



Advanced Designs
for Fine Grinding

NETZSCH

Grinding & Dispersion





DRY GRINDING AND CLASSIFYING

DISPERSION, PRE-MIXING & DE-AERATION

PLANETARY MIXERS

WET GRINDING AND DISPERSION

MODULE SYSTEMS

LABORATORY MILLS

ZSCH

TABLE OF CONTENTS:

COMPANY PROFILE	3-6
DRY GRINDING AND CLASSIFYING	7-20
Application Chart	8
Jet Mills	9-10
Classifier Mills	11-12
Impact Mills	13-14
Universal Mills	15-16
Air Classifiers	17-20
DISPERSION, PRE-MIXING & DE-AERATION	21-32
Application Chart	22
Dispensers	23-30
De-Aerators	31-32
PLANETARY MIXERS	33-36
WET GRINDING AND DISPERSION	37-57
Introduction	37-40
Application Chart	41-42
Grinding Mills	43-48
Technical Specifications	49
Dynamic Cartridge Media Separator™	50
Mechanical Seals and Service	51-52
Turbomill®	53-56
Mill Options	57
MODULE SYSTEMS	58-62
Dry Grinding & Classifying Systems	59
Control, Automation and Data Acquisition	60
Wet Grinding & Dispersion Systems	61-62
LABORATORY MILLS	63-68
Dry Grinding & Classifying	63-65
Wet Grinding & Dispersion	66-68
REFERENCE	69-72
Glossary of Terms	69-70
Metric Conversion Chart	71
Particle Size Conversion Chart	72
Media Specifications Chart	72



For more information call 610.363.8010

NETZSCH GRINDING & DISPERSION—NETZSCH INCORPORATED

Matching the exact requirements of each customized application. Exceeding customer expectations with R&D support, technical consulting and service. Delivering equipment of exceptional quality and absolute functional reliability. Backed by over a 100-year history of advances, innovation and superior performance.

SIZE REDUCTION, NETZSCH IS A UNIQUELY CAPABLE RESOURCE

Netzsch is a fully staffed, single-source, U.S. supplier of grinding and dispersion equipment. Our Exton, Pa, corporate headquarters houses every phase of machinery development and production: R&D, engineering, manufacturing, comprehensive analytical and proving laboratory, service and parts inventory. We welcome customer visits to our facility.

Netzsch Incorporated is part of the Netzsch Group of companies, diversified global manufacturers with operations in 14 countries spanning four continents. The Grinding and Dispersion division maintains 36 locations throughout the world. Global technology transfers advance state-of-the-art processing solutions and bring these benefits to our North American customers.

Our extensive experience in scale-ups covers all machine types, adding value to our customers' installations and ensuring the viability of their investments.



Our seven-acre campus contains over 70,000 square feet with manufacturing, engineering, testing laboratories, marketing and corporate offices.



U.S.-based engineering meets the needs of our domestic customers.

Every machine Netzsch manufactures carries this performance commitment:

Netzsch guarantees that the supplied equipment will operate exactly as promised. We stand behind every machine we manufacture.

SINGLE-SOURCE RESPONSIBILITY PROVIDES SINGLE-SOURCE GRINDING ASSURANCE

Netzsch technical sales staff provides customers with direct access to engineering expertise. Thorough understanding of the process and each application's objectives enables optimal, sound recommendations.



Customers visit our full-scale proving laboratory as part of a facility tour.

We engineer the full range of particle size reduction needs — systems that will accommodate the highly coarse to the submicron size particle reductions.

NETZSCH

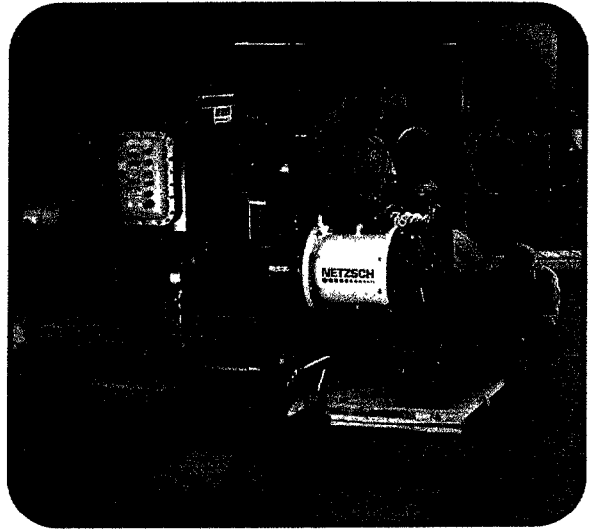
Grinding & Dispersion

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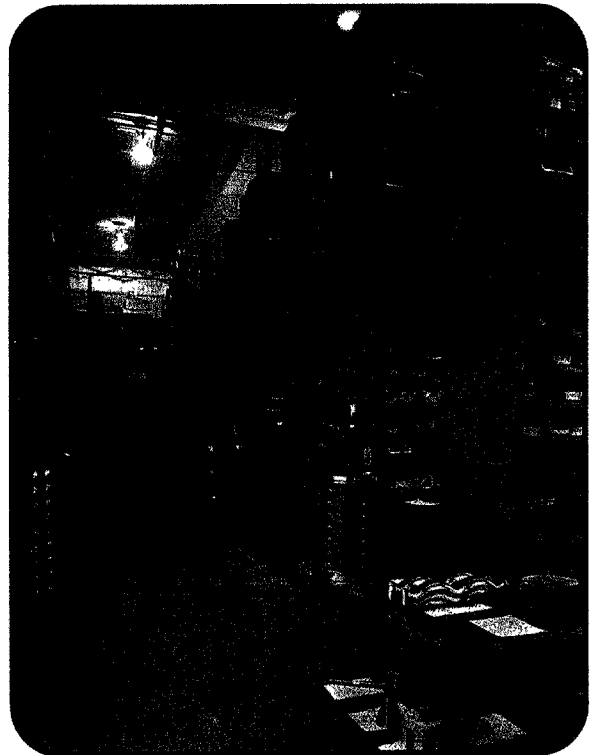
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NETZSCH OFFERS OUR CUSTOMERS DISTINCT ADVANTAGES:

- *Quality is designed, engineered and built into every machine. All component parts as well as the final product meet Netzsch rigorous quality standards. The result is not only consistent quality grinding, but at the lowest cost...so the highest quality standards for our customers' products can be achieved.*
- *Throughout the decision process customers interface with our expert engineering and sales staff. Customers' requirements are carefully matched to create the machine's most appropriate configuration for process optimization.*
- *Netzsch machines are engineered for long-term reliability, durability and cost efficiency.*
- *Low energy consumption is a distinguishing advantage. Effective use of energy is an across-the-board design feature.*
- *Netzsch advanced designs offer significant improvements over older technology units (eg, Sand Mills, Ball Mills). They require less floor space, provide lower overall cost of operation and are supported by a comprehensive service department and spare parts inventory.*
- *Same-day shipment for most spare parts.*
- *Integration of Netzsch equipment into an existing system is readily accomplished.*

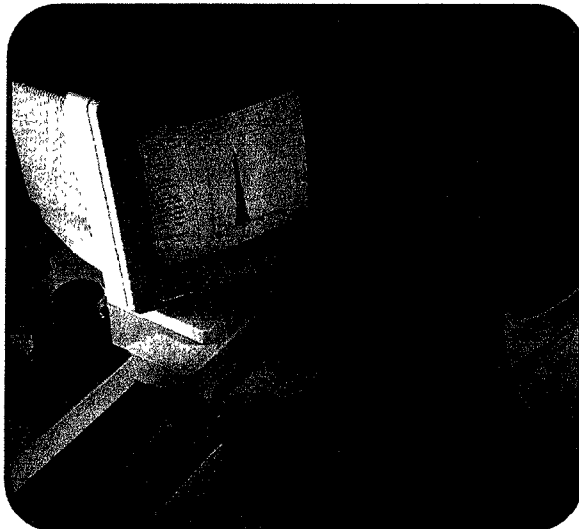


A Netzsch LMZ-25 in final stages of production.



Our large spare parts inventory ensures quick order turnaround.

- *Should the demands of processing change, Netzsch machines are easily convertible to meet new requirements.*
- *Netzsch designs offer many standard features that in other grinding units are available only as options, including drive components, sealing components and electrical controls.*
- *The Netzsch equipment rental fleet enables customers to perform in-plant evaluations on production-size machinery prior to purchasing. Many machines, from lab size to larger, are available through the rental program.*
- *The Netzsch Analytical Laboratory is the largest and most versatile in the industry. Material testing in an operating pilot plant environment is available to our customers.*
- *All Netzsch equipment is custom-engineered for individual applications and to meet the specific requirements of individual industries. Thousands of machine variations can be configured utilizing Netzsch standard components.*
- *Automated process control systems allow consistent repeatability and provide for user-friendly operation.*
- *To our customers, these Netzsch advantages mean that Netzsch grinding equipment can be specified, purchased and operated with complete confidence.*



Particle size analyzer provides technical data for all lab tests.



In-house, state-of-the-art machine center used to manufacture parts.

DRY GRINDING & CLASSIFYING

Dry grinding is the process of reducing the particle size of materials while suspended in a gas. Two methods can be employed to perform size reduction: mechanical or air. In the mechanical method, rotating and stationary elements impart grinding energy, thus reducing particle size. In the air method, particle collision occurs with high pressure compressed air or nitrogen. Classifying is the process of using air and mechanical methods to separate particles according to size.

NETZSCH TECHNICAL EXPERTISE

With over 60 years' experience in the dry grinding and classifying industry, thousands of machines have been supplied to a broad range of markets. Machines range from small laboratory size to large production models. Each machine is tailored to the application. For example, food and pharmaceutical applications require polished stainless steel finishes and sanitary design, while the minerals and abrasives industries require wear-resistant or ceramic-lined machines. Our in-house engineering staff can offer the most productive and economical solutions for your requirements.

NETZSCH TECHNOLOGICAL ADVANCES

Subtle innovations permeate our equipment lines. Most notable of these innovations are our classifier wheels and jet mill technology.

Our classifier wheels and classifying technology are unmatched in the industry. Four styles of classifier wheels are available for the CGS, CFS, CSM and CP machines. These patented designs yield superior results.

Jet Mill grinding efficiency is largely controlled by the size, spacing and pressure of grinding jets. Recent innovations in the layout of jet nozzles have led to significant improvements in yields and throughput. See page 9 for more information.

Automatic/PLC controls can be supplied with all Netzsch equipment. We design to your specific requirements.

APPLICATION CHART

	CGS JET MILL	CSM CLASSIFIER MILL	CP IMPACT MILL	CUM UNIVERSAL MILL	CFS AIR CLASSIFIER	CFS HD-S AIR CLASSIFIER
Ultra-fine Grinding	A	B	B	B	A	A
Particle Size Control	A	A	A	A	A	A
Coarse Grinding	A	B	B	A	A	A
Heat-sensitive Materials	A	A	A	A	A	A
Ease of Product Change	A	A	A	A	A	A
Ease of Cleaning	A	A	A	A	A	A
Pressure Shock Resistance*	A	A	A	A	A	A
	APPLICATIONS	APPLICATIONS	APPLICATIONS	APPLICATIONS	APPLICATIONS	APPLICATIONS
	Chemicals	Coarse Grinding	Coarse Grinding	Grinding	High Speed	High Speed
	Comminution	Food	Pharmaceuticals	Slurries	High Speed	High Speed
	Explosive Materials	Minerals	Grain	Sugar		
	Inks	Silica	Charcoal	Crystallites		
	Paints	Silica Gel	Limestone	Amber		
	Plastic Compounds	Resins	Talcum	Vegetables		
	Resins	Waxes	Peat	Chemicals		
	Textiles	Dyes	Toner			
	Pharmaceuticals					
	Comminution					
Mohs' Hardness	1-4	1-5	1-5	1-5	1-5	1-5
Moisture†	<10%	<5%	<5%	<5%	<5%	<5%

A = Excellent B = Good C = Satisfactory

*Non-Pressure Shock Resistance (PSR) available

†Moisture content must be low enough to allow the products/powders to remain flowable

Other Products Offered by Netzsch:

- Single Roller Grinders
- Granulators
- Plastcompactors



For more information call 610.363.8010

CGS FLUIDIZED BED JET MILL

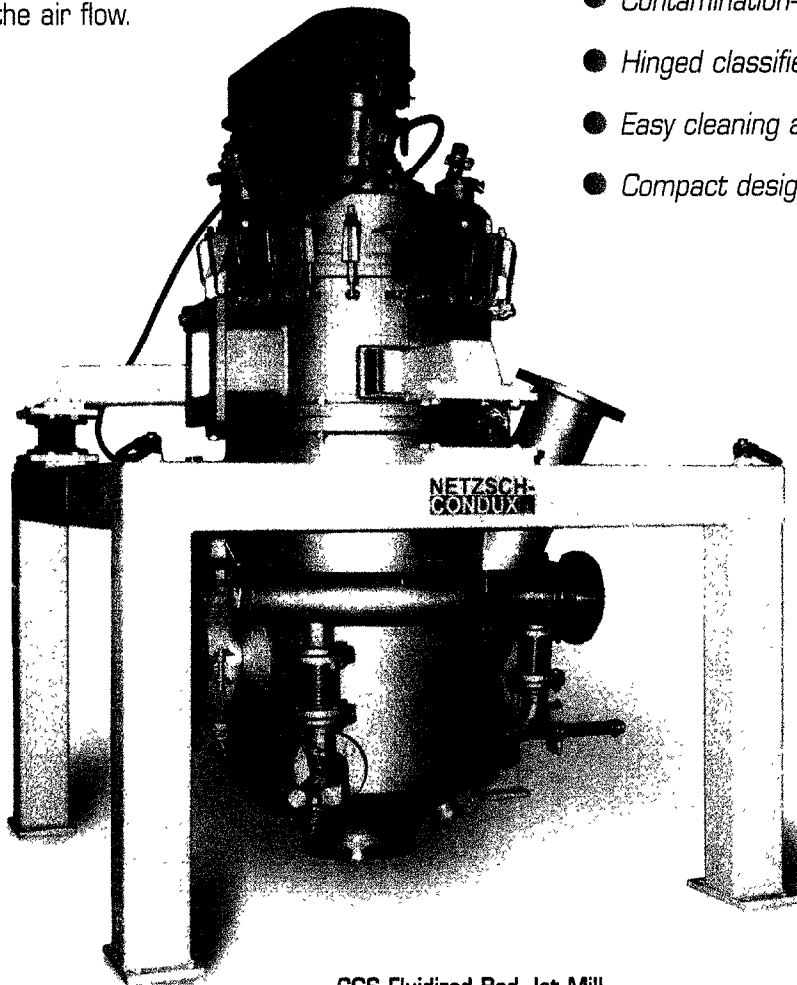
The CGS is a Fluidized Bed Jet Mill using high pressure air or nitrogen to reduce friable particles of any hardness to a size of 2 μm to 70 μm . Jet Mills are used primarily for hard abrasive materials and/or temperature-sensitive materials.

ENGINEERING AND OPERATING PRINCIPLES

High pressure air (or nitrogen) is supplied to the grinding tank through three Laval nozzles. The expanding gas agitates a fluidized bed of product, resulting in shear and collision of the particles, thus reducing their size. A variable speed classifier wheel controls the outlet size of the particles. This concept provides for excellent grinding; wear and contamination are minimized. The efficiency is adjusted by varying the size, spacing and configuration of nozzles and by controlling the air flow.

FEATURES AND BENEFITS

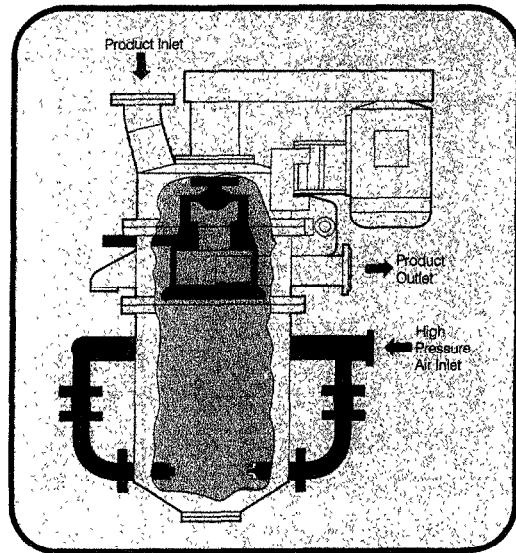
- *Ultra-fine grinding*
- *Superior nozzle design*
- *Patented classifier technology*
- *No oversize particles*
- *Tight particle size control*
- *Patented single classifier wheel mounted on vertical shaft*
- *Contamination-free*
- *Hinged classifier head*
- *Easy cleaning and maintenance*
- *Compact design*



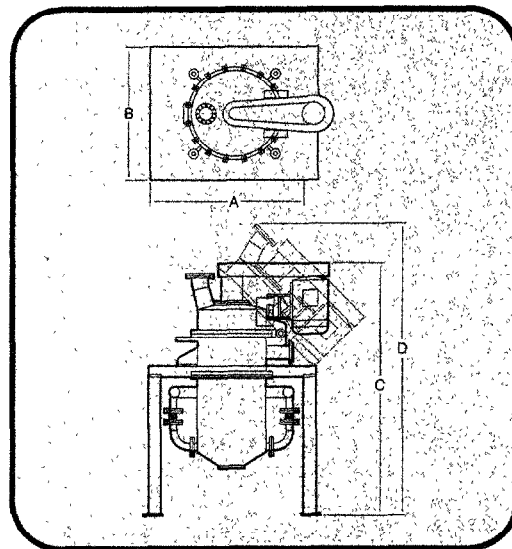
CGS Fluidized Bed Jet Mill

ATIONS

- Ceramic inner lining
- Polyurethane inner lining
- Hot gas operation
- Ceramic classifier wheel
- Special nozzle designs
- Automated controls
- Pressure shock resistance (PSR)
- Closed-loop processing



CGS Process Flow Diagram



CGS Technical Dimensions

TECHNICAL SPECIFICATIONS

Model	Scale-up Factor*	Classifier Power (kw/hp)	Classifier Speed Max (rpm)	Nominal Air Flow (m ³ -hr/cfm)	A (mm/in)	B (mm/in)	C (mm/in)	D (mm/in)	Approx. Weight (kg/lb)
CGS-11	0.5	1.0/1.3	1500	1000/350	600/24	1300/51	2000/79	2200/87	340/750
CGS-22	0.5	2.0	1500	2000/700	1000/40	1600/63	2400/94	1670/66	570/1250
CGS-33	1	6.5/7.5	2000	3500/1200	1300/51	1900/75	3100/122	2200/86	1150/2500
CGS-71	2	10/20	2000	1700/600	1500/59	2000/79	3400/134	3100/124	2020/4450
CGS-100	4	20/40	2000	2400/850	1500/59	1900/75	2850/110	3800/150	4300/9450
CGS-120	6	20/40	2200	3100/1100	2200/87	2200/87	4320/170	3200/124	6700/14600
CGS-150	10	60/125	1800	10000/3500	3000/118	5000/195	7000/275	4000/1515	6050/13400

Note. In accordance with the Company's policy of continual product development and improvement, the above specifications are subject to amendment without notice.

*CGS 50 baseline scale factor.

CSM CLASSIFIER MILL

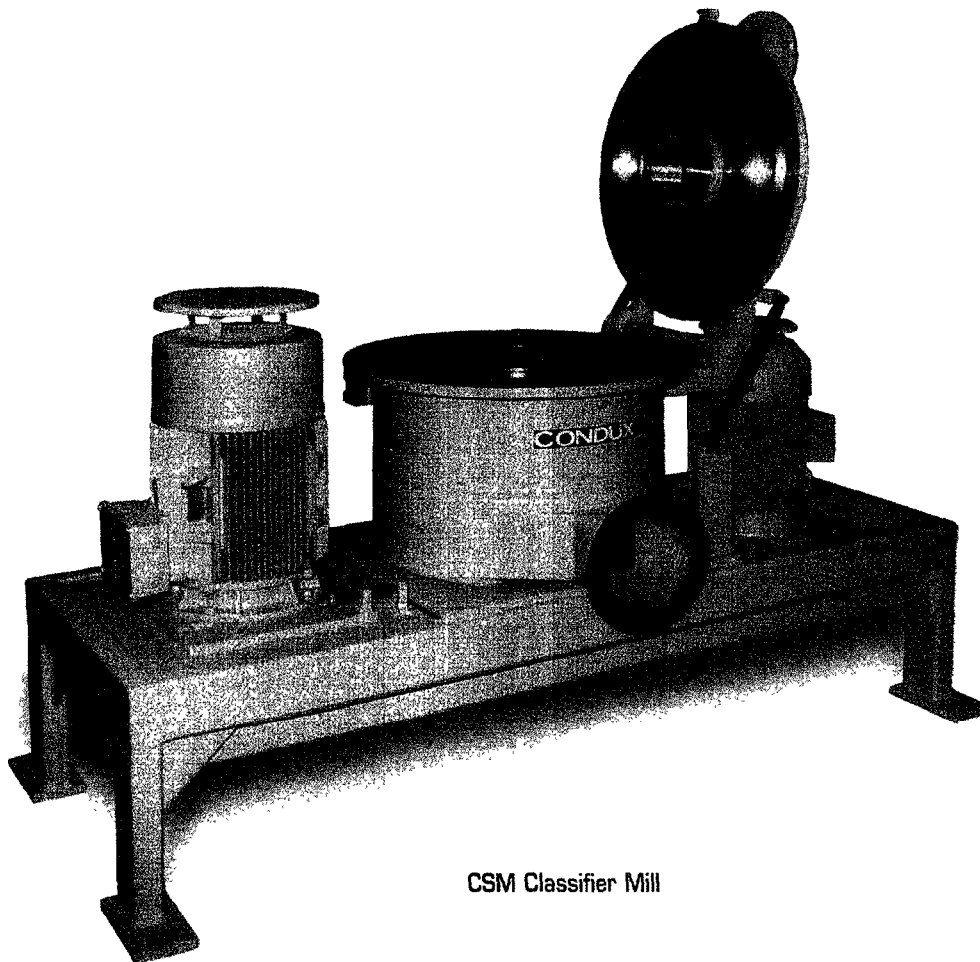
The CSM Classifier Mill is used to grind materials up to a Mohs' hardness of 3.5. Deagglomeration is possible on products up to a Mohs' hardness of 5. Particle sizes of 8 μm to 180 μm can be achieved and tightly controlled by the built-in classifier. High volume air flows allow the processing of temperature-sensitive materials.

ENGINEERING AND OPERATING PRINCIPLES

Particles are ground by applying mechanical force through a rotating grinding disc and stationary grinding track. High volume, low pressure air circulates the particles between the grinding zone and the classifying zone. In the classifying area, a variable speed classifier wheel controls the outlet particle size.

FEATURES AND BENEFITS

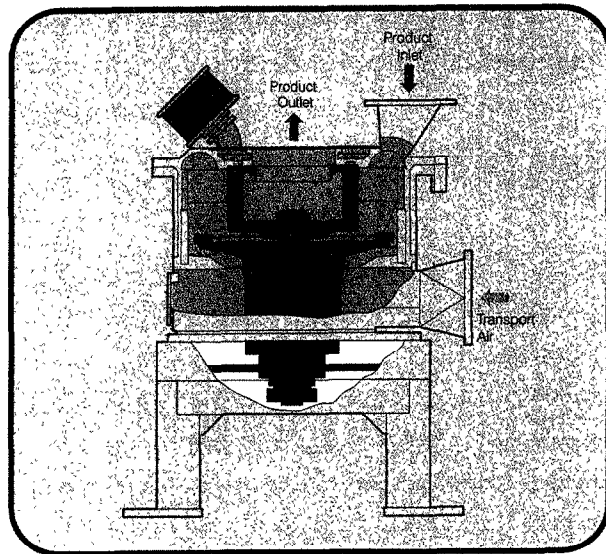
- *Narrow outlet particle size control*
- *Excellent bearing and classifier purge*
- *Replaceable beaters and grinding track*
- *Control of process temperature*
- *Superior classifier wheel design*
- *Easy cleanup and product changes*
- *Ease of access for routine maintenance*



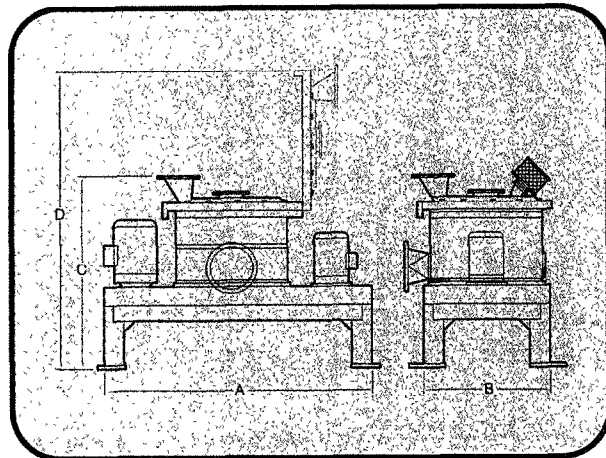
CSM Classifier Mill

ATIONS

- Cooled air milling
- Automated controls
- Ceramic grinding elements
- Pressure shock resistance (PSR)
- Ceramic classifier wheel
- Hard metal classifier wheel
- Closed-loop processing



CSM Process Flow Diagram



CSM Technical Dimensions

TECHNICAL SPECIFICATIONS

Model	Scale-up Factor*	Mill Power (kw/hp)	Classifier Power (kw/hp)	Classifier Speed Max. (rpm)	Nominal Air Flow (m ³ -hr/cfm)	A (mm/in)	B (mm/in)	C (mm/in)	D (mm/in)	Approx. Weight (kg/lb)
CSM 360	1	110/150	110/150	1100	1100/1100	1100/1100	1100/1100	1100/1100	1100/1100	2200/2400
CSM 360	2	220/300	220/300	1100	2200/2200	2200/2200	2200/2200	2200/2200	2200/2200	4400/4800
CSM 360	3	330/450	330/450	1100	3300/3300	3300/3300	3300/3300	3300/3300	3300/3300	6600/7200
CSM 360	4	440/600	440/600	1100	4400/4400	4400/4400	4400/4400	4400/4400	4400/4400	8800/9600
CSM 360	5	550/750	550/750	1100	5500/5500	5500/5500	5500/5500	5500/5500	5500/5500	11000/12000
CSM 360	6	660/900	660/900	1100	6600/6600	6600/6600	6600/6600	6600/6600	6600/6600	13200/14400
CSM 360	7	770/1050	770/1050	1100	7700/7700	7700/7700	7700/7700	7700/7700	7700/7700	15400/16800
CSM 360	8	880/1200	880/1200	1100	8800/8800	8800/8800	8800/8800	8800/8800	8800/8800	17600/19200
CSM 360	9	990/1350	990/1350	1100	9900/9900	9900/9900	9900/9900	9900/9900	9900/9900	19800/21600
CSM 360	10	1100/1500	1100/1500	1100	11000/11000	11000/11000	11000/11000	11000/11000	11000/11000	22000/24000

Note: In accordance with the Company's policy of continual product development and improvement, the above specifications are subject to amendment without notice.

*CSM 360 baseline scale factor:

CP IMPACT MILL

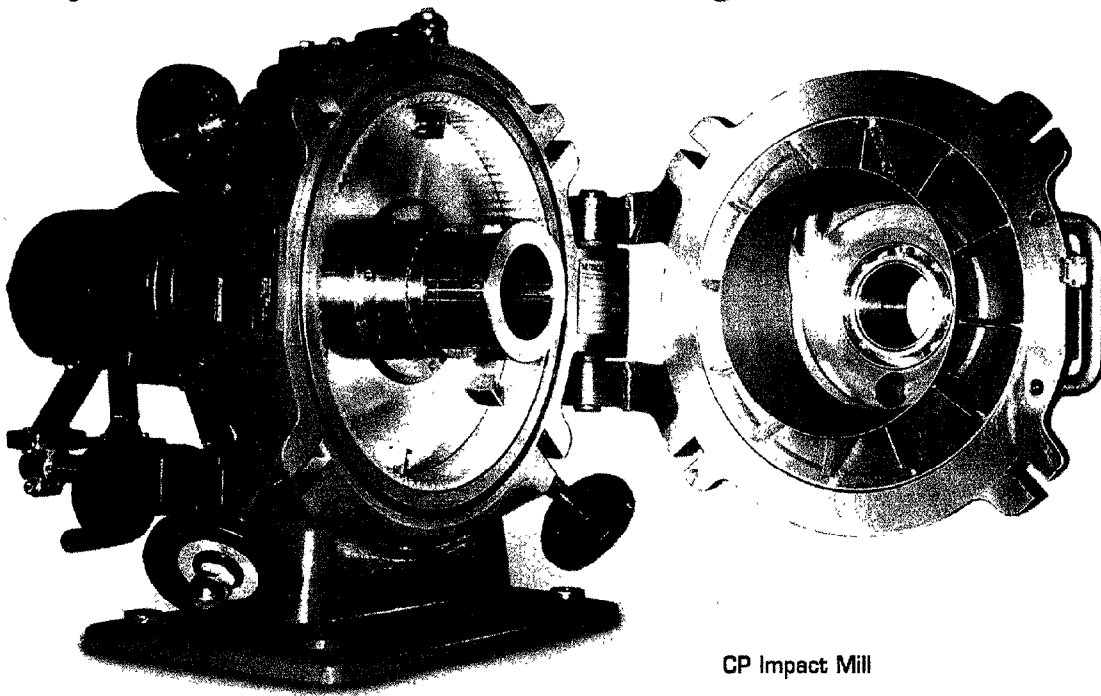
The CP Impact Mill is a unique single drive version of the classifier mill used to grind material to a final size of 30 μm to 150 μm . Outlet particle size is controlled with a variable area classifier wheel.

ENGINEERING AND OPERATING PRINCIPLES

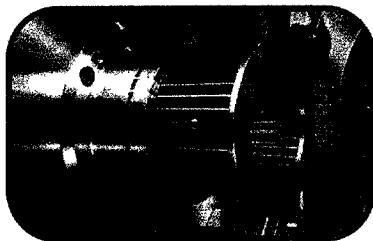
Similar to the traditional classifier mill, particles are ground by a rotating grinding disc and stationary grinding track. Unlike a traditional classifier mill, a single drive shaft rotates the grinding disc and the classifier wheel. Outlet particle size is adjusted by changing the outlet area of the classifier wheel, not the speed (see below). The result is a sharp cut-point and a *single* drive shaft. The grinding area has also been changed to a vertical layout to simplify cleaning.

FEATURES AND BENEFITS

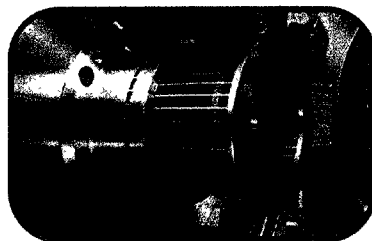
- *Easy cleaning*
- *Fast product or color changes*
- *Single drive shaft*
- *Tight outlet particle size control*
- *Lower energy consumption*
- *Optimized product flow*
- *Compact design*
- *Reduced maintenance*



CP Impact Mill



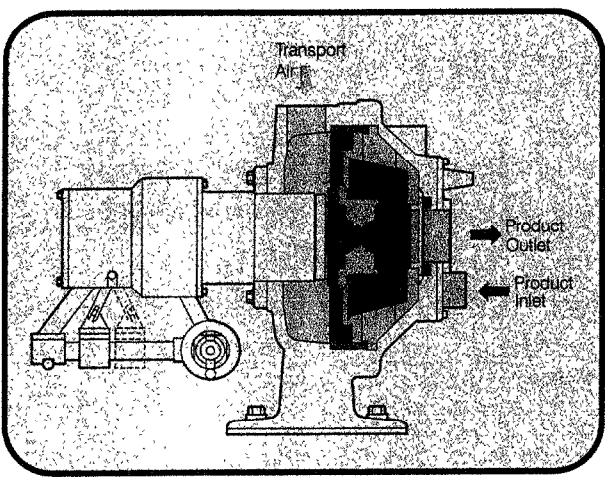
Classifier wheel "fine"



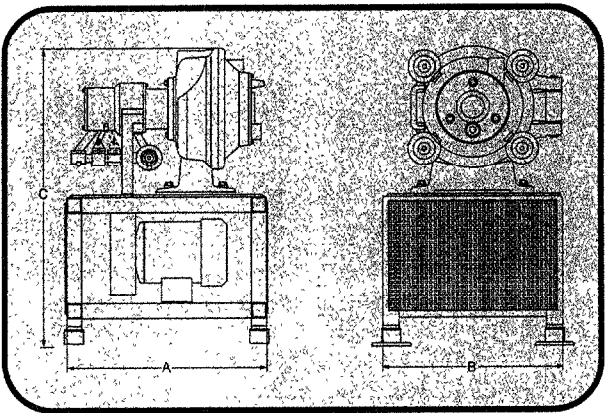
Classifier wheel "coarse"

ATIONS

- Cooled air milling
- Automated controls
- Ceramic grinding elements
- Pressure shock resistance (PSR)
- Closed-loop processing



CP Process Flow Diagram



CP Technical Dimensions

TECHNICAL SPECIFICATIONS

Model	Scale-up Factor*	Throughput Max. (m ³ -hr/cfm)	Rotor Speed Max. (rpm)	Mill Power (kw/hp)	A (mm/in)	B (mm/in)	C (mm/in)	Approx. Weight (kg/lb)
CP 360	1	1000	1500	15/20	1000/40	1000/40	1000/40	1000/2200
CP 360	2	2000	1500	15/20	1000/40	1000/40	1000/40	1000/2200
CP 360	3	3000	1500	15/20	1000/40	1000/40	1000/40	1000/2200
CP 360	4	4000	1500	15/20	1000/40	1000/40	1000/40	1000/2200
CP 360	5	5000	1500	15/20	1000/40	1000/40	1000/40	1000/2200
CP 360	6	6000	1500	15/20	1000/40	1000/40	1000/40	1000/2200
CP 360	7	7000	1500	15/20	1000/40	1000/40	1000/40	1000/2200
CP 360	8	8000	1500	15/20	1000/40	1000/40	1000/40	1000/2200
CP 360	9	9000	1500	15/20	1000/40	1000/40	1000/40	1000/2200
CP 360	10	10000	1500	15/20	1000/40	1000/40	1000/40	1000/2200

Note: In accordance with the Company's policy of continual product development and improvement, the above specifications are subject to amendment without notice.

