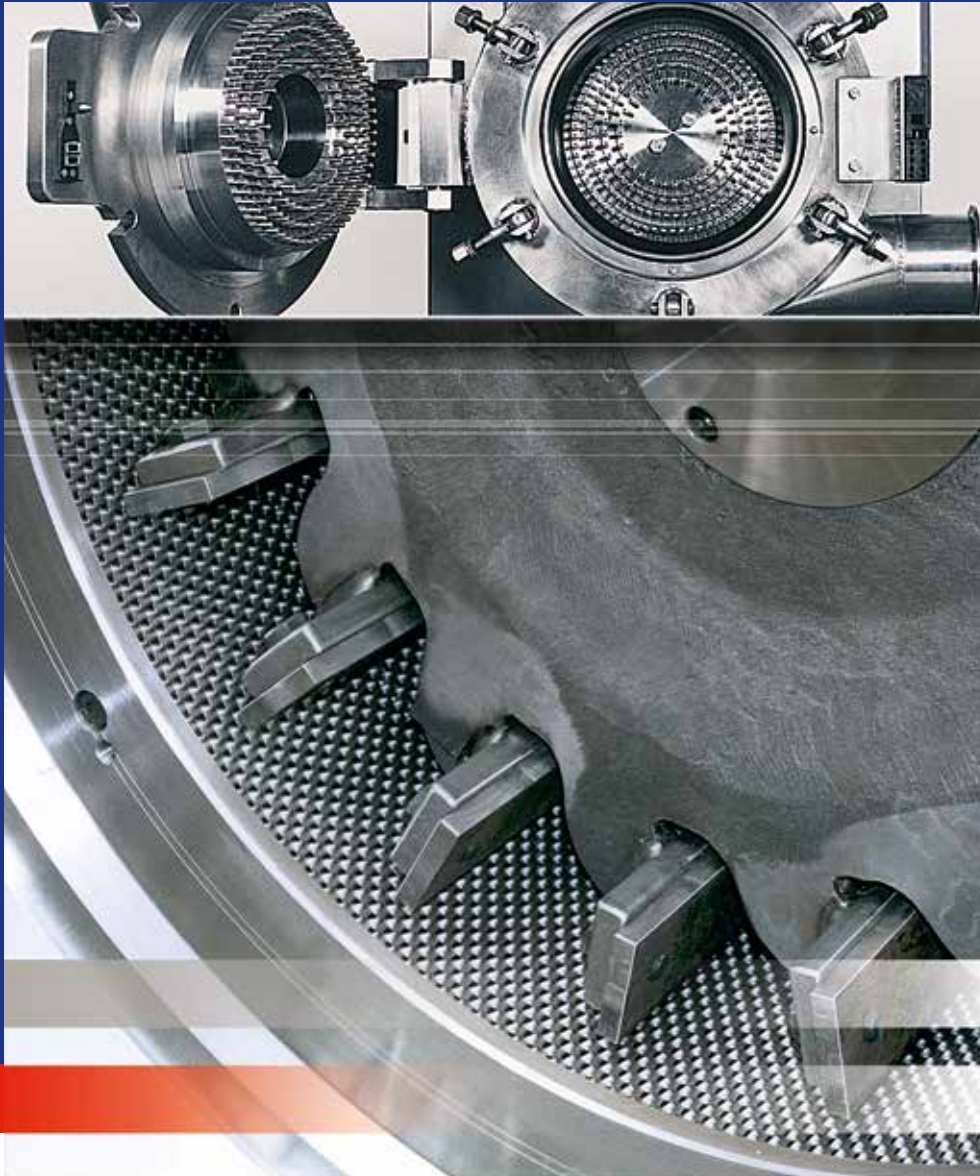


ULTRAPLEX® FINE IMPACT MILLS

TYPES 100 UPZ – 1400 UPZ



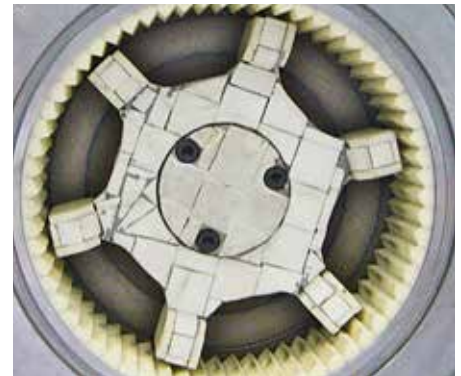
HOSOKAWA ALPINE

PROCESS TECHNOLOGIES FOR TOMORROWSM



Whether for the laboratory or for high throughput rates, the 100 – 1400 UPZ product line is suitable for any task.

WEAR PROTECTION
ALUMINIUM OXIDE



PRINCIPLE OF OPERATION

Alpine Ultraplex UPZ fine impact mills offer versatility in use combined with simplicity in operation. Because of the wide variety of feed materials, where every comminution task demands its own tailor-made solution, the UPZ mills can be equipped with a variety of easily interchangeable milling elements. Tough-fibrous roots and spices, for example, require completely different milling elements to granulated sugar in order to optimally fulfil the individual requirements, both technical and commercial.

The possibilities range from equipping the UPZ mills as a pin mill without sieve with one rotating and one stationary pin disc. Or as a beater mill with beater disc, swing or plate beater unit for operation with milling tracks or sieves.

The overall result is a host of practice-oriented and perfectly coordinated equipment combinations. In short, the UPZ mill can be tailored to match every customer's individual requirements.

FEATURES

UPZ fine impact mills can be equipped with a host of different milling elements, thus fulfilling a great variety of demands on the end product, for example:

- High fineness with sharp top cut
- Production of end products that are low in fines with good flow properties
- Production of powders with a high bulk density
- Production of powders with a high mass fraction within a defined particle size range



1400 UPZ WITH PIN DISC UNIT



**100 UPZ
CRYOGENIC MILLING
SYSTEM**

VERSATILITY

The interchangeability of the milling elements is becoming increasingly important for the user. The UPZ offers the right milling element for every job:



UPZ BEATER DISC UNIT

- Beater cams made of wearproof cast steel
- Rotating milling ring on housing side, stationary milling ring on door side
- Suitable for milling compact, coarse lumps of material in one step to medium fineness



UPZ SWING BEATER UNIT

- Heavy-duty beaters made of wearproof cast metal
- To order, also available with hardfacing
- Universal in operation for coarse feed material
- For medium end-product fineness values

