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HICON®

EBNER GROUP Journal for technology and progress

EBNER GROUP

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

In this issue we focus on two closely-related themes: innovative “green” developments and our customers as driving forces and partners in this transformation.

Often the path towards increased sustainability begins by taking small steps in one’s own backyard - for which reason we open with the efforts we have made to optimize the use of resources at our offices in Wadsworth, Ohio (USA). We then learn more about our innovative and eco-friendly ambitions in Norway, a nation that has been playing a leading role in the drive toward climate-neutral industry. Next, we visit a green product development that has the potential to make a difference in a variety of industrial sectors - TPS plasma burners. Finally, we are pleased to be able to describe the success of the pilot phase of our GREENBAFx® bell annealer at one of our long-term customer’s works.

However, investing in a sustainable future does not always mean making new investments. We also offer the right solutions for extending the service life of your facility and increasing its efficiency with modernizing features. For this reason this issue also includes an article describing the modernization of an existing facility, bringing it up to the latest technical standards - a project that was able to increase productivity even as it also reduced energy consumption.

One of our key objectives is to not limit our extensive range of services to our own facilities and in fact we also have extensive expertise with non-EBNER facilities. We are convinced that we must contribute to global decarbonization, and one means of doing so is making our knowledge and our technical solutions available to every company in the market - regardless of the original manufacturer of their facilities.

This issue also sees us take a look at our locations in Mexico and India, both of which have begun to play meaningful strategic roles in the EBNER GROUP, and report on a variety of other intriguing projects and new developments.

I hope you enjoy this issue!

Yours,
Robert Ebner
CEO EBNER GROUP

EBNER receives a Climate Protection Award from the Municipality of Leonding

SUSTAINABILITY / NACHHALTIGKEIT
SAPHIR / SAPPHIRE
STAHL / STEEL
ALUMINIUM / ALUMINUM
CUSTOMER SERVICE
FERTIGUNG / MANUFACTURING
ENGINEERING
DIGITALISIERUNG / DIGITALIZATION

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Driving Green Technologies:
at EBNER, sustainability begins at home

www.ebner.cc

HERBERT GABRIEL

EBNER Furnaces
Managing Director
sales@ebnerfurnaces.com

For EBNER, “sustainability” is more than just a word. At a time when EBNER facilities stand out for their energy-efficient processes and low emissions, EBNER Furnaces in Wadsworth, Ohio (USA) is also strongly emphasizing environmental awareness and resource conservation.

For years, investments have been made in improving the energy efficiency of company buildings. High-quality insulation, energy-efficient modern windows and automatically-controlled ventilation and shading systems ensure that a minimal amount of energy is wasted. Another important step was made when the company switched over the entire lighting system to LED technology a few years ago. Along with a noticeable drop in electrical and maintenance costs, the quality of the lighting was significantly improved - which had a positive effect on both workplace safety and product quality. The new lighting was rounded out with a new air conditioning system for the office spaces and a new ventilation system for the workshops, which improved air quality and lowered energy consumption.

Sustainability is also being emphasized during manufacturing. Steel scrap is collected by alloy type, increasing both its value and its ability to be recycled. Four electric company vehicles are now in use, reducing both the operating costs and the emissions created by our vehicle fleet.

Another milestone was passed only a short time ago, when the company invested in a generously-dimensioned photovoltaic array. With a total output of 535 kW and the ability to supply the public grid with up to 350 kVA, EBNER covers an average of 70 % of its own annual energy needs. Furthermore, on sunny summer days the array produces surplus energy – offsetting the peak loads created by air conditioning units. The installation will pay for itself in less than five years, a clear sign that ecological responsibility and economic efficiency can go hand in hand.

All these steps add up to a consistent overall approach. From a location that has optimized its energy use to manufacturing processes that conserve resources and an extensive supply of energy from a renewable source, EBNER Furnaces has made it a priority to implement the idea of DRIVING GREEN TECHNOLOGIES - a demonstration of the fact that sustainability begins at home.

ADVANCED MATERIALS

FAMETEC®

Green sapphire

Sapphires from the Arctic, produced with sustainable technology

www.fametec.co

JONGKWAN PARK

FAMETEC
Chief Technology Officer
info@fametec.co

Sulitjelma, a former copper mining town located within the Arctic Circle in Norway, is now the home of ARCTICSapphire. Instead of digging up ore, the town has become focused on growing sapphire crystal - a highly sought-after material with immense industrial value. By employing technologies developed in-house, ARCTICSapphire is pioneering a new chapter in sustainable crystal manufacturing.

REDEFINING SAPPHIRE PRODUCTION

Traditional sapphire crystal production, long dominated by Russian and Chinese suppliers, is a notoriously energy-intensive and carbon-heavy process. **ARCTICSapphire** is turning this on its head by leveraging the unique resources of Sulitjelma and advanced technology. The town's abundant, clean hydropower and access to cold water create the ideal conditions for a more sustainable approach.

At the core of **ARCTICSapphire**'s operation is the McSAP furnace, a revolutionary system developed by **FAMETEC**, another member of the **EBNER** GROUP. This cutting-edge technology allows for multiple, tailored crystal growths in a single operation, a significant departure from older methods. The furnace's exceptional repeatability and reproducibility not only enable automation, but also guarantee world-class quality. This technological leap, combined with 100 % green hydropower, puts **ARCTICSapphire** on track to deliver the "greenest sapphire production in the world."

A STRATEGIC ADVANTAGE IN A SHIFTING WORLD

Sapphire is a vital semiconductor substrate for next-generation technologies like LEDs, micro-LEDs and GaN power devices. Its superior hardness, transparency and stability in extreme temperatures also make it essential for optics, medical devices, aerospace applications and luxury watches.

In a global economy grappling with trade tensions and the push for economic independence, **ARCTICSapphire**'s “made in Europe and carbon-neutral” product provides a powerful strategic advantage. As Europe seeks to reduce its reliance on imports from Russia and China, **ARCTICSapphire** is perfectly positioned to provide a cleaner, greener, and geopolitically independent supply chain. This is a product that does not exist anywhere else in the world, giving the company a unique market position.

SCALING UP FOR A SUSTAINABLE FUTURE

ARCTICSapphire is (for the moment) a small-scale operation, but has a bold vision for the future. The company has already begun mass production, targeting two tons per month by 2025 and expecting to create up to 300 new jobs over the next few years. Demand is already rising, with a Norwegian oil company and a European watchmaker qualifying **ArcticSapphire**'s products and inquiries pouring in from a wide variety of industries.

As members of the **EBNER** GROUP**,** **ARCTICSapphire** and **FAMETEC** – in particular, its R&D center in Austria – are continually extending their competitive advantage by advancing their technological lead, and **ArcticSapphire** is poised to become a global leader in sustainable sapphire production.

The company's vision extends beyond its own success: another one of its goals is to establish Sulitjelma as the first zero-emission industrial park in northern Norway, demonstrating that a town's legacy of resourceful industry can be rekindled with a modern, sustainable purpose.

EBNER®

GREENBAFx®

Success of a pilot facility at the Waelzholz works

GREENBAFx

PETER SEEMANN

EBNER **Industrieofenbau**
Senior Principal Technology Expert
sales@ebner.cc

ANDREAS SAUSCHLAGER

EBNER **Industrieofenbau**
Senior Principal Technology Expert
sales@ebner.cc

The demands placed on modern manufacturing processes are extremely diverse: industries require processes that are energy efficient, reduce carbon emissions, are highly automated and are cost effective. With the development of the recently-introduced GREENBAFx® line of bell annealer facilities, EBNER has marked another milestone in the field of sustainable heat treatment. This innovative technology combines extremely high energy efficiency with zero emissions and fully-automated processes, blending environmental responsibility with financial benefits.

EFFICIENT AND SUSTAINABLE HEAT TREATMENT: A NEW APPROACH

GREENBAFx® stands out due to its high energy efficiency and its zero-emission heat treatment process. Integration of the heating system into the workbase and the direct transfer of thermal energy minimize heat losses, while an innovative energy exchange system uses the energy released during the cooling process to preheat another charge. The use of a single “process” bell, which combines the functions of a heating bell, cooling bell and inner cover, greatly simplifies operations. This design significantly reduces the required number of interventions and crane movement cycles, as well as waiting times. The reduction of thermal stresses extends the service lives of components, and the wide variety of cooling options allows flexible production without sacrificing quality. In addition to all this, GREENBAFx® allows thermal energy to be efficiently recovered. A hybrid heating system (gas/electric) is available as an option, and existing facilities can be easily upgraded.

