

FLOAT GLASS | PATTERNED GLASS | COATED GLASS |
ARCHITECTURAL GLASS | SAFETY GLASS



Glass Technology

A company introduces itself



GRENZEBACH has achieved its leading position as an acknowledged specialist in handling and processing technology through intensive know how and long experience in the construction of processing equipment for material flow.

From a single machine to a complete production line – with its efficient process controlled equipment we are the trend setter for the flat glass industry. Working in close communication with our customers all over the world we design, manufacture and deliver project technology that is precisely designed for individual production needs. Just as recognised as its flat glass technology, the GRENZEBACH overall concept of manufacturing lines combined

with good control technology is successful in the production and processing of building panels, in the processing of gypsum from raw material to finished plaster board and in cutting and drying of veneers. “Open to new ideas” provides the basis for continuous new development in all aspects of our business. The capability to find innovative solutions and to implement them successfully is our task. GRENZEBACH place great emphasis on maintaining cooperative partnership with its customers and business partners. While taking full advantage of modern communications technology, the direct and personal contact is especially important to us. With our affiliates and representation offices throughout the world we are always close to your vicinity.

with good control technology is successful in the production and processing of building panels, in the processing of gypsum from raw material to finished plaster board and in cutting and drying of veneers. “Open to new ideas” provides the basis for continuous new development in all aspects of our business. The capabi-

A competent Partner for the Flat Glass Industry



Producers of flat glass trust in Grenzebach technology. Optimal coordination between solid mechanical engineering and intelligent control technology results in a highly reliable plant with peak availability and guarantees efficient production.

With a design individually laid out to the special characteristic of the desired production needs, float glass, coated glass, patterned and wired glass, safety glass and other special glass are produced on Grenzebach machinery all over the world. Innovative technology ensures continuous operation for many years and cross-linked machine components together with operator friendly controls guarantee optimum results. Experience gained in many successful instal-

lations is implemented in our new and further developments. Our customers can combine their individual After-Sales Service package and thus relieve themselves from the burden of maintaining and servicing their valuable production machinery. The global presence and manufacturing capabilities all over the world brings Grenzebach close to its customers.

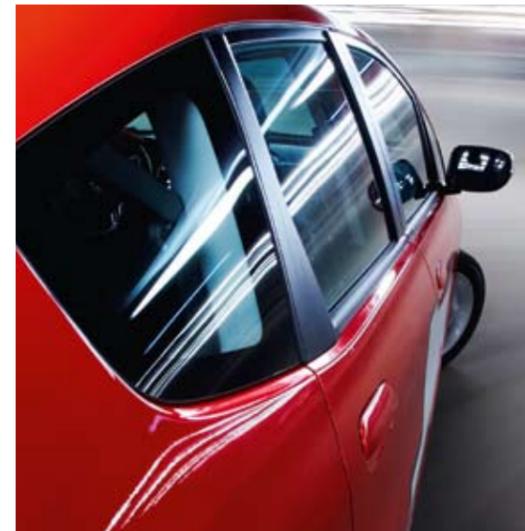
Glass works



Service at Grenzebach: Round the clock. Round the globe. The 24/7 principle applies – availability 24 hours a day, 7 days a week.

Grenzebach always finds a solution for the customer's needs. The entire group is focused on the client's requirements. We know that smoothly running plants and machinery form the basis for success. Reliability, expertise, rapid action are key Grenzebach maxims. The production plants we supply are an important cornerstone for our customer's success. We take this responsibility very seriously. Therefore, service at Grenzebach is concentrated in a separate division. From the initial machine design right through production, Grenzebach engineers ensure long serviceability and the highest possible quality and precision. We accompany our customers through all operating phases of the plants. Grenzebach companies located all over the world employ qualified employees to provide installation, startup and training services in that

region, so that customers can be supported in their own language, their own culture and their own time zone. We never leave anything to chance, we use the latest technology and media to keep in permanent touch. Grenzebach is able to access the customers' control system remotely, monitor operations and intervene with corrective action if required. We always keep a close eye on the plants we have supplied, and respond immediately when needed – anywhere in the world. Far-ranging vision, expertise, preventative action and close cooperation with customers make it possible to guarantee that our plants will operate safely and precisely over decades. It is often the case that our customers' requirements and their products will change over time. Software updates enable our engineers to adapt the functions of the plants accordingly. Our comprehensive package with integrated spare parts supply is very popular with many customers. This ensures the plants are always maintained in peak condition both now and for the future.



