

EXPLANATION OF ANALYSES

FOR USE AS AN AID IN UNDERSTANDING AND INTERPRETING OIL ANALYSES

METAL ANALYSIS

Metals are quantitatively analyzed by a simultaneous inductively coupled argon plasma spectrometer. Below is a list of metals and their common sources:

Aluminum	Pistons, Bearings, Dirt
Antimony	Grease, Bearings
Barium	Additives, Water, Grease
Boron	Coolant, Additive, Sea Water
Cadmium	Bearings, Plating
Calcium	Detergent, Dispersant Additive
Chromium	Cylinders, Rings, Gears, Crankshafts, Coolant
Copper	Bearings, Bushings, Bronze, Coolers
Iron	Cylinders, Rust, Crankshaft, Water
Lead	Bearings, Gasoline, Grease, Paint
Magnesium	Additives, Bearings, Sea Water
Molybdenum	Additives, Rings
Nickel	Shafts, Gears, Rings, Turbine Components
Phosphorus	Additives, Gears
Silicon	Dirt, Defoamants, Sealants
Silver	Bearings
Sodium	Coolant, Sea Water, Additive
Tin	Bearings, Solder, Coolers
Titanium	Turbine Components, Springs, Valves
Zinc	Additives, Bearings Plating

The **wear** metals are Aluminum, Antimony, Cadmium, Chromium, Copper, Iron, Lead, Magnesium, Molybdenum, Nickel, Silver, Tin, and Titanium. An increasing trend of one or more of these metals is a warning that abnormal wear may be occurring and corrective action may be necessary.

The **additive** metals blended into the lubricants by the manufacturers are Barium, Calcium, Magnesium, Phosphorus, and Zinc. Phosphorus and Zinc are anti-wear metals. Calcium, Barium and Magnesium are detergents and dispersants. They pick up wear and contaminated particles then carry them to the filters for removal.

Boron and **Sodium** may indicate coolant leaks. Sodium Borate and Sodium Chromate are used as coolant additives. In the event of a coolant leak these trace metals will remain in the lubricant even if the water has evaporated due to operating temperatures.

PHYSICAL PROPERTIES ANALYSES

VISCOSITY:

The viscosity test is an indication of proper lubricant in use, oxidation and contamination such as fuel dilution.

WATER:

The presence of water in most lubrication systems is abnormal. Possible sources of water are condensation, coolant leaks and outside contamination.

SOLIDS:

This test measures total solids, both suspended and settleable. An abnormal amount of solids in the lubricant could indicate carburization problems if the unit is running to rich or to lean, the oil filter has reached maximum usefulness and is no longer able to remove contaminants and if the air intake system is not operating properly.

FUEL DILUTION:

Measures the amount of unburned fuel in the lubricant. This test could indicate leaks in the fuel line, carburetor, injectors and fuel pump.

GLYCOL:

Analysis results are reported as POS (Positive) or NEG (Negative). Glycol present in the lubricant normally indicates a coolant leak. The presence of glycol in a lubricant could cause serious damage to the unit and should be dealt with immediately.

TOTAL ACID NO.

Indicates acidic products present in the Lubricant. High Acid no's usually mean overheated or oxidized oil, etc.

TOTAL BASE NO.

Indicates reserve alkalinity of lubricant. A low TBN indicates a depletion of additives and a low dispersion characteristic.

OXIDATION:

At elevated temperatures, oil exposed to oxygen from the air will oxidize to form a variety of compounds. The majority of these are carbonyl containing compounds e.g. carboxylic acid.

NITRATION:

Nitration products are formed during the fuel combustion process in internal combustion engines. Most nitration products are formed when an excess of oxygen is present. These products are highly acidic, form deposits in combustion areas and rapidly accelerate oxidation.

SOOT:

Measure of the level of unburned fuel in oil. Relevant for diesel engines.

EXPLANATION OF RECOMMENDATION CODES

Normal (N) means that unit and oil appear to be in satisfactory condition. It indicates there has been no significant change in the trend pattern.

Moderate (M) indicates there has been a change in unit or oil condition, or both. In either case, these values bear watching and additional samples may be necessary to confirm potential problem area(s).

Critical (C) indicates there has been a significant change in the unit or oil condition, or both. Specific recommendations will be made, but are dependent on complete correct data on both unit and oil. An additional sample should be taken immediately to confirm the critical problem area(s).