

Proven Excellence.



## Accessories for Rosand Rheometers

Dies, Pressure Transducers, Pistons, Tools and Special Accessories

## Analyzing & Testing

# Introduction

## Rosand Rheometer Series

The Rosand series of high pressure capillary rheometers are class-leading instruments, providing robust research for high force conditions. The wide range of shear rates these instruments can apply, enables correlation with material processing conditions, from research through to quality control applications.

## Accessories for the Rosand Rheometer Series

The Rosand range of capillary rheometers can be easily adapted and configured to provide insight into different material properties, with an extensive range of dies, transducers, pistons and accessories, addressing a wide variety of applications.

The large selection of dies and accessories are optimized for rheological characterization of complex fluids and soft solids, including dispersions, emulsions, polymer and surfactant solutions, pastes, adhesives and inks.



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Dies and Die Nuts

Pressure Transducers

Pistons and Piston Tips

Tools

Special Accessories

# Dies and Die Nuts

- Tungsten carbide dies for high precision, accurate dimensions better than ISO standard requirements on diameter (+/- 5 microns\*, ISO is 7 microns) and length (+/- 25 microns).
- Extensive range of die lengths, entry angles and diameter options to cover a wide range of sample types and shear rates
- Robust steel die nuts provide cost saving solutions for multi-die usage
- Temperature range: 5°C to 500°C
- Dies: Material options of tungsten carbide, corrosion resistant tungsten carbide and other materials are available on request

\* up to a die diameter of 0.25 mm the die accuracy may deviate from the above mentioned values

Material options of tungsten carbide, corrosion resistant tungsten carbide, and other materials are available on request



Capillary and zero-length orifice dies

## Capillary Dies

| Capillary Dies and Die Nuts     |                                    |                     |           |                      |                  |
|---------------------------------|------------------------------------|---------------------|-----------|----------------------|------------------|
| Name and Diameter x Length (mm) | Material                           | Die Entry Angle (°) | L/D Ratio | Barrel Diameter (mm) | Order Number     |
| Capillary Die 0.25 x 8          | Tungsten carbide die and steel nut | 180                 | 32        | 15                   | DA-0.25-8-180-15 |
| Capillary Die 0.5 x 8           | Tungsten carbide die and steel nut | 180                 | 16        | 15                   | DA-0.5-8-180-15  |
| Capillary Die 1.0 x 10          | Tungsten carbide die and steel nut | 180                 | 10        | 15                   | DA-1.0-10-180-15 |
| Capillary Die 1.0 x 16          | Tungsten carbide die and steel nut | 180                 | 16        | 15                   | DA-1.0-16-180-15 |
| Capillary Die 1.0 x 20          | Tungsten carbide die and steel nut | 180                 | 20        | 15                   | DA-1.0-20-180-15 |
| Capillary Die 1.0 x 60          | Tungsten carbide die and steel nut | 180                 | 60        | 15                   | DA-1.0-60-180-15 |

| Capillary Dies and Die Nuts     |                                    |                     |           |                      |                  |
|---------------------------------|------------------------------------|---------------------|-----------|----------------------|------------------|
| Name and Diameter x Length (mm) | Material                           | Die Entry Angle (°) | L/D Ratio | Barrel Diameter (mm) | Order Number     |
| Capillary Die 1.5 x 24          | Tungsten carbide die and steel nut | 180                 | 16        | 15                   | DA-1.5-24-180-15 |
| Capillary Die 2.0 x 32          | Tungsten carbide die and steel nut | 180                 | 16        | 15                   | DA-2.0-32-180-15 |
| Conical Capillary Die 0.5 x 8   | Tungsten carbide die and steel nut | 90                  | 16        | 15                   | DA-0.5-8-90-15   |
| Conical Capillary Die 1.0 x 16  | Tungsten carbide die and steel nut | 90                  | 16        | 15                   | DA-1.0-16-90-15  |
| Conical Capillary Die 1.5 x 24  | Tungsten carbide die and steel nut | 90                  | 16        | 15                   | DA-1.5-24-90-15  |
| Conical Capillary Die 2.0 x 32  | Tungsten carbide die and steel nut | 90                  | 16        | 15                   | DA-2.0-32-90-15  |

Alternative material, length and die diameter options are available. Including options for barrel diameters of 9.5, 12, 19 and 24 mm

| Long and Zero-Length Die Package<br>Bagley Correction and Uniaxial Extensional Viscosity |                                    |                     |                      |                    |
|------------------------------------------------------------------------------------------|------------------------------------|---------------------|----------------------|--------------------|
| Package Comprises of:                                                                    | Material                           | Die Entry Angle (°) | Barrel Diameter (mm) | Order Number       |
| Orifice Die 1.0 x 0.25                                                                   | Tungsten carbide die and steel nut | 180                 | 15                   | DA-1.0-0.25-180-15 |
| Capillary Die 1.0 x 16                                                                   | Tungsten carbide die and steel nut | 180                 | 15                   | DA-1.0-16-180-15   |

ISO11443

To determine the true shear rate and true shear stress, capillary dies of the same diameter and inlet angle, and having at least two different L/D ratios selected from the recommended series L/D = 0.25 to 1, 5, 10, 16, 20, 30 and 40 are required.

