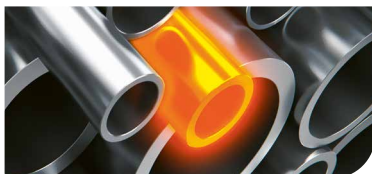


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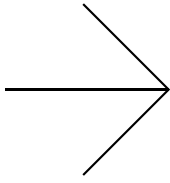


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Europe's long road to decarbonisation

Climate-friendly, CO₂-reduced steel is now a reality. When it is produced from scrap in an EAF powered by fossil-free electricity, it has a significantly lower Product Carbon Footprint (PCF) than comparable material produced via the BF-BOF route. This CO₂-reduced steel helps processors to achieve a positive impact on the product carbon footprint of certain consumer goods, for example. This is precisely how companies can differentiate themselves to the end customer, whether as a supplier of consumer goods such as vehicles of all kinds, household appliances, etc., or as a supplier of construction work or services such as mobility or communication.

Steel supply chains have already adapted to labelling a low carbon footprint as an important product feature. In this issue we again have numerous examples of how the European steel sector has made the switch. When this climate-friendly steel is even transported in hydrogen-powered trucks, the steel industry seems to be well positioned in the fight against climate change.

But appearances can be deceiving. Steel production in Europe is under severe pressure. In 2023, crude steel production in the EU-27 fell by 7.4%, while global steel production was practically on a par with the previous year (source: worldsteel). No other region in the world saw such a drop in steel production in 2023. In the rest of Europe (excluding Russia, the other CIS and Ukraine), the

situation is not much better, with a decline of 4.6%. Now Tata Steel is pulling the cord. In this issue we report that Tata Steel is planning to shut down the two blast furnaces at its Port Talbot site (Wales, UK) before the end of this year. According to Tata Steel, the Port Talbot integrated steelworks produced around 3.2 million tonnes of crude steel per annum, mainly slabs for further processing in its own plants. Tata Steel remains committed to building an EAF at Port Talbot to resume slab production at a later date. For the time being, however, slabs will be sourced from other group sites, such as in the Netherlands or India.

It remains to be seen whether Tata Steel Europe will be the only steel producer to take such drastic measures. Reducing CO₂ emissions from the steelworks by closing them would be by far the worst option.



Arnt Hannewald,
Dipl.-Ing., Editor

Arnt Hannewald



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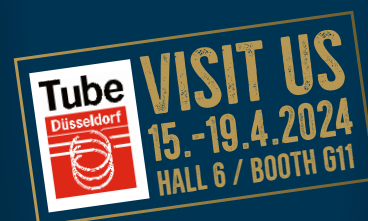
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EUROPE – AUSTRIA

RHI Magnesita takes next step in digital transformation of procurement processes

Refractories specialists RHI Magnesita have entered into a long-term partnership with Metalshub to optimise and digitalise the supplier management and procurement processes for raw materials across the entire RHI Magnesita group.

RHI Magnesita operates 47 production sites and seven recycling facilities worldwide. Having made the digital transformation one of their strategic targets for the coming

years, they have selected Metalshub's cloud-based supply chain solution to become the single supplier management and procurement solution for all raw material purchases. "By partnering with Metalshub, RHI Magnesita will further improve our internal and external raw material procurement processes," says Marie-Laure Boisson, Head of Raw Material Procurement at RHI Magnesita.

Metalshub, founded in 2016 in Düsseldorf by Dr. Sebastian Kreft and Dr. Frank

Jackel, is a leading software provider for the raw materials industry, unlocking supply chain value for buyers and sellers of metals and minerals. With its strong focus on the particularities of metal and mineral products, Metalshub provides a competitive edge by reducing operational inefficiencies and bringing more insights into carbon emissions along the supply chain.

■ *Metalshub / RHI Magnesita*

voestalpine places order for supply of EAF for its Linz site



Future location of the new electric arc furnace and its associated plant units within the Linz steel complex (Photo: voestalpine)

voestalpine has placed an order with Primetals Technologies for a 180-t EAF Ultimate to be implemented at the Austrian steel producer's site in Linz. Startup of the furnace is scheduled for 2027.

Primetals Technologies will supply the complete EAF Ultimate equipment, a dedusting system, electrical grid stabilization, and material handling for alloying materials and additives. The order scope

includes responsibility for installing the EAF's entire process equipment, including automation, power supply, capacitor bank, conveyor technology, dedusting, and monitoring assembly and commissioning. The EAF will be designed to incorporate industry-leading solutions for environmentally friendly steel production, such as the heat recovery system that will convert much of the waste heat into steam for use in other production units.

This project plays a key role in voestalpine's green transition program "greentec steel." As a first step in this ambitious decarbonization program, voestalpine decided to build an electric arc furnace at each of its sites, in Linz and Donawitz. The contract for the EAF at the site in Donawitz had been awarded to Danieli in summer 2023.

■ *voestalpine / Primetals Technologies*

EUROPE – FINLAND

Outokumpu increases ownership in Tornio-based wind farm



Nordic scenery at the Rajakiiri wind farm in Tornio
(Photo: Outokumpu)

Outokumpu has decided to invest in a further stake in the Rajakiiri wind farm in Tornio as part of its strategy to become more sustainable and increase its self-sufficiency in energy production.

“In the summer of 2023, we started a journey to gradually increase our investments in electricity production to better diversify our energy consumption sources and reduce our electricity-related risk through more predictable energy pricing and less market-based volatility”, says Tony Lindström, General Manager of Outokumpu EvoEnergy. The wind farm has been in operation since 2015 and has still an estimated 16 years of production life ahead of it. With this latest investment, Outokumpu’s ownership in the 45 MW wind farm in Tornio rises to a level of close to 9 MW and 19.9 percent of the shares.

“Further investment in Rajakiiri provides us better access to the windmills close to our operations. Eventually, it will open a long-term strategic access to upcoming Rajakiiri plans for further on-shore and off-shore investments”, adds Lindström.

Outokumpu



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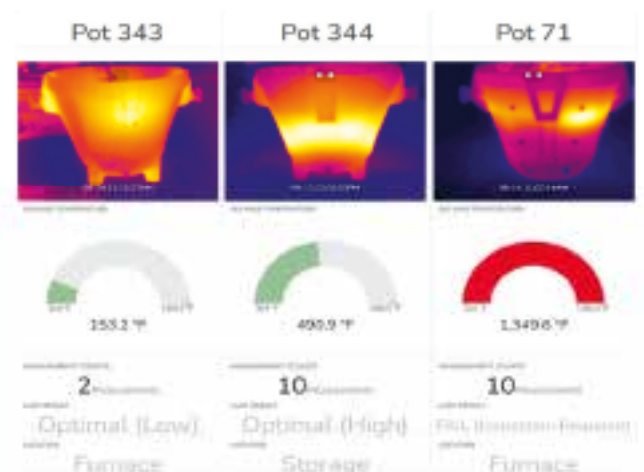
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In addition to designing, optimizing and supplying products for the ferrous and non-ferrous industries, CCE has been heavily involved in the development of reverse engineering services and the CCE Slag Pot Monitoring System in recent years.

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EUROPE – FINLAND

Outokumpu to digitalise raw material sourcing

Outokumpu and Metalshub, providers of raw material procurement solutions, are extending their partnership to digitalise the stainless steel producer's raw material sourcing activities.

In order to guarantee a traceable supply chain for its customers, Outokumpu has in place stringent requirements on its suppli-

ers. Developing and digitising the supply chain processes is an important part of this. From the very beginning, Outokumpu has used Metalshub for spot-demand sourcing through their public tendering process. Now, Outokumpu has contracted Metalshub to expand the usage from solely public tendering purchases to also capturing direct-to-supplier or contract call-offs via the

sourcing platform. This will improve operational efficiency and standardise documentation in the collaboration with Outokumpu suppliers. Additionally, Outokumpu sees this shift as a necessity to ensure a documented and compliant sourcing process is in place.

■ *Outokumpu / Metalshub*

Outokumpu acquires minority share in Cronimet North-East

Outokumpu and Cronimet have agreed to expand their long-term collaboration to further secure the sourcing and retain the supply of high-quality scrap within Northeastern Europe.

Outokumpu has now completed the acquisition of a 10 percent minority interest in Cronimet North-East GmbH, which holds Cronimet's subsidiaries in the surroundings of Outokumpu's European production sites. As a shareholder, Outokumpu acts as a strategic partner in Cronimet's North-

eastern business, while Cronimet retains full operational control of the companies involved.

"We want to accelerate the circular economy in the Northeastern European market area and source recycled steel, which is collected here in the area, close to where it is needed," says Marc-Simon Schaar, Chief Procurement Officer at Outokumpu. Jürgen Pilarsky, CEO of Cronimet, adds: "I also see our collaboration as a chance to learn from each other and as a great opportunity to drive our CO₂ reduc-

tion ambitions forward together, as we are both committed to the SBTi targets."

In addition to agreeing on the sourcing and supply of high-quality scrap within Northeastern Europe, the parties will also cooperate on joint innovation and research with the goal to improve technologies to further reduce CO₂ emissions, to lower costs through better predictability and drive waste reduction within the supply chain.

■ *Outokumpu / Cronimet*

EUROPE – GERMANY

cunova receives PCF certificate for mould tubes

cunova GmbH, manufacturers of customer-specific copper and copper alloy products, has received Product Carbon Footprint (PCF) certification from the German Technical Inspection Agency TÜV for its mould tubes.

The TÜV certificate was awarded on the basis of a comprehensive study performed in accordance with the international standard ISO 14067:2018. The study is a core element of a Master's thesis entitled "Ecological audit of copper products using the example of mould tubes", successfully submitted by working student Alina Rahe in August 2023 at the University of Münster. "She assessed the greenhouse gas emissions of our mould tubes across their entire life cycle – from production to recy-



cling – and confirmed the effectiveness of our innovative recycling principle," explains Dr. Alexander Beel, who supervised the certification process as a member of cunova's product development and digitalisation department. "We are proud that this certificate confirms that our products not only fulfil the highest quality standards, but also play a positive role in the global concept of sustainability," emphasises Tom Beyer, Head of Sales Mould Tubes.

■ *cunova*

Tom Beyer, Head of Sales Mould Tubes, and Dr. Alexander Beel, Product Development and Digitalization Department of cunova, presenting the PCF certificate for copper mould tubes (Photo: cunova/Hopkins)

Salzgitter Flachstahl restarts blast furnace A after relining

Salzgitter Flachstahl has refired its blast furnace A after a complete relining. The modernization project lasted just over 100 days.



Shortly before the restart of blast furnace A at Salzgitter Flachstahl GmbH (from left): Rene Rockstroh, General Manager Blast Furnace Works; Matthias Rami, Manager Blast Furnace B; Ferdinand Onkes, Plant Engineer; Daniel Tschenett, Manager Blast Furnace A; Dr. Tatjana Mirkovic, Superintendent Blast Furnace, and Dirk Hoffmann, Pirson Montage AG (Photo: Salzgitter AG)

The 2 million t/year blast furnace A has been completely relined with 3,000 t of carbon bricks and other refractory materials. The highly complex process and control technology was also revamped in the course of the project. A key partner in the project was the company Pirson Montage. With the relining of blast furnace A now completed, Salzgitter Group has taken an important operational step towards securing hot metal supply during the incremental transformation phase towards low-CO₂ steel production by 2033.

Ulrich Grethe, Chairman of the Management Board of Salzgitter Flachstahl GmbH, said: "This relining provides us and our customers and partners the security we need to continue to consistently drive the transformation of steel production forward. Based on a secure basic supply of pig iron, we will complete the next steps of SALCOS® - Salzgitter LowCO₂ Steelmaking."

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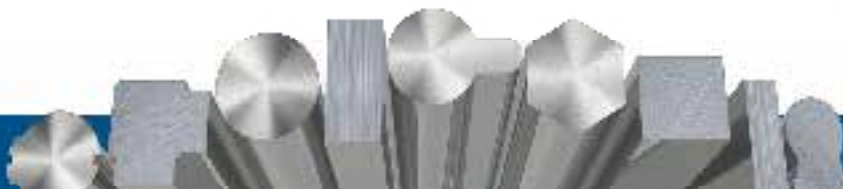
- Reduced energy input during the following heat treatment process
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EUROPE – GERMANY

Salzgitter orders process automation package for hot strip mill

Salzgitter Flachstahl GmbH has awarded SMS group the contract to supply a comprehensive technology package for its hot strip mill in Salzgitter. New control concepts will provide capacity and productivity increases in the rolling mill.

Following the systematic mechatronic modernization of the hot strip mill in recent years, Salzgitter will now implement control systems and process models from SMS group's X-Pact® product family. Alongside an array of new functions and a harmonized tool environment,

the scope of supply also includes the X-Pact® integrated temperature model, a learning, self-optimizing process control feature. This combines all process steps to form a superordinate temperature model and generates comprehensive recommendations for enhancing product quality and plant productivity. The included X-Pact® plant pacing system will optimize the throughput and productivity of the entire plant.

In addition to the Level 2 automation, the integrated strip guiding control system, known as X-Pact® centerline control,

is also part of SMS's scope of supply. This solution utilizes a camera system to detect deviations in the strip flow and calculates correction signals for each mill stand. The technology package for Salzgitter Flachstahl is rounded off by the new X-Pact® PEAK control concept, which helps to boost capacity and productivity levels in the rolling mill.

■ *SMS group*

EUROPE – FRANCE

ArcelorMittal hosts French Minister of Economy and Finance at Dunkirk steelworks

In January 2024, Bruno Le Maire, the French Minister for Economy and Finance, paid a visit the Dunkirk steelworks of ArcelorMittal France.

The visit was designed to update Mr Le Maire on the decarbonisation plans and on progress at ArcelorMittal's French steel-making operations. The plans, first announced in February 2022 and supported by funding from the French government, are central to the company's target to reduce the carbon intensity of the steel

produced by ArcelorMittal in Europe by 35 percent, by 2030.

In Dunkirk, ArcelorMittal produces approximately 5 million t/year of steel with two blast furnaces. It is intended to build a 2.5 million t DRI plant and two electric arc furnaces, replacing one of the currently operating blast furnaces. Following successful completion of the pre-FEED (front-end engineering design) stage in 2023, the project is currently in the FEED stage. Completion of the FEED stage, expected later this year, will deter-

mine the industrial layout for the project, the implementation schedule and final budget, and confirm the viability of the project.

In addition, ArcelorMittal recently signed a letter of intent with French state-owned energy supplier EDF Energy for the long-term supply of low-carbon electricity to steelmaking sites in Dunkirk and Fos-sur-mer.

■ *ArcelorMittal*

EUROPE – SWEDEN

H2 Green Steel raises more than 4 billion euros in debt financing

H2 Green Steel (H2GS AB), founded in 2020 with the ambition to accelerate the decarbonization of the steel industry using green hydrogen, has signed definitive debt financing agreements for 4.2 billion euros in project financing.

Total equity funding to date amounts to 2.1 billion euros. The company has also been awarded a 250 million euro grant

from the EU Innovation Fund. H2 Green Steel has now secured funding of close to 6.5 billion euros for the world's first large-scale green steel plant in Northern Sweden.

The construction of the flagship green steel plant in Boden, with integrated green hydrogen and green iron production, is well under way. The supply contracts for the hydrogen, iron and steel

equipment are in place. A large portion of the electricity needed has been secured in long-term power purchase agreements, and half of the initial yearly volumes of 2.5 million t of near zero steel have been sold in binding five- to seven-year customer agreements.

■ *H2 Green Steel*

Ceba and Kanthal enter into strategic partnership on preheater technology

Kanthal, industrial heating technology specialists, and Ceba, experts in equipment for ladle and tundish preheating and drying, have entered into a partnership to offer sustainable electric solutions for these processes and advance the green technology shift.

As the steel and metals industry is looking for ways to decarbonize production, the demand for sustainable heating solutions

is growing. Ladle and tundish preheating and drying are processes that today rely on fossil fuels with open flames powered by gas burners. Kanthal and Ceba have now joined forces to provide innovative electrified alternatives to these processes, contributing to the reduction of carbon emissions and improvement of workplace safety.

The collaboration brings together Kanthal's cutting-edge industrial heating

technology and Ceba's proficiency in engineering and manufacturing industrial heating equipment, delivering comprehensive electrified solutions for industrial heating requirements across various sectors. Ceba will develop equipment that incorporates existing heating technology from Kanthal.

■ *Ceba / Kanthal*

EUROPE – TURKEY

Habas Group invests in new tin-plate complex

Habas is going to build a new greenfield flat-steel facility in Aliaga, near Izmir. The 900,000 t/year flat steel complex will be supplied by Danieli.

The new complex will comprise four process areas: electrolytic cleaning, cold rolling and tempering, electrolytic tinning,

and continuous annealing. The facilities will be laid out for the production of 250,000 t/year of tinfoil in various steel grades, 150,000 t/year of thin, continuous annealed cold-rolled coil in commercial, drawing and HSS grades, and 500,000 t/year of semi-finished products, such as electrolytically cleaned, full-

hard coils. The new complex will operate with Danieli Automation electrical equipment and control systems. The plant will gradually come on stream starting from late 2024.

■ *Danieli*

JV of Messe Düsseldorf and Deutsche Messe to stage Ankiros/Turkcast and Aluexpo

The two German trade fair companies have pooled their expertise in a joint venture, with each of them holding a 50% share in "Hannover Messe Ankiros Fuarcilik A.S."

In this venture, Messe Düsseldorf contributes its network and industry expertise gained through its trade fairs Gifa, Metec, Thermprocess and Newcast ("The Bright World of Metals"). Deutsche Messe AG contributes its longstanding experience on the Turkish market. Thus, the Messe Düsseldorf Group is adding the three leading

Eurasian metallurgy, foundry and aluminium trade fairs Ankiros/Turkcast and Aluexpo to its global metal trade fair portfolio. Malte Seifert, Director of Gifa, Metec, Thermprocess and Newcast at Messe Düsseldorf, commenting on the new joint venture: "By expanding The Bright World of Metals to include these Eurasian satellite trade fairs, we are taking an important strategic step to increasingly focus on NF-metals in addition to steel and ferrous metals. With this move we are strengthening key mechanical engineering segments such as die casting." Ibrahim Anil, Founder

and General Manager of "Hannover Messe Ankiros Fuarcilik A.S.", emphasises the advantages of the partnership: "To ensure the continuity of the success stories of Ankiros/Turkcast and Aluexpo and to institutionalise the structure, I am passing the baton to capable hands. As I continue in my role as the General Manager, I am transferring my partnership rights to Messe Düsseldorf. Two leading trade fair companies will now ensure further growth of these trade fairs."

■ *Messe Düsseldorf / Deutsche Messe*

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TRANSFORMATION WITH HEAVY IMPACT

Tata Steel to close coke and ironmaking operations in Wales, UK

Tata Steel has announced the next steps in its ambitious transformation from blast furnaces to green steelmaking in the UK, with plans to close the blast furnaces and coke ovens at Port Talbot as early as 2024. Up to 2,800 employees are expected to be potentially affected, with around 2,500 roles being affected over the next 18 months.



Port Talbot's two blast furnaces and coke ovens would close in a phased manner this year, with the first BF closing already around mid-2024 (Picture: Tata Steel)

In mid-January, Tata Steel UK announced that it was launching a statutory consultation as part of its plan to transform and restructure its UK business. The plan is designed to reverse more than a decade of losses and move away from the old blast furnace business to a more sustainable, green steel business. The transformation would secure most of Tata Steel UK's existing product capability and maintain the country's self-sufficiency in steelmaking, while reducing Tata Steel UK's CO₂ emissions by 5 million tonnes per

year and the UK's overall emissions by around 1.5%.

Under the transformation plan, Tata Steel will embark on a £1.25 billion investment in electric arc furnace technology in Port Talbot and asset upgrades to secure long-term, high-quality production at the UK's largest steelmaker.

The proposed investment is supported by the UK Government, which has committed up to £500 million to enable the transformation. Tata Steel plans to invest £750 million in the project, alongside fund-

ing for a comprehensive support package for affected employees, business restructuring and transition costs as part of its long-term commitment to UK production.

Tata Steel has engaged in several months of detailed discussions with the UK Steel Committee and its advisors, which examined feasibility studies and financial analysis of the long-term viability of steelmaking at Port Talbot.

In discussions with the UK Steel Committee, Tata Steel has agreed to revise its proposal and would continue to operate

We recognise this proposed restructuring would have a major impact on the individuals and communities concerned, whom we will support with dignity and respect.

T V Narendran, Tata Steel's Chief Executive Officer and Managing Director

the Port Talbot hot strip mill throughout the transition period and in future. It has also carefully considered the committee's endorsed proposal for partial continuity of blast furnace steelmaking assets until electric arc furnace facilities are commissioned in Port Talbot.

As part of the review of the endorsed proposals, Tata Steel commissioned independent engineering studies and analysis of alternative-scenarios which concluded that continued blast furnace production while constructing the new electric arc furnace is not feasible due to the following:

- › The projected operating costs of such a configuration are financially unaffordable.
- › Building the electric arc furnace in an already operating steel melt shop would be fraught with risk, significantly increasing costs, creating a sub-optimal plant layout, delaying implementation of the plan and jeopardising the proposed business transformation programme.

- › The near end-of-life condition and deteriorating operating performance of several heavy end assets in Port Talbot.

Details of the proposed programme schedule

Under Tata Steel's proposed restructuring programme, Port Talbot's two high-emission blast furnaces and supporting facilities would be closed in a phased manner. The first blast furnace and coke ovens closing around mid-2024 and then progressively winding down the remaining heavy end assets during the second half of the calendar year. The proposal also includes a wider restructuring of other locations and functions across the company, including the intended closure of the Continuous Annealing Processing Line (CAPL) in March 2025.

Tata Steel has developed detailed plans which would enable it to secure continuity of supply through its existing downstream

and steel processing sites for UK and overseas customers, utilising imported semi-finished steel including from Tata Steel plants in the Netherlands and India as well as other select strategic suppliers until the commencement of electric arc furnace production.

In order to be able to deliver the proposed electric arc furnace in 2027, Tata Steel has begun engineering design work and construction planning for a furnace which would be among the most modern in the world. It is in advanced planning discussions with National Grid in relation to enabling infrastructure and has also begun engagement with the local authority and regulators.

Support for employees

The transition at Tata Steel's UK operations is subject to consultation but could be expected to result in up to 2,800 potential job losses across the business out of which around 2,500 roles could be impact-

Key highlights of the proposed transformation plan

Tata Steel considers that continued blast furnace production is not feasible or affordable.

Up to 2,800 employees are expected to be potentially affected, out of which around 2,500 roles would be impacted in the next 18 months.

Port Talbot's two blast furnaces and coke ovens would close in a phased manner with the first blast furnace closing around mid-2024 and the remaining heavy end assets would wind down during the second half of 2024. The proposal also includes a wider restructuring of other locations and functions

across the company, including the intended closure of the Continuous Annealing Processing Line (CAPL) in March 2025.

In discussion with the UK Steel Committee, Tata Steel has agreed that it would continue to operate the hot strip mill through the proposed transition period and in future. In addition, the downstream and steel processing centres would continue to serve customers by utilising imported semi-finished steel from Tata Steel plants in the Netherlands and India as well as other select strategic suppliers.

ed during the next 18 months. Tata Steel expects that a further 300 roles could be impacted in three years, which could include the potential consolidation and rationalisation of cold rolling assets in Llanwern once the required investments are completed at Port Talbot.

Throughout the proposed restructuring, Tata Steel remains committed to maximising voluntary redundancy before seeking any compulsory reductions.

Tata Steel will support all those potentially impacted through a comprehensive support package including redundancy terms, skills training, community-support programmes and job-seeker initiatives.

Tata Steel and the UK and Welsh governments have also established a dedicated Transition Board to support potentially affected employees, contractor employees and their communities, with £100 million funding for short-term support and long-term economic regeneration.

T V Narendran, Tata Steel’s Chief Executive Officer and Managing Director, said: “The course we are putting forward is difficult, but we believe it is the right one. Having invested almost £5 billion in the UK business since 2007, we must transform at pace to build a sustainable business in the UK for the long-term. Our ambitious plan includes the largest capital expendi-

ture in UK steel production in more than a decade, guaranteeing long-term, high-quality steel production in the UK and transforming the Port Talbot facility into one of Europe’s premier centres for green steelmaking.”

“We recognise this proposed restructuring would have a major impact on the individuals and communities concerned, whom we will support with dignity and respect. In consultation with our union partners, Tata Steel will offer a comprehensive support package to mitigate the impact of any anticipated job losses, including helping employees to retrain and find new jobs. We will continue our work with the UK and Welsh governments, trade unions and the community to help those who may be affected through the proposed transition.”

Economic regeneration and emission reductions

Subject to consultation, and subsequent to the proposed closure of some of the heavy end assets in Port Talbot, Tata Steel will continue to focus on facilitating wider economic regeneration in the Port Talbot area.

The proposal to invest in electric arc furnace technology, which would be fed by predominantly UK-produced scrap, fol-

lows a comprehensive analysis into all the financial and technological options available. The transition mirrors the successful installation of such low-carbon production facilities in other major steel producing markets such as the United States, where it has cut emissions whilst guaranteeing production of complex, high quality steel. On completion, the programme would transform the competitiveness of Tata Steel UK, secure most of its capability in terms of end products, whilst cutting its carbon emissions by about 85% and the UK’s overall carbon emissions by about 1.5%. The proposal to use UK-sourced scrap as the raw materials for future steelmaking would also maintain the country’s self-sufficiency as almost all of the raw materials for the current blast furnaces need to be imported.

Tata Steel UK intended to begin a formal information sharing and consultation process with employees and their representatives on the proposals, since the proposed restructuring is subject to a detailed consultation process with the relevant stakeholders.

■ *Tata Steel UK*

Mill Steel Company appoints Justin Powell as Chief Financial Officer

Mill Steel Company, Grand Rapids (Michigan/USA), distributor of flat-rolled carbon steel and aluminium, has appointed Justin Powell as its new Chief Financial Officer (CFO). This appointment follows the retirement of Marc Rabitoy as CFO.

Before joining Mill Steel Company, Justin Powell served as CFO at Clark-Dietrich Building Solutions, where he played a pivotal role in optimizing the steel framing business while expanding the portfolio of value-added, downstream brands, products, and services. Prior to that, Powell spent 15 years with Blue-



Scope Steel in various executive finance roles across BlueScope’s global portfolio.

■ *Mill Steel Co.*

Justin Powell is the new CFO of Mill Steel Company (Picture: Mill Steel Co.)

STEEL LONG PRODUCTS

Deacero to build another minimill for large sections in Mexico

The Ramos Arizpe site will double capacity covering production of sections up to 702 mm.

Deacero is said to be the largest long-product Mexican steel producer. Deacero awarded Danieli the order for a new 1.5 million t per year minimill to produce large sections up to 702 mm (27"). This will be the fifth minimill Danieli is supplying to Deacero. The new minimill will be strategically installed at Ramos Arizpe's existing facilities very close to the existing minimill for small sections producing approximately 1.5 million t per year of sections from 6,35 mm to 254 mm (¼ to 10").

Deacero has decided for a complete range of advanced technologies – from scrap processing to melting and secondary refining, beam blank and billet casting, and hot-rolling and finishing, all together ensuring the high performances at optimized energy consumption rates for competitive green steel production.

The steelmaking facility will include a 150-t "Zero-Man-Around" EAF, served by automatic raw material handling designed for additional ECS endless scrap charging, and a twin LF secondary refining station.

A 10-m radius six-strand continuous casting machine, equipped with mould stirrers and two cooling beds, will deliver 180x180 and 280x220-mm billets/blooms, 480x150-mm mini-slabs, and 280x220x90 and 480x380x90-mm beam blanks.



Deacero awarded Danieli the order for a new 1.5 million t per year minimill to produce large sections (Picture: Danieli)

The heavy-duty medium section mill, fed by a 180-t/hour walking-beam reheating furnace, will consist of a breakdown mill (BDM) and an ultra-flexible reversing mill (UFR) equipped with four universal-type stand core concept (SCC) stands, followed by complete straightening and finishing services for sections up to 27" (702 mm).

Q-Drive, high-performance water-cooled vector-controlled drives will power the section mill. A new large Hi-Profile, on-line profile measuring device will also be able to detect the typical rolling defects on the material surface.

The minimill will be characterized by advanced Danieli Automation solutions such the Q3 platform specifically engineered around the fundamental value of integration. A common data lake storage of heterogeneous data types from diverse systems will enable data-driven decision-making and analytics, as well as the possibility to manage AI-based models.

Plant startup is foreseen by Q1 2026.

| Danieli

New scrap processing plants to provide feedstock for the meltshops

Deacero has also ordered five steel scrap-shredding plants to process light domestic scrap and car bodies. The quality proler produced by the new scrap processing plants will be mainly used by Deacero to feed its meltshops in Mexico. Four out of the five plants will operate 2000-hp shredders for 50 t per hour ferrous output each, while the fifth, equipped with a 4000-hp shredder, will guarantee 100 t per hour.

Ferrous downstream lines of the new plants will include magnetic-separation ensuring a high level of scrap cleanliness (proler), while flexible inline/offline nonferrous separation will recover zorba, a high-purity nonferrous metals mix.

| Danieli Centro Recycling

DECARBONIZATION

Plug Power starts production of green hydrogen in Georgia, USA

The start of the largest proton exchange membrane electrolyzer in the United States is also a first-hand showcase for electrolyzer-produced hydrogen. The first cryogenic trailer has been filled immediately.



