

NETZSCH



NETZSCH Fluidized Bed Jet Mill CGS

Ultra Fine Dry Grinding

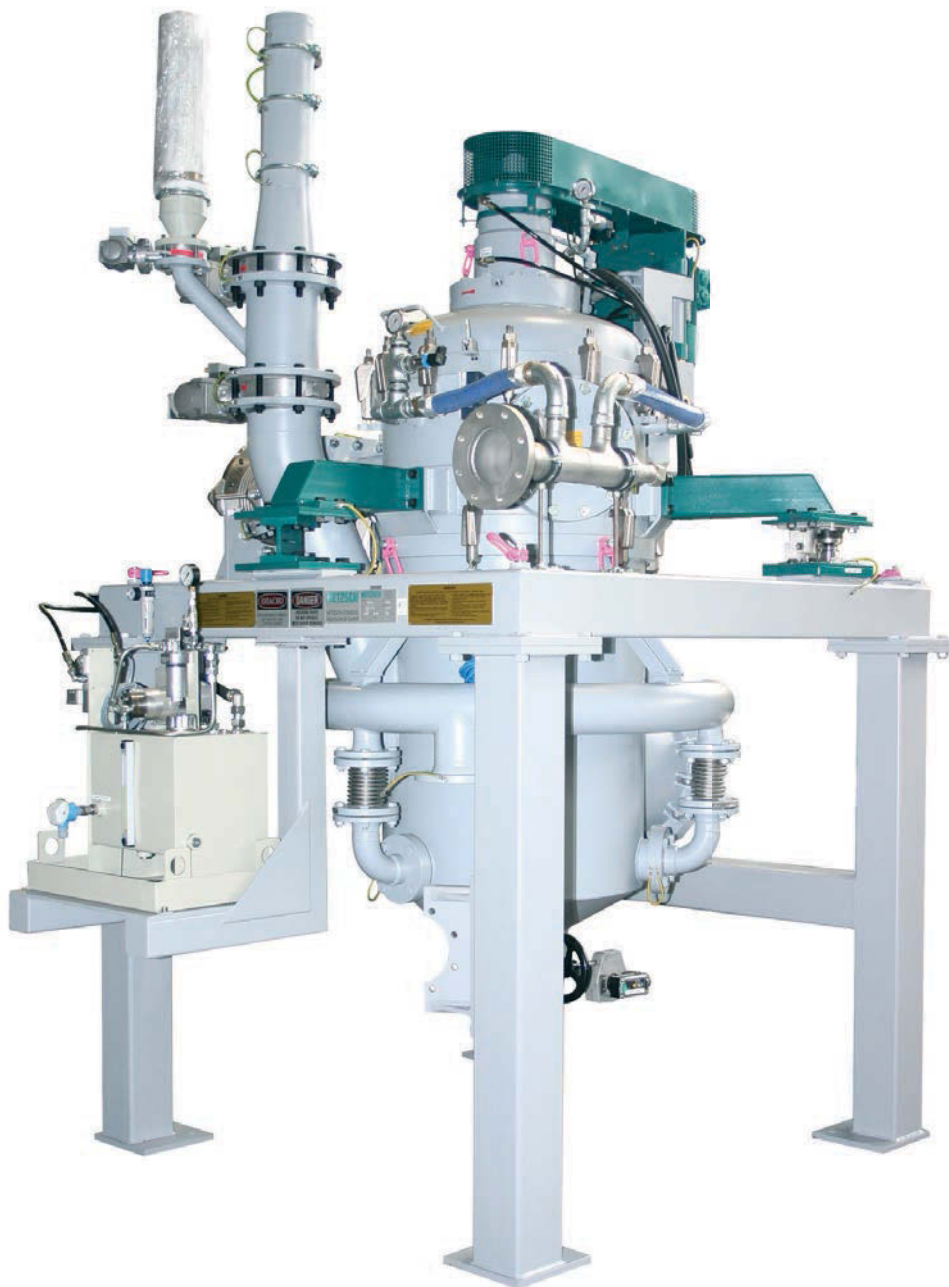
Business Unit
GRINDING & DISPERSING

NETZSCH Fluidized Bed Jet Mill CGS

Fluidized Bed Jet Mills set future trends for the fine grinding of dry materials within the range of $d_{97} = 2 \mu\text{m}$ to $d_{97} = 70 \mu\text{m}$ and are suitable for