GREENBAFx®: TWO OPTIONS TO MAXIMIZE SUSTAINABILITY

To optimally fulfill the widely differing needs encountered throughout the industry, GREENBAFx® is available in two design variants. Both variants are intended to significantly reduce energy consumption and emissions, but differ in how they use and recover thermal energy.

THE “BASIC” CASE: DIRECT ELECTRIC HEATING

- High-performance heating system, integrated into the workbase diffuser
- No need to exchange bells; only two crane movements are needed per annealing cycle
- Fully-automated process sequence using a process bell
- Alternatively, hybrid operation with a heating bell (gas/electric heating) is possible
- Due to the reduction of heat losses, savings of up to 5 % in net energy consumption can be achieved
- Zero emissions: no CO_2 or NO_x is emitted

THE “ADVANCED” CASE: THERMAL ENERGY RECOVERY THROUGH HEAT EXCHANGE

- Use of the energy released during cooling to preheat a neighboring coil stack
- Up to 30 % of the energy fed into the system can be recovered
- Fully-automated process sequence using a process bell
- Alternatively, hybrid operation with a heating bell (gas/electric heating) is possible
- The consumption of electrical energy by a typical 60 t charge is reduced from 178 kWh/t to 124 kWh/t (in comparison to a conventional bell annealer facility with an electric heating system)
- Improved coil quality due to reduced heating and cooling rates

By employing a GREENBAFx® facility, energy savings of up to 30 % can be achieved. This not only represents a significant reduction in electrical energy consumption, but also leads to a significant reduction in operating costs. Furthermore, this technology contributes to the sustainability of a manufacturing process, in that it significantly reduces carbon and NO_x emissions. The compact design allows available space to be efficiently used, and also makes the system eminently suited for retrofitting at existing facilities. At the same time, a GREENBAFx® ensures maximum process stability and the highest product quality - environmental and financial advantages are united in a single design.

SUCCESSFUL PRACTICAL TESTS AT THE WAELZHOLZ WORKS IN HAGEN, GERMANY

Founded in 1829, Waelzholz today is an innovative and internationally-active family-owned company employing cutting-edge technology, with branches on four continents. Over 2400 employees throughout the world manufacture tailor-made steel strip and profiles - not only in Europe, but in China, North America and South America as well. As one of EBNER's long-term customers, Waelzholz consciously chose to cooperate with EBNER on the GREENBAFx® technology project - with the goal of aggressively pushing both energy efficiency and sustainability forward.

THE ROAD TO OVER 100 SUCCESSFUL ANNEALS

The cooperation between Waelzholz and EBNER on the GREENBAFx® began when one workbase at the Waelzholz works was rebuilt in February, 2024. Long-term testing of the facility was then conducted under industrial conditions.

Between June 2024 and August 2025, the facility was repeatedly optimized under real production conditions. This allowed major progress to be made and performance to be significantly improved, in that annealing times were optimized and hydrogen consumption was sharply reduced. In addition to this, information was collected on the system's durability during continuous operation, and additional improvements were made to components.

August 2025 marked a significant achievement: the facility had successfully completed over 100 anneals, and nothing could stop the successful roll-out of this new technology.

Thanks to the close cooperation between EBNER and Waelzholz, GREENBAFx® is the most technologically advanced and future-oriented solution currently available, marking real progress for our industry in terms of energy efficiency and sustainability.

PROFITABILITY AND THE ENERGY REVOLUTION

Over the last few decades, bell annealer facilities have typically been heated with natural gas; this has been due to the fact that the cost of fuel gas was significantly lower than that for electrical energy. The innovative GREENBAFx® design, with its thermal energy recovery systems, eliminates most of this price difference between natural gas and electrical energy - even in regions where electrical energy is relatively expensive, such as Central Europe.

This makes a significant contribution to the energy revolution - although, in the final analysis, the transition to renewable energy will depend on the regionally-varying frameworks for energy policy.

GREENBAFx® workbase, C.D. Waelzholz

www.t-p-s.cc

Plasma burners

Zero-carbon solutions to decarbonize industry

WERNER WIGGEN

TPS
Managing Director
info@tps-gmbh.cc

Alongside the process used to reduce primary material, one of the most impactful points that can be leveraged to reduce the carbon footprint of aluminum production is the melting process. Currently, regenerative burner systems fueled with natural gas are the standard technology used in large-scale industrial melting furnaces. Although such systems are extremely efficient, they emit a significant amount of CO_2 - a fact that stands in stark opposition to ambitious climate-related goals. Fortunately, economical decarbonization does not require existing facilities to be completely replaced: targeted rebuilds can be used instead. For such rebuilds, plasma burner technology currently represents the most cost-effective and future-oriented technology under development.

PLASMA BURNERS AND DECARBONIZATION

Plasma burners allow heat to be input into a process without carbon emissions, even as they also fulfill the strict requirements for temperature and process stability associated with the melting of aluminum. Due to their ability to be integrated into existing furnace systems, they offer a realistic and cost-effective way to transform the industry into a sustainable one.

Plasma, often referred to as the fourth state of matter, is an ionized gas. It conducts electricity, which allows electrical energy to be directly converted into thermal energy with an extremely high power density.
This allows temperatures of several thousand degrees Celsius to be achieved, ideal for high-temperature processes like those used to melt metal. The most significant advantage when compared to other common combustion processes is the zero-carbon generation of heat.

DEVELOPMENT AND CURRENT STATUS

TPS was founded in 2022, with the goal of establishing plasma burners as a cost-effective product for industrial use. The company's focus has been on Inductively Coupled Plasma (ICP), in which an inductor is used to create plasma in a ceramic tube. When compared with the more common Direct Current Plasma (DCP), the main advantage of this technology is the elimination of electrode burnoff - which significantly shortens maintenance intervals. By scaling the system and further refining the power electronics, **TPS** intends to offer ICP systems that are not only priced lower, but also offer higher efficiencies than the technological alternatives. The first prototype expected to fulfill these requirements is currently being tested in a pilot caster at the C-R-C.

An additional significant milestone was passed at Freiberg University's Foundry Institute in 2025: for the first time, 100 kg of aluminum was melted using only a plasma burner system developed in-house. After the furnace was preheated for over 20 hours, 100 kg of aluminum was placed inside and melted in about 2 hours. Trials in which the process employed in a traditional bath-type furnace was reproduced showed very promising results. Reductions in the amounts of dross and hydrogen inclusions were noted, indicating an improved melt quality. These results will soon be validated by making direct comparisons with gas-fired burner systems.

FUTURE PROSPECTS AND FURTHER DEVELOPMENT

In parallel with the tests conducted in Freiberg, a pilot project in Ranshofen has been running at full speed. In 2025, stable outputs reaching up to 750 kW should be achieved. The goal is to raise this to 1 MW by 2026, and **TPS** plans to base a modular heating system around this 1 MW burner design. Due to the compact construction, it is possible to integrate several of these systems into the extant flanges of regenerative burners. This means that installation in the majority of existing facilities is possible.

The next great step in development will be a long-term test of the prototype in an industrial furnace, which is planned for 2026. Alongside the melting of aluminum, **TPS** envisions additional applications for this technology in other high-temperature processes. These include the heat treatment of steel, the production of cement and glass, and a number of applications in the chemical industry. The technology can be employed in any application where both high performance and high temperatures are required.

WRUtec

THERMAL PROCESSES

Innovation meets industry

WRUtec reimagines hydromechanical cleaning processes for the metals industry: precision, efficiency and sustainability using pulse technology

ROBERT WRULICH

WRUtec
Founder & Managing Director
robert.wrulich@wrutec.com

Metals processing industries are facing a steadily-rising demand for increased quality, efficiency and sustainability. This is especially true in the steel and copper base metals industries, where powerful descaling processes that make efficient use of resources are crucial for ensuring consistent product qualities and economical operation. To address this need, WRUtec employs a simple yet effective principle: pulsed water jets.

With the strategic support of the **EBNER** GROUP, the next step in the company's growth has successfully been taken. The GROUP is significantly assisting WRUtec in establishing its innovative pulse technology in the global metals industry - promoting a movement toward increased sustainability in industrial surface cleaning.

PULSED JETS REPLACE CONTINUOUS STREAMS

WRUtec has redefined industrial cleaning by employing an extremely simple yet extremely effective physical principle: instead of a constant stream of water, WRUtec systems create short, highly intensive pulses of pressure. This kind of pulsing creates an exceptional amount of force, providing a hitherto-unachieved combination of

- **maximum cleaning efficiency**
- **high precision**
- **a significant reduction in water and energy consumption**

When descaling slabs or wide strip, one of the central processing steps in the metals industry, water and energy savings of up to 50 % can be achieved - without compromising or reducing cleaning quality.

