

HICON®

EBNER GROUP Journal for Progress in Industrial Furnace Technology

75 YEARS OF
EBNER
IN MOTION



EBNER

**Ladies and Gentlemen,
Esteemed readers of the
HICON® Journal,
Dear friends and colleagues of the
EBNER GROUP!**

The **EBNER** Group keeps growing not only in expertise and technology, but also in experience. If you put together the number of years that all **EBNER** Group members have been in business, the wealth of experience now adds up to 470 years of company history.

Last year our **EBNER** site in China celebrated its 20th anniversary and this year marks the 75th anniversary of the founding of **EBNER** Industrieofenbau GmbH in Leonding. Our Canadian subsidiary GNA is celebrating a milestone birthday this year with its 40th anniversary.

Despite the fast-paced times, for decades **EBNER** has remained true to its original corporate values and philosophy, focusing on intensive research and development, in-house manufacturing and the best customer service. I am therefore especially pleased that this steadfast approach led to a record number of incoming orders in the Group last year.

The long-term trust of our customers to realize their strategies for growth and plans for a green future with **EBNER** technology is the greatest motivation for us to deliver outstanding quality every day.



This issue is dedicated not only to the fast-growing aluminum industry, where we won a significantly large number of orders, and a report on a major customer project, but also to the topic of sustainable technologies and R&D projects. It also illustrates how the individual strengths and competencies of each company in the **EBNER** Group contribute to our overall corporate success.

I hope you enjoy this issue, and look forward to greeting many of you in person at our next trade fair.

Yours, Robert Ebner
CEO

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An anniversary on our anniversary

As EBNER celebrates its 75th anniversary, work begins on its 101st pusher furnace.



GÜNTER MASCHER
EBNER Product Manager

While it may not seem that long ago, it will soon be 40 years since the mid-1980s saw EBNER deliver its prototype pusher furnace facility.

At that time, it was a challenging task for the company to deliver a new type of furnace to a country as far away as Taiwan. The customer's high degree of satisfaction ensured that EBNER invested further development work in this furnace type, and additional customers were quickly won over.

Around two decades later, in 2002, the first international HICON® aluminum symposium saw our customers report their experiences with the pusher furnaces that had been installed thus far. At the time of the symposium, EBNER could proudly count over 30 pusher furnaces installed throughout the world. The positive feedback, paired with our continuous development and research, encouraged the further spread of these furnaces.

RAPID DEVELOPMENT AND INCREASING DEMAND

With its many advantages, our pusher furnaces quickly grew to dominate the market - forcing out other traditional types of ingot heating furnaces such as soaking pit furnaces and batch-type ("chamber") furnaces. Our customers now only request these other types for special applications.

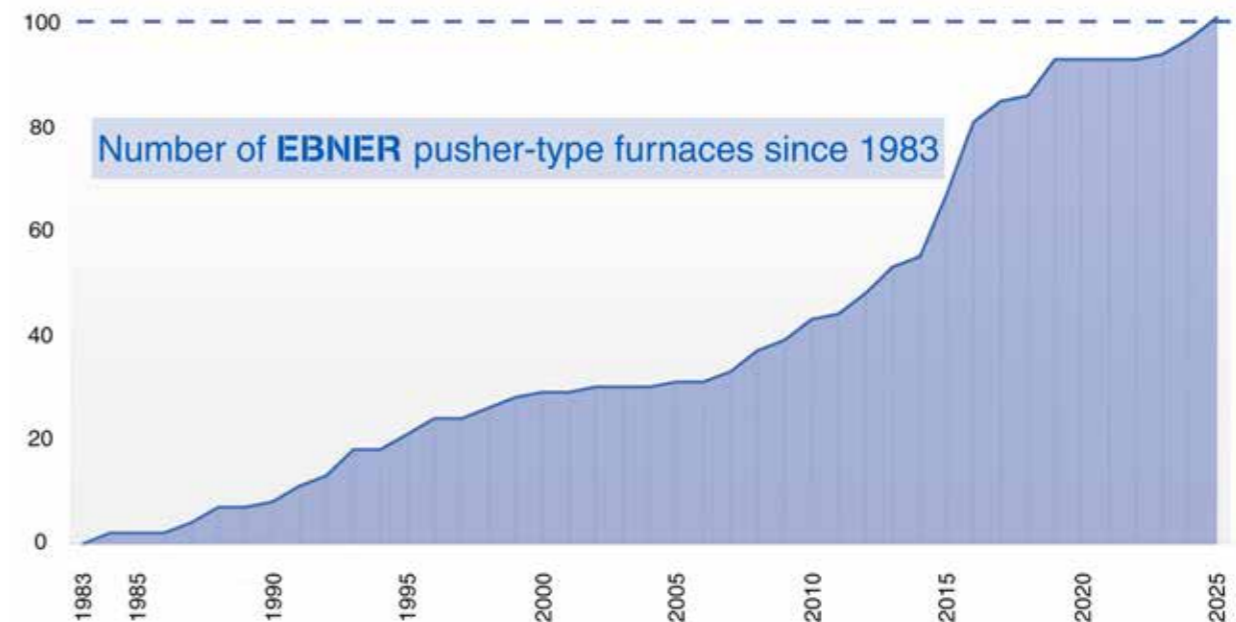
Of particular note is the change in charge dimensions, with increasingly large ingots becoming common - particularly at new hot rolling mills. This increase is reflected in the dimensions and throughputs of our furnaces.



Our first pusher furnace facility in Taiwan

As a result of the constant stream of orders, EBNER has been able to retain its hard-earned technical expertise and incorporate it into every new facility. The knowledge we have acquired has not been lost through subcontracting or the departure of employees, as has been the case at some of our competitors.

Around 2010, the number of bid requests rose sharply as a state-of-the-art flat aluminum strip industry developed in China. Well-known manufacturers were won over, choosing to install our furnaces at their works. This development is clearly reflected in the following chart, which shows the number of our furnaces over time.





EBNER pusher furnace facility in Brazil

Over the decades, **HICON®** pusher furnaces - like many other types of **EBNER** furnace - have undergone extensive technical development and been extensively automated.

HIGH FLEXIBILITY AND ADAPTABILITY

To limit the risks presented by advancing technology to the greatest possible extent, **EBNER** is capable of testing the practicality of newly-developed theoretical improvements in our in-house test center. A wide variety of trials and tests can be conducted, ranging from initial heat treatment trials in small batches to straightforward tests of engineering ideas, stress testing of new devices and the assembly and testing of complete furnace component groups - many things are possible.