- a large range of materials of any hardness
- low contamination milling
- grinding with
 - cold gas (0°C- 20°C)
 - hot gas up to 250°C
 - inert gas

A wide range of machine sizes including lab-scale machines for research or small production amounts as well as larger production scale machines allow the milling of product quantities from a few kg/h to several t/h.



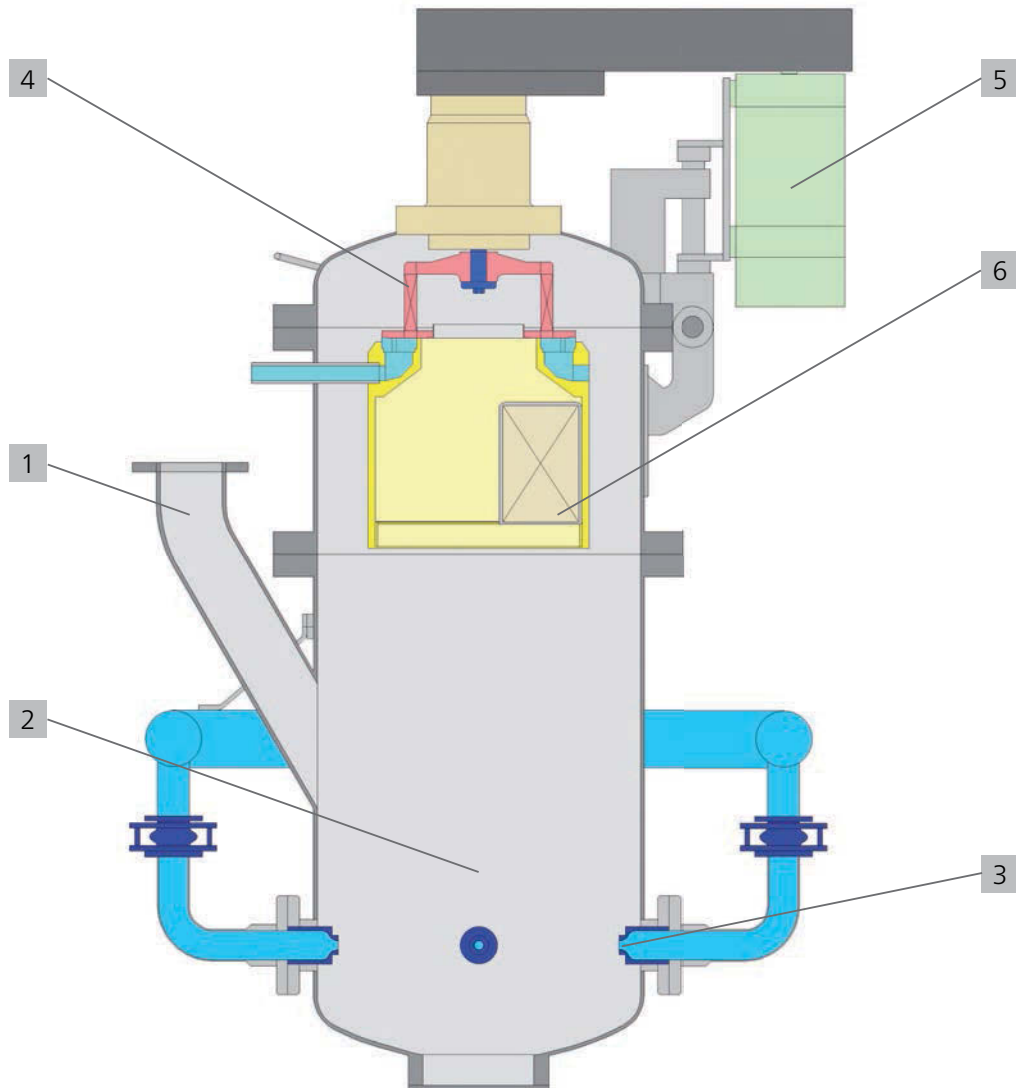
Fluidized Bed Jet Mill Type CGS 71 with oil circulating lubrication for hot gas operation

