VECTRON
acoustic wave sensors

"We Can Sense It"

Monitoring Oil Condition in Maritime Diesel Engine Using ViSmart Viscosity Sensor

Commercializing technology based on quartz crystal acoustic wave research Vectron International introduced the first commercially available solid state viscometer designed for integration into in-line, real-time viscosity oil condition monitoring for embedded mobile and fixed asset applications.

Contaminants in oil (water, solvents and fuel) and the constant temperature cycling are known to degrade viscosity of oil which in turn can cause damage to internal components of diesel assets, whether they are trucks or construction equipment. High water contamination levels in diesel fuel have been shown to be the reason for corrosion and pitting leading to increased metal wear particle counts. The presence of residual cleaning solvents and fuel contamination has caused seals to swell and create less then ideal engine operating situations. In fixed assets such as gearboxes and power generation sets, the challenging environment of plant operation over a course of time reduces the hydrodynamic lubricity of the oil due to the reduction of additives and detergents in the oil. The requirements placed on equipment readiness and safety has placed greater emphasis on onboard knowledge of lubricant condition and capability to prognosticate failure. Knowledge of viscosity in real time provides a significant benefit to measure the condition of oil during commercial operations and prevent incipient mechanical failure.

Conventional mechanical and electro-mechanical viscometers designed primarily for laboratory measurements are difficult to integrate into the control and monitoring environment. As a consequence, many companies rely on decisions based on intermittent "snapshot" data acquired from periodic sampling where conventional instrumentation can be affected by temperature, shear rate and other variables.

Acoustic wave sensors offer a number of advantages over conventional mechanical and electromechanical viscometers as they are small solid-state devices that can be completely immersed in the oil providing an instantaneous viscosity data stream for embedded OEM or end-user spot-check applications. The sensors are unaffected by shock or vibration or by flow conditions so they can be used in harsh operating conditions to measure viscosity of oil from 0 to 500 cP with a temperature range of -25˚C to 125˚C. At the same time, sensor measurements are not affected by particulates.

Measurements are made by placing a hermetically packaged quartz crystal chip with an abrasion resistant proprietary hard-coat surface in contact with the oil. The oil's viscosity determines the thickness of the oil hydro-dynamically coupled to the surface of the sensor. As the acoustic wave penetrates the oil, viscosity is calculated by measuring the power loss. Because the acoustic wave sensor is a solid-state device no bigger than a matchbox, it requires no calibration, contains no moving parts, and can be completely embedded for hardware integration to any control platform.

A major customer in the maritime industry decided to integrate the ViSmart viscosity to onboard diesel engine sensor in order to continuously monitor the condition of the oil as a function use in order to ensure the engine was operating within its specified parameters and to be proactive about preventative maintenance by providing current, accurate and reliable viscosity data.

An extended test on a shipboard engine was carried out (see Figure 1). Commercially available oil was monitored for a baseline viscosity performance. As seen in Figure 2 a first test was carried out to test the performance of the sensor in regards to monitoring the viscosity of the temperature of a commercial oil type. It is observed that the response of the sensor is instantaneous and accurate.

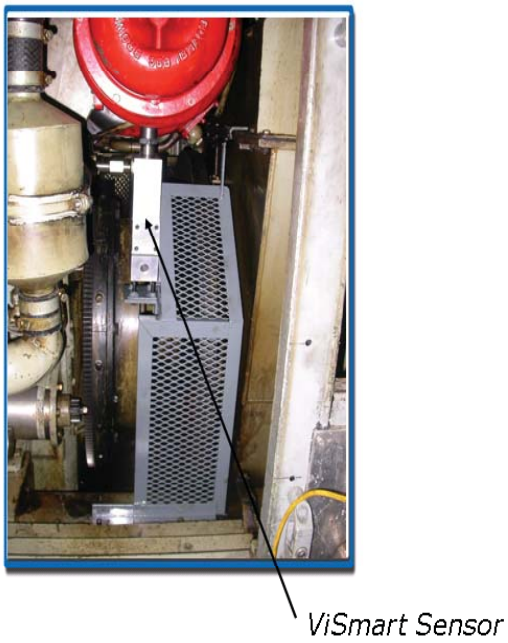

Figure 1: ViSmart viscosity sensor install on a maritime diesel engine

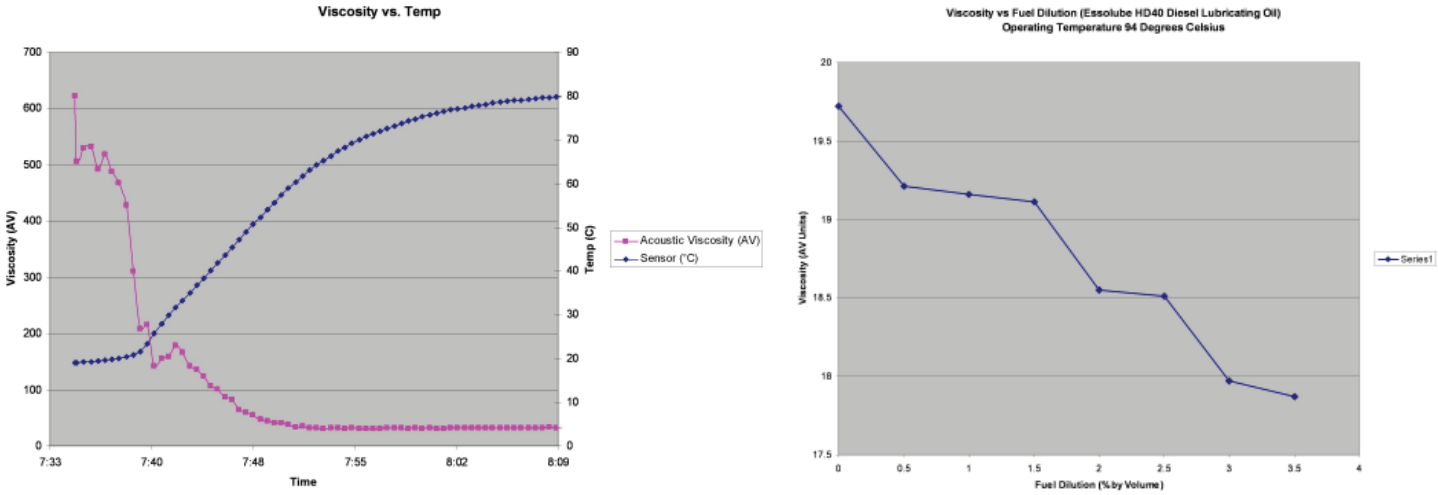

Figure 2: Viscosity changes as a function of fuel dilution across a temperature range using the ViSmart

Vectron, as a strategic partner, is now working with the customer on integrating the ViSmart viscosity sensor to the engines and assisting in bringing a valued-added solution to the end customer. As part of its continuous efforts to embed additional function to the sensor, Vectron is working on detecting water and soot concentrations within the same sensor platform.

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