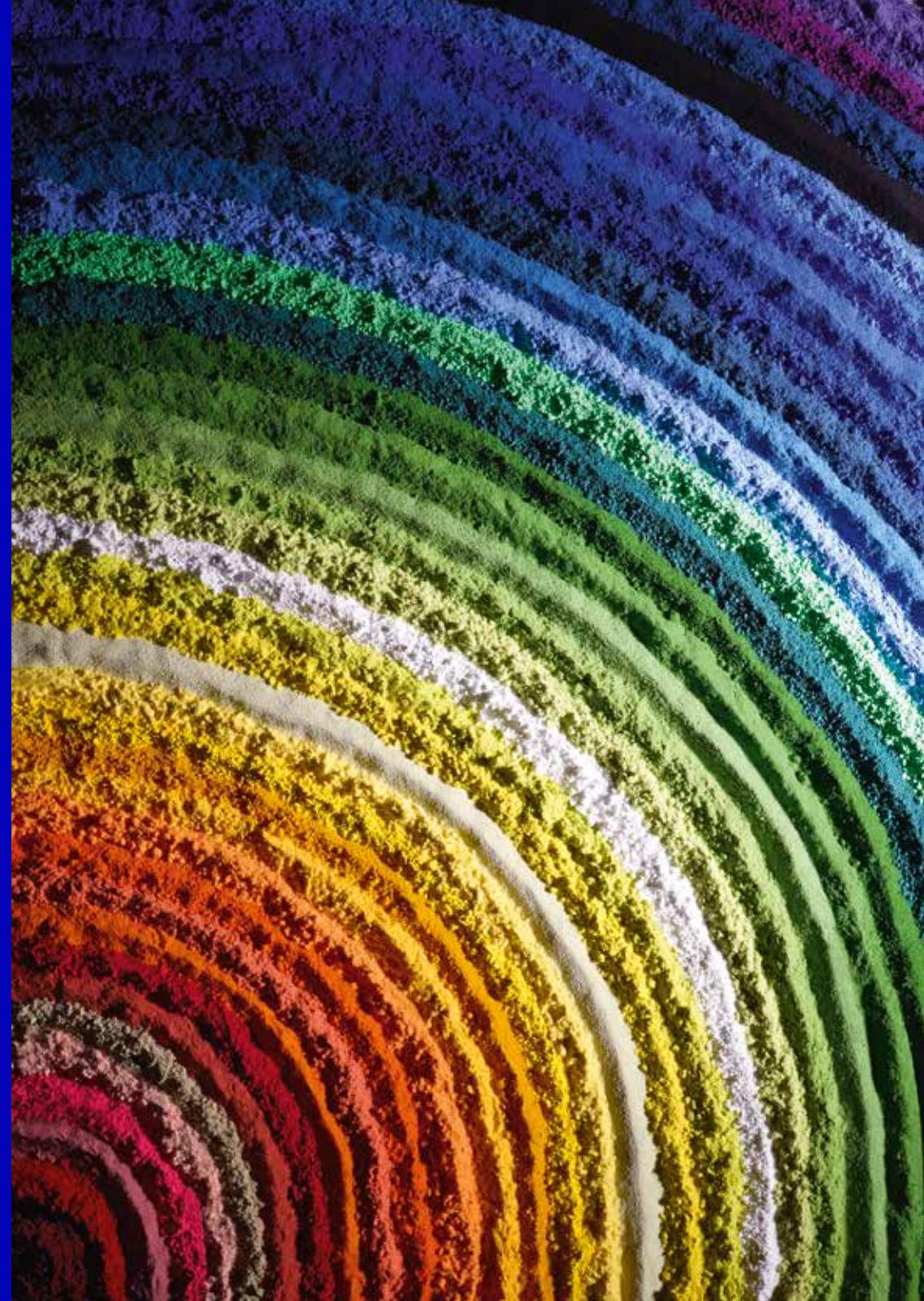


# GEA drying and particle formation technologies

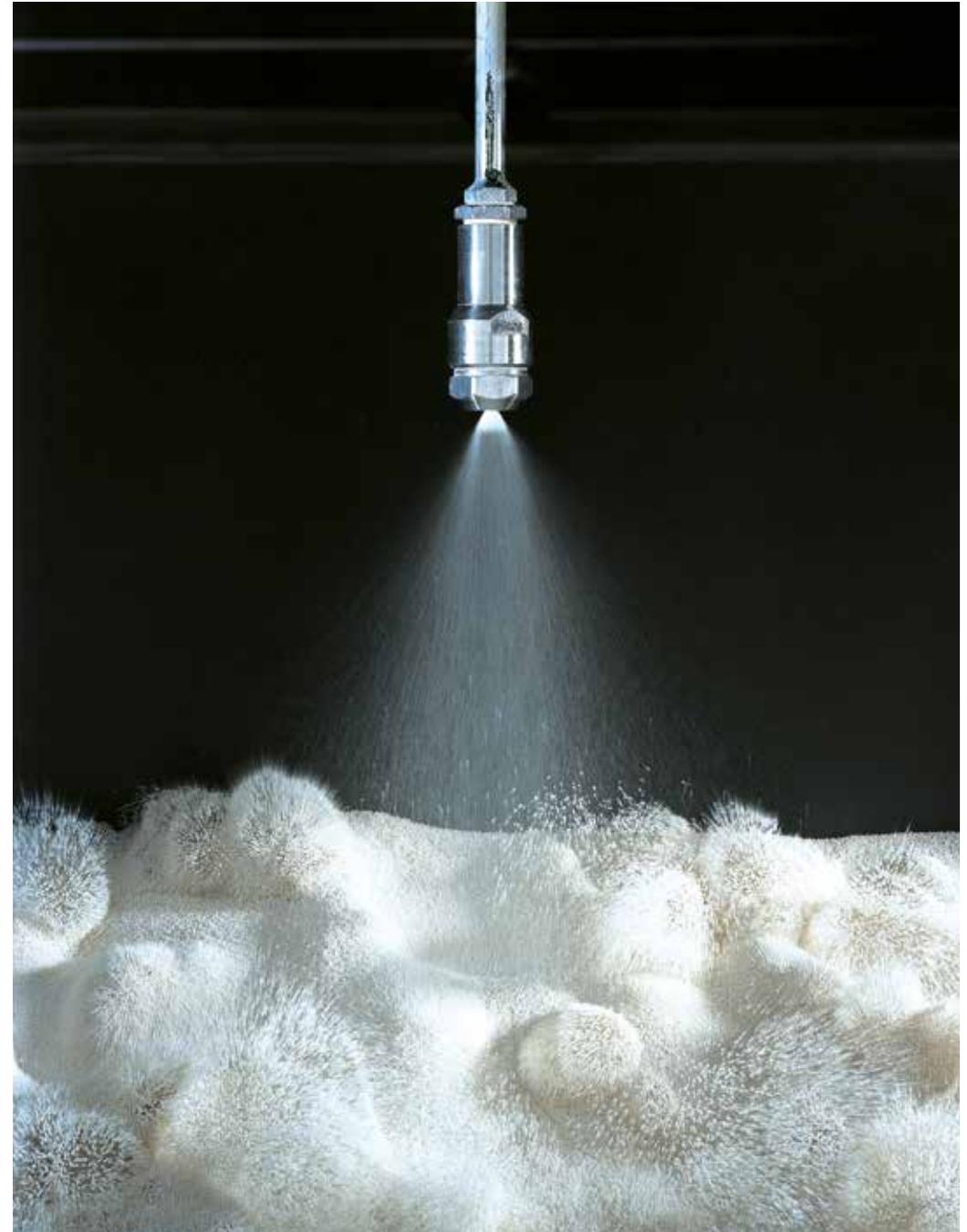
For the world's chemical industry



# Content

GEA has provided world-class industrial drying solutions since 1928 that enable businesses like yours to stay competitive, profitable and at the forefront of their industry.

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# The right process for your product.

GEA helps you to make the most of new opportunities across a full spectrum of products.



## Ceramics

Traditional through to high-tech

- Proppants
- Hydroxyapatite
- Carbides
- Catalysts
- Ferrites
- Titanates
- Al<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub>, Fe<sub>3</sub>O<sub>4</sub>
- Kaolin
- Silicon oxide/nitride
- Zinc oxide
- Zirconium oxide/silicate



## Hardmetals

More than 130 installations

- Tungsten carbides
- Ready-to-press (RTP) powders



## Lithium batteries

From Cathode to Anode

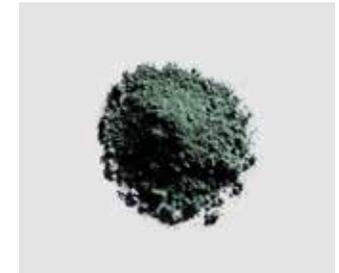
- Cathode material
- Anode material
- Ultra-fine powder



## Agrochemicals

The broadest range of solutions

- Fungicides
- Herbicides
- Insecticides
- Potash
- Phosphate rock
- Monoammonium phosphate
- Diammonium phosphate
- Calcium chloride
- Ammonium nitrate
- Ammonium sulphate
- Urea



## Tannins

Preserve tannin activity

- Synthetic tannins
- Basic chromium salts
- Natural extracts
- Sulphonated phenol
- Chrome tannin
- Chestnut, mimosa extract
- Myrobalan, quebracho extract
- Wattle extract

# The right process for your product.

GEA dryers are designed to convert liquids to powder by means of gentle drying in a high-efficient range.