With our experience and flexibility, **EBNER** is in a position to develop special solutions for specific customer requests for both new facilities and modernization projects.

CONTINUOUS DEVELOPMENT TO SUPPORT SUSTAINABILITY

Ongoing development has led modern furnaces to be many times more sophisticated, more powerful and more efficient than the first pusher furnaces. They are also automated to a far higher degree.

Despite this, the effort to improve our products never ceases and **EBNER** is continuously developing solutions to meet our customers' needs. Currently, alternative heating systems and energy conservation are major issues. The related work on eco-friendly solutions employs the strategic framework of our **E³** (EMISSION EFFICIENCY) approach.

THE EBNER GROUP: A FULL SOLUTION PROVIDER

The **EBNER** Group has steadily grown through the addition of new companies, meaning that a wide variety of facilities and furnace types can now be offered by the Group. The equipment covers the complete spectrum of production steps.

Of particular note is an alternative method of manufacturing strip, one that uses a continuous casting process. This replaces the manufacture of strip from cast rolling ingots (for which a hot rolling mill equipped with pusher furnaces is required).

As the production of cast strip using a twin-roll caster was developed in the mid 1950s, this method has always coexisted with other processes. However, this production process was significantly advanced in the 1990s through the development of a belt caster by HAZELETT Strip Casting Corporation. HAZELETT has been a member of the **EBNER** Group since 2021. Thanks to the belt caster both the quality of casts and the throughput have continued to improve.

The need to increase quality and throughput capacities, along with the one hundred hot rolling mills operating throughout the world, assure us that the demand for new pusher furnaces to manufacture aluminum strip and plate will continue or even grow. We can also upgrade existing pusher furnace facilities, employing individualized modernization programs to bring them up to the latest technological level.

Our know-how and experience make us optimistic that in the future we will be able to successfully implement many pusher furnace projects for our customers, and we are thus ready for the next one hundred **EBNER** pusher furnaces.



EBNER pusher furnaces installed worldwide

EBNER pusher furnace (furnace entry) with an extremely long rolling ingot in a state-of-the-art plant





20 years of EBNER China.

Looking back at a successful past and looking forward to an exciting future.



JIASHENG WANG
Managing Director - EBNER Industrial Furnaces Taicang

In 2001, following China's admission to the WTO, EBNER decided to invest in China in anticipation of the development of the Chinese market.

On August 22, 2001 the head of the development zone received our business license from the Industrial and Commercial Bureau and personally delivered it to the temporary office we had rented in the Xiangtang Building on Chaoyang Road, Taicang City. That was the start of EBNER China.

Since then, EBNER Taicang has grown to incorporate five companies: EBNER Industrial Furnaces, EBNER Trading, EED Industrial Furnaces, Gautschi Industrial Equipment and Hazelett Trading. The location employs nearly 250 people, who represent six well-known brands of industrial furnaces used for the heat treatment of metals.

At present, EBNER China's plant in Taicang, located at Beijing East Road 82, covers an area of 66,600 square meters and includes buildings with an area of 40,000 square meters. Of the 250 employees, around 2/3 are technicians and engineers, of whom around 60 % have over 10 years of experience with EBNER.

Highlights of the last 20 years of EBNER China's history include:

2000

Our first manufacturing order came from overseas - a bell annealer furnace (BAF) was fabricated and exported to Japan. Another milestone was met in this year: a bell annealer project with a private company located in Wu Xi, Xi Cheng Steel, was acquired. This was the first project which EBNER China participated in the bidding process.

2003

In 2004, we completed the first phase of the construction of the Chaoyang Road factory, and started production in our own workshop.

2004

2005

EBNER Trading Company was established in November 2005 to simplify the importing and exporting of goods.

2006

From 2002 to 2008, the company had a significant share of the Chinese market, with EBNER holding two-thirds of the domestic market. In 2006, our domestic order volume rose to 127 bell annealers.

2007

In 2007, the company started with a second brand, which later became EED, to develop the mid-range market in China.

2009

City expansion and new planning in the spring of 2009 led to the project to relocate the factory to Taicang with the support of the government.

2010

2011

In early 2011, EED was founded in Wuhan.

2012

At the end of 2011, the company moved to the new Beijing Road plant in Taicang and celebrated its 10th anniversary on September 28, 2012. 2012 saw the peak of EBNER China's production and volume of operations with the Tianjin Zhongwang project. This was the largest single project ever for aluminum strip processing, not just in China but in the world. EBNER China provided all melting and holding furnaces, pusher furnaces, roller-hearth furnaces, aging furnaces and continuous floater (air cushion) furnace facilities, thus establishing EBNER as the dominant supplier of industrial furnaces for aluminum strip processing globally.

2017

After several difficult years, EED was successfully established as another EBNER brand in China and in 2017 EED also relocated to Taicang. EED has a good technical team and has gained a number of solid customers in the domestic industry. Notably, it has brought a stable manufacturing workload to EBNER Taicang and has contributed significantly to the company's success in China.

2022





NEW STRATEGIC GOALS

During the last 20 years **EBNER** China has been confronted with several challenges such as the SARS crisis in 2003, the global financial crisis in 2008, the US-China trade war starting in 2018 and the COVID-19 pandemic, which began in 2020. The last crisis resulted in an increased atmosphere of anti-globalization sentiment, making it necessary to adjust our business strategy.

In line with this new strategy, we have been focusing our efforts on developing and cultivating our own products that are suitable for the Chinese market, such as press hardening furnaces (PH), while at the same time striving to maintain the export market. For a long time, our core business mainly comprised the production of complete sets of equipment, as directed by the headquarters in Leonding, Austria. However, press hardening furnaces for the Chinese automotive industry became an exception. Due to market demands, press hardening furnace

projects are run completely by **EBNER** China, including product marketing, design, manufacturing, installation, commissioning and start-up, as well as improvement, adaptation and development. Our success is evident, as we have sold 23 press hardening furnaces to date, covering about half of **EBNER** China's manufacturing volume. We have decided to make BAF furnaces and FAST continuous annealing furnaces the next products we produce independently, and are investing considerable resources into developing these products, optimizing the cost structure and developing the market ourselves.

