Sample Preparation & Quality Control

Milling

Sieving

Assisting

Including latest product news!
RETSCH Sets Standards

More than 90 years of experience in the preparation and characterization of solids – quality “made in Germany”.

As the world-market leader in milling and sieving technology we are constantly striving for customer and market oriented solutions in our research and development activities and implement them systematically in our products and services. The RETSCH philosophy is based on customer orientation and leading edge technology. Based on the principle of the Greek philosopher Aristotle, “The whole is greater than the sum of its parts”, RETSCH develop instruments whose high-quality components are designed for perfect interaction. Thus, they not only guarantee representative and reproducible results for grinding and particle analysis but also allow for easy and comfortable operation.

With RETSCH you get

■ First-class product quality
■ Comprehensive application support including test grindings
■ Excellent sales and service network throughout the world
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1915
The company is founded by F. Kurt Retsch in Duesseldorf.

1923
The company’s first own piece of laboratory equipment is developed, a mortar mill, which becomes known as the RETSCH Mill and is synonymous with the concept of easier and better laboratory work.

1952
Engineer Dirk Sijsling assumes management responsibility for F. Kurt Retsch KG. The production of laboratory equipment becomes more and more important.

1959
RETSCH enlarges the equipment program for sieve shakers, sample dividers and magnetic mixers. The wider production program needs more room, and so the company moves to Haan.

1963
RETSCH intensifies its cooperation with universities and institutes to ensure that their equipment is always up to the latest technological standards. By the end of the sixties, the export share has increased to 35%.

1976
The company moves to new offices in Haan, which with continual enlargements, is where the company sits today.

1989
André Verder and Frans Bakker take over the F. Kurt Retsch GmbH shares in equal parts. Gradually RETSCH manages the transition from a family business to an internationally active company.

1993
A subsidiary in United Kingdom is opened

1998
Foundation of Retsch Technology as a profit center under the roof of RETSCH in co-operation with Jenoptik L.O.S. GmbH.

1999
A subsidiary in Japan is opened.

2000
Foundation of Retsch Technology as an independent company.
A subsidiary in the USA is opened.

2005
90 years RETSCH: The headquarters in Haan, Germany, are rebuilt and modernized. The extended and completely refurbished application laboratory is put into operation.

2006
A subsidiary in China is opened.

2008 - 2010
RETSCH opens subsidiaries in Italy, Norway, South Korea and Russia.

RETSCH – the company

RETSCH is active in the fields of neutral-to-analysis sample preparation as well as size and shape characterization of solids and enjoys the trust of customers throughout the world.

From the preparation of a representative sample, the contamination-free size reduction process in compliance with related standards to exact and reproducible sieve analyses – RETSCH instruments are essential tools for preparing samples for laboratory analyses. They are characterized by reliability, precision and durability. These three decisive criteria, in addition to over 90 years experience in this sector, have made us the market leader in the manufacture of instruments and supply of solutions. Worldwide sales and marketing of the products are carried out in cooperation with our own subsidiaries, authorized distributors and laboratory dealers in more than 75 countries as well as directly to the end customers.

Integrated Solutions
We see ourselves as solution providers. In addition to our extensive product program we offer competent application support and technical assistance.

Application Consulting
For us professional customer service is about offering individual and specific advice, by phone or in our application laboratory, for every application. Thus, we find the optimum solution for each sample preparation task.

Free-of-charge Test Grinding
Our application laboratory processes and measures your samples free-of-charge and provides a recommendation for the most suitable method and instrument. All you have to do is fill in the questionnaire and send it to us together with your sample.

Mobile Application Laboratory
With our RETSCH Bus, the laboratory on wheels, we offer you the possibility of an individual, specific and free-of-charge application consultation.
Technical Service

RETSCH instruments are designed for a long working life and only require a minimum of maintenance. In case a technical problem does occur, our technical service hotline will help you to solve it quickly and professionally.

Seminars and Workshops

Alone or with renowned partners in the laboratory industry we regularly offer practical seminars and workshops about different aspects of sample preparation, particle measurement and analytics. The dates and places can be found on our website.

Customer Magazine “the sample”

RETSCH’s popular customer magazine “the sample” provides readers with the latest information about products, applications, seminars and campaigns. Detailed articles give insight into the particularities of sample preparation and particle analysis and provide valuable tips and tricks.

Product Videos

With RETSCH’s operation and application videos, no question is left unanswered. The viewer can take a look into the sieve or the grinding jar and see for himself how the machine works. Realistic computer animations help to understand the working principle, the operation and a range of applications are explained in detail.
Milling
The Art of Homogenization

A reliable and accurate analysis can only be guaranteed by reproducible sample preparation. The “art of milling and homogenization” with regards to the subsequent analysis therefore consists in turning a laboratory sample into a representative part sample with homogeneous analytical fineness. For these tasks RETSCH offers a comprehensive range of the most modern mills and crushers for coarse, fine and ultra-fine size reduction of almost any material. The choice of grinding tools and accessories not only ensures contamination-free preparation of a wide range of materials but also the adaptation to the individual requirements of such different areas of application as construction materials, metallurgy, foodstuffs, pharmaceuticals or environment.
The matrix below demonstrates the interdependence of instrument, sample material and working principle.

**Selection Guide**

|--------------------|-------------|------------------------|--------------|-------------------|-------------------|--------------|------------|---------------|-----------|-------------|----------|---------------------|

- **preliminary size reduction**
- **fine grinding**

The Selection Guide gives you an overview of the RETSCH instruments which are, in principle, suitable for certain materials.

<table>
<thead>
<tr>
<th>Feed size* approx. (mm)</th>
<th>35</th>
<th>50</th>
<th>90</th>
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</tbody>
</table>

✔ suitable  ○ suitable to a limited extent  *depending on sample and grinding time

This chart serves only for orientation purposes. The selection of the appropriate mill depends on a variety of parameters of the actual application. Please contact us to discuss the best solution.
The powerful RETSCH Jaw Crushers are designed for the rapid, gentle coarse and primary crushing of hard, brittle and tough materials. The breaking jaws are available in a variety of materials which include heavy-metal-free steel. Their efficiency and safety makes these pulverizers ideal for sample preparation in laboratories and industrial plants. Four basic models are available: from the compact bench-top model BB 51 to the biggest floor model, BB 300 which allows for feed sizes up to 130 mm. RETSCH jaw crushers combine increased operating convenience with maximum working safety.

