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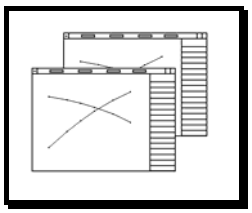
GÖTTFERT®
WERKSTOFF-PRÜFMASCHINEN GMBH



RHEO-TESTER 2000

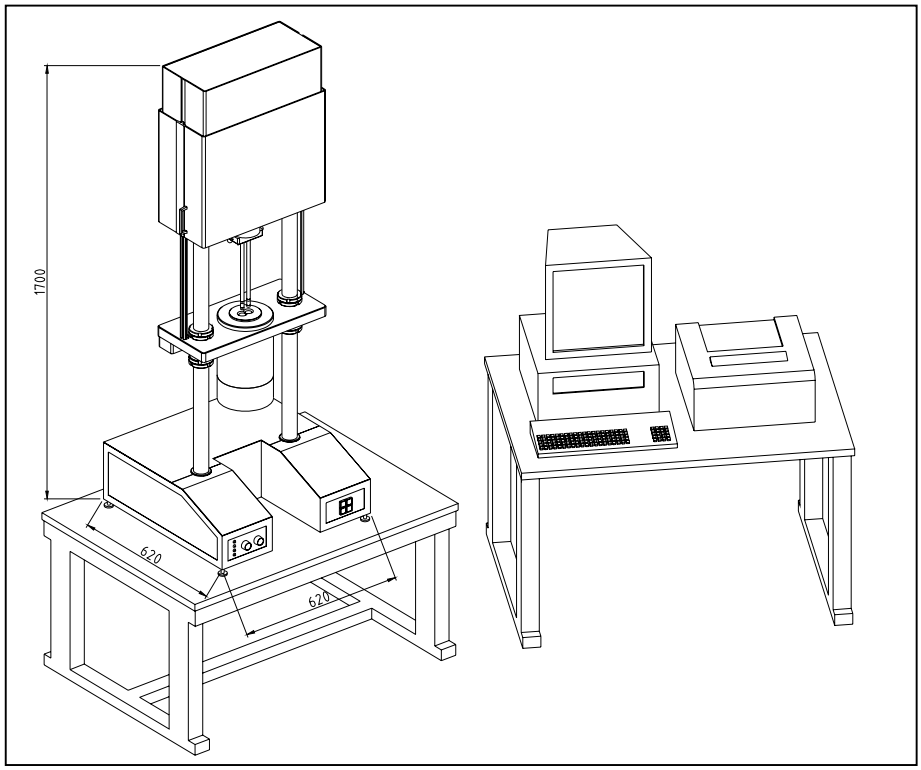
Single-bore or dual-bore-system, with Windows user interface

The RHEO-TESTER 2000 is a new, table-top High-Pressure Capillary Rheometer according to DIN 54811, ASTM D 3835, ISO 11443 to determine the flow behaviour and viscosity of thermoplastics and rubbers.

The RHEO-TESTER 2000 is used in the field of research and development as well as for quality control and inspection of incoming goods.

RHEO-TESTER 2000 has following features:

- Single-bore or dual-bore-system
- Presetting, measurement control and evaluation via the Windows programme WinRHEO 32bit or WebRheo (see separate product description)
- Microprocessor system for data acquisition
- Electronics are now based on the modular CAN-Bus system
- Temperature controller with max. 4 heater circuits with own microprocessor
- Electrically heated test chamber with easy interchangeable test barrels
- Every bore can make use of one pressure transducer and / or one force transducer
- Operation mode “Constant speed“: presetting of max. 20 values for test piston speed, determination of melt pressure (alternatively force)
- Operation mode “Constant pressure“: presetting of max. 20 values for melt pressure (alternatively force) , determination of test piston speed
- Determination of the apparent and true shear stress, by real test pressure measurement
- Test data storage and presetting of the next value is done automatically, after stabilisation of the test data (e.g. stationary flow)
- Die swell measurement



Picture: Total view RHEO-TESTER 2000 with PC, printer and special table

The RHEO-TESTER 2000 consists of following components:

Frame

The machine body of RHEO-TESTER 2000 is designed with a stable column type frame construction in order to cope with the high test forces. Test chamber, CAN-bus-electronics and test piston drive are located separately.

Test piston drive

The piston is driven by a high quality Precision Screw Jack that is generally maintenance free and powered by a stepper motor drive.

Protection hood

The protection hood is made of Plexiglas for covering the dangerous area, according to VBG4, around the test piston. For cleaning and feeding of test barrel, the protection hood can be moved upwards. The test piston cannot be driven downwards until the protection hood is closed.

Temperature controller

The temperature control is done via a microprocessor-controlled temperature controller with up to 4 heater circuits for a range of 60 - 400.0 ° C (extended range up to 500 ° C, see options). The set temperatures are preset via the PC. The actual value is displayed on the PC-monitor with a resolution of 0.1 ° C.

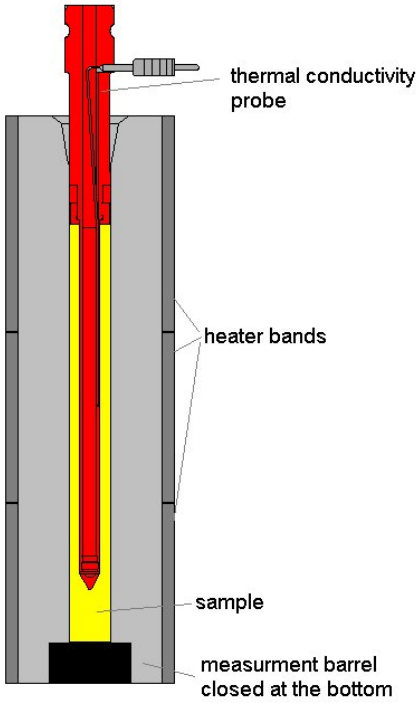
Temperature- , Pressure- and Force measurement

Data is fed into the special CAN-Bus system amplifiers (see list of options for specifics).

Thermal conductivity measurement

A good value option for the capillary rheometer

Similar example:
See RHEOGRAPH 6000 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 Rheotester 2000 and Rheograph 6000 is a good value option.

Thermal conductivity probe
The thermal conductivity measurement probe can be integrated into a single or triple 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.

