

# Size Reduction with Cutting Mills



**Retsch**<sup>®</sup>  
Solutions in Milling & Sieving

# Cutting Mills

RETSCH cutting mills are used successfully for the efficient preliminary size reduction of a huge variety of materials. The mills offer a high level of operational safety and convenience. The wide selection of accessories allows for easy adaptation to different application requirements.



**Milling**

- Jaw Crushers
- Rotor Mills
- **Cutting Mills**
- Knife Mills
- Mortar Grinders
- Disc Mills
- Mixer Mills
- Planetary Ball Mills

**Sieving****Assisting****Cutting Mills**

– Applications	4
– Cutting Mill SM 300	7
– Cutting Mill SM 200	8
– Cutting Mill SM 100	9
– Selection guide / Technical data	9
– Accessories	
– Rotors	10
– Hoppers	10
– Bottom sieves	10
– Cyclone-suction-combination	11
– Sample collecting systems	11
– Order data	11-12



**RETSCH cutting mills** are used for the preliminary size reduction of soft, medium-hard, fibrous, elastic and tough materials. A representative sub-sample should then be taken for the subsequent reduction down to analytical fineness.

**Pulverization with Mixer Mills**

For the pulverization of **hard, medium-hard and brittle** as well as **soft, elastic or fibrous** products RETSCH mixer mills are highly suitable. They are used for **small sample volumes** and **cryogenic grinding**.

**Fine grinding with Ultra Centrifugal Mills**

RETSCH's Ultra Centrifugal Mill is suitable for grinding **soft, medium-hard and brittle materials** with a feed size up to 10 mm. It achieves grind sizes down to 40 microns.

**Sample Divider**

No matter whether rotary sample dividers, rotary tube sample dividers or sample splitters – RETSCH sample dividers will provide you with **representative sub-samples** from pourable powders and bulk materials.

The main areas of application for cutting mills are:

#### Agriculture

Plant materials, straw

#### Chemicals and plastics

PET preforms, plastic toys, polymers, resins, rubber

#### Environmental research

Cables, cardboard, electronic components, foil, leather, paper, refuse derived fuels, textiles, waste, wood

#### Foods and feeds

Animal feed, feed pellets, spices

#### Geology and metallurgy

Aluminum slag, lignite, non-ferrous metals

#### Medicine and pharmaceuticals

Bones, drugs, pharmaceutical products

and many more...

# Applications

Cutting mills are used for the **preliminary grinding of soft, medium-hard, elastic and fibrous materials as well as heterogeneous mixes of products**. Size reduction by cutting and shearing is carried out gently and quickly which makes the mills suitable for **temperature-sensitive samples**. Typical applications of the cutting mills include sample preparation for heavy metal analysis within the context of RoHS and WEEE, size reduction of refuse derived fuels as well as processing of biomass for renewable energy research.

## Free test grinding

For RETSCH, professional customer service includes offering our customers the individual advice they need to find the best possible 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-us.com/testgrinding](http://www.retsch-us.com/testgrinding).



## Application examples

Cutting mills	Model*	General remarks	Rotor	Sieve	Feed size	Sample amount	Grinding time	Speed	Final fineness
Bones	SM 200		6-disc	8 mm	Ø 30 x 100 mm	100 g	1 min	1,500 min <sup>-1</sup>	6 mm
Electr. scrap/ circuit boards	SM 300		6-disc	4 mm	60 x 100 mm	4 pcs.	1 min	1,500 min <sup>-1</sup>	3 mm
Feed pellets	SM 100		Parallel	4 mm	15 mm	500 g	3 min	1,500 min <sup>-1</sup>	1.5 mm
Paper	SM 100	scrunched up	Parallel	4 mm	DIN A4	100 g	2 min	1,500 min <sup>-1</sup>	2 mm
PET preforms	SM 300		6-disc	6 mm	Ø 30 x 100 mm	6 pcs.	1 min	700 min <sup>-1</sup>	5 mm
Refuse derived fuels (RDF)	SM 300	light fraction	Parallel	4 mm	60 mm	2 l	2 min	3,000 min <sup>-1</sup>	4 mm
Rubber soles	SM 300	in quarters	Parallel	6 mm	100 x 150 mm	200 g	1 min	3,000 min <sup>-1</sup>	5 mm
Straw	SM 300		Parallel	1.5 mm	200 mm	100 g	30 sec	1,500 min <sup>-1</sup>	95% <0.5 mm
Thermoplastic	SM 300	pre-cooling with LN <sub>2</sub>	6-disc	8 mm	130 x 60 x 30 mm	350 g	30 sec	2,000 min <sup>-1</sup>	6 mm
Wood	SM 300	cyclone-suction- combination	Parallel	1 mm	20 x 50 x 200 mm	500 g	3 min	2,500 min <sup>-1</sup>	95% <0.5 mm

This chart serves only for orientation purposes.