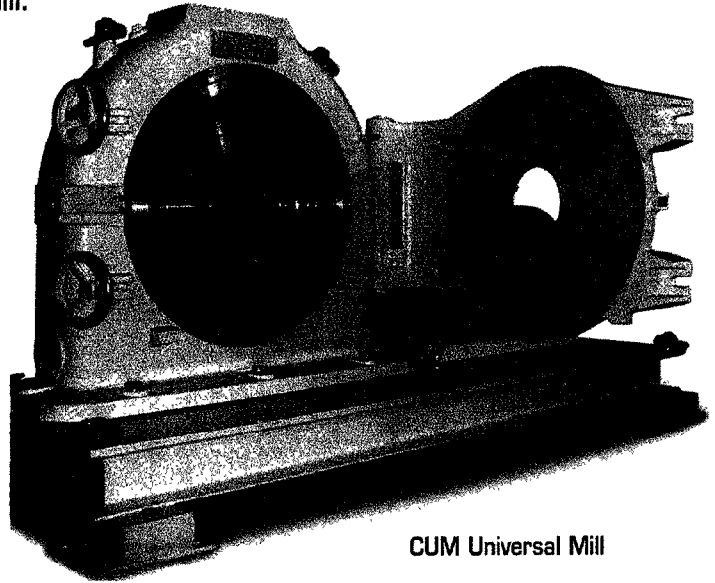
*CP 360 baseline scale factor.

CUM UNIVERSAL MILL

The CUM Universal Mill is used to grind material between 50 μm and 2000 μm . There are four independent attachments for grinding that offer the ability to grind a broad range of feed particles. Interchangeability is a key feature of this mill.

ENGINEERING AND OPERATING PRINCIPLES

The Universal Mill allows a selection of four different rotating and stationary elements. Depending upon the material to be processed and the desired end product fineness, these interchangeable tools provide optimal grinding results.



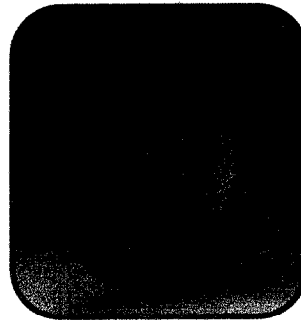
CUM Universal Mill



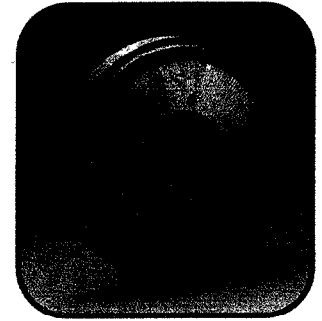
The **Wing Beater** is a fixed-arm impact tool. The stationary element contains either a screen or a combination screen/grinding track. Finished product fineness down to 500 μm .



The **Blast Rotor** is a very aggressive fixed-blade rotor that produces high energy and high air flow. A screen or screen/grinding track combination controls the outlet particle size. Produces finished product down to 100 μm .



The **Pin Disc** is an aggressive high speed grinding tool using pins to produce impact. This tool does not use a fixed blade, rather a set of stationary and rotating pins. Counter rotating discs are also available. Finished product fineness down to 50 μm .



Grinding Discs are a pair of serrated plates used to pulverize different materials, primarily plastic pellets. Particle size is controlled by adjusting the gap between the discs. Produces finished product down to 400 μm .



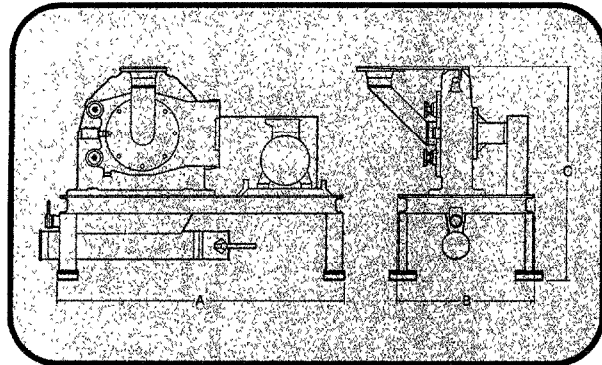
Optional: Screen insert, a long grinding track or a combination of grinding track and screen.

FEATURES AND BENEFITS

- Ultimate flexibility
- Easily interchangeable grinding elements
- Simple rugged design
- Easily adjustable outlet size
- Simple to operate
- Temperature control

ADVANTAGES

- Variety of grinding elements
- Stainless steel construction
- Pressure shock resistance (PSR)



CUM Technical Dimensions

TECHNICAL SPECIFICATIONS

	CUM 150	CUM 300	CUM 450	CUM 680	CUM 900	CUM 1250
Scale-up Factor*	1	2	3	4.5	6	8.3
Wing Beater						
Diameter (mm/in)	150/6	300/12	450/18	680/27	900/36	1250/49
Speed (rpm)	1100	1100	1200	1200	1100	1100
Power (kw/hp)	11/15	31/41	27/36	30/40	75/100	100/130
Air Flow (m ³ -hr/cfm)	100/35	300/105	450/155	680/235	900/315	1250/435
Blast Rotor						
Diameter (mm/in)	150/6	300/12	450/18	680/27	900/36	1250/49
Speed (rpm)	1500	7500	4000	3700	3500	1600
Power (kw/hp)	7.5	19/25	37/50	75/100	110/150	200/260
Air Flow (m ³ -hr/cfm)	100/35	300/105	450/155	680/235	900/315	1250/435
Pin Disc						
Diameter (mm/in)	150/6	300/12	450/18	750/30	900/36	1250/49
Speed (rpm)	1800	3200	3500	3500	3200	3200
Power (kw/hp)	17.5	13/17	37/50	75/100	110/150	200/260
Air Flow (m ³ -hr/cfm)	100/35	300/105	450/155	680/235	900/315	1250/435
Counter-rotating Pin Disc						
Diameter H/D* (mm/in)	150/6	300/12	450/18	680/27	900/36	1250/49
Speed H/D (rpm)	1500	2000/1400	2000/1400	2000/1400	2000/1400	2000/1400
Power H/D (kw/hp)	17.5	22/29	40/53	60/80	80/105	120/160
Air Flow (m ³ -hr/cfm)	100/35	300/105	450/155	680/235	900/315	1250/435
Grinding Disc						
Diameter (mm/in)	150/6	300/12	450/18	680/27	900/36	1250/49
Speed (rpm)	1100	1200	1200	1200	1100	1100
Power (kw/hp)	11/15	31/41	27/36	30/40	75/100	100/130
Air Flow (m ³ -hr/cfm)	100/35	300/105	450/155	680/235	900/315	1250/435
Dimensions						
A (mm/in)	1100/43	1600/63	2000/79	2400/94	2700/106	3000/118
B (mm/in)	1100/43	1600/63	2000/79	2400/94	2700/106	3000/118
C (mm/in)	1100/43	1600/63	2000/79	2400/94	2700/106	3000/118
Approx. Weight (kg/lb)	230/506	425/937	630/1388	2050/4528	3900/8582	5000/11018

Note: In accordance with the Company's policy of continual product development and improvement, the above specifications are subject to amendment without notice.

H/D = Housing and door drive

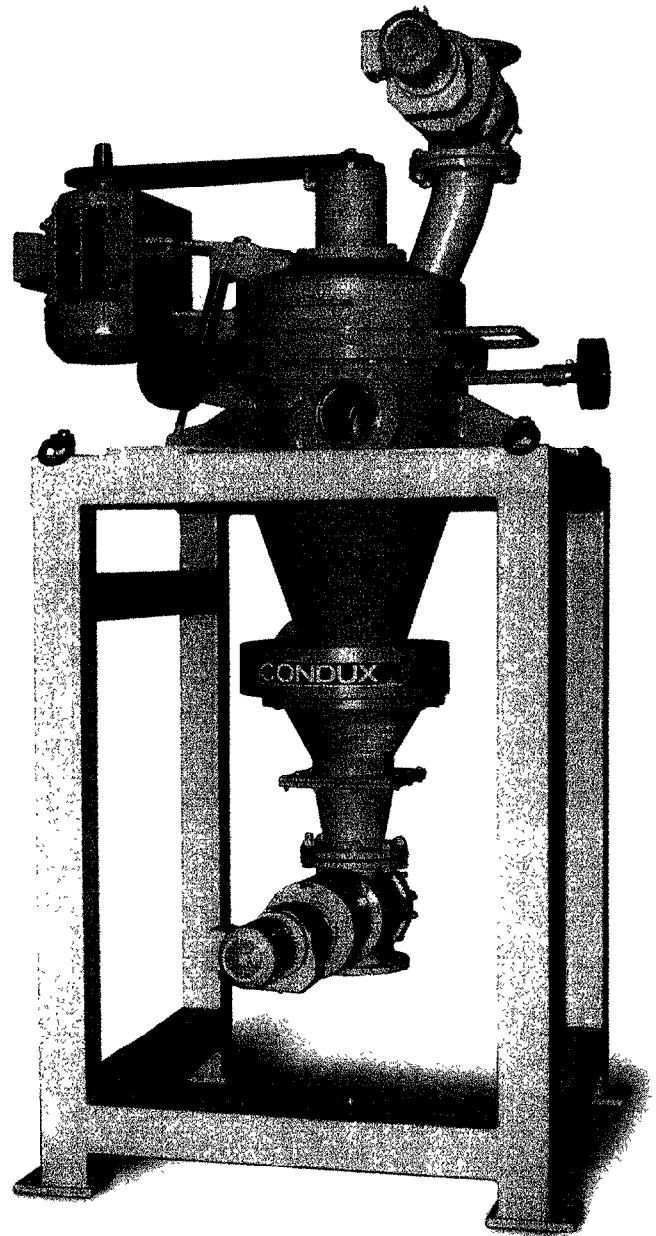
*CUM 300 baseline scale factor

CFS MECHANICAL AIR CLASSIFIER

The CFS Mechanical Air Classifier is a cyclone classifier with an internal classification wheel used to separate particles of any hardness in the 25 μm to 150 μm range. Outlet particles can be varied in size by adjusting the classifier wheel speed.

ENGINEERING AND OPERATING PRINCIPLES

A vortex of inlet air is created at the base of the classifier cone. Material is metered into the top of the machine. Coarse particles migrate to the center of the vortex and exit the rotary outlet valve at the bottom of the cone. Fine particles are carried in the classifying air at velocities sufficient to allow them to pass through the rotating classifier wheel. The outlet particle size is adjusted by varying the speed of the classifier wheel.



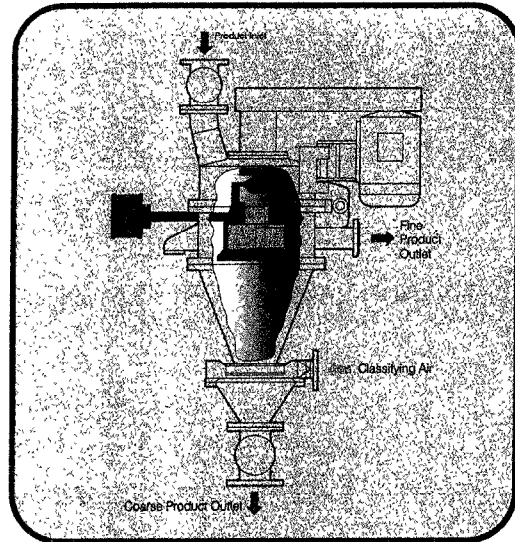
CFS Mechanical Air Classifier

FEATURES AND BENEFITS

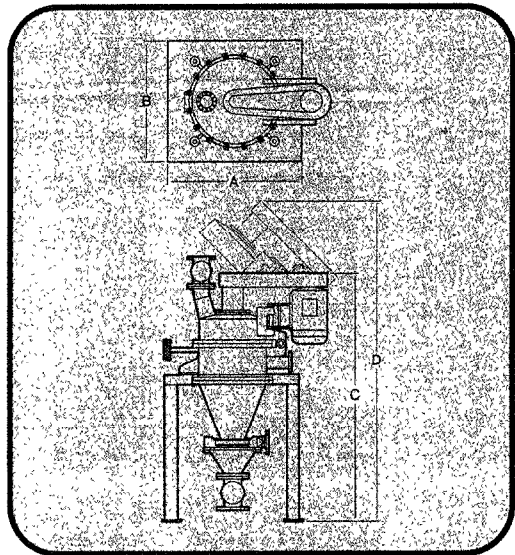
- Easily adjustable outlet size
- Easy cleaning and maintenance
- Sharp cut-points
- Patented single classifier wheel mounted on vertical shaft
- No oversize particles
- Even classifier wheel loading

CONDITIONS

- Wear-resistant ceramic lining
- Pressure shock resistance (PSR)
- Ceramic classifier wheel
- Hard metal classifier wheel
- Closed-loop operation
- Automated controls



CFS Process Flow Diagram



CFS Technical Dimensions

TECHNICAL SPECIFICATIONS

Model	Scale-up Factor*	Classifier Power (kw/hp)	Classifier Speed Max. (rpm)	Nominal Air Flow (m ³ -hr/cfm)	A (mm/in)	B (mm/in)	C (mm/in)	D (mm/in)	Approx. Weight (kg/lb)
CFS 10	1	1.5/2	1500	100/350	100/4	100/4	100/4	100/4	100/220
CFS 20	2	3.0/4	1500	200/700	200/8	200/8	200/8	200/8	500/1250
CFS 30	3	4.5/6	1500	300/1050	300/12	300/12	300/12	300/12	800/1900
CFS 40	4	6.0/8	1500	400/1400	400/16	400/16	400/16	400/16	1000/2300
CFS 50	5	7.5/10	1500	500/1750	500/20	500/20	500/20	500/20	1300/3000
CFS 60	6	9.0/12	1500	600/2100	600/24	600/24	600/24	600/24	1600/3700
CFS 70	7	10.5/14	1500	700/2450	700/28	700/28	700/28	700/28	2000/4500
CFS 80	8	12.0/16	1500	800/2800	800/32	800/32	800/32	800/32	2400/5500
CFS 90	9	13.5/18	1500	900/3150	900/36	900/36	900/36	900/36	2800/6500
CFS 100	10	15.0/20	1500	1000/3500	1000/40	1000/40	1000/40	1000/40	3200/7500

Note: In accordance with the Company's policy of continual product development and improvement, the above specifications are subject to amendment without notice.

*CFS 85 baseline scale factor

CFS HD-S MECHANICAL AIR CLASSIFIER

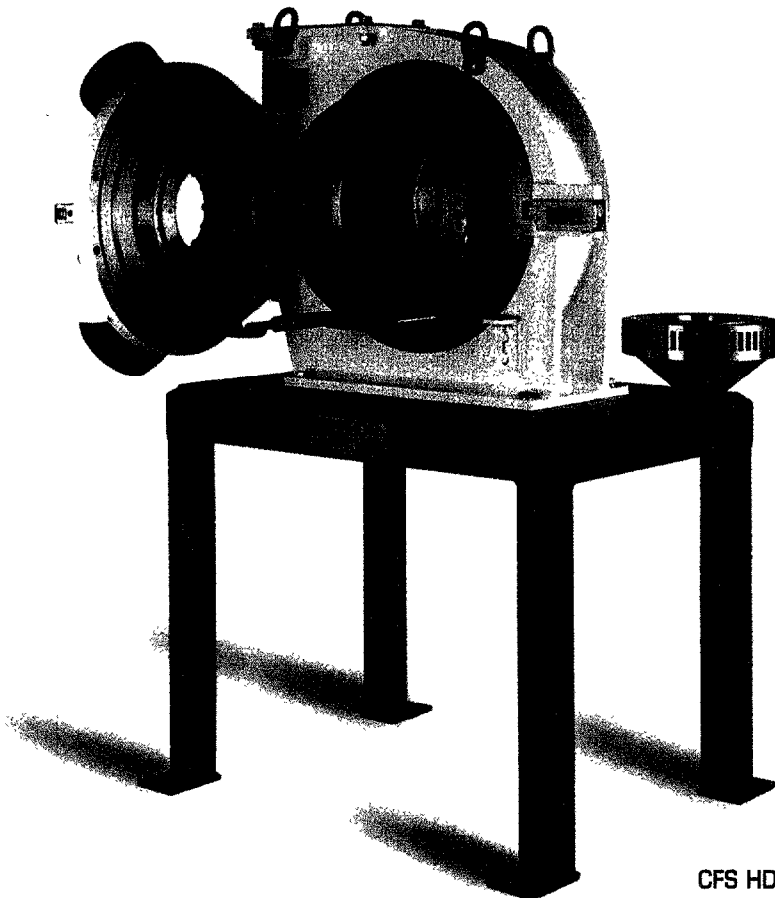
The CFS HD-S is a high dispersion, ultra-fine classifier used to separate particles of any hardness in the 1 μm to 50 μm range. This Netzsch machine produces the sharpest cut-point in the industry.

ENGINEERING AND OPERATING PRINCIPLES

Classifying air is drawn into the classifier via a downstream blower. The air passes through a distribution ring where it disperses the incoming powder. The coarse material continues in a spiral action and is discharged through a double flap valve located at the bottom of the classifier. Fines are carried with the classifying air through the patented classifier wheel to the separation cyclone or baghouse. Coarse material has an unimpeded path to the outlet and, is therefore, efficiently classified without being accidentally ground. The constant velocity classifier wheel, dispersion ring and spiral coarse outlet path combine for the sharpest cut-point available.

FEATURES AND BENEFITS

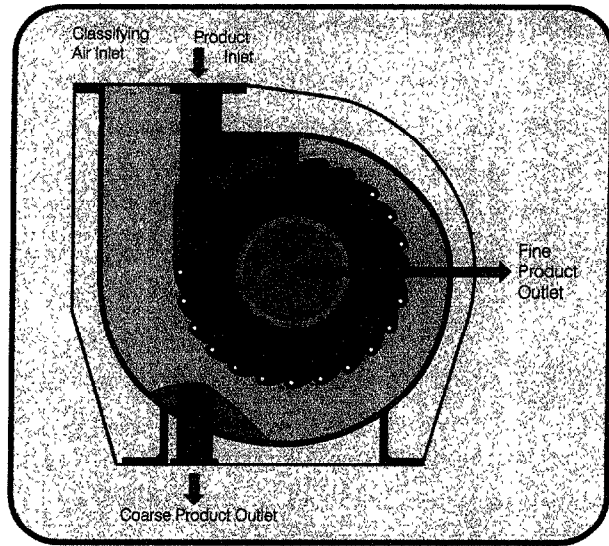
- *Ultra-fine classification*
- *Superior bearing design*
- *Extremely sharp cut-points*
- *No oversize particles*
- *High yields/high efficiency*
- *Spiral coarse product outlet flow*
- *Easy access to classifier wheel*
- *Compact design*
- *Constant velocity classifier wheel*
- *Energy efficient*



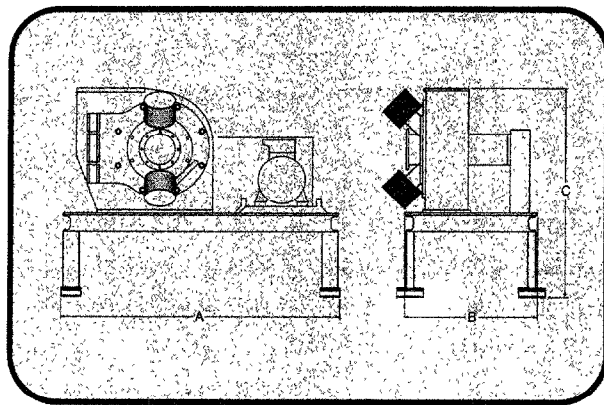
CFS HD-S Mechanical Air Classifier shown with classifier wheel removed

FEATURES

- *Stainless steel construction*
- *Ceramic classifier wheel*
- *Hard metal classifier wheel*
- *Pressure shock resistance (PSR)*
- *Automated controls*
- *Wear-resistant design*



CFS HD-S Process Flow Diagram



CFS HD-S Technical Dimensions

TECHNICAL SPECIFICATIONS

Model	Scale-up Factor*	Classifier Power (kw/hp)	Classifier Speed Max. (rpm)	Nominal Air Flow (m ³ -hr/cfm)	A (mm/in)	B (mm/in)	C (mm/in)	Approx. Weight (kg/lb)
CFS 85	1	1.5/2	2000	1000/35	1000/40	1000/40	1000/40	300/750
CFS 100	1.18	2.0/2.7	2000	1300/46	1300/51	1300/51	1300/51	400/1100
CFS 125	1.47	2.5/3.4	2000	1600/57	1600/63	1600/63	1600/63	500/1400
CFS 150	1.77	3.0/4.1	2000	2000/71	2000/79	2000/79	2000/79	700/1950
CFS 200	2.37	4.0/5.4	2000	2600/93	2600/103	2600/103	2600/103	1000/2750
CFS 250	2.98	5.0/6.8	2000	3300/117	3300/130	3300/130	3300/130	1400/3900
CFS 300	3.61	6.0/8.1	2000	4000/142	4000/155	4000/155	4000/155	2000/5500
CFS 400	4.74	8.0/10.8	2000	5300/189	5300/209	5300/209	5300/209	2800/7750
CFS 500	5.88	10.0/13.5	2000	6700/239	6700/263	6700/263	6700/263	3800/10500
CFS 600	7.03	12.0/16.2	2000	8100/290	8100/315	8100/315	8100/315	5000/13900
CFS 800	9.16	16.0/21.6	2000	10700/383	10700/423	10700/423	10700/423	7200/15950

Note: In accordance with the Company's policy of continual product development and improvement, the above specifications are subject to amendment without notice.

*CFS HD-S 85 baseline scale factor

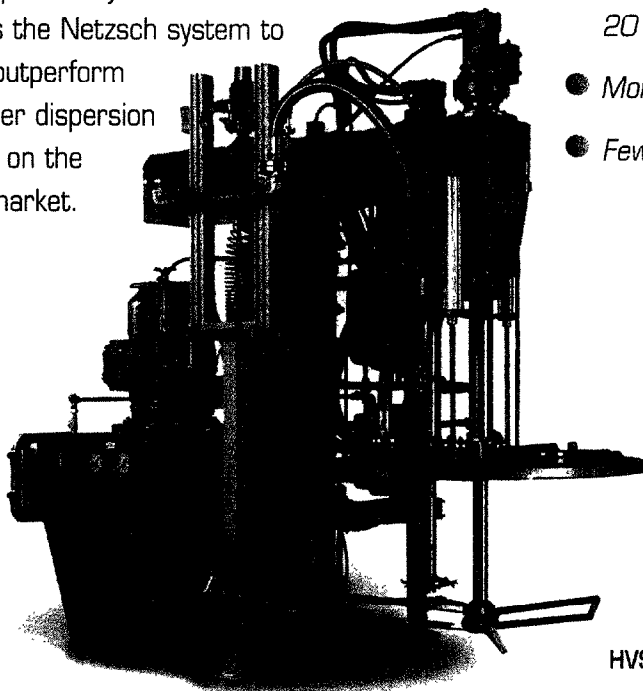
DISPERSION PRE-MIXING & DE-AERATION

Particles such as pigments, colorants, fillers, liquids and emulsions can be blended, pre-mixed, dispersed and letdown through the process known as dispersion. Netzsch dispersion and pre-mixing equipment is state-of-the-art technology, incorporating computer automation for repeatable and consistent results. The Netzsch De-Aerator is a versatile machine used to remove air from various slurries over a wide range of viscosities.

NETZSCH TECHNICAL EXPERTISE

With over a hundred years' experience in engineering and manufacturing machinery, Netzsch technological strength has produced a diversity of equipment geared to specificity of application. In the areas of dispersion, pre-mixing and de-aeration, the wide selection of Netzsch machinery to process high quality applications represents a strength that is unparalleled in the industry.

During the last decade most of the world's leading coating manufacturers have purchased Netzsch dispersers. Most of these units have included the Acoustic Dispersion System (ADS) and the vacuum feeding system, which provide total repeatability...this combination enables the Netzsch system to totally outperform any other dispersion system on the world market.



NETZSCH TECHNOLOGICAL ADVANCES

Both of the following options are Netzsch exclusive designs, which provide advantages unique in the industry.

The **CLEANING SYSTEM** is totally enclosed and uses clean-in-place (C-I-P) spray balls and flush mounted spray nozzles that are strategically positioned throughout the vessel.

The Cleaning System can be operated either manually or automatically using a programmable logic controller (PLC). Its significant advantages include:

- *Greatly reduced cleaning time (for example: a batch color change usually takes one hour... the Cleaning System reduces this change to 20 minutes)*
- *More thorough cleaning*
- *Fewer cleaning materials required*

HVS-TS Twin Shaft Disperser

The **ACOUSTIC DISPERSION SYSTEM™ (ADS)** operates on sound signals created by the high speed blade. This patented Netzsch innovation adds automatic features to the disperser. For additional information please refer to the Systems Section (page 62).

OPTIONAL FEATURES

- *Autoraise — automatic dispersion blade positioning*
- *Autoload — automatic solids loading*
- *Autocycle — automatic dispersion*

APPLICATION CHART

CONDITIONS	HVS-HS	HVS-HT	HVS-TS	PMD-VC	NMD
Finest Dispersion	A	B	A	A	B
Heat-sensitive	A	A	A	B	A
High Viscosity	B	A	A	A	B
Ease of Product Change	A	A	B	A-C	A
Large Volume Production	C	C	B	A	B
Easy Cleaning	A	A	B	A-C	A
Vacuum Operation	A	A	C	A	A
Flexibility	B	C	A	A-C	A
High Thixotropy	A	A	A	A	A
Making Solutions	B	B	A	A	C
APPLICATIONS	APPLICATIONS	APPLICATIONS	APPLICATIONS	APPLICATIONS	APPLICATIONS
Oil Based Paints	Textured Paints	Oil based Paints	Emulsion Paints	Emulsion Paints	Solvent based Paints
Emulsion Paints	High Viscosity Oil based Priming Inks	Emulsion Paints	Undercoats	Undercoats	Paints (waxes)
Plastics	Adhesives	Adhesives	Texture paints	Adhesives	Blends
Organicols	Sealants	Sealants	Adhesives	Plastics	Plastics
Dissolving Resins	Mastics	Plastics	Sealants	Dissolving Resins	Dissolving Resins
Liquid Inks		Organicols	Plastics	Plastics	
Pre-mixing for Bead Mills		High Viscosity Priming Inks	Organicols	Organicols	Pre-mixing for Bead Mills
		Liquid Inks	Blumen Solutions	Blumen Solutions	
		Pre-mixing for Bead Mills	Dissolving Resins	Dissolving Resins	
		Textured Paints	Pre-mixing for Bead Mills	Pre-mixing for Bead Mills	
Viscosity	Low to Medium Viscosity Products	High Viscosity Products	Medium to High Viscosity Products	Low to High Viscosity Products	Low to Medium Viscosity Products

A = Excellent B = Good C = Satisfactory

*Depending upon the system that is engineered into the PMD installations, ie, extent of cleaning systems installed, spray heads, spray nozzles and cleaning solution used.



PMD-VC VARIABLE CAPACITY DISPENSER

The patented PMD-VC (Pre-Mixer Dispenser) is a totally enclosed automated dispersion processing system for batch sizes ranging from 50 - 10,000 liters and larger, for low to high viscosity dispersion and for high shear dispersion/low speed agitation. Netzsch PMD-VC furnishes high quality product, provides a cleaner and safer working environment, a lower atmospheric emission (VOC) and complete automatic control.

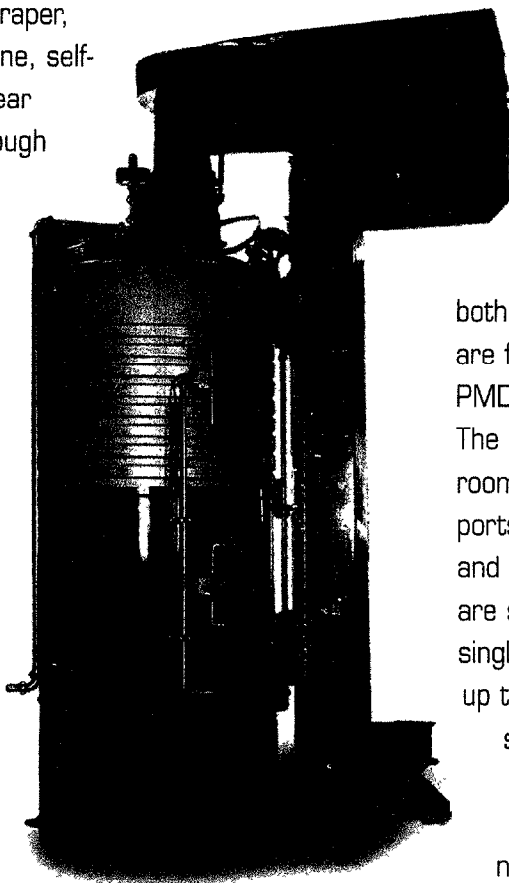
ENGINEERING AND OPERATING PRINCIPLES

Netzsch PMD-VC is used for mixing and dispersing solids into a liquid. Its optimal use is for large volume, frequent and similar product batches. This design integrates the high shear disperser, low speed tank scraper, vessel cover and vessel as one, self-contained unit. The high shear disperser (HSD) is fitted through the vessel cover. The low speed agitator (LSA) is fitted through the vessel bottom. The HSD has a hydraulic raise and lower assembly that allows the disperser shear zone to traverse vertically through the batch. The LSA, operating independently of the HSD, moves the batch material from the vessel walls towards the high shear zone. This is important on high viscosity materials where circulation is not pronounced. The LSA increases the efficiency of heat transfer by providing continual movement of product away from the jacketed vessel wall (eliminating product thermal barriers). Reduction in energy per working volume is achieved by the LSA providing

circulation of the product (typically accomplished by an oversized HSD motor), resulting in lower process temperatures and reduced power consumption. The cooling capacity of the PMD-VC

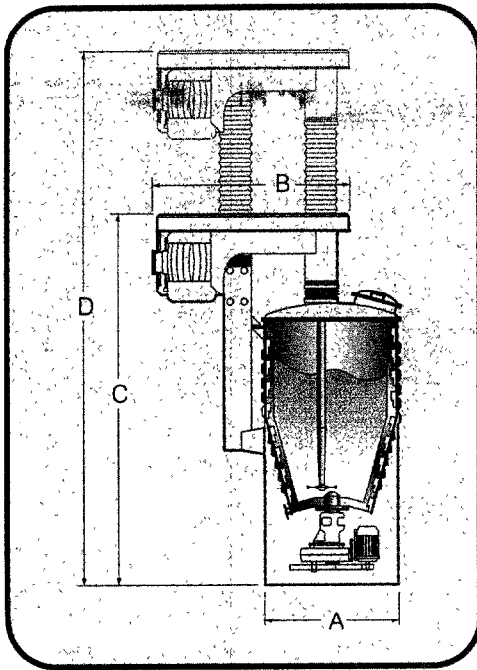
is further enhanced by the cone-shaped vessel which, by design, positions the cooling surface much closer to the energy zone created by the high speed blade. Unlike

competitive machines where both low and high shear dispersers are fitted through the top, the PMD-VC provides smooth operation. The PMD-VC cover allows more room for other uses such as additive ports, manways, electrical devices and cleaning equipment. PMD-VCs are supplied as standard with a single speed, directly driven motor up to 2,500 liters in size; and a single speed motor, belt-driven shaft for machines over 2,500 liters. Single speed is normally used for easy-to-disperse products that are then discharged into a further process, ie, tinting or filling. Many options are available to enhance both versatility and productivity. The most popular are the sub-level vacuum feeding and the above-level Acoustic Dispersion System™ (ADS). (See page 61).



FEATURES AND BENEFITS

- Minimum batch size — 25% working capacity
- Totally enclosed system reduces emissions
- Bottom-driven LSA allows for a more functional vessel cover, eg, raw material feeders and dischargers
- Eccentrically mounted HSD creates circulating vortex and provides a more homogeneous product
- Flexible application — high or low viscosities
- Mixing and letdown in same unit



OPTIONS

Numerous options are available, enabling the machine to be custom-designed to suit every application:

- Stainless steel wetted parts
- Vacuum rated vessels
- Cooled, jacketed tanks
- Explosion-proof
- Variable speed by frequency inverter
- Mechanical variable speed belt drive
- Hydraulic variable speed
- Two-speed motor

As upgrades to the standard system, Netzsch offers these automation options:

- Cleaning systems using medium pressure cleaning heads or unique surface cleaning nozzles
- Acoustic Dispersion System (ADS)
- Solids feeding systems: big bag dischargers, screw conveyors, silo feeds, bag slitters, sub-level vacuum feeding systems
- Batch control systems
- Fully automatic control system

TECHNICAL SPECIFICATIONS

Model	Working Capacity (l/gal)	Minimum Liquid Load (l/gal)	Typical High Shear Motor (kw/hp)	A (mm/in)	B (mm/in)	C (mm/in)	D (mm/in)	Approx. Weight (kg/lb)
PMD-VC 50	50/112	15/4	3/0	400/16	100/4	2130/84	2800/112	500/1100
PMD-VC 250	250/668	60/17	11/15	670/26	160/6	3340/132	3600/142	1500/3300
PMD-VC 500	500/132	125/33	16/20	840/33	208/8	4850/192	4950/171	1800/3920
PMD-VC 1250	1250/330	300/79	19/25	1100/43	282/11	6130/242	6610/221	2500/5500
PMD-VC 2500	2500/660	600/158	37/50	1450/57	370/14	8400/330	8600/323	3800/8360
PMD-VC 5000	5000/1320	1200/317	65/75	1900/72	470/18	11400/448	12000/464	7500/16500
PMD-VC 7500	7500/1980	1800/475	75/100	2000/79	500/19	12100/473	12710/504	8500/18700
PMD-VC 10000	10000/2640	2400/630	90/125	2300/91	590/23	12160/475	12710/504	9500/20900

Note: In accordance with the Company's policy of continual product development and improvement, the above specifications are subject to amendment without notice.