The 20 years of **EBNER** China are a testament to enduring effort and a dedication to a long-term approach. At the same time, **EBNER** China is able to recognize and actively react to change, responds to trends, is consistently innovative and is constantly striving to provide exceptional service to our market sector.

www.ebner.cc

EBNER press hardening furnace



“On the occasion of our 20th anniversary, I would like to express my thanks and appreciation to all the people with whom I have enjoyed two decades of successful teamwork. I look forward to the next 20 years of success!”

Jiasheng Wang (Managing Director, **EBNER** Taicang)

A booming aluminum industry.

Decades of experience and an international presence, paired with a focus on sustainability, efficiency and the highest possible quality, make **EBNER** an attractive partner in the aluminum market.



MARKUS GANGL
EBNER Product Manager
Aluminum

For the **EBNER** Group, as well as the entire aluminum industry, the Aluminium trade fair (held September 27 - 29, 2022 in Düsseldorf, Germany) marked the long hoped-for start of a market upturn following the crisis of the corona pandemic.

Following the pandemic-induced postponement of the trade fair, which was originally scheduled for March, 2020, we - like everyone in the entire industry - had been looking forward to it with great excitement. Now that the difficult days of the pandemic were over, a strong sense of optimism could be felt in the air.

After countless video conferences and telephone calls, both exhibitors and visitors were delighted to be able to speak with their business partners face-to-face and begin to look forward to the future. This was reflected in the number of animated meetings and lively discussions held at our well-visited booth, and we were able to establish the foundations for successful projects with several of our customers.

SUSTAINABILITY: A DRIVING FORCE FOR ALUMINUM PRODUCTS

The recovery of the automotive industry is only one factor in the increased demand for aluminum products: the trend toward replacing plastic bottles with aluminum cans and bottles is also a contributing factor. The idea of sustainability is what is being focused on here, as aluminum is a material that can be recycled virtually an endless number of times.

REGIONALIZATION: A DRIVING FORCE FOR MAJOR INVESTMENT AT A LOCAL LEVEL

Another trend of note is the increased pressure placed on supply chains by both the pandemic and current conflicts. For the first time in decades, investments are being made in completely new aluminum plants - particularly in the USA. These investments are intended to reduce the share of imports, as well as to reduce dependence on global supply chains that may potentially be disturbed. As in other industrial sectors, a trend toward increased regionalization is visible.

The industrial Steel Dynamics group, already very successful in the steel sector, is leaving nothing to chance as it enters the aluminum industry. It chose industry-leading technology from **EBNER** for every one of the heat treatment facilities needed at its newly-founded, state-of-the-art Aluminum Dynamics plant - a 1.9 billion dollar flat rolling mill for recycled aluminum located in Columbus/Mississippi, USA. Our decades of experience, along with our focus on sustainability, efficiency and the highest possible quality, were the main factors contributing to the decision to choose **EBNER** as a partner for implementation of this project.

THE AEROSPACE INDUSTRY SOARS TO NEW HEIGHTS WITH EBNER TECHNOLOGY

The outlook is also very positive for the aerospace industry. After the downtime caused by lockdowns, the demand for air travel has risen sharply. However, high fuel prices - combined with the high ticket prices they lead to - have dimmed this bright outlook somewhat. In turn, this is motivating airlines to replace their fleets: in some cases it is no longer profitable to operate older aircraft, as they have higher fuel consumption. Over the long term, airlines can only remain competitive with new, efficient planes. Aluminum plays a significant role here, as well. Lightweight, high strength aluminum alloys - which of course require appropriate heat treatment - are fundamental to modern aircraft.

EBNER's product line includes equipment suitable for this application, as it meets strict aerospace industry standards like AMS (Aerospace Material Specifications) 2750.

OUTLOOK

The next highlight will be this year's Aluminum USA trade fair, which will be held in Nashville/Tennessee, USA on October 25 - 26, 2023. This event, the industry's most important fair in North America, covers the entire value-added chain for aluminum. It is an ideal stage for the entire **EBNER** Group, a full-solution provider, to present its innovative products. If you would like to meet our team of experts, feel free to visit our booth - we look forward to seeing you there!



New dimensions.

EBNER supplies the furnace facilities for a new state-of-the-art flat rolling mill in the USA - a plant that will have no equal in processing recycled aluminum.



BJ AUSTIN
VP Sales - **EBNER** Furnaces

Steel Dynamics (SDI) was started in 1993 by three former Nucor executives, and has grown to be counted among the top 50 steel producers worldwide and the top 4 in the US.

SDI and **EBNER** became partners in the early days after SDI's founding, and have maintained a close relationship as SDI's flat rolled steel operations have grown.

This past year, when SDI decided to diversify its operations by adding a new flat rolled metal - aluminum - to its product line, it once again trusted **EBNER** to support the expansion of its business.

AN AMBITIOUS STRATEGY FOR GROWTH

In 2021, SDI began looking for ways to once again put its profits to work and ensure future growth. As SDI surveyed the world of steel, it noticed another strategic metal with a rising market value, a gap between available mill supply and growing demand, and which fit well into its familiar, sustainable circular manufacturing model - aluminum.

SDI was aware that that many customers for SDI steel are also significant consumers and processors of aluminum flat rolled products, and knew they would value finding the company's high-quality, sustainable, customer-cen-

tric approach applied to the aluminum flat rolled market. While SDI had not yet been involved in aluminum production it recognized that, with the help of industry experts who know the nuances of aluminum production, it could leverage its knowledge of familiar processes and equipment.

After a team of aluminum experts had been gathered under the name Aluminum Dynamics, and board approval for construction and operation of an aluminum plant had been granted in July, 2022, the next chapter in SDI's success story looked to be one that would focus on aluminum.

The board's approval represented a bold and expanded vision compared to previous plant proposals, which were primarily intended to serve the automotive and industrial markets. The new 650 kMT plant, the most modern and energy-efficient mill in North America, will also have the capacity to serve the growing beverage market. It will thus be able to respond to the urgent calls from the US market for high-quality, domestically produced flat-rolled aluminum.

EBNER: CONVINCING EXPERIENCE AND QUALITY

To successfully implement its plans, SDI once again chose to rely on **EBNER**'s extensive experience with pusher-type furnaces (for preheating and homogenizing ingots/plates used for hot-rolled coils), floater-type furnaces (for continuous annealing and solution heat treatment of finishing sheet) and batch-type coil annealing furnaces (for intermediate and finished cold-rolled coils) used to produce high-quality aluminum alloys for the

automotive industry, can stock, and common alloy sheet.