Operating Principle

The product to be milled is fed through a double flap valve, into the flanged inlet (1) above the milling nozzles. A bed of material with increasing velocity is formed in the base of the milling chamber (2) which is fluidized by the gas stream from the milling nozzles (3). Particles from the fluid bed are drawn into the gas stream and accelerated with increasing velocity towards the centre of the chamber.

Milling occurs by particle to particle impact along the gas stream and at the centre of the chamber. The milling gas, laden with particles, rises centrally to the classifier wheel (4), which is driven by a controlled variable speed motor (5) with belt drive. Coarse particles are rejected by the classifier wheel and return directly to the fluidized bed.

Fine particles together with the milling gas exit at the fines outlet (6) and are separated in a cyclone or filter system.



Characteristics

Patented classifier design

Production of even finer materials than in the past is now possible with the new *ConVor*[®] classifier design.

Constant radial velocity inside the classifier wheel, a co-rotating (exchangeable) immersion tube as well as a sturdy mechanical assembly make it possible to achieve the highest degree of fineness with maximum throughputs and this with only one classifier wheel. The classifier wheel is fitted with a vertical shaft. The resulting symmetrical assembly of the classifier wheel and the mill housing guarantees optimum flow. Coarse particles are directed back to the fluidized bed, without overloading the classifier wheel. This ensures considerably reduced load on the classifier motor and minimal wear.



Classifier wheel *ConVor*[®]

Gas purged classifier gap

In the fines outlet housing, through which the milling air, classifier air and the fines leave the mill, the impact velocity has been reduced, so that wear and the formation of build-up have been largely eliminated.

The gap between classifier wheel and the fines outlet is purged with gas. To a large extent, this prevents coarse particle migration into the fine product. The hinged classifier head simplifies cleaning and maintenance. Therefore, the classifier wheel and fines outlet are easily accessible.

Low bed residue simplifies product change process and reduces the dwell time of the product in the milling chamber.

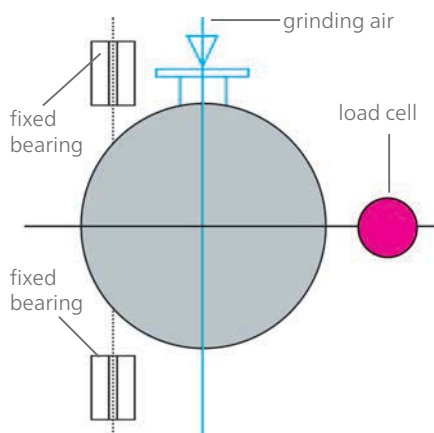


Weighing System

The fluidized bed level in the milling chamber controls the product feed. The weight of the bed is constantly monitored by the weighing system, which comprises one load cell and two fixed bearings. The data is analyzed and transmitted to the feeding system to ensure that the fluidized bed depth is maintained at its optimum level.



Load cell, mounted on CGS

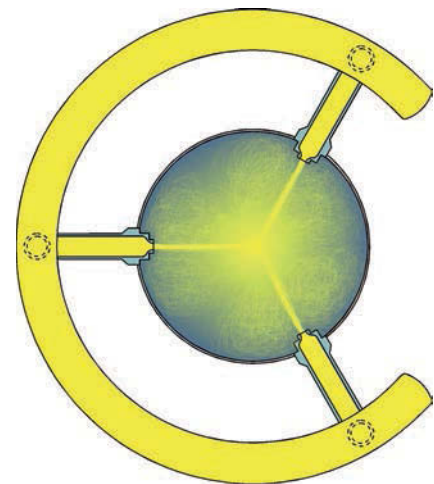


No contamination of the material

The nozzles only supply the milling gas. The product is accelerated in a free gas jet. Size reduction is carried out through the impact of particle against particle.

