ПЛАНЕРАТНА ТОПКОВА МЕЛНИЦА PM 300

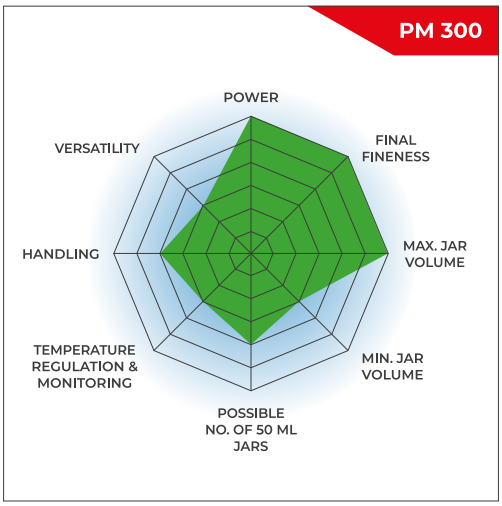
The Planetary Ball Mill PM 300 is a powerful and ergonomic benchtop model with two grinding stations for grinding jar volumes up to 500 ml. This setup allows for processing up to 2 x 220 ml sample material per batch. Thanks to the high maximum speed of 800 rpm, extremely high centrifugal forces result in very high pulverization energy and consequently in short processing times.

The PM 300 is ideally suited for virtually all industries where the quality control process places the highest demands on purity, speed, fineness and reproducibility. Thanks to its enormous energy input of up to 64.4 times the acceleration of gravity, this mill is the perfect choice for tasks in research like mechanochemistry (co-crystal screening, mechanosynthesis, mechanical alloying and mechano-catalysis), or for ultrafine colloidal grinding on a nanometer scale.

Click to view video

THE POWERFUL, ERGONOMIC PLANETARY BALL MILL

- Max. speed 800 rpm, large sun wheel
- Up to 10 mm feed size and 0.1 µm final fineness
- 2 grinding stations for jars of min. 12 ml and max. 500 ml, jars of 12 – 80 ml can be stacked (two jars each)
- GrindControl to measure temperature and pressure inside the jar.
- Aeriation lids to control the atmosphere inside the jar
- Bench top model, touch screen, storable SOPs and cycle programs, 5 different jar materials for dry and wet grinding

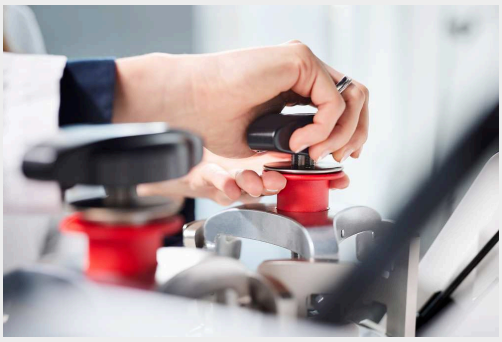


FAST & POWERFUL

- Loss-free size reduction down to the submicron range
- Wet grinding yields particle sizes in the nanometer range (<100 nm)
- Variable speed from 50 to 800 rpm, speed ratio 1:-2
- Milling with up to 64.4 x acceleration of gravity
- Batch-wise processing with max. 2 x 220 ml sample
- Possibility to stack jars enables simultaneous processing of 4 samples

SAFE AND EASY HANDLING

- Easy and safe clamping of the grinding jars thanks to lockable sun wheel
- The Safety Slider prevents starting the machine without securely clamped jars
- Perfect stability on the lab bench thanks to FFCS -technology
- Comfortable parameter setting via Touch display
- Automatic grinding chamber ventilation with directed air stream for perfect jar cooling
- Programmable starting time
- Both grinding jars are freely accessible
- Ergonomic clamping unit with smooth surfaces



SETTINGS & OPTIONS

- Dry and wet milling possible
- Suitable for long-term trials, 99 h max.
- Programmable breaks e.g. for cooling
- Automatic calculation of the total process time
- Direction reversal helps to minimize caking effects
- Smart service interval notification based on usage

REPRODUCIBILITY

- Reproducible results due to speed control
- Indication of load-defined speed, independent of set speed
- 12 SOPs and 4 cycle programs can be stored
- Power failure backup ensures storage of remaining processing time

THE BEST ALTERNATIVE TO A RETSCH PLANETARY BALL MILL? A RETSCH MIXER MILL.

