



# RHP

## High Pressure Roll Mill



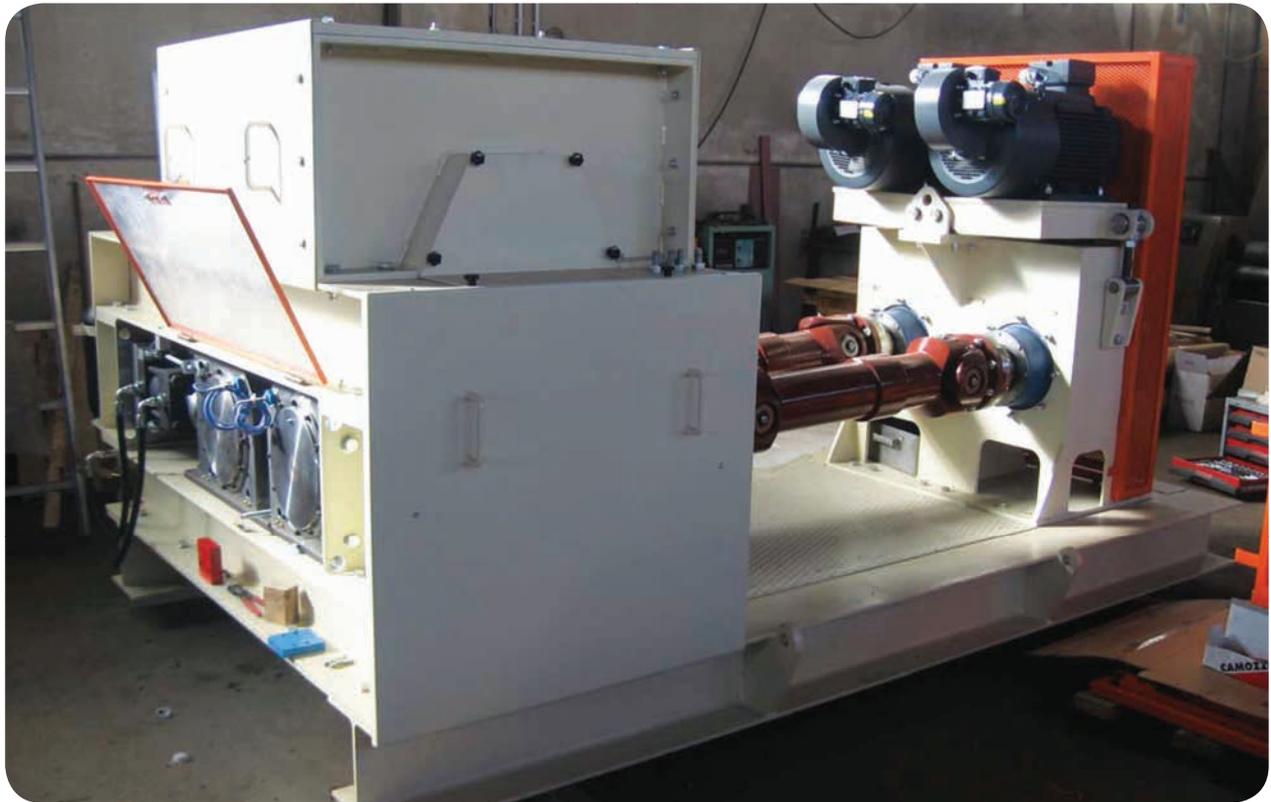
High performance fine milling

Energy efficiency

Flexibility and control

## RHP high pressure roll mill

*The smart way of fine milling*



### Auto-comminution principle

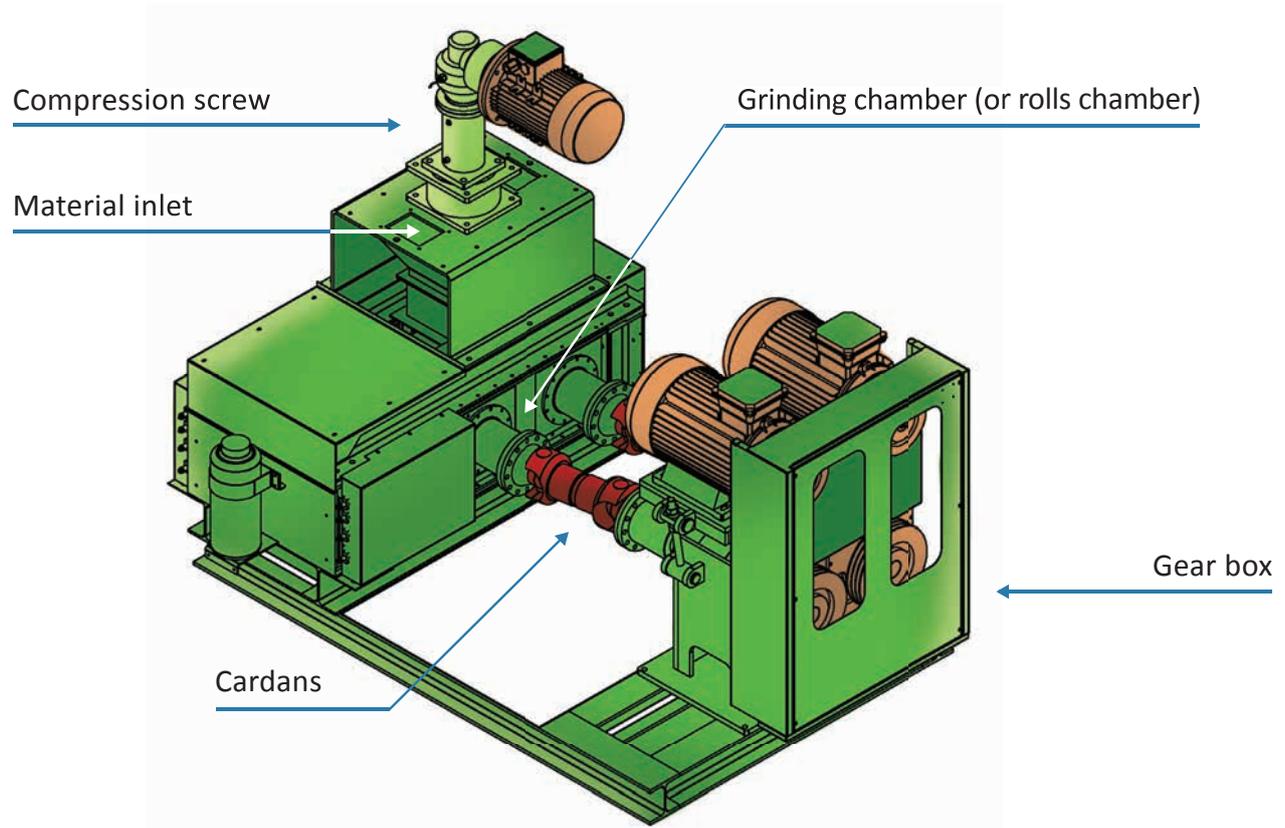
In a traditional tubular mill, grinding is due to the compression and attrition of the mineral to be milled between the balls (or pebbles) and the drum.

RHP high pressure roll mills upsets this principle: the material is forced to pass through two rolls and it's the pressure between the grains which causes the crushing.

The results? A more efficient, lightweight, versatile and reliable machine.

### Advantages

- Reduced energy consumption thanks to the auto-comminution principle and the lightness of the machine.
- Reduced investment and operating costs.
- Minimal retention volumes, allowing very short times in start-up, stop and production changes.
- Product's granulometric curve closed to the desired value.
- Granulometric curve always under control by automatic action on multiple regulation parameters.
- Mixtures feeding.



## Dry milling

### RHP configuration

RHP is a dry milling machine (maximum moisture 1%). Main components are the two grinding rolls and the compression screws.

The screws introduce the material in the grinding chamber, pushing it against the counter-rotating rolls, one in a fixed position and the other one movable. The movable roll is pressed against the fixed one by two hydraulic actuators.

RHP is an high pressure roll mill: unlike a conventional roll mill, the compression of the material against the rolls allows the fine grinding, not a simple lamination.

