TECNOVERITAS®

Dedicated to innovation

Laboratorial Analysis Catalogue

April 2020

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About Laboratory Analysis

The trials performed follow international standards, such as ISO or ASTM, which assures that the parameters are determined according to commonly used and exact tests.

Why should you analyse your fuel/oil?

Throughout the times, fossil fuels and luboils have suffered a considerable increase in terms of demand. Its search began with industrialization and the need to increase activities due to the energy demand and grew with the expansion of the transport network.

Fuel oil, diesel oil (heating, marine diesel oil, or road diesel), as well as lubricating and hydraulic oils, had since very soon found applicability on internal combustion engines, cars, marine diesel engines, industries (as rust and corrosion inhibitors) or diesel-electric power units. More recently, other types of fuels (distillates) have also found applications, such as LSFO (low sulphur fuel oil), automotive gasoline (kerosene), and aviation gasoline (jet-fuel).

With the unstoppable growth of fuel prices and with the latest restrictive regulatory legislation on fossil fuel emissions taking place (to mitigate air pollutant consequences to the atmosphere as well as raising awareness among the public) it becomes more urgent than ever to know the fuel that you are burning.

TecnoVeritas Express Oil Analysis Service

TecnoVeritas has an express service of luboil and hydraulic oil analysis, which is reinforced by our kit:

- 1 vacuum system (a syringe with an appropriate hose);
- 5 test bottles for sample recovery; and
- Instruction leaflet.

This valuable tool allows planning maintenance, as well as reducing any risk of unplanned downtime and expensive repairs. In other words, the analysis result enables to replace any necessary component before any problem and damage occur. The regular analysis enables trends to become visible and brings more control to equipment health management.

Which are the steps for the Oil Analysis

Sampling: the required samples are taken and sent to TecnoVeritas Laboratory due to the Oil Analysis Kit.

Oil analysis: we receive and characterise the sample according to a high range of parameters, such as density, viscosity, water content, sulphur content, flash and fire point, corrosiveness, among others.

The result: the diagnosis of the analysis are quickly made available to the client (within 48 hours), and presents immediate recommendations for actions and valuable explanations to avoid critical and undesirable situations.

Laboratory Analysis List

Residual Fuel Oils (HFO, LSFO, and VLSFO)

- Petroleum Products Transparent and Opaque Liquids. Determination of Kinematic Viscosity (NP EN ISO 3104:1999);
- Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (ASTM D445-19);
- Standard Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method (ASTM D1298 - 12b(2017));
- Standard Test Method for Density, Relative Density, or API Gravity of Liquid Petroleum by Portable Digital Density Meter (ASTM D7777 - 13(2018)e1);
- Petroleum Products: Determination of Ash (ISO 6245:2001(E));
- Determination of Carbon Aromaticity Index (CCAI) (ISO 8217:2017);
- Standard Test Method for Water in Petroleum Products and Bituminous Materials by Distillation (ASTM D95-13);
- Determination of Water Content by the Petroleum Column Method;
- Standard Test Method for Flash Point by Pensky-Martens Closed Cup Tester (ASTM D93-19);
- Petroleum Products - Total Sediment in Residual Fuel Oils - Part 1: Determination by Hot Filtration (ISO 10307-1:2009(en));
- Determination of Asphaltenes (Reference Spot Test);
- Standard Test Method for Sulphur in Petroleum and Petroleum Products by Energy Dispersive X-Ray Fluorescence Spectrometry (ASTM D4294-16);
- Critical Metals and Elements Monitoring by X-Ray Fluorescence Spectrometry;
- Standard Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test (ASTM D130-19);
- Determination of High Heating Value (HHV) and Low Heating Value (ISO 8217:2017 - Annex A);
- Determination of Water Nature;
- Cleanliness and Compatibility of Residual Fuels by Spot Test (ASTM D4740-19);
- Determination of Catalytic Fines in Fuel Oil.

