



Increasing emissions control and demands for higher horsepower and improved fuel efficiency are largely responsible for the changes in both engine and cooling system design over the past decade. As a result, system operating temperatures have increased dramatically, requiring better heat transfer capability, the use of higher performance coolant formulations and improved cooling system maintenance practices.

Using ion chromatography to monitor coolant formulations can significantly reduce premature engine and component failure. The IC detects degradation acids and other contaminants that can develop as a result of engine hot spots, air leaks, combustion gas leaks or electrical ground issues. If glycolates form but are left untreated, glycol will continue to breakdown forming acetates, formates and oxalates that can cause severe corrosion of cooling system components and eventually lead to engine failure.

IC testing also determines whether or not the quality of the glycol in a new coolant reference is adequate for use in the system. Coolants not recycled properly may contain traces of degradation acids and other contaminants that can damage system components.

Ion Chromatography identifies:

- Additives – nitrite and nitrate (metal-protecting inhibitors)
- Chlorides and sulfates – contamination from poor source water, air or combustion gas leaks or residual sulfuric acid cleaner; sulfate can also form scale
- Degradation acids – glycolates, acetates, formates and oxalates form as a result of glycol breakdown

Ion chromatography separates ions from polar molecules based on their charge. The sample is passed through a column and adsorbed by an extraction liquid, or eluent, consisting of a pH buffer solution and a salt mixture. A conductivity detector detects the ions' electrical charge as they exit the column. The amount of time it takes the ions to exit the column determines their level of concentration. Computer software then generates a chromatogram or visual representation of the separation and shows the order and time of elution, as well as the amount of material present. The exact concentration level of each ion is calculated using a calibration curve that is created using solutions of known concentration.



POLARIS Laboratories' Advanced Condition Monitoring test package should be used for new coolant reference samples or if the cooling system is experiencing specific issues. Source water samples require IC testing to determine whether or not they meet both OEM and ASTM specifications. Seasonal testing is also recommended prior to the extreme temperature changes of both summer and winter.

This test package includes:

- Visual Inspection – color, oil, fuel, magnetic precipitate, non-magnetic precipitate, & odor
- pH
- % Glycol
- Freeze Point
- Boil Point
- Specific Conductance
- Foam
- Corrosion, Contaminant & Additive Metals by ICP
 - Iron, Copper, Aluminum, Lead, Tin, Zinc, Silver, Titanium, Calcium, Magnesium, Phosphate, Borate, Molybdate and Silicate
- SCA# (Supplemental Coolant Additives)
- Total Hardness
- Degradation Acids & Contaminants by IC
 - Nitrite
 - Nitrate
 - Chloride
 - Sulfate
 - Glycolate
 - Acetate
 - Formate
 - Oxalate

POLARIS Laboratories' Advanced Condition Monitoring for Extended Life Coolants monitors azoles and organic acid levels in organic-based coolants:

- OATs – Organic Additive Technology
- NOATs – Nitrite Organic Additive Technology
- HOATs – Hybrid Organic Additive Technology
- NAPS – Non-nitrite Amine Phosphate Silicate



POLARIS™
Laboratories

TECHNICAL BULLETIN

It includes all the tests above plus High Performance Liquid Chromatography (HPLC) to identify coolant “mixing” – topping off with the wrong formulation – and determine whether or not the inhibitors will provide cooling system protection.