Innovative Float Glass Production from Cold End to Warehouse

Since the introduction of float glass technology to the market, the name of Grenzebach has been inseparably associated with handling and processing of flat glass.

Whether as a complete line or as a single component, for simple or for complicated production processes – based on our long experience in engineering we offer technology of high standards with the best results. From lehr to warehouse the line is separated in several sections which need to be precisely connected to one another.

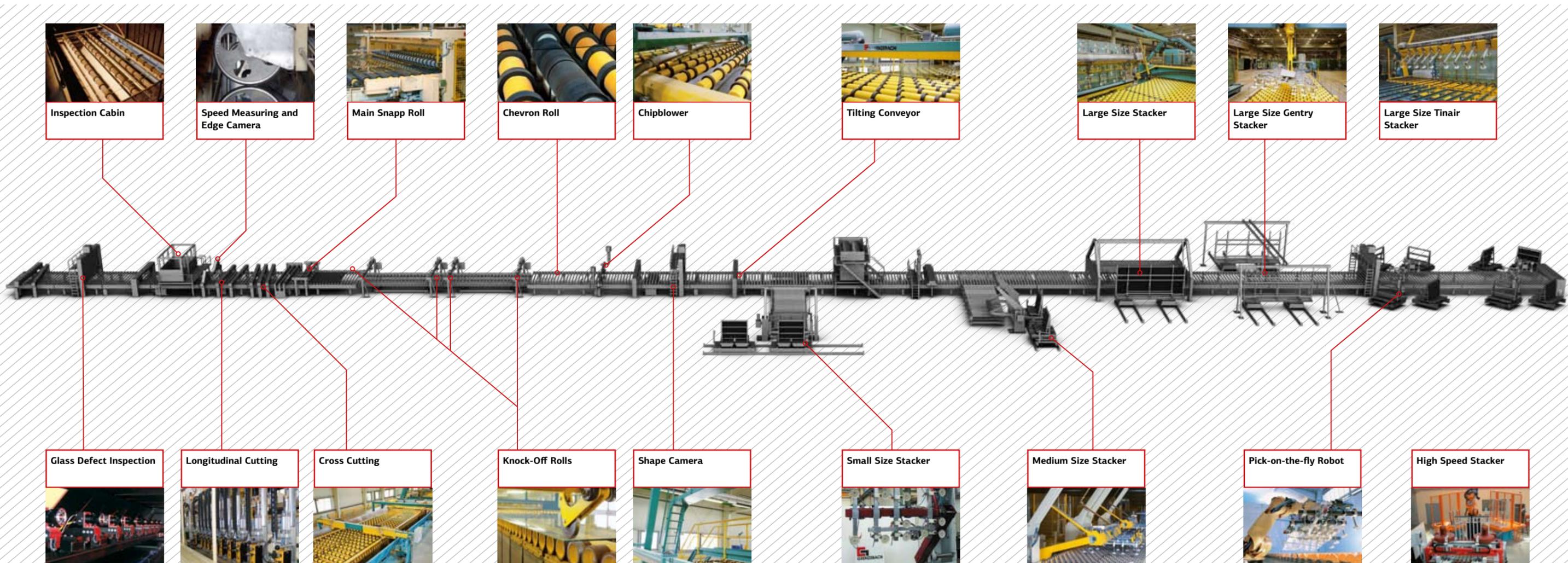
- Take over of the glass ribbon coming from the lehr with a synchronised conveyor system
- Quality inspection
- Quality and capacity optimised cutting of the glass ribbon into sheets in relation to order requirements
- Snapping and size control
- Rejection of faulty glass sheets
- Sorting according to size and quality
- Stacking onto glass racks of various design
- Rack storage and administration of quality data
- Removal and reinsertion to off- line handling

Float Cutting Technology

Extreme cutting accuracy and high availability are only two of the many standards that have to be met. The longitudinal and the cross cutter are equipped with the field-proven Grenzebach cutter heads with electromagnetic cutting force generator. They allow to precisely regulate the required cutting force. The speed of the glass ribbon determines the positioning of the cutter heads and the cutter head controller enables a smooth lowering of the cutting wheel by jump-cut function. The cutting equipment reaches its highest level of functionality in combination with the Grenzebach supervision and optimisation system.

