NEW!

Our HICON Journal is now available by email
With Steve Jobs’ “I have my head in the clouds, but my feet firmly on the ground” in mind, we here at EBNER have sought to think outside the box over the past few years. 2015 was marked by intensive work on our projects, and we were able to successfully hand over numerous facilities to our customers. But even among all the success and pressure, one must take the time to critically review it all: how can we create even more benefits for our customers, and how can we provide them with more of the advantages of our unique position? This year, our particular goals are to listen better, and to proactively approach the multifaceted challenges facing our customers with innovative and flexible solutions.

One result of listening and innovatively implementing a customer’s desire for a future-oriented facility was thoroughly and successfully tested in 1:1 scale at our laboratory in Linz, and is now being installed on site. We are convinced that this new technology will permanently alter the market for high-tensile steels.

Just as trend-setting and just as cutting-edge is the EBNER HICON® Digital Services (EBNER HDS) customer service package, which is soon to be released. You can get a personal impression of the many possibilities found in our HDS package at EBNER seminars that will be held throughout the world in the next few months, or at the next major international trade fair. The package is a good example of how we hope to accompany you into our mutual future as partners, with advantages for us both.

From now on, in order to stay informed of the latest developments even more rapidly and on-time, you can receive your copy of the HICON® Journal via email. As owner and CEO, your personal feedback is naturally extremely important to me, allowing myself and my team to actively help your company face the challenges you see. Please feel free to email me with your requests, concerns, and thoughts on how we here at EBNER can better support you at ceo@ebner.cc

Yours sincerely, Robert Ebner
CEO
Markus Luger is EBNER’s new COO.

HICON®: Mr. Luger, you’re not a new face at EBNER.

Luger: That’s true. I’ve been at EBNER for many years now. My career began with an apprenticeship as a high-voltage electrician. I then attended a technical school in addition to working, graduating with a Matura (a diploma qualifying the recipient to attend university). In 2002, I joined EBNER and spent 6 years working in the Commissioning Department, while at the same time completing a course of study in industrial engineering. I then switched to the Sales Department for two years, where I mainly focused on our aluminum facilities, before being given the opportunity to help shape the turn-around at GAUTSCHI ENGINEERING in Switzerland.

GAUTSCHI has always been an interesting competitor and potential candidate for the EBNER Group, which became a reality in 2010. GAUTSCHI was added to the EBNER Group to expand our product range, per our “Full-Solution Provider” strategy. EBNER has decades of experience in developing subsidiaries in the USA and China, which was a great advantage for us here. GAUTSCHI is a huge asset, expanding the EBNER Group’s product range to include melting and casting, and adding nearly 100 years of experience. GAUTSCHI has a lot in common with EBNER; it was also owner operated in its early years, for example. After some difficult years being owned by an investment group, EBNER is now bringing GAUTSCHI back into a family-owned company with a long-term strategy. After this take over, I stayed at GAUTSCHI for four years to assist in fully integrating the companies, to find and make use of synergies, and to make sure our clear two brand strategy for heat treatment facilities was implemented. Our owner encourages a competitive spirit amongst the best and brightest within the company, to ensure constant innovation of our products. I returned to EBNER as head of the Project Management Department. I have been responsible for the operative departments of EBNER as COO since August of 2015.

HICON®: What are your goals as EBNER’s COO, and what measures do you intend to take? What is EBNER’s strategy to remain successful in the long term?

Luger: The customer tells us what is wanted and what is needed, our job is to make it happen. We are focusing intensively on better understanding and meeting the needs of the customers, thereby creating additional value for them. More customer contact and paying good attention to what is being said: this is how we can be an even better long-term partner for our customers.

It is our clear goal to develop unique selling points with our customers, to generate a competitive advantage for them. To work with our customers on what the market demands, and develop custom solutions. A few examples from our current programs:

- Increasing efficiency of our in-house processes, e.g. by better using synergies.
- Increasing the energy efficiency of our products (large recuperator, heat exchanging bells).
- Optimizing production costs by implementing SPC and Industry 4.0 projects.

(Note: see page 26 of this issue.)

HICON®: In the last issue, Mr. Heinz, CTO, discussed innovation. Six months have gone by - what concrete innovations have been made and how do these contribute to EBNER’s future growth?

Luger: As I already mentioned, our main focus at the moment is on increasing efficiency and saving energy. We are planning symposia on steel, aluminum and stainless steel in Europe, America and China. We will be sending our customers more information, and we are very excited about introducing our latest innovations face to face.

HICON®: How do you, personally, save energy?

Luger: I sometimes take the stairs instead of using the elevator.
Auto Innovation.

From process development 11 years ago through U.S. expansion today, Mubea relies on EBNER technology to provide the highest quality, lightest weight, best performing components to its customers—automotive manufacturers.

