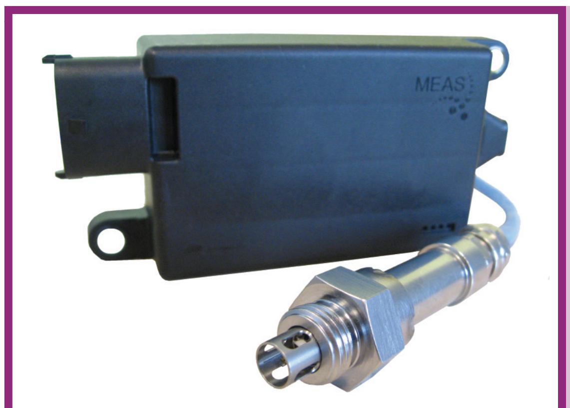


An On-line Fluid Property Analyzer Reduces World Demand for Oil and Improves Operating Profits

Lisa Bernasconi, Product Marketing Engineer & Mark Uhrich, Director of Business Development for Fluid Property Sensors, Measurement Specialties, Inc. Tel:+33 (0)561 194 543 or for USA: +1 757-766-1500 Email: fluid.sales@meas-spec.com Web: www.meas-spec.com

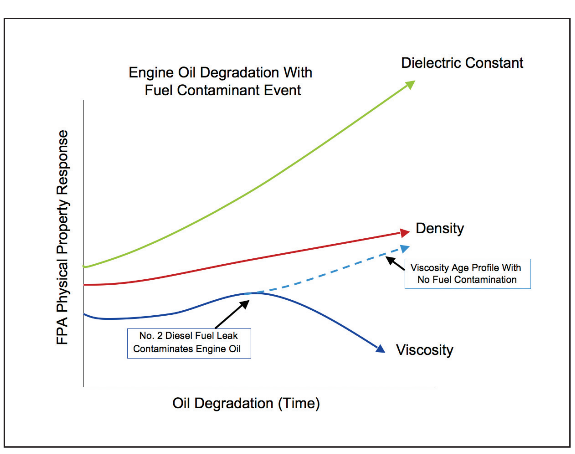
Conservative oil drain intervals protect the performance and health of engines, transmissions, hydraulic fluid systems, gear boxes and other lubricated operating equipment. Yet, the world demand and dramatic price increase of oil are stressing maintenance budgets and eroding the operating profits of vehicle and equipment owners. To reduce demand, while still protecting machinery and improving operating profits, we must make smarter use of the world's limited oil supply. Drain intervals should, and can be safely extended with an effective on-line, real-time fluid property sensor. Condition based drain intervals not only reduce oil consumption and maintenance costs, but provide incremental vehicle and equipment protection through the immediate detection of contaminants infiltrating lubricants and oils. On-line sensor performance must be comprehensive to achieve this goal.

An On-line Multi-Parameter Sensor Detects Oil Contaminants and Degradation

Measurement Specialties has developed an on-line sensor that directly and simultaneously measures the viscosity, density, dielectric constant and temperature of fluids. This multi-parametric Fluid Property Analyzer FPA2400BST (FPA) can detect contaminants and the degradation profile of oils and lubricants, and even determine fuel quality for optimising engine operation. Oil contaminants and degradation change the important physical properties measured by the product. This allows the sensor to support condition based drain intervals to provide real-time protection of operating assets and help vehicle and equipment owners reduce asset downtime and improve operating profits.

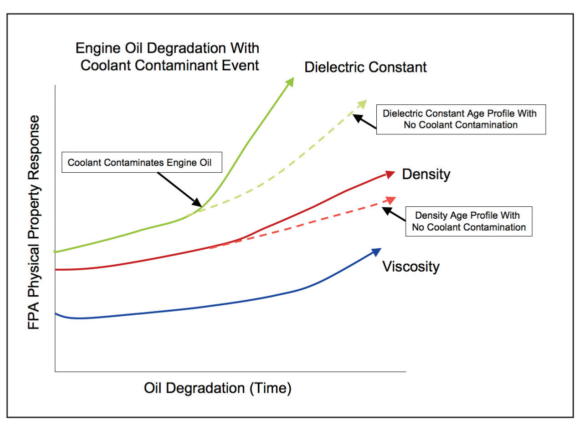
Just as a laboratory relies on multiple analytical tests to assess the condition of fluids like oil, the FPA relies on its measure of the multiple physical properties of fluids to determine their condition. Contaminants like soot, water, ethylene glycol coolant and fuel in engine oil are easily detected by their impact on the viscosity, density and dielectric constant of oil. Oil oxidation also changes these properties in a detectable manner.

