

LAARMANN[®]

Innovators in Solids

Sample Preparation

LM PBM1000 PLANETARY BALL MILL

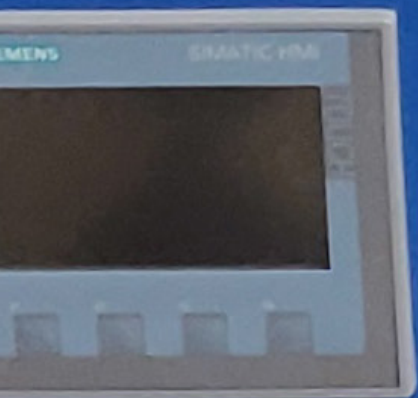
High efficient fine grinding



FOR RAPID FINE MILLING OF SOFT, HARD,
BRITTLE AND FIBROUS MATERIAL TO END
FINENESS $< 1\mu\text{m}$

LMPBM1000 PLANETARY BALL MILL

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Features and benefits

- Quick and easy to clean
- Rapid fine grinding
- Easy exchange of grinding jars and balls
- Grinding jars and balls made from a wide range of materials available
- Grinding jar volume from 12ml up to 500ml
- Can be expanded from 1 to 4 grinding jar positions
- CE-certified
- End fineness $<1\mu\text{m}$
- Programmable control

PBM1000 Description

The LAARMANN® Planetary Ball Mills are used for fine grinding of soft, hard to brittle or fibrous materials. Dry and wet grindings are possible. They support the daily sample preparation for laboratory and development usage.

Working principle

LAARMANN® Planetary Ball Mills consist of several cylindrical grinding jars (positioned on the sun wheel as shown in the figure) which are filled with loose grinding balls. Two superimposed rotational movements move the grinding jar: like in a planetary system, the grinding jars rotate in an orbit around the centre.

This rotational movement is the self-rotation of the grinding container superimposed. The resulting centrifugal and acting acceleration forces lead to strong grinding effects. Furthermore, there are forces working according to the Coriolis acceleration. The result is an intensive grinding effect between the grinding balls and the sample.

Depending on the speed ratio, different movement patterns of the grinding media can be achieved. It is achieved with the grinding balls that are bouncing off in the inner wall of the grinding jar. When hitting the wall of the grinding jar, the sample will be milled. In a different motion pattern, the grinding balls roll over the sample and mill the ground material.

Operation

LAARMANN® Planetary Ball Mills enable the convenient programming of the following grinding parameters:

- Grinding duration in hours and minutes
- Speed
- Speed ratio (speed sun wheel : grinding jar)

Advantages

With our LAARMANN® Planetary Ball Mills becomes an easy task for the operator because of the user friendly program with options such as speed, rotation reversal and grinding time.

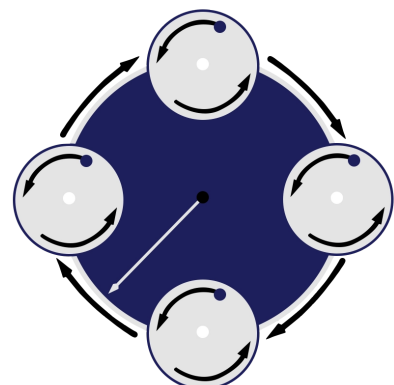
It also ensures safety for the operator because of the clamping of the grinding jars and built in safety system of the machine that ensures the machine will not start if the gap is open and stops when the gap is opened while running.



Planetary ball mill closed



Counter weight with 1 jar. can be expanded for 1-4 positions



Movement planetary mill

Grinding jars available with different materials

- Stainless steel
- Hardened steel
- Tungsten carbide
- Agate
- Sintered corundum
- Zirconium oxide
- Pu-coated
- PTFE-coated

Others on request

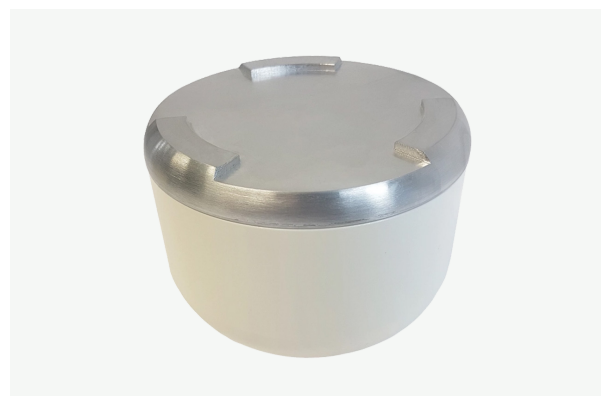
Features of grinding jars

The grinding jars are built from one block of the required material or built with a stainless steel protective jacket with liner from the above materials. Unique advantages of grinding jars:

- Safe according to stainless steel protective jacket
- Easy opening according to gap between lid and jar
- Self-centring base of grinding jar
- dust-proof sealed by O-ring or other seal

The selection of the right grinding jar and the correct filling level has a big impact on the grinding result. According to the application, you have to select the correct material and amount/volume for the grinding jar and the grinding balls.