The innovation has paid dividends for both companies. TRB® formability, up to 25 % weight reduction, and labor reductions from single-piece instead multi-piece design now has 21 automotive manufacturers and 12 Tier 1 automotive systems suppliers relying on Mubea’s process. And through 4 expansions over 11 years, Mubea continues to trust EBNER HICON/H2® bell annealer technology to ensure the consistent, uniform strip quality and coil production rates required to manufacture tailored rolled blanks for its optimum chassis, structure, and interior part forming applications. In July 2015, Mubea and EBNER completed the fourth and latest installation at Mubea’s U.S. plant in Northern Kentucky, expanding plant capacity by 50%.

In addition to performance, EBNER bell annealer equipment delivers on the reliability that Mubea counts on to meet its customer’s Just-In-Time production philosophy. EBNER Project Managers, Kim Swisher and Adam Geiger, concur that EBNER and Mubea have a good working relationship, which reflects Mubea’s confidence in EBNER HICON/H2® bell annealer facilities.

WHAT DOES THE FUTURE HOLD?
Mubea is bullish on its lightweight competence and innovation with TRB® applications driving further market penetration and growth; and EBNER intends on being by their side as a trusted partner helping to fulfill these new obligations.

"DRIVEN BY THE BEST" is Mubea’s slogan describing the demands of its automotive customers and the challenges that drive the company. Tailored rolled blanks (TRB®) is one Mubea lightweight innovation developed to meet the “…most important objective of the automotive industry: the sustained reduction of fuel consumption and emission levels.”

Mubea’s genius was recognizing that selectively decreasing the thickness of formed parts could reduce the weight of conventional parts by up to 25%, so it created a process where one continuous roll of steel is able to be flattened into varying thicknesses. Mubea engaged EBNER because Mubea understands how important strip properties, strip surface quality, and coil production are to achieving this lightweight innovation. Additionally, EBNER, like Mubea, has an environmental interest in minimizing energy consumption that continues today.

“BJ AUSTIN
EBNER news from the USA.

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NEW EBNER FACILITIES IN NORTHERN CHINA.
In 2015, in the middle of Shandong Province, the key facilities for producing aerospace-grade aluminum plate were started up. A HICON® roller-hearth furnace and a HICON® batch-type aging furnace started operation right on schedule. The net charging length of the roller-hearth facility is 32.4 meters with a width of 3.2 meters (106'4" x 10'6"), while the aging furnace can hold a charge of 26.9 meters by 4.7 meters (88'3" x 15'5"). This fulfills the requirement for the wing panels of the medium-sized single-aisle airplanes which are predicted to be most in demand in future.

EBNER facilities offer overwhelming advantages in processing aerospace grade materials. Qixing, as a new company to this market, can narrow its gap to the market leaders by using EBNER technology, which can completely fulfill AMS standards and help the customer take its place among aerospace industry suppliers.

INCREASING PROFIT.
As more plants start production for the aluminum industry, market competition is getting fierce. As a result, profit margins are shrinking for some aluminum manufacturers. Qixing therefore strategically decided to enter the high-end market, choosing technically sophisticated EBNER furnaces. Working with EBNER is the right move for Qixing, since EBNER technology can ensure its products are more competitive on the market.

SMOOTH START UP.
If you had to choose one word to describe the people of Shandong Province, it would be "hospitality". With the support of Qixing, the installation and commissioning of the facilities was completed successfully. In spite of the culture difference between China and the West, EBNER and Qixing worked together smoothly to produce first-class products.

Although well-known for its household aluminum foil products, consumers may not be aware that Zouping Qixing Industrial Aluminium Co., Ltd. will also be producing materials for the planes they fly in, as it enters the booming Chinese aerospace industry.
Innovations for existing facilities.

The EBNER Customer Services Department, seeks to meet our customers’ challenges in operating heat treatment facilities with innovative products and solutions.

EBNER. AERO & AUTOPERFECT.
Upgrades for temperature accuracy and quality assurance during heat treatment. Both the aerospace and automotive industries regulate the heat treatment of high-quality materials with their own standards.

For aircraft, the SAE Aerospace standard AMS 2750E (Aerospace Material Specification) applies. The equivalent in the automotive industry is the AIAG (Automotive Industry Action Group) COI-9 (Continuous Quality Improvement) standard. Alongside requirements for maintenance and how facilities are operated, these standards establish special requirements in the following areas:

- Quality and applicational scope of thermocouples
- Instrumentation design and instrument testing
- System Accuracy Tests (SAT) for temperature measurement systems
- Temperature Uniformity Survey (TUS) inside the furnace
- Documented verification of tests and analyses

With the individually-tailored upgrade package AERO & AUTOperfect, EBNER can fulfill every one of these requirements with innovative, advanced technology. Existing facilities are analyzed, and the resulting report is used to develop a package of solutions. We stand by the customer during all necessary testing (instrumentation, SAT and TUS). Appropriately-calibrated instrumentation and SAT/TUS thermocouples are, of course, made available.

