

NETZSCH

Proven Excellence.



Rosand RH7/RH10

Capillary Rheometer Backed with Rheological Experience

Analyzing & Testing

Rosand RH7/RH10

Advanced, Powerful Floor Standing Capillary Rheometers for Research and Product Development

Flexible measurement capabilities for materials under high pressure and high shear rate extrusion



Since its launch, the Rosand RH7 has set new standards in research level capillary rheometry. Today, the Rosand RH7 is used in hundreds of research laboratories around the world for a range of applications including polymers, foods, coatings and ceramics.

Continuous development of the original RH7 design and its operating software has produced a generation of floor standing capillary units with market leading performance characteristics and capabilities.

The current RH7 and RH10 models, which differ in their maximum force range and speed, retain the robust H frame design principle, which lies at the heart of the instruments' ability to operate under high loading conditions. A new digital drive system gives the RH7 and RH10 unsurpassed performance in terms of speed control, accuracy, and dynamic operating range. This hardware is supported by the latest generation of Windows™ based software, Flowmaster™, with many experimental possibilities.

Rosand Twin Bore Principle

Rosand capillary rheometers were the first to introduce the twin bore measurement principle to the commercial market. Simultaneous measurements can be made on both long and short dies to determine the inlet pressure drop at the die and, therefore, absolute viscosity, using the Bagley method. More commonly, Rosand *zero length* dies are used to directly measure the inlet pressure drop and measure the extensional viscosity using the Cogswell method.

The twin bore technique offers obvious experimental advantages including improved throughput since both experiments are preheated simultaneously. Alternatively, the software can be configured to run a two material test, thereby measuring the viscosity of two different materials simultaneously.

Rigid H Frame Design

The H frame design principle provides a vertical stiffness well in excess of that achievable with cantilever or C frame designs. The frame is effectively rigid at loads well in excess of the 100 kN measurement limit. This is an important consideration in transient tests such as PVT, which rely upon compliance free measurement for accurate volume determination.

Bi-Modal Speed Control

Bi-modal digital speed control technology has been developed for the latest generation of Rosand capillary rheometers. The technology uses different speed control algorithms suited to high and low speed operation to optimize performance. This gives the instrument a wide dynamic range in speed control. In practice, the lower limit is determined only by long experimental times at low shear rates but a dynamic range in speeds in excess of 200,000 : 1 is available if required. This greatly enhances the system's flexibility and means that a greater range of shear rates can be covered using a particular die.

Integral Fume Chamber with Extraction

For operator safety, the RH7 and RH10 are equipped with a safety interlocked fume chamber with fan extraction of the gases to a vent at the back of the rheometer unit. An extractor fan is also situated below the rheometer barrel.

Floor Standing Design

The floor standing design allows for an open architecture below the barrel and heater assembly. This space can be used to accommodate other experimental options such as die swell measurement, a slot die and haul-off (melt strength).



*Rheological
measurement
made easy*

HOW IT WORKS

The Rosand RH7 and RH10 capillary rheometer systems enable controlled extrusion (by volumetric flow) of a sample through a high precision die of known dimensions, to characterize material flow properties typically under conditions of high force (or pressure) and/or high shear rate. Using a twin bore barrel and a *zero length* die configuration allows simultaneous determination of shear viscosity and extensional (elongational) viscosity as a function of shear (or deformation) rate.

A capillary rheometer system comprises several key components to enable robust, reliable and accessible rheological measurements for a particular sample or application:

Capillary Rheometer Base Unit

Includes the barrel with bores to load the sample – the bore diameter and barrel material must be compatible with the material(s) under test. The base unit also includes a head unit, which has a mechanical connection to the pistons which are used to extrude the sample. Key system functions of drive force and piston speed range are controlled by the base unit.

Die and Pressure Transducer Combination

The die is mounted at the bottom of the barrel bore, and its dimensions define the applied shear field. A melt pressure transducer is mounted in the barrel to measure the resultant pressure at the die entrance as the material is extruded. The die dimensions and pressure transducer range must be appropriate to the sample type and test under consideration.

Temperature and/or Environmental Control Options

Accurate control of barrel temperature is essential since rheological properties are a strong function of temperature. For thermally-sensitive materials, thermal equilibrium times and inert test environments are critical considerations to ensure reliable data.

OPTIONS

The Rosand RH7 and Rosand RH10 capillary rheometers can be configured with a variety of options to provide complete measurement solutions across all applications.

Barrel Materials and Dimensions

For aqueous or aggressive materials, stainless steel or Hastelloy barrels are available in place of the standard Nitrided steel version. The wide dynamic range in speed means that the standard 15 mm diameter barrel is suitable for the vast majority of testing applications. However, barrels are available with 9.5 mm, 12 mm, 19 mm and 24 mm bores as an option.