\*Some of the sample materials could also be successfully processed in another model of the cutting mill family.

The RETSCH application database contains more than 1,000 application reports. Please visit [www.retsch-us.com/applicationdatabase](http://www.retsch-us.com/applicationdatabase).

# Cutting Mills

## SM 100, SM 200 and SM 300

The perfect cutting mill for every requirement



SM 100

SM 200

SM 300



### Benefits at a glance

- Powerful primary and fine size reduction
- Selection of models to suit different requirements
- Quick cleaning, easy handling
- Defined final fineness due to bottom sieves with aperture sizes from 0.25 - 20 mm
- Wide range of accessories including various hoppers, collecting systems, rotors and sieves
- Highest safety standard

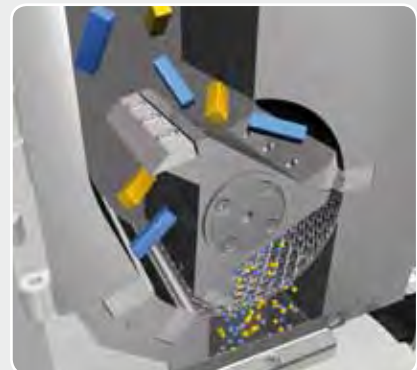
The RETSCH cutting mills provide highly efficient primary size reduction of such heterogeneous material mixes as waste or electronic components but are also suitable for many other types of samples. With the SM 100, SM 200 and SM 300 RETSCH offers three models for different requirements. No matter, whether it is a standard mill for routine applications or a powerful and flexible model to handle a vast range of sample materials, RETSCH provides the suitable instrument. A wide selection of sieves, hoppers and collecting systems allows for easy adaptation to individual

application tasks. All three models are available in a special version for heavy-metal-free size reduction which makes them ideal for preparing samples for heavy metal analysis within the context of RoHS and WEEE regulations.

### Cutting mill technology

Size reduction in the cutting mills takes place by cutting and shearing forces. The sample passes through the hopper and into the grinding chamber. There it comes into contact with the rotor and is comminuted between the rotor blades and the stationary cutting bars inserted in the housing. The dwelling time of the sample in the chamber is short; as soon as it is small enough to pass through the openings of the bottom sieve it is discharged and collected in the receptacle. The rotor speed of 1500 min<sup>-1</sup> (SM 100 and SM 200)

resp. 700 to 3,000 min<sup>-1</sup> (SM 300) ensures gentle and rapid size reduction. The motor ratings are 1.5 kW (SM 100), 2.2 kW (SM 200) and 3 kW (SM 300). The optional cyclone-suction-combination (SM 200, SM 300) not only has a cooling effect on the sample but also improves the discharge of material from the grinding chamber.



# Cutting Mill SM 300

The high performance model with RES technology

SM 300 with fold-back universal hopper



## High torque for primary and fine size reduction

Cutting mills are used in many different areas of sample preparation for subsequent analyses. To allow for optimum adaptation to the sample properties with regards to breaking behavior and temperature sensitivity, the SM 300 features a **variable speed from 700 to 3,000 min<sup>-1</sup>**. Thus it is possible to grind a great variety of products with one mill, including tough and thermally sensitive materials. Thanks to its flexibility, the SM 300 is particularly suitable for the varying application tasks of contract laboratories.

An additional flywheel mass accounts for a **very high torque** which enables the SM 300 to grind many materials to analytical fineness in only one working run (RES technology, see text on the right). The grinding chamber geometry has been thoroughly optimized. The good feeding properties and the wide opening of the hopper allow for large sample volumes resp. pieces which helps to improve the throughput. Moreover, the SM 300 is equipped with **double acting cutting bars** which substantially increase the number and effectiveness of the cutting events.

In combination with the wide selection of accessories, the SM 300 is ideally suited for the effective size reduction of cuttable materials and heterogeneous mixes.

