SUPER-ORION® BALL MILL S.O.

MINERALS & METALS

HOSOKAWA MICRON

HOSOKAWA ALPINE

PROCESS TECHNOLOGIES FOR TOMORROW℠

ALPINE MINERALS & METALS

SUPER-ORION® BALL MILL S.O.

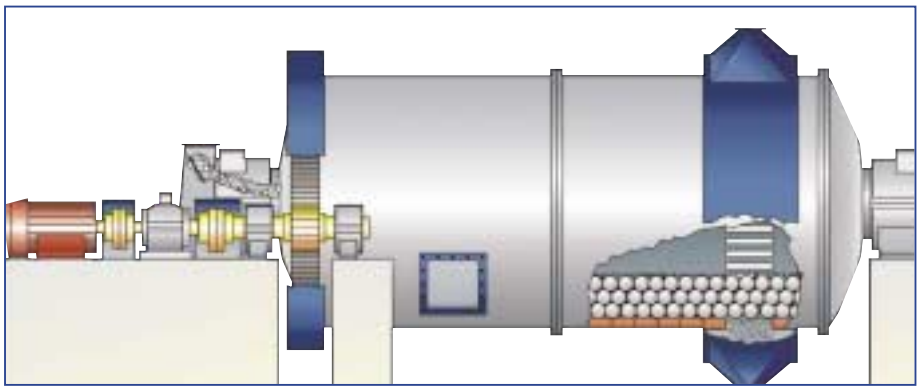
HOSOKAWA MICRON

Super-Orion Ball mills - An established concept with leading-edge refinements.

Ball mills have been the mill of choice for years for manufacturing high-grade mineral powders. These legacy mills are still popular due to their low operating and maintenance costs regardless of whether the material displays Mohs hardness values of over 4 or is soft - such as limestone or barite. Because of hard abrasive constituents limestone or barite cause a high degree of wear with high-speed mills; however, Super-Orion ball mills ensure low-wear and cost-effective processing.

Over the years, we have continuously improved what started as a simple ball mill for the non-metallic mineral sector to a high-tech machine for the mineral powder industry. The original grinding principle and the unparalleled robustness of the machine are two features which have not changed, and today, there are three different standard designs available.

PRINCIPLE OF OPERATION



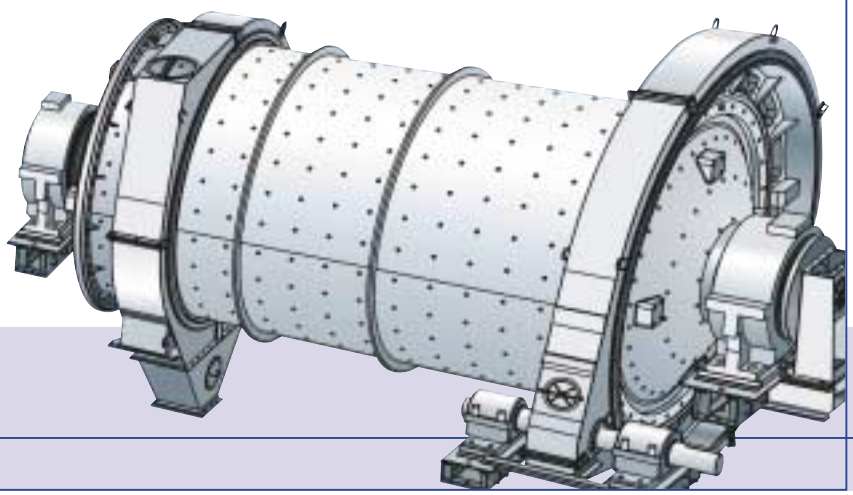
BALL MILL S.O.

This is the classic standard design - a design which has proved itself in operation throughout the world over the years - both the design and efficiency have been continually refined to satisfy the market trend for finer and purer products.

FEATURES

- Cast side plates bolted to a rolled-steel drum with integrated manhole.
- Drive via ring and pinion gear with automatically controlled tooth lubrication, primary gearing with couplings and high-performance gearbox.
- Bearing unit: journal bearing designed as a friction bearing with closed loop oil recirculating lubrication with temperature control.
- Product discharge via adjustable slots located around the periphery of the drum. Two-piece discharge housing with top venting connection with inspection cover.

