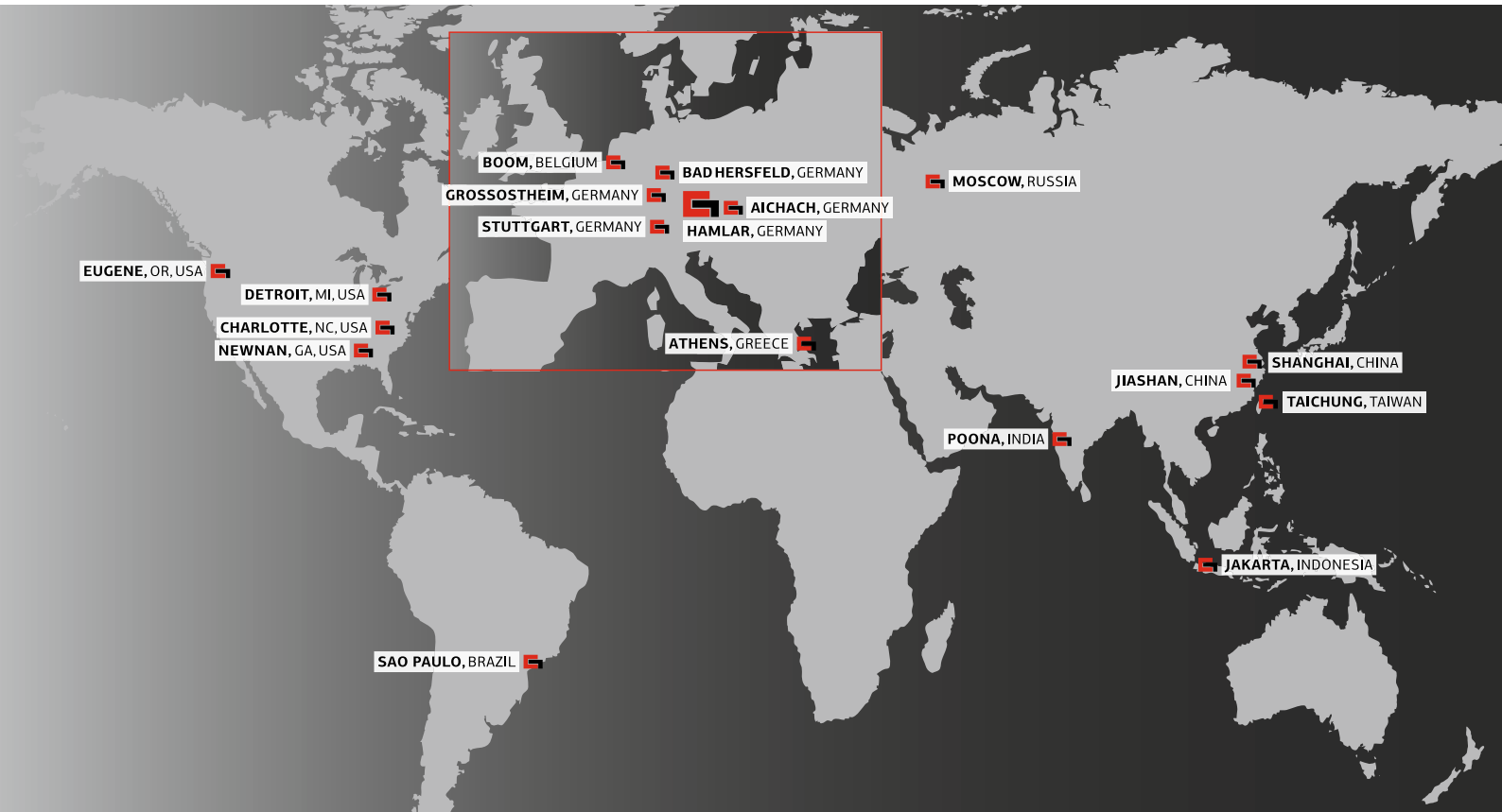


PLASTER | PLASTERBOARD | GYPSUM BLOCKS



Gypsum Solutions

High tech solutions have a name – Grenzebach



Grenzebach stands for intelligent handling, processing and automation technology focused on quality & performance.

