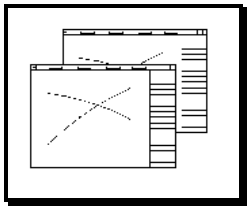
Göttfert Werkstoff-Prüfmaschinen GmbH
Siemensstraße 2
74722 Buchen
e-mail: info@goettfert.de
Homepage: http/www.goettfert.com

GÖTTFERT®
WERKSTOFF-PRÜFMASCHINEN GMBH



RHEOGRAPH 25
Singe or Twin barrel system

The RHEOGRAPH 25 is an innovative High-Pressure Capillary Rheometer, according to DIN 54811, to determine the flow behavior and viscosity of thermoplastics and rubbers.

Features:

Constant high piston force 25 kN

Single or twin barrel system:
∅ 12, 15, 20 or 25 mm design

Dynamic speed range:
1:800000

High dynamic piston acceleration:
0-40 mm/s in 0.6 s

Position acquisition:
high resolution
encoder (0.0000016 mm)

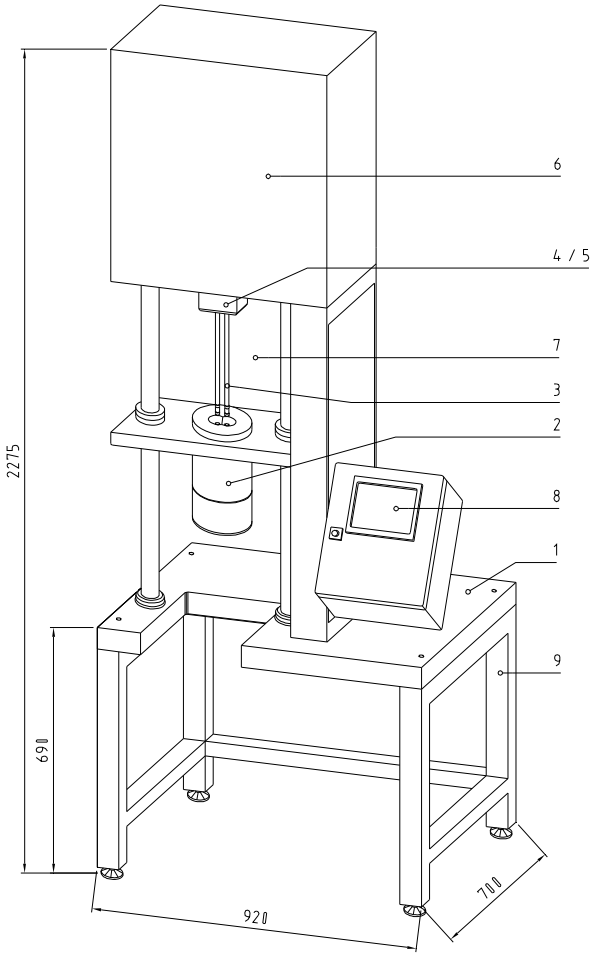
Increased pressure transducer sensitivity: resolution increased by 10 times

Automatic pressure transducer identification: Plug & Test

The RHEOGRAPH 25 is used in the field of research and development as well as for quality control and inspection of received goods.

Further features of the RHEOGRAPH 25:

- Windows database software for parameter setting and online monitoring via Ethernet, as well as free definable test evaluation
- Commissioning, test data recording and current status indication via integrated 5,7“ Color-QVGA-touch screen
- Compact and service friendly design with easily accessible components
- Temperature range up to 400℃ (500℃ optional), tem perature control algorithm, resolution 0,01℃
- 5 temperature calibration data sets each with separate control parameters for optimal adaptation over the full temperature range
- Integrated timer for automatic heat up
- Electrically heated test chamber with easy exchangeable test barrel
- Test barrel and options fitting with up to 5 pressure transducers as well as up to 3 force transducers
- Drive torque monitoring and display
- Infinitely variable manual piston drive control
- Operation modes constant speed, constant pressure/force or PVT measurement
- Determination of apparent resp. real shear stress by real test pressure measurement
- Automatic test data acceptance and setting of the next specification value after stabilisation of test data
- PVT measurement isobaric or isothermal
- Static and dynamic die swell measurement (Option)
- Manual or automatic melt cutting unit (Option)
- Thermal conductivity (Option)
- Counter pressure chamber (Option)
- Slit die (Option)
- Shark Skin (Option)



1. Ground frame
2. Test chamber
3. Test piston (Option)
4. Test piston holder
5. Exchangeable force transducer (Option)
6. Spindle drive with servo motor cased with a hood
7. Protection hood
8. Touchscreen Panel for controlling
9. Below frame (option)

Figure: Total view of the RHEOGRAPH 25

The RHEOGRAPH 25 consists of the following components:

Frame

The machine body of RHEOGRAPH 25 is designed in a stable frame resp. column type construction in order to cope with the high test forces. Test chamber, electronics and test piston drive are located separately.

Test piston drive

The test piston drive is made via a double ball screw shaft, activated by a servo motor with a sprocket belt gear.
Sprocket belt gear, ball screw shaft and cylinder rod are located in one housing. The cylinder rod guide is free of lubricant.

Chamber heating

The test chamber temperature is controlled by a special temperature control algorithm. The resolution of the set temperatures is 0.1 °C. During th e test, the temperatures are displayed on the screen with a 0.01 °C resolution.

Safety system

- Comprising of a protective hood around the test piston made of plexi glass according to VGB 4. For cleaning and filling of the test barrel the hood can be opened. The piston can move only, when the hood is closed.
- Test piston overload detection via torque, pressure transducer and force transducer monitoring
- Touch protection of hot test chamber via reflector cover

Controlling

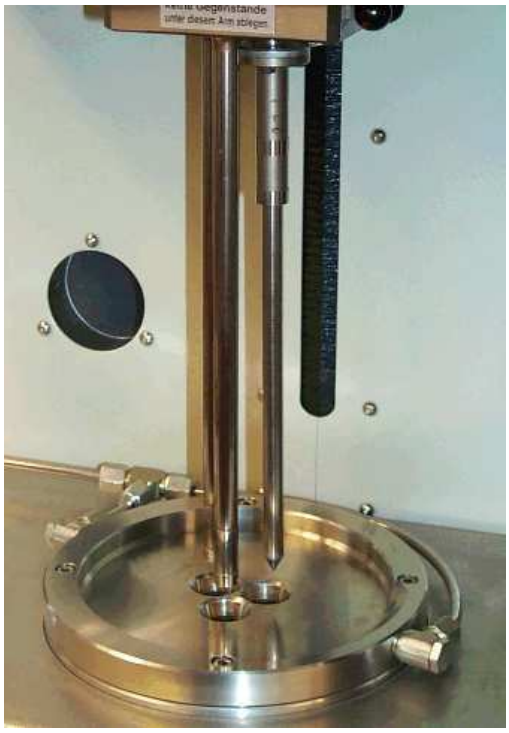
A panel PC with real time processing system controls the device.
All service operations at the device can be handled via touch screen display (5,7", QVGA color).

Connections: Digital/analogue I/O units via CAN bus
PC via Ethernet
Special options via RS232

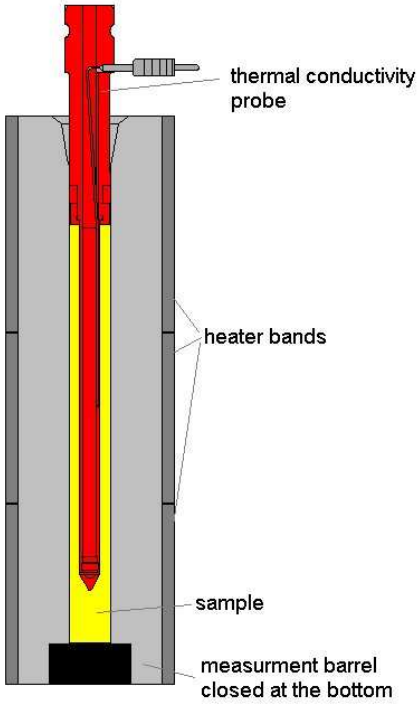
PC-Software LabRHEO

With the PC program LabRHEO the setting of parameters and evaluation of raw data is performed.
Requirements of the PC: Ethernet port and Windows XP operating system with SP2

Thermal conductivity measurement
A good value option for the capillary rheometer



Triple bore capillary rheometer with thermal conductivity probe



Thermal conductivity probe

Simulation in industrial processing like injection moulding is commonly used to optimize moulded parts. Rheological and pVT-data from the plastic or elastomer materials are used to simulate flow and shrinkage during the process. To also optimize heat transfer data for **thermal conductivity** are necessary. Where heat transfer is not fully optimised cycle times can be longer than necessary and hot spots can occur leading to high scrap rates. Further rheological and pVT-data are temperature dependant where deviations in the simulated temperature history due to inaccurate **thermal conductivity** data can result in deviation of calculated flow lines and shrinkage.
The data for thermal conductivity are generally determined far from processing conditions or an expensive additional device for measurement is necessary. Here the thermal conductivity probe for the capillary rheometer RHEOGRAPH 25 is a good value option.

Thermal conductivity probe

The thermal conductivity measurement probe can be integrated into a single or twin bore capillary rheometer. Here one barrel is provided to measure thermal conductivity. The provided barrel is closed at the bottom instead of inserting a capillary. A defined volume of polymer granulates or powder is filled into the barrel. The thermal conductivity probe is moved into the barrel and the sample flows into the annular gap between probe and barrel. The probe consists of a thin walled piston with a heating bar and a thermocouple in the centre. With a high accuracy power supply a defined heat flow is generated through the sample. The increase of temperature in the probe is measured. Thermal conductivity is then calculated from the temperature increase and the heat flow. At the upper end of the probe a sealing ring is placed to generate different pressures on the sample. A maximum pressure near 1000 bar can be build up. The pressure can be measured in molten status of the sample by the pressure transducer normally placed before the capillary. Below the melting point the pressure can be measured by a force sensor in the socket for the thermal conductivity probe. This technique allows proceeding tests condition in the range of industrial injection mould processing and meets the ASTM standard D5930.

Results

Figure 1 shows the high influence of pressure on thermal conductivity for different polyethylene materials. The pressure rise to 900 bar increases the thermal conductivity for the LDPE material by app. 10% and for the HDPE material by app 15%.
A similar increase (12%) can be found in figure 2 for a PP polymer (PP1) raising the pressure to 600 bar. The change of thermal conductivity with temperature is even higher (Figure 3). Thermal conductivity increases in the area of crystallization from molten to solid state about 20%.
Even the few examples show that thermal conductivity changes significantly with the influence of pressure and temperature.