On the 1st of February, the first Plug tanker was filled with liquid green hydrogen produced at the Woodbine, Georgia plant and headed directly to customers (Picture: Plug)

Plug Power Inc., a provider of comprehensive hydrogen solutions for the green hydrogen economy, has started operation of the largest liquid green hydrogen plant in the U.S. market end of January 2024. A truly unique accomplishment, this is the largest electrolytic liquid hydrogen production plant, and largest PEM electrolyzer deployment operating in the U.S., representing a landmark achievement in Plug's build-out of a vertically integrated hydrogen ecosystem. The plant showcases Plug's own electrolyzer technology, demonstrating first-hand to cus-

tomers its reliability in producing sustainable fuel.

Located in Woodbine, Georgia, the plant is designed to produce 15 tons per day of liquid electrolytic hydrogen – enough to power approximately 15,000 forklifts per day. Through eight 5-megawatt (MW) PEM electrolyzers, water is separated into hydrogen and oxygen. The hydrogen gas is then condensed into liquid form at $-252,8^{\circ}\text{C}$ (-423F) to be delivered to customers' hydrogen fueling stations through Plug's logistics network using Plug cryogenic trailers.

This new facility will bolster Plug's supply of liquid hydrogen currently being delivered to Plug's pedestal customers for material handling operations, fuel cell electric vehicle fleets, and stationary power applications. Liquid hydrogen production, in addition to the on-going gaseous hydrogen production, is expected to positively impact Plug's bottom line and provide an additional step change in fuel margin expansion.

The addition of this liquid green hydrogen production plant to Plug's electrolyzer, fuel cell, and cryogenic equipment manu-

facturing facilities enables Plug to further its vision for building a vertically integrated green hydrogen ecosystem, a one-stop shop for producing, liquefying, storing, and transporting hydrogen. The continued build-out of Plug's global hydrogen network allows customers to seamlessly integrate hydrogen into its operations across multiple industries.

Customer demand for green hydrogen has grown as a low-carbon energy source for hard-to-decarbonize industries, such as heavy-duty transportation, heavy manufacturing (steel, cement, aluminium, and chemicals), stationary power generation, and aviation. In addition, hydrogen-supportive policies in both Europe and the U.S. have improved the economic attractiveness of green hydrogen.

"We have achieved a historic milestone for Plug and the entire hydrogen ecosystem," said Andy Marsh, Plug Power CEO. "Bringing this green hydrogen plant online demonstrates that we are the leading builder of global hydrogen infrastructure for supporting customer demand in decarbonizing their operations."

Plug finished the plant at a rapid pace of 18 months, more than two times faster than the three-year industry standard for hydrogen plants. The location of the plant near I-95 (one mile away) and I-10 (20 miles away) enables easy access to commercial and industrial centers, including Plug's pedestal customers throughout the U.S.

The company has been operating a pilot gaseous hydrogen plant in Georgia using Plug's 5 MW electrolyzer platform for over a year now, supporting high pressure tube trailer filling for Plug as well as other customers. The company is doing substantial work on other U.S. based plants, including plants in Louisiana, New York and Texas.

First customer fill

On 1 February, the first Plug tanker was filled with liquid green hydrogen produced at the Woodbine, Georgia plant and headed directly to customers. The achievement comes one week after the plant officially became operational. A Plug cryogenic trailer was filled with liquid hydrogen for use at Walmart, Amazon and Home Depot locations. From production to fill, the process was completed in about four days, and now-on, the trailers will deliver the green hydrogen to customers through

The first delivery of our green hydrogen molecule marks a critical milestone for the green hydrogen economy.

Andy Marsh, CEO of Plug

Plug's extensive logistics network. "The first delivery of our green hydrogen molecule marks a critical milestone for the green hydrogen economy," said Andy Marsh, CEO of Plug. "There's no doubt that Plug is demonstrating the future with real products and projects at scale." The company's advanced cryogenic and liquefaction capabilities are integral to its operations, allowing the green hydrogen to be

safely and efficiently transported to customers. Plug's liquid hydrogen tankers can transport up to 80,000 pounds (36.3 t) per maximum gross vehicle weight. It takes approximately eight gas tube trailers to deliver the same amount of gaseous hydrogen as one liquid hydrogen tanker.

■ Plug Power Inc.



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THE AMERICAS – BRAZIL

Sinobras starts up new wirerod and bar rolling mill



The Danieli and Sinobras teams celebrating the startup of the new rolling mill
(Photo: Danieli)

Siderúrgica Norte Brasil (Sinobras) has produced the first steel coil on its new No. 2 rolling mill in Marabá, in the state

of Pará. The mill, supplied by Danieli, adds 500,000 t/year of wirerod and spooled rebar in coils to the company's capacity.

The new rolling mill features an innovative, full cantilever stand configuration with a total of 26 passes. Ten cantilever stands arranged in H/V configuration are followed by a series of Delta-type, fast-finishing blocks for the remaining 16 passes of the reduction sequence.

Sinobras, a company of the Brazilian Aço Cearense Group, can produce plain rounds from 5.5 to 16 mm dia. and rebar from 6.3 to 16 mm dia. at a maximum finishing speed of 110 m/s on the new mill. The two finishing lines for wirerod and rebar-in-coil are readily prepared for the addition of in-line quenching and tempering. With the Danieli spooler technology, Sinobras produces twist-free spooled bars in coils that do not require unwinding and rewinding before use in downstream lines.

| Danieli

THE AMERICAS – CANADA

Gerdau Whitby completes meltshop upgrade

Gerdau has successfully commissioned the upgraded meltshop at its Whitby steel mill, Ontario. The pro-

ject included replacing an existing EAF with a Danieli UHP FastArc furnace.

The meltshop capacity has been increased from 650,000 to 1,100,000 t/year in two steps. The new, scrap-based FastArc furnace has a nominal tap weight of 125 t, and features a 6,500-mm-dia. lower shell, 610-mm-dia. electrodes, a 120-MVA transformer and a chemical package. The Danieli technological packages installed include Q-Smartec to reduce electrode consumption, an automatic sander with automatic sand refill, leakage detection system for shell panels, wireless RTD temperature transmitters and a Motank automatic slag door cleaning ram. The Danieli supply scope also included new material handling systems and the upgrading of the primary suction system of the fume treatment plant.



The meltshop and project teams after the successfully completed upgrading project
(Photo: Danieli)

| Danieli

THE AMERICAS – DOMINICAN REPUBLIC

Ecoacero to build new rebar mill



From left to right: Pedro Estrella, Director of Ecoacero; Giuseppe Maniscalco, CEO industrial division Grupo Estrella; and Filippo Verlezza and Nicola Redolfi, both SMS group (Picture: SMS group)

Ecoacero, company of the Estrella Group, has placed an order with SMS group for a new rebar mill. With the products from the 400,000 t/year mill, to be built in Santo Domingo, Ecoacero will serve customers in the growing construction industry in the Caribbean and Central America.

With the decision to invest in a rebar mill project, Estrella, one of the largest construction services and products group in the Dominican Republic, has made a strategic move to strengthen its vertical integration. The project consists of two phases.

For the first phase, SMS group will provide the design of the entire rebar rolling mill and supply the mechanical and electrical equipment. Additionally, SMS will supply a billet reheating furnace feeding the rolling mill. A MEERdrive® finishing block and water boxes for the quenching and self-tempering process are also part of this project

phase. SMS will supply the rolling mill complete with Level 1 and Level 2 automation systems linked with the SMS Mercury process optimization system.

The second phase of the project consists of a modern electric arc furnace, characterized by high electrical efficiency and featuring advanced burner and oxygen injector technology. The scrap-charged furnace will be equipped with the latest SMS technologies for safe, automatic and carbon-reducing operation. The entire process chain of melting, refining and casting will be monitored by an X-Pact® Level 2 system to ensure smooth interfacing with the phase-1 rolling mill.

■ SMS group



More Precision Non-contact strip thickness measurement

- **For high speed measurements**
128,000 measuring points/sec provide high precision even for button plate and checker plate
- **Innovative laser line**
Recognition of and compensation for tilted strips especially in slitting lines
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THE AMERICAS – MEXICO

Ternium to build direct reduction plant

Ternium is going to build a DRI plant at its Pesquería facility that will produce quality DRI for a new steel mill. The plant will use the Energiron direct reduction technology jointly developed by Tenova and Danieli.

The new 2.1 million t/year DRI plant will feed an electric arc furnace with up to 600°C hot DRI using the proven Hytemp®

pneumatic transport system. Hybrid by design, the Energiron technology makes it possible to use natural gas, hydrogen or any mix of these as reducing agent. Additionally, the technology has the capability to capture CO₂. The new direct reduction plant is scheduled to start production in early 2026.

The DRI plant is part of a project conceived to integrate Ternium's down-

stream operations, complying with USMCA (US, Mexico and Canada Agreement) "melted and poured" rule of origin regulations, as well as advancing the company's 2030 decarbonization commitment.

■ *Danieli*

THE AMERICAS – USA

Acerinox to acquire Haynes International

Acerinox has entered into a definitive agreement under which its wholly owned U.S. subsidiary North American Stainless (NAS) will acquire Haynes International.

The acquisition of Haynes, developer, manufacturer and marketer of technologically advanced high-performance alloys, strengthens Acerinox's global leadership

position in the high-performance alloy segment. In addition to creating additional value through the combination of complementary businesses, including expansion of U.S. operating capabilities and a worldwide sales and distribution network with 14 additional locations internationally, it adds extensive R&D capabilities and a significant patent portfolio, including 17 U.S. patents and published applications.

The transaction includes for Haynes to reinvest a major sum over the next four years in the newly combined U.S. business, mostly in Haynes's Kokomo operations, in order to create an integrated HPA and stainless steel platform.

■ *Acerinox*

JSW Steel U.S.A. invests in new vacuum degasser and casting infrastructure upgrade

JSW Steel U.S.A. and Primetals Technologies have entered into an agreement to upgrade the slab casting infrastructure at JSW Steel's Mingo Junction, Ohio, plant. The project encompasses steel-making, secondary metallurgy, and continuous casting processes.

As part of the project, Primetals Technologies will install a 230-t vacuum tank degasser (VTD) with a dry mechanical vacuum pump system, allowing JSW Steel U.S.A. to produce cleaner steel and reduce levels of carbon, oxygen, nitrogen, hydrogen, and sulfur in different process steps. The VTD design includes all the mechanical and electrical equipment for the plant, including the mechanical dry pumps, vacuum filters, and dust catcher.

It also includes integrating new material handling technologies, associated auxiliary systems, a metallurgical process model, and complete Level 1 and Level 2 automation systems.

For the 2-strand continuous caster upgrade, the project scope includes key mechanical equipment, Level 1 automation for strand No. 2, a complete Level 2 automation system, and a mould-monitoring system. Moreover, JSW Steel U.S.A. has signed up for a long-term software subscription model, based on a software as a service (SaaS) concept. Primetals Technologies plans to keep the caster downtime to just 30 days, among others by retaining the existing concrete foundations and strand supporting structure. The new strand containment will be fixed with

a specially designed adapter solution. At one of the strands, a Smart Segment, a patented continuous bending and straightening process, will allow for online and remote adjustment of the roll gap. This strand will be dedicated to producing API grades and high-grade plates.

Work on the project has begun and is scheduled for completion in the second half of 2025.

■ *Primetals Technologies*

THE AMERICAS – USA

Boston Metal secures funding for further development of new metals technology

Boston Metal is commercializing Molten Oxide Electrolysis (MOE), a metals technology powered by electricity, to decarbonize steelmaking and transform how metals are made. A further multi-million investment secured in Series C2 funding will accelerate the company's path to commercialization.

Boston Metal is headquartered in Woburn, Massachusetts and has a wholly owned subsidiary in Brazil. "Our commitment to innovation and sustainability in metals production remains unwavering and this funding will be instrumental in advancing our

long-term goals," said Tadeu Carneiro, CEO of Boston Metal.

Boston Metal's Molten Oxide Electrolysis (MOE) technology is a direct, one-step process that can produce high-quality steel from abundant medium- and low-grade iron ores. This flexibility is unique and positions MOE to meet the growing demand for environmentally sustainable steel in various industries. MOE also allows for the extraction of high-value metals from previously unusable low-concentration materials, like mining waste.

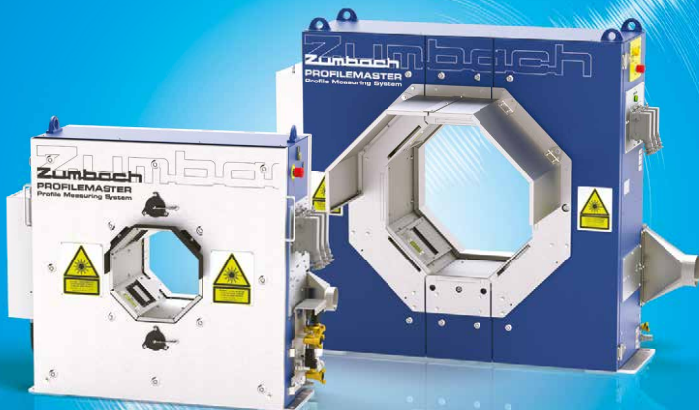
Building on its Series C1 funding momentum, Boston Metal is accelerating

its mission to commercialize breakthrough green steel technology by 2026 to support the steel industry's 2050 zero-carbon goals. The company expects to start generating revenue from its high-value metals business as early as 2024.

Boston Metal was recent selected by the U.S. Department of Energy to establish a chromium metal manufacturing plant in Weirton, West Virginia, to onshore production of a material critical to the aerospace, chemical processing and nuclear industries.

■ *Boston Metal*

Zumbach
SWISS PRIME MEASURING SINCE 1957



4 - 8

Number of cameras



5

Min. object diameter (mm)



720

Max. object diameter (mm)

PROFILEMASTER® SPS Profile Measuring System

The PROFILEMASTER® SPS is a light section measuring device for measuring contours and dimensions on profiles of all kinds in cold and hot steel applications.

Benefits:

- ✓ Maximum measuring accuracy thanks to temperature-stabilized measuring systems
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- ✓ High-precision measurements
- ✓ Detects process problems at an early stage
- ✓ Fast maintenance and easy cleaning



THE AMERICAS – USA

Nucor Steel Brandenburg inaugurates new facility

Nucor Steel Brandenburg has recently celebrated the inauguration of its new greenfield facility at the Buttermilk Falls Industrial Park site located on the Ohio River in Brandenburg, Kentucky. The core unit of the works is the single-strand continuous caster supplied by SMS for the production of ultra-wide and ultra-thick slabs.

For the new steel complex, SMS supplied the following key equipment: A single-strand continuous caster for ultra-wide and ultra-thick slabs, walking beam and bogie hearth furnaces, a continuous heat treatment line and heavy-plate treatment section, as well as the water treatment system.

The continuous casting plant is capable of producing 1.45 million t/year of slabs in widths of up to 3.15 m and thicknesses of 200 mm, 250 mm and 300 mm. Equipped with low-NO_x flameless and versatile SMS ZEROFlame burners, the stage 1 automation system, X-Pact® DigiMod Control, and



Al Behr, Executive Vice President; Steve Meredith (R), U.S. Senator District 5; David Sumoski, COO Nucor Corporation; Johnny Jacobs, Vice President and GM (Construction); Andy Bashear (D), Governor Commonwealth of Kentucky; Chris Rice, Vice President and General Manager Brandenburg (from left to right) at the inauguration ceremony in Brandenburg, Kentucky (Photo: SMS group)

the stage 2 heating optimization system, X-Pact® Prometheus, the reheating furnace reliably sets the desired temperature profile and uniformity for any material and steel grade, while minimizing fuel consumption, decarburization and scale loss.

As a lifecycle partner, SMS has set up a repair service center at the Nucor Brandenburg site, offering repair services for continuous casting molds and contain-

ment segments as part of a long-term service agreement.

One of the most important products to be manufactured at the new facility is Nucor's Elcyon™, a heavy plate product made from recycled materials and specially developed for the offshore wind industry.

■ SMS group

Nucor Steel West Virginia breaks ground for new sheet mill

With a groundbreaking ceremony, Nucor Corporation kicked off construction of a state-of-the-art sheet mill at its Apple Grove site in West Virginia. The equipment for the steelmaking plant will be supplied by SMS group.

The new sheet mill represents the largest manufacturing investment in West Virginia history. "With our circular production method, Nucor Steel West Virginia will produce sustainable sheet steel with some of the lowest embodied carbon in the world," said Leon Topalian,

Chair, President and CEO Nucor Corporation.

The equipment supplied by SMS for the new steelmaking plant consists of two 200-t DC electric arc furnaces, two twin-ladle metallurgy furnaces, two vacuum tank degassers with oxygen blowing and seven transfer cars. Production of the first heat is currently planned for the first quarter of 2026.

As part of the groundbreaking ceremony, the Nucor team organized the Guinness Book of World Records to witness the longest ever shovel relay. More than 545 dedicated participants lined up to successfully complete the 1 km relay and set a new record.

■ SMS group



"Record breaking" groundbreaking event for Nucor's new sheet mill (Photo: SMS group)

ASIA – INDIA

Bhilai Steel Plant refurbishes slab caster

Bhilai Steel Plant, part of SAIL Steel Authority of India, has brought its No. 6 slab caster at its Chhattisgarh facilities back on stream after a refurbishment performed by Danieli Service India.

The target of the project was to bring the slab caster back to its original, high performance level. Danieli Service supported Bhilai Steel Plant with condition analysis, segments alignment, data collection and the development of restoration solutions to reduce plant downtimes and maximize cost savings.

The mechanical activity included the complete dismantling and replacement of the turret bearing, machining of the turret body and bearing seating area, plus erection and alignment of the new segment extraction guides, restoration of damaged parts, and alignment of the machine casting radius. The project involved specialist



The slab caster at the Bhilai Steel Plant during refurbishment (Photo: Danieli)

mechanical experts from the Danieli headquarters and Danieli India supervisors. The task was completed in 38 days.

| Danieli

ASIA – JAPAN

Daido Steel uses integrated computational design platform in materials development

Daido Steel uses an integrated computational materials design and engineering software platform from QuesTek to design, develop and deploy novel materials.

The comprehensive ICMD® (Integrated Computational Materials Engineering) software from QuesTek will help Daido drive core initiatives, such as sustainability and new market opportunities, through materials innovation.

“Sustainability is a core value of our organization, as we continue to honour our 2013 commitment to a 50 percent reduction of our CO₂ emissions by 2030,” says Daido Steel. “ICMD® will streamline our materials R&D process to be greener and more efficient, as well as enabling our engineers to develop lighter, more fuel-efficient materials that reduce or eliminate the environmental impact of rare earth elements.”

ICMD® fully embodies QuesTek’s physics-based modelling approach to

materials engineering. Where useful it also utilizes AI, ML and DFT techniques. Available as an SaaS platform, ICMD® speeds up the process of developing and qualifying new materials, or optimizing existing alloy systems, by enabling engineers to predict material properties and performance with a very high degree of accuracy.

| QuesTek

ASIA – CHINA

Baosteel Zhanjiang starts production of direct reduced iron

Baosteel Zhanjiang Iron & Steel has started DRI production with its new Danieli-supplied direct reduction plant.

Featuring Energiron ZR –Zero Reformer technology, the new plant will produce 1 million t/year of quality DRI by using

natural gas, coke-oven gas, and hydrogen. Energiron DRI plants are hybrid-ready by design. DRI pellets processed by Energiron plants, a process jointly developed by Tenova and Danieli, allow up to 96 percent metallization and variable carbon-content ranging from 0.5 percent, with extensive use of hydrogen, and up to 4.5 percent, using 100 percent natural gas.

The Baosteel Zhanjiang DRI plant is the second Energiron DRI plant in China, following that of HBIS, which started operation in May 2023.



The new DRI plant recently commissioned at Baosteel Zhanjiang Iron & Steel (Photo: Danieli)

| Danieli

ASIA – OMAN

Vulcan Green Steel to build DRI plant

Vulcan Green Steel, a newly established entity of the Jindal Steel Group, is going to build a direct reduction plant in Duqm, in the Al Wusta region of the Sultanate of Oman. The plant will use the Energiron direct reduction process jointly developed by Tenova and Danieli.

The new Energiron direct reduction plant will produce DRI feed for a new electric

steelmaking complex. Being hydrogen-ready, it will start operation with a natural-gas feed and switch to using hydrogen in blends as hydrogen becomes available on site. The single-module, zero-reformer Energiron plant will hot charge the EAF with DRI at temperatures higher than 600 °C, providing energy savings for steelmaking. The plant will also be able to produce HBI for storage or export.

The technology has the capability to capture the CO₂ from the process and utilize it for other applications, further reducing the overall carbon emissions of the plant and providing an additional revenue stream for the plant operations. The DRI plant at Duqm is scheduled for completion by 2026.

| Danieli

ASIA – SOUTH KOREA

SeAH Changwon Special Steel orders electromagnetic stirrer for EAF

SeAH Changwon Special Steel has placed an order with ABB for a second ABB ArcSave® electromagnetic stirrer for an electric arc furnace at its integrated special steel plant in South Korea.

The plant produces 1.2 million t of steel and 1 million t of steel products annually. ABB ArcSave will be installed on an EAF that produces carbon and stainless steel and has a steelmaking capacity of 100 t.

Requiring no physical contact with the bottom of the EAF, ABB ArcSave enhances metallurgical performance during the melting of large scrap items, reducing stratification via forced convection. This improves EAF operation by homogenizing temperature distribution and chemical composition, while speeding up scrap and ferroalloy melting compared with natural convection alone.

The new order follows the installation of an ABB ArcSave electromagnetic stirrer on an SeAH EAF in 2018. By introducing electromagnetic stirring and replacing an existing bottom gas stirring installation, SeAH was able to reduce bottom skull thickness from up to 1,000 mm to less than 200 mm.

| ABB

AUSTRALIA AND NEW ZEALAND

GSWA and MGS launch cooperation on green HBI project in Western Australia

Building upon its plans to set up green steel production in Thailand, Meranti Green Steel (MGS) has announced a cooperation with Green Steel of WA (GSWA) to jointly develop a pelletizing, direct reduction, and green HBI operation in West Australia.

In anticipation of a joint venture, MGS and GSWA are working together on the pre-engineering, site selection, and infrastructure preparation for the production of high-grade iron ore pellets, direct reduction of the pellets, and briquetting of the reduced iron for export including into MGS' new green steel plant in Thailand.

Dr. Sebastian Langendorf, CEO of MGS states, "Leveraging on Western Australia's ideal conditions for green iron making, including the availability of relevant ore, competitive natural gas, world-class renewable energy conditions for the production of green hydrogen, and required infrastructure, GSWA's and our shared goal is to develop a leading green HBI hub for the region. With our presence in Southeast Asia and GSWA's strong green steel and ironmaking capability in Western Australia, both linked by Danieli's green steel and ironmaking technologies, the cooperation between MGS and GSWA is perfectly complementary."

The cooperation with GSWA will support MGS' plans for green steel making in Thailand. Due to favourable iron making conditions in Western Australia, MGS will develop its green steel business in Thailand in two steps, with an EAF and hot strip mill in phase 1, and a direct reduction plant in a later phase 2, once green hydrogen conditions are ready. MGS is also in early discussions with potential partners in Indonesia for the set-up of a green steel business, which will be supported by green HBI from Western Australia in the future.

| Meranti Green Steel

New Zealand Steel orders meltshop equipment

In line with New Zealand's target for net-zero-carbon emissions by 2050, New Zealand Steel, part of BlueScope Group, selected the Danieli-patented Digimelter® to reduce overall carbon emissions at the New Zealand Steel works located at Glenbrook, south of Auckland.

Danieli Digimelter is designed to operate with significant amounts of hot metal, as well as the future utilization of HBI, guaranteeing full flexibility for the use of raw materials and the conditions required for the existing secondary metallurgy stations. The Tornado® endless scrap-charging and preheating system enhances the heat transfer to the scrap, optimizing the off-gas flow to ensure maximum pre-heating efficiency. This is particularly important in case of charge mix strategies with variable percentages of scrap. The Q-Melt® control suite, along with the zero-man-around technology packages, will ensure real-time control of the process param-



Representatives of New Zealand Steel and Danieli shaking hands over the meltshop project (Photo: Danieli)

eters according to real process requirements, with minimal operator intervention. Danieli will also supply a fume-treatment plant that ensures low dust release at the stack, in accordance with European stand-

ards. The new Digimelter is scheduled to be operational by 2026.

| Danieli



With around two thirds of the exhibitors, wire and Tube are among the trade fairs with the highest internationality in Messe Düsseldorf's portfolio (Picture: ct/Messe Düsseldorf)

METAL TRADE FAIR SUMMIT IN GERMANY IN APRIL

wire 2024 and Tube 2024 to set benchmarks

wire and Tube 2024 will once again impressively confirm their position as the leading international trade fairs for the wire, cable, tube and pipe industries and their suppliers. Global players from all over the world will present their range of technologies and services at the metal summit 2024 in Düsseldorf from 15 to 19 April.

Some 2,300 exhibitors on more than 118,000 square metres of net exhibition space – with these numbers wire and Tube 2024 are setting a powerful agenda. Trade visitors from all over the world are expected. With around two thirds of the exhibitors, wire and Tube are among the trade fairs with the highest internationality in Messe Düsseldorf's portfolio. They come mainly from the strong European production countries, from the USA, Central and South America, Asia and the African continent.

"The Düsseldorf trade fair venue is the absolute front-place for the wire and Tube sectors when it comes to presenting innovations from the relevant industries to a broad, international audience," says a delighted Daniel Ryfisch, Director wire/

Tube & Flow Technologies at Messe Düsseldorf.

In addition to the classic themes such as machinery and equipment for wire, cable and tube production, processing and end products, wire and Tube place a strong focus on topics such as stainless steel, hydrogen, plastic tubes, cutting and slitting technologies and e-mobility. In addition, the topics of fastening and joining technologies, spring manufacturing technology and glass fibre technologies continue to move to the fore. The main industries here are the chemical, oil and gas sectors, the automotive industry, the construction sector and the entire telecommunications sector.

wire 2024 occupies exhibition halls 9 to 17: wire, cable, wire products and technol-

ogies are scheduled in halls 9 to 12 and hall 15. Meet China's Expertise can be found in Hall 14. Hall 16 will become a special hall for fastening and fixing technologies and for spring making technology, including their end products such as screws, grooves, eyelets and technical springs. This creates an exclusive, separate technology area here. The large area for heavy, space-consuming mesh welding machines will be located in the central Hall 17.

Tube 2024 occupies exhibition halls 1 to 7a: tube accessories, tube manufacturing and the tube trade are located in halls 1, 3, 4, 5, 6 and 7a. A new feature is the special area for plastic tubes in Hall 1, which provides the space for plastic tubes that they currently occupy with increasing

tendency in the manufacturing and processing industries.

Forming and bending technology is to be found in Halls 5 and 6, and pipe processing technology in Halls 6 and 7a. Machinery and equipment will follow in Hall 7a. Hall 7 is once again reserved for Chinese pipe producers and pipe processors with Meet China's expertise.

Exciting line-up of side events

The innovations showcased by the industry players in the exhibition halls will be accompanied by an extensive programme of supporting events tuned to the market – and what's more – on all five trade fair days.

Premiere for the wire & Tube BME Einkäufertag / Buyers' Day on the Forum stage of Hall 1 A47 on Monday, 15 April. Everything revolving around Due Diligence Supply Chain Acts, sourcing and logistics, transparently compiled and presented by the Federal Association of Materials Management, Purchasing and Logistics (Bundesverband Materialwirtschaft, Einkauf und Logistik).

On Tuesday, the wire & Tube Convention 2024 will follow with entirely different exhibitor insights for the Green Steel theme and its implementation in their own manufacturing halls. The organiser is the "Agentur Stahl-Kommunikation".

From Monday, the SawExpo Forum will present news and trends from the multifaceted field of sawing and milling technologies in daily snapshots in Hall 6 G07. SawExpo GmbH is the organiser.

In the Special Area Plastic Tubes & Pipes (Hall 1 C35) exhibitors will be showcasing the complete supply chain for plastic tubes and pipes and provide impressive demonstrations of possible processing and finishing methods for plastic tubes and pipes.

At the BDS Forum (Hall 1 A47) the Federal Association of the German Steel Trade (Bundesverband Deutscher Stahlhandel) will provide information on global trends in the steel trade. Here, experts will analyse the impact of current economic policy trends in the steel trade. Steel traders will also discuss sourcing and sales markets, economic framework conditions and the mega themes digitalisation and AI.

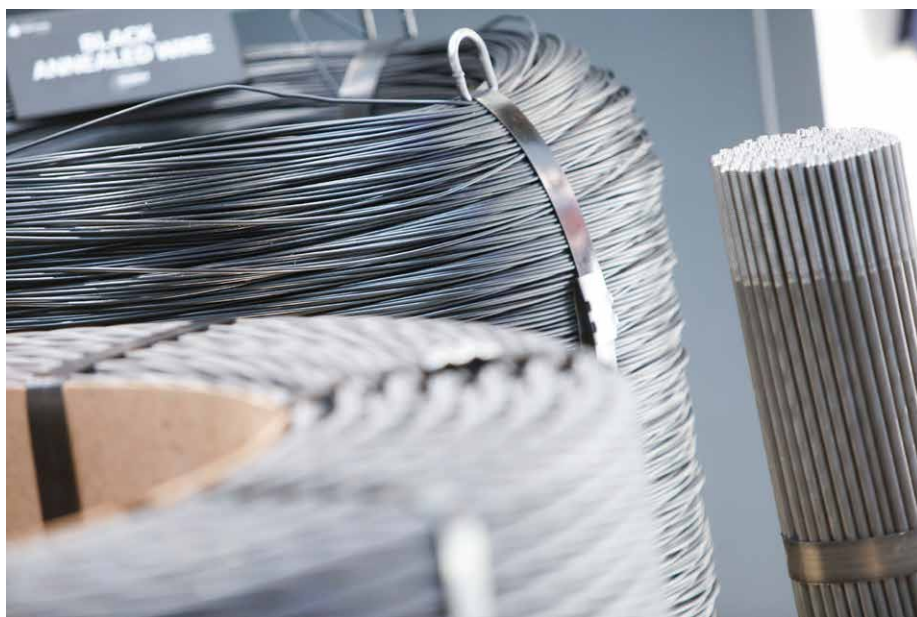
The ITA Forum (also on the Forum stage in Hall 1 A47) will address the global economic challenges for the industry in

lectures and will project concrete impact scenarios for the tube and pipe industry.