We are an internationally operating, expanding family-owned company focusing on plant engineering, construction and automation and provide customized equipment based on cutting-edge technologies designed to perform highly sophisticated processing and automation tasks.

The Grenzebach Group encompasses the four business units “Glass”, “Building Materials”, “Intralogistics” and “Service” to serve glass makers, building material producers, international logistics groups as well as the automotive, the aviation and the food industry. Other areas of expertise are mechanical and thermal process engineering. At locations in Europe, America and Asia more than 1600 Grenzebach employees develop high-tech solutions for the complex manufacturing needs of its customers.

Grenzebach is the world’s leading supplier of equipment and systems for the building materials industry. Whether gypsum, wood, mineral wool or thermal process

engineering – Grenzebach customers everywhere benefit from the expertise and more than 90 years of experience the specialists in Bad Hersfeld can look back on. The former Babcock company has been a member of the Grenzebach Group since 2002.

High reliability, low operational cost, optimal energy efficiency – in gypsum processing Grenzebach systems stand for highest quality standards. Grenzebach designs, manufactures and supplies turnkey production lines for gypsum plasterboards, gypsum construction blocks, panels and ceiling tiles. Our reputation for reliable equipment and special purpose machinery satisfy the high expectations of our customers.

Grenzebach places great emphasis on maintaining cooperative partnerships with its customers. With production facilities in Germany, the USA and China we are always close at hand. Our representatives provide on-site support and service around the world.

A competent partner for the gypsum industry



The Grenzebach gypsum division offers its customers a comprehensive range of both standard and specialist equipment from rock handling, milling and calcining through all stages of wallboard manufacture as well as bag plaster processing.

Our scope of supply includes:

- Turnkey plants
- Product and market assessments
- Land procurement
- Factory design and construction
- Civil work
- Machinery specification, design and manufacture
- Installation and commissioning
- Operator training and start-up support

Complete production lines for gypsum products – to meet customers' own specifications or to meet agreed production targets

Support services:

- Feasibility studies
- Raw material analyses
- Upgrades of existing equipment
- After sales services
- Service and maintenance contracts

Grenzebach calcining and drying systems

Grenzebach designs and builds plants for the treatment and conversion of natural and synthetic gypsums into plaster.

The finished products obtained can be used for a variety of applications. Aside from the processing of natural gypsum, the utilization of synthetic gypsum has become increasingly important throughout the world. New concepts for calcining synthetic gypsum, developed and implemented by Grenzebach, have set standards in the gypsum industry world-wide.

The calcining process is an important factor in the control of the product characteristics, because it substantially affects the plaster's crystal structure and the phase composition.

Different drying and calcining technologies

Drying plants

- Flash dryer
- Paddle dryer
- Mill dryer

Calcining plants

- Ring roller mill (flash calcining)
- Hammer mill (flash calcining)
- Rotary kiln
- Rotary tubular calciner – gas fired
- Rotary tubular calciner – steam heated
- Gypsum kettle
- Autoclave (alpha hemihydrate)

Based on the raw material and the expected quality of the finished product, we offer the most suitable technology available. We are proud of the eighty or more plants built by Grenzebach during the past 50 years reflecting our know-how and expertise.