Historical Bagley method

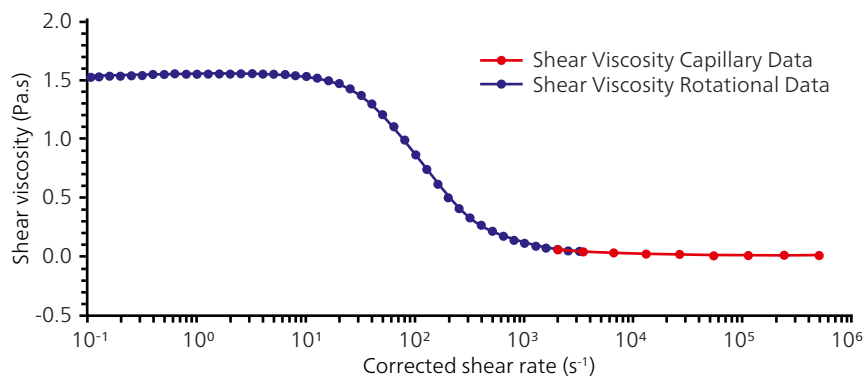
| ISO11443 Die Package                                                       |                                    |                     |                |                      |              |
|----------------------------------------------------------------------------|------------------------------------|---------------------|----------------|----------------------|--------------|
| Package Comprises of:                                                      | Material                           | Die Entry Angle (°) | L/D Ratios     | Barrel Diameter (mm) | Order Number |
| Capillary Die 1.0 x 10<br>Capillary Die 1.0 x 16<br>Capillary Die 1.0 x 20 | Tungsten carbide die and steel nut | 180                 | 10<br>16<br>20 | 15                   | ROS4014      |

# Orifice Dies

| Orifice Dies           |                                                |                     |                      |                     |
|------------------------|------------------------------------------------|---------------------|----------------------|---------------------|
| Name and Diameter (mm) | Material                                       | Die Entry Angle (°) | Barrel Diameter (mm) | Order Number        |
| Orifice Die 0.25       | Tungsten carbide die with integrated steel nut | 90                  | 15                   | DA-0.25-0.25-90-15  |
| Orifice Die 0.5        | Tungsten carbide die with integrated steel nut | 90                  | 15                   | DA-0.5-0.25-90-15   |
| Orifice Die 1.0        | Tungsten carbide die with integrated steel nut | 90                  | 15                   | DA-1.0-0.25-90-15   |
| Orifice Die 1.5        | Tungsten carbide die with integrated steel nut | 90                  | 15                   | DA-1.5-0.25-90-15   |
| Orifice Die 2.0        | Tungsten carbide die with integrated steel nut | 90                  | 15                   | DA-2.0-0.25-90-15   |
| Orifice Die 0.25       | Tungsten carbide die with integrated steel nut | 180                 | 15                   | DA-0.25-0-180-15    |
| Orifice Die 0.5        | Tungsten carbide die with integrated steel nut | 180                 | 15                   | DA-0.5-0.25-180-15  |
| Orifice Die 0.75       | Tungsten carbide die with integrated steel nut | 180                 | 15                   | DA-0.75-0.25-180-15 |
| Orifice Die 1.0        | Tungsten carbide die with integrated steel nut | 180                 | 15                   | DA-1.0-0.25-180-15  |
| Orifice Die 1.5        | Tungsten carbide die with integrated steel nut | 180                 | 15                   | DA-1.5-0.25-180-15  |
| Orifice Die 2.0        | Tungsten carbide die with integrated steel nut | 180                 | 15                   | DA-2.0-0.25-180-15  |

Orifice dies are also available in alternative material options and for barrel diameters of 9.5, 12, 19 and 24 mm. Please contact your local sales representative for the order numbers.





Viscosity measurement of a shower gel at room temperature over a wide shear rate range utilizing both a Rosand capillary rheometer as well as a Kinexus rotational rheometer



## FreeFlow Dies

### Uniaxial and Planar Extensional Viscosity

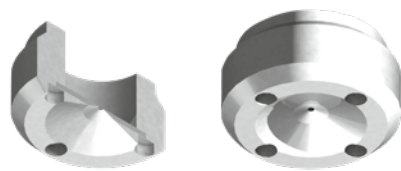
- Extensional viscosity ( $\eta_e$ ) represents one of the key rheological properties that has a strong influence on the processability of polymer melts, the mechanical properties of final products and the efficiency of manufacturing processes.
- Determining  $\eta_e$  is therefore essential for achieving ecological, energy and resource efficiency.
- The unique *FreeFlow* dies have been optimized to allow precise determination of uniaxial and planar extensional viscosity.

*FreeFlow* dies are also available in other dimensions. Please contact your local sales representative for special orders.

### FreeFlow Circular Dies

| FreeFlow Circular Orifice Dies |                        |                     |                                                                                                                                                                                                                                                                                             |                                         |
|--------------------------------|------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| Name                           | Diameter x Length (mm) | Die Entry Angle (°) | Remarks                                                                                                                                                                                                                                                                                     | Order Number                            |
| Orifice Die 0.5                | 0.5 mm x 0.25 mm       | 180                 | These dies avoid the sticking of the material in the downstream region after the material leaves the die (die exit). It ensures the accurate determination of the entrance pressure drop and of the uniaxial extensional viscosity. These dies are suitable for a barrel diameter of 15 mm. | Contact your local sales representative |
| Orifice Die 1.0                | 1.0 mm x 0.25 mm       | 180                 |                                                                                                                                                                                                                                                                                             |                                         |
| Orifice Die 1.5                | 1.5 mm x 0.25 mm       | 180                 |                                                                                                                                                                                                                                                                                             |                                         |
| Orifice Die 2.0                | 2.0 mm x 0.25 mm       | 180                 |                                                                                                                                                                                                                                                                                             |                                         |

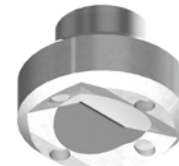
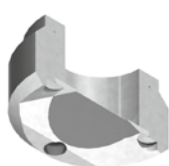
*FreeFlow* dies are also available in alternative material options, die diameters, lengths and for barrel diameters of 9.5, 12, 19 and 24 mm. Please contact your local sales representative for the order numbers.



