/4 - 6-1/4
100-125	2	23507189	6-1/4 - 7-3/4
125-150	2	23508427	7-3/4 - 9-1/4

*Listed in Table 13 are *POWER COOL* 2000 part numbers.

Table 26. Coolant Inhibitor Element Size Requirements – Maintenance Dosage for IEG, IPG, Precharged, and Water-Only Coolant Mixtures

Cooling System Capacity (Gallons)	Filter Quantity	Part Number	Number of Pints*
0-8	1	23516488	N/A
8-20	1	23516489	N/A

Need Release: Use only per specific engine operator's guide instructions.

*Listed in Table 13 are *POWER COOL* 2000 part numbers.

Table 27. Need Release Filters

DETROIT DIESEL



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