## Detergents

For household and industrial applications

- Dispersing agents
- Emulsifying agents
- Chelating agents
- Enzymes
- Optical brightener
- Phosphates
- Sulphonates
- Silicates
- Surface active ingredient



## Dyestuff & pigments

For a rainbow of colors

- Acid / azoic dyes
- Basic dyes
- Disperse dyes
- Reactive dyes
- Dyestuff intermediates
- Related fillers
- Barium sulphate
- Cadmium carbonate / sulphide
- Calcium carbonate
- Ceramic colorants
- Iron oxide (black, red, yellow)
- Kaolin
- Lithopone
- Phthalocyanines
- Titanium dioxide
- Zinc chromates



## Organic chemicals

From fine crystals to coarse granulates

- Organic acids
- Plant materials
- Microorganisms
- Waste water drying
- Amino and fatty acids
- Benzoates
- Butyrates
- Chloramines
- Gluconates
- Hydrazines
- Phthalates
- Purified terephthalic acid
- Salicylates
- Salicylic acid
- Sorbates
- Stearates
- Bio-based chemicals



## Inorganic chemicals

From aluminium to zinc compounds

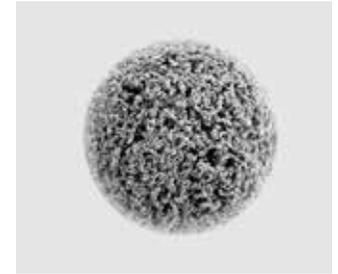
- Salts
- Minerals
- Zeolites
- Silicates
- Sands



## Polymers

Leading experience since 1952

- Polymer melts
- s-PVC, e-PVC, c-PVC
- ABS
- MBS
- HDPE
- PP
- POM
- PVA
- PMMA
- PVAc, EVA
- PVP
- Acrylic resins
- Formaldehydes
- EPS
- PAN
- PAM



## Nano material

When you need to get small

- Inorganic nano material
- Organic nano material
- Pharmaceuticals

# The intelligence behind your process.

Whatever your product requirements, the GEA International Test Centers offer the largest and most sophisticated facilities for drying process development.

Whether at the first stages of development or the final phases of refinement, our test centers provide the intelligence that brings your ideas to life.

## **The world's largest testing facility**

Made up of over 35 pilot plants, the largest of the GEA International Test Centers houses the most advanced freeze, fluid bed, flash and spray drying technology available today.

We are able to test a huge variety of conditions to make sure your powder is not only possible, but that its production process is viable, sustainable and cost effective.

## **Our guarantee – your process**

No matter which industry or market you or your customers operate in, our International Test Centers exist to give you complete confidence that you have the most appropriate drying solution for your needs.

To show our commitment, we will guarantee that the process we've developed is set up in the most effective way to achieve your desired results.

As every customer, plant and product comes with their own unique requirements, we make no assumptions as to how your new powder will behave. Our in-depth analyses cover every possible factor so you can make fully informed decisions regarding your product's commercial potential.



Our test facilities comprise more than 35 pilot plants and house a complete range of advanced auxiliary equipment.

# From conception to completion.

Unique analytical and laboratory capability supports you in your product development.

Our testing program includes:

- **Feasibility studies** – the first step for every new project is a feasibility study that evaluates whether your product is able to be dried, agglomerated, extracted, concentrated or whatever you need it to be. If you already have a prototype, we can investigate the best ways to recreate it on an industrial scale with the same (or better) characteristics.
- **Pre-production analysis** – with GEA's DRYING KINETICS ANALYZER it is possible to conduct early stage tests using only a few milliliter of material, covering a wide range of feed properties and drying parameters. This keep costs and timeframes to a minimum and can be incorporated into Computational Fluid Dynamics simulations to optimize your process design.
- **Pilot testing** – pilot tests obtain all the necessary data for drying your product and to optimize your production process. We cover all drying techniques to ascertain which gives the best results and fits with your existing capabilities. Our GMPapproved Pharma Test Station meets all regulatory guidelines and is capable of producing samples for clinical trials.
- **Laboratory analysis** – our analytics laboratory is fully equipped to investigate and allocate your product's characteristics. Key properties can be appraised, such as droplet formation and expected behaviour during and after the drying process, particle size distribution, bulk density, moisture content, photomicroscopic analysis, flowability and hygroscopicity.

## DRYNETICS® analysis by GEA



### 1. Single droplet experiments →

- Temperature
- Size and position
- Adhesion/stickiness

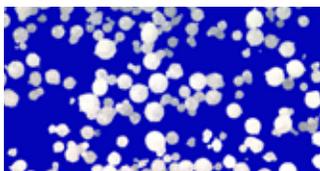
### 2. Advanced data analysis →

- Drying kinetics
- Morphology
- Stickiness

### 3. CFD simulations

- Velocity profiles
- Temperature profiles
- Moisture
- Deposits

# The right technology for your product.



## Turn liquid into powder, agglomerates or granulates

Use spray drying to remove the moisture from liquid feedstocks such as solutions, emulsions and pumpable suspensions. This is an ideal approach when your end-product must comply with precise powder properties.



## Spray drying

**P8**

Spray drying starts with the atomization of a liquid feedstock into a spray of droplets. The droplets make contact with hot air in a drying chamber, evaporate and form particles.



## Turn wet powder into dry powder, agglomerates and granulates

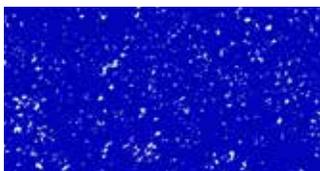
Use fluid bed drying for powders, granules, agglomerates and pellets with an average particle size of 50-5,000 microns.



## Fluid bed drying and processing

**P14**

Fluid bed drying achieves uniform processing conditions by passing a gas through a product layer under controlled velocity conditions to create a fluidized state.



## Turn wet solids or paste into powder

Use flash drying to obtain a fine, homogeneous and non-agglomerated dry product from pastes, filter cakes and highly viscous liquids.



## Flash drying

**P20**

Wet material is dispersed into a stream of heated air or other gas which conveys it through a drying duct where high heat and mass transfer rates rapidly dry the product.



## Turn melt into powder

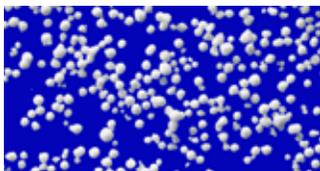
Use spray congealing to transform melted feedstocks into free-flowing, spherical particulates of a controlled particle size.



## Spray congealing

**P25**

The melt is sprayed into a cooling chamber. After contact with cool air, the spray solidifies. The atomization is either done by nozzle spraying or by prilling using a rotary atomizer.



## Create chemical reactions

Spray drying can be used to allow chemical reactions in atomized droplets to create products with specific characteristics.



## Spray dryer reactor

**P26**

Reactions between gas phase components and liquid phase chemicals are very rapid and have a uniform heat impact. As a result, spray dryers can be used to create substances such as paraformaldehyde, gelatinized starch and silica gels, and can also be used to reduce harmful emissions in flue gases.

# Your spray drying solution.

Our fully customizable and highly reliable spray dryers deliver quality powders that enable you to meet your customers' needs today and tomorrow.

## The industry standard

Spray drying is the most widely used process for the production of powders, granulates or agglomerates from a liquid or a slurry. It is the preferred method for drying thermally-sensitive materials and due to its consistent particle size distribution, the process is well suited to many other product types.

## Technology that meets your needs

Our spray dryers range from conventional models through to highly sophisticated systems that can be specially calibrated for your individual requirements.

Every spray dryer consists of a feed pump, atomizer, air heater, air disperser, drying chamber and systems for exhaust air cleaning and powder recovery. The process converts a liquid feed into droplets which are evaporated under controlled conditions to produce a dry powder with specific properties.

Our specialists will make sure you get the optimal spray drying solution and support for your needs. Furthermore, in order to keep your employees safe and your environmental footprint low, GEA plants are fully compliant with all international regulations.