EBNER. HEAT RECOVERY.
Utilization of exhaust gas energy in heat treatment facilities. The efficient use of waste heat and its recirculation in industrial processes has steadily increased in importance, due to rising energy prices and increasingly stringent environmental legislation. Particularly in the field of industrial furnaces, individual requirements are of first importance. On the one hand, influence on the production data of the facility must be minimized. On the other hand, efficient energy recycling must be ensured.

EBNER has chosen to face these issues head-on, and can offer a solution to fully meet their challenges with the HEAT RECOVERY program. In this program, the focus is on three key points:

1. System design
2. Calculation of an appropriate ROI and
3. Influence on the existing exhaust gas system.

We then lay out the control concept for the secondary circuit, depending on the situation on site and how the energy is recycled. An appropriate automation system is supplied, either an integrated system or a stand-alone solution, as desired by the customer. Finally, an individualized split-up of the scope ensures that our customers receive the most efficient implementation of the project.

EBNER. INNER COVERS.
High-quality inner covers as spare parts, ensuring the smooth operation of bell annealer facilities. The quality of an inner cover, a central component of a bell annealer facility, is a fundamental requirement for trouble-free operation of the complete system. Due to the thermal stresses an inner cover is exposed to, “low-cost” versions endanger the safety of a facility even while their reduced durability increases running maintenance costs.

With our standard line of original EBNER INNER COVERS, EBNER offers a product with the highest possible quality and reliability for both EBNER and non-EBNER facilities. Carefully-selected materials, special fabrication techniques (corrugation), state-of-the-art welding technologies and custom designs (which take into account everything from heating bell compatibility to the sizing of the component plate) increase more than cover durability; the time in which repairs are possible is also extended.

Our extensive experience and many references underscore the validity of this philosophy. We would be glad to discuss your wishes and requirements in person!
Due to increased demand for high strength steels, NSY decided to invest in advanced hot-forming equipment and a hot forming line from EBNER with the most advanced technology. This allows NSY to produce hot-formed structural parts according to CQI-9 standards, fulfilling the global requirements of OEMs.

Nanjing Starq Y-TEC Automobile Parts Co. Ltd (NSY) is a joint venture company founded in 2011 by Chongqing Starq Group of China and Y-TEC of Japan. Chongqing Starq Group was founded in 2001 and produces formed and welded parts for the automobile industry. Starq Group is a key supplier of Changan Ford and Mazda. Y-TEC was founded in 1960 and is one of Japan’s complete automobile chassis suppliers, holding several chassis-related patents. Y-TEC is Mazda’s most important supplier.

NSY’s target is clear: to become one of the world’s top suppliers specializing in the design, development and manufacture of automobile chassis components. To this end, they required top suppliers of production equipment.

Only a few months passed between the first proposal and the signing of the contract with EBNER. Due to the excellent professional cooperation between EBNER and NSY, the project was completed on schedule without any interruption.

In order to keep investment costs and production costs low, EBNER delivered a hybrid HOTPHASE® roller hearth furnace to heat treat coated and uncoated blanks. The first zones are equipped with gas-fired radiant tubes, while the soaking zone of the furnace is electric heated.

With a usable width of 1.9 m and a length of 30 m, this line has a cycle time of 6spm (strokes per minute). A newly-developed servo-driven centering and lifting system was installed to perfectly center four blanks per batch.

With their EBNER HOTPHASE® roller hearth furnace, NSY is set to produce first class products for their most discerning customers.

Just before our editorial deadline, EBNER received an additional order for one new roller-hearth furnace for hot forming from NSY. The excellent teamwork of the two companies is going into the next phase.

**EBNER HOTPHASE® FURNACE ADVANTAGES AT A GLANCE.**

- Special coating on hearth rollers guarantees a longer service life time.
- Gas-heated radiant tubes above and below the hearth rollers to guarantee perfect temperature uniformity on the blanks.
- Silicon carbide radiant tubes are maintenance free.
- Roller bearings mounted away from the furnace shell to prevent heat and dust in the bearings (no additional cooling for bearings is needed).
- Servo-driven ceramic doors at the entrance and exit of the furnace will not deform and guarantee exact positioning.
- Quick coupling of rollers for easy replacement at production temperature. No need to cool down the furnace and open the roof for replacement.
- Servo-driven centering and lifting system is quickly adjusted by the "one-pin fixture" and "rail guide" systems.
- Fully automatically controlled and motorized valves at the mixing station and dewpoint regulation system for exact control of the atmosphere and highest standard for safety control.
- Light barrier mounted at the entrance and exit roller table to track the blanks. No glass cleaning or broken glass replacement necessary.
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First things first: why has EBNER developed the E³ concept, and what are its advantages for you? Since it is difficult to make predictions about the development of the energy market and the volatility of primary energy prices, EBNER has dedicated itself to making the best, most efficient possible technologies available to its customers. Industrial emissions such as CO₂ and NOₓ cannot be ignored - not only because of the environmental burden they pose, but also because CO₂ emissions in particular lead to increased costs. It is also possible that future regulations will introduce even stricter limits on emissions, or lead to increased financial burdens.