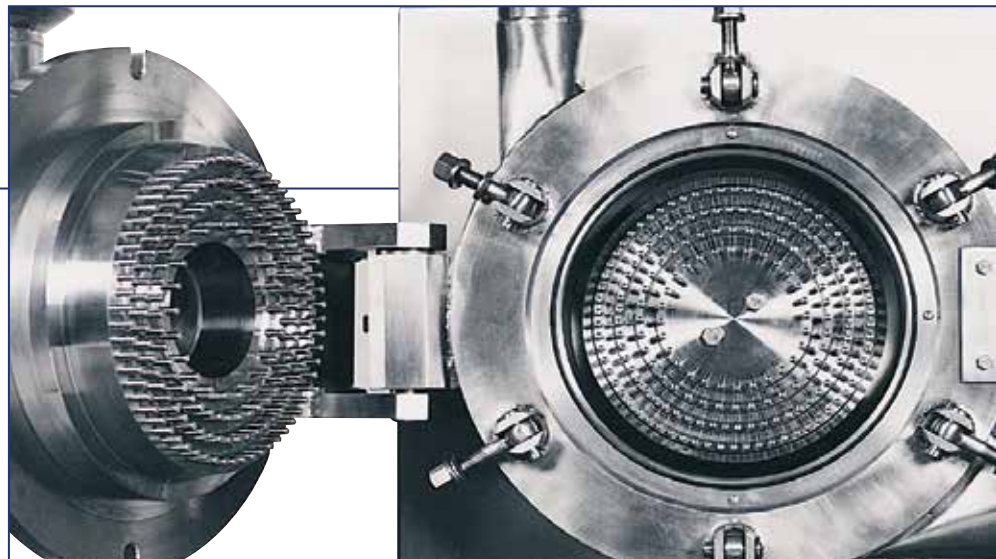


UPZ PLATE BEATER UNIT

- Powerful, wear-resistant beater plates
- High air flow for cool milling of heat-sensitive and greasy materials
- Achieves extremely high powder fineness values; comparable with the pin mill

UPZ PIN DISC UNIT

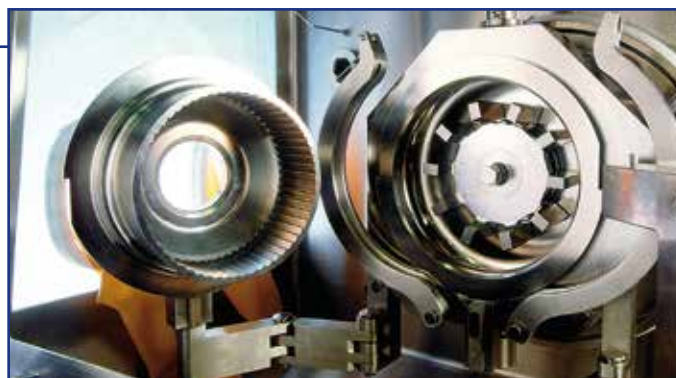
- Pin mill with one rotating and one stationary pin disc
- Suitable for materials up to a Mohs' hardness of 3, max. 0.1% permissible fraction of abrasive components
- Extremely high end-product fineness values
- Low energy consumption



**250 UPZ WITH
PIN DISC UNIT**

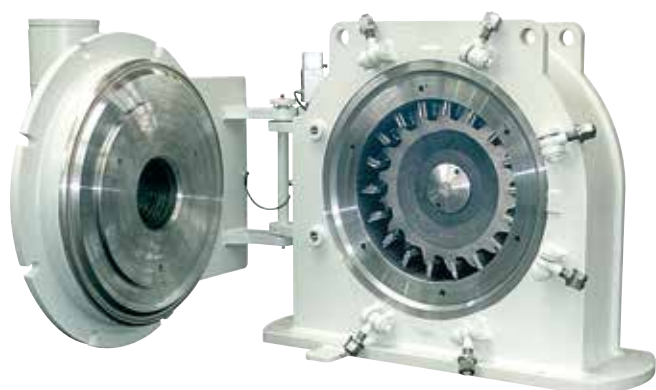


160 UPZ FINE IMPACT MILL IN MIRROR FINISH



315 UPZ FINE IMPACT MILL INTEGRATED INTO AN ISOLATOR

800 UPZ FINE IMPACT MILL WITH PLATE BEATER UNIT AND SIEVE GRATE PRESSURE-SHOCK-PROOF TO 10 BAR (g)

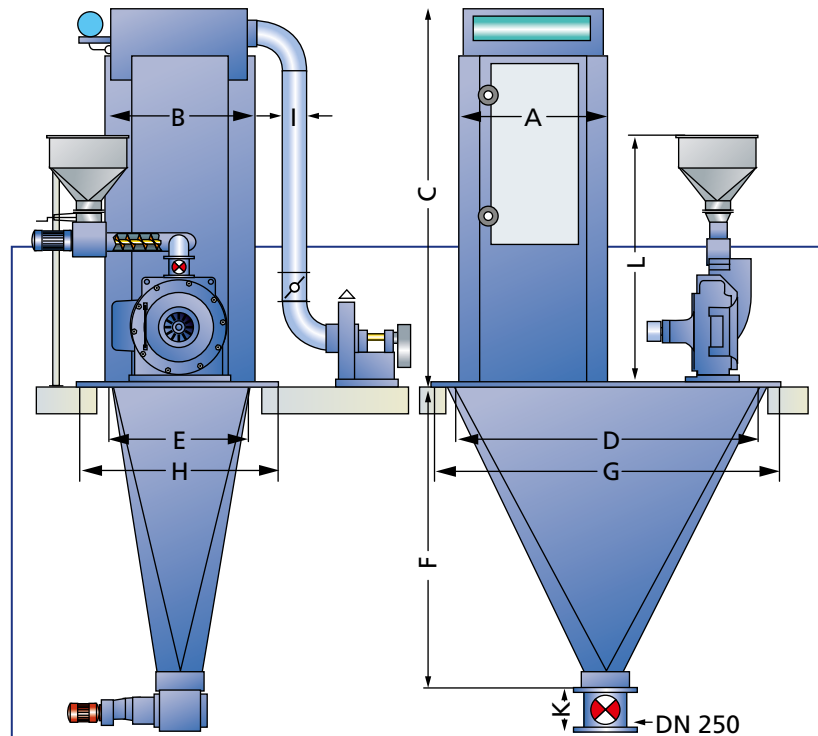
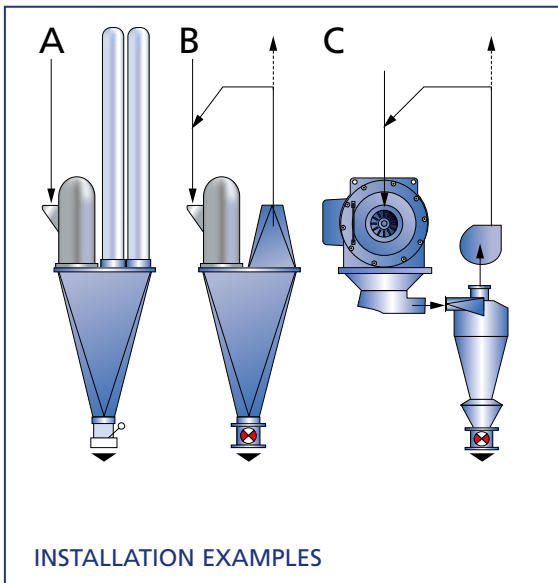