Low Temperature

For applications that require sub-ambient measurements, a special cooling coil option is available.





Accessories

Several accessories are available to suit particular applications or enhance the testing capability of the base units.

Main Accessories:

- Alternative test dies
- Alternative pressure transducers
- Nitrogen purge
- *Tragethon* haul-off (melt strength)
- Melt tension apparatus with automatic spooling
- Laser die swell measurement
- Slot die assembly
- PVT test
- Die and melt cutters





Continuous development of the Rosand Flowmaster™ software has produced a comprehensive data acquisition and analysis package with a wide range of measurement options and an extensive help system.

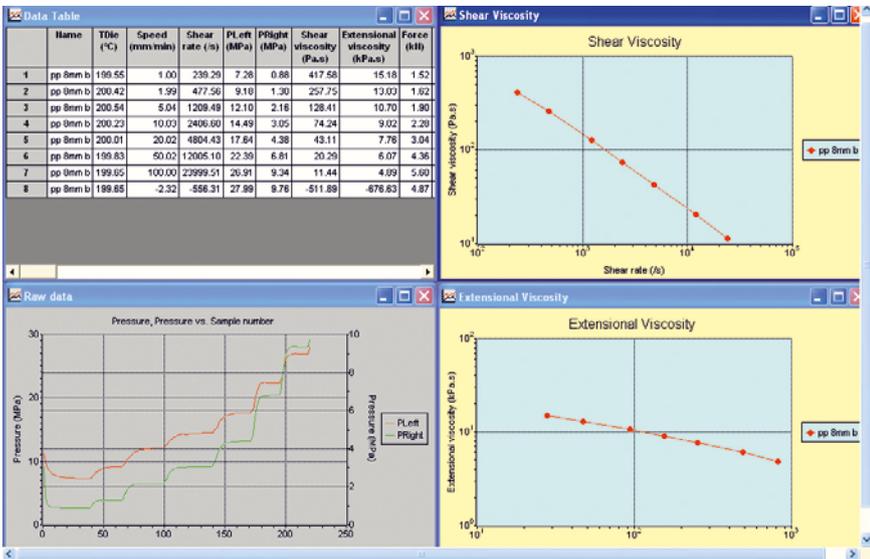
FLOWMASTER™ SOFTWARE

Software Modules and Analysis Functions Included

- Constant shear test
- Extensional test
- Manual control
- Flow/no flow
- Non-Newtonian index
- Bagley correction by orifice die and extrapolation methods
- Rabinowitsch correction
- Hagenbach correction for fluid inertia
- Cogswell convergent flow model and extensional viscosity assessment
- Extensive plot and print options
- Data export

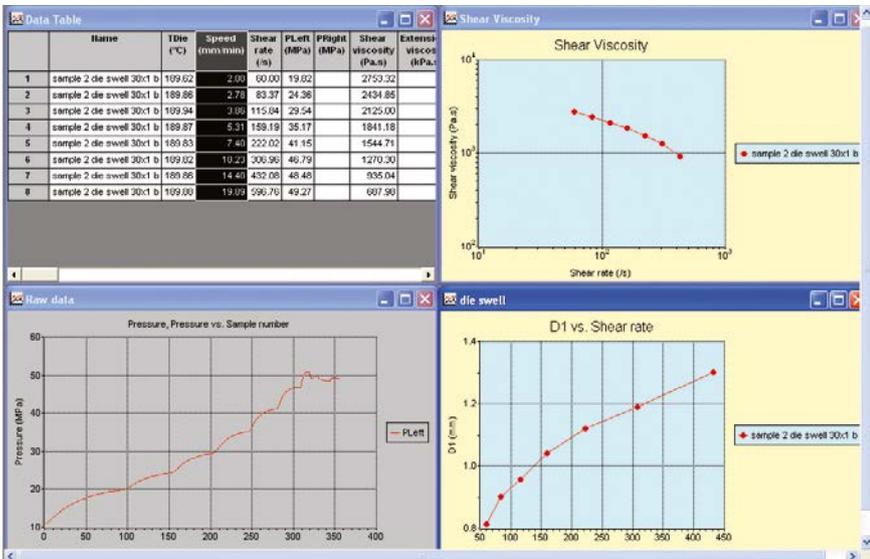
Software Options

- Wall slip analysis
- Melt fracture/flow instability
- Die swell
- Material degradation/thermal stability
- Low-speed degradation
- Eta-0 (Intrinsic Melt Viscosity)
- Stress relaxation
- Low-level scripting