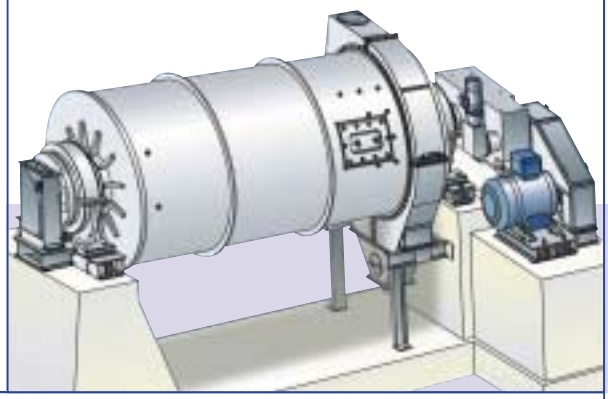
SUPER-ORION S.O. - CLASSIC DESIGN

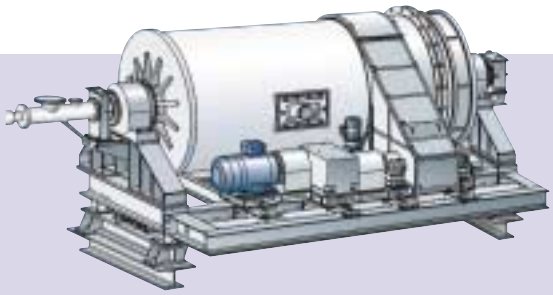


BALL MILL S.O.-CL (COMPACT LINE)

FEATURES

- Completely enclosed welded design in high-grade steel.
- Direct drive via bearing journal with top-mounted gearbox. Motor connected to gearbox via a V-belt drive.
- Product discharge via slots located around the periphery of the drum.





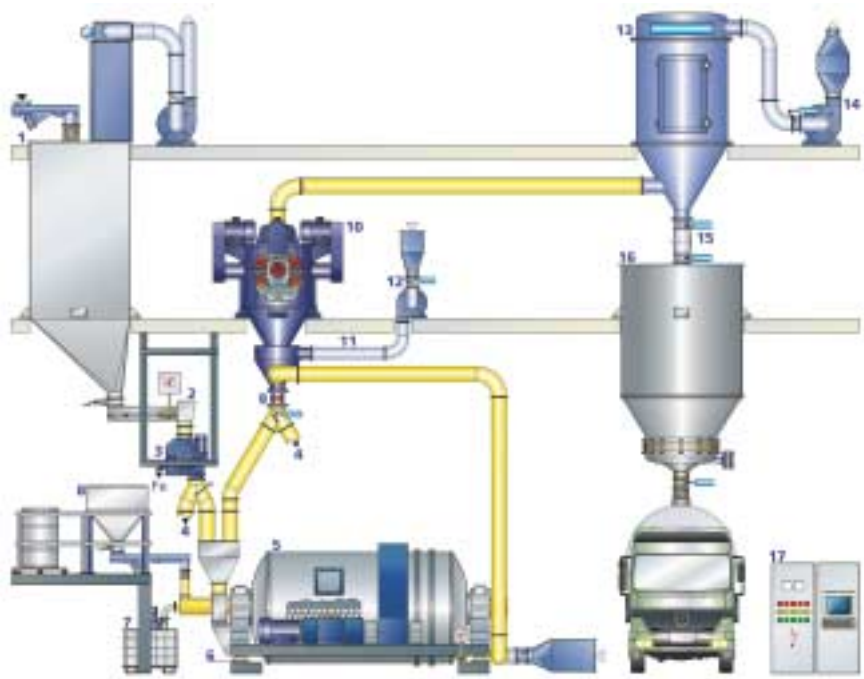
BALL MILL S.O.-SF (SUPER FINE)

FEATURES

- High-tech mill for manufacturing ultrafine fillers.
- Special design as for S.O.-C.L above, albeit with additional features:
- Slotted panel to separate the grinding media and the discharge area from the end product.
- Special-design grinding media.
- High-precision speed control via frequency converter.
- Load cells.