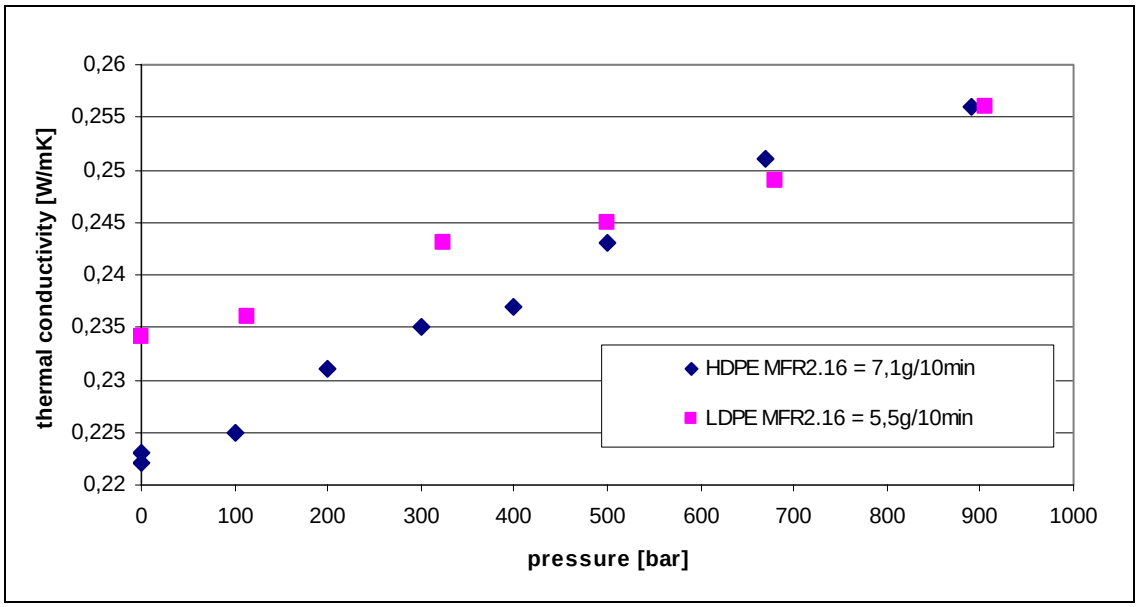


Figure 1: Effect of pressure on thermal conductivity of different PE types

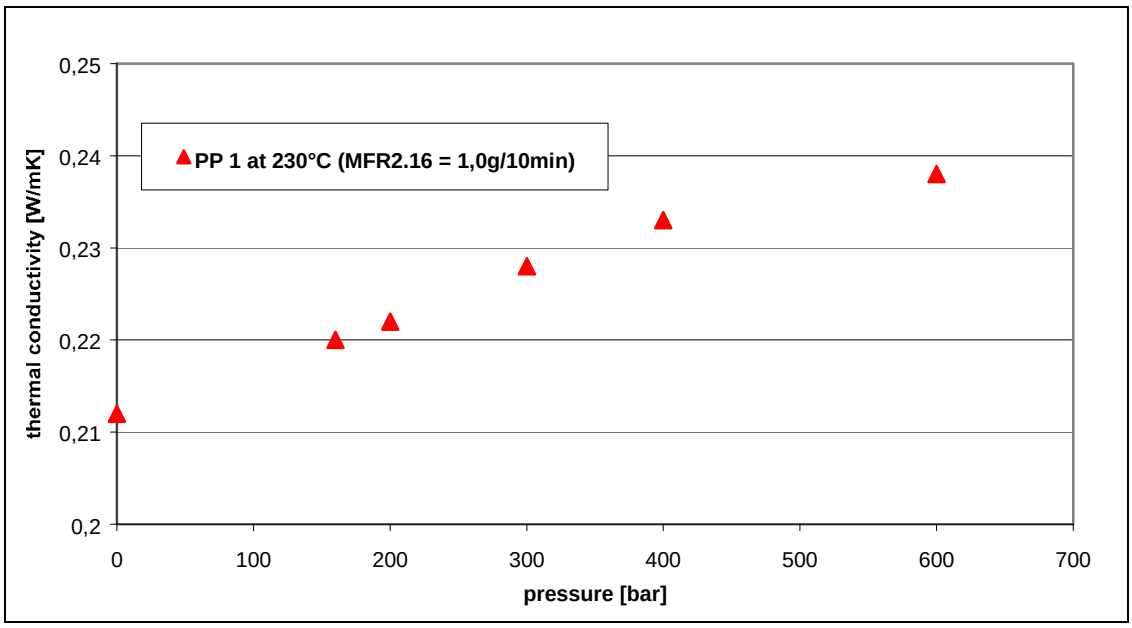


Figure 2: Pressure influence on thermal conductivity on PP

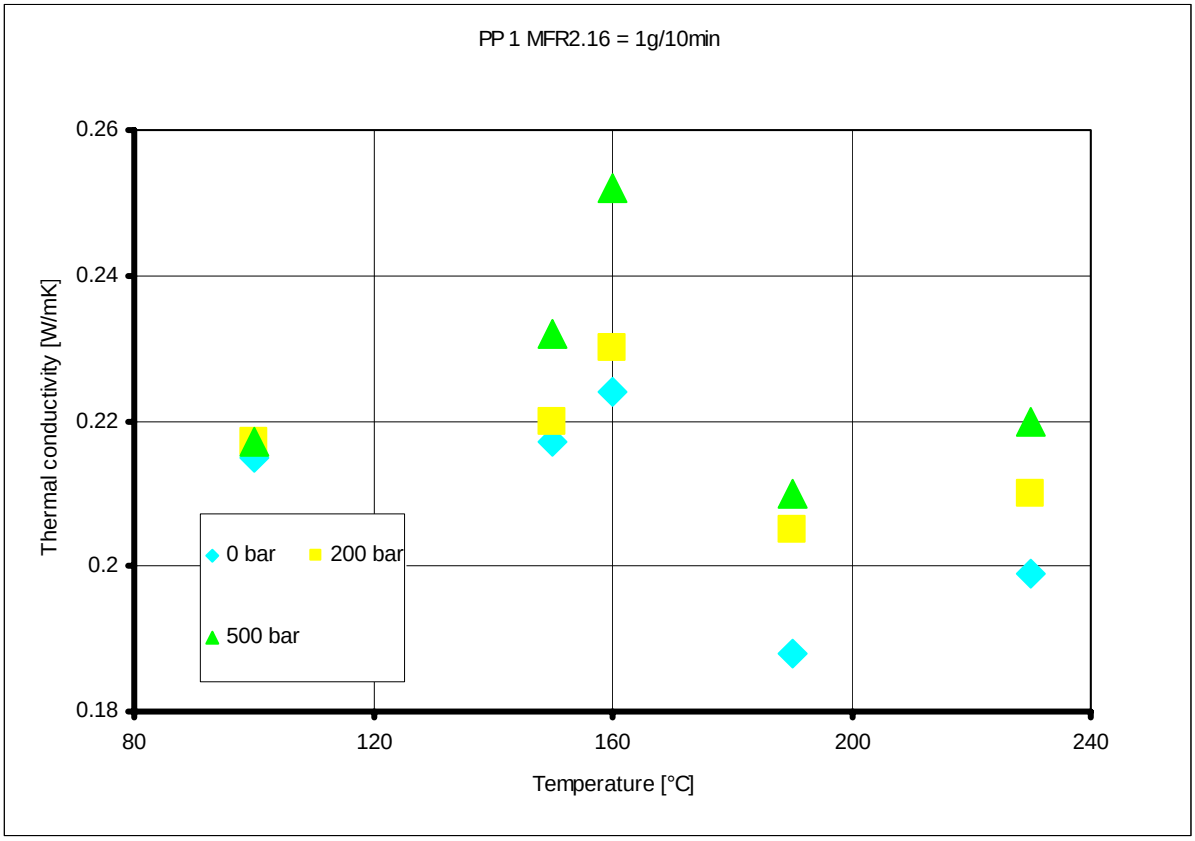


Figure 3: Temperature influence on thermal conductivity on PP

Technical data

Test chamber:
3 heater circuits, electrically heated, temperature transducer PT 100 1/3 DIN
Temperature variation over time in usable range: less than ± 0.2 ° C
Spatial temperature distribution in usable range:
60 up to 300 ° C: ± 0.5 ° C
301 up to 400 ° C: ± 1.0 ° C

Temperature controller:
One temperature controller for the controlling of up to 4 heater circuits with its own microprocessor.

