pulverisette 6

Planetary Mono Mill

- Extremely rapid grinding of lab samples down to < 1 µm
- Planetary ball mill with a single grinding station and compensation for unbalance
- Suitable for hard to soft grinding materials

milling **sample preparation**

planetary ball mill

for your lab

FRITSCH

Planetary Mono Mill

Field of application

For fine comminution of dry lab samples or solids in suspension down to colloidal fineness. For mixing and perfect homogenization of emulsions or pastes as well as for mechanical alloying.

max. feed size < 10 mm,
feed quantity: up to 225 ml,
final fineness about 1 µm

Examples of application

Geology and mineralogy
stones, pebbles, sand, minerals

Ceramics
porcelain, sintered ceramic, clay, fireclay

Chemistry
plant protectives, fertilisers, slats, inorganic and organic materials

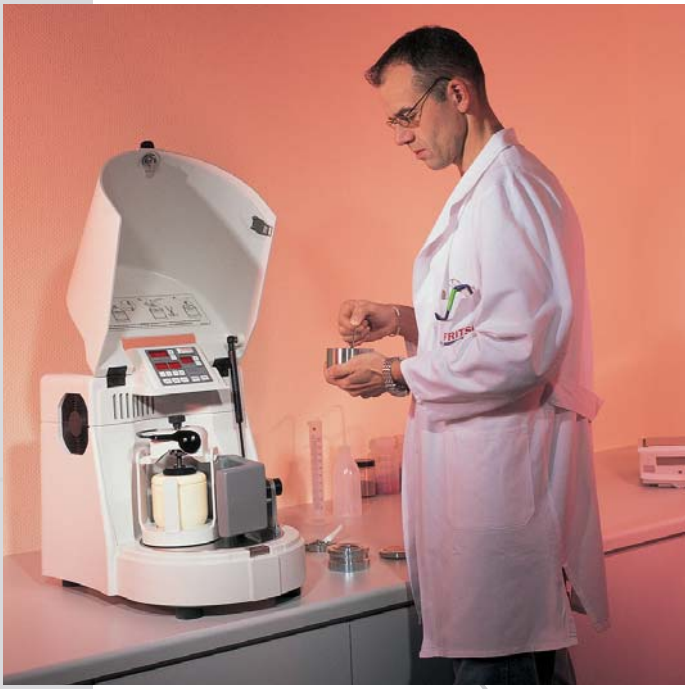
Biology
plants, leaves, freeze-dried samples

Medicine, pharmacology and galenite research
eye therapeutics, jellies, cremes, extracts, drugs, pastes, dragées, tablets

Nuclear research
radioactive samples

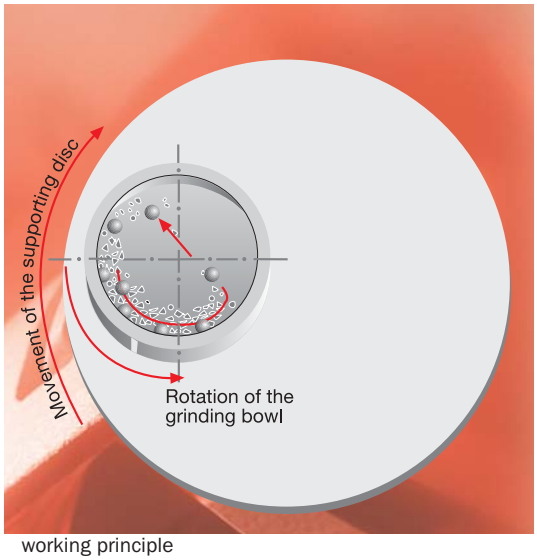
Material technology
pigments, precious material, new materials, alloys, mechanical activation

Analytic preparation
spectroscopy, X-ray fluorescence, X-ray structure analysis, chromatography



fine grinding quality control

Planetary Mono Mill



working principle


adjustable compensation mechanism for compensation of unbalance

Method of operation

In the planetary mono mill pulverisette 6 grinding bowls rotate around their own axes while also orbiting around a central axis. As a result, forces are exerted on the grinding balls and material which are constantly changing direction and amount. Optimum grinding ball movements are obtained due to design of geometry and transmission ratios.