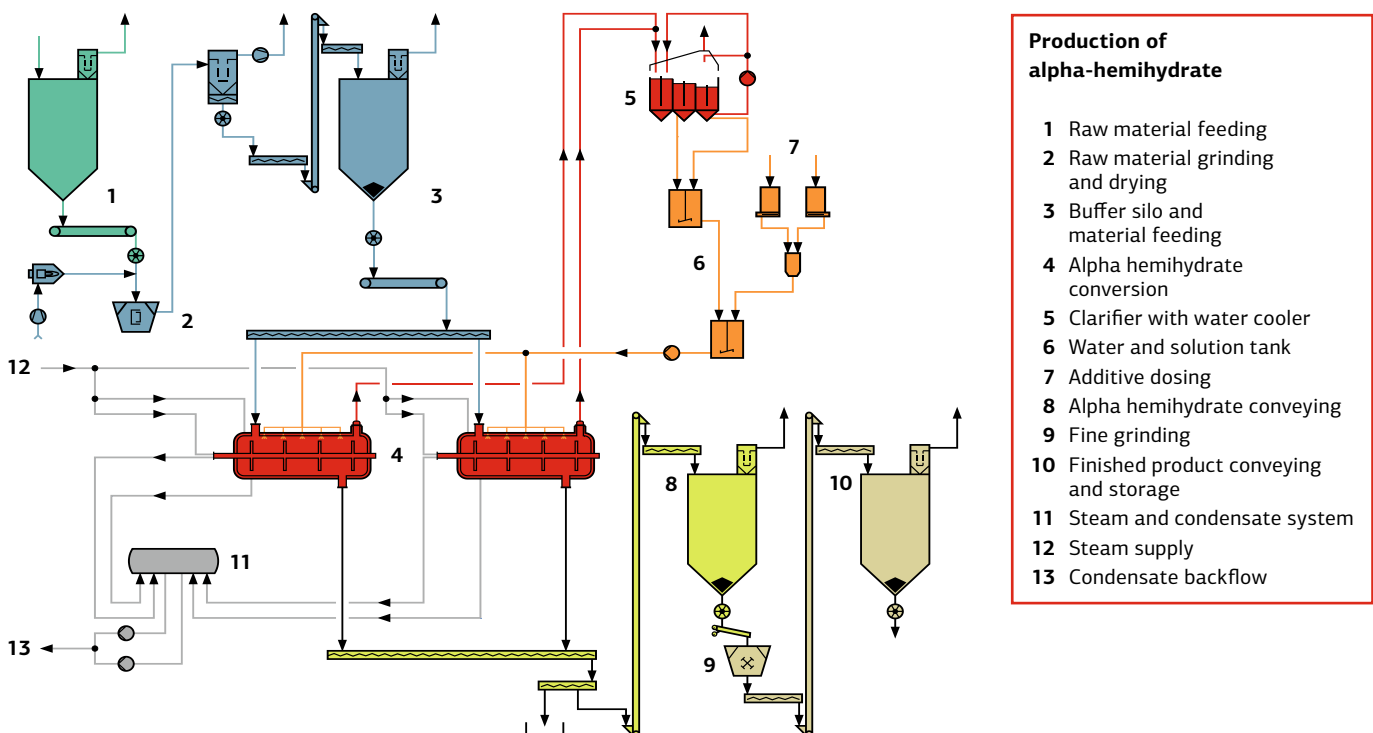
Rotary tubular calciner with integrated cooler



