

# Size reduction and homogenization with knife mills



**Retsch**<sup>®</sup>

Solutions in Milling & Sieving

# Knife Mills

RETSCH knife mills provide completely homogeneous and reproducible size reduction results in seconds so that representative samples can be taken from any location in the grinding container.



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**Sieving****Assisting****Knife Mills**

- Applications	4
- Tips for optimum results with knife mills	5
- RETSCH Knife Mills	6
- Selection guide / Technical data	7
- Knife Mill GRINDOMIX GM 200	8
- Accessories GRINDOMIX GM 200	9
- Knife Mill GRINDOMIX GM 300	10
- Accessories GRINDOMIX GM 300	11
- Order data	12



**RETSCH knife mills** are particularly suitable for grinding and homogenizing soft to medium-hard, elastic, fibrous, dry or wet materials. They achieve grind sizes down to approx. 300 microns. The maximum feed size is 130 mm, depending on the instrument. RETSCH offers a whole range of size reduction devices for the various requirements of foods and feeds preparation:

**Rotor Mills**

RETSCH's **Ultra Centrifugal Mill ZM 200** 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. The **Rotor Beater Mills SR 200 and SR 300** are available for the size reduction of **larger sample volumes**.

**Cyclone Mill**

The **Cyclone Mill TWISTER** was specially designed for the processing of **foods and feeds** for subsequent **NIR analysis**. The optimum air throughput prevents the sample material from heating up during grinding.

**Sample Dividers**

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 knife mills are:

**Agriculture**

Feed pellets, plant parts, seeds

**Foods**

Candy, cereals, cereal bars, cheese, cocoa nibs, deep-frozen products, dried and fresh fruit, fish, lettuce, meat, nuts, oil seeds, sausages, spices, vegetables

**Medicine and pharmaceuticals / cosmetics**

Coated tablets, dietary supplements, pharmaceutical products, soap

and many more...

# Applications Knife Mills

In food or nutritional laboratories, in chemical or biological research institutes – homogeneous sample material is required everywhere for the accurate analysis of food and feed materials. With the GRINDOMIX knife mills, RETSCH provides size reduction and homogenization instruments that meet and exceed all special laboratory and analytical requirements. They process **substances with a high water, oil or fat content** just as quickly and reliably as **dry, fibrous, soft, elastic and medium-hard products**.

## 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.com/testgrinding](http://www.retsch.com/testgrinding).



## Application examples

Knife Mills	Model	Container	Lid	Feed size	Feed quantity	Pre-grinding time / speed	Fine grinding time / speed	Final fineness
<b>Almonds</b>	GM 300	PC	PC	1 – 15 mm	500 g	20 s / 3,000 min <sup>-1</sup> (impact)	50 s / 4,000 min <sup>-1</sup> (cutting)	homogeneous
<b>Beans, frozen</b>	GM 300	PC	PC	5 – 50 mm	750 g	10 s / 3,000 min <sup>-1</sup> (impact)	20 s / 3,000 min <sup>-1</sup> (cutting)	homogeneous, <500 µm
<b>Beef stew</b>	GM 300	PC	OC	0 – 10 mm	1,200 g	-	30 s / 3,500 min <sup>-1</sup> (cutting)	homogeneous, <1 mm
<b>Cabbage</b>	GM 300	PC	PC	100 mm	1,000 g	30 s / 3,000 min <sup>-1</sup> (cutting)	30 s / 3,000 min <sup>-1</sup> (cutting)	homogeneous
<b>Feed pellets</b>	GM 300	SS	PC	0 – 20 mm	600 g	30 s / 3,000 min <sup>-1</sup> (impact)	30 s / 3,000 min <sup>-1</sup> (cutting)	homogeneous, <1 mm
<b>Licorice (with dry ice)</b>	GM 300	SS	GL	0 – 30 mm	500 g	40 s / 1,000 min <sup>-1</sup> (impact, RM)	20 s / 4,000 min <sup>-1</sup> (impact)	homogeneous
<b>Salami</b>	GM 200	PP	PP	30 mm	200 g	-	10 s / 7,500 min <sup>-1</sup> (cutting)	homogeneous
<b>Tablets</b>	GM 200	PP	PP	10 – 20 mm	25 g (20 tablets)	-	10 s / 7,000 min <sup>-1</sup> (impact)	homogeneous, <500 µm
<b>Turkey</b>	GM 300	PC	GL	10 – 150 mm	500 g	-	30 s / 4,000 min <sup>-1</sup> (cutting, RM (5 s))	homogeneous

This chart serves only for orientation purposes.