The great advantage of E³ technology is the many years of experience that EBNER has in the field of heat treatment. All energy-related issues have been gathered together under the umbrella of E³, and are being continuously improved. EBNER has a broad portfolio of innovative products that can reduce the energy consumption in your plant.

HEAT EXCHANGE WITH HEAT EXCHANGING BELL (patented by EBNER)
During an anneal, the thermal energy of the net and tare weights released from the cooling process used to be transferred only to the cooling air and/or the cooling water. In this heat exchanging design, an insulated heat exchanging bell and a powerful recirculation fan use a significant part of this energy to pre-heat a new, cold charge on a different workbase up to a temperature optimized for the process.

Energy is exchanged between the workbases, which are connected by insulated ducts, by circulating an air/exhaust mixture drawn from between the heating bell and inner cover. This means that the proven high-convection design and safety concept for the workload space remain intact, and the best possible results (uniformity, surface quality, etc.) continue to be guaranteed. We first reported on this development in 2009, and since that time increasing numbers of customers have taken advantage of the benefits of this technology.
GETTING THE MOST OUT OF THE HYDROGEN.

If hydrogen is used as process atmosphere, it can be recycled and reused in a variety of ways. At most facilities, it is possible to convert contaminated hydrogen into thermal heating energy at the outburner.

A second method of recycling is to collect hydrogen from the process atmosphere when it is only slightly contaminated with evaporating products, and reuse it during the next annealing cycle. It can be employed in the first phase of the anneal, where large amounts of drawing compound evaporate. This process sequence is illustrated in the figure below. A third option is to clean and reuse the hydrogen.

To do so, the drawing lubricant, any contaminating gas and any moisture must be removed from the hydrogen atmosphere using special filters, catalysts and molecular sieves.

ADDITIONAL WAYS TO SAVE ENERGY.

Customer and plant-specific conditions may offer additional possibilities for increasing the energy efficiency of a heat treatment facility. EBNER has the know-how to recognize this potential, the expert knowledge to develop individually-tailored solutions and the expertise to implement specific measures. All this can increase the energy efficiency of your company.

CURRENT PROJECTS AND FUTURE DEVELOPMENTS.

EBNER is currently working on an energy-saving system in which an additional heat exchanger placed upstream of the exhaust blower supplies heated water to a pickling line. Another example of a project currently under development is a system that uses stack gas in a steam generation unit.

Since it is possible to regulate the maximum exhaust gas temperature without influencing the furnace atmosphere, a new exhaust system does not usually need to be installed.

A further advantage of the heat exchanger design developed as a part of the E³ program is that it is not necessary to add a new exhaust blower for high temperatures. We are also working on designs to allow hydrogen process atmosphere to be used at a downstream fuel cell. This in situ utilization of the hydrogen allows the per-tonne cost of electrical energy to be reduced.
Quality runs in the family.

Bandstahl Schulte specializes in the high-quality production and processing of steel strip in all grades, and has a deep commitment to its location in Hagen, Germany. For this reason, an extremely productive and cooperative partnership has developed over the past 5 years between Bandstahl Schulte and EBNER, which has also been a family-owned company for three generations.

However, a great deal of preparation and convincing was still required before an order was placed in 2011 for a state-of-the-art gas-fired HICON/H2® bell annealer facility with two workbases. The new facility replaced conventional HN workbases, which could no longer fulfill modern requirements for quality and efficiency. The new HICON/H2® technology proved itself, and in 2015 an order was placed for a facility expansion of one additional workbase, a heating bell and a cooling bell. The facility was designed to allow all bells to be used interchangeably, increasing overall throughput about 70%.

The facility is used to heat treat steel strip coils of all grades: from low-carbon to high-carbon (alloyed and unalloyed), as well as deep drawing grades. Coils have a maximum outer diameter of 1900 mm (6’3”), with strip widths varying between 9 and 650 mm (0.35” to 2’2”). Stacking heights up to 4000 mm (12’9”) are possible, which means that up to 70 t (77 USt) of strip can be charged.

As is usual, the EBNER facility runs fully automatically. Automatic utility couplings and a state-of-the-art Process Control System ensure both increased safety and increased efficiency. In order to make facility operation even more economical, waste heat from the stack gas is used to heat both water and office space.

Many EBNER patents are integrated into this facility, including an integrated process atmosphere cooler in the workbase. This results in cooling rates up to 20% higher than those of competing designs.

A successful test anneal was a significant factor in the decision to place an order with EBNER. A production charge from the customer was heat treated in an EBNER bell annealer, under production conditions. A variety of small-scale tests were also carried out in our Research and Development laboratory. This is EBNER’s perennial advantage over the competition.

Bandstahl Schulte: Two brothers, Carl-Michael and Wolfram Schulte, have been both CEOs and owners for many years. In our opinion, this kind of continuity is essential for the long-term success of a business.

