

HICON®

EBNER GROUP Journal for technology and progress



Austrian Foreign Minister Beate Meinl-Reisinger visits **EBNER** Taicang



EBNER GROUP

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

The **EBNER** GROUP is realigning its **Process Technologies** business unit (formerly Thermal Processes) and distributing its expertise between three divisions

- **EBNER** Casthouse Technologies,
- **EBNER** Heat Treat Technologies and
- **EBNER** Customer Service.

The aim is to leverage the strengths of the GROUP members as full-solution providers and deliver even greater value to customers worldwide.

Under **EBNER** Casthouse Technologies, the expertise of HAZELETT, HPI, Gautschi, and GNA in the liquid metal sector is brought together. This combined know-how strengthens collaboration across the GROUP and enables integrated casting and process solutions throughout the entire value chain.

The **EBNER** Heat Treat Technologies division represents the Group's comprehensive heat treatment expertise.

Both divisions are built on three core strengths of the **EBNER** GROUP.

1. Global Research & Development Expertise

The globally connected R&D centers are available to all group companies:

- **Kingston, Canada:** Focus on HAZELETT and GNA
- **CRC Ranshofen, Austria:** Development activities for Gautschi und HP
- **EBNER TECHCenter, Leonding, Austria:** Platform for innovation and technology development



This structure fosters innovation and enables tailored solutions for customers around the world.

2. Global Manufacturing Footprint

The **EBNER** GROUP operates production facilities in all key markets:

- **North America:** Ohio/USA, Vermont/USA and Ramos Arizpe/Mexico
- **Europe:** Leonding, Austria
- **Asia:** Taicang, China and the newly established site in Pune, India

This global presence ensures close customer proximity as well as flexible and efficient project execution.

3. Global Customer Service

An international service network ensures high equipment availability, rapid response times, and long-term customer partnerships worldwide.

WIN TECH: A Cost-Effective Complement to the Premium Portfolio

With WIN TECH Solutions, the **EBNER** GROUP offers a dedicated product line that combines solutions from both **Heat Treat Technologies** and **Casthouse Technologies**. The brand represents cost-efficient alternatives to the premium portfolio and is tailored to customers seeking robust, reliable, and economically attractive solutions.

Yours,
Robert Ebner
CEO **EBNER** GROUP

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IMPRESSUM:

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Strengthening China-Austria Ties

EBNER Taicang welcomed the Austrian Minister of Foreign Affairs and Economic Delegation for a landmark visit focused on cooperation and future growth.



JIASHENG WANG

EBNER Industrial Furnaces
Managing Director

On June 23, 2026 we had the distinct honor of welcoming the Austrian Foreign Minister Ms. Beate Meini-Reisinger, together with the Austrian Ambassador to China, the Austrian Consul General in Shanghai and the Vice President of the Austrian Economic Chamber, leading a high-level economic delegation to our facilities. The joint presence of officials from the Austrian Foreign Ministry and the Austrian diplomatic missions in China made this not

only the highest-level foreign affairs event ever hosted by EBNER Taicang since its founding, but also the highest-ranking reception of a serving foreign leader in the history of Taicang City and stands as a vivid testament to the profound integration of economic cooperation between China and Austria. Senior leaders from Suzhou and Taicang paid a personal visit to our company and, together with the Foreign Minister and her delegation, conducted a comprehensive tour of our facilities.

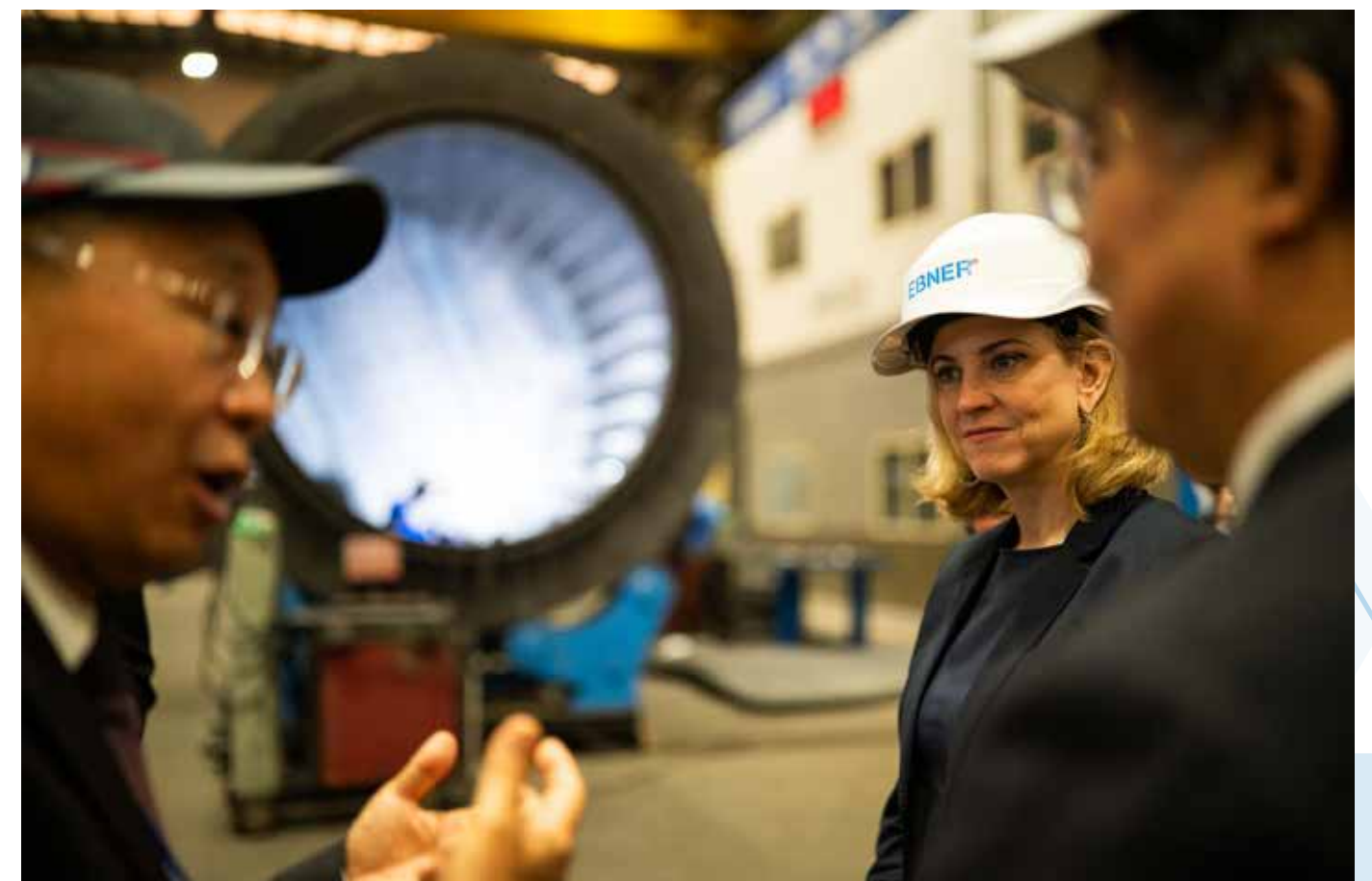
To mark this occasion, we hosted an exquisite cold buffet luncheon. A display area was set up in the venue to showcase EBNER GROUP's full industry portfolio and diversified strengths in China. In a relaxed atmosphere, the delegation engaged in in-depth discussions with the management team on cross-cultural integration, localization strategies, and opportunities for Sino-Austrian industrial cooperation. Several local Austrian companies were specially invited to participate in this event, which not only provided the delegation with a more comprehensive perspective on the Austrian companies ecosystem in China but also further strengthened the cohesion and cooperation network within the local Austrian business community.

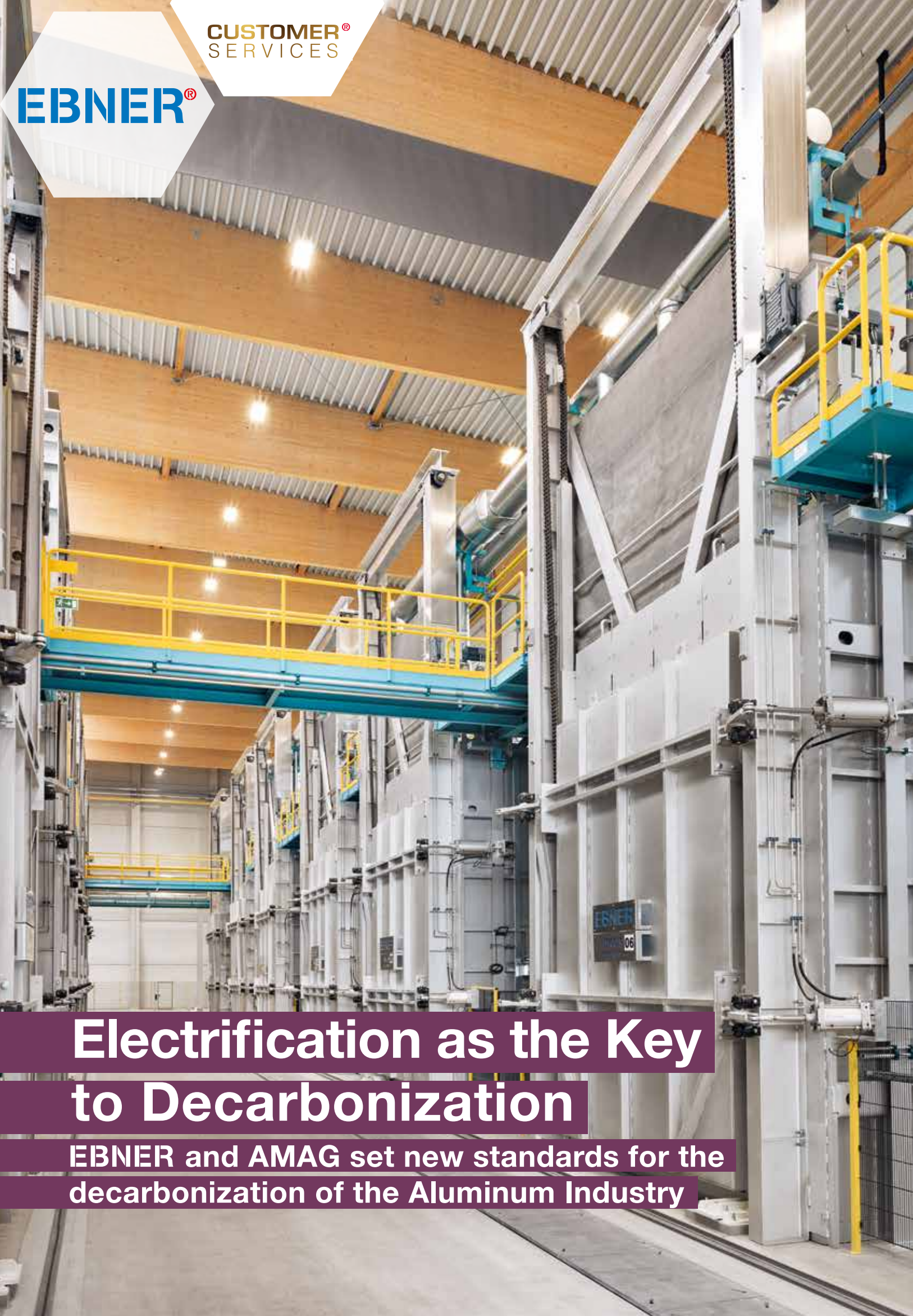
The delegation then proceeded to tour the production facility, where they gained firsthand insight into our state-of-the-art manufacturing techniques and rigorous quality management systems.