*“Auto-comminution allows the transformation of about 50% of the supplied energy into useful energy for grinding. In a tubular mill this value is only 20%.”*

Edoardo Melis  
Designer, Minerali Industriali

### A versatile machine: RHP applications

RHP roll mills are adaptable to a wide range of grinding requests. Generally, the machine can be fed with material in size up to 5 mm. In some applications it may be up to 10 mm.

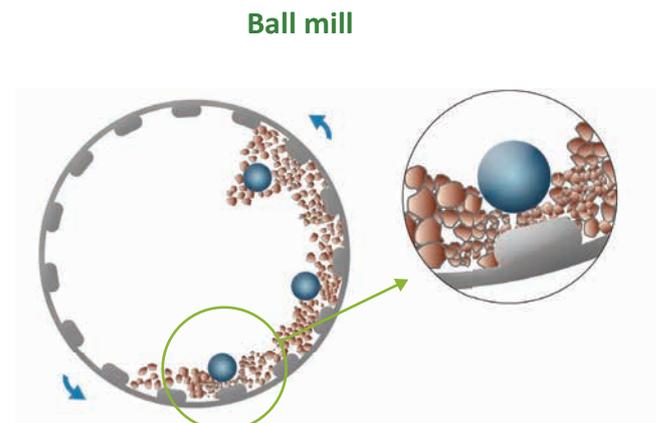
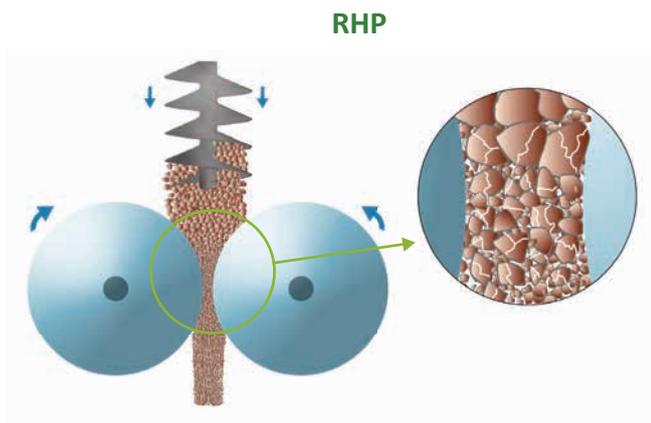
Depending on the settings of the machine and on the associated classification system, it's possible to obtain fine material with d50 greater than or equal to 8  $\mu\text{m}$  and d98 greater than or equal to 30  $\mu\text{m}$ .

RHP roll mills are suitable for granulates and micronized production in the following areas, without prejudice the adaptability of the machine to practically any need of fine grinding:

- hard materials such as quartz, feldspar and granite, up to 9 hardness in the Mohs scale;
- soft materials grinding such as calcium carbonate, dolomite and raw kaolinite;
- scrap or waste recovery in various industrial sectors, as the glass and ceramic one.

RHP roll mills can also be fed with mixtures (kaolin and quartz, feldspar and clay, ecc...).

Large particle size spectrum of the final product: from 0 ÷ 1'000  $\mu\text{m}$  to 0 ÷ 30  $\mu\text{m}$  range



### Auto-comminution principle

In a traditional tubular mill, grinding is carried out for compression and friction of the material between the pebbles (or balls) and the rotating coated drum.

About 20% of the energy used for the rotation of the drum is converted into mechanical energy useful for grinding. The remaining 80% is used in part for transport and lifting of the material, partly dissipated as heat along the path inside the drum: the material coming out from the mills has normally a temperature of about 50 °C more than the entrance.

Instead, in a RHP roll mill the material crushing is mainly due to the grains auto-comminution, forced to pass between two rolls. The material is always involved in the grinding process and the dispersions are minimal, thanks to a very fast passage in the grinding section: about 50% of the energy supplied to the machine is directly useful for the grinding and the temperature increase of the material between input and output is only 10 °C.