Stacking Technology – the perfect device for each glass

For feeding of glass into a production line and for precise stacking Grenzebach offers economical technology – from simple manual take-off up to fully automated stacking for small and middle sizes and for jumbo formats weighing more than 1000 kg. Grenzebach swing arm stackers are using crank gear drives for a controlled, smooth motion at each end of the stroke. Our tinside /air-side stacker offers the option to take off glass sheets alternatively from upside or from below and in certain applications, robots create a use full alternative for take-off or feeding.



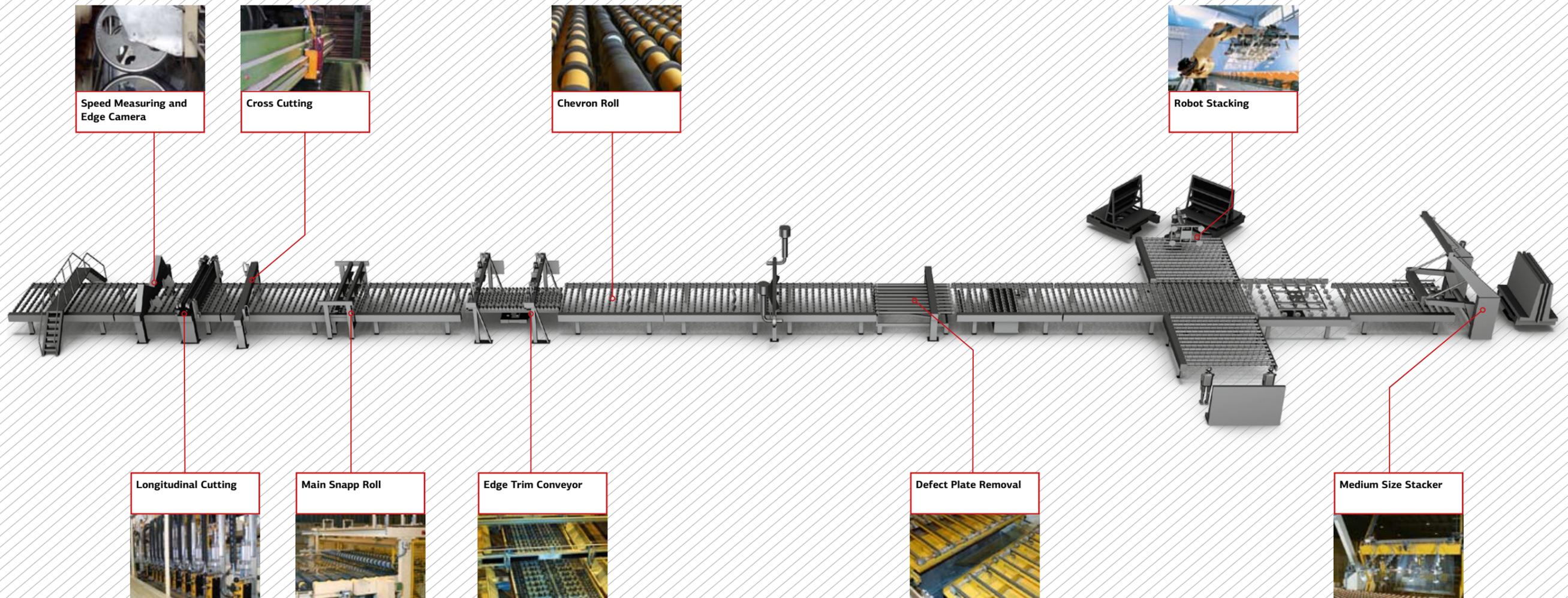
Efficient Technology for Patterned and Wired Glass

With the increasing demand for solar glass, patterned glass lines experience a kind of Renaissance. Grenzebach machinery for these glasses offer a concept of high operational safety and efficient production.