During the visit, the Foreign Minister lingered for a long time in front of one welder's workstations and had a cordial conversation with her. This employee shared her work experience at EBNER Taicang - from an ordinary technician to a key technical leader and said something simple yet powerful: „We are one

big family.“ Her sincere words resonated with everyone present - the cohesion of a company lies in the heartfelt recognition and passion of every ordinary employee. The delegation highly praised our company's achievements in technology implementation, lean management and team building.

Ever since its founding, EBNER Taicang has benefited from the unwavering support and thoughtful guidance of the Suzhou and Taicang local governments. The ongoing enhancement of the business environment serves as a strong foundation for the development of foreign-invested high-end manufacturing. The smooth and successful execution of this high-level visit stands as yet another testament to the enduring and mutually beneficial partnership between EBNER and the local government. We are not only the „movers“ of Austrian technology, but also the „practitioners“, actively contributing to the success of Chinese and Austrian cooperation.





Electrification as the Key to Decarbonization

EBNER and AMAG set new standards for the
decarbonization of the Aluminum Industry



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The aluminum industry worldwide faces the challenge of making its production processes more sustainable and climate-friendly. A key lever in this transformation is the decarbonization of energy-intensive heat treatment processes. Together with AMAG Austria Metall AG in Ranshofen, **EBNER** is actively driving this change and demonstrating how existing heat treatment facilities can be prepared for a low-carbon future.

CLIMATE NEUTRALITY AS A LONG-TERM GOAL

As part of its long-term decarbonization strategy, AMAG aims to achieve climate-neutral operations at its Ranshofen site by 2050. The focus is on the efficient use of recycled materials, the continuous improvement of energy efficiency, and the gradual replacement of fossil fuels with renewable alternatives. Thanks to its high recycling rate and the use of renewable electricity, the site is already among the most CO₂-efficient aluminum production facilities in Europe.

Against this backdrop, **EBNER** was commissioned in 2021 to conduct comprehensive feasibility studies on the decarbonization of existing heat treatment equipment. The objective was to evaluate various heating technologies in terms of technical feasibility, economic viability, energy efficiency, and CO₂ reduction potential. Based on these studies, the decision was made to convert two existing gas-fired batch annealing furnaces at AMAG's rolling mill to electric heating.

TWO HEATING CONCEPTS TESTED IN PRACTICE

The technical challenge was to integrate the new heating systems into the existing furnace infrastructure without altering the proven process conditions. To achieve this, two different electric heating concepts were installed and tested under real production conditions: a tubular heating system and **EBNER**'s proprietary plate heating system.

Following successful installation and commissioning, extensive temperature uniformity surveys were conducted to verify the thermal performance of the electric heating systems. The results confirmed the high expectations: both heating concepts achieved excellent temperature uniformity and met the stringent requirements of AMS 2750 and AMS 2772 aerospace standards. At the same time, electric heating enabled faster heating rates and significantly more precise temperature control, ensuring that the consistently high product quality was fully maintained.

UP TO 29 PERCENT LOWER ENERGY CONSUMPTION

The efficiency and sustainability gains achieved are particularly remarkable. Compared to the previous natural gas-fired operation, the electric heating systems reduce energy consumption by an average of 26 to 29 percent. In addition, each furnace can save approximately 100 metric tons of CO₂ emissions annually. Even more significant, however, is the long-term potential: the knowledge gained through this project provides the foundation for future electrification initiatives that could reduce CO₂ emissions by up to 45,000 metric tons per year. This would correspond to approximately 40 to 50 percent of the site's Scope 1 emissions (as of 2024) in Ranshofen.

A PRACTICAL SOLUTION FOR EXISTING FACILITIES

The conversion serves as an excellent example of how existing industrial facilities can be successfully modernized through innovative technologies. **EBNER**'s proprietary plate heating system offers a decisive advantage: in many cases, it can be integrated into existing equipment with relatively limited modifications, providing customers with a practical pathway to decarbonize their production processes.

At the same time, AMAG consciously pursues a technology-neutral approach. In addition to electrification, alternative energy sources such as hydrogen are also being evaluated. Through targeted pilot projects, a solid knowledge base is being established that enables a gradual and economically viable transformation of production processes without compromising ongoing operations or the high quality of the final products.



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TECHNOLOGY FOR A MORE CLIMATE-FRIENDLY INDUSTRY

The joint project between **EBNER** and AMAG clearly demonstrates that decarbonization, industrial efficiency, and the highest quality standards do not have to be mutually exclusive. On the contrary, the successful conversion of the heat treatment furnaces illustrates how innovative technologies can already make a tangible contribution to creating a more sustainable industry. Through projects such as this, **EBNER** is making an important contribution to the transformation of energy-intensive production processes and supporting its customers on their journey toward a more climate-friendly future.





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The metals industry is undergoing a fundamental transformation driven by rising energy costs, tightening environmental regulations, and the global push toward decarbonized production. As gas-fired furnaces face increasing scrutiny due to emissions, volatility in fuel supply, and high operating expenses, producers are turning to electrification as a strategic path forward.

Modern rolling mills and foundries are seeking technologies that not only reduce CO₂ emissions but also deliver higher process stability, predictable energy consumption, and long term operational resilience. Against this backdrop, the introduction of **EBNER GROUP**'s first electric heated pusher furnace marks a decisive step into the next generation of sustainable and efficient heat treatment systems.

FURNACE DESIGN AND OPERATION

The pusher-type furnace is the most advanced solution for reheating and homogenizing aluminum ingots in modern rolling mills. Operating in a semi-continuous mode, it delivers exceptional process stability, high throughput, and uniform thermal treatment across all ingot dimensions.

Inside the furnace, the rolling ingots rest on rails inside a tunnel-shaped chamber and move through the system as a tightly packed charge. Each time a new ingot is introduced, a pushing mechanism advances the entire furnace load by one position. The furnace itself is divided into three separate process zones. First, ingots are preheated in the input zone located at the furnace inlet using hot furnace atmosphere from downstream areas. Second, the ingots enter the heating zone where they are brought up to the desired heat-treatment temperature. Third, the ingots move through the holding zone where complete temperature equalization is ensured before the ingots are transported out of the furnace.

The heat treatment process is fully automated. When the rolling mill requests an ingot, the discharge door opens and a mechanical extraction device pulls the rolling ingot out on its sliding shoes before transferring it to the roller table. The shoes are then placed onto the transport carriage and travel back to the furnace inlet. There, they are repositioned on the rails while

the next rolling ingot is measured, centered, raised, and placed onto them. Once the inlet door opens, a powerful hydraulic cylinder pushes the new ingot into the furnace, advancing the entire furnace charge by one position. This optimized cycle ensures a smooth production flow and enables the retrieval of an ingot roughly every five to six minutes.

Electric heating elements are installed at the top of the furnace and arranged into different registers, delivering up to 820 kW of power. Four registers per furnace zone provide a total connected load of 10.1 MW. For installation or maintenance, the heating elements can be lifted in or out of the furnace using the overhead crane. Manufactured from high-resistance heating material, the heating elements offer stepless power control for precise temperature regulation and highly efficient plant operation.

FEATURES AND BENEFITS OF THE EBNER GROUP ELECTRIC PUSHER FURNACE

The primary advantage of electric heating is the significantly higher energy efficiency. Unlike conventional gas fired furnaces, the electric system generates no exhaust gas heat losses. The electric pusher furnace operates as a fully closed system in which the furnace atmosphere is continuously recirculated, minimizing thermal losses and ensuring exceptionally efficient plant performance.

In addition, electric heating elements respond far faster and with greater precision than conventional burners, resulting in superior temperature uniformity and shorter heat-up times through optimal use of overheat temperature. Thanks to this optimized design, the energy demand for heating and homogenization has been reduced to just 143 kWh/t – representing 35% energy savings compared to conventional pusher furnaces.

Use of electrical heating elements reduces the facility's complexity and minimizes the number of wear-prone parts. Electrical heating allows for the removal of several assemblies that require intensive monitoring and upkeep, such as gas trains and pressure regulation units, burner assemblies, combustion air blowers and ducting, flue-gas ducting, and

The Electric Pusher Furnace

A New Benchmark for Sustainable
Aluminum Processing

emission-control equipment. As a result, the system becomes leaner, more dependable, easier to operate, and easier to maintain. This leads to the following advantages:

- SHORTER PLANNED MAINTENANCE SHUTDOWNS
- REDUCED SPARE-PARTS INVENTORY
- FACILITY FOOTPRINT IS REDUCED
- FEWER INSPECTIONS REQUIRED
- NO BURNER TUNING OR PERIODIC COMBUSTION OPTIMIZATION
- NO COMBUSTION RESIDUES OR SOOT, RESULTING IN MORE STABLE LONG-TERM PERFORMANCE
- HIGHER FURNACE AVAILABILITY AND LOWER MAINTENANCE COSTS

The electric pusher furnace is fully future-proof with respect to tightening environmental regulations and allows for the complete elimination of direct emissions of CO₂ and NO_x. When powered by green electricity, it is possible to achieve 100% renewable furnace operations. As a result, the electric pusher furnace is particularly well-suited for the reduction of CO₂ emissions in the rolling mill and can thus provide a significant contribution to environmental protection efforts and long-term corporate sustainability goals.