### Benefits at a glance

- Powerful size reduction thanks to 3 kW drive with high torque and RES technology
- Perfect adaptation to application requirements by variable speed from 700 to 3,000 min<sup>-1</sup>
- Optimum cutting effects thanks to double acting cutting bars
- Quick and easy cleaning due to fold-back hopper, smooth surfaces and push-fit rotor
- Highest safety standards due to motor brake, central locking device, electronic safety check and comfort base frame



The variable speed is entered via the convenient operating panel of the SM 300

## Easy operation and cleaning

Operation of the SM 300 is exceptionally simple and safe. A safety switch prevents the mill from being switched on with the door open. An **electronic safety check** ensures that the door cannot be opened when the motor is running – the **motor brake** makes the rotor come to an immediate standstill after the mill has been switched off.

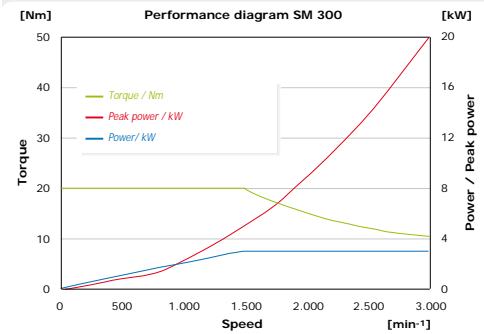
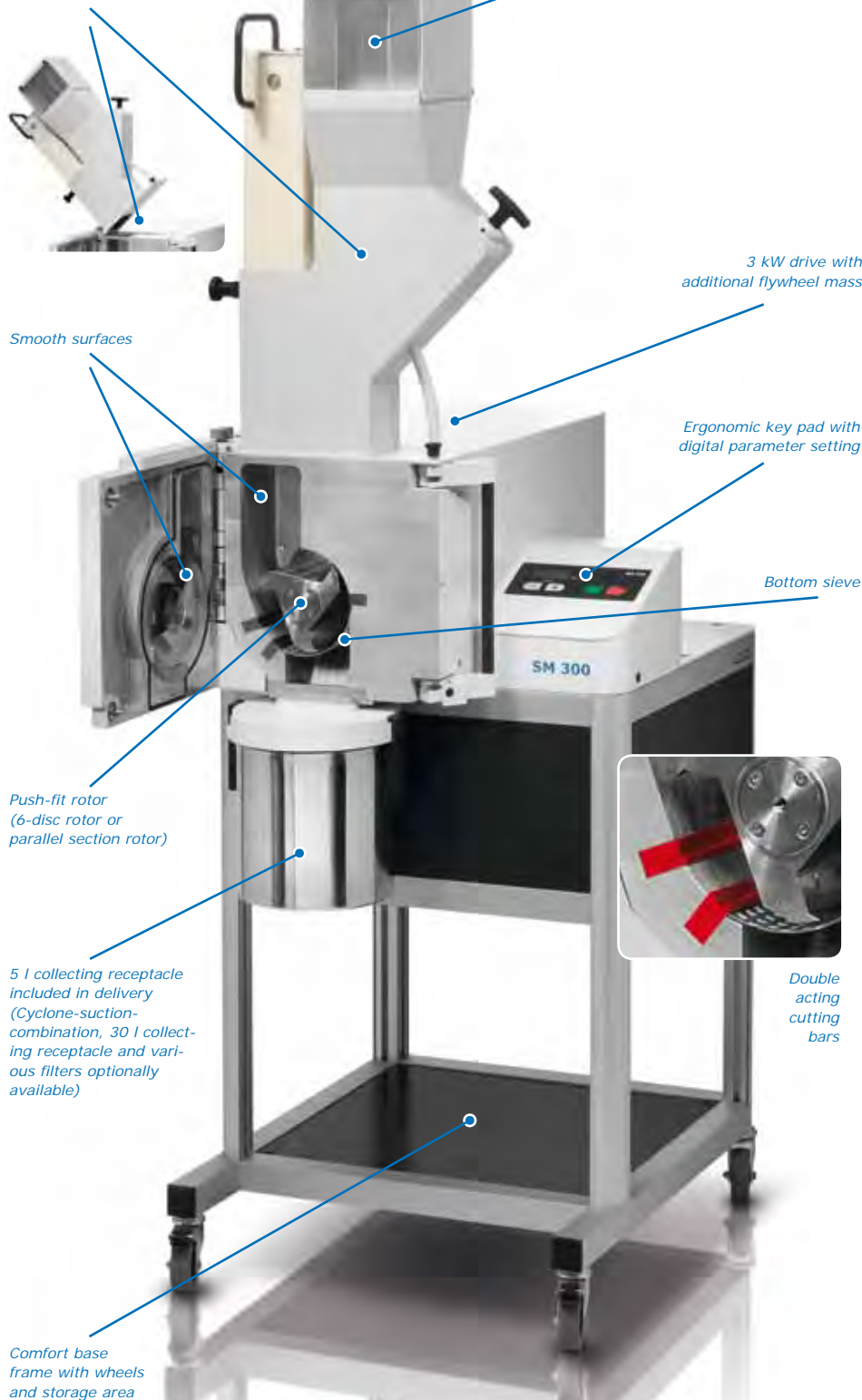
The hopper can be folded back to get full access to the grinding chamber which, in combination with the smooth surfaces, greatly facilitates cleaning the mill. The push-fit rotor can be removed without tools.



