

# Mixer Mills

## MM 200, MM 301



### Grinding

RETSCH mixer mills have been specifically developed for dry and wet grinding of small sample quantities.

### Mixing

RETSCH mixer mills are the perfect universal products for mixing and homogenizing powders and suspensions.

### Cell Disruption

RETSCH mixer mills are excellently suitable for disrupting biological cells as well as for the isolation of DNA and RNA.

### Advantages that help you on a daily basis

- Quick and efficient size reduction with a homogenizing effect.
- Higher grinding energy due to enlarged swinging radius.
- Easy grinding jar replacement.
- High sample throughput due to short grinding times and two grinding sites.
- 20 samples can be processed for DNA/RNA analysis in one single operation.
- Grinding time and oscillation frequency are digitally preset.
- Memory keys for 3 standard working programs.
- Screw-top jars guarantee full material recovery with dry and wet grinding (standard feature of the MM 301).
- Setable parameter lock.
- Reliable wet grinding without loss of material.
- Automatic centering of grinding jars (MM 301) for easier, quicker and safer handling.

### Performance Features

|                      |   |
|----------------------|---|
| Application          | size reduction (dry and wet grinding), mixing, homogenizing, and cell disruption  |
| Areas of application | agronomy, biology, biotechnology, chemistry, ceramics, glass, medicine, pharmaceuticals, criminology, environment, mineralogy, metallurgy |
| Feed material        | hard, medium-hard, soft, brittle, elastic, and fibrous  |
| Feed particle size   | up to 6 mm for the MM 200, up to 8 mm for the MM 301  |
| Final fineness       | approx. 5 $\mu\text{m}$ (depending on material)   |
| Sample volume        | MM 200: max. 2 x 10 ml, MM 301: max. 2 x 20 ml  |

**Retsch**<sup>®</sup>

Solutions in Milling & Sieving

# Mixer Mills MM 200, MM 301

The RETSCH mixer mills MM 200 and MM 301 serve the purpose of fine and ultra-fine grinding of not only hard, medium-hard, and brittle samples, but also elastic and fibrous ones. With our mills you can grind:

- Tissues, bones and hair
- Chemicals, drugs, coated and uncoated tablets
- Minerals, ores, and alloys
- Glass and ceramics
- Soils and slurries
- Plant materials, conifers, grains, and oil-containing seeds
- Synthetic materials
- Waste samples
- Wool, textiles, and much more

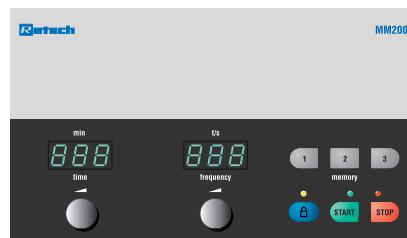
These mixer mills grind, mix, or homogenize 2 samples from 0.2 ml up to 20 ml in a single operation or process up to 20 samples for cell disruption.

The grinding efficiency is very high resulting in extremely short grinding times.

With the efficient mixer mills MM 200 and MM 301, a fineness down to 5  $\mu\text{m}$  is possible (depending on the material).

In addition, the mixer mill MM 301 features an automatic lock/self-locking clamping device for the grinding jars. The resulting secure and well-defined positioning of the grinding jars ensures maximum reproducibility in sample preparation and simplifies handling during clamping and removing of the grinding jars.

Due to the screw-top grinding jars of the MM 301, the sample is even more securely closed, so that wet grinding can be executed simply and without any sample loss.



## Grinding jars and balls

The grinding results are greatly influenced by the choice of grinding accessories. Jar volumes, ball charges, as well as their materials should be selected according to the nature and quantity of the sample to be ground. In order to avoid interference with the results of the subsequent analysis, choose an analytically neutral material.

The grinding energy is determined by the mass and material density of the grinding balls. The greater the density and mass of the balls, the higher the grinding energy will be. The jars and balls should always be chosen of the same materials. The opposite tables will assist you in selecting the appropriate grinding accessories.

|  | MM 200  | MM 301  |
|--|---|---|
| Sample volume max.   | 2 x 10 ml   | 2 x 20 ml   |
| Feed grain size max.   | 6 mm  | 8 mm  |
| Final fineness down to   | < 10 $\mu\text{m}$  | < 5 $\mu\text{m}$   |
| normal grinding times  | Ø 2 minutes   | Ø 2 minutes   |
| Wet grinding   | Grinding jars 25 ml, special steel  | All grinding jars   |
| Cell disruption with Eppendorf vials (more options on request) | <ul style="list-style-type: none"> <li>■ Adapter rack for 5 vials up to 2 ml</li> <li>■ Adapter rack for 10 vials up to 0.4 ml</li> </ul> | <ul style="list-style-type: none"> <li>■ Adapter rack for 5 vials up to 2 ml</li> <li>■ Adapter rack for 10 vials up to 0.4 ml</li> <li>■ Adapter rack for 10 vials up to 2 ml</li> </ul> |
| Clamping device  | Basic   | Comfort   |
| Automatic centering  | No  | Yes   |
| Memory keys  | Yes   | Yes   |
| Re-set lock  | Yes   | Yes   |
| Digital pre-selection of the milling duration                  | Yes   | Yes   |
| Tandem grinding containers                                     | Yes   | Yes   |



Mixer Mill MM 200



Range of grinding jars



Mixer Mill MM 301

# Grinding, mixing and cell disruption with maximum reproducibility

## Wet grinding

Screw-top grinding jars offer the ideal prerequisite for wet grinding. An additional Teflon gasket prevents leakage of liquids and materials, even at maximum mixing power.

