



GEA centrifuges for industrial minerals

Processing of calcium carbonate,
kaolin and titanium dioxide



MINERAL PIGMENTS

are used in order to stabilize ceramics, improve the characteristics of paper and produce paints or plastics. GEA has developed tailor-made centrifuges for classification, thickening and dewatering of calcium carbonate, kaolin and titanium dioxide.

Reliable

The comprehensive GEA know-how in the design, production and process integration of centrifuges is essential for optimum results in the recovery of industrial minerals.

Whether processing calcium carbonate, kaolin or titanium dioxide: GEA centrifuges, systems and process lines set standards for performance, service life as well as for economic and environmentally reliable operation.

Plan your success

Thanks to the many years of experience and continuous investments in research and development, the company offers its customers a crucial technological edge. The GEA global network of test centers is available for complex trials in order to create a reliable decision-making basis for investments.

From initial advice, basic and detailed engineering right through to the commissioning of the installations, GEA offers a perfect combination of process knowledge, sound knowledge in plant construction, first-class products and technologies. The result is reliable process management with maximum availability of the centrifuges which are used.

Whatever objectives are relevant: the solutions from GEA mean that success can be planned. Agreed performances are attained reliably and permanently.

Benefits at a glance:

- Optimum process results
- Permanently reduced production costs
- Maximized production capacities
- Protection of people and environment

More than just a centrifuge

GEA offers a comprehensive range of services to the industry.

GEA supports its customers from the initial product test in the decision-making process right through to 24-hour service after the centrifuges have been installed.

Product tests are carried out to determine how the product can be separated most effectively and what materials which come into contact with product have to be used. In addition, initial recommendations are also provided with regard to the design of the process, and cost estimates are made. The optimum process design

is developed by the process experts in close cooperation with the customer.

Thus, GEA project management offers all services from a single source – from the individual installation layout right through to the commissioning of the installations and comprehensive service options. The involvement of all parties and resources means that it is always possible for customer requirements to be met, and in many cases even exceeded, in terms of cost and production efficiency.

Benefits at a glance:

- All services from a single source
- Customer- and application-oriented engineering
- Support for process development, designing the process accessories and the installation layout by way of reliable scale-up
- Reliable compliance with all agreed specifications, budgets and delivery deadlines

- Complete assembly and testing of the installations in the ISO 9001 certified production facility
- On-site assembly of certain installation types is also possible
- Service network operating throughout the world

... which provide every customer with the necessary security.

PROCESS SECURITY

GEA combines top separating technology performance with comprehensive responsibility for reliable process management.



Calcium Carbonate – Classification and Dewatering of GCC and PCC

Decaners from GEA are used in GCC and PCC processes. The recovery of high-purity particles extending down to the nano range meets the industry's highest quality standards.

Calcium carbonate is used in a broad spectrum of applications. Besides its use as a filler for paints and plastics, it plays an important role as a coater in the paper industry.

Intelligent treatment techniques are required for classifying, sorting and dewatering calcium carbonate. The product quality is determined by the particle size distribution and purity. The decisive factor is the concentration of the valuable particles with a size $<2\ \mu\text{m}$ and a dense particle distribution. A higher process flexibility must also be assured to recover different quality grades and to boost the recovered yield.

In the traditional GCC method (ground calcium carbonate), blocks of marble are ground before being classified and dewatered to the specifications of the intended application. The PCC process configuration (precipitated calcium carbonate) is exactly the opposite. Individual crystals are stimulated to grow in a reactor by adding calcium oxide and are then dewatered. GEA supports both processes with customized and individually configured process lines.

Very precise classification cut

The GEA decanter series is specifically designed for the recovery of particles in the micro and nanosize range. The

continuous processing mode supports solid-liquid separation and classification by different particle sizes and liquid densities. The very precise classification cut enables the particle size distribution to be adjusted so that the quality specifications are always spot-on. Adding on a second classification stage has the advantage that existing product losses can be transformed into the desired higher quality without excessive expenditure.

Dewatering of the superfine particles to a dry substance content in excess of 70 percent subsequently ensures controlled, stable solids concentrations. Clarification additionally minimizes the contaminants.

