

UNDERSTANDING YOUR ENGINE REPORT

It's easy!

You don't need to be an expert . . . The built-in diagnostics do it for you!

The analytical test results and diagnostic comments / recommendations have been provided by the On-site Analyzer (OSA), which incorporates the latest technological advancements in the oil analysis industry.

The tests include optical emission spectroscopy and infrared spectroscopy to monitor engine or transmission internal wear rates as well as the physical properties of the oil to determine the oil's condition and serviceability.

We test for 10 elements: 6 wear metals, 1 additive metal, and 3 contaminant metals. The wear metals are minute particles of metal suspended in the oil, which are formed by friction between moving parts, abrasion or corrosion. The On-Site Analyzer produces a measurement in parts per million (ppm). These results are scientifically matched against known engine or transmission wear patterns and reported in the diagnostic comment section depending on the severity of the situation and on the following wear information for engines, transmissions and gear boxes (maximum 90 weight oil or 80W90 multi-grade oils). The condemning limits (or break points) are dependent on the engine or transmission make, the total number of miles on the system (or since overhaul).

Diagnostics:

Air Filter: Abnormal condition usually caused by the ingestion of dirt, resulting from a failed or torn air filter.

Bearings, Bushings, Camshaft and Crankshaft:

Abnormal condition can be caused by local oil starvation resulting from a blocked oil-way, or ingested dirt or other abrasive material, or the presence of corrosive materials from a heavily degraded engine oil (too many hours on the oil)

Cooling System: Abnormal condition can be caused by leaks from gaskets or seals, a broken head gasket or from a cracked engine block.

Cylinders, Piston Rings, Pistons: Abnormal condition can be caused by poor lubrication resulting from blocked oil-ways or excessive deposits in the ring zone or the ingested dirt or other abrasive materials.

Engine Block: Abnormal condition can be caused by a cracking or distortion of the engine block resulting from extreme low or high temperatures.

Fuel System: Abnormal condition can be caused by leaks in internal fuel lines, a failed fuel pump diaphragm, or leaking fuel injectors (seats).

Summary Diagnostics:

Wear Metals: Abnormal condition can be caused by ingestion of dirt or other abrasive materials (failed air filter), local oil starvation (block oil-way), or corrosion caused by.

Coolant Content: Abnormal condition can cause severe degradation of the lubricant, leading to local oil starvation, lubricant failure and eventual excessive mechanical wear.

Sludge Potential: Abnormal condition can be caused by over-extension of the oil life or from regular short journeys where engine does not reach normal operating temperature.

Fuel Content: Abnormal condition can be caused by leaks in internal fuel lines, a failed fuel pump diaphragm, or leaking fuel injectors (seats).

Water Content: Abnormal condition can be caused by excessive condensation, and at high levels from a cracked engine block, a broken head gasket, a leaking water pump seal, or simply ingestion of water from operating vehicle in flood conditions.

Wear Metal Associations:

Aluminum: Pistons, engine blocks, blowers, and bearings.

Chromium: Compression rings, cams, low friction bearings, liners, zinc chromate cooling system inhibitor.

Copper: Bearings, bushings, thrust washers, oil cooler, and clutches, oil additive.

Iron: Crankshaft, valve train, cylinders, gears, liner, and bearings.

Lead: Bearings, contaminant from leaded gasoline (automotive only).

Tin: Pistons, bearings, and bushings.

Additive Metals:

Molybdenum: EP additives, alloying metal with iron, rings, friction reducing coating.

Contaminant Metals:

Contaminant metals result primarily through problems with the air intake system (Silica - dirt) or because of coolant leaks (Potassium, Sodium and sometimes Silicone are typical additives in water treatment chemicals). These metals are also measured in ppm and evaluated on content and severity.

Silicon: Usually an indication of dirt ingestion when (the ratio of silicon to aluminum is 3.4:1) as the root resulting in abrasive wear, seal material, or a silicon based oil or coolant additive, piston torching with an increase in iron and chromium (the ratio of silicon to aluminum is 1:1).

Potassium: A common coolant additive that is an indication of a cooling system problem, fly ash, road salt, and trace element in fuel.

Sodium: oil additive constituent, coolant additive, road salt, salt water, fly ash, dirt, and grease.

Physical Properties: This section contains the physical data of your oil analysis and is explained as follows:

Water: Measured in % weight, can be an indication of condensation due to a cold running system, a cooling system leak, or outside contamination (severe at greater than 1%).

Glycol: Measured in % weight, is in the formulation of most commercial coolant. Its presence usually indicates some type of coolant leak (Abnormal at greater than 0.6%).

Fuel Dilution: Measured in % weight, can indicate faulty combustion, rich air/fuel mixture when present at between 2% and less than 5%. An injector problem or internal fuel line leak is typically indicated when fuel is detected in high level. This test result is accurate within $\pm 4\%$ for diesel engines and within $\pm 1.5\%$ for gasoline engines.

Oxidation: Measured in absorbance units, is the result of oxygen in the air interacting with the oil at elevated temperatures, and is a normal process as the oil ages. When an engine is operated continuously at high temperatures for extended periods, or when a drain interval is over-extended then values greater than 25 may be observed and an oil change is normally recommended. This test is accurate within ± 4 absorption units.

Nitration: (Applicable for gasoline engines only) measured in absorbance units. Nitration products are formed during the fuel combustion process. The products are often corrosive and can accelerate oil deterioration.

Viscosity (Estimated value): This calculated measurement is an indication of the oil's ability to flow and lubricate the moving parts of the engine or transmission. It's an indication whether the oil is too thick or too thin. As an approximate guide, the viscosity of 15W40 weight diesel engine oil should be between 12.4 and 16.3. The viscosity of 10W30 weight automotive oil should be between 9.3 and 12.4.

The reported viscosity is an estimated number only. This estimated calculated viscosity is accurate within ± 1.5 cSt.

Total Base Number (TBN, Estimated Value): A calculated measurement of the oil's alkaline reserve (additive) package of the oil that is capable of neutralizing acidic contaminants, primarily formed by the adsorption of combustion gases and the aging of the oil. Combustion by-products are the source of the strongest acids, therefore, over-extended oil drain intervals, insufficient additive package, or overheating are causes for a low TBN. Typically, when the TBN is below 3, it is an indication that the oil is no longer serviceable and should be scheduled for an oil change.

Additional Physical Properties (Diesel Engines Only):

Soot: Measured as %soot, is a normal combustion by-product of diesel fuel and appears as a contaminant in the oil. At high levels it can cause an increase in the oil's viscosity (thickening of the oil.) Higher than normal levels can indicate an improper air/fuel ratio, defective air intakes or injectors and can cause deposits, thickening and over-extension of the oil additives.

ACCURACY OF RECOMMENDATIONS IS DEPENDENT ON REPRESENTATIVE OIL SAMPLES AND COMPLETELY CORRECT DATA ON BOTH VEHICLE AND OIL. THIS ANALYSIS IS INTENDED AS AN AID IN PREVENTING MECHANICAL WEAR. NO GUARANTEE, EXPRESSED OR IMPLIED, IS MADE AGAINST FAILURE OF THESE COMPONENTS. ON-SITE ANALYSIS LIABILITY IN ANY CASE IS LIMITED TO THE COST OF THE REPORTED ANALYSIS.