Benefit from particularly ergonomic handling while achieving the same finenesses down to the nanometer range.

PLANETARY BALL MILL PM 300

SAFETY FIRST:
AUTOMATED NOTIFICATION OF CLAMPING FORCE

Operation of the RETSCH planetary ball mills is particularly safe. They feature a robust Safety Slider which ensures that the mill can only be started after the grinding jar has been securely fixed with a clamping device. The self-acting lock ensures that the jar is seated correctly and securely. This proven solid mechanical system is less failure-prone than electronic solutions - the user has full access to the sample at any time. When the electronic system fails, it is not possible to unlock the jars, for example. A unique safety feature of the PM 300 is an acoustic signal and notification in the display when the clamping unit has been fixed with the required force of 25 Nm. RETSCH offers a convenient clamping aid to facilitate the process. This is particularly helpful when the machine is operated in the upper speed range between 600 and 800 rpm.

PLANETARY BALL MILL PM 300

WET AND NANO-SCALE GRINDING WITH THE PM 300

Wet grinding is used to obtain particle sizes below 5 µm, as small particles tend to get charged on their surfaces and agglomerate, which makes further grinding in dry mode difficult. By adding a liquid or dispersant the particles can be kept separated.

To produce very fine particles of 100 nm or less (nano-scale grinding) by wet grinding, friction rather than impact is required. This is achieved by using a large number of small grinding balls which have a large surface and many friction points. The ideal filling level of the jar should consist of 60 % small grinding balls.

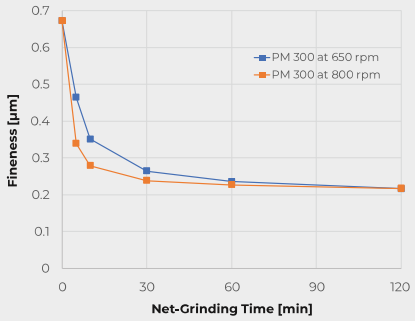
For more details on jar filling, wet grinding and sample recovery watch the video.

Click to view video

The video shows wet grinding in the Planetary Ball Mill PM 100.

TITANIUM DIOXIDE IN 125 ML JAR

The graphic shows the result of pulverizing titanium dioxide (TiO2) at 650 rpm and 800 rpm in the PM 300 and the net processing time. With the higher energy input at 800 rpm, the particle size decreases faster. However, the increased warming effects at 800 rpm should also be considered, as they might make longer breaks necessary.



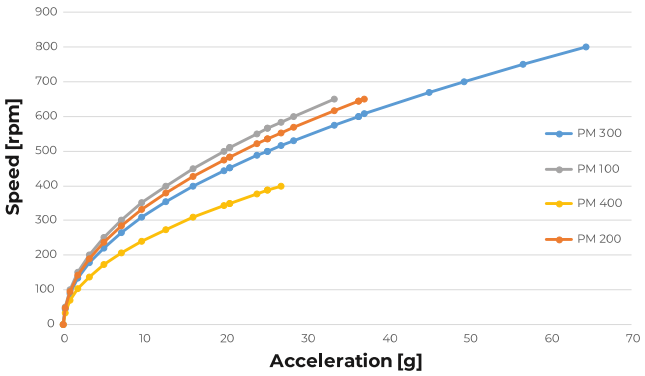
Net processing time of titanium dioxide with 0.1 mm grinding balls in sodium phosphate solution

PLANETARY BALL MILL PM 300

APPLICATIONS IN MECHANOCHEMISTRY

RETSCH Planetary Ball Mills are perfectly suited for processes like mechanical alloying or mechanosynthesis. For most reactions, the 1:-2 speed ratio of jar to sun wheel of the models PM 100 and PM 200 is fully adequate, as the ball charge produces enough impact energy. However, greater energy is required for some reactions. Here the PM 400 MA can be used with the increased speed ratio of 1:-2.5 or 1:-3.0.

The PM 300 works with a speed ratio of 1:-2, but in contrast to other models, it reaches up to 64.4 x acceleration of gravity thanks to the maximum speed of 800 rpm and the large sun wheel. Together with the option to use four small, stackable grinding jars sized 12 to 80 ml for small scale operations, or two jars sized up to 500 ml for upscaling purposes, this planetary ball mill is highly suitable for research applications in mechanochemistry.