Highly efficient milling procedure

The principle of milling in a fluidized bed guarantees the best use of energy. By using only a few, large, precisely positioned nozzles, this advantage is increased. Losses in the grinding gas supply are avoided by an optimum geometry of all pressure gas supply parts.



Nozzle arrangement

Efficient and flexible

Alternatives

The design and machine size depends on the nature of the product and its particle size requirements. The mill is available in seven production sizes plus two for laboratory use, in addition special designs for machines can be chosen for a wide range of applications.

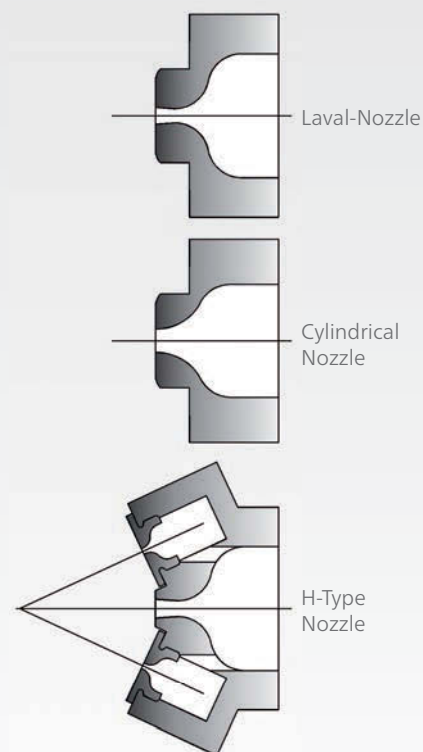
Bearings

The solid construction of the bearing housing and the optimized geometry of the locking gas sealing on the side of the classifying chamber guarantee a long life and excellent, quiet mechanical running. Two types of bearings are available:

- grease lubricated
- oil circulating lubrication for hot gas operation.

Nozzles

The grinding gas nozzles can be delivered in various executions and are selected to suit the desired fineness and throughput. The execution, diameter and the (patented) distance between nozzles are selected to suit the grinding gas pressure for the particular application, which is determined via a process, for which a patent has also been applied.



Fluidized Bed Jet Mill Type CGS 180 for milling air consumption of 11 660 m³/h.

Materials of construction

The choice of material depends on the product to be milled. Carbon steel as well as acid- and corrosion resistant stainless steels are standard. In addition, wear protection designs are available for milling of very hard abrasive material, which guarantee a contamination-free product. For example, grinding chamber and fines outlet are lined with ceramic or Vulkollan.

The classifier wheel is available in ceramic or hard metal design for the highest operational demands. The advantages of the hard metal classifier wheel, compared to other wear protected classifier wheels, is its higher mechanical resistance, which means it can be operated at maximum classifier wheel speeds. Therefore, extremely high finenesses can also be obtained using just one classifier wheel.



Grinding chamber with ceramic lining

Saving energy with the

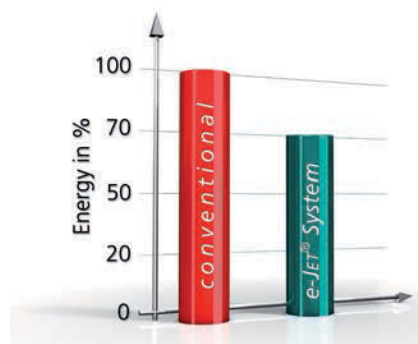
E-JET[®] *System*

The unique grinding process *E-JET[®]*, for which a patent has been applied, makes the use of air jet mills significantly more efficient through adapted grinding conditions and an optimized process. Energy savings of up to 30 % for e.g. minerals or amorphous chemical products, are convincing arguments!

