

Size reduction with Disc Mills and Mortar Grinders



Retsch[®]
Solutions in Milling & Sieving

Vibratory Disc Mill

The RETSCH RS 200 is the ideal tool for fast and powerful grinding of sample materials for spectral analyses. It achieves grind sizes below 100 microns within seconds and with excellent reproducibility.





Milling

- Jaw Crushers
- Rotor Mills
- Cutting Mills
- Knife Mills and Blenders

- Disc Mills

- Mortar Grinders

- Mixer Mills
- Planetary Ball Mills

Sieving

Assisting

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RETSCH Disc Mills and Mortar Grinders are used primarily for fine and very fine comminution of soft, hard and brittle materials. A final fineness of approx. 100 µm can be achieved with disc mills and <10 µm with mortar grinders. A maximum feed size of up to 20 mm is possible depending on the instrument used. If the grain size of the sample is greater than this, it must first be pulverized.

Preliminary Size Reduction



For **coarse and primary size reduction** RETSCH jaw crushers have proven themselves to be highly efficient. They are available in 4 different sizes. Depending on the model, they can comminute hard, brittle or tough material to a final size of 0.5 - 5 mm.

Assisting



For the subsequent pulverization a **representative part-sample** must first be obtained, e.g. with the sample divider PT 100 from RETSCH.

RETSCH offers two models of hydraulic **pellet presses** to prepare solid samples for XRF analyses

The main areas of application for Vibratory Disc Mills are:

Ceramics and Glass

Construction Materials
 cement, cement clinker,
 concrete

Environment
 electronic components,
 plant materials, soil

Mineralogy and Metallurgy
 coal, coke, corundum,
 metal oxides, ores, slag

and many more...

Applications Vibratory Disc Mill

The RETSCH Vibratory Disc Mill is particularly suitable for rapid, loss-free grinding of hard, brittle and fibrous materials to analytical fineness. The mill is primarily used for sample preparation for spectral analysis.

Free test grinding

As part of RETSCH's professional customer support we offer our customers the individual advice required to find the optimum solution for their sample preparation task. To achieve this our application laboratories process and measure samples free-of-charge and provide a recommendation for the most suitable method and instrument.

For more information please visit our website www.retsch.com/testgrinding.



Application examples

Vibratory Disc Mill	Grinding set	Feed size	Sample amount	Grinding time	Revolution speed	Final fineness
Catalysts	50 ml Zirconium oxide	10 mm	25 g	1 min	1400 rpm	100 µm
Cement Clinker	100 ml Hardened steel	4 mm	100 ml	90 sec	1400 rpm	75 µm
Corundum	100 ml Tungsten carbide	2 mm	110 g	5 min	1400 rpm	100 µm
Electronic Scrap	100 ml Hardened steel	10 mm	70 g	6 min	1400 rpm	100 µm
Fe-/Cr-/Mo-Alloys	100 ml Tungsten carbide	0.5 mm	175 g	5 min	1500 rpm	100 µm
Ferro-Molybdenum	100 ml Tungsten carbide	5 mm	70 ml	3 min	1500 rpm	150 µm
Refractories	100 ml Tungsten carbide	15 mm	100 g	5 min	1400 rpm	60 µm
Silicon Carbide	100 ml Tungsten carbide	2 mm	70 g	30 sec	1400 rpm	100 µm
Slag, dross	250 ml Tungsten carbide	20 mm	150 ml	2 min	1200 rpm	90 µm

This chart serves only for orientation purposes.

RETSCHE's application database contains more than 1,000 application reports. Please visit www.retsch.com/applicationdatabase.

Vibratory Disc Mill RS 200

Fast and
reproducible

Analytical fineness in seconds

No grinder can beat the speed of a Vibratory Disc Mill when it comes to preparing samples for spectral analyses.