DESIGNS

- Cast housing with standard discharge available up to machine size 1000
- Welded housing with either standard or tangential discharge in mild steel or stainless steel (e.g. 1.4541, 1.4571, 1.4404) for all machine sizes
- Explosion-pressure-shock-proof design for a maximum explosion overpressure of 10 bar (g) with type test certificate as defined in the ATEX Directive 94/9/EC
- Application-specific pharma designs, i.e. polished, monobloc, SIP/ CIP, isolator integration
- Connection flange order-specific
- Bearing unit protected against dust by rinsing air (automatic air intake or forced rinsing)
- Bearing unit with special sealing rings, gas-tight design also possible
- Bearing unit permanently lubricated or designed for relubrication
- Safety interlock
- Optional wear-protection elements
- Milling track ejector optional

Product line	Type	100	160	250	315	500	630	800	1000	1250	1400
Fine impact mill UPZ											
Scale-up factor	F = approx.	0.06	0.25	0.5	1	2	3.6	4.5	6.3	9	14
Max. air flow rate	m ³ /h	-	-	870	1600	3200	5700	7500	10000	12500	14000
Plate beaters	< 120 m/s										
Speed	rpm	18000	14000	8300	7100	4600	3480	2850	2380	1860	1490
Drive	kW	1.5	5.5	11	18.5	37	75	90	110	250	315
Pin disc	< 150 m/s										
Speed	rpm	22000	18000	11000	9000	5910	4920	3400	2900	2700	2200
Drive	kW	1.5	5.5	11	18.5	37	75	90	110	250	355
Beater disc	< 85 m/s										
Speed	rpm	18000	7600	6300	5000	3100	2445	2000	1475	1320	1100
Drive	kW	1.5	5.5	7.5	11	22	37	45	55	90	160
Swing beaters	< 85 m/s										
Speed	rpm	-	7600	6300	5000	3310	2445	2000	1475	1320	-
Drive	kW	-	5.5	7.5	11	22	37	45	55	90	-
Fan beaters	< 120 m/s										
Speed	rpm	-	-	8550	-	4600	-	-	2380	1860	-
Drive	kW	-	-	11	-	37	-	-	110	250	-

STANDARD MILLING SYSTEMS



Schematic A: the system is dedusted using filter hoses which need to be cleaned from time to time by manual shaking. Only suitable provided that the air flow rate of the machine is low (types 160 to 500 UPZ) and the dust is harmless.

Schematic B + C: circuit-air operation. Only a small amount of leakage air is dedusted (not suitable for heat-sensitive materials). Advantage: favourable innovation costs for the system accessories.

Fine impact mill UPZ with filter ¹⁾ AE		Type	160		315			500				630			
		Type	6 M	4 S	20 L	12 L	9 M	36 L	25 L	16 L	12 L	42 EL	36 L	25 L	20 L
Machine with:															
Plate beater unit			•	-	•	-	-	•	-	-	-	•	-	-	-
Swing beater unit			+	•	+	•	-	+	•	-	-	+	•	-	-
Pin disc			+	•	+	•	-	+	+	•	-	+	-	•	-
Beater disc			n. a.		+	+	•	+	+	+	•	+	-	+	•
Exhaust fan	approx.	kW	0.75	0.75	2.2	1.1	1.1	4	3	2.2	2.2	7.5	4	3	2.2
Standard filter ¹⁾	A	mm	580	500	920	750	580	1100	920	750	750	1100	1100	920	920
(position of door to order)	B	mm	400	400	750	580	580	1100	920	750	580	1300	1100	920	750
	C	mm	2150	1545	2990	2990	2150	2990	2990	2990	2990	3610	3610	2990	2990
Hopper	D	mm	1450	1450	2000	1500	1450	2000	2000	1800	1800	2600	2250	2000	2000
	E	mm	620	610	800	610	610	1150	950	800	610	1350	1150	950	880
	F	mm	1400	1400	2000	1500	1400	2000	2000	1850	1850	2850	2200	2000	2000
Installation plate	G	mm	1750	1750	2300	1800	1750	2300	2300	2100	2100	2900	2550	2550	2550
	H	mm	1000	1000	1500	1200	1000	1500	1500	1200	1200	2300	1850	1850	1850
Clean gas line Ø	I	mm	100	100	160	125	100	224	180	160	160	315	224	180	160
Discharge unit															
Rotary slide valve	K	mm	250												
Rotary valve	K	mm	300		400			400				400			
Feed unit															
Channel	L	mm	1010		1480			2100				2400			
Screw	L	mm	1000		1280			1700				2050			

¹⁾ Standard filter: the beater unit dictates the air flow rate of the machine and thus the necessary filter size. The layout of standard milling systems applies for standard milling applications.

- = Requisite filter size for operation
- + = Filter also suitable for operation
- = Filter not suitable for operation

Machine sizes 800, 1000, 1250, 1400 UPZ:

The layout of the milling system including the machine accessories is project-specific for these models.



UPZ fine impact mills are technically mature, reliable and universal in use.

APPLICATIONS

UPZ fine impact mills are universal in operation for the size reduction of soft materials up to 3 on the Mohs scale. The product is fed centrally via the mill door. The machine housing is designed to accommodate all the different milling elements. The fineness is adjusted by selection of the corresponding size reduction elements and as a function of the machine speed; the belt pulley needs to be exchanged in the case of the larger machine sizes. Smaller machines are often driven using frequency converters. The UPZ is used in many branches of industry for a great variety of different applications. Most applications are to be found in the chemicals industry, foodstuffs and animal feed industry as well as in the pharmaceuticals industry. The mill door can be hinged open wide to provided optimum access for cleaning.