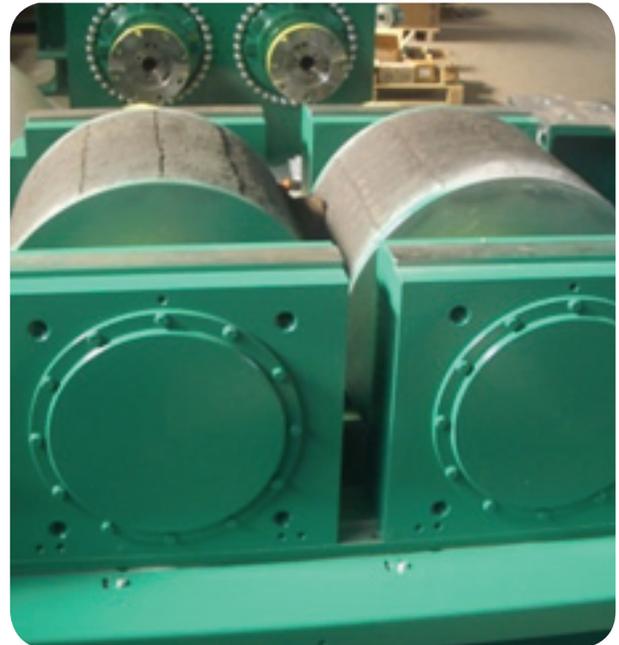


### Drive shaft transmission and torque control

Each roll is driven by a dedicated motor: the coupling engine/roll passes through a planetary gear and a telescopic universal joint. The movable roll is disengaged from the fixed position of the gearbox, and can be pressed on the fixed roll by the hydraulic control unit without alignment problems. Gearboxes are mounted on the same basement, downloading on it identical torques thanks to the current control of the engines via VSD: do not need a torque arm on the machine exterior and vibrations are significantly attenuated.

### Grinding rolls

Milling rolls hardness is ensured by tungsten carbide coating to a thickness of about 5 mm. Jagged rolls surface helps the transmission of the pressure to the material. When coating is consumed, recharging is required on site, consisting in a simple building-up welding. To speed up the maintenance, Minerali Industriali recommends to have two additional rolls, to be used during the previous ones regeneration. Indicatively, it's suggested to check the coating and eventually regenerate it every 2'000 hours. This value is variable depending on the material and the requested grain size. The regeneration process takes about 5 hours per roll for the RHP 64 model.



### Pre-compression screws

Depending on the machine size, RHP roll mills are supplied with one or two pre-compression screws. They are coated with alumina bricks glued to a spiral of wear-resistant steel.

### 5 different sizes to satisfy any production requirement

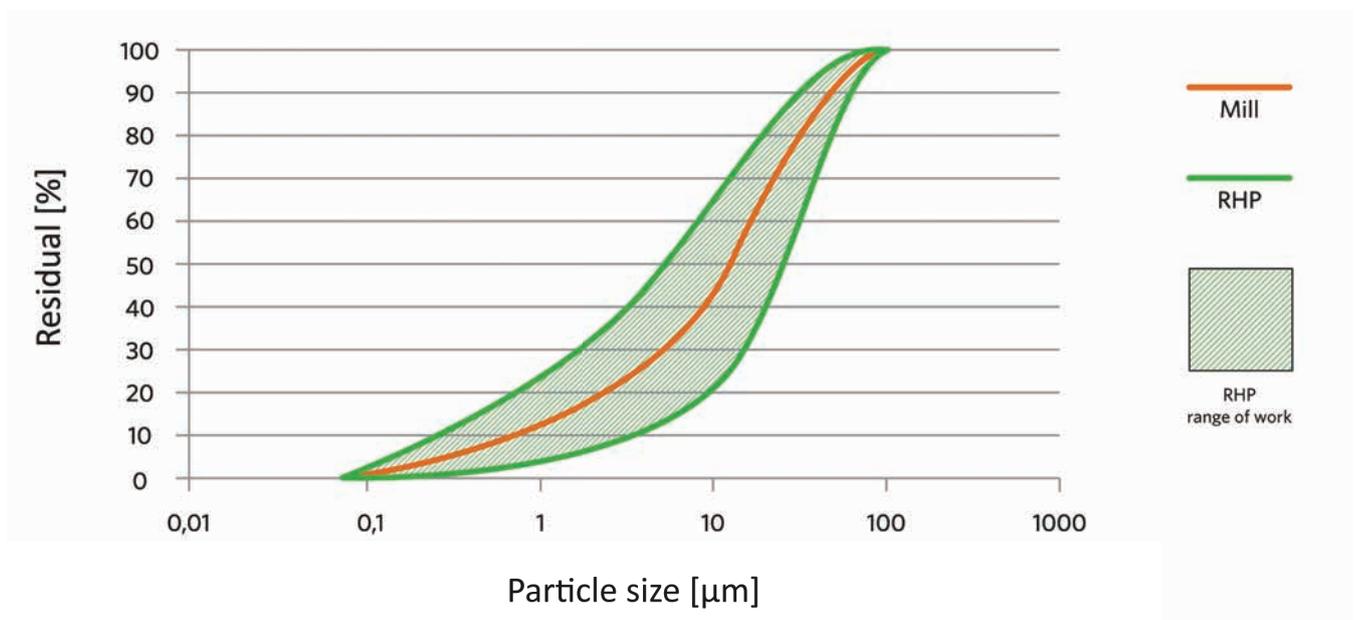
RPH Model	Power [kW]	Production (d98 < 75 μm) [t/h]	Production (d98 < 300 μm) [t/h]	Ø rolls [mm]	Rolls width [mm]	Grinding area [dm <sup>2</sup> ]	Dimensions LxWxH [mm]	Weight [kg]
RHP 16	8	0,4	1	160	135	2,2	1'200x750x1'200	950
RHP 24	22	1	2,5	240	200	4,8	1'850x1'100x1'800	1'950
RHP 35	45	2	5	350	250	8,8	2'800x1'550x2'100	4'500
RHP 46	90	4	10	460	405	18,6	3'850x2'000x2'500	7'500
RHP 64	180	8	20	640	635	40,6	4'200x2'400x2'900	10'500