Preset temperature value:
On the PC from 060.0 - 400.0 ° C
(extended range up to 500.0 ° C, see options)

Display of actual temperature:
000.0 - 500.0 ° C on the PC-monitor

Accuracy of Temperature Measurement:
0.1°C

Test barrel:
9.55 + 0.01 mm diameter, length 270 mm
12.0 + 0.01 mm diameter, length 270 mm

Test piston:
9.54 - 0.01 mm diameter, 285 mm length
11.99 - 0.01 mm diameter, 285 mm length

Capillary:
see options

Speed range:
Lowest test speed:
Highest test speed:
Resolution:
1 : 400 000
0.00005 mm/s
20 mm/s
0.00008 mm/step

Test Force:

Single-bore-system	Dual-bore-system
20 kN up to 8mm/s	10 kN up to 8mm/s
15 kN 8 to 12 mm/s	7.5 kN 8 to 12 mm/s
9 kN 12 to 15 mm/s	4.5kN 12 to 15 mm/s
6 kN 15 to 20 mm/s	3 kN 15 to 20 mm/s

Special Remark:
For safety reasons, the 9.55 mm measurement system may only be used up to a maximum of 12kN

Maximum Test Pressure:
9.55 mm measuring system: 1670 BAR (or 24221 PSI)
12 mm measuring system: 1770 BAR (or 25671 PSI)

Force transducer (option):
Nominal range: 20 kN measuring error < ± 0.02 % of nominal range*
20 kN measuring error < ± 0.02 % of nominal range *
(for dual-bore-system)
* sum of errors of non-linearity and hysteresis

Melt pressure transducer:
Max. 2 transducers can be installed.
Technical data, see options

Shear Rates (s^{-1}):

		Shear Rates (s^{-1}) at piston speed 0,00005 mm/s	20 mm/s
Capillary ⦰ mm	**System ⦰ (mm)**	**Min. shear rate**	**Max. shear rate**
0,1	9,5	36,1	1,444E+07
0,3	9,5	1,337	5,348E+05
0,5	9,5	0,288	1,155E+05
1	9,5	0,0361	1,444E+04
2	9,5	0,004513	1,805E+03
4	9,5	0,0005640	2,256E+02
6	9,5	0,00016713	6,685E+01

Capillary ⦰ mm	System ⦰ (mm)	Min. shear rate	Max. shear rate
0,1	12	57,6	2,304E+07
0,3	12	2,133	8,533E+05
0,5	12	0,461	1,843E+05
1	12	0,0576	2,304E+04
2	12	0,0072	2,880E+03
4	12	0,0009	3,600E+02
6	12	0,000267	1,067E+02

Capillary ⦰ mm	System ⦰ (mm)	Min. shear rate	Max. shear rate
0,1	15	90	3,600E+07
0,3	15	3,33	1,333E+06
0,5	15	0,72	2,880E+05
1	15	0,09	3,600E+04
2	15	0,01125	4,500E+03
4	15	0,001406	5,625E+02
6	15	0,00041667	1,667E+02

Power supply:	see options
Electrical connections:	1 serial connection for PC
Ambient temperature:	+ 10 up to + 40 ° C
Air humidity:	max. 90 % not-condensing
Dimensions:	Width: 620 mm, depth: 620 mm, height: 1700 mm
Weight:	approx. 200 kg

Finish

Hood cover: pastel orange RAL 2003
Front and cover plate: beige-mat
Frame: grey-brown RAL 8019

Göttfert GmbH provides full warranty for machines that have been supplied as complete system that means with PC and printer by Göttfert. 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-Göttfert supply).

If the customer provides the PC by himself, Göttfert cannot guarantee the troublefree functioning of PC and Göttfert 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 Göttfert. Support for possible adjustments will be charged on an actual expense basis.

Accessories

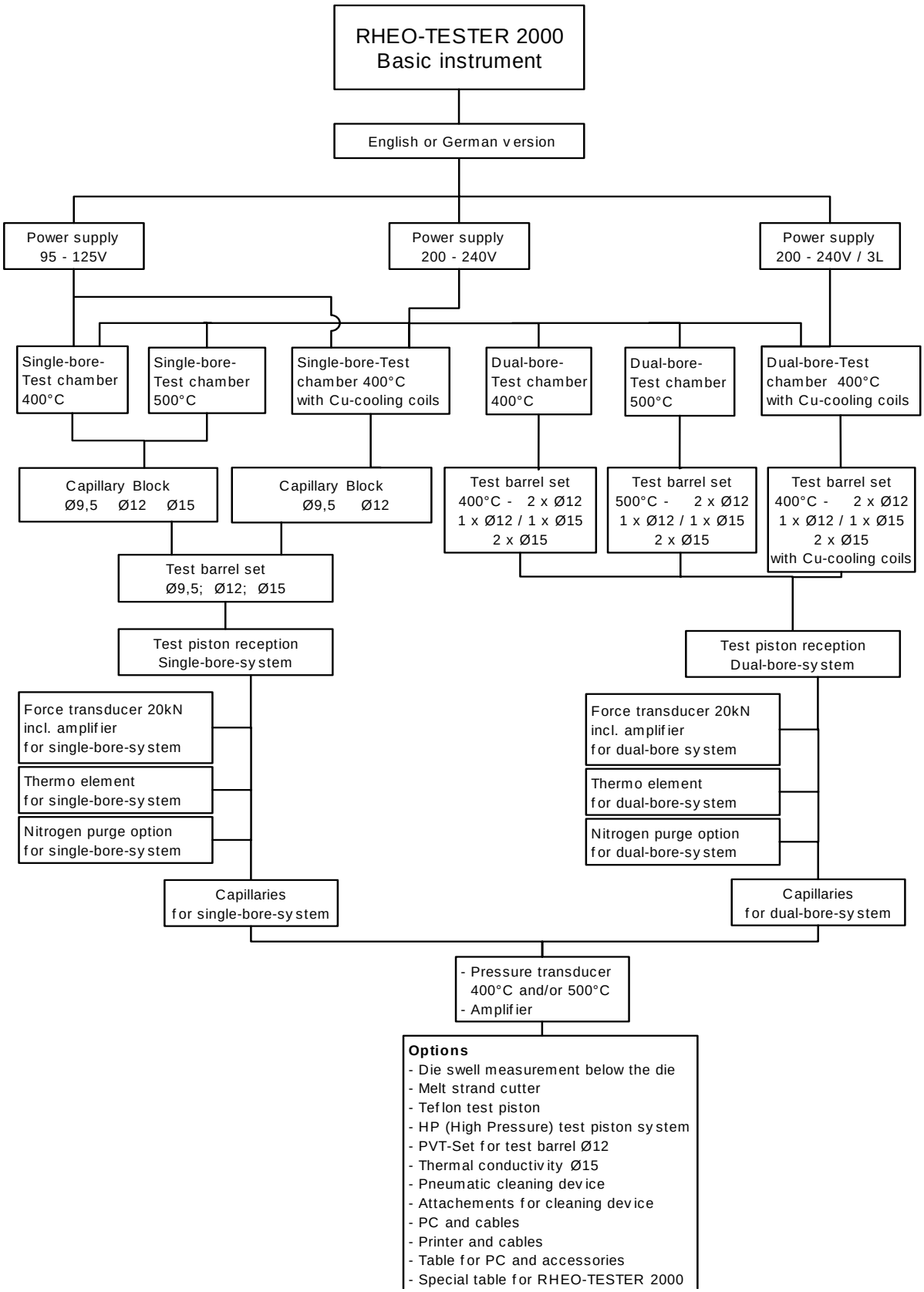
1 Operating manual
2 Keys for main switch
1 Cover disk
1 Mirror for magnetic base
1 Feeder
1 Cleaning tool for pressure transducer with bore M18 x 1.5
1 Tube graphite paste
1 Set fuses
1 Set wrenches
1 Pair of tweezers
1 Brass brush