## FreeFlow Rectangular Dies

| FreeFlow Rectangular Orifice Dies |                                       |                     |                                                                                                                                                                                                                                                                                                    |                                         |
|-----------------------------------|---------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| Name                              | Gap (Thickness) x Width x Length (mm) | Die Entry Angle (°) | Remarks                                                                                                                                                                                                                                                                                            | Order Number                            |
| Orifice Die 0.5                   | 0.5 mm x 10 mm x 0.25 mm              | 180                 | These dies avoid the sticking of the material in the downstream region after the material leaves the die (die exit). It allows the accurate determination of the entrance pressure drop and of the planar extensional viscosity. These dies are suitable for a barrel diameter of 15 mm.           | Contact your local sales representative |
| Orifice Die 1.0                   | 1.0 mm x 10 mm x 0.25 mm              | 180                 |                                                                                                                                                                                                                                                                                                    | Contact your local sales representative |
| Long Die 0.5                      | 0.5 mm x 10 mm x 16 mm                | 180                 | These dies avoid the sticking of the material in the downstream region after the material leaves the die (die exit). It allows the determination of the rheological properties at low shear rates and of the planar extensional viscosity. These dies are suitable for a barrel diameter of 15 mm. | Contact your local sales representative |
| Long Die 1.0                      | 1.0 mm x 10 mm x 16 mm                | 180                 |                                                                                                                                                                                                                                                                                                    | Contact your local sales representative |

FreeFlow rectangular dies are available down to 78.5 microns in gap and 120 microns in length.



# Pressure Transducers

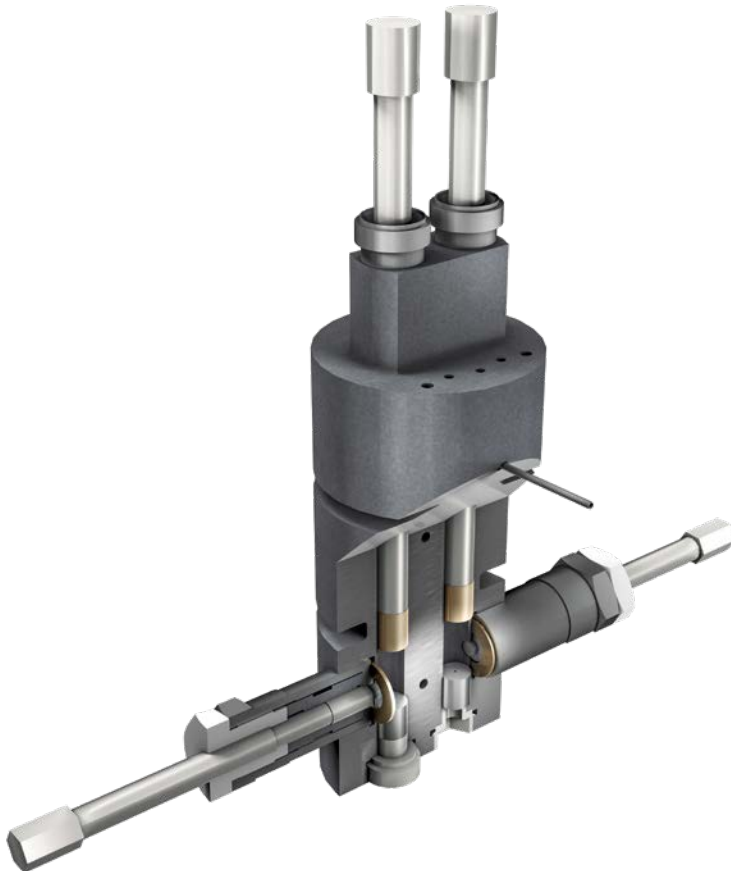
- Automatic connection detection
- Special, high accuracy pressure sensors for low stress measurements
- RoSH compliant up to 1600 bar, mercury filled for high temperature and high pressure applications up to 2000 bar
- Extensive selection of pressure options suitable for measurements of a wide variety of materials and viscosities

| Transducers |       |                                                              |              |
|-------------|-------|--------------------------------------------------------------|--------------|
| Name        | MPa   | Remarks                                                      | Order Number |
| 250 PSI     | 1.72  | maximum working temperature 500°C<br>accuracy +/- 0.25% FSO* | ROS0491      |
| 500 PSI     | 3.45  | maximum working temperature 400°C<br>accuracy +/- 0.5% FSO   | ROS0436      |
| 35 Bar      | 3.5   | maximum working temperature 500°C<br>accuracy +/- 0.5% FSO   | ROS0510      |
| 35 Bar      | 3.5   | maximum working temperature 500°C<br>accuracy +/- 0.25% FSO  | ROS0511      |
| 1,000 PSI   | 6.89  | maximum working temperature 400°C<br>accuracy +/- 0.5% FSO   | ROS0437      |
| 70 Bar      | 7.00  | maximum working temperature 500°C<br>accuracy +/- 0.5% FSO   | ROS0520      |
| 70 Bar      | 7.00  | maximum working temperature 500°C<br>accuracy +/- 0.25% FSO  | ROS0521      |
| 1,500 PSI   | 10.34 | maximum working temperature 400°C<br>accuracy +/- 0.25% FSO  | ROS0438      |
| 100 Bar     | 10.00 | maximum working temperature 500°C<br>accuracy +/- 0.25% FSO  | ROS0530      |
| 3,000 PSI   | 20.68 | maximum working temperature 400°C<br>accuracy +/- 0.25% FSO  | ROS0439      |
| 200 Bar     | 20.00 | maximum working temperature 500°C<br>accuracy +/- 0.25% FSO  | ROS0540      |

\* FSO (Full Scale Output)