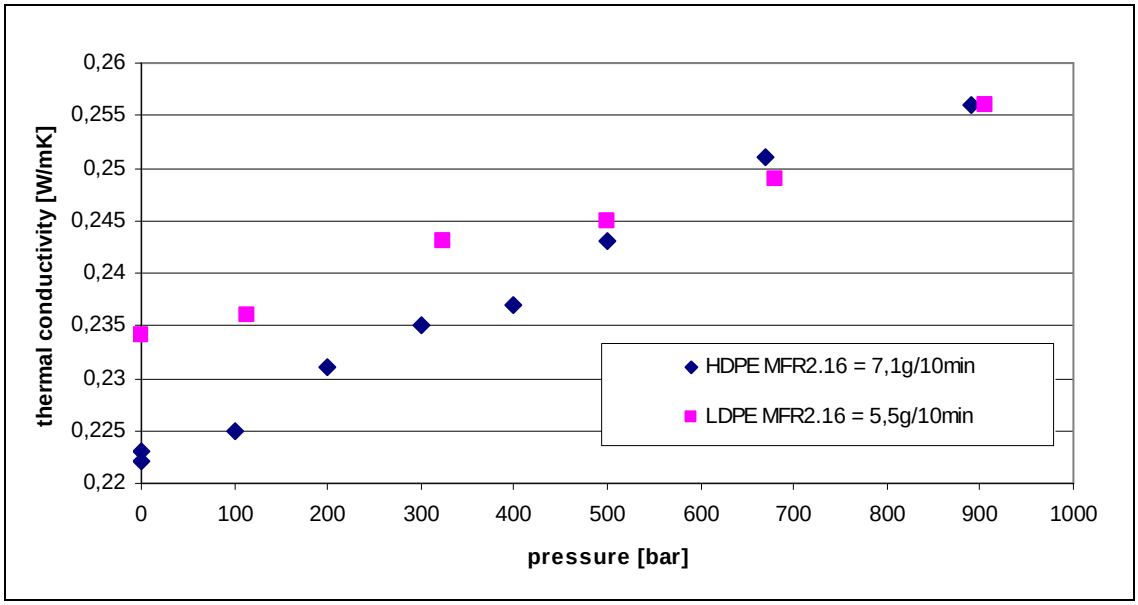


Figure 1: Effect of pressure on thermal conductivity of different PE types

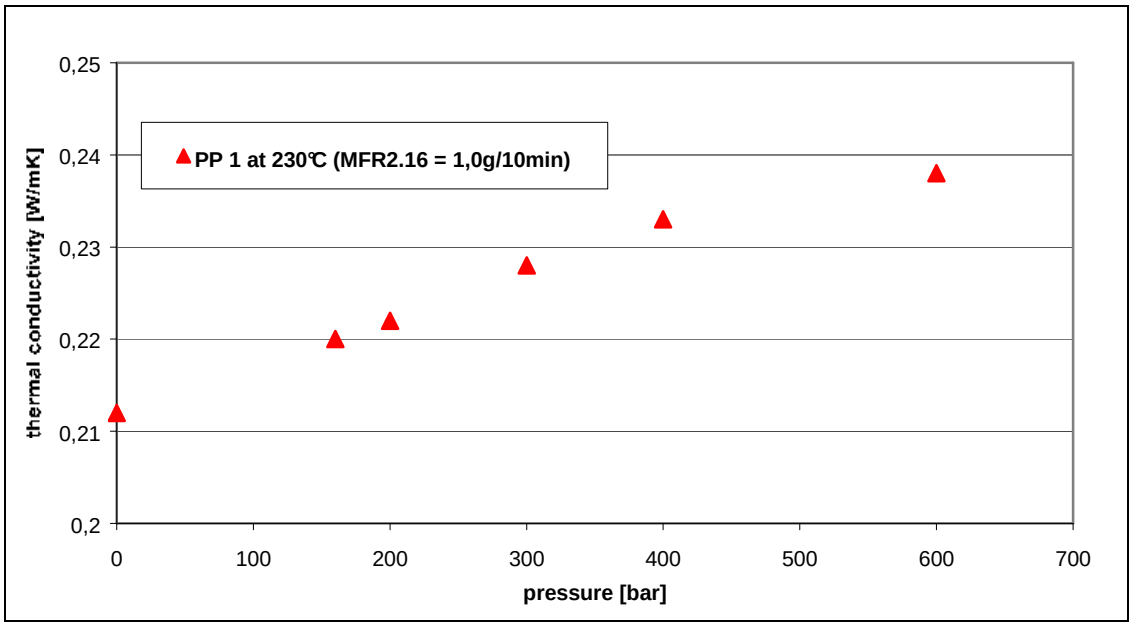


Figure 2: Pressure influence on thermal conductivity on PP

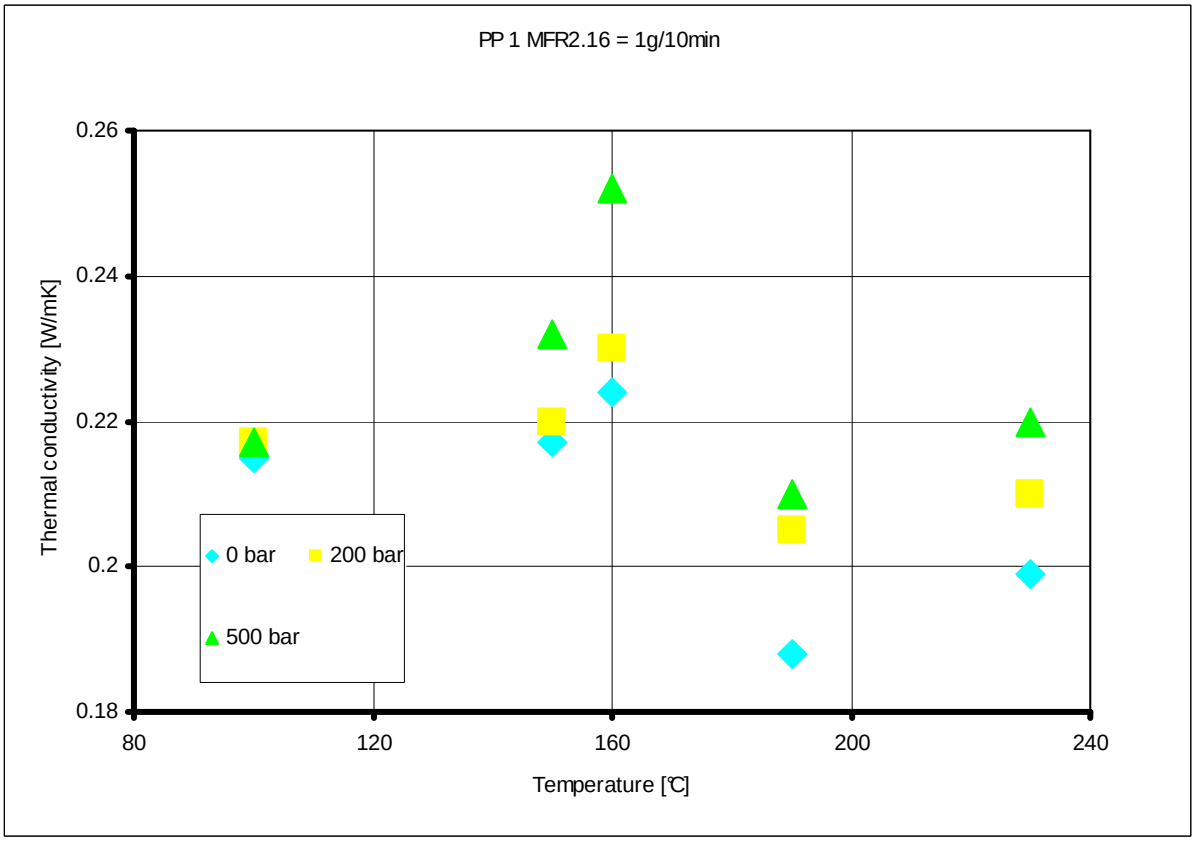
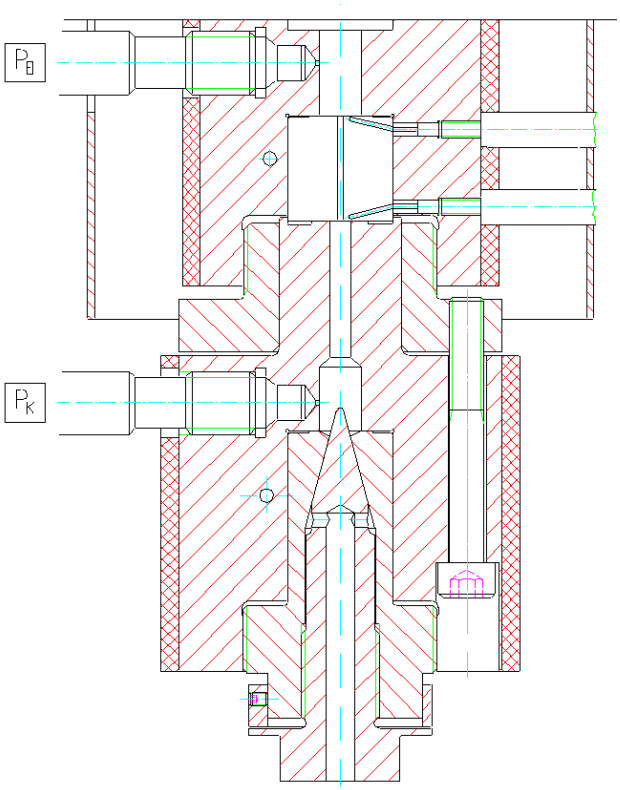


Figure 3: Temperature influence on thermal conductivity on PP

Counter pressure Chamber

Determination of the pressure influence on the viscosity function



Picture: Counter pressure Chamber

Polymers are disposed to high pressures within processing machinery. The pressure has a considerable influence on the viscosity function and causes non neglect able changes in viscosity. The phenomena could not be analyzed by previous simple testing methods. For that reason the counterpressure chamber has been developed as an optional device for capillary rheometers to determine data for process simulations, especially for processing at high pressures like for example melt pumps, injection moulding, extrusion dies, tests for the changed wall slipping in the extruder etc.

Using the option counter pressure chamber with the high pressure capillary rheometer the serious and often not neglect able influence of pressure on viscosity function and wall slip behaviour can be analyzed.

The pressure influence on viscosity function

The consideration of pressure influence on viscosity is insufficient. Because capillary rheometer testing is favourably suited to evaluate process relevant data, the counter pressure chamber was developed as an option for the Rheograph 25.

A mean variable pressure $P_m = \frac{P_{entrance} + P_{chamber}}{2}$ is generated by the counter pressure chamber inside the pressure chamber causing a change in viscosity.

Figure 1 shows the measuring data for the viscosity as function of pressure P_m for different shear rates. The approximated data can be plotted as a viscosity function or flow curve with the parameter pressure P_m (figure 2). The single curves can be summarized to a master curve with a shift factor a_P (figure 3).

The determination of the pressure coefficient α delivered values between $\alpha \approx (0{,}4 \div 1) \cdot 10^{-8}$ [Pa^{-1}]. These coefficients are in good accordance to literature data.

A higher precision in injection moulding simulation can be realized with the now possible experimental determination of the complete viscosity function in dependence of shear rate, temperature and pressure.

Change of wall slip behaviour

The following example makes clear: For wall slipping materials

1. wall slip behaviour is influenced (figure 4) and
2. critical shear stress at the beginning of wall slip is moved to higher values (figure 5) with the counter pressure.

Figure 4 shows the following 3 areas of wall slip in dependence of the counter pressure:

Area A: The counter pressure leads to a rise of the normal force at the capillary wall by the melt, wall slip velocity decreases to zero and the Coulomb friction is dominating.

