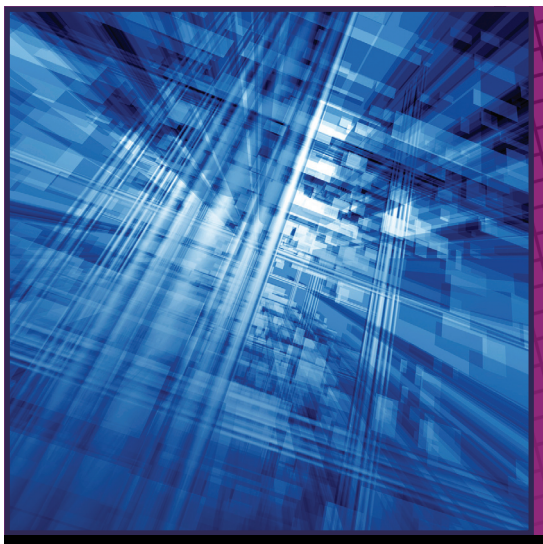

Increasing Demand for High Quality Base Oils Require On-line Process ASTM D 445 Analysers

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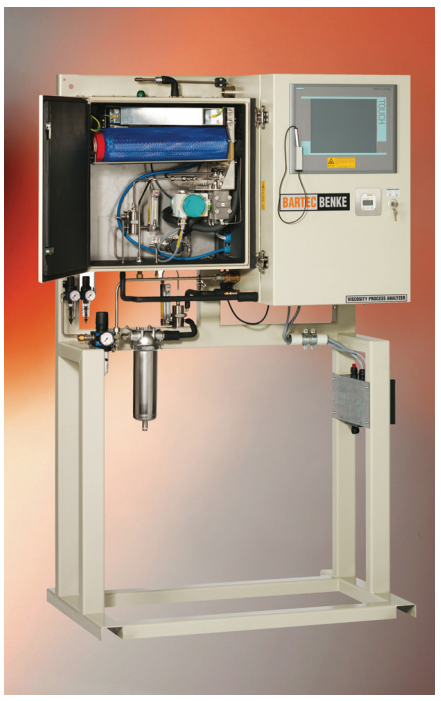
Dramatic growth in industrial output in Asia combined with changes in automotive engine designs to comply with tightening environmental regulations has led to an increase in the supply of Group II and III base oils. Specifically in the USA, government lead innovations are requiring an increase in corporate average fuel economy for gasoline engines by over 50% from 2011 to 2016 and in the EU, a decreased carbon dioxide emission by over 25% for new cars is set. During the period from 2008 to 2012, demand change by viscosity grade has also led to a shift from Group I to Group II/III even though the demand for base oils in general is globally stagnating.



On this global basis, paraffinic base oil supply has been dominated by US-based refiners but as the growth in car sales in China and India surges ahead, Group II/III base oil production is expected to fulfil the market requirement with Group I oil plants being phased out or upgraded to produce Group II oils. As a result, refiners are already taking steps to increase production with a number of new Group II/III base oil plants recently started up or in construction phase. Consequently, the market place has become more price-competitive with refiners looking for ways to improve efficiencies in their lube oil processes. One way to achieve this is by using accurate and reliable online analysis techniques that reduce give-away and increases the yield of products of higher economic value.

There are many different types of on-line/in-line viscometers available on the market, which would seem to fit this requirement. However, it can be shown that systems that comply with ASTM D 445, allow more precise control of lube oil processes, which can lead to increases in revenue. For example, an error of 1 percent product viscosity that causes a blend adjustment can easily result in increasing product cost by €0.01 a gallon. For a large lubricant manufacturer, this can amount to €900,000 in lost revenue per year.