Main areas of application
Cement clinker, coal, construction materials, granite, metal alloys, quartz, ores, oxide ceramics, silicon, slag, tungsten alloys

The robust floor models BB 100, BB 200 and BB 300 feature:

- **Powerful size reduction with high throughput**
- **High final fineness** (down to \(d_{90} < 2\) mm)
- **Wear compensation due to zero point adjustment**
- **Batch-wise and continuous operation**
- **Wide selection of breaking jaw materials**
- **Safe and simple handling and cleaning**

RETSCH Jaw Crushers are primarily used in laboratories and pilot plants, often under rough conditions. For applications such as the quality control of raw materials the BB 200 and BB 300 can be integrated into the process line for continuous operation.
Jaw Crusher BB 51

The BB 51 jaw crusher is particularly useful in reducing small laboratory samples with a large feed size down to < 0.5 mm in one easy step. Samples such as stone, minerals, ores, glass, synthetic resins and many other hard or brittle substances are ground without contamination, using grinding tools of manganese steel, stainless steel, wear-resistant tungsten carbide, zirconium oxide or heavy metal-free steel. The grind size is controlled through a digital gap width setting. The BB 51 features a zero-point-adjustment to compensate for wear and assure reproducible samples at all times. With its small footprint and dust-tight housing, this unique jaw crusher easily fits on any laboratory bench.

- High final fineness ($d_{90} < 0.5$ mm)
- Digital gap width setting
- Breaking jaws in 5 different materials
- No-rebound feed hopper
- Dust-tight, no maintenance required

### Performance data

<table>
<thead>
<tr>
<th>Application: Coarse and pre-crushing</th>
<th>BB 51</th>
<th>BB 100</th>
<th>BB 200</th>
<th>BB 300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of material: medium-hard, hard, brittle, tough</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Feed size*:</td>
<td>&lt; 35 mm</td>
<td>&lt; 50 mm</td>
<td>&lt; 90 mm</td>
<td>&lt; 130 mm</td>
</tr>
<tr>
<td>Final fineness*:</td>
<td>&lt; 0.5 mm</td>
<td>&lt; 4 mm</td>
<td>&lt; 2 mm</td>
<td>&lt; 5 mm</td>
</tr>
</tbody>
</table>

* depending on feed material and instrument configuration/setting
Rotor Mills

Ultra Centrifugal Mill ZM 200

The powerful and versatile ZM 200 offers the ultimate in performance and operating comfort. This widely used mill pulverizes a great variety of substances extremely fast, thus allowing for a high sample throughput without degradation of sample properties. The grinding sets can be cleaned easily without any tools which helps to avoid cross contamination from frequently changing samples.

■ Robust high torque motor with speed range from 6,000 to 18,000 rpm
■ Rapid and gentle size reduction by 2-step rotor/screen system
■ Easy to operate and clean
■ Automatic feeding system for sample volumes of up to 4.5 liters

Cyclone Mill TWISTER

The cyclone mill TWISTER is used for the sample preparation prior to NIR analysis. It is suitable for the quick and gentle grinding of fibrous and soft products down to analytical fineness. Typical applications include feeds, forage and grain. The high speed and the optimized form of the rotor and the grinding chamber generate an air jet which carries the sample through the cyclone into the sample bottle and also has a cooling effect on the material.

■ 3 controlled speeds
■ Cyclone separator with 250 ml collecting bottle for quick sample extraction
■ No cross contamination thanks to easy cleaning

Main areas of application

- Bones, cereals, chemicals, coal, drugs, fertilizers, food & feed, minerals, plastics, pharmaceutical products, plant materials, powder coatings, secondary fuels, spices

Performance Data ZM 200

- Application: fine grinding
- Feed material: soft, medium-hard, brittle, fibrous
- Feed size*: < 10 mm
- Final fineness*: < 40 µm

Performance Data TWISTER

- Application: Sample preparation for NIR analysis
- Feed material: fibrous, soft
- Feed size*: < 10 mm
- Final fineness*: < 500 µm
Milling

www.retsch.com/sr200
www.retsch.com/sr300
www.retsch.com/sk100

Main areas of application

Chemicals, coal, construction materials, drugs, spices, feed pellets, fertilizers, grains, seeds, pharmaceuticals, soils

Rotor Beater Mills SR 200 and SR 300

Due to their robust design and their ability to process large amounts of sample, the Rotor Beater Mills SR 200 and SR 300 are ideal for small-scale production and are also suitable for installation into automated preparation systems. The SR 300 is the leader among the Rotor Beater Mills. Its high speed allows a high sample throughput. Grinding chamber, feed hopper and material inlet and outlet are completely made from high-quality stainless steel.

- High throughput
- Final fineness down to 50 µm
- Easy handling and cleaning
- Exchangeable grinding and sieve inserts
- Distance rotor for thermally sensitive samples
- Quick-action door lock and motor brake

Cross Beater Mill SK 100

Like the Rotor Beater Mills, the Cross Beater Mill SK 100 is suitable for coarse and fine size reduction, either in batches or continuously. This robust mill is used in the laboratory as well as under rough conditions in production facilities. Due to its powerful drive, it is often possible to achieve a fineness < 100 µm in a single working step. Moreover, the SK 100 offers the highest possible degree of operating safety.

