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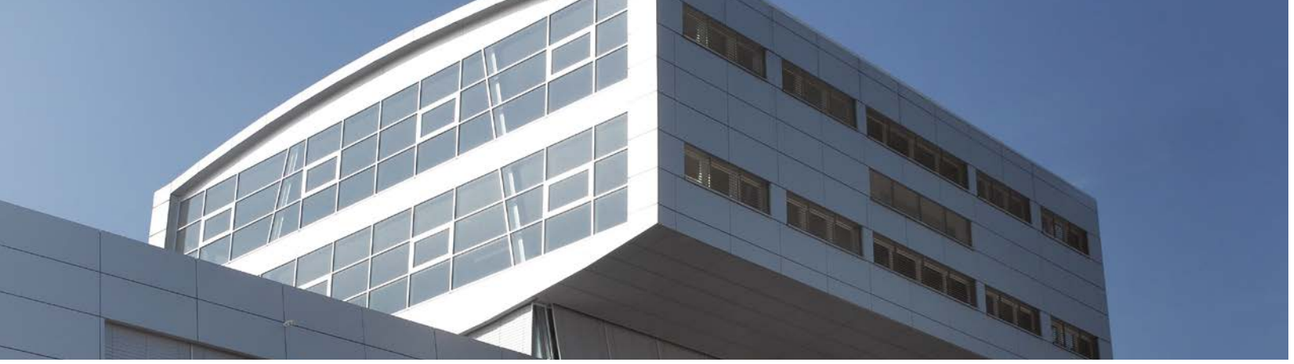
HICON®

EBNER Group Journal for Progress in Industrial Furnace Technology

HICONSABER®

THE EBNER FACILITY OF THE FUTURE



EBNER

**Ladies and Gentlemen,
Esteemed readers of the
HICON® Journal,
Dear friends and colleagues.**

2020 opens a new decade, a milestone bringing a time of both change and innovation at **EBNER**.

One of the most important goals that we have set for ourselves and, as is usual at **EBNER**, have defined in customer oriented terms, is *We make our customers Total Cost of Ownership champions*. **EBNER** facilities stand out due to the performance advantages they offer, features that despite higher initial investment costs make customers TCO champions in only a few years.

Please take the time to read the article on page 4, in which we show you concrete examples of significant differences between ourselves and competitors from America, Asia and Europe.

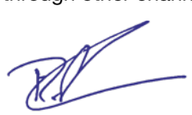
Turning to environmental issues, which are receiving more and more focus as time goes on, environmental impact and sustainability have played a significant role at **EBNER** for years. We will expand this approach even further in 2020 and work even more intensively on go-green developments and products, which should allow our customers to become showcase examples in this area as well.

In the meantime, the **EBNER HICON®** magazine has evolved into a magazine for the whole group. In this issue, you will thus find an exciting mix of themes and projects from every **EBNER** Group company.

I would, however, like to mention one article in particular You will certainly be able to remember that in 2018 we introduced a unique design for a bell annealer charging system that had been developed in-house here at **EBNER**. One such system has recently been successfully installed at one of our customer's works, and a full report can be found on page 28.

On a more unfortunate note, shortly before this issue went to print I learned to my regret that my team and I will not be able to meet you in person at the WIRE & TUBE trade fair (March 30 - April 3, 2020).

We will, of course, still be available to host individual visits to our company. Should you be interested, will strive to keep you informed of **EBNER**'s new developments through other channels and forms of presentation.



Yours, Robert Ebner
CEO

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TOTAL ACQUISITION COSTS

ONGOING OPERATING COSTS

TCO champion.

EBNER makes its customers Total Cost of Ownership champions.

What is TCO?

TCO stands for Total Cost of Ownership, a comprehensive measure of the costs of products, goods and services. It takes into account not only the cost of procurement, but also the direct and indirect running costs that are created over the complete service life of the product. This approach to costs provides valuable assistance when examining business-related questions such as whether or not to invest.

FRANZ WIESINGER

EBNER technical article

To companies that want to remain competitive in hotly contested markets, the nuts and bolts of long-term success are low operating costs, short production cycles, low energy costs and high quality the cost of procuring a facility that will remain in operation for twenty years or more makes up around 15 % of its overall cost. The remaining 85 % of its cost is comprised of continuous expenses for maintenance and repair, as well as the cost of energy. Together, these are the real cost drivers.

This larger fraction is often underestimated or ignored, as it is hidden at the time of purchase - it can be compared to an iceberg, the bulk of which is hidden below the surface of the water. This means that investment decisions are often made before adequate information on long-term running costs is available.

EBNER is quite aware of these long-term costs, for which reason a significant element in our strategy has been to make our customers TCO champions.

There are many features of our facilities that can make you a TCO champion:

- Short annealing times
- Low energy consumption
- High throughput capacity
- High facility availability
- Long service life
- Continuous improvement
- High economy
- World-wide service

EBNER is not shy of being directly compared to its competitors in any of these categories. As a pioneer in the field of industrial heat treatment, we have over 70 years of experience in furnace design and fabrication. Our high-quality manufacturing facilities in Austria, the USA and China guarantee not only the highest possible quality and the longest possible service life, but state-of-the-art technology as well. Those willing to take a look at all the costs when investing in a facility may be surprised to see how quickly they, despite an initially-higher investment, reach the break-even point and enter the circle of TCO champions.

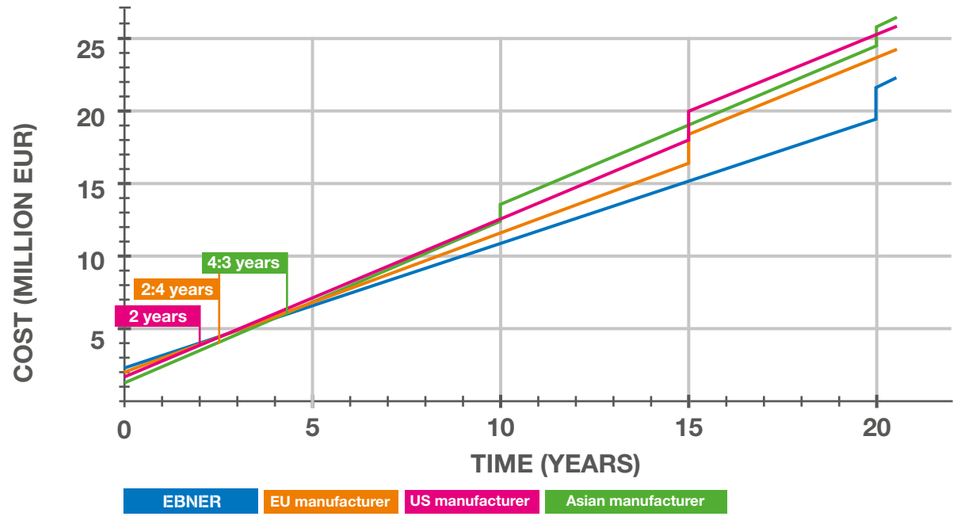
	ASIA	EU	USA
Production time (h/t)	30.4 %	4.7 %	30.4 %
Annual throughput (t/year)	-25.2 %	-5.3 %	-23.4 %
Energy consumption			
electrical power (kWh/t)	+30.5 %	-3.7 %	0 %
gas (m^3/t)	+8.5 %	+7.4 %	+10.3 %
Operating costs (OPEX)			
EUR/t	+28.7 %	+10.7 %	+23.7 %
EUR/year (identical throughput)	+21.2 %	+9.5 %	+17.1 %
Gross profit (EUR/t)	-21.2 %	-7.8 %	-17.4 %
Break-even point (max. throughput):	4.3 years	2.4 years	2.0 years

Comparison is based on a bell annealer facility with 3 workbases, 2 heating bells and 1 cooling bell (HOg 430/530 St-H_2-D).

Comparison with an Asian competitor
Despite the lower procurement costs offered by our competitor, the break-even point is reached at around 4.3 years of service. After 8 years of service, savings have reached over one million Euros.

Comparison with a European competitor
When compared to our European competition, our short processing cycles, high energy efficiency and high throughputs make you an **EBNER** TCO champion in only 2.4 years.

Comparison with an American competitor
Despite the higher procurement costs of an **EBNER** facility, the break-even point is reached after only about 2.0 years. After 15 years of service, savings have reached 4.8 million Euros.



New and unique.

HPI/Gautschi Casthouse Revolution Center – start up in April, 2020 in Ranshofen.

TOM JUMELET

GAUTSCHI News
from Austria

RAINER EDTMEIER

HPI news
from Austria

With the joint forces of HPI and Gautschi under the umbrella of the EBNER Group, it was clear that our shared market position as the full solution provider of aluminum casthouses would be strengthened.

BACKGROUND AND GOALS

Our combined product lines include melting furnaces for both primary applications and a variety of common types of scrap. They include furnaces with capacities from 8 to 140 t and melt rates up to 40 t/h, horizontal (HPI) and vertical (Gautschi) casting machines and heat treatment furnaces designed for either continuous or batch operation. Charging machines, US testing systems and billet sawing machines round out our product range.