Ring-roller mill for drying or mill calcining

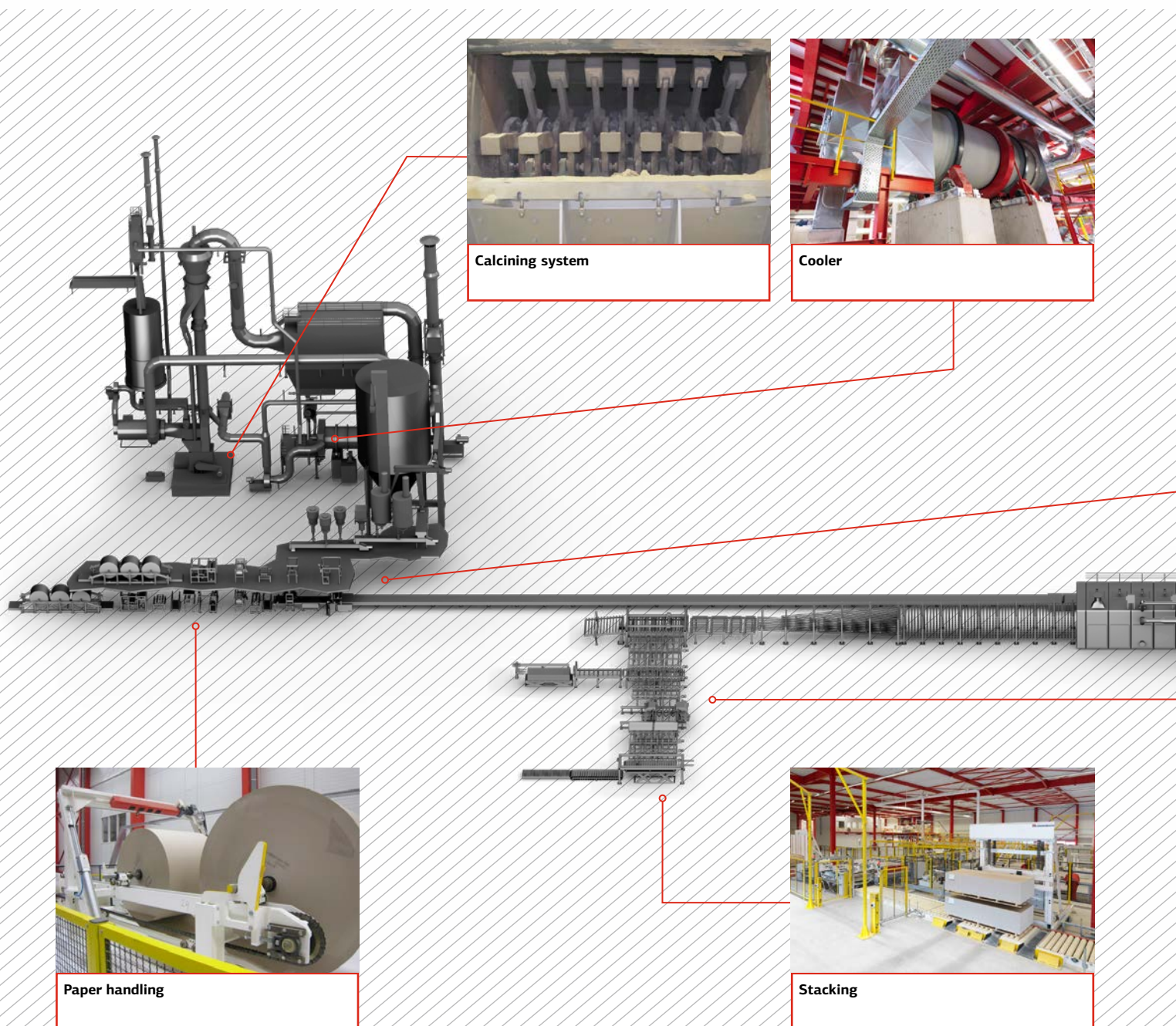
Grenzebach's range of equipment covers all types of equipment and processes used by the industry. We build calcining systems for all product qualities; directly or indirectly heated, short or long residence time equipment, such as mill calciners, rotary kilns, calcining kettles, rotary tubular calciners and continuous autoclaves for wet calcining of dihydrate into alpha-hemihydrate. With our proven and time-tried systems we can provide solutions that are tailored to meet customers' specific needs.

The choice of calciner depends on the desired product quality and on such factors as availability, the cost of fuel and electrical energy, manning levels, the degree of automation required, the plant size and operating mode as well as the raw material available. Grenzebach's specialists, who have gained their experience from projects in all parts of the world, will assist customers in selecting the most economical system.



Production line for gypsum plasterboard

Grenzebach offers its customers **all possible options for the production of gypsum plasterboard**, from a low cost solution for producers entering the market to highly sophisticated automated plants with very large capacity and high yield.



Whether your need is for a single item of equipment, a full production line or a turnkey plant, you can be sure of expert advice, excellent technology, reliable equipment and start-up support. Our after sales team are at your service, providing technical support, spare parts and advice, 24 hours each day. A hot-line teleservice enables us to solve many problems on-line.

All our systems have been proven through many years of experience in the gypsum industry. Technology is constantly updated by the introduction of practical solutions, often developed in partnership with our customers, and reflecting industry standards in motor and control technology. This schematic drawing provides an example of a typical plaster-board production facility. Actual plants may vary, depending on the type of gypsum used, required capacities, product differences and individual preferences.