- High throughput
- Final fineness down to 100 µm
- Easy handling and cleaning
- Wide range of accessories

Performance Data SR 200 / SR 300

Application: size reduction, deagglomeration
Feed material: soft, medium-hard
Feed size*: < 15 mm
Final fineness*: < 80 µm / < 50 µm
*depending on feed material and instrument configuration/settings

Performance Data SK 100

Application: size reduction
Feed material: medium-hard, brittle
Feed size*: < 15 mm
Final fineness*: < 100 µm
*depending on feed material and instrument configuration/settings

Main areas of application

Cement clinker, coke, glass, gravel, minerals, ores, oxide ceramics, slags, soils

SR 300
SK 100

**Note:** The text continues on subsequent pages with similar content and images.
Cutting Mills

Cutting mills SM 100, SM 200 and SM 300

The cutting mill SM 100 processes soft, medium-hard, elastic and fibrous products which can be comminuted without requiring extremely high forces. The mill is particularly suited for routine applications. It is easy to operate and can be mounted on a solid table or on the optional base frame.

The RETSCH Cutting Mills SM 200 and SM 300 excel especially in the tough jobs where other cutting mills fail. They provide highly efficient primary size reduction of such heterogeneous materials as waste or electronic components but are also suitable for many other types of samples. The mills offer a high level of operational safety and a long service life of the grinding tools. A wide selection of screens, hoppers, collection systems as well as a cyclone-suction-combination allow for easy adaptation to the individual application task. All units are also available in a special version for heavy-metal-free size reduction.

- Powerful size reduction, including heterogeneous materials
- SM 300 with variable speed
- Defined final fineness
- Low heat build-up
- Quick and easy cleaning
- Wide range of accessories

Main areas of application

Bones, cables, cardboard, computer and electronic waste, drugs, feeds, foils, leather, light metal scrap, lignite, non-ferrous metals, organic and inorganic waste, paper, plant materials, plastics, rubber, spices, straw, secondary fuels, wood

Performance Data

SM 100 / SM 200 / SM 300

<table>
<thead>
<tr>
<th>Application:</th>
<th>size reduction</th>
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<tbody>
<tr>
<td>Feed material:</td>
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<tr>
<td>Feed size*:</td>
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<tr>
<td>Final fineness*:</td>
<td>0.25 - 20 mm</td>
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</table>

*depending on feed material and instrument configuration/settings

www.retsch.com/sm100
www.retsch.com/sm200
www.retsch.com/sm300
Knife Mills

Knife Mills GRINDOMIX GM 200 and GM 300

The GRINDOMIX Knife Mills set new standards in food sample preparation. The cutting effect produced by the steel blades in conjunction with the patented gravity lid results in the size reduction and perfect homogenization of samples high in water or oil content. It is possible to take a random, yet representative sub-sample from any location in the grinding chamber and still obtain a meaningful analysis result. The GM 200 and GM 300 produce representative samples with a minimum standard deviation in as little as 30 seconds. With its sturdy design, industrial motor, high safety standard and digital parameter settings including memory the GRINDOMIX mills are truly professional laboratory devices that easily outperform any household mixer or conventional knife mill. A wide range of containers and lids makes it easy to adapt the mill to various applications.

The GM 300 is suitable for the fast and reproducible grinding and homogenizing of sample volumes up to 4,500 ml.

- Perfect homogenization
- Results with minimum standard deviation
- Variable speed
- For sample volumes up to 700 ml or 4,500 ml
- Autoclavable grinding tools
- Unique lids for volume adaptation of grinding chamber
- Accessories for heavy-metal-free grinding

www.retsch.com/gm200
www.retsch.com/gm300
**Disc Mills**

**Vibratory Disc Mill RS 200**

No grinder can beat the speed of a Vibratory Disc Mill when it comes to preparing samples for spectral analyses. The RETSCH RS 200 with its powerful stabilized plane drive achieves grind sizes between 40 and 100 microns within seconds and with excellent reproducibility. The powerful instrument runs steadily and smoothly, even with heavy grinding sets and at maximum speed. Thanks to grinding sets in various materials and sizes, this mill can be used for a wide range of sample materials.

- **Analytical fineness in seconds**
- **Excellent reproducibility**
- **Powerful stabilized-plane-drive**
- **Easy 1-button operation with graphics display**
- **10 parameter combinations can be stored**

**Performance Data RS 200**

<table>
<thead>
<tr>
<th>Application:</th>
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<tr>
<td>Final fineness**:</td>
<td>&lt; 40 µm</td>
</tr>
</tbody>
</table>

*depending on feed material and instrument configuration/settings

**Main areas of application**

Cement, cement clinker, ceramics, coal, coke, concrete, corundum, glass, metal oxides, minerals, ores, silicates, slag, soils

**Disc Mill DM 200**

The Disc Mill DM 200 allows for the fine grinding of larger batches of hard, abrasive substances. The rugged design permits use under rough conditions in laboratories and pilot plants as well as in-line for quality control of raw materials. The Disc Mill achieves an average final fineness of approximately 100 microns often in a single grinding process.

- **Short grinding times, high final fineness**
- **Accurate gap setting ensures reproducible grinding**
- **Grinding discs made of 4 different materials**

**Performance Data DM 200**

<table>
<thead>
<tr>
<th>Application:</th>
<th>size reduction, pre-crushing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed material:</td>
<td>medium-hard, hard, brittle</td>
</tr>
<tr>
<td>Feed size*:</td>
<td>&lt; 20 mm</td>
</tr>
<tr>
<td>Final fineness**:</td>
<td>&lt; 100 µm</td>
</tr>
</tbody>
</table>

*depending on feed material and instrument configuration/settings

**Main areas of application**

Bauxite, clinker, coal, coke, dental ceramics, dried soil, glass, gypsum, ores, quartz, sewage, sintered ceramics, sludge slag, steatite
Mortar Grinders

Mortar Grinder RM 200

The RM 200 is the latest generation of the classic "RETSCH Mill" which replaced manual mortars and pestles more than 80 years ago. It is widely used for reproducible sample preparation in R&D, materials testing and especially in pharmaceutics and homeopathy. Many different materials can be easily and efficiently processed in wet or dry condition. The grinding sets of the RM 200 can be selected out of 7 different materials which allows for neutral-to-analysis sample preparation. The new generation of mortar grinders is exceptionally powerful, safe and easy to operate.

