P-5 premium

PLANETARY MILL

FRITSCH

TECHNICAL SPECIFICATIONS

EASY WORKING. GREAT RESULTS.

CONTENT

TECHNICAL DATA

P-5 premium – Planetary Mill

Working principle	Impact force
Material-type	Hard, medium-hard, soft brittle, tough, moist
Fields of application	Biology Chemistry Ceramics Geology and mineralogy Metallurgy Material research Mechanical alloying Nanotechnology Pharmaceuticals
Grinding station	2 stations
Grinding tools	Grinding bowls + balls
Materials grinding tools	Agate, hardened stainless steel, hardmetal tungsten carbide, zirconium oxide, Silicon nitride
Grinding bowl sizes	500 ml, 420 ml, 250 ml, 150 ml, 125 ml
Grinding ball sizes	0.1–20 mm
Max. initial size / feeding size	10 mm
Sample quantity	30–450 ml
Final fineness (depends on application)	< 0.05 µm colloidal grinding
Average grinding time to analytical fineness	3 min
Grinding process	Dry/wet
Grinding in inert gas	Yes
Gas pressure and temperature measurement	Yes
Software MillControl	Yes
RPM of main disk	100–800 rpm
Relative bowl speed	1600 rpm

Transmission ratio planetary disk/ grinding bowl	$i_{relative}$ = 1 : -2
Effective diameter of main disk	180 mm
Centrifugal acceleration (g = 9.81 m/s²)	64 g
Interface	Yes
Power consumption	2800 W
Electrical details	200–240 V/1, 50/60 Hz
Emission sound pressure level at the workplace acc. to DIN EN ISO 3746 *(workplace related)*	84 dB
Weight	110 kg
Safety class	IP21
Dimensions (W x D x H)	Bench-top: 82 x 52 x 48 cm

ACCESSORIES

P-5 premium – Planetary Mill

Order no.	Article
	**Instrument without grinding bowls and balls, incl. ServoLOCK clamping system**
05.7020.00	for 200–240 V/1~, 50–60 Hz, 2,800 watts *Other voltages on request!*
	**Grinding bowls for Planetary Mill P-5 premium**
	Grinding bowls with lid and seal ring
	Grinding bowls 420–500 ml volume for P-5 premium
50.6400.00	Agate 420 ml volume, with steel casing
50.6490.00	Zirconium oxide 500 ml volume, with steel casing
50.6550.00	Hardened, stainless steel 500 ml volume
50.6580.00	Hardmetal tungsten carbide 500 ml volume, with steel casing
50.6480.00	Silicon nitrite 500 ml volume, with steel casing
	Grinding bowls 250 ml volume for P-5 premium
50.6610.00	Agate 250 ml volume, with steel casing
50.6700.00	Zirconium oxide 250 ml volume, with steel casing
50.6760.00	Hardened, stainless steel 250 ml volume, with steel casing
50.6790.00	Hardmetal tungsten carbide 250 ml volume, with steel casing
50.6450.00	Silicon nitride 250 ml volume, with steel casing
	Grinding bowls 125–150 ml volume for P-5 premium
50.6840.00	Agate 125 ml volume, with steel casing

Order no.	Article
	Grinding bowls 125–150 ml volume for P-5 premium
50.6900.00	Zirconium oxide 150 ml volume, with steel casing
50.6920.00	Hardened, stainless steel 150 ml volume
50.6940.00	Hardmetal tungsten carbide 150 ml volume, with steel casing
50.6837.00	Adapter for all grinding bowls P-5 premium 125–150 ml volume *(Essential, if only one grinding bowl is inserted in the grinding bowl holder)*
50.6830.00	Stacking ring for all grinding bowls P-5 premium 125–150 ml volume *(Essential, if 2 grinding bowls 125–150 ml volume per grinding bowl holder are used)*

Accessories for Planetary Mill P-5 premium

	Software
83.5605.00	Software MillControl for Windows *For automatic control of the mill and validation of the grinding process*
	Certification for P-5 premium
96.0310.00	IQ/OQ documentation (questionnaire format – implementation not included)
	Accessories for all grinding bowls P-5 premium
50.6733.00	Special emptying device for all premium grinding bowls 500 ml, 250 ml, 150 ml volume, except agate
50.6980.24	Replacement grinding bowl seal tape for all premium grinding bowls 125–500 ml volume
	Replacement seal rings for grinding bowls P-5 premium
84.0163.15	Replacement seal ring Viton 88.49 x 3.53 mm for premium grinding bowls 125–150 ml volume
84.0164.15	Replacement seal ring Viton 88 x 4 mm for premium grinding bowls 250–500 ml volume, all gassing lids for premium grinding bowls 125–500 ml volume and all EASY-GTM grinding bowls 250 ml volume

