AIR CLASSIFIERS FOR INDUSTRIAL MINERALS
CTM SERIES

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Cement & Mining Technology

CEMTEC – your partner for success.

CEMTEC operates on the basis of individual responsibility. Each member of our team is authorised to make high-level decisions. The entire responsibility for a project – from planning to commissioning – rests with a single person. This means that you will have the same, competent contact partner for all your queries, wishes and suggestions, without exception. In addition to standard orders, your individual requirements can also be fulfilled rapidly and without complications.

CEMTEC HEADQUARTERS AT ENNS AUSTRIA

CEMTEC manages projects for the cement and processing industry worldwide.

CEMTEC supervises each project from start to finish. From planning to commissioning. Our product spectrum includes tube mills for grinding a wide range of bulk materials and minerals, as well as rotating drums for thermal treatment (calcination, drying, cooling) and mechanical processing (mixing, washing, conditioning, etc.) of different bulk materials. We also offer erection supervision, commissioning and technical support. Successful projects all over the world attest to the competence of CEMTEC.

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Classification in new dimensions

The new CTM fine classifier series is based on the latest findings (4th generation) in the field of classification technology.

This series was developed by a team of experts with international experience and extensive know-how in machine and process engineering development and the design of air classifiers for classifying metal oxides, mineral fillers (CaCO$_3$, talcum, mica, dolomite), cement and slag, together with the required steps such as reconciliation with the grinding unit and configuration of the corresponding peripheral equipment (materials handling, air technology, product transport).

Particle size distribution and grade efficiency curve CTM 0400

Deformation in X direction (radial) of the classifier cage.

CLASSIFIERS

The design of this series was geared to optimized production, operating and maintenance costs. This was achieved by new combinations of rotor geometry and improved flow design. It is expressed in classifying efficiency, low bypass of fines (see Tromp's curves) and the resulting reduced pulverization and classification energy.

The corresponding stress design and optimisation by FEM simulations, together with vibration tests and modal analyses, guarantee the lowest possible maintenance costs on the one hand and optimised manufacturing costs on the other hand. This means that all series are designed so that the critical rotor speeds far exceed the maximum operating speed.

The optimised classification installation is supplemented by comprehensive advice for the required peripheral equipment, which plays a critical role in ensuring optimum production conditions.

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Advantages of the CTM air classifier series

|	
Extremely good top cut (d98)	due to specially formed rotor blades and rotor labyrinth with sealing air
Low vibration level	max. operating speed < n-critical
Low operating costs	due to low speed levels
Reduced pressure loss	due to optimised air-flow design (spiral housing and air guide vanes) and reduced speeds (curved rotor blades)
Reduced power consumption	due to reduced operating speed and pressure drop
Reduced wear	due to reduced operating speeds and optimised wear protection on areas subject to stress, due to use of high-strength steels, compound liner plates and highly wear-resistant HVFB coatings on exposed areas (depending on respective application)