Achievable acceleration in different planetary ball mills dependent on speed setting

EASYFIT GRINDING JARS FOR EXCELLENT RESULTS

The performance and the result of sample preparation are also determined by the choice of the grinding jar and its ball charge. The EasyFit range of jars has been specially designed for extreme working conditions such as long-term trials, even at maximum speed of 800 rpm, wet grinding, high mechanical loads and maximum speeds as well as for mechanical alloying. This line of jars is suitable for all RETSCH planetary ball mills.

The new EasyFit grinding jar series features a structure on the bottom of the 50-500 ml jars called Advanced Anti-Twist (AAT). This ensures that the jars are tightly fixed without the risk of twisting, even at high speed, and that wear and tear is drastically reduced. Secure clamping of the jars is made much easier: to find the correct clamping position, a maximum twist of 60° is required.

The geometry of the EasyFit jars in the 50 ml and 250 ml sizes has been enlarged in diameter and reduced in height compared to the previous "comfort" models. This offers two advantages: better grinding results and interchangeable lids, as there are only three diameter dimensions for the entire grinding jar range.

Diameter categories

- Diameter 1: 12 ml and 25 ml grinding jars
- Diameter 2: 50 ml, 80 ml and 125 ml grinding jars
- Diameter 3: 250 ml and 500 ml grinding jars

- Available jar sizes: 12 ml / 25 ml / 50 ml / 80 ml / 125 ml / 250 ml / 500 ml
- Innovative Advanced Anti-Twist (AAT) function ensures secure fit of grinding jars
- High flexibility thanks to suitability of three lid sizes for all seven jar sizes
- Pressure-tight and dust-proof O-ring sealing prevents material spillage
- Jars and balls available in 5 materials: hardened stainless steel, tungsten carbide, agate, sintered aluminium oxide, zirconium oxide
- Stainless steel protective jacket for agate, sintered aluminum oxide, zirconium oxide and tungsten carbide grinding jars
- A groove between jar body and lid allows for easy opening of the lid, e. g. with the help of a spatula, if there are underpressure effects inside the jar

ADAPTER FOR SPECIAL APPLICATIONS

With a special adapter, co-crystal screening can be carried out in a planetary ball mill, using disposable vials such as 1.5 ml GC glass vials. The adapter features 24 positions arranged in an outer ring with 16 positions and an inner ring with 8 positions. The outer ring accepts up to 16 vials, allowing for screening up to 64 samples simultaneously when using the Planetary Ball Mill PM 400. The 8 positions of the inner ring are suitable to perform trials with different energy input, e.g. for mechanosynthesis research.

Click to view video

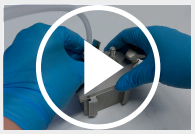
JARS & LIDS FOR SPECIAL APPLICATIONS

- For colloidal or wet grinding, the use of a grinding jar with a special closure device is recommended
- The special closure device is designed for ergonomic handling
- Aeration lids are designed for working under inert atmosphere, for example if oxygen can influence the grinding process or the mechanosynthesis. The lids allow the introduction of gases like argon or nitrogen into the grinding jar.
- Optional pressure and temperature measuring system PM GrindControl

Both the aeration lid and GrindControl can now be equipped with inlays of different materials. Thus, the lid can be used for, e. g. a steel and a zirconium oxide jar by simply exchanging the inlay.

GrindControl

Aeration lid



Click to view video

Video: Aeration lid

PLANETARY BALL MILL PM 300

RECOMMENDED JAR FILLINGS

To produce optimum grinding results, the jar size should be adapted to the sample amount to be processed. The grinding balls are ideally sized 3 times bigger than the largest sample piece. Following this rule of thumb, the number of grinding balls for each ball size and jar volume is indicated in the table below. To pulverize, for

example, 200 ml of a sample consisting of 7 mm particles, a 500 ml jar and grinding balls sized at least 20 mm or larger are recommended. According to the table, 25 grinding balls are required.