Benefits at a glance

- Extremely short grinding time
- Speed range 700 rpm - 1500 rpm, freely selectable
- Quick action clamping device for grinding set
- Reproducible results
- 1-button operation with graphic display
- 10 SOPs can be defined and stored for routine applications
- Programmable starting time
- Grinding sets in different sizes and materials
- Agate recognition for automatic speed reduction
- Sealed, noise-insulated grinding chamber
- Maintenance-free
- 2-year warranty, CE-conform

The powerful drive of RETSCH's RS 200 allows for the extremely rapid formation of the movement pattern of the grinding discs inside the jar which leads to analytical fineness after a very short grinding time. Moreover, the RS 200 provides grinding results with excellent reproducibility.

The instrument runs steadily and smoothly, even with heavy grinding sets and at maximum speed. The new **Stabilized-Plane-Drive** ensures that the main directional movement of the drive train is secured in a plane. This prevents the jar from gyrating or tumbling so that the energy is fully available for the grinding process.



Thanks to grinding sets in various materials and sizes, this mill can be used for a wide range of sample materials. With its robust design, it has proven to be very suitable for use in the building materials sector (cement), in geology, mineralogy, metallurgy and in power plants.

Vibratory Disc Mill technology

The vibratory disc mill comminutes by pressure, impact and friction. The grinding set is firmly attached to the vibration plate with a quick-action lever. The plate with the grinding set is subjected to circular horizontal vibrations. The centrifugal force acting on the grinding rings in the dish results in extreme pressure, impact and frictional forces acting on the sample, producing analytical fineness in 1-3 minutes.

The circular vibrations are produced by a frequency controlled 1.5 kW 3-phase motor. Its speed can be selected between 700 rpm - 1500 rpm in order to adapt to the characteristics of the sample material. A sensor recognizes the presence of agate grinding sets and automatically limits the speed to 700 rpm to avoid damaging the agate. The cover of the noise-insulated grinding chamber has a safety interlock and can only be opened when the mill is at a standstill.



Selection of grinding sets



Exceptionally simple and safe handling

A grinding set for the vibratory disc mill consists of a grinding dish with cover and a grinding disc. The 100 ml and 250 ml grinding sets contain an additional grinding ring.

These grinding sets feature the following advantages:

- safe, non-slip attachment with integral safety devices on cover and base
- user-friendly gripping on cover and base
- gap between dish and cover edge for easy opening
- optimal sealing with O-ring
- protective jacket made from stainless steel (for agate, zirconium oxide and tungsten carbide dishes)
- grinding set identification (article number, material and volume)
- marking field (e.g. for information about sample)

The grinding sets have been developed especially for extreme test conditions such as high sample throughput and high mechanical stress.

Grinding sets RS 200 – guidelines for sample amount

Grinding set nominal volume	Sample amount	Max. feed size
50 ml	15 - 50 ml	< 5 mm
100 ml	35 - 100 ml	<10 mm
250 ml	80 - 250 ml	<15 mm

In addition to the instrument settings, the filling level of the grinding set is also of crucial importance for a successful grinding process in vibratory disc mills. The table provides guidelines for the recommended sample amount depending on grinding sets used.

Material composition guidelines

Grinding set	Material no. or name	approx. hardness	Material analysis (in %)
Hardened steel	1.2080	62-63 HRC	Fe (85.34), Cr (12), C (2.2), Mn (0.45), Si (0.4), P (0.03), S (0.03)
Steel for heavy-metal-free grinding	1.1740	60-63 HRC	Fe (98.008), C (0.65), Mn (0.8), Si (0.4), P (0.035), S (0.035)
Tungsten carbide	WC	1180-1280 HV 30	WC (94), Co (6)
Agate	SiO ₂	6.5-7.0 Mohs	SiO ₂ (99.91), Al ₂ O ₃ (0.02), CaO (0.01), Fe ₂ O ₃ (0.01), K ₂ O (0.01), Na ₂ O (0.02), MgO (0.01), MnO (0.01)
Zirconium oxide*	ZrO ₂	1250 HV 0.5	ZrO ₂ (94.5), Y ₂ O ₃ (5.2), SiO ₂ / MgO / CaO / Fe ₂ O ₃ / Na ₂ O / K ₂ O (<0.3)

The above percentages are mean values. We reserve the right to make alterations.