APPLICATION OVERVIEW

Alpine UPZ fine impact mills can be employed for a multitude of different products and applications – even under extreme conditions. Typical application areas and materials are:

CHEMICALS INDUSTRY

Fertilisers, pesticides, paints and pigments; general chemicals such as solid acids, salts, silicates, wax, resins, carbon black, stearates, sulphates, phosphates, etc.

PHARMACEUTICALS INDUSTRY

Besides antibiotics, especially suitable for natural products such as herbal teas, roots, senna pods, hibiscus, sage, rose hips, raspberry and blackberry leaves, camomile, etc.

HERBS AND SPICES INDUSTRY

Savoury, rosemary, celandine, saffron, celery, onions, pepperwort, parsley, turmeric, etc.

FOOD AND CONFECTIONERY INDUSTRY

Bakery product rejects, oat flakes, potato flakes, casein, baby food, skimmed milk powder, cake mix flours, dried fruits, pasta rejects, mushrooms, sugar, starch, gelatine and pectin, flavouring agents, food colourings, etc.

ANIMAL FEED INDUSTRY

Soy flour, freeze-dried meat, corn cobs, pea pods, pea fibre, extruded cereal such as barley, rye and wheat, draff, pomace and marc, molasses, clay, pulp and sugar beet parings, etc.

MINERAL POWDER INDUSTRY

Gypsum, limestone, kieselguhr, expanded perlite, etc.

PLASTICS INDUSTRY

Fine milling of polyamides, PVC, PTFE, PE, etc. under normal temperatures or in cryogenic mode.



1000 UPZ WITH BEATER DISC UNIT AND MILLING RING



160 UPZ IN MONOBLOCK DESIGN WITH BEATER DISC UNIT AND SIEVE BASKET

CRYOGENIC MILLING



CRYOGENIC MILLING SYSTEMS

Some materials are not easy to grind because they are tough and elastic. Amongst these are thermoplastics, elastomers, waxes, paint additives and even some metals. Over and above this, the risk of oxidation and even dust explosion is always present.

Cryogenic milling eliminates these problems. The feed material is cooled down to the glass transition temperature with supercooled liquid nitrogen or carbon dioxide and is thus embrittled. This is necessary because of the elastic-viscous characteristic of some products. The requisite amount of energy needed to reach the point of fracture is of prime importance. If the requisite stress at break of a brittle material is above that of an elastic material, the amount of comminution energy needed is nevertheless much lower. In practice, this means that if elastic materials are embrittled using supercooled liquid nitrogen LN₂ or dry ice

(CO₂), impact mills can achieve throughputs that are two to three times higher than normal as well as high particle fineness values.

Cryogenic milling makes it possible to execute processes at high stressing speeds and short stressing cycles.

The product and the system are either cooled by direct injection of the cooling agent into the mill or, if longer residence times or lower temperatures are necessary, by means of pre-cooling and material embrittlement using a screw cooler.

Enthalpy	CO ₂	330 kJ/kg (-20°C)
Enthalpy	LN ₂	363 kJ/kg (-20°C)

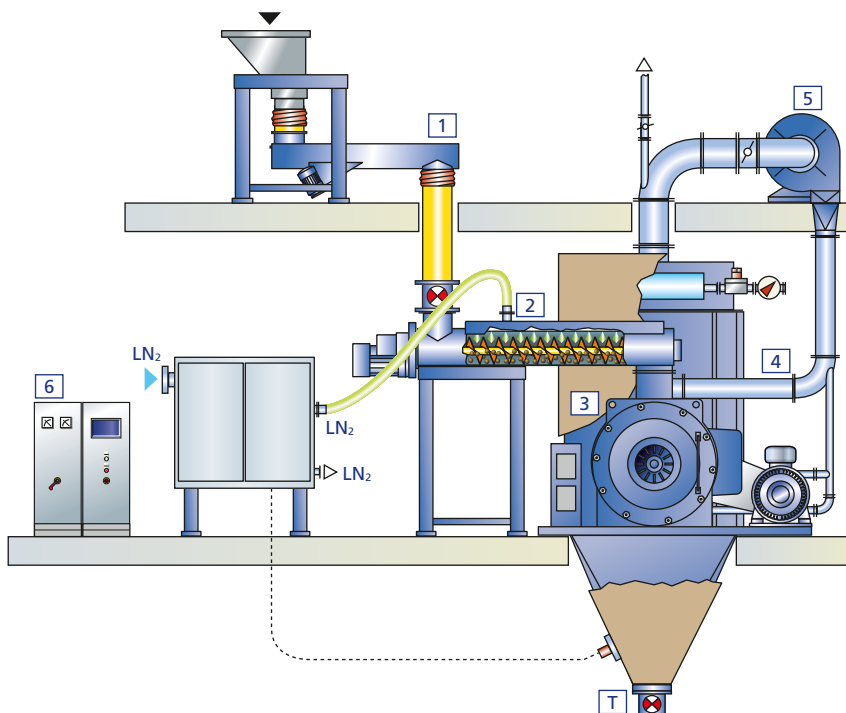
With cryogenic milling, it is possible to comminute plastics and rubber granules, etc. to fine, free-flowing powders.

Typical materials are: polyamide, hotmelt adhesives, PVC, polyester, caoutchouc and rubber, etc.

In the foodstuffs industry, cryogenic milling is used above all to grind spices. It is possible with cryogenic milling to improve the aroma by reducing the loss of essential oils (approx. 3 to 10% loss) in comparison to milling at ambient temperature (approx. 15 to 43% loss). Over and above this, the level of milling performance is twice as high.

Not only spices, but also other materials with extremely low melting points, i.e. mixes containing fat such as baking aids, etc. are ground cryogenically with Alpine systems.

