Leading Evaporation & Crystallization

Over a hundred years of innovative and proven solutions
For over 100 years GEA Process Engineering has provided leading evaporation and crystallization technology for several markets worldwide. Today’s customers’ concerns cannot be satisfied by technology alone: they need know-how.

Know-how, gained from experience, is critical to ensure a successful project. It’s essential to make sure that socio-economic factors are taken into account particularly in rapidly-growing markets. It provides the resource to bring customers’ ideas to life. It improves Overall Equipment Efficiency (OEE) to optimize performance, long-term productivity and product quality. It helps save energy and reduce the impact on the environment. And it reduces both capital and production expenditure.

At GEA Process Engineering we understand the challenges of fast growing and mature markets; we know the effects of changing legislation and help customers to plan for future developments; everything we do has the environment at its heart yet we know that every innovation has to contribute to customers’ bottom lines.

Our commitment
We believe that true business partnerships are forged out of trust, commitment and a mutual respect for each other’s abilities. We commit, therefore, to listen carefully to our customers’ needs: be flexible to ensure that we achieve their objectives despite changing circumstances; add value, improve performance and increase profitability; and be the guardians of the environment on their behalf.

Many reasons why GEA Process Engineering has the confidence, technology and know-how to make every customers’ projects, successful projects.
The GEA Group is one of the largest providers for equipment and process technology particularly for the food and energy industries where it ranks among the market and technology leaders.

The GEA Group focuses on demanding production processes and supplies its customers with efficient solutions in various end markets. In 2012 the GEA Group employed some 24,500 people who generated revenue of € 5.7 billion, providing the world with innovative solutions for smart food processing and for a more efficient use of energy resources. GEA is a global engineering group recognized for its excellent technologies, its dedication to provide best solutions to its customers, and its management principles.

GEA Group organization

GEA Group Evaporation & Crystallization Strategic Business Unit is made up of several companies based mainly in Europe and North America. The Strategic Business Unit is in charge of the development, innovation, sales and services for evaporation and crystallization technologies. A wide range of know-how and expertise enable us to be at the forefront and provide customers with the best suitable solutions.

In France, the Evaporation and Crystallization Technology Center includes an engineering and design office, a laboratory and a pilot test center. The facilities are located near to Paris, in Montigny-le-Bretonneux, where 180 engineers and technicians are employed.

Our strength is based on more than one hundred years of proven expertise. The heritage of Paul Kestner, a well-known French physicist who took out patents for climbing and falling film evaporation technologies in the 1900s, has been enriched over time. Thanks to a complete in-house expertise and a strong team spirit, we are able to handle new challenges and help make your evaporation and crystallization projects a success.

Key data:
- Over 3,000 evaporation plants worldwide
- Over 1,500 crystallization plants worldwide

GEA Process Engineering designs, develops process solutions and systems, provides a complete range of services for the dairy, brewery, food, pharmaceutical, chemical, mining and metals industries. It is recognized as a world leader within liquid processing, concentration (membrane techniques, evaporation & crystallization), industrial drying, powder processing and handling, solid dosage processing, aseptic packaging, and emission control technologies.
Creative processes for several industries

GEA Process Engineering is World leader on supplying evaporation and crystallization solutions. Over 4,500 plants worldwide have been installed for several industries related to Mining & Metals refineries, Chemicals and Waste Water markets.

Mining & Metals Refineries
- Alumina
- Copper
- Nickel
- Titanium
- Lithium
- Magnesium
- Manganese
- Hydrometallurgy for any other metals

Chemical Industry
- Strong acids
- Fertilizers
- Biomass (Green Chemicals)
- Salts / Crystals
- Metallic Chloride
- Other chemicals (Chlorides, Nitrates, Sulphates...)

Waste Water & ZLD
- Chemical
- Oil and Gas
- Nuclear

Waste Water
Votorantim Metais Nickel is a leading electrolytic Nickel producer in Latin America. In their plant, an effluent mainly containing Sodium Sulfate shall be minimized before going to the waste water treatment plant. GEA supplied a turnkey plant to valorize this by-product. In order to match the customer expectations regarding energy consumption, Mechanical Vapor Recompression was installed. The feed mixture is first pre-concentrated in a falling film evaporator, then the product is crystallized in a forced circulation crystallizer and dried in a fluid bed dryer before bagging.

