FANPRO®
LUBRICANT ANALYSIS

STANDARD OIL TESTS

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Why Testing?

Several considerations are necessary for implementing and maintaining an effective fluid testing program. When companies transition from preventive maintenance to predictive maintenance, they realize greater impact, uptime and savings. These are proven results that drive performance and business success.

Lubricant provides a snapshot of what is happening inside your equipment. It can tell you the condition of the fluid and identify component wear, corrosion or contamination in engines, transmissions, hydraulics, gears, bearings and final drives so that you can:

- Safely extend drain intervals
- Maximize asset reliability
- Extend equipment life
- Minimize downtime by identifying minor problems before they become major failures
- Increase resale value

Gathering data about the fluids that help your equipment perform is critical, but the data alone won't solve your problems. Your data is reviewed and precise recommendations are crafted by the best data analysts in the industry, assuring you get insightful, specific, actionable information fast

The **five standard FanPro™ tests** that Lubretec offers for monitoring of industrial equipment are:

- Hydraulic or Circulating oils
- Gearbox or Bearing oils
- Compressor oils
- Diesel engine oils
- Wind Turbine System Oils

Standard Test: Hydraulic or Circulating oils

Item nr. FP-41PK

Hydraulic systems, including automatic powershift transmissions, require the fluid's viscosity to be low enough to minimize friction loss, yet high enough to prevent fluid leakage and provide satisfactory protection against wear, and should have good oxidation stability to prevent sludge from forming.
Several methods are used to analyze oil condition and contamination.
This standard test includes:

- **Elemental Metals (24) by ICP (or Spectroscopy)**

  Elemental Analysis, or Spectroscopy, identifies the type and amount of wear particles, contamination and additives. Determining metal content can alert you to the type and severity of wear occurring in the unit. Measurements are expressed in parts per million (ppm). It provides rapid screening of used oils for indications of wear.

- **Karl Fischer Water ppm**

  This test produces iodine when electricity is conducted across a mesh screen. The current needed to create iodine and remove existing water is measured and converted to parts per million (ppm).

- **Viscosity @ 40°C or 100°C**

  ASTM test uses a constant temperature bath. The efflux time is measured between two points. The viscosity is computed by using a calibration constant and the efflux time. Viscosity is reported in centistokes (cSt) at 40ºC or 100ºC.

- **Total Acid Number (TAN)**

  TAN is a measure of the total concentration of acids, both weak and strong, present in the oil. It is an indicator of oil health. Useful in monitoring acid buildup in oils due to depletion of antioxidants. High acid levels can indicate excessive oil oxidation or depletion of oil additives, which can lead to corrosion of the internal components.

- **ISO Particle Count***

  As particles in the oil flow pass a laser, the laser light is blocked allowing individual particles to be counted and sized. The resulting data is a distribution of the concentration of particles in various size ranges.

Sample bottle size: 90 ml.

Standard Test: Gearbox or bearing oils

Item nr. FP-41Q

Although contamination by dirt and water should be closely monitored in manual transmissions, differentials, final drives and planetaries, the biggest concern for these systems is the type of wear occuring.

The test includes:

- **Elemental Metals (24) by ICP (or Spectroscopy)**

  Elemental Analysis, or Spectroscopy, identifies the type and amount of wear particles, contamination and additives. Determining metal content can alert you to the type and severity of wear occurring in the unit. Measurements are expressed in parts per million (ppm). It provides rapid screening of used oils for indications of wear.

- **Water % by Crackle (Karl Fischer if Crackle is Positive)**

  To detect the presence of water in lubricating oil. Water contamination is detrimental to any lubricant.

- **Viscosity @ 40°C or 100°C**

  ASTM test uses a constant temperature bath. The efflux time is measured between two points. The viscosity is computed by using a calibration constant and the efflux time. Viscosity is reported in centistokes (cSt) at 40ºC or 100ºC.

- **Total Acid Number (TAN)**

  TAN is a measure of the total concentration of acids, both weak and strong, present in the oil. It is an indicator of oil health. Useful in monitoring acid buildup in oils due to depletion of antioxidants. High acid levels can indicate excessive oil oxidation or depletion of oil additives, which can lead to corrosion of the internal components.

