HOSOKAWA
ALPINE Aktiengesellschaft & Co. OHG
P.O. Box 10 11 51
D-86001 Augsburg / Germany

Delivery address
Peter-Dörfler-Str. 13 - 25
D-86199 Augsburg / Germany

Tel.: 0049 (0)821 59 06-0
Fax: 0049 (0)821 57 35 78
E-Mail: mail@alpine.hosokawa.com

Internet: *www.alpinehosokawa.com*

HOSOKAWA
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Hosokawa Alpine Aktiengesellschaft & Co. OHG 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, product recovery, plastics processing and confectionery products. The Group maintains facilities for research, engineering, manufacturing and service in each of the world's major industrial markets.

CW 7.99/1.5e

All details in this brochure are purely informative and non-binding. Authoritative for actual orders are our quotations.

CONTRAPLEX® WIDE CHAMBER MILLS WITH TWO ROTATING STUD DISCS

DIN EN ISO 9001 DNV Certified Company

HOSOKAWA
ALPINE Aktiengesellschaft & Co. OHG

Process Technologies For Tomorrow℠

Contraplex® Wide-Chamber Mills

...the proven system to solve difficult size reduction problems

High-efficiency grinding technology without parallel

Where other systems in many cases would fail, Contraplex® Wide-Chamber Mills enable the trouble-free ultra-fine grinding of difficult products even in continuous operation.

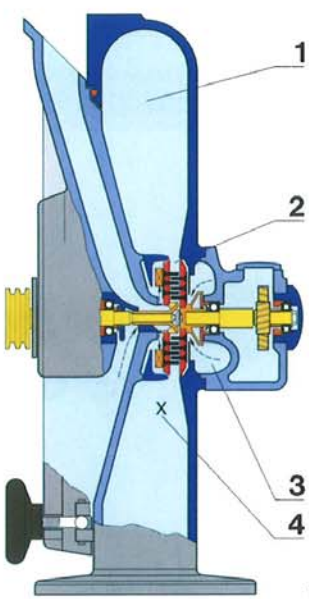
This is particularly true when dealing with greasy, oily, sticky, or heat-sensitive products. With some mill designs, deposits start to build up in the housing, and the grinding media or sieve inserts block with grease.

The operators of Contraplex® mills can be secure in the knowledge that our mills are not subject to the foregoing problems, allowing a rational production when processing such difficult materials.
Within the achieveable grinding fineness range, the Contraplex® mills also offer power, cost, and quality advantages.
Alpine has built these stud mills for decades, and is constantly striving to improve and further develop them. A few years ago, the introduction of the type 1120 CW onto the market (perhaps the largest stud mill in the world) scaled up the existing series a further important step.
As you can see: it is no problem for us to solve your problem, even when extremely high throughput rates are demanded. Why not convince yourself by attending a machine trial?

Contents **Page**

Ill. 1 = Type 250 CW;
Ill. 2 = Design schematic

1



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High grinding fineness with low specific energy consumption

Universal application
Contraplex® Pin Mills are extremely versatile: on the one hand they produce remarkably high fineness, and on the other, are eminently suited to the size reduction of particularly difficult materials. For many size reduction tasks, e.g. in the foodstuffs field and when grinding with liquid nitrogen, the Contraplex® is often the only suitable fine-grinding mill. The efficiency depends to a great extent on the hardness and purity of the feed material. As a general rule, the following products can be handled
- materials up to a max. Mohs hardness of 3
- a max. of approx. 0.1% permissable harder or abrasive constituents.

Typical fields of application are:
☐ Spices, foodstuffs and confectionery containing fat or oil, e.g. nutmeg, mace, cloves, mustard seeds, star aniseed, full-fat soya beans, cocoa press cakes, lactose, sugar, biscuit pieces containing fat.
☐ Pigments such as blancfix, white – lead, lithopone, and zinc oxide, etc.
☐ Pesticides
☐ Stearates, nitrates, metal oxides
☐ Soft, pure minerals, etc.

Contraplex® Features	Application advantage = a challenge to competitive systems
1 **"CW" wide chamber housing**	**Prevents the formation of deposits** and thus machine blocking. Generously-proportioned machine housing in comparison to the stud disc Ø. Greasy, heat-sensitive or sticky materials which possess a tendency to from deposits can therefore only be ground in continuous operation with the Contraplex® mills. Besides the wide-chamber housing, the rotation of the two stud discs is a significant characteristic of the Contraplex®. As well as the direction of rotation, the rotation speed can also be varied, offering the following important application advantages:
2 **Two rotating stud discs** Direction of rotation: either in the same ↻ or in opposite directions ↻↺	**Higher grinding fineness.** Depending on the type, the max. relative speed of both discs is approx. 240 m/s. Single-rotor stud, beater, cross-flow, and turbo-mills, etc. cannot achieve this high speed. Contraplex® therefore produces higher grinding fineness, especially with brittle, crystalline materials. **Lower power consumption.** The ultra-fine grinding of brittle, crystalline materials is the domain of the Contraplex® mills. In comparison to jet, cross-flow, and turbo-mills, etc., the Contraplex® has a much more favourable power consumption – depending on the process, up to 50% lower! **Individual adaptation of the grinding conditions** to suit the feed material. The wealth of possibilities available in setting the direction of rotation and the speeds of the two discs ensures that each and every product, especially when heat-sensitive, is ground to an optimal fineness, is gently handled, and that the stud discs remain free of deposits. **Intensive, agglomerate-free, and homogeneous mixing-grinding** of products consisting of two or more components (foodstuff technology).
3 **Rinsing air protection**	**Air sucked in from the atmosphere** prevents the penetration of products into the bearing and the depositing of product behind the stud discs.
4 **Stud mill without sieve**	**Trouble-free continuous operation.** Products which cannot be ground in sieve mills due to their tendency to block the sieve performations – especially fine-mesh sieves – can be ground to high fineness.

Illustrated: Types 250 CW, 400 CW, and 630 C

Design

☐ Machine housing with a large door offers optimal accessibility for cleaning and maintenance.

☐ Drive: Types 250 CW and 400 CW
- driven on the housing side by means of a flanged-on single-stage spur gear system.
  driven on the door side directly via the mill shaft. The mill door has an adjustable support for the drive motor.