- Reproducible dry and wet grinding
- Easy exchange of pestle and mortar without tools
- Closed, dust-tight grinding chamber with windows
- Grinding sets in 7 different materials
- High-performance drive with electronic control

Main areas of application

Ashes, cement clinker, chemicals, cocoa beans, drugs, food, frozen yeast cells, oil seeds, salts, pharmaceutical and homeopathic raw materials and products, silicates, slag, soil, spices

Performance Data RM 200

Application: size reduction, mixing, triturating
Feed material: soft, hard, brittle, pasty, dry and wet
Feed size*: < 8 mm
Final fineness*: < 10 µm

*depending on feed material and instrument configuration/settings
Main areas of application
Alloys, bones, cereal grains, ceramics, chemicals, drugs, glass, hair, minerals, oil seeds, ores, plant materials, plastics, sludge, soils, coated and uncoated tablets, textiles, tissue, waste samples, wool

Mixer Mills

Mixer Mill MM 400

The RETSCH Mixer Mill MM 400 is a true laboratory “all-rounder”. It has been developed specially for dry, wet and cryogenic grinding of small sample amounts. This high-performance ball mill usually grinds and homogenizes powders and suspensions in only a few seconds and achieves grind sizes down to the nano range. It is also perfectly suitable for the disruption of biological cells as well as for DNA/RNA recovery. Due to its great versatility, the MM 400 is used in many different industries ranging from pharmaceutics and biology to mineralogy, environment or plastics.

- Rapid and efficient pulverization and homogenization
- Reproducible results due to digital parameter setting
- Grinding jars in various sizes and materials
- 9 parameter combinations can be stored
- Simultaneous preparation of up to 20 samples

Mixer Mill MM 200

The Mixer Mill MM 200 is also used for efficient size reduction and homogenization of 2 samples simultaneously. It works with the same functional principle as the MM 400. This mill is highly suitable for grinding dry samples in small quantities and offers a favourably priced alternative to the MM 400 for routine applications. The grinding jars for the MM 200 have a push-fit lid.

<table>
<thead>
<tr>
<th>Performance data</th>
<th>MM 200</th>
<th>MM 400</th>
<th>CryoMill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application:</td>
<td>Size reduction, mixing, homogenization, cell disruption</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of material:</td>
<td>soft, medium-hard, hard, brittle, elastic, fibrous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feed size*:</td>
<td>&lt; 6 mm</td>
<td>&lt; 8 mm</td>
<td>&lt; 8 mm</td>
</tr>
<tr>
<td>Final fineness*:</td>
<td>&lt; 10 µm</td>
<td>&lt; 5 µm</td>
<td>&lt; 5 µm</td>
</tr>
</tbody>
</table>

* depending on feed material and instrument configuration/settings
CryoMill

The CryoMill has been specially designed for cryogenic grinding. It features an integrated cooling system which continually cools the grinding jar with liquid nitrogen before and during the grinding process. Thus the sample is embrittled and volatile components are preserved. The liquid nitrogen circulates through the system and is continually replenished from an autofill system in the exact amount which is required to keep the temperature at –196 °C. The automatic cooling system guarantees that the grinding process is not started before the sample is thoroughly cooled. This results in reduced consumption and guarantees reproducible grinding results.

The size reduction principle is the same as that of the MM 400. With a vibrational frequency of 25 Hz the CryoMill grinds most materials very effectively in a few minutes. The combination of impact and friction leads to substantially finer grind sizes compared to other cryogenic mills.

The CryoMill is equipped with one grinding station for grinding jar volumes of 25 ml, 35 ml and 50 ml. It is also possible to use adapters for 4 grinding jars of 5 ml each as well as for reaction vials.

- Fast, efficient cryogenic grinding at -196 °C
- Ideal for plastics, temperature-sensitive materials and samples with volatile components
- Particularly safe due to autofill system for liquid nitrogen
- Highly reproducible grinding results
- Programmable cooling and grinding cycles
- Also suitable for dry and wet grinding
Planetary Ball Mills

The innovative Planetary Ball Mills meet and exceed all requirements for fast and reproducible grinding down to the nano range. They are used for the most demanding tasks, from routine sample processing to colloidal grinding and mechanical alloying. The grinding parameters are easily selected and stored with one single button. All planetary mills feature programmable starting time, power failure backup with storage of remaining grinding time and a built-in fan which cools the grinding jars during operation. The comfort grinding jars are dust-tight and unusually simple and safe to handle.

- Extreme speed, final fineness down to the nano range
- Reproducible results due to energy and speed control
- 1-button operation with graphics display
- 10 parameter combinations can be stored
- Smooth and stable operation
- Automatic grinding chamber ventilation
- Suitable for long-term trials and continuous use

Planetary Ball Mill PM 100

This single station ball mill pulverizes and mixes a wide range of materials and can be operated with grinding jars from 12 ml to 500 ml. It is especially safe to operate on a laboratory bench thanks to the new FFCS technology which helps to compensate vibrations.

Planetary Ball Mill PM 100 CM

This ball mill offers all the performance and convenience of the classic PM 100, only the speed ratio of sun wheel to grinding jar is 1:-1 instead of 1:-2. This results in a different ball movement so that the sample is not so much crushed by impact effects but more gently ground by pressure and friction. This not only leads to less abrasion but also reduces the heat build-up inside the jar.
Main areas of application

Alloys, ceramics, chemicals, glass, minerals, ores, plant materials, soils, sewage sludge, household and industrial waste

Planetary Ball Mill PM 200

The PM 200 is equipped with two grinding stations and accepts grinding jars up to 125 ml. It is used for the pulverization and mixing of smaller sample volumes.

Planetary Ball Mill PM 400

The robust floor model features four grinding stations and accepts jars from 12 ml to 500 ml. It can process up to 8 samples simultaneously thus generating a high sample throughput. The PM 400 is also available with 2 grinding stations and different speed ratios. The model “MA-type” was especially developed for mechanical alloying of hard-brittle materials.