HVS HYDRAULIC VARIABLE SPEED DISPERSERS

HVS Hydraulic Variable Speed Dispersers incorporate hydraulic systems for mixing and dispersing solids in a liquid. A hydraulic system enables uniform and constant torque, a major benefit for high viscosity materials. Netzsch offers three distinct types of dispersers to suit virtually every application.

ENGINEERING AND OPERATING PRINCIPLES

There are no belts or sheaves for maintenance or constant adjustments. One hydraulic reservoir is used for both the operation and the raise and lower feature. The disperser shaft(s) start from 0 RPM and, with push-button control, increase speed to maximum RPM, providing infinite speed control. Constant torque is essential to maintain uniform speed for laminar flow to produce a shear dispersion.

HVS machines work with most existing tanks. Raw materials can be manually added through the cover hatch, which includes a catch grill. Optional automation features allow liquids to be pumped and solids to be metered into the tank as the HVS is mixing. The metering process can be performed through either gravity or vacuum processing. This feature is discussed further in the Systems Section of this catalog (page 61).

All HVS machines are designed with the environment and operator safety in mind. The optional sliding seal tank cover allows sealed operation when the cover is in place. The tank clamping mechanism ensures the tank is secure before the machine will operate. A safety switch prevents the machine from operating until the cover is in place.

FEATURES AND BENEFITS

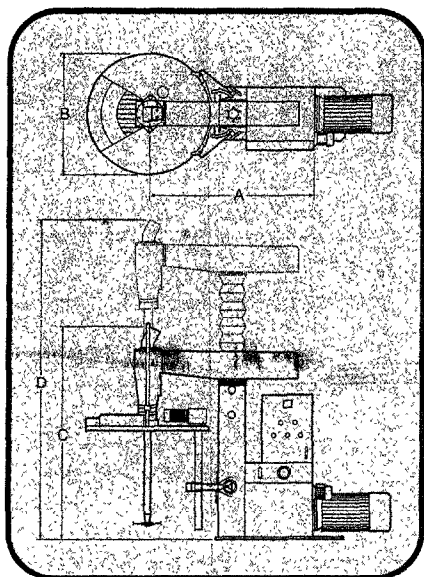
- *Able to start at 0 RPM*
- *Smooth operation*
- *Infinite speed control*
- *High torque*
- *Faster batch times*
- *More homogeneous dispersion*
- *Increased reliability*
- *No belts*
- *High viscosity capability*
- *Mixing and letdown in same unit*

OPTIONS

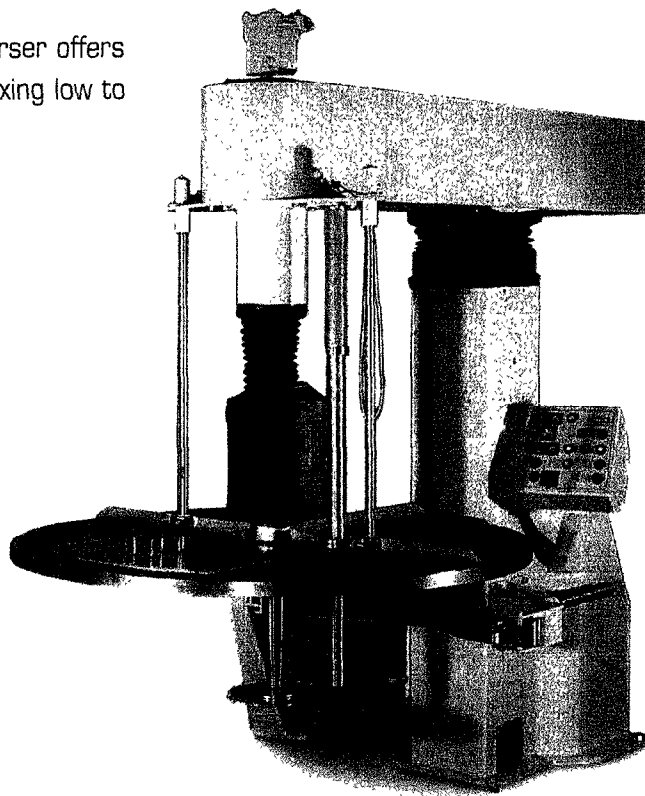
- *Covers—vacuum or other*
- *Swivel head*
- *Scraper arm*

HVS-HS HYDRAULIC VARIABLE SPEED, HIGH SHEAR DISPENSER

This hydraulic high speed, high shear disperser offers variable control from 0 - 1300 RPM for mixing low to medium viscosity products.



HVS-HS Technical Dimensions



HVS-HS Hydraulic Variable Speed, High Shear Disperser shown with optional tank cover

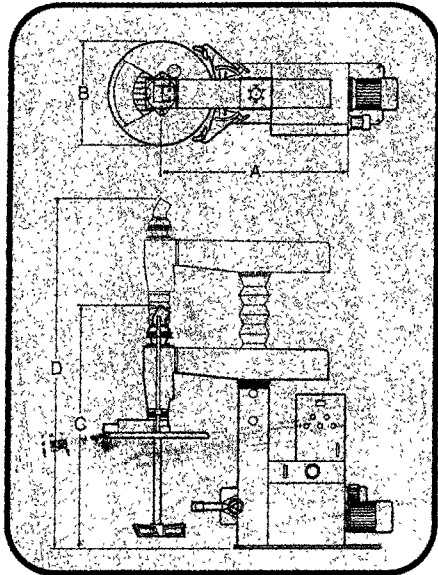
TECHNICAL SPECIFICATIONS

Model	Main Motor [kw/hp]	Maximum Capacity [l/gal]	A [mm/in]	B [mm/in]	C [mm/in]	D [mm/in]	Approx. Weight [kg/lb]	Cooling Water [lpm/gpm]
HVS-HS 25	11.75	122/320	1050/41	300/12	2510/99	443/174	1600/353	150
HVS-HS 50	18.25	122/320	1050/41	300/12	2510/99	443/174	1600/353	150
HVS-HS 60	18.25	202/535	1050/41	300/12	2510/99	443/174	1600/353	200
HVS-HS 75	24.75	202/535	2050/81	300/12	2510/99	443/174	2000/440	200
HVS-HS 100	32.25	202/535	2050/81	300/12	2510/99	443/174	2000/440	200

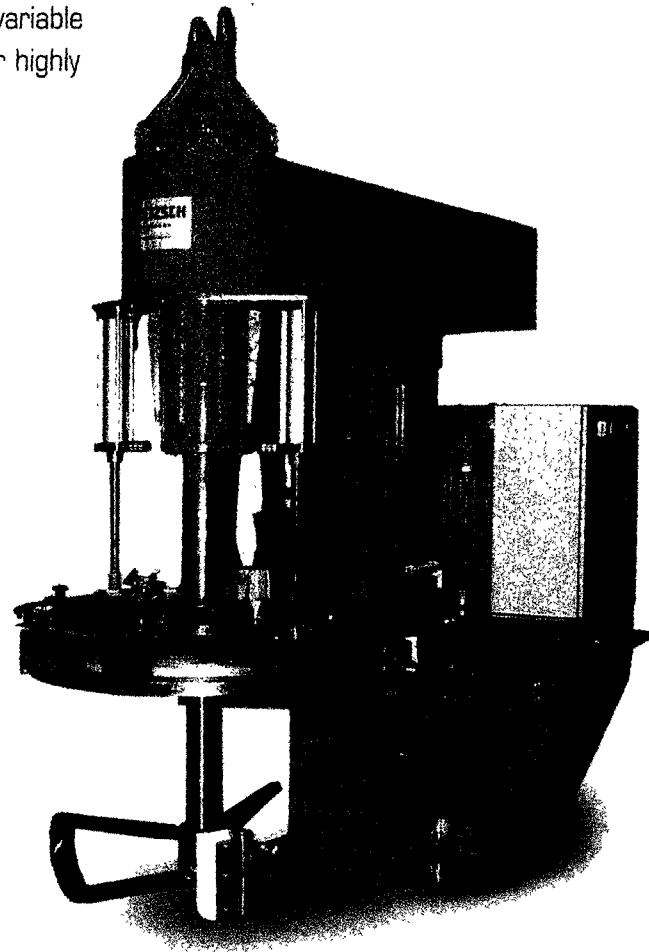
Note: In accordance with the Company's policy of continual product development and improvement, the above specifications are subject to amendment without notice

HVS-HT HYDRAULIC VARIABLE SPEED, HIGH TORQUE DISPENSER

This hydraulic high torque dispenser provides variable control from 0 - 250 RPM and is designed for highly viscous materials.



HVS-HT Technical Dimensions



HVS-HT Hydraulic Variable Speed, High Torque Dispenser shown with optional vacuum tank cover

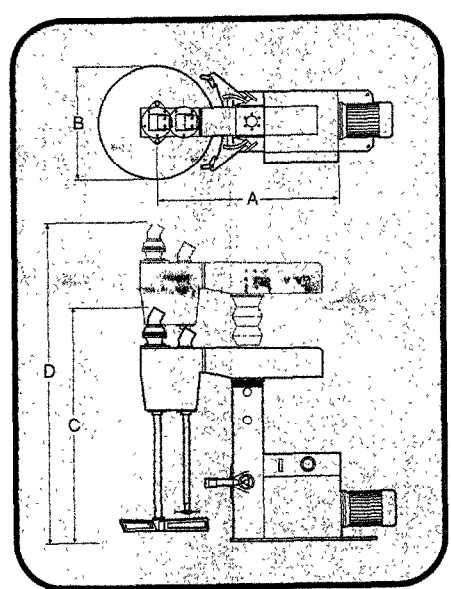
TECHNICAL SPECIFICATIONS

Model	Main Motor [kw/hp]	Maximum Capacity [l/gal]	A [mm/in]	B [mm/in]	C [mm/in]	D [mm/in]	Approx. Weight [kg/lb]	Cooling Water [lpm/gpm]

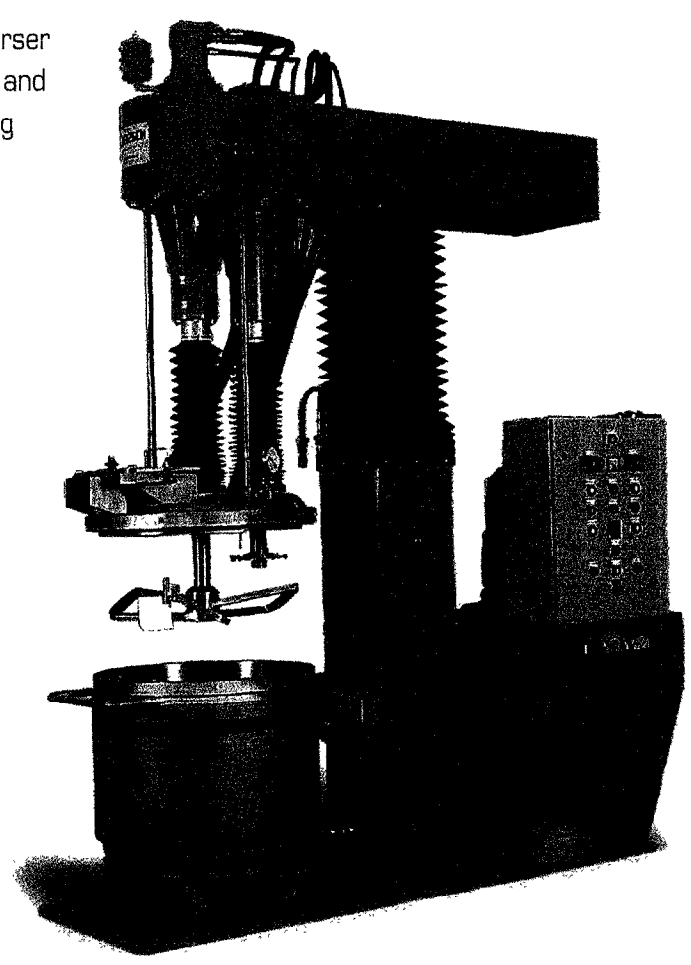
Note: In accordance with the Company's policy of continual product development and improvement, the above specifications are subject to amendment without notice.

HVS-TS HYDRAULIC VARIABLE SPEED, TWIN SHAFT DISPENSER

This twin shaft, hydraulic high speed disperser offers variable control from 0 - 250 RPM and from 0 - 1300 RPM and is used for mixing medium to high viscosity products.



HVS-TS Technical Dimensions



HVS-TS Hydraulic Variable Speed, Twin Shaft Disperser shown with optional vacuum tank cover

TECHNICAL SPECIFICATIONS

Model	Main Motor [kw/hp]	Maximum Capacity [l/gal]	A [mm/in]	B [mm/in]	C [mm/in]	D [mm/in]	Approx. Weight [kg/lb]	Cooling Water [lpm/gpm]
HVS-250	15/20	200/265	100/4	150/6	200/8	1625/64	1800/2600	14/4
HVS-500	30/40	400/530	100/4	150/6	200/8	3050/120	1750/2650	20/6
HVS-750	45/60	600/795	100/4	150/6	200/8	4085/150	2075/2885	20/6
HVS-1000	75/100	1000/1330	100/4	150/6	200/8	4745/170	3100/3920	20/6

Note: In accordance with the Company's policy of continual product development and improvement, the above specifications are subject to amendment without notice.

NMD MECHANICAL VARIABLE SPEED DISPERSER

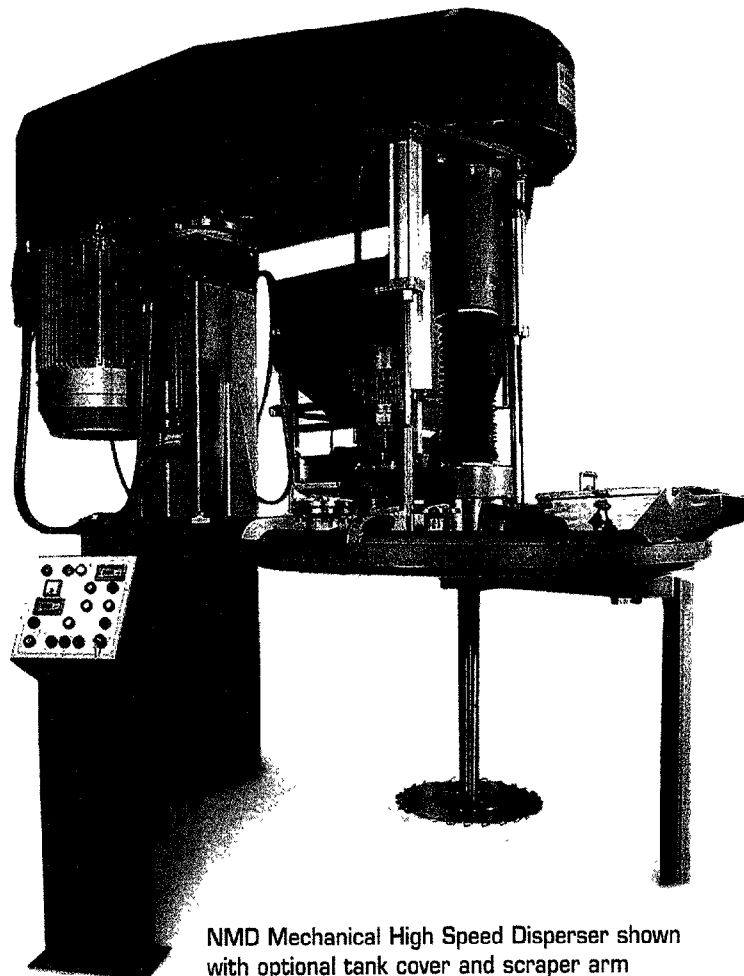
The Netzsch NMD Mechanical High Speed Disperser provides variable speed control for low to medium viscosity products. Featuring smooth and simple operation, this user-friendly machine offers the maximum in cost-efficient dispersion.

ENGINEERING AND OPERATING PRINCIPLES

The NMD is a highly economical "change can" machine used for mixing and dispersing solids into a liquid. Shaft drive systems can be either mechanical split pulley or variable by frequency inverter. With either drive the shaft starts from the minimum speed and increases smoothly to the maximum speed. When stopping the machine the shaft is automatically reduced to the minimum speed. This reduces the chance of the disperser being started with a shaft set at high speed. With a 5:1 mechanical speed reduction, the NMD is a significant improvement over the industry standard of 3:1, allowing both a lower minimum speed when required and infinite speed control. The disperser shaft is constructed of a large diameter titanium alloy stainless steel for strength. The shaft is held in place by large angular contact roller bearings and tapered to the shear blade for rigidity. With its innovative design, NMD can operate in a wide spectrum of product viscosities and rheologies with superior stability. The NMD is available in sizes from 20 HP to 60 HP.

OPTIONS

- *Vacuum and non-vacuum cover with loading hatch*
- *Swivel head*
- *Safety cover*
- *Scraper arm*
- *Frequency inverter*
- *Sub-level feeding*



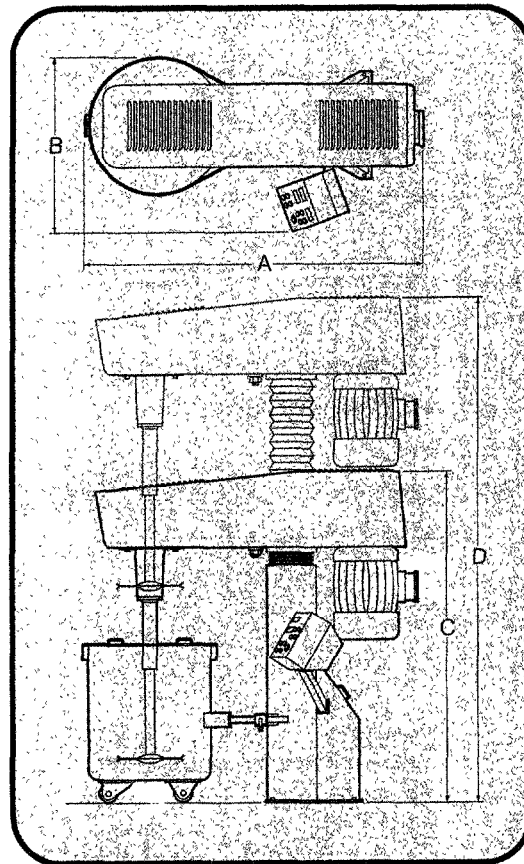
NMD Mechanical High Speed Disperser shown with optional tank cover and scraper arm

● TZSCH EXCLUSIVE STANDARD FEATURES

- Automatic dispersion mode standard
- Automatic batch timer standard
- Stainless steel, dynamically balanced tapered shaft with high titanium content
- Large bearing distances provide greater strength and stability
- Intermediate drive shaft to give 5:1 ratio
- Shaft automatically returns to minimum RPM on shut off
- Column bellows for dust protection
- Height limit switch returns shaft to minimum RPM prior to shut off
- Push-button speed control

● ADDITIONAL FEATURES AND BENEFITS

- Stainless steel, hard chrome-plated, high speed dispersion blade
- Shaft protection sleeve
- Dynamically balanced, high efficiency, V-belt drive
- Control panel with AMP, hour, and RPM meters
- Vessel secured via ratchet mechanism with protection switch
- Maintenance-free, digital speed indicator
- Electrohydraulic raise and lower feature with push-button panel



NMD Technical Dimensions

TECHNICAL SPECIFICATIONS

Model	Main Motor* [kW/hp]	A [mm/in]	B [mm/in]	C [mm/in]	D [mm/in]	Approx. Weight [kg/lb]	Speed [rpm]
NMD-10	10/13.4	1100/43.3	1100/43.3	1100/43.3	1100/43.3	1100/2420	150-1500
NMD-15	15/20.1	1100/43.3	1100/43.3	1100/43.3	1100/43.3	1100/2420	150-1500
NMD-20	20/26.8	1100/43.3	1100/43.3	1100/43.3	1100/43.3	1200/2640	150-1600
NMD-25	25/33.5	1100/43.3	1300/51.2	1100/43.3	1100/43.3	1700/3740	275-1370
NMD-30	30/40.2	1100/43.3	1300/51.2	1100/43.3	1100/43.3	1800/3960	275-1370
NMD-40	40/53.5	1100/43.3	1300/51.2	2200/86.6	2410/94.9	1800/3960	275-1370
NMD-50	50/67.1	1100/43.3	1300/51.2	2200/86.6	2410/94.9	1900/4180	275-1370

Note: In accordance with the Company's policy of continual product development and improvement, the above specifications are subject to amendment without notice

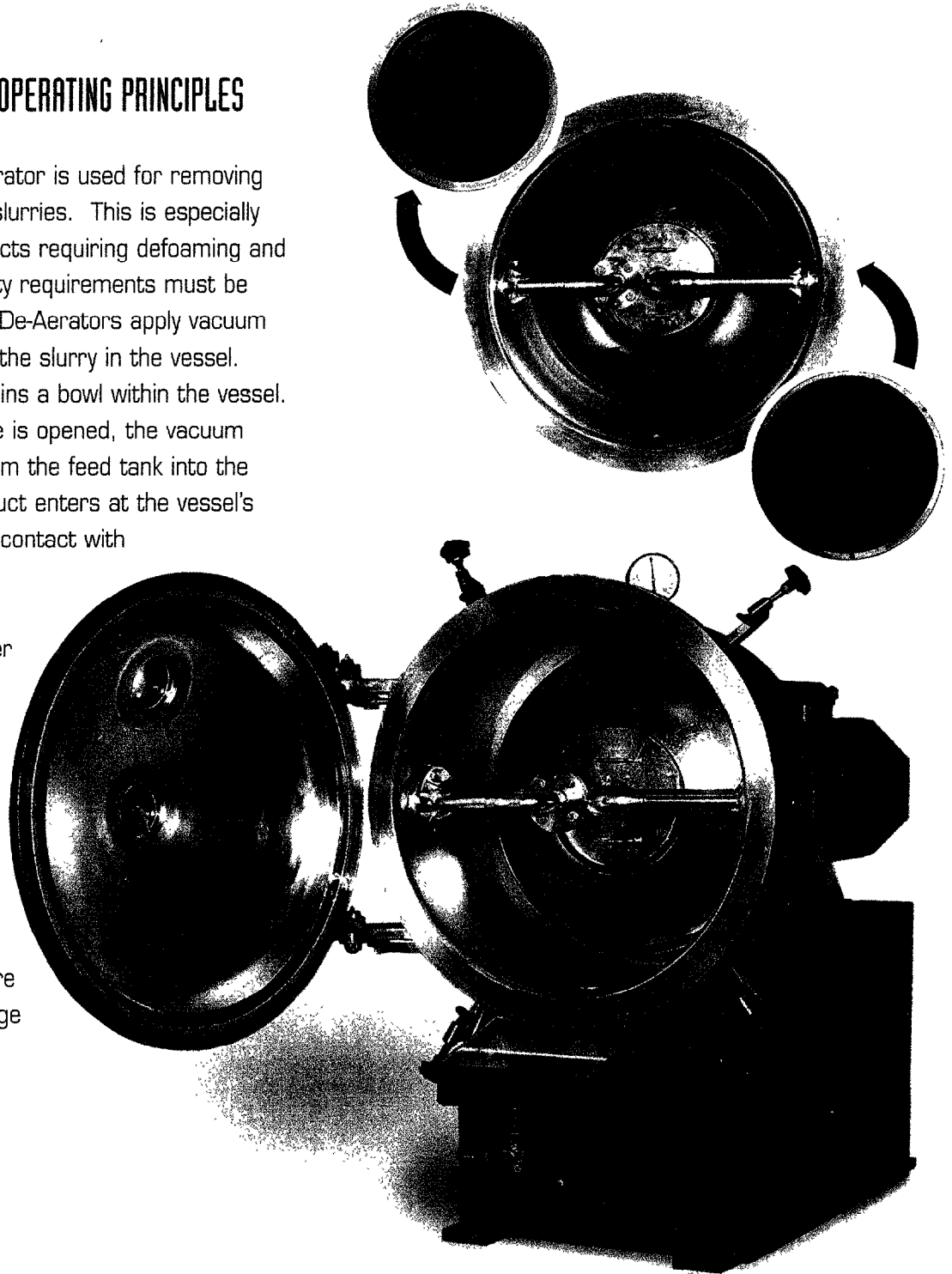
*Each machine is available in next motor size.

DA DE-AERATOR

The Netzsch De-Aerator is a versatile continuous machine used to remove air from various slurries over a wide range of viscosities. Netzsch De-Aerators can de-gas quantities as low as 25 liters and can be fitted in-line from a bulk storage vessel.

ENGINEERING AND OPERATING PRINCIPLES

The Netzsch De-Aerator is used for removing entrained air from slurries. This is especially important for products requiring defoaming and when specific density requirements must be achieved. Netzsch De-Aerators apply vacuum to a thin coating of the slurry in the vessel. An external drive spins a bowl within the vessel. When the inlet valve is opened, the vacuum draws the slurry from the feed tank into the vessel. Slurry product enters at the vessel's center, coming into contact with the spinning bowl. Centrifugal forces distribute a thin layer of slurry, covering the bowl. The vacuum then removes the exposed air. When the slurry reaches the bowl's circumference, the centrifugal forces are sufficient to discharge the slurry product.



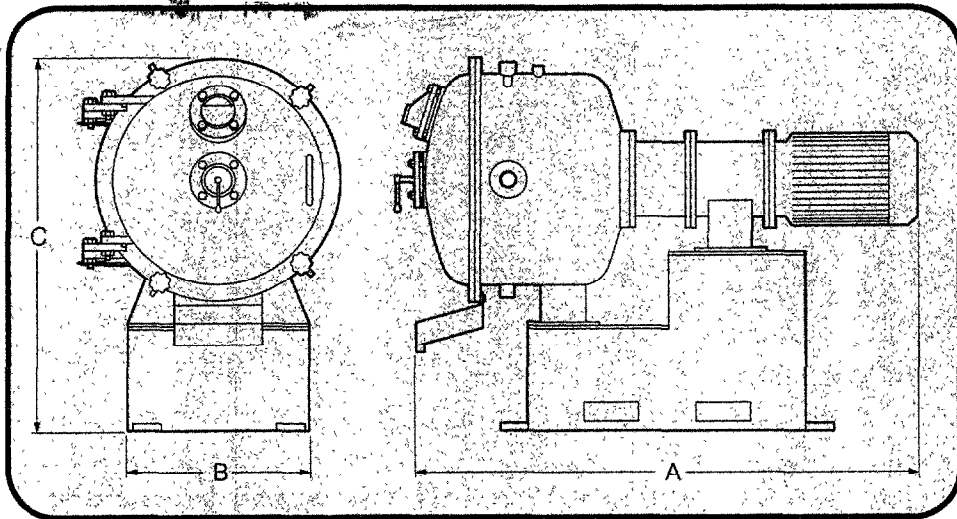
DA De-Aerator

FEATURES AND BENEFITS

- Faster throughput than conventional methods,* eg, 3-roll mill
- No solvent loss
- Compact
- More efficient
- Environmentally friendly
- Minimal operator supervision
- Totally enclosed system
- Few moving parts
- Fast and easy cleaning

OPTIONS

- Variable speed (Model DA-VS)
- In-line solvent recovery system for solvent-based products



DA & DA-VS Technical Dimensions

TECHNICAL SPECIFICATIONS

Model	Main Motor [kw/hp]	A [mm/in]	B [mm/in]	C [mm/in]	Approx. Weight [kg/lb]	Speed [rpm]
DA	1.5/2	1143/45	1143/45	1368/54	620/1365	700
DA-VS	1.5/2	1143/45	1143/45	1368/54	620/1365	700-3400

Note: In accordance with the Company's policy of continual product development and improvement, the above specifications are subject to amendment without notice.

*Consult factory for throughput rates for your specific application.

PM PLANETARY MIXERS

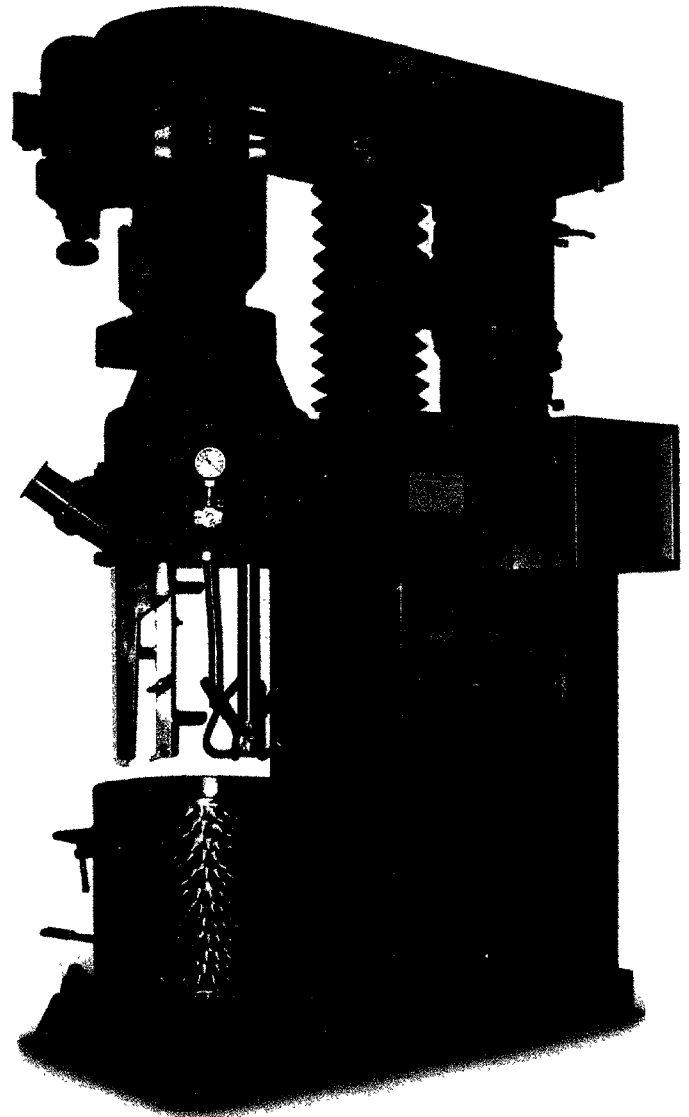
Years of operation in both production and laboratory facilities have proven Netzsch Planetary Mixers' value in processing high viscosity pastes in the high range of 1 Pascal/second to 2,000 Pascal/second (10 poise to 20,000 poise). The Planetary Mixer is ideal for products such as silicone pastes, filling compounds and sealants that, due to flow behavior, have no vortex and have localized high temperature around the high speed dispersion blade. Planetary Mixers process materials that increase in viscosity during the dispersion phase without any loss in dispersion efficiency. This is due to the ability to adjust the mixing and dispersing speeds. Dispersion of extremely high viscosity products like window glue or carbon blacks is easily accomplished with the high shear energy of the Netzsch Planetary Mixer. Dispersing very light or agglomerated powders in any liquid results in optimal degrees of fineness and distribution. The Netzsch Planetary Mixer eliminates problems associated with high viscosity dispersions such as large clusters or balls.

ENGINEERING AND OPERATING PRINCIPLES

Netzsch offers two different Planetary Mixers. The PMH consists of a high speed butterfly shaft and low speed axial flow agitator. The PML consists of two low speed axial flow agitators. Both systems rotate eccentrically in the process vessel. The two systems rotating in the vessel create a rotating shear zone, ensuring superb dispersion results. The high and low speed systems have separate drives, allowing precise control of the mixing and dispersing process.

The two independently operating mixing systems are hydrostatic variable speed drives. This system guarantees low energy consumption with optimal dispersion quality in a short period of time. The low energy consumption makes the system ideal for temperature-sensitive products.

A tank wall scraping blade eliminates dead zones at the tank wall and ensures thorough movement and mixing of the product. The scraping blade enhances the heat transfer from the vessel cooling or heating jacket by continuously sweeping material from the heat transfer surface.



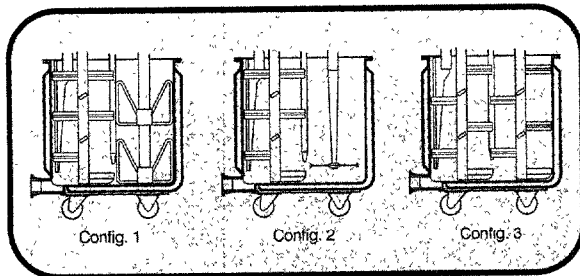
PMH Planetary Mixer

Optional equipment, such as spray balls and temperature probes, can be mounted to the planetary system, increasing cleaning efficiency and temperature control.

The **PMH Mixer** (high energy input) (Config. 1) performs fine disintegration and dispersion. The PMH is ideal for mixing and dispersing products that increase in viscosity during the process cycle (eg, feeding of solids, chemical reactions). The PMH develops the high shear forces required for difficult to wet dispersions and/or that have poor flow characteristics. This gives the machine the ability to process formulations up to over 20,000 poise. Alternately, the PMH can be supplied with a high speed dissolver blade as shown (Config. 2).

The **PML Mixer** (low speed) (Config. 3) with axial flow agitators performs kneading or low energy dispersion. The PML is ideal for applications where the viscosity is constant, only low shear forces are necessary or materials are temperature-sensitive. The PML offers excellent results on products up to 6,000 poise or less.

Planetary Mixer Blade Configurations



Selection of mixing and dispersing tools and different butterfly and toothed disperser blades allow optimization of the machine for specific processes.