### Complete regulation of the machine for particle size curves always under control

Traditional mill is a heavy machine with a few parameters to adjust.

With the RHP roll mills the grinding process is always under control: there are a lot of parameters to adjust like the rolls distance and speed, the torque transmitted to them, the compression generated by the screws, etc... .

This feature allows a greater control of the granulometric curve, improving the particle size distribution for next processes and regulating the fine percentage.



### Coating and grinding media costs recovery

Thanks to the lower surface to be coated and the grinding media absence (balls or pebbles), maintenance and “hard” parts replacement costs are greatly reduced compared to a classic tubular mill (typically less than 45%).

### Smaller sizes, lightweight, low noise and vibration

Compared to a tubular mill, RHP roll mills are less bulky and much lighter. Foundations and support structures are strongly simplified, thanks to the lightness of the machine and by less vibrations produced. The noise level is considerably lower than a traditional mill one.

### Reliability

Over the years all the Minerali Industriali’s mills were successfully replaced by 20 high-pressure roll mills, for a total of over 1 million hours of activity and over 6 million tons produced. Approximately 10 machines were sold to external customers up to December 2012. Minerali Industriali’s customers are very satisfied using RHP roll mills.

### Fast transitions

RHP roll mills are flexible machines. The retention volume in the system is very low, ensuring a very short time of start, stop and production change: from 5 minutes up to 15 minutes depending on the particle size and on circulating load in the system (for example, for  $d_{50} = 50 \mu\text{m}$  the circulating load is about 2 times the fed, for  $d_{50} = 10 \mu\text{m}$  the circulating load is almost 6 times).



### Reduced energy consumption

At equal production rates, using auto-comminution principle and having much lighter moving parts, RHP roll mills have a power consumption from 30% to 50% lower compared to a traditional mill.