ADVANTAGES
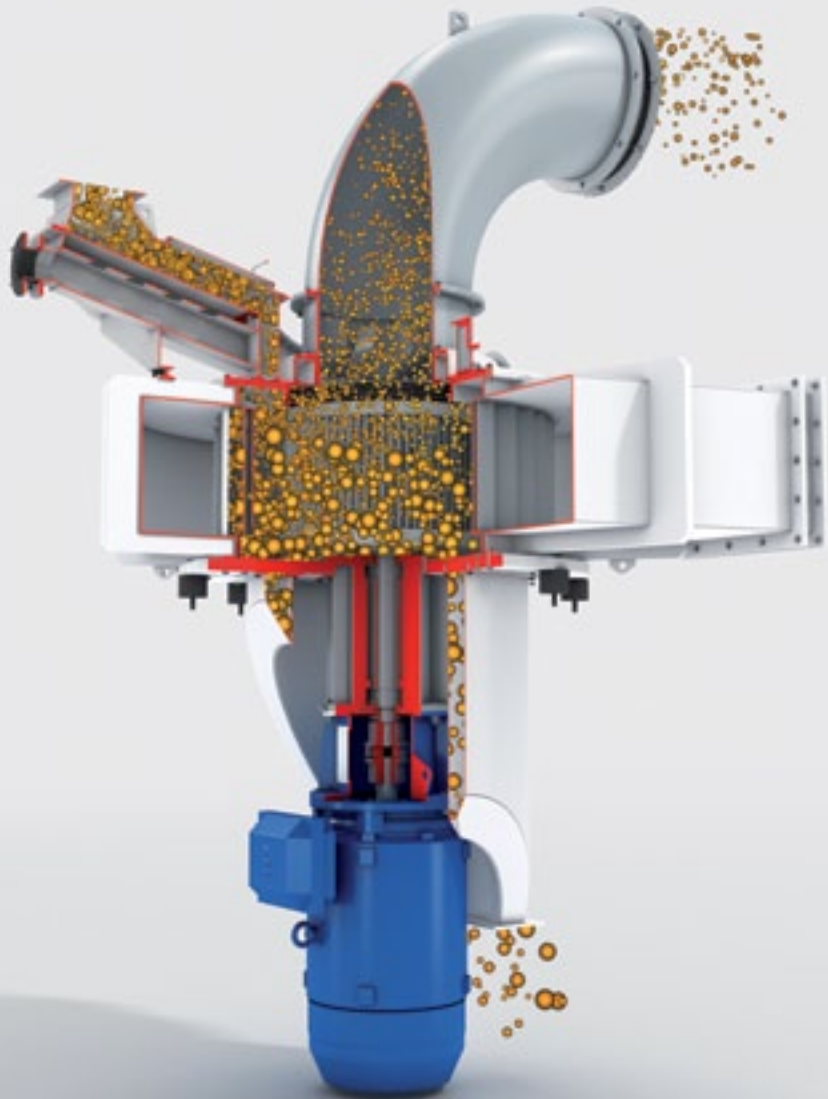
The newly developed CTM series (for fine industrial minerals d98=6-45 µm) is a new and innovative design which guarantees peak production with the finest quality and optimised operating costs.

The modular built classifier permits optimum tailor-made solutions for CEMTEC ball mills and vertical roller mills.

Since the classifier series are modular, versions with air feed from below are also possible (combined with the CEMTEC vertical roller mill series) or as a standalone solution for tailor-made applications.

Detail-oriented, sophisticated and practical solutions secure a number of advantages which are reflected in quality, low installation, production and maintenance costs.

General function of the CTM series

The CTM series are designed as rod basket deflector wheel classifiers and geared to the varying requirements for extremely fine classification. Particle sizes with a top cut (d98) of 30-40 µm to 6 µm are obtained in coarser industrial minerals.

In the CTM series the feed fraction is fed into the classifying chamber via an air slide. The air flows tangentially into the classifying chamber via an aerodynamically configured spiral housing and air guide vanes, whereby the feed fraction fed in from above is pre-accelerated and brought to rotor peripheral speed by the flow forces. In the classifying zone the feed fraction is exposed for the main part to centrifugal, drag and flow forces.

In the classification zone the particles are subjected to two main forces
- centrifugal force

$$F_c = d_p^3 * \rho_p * R * n^2 * \pi^3 / 5400$$

and

- drag force of the air

$$F_w = d_p * 3\pi * \eta_g * v_{rad}$$

d_p	particle diameter
ρ_p	particle density
η_g	viscosity of the gas
v_{rad}	radial speed of the gas
R	radius of classifying rotor
n	operation speed (rpm)

● PARTICLE
← FLOW DIRECTION

DRAG FORCES (AIR)

CENTRIFUGAL FORCE

CLASSIFICATION IN CENTRIFUGAL FORCE FIELD

FUNCTION

Centrifugal force predominate for particles larger than the cut size, and drag forces predominate for particles smaller than the cut size. The coarse particles fall spirally outside the rotor bowl into the coarse particle discharge, the finer particles are transported by the air flow through the rotor and fine particle discharge to the downstream classification devices.