The last two trade fair days will be all about the so-called High Potentials – i.e. promising skilled workers and young talents. Be they trainees, students or potential career changers – they will all have the opportunity in Hall 6 G07 to learn about vocational training and career opportunities in the versatile field of cutting technologies in numerous talks and information slots. Organised by SawExpo GmbH.

Also new are the daily digital ecoMetal and high potential Trails, allowing visitors to put together their personal itineraries online or by QR code to meet exhibitors from the fields of ecoMetals (producing sustainably and in a resource/environment saving way) and High Potentials (introducing themselves as attractive trainers/employers).

■ Messe Düsseldorf



Machinery and equipment for bar, wire, rope and cable production, processing and finished products will be on display in halls 9 to 17 (Picture: ct/Messe Düsseldorf)



Tube 2024 will occupy halls 1 to 7a and will showcase tube and pipe accessories, tube and pipe manufacturing and the tube and pipe trade (Picture: ct/Messe Düsseldorf)

PIPE INDUSTRY IN DEMAND

On a hydrogen course with pipelines

Politicians and the economy are longing for increased hydrogen use and have long since embarked on a search for solutions. Not only must the production and storage of hydrogen be ensured, but also its transport must be regulated so that the hydrogen reaches the point of use from the place of production. However, there is a high investment requirement for hydrogen storage and transport routes.



VNG is researching how climate-neutral hydrogen can be produced, transported, stored, and marketed on an industrial scale in the future (Picture: VNG AG)

Europe plans to be carbon neutral by 2050. Hydrogen will be co-decisive in achieving climate neutrality – in several respects. As a storage medium, it can be used to compensate for the fluctuations between energy production and consumption that occur when renewable energies are used. In addition, the use of green hydrogen makes the industry – such as in steel production – CO₂-neutral. An infrastructure consisting of pipelines and plant technology is necessary.

Safe hydrogen transport will play a central role in a renewable energy mix – and the pipe industry is already H₂-ready. Mannesmann supplies steel pipes that are designed for transport and storage. For H₂ forwarding – for example in pipelines – the

inner surface is manufactured free of surface deposits. Internal attack points for hydrogen are kept to a minimum by falling

below the phosphorus and sulphur content – compared to the EIGA Directive. “A further lowered carbon equivalent ensures excellent weldability of our pipe material,” Mannesmann stresses. This ensures long service life.

Pipe industry ready for hydrogen

Together with partners from the steel distribution sector, Benteler Steel/Tube supplies the Benteler Hyresist product family, which includes seamless, hot-rolled pipes and meets the requirements of the European Industrial Gases Association (EIGA) for pipes for distribution networks. The criteria are: hydrogen-compliant steel analysis, pressure resistance and homogeneous structure. With an outer diameter of 21.3 to 141.3 mm, the dimension range of the Benteler pipe solution corresponds to the current specifications for hydrogen pipes. “In addition, optimised mechanical values and the high purity of the steel materials used, prevent hydrogen embrittlement,” the company explains.

Butting is also ready for the H₂ pipe market. According to the company, vacuum-insulated transfer lines could save time and resources compared to conventionally foam-insulated pipes. The cost-eff-



Innovations in these fields will be presented at Tube Düsseldorf from 15 – 19 April 2024 at Düsseldorf Fairgrounds.



efficient transfer of liquid natural gas and liquid hydrogen requires pipeline systems in much larger dimensions than other cryogenic liquids. Thus, smaller pipe diameters can be selected, whereby the material expenditure is reduced. In addition to standard lines, the company's expertise includes transfer systems for trailers (helium and hydrogen), hydrogen systems for the automotive industry and refuelling systems for the aerospace industry (hydrogen and oxygen).

Major projects in Germany

It is important to act with foresight. Thus, in Wolfsburg, two state-of-the-art gas-fired power plants will secure the energy supply of the VW plant and the city of Wolfsburg. "Mannesmann H2ready® pipes from Mannesmann Line Pipe have already been used in the construction of the supply line so that they can also be operated with hydrogen in the future," explains Mannesmann. The nearly 1,900 tubes have individual lengths of up to 18 metres in L360NE quality and, in the main, a diameter of 406.4 mm. The route runs parallel to an already existing line and has been laid over a length of nine kilometres without a trench and thus particularly gently. For this purpose, the pipes were additionally wrapped with GRP (glass-reinforced plastic).

For the connection of the LNG gas terminal from Brunsbüttel to Hetlingen, Mannesmann Grossrohr GmbH (MGR), a subsidiary of Salzgitter AG, supplies pipes with a diameter of DN 800 for a total length of about 54 kilometres on behalf of Gasunie Deutschland. The approximately 3,200 pipes are specified "so that hydrogen can also be transported through the line in the future," explains MGR. It is scheduled to come into operation by the end of 2023.

A currently eye-catching construction project is the connection of the LNG terminal Wilhelmshaven with H₂-ready steel pipes from Mannesmann Line Pipe on behalf of the energy grid operator EWE Netz. With around 16,000 tons of H₂-ready pipes, Mannesmann is contributing to the expansion of the LNG infrastructure in Northwest Germany. In total, the company supplies about 4,100 pipes in the dimension range DN 600 in lengths of 18 to 12 meters. The commissioning of the line is to take place at the end of 2023.

More climate-friendly steel production

For the production of pipes for hydrogen transport, H₂-optimized steels are required for safe and durable pipeline transport systems, which thyssenkrupp also supplies. In addition to the low-alloy steel grades X42 and X52, which are suitable for the transport of gaseous hydrogen and hydrogen mixtures, the Group has optimised material concepts for the strength range up to X70. "These steels are optimised with regard to the expected standard requirements of longitudinal and spiral seam tubes for hydrogen transport, in particular for the limited contents of carbon, phosphorus and sulphur," explains thyssenkrupp.

The production of steel – with the help of hydrogen – should also become more climate-friendly. thyssenkrupp Steel is therefore investing in the decarbonisation of its steel production, which in turn improves the ecological balance of steel pipes. The Group therefore commissioned SMS with the engineering, supply and construction of a hydrogen-powered direct reduction plant, two smelters and associated ancillary units at the Duisburg site. It is one of the world's largest industrial decarbonisation projects with an order volume of more than 1.8 billion euros for SMS alone, with commissioning scheduled for the end of 2026.

Building the H₂ infrastructure

With SALCOS® (Salzgitter Low CO₂ Steel-making), Salzgitter, together with partners from business and research, is striving to lay the foundations for steel production that is almost CO₂-free. Central elements of the program are electricity from renewable sources and its use in the production of hydrogen by electrolysis. "This green hydrogen will replace the coal we are currently using in the conventional blast furnace process," the Group explains. This is made possible by means of so-called direct reduction plants, in which iron ore is reduced to iron in the solid state directly by hydrogen. With this technology, instead of CO₂, water vapour is emitted.

There is a lot to do: For example, Germany is not sufficiently prepared for the ramp-up of the hydrogen economy. This is the result of the H₂ balance sheet, an analysis by the energy group E.ON, which is based on data from the Institute of Energy Economics at the University of Cologne. "Looking ahead to 2030, it turns out that neither the domestic generation capacity of green hydrogen is sufficient nor can German import needs be met." There is also a lack of infrastructure – still. Now the pipe industry is also required here. It is ready for implementation.

■ Messe Düsseldorf

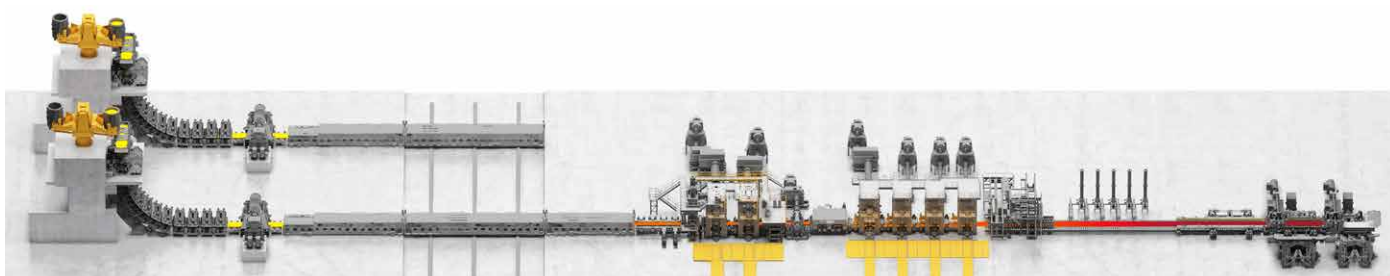


From left: Gilles Le Van, Vice President Larges Industries and Energy Transition at Air Liquide Central Europe, NRW Minister Mona Neubaur and Bernhard Osburg, CEO of thyssenkrupp Steel, inaugurate the first hydrogen pipeline to supply the Duisburg iron and steel works (Picture: thyssenkrupp Steel Europe AG)

VERTICALLY INTEGRATED VALUE CHAIN – FROM MINERAL TO COIL

New NMDC greenfield steel plant commissioned in India

NMDC Steel Ltd. has chosen thin slab technology to enter the steelmaking business. The new hot strip mill is part of NMDC’s new integrated steel complex at Nagarnar in Chhattisgarh, India, and is designed to produce 2.9 million tonnes of hot-rolled coils per year.



It is the first plant in India featuring vertical-curved casters and hot-strip mill with separation between roughing and finishing
(Picture: Danieli)

NMDC Steel Limited is a public sector company under the administrative control of the Ministry of Steel, Government of India. The company owns and operates the new integrated iron and steel complex now in operation at Nagarnar, Chhattisgarh. This project was developed by the state-owned National Mineral Development Corporation (NMDC) – traditionally a mining company – with the

objective of expanding its downstream operations into the steel value chain.

The steel plant is expected to make its mark in the flat products market. The competitive advantage of this new greenfield site also lies in the iron ore supply link with the Bailadila mines, barely 100 km from Nagarnar. With the implementation of reliable and efficient technology, and the creation of 10,000 direct jobs as well as

20,000 indirect jobs, the NMDC steel plant brings sustainable economic development to the region.

Hot metal production begins first

In August 2023, the 4,506 m³ working volume blast furnace #1 at the Nagarnar was put into operation by joint Danieli Corus and NMDC teams with the first hot metal



Good coils right after the first slab on August 24, 2023 (Picture: Danieli)



Rolling mill in 2 + 4 stand configuration with the option for possible installation of a fifth finishing stand (Picture: Danieli)

being tapped within 48 hours of the blow-in. The successful commissioning of one of the largest blast furnaces in India represents a crucial step for this entirely new plant.

Danieli Corus was contracted for the blast furnace complex, for which Danieli

Corus proprietary technologies were applied, such as the “indestructible” plate-cooled lining technology, hot-blast stoves with the acclaimed long-life design allowing for refractory expansion allowance, and a tangential single-inlet gas cleaning cyclone.

Upon commissioning, the new blast furnace received its name “Maa Danteshwari” – after the most revered goddess of the Bastar area. The furnace was designed for a daily production of 9,500 tons of hot-metal at a pulverized coal injection rate of 150 kg/t_{HM}, with a design provision for 200 kg/t_{HM}.

Nagarnar integrated flat steel complex

As a forward integration and business diversification plan, the 3 million t/year integrated steel plant at Nagarnar has been designed for and is now operating on the BF - BOF route. The major technological facilities of the Nagarnar Steel Plant include:

- › two 7 m tall coke ovens.
- › one of the largest blast furnaces in India with a capacity 4,506 m³ (Useful Volume),
- › a basic oxygen furnace (BOF), and
- › a hot strip mill coupled with thin slab caster (TSC),

It provides in house generation of 80 MW power using off gas and waste heat. The power blowing station is based on 100% CO gas, with zero use of fossil fuel.

With energy efficient cutting-edge technology, the energy consumption of this steel plant is estimated to be 5.9G Cal/t. The integrated steel plant will be operating with a zero liquid discharge, ensuring that effluent water is treated and reused. The latest wagon tipping arrangement, which is capable of handling DFC wagons in future, is being installed. The coke plant houses eco-friendly coke-oven batteries and recovery type CDCP. It also has the single largest coke-oven gas handling by product plant producing tar, naphthalene, and elementary sulphur.

■ *NMDC Steel Ltd.*

Perfect start of the hot strip mill

NMDC Steel Ltd. relied on Danieli and its QSP technology to enter the HRC production business. The Danieli QSP plant has been designed to produce 2.9 million t/year of hot-rolled coils, in strip thicknesses ranging from 1.0 mm to 16 mm, widths from 900 to 1,650 mm, in coils weighing up to 35 tons.

This project consisted of a complete turnkey package led by Danieli, which supplied equipment as following:

- › two thin-slab casters,
- › a tunnel furnace,
- › a complete rolling mill in 2R + 4R (5F) stand configuration,
- › two down coilers,
- › coil handling system with automatic pallet conveyor,
- › off-line sample collecting and inspection systems,
- › automation process controls and power distribution,
- › metallurgy laboratory,
- › segment and roll grinding workshops,
- › water treatment plant and
- › the balance of the plant.

The thin-slab casters feature the renown Danieli vertical-curved design with a 5-m radius and a metallurgical length of 14 metres, having an hourly average capacity in excess of 205 tons per strand. The QSP plant is operated using Danieli Automation L1 equipment and L2 process control. Plant automation includes patented liquid core technology with dynamic soft reduction for the highest productivity and best surface and internal quality of the slabs.

The rolling mill makes use of a fine-shape control system with hydraulic automatic gauge control (HAGC), heavy work roll bending, the Danieli-patented optimized shaped roll (OSR), and intensive cooling for thermomechanical rolling. The finishing mill was designed for possible installation of an additional (fifth) stand.

The QSP plant had an impressive start-up being able to produce good coils right after the first slab, as soon as the liquid steel was made available, on August 24, 2023. The thin-slab casting line #1 was commissioned reaching 19 heats (66% of production) in 24 hours on October 17, and the same target was reached for casting line #2 on November 18. In December, the achievements were confirmed during 72



More than 10,000 hot rolled coils have been produced during the first four months
(Picture: Danieli)

hours of continuous operation for each line.

More than 10,000 hot rolled coils have been produced during the first four months, and commissioning is continuing with the plant operating on three shifts. Hot-rolled coil consumers from leading industries have shown interest and appreciation in the quality produced on this QSP mill.

Products and key markets

The product mix of Nagarnar Steel Plant consists of low-carbon steel, HSLA and dual phase steel and API quality steel that can be rolled in to thickness range from 1 mm to 16 mm. With its capability to produce 1,650 mm wide hot strip, the thin slab caster at Nagarnar Steel Plant is the widest HRC technology in the public sector of India. Hot rolled coils, sheets

and plates coming off one of India's latest and most modern mill are expected to meet the growing demand for quality HRC required in the manufacture of LPG cylinders, bridges, steel structures, ships, large diameter pipes, storage tanks, boilers, railway wagons and pressure vessels and in construction of tanks, railway cars, bicycle frames, engineering and military equipment and automobile and truck wheels, frames and body parts. The plant will also be producing special type of steels to be used in manufacture of generators, motors, transformers and automobiles at a later stage.

■ NMDC Steel Ltd./Danieli/Danieli Corus



Slag pot carrier operated by Harsco at a steelmaker in Brescia, Italy (Picture: TII Group)

SLAG MANAGEMENT

Remote diagnosis for the slag pot carrier

Harsco Environmental has added another vehicle to its fleet of KAMAG SPC slag pot carriers at its Brescia facility. Once again, Harsco Environmental has decided in favour of a special vehicle from TII KAMAG primarily because of the positive experience gained through the use of existing vehicles as well as the option of remote diagnosis and maintenance.

Since 2013, Harsco Environmental, a specialist in waste disposal services in steel mills, has been using a KAMAG SPC (Slag Pot Carrier) at a steel manufacturer's plant in Brescia, Italy, to transport molten slag from the furnace to the tipping pits. A demanding task under extreme conditions such as heat and sharp-edged, dusty and heavy transport materials that require particularly robust and powerful vehicles. The experience at the Brescia site and other Harsco Environmental operational facilities in Europe have shown that the KAMAG SPC comfortably meets the requirements. The environmental service provider is also impressed by the quality of the KAMAG scrap basket transporters which the company also uses in Brescia.

Remote diagnosis and maintenance reduce downtimes

For this reason, Harsco Environmental has now acquired a fourth slag pot carrier from TII KAMAG through the company's Italian dealer, Fratelli Ursini. "We appreciate the ease of handling and reliability of the KAMAG transporters," explained Stefano Balducci, Asset and Maintenance Manager at Harsco Environmental.

Remote maintenance has been a requirement that we made clear from the start.

Stefano Balducci, Asset and Maintenance Manager at Harsco Environmental

"One thing more in the favour of TII KAMAG is that the manufacturer has always adapted its transport solutions to fully comply with our special requirements at the Brescia location," said Stefano Balducci. Another plus point for TII KAMAG is the option of remote maintenance. "This is a requirement that we made clear from the start. "Remote diagnosis guarantees our service technicians of receiving a precise error analysis when required and, in connection with remote maintenance, ensures the shortest possible downtimes," according to Daniele Rizi, workshop manager at Harsco Environmental.

Full-range of transport solution

TII KAMAG provides solutions for all transport tasks in the metals industry. The indus-

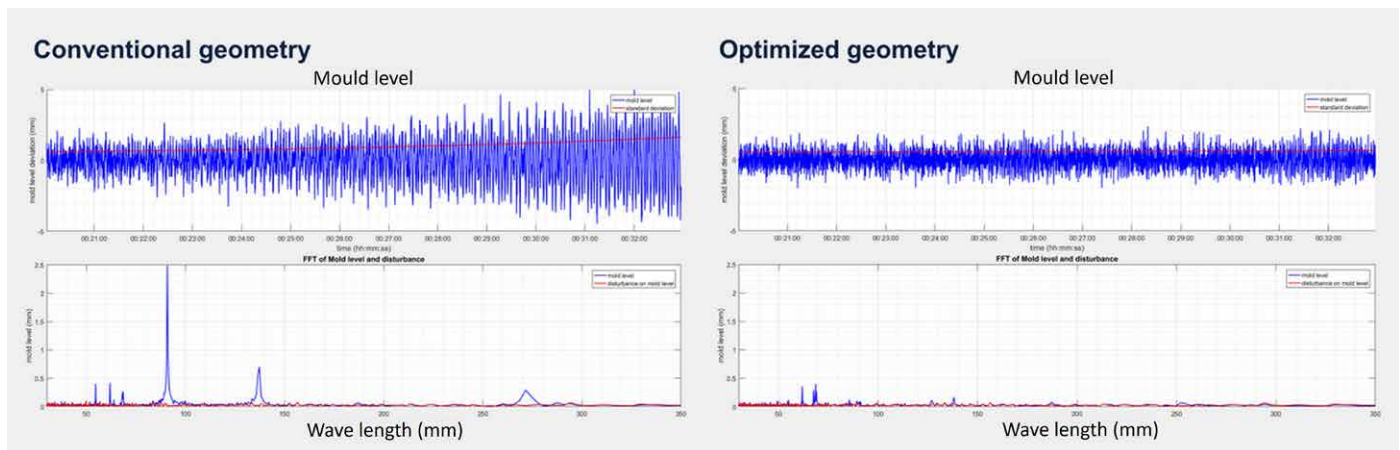
try expert for in-plant transportation assignments, a subsidiary of the TII Group, offers transport solutions for scrap management as well as for molten steel, slag and semi-finished product transports. The range of slag pot carriers includes vehicles in platform and U-frame designed constructions. TII KAMAG produces the platform slag pot carrier with two or three axles and provides payloads of 40 to 120 tonnes. The range of vehicles for the metallurgy sector also includes ladle and slab carriers, industrial lift transporters and scrap basket transporters as well as set-down skip loaders, articulated vehicles and coil transporters.

■ TII – Transporter Industry International

CONTINUOUS CASTING

An advanced solution for continuous casting at higher speeds

The latest development in mould level control technology enables higher casting speeds and higher productivity, while producing consistently high quality slabs



This graph visualizes the great discrepancy in stability between non-optimized and optimized casters, as it shows mould level deviation in a continuous caster before optimization (left side) and after optimization (right side). The discrepancies are shown in the upper graph on both sides of the standard deviation curve indicated in red (Picture: Primetals Technologies)

For decades, Primetals Technologies has been refining the roll geometry of the continuous casting machines it supplies to achieve an increasingly stable mould level during the casting process. The latest development is a ground-breaking model for determining the ideal casting roll geometry at the design stage. This solution allows for a preview of how the caster will perform during operation, as it simulates both the unsteady bulging effect and mould level fluctuations caused by the phenomenon of bulging. The model enables steel producers to implement new or revamped casters that are designed to minimize mould level fluctuations during production. Therefore, they will be able to cast at higher speeds while producing slabs of high metallurgical quality.

A stable process during continuous casting is essential to produce high-quality products. Bulging is common and occurs as liquid steel at the core of the hot strand pushes against the shell of the slab as the strand moves between two rolls. During this process, heavy fluctuations in the

mould level can build up, which might cause surface defects, or, in a worst-case scenario, a breakout, in which liquid steel pours out of the shell. Intensified bulging often results in operators having to reduce the casting speed.

Unsteady bulging reduced

Unsteady bulging is a complex problem involving, among other factors, mould level deviations, solidification in the mould, and shell growth in the secondary cooling zone. The newly developed model is designed to consider all these parameters. Utilizing Fourier transform, an advanced mathematical method, Primetals Technologies' innovative software tool is capable of including a wide spectrum of parameters such as targeted steel grade, section size, and casting speed in its calculations. In this way, it identifies just the right frequency spectrum needed to set the optimal roll geometry.

Thanks to these simulations, it is possible to optimize the distance and diameter of

the rolls before installing the equipment. Roll pitches are one of the main factors causing unsteady bulging, and by optimizing roll geometry, unsteady bulging is reduced by about 50 percent. Over the last months, this remarkable achievement was accomplished repeatedly at several steel plants where this solution is already implemented.

There are more benefits to be had with the new software model. Minimizing the occurrence of unstable bulging increases the caster's range to include peritectic and ferritic steel grades, as no reduction in casting speed is necessary. Moreover, smoother strand shells and increased slab-surface quality are ensured.

The optimization of the rolls can be executed also for existing casters implemented by other plant builders. Primetals Technologies has developed a solution to optimize the continuous casting process by adjusting the distance and diameter of the rolls already before implementing the machine.

Primetals Technologies

SMART COMMUNICATION

Reliable rugged tablets to optimise productivity

Getac F110 and A140 total solutions support ArcelorMittal France in its digitalisation processes as well as its ongoing commitment to improve working conditions

ArcelorMittal France continues to place its trust in Getac's total rugged computing solutions. To carry out its maintenance and production operations, the Dunkirk site in France uses a combination of Getac rugged tablets, docking stations and vehicle power adapters, as well as remote antennas attached directly to the machines. The fully rugged F110 and A140 tablets are reliable and perfectly suited to use in materials handling equipment that is subject to strong vibrations, heat or dust, as well as intensive use of the screen.

As the world's leading steel and mining company, ArcelorMittal aims to produce

ever smarter steels that have a positive effect on people and the planet. Steels made using innovative processes that consume less energy emit much less carbon and reduce costs, resulting in cleaner, stronger and reusable steels. The company also produces steels for electric vehicles and renewable energy infrastructures that will support societies in their transformation over the coming decades.

By equipping itself with these tablets for the past three years, ArcelorMittal France has benefitted from IT solutions and accessories such as docking stations, chargers and remote antennas, as well as Getac's Bumper-to-Bumper warranty,

including accidental damage as standard. The total solution also includes technical service project monitoring to adapt the solutions to changing needs.

Indeed, the fully rugged Getac F110 tablet enables ArcelorMittal users to work effectively in a difficult operating environment, thanks to its data storage capacity, autonomy and fast connectivity for transferring data quickly and efficiently.

In addition, the Getac A140 fully rugged tablet boasts a 14-inch screen, giving ArcelorMittal France's workers the ability to access large amounts of information simultaneously, while its dual removable and hot-swappable battery design further boosts productivity. "The Getac tablets have considerably improved the availability of our slab handling application and equipment. In fact, they have eliminated equipment-related network loss problems, as they can connect to the 4G/5G network," explains Sébastien Denisselle, Decarbo Digital Project Manager, ArcelorMittal France Dunkerque.

This robust connectivity ensures that the operations are not disrupted by communication problems, which is essential in this operating environment. Furthermore, the tablets offer a user-friendly, intuitive interface that makes it easy to view and use the various applications, considerably improving the efficiency of teams in the field. This ease of use also enables operators to adopt the technology quickly.

"We're very proud to support a major group like ArcelorMittal in its digital transformation and its drive to improve working conditions by equipping its teams with high-performance, mobile Getac rugged solutions," says Jimmy Lin, Getac Technology France Director.

The Getac rugged solutions selected by ArcelorMittal offer a number of advantages:



The Getac tablets have considerably improved the availability of the slab handling application and equipment at ArcelorMittal Dunkerque (Picture: Getac)

- › Improved connectivity and continuous availability thanks to 4G/5G, two essential elements for carrying out industrial operations without interruption.
- › The 14-inch A140 rugged tablets, offering an interface that makes viewing documents easier.
- › The F110 and A140 tablets also offer flexibility of use and deployment for optimised operations.
- › Getac's Bumper-to-Bumper warranty, including accidental damage as standard.

"The flexibility of Getac tablets is a major advantage in busy operational environments. The ability to interchange tablets between different machines while remaining operational is a precious asset. This

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The Getac tablets have eliminated equipment-related network loss problems, as they can connect to the 4G/5G network.

Sébastien Denisselle, Decarbo Digital Project Manager, ArcelorMittal France Dunkerque.

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enables us to react quickly to changing needs in the field and optimise the use of our resources. Getac tablets play a key role in improving our productivity, efficiency, and ability to maintain high-perfor-

mance operations, even in the most demanding situations," adds Sébastien Denisselle from ArcelorMittal France.

■ *Getac Technology Corporation*

New chock-changing device for the blooming mill



This new device makes the assembly and disassembly of work roll arrangement safer, faster and more precise (Picture: Danieli)

A tailor-made solution for improved safety operations and lower OpEx

The revamping team from Danieli Service designed and supplied a new chock-changing device for blooming mill 800 of Acciaierie Bertoli Safau (ABS), which was installed in its roll shop in Cagnacco, Italy.

The target of the project was to satisfy the ABS requests in terms of improved maintenance safety operations, and reduced damages to the rolls, chocks and

bearings. Cranes are no longer needed for chock-roll changes once the rolls are put on the new changing device. Furthermore, the investment allowed for faster mounting and dismantling operations, reducing maintenance costs.

The scope of supply included the mechanical, hydraulic and electrical equipment, installation advisory services, and personnel certification training.

This new device makes the assembly and disassembly of work roll arrangement

safer, faster and more precise. All machine movements are hydraulically actuated by manual levers mounted on a dedicated valve bench located in front of the machine.

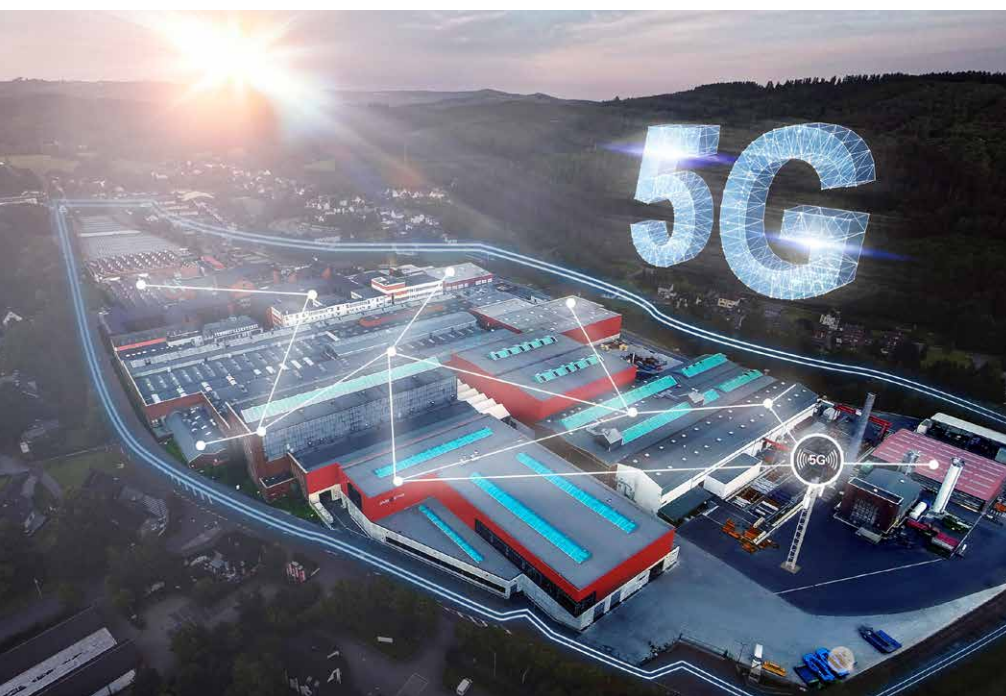
Thanks to sliding plates and covers the personnel can walk all around the rig and carry out the maintenance operations safely.