Hydrometallurgy
At Goro in New Caledonia, Vale has set-up a hydrometallurgical complex to extract Nickel and Cobalt from laterite with sulfuric acid leaching. Within this process a nickel chloride solution containing hydrochloric acid has to be concentrated, hydrochloric acid in the evaporation condensate is recovered for other uses. GEA successfully installed a skid mounted triple effect falling film evaporation plant in anticorrosive materials. Most key equipments were manufactured in France including piping, valving and steel structure, delivered to Philippines for erection and delivered to the site in four separate modules.

Alumina
Pingguo Aluminium pioneered Alumina production in China. In order to maintain the water balance in the Bayer process, spent liquor (a mixture of caustic soda and sodium aluminate used for the digestion of bauxite) is concentrated in an energy savings five and six effects falling film evaporation plant. In order to purify this liquor a superconcentrator for decarbonatation is used. In total 850 Tons of water are evaporated per hour and Pingguo has set a landmark for alumina falling film evaporation plant in China.

Green Chemicals
One major biobased chemical producers, has set-up in North America the first commercial scale production bio-succinic plant from several renewable feedstocks. With its experience in the field of green chemicals, GEA delivered a comprehensive package from pre-concentration to drying. The weak solution is first concentrated in a multiple effect falling film evaporation plant, crystallized, separated in a centrifuge and dried in a fluid bed dryer. Material of construction are chosen for a good corrosion resistance to the organic acid, ensuring a long plant lifetime.

Focus on some references
By choosing GEA, our clients opted for a reliable partner offering the best suitable technology for their needs.
Evaporation and crystallization plants are required whenever in a process: water or any other solvent has to be removed, concentration has to be increased or volume reduced, valuable and pure crystals have to be produced, by-products or impurities have to be stripped or precipitated.

To satisfy the wide spectrum of process requirements, GEA design solutions with all types of evaporators. Each type offers its own benefit, and the most suitable type is selected in each case with consideration of the main process parameters: scaling tendency, product thermal sensitivity, annual operating hours, and accessibility for maintenance. GEA also designs smart solutions to clean vapor or recover gas distilling from evaporated liquor.

To ensure the longest lifecycle, GEA evaporation plants are made of the most adequate materials of construction from carbon steel, stainless and duplex steel to high nickel alloys, nickel, titanium, but also graphite and fiberglass reinforced plastics for highly corrosive applications.

Evaporator
- High condensate quality
- Flexible operation
- Low residence time
- High heat transfer coefficient

To meet customer specification in purity, particle size, operating time, while minimizing investment and operating costs, the GEA highly skilled process engineers design crystallization plants with a full range of crystallization technologies.

For high standards of quality, recrystallization can be applied to improve the purity of final product. GEA extensive experience in building continuous crystallization plants is essential to satisfy customers’ needs.

Crystallization technology
- Supersaturation is the driving force of crystallization. It is mainly achieved by evaporation, cooling or chemical reaction. Evaporative crystallization is usually chosen when solubility of the solute is nearly independent of temperature and supersaturation is achieved by concentrating the slurry. Vacuum cooling crystallization is usually chosen when the solubility of the substance to be crystallized is strongly dependent on temperature. The main advantage of vacuum cooling crystallization is the absence of cooling surfaces that avoids incrustation.

For more information, contact us!
Lithium

Rechargeable lithium batteries are in every mobile devices. The rapid growth in the use of lithium batteries has considerably stimulated the demand and the production of Li₂CO₃. GEA helps its customer to develop the different stages within the two major process for lithium carbonate production: brine concentration, (LiCl, Li₂SO₄,…), reactive crystallization, crystallization of by-products (Na₂SO₄, NaCl,…). GEA also supplies Lithium Hydroxide LiOH, H₂O evaporation and crystallization plants.

