RHEOTEK POLYMER VISCOMETER

PA, PET, PVC, PLA, PBT, PC, PE, PP & other polymers

Polyamides (PA), Nylon, Polyethylene Terephthalate (PET), Polyester, Polyvinyl Chloride (PVC), Polyethylenes (PE), Polypropylenes (PP), Polycarbonate (PC), Polylactic Acid (PLA), Polybutylene Terephthalate (PBT), Cellulose Acetate, Ink, Pulp, Cellulose, Electrical Papers & Other Polymers

ASTM D789, D871, D1243, D1601, D2857, D4020, D4603 & D1795
ISO 307, 5351 & 1628 PART 1 TO 6
DIN Norms 53726, 53727, 53728, 7744

Automated Solution Viscosity - Key features

- Sample preparation
- Sample dissolution
- Filling stations – sample loading
- Smart sampling – XYZ auto sampler
- Measurement of flow times
- “Safe vacuum” solvent cleaning
- Calculation of results
- Powerful results database
- LIMS

The RPV has been optimized for the highest precision of results & long term reliability

Viscosity Innovation through automation

RPV

The **RHEOTEK Polymer Viscometer** (RPV) provides a reliable and precise method for measuring dilute solutions of polymers.

In this very operator sensitive test, automation using the RPV minimizes the variability of results. This is achieved by reducing the operator influence on sample preparation, tight control of dissolution heating times, accurate flow time measurements and highly efficient solvent cleaning. In addition, the RPV ensures compliance to test methods, and reduces operators’ exposure to hazardous chemicals.

Several levels of automation are available:

RPV-1: automates solution viscosity measurements, cleaning & results.

RSS: automates sample loading into the viscometer tubes.

ISP-1: integrates and automates the sample preparation.

SD-1: automates the sample heating & stirring.

RPV auto: includes all of the above in one analyzer.

Key application features:

Filling station

Sample filling

Standard RPV systems are supplied with the unique RHEOTEK filling stations. The operator simply removes the cap and pours the sample into the filling funnel. RSS and Auto systems have the ability to load the sample automatically using the RHEOTEK Smart Sampler.

For PE or PP applications, the RPV High Temperature system uses a specially manufactured glass funnel which can be heated in an oven prior to sample filling.

Ultimate degree of Automation

All RPV systems automate the measurement of flow times, cleaning and calculation of results. In addition systems can be be integrated with the RHEOTEK Sample Preparation System (iSP-1). The iSP-1 prepares the concentration of the polymer solution on a “weight to weight” basis ensuring the highest level of precision.

Auto systems combine not only control of the sample preparation process, but also sample dissolution. The RPV Auto system controls the heating and stirring times of polymer solutions, as well as cooling prior to measurement. Sample dissolution control is critical in order to ensure that polymer solutions, such as PET, do not degrade and produce incorrect low IV results.

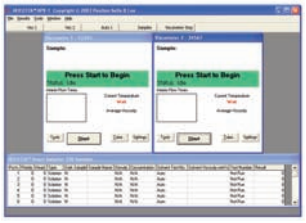
Sample heating and cooling

Precision

Every part of the RPV system has been optimized to provide the best possible measurement precision. While overall precision is sample dependent, the following standard deviations are achievable:

< 0.15%	PVC (ASTM D1243)	< 0.03%	PA in sulfuric acid (ISO 307)
< 0.10%	PA in formic acid (ASTM D789)	< 0.26%	PET (ASTM D4603)

High precision allows tighter control of a polymer process, providing large potential savings for the resin manufacturer or processing plant.



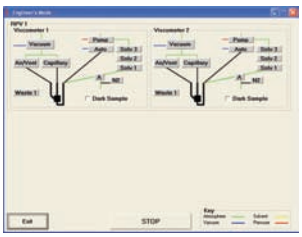
RPV software

Chemically resistant design & components

Materials and components used in the RPV are designed to be resistant to a wide range of solvents and acids. Typical solvents suitable for cleaning include Phenol/TCE, OCP, Formic Acid, Cyclohexanone, Chloroform and Acetone. In certain instances, a special anti-corrosive coating will be applied to critical parts of the instrument to withstand sulfuric acid and dichloroacetic acids.