Both HPI and Gautschi have been supplying the international aluminum industry with casting facilities for billets and slabs for many years, though HPI has focused on horizontal casting while Gautschi has focused on vertical casting.

Several years ago, Gautschi began to refine an existing mold design for vertical continuous casting that had proven itself in industrial applications. The main goals were to increase yields and to enable a completely autonomous casting process - without any intervention by the operators required.

The increase in yield would be achieved primarily by reducing butt curl (distortion of the bottom part of the billet that develops during the initial stage of casting), but also by reducing butt swell (expansion of the bottom part of the billet).

This innovative mold has successfully gone into operation at Aleris' Belgian works, and other projects are currently underway in the USA and China. Tests carried out on 3xxx, 5xxx,6xxx and 7xxx alloys showed a significant improvement in yields, paired with extremely high process safety: it was no longer necessary for the operators to intervene in the casting process.

Decades of continuous progress and the technical development that has come with it have made HPI the technology leader in many aspects of horizontal casting. Together with its customers and project partners, HPI is constantly pushing the development of molds, materials and equipment forward.

HPI/GAUTSCHI CASTING CENTER IN RANSHOFEN, AUSTRIA

The technologies used in continuous casting, as well as the automation systems that are associated with them, are very advanced. Interventions in the process sequence by the operators, in particular those around molten metal, have become virtually unnecessary. This ensures that the highest safety-related requirements can be fulfilled.

The newly-built Casthouse REvolution Center includes facilities for both vertical and horizontal casting, and is located immediately next to the office building.

CASTHOUSE DESIGN

A dedicated hall was built for the pilot facility next to HPI's offices in Ranshofen. Two complete, automated casting lines are installed:

» **Gautschi line**
The line installed by Gautschi is comprised of a 7.5 t gas-fired casting furnace, equipped with the appropriate metal treatment equipment. Paired with a full-scale vertical casting unit sized for industrial production this line fulfills all the requirements for carrying out state-of-the-art technological casts, even with regard to automation and hands-free casting.

» **HPI line**
HPI installed the horizontal casting line, which incorporates an electric furnace, in-line metal treatment and a state-of-the-art casting facility. If needed, the 7.5 t furnace from the neighboring Gautschi line can also be used.

A fully-equipped lab with metallographical and analytical equipment has also been provided, where all required testing and sampling can be carried out.

STARTUP

The first casts are planned for the end of the first quarter, 2020. The casting center will then be available to fill a wide variety of roles, as a casthouse for customer projects, trial runs, training and product development. In particular, these will include:

» Training and testing for our customers
» Mold development, both customized and general
» Customized alloy development
» (Small) production runs with exotic/small batches for our customers
» Technological development such as advanced burner technology and CO_2-free melting

www.c-r-c.info

HPI's new offices in Ranshofen, Austria

FEEL FREE TO CONTACT US!

If you are interested in visiting our new casting center for a demonstration, specific tests or small production runs, please feel free to contact

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HPI Managing Director and Head of Sales
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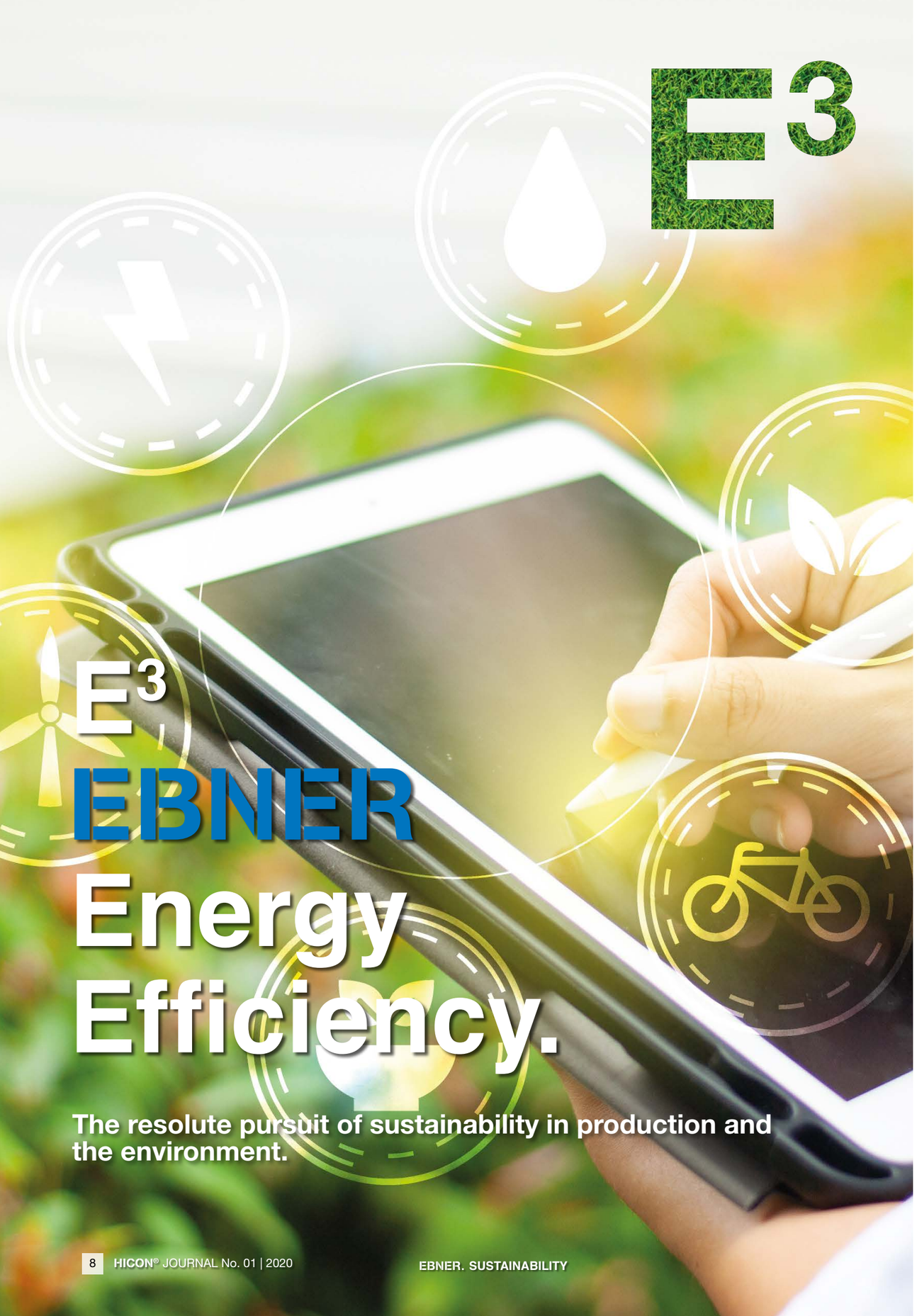


WALTER VORTREFFLICH

EBNER sustainability

EBNER takes environmental responsibility very seriously. To us, “economy” and “ecology” are not opposites. As a globally-active family-owned company we constantly take an environmentally-aware approach, setting standards for environmentally-friendly production.

Customers place their trust in **EBNER**, not only because we are the world market leader for heat treatment furnace facilities but also because we are pioneers in the field of environmental protection.

E³ - EBNER ENERGY EFFICIENCY.

Within the framework of sustainable production, **EBNER** focuses on the environment and has developed facilities with an exceptional degree of energy efficiency.

Through the use of new technologies such as energy recovery, lightweight workbases or combustion air preheating using large recuperators, **EBNER** has continuously improved the energy efficiency of its facilities.

Comparisons made by customers between our facilities and those from our competitors show that we have a clear and measurable advantage in terms of energy consumption. Today, it is already possible to operate the majority of our facilities CO_2-neutrally with renewable energy. Our goal is to enable climate-neutral operation of every **EBNER** facility by 2024, using renewable energy.

SUSTAINABILITY AT EBNER

As a pioneer in the field of industrial plant engineering, we recognize the responsibility we have toward the environment. It is for this reason that we have deeply anchored the principle of sustainability in our company’s goals, obligating ourselves to uphold it.

GUIDING PRINCIPLES FOR SUSTAINABILITY IN THE EBNER GROUP

- Sustainability is a significant element in our company strategy.
- Our technology and solutions require sustainable development.
- Sustainability in thought and action is reflected in our processes and in our products.
- We conserve resources, and actively take measures for environmental protection.
- In each of our regions, we accept our social responsibilities.

Concrete measures for environmental protection are laid down in the **E³** principles, and include the areas listed below.