EBNER: What are the advantages of a HICON/H2® bell annealer facility?
Bandstahl Schulte: EBNER HICON/H2® technology, paired with EBNER’s integrated cooler, is simply the highest-performing technology currently available on the market.

EBNER: That would seem to be a clear advantage in terms of the economical production of the required material grades.
Bandstahl Schulte: Along with EBNER’s proven technology, we were sold on their customer support and service. In this regard, EBNER’s service center in the Hagen area was of extreme importance.
HICON\(/{H_2}\)\textsuperscript{®} bright annealing technology for high-alloyed steel strip.

This is the second part of an article on HICON\(/{H_2}\)\textsuperscript{®} bright annealing lines, which was recently published in the journals Heat Processing and Gaswärme International.

SASCHA EPPENSTEINER

In this second part, we present the various facility layouts, the technical advantages of the EBNER design, as well as a comparison between EBNER technology and the heat treatment technology of our competitors.

**VERTICAL CONCEPT.**

Figure 2 shows the typical layout of a continuous HICON\(/{H_2}\)\textsuperscript{®} vertical bright annealing line.

The main facility sections are as follows:

- Pay-off / inlet section, consisting of coil cars, pay-off reels, pinch rolls, flattening machine, shears, bridles, steering guide rolls, looper, etc. to unwind and transport cold rolled strip.
- Strip joining section (welder) to join the strip head and tail to form a continuous strip.
- Strip cleaning section to remove lubricant residues and fines from the strip before it enters the heat treatment section.
- Heat treatment section (furnace and cooler) to heat treat the strip in hydrogen process atmosphere.
- Outlet / take-up section, consisting of looper, bridles, inspection stand, steering guide rolls, shear, take-up reel, coil car, etc. to transport and coil the annealed strips.
- Electrical equipment with process control system, to control, supervise and visualize the entire process sequence, calculate annealing programs with automatic setpoint allocation and exchange data with higher level systems.

HICON\(/{H_2}\)\textsuperscript{®} vertical bright annealing lines are ideally matched to the strip dimensions and production capacity specifications. They can cover the following spectrum of dimensions and throughputs:

- Strip widths: 400 to 1600 mm
- Strip thicknesses: 0.02 to 4.5 mm
- Throughputs: approx. 1000 to 28,000 kg/h

**HEAT TREATMENT SECTION.**

See figure 3. The strip enters the heat treatment section through an inlet seal with driven rolls, passes over a precisely-balanced dancer roll and through the furnace from bottom to top contact-free.

Because the dancer is located after the inlet seal (i.e. it runs in process atmosphere), the tension applied to the hot strip is as low as possible and can be adjusted very precisely. This is because the tension is not influenced by friction at the inlet seal. See figure 4.

Relatively little tension is caused by the weight of the strip, and none or virtually none is added by the dancer. This means that even in long furnaces the lowest possible tension is maintained and excellent strip geometry is ensured.

The heating zone consists of a fiber insulated furnace with a gas-tight muffle, which is heated from outside by all-metal high-velocity gas burners. The burners are arranged at a tangent to the muffle. The entire volume of stack gas passes down over the muffle from above in contra-flow to the direction of strip transport, passing through a central recuperator out into the open.

The dissipated energy is used to preheat the combustion air. Thanks to the latest ECOBURN® burner technology, the lowest emissions are achieved despite the high annealing temperature and high combustion air preheating temperature.

The inside of the muffle is part of the workload space, in which the strip is heated up to the desired temperature level in 100% hydrogen process atmosphere with the lowest dewpoint.

Of course, when the muffle is heated it expands and the resulting elongation needs to be accommodated without risk of leaks occurring. The solution offered by this concept involves a ring-shaped liquid seal into which the lower end of the muffle protrudes.
The advantages are that the heavy inlet plug and seal are not flanged onto the lower end of the muffle; instead they are mounted on top of the inlet seal box and do not move with the muffle (see figure 6). As a result, the tension on the muffle (the walls of which increase in thickness toward the top) is as low as possible and the permanent elongation of the muffle - due to grain growth at elevated temperatures - is slowed.

This increases the stability of the shape of the muffle and extends its service life.

Another advantage of this concept is that the irreversible elongation of the muffle can simply be cut off using a plasma torch without having to remove the muffle and without having to perform welding work on the muffle. Following directly after the heating zone is the multi-stage HICON/H2® jet cooler, in which the strip is plunge-cooled in hydrogen process atmosphere (see figure 7). The recirculation fans are connected gas-tight to the frequency controlled fan motors and the cooler shell. The cooling gas is recooled by a low-maintenance heat exchanger.

A specially designed jet nozzle system delivers a high rate of cooling and excellent strip stabilization without risk of over-cooling the strip edges. Several movable dampers are arranged on either side of the first section of the symmetrical jet cooler to adjust the flow of atmosphere over the full width of the strip. A camera system is used to monitor the strip geometry.