RM = reverse mode, SS = stainless steel, PP = polypropylene, PC = polycarbonate, GL = gravity lid, OC = GL with overflow channels.

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

# 5 tips for optimum results with knife mills

Foodstuffs occur in greatly varying forms and consistencies and are usually inhomogeneous. To obtain meaningful and reliable analysis results, however, the samples to be analyzed have to be homogeneous and representative. Thanks to the digitally controlled grinding parameters and the wide range of accessories, the GRINDOMIX knife mills are ideally suited for such applications.


**1**

When preparing **liquid samples** the use of RETSCH's patented **gravity lid with overflow channels** provides the best results. The lid reduces the grinding chamber volume and is designed in such a way that it floats on the surface of the sample. The result is a thorough homogenization of the complete sample material.

**2**

When grinding **fairly hard products** such as feed pellets, for example, a stainless steel grinding container should be used to minimize wear, which is inevitable with mechanical size reduction.

**3**

The reverse mode allows for adaptation to the sample properties. **Medium-hard materials** (such as peeled nuts or frozen vegetables) can be submitted to **preliminary size reduction** with the breaking bar of the knife **in reverse mode** before they are pulverized with the blades.

**4**

The **interval mode** improves the grinding process in such a way that the material is not permanently thrown upwards, but can settle down in defined intervals. The **mixing of the sample** results in a very effective size reduction, as all components are repeatedly submitted to the grinding process.

**5**

When processing samples with volatile components care must be taken that the sample is not warmed during grinding. This effect can be avoided by **cooling the sample**, e.g. by mixing it with **dry ice**. Moreover, a finer grind size and greater homogeneity are obtained with frozen material because the embrittlement improves the breaking properties of the sample.

## Patented – the variable-volume grinding chamber of the GRINDOMIX GM 200 and GM 300

In order to prevent the sample from being thrown against the container walls by the rotating knives and thus being removed from the size reduction process, the **gravity lid** developed by RETSCH reduces the volume of the container (patent EP 906 741). This piston-like lid drops under its own weight during the grinding process, so that it always rests directly on the sample material. In this way the GRINDOMIX knife mills achieve a **thorough homogenization of the complete sample material**.

Alternatively, the **gravity lid** can also be supplied **with overflow channels**. This lid is particularly suitable for products with a very high liquid content. The released cell liquid can separate out by centrifugal force and flow up the container walls as a thin film. If this liquid penetrates the gap between the gravity lid and the container wall then it is returned to the center of the container via the overflow channels. The result is **perfect homogenization**.

The complete range of accessories for the GM 200 and GM 300 can be found on pages 9 and 11.



# Knife Mills

## GRINDOMIX GM 200 and GM 300



The **GRINDOMIX GM 200** homogenizes **sample volumes up to 700 ml** completely and reproducibly and is superior to any household mixer.



The **GRINDOMIX GM 300** allows for processing entire household quantities thanks to the grinding container's **nominal volume of 4,500 ml**.

### Benefits at a glance

- Thorough size reduction and homogenization of the complete sample material in seconds
- Pre- and fine grinding in one mill
- Autoclavable grinding tools
- Perfect adaptation to application requirements by variable speed
- Optional gravitation lid for automatic reduction of the grinding chamber volume
- Wide selection of accessories

### Perfect homogenization with high reproducibility

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.

Whereas the GM 200 homogenizes up to 700 ml of sample material quickly and reproducibly, the GM 300 allows for processing up to 4,500 ml. The mills produce **representative samples with a minimum standard deviation** in as little as 30 seconds thus beating any household mixer or conventional knife mill by far. A wide selection of containers and lids makes it easy to adapt the variety of applications in a professional laboratory.