FEATURES AND BENEFITS

- *Fast adjustment of mixing process by variable speed drive*
- *Choice of mixing blades*
- *Easily removable mixing blades*
- *Reproducible processing by controllable hydrostatic drive*
- *Geometrical design of the vessel results in high shear efficiency at low speed*
- *Vacuum construction*
- *Vessel wall scraping blade results in fast and efficient heat transfer*
- *Batch process temperature up to 200°C*
- *Reinforced bearings*
- *Dispersion of the most difficult-to-wet solids*
- *Large machine size range, from 0.5 liter lab unit to 1600 liter production machine*

OPTIONS

- *Vacuum pump of up to 400 m³/hr results in extremely efficient de-aeration*
- *Fast and thorough cleaning through the use of spray balls and PTFE*
- *Digital temperature indication with rotating temperature probe*
- *Explosion-proof design*

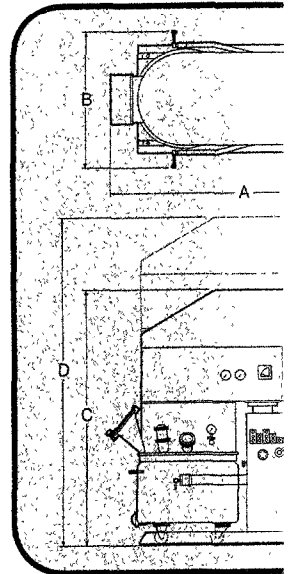
NETZSCH
Grinding & Dispersion
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For more information call 610.363.8010

PLANETARY MIXERS

APPLICATIONS

- Silicone pastes
- Fillers
- Acrylate pastes
- Latex materials
- Glues
- Adhesives
- Sealants
- Dental pastes
- Tint bases
- Offset inks
- Coating bases
- Metal pigments
- Cosmetics
- Pharmaceuticals
- Polyurethane materials
- Rubber materials
- Epoxy resins
- Hot melt adhesives
- Highly filled pastes
- Dental fillers
- Rustproofing compounds
- Building materials
- Plastisols



Planetary Mixer Technical

TECHNICAL SPECIFICATIONS

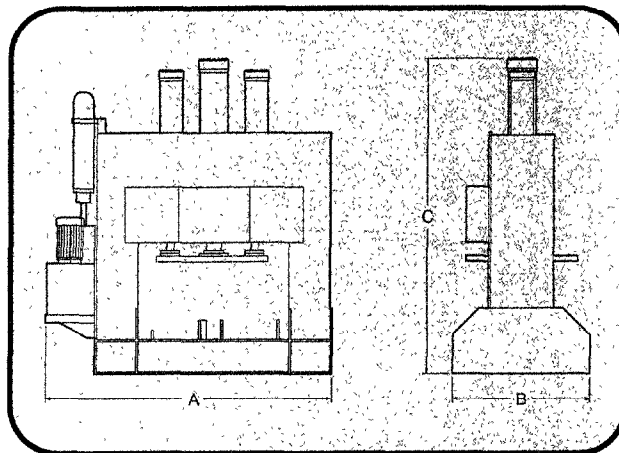
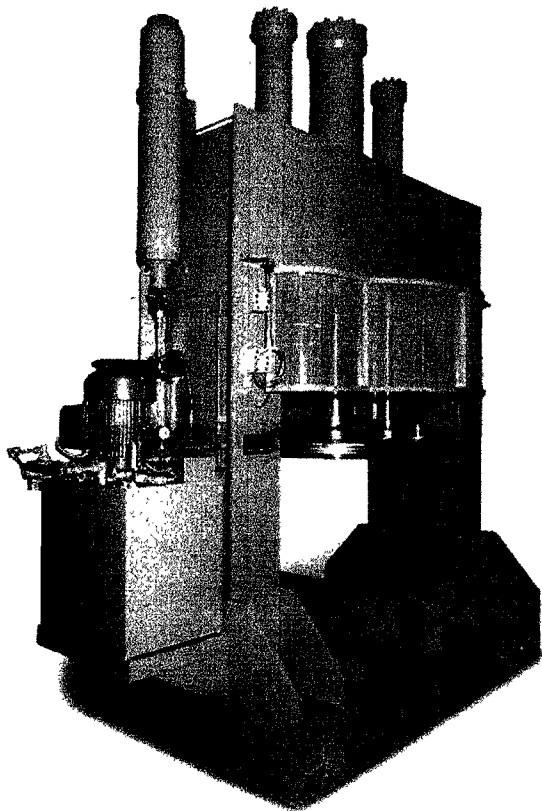
Model	A (mm/in)	B (mm/in)	C (mm/in)	D (mm/in)	Working Volume (l/gal)	Total Volume (l/gal)
PMH 1	950/37	500/20	1100/43	1350/53	7/2	11/28
PMH 3	1150/45	600/24	1800/71	1900/75	8/21	12/31
PMH 90	1650/65	1000/39	2020/80	2640/104	70/19	90/24
PMH 185	1950/77	1000/39	2300/91	3000/118	150/40	185/49
PMH 320	2750/108	1400/55	2400/94	3100/122	280/69	320/85
PMH 600	3800/150	1500/59	2800/110	3800/150	450/119	600/159
PMH 750	3800/150	1600/63	3000/118	4100/161	600/159	750/199
PMH 1300	5150/203	2020/80	3000/118	4050/159	1050/277	1300/343
PMH 1600	5200/205	1820/71	3200/126	4400/173	1250/330	1600/423
PMI 1	950/37	500/20	1100/43	1350/53	7/2	11/28
PMI 3	950/37	700/28	1600/63	1600/63	6/16	8/21
PMI 90	1400/55	900/35	1800/71	2200/87	75/20	90/24
PMI 185	1400/55	1050/41	1700/67	2420/95	150/40	185/49
PMI 320	1900/75	1350/53	1900/75	2500/100	290/68	320/85
PMI 600	2200/87	1600/63	2300/91	3200/126	450/119	600/159
PMI 1000	2350/93	1650/65	2530/100	3650/145	750/198	1000/264

Note: In accordance with the Company's policy of continual product development and improvement, the above specifications are subject to amendment without notice.

*Vessel raises and lowers.

BP CONTAINER PRESS OUT

To complement the Planetary Mixers, Netzsch manufactures the BP System for pressing out or removing high viscosity pastes from the vessel. The system is designed for use with Netzsch PMH and PML machines and tanks from 90 liters to 1600 liters. Special sizes available upon request. Please consult the factory.



Container Press Out Technical Dimensions

TECHNICAL SPECIFICATIONS

Model	A (mm/in)	B (mm/in)	C (mm/in)	Volume (l/gal)	Power (kw/hp)
BP 90	1000/39	600/20	1000/75	30/24	2.5/3
BP 105	2000/79	1000/35	2200/87	165/48	3.5/5
BP 225	2200/87	1200/47	2300/91	320/85	5/7
BP 600	2500/96	1300/51	3000/118	600/160	7.5/10
BP 750	2500/96	1300/51	3350/132	750/198	7.5/10
BP 1000	2700/106	1200/47	3600/142	1000/264	11/15
BP 1300	3000/118	1400/55	3800/142	1300/343	11/15
BP 1600	2800/110	1600/59	3900/154	1600/423	11/15

Note: In accordance with the Company's policy of continual product development and improvement, the above specifications are subject to amendment without notice.

WET GRINDING AND DISPERSION

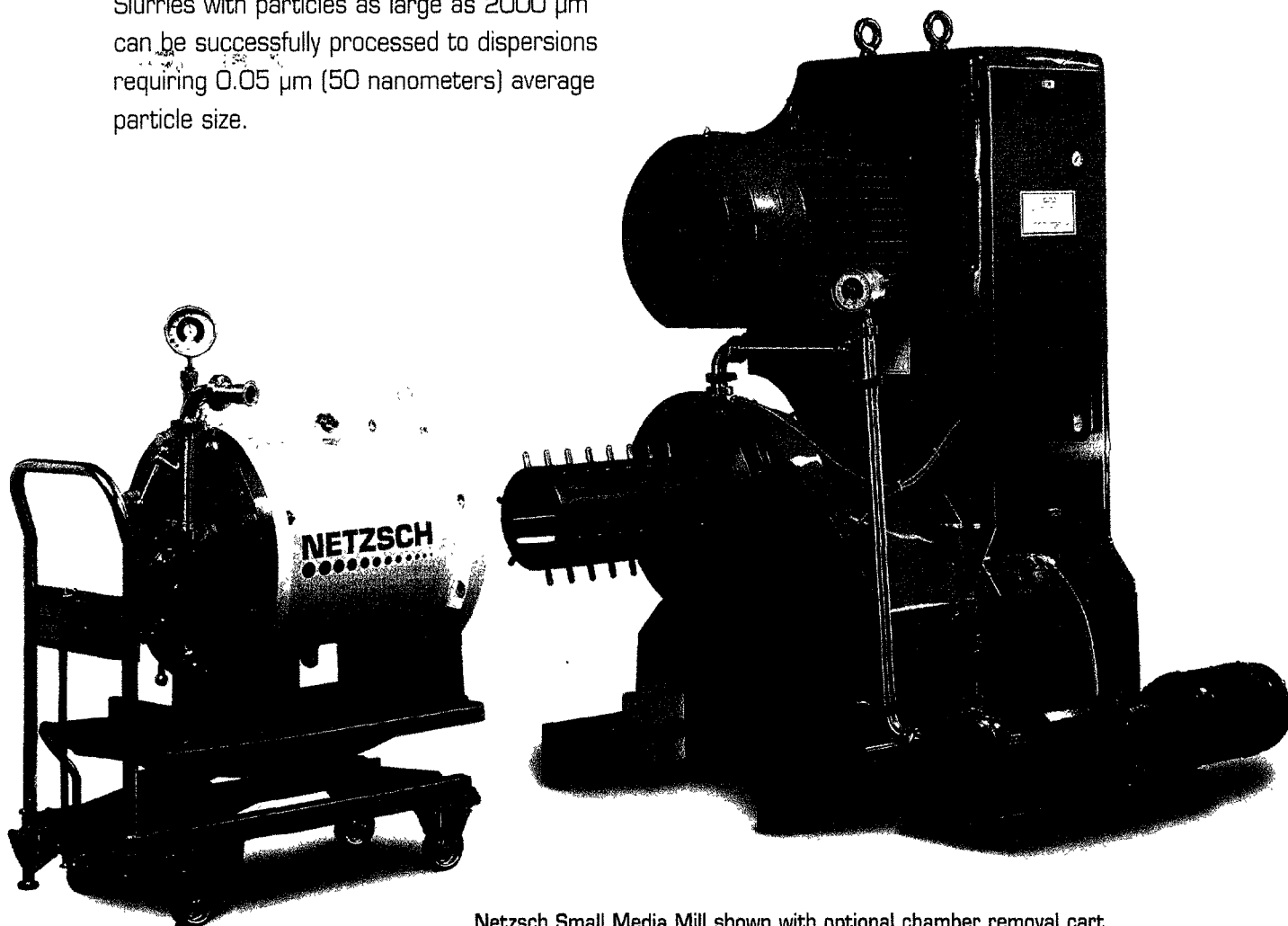
Netzsch manufactures equipment for grinding (particle size reduction of solids) and dispersion (distribution of resultant particles in a liquid).

RANGE OF PARTICLE SIZE REDUCTION

The purpose of using a small media mill for grinding and dispersion is to obtain a uniform particle size distribution in the micron and submicron (or nanometer) particle size range. Typically slurries are processed with 50 μm to 200 μm average particle size to less than 1 μm (submicron) average particle size. Slurries with particles as large as 2000 μm can be successfully processed to dispersions requiring 0.05 μm (50 nanometers) average particle size.

ENGINEERING & OPERATING PRINCIPLES

Particles are dispersed by shearing forces (tearing apart), impact or impinging forces (crushed by outside force), and attrition (tearing and crushing each other apart). The Netzsch Small Media Mill is the best available technology for this process.



Netzsch Small Media Mill shown with optional chamber removal cart

A small media mill is an enclosed vessel filled with small spheres or beads (the grinding media) that are activated by an agitator shaft, creating shearing and impacting forces. The agitator design selected is based on the material to be processed. The rotation of the agitator imparts energy to the surrounding media. These forces act on the solids suspended in a liquid as they are continuously pumped through the grinding chamber. The forces either tear apart and/or crush the solids, resulting in an overall reduction in the particle size. The particles are simultaneously dispersed in the liquid. Grinding media is retained inside the mill by the Netzsch patented Dynamic Cartridge Media Separator™ (page 50). The process parameters are agitator speed, product flow rate and grinding media. This continuous process is made possible by utilizing a positive displacement pump.

Netzsch Small Media Mills have many applications in the following industries:

- *Paint and coatings*
- *Printing inks*
- *Magnetic coatings*
- *Paper coatings*
- *Mineral and ore processing*
- *Pharmaceuticals*
- *Cosmetics*
- *Food and confections*
- *Agriculturals*
- *Ceramics*
- *Electronics*

Netzsch grinding and dispersion small media mills offer the following superior properties:

- *Specific particle size distribution*
- *Maximum, uniform color development*
- *Gloss*
- *Transparency*
- *Magnetic strength*
- *Suspension*
- *Coating thickness*
- *Structural strength*

NETZSCH
Grinding & Dispersion
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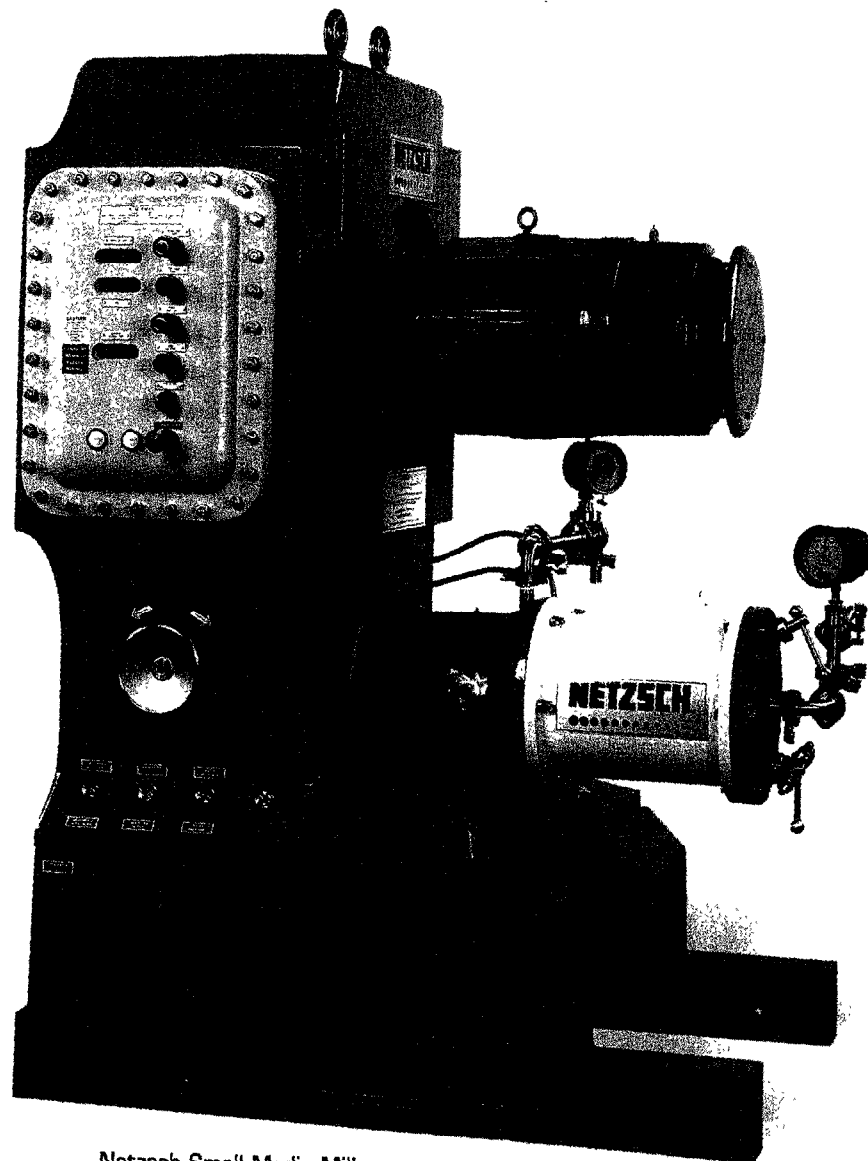
For more information call 610.363.8010

NETZSCH DISPERSION SYSTEMS

A key advantage of the Netzsch product line is the wide variety of agitation systems. Netzsch Small Media Mills are available in six distinct system configurations:

- Horizontal Disc
- Vertical Disc
- Horizontal John/Peg
- Vertical John/Peg
- Zeta Circulation
- Turbomill®

Each machine has its own particular advantage and application. In most cases, due to the modular design of the machines, the Disc, John and Zeta grinding systems are interchangeable on the same machine drive system. Please refer to the application chart on pages 41 and 42.



Netzsch Small Media Mill

NETZSCH EXCLUSIVE STANDARD FEATURES

- *Patented Dynamic Cartridge Media Separator™ (DCMS) design allows use of media as small as 100 µm in diameter*
- *Reliable double-acting mechanical seals produced and certified by Netzsch personnel*
- *Totally enclosed grinding vessels eliminate the undesirable effects of air entrapment and the environmental concerns of solvent emission*
- *Cooling water control valves*
- *Media drain and fill plugs provide ease of filling and discharging media*
- *Protection devices – pressure switch, seal level switch, seal pressure switch*
- *Machine designed for ease of maintenance*

ADDITIONAL FEATURES AND BENEFITS

- *Grinding mills available in sizes ranging from 0.5 liters to 1,300 liters for production rates of 25 milliliters per minute to 140 liters per minute*
- *Feed pump included with machine. Gear-type, positive displacement pumps are provided as standard*
- *All feed pumps are supplied with variable speed drives*
- *Continuous operation*
- *Chamber removal system – on large machines a rail system is standard, on small machines a removable cart is available*
- *Three drives available: fixed speed with or without fluid clutch, mechanical variable speed, electrical variable speed*
- *Engineered for high energy input*
- *Slurries ranging from 5% solids to 95% solids can be processed*
- *Slurries with viscosities ranging from 1 poise to 12,000 poise are processed*
- *Specific particle size distributions are achieved through selection of the proper milling variables*
- *Uniform activation of the grinding media in all systems results in efficient grinding and narrow particle size distributions*
- *Materials of construction allow processing of solvent systems and aqueous systems in pH range of 2-13. Ceramic materials of construction are available for metal-free grinding*

**Other Products Offered
by Netzsch:**

**Three Roll Mills
Vertical Mills**

APPLICATION CHART

The following chart will assist in your machine selection.

CONDITIONS	DISC MILL	JOHN/PEG	ZETA
Fine Grinding	B	A	A
Fine Dispersion	A	A	A
Large Production Volume	A	B	A
Operation Simplicity	B	B	A
Fast Cleaning	B	B	A
Low Viscosity	B	C	A
Medium Viscosity	B	B	A
High Viscosity	C	A	A
Heat-sensitive	B	B	A
Low Contamination*	A	B	B

*Dependent upon material of construction

APPLICATIONS	DISC MILL	JOHN/PEG	ZETA
Automotive	B	C	A
Coil Coatings	A	C	A
Colorants	A	C	A
Conductive Coatings	B	B	A
High Solids	A	B	A
Industrial/Architectural	A	D	A
Latex Pigment Dispersions	A	C	A
Pigment Dispersions	B	C	A
Powder Coating Resins	A	C	A
Tint Bases	B	B	A
Wood Coatings/Stains	B	B	A
Aluminum Oxide Slips	A	C	A
Barium Titanate	A	C	A
Glazes	A	C	A
Silicon Nitride Slips	A	C	A
Zirconium Oxide Slips	A	C	A
Abrasive Slurries	A	C	A
Dental	B	C	A
Electronics	B	C	A
Ferrites	B	A	A
Tungsten Carbide	C	A	B
Aluminum Trihydrate	A	C	A
Calcium Carbonate	A	C	A
Calcium Sulfate	A	D	A
Clay Slurries	A	C	A
Coal Water Slurries	A	B	A
Limestone	A	C	A
Titanium Dioxide	A	C	A
Adhesive Resins	A	C	A
Calcium Carbonate	A	C	A
Fax Coatings	A	D	A
Starch	A	D	A
Temperature-sensitive	A	C	A
Thermal	B	C	A
Antacids	A	B	A
Aseptic	A	B	A
Barium Sulfate	A	B	A
Ingestible	A	B	A
Injectable	A	B	A
Oral	A	B	A
Sprays	A	B	A
Vitamins	A	B	A

APPLICATIONS	DISC MILL	JOHN/PEG	ZETA	TURBOMILL ⁴⁰
Color News Inserts	B	B	A	B
Film	B	B	A	B
Flexographic	B	B	A	B
Gravure	B	B	A	B
Letterpress	B	B	A	B
Magazines	B	B	A	B
Newsprint	B	A	A	B
Offset	B	A	A	B
Packaging	B	B	A	B
Paste Inks	B	A	A	B
Screen	B	B	A	B
Textile Dyes	B	B	A	P
Textile Inks	B	B	A	B
Ultraviolet Curing	B	B	A	A
Bases	B	B	A	A
Eyeliners	B	B	A	A
Lipstick	B	A	A	C
Nail Polish	B	B	A	A
Fungicides	A	C	B	P
Herbicides	A	C	B	P
Pesticides	A	C	B	P
Candy Coatings/Inks	B	A	A	B
Cheese	B	A	A	C
Chocolate	B	A	B	C
Cocoa Liquor	A	B	B	C
Dyes	B	C	A	P
Preservatives	A	B	A	B
Carbon Black	B	B	A	P
Ferrites	B	B	A	P
Iron Oxide	B	B	A	P
Carbazole	B	B	A	P
Phthalocyanine Blue	B	B	A	P
Phthalocyanine Green	B	B	A	P
Quinacridone	B	B	A	P
Toners	B	B	A	B
Yeast	A	B	A	A
Bacteria	A	B	A	A
All Computer Formats	A	B	A	P
Audio	A	B	A	P
Credit Card	A	B	A	A
Data Cartridges	A	B	A	P
Floppy Disks	A	B	A	P
Video	A	B	A	P
Caulks	C	A	A	C
Cutting Oils/Emulsions/Clays	A	B	A	B
Detergents	A	C	A	P
Graphite	A	A	A	P
Lubricants	B	B	A	P
Motor Oil/Fuel Additives	B	B	A	B
Photographic Dyes	B	C	A	P
Teflon [®] Coatings	B	A	A	P

A = Excellent

B = Good

C = Satisfactory

P = Pregrinding

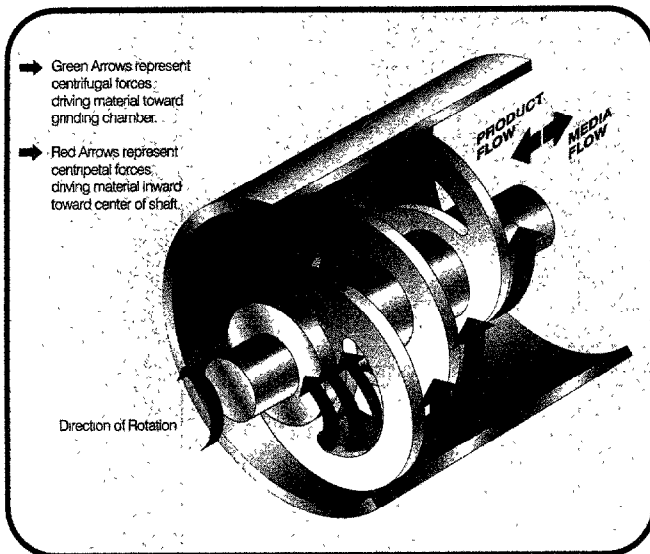
Consult your Netzsch representative for additional applications

LMC/LME DISC MILLING SYSTEM

The Netzsch Disc Milling Systems are the most successful disc grinding systems in the world. These systems are optimized for the product to be processed by selecting the correct disc type; Molinex™ (eccentric disc), Trinex™ (tri-lobe disc), or concentric disc. The Netzsch Disc Milling Systems are suited for a wide variety of applications and are typically used for discrete pass processes.

ENGINEERING AND OPERATING PRINCIPLES

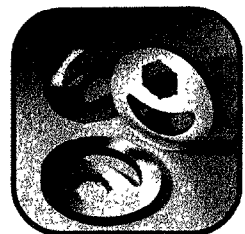
The function of the disc is to accelerate the grinding media centrifugally from the outer edge and centripetally from the inner edge of the disc creating shearing forces between the disc and the media (see figure). This agitation is carried to the surrounding media radially and axially by the kinetic energy imparted to the media by the disc.



Molinex Disc System

Netzsch offers three types of disc agitation systems:

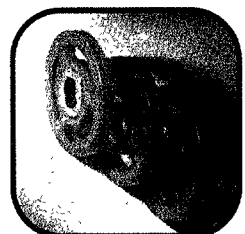
- The most popular of these is the **Molinex Disc System**, which consists of eccentric discs. When the shaft is rotated, the eccentric mounting of these discs creates an augering effect that pulses the grinding media against the product flow. This reduces hydraulic packing and results in an even distribution of the grinding media in the chamber.
- **Trinex (tri-lobe) Discs** apply the principles of the eccentric disc pulse grinding effect at higher frequency.
- **Concentric Discs**



Molinex Discs



Trinex Discs



Concentric Discs

The disc milling systems are primarily used for processing low to medium viscosity (1 to 200 poise) formulations. Solids levels in paint applications have been as high as 85% for industrial and furniture paints and ceramic slurries or slips. These systems are available in both horizontal and vertical configurations.

FEATURES AND BENEFITS

Cooling Efficiency

Cooling efficiency is enhanced through the use of a two-zone spiraled jacket. The spiral design creates these desired effects: cooling to the entire chamber; greater temperature control due to increased surface area; and reduced pressure drop by the use of two inlet and discharge ports.

An Investment for the Future

The rugged and durable design of Netzsch machines ensures years of reliable, satisfactory service.

Process Flexibility

Netzsch disc systems can be converted between Molinex, Trinex and concentric discs, providing flexibility to changing demands.

Media Separation

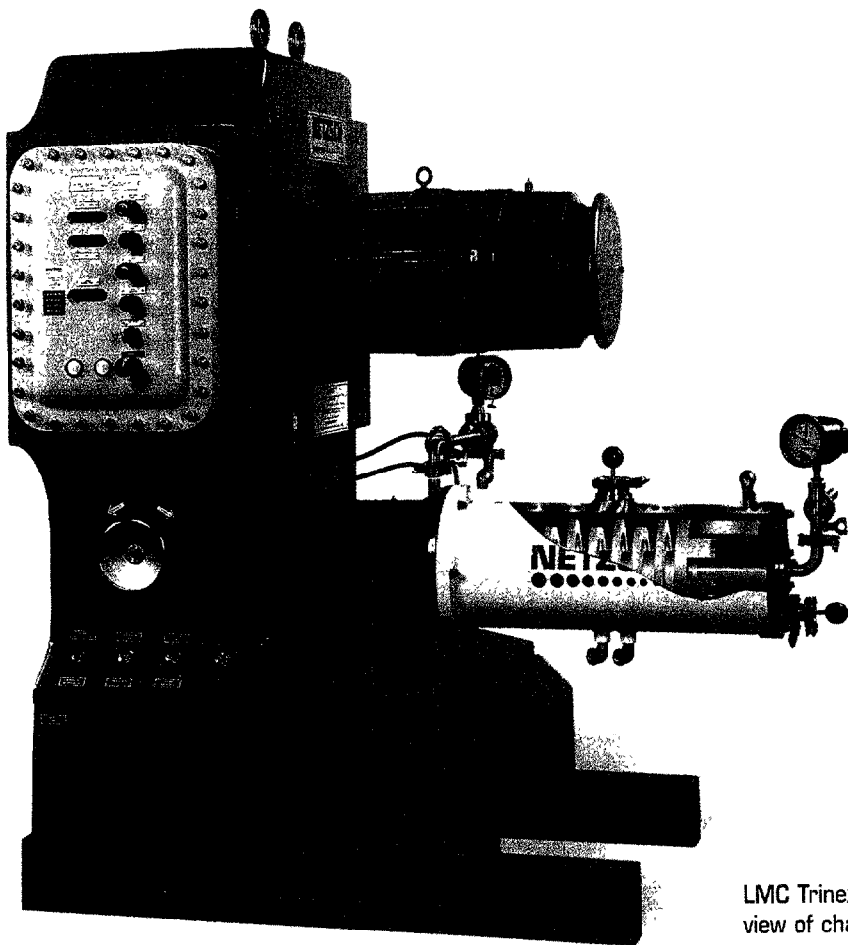
The Netzsch engineered and patented Dynamic Cartridge Media Separator™ (DCMS) is unique to the industry and offers one of the major advantages of all Netzsch machines. By centrifugally separating the beads from the product, the system can handle the finest grinding media available and allows the highest throughput rates of any horizontal bead mill. The DCMS is the best technology available in bead separation. (See page 50 for additional information.)

Flexible Construction

All disc designs are available for use on any Netzsch machine, allowing conversion of our existing machines to the very latest technology.

Range of Available Materials:

- *Special wear-resistant steel*
- *Hardened chrome steel discs*
- *Stainless steel (304 or 316)*
- *Hastelloy C*
- *Polyurethane*
- *UHMW polyethylene*
- *Polyamide (Nylon®)*
- *Aluminum oxide*
- *Zirconium oxide*
- *Silicon nitride*
- *Silicon carbide*



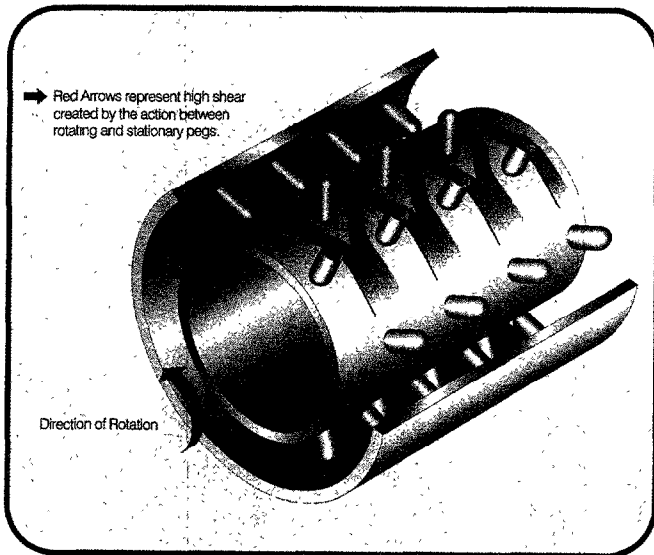
LMC Trinex Disc System with cutaway view of chamber area

LMJ JOHN SYSTEM

The John System, the world's first patented peg system, was invented by Netzsch. This system is best suited for highly viscous and/or hard-to-grind materials and is typically used for discrete pass processing.

ENGINEERING AND OPERATING PRINCIPLES

Until the development of the John System, vertical mills used long bars attached to a small diameter agitator shaft. The John System incorporates a large diameter cooled shaft with short pegs radially fastened to the diameter (see figure). This design eliminates the low energy zone and results in uniform peripheral speeds. The product to be processed passes through the small annulus created by the large diameter shaft and the chamber wall. The uniform grinding action ensures complete dispersion of very high viscosity/high solids formulas.



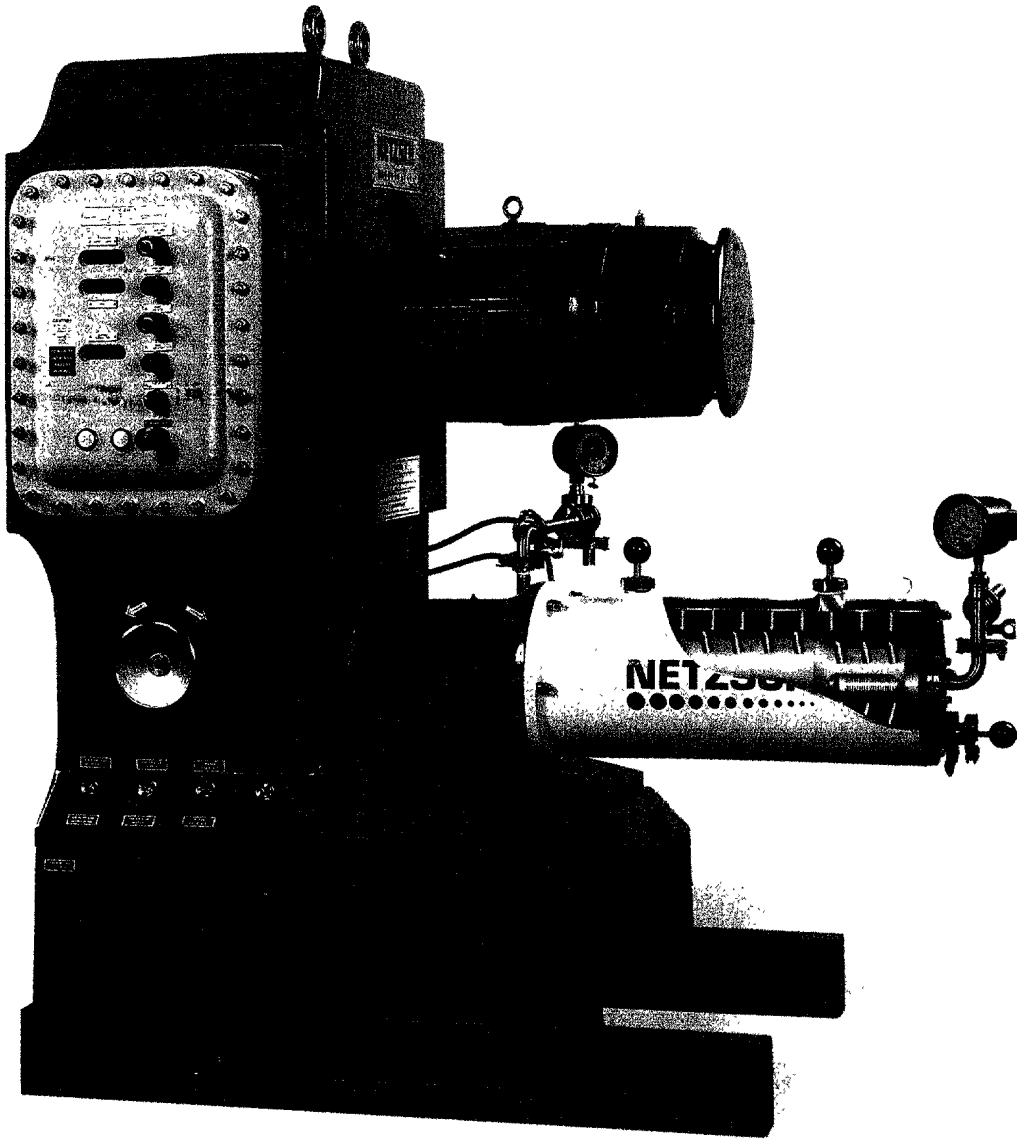
John System

FEATURES AND BENEFITS

- Large diameter shaft is cooled for additional temperature control
- Pegs are made of Tungsten Carbide for extremely long life and low, long-term maintenance costs. The pegs are easily replaced
- Shafts are available with replaceable wear sleeves
- Products in the range of one million centipoise have been processed successfully. High solids tint bases of 96% total solids are also processed with success
- Available in both horizontal and vertical configurations

NETZSCH VERTICAL MILLS

Vertical Mills are available in sizes that have been designed for specific applications such as grinding ferrites, offset inks and chocolate.