<table>
<thead>
<tr>
<th>Performance data</th>
<th>PM 100</th>
<th>PM 100 CM</th>
<th>PM 200</th>
<th>PM 400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application:</td>
<td>Size reduction, mixing, homogenization, colloidal grinding, mechanical alloying</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of material:</td>
<td>soft, medium-hard, hard, brittle, fibrous, dry and wet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feed size*:</td>
<td>&lt; 10 mm</td>
<td>&lt; 10 mm</td>
<td>&lt; 4 mm</td>
<td>&lt; 10 mm</td>
</tr>
<tr>
<td>Final fineness*:</td>
<td>&lt; 0.1 µm</td>
<td>&lt; 0.1 µm</td>
<td>&lt; 0.1 µm</td>
<td>&lt; 0.1 µm</td>
</tr>
</tbody>
</table>

* depending on feed material and instrument configuration/settings
Particle Sizing
When Size Matters

Particle size distribution influences the physical and chemical properties of solids. Therefore this criterion is of highest importance in the context of quality control and monitoring of powders and granulates. A reliable product quality can only be guaranteed if the size distribution is maintained, as the following examples show:

- the strength of concrete
- the taste of chocolate
- the flow characteristics and solubility of washing powders
- the opacity of paint
- the release of active ingredients in pills

RETSCH sieve shakers and test sieves are the key to easy, rapid, reproducible and, above all, accurate analyses. The product line is completed by the optical particle analysis systems of Retsch Technology which operate with digital image processing.
Sieve analysis
AS 200
AS 300
AS 450
AS 400
AS 200 tap
AS 200 jet
d
digital Image Processing
CAMSIZE®
CAMSIZE XT

The perfect solution for each measuring range

<table>
<thead>
<tr>
<th></th>
<th>1 µm</th>
<th>1 mm</th>
<th>1 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sieve analysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AS 200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AS 300</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AS 450</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AS 400</td>
<td></td>
<td>20 µm</td>
<td>25 mm</td>
</tr>
<tr>
<td>AS 200 tap</td>
<td>20 µm</td>
<td>40 mm</td>
<td>125 mm</td>
</tr>
<tr>
<td>AS 200 jet</td>
<td>45 µm</td>
<td>63 mm</td>
<td></td>
</tr>
<tr>
<td>Digital Image Processing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAMSIZE®</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAMSIZE XT</td>
<td></td>
<td>30 µm</td>
<td>30 mm</td>
</tr>
</tbody>
</table>

- dry measurement
- wet measurement
Main areas of application

Chemicals, coal, coffee, fertilizers, fillers, flour, metal powders, minerals, sand, seeds, soils, washing powder, cement clinker

Sieve Shakers

Sieving with a three-dimensional effect

RETSCH analytical sieve shakers are used in research and development, quality control and production monitoring. The patented electromagnetic drive of the sieve shakers AS 200 control, AS 300 control and AS 450 control produces a 3-D throwing motion which ensures optimum use of the open sieve area and lets the sample move equally over the whole sieving surface. These instruments feature digital amplitude adjustment which allows for sharp fractionizing of the sample even after very short sieving times. All sieve shakers of the series “control” come with an inspection certificate and can be calibrated. They are suitable as measuring instruments according to DIN EN ISO 9000 ff.

- Sieving with 3-D effect
- For dry and wet sieving
- 9 parameter combinations can be stored
- All-digital controls
- Independent of power frequency, loading, age when working in sieve acceleration mode
- Comparable and reproducible sieving results worldwide
- Integrated interface
- Low noise, no maintenance required

Sieve Shaker AS 200 control

The AS 200 control is designed for sieves with a diameter up to 203 mm (8”). It covers a measuring range from 20 µm to 25 mm. The AS 200 control offers a decisive advantage: Instead of the vibration height, the sieve acceleration, which is independent of the power frequency, can be set. Thus, comparable and reproducible sieving results world-wide are guaranteed. The AS 200 is also available as “basic” version with analogue parameter setting and as “digit” version with digital time control and interval operation.

AS 200 control
Sieve Shaker AS 300 control

The AS 300 control accepts sieves with a diameter up to 315 mm (12”). The measurement range lies between 20 µm and 40 mm. Due to the greater sieving surface, the average sieving time can be considerably reduced with this model. Another advantage is the high feed quantity of 6 kg which can be separated in one working run. Just like the AS 200 control, this siever allows for the setting of the sieve acceleration instead of the vibration height.

- Excellent separation efficiency even with short sieving times
- For high sieve loads (up to 25 kg)
- Sieve stack up to 963 mm height, Ø 400 / 450 mm
- Mobile operation panel for comfortable handling

Sieve Shaker AS 450 control

The AS 450 control is designed for 400 mm and 450 mm sieves. The measurement range lies between 20 µm and 125 mm. Due to the powerful electromagnetic drive, this sieve shaker achieves an amplitude of up to 2.2 mm which renders the separation process much more effective than with other sieve shakers of this type. The AS 450 control can separate sample amounts of up to 25 kg in one working run.

Main areas of application

AS 450 control:
Cement clinker, chemicals, coal, coke, construction materials, fillers, minerals, ores, plastics, sand, soils

### Performance data

<table>
<thead>
<tr>
<th></th>
<th>AS 200 basic</th>
<th>AS 200 digit</th>
<th>AS 200 control</th>
<th>AS 300 control</th>
<th>AS 450 control</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Applications:</strong></td>
<td>separation, fractioning, particle size determination</td>
<td>powders, bulk materials, suspensions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Measuring range:</strong></td>
<td>20 µm to 25 mm</td>
<td>20 µm to 25 mm</td>
<td>20 µm to 25 mm</td>
<td>20 µm to 40 mm</td>
<td>20 µm to 125 mm</td>
</tr>
<tr>
<td><strong>Max. batch / feed capacity:</strong></td>
<td>3 kg</td>
<td>3 kg</td>
<td>6 kg</td>
<td>25 kg</td>
<td></td>
</tr>
<tr>
<td><strong>Adjustment of amplitude:</strong></td>
<td>analog</td>
<td>analog</td>
<td>digital</td>
<td>digital</td>
<td>digital</td>
</tr>
<tr>
<td><strong>Suitable sieve diameters:</strong></td>
<td>100 mm to 200 mm / 8”</td>
<td>100 mm to 200 mm / 8”</td>
<td>100 mm to 315 mm</td>
<td>400 mm</td>
<td></td>
</tr>
</tbody>
</table>

*depending on feed material and used sieve set
Sieve Shakers

**Horizontal circular sieving motion**

The horizontal circular sieving motion is preferably used for long or fibrous, needle-shaped or flat materials. The horizontal orientation of the particles allows for better reproducibility of the sieving results.