Grinding jar nominal volume	Sample amount	Max. feed size	Recommended ball charge (pieces)					
			Ø 5 mm	Ø 7 mm	Ø 10 mm	Ø 15 mm	Ø 20 mm	Ø 30 mm
12 ml	до ≤5 ml	<1 mm	50	15	5	-	-	-
25 ml	до ≤10 ml	<1 mm	95 – 100	25 – 30	10	-	-	-
50 ml	5 – 20 ml	<3 mm	200	50 – 70	20	7	3 – 4	-
80 ml	10 – 35 ml	<4 mm	250 – 330	70 – 120	30 - 40	12	5	-
125 ml	15 – 50 ml	<4 mm	500	110 – 180	50 – 60	18	7	-
250 ml	25 – 120 ml	<6 mm	1100 – 1200	220 – 350	100 – 120	35 – 45	15	5
500 ml	75 – 220 ml	<10 mm	2000	440 – 700	200 – 230	70	25	8

If a pulverization process in a planetary ball mill is successful depends on the machine settings but also on the filling level of the grinding jar. The usable volume of the jars depends on the type of sample material. The number of grinding balls given in the table reflect the minimum amount per jar. A better result is obtained with a larger number of suitable balls, if indicated. In exceptional cases, the number of balls can be reduced by not more than 15%; however, that will result in increased wear of the grinding tools.

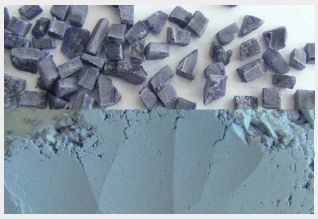
ТИПИЧНИ МАТЕРИАЛИ ЗА ПРОБА

RETSCH planetary ball mills are perfectly suitable for size reduction of, for example, alloys, bentonite, bones, carbon fibres, catalysts, cellulose, cement clinker, ceramics, charcoal, chemical products, clay minerals, coal, coke, compost, concrete, electronic scrap, fibres, glass, gypsum, hair, hydroxyapatite, iron ore, kaolin, limestone, metal oxides, minerals, ores, paints and lacquers, paper, pigments, plant materials, polymers, quartz, seeds, semi-precious stones, sewage sludge, slag, soils, tissue, tobacco, waste samples, wood, etc.

Very hard, abrasive: Industrial diamonds

11 g sample
50 ml tungsten carbide grinding jars
4 x 20 mm tungsten carbide grinding balls
4 min at 400 rpm

Hard-brittle: Sodalite mineral



85 g sample
125 ml zirconium oxide grinding jars
7 x 20 mm zirconium oxide grinding balls
12 min at 500 rpm

Nano grinding: Aluminum oxide

100 g sample + 190 ml sodium-phosphate solution
500 ml zirconium oxide grinding jars
1 kg 2 mm zirconium oxide grinding balls
3:30 min net-grinding at 650 rpm

Grinding breaks help to keep temperature lower

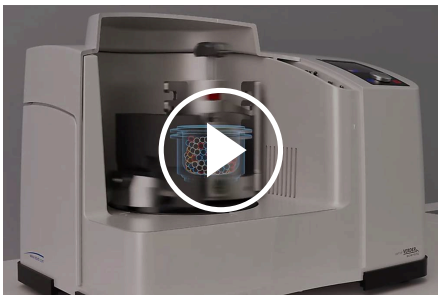
Medium-hard, tough: Polyester terephthalate resin

125 g sample
500 ml zirconium oxide grinding jars
8 x 30 mm zirconium oxide grinding balls
3 min at 350 rpm

ПРИНЦИП НА РАБОТА

Смилащите цилиндри са закрепени ексцентрично на слънчевото колело. Посоката на движение на слънчевото колело е обратна на посоката на движение на смилащите цилиндри и имат предавателно съотношение 1:-2.

Смилащите топки в цилиндърите се движат под въздействието на наслагвани ротационни движения, така наречените Кориолис сили. Взаимодействието на енергиите на смилащите топки и цилиндъра, довеждат до много ефективно намаляване размера на частиците.