LMJ John System with cutaway view of chamber area

LMZ ZETA SYSTEM

The Netzsch Zeta System is the most versatile grinding system available. The Zeta System was specifically developed by Netzsch engineers for high energy, high flow, multiple pass grinding to achieve very narrow submicron particle size distributions with excellent repeatability. This system combines the well-known John System with the Netzsch patented Dynamic Cartridge Media Separator™ (DCMS).

ENGINEERING AND OPERATING PRINCIPLES

Extensive research has shown that when running passes through a media mill a portion of the batch bypasses the grinding process, short-circuiting through the chamber. This phenomenon, called the residence time distribution, is inherent in all media mills regardless of design. The ideal mill would have plug flow. In other words, all the material passing through the machine would travel at the same velocity with uniform grinding. To achieve plug flow, high throughput rates are required. This results in a uniform velocity of the particles through the mill.

At high flow rates, the horizontal (or vertical) disc mill is very sensitive to hydraulic packing of the media (or pressure grinding). Therefore, a design is required that will increase the kinetic energy of the beads and reduce the hydraulic packing associated with high velocity flow. The open surface area of the discharge must be increased to allow the high flow rate to occur without high chamber pressure.

The Zeta agitator design is based on the John System. This system produces a uniform activation of the media. The chamber length is

decreased to reduce the hydraulic compression and to increase the energy density. The centrifugal compression of the media is controlled by the rotor speed to counteract the product throughput. The DCMS on the Zeta System is enlarged to nearly the length of the mill chamber, resulting in high surface area. Centrifugal compression and the DCMS allow maximum fluidization of the grinding media while reducing chamber pressures at high flow rates. The DCMS allows the use of grinding media as small as 100 μm . Media size is one of the most critical factors in producing submicron particle size distributions.

Residence time in the mill is reduced to 10 to 60 seconds versus 2 to 10 minutes on conventional mills. Cumulative residence time produced by multiple passes and total energy input is much less than a conventional milling system. In the period of time required to run one or two passes on a horizontal mill, the Zeta System is capable of running 12 or more passes or turnovers of a batch. The intermixing in the tank and high turnover rate ensures that the material is completely dispersed.

FEATURES AND BENEFITS

Ease of Operation

In circulation grinding, precise flow control is not required. It is also not necessary for the operator to closely monitor the tank level. The pump has constant head pressure, eliminating the concern of lost flow. This translates into less supervision.

Consistent and Repeatable Quality Control

Dispersion quality is achieved as a function of time and energy input to the batch. The material is processed for a predetermined amount of time and energy based on batch size. When time is up, quality is checked. Should further grinding be required, it is simply a function of running longer, not running an additional pass through a standard bead mill. Grind quality is constantly improving, resulting in reproducible product quality.

Precise Temperature Control

High throughput rates and precise control of bead compression result in absolute product temperature control.

Simple Cleanup

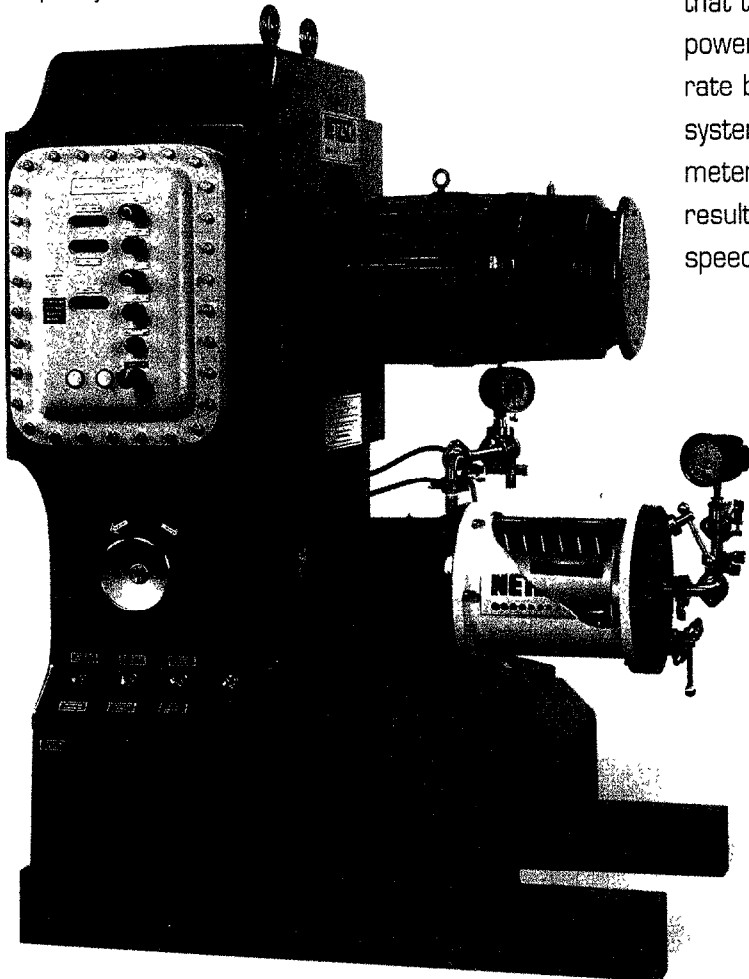
Low mill volume results in less mill volume to flush. Higher flow rates rinse piping more effectively.

Requires Less Media

Due to the smaller chamber volume, the cost for charging a mill is much lower than other mills.

Process Control

The use of a process controller to adjust the agitator speed based on power input ensures that the mill is always running at maximum power input. Controlling the product throughput rate by mill back pressure means that the system does not need an expensive mass flow meter to precisely control flow rate. Feedback results are instantaneous when flow and agitator speed are adjusted.



LMZ Zeta System with cutaway view of chamber area

TECHNICAL SPECIFICATIONS FOR DISC, JOHN AND ZETA SYSTEMS

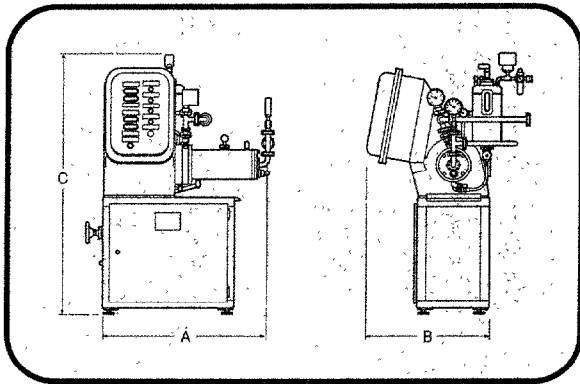


Figure 1

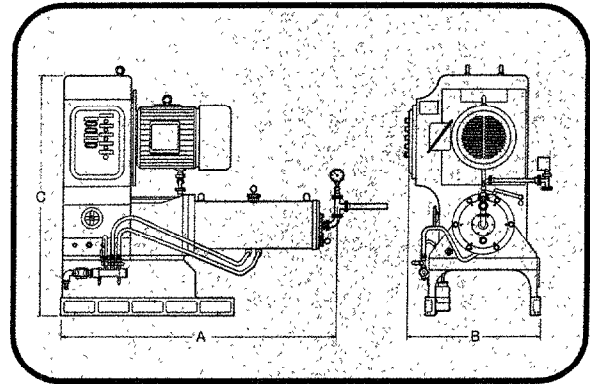


Figure 2

TECHNICAL SPECIFICATIONS

Model	Figure	A (mm/in)	B (mm/in)	C (mm/in)	Approx. Weight (kg/lb)	Chamber Volume* (l/gal)	Main Motor (kw/hp)
LME 4	1	940/37	740/29	1500/59	280/617	4/1.1	6/7.5
LME 12	1	1380/51	810/32	1780/70	600/1322	13/3	12/20
LMC 20E	2	1600/63	940/37	1800/71	1611/3550	21/6	20/30
LMC 45E	2	1980/77	940/37	1800/71	1960/4320	47/12	33/50
LMC 60E	2	2030/80	940/37	1800/71	1974/4350	53/14	33/50
LME 100K	2	2590/102	1300/51	2260/89	7714/3500	115/30	55/75
LME 200K	2	2670/105	1300/51	2260/89	8155/3700	292/63	75/100
LME 500K	2	3680/145	1650/65	2640/104	17852/8100	530/140	180/250
LME 1000K	2	4500/177	2250/89	1900/75	12000/26400	1022/270	355/750
LMJ 2	1	940/37	740/29	1500/59	280/617	2.4/0.6	6/7.5
LMJ 8	1	1300/51	810/32	1780/70	600/1322	8/2.2	12/20
LMC 14J	2	1600/63	940/37	1800/71	1611/3550	15/4	20/30
LMC 20J	2	1600/63	940/37	1800/71	1611/3550	20/6	20/30
LMC 35J	2	2110/83	940/37	1800/71	1974/4350	35/9	33/50
LMJ 80	2	2180/86	1300/51	2260/89	8155/3700	74/20	75/100
LMZ 2	1	790/31	740/29	1500/59	280/617	1.6/0.4	6/7.5
LMZ 4	1	1070/42	810/32	1780/70	600/1322	4/1.1	12/20
LMZ 10	2	1270/50	940/37	1800/71	1611/3550	10/2.6	20/30
LMZ 25	2	1830/72	940/37	1800/71	1974/4350	25/7	33/50
LMZ 60	2	2060/81	1300/51	2260/89	8155/3700	62/16	90/125
LMZ 150	2	2840/112	1500/59	2260/89	17852/8100	160/40	180/250

Note: In accordance with the Company's policy of continual product development and improvement, the above specifications are subject to amendment without notice.

*Chamber volumes vary depending upon disc system. All volumes shown are for use with the Dynamic Cartridge Media Separator™.

Dimensions shown are without process feed pump.

PATENTED NETZSCH DYNAMIC CARTRIDGE MEDIA SEPARATOR™ (DCMS)

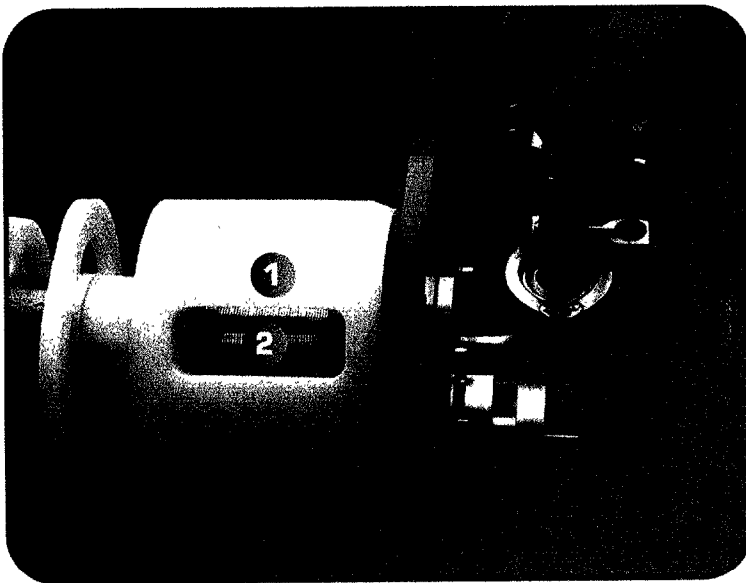
The DCMS is a standard separation system of all horizontal Netzsch mills. The Netzsch DCMS consists of only two parts: the dynamic shaft extension (part of the mill's agitator shaft) and the screen element. This combination and its physical location within the mill result in media separation superior to any separator. This patented Netzsch innovation separates grinding media from milled product.

ENGINEERING AND OPERATING PRINCIPLES

The DCMS operates by creating a media-free zone around the screen. A rotating or dynamic shaft extension attached to the end of the agitator shaft surrounds the screen. During operation, this shaft extension centrifuges the higher mass media away from the screen. The media passes through the slots in the shaft extension and is returned to the grinding zone of the mill. Because there is more open surface area on the screen element than other separators, higher throughputs, lower chamber pressures and reduced process temperatures are achieved.

FEATURES AND BENEFITS

- *Easy to clean*
- *Few parts*
- *Easy to access*
- *Extended life*
- *Variety of slot widths available*
- *Stainless steel standard
Other materials available*
- *Media down to 100 µm*



Netzsch Patented Dynamic Cartridge Media Separator™

1. Dynamic Shaft Extension
2. Stationary Screen

NETZSCH MECHANICAL SEALS AND MECHANICAL SEAL SERVICE

The Netzsch Cartridge-Type Mechanical Seal is an exclusive Netzsch design that provides a seal between the rotating and non-rotating parts of the grinding mill. This seal is double-acting, pressurized, and internally cooled. The Netzsch Mechanical Seal System consists of three major components: the mechanical seal, the seal reservoir and seal protection switches. Netzsch Mechanical Seals are completely serviced and repaired in our factory.

ENGINEERING AND OPERATING PRINCIPLES

Mechanical Seal

The function of the mechanical seal is to separate the rotating agitator shaft, the material being processed and the bearings. The pressurized double-acting mechanical seal accomplishes this with two sets of highly polished seal faces constructed of quality materials. On the process side, Netzsch utilizes tungsten carbide and silicon carbide. These materials have been selected for their abrasion resistance. The seal face materials on the atmospheric side are chrome steel and carbon. The tungsten carbide and the chrome face rotate with the agitator while the silicon carbide and carbon ring are held stationary in the seal housing. This sliding action between the seal faces creates the sealing surfaces.

Seal Reservoir

A seal fluid provides lubrication to the seal faces and acts as a cooling medium, increasing the life of Netzsch seals. The seal fluid circulates from the mechanical seal to the seal reservoir where it is cooled and returned to the seal. An integral pump located in the mechanical seal provides the circulation, eliminating the need for an external seal fluid pump. A thin film of seal fluid between the seal faces provides a continuous rinsing action. Any fluid compatible with the material processed can be used.

Seal Protection Switches

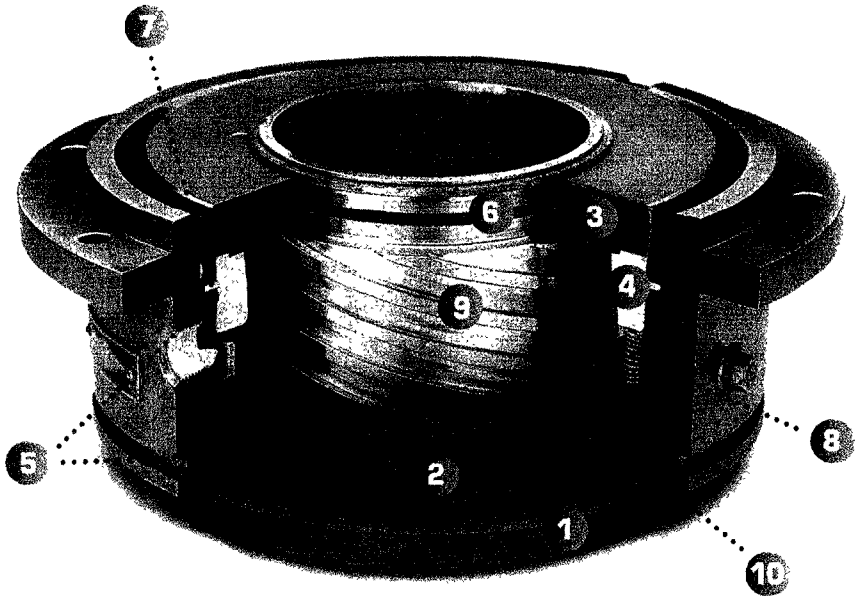
Netzsch mechanical seals are protected by three standard seal protection switches. A pressure switch on the process feed piping protects the seal from high process pressure. Similarly, an air pressure switch located on the seal reservoir monitors constant seal pressure. A liquid level switch monitors seal fluid level to ensure that the seal operates with lubrication and cooling. The seal protection switches are engineered to increase the service life of the mechanical seal and the mill.

FEATURES AND BENEFITS

- *Netzsch Mechanical Seals are completely preassembled and pretested in our factory*
- *Cartridge design is easily installed*
- *Fluid level and pressure switches standard*
- *Long life*
- *Superior design*
- *Designed for use with the smallest media on the market*
- *Integral pump*
- *Optional materials of construction are available*

DOUBLE-ACTING MECHANICAL SEAL

1. Tungsten carbide dynamic ring
2. Silicon carbide stationary ring
3. Chrome steel dynamic ring
4. Carbon stationary ring
5. Perfluoroelastomer O-ring
6. Viton® O-ring
7. PTFE backup ring
8. Compression spring
9. Integral pump
10. Media excluder ring



Netzsch Cartridge-Type Mechanical Seal

MECHANICAL SEAL SERVICE — IN-HOUSE REPAIRS/REBUILDS

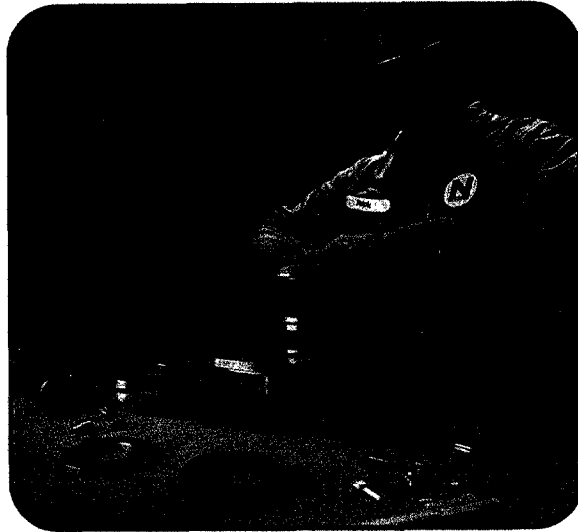
The Netzsch Mechanical Seal Program provides the customer with three repair alternatives:

1. Return the used mechanical seal for repair.
2. Purchase a rebuilt mechanical seal and return the used one for core credit.
3. Purchase a new mechanical seal.

Both new and rebuilt mechanical seals are available from stock. Emergency, same-day service is available.



In-house lapping machines allow Netzsch complete control over manufactured seal parts.



Highly skilled technician assembles mechanical seal for our customers.



Newly redesigned and patented, Netzsch Turbomill® provides significant improvements: finer grinding for enhanced quality and faster grinding for higher productivity. The Turbomill can achieve throughput time reductions of as much as 50%. Netzsch Turbomill is easy to operate; cleanup and changeovers are simple. Turbomill requires no supporting equipment.

ENGINEERING AND OPERATING PRINCIPLES

The Turbomill utilizes a sealed rotating basket. The basket is filled to between 80 and 96% by volume with grinding beads. Inside the basket a fixed grinding disc is attached to a shaft that is concentric to the basket drive shaft. This inner shaft is locked to prevent the disc from rotating.

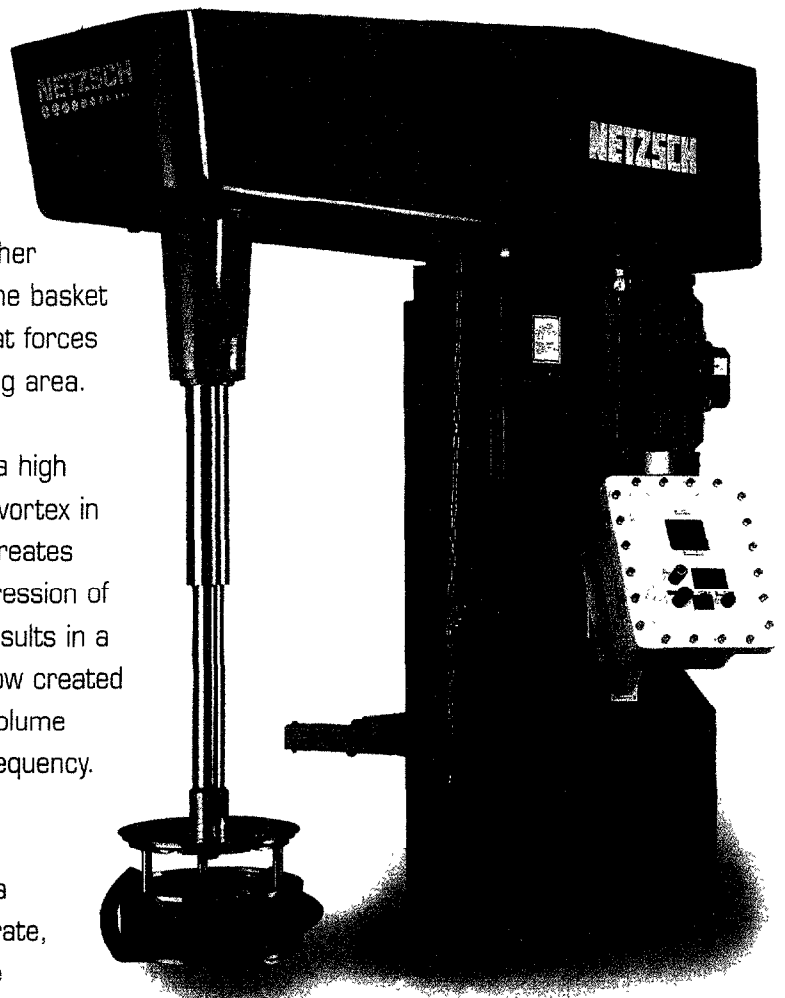
The sieve basket rotates around the fixed grinding disc. When the basket is rotated the centrifugal force compresses the beads against the grinding disc. Shearing forces for dispersion are created between the fixed disc, the moving beads and the rotating basket. Rods mounted to the grinding disc create turbulence for higher shearing force. The hollow center of the basket creates a centrifugal pumping force that forces the material to flow through the grinding area.

As the basket is an impeller similar to a high speed dissolver, the product flows in a vortex in the batch tank. A high basket speed creates circulation of the batch and high compression of the media. This media compression results in a fine particle size. The high resultant flow created by the basket ensures that the batch volume passes through the basket with high frequency.

The high batch turnover rate gives a narrower particle size distribution and a "cleaner grind." With a high pumping rate, settling problems that may occur in the

process tank are eliminated. Higher viscosity or thixotropic products are handled by adding pumping blades to the basket. Blades are supplied with every machine.

Steel or ceramic beads can be used. The basket is available in various slot sizes accommodating bead diameters of 0.8 mm to 3 mm.



Netzsch TM Turbomill shown with basket open and blades attached

FEATURES AND BENEFITS

Simple Operation

Batch process ensures uniform grinding.

Rotating Basket Provides Fast Cleanup

The patented rotating basket facilitates easy cleaning. Cleaning of the basket includes: rotating the basket in solution at various speeds to clean the beads; quickly brushing the outside of the basket to remove any remaining film; and raising the basket from the tank, spinning and wiping clean.

Small Batch Production

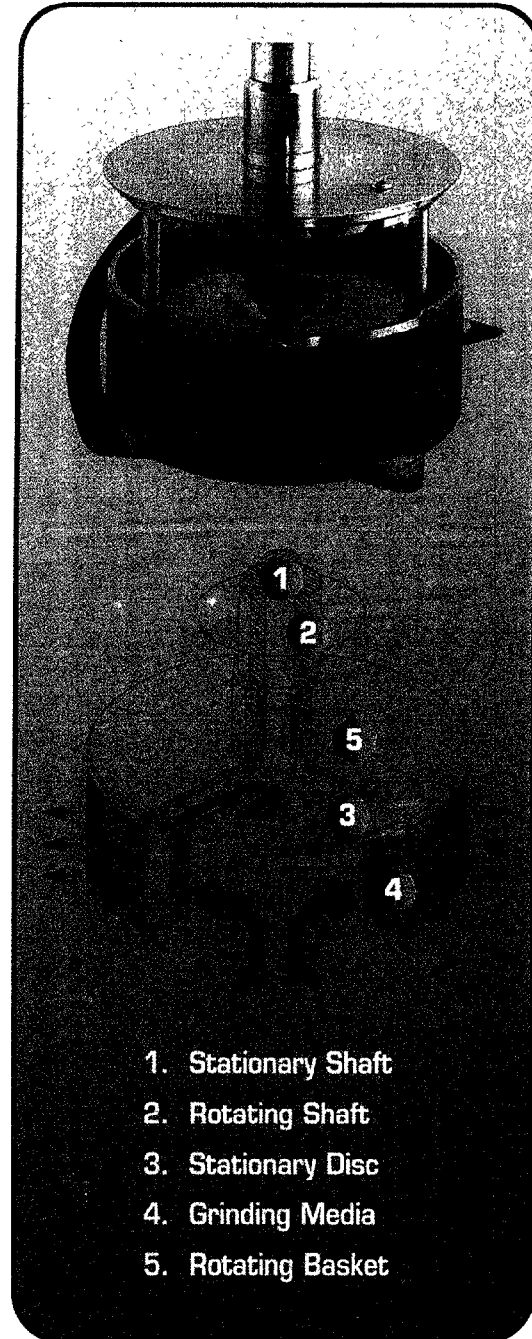
The unique flexibility of the TMC 50 allows use of the TMC 10 basket as well as the larger TMC 50 basket. This allows a production range of 10 - 500 gallons.

100% Batch Yield

When grind quality is achieved, the basket is raised from the batch. It is rotated very briefly to spin or centrifuge the remaining product from the basket to yield nearly 100% finished product. Waste material and cleaning is reduced.

Environment - Minimal Solvent Emissions

Production of solvent borne products poses environmental concern for solvent emissions. Since there are no feed and discharge tanks requiring extra lids or no open flow discharge into a tank, Turbomill has minimal solvent emission. The tank lid is designed to allow solvent vapors to condense and drip down the inner walls of the tank, cleaning the upper portion of the tank.



FEATURES AND BENEFITS (cont.)

Sealed Basket

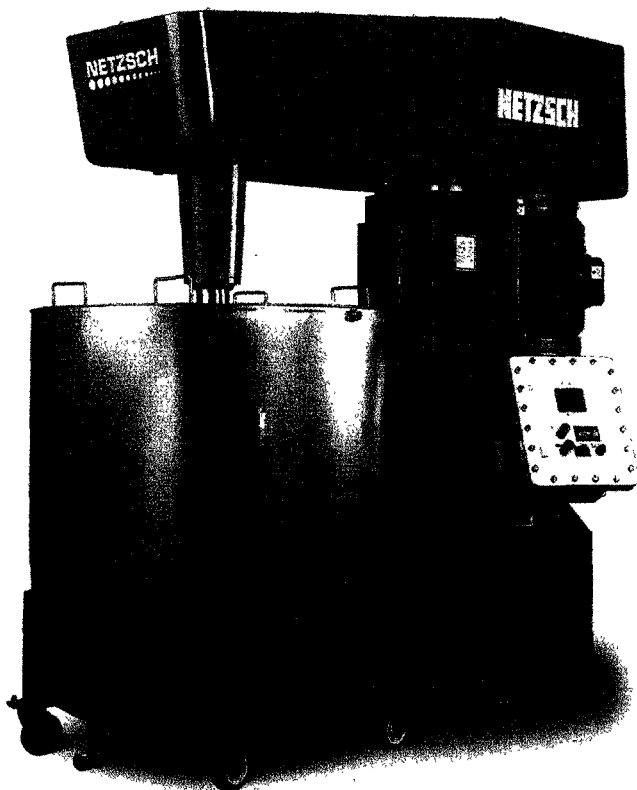
Beads are completely enclosed by the basket, preventing accidental discharge of grinding media into the batch.

Batch De-Aeration

The basket is lowered into the premixed batch and turned on and off for a few cycles. This procedure causes air bubbles to rise from the batch. Priming the basket and pregrinding the solids de-aerates the batch and prevents it from becoming foamy.

Standard Variable Speed Drive

Speed of the basket is controlled with a Variable Frequency Drive supplied with each machine. The maximum speed is determined either by power consumption or by the vortex level.



Netzsch TM Turbomill shown with optional 280 gal. mixing tank

Use of Existing Tanks

The Turbomill can use any tank already in use in the factory. However, if the existing tanks do not have cooling jackets, the product will increase in temperature during dispersion. If the product is easy to grind, temperature rise is minimal. This also allows the Turbomill to operate in 55 gallon drums. However, if a more difficult-to-grind material is processed, a jacketed tank is required and can be supplied.

Safety

Minimal Peripheral Equipment — The Turbomill does not require a feed pump and associated pipe work.

Small Bead Quantity

Minimal bead requirement enables cost-effective use of high quality ceramic beads.

Low Maintenance

The mechanical seal between the inner and outer shaft runs under very low pressure resulting in long life.

Premixing

For preparing dispersion from start to finish, Turbomill makes an excellent pre-dispersion for bead milling, increasing bead mill productivity.

OPTIONS

Tank

304 ss jacketed tank with dish-bottom and integral drain. Includes cover and wheels.

Thermometer

Gauge to measure process temperature.

OVERALL DIMENSIONS

	TMC 10 (mm/in)	TMC 50 (mm/in)	TM 100 (mm/in)
(A) Length	1550/61	2640/100	2660/105
(B) Width	1120/44	1400/55	2450/97
(C) Height	1515/60	2410/95	2640/104
(D) Raised Height	2260/89	3680/145	4100/162
Max. Tank O.D.	600/24	1120/49	1700/67
Basket Height*	215/9	280/11	320/13
Max. Tank Height	960/37	1550/61	1810/71
Approx. Weight (kg/lb)	1400/640	3750/1700	5732/2600

*Distance from floor to bottom of basket

Tank Dimensions

	TS 75	TS 150	TS 280
Working Volume (l/gal)	220/55	440/110	1760/220
Depth (mm/in)	840/33	1090/43	1240/49
Inside Diameter (mm/in)	650/26	810/32	1040/41
OD (mm/in)	740/29	890/35	1120/44

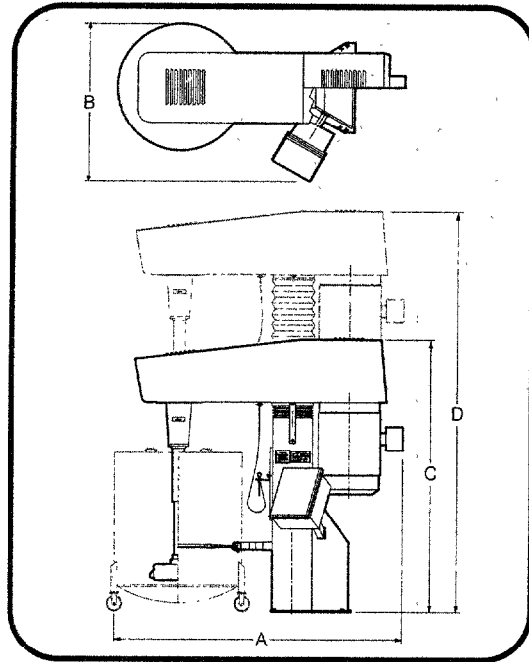
Media Options and Basket Charge

	Density	TMC 10	TMC 50	TM 100
Zr Ceramic	6.0	10 kg	33 kg	97 kg
ZTA Ceramic	4.2	7 kg	25 kg	70 kg
Steel	7.6	13 kg	48 kg	133 kg

Media Ordering Information

	Pregrinding	Coarse Below 30 µm	Fine Below 10 µm
Basket Slot	1.5 mm	1.5 mm	.5 mm
Media Size	3 mm	2 mm	1 mm
Zr Ceramic	634981	634979	634975
ZTA Ceramic	635092	635091	635089
Steel	443035	443171	629022

Other sizes available upon request



Turbomill Technical Dimensions

TECHNICAL SPECIFICATIONS

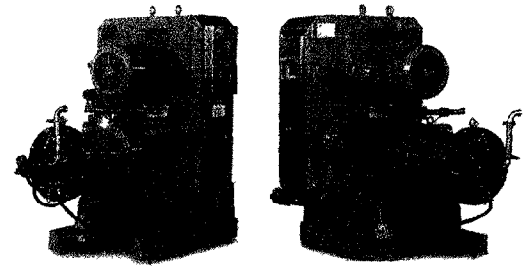
	TMC 10	TMC 50	TM 100
Horsepower	10	50	100
Operating Voltage	460	460	460
Electrical Classification	NEMA 7, Class I, Division 1, Group D		
Safety Switches	Tank secured in place, basket in lowered position		
Control Panel	Start/Stop/Emergency Stop Pushbuttons, Ammeter, RPM Meter, Hour Meter		
Hydraulic Pump HP	1	1	1
Basket Volume	2.7 liters	10 liters	28 liters
Bead Volume Required	2.6 liters	9.6 liters	26.5 liters
Basket Diameter	270 mm	430 mm	620 mm
Frequency Inverter	Yes	Yes	Yes
Basket Speed Range RPM	50 - 650	100 - 650	100 - 250
Batch Volume Range	40 - 220 ltr/10 - 55 gal	180 - 1900 ltr/45 - 500 gal	800 - 4000 ltr/200 - 1000 gal

*Infinitely variable by frequency inverter between speed range.

Note: In accordance with the Company's policy of continual product development and improvement, the above specifications are subject to amendment without notice.

MILL OPTIONS

Netzsch mills are supplied with many standard features. Netzsch offers the following optional accessories or features:



MILL DRIVE SYSTEM

A variety of mill drive systems is available.

- Fixed speed drive via belts and sheaves
- Infinitely variable speed via split pulley drive
- Mechanical soft start (fluid clutch)
- Electronic soft start
- Infinitely variable speed via variable frequency drive

MEDIA FILLING

- Funnel
- Eductor system
- Automatic refilling system

MEDIA COLLECTION TRAY

- Stainless steel tray with replaceable screen and valve

RAMBER REMOVAL SYSTEM

- Mobile cart with hydraulic jacking system
- Integral wheel and rail system



PROCESS FEED PUMPS

Netzsch mills shown with many optional features

Available pumps:

- Gear pump
- Peristaltic pump
- Diaphragm pump
- Nemo® Progressing Cavity Pump

Available drives:

- Mechanical variable speed
- Variable frequency drive

ELECTRONIC CONTROLS

- Netzsch Auto-Mate™ 2000 control package
- Data acquisition
- Temperature and pressure transmitter
- Mass flow meter
- Process flow detector
- Process temperature switch
- Coolant water control valve

GRINDING MEDIA

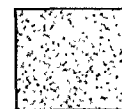
In addition to mill options and accessories, Netzsch carries a full line of grinding media. For your glass, ceramic, special ceramic and steel media needs, please consult your Netzsch representative. (See page 72 for Media Specifications Chart.)