*Yttrium-part-stabilized

Sample preparation for XRF analysis

RETSCHE offers the **Pellet Press PP 40** as a useful complement to sample preparation in the RS 200. The press features individual pressure force regulation from 10 to 400 kN. It not only controls the pressure force but also the pressure build-up and release during the pressing process. This reduces the internal stress on the sample and ensures that even difficult materials are pressed perfectly.

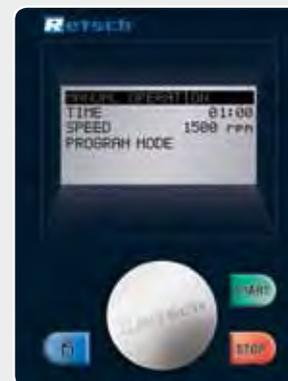
The PP 40 is available with 4 different pressing tools additionally allowing for free pressing.

Please refer to the brochure „Assisting“ for more details about the RETSCHE Pellet Presses.



Performance data		RS 200
		www.retsch.com/rs200
Field of application	size reduction, mixing, trituration	
Feed material	medium-hard, hard, brittle, fibrous	
Feed size*	<15 mm	
Final fineness*	<40 µm	
Batch size/Feeding quantity	35 - 150 ml	
Speed settings	700 rpm to 1500 rpm, continuously adjustable	
Digital grinding time setting (hours:minutes:seconds)	00:00:01 to 99:59:59	
Technical data		
Drive	frequency controlled 3-phase motor	
Nominal motor performance	1.5 kW	
Protection code	IP 40	
B x H x D	836 x 1220 x 780 mm	
B x H x D (with open cover)	836 x 1900 x 780 mm	
Weight (without grinding set)	approx. 210 kg	
Noise values (Noise measurement according to DIN 45635-31-01-KL3)		
Emission value with regard to workplace	L _{peak} 84 dB(A)	
Measuring conditions:		
Grinding set	250 ml hardened steel	
Feed material	100 g cement clinker, grain size <2 mm 6 milling aid tablets C20	
Speed	1450 rpm	
*depending on feed material and instrument configuration/settings		

Maximum operating comfort



Operation of the Vibratory Disc Mill is easy and convenient. The grinding parameters are entered using a single button. In addition to the current settings a graphics display shows service and operating information. Up to 10 Standard Operating Procedures (SOPs) can be defined and stored for routine applications. The user can choose between 13 languages for menu guidance.

Vibratory Disc Mill order data

Vibratory Disc Mill RS 200			Item No.	Item No.
Vibratory Disc Mill RS 200 (please order grinding set separately)				
RS 200 for 220–230 V, 50/60 Hz				20.725.0001
Grinding set for RS 200	Material	Nominal volume	Grinding set	Spare Viton O-rings
50 ml nominal volume (sample amount: 15 - 50 ml, max feed size: <5 mm)				
	Hardened steel	50 ml	01.462.0170	05.114.0075
	Tungsten carbide	50 ml	01.462.0177	05.114.0068
	Agate (only for 700 rpm)	50 ml	01.462.0178	05.114.0069
	Zirconium oxide	50 ml	01.462.0193	05.114.0069
	Steel 1.1740	50 ml	01.462.0002	05.114.0075
100 ml nominal volume (sample amount: 35 - 100 ml, max feed size: <10 mm)				
	Hardened steel	100 ml	01.462.0171	05.114.0067
	Tungsten carbide	100 ml	01.462.0265	05.114.0070
	Agate (only for 700 rpm)	100 ml	01.462.0179	05.114.0070
	Zirconium oxide	100 ml	01.462.0192	05.114.0067
250 ml nominal volume (sample amount: 80 - 250 ml, max feed size: <15 mm)				
	Hardened steel	250 ml	01.462.0263	05.114.0076
	Tungsten carbide	250 ml	01.462.0264	05.114.0067
	Steel 1.1740	250 ml	01.462.0266	05.114.0076

The main areas of application for Disc Mills are:

Ceramics and Glass

dental ceramics, electrotechnical porcelain, glass, hydroxyapatite, sintered ceramics, steatite

Construction Materials

concrete, construction waste, granite, gypsum

Environment

dried soil samples, drilling cores, sewage sludge

Mineralogy and Metallurgy

bauxite, cement clinker, chamotte, coal, coke, ferro-alloys, ores, quartz, slag

and many more...