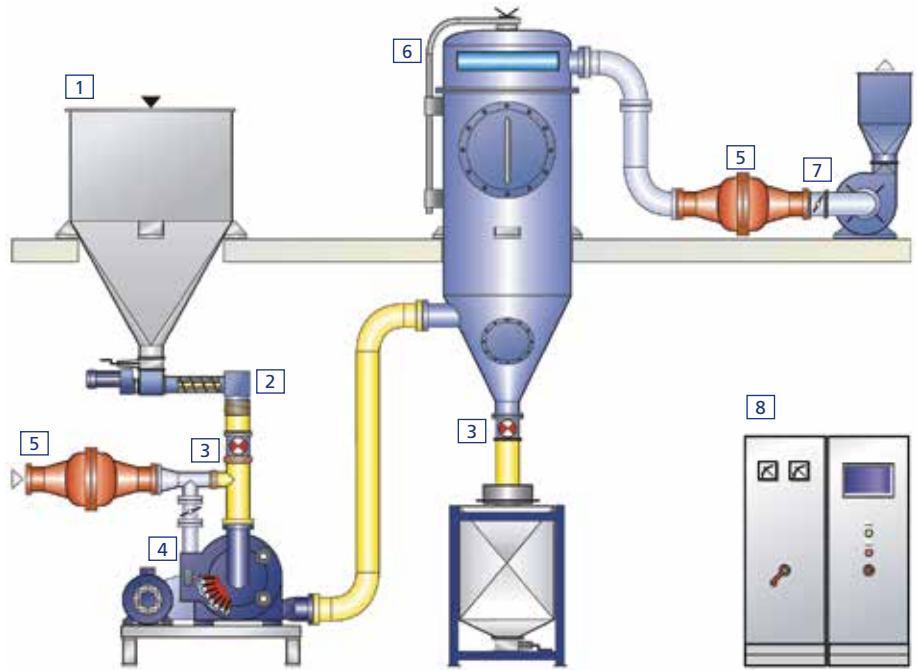
UPZ CRYOGENIC MILLING SYSTEM IN CIRCUIT-GAS MODE WITH LN₂



- 1 Feed metering unit: channel, screw, rotary valve, etc.
- 2 Screw cooler with LN₂ supply
- 3 Fine impact mill UPZ
- 4 Automatic filter, frequently in quick-change design
- 5 Fan
- 6 System control cabinet
- T Temperature sensor



- 1 Feed bin
- 2 Feed metering unit
- 3 Rotary valve
- 4 Fine impact mill UPZ
- 5 Explosion barrier valve
- 6 Automatic filter
- 7 Fan
- 8 System control cabinet



LACTOSE

Lactose, i.e. milk sugar, is yielded indirectly when making cheese. It is used in foodstuffs such as sauces, soups and confectionery products and also as an excipient in the pharmaceuticals industry. Special micronised qualities are used as carriers in inhalants (DPIs). Discharged normally from spray-driers or fluidised-bed driers, the lactose must be processed gently under the highest quality conditions. A distinction is made here

between food- and pharma-grade products. The mass products for the foodstuffs industry can be produced optimally with a fine impact mill from the UPZ product line. External classification is not necessary, not

even for fineness values < 75 µm. A great advantage worthy of emphasis is that the UPZ mills can be operated in three-shift mode for about a week before they need cleaning



UPZ guide values	Fineness	Throughput kg/h
500 UPZ	95 % < 100 mesh (150 µm)	1200
800 UPZ	97 % < 90 mesh (180 µm)	2500
800 UPZ	97 % < 60 mesh (250 µm)	2700
800 UPZ	97 % < 30 mesh (600 µm)	4000
1250 UPZ	90 % < 200 mesh (75 µm)	3000
1250 UPZ	97 % < 200 mesh (75 µm)	1800





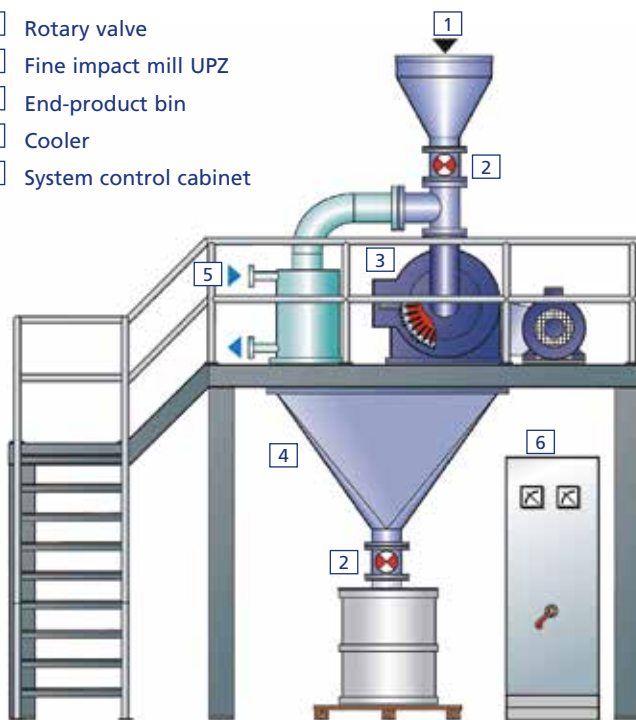
SUGAR MILLING

Singled out for description here are the milling of saccharose and modified (mostly thermally treated) starch. The system design for sugar and starch milling is identical. The systems are offered in pressure-shock-proof or pressure-relieved design to comply with

ATEX guidelines. Selection of the machine type is dictated by the required end-fineness values needed for the application.

Example of a system in pressure-shock-proof design to 10 bar overpressure with UPZ fine impact mill and internal air/gas circuit.

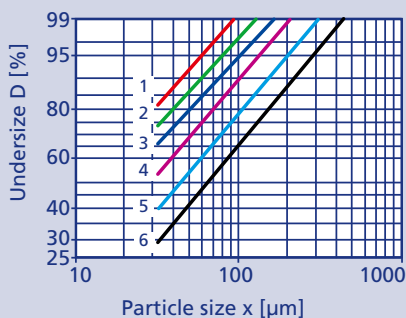
- 1 Feed bin
- 2 Rotary valve
- 3 Fine impact mill UPZ
- 4 End-product bin
- 5 Cooler
- 6 System control cabinet



SUGARPLEX 315 SX
IN THE HOSOKAWA ALPINE
TEST CENTRE

Monosaccharide	Disaccharide	Oligosaccharide, polysaccharide
Dextrose or glucose	Saccharose (beet sugar or cane sugar – glucose + fructose)	Starch from roots, e.g. potatoes, starch from fruits, e.g. chestnuts, starch from seeds, e.g. wheat, rice, peas, corn, starch from vegetable pith
Fructose	Maltose (malt sugar + glucose)	Cellulose Hemicellulose
Galactose	Lactose (milk sugar- glucose + galactose)	Chitin

➔ Increase of the complex structure of carbohydrates ➔



Sugar milling with the Alpine Sugarplex 315 SX

Curve	Fineness	Energy consumption kWh/t	Throughput rate kg/h
No. 1	99% < 90 µm	27.3	500
No. 2	99% < 130 µm	19.3	1,000
No. 3	99% < 150 µm	16.5	1,500
No. 4	99% < 215 µm	10.2	2,000
No. 5	99% < 315 µm	7.7	2,500
No. 6	99% < 450 µm	5.8	3,000