OUTLOOK

The introduction of EBNER GROUP’s first electrically heated pusher furnace marks a decisive technological shift for aluminum rolling mills seeking higher efficiency, lower emissions, and greater operational stability. By combining the proven advantages of pusher-type furnace design with a fully electric heating system, the solution delivers exceptional energy efficiency, precise thermal control, simplified plant infrastructure, and significantly reduced maintenance requirements. The elimination of combustion-related components not only minimizes wear and downtime but also creates a cleaner, safer, and more predictable production environment.

Looking ahead, the electric pusher furnace provides a future-proof platform for the evolving needs of the metals industry. As energy markets continue to shift and decarbonization targets become more stringent, electrically heated systems will play an increasingly vital role in sustainable heat-treatment operations. With the ability to operate entirely on renewable electricity, the furnace enables rolling mills to reduce their CO₂ footprint and align with long-term corporate sustainability strategies.

TECHNICAL SPECIFICATIONS
FURNACE CAPACITY

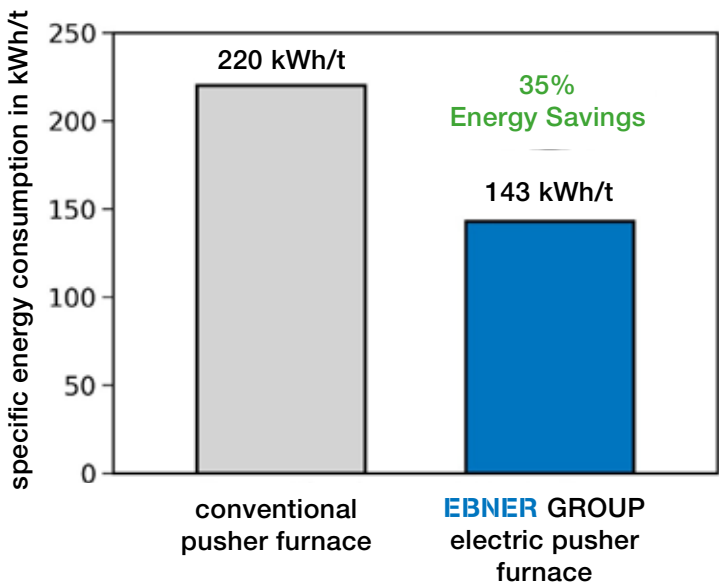
Parameter	Value
max. ingot dimensions	4.850 x 2.330 x 540 mm
max. ingot mass	15 t
max. furnace capacity	450 t
max. number of ingots	30

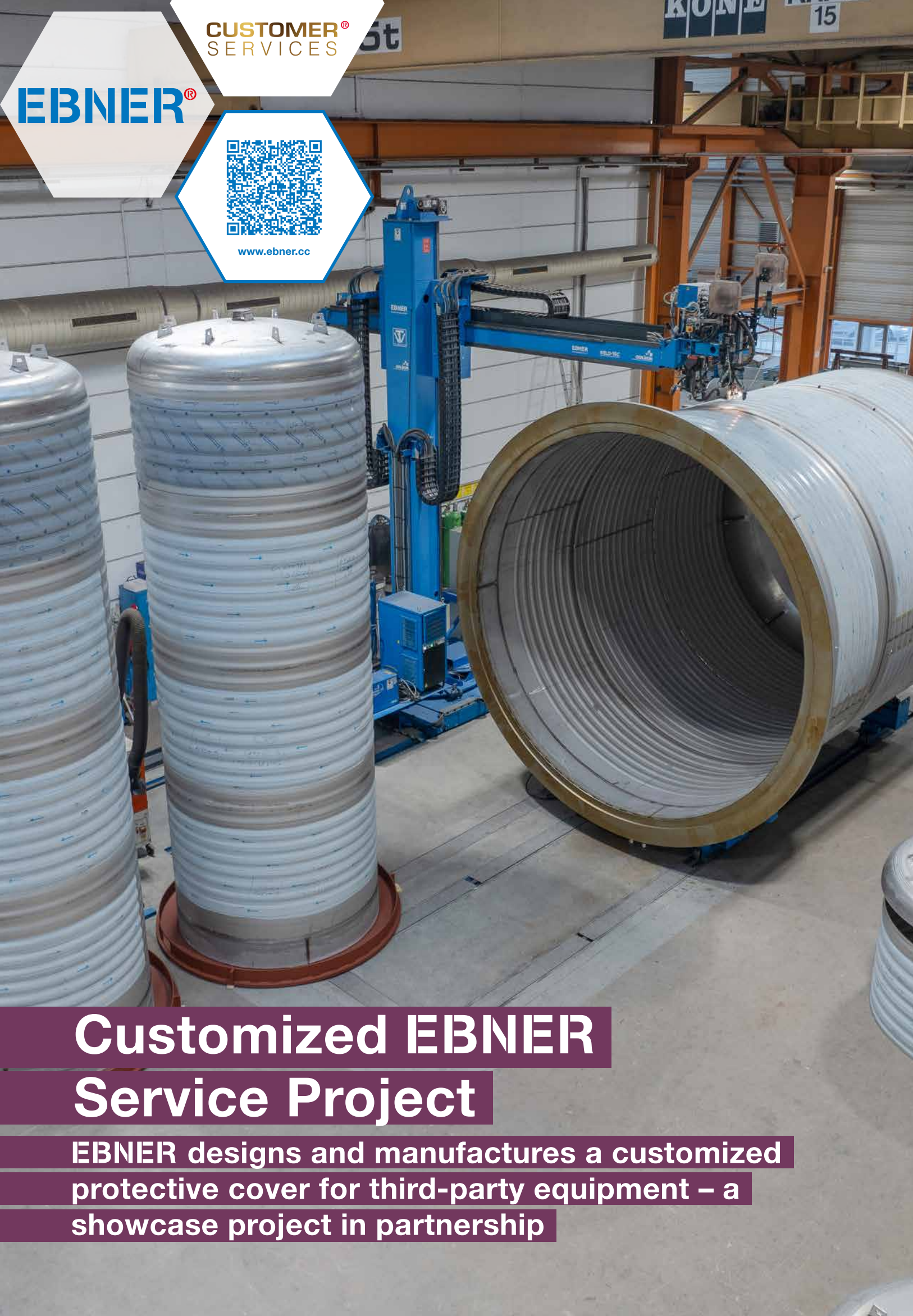
MAIN PROCESS PARAMETERS

Parameter	Value
Number of zones	5
Throughput during unloading	150 t/h
Approximate cycle time	ca. 6 min
max. furnace temperature	680 °C
Total electric heater power	10.1 MW
CO ₂ - emissions	No direct CO ₂ -emissions
NO _x - emissions	No direct NO _x -emissions

PERFORMANCE TEST RESULTS

Parameter	Value
Heating time	480 min
Specific energy consumption	143 kWh/t
Temperature uniformity	± 2.5 °C
Average shell temperature for 540 °C process	< 45 °C





Customized EBNER Service Project

EBNER designs and manufactures a customized protective cover for third-party equipment – a showcase project in partnership

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The successful collaboration between **EBNER** and the European customer goes back almost three decades. As early as 1995, the first **EBNER** bell annealer for wire went into operation at the customer's facility, followed by another plant in 2004. In the years that followed, contact was continuously maintained through spare parts supply and service support, resulting in an ongoing technical exchange that further strengthened the trusting relationship between the two companies.

THIRD-PARTY EQUIPMENT WITH HIGH WEAR

In 2017, the company invested in a new third-party plant. Just three years after the commissioning of this plant, the customer approached us again in 2020 with the question of whether **EBNER** could manufacture a replacement protective cover for the third-party annealing base.

A team from **EBNER** Customer Service subsequently visited the site to assess the situation firsthand. In addition to measuring the protective cover, the reason for the unusually rapid wear was also investigated. It became apparent that the gas deflection within the distribution device of the annealing base had not been optimally designed, which was a significant factor contributing to the shortened service life of the existing cover.

From a technical perspective, it was therefore clear that simply reproducing the cover without design modifications would not be a sensible solution. As a result, no order was placed at that time.

In 2023, the customer contacted **EBNER** again. The positive experience gained from nearly 30 years of cooperation ultimately led to a renewed interest in an **EBNER** quality solution. In 2024, the company finally awarded **EBNER** the contract for the design and manufacture of the protective cover.

CUSTOMIZED DESIGN AND TECHNICAL OPTIMIZATIONS

Working closely with the customer, **EBNER** developed a new, optimized protective cover whose design was specifically tailored to the operating conditions of the third-party annealing base.

Numerous design improvements were incorporated to significantly reduce wear. At the same time, the customer optimized the gas guide baffles of the annealing base, creating a combination of measures that will

contribute to longer service life and greater process reliability in the long term.

After completion of the design phase, the protective cover was manufactured entirely at **EBNER**'s production facility in Linz, Austria. In autumn 2025, the customer visited the **EBNER** workshop to inspect the finished cover in person, and the feedback was overwhelmingly positive.

The protective cover was delivered at the end of 2025, and installation was completed at the beginning of 2026. The plant was subsequently put into successful operation.

SERVICE FOR NON-EBNER EQUIPMENT

EBNER would like to sincerely thank the customer for their trust, constructive cooperation, and willingness to jointly tackle the technical challenges associated with third-party equipment.

This project once again demonstrated that strong partnerships and outstanding engineering expertise lead to convincing solutions not only for **EBNER** plants, but also for third-party equipment.



The Autonomous Casthouse

Redefining Safety, Efficiency, and Performance in Aluminum Casting

AI
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The **EBNER GROUP** companies GNA, Gautschi, and HPI combine extensive hands-on experience with deep metallurgical expertise to deliver fully integrated solutions for Aluminum casthouse operations. As full-solution providers of casthouse equipment, they have jointly developed a comprehensive automation concept that seamlessly connects all processes and equipment across the Aluminum casthouse. Supported by **EBNER GROUP** Digital Solutions, this approach leverages state-of-the-art and leading-edge programming techniques to enable intelligent, automated operations. The result is a smarter casthouse environment that enhances safety, increases operational efficiency, and supports compliance with the highest environmental standards. This article presents the concept, its architectural foundation, nine modular use cases that can be deployed individually or as part of an integrated roadmap, and a pragmatic pathway for adoption in greenfield, brownfield and existing installations.