Up to now, air jet mills were mainly used for higher value-added products, but the new „*E-JET[®]* system“ can now be used for jet-milling in completely new fields of application.

Even products which could previously only be produced economically on mechanical mills, can now be produced cheaply and with negligible wear costs on the Fluidized Bed Jet Mill of type CGS. There is also a considerable potential for improving the cost effectiveness of already existing applications through energy savings. The overall lower investment costs for a grinding plant make the new „*E-JET[®]* system“ an extremely interesting alternative.

- Lower investment costs
- Lower production costs
- For all machine sizes
- Many different products
- Highest grinding fineness
- Final product free of oversized particles
- Steep particle size distribution
- Grinding with minimum contamination
- Can be retrofitted on many already existing plants



The newest innovation

Jet grinding with superheated steam – the new *S-JET[®]* system. This patented process, which renowned experts in the field of mechanical process engineering describe as a quantum leap for dry grinding, represents the latest further development of jet-milling. Now final finenesses in submicron ranges (e.g. d_{50} 0.2 μm) can also be achieved.

Ask us for further details!

S-JET[®] *System*

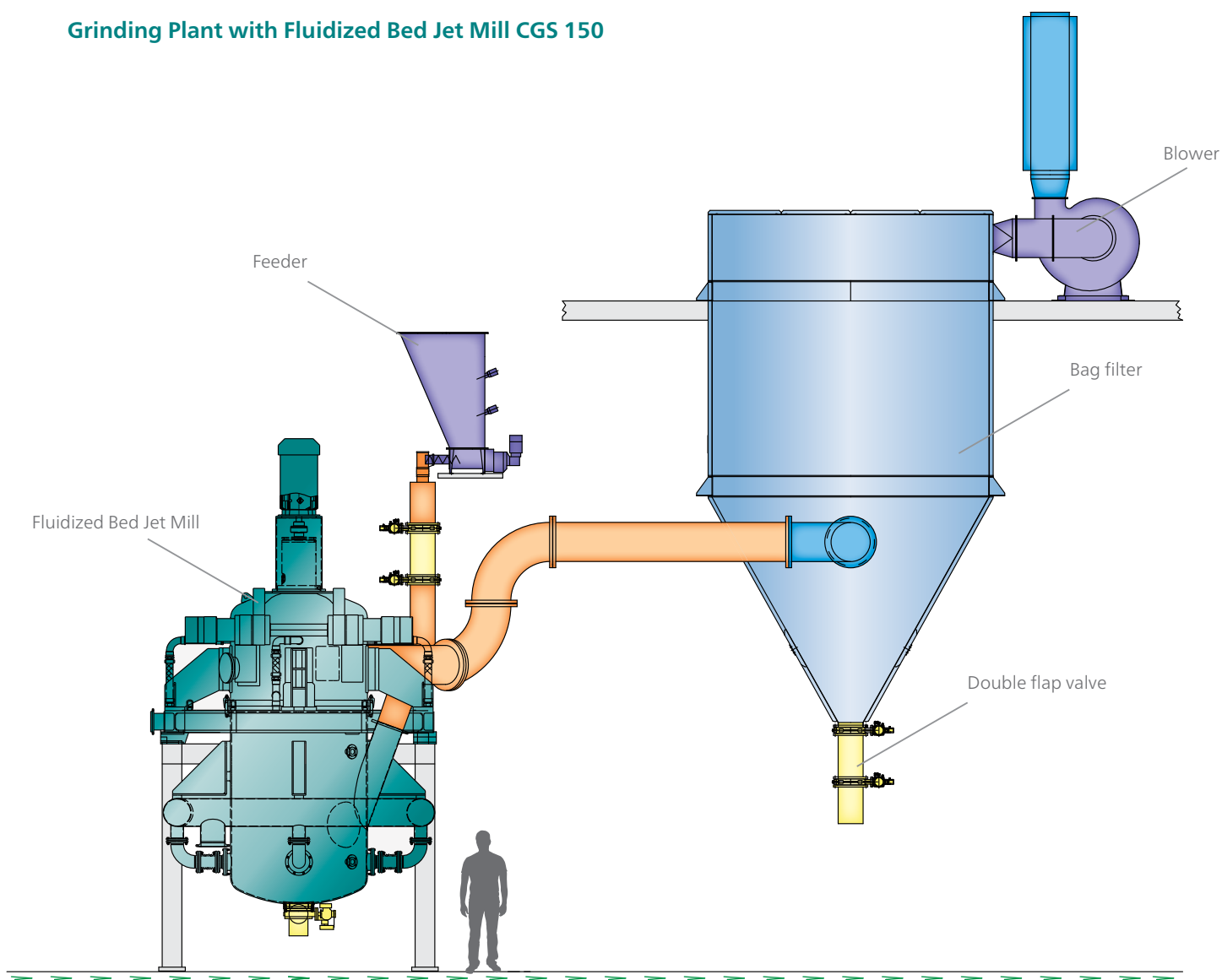
Machines and plant design

The Fluidized Bed Jet Mill can be designed in various executions depending on product and requirements.

The Fluidized Bed Jet Mill type CGS and its corresponding equipment can be manufactured in PSR 10 bar (g), suitable for products with dust explosion hazards and also gas tight, suitable for inert gas operation.



Grinding Plant with Fluidized Bed Jet Mill CGS 150