Automatic Viscometer Cleaning

The RPV automatic cleaning system has been optimized to use the minimum amount of solvent to clean and dry the viscometer. The RPV ensures that all traces of sample/solvent are removed. The RPV solvent cleaning system removes the risk of sample carry over. In some instances an optional third solvent can be used in the cleaning cycle.



RPV diagnostics

Software

The RPV software automatically calculates kinematic viscosity, relative viscosity, specific viscosity, reduced viscosity, inherent viscosity, K-value, intrinsic viscosity, viscosity number, molecular weight & degree of polymerization. A powerful database stores raw data 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. The software has sophisticated maintenance tools to enable the fast diagnosis of problems. Protection within the software prevents unauthorized changes to key parameters.

Diagnostics & Service Support

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

Solution Polymer Systems available:

RHEOTEK Polymer Viscometer (RPV-1)

Standard RPV-1

RHEOTEK RPV-1 standard systems are configured with one to four measuring positions – allowing up to four simultaneous measurements. Typical sample throughput per position is 3-4 samples per hour. Each position has its own filling station, NIR detection of flow times and solvent cleaning. The standard RPV systems are suitable for most types of polymers (except PP & PE, see High Temperature RPV-1 (HT) below). Options include integrated Sample Preparation (iSP-1), Sample Dissolution(SD-1), third solvent and nitrogen purge.

Automatic Ink Viscometer

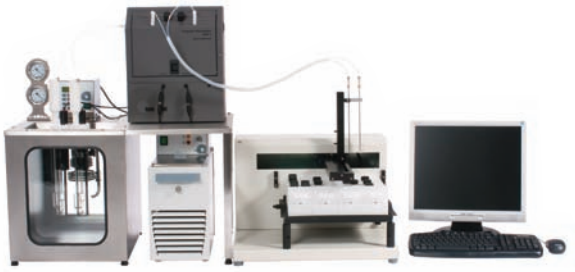
RHEOTEK Automatic Ink Viscometer system is supplied with 4 measuring positions, three cleaning solvents and a specially developed glass capillary viscometer for dye and pigment inks.

High Temperature RPV-1 (HT)

RHEOTEK RPV (HT) systems are specially adapted for measuring polyethylenes (PE) and polypropylenes (PP) at 135 ºC, in accordance with ASTM D1601, ASTM D4020 & ISO 1628 Part 3. Systems are configured with a high temperature sample control module and a sample filling kit. A sample preparation system with 5 decimal place balance is available as an option.

RHEOTEK Polymer Viscometer (RSS) Smart Sampler

RPV RSS systems are configured with one or two measuring positions and the RHEOTEK XYZ Smart Sampler. Automatic unattended operation of multiple sample racks is routine. This reduces operator exposure to solvents and allows greater efficiency. Typical sample throughput is 6 to 8 samples per hour with two measuring positions operating simultaneously. Sample preparation (iSP-1) and sample dissolution (SD-1) modules can be integrated as options.



RHEOTEK Polymer Viscometer Auto

RPV Auto systems are available for PET, PVC, PA as well as other polymer applications. Auto systems fully integrate sample preparation, sample dissolution & sample loading, as well as flow time measurement, cleaning and reporting of results. One or two heating and stirring zones can be configured to control the dissolution of batches of samples. Both heating temperatures and stirring times are computer controlled and samples are cooled prior to being automatically loaded into the viscometer. Typical sample throughput is 6 to 8 samples per hour with two measuring positions.

The **AutoPET** system is configured specifically for fully automating the Intrinsic Viscosity of polyethylene terephthalate (PET) in accordance with ASTM D4603 and/or ISO 1628 Part 5. The AutoPET is the most advanced fully automated viscometer available for polyester.

The **AutoPVC** system is configured specifically for fully automating the Inherent Viscosity or K-value of polyvinyl chloride (PVC) in accordance with ASTM D1243 or ISO 1628 Part 2.