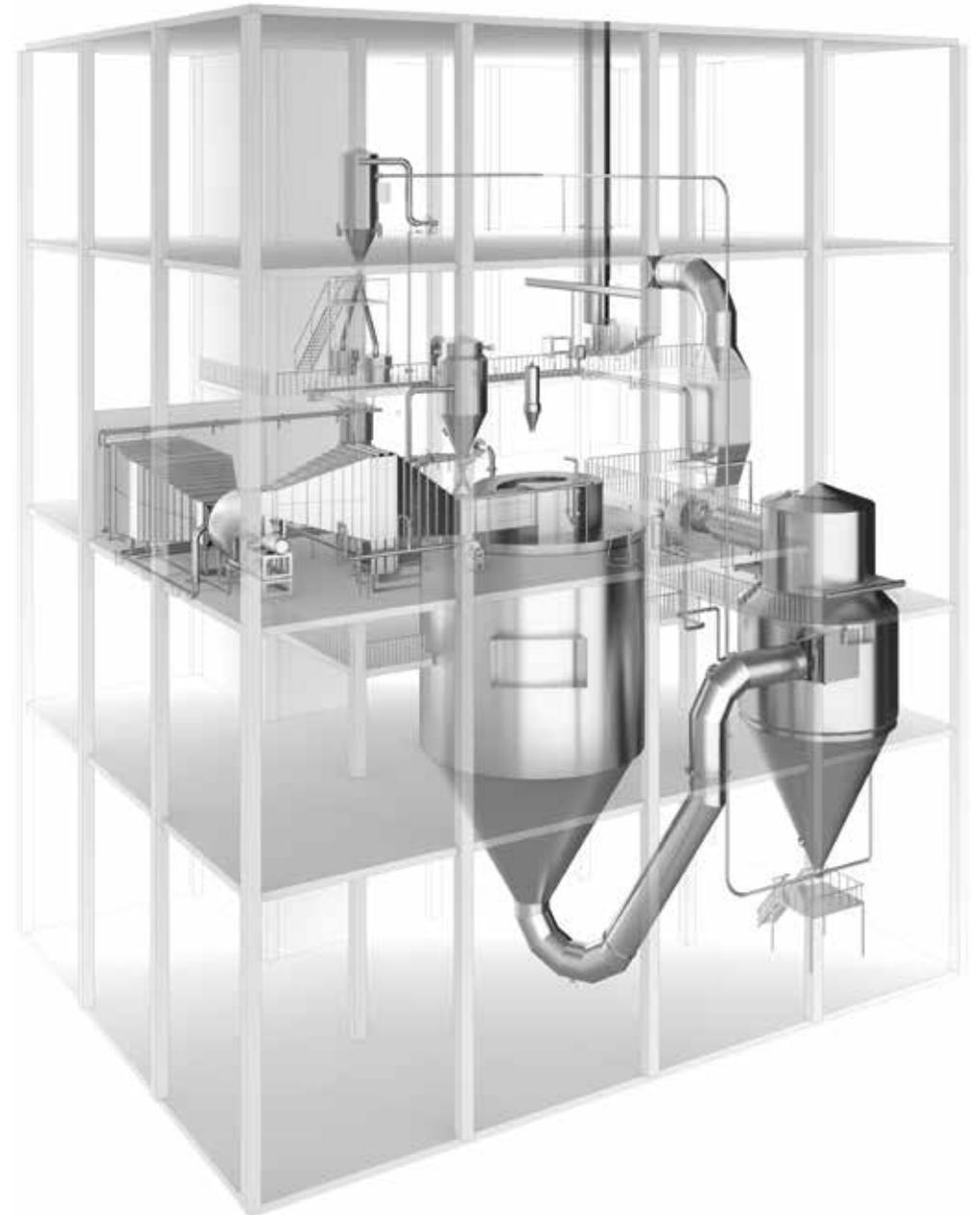
GEA SD-R spray dryer

**Your products**

- Spray drying converts liquid into a dry or semi-dry powdered product.
- Agrochemicals
- Ceramics
- Detergents & surface active agents
- Dyestuffs & pigments
- Hardmetals
- Inorganic chemicals
- Organic chemicals
- Polymers & resins
- Tannins and other products

**Your advantages**

- Unique selection of atomizer systems and chamber designs
- Tailor-made designs to meet your specific requirements
- Superior powder quality with operational excellence and low energy consumption
- Long operating intervals between cleaning



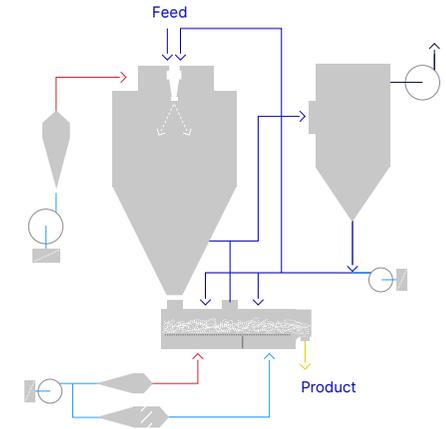
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GEA SD-R spray dryer

# World-class system design.

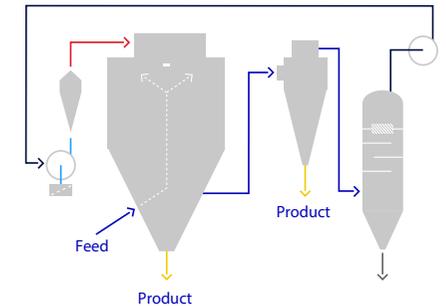
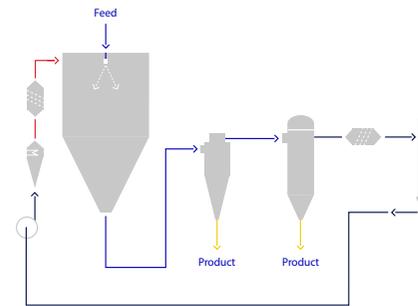
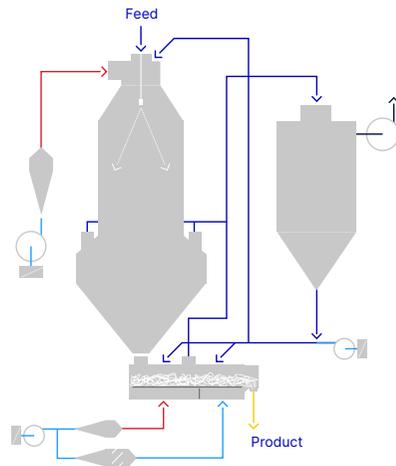
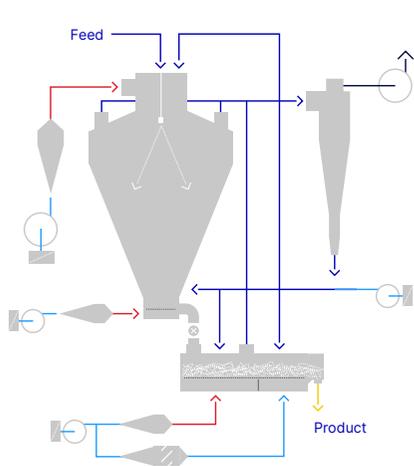
Since your powder's characteristics can vary depending on the initial product and your requirements, no single spray dryer is suitable for every application.

GEA offers a complete range of system and chamber designs that give you the flexibility and control to maintain a highly efficient process and production.



→ Fresh Air   
 → Drying Air   
 → Feed   
 → Exhaust Air   
 → Powder Discharge   
 → Condensate

Spray Dryer with VIBRO-FLUIDIZER®



Fluidized spray dryer, GEA FSD®

NOZZLE TOWER

Spray dryer closed-cycle configuration

HC spray dryer

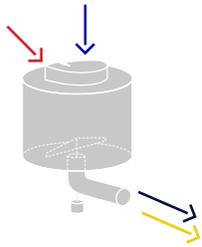
# Spray dryer chamber designs

→ Fresh Air    → Drying Air    → Feed    → Exhaust Air    → Powder Discharge

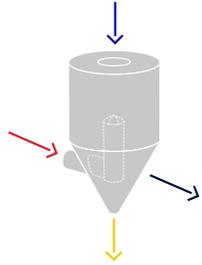


1. Co-current, with integrated fluid bed, rotary or nozzle atomizer.

2. Co-current, conical base with rotary atomizer, for both heat sensitive and stable products.



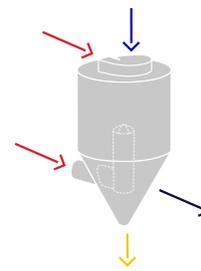
3. Co-current, flat base with rotary atomizer, for special products. Also suitable for spray congealing.



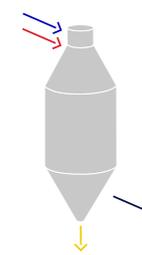
4. Co-current, with rotary atomizer, for drying chemicals at high inlet air temperatures.