## RES Technology – Peak power of up to 20 kW

Fold-back hopper with plastic plunger (also available in wood or aluminum)

Large feed opening with splash-back protection



The diagram shows the torque (green) and the power (blue) of the drive as well as the temporarily achievable peak power (red) against the speed. The peak power increases over the entire speed range. That means, the higher the speed, the more power is temporarily available for the cutting events. In the speed range up to 1,500 rpm, the power is a result of the product of torque and speed. It ascends linearly until reaching the nominal power. This means, if the speed is doubled from 750 rpm to 1,500 rpm, the power is also doubled from 1.5 kW to 3 kW (maximum drive performance).

At speeds >1,500 rpm, the power remains constant (maximum drive performance). The available torque decreases because of the aforementioned proportionality. **In this speed range, the available peak power is gained by the great flywheel mass** (Rotational Energy Storage technology). Here the power corresponds to the rotational energy stored in the flywheel mass which increases quadratically with the speed. If the speed is doubled from 1,500 rpm to 3,000 rpm, the temporarily available peak power is quadrupled from 5 kW to 20 kW.

**This additional energy allows for the successful size reduction of difficult materials, such as, for example, rubber shoe soles in the SM 300 without rotor blockage.**

# Cutting Mill SM 200

The universal  
standard model



SM 200 with  
fold-back  
hopper and  
parallel section rotor

## Powerful size reduction of many different materials

The RETSCH cutting mill SM 200 is a powerful and easy-to-operate instrument for efficient primary and fine size reduction.

The hopper can be folded back and the push-fit rotor and sieve can be removed without tools for easy cleaning.

Within the group of the RETSCH cutting mills, it is the universal standard model which covers a vast range of applications with its **strong 2.2 kW drive and 1,500 rpm rotor speed**. When operated with the optional cyclone-suction-combination, the SM 200 is also suitable for grinding light sample materials or smaller quantities.

In combination with its various accessories, the SM 200 can be used for many different applications. In addition to a **heavy-metal-free version**, a wide selection of hoppers, rotors, sieves and collecting systems (see pages 10 – 11) is available.

### Benefits at a glance

- Powerful size reduction with 2.2 kW drive
- Optimum cutting effects thanks to double acting cutting bars
- Quick and easy cleaning due to fold-back hopper, smooth surfaces and push-fit rotor
- High safety standard due to motor brake, central locking device and base frame

Operation of the SM 200 is easy and safe. A safety switch prevents the mill from being switched on with the door open. A motor brake makes the rotor come to an immediate standstill after the mill has been switched off.

### Tips for perfect results

**Fibrous and bulky materials** (e. g. hay or paper) are easier to grind when they have been balled up before being fed into the hopper.



The size reduction of rubber and thermoplastic is facilitated by using **liquid nitrogen to embrittle the sample material**.



If larger sample pieces need to be ground very finely, it is recommended to first use a **bottom sieve with large perforations for primary size reduction** and then a smaller sieve for fine grinding.





# Cutting Mill

## SM 100

The budget-priced basic model

### For routine applications

The SM 100 is the budget-priced basic model among the RETSCH cutting mills. It is suitable for the size reduction of soft, medium-hard, elastic or fibrous products which can be comminuted without requiring extremely high forces. The mill is particularly suitable for routine applications. It is easy to operate and can be mounted on a solid table or on the optional base frame.