TYPICAL PROCESS FLOW DIAGRAM

1. Feed Silo, Dosing, Dedusting
2. Weigh Belt Feeder
3. Drum Magnetic
4. Sampling Port
5. Ball Mill S.O.
6. Load Cells
7. Grinding Aid
8. Grinding Media Refilling
9. Rotary Valve
10. Ultrafine Classifier ATP
11. Secondary Air
12. Throttle Valve Pneumatic Actuated
13. Automatic Filter
14. Blower
15. Throttle Valve Pneumatic Actuated
16. Fine Product, Double Flap Valve
17. Control Cabinet



ALPINE MINERALS & METALS

BALL MILL S.O. IN STEEL FOR MINERAL FILLERS APPLICATIONS

HOSOKAWA MICRON

The ball mill continues to be the most popular machine when it comes to manufacturing mineral fillers.

FEATURES

- Low maintenance costs.
- Extremely long service life (over 50 years).
- Extremely robust.
- Low specific energy consumption.

An important decision driver for using a ball mill as the principal size reduction machine is its enormous flexibility in the ultrafine range. With the Super-Orion ball mill, fine products such as paper fillers in coating quality (d_{80} = 2 µm) as well as coarse fillers, e.g. dolomite powder for bitumen fillers (d_{97} = 100 µm) can be produced.

Examples of functional mineral fillers:

- Limestone, chalk, marble
- Dolomite
- Kaolin, calcined kaolin, bentonite
- Talc
- Barite

Even ultrafine products are produced directly from the mill/classifier circuit. No additional secondary classification is required. This helps to avoid waste or coarse materials for which there is little market demand.

Our mills for fillers are all plated with high-grade steel which is optimally matched with the low-wear steel grinding media. Selection of the grinding media is a function of the feed material and of the desired end product. State-of-the-art scientific knowledge and calculation methods are applied to the selection of the media type, composition and size. The use of highly wear resistant materials prevents discoloration; a frequent requirement for top-quality fillers used in plastics, paints or paper.

The values in the table below are based on production runs with medium-hard limestone. This information is purely informative. Guaranteed values provided only after trials are conducted with the original feed material. The values refer to mills operated in circuit with suitable classifiers.

VARIANT RANGE (STEEL-PLATED MILL)

■ = available sizes ● = option

Machine size/ design	125/ 125	125/ 160	125/ 200	160/ 160	160/ 200	160/ 270	160/ 330	200/ 270	200/ 330	200/ 400	200/ 470	200/ 530	200/ 600	270/ 300	270/ 400	270/ 500	270/ 600	300/ 600
S.O.	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
S.O.-CL	■	■	■	■	■	■	■	■	■	■	■							
S.O.-SF							■	■	■	■	■							
Slotted panel							●	●	●	●	●	●	●				●	●
Motor [kW]	22	30	37	55	75	90	110	160	200	250	250	315	400	340	450	560	630	900
Throughput [t/h] of limestone d_{70} 2 µm ATP-NG classifier							0.6 500	0.8 315/3	1.0 315/4	1.2 315/6								
Throughput [t/h] of limestone d_{97} 10 µm ATP classifier				0.5 315	0.7 400	0.9 500	1.1 500	1.5 630	1.9 2 x 500	2.3 2 x 500	2.7 500/3	3.0 500/3	3.5 500/4	3.7 500/4	4.9 3 x 630	6.1 630/4	7.4 2 x 500/4	9.8 500/4 630/4
Throughput [t/h] of limestone d_{97} 40 µm ASP classifier				1.8 315	2.3 315	3.1 400	3.8 500	5.4 630	6.6 630	8.0 800	9.4 800	10.6 1000	12 1000	13 1000	17 1250	21 1250	26 1500	33 1500

BALL MILL S.O. FOR THE MANUFACTURE OF CERAMIC RAW MATERIALS

The Super-Orion ball mill has become the standard around the world for processing ceramic raw materials. Combined with a classifier, the ball mill usually forms the heart of the process. In spite of ceramic raw materials having a Mohs hardness of between 5 and 8, i.e. are extremely abrasive; grinding must be performed without iron contamination if the colour integrity of the end product is to be ensured. Because of this, the ball mill is usually lined with silex bricks (see table below for variants). High-grade flintstone is used for the grinding media; an inexpensive solution with respect to the investment costs. For special applications, ball mills are lined with aluminium oxide (see page 6 for the variant range) and operated with Al_2O_3 grinding media. The alu-oxide lining serves to triple the life of the lining. And the wear to the Al_2O_3 grinding media brought about by friction is also lower than with conventional grinding media.

