

RHEOTEK AUTOMATIC VISCOMETER

Base oils, formulated oils, new & used lubricants,
distillate fuels, residual fuels, used oils

Test Methods: ASTM D445, D2270, ISO 3104, IP 71, IP 543
Specifications: ISO 8217

Automatic Capillary Viscometer – Key Features

- Two full range measuring positions
- Smart XYZ auto sampler
- Heated sample rack
- Precise nIR detection
- Transparent, opaque and black oils
- In-situ cleaning
- Viscosity Index



AV-2

The RHEOTEK Automatic Viscometer (AV-2) provides a reliable and precise method for measuring petroleum liquids.

The AV-2 reverse flow capillary tube is suitable for measuring transparent, opaque and black oils.

The AV-2 is configured with two capillary tubes, allowing simultaneous measurements.

The two viscometers can be operated at the same or different temperatures. Viscosity Index can be calculated for oils measured at 40 and 100°C.

Typical applications include the measurement of new and used lubricants, distillate and residual fuels.

A heated sample rack is available to hold higher viscosity samples or residual fuels prior to measurement.

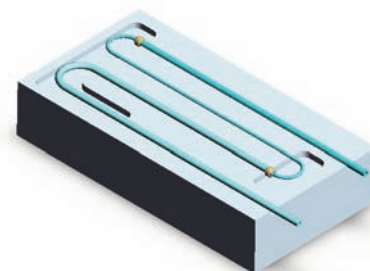
The AV-2 meets the precision requirements of ASTM D445 and is fully compliant with IP543.

Several AV-2 models are available depending upon the nature of the application.

Features of operation:

Capillary tubes

At the heart of the AV-2 are two traditional capillary tubes, which determine viscosity by measuring flow times. This ensures optimal precision of measurement but without the inconvenience of maintaining glass tubes in a liquid bath. The AV-2 capillary tubes are specially well suited to measure black oils and residual fuels. The efficient cleaning cycle ensures that the capillary is thoroughly cleaned and dried after each flow time determination.



The horizontal capillary is housed in a temperature controlled metal block

Precision

The AV-2 determines the kinematic viscosity of oils and fuels within the precision requirements for ASTM D445.

The AV-2 is fully compliant with standard test method IP 543, a specific method for determining the kinematic viscosity of distillate & residual fuel oils. This method is ideal for marine fuel oil testing laboratories, as well as refineries.

IP 543 confirms that there is good correlation between viscosities determined by the automatic capillary tube method and IP 71, ISO 3104 & ASTM D 445 manual kinematic viscosity results.

Calculation of Results

The AV-2 measures flow times, t , and determines viscosity, η , in mPa.s, cP. Standard kinematic viscosity models also determine density, ml/g, to a precision of four decimal places. The two values are used to calculate and report kinematic viscosity in mm²/s, cSt. The result database records all measurements and calculations in order to provide complete traceability of results.

The AV-2 determines two successive viscosity values, η_1 and η_2 , from the measured flow times, t_1 and t_2 obtained from a constant driving force, and the viscometer constant, C , by means of the equation

$$\eta_{1,2} = C \cdot t_{1,2}$$

The reported viscosity result, mPa.s, is the average of η_1 and η_2 .

The Kinematic Viscosity result, v , is calculated from the determined viscosity, η , and the density, ρ , by means of the following equation $V = \eta/\rho$

One advantage of the AV-2 is that viscosity results, η , are not affected by changes in density. This is especially useful when comparing used oil results, whereby kinematic viscosity will be affected by changes in the density as well as viscosity of the oil.

Two sample paths

The AV-2 is configured with two sample paths – including sample loading, measurement and cleaning. Sample vials are placed in a heated or non-heated rack on the auto sampler. Each sample can be measured either in one or both viscometers simultaneously.

Cleaning

The AV-2 uses a highly efficient cleaning cycle to remove all traces of sample. Two solvents are used, the first solvent is miscible with the sample, followed by a drying solvent. At the end of the cleaning cycle, air is used to dry the sample paths, prior to loading of the next sample. An aromatic solvent, such as Toluene is recommended for used oils and residual fuels.

Software

The AV-2 software automatically calculates kinematic viscosity, dynamic viscosity and Viscosity Index. A powerful database stores all flow times as well as calculated results. Data can be easily sorted, filtered and retrieved. A wide variety of statistical graphing and extrapolation options are available to suit individual laboratory reporting requirements.

Diagnostics & Service Support

The AV-2 system software offers real time engineering screens and remote reviewing of system files. RHEOTEK provides support from local service offices and agents throughout the world.

AV-2 Systems available:

Base & Formulated oils:

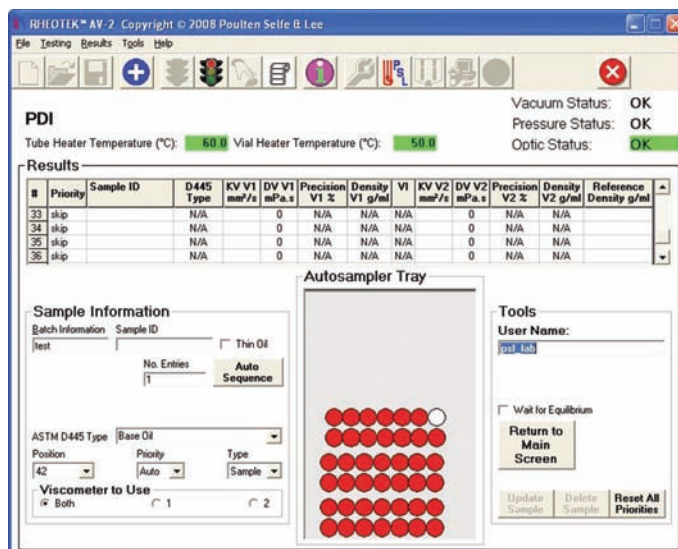
RHEOTEK AV-2 Lubes Model

Suitable for measuring the kinematic viscosity of base oils and new and used lubricants at 40 and 100°C. Typical viscosity range 1 to 1,000 mm²/s at 40°C, 1 to 50 mm²/s at 100°C. Reported results include Kinematic Viscosity and Viscosity Index.