Petroleum Distillates (Diesel, Gasoline and Other Petroleum Light Products)

- Petroleum Products Transparent and Opaque Liquids. Determination of Kinematic Viscosity (NP EN ISO 3104:1999);
- Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (ASTM D445-19);
- Standard Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method (ASTM D1298 - 12b(2017));
- Standard Test Method for Density, Relative Density, or API Gravity of Liquid Petroleum by Portable Digital Density Meter (ASTM D7777 - 13(2018)e1);
- Determination of Water Content by the Petroleum Column Method;
- Standard Test Method for Sulphur in Petroleum and Petroleum Products by Energy Dispersive X-Ray Fluorescence Spectrometry (ASTM D4294-16);
- Critical Metals and Elements Monitoring by X-Ray Fluorescence Spectrometry;

- Standard Test Method for Flash Point by Pensky-Martens Closed Cup Tester (ASTM D93-19);
- Standard Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test (ASTM D130-19);
- Petroleum Products - Total Sediment in Residual Fuel Oils - Part 1: Determination by Hot Filtration (ISO 10307-1:2009(en));
- Standard Test Method for Free Water and Particulate Contamination in Distillate Fuels (Visual Inspection Procedures) (ASTM D4176-04).

Hydraulic and Lubricating Oils

- Petroleum Products Transparent and Opaque Liquids. Determination of Kinematic Viscosity (NP EN ISO 3104:1999);
- Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (ASTM D445-19);
- Standard Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method (ASTM D1298 - 12b(2017));
- Standard Test Method for Density, Relative Density, or API Gravity of Liquid Petroleum by Portable Digital Density Meter (ASTM D7777 - 13(2018)e1);
- Standard Practice for Calculating Viscosity Index from Kinematic Viscosity at 40ºC and 100ºC (ASTM D2270-10);
- Determination of Water Content by the Petroleum Column Method;
- Standard Test Method for Water in Petroleum Products and Bituminous Materials by Distillation (ASTM D95-13);
- Standard Test Method for Sulphur in Petroleum and Petroleum Products by Energy Dispersive X-Ray Fluorescence Spectrometry (ASTM D4294-16);
- Critical Metals and Elements Monitoring by X-Ray Fluorescence Spectrometry;
- Insoluble Content and Degree of Dispersion (Reference Spot Test);
- Standard Test Method for Flash Point by Pensky-Martens Closed Cup Tester (ASTM D93-19);
- Standard Test Method for Acid and Base Number by Color-Indicator Titration (ASTM D974);
- Standard Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test (ASTM D130-19).

Residual Fuel Oils (HFO, LSFO, and VLSFO)

Petroleum Products Transparent and Opaque Liquids. Determination of Kinematic Viscosity (NP EN ISO 3104:1999)

Description: The viscosity corresponds to a physical property that characterizes the resistance of a given fluid to flow, as well as the shear deformation. It corresponds to the internal friction in fluids due to intermolecular interactions and this magnitude is generally a function of temperature. In addition to being a function of temperature, in particular, the kinematic viscosity is a function of the specific mass of the product.

Advantage: The present test makes it possible to determine the viscosity of the fuel/oil by using a kinematic viscometer set at a specific temperature (40°C). The test is based on the international standard ISO 3104:1999 and allows the determination of values in the range of 5-700 mm^2/s (cSt) using the gauge used.

Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (ASTM D445-19)

Description: The viscosity corresponds to a physical property that characterizes the resistance of a given fluid to flow, as well as the shear deformation. It corresponds to the internal friction in fluids due to intermolecular interactions and this magnitude is generally a function of temperature. In addition to being a function of temperature, in particular, the kinematic viscosity is a function of the specific mass of the product.

Advantage: The present test makes it possible to determine the viscosity of the fuel/oil by using a kinematic viscometer set at a specific temperature (40°C). The test is based on the international standard ASTM D445-19 and allows the determination of values in the range of 5-700 mm^2/s (cSt) using the gauge used.

Figure 1 - Kinematic viscosity using Cannon Fenske calibrated viscometers or Ford cup calibrated viscometer.

Standard Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method (ASTM D1298 - 12b(2017))

Description: It consists of a quick and non-destructive method for determining the amount of matter that is present per unit of volume.

Advantage: This test enables the determination of the density of any fuel/oil, in the following range of values: 0.85 to 1.05 g/cm^3.

Figure 2 – Assembly for the Standard Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method.