Area B: Material moves oscillating – slip-stick dominate, wall slip velocity follows an oscillation around a mean value.

Area C: A slip film occurs, on which the material is moving.

The characteristics in figure 4 and 5 delivers an extended basis for the simulation of processing techniques with the boundary condition wall slip at screw and die.

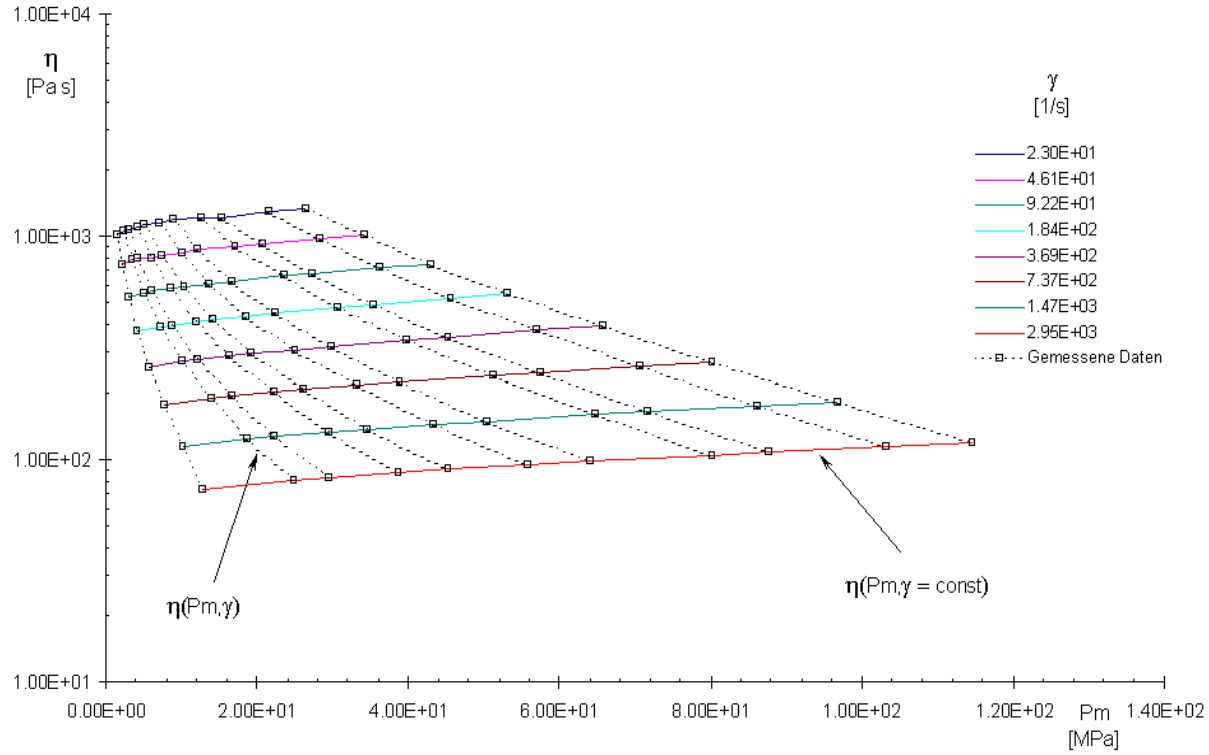


Figure 1: Viscosity versus pressure as a function of shear rate

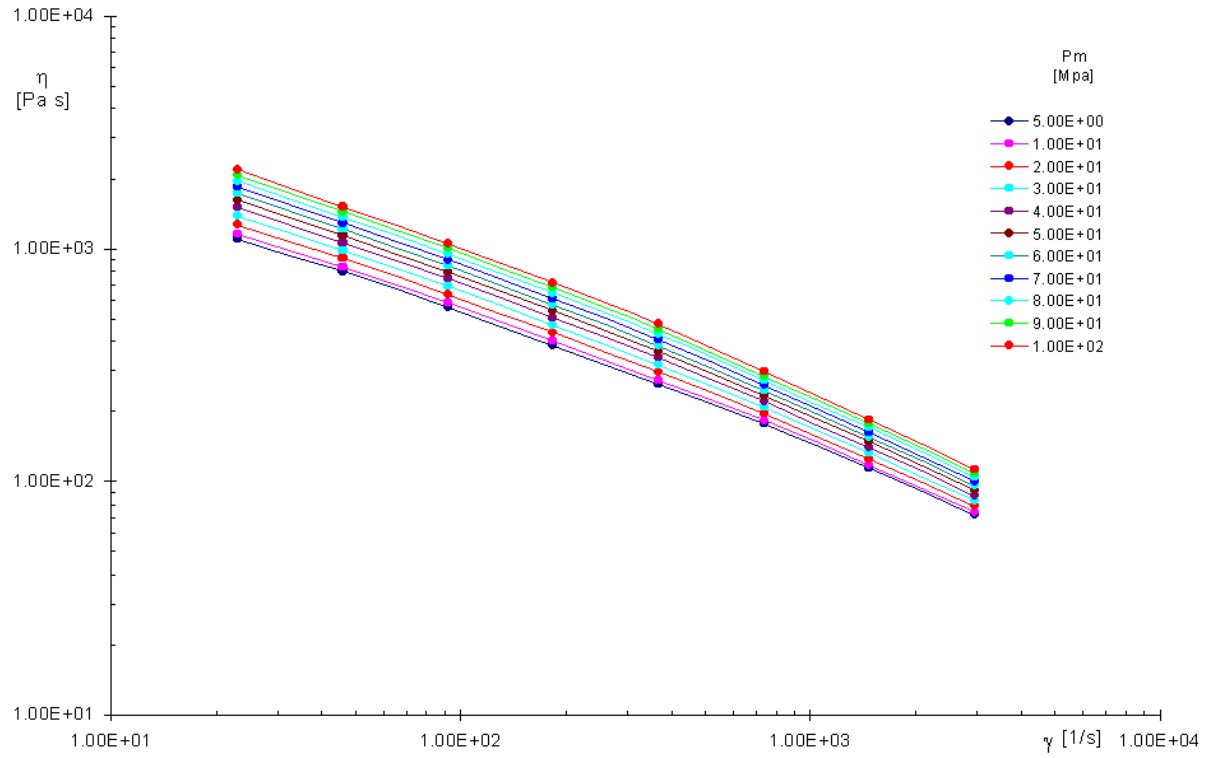


Figure 2: Plot of viscosity function for different pressures

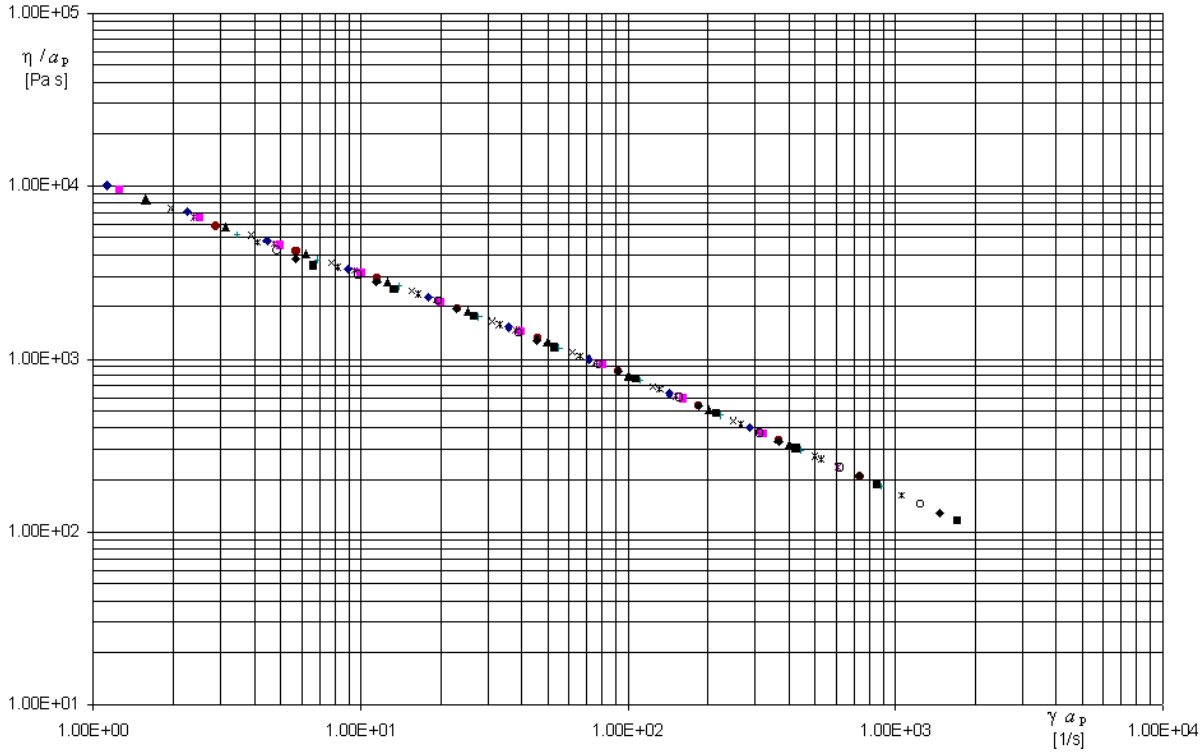


Figure 3: Pressure master curve

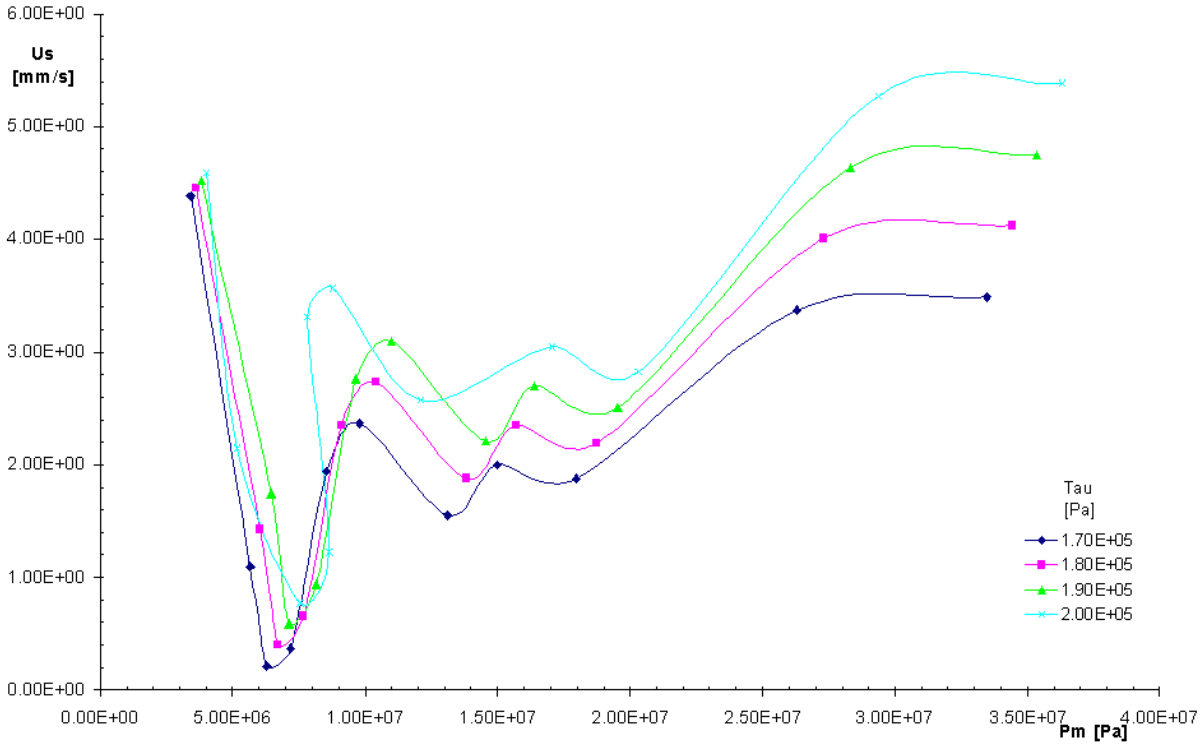


Figure 4: Slope of wall slip velocity at constant shear stress as a function of pressure