The adjustable dampers together with the specially designed jet nozzles and low strip tension controlled by the precision dancer roll ensure the best possible strip geometry at high facility outputs. Because the cooling zone is above the heating zone and can be moved sideways away from the facility center line, it is a straightforward procedure if the muffle ever needs to be removed. This can be done within the building tower without needing a higher crane.

After leaving the cooler, the strip passes through the top roll box with strip center steering system into the gas-tight return duct down to the outlet seal. The inlet and outlet seals are both located at the same level to balance the updraft of the very low density hydrogen. Nitrogen locks are also provided in order to ensure the highest degree of safety. The process atmosphere flows against the direction of strip transport from the HICON/H2® jet cooling zone towards the inlet seal. This achieves the best cleaning effect.

A hydrogen recycling system can be implemented to clean the contaminated process atmosphere. This system brings about a savings of 50-70% in fresh gas. All water-bearing parts are metallically encapsulated and sealed with machined flanges and O-ring seals. Thanks to the entire system being ppm-tight, a dewpoint of -60 °C can be maintained inside the workload space when processing with 100% hydrogen.

This prevents partial oxidation of alloying elements with an affinity to oxygen such as Cr, Mn, Si, Ti, Al and enables processing of materials that are otherwise difficult to bright anneal. In addition to the standard Cr and CrNi grades, Cr-Al-Fe-alloys and titanium can also be annealed. For the latter, argon needs to be used as process atmosphere since titanium is susceptible to hydrogenation and nitriding.
HORIZONTAL CONCEPT. 

HICON/H® horizontal bright annealing lines are ideally matched to processing requirements. They can cover the following spectrum of dimensions and throughputs:

- Strip widths: 200 to 650 mm
- Strip thicknesses: 0.02 to 3.0 mm
- Throughputs: approx. 500 to 1300 kg/h

The horizontal bright annealing line concept is based on the same technology as vertical lines. As many of the advantages of the vertical configuration as possible have been transferred to the horizontal version (see figure 8).

The inlet seal box is implemented as a gas-tight casing (figure 8). The inlet seal box with integrated dancer roll is very precise.

The horizontal bright annealing line concept is based on a process atmosphere of around 75% hydrogen and 25% nitrogen with a dewpoint of approx. -45°C (approx. 70 ppm H20). Compared to this concept, HICON/H® technology offers the following key advantages:

- The use of a gas-fired combustion system is possible, resulting in considerably lower operating costs due to the lower price of natural gas.
- The workload space is encapsulated in metal: - An oxide-free strip surface is achieved, even with alloys that are difficult to bright anneal, because the H2/H2O ratio (= reduction potential of the process atmosphere) is approx. 9 times higher.
- It is not possible for the process atmosphere to penetrate the insulation material, meaning that heat losses are much lower.
- Even lower hydrogen consumption can be achieved by using a hydrogen recycling system.
- Extremely quick purging and restarting times (back to producing BA/2R quality surface finish after downtime) = approx. 2.5 N/mm² approx. 5 N/mm²

COMPARISON WITH ALTERNATIVE CONCEPTS.

Alternative facility concepts do not use an all-metal encapsulated workload space. In such cases, the workload space consists of exposed insulation material in which metallic or molybdenum heating elements are embedded. These facilities are usually operated with a process atmosphere of around 75% hydrogen and 25% nitrogen with a dewpoint of approx. -60°C (= approx. 750 000 ppm H2 (=75%) 70 ppm H2O (= -60°C)).

The horizontal bright annealing line concept is based on the same technology as vertical lines. As many of the advantages of the vertical configuration as possible have been transferred to the horizontal version (see figure 8). The horizontal bright annealing line concept is based on a process atmosphere of around 75% hydrogen and 25% nitrogen with a dewpoint of approx. -45°C (approx. 70 ppm H20). Compared to this concept, HICON/H® technology offers the following key advantages:

- The use of a gas-fired combustion system is possible, resulting in considerably lower operating costs due to the lower price of natural gas.
- The workload space is encapsulated in metal: - An oxide-free strip surface is achieved, even with alloys that are difficult to bright anneal, because the H2/H2O ratio (= reduction potential of the process atmosphere) is approx. 9 times higher.
- It is not possible for the process atmosphere to penetrate the insulation material, meaning that heat losses are much lower.
- Even lower hydrogen consumption can be achieved by using a hydrogen recycling system.
- Extremely quick purging and restarting times (back to producing BA/2R quality surface finish after a shutdown)
- Using 100% hydrogen process atmosphere:
  - No nitridding of Cr steels (even if strip stops)
  - Power requirement for cooling gas recirculation is very low because 100% hydrogen has a very low density
  - Inlet seal box with integrated dancer roll:
  - Sealing system does not interfere with strip tension inside the workload space
  - Strip tension can be regulated precisely inside the workload space
  - Strip passes from bottom to top, making it possible to operate at a low strip tension that has a positive effect on strip geometry

SUMMARY.