Standard Test Method for Density, Relative Density, or API Gravity of Liquid Petroleum by Portable Digital Density Meter (ASTM D7777 - 13(2018)e1)

Description: This test method covers the determination of the density, relative density, or API gravity of liquid petroleum products using portable digital density meters at test temperatures between 0°C and 40°C.

Advantage: This test method is suitable for determining the density to the

Standard Test Method for Water in Petroleum Products and Bituminous Materials by Distillation (ASTM D95-13)

Description: This test method covers the determination of water in the range from 0% to 25% by volume in petroleum products, tars, and other bituminous materials by the distillation method.

Advantage: A quick method that allows accurate quantification of the water content.

Figure 5 - Dean Stark Assembly for water determination.

Determination of Water Content by the Petroleum Column Method

Description: The water content of a fuel is determined to minimize the possibility of corrosion problems, especially in cases where the sulphur content is high, as well as to avoid influences on the calorific value of the fuel/oil. Water increases the possibility of the formation of emulsions, which can cause problems in the nebulization of the product.

Advantage: A quick method that allows accurate quantification of the water content (on a scale from 0 to 1 v/v %).

Figure 6 – Assembly for the Determination of water content by the petroleum column method.

Standard Test Method for Flash Point by Pensky-Martens Closed Cup Tester (ASTM D93-19)

Description: The flash point corresponds to the lowest temperature at which fuel/oil releases enough vapour to form a flammable mixture from an external source of heat. It is not sufficient for combustion to be maintained. In turn, the point of combustion is the lowest temperature at which the vapour of a sample will continue to burn for at least 5 seconds after ignition by an open flame.

Advantage: Determine the flash point and combustion point of a fuel/oil sample using the open cup method (according to international standard) and closed cup combustion point (Pensky-Martens method). It assesses the range of applicability (combustion) of the fuel/oil and assesses its danger.

Figure 7 – Assembly for the Determination of the flash point by the Pensky-Martens closed cup method.

Petroleum Products - Total Sediment in Residual Fuel Oils - Part 1: Determination by Hot Filtration (ISO 10307-1:2009(en))

Description: Method of determination of total sediments in residual fuel having a maximum viscosity of 55 mm^2/s at 100°C or for mixtures of distillates containing residues.

Advantage: It allows to determine accurately (through a gravimetric method after vacuum filtration, preceded or not of thermal or chemical ageing) the content of insoluble organic material or inorganic material up to a range of 0.50 wt% for residual fuel or 0.40% for distillates.

Determination of Asphaltenes (Reference Spot Test)

Description: Asphaltenes are heavy petroleum aromatic compounds with higher boiling points. They are formed by aromatic rings, having paraffin-like chains and high polarity. These compounds can cause serious problems during the production of oil. These problems include the formation of organic deposits in reservoirs and runoff lines, changes in rock wettability, and the formation and stabilization of emulsions.

Advantage: Quick method for determination of asphaltenes by comparison with normative tables.

Figure 8 - Assembly for the Determination of Asphaltenes.

Standard Test Method for Sulphur in Petroleum and Petroleum Products by Energy Dispersive X-Ray Fluorescence Spectrometry (ASTM D4294-16)

Description: Test that allows determining according to ASTM standard the sulphur content of the fuel/oil. A test portion is placed in the beam emitted from an x-ray source. The excitation energy may be derived from a radioactive source, such as 55Fe, or an x-ray tube. The resultant excited x-radiation is measured and the cumulative count is compared to a calibration chart representing the counts concerning the sulphur content in mass percentage [%(m/m)], in a series of calibration samples covering the range of sulphur contents under examination.

Advantage: To enable the determination of the sulphur content present in samples of petroleum products, such as naphtha's, types of gasoline, distillates, residual oil fuels, by the technique of x-ray fluorescence spectrometry (FRX) in a scale from ppm to wt% sulphur (5.00).

Figure 9 – Assembly for the Energy-dispersive x-ray fluorescence spectrometry: sulphur determination, critical metals, and elements monitoring.

Critical Metals and Elements Monitoring by X-Ray Fluorescence Spectrometry

Description: Monitoring of the presence of wear metals (case of V, Ni, Na, Ca) present in petroleum product samples by FRX technique.