Practical examples Type 315 UPZ Spices	Throughput approx. kg/h	Fineness approx. 95% < μm
Basil with 50% marjoram	140	600 μm
Chillies	200 - 250	500 μm
Curcuma	150	180 μm
Curry	200 - 400	450 μm
Ginger	150 200 - 300	220 μm 400 μm
Cardamom (capsules) Cardamom	250 80 - 100	500 μm 180 μm
Garlic	200	160 μm
Caraway	100	700 μm
Bay leaves	250	300 μm
Marjoram	150	600 μm
Paprika	250	550 μm
Pepper	230 - 350	550 μm
Rosemary	150	300 μm
Thyme	160 800	200 μm 2000 μm
Cinnamon	100	150 μm

Dried vegetables	Throughput approx. kg/h	Fineness approx. 95% < μm
Carrots	600 - 800 100 - 150	630 μm 315 μm
Garlic	450 - 550	315 μm
Parsley	300	180 μm
Mushrooms	200	200 μm
Celery	600	630 μm
Spinach	150	150 μm
Onions	1000	250 μm

Reference values for milling at ambient temperature

SPICES AND DRIED VEGETABLES

In the spice industry, the UPZ is well-established around the world as a universal all-round mill for granular to ultrafine end fineness values for almost all spices. It is only when the spice in question contains a high content of oil that we recommend our Contraplex CW pin mills.

Scale-up factors of the most common types:

- 315 UPZ F = 1
- 500 UPZ F = 2
- 630 UPZ F = 3.6

The material properties – especially the wear behaviour – dictate the type of mill. UPZ mills are the mills of choice for root spices, seeds, husks with a high ash content and extremely hard kernels such as those in rose hips.

The vast differences in the grindability of the spices make it possible to only quote reference values. Many factors have an influence, e.g. moisture content, purity, content of essential oils and the provenance of the spices.



500 UPZ WITH SWING BEATER UNIT

APPLICATION EXAMPLE CORK PRODUCTS



CORK GRANULES

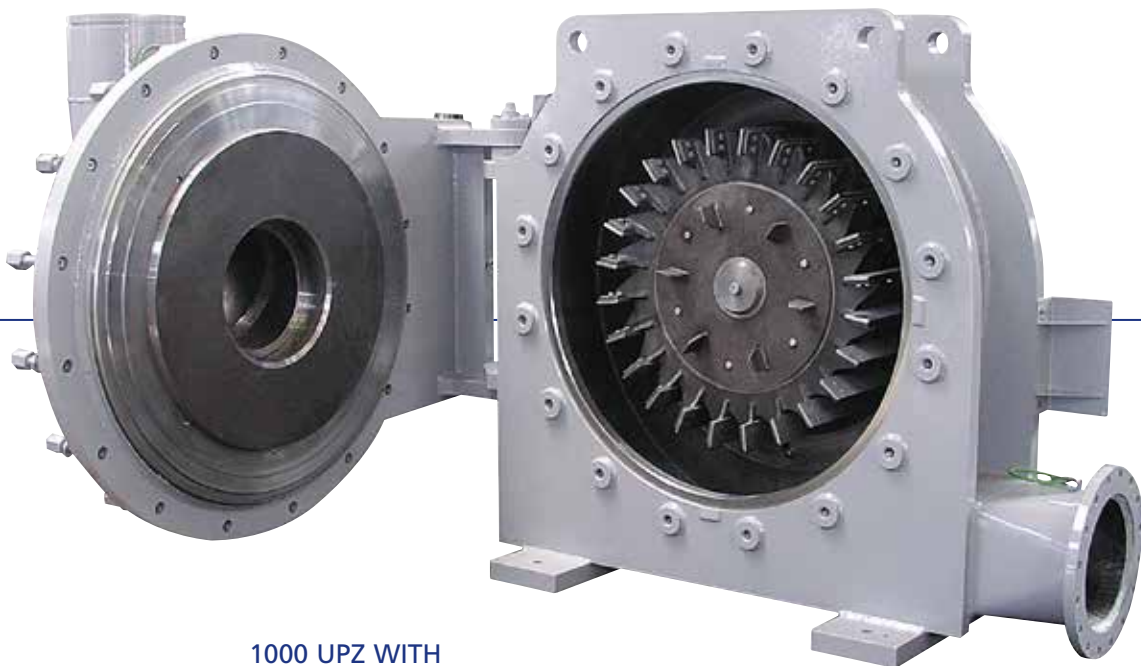
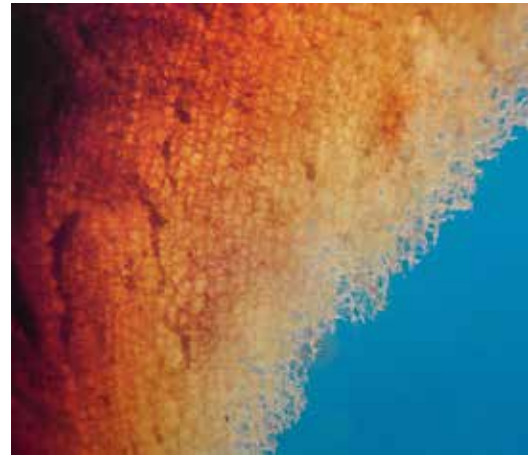
Because cork is extremely compressible, elastic, insulating, flame-retarding and as a natural product, is moreover eco-friendly, cork is becoming increasingly popular as a floor covering, as a noise and heat insulation material or for special applications (seals, polishing discs, vibration dampers, etc.). However, it is also exactly these excellent properties that make cork so difficult to grind mechanically.

Such a tough and elastic product cannot be comminuted by impact force alone. A cutting-rasping force must predominate. Although an extremely difficult task for

the field of comminution engineering, Alpine's UPZ fine impact mill with a specially developed milling track/beater unit combination is able to master it. There are a number of systems already in operation for milling granulated cork to produce pressed corks, for example.

System example for Alpine's cork fine impact mills:

- Alpine Ultraplex Fine Impact Mill 1000 UPZ
- Installed drive power 132 kW
- Throughput: 360 kg/h
- Fineness: 94% < 1 mm
- Feed size: cork granules 25 x 25 x 18 mm



1000 UPZ WITH
PLATE BEATER UNIT
PRESSURE-SHOCK-PROOF
DESIGN 10 BAR (g)



Polyoxymethylene (POM) is ideal for use as a universal material for components in the field of precision-mechanics and apparatus engineering.

