



Solutions for Mining & Mineral



Throughout North America, GEA is making substantial contributions in a broad range of mining operations. These contributions enhance the cost-effectiveness and environmental compatibility of required production processes in the industrial mineral and metallurgy categories.

As a systems technology leader, GEA offers equipment and services in:

- Cooling & Climate Conditioning
- Evaporation and Crystallization
- Drying, Cooling, Calcining and Conditioning
- Emission Control
- Separation Technologies

GEA Service – For your continued success

Getting you started

We start as we mean to go on, a supportive and committed partner for life. We plan and build around individual needs, sharing process knowledge, training staff and supporting operators to get our customers up and running, and ensure a smooth, seamless on-going service.

Keeping it running

To ensure our customers benefit from continuous production processes with minimal unexpected downtime, we provide fast, efficient maintenance and best quality spare part support, whenever and wherever it's needed.

Constantly improving

We safeguard our customers' investment by constantly looking ahead, modernizing and upgrading processes and equipment to meet changing needs and new market demands. Always working to increase production efficiency and ensure peak performance.

Together with you

Commitment to our customers and their business means investing in their objectives, their risks and their future success. We work in ever closer collaboration, providing on-going systems audits and on-site support, guiding ever better performance through innovative new service models.

Cooling & Climate Conditioning

GEA applies its expertise in industrial refrigeration to the mining industry to enhance operational efficiency, reduce climatic hazards and address worker health and comfort.

Our GEA screw compressors are at the heart of our offerings which include both surface and subsurface applications.

Some examples of the solutions we provide are refrigeration stations, air conditioning systems, ice or ice water production to maintain the temperature at the mining face and freezing installations to produce cold brine for soil freezing in the shaft exaction process.

Leading mining companies worldwide turn to GEA to provide the reliable, customized cooling solutions they need for their most demanding requirements.

Evaporation and Crystallization

GEA is the world leader in evaporation and all types of crystallization equipment design and technology. Our expertise includes thousands of installations worldwide. With this deep knowledge base, GEA is able to implement the R&D necessary to devise the process components which best meet the customer's needs. By closely coordinating project protocols, our customers regularly meet and exceed quality and production targets.



Process development

Bench scale and pilot test plant facilities located in the United States, as well as in France and Germany, offer customers the opportunity to refine their requirements. Data collected is used to develop customized unit operations and establish warranty values at mining locations. This information is also used to develop custom plant designs as well as modular evaporator and crystallizer units. Our GEA engineers are available to assist customers with test program development and data evaluation.

GEA provides evaporation, crystallization, rectification and distillation pilot and feasibility testing at several locations around the world



Large GEA crystallizer

Capital equipment design and supply

At GEA we design and fabricate evaporators and crystallizers. We can also supply main peripheral components, such as heat exchangers, piping and pumps. In some cases, turn-key supply is an option. Our equipment is shop-or-field fabricated to ASME specifications. Installation is always conducted under our supervision. Depending on the ultimate application, components are supplied in a broad range of material, from simple steel to non-ferrous alloys and synthetic or lined material.

Zero Liquid Discharge (ZLD)

The implementation of strict environmental regulations, rigorous permitting processes, lack of water availability, and the economic benefits of water reuse have many industrial facilities implementing Zero Liquid Discharge (ZLD) systems. ZLD systems from GEA combine membrane filtration, evaporation and crystallization to eliminate or reduce wastewater effluent from the customer's plant. The end result is environmental compliance and production of highly pure water for reuse. In some cases, valuable by-products can also be recovered.



A GEA evaporation crystallization system for a mining application



Typical ZLD system

Evaporation and crystallization experience in:

- Aluminium
- Borax
- Copper
- Phosphates and fertilizers
- Nickel
- Nitrates
- Titanium
- Potash (KCl, KNO₃, KOH)
- Lithium
- Iron
- Magnesium
- Calcium
- Manganese
- Hydrometallurgy for any other metals
- Salt

Drying, Cooling, Calcining and Conditioning



Working with GEA on a drying solution means having a solid partnership every step of the way, from process testing and design, throughout project execution, to the start-up and operation of your plant. With over 100 years of experience in supplying industrial thermal processing systems, we offer a complete range of technologies for the mining and minerals industries including:

- Flash dryers and ring dryers
- Column dryers and coolers
- Fluidized bed dryers and coolers
- Conditioning systems
- Rotary dryers, coolers and calciners

With thousands of references worldwide, we maintain our leading position by focusing on product quality, system reliability, energy savings and emission control.