The multiparameter measurements performed by the FPA are the key to effective fluid condition monitoring. Single parameter sensors, such as conductivity sensors or acoustic viscosity sensors that only measure a single physical property do not provide sufficient resolving power to reliably determine oil age and contaminant loading.



For instance, if standard No. 2 diesel fuel were to contaminate engine oil due to piston blow-by, post-combustion fuel injection to feed an exhaust gas after treatment system or a leaking high pressure common rail, the diesel fuel will cause the engine oil viscosity to decrease. But, the fuel contamination will not cause any change to the dielectric constant or density of the oil. The FPA can easily detect this event showing a remarkable decrease in measured viscosity and no change to density and dielectric constant in the aging oil.

By contrast, if an engine becomes contaminated with coolant from a head gasket seal leak, the coolant, even at low concentrations, will cause a dramatic increase in the electrical properties and increase in the density of the oil, while the viscosity will not change remarkably unless a catastrophic event were to occur. The FPA will make an early detection of coolant in oil by identifying abnormal changes in dielectric constant and density, but no measured change in viscosity at low coolant concentrations. The rapid detection of a coolant leak can prevent sludging or catastrophic failure of the engine.



These two examples highlight the need for a multi parameter sensor that can make direct, simultaneous and real-time measurements of the important physical properties of oil to effectively and reliably detect oil contaminants and oil degradation in engine. The same applies for more simple systems like transmissions, gear boxes and hydraulic equipment. Single parameter electrical property or acoustic viscosity sensors fail to provide the necessary resolving power to effectively monitor oil contamination and degradation. The FPA isolates the detection of common contaminants compared to oil age degradation profile to support condition based oil drain intervals.

Robust Sensing Technology Performs in Hostile Environments

The Fluid Property Analyzer utilizes a tuning fork mechanical resonator whose method of simultaneously and directly measuring viscosity, density and dielectric constant is patented. The sensor is factory calibrated with NIST traceable standards and does not rely on correlation to lab methods to make its measurements. The sensor can be directly installed into high pressure, high flow conduits or process streams as well as fluid reservoirs. The sensor's measurement accuracy and precision are not affected by static or changing fluid flows or pressure. The sensing element has effectively monitored fluids in a broad application space including pressures exceeding 5,000 psi, temperatures ranging from -60°C to 150°C and vibration extremes up to 46 Grms. These sensors have demonstrated superior performance during thousands of operating hours on hydraulic fluid, gear oil, on and off road commercial vehicle engine operation and a diverse suite of industrial applications. The sensor is resistant to contamination and corrosive degradation from materials such as particles, fuel, ethylene glycol, wear metals, acids and bases.

Laboratory Quality Performance in an On-Line Sensor

The quality of the FPA measured viscosity, density and dielectric constant properties compares favorably to the same values measured by standard analytical laboratory instruments. The robust performance of an on-line sensor to demonstrate comparative performance to laboratory instrumentation offers vehicle and equipment owners the ability to rely on the absolute measured values from the FPA to determine oil age, condition or contaminant loading, or support the creation of sophisticated asset reliability algorithms that may lead to active process monitoring feedback loops to enhance equipment control and diagnostics.

Conclusion

The FPA2400BST is a powerful sensing product whose ability to directly and simultaneously measure the viscosity, density, dielectric constant and temperature of fluids has been tested in a broad range of applications for nearly 10 years. Relying on patented tuning fork technology, the sensor monitors the direct and dynamic relationship between multiple physical properties to determine the quality, condition and contaminant loading of fluids such as engine oil, fuel, transmission and brake fluid, hydraulic and gear oils, refrigerants and solvents.

The multi-parametric analysis capability improves fluid characterization algorithms. The FPA provides in-line monitoring of fluids for a wide range of aftermarket installations including fluid reservoirs, process lines and pressurized high flow conduits for applications that include HVAC&R, compressors, industrial equipment and turbines. The FPA connectivity and communication with distributed or vehicle control systems is achieved through one of the optional RS232/485, USB, CAN 2.0B or 2.0A and analogue configurations. A simple graphical user interface operates on standard PC hardware and enables easy set-up and operation of the FPA when it is not interfaced to automated distributed control or vehicle control systems. Remote installations and applications are supported with on-board datalogging capabilities.