## Transducers

| Name       | MPa    | Remarks                                                                                                                    | Order Number |
|------------|--------|----------------------------------------------------------------------------------------------------------------------------|--------------|
| 5,000 PSI  | 34.47  | maximum working temperature 400°C<br>accuracy +/- 0.25% FSO                                                                | ROS0440      |
| 350 Bar    | 35.00  | maximum working temperature 500°C<br>accuracy +/- 0.25% FSO                                                                | ROS0550      |
| 10,000 PSI | 68.95  | maximum working temperature 400°C<br>accuracy +/- 0.25% FSO                                                                | ROS0441      |
| 700 Bar    | 70.00  | maximum working temperature 500°C<br>accuracy +/- 0.25% FSO                                                                | ROS0560      |
| 15,000 PSI | 103.42 | maximum working temperature 500°C<br>accuracy +/- 0.25% FSO                                                                | ROS0457      |
| 1000 Bar   | 100.00 | maximum working temperature 500°C<br>accuracy +/- 0.25% FSO                                                                | ROS0570      |
| 1600 Bar   | 160.00 | maximum working temperature 300°C<br>accuracy +/- 0.5% FSO                                                                 | ROS0580      |
| 30,000 PSI | 206.84 | maximum working temperature 440°C<br>accuracy +/- 0.25% FSO<br>NOTE: This component contains mercury (40 mm <sup>3</sup> ) | ROS0488      |
| 2000 Bar   | 200.00 | maximum working temperature 440°C<br>accuracy +/- 0.25% FSO<br>NOTE: This component contains mercury (40 mm <sup>3</sup> ) | ROS0590      |

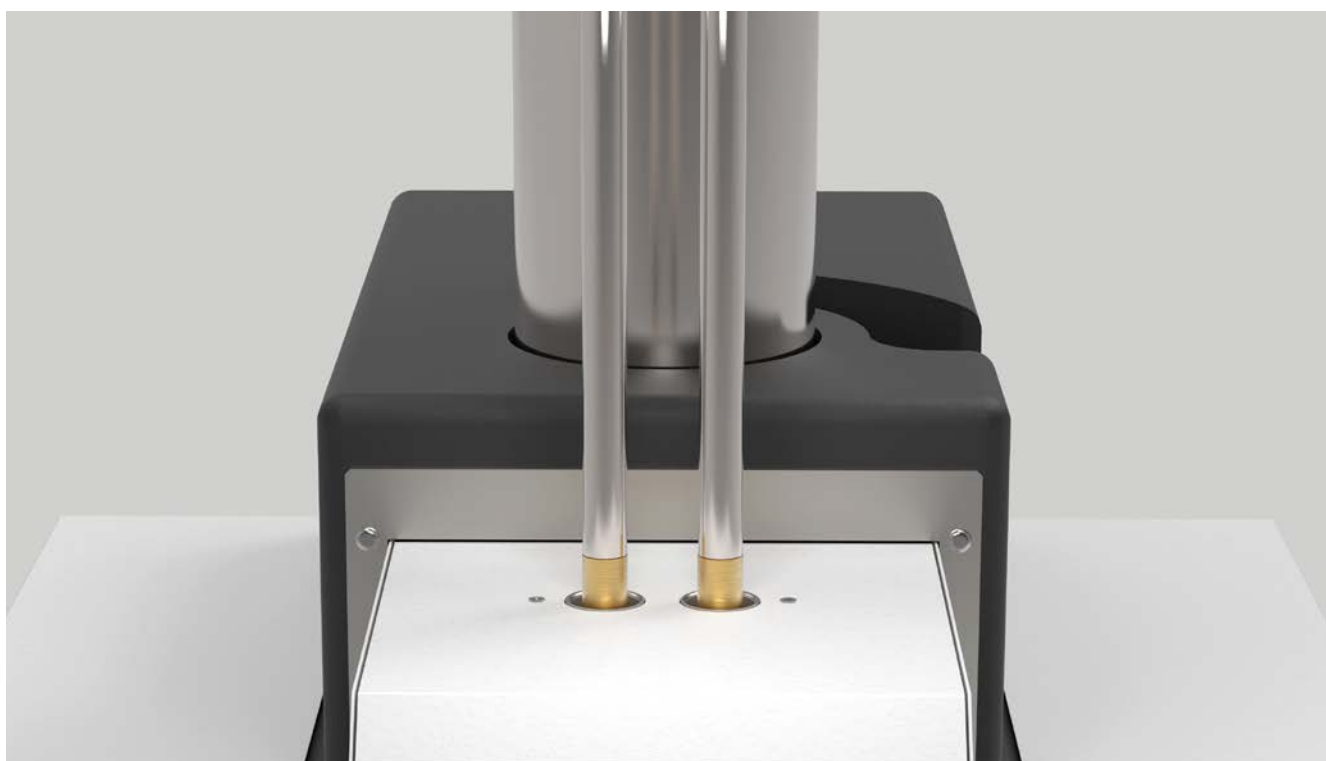


# Pistons and Piston Tips

- Temperature range: 5°C to 500°C
- Cleaning pistons available for easier cleaning
- High temperature and fluid piston tip options
- Material options for piston tips are available on request

## Pistons

| Pistons              |             |                    |            |              |
|----------------------|-------------|--------------------|------------|--------------|
| Name                 | Barrel (mm) | Material           | Remarks    | Order Number |
| Piston               | 15          | High Tensile Steel | For RH7/10 | RH9-110-006  |
| Cleaning Piston Set  | 15          | Stainless Steel    | For RH2000 | ROS0435      |
| Cleaning Piston Set  | 15          | Stainless Steel    | For RH7/10 | ROS0051      |
| Piston Cleaning Tool | -           | Hastelloy          | For RH2000 | ROS0486      |