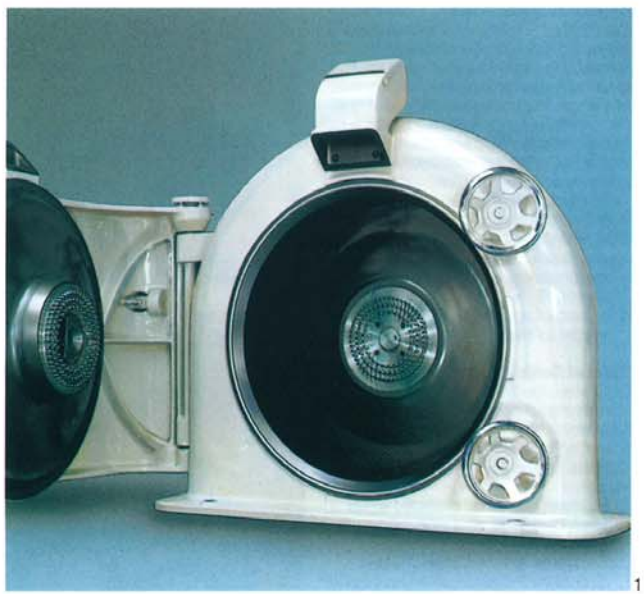
☐ Special bearing seals guard against the penetration of dust or rinsing water into the bearing, and the leakage of oil or grease into the grinding chamber.

☐ Pins made of special steel.

☐ Mechanical or electro-mechanical door interlocking to ensure safety during run-down.

Illustrations:

Ill. 1 Type 250 CW
Ill. 2 Type 400 CW
Ill. 3 Type 630 C
Ill. 4 Type 710 CW
Ill. 5 Grinding systems with 710 CW
Ill. 6 Type 1120 CW
Ill. 7 Grinding system with 2x250 CW
Ill. 8 Grinding system with 630 C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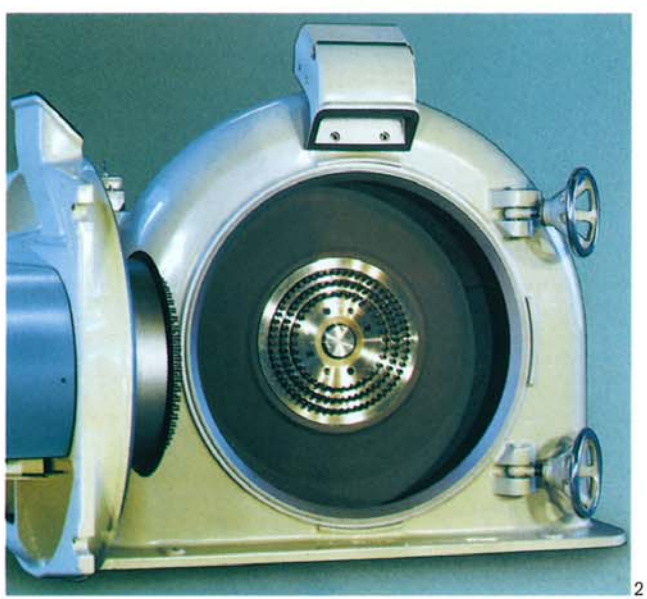
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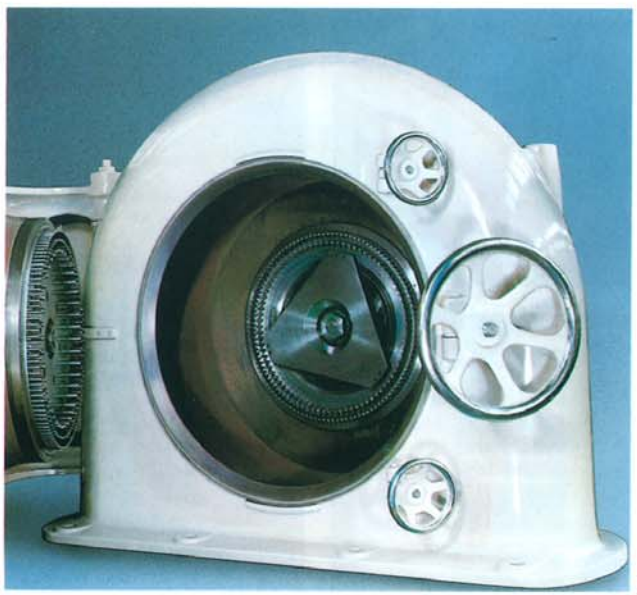
Illustrated: Types 710 CW and 1120 CW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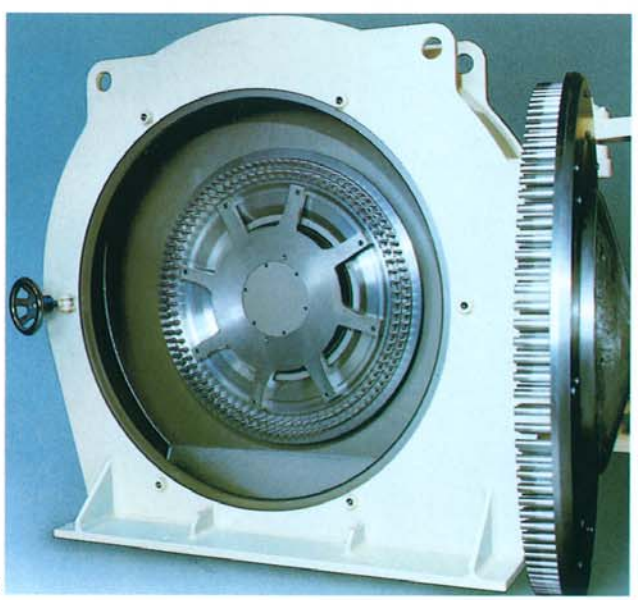
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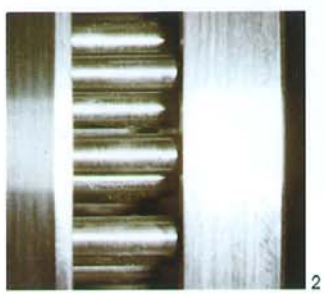
Robust construction – reliable operation

III. 1 After removal of a cover disc, worn grinding pins can simply be pushed out of the stud disc towards the rear. The newly-studded disc only needs to be statically balanced.
III. 2 The closely intermeshing pin rows and the optimally coordinated pin length and distribution guarantee superior grinding results. In extreme cases, adaptation to difficult materials is achieved by variation of the number and configuration of pins.