Example: Pharmaceuticals

The pharmaceutical industry requires products such as active ingredients and excipients as well as finished active ingredient formulations to be of a precisely defined high fineness, justifying the use of a fluidized bed jet mill. The same applies partly to the food industry. In this industry, the extremely high quality required of the final product also applies to the machines and plants used in the production process which must in turn ensure the reproducibility and consistent high quality of final products.

The Fluidized Bed Jet Mill is optionally available in a Pharma design to meet the high demands of these industries. The types of stainless steel used, 1.4571, (316 Ti), 1.4435 and 1.4404 (316 L), are pretreated by grinding and finished with an electrolytic polishing to give the necessary surface finish with an average peak-to-valley height of $Ra < 0.8 \mu\text{m}$ or even higher if required. Construction in accordance with GMP ensures rapid and thorough cleaning on completion of the batch to prevent contamination of the next batch, which would impair the required hygienic, technical and pharmacological parameters. Pipework connections and/or plant components using quick release clamps simplify the rapid dismantling of the plant for cleaning purposes. FDA approved materials are standard for e.g. sealings and lubricants.

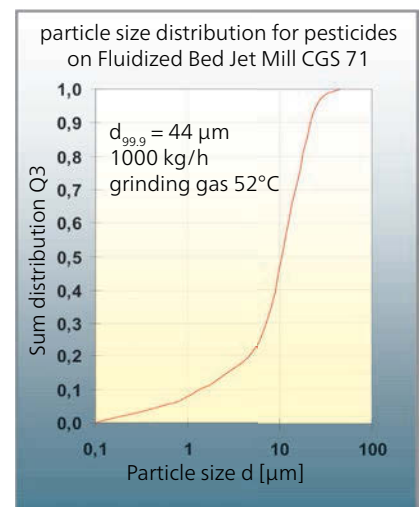
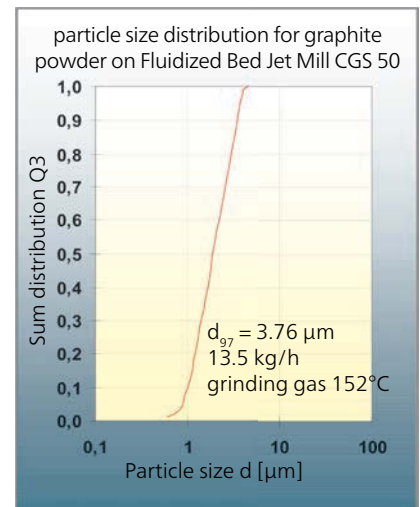
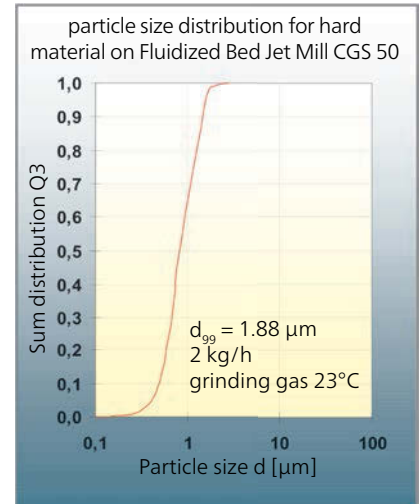
In order to keep abreast of this application area, special know-how is required. NETZSCH has a team for Pharma projects, which liaises with renowned scientific institutions in order to be able to offer our customers competent and professional consulting.