The grinding balls are carried up the inner wall of the bowls and, under certain conditions, are propelled off the inner wall. After crossing the grinding bowl the material and the grinding balls collide with the opposite wall of the bowl. The energy developed through the impact is several times higher than for conventional ball mills. The outcome: Excellent grinding results and much short grinding times.

membrane keyboard

Planetary Mono Mill

Advantages

- Very high grinding performance despite small space requirement
- No-loss grinding, even in suspension
- Quick, secure fastening of the grinding bowls
- Grinding chamber cooled by built-in fan permits longer grinding times
- Reproducible grinding results due to controlled drive and programmable electronic system
- Extensive accessories
- Precise speed display and microprocessor control electronic system
- Compensation of unbalance of all grinding bowls using a compensation mechanism which is easy to operate
- No additional counterweights are required
- Simple cleaning of grinding elements
- Possibility of grinding in two grinding bowls (80 ml) simultaneously
- Grinding parameters can be controlled even when grinding chamber is open, due to clearly visible control panel
- Built in selection of mains voltage available (100-120/200-240 V)
- High speed range
- Simple handling, ergonomic design
- Safety standard EN 61010 and CE mark
- 2 year guarantee

Design Characteristics

- New laboratory mill based on the principle of planetary ball mills with just one grinding bowl holder
- Adjustable mass to compensate unbalances
- Exact transmission ratios due to toothed belt
- Grinding bowls in sizes 80 to 500 ml
- Speeds of up to 650 rpm
- Grinding chamber completely encapsulated but easy to open
- New electronic system with timer and programmable reversing unit
- Programmable interval and break times
- RS232 interface to output process data (Validation)
- Ergonomically mounted membrane keyboard IP65, with protection against splash water spillage
- Plastic housing which can be recycled
- Power-saving function

ball mill sample preparation grinding

grinding bowls and balls

Accessories

Grinding bowls and balls

Grinding bowls and balls are available in 8 different materials to avoid contamination of samples due to unwanted wear of grinding elements.

Material	Density g/cm³	Abrasion resistance	Material to be ground
Agate 99.9 % SiO_2	2.65	good	soft to medium-hard samples
Silicon nitride 90 % Si_3N_4	3.1	extremely good	abrasive samples, iron-free grinding
Sintered corundum 99.7 % Al_2O_3	> 3.8	fairly good	medium-hard, fibrous samples
Sintered corundum-2 85-90 % Al_2O_3	> 3.8	fairly good	medium-hard, fibrous samples
Zirconium oxide 94.8 % ZrO_2	5.7	very good	fibrous, abrasive samples
Stainless steel bowls: 17-19 % Cr + 8-10 % Ni balls: 12.5-14.5 % Cr + 1 % Ni	7.8	fairly good	medium-hard, brittle samples
Tempered steel bowls: 11-12 % Cr balls: 1-1.65 % Cr	7.9	good	hard, brittle samples
Hard metal tungsten carbide bowls: 93.5 % WC + 6 % Co lids: 84.5 % WC + 15 % Co balls: 93.2 % WC + 6 % Co	14.89 13.97 14.7	very good	hard, abrasive samples

Recommended number of balls per grinding bowl

Grinding bowl/ useful capacity	80 ml 1-30 ml	250 ml 30-125 ml	500 ml 80-225 ml
Balls			
5 mm	250	1200	2000
10 mm	30	50	100
15 mm	10	45	70
20 mm	5	15	25
30 mm		6	10
40 mm			4

The quoted number of balls per bowl is the minimum quantity; depending on the material behaviour it shall be possibly increased.