Advantage: It allows to rapid monitor the presence of metals and elements in the sample and its user to control its products eliminating the degradation of equipment and reduce maintenance costs.

Figure 10 - X-Ray Fluorescence Spectrometer for determination of critical metals and elements

Standard Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test (ASTM D130-19)

Description: Determine the degree of corrosiveness to the copper of samples of petroleum products containing a steam pressure of not more than 124 kPa (18 psi) at 37.8°C.

Advantage: It allows an accelerated ageing process to verify the presence of metal-fuel damage equipment or materials by the oxidation-reduction reaction.

Figure 11 - Assembly for Standard Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test.

Determination of High Heating Value (HHV) and Low Heating Value (ISO 8217:2017 - Annex A)

Description: Heat of combustion corresponds to the amount of energy per unit mass (or volume, in the case of gases) released in the oxidation of a given fuel. The higher the calorific value, the greater the energy contained in the fuel.

Advantage: Determine the heat of combustion of the fuel under analysis and its applicability.

Determination of Water Nature

Description: A quick method of determining the nature of the water present in the fuel, in particular specifying whether.

Advantage: Neglect the presence of salts present in the water that lead later to phenomena like corrosion or degradation of materials.

Cleanliness and Compatibility of Residual Fuels by Spot Test (ASTM D4740-19)

Description: This test method covers a procedure for determining the cleanliness of residual fuel oil and the compatibility of residual fuel oil with a blend stock. It applies to residual fuel oils with viscosities up to 50 cSt (1 cSt = 1 mm^2s) at 100°C.

Advantage: A quick method to evaluate the compatibility of different heavy fuel samples.

Determination of Catalytic Fines in Fuel Oil

Description: Catalytic fines are responsible for many of the wear issues that occur in engines. They are tiny contaminant particles that are created by the catalytic cracking refinery process. Made from aluminium and silica, which are used as catalysts in the refinery process some of these particles are carried over into the residual oil via the slurry oil from the process.

Advantage: Quick determination of cat fine, which can prevent damage in equipment and enhance their lifetime of operation.

Figure 12 - Centrifuge for cat fines determination.

Petroleum Distillates (Diesel, Gasoline and Other Petroleum Light Products)

Standard Test Method for Free Water and Particulate Contamination in Distillate Fuels (Visual Inspection Procedures) (ASTM D4176-04)

Description: Covers two procedures for estimating the presence of suspended free water and solid particulate contamination in distillate fuels having distillation endpoints below 400°C and an ASTM colour of five or less.

Advantage: Quick test for evaluating the presence or absence of water and particulate matter.

Hydraulic and Lubricating Oils

Standard Practice for Calculating Viscosity Index from Kinematic Viscosity at 40°C and 100°C (ASTM D2270-10)

Description: The viscosity index is a widely used and accepted measure of the variation in kinematic viscosity due to changes in the temperature of a petroleum product between 40ºC and 100°C. A higher viscosity index indicates a smaller decrease in kinematic viscosity with increasing temperature of the lubricant. The viscosity index is used in practice as a single number indicating temperature dependence of kinematic viscosity.

Advantage: From experimental data, it can quickly understand the tribological behaviour of the oil.

Insoluble Content and Degree of Dispersion (Reference Spot Test)

Description: Determination of the fraction of insoluble matter present in the sample of the oil under study by comparison with reference letters.

Advantage: It allows for an expeditious determination of the level of contamination of insoluble present in the sample, as well as the degree of dispersion of the samples (e.g. soot concentration). It allows evaluating the need to replace the product in order not to detect equipment and materials.

Figure 13 - Assembly for Insoluble content and degree of dispersion.

Standard Test Method for Acid and Base Number by Color-Indicator Titration (ASTM D974)

Description: Determination of acid or basic constituents in oil samples. It is applicable for the determination of acids or bases whose dissociation constants in water are greater than 10^{-9}.

Advantage: A quick method of determining the level of acidity/basicity of the oil.

Figure 14 – Assembly for Standard Test Method for Acid and Base Number by Color-Indicator Titration.

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