1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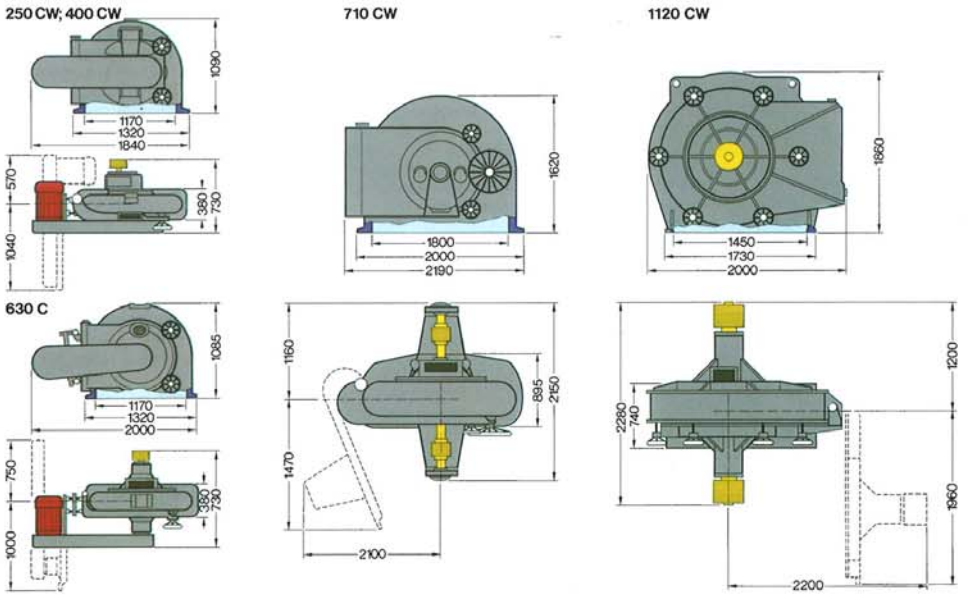
Standard grinding systems:
By varying certain components at the initial stage, it is possible to alter the air throughput of the Contraplex® mills independently of the stud disc speed. The table gives a choice of 2 standard systems:
- ☐ Index[1]: Systems for heat-sensitive materials (machine with "large gap")
- ☐ Index[2]: System for non-heat-sensitive materials (machine with "small gap")

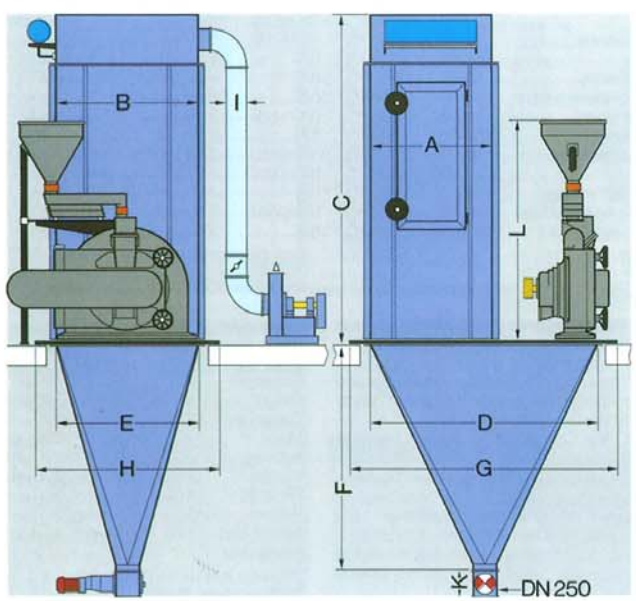
Contraplex®		Type	250 CW		400 CW		630 C		710 CW		1120 CW
Scale-up factor		F = approx.	1		2,5		5,5		9		22
Drive power											
Housing side		max. kW	15		30		55		110		250
Door side		max. kW	7,5		15		55		110		250
Pin disc speed											
Housing side		max. min^{-1}	11 200		8400		3550		3550		2250
Door side		max. min^{-1}	5600		4500		3150		3150		2000
Pin rows: Housing-/door side			3/3		3/3		2/3		2/3		2/3
Air throughput at max. speed for:											
– heat-sensitive materials[1]		max. m^3/h	1000		2400		4400		5900		23000
– non-heat-sensitive materials[2]		max. m^3/h	600		1500		2100		3100		12000
Weight, without motor and feeder		approx. kg	900		1000		1400		3800		5000
Standard grinding systems		Index [1)2)]	1)	2)	1)	2)	1)	2)	1)	2)	
Exhaust fan		kW	2,2	1,5	3	2,2	5,5	3	7,5	5,5	
Alpine filter		Type	M12	K12	M25	M16	G35	M25	G49	M35	
		m^2	9,6	4,8	20	12,8	42	20	59	28	
	A	mm	660	660	1100	880	1100	1100	1540	1100	
	B	mm	880	880	1100	880	1540	1100	1980	1540	
	C	mm	2250	1250	2350	2250	3350	2350	3500	2350	
Hopper	D	mm	1600	1600	2000	2000	2250	2000	3300	3300	
	E	mm	1200	1200	1200	1200	1550	1200	2000	2000	
	F	mm	1600	1600	2000	2000	2200	2000	3300	3300	
Installation console	G	mm	1900	1900	2300	2300	2550	2300	3600	3600	
	H	mm	1500	1500	1500	1500	1850	1500	2300	2300	
Clean gas ducting-Ø	I	mm	125	90	200	160	250	200	315	250	Layout depends on project
Rotary valve	K	mm	400		400		400		400		
Feed rating channel/screw approx.	L	mm	2050/1850		2250/2020		2200/2050		2550/2280		

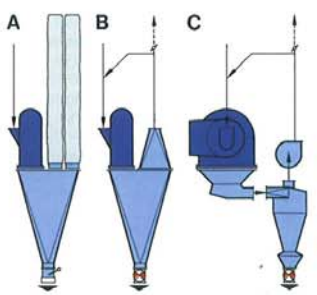
Index 1)2): Total air volume at a counter pressure of 0 da Pa and at max. speed of the housing and door-sided stud discs.

Standard Alpine services:

Application trials – System conception – System design and manufacture – Commissioning – Personnel training courses







A Filter bags for low air volume (Type 250 CW…630 C) and non-dangerous materials.
B + C Closed-circuit operation, only a small portion of the air flow is filtered. Only suitable for materials which are not sensitive to heat. The advantage lies in the lower capital cost.

Spices

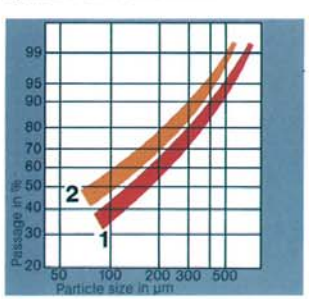
Among users, the Contraplex® wide chamber mills are looked upon as the "classic" spice mills.
For the fine grinding of spices, the Contraplex® mills offer the following advantages:
☐ Universal application for a great variety of spices; especially greasy and sticky ones which cannot be handled on other grinding sxstems.
☐ Continuous operation over long periods of time, even with very difficult spice types which pose technical grinding problems.
☐ The speeds can be selected to ensure a "gentle" grinding with maximum retention of the essential oils, even when high grinding finenesses are demanded.
☐ "Cool" grinding of heat-sensitive spices is achieved by high air volume rates.
The application table gives a general guide to the grinding of various spices at normal temperatures. Due to the strong contrasts in the grindability of spices, these data are for guidance only.