The wide range of accessories makes the SM 100 a versatile instrument. A special version of the mill is available for **heavy-metal-free grinding**.



SM 100 with universal hopper, parallel section rotor and optional base frame

## Selection guide for cutting mills

Performance data		SM 100	SM 200	SM 300
		<a href="http://www.retsch-us.com/sm100">www.retsch-us.com/sm100</a>	<a href="http://www.retsch-us.com/sm200">www.retsch-us.com/sm200</a>	<a href="http://www.retsch-us.com/sm300">www.retsch-us.com/sm300</a>
Applications		size reduction by cutting	size reduction by cutting	size reduction by cutting
Field of application		agriculture, biology, chemicals / plastics, food, engineering / electronics, medicine / pharmaceuticals, environment / recycling		
Feed material		soft, medium-hard, elastic, fibrous	soft, medium-hard, tough, elastic, fibrous	soft, medium-hard, tough, elastic, fibrous
Material feed size*		max. 60 x 80 mm	max. 60 x 80 mm	max. 60 x 80 mm
Final fineness*		0.25 - 20 mm	0.25 - 20 mm	0.25 - 20 mm
Cutting bars		standard cutting bars	double acting cutting bars	double acting cutting bars
Rotors	6-disc rotor:	yes	yes	yes
	Parallel section rotor:	yes	yes	yes
Hopper	Universal hopper:	yes	yes, fold-back	yes, fold-back
	Long stock hopper:	yes	yes, fold-back	yes, fold-back
Collecting receptacle	Standard:	5 liters	5 liters	5 liters
	Options:	0,25 / 0,5 / 30 liters	0,25 / 0,5 / 30 liters	0,25 / 0,5 / 30 liters
	with cyclone:	–	0,5 / 1 / 2 / 5 liters	0,5 / 1 / 2 / 5 liters
Technical Data				
Drive		3-phase-motor	3-phase-motor	frequency-controlled 3-phase-motor
Motor brake		–	yes	yes
Rotor speed at 50 Hz		1,500 min <sup>-1</sup>	1,500 min <sup>-1</sup>	700 – 3,000 min <sup>-1</sup>
Drive power		1,500 W	2,200 W	3,000 W
W x H x D (with base frame and universal hopper)		approx. 582 x 1.675 x 700 mm	approx. 576 x 1.675 x 760 mm	approx. 795 x 1.691 x 765 mm
Net weight (without hopper)		approx. 73 kg	approx. 90 kg	approx. 160 kg

\*depending on feed material and instrument configuration/settings

# Accessories for cutting mills

Thanks to the comprehensive range of accessories, the RETSCH cutting mills are universally suitable size reduction instruments.

## Selection of rotors

2 different rotor versions are available for the cutting mills: a parallel section rotor and a 6-disc rotor.

The **parallel section rotor** (1) is equipped with 3 cutting plates (2) and is suitable for universal use. The **6-disc rotor** (3) with its 18 replaceable and reversible hard metal cutting tips (4) is mostly used for medium-hard and brittle materials. Both rotors are available in steel St 1.0580 for **heavy-metal-free size reduction**. The optional extraction tool (5) provides for convenient removal of the rotor.



1. Parallel section rotor, 2. Cutting plate for parallel section rotor, 3. 6-disc rotor, 4. Reversible cutting tips, 10 pcs., 5. Extraction tool for rotor

## Selection of hoppers

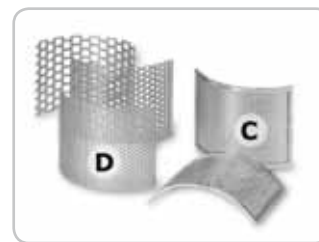
The convenient **universal hopper (A)** is suitable for feeding most of the bulk and individual samples. The maximum input opening is 88 x 84 mm. The hopper is supplied with a plastic plunger. For special applications plungers made from wood or aluminum are available.



The **long stock hopper (B)** is specially designed for feeding in long samples. The maximum input opening is 30 x 80 mm. A wooden plunger is part of the delivery scope.

## Selection of bottom sieves

The bottom sieve is selected according to the type of sample and degree of final fineness required. Sieves with a perforation size up to 2 mm have trapezoid holes (C); sieves 4 mm and above have square holes (D). For coarse, preliminary size reduction the use of a 20 mm bottom sieve is recommended. The standard sieve versions are made of stainless steel. Bottom sieves made of steel St 1.0353 are also available for **heavy-metal-free size reduction**.