BACKGROUND

The Aluminum casthouse is a place where extreme heat, hazardous materials and relentless production schedules converge. Yet for decades, the fundamental way casthouses operate has remained largely unchanged: experienced operators walk the production floor, make judgment calls based on intuition and habit, record data in disconnected systems, and respond to failures only after they occur.

This model is reaching its limits. Tightening safety regulations, rising energy costs, increasing alloy complexity, and a shrinking pool of experienced metallurgical talent are creating mounting pressure on casthouse operators worldwide. At the same time, the technologies needed to address these challenges, in particular industrial IoT, machine learning, digital twins, and intelligent automation, have matured to the

point where deployment at scale is no longer aspirational. It is commercially viable, field-validated in initial deployments, and strategically necessary.

The Autonomous Casthouse is the response to this inflection point. It is a comprehensive, scalable vision for a casthouse that monitors itself, optimizes its own performance, and protects its people, not through human vigilance alone, but through intelligent systems that work continuously, consistently and without

fatigue. Grounded in over a century of casthouse engineering expertise and built on the **EBNER GROUP** Digital Platform, the Autonomous Casthouse does not replace the human operator. It elevates that operator from a reactive firefighter to a strategic supervisor, supported by data, guided by intelligence, and freed from hazard.

FOUR CORE PRINCIPLES

1

**Uncompromising
Safety Through
Automation**

In Aluminum casthouses, personnel safety is the highest priority. Any contact between employees and molten Aluminum must be absolutely prevented. Whenever molten metal is transported in open vessels, such as pouring launders, molds, or tapping ladles, operators must be kept outside the hazardous zone.

The Autonomous Casthouse concept ensures that all critical process sequences are monitored remotely from secure operator control rooms. Human presence in dangerous zones is eliminated, while advanced automation and intelligent supervision maintain full process visibility and control. Plant logistics are reinforced by networked Autonomous Transport Vehicles (ATVs) integrated into the digital control architecture; laser scanners, protective fields, Blue Spot warning projections and camera-based motion detection stop vehicles whenever personnel enter the travel path.

2

**Error Prevention
for Higher
Productivity and
Consistent Quality**

The productivity of a casting facility and the quality of its output depend heavily on consistent execution across shifts and personnel. The Autonomous Casthouse reduces human error by automating routine tasks and standard decisions while providing smart support for operational judgment.

Through continuous monitoring and intelligent rule sets, the system detects potential deviations early or prevents them entirely. Automation pre-evaluates decisions, monitors process boundaries, and handles repetitive interventions, freeing operators to focus on judgment intensive tasks where human expertise creates the greatest value.


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3

Documentation, Transparency, and Continuous Process Improvement

Modern casting installations are equipped with a multitude of sensors and actuators. These process signals are recorded, structured, and used to display key operational metrics such as energy and media consumption.

In the Autonomous Casthouse, this data actively drives improvement. Advanced analytical functions evaluate historical and real-time information to generate actionable recommendations for process improvements. The system either suggests parameter changes or automatically adapts process parameters to optimize performance, increase stability, and continuously improve overall casthouse efficiency. The result is a closed loop from sensor to action, where every cast improves the next.

4

Maintenance and Asset Protection through Intelligent Insights

Proper maintenance is essential to reducing operating costs, maximizing output, and ensuring long-term equipment reliability. The same process data used for optimization also feeds predictive maintenance strategies.

Intelligent algorithms continuously analyze the condition of critical components, such as fans, pumps or drives, identify early signs of wear, and trigger condition-based inspections or automatically generate maintenance work orders. During maintenance execution, supportive remote applications accessible via VR headsets or mobile devices, bring expert guidance directly to the field technician's point of view. Integrated spare-parts management closes the loop by reducing the risk of production stoppages caused by missing parts.

THE DIGITAL FOUNDATION: A SCALABLE ARCHITECTURE

To realize the Autonomous Casthouse as a multiple application architecture, the digital foundation is provided by the proven **EBNER GROUP** Digital Platform, a scalable solution architecture built on decades of metallurgical expertise and cutting-edge technologies including machine learning, IoT connectivity, and Digital Twin simulation. Security is built in by design, and all process data and trained models remain the operator's property, never shared across customers.

The digital approach delivers tangible benefits across two key integration dimensions:

1. Horizontal Integration = Digitally Optimized Material Flow.

Seamless communication between production steps is enabled via industry-standard interfaces at the SCADA level (Level 2). This supports optimized material flow, integration with Manufacturing Execution Systems (MES, Level 3), and implementation of lean, data-driven workflows throughout the casthouse.

2. Vertical Integration = Digitally Optimized Equipment Performance.

Leveraging deep furnace and process expertise, vertical data flow from Level 1 (PLC) to Level 2 (SCADA) and upwards to MES (Level 3) or ERP (Level 4) via standardized APIs are ensured. This enables smart equipment capable of adapting to process variables such as alloy type, while meeting industry standards and improving energy efficiency.

The Core Digital Suite consisting of the HMI operator interface, process intelligence layer (VISUALFURNACES), traceability module (TRACKperfect) and maintenance module (MAINTAINperfect) is integrated in all GNA, Gautschi or HPI equipment. Both integration dimensions are designed to be open and vendor-neutral, allowing seamless integration of non-**EBNER GROUP** equipment.

„The Autonomous Casthouse does not replace the human operator. It elevates the job of the operator from a reactive firefighter to a strategic supervisor.“

MODULAR USE CASES IN PRACTICE

Each use case can be deployed stand-alone or as part of an integrated Autonomous Casthouse roadmap, enabling phased investment and quick wins. These use cases cluster naturally into three phases of the casting process.

PRE-CAST INTELLIGENCE

PRE-CAST INTELLIGENCE

Input Planning. Conventional charge planning focuses on scrap chemistry, but optimal charging is also driven by raw-material cost, energy input and achievable yield. A smart charge-planning module generates a ranked list of recommendations from real-time chemistry, current raw material costs, energy input parameters, and yield targets. The shift supervisor reviews the recommendations and confirms a data-driven decision within minutes, reducing raw material cost per ton and improving first-cast quality.

Automation of the Charging Process. Today, the decision when to reload a furnace is often a judgement call made by opening the door and visually assessing the melt. On a good day, this works. But timing errors, recharging too early or too late, create excess dross, waste energy, and reduce throughput, with measurable variation between day and night shifts. A camera system installed inside the furnace chamber continuously analyzes the melt state and combined with other process parameters like gas, power consumption and furnace temperatures the optimal recharge moment is automatically determined. The subjectivity is removed entirely. Dross formation is reduced, metal yield increases, performance becomes consistent regardless of who is operating the furnace.

Automatic Dosing of Alloying Components.

Manual alloying addition is a familiar scene: an operator approaches the furnace with bagged material, tosses it into the melt, and waits. The precision of this process depends entirely on the individual, their calculation accuracy, their consistency, and their proximity to the hazard zone. Overshooting is common. Repeatability is poor. Automated dosing systems use calibrated storage con-

tainers with precision discharge mechanisms to add Si, Mn, Cu, Fe, and other elements via the charging chute alongside loaded scrap. An electromagnetic stirrer at the furnace bottom ensures rapid dissolution and homogeneous distribution. In furnaces with an open side well, alloying materials can alternatively be added directly to the liquid metal, provided a drying or preheating system prevents moisture introduction. Alloy overshooting is reduced, composition consistency improves, and operators are no longer required near the melt for this task.

Fine-Tuning of alloy composition.

Magnesium is highly reactive at casting temperatures. Even a well-prepared melt can arrive at the holding furnace with Mg levels below specification due to oxidation losses during launder transfer. Such silent yield loss forces costly rework including additional alloying cycles. Magnesium-in-got submergence devices installed above the launder perform precise, automated Mg addition during transfer, compensating for oxidation losses in real time. Target composition is achieved in a single pass, eliminating correction loops and improving production efficiency from the very first cast.

Automation of the Dross Skimming Process.

Dross skimming is one of the most physically demanding and hazardous tasks in the casthouse. An operator is controlling a long-wearing skimming rake across the surface of the melt, working in intense heat, often with limited visibility through fume and glare. Mechanic impacts on furnace wall refractory, or the furnace sill are not unusual. The quality of skimming varies from person to person and shift to shift, directly affecting metal recovery and furnace cleanliness. Automated skimming machines equipped with onboard cameras execute the task without human presence at the furnace door, with an operator cabin available for manual override. A supervised learning period trains the system on the specific furnace geometry and dross behavior, afterwards it operates autonomously with consistent technique. Periodic manual furnace-wall and bottom cleaning remains, but the high-frequency, high-exposure skimming task is fully removed from the manual workflow.

IN-CAST AUTONOMY

IN-CAST AUTONOMY

Cast Start Monitoring. Before every cast, a sequence of checks must be completed: Is the distribution launder positioned correctly? Are the molds properly preheated? Are the cooling water systems at the right flow rates? Is the downstream receiving equipment in place? A missed step on this checklist can trigger a casting failure, at best a costly restart, at worst a safety incident involving uncontrolled melt release. Optical and thermal imaging cameras combined with artificial intelligence now perform this verification automatically, scanning all system components in parallel before transfer or casting is permitted to begin. The result is a documented, auditable confirmation of casting readiness faster than any manual checklist, and with zero chance of an oversight due to distraction or fatigue.

100% Hands-Off Casting. The cast start is the single most hazardous moment in the entire casthouse operation. An experienced caster manually opens dams to fill the launder sections, waits until the molds are filled and starts the strands conveyor. A decision window of seconds, with consequences measured in tonnes. Even for veteran operators, this moment carries irreducible risk. For less experienced personnel, it is the greatest source of casting failures and safety incidents. Full automation of the pouring start uses sensors and automated dams to execute this critical phase precisely and repeatably. The experienced caster remains in the loop, but now at the operator station rather than at the pit edge, supervising the sequence from a safe position. The highest-risk phase of casthouse operation is removed from the manual domain without compromising process control or the irreplaceable judgement of the human expert. Automation of this phase is supervised and engineered to functional-safety standards: the system executes the sequence while the caster authorizes the start and retains override at all times. „Hands-off“ refers to physical distance from the hazard zone, not to removing human accountability.