Mustard seeds, black or white.
The Contraplex® mills are eminently suitable when it comes to the dry grinding of the entire seed. Both white and black seeds demonstrate roughly the same characteristics as regards grindability. In spite of an approx. 20–35% fat content, the Contraplex® can be operated at relatively high speeds. The diagram shows practical values for the type 250 CW:
☐ Curve 1: approx 200–250 kg/h
Speed: 9000/3000 contra
☐ Curve 2: approx. 100–150 kg/h
Speed: 11200/3000 contra

Grinding at normal temperature with Contraplex® type 250 CW

Spice:	Speed, r.p.m. Housing	Door	Capacity approx. kg/h	Fineness appr. 95% <	Energy approx.
Aniseed	11200	3000 ↻●	100–150	1 mm	7+2 kW
Chillies,	11200	3000 ↻●	120–150	750 µm	10+4 kW
entire pods	11200	5600 ↻●	70	400 µm	10+5 kW
Fennel seeds	11200	3000 ↻●	80–100	1.5 mm	7+1 kW
	11200	3000 ↻●	100	600 µm	9+4 kW
Ginger	11200	3000 ↻●	60–80	300 µm	9+4 kW
Cardomom	10000	3000 ↻●	100	400 µm	6+3 kW
Caraway	10000	3000 ↻●	70–100	700 µm	8+3 kW
	10000	3000 ↻●	70–100	420 µm	2nd grinding
Coriander	10000	3000 ↻●	200	630 µm	7+3 kW
Mace	10000	3000 ↻●	150–200	1 mm	5+1 kW
Nutmeg	10000	3000 ↻●	100–200	1.2 mm	5+1 kW
	11200	2000 ↻●	150–200	800 µm	5+1 kW
	7000	3000 ↻●	150–200	600 µm	5.5+1.5 kW
Cloves	8000	3000 ↻●	70–100	500 µm	5+2 kW
	11200	3000 ↻●	100	850 µm	6+2 kW
Paprika	8000	5000 ↻●	200	400 µm	10+4 kW
Paprika seeds	11200	3000 ↻●	200	650 µm	10+4 kW
Pepper	11200	5000 ↻●	100–150	200 µm	9+5 kW
Pimento	10000	2000 ↻●	150	500 µm	6+2 kW
Mustard seeds	9000	3000 ↻●	200–250	500 µm	8+3 kW
	11200	3000 ↻●	100–150	400 µm	10+3 kW
Star aniseed	11200	3000 ↻●	150	400 µm	9+3 kW
Juniper berries	11200	2000 ↻●	150–200	1.5 mm	6+2 kW
Cinammon	11200	3000 ↻●	150	200 µm	10+4 kW

Legend: Pin disc direction of rotation: ↻● = in opposite directions; ↻● = in the same direction



The cryogenic grinding of spices with the aid of liquid nitrogen is becoming more and more popular.
These "cool" grinding systems predominantly feature the Contraplex® Wide-Chamber Mills, because:
☐ the Contraplex® achieves very high grinding fineness.
☐ the Contraplex® can be operated with a relatively low air volume (see page 6, Standard Systems). This means a lower nitrogen consumption and a commensurately higher profitability. See page 14 for further special features.

Cryogenic grinding:
Guide values – Type 250 CW*

Spice	kg/h	Fineness
Coriander	550	98% < 700 µm
Ginger	250	98% < 500 µm
Coriander	250	98% < 500 µm
Mace	300	98% < 500 µm
Nutmeg	300	98% < 500 µm
Cloves	280	98% < 500 µm
Pimento	400	98% < 500 µm
Pepper	350	98% < 500 µm
Senna leav. (medicam.)	150	55% < 1.0 mm

* Grinding is influenced by: climatic conditions, orgin of spices, etc.

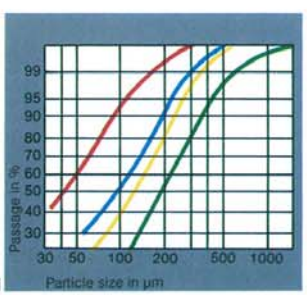
Jelling and thickening agents

With demands for high fineness, the Contraplex® can be employed for:
- Agar-agar
- Alginate (sodium alginate)
- Cellulose ether
- Cellulose derivative
- Gelatine
- Gum arabic
- Gum karaja
- Guar seed flour
- Pectin, etc.

Some materials such as agar-agar or alginate are glutinously elastic and are therefore more difficult to grind. Whereas some of these substances can be ground to the required fineness in one grinding operation, substances which are difficult to grind need 2–3 passes.

Ill. 1 shows a capacity example for agar-agar:

250 CW – grinding ops.	Grindability of agar-agar difficult	easy
green 1x	45 kg/h	–
yellow 2x	55 kg/h	–
blue 3x	95 kg/h	–
red 1x	–	70 kg/h



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Full-fat soya beans

Besides being used for the fine grinding of full-fat soya, Contraplex® mills are especially employed for the grinding of "extrusion-cooked full-fat soyflour". This material, which derives from the so-called "Wenger process", has a strong tendency to stick and deposit. The manipulation of this substance is much more problematic than that of the normal full-fat soya. With this "extrusion-cooked" material, the Contraplex® achieves the following fineness:
approx 95% < 100 mesh/150 µm
(96–98% < 75 mesh/200 µm)
Depending upon the grindability of the material, the specific energy consumption for the grinding is approx.
55–70 kWh/t.
Capacity guide values are:
Type 400 CW –
approx. 400–600 kg/h
Type 710 CW –
approx. 1500–2400 kg/h
Type 1120 CW –
approx. 3500–5200 kg/h.

Broken biscuits and wafers

The intensive and trouble-free fine grinding of bakeware rejects with a high fat content calls for the employment of the Contraplex® Wide-Chamber Mill, as a fat content in excess of approx. 5–6% causes depositing problems with conventional systems. The Contraplex® is well able to cope with products with an average fat content of up approx. 30%. With higher fat contents, the ground material discharges from the mill as a paste.