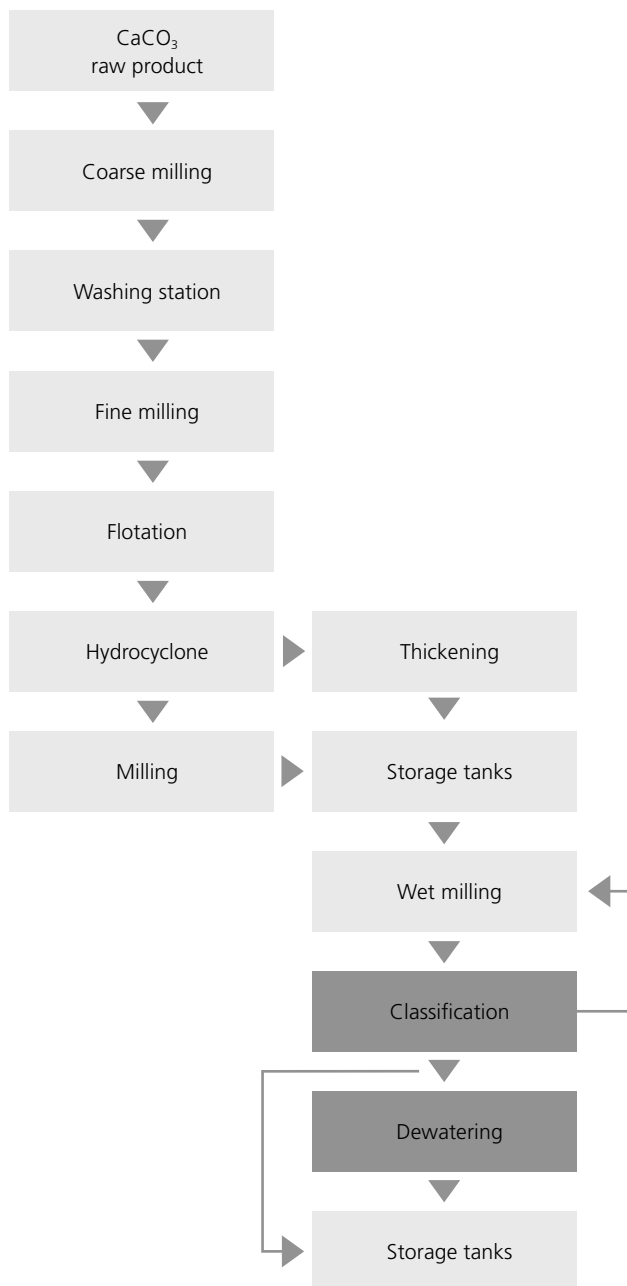
Whether GCC or PCC: the result is in either case a highly pure, pasty slurry which fulfils all the demands of the paper manufacturer.

Benefits at a glance:

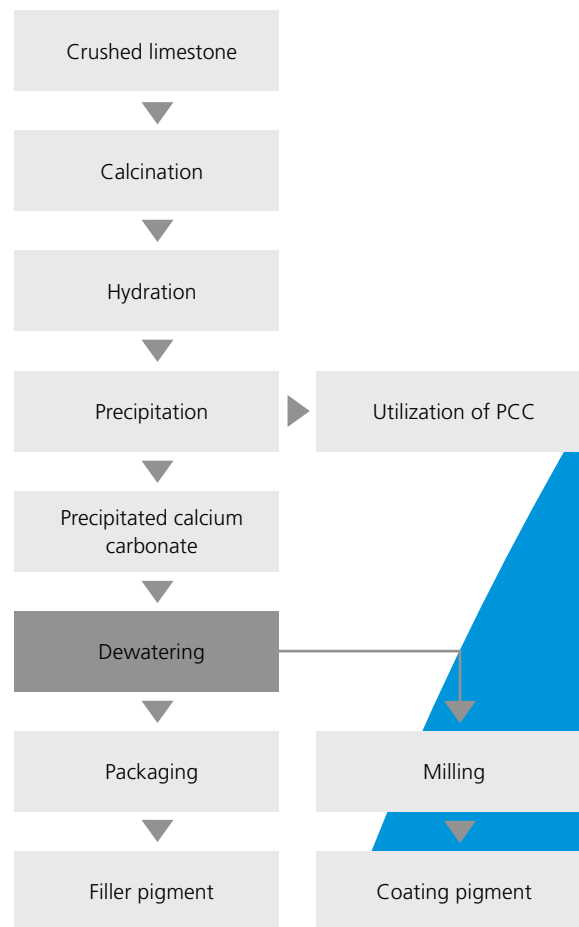
- Continuous process
- Support of GCC and PCC recovery
- High product purity
- High yields, less product losses
- Dry substance contents of more than 70 percent



Recovery of ground calcium carbonate (GCC)



Production of precipitated calcium carbonate (PCC)



Kaolin and Titanium Dioxide – More Product of Higher Quality

Kaolin, also known as china clay, is a pigment recovered from kaolinite, a weathering product of feldspar. It is valued as a filler and whitener in many industries. High-grade kaolin is very much demanded by the paper industrie being an ideal luminous filler and coater in the production of high quality paper.

Brightness, opacity, purity and gloss define the pigment quality of kaolin. These parameters are essentially determined by the particle size distribution. Particles smaller than $0.2\text{ }\mu\text{m}$ are irrelevant in the production of white colour because they no longer diffract the light. Particles larger than $2\text{ }\mu\text{m}$, by contrast, negatively impact the whiteness. Coarser particles with a diameter above $20\text{ }\mu\text{m}$ in particular must be as few as possible to produce a good paper quality.

Optimum particle size distribution

High-performance GEA decanters are ideal in the process. Thanks to their accurate classification cut, the particle size distribution can be configured to desired

quality with minimum product losses. The impact on yield and margin is substantial. A few percent more make the difference in view of an annual production of many thousand tonnes while a higher degree of whiteness allows to demand higher prices.

With a newly developed recovery process, GEA has also succeeded in substantially reducing the losses of the $2\text{ }\mu\text{m}$ fractions. The already minimal product loss can be transformed into the desired higher quality without difficulty by adding on a second classification stage. At the same time, the manufacturer has the possibility to produce two different pigment qualities with the first and second stage.



Kaolin processing



Titanium oxide in the chloride process

Titanium dioxide has the highest opacity of the entire range of white pigments plus a very good whitening power. These properties not only make it attractive for the production of paper. It is also of significant interest for paints and lacquers, as sun blockers in sun tan lotions, as a constituent of solar cells and ceramic capacitors or as nano particles for self-cleaning surfaces.