26 % energy savings
through the use of hydrogen as a process atmosphere

Heat exchanging bells for maximum energy utilization
25 % energy savings with the use of an **EBNER** heat exchanging bell

8 % reduction in CO_2 emissions
through combustion air preheating with an **EBNER** large recuperator

Up to 50 % energy savings
through thermal energy recovery

40 % hydrogen savings
through process atmosphere recycling

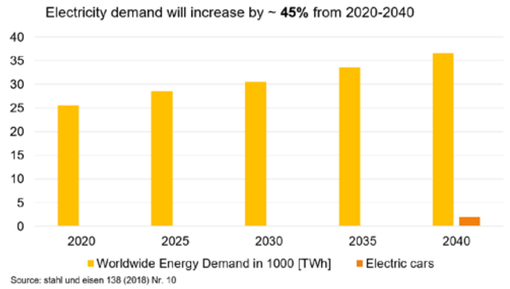
ECO-friendly technology

Heat treatment facilities of the future.

The effects of increasing global energy demand on grain-oriented electrical strip.

MARIUS KREUZEDER
EBNER technical article

The global demand for electrical power will grow by about 45 % between 2020 and 2045. In turn, this will require expansion of existing energy infrastructure over the next few decades. The increase in demand will be caused not only by the increasing numbers of electric vehicles, but also by the general increase in the availability of electricity throughout the world. Paired with the demand for power is a strong and ever-increasing interest in grain-oriented electrical steel strip (~7 % CAGR), which is used in the manufacture of efficient transformers.

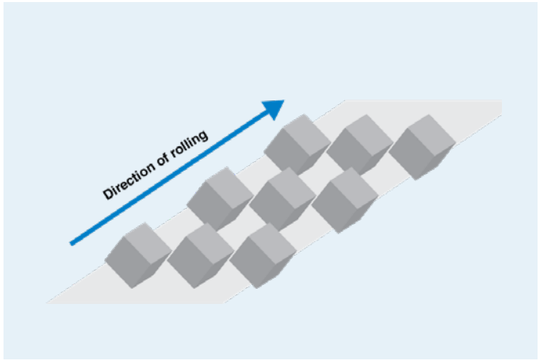


Transformers are essential components of any power distribution network. They are needed to convert current into a suitable form before it can be transported or used.

The core of the transformer needed for this conversion consists of efficient grain-oriented (GO) electrical steel strip, which is also known under a variety of names such as silicon steel and transformer steel. Transformers can be generally divided into two types, large power transformers and the smaller distribution transformers.

The use of standard grades of CGO (conventional grain-oriented) steel is generally used for distribution transformers, while the highly-efficient HGO (highly permeable grain-oriented) grades are preferred for power transformers.

Grain-oriented electrical steel strip is particularly well-suited for use in transformers, as in static applications the magnetic fluxes run in defined directions. The grain oriented electrical steel strip has outstanding magnetic



Perfect Goss orientation of the grains in the direction of rolling

properties in the direction of rolling, due to a preferential orientation of the grains. The strict orientation of the easily-magnetizable grains, known as “Goss” orientation (see figure *Perfect Goss orientation of the grains in the direction of rolling*), makes the magnetization processes in the direction of rolling very favorable in terms of energy.

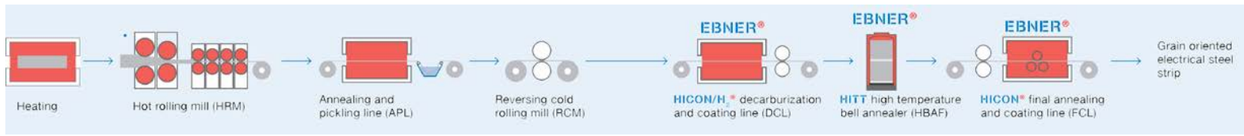
To reduce eddy current losses and improve energy efficiency, extremely thin material (0.18 - 0.35 mm) is used, grain sizes up to several cm are selected and the material is alloyed with around 3 % Si.

Compared to NGO electrical steel strip, the production of GO electrical steel requires a highly complex, multi-stage heat treatment process. The complete production workflow can be seen in the figure shown below. It is very important that the individual heat treatment steps are perfectly matched with the alloying system in order to achieve the best magnetic properties. **EBNER** offers the facilities described below for this application:

» HICON/H_2® decarburizing and coating line (DCL)

After cold rolling, grain-oriented electrical steel strip is heat treated in a continuous furnace to decarburize and recrystallize it. In **EBNER HICON/H_2®** decarburizing lines, this process takes place in a finely-tuned and precisely-maintained furnace atmosphere. The highly efficient and consistent decarburization process inhibits magnetic aging, and ensures the long-term efficiency of a transformer. Optionally, ammonia can also be used to nitride special HGO (highly-permeable grain-oriented) grades in a nitriding zone following decarburization, which improves magnetic characteristics even further

Production workflow of grain-oriented electrical steel strip



HICON/H_2® decarburization line at GO Stalprodukt, Frydek-Mistek, Czech Republic

during the high-temperature anneal. The strip is then cooled slowly and evenly, and coated with a magnesium oxide layer in either an in-line or off-line process. **EBNER** offers these lines in cooperation with selected strip handling partners.

THE STRENGTHS OF AN EBNER FACILITY, COMPARED TO STANDARD DESIGNS, PROVIDE SIGNIFICANT ADVANTAGES TO OUR CUSTOMERS AND INCLUDE THE FOLLOWING:

» **Precise atmosphere flow, separation of atmospheres and exact control of the atmosphere humidification and supply system**

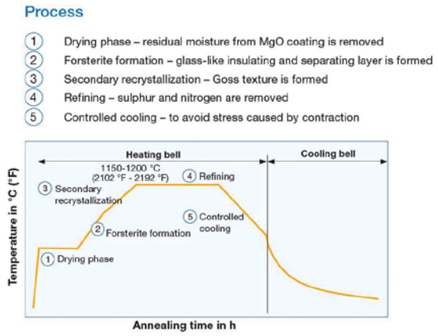
- Perfect dewpoint control using the humidifier
- Controlled convection to ensure even decarburization
- Low CO levels to increase the decarburization rate
- No contamination of the atmospheres from the different technological zones

» **Extremely low carbon contents (< 0.0030 % C, 30 ppm)** ensure the best possible magnetic properties without aging

» **The very latest burner/radiant tube technology and rapid heating-up systems** for high heating gradients to achieve efficient decarburization and improved texture (crystalline orientation)

» **HITT high temperature bell annealer facility (HBAF)**

For high-temperature anneals (HTA), **EBNER** has developed the **HITT** (High Temperature & Tight) line of 2-stack bell annealers High-temperature anneals use secondary recrystallization to form grains with the magnetically advantageous Goss texture (3). The high processing temperatures (above 1150 °C) and straight hydrogen atmospheres also remove sulfur and nitrogen from the material. First, a drying phase (1) is used to dry the MgO coating applied during an upstream process, which inhibits the formation of stickers in the wraps at high workload space temperatures by forming a Forsterite layer (2). The processing steps (1 - 5) of the high-temperature anneal are depicted schematically below.



Schematic representation of a **HITT** annealing cycle and its component phases

In contrast to standard multi-stack furnace designs, a **HITT** bell annealer is a gas-tight design in which each coil stack is enclosed within a single heating bell. The atmosphere around each coil stack is isolated from the surrounding heating or cooling chamber by the hydraulically-clamped inner cover, with its silicone seal.

The heating system may be gas-fired or electric, ensuring that the facility operates as economically as possible. A cooling bell is employed to ensure rapid cooling, which takes place in 100 % hydrogen.

The features described above provide customers with significant advantages when compared to standard designs:

» **Homogeneous magnetic properties, shorter annealing cycles, extended inner cover service life, increased productivity** due to uniform temperature distribution within the charge stack thanks to the patented coil support structure and symmetrical heating

» **Significantly reduced consumption of N_2 and H_2 (up to 50 %, compared to other designs)** thanks to the encapsulated workload space; argon is not required as a process atmosphere in the cooling phase

» **Significantly increased productivity, improved surface finish and prevention of further nitriding** by cooling in 100 % hydrogen atmosphere

» **HICON® final annealing and coating line (FCL)**

The **HICON®** final annealing and coating line is the last production step in terms of heat treatment. The material is coated with an inorganic and surfactant insulating coating, and is then dried and sintered in a catenary furnace. This is followed by thermal leveling (thermo-stretching) in a continuous furnace, which takes place in atmosphere to improve flatness without affecting the magnetic characteristics. In this production step, the challenge is not only to provide the correct strip tension but also to apply the correct thickness/composition of coating to achieve optimal magnetic and geometric properties.

EBNER offers these lines in cooperation with selected strip handling partners.

Unique characteristics of our lines include the following:

» **Controlled thermal leveling provides perfect control over the geometric properties** of the final product

» **Homogeneous controlled cooling** ensures ideal flatness and prevents interior stresses

HITT high-temperature bell annealer (HBAF) charged with 2 GO coils

TECHNICAL DATA	
workload space diameter:	2200 mm
charging height:	3000 mm
max. net charge:	36 t
heating:	gas-fired or electric heated

Automated non-destructive quality assurance

HPI supplies a variety of solutions for non-destructive material testing.

RAINER EDTMEIER

HPI news
from Austria

The constant increase of the safety requirements for aircraft also leads to the continuous improvement of quality control. These notably expensive controls can be both sped up and fully documented by using automated testing procedures.