Installation with Fluidized Bed Jet Mill CGS 32 in „Pharma design“

Examples of Applications and Technical Data

Examples of products	Fineness [μm]	Size	Capacity [kg h^{-1}]
Active coal	d_{99} 16	CGS 180	4 800
Ceramic catalyser	d_{90} 10	CGS 32	30
Ceramic pigments	d_{99} 9.1	CGS 50	535
Ceramic pigments	d_{95} 5.2	CGS 71	900
Cobalt metal	d_{97} 10	CGS 50	200
Cobalt oxide	d_{99} 5.8	CGS 71	700
Dental ceramics	d_{50} 2 - 35	CGS 32	150
Glass flakes	d_{50} 12.2 - 25	CGS 50	13 - 75
Glass frits	d_{50} 2.5 - 7	CGS 71	36
Graphite (natural)	d_{97} 3.76	CGS 50	13.5
Graphite (syn.)	d_{97} 2.94	CGS 50	19.7
Hard materials	d_{97} 2.75	CGS 50	137
Hard materials	d_{50} 0.8	CGS 16	4.5
Hard materials	d_{99} 1.88	CGS 50	2
Iron oxide	d_{97} 2.7	CGS 100	1 000
Lithium cobalt oxide	d_{99} 6	CGS 50	700
Manganese oxide, activated	d_{50} 1.8	CGS 32	50
Mica	d_{99} 24.1	CGS 71	193
Molybdenum	d_{99} 34	CGS 16	32
Molybdenum disulphite	d_{99} 3.5	CGS 50	45
Neodymium ferroboron	d_{97} 4 - 40	CGS 10	5
Organic pigments	d_{99} 6.5	CGS 50	79
Oxalates	d_{97} 5 - 10	CGS 32	15 - 45
Pesticide	$d_{99,9}$ 44	CGS 71	1 000
Petrol coke, calcined	d_{70} 5	CGS 10	1 - 5
Pharmaceutical products	d_{97} 20	CGS 32	100
Powder coating	d_{97} 8.9	CGS 50	55
Ruthenium	d_{99} 50	CGS 16	40
Shell lime	d_{99} 6.3	CGS 50	39
Silica gel	d_{50} 8	CGS 50	290
Silica	d_{90} 9.8	CGS 71	360
Silicates, inorganic	d_{95} 10	CGS 50	100
Talc	d_{99} 10 - 20	CGS 120	830 - 2 200
Tungsten carbide	d_{99} 3	CGS 50	66
Toner (one comp.)	d_{95} 13.5	CGS 50	56
Toner (two comp.)	d_{50} 11	CGS 71	86
Toner (micro)	d_{50} 6.2	CGS 180	375
Toner (colour)	d_{99} 14.2	CGS 71	200
Wax	d_{97} 11	CGS 71	330