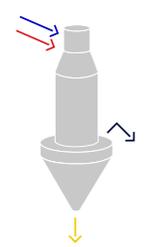
5. Co-current, with rotary atomizer, for drying mineral concentrates at ultra high inlet air temperatures.



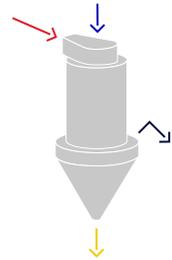
6. Co-current, compound air disperser with rotary atomizer, for very large volumes of high inlet air temperatures.



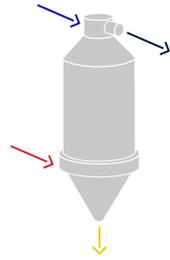
7. Co-current, with nozzle atomizer.



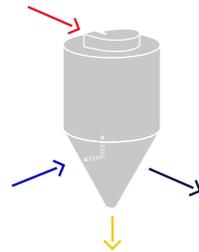
8. Co-current, with nozzle atomizer.



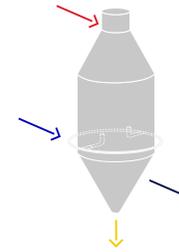
9. Co-current, with nozzle atomizer.



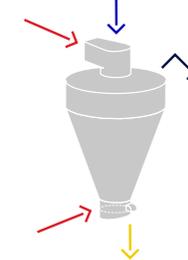
10. Counter-current, with nozzle atomizer.



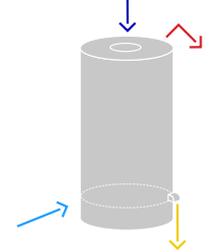
11. Mixed flow, with nozzle atomizer for coarse powders of heat-stable products.



12. Mixed flow, with nozzle atomizer.



13. Mixed flow, with integrated fluid bed, rotary or nozzle atomizer for non-dusty, free-flowing products.



14. Counter-current, with integrated fluid bed, rotary atomization for spray cooling/congealing.

# The heart of your spray drying plant

As the central and most important part of your spray drying installation, GEA rotary atomizers and nozzles are engineered with precision and manufactured by us to the highest standards.

## Quality where you need it most

Productivity, reliability and efficiency are not only a result of superior design, but of quality components. For spray drying, one of the most important components is the GEA rotary atomizer, which sits at the heart of your system and forms the spray.

GEA offers a full range of atomizer types or corresponding nozzles. Different designs result in different powder characteristics; the right one for you depends on the nature of your initial product and what you are aiming to achieve. Our specialists will help you understand which is most appropriate for your requirements.



### Engineered for your application

GEA rotary atomizers help you to obtain key production parameters, such as, particle size, particle size distribution, density and through-put.

Thanks to our proprietary designs, our feed systems handle higher solids content and operate at relatively low pressures to keep your output high and energy costs low.

As we often create application-specific solutions for the food and pharmaceutical industries, we also take great care when creating systems that require exceptional hygiene and surface quality or that are prone to clogging and would otherwise require frequent maintenance.

### The GEA rotary atomizer

Johan E. Nyrop (the founder of "Niro Atomizer", the company which later became part of GEA), obtained his first patent for a rotating atomizer in 1924. Since then, GEA's exceptional rotary atomizer designs have led the industry for performance, availability, superior product quality and the lowest energy consumption.

### Your advantages

- Unique and patented nozzle designs
- Rotary atomizer with market-leading velocity
- Broad selection of atomizer wheel designs
- Abrasive and viscous feeds beyond the norm
- Proprietary designs give you the broadest range of powder properties



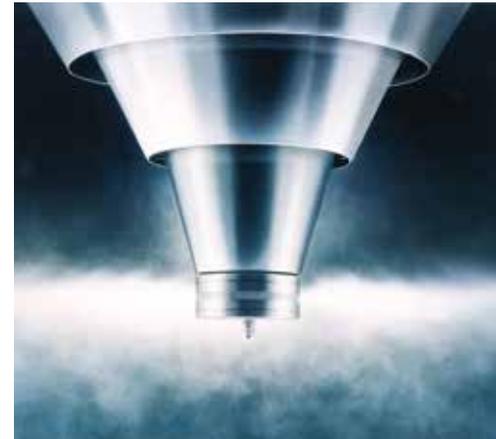
Decades of spray drying know-how goes into our patented technology, enabling you to create quality powders with specific properties.



Co-current nozzle



Fountain nozzle



Rotary atomizer



COMBI-NOZZLE®

# Your fluid bed drying solution.

Perfect for heat sensitive products, fluid bed drying can be an exceptionally useful addition to your spray drying production process or a highly effective standalone solution.

## Higher drying rates

Fluid bed drying is an efficient method to remove residual moisture from an existing powder. During the process, the moist powder is fluidized, dried and carried through each section of the fluid bed using hot gas blown through specially perforated plates.

Fluid bed drying is ideally suited for powders, granules, agglomerates and pellets with an average particle size between 50 microns and 5 mm.

## CONTACT FLUIDIZER

One of our most efficient fluid bed dryers, the CONTACT FLUIDIZER is a prime example of how our latest systems have been designed to meet your specific requirements.

### Key features include:

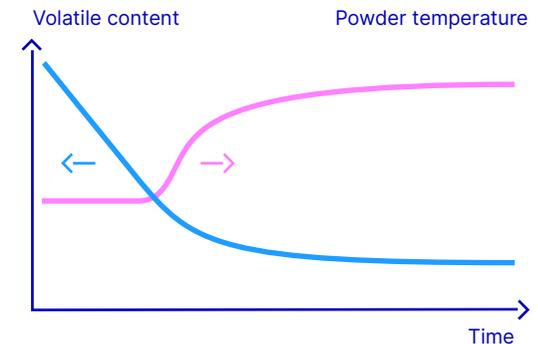
- **Multiple drying sections** for optimal heat economy and uniform powder properties
- **Proprietary rotary feed distributor** for constant temperatures and moisture, superior fluidization and material dispersion
- **Optimal plug flow drying conditions** using compartments connected by underflow gates to reduce backmixing
- **Robust GILL PLATE** distributor plate for easy emptying and conveying of oversized material

- **Hot air plenum chambers** for excellent air distribution and easy draining
- **Heat panel banks** on overhead rollers reduce heat damage and allow for easy inspections
- **Internal BARRIER GAS** heat tracing and flushing prevents wet deposits and condensation
- **Special high temperature fluidized-bed design** for optimum energy efficiency

### Your products

- Turn wet powder into dry powder and powder into agglomerates and granulates.
- For drying moist or damp powders, filter cake or centrifuge cake
- For powders, granules, agglomerates and pellets with average particle size of 50 microns to 5 mm
- Plastics; s-PVC, HDPE, ABS, PE, PTFE, POM
- PTA, CTA
- Sodium carbonate, sodium bicarbonate
- Silica, sand
- Fertilizers
- Calcium chloride, salts
- Amino acids