The chloride process has established itself worldwide for the recovery of titanium dioxide. This process has the advantage that the chlorine remains in the process circuit to a large extent and no environmentally hazardous dilute acid is produced. GEA supports this process through the integration of a special nozzle separator.

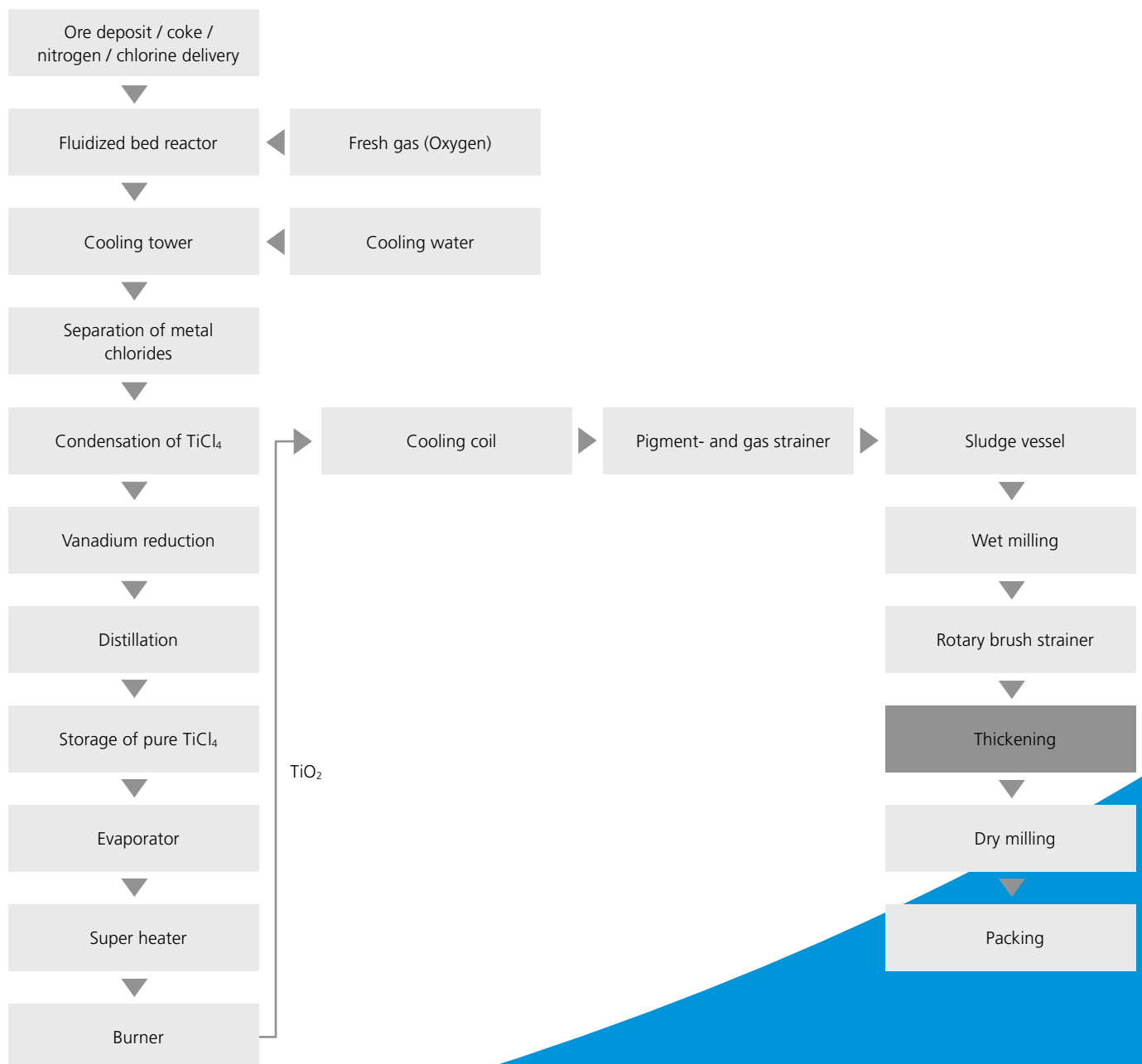
The opacity as well as the optimum consistency and brilliance of the titanium dioxide heavily depends on the size of the particles. The use of centrifuges from GEA makes it possible to classify the titanium dioxide so that there is a particularly large number of superfine particles in the quality-enhancing size of approx. 0.2 to 1 μm . Rotary brush strainers are installed upstream of the nozzle separators to remove the coarser fractions and hence protect the nozzles from possible blockage.

Benefits at a glance:

- Premium product quality
- Higher yield – minimal product losses
- Continuous process
- High availability of the centrifuges used
- Both separators and decanters in the product line



Titanium dioxide processing



Classifying decanters – precise right down to the nano range

Classifying decanters from GEA convince through optimal process control in the micro and nanosize range.

Decanters from GEA used in the mineral processing sector are horizontal, solids-oriented solid-wall scroll centrifuges.