TAILOR-MADE SOLUTIONS FOR THE METALS PROCESSING INDUSTRY

For a descaling process, central challenges include the high water consumption created by energy-intensive pump systems and the inefficient cooling rates this leads to. These challenges also have a negative influence on downstream processes, meaning that targeted technological solutions are required. With the refinement of our pulse cleaning technology, we provide cost-effective descaling that saves resources and ensures process stability.

To meet the descaling needs of the steel and copper base metals industries, the high-pressure pulse systems offered by WRUtec are scalable - allowing them to be seamlessly integrated into both existing and new production lines. Working closely together with our customers, we develop individualized nozzle designs, pump systems and unit layouts to provide tailor-made solutions meeting specific requirements.

ARE YOU FACING DESCALING OR HYDRO-MECHANICAL CLEANING CHALLENGES?

We look forward to hearing from you!

www.wrutec.com

WRUtec
FORCE.
PRECISION.
PULSE.

MICHAEL MEISCZUK

EBNER Industrieofenbau
Senior Sales Manager, Upgrades & Rebuilds
service@ebner.cc

The continuous development of existing facilities is a central element in modern industrial processes, particularly in stainless steel manufacturing. One recent example of a successful modernization has been provided by EBNER Industrieofenbau, as it extensively revamped a vertical bright annealing line (line BA2) at ARINOX SpA - a leading manufacturer of precision stainless steel strip.

DECADES OF PROVEN EBNER TECHNOLOGY

ARINOX was founded in 1990 as a member of the Arvedi Group, and specializes in the manufacture and sale of thin and ultra-thin stainless steel strip. With an annual capacity of over 65,000 metric tons, the company supplies its products to customers in the automotive industry, the machine manufacturing industry, and the electronics industry, as well as in other high-tech sectors. Its export share is over 80 %, with its key markets being in Europe, the Americas and both the Middle and Far East. ARINOX is the world's largest operator of EBNER vertical annealing lines, with a total of five facilities installed at the same site. Lines BA1 and BA2 date back to 1990, when the company was founded, and are still being operated today.

THE MODERNIZATION OF LINE BA2

Annealing line BA2 was comprehensively modernized over the course of the recent project. Major goals were to upgrade the facility to meet the latest technical standards, increase its energy efficiency and reduce its environmental impact by recycling hydrogen.

TECHNICAL DATA OF THE FACILITY:

- **Strip width:** 400 - 670 mm
- **Strip thickness:** 0.2 - 2.0 mm
- **Max. strip speed in furnace:** 40 m/min
- **Max. throughput:** 3.9 t/h
- **Materials:** AISI 304, 316, 310, 301, 409, 430
- **Year of original installation:** 1990

SCOPE OF THE MODERNIZATION

MODIFICATIONS	NEW COMPONENTS AND EQUIPMENT
Modernization of the inlet seal with the installation of new powered sealing rolls, an oxygen detection system and adjustable sealing rolls at the outlet of the seal box	Two new valve stands
Modification of the furnace shell to accept new thermocouples	New pressure control station for nitrogen
Upgrade of the inlet seal plug with a new water cooling system	New flow metering system
Rebuild of the cooling zone with frequency-controlled blowers and new thermocouples for the heat exchanger	A complete new set of analyzers for the process atmosphere
Modification of the shell of the top roll box	New electrical control center with S7-1500F and the latest version of the VISUALFURNACES® Process Control System (PCS)
Safety-related upgrades at the outlet seal	New hydrogen recycling system offering impressive recirculation rates of up to 80 %
Alteration of the direction of atmosphere flow	
Optimization of the cooling water supply system	
Modification of the atmosphere extraction system	

HYDROGEN RECYCLING: LOWERING COSTS AND INCREASING EFFICIENCY

Bright annealing lines for stainless steels and copper alloys typically use process atmospheres with high hydrogen contents (up to 100 % H_2). This inhibits oxidation of the strip surface during the heat treatment process. However, the consumption of hydrogen represents a significant cost factor for operation of such facilities (OPEX). Given the increasing price of utilities, the need to optimize operating costs is constantly increasing in importance. This is exactly where **EBNER**'s fully-integrated hydrogen recycling system comes into its own: it enables the consumption of hydrogen to be significantly reduced during an anneal. Contaminated process atmosphere is drawn off at the inlet lock of the furnace and led through a multi-stage purification unit, which incorporates an activated carbon filter, an auxiliary filter, a catalytic converter and a molecular sieve adsorber. Once purified, the clean gas is returned to the heat treatment facility.

THE ADVANTAGES

- Recycling rates of up to **80 %**
- No negative effects on the strip surface
- Operation is fully safe
- **Amortization period:** 1 - 3 years, depending on output and utility prices

LEARN MORE

www.ebner.cc

RESULTS AND CUSTOMER SATISFACTION

Over the course of the project, the feedback received from ARINOX was extremely positive. Particularly singled out for praise were the on-schedule implementation, adherence to planned stoppage times and the high quality of the components and systems that were supplied. The modernization not only brought the facility up to the latest technological standards, but also represented a significant step forward in the effort to establish more sustainable production methods.

The integration of a hydrogen recycling system into the facility allows process gases to be efficiently recovered and re-used, providing both ecological and financial benefits. With a recirculation rate of up to 80 %, ARINOX is setting a new standard for the low-emission processing of stainless steel.

TARGETED UPGRADES TO INCREASE FACILITY EFFICIENCY

The successful modernization of vertical bright annealing line SA2 at the ARINOX works is an impressive demonstration, showing how existing facilities can be made ready for the future by choosing selected upgrades and installing innovative technologies. **EBNER** has once again shown that it is a competent and reliable partner for challenging modernization projects - offering tailor-made solutions, a high degree of technical precision and a strong emphasis on sustainability.

Customer Service

Premium technology as a service

EBNER expands its service portfolio to include non-EBNER heat treatment facilities

MICHAEL SCHIESSER

EBNER Industrieofenbau
Executive Vice President, Customer & Site Services
service@ebner.cc

For decades, as the world's leading manufacturer of industrial facilities for the aluminum, steel and copper base metal industries, EBNER has stood for high quality, technological Innovation and tailor-made heat treatment solutions.

Since the beginning of this year, EBNER has been placing additional emphasis on a strategically vital business sector: the modernization and service of, as well as the supply of components for, heat treatment facilities that were not manufactured by EBNER itself.

This expansion of EBNER's portfolio of services is, however, not entirely new. In the past, a number of successful modernization projects have been carried out at competitor's facilities. One outstanding example of this is the complete modernization of the automation and visualization systems of a 32-workbase bell annealer facility in Italy, over the course of which EBNER demonstrated its expertise in control technology and process optimization. The facility was not only revamped to meet the latest technical standards, but its efficiency and ease of operation were significantly improved through installation of the VISUALFURNACES® Process Control System (PCS).

Another successful project was the integration of EBNER ECOBURN technology into a non-EBNER facility to reduce NO_x emissions. Implementation of this extremely efficient burner technology meant that exceptionally low emission values could be achieved - making a significant contribution to sustainability and compliance with future environmental protection standards.

Another focus is being placed on the design and fabrication of inner covers and workbase components for bell annealers processing steel strip or steel wire. These pieces of equipment are customized to suit individual needs, and fulfill the highest standards for safety, durability and thermal efficiency. A particular highlight is the workbase repair kit specially developed by EBNER, which ensures that a facility is shut down for the least possible amount of time. It is installed on site, minimizing interruptions to production and maximizing cost effectiveness.

The ability to install premium technology at non-EBNER facilities offers the operators of existing facilities a decisive advantage: they can modernize their current systems and, at the same time, take advantage of the latest developments and innovations from EBNER – without needing to make a completely new investment.

With this strategic expansion, EBNER has positioned itself to be more than just the technology leader. It is also a reliable partner for the modernization and optimization of existing heat treatment facilities, regardless of their original manufacturer. Customers can benefit from tailor-made solutions, short shutdown times and access to state-of-the-art technologies that pave the way into a more sustainable and efficient future.

EBNER CAN ADDRESS A WIDE VARIETY OF ISSUES THAT ARE CRUCIAL FOR THE FUTURE OF HEAT TREATMENT. THEY INCLUDE:

ELECTRIFICATION AND HYBRID HEATING

Our electric heating systems can be easily integrated into existing furnace systems. We offer future-proof solutions that fulfill the strictest regulations, even as they provide long-term reductions in operating costs.