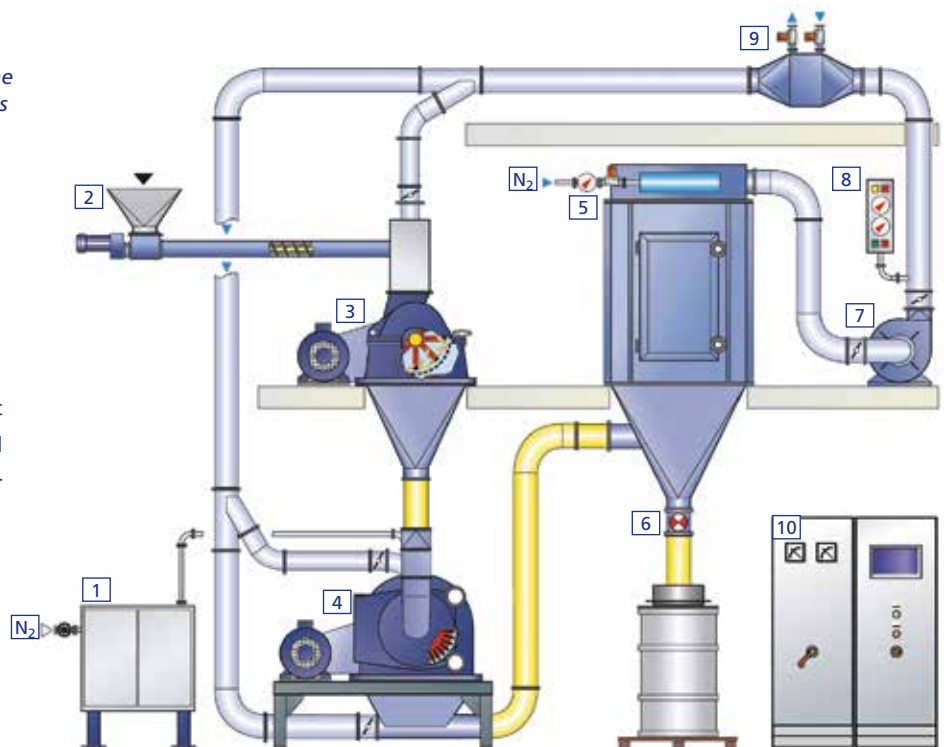
PROCESSING OF POLYOXYMETHYLENE (POM)

Because of its high stiffness, low coefficient of friction and excellent dimensional stability, POM is often used as a material for precision components.

POM has excellent properties:

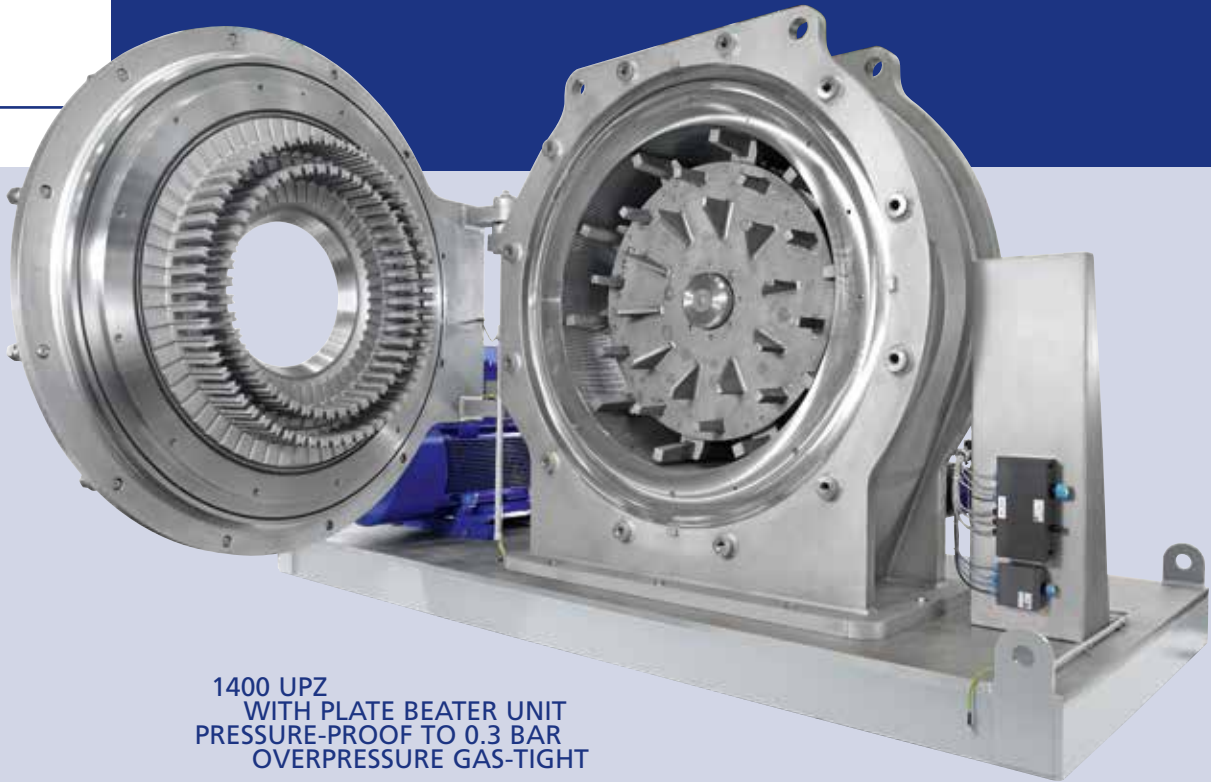
- Low frictional resistance
- High heat deflection temperature (HDT)
- Good abrasion resistance
- High strength and stiffness
- Good fatigue resistance at alternating stress
- Good electric and dielectric properties
- Low water absorption
- High dielectric strength
- Good resistance to chemical attack

This material is used for special components such as gear wheels, control cams, slide bushes, feed rolls, spring elements, valve balls or snap-fastening elements.



There are two fundamental process methods for which the Alpine UPZ fine impact mills are employed, namely the dry and the wet process. The low milling energy, size reduction at temperatures that are gentle on the material and milling elements that are universal in use for the production of different product qualities all highlight the benefits of the UPZ fine impact mill.