Further application examples
Standard values for type 250 CW

Product	appr. kg/h	Fineness %< µm
Bakeware rejects		
– Fat ≦ 30%	400	97%< 750
– Fat > 30%	250	pasty
Peas, shelled	200	99%< 120
Peanuts, roasted	350	pasty
Fennel	100	95%< 600
Fructose	150	80%< 1000
		95%< 2000
Gum-Karaja	80	95%< 150
Oat flakes	200	85%< 200
		98%< 400
Oat grain	180	92%< 200
		99%< 400
Casein	300	84%< 200
		99%< 160
Caraway	100	99%< 630
Linseed	100	33%< 200
		83%< 500
Skimmed milk powder	600	80%< 32
Corn flakes	100	85%< 200
		96%< 400
Cornstarch, native	600	99%< 40
Flour, cake-mix flour	350	aerate
Pectin	250	95%< 500
	100	95%< 350
Glucose	150	99%< 120
Tomato pulp	400	90%< 200
Whole milk powder	250	50–200 µm
Wheat:		
– starch, native	300	99%< 40
– source starch	150	98%< 40
Sugar	150	99%< 63
Coloured sugar	150	95%< 40
Onions	200	99%< 200

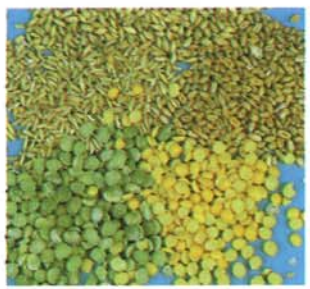
2

3

4

Ill. 2 Grinding system with Type 710 CW for full-fat soya.
Ill. 3 Broken biscuits and wafers: For higher fat contents, the Contraplex® is unquestionably the better choice.
Ill. 4 Type 250 CW in stainless steel design.

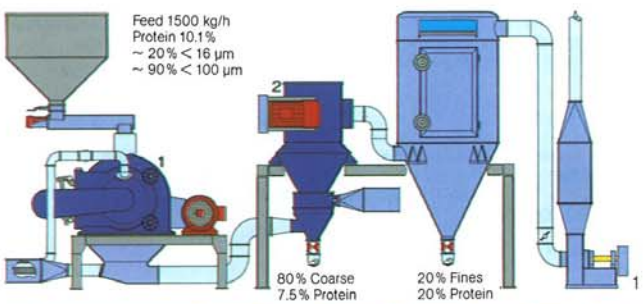
Protein enrichment of flours by size reduction and air classification



Application examples
Within the field of protein enrichment, Contraplex® mills are employed for the intensive but gentle fine grinding of:
- ☐ Wheat flour: hard and soft wheat
- ☐ Faba beans
- ☐ Mung beans
- ☐ Peas, beans, barley (shucked)
- ☐ Potato flour, cotton seed
- ☐ Cornflour, corn grits
- ☐ Sorghum, soya flour – extracted
- ☐ Petroprotein flour
- ☐ Rape flour – free of oil, etc.

Contraplex® advantages
- ☐ Gentle grinding which avoids any damage to the protein and the starch grains. In spite of this, the intensive – and selective – grinding provides the best conditions for an optimal protein shifting in the classifying stage.
- ☐ Lower specific energy requirements.
- ☐ Optimal preservation of substance; cool grinding is ensured due to the high air volume through the mill.
- ☐ Individual setting of the grinding parameters: speed, direction of rotation, etc.

Practical example: wheat flour
Ill. 1 shows the system concept with single-stage grinding and classification. Aim of the protein shifting in this project: ☐ the production of a low-protein flour (coarse material from the classifying stage 2).
1 = Contraplex® 630 C for the subsequent grinding of wheat flour as a preparation for the classification.
2 = AlpineTurboplex® AirStreamClassifier Type 500 ATP-GS/S for the precision classification at approx. 15 microns.
System capacity: 1.5 t/h feed.



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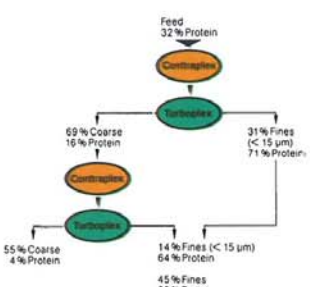
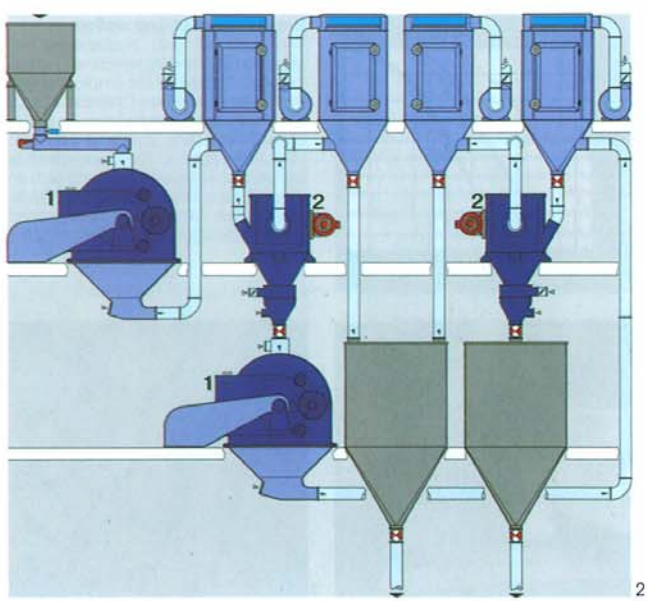
Faba beans
Ill. 2 shows a system concept with two-stage processing (option). The subsequent grinding of the classifier coarse material from the 1st classifying stage results in a very high protein enrichment and, simultaneously, a higher yield.
1 = Contraplex® 710 CW
2 = Alpine Turboplex® Ultra-Fine Classifier Type 500 ATP-GS.
System capacity: approx. 2.8 t/h feed.
The schematic shows guide values for the products.





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Cocoa powder: Cool grinding-classifying systems with the Contraplex® cocoa mills

Ultra-fine cocoa powder
For the fine grinding of cocoa press cakes (fat content: 12–14 % or 22–24 %), Alpine supplies complete grinding-classifying-cool systems (see system schematic). Cocoa powder fineness of at least 99.9 % < 75 µm can be achieved with these systems! This fineness – 100 % controlled for oversize particles by the integrated Alpine cocoa classifier – is rated as the best on the market.
Temperature level in continuous operation: Feed: press cakes approx. 80° C cocoa powder end fineness 17° C.