Our product range includes:

- **Coiled heating elements** - compact, powerful heating elements for precise temperature control
- **Resistor elements** - durable resistance heating elements for industrial applications
- **Heating rods** - versatile heating elements that are extremely energy-efficient
- **HICON plate heater** - patented, high-performance heating system developed by EBNER for the efficient and even distribution of heat

Thanks to their modular designs, our components are ideal for retrofitting into existing systems. Make the switch to electric heating quickly, efficiently and sustainably.

COMBUSTION AND DeNO$_x$

State-of-the-art burner technologies such as EBNER ECOBURN reduce emissions to a minimum and fulfill the most stringent environmental regulations. The use of technologies like ECOBURN FL (flameless) or ECOBURN H_2 FLEX (H_2 + CH_4) can lower NO_x emissions by up to 60 %. Exhaust gas recirculation and atmosphere outburners raise energy efficiency even further.

- **ECOBURN FL flameless burner**
- **ECOBURN H_2 FLEX dual fuel burner**
- **SCR / SNCR DeNO$_x$ reactors**

ATMOSPHERE AND GAS SAVINGS

Optimized process atmospheres and reductions in gas consumption lower operating costs and reduce environmental impacts.

UPGRADES TO MECHANICAL AND THERMAL MANAGEMENT SYSTEMS

Upgrades to mechanical and thermal systems extend the service life and efficiency of an existing heat treatment facility. EBNER supplies custom-fit inner covers, insulation and mechanical components - tailored to match existing circumstances like atmospheres, temperatures, peripheral components and customer requirements. The dimensions of materials, alloys and types of weld seams are carefully selected, while fabrication is carried out in one of the EBNER workshops scattered across the globe to ensure rapid delivery.

- **Impellers and recirculation fans**
- **State-of-the-art insulation and lining kits, developed in-house**
- **Efficient furnace inlet locks for continuous facilities (e.g. floater furnaces)**
- **Penetration thermocouples for pusher furnaces**

YOUR ADVANTAGES AT A GLANCE:

Substantial energy savings through improved insulation and optimized inlet sections

- Shortened cycle times while product quality remains unchanged
- Rapid amortization due to measurable improvements in efficiency

An EBNER retrofit won't just future-proof your facility - it will significantly improve its economic attractiveness.

WASTE HEAT RECOVERY

Compact and efficient recuperators and high-quality heat exchangers allow the recovery of thermal energy from hot streams of exhaust gases. This energy can be used to directly preheat combustion air, generate steam or heat buildings through an HVAC system. The results: perceptible savings and an amortization period that can be measured in months instead of years. Our product range includes:

- **Heat recovery systems** - for the efficient use of waste heat
- **Large recuperators** - powerful thermal energy recovery for large-scale facilities and high-volume gas flows

Integrating our solutions into an existing facility is simple and straightforward, offering an easy way to lower operating costs and carbon emissions - without compromising the quality of your process.

DIGITAL & AI PROCESS CONTROL

Intelligent process control using algorithms supported by AI for maximum transparency and efficiency.

PLC/AUTOMATION SYSTEMS MODERNIZATION

Modernization of PLCs and automation systems to provide future-proof control systems.

MEASUREMENT AND SENSORS

Integration of cutting-edge sensor systems for accurate supervision and control of processes. Extremely accurate sensors and state-of-the-art measuring systems allow the uninterrupted supervision and control of a heat treatment process. Our new temperature measurement system enables you to carry out a Temperature Uniformity Survey (TUS) or take measurements during water quenching - with minimal facility downtime. Thanks to its rapid installation, durable insulation and 6-channel data logging system, it allows an entire solution annealing process to be accurately and reliably mapped.

YOUR ADVANTAGES AT A GLANCE

- **Complies with AMS 2750 and CQI-9 for Temperature Uniformity Surveys (TUS)**
- **The entire process is covered, including water cooling**
- **Watertight, easy to use and extremely reliable**

MODERNIZATION OF PLCs/AUTOMATION SYSTEMS

Our R&D services assist you in continuously improving processes: EBNER offers extensive support for the development and optimization of your heat treatment process, from the initial idea all the way up to implementation at production scale. Our Research and Development Department combines a deep understanding of heat treatment processes with cutting-edge technology, allowing them to develop tailor-made solutions that meet your specific requirements.

OUR SERVICES AT A GLANCE

- **Modeling, simulations & prototyping**
  Using advanced approaches to simulation like CFD (Computational Fluid Dynamics) and FEM (Finite Element Method), we analyze thermal and mechanical processes and atmosphere flows. New designs are tested in our pilot and prototyping facilities under realistic conditions.
- **An extensive, well-equipped lab**
  A wide variety of modern testing instruments are available to provide accurate material and process data: Hardness testing/microscopy/chemical analysis/Epstein testing (to assess magnetic properties)
- **Individualized testing plans and consulting**
  Our R&D experts develop tailored testing plans and stay by your side during trials - from test anneals to component anneals and the analysis of samples.
- **Process optimization**
  Based on the data that were collected and the results of the simulations, we provide support during the targeted optimization of your heat treatment process - for more efficiency, quality and sustainability.

GLOBAL SERVICE

Individualized service and maintenance agreements for heat treatment facilities allow EBNER to make sure that existing systems - regardless of manufacturer - continue to perform at their maximum. Whether through the replacement of mechanical components, the optimization of a heating system, the replacement of insulation or the installation of an energy-efficient upgrade: our services improve facility availability, lower energy consumption and extend the service life of your investment. Thanks to our decades of experience and the global reach of our manufacturing centers, we can guarantee rapid implementation and sustainable results - for more efficiency, less downtime and maximum operational safety.

EBNER sets new standards

A new and innovative temperature measurement system provides precise measurements and minimizes production downtime

MARKUS GANGL

EBNER Industrieofenbau
Senior Product Manager
sales@ebner.cc

Until now, conventional methods of measuring temperatures during a heat treatment process have been associated with extended interruptions in production and increased error frequencies. With the new and innovative temperature measurement system from EBNER, these problems belong to the past.

The new **EBNER** temperature measurement system pairs, for the first time ever, a full set of measurements taken throughout the entire process - from the furnace all the way up to the water quench - with minimal downtime. The system is distinguished by its high degree of automation, its well-thought-out design, its watertight construction and its ease of installation. It supplies accurate data that comply with AMS 2750 and CQI-9.

EBNER has recently been able to successfully implement the new temperature measurement system at several of its customers' works, one of which is a globally active aluminum rolling and recycling company. That customer reports on their practical experience with the system in the following interview.

HICON: Why is a temperature measurement system of interest to a company operating a continuous annealing facility?

Customer: The measurement system can be used to determine the temperature uniformity across the width of the strip and to check both the heating-up and cooling rates. It can also be used to take the TUS measurements specified in the CQI-9 standard.

HICON: Now that you have had it in use, what do you see as the greatest advantages offered by the temperature measurement system? What concrete benefits did the new measurement system provide?

Customer: Using the new temperature measurement system provided us with a number of concrete benefits. Particularly noteworthy was a significant reduction in the effort involved in taking measurements. The temperature measurement process was considerably more efficient, and taking measurements required significantly less time and labor. Another major benefit was that temperature measurements could be taken directly, while the line was running at production speed. This not only allowed us to record process data that were extremely close to reality, but also meant that the production sequence was not interrupted and that our overall efficiency was increased.

HICON: Have there been measurable improvements, for example in efficiency, quality, or time/cost savings?

Customer: Yes. When using the new temperature measurement system, we recorded a significant reduction in the consumption of thermocouple wire. This had a positive effect on operating costs, and notably increased the efficiency of the process that was running.

HICON: How did implementation of the temperature measurement system go? Were there any technical challenges when integrating it into your existing infrastructure?

Customer: Implementation of the measuring system ran very smoothly. No technical problems were encountered, and we could integrate it into our existing infrastructure without much effort.

HICON: How would you rate the accuracy and reliability of the new EBNER temperature measurement system?

Customer: In our opinion, the accuracy of the system is very high. The system delivers extremely precise and reliable results, especially in the water cooling section.

HICON: How well does the measurement system work under real production conditions?

Customer: As we only employed the measuring unit under real production conditions, we can confirm that it is fully functional during ongoing operation. We are very satisfied with its performance under these conditions.

HICON: Are there functions that you found to be very useful or that you think should be improved?

Customer: We found it particularly useful to be able to safely and reliably measure the strip temperature in the water cooling section. This function is particularly relevant to our process and adds significant value.

HICON: How was your experience working together with the EBNER team on documenting and processing the measured values?