**Sieve Shaker AS 400 control**

The AS 400 control accepts sieve stacks from 100 to 400 mm (4” - 16”) diameter which allows for versatile use. The horizontal, circular sieving motion ensures exact separation of fine and coarse-grained products. The AS 400 is the only horizontal sieve shaker with all digital controls.

- Measuring range 45 µm to 63 mm
- All-digital controls
- Easy operation
- Low-noise, no maintenance required

**Sieve Shaker AS 200 tap**

The AS 200 tap sieve shaker combines horizontal circular sieving with vertical tapping motions which reproduces the principle of hand sieving as is specified in various standards for particle size analysis. The uniform mechanical sieving motion produces reliable and reproducible measurement results.

- Measuring range 20 µm to 25 mm
- Robust, no maintenance required
- Digital timer
- Integrated interface
Air Jet Sieving

The method of moving the sieving material solely by an air flow has proven itself for classifying fine powders which tend to agglomerate and therefore cannot be separated using conventional sieve shakers. The air jet disperses the powder and at the same time purges the sieve mesh continuously. Air jet sieving is considerably faster than vibration sieving, yet gentle on the material.

Sieving machine AS 200 jet

The air jet sieving machine AS 200 jet is particularly suitable for the sieving of light materials with particle sizes down to 10 microns. An industrial vacuum cleaner generates a jet of air which blows through a rotating slotted nozzle against the sieve mesh. The particles on the sieve are dispersed by impact on the lid and distributed all over the sieve surface. Each sieving process provides one fraction. The undersize particles can be collected in a cyclone for further treatment. A special feature of the AS 200 jet is the Open Mesh Function. This procedure greatly reduces the number of near-mesh particles allowing for optimum separation efficiency and reproducibility. The AS 200 jet is designed for operation with RETSCH’s high quality sieves with 200 mm or 203 mm (8”) diameter.

- Measuring range 10 µm to 4 mm
- Fast and efficient procedure
- Open Mesh function to reduce the number of near-mesh particles
- Digital parameter setting
- Optional cyclone and automatic vacuum control

Main areas of application

Construction materials, spices, catalysts, plastics, flour, pharmaceuticals

Applications:

- separation, fractioning, particle size determination
- powders, bulk materials

Feeding material:

- 45 µm to 63 mm
- 20 µm to 25 mm
- 10 µm to 4 mm

Max. batch / feed capacity:

- 5 kg
- 3 kg
- 0.1 kg

Adjustment of Amplitude / speed:

- digital, 50 - 300 min⁻¹
- fixed, 280 min⁻¹, 150 taps
- digital, 5 - 55 min⁻¹

Suitable sieve diameters:

- 100 - 400 mm
- 200 mm / 8”
- 200 mm / 8”

*depending on feed material and used sieve set
Test Sieves

**Highest precision for accurate results**

RETSCH test sieves are manufactured using a unique, fully automatic production process which results in a superior product quality. RETSCH’s quality test sieves are available in the four most widely used frame sizes:

- 200 x 50 mm
- 200 x 25 mm
- 203 x 50 mm (8” x 2”)
- 203 x 25 mm (8” x 1”)

- One piece construction and fabric-transition without any grooves to prevent cross contamination (no solder, no epoxy, no residues, etc.)
- A high degree of corrosion resistance and ease of cleaning due to high-alloy stainless steel
- 15% lighter than traditional sieves while at the same time increasing the free sieve area
- Excellent product quality due to fully automatic production and extensive optical inspection with optimum design
- Permanently tight sieve fabric thanks to innovative resistance welding technology
- Maximum stability and optimum sealing when used in sieve stacks
- Individualized laser engraving allows for clear labeling of the sieves with full traceability
Quality control at the highest level

At RETSCH each sieve is subjected to a final quality check. This includes the optical measurement of the sieve mesh and recording the data on a high tech measuring system. The method and its results can be followed on a monitor. The instrument reads off the barcode on the sieve; this is programmed with the particular sieve standard which is valid for the sieve. Depending on the customer’s requirements, sieves can be supplied with a test report, inspection certificate or calibration certificate. The sieve and its accompanying documents are packed in an individually marked cardboard box, which is then sealed in plastic film to protect it against environmental influences. Thanks to the high inventory level in our warehouse, RETSCH high-quality sieves are available for our worldwide customers at any time.

Tested quality – with certificates

Every Retsch high-quality sieve receives a test report before it is delivered. On request, an inspection certificate according to DIN ISO 3310-1 is available, too, which documents the measuring results in tabular and graphical form. The calibration certificate provides even more statistical details.

As a special service RETSCH offers recalibration of the test sieves. After the standard measuring process of the sieves, all relevant data are recorded and confirmed in the certificate.

Evaluation Software EasySieve®

EasySieve®, the software for particle size analyses, exceeds manual evaluation in many aspects, due to the fact that the software is able to automatically control the necessary measurement and weighing procedures – from the registration of the weight of the sieve up to the evaluation of the data.
Main areas of application
Abrasives, carbon products, pelletized carbon black, coffee, catalysts, fertilizers, foodstuffs, glass, ceramics, metal powders, pharmaceuticals, plastics, polystyrene, refractory products, salt, sugar, sand

CAMSIZER®

Particle size and particle shape analysis with digital image processing

The CAMSIZER is a compact laboratory instrument for simultaneous measurement of particle size distribution and particle shape of powders and granules. Based on digital image processing by the unique, patented two-camera system pourable solids in a range from 30 µm to 30 mm can be measured. Thanks to the unique scanning of all particles and the newly developed fitting algorithms, measuring results are 100% compatible to those of sieve analysis. This makes the CAMSIZER the ideal time- and cost-saving alternative to sieving.