Applications Disc Mill

The RETSCH Disc Mill DM 200 is used for batchwise or continuous preliminary and fine size reduction of medium-hard to hard-brittle solids (up to 8 Mohs). The disc mill can grind such sample materials to an average final fineness of approx. 100 µm in one go.

Free test grinding

As part of RETSCH's professional customer support we offer our customers the individual advice required to find the optimum solution for their sample preparation task. To achieve this our application laboratories process and measure samples free-of-charge and provide a recommendation for the most suitable method and instrument.

For more information please visit our website www.retsch.com/testgrinding.



Application examples

Disc Mill	Grinding discs	Gap width	Feed size	Sample amount	Grinding time	Final fineness
Aluminium-Silicon-Oxide-Nitride	Manganese steel	0 mm	3 mm	200 g	1 min	0.5 mm
Cement Clinker	Hardened steel	0.1 mm	15 mm	250 g	5 min	0.3 mm
Ferro-alloy	Manganese steel	0.3 mm	10 mm	200 g	2 min	0.5 mm
Glass Pellets	Manganese steel	0.2 mm	20 mm	130 g	30 sec	0.5 mm
Lime	Hardened steel	0.2 mm	10 mm	250 g	2 min	0.2 mm
Marl	Hardened steel	0.3 mm	10 mm	100 g	1 min	0.2 mm
Salt	Hardened steel	0.1 mm	10 mm	500 g	2 min	0.1 mm
Shale	Hardened steel	0.1 mm	10 mm	200 g	2 min	0.3 mm
Stones	Hardened steel	0.2 mm	5 mm	250 g	5 min	0.2 mm
Titanium Sponge	Manganese steel	0 mm	10 mm	290 g	30 sec	0.1 mm

This chart serves only for orientation purposes.

RETSCHE's application database contains more than 1,000 application reports. Please visit www.retsch.com/applicationdatabase.

Disc Mill DM 200

Suitable for hardness
up to 8 Mohs



DM 200

Benefits at a glance

- Accurate gap setting for reproducible grinding results
- Short grinding times, high final fineness
- Contamination-free grinding with grinding discs made from 4 different materials
- Grinding discs with long working life
- Easy cleaning
- Dust-free grinding thanks to connector for dust extraction
- Maintenance-free 3-phase geared motor
- 2 year warranty, CE-conform

Grinding even the hardest products

Thanks to its robust design, the RETSCH Disc Mill DM 200 can be used under rough conditions in laboratories and pilot plants, as well as online for the quality control of raw materials.

A particular advantage of the mill is the **large sample feed size**, with an edge length of up to 20 mm. The final fineness – which can be as high as 100 microns - depends on the set grinding disc gap width and the breaking properties of the particular sample. The powerful DM 200 usually requires only a few minutes to achieve the desired grind size.

The gap between the grinding discs can be adjusted – even during operation – via a scale with an accuracy of 0.1 mm. This ensures reproducible grinding results.

The RETSCH Disc Mill DM 200 is very simple to operate. When the grinding process is finished, the hinged grinding chamber can be opened completely so that the mill is fully accessible for cleaning and changing the grinding discs. The DM 200 can be equipped with an optional connecting piece for a dust exhaust system which allows for removal of fine dust during grinding.

Disc Mill technology

The feed material enters the dust-proof chamber from the filling hopper and is fed centrally between two vertical grinding discs. A moving grinding disc rotates against a fixed one and draws in the feed material. The necessary size reduction effects are generated by pressure and frictional forces. The progressively arranged teeth of the grinding disc first subject the sample to preliminary crushing; centrifugal force then

moves it to the outer regions of the grinding discs where fine grinding takes place. The processed sample exits through the grinding gap and is collected in a receiver. The gap width between the grinding discs is continuously adjustable during operation in the range between 0.1 and 5 mm; an additional observation window is provided for checking the gap setting.