The hallmarks of **EBNER** quality such as temperature uniformity during processing, the surface quality of the material, the reliability of the equipment, the ease of operation provided by innovative automation software and low environmental impact were influential factors in the choice.

In the fall of 2022, **EBNER**'s price/performance ratio provided the final impetus for SDI to place an order with **EBNER** for the supply of all three types of furnace. These furnaces will support the production of 950 kilotonnes of rolling ingots/plates and 650 kilotonnes of finished flat products at the Columbus, Mississippi (USA) works.

On March 7, 2022 Herbert Gabriel, **EBNER** Furnaces' General Manager, had the pleasure of joining the Aluminum Dynamics team for a groundbreaking ceremony during which the main partners for the project were recognized.

It is truly an honor for the entire **EBNER** team to support SDI and Aluminum Dynamics during this exciting project, and we look forward to continuing the partnership forged almost 30 years ago. We would like to thank the entire team from SDI and Aluminum Dynamics for their professionalism and for the trust they place in **EBNER**.

“

Following the choice for **EBNER**, Mark D. Millett, Chairman, President, and CEO of Steel Dynamics, Inc. stated: “We are excited to partner with **EBNER** on this project. Their industry-leading technology, focus on environmental impact mitigation, and high-quality equipment drove this important decision.”

Robert Ebner, CEO of the **EBNER** Group, commented: “Seeing the mini-mill mentality transitioning into aluminum, paired with an extremely high level of professionalism and passion, makes everybody from the **EBNER** team tremendously excited about this project and [it] poises us to provide world class technology for highest temperature uniformity, industry leading productivity with a low carbon footprint.”

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Taking temperature measurement to the next level.

The **EBNER** R&D Department has developed a groundbreaking temperature measurement system for float furnace facilities that operates both safely and efficiently, providing periodic verification of the entire heat treatment process.



MICHAEL BLAIMSCHEIN
EBNER Sales Manager



MICHAEL KLOSTERMANN
EBNER Product Expert

To supply high-quality aluminum strip to the aerospace industry, certification in accordance with the AMS 2750 standard is required. To fulfill the requirements of this standard, the operator of a heat treatment facility must carry out temperature measurements at periodic intervals under processing conditions.

This form of quality assurance is referred to as the “Temperature Uniformity Survey”, or TUS. A similar standard has also been defined for use during the manufacture and supply of automotive sheet. Fulfillment of the requirements of the AMS 2750 / CQ19 standards is often required by companies located further down the supply chain. Many aluminum producers go even further and

also take measurements of the material temperature, which may also be required for quality assurance purposes as agreed upon with their customers.

DEVIATING VALUES: THE GREAT CHALLENGE

The current technological standard for taking measurements at a float furnace facility calls for fiber optic thermocouples and an external recorder for the measured data, which is installed alongside the facility. Depending on the type of measurement taken, the length of the thermocouple lines may range between 70 and 120 m per measuring point. To verify the uniformity of the temperature, at least three thermocouples must be affixed to the strip. However, due to the length of some of the lines and the variation in temperatures along the length of the wires, deviations may be found in the values recorded for these measurements. Furthermore, to carry out measurements in this way requires a large number of personnel to ensure that the thermocouples are properly guided. This limits reliability, particularly at high strip speeds.

Due to the ever-increasing emphasis on process stability, it is necessary to continuously measure cooling within the water quench. Using conventional methods of measurement, this can only be realized to a limited extent - and that with difficulty. This means that, at this time, a significant portion of the heat treatment process can only be monitored with great effort or using mathematical modeling.

EBNER'S NEW DEVELOPMENT: A SOLUTION

Our new temperature measurement system prevents these problems from arising at all. One of the key points in our approach is a redesign of the temperature sensing equipment, which is now comprised of multiple reusable systems. This significantly reduces the wear on thermo-

couples. During development, another focus was placed on an alternative method of securing the thermocouples, which are now independent of the carrier strip. This reduces facility downtime, as there is no need to reconfigure to handle new strip dimensions. The clear USP for this system is, however, its ability to record the entire temperature profile of the process - including the water quench.

The new measuring system is comprised of a frame of steel tube, which is secured to a strip. Mounted on the frame are samples with sheathed thermocouples welded or soldered on; these are linked to the data logger, which travels with the frame. The carrier frame can be adapted to fit different widths of strip using telescoping rails. The data logger is mounted in the center of the carrier frame, and is protected from the heat treatment process by a heat-resistant casting. The design ensures that all sensitive electronics can travel safely through the facility, even with low pass heights. The carrier system was optimized using finite element simulations, ensuring that the weight placed on the strip by the measuring electronics was kept as low as possible.

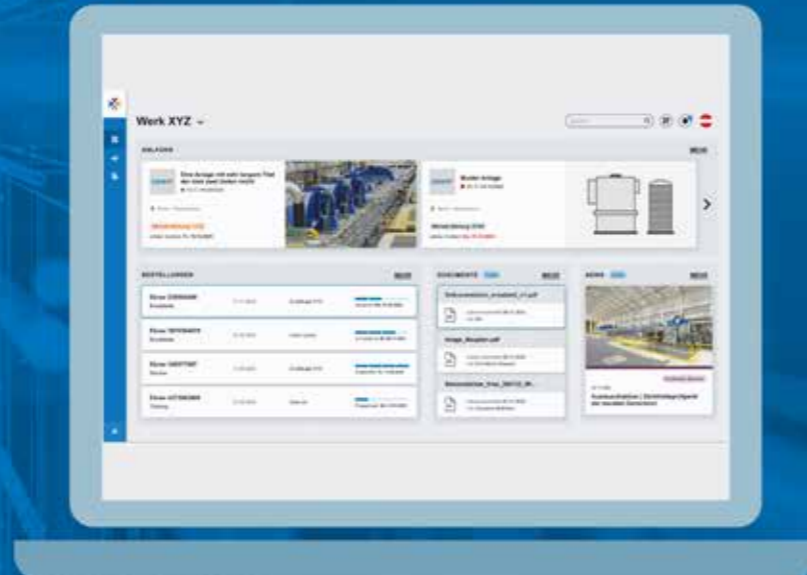
Using the new **EBNER** measuring system, the temperature profile of a facility can be verified easily, quickly, and safely - and without long downtimes. The water resistance of the data logger was a particular challenge for our developers, but in the end it was overcome through adaptations to the heat-resistant case and the quench deflector. Our in-house development team is now working with our partner and the supplier of the electronic measuring equipment to develop our existing prototype into a product ready for series production. **EBNER** will soon be able to assist its customers with their certification needs.