POST-CAST AND CONTINUOUS IMPROVEMENT

POST-CAST AND CONTINUOUS IMPROVEMENT

Traceability for Qualified Processes. Automotive and aerospace customers operate under some of the most rigorous quality and traceability requirements in manufacturing. Every cast must be documented. Every deviation must be recorded and traceable. Reporting packages that once required hours of manual assembly after each cast are now a regulatory baseline expectation rather than a differentiator. For semi-finished products destined for these sectors, the Autonomous Casthouse automatically traces the entire production process, identifies and logs deviations in real time and generates complete production reports without manual input — built on TRACKperfect as the qualified-process data layer. Root-cause analysis that once took days can be completed in minutes giving quality teams immediate answers and auditors complete confidence.

Process optimizer. Every senior caster carries years of refined knowledge in their head. This tacit expertise is among the most valuable assets a casthouse possesses and among the most fragile. It walks out the door when experienced operators retire. A deep-learning engine analyzes all available process data across hundreds or thousands of process cycles, correlating parameters, identifying patterns invisible to human inspection, and progressively building a model of optimal casthouse behavior. Initially, the system suggests parameter changes while human experts make the final call. Over time, their informed decisions refine the engine's recommendations, creating a feedback loop that captures institutional knowledge and improves autonomously long after the people who built it have moved on.

IMPLEMENTATION PATHWAY

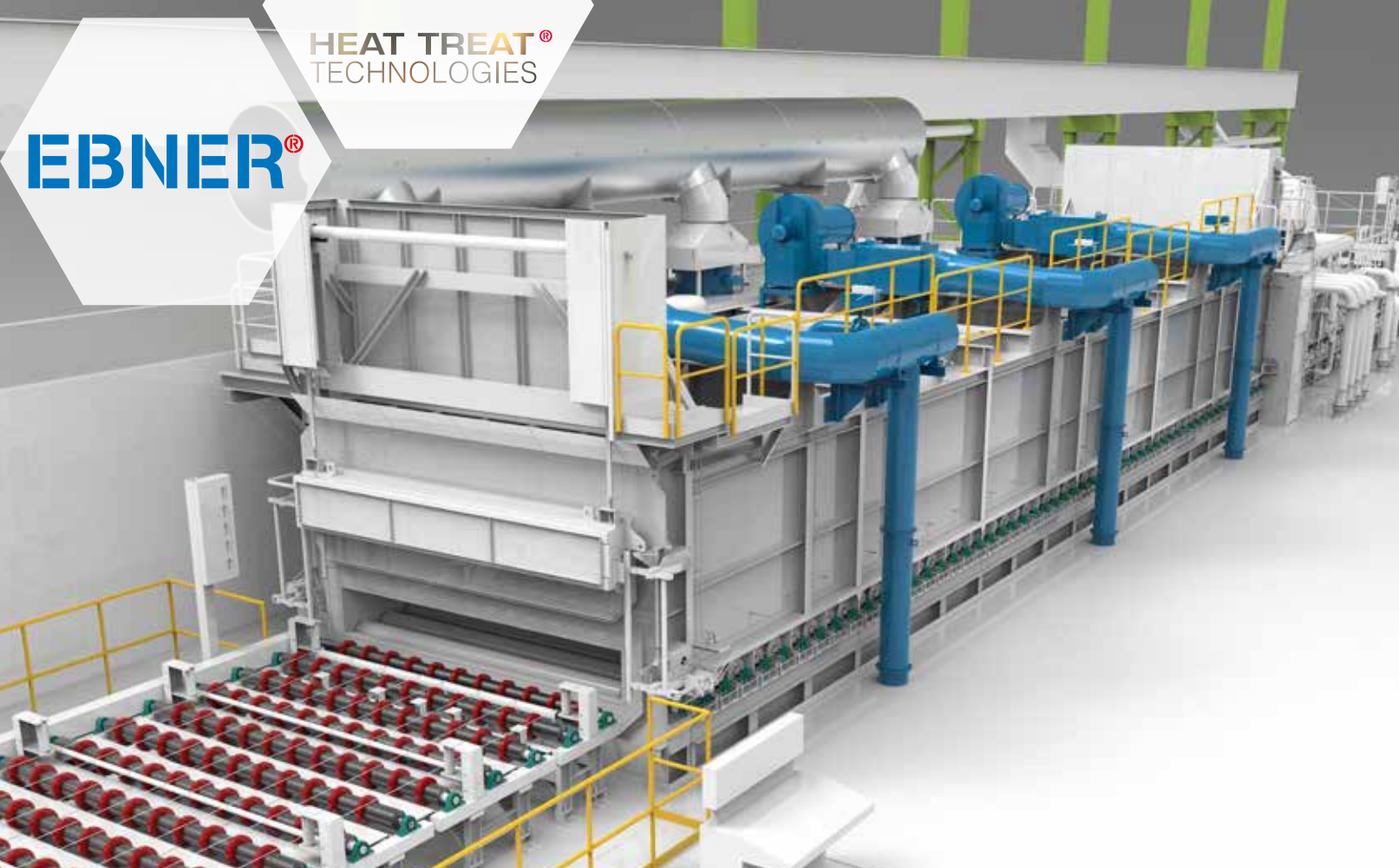
The implementation of Autonomous Casthouse functions in a greenfield, brownfield, or existing casting facility depends on the specific operational context, the available infrastructure, and the strategic objectives. The effort required for programming, commissioning, and integrating extended use cases is defined by the agreed scope and the expectations of the operating team.

The foundation for this implementation has already been established with the **EBNER GROUP** Digital Platform. There are virtually no limits to realizing both existing and future use cases in Aluminum casthouses. Step by step, the digitalized casthouse of the future can be developed by combining the Aluminum casting expertise of GNA, Gautschi and HPI with the automation competence of **EBNER GROUP** Digital Solutions and the goals, ideas, and requirements of casthouse operators themselves.

The Autonomous Casthouse is not a single product to be purchased, nor a forklift upgrade to be installed overnight. It is an architecture and a roadmap. Operators choose their entry point, e.g. a single high-impact module such as automated cross skimming or 100 % hands-off casting or a safety-driven retrofit of the operator control room and grow from there. Every step delivers measurable value on its own. Every step makes the next one easier.



AI Modified



ETI Alüminyum invests in State-of-the-Art EBNER Technology

Long-Standing Partnership Leads to a Major Order in the Turkish Aluminum Industry



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Patience, perseverance, and a partnership built on mutual trust and collaboration have paid off: ETI Alüminyum A.S., Turkey's only fully integrated aluminum production facility, has chosen to invest in two state-of-the-art heat treatment plants from **EBNER**.

For **EBNER**, this order represents another important milestone in its long-standing partnership with the Turkish aluminum producer. Since 2007, numerous projects and intensive discussions have shaped the relationship between the two companies. The decisive step came in April 2024, when a delegation from ETI Alüminyum visited our company. During this visit, a symbolic handshake with Mr. Ebner paved the way for the successful conclusion of this major order.

STRATEGIC PARTNER TO THE TURKISH ALUMINUM INDUSTRY

ETI Alüminyum, headquartered in Seydisehir in the province of Konya, holds a unique position within the Turkish industry. As the country's only integrated aluminum plant, the company covers the entire value chain, from bauxite mining and aluminum production to the manufacture of finished products. With its extensive production facilities, ETI Alüminyum today contributes approximately 10% of Turkey's total aluminum output, making it a significant driver of both the regional and national economy.

To meet the growing demands of the market and further strengthen its competitiveness, the company has chosen to invest in state-of-the-art heat treatment

technology from Austria. In addition to the technological performance of the equipment, **EBNER**'s outstanding technical expertise, extensive experience in the aluminum industry, and the trust-based partnership developed over many years were key factors in the decision-making process.

STATE-OF-THE-ART TECHNOLOGY FOR SUPERIOR PRODUCT QUALITY

The scope of supply includes two key facilities for the heat treatment of aluminum plates.

■ **HICON® ROLLER-HEARTH FURNACE FOR SOLUTION HEAT TREATMENT AND QUENCHING**

The first facility is an **EBNER HICON®** roller-hearth furnace designed for the solution heat treatment and subsequent quenching of rolled aluminum plates.

In this state-of-the-art facility, aluminum plates are heated precisely and uniformly to the required solution heat treatment temperature in a batch process. This is followed by rapid cooling using **EBNER**'s proven high-pressure and low-pressure quenching technology. This process step is essential for achieving the desired material properties required for demanding applications.

A key advantage of the **HICON®** roller-hearth furnace is its modular plant design. Both the overall length of the installation and the number of furnace and quench zones can be precisely tailored to the customer's production requirements. This provides maximum flexibility while ensuring outstanding energy efficiency.

After quenching, the plates can be further processed and levelled to relieve residual stresses within the material, thereby creating the foundation for meeting the highest quality standards.

■ **HICON® BATCH TYPE FURNACE FOR AGING**

The heat treatment line is complemented by an electrically heated **HICON®** batch type furnace. This system is designed for the aging heat treatment of aluminum plates and aluminum alloys.

After solution heat treatment, many aluminum alloys require a controlled ageing process to achieve their final mechanical properties. The **EBNER HICON®** batch type furnace ensures precise temperature control over several hours, delivering exceptional process accuracy and repeatability.

A sophisticated air circulation system ensures that the heated air is distributed uniformly across the aluminum plates or plate stacks. Regular reversals of the airflow direction, combined with

heating elements located in both the furnace floor and roof, prevent temperature variations throughout the load. In addition, individually controlled temperature zones enable optimal results, even under varying production requirements.

The result is aluminum products with outstanding material properties in terms of strength, hardness, and elongation, characteristics that are of critical importance, particularly for demanding industrial applications.

SUCCESS THROUGH TEAMWORK

The order from ETI Alüminyum is an excellent example of how sustainable customer relationships, technical excellence, and perseverance lead to long-term success. After many years of close cooperation and continuous project development, a shared vision has now been transformed into a tangible investment project.

This success would not have been possible without the dedication and commitment of numerous colleagues. From Sales and our local representative, through Project Management and Engineering, to the various technical departments, many employees contributed their expertise, experience, and passion to earning the customer's trust and securing this significant order.