An example is the use of the process viscosity analyser VISC-4 by BARTEC BENKE. The VISC-4 is a capillary type viscometer where the capillary temperature is controlled to +/-0.02K according to ASTM D 445. The temperature control is the single most important parameter for obtaining accurate and precise Kinematic Viscosity measurements. This is especially true for petroleum products as their rate of viscosity per unit temperature is significantly greater than other products. Thus, a slight variation in temperature can have a very large effect on the viscosity of the fluid. The VISC-4, with its precise temperature control design, has provided readings that show that the analyser meets and exceeds the requirements of ASTM D 445 (see Table 1 and Figure 1).

Lube base oil Grades	Average reading of VISC-4	Repeatability according to ASTM D 445	Repeatability results of VISC-4 readings
Grade 150N, wax free	6.612 cSt	<0.0073 cSt	0.004 cSt
Grade 150D, with wax	7.03 cSt	<0.008 cSt	0.004 cSt
Grade 100D, with wax	4.19 cSt	<0.005 cSt	0.003 cSt
Grade 100N, wax free	4.226 cSt	<0.005 cSt	0.003 cSt

Table 1: VISC-4 Kinematic Viscosity readings @ 100°C for different grades of lube base oils over a 12hr test run

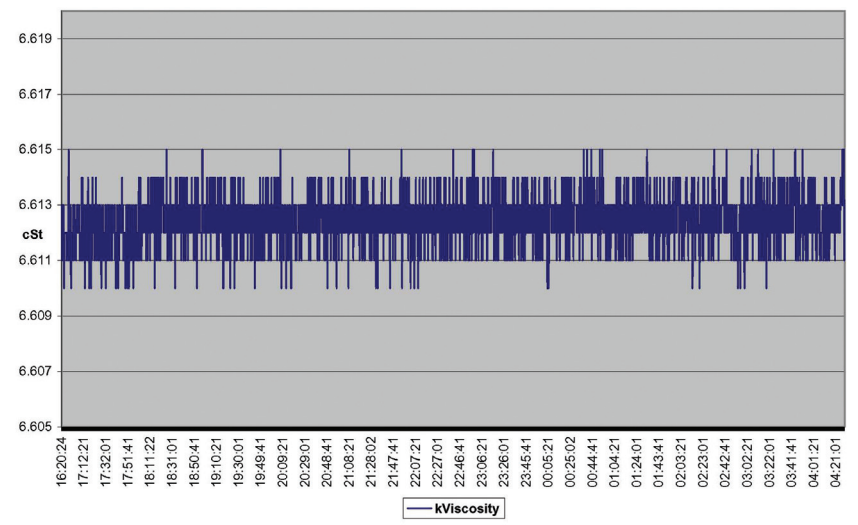


Figure 1: VISC-4 Kinematic Viscosity readings @ 100°C for 150N grade of lube base oil over a 12hr test

Medium	Kin. Visc@40°C [cSt]	Kin. Visc@100°C [cSt]	Visc. Index
Base Oil Group II	108	12.2	103
	Kin. Visc@39.9°C [cSt]	Kin. Visc@99.9°C [cSt]	
Base Oil Group II calculated acc. ASTM D 341	108.56	12.23	
	Kin. Visc@40.1°C [cSt]	Kin. Visc@100.1°C [cSt]	
Base Oil Group II calculated acc. ASTM D 341	107.44	12.17	
	Kin. Visc@39.9°C [cSt]	Kin. Visc@100.1°C [cSt]	Visc. Index
Base Oil Group II calculated acc. ASTM D 341	108.56	12.17	102.03
Deviation in cSt by 0,1 °C	**0.56**	**0.03**	not applicable
Deviation in % by 0,1 °C	**0.52**	**0.25**	**0.94**
ASTM D 445 requirements max. deviation in %	**max. 0.11**	**max. 0.11**	** see note
VISC-4 Repeatability for base oils in %	**0.06 – 0.11**	**0.06 – 0.11**	**max. 0.20**

[**Note: According to ASTM D 2270 - If Viscosity Index calculated for a given sample using Kinematic Viscosity measurements from different Test methods are in disagreement, the values calculated from Test-Method D 445 measurements shall be accepted.]