In order to provide the optimal system for the application, costs for maintenance, personnel, etc. have to be considered in detail. Not only is a lined ball mill necessary for grinding without iron contamination, but the classifier must also be suitably protected against wear. As a result, the product-contact components of all suitable classifier models such as Turboplex, Stratoplex, and Ventoplex are protected against wear with ceramic or PU. Particular attention must be paid to the classifying wheel because wear increases with the square of the speed (double the speed = four times the wear). Because of this, classifying wheels in all ceramic construction are employed for the ATP Turboplex classifiers.

The values in the table below are based on production runs with feldspar and silica sand of medium grindability. This information is purely informative. Guaranteed values provided only after trials are conducted with the original feed material. The values refer to mills operated in circuit with suitable classifiers.

VARIANT RANGE: SILEX LINING/
FLINTSTONE GRINDING MEDIA

■ = available sizes ● = option

Machine size/ design	150/ 150	150/ 190	150/ 260	150/ 320	190/ 190	190/ 260	190/ 320	190/ 390	190/ 460	190/ 520	190/ 590	255/ 300	255/ 400	255/ 500	255/ 600	255/ 700
S.O.	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
S.O.-CL	■	■	■	■	■	■	■	■	■	■	■	■	■	■	●	
Slotted panel								●	●	●	●		●	●	●	●
Motor [kW]	22	30	37	45	45	55	75	90	110	132	160	160	200	250	315	355
Throughput [t/h] of feldspar d_{97} 63 µm					1.0	1.3	1.6	2.0	2.4	2.6	3.0	3.2	4.3	5.4	6.5	7.7
ASP classifier					315	315	315	315	315	400	400	400	500	500	630	630
Throughput [t/h] of silica sand d_{97} 40 µm					0.6	0.8	1.0	1.2	1.4	1.6	1.9	2.0	2.6	3.3	4.0	4.7
ASP classifier					315	315	315	315	315	315	315	400	400	500	500	630

ALPINE
MINERALS
& METALS

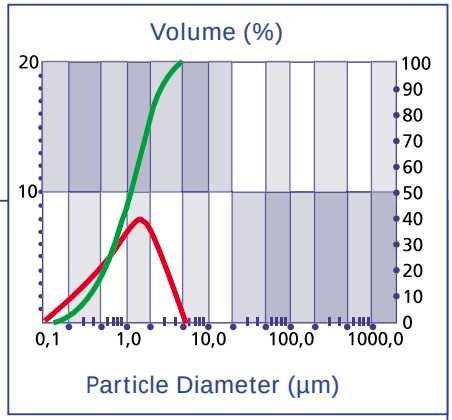
BALL MILL S.O.
FOR TECHNICAL CERAMICS

(AL_2O_3 , ZrO, ZIRCONIUM SILICATE, ETC.)

HOSOKAWA MICRON

ALUMINIUM OXIDE
GRINDING MEDIA

ALUMINIUM OXIDE
CYLPEBS



The values in the table below are based on production runs with zircon sand, aluminium oxide and silica sand of medium grindability. This information is purely informative. Guaranteed values provided only after trials are conducted with the original feed material. The values refer to mills operated in circuit with suitable classifiers.

ALUMINIUM OXIDE LINING
WITH ALUMINIUM OXIDE GRINDING MEDIA

■ = available sizes ● = option

Machine size/ design	**155/ 155**	**155/ 195**	**155/ 265**	**155/ 325**	**195/ 195**	**195/ 265**	**195/ 325**	**195/ 395**	**195/ 465**	**195/ 525**	**195/ 595**	**265/ 300**	**265/ 400**	**265/ 500**	**265/ 600**	**265/ 700**
S.O.	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
S.O.-CL	■	■	■	■	■	■	■	■	■	■	■	■	■	■	●	●
Slotted panel								●	●	●	●		●	●	●	●
Motor [kW]	30	37	45	55	55	75	90	110	132	160	160	200	250	345	355	400
Throughput [t/h] of zircon sand d_{50} 1,2 µm								0.3		0.4	0.4		0.6	0.8	0.9	1.1
ATP classifier								200/4		315/3	315/3		315/3	315/6	315/6	315/6
Throughput [t/h] of aluminium oxide d_{50} 2 µm								0.5		0.7	0.8		1.1	1.4	1.6	2.0
ATP classifier								315/3		315/3	315/6		315/6			3 x 315/3
Throughput [t/h] of silica sand d_{97} 40 µm					0.7	1.0	1.2	1.4	1.7	2.0	2.2	2.4	3.2	4.0	4.8	5.7
ASP classifier					315	315	315	315	315	400	400	400	500	500	630	630

BALL MILL S.O. - STATE-OF-THE-ART CONTROL AND LOAD CELL TECHNOLOGY

Our state-of-the-art PLC unit combined with the optional load cell technology, converts the robust ball mill with its proven grinding system into an extremely flexible high-tech system.