- Digital image processing with patented two-camera-system (acc. to ISO 13322-2)
- Simultaneous analysis of particle size, shape, number and density
- Very short measuring time (2-3 min.)
- Results are 100% compatible to sieve analysis
- Greatest possible accuracy and reproducibility

CAMSIZER® AutoSampler

The use of the optional AutoSampler maximizes the efficiency of the CAMSIZER. No matter whether varying sample materials are to be analyzed or series measurements need to be carried out, the AutoSampler adapts itself perfectly to the defined measuring routine.

CAMSIZER® Online

Due to its robust construction and interference-free measuring principle, the CAMSIZER is particularly suitable for integration in the production line in online operation. In such applications, the online version of the CAMSIZER is optimally matched to the specific “on-site” needs.
CAMSIZER XT - characterization of fine powders > 1 micron

The CAMSIZER XT substantially improves the quality control of fine powders and suspensions in the range 1 µm to 3 mm. It is based on the same two-camera system as the CAMSIZER, but optimized for finer particles. With the modular X-Change system the CAMSIZER XT offers three options for sample feeding:

- Pourable, not agglomerated particles are fed to the analysis area by the vibrating feeder of the “X-Fall” module. With the “X-Jet” module agglomerated particles can be accelerated and dispersed through a nozzle with adjustable overpressure. Finally, particles can be dispersed in liquids in the wet module “X-Flow” with ultrasound. Thus it is possible to choose the optimum method for each sample type.

- Newly developed optical system with ultra-strong LEDs for highest resolution and excellent depth of focus

- Reliable detection of smallest amounts of “undersize” and “oversize”

- Modular system X-Change for dry and wet dispersion

- Very short measuring time (1-3 min.)

Main areas of application

- Abrasives (medium-sized and small grit), cement, detergents and enzymes, metal and ore powders, plastic fibres and powders, pharmaceutical powders and granules, pulverized and granulated food, sand, wood fibres

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**Performance data**

<table>
<thead>
<tr>
<th>CAMSIZER®</th>
<th>CAMSIZER XT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range:</td>
<td>30 µm - 30 mm</td>
</tr>
<tr>
<td>Measuring principle:</td>
<td>Dynamic digital image processing (ISO 13322-2)</td>
</tr>
<tr>
<td>Measuring time:</td>
<td>approx. 2 - 3 min</td>
</tr>
<tr>
<td>(depending on the desired measuring statistics)</td>
<td></td>
</tr>
<tr>
<td>Measurements:</td>
<td>60 images/sec</td>
</tr>
<tr>
<td>&gt; 780,000 Pixel</td>
<td>approx. 1.3 MPixel</td>
</tr>
<tr>
<td>Options:</td>
<td>AutoSampler; Online-Version</td>
</tr>
</tbody>
</table>
Assisting

The Key to Greater Efficiency in the Laboratory

From representative, reproducible sampling and sample division to uniform, continuous material feed; from efficient preparation of solid pellets for XRF analysis to rapid cleaning of grinding tools and test sieves to gentle sample drying: RETSCH offer a comprehensive program of useful and cost-effective assistants which enhances the performance of our mills and sieve shakers even further.
Comparison of different sampling and sample division methods

A Rotary sample dividers
B Sample splitters
C Coning and quartering
D Random sampling

The diagram shows qualitative variations among part samples for various methods of sampling and sample division.

Example: Bulk material, feed size < 5 mm
Sample Dividers
PT 100, PT 200, RT 6.5 - RT 75

Sample dividers are essential for the exact and representative division of pourable bulk goods in the laboratory. The Rotary Sample Divider PT 100 uses the most exact division method which produces the smallest qualitative variations. In addition to the PT 200, which divides larger amounts up to 30 l per run, RETSCH offer the sample splitter RT for manual division.

<table>
<thead>
<tr>
<th>Performance data</th>
<th>PT 100</th>
<th>PT 200</th>
<th>RT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application:</td>
<td>Sample division</td>
<td>Sampling,</td>
<td>Sample division</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sample division</td>
<td></td>
</tr>
<tr>
<td>Feed material:</td>
<td>Bulk materials</td>
<td>Bulk materials</td>
<td>Bulk materials</td>
</tr>
<tr>
<td>Number of part samples:</td>
<td>6, 8 or 10</td>
<td>1-3</td>
<td>2</td>
</tr>
<tr>
<td>Feed size:</td>
<td>&lt; 10 mm</td>
<td>&lt; 10 mm</td>
<td>&lt; 4 - 50 mm</td>
</tr>
<tr>
<td>Collector volume:</td>
<td>100, 250, 500 ml</td>
<td>500 ml, 30 l</td>
<td>2.5 l, 8 l</td>
</tr>
</tbody>
</table>

Vibratory Feeder DR 100

The Vibratory Feeder DR 100 is ideal for the uniform, continuous feed of pourable bulk materials and fine powders. It is used in combination with RETSCH mills and sample dividers and is also suitable for balances and particle measurement systems. Thanks to the wide range of accessories, the Vibratory Feeder DR 100 can be used for a variety of applications.

<table>
<thead>
<tr>
<th>Performance data</th>
<th>DR 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application:</td>
<td>Feeding, conveying</td>
</tr>
<tr>
<td>Feed material:</td>
<td>Bulk materials</td>
</tr>
<tr>
<td>Feed size:</td>
<td>2 - 12 mm</td>
</tr>
<tr>
<td>Time setting:</td>
<td>1-99 min. digital, continuous operation</td>
</tr>
<tr>
<td>Flow rate:</td>
<td>0-5 l/min, continuously adjustable</td>
</tr>
</tbody>
</table>
**Fluid Bed Dryer TG 200**

The Fluid Bed Dryer TG 200 is used in the laboratory for the gentle drying of bulk materials without localized overheating. The average drying time lies between 5 to 20 minutes which represents a substantial saving in time compared to other drying methods. Typical materials include coal, plastics, soils, pharmaceutical products or plant materials. The TG 200 can also be used for drying test sieves.