Table 2: Deviation of Kinematic Viscosity and Index by Temperature accuracy of ± 0.1 K

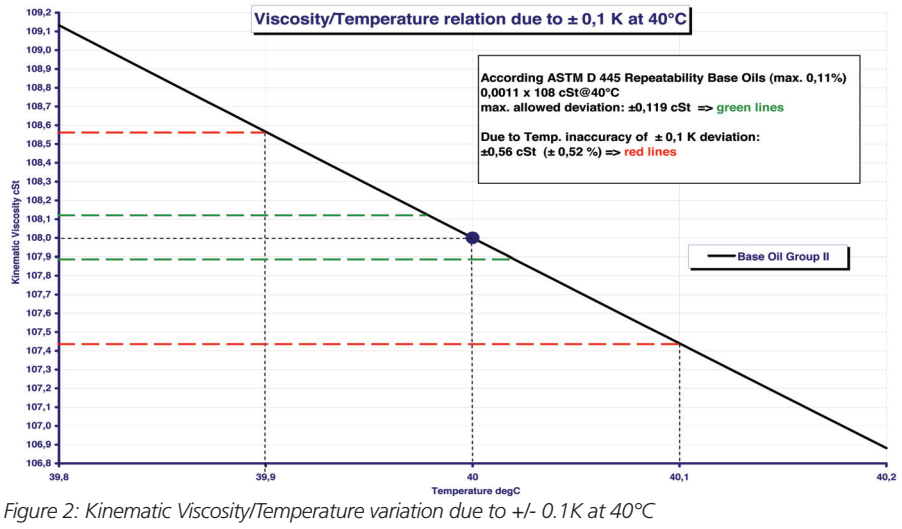


Figure 2: Kinematic Viscosity/Temperature variation due to +/- 0.1K at 40°C

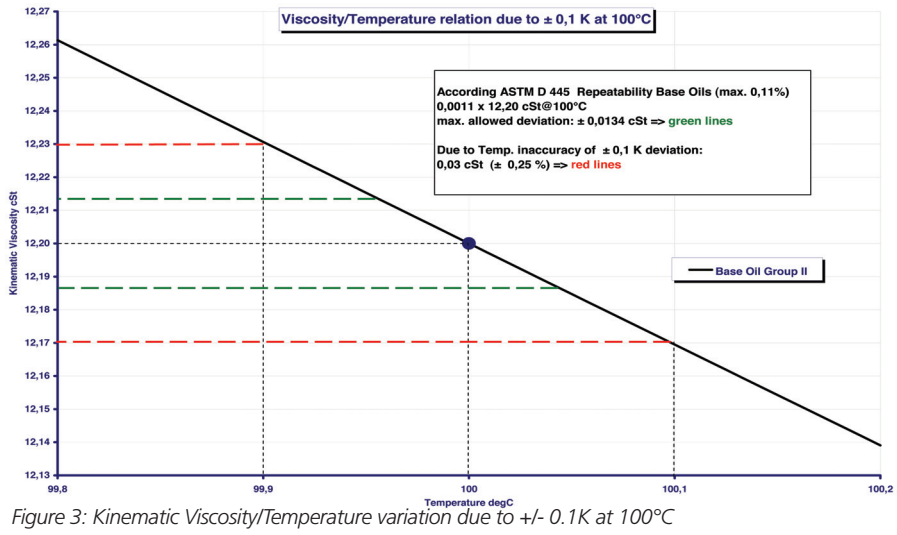


Figure 3: Kinematic Viscosity/Temperature variation due to +/- 0.1K at 100°C

From Table 2 and Figure 2, a 0.1K variation in temperature will cause the Kinematic Viscosity to change by 0.56cSt, which represents a 0.52% deviation at the measured value of 108cSt @ 40°C.