**Case of study: comparison between a RHP 64 and a tubular mill installed in the same plant  
(Sasil S.p.A., Brusnengo - BI - ITALY)\***

			Tubular mill	RHP 64	Differences [%]
Basic data	Dimensions	[mm]	Ø 2'600; L = 5'700	Ø 640; L = 635	
	Used power	[kW]	205	130	-37%
	Production rate	[t/h]	6,4	7	+9,4%
	Specific grinding energy	[kWh/t]	32	18,5	-42%
	Classification installed power	[kW]	30	30	
	Grinding media consumption (alumina balls)	[kg/t]	0,7	0	
	Total specific energy (grinding + classification)	[kWh/t]	36,7	22,8	-38%
Production costs per ton**	Manpower (1 person, 25 €/h)		3,90	3,57	-8%
	Electrical energy for grinding only (0,17 €/kWh)		5,44	3,15	-42%
	Total electrical energy (grinding + classification) (0,17 €/kWh)	[€/t]	6,24	3,88	-38%
	Coating consumption		0,23	0,64	
	Grinding media consumption (alumina sphere at 1,35 €/kg)		0,95	0	-46%
	Total production cost		11,32	8,09	-29%
Main data	Annual production	[t]	30'000	30'000	
	Total production cost**	[€]	340'000	243'000	-29%
	ANNUAL TOTAL SAVING**	[€]	~97'000		

\* Data referred to the treatment of silica sand.

\*\* Costs based on italian rates.

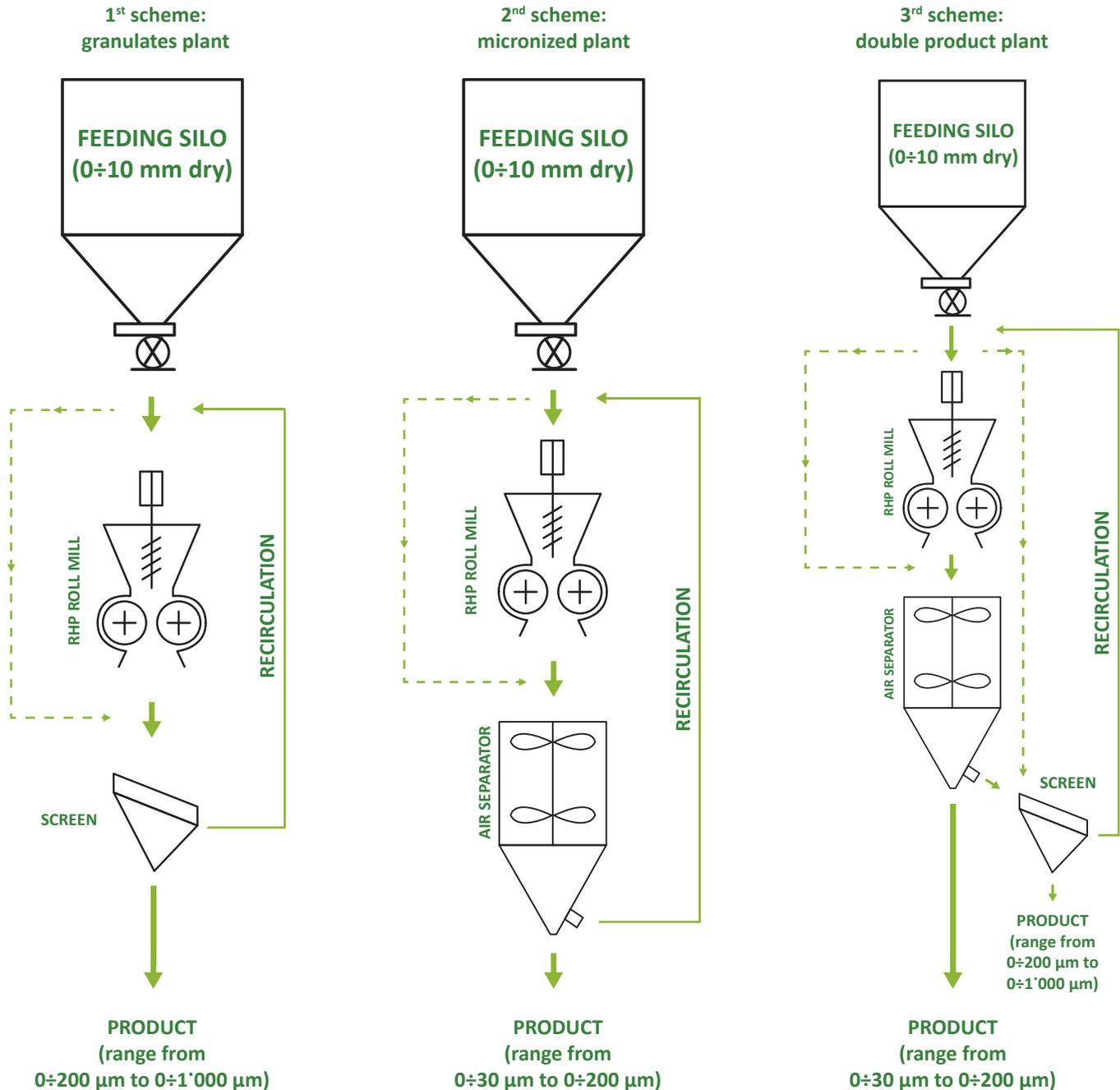
NOTE: according to the local law, it is possible to have an energy saving contribution.