Mixing and forming



Board dryer



Knife



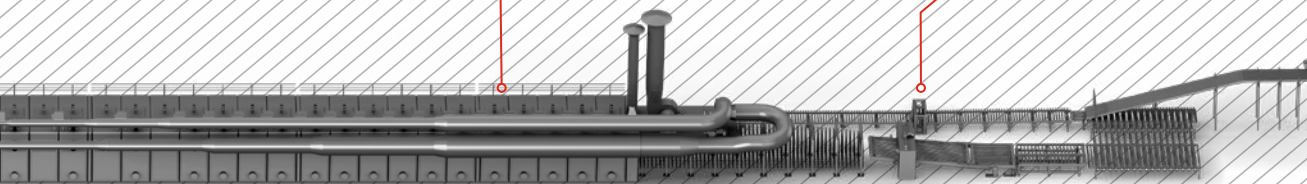
Bundler



Tipple feeder



Wet end transfer



Grenzebach board dryers



All Grenzebach dryer designs result from years of industry experience combined with extensive testing in our laboratories and the application of the latest numeric analytical methodology. We are uniquely positioned to provide the best solution for your drying needs, based on the nature of your raw materials, market demand and your operational philosophy.

Longitudinal dryer

The Grenzebach longitudinal dryer sets the standard for the gypsum wallboard industry. As the workhorse of the plasterboard industry the longitudinal design dryer is available from an energy efficient two and three zone version to a high-efficiency "Two-Stage" model with large-scale heat recovery. Features such as large, easy opening doors and bearings

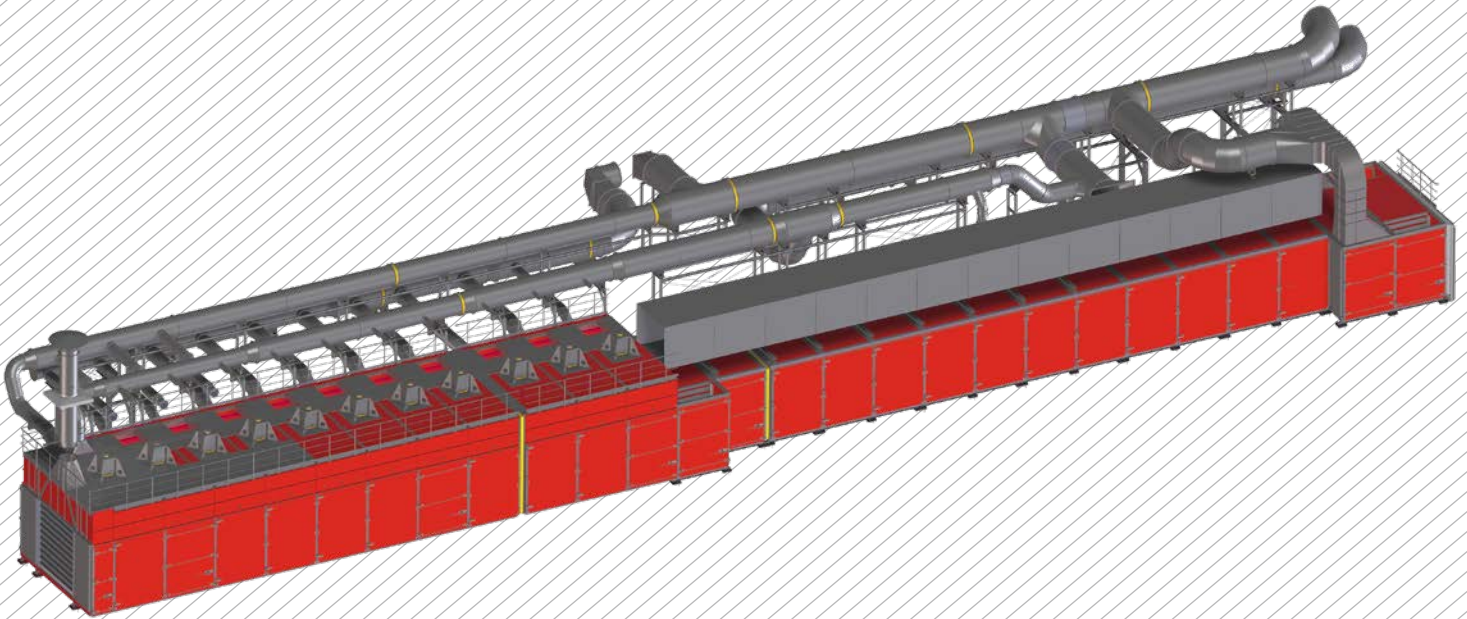
mounted outside the drive sprockets make for easy maintenance of the Grenzebach dryer. Multiple delivery deck dampers easily adjusted during normal dryer operation allow for better flow control, thus providing better quality through a uniform drying profile.