In practice, the interaction of the classification forces is far more complex, because particle swarms (intensive dust clouds) rather than individual particles are subjected to the process.
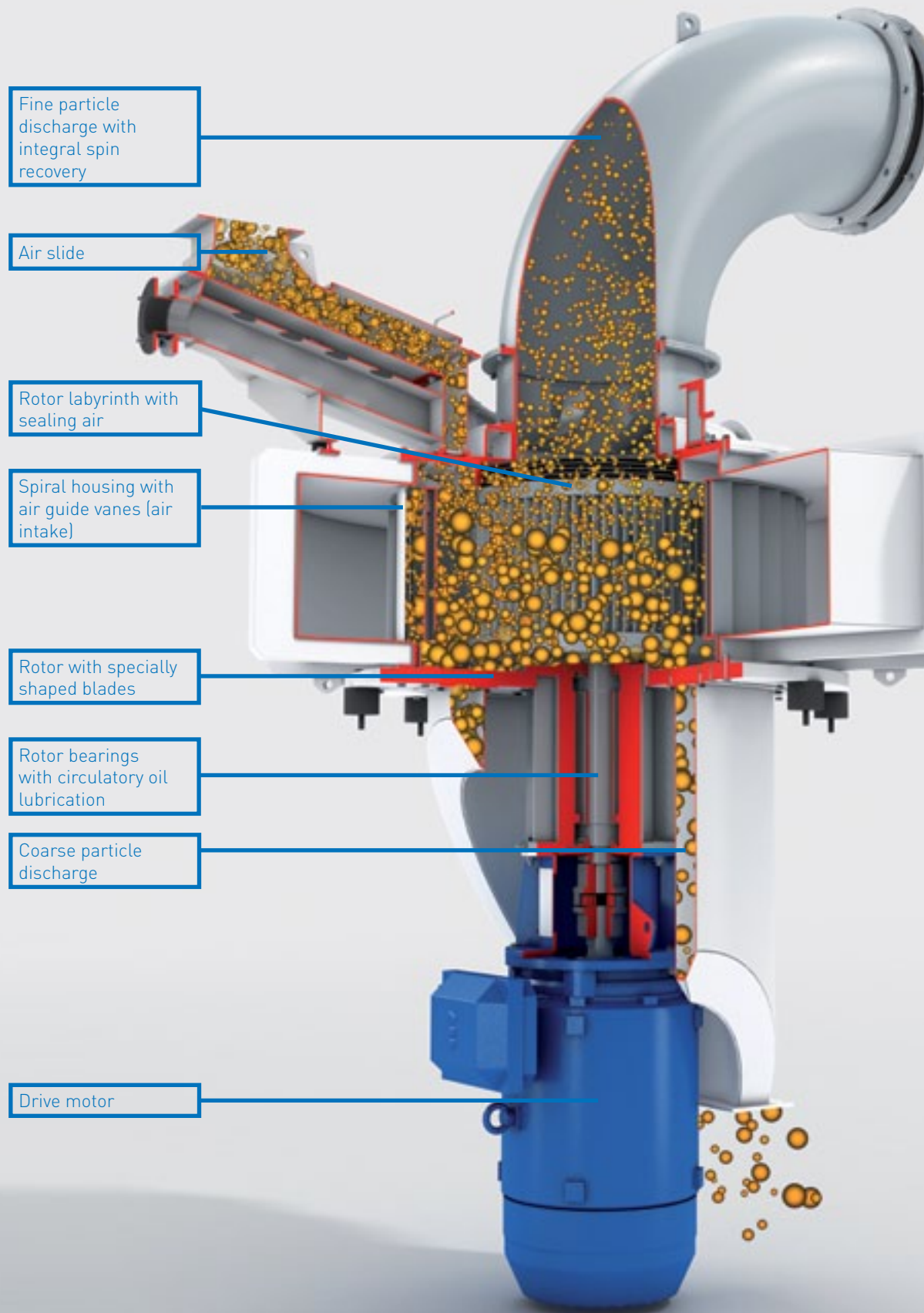
With the appropriate engineering design the centrifugal force generated by the rotation of the classifier cage is amplified by effective flow configuration. This additionally reduces the possible cut size. The classifying rotor can then operate at a lower speed (with correspondingly less pressure loss).

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General structure of CTM classifiers

Classifiers consist of the main assemblies shown below. The classifier bearings can be lubricated by a circulatory oil lubrication system with integral oil cooler or by a grease lubrication system. This ensures adequate lubrication conditions over the entire speed range and for higher process temperatures.