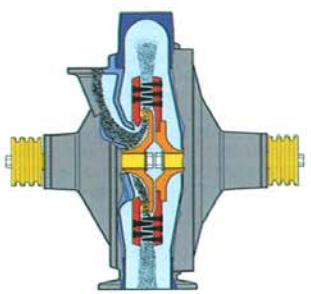
Standard capacity values
Cocoa powder fineness*
99.9 % < 75 µm or finer

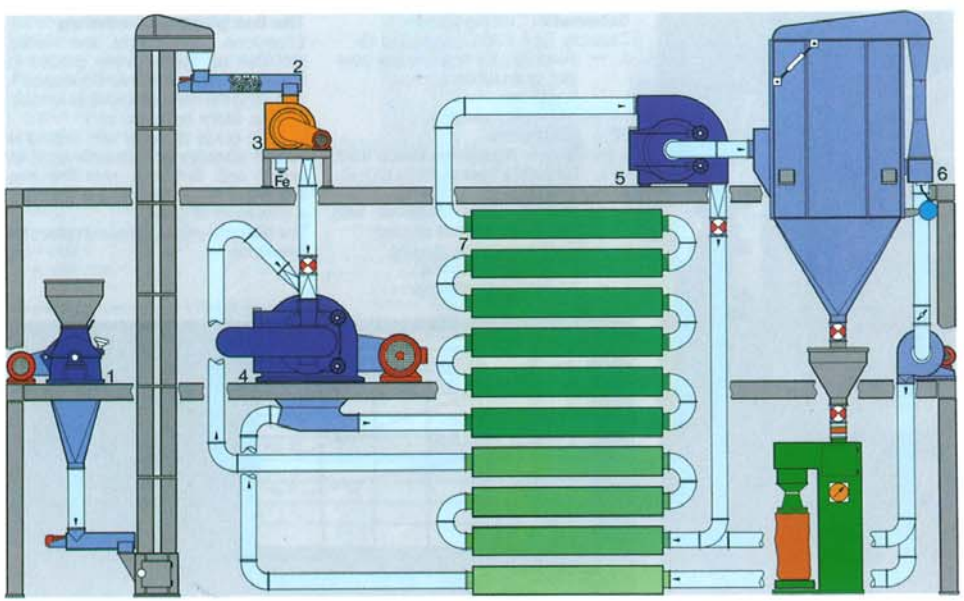
Contraplex® Typ	Cocoa press cakes Fat content: 12–14 %	22–24 %
400 CW	400 kg/h	300 kg/h
630 CW	1 200 kg/h	900 kg/h
800 CW	2 000 kg/h	1 500 kg/h

*) The cocoa powder fineness is achieved by using the Contraplex together with the Alpine cocoa classifier.

The Contraplex® Cocoa Mill is in every detail constructionally designed to meet the special demands of cocoa fine grinding. This also means that a cooling of the housing is not necessary.
Features:
- ☐ Free-standing pin discs
- ☐ Wide chamber housing even with the Type 630 CW (sectional view).
- ☐ Conical housing interior
- ☐ Hard-wearing pins
- ☐ Special pin arrangement.

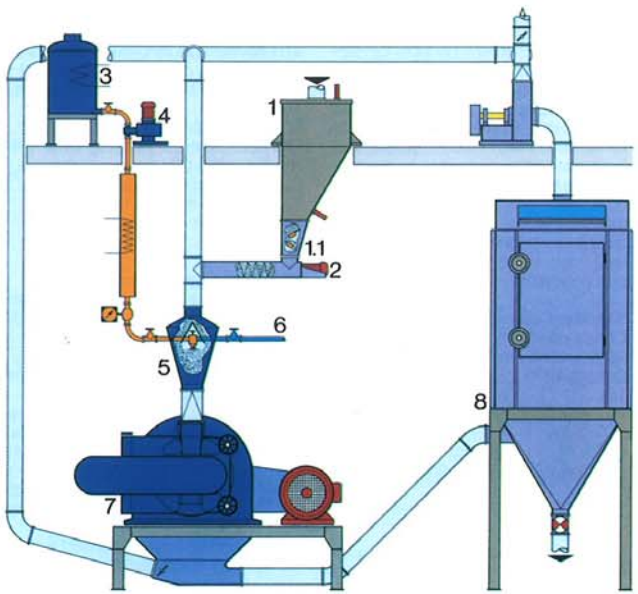
Key to the system schematic
1 = Alpine Hammer Mill for the precrushing of press cakes
2 = Feed screw
3 = Metal separator
4 = Alpine Contraplex® Wide Chamber Cocoa Mill
5 = Alpine Cocoa Classifier, designed as an air flow classifier for inline operation with the Contraplex®
6 = Alpine Filter, alternatively cyclone, for the end-product collection.
7 = Double-walled cool duct system for the mill product; classifier coarse material; clean gas.

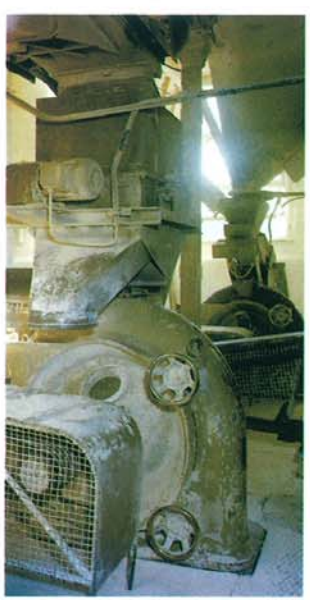




Mineral powder coating
Ultra-fine grinding of soft, pure minerals

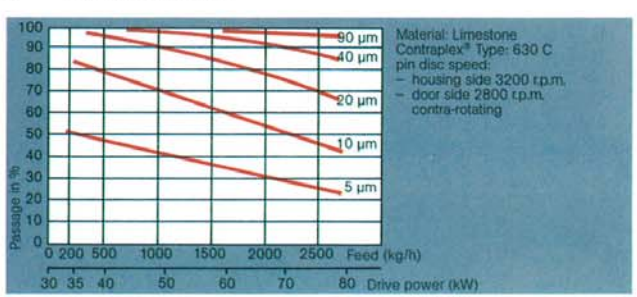
Mineral powder coating
Contraplex® pin mills have already successfully proved themselves in practise for the surface coating of finely-ground mineral powders, e.g. limestone and chalk, etc.
Stearic acid is frequently used for treating dry material; depending on the mineral and the fineness, the coating rate ranges from 0.5–1.5 %.
The Alpine coating system is characterized by special know-how. This applies not only to the entire control and regulating technique, but also especially to the supply of the stearic acid, the spray technique in the spray container (5), and the air circulation in closed-circuit operation.
The actual coating process takes place in the Contraplex®. The process is very successfully supported by the "mixing-grinding" effect:
The end product is an optimally surface-coated, disagglomerated material; the granulation is the same as, or finer than, the feed material.





Schematic: Coating system
Capacity Type 630 C: approx. 2 t/h
1 = Feed silo for fine mineral powder; granulation approx. 10–15 µm
1.1 = Magnetic cascade
2 = Feed screw
3 = Supply hopper for stearic acid; heated to approx. 100–120° C
4 = Feed pump
5 = Stearate spray container with adjustable special nozzles
6 = Compressed air ducting
7 = Contraplex® pin mill
8 = Alpine automatic filter

The fine grinding of minerals
Limestone, chalk, calcite, and marble, etc. can be economically ground to high finenesses on the Contraplex®, providing the composition is as follows:
☐ Max. Mohs hardness of 3
☐ High grade of purity with regard to harder, abrasive constituents such as quartz and flintstone, etc. The free amount of these impurities is limited to a maximum of 0.1 %.
The diagram shows standard values for limestone.