In particular, non-destructive methods of material testing can be used. Among these methods is conductivity testing, currently employed by our customer KUMZ, for which a system was successfully handed over at the end of November, 2019.

CONDUCTIVITY TESTING

Conductivity is a physical measure reflecting the ability of a material to conduct electric current. Conductivity is the constant of proportionality between the density of the current and the strength of the electrical field. In a formula, it is usually represented by the Greek letter sigma (σ). The value itself is usually given in a derived SI unit, *siemens per meter* (S/m) - e.g. A/(Vm). As aluminum alloys exhibit very high conductivity, values are given in MS/m in all typical applications. When providing values, another possibility is to use the international copper standard. In this case, a value is given as a percentage of the conductivity of pure annealed copper. For this reason it is referred to as *percent of International Annealed Copper Standard*, abbreviated %IACS.

When measuring conductivity using eddy currents, a fluctuating magnetic field is created using a coil. This induces a voltage in the material to be tested. Depending on the specific conductivity of the material, eddy currents develop in the material that in turn generate a second magnetic field. In accordance with Lenz's law, this magnetic field opposes the first field and and is measured with a second coil. The amplitude and phase of the signal that is received are important when assessing the conductivity. Due to the "skin effect", the eddy currents are more dense in layers near the surface; the higher the frequency of the magnetic field, the less it penetrates into the material.

To use an eddy current testing method is to use a fast, comparative method. That is, a reference standard is compared to the tested material to, for example, determine the success of heat treatment, the microstructure, or alloy composition.

A roller table moves an aluminum slab through a fixed measuring unit, in which the specific conductivity is measured by oscillating probes positioned above and below the plate.

Thickness measurement

Conductivity testing

The sampling programs can be pre-defined for each plate, and are based on internationally recognized standards such as ASTME 1004-02, MIL STD-1537C, EN2004-1 and AMS 2772F, as well as on the customer-specific testing regulations encountered in the aerospace industry.

When used in the laboratory, it is relatively simple to control physical influencing factors such as the lift-off effect, edge effect and the temperature during measurement. In industrial applications under harsh conditions, this can be an extremely challenging task.

GEOMETRIC MEASUREMENT

The contact-free measurement of plates is carried out using laser triangulation on a precisely-aligned measuring table 35 meters in length. The high-speed control system collects and processes data as a measuring frame travels over the plate. Along with the length and width, the flatness and squareness can be determined and displayed to the operators at the operator interface. Mechanical measuring probes also determine the plate thickness, depending on the temperature, at different freely-selected positions.

PLATE MARKING

Following conductivity measurement, plates pass through a marking station. Here, ink jet heads mark the upper surface of the plates in accordance with either of the marking variants described in the ASTM B-666 and ASTM B-666 M-01 standards. For plate widths up to 2000 mm, the desired text is printed in lines spaced up to 150 mm apart. Plates with widths over 2000 mm are printed with two lines along their circumference.

A needle printing station is installed at the end of the facility which, depending on the thickness of the plate, scribes the upper or front sides with a pre-selected text. Depending on the specifications, this text can be generated from a combination of the plate ID number, date or other characteristics.

DATA PROCESSING AND DOCUMENTATION

All required basic data such as the unique plate ID number and the testing specifications that must be observed are sent to the facility by the higher level Manufacturing Execution System (MES, level 3). In return, all information starting with the measurement and calibration data and continuing on up to the marking options for the ink jet and needle printers is displayed at the operating station, saved, and transmitted to the level 3 system. This ensures full documentation of the testing procedure.

Geometric measurement

EBNER strip cleaning unit with strip transfer from the rinsing zones to the dryer

EBNER strip cleaning facilities.

Integrated into annealing lines or as stand-alone equipment.

HUBERT BINDREITER
EBNER technical article

The incoming material for continuous strand annealing lines generally comes from a cold rolling mill, and the surface of the roll-hardened strip is generally covered with rolling lubricant, rolling lubricant emulsion and metal fines. This means that it is necessary to clean the strip before annealing.

Residual lubricants adhering to the surface of the strip negatively influence both the stability of the process and the quality of the strip. Furthermore, clean strip surfaces minimize contamination inside the furnace, and so increase the availability of a facility.

THE DEVELOPMENT OF EBNER STRIP CLEANING SYSTEMS

In the past, over 20 projects involving strip cleaning systems were implemented in partnership with Nisterhammer, a specialist in strip cleaning systems. During these projects, the complete automation system and all commissioning work were provided by EBNER.

When Nisterhammer shut down operations in 2014, EBNER was faced with the challenge of either finding an alternative partner or expanding its its existing know-how and turning it into a new EBNER product.

The basic technology possessed by Nisterhammer was acquired, improved by a team of experts, and developed into a new line of products.

GENERAL PRINCIPLES AND LAYOUT

A cleaning facility consists of 3 cleaning zones, with a dryer installed downstream of them. The individual zones are separated by pairs of squeeze rolls.

» Cleaning zone 1: the high pressure zone

Hot demineralized water:, **without any chemical cleaning agents added** heats the strip and the rolling lubricant/lubricant emulsion adhering to it. The lubricant and emulsion are then washed off the strip. This is carried out at high pressure by special nozzles. A full-flow filtering process is then used to efficiently separate the mixture of lubricant and demineralized water in a coalesence separator. Thus, clean water is again available for further use in the water circuit.

» Cleaning zone 2: the brushing zone

In this zone, nozzles spray hot lye over the strip - or, in **new design variants**, **no chemical cleaning agents** are used. The film of lubricant still coating the strip is broken up by rotating brushes, which support the cleaning effect. This also washes off any remaining fines.

» Cleaning zone 3: the rinsing

In the three-stage rinsing zone, the strip is rinsed with hot demineralized water to remove any alkaline residues.

The system is built as a series of cascades. Fresh demineralized water is only supplied to rinsing zone 3, and runs back to the upstream rinsing and/or cleaning zones. This ensures that the consumption of fresh water is kept low.

After the cleaning process, the strip runs through the HICON® dryer.

» HICON® dryer

The high-convection dryer removes any residual moisture from the surface of the strip.

The following heating systems are available:

- Electric heating system
- Natural gas heating system
- Steam heating system
- Combined systems making use of waste heat from the annealing furnace

INTEGRATING A STRIP CLEANING FACILITY INTO AN ANNEALING LINE

In 2019, two strip cleaning facilities were integrated into continuous bright annealing lines and successfully went into operation.

The line at VDM Metals (Werdohl , Germany) processes thick special alloy (Ni-based, Fe-based, etc.) strip (see the report in HICON® Journal no. 02/2019, pp. 4 - 7).
At Arinox S.p.A. (Sestri Levante, Italy), wide and thin precision steel strip is processed at high line speeds.

STRIP CLEANING FACILITIES IN STAND-ALONE DESIGNS

Operating a strip cleaning facility as an offline unit can make good sense.
Roll-hardened material that does not require a final heat treatment step can be cleaned without a complicated bypass of the furnace and the consequent loss of valuable annealing capacity.
Several annealing lines can be supplied with material from a central cleaning facility, meaning that the annealing lines do not require integrated cleaning sections.
A stand-alone strip cleaning facility offers a high degree of flexibility, as the design of the facility does not need to take into account any limitations on line speed that may be required by the heat treatment process.
Finally, as it is not absolutely necessary to operate the strip cleaning facility continuously, the strip handling systems can be relatively simple.

ADVANTAGES OF THE EBNER SYSTEM

Cleaning with pure demineralized water in the first cleaning zone	+ Low operating costs due to a 50 - 100 % reduction in the consumption of alkaline cleaning agents + Eco-friendly
Efficient separation of lubricant and water using full-flow filtering	+ Perfect cleaning results + Simple waste water treatment + Eco-friendly
Special roller bearings and guides	+ Elimination of strip off-tracking / wrinkle formation
Conductivity regulation in brushing and rinsing zones	+ Highly-stable process + Improved cleaning and rinsing results
Multiple uses of demineralized water (cascade principle)	+ Low demineralized water consumption (approx. 1 m³/h)
Use of waste heat from the furnace to heat the dryer and utility tanks	+ Low operating costs due to savings of up to 200 kWh/h
Fleece rollers used for final squeezing	+ Perfect drying results

SAVINGS IN UTILITY SUPPLY COSTS (LYE, ELECTRICITY, DEMINERALIZED WATER) OF 40 - 50 %, COMPARED TO STANDARD FACILITY DESIGNS

The best of both worlds.

Aluminum and steel.

HERBERT GABRIEL

EBNER news
from the USA

The title of our customer symposium hosted last fall at EBNER Furnaces in Wadsworth, Ohio (USA) said it all.

At the symposium, thermal processing solutions for both metals were reviewed with the goal of inspiring ideas on how each industry can adopt methods that may help improve their own “world”.
To achieve this goal, we invited speakers from all the **EBNER** Group companies: Gautschi, HPI and our newest member, GNA Alutech.

Around 25 customers participated in the two-day symposium, where topics ranged from safety, equipment modernization and digitalization to equipment design. A session on customer services solutions and **EBNER**’s recent and current R&D projects rounded the program out - along with evening programs, of course.