Alumina and Aluminium

Aluminium is a light metal used when excellent thermal conductivity, weight reduction and mechanical strength are needed, for example in aircrafts, cars, cans, laptop and mobile phones casing. This metal has another asset: it can be recycled almost indefinitely. With more than 130 Alumina evaporation lines worldwide, GEA Process Engineering is the world leader in caustic spent liquor evaporation and purification.

Enhance environment protection

Minimize liquid waste reject by concentration and zero liquid discharge crystallisers allowing to recover water or/and valuable products

International water protection has resulted in very strong environmental awareness and as a direct consequence more regulations on the use and discharge of waste water. In light of this, creative evaporation and crystallization solutions brings great benefits to customers in the whole water cycle management of industrial processes and allow: compliance with environmental laws, recovery of distilled water, recovery of valuable chemicals, financial profit of waste treatment as well as highly positive improvement of corporate and social community image.

In particular, GEA Process Engineering designed tailor-made solutions for complex water treatment projects involving fractional crystallization which allows separating salts from a mixture, for example sodium chloride and sodium sulfate.

Save energy

Evaporation and crystallisation processes require energy so the operating cost is directly linked to the selected thermal arrangement: single effect, multiple effect, thermal vapour recompression or mechanical vapour recompression and combination of those arrangements. A new plant must balance energy cost and capital cost, and GEA Process Engineering makes the best compromise according to customer budget and energy price. For existing plants, in order to save energy, we propose audits to upgrade units with improved arrangement or/and more modern technology.

Produce ecofriendly products

Biobased chemicals

Biotechnology offers many solutions to our changing world: valuable chemical production by fermentation of biomass, conversion of waste biomass into valuable cellulose or in bioethanol (sulfuric acid lyses). Bio-based succinic acid is produced by fermentation from biomass resources and genetically modified organisms. In term it could replace oil based succinic acid and become a platform molecule to many chemicals and biopolymers, solvents, fine chemicals, pharmaceuticals and additives. GEA Process Engineering successfully delivered plants to all major producers.
Bringing customers’ ideas to life by combining our experience, know-how and ability to listen and dialogue. We offer a number of core competencies, from engineering to a complete range of Services. Our Evaporation and Crystallization solutions respond to specific customer needs and comply with high requirements in terms of standards, best available technology, plant performances and security standards.

Top Level Team
Our project team includes senior engineers in comprehensive disciplines such as: process, mechanic, projects, R&D, instrumentation and control, erection, commissioning, 2D and 3D design.

Design
Reliability, ergonomics, maintenance approach from design, sustainable development... these represent the cornerstones for lasting performance. Our experienced engineers and the best calculation and forecasting tools allow us to face up to all your challenges.

Computer modeling
Optimisation of equipment process design with computational fluid dynamic: separator size, elutriation leg, three phase flow distribution in crystallizer, axial flow pump discharge, directionnal guide vane to avoid abrasion. We also offer optimization of mechanical design with Finite element modeling: thickness reduction, nozzle stress on equipment.

Project Management
We ensure that our customers benefit from efficient planning and contract execution. Each day, our teams build plants around the world, with a full commitment to quality and a strong coordination with our clients’ teams.

Procurement
We have a worldwide supply chain with qualified subcontractors and a long-term relationship which are both essential to ensure your entire satisfaction.

Site Services
We place high importance on supervision during the assembly and commissioning to ensure performances guarantee.
More than 1 000 m² to test your products! Since 1902, year of foundation of our Test Center, around 1 000 products have been referenced. Each year, 30 new products are successfully tested and half of pilot tests are converted into industrial units.

Lab Test

The laboratory is a key part of our Test Center. The primary aims of the laboratory are to study the behaviour of the product at all process stages and to check the feasibility of the process with small quantities. Also, to determine the physical properties of the product at any stage of the investigation. Last but not least, to optimise the cost of the pilot plant testing by selecting the most promising processes. A full range of equipment is available to determine physical properties of solution. We only need 10 to 20 litres of your product to carry out successfully the lab test.

To select the most suitable material of construction, corrosion tests can be carried out. An autoclave is available to perform tests at high temperature.