Customer: Our experience with the **EBNER** team was very positive. **EBNER** provided the measured data in a structured and easy to understand format, which greatly eased our evaluation and analysis.

HICON: In light of your experience, would you recommend the temperature measurement system to others?

Customer: Yes, definitely. The temperature measurement system greatly simplifies measurement of the strip temperature. It is a practical and efficient solution that we can recommend without hesitation.

HICON: Are there any potential improvements to the temperature measurement system that need to be made?

Customer: At this time, we don't see an urgent need to make any improvements to the system.

Revolutionize the supervision of your heat treatment process

Regardless of whether you need to carry out a Temperature Uniformity Survey (TUS) as defined in AMS 2750 or CQI-9 or to precisely record metal temperatures throughout an entire solution annealing process, the modular **EBNER** temperature measurement system is sure to offer reliable service and is suitable for a wide variety of heat treatment requirements.

Would you like to take your temperature measurements to the next level? We would be happy to discuss the applications with you - please feel free to contact us!

Temperature-measurement-system

THERMAL PROCESSES

EBNER®

Manufacturing - keeping its finger on the pulse of the times

Investment in a new, state-of-the-art machining center in Leonding, Austria

www.ebner.cc

GEORG GATTRINGER

EBNER Industrieofenbau
EVP Manufacturing
sales@ebner.cc

Key components for our heat treatment facilities are manufactured at the EBNER works in Leonding, Austria - everything from fan impellers and workbases to protypes. Our high-precision manufacturing is carried out by teams of specialists, who fulfill the highest quality criteria even as they meet the strictest deadlines.

Thanks to our extensive know-how and our decades of experience in metalworking and machining, the entire manufacturing process - from cutting up to welding - can be encompassed within our main Austrian works. Processing around 560 metric tons of heat-resistant materials every year, we fabricate complex components precisely and efficiently, ensuring that they are of the highest possible quality.

A significant element in this process is EBNER's welding expertise. EBNER is certified in accordance with ÖNORM ISO 3834-2, and all welding procedures are subject to extensive testing. During the planning phase, parameters are optimized on trial pieces. For quality assurance non-destructive testing methods like X-ray testing (RT) and dye penetrant testing (PT) are employed, with mechanical testing (including bend and tensile strength tests) also seeing use. To round out the tests, metallographic sections are analyzed to provide detailed evaluations of the microstructural properties of the weld seams. A specific Welding Procedure Specification (WPS) is defined for each combination of materials, ensuring that results are reproducible. This ensures that the properties of the base material, as well as the quality of the weld seam, remain constant over the long term.

By investing in a new, state-of-the-art machining center, EBNER is once again underscoring its commitment to maintaining its presence in Austria and to continuously developing its Leonding works. The following interview provides insights into the strategic goals that shaped the project, the technical highlights of the new equipment and the challenges that were faced before this modernization project could be fully implemented. The answers show how EBNER's workshop really does keep its finger on the pulse of the times.

HICON: Which core competencies can be found in the Leonding manufacturing center?

Our manufacturing team in Leonding leads the way when it comes to the introduction of new systems and new processes. Projects like *PMI* (3D data files for manufacturing centers), *Spare Items* (replacement of slow-moving items) and *Intralogistik* (optimized movement between storage locations) set standards that were later implemented at the other manufacturing centers of the EBNER GROUP. This allows us to provide our customers with an equally high standard of quality anywhere in the world.

HICON: What does the opening of the new machining center mean for the EBNER workshop in Leonding, Austria?

This investment clearly shows our commitment to our Austrian works, and responds to the rising level of quality our customers demand from us as the primary supplier. At the same time, we are of course proud to have high-end equipment like the new PAMA in our machine park.

HICON: In making this investment, what strategic goals is EBNER pursing?

This new machining center replaces the old Colgar center, which while reliable had been in operation for around 25 years. The alternative would have been to contract with an external company for machining tasks. That would have, however, created significant additional costs due to the logistics of shipping large components and the need for special transports. In-house production also provides us with a great deal of flexibility and independence, both of which are very advantageous to our customers.

HICON: What manufacturing capabilities does the new machining center offer?

With the new PAMA, we are capable of machining workbases up to size 490, with a diameter of 6150 mm. Furthermore, horizontal muffles with lengths up to 18 m can be machined.

HICON: Is there a particular highlight that you would like to point out?

Integrating the new equipment into our workshop, which is only 20 meters wide, was a real challenge. However, thanks to the flexibility of the housing of the PAMA unit, we could find a solution that not only saves space but can be expanded to suit components of any size.

HICON: What advantages will the new machining center bring?

The extended reach of the axes and the larger table reduce the number of clamping procedures and reduce processing times. Together, these also reduce costs.

HICON: Will the new machining center contribute to more sustainable manufacturing/conserve resources?

Absolutely - components can now be fully machined in-house. This means that the transport of heavy loads is eliminated, which not only reduces costs and carbon emissions but also reduces fabrication times.

HICON: How long did it take to implement the project? Was any particular preparatory work necessary or did any conditions have to be fulfilled to create the framework for the project?

The first discussions took place back in 2018. Concrete planning began early in 2022, and the equipment was purchased in mid-2023. The delivery period was around 12 months, after which installation began.
Once of the greatest challenges was certainly that of installing the foundation while production was still going on - which was only made possible by moving most fabrication to the night shift. We also introduced new CAM software, and the production team attended extensive training sessions alongside their normal daily duties.

HICON: How long has the new machining center been operating, and what conclusions can you draw now that the first production phase is over?

The center has been officially in operation since June, 2025 and we have already carried out our first machining projects. They reflected the excellent coordination that exists between a wide variety of different departmental areas, from the team of operators to programming and tool preparation.

HICON: What does "keeping your finger on the pulse of the times" mean for you and your team?

Even if the next few years are very challenging, we are convinced that - thanks to our know-how and the expertise found among our employees - we will be able to extend our technological lead and will continue to pave the way for our subsidiaries throughout the world. To continue to be successful, we constantly track new technologies and make careful decisions regarding investment. It isn't just about using the latest technologies, but about efficiently integrating our existing resources into our product range and our processes. Well thought out and lean workflows often allow decisive savings to be achieved.

EQMS

Precision fabrication and manufacturing expertise at the highest level

DANIEL SCHULT

EQMS
Commercial and Process Management
office@eqms.mx

With “enineering excellence and precision metalworking” as its guiding principle, EQMS (Excellent Quality Manufacturing Services) has established itself as a reliable partner for challenging metalworking jobs since it was founded in August, 2022. EQMS has been operating since May, 2023, and since 2025 it has been based at a new, state-of-the-art workshop in Ramos Arizpe, Coahuila, Mexico. The company offers tailor-made, individualized manufacturing solutions to international customers from many industrial sectors.

The company's current location in Ramos Arizpe, in the heavily-industrialized northern part of Mexico, has many logistical advantages. For example, proximity to the US border shortens delivery times and provides efficient transport routes to North American customers. In an era when global supply chains are being tested, this offers a significant competitive advantage. At the same time, customers based in Mexico or other parts of the world benefit from the region’s well-developed infrastructure, Ramos Arizpe's proximity to the important cluster of industry surrounding the city of Monterrey and the availability of highly-qualified employees. Its strategic location has thus made EQMS an ideal partner for international metalworking projects.

6000 SQUARE METERS OF STATE-OF-THE-ART MANUFACTURING

Since early 2025, EQMS has been operating from a new manufacturing center with 6000 m² (almost 65,000 square feet) of production space. The center is equipped with the latest technologies used to weld, cut, bend and roll thick metal sheet material. Eight cranes with a total capacity of 165 metric tons ensure that even the heaviest components are efficiently transported. The production team currently consists of over 30 highly-qualified specialists, including industrial welders, precision sheet metal workers and industrial machinists.