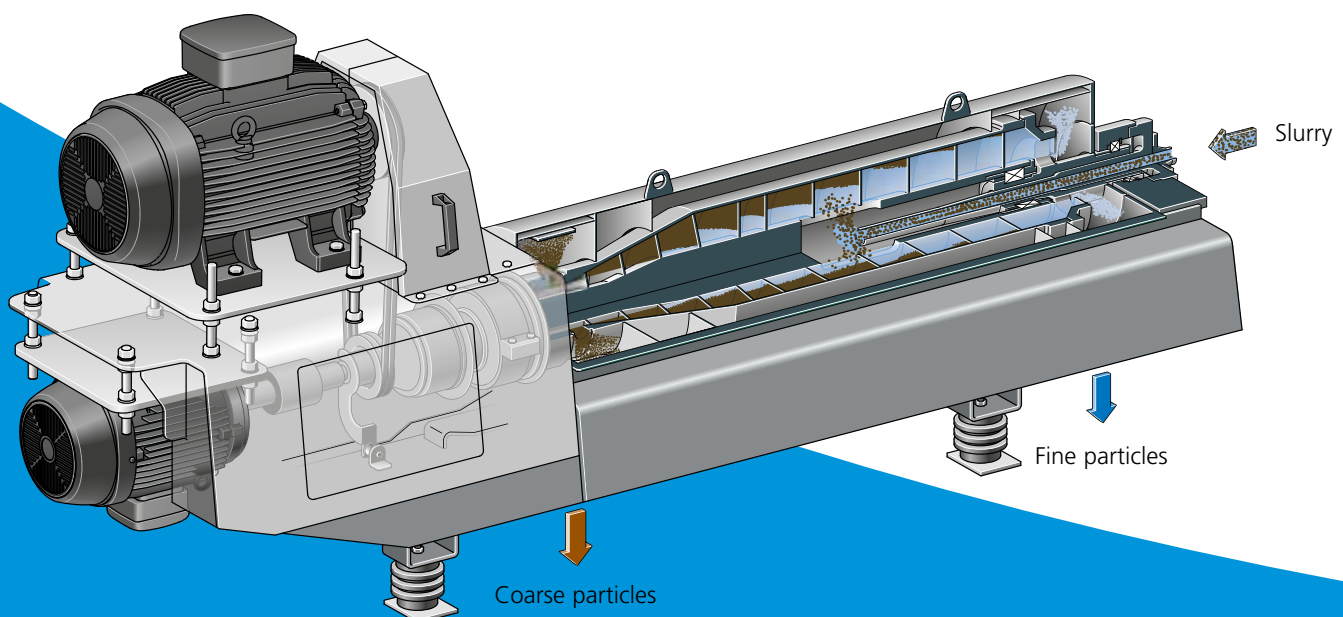
In the version as classifying decanter, they take on the job of continuously processing the slurry so that the particle size distribution and purity of the product conform exactly to the specifications.

The innovative technology of the classifying decanter enables an accurate classification cut. This means optimum process control for the recovery of particles in the micro and nanosize range. The particle size distribution can be both displaced and altered. Adjustment to the smallest grain sizes is also possible without difficulty. Valuable substances are recovered, undesirable superfine particles and impurities are separated reliably.

Depending on capacity and requirement profile, different sizes and drive concepts are available. In addition, the classifying decanters convince through robustness, a long life cycle, high torques, user friendliness, low energy consumption and low maintenance expenditure.

Benefits at a glance:

- Recovery of valuable substances
- Separation of diverse particles
- Separation of superfine particles and impurities
- Displacement of the particle size distribution
- Altering the particle size distribution
- Adjustment to smallest grain sizes



Dewatering decanters for highest dry substance

Dewatering decanters from GEA ensure maximum solids concentrations.

Like the classifying decanters, the dewatering decanters from GEA also operate in continuous processing mode. These solid-wall scroll centrifuges are used in the mineral processing sector for dewatering suspensions.

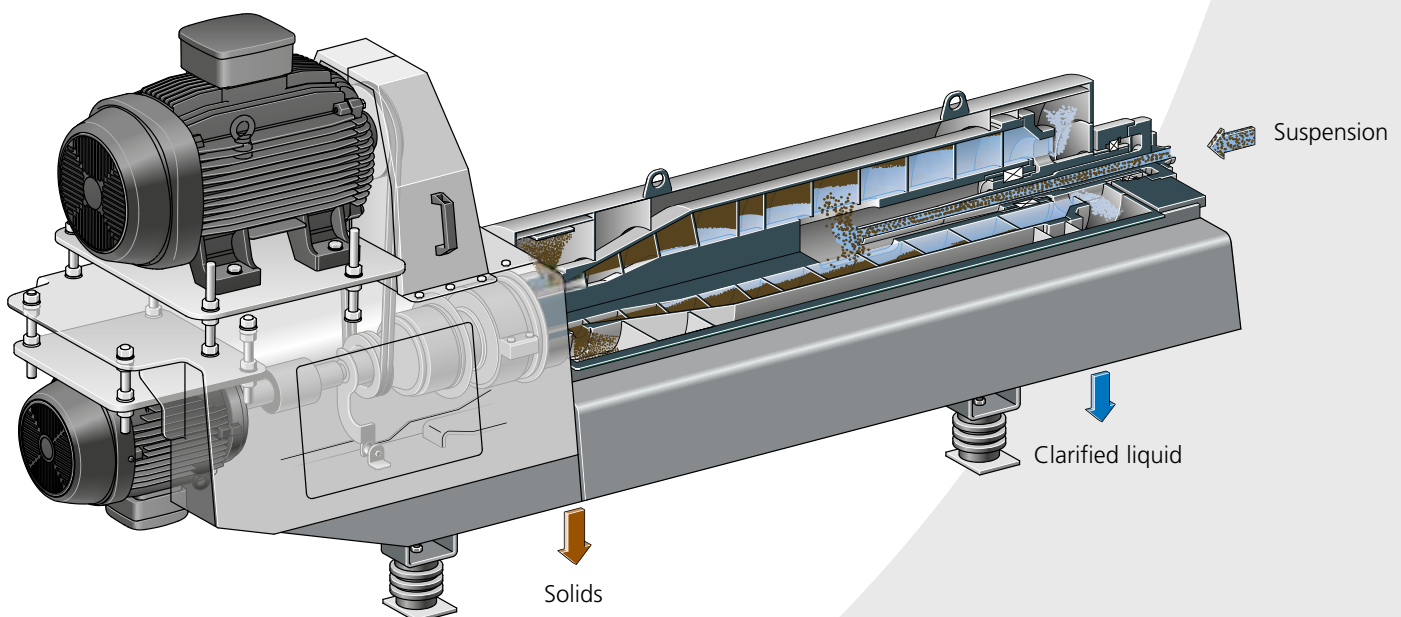
Decanters operating at high speeds and high torques are required for dewatering fine particles. At the same time, the large product streams require large diameters. The centrifuges from GEA meet these demands in every respect.