■ *Danieli Service*

DIGITALIZATION

Highest mobile communications standard for real-time networking

SMS group is building a private 5G network for researching real-time applications for the metallurgical industry. With a data rate of ten gigabits per second, real-time applications of large-scale plants can be used more securely and more flexibly in production while cutting emissions at the same time.



SMS group is using a “private 5G network” for research and development

(Picture: SMS group)

SMS is building its own “private 5G Campus network” for research and development at its Hilchenbach workshops in Germany. Together with Mugler and Ericsson, a private 5G infrastructure was set up here that enables not only the testing of the highest mobile communications standard currently available, but also the advancement of new developments for the metallurgical industry. The industry is facing immense challenges when it comes to the development of new materials and the reduction of energy consumption and emissions. To achieve these far-reaching goals, a high degree of automation, digitalization in a real-time network environment is required.

The use of a private 5G network offers a whole array of approaches to solutions,

which SMS is now testing for the first time on an industrial scale and developing for customers in the metallurgical industry around the world.

A “private 5G network” means creating your own network infrastructure based on a frequency and coverage area licensed for the customer that enables the worldwide provision and processing of data in real time.

The private 5G standalone Campus network used at SMS provides the basis for an initial test environment for the implementation of various 5G use cases. The network based on Ericsson Private 5G Technology (EP5G) was implemented by Mugler. Thanks to the efficient collaboration of all project partners, the system went live just four weeks after the project was launched.

Tests are carried out on applications from the fields of mobility and automated guided vehicles (AGV), the Industrial Internet of Things (IIoT), and lone worker applications. These are integrated and comprehensively tested at SMS’s Hilchenbach site, with the aim of optimizing their practical implementation. Moreover, the new private 5G network location serves as a platform for putting into practice the findings gained within the framework of the 5G-Furios research projects being run and funded by the state of North Rhine-Westphalia, the European Union’s Horizon 2020 project Zero-SWARM, and the CLOUD56 research project of the Federal Ministry for Digital and Transport (BMDV). The SMS test environment offers a unique opportunity to test use cases internally and to present them to potential customers in a clear and illustrative way. The 5G Campus network represents an important step in the evaluation of advanced digitalization technologies and their applications in the steel industry.

“This partnership gives us the opportunity to take huge strides in digitalizing the industry and developing new solutions by utilizing SMS group’s footprint in the steel industry and the 5G technology from Ericsson,” emphasizes Stefan Richter, Head of Local Networks - Campus Networks at Mugler SE. “We serve the market with a sensor solution for production companies that is scalable and easy to integrate. Thanks to the 5G connectivity, it enables the transmission and processing of data to gain insights into the process that were jointly developed and tested at SMS group in Hilchenbach. SMS group is closing the gap between physics, sensor technology, OT, and IT,” says Jens Petri, Head of Technologies and Partnerships at SMS digital.

■ SMS group

STRIP PROCESSING

CO₂-neutral heat treatment of precision strip in a bell-type annealing plant

As a contribution to decarbonize the steel value chain, steel strip was fossil-free heat-treated in an industrial bell-type annealing plant at German steel strip manufacturer thyssenkrupp for the first time in the world. In future, up to 2,600 kg of CO₂ could be saved per annealing cycle by using regenerative produced hydrogen, while maintaining productivity and product properties.



Ultra-low NO_x HPH® Flameless heating hood of the bell-type annealing plant at thyssenkrupp Hohenlimburg (Picture: LOI Thermprocess)

Tenova LOI Thermprocess, part of Tenova and one of the leading companies supplying industrial furnace systems for the heat treatment of metals, has once again proven that CO₂-neutral heat treatment can go together with low-nitrogen oxide (NO_x) emissions in a cooperation project with thyssenkrupp Hohenlimburg GmbH. In bell-type annealing plants, which have so far been mainly operated with natural gas, precipitation and spheroidizing annealing of steel coils is carried

out to specifically adjust the mechanical properties for subsequent rolling processes or the required product properties at the end customer.

At thyssenkrupp's Hagen-Hohenlimburg site in Germany, the latest generation heating hoods with LOI's patented ultra-low NO_x HPH®-flameless concept has been proving its worth for around 12 years. By significantly increasing air preheating temperatures to 600°C, this innovative technology has led to energy savings and therefore CO₂ reduction of up to 12%.

In a campaign involving several annealing cycles, a further step has been taken towards decarbonizing steel production as part of the joint project. In production trials, the fuel gas supply for the heat treatment of hot-rolled narrow strip was gradually converted from natural gas to up to 100% hydrogen. For the first time in the world, 70 t of steel strip were heat-treated in a bell-type annealing plant with Tenova LOI's HPH®-flameless technology in a locally CO₂-neutral process. The flameless concept demonstrates its advantages impressively here because despite the higher combustion temperature compared to natural gas and thus a tendency towards higher nitrogen oxide emissions, it results in remarkably low NO_x emissions.

For the flexible delivery of natural gas/H₂ mixtures, a specially developed mobile natural gas/hydrogen mixing station was used during the annealing process to assess the influence of increased hydrogen admixtures on the overall system. The increased hydrogen requirements for the annealing cycles due to the approximately one-third lower calorific value were supplied by a special trailer and fed directly into the pipework systems of the bell-type annealing plant.

It has been proven that the particularly efficient ultra-low NO_x HPH®-flameless bell-type annealing plant from LOI Thermprocess is ideally suited for use with hydrogen. Up to 2,600 kg of CO₂ can be saved per annealing cycle by using regenerative produced hydrogen, while maintaining productivity and product properties.

"The project is part of thyssenkrupp Steel Europe's long-term decarbonisation strategy and includes the goal of achieving climate neutrality in all downstream production processes by 2045 at the latest, in addition to iron and steel production," says Jan Bernhofen, Team Coordinator Processing at thyssenkrupp Hohenlimburg GmbH.

"The combustion of hydrogen is technically more complex than the direct use of electricity or the combustion of natural gas. This project has provided us with further insights into the decarbonization of the bell-type annealing process and is helping us on our joint path towards the transformation to climate-neutral steel production. Tenova LOI Thermprocess supplies the suitable technologies for a wide variety of plant types," says Dr Gökhan Gula, Project Manager and Process Engineer at Tenova LOI Thermprocess.

| LOI Thermprocess – a Tenova company

CONTINUOUS GALVANIZING LINES

Successful optimization and control of the thermal performance at NLMK Strasbourg

Steelmakers often opt for advanced modeling to enhance quality and productivity, as well as to prevent human errors since process management is becoming more demanding.



A gloss meter was introduced at the furnace's entrance to measure strip brightness (Picture: Fives)



Together the teams of NLMK Strasbourg and Fives achieved the impossible (Picture: Fives)

NLMK Strasbourg in France, a steel-maker of galvanized and pre-painted steel for the automotive and construction sectors, was looking for a solution to improve coil quality produced by its existing galvanizing line of 400,000 tonnes per year capacity. The line featured a horizontal, short but very powerful furnace that generated rapid temperature increases over short distances, unlike modern lines that are longer with gradual temperature rises. Temperature variations were the primary source of these problems, leading to rejects and financial losses. Conventional control methods proved inadequate due to latencies, downtime, and non-linear process effects.

International engineering group Fives introduced a predictive furnace control solution -Virtuo™-L to NLMK's team to overcome

quality issues. "The heart of the challenge laid in anticipating the furnace's behaviour. If we could predict the furnace's response to temperature variations, informed decisions could be made to maintain product quality," explains Antoine Bonnemaïson, Head of Transformation at NLMK Strasbourg.

This challenge required significant adjustments to ensure Virtuo™-L could adapt to the unique configuration. The deployment of Virtuo™-L began with simple modelling based on physical equations and complex parameters to adjust to the atypical furnace. Later, it transformed into a hybrid model, combining recorded data with automatic coefficient calculations. This transformation allowed the furnace to compensate for physical phenomena not captured by the initial model. Operators were educated about the

changes introduced by the model, particularly with regard to furnace power and line speed. Understanding the process managed by a digital solution was an important step forward in their daily operational life.

Achieving the impossible

Implementing the Virtuo™-L solution had a substantial impact on the project. A key innovation in the project was resolving a problem that was linked to the quality of incoming steel coils and marked by high variability due to the strip's surface condition. A gloss meter was introduced at the furnace's entrance to measure strip brightness, thus enabling anticipation of behaviour variations and furnace readjustments.

"This project represents a significant success with great potential. The highly customized solution resulted in continuous improvement of product quality, reduction of downgraded coils, and simplification of the operators' work. We have a unique solution that pays back its investment," adds Antoine Bonnemaïson.

We have a unique solution that pays back its investment.

Antoine Bonnemaïson, Head of Transformation at NLMK Strasbourg

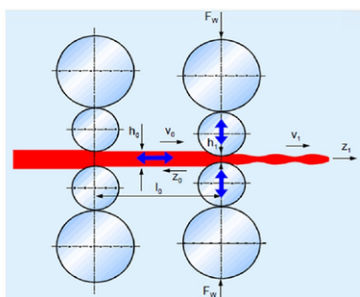
| Fives

COLD ROLLING

Active chatter damping long-term experience

Chatter management can be understood as a basic concept to operate a rolling mill at low chatter levels in order to achieve maximum speeds and production. Important tools, which are necessary to reach this aim, are a chatter monitoring system and an active chatter damping system. An overview from the general idea of active chatter damping up to operational and long-term results of the pilot installation is given. Especially by the demonstrated operational results, the great potential of active chatter damping for cold rolling mills is shown.

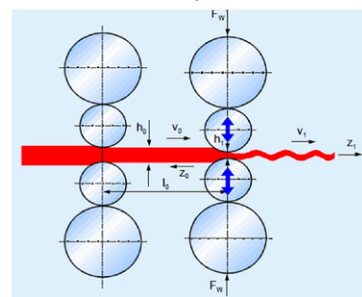
3rd Octave Chatter (100 Hz – 200 Hz)



Characteristics

- › Process instability mainly in the last or second last stand
- › Self excited vibration
- › Vertical antiphase vibration of the upper and lower roll set, entry strip tension vibration

5th Octave Chatter (440 Hz – 1000 Hz)



Characteristics

- › Weakly damped vibration (bending) modes of the roll set
- › External excitation
- › Oscillations of the mill stand and roll set

Figure 1. Schematic overview of the chatter mode with process (tension) and product (thickness) variations (Picture: SMS group)

Even nowadays, the production and product quality of cold-rolled strip is strongly affected by 3rd octave and 5th octave chatter. Both chatter categories interfere quality parameters, like thickness, shape or surface quality. As they tend to occur at higher speeds, the rolling speed of the mill has to be limited. Since the 3rd octave and the 5th octave chatter are the chatter issues, which affect quality and production most of all during cold rolling, this paper primarily focuses on SMS group's expertise in the mechanisms and countermeasures on the related mechanisms. After summarizing the mechanisms, the concept of chatter management is briefly described. It includes approaches for countermeasures and can be seen as an indispensable component of high-speed cold rolling mills. The most promising approach, the active chatter damping, is presented in detail showing the benefits by operational results.

The mechanisms of 3rd and 5th octave chatter

3rd octave chatter usually occurs in the frequency range of 100 Hz - 200 Hz. The known cause of 3rd octave chatter is the instability of the process in the last or second last mill stand, which leads to the excitation of a vertical mechanical chatter mode of the roll set. In addition to a corresponding fluctuation in the entry tension, this also leads to fluctuations in the exit thickness of the rolled product in conjunction with a high risk of a strip break. **Figure 1** provides a schematic overview of the mode of chatter with the process (tension) and product (thickness) fluctuations mentioned before. Measurements prove the theoretical descriptions of the phenomenon. **Figures 2** illustrates the resulting thickness fluctuations in the third measurement record.

5th octave chatter, by definition, influences the cold rolling process in a frequency range above 440 Hz. 5th octave chatter are caused by poorly damped natural modes of chatter of the roll set, which in large numbers occur within the frequency range between 440 and 1000 Hz. There is no feedback loop related to 5th octave chatter, which could potentially cause instability. The presence of the relevant sources of excitation, like tooth mesh frequencies in gear stages, often excites several modes of 5th octave chatter, which affect the shape and surface quality ("chatter marks") of the strip. A typical 5th octave chatter mode, for example, results in the work rolls (WR) moving in phase between two backup rolls (BUR) in the vertical plane of the mill stand. This mode is illustrated in **figures 2 and 3** together with an example of related chatter marks on the strip surface.

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Chatter management

As described, chatter is not a phenomenon caused by one single root but by a combination of different causes and mechanisms. It is essential that the mechanical equipment is in good condition to ensure stable rolling at high speeds because many components that are in bad shape or out of tolerance due to wear may excite chatter in the rolling mill and increase the general chatter level.

Therefore, measures and tools are required that enable mill operators and suppliers to avoid chatter by eliminating the sources (if possible), by monitoring unavoidable sources by means of early warning systems, by maintenance scheduling and execution strategies to minimize avoidable excitation levels ("predictive maintenance") and by being ready to implement countermeasures in cases where chatter occurs. All this calls for an integrated chatter management system, which ideally consists of the following components:

- Online chatter monitoring system with additional early warning functions.
- Optimized mill design to minimize susceptibility to chatter.
- Gradual improvements in maintenance and service to prevent the mill from rising chatter levels over its lifetime.
- Use of passive chatter damping equipment to reduce chatter as much as possible without affecting product quality.
- Active chatter damping to optimize the productivity of the mill and further improve the quality of the rolled products.

In the following sections details of SMS group's chatter monitoring system Genius CM® Chatter Plus and the SMS group's active chatter damping system X-Pact® Active Chatter Damping are presented, in order to demonstrate the practical relevance as well as solutions for the issues mentioned above.

Chatter monitoring system Genius CM® Chatter Plus

Basic and necessary functions included in the online chatter monitoring system Genius CM® Chatter Plus are the following ones:

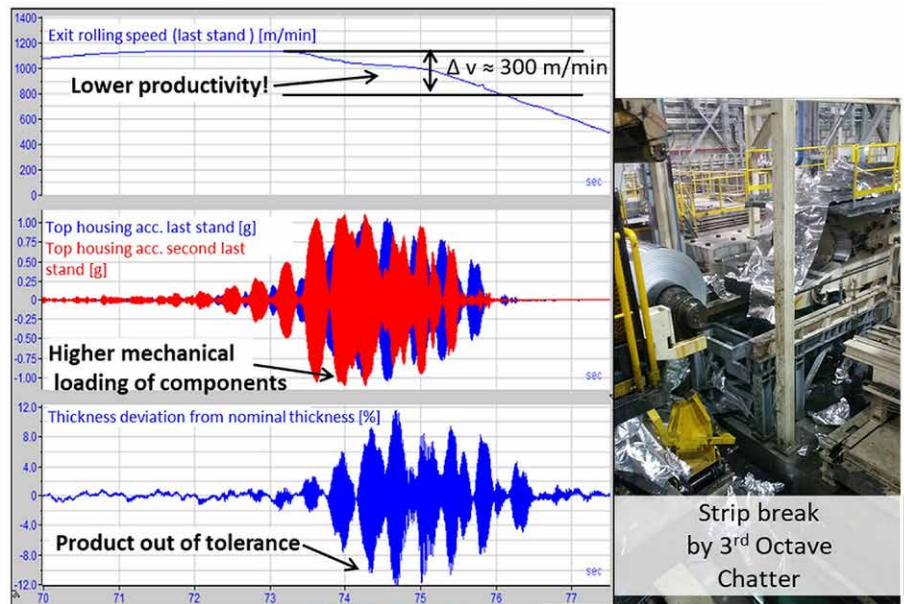


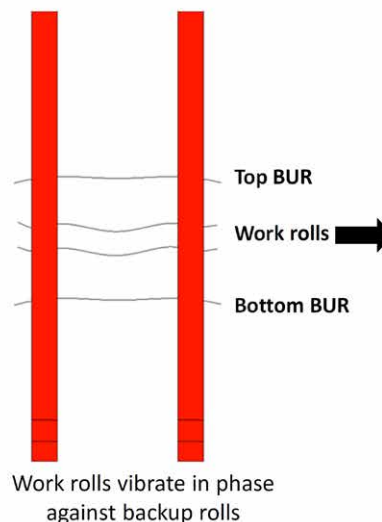
Figure 2. Influence of 3rd octave chatter on plant and product (Picture: SMS group)

- Chatter measurement using acceleration sensors on top of the mill housings on operator and drive side.
- Dedicated Human Machine Interface (HMI) for online visualization of the current, real-time Fast Fourier Transform (FFT)-analyzed chatter amplitudes of all mill stands.
- Long-term storage of chatter and assigned process data to quickly analyze the chatter status of the mill and the development of chatter levels in general or in detail at any time (figures 4 and 5).
- Triggering of Automatic Slow Down (ASD) of the mill in the event of sudden 3rd octave chatter in order to avoid strip breaks.

X-Pact® Active Chatter Damping (ACD)

Usually the state-of-the-art way to react on occurrence of 3rd octave chatter is the automatic deceleration of the rolling speed of a mill triggered by the online chatter monitoring system. A quite new but proven approach to overcome this

Cross-sectional view of mill stand



Example of marks on strip surface due to 5th Octave Chatter → product not saleable!

Figure 3. Influence of 5th octave chatter on plant and product (Picture: SMS group)

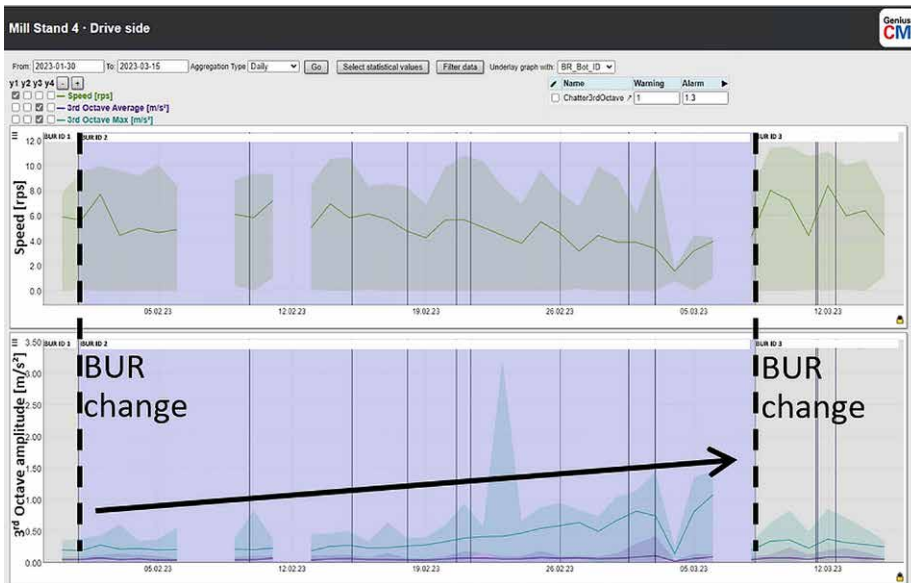


Figure 4. Trend graph showing increase of amplitudes over the backup roll campaign (Picture: SMS group)

practice and to even increase rolling speeds for chatter-critical materials is the active chatter damping. SMS group developed an active chatter damping system with the product name X-Pact® Active Chatter Damping (ACD). Piezo stacks as electro-mechanical actuators are located in a so-called actuator box, which is placed within the mill stand in the area between bottom backup roll chocks and wedge adjustment system.

General idea. The main idea behind active chatter damping is to eliminate chatter by applying a counteracting chat-

ter to a mechanical system. As a basic rule, an active chatter damping system calculates a correction signal based on a measured chatter signal. The correction signal is applied to the vibrating system in such a way, that, in the best-case scenario, it fully eliminates the chatter at the location where it originally occurred. From the mechanical point of view, this mechanism is equivalent to an increased system damping. The following components are required to realize an active chatter damping system: sensors, e.g. accelerometer, to measure the chatter signal, an actuator to apply the counter-

acting signal and a control system to calculate the correction signal for the actuator in real time, taking into account the transfer behaviour between sensor and actuator.

Pilot installation. The pilot unit of the X-Pact® Active Chatter Damping system for the suppression of 3rd octave chatter was installed as a retrofit solution in the last stand of an operating four-stand tandem cold mill for aluminium strip in March 2017. At this plant, the chatter monitoring system Genius CM® Chatter Plus had been already installed before.

X-Pact® Active Chatter Damping is running in a stand-alone cabinet, which also contains the power supply for the piezo elements (DC-links and amplifiers). An interface to the Level 1 automation of the rolling mill exists in order to use the functionalities of the ACD remotely and to exchange signals and data. **Figure 6** provides an overview of the ACD components and the arrangement of the actuator boxes in the mill stand.

Operational results from the pilot installation

The basic functionality of the control was proofed during commissioning by a significant reduction of chatter amplitudes in the 3rd octave chatter frequency range with the ACD system switched on. During a following optimization phase of the control algorithm a high-speed trial period was carried out in order to demonstrate and evaluate the performance of the system. Planned black-and-white trials with the ACD system switched on/off were not possible since a severe strip break happened when rolling the first trial coil with the system switched off. Subsequently, all remaining trial coils were rolled with the ACD switched on.

Figure 7 shows the general capability of the ACD to keep chatter amplitudes under control. An average ACD load of just 15% was sufficient to reach a speed level of slightly above 1700 m/min. The optimization of the pilot ACD installation and the integrated force measurement, including improvements to the mechanical design, was completed one year after commissioning.

During the permanent use in rolling operation until today, many experiences regarding the behaviour of the system in

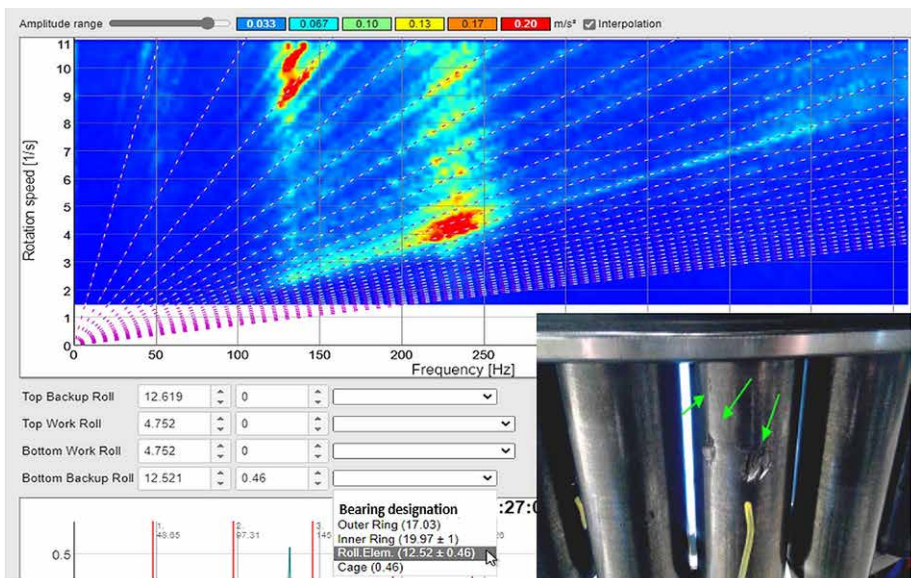


Figure 5. A detailed analysis indicates the roller elements of a backup roll bearing as main excitation source (Picture: SMS group)

the context of different chatter and excitation mechanisms were gained. The following main mechanisms could be derived:

- Case 1: usage of the last stand outside the stable operation area. Very rare cases from the initial use of the system, which indicate a direct instability of the 3rd octave chatter mode in the last mill stand. All of the observed cases were caused by an instability in the roll gap, which significantly increased the ACD load, but was handled by the ACD.
- Case 2: external excitation of the last stand by higher order harmonics of mechanical components. Excitations due to higher harmonic orders of mechanical components were present in the last mill stand. If these excitations had a high amplitude and were within the 3rd octave frequency range, they caused higher ACD loads, which were handled by ACD.
- Case 3: excitation of the last stand by interaction via strip flow. Excitations were present in the second last stand or in the interstand area, which caused corresponding variations in the roll force and the exit thickness. Via strip flow, the thickness variation of the second last stand was transferred into the last stand where it now has potential to excite the 3rd octave chatter mode and to cause high ACD loads, still handled by the ACD.

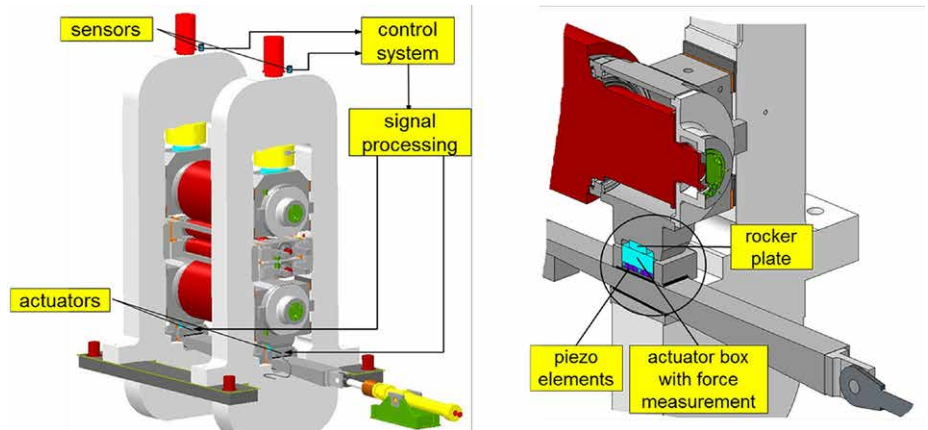


Figure 6. Overview of the ACD components (left) and the arrangement (right) of the actuator box in the mill stand (Picture: SMS group)

In order to minimize the occurrence of the cases 1 an optimized strategy to observe the roll gap stability was implemented, which focusses on the setting of the mill under consideration of tribological conditions. All of the observed cases 2 and 3 were related to the described external excitations and further detail investigation of related mechanical components is necessary in order to keep the ACD load lower than currently observed.

After several years of operation, an on site review of the system was carried out from end of March to begin of April 2022 in order to improve the system by implementing optimizations and in order to check the functionality and condition of

the whole assembly (e.g. cabinet, wiring etc.). During this period the before mentioned findings and mechanisms were reconfirmed again. **Figure 8** shows a trial, where the ACD was switched off for a short period during rolling of a coil. Clear differences in the speed and chatter levels are visible in **figure 8**. The influence of excitations by mechanical components, like summarized in the described cases 2 and 3 above, was obvious in some parts of this coil.

For automatic evaluation of the rolled coils and the ACD behavior, an offline analysis tool was developed after the optimization period mentioned above. An overview of evaluated statistical values for the period from begin of March to

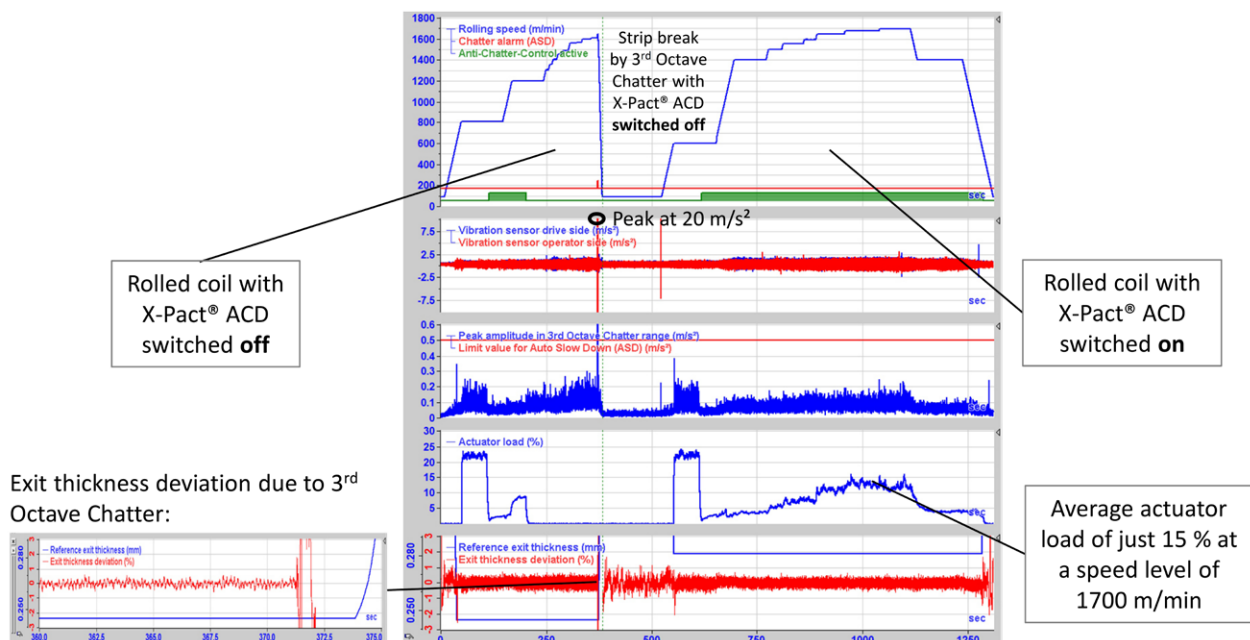


Figure 7. High-speed trials with the pilot ACD system in a tandem cold rolling mill during the optimization phase (Picture: SMS group)

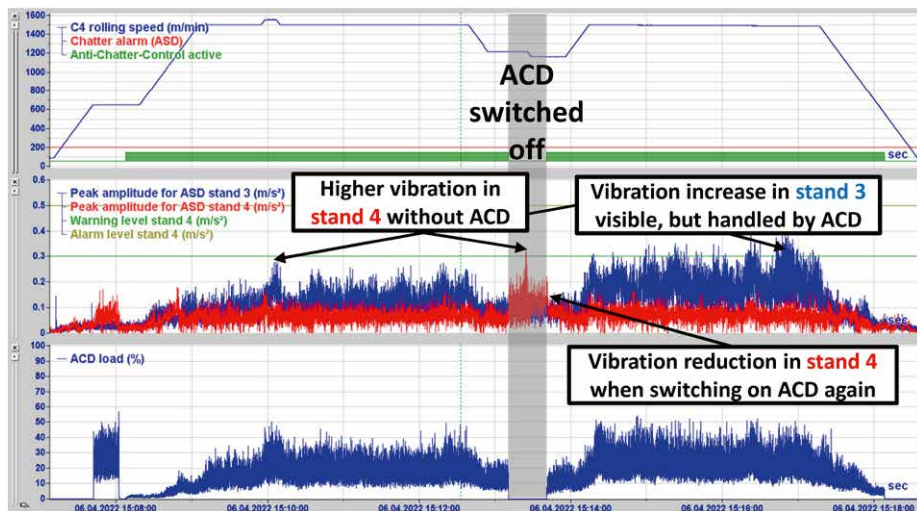


Figure 8. Test coil with switched-off ACD system shows differences in speed and chatter levels compared to ACD on (Picture: SMS group)

begin of April 2022 is shown in **figure 9** for all coils with a maximum rolling speed above 700 m/min. The first chart shows the widths of the rolled coils by green dots and the exit thicknesses of chatter-critical and not chatter-critical material by blue and red dots. The maximum rolling speed of the last stand, where the ACD is installed, is shown per coil in the second chart, while the third chart shows the corresponding maximum and aver-

age ACD loads by blue and red dots. In order to show the general chatter status, the fourth chart shows the evaluated maximum peak amplitudes in the 3rd octave chatter frequency range evaluated by the Genius CM® system for the second last stand in blue and for the last stand in red. Solid black and dashed orange vertical lines in all charts mark roll changes for the second last and the last stand.