Service	Materials	Max. thickness	Max. length/ size	Equipment
Plasma cutting	Mild steel Stainless steel	Mild steel: 80 mm Stainless steel: 152 mm	3×6 m table	Hypertherm HPR800XD + Spektron 1020
Oxyacetylene cutting	Mild steel	up to 80 mm		
Cutting w. shear	Mild steel Stainless steel	Mild steel: 20 mm Stainless steel: 15 mm	4080 mm	Durma VS4020
Cutting w. shear		Mild steel: 13 mm Stainless steel: 9 mm	3080 mm	Durma VS3013
Press brake	Steel sheet	-	4000 mm	Durma AD-S 40400 (400 t)
Bending profiles	Assorted metals		Project-dependent	Durma PBH 125
Rolling machine	Steel sheet	6 mm	2050 mm	Durma HRB 4 20170
Rolling machine		40 mm	3100 mm	Durma HRB 4 30460
Welding	Mild steel Stainless steel Aluminum	-	-	Fronius TransSteel 4000Puls, iWave 300i

A DEPENDABLE PARTNER FOR CONTRACTED MANUFACTURING

EQMS specializes in contract manufacturing for a wide variety of metalworking projects, particularly applications involving thick steels. With its extensive park of modern machinery, including CNC cutting shears, press brakes, and bending machines for metal profiles, as well as both plasma and torch cutting tables, EQMS offers a wide range of finishing and manufacturing capabilities. The combination of technical equipment, qualified personnel and international focus makes EQMS a strong and reliable partner for companies that demand high quality and short delivery times.

A sample of some of our most recent projects shows the wide range of competencies that EQMS can offer.

- **Fabrication of duct rings for a US customer:**
  The project included the manufacture of four different types of duct ring for an American company.
- **Ventilation ducts for an industrial furnace installation:**
  For a US company, EQMS fabricated the precisely-dimensioned ventilation ducts required for a high-performance industrial furnace.
- **Cooling/ventilation system for steel coil processing:**
  This specially-developed ventilation system supports the controlled cooling of steel coils following a hot rolling process, fulfilling the highest requirements for temperature control, material quality and process compatibility.
- **Ventilation ducts for Gautschi:**
  On behalf of Gautschi Engineering GmbH, individual ventilation ducts were fabricated for industrial applications.
- **Power cabinets for HAZELETT:**
  Custom power cabinets fabricated for HAZELETT are an excellent indication of EQMS’ versatility, with this project illustrating our expertise with industrial electrical components.

With a clear goal of becoming one of Mexico’s leading metalworking contractors, recognized for its uncompromising quality, productivity and efficiency, EQMS is looking forward to the future. Our modern facility in Ramos Arizpe offers us ideal conditions for completing many more challenging metalworking projects, as well as for creating strong and lasting partnerships.

VAREGA$^{ENVICOM®}$: advancing the energy efficiency and sustainability of melting technology

MARKUS BAUINGER

Gautschi Engineering GmbH
Sales Manager
info@gautschi.cc

Companies in the aluminum industry are finding it increasingly challenging to balance energy efficiency, environmental impact and operational safety. Gautschi has risen to meet this challenge by taking a long-term approach to technology, and can now present the VAREGA$^{ENVICOM®}$ regenerative burner system: a system that has been specially developed for use in aluminum melting furnaces.

Gautschi began to develop proprietary burner systems in 1958. By the 1990s, with its release of the VAREGA regenerative burner system, Gautschi was setting new standards for energy consumption when melting aluminum. To not only meet today's demand for BAT (the "Best Available Technology"), but to surpass it by fulfilling the most stringent requirements for environmental impact mitigation, development of the burner product line continued and it is now available as VAREGA$^{ENVICOM®}$.

REDUCED ENERGY CONSUMPTION / CARBON FOOTPRINT

VAREGA$^{ENVICOM®}$ burners employ a regnerative thermal energy recovery system, which can preheat the combustion air up to a temperature of 1050 °C. When heating aluminum from 20 °C (solid) to 720 °C (liquid), this allows a specific energy consumption below 550 kWh per metric ton of aluminum to be achieved. Furthermore, the carbon footprint remains below 110 kgCO_2eq per metric ton of molten aluminum.

REDUCED EMISSIONS

The high combustion air temperature theoretically allows an adiabatic flame temperature of 2272 °C. However, high flame temperatures can cause undesirable nitrogen oxides to form in the exhaust gas. To allow stricter emissions limits to be upheld, the a burner head design was developed that significantly reduces the flame temperature. Two methods are used to achieve this:

- **Staged combustion**
  The controlled distribution of the fuel/air mixture among multiple burner head zones allows targeted reduction of the flame temperature without affecting combustion efficiency.

- **Internal Flue Gas Recirculation** (IFGR)
  In the combustion chamber, part of the hot exhaust gas mixture is mixed with the combustion air. This reduces the oxygen concentration, further reducing the flame temperature.

MEASURED VALUES

Under real-life conditions, the following average exhaust gas values were measured at a 35-ton Gautschi melting furnace (SVE-35) equipped with a 5 MW VAREGA$^{ENVICOM®}$ heating system:

- NO_x: ≤ 140 ppm
- CO: ≤ 44 ppm
- VOC/TOC: ≤ 5 mg/m³ at s.t.p.

THE ADVANTAGES

To increase operational safety, the positioning of the flame supervision system in the burner head has been optimized. The state-of-the-art burner control system incorporates high-quality measurement and control units for safety-relevant tasks that fully comply with EN 746-2 or comparable standards. Separate fans supply the pilot and main burners with cooling and combustion air, with the combustion air supply switching alternately between the burners. Measurement of the oxygen content in the furnace chamber allows precise control of the gas/air ratio, allowing a target oxygen content value of 2 % to be maintained in the furnace atmosphere. An exhaust gas fan creates the negative pressure required to draw exhaust gases out of the furnace chamber and through the regenerating material, while the pressure inside the furnace is regulated using a pressure control valve in the exhaust gas line. Continuous supervision of the process is possible, thanks to additional pressure and temperature measuring systems integrated directly into the burner. The full integration into the furnace control system allows all relevant operating data to be visualized in real time. This means that an overview of the process is available to the operators at any time.

MODULAR, EASY TO MAINTAIN, FLEXIBLE

The regenerators of the VAREGA$^{ENVICOM®}$ system can be flexibly configured and can be equipped with ceramic balls or honeycomb bricks, whichever is best suited to their intended application.

- **Honeycomb bricks:**
  Ideal in dusty conditions, such as those found in scrap recycling facilities. They are distinguished by the small pressure loss they allow and their long maintenance intervals.

- **Ceramic balls:**
  Have the advantage of allowing straightforward, rapid replacement of the storage material. They allow the volume of the regenerator to be reduced and the initial load of filling material is less expensive.

The system is also extremely flexible in terms of the arrangement of the regenerators. Depending on the space available and maintenance requirements, a choice can be made between two variants:

- **Roof-mounted:**
  Allows easy, rapid access to the regenerator, without the need to remove bolts or release clamps. This is ideal for reducing the time required for maintenance.

- **Floor-mounted on rails:**
  Allows the use of high-volume regenerators, and can be removed for maintenance without the use of a crane. This variant is particularly advantageous when available space is very limited or in workshops with limited crane availability.

BURNER SIZES AND MELTING RATES

Burner output	Melting rate
Single head	
2 MW	~ 2.7 t/h
4 MW	~ 5.5 t/h
5 MW	~ 6.8 t/h
6 MW	~ 8.2 t/h
8 MW	~ 11.0 t/h
Dual head	
10 MW	~ 13.7 t/h
12 MW	~ 16.4 t/h

The arrival of VAREGA$^{ENVICOM®}$ has introduced a future-oriented burner that unites the highest possible energy efficiency, low environmental impact and operational safety in a single system. With its introduction, Gautschi has made a powerful statement supporting sustainable aluminum production and demonstrated yet again the innovative power of the **EBNER** GROUP.

www.gautschi.cc

MANOJ KUMAR

EBNER Industrieofenbau
VP Product Development
sales@ebner.cc

Spiking is a short and fast heat treatment process applied to solution annealed aluminum strip after quenching, creating specific mechanical properties in semi-finished or finished products.

THE USE OF SPIKING DURING THE MANUFACTURE OF AUTO BODY SHEET FROM AA6XXX ALUMINUM ALLOYS

Due to their strength, formability and low weight, aluminum alloys from the AA6xxx (Al-Mg-Si) series are often used for auto body parts. To support the ongoing effort to reduce vehicle weight, these alloys must be easy to form and increase in strength during the baking process for paint. Sheet was formerly supplied with a T4 temper, which simplified logistics but led to inconsistent characteristics and meant that the final strength after paint baking was inadequate.

In response, automobile manufacturers introduced reheating and two-stage heat treatments during the 1990s. These approaches were, however, unsuitable for high-speed production.

Development of the heat treatment process therefore continued, leading to the integration of reheat furnaces into continuous annealing lines. This integration allowed a pre-aging step to be carried out without slowing production. By the end of the 90s, this had become the standard for alloys like AA6016 and AA6111.