Selection of grinding discs



A set of grinding discs for the DM 200 consists of a fixed and a rotating grinding disc. The material should be selected so that contamination of the sample is avoided and abrasion minimized. 4 different materials are available.

For standard size reduction,

e.g. minerals with Mohs hardness 3 - 6

- grinding disc set made from hardened steel or manganese steel

For extreme size reduction,

e.g. minerals with Mohs hardness >6

- grinding disc set made from tungsten carbide (WC)

For heavy-metal-free size reduction,

e.g. dental ceramics

- grinding disc set made from zirconium oxide

After a long period of use the grinding discs will show signs of mechanical wear. However, before they need to be replaced by new ones, the opposite side of the teeth can also be used by changing the direction of rotation of the motor. This considerably extends the working life of the grinding discs.

Material composition guidelines

DM 200 Grinding discs	Material no. or name	approx. hardness	Material analysis (in %)
Hardened steel	1.2601	60-62 HRC	Fe (83.59), Cr (12), C (1.75), Mo (0.7), W (0.6), V (0.5), Si (0.4), Mn (0.4), P (0.03), S (0.03)
Manganese steel	1.3401	**	Fe (ca. 83.6 – 85), C (1.1-1.3), Si (0.3-0.5), Mn (12-13), P (0.1), S (0.04), Cr (1.5)
Tungsten carbide	WC	1180-1280 HV 30	WC (90.3), Co (9.5), TaC (0.2)
Zirconium oxide	ZrO ₂	1200 HV	ZrO ₂ (94.8), HfO ₂ (1.5), SiO ₂ (<0.1), Al ₂ O ₃ (<0.1), Fe ₂ O ₃ (<0.05), CaO (<0.05), MgO (<3.1-3.3), Na ₂ O (<0.03), others (<0.1)

The above percentages are mean values. We reserve the right to make alterations.

** no information about hardness available

Strong combination: Pre- and fine grinding in one step

Progressive size reduction with excellent results

The Disc Mill DM 200 grinds the sample material by pressure and frictional forces between a moving and a fixed grinding disc. The progressively arranged teeth of the grinding discs in the central area pre-crush the sample before it is finely ground in the outer region. **This special grinding disc shape allows even very hard samples to be comminuted efficiently.** The ground material then falls through the grinding gap into a receptacle and can be easily recovered for further treatment.

Performance data		DM 200
		www.retsch.com/dm200
Field of application		preliminary and fine comminution
Feed material		medium-hard, hard, brittle
Feed size*		<20 mm
Final fineness*		<100 µm
Hopper volume/Throughput*		2.5 l / up to 150 kg/h
Gap width setting		continuous, 0.1 - 5 mm
Grinding disc speed at 50 Hz		440 rpm
Grinding disc speed at 60 Hz		528 rpm
Technical data		
Drive		3-phase geared motor
Nominal motor performance		1500 W
B x H x D		440 x 400 x 870 mm
Weight		approx. 140 kg
Noise values (Noise measurement according to DIN 45635-31-01-KL3)		
Emission value with regard to workplace		L_{pAeq} 69.4 dB(A)
*depending on feed material and instrument configuration/settings		



For the rapid, continuous grinding of large quantities of coarse material to analytical fineness, the combination of the RETSCH Jaw Crusher BB 200 and the RETSCH Disc Mill DM 200 is the perfect solution. The crusher is mounted above the disc mill on a frame and both instruments are connected by a chute. With this construction, samples of up to 90 mm feed size can be ground down to 100 microns in one single step.