Fluid bed dryers and coolers

GEA fluid beds are used for a broad range of mineral products. These rectangular or cylindrical systems reduce drying and cooling times since the high heat transfer coefficient is achieved in the fluidized state. Fluid beds are ideally suited to multi-zone operation with drying and cooling taking place in the same unit. The equipment can be designed for high temperatures and is available in an all metal, washable design. Contact tubes or plates can be incorporated with non-cohesive materials. The result

is a significant reduction in airflow compared with the typical standard fluid bed providing a higher thermal efficiency as well as lower electrical consumption and reducing footprint.

Flash dryers and coolers

Suited for producing fine powders from cakes, crystals, granules, pastes, sludges and slurries, GEA flash dryers provide simultaneous processing and pneumatic conveying. Our flash dryer is a pneumatic system used primarily for free moisture removal with drying taking place in a matter of seconds. Wet material is dispersed into a stream of heated air (or gas) which conveys it through a drying duct, producing a powder before reaching the product collection system. Low attrition designs are also available.

Ring dryers

For products requiring additional residence time, we have our proprietary ring dryer, which is also a pneumatic-type system, similar to the flash dryer but with the addition of a manifold to provide selective recirculation of semi-dry material, lowering exhaust temperatures, increasing efficiency and improving product quality. If particle size reduction is required, we have several different feed dispersers and disintegrators that can be incorporated.



Washable design of high temperature fluid bed dryer



Flash dryer



Ring dryer



Rotary dryer systems

Rotary dryers, coolers and conditioners

Known as industry workhorses, rotary dryers and coolers are widely used in the mining industry. Their robust, but simple construction combines flexibility and reliability, enabling operation under the toughest conditions. Hot gas, ambient or conditioned air can flow in a co-current or counter-current direction. The internal design of the equipment influences the rate of heat and mass transfer and efficiency of the system. Conditioning systems that enable a complete process of glazing, polishing and drying can also be supplied by GEA.

Column processors

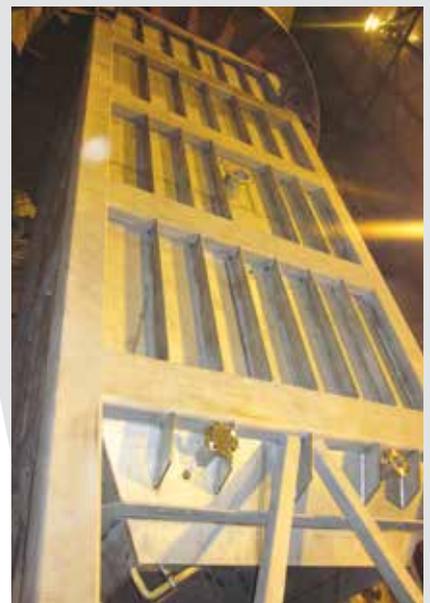
GEA column processors are used for cooling, heating, and purging of volatiles and residual moisture from free-flowing materials like amorphous or crystalline powders and granules. Columns are frequently used for diffusion controlled processes because residence times of up to 24 hours can be achieved. The contact column unit provides high heat transfer rates in a simple, compact, and space-saving design. Minimal, if any, air handling equipment is required, and with the exception of feed and discharge conveyors and the water recirculation pump, the column processor has no moving parts. The result is a reliable, ecological and economical bulk processing solution.

Pilot plant facilities

GEA offers extensive pilot plant facilities in the United States and Denmark and a number of mobile units available for on-site testing. This allows testing of customer materials on a full range of equipment. Once drying parameters have been established, we can then scale up and ensure compliance with specific requirements such as residual moisture content and particle size distribution.