Pigments – pesticides – E-PVC – general chemical products

Paint industry; pigments
The loosening up and fine grinding of the primary particles, agglomerated together in the manufacturing process, back to the primary particle size is a common demand when milling pigments.
Many pigments stand out by virtue of their critical technical-grinding property: they have a strong tendency to form deposits, thus blocking the grinding media and leading to clogging of the mill housing.
Because of the special advantages of the Contraplex®: wide chamber housing against deposit formation; high milling fineness; and low specific energy consumption, it is employed very successfully for the "fine grinding" of pigments.
Application examples:
☐ Pigments: Blancfix – red lead – white lead – chromium oxide – blue iron cyanogen – lithopone – zinc oxide, etc.
Type 250 CW: approx. 200–300 kg/h
approx. power demand 7–12 kW
☐ Dyes, when high finenesses are required
☐ Food colourings,etc.

Pesticides
Application features for the Contraplex® Wide-Chamber Mill are:
☐ Fineness: for dusting agents
☐ Product properties:
1) Formulations with sticky substances, i.e. strong tendency to deposit.
2) Heat-sensitive substances with low inert carrier quotient. Lindane (100 %) is even ground to spray media fineness.
☐ Inert carriers: slightly abrasive
☐ Mode of operation: Continuous operation or extended cleaning intervals.

Standard values: Type 250 CW

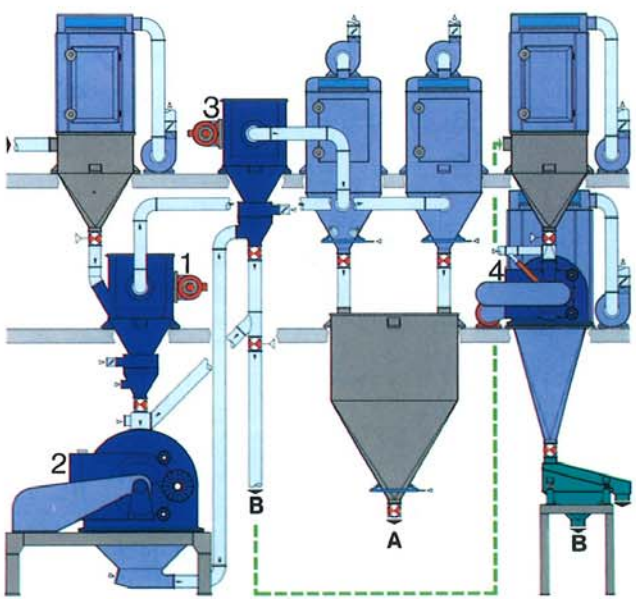
Material*	kg/h	% < µm
Aldrin (40 %)	200	98 < 75
Captan (100 %)	250	99.5 < 40
DDT (75 %)	200	97 < 70
Dieldrin (50 %)	300	99 < 40
Diphenamide (70 %)	200	98 < 40
Copper oxychloride	200	99.5 < 40
Lindane (50 %)	200	98 < 75
Lindane 100 %	200	99.5 < 40
Maneb	150	95 < 32
Simazin	150	99.9 < 45
Zineb; Ziram	150	99.9 < 40

*) % = active substance concentration

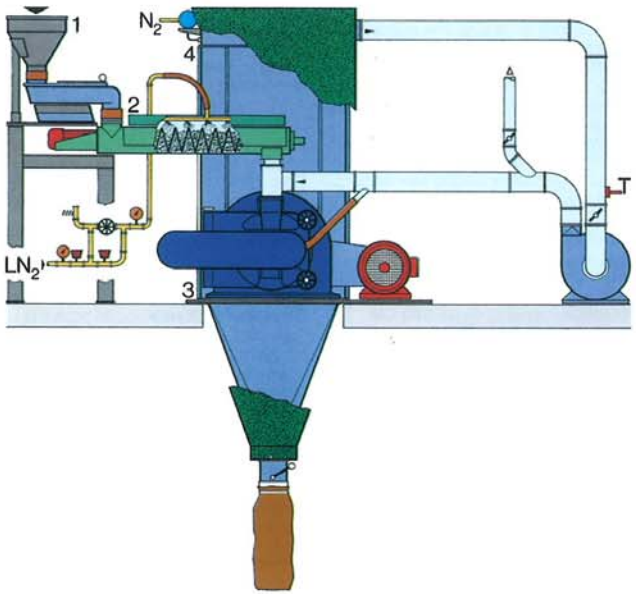
Chemical industry

Standard values for type:	250 CW kg/h	Fineness % < µm
Adsorption agent	150	99 % < 15
Ammonium nitrate	400	99 % < 120
Earthy cerussite	300	99 % < 20
Potassium sulphate	200	99 % < 20
Potassium carbonate	1500	98 % < 40
Magnesium oxide	300	99 % < 30
Melamine	600	99 % < 60
Sodium phosphate	500	95 % < 50
Vitamin C	450	98 % < 120

E-PVC Grinding-Classifying Systems
The system schematic shows an Alpine grinding-classifying system for the processing of spray-dried E-PVC.
Process data are:
☐ Feed material:
– spray product fineness approx. 90 % < 63 µm
☐ End product fineness:
– Quality A: 0.5 % R 63 µm
1.5 % R 40 µm
– Quality B: < 315 µm
☐ System capacity:
– Feed approx. 1.8 t/h
– Quality A: approx. 1670 kg/h
– Quality B: up to 7 % ≙ 130 kg/h.
Major processing stages are:
1 = Alpine Turboplex® Ultra-Fine Classifier to classify the "quality A". Fines yield approx. 50 %.
2 = Contraplex® Wide-Chamber Mill Type 710 CW to finely grind the coarse material from the classifier (stage 1).
3 = Alpine Turboplex® Ultra-Fine Classifier to classify the "quality A".
4 = Contraplex® Wide-Chamber Mill Type 250 CW for the subsequent post-grinding of the classifier coarse material from stage 3 to an end-product fineness matching "quality B".



Cryogenic grinding with liquid nitrogen



Why nitrogen cooling?
At normal temperatures, tough and elastic materials cannot be ground to a fine-grained powder, even when the grinding media are run at high speed. With "cool" grinding, however, the use of liquid nitrogen renders the material brittle prior to the cool grinding stage, with the effect that plastics and rubber granulates, etc. can now be ground to a fine, easily-flowing powder.
Typical materials are:
– Polyamide – fusion adhesive – PVC – Polyester – caoutchouc – rubber, etc.
Dependent on the product and the fineness, the specific nitrogen consumption ranges between approx. 0.7 and 2.5 kg N_2/kg powder. In the majority of cases, employment of the 250 CW and 400 CW models is sufficient to cover the customary capacity demands.
Contraplex® cool grinding advantages:
- extremely high grinding finenesses
- favourable N_2 consumption due to low milling air volume

Existing machines can be converted to operate as "cool" grinding mills.