GENERAL STRUCTURE

Fine particle discharge with integral spin recovery

Air slide

Rotor labyrinth with sealing air

Spiral housing with air guide vanes (air intake)

Rotor with specially shaped blades

Rotor bearings with circulatory oil lubrication

Coarse particle discharge

Drive motor

STANDARD SIZES

Size		CTM-0070	CTM-0110	CTM-0180	CTM-0250	CTM-0400	CTM-0540	CTM-D 0740	CTM-D 0940
Classifier air flow	m³/h	4.200	6.600	10.800	15.000	24.000	32.400	44.400	56.400
Rotor diameter	m	0,32	0,43	0,55	0,655	0,825	0,96	0,825	0,825
Max. classifier speed	rpm	4.000	3.500	3.000	2.800	2.500	2.300	2.500	2.500
Max. install. capacity	kW	15	22	45	75	90	132	250	250
Max. feed quantity*	t/h	5,5	8,6	14,0	19,5	31,2	42,1	57,7	73,3
Max. fines quantity*	t/h	1,5	2,3	3,8	5,3	8,4	11,3	15,5	19,7

* Input = 70% <30µm   Product topcut D98 = approx. 30 µm (depending on mineral, grain size distribution of classifier feed material and grinding aid)
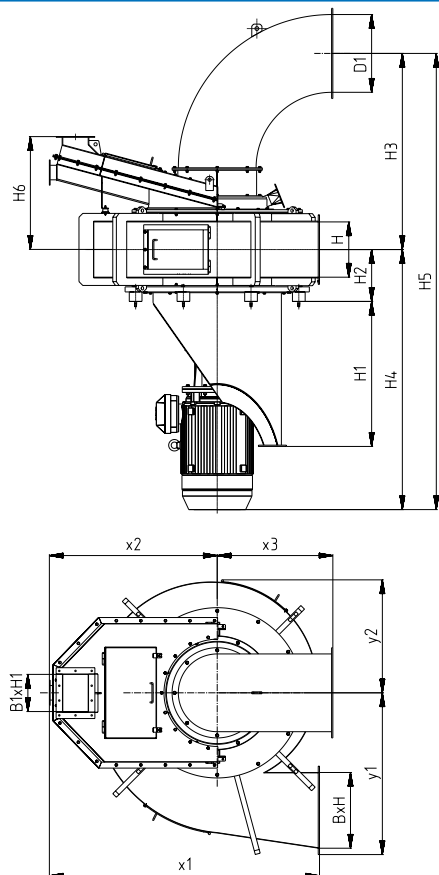
CTM SERIES

STANDARD DIMENSIONS

SIZE	CTM-0070	CTM-0110	CTM-0180	CTM-0250	CTM-0400	CTM-0540
D1	250	300	400	500	600	700
H	210	250	300	360	440	610
H1	600	740	940	1080	1320	1510
H2	260	320	360	400	450	490
H3	910	1005	1180	1360	1550	1785
H4	1180	1240	1460	1800	2140	2450
H5	2090	2245	2640	3160	3690	4235
X1	1000	1450	1650	1850	2100	2400
X2	550	800	950	1100	1250	1450
X3	390	465	615	765	915	1065
Y1	720	855	1020	1115	1250	1275
Y2	450	560	672	745	868	912
BxH	360x200	420x245	500x300	530x355	590x435	600x620
B1xH1	200x120	200x120	220x140	240x160	260x160	300x180

The stated dimensions are standard sizes in mm. Dimensions for CTM-D 0740 and CTM-D 0940 on request.

The CTM classifier series is characterised by a very good top cut and minimized screen residue. e.g. 45 µm. This is for the main part achieved by a very good top cut and air swept seal between rotor and housing.

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NEAR-SIZE PARTICLES

Simplified theoretical near-size particles depending on centrifugal acceleration and radial feed rate [V-rad]

Radial air velocity [V-rad m/sec]

theor. near-size particles ~ d90 - d98 [µm]