We would like to extend our sincere thanks to everyone involved for their dedication and commitment. We look forward to working together with ETI Alüminyum on the next stages of this exciting project. Once again, this project demonstrates that technological excellence, strong customer relationships, and perseverance are the foundations of sustainable success.



www.ebner.cc



CONTIGRID™:

Integrating Proven Process Technology with Next-Generation Grid Manufacturing



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As battery manufacturers expand production capacity and seek greater process efficiency, the limitations of traditional grid manufacturing approaches are becoming increasingly evident. Fragmented equipment layouts, multiple suppliers, and disconnected process steps introduce unnecessary complexity, variability, and project risk.

In response, HAZELETT and Eagle Oxide introduce CONTIGRID™, a fully integrated lead grid manufacturing platform designed to deliver a continuous, synchronized process from melt to finished grid. Beyond just the equipment, a deep process and integration experience is offered, unique in the industry.

A FOUNDATION BUILT ON PROVEN BATTERY GRID TECHNOLOGY

To produce the high throughput of nearly 1 million grids per day, a melting furnace capable of over 16MT of melt rate is needed. The Eagle lead melting system provides this capability via immersion burner tubes vs. external burners and a crucible. A single pot of 45MT capacity handles new lead feed as well as the high rate of chip return easily, facilitating a smaller footprint and automatic alloy control.

At the heart of CONTIGRID™ is HAZELETT's well-established twin-belt continuous casting technology, widely recognized for its capability to produce high-quality

lead alloy strip in a stable and controlled process environment.

The HAZELETT® LS1800 twin-belt caster operates using two opposing, water-cooled steel belts that form a moving mold, supported by precision back-up rolls and sealed by edge dam systems. This design enables continuous casting of lead strip with consistent geometry and metallurgical properties.

Typical operating parameters for the LS1800 platform include:

- Casting speeds of up to 7 m/min
- Strip thickness ranges from approximately 9–15 mm
- Output capability exceeding 15 MT/hr depending on strip dimensions

This casting approach provides a stable, continuous feedstock for downstream rolling and grid production—forming the technological backbone of the CONTIGRID™ concept.

FROM CONTINUOUS CASTING TO CONTINUOUS GRID PRODUCTION

While continuous casting and rolling have long been proven technologies, traditional grid production still relies on multiple interconnected systems that often operate independently. CONTIGRID™ addresses this challenge by integrating the entire production chain—from molten metal to finished grid—into one balanced process.

The rolling process has been optimized beyond previous work to provide the best corrosion resistant material in the highest throughput rate. Thickness can be .55mm up to 1.5mm with automatic tensioning and roll schedule adjustments. Carefully controlled cooling of the rolls and strip provide the favorable metallurgical properties for a stamped grid design.

The coil handling equipment is also automated such that no manual intervention is required during coil changes that occur in less than a minute.

The punch press utilized in the grid stamping process has been modified to accommodate the lead environment and is capable of rates up to 500 spm and 125 Ton load. Well-developed die designs that are double wide produce 2 grids with every stroke.

CONTIGRID™ is not simply a collection of equipment—it is a fully engineered production platform that integrates:

- Eagle Oxide's state-of-the-art alloy melting and controlled metal feeding equipment

■ HAZELETT's LS1800 Twin-Belt Caster

- Precision high-load rolling mills with integrated tensioning and strip cooling control
- Automated coil handling up to 12,000 lbs and 150 cm in diameter.
- Progressive grid stamping at 800 grids per minute
 - Precise, robust die designs with integrated lubrication for high uptime
 - Best in class push-pull servo feeders
 - Best in class push-pull servo feeders

Each stage is engineered to operate in synchronization with the next, eliminating bottlenecks and reducing manual intervention throughout the process.

ENGINEERING INTEGRATION AT EVERY STAGE

A key advantage of CONTIGRID™ lies in its system-level engineering. Rather than optimizing individual machines, the platform is designed as a complete manufacturing ecosystem, where process variables—such as casting speed, strip thickness, and downstream stamping rates—are balanced across the entire line.

For example, the upstream metal feeding system ensures stable and controlled delivery of molten lead into the casting mold through systems such as tundish flow control and automated pool level monitoring. The alloy to the casting process is automatically controlled by adjusting the ratio of elements to maintain specification.

These controls allow the casting process to operate under consistent thermal and flow conditions, which directly impacts downstream product quality.

This results in strip that is both dimensionally consistent and suitable for high-speed downstream processing.

AN ADVANTAGE ON THE MARKET: SCALE CAPACITY WITH CONFIDENCE

For battery manufacturers, the decision to invest in new grid capacity is no longer just about adding equipment—it is about reducing risk, accelerating timelines, and maximizing return on investment.

CONTIGRID™ is specifically designed to address these priorities.

One of the most significant challenges in traditional grid line projects is the coordination of multiple vendors and interfaces. Each additional interface introduces risk—whether in engineering responsibility, commissioning timelines, or long-term operational performance.

CONTIGRID™ addresses this directly by providing:

- A single, integrated process flow
- Coordinated, experienced engineering across all stages
- A unified approach to commissioning and startup – one source for everything

This reduces the number of critical interfaces and shortens the path to full production, enabling manufacturers to bring new capacity online more efficiently.

OPERATIONAL BENEFITS FOR BATTERY MANUFACTURERS

By combining Hazelett's casting technology with Eagle Oxide's expertise in downstream systems, CONTIGRID™ delivers measurable operational advantages:

IMPROVED THROUGHPUT	ENHANCED PRODUCT CONSISTENCY	MATERIAL EFFICIENCY	SIMPLIFIED EXECUTION
A continuous, synchronized process enables higher overall line utilization compared to batch or semi-integrated approaches.	Integrated process control across casting, rolling, and stamping improves dimensional accuracy and repeatability of the final grid. Expected throughput of 1million grids per day based upon balanced casting and rolling to support 800 grids per minute and 87% OEE.	The continuous strip process minimizes handling losses and supports improved yield across the production line.	Integrated supply reduces project complexity, accelerates commissioning, and provides clearer accountability throughout the project lifecycle.

A COLLABORATIVE APPROACH BACKED BY EXPERIENCE

CONTIGRID™ is the result of long-standing collaboration between HAZELETT and Eagle Oxide, combining expertise in:

- Continuous strip casting systems
- Lead handling and process control
- Grid stamping and downstream battery manufacturing

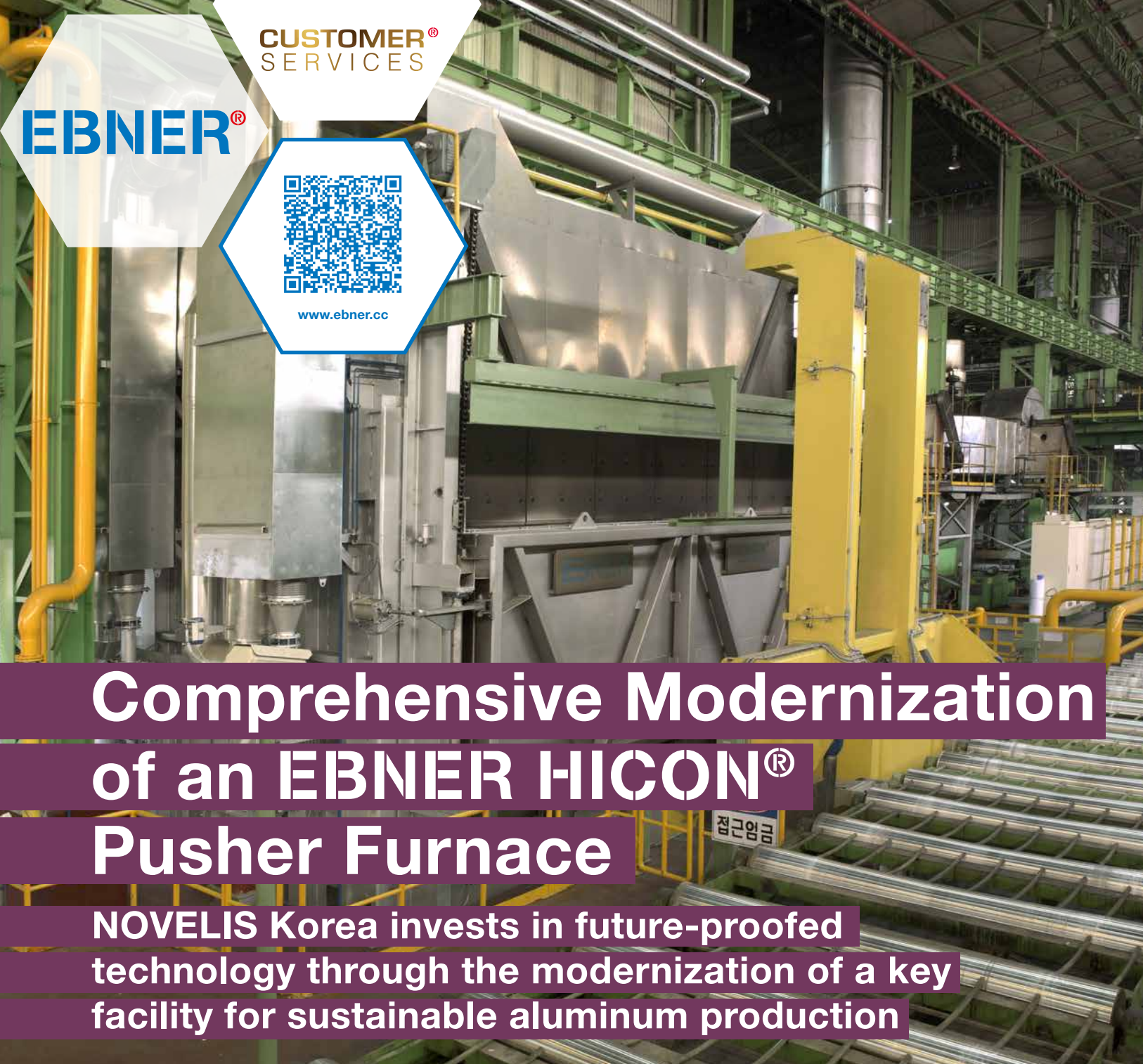
This collective experience—spanning decades of installed systems and real-world operation—has been consolidated into a single, unified offering designed to meet the needs of modern battery manufacturing facilities.

POSITIONING FOR THE NEXT GENERATION OF PRODUCTION

As the industry continues to evolve, manufacturers are increasingly focused on scalability, consistency, and reduced operational risk. CONTIGRID™ represents a shift toward fully integrated production platforms that align technology, engineering, and execution into a single solution.