Normally grinding bowls and balls of the same material are used. To shorten the grinding time, larger or heavier balls (higher density) can be used (high grinding energy):
e.g. tungsten carbide balls in the steel grinding bowl or zirconium oxide balls in the silicon nitride bowl.

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Special Accessories

Grinding in an inert atmosphere

- Special lid – Using a special lid for the grinding bowl, material can also be ground in an inert atmosphere. The cover is fitted with an inlet and outlet valve with quick-action vent.
- Additional lock-system - If the grinding bowl should be filled in a glove box, the additional lock-system must be used for the transport of the filled grinding bowl.
- Special lid and additional lock-system can also be combined.

grinding in an inert atmosphere

GTM - Gas pressure and temperature measuring system

This system enables the laboratory planetary mill to be converted in an analytical measuring system. Continual monitoring of gas pressure and temperature enable thermal effects and physical and chemical reactions (pressure increase or decrease) to be monitored "in situ" in the grinding bowl. Without having to modify the mill itself, a grinding bowl is used with an integral radio transmitter in the lid.

A receiver transfers the data to a computer, and a WINDOWS™ program presents the measured values in graph form. In Excel™, the data is presented in tabular form.

Please ask for the detailed brochure on the gas pressure and temperature measuring system (GTM).


pulverisette 6 with GTM-System

quality
milling control
pulverisette 6

Technical data

working principle	impact force (mainly)
max. feed size (depending on the material)	10 mm
min. sample quantity	1 ml
max. sample quantity	225 ml
final fineness	< 1 µm
typical grinding time (e. g. for quartz sand up to d_{50} = 10 µm)	4 min
grinding process	dry / wet
speed of the main disc	100 - 650 rpm
transmission ratio	$i_{relative}$ = 1 : -1.82
electrical details	100-120/200-240 V/1~, 50-60 Hz, 1100 watt
motor-shaft-power according to VDE 0530, EN 60034	0.75 kW
weight	net: 63 kg, gross: 83 kg
dimensions w x d x h	table instrument: 37 x 53 x 50 cm
packing details	wooden case: 68 x 54 x 72 cm

Special Accessories

Order no.	Description
	Accessories for grinding in an inert atmosphere and for mechanical alloying
	Grinding bowls 500 ml volume with lid with 2 valves and seal ring
50.8000.00	agate, 500 ml volume
50.8200.00	stainless steel, 500 ml volume
50.8400.00	tempered steel, 500 ml volume
50.1230.16	replacement seal ring made of Viton for lid with 2 valves for all bowls of 500 ml volume
	Grinding bowls 250 ml volume with lid with 2 valves and seal ring
50.8100.00	agate, 250 ml volume
50.8300.00	stainless steel, 250 ml volume
50.8500.00	tempered steel, 250 ml volume
50.8600.00	hardmetal tungsten carbide, 250 ml volume
50.2230.16	replacement seal ring made of Viton for lid with 2 valves for all bowls of 250 ml volume
	Grinding bowls 80 ml volume with lid with 2 valves and seal ring
50.8800.00	stainless steel, 80 ml volume
50.8700.00	tempered steel, 80 ml volume
50.4230.16	replacement seal ring made of Viton for lid with 2 valves for all bowls of 80 ml volume
90.1400.00	additional lock-system (for the transport of the closed grinding bowl)