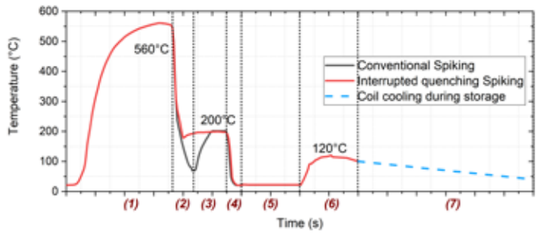

Figure 1 shows a schematic depiction of the heat treatment process for AA6016 sheet, including spiking heat treatment, at a CASH line. (1) solution annealing, (2) conventional or two-stage (interrupted) quenching, (3) spiking heat treatment, (4) cooling, (5) transfer time to reheat furnace, (6) reheating and (7) coil cooling during storage.

The next innovation was “spiking” - a short-duration heat treatment that followed quenching (fig. 1). During spiking, the strip is reheated to 100 - 300 °C for 5 - 60 seconds and then cooled down at a rate of 1 - 25 K/s. Spiking promotes the formation of clusters, even as it also improves behavior during hardening and the consistency of mechanical properties. Studies conducted by **EBNER** show that AA6016 sheet exhibits a 7 % increase in yield strength when spiking, pre-aging and baking are employed (fig. 2).

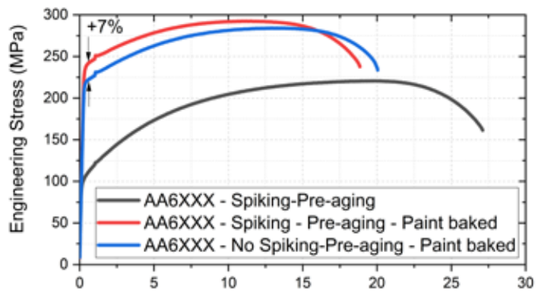

Figure 2. The effect of spiking on the behavior of AA6016 during baking.

EBNER also developed and patented (WO2019141682A1) a system for integrating a spiking furnace into continuous (CASH) heat treatment lines, combining solution annealing, cooling in a **SMARTQUENCH®** and spiking in a single facility (fig. 3). This arrangement supports spiking heat treatment, as well as conventional or two-stage (interrupted) quenching (fig. 1). Both temperatures and times can be precisely controlled. The results include improved strength, reduced deformation and consistent mechanical properties from charge to charge.

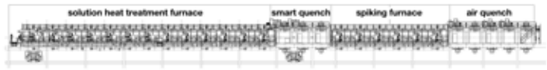

Figure 3: CASH line with integrated spiking furnace.

The effectiveness of spiking depends on the composition of the alloy, stretching, temperature control, pre-aging and the conditions during baking. It has become one of the key techniques for improving the performance and reliability of AA6xxx aluminum during the manufacture of automobiles.

EBNER customers have confirmed the effectiveness of spiking heat treatment, with strengths increased up to 40 % after paint baking. Their experience shows that, with the proper selection of alloys and precise thermal control, a wide range of tensile properties can be achieved - without a need to subject the charge to an additional hardening process. Figure 4 shows that the yield point (YS) of AA6111 coils increases significantly during spiking heat treatment, meaning that the sheet specified for an auto body can potentially be downgauged. The yield point of AA6111 almost exactly corresponds to that of AA5xxx alloys with an H temper. However, the total elongation is much higher, meaning that AA6111 could replace 5086-H34 but offer far superior ductility.

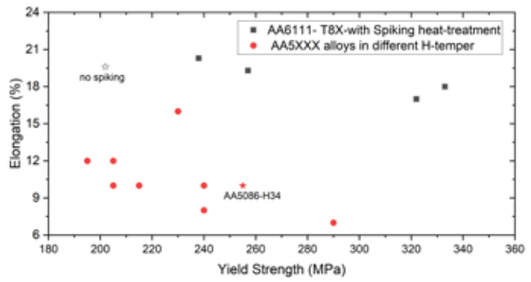

Figure 4: Comparison of typical tensile properties of widely-used AA5xxx alloys (H temper) with AA6111 alloys (T8X temper) that have undergone spiking heat treatment

THE USE OF SPIKING DURING THE PRESSING OF AUTO BODY SHEET FROM AA6XXX ALUMINUM ALLOYS

Abstracts of the patents issued to leading OEMs and research institutes list a variety of forming processes for AA6xxx and AA7xxx aluminum alloys. However, each process has its limitations - such as thinning, cracking or an inconsistent strength after hardening. In response, **EBNER** developed and patented (A2024-89041-WO) a new forming process with spiking (fig. 5). In this process, sheet is solution annealed before forming, quenched and then spiked. In comparison to W tempers and hot forming/die quenching, spiking significantly improves the material’s ability to be deep drawn - it is from 1.5 to 2 times better - and ensures that tensile properties are consistent. This increases process stability, reduces residual tension and improves both work hardening and paint bake strength, making it ideal for automotive components.

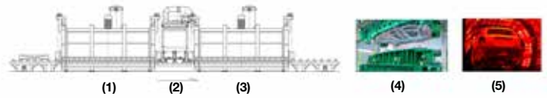

Figure 5: Manufacturing sequence for automotive components when forming with spiking (SPF). (1) solution heat treatment, (2) quenching, (3) spiking heat treatment, (4) pressing and (5) baking.

THE USE OF SPIKING DURING THE MANUFACTURE OF AIRCRAFT SKIN FROM AA2XXX ALUMINUM ALLOYS

Aluminum alloys for aerospace applications must offer a balanced ratio between strength and ductility, while at the same time possessing excellent formability to allow the manufacture of complex fuselage shapes. Common forming processes employing T3, O or W tempers require more heat treatment steps and cold storage, leading to high production costs. **EBNER**’s investigation of the spiking heat treatment of AA2024 alloys showed that both formability and mechanical properties were significantly improved. Spiking for only a few minutes at 175 - 250 °C improved the ratio of Rm/Rp0.2 by over 10 % and also improved elongation, enabling the continuous production of fuselage skin with improved storage characteristics and reduced deformation. Based on these results, a new process path for AA2xxx alloys (fig. 6) was developed and patented (A2024/89041-AT) that combined spiking with continuous heat treatment in a CASH line (for sheet up to 6-8 mm) or with a roller-hearth furnace (for thicker sheet). This new approach offers aircraft manufacturers improved formability, stable mechanical properties and reduced operational complexity, making it an extremely promising solution for the efficient and high-quality production of aerospace components.

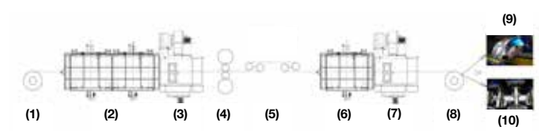

Figure 6: T3SP heat treatment of AA2024 in a CASH (Continuous Annealing & Solution Heat treatment) line. (1) pay-off reel, (2) solution annealing, (3) quenching, (4) skin pass rolling, (5) tension leveling, (6) spiking heat treatment, (7) cooling to reheat temperature, (8) take-up reel and (9) stretch forming or (10) roll forming.

THOMAS LANGTHALER

EBNER Industrieofenbau
EVP Engineering
sales@ebner.cc

ALEXANDER POCHERDORFER

EBNER Industrieofenbau
Senior Manager Concept Engineering
sales@ebner.cc

The EBNER Engineering Department is the heart of our company, combining decades of experience with concentrated engineering expertise. Our design team brings around 4000 years of collective experience to the development of advanced heat treatment facilities designed for extreme thermal requirements. We specialize in designing and implementing tailor-made solutions - from the initial idea all the way through to the creation of detailed manufacturing drawings.

Our engineering experts and designers from the Mechanical Engineering, Electrical Engineering and Engineering Support departments make sure that ideas turn into cost-effective, precise and reliable facilities. This involves:

- The calculation and simulation of mechanical, thermal and atmosphere flow characteristics.
- The design of complex thermal systems, vessels and facilities.
- The integration of generic control models with automated CAD processes.
- Close coordination of engineering planning with manufacturing to ensure smooth installation and commissioning at the customer's works.

"CONCEPT ENGINEERING" - A CATALYST FOR INNOVATION

In an era when the ability to develop technologies and quickly react to market needs is decisive, our "Concept Engineering" department is playing a central role. This small, highly-specialized team of experienced engineers works closely together with every other relevant department. The high degree of cooperation enables us to recognize new challenges well in advance, quickly transforming them into technical solutions. Our goal is to make focused improvements to existing products, opening new markets at the same time. Our role is to act as the driving force and connecting link between an idea and its implementation, always seeking to advance those innovations that create real added value.