Due to their very high speeds, the dewatering decanters are capable of producing end products with an extremely high dry substance. Variable drives with torque-dependent differential speed regulation ensure constant solid concentrations, even with fluctuating feed concentrations.

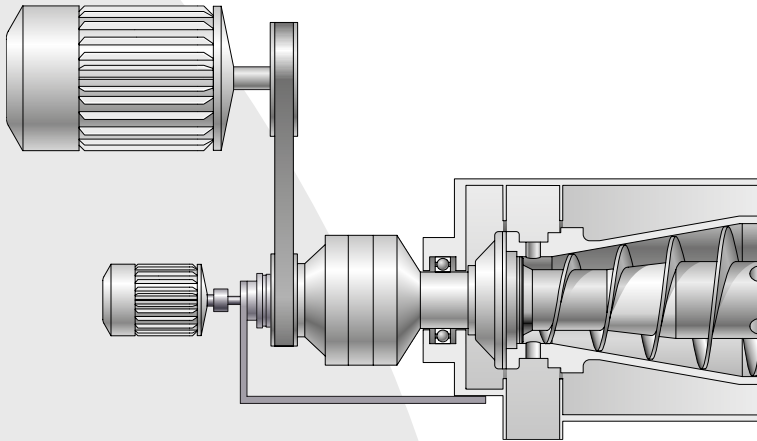
Their robustness and wear resistance make the dewatering decanters extremely reliable in long-term operation too. The decisive advantages of the centrifugal system as opposed to filter press techniques are the closed and continuous processing and the avoidance of the laborious filter handling. Compared with evaporator technology, the energy consumption is significantly lower.

Benefits at a glance:

- Maximum solids concentration
- High product quality
- High availability
- Optimized drive systems
- A wide range of decanters specially designed for the optimum dewatering of inorganic pigments



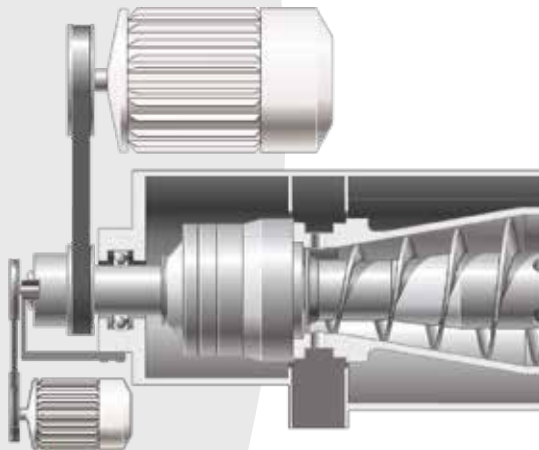
Innovative drive concepts for decanters



GEA summationdrive

The summationdrive always provides the full torque across the entire regulation range. It supplies only the power which is actually required, because the secondary motor is operated purely as a motor, and there are no braking effects. Accordingly, the drive does not require any backdrive and provides savings in terms of unnecessary conversion losses as well as belt drives, shaft loads and construction space.

In the version used for higher differential speeds, the drive combines the output of the primary and secondary motor (summation) and thus minimizes energy consumption. Conversion to the higher differential speed range is possible without having to replace the gear. In both drive versions, the differential speed is provided over large ranges without any interruptions.



Differential gear drive

The differential gear drive is recommended whenever it is necessary to automatically regulate the scroll speed in addition to regulating the bowl speed. This can be achieved by means of two gears. The secondary motor drives the central input shaft and generates the differential speed proportionally to its own speed. A second input shaft without any speed is connected to the housing.

This means that the differential speed is not dependent on the bowl speed. Differential gear drives are used primarily in the lower range of the differential speeds.

Decanter wear protection – no chance for abrasion and corrosion

GEA uses highly resistant duplex steel and special armour-plating for all parts which come into contact with product.