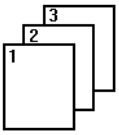
Please pay attention to the fact that the RHEO-TESTER 2000 is equipped with microprocessors. In order to guarantee a trouble free operation, the power supply must be free of interferences. Should there occur any interference you have to connect line filters or mains stabilisers on line side.

RHEO-TESTER 2000

Basic instrument
Order number 5.19.000

On the next page, please find a table showing the versions of RHEO-TESTER 2000 with the possible options.


RHEO-TESTER 2000
Basic instrument
English or German version
Power supply
95 - 125V
Power supply
200 - 240V
Power supply
200 - 240V / 3L
Single-bore-
Test chamber
400°C
Single-bore-
Test chamber
500°C
Single-bore-Test
chamber 400°C
with Cu-cooling coils
Dual-bore-
Test chamber
400°C
Dual-bore-
Test chamber
500°C
Dual-bore-Test
chamber 400°C
with Cu-cooling coils
Capillary Block
Ø9,5 Ø12 Ø15
Capillary Block
Ø9,5 Ø12
Test barrel set
400°C - 2 x Ø12
1 x Ø12 / 1 x Ø15
2 x Ø15
Test barrel set
500°C - 2 x Ø12
1 x Ø12 / 1 x Ø15
2 x Ø15
Test barrel set
400°C - 2 x Ø12
1 x Ø12 / 1 x Ø15
2 x Ø15
with Cu-cooling coils
Test barrel set
Ø9,5; Ø12; Ø15
Test piston reception
Single-bore-system
Test piston reception
Dual-bore-system
Force transducer 20kN
incl. amplifier
for single-bore-system
Thermo element
for single-bore-system
Nitrogen purge option
for single-bore-system
Force transducer 20kN
incl. amplifier
for dual-bore system
Thermo element
for dual-bore-system
Nitrogen purge option
for dual-bore-system
Capillaries
for single-bore-system
Capillaries
for dual-bore-system
- Pressure transducer
400°C and/or 500°C
- Amplifier
Options
- Die swell measurement below the die
- Melt strand cutter
- Teflon test piston
- HP (High Pressure) test piston system
- PVT-Set for test barrel Ø12
- Thermal conductivity Ø15
- Pneumatic cleaning device
- Attachements for cleaning device
- PC and cables
- Printer and cables
- Table for PC and accessories
- Special table for RHEO-TESTER 2000



Options

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

- **Power Supply**
- **English Version** or **German Version**
- **Test Chamber** (Single- or dual-bore-system)
- **Capillary Block** (Single-or dual-bore-system)
- **Test Barrel Set** (Single- or dual-bore-system)
- **Test Piston Reception** (Single- or dual-bore-system)
- **Round Hole Capillary** (Single- or dual-bore-system)
- **Test Pressure Transducer with amplifier for CAN-Bus system**
- **Personal Computer** (separate product description), **Connection Cable**
- **Printer, Printer Cable**

Further supplementary options:

- **Force Measurement** (Single- or dual-bore-system)
- **Thermocouples** (Single- or dual-bore-system)
- **Die Swell below of Test Chamber**
- **Melt Cutting Unit**
- **Nitrogen Purge Unit**
- **Test Piston with Teflon Ring**
- **Test Piston with HP-System Sealing**
- **PVT Sets for Test Barrel Ø 12 mm**
- **Thermal conductivity Ø 15 mm**
- **Pneumatic Cleaning Device**
- **Cleaning Set**
- **Special Table**

Power Supply

Following power supplies are available:

Power Supply 200…240V~ / 1L, N + PE

Voltage:	200…240V~
Permissible voltage fluctuations:	+/- 0%
Frequency:	50 Hz
Power consumption:	approx. 5 kW

Order number 5.19.007

Power Supply 200… 240 V~ / 3L + PE without N

Voltage:	200…240V~
Permissible voltage fluctuations:	+/- 0%
Frequency:	60 Hz
Power consumption:	approx. 5 kW

Order number 5.19.008

Power Supply 95…125V~ / 1L, N + PE
(only for 400°C and single-bore-system)

Voltage:	95…125V~
Permissible voltage fluctuations:	+/- 0%
Frequency:	60 Hz
Power consumption:	approx. 2.7 kW

Order number 5.19.009

Other power supply voltages available on request.

RHEO-TESTER 2000 - language version and user manual:

English Version
Programs and user manual in English.
Order number 5.19.002

German Version
Programs and user manual in German.
Order number 5.19.001

English User Manual
One user manual is by standard supplied with the basic instrument.
Order number 5.19.004

German User Manual
One user manual is by standard supplied with the basic instrument.
Order number 5.19.003

The user manual contains operating manual, technical documentation, program documentation and calculation basis.

Options: Test Chamber Single-Bore-System

The test chambers with 230V heater bands can be ordered with power supply 200...240V~/1L, N+PE or 200...240V~/3L+PE without N .

Test Chamber up to Operating Temperature 400 ° C / 230 V
Order number 5.19.130

Test Chamber up to Operating Temperature 400 ° C / 115 V
Order number 5.19.132

Test Chamber up to Operating Temperature 500 ° C / 230 V
Order number 5.19.133

Test Chamber with Rolled-in Copper Pipes up to Operating Temperature 400 ° C / 230 V
To attach an external cooling device.
Recommended for standard tests at temperatures below 60 ° C and for PVT-measurements in all temperature ranges.
Order number 5.19.134

Test Chamber with Rolled-in Copper Pipes up to Operating Temperature 400 ° C / 115 V
To attach an external cooling device.
Recommended for standard tests at temperatures below 60 ° C and for PVT-measurements in all temperature ranges.
Order number 5.19.135

Capillary Block (Single-Bore-System)

For round hole capillaries up to 30 mm length.
With capillary nut, capillary nut wrench for capillaries and two thermocouple bores.