- 1 Control unit for N₂
- 2 Metering unit for feed material
- 3 Hammer mill Ha (preliminary crushing)
- 4 Fine impact mill UPZ
- 5 Automatic filter
- 6 Rotary valve
- 7 Fan
- 8 O₂ sensor
- 9 Heat exchanger
- 10 Process automation



1400 UPZ
WITH PLATE BEATER UNIT
PRESSURE-PROOF TO 0.3 BAR
OVERPRESSURE GAS-TIGHT

DRY PROCESS

The following reference values are achieved with a 1000 UPZ milling system:

Feed size: up to 50 mm
Throughput: approx. 1600 - 2000 kg/h
Fineness: approx. 99% < 1000 µm
with low fines portion
< 100 µm

The Alpine 1400 UPZ fine impact mill has been delivered for this application numerous times, whereby the following guide values were achieved in practical operation:

Throughput: approx. 5 - 10 t/h
dependent on the end-product fineness
Liquid portion: approx. 5 - 10 t/h
dependent on the solids throughput
Fineness: approx. 1% to 10%
residue on 1 mm

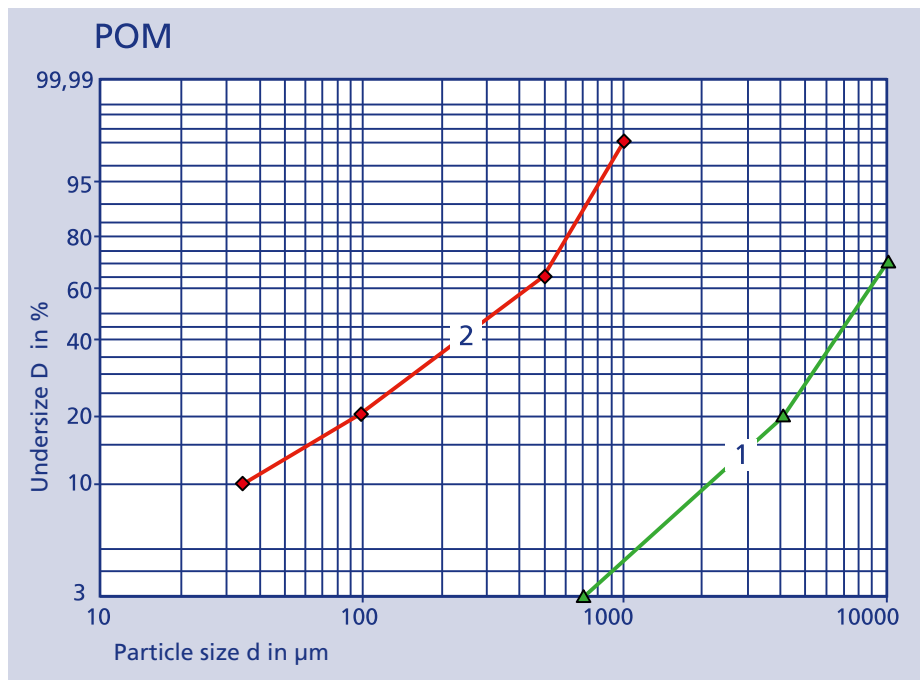
WET PROCESS

The so-called wet comminution process calls for UPZ mills in special design.

The emphasis here is placed on:

- Special mill bearing seals
- Machine in gas-tight and pressure-proof design to 0.3 bar overpressure
- Special construction materials with certificate

Curve 1) Feed
Curve 2) End product





*The more demanding the task,
the more you benefit from our
comprehensive range of services*

CONSULTING SERVICES

Problem specification, exploration of different technical solutions, product-specific processes, consideration of safety aspects, different system concepts, e.g. pressure-shock-proof, inert gas mode, CIP/SIP, etc.

TRIALS

Milling and classifying trials, laboratory analyses, determination of energy requirements and production costs, manufacture of product samples, rental systems.

ENGINEERING

Initial design stage:

conceptual studies – basic engineering, flowcharts – installation planning; safety concepts, e.g. ATEX; project documentation
Detail planning:

P&I diagrams; calculation and layout; specification of components; design, programming and networking of visualisation systems; structural steel engineering with static calculations; planning the piping and ductwork; official

acceptance of subcontractor work.

PROCESS AUTOMATION

Control cabinets, conventional control units (Plexwire), process control with PLC, visualisation systems, process data archiving, logic diagrams, teleservice connection for remote maintenance.

DOCUMENTATION

- Operating instructions, operating manuals
- "As built" documentation
- Software documentation
- Documentation as per 21 CFR Part 11 for the pharmaceuticals industry
- CE certification

MANUFACTURING

Areas of competence:

- CNC autogenous and plasma flame cutting.
- Manufacture of pressureless and pressure-shock-proof welding subassemblies in different material qualities by qualified machinists and welders
- CNC processing of complex components for film blowing systems and pharma machines using turning, drilling, milling and grinding.

ASSEMBLY

- Assembly of complicated subassemblies and machines of different design and dimension
- Design consultancy in all manufacturing issues
- Test runs, factory acceptance tests (FAT)

ENGINEERING PLANNING AND SUPERVISION

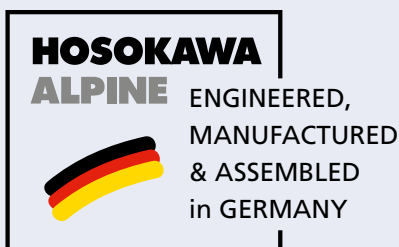
- Project coordination
- Installation and assembly of complete systems on the customer's premises by competent field service engineers all over the world
- On-site supervision

COMMISSIONING

- Commissioning, training, test runs, site acceptance tests (SAT)

TOLL MILLING

Our affiliated company, Hosokawa Micron Powders GmbH in Cologne, offers a wide range of toll processing services. We would be glad to give you the contact details.



MADE IN GERMANY

A high-quality product calls for competence in development, engineering, manufacture and assembly. And this competence in turn stems from the training, know-how, experience and motivation of the company staff. The environment of the company headquarters in Augsburg has always fulfilled these requirements in the best possible way. And it is here that we find the dedicated and excellently trained staff who render a great service to the company, the products and the success of our customers.

For this reason and in the tradition of our own self-imposed commitment to high quality, we will continue to lay store by Germany as a business location. The new emblem for our letterheaded company paper with the message ENGINEERED, MANUFACTURED AND ASSEMBLED IN GERMANY underlines this commitment.

ALPINE'S TESTING CENTRE



With a floor area of 3000 m² spread over 4 stories, the Hosokawa Alpine application testing centre in Augsburg is one of largest testing centres in Europe dedicated to the wet and dry processing of products in powder form.

With over 60 state-of-the-art machines and complete systems on both a production and laboratory/pilot scale as well as the associated testing laboratory, we offer you the most comprehensive range of testing possibilities aimed at optimum system layout and determination of process-related guaranteed values.

The 20-strong team in the testing centre is made up of test engineers, laboratory technicians, system assistants and mechanics, is fully conversant with the technical characteristics of every system and has a great deal of experience in handling a wide variety of different products.

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HOSOKAWA ALPINE Aktiengesellschaft

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.

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