- 100g
- 1000g
- 3000g
- Ind. minerals sector
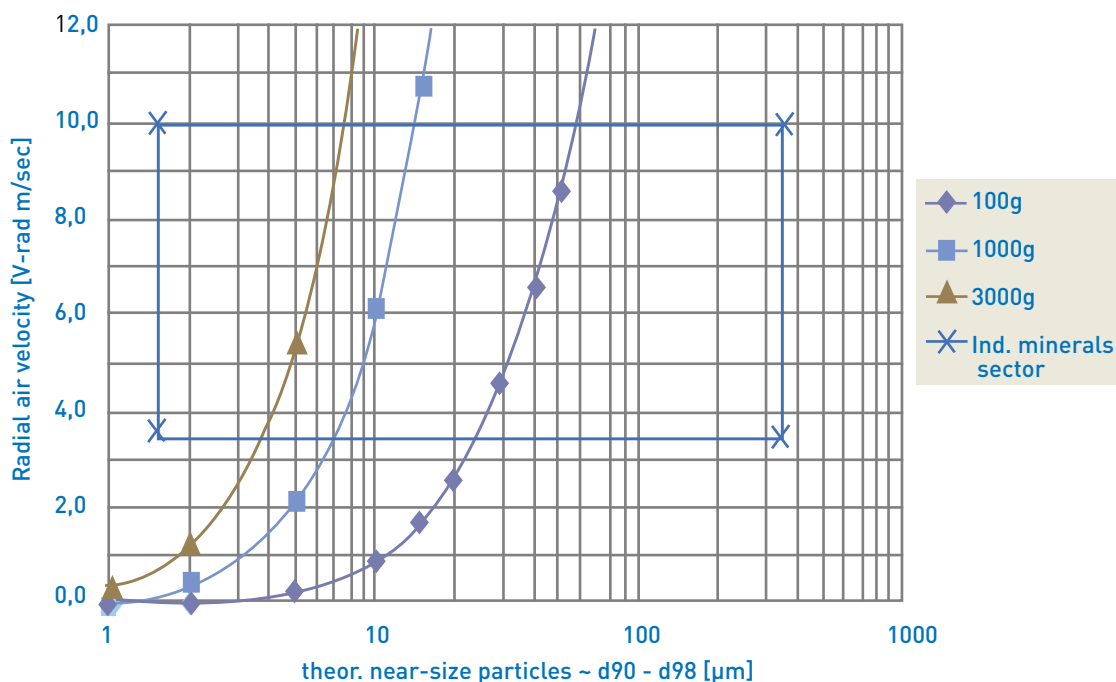
For **cement classification** the average radial air velocity is approx. 4.5-5 m/sec, for industrial minerals approx. 6-10 m/sec. In conjunction with the desired maximum particle size this gives the required centrifugal acceleration in g, enabling the required machine speed combination to be calculated. Depending on the classifier speed, in practice the result will deviate by approx. 10-20%.

CENTRIFUGAL ACCELERATION

Relationship of centrifugal acceleration to rotor speed for the CTM model series

Centrifugal acceleration (g)

Rotor speed [µm]

- CTM 0008
- CTM 0070
- CTM 0110
- CTM 0180
- CTM 0250
- CTM 0400
- CTM 0540
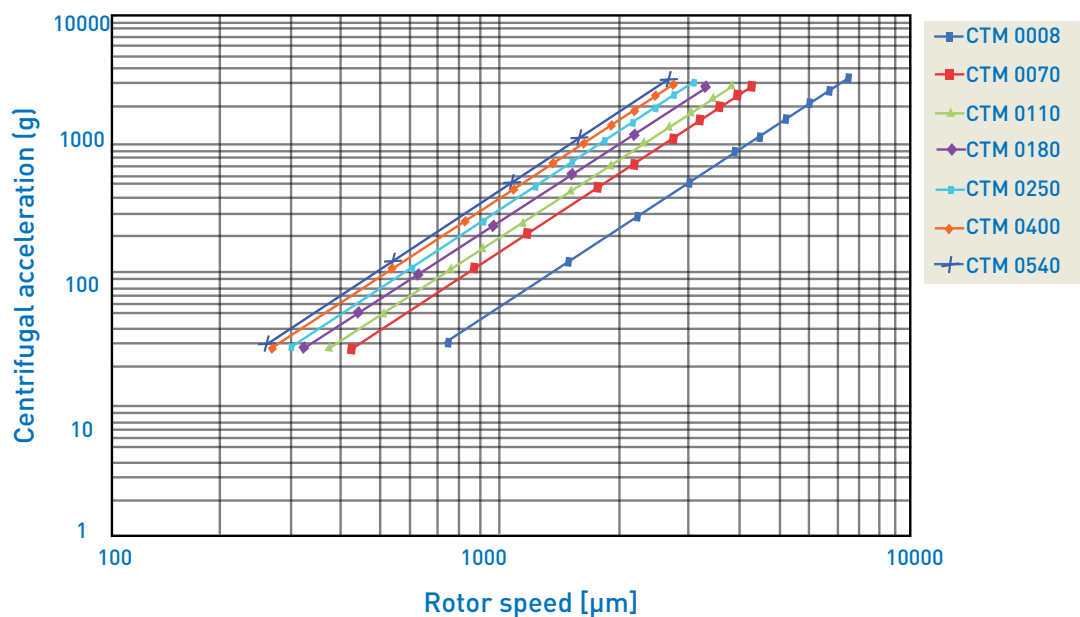
The deviations arising are influenced by speed level, particle shape and classifying air temperature.