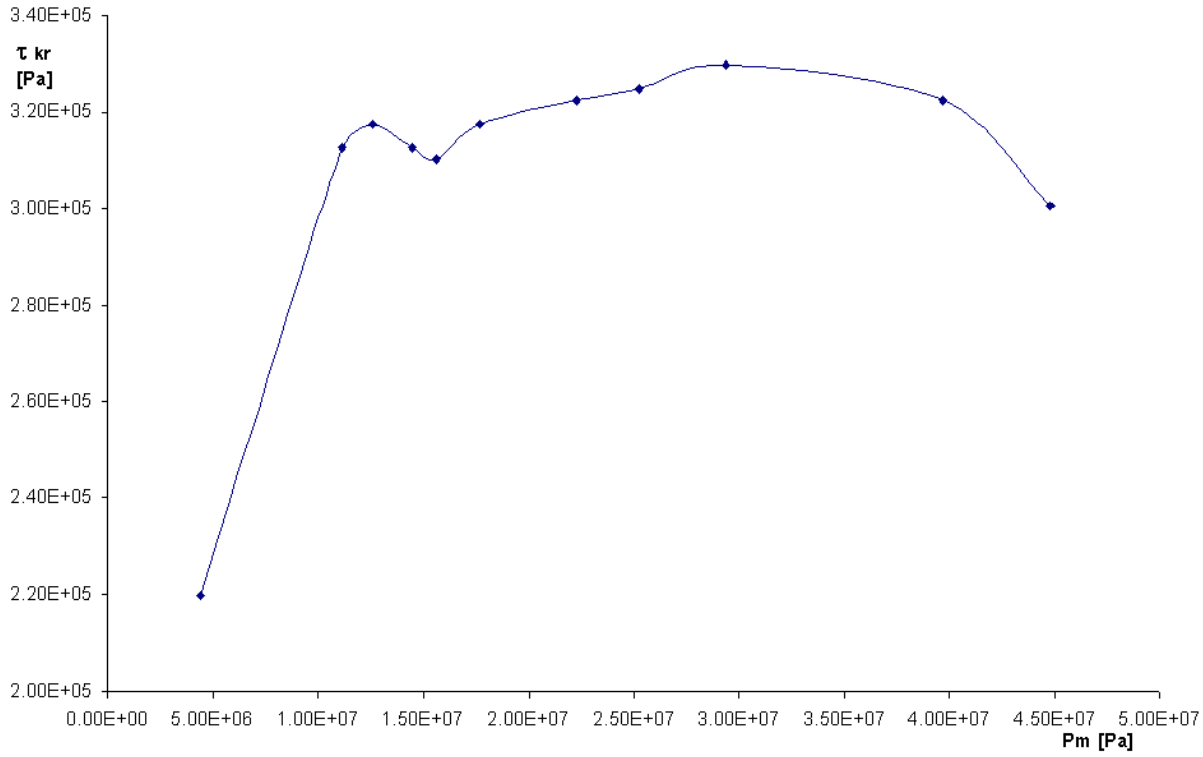


Figure 5: Pressure dependency of the critical shear stress

Technical data

Test chamber:	Three heater circuits, electrically heated, temperature transducer PT 100 1/3 DIN Temperature variation over time in usable range: less than ± 0,2 ℃ Spatial temperature distribution in usable range: 60 up to 300 ℃: ± 0,5 ℃ 301 up to 400 ℃: ± 1,0 ℃
Temperature controller:	Temperature control algorithm, resolution of real temperature 0.01℃
Preset temperature value:	0,0 - 400,0 ℃ (extended range up to 500.0 °C, see options)
Test barrel:	12,0 + 0,01 mm diameter, 230 mm usable length 15,0 + 0,01 mm diameter, 230 mm usable length 20,0 + 0,01 mm diameter, 230 mm usable length 25,0 + 0,01 mm diameter, 230 mm usable length
Test piston:	11,99 - 0,01 mm diameter, 285 mm length 14,99 - 0,01 mm diameter, 285 mm length 19,99 - 0,01 mm diameter, 285 mm length 24,99 - 0,01 mm diameter, 285 mm length
Capillary:	see options
Servo drive:	Resolution: 0.0000016 mm Speed range: 1 : 800 000 Lowest test speed: 0,00005 mm/s Highest test speed: 40 mm/s Feeding speed: 0,0001 - 40 mm/s
Test pressure at:	12,0 mm test barrel diameter: 1770 bar (at 20 kN test force) 15,0 mm test barrel diameter: 1410 bar (at 25 kN test force) 20,0 mm test barrel diameter: 715 bar (at 25 kN test force) 25,0 mm test barrel diameter: 510 bar (at 25 kN test force)
Force transducer (option):	Nominal range: 25 kN accuracy class 0,02 sum of errors (according to the real value) • 0,4% test range 1% - 100% • 0,8% test range 0,4% - 1%
Melt pressure transducer:	Up to 5 transducers can be installed Technical data, see options
Power supply:	see options
Permissible voltage variations:	± 10 %
Frequency:	50 Hz
Protective earthing:	Earth resistance less than 5 Ohm
Short-time breaks:	less than 10 msec
Power consumption:	approx. 5 kW
Ambient temperature:	+ 10 up to + 40 °C
Air humidity:	max. 90 % not-condensing
Dimensions:	Width: 920 mm, depth: 600 mm, height: 1655 mm
Weight:	ca. 400 kg

Finish

Front and cover plate: light grey RAL 7035
Test chamber hitch: grey-brown RAL 8019

Goettfert GmbH provides full warranty for machines that have been supplied as complete system that means with PC and printer by Goettfert. PC means generally the complete system comprising of PC, monitor, keyboard, interfaces, mouse and if applicable joysticks.
Principally, we do not give a functioning guarantee for connecting externally supplied PCs and printers (non-Goettfert supply).
If the customer provides the PC by himself, Goettfert cannot guarantee the trouble free functioning of PC and Goettfert unit. Service work, which will be essential due to appearing problems in regard to configuration, serial interfaces, connection cables, communication etc. do not belong to the warranty obligations and will therefore be invoiced on an actual expense basis.

Due to the various printer executions that are available on the market, we do not give any function guarantee for printers not supplied by Goettfert. Support for possible adjustments will be charged on an actual expense basis.

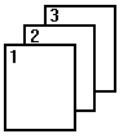
Accessories

1	User information
2	Keys for main switch
2	Keys for cabinet
1	Cover disk
1	Mirror for magnetic base
1	Feeder
1	Cleaning tool for pressure transducer with bore ½“-20 UNF-B
1	Tube graphite paste
1	Set fuses
1	Set wrenches
1	Pair of tweezers
1	Brass brush

Please pay attention to the fact that the RHEOGRAPH 25 is equipped with microprocessors. In order to guarantee a trouble free operation, the power supply must be free of interferences. Should there occur any interference you have to connect line filters resp. mains stabilisers on line side.

RHEOGRAPH 25

Basic instrument
Article number 5.29.000



Options

The basic instrument is no functioning instrument without adding the following optional units:

- **Power Supply**
- **English Version** or **German Version**
- **Test chamber design 1** with
  - Test barrel set
  - Heating
  - Capillary block
  - Test piston
  - Test piston reception with/without force transducer
  - Test piston holder
  - Capillary

Or

- **Test chamber design 2** with
  - Test barrel set
  - Heating
  - Test piston
  - Force transducer or blind plug
  - Capillary
- **Pressure transducer (s)**

Further supplementary options:

- **Thermocouples**
- **Thermo-voltage-module**
- **Thermal conductivity**
- **PVT set**
- **Counter pressure chamber**
- **Die swell below test chamber**
- **Melt cutting unit**
- **Sliding table for RHEOTENS**
- **Nitrogen purge unit**
- **Slit die**
- **Pneumatic cleaning device**
- **Battery operated cleaning device**
- **Cleaning set**
- **Machine table**
- **PC table**
- **Printer, printer cable**

Power supply

Following power supplies are available:

Power supply 3 x 400 V

Voltage:	3 x 400V, 3L + N + PE
Permissible voltage fluctuations:	+/- 10%
Frequency:	50 Hz
Power consumption:	approx. 5 kW

Article number 5.29.005

Power supply 3 x 230 V

Voltage:	3 x 230V, 3L + PE without N
Permissible voltage fluctuations:	+/- 10%
Frequency:	60 Hz
Power consumption:	approx. 5 kW

Article number 5.29.006

Other power supply voltages available on request.

Language version and user information:

English Version

Marking and user information in English.

Article number 5.29.003

German Version

Marking and user information in German.

Article number 5.29.001

English User Information

Additional user information
One user information belongs to standard scope of the basic instrument.

Article number 5.29.004

German User Information

Additional user information
One user information belongs to standard scope of the basic instrument.

Article number 5.29.002

The user information contains operating manual, technical documentation, calculation basis as well as LabRheo program documentation.

Selection for test chamber type and force measurement

	Test chamber type	Pressure limit value
1	Test barrel D 12 mm	At 20 kN Maximum of allowed pressure 1770 bar
	Test barrel D 15 mm	At 25 kN Maximum of pressure 1414 bar
	Test barrel D 20 mm	At 25 kN Maximum of pressure 715 bar
	Test barrel D 25 mm	At 25 kN Maximum of pressure 509 bar
2	Test barrel 2 x D 12 mm	At 2x12,5 kN Maximum of pressure 2x1105 bar
	Test barrel 2 x D 15 mm	At 2x12,5 kN Maximum of pressure 2x707 bar
	Test barrel 1 x D 15 mm 1 x D 12 mm	At 2x12,5 kN 707 bar Maximum of pressure 707 bar Maximum of pressure 1105 bar

TEST CHAMBER DESIGN 1

Single Barrel Design for Test Barrels Ø12; Ø15; Ø20; Ø25

The test chamber is electrically heated via a temperature controller with 3 heating circuits.
Temperature distribution over the usable test barrel length: ± 0,5°C.
The test chamber can be equipped with various test barrels, test pistons and dependent on the capillary type with different capillary blocks.

Test Chamber Design 1

Article number 5.29.336

Test Barrel Set

With melt pressure bores with a thread ½“-20 UNF at the outlet of the test barrel.
With cleaning tools for the relevant test barrel diameter, comprising of a brass scraper , a piston for cleaning the test barrel, a steel brush and a tamping piston.
Please select a suitable test barrel set.