Cross-flow jet dryer

Drying gypsum plasterboard with Grenzebach jet-type dryers has been common practice in the industry for over 20 years. This dryer concept is particularly suited for factories planning future expansion. The modular design allows the jet-type dryer to be optimally adjusted to the required capacity, and it can be easily extended by adding further sections if necessary. The cross-flow configuration allows multiple airflow zones with short flow paths allowing airflow and temperature characteristics that can be optimized for the best drying schedule for each individual product type. The flow pattern from the individual jet tubes has been carefully designed and tested to provide uniform drying conditions across the width of the board decks. Additional features such as adjustable tube height and damper sections allow further adjustments based on measured drying uniformity.

The jet-type dryer can have 6 to 14 decks and a useful width of 114" to 173". The dryer's functional principle is based on ultra-efficient heat transfer through impinged air. The drying air flows vertically onto the boards from above and below through hole-type nozzles in the jet box. This arrangement protects the cut board edge from being burnt in the dryer. The design of the delivery plenum with matching nozzles coupled with easy adjustment devices ensures that optimum board quality is achieved in the shortest possible drying time. The drying air can be heated either directly by means of gas or light fuel oil, or indirectly via a steam or thermal-oil heat exchanger with oval finned tubes.



Grenzebach combination dryer for gypsum plasterboards

Combines the advantages of cross-flow and longitudinal-flow drying

- High evaporation rate and flexibility (e.g. regarding product changes) in the cross-flow part
- Final drying at adequate dwell times in the longitudinal-flow part
- EOS (Energy Optimizing System) available so that specific energy consumption is not higher than in a conventional longitudinal-flow dryer



Heat recovery systems

Grenzebach can furnish fully developed heat recovery solutions for all dryer systems, comprising:

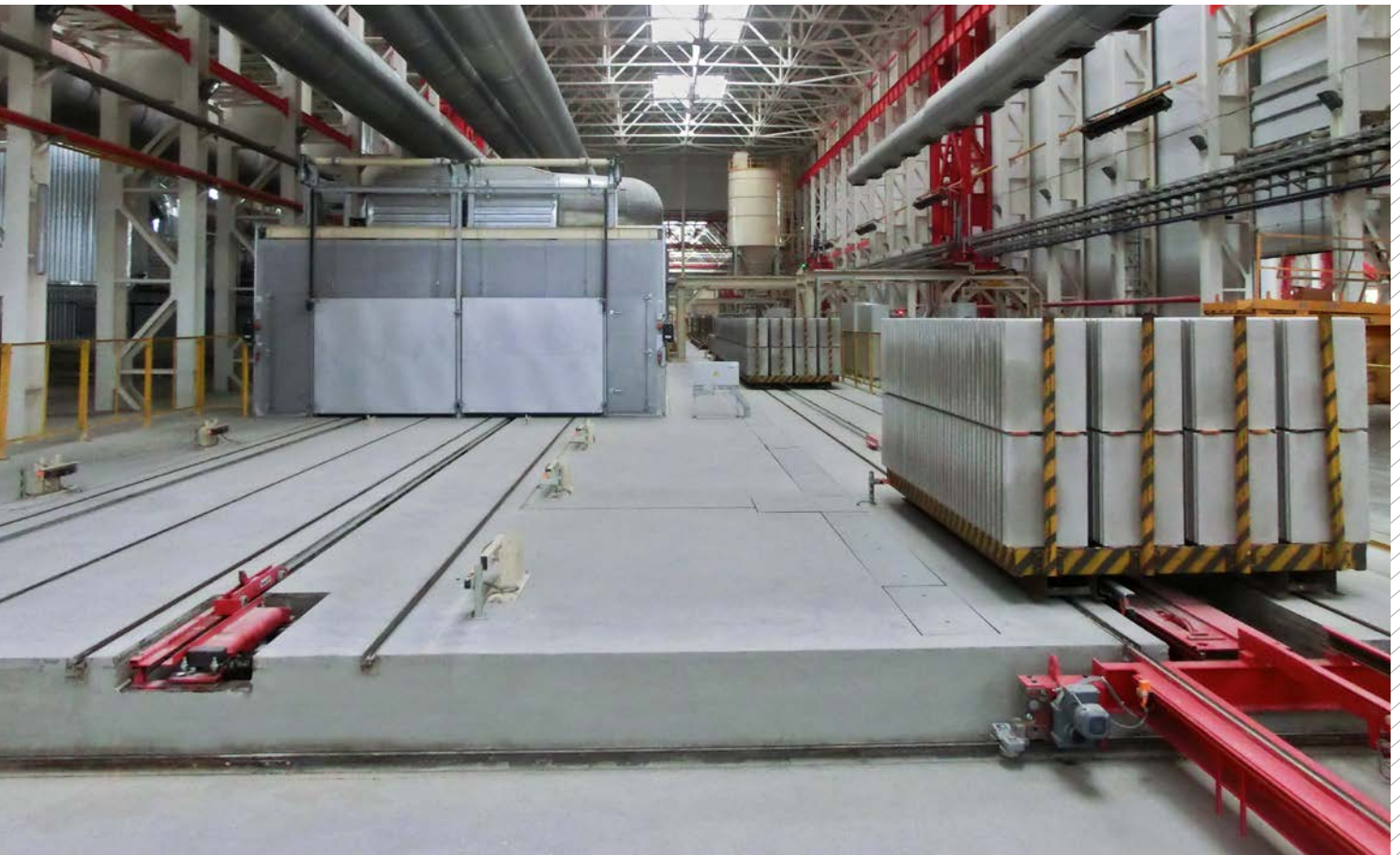
- Specially engineered counterflow plate-type heat exchangers
- Exhaust return systems, such as EOS for the longitudinal-flow and CES for the cross-flow dryer
- Pre-drying sections

Screen belt dryer

The Grenzebach screen belt dryer provides specialty drying for mineral fibre, gypsum fibre or other products having low strength when wet. The screen belt dryer combines the operational advantages of the cross flow jet dryer with the unique carrying capabilities of the screen belt conveyor. Standard Grenzebach design features are included to provide uniform drying profiles, thermal energy efficiency and ease of maintenance.

Grenzebach gypsum block technology

Gypsum blocks are building elements produced from calcium sulphate and water that may incorporate fibres, fillers, aggregates and other additives. They are moulded with tongue and groove and used as partitions in the interior finish of buildings.



Dryer outlet side with semi-automatic shuttle transport system

The blocks are usually made in sizes of 500 x 666 mm, with thicknesses ranging from 50 to 120 mm. Solid blocks as well as hollow blocks can be produced.

Gypsum blocks are easy to install, fire-proof, vermin-free and mould-resistant and help to regulate room humidity.

Grenzebach supplies complete production lines for gypsum blocks with different capacities adapted to the customer's requirements and the needs of the market.

Forming machine

Two different drying processes are possible: "fast" drying in a heated dryer within hours and "slow" drying in racks in the open air within days.