Order no.	Article
	**Gassing lids and screw-on grinding bowl lids for Planetary Mill P-5 premium**
	Accessories for grinding in inert gas and for mechanical alloying
	Gassing lid with valves and seal ring for all premium grinding bowls 500 ml, 420 ml, 250 ml, 150 ml and 125 ml volume for P-5 premium
50.6407.00	Agate, with steel casing
50.6497.00	Zirconium oxide, with steel casing
50.6557.00	Hardened, stainless steel, with steel casing
50.6587.00	Hardmetal tungsten carbide, with steel casing
	Screw-on grinding bowl lids with seal ring for all premium grinding bowls 500 ml, 420 ml, 250 ml, 150 ml and 125 ml volume for P-5 premium
50.6405.00	Agate, with steel casing
50.6495.00	Zirconium oxide, with steel casing
50.6555.00	Hardened, stainless steel, with steel casing
50.6585.00	Hardmetal tungsten carbide, with steel casing
	Gassing lids with Swagelok valves are available on request.

Order no.	Article
	**EASY-GTM – Gas pressure and temperature measuring system with gassing valves for Planetary Mill P-5 premium**
	EASY-GTM with gassing valves for controlling the grinding process by continuous measurement of gas pressure and temperature and for grinding in inert gas
81.0013.00	Receiver unit – board and software MillControl
50.9250.00	250 ml grinding bowl made of zirconium oxide with special lid with gassing valves and transmitter
50.9280.00	250 ml grinding bowl made of hardened, stainless steel with special lid with gassing valves and transmitter
50.9310.00	250 ml grinding bowl made of hardmetal tungsten carbide with special lid with gassing valves and transmitter
	Only one receiver unit with software MillControl has to be ordered.
	Special lids for EASY-GTM with Swagelok valves are available on request.
	**Accessories for single-use technology for Planetary Mill P-5 premium**
50.6200.00	Grinding bowl aluminium, modified according to customer for the use of tubes
50.6436.00	Grinding bowl made of aluminium with 5 tubes 25 ml volume
50.6437.00	Set of tubes 25 ml volume with lids (set = 10 pieces)

Order no.	Article
	**Grinding balls for Planetary Mills**
	Grinding balls 20 mm dia. for grinding bowls 500 ml, 420 ml, 250 ml, 150 ml, 125 ml
55.0200.05	Agate, polished
55.0200.06	Sintered corundum (99.7 % Al_2O_3)
55.0200.27	Zirconium oxide
55.0200.09	Hardened, stainless steel
55.0200.08	Hardmetal tungsten carbide
55.0200.31	Silicon nitride
	Grinding balls 15 mm dia. for grinding bowls 500 ml, 420 ml, 250 ml, 150 ml, 125 ml
55.0150.05	Agate, polished
55.0150.06	Sintered corundum (99.7 % Al_2O_3)
55.0150.27	Zirconium oxide
55.0150.09	Hardened, stainless steel
55.0150.08	Hardmetal tungsten carbide
55.0150.31	Silicon nitride
	Grinding balls 10 mm dia. for grinding bowls 500 ml, 420 ml, 250 ml, 150 ml, 125 ml
55.0100.05	Agate, polished
55.0100.06	Sintered corundum (99.7 % Al_2O_3)
55.0100.27	Zirconium oxide
55.0100.09	Hardened, stainless steel
55.0100.08	Hardmetal tungsten carbide
55.0100.31	Silicon nitride

Order no.	Article
	Grinding balls 5 mm dia. for grinding bowls 500 ml, 420 ml, 250 ml, 150 ml, 125 ml
55.0050.05	Agate, polished (100 pieces weigh approx. 17 g)[1)]
55.0050.06	Sintered corundum (99.7 % Al_2O_3) (100 pieces weigh approx. 48 g)[1)]
55.0050.27	Zirconium oxide (100 pieces weigh approx. 38 g)[1)]
55.0050.09	Hardened, stainless steel (100 pieces weigh approx. 52 g)[1)]
55.0050.08	Hardmetal tungsten carbide (100 pieces weigh approx. 97 g)[1)]
55.0050.31	Silicon nitride (100 pieces weigh approx. 48 g)[1)]
	[1)] *The number of balls required for each grinding bowl can be determined by weighing them using the weight specifications.*
	Grinding balls ≤ 3 mm dia. for grinding bowls 500 ml, 250 ml, 150 ml
55.0030.27	Zirconium oxide 3 mm dia.
55.0020.27	Zirconium oxide 2 mm dia.
55.0015.27	Zirconium oxide 1.5 mm dia.
55.0010.27	Zirconium oxide 1 mm dia.
55.0005.27	Zirconium oxide 0.5 mm dia.
55.0001.27	Zirconium oxide 0.1 mm dia.
55.0030.09	Hardened, stainless steel 3 mm dia.
55.0010.09	Hardened, stainless steel 1 mm dia.
55.0030.08	Hardmetal tungsten carbide 3 mm dia.
55.0016.08	Hardmetal tungsten carbide 1.6 mm dia.
55.0006.08	Hardmetal tungsten carbide 0.6 mm dia.
	Further grinding balls ≤ 3 mm dia. are available. *Grinding balls are also available in other sizes.*