Glass



ZTA



TZP



Steel

NETZSCH MODULE SYSTEMS

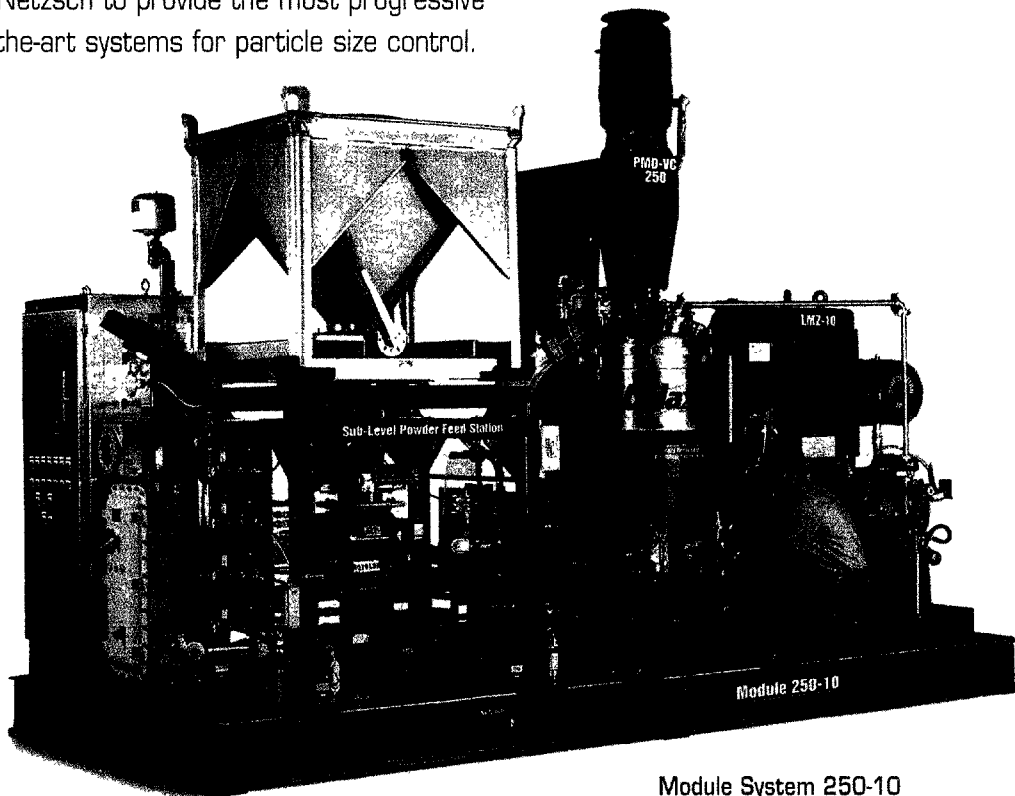
Today's processing demands require increasingly flexible and complex systems. The Netzsch Module System provides the answer for new process systems while reducing on-site engineering demands.

A system is a collection of equipment and control hardware that can perform one or more process tasks such as classifying, milling, mixing or dispersing. The procedure to control these tasks is the "strategy engine" to drive the system for a particular product.

NETZSCH TECHNICAL EXPERTISE

The Netzsch name is synonymous with the world leader of controlled particle size distribution and reduction equipment. Netzsch has extended its technical expertise to develop engineered system modules for specific particle size distribution applications in both wet and dry applications. Netzsch has developed system modules since the early 1980s. This extensive experience has allowed Netzsch to provide the most progressive state-of-the-art systems for particle size control.

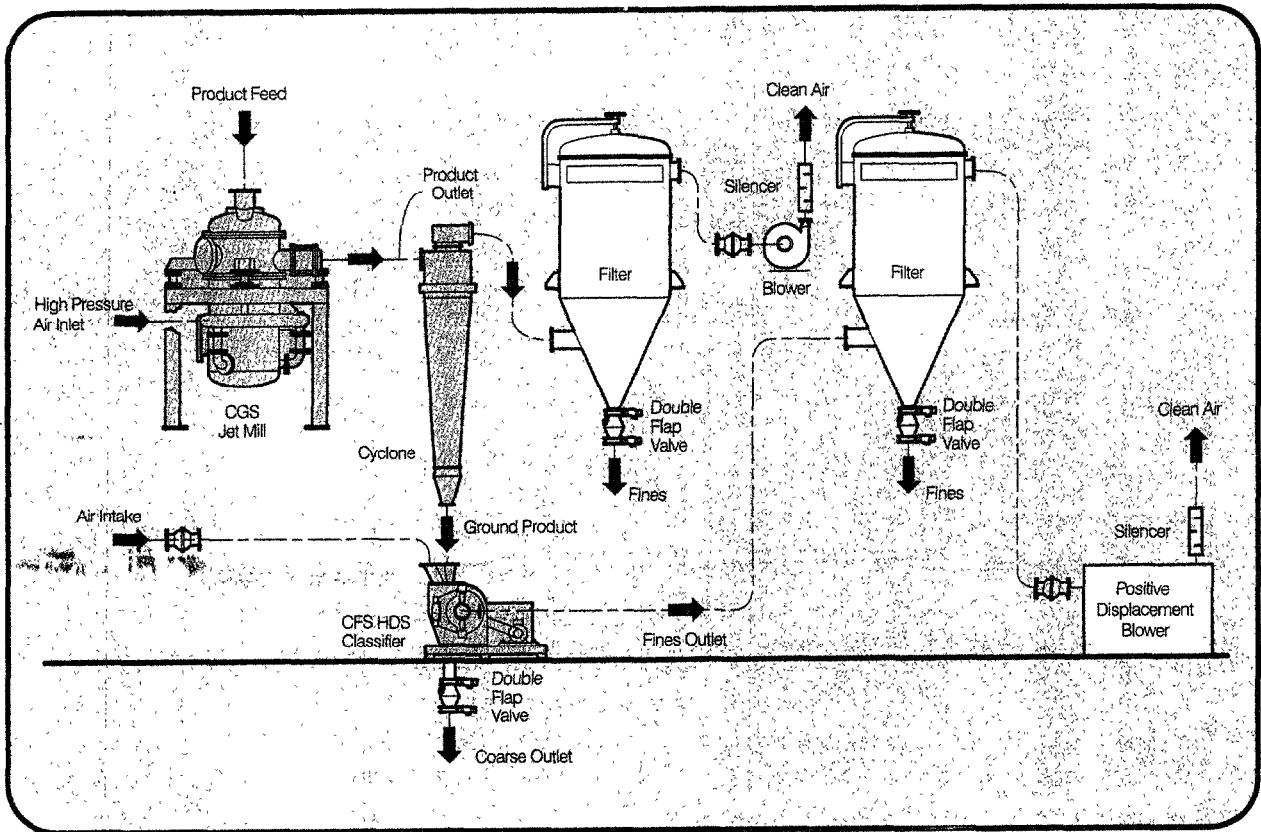
Netzsch has a total systems group that uses advanced and well-defined hardware and software. The total team concept is used to conceive, design, construct, install, train and support the Netzsch Module System. Similar to the way in which different types of machines work together, the Netzsch team works with our customers to create the future.



Module System 250-10

DRY GRINDING AND CLASSIFYING SYSTEMS

DRY GRINDING AND CLASSIFYING SYSTEM



Classifying

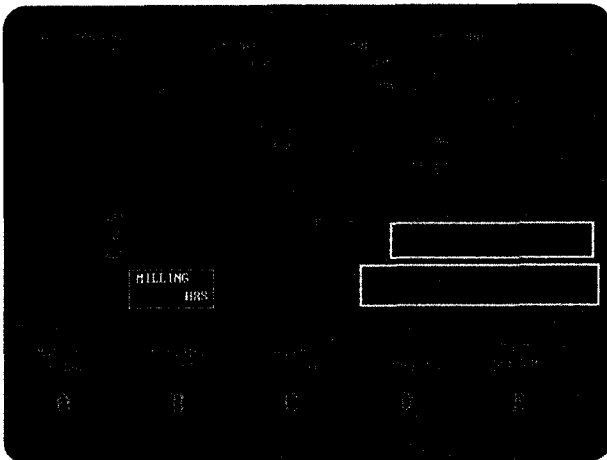
Grinding and classifying of powders normally involves not only grinding and/or classifying, but also powder handling. The above diagram highlights a system which uses all three. A Netzsch CGS Jet Mill grinds the powder to a specific, controllable top size. A downstream blower conveys the ground material to a cyclone that discharges the powder. A Netzsch CFS HD-S Classifier removes ultra-fine particles. Baghouse filters clean the conveying air before it is discharged to the atmosphere. Contact your Netzsch representative with your specific application.

Jet Milling

The use of a Jet Mill for particle size reduction requires a system with peripheral equipment similar to classification. Added to this system is a compressed air module used to supply compressed air or gas for impact grinding in the jet mill. Netzsch designs systems for jet milling according to the specific application.

Control System Types

The control of a system can be either a unit or multiple operation procedure. A unit procedure is a single function such as classifying, mixing or milling. An operation is a collection of units preparing elements for the final product, such as bases or coatings. The control of these operations progresses from basic programmable logic controllers (PLC) to distributed control systems (DCS). A human-machine interface (HMI) is used to give direction to the controlling software. Graphic displays such as the one shown below enable the operator or supervisor to give direction or receive information from the operation.



HMI Graphic Display

Automation

Automation is the sequencing of valves, motors, pumps, etc. to enable accurate and consistent results so that high quality and productivity are achieved.

Data Acquisition

Data acquisition is the recording of operational parameters for a given procedure. Data are collected in a database for use in performance reports. These reports include alarms, system trends, messages and maintenance information.

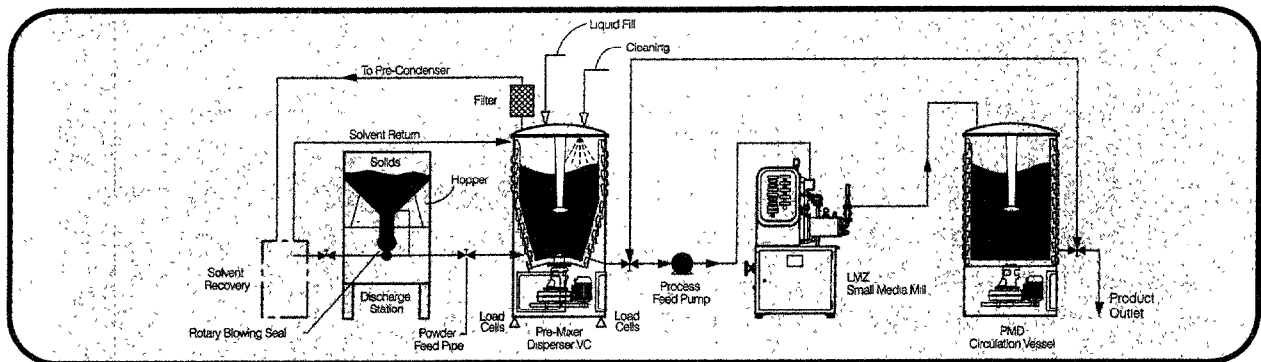
Netzsch has designed systems for controlled particle sizing for more than twenty years. Netzsch is the leader in the industry offering:

- *State-of-the-art control technology*
- *Automation*
- *Data acquisition*
- *In-house process engineering*
- *Design*
- *Programming for all applications*

For your next project consider Netzsch as your single source supplier.

WET GRINDING AND DISPERSION SYSTEMS

SUB-LEVEL FEEDING



Vacuum prepared pre-mix for wet milling dispersion is a technological advancement developed by Netzsch. This patented process, as illustrated above, allows the feeding of raw materials via vacuum into a vessel and the degassing of pre-mix. This is defined as sub-level feeding. Sub-level feeding begins by adding the major liquids to the vessel followed by applying a vacuum to the vessel. Powder is transported to the mixing vessel by a gas media and enters the vessel beneath the liquid level. Depending on the application, the gas media can be air or an inert gas such as nitrogen. The liquid in the vessel acts as a filter, retaining the powder and allowing the gas to enter and exit the mixing operation.

Elimination of Liquid/Gas/Solid Phase

During the separation of the transport gas and powder in the vessel, the embedded air in the "as received" powder is removed. By the use of vacuum during the dispersing operation, the liquid pressure can be reduced to a point where vaporization occurs. The removal of air voids in the porous solid particles being replaced with liquids greatly enhances the ability to disrupt the large particles. Removing the air with the use of vacuum provides a significant advantage, allowing the mechanical energy from the high speed disperser (HSD) to disperse the solids in the liquid. In a non-vacuum system, the HSD must first break down the air boundaries prior to

reaching the solid-liquid boundary. These air boundaries, if not removed, could cause problems with further product processing.

Powder Feed Station

A powder feed station is used to dispense powder into a transport pipe affixed to the base of the vessel. The powder feed station mobilizes and meters the powder into the transport pipe. The particles accelerate in this pipe to break down dead zones.

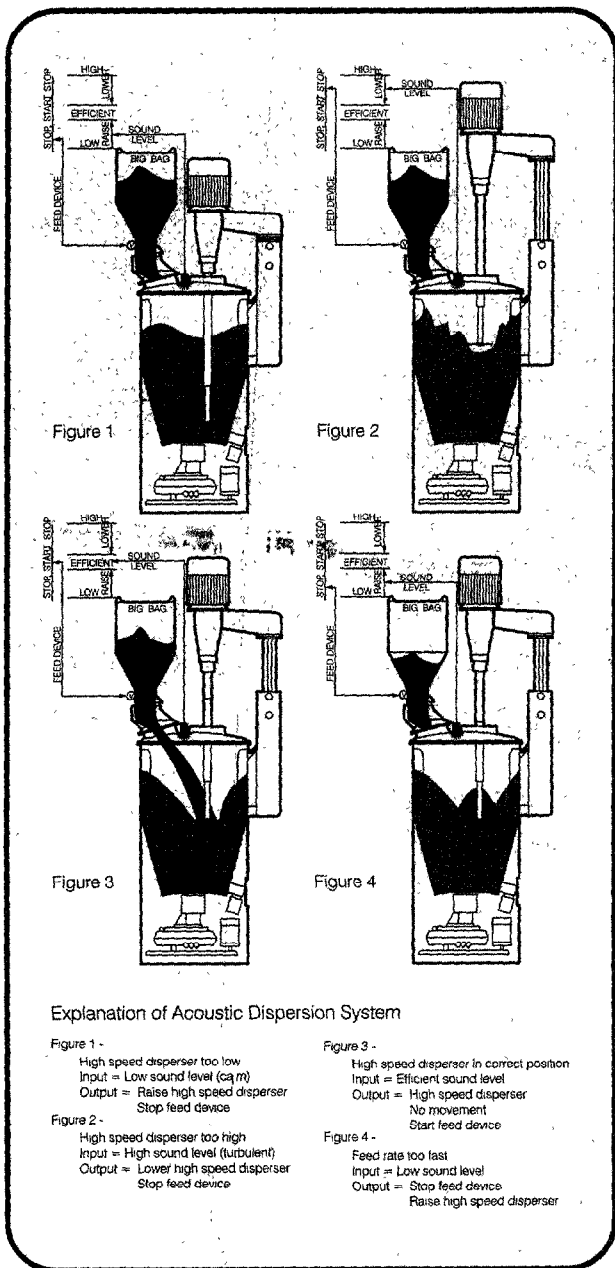
Solvent Recovery — Emissions Control

Vapors removed from the vessel during the vacuum feeding process are reclaimed by the vacuum pump. As the vapors discharge from the vessel and pass through the vacuum pump, condensing occurs. The condensate collects in the vacuum systems reservoir. The condensate is then returned to the vessel, thus minimizing solvent loss.

Advantages of Sub-Level Feeding

- *Accurate and precise measurement of feeding process*
- *Totally enclosed system offers protection for the environment and the operator*
- *Repeatability from batch to batch*
- *Batch time reduction*

ABOVE-LEVEL FEEDING



Acoustic Dispersion System™

For applications where ingredients are added from above the liquid level, Netzsch has developed the patented process Acoustic Dispersion System (ADS). This system allows the dispensing of powder ingredients in a uniform and controlled manner.

Engineering & Operating Principles

The principle of ADS is to measure sound created by the high speed impeller and convert those signals to automatically raise or lower the disperser. The system includes a powder discharger affixed to the cover of the vessel, a microphone placed in the vessel cover and a controller. With the liquid additions complete and disperser blade energized, powders are uniformly dispensed into the vessel. The sound level in the vessel diminishes. Dispensing is stopped and the mixer blade is raised to thoroughly mix the powders into the liquid. As the sound level increases, the disperser blade lowers into the batch and the discharger dispenses more powders.

Advantages of the ADS System:

- Reduces processing time
- Eliminates overloading of powders being added to a vessel
- Removes operator responsibility to dispense powders into the mixer and continually adjust the disperser blade's location

Wet Grinding Mill Systems

To complete preparation and processing of a dispersion, a grinding mill is added as part of the system. From a system standpoint, it is not important whether the mill is operated in discrete pass or circulation mode.

Discrete Pass — The normal discrete pass system includes a pre-mix vessel, a mill and a secondary vessel.

Circulation System — The circulation system requires only a pre-mix vessel and a mill.

LABORATORY MILLS—DRY GRINDING & CLASSIFYING

CSM 80 CLASSIFIER MILL

The Netzsch CSM 80 Classifier Mill is used to grind and classify soft to medium hard materials (Mohs' hardness 1 to 5). This machine is ideally suited for applications where precise top-size control is required up to 150 μm .

FEATURES AND BENEFITS

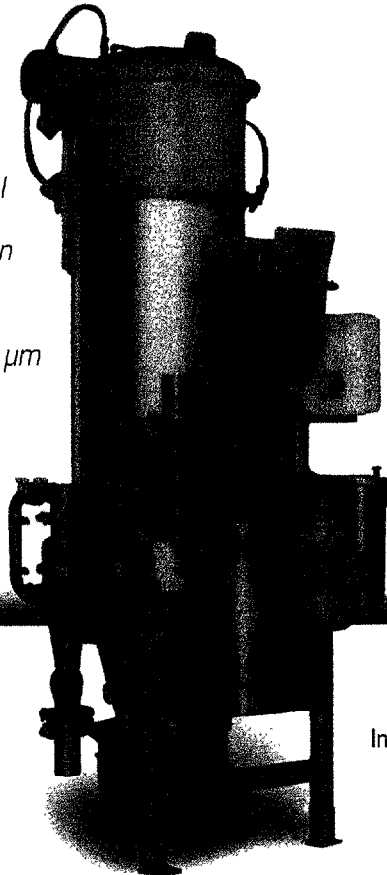
- Interchangeable between CGS Jet Mill or CFS Mechanical Air Classifier
- Independent, infinitely variable speed grinding and classifying drive motors
- Compact
- Technologically advanced classifier wheel
- Optional pressure shock resistant (PSR) configuration
- No oversize material
- Continuous operation
- Output particle size range 8 μm to 150 μm

CGS 16 JET MILL

The Netzsch CGS 16 Jet Mill is used to grind hard (up to Mohs' hardness 9) and/or temperature-sensitive materials. This machine is designed to grind small sample quantities and to test grinding feasibility.

FEATURES AND BENEFITS

- Interchangeable between CSM Classifier Mill or CFS Mechanical Air Classifier
- Infinitely variable speed classifier drive
- Technologically advanced classifier wheel
- Three high-pressure laval grinding nozzles
- Compact
- No grinding parts to contact product
- Contamination-free grinding
- Exact particle size control
- Extremely fine output particle size (2 μm to 70 μm)
- Can be used for experimentation or small production
- Easy cleaning



Interchangeable CSM 80, CGS 16 and CFS 8 Lab Mill System

CFS 8 MECHANICAL AIR CLASSIFIER

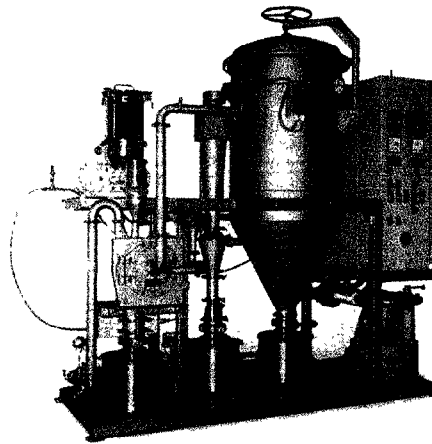
The Netzsch CFS 8 Mechanical Air Classifier is our laboratory version of the production size CFS Classifier. This machine is primarily used to determine whether a material can be classified. It can also be used for scale-up to production size units.

FEATURES AND BENEFITS

- *Interchangeable between CGS Jet Mill or CSM Classifier Mill*
- *Infinitely variable speed classifier drive*
- *Technologically advanced classifier wheel*
- *Cyclone/vortex design*
- *Compact*
- *Exact particle size cut-point from 150 μm down to 25 μm*
- *No residual material remains in machine upon shutdown*
- *Inherently self-cleaning*

CFS 8 HD-S MECHANICAL AIR CLASSIFIER

The Netzsch CFS 8 HD-S Mechanical Air Classifier is our laboratory version of the high dispersion production size classifier. This classifier is used for sample preparation and for scale-up to production size machines. This machine provides extremely accurate particle size cut-point from 50 μm down to 1 μm .



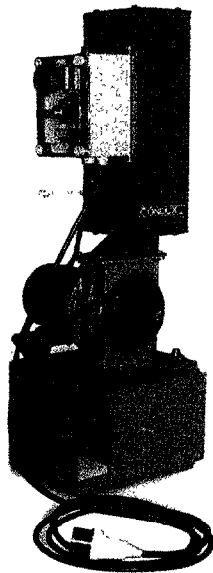
FEATURES AND BENEFITS

- *Patented, purged constant velocity classifier wheel*
- *Infinitely variable speed classifier drive*
- *Spiral coarse-product discharge*
- *Purged sealed bearings*
- *Extremely accurate particle size cut-point from 50 μm down to 1 μm*
- *Independent or system operation*
- *Small to large production runs*
- *High dispersion of incoming material*

LABORATORY MILLS—DRY GRINDING & CLASSIFYING (cont'd)

CS 150/100-2 CUTTING GRANULATOR

The Netzsch CS 150/100-2 Cutting Granulator is a high speed rotary knife mill primarily used for sample preparation. The machine is used to reduce non-friable materials such as plastic and rubber.

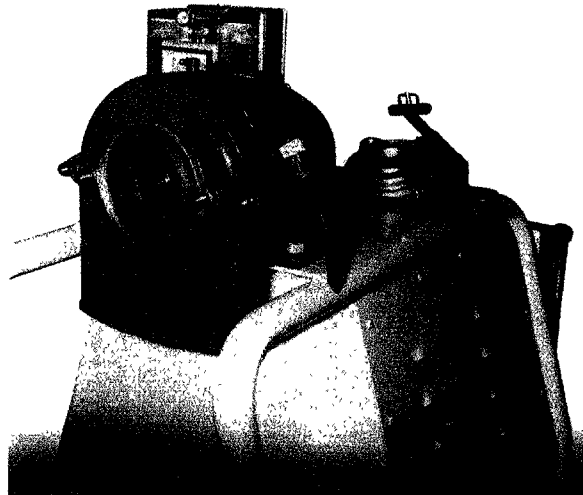


FEATURES AND BENEFITS

- *Direct drive, fixed speed rotor*
- *Interchangeable outlet screens*
- *3-knife claw style rotor, 2-bed knives*
- *Product collection hopper*
- *Easy material processing*
- *Many uses*
- *Compact*
- *Resharpenable/reversible knives*
- *Particle size down to 0.5 mm*

CUM 100 UNIVERSAL MILL

The Netzsch CUM 100 Universal Mill is our most flexible machine for dry grinding of small quantities and is a laboratory version of our production size universal mill. Interchangeable grinding tools are used to reduce friable materials.



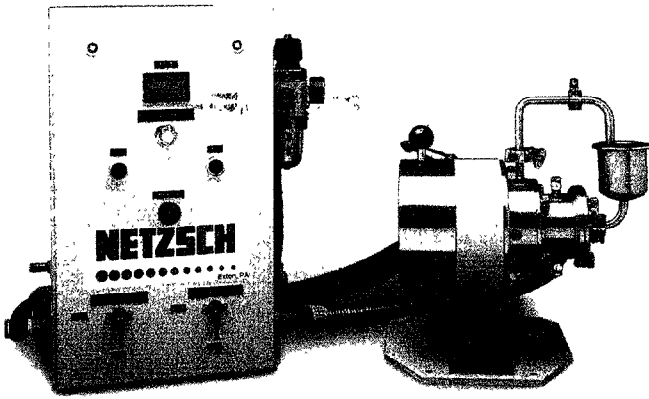
FEATURES AND BENEFITS

- *Interchangeable rotors:
wing beater, blast rotor, pin disc*
- *Built-in product feeder with hopper*
- *High impact, high speed grinding*
- *Extremely versatile*
- *Easy rotor changes to adjust outlet size*
- *Can accept many types of collection bins*
- *Particle size reduction to 50 μ m*

LABORATORY MILLS—WET GRINDING & DISPERSION

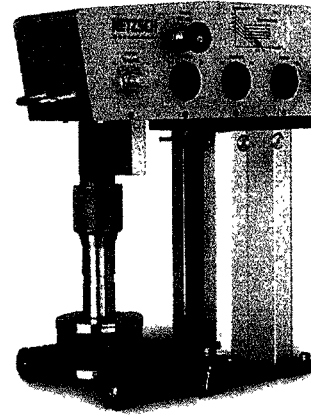
NETZSCH MINIZETA™

The Netzsch MiniZeta is a high energy grinding system designed for small batch analysis. This machine is scalable to larger size Zeta Mills, simple to operate and is portable.



NETZSCH MINI TURBOMILL®

Similar in concept to the MiniZeta, the Mini Turbomill is designed for the laboratory that requires small batch analysis. The Mini Turbomill is used to evaluate dispersions and to determine process capability of our larger Turbomills.



FEATURES AND BENEFITS

- Circulation or discrete pass milling
- Infinitely variable speed drive via air or electric motor
- Batch size down to 250 mL
- Tilttable chamber design
- Integral pumping system
- Chamber volume — 300 mL
- Scalable
- Versatile
- Portable
- Compact

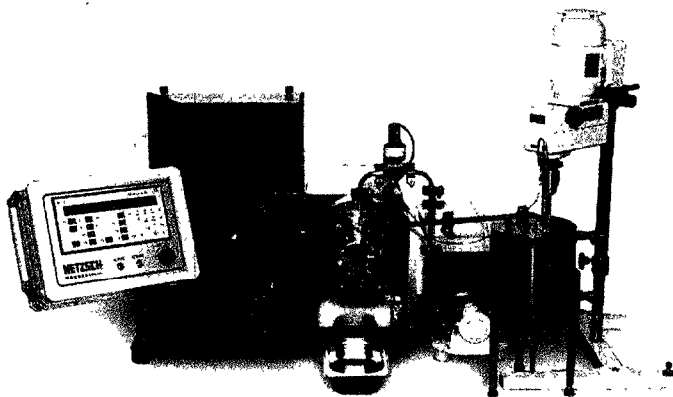
FEATURES AND BENEFITS

- Batch sizes 1 to 4 liters
- Stainless steel grinding basket
- Infinitely variable speed drive via air motor
- Inherently explosion proof
- Fast/easy cleanup
- No auxiliary equipment required (eg, pumps, pre-mixing)
- Portable
- Scalable

LABORATORY MILLS—WET GRINDING & DISPERSION

NETZSCH LABSTAR™

Netzsch Labstar is our most flexible laboratory machine and is capable of operation in both horizontal and vertical positions. Netzsch Labstar is convertible between the Trinex and Zeta Systems. Trinex is a disc system for discrete pass milling. Zeta is a peg agitation system for circulation milling.



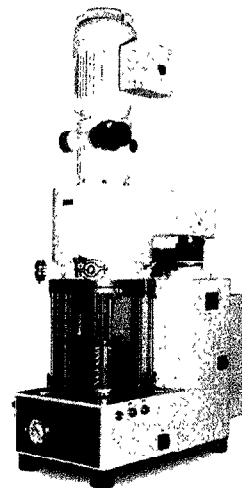
FEATURES AND BENEFITS

- *Batch sizes greater than 1 liter*
- *Interchangeable agitating systems*
- *C-I-P design/fast, easy cleanup*
- *Variable speed drive through frequency inverter*
- *Choice of pumps*
- *Double-acting mechanical seal*
- *Vertical or horizontal operation*
- *Optional PLC control*
- *Wide variety of materials*
- *Non-metallic version available*
- *Scalable*
- *Chamber volume — 0.7 Trinex System
— 0.6 Zeta System*

PML LOW SPEED PLANETARY MIXER

PMH HIGH ENERGY PLANETARY MIXER

Netzsch Planetary Mixers are ideally suited for medium to high viscosity materials.

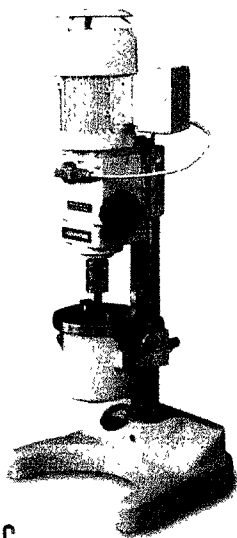


FEATURES AND BENEFITS

- *1 liter and 8 liter sizes available*
- *Twin mixing blades*
- *Infinitely variable speed drive*
- *Vacuum operation*
- *Clear vacuum chamber*
- *Mixing vessel can be a standard commercial can*
- *Simple, fast vessel clamping assembly*
- *Compact design*

PE 075/PR 1S LABORATORY ATTRITION MILL

This Laboratory Attrition Mill is designed for evaluation of very small quantities of material. The grinding vessel is jacketed for cooling or heating. The chamber can be raised, lowered and removed for ease of discharging and cleaning.



FEATURES AND BENEFITS

- *Variety of chamber and shaft materials (PE 075 only)*
- *Peg agitation system (PR 1S only)*
- *PE 075 — 150 - 300 mL*
- *PR 1S — 1 liter*
- *Infinitely variable speed drive*
- *Small batch size*
- *Portable*
- *Compact*

GLOSSARY OF TERMS

Agglomerate	A particle composed of fragments of various sizes.
Aggregate	A collection of particles clustered in a dense mass.
Cavitation	The sudden formation and collapse of low-pressure bubbles in liquids such as those resulting from rotation of a propeller.
Centipoise	A unit of measure (centimeter-gram-second) equal to one hundredth (10^{-2}) of a poise.
Centrifugally	Moving or directed away from a center or axis.
Centripetally	Moving or directed toward a center or axis.
Concentric Disc	A round grinding disc with the center hole having a common center.
Cut-Point	Defined particle size at which separation is desired.
Disperse	To distribute (particles) evenly throughout a medium.
Dispersion	The process of distributing particles evenly throughout a medium.
Eccentric Disc	A round grinding disc with an offset center hole.
Friable	Brittle.
Grinding	The process of reducing particle size.
Horizontal Mill	Mill with grinding chamber oriented parallel to the ground.
Hydraulic Packing	Wet milling term to describe the condition of high bead compression caused by liquid flow. Same as pressure grinding.
John Mill	Wet milling system consisting of a large diameter shaft. The agitator shaft and chamber are fitted pegs mounted to a chamber vessel.
Kinetic Energy	The energy possessed by a body in motion, equal to one half the mass of the body times the square of its speed.
Laval Nozzle	Nozzle used to accelerate grinding gas to supersonic velocity.
Micron (μm)	A unit of length equal to one thousandth (10^3) of a millimeter or one millionth (10^6) of a meter.
Mohs'	Empirical scale of material hardness from (1) talc to (10) diamonds.
Molinox Mill	Wet milling system consisting of several types of eccentric discs fitted to a rotating shaft.
Newton	The unit of force required to accelerate a mass of one kilogram one meter per second per second, equal to 100,000 dynes.

Nanometers	One billionth (10^9) of a meter.
PLC	Programmable Logic Controller. Programmable process control for automated operation.
PTFE	Abbreviation for polytetrafluoroethylene.
Pascal	A unit of pressure equal to one Newton per square meter.
Peristaltic Pump	Pump that uses wavelike contractions of tubular structures. Same as a hose pump.
Poise	A centimeter-gram-second unit of dynamic viscosity equal to one dyne-second per square centimeter.
Pressure Grinding	Wet milling term to describe the condition of high bead compression caused by liquid flow. Same as hydraulic packing.
Pressure Shock Resistance	Able to withstand 10 bar.
Process Controller	Programmable devices used for electronic or electrical control of a system, ie, PLC.
Residence Time	Theoretical amount of time a particle remains in the grinding zone.
Residence Time Distribution	Variation of residence times for all particles passing through a media mill.
Submicron	Less than one micron.
Trinex Disc	Netzsch tri-lobe disc designed to increase the pulse frequency and surface area of the disc.
μm	See micron.
Vertical Mill	Mill with grinding chamber oriented perpendicular to the ground.
Viscosity	The quality or state of being viscous. The property of resistance to flow in a fluid or semifluid.
Wetting	The process of coating a particle with a liquid.
Zeta Mill :	Netzsch term used to describe a circulation mill.