Capillary Block Ø 9.55 mm
Order number 5.13.165

Capillary Block Ø 12 mm
Order number 5.13.166

Capillary Block Ø 15 mm
Order number 5.13.167

Capillary Block Ø 9.55 mm with Rolled-in Copper Pipes
To attach an external cooling device.
Recommended for standard tests at temperatures below 60 ° C and for PVT-measurements in all temperature ranges.
Order number 5.13.182

Capillary Block Ø 12 mm with Rolled-in Copper Pipes
To attach an external cooling device.
Recommended for standard tests at temperatures below 60 ° C and for PVT-measurements in all temperature ranges.
Order number 5.13.183

Test Barrel Set (Single-Bore-System)

Consisting of test barrel, hardened and polished with inlet piece above and test piston, length of the piston 285 mm.

With cleaning tool, consisting of brass scraper, one cleaning piston for test barrel, one tube brush and one feeding tool.

Test Barrel Set for Ø 9.55 mm
Order number 5.13.162

Test Barrel Set for Ø 12 mm
Order number 5.13.163

Test Barrel Set for Ø 15 mm
Order number 5.13.164

Test Barrel Sets in Very High Corrosion and Wear Resistant Style available

Technical data:
- Steel resistance to rust and acid
- lionitrated approx. 0.15 mm deep
- Surface hardness approx. 1000-1100 HV

Order number ..... please inquire

Test Piston Reception (Single-Bore-System)

Test piston reception (prepared to receive one force transducer) with test piston holder incl. blind plug to insert instead of force transducer.
Order number 5.19.025

Force Measurement (Single-Bore-System)

For additional measurement of test force at the test piston. The sensors are made of stainless steel and are inserted in the test piston reception instead of the blind plug.
The high-precision force transducer stands out for reliable application and high dynamic capacity, extreme long life and very high accuracy of < ± 0.02 % nominal range (sum of errors of non-linearity and hysteresis). Please order one force transducer and one amplifier for his application.

Force Measurement Amplifier
Connecting the transducer to the CAN-Bus system
Order number 8.81.629

Force Measurement 20 kN (Single-Bore-System)
Scope of supply: 1 force transducer 20 kN
Order number 5.13.645

Thermo couple

By means of following thermocouples it is possible to measure the melt temperatures in the inlet of the round hole capillaries. With capillary length of ≥ 30 mm the melt temperature can be measured in the inlet and outlet of the round hole capillaries. Each thermocouple needs a thermovoltage amplifier.

Thermovoltage Amplifier
To amplify the signals of 2 thermocouples via CAN-Bus
Order number 5.19.014

Thermocouple for round hole capillary
Thermocouple with holder and screw, suitable for round hole capillaries to measure the melt temperature.
Length: 75 mm diameter: 1 mm type: Fe-Const.
Order number 5.09.300

Nitrogen Purge Unit

To attach to the feeding bore of the test chamber of RHEO-TESTER 2000.
Consisting of a capillary ring with connection part for the nitrogen gas.
The testing material has to be conditioned and fed by the customer.
Order number 5.19.140

Round Hole Capillaries (Single-bore-system)

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.

Capillary L/D = 30/0.5 = 60
with 0.5 mm diameter, 30 mm length
Order number 4.23.232

Capillary L/D = 20/0.5 = 40
with 0.5 mm diameter, 20 mm length
Order number 4.23.231

Capillary L/D = 15/0.5 = 30
with 0.5 mm diameter, 15 mm length
Order number 4.23.230

Capillary L/D = 10/0.5 = 20
with 0.5 mm diameter, 10 mm length
Order number 4.23.397

Capillary L/D = 5/0.5 = 10
with 0.5 mm diameter, 5 mm length
Order number 4.23.395

Capillary L/D = 2.5/0.5 = 5
with 0.5 mm diameter, 2.5 mm length
Order number 4.23.396

Capillary L/D = 40/1 = 40
with 1 mm diameter, 40 mm length
Order number 4.23.107

Capillary L/D = 30/1 = 30
with 1 mm diameter, 30 mm length
Order number 4.23.235

Capillary L/D = 20/1 = 20
with 1 mm diameter, 20 mm length
Order number 4.23.234

Capillary L/D = 10/1 = 10
with 1 mm diameter, 10 mm length
Order number 4.23.397

Capillary L/D = 5/1 = 5
with 1 mm diameter, 5 mm length
Order number 4.23.398

Capillary L/D = 2.5/1 = 2.5
with 1 mm diameter, 2.5 mm length
Order number 4.23.393

Capillary L/D = 30/2 = 15
with 2 mm diameter, 30 mm length
Order number 4.23.237

Capillary L/D = 20/2 = 10
with 2 mm diameter, 20 mm length
Order number 4.23.236

Capillary L/D = 10/2 = 5
with 2 mm diameter, 10 mm length
Order number 4.23.399

Other round hole capillaries, also with run in angle, or slit dies available on request.

Special Capillary Nut

for round hole capillary up to 40 mm length
Order number 5.13.138

Options: Test Chamber Dual-Bore-System

The option test chamber dual-bore-system can be ordered only with the power supply 200...240V~ / 1L, N+PE or 200...240V~ / 3L + PE without N .

Test chamber

The test chamber will be supplied as a basic unit with the appropriate heating elements for the heating circles 1 and 2, and can be equipped with different test barrels.

Test Chamber up to Operating Temperature 400 ° C
Order number 5.19.100

Test Chamber up to Operating Temperature 500 ° C
Order number 5.19.021

Test Chamber with Rolled-in Copper Pipes up to Operating Temperature 400 ° C
To attach an external cooling device.
Recommended for standard tests at temperatures below 60 ° C.
Order number 5.19.022

Test Barrel Set (Dual-Bore-System)

Consisting of the appropriate capillary block inclusive the heating for the heating circle 3 and two test pistons, length of the piston 285 mm.
With 3 capillary nuts, capillary nut wrenches for capillaries, reflector cover, melt pressure measuring threading and thermocouple threading at the inlet of the capillary.
With cleaning tool, consisting of brass scraper, one cleaning piston for the test barrel, one tube brush and one feeding tool.

Test Barrel Set for 2 x Ø 12 mm - 400 ° C
Order number 5.19.029

Test Barrel Set for 1 x ∅ 12 mm and 1 x ∅ 15 mm up to Operating Temperature 400 °C
The permissible test pressure for the test channel ∅ 15 mm amounts to 1000 bar.
Order number 5.19.165

Test Barrel Set for 2 x ∅ 15 mm up to Operating Temperature 400 °C
The permissible test pressure amounts to 1000 bar.
Order number 5.19.177

Test Barrel Set for 2 x Ø 12 mm - with Rolled-in Copper Pipes up to Operating Temperature 400 ° C
To attach an external cooling device.
Recommended for standard tests at temperatures below 60 ° C.
Order number 5.19.039

Test Barrel Set for 1 x Ø 12 mm and 1 x ∅ 15 mm -with Rolled-in Copper Pipes up to Operating Temperature 400 °C
To attach an external cooling device.
Recommended for standard tests at temperatures below 60 ° C.
The permissible test pressure for the test channel ∅ 15 mm amounts to 1000 bar.
Order number 5.19.179

Test Barrel Set for 2 x Ø 15 mm - with Rolled-in Copper Pipes up to Operating Temperature 400 °C
To attach an external cooling device.
Recommended for standard tests at temperatures below 60 ° C.
The permissible test pressure amounts to 1000 bar.
Order number 5.19.180

Test Barrel Set for 2 x Ø 12 mm - 500 ° C
Order number 5.19.033

Test Barrel Set for 1 x ∅ 12 mm and 1 x ∅ 15 mm up to Operating Temperature 500 °C
The permissible test pressure for the test channel ∅ 15 mm amounts to 1000 bar.
Order number 5.19.181

Test Barrel Set for 2 x ∅ 15 mm up to Operating Temperature 500 °C
The permissible test pressure amounts to 1000 bar.
Order number 5.19.182

Test Barrel Set (Dual-Bore-System) – Corrosion and Wear Resistant Version up to Operating Temperature 400 °C

Consisting of the appropriate capillary block inclusive the heating for the heating circle 3 and two test pistons, length of the piston 285mm.
With 2 capillary nuts, capillary nut wrenches for capillaries, reflector cover, melt pressure measuring threading and thermocouple threading at the inlet of the capillary.