Gypsum block unloading and compacting unit



Grenzebach gypsum block dryer, view from the inlet side

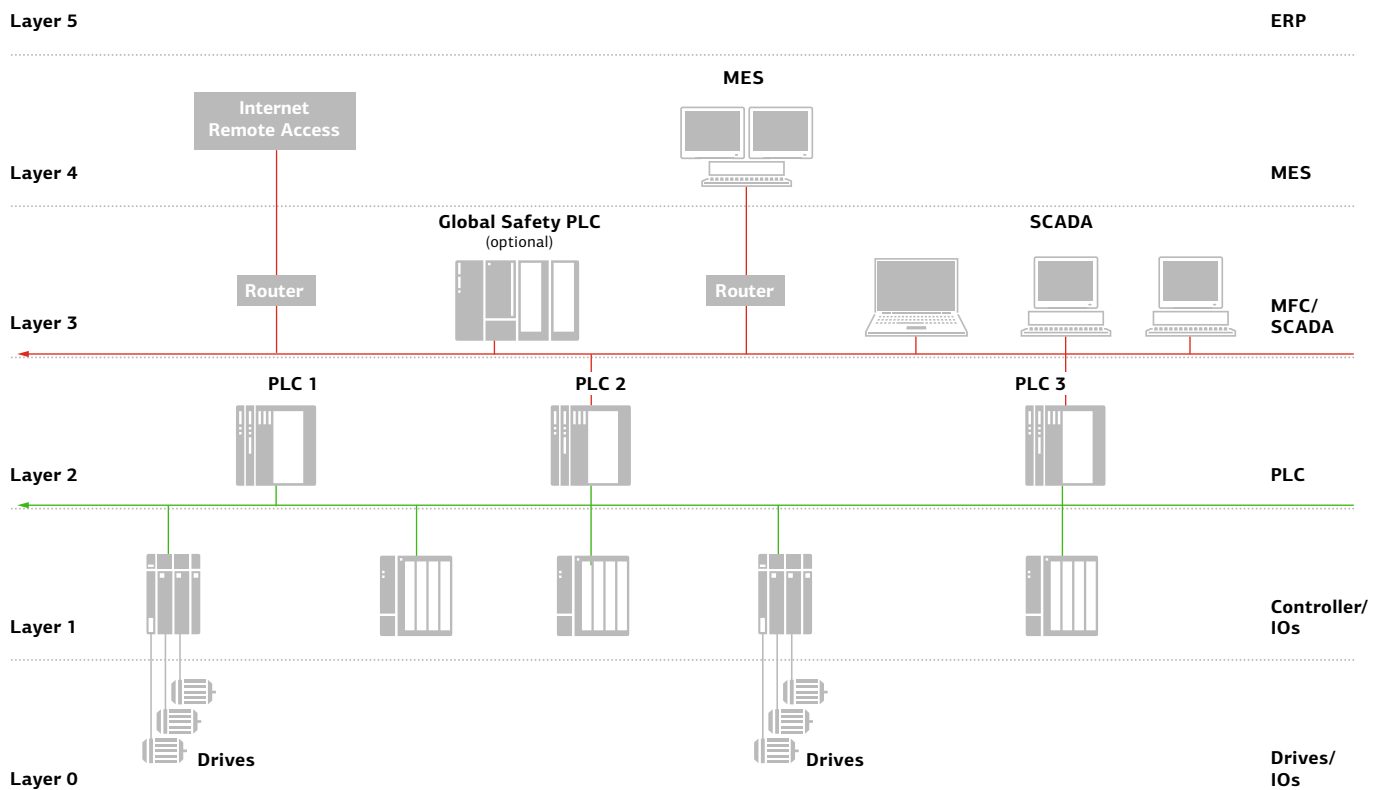


Forming machine

Control technology for various levels of automation

Depending on the line concept and the required degree of automation, **Grenzebach turnkey systems are offered on the following basis.**

Grenzebach control architecture



For complex building materials production lines, Grenzebach offers state-of-the-art control technology with an intelligent operation structure characterized by fast reaction, reliability and user friendly application.

- Process control systems
- Simulation
- Visualisation
- Operation with high user acceptance
- Line control systems
- CNC controls with CAD application
- Inspection systems
- Administration systems
- Order management
- Stock management
- Quality management to ISO 9002
- Optimization
- Training
- Teleservice/hotline
- 24 hour service

Grenzebach HMI-PLC control system