Measuring setup on aluminum strip



EBNER Customer Portal

- Relevant data displayed in a user-optimized format (KPIs, facility data, facility documentation ...)
- Integrated SMART Services for all user devices
- Dashboard can be individually customized
- Embedded data services
- Single-sign-on for customers
- Highest possible level of security
- Orders for spare parts
- Company news



Advances through digitalization.



ROBERT WRULICH
EBNER VP Digital Solutions

Our digitalization strategy is based on the needs of our customers and is the foundation for our digital path into the future.

Our goal is to ensure that EBNER facilities are state-of-the-art, for which reason we focus on continuously developing our products to increase their efficiency and optimize processes.

Inspired by this approach, two of our current digitaliza-

tion projects are the implementation of a new EBNER customer portal and further development of EBNER's VISUALFURNACES® Process Control System (PCS).

THE EBNER CUSTOMER PORTAL

Communication with and for our customers has been a significant factor in the success of our company, so we are constantly searching for ways to simplify and optimize communications for our customers.

We are currently deep in development work for an EBNER customer portal, which will offer every important feature needed to be able to react quickly and purposefully to customer requests.

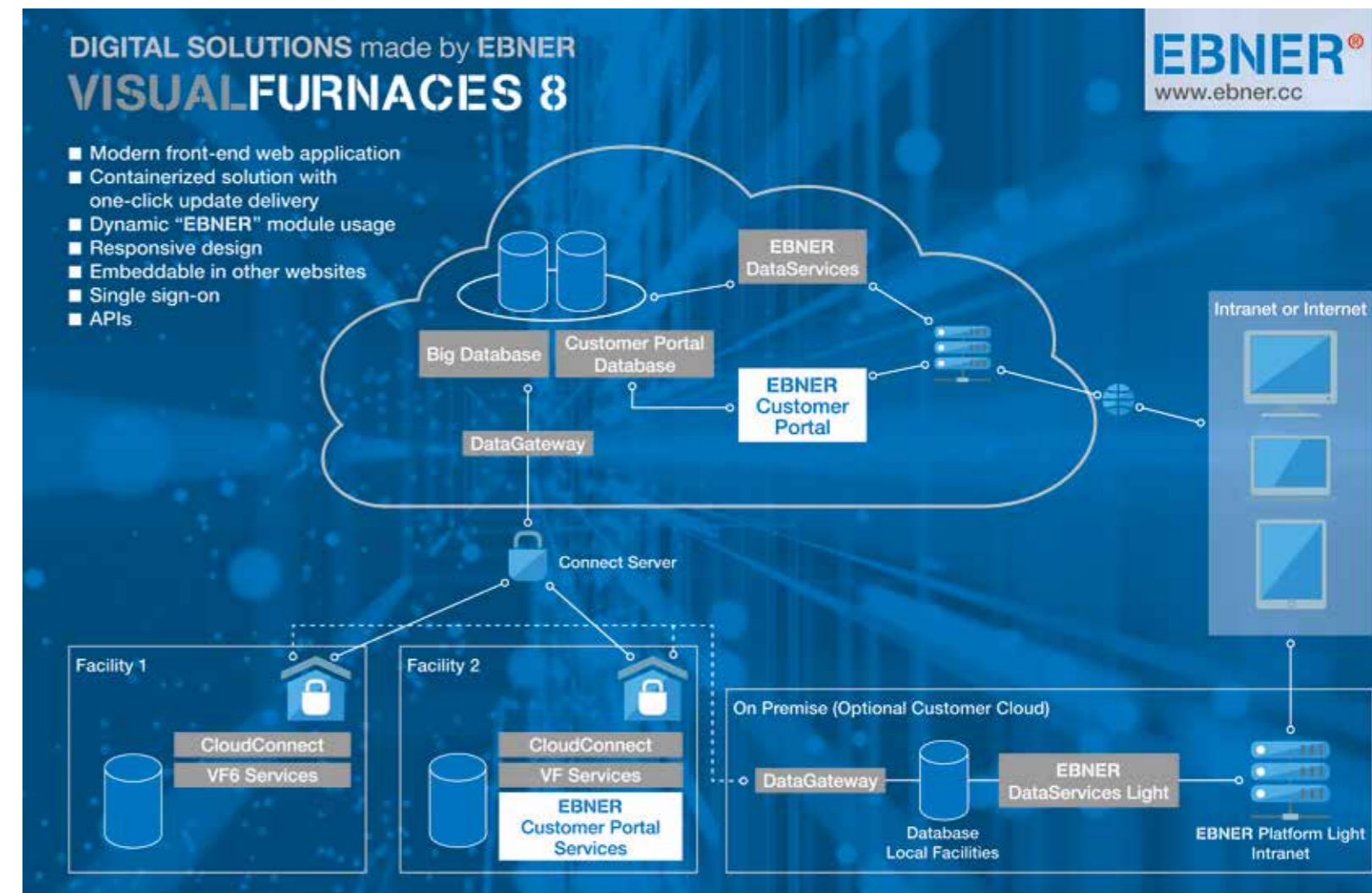
The portal will incorporate the following features:

- » Centralized facility information: information such as the facility user manual, spares list, drawings, orders, general facility data and every one of your contacts at EBNER will be in one place
- » User administration: the allocation of roles and user authorizations are under the customer's control for the highest possible level of security
- » Corporate group, company and facility overviews are automatically based on assigned roles, allowing use throughout a group - including all facility information
- » The provision of information is greatly simplified and reaction times are reduced when requests are made: virtually every process can be performed through the portal, from inquiries, quotes and orders to service overviews and scheduling
- » Spare part management to simplify the identification of spare parts for customers and process inquiries more rapidly
- » Individualized dashboard
- » The platform for all future EBNER apps

VISUALFURNACES®8

Our proven Process Control System (PCS), VISUAL-FURNACES®, is being upgraded to provide our customers with even more flexibility. The newest version, VISUALFURNACES®8, will simplify supervision, production planning and utilization through high-level, decentralized access. The update will also offer the following benefits:

- » Hardware-independent deployment provides maximum customer flexibility
- » Thanks to its hybrid architecture, can be operated either on-premises or on the cloud
- » "One-click" updates for all EBNER modules ensure that you are kept up to date!
- » EBNER edge devices provide our customers with maximum data security and transparency
- » Single sign-on for all applications
- » The planning of future production in the web app can also be carried out at a higher level - providing maximum flexibility
- » Data is provided to higher-level (level 3 and level 4) systems using standardized APIs
- » Overview of the status of every facility, including KPIs
- » Dynamic employment of modules; newly-developed modules rapidly become ready
- » All established EBNER PERFECT modules, including extensions





Since its foundation in 1922, Gautschi Engineering GmbH is one of the most innovative and competitive full-solution suppliers for aluminum melting and casting processes.