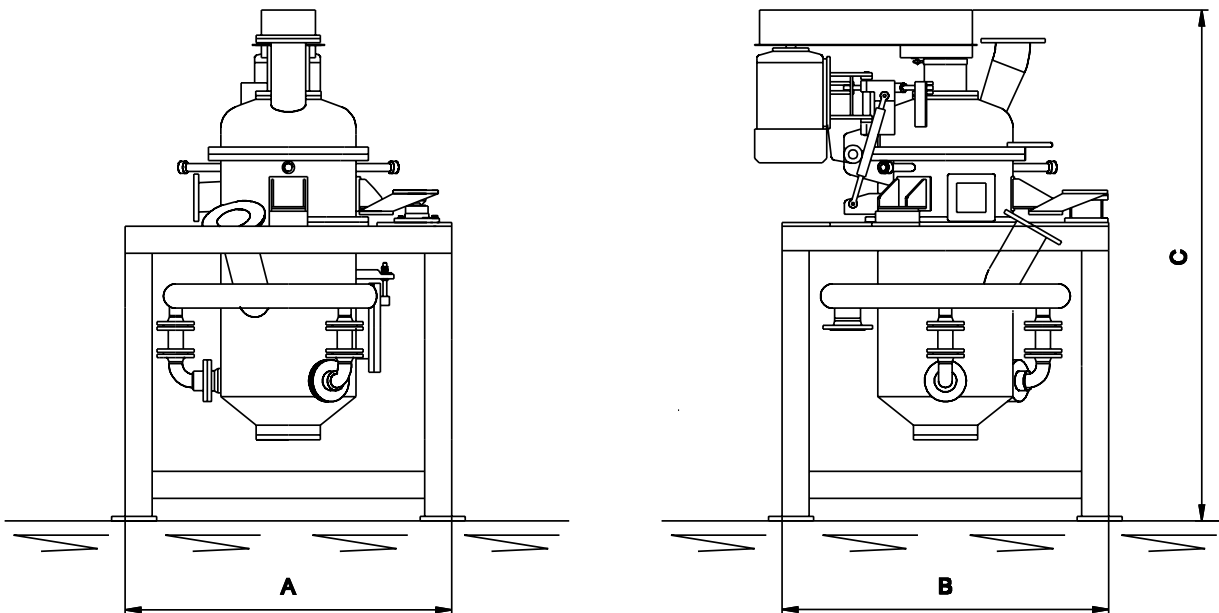


Technical data		CGS 10	CGS 16	CGS 32	CGS 50	CGS 71	CGS 100	CGS 120	CGS 150	CGS 180
Capacity factor		-	-	0.35	1	2	4	6	9	12
Air flow *	m ³ h ⁻¹	60	90	330	960	1 920	3 860	5 770	8 930	11 660
Number of milling nozzles	pcs.	3	3	3	3	3	3	4	4	4
Nozzle diameter	mm	2.1	2.6	5.0	8.5	12.0	17.0	18.0	22.4	25.6
Milling chamber **	mm	170	210	350	600	800	1 200	1 500	1 800	2 100
Classifier wheel power max.	kW	0.55	1.5	2.2	7.5	15	30	45	75	90
Max. speed	min ⁻¹	18 000	12 000	7 000	5 100	3 600	2 300	2 200	1 700	1 400
Fineness d ₉₇ ***	µm	2 - 120	2 - 120	2.5 - 70	2.5 - 80	3 - 85	3.5 - 90	4 - 90	5 - 90	5 - 90
Length (A)	mm	250	500	1 000	1 450	1 800	2 140	3 300	3 600	4 200
Depth (B)	mm	360	550	1 000	1 450	1 800	2 340	3 300	3 600	4 200
Height (C)	mm	650	800	1 575	2 270	2 880	3 930	5 000	7 000	7 700
Weight (approx.)	kg	80	160	680	1 200	3 000	5 400	12 500	24 000	29 000

* Air flow based on pressure of 8 bar (abs.) and 20°C

** outer ø

*** based on limestone (density 2.7 kg/l)



Test our Fluidized Bed Jet Mill CGS!

We can run trials in our laboratory on different machine sizes with your material!

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