Advantage is taken of our know-how gained in many years of manufacturing float glass technology – especially cutting machinery – to secure high quality of this valuable end product, optimum yield from the material and cost-saving operation, thus contributing largely to our customers' success. The endless glass ribbon flows onto the Grenzebach line in various widths, thickness and production speeds. Our cold end equipment will accommodate all conventional patterns. In the cutting area, horizontal and longitudinal cutting bridges divide the glass ribbon. An electromagnetic system determines the cutting strength and proven Grenzebach cutting heads guarantee precise cuts. Special production steps are also required for processing of wired glass.



When operating machinery with wire inlay it is possible to integrate a wire-shearing device after snapping of the cross cut. Following this operation, trimming and disposal of the glass edge is effected on a conveyor that can be varied in width. After trimming, the glass panel is conveyed to the stacking device and taken off. Grenzebach offers a complete range of equipment for stacking various glass sizes. Customers can choose from a simple manual take-off to fully automated stacking. Robots are increasingly used, due to their extreme flexibility. Stacking can be made on all conventional racks, in boxes and also in end caps. Highly automated devices can even be equipped with automatic end cap packing.



Effective Processing Systems for Coated Glass

Many years of experience, gained in the float glass sector, are the basis for optimum processing and for quality oriented handling.

Flexible feeding of various glass sizes, smooth transport and a stacking technology, designed to the characteristics of the product, determine the various sectors of a processing line for coated glass.

- Take-off from racks/storage
- Transport
- Washing machine
- Clean-room
- Coating
- Quality control
- Cutting, snapping
- Cover sheet feeding
- Stacking
- Sealing

Equipment to meet every production need

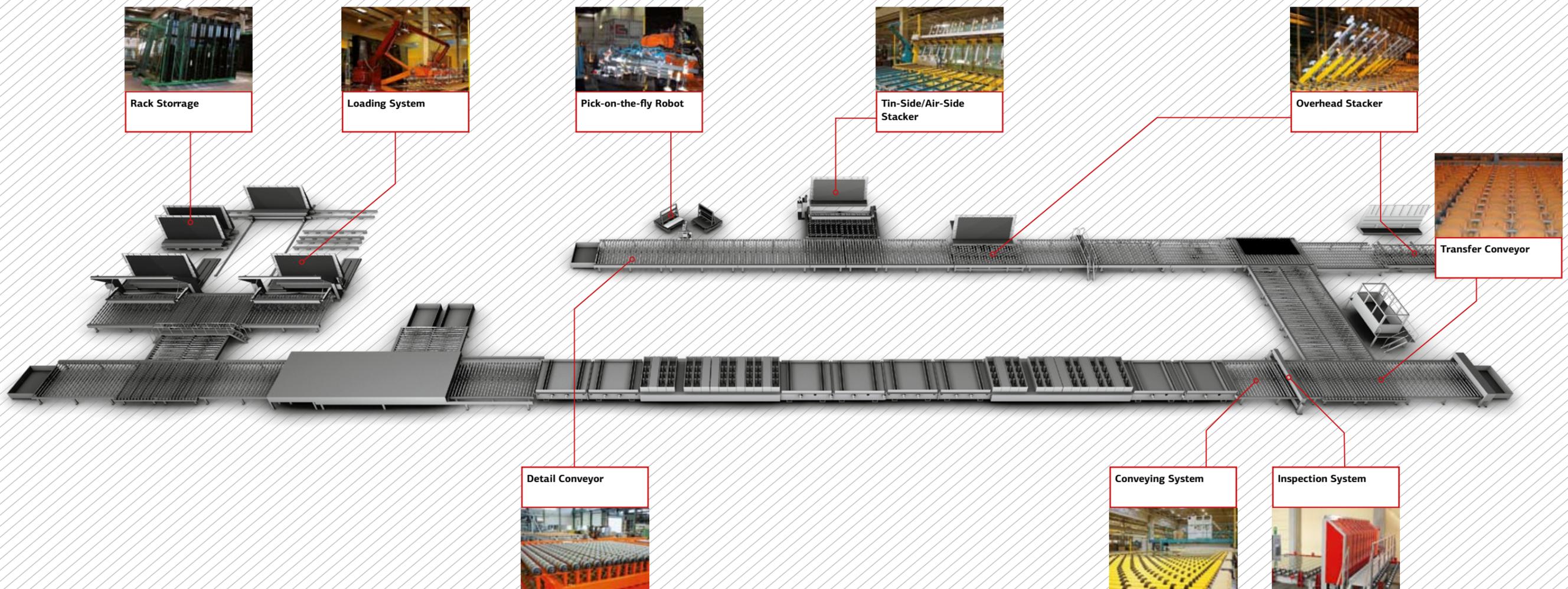
Grenzebach Magnetron lines are our response to the market's increasing demand for coated glass. Usually working off-line, these lines can process all sizes of glass. Taken from temporary glass rack storage, jumbo or mid-sized glass formats are fed into the line by swing-arm stackers or gantry feeders. Robots are used to handle small glass plates, alternatively, sheets of any size can also be loaded manually. The glass first passes through a washing machine before it is transported into a clean room and enters the coater. Following the coating process, the line has provision for inspection of thickness and coating quality either automatically or by the operator. Grenzebach also offer systems to control the entire surface coating and provide cutting and snapping equipment for partitioning jumbo or LES plates into small glass sheets.