## Perfect adaptation to application requirements

The table gives a rough orientation as to which instrument configuration is most suitable for which type of material.

Type of material	6-disc rotor	Parallel section rotor	recommended speed		
			700 min <sup>-1</sup>	1,500 min <sup>-1</sup>	3,000 min <sup>-1</sup>
medium-hard/brittle	++				
medium-hard/elastic*	++	+			
medium-hard	++	++			
soft	+	++			
elastic*	+	++			
tough-elastic*	+	++			
fibrous		++			

\*The size reduction of elastic and temperature-sensitive samples can be improved by cooling with dry ice or pre-embrittlement with LN<sub>2</sub>.

++ highly suitable + suitable to a limited extent  optimum speed

SM 300 with  
cyclone-suction-  
combination

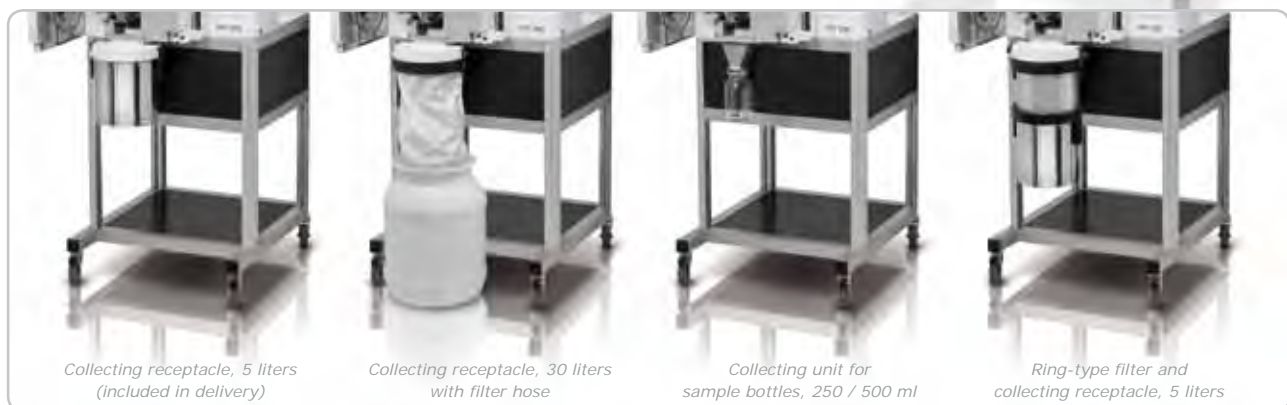


## Cyclone-Suction-Combination

The SM 300 can be optionally equipped with a cyclone-suction-combination. In addition to a **cooling effect on the sample material and the grinding tools**, it also improves the discharge of material from the grinding chamber and is therefore recommended for grinding small volumes or low density materials. Thanks to the improved discharge less cleaning is required. The cyclone can be equipped with 0.5, 1, 2 and 5 liters sample bottles.

## Other Accessories

For a higher throughput the 5 liters collecting receptacle can be replaced by a 30 liters plastic receptacle. For smaller quantities, a collecting unit for 250 ml and 500 ml sample bottles is available. For bottom sieves with small aperture sizes the use of a stainless steel ring-type filter between mill and collecting receptacle is recommended.



Collecting receptacle, 5 liters  
(included in delivery)