- **Particle Quantifier**

  The Particle Quantifier exposes the oil sample to a magnetic field. The presence of any ferrous (iron based) metal causes a distortion in the field, which is represented as the PQ Index. PQ Index correlates well with Direct Read Analytical Ferrography (large).

Sample bottle size: 90 ml.

For more info.: please contact Lubretec B.V. – tel. +32 (0) 3 312 24 73– email info@lubretec.com

Standard Test: Compressor oils

Item nr. FP-41RWP

Fluid Analysis is important in any Reliability Centered Maintenance program. Knowing which tests are best suited for compressor fluids is critical. The following tests are useful for compressors and provide valuable information to help monitor the health of your compressors' fluid and internals, and warn of impending failures.

- **Elemental Metals (24) by ICP (or Spectroscopy)**

  Elemental Analysis, or Spectroscopy, identifies the type and amount of wear particles, contamination and additives. Determining metal content can alert you to the type and severity of wear occurring in the unit. Measurements are expressed in parts per million (ppm). It provides rapid screening of used oils for indications of wear.

- **Water Karl Fischer, PPM**

  This test produces iodine when electricity is conducted across a mesh screen. The electrical current needed to create iodine and remove existing water is measured and converted to parts per million (ppm).

- **Viscosity @ 40°C**

  ASTM test uses a constant temperature bath. The efflux time is measured between two points. The viscosity is computed by using a calibration constant and the efflux time. Viscosity is reported in centistokes (cSt) at 40ºC

- **Oxidation/Nitration by FTIR**

  As oil oxidizes, its ability to lubricate diminishes and, in cases of severe oxidation, noticeable changes occur: it becomes darker and emits odor; varnishes, lacquers and resins are formed; and in the advanced stages viscosity increases, often rapidly. Nitration is the reaction of the oil with combustion by-products of nitrogen. These reactions tend to become more pronounced at higher temperatures.

- **Total Acid Number (TAN)**

  TAN is a measure of the total concentration of acids, both weak and strong, present in the oil. It is an indicator of oil health. Useful in monitoring acid buildup in oils due to depletion of antioxidants. High acid levels can indicate excessive oil oxidation or depletion of oil additives, which can lead to corrosion of the internal components.

Sample bottle size: 90 ml.

Standard Test: Diesel Engine oils

Item nr. FP-51R

Diesel engines are the power units for your business and without power, all work stops. It is imperative to monitor wear, contamination and the oil's properties to insure these engines do not fail prematurely. Unscheduled downtime is far more costly than the cost of repairs. Monitoring the condition of the fuel along with the oil puts all of the pieces of the puzzle together to tell a clear story. Choose the testing regime below that meets your maintenance and financial goals for your fluid analysis program

- **Elemental Metals (24) by ICP (or Spectroscopy)**

  Elemental Analysis, or Spectroscopy, identifies the type and amount of wear particles, contamination and additives. Determining metal content can alert you to the type and severity of wear occurring in the unit. Measurements are expressed in parts per million (ppm). It provides rapid screening of used oils for indications of wear.

- **Fuel Dilution % by Range in Viscosity confirmation by GC**

  A method for testing fuel dilution is gas chromatography (GC). In this method, the lubricating oil is injected directly into a GC according to ASTM D3524, ASTM D3525 or DIN 51380. The fuel dilution test is typically performed either when a significant drop in sample viscosity is measured, or when the flash-point test has failed.

- **Soot % by FTIR (Fourier Transform Infrared Spectroscopy)**

  The soot index is a linear measurement that measures the extent to which the oil has become contaminated by fuel soot, an unwanted by-product of combustion.

- **Total Base Number (TBN)**

  TBN measures the amount of active additive left in a sample of oil.
  It determines how much reserve additive the oil has left to neutralize acids.
  Base number testing is very similar to acid number testing except that the properties are reversed. The sample is titrated with an acidic solution to measure the oil's alkaline reserve.

- **Water % by crackle of FTIR Viscosity @ 100°C**

  To detect the presence of water in lubricating oil.

Sample bottle size: 90 ml.