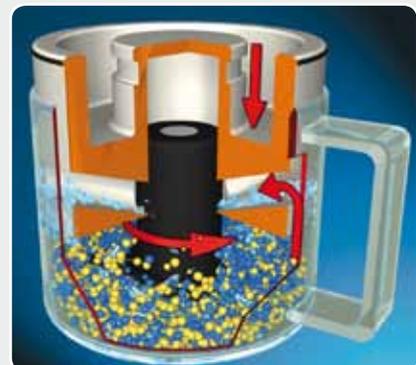
# Selection guide for knife mills

Performance data		GRINDOMIX GM 200	GRINDOMIX GM 300
		<a href="http://www.retsch.com/gm200">www.retsch.com/gm200</a>	<a href="http://www.retsch.com/gm300">www.retsch.com/gm300</a>
Applications		size reduction, homogenization and mixing	
Field of application		agriculture, biology, food, medicine / pharmaceuticals	
Feed material		soft, medium-hard, elastic, fibrous, containing water / fat / oil, dry	
Material feed size*		approx. 10 – 40 mm	< 130 mm
Final fineness*		< 300 µm	< 300 µm
Batch size / feed quantity*	with standard lid	700 ml	4,500 ml
	with reduction lid	300 ml	-
	with gravity lid	300 – 600 ml	4,000 ml
Speed setting		digital, 2,000 - 10,000 min <sup>-1</sup>	digital, 500 - 4,000 min <sup>-1</sup>
Knife diameter		118 mm	180 mm
Knife peripheral speed		approx. 12.4 - 62 m/s	approx. 4.8 - 38 m/s
Number of blades		2	4
Grinding time setting		digital, 1 s - 3 min	digital, 5 s - 3 min
Interval mode		yes	yes
Reverse mode		yes	yes
SOPs		3, programmable plus Quick Start	10, programmable
Technical data			
Drive power		900 W	1,100 W (short-term peak 3,000 W)
W x H x D		approx. 350 x 275 x 392 mm	approx. 440 x 340 x 440 mm
Net weight		approx. 10 kg	approx. 30 kg
Noise values (noise measurement according to DIN 45635-31-01-KL3)			
Emission value with regard to workplace*		LpAeq 71.5 dB(A)	LpAeq 76.7 dB(A)
*depending on feed material and instrument configuration/settings			

## Knife mill technology

Two (GM 200 ) resp. four (GM 300) sharp, robust blades rotate in the center of the grinding container. Depending on the rotational direction, size reduction is effected with the blunt side (preliminary size reduction) or the sharp side (fine grinding).

The knives are indirectly driven by a powerful industrial motor. A preset speed which is maintained electronically ensures optimum adaptation to different application requirements as well as a high degree of reproducibility.



# Knife Mill GRINDOMIX GM 200

For sample volumes  
up to 700 ml



GM 200 with  
plastic container

## Quick, flexible sample preparation

The GRINDOMIX GM 200 is used for grinding and homogenizing foods, feeds and other sample materials in accordance with special laboratory and analytical requirements. Organizations like the German Federal Institute for Risk Assessment recommend the GM 200 for the sample preparation to analyses on acrylamide. **It processes up to 700 ml sample material quickly and reproducibly** so that a random yet representative sample can be taken from any location in the grinding container.

### Benefits at a glance

- Powerful size reduction thanks to 900 W industrial motor
- For sample volumes up to 700 ml
- Variable speed from 2,000 – 10,000 min<sup>-1</sup>
- Autoclavable grinding tools
- Interval and reverse mode
- 3 Standard Operating Procedures (SOPs) can be stored
- Quick Start Mode

Operation of the GM 200 is easy and safe. Grinding time and speed are digitally set and displayed. 3 Standard Operating Procedures can be stored for routine operations. The Quick Start mode with fixed speed (4,000 min<sup>-1</sup>) allows for grinding without setting parameters. Before and after the grinding process, the container with its lid, inserted knife and sample, can be installed and removed as a complete unit.

Thanks to the combination of different grinding containers and lids, the digital setting of the parameters and the possibility to store individual grinding programs, the GM 200 can be adjusted to the many different requirements of sample preparation. **All these features make the GRINDOMIX knife mills the professional solution for the laboratory.**

## Better than any household mixer!

- In conventional mixers the sample can separate out and is no longer subjected to the size reduction process. This means that the sample is not fully reduced in size. The GRINDOMIX knife mills, however, will always produce a **perfectly homogeneous sample**.
- Even after a grinding time of only 10 to 30 seconds, most of the samples processed by the GRINDOMIX are so homogeneous that a random but nevertheless representative sample can be taken. **The standard deviation of analytical results is 10 times smaller** than with samples prepared in household mixers. This applies even to difficult substances such as streaky bacon or heterogeneous types of meats.
- The GRINDOMIX mills are also suitable for use under the strict hygienic standards of food and pharmaceutical laboratories thanks to the **autoclavability** of the grinding tools



The picture shows a comparison between the degree of size reduction of raw potatoes homogenized with a household mixer (left) and the GRINDOMIX GM 200 (right)

# Accessories



A range of different containers and lids is available for the GRINDOMIX GM 200 and can be used to optimally adapt the mill to a particular application.