Crud treatment and recovery of organic components expose decanters to extreme material strain. The low pH value of the process (pH 2) and high operating temperature in conjunction with a range of high chloride concentrations result in corrosion. The only way to tackle this problem is to use an extremely high quality material. GEA therefore uses highly resistant duplex or super-duplex stainless steels for manufacturing all components of the decanter which come into contact with product.

This material is not affected by pitting, and also features higher abrasion protection than stainless steel which is normally used. In permanent contact with abrasive particles in metallurgy, this wear protection is an essential advantage.

In addition, all places at which increased levels of wear can be expected have to be provided with special armour-plating in order to ensure permanent operation of the decanter. The most suitable form of armour-plating according to the specific application is defined in close cooperation with the customer.

One possible solution is spray cladding, in which carbide is for instance welded on to the vane of the scroll or areas in the distributor. The advantage of this solution is that the protecting material combines with the base material in the welding process.

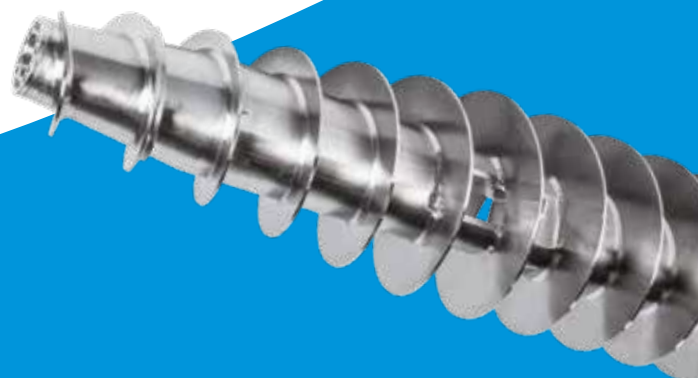
GEA also offers the possibility of using tiles instead of or in addition to carbide plating. Tiles are generally used in conjunction with highly abrasive products. GEA also has the know-how for cladding certain areas with ceramics in order to provide special protection.

Depending on specific requirements, GEA offers wear and corrosion protection in the form of

- Carbide cladding
- Tiles
- Ceramics
- Use of high-quality steels
- Rubber linings
- Coatings



GEA tackles problems posed by abrasive particles with special armourplating for all decanter components which are at risk.



Rotary brush strainers and wear protection

Upstream rotary brush strainers and a special coating for components which are at risk protect the separators against clogging and abrasion.

Excessively large solid particles can clog the nozzles of the separators. This is reliably avoided by installing a rotary brush strainer from GEA upstream.

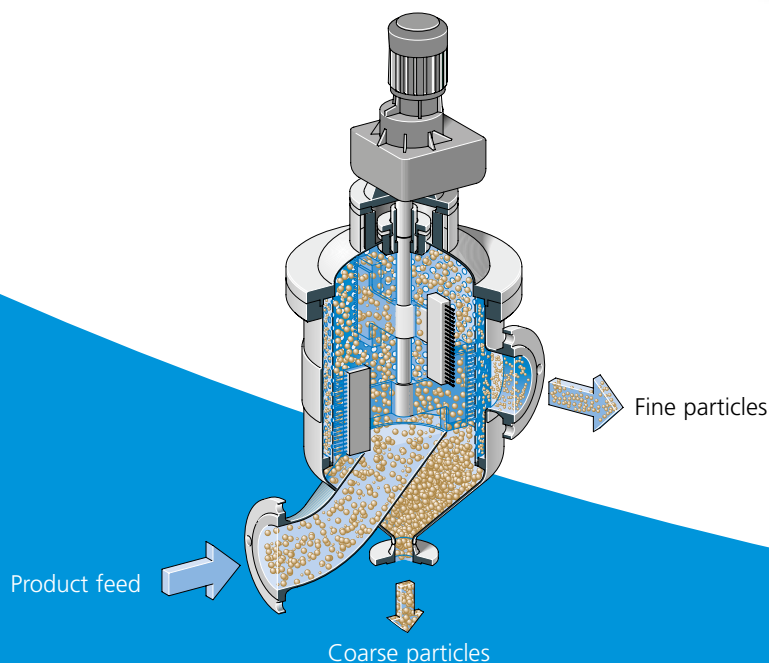
The product is fed into the strainer insert through the inlet, and flows through the strainer in the chamber to the discharge. The coarse solids are retained and scraped off the interior of the strainer by the rotating brushes. They fall into the conical base, from which they are discharged manually from time to time or automatically through the solids discharge.

Special coating against abrasion

In order to ensure that maximum performances are permanently achieved, the nozzle-type separators are also equipped with a special wear protection against abrasion. This solution comprises coated wear plates as well as a coating on the distributor bottom and the bowl bottom.