The diagram shows the influence of the used roll sets by the areas between roll changes as well as differences in the speed and chatter levels with and without ACD, especially for chatter-critical material. Within the period 1171 coils were rolled, 988 chatter-critical and 183 not chatter-critical. Out of these 988 coils, 586 were rolled with ACD and 402 without ACD. Even if the reasons for a speed limitation are not clear for all of the coils in such kind of evaluation, the speed increase potential with ACD is obvious for chatter-critical material. The average of the maximum speeds per coil with ACD was 1283.3 m/min while it was just 1102.5 m/min without ACD. This means, that an absolute increase of 180.8 m/min respectively a relative increase of 16.4% was achieved by using the ACD. The same applies for the average of the maximum chatter peak amplitudes per coil for the last stand. With ACD an absolute decrease of -0.11 m/s² (0.17/0.28 m/s² with/without ACD) respectively a relative decrease by 39.3% was achieved. The analysis results are in accordance with the observed operator practice for single coils rolled without ACD. In this case, the rolling speed during the coils or for subsequent coils is usually reduced depending on the currently

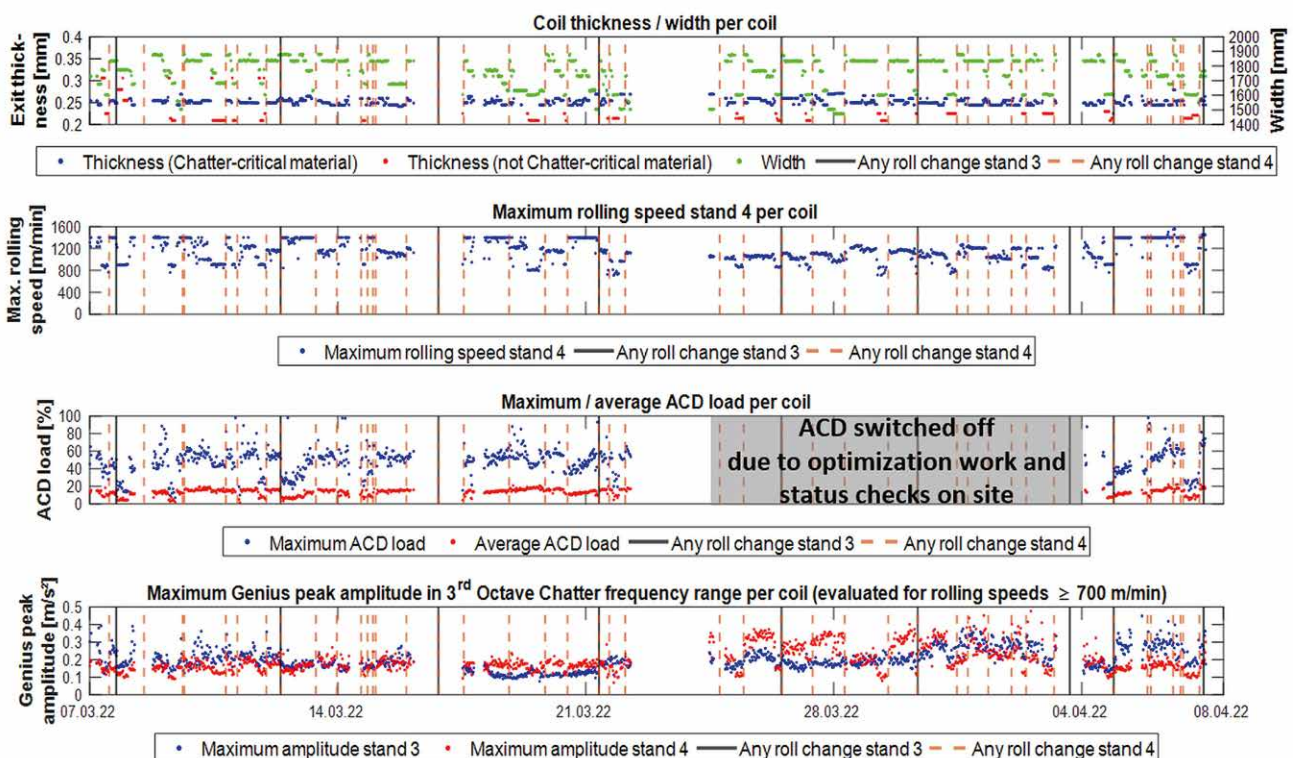


Figure 9. Statistical analysis clearly shows the differences in speed and chatter levels depending on the roll sets used and on using the ACD (Picture: SMS group)

observed chatter situation using the Genius CM® Live-HMI.

Based on the long-term experiences gained with the ACD pilot installation the following benefits for the customers can be derived:

- › Increase of rolling speed depending on the general chatter status of the rolling mill.
- › Increase of production depending on the achieved speed increase and the share of chatter-critical material in the product mix.
- › Prevention of strip breaks with further positive impact on the production.

- › Identification of “bad” mill equipment, like “bad” roll sets, depending on the ACD load.
- › Protection and increase of lifetime of mill equipment due to the prevention of strip breaks or due to the reduction of chatter amplitudes.

Product development

After the convincing results of the pilot installation, the ACD system is now ready for the installation in other cold rolling mills. A parallel product development, with focus on product series implementation and improvements regarding performance

and durability, was carried out. The following list shows a few examples:

- › Modular design including modular series categories and scaling factors.
- › Improvement of the integration of the piezo stacks to achieve a better load distribution and to increase the performance.
- › Integration of ACD features to the scope of Genius CM® Chatter Plus, like ACD-specific trend graphs.
- › Development of a standalone automation application.

The improved system will be integrated in the most recent application within a new aluminium tandem cold rolling mill order.

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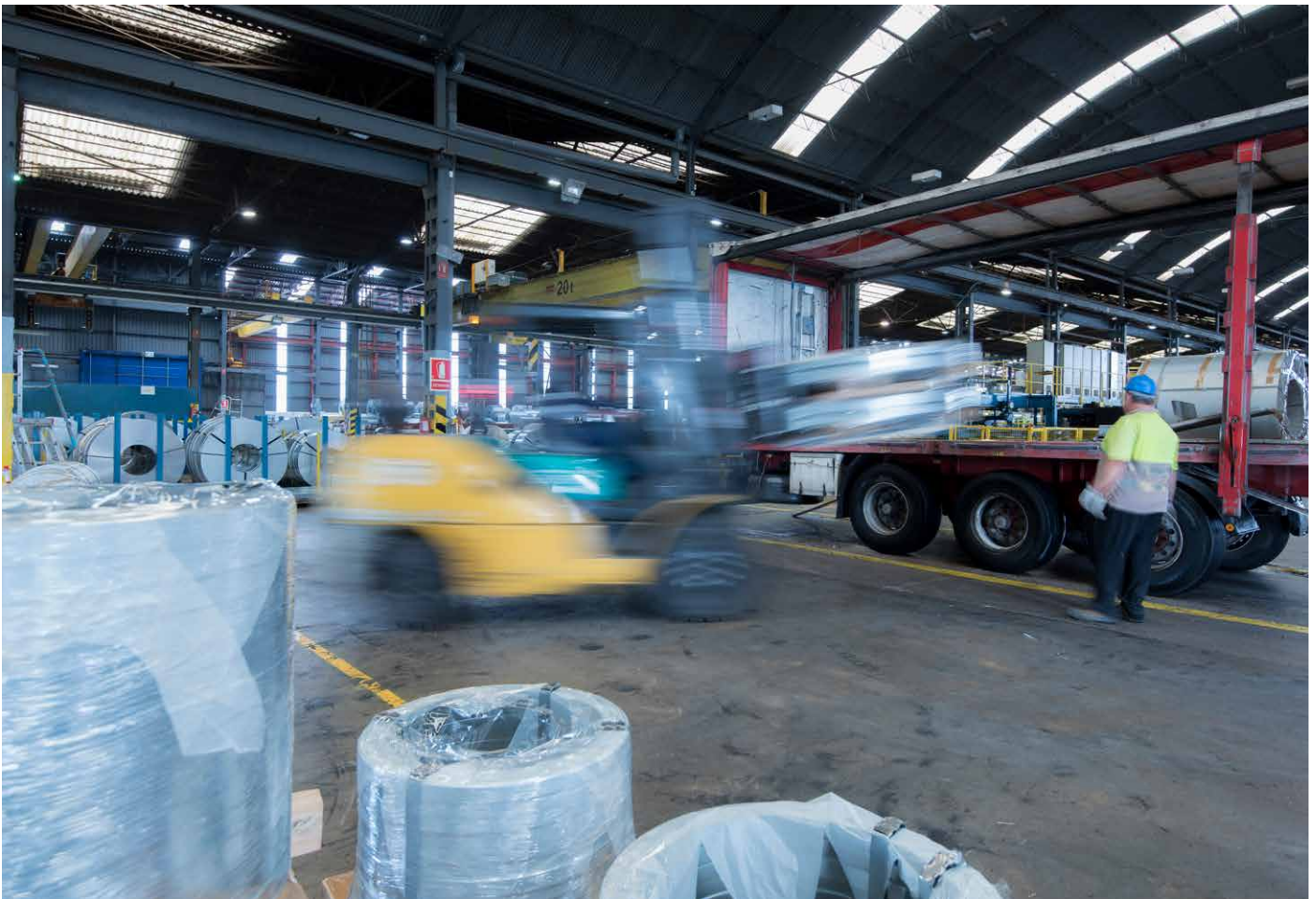
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DIGITALIZATION

Digital solution supports low-carbon metals sourcing with carbon reports

Suppliers and customers of the European materials distribution units of thyssenkrupp Material Services can now access on-demand product carbon footprints using a new carbon traceability and intensity tool.



Comprehensive “cradle-to-customer” calculations inform decarbonisation strategies across the supply chain (Picture: thyssenkrupp)

Thyssenkrupp Materials Services and CarbonChain announce partnership to advance low-carbon procurement with new carbon traceability and intensity tool. Powered by CarbonChain’s industry-leading carbon accounting software, thyssenkrupp Materials Services is enhancing its product carbon footprinting capabilities. The initiative sees an innovative traceability and carbon intensity tool rolled out to customers and suppliers of thyssen-

krupp Materials Services’ distribution units Materials Eastern Europe as well as Materials Western Europe.

The collaboration aims to strengthen industry standards for emissions transparency and data quality, providing more accurate carbon intensities faster. The tool will use asset-specific emissions factors and activity-based methods, instead of relying on global averages. This allows customers who are seeking lower-carbon materials to easily identify, compare and

select them, while leveraging this data to build sustainable procurement strategies to achieve their net-zero goals.

CarbonChain empowers companies to make climate-conscious decisions to accelerate action toward a net-zero economy. Its AI-empowered carbon accounting platform automates emissions tracking with accurate, granular, asset-level data for carbon-intensive supply chains, including metals, mining and manufacturing. CarbonChain’s methodology V0.94

Procurers can now make more sustainable choices and prepare for carbon regulations that are spreading through metal supply chains.

Jörg Heiles, CEO Operating Unit Materials Eastern Europe

has been validated by SGS and verified by Bureau Veritas for manufacturers, commodity traders and banks to unlock unrivalled insight into carbon-related risks and opportunities in near real-time.

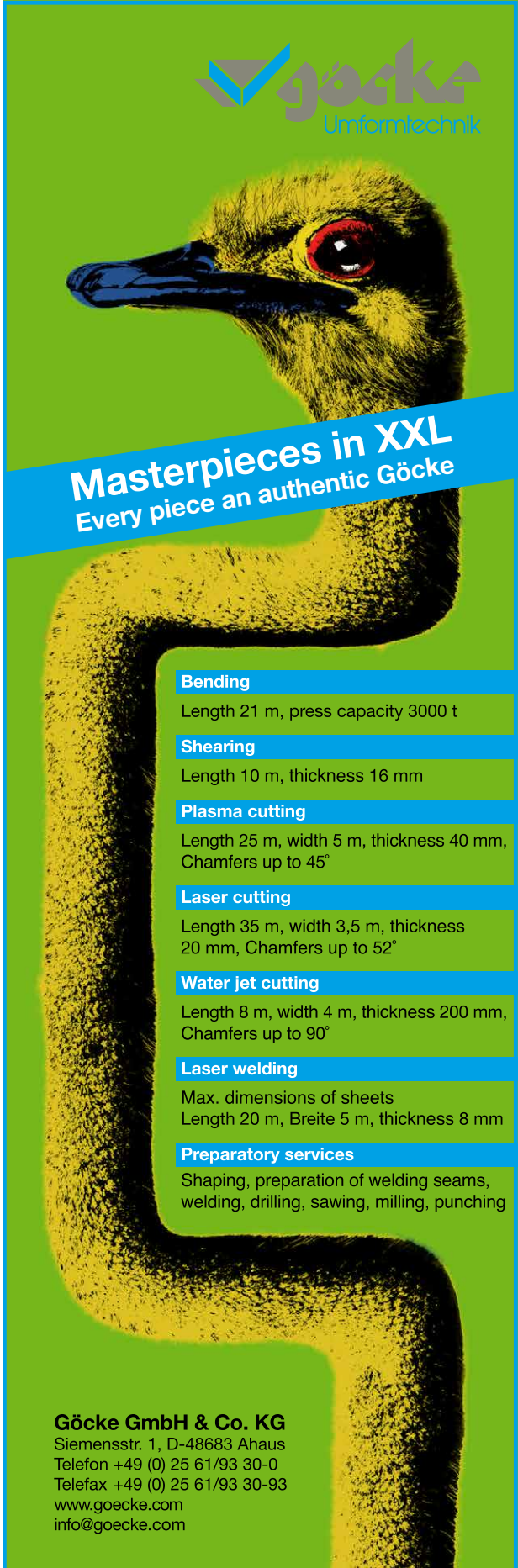
CarbonChain's comprehensive metals emissions database will be enriched with primary data from thyssenkrupp Materials Services' suppliers, covering steel, stainless steel, aluminium and other metals. Globally these metals are responsible for around 12% of the world's greenhouse gas emissions, yet there is significant variation and emissions reduction potential. For instance, the carbon intensity of one tonne of primary aluminium can be as little as 3 tonnes of carbon dioxide equivalent (CO₂e), or more than 28 tonnes of CO₂e, depending on the carbon intensity of the energy sources used and the type of production process.

thyssenkrupp Materials Services' product carbon footprint reports will be provided on request, quote or delivery, and detail emissions breakdowns by lifecycle stage and source, offering clear insights into carbon hotspots and encompassing all greenhouse gas emissions from the point of origin till the gate of the customer.

Jörg Heiles, CEO Operating Unit Materials Eastern Europe said: "thyssenkrupp Materials Services is committed to driving carbon transparency in the metals industry. Our enhanced product carbon footprint calculator will provide full supply chain transparency and intensity calculations, so that procurers can make more sustainable choices and prepare for carbon regulations that are spreading through metal supply chains."

Adam Hearne, CEO and Co-founder of CarbonChain, said: "Procurers can't meet their net-zero targets without knowing the carbon footprint of the goods they buy. Meanwhile, metals producers who are decarbonising their industrial processes are facing barriers to quantifying and reporting their emissions reductions. thyssenkrupp Materials Services and CarbonChain are uniquely placed to bridge this gap and provide on-time, quality data for carbon-informed trade."

CarbonChain



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Masterpieces in XXL
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Bending
Length 21 m, press capacity 3000 t
Shearing
Length 10 m, thickness 16 mm
Plasma cutting
Length 25 m, width 5 m, thickness 40 mm, Chamfers up to 45°
Laser cutting
Length 35 m, width 3,5 m, thickness 20 mm, Chamfers up to 52°
Water jet cutting
Length 8 m, width 4 m, thickness 200 mm, Chamfers up to 90°
Laser welding
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HOME OF SUPER DUPLEX

Taming unruly metals

More capacity, shorter cutting times and precise cutting results: UK metal distributor Langley Alloys was looking for more efficient sawing technology. The result: new band saws, with which the company can also process hard-to-cut metals.

Langley Alloys knows its way around materials that are considered “difficult” in the industry. The company from Newcastle upon Tyne (North East England/UK) sells bars, tubes and sheets made of high-performance metals, but is also active as a component manufacturer. 70 employees take care of cutting duplex or super-duplex stainless steels, high-strength austenitic stainless steels, copper-nickel and nickel-based alloys. Customers from different industries trust in the precision, reliability, and expertise of the specialised trader. The spectrum ranges from small workshops and the automotive industry to large steel constructors for bridges, industrial buildings or ships.

The challenge. Langley Alloys’ saw fleet reached its limits after ten years. An expansion of capacity was not possible with the existing machines. In addition, the lack of space in the production hall prevented the acquisition of further band saws. The specialist had clear ideas about his new sawing solution: in any case, it

should be possible to use carbide bands in order to achieve shorter cutting times for larger stocks of nickel alloys. With this idea, Langley Alloys approached Kasto’s UK branch in Milton Keynes to discuss possible options.

The solution. For several years band saws of the KASTOtec AC 4, KASTOwin A 4.6 and KASTOwin pro AC 5.6, have been processing their difficult-to-cut metals. Langley Alloys were able to significantly increase the cutting capacity and precision – without complex monitoring.

Thanks to the improved CNC control of the new machines, the employees can set up the different sawing jobs faster, utilising the machines to correctly set the speed and feed for each job, not having to rely on the operator’s knowledge – this opens up a greater potential for operator selection!

The saws handle all sawing jobs at Langley Alloys with very little down-time. If there are any problems, the Kasto Ltd. Service Team are always quickly on-site to

service or maintain them. Since the purchase of the very first saw from Kasto six years ago, the metal specialist have eight machines in daily use across their UK sites – Very soon to be expanded!

The conclusion. “Kasto’s band saws are ideal for cutting our difficult materials. Here we wanted to become more efficient, and we have succeeded with the new acquisitions,” Managing Director Rodney Rice explains the decision.

■ Kasto Maschinenbau

About Langley Alloys. The company was created in 1938, with the objective of developing high-performance alloys for naval and aerospace applications. The company’s history includes the patent for the very first commercial super duplex stainless steel, Ferralium 255, and the invention of the highest-strength copper-nickel alloy Hiduron, now widely used in modern subsea applications.

These days Langley Alloys operate from specialist facilities in the UK and USA, where comprehensive stockholding of bars, plate and pipes allows the company to supply customers globally. And as a distribution partner for Alleima (formerly Sandvik) and voestalpine Böhler Edelstahl, the company carries an extensive range of their stainless steels, duplex and super duplex stainless steels and nickel alloys. In fact, they like to call themselves #thehomeofsuperduplex, reflecting their role in the development and focus on distributing the most complete range of these alloys.

Continued investment in in-house inspection, testing and machining capabilities allow Langley Alloys to be a one-stop supplier of choice, saving their customers considerable cost, time and effort.



Metal distributor Langley Alloys relies on band saws from Kasto for the machining of difficult-to-cut alloys (Picture: Kasto Maschinenbau)

THYSSENKRUPP MATERIALS SERVICES USES HYDROGEN-POWERED TRUCKS



Hydrogen-powered trucks reduce the carbon footprint of material deliveries. (Picture: thyssenkrupp Plastics)

In January 2024, thyssenkrupp Materials Services started using the first hydrogen-powered trucks for deliveries to its customers. Two new vehicles with the environmentally friendly drive system from the logistics partner ep-Group have

been in use for the subsidiary thyssenkrupp Plastics.

“With the first hydrogen-powered trucks, we are using the latest mobility options for our transport routes together with the

ep-Group. This not only reduces our own carbon footprint but also the one of our customers. We take sustainability into account along the entire supply chain, and transportation plays a key role in this,” says Martin Stillger, CEO of thyssenkrupp Materials Services.

The exhaust pipe of the trucks releases no fumes but steam. The steam is produced in a fuel cell that generates electricity from hydrogen for the electric drive. The trucks have a range of around 450 km and a top speed of 85 km/h. The switch to hydrogen-powered trucks is a consistent contribution to the climate protection goals set by the materials distribution and service provider. The company has set itself the goal of becoming carbon neutral by 2030.

In addition to thyssenkrupp Plastics, further subsidiaries are to follow suit this year with the use of hydrogen-powered trucks. Furthermore, thyssenkrupp Materials Services is testing various drive options for heavy truck transportation worldwide. For example, a pilot project is currently running in North America for the use of renewable natural gas.

■ *thyssenkrupp Materials Services*

TATA STEEL SIGNS MEMORANDUM OF UNDERSTANDING FOR GREEN STEEL SUPPLY

Tata Steel Nederland has signed a memorandum of understanding with automotive supplier SNOP for the long-term supply of steel with a lower environmental footprint.

When the IJmuiden steelworks switches to its new steelmaking route, Tata Steel

will supply SNOP with Zeremis embodied green steel. Zeremis® Carbon Lite steel has an allocated carbon footprint reduction of up to 90 percent (maximum reduction for the sum of scope 1, 2 and 3 emissions). The use of lower CO₂ steel enables the tier-one automotive supplier to manufacture high-strength structural

car components, as well as outer panels for light commercial vehicles and high-end sports cars for various major car manufacturers.

■ *Tata Steel Europe*

TIMKEN STEEL CHANGES NAME TO METALLUS INC.

TimkenSteel is now named Metallus Inc. In accordance with the name change, the company unveiled a new company website in February 2024.

The new name honors the company’s century-long legacy as an industry-leading

producer of strong, sustainable steel and reflects its vision to harness the enduring power of high-performance metals. “We are extremely proud of the company we have built over the past decade since becoming an independent company,” said Mike Williams, president and chief execu-

tive officer. Operating as Metallus, the company will continue to serve the automotive, energy and a variety of industrial end markets with targeted growth in aerospace and defense.

■ *TimkenSteel / Metallus*

KLÖCKNER & CO TO SELL FOUR EUROPEAN COUNTRY ORGANIZATIONS

Klöckner & Co intends to sell parts of its European commodity distribution business. In this regard, the company has received an irrevocable offer by the Spanish Hierros Añon S.A. that comprises all relevant terms and conditions regarding an acquisition of the country organizations in France, the United Kingdom, the Netherlands, and Belgium.

With the proposed transaction, the Management Board of Klöckner & Co would continue to prioritize businesses with high-

er value-added products and services along the value chain of its customers like processing and fabrication services. The proposed sale would significantly reduce the company's dependence on volatile commodity markets. Going forward, Klöckner & Co will continue to concentrate on the growth of its biggest market in North America and its attractive European activities in Germany, Austria, and Switzerland (DACH).

The proposed transaction is expected to have a considerably positive impact on

the group EBITDA before material special effects from the financial year 2024 onwards. In addition, the company expects a one-time negative effect on the group equity of around EUR 210 million based on the current equity of the organizations and further deconsolidation effects. However, the equity ratio of the remaining group is expected to increase to approximately 51 percent.

■ *Klöckner & Co*

THYSSENKRUPP MATERIALS DE MÉXICO OPENS NEW SERVICE CENTER

thyssenkrupp Materials de México has inaugurated a new service center in San Luis Potosí. The new facility is part of thyssenkrupp Materials Services' growth strategy in North America.

thyssenkrupp Materials de México specializes in the distribution of materials and the provision of services for factories in the North American market. With the opening of the new facility in San Luis

Potosí, the company is consolidating its leading market position and demonstrating its ability to adapt its production model to the ever-changing needs of its customers.

thyssenkrupp Materials de México now has four service centers in the country, which are strategically located very close to numerous original equipment manufacturers (OEM) and various industry suppliers. Delivery routes will be shorter and the

direct connection of the railway line of the San Luis Potosí facility enables operations to be carried out in a manner that is more profitable and sustainable, in addition to deliveries "just in time." The new site and the center in Silao, which has a steel and aluminium blanking line, will be operated jointly due to their close proximity.

■ *thyssenkrupp Materials Services*

ARCELORMITTAL PARTNERS WITH IIT MADRAS ON HYPERLOOP TEST FACILITY

ArcelorMittal has established a partnership with Indian Institute of Technology Madras and its Hyperloop start-up. Hyperloop's central objective is the advancement and commercialization of Hyperloop technologies for high-speed, affordable, reliable and sustainable transportation.

ArcelorMittal and ArcelorMittal Nippon Steel India is providing foundational steel

materials, as well as engineering, design and project management expertise to support the creation of India's and Asia's first Hyperloop test track at IIT Madras' Discovery Campus at Thaiyur. AM/NS India is supplying almost 400 t of steel for the fabrication of a 400 metre vacuum tube at the site, in which autonomous, levitating pods will be tested at speeds of up to 200 km/h. The test facility is expected to be operational by the end of Q1 2024.

Following the completion of the proof-of-concept phase, the next stage would be the development of an operational demonstration route to validate the techno-commercial prospects of this Hyperloop technology.

■ *ArcelorMittal*

THYSSENKRUPP MATERIALS SERVICES SELLS SPANISH SUBSIDIARY

thyssenkrupp Materials has sold its subsidiary thyssenkrupp Materials Processing Lamincer S.A.U. to Arania S.A.U. This sale marks a further step in thyssenkrupp Materials' strategic portfolio development.

"With the successful sale of thyssenkrupp Materials Processing Lamincer, we have

taken a further step in sharpening our profile," says Martin Stillger, CEO of thyssenkrupp Materials Services. Arania has more than 80 years of experience in the cold-rolled, high-carbon and low-carbon sector. Today, Grupo Arania has four steel divisions – cold-rolled strip, welded tubes, heavy loads and lightweight loads storage systems – and five production locations.

thyssenkrupp Materials Services continues to be active at several locations in Spain with its companies thyssenkrupp Materials Processing Europe, thyssenkrupp Plastic Ibérica, and thyssenkrupp Materials Ibérica.

thyssenkrupp Materials Services

AUBERT & DUVAL ORDERS CLOSED-DIE FORGING PRESS

Aubert & Duval has placed an order with SMS group for a hydraulic closed-die forging press for its Pamiers site in Ariège. The new press will enable Aubert & Duval to produce high-precision forgings, such as turbine disks, shafts and structural parts.

The four-column, hydraulic closed-die forging press to be supplied by SMS will

have a forging force of 60 MN. The modular structure of the hydraulic press means it can accommodate an isothermal forging module, which Aubert & Duval will use in future to produce high-performance components based on vacuum powder metallurgy for aircraft and engines. The force-transmitting telescopic cylinder will be driven by frequency-controlled pumps that can be switched

off. This provides for energy-optimized press control with three press force stages (20, 40, and 60 MN) and the possibility to process completely new material combinations.

SMS group

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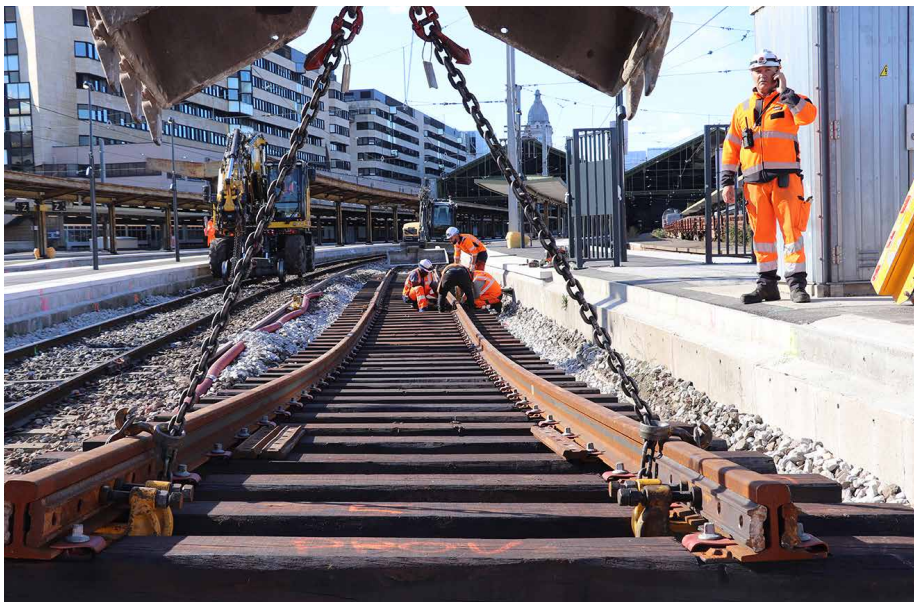
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RAILS

Sustainable mobility breakthrough

Rail transport is generally considered to be climate friendly. However, rails produced from low-CO₂ steel enable rail network operators to drastically reduce their carbon emissions even further. In close alliance with the state-owned railroad operator in France (SNCF - Société Nationale des Chemins de Fer Français), rail supplier Saarstahl Rail has been successfully implementing the low-CO₂ rail concept in practice. In the meantime, further railroad network operators and infrastructure firms have awarded Saarstahl Rail contracts for “green” rails worth millions of Euros.