Our guest speaker from Alumore gave us great overview of a modernization project at a vertical casting pit, while Kaleb Wright from GNA introduced us to the fully automatic casthouse, where the processes and equipment are integrated into a much safer and more economical solution.

Rainer Edtmeier, HPI’s General Manager, introduced the group to the advantages of their horizontal casting plants for extrusion and forging billets, plates and slabs. One of the highlights was the progress report on the construction of their new pilot casthouse plant (Casthouse Revolution Center) in Austria, where customers can see these advantages first hand. They can also develop casting processes and alloys at the plant, as well as obtain hands-on training for their operators with real equipment and liquid metal.

The casthouse was designed in close cooperation with Gautschi, and so naturally includes a vertical casting pit. Tom Jumelet, Gautschi’s Chief Technology Officer, presented the aspects of vertical direct chill casting for rolling slab. This process uses their brand-new mold, which is getting a lot of attention due to lower CAPEX and OPEX.

Further symposium topics included recent and current R&D projects at **EBNER**, Gautschi and HPI. Thermal process digitalization was covered by our Chief Sales Officer, Walter Vortrefflich.

A presentation on our full range of Customer Service capabilities was the segue from liquid metals to the thermal processing of solid metals.

Advances in the field of aluminum heat treatment lines, from pre-heating, annealing and solution heat treatment to aging, were intensively discussed. A relatively new application, the hot forming of aluminum blanks for the automotive industry, was presented. This included an introduction to the pilot roller hearth furnace in our R&D facility in Austria, where we can assist our customers with product development

EBNER’s most recent development, a fully automated charging and equipment handling system for bell annealer facilities, could not be left out and yet another presentation described it in detail. This new system has just been installed at one of our customer’s works. You can read more about this installation in the article on page 28.

Our steel audience took note of **EBNER**’s product range for the processing of electrical steels (both NGO and GO grades), as well as our solutionsfor the processing of advanced and third-generation high strength steels in batch and continuous lines.

The symposium was rounded off by a round table discussion on future industry needs, and of course a social program with visits to the local Wolf Creek Winery and an “Octoberfest” celebration with live music at the **EBNER** company pavilion where everybody had a good time.

We would like to express our heartfelt thanks to all participants and organizers for making this a stimulating symposium.

www.ebnerfurnaces.com

Herbert Gabriel , Managing Director **EBNER** Furnaces, USA

Proven EBNER technology.

The success of HICON® floater furnace facilities in China, as seen at Chalco Ruimin.

CHALCO RUIMIN. CHINA

ZHANG LU

EBNER news
from China

CHEN BIN

EBNER News
from China

At 10:18 a.m. on November 18, 2019, customer Chalco Ruimin celebrated the end of its "production line project of aluminum alloy plate and strip for automobile lightweight" with an equipment assessment and acceptance ceremony, held in the warm winter sun to the sound of firecrackers.

The customer expressed their sincere approval for the efforts and fruitful work of those participating in the project, their great expectations for future production, and planned follow-up projects with subsequent equipment. At the end of ceremony, the final acceptance inspection certificate (FAC) of the project was signed by both the customer and the equipment supplier representative. **EBNER**'s 000726 Chalco Ruimin air cushion furnace project had come to a successful end!

ADVANCED TECHNOLOGY

EBNER's rich experience, along with the advanced technology of **HICON®** air cushion furnaces, established a good foundation for the success of the project. **EBNER**'s 000726 Chalco Ruimin air cushion furnace project is the first time that **EBNER** installed the new **SmartQuench®** functionality for a Chinese customer. This technology allows the continuous adjustment of cooling rates within a range from 500 °C/s to 10 °C/s, and its advanced nature has won market recognition for **EBNER**.

RELIABLE QUALITY

The importance of quality for a company is self-evident, and is a determining factor in the vitality of a company. **EBNER** adheres to the concept of *quality first*, and instills this concept into every process making up the production, installation, testing and commissioning of a product.

Every **EBNER** employee knows that only by firmly controlling the quality, then we can bring reliable products to our customers, and reliable equipment means a reliable future for our customers.

EFFICIENT MANAGEMENT

Although the project is subject to many uncontrollable factors, it ran according to plan. The production line was handed over to the customer on time, thanks to efficient management and excellent cooperation within the team.

Air cushion furnace facility: view towards furnace from quench

CHALCO RUIMIN. CHINA

Today, time means opportunity and profit – so the efficiency of **EBNER**'s management directly leads to customer satisfaction.

THE FUTURE

EBNER's involvement in China's air cushion furnace market originated with Chalco Southwest Aluminum. This was also the first time that **EBNER** air cushion furnace had entered the Chinese market.

Up to December, 2019, seven air cushion furnace production lines had been put into production in the Chinese market. Another four air cushion furnace production lines are in the design, manufacturing or installation phases, and will go into production in the near future. With the continuous development of vehicles using new energies, the demand for high-end aluminum plate for automobiles is increasing.

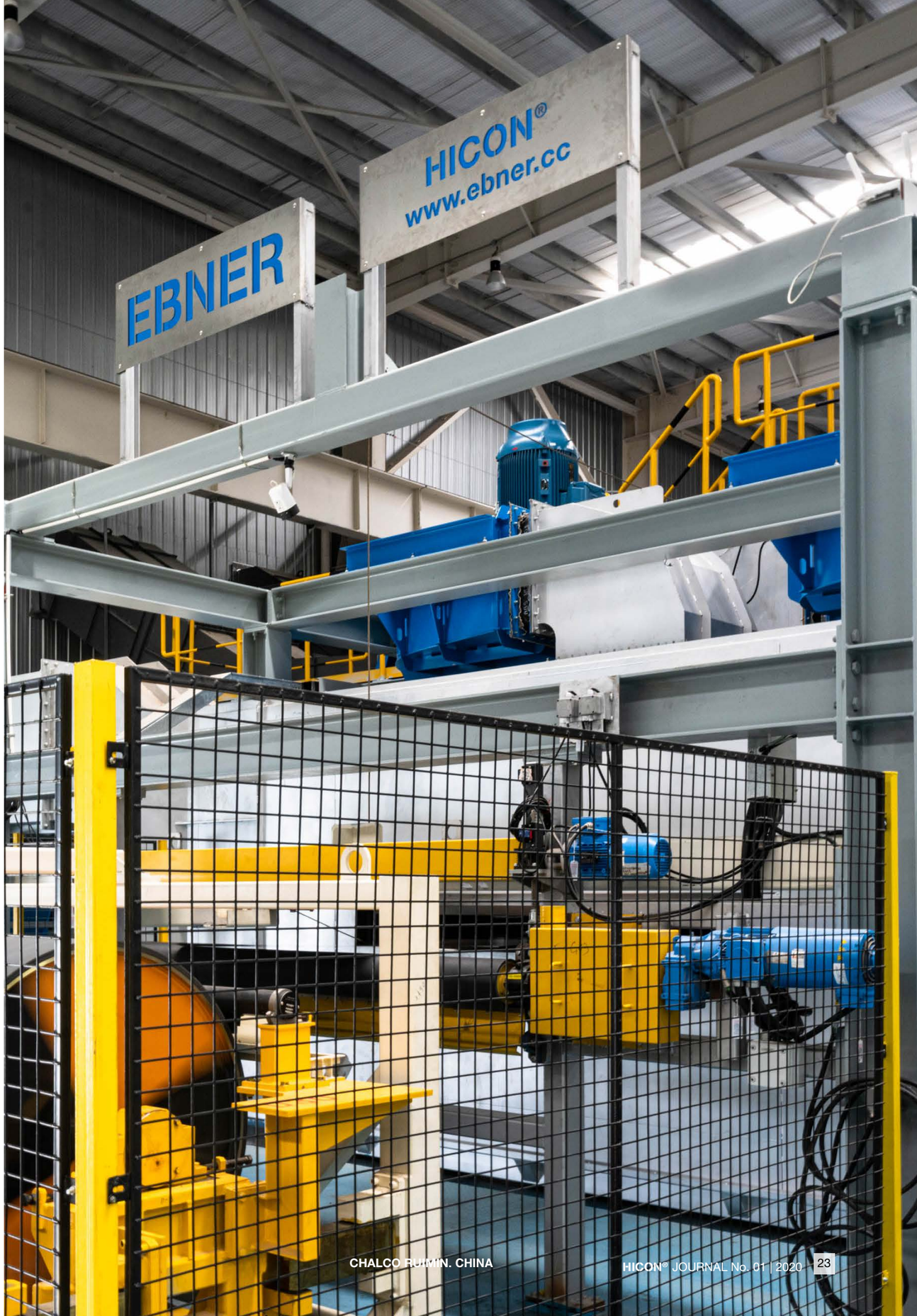
In order to meet the needs of the leap forward in the development of aluminum processing at Chalco, as well as to meet the increasingly strict requirements of the Chinese market for high-end plate and strip such as automotive plate or aviation plate, Chalco Ruimin selected **EBNER** air cushion furnace equipment.