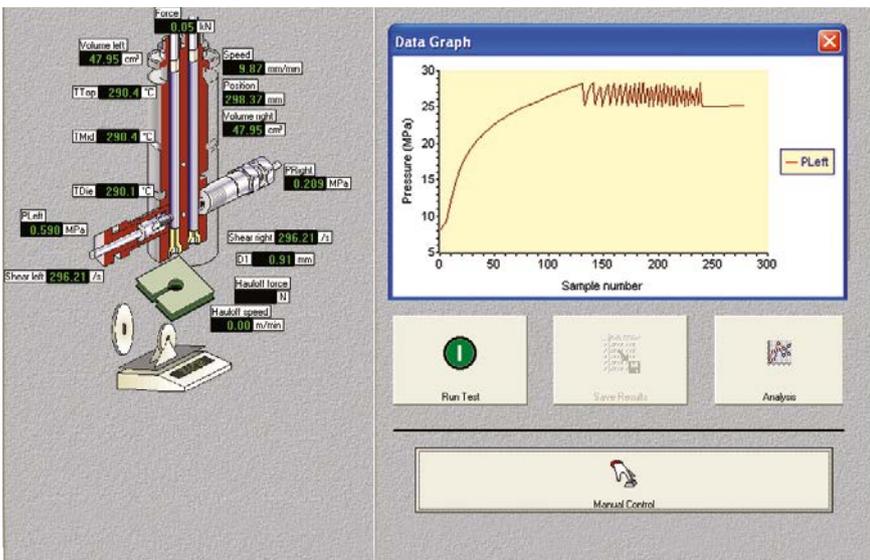
Constant Shear and Extensional Tests

Measurement of shear or extensional stress and shear or extensional viscosity as a function of shear rate. Extensional tests are carried out with an orifice die.



Die Swell

Measurement of the extrudate diameter close to the die exit. Directly interfaced with the control software and die swell is stored as part of the measurement data file.



Melt Fracture/Flow Instability

Accelerated shear rate ramp with continuous monitoring of the pressure to detect flow instabilities, such as melt fracture which may occur during flow through a capillary die.



APPLICATIONS

- Characterization of polymer melts and suspensions across a range of shear rates and temperatures
- Simulation of extensional viscosity dominated processes such as fibre spinning, blow molding, film blowing and thermoforming
- Assessment of extrusion behavior for processes such as injection molding and hot melt extrusion
- Evaluation of material behaviour at process relevant shear rates such as high speed coating and printing applications
- Detection of polymer instabilities such as melt fracture and thermal degradation
- Measurement of material elasticity and related properties such as die swell

POLYMERS

COATINGS

CERAMICS

METALS

PHARMA-
CEUTICALS

SEALANTS

FOODS

Rosand RH7/RH10

Maximum force	<ul style="list-style-type: none"> ▪ RH7: 50 kN ▪ RH10: 100 kN
Frame stiffness	250 kN
Maximum speed	<ul style="list-style-type: none"> ▪ RH7: 600 mm/min ▪ RH10: 1200 mm/min
Dynamic range in speed	up to 400,000:1
Speed uncertainty	< 0.1%
Temperature range	Ambient to 400°C (500°C optional) 5°C to 300°C (low temperature cooling coil option)
Temperature control	< ± 0.1°C
Bore diameter	15 mm standard (9.5, 12, 19 and 24 mm bore options)
Barrel bore length	290 mm
Barrel material	Nitrided steel standard (Hastelloy or stainless steel options)
Pressure transducer ranges	30000, 20000, 10000, 5000, 1500 or 500 psi
Pressure transducer accuracy	< 0.5%
Dies	Tungsten carbide, precision ± 5 µm
Die diameter	0.5 to 2 mm (in 0.5 mm increments) and 3 mm standard (other diameters, including fine bore dies, available to special order)
Height	2.45 m
Width	0.80 m (without accessories)
Depth	0.90 m (without accessories)
Weight	350 kg (without accessories)
Power requirements	<ul style="list-style-type: none"> ▪ 3-phase, AC, 415 V und 16 A (RH7) ▪ 3-phase, AC, 415 V und 32 A (RH10)

Technical Specifications



All over the world, the name NETZSCH stands for comprehensive support and expert, reliable service, both before and after sale. Our qualified personnel from the technical service and application departments are always available for consultation. In special training programs tailored for you and your employees, you will learn to tap the full potential of your instrument.

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LABORATORY



Application Service and Contract Testing



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Our performance standards are high. We promise our customers Proven Excellence – exceptional performance in everything we do, proven time and again since 1873.

When it comes to Thermal Analysis, Calorimetry (adiabatic & reaction), the determination of Thermophysical Properties, Rheology and Fire Testing, NETZSCH has it covered. Our 50 years of applications experience, broad state-of-the-art product line and comprehensive service offerings ensure that our solutions will not only meet your every requirement but also exceed your every expectation.

Proven Excellence.■

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