With cleaning tool, consisting of brass scraper, one cleaning piston for the test barrel, one tube brush and one feeding tool.

Technical data:

- Steel resistance to rust and acid
- lionitrated approx. 0.15 mm deep
- Surface hardness approx. 1000-1100 HV

Test Barrel Set– Corrosion and Wear Resistant Version
For 2 x Ø 12 mm
Order number 5.19.158

Test Barrel Set – Corrosion and Wear Resistant Version
For 1 x ∅ 12 mm and 1 x ∅ 15 mm
The permissible test pressure for the test channel ∅ 15 mm amounts to 1000 bar.
Order number 5.19.166

Test Barrel Set – Corrosion and Wear Resistant Version
For 2 x ∅ 15 mm
The permissible test pressure for the test channel ∅ 15 mm amounts to 1000 bar.
Order number 5.19.178

Test Piston Reception

Test piston reception (prepared to receive up to two force transducers) with test piston holder
Incl. 2 blind plugs to insert instead of force transducer.
Order number 5.19.026

Force Measurement

For additional measurement of test force at the test piston. The sensors are made of stainless steel and are inserted in the test piston reception instead of the blind plug.
A separate force measurement can be used for each test piston.

Force Measurement Amplifier
Connecting the transducer to the CAN-Bus system. Every transducer needs one amplifier!
Order number 5.13.629

Force Measurement 20 kN (Dual-Bore-System)
The high-precision force transducer stands out for reliable application and high dynamic capacity, extreme long life and **very high accuracy of ± 0.02 % nominal range** (sum of errors of non-linearity and hysteresis). Please order one force transducer and one amplifier for his application.
Scope of supply: 1 miniature force transducer 20 kN
Order number 5.13.675

Thermo elements

By means of following thermocouples it is possible to measure the melt temperatures in the inlet of the round hole capillaries. Each thermocouple needs a thermo-voltage-amplifier.

Thermovoltage-Amplifier
To amplify the signals of a thermocouple via CAN-Bus
Order number 5.19.014

Thermocouple
Thermocouple with holder and screw, suitable for round hole capillaries to measure the melt temperature. Every capillary can make use of one thermocouple.
Length: 75 mm diameter: 1 mm type: Fe-Const.
Order number 5.13.679

Nitrogen Purge Unit

To attach to the feeding bore of the test chamber of RHEO-TESTER 2000.
Consisting of a capillary ring with connection part for the nitrogen gas.
The testing material has to be conditioned and fed by the customer.
Order number 5.19.023

Round Hole Capillaries (Dual-Bore-System)

Each capillary has a bore hole to receive a thermocouple Fe-Const. to measure the test temperature in the inlet of capillary.
The capillaries consist of a hardened steel jacket with a hard metal insert.

Capillary L/D = 30/0.5 = 60
with 0.5 mm diameter, 30 mm length
Order number 4.23.335

Capillary L/D = 20/0.5 = 40
with 0.5 mm diameter, 20 mm length
Order number 4.23.334

Capillary L/D = 10/0.5 = 20
with 0.5 mm diameter, 10 mm length
Order number 4.23.332

Capillary L/D = 5/0.5 = 10
with 0.5 mm diameter, 5 mm length
Order number 4.23.331

Capillary L/D = 2.5/0.5 = 5
with 0.5 mm diameter, 2.5 mm length
Order number 4.23.330

Capillary L/D = 30/1 = 30
with 1 mm diameter, 30 mm length
Order number 4.23.277

Capillary L/D = 20/1 = 20
with 1 mm diameter, 20 mm length
Order number 4.23.276

Capillary L/D = 10/1 = 10
with 1 mm diameter, 10 mm length
Order number 4.23.275

Capillary L/D = 5/1 = 5
with 1 mm diameter, 5 mm length
Order number 4.23.337

Capillary L/D = 2.5/1 = 2.5
with 1 mm diameter, 2.5 mm length
Order number 4.23.336

Capillary L/D = 1/1 = 1
with 1 mm diameter, 1 mm length
Order number 4.23.348

Capillary L/D = 30/2 = 15
with 2 mm diameter, 30 mm length
Order number 4.23.340

Capillary L/D = 20/2 = 10
with 2 mm diameter, 20 mm length
Order number 4.23.339

Capillary L/D = 10/2 = 5
with 2 mm diameter, 10 mm length
Order number 4.23.338

Other capillaries, also with run in angle, available on request.

Options: Single- or Dual-Bore-System

Pressure Transducers

In order to measure the test pressures, it is necessary to use CAN-Bus capable pressure transducers. These can be order from GOETTFERT. Other products may or may not work, but if used, have to be tuned by a GOETTFERT service technician to work accurately.

The pressure transducers are calibrated due to a defined procedure which guarantees an accuracy below ± 0,2 % of end value.

Test Pressure Transducer 0 - 2000 bar, Class I up to 400 ° C
With amplifier for CAN-Bus system.
Thread: M18 x 1.5
Order number 8.81.168

Test Pressure Transducer 0 - 1000 bar, Class I up to 400 ° C
With amplifier for CAN-Bus system.
Thread: M18 x 1.5
Order number 8.81.160

Test Pressure Transducer 0 - 1400 bar, Class I up to 400 ° C
With amplifier for CAN-Bus system.
Thread: M18 x 1.5
Order number 8.81.161

Test Pressure Transducer 0 - 700 bar, Class I up to 400 ° C
With amplifier for CAN-Bus system.
Thread: M18 x 1.5
Order number 8.81.162

Test Pressure Transducer 0 - 500 bar, Class I up to 400 ° C
With amplifier for CAN-Bus system.
Thread: M18 x 1.5
Order number 8.81.163

Test Pressure Transducer 0 - 200 bar, Class I up to 400 ° C
With amplifier for CAN-Bus system.
Thread: M18 x 1.5
Order number 8.81.164

Test Pressure Transducer 0 - 100 bar, Class I up to 400 ° C
With amplifier for CAN-Bus system.
Thread: M18 x 1.5
Order number 8.81.165

Test Pressure Transducer 0 - 50 bar, Class I up to 400 ° C
With amplifier for CAN-Bus system.
Thread: M18 x 1.5
Order number 8.81.166

Test Pressure Transducer 0 - 20 bar, Class I up to 400 ° C
With amplifier for CAN-Bus system.
Thread: M18 x 1.5
Order number 8.81.167

Other transducers, available on request.