Laying of the green rails by SNCF Réseau

(Picture: SNCF Réseau / Maximilien Stein Yengo)

The sustainable production method and use of almost 100% recycled steel scrap are the keys to success for the decarbonized rails. Guaranteeing the necessary supply reliability of environmentally friendly rails for rail network operators requires a sufficient stock of industrial scrap and – depending on the desired steel specifications – up to 70% used rails as well as other steel components from rail networks. Saarstahl Rail therefore purchases used rails and steel scrap from rail network operators to recycle these at Saarstahl Ascoval. In Saint-Saulve near Lille, Saarstahl Ascoval melts down the mix of raw materials in an Electric Arc Furnace (EAF) and casts the rail steel produced into blooms. These are then transported by train to the Saarstahl Rail production facility in Hayange to the north of Metz, where

they are rolled to create green rails. The comprehensive final testing, using laser, ultrasound, and visual inspections, is also performed in Hayange. The checks performed here include compliance with the stipulated Euronorm flatness tolerance of less than 0.3 millimetres per three metres of rail to guarantee optimum tracking stability and passenger comfort for the high-speed trains, which reach speeds more than 300 km per hour (185 mph). Compared with conventional rail steel, which is produced in a blast furnace route with an oxygen converter using iron ore and coal as raw materials, the new production method reduces carbon emissions up to 70%. Whereas 2.61 tons of CO₂ are generally emitted per ton of steel, this figure is reduced to just 0.77 tons per ton of steel with the new process.

Sustainable procurement policy

The manufacturer specializes in all types of rail networks worldwide. Its portfolio comprises over 100 different rail profiles and 25 steel grades in lengths of up to 108 metres with metallurgical and mechanical properties in conformity with customers' specifications – all offered from a single source, regardless of whether they are produced from green or conventional steel. SNCF, one of Saarstahl Rail's most important customers, was the first rail network operator to seek a solution for decarbonization of rails. It found the right development partner in the supplier that has demonstrated expertise and reliability over many years. According to Cyrille Blard (in charge of sustainable economy at SNCF) there were two key reasons behind the decision to place greater emphasis on development of sustainable products in its procurement policy. By procuring materials through a regional circular economy, the aim was to secure independence from geopolitical influences, such as those encountered during the COVID-19 pandemic or due to the war in Ukraine. “This allows us to produce brand new materials from used custom materials, which represents a win for both sides of the lifecycle.” The fact that the French government has issued a target to reduce carbon emissions by 25% by 2030 was the other key factor in increasing the focus on sustainable products. “SNCF Réseau already greatly exceeded this target in 2022 with a reduction of 34%,” comments Cyrille Blard with pride. He goes on to add: “The green rails made a significant contribution to this!”

Saarstahl Rail produced its first green rails in the summer of 2020. SNCF

This is a genuine partnership: Sairstahl Ascoval needs scrap rails as a raw material, while SNCF needs new green rails from Sairstahl Rail.

Cyrille Blard is in charge of sustainable development at Société Nationale des Chemins de Fer Français (SNCF)

Réseau, the owner of the French rail network, tested the product that same year. With tests rails having already successfully passed both the test and official approval process in Rennes and Cannes at the start of December, Sairstahl Rail supplied SNCF with almost 1,000 more tons of green rails that same month. Since 2020, all major rail renewal projects in the French rail network have been implemented with green rails. As part of a seven-year contract, SNCF Réseau is ordering around 130,000 tons of rails per year (more than 1,000 kilometres of railroad line) from Sairstahl Rail. In 2023, some 90% (125,000 tons) of these were already green rails. This helped the railroad network operator save around 200,000 tons of CO₂ equivalents. The annual requirement for rails as per SNCF's multi-year track renewal plan remains constant up to 2030. Sairstahl Rail delivers the desired batches to a production unit of SNCF in Saulon-la-Chapelle by train. The 108-metre-long rails are then welded together here to produce segments of up to 432 metres in length. On a project-by-project basis, used rails are cut into 1.5-metre-long segments directly on the construction site or at the SNCF facility in Saulon-la-Chapelle, or transported once a month by train in segments measuring no more than 18 metres in length to the steel works in Saint-Saulve, where they are cut then melted down. This process of returning and recycling 50,000 tons of used rails per year (status as at 2023) is contractually agreed with Sairstahl Rail and is of critical importance for SNCF in securing the specific chemical composition and mechanical properties of the rails.

Ambitious goals

Cyrille Blard emphasizes the commitment of both parties to make every effort to use old, unusable rails for the reprocessing to green rails. However, the actual figure is currently lower due to a lack of availability of used rails. The SNCF manager links this objective to the vision of finding a new way of pricing steel in the long term, whereby SNCF is the process-independent owner of the steel material, and the rail manufacturer is a contractor that converts used rails into new green rails. "This would require the rail supplier and SNCF to work together even more closely in future."

Sairstahl Rail and SNCF have already been cooperating for many years. Besides supplying rails, this cooperation also

encompasses joint research and development. "We engage in a very wide range of activities and hold regular meetings to discuss both technical and logistical questions," comments Dominique Chiesura, Commercial Director of Sairstahl Rail. Cyrille Blard goes on to add: "This is a genuine partnership, which is precisely what we need for the new rails. Sairstahl Ascoval needs scrap rails as raw material, while SNCF needs new green rails from Sairstahl Rail." The success already enjoyed shows that he is right: "At first, only very few people believed that the new green rails were really as good as the ones currently in use." The key was therefore to do a lot of convincing, both internally and externally, but: "We demonstrated that the recycled material in the green rails offers the same consistently high quality

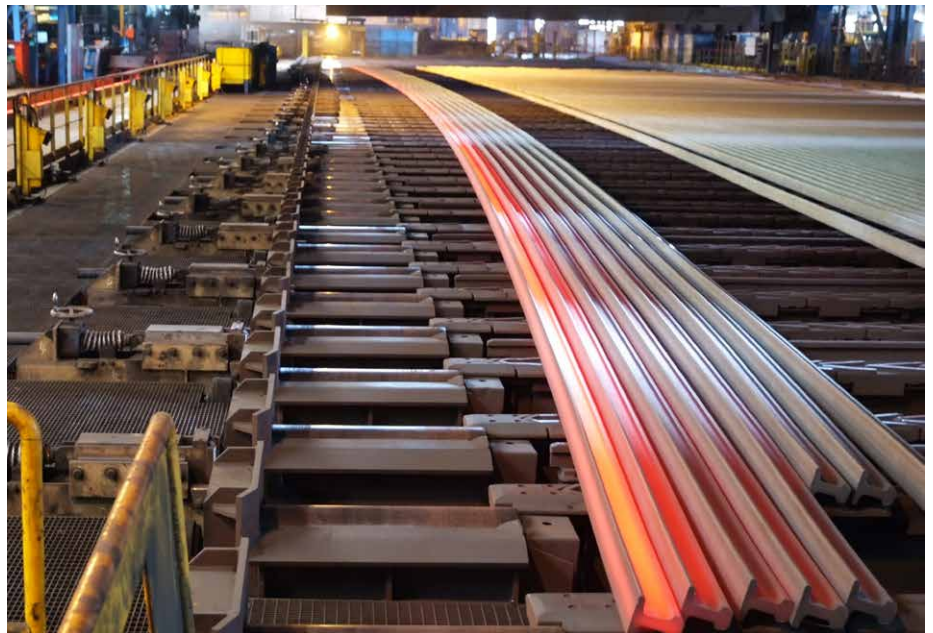


The ready-to-install green rails are transported to the customer by train
(Picture: Sairstahl Rail Hayange)

as new material.” For him, this proves that things have changed, together with the mindset and the way in which the network is operated. For example, his team also demonstrated that recycled and reprocessed gravel can be even better than new ballast from the quarry. “We’re also working on using our old rails from a high-speed line for a less busy route with lower speeds before they actually reach the end of their useful life and are then sent off to Saarlühl Ascovall.” A renegotiation of the multi-year contract with Saarlühl Rail is scheduled for the coming year. “Obviously, we hope that we can continue working with Saarlühl Rail and Saarlühl Ascovall in the future, but since we’re talking about one of the largest economic markets for rails, a public tender process is stipulated,” comments Cyrille Blard. This tender process will also include an evolution clause for CO₂ reduction through green rails, as well as the return of used rails.

Full steam ahead for green rails in Europe

For Saarlühl Rail, the chances of winning a follow-up order from SNCF Réseau look pretty good, as underlined by various other tender processes that the company has successfully won recently. For example, the company has to date supplied all rails for the Grand Paris Express megaproject (4 new metro lines), involving some 20,000 tons of green rails.



The hot-rolled rails are produced in lengths of up to 108 metres
(Picture: Saarlühl Rail Hayange)

Among other uses, these were laid along the first low-carbon Metro line in Paris – the new line 16, which connects the north of the French capital with the east in a 26-kilometer loop. In total, the ring railroad that is currently under construction for the greater Paris area will cover 220 kilometres, which will double the scope of the existing Metro network. The Société du Grand Paris, the company responsible for construction of the network infrastructure, is keen to reduce

carbon emissions by 25% along the entire route, which would mean a total saving of one million tons of CO₂. This represents a steep challenge for Dominique Chiesura: “We need to make sure that 100% of the new routes included in Europe’s largest infrastructure project run on green rails!” Belgian railroad network operator Infrabel is also investing in the environmentally friendly rails. Some 2,800 kilometres of green rails have been ordered. A total of 20,000 tons of these rails from Saarlühl Rail are now planned to be used for reconstruction of the destroyed rail network in Western Ukraine. Green Steel from Saarlühl is also used in other Railway components such as fastenings, pre-stressed steel for concrete sleepers.

For the Saarlühl Group, which operates out of Völklingen, Germany, the rapidly growing development of the business with green rails is also seen as the spearhead for decarbonization in the Group. The Group, which specializes in the manufacture of thermos-mechanically rolled spring steel and bar steel, as well as semi-finished and forged products for the automotive, construction, and aerospace industries, is helping drive the transition to more eco-friendly modes of transport with green steel.



Rails prepared for final inspections and finishing (Picture: Saarlühl Rail Hayange)

| Saarlühl Rail

GROWING DEMAND FOR ELECTRICAL STEEL

Accelerate deployment of renewable energy projects worldwide

GE Vernova's commitment to powering the planet is now fully focused on the energy transition. To create its highly efficient products and services, the company makes extensive use of electrical steels produced by ArcelorMittal Europe – Flat Products. While most of these steels are used in Europe, the resulting products are deployed worldwide.

GE Vernova estimates that their products and technologies deliver around 30-percent of electricity worldwide across an installed base generating approximately 2,200 GW of power. GE has always been a technology leader in the power sector and has a suite of complementary technology including gas-fired power, onshore and offshore wind, hydro, small modular reactors, battery storage, hybrids and grid solutions needed for the energy transformation.

The relationship between ArcelorMittal Europe and GE Vernova is built on legacy gas turbine generators which convert natural gas to electrical energy. Today that focus has shifted to alternative fuels, like hydrogen. Ben Holmes, Senior Commodity Manager at GE Vernova, explains: "GE Vernova is active in every energy generation segment and provides solutions needed for the energy transformation. We also use ArcelorMittal's electric steels in electric motors for ships and production equip-

ment. This includes the electric motors that ArcelorMittal uses in its steel rolling mills.

Investment in electrical steel production important for future supply

A key growth area is renewable energy. "This industry segment is predicted to grow exponentially over the next five to ten years," notes Ben Holmes. "It will lead to significant additional demand for electrical steels in the years to come. ArcelorMittal's investment in its new electrical steels production facility in Mardyck (France) has the potential to help us aim to meet that demand."

"ArcelorMittal's Mardyck announcement came at a time of rapidly growing demand for electrical steels in Europe," says Ben Holmes: "The new capacity will help GE Vernova to meet the challenges of the energy transition as we move through this decade."

ArcelorMittal has also continued to invest in its existing electrical steel mill at St-Chely d'Apcher (France) to supply the increased demand for electrical steels from customers and help them meet the challenges of the energy transition. The investments in St-Chely d'Apcher and Mardyck will provide the market with local capacity and volumes and ease concerns over long-term supply of electrical steels.

Developing future products

"A key advantage of ArcelorMittal's current offerings is the diversity of steel grades and sizes" notes Ben Holmes. "We're constantly looking for opportunities to provide better performance to enhance the efficiency of our electrical machines," says Ben Holmes. "The ArcelorMittal Europe team continues to provide support with a view to developing new electrical steel products. ArcelorMittal are positioned to potentially have a key role to play in our supply chain."

Sustainability is another area that is becoming increasingly important for GE Vernova as it looks to the future notes Ben Holmes: "We have set the goal of aiming to achieve carbon neutrality in our facilities and operations by 2030. As part of that process, our renewable energy business partners with EcoVadis – a leading provider of business sustainability ratings – to audit our operations. EcoVadis will look at the performance of our suppliers such as ArcelorMittal. The assessment covers environmental factors as well as corporate governance and social considerations." ArcelorMittal's XCarb® initiative could make a positive contribution to this assessment."



GE Vernova generators make extensive use of electrical steels to produce electricity from different energy sources (Picture: GE Vernova)

| ArcelorMittal Europe

CLIMATE-FRIENDLY STEEL PARTNERSHIP

Sustainable steel for a new offshore wind park in the Baltic Sea

A low CO₂ steel production partnership between Vestas and ArcelorMittal will make its first delivery of XCarb® recycled and renewably produced heavy plate steel to an offshore wind farm, built by Baltic Power in Poland



Low carbon-emissions steel significantly reduces the lifetime CO₂ footprint of wind turbine towers (Picture: Vestas)

Vestas, the energy industry's global partner on sustainable energy solutions, has established a partnership with ArcelorMittal to launch a low carbon-emissions steel offering that significantly reduces the lifetime carbon dioxide emissions from the production of wind turbine towers.

The low carbon-emissions steel is produced using 100% steel scrap which is melted in an electric arc furnace powered by 100% wind energy at the ArcelorMittal steel mill, Industeel Charleroi, in Belgium. The steel slabs are then transformed into

heavy plates used for the manufacture of wind turbine towers, at ArcelorMittal's heavy plate mill in Gijón, Spain. These heavy plates, made with XCarb® recycled and renewably produced heavy plate steel, are initially suitable for the entire onshore wind turbine towers and the top section of offshore wind turbine towers. The low carbon-emissions heavy plate steel has an Environmental Product Declaration (EPD), certified by an independent party, detailing the complete environmental footprint of the product, and allowing easier comparison between

products. ArcelorMittal is the only steel producer to produce low-carbon emissions heavy plate steel in large dimensions (up to 18 tonnes), minimising the need for welding and associated CO₂ emissions.

By utilising low carbon-emissions steel in the top two sections of an offshore tower, this emissions reduction translates to a 25% reduction in emissions compared with a tower made from steel produced via the conventional steelmaking route. For an entire onshore tower, the CO₂ reduction is at least 52%.

Commitment from Baltic Power wind farm

Steel and iron constitute 80-90% of a wind turbine’s material mass, and approximately 50% of a turbine’s total lifecycle emissions. With the partnership with ArcelorMittal, Vestas has taken an important step forward to reduce CO₂ emissions occurring in its supply chain and can achieve a 66% decrease in emission intensity per kg steel compared with steel made via the conventional steelmaking route.

Even though the low carbon-emissions steel is not yet a standard offering from Vestas, the first project using low carbon-emissions steel will be the Baltic Power offshore wind farm off the coast of Poland. During 2025, Vestas will start the construction of the offshore wind farm, expected to generate up to up to 1.2 GW and ultimately supply clean electricity to more than 1.5 million households in Poland. Vestas will supply, install, and commission 76 V236-15.0 MW wind turbines for the Baltic Power project. Around 52 towers out of 76 will be made with low carbon-emissions steel.

Dieter Dehoorne, Head of Global Procurement at Vestas, says: “Finding ways to decarbonise the emissions produced during the raw material extraction and refinement of steel is vital for us and the industry in general. Vestas sees the partnership with ArcelorMittal and the adoption of low-emission steel as a significant lever in reducing CO₂ emissions within the wind industry. Commitment from our customers is vital to drive the transition so we are very happy that we can provide value to our customers with this solution. The Baltic Power project stands as a solid example of this progress, having secured the first order and affirming the delivery of substantial value to our customers.”

Jaroslaw Broda, CEO Baltic Power, says: “As the first offshore wind farm in the world to utilize low-emission steel, Baltic Power, a joint venture between Orlen and Northland Power, is pioneering a sustainable future in the renewable energy sector. Being the largest investment in renewable sources in this part of Europe, our project is setting new benchmarks. The use of low-emission steel from Vestas and ArcelorMittal in our wind farm underscores our commitment to

With stronger public policy support for the use of low carbon-emissions steel in the building of renewables infrastructure, this project could be the first of many to provide wind energy for homes and industry across Europe.

Laurent Plasman, CMO Industry, ArcelorMittal Europe – Flat Products

innovation and environmental stewardship. We are proud to lead the way in transforming Poland’s energy landscape as we progress towards completing the construction by 2026.”

The Orlen Group, which owns Baltic Power, is the largest fuel and energy com-

pany in Central Europe. The Orlen Group aims to become a net zero carbon business by 2050.

| ArcelorMittal



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SUSTAINABLE CONSTRUCTION HAS TAKEN ON A WHOLE NEW DIMENSION

Fossil-free steel roofing for homes

Plannja, a manufacturer of sheet metal products and part of Ruukki Construction, is the first in Scandinavia to deliver residential roofing products featuring fossil-free steel. The pilot delivery goes to a residential area being built by OBOS in Björrod in Västra Götaland, Sweden.



Bjorrodbacken 3D Nord visualization (Picture: SSAB)

Plannja has already started delivery of roofing sheets made of fossil-free steel to OBOS. OBOS, a market-leading producer of single-family homes, has a clear sustainability strategy and ambition to reduce the climate impact both at the production stage and throughout the lifecycle of the home. The delivery is the first of its kind in Sweden, and goes to a carefully selected housing project in Björrod in Västra Götaland.

The project consists of eight single-family homes, which will soon be able to boast roofs made of fossil-free steel. The roofing product used is the profile Plannja Trend, using a bio-based colour coating with Swedish rapeseed oil, which provides an additional environmental bonus. Outside Scandinavia, Ruukki Construction offers the corresponding product as Ruukki Classic.

“We take a very positive view of this initiative, where we, together with Plannja, take responsibility for reducing the climate impact of housing construction. At the same time, we are meeting the long-term growing demand for housing with a lower climate impact. OBOS has a long and suc-

cessful collaboration with Plannja. Having a steady supplier is crucial to be efficient in our respective companies’ production processes,” says Joakim Henriksson, CEO of OBOS Sweden.

For the housing project in Björrod, the roofing sheets and fittings will be produced from fossil-free steel in Plannja’s production facilities in Järnforsen and Landsbro, Sweden. “We strive to lead the construction and house manufacturing industry towards a fossil-free future. By introducing fossil-free steel in our roofing

and façade products, we will be able to significantly reduce the carbon footprint of the built environment. It feels great to be able to offer homes with roofs made of fossil-free steel. Sustainable construction has taken on a whole new dimension,” says Torbjörn Henrysson, Business Director at Plannja Steinwalls AB, which specializes in sheet metal products for the single-family house industry.

Plannja is part of Ruukki Construction and in line with the joint sustainability pledge, which was made back in 2021, the businesses have committed to be the first companies in the world to offer building products made from fossil-free steel. Both Ruukki and Plannja have systematically reduced emissions from their operations by more than 50% since 2019 with the goal of achieving an overall reduction in emissions of 70% by 2030. The multi-year investment program aims to minimize the environmental impact of operations and product ranges in the future.

In November 2023, Ruukki Construction announced the first fossil-free pilot projects in Sweden and Finland, and next year, Ruukki and Plannja will start more pilot projects with fossil-free steel products in selected European countries.

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Joakim Henriksson, CEO of OBOS Sweden

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02 Raw material pretreatment

02.01 Ore dressing

740 Mixers/core sand mixers



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03 Iron making

03.01 Blast furnaces

1150 Heat recovery systems



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03.02 Direct reduction plants

1160 Direct reduction plants



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04 Steelmaking

1668 Equipment for steelmaking plants



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1699 Steel mill equipment



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04.04 Electric steel plant

1875 Electric arc ladle furnaces



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04.07 Secondary metallurgy

2028 Equipment for chemical heating



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2030 Argon purging equipment



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04.07 Secondary metallurgy

2080 Ladle metallurgical plants



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2110 Secondary metallurgical plants

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2120 Steel degassing plants

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2130 Steel desulfurization plants

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2140 T+P lance equipment

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04.09 Components

2150 Deslagging machines



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2180 Break-out machines for electric furnaces, converters, ladles, etc.



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2182 Burning lances (oxygen) for tundish and ladle gate valves

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2230 Charging machines (trough and tongs)



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2270 Injection plants for argon

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04.09 Components

2440 Handling equipment for oxygen/carbon lances

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04.09 Components

2490 Coal dust injection lances

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2530 Lance robots/-manipulators

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2580 Oxygen nozzles



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04.09 Components

2600 Oxygen lance equipment



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2655 Fuses (multifunction) for burners



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2660 Special safety oxygen hose reels



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07 Hot rolling

07.10 Components

4430 Decoilers and rewinders



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08 Forging, extrusion

08.03 Components

5150 Forging manipulators



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5155 Forging manipulators, rail-mounted



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5160 Forging robots



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5180 Transport manipulators



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10 Cold rolling

10.01 Cold rolling mills

5490 Strip, sheet, cold and metal rolling mills



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10.04 Annealing lines

5670 Annealing lines



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11 Surface treatment

11.04 Surface treatment plants

6270 Strip edge trimming



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11.04 Surface treatment plants

6280 Strip processing and finishing lines



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11.05 Aluminizing, tin plating, galvanizing

6630 Hot dip galvanizing lines



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13 Production of tubes/pipes

13.04 Finishing lines for tubes

7520 Tube bending machines



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7544 Tube straightening machines



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14 Sheet metal processing

14.03 Welding technology

8120 Strip welding machines



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14.03 Welding technology

8205 Laser welding machines



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8210 Laser beam welding machines



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8220 MIG, MAG and TIG\O57TIG welding torches



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8257 Rolling seam resistance welding equipment



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14.03 Welding technology

8330 Welding machines, general



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8360 Welding accessories, general



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8380 Butt welding machines, electric



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8400 Resistance welding equipment



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16 Furnace and energy technology

10170 Furnace optimization (conversion to low NOx combustion)



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10190 Rational use of energy



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16.02 Forging furnaces

10230 Forging furnaces



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16.03 Roller Hearth Continuous Furnaces

10260 Roller Hearth Continuous Furnaces



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10270 Roller hearth and walking beam furnaces



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16.05 Top-hat furnaces

10310 Top-hat furnaces



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16.08 Heating furnaces and heat treatment plants

10408 Continuous furnaces



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10410 Co-step furnaces



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10430 Bogie hearth furnaces



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10460 Chamber furnaces



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16.08 Heating furnaces and heat treatment plants

10510 Roller hearth and walking beam furnaces



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10540 Pusher-type, roller and rotary hearth furnaces



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10560 Heat treatment plants



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10562 Heat treatment furnaces (continuous and discontinuous)



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10570 Heat treatment furnaces for batch operation, open heated



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16.09 Bath furnaces

10580 Aluminum melting furnaces



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16.13 Components

10890 Natural gas burners



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11010 Regenerative burners



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11020 Recuperative burners



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16.13 Components

11070 Radiant tube burners



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18 Machinery and plant engineering

12210 Plant engineering, general



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18.10 Power and work machines

13070 Piston pumps



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 E-Mail: info@hydrowatt.com
 Internet: www.hydrowatt.com

18.10 Power and work machines

13160 Vacuum pumps



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21 Measuring and testing technique

16488 Multichannel measuring systems



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21.02 Measurement of physical properties

16608 Strip thickness control (AGC)



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16612 Strip flatness measurement



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21.02 Measurement of physical properties

16652 Dressing degree and mass flow measuring systems



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16660 Thickness measuring systems and devices



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21.02 Measurement of physical properties

16830 Speed measuring devices



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16892 Force measuring systems



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21.02 Measurement of physical properties

16910 Length measuring devices for tubes



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16950 Length and speed measuring systems (optical)



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16960 Laser speed and length measuring systems



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21.02 Measurement of physical properties

17300 Rolling mill measuring systems



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21.03 Quality management

17380 Measuring instruments for quality management



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17409 Surface inspection systems



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24 Environmental protection and disposal

24.01 Dedusting and gas cleaning

18360 Exhaust gas cooling systems



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18400 Treatment of dusts from steel mills and foundries



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List of Products

01 Raw materials, auxiliary materials and operating materials

01.01. Ores

- 10 Chrome ore
- 20 Iron ores
- 30 Ores
- 40 Manganese ore
- 50 Steel mill ores

01.02. Coal, coke

- 60 Lignite coke
- 62 Injection coal
- 65 Foundry coke
- 67 Coal / coke conveyor
- 70 Coke
- 80 Coke breeze
- 90 Coke breeze, dry
- 100 Petroleum coke
- 110 Hard coal, anthracite

01.03. Scrap

- 120 Scrap metal

01.04. Sponge iron

- 128 Sponge iron
- 130 Sponge iron

01.05. Metals and alloys

- 140 Cermix metal
- 150 Chromium metal
- 160 Cobalt
- 170 Deoxidation alloys
- 180 Iron granules
- 190 Iron powder
- 200 Ferrobor
- 210 Ferrochrome
- 220 Ferromanganese
- 230 Ferromolybdenum
- 240 Ferronickel
- 250 Ferroniobium
- 260 Ferro-niobium carbide
- 270 Ferroniob powder
- 280 Ferrophosphorus
- 290 Ferro-selenium
- 300 Ferrosilicon
- 310 Ferro-silicon-magnesium
- 315 Ferro-silicon-manganese
- 320 Ferrotitanium
- 330 Ferrovanadium
- 340 Ferrotungsten
- 350 Ferrozinc
- 380 Alloys
- 385 Magnesium alloys
- 390 Manganese metal
- 400 Metals and alloys
- 410 Metal powder
- 420 Molybdenum
- 430 Molybdenum oxide
- 435 Non-ferrous metals
- 440 Nickel

- 450 Nickel-based alloys
- 460 Nickel niobium
- 470 Niobium, metals and alloys
- 475 Pure iron
- 480 Silicon carbide
- 490 Silicon and silicon alloys
- 500 Special metals
- 510 Special alloys
- 520 Tantalum
- 530 Titanium and titanium alloys
- 540 Vanadium metal
- 550 Vanadium pentoxide
- 560 Master alloys
- 570 Tungsten
- 572 Tungsten granules for C and S analysis
- 610 Alloying additions

01.06. Additives and fluxes

- 580 Carburizing agent
- 590 Fluorspar
- 600 Lime and limestone
- 612 Slag conditioner
- 616 Olivine
- 618 Raw bauxite

01.07. Gases

- 620 Acetylene
- 625 Argon
- 630 Gases, technical
- 640 Carbonic acid
- 650 Oxygen
- 660 Protective gas
- 670 Nitrogen
- 675 Hydrogen

01.08. Lubricants

- 680 Coating powder
- 690 Lubricants

01.09. Composite materials

- 678 Bimetal for saws

01.10. Water

- 691 River water / additional water

01.11. Other

- 695 Glass granules
- 698 Titanium dioxide for hearth protection / repair

02 Raw material pretreatment

- 700 Engineering and technical assistance
- 703 Engineering and project management

02.01. Ore dressing

- 710 Ore and aggregate processing plants
- 720 Crushing plants
- 730 Grinding and mixing plants
- 740 Mixers / core sand mixers

- 750 Screens
- 760 Screens and screening plants

02.02. Coal preparation

- 770 Coal preparation plants
- 780 Coal grinding plants

02.03. Coal burden preparation

- 790 Coal burden preparation

02.04. Pelletizing plants

- 795 Ore preparation plants
- 797 Conveying plants for pellets
- 800 Pelletizing plants
- 810 Pelletizing plants with ore preparation plants

02.05. Sintering plants

- 820 Sintering plants
- 822 Sinter hot material conveyors
- 826 Grate bars for sinter plants

02.06. Briquetting plants

- 830 Briquetting plants
- 840 Briquetting of coal and coke
- 850 Compacting plants

02.07. Coke plants

- 858 Emission control in coking plants, charging and discharging
- 859 Heat-recovery coking plants
- 860 Coke plants, general
- 870 Coke crushing and screening plants
- 890 Coke ovens
- 900 Coke oven operating machines
- 910 Coke oven gas treatment plants
- 920 Coke ramming and extruding machines
- 950 Heat exchangers

02.08. Scrap processing plants

- 968 Coil magnets
- 970 Lifting magnets
- 980 Magnetic drums
- 990 Packing presses
- 999 Scrap drying plants
- 1000 Scrap mills, lickier-ins
- 1010 Scrap shears
- 1015 Scrap shear blades
- 1017 Scrap magnets
- 1020 Shredder plants
- 1021 Safety equipment for electric load lifting magnets
- 1022 Separation magnets
- 1030 Chip crusher

02.09. Other equipment

- 1041 Equipment for granulation of sludges and dusts
- 1050 Ferroalloying plants
- 1058 Lime burning plants
- 1060 Lime slaking plants
- 1070 Roasting plants