# Piston Tips

| Piston Tips                  |             |                 |            |                |
|------------------------------|-------------|-----------------|------------|----------------|
| Name                         | Barrel (mm) | Material        | Remarks    | Order Number   |
| Piston Tip                   | 9.5         | Phosphor Bronze | For RH2000 | RH2000-100-501 |
| Piston Tip                   | 12          | Phosphor Bronze |            | RH9-110-008    |
| Piston Tip                   | 15          | Phosphor Bronze |            | RH9-110-009    |
| Piston Tip                   | 19          | Phosphor Bronze |            | RH9-110-010    |
| Piston Tip                   | 15          | PEEK            |            | ROS0044        |
| Fluid Piston Tip             | 9.5         | Phosphor Bronze |            | RH7-013-095    |
| Fluid Piston Tip             | 12          | Phosphor Bronze |            | RH7-013-012    |
| Fluid Piston Tip             | 15          | Phosphor Bronze |            | RH7-013-015    |
| Fluid Piston Tip             | 19          | Phosphor Bronze |            | RH7-013-019    |
| Fluid Piston Tip             | 24          | Phosphor Bronze |            | RH9-110-060    |
| High Temperature Piston Tip  | 15          | Phosphor Bronze |            | ROS0040        |
| High Temperature Piston Tip  | 15          | Phosphor Bronze | For RH2000 | ROS0039        |
| Piston Tip with Pressure Lip | 12          | PEEK            |            | ROS0183        |
| Piston Tip with Pressure Lip | 9.5         | PEEK            |            | ROS0419        |
| Piston Tip with Pressure Lip | 15          | PEEK            |            | ROS0179        |
| Piston Tip with Pressure Lip | 24          | PEEK            |            | ROS0038        |



# Tools

- Go no-go gauges for checking die diameter and wear
- Die cleaners for efficient cleaning of inside the die
- Brushes for external cleaning of pistons, dies and rheometer parts

## Cleaning Tools

| Cleaning Tools                   |                                                                        |                |
|----------------------------------|------------------------------------------------------------------------|----------------|
| Name                             | Material / Remarks                                                     | Order Number   |
| Piston and Die Cleaning Brush    | Brass Wire                                                             | NGB824831      |
| Brush Adapter Auto Cleaning Tool |                                                                        | ROS0008        |
| Tool Box for RH2000              | Mirror, sample loading funnel, cleaning brushes, heat resistant gloves | RH2000-095-201 |
| Tool Box for RH7/10              | Mirror, sample loading funnel, cleaning brushes, heat resistant gloves | RH7-095-201    |



# Die Cleaners and Go No-Go Gauges

| Die Cleaners and Go No-Go Gauges |                       |                                                                      |              |
|----------------------------------|-----------------------|----------------------------------------------------------------------|--------------|
| Name                             | For Die Diameter (mm) | Remarks                                                              | Order Number |
| Die Cleaner                      | 0.25                  |                                                                      | RH10-110-090 |
| Die Cleaner                      | 0.5                   |                                                                      | RH10-110-091 |
| Die Cleaner                      | 1.0                   |                                                                      | RH10-110-092 |
| Die Cleaner                      | 1.5                   |                                                                      | RH10-110-093 |
| Die Cleaner                      | 2.0                   |                                                                      | RH10-110-094 |
| Die Cleaner                      | 2.5                   |                                                                      | RH10-110-095 |
| Die Cleaner                      | 3.0                   |                                                                      | RH10-110-096 |
| Go No-Go Gauge                   | 0.5                   | 0.495-0.505 mm<br>Tolerances: Go: +/-1.5-1.0 µm<br>No-go: +/- 1.0 µm | RH9-200-081  |
| Go No-Go Gauge                   | 1.0                   | 0.995-1.005 mm<br>Tolerances: Go: +/-1.5-1.0 µm<br>No-go: +/- 1.0 µm | RH9-200-082  |
| Go No-Go Gauge                   | 1.5                   | 1.495-1.505 mm<br>Tolerances: Go: +/-1.5-1.0 µm<br>No-go: +/- 1.0 µm | RH9-200-083  |
| Go No-Go Gauge                   | 2.0                   | 1.995-2.005 mm<br>Tolerances: Go: +/-1.5-1.0 µm<br>No-go: +/- 1.0 µm | RH9-200-084  |
| Go No-Go Gauge                   | 2.5                   | 2.495-2.505 mm<br>Tolerances: Go: +/-1.5-1.0 µm<br>No-go: +/- 1.0 µm | RH9-200-068  |
| Go No-Go Gauge                   | 3.0                   | 2.995-3.005 mm<br>Tolerances: Go: +/-1.5-1.0 µm<br>No-go: +/- 1.0 µm | RH9-200-062  |
| Go No-Go Gauge                   | 4.0                   | 3.995-4.005 mm<br>Tolerances: Go: +/-1.5-1.0 µm<br>No-go: +/- 1.0 µm | RH9-200-070  |



# Special Accessories

## Die Swell – Single or Dual Axis

- Direct measurement of sample elasticity during the extrusion process
- Measurement of the thickness of the extrudate
- Material is extruded through a die of a known diameter, the diameter of the extrudate will depend on the material
- The result is dependent on the shear rate, residence time in the die and indirectly the extensional viscosity
- Run at the same time as a shear viscosity experiment
- Laser measurement system, with an option of:
  - Number of axis (single or double)
  - Number of extrudates (single or dual)
  - Resolution (10  $\mu\text{m}$  or 1  $\mu\text{m}$ )



| Die Swell                                 |                          |                                                                                |                |
|-------------------------------------------|--------------------------|--------------------------------------------------------------------------------|----------------|
| Name                                      | Instrument Compatibility | Remarks                                                                        | Order Number   |
| Single Extrudate<br>Single Axis Die Swell | RH7 and 10               | Measurement in one direction<br>For left bore<br>1 micron resolution           | RH7-011-003    |
| Single Extrudate<br>Dual Axis Die Swell   | RH7 and 10               | Measurement in two directions<br>For left bore<br>1 micron resolution          | RH7-011-004    |
| Twin Extrudate<br>Single Axis Die Swell   | RH7 and 10               | Measurement in one direction<br>For left and right bore<br>1 micron resolution | RH7-011-018    |
| Single Extrudate<br>Single Axis Die Swell | RH2000                   | Measurement in one direction<br>For left bore<br>1 micron resolution           | RH2000-011-015 |
| Twin Extrudate<br>Single Axis Die Swell   | RH2000                   | Measurement in one direction<br>For left bore<br>1 micron resolution           | RH2000-011-018 |