Since ASTM D 445 requires a maximum deviation of 0.11%, a +/-0.1K temperature control of any sensor or measuring device will not enable conformance to ASTM D 445.

From the results achieved by the VISC-4, see Table 1 and Figure 1, conformance to ASTM D 445 is achieved.

This excellent and reliable performance allows plant operators to optimise the production of higher value products. Remarkable is the payback time for the VISC-4, which is in the region of only 1 to 2 months.

The VISC-4 is available in several variants for different measurement ranges and temperature ranges: depending on the respective ranges and their combinations, Kinematic Viscosities from 0.7 cSt to 1,000 cSt can be measured at temperatures from 20°C to 100°C. The VISC-4 is ATEX, CSA and GOST approved for use in zone 1 of hazardous areas (note: other regional certifications also available). The continuous display of the Kinematic Viscosity, the high temperature precision and the minimised maintenance expenditure show the high process efficiency of the Viscosity Process Analyser VISC-4, which has been confirmed by the tests that have been conducted. Other products that can be measured using the VISC-4 include bunker fuels, gasoils and crude oils.

Online-TOC Analysis with New Communication Modes Expands the Scope of Applications and reduces Operating Costs

Shimadzu (Germany) has introduced its new TOC-4200 online analyser. This analyser represents a new generation of instruments applying new modes of communication such as web-based monitoring or the Modbus protocol for digital two-way communication. The system supports virtually all TOC analytical applications such as the monitoring of surface waters, pure water or purified water, as well as monitoring the contaminant levels and pollutant loads in various waters. The TOC-4200 can be applied in wastewater treatment plants (influent and effluent) or in power plants (cooling water circuits, washing water, recovered water, condensates). In addition, the analyser offers new functionalities enabling extended application possibilities.

The digital Modbus function allows two-way communication with multiple instruments via a single integrated signal line, thereby reducing electrical wiring complexity. Modbus enables integration into bidirectional communication networks. The optional web-based monitoring function allows access to measurement data or instrument functions from any network-connected computer worldwide.

The TOC-4200 operates using the well-known catalytic combustion method with NDIR-detection. The relatively low combustion temperature, platinum catalyst, small injection volume and integrated sample pretreatment system allow a reliable TOC determination with low maintenance requirement.

The new design includes spatial separation of electronic components, measuring system and fluids. The instrument is operated via a color touch-screen. The clear menu navigation simplifies the creation of calibration curves and measurement methods. A calendar function helps in planning automated determination of control samples or calibration curves.

In order to guarantee a smooth measuring process, the TOC-4200 records the consumption of the reagents required. A warning is given as soon as reagents need to be refilled, thereby preventing unnecessary interruption of measurements.

The instrument allows straightforward TOC analysis of offline samples without the need to interrupt online operation. After determination of the TOC value has been completed, the program returns automatically to the online mode.

The kit for high-salt samples increases maintenance intervals by a factor of up to 10 for the measurement of seawater, wastewaters or other samples containing high salt loads. The TN measuring module enables the determination of the total nitrogen content (TN) via catalytic combustion and chemiluminescence detection.

An optionally available, high-sensitivity kit enables measurement of samples with TOC concentrations below 1 mg C/L, e.g. groundwater, drinking water or recovered deionised water from semiconductor production.

PetroSense Oil and Fuel Detection

The PetroSense range of sensors is now supported by **Envirologger** (UK), an advanced battery powered datalogger with extensive communications capability, including automatic data transfer to web sites.

The probes can detect minute traces of hydrocarbons in soil or water and the data is transmitted instantaneously to a central server and relayed to the client on a web site, by email, SMS, file transfer protocol or via site manager software.

Applications include process water, wastewater, oil field produced water, separation vessel effluent, storm water run-off, bilge and ballast water, groundwater remediation monitoring, carbon filter bed breakthrough and heat exchanger leak detection.