Click to view video

PLANETARY BALL MILL PM 300

TECHNICAL DATA

Приложения	pulverizing, mixing, homogenizing, colloidal milling, mechanical alloying, mechanochemistry, co-crystal screening
Област на приложение	chemistry, биология, геология / металургия, инженеринг / електроника, медицина / фармация, околната среда / рециклиране, селското стопанство, строителни материали, стъкло / керамика
Материали	мек, твърд, крехък, влакнести - сухи или мокри
Принцип на смилане	удар, триене
Максимален размер на захранващият продукт	< 10 мм
Големина след смилане*	< 1 микрона, за колоидално смилане < 0.1 микрона
Размер на партидата / количество на пробата*	max. 2 x 220 ml
Брой на смилачните станции	2
Съотношение на скоростта	1 : -2
Скорост на слънчевото колело	50 - 800 min-1
Диаметър на слънчевото колело	180 мм
G-force	64 g
Видове смилачни цилиндри	optional areation covers, safety closure devices
Материал на смилащите части	hardened stainless steel, волфрамов карбид, ахат, спечен алуминиев оксид, циркониев оксид
Обем на смилачната камера	12 мл / 25 мл / 50 мл / 80 мл / 125 мл / 250 мл / 500 мл
Stackable grinding jars	12 ml / 25 ml / 50 ml / 80 ml
Adapter for single-use glas vials	24 x 1.5 ml / 7 x 20 ml
Настройване времето за смилане	digital, 00:00:01 to 99:59:59
прекъсната работа	да, с обръщане на посоката
Време на прекъсванията	00:00:01 до 99:59:59
Време за пауза	00:00:01 до 99:59:59
Запаметяване на настройки	12
Програми за съхранение на цикъла	4
Възможност за измерване на вложената енергия	да
Интерфейс	USB, RASPI

Задвижване	Трифазен асинхронен мотор с честотен преобразувател
Мощност на двигателя	2,5 kW
Данни за електрозахранването	200-240 V, 50/60 Hz
Захранване	еднофазово
Защита	IP 20
Енергийна консумация	~ 3335 VA
Размери затворена	745 x 525 x 580 mm
Нетно тегло	~ 118 kg
Стандарти	CE
Патенти	да

в зависимост от захранващият материал и настройките на инструмента

www.retsch.bg/pm300

ДАННИ ПОРЪЧКА

PLANETARY BALL MILL PM 300

(please order grinding jars and balls separately)

20.570.0001		PM 300	with 2 grinding stations, speed ratio 1 : -2

ACCESSORIES PLANETARY BALL MILLS

22.661.0005	Clamping unit for PM 300
03.025.0178	Adapter for stacking grinding jars 50 ml - 80 ml
03.025.0182	Adapter for the use of grinding jars 12 ml and 25 ml (only for PM 300)
03.486.0062	Opening aid for clamping unit of planetary ball mills
99.200.0041	IQ/OQ Documentation for PM 300

PRESSURE AND TEMPERATURE MEASURING SYSTEM GRINDCONTROL FOR PLANETARY BALL MILLS

incl. sensors and transmitter unit, inseert of lid, software, case, opening aid and cleaning accessories for PM (please order grinding jars separately)

22.782.0033	GrindControl for PM grinding jar EasyFit 50 - 125 ml
22.782.0034	GrindControl for PM grinding jar EasyFit 250 - 500 ml

GRINDCONTROL LID INSERTS

03.474.0243	GrindControl lid insert for 50, 80, 125 ml, stainless steel
03.474.0246	GrindControl lid insert for 50, 80, 125 ml, zirconium oxide
03.474.0244	GrindControl lid insert for 250 or 500 ml, stainless steel
03.474.0247	GrindControl lid insert for 250 or 500 ml, zirconium oxide

ACCESSORIES FOR PM GRINDCONTROL WITH GRINDING JARS EASYFIT

05.114.0056		O-ring for 50, 80 or 125 ml
05.114.0054		O-ring for 250 ml - 500 ml grinding jars EasyFit (PM)
03.111.0438		Flat gasket for 50 ml, 80 ml or 125 ml
03.111.0439		Flat gasket for 250 ml - 500 ml
22.186.0007		Sintered filter with O-ring, set of 10 pieces
22.864.0001		Valve set M8x1 for GrindControl and aeration lids

GRINDING JARS EASYFIT

(grinding jars EasyFit are suitable for all planetary ball mills)

HARDENED STAINLESS STEEL		
01.462.0239		12 ml
01.462.0240		25 ml
01.462.0516		50 ml
01.462.0517		80 ml
01.462.0518		125 ml
01.462.0519		250 ml
01.462.0520		500 ml

TUNGSTEN CARBIDE	
01.462.0494	50 ml
01.462.0495	80 ml
01.462.0527	125 ml
01.462.0497	250 ml
01.462.0498	500 ml