Test Barrel Set Ø12

Article number 5.29.337

Test Barrel Set Ø12 corrosion resistant for Polymers with abrasive and corrosive Additives
Article number 5.29.338

Test Barrel Set Ø12 with rolled-in Stainless steel pipe for connection of an external tempering unit. Recommended for standard tests below 60 °C and for PVT measurements at all temperature ranges.
Article number 5.29.339

Test Barrel Set Ø15
Article number 5.29.340

Test Barrel Set Ø15 corrosion resistant for Polymers with abrasive and corrosive Additives
Article number 5.29.341

Test Barrel Set Ø15 with rolled-in Stainless steel pipe for connection of an external tempering unit. Recommended for standard tests below 60 °C and for PVT measurements at all temperature ranges.
Article number 5.29.342

Test Barrel Set Ø20
Article number 5.29.343

Test Barrel Set Ø20 corrosion resistant for Polymers with abrasive and corrosive Additives
Article number 5.29.344

Test Barrel Set Ø20 with rolled-in Stainless steel pipe for connection of an external tempering unit. Recommended for standard tests below 60 °C and for PVT measurements at all temperature ranges.
Article number.....5.29.345

Test Barrel Set Ø25
Article number 5.29.346

Test Barrel Set Ø25 corrosion resistant for Polymers with abrasive and corrosive Additives
Article number 5.29.347

Test Barrel Set Ø25 with rolled-in Stainless steel pipe for connection of an external tempering unit. Recommended for standard tests below 60 °C and for PVT measurements at all temperature ranges.
Article number 5.29.348

Heating for the test barrel

Comprising of heater element, reflector jacket and temperature sensor PT 100 DIN for the required temperature range.
Please select a heating.

Heating up to 400°C for Test Barrel Set standard and corrosion resistant
Article number 5.29.310

Heating up to 400°C for Test barrel with rolled-in stainless steel pipe
Article number 5.29.352

Heating up to 500°C for Test Barrel Set standard and corrosion resistant
Article number 5.29.257

Heating up to 500°C for Test barrel with rolled-in stainless steel pipe
Article number 5.29.354

Capillary Block

For round hole capillaries up to 30 mm Length. With capillary nut, capillary wrench, heater element, reflector jacket, PT 100 temperature sensor and 2 thermocouple bores.
Please select a capillary block suitable for the heating and the barrel set.

Capillary Block up to 400℃ ; L= ≤30 mm
Article number 5.29.247

Capillary Block up to 400℃ ; L= ≤30 mm with rolled-in Stainless steel pipe
for connection of an external tempering unit. Recommended for standard tests below 60 ℃ and for PVT measurements at all temperature ranges.
Article number 5.29.356

Capillary Block up to 500℃ ; L= ≤30 mm
Article number 5.29.357

Capillary Block up to 500℃ ; L= ≤30 mm with rolled-in Stainless steel pipe
for connection of an external tempering unit. Recommended for standard tests below 60 ℃ and for PVT measurements at all temperature ranges.
Article number 5.29.358

Test Piston

The **test piston with Teflon ring** is especially suited for the testing of low viscous media like for example PA and PET with a melting temperature higher than 120 ℃..
Max. Temperature 240 ℃, Length 285 mm.

Die **test piston with HP sealing** is especially suited for the testing of low viscous media and for the PVT option. Its mainly used for media being in liquid state at room temperature. Length of this test piston is 285 mm. The HP sealing comprises of an active and a passive sealing system. The passive sealing system is made of various high performance polymers. The active sealing system is made mainly of sintered materials on basis of PTFE. The HP sealing seals liquid and gas media. It is conceived exclusively for the linear operation.
The special characteristics of the HP sealing are :

- High lifetime at high wear resistance
- Lowest possible friction value
- No clatter (Slip-Stick) at low rates
- No sticking to the tread area also after a longer standstill
- Operation temperature up to +280℃
- Operation pressure up to 2000 bar
- Max. rate. 20 mm/s

Please select one or various test pistons suitable to the test barrel.

Test Piston Ø12
Article number 5.09.101

Test Piston Ø12 corrosion resistant for Polymers with
abrasive and corrosive Additives
Article number 5.09.224

Test Piston Ø12 with Teflon ring
Article number 5.12.116

Test Piston Ø12 with HP-sealing
Article number 5.12.192

Test Piston Ø15
Article number 5.09.102

Test Piston Ø15 corrosion resistant for Polymers with abrasive and corrosive Additives
Article number 5.09.225

Test Piston Ø15 with Teflon ring
Article number 5.12.175

Test Piston Ø15 with HP sealing
Article number 5.12.408

Test Piston Ø20
Article number 5.11.150

Test Piston Ø20 corrosion resistant for Polymers with abrasive and corrosive Additives
Article number 5.09.226

Test Piston Ø20 with Teflon ring
Article number 5.12.179

Test Piston Ø20 with HP sealing
Article number 5.12.198

Test Piston Ø25
Article number 5.09.230

Test Piston Ø25 corrosion resistant for Polymers with abrasive and corrosive Additives
Article number 5.09.227

Test Piston Ø25 with Teflon ring
Article number 5.09.231

Test Piston Ø25 with HP sealing
Article number 5.09.235

Test Piston reception

The **Test Piston receptions without Force transducer** are equipped with a blind plug, which can be later on replaced by the force transducer.

The **Test Piston receptions with Force transducer** are equipped with a precision force transducer for the relevant measuring range with following technical data:

- Accuracy class 0,02
- Total deviation (in regard to actual value)
  - 0,4% within test range 1% up to 100%
  - 0,8% within test range 0,4% up to 1%

Please select a test piston reception.

Test Piston reception without Force transducer
(prepared for 25 kN Force transducer)
Article number 5.29.091

Test Piston reception with 25 kN Force transducer
incl. Measuring amplifier CAN-Bus Module
Article number 5.29.092

Test Piston holder

Each force transducer has different dimensions according to the test range and each test piston has different admissions according to the diameter. Therefore a test piston holder must be selected due to the test piston diameter.

Test Piston holder 25 kN-Design for Test Piston Ø12; Ø15
Article number 5.29.093

Test Piston holder 25 kN-Design for Test Piston Ø20; Ø25
Article number 5.29.094

Round Hole Capillaries for Test Chamber Design 1

Single Barrel Design D = 12 mm up to 30 mm

Each capillary has a bore hole to receive a thermocouple Fe-Const. to measure the test temperature in the inlet of capillary.
Capillaries with 30 mm length have a second bore hole to receive a second thermocouple to measure the test temperature in the outlet of capillary.
Capillaries with a length up to 10 mm are completely made of hard metal.
Capillaries with more than 10 mm length consist of a hard metal insert and a hardened steel jacket.
Note: all capillaries with a length of < 20 mm have for constructional reasons a total outer length of 20 mm, whereas the inner length is equal with the indicated measuring length.

Capillary L/D = 30/0,5
With 0,5 mm diameter, 30 mm Length
Article number 4.23.271

Capillary L/D = 20/0,5
With 0,5 mm diameter, 20 mm Length
Article number 4.23.353

Capillary L/D = 15/0,5
With 0,5 mm diameter, 15 mm Length
Article number 4.23.352

Capillary L/D = 10/0,5
With 0,5 mm diameter, 10 mm Length
Article number 4.23.351

Capillary L/D = 5/0,5
With 0,5 mm diameter, 5 mm Length
Article number 4.23.350

Capillary L/D = 30/1
With 1 mm diameter, 30 mm Length
Article number 4.23.272

Capillary L/D = 20/1
With 1 mm diameter, 20 mm Length
Article number 4.23.274

Capillary L/D = 15/1
With 1 mm diameter, 15 mm Length
Article number 4.23.365

Capillary L/D = 10/1
With 1 mm diameter, 10 mm Length
Article number 4.23.270

Capillary L/D = 5/1
With 1 mm diameter, 5 mm Length
Article number 4.23.355

Capillary L/D = 30/2
With 2 mm diameter, 30 mm Length
Article number 4.23.273

Capillary L/D = 20/2
With 2 mm diameter, 20 mm Length
Article number 4.23.279

Capillary L/D = 10/2
With 2 mm diameter, 10 mm Length
Article number 4.23.278

Capillary L/D = 5/2
With 2 mm diameter, 5 mm Length
Article number 4.23.356

Capillary L/D = 40/1
With 1 mm diameter, 40 mm Length.
In order to apply capillaries L = 40 the capillary nut 5.13.844 is required.
Article number 4.23.359

Capillary nut for Capillaries of 40 mm Length
Article number 5.13.844

Further capillary geometries – also with run in angle – on request.

TEST CHAMBER DESIGN 2

Multi-Barrel Design for test barrel systems 2xØ12; 2xØ15; 1xØ12/1xØ15

The test chamber is electrically heated via a temperature controller with 3 heating circuits.
Temperature distribution over the usable test barrel length: ± 0,5°C.
The test chamber can be equipped with various test barrels and test pistons.

Test Chamber Design 2
Article number 5.29.360

Test Barrel Set

2-barrel design for round hole capillaries up to 30 mm length, each with melt pressure measuring bore with thread ½“-20 UNF at the outlet of the test barrels and a thermocouple bore Fe-Const at the inlet of the capillary for measuring the temperature.
Each test barrel set consists of necessary capillary nuts and capillary nut wrenches.
With cleaning tools for the relevant test barrel diameter, comprising of a brass scraper , a piston for cleaning the test barrel, a steel brush and a tamping piston.

Please select among the below a suitable Test Barrel Set.

Test Barrel Set 2xØ12
Article number 5.29.309

Test Barrel Set 2xØ12 corrosion resistant for Polymers with abrasive and corrosive Additives
Article number 5.29.361

Test Barrel Set 2xØ12 with rolled-in stainless steel pipe for connection of an external tempering unit. Recommended for standard tests below 60 ℃ and for PVT measurements at all temperature ranges.

Article number 5.29.362

Test Barrel Set 2xØ15
Article number 5.29.363

Test Barrel Set 2xØ15 corrosion resistant for Polymers with abrasive and corrosive Additives
Article number 5.29.364

Test Barrel Set 2xØ15 with rolled-in stainless steel pipe for connection of an external tempering unit. Recommended for standard tests below 60 ℃ and for PVT measurements at all temperature ranges.
Article number 5.29.365

Test Barrel Set 1xØ12/1xØ15
Article number 5.29.366

Test Barrel Set 1xØ12/1xØ15 corrosion resistant for Polymers with abrasive and corrosive Additives
Article number 5.29.367

Test Barrel Set 1xØ12/1xØ15 with rolled-in stainless steel pipe for connection of an external tempering unit. Recommended for standard tests below 60 ℃ and for PVT measurements at all temperature ranges.
Article number 5.29.368

Heating for Test barrel

Comprising of heater element, reflector jacket and temperature sensor PT 100 DIN for the required temperature range.
Please select a heating.