Rotary dryer internals



Column cooler with maintenance-friendly removable embedded heat exchange units

Emission Control

GEA has a 120 year history in gas emission control. With an installation base of more than 15,000 cleaning units worldwide, the company specializes in chemical, cement, glass and metallurgical applications. A particular emphasis is technology that removes sulfur dioxide bearing gases from plant sites, including:

- Flash smelters
- Converters
- Roasters
- Sinter plants
- QSL reactors
- Rotary kilns
- Anode and electric furnaces
- Spent acid plants

GEA offers customized system designs that feature state-of-the-art microprocessor controls to best meet individual needs. Our electrostatic precipitators, scrubbers, bagfilters and removal towers produce consistent results under large gas flow conditions.

Wet Gas Electrostatic Precipitators (WESP)

The GEA WESP is of a proprietary, robust design. It has a unique alignment mechanism that holds electrodes rigidly in place. This reduces installation and maintenance time and improves performance. The field strength is consistently maintained at high levels with minimal sparking, resulting in the highest available efficiency. The greater the electrostatic field strength, the greater the particle migration velocity (velocity component towards the collection tube). Increased migration velocity achieves higher particle collection efficiency using a lower specific collection area (SCA) than conventional precipitators. The result is a smaller, less expensive unit.

Hot Gas Electrostatic Precipitators (HESP)

GEA technology is used for the separation of dust at temperatures of up to 450° C. An essential factor in achieving maximum collection efficiency is an even distribution of the gases over the entire cross section of the precipitator. This is ensured by correct design of the precipitator inlet transition duct and the installation of specially designed gas deflection and distribution plates. Experience gained from extensive testing on two- and three-dimensional models in our laboratory and from measurements in operational industrial plants were used to establish these standards. Our designs guarantee a very even gas distribution with low pressure loss utilizing a structure of a minimum size.



Wet gas electrostatic precipitator for nickel smelter



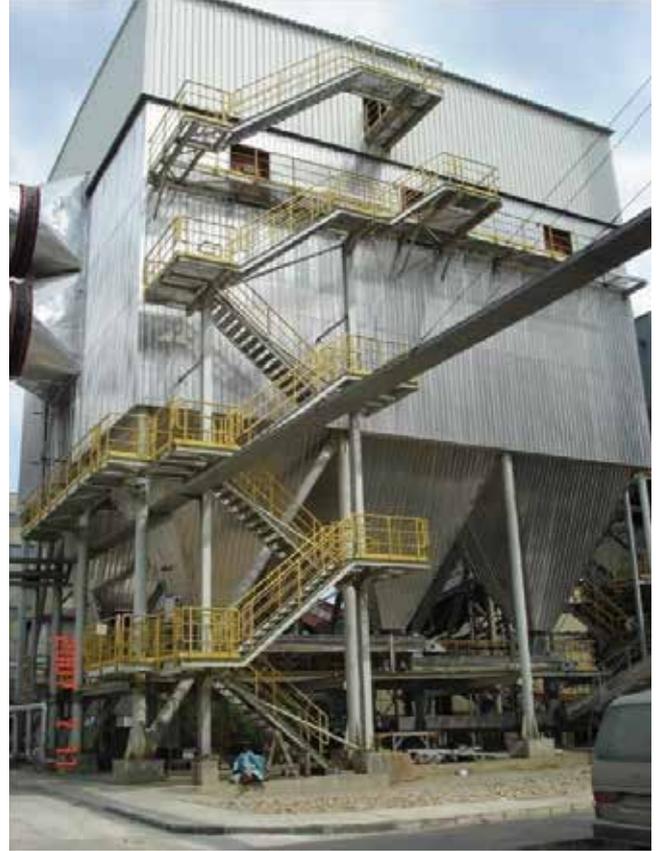
Hot gas electrostatic precipitator for zinc-fluidized bed roaster

GEA low pressure bag filter

Our technology has been optimized for large, multiple-compartment designs, containing up to 1,150 bags of eight meters in length which equals approximately 3,700 square meters of filtration area per cell. Bags are easily accessible and can be changed without tools. Low maintenance cost with only one pulse air diaphragm valve per compartment (typically, four in total for a kiln). Air compressors are not needed. Instead, roots-type blowers provide the air required for cleaning.