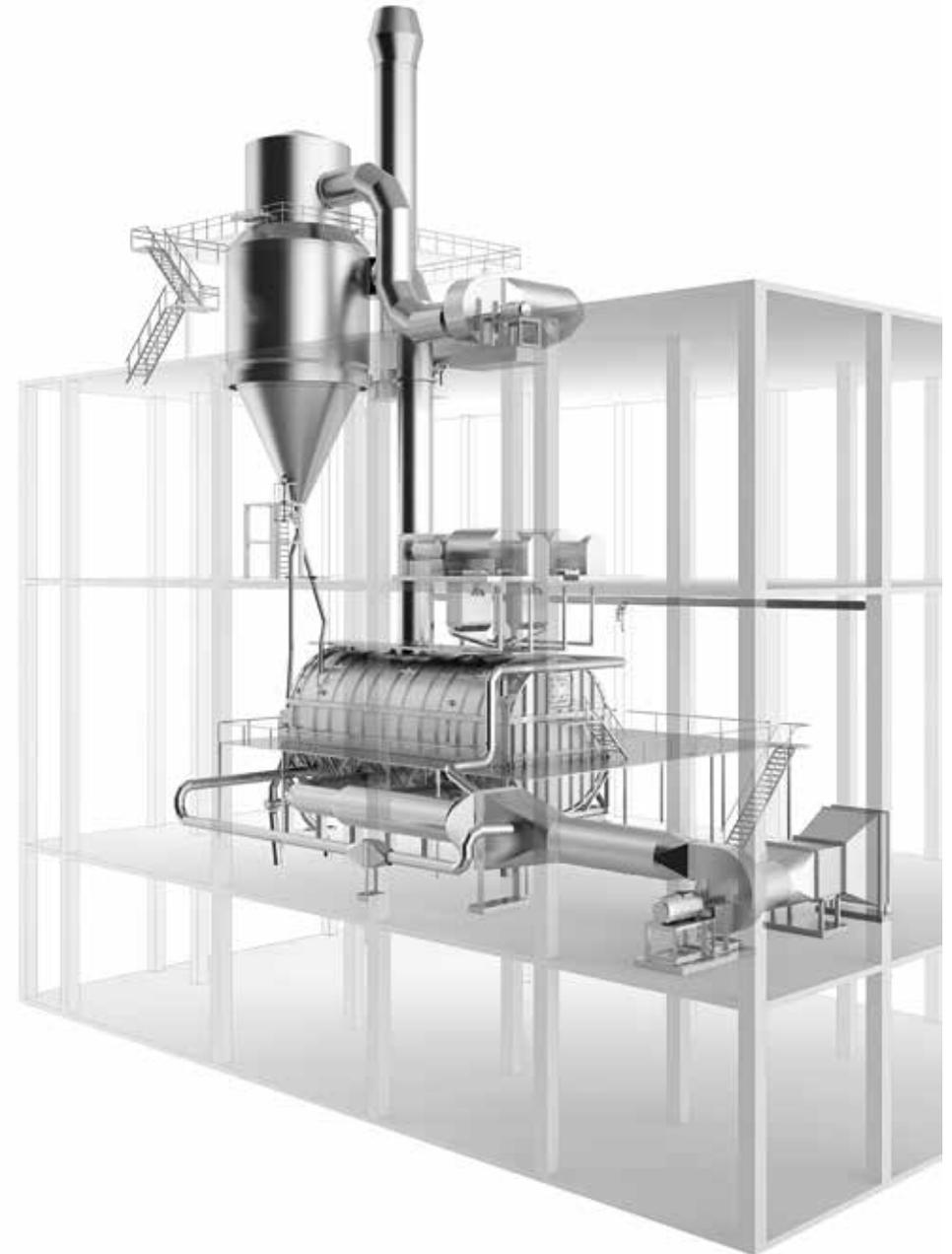
## Product drying curve



GEA fluid bed dryer: CONTACT FLUIDIZER

**Key features include:**

- **Multiple drying sections** for optimal heat economy and uniform powder properties
- **Proprietary rotary feed distributor** for constant temperatures and moisture, superior fluidization and material dispersion
- **Optimal plug flow drying conditions** using compartments connected by underflow gates to reduce backmixing
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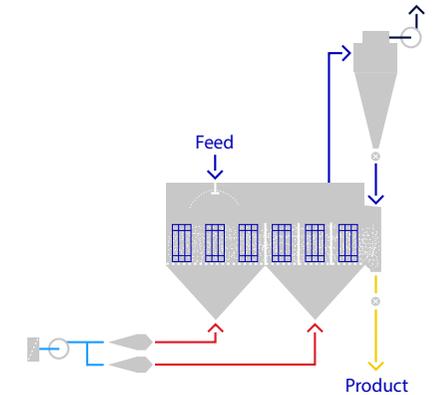
# Fluid bed process systems

The GEA product range includes several types of fluid beds.

We offer two types of fluid bed models, designed to optimize the flow pattern of solids within the dryer and cater for particles of all sizes.

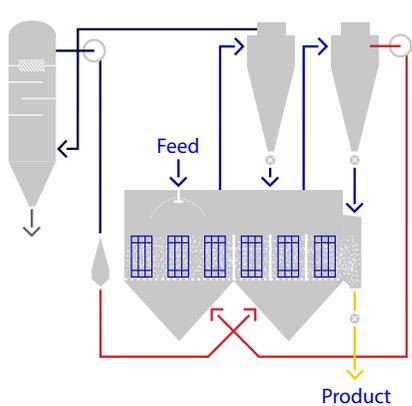
- **Back mix fluid bed drying** – for feeds that require a degree of drying before fluidization is established
- **Plug flow fluid bed drying** – for powders that are directly fluidizable and can achieve the controlled residence time that is the pre-requisite for obtaining the right particle properties

A fluid bed can be stationary or vibrating and is installed either as individual units or combined unit to form a specialized solution for effective drying.

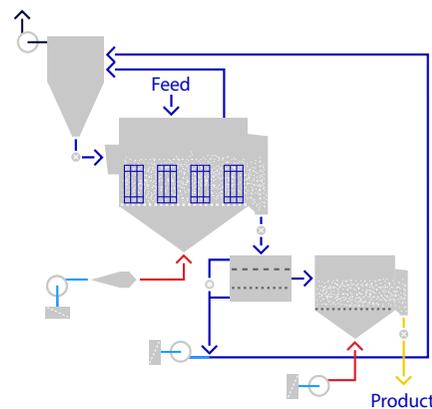


CONTACT FLUIDIZER

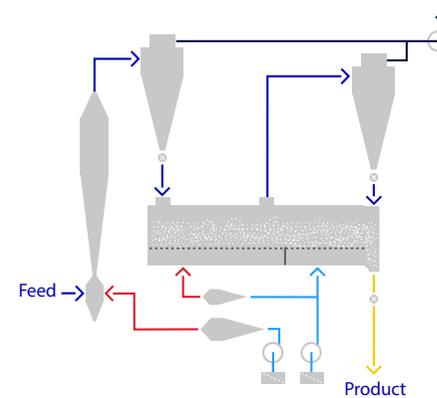
→ Fresh Air    → Drying Air    → Feed    → Exhaust Air    → Powder Discharge    → Condensate



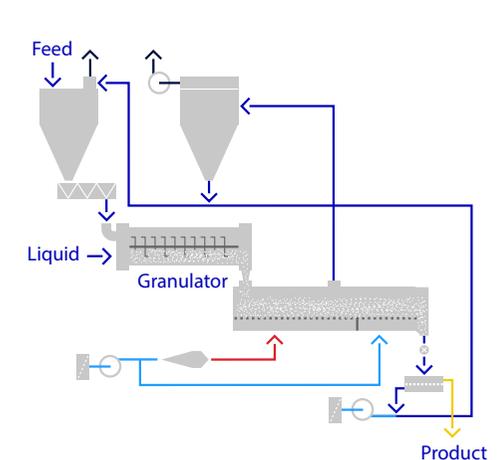
CONTACT FLUIDIZER in side-by-side configuration, closed cycle



SPRAY FLUIDIZER



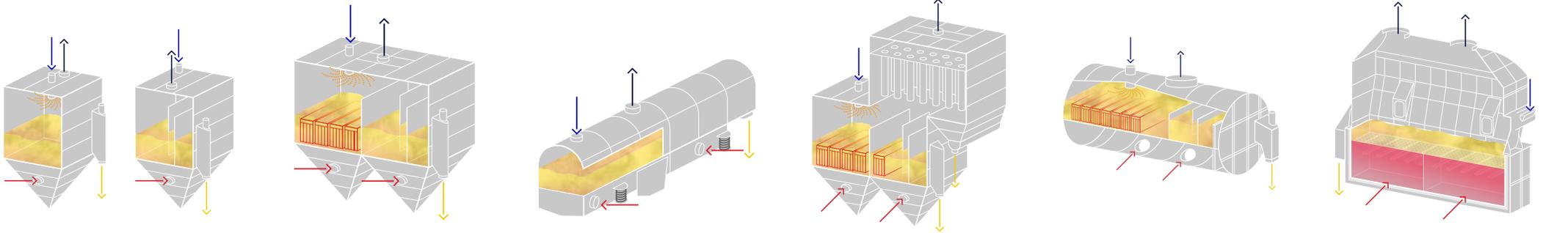
Flash dryer system



Mechanical granulation system

# Fluid bed types

→ Drying Air    → Feed    → Exhaust Air    → Powder Discharge



Back-mix flow, Plug flow

CONTACT FLUIDIZER  
(Type FBY)

VIBRO-FLUIDIZER®

CONTACT FLUIDIZER with  
integrated filters

CONTACT FLUIDIZER  
(Type FBC)

HIGH TEMPERATURE FLUIDIZER

# Fluid bed – key features

At GEA, we have invested in decades of research, drying expertise and application know-how to offer you the industry's leading portfolio of fluid bed hardware.

Our fluid beds can be used as a stand-alone unit for a specific purpose or be incorporated into a larger system, depending on your requirements. All our systems are designed and built to ensure you benefit from many years of trouble-free operation and efficient performance.