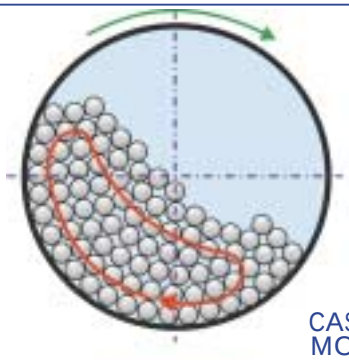
VARIABLE-SPEED DRIVE

Ball mills are usually operated at 75% of the critical speed, i.e. in the fringe area between cascading and free-fall. This is often referred to as the “angle of break”. With a specially designed frequency converter, it is even possible to operate a heavy ball mill at variable speed. And if the S.O.-SF is to be used for grinding ultrafine products or if it is planned to change the product frequently, operation with a frequency converter is particularly advantageous.

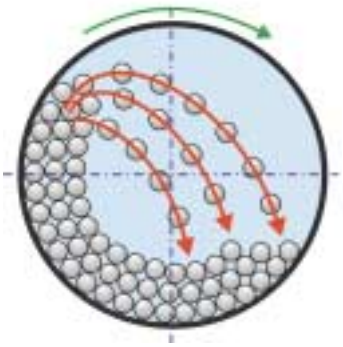
LOAD CELL TECHNOLOGY RESULTS IN PRECISION PRODUCT LEVEL CONTROL

Current-day applications demand exact measurement of the amount of product in the mill for optimum grinding efficiency. Because of this, an optional accessory offered for our ball mills is the load cell system which permits control and precise metering of the feed product via a terminal with a tolerance of ±25 kg. This provides the user with the possibility of entering and monitoring up to 4 limit values entered direct at the weighing terminal or via a bus or serial 4-20 mA TTY interface. The complete ball mill is located on a steel or concrete frame designed to rest on a defined number of load cells. The load cells are integrated into a control unit and determine the total weight of the ball mill with mill, grinding media and product. Subtracting the weight of the mill and grinding media results in the weight of product in the mill. This is managed by state-of-the-art electronics in the kg measuring range.

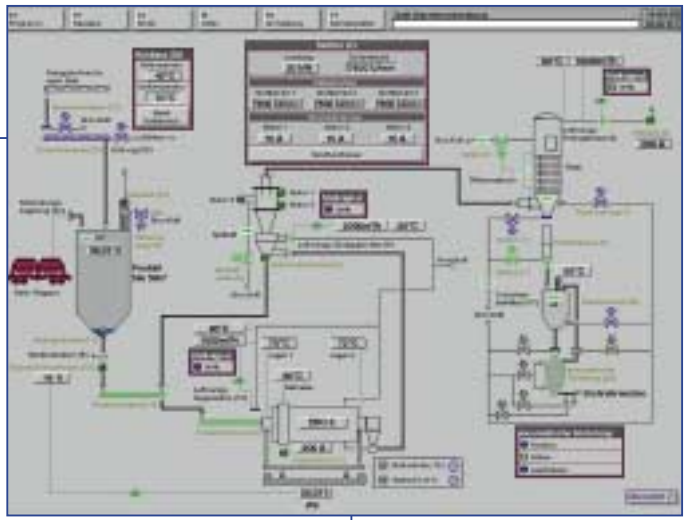
The addition of virgin feed can be controlled with such precision that the mill always operates at optimum load. This means that no-load operation or overfilling is reliably prevented, and the mill operates in an exceedingly cost-effective manner.



CASCADING MOTION



FREE-FALL MOTION



LOAD CELLS

MILL DRIVE

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HOSOKAWA
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Hosokawa Alpine is a member of the Hosokawa Micron Group, responding to global needs through emphasis on materials science and engineering. The Group is an international provider of equipment and technology for powder and particle processing, plastics processing and confectionery products. The Group maintains facilities for research, engineering, manufacturing and service in each of the world's major industrial markets.

Ball Mills 11.03/1e