## Grinding containers

The selection of the grinding container depends on the products to be processed. Standard plastic containers are suitable for the majority of applications. Other containers are available as accessories for special applications.

### ① Autoclavable plastic container\*, PC (Standard)

This transparent and scratch-resistant container is part of the standard delivery of the GRINDOMIX. For soft and elastic materials, products containing water, oils and fats.

### ② Plastic container, PP

This container is also suitable for soft and elastic materials and for all samples with a high water, oil or fat content. However, it can only be sterilized and autoclaved to a limited extent.

### ③ Glass container, borosilicate glass 3.3

Suitable for the same products as the plastic container. Additional advantages: the cutting process can be observed through the glass walls; it can also be sterilized and autoclaved.

### ④ Stainless steel container

Suitable for soft, medium-hard and elastic materials, products containing water, oils and fats. Particularly recommended for processing medium-hard products such as candy, cereals, nuts or feed pellets. It is more resistant to strong mechanical forces than plastic or glass and can be sterilized and autoclaved.

\*Autoclavable under standard conditions (30 min at 121°C).

## Grinding container lids

The selection of the lid depends on the grinding container and the sample material.

### ⑤ Standard lid, PP

Part of the standard delivery of the GM 200. For use with large sample amounts of small-sized materials such as seeds as well as meat, fish and cheese. With this lid the maximum feed quantity is 700 ml.

### ⑥ Lid, PP, for grinding chamber reduction to 500 ml

For smaller amounts of small-sized samples (max. 300 ml) it is advisable to reduce the grinding chamber volume. This lid can only be used with the standard plastic container.

### ⑦ + ⑧ Gravity lid, PP

The gravity lid allows the automatic adaptation of the grinding chamber volume to the particular amount of sample. It moves downward during the grinding process thus optimizing the grinding chamber volume. It is available without (7) and with (8) overflow channels. The latter is used with water-containing materials such as potatoes, sweet peppers, lettuce or tomatoes. The maximum amount of sample is 600 ml.

## Knives / Scraper

### ⑨ Knives\*

With 2 blades, made of stainless steel or pure titanium for heavy-metal-free size reduction.

### ⑩ Scraper

Facilitates the recovery of sticky samples from the container.

# Knife Mill GRINDOMIX GM 300

For sample volumes  
up to 4,500 ml



GM 300 with  
plastic grinding container

## The new dimension in food sample preparation

With its **special cutting knife system and variable-volume grinding chamber**, the GRINDOMIX GM 300 processes a great variety of sample materials quickly and reproducibly to completely homogeneous analytical samples – within seconds! A special advantage of the mill is the possibility to homogenize **sample volumes up to 4,500 ml** so that quantities such as 800 g deep-frozen fries or an entire loaf of bread can be processed in one working run.

### Benefits at a glance

- Efficient size reduction thanks to 1.1 kW industrial motor with temporary peaks up to 3 kW
- For sample volumes up to 4,500 ml
- Speed selectable from 500 – 4,000 min<sup>-1</sup>
- Autoclavable grinding tools
- Interval and reverse mode
- 10 Standard Operating Procedures (SOPs) can be stored

The GRINDOMIX GM 300 is easily adapted to a variety of applications. The speed is selectable from 500 to 4,000 min<sup>-1</sup> in steps of 100, the grinding time can be set from 5 seconds to 3 minutes. The mill can be operated in **interval or reverse mode**, if required. Depending on the rotational direction, size reduction is effected by impact with the breaking bar on the back of the knife or by cutting with the sharp blade. Thus it is possible to carry out **preliminary and fine size reduction with one mill**.

The standard delivery of the GM 300 includes an autoclavable 5 l plastic container with lid, a push-fit stainless steel knife with four blades and a scraper.

### Simple handling and cleaning

The handling of the GRINDOMIX GM 300 is **exceptionally comfortable and safe**. The grinding container and knife are easily attached without tools. When the set grinding time has expired, the motor is automatically switched off and the grinding container can be removed. Thus the GRINDOMIX, unlike many commercial household mixers, allows **filling and emptying the container outside the mill**. The knife remains on the knife holder during the process and can be easily removed for cleaning afterwards. Thanks to this quick and easy procedure, cross

contaminations caused by sample residues are successfully prevented. Another advantage of the GRINDOMIX knife mills: **the grinding tools are autoclavable**.