Heating up to 400℃ for Test Barrel Set Standard and corrosion resistant
Article number 5.29.311

Heating up to 400℃ for Test barrel with rolled-in Stainless steel pipe
Article number 5.29.369

Heating up to 500℃ for Test Barrel Set Standard and corrosion resistant
Article number 5.29.370

Heating up to 500℃ for Test barrel with rolled-in Stainless steel pipe
Article number 5.29.371

Test Piston

The **test piston with Teflon ring** is especially suited for the testing of low viscous media like for example PA and PET with a melting temperature higher than 120 ℃..
Max. Temperature 240 ℃, Length 285 mm.

Die **test piston with HP sealing** is especially suited for the testing of low viscous media and for the PVT option. Its mainly used for media being in liquid state at room temperature. Length of this test piston is 285 mm. The HP sealing comprises of an active and a passive sealing system.

The passive sealing system is made of various high performance polymers. The active sealing system is made mainly of sintered materials on basis of PTFE. The HP sealing seals liquid and gas media. It is conceived exclusively for the linear operation.
The special characteristics of the HP sealing are :
- High lifetime at high wear resistance
- Lowest possible friction value
- No clatter (Slip-Stick) at low rates
- No sticking to the tread area also after a longer standstill
- Operation temperature up to +280°C
- Operation pressure up to 2000 bar
- Max. rate. 20 mm/s

Please select one or various test pistons suitable to the test barrel.

Test Piston Ø12
Article number 5.09.101

Test Piston Ø12 corrosion resistant for Polymers with abrasive and corrosive Additives
Article number 5.09.224

Test Piston Ø12 with Teflon ring
Article number 5.12.116

Test Piston Ø12 with HP sealing
Article number 5.12.192

Test Piston Ø15
Article number 5.09.102

Test Piston Ø15 corrosion resistant for Polymers with abrasive and corrosive Additives
Article number 5.09.225

Test Piston Ø15 with Teflon ring
Article number 5.12.175

Test Piston Ø15 with HP sealing
Article number 5.12.408

Force transducer

The Test Piston holder can be equipped with a force transducer or a blind plug, which can be later on replaced by the force transducer.
The precision force transducers for the relevant measuring ranges have following technical data:

- Accuracy class 0,02
- Total deviation (in regard to actual value)
  - 0,4% within test range 1% up to 100%
  - 0,8% within test range 0,4% up to 1%

Please select a force transducer or the blind plug.

Force transducer 25 kN incl. Measuring amplifier CAN-Bus Module
Installed in test piston holder at test piston 1
Article Number 5.29.095

Blind Plug
Installed in test piston holder at test piston 1
Article number 5.29.096

Round hole capillaries for Test Chamber Design 2

2-Barrel design D = 12 mm and 15 mm
Each capillary with L>5mm has a bore hole to receive a thermocouple Fe-Const. to measure the test temperature in the inlet of capillary.
Capillaries are completely made of hard metal.
Note: all capillaries with a length of < 20 mm have for constructional reasons a total outer length of 20 mm, whereas the inner length is equal with the indicated measuring length.

Capillary L/D = 30/0,5
With 0,5 mm diameter, 30 mm Length
Article number 4.23.681

Capillary L/D = 20/0,5
With 0,5 mm diameter, 20 mm Length
Article number 4.23.680

Capillary L/D = 15/0,5
With 0,5 mm diameter, 15 mm Length
Article number 4.23.679

Capillary L/D = 10/0,5
With 0,5 mm diameter, 10 mm Length
Article number 4.23.678

Capillary L/D = 5/0,5
With 0,5 mm diameter, 5 mm Length
Article number 4.23.677

Capillary L/D = 2,5/0,5
With 0,5 mm diameter, 2,5 mm Length
Article number 4.23.676

Capillary L/D = 0/0,5
With 0,5 mm diameter, 0 mm Length
Article number 4.23.675

Capillary L/D = 30/1
With 1 mm diameter, 30 mm Length
Article number 4.23.686

Capillary L/D = 20/1
With 1 mm diameter, 20 mm Length
Article number 4.23.655

Capillary L/D = 15/1
With 1 mm diameter, 15 mm Length
Article number 4.23.685

Capillary L/D = 10/1
With 1 mm diameter, 10 mm Length
Article number 4.23.684

Capillary L/D = 5/1
With 1 mm diameter, 5 mm Length
Article number 4.23.683

Capillary L/D = 2,5/1
With 1 mm diameter, 2,5 mm Length
Article number 4.23.682

Capillary L/D = 0/1
With 1 mm diameter, 0 mm Length
Article number 4.23.654

Capillary L/D = 30/2
With 2 mm diameter, 30 mm Length
Article number 4.23.691

Capillary L/D = 20/2
With 2 mm diameter, 20 mm Length
Article number 4.23.690

Capillary L/D = 10/2
With 2 mm diameter, 10 mm Length
Article number 4.23.689

Capillary L/D = 0/2
With 2 mm diameter, 0 mm Length
Article number 4.23.688

Capillary L/D = 40/1
With 1 mm diameter, 40 mm Length.
In order to apply capillaries L = 40 the capillary nut 5.13.507 is required.
Article number 4.23.687

Capillary L/D = 40/2
with2 mm diameter, 40 mm Length
Article number 4.23.692

Capillary nut for Capillary with 40 mm Length
Article number 5.13.507

Further capillary geometries – also with run in angle – on request.

Options for all 2 Test Chamber Designs

Test pressure transducer

For determination of test pressure one or more pressure transducers with CAN bus supply are necessary.
Suitable transducers can be ordered from GOETTFERT.
Maybe that foreign products can be installed. But they has to be checked by GOETTFERT and prepared for the CAN bus.

The special calibrated transducers with integrated limit control guarantees a resolution of ± 0,2 % from end value.

Test pressure transducer 0 - 2000 bar Quality class I up to 400℃
With measuring amplifier for feeding in to the CAN-Bus..
Thread: ½“-20 UNF.
Article number 8.81.182

Test pressure transducer 0 - 1000 bar Quality class I up to 400℃
With measuring amplifier for feeding in to the CAN-Bus..
Thread: ½“-20 UNF.
Article number 8.81.181

Test pressure transducer 0 - 1400 bar Quality class I up to 400℃
With measuring amplifier for feeding in to the CAN-Bus..
Thread: ½“-20 UNF.
Article number 8.81.188

Test pressure transducer 0 - 700 bar Quality class I up to 400℃
With measuring amplifier for feeding in to the CAN-Bus.
Thread: ½“-20 UNF.
Article number 8.81.187

Test pressure transducer 0 - 500 bar Quality class I up to 400℃
With measuring amplifier for feeding in to the CAN-Bus.
Thread: ½“-20 UNF.
Article number 8.81.180

Test pressure transducer 0 - 200 bar Quality class I up to 400℃
With measuring amplifier for feeding in to the CAN-Bus.
Thread: ½“-20 UNF.
Article number 8.81.186

Test pressure transducer 0 - 100 bar Quality class I up to 400℃
With measuring amplifier for feeding in to the CAN-Bus.
Thread: ½“-20 UNF.
Article number 8.81.185

Test pressure transducer 0 - 50 bar Quality class I up to 400℃
With measuring amplifier for feeding in to the CAN-Bus.
Thread: ½“-20 UNF.
Article number 8.81.184

Test pressure transducer 0 - 20 bar Quality class I up to 400℃
With measuring amplifier for feeding in to the CAN-Bus.
Thread: ½“-20 UNF.
Article number 8.81.183

Test pressure transducer 0 - 2000 bar Quality class I up to 500℃
With measuring amplifier for feeding in to the CAN-Bus.
Thread: ½“-20 UNF.
Article number 8.81.399

Test pressure transducer 0 - 1400 bar Quality class I up to 500℃
With measuring amplifier for feeding in to the CAN-Bus.
Thread: ½“-20 UNF.
Article number 8.81.398

Test pressure transducer 0 - 1000 bar Quality class I up to 500℃
With measuring amplifier for feeding in to the CAN-Bus.
Thread: ½“-20 UNF.
Article number 8.81.397

Test pressure transducer 0 - 700 bar Quality class I up to 500°C
With measuring amplifier for feeding in to the CAN-Bus.
Thread: ½“-20 UNF.
Article number 8.81.396

Test pressure transducer 0 - 500 bar Quality class I up to 500°C
With measuring amplifier for feeding in to the CAN-Bus.
Thread: ½“-20 UNF.
Article number 8.81.395

Test pressure transducer 0 - 200 bar Quality class I up to 500°C
With measuring amplifier for feeding in to the CAN-Bus.
Thread: ½“-20 UNF.
Article number 8.81.394

Test pressure transducer 0 - 100 bar Quality class I up to 500°C
With measuring amplifier for feeding in to the CAN-Bus.
Thread: ½“-20 UNF.
Article number 8.81.393

Test pressure transducer 0 - 50 bar Quality class I up to 500°C
With measuring amplifier for feeding in to the CAN-Bus.
Thread: ½“-20 UNF.
Article number 8.81.392

Test pressure transducer 0 - 20 bar Quality class I up to 500°C
With measuring amplifier for feeding in to the CAN-Bus.
Thread: ½“-20 UNF.
Article number 8.81.391

Other pressure transducer ranges are available on request.

By means of following thermocouples it is possible to measure the melt temperatures in the round hole capillaries. Each thermocouple needs an input of a thermo-voltage-module. A double thermo-voltage-module is already supplied together with the basic instrument.

Thermocouple for Test Chamber Design 1

Thermocouple with holder and screwing, suitable for round hole capillaries to measure the melt temperature.
Length: 75 mm diameter: 1 mm type: iron-constantan
Article number 5.13.650

Thermocouple for Test Chamber Design 2

Thermocouple with holder and screwing, suitable for round hole capillaries to measure the melt temperature.
Length: 75 mm diameter: 1 mm type: iron-constantan
Article number 5.13.679

Thermo-voltage-module

For signal amplification of 2 thermocouples. This thermo voltage module is used for a third thermocouple.
Article number 5.29.387

Determination of thermal conductivity in the test barrel

The thermal conductivity measurement probe can be integrated into a single or twin bore capillary rheometer. Here one barrel is provided to measure thermal conductivity. The provided barrel is closed at the bottom instead of inserting a capillary. A defined volume of polymer granulates or powder is filled into the barrel. The thermal conductivity probe is moved into the barrel and the sample flows into the annular gap between probe and barrel. The probe consists of a thin walled piston with a heating bar and a thermocouple in the centre. With a high accuracy power supply a defined heat flow is generated through the sample. The increase of temperature in the probe is measured. Thermal conductivity is then calculated from the temperature increase and the heat flow. At the upper end of the probe a sealing ring is placed to generate different pressures on the sample. A maximum pressure near 1000 bar can be build up. The pressure can be measured in molten status of the sample by the pressure transducer normally placed before the capillary. Below the melting point the pressure can be measured by a force sensor in the socket for the thermal conductivity probe. This technique allows proceeding tests condition in the range of industrial injection mould processing and meets the ASTM standard D5930.