A jar filling should consist of about 1/3 sample and 1/3 ball charge. The remaining third is the free jar volume that is necessary for the movement of the balls. The following table provides recommendations.



500ml zirconium oxide jar



100ml agate jar and agate grinding jars



Zirconium oxide and stainless steel grinding balls

Nominal volume	Sample amount	Max feed size	Recommended grinding ball charge					
			5mm	10mm	15mm	20mm	30mm	40mm
125 ml	15-20 ml	< 4 mm	500 pieces	30 pieces	18 pieces	7 pieces		
250 ml	25-120 ml	< 6 mm	1200 pieces	50 pieces	45 pieces	15 pieces	6 pieces	
500 ml	75-220 ml	< 10 mm	2000 pieces	100 pieces	70 pieces	25 pieces	8 pieces	4 pieces

We recommend to select always grinding jars and balls build from the same material

Applications

The Laarmann PBM1000 Planetary Ball Mill is used for applications fields such as mining, geology, pharmaceuticals, ceramics, and chemical laboratories for sample preparation and ultra-fine particle size reduction. These are some of the application materials that the machine is able to process

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|-------------------|-----------------------|-------------------------------|
| ■ Wood fibres | ■ Tissue | ■ Clay minerals |
| ■ Plant materials | ■ Carbon fibres | ■ Ores |
| ■ Seeds | ■ Paints and lacquers | ■ Semi-precious stones |
| ■ Tobacco | ■ Catalysts | ■ Coal |
| ■ Betonite | ■ Plastics | ■ Alloys |
| ■ Concrete | ■ Pigments | ■ Metal oxides |
| ■ Gypsum | ■ Polymers | ■ Quartz |
| ■ Sand | ■ Cellulose | ■ Slags |
| ■ Stone | ■ Glass | ■ Electronic scrap |
| ■ Cement clinker | ■ Hydroxylapatite | ■ Organic and unorganic waste |
| ■ Hair | ■ Ceramic oxides | |
| ■ Bones | ■ Quartz | |
| ■ Kaolin | ■ Sludges | |



Technical specifications

Applications	Crushing and blending materials, achieving uniform mixtures, producing colloids through fine milling, combining metals mechanically, initiating solid-state reactions, reducing particles to the nanoscale, and screening for co-crystal formations.
Application fields	agriculture, biology, chemistry, construction materials, engineering / electronics, environment / recycling, geology / metallurgy, glass / ceramics, medicine / pharmaceuticals
Working principle	Impact / friction / shear / compression / attrition
Process materials	dry, wet, cryogenic - hard, soft, brittle and fibrous
Feed size	< 10 mm
Batch size / feed quantity	max 4 x 220ml / 8 x 20ml when stacked
End fineness	< 1µm; < 0,1µm for colloidal grinding
Speed setting	30 - 425 min ⁻¹
Speed ratio	1:-2 / 1:-2.5 / 1:-3, determine at order
Sun wheel speed	50-650 min ⁻¹
Setting adjustment method	digital control panel
Amount of grinding jar positions	1-4
Number of grinding jars	1-8
Consumable material/material of grinding tools	Hardened steel, agate, silicon nitride, stainless steel, zirconium oxide, aluminum oxide, tungsten carbide others on request
Jar coating	available on request
Consumable sizes/grinding jar sizes	12 ml / 25 ml / 50 ml / 80 ml / 125 ml / 250 ml / 500 ml
Stackable grinding jars	12 ml / 25 ml / 50 ml / 80 ml
Grinding ball sizes	0,1 - 50mm
Power supply	200-240 V 50/60 Hz
Central lubrication	yes, single point
Electrical requirements	0.75 kW
Power connection	1 phase
Standard	CE
Protection code	IP40
Weight	95kg
Dimensions (width x length x height)	759 x 480 x 548 mm