Pilot Test

20 units are available to validate the process at a pilot scale and when required to guarantee end product specifications such as purity of crystals, size of crystals... A wide range of utilities are present on site: steam boiler, 2 vacuum systems, hot water circuit, compressed air, chilled water circuit and a cold storage. Every year several continuous run (24h/24h) are carried out with success thanks to high qualification of our team. The amount of product to be treated can range from few kilograms to several tons. Tests can be performed in our facilities or on your site if product is non transportable.

A South-American company was seeking to add value to a by-product from an existing copper processing line.

The requirement was for a process line including a crystallization unit and a drying system. The line was to extract manganese from the copper ore waste stream, in the form of MnSO₄·H₂O, of sufficient purity that it could be used as a commercial fertilizer.

However, the application was potentially difficult, owing to the level of impurities in the feed material.

Thanks to our Test Center the engineering team was able to study precisely the client’s needs and design a tailor-made unit. Tests were made on a pilot plant to establish the suitability of the process by recreating the actual conditions that would apply to a full-scale industrial facility. Once satisfied with the product quality generated during the tests, including colour and particle size distribution, the customer placed an order for the industrial unit.
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**Complete Services Offer**

**Based on Total Productive Maintenance (TPM), GEA Process Engineering service approach consist on 6 main pillars. The goal of TPM is to eliminate losses and keep equipment producing only good quality products.**

**Our commitment**

Making customers life easier!

From spare parts to advanced services to customer, throughout the entire life of your plants, we offer a complete range of services in order to increase the production availability, reduce operating costs, realize energy savings, improve the quality of your products, ensure the reliability of your production.

**How do we proceed**

**Step 1: Audit of existing plants**

We discuss with client to understand his expectations. Then, a meeting is organized to receive maximum amount of information and obtain operating parameters. A visit of the plant is organized to check modifications (if any), to verify conditions of the plant and confirm available space.

**Step 2: Study and proposal**

Internal process calculations, Layout study, Price study, Technical & commercial proposal, Detailed project design, Procurement for equipment.

**Step 3: Modification and new performance test**

Erection or supervision for erection, Assistance for commissioning and performance test, Modification & new performance tests.

**Focus on Energy Savings: reducing steam consumption of an existing plant**

One of our European clients, who has a plant designed in the 60’s, did some modifications to increase capacity. However, new modifications did not take into account the process optimization to save energy. The client came to GEA to realize energy savings and increase its plant performance. First, our experts did a 2-day audit on site to record measurements of the equipment’s main functioning parameters. Then, 4 days in GEA office to do calculations in order to define a process solution to customer’s problem. Lastly, 1 day was spent for report preparation: explanation of the problem and proposed solutions. The study showed that the equipment was not adapted to available live steam pressure and to cooling water temperature. Proposals made by GEA were directly applied by the client. Modifications allowed steam savings for 4 months a year. For the remaining 8 months only half the previous quantity of steam was necessary.
Why choosing us?

Evaporation and Crystallization Experts,
more than a hundred years of proven expertise.

**Continuous Innovation**
GEA Group worldwide Technology Center

**Tailor-made**
solutions provider

**Skids** and Modular units

Process optimization, especially for
**Energy Savings** and **OPEX, CAPEX, OEE** effectiveness

Complete **in-house expertise**

**Anti-corrosion**
expertise, deep knowledge of exotic materials (FRP, Graphite, Nickel, special Alloys, Titanium...)

**State of the art design**
practices with CFD (Computational Fluid Dynamic) and Finite Element Modeling

**International Engineering standards**
(ASME, EN, AS, BS, TEMA, GB, CO2AP, IBR...)

Capacity to **manage large projects**
with a combination of technologies

**Worldwide**
Sales, project management & procurement
We live our values.
Excellence • Passion • Integrity • Responsibility • GEA-versity

GEA Group is a global engineering company with multi-billion euro sales and operations in more than 50 countries. Founded in 1881 the company is one of the largest providers of innovative equipment and process technology. GEA Group is listed in the STOXX® Europe 600 Index.

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