## Cell disruption

For breaking open microorganisms and bacteria, a 12.5 ml stainless steel jar with a special filling and discharge opening for cell suspensions is available. Smaller sample volumes, as commonly used for the isolation of DNA and RNA, are preferably prepared in disposable reaction vials (e.g. Eppendorf). For this purpose, adapter racks are available that hold up to 5 or 10 reaction vials.

Through the use of glass beads, cell disruption is effected in an extremely short time, which makes additional cooling unnecessary.

## Cold grinding

The mixer mills MM 200 and MM 301 work so efficiently that the duration of the grinding process is very short with minimum temperature rise. Thus, most materials can be ground and mixed without cooling.

Temperature-sensitive and elastic materials can be successfully processed by pre-cooling the grinding materials and jar. Agate and ceramic jars should not be cooled excessively, in order to prevent damage during the size reduction process.



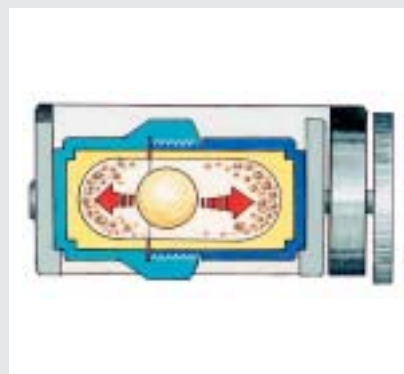
**Grinding jars– recommendations for material volume and balls**

| Grinding jar nominal volume | Sample volume | Max. feed particle size | Recommended ball charge |         |         |             |             |             |             |
|-----------------------------|---------------|-------------------------|-------------------------|---------|---------|-------------|-------------|-------------|-------------|
|                             |               |                         | Ø 30 mm                 | Ø 25 mm | Ø 20 mm | Ø 12 mm     | Ø 9/10 mm   | Ø 7 mm      | Ø 5 mm      |
| 1.5 ml                      | 0.2 – 0.5 ml  | 1 mm                    | -                       | -       | -       | -           | -           | -           | 1 to 2 pcs. |
| 5.0 ml                      | 0.5 – 2.0 ml  | 2 mm                    | -                       | -       | -       | -           | -           | 1 to 2 pcs. | -           |
| 10.0 ml                     | 2.0 – 4.0 ml  | 4 mm                    | -                       | -       | -       | 1 to 2 pcs. | 1 to 2 pcs. | -           | -           |
| 25.0 ml                     | 4.0 – 10.0 ml | 6 mm                    | -                       | -       | 1 pc.   | 2 pcs.      | -           | -           | -           |
| 35.0 ml                     | up to 15.0 ml | 6 mm                    | -                       | 1 pc.   | 1 pc.   | -           | -           | -           | -           |
| 50.0 ml                     | up to 20.0 ml | 8 mm                    | 1 pc.                   | 1 pc.   | -       | -           | -           | -           | -           |

## Technical details

The grinding container performs radial vibrations in a horizontal position. Thus, the material is hit alternately from various sides by the grinding balls. The intensity can be set precisely between 3 and 30 vibrations per second. A speed control keeps this value constant during the grinding process.

The grinding and mixing time can be digitally preset from 10 seconds up to 99 minutes. In stand-by mode, all parameters are maintained for subsequent trials. With 3 memory functions, different standard settings can be programmed. This guarantees maximum reproducibility for the preparation of samples.



## Order data

| Mixer Mill MM 200                                   |  |             |             | Item No.    |             |
|---|--|-------------|-------------|-------------|-------------|
| Type MM 200, 220 – 240 V, 50/60 Hz                  |  |             |             | 20.738.0001 |             |
| Type MM 200, 120 V, 50/60 Hz                        |  |             |             | 20.738.0005 |             |
| Grinding jars for MM 200                            |  | 1.5 ml      | 5 ml        | 10 ml       | 25 ml       |
| Agate   |  | 01.462.0112 | 01.462.0113 | 01.462.0008 | -           |
| Sintered alumina I                                  |  | 01.462.0110 | 01.462.0111 | 01.462.0007 | -           |
| Zirconium oxide                                     |  | -           | -           | 01.462.0194 | 01.462.0195 |
| Stainless steel                                     |  | 02.462.0057 | 02.462.0059 | 02.462.0061 | 02.462.0119 |
| Stainless steel, screw-top                          |  | -           | -           | -           | 02.462.0213 |
| Chrome steel 2                                      |  | 02.462.0056 | 02.462.0058 | 02.462.0060 | 02.462.0052 |
| Tungsten carbide                                    |  | 01.462.0114 | 01.462.0115 | 01.462.0009 | -           |
| Teflon  |  | -           | 02.462.0183 | 02.462.0184 | 02.462.0051 |
| Plastic (polystyrene) mixing jars, 28 ml, 100 units |  |             |             | 22.041.0003 |             |