**Plant scheme**

Similarly to the tubular mill plants, RHP roll mills are associated with an adequate classification system, which recirculates the thick part and provides the automatic stock of the fine part in silos:

- sieve systems for granulated products
- air classifier for micronized products

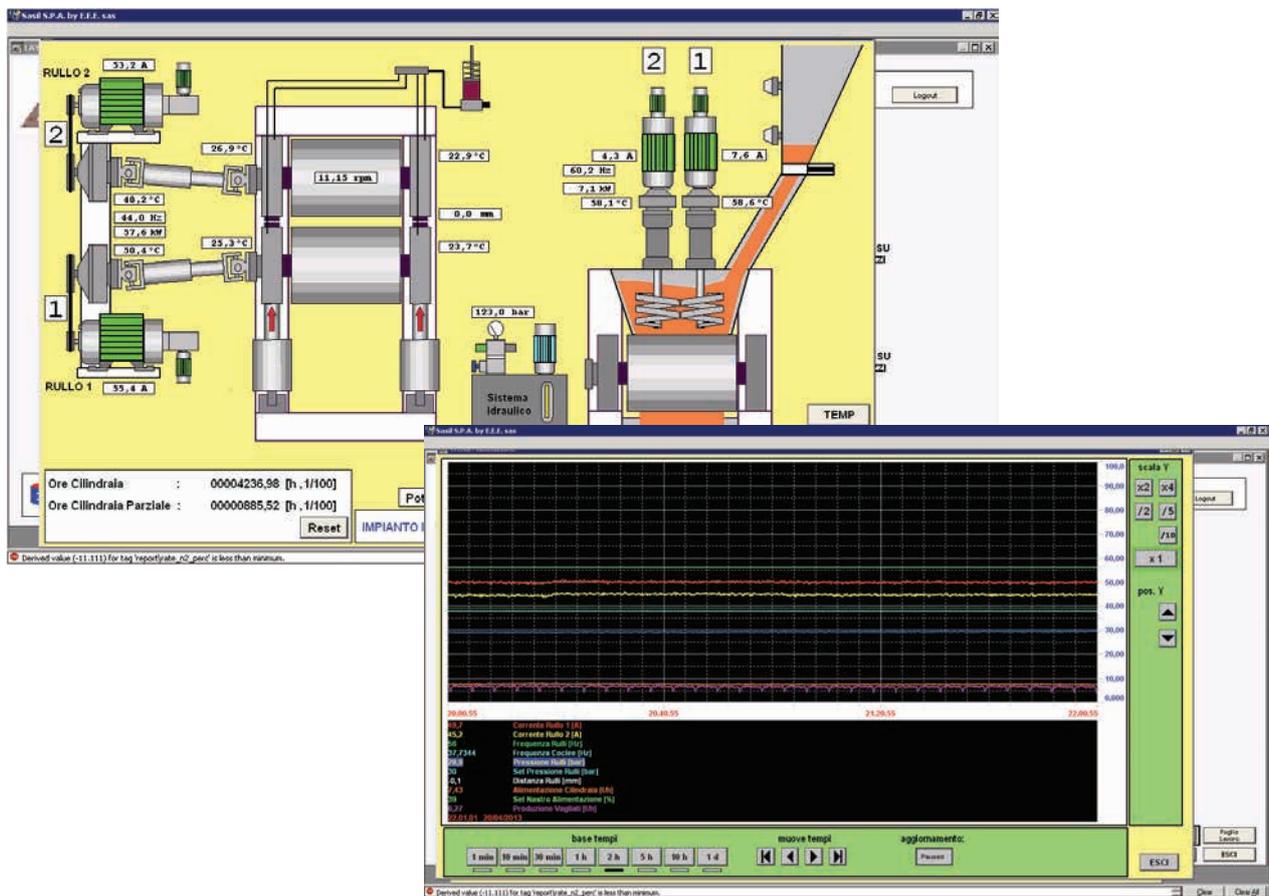
as the schemes below:



-----> : indirect feeding, suggested in case of an high percentage of fine particles in the raw material or if it is necessary to reduce fine production.

### Automation and adaptive material flow control

RHP roll mills are equipped with a dedicated software for monitoring, recording and real time data processing. The production is constantly monitored and optimized in function of the material flow (adaptive control) without need of adjustment by the operator. Drive shafts are equipped with strain gauge sensors to prevent system resonance, especially during the finer grinding. The machine can be remotely controlled and monitored (via ethernet, modbus, internet, etc...). Remote assistance is available on request.



### Patented technology

### Emissions trading

According to the local law, the substitution of a traditional mill with a RHP high pressure roll mill may permit the access to the emissions trading market.

### Industrial trials

Minerali Industriali's plants are available to customers visits and for industrial trials: it's possible to send a sample and get back analysis and a milled big bag or follow personally the trial in one of our worldwide plants. In this way the future user of the machine will be able to deliver to its customers (or for its own next treatments) an industrial sample of the material that will be produced by the RHP roll mill.

### Turnkey solutions

Minerali Industriali offers its multi-year experience in the mining sector providing a complete support for the whole grinding plant, starting from the raw material up to the final product: consulting, design, assistance, installation and commissioning of the plant, personnel training.

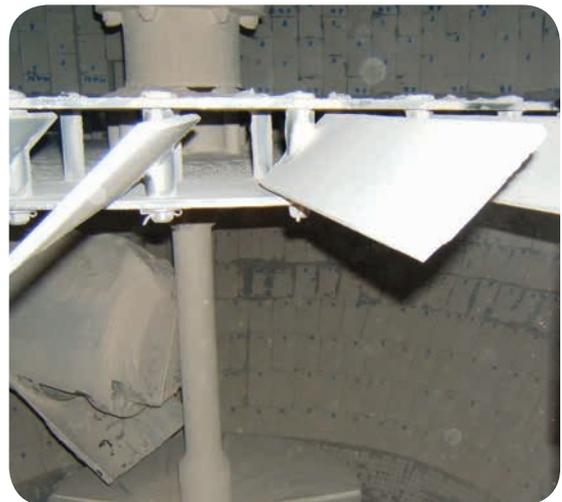
### Structures and storage



### Dust filtration



### Classification systems



Sieves and air separator provided by partner companies and modified by Minerali Industriali basing on its experience.

### Final product control

For particularly sophisticated applications it's possible to install an automatic magnetic sorter to remove metallic pollutants produced by the plant.



### Safety

Minerali Industriali's machines are designed and realized according to the best available standards, ensuring the highest degree of safety for the operators. All machines are CE certified.

### Laboratory tests

Minerali Industriali, as raw materials manufacturer for glass and ceramic industry, makes available its laboratories and experimental equipments for analysis and industrial simulations.

### Industrial trials

Minerali Industriali's plants are available to the customers for industrial trials.

### Efficiency warranty

Minerali Industriali equipment performances depend on the material to be treated. Based on the outcome of the industrial trial, Minerali Industriali declares and warrants the machine's production rate.

### Refunded trials

Minerali industriali asks to the interested customers to cover only the execution tests cost in its laboratories or plants. In case of machine purchase, this amount will be entirely refunded.

### Turnkey solutions

Minerali Industriali offer involves design, installation assistance, start-up and personnel training.

### Customer care

Minerali Industriali technical office is available for spare parts supply and for any assistance the customer may need.

### Payments facilities

Minerali Industriali collaborates with the leading credit institutions and it is available to study financial dedicated solutions with the customer.



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[youtube.com/mineraliindustriali](https://youtube.com/mineraliindustriali)