Thanks to the design of the facility featuring a metal-encased workload space and special seal system, it is possible to utilize a highly reductive process atmosphere of 100% hydrogen with a dewpoint of -60°C. In addition to processing standard stainless steel grades, these lines can also successfully bright anneal special materials such as Cr-Al-Fe alloys, CrMn steels, Ni-base alloys, NiFe (Invar) and duplex grades, while titanium and titanium alloys can be processed using argon process atmosphere.

In combination with precision strip tension control using a dancer integrated into the workload space and an efficient combustion system, HICON/H® technology offers manufacturers the highest product quality as well as cost-effective operation. The cost advantage of an EBNER facility compared to alternative concepts amounts to almost EUR 20 per metric ton. As a result of comprehensive experience gained from facilities already in operation (currently 60) and in-depth involvement in the metals industry, EBNER is able to adapt bright annealing lines to perfectly meet each customer’s needs while developing innovative solutions for immediate integration into their process technology.

**TABLE 1: COMPARISON OF PROCESS TECHNOLOGY CONCEPTS.**

<table>
<thead>
<tr>
<th>HICON/H®</th>
<th>Bright Annealing Line with Muffle</th>
<th>Direct-Heated Electric Facility (Brick-Type)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating System</td>
<td>ECOBURN® Gas Burners</td>
<td>Electric Mo Heating Elements</td>
</tr>
<tr>
<td>Workload Space</td>
<td>Metallically Encapsulated (With Muffle)</td>
<td>Exposed Insulation Material (Without Muffle)</td>
</tr>
<tr>
<td>Process Atmosphere</td>
<td>100% Hydrogen</td>
<td>Approx. 75-85% H2, Balance N2</td>
</tr>
<tr>
<td>Dewpoint</td>
<td>-60°C</td>
<td>-60°C</td>
</tr>
<tr>
<td>Reduction Potential</td>
<td>H2 = 100 000 ppm H2 (100%) H2O = 10 000 ppm H2O (60°C)</td>
<td>H2 = 750 000 ppm H2 (75%) H2O = 70 ppm H2O (60°C)</td>
</tr>
</tbody>
</table>

**TABLE 2: COMPARISON OF OPERATING COSTS.**

<table>
<thead>
<tr>
<th>HICON/H®</th>
<th>Bright Annealing Line with Muffle</th>
<th>Direct-Heated Electric Facility (Brick-Type)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Utility Costs per Ton</td>
<td>340 kWh/t</td>
<td>300 kWh/t</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>14 kWh/t</td>
<td>13 kWh/t</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>9 m³/t</td>
<td>5 m³/t</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>5 m³/t</td>
<td>8 m³/t</td>
</tr>
</tbody>
</table>

**Utility Costs per Ton:**

- Natural Gas: 0.3€/m³
- Hydrogen: 0.40€/m³
- Electricity (incl. Fans): 14 kWh/t
- Natural Gas: 0.3€/m³
- Hydrogen: 0.40€/m³
- Electricity (incl. Fans): 14 kWh/t

**Cost Advantage per Ton Annealed:**

- EBNER HICON/H®: 19.3 €/t
- Direct-Heated Electric Facility: ---

**Cost Advantage for 50,000 Tons/year:**

- EBNER HICON/H®: 1,737,000 €/y
- Direct-Heated Electric Facility: ---

Please contact us for this information in other units/currencies.

HICON® JOURNAL NO. 01 | 2016

EBNER. TECHNICAL REPORT.
We have only been able to network ourselves so completely and to communicate so easily for a few short years (the first practical smartphone was the iPhone in 2007; RFID technology only made components for widespread use available in 2007 and 2011; the first QR code was published in Germany’s SPEX magazine in 2007).

It has barely been 10 years since groundbreaking systems and methods became available on the market that not only reinvented the way we interact with technology, but also with all of the systems and processes that are integrated into it. New means and methods are accelerating processes and developments. Product individualization is increasing while cost-efficiency remains the same. Goal-oriented processing of the exponentially growing volume of data to make predictions gives us a completely new approach to the behavioral analysis of nature and machine (Big Data). The German government officially recognized these developments in 2012, by introducing a comprehensive governmental program based on a concept first made public in 2011: INDUSTRY 4.0. America and China have also intensively dedicated themselves to these developments, not only with direct action but also through the efforts of platforms like the IIC (Industrial Internet Consortium / USA) or the “Made in China 2025” program.