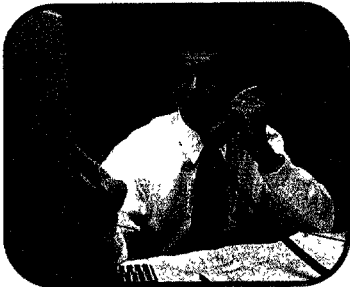
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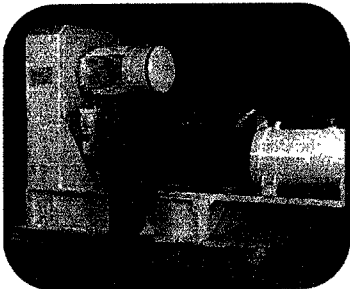
METRIC AND ENGLISH CONVERSIONS

To Convert	Multiply By	To Obtain
	14.5	Pounds per Inch ² (PSI)
	0.0002928	Kilowatt Hours
	0.01757	Kilowatts
	0.02358	Horsepower
	$(^{\circ}\text{C} \times 1.8) + 32$	Fahrenheit (Degrees)
	$^{\circ}\text{C} + 273.18$	Kelvin (Degrees)
	0.3937	Inches
	0.155	Inches
	0.03280	Feet
	0.01	Grams per Centimeter-Second
	0.01	Poise
	0.001	Pascal-Second
	$(^{\circ}\text{F} - 32) \times 5556$	Centigrade ($^{\circ}\text{C}$)
	0.3048	Meters
	0.00508	Meters per Second
	0.4335	PSI
	7.4805	Gallons
	28.32	Liters
	0.02832	Cubic Meters
	1.7	Cubic Meters per Hour
	0.1337	Cubic Feet
	0.009785	Cubic Meters
	3.785	Liters
	0.03527	Dunces
	42.418	BTU per Minute
	0.7457	Kilowatts
	25.4	Millimeters
	645.2	Millimeters ²
	0.01639	Liters
	0.03342	Atmospheres
	0.4912	Pounds per Inch ² (PSI)
	0.002458	Atmospheres
	0.03613	Pounds per Inch ² (PSI)
	2.2046	Pounds
	56.896	BTU per Minute
	1.341	Horsepower
	0.03531	Cubic Feet
	0.2641	Gallons
	3.281	Feet
	39.37	Inches
	35.31	Cubic Feet
	264.2	Gallons
	0.588	Feet ³ per Minute
	196.8	Feet per Minute
	0.003281	Feet
	0.03937	Inches
	28.349	Grains
	0.000145	Pounds per Inch ² (PSI)
	1	Grams per Centimeter-Second
	0.4536	Kilograms
	0.1198	Gallons
	0.06804	Atmospheres
	2.307	Feet of Water (4 $^{\circ}\text{C}$)
	6890	Pascal
	0.0689	Bar

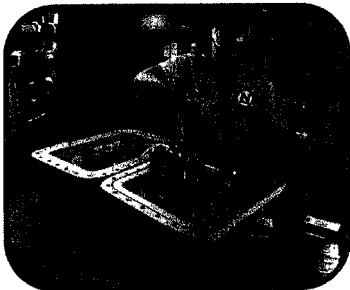
NETZSCH SERVES YOUR TOTAL NEEDS



Netzsch provides our customers with a 24-hour, 7 days per week hotline to speak directly to a service engineer.



Need a training seminar for your operators? Contact our service department to schedule one at our facility or yours.



UL listed electrical shop.



Each machine undergoes thorough and rigorous inspection prior to shipping.



Netzsch mechanical seals manufactured in our Exton, Pa facility.

Other Services Offered by Netzsch:

Our service engineers can meet your requirements for maintenance, repairs and conversions.

Netzsch also manufactures Nemo® Progressing Cavity Pumps and Filter Press Systems.



Incorporated

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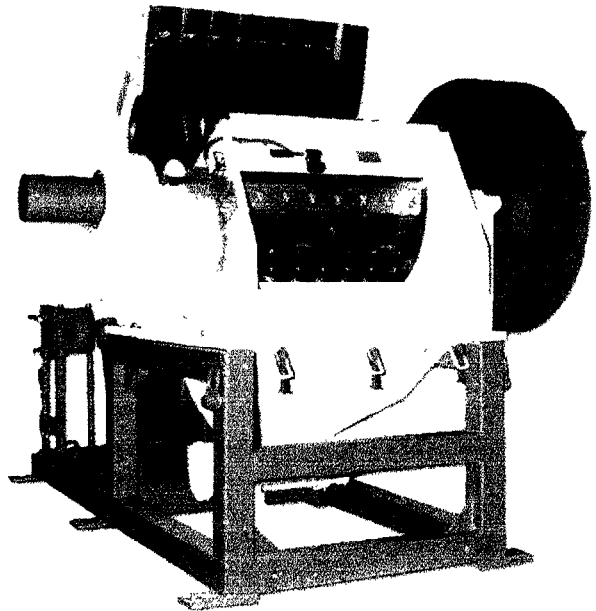
JOINT VENTURES

China, Japan and Slovenia

NETZSCH-CONDUX® Cutting Granulator CS

DESCRIPTION The Cutting Granulator CS is used to cut a wide variety of brittle and non brittle materials to less than 1000 micron. The shape and execution of the rotor body can be adapted to meet specific demands.

- FEATURES**
- Energy saving operation
 - Solid welded or cast construction
 - Bearings mounted outside cutting chamber
 - Easy replacement of screens using quick disconnects
 - Knives made of special high-alloy tool steel
 - Easy access for maintenance or cleaning activities
 - Adjustment of knives outside the granulator
 - Diagonally or horizontally divided, hinged machine housing
 - Open, rigid cutting rotor
 - Compact low weight
 - Various cutting geometries



OPERATING / ENGINEERING PRINCIPLES

- A conveyor belt is used for feeding material into the granulator
- The particle size is reduced in the granulator
- A screen is positioned underneath the rotor to prevent oversize material from exiting the machine before it is cut to the final size
- Finished materials conveyed to a cyclone to be collected

- Conveying air carries superfines into the dust collector for separation
- A radial fan is used for pneumatic conveying
- Machine housing contains two or more stationary knives and the cutting rotor is equipped with up to 16 knife rows



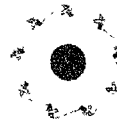
Claw-Type Rotor
Open rotor execution
Rotor shaft extends over whole rotor length
Supported rotary knives
Rotor star discs welded to rotor shaft



Cage Rotor
Most open rotor design with lowest shear
Forged shaft and discs
Rotor middle part is open for high air flow, thus optimal for heat sensitive products



Beam Support Rotor
Heavy duty open rotor design
Rotary knives are supported against cutting direction
Rotor shaft extends over whole rotor length



Multi-Edge Type Rotor
Open rotor design
Rotary knives are mounted in a hanging position
Size reduction with low friction
Optimal intake characteristics



Cassette Rotor
Closed rotor design
Most heavy duty rotor design
Rotor can be water cooled
Number of knives can be altered by replacing them with blanking plates

NETZSCH

Figure 1

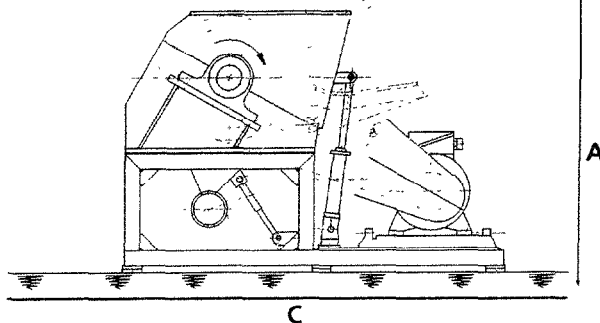
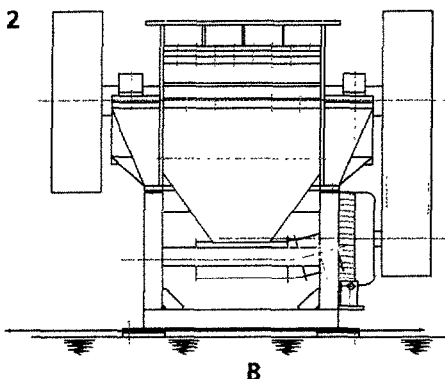


Figure 2



- TYPICAL APPLICATIONS**
- Carpets
 - Cellulose
 - Extrusion films
 - Extrusion profiles
 - Leaf and root drugs
 - Multiple pellets
 - Resorbable polymers
 - Spices
 - Thermosets

TECHNICAL SPECIFICATIONS

Model	Rotor Diameter	Working Width (mm)	Motor Size (kw/hp)	Inlet Opening with 2 Stationary Knives (mm)	Inlet Opening with 3 Stationary Knives (mm)	Rotary Knife Rows	A (mm/in)	B (mm/in)	C (mm/in)	Approx. Weight (kg/lb)
CS 300/400	300	400	5.5-37/7.5-50	440x430	340x430	3	900/35	1050/41	1850/73	1000/2200
CS 300/600	300	600	5.5-37/7.5-50	440x630	340x630	3	900/35	1250/49	1850/73	1250/2750
CS 300/800	300	800	7.5-37/10-50	440x830	340x830	3	900/35	1450/57	1850/73	1500/330
CS 300/1000	300	1000	11-37/15-50	440x1030	340x1030	3	900/35	1650/65	1850/73	1750/3850
CS 300/1200	300	1200	11-37/15-50	440x1230	340x1230	3	900/35	1850/73	1850/73	2000/4409
CS 400/400	400	400	15-55/20-75	400/430	310/430	3-7	1144/45	1250/48	1900/74	1300/2865
CS 400/600	400	600	15-55/20-75	400/630	310/630	3-7	1144/45	1600/63	1900/74	1700/3747
CS 400/800	400	800	15-55/20-75	400/830	310/830	3-7	1144/45	1750/89	1900/74	1830/4034
CS 400/1000	400	1000	15-55/20-75	510/1030	310/1030	3-7	1144/45	2000/79	1900/74	1950/4298
CS 400/1200	400	1200	22-75/30-100	510/1230	310/1230	3-7	1250/49	2300/91	2000/79	2100/4629
CS 500/600	500	600	55-110/75-150	665/630	580/630	3-7	1530/60	3000/118	4000/157	4200/9259
CS 500/800	500	800	55-110/75-150	700/830	580/830	5-7	1530/60	3200/126	4000/157	5000/11023
CS 500/1000	500	1000	55-110/75-150	700/1030	580/1030	5-7	1530/60	3400/134	4000/157	6000/13227
CS 500/1200	500	1200	75-132/100-200	700/1230	580/1630	5-7	1530/60	3600/142	4000/157	6800/14991
CS 500/1600	500	1600	75-132/100-200	-	580/1630	5-7	1530/60	4000/157	4000/157	7800/17195

Note: In accordance with the Company's policy of continual product development and improvement, the above specifications are subject to amendment without notice. Larger sizes up to 1000/2400 are available, please call for specifications.

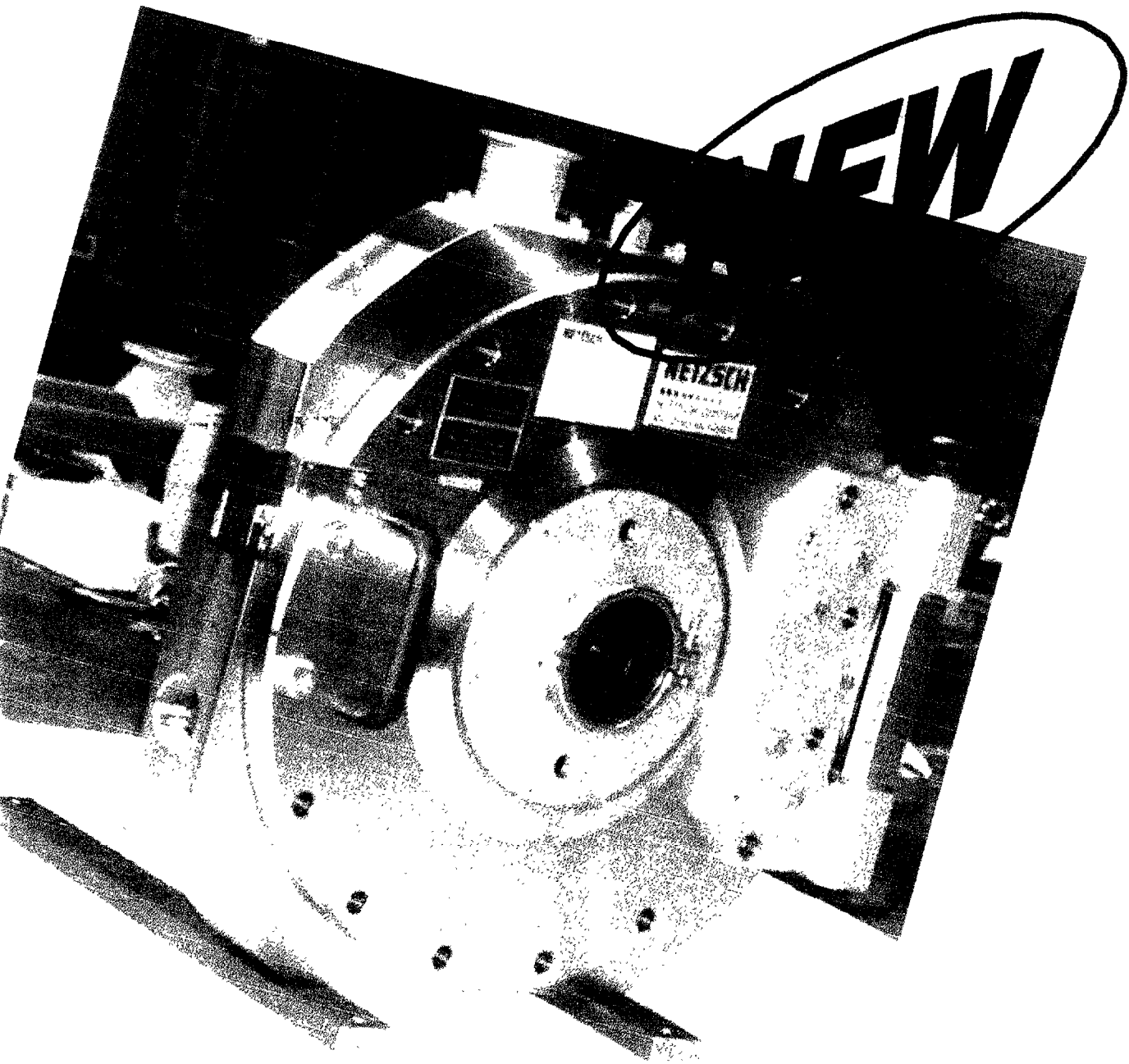
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NETZSCH



ConJet 32



Developed ConJet
Bed Jet Mill
jet mill with
dynamic air

classifier to achieve high degrees
of fineness, independent of the
load on the gas flow!

NETZSCH
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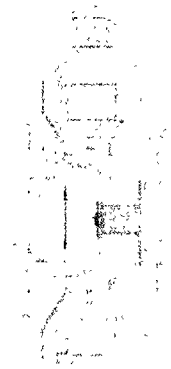
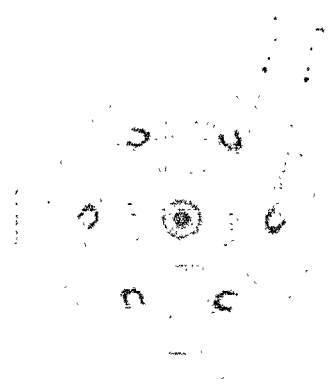
New High Density Bed Jet Mill with integrated Classifier

Technical Data		
Airflow capacity*)	m ³ h ⁻¹	330
No. of milling nozzles	Stk.	6
Nozzle diameter	Ø mm	4
Classifier drive capacity	kW	4
Max. rotation	min ⁻¹	7000
Fineness, example limestone (density 2,7)	µm (d ₉₀)	3,5
Weight	kg	ca. 470

*) at 7 bar (abs) and 20°C
subject to technical revisions



The further development of a spiral jet mill means that the influence of the product load on the fineness of the final product is now a negligible parameter! The independence of fineness of the ConJet's milling process makes the feeding of larger amounts of product possible, markedly increasing the efficiency and economy of the mill.



The heart of this mill is our proven high-precision classifier wheel, for exact limitation of the particle range in the milled product, free of oversized particles. A cohesively rotating immersion tube and optimum design produce the highest degrees of fineness.

A desired fineness is preset by adjusting of the rotational speed of the classifier wheel. Fine product particles whose size correspond to the set parameters are removed from

the machine by the classifier wheel; particles that are too large are rejected by the classifier wheel and returned to the product-laden gas to be remilled.

NETZSCH-CONDUX
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Telephone 0049 (0)6181/506-01
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e-mail info@ncx.netzsch.com
http://www.netzsch-condux.de

NETZSCH



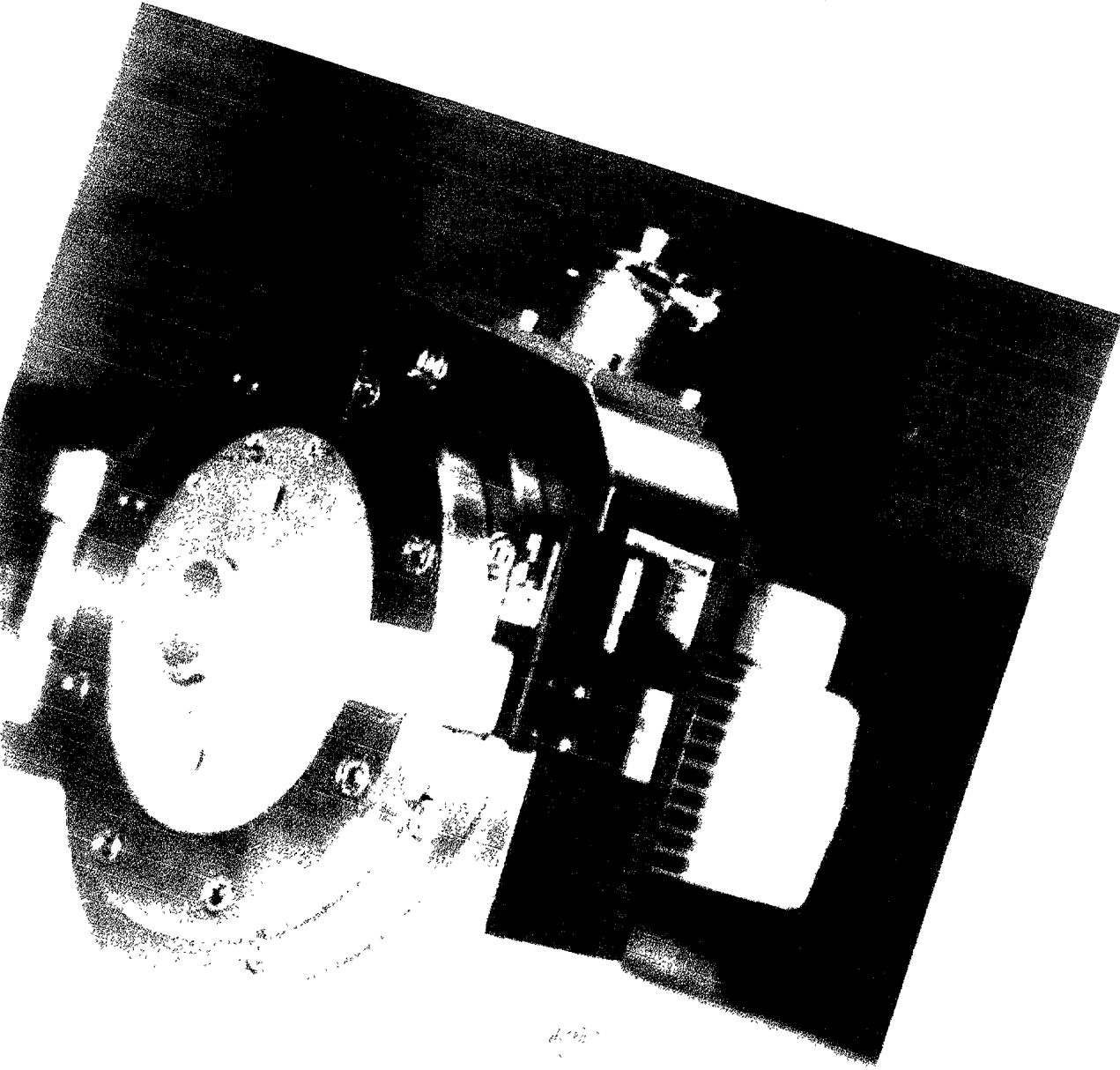
Examples of Applications:

- Pigments
- Cosmetic powder
- Silica
- Talcum
- Mica
- Rare Earth

Advantages:

- steep particle distribution
- Adjustable fineness
- High efficiency
- Easy cleaning
- Easy maintenance
- Compact

ConJet 16



ConJet
with
air
high
degrees of fineness, independent
of the load on the gas flow!

NETZSCH
.....

Universal mill: Grinding versatility in an economical package

Stephen Miranda NETZSCH Inc.

Are you searching for a versatile grinding machine to handle multiple bulk products? One solution may be a universal mill. The mill uses grinding tools that can be interchanged to handle a range of soft to medium-hard materials, providing the advantages of customized grinding in one housing. After outlining the universal mill's components, operation, and maintenance, this article gives information on grinding tools, special applications, and mill selection.

A universal mill is a form of mechanical impact mill that fractures and reduces particles with high-energy impingement. Called *universal* because it can be fitted with interchangeable grinding tools, the mill handles a range of feed characteristics and produces final products that meet various particle size requirements. By combining the capabilities of more than one mill in a single housing, the universal mill provides grinding versatility while conserving capital equipment outlay.

The universal mill can grind feed materials of up to 3.5 Mohs hardness, including pharmaceuticals, chemicals, fertilizers, cosmetics, food products, animal feeds, and mineral powders. The mill accepts feed materials with an average particle size typically up to 2 inches; a larger mill can handle materials up to 4 inches. The resulting final average particle size can range from fairly coarse to as fine as 20 microns. To grind heat-sensitive materials such as resins, the mill can be equipped with a grinding tool that generates high airflow and a wide housing that enlarges the grinding chamber and dissipates the grinding heat. **[Editor's note:** Also see the later section "Special applications"]

Mill components, operation, and maintenance

The universal mill is available in lab- or pilot-plant sizes, such as for pharmaceutical production, and in full-scale production sizes from about 6 to 27 inches (measured in terms of grinding tool diameter). Grinding capacities can range from a few kilograms to many tons per hour, depending on factors such as the feed characteristics and the desired final particle size. Construction materials for the mill's contact surfaces include carbon steel, hardened steel, cast iron, stainless steel, and sanitary-standard polished stainless steel.

Components. The universal mill, as shown in Figure 1, consists of a vertically oriented housing with a large door. Inside the housing, mounted on a motor-driven rotating shaft, is a grinding tool — a rotating disc (called a *rotor disc*) fitted with pins or teeth or a rotating wheel-like rotor fitted with blades or bars.

When the mill is fitted with a pin rotor disc, a second disc is mounted inside the mill's door so that its pins or teeth intermesh with those on the rotor disc. The door's disc can remain stationary or rotate; in the latter case, the door is fitted with a drive assembly that turns the disc counter to the rotor disc's rotational direction.

When the mill is fitted with a grinding tool other than a disc, the tool fits inside a *stator* (also called a *basket*), as shown in Figure 2, which adjusts the final product's fineness. The stationary, ring-shaped stator can be a screen, grinding track, or combination screen and grinding track. (No stator is required with a pin rotor disc.)

The universal mill's grinding tools can be removed and replaced easily and quickly. The time required to change the

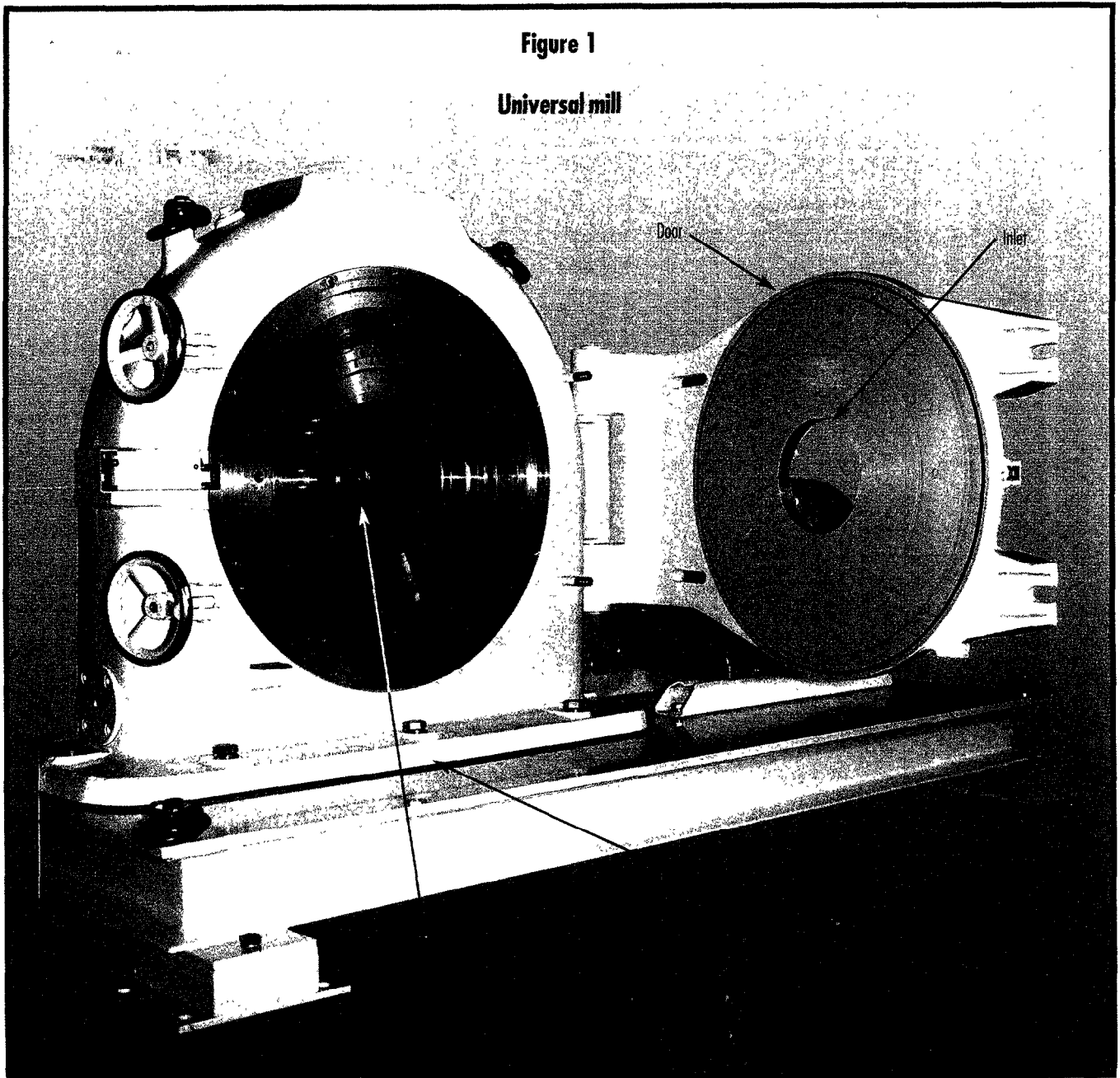
tools depends on the mill size: A 6-inch mill's grinding tool can be changed in a matter of a few minutes, and a 12-inch mill's tool takes about 30 minutes. Because handling the tools for larger mills typically requires lifting equipment, tool changes for larger mills can take somewhat longer.

Operation. The feed flows from a volumetric feeder by gravity through the universal mill's inlet, which directs the feed into the grinding chamber's center. The grinding tool (or tools) rotates at high speed, creating centrifugal force that accelerates the feed particles outward. The particles' high-speed outward flow hurls them against the pins, blades, or other elements at the tool's periphery. The particles' impact with these elements and other particles fractures and reduces them.

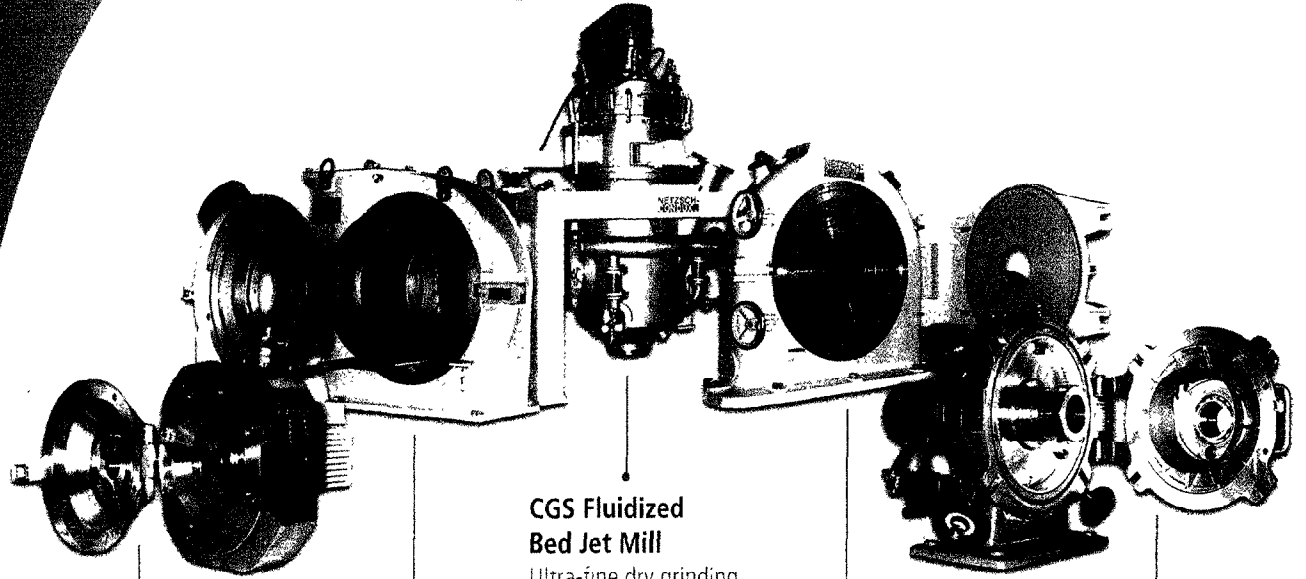
With disc grinding tools, desired-size particles exit the disc periphery and flow toward the mill's bottom outlet.

With other grinding tools, the reduced particles pass through the bars or blades to the stator:

- With a screen stator (Figure 2a), the desired-size particles pass through the screen openings (which can be of various shapes) and exit the mill's bottom outlet.
- With a grinding-track stator (Figure 2b), oversize particles impact the track's ribbed surface and bounce back into the grinding chamber for further grinding, and desired-size particles exit through the stator's rear discharge slot.



Fine Grinding Solutions by NETZSCH-CONDUX



CDS High Density Bed Jet Mill

New mill combines the compact design of a spiral jet mill with a high efficiency dynamic air classifier

CFS HD-S Air Classifier

High dispersion powder classification achieves extremely sharp cut points for any dry material

CGS Fluidized Bed Jet Mill

Ultra-fine dry grinding of any material regardless of hardness where steep particle size distributions are required

CUM Universal Mill

Multi-purpose system for dry grinding in a wide variety of applications

CP Impact Mill

Mechanical impact mill with internal air classifier provides optimum particle size control

NETZSCH-CONDUX manufacturers a complete line of dry grinding and classification equipment for a variety of powder processing applications.

- Our equipment satisfies many industries including:
 - Colorings and Coatings (Toner, Pigments, Powder Paint)
 - Life Sciences (Pharma, Foods, Crop Protection)
 - Plastics (Thermoplastics, Thermoset, Recycling)
 - Chemicals (Cellulose, Fillers, General Chemicals)
 - Minerals (Graphite, Abrasives, Metals)
 - Ceramics (Technical Ceramics, Ceramic Pigments)

- Guarantee higher profits through high energy efficiency, low maintenance costs and reliable operation
- Machines available in laboratory, pilot and full scale production sizes
- Backed by over 130 years of worldwide process experience

Dry Processing trials are available at our 16,500 square foot Technical Center. Contact NETZSCH for a Technical Center tour, to schedule a trial or to discuss your next dry powder processing application.

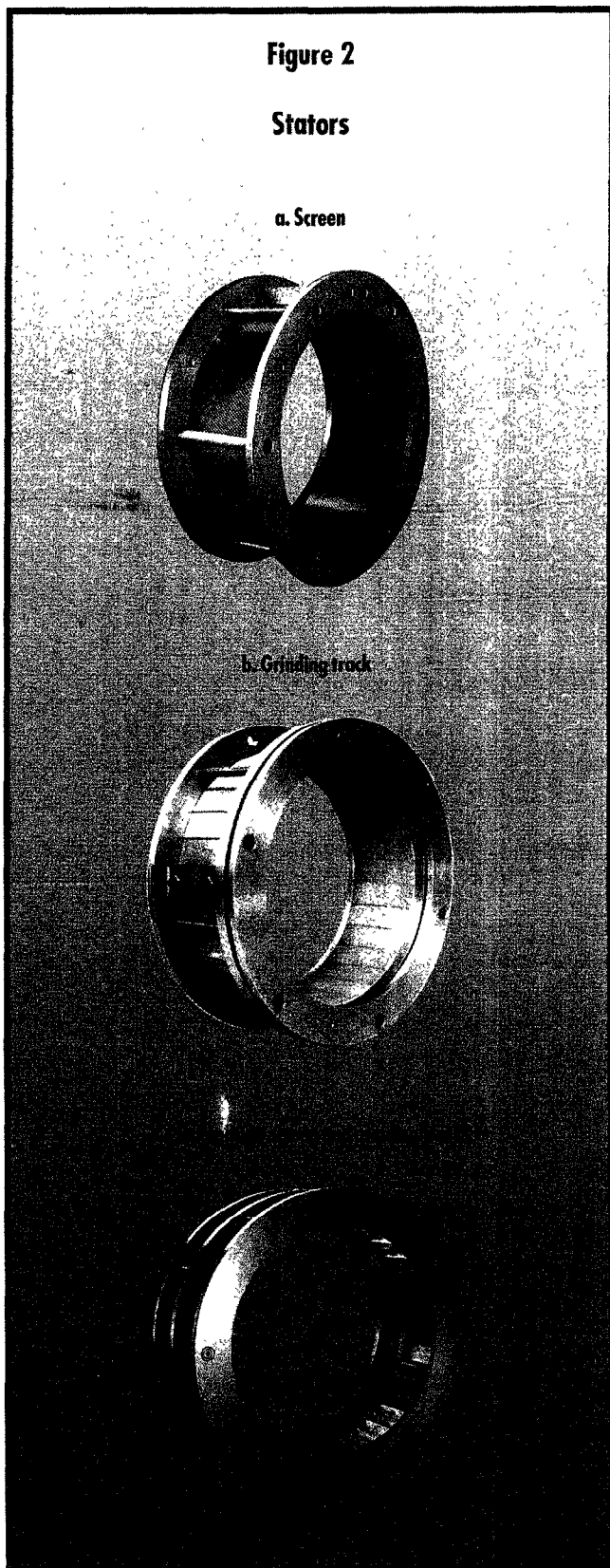
NETZSCH Incorporated - Dry Grinding & Classification Division
119 Pickering Way Exton, PA 19341
Phone: 610-363-8010 Fax: 610-363-0971
E-mail: grinding@netschusa.com

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NETZSCH

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- With a combination stator (Figure 2c), the screen sections control the final product's upper particle size by allowing desired-size particles to exit the screen openings, and the grinding track sections deflect oversize back into the grinding chamber for further reduction.