Compact Coil Furnace (CCF).

Green Gautschi technology for heat treatment.



OLIVER JANSEN
Gautschi Head of Sales

During the continuous evolution of Gautschi heat treatment facilities for coils, the company has been able to optimize annealing technology by adapting the design - without forgoing the use any proven technologies.

Customer requirements for low investment costs, as well as low production costs, were the driving forces behind the need to build a furnace that was as compact as possible. Although one must usually invest in measures designed to reduce energy consumption and production costs, this is not the case with a Gautschi Compact Coil Furnace (CCF).

CCF furnace technology has now been augmented by the incorporation of an electric heating system. This not only supports the EBNER Group's strategy for "Driving Green Technologies", but also meets the market's increasing demand for alternative solutions to conventional gas-heated facilities.

THE LAYOUT OF A CCF

The cylindrical central section accommodates the coil that is to be heat treated. By opening a double-leaf door, a coil can be charged/discharged from above.



During development, the following advantages of a CCF became apparent:

- » The reduced external surface area leads to a reduction of around 75 % in the energy consumption during holding.
- » The reduced volume of the furnace leads to a savings of around 55 % in atmosphere consumption.
- » The electric heating system reduces emissions to zero.
- » The facility is completely pre-assembled and tested in the Gautschi workshop.
- » The minimal requirements for the foundation allow the facility to be easily moved to a different location at a later date.
- » A customer's existing coil handling system can be used to charge/discharge coils; a special charging system is not required.
- » Should multiple CCFs be installed in a battery, a fully-automated charging system with a gantry crane can be used to charge and discharge the furnaces.

Recirculation fans and the heating system are installed in the two end sections positioned to the left and right. Heating can be carried out using either a gas-fired or electric system. Circulation air is distributed across the surface of a coil by a system employing round nozzles.

After a coil is charged, the two leaves of the door are closed. The end sections are then pneumatically shifted up to the central section. All furnace components are designed with dual seals, preventing the loss of thermal energy and making them air-tight. The annealing process can be carried out with or without process atmosphere. A cooling circuit can also be integrated at need. Control cabinets and the rack for the electric heating system can be installed near or alongside the furnace, as requested by the customer. Should the product mix be changed at a later date, the relatively simple design of the central section allows it to be easily replaced.

The heating elements are designed as modular units, and consist of tubular heating elements (12.5 mm) fabricated from stainless steel. All heating elements are installed in the end sections of the furnace, and are easy to replace. The temperature in each end section is controlled separately, using thyristor power controllers. The patented design of the furnace allows the customer's existing coil handling system to be used for charging. Either a coil grab or a C-hook may be used.

A CCF is an extremely energy-efficient and eco-friendly technology, and thus a solution that reduces costs. Savings are achieved through the reduction of energy and atmosphere consumption, with these reductions leading to a reduction in emissions or potentially even their elimination.

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A) REDUCED ENERGY CONSUMPTION

Compared to a conventional single-coil furnace, a new Compact Coil Furnace (CCF) has a significantly smaller exterior surface area. Despite the similar structure of the furnace walls, the consumption during holding at a temperature of 450 °C can be reduced by an impressive 75 %*. (*The savings that are achieved depend on the actual annealing temperature and the composition of the customer's product mix.)

Energy consumption of a single-coil furnace: 61.5 kW
Energy consumption of a CCF/Compact Coil Furnace: 15.3 kW

Assuming that an annealing temperature of 450 °C is required on 300 days out of the year, the savings that are achieved are as follows:

15 euro cents/kWh: € 49,900/year
20 euro cents/kWh: € 66,500/year

B) REDUCED ATMOSPHERE CONSUMPTION

Due to the significantly smaller volume of the furnace in comparison to a conventional single-coil furnace, process atmosphere consumption can be reduced by up to about 55 %. The gas that is saved does not need to be heated up, leading to additional energy savings. Single-coil furnace: 473.9 m³ at s.t.p. of process atmosphere would require 56.0 kWh per coil to be heated up to 450 °C

COMPACT COIL FURNACE: 214.9 m³ at s.t.p. of process atmosphere would require 25.4 kWh per coil to be heated up to 450 °C

The energy savings for the reduced amount of process atmosphere that is required thus total:

15 euro cents/kWh: € 4.60/coil
20 euro cents/kWh: € 6.10/coil

C) REDUCED/ELIMINATED EMISSIONS

When equipped with a gas-fired heating system, the carbon footprint will be significantly reduced due to the energy savings described above. When equipped with an electric heating system, the emissions fall to zero (assuming the electrical power comes from a green source).

D) Summary of potential savings for a CCF with an electric heating system

	CCF	SINGLE-COIL FURNACE	SAVINGS	QUANTITY	UNIT PRICE euro cents	COST REDUCTION
Energy consumption at 450 °C	15.3 kW	61.5 kW	-46.2 kW	300 days	15 ct/kWh 20 ct/kWh	49,900 EUR/year 66,500 EUR/year
Process atmosphere consumption	214.9 m ³ at s.t.p.	473.9 m ³ at s.t.p.	-259 m ³ at s.t.p.	300 coils/year	15 ct/m ³ at s.t.p. 20 ct/kWh	11,700 EUR/year
Energy consumption to heat up process atmosphere	25.4 kW	56 kW	-30.6 kW	300 coils/year	15 ct/kWh 20 ct/kWh	1,377 EUR/year 1,836 EUR/year
Total savings					15 ct/kWh 20 ct/kWh	62,977 EUR/year 80,036 EUR/year

TECHNICAL HIGHLIGHTS

- » 100 % CO₂-free -> zero emissions
- » Easy to integrate into existing facilities
- » Can be operated in flexible furnace atmospheres
- » Reduced dross
- » Developed in a cooperative effort with well-known institutions

Plasma burners

TPS has developed a zero-CO₂ alternative to common gas-fired burners.