Thermal conductivity sensor ∅ 15 mm
Temperature limit: 400°C
Pressure limit: 1000 bar
Piston with integrated heating cartridge and thermocouple.
Article number 5.13.862

Thermal conductivity sensor ∅ 20 mm
Temperature limit: 400°C
Pressure limit: 1000 bar
Piston with integrated heating cartridge and thermocouple.
Article number 5.13.863

Electronics

Power pack and controlling to the defined heat supply.
Article number 5.13.658

PVT - Set

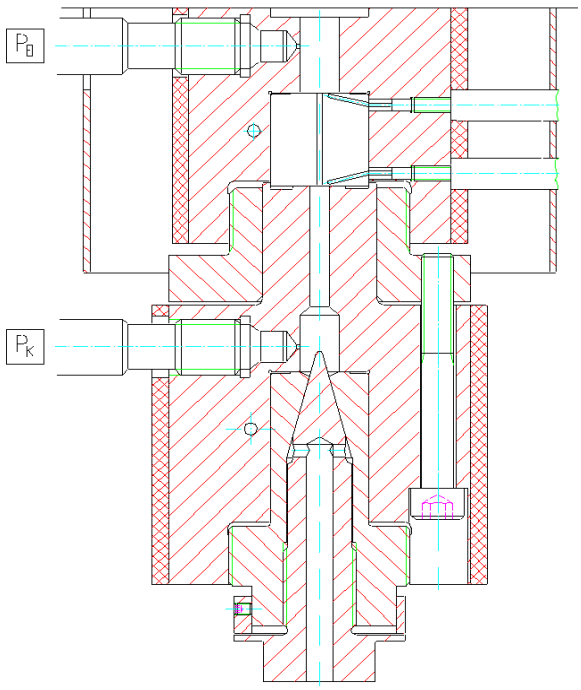
For measurement of PVT-diagrams. Furthermore required are the options **Force Measurement** and **Test Piston with Teflon Ring** or **Test Piston with HP sealing**.
At the 2-barrel system can be used only one test barrel for the PVT measurement.
Supplied accessories: 1 Capillary locking device
1 Support for capillary locking device
1 Arresting clip for piston reception
1 Round hole capillary 25/2 (only for PVT test)

PVT – Set – for Test Chamber Design 1
Article number 5.29.321

PVT - Set – for Test Chamber Design 2
Article number 5.29.372

Counter Pressure Chamber

Determination of the pressure influence on the viscosity function.



Polymers are disposed to high pressures within processing machinery. The pressure has a considerable influence on the viscosity function and causes non neglect able changes in viscosity. The phenomena could not be analyzed by previous simple testing methods. For that reason the counter pressure chamber has been developed as an optional device for capillary rheometers to determine data for process simulations, especially for processing at high pressures like for example melt pumps, injection moulding, extrusion dies, tests for the changed wall slipping in the extruder etc.

The pressure influence on viscosity function

The consideration of pressure influence on viscosity is insufficient. Because capillary rheometer testing is favourably suited to evaluate process relevant data, the counter pressure chamber was developed as an option for the Rheograph 25.

A mean variable pressure $P_m = \frac{P_{entrance} + P_{chamber}}{2}$ is generated by the counter pressure chamber inside the pressure chamber causing a change in viscosity.

Counter pressure chamber for Test Chamber Design 1

For Pressure transducer 1/2“-20 UNF up to 400 ℃

Article number 5.29.373

Counter pressure chamber for Test Chamber Design 2

For Pressure transducer 1/2“-20 UNF up to 400 ℃

Article number 5.29.374

Die swell tester, high resolution

Directly below the test chamber.

To determine the static and dynamic die swell by measuring the diameter of the extruded strand.

Consisting of:

- Laser measuring head: laser unit class 2 (630-680nm, power < 1 mW)
  Resolution 0,1 µm
  Operating range 32 mm, measuring range 0,2 up to 32 mm, repeatability ± 0,2 µm
- Swivelling arm with adjustable height for reception of laser measuring head and melt cutting unit. Adjustment range: approx. 80 mm.

Power supply and data acquisition by means of the instrument.

At the 2 barrel-system can be used only one test barrel for the die swell testing.
Article number 5.29.375

Die swell tester, low resolution

Directly below the test chamber.
To determine the static and dynamic die swell by measuring the diameter of the extruded strand.
Consisting of:
- Laser measuring head: Laser diode class 1 (780nm)
  Resolution 7 µm
  Operating range 28 mm, measuring range 0,15 up to 28 mm, repeatability ± 14 µm
- Swivelling arm with adjustable height for reception of laser measuring head and melt cutting unit. Adjustment range: approx. 80 mm.

Power supply and data acquisition by means of the instrument.
At the 2 barrel-system can be used only one test barrel for the die swell testing.
Article number 5.29.376

Melt Cutting Unit with Pneumatic Drive

The melt cutting unit is an additional option to the die swell tester with **high** resolution (5.29.375), which helps to achieve a better reproducibility of the test data.
The pneumatic driven melt cutting unit is used for cutting off the out-flowing melt strand. The construction of the melt cutting unit is based on two counter-running knifes which work like scissors.
Article number 5.29.377

Melt Cutting Unit with Pneumatic Drive

The melt cutting unit is an additional option to the die swell tester with **low** resolution (5.29.376), which helps to achieve a better reproducibility of the test data.
The pneumatic driven melt cutting unit is used for cutting off the out-flowing melt strand. The construction of the melt cutting unit is based on two counter-running knifes which work like scissors.
Article number 5.29.378

Sliding table for RHEOTENS

For reception of the RHEOTENS equipment
(RHEOTENS see separate product description)
Article number 5.29.325

Nitrogen Purge Unit (Single Barrel system)

To attach to the feeding bore of the test chamber of RHEOGRAPH 25.
Consisting of a capillary ring with connection part for the nitrogen gas.
The testing material has to be conditioned and fed by the customer.
Article number 5.29.379

Nitrogen Purge Unit (2-Barrel system)

To attach to the feeding bore of the test chamber of RHEOGRAPH 25.
Consisting of a capillary ring with connection part for the nitrogen gas.
The testing material has to be conditioned and fed by the customer.
Article number 5.29.380

If you want to use a slit capillary, then you need the following options:
Slit capillary – basic part; slit capillary – slit height 0,5 and/or 1 and/or. 2 mm and a heater element.
Please note that in principle the slit capillary is not suitable for all materials. Furthermore, the accessible shear rate range of the slit capillary is limited compared to the accessible shear rate range of the round hole capillaries.

Slit Capillary

Only for Test Chamber Design 1 (1 - Barrel)
The slit capillary can be equipped with 3 pressure transducers and 2 thermocouples, iron-constantan, for test temperature measurement. With the slit capillary the pressure difference is determined with the following equation:

$$\Delta P = Pent - Pexi$$

Pbef :Test pressure before the capillary
Pent :Test pressure in the inlet of capillary
Pmid :Test pressure in the middle of capillary
Pexi :Test pressure in the outlet of capillary

By means of pressure transducer Pmid (option) it is possible to say whether the viscosity of the material is dependent on pressure or not. The viscosity is pressure dependent, if the pressure decrease of the capillary is non-linear. Furthermore, when using Pmid the elastic pressure loss at the inlet ΔPe can be more accurately calculated.

The real shear stress is calculated with the pressure difference ΔP under consideration of the gap width and the distance of the pressure transducer.
The direct acquisition of the real wall shear stress with the slit capillaries saves a lot of time compared to several tests with round hole capillaries and following Bagley correction.

Dimensions of slit capillary:
Slit width: 10 mm; Slit height: 0,5 mm, 1 mm or 2 mm; Slit length: 100 mm; Inlet length: 30 mm; Outlet length: 20 mm
Distance of pressure transducer: Pent - Pexi: 50 mm
Pent - Pmid: 25 mm
Pmid- Pexi: 25 mm
Thread: ½“–20 UNF

Slit capillary
Basic part
Article number 5.29.381

Slit capillary
Capillary part with 0,5 mm slit height.
Article number 5.29.382

Slit capillary
Capillary part with 1,0 mm slit height.
Article number 5.29.383

Slit capillary
Capillary part with2,0 mm slit height
Article number 5.29.384

Heater element up to operation temperature 400 °C

With reflector jacket for slit capillary.
Article number 5.29.385

Heater element up to operation temperature 500 °C

With Reflector jacket for slit capillary.
Article number 5.29.386

Thermocouple for Slit Capillary

Thermocouple with holder and socket suitable for slit die for measuring the melt temperature.
Length: 75 mm Diameter: 1 mm Type: iron-constantan
Article number 5.13.650

Shark Skin Option

For detection of flow instabilities (Shark-Skin-Phenomena).
Comprising of slit die 30/3/0.3 mm, heater element and 3 pressure sensors for high frequency measurements up to 10 kHz, measuring range 2000 bar as well as evaluation software.
Article number 5.19.255

Cleaning Devices

With the following mentioned cleaning devices the cleaning of the test barrel can be simplified and done in a more effective way:

Pneumatic Cleaning Device

Together with the cleaning set the cleaning of test barrel can be done much quicker and easier with the pneumatic cleaning device:
The device requires an air supply of 4 - 6 bar. The compressed-air supply has to be oiled and free of water.
Supplied accessories: 1 Quick closure coupling for connection of air hose NW 9
1 Extension hose
Article number 5.11.082

Battery Operated Cleaning Device

Together with the cleaning set the cleaning of test barrel can be done much quicker and easier with the battery operated cleaning device:
Technical data: 9,6V nominal voltage
0-800 min^{-1} idle rotation speed
335mm whole length
Right / left run
Overload protection
Weight 1,3 kg

Supplied accessories: 1 battery charger 230 V
2 additional batteries 9,6V; 1300 mAh
1 coupling 5.11.155
Article number 5.11.160

Cleaning set
Consisting of steel brush and cleaning piston for the cleaning of test barrel with respectively one hinge part for the pneumatic cleaning device and the battery cleaning device.

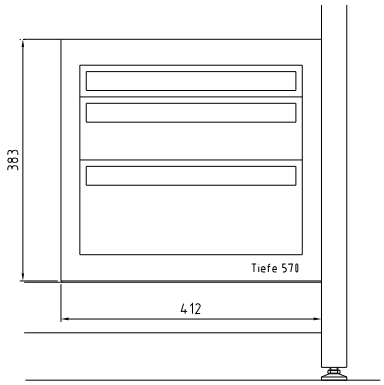
Cleaning set for 12 mm Test barrel
Article number 5.11.136

Cleaning set for 15 mm Test barrel
Article number 5.11.137

Cleaning set for 20 mm Test barrel
Article number 5.11.144

Cleaning set for 25 mm Test barrel
Article number 5.11.161

Machine table
For reception of the Rheograph. The Rheograph is screwed tight with the machine table. The table is made of anodized aluminium beams
Width: 920 mm, Depth: 700 mm, Height: 620 mm
Article number 5.29.087

Drawer for machine table


Robust drawer made of powder coated steel plate (RAL 7042) with 3 drawers 50 mm, 100 mm and 150 mm height. The drawer is screwed to the right of the machine table.
The drawers are equipped with maintenance-free ball beard pullouts (85% pullout depth) and have a bearing capacity of up to 50 kg. They are laid with sliding protective mats and are variable in space allocation inside. Marking inserts in the handle strip enable an individual marking of the single drawers. The drawer can be closed through the central locking.
Article number 5.29.295

PC Table
For reception of the Personal Computer (PC) and printer.
With 6-fold multiple socket for 220 V supply voltage.
Width: 920 mm, Depth: 700 mm, Height: 650 mm
Bestell Nummer 5.29.086

Printer
Each Windows compatible printer can be used. We offer optionally following type of printer.