Sophisticated stackers for a delicate material

Of vital importance in maintaining glass quality is its careful handling. Under no circumstances must glass be touched on the coated side. With our range of overhead stackers, tin-side / air-side stackers and robots –Grenzebach stacking technology satisfies this requirement, also ensuring accurate and gentle placing and preventing unwanted marks on the glass surface.

Options for special operations

Grenzebach lines can be adapted to suit special needs. For example, as a specific option for European glass coating lines, we offer protective sheet handling where the first sheet of a glass batch is left uncoated in order to protect the remaining sheets. The entire glass pack is sealed off by adhesive tape either on the stacker or off-line.



High Performance Cutting Lines

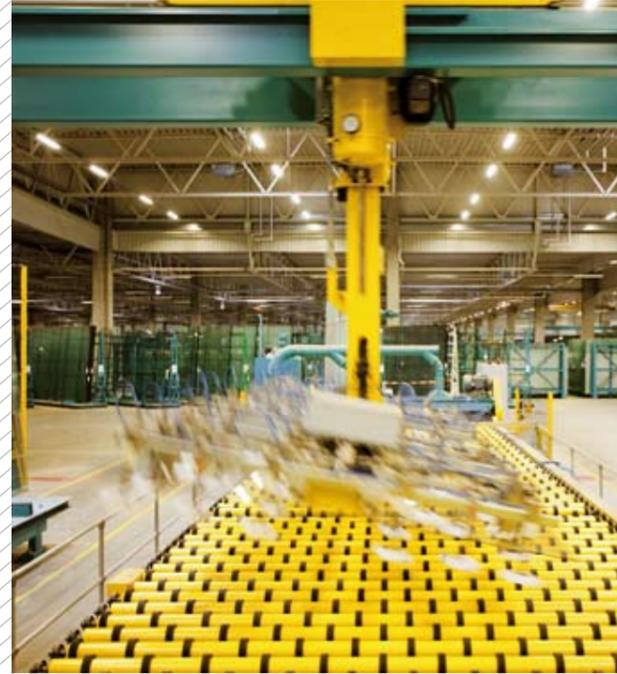


Quality and capacity optimisation at its best.

Lines that produce architectural glass in very high volumes demand very sophisticated equipment.. Their exact functioning greatly influences quality and usability of the glass – and finally also cost efficiency. Grenzebach cutting lines are well known for their flexibility in speed and their high cutting accuracy. In close communication with the customer the equipment is designed to production needs. Depending upon your requirements, Grenzebach cutting tables can handle straight cuts, intermittent cuts and free-form cuts. An optical sensor detects the edge positioning and there is no need to adjust the plate position on the cutting table. Cutting

force and lubricant feed are automatically varied to momentary cutting speed. The result: clean edges without flaking and chipping, easy and rapid separation of cuts and minimum cutting-oil deposits on glass. An industrial PC with Windows based computer screens and graphic operator screens has been developed to be user-friendly. The graphic pictures are true to scale based on a practical forms catalogue. The quick and easy cutting plans generated can be saved. A cutting plan optimisation is available on request. This recognises and facilitates the elimination of defects ensuring minimum wastage and a high glass yield.