WERNER WIGGEN
TPS Managing Director

Even though aluminum is a metal that, due to its low weight and the ease with which it can be recycled, is both important for and well-suited for many future products, its current carbon footprint is still high.

The higher the proportion of recycled material in a given mass of aluminum, the greater the impact of the carbon footprint of the melting process on overall emissions. At major facilities, the most current melting technology employs a gas-fired heating system equipped with regenerative burners. Even though these burners can operate extremely efficiently, consumption values of 550 – 600 kWh/t are not unusual. The combustion of natural gas releases 0.2 kg of CO₂ for each kWh of energy, which in turn means that 120 kg of CO₂ are released for each metric ton of aluminum that is melted. However, this does not take into account the emissions generated upstream, in the supply chain for the fuel gas (natural gas). These can add an additional 30 % to the emissions generated by combustion.

ZERO-CARBON ALTERNATIVES

A wide variety of zero-carbon alternatives for heating industrial processes are known. For example, many pro-

cesses can be heated in a carbon-neutral manner by using an electrical resistance heating system. However, the power density offered by such a system is inadequate for melting aluminum on a large scale. Furthermore, a melting process using induction leads to other problems when melting aluminum.

While induction furnaces with capacities up to 5 metric tons are suitable alternative designs, their weaknesses in areas such as ease of maintenance and process flexibility become ever more apparent as the furnaces are scaled up. For example, a casthouse that would like to replace a 100-ton round-top melting furnace would have to adapt all of its downstream processes to suit the new furnace design.

Another technology that can be employed at existing facilities is hydrogen combustion. However, a number of issues also inhibit the widespread use of this fuel. While on the one hand it is unclear when and if an adequate and affordable infrastructure will be available, it is also unclear at this time whether the use of hydrogen will have a negative impact on metallurgical properties. Hydrogen inclusions and the formation of aluminum oxides are critical issues to consider.



Ever since its founding in 2022, TPS (Thermal Processing Solutions GmbH) has been developing economical and sustainable technologies that will enable the employment of carbon-neutral heating systems in a wide variety of industries and fields.

PLASMA BURNERS: A POSSIBLE ECO-FRIENDLY SOLUTION

Another technology that is both eco-friendly and capable of fulfilling requirements is that used in what are known as *plasma burners*. Conventional plasma burners generate an arc between a cathode and an anode, which heats a gas and so creates plasma. However, this technology has a disadvantage in that, due to the extremely high temperatures that develop, the service lives of cathodes and anodes are very limited.

TPS chose to meet this exciting challenge head on, and develop a plasma burner both suitable for industrial applications and that would use induction to create plasma. This would have the advantage that critical components would not come into contact with the plasma, as the plasma itself would heat and melt the aluminum.

Using this technology, it would be possible to melt aluminum using a carbon-neutral method. One of the major factors considered in the design is that this technology would need to be capable of being installed at existing facilities equipped with gas-fired combustion systems. That is, the plasma burners must be able to replace the

gas burners of the old system. A further advantage offered by the design is that the technology can be employed in flexible furnace atmospheres. As the presence of oxygen in the furnace is eliminated, the amount of dross that is created can also be reduced.

TPS developed this technology in cooperation with well-known project partners.

By the end of 2023, the first conclusive results comparing the technology's influence on metallurgical characteristics to that of natural gas and hydrogen burners should be available. These results will be gathered using a laboratory furnace capable of processing charges up to 200 kg. The first installation under industrial conditions is planned to take place in 2025.



37% less CO₂

Integrated melting, casting & rolling lines for production of continuous cast aluminum strip with reduced CO₂ footprint.



DAVID HAZELETT

Hazelett Director

In cooperation with Mino S.p.A. and other EBNER Group members, Hazelett offers fully integrated lines for continuous casting of aluminum strip.

As mentioned in an article in the last issue of the HICON® journal, Hazelett offers a viable and tested solution to reduce the CO₂ footprint of aluminum sheet. Compared to the conventional DC casting/conventional hot rolling process, which includes many processing steps and requires substantial electrical and thermal energy input, continuous casting processes (Twin-roll Casting / TRC and Twin-Belt Casting / TBC) are much shorter and consume significantly less energy.

With the assistance of Hazelett and Gautschi, Mino has developed a model comparing the CO₂ footprint of these three processes for the transformation of aluminum into common alloy sheet products. In the last issue we reported on the result for foil stock, and have since applied the model to common alloy sheet.

Application of the model revealed that, compared to the conventional DC casting/hot rolling process, the Hazelett TBC process with in-line rolling provides a 37 % reduction in the CO₂ footprint for the transformation of aluminum to common alloy sheet.

This conclusion was reached using a “cradle-to-gate” analysis. “Cradle-to-gate” refers to the carbon impact of a product, starting from its origin to the moment the product exits the gate of the plant.