By building on proven casting fundamentals and extending integration across the entire production chain, CONTIGRID™ provides a practical and scalable pathway for the next generation of lead grid manufacturing.





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At Yeongju in South Korea, NOVELIS Korea is modernizing the **HICON®** pusher furnace facility that has been in operation since 2005 in cooperation with **EBNER**. The existing facility is used for heating and homogenizing aluminum ingots and represents an essential part of the production chain. The modernization aims to sustainably increase operational reliability, facility availability, and maintainability while establishing the technological foundation for future production requirements.

The facility is an **EBNER HICON®** pusher furnace of type STOG w-700/h-265/l-1875 for the heat treatment of aluminum ingots. The originally installed automation system was based on a GE FANUC PLC and had reached the end of its life cycle. As part of the project, the automation, instrumentation, control, and drive systems are therefore being comprehensively upgraded to state-of-the-art SIEMENS S7-1500 technology.

HOLISTIC MODERNIZATION APPROACH

As part of the modernization, numerous core components of the facility are being renewed and upgraded to the latest state of the art. The scope of supply includes, among other things:

- Replacement of the existing PLC control system with SIEMENS S7-1500
- Modernization of the process control system and visualization
- Renewal of the burner control system
- Replacement of sensors and field devices
- Modernization of the hydraulic system
- Optimization of the ingot pusher system
- Upgrade of the pressure-reducing station
- Modernization of the safety system, including protective devices
- Adaptation of the facility architecture to the latest technical standards

The technological benchmark for this project is the latest **EBNER** pusher furnace that has been operating successfully at the same site since 2023 and serves as a model for key system components.

ON-SITE ANALYSIS CREATES THE FOUNDATION FOR SUSTAINABLE SUCCESS

Before the project commenced, **EBNER** experts carried out extensive on-site analyses of the existing facility.

During these assessments, various optimization opportunities were identified, and several signs of aging and wear were detected. These issues are now being sustainably addressed as part of the modernization. By taking a holistic view of the facility, a modernization concept was developed that goes beyond merely replacing obsolete components and instead creates the basis for sustainably higher facility availability over the long term.

FOCUS ON AVAILABILITY AND FUTURE-PROOFING

One of the key benefits of the modernization is the assurance of long-term spare parts availability. The previously used automation components had already been discontinued or were only available to a limited extent. By migrating to current SIEMENS systems, NOVELIS will receive a future-proof platform for operation, maintenance, and future expansions.

In addition, the new system architecture enables improved diagnostic capabilities, greater data transparency, and more efficient maintenance. The moder-

nization therefore creates the conditions required for safe and economical facility operation for many years to come.

CLOSE COLLABORATION AS A KEY SUCCESS FACTOR

The project was developed through close cooperation between the teams of NOVELIS, **EBNER's** local representative office in Korea, and the specialist departments in Leonding, Austria. Numerous technical workshops, joint facility inspections, and detailed coordination meetings were conducted already during the quotation phase to define the optimal scope of modernization.

The intensive collaboration among all parties involved ensured that the modernization could be tailored precisely to the customer's requirements while also taking future expansion possibilities into account. With the modernization of the **HICON®** pusher furnace, NOVELIS Korea is taking an important step toward securing its competitiveness and production reliability. The combination of state-of-the-art automation and process technology, increased facility availability, and long-term spare parts security results in a future-proof solution for the aluminum industry.

The project once again highlights **EBNER's** expertise in the modernization of existing industrial furnaces and demonstrates how proven facilities can be successfully prepared for future requirements through targeted technical upgrades.





Unlocking the Full Potential of Aluminum Profiles

Experience the Future of Aluminum Profile Heat Treatment with EBNER



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Whether in aerospace, transportation, defense, or demanding industrial applications, aluminum profiles are expected to deliver an exceptional combination of strength, dimensional accuracy, corrosion resistance, and reliability.

Achieving these properties requires more than high-quality alloys. It depends on a precisely controlled heat treatment process that ensures consistent material performance throughout the entire production chain.

PRECISION STARTS WITH THE RIGHT SOLUTION HEAT TREATMENT

The foundation for outstanding profile quality is laid during solution heat treatment. Uniform temperature distribution, reproducible process conditions, and carefully controlled cooling rates are essential for creating the desired microstructure and mechanical properties. To meet these requirements, **EBNER** offers two specialized furnace solutions tailored to different profile geometries, alloy systems, and production demands.

ROLLER HEARTH FURNACES FOR HIGH-PERFORMANCE PROFILE HEAT TREATMENT

Our roller hearth furnaces set new standards in the solution heat treatment of high-performance aluminum profiles. Designed for complex geometries and demanding alloys (2xxx, 6xxx and 7xxx series), they ensure:

- Maximum temperature uniformity across the entire profile length

- Reproducible process conditions through precisely controlled furnace zones
- Minimal distortion due to optimized transport and heat transfer

A homogeneous and precisely controlled heating process is essential to achieve consistent material properties, especially for high-strength applications.

Combined with integrated high-performance quenching systems, these furnaces enable high cooling rates and uniform quench conditions, which are critical for achieving the desired microstructure and mechanical properties.

ALUMINUM TOWER FURNACES FOR SOLUTION HEAT TREATMENT OF LONG PROFILES

EBNER's Tower Furnace is the ideal solution for the heat treatment of long and complex aluminum profiles. The vertical arrangement allows profiles to be processed in a suspended position, minimizing deformation and ensuring excellent dimensional stability, even for thin-walled and high-strength products. Key benefits include:

- Minimal profile distortion due to vertical hanging of the material during heat treatment
- Excellent temperature uniformity throughout the entire load for consistent metallurgical properties
- High process flexibility for a wide range of profile lengths, alloys, and product geometries
- Efficient batch operation with optimized energy consumption and high throughput
- Automated material handling for maximum process reliability and reproducibility

By combining precise temperature control with optimized airflow technology, the Tower Furnace ensures homogeneous heating and soaking conditions, making it the preferred solution for demanding aerospace, transportation, and industrial profile applications.

MULTI-STAGE AGING TECHNOLOGIES: OPTIMIZING HIGH-STRENGTH ALUMINUM

One of the **EBNER** key highlights is the technology for multi-stage aging processes, particularly for T77 applications. This treatment condition is specifically designed to combine high mechanical strength with superior resistance to stress corrosion cracking, while ensuring a homogeneous precipitation structure throughout the material. Therefore, **EBNER** developed a special solution for this application.

MULTI-STAGE AGING TECHNOLOGIES FOR T77 APPLICATIONS

Achieving these characteristics requires highly accurate control of temperature and time parameters throughout the complete process chain. **EBNER's** aging systems enable flexible and fully reproducible multi-stage heat treatment cycles, allowing manufac-

turers to fine-tune material properties according to application-specific requirements.

The T77 condition is specifically designed to provide:

- Outstanding resistance to stress corrosion cracking (SCC)
- High mechanical strength
- Homogeneous precipitation structure

Achieving these properties requires highly precise control of temperature-time cycles throughout the entire process chain—from solution heat treatment to quenching and aging.

Our dedicated aging solutions allow for flexible and reproducible multi-stage heat treatment, ensuring optimal adjustment of material properties for aerospace and high-performance applications.

A COMPLETE HEAT TREATMENT SOLUTION FROM ONE SOURCE

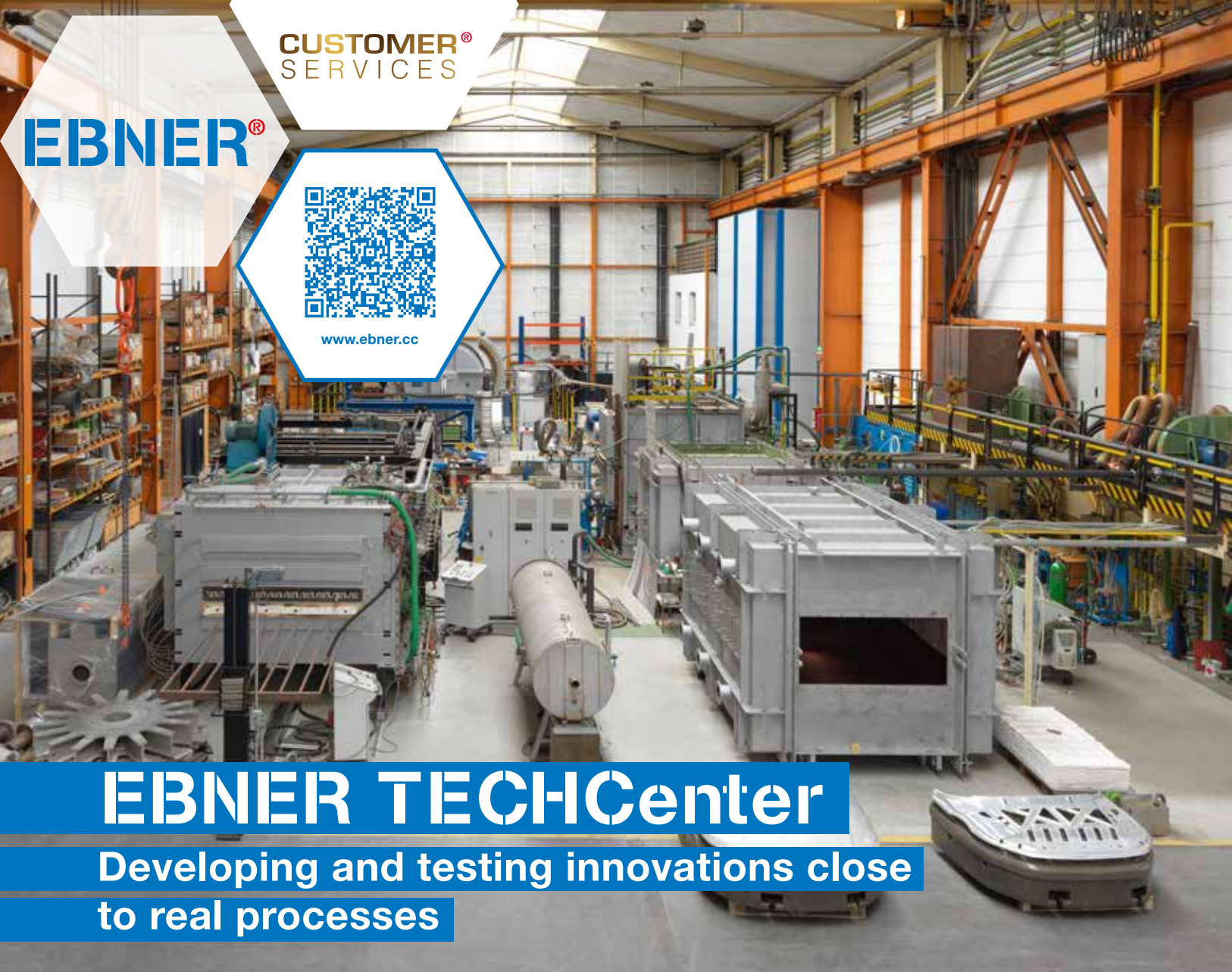
The greatest value is achieved when all process steps work together seamlessly. By combining advanced roller hearth or tower furnace technology with optimized quenching systems and sophisticated multi-stage aging solutions, **EBNER** provides a complete heat treatment concept for high-performance aluminum profiles. You will benefit from:

- Maximum process reliability for demanding alloys and applications
- Compliance with international standards such as AMS 2750 and CQI-9
- Tailored system concepts for future high-performance markets

These solutions enable you to unlock the full potential of your high-strength aluminum profiles and meet the increasing demands of aerospace, defense, and industrial applications.