The **AutoPA** system is configured specifically for fully automating the Reduced Viscosity of Polyamides (PA), nylon, dissolved in m-Cresol in accordance with ISO 307.

Viscosity Innovation through automation

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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 prcision 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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RPV Models

	Model	No. of viscometers	RSS	iSP-1	SD-1	3rd Solvent	Nitrogen Purge
STANDARD	RPV-1 (1)	1	n/a	option	option	option	option
	RPV-1 (2)	2	n/a	option	option	option	option
	RPV-1 (3)	3	n/a	option	option	option	option
	RPV-1 (4)	4	n/a	option	option	option	option
RSS	RPV-1 RSS (1)	1	Y	option	option	option	option
	RPV-1 RSS (2)	2	Y	option	option	option	option
AUTO SYSTEMS	RPV AutoPET (1)	1	Y	Y	Y	n/a	n/a
	RPV AutoPET (2)	2	Y	Y	Y	n/a	n/a
	RPV AutoPVC (1)	1	Y	Y	Y	n/a	n/a
	RPV AutoPVC (2)	2	Y	Y	Y	n/a	n/a
	RPV AutoPA (1)	1	Y	Y	Y	n/a	n/a
	RPV AutoPA (2)	2	Y	Y	Y	n/a	n/a
	RPV AutoPulp IVA	2	Y	Y	Y	n/a	Y
HT	RPV-1 HT (1)	1	n/a	option	option	n/a	n/a
	RPV-1 HT (2)	2	n/a	option	option	n/a	n/a
INK	RPV-1 INK	4	n/a	n/a	n/a	Y	n/a

RSS = RHEOTEK Smart Sampler, iSP-1 = integrated Sample Preparation, SD-1 = Sample dissolution module

Typical RPV Applications

	Test Method	Solvent	Concentration	˚C	Standard	RSS	Auto	HT
Polyamide (PA)	ASTM D789	Formic Acid	8.4%	25	1, 2, 3, 4	o/a	n/a	n/a
	ISO 307	Formic Acid	0.5%	25	1, 2, 3, 4	Y	n/a	n/a
	ISO 307	Sulfuric Acid ^ ~	0.5%	25	1, 2, 3, 4	Y	n/a	n/a
	ISO 307 DIN 53727	m-Cresol	0.5%	25	1, 2, 3, 4	Y	Y	n/a
Polyester (PET)	ASTM D4603	Phenol/ Tetrachloroethane	0.5%	30	1, 2, 3, 4	Y	Y	n/a
	ISO 1628-5 DIN 53728	Phenol/ Dichlorobenzene	0.5%	25	1, 2, 3, 4	Y	Y	n/a
	ISO 1628-5	Dichloroacetic acid~	0.5%	25	1, 2, 3, 4	Y	Y	n/a
PVC	ASTM D1243	Cyclohexanone/THF	0.2%	30	1, 2, 3, 4	Y	Y	n/a
	ISO 1628-2 DIN 53726	Cyclohexanone	0.5%	25	1, 2, 3, 4	Y	Y	n/a
PE & PP	ASTM D1601	Decahydro-naphthalene	0.022%	135	n/a	n/a	n/a	HT 1, 2
	ASTM D4020	Decahydro-naphthalene	0.022%	135	n/a	n/a	n/a	HT 1, 2
	ISO 1628-3	Decahydro-naphthalene	0.5%, 0.1%, 0.02%	135	n/a	n/a	o/a	HT 1, 2
Pulp, Cellulose & Electrical Papers	ISO 5351	CED Solution*	0.5% - 0.2%	25	2, 3, 4	N	Y	n/a
	ASTM D1795	CED Solution*	1% - 0.1%	25	1, 2, 3, 4	N	Y	n/a
	ASTM D4243	CED Solution*	0.2% - 0.05`%	20	1, 2, 3, 4	N	Y	n/a
	TAPPI T230	CED Solution*	0.5%	25	2, 3, 4	o/a	o/a	n/a

~ anti-corrosive option ^ third solvent option * nitrogen purge option

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