Material data grinding bowls/grinding balls

Material	Main component of the material*	Density g/cm³	Abrasion resistance	Sample material
Agate	SiO_2	2.65	Good	Soft to medium-hard samples
Sintered corundum	Al_2O_3	3.8	Fairly good	Medium-hard, fibrous samples
Silicon nitride	Si_3N_4	3.25	Extremely good	Abrasive samples, metal-free grinding
Zirconium oxide	ZrO_2	5.7	Very good	Fibrous, abrasive samples
Hardened stainless steel	Fe – Cr	7.7	Good	Hard, medium-hard, brittle samples
Hardmetal tungsten carbide	WC	14.3	Very good	Hard, abrasive samples

** At www.fritsch.de, you will find the standard analyses with detailed information on the materials directly next to the respective grinding bowls and balls.*

Recommended filling per grinding bowl

Grinding balls ≥ 5 mm: Recommended number of balls per grinding bowl

Grinding bowl Useful capacity (sample volume)		125 ml 15–50 ml	150 ml 20–70 ml	250 ml 30–125 ml	420 ml 60–200 ml	500 ml 80–225 ml
Balls diameter	5 mm	9	12	15	20	25
	10 mm	25	35	45	60	70
	15 mm	35	40	50	80	100
	20 mm	600	900	1200	1800	2000

Grinding balls ≤ 3 mm: Recommended ball mass per grinding bowl in grams

Grinding bowl Useful capacity (sample volume)		150 ml 20–70 ml	250 ml 30–125 ml	500 ml 80–225 ml
Material	Zirconium oxide	170 g	400 g	800 g
	Hardened, stainless steel	350 g	500 g	1100 g
	Hardmetal tungsten carbide	800 g	1000 g	2100 g

Grinding balls with a diameter of 3 mm and smaller must be weighed. The above table shows the required weight per grinding cup.

The usable capacity depends on the type of material.

The specified ball filling per cup is the minimum quantity; depending on the material behaviour, it may need to be increased.

In exceptional cases, the quantity of grinding balls can be reduced by up to 15 %. In order to achieve consistent grinding results in line with our recommendations, a longer grinding time is necessary, which may result in increased abrasion.

APPLICATION EXAMPLES

P-5 premium – Planetary Mill

Sample 1: Ferrous metal

Milling:

- 250 ml tungsten carbide grinding bowl
- 15 x 20 mm tungsten carbide grinding balls
- 450 rpm - 1
- 5 x 2 minutes

Sample 2: Iron-copper alloy

Milling:

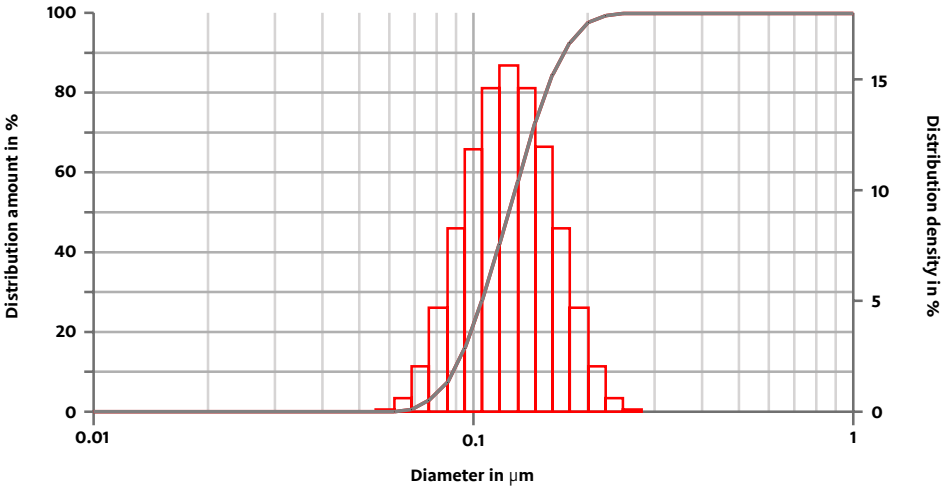
- Mechanical alloying of iron and copper powder
- 250 ml tungsten carbide grinding bowl
- 15 x 20 mm tungsten carbide grinding balls
- 450 rpm - 1
- 4 x 2 minutes

Sample 3: Glass (silicon dioxide)

Milling:

- 250 ml zirconium oxide grinding bowl
- 15 x 20 mm zirconium oxide grinding balls
- 450 rpm - 1
- Ball replacement at 0.5 mm
- Total grinding time 120 min (115 min) at 0.5 mm ball diameter

Particle size after milling



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for a non-binding consultation or individual test grinding to identify your ideal device configuration and optimal grinding parameters.

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