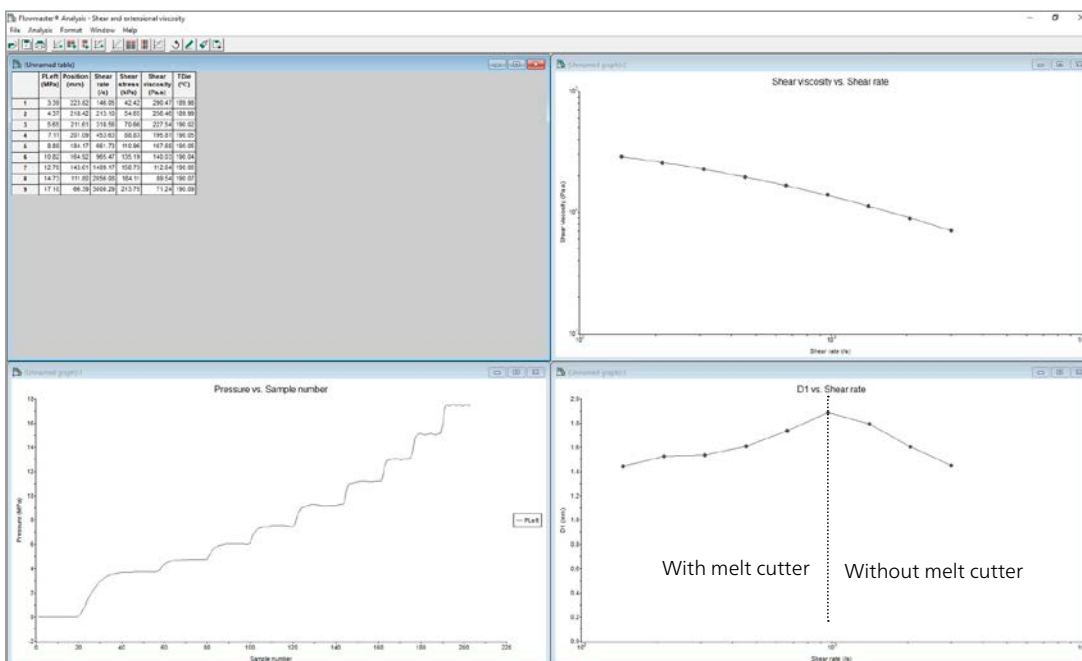
# Die Swell with Melt Cutters

- Melt cutters ensure that elongation of extrudate due to tension under gravity does not cause thinning of the strand.
- The unit allows tension-controlled die swell measurements to be made.
- Incorporates electromechanical scissor-cutter that automatically cuts the stand when it reaches the sensor below the cutter blade.

Please contact your local sales representative to determine suitability for melt cutter and your sample.

## Die Swell with Melt Cutters

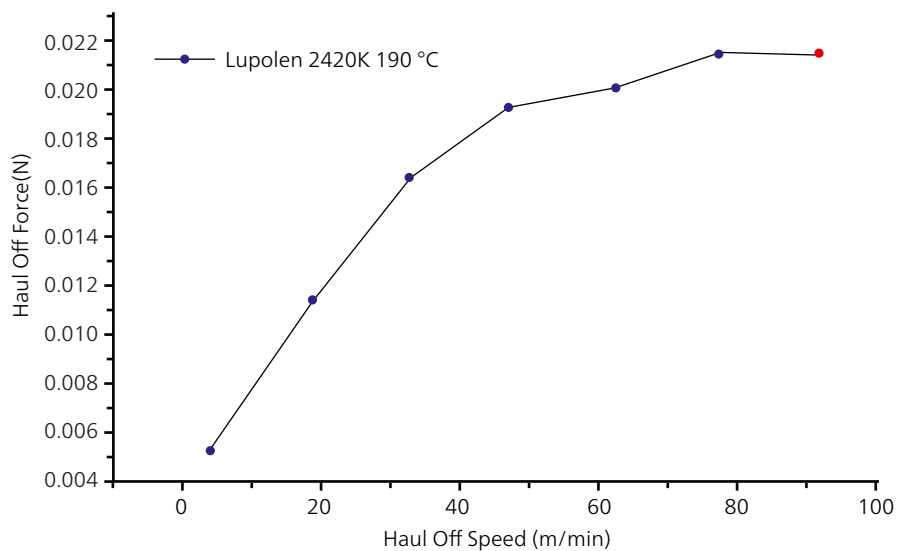
| Name                                                           | Instrument Compatibility | Remarks                                                                                           | Order Number   |
|----------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------------------------------|----------------|
| Single Extrudate<br>Single Axis Die Swell<br>with Melt Cutters | RH7 and 10               | Die to cut distance: 100 to 160 mm<br>Max shear rate: 1000 s <sup>-1</sup><br>1 micron resolution | RH7-015-003    |
| Single Extrudate<br>Dual Axis Die Swell with<br>Melt Cutters   | RH7 and 10               | Die to cut distance: 100 to 160 mm<br>Max shear rate: 1000 s <sup>-1</sup><br>1 micron resolution | RH7-015-004    |
| Twin Extrudate<br>Single Axis Die Swell<br>with Melt Cutters   | RH7 and 10               | Die to cut distance: 100 to 160 mm<br>Max shear rate: 1000 s <sup>-1</sup><br>1 micron resolution | RH7-015-002    |
| Single Extrudate<br>Single Axis Die Swell<br>with Melt Cutters | RH2000                   | Die to cut distance: 100 to 160 mm<br>Max shear rate: 1000 s <sup>-1</sup><br>1 micron resolution | RH2000-015-003 |
| Single Extrudate<br>Single Axis Die Swell<br>with Die Cutters  | RH2000                   | Die to cut distance: 0 mm<br>Max shear rate: 1000 s <sup>-1</sup><br>1 micron resolution          | RH2000-014-001 |