Benefits at a glance:

- Upstream rotary brush strainers prevent clogging of the nozzles
- Reliable protection against abrasion
- Maximum separation performance in the overall process
- Maximum maintenance intervals



Decanters from GEA – convincing right through to the smallest detail

Machine portfolio

- GEA as a complete-range provider for a range of 600 – 350,000 l/h

Special materials

- Parts which come into contact with product can be made of specific application-related materials, thus ensuring optimum resistance and product-neutral properties

GEA varipond®

- Automatic system for infinitely variable adjustment of the liquid level while the machine is running in order to adjust for product fluctuations in the feed
- Assures maximum dry substance values and separating efficiency in conjunction with different feed conditions, resulting in lower power consumption
- Assures optimum conveyance of highly viscous liquids – enhances conveyance efficiency
- Intelligent self-control

Separating zone adjustment during operation

- Assures optimum separation and clarification efficiency while the machine is running

Explosion-protected and gas- and pressure tight designs available

- Can be used for instance in explosive areas or for processing explosive or toxic products

Six scroll drive versions

- Drive versions tailored to meet the requirements of the specific process ensure maximum clarification and dewatering efficiency as well as cost-effectiveness of each individual application (energy and investment costs)
- All scroll drive versions are selected in accordance with product-specific characteristics

Adjustable bowl speeds

- Depending on suspension and/or solids densities the bowl speed can be adjusted by VFD

Wear protection

- Better availability, lower maintenance costs

Rotor concept

- Maximum speed, g-forces and g-volumes permit maximum throughputs and clarifying efficiency by use of product specific cone angle

Nozzle-type separators for efficient thickening and classification

Continuously operating nozzle-type separators from GEA are the first choice for efficient processing of superfine solids.

GEA nozzle-type separators discharge concentrated suspensions continuously via nozzles which are installed on the periphery of the bowl. The product flows via the feed into the bowl, where it is separated into concentrate (underflow) and centrate (overflow). The disc stack which is installed in the bowl increases the equivalent clarification area and thus the performance of the separator.

The size of the bowl diameter and thus the number of nozzles are linked proportionately to the potential concentration of the concentrate. The concentration increases in conjunction with increasing throughput, high initial concentration of the product, declining solids content in the discharge, small nozzle diameter and a low bowl speed.

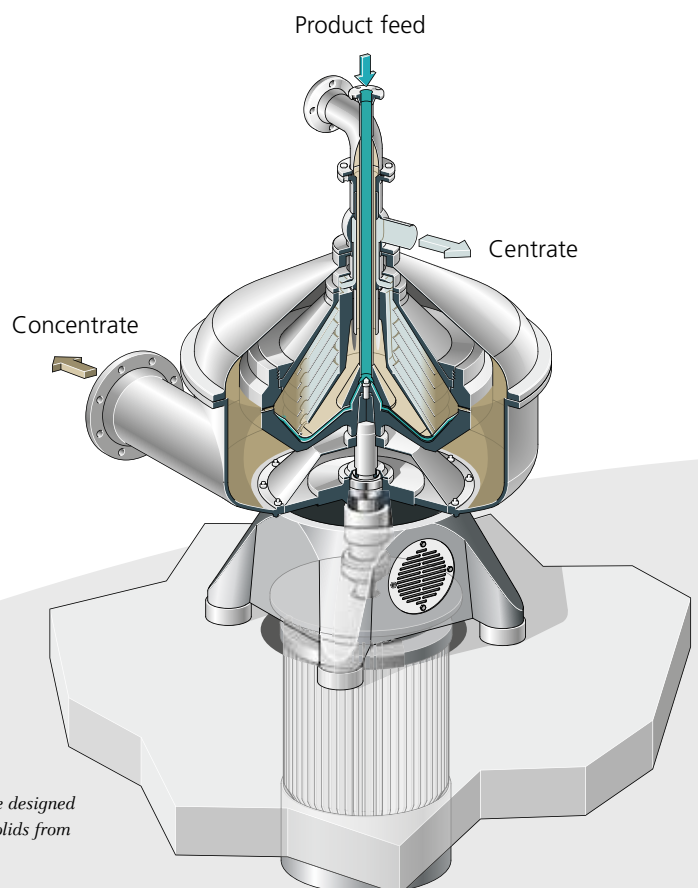
The task is to achieve a balance between these factors and the equivalent clarification area as a standard measure for the clarifying performance of the bowl, in order to make sure that the remaining solid content in the concentrate permanently meets the customer's requirements.

With the online analysis facility which is offered by GEA and which is based on measurement of the concentration of the product upstream and downstream of the nozzle-type separator, it is possible to adjust the clarifying performance of the centrifuge very precisely. The figures resulting from the concentration

measurements are used for automatically carrying out adjustments to the feed capacity and the concentrate recycling. This achieves constant concentration of the discharged suspension. Fluctuations in the process results can thus be reliably excluded.

Benefits at a glance:

- All operating sizes covered
- Continuous method of operation
- With concentrate recycling before the nozzle in order to increase the concentration
- Sophisticated online analysis for stable process conditions
- Direct drive for optimum energy efficiency and low service costs



GEA nozzle Separators are designed for thickening superfine solids from suspensions.

Drive concept for separators



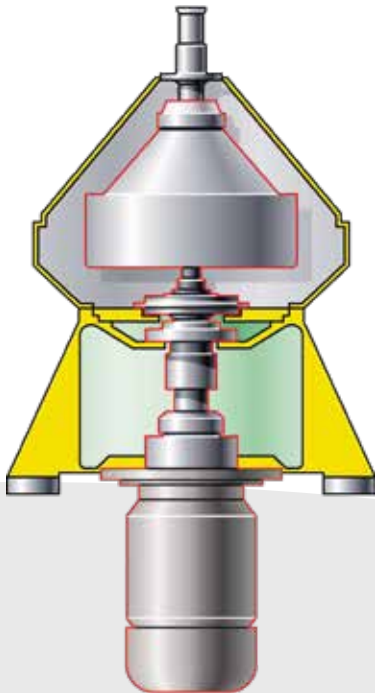
GEA Integrated directdrive[®]

The energy-efficient drive technology

GEA integrated **directdrive** ensures direct power transmission from an integrated frequency-controlled-phase motor to the bowl – without separate high-maintenance bearings.

