Understanding your Results

Elemental Analysis:
Elemental analysis, or spectroscopy, identifies the type and amount of wear particles, contamination and fluid additives. Determining metal content can alert you to the type of severity of wear occurring in the unit. Measurements are expressed in parts per million (ppm).

ASTM D5185 Wear Metals by ICP-OES (PPM)															
Cu	Fe	Cr	Al	Pb	Sn	Si	Ca	Mg	Zn	P	Mo	B	Ag	Ni	Na	K

Wear Metals: Combinations of these metals can identify components within the machine that are wearing. Knowing what metal a unit is made of influences the recommendations and determine the value of elemental analysis.

Contaminant Metals: Knowledge of the enviromental conditions under which a unit operates can explain varying levels of contaminant metals. Excessive levels of dust and/or dirt can be abrasive and accelerate wear.

Additive Metals: Knowledge of the enviromental conditions under which a unit operates can explain varying levels of contaminant metals. Excessive levels of dust and/or dirt can be abrasive and accelerate wear.

FT-IR Analysis:
Fourier Transform - Infrared Spectroscopy measures a sample using infrared light (Laser) to compare intesities of elements against a reference to quantify a value. When using against a referenced fluid it can determine a Water %, Acid/Base numbers, Nitration, Oxidation, Sulfation and many other elements in an oil.

Fuel and **Soot** are reported in % of volume. High fuel dilution decreases unit load capacity. Excessive soot is a sign of reduced combustion efficiency (Generally only found in engine oil samples)

Water in oil decreases lubricity, prevents additives from working and furthers ozidation. Its presence can be determined by FTIR and is reported in % of volume. Water by Karl Fischer determines the amount of water present by PPM.

Acid and Base Numbers are measured to determine if the lubricant is becoming acidic. A lubricant that becomes too acidic can cause corrosion to internal components. Note that the acid and base numbers do not begin at zero. They are also known as TAN and TBN

FT-IR Analysis (ASTM 2412)								
Oxidation (A/cm)	Sulfation (A/cm)	Nitration (A/cm)	Water (%)	Antifreeze (P/N)	Fuel (%)	Soot (%)	BN (mg KOH/g)	AN (mg KOH/g)

Nitration is a major concern in engine oils, specifically natural gas engine oils. Atmospheric nitrogen and oxygen react due to the heat produced and form nitrous oxides (NOx), which in turn react with the lubricant and produce organic nitrates, or are picked up as insoluble or soluble nitrous compounds. This causes the viscosity of the oil to increase.

Oxidation of oil is caused by the presence of air (oxygen) and heat. Carboxylic acids are formed when atmospheric oxygen reacts with the hydrocarbons in the lubricant. Such acids are weak, but they gradually gain a concentration highenough to cause serious corrosion of machinery parts. This is an inevitable activity that requires monitoring.

Sulfation occurs when oxygen, water and sulfur in the base oil or diesel fuel react due to heat, they can form sulfurous compounds, such as sulfur-based acids. These compounds are often discharged via exhaust. However, some compounds may remain and enter into the engine cavity. When the sulfur-based acids react with the base stock of the oil or with the additives in the oil, sulfation occurs.

Overall Severity of Sample

0	1	2	3
Normal	Reportable	Abnormal	Critical

Severity 0 (Normal) = Continue maintainence and sampling at normal intervals.

Severity 1 (Reportable) Continue maintainence and sampling at normal internals. Observe for trends in future testing.

Severity 2 (Abnormal) Sampling and maintainence of fluid should be shortened to half internals.

Severity 3 (Critical) Fluid should be changed, filtered or serviced along with filters.

Viscosity (cSt) (ASTM D445)	
100c	40c

Viscosity measures a lubricants resistance to flow at temperature and is considered its most important physical property. Depending on the product, it is tested at 40°c or 100°c and reported in Centistrokes.

Particle Count (Particles per 1mL) (ISO 4406/ISO 11500)							
ISO Class Code	>4 (µ)	>6 (µ)	>10 (µ)	>14 (µ)	>25 (µ)	>50 (µ)	>100 (µ)

ISO Code in an index number that represents a range of particles within a specific micron range. Each class designates a range of measured particles per one mL of sample. This test is valuable in determining large particle wear in filtered systems. This code is specified at 4, 6, & 14 Micron.

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