GEA radial flow scrubber technology

Radial flow scrubbers are adjustable high-efficiency scrubbers commonly used in the non-ferrous metal industry. They are especially suitable for batch processes in converters. Our GEA designs allow for several scrubbing stages in a single vessel and provide high collecting efficiencies for particulate material, e.g., arsenic, selenium and lead. Further, since radial flow scrubbers can be adjusted for the respective collecting efficiency, the scrubber can be operated at optimum differential pressure which helps to save energy. Additionally, gas flow can be configured for either a top or bottom inlet and raw gas temperatures of up to 800° C can be handled when materials are combined with a brick lining.



Bag filter for gases from anode furnace and secondary converter hoods

Special purpose gas scrubber systems



Separation Technologies



GEA is a world leader in mineral separation technology. From base, precious and platinum group metals to rare earth elements and uranium, our centrifuges set the standard for performance, reliability, and service life. Years of experience and continuous investment in research and development, help us provide customers with a crucial technological edge. Our Central Process Engineering facility is available for complex trials, so investment decisions can be made confidently.

From initial advice to testing, machine selection, and finally the startup and commissioning of an installation, GEA offers a perfect combination of process experience, plant construction, product and technical knowledge. Whatever the objective, solutions from GEA equal success.

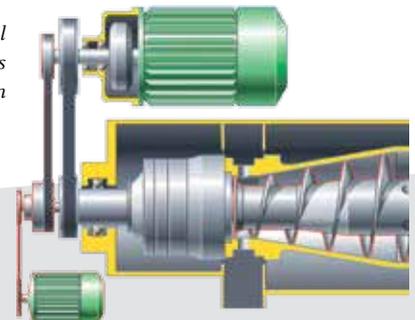
Classification, thickening and dewatering

Particularly important in the processing of industrial minerals, the GEA ecoforce™ decanter, is specifically designed for the recovery and classification of micro- and nano-size particles. This line of decanters can accommodate both two- and three-phase separation, using the same machine, and has the ability to classify materials by different particle sizes and liquid densities. This precise classification enables the particle size distribution to be adjusted so that quality specifications are always met. Adding on a second classification stage allows any product losses to be captured without excessive costs. Used for dewatering and thickening, our centrifuges are capable of producing products with an extremely high dry substance level. Variable drives with torque-dependent differential speed regulation ensure constant solid concentrations, even with fluctuating feed levels.

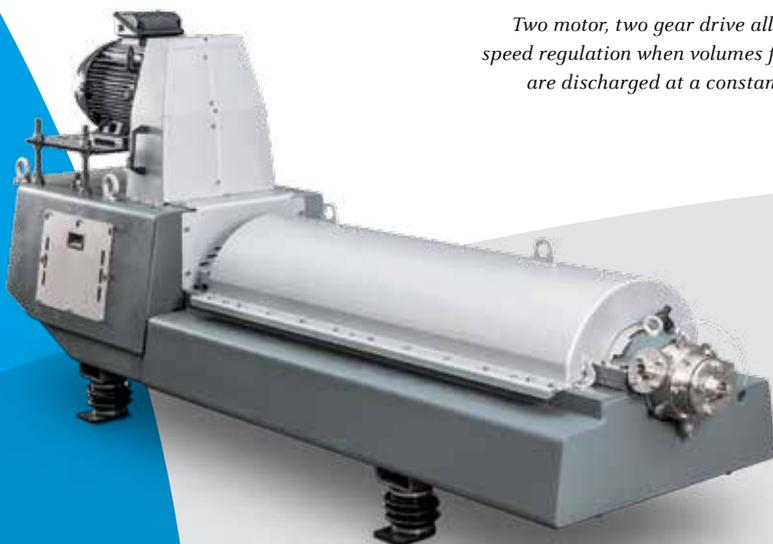
Crud treatment and solvent extraction

Three-phase decanters are ideally suited for this application and provide customers with a fast return on investment as valuable extractants are recovered. These decanters are designed to separate the emulsion, or “crud”, that is removed from the settling tanks of the SX/EW circuit, and breaks it into three phases: solid, aqueous, and organic. The decanter enables efficient recovery of clean aqueous and organic, along with the extractants. The extractants can then be recycled back into the circuit in a 100% closed and continuous process. Our decanters are available in a full range of capacities and are constructed with high-quality duplex steels and special armoring for maximum corrosion and wear protection. Additional features such as D-Control and GEA varipond® allow automatic, inline adjustments for precise control of the quality of the product coming from the decanter.