AGATE	
01.462.0509	50 ml
01.462.0511	80 ml
01.462.0515	125 ml
01.462.0502	250 ml
01.462.0506	500 ml

SINTERED ALUMINUM OXIDE	
01.462.0507	50 ml
01.462.0512	125 ml
01.462.0499	250 ml
01.462.0503	500 ml

ZIRCONIUM OXIDE	
01.462.0508	50 ml
01.462.0510	80 ml
01.462.0513	125 ml
01.462.0500	250 ml
01.462.0504	500 ml

ADAPTER FOR GLASS VIALS		
01.462.0540		Adapter for 24 x 1.5 ml glass vials, stainless, hardened steel
22.749.0009		Glass vial 1.5 ml incl. septum cap, 100 pieces
05.181.0112		Replacement pressure spring for adapter for 24 x 1.5 ml glass vials, 1 piece
01.462.0541		Adapter for 7 x 20 ml glass vials, stainless, hardened steel
22.749.0010		Glass vial 20 ml incl. septum cap, 100 pieces
05.181.0044		Replacement pressure spring for adapter for 7 x 20 ml glass vials, 1 piece

ACCESSORIES FOR GRINDING JARS EASYFIT FOR WET GRINDING,

GRINDING WITH INERT ATMOSPHERE AND MECHANICAL ALLOYING (MA)

AERATION LIDS (INCL. INLAY)

22.107.0613		for grinding jars EasyFit 50 ml - 125 ml, hardened stainless steel
22.107.0616		for grinding jars EasyFit 50 ml - 125 ml, tungsten carbide
22.107.0617		for grinding jars EasyFit 50 ml - 125 ml, agate
22.107.0615		for grinding jars EasyFit 50 ml - 125 ml, zirconium oxide
22.107.0618		for grinding jars EasyFit 250 ml - 500 ml, hardened stainless steel
22.107.0621		for grinding jars EasyFit 250 ml - 500 ml, tungsten carbide
22.107.0622		for grinding jars EasyFit 250 ml - 500 ml, agate
22.107.0620		for grinding jars EasyFit 250 ml - 500 ml, zirconium oxide
22.107.0619		for grinding jars EasyFit 250 ml - 500 ml, aluminum oxide
22.864.0001		Spare valve set for aeration lids M8x1

INLAY FOR AERATION LID

03.474.0225	for grinding jars EasyFit 50 ml - 125 ml, hardened stainless steel
03.474.0207	for grinding jars EasyFit 50 ml - 125 ml, tungsten carbide
03.474.0208	for grinding jars EasyFit 50 ml - 125 ml, agate
03.474.0206	for grinding jars EasyFit 50 ml - 125 ml, zirconium oxide
03.474.0226	for grinding jars EasyFit 250 ml - 500 ml, hardened stainless steel
03.474.0210	for grinding jars EasyFit 250 ml - 500 ml, tungsten carbide
03.474.0211	for grinding jars EasyFit 250 ml - 500 ml, agate
03.474.0209	for grinding jars EasyFit 250 ml - 500 ml, zirconium oxide
03.474.0215	for grinding jars EasyFit 250 ml - 500 ml, aluminum oxide

AERATION LIDS FOR GRINDING JARS EASYFIT

INCL. O-RINGS AND SINTERED FILTER (PLEASE ORDER LID INSERT AND GRINDING JAR SEPARATELY)

22.107.0636	Aeration lid for grinding jar EasyFit 50 ml - 125 ml
22.107.0637	Aeration lid for grinding jar EasyFit 250 ml - 500 ml

INSERT FOR GRINDING JAR EASYFIT		
03.474.0261		Aeration lid insert for grinding jar EasyFit 50, 80 oder 125 ml, stainless steel
03.474.0262		Aeration lid insert for grinding jar EasyFit 50, 80 oder 125 ml, zirconium oxide
03.474.0263		Aeration lid insert for grinding jar EasyFit 50, 80 oder 125 ml, tungsten carbide
03.474.0268		Aeration lid insert for grinding jar EasyFit 50, 80 oder 125 ml, agate
03.474.0264		Aeration lid insert for grinding jar EasyFit 250 oder 500 ml, stainless steel
03.474.0265		Aeration lid insert for grinding jar EasyFit 250 oder 500 ml, zirconium oxide
03.474.0266		Aeration lid insert for grinding jar EasyFit 250 oder 500 ml, tungsten carbide
03.474.0267		Aeration lid insert for grinding jar EasyFit 250 oder 500 ml, aluminum oxide
03.474.0269		Aeration lid insert for grinding jar EasyFit 250 oder 500 ml, agate
22.186.0007		Sintered filter with O-ring, set of 10 pieces
22.864.0001		Valve set M8x1 for GrindControl and aeration lids