Standard Test: Wind Turbine System oils

Item nr. FP-61R

Harsh environmental conditions, varying loads and speeds and necessary lubricant compatibility all contribute to stressed wind turbine gearbox lubricant performance. The industry's expectation of an increasing service life for gearboxes requires lubricants to exhibit exceptional durability and reliability in service. Wind turbines are one of the most challenging applications for industrial lubrication. The wind turbine gear oils are a significant contributor to the overall operating cost of wind power generation, especially the attendant costs of replacement and quality monitoring. By monitoring the gearbox and bearing lubrication, wear and tear can be detected at an early stage and damage can be avoided

- **Viscosity @ 40°C or 100°C**
  ASTM test uses a constant temperature bath. The efflux time is measured between two points. The viscosity is computed by using a calibration constant and the efflux time. Viscosity is reported in centistokes (cSt) at 40ºC or 100ºC.S ample bottle size: 90 ml.

- **Viscosity Index**
  Viscosity index (VI) is a measure for the change of viscosity with variations in temperature. The lower the VI, the greater the change of viscosity of the oil with temperature and vice versa. It is used to characterize viscosity changes with relation to temperature in lubricating oil.

- **Water Content in ppm**
  Water in any form will cause accelerated wear, increased friction and high operating temperatures. If left unchecked, water will lead to premature machine failure. In most systems, water should not exceed 500 ppm.

- **Oxidation**
  As oil oxidizes, its ability to lubricate diminishes and, in cases of severe oxidation, noticeable changes occur: it becomes darker and emits odor; varnishes, lacquers and resins are formed; and in the advanced stages viscosity increases, often rapidly.

- **ICP Elements (Wear, additives, contaminants etc.)**
  Inductively coupled plasma mass spectrometry (ICP-MS) is a type of mass spectrometry which is capable of detecting metals and several non-metals at concentrations as low as one part in 1015(part per quadrillion, ppq) on non-interfered low-background isotopes. This is achieved by ionizing the sample with inductively coupled plasma and then using a mass spectrometer to separate and quantify those ions.

For more info.: please contact Lubretec B.V. – tel. +32 (0) 3 312 24 73– email info@lubretec.com

- **Particle Count**

  Particle Count count testing is a way to monitor the level of solid contamination in the oil. Two types of automatic particle counts are used to test oil cleanliness: Light blockage and pore blockage. High particle counts means dirty oil. Results are reported as particles per milliliter in six ranges: >4, >6, >14, >25, >50 and >100. Codes are then assigned for particles in 5, 6 and 14 µm ranges (ISO 4406:1999). The result is reported by 3 numbers (see page 10).

- **Particle Quantifier (Ferrous Debris)**

  The Particle Quantifier exposes the oil sample to a magnetic field. The presence of any ferrous (iron based) metal causes a distortion in the field, which is represented as the PQ Index. PQ Index correlates well with Direct Read Analytical Ferrography (large).

Sample bottle size: 90 ml.

The International Organization for Standardization created the cleanliness code 4406:1999 to quantify particulate contamination levels per milliliter of fluid at three sizes: 4µ[c], 6µ[c], and 14µ[c]. This ISO code is expressed in 3 numbers: 19/17/14. Each number represents a contaminant level code for the correlating particle size. The code includes all particles of the specified size and larger. It is important to note that each time a code increases the quantity range of particles doubles.

ISO Cleanliness Codes

International Standard ISO 4406

Particle concentration (nr. of particles per)			ISO range number
# per ml		# per 100 ML	
More than	u/i		
80000	**160000**	**8M-16M**	**24**
40000	80000	4M-8M	23
20000	**40000**	**2M-4M**	**22**
10000	20000	1M-2M	21
5000	**10000**	**500K-1M**	**20**
2500	5000	250K-500K	19
1300	**2500**	**130K-250K**	**18**
640	1300	64K-130K	17
320	**640**	**32K-64K**	**16**
160	320	16K-32K	15
80	**160**	**8K-16K**	**14**
40	80	4000-8000	13
20	**40**	**2000-4000**	**12**
10	20	1000-2000	11
5	**10**	**500-1000**	**10**
2,5	5	250-500	9
1,3	**2,5**	**130-250**	**8**
0,64	1,25	64-130	7
0,32	**0,64**	**32-64**	**6**