Distillate & Residual fuels:

RHEOTEK AV-2 Fuels Model

Suitable for measuring the kinematic viscosity of distillate fuels (diesel and gas oils) at 40°C and residual fuel oil at 50°C. Two samples are measured simultaneously, side by side. Distillates are run first on both viscometers with the temperature set to 40°C. The temperature can then be automatically changed to 50°C with both viscometers testing residual fuels.



The user interface of the software is a standard Windows format

RHEOTEK AV-2 Refinery Fuels Model

Suitable for measuring the kinematic viscosity of distillate fuels (diesel and gas oils) at 40°C and residual fuel oil at 50, 80 and/or 100°C. Distillates can be selected to be tested on viscometers 1 and residual fuels on viscometer 2. The temperature of viscometer 2 can be changed between 50..100°C depending upon the laboratory's measuring requirements.

RHEOTEK AV-2 Residual Fuel Oil Model

Suitable for measuring the kinematic viscosity of residual fuel oil at 50, 80 and/or 100°C. Two different samples are measured side by side simultaneously. Separate auto sampler needles load simultaneously from two sample vials. Viscometers 1 and 2 operate at the same temperature in the range 50..100°C.

Typical viscosity range Residual Marine Fuel (RFO) 30 to 700 mm²/s at 50°C
Reported results: Kinematic Viscosity

Calibration of the AV-2 is carried out with UKAS (ISO 17025) certified PSL Viscosity Reference Standards



Used Motor oils:

RHEOTEK AV-2 UMO (40) Model

Suitable for measuring the viscosity of used motor oil at 40°C. Two samples are measured simultaneously side by side. The AV-2 UMO is optimized for high sample throughput with a smaller sample volume (< 5ml). Separate auto sampler needles load simultaneously from two sample vials. Viscometers 1 and 2 operate at 40°C.

RHEOTEK AV-2 UMO (100) Model

Suitable for measuring the viscosity of used motor oil at 100°C. Two samples are measured simultaneously side by side. The AV-2 UMO is optimized for high sample throughput with a smaller sample volume (< 5ml). Separate auto sampler needles load simultaneously from two sample vials. Viscometers 1 and 2 operate at 100°C.

PSL - a world leader in Viscosity Measurement

The RHEOTEK range of instruments are manufactured in the United Kingdom and the USA by Poulten, Selfe and Lee Ltd.

Poulten, Selfe & Lee Ltd. (PSL) was established in 1850. For more than 60 years the company has been specializing in viscosity measurement. PSL's high precision glass viscometers are used worldwide for manual and automated viscosity measurement.

All glass capillary viscometers are hand made by PSL's highly skilled glass blowing department and calibrated by the in-house ISO 17025 accredited laboratory.

Over the past decade, the company has developed a complete range of high precision automated viscometers. These are used in a wide range of industries including petrochemical, petroleum and pharmaceutical.

The company's USA operations are based in Kentucky. RHEOTEK USA Inc. provides sales, service and applications support to customers throughout the USA, Canada and Mexico.

Worldwide, the RHEOTEK range of instruments are sold and serviced by a network of authorized sales agents.

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Technical

Specifications	
Recommended Applications	Base oils Formulated oils Lubricants Distillate Fuels Residual Fuels Used oils
Precision	ASTM D445
Viscosity measuring range (40°C)	0.9 to 2,000 mm ² /s, cSt
Temperatures of operation	40, 50, 80 & 100°C
Low temperature (option)	20°C
Sample volume (minimum)	11 ml (single temperature analysis) 22 ml (dual temperature analysis) 4.5 ml (Used Motor Oil)
Sample heating	One heated sample rack is included
Auto Sampler	XYZ configuration suitable for accommodating a combination of heated and non-heated racks. Two sizes of standard rack capacity: 14 or 44 vials. Custom racks on request.
Sample loading	Vacuum or pressure
Vial type	Plastic (vacuum loading) or glass with septa and screw cap (pressure loading)
Filtration	Automatic in-line filtration with self-cleaning
Cleaning	Automatic in-situ cleaning using 2 solvents. Third solvent option on request.
User interface	WINDOWS software program with extensive results database
Data retrieval	USB ports & LIMS serial ports
Electrical	AC Voltage (Single phase) 240V/50/60Hz or 110V/50/60Hz
Dimensions	85 x 69 x 40cm (AV-2 Analyzer) 54 x 44 x 60cm (Auto Sampler)

Model Summary						
AV-2 Model	Cooling	Dynamic Viscosity (mPa.s)	Kinematic Viscosity mm ² /s	Viscosity Index	No. of simultaneous samples	Typical Viscometer Temperatures
Lubes	V1	Yes	Yes	Yes	1 (dual result)	40 & 100
Fuels 40/50	V1 & V2	Yes	Yes	n/a	2	40 or 50
Refinery fuels	V1	Yes	Yes	n/a	1 (dual result)	40 & 50, 40 & 80 or 40 & 100
RFO	n/a	Yes	Yes	n/a	2	50 & 50, 80 & 80, 100 & 100
UMO (40)	V1 & V2	Yes	Calc. From density factor	n/a	2	40 & 40
UMO (100)	n/a	Yes	Calc. From density factor	n/a	2	100 & 100