<table>
<thead>
<tr>
<th>Performance data</th>
<th>TG 200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Drying</td>
</tr>
<tr>
<td>Feed material</td>
<td>Bulk materials and solids, &gt; 63 µm</td>
</tr>
<tr>
<td>Temperature control</td>
<td>40 - 150 °C, continuously adjustable</td>
</tr>
<tr>
<td>Time setting</td>
<td>0 - 99 min. continuously adjustable</td>
</tr>
<tr>
<td>Container volume</td>
<td>1 x 6 l or 3 x 0.3 l</td>
</tr>
</tbody>
</table>

**Ultrasonic Baths UR 1, UR 2, UR 3**

RETSCH ultrasonic baths are used for the gentle and efficient cleaning of test sieves, glass and metal parts, metallographic and geological samples and many others. Further areas of application are sample preparation of suspensions (e.g. for wet sieving), dispersions in chromatography or the degassing of solutions.

<table>
<thead>
<tr>
<th>Performance data</th>
<th>UR 1</th>
<th>UR 2</th>
<th>UR 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Cleaning, dispersion, degassing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feed material</td>
<td>Test sieves, glass and metal components, suspensions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume</td>
<td>5.7 l</td>
<td>42 l</td>
<td>45 l</td>
</tr>
</tbody>
</table>

**Pellet Presses PP 25, PP 40**

For the preparation of solid samples for XRF analysis RETSCH offer 2 types of pellet presses. The automatic press PP 40 is a floor model which features an individual pressure force regulation of up to 40 t. The pellets are pressed into steel rings with an outer diameter of 40 and 51.5 mm. It is also possible to use aluminum cups. The manual hydraulic Pellet Press PP 25 is a compact bench-top model with pressing tools for 32 mm and 40 mm pellets.

<table>
<thead>
<tr>
<th>Performance data</th>
<th>PP 25</th>
<th>PP 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Preparation of pellets for spectral analyses</td>
<td></td>
</tr>
<tr>
<td>Feed material</td>
<td>Minerals, slag, ores, cement, raw materials etc.</td>
<td></td>
</tr>
<tr>
<td>Max. pressure</td>
<td>25 t</td>
<td>40 t</td>
</tr>
<tr>
<td>Pellet diameters</td>
<td>32 mm, 40 mm</td>
<td>40 mm, 51.5 mm</td>
</tr>
<tr>
<td>Parameter combinations</td>
<td>-</td>
<td>32</td>
</tr>
</tbody>
</table>
As a global market leader, RETSCH strive to provide information to customers worldwide 24 hours a day, 7 days a week. The website www.retsch.com is the ideal tool to get first-hand details on products, applications, contact persons, dates and events. The site, which is available in 15 languages, is updated on a daily basis.

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<table>
<thead>
<tr>
<th>Function &amp; Features</th>
<th>Information &amp; Downloads</th>
<th>Order data &amp; Quote request</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Application examples</td>
<td>- Videos</td>
<td>- Picture of each price list article</td>
</tr>
<tr>
<td>- Product advantages</td>
<td>- Brochures</td>
<td>- Order data</td>
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<td>- Technical features</td>
<td>- Application reports</td>
<td>- Request a free, non-binding quote!</td>
</tr>
<tr>
<td>- Function principle</td>
<td>- Tips &amp; Tricks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Operating instructions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and many more</td>
<td></td>
</tr>
</tbody>
</table>
Application Data Base

In order to find the best possible solution for your sample preparation task RETSCH offer free-of-charge test grindings and particle analyses which are carried out by our application specialists. The results are collected in a database which currently contains more than 1,000 test reports. For the online database we selected the most frequently occurring applications.

The application data base is an excellent tool to get a first orientation as to which instrument may be suitable for a particular application or sample material.

www.retsch.com/applicationdatabase

Test Grindings

The “application” menu offers the possibility to download the questionnaire for milling and sieving which you need to send in your sample for a free test grinding or particle size analysis.

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www.retsch.com/news
RETCH PRODUCT RANGE

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MILLING
- Jaw Crusher BB 51/BB 100/BB 200/BB 300
- Ultra Centrifugal Mill ZM 200
- Rotor Beater Mills SR 200/SR 300
- Cross Beater Mill SK 100
- Cyclone Mill TWISTER
- Knife Mills GRINDOMIX GM 200/GM 300
- Heavy-Duty Cutting Mills SM 100/SM 200/SM 300
- Mortar Grinder RM 200
- Disc Mill DM 200
- Vibratory Disc Mill RS 200
- CryoMill
- Mixer Mills MM 200/MM 400
- Planetary Ball Mills PM 100 CM/PM 100/PM 200
- Planetary Ball Mill PM 400
- Measuring System PM GrindControl

SIEVING
- Sieve Shakers AS 200/AS 300/AS 400/AS 450
- Tap Sieve Shaker AS 200 tap
- Air Jet Sieving Machine AS 200 jet
- Test Sieves Evaluation Software EasySieve® CAMSIZER®/CAMSIZE®
- Optical Particle Analyzer

ASSISTING
- Sample Dividers PT 100/PT 200
- Vibratory Feeder DR 100
- Rapid Dryer TG 200
- Ultrasonic Baths UR 1/UR 2/UR 3
- Pellet Presses PP 25/PP 40

Retsch GmbH
Retsch-Allee 1-5
42781 Haan · Germany
Phone +49 (0) 2104/2333-100
Fax +49 (0) 2104/2333-199
E-mail info@retsch.com
Internet www.retsch.com

Solutions in Milling & Sieving
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