Information Sheet # 42

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Your Reliable Guide for Power Solutions

To fulfill our commitment to be the leading supplier in the power generation industry, the Buckeye Power Sales team ensures they are always up-to-date with the current power industry standards as well as industry trends. As a service, our **Information Sheets** are circulated on a regular basis to existing and potential power customers to maintain their awareness of changes and developments in standards, codes and technology within the power industry.

Coolant Fluid Options for Generator Set Systems

1.0 Introduction

Engine coolant is a generic term used to describe fluids that remove heat from an engine. Anti-freeze is a more specific term used to describe products used to provide protection against freezing. It is common that both are used interchangeably.

This information sheet discusses types of anti-freeze/coolant fluids to suit engines used in generator set systems.

2.0 Different Types of Anti-freeze/Coolant fluids

There are many different types of anti-freeze/coolant fluids to suit heavy-duty diesel engine available on today's marketplace. In addition to providing freeze protection, anti-freeze performs several additional functions. The chemicals contained inhibit rust, corrosion and the formation of scale in the engine and radiator. Anti-freeze also provides protection against boiling in summer. At one atmosphere pressure, pure water boils at 212º F (100º C) while a 50/50 blend of water and ethylene glycol boils at 223º F (106º C).

We set out below the main variations of coolant that you can expect to come across, with the pros and cons.

1. **Ethylene glycol (EG).** This is supplied as a fully formulated, heavy-duty concentrate designed to meet the requirements of most major diesel engine manufacturers. It should be free of any nitrate, phosphate and amine. It provides an excellent corrosion protection for modern engine alloys employed in radiators, water circulation pumps, cylinder blocks and heads. EG has the chemical formula – $C_2H_6O_2$. It has a slightly higher boiling point than propylene glycol and is less expensive to produce. It is utilized more widely than propylene glycol and does have better heat transfer properties than propylene glycol. However, it is more toxic to aquatic and land based life forms than propylene glycol, and it can also disrupt sewage treatment processes.

   There are often a number of different grades that can best match the duty and/or application of the engine. They cover a wide spectrum and often are suitable for all year-round usage, providing complete cooling system protection. They are designed and formulated to reduce cavitation and contain anti-corrosive additives in order to protect cast iron, steel, copper and aluminum alloys, giving excellent hot and cold weather protection.

   Other premium formulations contain inhibitors, specially designed to be used in a broad range of heavy-duty diesel engines, particularly those with wet liners. It also can provide extended life protection for aluminum, yellow metal and ferrous alloys. Others can contain nitrite and molybdate corrosion inhibitors to help minimize wet liner cavitation and pitting.

2. **Propylene glycol (PG).** It is chemically similar to ethylene glycol with a chemical formula – $C_3H_8O_2$. It is less toxic than EG. Both new and used types are poisonous to humans and animals. Therefore it is very important that they be securely stored to protect the public.

   Note: A "waterless" coolant has been offered in the US market for several years. The manufacturer claims it protects the engine at temperatures above the boiling point of water, while reducing the load on the engine, thus saving fuel. The coolant contains a blend of glycols including ethylene glycol, and according to the manufacturer, can be used for the life of the engine, eliminating coolant change-outs and coolant disposal costs. It also does not require addition of supplemental coolant additives. The fluid prevents pump cavitation (vapor binding) because there is no vapor production in the pump. Controlled field test procedures of a vehicular application showed that there was a 7% improvement in fuel economy when fan-on temperature was raised to 230ºF.

3.0 Biodegradability

Both EG and PG have similar biodegradability properties and will eventually break down into non-toxic by products. However, neither should be dumped into the environment as anti-freeze picks up heavy metals, such as lead, during use in the engine.

4.0 Recycling

IMPORTANT! Both types of coolant should be returned to a recycling center to minimize harmful effects on the environment. Any spills should be cleaned up immediately. *(Continued over)*

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5.0 Mixture

Follow the engine manufacturer's instructions in all cases. Normally a 50/50 mixture will freeze protect down to minus 34º F and boil-over protect up to 265º F (if using a 15 PSI pressure cap). Never use concentrated antifreeze in a cooling system without adding water (unless special coolant specially designed to use without mixing). Hard tap water can cause scaling due to the chlorination treatment. Tap water also contains dissolved oxygen, calcium, magnesium, and other contaminates besides chlorine and chlorides than can significantly degrade corrosion inhibitor performance.

6.0 Change Intervals

Again, please follow engine manufacturer's instructions in all cases.

7.0 Extended Life coolant

Extended life coolant (ELC) is specially formulated to provide the correct amounts of metal corrosion protection inhibitors in the form of organic acid compounds when a 50/50 mixture of ELC concentrate and water is maintained. This 50/50 mix normally meets all the system requirements for freeze protection, metal corrosion protection and heat transfer. ELC increases maintenance intervals up to double that normal coolant life. However, we strongly suggest an effective way to avoid any coolant/cooling problems is to have regularly scheduled monitoring or analysis carried by your service provider. This will verify the proper chemistry of the coolant, identify any contaminants, diagnose the condition of the coolant and thus allow you to correct coolant or cooling system problems before costly failures occur.

6.0 Effects of Incorrect Coolants

Table "one" details the causes and effects of incorrect coolants. Systems engineers should be well aware of potential coolant issues.

RESULTS OF LAB TESTING of ENGINE COOLANT and the EFFECTS

LAB RESULT	CAUSE	EFFECT
Glycolate and Formate	Overheated coolant (glycol)	Corrosion
High Glycol Level	Too much concentrate added	Poor heat transfer and attacks solder
High Lead	Overheated coolant and/or high lead solder used	Attacks solder
Low pH with High Iron	Piston blow-by or overheated coolant	Severe corrosion
High Copper	Negative stray current or inadequate flushing after cleaning	Ammonia attack of copper radiator/ coolant cores
All Metals High with Low Glycolate	Positive stray current	Severe metal attack
Precipitate	High glycol level and/or unacceptable source water	Radiator/cooler tube block or water pump seal leakage
Unacceptable Hardness Level	Unacceptable source water	Precipitation of additives
Oil in Coolant	Cavitation through liners or heat exchanger leak	Engine seizure
High Chlorides	Contamination by source water or atmosphere	Iron corrosion
Low Sebacate	Standard coolant or water added to ELC	Attacks iron and solder
High Silicate and/or High Phosphate	Too much supplemental coolant additives (SCA)	Water pump leakage
Low Glycol Level	Too much water added to ELC	Cavitation, corrosion, reduced freeze point
Low Nitrate and/or High Iron	Not enough SCA added	Cavitation and corrosion
High Aluminum	Overheated coolant or low SCA	Attacks aluminum

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