## Feed spreader

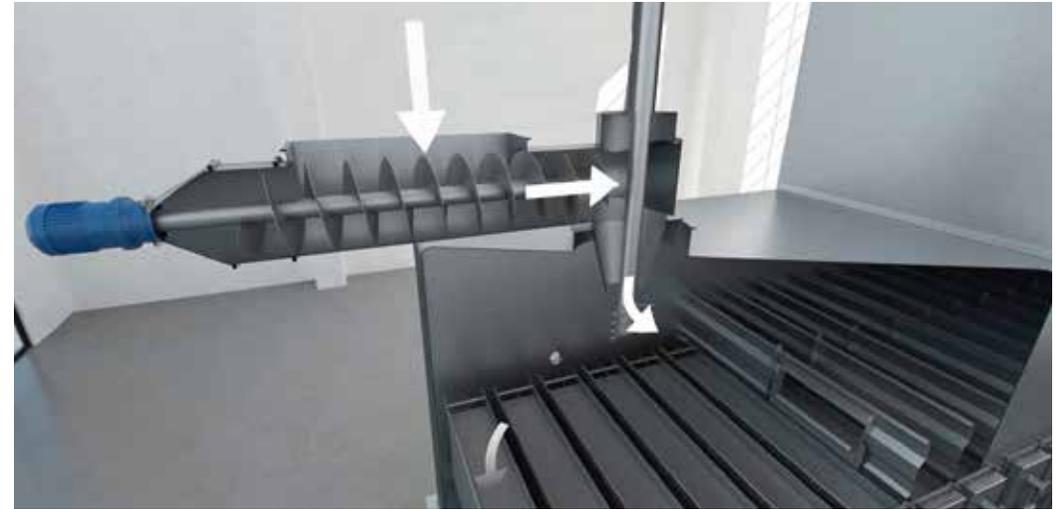
The GEA rotary feed spreader ensures uniform distribution of the wet feed material. This is an important stage for maintaining the homogeneity of the Back-Mix section and thereby overall system performance.

- Minimizes formation of lumps
- Efficient utilization of the Back-Mix section

## GILL PLATE

The GILL PLATE distributes the gas for the fluidization of the powder. It ensures an even gas distribution, effective transport of lumps and emptying of the fluid bed.

- Proprietary GEA design
- Number, size, and pattern of the gills are tailored to the application
- Excellent emptying and conveying of oversize material (if any)
- No backwards flow of particles
- Not prone to clogging
- No discolored particles as rounded corners ensures no deposits



GEA rotary feed spreader



GILL PLATE



### **BARRIER GAS system**

The patented BARRIER GAS heat tracing and flushing system lowers your investment costs. It is a highly effective way to prevent wet deposits and condensation, which helps to reduce possible corrosion damage.

- Flushing of ceiling and fluid bed walls above the product layer
- Internal hot air tracing instead of outside hot water tracing
- Allows for single wall construction
- No hot water tracing system means lower costs
- Easier and cheaper installation
- Less maintenance



### **Internal heating panels**

Our heating panels have been engineered for maximum thermal efficiency and are a highly reliable and vital component for transferring energy required for evaporation.

- Fully submerged in the fluidized powder
- High heat transfer
- Designed with virtually no horizontal surfaces, reducing risk of heat damage to powder
- Panel banks run on overhead rollers
- Heating panels can be inspected and cleaned externally
- External, movable frame with a trolley for easy outside inspection



### **High temperature chamber**

Our high temperature chamber design allows highly efficient drying with underbed temperatures up to 650°C.

- Insulated modular design overcomes expansion
- Optimized low airflow
- Internal insulation wall with continuous and washable lining
- Small space requirement

# Your flash drying solution.

The flash dryer is particularly suited to products that dry with a short residence time owing to the easy removal of free moisture or where diffusion to the surface occurs readily.

## Flash drying process

Flash drying is defined as the drying of particles that are suspended and conveyed in a hot air stream. Drying takes place in a matter of seconds. Wet material is dispersed into a stream of heated air or other gas which conveys it through a drying duct where high heat and mass transfer rates rapidly dry the product.

Product is separated using cyclones, and/or bag filters. Typically, cyclones are followed by scrubbers or bag filters for final cleaning of the exhaust gases to meet current emission requirements.

## Gentle drying of large quantities

High drying temperatures can be used with many products since flashing-off of surface moisture instantly cools the drying gas without overheating the product.

Many of the largest dryers in the world are flash dryers – some exceeding 20 tonnes of water evaporation per hour in a single system. Inlet air temperatures range from 100°C to 650°C while airflow can exceed 200,000 m<sup>3</sup>/h. .



GEA flash dryer

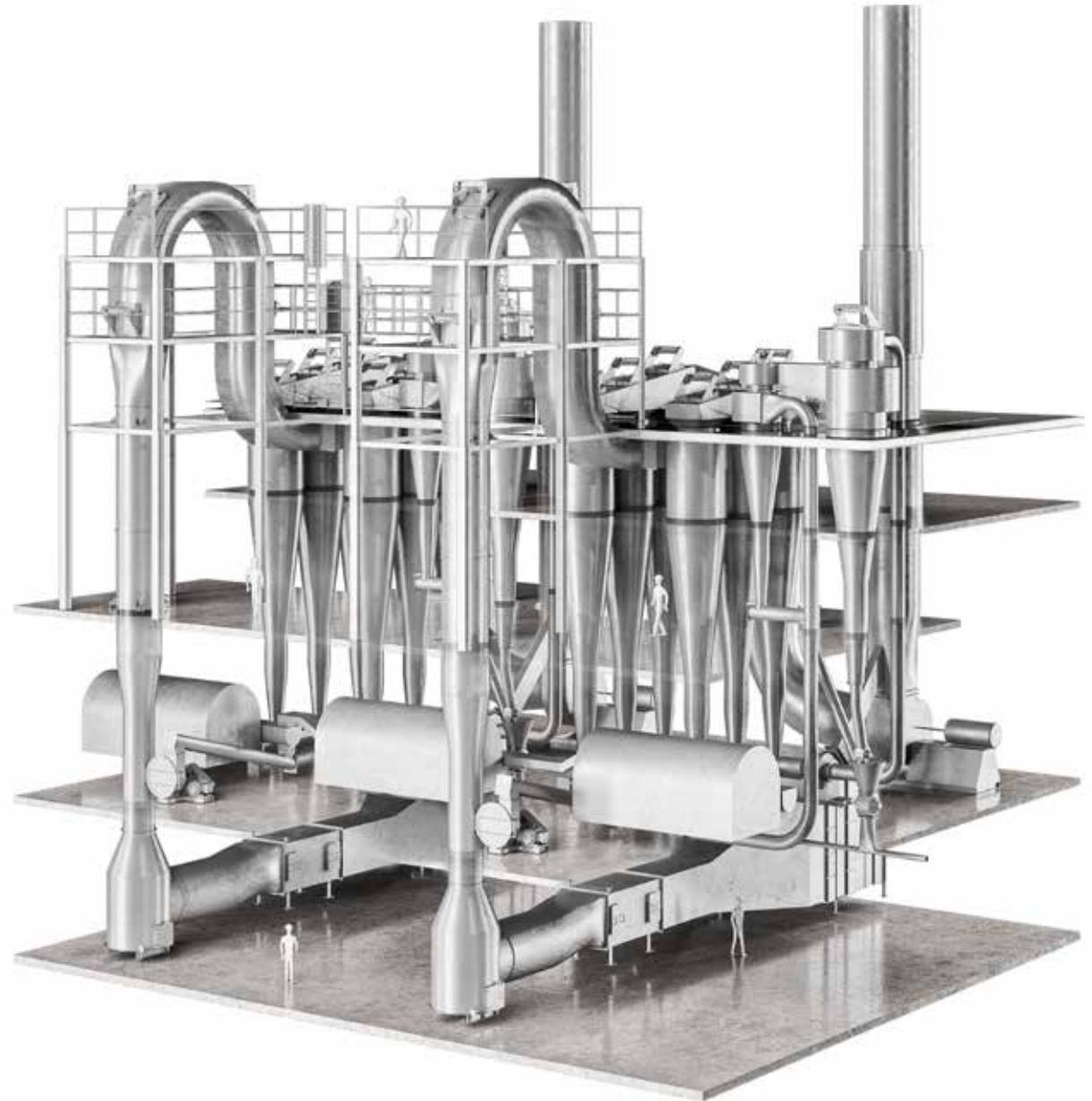
**Your products**

A broad range of feed materials including powders, cakes, granules, crystals, flakes, pastes, gels, and slurries can be processed. For slurries, pastes, or sticky materials, back mixing of the wet feed with a portion of dry product to produce a suitable conditioned material is required.