pulverisette 6

Ordering data

Order no.	Description
06.2000.00	**Planetary Mono Mill pulverisette 6** **without grinding bowls and balls, incl. "safe lock" clamping system** for 100-120/200-240 V/1~, 50-60 Hz, 1100 watt The voltage specified on the order form will be set by the factory
	Grinding bowls **Grinding bowls 500 ml volume with lid and seal ring**
50.1050.00	agate
50.1060.00	sintered corundum (99.7 % Al_2O_3)
50.1070.00	sintered corundum-2 (85-90 % Al_2O_3)
50.1310.00	silicon nitride
50.1110.00	zirconium oxide
50.1100.00	stainless steel
50.1090.00	tempered steel
50.1010.20	replacement seal ring PTFE 110/101 mm dia. for silicon nitride bowls of 500 ml volume
50.1230.20	replacement seal ring PTFE 116/110 mm dia. for all other bowls of 500 ml volume
	Grinding bowls 250 ml volume with lid and seal ring
50.2055.00	agate
50.2060.00	sintered corundum (99.7 % Al_2O_3)
50.2070.00	sintered corundum-2 (85-90 % Al_2O_3)
50.2310.00	silicon nitride
50.2110.00	zirconium oxide
50.2100.00	stainless steel
50.2090.00	tempered steel
50.2080.00	hardmetal tungsten carbide
50.2010.20	replacement seal ring PTFE 85/76 mm dia. for silicon nitride and agate bowls of 250 ml volume
50.2230.20	replacement seal ring PTFE 90/75 mm dia. for all other bowls of 250 ml volume
	Grinding bowls 80 ml volume with lid and seal ring
50.4050.00	agate
50.4060.00	sintered corundum (99.7 % Al_2O_3)
50.4310.00	silicon nitride
50.4110.00	zirconium oxide
50.4100.00	stainless steel
50.4090.00	tempered steel
50.4080.00	hardmetal tungsten carbide
50.4230.20	replacement seal ring PTFE 80/66 mm dia. for all bowls of 80 ml volume
90.1120.09	adapter for grinding bowl of 80 ml volume (essential, if only one grinding bowl is inserted in the grinding bowl holder)
	Grinding balls **Grinding balls 40 mm dia. for grinding bowls 500 ml**
55.0400.06	sintered corundum (99.7 % Al_2O_3)
55.0400.31	silicon nitride
55.0400.27	zirconium oxide
55.0400.10	stainless steel
55.0400.09	tempered steel
55.0400.08	hardmetal tungsten carbide
	Grinding balls 30 mm dia. for grinding bowls 500 ml, 250 ml
55.0300.05	agate, polished
55.0300.06	sintered corundum (99.7 % Al_2O_3)
55.0300.31	silicon nitride
55.0300.27	zirconium oxide
55.0300.10	stainless steel
55.0300.09	tempered steel
55.0300.08	hardmetal tungsten carbide
	Grinding balls 20 mm dia. for grinding bowls 500 ml, 250 ml, 80 ml
55.0200.05	agate, polished
55.0200.06	sintered corundum (99.7 % Al_2O_3)
55.0200.31	silicon nitride
55.0200.27	zirconium oxide
55.0200.10	stainless steel
55.0200.09	tempered steel
55.0200.08	hardmetal tungsten carbide
	Grinding balls 15 mm dia. for grinding bowls 500 ml, 250 ml, 80 ml
55.0150.05	agate, polished
55.0150.06	sintered corundum (99.7 % Al_2O_3)
55.0150.31	silicon nitride
55.0150.27	zirconium oxide
55.0150.10	stainless steel
55.0150.09	tempered steel
55.0150.08	hardmetal tungsten carbide
	Grinding balls 10 mm dia. for grinding bowls 500 ml, 250 ml, 80 ml
55.0100.05	agate, polished
55.0100.06	sintered corundum (99.7 % Al_2O_3)
55.0100.31	silicon nitride
55.0100.27	zirconium oxide
55.0100.10	stainless steel
55.0100.09	tempered steel
55.0100.08	hardmetal tungsten carbide
	Grinding balls 5 mm dia. for grinding bowls 500 ml, 250 ml, 80 ml
55.0050.05	agate, polished (100 pieces weigh approx. 17 g)*
55.0050.27	zirconium oxide (100 pieces weigh approx. 38 g)*
55.0050.10	stainless steel (100 pieces weigh approx. 51 g)*
55.0050.09	tempered steel (100 pieces weigh approx. 52 g)*
55.0050.08	hardmetal tungsten carbide (100 pieces weigh approx. 97)*
	*due to the indication of weight, the high number of balls per grinding bowl can be weight.

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