Disc mill order data

Disc Mill DM 200		Item No.
Disc Mill DM 200 (please order set of grinding discs separately)		
DM 200 for 3/N~ 400 V, 50 Hz		20.740.0001
DM 200 for 3~ 220-230 V, 50 Hz		20.740.0002
Grinding disc set DM 200		
Material	Hardened steel	22.456.0001
	Manganese steel	22.456.0002
	Tungsten carbide	22.456.0003
	Zirconium oxide	22.456.0004
Accessories		
Connector for dust extraction		22.481.0025
Frame for combination Disc Mill DM 200/Jaw Crusher BB 200		02.824.0054

The main areas of application for Mortar Grinders are:

Agriculture

oil seeds, plant material, soil

Biology

frozen yeast cells

Ceramics and Glass

Chemicals

Construction materials

cement clinker, tiles

Food

cocoa nibs, nuts, spices

Medicine / Pharma

pharmaceutical and homeopathic raw materials and finished products

Mineralogy and Metallurgy

quartz, salts, silicates, slag

and many more...

Applications Mortar Grinder

RETSCH Mortar Grinders comminute inorganic and organic substances to analytical fineness. They can mix and homogenize powders, suspensions and pastes. The grinders are also ideal for the uniform trituration of homeopathic and pharmaceutical products.

Soft, hard, brittle and pasty materials with a hardness of up to 9 on Mohs scale can be processed easily in RETSCH mortar grinders.

Free test grinding

As part of RETSCH's professional customer support we offer our customers the individual advice required to find the optimum solution for their sample preparation task. To achieve this our application laboratories process and measure samples free-of-charge and provide a recommendation for the most suitable method and instrument.

For more information please visit our website www.retsch.com/testgrinding.



Application examples

Mortar Grinder	General remarks	Grinding set	Pestle pressure	Feed size	Sample amount	Grinding time	Final fineness
Coated tablets		Agate	3	10 mm	5 g	5 min	200 µm
Cocoa nibs	pre-heating to 60 °C	Hard porcelain	4	10 mm	75 g	20 min	75 µm
Eucalyptus leaves		Hard porcelain	5	10 mm	80 ml	10 min	200 µm
Lactose		Stainless steel	0	1 mm	75 g	10 min	100 µm
Quartz sand		Zirconium oxide	7	5 mm	150 g	30 min	160 µm
Nickel alloys		Zirconium oxide	7	5 mm	120 g	20 min	200 µm
Soil		Agate	3	0.5 mm	20 g	40 min	40 µm
Table salt (NaCl)		Hard porcelain	5	1 mm	100 g	15 min	100 µm

This chart serves only for orientation purposes.

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Mortar Grinder RM 200

The unmatched original

Benefits at a glance

- Wet and dry grinding
- Reproducible results by adjustment of the pestle pressure (via a scale) and digital time setting
- 7 different grinding set materials
- Performance display
- Easy exchange of pestle and mortar without tools
- Closed, dust-tight grinding chamber with windows
- High-performance drive with electronic control
- Very easy to clean
- 2-year warranty, CE-conform



RM 200

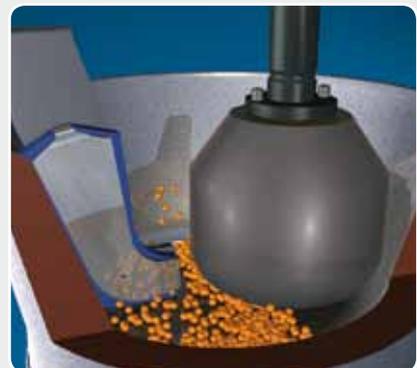
Grinding, mixing, trituration

RETSCH mortar grinders are suitable for reproducible sample preparation for subsequent analysis within the framework of quality assurance and GLP as well as for the preparation of prescriptions and formulations. Samples that are difficult to comminute can be successfully processed in mortar grinders by heating or cooling them, or by using grinding aids.

Mortar Grinder technology

Mortar grinders comminute, mix and triturate by pressure and friction. The function of the scraper is to feed the material into the area between the mortar and pestle. This forced feed ensures that the whole of the sample is continuously subjected to the grinding and trituration process and is also intensively mixed. The pestle is not located in the center of the mortar but is offset; contact with the rotating mortar and the sample causes it to

rotate automatically. The necessary grinding pressure is achieved by the weight of the pestle itself combined with the adjustable spring pressure acting on its axis.