Benefits at a glance:

- Improved level of efficiency ensures significant energy savings
- 35 % reduced space requirement for the separator
- Exceptionally maintenance-friendly drive concept
- Water-cooled motor works considerably more quietly than a conventional one
- Product feed and discharges in the bowl do not feature mechanical seals



Direct drive system

The direct drive is an example of intelligent simplification in separating technology. Wherever the upper limit for gear loads has been reached or belt drives are undesirable, our separators with direct drive permit virtually loss-free power transmission.

This boost in performance simultaneously reduces the costs of energy, wear, maintenance and space. The required power is transmitted directly to the bowl spindle by a 3-phase AC motor with frequency converter control via a torsionally elastic clutch. The spindle assembly is likewise supported by rubber-metal cushions. This makes possible low-vibration running at high bowl speeds.

Benefits at a glance:

- Extremely space-saving design
- Avoidance of housing deformation
- High performance input
- Low maintenance requirement

Separators from GEA – convincing right through to the smallest detail

Machine portfolio

- GEA supplies a complete machine portfolio (capacity up to 350,000 l/h) with compatible hydraulic performance parameters/ performance reserves – the right separator for every customer requirement

Modular total concept

- Customized solutions and delivery as required by customers

Operating the separators

- Personnel-friendly operating of the separators and, if required, 100 % remote-monitored operation possible, thus enhancing operational reliability and availability
- Combination of maximum robust nature and reliability
- Low water consumption as no cooling necessary for the drive and the slide ring packings

Special materials

- All product contacting components can be made of special metals, clad with special metals or coated resulting in optimum resistance against corrosion

Discharge and feed design

- Feed design can be adapted to product requirements
- Clarified liquid is discharged foam-free under pressure by use of a centripetal pump. Available discharge pressure is minimum 4 barg which makes the need of transport pump unnecessary

Direct drive

- Drives are low-wear and service-friendly
- Use of lubricants approved for food applications
- Available in explosion-protected design and ATEX-compliant
- Special drives possible if required by customer

Rotor concept

- Flow-optimized design (minimum flow resistance, minimum shearing forces) of all bowl parts assures optimum separating and clarifying results with minimum product damage
- Maximum speeds (g-forces)/equivalent clarification areas achievable



GEA Service – For your continued success



GEA Service – For your continued success

GEA Service offers dedicated teams of service experts. Our focus is to help our customers build, maintain, and improve their performance, market presence and competitive edge for the entire life cycle of their plants and equipment.

Partnering with GEA gives you the benefit of our world-renowned, customer-tailored service and recommended spares upgrade, modernization and optimization services. With our support you can be certain that every piece of GEA equipment and technology will operate optimally from day one, and for its complete lifespan, to give you maximum return on your investment.

- Getting you started – Seamless support for instant productivity and performance
- Keeping it running – The cost-efficient way of ensuring the safety and reliability
- Constantly improving – Sharing our knowledge to safeguard your investment
- Together with you – Enduring commitment to you and your business

Global test center network

Innovate, partner and prosper with GEA

Driving your future	Driving solutions	Driving technologies
By combining advanced in-house technology with a thorough understanding of the processing industries, we help our customers to maximize their development results, gain more know-how and discover additional opportunities for their applications.	From new product and feasibility trials to scale-up studies, training programs and process support, we believe that our services greatly benefit anyone involved in industrial R&D, equipment selection, process optimization and product development.	Overcoming technical barriers throughout the entire process chain, there's no limit to where the GEA global network of test centers can take your research.

The GEA global network of test facilities offers teams of experts who work closely with their customers to optimize procedures and evaluate their products, enabling them to achieve their process and production goals.

GEA test center Separation

At the GEA test center of competence, customers can test both new and established products in a wide range of separation operations or perform comparative process studies with our skilled operators. Other test programs in GEA test centers around the world can be involved to test entire manufacturing lines.

Prosper with GEA

Book your ticket to success at

gea.com/contact

On-site trials and technical center

Centrifuges are available for process trials at the operator's site to assess the feasibility and profitability of individual process steps and combined operations.

In co-operation with the customer, GEA also develops and tests completely new processes. In this way, the GEA test centers also underline the innovation strength of GEA as a leading international technology group.





GEA Global Test Center

We live our values.

Excellence • Passion • Integrity • Responsibility • GEA-versity

GEA is a global technology company with multi-billion euro sales operations in more than 50 countries. Founded in 1881 the company is one of the largest providers of innovative equipment and process technology. GEA is listed in the STOXX® Europe 600 Index. In addition, the company is included in selected MSCI Global Sustainability Indexes.

GEA Germany

GEA Westfalia Separator Group GmbH
Werner-Habig-Straße 1
59302 Oelde, Germany

Tel +49 2522 77-0
Fax +49 2522 77-2488

sales.germany@gea.com
gea.com