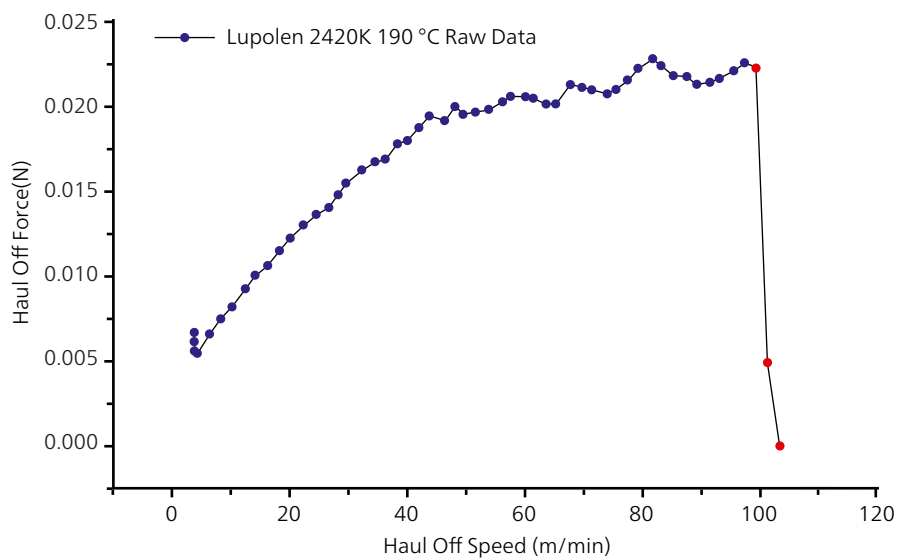
# Haul-Off and Melt Strength

- For determination of melt strength

| Haul Off                           |                       |                                                |              |
|------------------------------------|-----------------------|------------------------------------------------|--------------|
| Name<br>Diameter x Length          | Bore Diameter<br>(mm) | Remarks                                        | Order Number |
| Haul-Off Unit                      | 12                    | For RH7 and RH10 only                          | RH10-010-012 |
| Haul-Off Unit                      | 15                    | For RH7 and RH10 only                          | RH10-010-015 |
| Haul-Off Unit                      | 19                    | For RH7 and RH10 only                          | RH10-010-019 |
| Die and Nut Set<br>2 x 20 mm       | 9.5                   | RH9-190-007 tool is required<br>for assembling | RH7-011-095  |
| Die and Nut Set<br>2 x 20 mm       | 12                    | RH9-190-007 tool is required<br>for assembling | RH7-011-012  |
| Die and Nut Set<br>2 x 20 mm       | 15                    | RH9-190-007 tool is required<br>for assembling | RH7-011-015  |
| Die and Nut Set<br>2 x 20 mm       | 19                    | RH9-190-007 tool is required<br>for assembling | RH7-011-019  |
| Haul-Off Die Spanner               |                       |                                                | RH9-190-007  |
| Haul-Off Precision Balance         |                       |                                                | NGB826511    |
| Take Up Drum                       |                       | 125 mm PTFE Coated<br>Aluminium                | RH10-174-015 |
| Take Up Drum and Clamp<br>Assembly |                       | 125 mm and 5 Disposable<br>Cardboard Drums     | RH10-110-230 |
| Take Up Drum and Clamp<br>Assembly |                       | 76 mm and 5 Disposable<br>Cardboard Drums      | RH10-110-240 |
| Disposable Cardboard Drums         |                       | 125 mm Pack of 20                              | 520115-20    |
| Disposable Cardboard Drums         |                       | 76 mm Pack of 20                               | 520116-20    |



Haul off force vs. speed for HDPE at 190°C



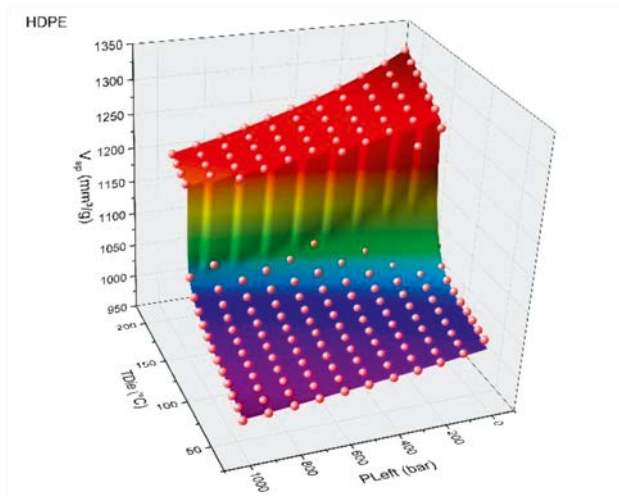
Raw data plot of haul off force vs. speed for HDPE at 190°C



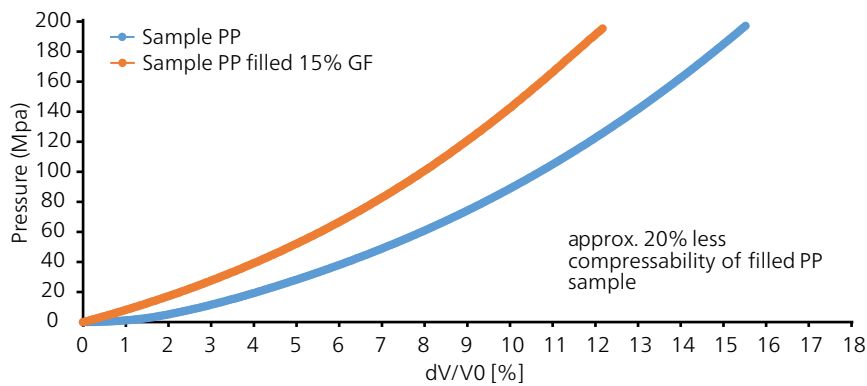
# pVT – Pressure, Volume, Temperature

- For determination of pressure, volume and temperature dependent properties of materials under isothermal measurement conditions
- Pressure dependent specific volume and density