CTM air swept seal

The sealing air is fed to the rotor labyrinth via the sealing air channel and flows to the classifying chamber or fine particle discharge. Suitable configuration and clearances guarantee optimum gap sealing. This prevents coarse particles (oversize grain) from being transported into the fine particle outlet.


Sealing air duct

Fine particle outlet

Classifying chamber
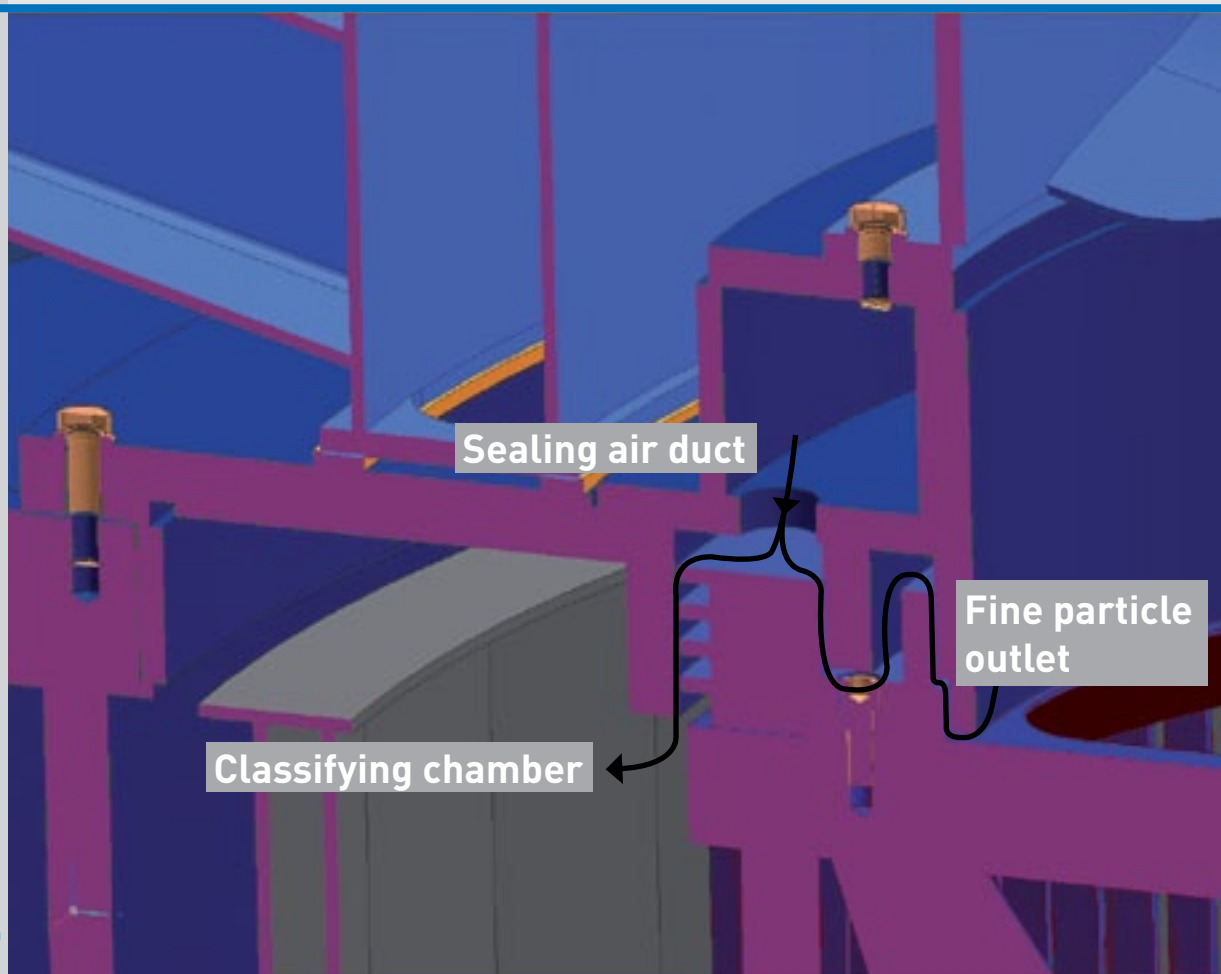
CTM wear protection

Depending on the application, the classifier housing and components subject to wear, such as air guide vanes, classifying rotor, fine particle discharge and coarse particle discharge are protected by appropriate measures.
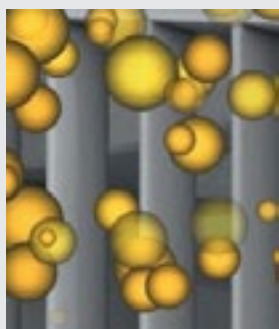
In the standard version the rotor is manufactured of highly wear-resistant structural steel. For more demanding applications additional measures are taken such as coating of high-wear zones.