EBNER will continue to help and support the growth of China's automotive market.

www.ruimin.com

TECHNICAL DATA OF FACILITY	
length of heating section	abt. 72 m
length of cooling section	32.3 m

EBNER HICON® reheat/aging furnace



Those who constantly improve stay on top.

From technological leaps and go-green developments on up to digitalization.

PETER SEEMANN

EBNER Research & Development

One of the most significant challenges of a fast-paced economy is the ability to quickly develop innovative ideas into profitable products and to find those products a long-term, competitive position in the market. To do so, EBNER makes use of structured, systematic processes.

WHAT FORM DOES THE INNOVATION PROCESS TAKE AT EBNER?

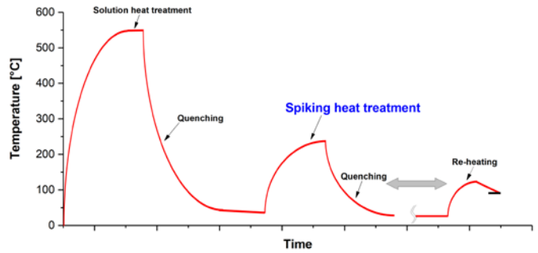
Innovative ideas are submitted to and collected at the **EBNER** Innovation Hub (EIH). A panel of experts, along with the employees who submitted the ideas, then evaluate the submissions and a decision is made as to which ideas to pursue. Every innovation is documented in a database at the EIH. This allows evaluations and analyses to be made and information to be displayed graphically, e.g. as a portfolio representation.

The inspiration for such innovative ideas comes from our customers, the industry, scientific research and of course from our employees. Ideas are recorded in an innovation “fact sheet”, and then described and evaluated in light of technical, economic and strategic criteria. If an innovation is "ready", it shifts to a product development process for further work.

The process of product development is carried out in a classic *stage-gate* process. For every phase, as well as for every gate, template documents stand ready for reporting, documentation and evaluation. These describe the required content, information and supporting records that are used by the panel of experts responsible for the relevant gate during the decision-making process. Evaluations are made using comparable criteria and indicators. This allows direct comparison of product development projects, evaluations and portfolio analyses.

Adaptive forms of these processes were deliberately chosen. Depending on the complexity and technical maturity of an innovation, it may move through the entire process or through an abbreviated/accelerated one. This minimizes the associated work, increases acceptance and the chances of success, and allows a flexible reaction to changes to the situation that occur at short notice.
At the end of the process a finished, market-ready product with an attractive potential return is available, and it is handed over to the Sales Department and Customer Services for marketing.
The following four **EBNER** developments are almost ready to market or have recently been placed on the market.

SPIKING FURNACE



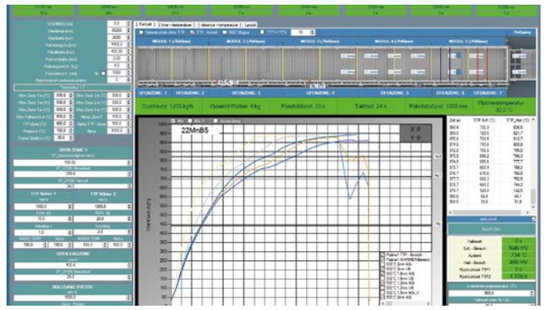
A typical heat treatment profile for AA6xxx strip during processing in a CASH line with additional spiking heat treatment

Spiking is a fast, short-duration heat treatment applied shortly after continuous solution annealing and quenching of AA6xxx automotive strip. It is an additional form of heat treatment differing from a reheating/pre-aging or stabilizing treatment flat-rolled automotive AA6xxx alloys processed with an additional spiking heat treatment step show increases in paint bake strength up to 7 %. **EBNER** has already manufactured and installed one such spiking furnace at one of the leading producers of automotive AA6xxx strip. Two other spiking lines will be installed soon in North America.

ALUMINUM HOT FORMING FURNACE

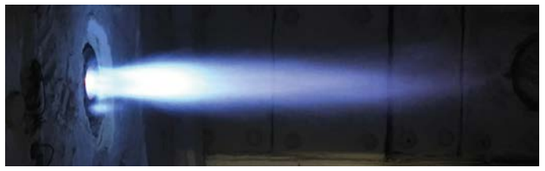
The aluminum hot forming furnace is a newly developed solution heat treatment furnace based on high convection heating technology (**HICON**®). It provides fast heating along with excellent temperature uniformity, meeting the CQI-9 standard for the automotive industry. An aluminum hot forming furnace heat treats high strength aluminum alloys to increase their formability, allowing 3D parts with complex shapes to be manufactured using hot forming and quenching (HFQ) technology. **EBNER** has two different designs for hot forming furnaces, depending on the throughput and footprint requirements. The first is the multi-level batch furnace, while the second is the roller-hearth furnace. A prototype roller-hearth hot forming furnace has already been installed in the **EBNER** R&D laboratory, to showcase aluminum hot forming solutions to customers.

A prototype roller-hearth furnace for aluminum hot forming



Depiction of the partial heating and cooling of blanks during tailored tempering

ADVANCED BURNERS AND ALTERNATIVE HEATING SYSTEMS



ECOBURN burner in the combustion chamber during trials

The main focus in this area has been optimization of the **EBNER ECOBURN** family of burners, to ensure the lowest possible NOx emissions – whether with burners that operate normally with a flame or burners designed for flameless combustion. These developments are of great importance to ensure that strict emissions guidelines such as the MCP (Medium Combustion Plant Directive) can be met. Work is currently focused on the **ECOBURN** FL burner, which is employed in high-temperature bright annealing lines and hardening and tempering lines, as well as in bell annealers. All developments will be integrated into other **ECOBURN** burners in the future, so that they are also optimized. In the **RECOTEB**® 2 project, long-term trials of a new double-P radiant tube burner are currently being carried at a hot-dip galvanizing facility. These trials will allow information on the service life, efficiency and NOx emissions to be gathered under production conditions. Along with reducing emissions when using natural gas as a fuel gas, work is also being carried out on alternative methods of reducing CO_2.

PROCESS MODELING

Increasingly complex heat treatment cycles, paired with increasing demands on process and production control systems, have meant that model-based control (Model Predictive Control, MPC) is also increasing in importance. Currently, multiple models are in development at **EBNER** that will cover almost our entire line of facilities. These models supply not only optimized control of the furnace with regard to the precision of the process, but can also intervene in the production control system to minimize scrap and downtime. In a preliminary step, the models can be used to precalculate changes in processes or dimensions, ensuring optimal setpoint changes. Subsequently, the models can also be used for permanent furnace control. Currently, the models are being interfaced with the control system of an **EBNER** facility to evaluate their responsiveness.
In the future, they will be further developed to allow use not only for MPC but also for PPC (Property Predictive Control).

HICONSABER®

The charging technology developed by **EBNER**, also known as **HICONSABER**®, has opened a new era in heat treatment with bell annealer furnaces. At typical bell annealer facilities, all handling movements of coils/carriers and bells are carried out by large, manually-operated overhead cranes. Charging and decharging the coils consumes about 10 % of the total processing time. Any improvements to these operations would have measurable effects on the entire process sequence, which led to the idea of the **HICONSABER**® system. This system is a fully automated one, in which a fully-automatic charging car collects the entire charge from the charging station and transports it to the workbase in a single step. The first fully automatic bell annealer facility equipped with the **HICONSABER**® system has already started production. You can find more information in the article starting on page 28.

EED Furnaces.

This member of the EBNER Group has a reputation for success in the Chinese copper market.

MA ZHIGUO

EED news
from China

LIU NING

EED news
from China

EED Furnaces (Taicang) Co., Ltd. is a company in China wholly owned by the European **EBNER** Group.

EED is a supplier of economy-class heat treatment furnaces operated by the **EBNER** team in Taicang, China. Based on **EBNER**'s technology and designs, **EED** develops markets by pursuing a 100 % made-in-China strategy. Sharing manufacturing resources with **EBNER** China, **EED** aims to provide outstanding quality.

As a member of the **EBNER** Group, **EED** mainly focuses on bell annealer furnaces, roller-hearth furnaces and batch-type (chamber) furnaces.

THE COPPER INDUSTRY IN CHINA

Over nearly a decade, China's copper processing industry has formed its own structure with copper wire, copper strip, copper pipe, copper rod and copper foil as the main subdivisions. The average annual increase in production is 7 – 9 %, even as capacity reached up to 16 million tons in 2019.

The majority of production is copper wire (44.64 %), with most of the rest as copper strip (19.88 %), copper pipe (15.61 %) and copper bar (13.70 %). These four products make up more than 90 % of the market share.

In terms of production, China plays an essential role in the global copper processing industry. However, at the level of products, we must still improve in comparison to other industrialized countries, especially in terms of quality, performance, diversification, refinement and uniformity. In 2019, China imported 2.3 million tons of processed copper materials.