Printer EPSON (current Type) Incl. USB printer cable
Article number 8.94.043

❑

RHEOGRAPH 25

Short text for quotation, confirmation, delivery note and bill.

Article number	Naming
5.29.000	**Rheograph 25** Basic instrument
5.29.005	**Power supply 3 x 400V ~ 50 Hz / 3L + N + PE**
5.29.006	**Power supply 3 x 230V ~ 60 Hz / 3L + PE without N**
5.29.003	**English Version** Marking and user manual in English
5.29.001	**German Version** Marking and user manual in German
5.29.004	**English User Information** One user manual is by standard supplied with the basic instrument.
5.29.002	**German User Information** One user manual is by standard supplied with the basic instrument.
5.29.336	**Test Chamber Design 1 (Single Barrel system)**
5.29.337	**Test Barrel Set for ∅ 12 mm**
5.29.338	**Test Barrel Set for ∅ 12 mm - corrosion resistant**
5.29.339	**Test Barrel Set for ∅ 12 mm – with rolled-in Stainless steel pipe**
5.29.340	**Test Barrel Set for ∅ 15 mm**
5.29.341	**Test Barrel Set for ∅ 15 mm - corrosion resistant**
5.29.342	**Test Barrel Set for ∅ 15 mm – with rolled-in Stainless steel pipe**
5.29.343	**Test Barrel Set for ∅ 20 mm**
5.29.344	**Test Barrel Set for ∅ 20 mm - corrosion resistant**
5.29.345	**Test Barrel Set for ∅ 20 mm – with rolled-in Stainless steel pipe**
5.29.346	**Test Barrel Set for ∅ 25 mm**
5.29.347	**Test Barrel Set for ∅ 25 mm - corrosion resistant**

5.29.348 Test Barrel Set for ∅ 25 mm – with rolled-in Stainless steel pipe

5.29.310 Heating up to 400℃ for Test barrel set St andard and corrosion resistant

5.29.352 Heating up to 400℃ for Test barrel set wi th rolled-in Stainless steel pipe

5.29.357 Heating up to 500℃ for Test barrel set St andard and corrosion resistant

5.29.354 Heating up to 500℃ for Test barrel set wi th rolled-in Stainless steel pipe

5.29.247 Capillary Block up to 400℃

5.29.356 Capillary Block up to 400℃ with rolled-in Stainless steel pipe

5.29.357 Capillary Block up to 500℃

5.29.358 Capillary Block up to 500℃ with rolled-in Stainless steel pipe

5.09.101 Test Piston ∅ 12 mm

5.09.224 Test Piston ∅ 12 mm corrosion resistant

5.12.116 Test Piston ∅ 12 mm with Teflon ring

5.12.192 Test Piston ∅ 12 mm with HP sealing

5.09.102 Test Piston ∅ 15 mm

5.09.225 Test Piston ∅ 15 mm corrosion resistant

5.12.175 Test Piston ∅ 15 mm with Teflon ring

5.12.408 Test Piston ∅ 15 mm with HP sealing

5.11.150 Test Piston ∅ 20 mm

5.09.226 Test Piston ∅ 20 mm corrosion resistant

5.12.179 Test Piston ∅ 20 mm with Teflon ring

5.12.198 Test Piston ∅ 20 mm with HP sealing

5.09.230 Test Piston ∅ 25 mm

5.09.227 Test Piston ∅ 25 mm corrosion resistant

5.09.231 Test Piston ∅ 25 mm with Teflon ring

5.09.235 Test Piston ∅ 25 mm with HP sealing

5.29.091 Test Piston reception without Force transducer for 25 kN

5.29.092 Test Piston reception with Force transducer for 25 kN

5.29.093 Test Piston holder 25 kN-Design ∅ 12/15

5.29.094 Test Piston holder 25 kN-Design ∅ 20/25

4.23.271 Capillary L/D = 30/0,5

4.23.353 Capillary L/D = 20/0,5

4.23.352 Capillary L/D = 15/0,5

4.23.351 Capillary L/D = 10/0,5

4.23.350 Capillary L/D = 5/0,5

4.23.272 Capillary L/D = 30/1

4.23.274 Capillary L/D = 20/1

4.23.365 Capillary L/D = 15/1

4.23.270 Capillary L/D = 10/1

4.23.355 Capillary L/D = 5/1

4.23.273 Capillary L/D = 30/2

4.23.279 Capillary L/D = 20/2

4.23.278 Capillary L/D = 10/2

4.23.356 Capillary L/D = 5/2

4.23.359 Capillary L/D = 40/1

5.13.844 Capillary nut for Capillary 40 mm Length

5.29.360 Test Chamber Design 2 (Multi-Barrel system)

5.29.309 Test Barrel Set for 2x ∅ 12 mm

5.29.361 Test Barrel Set for 2x ∅ 12 mm - corrosion resistant

5.29.362 Test Barrel Set for 2x ∅ 12 mm – with rolled-in Stainless steel pipe

5.29.363 Test Barrel Set for 2x ∅ 15 mm

5.29.364 Test Barrel Set for 2x ∅ 15 mm - corrosion resistant

5.29.365 Test Barrel Set for 2x ∅ 15 mm – with rolled-in Stainless steel pipe

5.29.366 Test Barrel Set for 1x ∅ 12 mm, 1x ∅ 15 mm

5.29.367 Test Barrel Set for 1x ∅ 12 mm, 1x ∅ 15 mm - corrosion resistant

5.29.368 Test Barrel Set for 1x ∅ 12 mm, 1x ∅ 15 mm – with rolled-in Stainless steel pipe

5.29.311 Heating up to 400℃ for Test barrel set St andard and corrosion resistant

5.29.369 Heating up to 400℃ for Test barrel set wi th rolled-in Stainless steel pipe

5.29.370 Heating up to 500℃ for Test barrel set St andard and corrosion resistant

5.29.371 Heating up to 500℃ for Test barrel set wi th rolled-in Stainless steel pipe

5.09.101 Test Piston ∅ 12 mm

5.09.224 Test Piston ∅ 12 mm corrosion resistant

5.12.116 Test Piston ∅ 12 mm with Teflon ring

5.12.192 Test Piston ∅ 12 mm with HP sealing

5.09.102 Test Piston ∅ 15 mm

5.09.225 Test Piston ∅ 15 mm corrosion resistant

5.12.175 Test Piston ∅ 15 mm with Teflon ring

5.12.408 Test Piston ∅ 15 mm with HP sealing

5.29.095 Force transducer 25 kN

5.29.096 Blind plug

4.23.681 Capillary L/D = 30/0,5

4.23.680 Capillary L/D = 20/0,5

4.23.679 Capillary L/D = 15/0,5

4.23.678 Capillary L/D = 10/0,5

4.23.677 Capillary L/D = 5/0,5

4.23.676 Capillary L/D = 2,5/0,5

4.23.675 Capillary L/D = 0/0,5

4.23.686 Capillary L/D = 30/1

4.23.655 Capillary L/D = 20/1

4.23.685 Capillary L/D = 15/1

4.23.684 Capillary L/D = 10/1

4.23.683 Capillary L/D = 5/1

4.23.682 Capillary L/D = 2,5/1

4.23.654 Capillary L/D = 0/1

4.23.691 Capillary L/D = 30/2

4.23.690 Capillary L/D = 20/2

4.23.689 Capillary L/D = 10/2

4.23.688 Capillary L/D = 0/2

4.23.687 Capillary L/D = 40/1

4.23.692 Capillary L/D = 40/2

5.13.507 Capillary nut for Capillary 40 mm Length

8.81.182 Test pressure transducer 0 – 2000 bar, Quality class I up to 400 °C

8.81.181 Test pressure transducer 0 – 1400 bar, Quality class I up to 400 °C

8.81.188 Test pressure transducer 0 – 1000 bar, Quality class I up to 400 °C

8.81.187 Test pressure transducer 0 – 700 bar, Quality class I up to 400 °C

8.81.180 Test pressure transducer 0 – 500 bar, Quality class I up to 400 °C

8.81.186 Test pressure transducer 0 – 200 bar, Quality class I up to 400 °C

8.81.185 Test pressure transducer 0 – 100 bar, Quality class I up to 400 °C

8.81.184 Test pressure transducer 0 – 50 bar, Quality class I up to 400 °C

8.81.183 Test pressure transducer 0 – 20 bar, Quality class I up to 400 °C

8.81.399 Test pressure transducer 0 – 2000 bar, Quality class I up to 500 °C

8.81.398 Test pressure transducer 0 – 1400 bar, Quality class I up to 500 °C

8.81.397 Test pressure transducer 0 – 1000 bar, Quality class I up to 500 °C

8.81.396 Test pressure transducer 0 – 700 bar, Quality class I up to 500 °C

8.81.395 Test pressure transducer 0 – 500 bar, Quality class I up to 500 °C

8.81.394 Test pressure transducer 0 – 200 bar, Quality class I up to 500 °C

8.81.393 Test pressure transducer 0 – 100 bar, Quality class I up to 500 °C

8.81.392 Test pressure transducer 0 – 50 bar, Quality class I up to 500 °C

8.81.391 Test pressure transducer 0 – 20 bar, Quality class I up to 500 °C

5.13.650 Thermocouple for Test Chamber Design 1

5.13.679 Thermocouple for Test Chamber Design 2

5.29.387 Thermo-voltage-module

5.13.862 Thermal conductivity sensor ∅ 15 mm

5.13.863 Thermal conductivity sensor ∅ 20 mm

5.29.658 Electronics for thermal conductivity

5.29.321 PVT set for Test Chamber Design 1

5.29.372 PVT set for Test Chamber Design 2

5.29.373 Counter pressure chamber for Test Chamber Design 1

5.29.374 Counter pressure chamber for Test Chamber Design 2

5.29.375 Die swell tester, high resolution

5.29.376 Die swell tester, low resolution

5.29.377 Melt cutting unit with pneumatic drive
additional option to the die swell tester with high resolution

5.29.378 Melt cutting unit with pneumatic drive
additional option to the die swell tester with low resolution

5.29.325 Sliding table for RHEOTENS

5.29.379 Nitrogen Purge Unit (Single Barrel system)

5.29.380 Nitrogen Purge Unit (2-Barrel system)

5.29.381 Slit capillary basic part

5.29.382 Slit capillary 0,5 mm Slit height

5.29.383 Slit capillary 1 mm Slit height

5.29.384 Slit capillary 2 mm Slit height

5.29.385 Heater element up to operation temperature 400℃ for Slit capillary

5.29.386 Heater element up to operation temperature 500℃ for Slit capillary

5.13.650 Thermocouple for Slit capillary

5.19.255 Shark Skin Option

5.11.082 Pneumatic Cleaning Device

5.11.160 Battery Operated Cleaning Device

5.11.136 Cleaning set for 12 mm Test barrel

5.11.137 Cleaning set for 15 mm Test barrel

5.11.144 Cleaning set for 20 mm Test barrel

5.11.161 Cleaning set for 25 mm Test barrel

5.29.087 Machine table

5.29.089 PC table

5.29.295 Drawer for machine table

8.94.043 Printer with USB cable

❑