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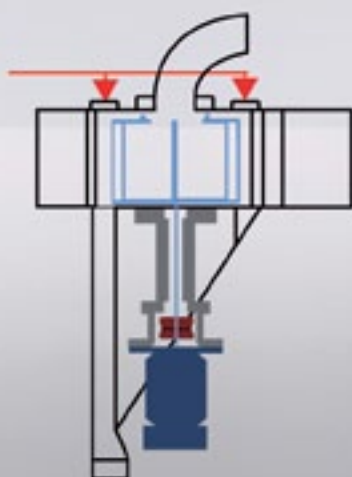Cement & Mining Technology
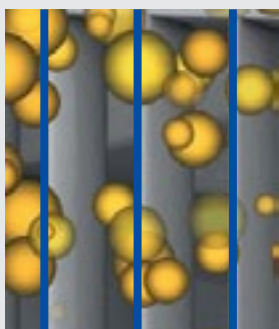
CTM classifier alternative designs

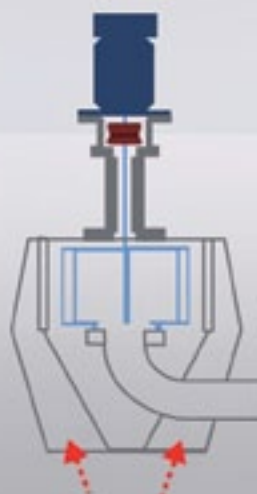The following versions are available for the CTM series:

CTM standard version: Material infeed above air slide, fine particle discharge top, drive unit below classifier

CTM-V „air swept"   Material feed from below with air flow (used for vertical roller mill) Fine particle discharge below, drive unit top

CTM-TB   Feed from above + „air-swept" - for combination
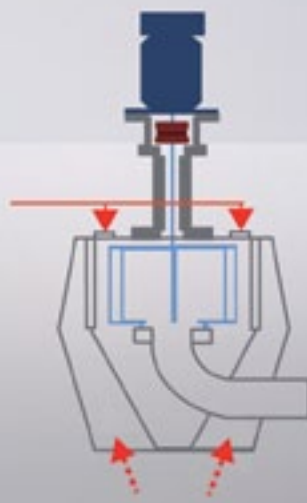
Standard solution Material feed from above	„air-swept feed" Material feed from below	Special solution Material feed from above + „air-swept feed"

**CTM**   **CTM-V**   **CTM-TB**

MODELS AVAILABLE

Process design, selectivity, efficiency of CTM classifiers

The process design is geared to production and product requirements. The fine product temperatures can be optimally set or adjusted for downstream process steps by appropriate configuration of the air circulation. CTM classifiers can thus be operated in an open or closed/semi-closed circuit.
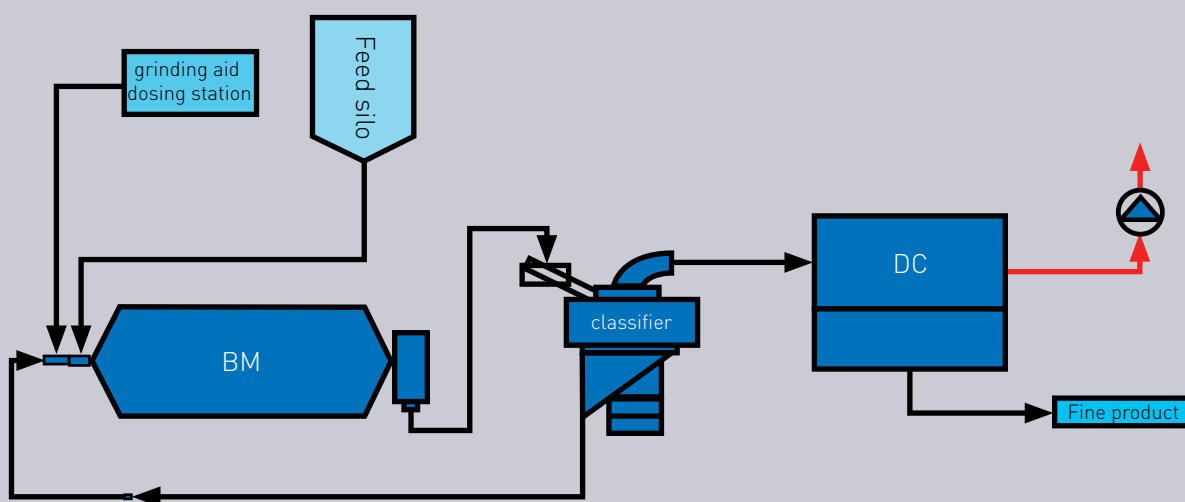
Particle size distribution and grade efficiency curve CTM 0400