Safe and convenient

The RM 200 is a dust-tight closed comminution system that can be used for dry and wet grinding. With a useful volume of 10 to 190 ml it is possible to achieve a final fineness of $<10\ \mu\text{m}$. The maximum feed size of the product depends on the properties of the material and is approx. 8 mm. The choice of a grinding set of 7 different materials allows **neutral-to-analysis sample preparation**.

The sample or grinding additives such as liquids can be added during operation via the right-hand Plexiglas window in the grinding compartment cover. The grinding process can be observed through the large windows.



The grinding time is set digitally between 0 and 99 minutes, continuous operation is also possible. In addition to the grinding time, the contact pressure of the pestle as well as its position in the mortar also has a considerable influence on the grinding results. The contact pressure can easily be set via a scale (1) on the cover of the RM 200. The positions of the pestle and the scraper are adjusted with the help of knobs (2).

The RM 200 features a performance display (3) which indicates the current workload of the mill. This helps to adjust the pestle pressure to the most suitable position.

The grinding chamber cover has a safety switch that cuts off the motor when the cover is raised. An electronic load and speed control protects the motor against overloading.

Performance data	RM 200
	www.retsch.com/rm200
Field of application	grinding, mixing and triturating
Feed material	soft, hard, brittle, pasty, dry and wet
Feed size*	$<8\ \text{mm}$
Final fineness*	$<10\ \mu\text{m}$
Batch size/Feeding quantity	10 - 190 ml
Setting grinding time	1 - 99 min / continuous
Setting pestle pressure/position	yes, via scale/via knob
Setting scraper position	yes, via knob
Technical data	
Power consumption	250 W (at 230 V, 50 Hz)
Speed	100 rpm
Protection code	IP 53
B x H x D	approx. 400 x 480 x 370 mm
Weight, net (without grinding set)	approx. 24 kg
Noise values (Noise measurement according to DIN 45635-31-01-KL3)	
Emission value with regard to workplace	$L_{pAeq}\ 71\ \text{dB(A)}$
Measuring conditions:	
Feed material	quartz sand
Feed size	$<1\ \text{mm}$

*depending on feed material and instrument configuration/settings

The original "Retsch Mill"

More than 80 years ago F. Kurt Retsch took out his first patent for a grinding instrument: a mortar grinder that became well-known throughout the world as the "Retsch Mill". Until 1923 heavy hand-operated mortars were the common tool for size reduction in laboratories. It frequently took hours of tiresome grinding until the material had achieved the necessary degree of fineness. However, when he invented the first mechanical mortar grinder,

F. Kurt Retsch put an end to all this, which brought both him and his company worldwide respect in the fields of science and research. Since then the "Retsch Mill" has been substantially enhanced and perfected and a complete family of laboratory mills and grinders has been added to the program which meets the latest requirements of GLP and CE.



F. Kurt Retsch and the original "Retsch Mill"

Selection of grinding sets



Mortar and pestle made of 7 different materials

The choice of the suitable grinding set material depends primarily on the hardness of the sample and the possible effects of any abrasion on the subsequent analysis or further processing. For example, the DAB (Deutsches Arzneimittel Buch – German Pharmacopoeia) stipulates the use of hard porcelain grinding sets for the preparation of pharmaceutical and homeopathic products.

For soft to medium-hard or pasty substances grinding sets made from hard porcelain or sintered aluminum oxide (Al_2O_3) are usually adequate.

For processing **hard, abrasive substances, for long-term and for heavy-metal-free processing**, we recommend the use of grinding sets

made from agate, zirconium oxide or tungsten carbide.

For less demanding applications, also **under rough conditions**, grinding sets made from hardened steel or stainless steel should be used. Stainless steel is also the material of choice for the grinding of frozen yeast cells.

The standard scraper is made from abrasion-resistant Vulkollan. A special version made from beech wood is available as an option for use in the pharmaceutical sector. A PTFE scraper is particularly suitable for cryogenic grinding.

The mortar of the RM 200 has a maximum useful volume of 190 ml.