Test Pressure Transducer 0 - 2000 bar, Class I up to 500 ° C
With amplifier for CAN-Bus system.
Thread: M18 x 1.5
Order number 8.81.262

Test Pressure Transducer 0 - 1000 bar, Class I up to 500 ° C
With amplifier for CAN-Bus system.
Thread: M18 x 1.5
Order number 8.81.260

Test Pressure Transducer 0 - 500 bar, Class I up to 500 ° C
With amplifier for CAN-Bus system.
Thread: M18 x 1.5
Order number 8.81.261

Other 500 ° C transducers, available on request.

Die Swell Tester, 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 - 680 nm, power < 1 mW)
  operating range 32 mm, measuring range 0.2 up to 32 mm, repeatability ± 0.2 µm
- Electronics
- 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.
The electronics of die swell tester is integrated in the machine.
Only one test barrel with the 2-bore-system can be used for the die swell testing.
Order number 5.19.015

Melt Cutting Unit with Pneumatic Drive

The pneumatic driven melt cutting unit is used for cutting off the out-flowing melt strand. The cutting process has to be initiated manually. The construction of the melt cutting unit is based on two counter-running knifes which work like scissors.
The melt cutting unit is an additional option to the die swell tester, which helps to achieve better reproducibility of the test data.
Order number 5.19.024

Test Piston with Teflon Ring

This test piston is especially suited for the testing of low viscous materials, as e. g. several types of polyamide and polyester with a melt temperature higher than 120 ° C.
Max. temperature: 240 ° C, length: 285 mm.

Test Piston with Teflon Ring 12 mm
Order number 5.12.116

Other dimensions of test piston available on request.

Test Piston with HP-System Sealing

This piston is well suited for testing with low viscous materials. It is preferably used for materials, which are in fluid state, under room temperature. Length 285 mm.
The HP-system sealing consists of an active and passive sealing system. The passive sealing system is made of several high-performance plastics, the active sealing system consists mainly of sintered materials on the basis of PTFE.
The HP-system sealing seals liquid and gaseous media. It was conceived exclusively for linear operation.

Special characteristics of the HP system sealing:
- high standing time at high abrasion resistance
- lowest possible friction
- no stick-slip at low speed
- no stick-slip on the counter-rotation surface, even after a longer period of standstill
- operating temperature up to +280°C
- test pressure up to 2000 bar
- piston speed max. 20 mm/s

Test Piston with HP-System-Sealing 12 mm
Order number 5.12.192

Other dimensions of test piston available on request.

PVT Sets for Test Barrel Ø 12 mm

For measurement of PVT-diagrams. Furthermore required (dependent on the material to be tested) are the options **Force Measurement** , **Test Piston with Teflon Ring or Test Piston with HP-System Sealing.**
At the 2-barrel system only one test barrel can be used for the PVT measurement.
Supplied accessories: 1 Arresting clip for piston reception
1 Round hole capillary with outlet screw (only for PVT measurement)
The recording of PVT diagrams is limited to 500 bar.
Order Number.....5.19.050

Determination of thermal conductivity in the test channel

Applicable with single bore- and dual bore system only with ∅ 15 mm
Temperature limit: 400°C
Pressure limit: 1000 bar

Thermal conductivity ∅ 15 mm
Piston with integrated heating cartridge and thermocouple
Order number 5.19.167

Electronics and evaluation software

Power pack and controlling to the defined heat supply
Evaluation program Excel Macro for determination of the thermal conductivity
Order number 5.19.160

With the pneumatic cleaning device the cleaning of test barrel can be done much quicker and easier:

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
Order number 5.11.082

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.

Cleaning Set for 9.55 mm Test Barrel Diameter
Order number 5.11.135

Cleaning Set for 12 mm Test Barrel Diameter
Order number 5.11.136

Connection cable PC - RHEO-TESTER 2000

Serial connection cable 9/9 pol. 4m length
Order number 6.82.546

Any printer that is supported by a Windows driver can be used.
We offer the following printer as option:

Printer EPSON…(current type)

Power supply: 220-240V / 50Hz
Order number 8.94.043

Printer cable, length 2 m

Order number 8.90.066

PC and Work Table

For reception of PC and printer.
With 6-fold multi-point connector for EU type 230 V power supply.
Width: 1100 mm, depth: 750 mm, height: 720 mm
Order number 5.13.300

RHEO-TESTER 2000 Table

Specifically designed to keep the work height user friendly
Width: 1100 mm, depth: 800 mm, height: 580 mm
Order number 5.19.013

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We reserve the right to change the above for technical improvements.

RHEO-TESTER 2000

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

Order Number	Naming
5.19.000	**RHEO-TESTER 2000** Basic instrument

Options

5.19.007	**Power Supply 200...240 V~ 50 Hz / 1L, N + PE**
5.19.008	**Power Supply 200...240 V~ 60 Hz / 3L + PE without N**
5.19.009	**Power Supply 95...125 V~ 60 Hz / 1L, N + PE** (only for 400°C and single-bore-system)
5.19.002	**English Version** Programs and user manual in English.
5.19.001	**German Version** Programs and user manual in German.
5.19.004	**English User Manual** One user manual is by standard supplied with the basic instrument.
5.19.003	**German User Manual** One user manual is by standard supplied with the basic instrument.

Options: Test Chamber Single-Bore-System

5.19.130	**Test Chamber up to Operating Temperature 400 °C / 230 V**
5.19.132	**Test Chamber up to Operating Temperature 400 °C / 115 V**
5.19.133	**Test Chamber up to Operating Temperature 500 °C / 230 V**
5.19.134	**Test Chamber with Rolled-in Copper Pipes up to Operating Temperature 400 °C / 230 V** To attach an external cooling device.

5.19.135 **Test Chamber with Rolled-in Copper Pipes up to Operating Temperature 400 °C / 115 V**
To attach an external cooling device.

5.13.165 **Capillary Block Ø 9.55 mm**

5.13.166 **Capillary Block Ø 12 mm**

5.13.167 **Capillary Block Ø 15 mm**

5.13.182 **Capillary Block Ø 9.55 mm with Rolled-in Copper Pipes**
To attach an external cooling device.

5.13.183 **Capillary Block Ø 12 mm with Rolled-in Copper Pipes**
To attach an external cooling device.

5.13.162 **Test Barrel Set for Ø 9.55 mm**

5.13.163 **Test Barrel Set for Ø 12 mm**

5.13.164 **Test Barrel Set for Ø 15 mm**

5.19.025 **Test Piston Reception for Single-Bore-System**
Test piston reception (prepared to receive one force transducer) with test piston holder.

8.81.629 **Force Measurement Amplifier**
Connecting the transducer to the CAN-Bus system.

5.13.645 **Force Measurement 20 kN for Single-Bore-System**

5.19.014 **Thermovoltage-Amplifier**
To amplify the signals of 2 thermocouples via CAN-Bus.

