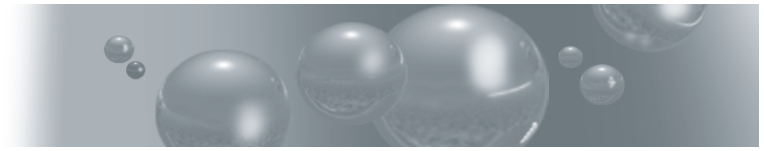
Scheduled Oil Sampling



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Wear Elements: Reported in ppm can elevate according to hours/miles in use, oil added, recent repairs, and other conditions may affect readings.

(Metals):	
Copper	Bearings, bushings, thrust washers, and brass parts. Engine readings may vary dramatically.
Iron	Rust, gears, shafts, cylinders, valve train components, and liners in some applications.
Chromium	Piston rings, chrome plated crankshafts, some exhaust valves, roller & ball bearings.
Lead	Found in many bearings, rod, turbo, camshaft, and some bushings. Gasoline additive.
Aluminum	Bearings, thrust washers, converter, pump bushings, and pistons. Dirt entry from clay soils.
Tin	Piston plate coating. Overlay of connection rod and crankshaft main bearings.
Nickel	Wear indicator in some bearings, shafts or valves.
Silver	Wear of some bearings, secondary indicator for cooler.
Titanium	Alloy in high quality gears and bearings.
Antimony	Bearing overlay alloy or oil additive.
(Contaminants):	
Sodium	Inhibitor from cooling system, or oil additive. Environmental contaminates (salt water).
Silicon	(DIRT) caused by dirt or dust entry. Silicone is used in some grease/anti-foam in oil.
(Additives):	
Molybdenum	Piston ring coating in some engines, or anti-wear additive in oil.
boron	Coolant additive.
Potassium	Coolant additive.
Phosphorus	Anti-rust agent, deposit reducer.
Zinc	Anti-oxidants, corrosion inhibitor, anti-wear, detergent, extreme pressure agent.
Calcium	Detergent, dispersant, acid neutralizer.
Barium	Corrosion inhibitor, detergent, rust inhibitor.
Magnesium	Dispersant, detergent, alloying metal.

Contamination:

Anti-freeze	Any amount unacceptable means coolant is transferring into the oil, possibility of contamination during draw.
Water	Can promote oil Oxidation, rust and the oils ability to lubricate properly, Possibility condensation.
Fuel (Diesel)	Fuel can reduce Viscosity, prevents proper lubrication, and may lower oil pressure.

Oil Condition Analysis: By Un-subtracted method this method performs its calculations on the ?neat? used oil spectrum without any subraction of the new oil reference spectrum. The Un-subtracted FTIR method removes the dependence on reference oil, therefore eliminating the majority of the reading failures. This method allows for all oil sample types to be analyzed by FTIR when using the zinc selenide (ZnSe) cell.

Oxidation	Oil oxidizes with age and service, or improper operating conditions. Causes varnish and thickening.
Nitration	High nitrogen caused oil thickening, filter plugging, and may be an indication of blow-by.
Sulfur	By-product of combustion, insoluble particulate that can plug filters, and deplete oil additives.
Soot	By percent allowable: 0-140% Allowable (Acceptable).
Soot by Wt	A measure of Soot by weight, corresponds to the amount of unburned fuel suspended in the oil. 0% Transmittance = 200% Allowable = 8% Wt Soot (Critical) 25% Transmittance = 150% Allowable = 6% Wt Soot (Abnormal) 50% Transmittance = 100% Allowable = 4% Wt Soot (Acceptable) 75% Transmittance = 50% Allowable = 2% Wt Soot (Extendable) 100% Transmittance = 0% Allowable = 0% Wt Soot (Unused)

Particle Count: Optically measured using light obstruction sensors utilizing a laser diode as illumination source and a photodiode detector.

ISO Code	11171 Cleanliness Code is the most wide spread system for representing contamination levels.
Channels*	4, 6, 10, 14, 18, 21, 38, 70um (Micron) are measured and reported
Counts	Cumulative Count of particles per/ml (approximately 14 drops of oil).
PVI	Mathematical formula that calculates large particle contamination.
P C Photo	Microscopic image when readings reach critical levels, image @ 60 X Magnification.

Viscosity:

Engine Oils		Gear Lubricants	
SAE Viscosity	Kinematic Viscosity	SAE Viscosity	Kinematic Viscosity
	cST at 100C		cST at 100C
5W	3.8 - 4.0	75W	4.1 - 6.9
10W	4.1 - 5.6	80W	7.0 - 10.9
15W	5.6 - 9.3	85W	11.0 - 13.4
20W	5.6 - 9.3	20W	13.5 - 23.9
20	5.6 - 9.2	90	24.0 - 40.9
30	9.3 - 12.4	140	41.0+
40	12.5 - 16.2	250	13-5 - 23.9
50	16.3 - 21.8	80W-90	24.0 - 40.9
60	21.9 - 26.1	85W-140	
5W30	9.3 - 12.4		
10W30	9.3 - 12.4		
15W40	12.5 - 16.3		