MEET EBNER AT ALUMINUM DÜSSELDORF

Visit **EBNER** at Aluminum Düsseldorf from October 6-8, 2026 and discover how advanced heat treatment technologies can help unlock the full performance potential of your aluminum profiles. From solution heat treatment and quenching to sophisticated aging technologies, **EBNER** delivers the expertise and equipment required for the next generation of high-performance aluminum products.



EBNER TECHCenter

Developing and testing innovations close to real processes



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Innovation emerges where ideas can be tested under real-world conditions. This is exactly where the **EBNER TECHCenter** comes in: As a reliable partner, **EBNER** supports companies in the process-oriented development of new technologies, the creation of prototypes, and the evaluation of technical performance limits. The goal is to align optimal process conditions with the desired material and product properties, thereby creating sustainable competitive advantages.

RESEARCH AND DEVELOPMENT WITH PRACTICAL RELEVANCE

The **EBNER TECHCenter** offers companies the opportunity to carry out research and development

projects in collaboration with an international network of experts. Depending on the specific requirements, customers work either with **EBNER** specialists or selected external partners. Extensive experience in innovation projects combined with an interdisciplinary approach provides the foundation for efficient development processes and technological excellence.

Key benefits include:

- Reduction of technical risks
- Shortened development times
- Optimization of cost structures
- Rapid validation of new technologies and processes

COMPREHENSIVE TESTING INFRASTRUCTURE

For practical investigations, the **EBNER TECHCenter** provides a wide range of batch and continuous pilot plants. This enables processes to be tested and optimized under conditions that closely resemble industrial production environments.

SIMCAL GEN3 AND GEN5

The **SimCAL** systems enable the simulation of industrial heat treatment processes on a laboratory scale. Individual annealing cycles can be reproduced flexibly and efficiently. While the **SimCAL** Gen3 is primarily used to investigate the mechanical properties of materials, the **SimCAL** Gen5 supports the development and optimization of complex continuous annealing processes. Laboratory-scale simulations eliminate the need for time-consuming and costly trials on production equipment.

POT FURNACE

The compact pot furnace is ideally suited for the heat treatment of metals, material testing, and small-batch experiments. Precise temperature control and short heating times make it possible to investigate a wide range of process parameters.

GREENBAF^x

With its patented **GREENBAF^x** technology, **EBNER** focuses on maximum energy efficiency, low emissions, and simplified operating procedures. The systems utilize innovative concepts for heat input and energy recovery, making a significant contribution to sustainable production processes.

HIGH-TEMPERATURE AND ROLLER HEARTH FURNACES

The **HITT** high-temperature bell annealing furnace enables specialized high-temperature annealing treatments under a hydrogen atmosphere. The portfolio is complemented by roller hearth furnaces operating at temperatures up to 980°C and 600°C, respectively, which are particularly suitable for applications in the automotive industry and for precise heat treatment processes.

HICON[®] FLOATER FURNACE

The **HICON[®]** Floater furnace enables contact-free heat treatment of metal strip. Innovative air circulation and nozzle systems achieve high heat transfer rates and throughput capacities. Subsequent precise quenching

ensures the desired material properties for a wide range of alloys and strip thicknesses.

ADVANCED MEASUREMENT AND TESTING TECHNOLOGY

In addition to its pilot plants, the **EBNER TECHCenter** features a comprehensive portfolio of measurement and testing methods, including:

- METALLOGRAPHIC EXAMINATIONS
- DESTRUCTIVE AND NON-DESTRUCTIVE TESTING METHODS
- CONTACT AND NON-CONTACT TEMPERATURE MEASUREMENTS
- ANALYSIS OF ATMOSPHERES, MEDIA, AND GASES
- CONDUCTIVITY MEASUREMENTS

These capabilities are complemented by extensive expertise in heat treatment processes for ferrous and non-ferrous materials.

TEST RIGS FOR FUTURE-ORIENTED TECHNOLOGIES

Specialized test rigs allow the development and optimization of components under real operating conditions. For example, the radiant tube test rig can be used to analyze furnace atmospheres, exhaust gases, and temperature distributions. The burner test rig is designed to evaluate flame characteristics, ignition behavior, and emission values, including tests using hydrogen as an energy carrier.

DRIVING INNOVATION TOGETHER

R&D collaborations at the **EBNER TECHCenter** provide the foundation for the efficient development of new technologies, the optimization of existing thermal processes, and the rapid transfer of innovative ideas into market-ready applications. Quality, precision, and future viability are always at the forefront. Customers benefit from a partnership-based approach and an infrastructure that translates research results directly into industrial applications.

The **EBNER TECHCenter** combines state-of-the-art testing technology, extensive analytical expertise, and decades of experience into a powerful platform for research, development, and innovation.



From Research to a Megawatt Prototype

Inductively Coupled Plasma as a Key Technology for Electric Process Heat



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Decarbonizing energy-intensive industrial processes is one of the greatest challenges of the coming years. The aluminum industry in particular faces the task of replacing fossil fuels such as natural gas with climate-friendly alternatives without compromising product quality, economic viability, or facility availability. One promising solution is the use of plasma as an electric heat source. To this end, **TPS** is developing a new technology capable of completely replacing conventional natural gas burners. This is achieved through inductively coupled plasma burners

specifically designed for industrial high-temperature processes.

PLASMA AS THE HEAT SOURCE OF THE FUTURE

Plasma is often referred to as the fourth state of matter. When sufficient energy is supplied to a gas, electrons are released from their atomic bonds. This creates an electrically conductive medium consisting of ions, electrons, and neutral particles. Natural examples of plasma include lightning and the sun.

For thermal industrial processes, plasma offers significant advantages. Since energy is coupled directly through electricity, heat can be generated entirely free of CO₂ emissions, provided that electricity from renewable sources is used. At the same time, the technology allows precise control of the process atmosphere through the selection of suitable process gases. In addition, its compact design enables comparatively simple integration into existing furnace systems and significantly reduces the effort required for retrofitting.

In principle, various plasma technologies exist. While arc plasmas are already available at high power levels, electrode wear results in increased maintenance requirements. Microwave plasmas are primarily suitable for lower power levels below approximately 100 kW. For industrial applications in the megawatt range, inductively coupled plasma technology offers the greatest potential in terms of efficiency, operating costs, and maintenance requirements.

SYSTEMATIC DEVELOPMENT OVER SEVERAL YEARS

Development work led by **TPS** began with feasibility studies at the University of Mining and Technology in Freiberg, Germany. Initial tests confirmed that aluminum can, in principle, be melted using plasma. At the same time, positive metallurgical effects were observed, including low oxide formation and low hydrogen pickup in the metal.

In parallel, **TPS** investigated various plasma concepts for industrial furnace systems at the Institute of Technology in Karlsruhe, Germany. The analyses showed that inductively coupled plasmas offer significantly greater economic potential at high power levels than alternative plasma technologies.

Over the following years, the work focused on optimizing plasma parameters, power electronics, and burner geometry. Numerous simulations and experimental trials resulted in continuous efficiency improvements and enabled operation with various process gases, including nitrogen, air, oxygen, and carbon dioxide.

An important milestone was reached in May 2025. For the first time, an aluminum melting furnace was operated exclusively with a **TPS** plasma burner. During this trial, 100 kg of aluminum was completely melted using plasma. The results showed very low dross formation as well as promising metallurgical properties of the molten metal.

THE STEP INTO THE MEGAWATT RANGE

Following successful validation at pilot scale, the current focus is on scaling the technology for industrial applications. At the Ranshofen site, a research and development system with a power rating of one me-

gawatt is currently in operation. This system forms the basis for the transition from the development phase to industrial deployment.

The installation is based on newly developed modular power electronics with an output of 1 MW per module, enabling the operation of an inductively coupled plasma burner in the power range relevant for industrial applications.

Particularly noteworthy are the expected efficiency levels. While previous solutions were often limited by high losses in the power electronics, the **TPS** concept achieves a burner efficiency of approximately 88 to 89 percent. This includes all conversion losses in both the burner and the power electronics. As a result, the technology reaches an efficiency range that enables the economically viable electrification of energy-intensive high-temperature processes. Another advantage lies in the extremely high plasma temperatures of well above 10,000 °C. This allows heat to be transferred with comparatively low process gas flow rates. Compared to conventional burner systems, this reduces exhaust gas losses and improves energy utilization within the furnace.

NEXT MILESTONE: INDUSTRIAL DEMONSTRATOR

The next development step this year is the integration of a 750 kW demonstrator into an aluminum melting furnace, where the system will be tested under near-production conditions. The objective is to validate the technology and collect data on energy consumption, process stability, melting performance, emissions, and metal quality.

The results achieved to date indicate that inductively coupled plasmas have the potential to make a significant contribution to the decarbonization of thermal industrial processes. With the current 1 MW prototype, **TPS** has reached a decisive stage of development and established the foundation for deploying this technology on an industrial scale.

NEWS

The HICON® Journal is also available by email!

Trade fairs. Conventions. 2026/2027					
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We look forward to seeing you there!



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