After exiting the mill, the particles fall by gravity or are drawn by a pneumatic conveying system to downstream processing or storage.

Maintenance. Regular preventive maintenance will keep the universal mill running smoothly. A critical maintenance step is inspecting the grinding tools and stators for wear. A screen stator can require more frequent inspection because it's subject to blinding and breakage. Rapid tool or stator wear can indicate a feed problem, such as over-feeding due to an improperly selected feeder.

More about the grinding tools

Your feed's characteristics and the particle size your final product requires are major factors in determining which grinding tool is best suited to your application. Some common grinding tools are shown in Figure 3.

Pin discs. Dry crystalline and brittle feeds, such as sugar, aspirin, sodium bicarbonate, kaolin, and carbon, can be handled by a mill equipped with *pin discs* (Figure 3a). When only one disc rotates, the pin discs can typically achieve a final average particle size of less than 50 microns. Fineness is controlled by the rotor disc's speed (which controls the disc's peripheral speed) and the number and arrangement of pins on the discs. When both discs rotate, the peripheral speed is much higher, and the final average particle size can be less than 30 microns. The higher energy applied during this operation, called *counter-rotation*, generates more heat and can require cryogenic cooling (discussed in the later section "Special applications").

Pin discs are often the best option for drug and food applications because they require no stator, eliminating stator screen-blinding problems and the need for grinding-track cleaning. The pin discs are also easier to access for good manufacturing practice (GMP) clean-in-place applications.

Wing beater. The universal mill can be equipped with a *wing beater* (also called a *blade beater* or *plate beater*), as shown in Figure 3b, to reduce soft, medium-hard, and some fibrous feeds to a final average particle size of less than about 400 microns. Typical soft feeds include coarse talc and lactose; medium-hard feeds (and those with abrasive impurities) include glass fibers, toner pregrind, and polyvinyl chloride; and fibrous feeds include coconut shells, herbs, root drugs, and wood. The wing beater has a series of rigid, replaceable blades around its periphery and is mounted inside a stator. The tool is often used with a screen or combination stator for soft to medium-hard feeds and with a grinding-track stator for medium-hard and fibrous feeds. The final particle size can be controlled by adjusting the tool's peripheral speed and choosing a particular stator.

Blast rotor. A *blast rotor* (also called a *turbine rotor* or *turbo rotor*), as shown in Figure 3c, allows the universal mill to

grind feeds ranging from brittle to elastic, including most of the materials handled by the other grinding tools. The blast rotor also handles feeds that are slightly abrasive (such as limestone containing a minor abrasive component) and feeds that are temperature-sensitive (such as resins and powder paints). The tool can achieve a final average particle size of less than about 40 microns. The blast rotor consists of several rigid, replaceable bars or blades mounted inside a pair of rings. It operates like a turbine, generating a large volume of airflow during grinding and quickly dissipating the grinding heat so the mill can handle temperature-sensitive feeds. The blast rotor is mounted inside a screen or combination stator. As with the wing beater, the final average particle size can be controlled by adjusting the tool's peripheral speed and choosing a particular stator.

Others. Various other grinding tools, many of them proprietary to one mill supplier, are available to grind feeds with particular characteristics, such as high moisture or fat content and extremely soft or fibrous consistency, and to produce a particular final particle size. Depending on its design, a grinding tool can apply impact, shear, or both to reduce the particles. [*Editor's note:* For more grinding tool information, contact the author and suppliers listed under "Universal" (page 211) in the "Mills" section in *Powder and Bulk Engineering's 2001-2002 Reference & Buyer's Resource* (August 2001).]

Special applications

To handle potentially explosive products, the universal mill can be constructed of components that are pressure-shock-resistant up to 10 bar. The mill's inlet and outlet can also be fitted with pressure-shock-resistant and flame-proof isolation valves (such as rotary and slide-gate valves). For further protection, fire-detection and -suppression systems and similar components can be installed in the mill and related equipment.

Although it's a more complex and costly option, the universal mill can also be installed in a closed-loop inert-gas grinding system to handle potentially explosive products. The system reduces explosion risks by using an inert gas such as nitrogen to reduce the oxygen content of the air in the mill. The closed-loop system can also handle products that tend to oxidize or undergo property changes in contact with oxygen.

The universal mill can be adapted for cryogenic grinding. This allows the mill to handle a product that can't be ground to the desired size at ambient temperatures (such as rubber or thermoplastics, which are too soft at ambient temperatures to be fractured during grinding) or to handle a product that's degraded by heat (such as a spice or flavoring that loses essential oils at high temperatures). In these applications, a cryogenic fluid can be sprayed into an upstream feed trough (or similar unit) to cool and embrittle the feed before it enters the mill. The fluid can also cool the air flowing through the mill during grinding.

Mill selection

Base your selection of the universal mill's components and features, including grinding tools, stators, and construction materials, on your feed and final product requirements. During the selection process, expect to work closely with the universal mill supplier. The supplier will ask you to describe the characteristics of each of your feeds, including the material type, particle size distribution, bulk density, flowability, friability, abrasiveness, temperature sensitivity, moisture or volatile content, and chemical corrosiveness. You'll also need to identify which properties — such as particle size distribution, bulk density, and moisture or volatile content — each of your final products must have.

During the selection process, expect to work closely with the universal mill supplier.

Considering where the mill will be located in your process is also important. The selected mill components will affect which upstream and downstream equipment, such as feeders and dust collectors, will best suit your grinding process. For instance, if your mill discharges by pneumatic conveying and one of the grinding tools you select is a blast rotor, you need to consider the high airflow volume produced by this grinding tool when sizing the dust collector and related ductwork downstream from the mill.

Once these preliminary selection steps are completed, the supplier's test center can run grinding tests with your feeds. The results can help establish which universal mill grinding tools and stators, which rotation speeds and other operating variables, and which mill size will best meet your grinding requirements. **PBE**

For further reading

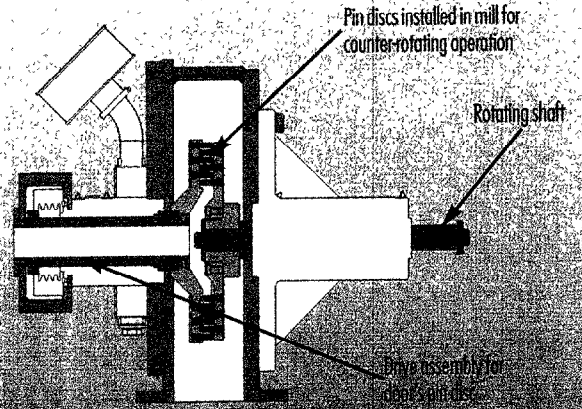
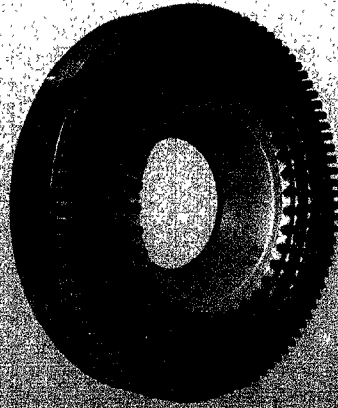
Find more information on universal mills and other grinding equipment in articles listed under "Size reduction" in *Powder and Bulk Engineering's* comprehensive "Index to articles" (in the December 2001 issue and at www.powderbulk.com).

Stephen Miranda is manager of business development for dry grinding at NETZSCH Inc., 119 Pickering Way, Exton, PA 19341; 610-280-1220, fax 610-280-1299 (smiranda@netzschusa.com). He holds a BS in biology from Fairleigh Dickinson University in Rutherford, N.J., and has 26 years experience in bulk solids size reduction.

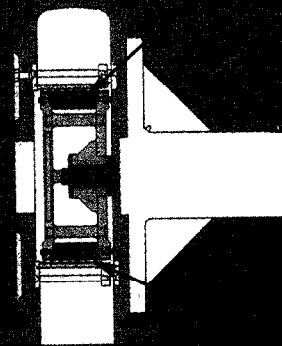
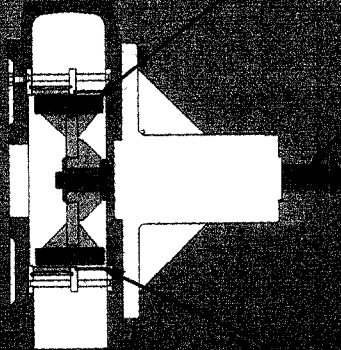
Figure 3

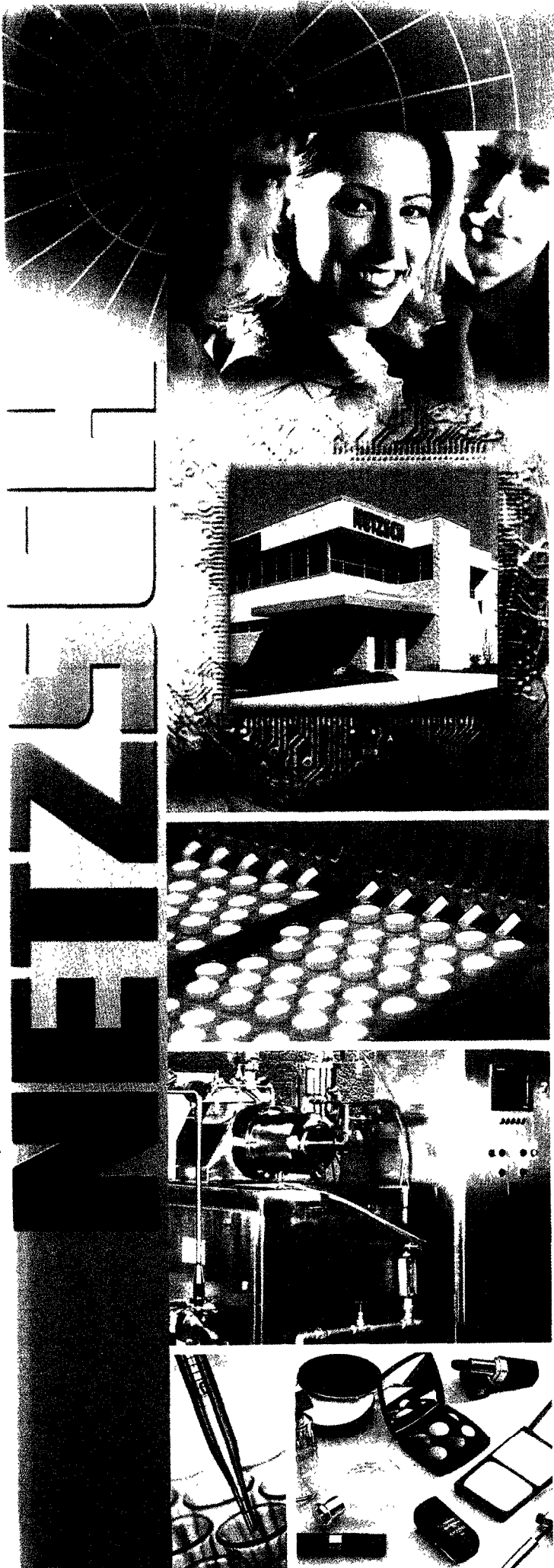
Some common grinding tools

a. Pin discs



b. Flap (also blade or pin) dresser





Grinding and Dispersing

Superior Grinding and Particle Size
Reduction Solutions for Pharmaceutical,
Food and Personal Care Applications

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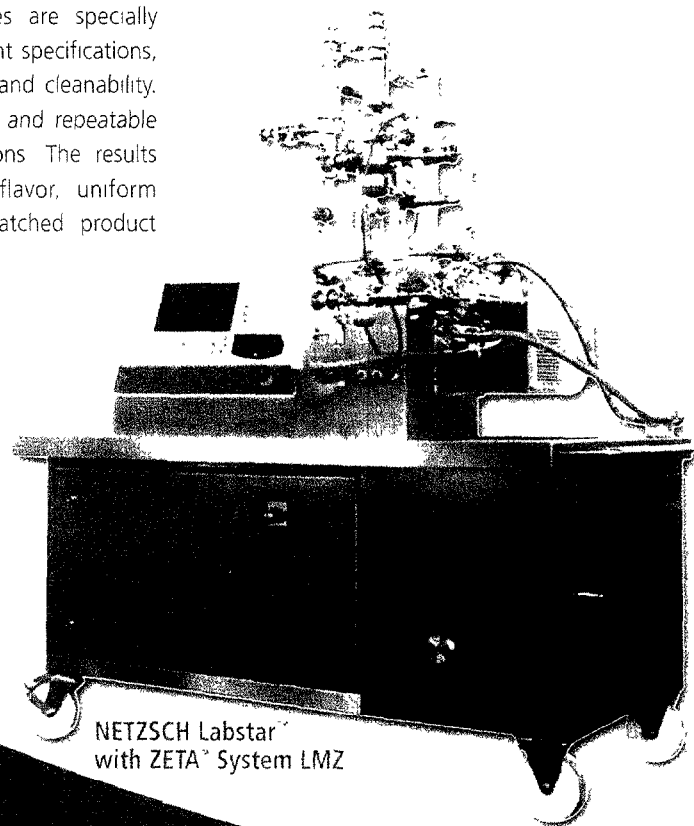
Manufacturer of Fine Particle Size Reduction Equipment

- Mixing and Blending
- Grinding and Dispersing
- De-Aerating

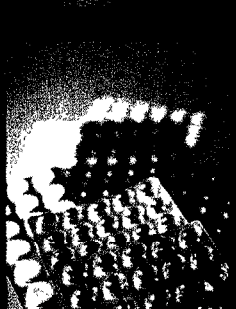
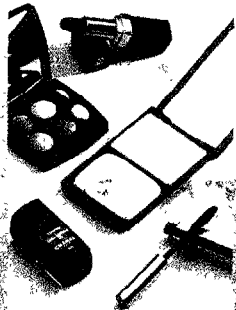
As product requirements in the pharmaceutical, nutraceutical, food and personal care industries advance in complexity, equipment that ensures repeatable performance is required.

NETZSCH, a global leader and trusted manufacturer of sophisticated grinding and dispersion equipment, has been the leading supplier of quality size-reduction equipment for over 130 years. Recognizing these growing demands, experienced NETZSCH engineers have designed the highest quality mixing and blending machinery, wet grinding and dispersion mills, dry grinding and classification systems and de-aerators for pharmaceutical, nutraceutical, food and personal care applications.

NETZSCH fine grinding machines are specially manufactured to the most stringent specifications, including sterility, heat sensitivity, and cleanability. Innovative designs provide precise and repeatable control of particle size distributions. The results include exact control of food flavor, uniform particle size of drugs and unmatched product performance.



NETZSCH Labstar™
with ZETA™ System LMZ



Application Expertise

NETZSCH supplies companies worldwide with proven, fine grinding equipment for sanitary and FDA-approved applications including:

- **Pharmaceutical**
Aseptic, Dry Powder Inhalants, Ingestible, Injectable, Oral, Sprays and Topical
- **Nutraceutical**
Food Supplements, Nutritional Supplements and Vitamins
- **Food**
Candies, Cheeses, Chocolates, Herbs and Spices
- **Personal Care**
Cosmetics, Gels, Soaps and Sunblock

Dispersion, Pre-mixing and De-Aeration Equipment

Model	Description
NETZSCH De-Aerator DA	Compact system that continuously removes trapped gas from various slurries over a wide range of viscosities
NETZSCH Mastermix Pre-Mix Dispenser PMD	Totally enclosed, automated pre-mixing dispersion system with sublevel powder feeding capabilities
NETZSCH Mastermix Shearmaster	High speed laboratory disperser for easy-product development testing in a contamination-free environment

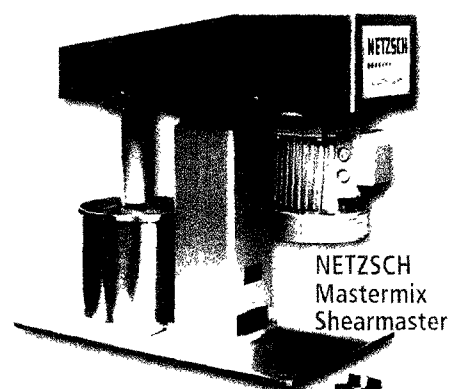
Wet Grinding Equipment

Model	Description	Particle Size Range
NETZSCH Labstar™	Flexible laboratory mill with interchangeable milling systems	10 µm to nanometers
NETZSCH ZETA™ System LMZ	Versatile system for high energy, high flow multiple pass grinding	10 µm to nanometers
NanoMill™	ZETA™ system fabricated for NanoSystems Inc.	below 400 nanometers

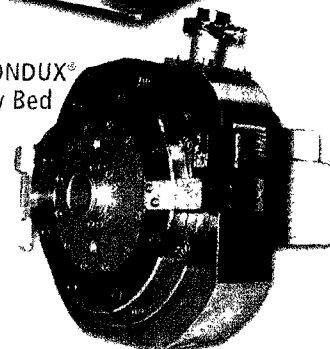
Dry Grinding and Classification Equipment

NETZSCH-CONDUX® High Density Bed Jet Mill CDS	Advanced spiral jet mill design with dynamic air classifier	$d_{50}=1 \mu\text{m}$ to $d_{50}=25 \mu\text{m}$
NETZSCH-CONDUX® Air Classifier CFS HD-S	High efficiency classifier for superfine classification	$d_{50}=1 \mu\text{m}$ to $d_{50}=25 \mu\text{m}$
NETZSCH-CONDUX® Universal Mill CUM	Flexible, high speed mill with interchangeable grinding elements	$d_{50}=10 \mu\text{m}$ to $400 \mu\text{m}$

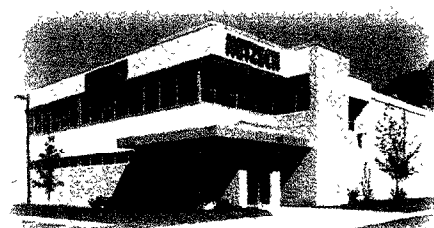
The local Sales Representative in your area is.



NETZSCH-CONDUX®
High Density Bed
Jet Mill CDS



Technology



The NETZSCH Technical Center is designed for feasibility, pilot and production testing of a diverse range of grinding machines. This 16,500 square foot facility includes both wet and dry processing suites, isolated hazardous material storage area, analytical laboratory, office suites, and client and training conference rooms. Testing and demonstrations on small laboratory scale mills up to pilot scale equipment is available. Factory acceptance tests can also be conducted in this laboratory.

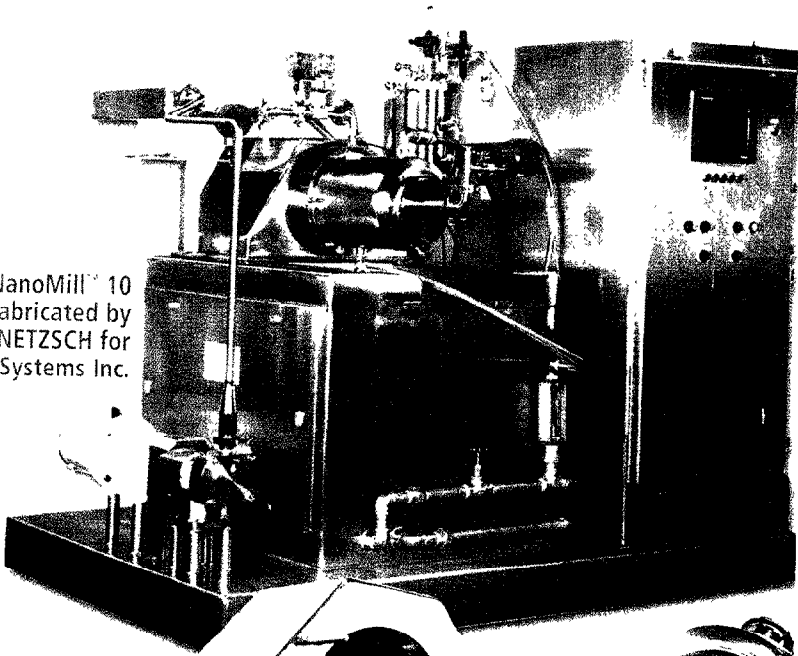
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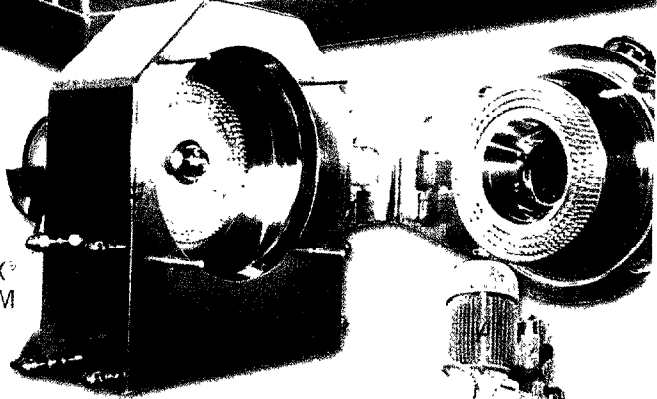
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Grinding and Dispersion Division
119 Pickering Way, Exton, PA 19341
Tel: 610-363-8010 Fax: 610-363-0971
E-mail: grinding@netzschusa.com
www.netzschusa.com

For more information on NanoSystems Inc.,
visit: www.nanocrystal.com

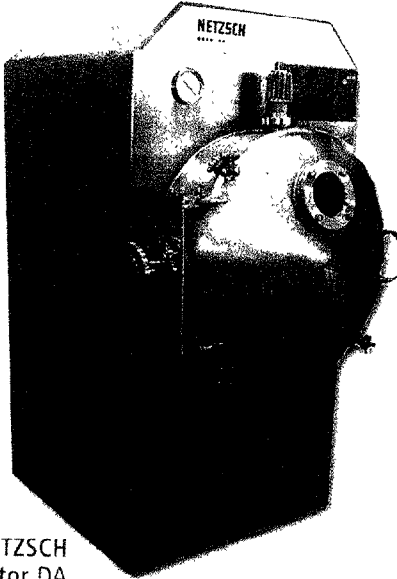
NanoMill™ 10
fabricated by
NETZSCH for
Systems Inc.



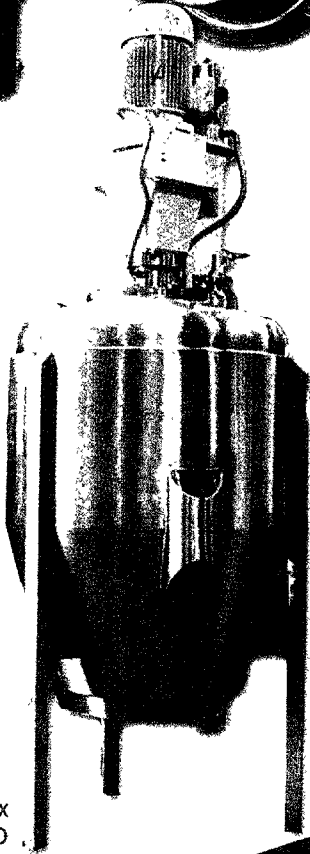
NETZSCH-CONDUX®
Versal Mill CUM



NETZSCH
Aerator DA



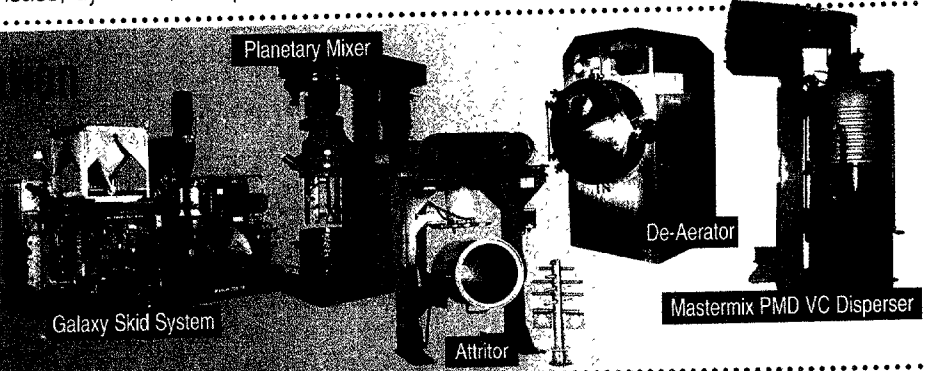
NETZSCH Mastermix
Pre-Mix Dispenser PMD



Netzsch Grinding Solutions



Netzsch is a single-source, U.S. supplier of grinding and dispersion equipment. Our Exton, PA headquarters houses every phase of machinery development and production: R&D, engineering, manufacturing, comprehensive analytical and proving laboratory, service and parts inventory. Our complete line of machinery satisfies a broad range of needs in many diverse industries including coatings, inks, paints, chemicals, ceramics, food, minerals, cosmetics, dyestuffs, and pharmaceuticals.



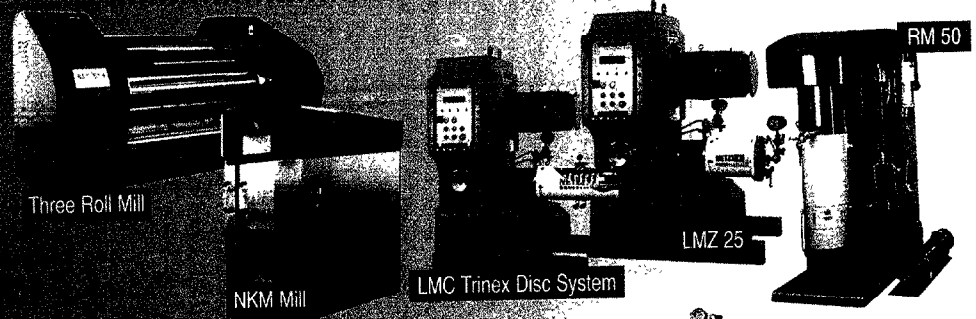
Galaxy Skid System

Planetary Mixer

Attritor

De-Aerator

Mastermix PMD VC Disperser



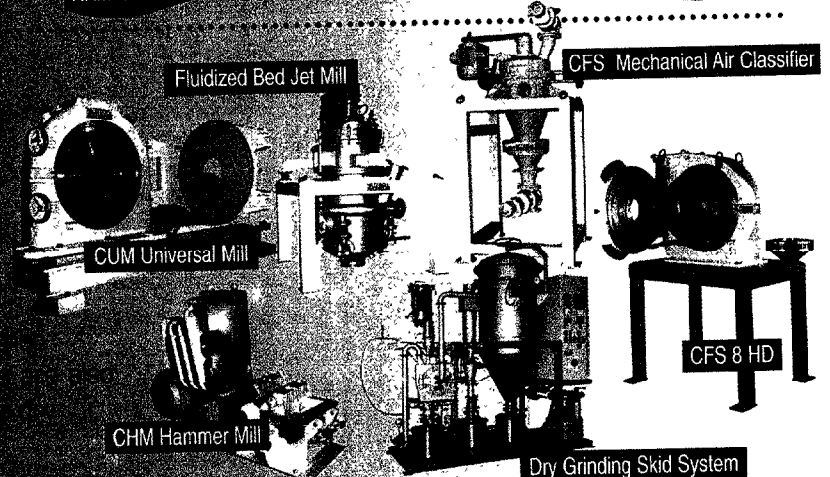
Three Roll Mill

NKM Mill

LMC Trinex Disc System

LMZ 25

RM 50



Fluidized Bed Jet Mill

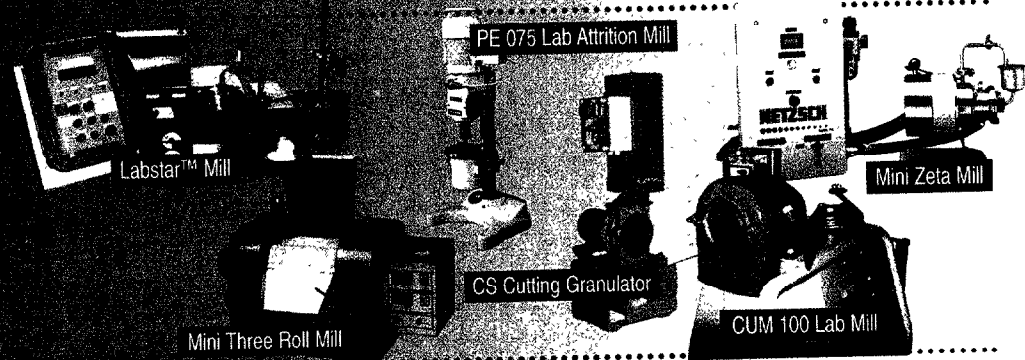
CUM Universal Mill

CHM Hammer Mill

CFS Mechanical Air Classifier

CFS 8 HD

Dry Grinding Skid System



Labstar™ Mill

PE 075 Lab Attrition Mill

CS Cutting Granulator

Mini Zeta Mill

Mini Three Roll Mill

CUM 100 Lab Mill

NETZSCH NEMO® NM Series Pumps...

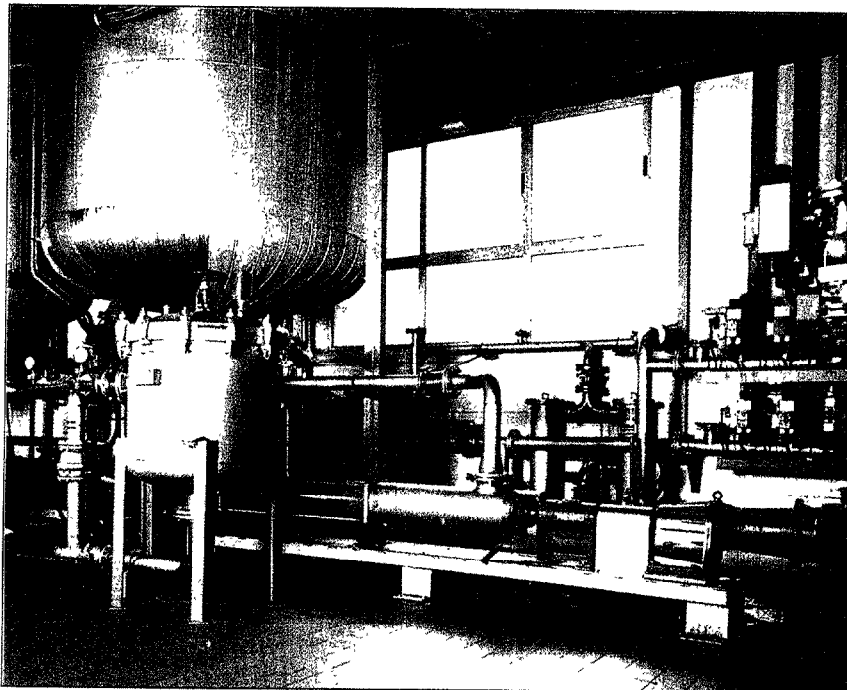
Unmatched in
Performance
More Economical
Easier to Service

NEMO® –
Your Best Choice

From the world leader in pumping technology, NETZSCH NEMO® now manufactures a more efficient, more economical and easier to service pump line – the NM Series. NM pumps offer the most comprehensive range of those key features critical to providing optimal performance in the toughest applications. Superior features represent the first half of the pump solution equation. The rest is furnished by NEMO® technical expertise and vast

experience with virtually every pumping material and environment. NEMO® representatives have the specialized knowledge and hands-on skills to meet the exact need of every application. They will match your needs with the appropriate pump configuration, choosing from:

- Solid Shaft Design
- Widest Range of Universal Joint Options
- Extra Long Connection Rod
- Widest Range of Customized Materials
- Thru Bolt Construction



Two NEMO® NM Pumps automatically suction lift detergents from two reaction vessels to large reservoir tanks 330 feet away

NEMO® PROGRESSING CAVITY PUMPS

NM

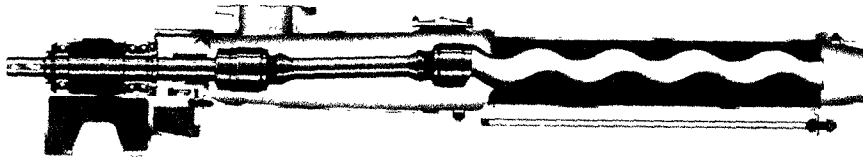
SERIES

The NM Series offers solutions to your pumping requirements with improved flexibility and design. An enlarged stuffing box and tapered suction housing results in more efficient and trouble-free operation. Available options include a choice of drives, type of suction and discharge connections, standard or portable baseplates, suction rotation, pumping direction, customized materials and bypass arrangements.

SY SERIES

The NEMO® SY series is utilized in the chemical, industrial, municipal, pulp and paper and oil industry. This general purpose pump is designed to handle

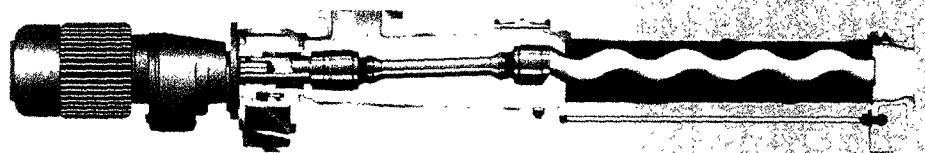
materials that vary from waterlike consistencies to viscous pastes and slurries. Shear-sensitive materials are also handled with complete ease with this style NEMO® pump.



BY SERIES

The NEMO® BY series is a modular construction pump. Its close coupled drive arrangement eliminates the need for a bearing housing, which decreases the

overall pump length. This feature helps minimize valuable manufacturing space requirements and reduces installation costs.



MINI METERING SERIES

The NEMO® NM Mini Metering series is utilized for metering both high and low-viscosity materials and offers pulsation-free

delivery. Without altering the overall pump dimension, this low cost modular design offers four rotor/stator element sizes which can be interchanged with minimal downtime. The NM Mini is available in standard design or close coupled construction.