Particularly in the area of customer service, intensive development has taken place - with our EBNER HDS’s product range, we will offer a multi-level program to optimize the services we provide. In the first level, EBNER HDS Field offers a structured, electronically-supported system with which the performance and documentation of services is brought up to the quality that we are accustomed to from the Automotive Standard. Required steps are carried out and documented with a high degree of process safety; logs and reports are created almost simultaneously and can be electronically edited/evaluated. In the next level, that of the EBNER HDS Customer, customer-specific packages can be structured in such a way that we can offer a customer a guided service, i.e. the ability to carry out a service themselves according to the service plan. To make any necessary support available immediately if a problem should occur, we are developing EBNER HDS Remote. Our specialists use a cloud computing solution to establish both voice and video communication with the customer, and are able to guide the customer through the necessary steps. Wasted time and cost of travel are eliminated. In order to make this service easier to use, the Customer Service courses of the EBNER Academy offer appropriate training programs and certification.

"The Most Innovative & Competitive Full Solution Provider In Thermal Processing": in order to live up to our company motto - a motto that was inspired by the developments described above - our EBNER HDS’s product range, we will offer a multi-level program to optimize the services we provide. In the first level, EBNER HDS Field offers a structured, electronically-supported system with which the performance and documentation of services is brought up to the quality that we are accustomed to from the Automotive Standard. Required steps are carried out and documented with a high degree of process safety; logs and reports are created almost simultaneously and can be electronically edited/evaluated. In the next level, that of the EBNER HDS Customer, customer-specific packages can be structured in such a way that we can offer a customer a guided service, i.e. the ability to carry out a service themselves according to the service plan. To make any necessary support available immediately if a problem should occur, we are developing EBNER HDS Remote. Our specialists use a cloud computing solution to establish both voice and video communication with the customer, and are able to guide the customer through the necessary steps. Wasted time and cost of travel are eliminated. In order to make this service easier to use, the Customer Service courses of the EBNER Academy offer appropriate training programs and certification.

INDUSTRY 4.0 is omnipresent in our developments to optimize our products, and we look forward to discussing your specific needs and applications at your convenience!

*HDS stands for HICON® DIGITAL SERVICES

### Trade fairs. Conventions. 2016.

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>City</th>
<th>Country</th>
<th>Booth No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. - 8.4.2016</td>
<td>WIRE 2016</td>
<td>Düsseldorf</td>
<td>DE</td>
<td>10C42-06</td>
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<tr>
<td>12. - 14.7.2016</td>
<td>ALUMINIUM CHINA</td>
<td>Shanghai</td>
<td>CN</td>
<td>1J01</td>
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<tr>
<td>26. - 29.9.2016</td>
<td>WIRE CHINA</td>
<td>Shanghai</td>
<td>CN</td>
<td>tba</td>
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<tr>
<td>5. - 7.10.2016</td>
<td>WIRE INDIA 2016</td>
<td>Mumbai</td>
<td>IN</td>
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<td>21. - 25.10.2016</td>
<td>EUROBLECH</td>
<td>Hannover</td>
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<tr>
<td>6. - 7.11.2016</td>
<td>JAHRESTAGUNG STAHL</td>
<td>Düsseldorf</td>
<td>DE</td>
<td>F08</td>
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<td>11. - 14.11.2016</td>
<td>METAL-EXPO</td>
<td>Moscow</td>
<td>RU</td>
<td>tba</td>
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<tr>
<td>29.11. - 1.12.2016</td>
<td>ALUMINIUM 2016</td>
<td>Düsseldorf</td>
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We look forward to seeing you there!

### New orders.

**GLOBAL SPECIAL STEEL PRODUCTS**

<table>
<thead>
<tr>
<th>Country</th>
<th>Heating bell for HICON/H₂® bell annealer facility for steel wire coils.</th>
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<tbody>
<tr>
<td>ES</td>
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**BRAUN CARTEC GMBH**

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<tr>
<th>Country</th>
<th>Moving a HOTPHASE® roller-hearth furnace facility for press hardening blanks.</th>
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<tr>
<td>DE</td>
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**COSMA ENGINEERING EUROPE GMBH**

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<tr>
<th>Country</th>
<th>HOTPHASE® roller-hearth furnace facility for press hardening blanks.</th>
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<tbody>
<tr>
<td>AT</td>
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**ARANIA S.A.**

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<thead>
<tr>
<th>Country</th>
<th>HICON/H₂® bell annealer facility for steel strip coils.</th>
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<tbody>
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<td>ES</td>
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**BROCKHAUS STAHL GMBH**

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<th>Country</th>
<th>HICON/H₂® bell annealer facility for steel strip coils.</th>
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<tbody>
<tr>
<td>DE</td>
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**NORTHEAST LIGHT ALLOY CO. LTD.**

<table>
<thead>
<tr>
<th>Country</th>
<th>HICON® roller-hearth furnace facility for aluminum plates.</th>
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<tr>
<td>CN</td>
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</table>

**POONGSAN CORPORATION**

<table>
<thead>
<tr>
<th>Country</th>
<th>HICON/H₂® bell annealer facility for brass strip coils.</th>
</tr>
</thead>
<tbody>
<tr>
<td>KR</td>
<td></td>
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We look forward to seeing you there!

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Fax: (+1) 330 335 1605  
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www.ebnerfurnaces.com

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