With the development of China's non-ferrous industry toward new, high-precision materials and deep processing, more opportunities for China's copper processing industry will appear in the future in the following areas:

» 5G base station construction
» UHV (ultra-high voltage)
» intercity high-speed railway and urban rail transit
» charging piles for electric vehicles
» development of big data centers

EED bell annealer for copper base metal

China's copper processing enterprises are highly concentrated in certain areas, mainly Guangdong, Zhejiang, Jiangsu, Jiangxi and Anhui. The four provinces make up around 55 % of China's entire copper processing capacity. The **EED** industrial furnace manufacturing plant is located in the center of these four provinces, making the production, transportation and servicing of the furnaces ultra-convenient.

China's copper processing enterprises are tied to the market, and are so subject to the main market currents across the globe. The demand for new facilities is thus rising gradually. However, the fierce competition and low overall profit in the industry make it impossible for many companies to buy the world's top-level equipment.

Sensitive to the possibility of modernization in the copper processing industry, **EED** took the initiative in contacting various enterprises. Between 2016 and today, as a member of the **EBNER** Group, we have sold 96 furnaces to customers in the copper processing field which have fully satisfied them in terms of both performance and energy consumption. **EED** has gradually been accepted by the Chinese copper industry, and has developed its own reputation.

EED customers include the Anhui Chujiang Group, the Ningbo Boway Group, the Ningbo Jintian Group, thje Ningbo Xingye Group and others.

www.eedfurnaces.com

A next generation EBNER facility.

The first fully-automatic EBNER HICON/H_2® bell annealer facility has successfully started production.

KARL WOHLFART

EBNER news
from Austria

Wieland Austria, based in Amstetten, Lower Austria, has been a leading manufacturer of copper and copper alloy specialty tube and long products for many years. The company has now placed its trust in new bell annealer technology from EBNER.

A NEW CONCEPT FOR BELL ANNEALER HANDLING SYSTEMS

The following requirements characterize conventional bell annealer installations:

- A reinforced shop structure and an overhead crane
- High crane hook elevation or installation of the facility in a foundation trench
- Continuous presence of operator personnel to manually handle the bells, as well as to charge/decharge the coils at the workbase

As in some cases these requirements lead to high investment costs or cannot be met, **EBNER** decided about two years ago to develop a completely new concept for the handling systems at **HICON/H_2**® bell annealer facilities.

The new concept is based around a handling device with an elevator car installed at shop floor level, which is designed to travel on rails. This handling device shifts entire charge stacks in one step, and is also used to shift heating bells, cooling bells and inner covers fully automatically. All these tasks can be carried out without an overhead crane.

THE FIRST ORDER

The new charging concept was first announced by **EBNER** at the WIRE & TUBE 2018 trade fair in Düsseldorf, Germany. Only three months later, Wieland Austria was convinced by the new concept and an order was placed for the turn-key delivery of a **HICON/H_2**® bell annealer facility to heat treat copper and copper alloy LWC coils.

The facility is comprised of two workbases, each with a stack height of 2350 mm, a gas-fired heating bell, two air / water cooling bells and a handling system (charger). The scope of supply also included special processing equipment required for the heat treatment of copper tube that sees use both before and during heat treatment, such as an N_2/H_2 mixing system to generate process atmosphere, a vacuum pump unit and an internal tube purging system. The entire process sequence, from the placement of an assembled charge stack, actual heat treatment with the heating and cooling sequences and on to retrieval of the charge takes place fully automatically, without any manual intervention.

A state-of-the-art process control system to monitor and supervise the process sequence, record and archive relevant process data and perform all data handling tasks - from planning to data exchange with the customer's production control system - was also installed.

VERSATILE APPLICATION

A bell annealer is characterized by its versatility and flexibility. Such a facility is capable at operating economically at low throughput levels and small batch sizes, and can be upgraded with relatively little effort by installing addi-

Gas-fired **HICON/H_2**® bell annealer facility with handling device for bells, inner covers and charge stacks

tional workbases - which is synonymous with increasing capacity.

For Wieland Austria, this aspect was a decisive factor in the decision to invest in this type of technology.

The need for material temperatures reaching more than 800 °C and the ability to use different process atmospheres with hydrogen contents up to 100 % were important additional factors in the decision.

Along with LWC coils, which are annealed in special charge baskets, it is also possible to charge the facility with large steel drums filled with up to 2.5 tons of copper mill products.

AUTOMATIC COIL HANDLING AND STACK FORMATION SYSTEM

A fully automatic coil handling and stack formation system was also integrated into the overall facility design. After the heat treatment sequence has been completed the coils are packed, with the complete packing system ordered by the customer from Ingenia (a subsidiary of the ASMAG Group).

The overall concept also allows the facility to be operated without direct supervision. There is also the possibility of using the new charger to buffer multiple coil stacks before or after heat treatment, annealing them them one after another.

Significant advantages provided by fully automated bell annealer facilities include:

- Installation of the furnace facility in a simple workshop structure, without the need for an overhead crane (if a crane is installed, it need only be a maintenance crane)
- Implementation of increased charging heights in existing annealing shops when investing in replacement equipment (without an overhead crane, stacking heights can be increased by 1 - 2 m)
- Reduction of operator personnel and/or existing personnel may be employed to carry out other tasks
- Reduction of workbase downtime to about half of current levels due to rapid and automatic travel movement and placement of the charge in a single step
- Increase of component service life and reduction of maintenance work through precise handling and exact positioning of bells and charges when shifted
- Increase in workplace safety through automatic operation
- Integration / interfacing with upstream and downstream processes

In a nutshell, in comparison with other automation systems, use of a fully automatic handling system at a bell annealer facility increases throughput capacity and process safety even as it reduces maintenance and personnel costs.

www.wieland.com

Fully automated coil handling and stacking station (Ingenia)

The PACC module from EBNER.

EBNER develops flexible and robust in-line technology to partially harden and temper (tailored temper) press-hardened components: the EBNER® PACC module (Precisely Accurate Contact Cool).

GERHARD SCHÖFL
EBNER technical article

The following announcement was made to the automotive industry in 2017: “Lightweighting does not bring significant advantages to electric vehicles; the weight of the vehicle is virtually insignificant.” - Prof. Dr. Ferdinand Dudenhöffer, CAR Center Automotive Research, University of Duisburg-Essen.

Today, we see a trend in exactly the opposite direction: there has been a massive increase in the amount of lightweighting in modern car bodies, utilizing flexible hard/soft zones in structural components.

If the generation of electricity is left out of the equation, electric motors are extremely efficient (efficiencies above 80 %). New developments also allow the recuperation of braking energy. This is what led to the thought that vehicle weights would only play a secondary role, as the energy required for acceleration would not be lost - at least in theory. Today, however, we have recognized that energy is actually lost twice: once during acceleration, and once during braking. This lowers the overall efficiency to around 60 %. An additional factor contributing to the rise of lightweighting is that components for electric vehicles, such as axles and batteries, are expensive. The lighter the vehicle, the smaller the motor can be - reducing cost. Furthermore, it should also be remembered that vehicle weights are restricted by European regulations for class B (standard passenger vehicle) driver’s licenses.

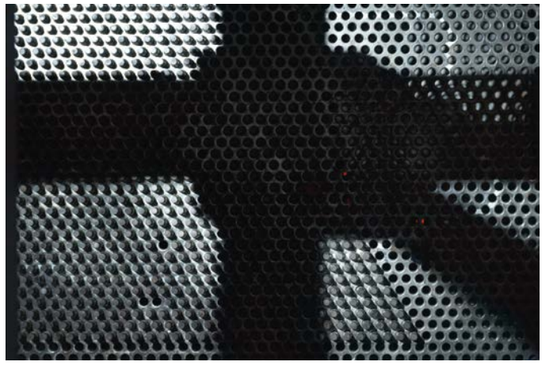
All this means that lightweighting is still important.

HOW DO YOU LIGHTWEIGHT STEELS?

The answer is press hardening. During press hardening, manganese-boron steel “blanks” - plates that have already been cut to size - are heated up to austenitizing temperature. They are then held at austenitizing temperature for about one minute to dissolve the carbides. The blanks are then transferred to a press equipped with a water-cooled die, and formed into a component.

The component is quenched to 170 °C at the same time, meaning that martensitic hardening also takes place. The result is a component with the highest possible strength, allowing the amount of required material to be reduced and with it the weight.

Demo press hardening line at the MAGNA works in Weikersdorf, Austria



Top view of the cooling section of a press hardening furnace

WHAT DO THE NEW IN-LINE PACC MODULES OFFER?