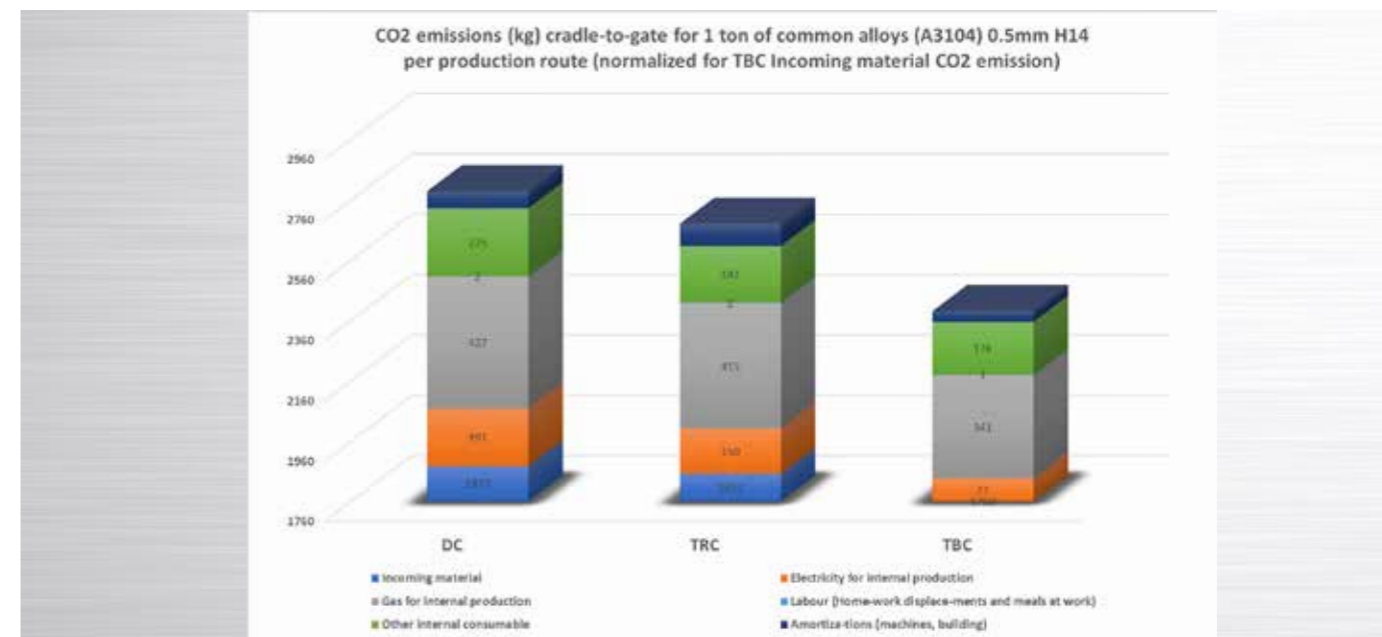
All CO₂ emissions required to transform the aluminum feedstock into coils of common alloy (0.5 mm thick, H14, 1750 mm wide) were considered. The feedstock is assumed to be a mix of 54 % primary ingot and 46 % scrap and alloying elements. The ADEMA Base Carbone database was used for the primary aluminum footprint. Because the CO₂ emissions related to the primary production of aluminum dominates the analyses, the graphical comparison shown below begins with the feedstock.

37% LESS CO₂

With a CO₂ footprint approx. 37 % smaller than a DC casting/conventional hot rolling process and a CO₂ footprint 17 % smaller than that of a TRC process, the Hazelett Twin-Belt Process stands alone as the “greenest” process for the production of aluminum common alloy.

Hazelett continues to refine and optimize its technologies to transform aluminum into an expanded range of aluminum sheet products with the lowest CO₂ emissions.

www.hazelett.com



HAZELETT
EBNER® GROUP MEMBER

Hazelett has been a global leader in developing and manufacturing continuous casting machines for the metal industry since 1919.

Service opens doors.

Service work continues to grow for GNA.



KALEB WRIGHT
GNA CTO

Since the implementation of the Field Service Group in 2019, GNA has continued to grow the footprint of their service division every year.

From refractory repairs/re-lines and combustion system upgrades to furnace rebuilds for improved efficiency and performance, GNA's service division is now actively providing services to cover every need of the North American aluminum industry.

Customers in the industry now acknowledge the GNA service division as a team with the know-how and experience needed to solve problems, even those that may have been issues for an extended period of time.

Nanshan Aluminum in Indiana, USA is a great example of this. For years, Nanshan had been struggling with problems with the burners at their batch homogenizing furnaces: the burners failed every 3 to 6 months, which both significantly impacted furnace operating expenses and led to costly downtimes.

Several companies had worked on the systems over the years, each attempting a new approach to solve the failures - all to no avail.

The customer reached out to GNA to discuss the issues they continued to experience with the burner systems. The furnaces were originally provided by GNA, though GNA had not manufactured the burners and combustion systems.

Following extensive discussions between Nanshan and GNA, it was felt that the new service team founded by GNA in 2019 could help the customer find a solution to the problem.

EFFICIENT PROBLEM ANALYSIS

An agreement was made to start from scratch in the approach to the premature burner failures. The team spent several days on-site disassembling existing burn-

ers and collecting design and process data. This led to a significant discovery: the burners were failing prematurely due to the build-up of heat in the burner tile itself. The burner could not dissipate heat properly and so allow the burner head to operate at its designed temperature.

QUICK PROBLEM SOLVING AND IMPLEMENTATION

GNA was able to take this discovery and rapidly develop a solution to the problem. A concrete repair plan was submitted to Nanshan, in which the cause of the system failures was described.

After the customer reviewed the plan and approved the proposed solution, the required materials were procured and the repair work, which required a shutdown of the furnace, could begin.

Installation of the new burner design was completed in only 4 days. But while the customer was very pleased with the speed of the work, it remained to be seen if the repairs would provide a long-term solution.

Today, over a year and a half later, the burners are still in operation and have saved the customer hundreds of thousands of dollars in repairs and lost productivity. Nanshan is now in the process of converting all their furnaces to this design, and is utilizing GNA for other service needs in the plant.

Working with Nanshan was a great experience for the GNA team, and an important partnership was established. Solving problems with furnaces may be what we do, but creating trusting relationships is what counts most.

With many more success stories like this, the Field Service Group continues to prove its value not just to GNA, but to the entire **EBNER** Group by opening doors and creating relationships.

www.gna.ca/en/



Since its founding in 1983, GNA has established itself as a leading provider of equipment and services, including melting and holding furnaces, for the aluminum industry.

NEWS

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Trade fairs. Conventions. 2023

MAY 8 - 11, 2023	AISTECH	Detroit	USA	Booth no.	2028
MAY 9 - 11, 2023	INTERWIRE	Atlanta	USA	Booth no.	1519
JUNE 12 - 16, 2023	THERMPROCESS	Düsseldorf	DE	Booth no.	9F57
JUNE 14 - 16, 2023	METAL + METALLURGY	Shanghai	CN	Booth no.	W5B21
JULY 5 - 7, 2023	ALUMINUM CHINA	Shanghai	CN	Booth no.	1H10
SEPT. 4 - 7, 2023	WIRE CHINA	Shanghai	CN	Booth no.	-----
OCT. 25 - 26, 2023	ALUMINUM USA	Nashville	USA	Booth no.	-----

We look forward to seeing you there!

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