- Agrochemicals
- Calcium silicate
- Calcium phosphate
- Coal
- Lignin
- Lithium carbonate
- Polystyrene (EPS)
- Ferrous and non-ferrous ores and powders

**Your advantages**

- Promotes quality on temperature sensitive products
- Flexibility to work with different dewatering systems and to enable use with friable and non-friable wet feeds
- Enables energy savings and system integration
- Suitable for operation with solvent and recovery thereof
- Cost effective and reliable with low maintenance and cleaning requirements

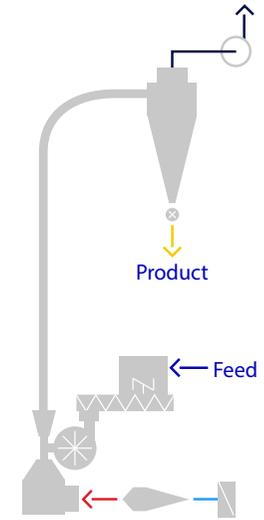


GEA flash dryer

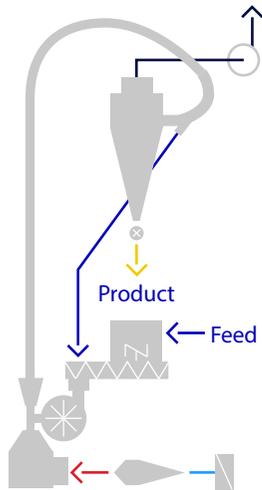
# Flash dryer types

GEA offer you a market leading range of flash dryer types designed to your product and capacity requirements.

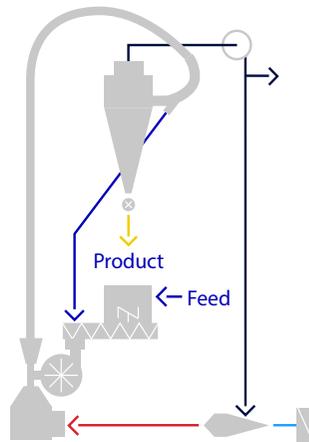
→ Fresh Air    → Drying Air    → Feed    → Exhaust Air    → Powder Discharge



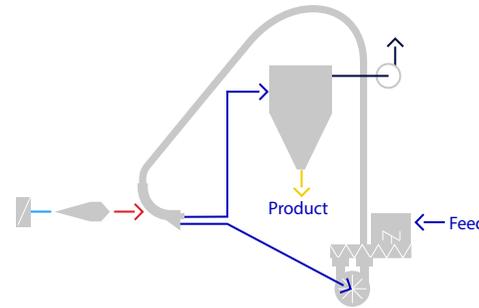
Flash dryer



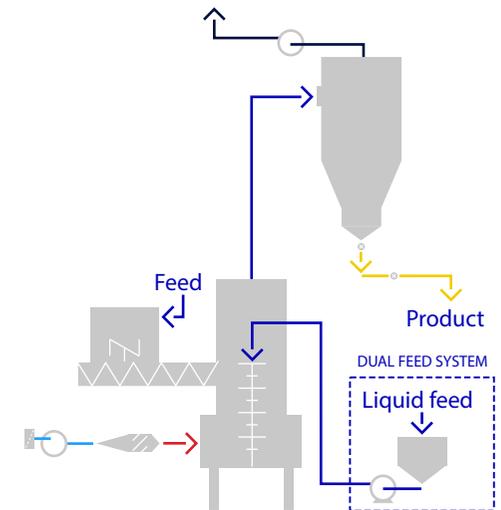
Feed-type ring dryer



Feed-type ring dryer with partial gas recycle



Ring dryer



SWIRL FLUIDIZER®

# Ring dryer

The presence of an internal manifold as classifier differentiates the ring dryer from the flash dryer. Ring dryers provide control of residence time and particle size.

## Efficient and even drying

Ring dryers employ the same basic principle as flash dryers in that the material to be dried is dispersed and conveyed through the dryer in a hot air stream. Particle size reduction is often provided by a disintegrator within the dryer. Ring dryers incorporate a centrifugal classifier allowing selective internal recirculation of semi-dried solids, effectively lengthening the retention time of larger particles in the dryer, while finer material, which dries more rapidly, exits the dryer and gets directly into the cyclone.

## Thermal efficiency

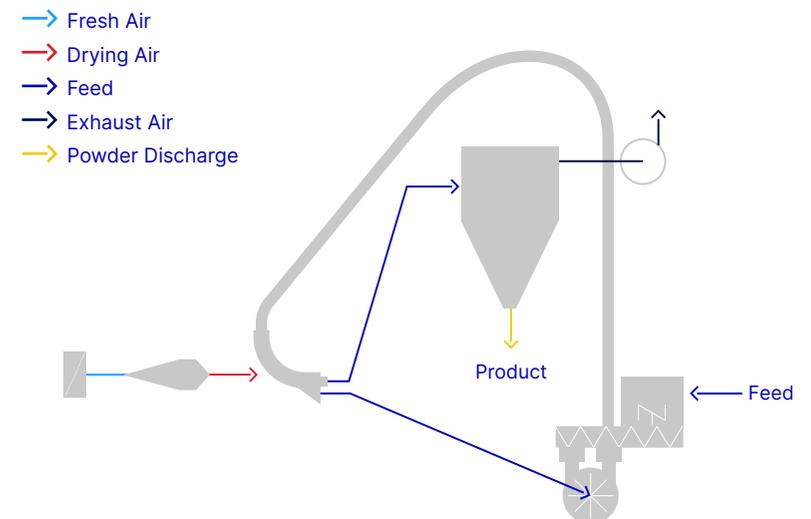
To optimize thermal efficiency and where inertization is required, recycling of exhaust gases can be used. This Partial Gas Recycle (PGR) configuration can be implemented on all our drying systems as well as retrofitted on customer's existing drying operations.

## Your advantages

- Use of the disintegrator/disperser in combination with the manifold provides close control of particle size, product moisture and exhaust temperature
- Provides the highest driving force to minimize required airflow and resulting dryer size and fan power.



Two ring dryers with partial gas recycle



GEA ring dryer

# SWIRL FLUIDIZER®

The SWIRL FLUIDIZER® is a cost-effective system for obtaining fine, homogeneous high quality powders from pastes, filter cakes and other viscous liquids.

## Disintegration and drying in a single step

The SWIRL FLUIDIZER® is a flash type dryer for products that are difficult to pump and disintegrate. It produces a fine powder in a single step without the need to dilute or back-mix the feed before drying and is suitable for a wide range of products and applications.

Its ability to handle even thick pastes makes the SWIRL FLUIDIZER® an ideal alternative to a conventional spray dryer. Unlike many other types of systems, processing time is short and eliminates the need for costly post-treatments.

GEA's SWIRL FLUIDIZER® is available as open, semi and closed-cycle plant.

## Dual feed system (patent pending)

Our Dual Feed System is able to dry products that have previously been impossible due to their solid content or low viscosity. The dual feed technology means that:

- The enlarged, moist surface ensures a rapid evaporation of the liquid
- Liquid feed-rate can be controlled very accurately
- Evaporation load of the dryer can be kept constant
- No need for additional mixing equipment

## Your products

Obtain a fine, homogeneous and non-agglomerated dry product from pastes, filter cakes and highly viscous liquids in one compact process step.

- Titanium dioxide
- Iron oxide
- Kaolin
- Silica
- Zeolite
- Aluminium and magnesium hydroxide

## Your advantages

- Designed for non-pumpable products
- Good tolerance towards changes in feed properties
- Plant requires minimal space
- Maintenance-friendly design
- Handles very high drying temperatures
- Compatible with heat-sensitive products
- Dual Feed System



# Spray congealing

Spray congealing (spray cooling) is a useful technology for generating free-flowing food ingredient powders directly from melted fats, waxes, oils or emulsifiers.

## Customized plants

Spray congealing is the term given to the transition of a melt from a soft or fluid state to a rigid or solid state by cooling. The liquid melt is atomized into a spray of fine droplets of spherical shape inside a spray cooling chamber. Here, the droplets meet a sufficiently cold airstream to solidify the droplets into spherical powder particles, creating a high quality free-flowing powder.

## Quality and control

As the atomization and air distribution technology for spray congealing is the same as that applied in the spray drying process, GEA offers unmatched application know-how and production control to ensure your product has exactly the right properties.

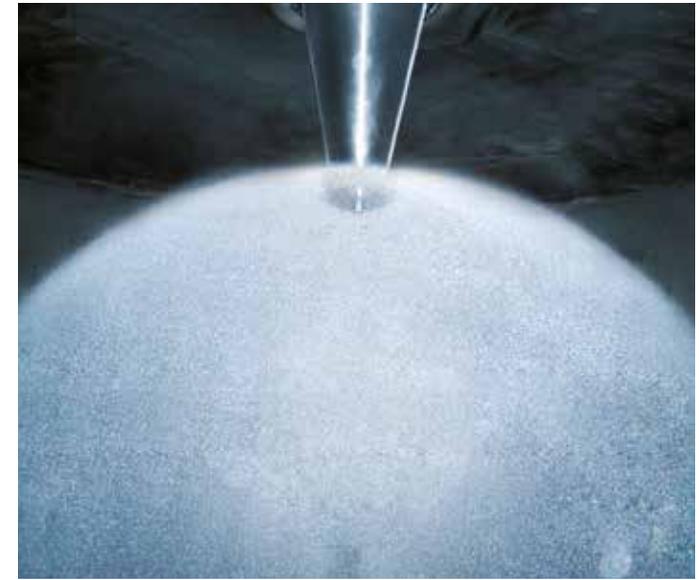
Our advanced spray congealing technology means you can even create average particle sizes ranging from 50 to 2,000 microns. If you require even smaller sizes, our special GEA two-fluid nozzles can create particles ranging from 3 to 50 microns.