03 Iron making

- 1080 Engineering and technical assistance
- 1090 Pig iron production plants
- 1100 Smelter reduction plants

03.01. Blast furnaces

- 1105 Energy recovery
- 1107 Expansion turbine
- 1110 Blast furnaces
- 1120 Blast furnace linings
- 1123 Blast furnace hearth protection/repair
- 1125 Blast furnace channel lining
- 1130 Blast furnace hot blast stoves
- 1140 Ceramic burners for hot blast stoves
- 1145 Shaft melting furnaces
- 1150 Heat recovery systems
- 1152 Hot blast stoves

03.02. Direct reduction plants

- 1160 Direct reduction plants
- 1170 Direct reduction plants with coal as reducing agent
- 1172 DRI hot material conveyor
- 1174 Fine ore reduction with coal or gas

03.03. Cupola furnaces

- 1180 Hot blast cupola furnaces
- 1190 Cold blast cupola furnaces
- 1195 Shaft furnaces for metallurgical residues

03.04. Components

- 1200 Valves for blast furnace reheaters
- 1205 Fittings for cupola furnaces
- 1207 Copper fittings for cupolas
- 1210 Slide gate maintenance
- 1220 Gassing systems for blast furnaces, cupolas and steel mills
- 1230 Blow mold changing and nozzle block removal carriages
- 1240 boring bar changing devices
- 1250 Nozzle bars
- 1260 Injection plants for carbon
- 1270 Equipment for injecting coal, oil or gas into the blast furnace
- 1280 Equipment for injecting oil or gas into the blast furnace
- 1285 Blast furnace gas expansion turbines
- 1290 Hood manipulators for use on iron channels
- 1295 Hot gas generators for blast furnace and coke gas
- 1300 Hot blast valves
- 1310 Blast furnace blowers
- 1320 Blast furnace stands and shells
- 1330 Blast furnace burdening / also burdening carriages
- 1340 Blast furnace probes
- 1350 Coal grinding, drying and injection systems
- 1351 Copper fittings for cupola furnaces
- 1353 Ladles and mixers, liquid pig iron, engineering and supply
- 1355 Process gas screw compressors
- 1360 Radar level measuring equipment

- 1370 Rest and shaft cooling plates for blast furnaces
- 1380 Pig iron bulk pouring machines
- 1390 Pig iron mixers
- 1400 Pig iron ladle, mixer and transfer cars
- 1410 Slag molds
- 1420 Slag ladles
- 1425 Hoses for blast furnace cooling
- 1430 Special fittings for blast furnace cooling
- 1432 Copper staves for blast furnace cooling
- 1440 Taphole tamping machines
- 1450 Tap hole and slag hole drilling machines
- 1458 Distributor systems for charging burden/ore/coke into the blast furnace
- 1460 Heat exchangers
- 1467 Weighing systems for torpedo cars
- 1470 Wind molds and nozzle stacks
- 1480 Wind vane

03.05. Blast furnace products for foundries

- 1490 Foundry pig iron
- 1500 Hematite pig iron
- 1510 Hematite pig iron for GG
- 1520 Blast furnace ferro-manganese
- 1550 Special pig iron for GGG
- 1560 Mirror Iron
- 1570 Steel iron

03.06. By-products

- 1580 Ferrous sulfate
- 1589 Blast furnace slag
- 1590 Blast furnace slag as a road construction material
- 1600 Blast furnace slag and LD slag
- 1620 Slag lime
- 1630 Slag Sand
- 1639 Converter lime
- 1640 Converter lime057 Thomas lime
- 1643 LD slag
- 1650 Thomas phosphate

04 Steelmaking

- 1668 Equipment for steelmaking plants
- 1670 Engineering and technical assistance
- 1680 Compact steelmaking equipment
- 1690 Second-hand steelmaking plant and equipment
- 1698 Steel mill plants and equipment
- 1699 Steel mill equipment
- 1700 Steel mill plants and equipment (stainless)
- 1710 Steel mill plants and equipment (complete)

04.01. Hot metal preparation plants

- 1715 Desulfurization plants with slag regeneration
- 1720 Hot metal desulfurization plants

04.02. Converter

- 1730 Blown steelmaking plants
- 1740 KTB (Kawasaki Top Blowing) equipment
- 1745 Combined bottom blowing at converter
- 1750 Converter plants

- 1755 Converter sealing plugs
- 1758 Setting machines for converter sealing plugs
- 1760 Purging stones

04.03. Energy optimization furnaces

- 1770 Energy optimization furnaces

04.04. Electric steel plant

- 1780 Charging equipment for electric furnaces
- 1788 Bottom blowing equipment for electric arc furnaces (nitrogen and argon)
- 1790 Bottom tapping
- 1795 CO post-combustion
- 1800 Three-phase arc furnaces
- 1810 Injection systems for electric furnaces
- 1820 Electrode holders and contact jaws for electric furnaces
- 1830 Electrode control for electric arc furnaces and ladle heating systems
- 1840 Electrode extruders
- 1850 Electrode support arms
- 1855 Aluminum electrode support arms, current-carrying (Hot Arms)
- 1860 Electrode support arms, current-carrying (Hot Arms)
- 1865 Electrode discharge arm insulation
- 1870 Electric arc furnaces
- 1875 Electric arc ladle furnaces
- 1880 Electric arc furnaces with integrated scrap preheating (shaft furnaces)
- 1885 Spare and wear parts, consumables
- 1890 Direct current arc furnaces
- 1900 Graphite electrodes
- 1908 Jet Box Technology
- 1910 Cooling elements (tube wall segments, bay covers, plate coolers)
- 1920 Oil/057gas oxygen burners (also post-combustion)
- 1930 Scrap baskets
- 1938 Scrap dryers
- 1940 Scrap preheating systems
- 1945 Poking machines for electric furnaces
- 1950 Electric tube systems for electric furnaces
- 1960 Water cooled cables
- 1970 Water cooling systems
- 1980 AC arc furnaces
- 1981 EAF high current insulation
- 1982 Power supplies for AC arc furnaces
- 1983 Power supplies for direct current arc furnaces

04.05. Induction furnaces

- 1990 Induction furnaces
- 1995 Protection system for induction coils
- 1996 Induction furnaces \ 057Repairs
- 2000 Water cooled cables

04.06. Vacuum furnaces

- 2008 High vacuum furnaces
- 2010 High vacuum furnaces (also electron beam melting furnaces)
- 2020 Vacuum induction melting furnaces
- 2021 Vacuum pumps, dry running, for vacuum furnaces
- 2025 Vacuum investment casting plants

04.07. Secondary metallurgy

- 2028 Equipment for chemical heating
- 2030 Argon purging equipment
- 2040 Blow and injection conveying systems for filter dusts
- 2042 blowing lances, combined, for RH
- 2050 CAS, CAS-OB and CAB-plants
- 2060 Injection plants for metallurgical processes
- 2070 Electroslag remelting plants
- 2080 Ladle metallurgical plants
- 2090 Plasma arc plants
- 2100 Plasma ladle furnaces
- 2110 Secondary metallurgical plants
- 2120 Steel degassing plants
- 2130 Steel desulfurization plants
- 2140 T+P lance equipment
- 2145 Induction stirrers for ladle furnaces
- 2147 Vacuum degassing plants
- 2148 Vacuum arc furnace

04.08. Tertiary metallurgy

- 2141 Electroslag remelting plant ESU plant
- 2142 Vacuum arc remelting /VAR plant
- 2143 Vacuum induction furnace /VIM plant
- 2144 Vacuum degassing equipment

04.09. Components

- 2150 Deslagging machines
- 2155 Tap hole sealing equipment for converters
- 2156 Converter tap hole drilling and setting machines
- 2160 Tapping gate for converters and electric arc furnaces
- 2170 Andromat manipulator
- 2175 Burning machines for ladles
- 2180 Break-out machines for electric furnaces, converters, ladles, etc.
- 2182 Burning lances (oxygen) for tundish and ladle gate valves
- 2184 CO injection equipment
- 2190 Handling equipment for oxygen/carbon lances
- 2200 Automatic purging gas dome stations
- 2210 Heating equipment for ladles, mixers, converters and tundishes
- 2215 Feeding equipment for metallurgical plants
- 2220 Brakes
- 2230 Charging machines (trough and tongs)
- 2235 Steam jet vacuum pumps for steel degassing
- 2240 Dolomite centrifugal machines
- 2250 Wire spooling machines
- 2268 Injection plants for argon in ladles
- 2270 Injection plants for argon
- 2280 Injection plants for iron carbide dusts
- 2290 Injection plants for Hy/DRI dusts
- 2300 Injection plants for lime granules
- 2310 Injection plants for carbon (electric arc furnaces)
- 2312 Injection plants for alloying materials
- 2320 Electric heating elements for steel degassing plants
- 2340 Electromagnet. Conveying and dosing troughs for liquid metals
- 2350 Desulfurization equipment
- 2360 Oriel tapping fillers, electric arc furnaces
- 2370 Casting ladles, general

- 2380 Casting ladle heaters
- 2390 Ladles for steel mills
- 2400 Casting ladle gates (also slide gate gates)
- 2410 Pouring stream protection
- 2420 Casting carriages
- 2430 Handling equipment
- 2440 Handling equipment for oxygen/carbon lances
- 2450 Metallurgical and rolling mill hydraulics
- 2460 Lime-oxygen dosing and injection systems
- 2480 Tilting chairs for ladles
- 2490 Coal dust injection lances
- 2500 Ingot molds and casting molds for steel mills
- 2510 Ingot mold cars
- 2514 Continuous optical analysis equipment for process vessels
- 2515 Continuous optical temperature measurement for process vessels
- 2520 Converter blowing lance changing device
- 2525 Converter temperature and sampling equipment
- 2530 Lance robots \ 057-manipulators
- 2540 Alloying equipment for steel mills
- 2541 Multifunction lances and burners for electric furnaces
- 2542 Ladles and mixers, liquid pig iron, engineering and supply
- 2543 Mixer ladles
- 2545 Ladle sliders (steel mill ladle slider material)
- 2550 Ladle cars
- 2560 Robots for cutting slag
- 2570 Sand feeding devices for ladle tap hole
- 2580 Oxygen nozzles
- 2590 Oxygen lances
- 2600 Oxygen lance equipment
- 2610 Oxygen tubes, heat protected
- 2615 Shadow tube manipulators
- 2618 Slag with space resistant property
- 2620 Slag bucket
- 2630 Slag retaining device for converter
- 2640 Slag carts
- 2650 Hose reels
- 2655 Fuses (multifunction) for burners
- 2660 Special safety oxygen hose reels
- 2665 Stone coating agent for ladle gate valves
- 2666 Stone coating agents for slide gate systems
- 2668 Poking machines for electric furnaces
- 2669 Sublances
- 2670 Immersion tube spraying devices
- 2680 Torpedo car radar level measuring devices
- 2686 Vacuum pumps, dry running, for vacuum furnaces
- 2690 Preheating and drying stations for ladles and tundishes
- 2695 Weighing systems for scrap and alloying elements
- 2700 Heat exchangers for steel mills
- 2702 Flame cutting machines for ladles
- 2704 Crucibles for remelting furnaces
- 2705 Process gas analyzer

04.10. Steel mill supplies

- 2706 Sealing cords and packings up to 1260 °C
- 2710 Carburizing agents of all kinds

- 2720 Deoxidizing agent
- 2730 Deoxidation technology
- 2735 EBT taphole plugging compound
- 2740 Dephosphorizing agents
- 2750 Desulfurization and deoxidation agents
- 2760 desulfurization agents (also magnesium)
- 2770 ESU slags
- 2780 Ferroniob cored wires
- 2790 Cored wires
- 2798 Casting heads
- 2800 Casting powder
- 2801 Casting powders, granulated and powdered
- 2810 Graphite
- 2820 Graphite powder
- 2825 Heat protection fabric to 1260 °C
- 2827 Insulating covering agents for tundishes, ladles and troughs
- 2830 Molds
- 2840 Mould inserts
- 2845 Chill putty, -filler up to 1600 °C
- 2850 Ingot mold spray and plate protection
- 2855 Oxygen nozzles and blowing lances
- 2860 Blowhole powder
- 2865 Mats and felts up to 1260 °C
- 2868 Olivine slag conditioner
- 2870 Ladle covering agent
- 2871 Ladle covering agents, granulated and powdered
- 2880 Ladle slide sand
- 2885 Rotary slide gate for steel ladles
- 2888 Slag granulation
- 2890 Slag sands
- 2900 Slag foaming
- 2904 Protective blankets made of textile fabric up to 1260 °C
- 2905 Special adhesives up to 1200 °C
- 2910 Steel mill ladle slide material
- 2915 Crucibles for ESR, VAR and casting rolls
- 2920 Tundish covering material, granulated and powdered

04.11. Preparation of steel mill materials

- 2930 Processing of used refractory materials
- 2940 Processing of steel mill dusts, fines and oil-containing steel mill sludges
- 2950 Slag preparation (slag transport and recycling)
- 2954 Separation magnets

04.12. Services

- 2956 Engineering for steel mill plants and equipment
- 2957 Hydraulic cylinder repair
- 2958 Slag bucket maintenance

05 Continuous casting

- 2960 Engineering and technical assistance

05.01. Continuous casting plants of various designs

- 2962 Flat ingots
- 2965 Casting platform robot
- 2970 Casting wheel plants
- 2980 Casting wheels

- 2982 Casting rolls, rollers
- 2990 Horizontal continuous casting plants
- 3000 Continuous casting plants, general
- 3010 Vertical continuous casting plants

05.02. Continuous casting plants for different product dimensions

- 3020 Beam-blank continuous casters
- 3030 Continuous slab casters
- 3035 High-speed continuous billet casters
- 3040 Continuous billet casters
- 3043 Continuous billet casters, horizontal
- 3045 Combined continuous slab casters
- 3050 Round continuous casters
- 3055 Round continuous casting machines, horizontal
- 3058 Continuous bloom casting plants
- 3060 Continuous bloom and slab casters
- 3070 Continuous bloom and billet casting plants
- 3075 Continuous bloom and billet casting plants, horizontal
- 3080 bloom and round continuous casting plants
- 3085 bloom and billet continuous casting plants, horizontal

05.03. Spray compacting plants

- 3090 Spray compacting plants

05.04. Components

- 3100 Al wire injection plants
- 3110 Slab edge adjustment
- 3120 Slab edge heating, inductive
- 3130 Slab cooling plants
- 3140 Slab cooling boiler/heat recovery plants
- 3150 Slab cross-cutting and slitting lines
- 3160 Slab grinding machines
- 3166 Soft slab turning and transporting magnets
- 3170 Brakes
- 3180 Flame removal equipment
- 3190 Flame cutting equipment
- 3200 Slewing ring for water cooled rolls
- 3210 DS stamping machine
- 3216 Electromagnetic brakes, EMBR
- 3220 Single material nozzles for continuous casting cooling
- 3230 Deburrer
- 3240 Inks for marking equipment
- 3250 Paint signing equipment
- 3260 Casting powder feeder
- 3262 Casting stream protection by argon
- 3270 Inductive stirring
- 3280 Cold distribution plates (tundish plates)
- 3290 Marking equipment for slabs, ingots and billets
- 3292 Billet grinding machines
- 3300 Billet processing machines
- 3310 Billet sawing machines
- 3320 Billet grinding machines
- 3330 Mould flow measuring equipment
- 3340 Reading systems for automatic identification of impact and directly applied marks
- 3345 Air atomization nozzles for continuous casting cooling

- 3346 Marking machines
- 3350 Emergency cutting torches
- 3355 Optical product recognition (OPR) for marked billets
- 3360 Plasma tundish heating
- 3370 Plate molds
- 3380 Precision stopper device
- 3390 Tube molds
- 3400 Shadow tube manipulators
- 3405 Safety device for electrolift magnets
- 3410 Marking colors
- 3415 Slab magnets
- 3420 Stamping machines
- 3422 Stamping machines, hydraulic or pneumatic drive
- 3429 Continuous casting molds
- 3430 Continuous casting molds (also made of electrographite)
- 3440 Continuous casting rolls
- 3450 Tundish heating
- 3460 Tundish (manifold) plasma heater
- 3470 Tundish flow control
- 3480 Tundish gate valve (Tundish gate valve) bloom and billet adjustments
- 3490 Heat exchangers
- 3500 Weighing systems for ladles, tundish etc.
- 3510 Two-substance nozzles for continuous casting cooling

05.05. Operating materials

- 3520 Casting powder
- 3530 Lubricants for continuous casting plants
- 3535 Welding consumables for regeneration and against wear

05.06. Services

- 3537 Grinding and scarfing of slabs, billets and blooms

06 Near net shape casting

- 3540 Engineering and technical assistance

06.01. Equipment

- 3550 Strip casting lines
- 3560 Thin strip casting plants
- 3570 Thin slab casting plants
- 3572 Thin slab casting and rolling lines with direct bond
- 3573 EUROSTRIP strip casting plants
- 3574 EUROSTRIP direct strip casting and rolling lines
- 3575 Continuous billet casting plants

06.02. Components

- 3590 Flame cutting equipment
- 3600 Flame cutting equipment
- 3610 DS stamping machine
- 3630 Thin slab cross and slitting lines
- 3640 Thin slab grinding machines
- 3670 Color marking equipment
- 3680 Casting powder feeder
- 3690 Ingot molds

- 3700 Reading systems for automatic identification of impact and directly applied characters
- 3710 Marking inks
- 3712 Stamping machines, hydraulic or pneumatic drive

06.03. Operating supplies

- 3750 Coolant
- 3760 Lubricants

07 Hot rolling

- 3770 Engineering and technical assistance
- 3780 Second-hand hot rolling mills

07.01. Hot strip mills

- 3773 Flat block plants
- 3776 Flat block plants for rolling
- 3790 Thin slab mills
- 3805 Modernization of hot rolling mills
- 3820 Steckel rolling mills, complete
- 3830 Rolling mills, complete
- 3840 Hot rolling mills for slab products

07.02. Heavy plate mills

- 3850 Hot rolling mills, complete

07.03. Billet and semi-finished product mills

- 3860 Ingot, billet and plate mills
- 3861 Ingot, billet and semi-finished product mills

07.04. Section mills

- 3870 Rolling mills for light sectional steel
- 3875 Roll forming mills
- 3880 Special section rolling mills
- 3881 Rail rolling mills
- 3890 Beam and other section mills

07.05. Bar and wire rod mills

- 3900 Automatic coil handling
- 3910 Guide equipment for wire rod, bar and fine iron mills
- 3920 Calibrating mills
- 3930 Precision rolling systems
- 3940 Reducing and sizing mills
- 3944 Reducing and sizing mills
- 3950 Bar and wire rod mills
- 3955 Bar and wire rod mills for carbon and stainless steels
- 3960 Bar mills
- 3968 Rolling mills for flat products
- 3970 Rolling mills for long products
- 3974 Rolling mills for wire rod, rebars and bars

07.06. Ring rolling mills

- 3980 Ring rolling machines and plants
- 3981 Wheel rolling machines and plants

07.07. Finishing lines

- 3990 Finishing lines
- 4000 Finishing machines

- 4010 Chamfering machines for round and square billets
- 4017 Flat block plants for rolling
- 4020 Flying shears
- 4030 Hot/cold cut-off grinding machines
- 4040 Cold circular sawing machines
- 4050 Profile steel roller straightening machines
- 4060 Rotary saws
- 4065 Second-hand finishing lines
- 4070 Packing lines
- 4080 Hot straightening and cutting-off machines

07.08. Rolls for hot rolling mills

- 4090 Work rolls
- 4100 Plate rolls
- 4110 Ingot rolls
- 4120 Slab rolls
- 4128 EcoRolls
- 4130 Fine iron and wire rolls
- 4135 Ferrous cast rolls
- 4140 Forged rolls
- 4160 Chilled cast iron rolls
- 4170 Tungsten carbide \ 057steel rolls
- 4180 Caliber rolls
- 4190 Billet and semi-finished rolls
- 4200 Straightening rolls
- 4210 Ductile iron rolls
- 4220 Cast steel rolls
- 4230 Back-up rolls
- 4240 Composite casting rolls
- 4250 Composite casting rolls in high chrome and indefinite materials
- 4260 Composite chilled cast rolls
- 4270 Composite rolls
- 4280 Rolls for tube mills
- 4290 Roll rings

07.09. Roll machining and machines

- 4300 EDT systems
- 4320 High wear resistant coatings on rolls etc.
- 4330 Caliber processing machines
- 4340 Caliber groove grinding and milling machines
- 4350 Groove milling machines
- 4355 Ring expanders
- 4360 Special machines
- 4370 Roll machining machines
- 4380 Roll turning machines
- 4390 Roll grinding machines
- 4395 Roll grinding wheels
- 4400 Roll blasting machines
- 4410 Lines for roll forming
- 4420 Roll surface, services

07.10. Components

- 4430 Decoilers and rewinders
- 4432 Decoiler components
- 4440 Drives, gearboxes and comb mill stands
- 4450 Strip cooling equipment
- 4460 Belt grinding machines
- 4470 Brakes
- 4479 Coil magnets
- 4490 Nozzles for descaling
- 4500 Nozzles for roll cooling
- 4503 Roll cooling (stainless steel)
- 4510 Electric rolls and roller tables
- 4515 Scrapers for hot strip lines up to 1000 °C

- 4520 Descaling systems with solid abrasives
- 4528 Descaling systems with high pressure water
- 4530 Descaling systems with liquid abrasives
- 4540 Colors for marking equipment
- 4550 Paint marking systems
- 4560 Grease lubrication systems
- 4570 Scarfing systems, hot and cold
- 4580 Scarfing equipment, machines and plants
- 4582 Scarfing plants, robot controlled
- 4590 Gear rollers
- 4600 Semi-finished product testing, sorting and fettling lines
- 4610 Decoilers
- 4630 Edging and shifting devices
- 4640 Marking lines for plates, slabs and tubes
- 4650 Marking systems for profiles, strips and sheets
- 4660 Marking lines for slabs and blocks
- 4680 Compactor and press binding lines for wire rod
- 4690 Cooling beds
- 4700 Reading systems for automatic identification of impact and directly applied marks
- 4710 Oil-hydraulic setting devices
- 4720 Oil and emulsion circulation systems
- 4730 Roller tables
- 4740 Rotating and stationary shear blades
- 4750 Lubrication systems
- 4760 Quick change stands
- 4770 Safety device for electrolift magnets
- 4780 Marking inks
- 4790 Marking pins for hot surfaces
- 4800 Steel strapping
- 4810 Stamping machines
- 4820 Stamping machines and stamps for hot and cold operation (also fully automatic)
- 4830 Stamps and tools
- 4840 Transport equipment for wide strapping
- 4850 Strapping machines for coils
- 4860 Heat exchangers
- 4870 Roll transport devices
- 4880 Roll cooling systems, controllable
- 4890 Roll matting systems
- 4892 Roll guides
- 4893 Roll rings
- 4897 Weighing systems for coils and bundles

07.11. Operating fluids

- 4900 Lubricants for hot rolling mills

07.12. Services

- 4920 High wear resistant coating on rolls etc.

08 Forging, extrusion

- 4930 Engineering and technical assistance
- 4940 Modernization of water hydraulic control systems

08.01. Forging machines

- 4950 CNC precision forging machines
- 4960 Open-die forging lines
- 4970 Die forging lines

- 4980 Die spraying plants
- 4985 Hot isothermal forging plants (HIF)
- 4990 Hydraulic forging presses
- 5000 Cold extrusion presses
- 5020 Presses, general
- 5030 Pressing and forging machines
- 5040 Radial forging machines
- 5050 Radial and axial die rolling machines and plants
- 5060 Radial forging machines
- 5061 Radial forging machines, hydraulic
- 5070 Ring blank presses
- 5080 CNC precision forging machines
- 5084 Forging rolls
- 5090 horizontal forging machines, upsetting machines

08.02. Extrusion presses

- 5100 Metal pipe and tube extrusion presses
- 5110 Steel pipe extrusion presses
- 5120 Extrusion presses for profiles

08.03. Components

- 5130 Brakes
- 5150 Forging manipulators
- 5155 Forging manipulators, rail-mounted
- 5160 Forging robots
- 5180 Transport manipulators
- 5184 Water hydraulic drive and control technology

08.04. Operating materials

- 5190 Lubricants for extrusion presses
- 5195 Heat resistant sliding materials

09 Powder metallurgy

- 5200 Engineering and technical assistance
- 5210 Powder Metallurgy

09.01. Hard alloys

- 5220 Hard alloys, general
- 5230 Machinable and hardenable hard alloys

09.02. Hard materials

- 5290 Tungsten carbide

09.03. Hard metal powders

- 5300 Iron, steel, alloy powders, non-ferrous metal powders
- 5310 Carbide powder

09.04. Additives

- 5320 Binder metals
- 5330 Organic additives

09.05. Machines and equipment for powder production

- 5340 Machines and equipment for water atomization
- 5350 Machinery and equipment for melt atomization
- 5360 Machines and equipment for spray drying
- 5370 Powder manufacturers

09.06. Machines and equipment for production of powder metallurgical products

- 5370 Plants, complete
- 5380 Hot and cold isostatic presses and plants
- 5390 Metal powder presses
- 5400 Presses
- 5405 Powder presses, hydraulic, mechanical, hybrid
- 5410 Protective gas furnaces
- 5420 Vacuum furnaces
- 5422 Vacuum pumps, dry running, for vacuum furnaces

09.07. Powder metallurgy manufactured products

- 5430 PM metals/sintered metals
- 5432 PM rolling rings
- 5440 PM steels
- 5450 Composite materials

09.08. Further processing of powder metallurgy products

- 5460 Plasma powder cladding
- 5470 Thermal spraying

09.09. Additive manufacturing

- 5475 3-D printing
- 5476 Additive manufacturing processes

10 Cold rolling

- 5480 Engineering and technical assistance

10.01. Cold rolling mills

- 5490 Strip, sheet, cold and metal rolling mills
- 5510 cold rolling blocks for wire
- 5520 Cold rolling mills, complete
- 5523 Modernization of cold rolling mills
- 5530 Second-hand cold rolling mills
- 5540 Rolling mills for flat products

10.02. Skin pass mills

- 5550 Skin pass mills
- 5555 Skin pass mills for hot and cold strip

10.03. Finishing lines

- 5560 Finishing lines
- 5570 Finishing machines
- 5580 Strip edge trimming lines
- 5590 Strip processing lines
- 5595 Spreader rolls
- 5600 Slitting and cut-to-length lines
- 5610 Slitting and cut-to-length machines
- 5620 Straightening machines for strips and sheets
- 5630 Roller levelers
- 5640 Stretch levelers for strip
- 5650 Current guide rolls
- 5660 Packaging lines

10.04. Annealing lines

- 5668 Continuous annealing
- 5670 Annealing lines
- 5672 Annealing and pickling lines

- 5680 Annealing lines, inductive
- 5682 Annealing plants, continuous
- 5685 Modernization of annealing and pickling lines

10.05. Rolls for cold rolling mills

- 5686 Squeeze rolls
- 5690 Work rolls
- 5695 Spreader rolls
- 5700 Dressing rolls
- 5710 Polishing rolls
- 5715 Straightening rolls
- 5720 Straightening rolls
- 5730 Backing rolls
- 5750 Nonwoven rolls
- 5760 Rolls
- 5763 Roll sealing sleeves
- 5766 Roll core production and machining
- 5770 Rolls with polyurethane coating

10.06. Components

- 5780 Drives, gears and comb mill stands
- 5784 Strip guiding
- 5790 Tape remover
- 5800 Brakes
- 5803 Brake felt, stripper felt
- 5810 Letter and number types for stamping machines
- 5814 Labeling machines for rolled profiles (cold)
- 5830 Labeling machines
- 5840 Color marking machines
- 5845 Reel covers
- 5850 Reading systems for automatic identification of impact and directly applied characters
- 5860 Marking systems
- 5870 Oil circulation systems
- 5880 Rotating and stationary shear blades
- 5890 Marking inks for stamping machines
- 5900 Marking devices
- 5910 Marking pens for metals
- 5920 Steel strapping
- 5930 Stamping machines and stamps for hot and cold operation (also fully automatic)
- 5932 Roller cooling systems for high demands
- 5940 Heat exchangers
- 5950 Winding coils
- 5952 Weighing systems for bundles and coils

10.07. Operating materials

- 5960 Lubricants for cold rolling

11 Surface treatment

- 5970 Engineering and technical assistance
- 5980 Descaling of sheet metal parts
- 5988 Titanium processing

11.01. Descaling equipment

- 5990 Bend descaling for strip
- 6000 Bending descaling for wire
- 6010 Descaling systems with solid abrasives
- 6018 Descaling systems with high pressure water

- 6020 Descaling systems with liquid abrasives
- 6030 Free blasting systems
- 6040 Chamber blasting systems
- 6050 Shot peening systems
- 6060 Trough belt blast cleaning systems
- 6070 Roller table systems

11.02. Pickling plants

- 6080 Preparation of pickling baths
- 6088 Pickling lines, exhaust gas free, for stainless steel
- 6090 Pickling lines, complete
- 6100 Pickling lines for strip and wire
- 6109 Pickling tanks for high mechanical stress
- 6110 Pickling tanks and electrolysis cells for high mechanical stress
- 6120 Pickling baskets and hooks
- 6130 Pickling agents
- 6140 Pickling products for stainless steel
- 6150 Pickling products for stainless steels
- 6160 Pickling and surface treatment plants, general
- 6170 Pickling and surface treatment plants for wire
- 6180 Pickling additives
- 6190 Contract pickling plants
- 6192 Pumps for steel and stainless steel pickling
- 6200 Regeneration plants for pickling solutions
- 6203 Push pickling lines