- BSFG 5529
- CTM 4005917
- CTM 4005529
- BDFG 0917

Q3(x) / %

T(x) / %

Particle diameter [µm]
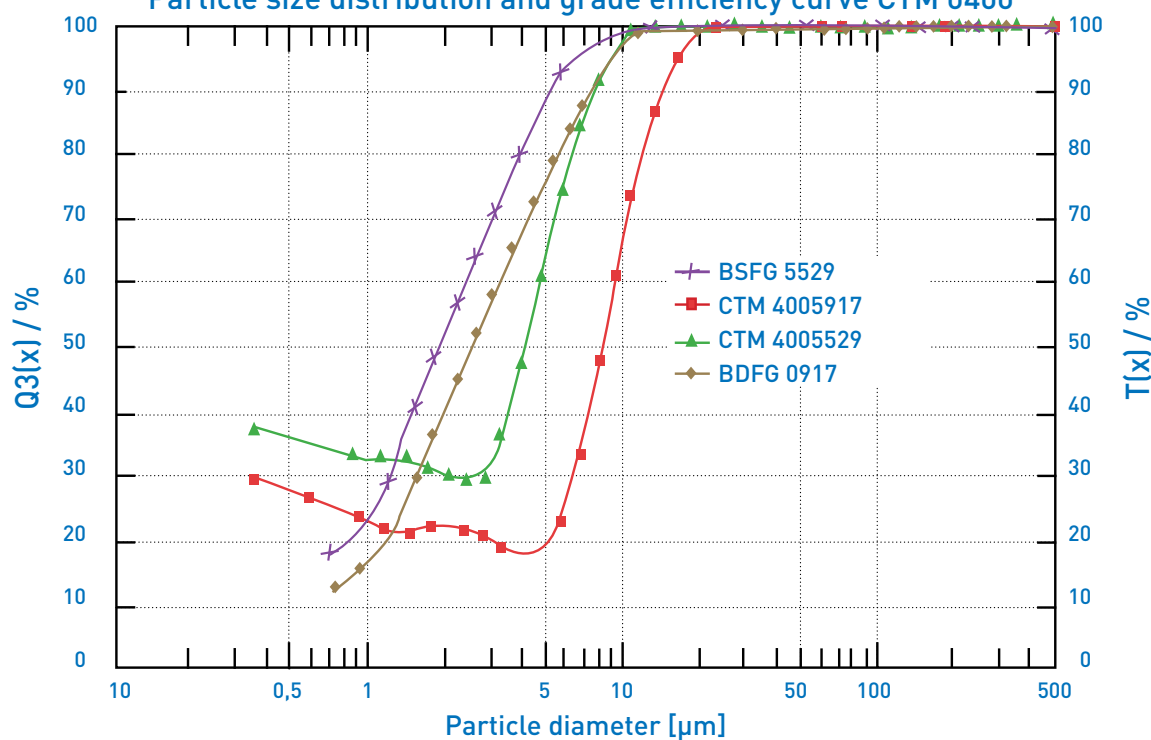
The newly developed CTM series for minerals and fillers distinguishes itself by extremely high yield of fines and low levels of screen residue. This results in additional optimisation of the specific production and investment costs, together with an indirect reduction of the specific grinding energy.

This again has a critical influence on the yield of fines and the bypass of fines due to the selection and degree of grinding conditioning.

CROSS-SECTIONS

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EACH PROJECT STARTS IN OUR **PILOT PLANT!**

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