Collecting receptacle, 30 liters  
with filter hose

Collecting unit for  
sample bottles, 250 / 500 ml

Ring-type filter and  
collecting receptacle, 5 liters

## Order data sample collecting systems

Sample collecting systems	Item no.
<b>Cyclone-suction-combination for SM 200 / SM 300</b>	
Cyclone unit incl. 1 sample bottle 500 ml (to be used with industrial vacuum cleaner)	22.020.0004
Industrial vacuum cleaner HDS 2000, 120 V, 50/60 Hz (other electrical versions available)	22.748.0003
Filter bags for industrial vacuum cleaner HDS 2000, 5 pieces	32.524.0005
HEPA filter for industrial vacuum cleaner HDS 2000, 1 piece	32.524.0006
Sample bottles, 500 ml, 10 pieces	22.523.0002
Holder for sample bottles 1 / 2 / 5 liters	22.001.0001
Sample bottle, 1 liter, 1 piece, to be used with holder 22.001.0001	05.239.0011
Sample bottle, 2 liters, 1 piece, to be used with holder 22.001.0001	05.239.0010
Sample bottle, 5 liters, 1 piece, to be used with holder 22.001.0001	05.239.0009
<b>Collecting receptacles for SM 100 / SM 200 / SM 300</b>	
Collecting unit 250 / 500 ml, incl. 2 sample bottles	22.003.0008
Sample bottles, 250 ml, 10 pieces	22.523.0001
Collecting receptacle, 5 liters, stainless steel	22.003.0007
Collecting receptacle, 30 liters, plastic, incl. adapter and filter hose	22.003.0010
Ring-type filter for collecting receptacle 5 liters	22.187.0006
Dust filter clamping rings for ring-type filter, incl. 5 dust filters	22.748.0001
Dust filters for ring-type filter, 25 pieces	22.524.0002

## Order data cutting mills

Cutting mills		Item no.			Item no.		
supplied with collecting receptacle, 5 liters and base frame (only SM 200 and SM 300) (please order rotor, hopper, bottom sieve, and for SM 100 base frame, separately)							
Cutting mills		for standard size reduction		for heavy-metal-free size reduction			
SM 100	3~ 200 V, 60 Hz	20.727.0004			20.727.0005		
Base frame with wheels for SM 100		22.824.0005					
SM 200	3~ 200 V, 60 Hz	20.728.0003			20.728.0004		
SM 300	220-230 V, 50/60 Hz	20.729.0002			20.729.0005		
<b>other electrical versions available for the same price</b>							
Rotors for SM 100 / SM 200 / SM 300		for standard size reduction		for heavy-metal-free size reduction			
6-disc rotor		stainless steel:	22.608.0022	steel 1.0580:	22.608.0028		
Parallel section rotor		stainless steel:	22.608.0021	steel 1.0580:	22.608.0018		
Hoppers for SM 100 / SM 200 / SM 300		for SM 100		for SM 200 / SM 300			
Universal hopper with plastic plunger		22.785.0007			22.785.0001		
Long stock hopper with wooden plunger		22.408.0004			22.408.0003		
Plastic plunger for universal hopper		22.725.0010			22.725.0010		
Wooden plunger for universal hopper		22.725.0011			22.725.0011		
Aluminum plunger for universal hopper		22.725.0012			22.725.0012		
Bottom sieves							
Trapezoid holes, stainless steel		0.25 mm	0.50 mm	0.75 mm	1.00 mm	1.50 mm	
for standard size reduction		03.647.0312	03.647.0313	03.647.0314	03.647.0315	03.647.0316	
Square holes, stainless steel		2.00 mm	4.00 mm	6.00 mm	8.00 mm	10.00 mm	20.00 mm
for standard size reduction		03.647.0318	03.647.0320	03.647.0321	03.647.0322	03.647.0024	03.647.0062
Trapezoid holes, steel 1.0353		0.25 mm	0.50 mm	0.75 mm	1.00 mm	1.50 mm	
for grinding without heavy-metal contamination		-	03.647.0326	03.647.0327	03.647.0328	-	
Square holes, steel 1.0353		2.00 mm	4.00 mm	6.00 mm	8.00 mm	10.00 mm	20.00 mm
for grinding without heavy-metal contamination		-	03.647.0333	-	03.647.0335	-	-

Please refer to the previous page for order data of various sample collecting systems.

Accessories for Rotors		Item no.			Item no.
Reversible cutting tips for 6-disc rotor		for standard size reduction		for heavy-metal-free size reduction	
Reversible cutting tips, 10 pieces		tungsten carbide:	22.908.0001	tungsten carbide:	22.908.0001
Cutting plates for parallel section rotor					
Cutting plates, 1 set (3 pieces)		stainless steel:	22.151.0004	steel 1.1740:	22.151.0006
Cutting bars for SM 100					
Cutting bars, 1 set (3 pieces)		stainless steel:	22.152.0007	steel 1.1740:	22.152.0009
Double acting cutting bars for SM 200 / SM 300					
Double acting cutting bars, 1 set (3 pieces)		stainless steel:	22.152.0003	steel 1.1740:	22.152.0005
Additional items					
Replacement extraction tool for rotor		22.225.0002			



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