SAFETY CLOSURE DEVICES

22.867.0011	for grinding jars EasyFit 50 ml - 125 ml
22.867.0012	for grinding jars EasyFit 250 ml - 500 ml
02.486.0055	Opening aid for safety closure device

GASKETS FOR GRINDING JARS EASYFIT

O-RINGS		
05.114.0086		O-ring for 12 ml grinding jar EasyFit
05.114.0085		O-ring for 25 ml grinding jar EasyFit
05.114.0054		O-ring for 250 ml - 500 ml grinding jars EasyFit
05.114.0056		O-ring for 50 ml - 125 ml grinding jars EasyFit
05.114.0063		O-ring for 250 ml - 500 ml grinding jars EasyFit, agate
03.111.0438		Flat gasket for 50 ml, 80 ml or 125 ml
03.111.0439		Flat gasket for 250 ml - 500 ml

GRINDING BALLS

HARDENED STEEL

05.368.0029		5 mm Ø
05.368.0030		7 mm Ø
05.368.0059		10 mm Ø
05.368.0032		12 mm Ø
05.368.0108		15 mm Ø
05.368.0033		20 mm Ø
05.368.0057		30 mm Ø

STAINLESS STEEL

22.455.0010		2 mm Ø, 500 g (approx. 110 ml)
22.455.0011		3 mm Ø, 500 g (approx. 120 ml)
22.455.0002		3 mm Ø, 200 pieces (approx. 6 ml)
22.455.0001		4 mm Ø, 200 pieces (approx. 14 ml)
22.455.0003		5 mm Ø, 200 pieces (approx. 25 ml)
05.368.0034		5 mm Ø

05.368.0035		7 mm Ø
05.368.0063		10 mm Ø
05.368.0037		12 mm Ø
05.368.0109		15 mm Ø
05.368.0062		20 mm Ø
05.368.0105		25 mm Ø
05.368.0061		30 mm Ø

TUNGSTEN CARBIDE		
22.455.0006		3 mm Ø, 200 pieces (approx. 6 ml)
22.455.0005		4 mm Ø, 200 pieces (approx. 14 ml)
22.455.0004		5 mm Ø, 200 pieces (approx. 25 ml)
05.368.0038		5 mm Ø
05.368.0039		7 mm Ø
05.368.0071		10 mm Ø
05.368.0041		12 mm Ø
05.368.0110		15 mm Ø

05.368.0070		20 mm Ø
05.368.0069		30 mm Ø

AGATE		
05.368.0024		5 mm Ø
05.368.0025		7 mm Ø
05.368.0067		10 mm Ø
05.368.0027		12 mm Ø
05.368.0111		15 mm Ø
05.368.0028		20 mm Ø
05.368.0065		30 mm Ø

SINTERED ALUMINUM OXIDE		
05.368.0021		10 mm Ø
05.368.0112		15 mm Ø
05.368.0054		20 mm Ø
05.368.0053		30 mm Ø
05.368.0052		40 mm Ø

ZIRCONIUM OXIDE		
32.368.0005		0.1 mm Ø, 0.5 kg (approx. 135 ml)
32.368.0003		0.5 mm Ø, 0.5 kg (approx. 135 ml)
32.368.0004		1 mm Ø, 0.5 kg (approx. 135 ml)
05.368.0089		2 mm Ø, 0.5 kg (approx. 135 ml)
05.368.0090		3 mm Ø, 0.5 kg (approx. 140 ml)
22.455.0007		3 mm Ø, 200 pieces (approx. 6 ml)
22.455.0009		5 mm Ø, 200 pieces (approx. 25 ml)
05.368.0146		7 mm Ø
05.368.0094		10 mm Ø
05.368.0096		12 mm Ø
05.368.0113		15 mm Ø
05.368.0093		20 mm Ø
05.368.0106		25 mm Ø
05.368.0092		30 mm Ø