Cryogenic grinding of foodstuffs
Whereas cryogenic grinding is employed predominantly for spices, the Alpine cryogenic grinding systems are also used in practise for other materials with an extremely low melting point, such as fatty mixtures, baking agents, and pure coffee, etc.
The advantages are:
☐ Optimal retention of aroma and strength. In contrast to normal grinding, where between approx. 15 and 43 % essential oils are lost, the loss with cryogenic grinding is minimal (approx. 3–10 %), representing a vast improvement – see table.
☐ Approx. 2 or 3 times more grinding capacity.
☐ No danger of overheating, etc.

Table: A comparison of the essential oil content:

Spice			Grinding			
Type	Original		Normal		Cool (LN_2)	
	v/g	%	v/g	%	v/g	%
Pepper						
– white	3.38	100	1.95	57.8	3.19	94.5
– black	3.37	100	2.21	65.7	3.09	92.0
Pimento	3.19	100	2.71	85.0	3.08	97.0
Mace	16.1	100	9.10	56.5	14.5	90.0
Cloves	17.3	100	11.5	66.0	16.5	95.0

v/g = ml/100 g

System construction
The schematic shows the basic construction of a cryogenic grinding system.
1 – Feed screw, alternatively: vibratory channel or rotary valve
2 – Screw cooler with whirling motion and liquid nitrogen feed (LN_2)
3 – Contraplex® Stud Mill
4 – Automatic filter in quick-change design; advantageous if the product is changed frequently
T – Temperature sensor
Turquoise – Insulated system components

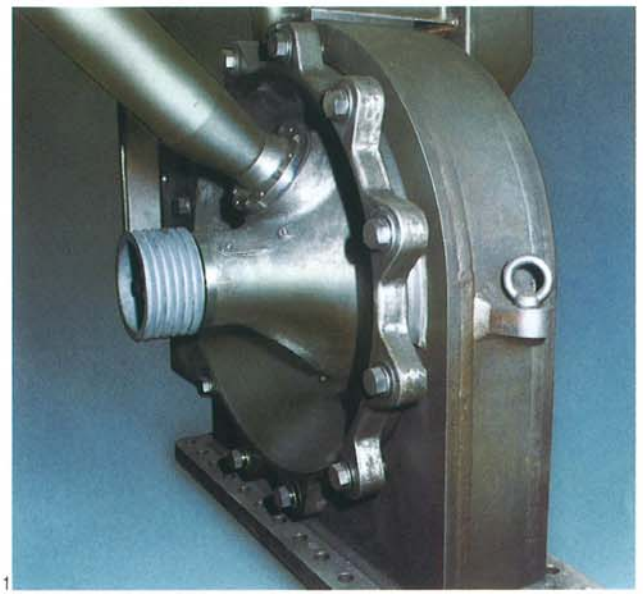
Consumption kg LN_2/kg product
(non-binding standard values)

Specific Grinding Capacity	Temperature at mill outlet		
	–10°C	0°C	+10°C
0.02 kWh/kg	0.25	0.2	0.15
0.05 kWh/kg	0.5	0.45	0.4
0.1 kWh/kg	1.0	0.9	0.85
0.15 kWh/kg	1.45	1.4	1.35

Practical values for spices:
Temperature at mill outlet approx. 0° C; sometimes as low as –5° C to –10° C. Consumption, dependent on spice and fineness, approx. 0.2–0.8 kg LN_2/kg product.

Explosion-pressure-shock-proof systems

Dust explosions can cause considerable damage to personnel and property, the consequences of which do not bear thinking about. The fine grinding process presents a special risk with respect to the possibility of an explosion occurring, for the explosion behaviour of dusts is, to a great extent, dependent on the particle size distribution. In short, fine dusts explode more violently than coarse dusts, but with a size of above approx. 400 microns there is usually little risk of an explosion.
It is important to realise that explosion-endangered materials are incredibly numerous and can be found without exception in every branch of industry.
When dealing with these kinds of materials, it is advisable to select the machines and system components in a pressure-shock-proof design; we will be happy to consult with you on the layout.
Upon request, our specialists will offer you comprehensive advice on all the protective measures available for your particular problem.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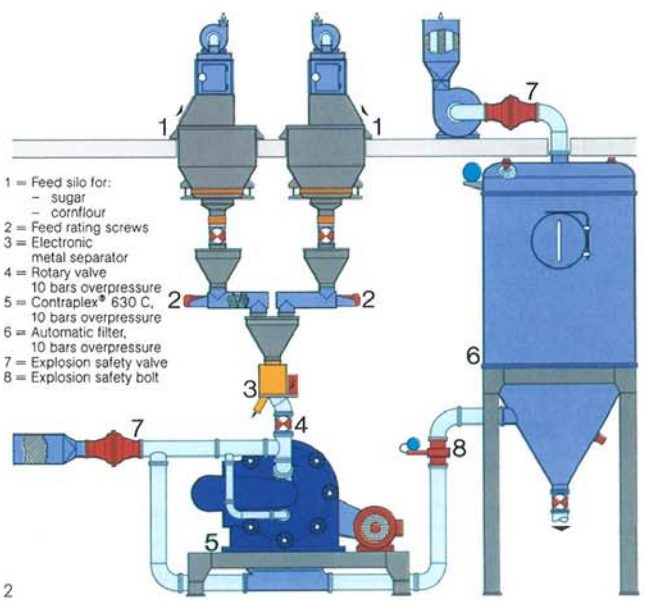
Dust explosin classes (St 1–St 3)
for some dust types:

Dextrose	St 1
Albumin, milk and fat	St 2
Cocoa-sugar mixtures	St 2
Cornflour	St 2
Lactose	St 1–2
Milk powder	St 1
Wheat flour	St 1
Sugar	St 1–2
E-PVC	St 1
Pigments	St 1–3
Pesticides	St 1–3
Zinc stearate	St 2

Explosion-pressure-shock-proof grinding systems for 10 bars overpressure
Ill. 1 = Type 630 C, 10 bars overpressure
Material: Sugar-cornflour mixture
Dust explosion class St 2
Feed: Sugar in granules
Cornflour as a powder
Fineness: 90 % < 75 µm
Capacity: approx. 5 t/h
Spec. energy: approx 19 kWh/t
Temperatures:
- Feed material 20° C
- Mill product/Mill 42° C
- Suction air – mill 25° C



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