HEAT TREATMENT OF CLAD ALUMINUM SHEET - RESPONDING TO AN UNFULFILLED CUSTOMER NEED

One example of our current work is the development of a furnace to heat treat clad aluminum sheet. This type of thin sheet, which consists of a base material to which cladding has been applied, provides a number of advantages. It combines the mechanical properties of the base material with the functional properties of the cladding, for example corrosion protection or improved weldabilty.

However, to achieve the desired mechanical properties in the final product, it is essential that heat treatment is both extremely precise and suitable for both materials. The cladding is extremely thin, and damage to it must be prevented at all costs. At the same time, during a solution anneal the material is extremely soft and is inclined to deform. The sheet must therefore be transported through the furnace very carefully - a task that places extreme demands on mechanical and control systems.

A particular challenge must be faced when the material enters the quenching zone: the material requires extremely rapid and precisely controlled cooling to achieve the desired properties, but distortion of the plates and the creation of defects must be prevented. The accuracy of the temperature plays a decisive metallurgical role in this, significantly influencing whether or not the dimensions of the sheet remain stable. It is throughput, however, that is the deciding factor in determining whether or not the process is profitable.

Our solution takes all of these aspects into account. It combines a specially-developed transport system, an extremely accurate temperature control system and flexible quenching options to provide a reproducible heat treatment process that also delivers high productivity. With this facility we have not only responded to an unfulfilled customer need, but have set new standards in the processing of clad aluminum sheet.

THE ADVANTAGES FOR OUR CUSTOMERS AND A GLIMPSE OF THE FUTURE

Thanks to our high degree of flexibility and the close cooperation between all of our departments - from R&D to Purchasing and Manufacturing - we are able to develop tailor-made solutions that are both technologically advanced and financially appealing. **EBNER** Engineering is readying itself to face future challenges by increasing its use of Artificial Intelligence (AI), developing new products focusing on reducing CO_2 and continuing to refine our internal processes. Flexible company structures ensure that we can provide a quick and personalized response, passing on the know-how we have built up over the years to provide tailor-made solutions.

THERMAL PROCESSES

EBNER software excellence

How the EBNER GROUP's global software hub in India is driving digital transformation in industrial furnace technology

SURESHRAM VARADARAJAN MAIER

EBNER India Country Manager
sales@ebner.cc

In the world of industrial furnaces, a new revolution is underway. While hardware remains essential, the true power of a furnace now lies in its software. Furnaces today are no longer standalone products — they are intelligent, connected systems that rely on software for performance, efficiency, and long-term reliability.

At the EBNER GROUP, we have made a strategic decision to put our customers at the forefront of this digital transformation. We have established our Mumbai, India office as the global hub for industrial software development for all EBNER GROUP companies.

This move is backboned by our aim of building smarter and more efficient furnaces, giving customers a competitive edge by making use of India's global software technology powerhouse.

A GLOBAL COLLABORATION FOR EXCELLENCE

India is a recognized leader in software technology, but its expertise goes deeper. For decades, Indian engineers have been building the specialized industrial software that powers factories, robotics, and large-scale manufacturing equipment. Having established its Mumbai subsidiary in India in 2009 as a service center, EBNER has strategically expanded its capabilities, leveraging the unique combination of deep engineering knowledge and cutting-edge software skills within the Indian workforce. The ability of the Indian team to scale with EBNER's growth makes the subsidiary an ideal location to serve as the global software hub for all EBNER GROUP companies. This allows the delivery of solutions that are perfectly tailored to customer needs. With more than 5 million IT professionals, India combines scale with specialization, making it an ideal home for the EBNER GROUP software hub.

The Mumbai software hub is not an isolated outpost but part of a globally integrated development team. Our teams in India and Austria work hand-in-hand, each contributing their strengths. The Indian team is deeply integrated into the development of advanced software systems, bringing their technical expertise and agility to the forefront. At the same time, the Austrian teams contribute decades of furnace-building experience, ensuring software innovations align with mechanical engineering excellence and real-world customer needs. This collaborative model is built on shared ownership and mutual respect. Daily virtual meetings, joint design sessions, and exchange programs ensure ideas flow freely across borders.

OUR CUSTOMERS' BENEFITS

The new software hub in India will become the backbone of our group's digital transformation, building furnaces that are smarter, more reliable and easier to maintain. This includes:

- **Control and automation systems:** Software for PLCs, HMIs and furnace controllers.
- **Predictive maintenance:** Data analytics that help customers avoid downtime.
- **Digital twins:** Virtual models of furnaces for testing, training, and optimization.
- **Industrial IoT platforms:** Connectivity between furnaces, sensors, and production systems.
- **Customer apps & interfaces:** Tools that give operators and managers real-time insights.

The Indian subsidiary is already home to talented engineers working in software engineering, commissioning & service, electrical & automation and mechanical engineering. Their work will now be scaled up and integrated into all possible EBNER GROUP projects.

The future of furnace building is connected, intelligent, and sustainable. Our software hub in India positions us at the heart of this transformation:

- **Connected furnaces** that share real-time data with operators worldwide.
- **AI-driven quality control** that ensures precision and reliability.
- **Green digital solutions** that optimize energy use and reduce waste.

India's software excellence, combined with the EBNER GROUP's engineering expertise, creates a powerful combination: furnaces that are not just built, but engineered for the future green environment and to achieve a new level of operational excellence.

Digitalization

Representative image, without actual data

NEWS

THE HICON® Journal is also available by email!

Trade fairs. Conventions. 2025/2026

DEC. 2 - 4, 2025	**MTM EXPO SHANGHAI**	Shanghai	**CHINA**	Booth no.	**B080**
APRIL 13 - 17, 2026	**WIRE DÜSSELDORF**	Düsseldorf	**DE**	Booth no.	**TBA**
APRIL 27 - 29, 2026	**ALUMINUM ARABIA**	Riyadh	**SAU**	Booth no.	**B90**
OCT. 6 - 8, 2026	**ALUMINUM DÜSSELDORF**	Düsseldorf	**DE**	Booth no.	**6H20**

We look forward to seeing you there!

EBNER Industrieofenbau GmbH
T: (+43) 732 6868, E: sales@ebner.cc
EEMCO GmbH
T: (+43) 732 6868, E: office@eemco.at
FAMETEC GmbH
T: (+43) 732 6868, E: info@fametec.co
SiCreate GmbH
T: (+43) 732 6808-0, E: info@sicreate.cc

Ebner-Platz 1
4060 Leonding
AUSTRIA

EBNER Furnaces, Inc.
T: (+1) 330 335 1600
E: sales@ebnerfurnaces.com
Gautschi North America LLC.
T: (+1) 330 335 1660, E: info@gautschi.cc
HPI LLC.
T: (+1) 330 335 1600, E: hpi@hpi.at

224 Quadral Drive, Wadsworth, Ohio 44281
USA

EBNER Industrial Furnaces (Taicang) Co.,Ltd.
T: (+86) 512 5357 6868, E: sales@ebner.cn
Gautschi Industrial Equipment (Suzhou) Co., Ltd.
T: +86 512 5383 6642-801
E: info@gautschi.com.cn
EED Furnaces (Taicang) Co.,Ltd.
T: (+86) 512 / 5320 8896
E: eed-sales@eedfurnaces.com
Hazelett Trading (Taicang)
T: +86-512-5395-0211, E: htt@hazelett.com

Beijing East Road 82, 215400 Taicang, Jiangsu
CHINA

Gautschi Engineering GmbH
T: (+43) 720 569 100, E: info@gautschi.cc
HPI High Performance Industrietechnik GmbH
T: (+43) 7722 68420, E: hpi@hpi.at
C-R-C Casthouse (R)Evolution Center
T: (+43) 720 569 150, E: sales@crc.info

Schloßstraße 32, 5282 Ranshofen
AUSTRIA

GNA alutec Inc.
T: (+1) 514 956 1776, E: info@gna.ca

9495 Trans-Canada Hwy
Saint-Laurent, Quebec, 4HS 1V3
CANADA

EBNER Vision India Pvt. Ltd.
T: (+91) 22 6139 3333
E: office-ei@ebner.co

L&T Seawoods, Unit No.: C-402
Level 4 / C wing / Tower 1 / Plot R-1
Sector 40 / Seawoods Railway Station
Nerul Node / Navi Mumbai- 400706
INDIA

EBNER F&E Labor, Leonding

Casthouse (R)Evolution Center, Ranshofen

Hazelett Strip-Casting Corporation
T: (+1) 802 863-6376
E: hazelett@hazelett.com

PO Box 600
135 West Lakeshore Drive
Colchester, Vermont 05446
USA

Hazelett F&E Labor, Kingston