Coolant Analysis Interpretation Guide

BASIC ANALYSIS

Physical Tests		
Test	**Typical Values or Flagging Limits**	**Function or Effect**
Glycol %	Glycol level will vary depending on glycol type, application, and the pressure, elevation, and temperature at which the system operates.	• Glycol is used to suppress the freeze point and elevate the boiling point of coolant.
Freeze Point	In general, freeze point should be a minimum 5°C lower than the expected ambient temperature.	• Serious damage to the engine and radiator can occur when water expands when frozen.
Boiling Point	In general, boiling point should be a minimum 10°C above the maximum operating temperature of the cooling system.	• Boiling will dramatically reduce the heat transfer properties of coolant. • Boiling point decreases 1.7°C for every 1000 feet above sea level, and increases approximately 1.5°C for each system psig.
pH	Conventional Coolant: Between 8.5 and 11 Long Life Coolant: Between 7 and 9	• Indication of the acidity/ alkalinity of the coolant. • Improper pH levels can lead to metal corrosion. • Low pH can indicate combustion blow by, local hot spot or air leak. • High pH may be a sign of excessive additive treatment or a blend of conventional and long life coolants.
Conductivity	> 6600 Reportable > 7500 Unacceptable > 8000 Severe	• (µS/cm) Measure of the coolants ability to resist carrying an electrical charge. • High conductivity can reduce to effectiveness of inhibitors and lead to cooling system corrosion.
Ion Chromatography Note: Due to interferences inherent to some coolant formulations and chemistry, some ions may not be reportable.		
Nitrites	> 1200 ppm (nitrite only formulation) > 300 ppm (Nitrite and Molybdate formulation)	• Primary inhibitor for iron protection; used to prevent cavitation of wet sleeve liners. • Rapid depletion of Nitrite and an increase in glycolate indicates general overheating of the coolant system or a localized hot spot. • Rapid depletion of Nitrite without increase in Glycolates indicates Nitrite oxidation by a positive stray current.
Molybdates	> 300 ppm (Nitrite and Molybdate formulation) Alarms are based on New Coolant Reference	• Primary inhibitor for iron protection; used to prevent cavitation of wet sleeve liners.
Nitrates	Reportable +/- 10% from new coolant Unacceptable +/- 20% from new coolant Severe +/- 30% from new coolant	• Protection of light alloys, solder and aluminum from corrosion. • Nitrate levels may increase as nitrites are chemically transformed into Nitrate.
Chlorides	New Coolant < 25 ppm Used Coolant < 75 ppm	• Contaminant that can lead to extreme corrosion. • Chlorides can result from aging coolant, or come from hydrochloric acid cleaners or chlorinated water. • Distilled water is recommended when diluting concentrated (not pre-mixed) glycol.
Phosphates	> 25% Reduction from new coolant	• Iron corrosion protection and pH control. • Over treatment can lead to heavy precipitation in the coolant resulting in a plugged radiator or oil cooler.
Sulphates	New Coolant < 50 ppm Used Coolant < 300 ppm	• Contaminant that can combine with calcium to form scale. • Sulphates can result from aging coolant, or come from sulfuric acid cleaners or tap water. • Distilled water is recommended when diluting concentrated (not pre-mixed) glycol.
Glycolates	Typical <1000 ppm Reportable >1500 ppm Unacceptable >2000 ppm Severe >2500 ppm	• Breakdown (oxidation) by-product of glycol usually caused by localized overheating, air leak or general excessive temperature. • Promotes Iron corrosion
Oxalates	Typical <25 ppm Reportable >50 ppm Unacceptable >100 ppm Severe >150 ppm	• Breakdown (oxidation) by-product of glycol usually caused by localized overheating, air leak or general excessive temperature. • Promotes Copper corrosion and leads to hard deposit precipitates.

Color & Clarity
Coolant should be clear and bright. A change from new is indicative of a mixing of coolants and/ or contamination/ degradation. Coolant Analysis Report Abbreviations:

CCO - Clear, colorless	LOR - Light orange	BLU - Blue	DBR - Dark brown
OWH - Off White	FYE - Fluorescent yellow	LBL - Light blue	BRO - Brown
RED - Red	LGR - Light green	PUR - Purple	LBR - Light brown
LRE - Light red	FGR - Fluorescent green	LPU - Light purple	RBR - Red-brown
FOR - Fluorescent orange	YGR - Yellow-green	FPI - Fluorescent pink	YBR - Yellow-brown
ORA - Orange	DBL - Dark blue	PIN - Pink	GBR - Green-brown
CLR - Clear	HAZ - Hazy	CLD - Cloudy	

Odor
Unusual odors in coolant can be an indication of contamination such as diesel fuel, residual cleaners, or adverse conditions such as general or localized overheating. Coolant Analysis Report Abbreviations:

GD - Good, acceptable	NH4 - Ammonia	FUN - Fungal odor	SOL - Solvent
FUE - Diesel fuel	BUR - Burnt odor	SUL - Sulphide	

Precipitate / Magnetic Precipitate
Precipitates are often caused by poor source of water or over concentration of coolant inhibitors, air leaks, or defective electrical grounds. Solids in the cooling system can lead to water pump and seal abrasion and subsequent leakage liner pitting, copper and aluminum corrosion, and plugged oil cooler and radiator. Magnetic Precipitate is a sign of severe wear in cooling system. Coolant Analysis Report Abbreviations:

FLU - Fluffy/wooly	FLA - Flakes	SLU - Sludge	CHU – Chunks

ADVANCED COOLANT ANALYSIS (Includes Basic Coolant Analysis)

Test	Typical Range			Function or Effect
Reserve Alkalinity	Alarms are based on New Coolant Reference			• A measure of the coolants ability to neutralize acids from glycol oxidation products or exhaust blow by. • High reserve alkalinity is an indication of over concentration of additives. • Low reserve alkalinity is an indication of over dilution or neutralization of additives.
Specto-chemical (ppm)				
	Reportable	**Unacceptable**	**Severe**	**Primary Source** (Some elements may originate from 2 or more sources)
Iron	10	15	20	Wear Element
Copper	5	10	15	Wear Element
Lead	5	10	15	Wear Element
Tin	5	10	15	Wear Element
Silver	5	10	15	Wear Element
Aluminum	5	10	15	Wear Element
Zinc	10	15	20	Wear Element
Calcium	60	80	100	Contaminant (typically from water)
Magnesium	20	30	40	Contaminant (typically from water)
Silicon	Alarms are based on New Coolant Reference			Additive Element
Potassium	Alarms are based on New Coolant Reference			Additive Element
Sodium	> 2000 ppm Long Life Coolants < 5000 ppm Conventional coolants			Additive Element
Boron	Alarms are based on New Coolant Reference			Additive Element
Phosphorous	Alarms are based on New Coolant Reference			Additive Element
Molybdenum	Alarms are based on New Coolant Reference			Additive Element

- Coolants are carefully formulated mixtures of water, glycol, and inhibitors. Mixing coolants at anytime is not recommended and may lead to a loss of protective ability, damage to cooling system and engine, and/or a reduced coolant service life. Use of distilled or deionized water is recommended when added water is needed.
- Change coolant as per engine manufacturers instructions.
- Coolant Analysis is recommended up to every 250 hours.
- This guide is intended as a general reference only. Alarm limits indicated are typical; actual alarm limits may differ and are dependant on application, coolant type and other factors. Adequately completed coolant sample information is important for accurate flags and recommendations.

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