Two motor, two gear drive allows differential speed regulation when volumes fluctuate. Solids are discharged at a constant concentration



GEA ecoforce crudMaster™ decanter



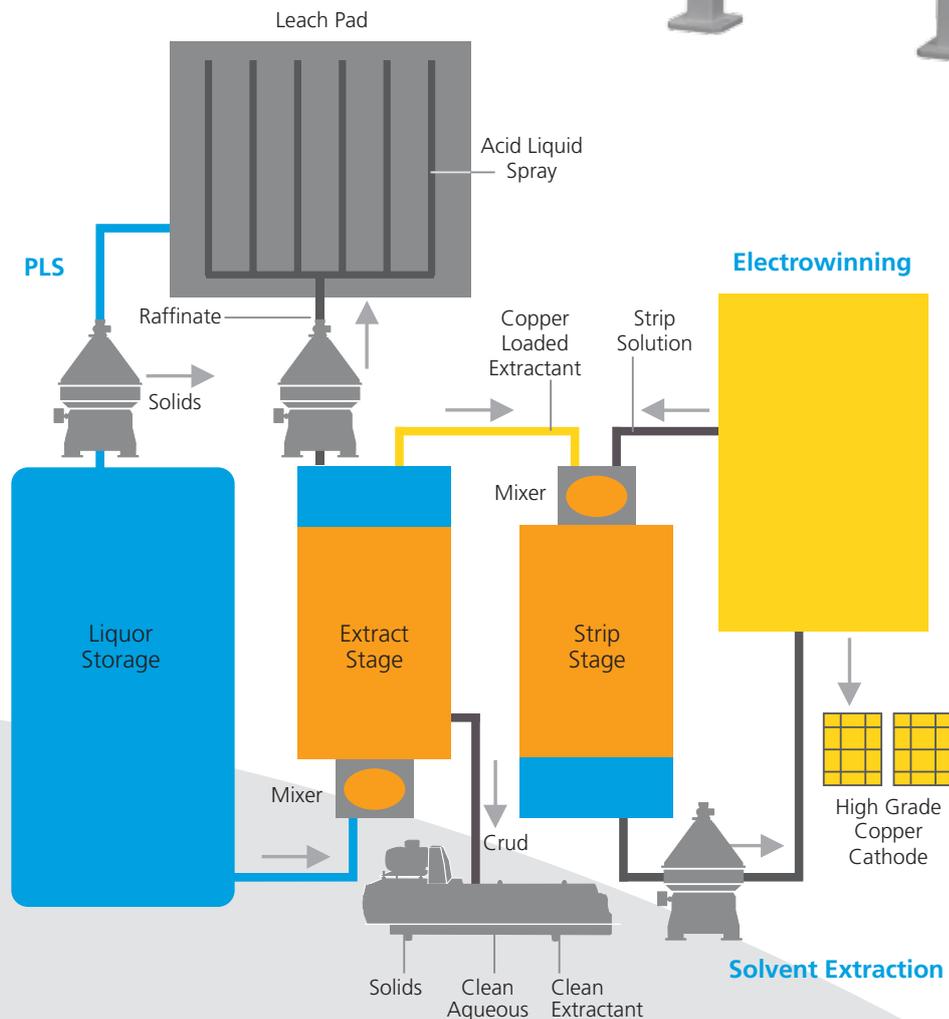
Pure leach solution (PLS) Clarification

In addition to traditional crud and clay treatment with decanters, GEA offers PLS clarification with direct drive nozzle-type separators. The advantage of this innovative process is that impurities considered to be responsible for the formation of crud are removed from the process before the crud has a chance to form. These separators are equipped with special wear protection against abrasion. To protect against clogging and abrasion a rotary brush strainer can be installed upstream.

Nozzle separators or definers are designed for thickening superfine solids, so crud does not form



Application of decanters and definers in the SX/EW process





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 listed in selected MSCI Global Sustainability Indexes.

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