Advantages of Kinematic Viscosity Measurement in Used Oil Analysis

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Used oil analysis laboratories have long relied on viscosity measurement as a key parameter in determining the condition of in-service engine oil. However, the methods used to determine viscosity often vary in laboratories due to the use of a wide array of instruments and measurement techniques. There is limited standardization between commercial oil analysis laboratories on how this key parameter is measured.

In contrast, the lube oil manufacturing industry relies on a standardized test methodology for determining the viscosity of engine oil throughout the formulary design, manufacturing and distribution processes. This methodology has predominately been ASTM D 445 - one of the oldest and most widely used test methods in all of ASTM D02. For more than 70 years, users have relied on D445 methodology and instrumentation to provide accurate results for their fluids' viscosity.

Advantages

Lube manufacturers have discovered that kinematic methods offer several advantages, including precision. Coupled with a high-precision thermostatically controlled bath and a timing device with an accuracy better than +/-0.001 second, kinematic viscometers are typically ten times more precise than other viscosity measuring devices such as dynamic rotational and differential pressure instruments.

A second advantage is intrinsic to the measurement method. Kinematic viscosity relies on gravity and the density of the fluid to provide the motivational force for movement of the liquid in the viscometer. Consequently, kinematic viscometers test the liquid under a low and relatively narrow band of shear rates. Shear rate is an important instrument parameter when comparing results between two or more laboratories using different instruments. Correlation errors can result when comparing measurements of non-Newtonian fluids measured with other techniques where shear rates may be orders of magnitude higher than kinematic viscometers and perhaps even variable across the instrument's measuring range. While lubricant base oils are typically regarded as being Newtonian fluids, when formulated into today's engine oils with additives and VI improvers, they can become non-Newtonian fluids. In-service oils with soot and other contaminates provide less predictable viscosities under variable or undefined shear rates.

Kinematic methods also offer an economic advantage. Within the last several years, there have been new advancements in the manufacture of automated kinematic viscometers that meet D445 test requirements. These new instruments have a lower cost than earlier models, require less bench space and can provide measurement cycle times of three to five minutes. These attributes lead to a reduced cost per test while providing higher accuracy and better correlation of a standardized test.

Historic Challenges

In the past, operating cost pressures drove many laboratories to seek the quickest test cycle time and the lowest cost of instrument ownership and individual test measurement. The labor intensive manual kinematic viscometer procedure or the high capital expense associated with automated kinematic viscometers forced labs to look for alternative instruments or even modified D445 instruments. Additionally, little guidance was provided by traditional kinematic viscosity methods such as D445 on how to properly test in-service lubricants and limited industry support for developing improved standardized methods for these fluids.

New Directions for Used Oil

Fortunately, these issues are being resolved due to the establishment of the ASTM Committee D02.96 to standardize in-service lubricant testing and condition monitoring services. This committee's charter includes, in part, evaluating viscosity testing and making recommendations for revisions to existing test methods to cover the scope of testing in-service lubricants. Some of their work has culminated in the development of new kinematic viscosity test methods (Houillon viscosity) and the recent decision to add precision for in-service engine lubricants to D 445.

At the June D02 meeting in Toronto, Ontario, Subcommittee 7 Section A held a meeting at which new provisions to the D 445 method were discussed and approved, including more detailed provisions in Section 6.1.2 for the use of automated instruments.

Because the current D 445 precision statement was derived using materials with older formulations, the subcommittee is planning a new round robin study of precision and bias for manual and automated instruments measuring newer petroleum-based products including used engine oils.

Editor's Note:

C. Patrick Maggi is president of Cannon Instrument Company and Chairman of ASTM D02 Subcommittee 7 Section A. If you are interested in learning more about the ongoing work with D445 or are interested in participating, please contact Pat at patmaggi@cannoninstrument.com.

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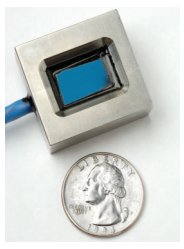
The Smart Solution to a Wide Range of Viscosity Measurement Applications



Vectron Inc. (USA) has introduced the new ViSmart™ solid-state viscometer designed to provide instantaneous sample and/or continuous, real-time, in-process viscosity measurements for process control in a robust cost-effective package weighing just 4 oz. The ViSmart™, with integrated temperature measurement capability uses robust and reliable semiconductor technology and has no moving parts packaged in a very portable size. It is unaffected by vibration or flow conditions and does not need field calibration. The ViSmart™ integrates to the eCup™ handheld reader or the ViscNet™ control hub where on board-electronics then transmit viscosity and temperature readings in real-time using standard communications protocols to provide a continuous audit trail to help control operating costs and maintain quality standards. The ViSmart™ at a size of 1.3in x 1.1in x 0.4in is hermetically sealed for complete immersion in fluid stream for process control or can be used in lab environments. The ViSmart™ measures viscosity of fluid from 10 to 10,000 centipoise and rated for temperatures up to 135?C in the standard package, with custom options and configurations available for specific industry applications and process environments. The ViSmart™ is designed for challenging manufacturing environments to provide temperature and viscosity measurement ranging from oil and lubricants to coatings and wide variety of chemicals and processing fluids.

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New Semi-Automatic Viscometer

Spectro Incorporated (USA) has introduced the new Spectro-Visc Viscometer, a fast, accurate and cost effective instrument for the determination of kinematic viscosity in used oils and other fluids. The Spectro-Visc is ideal for used oil analysis laboratories that test a wide range of lubricant viscosities; it also conforms to the requirements of ASTM D 445, D 7279, IP 71 and ISO 3104.

The Spectro-Visc is a self-contained viscometer system that consists of a thermostatic bath with circular heater and control column. The bath contains 4 viscometer tubes together with optical sensors to detect the flow of oil through the tubes. The measuring tubes operate independently of each other and the control column has an LCD display and an array of LED's that provide the user information about the system's status. An optional external computer is also available when more extensive data handling is required.

According to Daniel Anderson, Vice President and Product Manager, the Spectro-Visc has features that make it an ideal viscometer for the oil analysis laboratory. It is extremely easy to replace viscometer tubes without the need to drain the bath or to re-align the optical sensors. The entire process takes approximately 3 to 5 minutes; an important consideration in laboratories where sample throughput is important and highly trained technicians are not always available to perform maintenance. The Spectro-Visc can also carry out analyses without the need of an external computer, and advantage in most laboratories that already have LIMS (Laboratory Information Management System) where an additional computer is not required and just takes up more space.

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New Model Q-Quick Action Viscometer Lab Stand Makes Taking Measurements Easier Than Ever

Brookfield Engineering (USA) introduces the new Quick Action Lab Stand for laboratory viscometers. This newly designed spring loaded lab stand makes taking measurements easier than ever. The Model Q is one more example of how Brookfield is working to simplify your testing process!

With the push of a button, the viscometer glides up and down, allowing for quick positioning and faster measurements.

The Model Q is ideal for lab environments with multiple operators and those with frequent testing needs. It is available as an option on new Brookfield viscometers or as a retrofit for existing instruments. Model Q is designed for use with the Brookfield DV-I Prime or DV-I+, DV-II+, DV-E and Dial Reading Viscometers.

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