The GM 300 features a convenient 1-button operation with graphic display. All grinding parameters are digitally set and 10 Standard Operating Procedures (SOPs) can be stored.



# Accessories



A range of different containers and lids is available for the GRINDOMIX GM 300 and can be used to optimally adapt the mill to a particular application.

## Grinding containers

The selection of the grinding container depends on the products to be processed. Standard plastic containers are suitable for the majority of applications. Other containers are available as accessories for special applications.

### ❶ Autoclavable plastic container\* (Standard)

This transparent and scratch-resistant container is part of the standard delivery of the GRINDOMIX. For soft and elastic materials, products containing water, oils and fats.

### ❷ Stainless steel container

Suitable for soft, medium-hard and elastic materials, products containing water, oils and fats. Particularly recommended for processing medium-hard products such as candy, cereals, nuts, deep-frozen products or feed pellets. It is more resistant to strong mechanical forces than plastic and can be sterilized and autoclaved.

## Grinding container lids

The selection of the lid depends on the grinding container and the sample material.

### ❸ Standard lid\* made of autoclavable plastic

Part of the standard delivery of the GM 300. For use with large sample amounts of small-sized materials such as seeds as well as meat, fish and cheese. With this lid the maximum feed quantity is 4,500 ml.

### ❹ + ❺ Gravity lid made of autoclavable plastic

The gravity lid allows the exact adaptation of the grinding chamber volume to the particular amount of sample. It moves downward during the grinding process thus optimizing the grinding chamber volume. It is available without (7) and with (8) overflow channels. The latter is used with water-containing materials such as potatoes, sweet peppers, salads or tomatoes. The maximum amount of sample is 4,000 ml.

## Knives / Scraper

### ❻ Knives\*

With 4 blades, made of stainless steel, autoclavable

### ❼ Scraper

Facilitates the recovery of sticky samples from the container.

\*Autoclavable under standard conditions (30 min at 121°C).

## Order data knife mills

GRINDOMIX GM 200			Item No.
GRINDOMIX GM 200, complete with grinding container 1 liter of autoclavable plastic, standard lid, stainless steel knife			
GM 200 220–240 V, 50/60 Hz			20.253.0001
GM 200 100–120 V, 50/60 Hz			20.253.0002
<b>other electrical versions available for the same price</b>			
Grinding containers for GM 200			
Grinding container, 1 liter,	autoclavable plastic (transparent and scratch-resistant)		03.045.0057
Grinding container, 1 liter,	PP		03.045.0047
Grinding container, 1 liter,	glass		03.045.0046
Grinding container, 1 liter,	stainless steel		03.045.0050
Lids	for grinding container of:	stainless steel/glass	PP/plastic
Standard lid,	PP	03.107.0505	03.107.0505
Standard lid,	PP, 100 pcs.	22.107.0022	22.107.0022
Reduction lid,	PP, for chamber reduction to 0.5 liters	–	03.107.0310
Gravity lid,	PP	02.107.0328	02.107.0327
Gravity lid,	PP, with overflow channels	02.107.0308	02.107.0323
Accessories and spare parts for GM 200			
Scraper			05.723.0001
Knife of pure titanium			02.446.0021
Spare knife of stainless steel			02.446.0047

GRINDOMIX GM 300			Item No.
GRINDOMIX GM 300, complete with grinding container 5 liters of autoclavable plastic, standard lid, knife and scraper			
GM 300 220–230 V, 50/60 Hz			20.252.0001
<b>other electrical versions available for the same price</b>			
Grinding containers for GM 300		without knife holder	with knife holder
Grinding container, 5 liters,	autoclavable plastic (transparent and scratch-resistant)	03.045.0056	02.045.0056
Grinding container, 5 liters,	stainless steel	03.045.0055	02.045.0055
Lids			
Standard lid,	autoclavable plastic		02.107.0449
Gravity lid,	autoclavable plastic		02.107.0465
Gravity lid,	autoclavable plastic, with overflow channels		02.107.0480
Accessories and spare parts for GM 300			
Scraper			05.723.0002
Spare knife of stainless steel, autoclavable			02.446.0030



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RETSCH – Your specialist for sample preparation offers you a comprehensive range of equipment. Please request information on our crushers, mills, sieve shakers, sample dividers, feeders as well as cleaning and drying machines.