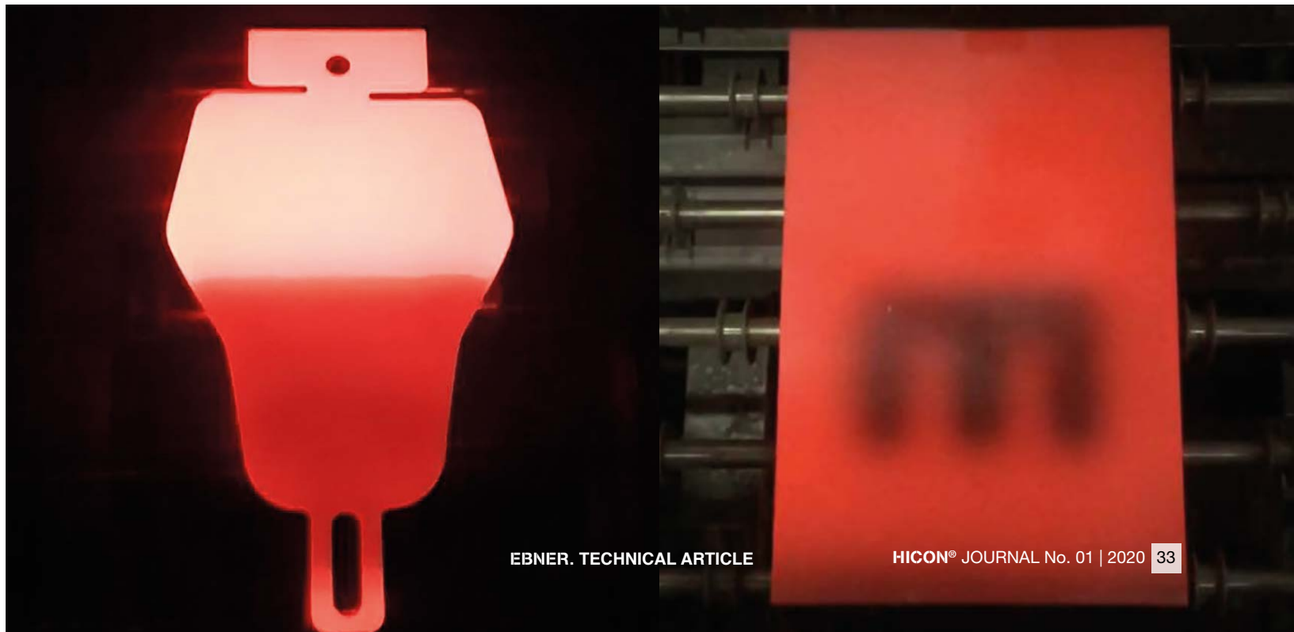
For some time, **EBNER** has been investigating new in-line technologies to partially harden and temper the hard/soft zones in structural components. This process is also known as *tailored tempering*. The high component strength and low component weight provided by this process, as well as the precisely-tuned deformation of the component in a crash, are major reasons why tailored tempering is desirable.
Very hard components are also difficult to weld - it is therefore important that components be fabricated with soft zones, easing assembly and installation. Currently, press hardening is generally carried out with hot forming equipment in a press. Disadvantages of the approach include the high costs of the press, the rapid wear of hot sections, component distortion and limited flexibility should changes be desired.

The new in-line **PACC** module for partial hardening and tempering was developed by **EBNER**s in-house R&D Department. This new technology makes it possible to easily create flexible soft zones in press-hardened components. It involves partially cooling the blanks directly in the furnace, where as in usual processes the blanks are heated up to austenitizing temperature. Partial cooling of specific areas takes place in the last section of the furnace facility, with cooling pins (Contact Cool) applied to the workpiece to lower the temperature of the soft zones.

The blanks are then formed in the press in the usual way. The dies are (only) cooled, not heated. The geometry of the soft zones can be easily adapted, using a cartridge system. Additional advantages are a simple, robust system, no component distortion and flexible, adaptable transition zones. The service costs for stamping/pressing are also reduced significantly.

In cooperation with MAGNA, a prototype facility equipped with a new in-line **PACC** module has been installed at the MAGNA works in Weikersdorf, Austria. The line is currently producing components for the automotive industry under production conditions, to the complete satisfaction of all parties.

Blank with different temperature zones after a tailored tempering process in an **EBNER PACC** module



GNA alutech inc.

The specialist for recycling furnaces and autonomous casting solutions.

TED PHENIX

EBNER News
from Canada

In June, 2019, the EBNER Group acquired a majority share of the Canada-based company GNA. GNA was founded 37 years ago by Ted Phenix in Montreal, Canada, and is an equipment supplier to the aluminum industry.

We mainly provide equipment for casthouses, such as melting furnaces for both clean and contaminated scrap, casting furnaces and homogenization furnaces, but are also the market leader in cathodes for the primary aluminum industry. Our main market is North America, though we have also supplied customers in China, the Middle East, Europe, India and South America.

An extensive description of GNA and its history was already provided in the last issue of the HICON® Journal. In this article we would like to highlight the developments GNA has made in two specific areas of our portfolio. These are our 'bread and butter' products, currently leading the way in reliability and performance at our client's plants.

SINGLE CHAMBER RECYCLING FURNACES

GNA has developed furnaces for melting (light) clean and contaminated scrap, including a single chamber furnace for painted profiles and chips. For chips, we use either a metal pump, like an EMP, or a side well with a separate mechanical pump to ingest the chip feed and make sure chips are submerged beneath the bath surface as fast as possible.

Since Gautschi has also recently developed similar technologies, GNA and Gautschi are working closely together to further develop this furnace type.

The GNA furnace is equipped with a specific combustion mode that includes oxygen injection into the melting furnace atmosphere at a specific time and under specific conditions monitored and controlled by the furnace PLC system.

This process allows the fumes from burning the paint or other similar contaminant to be in the furnace without the requirement for an external oxidizer or incineration process. Exhaust flue gases are monitored for oxygen content and when a specific level is reached, "fume destruction mode" is turned off and the furnace combustion system automatically returns to normal melting mode.

A pivoting 50 t scrap melting and holding furnace

Contaminant levels of up to 5 % can be successfully treated in the furnace with no ill effect on metal quality or refractory condition. Melt rates of up to 18,000 kg/h and more are currently achieved at various plants throughout the US and Mexico.

MULTI-CHAMBER FURNACES

GNA has developed our own multi-chamber furnace for recycling contaminated scrap, such as castings coated with grease and oil, heavy section painted profiles, sheets, and even coils contaminated with rolling oil with contamination levels up to 5 - 7 %. Once again, GNA and Gautschi are working together in using the multi chamber concept for a continuous casting operation using a melting/casting furnace.

The first-ever rotary furnace project with a capacity of 9 t

The shell of a 145 t dual-chamber melting furnace during installation

The completed shell of the 145 t dual-chamber melting furnace

ROTARY FURNACES

GNA has taken over the marketing and sales of a tiltable rotary furnace (TRF) for heavy contaminated scrap, dross and other forms of aluminum scrap. As the furnace has a door opening with a diameter of 2100 mm, GNA is now working together with specific clients and starting discussions on using the TRF to melt scrap coils.

The process used in the TRF furnace is based on using salts that bind to organic compounds in the scrap. This avoids excessive burning of the aluminum as the high amount of contamination combusts. GNA has designed the furnace in such a way that easy loading and operation is combined with high flexibility, as there are a wide variety of raw materials that can be processed. Specific fuel consumption varies with the type of cold charge, but typical consumption numbers are less than 50 m³/t.

With these three types of furnaces in our portfolio, GNA can offer a wide range of possibilities to the aluminum recycling industry.

AUTONOMOUS CASTING

Over the last several years, GNA has been working together with a customer to implement a new and revolutionary concept for operating a casthouse in "hands free" mode. In this concept, the majority of the operations have been automated and are controlled by a unified central control system. This provides a very important safety improvement over typical operations, where operators are constantly interacting with a hot furnace and in close proximity to charging, skimming, alloying and other activities involving molten metal. No manual intervention from operators is required close to the furnaces or casting machine, and the role of an operators is now more that of an observer.

The basic idea was developed by Kaleb Wright, now the CTO of GNA, supported by Ted Phenix. Working in close cooperation with the customer, it has now been installed as a part of a scrap melting operation in the southern US, using GNA furnaces.

All operations which normally require manual intervention or a visual check near the furnaces have been automated and integrated in a single operating production line. This includes the loading of cold metal into the melting furnace, dross removal at the furnace bath, the addition of alloying elements, temperature control, and the automatic transfer of molten metal to the holding furnace.

This plant is currently evaluating the process of integrating an automatic metal sampling system from another supplier and the addition of a new skimming machine. If these two systems can operate autonomously, the upgrades would allow this casthouse to operate fully automatically. Once all tests have been completed at this casthouse in the US, GNA will be ready to offer this solution to the world - including customers of Gautschi and HPI.

While this innovation does not drastically reduce the amount of personnel needed, it transforms their job from handling to continuous improvement and monitoring. It reduces variability in the process, resulting in faster cycle times, less variation in alloying, better dross removal practice and lowers the potential for operator-induced error overall.

Melting furnace with a capacity of 18 t/h

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NEWS

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December 7 - 11, 2020	**TUBE DÜSSELDORF**	Düsseldorf	**DE**	Booth No.	**TBA**
December 7 - 11, 2020	**WIRE DÜSSELDORF**	Düsseldorf	**DE**	Booth No.	**TBA**

We look forward to seeing you there!

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