Flexible Systems for Safety Glass



In modern architecture, glass is getting more and more important as an element of design as well as a functional building material. Consequently the need for laminated and strengthened glass is constantly rising and its application determines the type of glass.

Laminated glass is used as a standard for many applications like overhead installations, bullet proof glass, as sound proof glass and in many other variations. As flexible as its scope of use are the solutions for its production. According to the specific requirements. Grenzebach meets these needs by offering functional technology for laminating production lines.

The components of a Grenzebach laminated glass line are

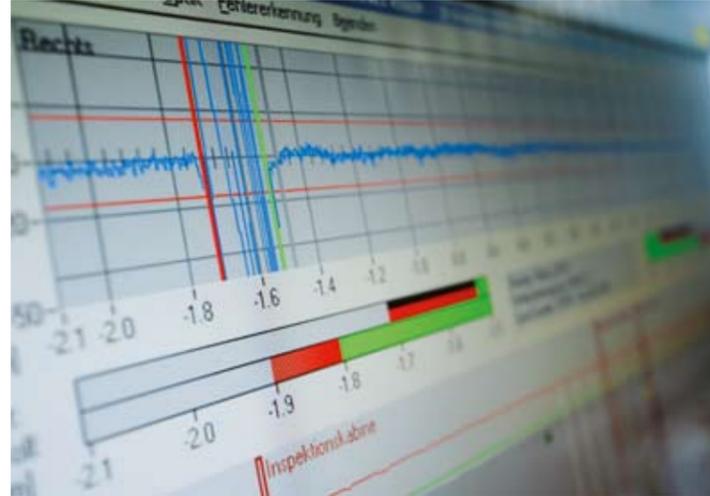
- Loaders to bring the glass into the production line
- Glass transport
- Washing machine
- Clean room with foil application
- Application of cover plate and edge trim
- Pre Lamination and transport of glass sheets to a stacker
- Stacking of sheets onto autoclav racks
- Autoclav
- Repacking on transport racks
- Optical inspection

Beside that tempered glass has is playing a dominant role in facades, furniture and other applications, where a certain strength of the glass is required. In addition in case of a breakage, the much smaller parts significantly reduce the change to be injured by sharp glass edges.

The components of a Grenzebach tempered glass line are

- Loaders to bring the glass into the production line
- Glass transport
- Seaming and grinding
- Washing machine
- Unloading

Control Technology made by Grenzebach



Control of the production process at all times, quick reaction and full use of the line capacity – the Grenzebach control system meets these requirements at its best.

Grenzebach offers a complete range of machine controls, always designed to the specific applications. From PLC control up to complex controls for robot moves. Operating menus can be recalled separately for production, quality assurance, maintenance and programming. The graphic operation concept is clearly structured and all stations are fully linked with each other. It is possible to determine in advance any function patterns while illogical entries are rejected and an explanation is given. Host computer and optimising system undertake overriding tasks such as production planning, administration of orders, capacity and quality optimised production and reporting to an ERP system with up and download function. This means that the Grenzebach system can be fully integrated into an existing ERP concept. Training programmes and teleservice to find fast solutions to problems support the operating staff. Updates can be uploaded easily.

Grenzebach offers a vast range of control technology for every level of automation:

- PLC controls for machine controlling
- IPC based controls
- CNC controls
- Robot controls
- Intelligent drive technology
- Visualisation and operation
- Host and optimisation systems
- Reporting tools
- ERP connection
- Training
- Teleservice and 24 hour service

Innovation made by Grenzebach



Ultrasonic bonding unites metal and glass

Wherever metal meets glass, the connection has previously been of rather short duration. However, interfaces of this kind are widely used in practice, such as in façade elements or brackets for solar modules. Grenzebach has addressed this topic and already registered a patent for ultrasonic welding. This process makes it possible to achieve a lasting bond between glass and metal. At present, the technology for ultrasonic welding is still being improved and refined; a test machine is already running. There are many interesting potential applications for this process, representing new markets for the Grenzebach Group once again.

