Spectrochemical Analysis

Element	**Possible Sources**
Iron	Indicates wear originating from rings, shafts, gears, valve train, cylinder walls, and pistons in some engines
Chromium	Primary sources are chromed parts such as rings, liners, etc., and some coolant additives
Nickel	Secondary indicator of wear from certain types of bearings, shafts, valves and valve guides.
Aluminum	Indicates wear of pistons, rod bearings, and certain types of bushings.
Lead	In diesel engines, overlay of most main/rod bearings. In gasoline engines, mostly from tetraethyl lead contamination.
Copper	Wear from bearings, rocker arm bushings, wrist pin bushings, and thrust washers, other bronze and brass parts. In some transmissions, wear from discs and clutch plates.
Tin	Indicates wear from bearings when babbit overlays are used. Also an indicator of piston wear in some engines.
Silver	Wear of bearings which contain silver alloy. In some instances, a secondary indicator of oil cooler problems, especially when coolant in sample is detected.
Titanium	Alloy in high quality steel for gears and bearings.
Silicon	A measure of dust and dirt contamination, usually indicating improper air intake filtration. Excessive dirt and abrasives can greatly accelerate component wear.
Boron	Coolant additive, used as an additive in some oils.
Sodium	Coolant additive, used as an additive in some oils.
Potassium	Coolant additive.
Molybdenum	Indicates ring wear, used as an additive in some oils.
Phosphorus	Antirust agents, spark-plus and combustion chamber deposit reducers.
Zinc	Antioxidants, corrosion inhibitors, antiwear additives, detergents, extreme pressure additives.
Calcium	Detergents, dispersants, and neutralizers.
Barium	Corrosion inhibitors, detergents, rust inhibitors.
Magnesium	Dispersant, detergent additive, alloying material.
Antimony	Wear metal or oil additive.
Vanadium	Heavy fuel contaminant

Explanation

The lab interpretation separates the overall component and lubricant condition and the relative severity of contamination and wear into three classifications.
These classifications are NORMAL, CAUTION, and DANGEROUS and are assigned using trend guidelines and wear limits.
N=Negative, T=Trace, P=Positive, N/R=No Reading or Test Not Performed, A/CM = absorbance per centimeter
Any abnormal readings on FTIR analysis will be noted in the recommendations area on the report.
Tests by A.S.T.M. and ICP Emission and F.T.I.R. (Infrared) Spectroscopy. Values expressed in Parts Per Million (PPM) by weight for Wear, Contamination, and Additive metals. Shaded Yellow area = Current Sample.

Physical Data and FTIR Infrared

Test Properties	
Water	Promotes lubricant breakdown and component part corrosion. Test results are reported as negative, trace or positive and/or reported as % volume.
Glycol	Positive test results indicate the presence of glycol contamination, most often associated with cooling system leaks. Glycol contamination promotes lubricant breakdown, sludging, bearing wear, and corrosion. Test results are reported as negative, trace or positive and/or reported as % volume.
Fuel Dilution	Indicates the relative amount of unburned fuel present in the engine lubricant. Excessive fuel dilution reduces lubricant load carrying capacities. Test results are reported in % volume.
Viscosity	Measures a lubricant’s resistance to flow. Viscosity is considered the single most important physical property of a lubricant. Changes in viscosity indicate improper servicing, dilution, or contamination.
Fuel Soot	Measures the amount of insoluble fuel soot carbon suspended in the engine lubricant. Higher values indicate reduced combustion efficiency due to incorrect fuel/air ratio, or a clogged air filter or an over-extended oil change period.
Oxidation	Measures the overall breakdown of the lubricant due to aging, operating conditions or internal overheating. The degree of oxidation is a good indicator of oil degradation. A rapid increase in oxidation may indicate an engine overheating or depletion of the anti-oxidant additive due to an over-extended drain period.
Nitration	Measures the buildup of acidic materials during normal service or, in diesel engines, as a result of cylinder wall/compression ring blow-by. A high nitration value may indicate incorrect fuel/air ratio, incorrect spark timing, excessive loads, low operating temperature or piston blow-by.
Sulfur	Measures the buildup of sulfur oxides which are produced by the combustion of sulfur compounds present in the fuel. These oxides react with water, also produced by the combustion process, to form sulfuric acid. A rapid increase in the sulfate value may indicate the use of high sulfur content fuel, poor combustion, over cooling, or the rapid depletion of anti-wear additive.
Anti-Wear Additive	Measures the breakdown of additives, mainly ZDDP (zinc di-alkyl- or di-aryl dithiophosfates) which are consumed during the normal life of the oil. The consumption of anti-wear additive is accelerated by the presence of water. A rapid loss of anti-wear additive may indicate excess loads or contamination by water from a coolant leak.
Ester Breakdown	Measures the breakdown of synthetic poly-ol esters. These esters are susceptible to breakdown in the presence of water and acids (hydrolysis). Ester breakdown may indicate the presence of water from condensation caused by low operation temperatures or from a coolant leak.

FTIR stands for Fourier Transform Infrared. This instrumental technique allows the lab to determine numerous oil conditions. Oil Degradation – As your oil ages several things happen to it. The Oil chemically reacts with the air. If it combines with oxygen, it is called Oxidation. If it combines with nitrogen, it is called Nitration. Both cause the oil to thicken and cause buildup of a varnish-like material on component parts. Fluid Entry – In addition to the oil in your equipment, there are usually 3 other fluids flowing through the systems: water, antifreeze and diesel fuel. All 3 are critical to the proper functioning of your equipment – none belong in your oil! FTIR will detect the presence of Water, Soot, Fuel, Ethylene Glycol, Sulfur, Nitration, Oxidation, and Additive Depletion.

FT-IR analysis is performed on engine samples and requires a reference sample of new oil for comparison against the used engine oil.

Thank You for Choosing Modern Machinery
This analysis is intended as an aid in preventative maintenance. No guarantee, expressed or implied, is made against failure of this component.
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