## Your products

- Create average particle sizes of 50-2,000 microns (or even 3-50 microns using our special nozzles).
- Wax
- Stearic acid
- Glycerides
- Emulsifiers
- Bisphenol A
- Magnesium chloride
- Monoglycerides
- Sodium bisulphate
- Paraformaldehyde

## Your advantages

- Compact plant design means a smaller building
- Rotary prilling wheel atomization using our unique rotary atomizer
- Flexible particle sizes using simple prill wheel modification
- Integrated fluid bed design
- Simple operation
- Narrow and uniform particle distribution for free-flowing products
- Can be supplied in open- or closed-cycle designs



Spray atomization and final powder in spray congealing of melted fat and hydrogenated vegetable oils.



GEA closed-cycle spray congealing process

# Spray dryer reactor – create chemical reactions.

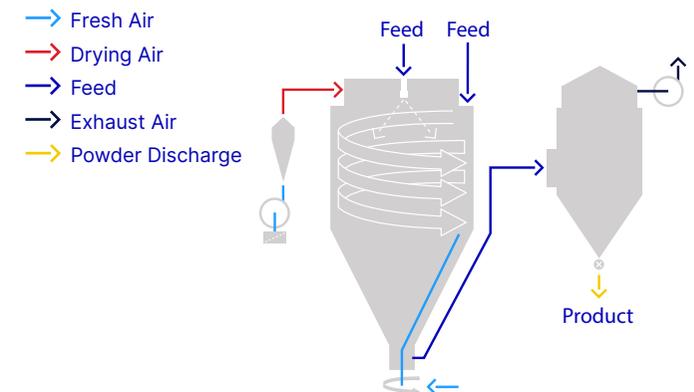
This spray drying process can be used to create rapid and highly uniform chemical reactions between gas phase components and liquid phase chemicals.

## Polymerization and Gelatinization

Spray drying can also be used to create polymerization reactions with specific properties by controlling the drying atmosphere. The resulting product is discharged as a finished powder, that requires no further treatment. Spray drying is well suited for creating gelatinized products. Consistent quality is achieved due to the immediate and uniform heat impact from the drying gas, giving ideal conditions for the gelatinization process. Also, two different liquids can be mixed at the moment of atomization, resulting in a powder that typically will be ready for use out of the dryer.

## Effective pollutant removal

The spray drying process is effective in cleaning flue gases from coal fired power stations and waste incineration plants. The acidic components are absorbed into slaked lime to create a dry powder that is often used in building materials, or allows for depositing in landfill.



Spray dryer reactor

# Complete efficiency and control.

A class-leading installation is one half of your solution; a powerful automation and control system that gives you complete command over its vast array of complex processes completes the picture.



GEA's state-of-the-art control system integrates a logging, tracking, tracing and reporting record in a single comprehensive and fully customizable plant management solution.

## Advanced software systems

With unmatched competence in every aspect of the spray drying process, GEA provides reliable, flexible and user-friendly software systems GEA Codex® that drive performance and efficiency across your plant's operations.

## GEA Codex® build on modules, for you to select

It consists of GEA Codex® MES, that can be used to build complete manufacturing operations management and of . GEA Codex® Process Control that incorporates established standards for HMI design, including alarms, distributed engineering and flexible control modules for market-leading platforms.

## Optimized performance

As the central 'brain' that integrates and governs your network of components, hardware and systems, our plant management software enables you to oversee and optimize production and to keep productivity in line with your commercial and strategic objectives.

An intuitive user interface allows you to monitor and control every part of your installation with ease and our intelligent, automated safety systems alert you at the first sign of irregularity so you can address any issue far in advance of it becoming a serious problem.

Our advanced plant management solutions include:

- PLC and SCADA programming and development
- Track and trace control
- Instrumentation and industrial net-working
- Data logging and reporting
- Electrical design, hardware and instruments
- Risk assessment and failure-mode effect analysis (FMEA)

Our systems also keep you compliant with all international standards.

# Stay productive, protected and compliant.

Keeping your plant in optimal condition is the best way to extend its lifespan and to make sure you stay compliant and your workforce stays safe.

## Safety first

The very nature of powder production means that your process will generate a fine dust that is suspended in air, which can lead to explosions or fires.

Each year, hundreds of companies rely on our comprehensive safety assessment programmes to safeguard against these dangers and minimize risks to their equipment, employees and reputation.

## Evaluating safety

GEA offers a complete range of services for the evaluation of your plant's condition and operating environment. If additional safety measures are needed, we will help you plan the best way to implement them with minimal disruption, downtime and expense.

We ensure that your GEA drying plant complies with all international legislation, including ATEX, and can also provide the input for a detailed Explosion Protection Document – something many authorities and insurance companies demand as a guarantee of compliance.

## Our safety services cover:

- EU directives and harmonized standards – consultation on matters related to the directives and the CE marking of plants and equipment
- Technical consulting service – review of all compliance issues and procedures, with advice for risk reduction measures
- Technical documentation service – guidance in drafting an EC Declaration of Conformity and other mandatory documentation
- Explosion protection advisors – on-site inspection, reports and advice for the specification and installation of safety equipment on new installations and existing plants

## Protective measures

- Venting systems to direct explosive pressure away from equipment
- Suppression systems that prevent the release of hazardous chemicals
- Designing the plant to withstand explosions (containment)
- Isolation systems that prevent propagation of an explosion
- Automated fire extinguishing systems



## Safety Systems

- Temperature switches
- Air flow switches for cooling air
- CO monitoring
- Flow control
- Vibration monitoring of rotary atomizer

# Your project is in safe hands.

With over 10,000 installations across virtually every industry and hundreds of new projects in progress every year, we offer unparalleled experience in managing your project from start to finish.

## The right people

Over eight decades, we've fine-tuned our approach to maintaining the highest standards of quality and efficiency at every stage.

As a key part of this, we allocate a dedicated Project Manager as your single point of contact to keep everything transparent and tightly organized, and who fronts a larger team of specialists hand-picked for your specific project.

## The right training

We have invested heavily in training all our Project Managers to have the right skill set, application expertise and experience to guide you seamlessly through the process. To be qualified as a GEA Project Manager, our staff must have extensive exposure on accounts of all sizes, locally and globally, and have passed an international project management course.

Not only does this guarantee excellent technical and organizational strengths, it also ensures they possess every attribute necessary for the smooth running of your project, including strong communication skills, multiple languages and solid problem-solving abilities.

## On time and on budget

Thanks to our vast expertise, our proven and trusted approach ensures a reliable outcome every time, on time and on budget.

This includes:

- Initial meetings to get to know everyone involved and outline project expectations
- Basic Engineering Package to highlight potential technical issues and solutions
- Planning for key milestones, site management, installation, commissioning and safety audits
- 3D CAD plant design, including ERP systems, for optimization and fault-finding prior to construction
- Transparent and timely management of your plant's construction and installation
- Commissioning by the project manager, process control expert and process technologist

Finally, when everything has been thoroughly tested and your employees trained in its operation, the plant is handed over to you for production, with our on-going support as needed.

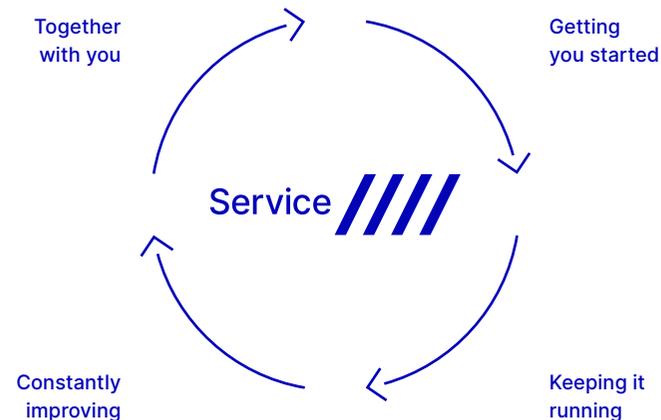




# FOR YOUR CONTINUED SUCCESS.

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 safety and reliability

**Constantly improving –**  
Sharing our knowledge to safeguard your investment

**Together with you –**  
Enduring commitment to you and your business

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