The new vacuum insulating glass (VIG)

The production of sheets of glass with significantly improved insulating values represents a promising future technology. The new vacuum insulating glass (VIG) has heat transmission values that would otherwise only be possible with triple glazing. Instead of using a noble gas in between the panes for insulating purposes as in the past, VIG has a vacuum between two panes. This vacuum provides extraordinarily good insulation. In addition, the complete glazed panel is very thin, because the vacuum between the two panes of glass only needs to be about 1 mm thick. As a result, window glazing of this kind is perfectly suited for renovating old buildings. VIG is a real product for the future, but it does need a special manufacturing process. Grenzebach is conducting intensive research and development here. The first complete pilot plant for manufacturing vacuum insulating glass is planned for the near future.

Laser cutting

The laser cutting process runs similar to the conventional cutting process. Its absolute advantage, however, is the total lack of micro cracks on the glass surface. The Grenzebach laser cutter uses a CO2 laser with a specific wave length that is absorbed by the top glass layers and where it is converted into heat. A set of special and adjustable mirrors deflect and focus the laser beam over a specific length along the score line. This is done several hundreds of times within a second and heats up the glass surface in a controlled way. The heat is applied in a way that avoids negative effects to the glass structure.



GRENZEBACH Automation GmbH

Wikingerstraße 11
76189 Karlsruhe, Germany
Phone: +49 721 95240-4000
Fax: +49 721 95240-50
e-mail: info.ga@grenzebach.com

GRENZEBACH Corporation

10 Herring Road
Newnan, Georgia 30265, USA
Phone: +1 770 253-4980
Fax: +1 770 253-5189
e-mail: info.gn@grenzebach.com

GRENZEBACH Machinery (India) Pvt. Ltd.

Devdar 4th Floor, Plot No. 83, S.No. 98
Bhusari Colony, Poona 411038
Maharashtra, India
e-mail: info.gpun@grenzebach.com
e-mail: amod.patwardhan@grenzebach.com

GRENZEBACH Maschinenbau GmbH

Albanusstraße 1-3, Hamplar
86663 Asbach-Bäumenheim, Germany
Phone: +49 906 982-2000
Fax: +49 906 982-2108
e-mail: info@grenzebach.com

LJU Automatisierungstechnik GmbH

Am Schlahn 1
14476 Potsdam, Germany
Phone: +49 33201 414-16
Fax: +49 33201 414-19
e-mail: info.glju@grenzebach.com

GRENZEBACH Machinery (Shanghai) Ltd.

388 Minshen Road, Songjiang Industrial Zone
Shanghai 201612, P.R. China
Phone: +86 21 6126-8000
Fax: +86 21 57685220
e-mail: info.gs@grenzebach.com

GRENZEBACH Mashtech Ltd.

No. 61 Novocheremushkinskaya Street
Moscow 117418, Russia
Phone: +7 495 626-5881
Fax: +7 495 626-5882
e-mail: info.gmos@grenzebach.com

GRENZEBACH BSH GmbH

Rudolf-Grenzebach-Straße 1
36251 Bad Hersfeld, Germany
Phone: +49 6621 81-3000
Fax: +49 6621 81-93613
e-mail: info.gbsh@grenzebach.com

GRENZEBACH Algoscan GmbH

Machtlfinger Straße 21
81379 Munich, Germany
Phone: +49 89 748558-0
Fax: +49 89 748558-599
e-mail: info.gal@grenzebach.com

GRENZEBACH Machinery Taiwan Ltd.

No. 38, 2F, Keya Rd., Central Taiwan Science Park
Taichung 428, Taiwan R.O.C.
Phone: +886 4 25667796-101
Fax: +886 4 25687896
e-mail: info.gtai@grenzebach.com

GRENZEBACH Machinery S. r. L.

Via Savona 11
12045 Fossano, Cuneo, Italy
Mobile: +39 348 6042740
Fax: +39 0172 630716
e-mail: info.gfos@grenzebach.com