| Mixer Mill MM 301                       |  |             |             |             |             | Item No.    |             |
|---|--|-------------|-------------|-------------|-------------|-------------|-------------|
| Type MM 301, 220 – 240 V, 50/60 Hz      |  |             |             |             |             | 20.741.0001 |             |
| Type MM 301, 120 V, 50/60 Hz            |  |             |             |             |             | 20.741.0004 |             |
| Grinding jars with screw-top for MM 301 |  | 1.5 ml      | 5 ml        | 10 ml       | 25 ml       | 35 ml       | 50 ml       |
| Agate                                   |  | -           | 01.462.0232 | 01.462.0233 | -           | -           | -           |
| Zirconium oxide                         |  | -           | -           | 01.462.0234 | 01.462.0201 | 01.462.0215 | -           |
| Stainless steel                         |  | 01.462.0230 | 01.462.0231 | 01.462.0236 | 02.462.0213 | 01.462.0214 | 01.462.0216 |
| Chrome steel                            |  | -           | -           | -           | 01.462.0237 | -           | -           |
| Tungsten carbide                        |  | -           | -           | 01.462.0235 | 01.462.0217 | -           | -           |
| Teflon                                  |  | -           | -           | -           | 01.462.0238 | -           | -           |

| Grinding balls for MM 200 and MM 301 |             |             |             |             |             |             |             | Item No. |
|--------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|----------|
| Grinding balls                       | 5 mm Ø      | 7 mm Ø      | 9/10 mm Ø   | 12 mm Ø     | 20 mm Ø     | 25 mm Ø     | 30 mm Ø     |          |
| Agate                                | 05.368.0024 | 05.368.0025 | 05.368.0026 | 05.368.0027 | -           | -           | -           |          |
| Hard porcelain                       | 05.368.0019 | 05.368.0020 | -           | -           | -           | -           | -           |          |
| Sintered alumina I                   | -           | -           | 05.368.0021 | 05.368.0022 | -           | -           | -           |          |
| Zirconium oxide                      | -           | -           | -           | 05.368.0096 | 05.368.0093 | 05.368.0106 | 05.368.0092 |          |
| Stainless steel                      | 05.368.0034 | 05.368.0035 | 05.368.0036 | 05.368.0037 | 05.368.0062 | 05.368.0105 | 05.368.0061 |          |
| Chrome steel 4                       | 05.368.0029 | 05.368.0030 | 05.368.0031 | 05.368.0032 | 05.368.0033 | -           | -           |          |
| Tungsten carbide                     | 05.368.0038 | 05.368.0039 | 05.368.0040 | 05.368.0041 | 05.368.0070 | -           | -           |          |
| Teflon with steel core               | -           | -           | 05.368.0045 | 05.368.0046 | 05.368.0047 | -           | -           |          |
| Polyamide for mixing container       | 05.368.0042 | 05.368.0043 | 05.368.0044 | 05.368.0003 | -           | -           | -           |          |

| Accessories for cell disruption with MM 301                                   | Item No.    |
|---|-------------|
| Adapter rack MM 301 for 10 standard reaction vials with and without screw-top | 22.001.0013 |
| Holder for 5 reaction vials 2 – 1.5 – 0.7 ml                                  | 22.008.0001 |
| Holder for 5 reaction vials 2 – 1.5 – 0.7 ml with screw-top                   | 22.008.0004 |
| Safe-Lock reaction vials 2.0 ml, 1000 units                                   | 22.749.0001 |
| Safe-Lock reaction vials 1.5 ml, 1000 units                                   | 22.749.0002 |
| Safe-Lock reaction vials 0.5 ml, 500 units                                    | 22.749.0003 |

| Technical data   |                               |
|--|-------------------------------|
| MM 200   | W x H x D: 300 x 182 x 465 mm |
| MM 301   | W x H x D: 300 x 225 x 470 mm |
| Weight: approx. 20 kg. without grinding jars               |                               |
| Characteristic noise values: L <sub>pAeq</sub> 60-65 dB(A) |                               |

| Grinding balls for reaction vials   |             |             |             | Item No. |
|-------------------------------------|-------------|-------------|-------------|----------|
| Grinding balls                      | 3 mm Ø      | 4 mm Ø      | 5 mm Ø      |          |
| Stainless steel, approx. 200 units  | 22.455.0002 | 22.455.0001 | 22.455.0003 |          |
| Tungsten carbide, approx. 200 units | 22.455.0006 | 22.455.0005 | 22.455.0004 |          |

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