5.09.300 **Thermocouple for Round Hole Capillary**

5.19.140 **Nitrogen Purge Unit**

4.23.232 **Capillary L/D = 30/0.5 = 60**

4.23.231	**Capillary L/D = 20/0.5 = 40**
4.23.230	**Capillary L/D = 15/0.5 = 30**
4.23.394	**Capillary L/D = 10/0.5 = 20**
4.23.395	**Capillary L/D = 5/0.5 = 10**
4.23.396	**Capillary L/D = 2.5/0.5 = 5**
4.23.107	**Capillary L/D = 40/1 = 40**
4.23.235	**Capillary L/D = 30/1 = 30**
4.23.234	**Capillary L/D = 20/1 = 20**
4.23.397	**Capillary L/D = 10/1 = 10**
4.23.398	**Capillary L/D = 5/1 = 5**
4.23.393	**Capillary L/D = 2.5/1 = 2.5**
4.23.237	**Capillary L/D = 30/2 = 15**
4.23.236	**Capillary L/D = 20/2 = 10**
4.23.399	**Capillary L/D = 10/2 = 5**
5.13.138	**Special Capillary Nut** for round hole capillaries up to 40 mm length

Other round hole capillaries, also with run in angle, or slit dies available on request.

Options: Dual-Bore System

5.19.100	**Test Chamber up to Operating Temperature 400 °C**
5.19.021	**Test Chamber up to Operating Temperature 500 °C**
5.19.022	**Test Chamber with Rolled-in Copper Pipes up to Operating Temperature 400 °C**
5.19.029	**Test Barrel Set 2x Ø 12 mm - 400 °C**
5.19.165	**Test Barrel Set 1x Ø 12 mm and 1x Ø 15 mm**

5.19.177 **Test Barrel Set 2x Ø 15 mm**

5.19.039 **Test Barrel Set 2x Ø 12 mm – with Rolled-in Copper Pipes up to Operating Temperature 400 °C**
To attach an external cooling device.

5.19.179 **Test Barrel Set 1x Ø 12 mm and 1x Ø 15 mm – with Rolled-in Copper Pipes up to Operating Temperature 400 °C**

5.19.180 **Test Barrel Set 2x Ø 15 mm – with Rolled-in Copper Pipes up to Operating Temperature 400 °C**
To attach an external cooling device.

5.19.033 **Test Barrel Set 2x Ø 12 mm up to Operating Temperature 500 °C**

5.19.181 **Test Barrel Set 1x Ø 12 mm and 1x Ø 15 up to Operating Temperature 500 °C**

5.19.182 **Test Barrel Set 2x Ø 15 mm up to Operating Temperature 500 °C**

5.19.158 **Test Barrel Set 2x Ø 12 mm - corrosion and wear resistant version**

5.19.166 **Test Barrel Set 1x Ø 12 mm and 1x Ø 15 mm - corrosion and wear resistant version**

5.19.178 **Test Barrel Set 2x Ø 12 mm - corrosion and wear resistant version**

5.19.026 **Test Piston Reception**
Test piston reception (prepared to receive up to two force transducer) with test piston holder.

8.81.629 **Force Measurement Amplifier**

5.13.675 **Force Measurement 20 kN for Dual bore system**

5.19.014 **Thermovoltage-Amplifier**
To amplify the signals of 2 thermocouples via CAN-Bus.

5.13.679 **Thermocouple**

5.19.023 **Nitrogen Purge Unit**

4.23.335 **Capillary L/D = 30/0.5 = 60**

4.23.334 **Capillary L/D = 20/0.5 = 40**

4.23.332 **Capillary L/D = 10/0.5 = 20**

4.23.331 **Capillary L/D = 5/0.5 = 10**

4.23.330 **Capillary L/D = 2.5/0.5 = 5**

4.23.277 **Capillary L/D = 30/1 = 30**

4.23.276 **Capillary L/D = 20/1 = 20**

4.23.275 **Capillary L/D = 10/1 = 10**

4.23.337 **Capillary L/D = 5/1 = 5**

4.23.336 **Capillary L/D = 2.5/1 = 2.5**

4.23.348 **Capillary L/D = 1/1 = 1**

4.23.340 **Capillary L/D = 30/2 = 15**

4.23.339 **Capillary L/D = 20/2 = 10**

4.23.338 **Capillary L/D = 10/2 = 5**

Other round hole capillaries, also with run in angle, or slit dies available on request.

Options: Single- or Dual Bore

8.81.160 **Test Pressure Transducer 0 - 1000 bar, Class I up to 400°C**
With amplifier for CAN-Bus system.

8.81.161 **Test Pressure Transducer 0 - 1400 bar, Class I up to 400°C**
With amplifier for CAN-Bus system.

8.81.162 **Test Pressure Transducer 0 - 700 bar, Class I up to 400°C**
With amplifier for CAN-Bus system.

8.81.163 **Test Pressure Transducer 0 - 500 bar, Class I up to 400°C**
With amplifier for CAN-Bus system.

8.81.164 **Test Pressure Transducer 0 - 200 bar, Class I up to 400°C**
With amplifier for CAN-Bus system.

8.81.165 **Test Pressure Transducer 0 - 100 bar, Class I up to 400°C**
With amplifier for CAN-Bus system.

8.81.166 **Test Pressure Transducer 0 - 50 bar, Class I up to 400°C**
With amplifier for CAN-Bus system.

8.81.167 **Test Pressure Transducer 0 - 20 bar, Class I up to 400°C**
With amplifier for CAN-Bus system.

8.81.168 **Test Pressure Transducer 0 - 2000 bar, Class I up to 400°C**
With amplifier for CAN-Bus system.

8.81.260 **Test Pressure Transducer 0 - 1000 bar, Class I up to 500°C**
With amplifier for CAN-Bus system.

8.81.261 **Test Pressure Transducer 0 - 500 bar, Class I up to 500°C**
With amplifier for CAN-Bus system.

8.81.262 **Test Pressure Transducer 0 - 2000 bar, Class I up to 500°C**
With amplifier for CAN-Bus system.

5.19.015 **Die Swell Tester, Directly below the Test Chamber**
To determine the static and dynamic die swell by measuring the diameter of the extruded strand.

5.19.024 **Melt Cutting Unit with Pneumatic Drive**
The pneumatic driven melt cutting unit is used for cutting off the out-flowing melt strand.

5.12.116 **Test Piston with Teflon Ring 12 mm**

5.12.192 **Test Piston with HP-System Sealing 12 mm**

5.19.050 **PVT Sets for Test Barrel Ø 12 mm**
For measurement of PVT-diagrams

Determination of thermal conductivity in test channel

5.19.160 **Electronics and evaluation software**

5.19.167 **Thermal conductivity Ø 15 mm**

5.11.082 **Pneumatic Cleaning Device**
The cleaning of test barrel can be done much quicker and easier.

5.11.135 **Cleaning Set for 9.55 mm Test Barrel Diameter**

5.11.136 **Cleaning Set for 12 mm Test Barrel Diameter**

6.82.546 **Connection cable PC - RHEO-TESTER 2000**

8.94.043 **Printer EPSON**

8.90.066 **Printer cable**

5.13.300 **PC and Work Table**
For reception of PC and printer.

5.19.013 **RHEO-TESTER 2000 Table**
Specifically designed to keep the work height user friendly.

We reserve the right to change the above for technical improvements.