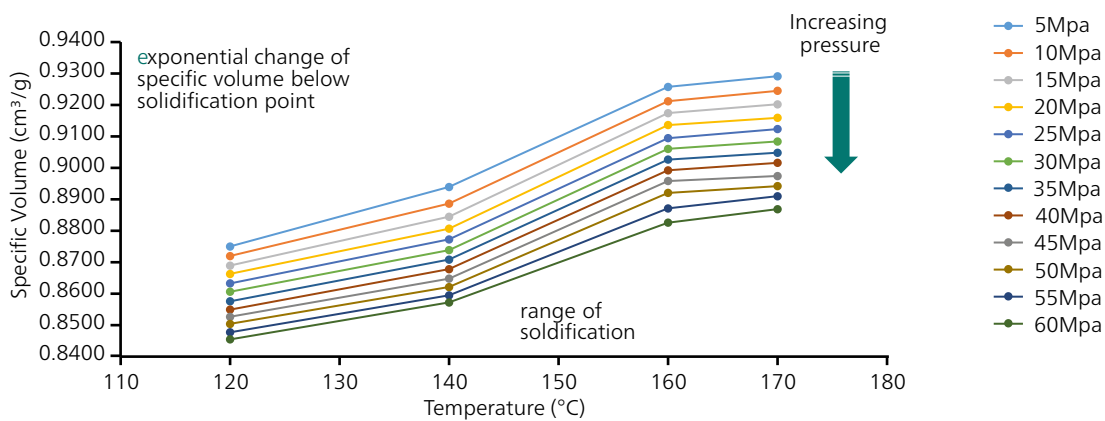
| pVT        |                    |                                                                                       |              |
|------------|--------------------|---------------------------------------------------------------------------------------|--------------|
| Name       | Bore Diameter (mm) | Remarks                                                                               | Order Number |
| pVT System | 9.5                | For RH7 and RH10 only                                                                 | RH10-012-095 |
|            |                    | For mounting, a torque spanner (NGB824798) and special tool (RH9-190-007) is required |              |
|            |                    | Includes: 10 seals for use up to 250°C<br>10 seals for use up to 300°C                |              |
| pVT System | 12                 | For RH7 and RH10 only                                                                 | RH10-012-012 |
|            |                    | For mounting, a torque spanner (NGB824798) and special tool (RH9-190-007) is required |              |
|            |                    | Includes: 10 seals for use up to 250°C<br>10 seals for use up to 300°C                |              |
| pVT System | 15                 | For RH7 and RH10 only                                                                 | RH10-012-015 |
|            |                    | For mounting, a torque spanner (NGB824798) and special tool (RH9-190-007) is required |              |
|            |                    | Includes: 10 seals for use up to 250°C<br>10 seals for use up to 300°C                |              |
| pVT System | 19                 | For RH7 and RH10 only                                                                 | RH10-012-019 |
|            |                    | For mounting, a torque spanner (NGB824798) and special tool (RH9-190-007) is required |              |
|            |                    | Includes: 10 seals for use up to 250°C<br>10 seals for use up to 300°C                |              |
| pVT System | 24                 | For RH7 and RH10 only                                                                 | RH10-012-024 |
|            |                    | For mounting, a torque spanner (NGB824798) and special tool (RH9-190-007) is required |              |
|            |                    | Includes: 10 seals for use up to 250°C<br>10 seals for use up to 300°C                |              |



Pressure-specific volume-temperature diagram of HDPE  
(third party software employed for analysis)



Change of volume as a function of pressure of PP filled and unfilled at 200°C



Change of specific volume as a function of pressure and temperature of PP

## Slot Die

- Direct measurement of pressure drop along the length of the die
- Pressure transducers along the die record the pressure of the material as it approaches the exit of the die
- Removes the entrance and exit pressure effects
- Allows the pressure to be monitored along the length of the die

| Slot Die         |            |                                             |              |
|------------------|------------|---------------------------------------------|--------------|
| Name             | Width (mm) | Remarks                                     | Order Number |
| Mounting Fixture |            | Enables secure installation of the slot die | RH7-008-008  |
| Slot Die Insert  | 0.5        |                                             | RH9-142-012  |
| Slot Die Insert  | 0.75       |                                             | RH9-142-017  |
| Slot Die Insert  | 1.0        |                                             | RH9-142-013  |
| Slot Die Insert  | 1.5        |                                             | RH9-142-014  |
| Slot Die Insert  | 2.0        |                                             | RH9-142-015  |
| Slot Die Insert  | 2.5        |                                             | RH9-142-018  |

## Barrel Extension

Please contact your local sales representative as a special order

- For dies with a total length of more than 36 mm, a barrel extension is required

| Barrel Extension              |                          |                                                |              |
|-------------------------------|--------------------------|------------------------------------------------|--------------|
| Name                          | Instrument Compatibility | Remarks                                        | Order Number |
| 25 mm Heated Barrel Extension | RH2000                   | For 15 mm barrel. Maximum temperature is 350°C | RH9-145-900  |
| 25 mm Heated Barrel Extension | RH7/10                   | 15 mm barrel. Maximum temperature is 350°C     | RH9-145-100  |

# Nitrogen Purge

- Suitable for materials prone to oxidative degradation
- Enables the steady flow of nitrogen at the entrance of the barrel

| Nitrogen Purge |                          |                |
|----------------|--------------------------|----------------|
| Name           | Instrument Compatibility | Order Number   |
| Nitrogen Purge | RH7 and 10               | RH7-007-001    |
| Nitrogen Purge | RH2000                   | RH2000-007-001 |



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