Tips for optimum results

- Samples that are difficult to grind can be cooled or processed by using grinding aids.
- For the preparation of pastes the mortar containing the sample (e.g. cocoa nibs) should first be heated in a temperature cabinet.
- The addition of Aerosil® helps to avoid caking when grinding pharmaceutical products.
- Pure quartz sand can be added as a grinding aid when processing oil seeds (rape seed, soybean, mustard, etc.).

Material composition guidelines

Grinding set	Material no. or name	Mortar Pestle	approx. hardness	Material analysis (in %)
Hardened steel	1.2080	■	60 HRC	Fe (85.34), Cr (12), C (2.2), Mn (0.45), Si (0.4), P (0.03), S (0.03)
	1.2379	■	58-60 HRC	Fe (84.5), Cr (11.5), C (1.55), V (0.95), Mo (0.75), Mn (0.3), Si (0.4), P (0.015), S (0.015)
Stainless steel	1.4034	■ ■	48-52 HRC	Fe (84.5), Cr (13), C (0.42), Mn (1), Si (1), P (0.05), S (0.03)
Tungsten carbide	WC	■ ■	1180-1280 HV 30	WC (94), Co (6)
Agate	SiO_2	■ ■	6.5-7.0 Mohs	SiO_2 (99.91), Al_2O_3 (0.02), Na_2O (0.02), Fe_2O_3 (0.01), K_2O (0.01), MnO (0.01), MgO (0.01), CaO (0.01)
Sintered alum. oxide	Al_2O_3	■ ■	1750 HV	Al_2O_3 (99.7), SiO_2 (0.075), MgO (0.075), CaO (0.07), Na_2O (0.01), Fe_2O_3 (0.01)
Zirconium oxide*	ZrO_2	■ ■	1200 HV	ZrO_2 (94.5), Y_2O_3 (5.2), SiO_2 / MgO / CaO / Fe_2O_3 / Na_2O / K_2O (<0.3)
Hard porcelain		■ ■		SiO_2 (68.5), Al_2O_3 (26.1), K_2O (3.92), Fe_2O_3 (0.52), MgO / CaO / Na_2O / TiO_2 (<0.2)

The above percentages are mean values. We reserve the right to make alterations.
*Yttrium-part-stabilized

Mortar grinder order data

Mortar Grinder RM 200		Item No.	Item No.
Mortar Grinder RM 200 (please order mortar and pestle separately)			
RM 200	for 230 V, 50 Hz		20.455.0001
RM 200	for 110 V, 60 Hz		20.455.0003
RM 200	for 120 V, 60 Hz		20.455.0004
Mortars and pestles for RM 200		Mortar	Pestle
Material	hardened steel	02.460.0018	02.461.0112
	stainless steel	02.460.0057	02.461.0113
	tungsten carbide	02.460.0021	02.461.0114
	agate	02.460.0098	02.461.0115
	sintered aluminum oxide	02.460.0017	02.461.0116
	zirconium oxide	02.460.0086	02.461.0117
	hard porcelain	02.460.0016	02.461.0118
	Accessories for RM 200		
Scraper, beech wood			22.008.0025
Scraper, PTFE (e.g. for cryogenic grinding)			22.008.0024
Spare scraper, Vulkollan			22.862.0012

Agate hand mortars

Hand mortars made from agate are particularly suitable for grinding, mixing and triturating medium-hard to hard substances. Agate is extremely abrasion-resistant and very pure (99.9% SiO₂). This guarantees its neutrality for the subsequent analysis.

The quality of RETSCH hand mortars is particularly high. The abrasion surfaces are smooth and flawless, the outer surfaces are uniformly ground.



Hand mortar order data

Hand mortar with pestle, agate			Item No.	Hand mortar with pestle, agate			Item No.
Volume (ml)	Outer Ø (mm)	Inner Ø (mm)		Volume (ml)	Outer Ø (mm)	Inner Ø (mm)	
8	40	30	20.262.0001	50	100	85	20.262.0006
10	50	40	20.262.0002	80	110	95	20.262.0007
16	60	50	20.262.0003	130	130	110	20.262.0008
25	70	55	20.262.0004	180	150	130	20.262.0009
30	80	65	20.262.0005	300	175	145	20.262.0010

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