11.03. Grinding and polishing machines

- 6210 Belt grinding machines
- 6230 Centrifugal grinding plants
- 6240 Polishing plants
- 6250 Drag grinding plants

11.04. Surface treatment plants

- 6260 Coil coating lines
- 6270 Strip edge trimming
- 6280 Strip processing and finishing lines
- 6282 Electrolytic strip pre-cleaning plants
- 6285 Strip washing lines
- 6290 Coating plants
- 6295 Burnishing plants and means
- 6300 CVD coating plants
- 6310 Services pickling and electropolishing of steel and stainless steel
- 6320 Oiling machines
- 6330 Electropolishing plants
- 6340 Deburring
- 6350 Deburring machines
- 6360 Color coating machines
- 6370 Paint spraying plants
- 6380 Vibratory finishing machines for surface treatment of metal parts
- 6386 High pressure water jet cleaning technology
- 6390 Shot peening
- 6400 Plastic coating plants
- 6410 Metal working equipment, electrochemical
- 6420 Metal degreasing lines
- 6430 Degreasing lines for metal strip
- 6440 Lines for cleaning and drying of metal
- 6450 Surface treatment, surface technology
- 6460 Surface treatment lines
- 6470 Surface drying, general
- 6480 Surface drying, inductive

- 6490 Surface finishing
- 6500 Phosphating plants
- 6510 Phosphating process
- 6520 Plasma CVD coating systems
- 6525 Plasma generators, power supply
- 6527 Blank washing systems
- 6530 Plating plants
- 6540 Plasma CVD systems
- 6550 PVD coating systems
- 6565 Blasting plants
- 6570 Pretreatment plants for galvanizing plants
- 6580 Water demineralization for surface treatment

11.05. Aluminizing, tin plating, galvanizing

- 6600 Equipment for hot-dip galvanizing and aluminizing of strip
- 6603 Equipment for hot-dip galvanizing, tin-plating and aluminizing of strip
- 6610 Electrolytic galvanizing equipment
- 6620 Electrolytic galvanizing lines
- 6630 Hot dip galvanizing lines
- 6640 Hot dip galvanizing lines, accessories
- 6642 Hot dip galvanizing lines, zinc bath equipment
- 6648 Galvannealing
- 6650 Galvannealing, inductive
- 6660 High current lines for electrolytic galvanizing plants
- 6670 Galvanizing
- 6675 Tin plating plants
- 6680 Tin fusion, inductive

11.06. Corrosion protection

- 6690 Linings and coatings
- 6700 Coatings, inorganic
- 6702 Coatings, overlays, expert opinions
- 6710 Burnishing and corrosion protection
- 6720 Oilers
- 6730 Electrophoretic dip coatings
- 6740 Rubber coatings
- 6744 Corrosion protection systems
- 6750 Corrosion and oxidation protection
- 6755 Oil felt
- 6760 Powder coatings
- 6770 Rust protection paints
- 6780 VPI/VCI corrosion protection papers and films

11.07. Components

- 6790 Nozzles (also blow-off and descaling nozzles)
- 6795 Rubber and PU reel covers
- 6800 Rubber and PU roller covers for the sheet metal finishing industry
- 6810 Rubber rollers for the sheet metal finishing industry
- 6820 Spray pipes
- 6826 Weighing systems for coils and bundles

11.08. Operating materials

- 6830 Chips and compounds for vibratory finishing
- 6840 Wire grit
- 6860 Electrocorundum abrasives
- 6865 Bonded coatings

- 6870 Metal cleaners
- 6880 Phosphating agents
- 6890 Blasting glass beads
- 6898 Steel blasting media
- 6900 Blasting media and technology, general

11.09. Services

- 6906 Large format surface grinding
- 6910 Contract finishing

11.10. Wear protection

- 6914 Ceramic wear protection
- 6916 Linings and coatings
- 6918 Wear protection, metallic
- 6919 Wear protection, general

12 Production of bright steel and wire

- 6920 Engineering and technical assistance
- 6925 Second-hand equipment

12.01. Wire rod mills

- 6930 Wire and fine steel rolling mills
- 6940 Wire stretching machines
- 6950 Guiding equipment for wire rod and fine iron rolling mills
- 6960 Rolling machines for flat wires and wire profiles

12.02. Wire, bar and profile drawing

- 6965 Drawing tools
- 6970 Wire drawing machines
- 6980 Wire drawing machines
- 6990 Bar and profile drawing machines
- 7000 Bar drawing benches

12.03. Finishing lines for drawing shops

- 7010 Automatic stirrup bending machines
- 7020 Combi automatic machines
- 7030 Wire straightening and cutting machines
- 7040 Rotary peeling machines for bars and wire
- 7050 Bar straightening and polishing machines
- 7060 Peeling machines for bars
- 7065 Grinding machines
- 7070 Grinding machines for bars

12.04. Components

- 7080 Binding machines for wire rod, concrete and bar steel
- 7090 Brakes
- 7100 Seals for rolling mills
- 7110 Wire cooling lines
- 7120 Wire coil and coiling machines
- 7140 Wire and bar pointing machines
- 7150 Electric rolls and roller tables
- 7160 Colors for marking equipment
- 7170 Ink marking systems
- 7180 Hook web systems
- 7200 Compactor and press binding systems for wire rod
- 7210 Reading systems for automatic identification of impact and directly applied characters

- 7220 Marking systems
- 7230 Marking inks
- 7235 Spools for winding and unwinding, rewinding
- 7240 Stamping machines and stamps for hot and cold operation (also fully automatic)
- 7250 Heat exchangers

12.05. Operating supplies

- 7270 Lubricants and process materials
- 7280 Drawing agents (greases, oils, soaps, etc.)

13 Production of tubes / pipes

- 7290 Engineering and technical assistance
- 7295 Second-hand equipment

13.01. Tube rolling mills

- 7300 Expanding mills
- 7310 Diescher rolling mills
- 7320 Forming mills
- 7330 Sizing mills
- 7340 Reducing mills
- 7350 Pipe and expander mills
- 7360 Pipe rolling mills with planetary piercing mill
- 7370 Pitch rolling mills
- 7380 Plug rolling mills
- 7390 Stretch-reducing mills

13.02. Tube drawing machines

- 7400 Continuous drawing machines
- 7410 Tube drawing machines
- 7420 Drum drawing machines
- 7430 Drawing benches

13.03. Pipe welding machines

- 7440 Longitudinal seam pipe welding machines
- 7450 Pipe welding plants
- 7460 Spiral pipe plants

13.04. Finishing lines for tubes

- 7480 Finishing lines
- 7490 Finishing lines for tubes
- 7495 Deburring machines for tubes, profiles and solid bars
- 7500 Travelling cut-off machines
- 7510 Straightening machines for tubes, sections and bars
- 7520 Tube bending machines
- 7530 Pipe end calibrating and upsetting presses
- 7540 Pipe deburring equipment
- 7542 Pipe deburring machines
- 7544 Pipe straightening machines
- 7550 Pipe straightening presses
- 7560 Pipe straightening and cutting machines
- 7570 Pipe grinding machines (internal and external)

13.05. Components

- 7580 Binding machines
- 7600 Colors for marking equipment
- 7610 Paint signing machines
- 7615 Cleaning machines for tubes, profiles and solids

7620 Pipe pointing machines
 7630 Pipe marking equipment
 7640 Pipe testing equipment
 7650 Pipe sawing machines
 7660 Pipe spooling machines
 7663 Automatic sawing machines
 7665 Technical brushes

14 Sheet metal processing

7690 CAD constructions
 7700 Spinning of sheet metal parts
 7710 Spinning of sheet metal parts
 7720 Engineering and technical assistance
 7730 Cold forming of sheet metal parts and panels

14.01. Plants, presses, machines

7740 Bending machines
 7750 Strip edge trimming machines
 7760 Strip straightening machines
 7765 Strip preparation lines for profilers
 7780 Sheet metal round bending machines
 7790 Sheet metal stacking machines, automatic
 7800 Sheet metal forming
 7810 Sheet metal working machines, general
 7820 Flanging machines
 7825 Pressure joining machines
 7830 Deburring machines
 7835 Deburring machines for tubes, profiles and solid bars
 7840 Die bending presses
 7845 Hot and cold riveting machines
 7848 Hydraulic high-pressure sheet metal forming presses and lines
 7849 Hydroforming (IHU)
 7850 Hydraulic presses and plants
 7860 Hydraulic presses for raw forming
 7868 Internal high pressure forming
 7870 Cold extrusion presses
 7880 Cold forming lines
 7882 Press feeding systems
 7910 Roller profiling lines
 7920 Round forming presses (presses)
 7921 Wobble forming presses
 7922 Special lines for coil processing
 7924 Punching and pre-punching lines
 7926 Dividing levelers
 7930 Deep drawing presses
 7940 Pre-rounding presses (presses)
 7945 Feed straightening machines
 7947 Roll feeders
 7950 Roll forming of strip
 7960 Tooling and sheet metal working machines, used

14.02. Slitting lines

7970 Strip slitting lines
 7980 Sheet metal cut-to-length and cut-to-length lines
 7990 Sheet metal cutting, laser cut
 7995 Slitting blades and accessories for slitting lines
 8010 Fine blanking lines
 8015 High pressure water jet cutting technology
 8020 Slitting and cut-to-length lines

8030 Slitting and cut-to-length machines
 8040 Laser cutting systems
 8050 Plasma cutting systems
 8070 Cut-to-length lines
 8072 Shears
 8075 Shears (standing and flying) for sheet metal working
 8080 Second-hand laser beam cutting machines
 8090 Blast machine performance tuning
 8100 Waste optimization systems

14.03. Welding technology

8110 Deposition welding on rollers etc.
 8115 Fire protection blankets made of textile fabric
 8120 Strip welding machines
 8130 Stud welding machines
 8140 Electron and laser beam welding (service)
 8150 Electron beam welding machines
 8170 Gouging machines
 8180 Lattice girder welding machines
 8190 Carbon electrodes (welding carbons)
 8200 Mould welding
 8205 Laser welding machines
 8210 Laser beam welding machines
 8215 Solder protection mats made of textile fabric
 8220 MIG, MAG and TIG \ 057TIG welding torches
 8230 Peripheral devices for robots
 8250 Repair of cracks and engravings
 8257 Rolling seam resistance welding equipment
 8260 Repair welding
 8280 Welding, general
 8288 Welding wire
 8290 Welding wire, stainless
 8300 Welding wire and filler metals (also from CuAl alloys)
 8310 Welding electrodes
 8312 Welding protection blankets made of textile fabric
 8314 Welding protection fabric up to 1250 °C
 8316 Welding protection mats and curtains made of textile fabric up to 1250 °C
 8318 Welding protection paste up to 1400 °C
 8320 Welding constructions
 8330 Welding machines, general
 8340 Welding robots
 8350 Welding technology, general
 8360 Welding accessories, general
 8363 Wire mesh welding
 8370 Sensor systems for automated welding
 8380 Butt welding machines, electric
 8400 Resistance welding equipment

14.04. Components

8410 Brakes
 8415 Color marking systems
 8420 Laser marking equipment
 8430 Plate stretcher
 8435 Profile Stretchers
 8440 Rotary shear blades and accessories
 8450 Cutting and punching tools
 8470 Marking pins for metals
 8480 Deep drawing tools

14.05. Services

8481 Electron and laser beam welding
 8482 Laser cutting of steels and sheet metal processing
 8483 Laser welding
 8484 Water jet cutting of steels
 8485 Tube laser cutting
 8486 Large format surface grinding

15 Steel products

15.01. Rolled steel

8489 Folded profiles, welded structural elements
 8490 Aluminized sheet (hot-dip aluminized or roll clad)
 8500 Aluminum-zinc coated steel sheet
 8510 Antiphon sheets
 8520 Elevator guide rails
 8530 Strip steel, hot rolled
 8540 Machined sheet
 8550 Container bottoms
 8560 Coated sheet (painted, foil coated)
 8570 Reinforcing steel
 8580 Reinforcing steel in coils, cold-rolled
 8590 Reinforcing steel in coils, hot rolled
 8600 Reinforcing steel in bars
 8610 Reinforcing steel in bars and coils
 8620 Reinforcing steel (stainless)
 8630 Wide strip, organically coated
 8640 Wide strip, cold rolled
 8650 Wide strip, hot and cold rolled
 8660 Wide flat steel
 8670 Wide-flange beams
 8672 Cellform beams
 8680 Electrical sheet and strip
 8690 Enameled steel sheet
 8700 Thin sheet in further processed special designs
 8710 Thin sheet, cold-rolled
 8720 Thin sheet, surface finished
 8740 Sheet products, laser welded
 8750 Sheet products, mash-seam welded
 8760 Flat steel
 8769 Sectional steel
 8770 Shaped steel (incl. pit lining)
 8780 Welded sections
 8790 Heavy plate
 8795 Heavy plate blanks
 8800 Heavy plate products, pressed, dimpled, bent, edge-finished
 8810 Heavy and medium plate, incl. lining plate
 8820 Semi-finished products
 8830 Semi-finished products, continuously cast
 8831 Semi-finished products, continuously cast, ingot
 8840 Semi-finished products for rolling
 8850 Semi-finished products for forging
 8860 Superstructure material
 8870 Clad steel sheet
 8880 Rails
 8890 Shipbuilding material
 8900 Shipbuilding profiles
 8910 Forging semi-finished products
 8915 Forged bars
 8920 Slit strip

- 8922 Slit strip, surface finished
- 8930 Cold drawn special steel sections
- 8940 Special profiles, hot rolled
- 8950 Special profiles, hot rolled and drawn for lift trucks, vehicle, machine and pipeline construction
- 8960 Special profiles, hot extruded
- 8970 Bar steel (quality, case-hardened, quenched and tempered, spring, free-cutting)
- 8975 Bar steel (angle steel)
- 8976 Steel bars (stainless steel, all dimensions)
- 8980 Steel sheet piling sections (box piles and accessories, driven steel piles)
- 8981 Steel sheet piling sections (box piles and driven steel piles)
- 8985 Steel sheet pile sections, box piles, steel piles, anchoring and accessories
- 8990 Continuous cast billets
- 8992 Trapezoidal profiles - PUR and mineral wool, sandwich elements, acoustic elements, cassettes
- 9010 Galvanized steel strip
- 9020 Galvanized profiled steel sheet
- 9030 Galvanized steel sheet in sheets and rolls, galvanized strip steel
- 9040 Honeycomb beams, machined beams
- 9050 Wire rod
- 9060 Wire rod, flat or round
- 9070 Wire rod, round
- 9080 Wire rod in spring steel grades
- 9090 Wire rod in cold heading grades
- 9100 Wire rod in welding wire grades
- 9130 Rolled steel
- 9140 Hot wide strip
- 9150 Tinplate and strip, ultra-fine sheet and strip, tin-plated sheet and strip, special chrome-plated ultra-fine sheet and strip (ECCS)
- 9160 Y-sleepers

15.02. Pipes

- 9170 Fittings for pipes, stainless
- 9180 Large-diameter pipes
- 9190 Large diameter tubes, spiral welded
- 9200 Boiler tubes
- 9220 Flanges, stainless
- 9230 Oilfield tubes
- 9260 Clad tubes
- 9270 Precision steel tubes, welded
- 9280 Precision steel tubes, seamless and welded (round, oval, square, rectangular and as special sections)
- 9290 Precision steel tubes, seamless and welded, with surface finishing such as electrogalvanizing, chromating, phosphating, etc.
- 9300 Tubes prematerial (round and square)
- 9310 Tubes
- 9320 Tubes made of degussite
- 9330 Tubes made of cold-tempered steels, weldable fine-grained steels
- 9332 Tubes, ceramic
- 9334 Tubes of circular or square cross-section
- 9335 Tubes, circular or square cross-section, hot-dip galvanized
- 9340 Stainless steel tubes
- 9345 Pipe parts and components

- 9350 Tube products (U-tubes, also with special radii, coil systems, etc.)
- 9360 Centrifugally cast tubes (also made of stainless steel)
- 9370 Special section tubes, welded, cold-rolled
- 9380 Steel drainage pipes, hot-dip galvanized
- 9390 Steel pipes, machined
- 9400 Steel pipes, welded
- 9410 Steel tubes, seamless
- 9420 Door reinforcement tubes, welded
- 9430 Door reinforcement tubes, seamless
- 9440 Cylinder tubes

15.03. Forgings

- 9450 vessels (flanges, nozzles, etc.)
- 9460 Products for general engineering (crankshafts, tools, gears, etc.)
- 9470 Products for power engineering (generator parts, turbine parts, etc.)
- 9480 Products for aircraft engine construction (e.g. compressor blades, disks)
- 9490 Products for shipbuilding
- 9500 Open die forgings, general
- 9510 Die forgings, general
- 9520 Seamless rolled rings
- 9530 Forgings, general
- 9532 Non-ferrous forgings (copper and copper alloys, aluminum alloys)

15.04. Railroad rolling stock

- 9540 Axles
- 9550 Wheel tires

15.05. Steel in the following delivery forms

- 9560 Structural steels, general
- 9570 engineering steels, case-hardening steels, quenched and tempered steels, surface-hardening steels, low-temperature steels, cold-heading steels, fine-grained steels, steels resistant to compressed hydrogen
- 9580 Stainless steel special remnants (Ia and IIa quality)
- 9590 Stainless steels
- 9600 Case hardening steels, foreign standard steels, wear resistant steels
- 9610 Case-hardened steels, nitriding steels, spring steels, foreign standard steels, wear-resistant steels
- 9618 ESU remelted steels
- 9620 Spring steel wire, stainless
- 9625 Thin sheets
- 9630 High temperature steels and alloys
- 9635 Perforated plates
- 9638 Cold rolled sections
- 9640 Stainless bars and tubes
- 9641 Stainless bars
- 9642 Special sections, hot rolled, hot extruded or drawn
- 9650 Stainless, acid and heat resistant steels
- 9655 Stainless, acid and heat resistant steels and alloys
- 9660 Stainless, acid- and heat-resistant steels and alloys, also heating conductor and resistance alloys
- 9670 High-speed steels
- 9680 Special structural steels, alloyed, weldable

- 9685 Engineering steels, alloyed, weldable
- 9690 Steels with special physical properties
- 9696 Chromium-plated steels
- 9700 Pre-machined steels in bars and plates, rough milled, fine milled, ground
- 9710 Rolling bearing steels
- 9714 Mild unalloyed steels
- 9718 Tool steels, hardened
- 9720 Tool steels, alloyed and unalloyed

15.06. Drawing and cold rolling mill products

- 9730 Bright steel (including free-cutting bright steel, bright steel shafts, bright special sections)
- 9740 Spring steel strip
- 9750 Cold rolled strip
- 9751 Hardened strip steel
- 9755 Cold rolled strip, coated
- 9760 Cold rolled strip with bright surface
- 9770 Cold rolled strip with refined surface
- 9780 Cold rolled clad strip
- 9790 Cold rolled profiles from hot rolled or cold rolled strip
- 9800 Cold rolled profiles with refined surface
- 9810 Body parts
- 9814 Sheet metal formed parts
- 9817 Precision strip steel
- 9820 Pressed, stamped and drawn parts
- 9830 Steel strip for packaging purposes
- 9838 Tailored beams
- 9840 Tailored blanks (sheet blanks)
- 9850 Formed tube and sheet components for the automotive industry
- 9860 Drawing and cold rolling mill products
- 9870 Cylinder tubes for hydraulics and pneumatics

15.07. Wire and wire products

- 9880 Anchor steel, screwable
- 9885 Structural steel mesh
- 9890 Reinforcing wire, reinforcing mats, pit mats
- 9900 Reinforcing meshes for reinforced concrete
- 9920 Wire meshes
- 9930 Wire mesh
- 9932 Wire mesh
- 9950 Wire ropes and strands
- 9960 Wire and wire products
- 9970 Iron, free-cutting, cold extrusion and cold heading wires
- 9980 Iron fine and superfine wires
- 9990 Iron and steel wire, drawn
- 10000 Spring steel wire, oil hardened
- 10010 Spring steel wire, unalloyed
- 10015 Profile wire
- 10020 Flat and shaped wires
- 10025 Threaded steel
- 10030 Other wire products
- 10035 Prestressing steel
- 10040 Prestressing steel, prestressed concrete strands
- 10050 Galvanized and PVC coated iron wire

15.08. Steel construction

- 10058 Car lifts, mobile
- 10060 Automatic reinforcement station
- 10070 Sheet metal structures

- 10080 Bridge construction
- 10090 Hall construction
- 10100 Masts
- 10110 Steel construction, general
- 10115 Joining technology in steel construction, general
- 10120 Steel construction, general
- 10130 Assembly hall construction

15.09. Services

- 10140 Deep hole drilling, contract
- 10141 Deep hole drilling, horizontal
- 10145 Forming and smoothing
- 10146 Cutting tool steel

16 Furnace and energy technology

- 10150 Engineering and technical assistance
- 10152 Waste gas systems behind electric arc furnaces
- 10154 Waste heat systems behind walking beam furnaces and pusher furnaces
- 10160 Complete heating systems
- 10170 Furnace optimization (conversion to low NOx combustion)
- 10180 Process control systems for industrial furnaces and energy plants
- 10190 Rational use of energy

16.01. Rolling mill furnaces

- 10200 Deep annealing furnaces
- 10210 Rolling mill furnaces, induction
- 10220 Rolling mill furnaces

16.02. Forging furnaces

- 10230 Forging furnaces
- 10240 Forging furnaces, gas fired
- 10250 Forging furnaces, induction

16.03. Roller Hearth Continuous Furnaces

- 10260 Roller Hearth Continuous Furnaces
- 10270 Roller hearth and walking beam furnaces

16.04. Continuous furnaces for wide strip

- 10280 Strip heating, inductive
- 10290 Strip edge heating, inductive
- 10300 Continuous furnaces for wide strip

16.05. Top-hat furnaces

- 10310 Top-hat furnaces
- 10320 Top and pot annealing furnaces

16.06. Vacuum furnaces

- 10330 Vacuum annealing furnaces
- 10340 Vacuum hardening furnaces
- 10341 Vacuum pumps, dry running, for vacuum furnaces

16.07. Hardening and tempering equipment

- 10350 Quenching baths
- 10355 Carburizing furnaces
- 10360 Hardening furnaces

- 10370 Hardening plants, general
- 10375 Hardening and tempering plants, electrically heated
- 10380 Hardening and tempering plants, gas heated
- 10390 Hardening and tempering plants, with inductive heating
- 10400 Hardening and tempering plants, with resistance heating
- 10401 Laser hardening systems
- 10403 Nitriding furnaces

16.08. Heating furnaces and heat treatment plants

- 10408 Continuous furnaces
- 10410 Co-step furnaces
- 10420 Hardening furnaces
- 10430 Bogie hearth furnaces
- 10440 Induction heating plants
- 10450 Industrial furnaces, used
- 10460 Chamber furnaces
- 10470 Conductive heating plants
- 10480 Furnaces with mechanically driven hearth
- 10490 Patenting plants for wire
- 10500 Plasma nitriding plants
- 10505 Radiators
- 10510 Roller hearth and walking beam furnaces
- 10520 Pit furnaces
- 10530 plug furnaces
- 10540 Pusher-type, roller and rotary hearth furnaces
- 10545 Tempering and drying plants
- 10550 Vertical and horizontal strip furnaces for heat treatments
- 10560 Heat treatment plants
- 10562 Heat treatment furnaces (continuous and discontinuous)
- 10570 Heat treatment furnaces for batch operation, open heated

16.09. Bath furnaces

- 10580 Aluminum melting furnaces
- 10582 Aluminum melting and holding furnaces
- 10590 Furnaces and plants for lead coating, galvanizing and tinning
- 10600 Salt and metal bath furnaces

16.10. Industrial furnaces for special purposes

- 10610 Furnaces for the ceramic industry
- 10615 Lime kilns
- 10620 Inert gas, vacuum furnaces
- 10630 Tempering furnaces
- 10640 Drying furnaces for casting cores, molds and mold covers
- 10650 Drying furnaces for stopper rods
- 10652 Microwave ovens/dryers
- 10660 Accessories for industrial furnaces

16.11. Protective gas plants

- 10670 Protective gas plants

16.12. Insulations

- 10680 Block insulation
- 10690 Firing pads
- 10700 Calcium silicate

- 10710 Insulation materials
- 10720 Vibration protection
- 10730 Backing insulation
- 10732 Electrical insulation systems for arc furnaces and transformer houses
- 10735 Heat protection and insulation products
- 10740 Insulating and sealing boards, asbestos-free
- 10744 Insulating fabrics up to 1260 °C
- 10746 Insulating cords, tapes, packings and hoses up to 1260 °C
- 10748 Support arm insulations, asbestos-free
- 10750 Insulating bricks
- 10760 Cooling pipe insulations
- 10770 Furnace components
- 10780 Sound insulation
- 10790 Vibration insulation
- 10800 Thermal insulation
- 10803 Wool felt for bright annealing furnaces

16.13. Components

- 10805 Exhaust technology
- 10810 Bath rollers
- 10820 Belt coolers, belt dryers
- 10830 Block pressers
- 10840 Block and slab pushers for heating furnaces
- 10850 Burners for gas and oil
- 10860 Custom-made burners
- 10870 Feeding and discharging machines
- 10880 Electric heaters
- 10890 Natural gas burners
- 10895 Furnace probes (for the use of video cameras)
- 10900 Gas burners
- 10910 Generators for protective and reaction gases
- 10915 Hardeners
- 10920 Heating conductors
- 10930 Hearth rollers
- 10950 pulverized coal furnaces (also -plants)
- 10960 Laser light barriers
- 10970 Oil burners
- 10990 Furnace riders
- 11000 Furnace rollers
- 11005 Plasma generators
- 11010 Regenerative burners
- 11020 Recuperative burners
- 11028 Recuperators
- 11030 Recuperators, regenerators
- 11040 Rollers (e.g. from SIC)
- 11050 Safety devices for EAF oxygen-fuel burners
- 11060 Jet tubes
- 11070 Radiant tube burners
- 11078 Vacuum pumps, dry running, for vacuum furnaces
- 11080 Heat exchangers
- 11090 Heat recovery systems
- 11092 Weighing systems for melting furnaces
- 11093 Wool felt for bright annealing furnaces

16.14. Operating materials

- 11110 Hardening agents (also hardening powders and carbon restoration agents)
- 11120 Hardening oils
- 11150 Fire-resistant hydraulic fluids

- 11160 Polymer solutions
- 11170 Lubricants
- 11180 Spray cleaners
- 11190 Heat transfer fluids

16.15. Services

- 11200 Energy consulting
- 11210 Energy saving
- 11215 Commissioning, maintenance and service of heating equipment
- 11240 Planning and projecting of energy-technical plants

17 Refractory technology

- 11245 Product know-how for basic refractory bricks and mixes
- 11248 Monitoring of refractory components

17.01. Raw materials, precursors and binders for refractory materials

- 11250 Aluminum hydroxide
- 11260 Alumina, alumina
- 11263 Reinforcing wires for refractory mixes
- 11265 Binders for the production of refractory materials
- 11270 Electrocorundum
- 11280 Graphite
- 11290 Adhesive sand
- 11300 Coke breeze
- 11310 Coke breeze, dry
- 11320 Magnesium oxide
- 11330 Microsilica
- 11360 Silicon carbide
- 11366 Titanium dioxide
- 11370 Clays
- 11380 Alumina specialties
- 11390 Zirconia

17.02. Plants for the production of refractory materials

- 11400 Equipment for the production of refractory materials

17.03. Refractory materials and equipment

- 11410 Tapping stones for converters and electric arc furnaces
- 11420 Painting, filling and plastering materials
- 11430 Basic ramming, gunning and casting mixes
- 11440 Basic bricks (magnesia, magnesia-chromium, chromium ore, chromite, dolomite, spinel, forsterite and carbon bricks)
- 11450 Calcium silicate
- 11460 Dolomite products
- 11470 Electrode masses
- 11480 Fiber ceramic moldings, vacuum formed
- 11481 Fiber ceramic moldings, vacuum formed, up to 1750 °C
- 11485 Fiber mats and felts up to 1600 °C
- 11490 Fiber products, ceramic
- 11500 Prefabricated parts, refractory
- 11510 Refractory concrete

- 11512 Refractory concrete, high strength, for industrial floors
- 11520 Refractory products, general
- 11530 Refractory ramming mixes
- 11540 Refractory anchorages
- 11550 Refractory material
- 11560 Lightweight refractory bricks
- 11570 Lightweight refractory and insulating mixes
- 11580 Lightweight refractory and insulating bricks
- 11590 Gas purging equipment, refractory
- 11600 Pouring mixes, self-flowing
- 11610 hearth masses
- 11620 High-fire bricks
- 11630 Blast furnace bricks
- 11640 Induction furnace mixes
- 11650 Insulating material, asbestos-free
- 11660 Isostatically pressed products
- 11670 Carbon and graphite bricks
- 11690 Converter bricks
- 11700 Arc furnace bricks
- 11710 Perforated bricks
- 11720 Masses, refractory (general)
- 11725 MgO-C bricks
- 11730 Mortars and mastics, refractory
- 11740 Mux masses
- 11750 Ladle masses
- 11752 Torpedo ladle lining
- 11755 Ladle lining, monolithic
- 11760 Ladle bricks
- 11768 Products made of \ 050HTW \ 051 high temperature wool
- 11790 Gutter and taphole masses
- 11800 Gutter lining, cooled
- 11810 Acid resistant bricks
- 11820 Acid ramming and centrifugal masses
- 11830 Firebricks
- 11840 Shadow pipe
- 11850 Slide gate ceramics
- 11860 Cast basalt
- 11865 Protective blankets made of textile fabric, refractory
- 11870 Silicon carbide bricks
- 11880 Silica bricks, tondina bricks
- 11886 Special adhesives up to 1200 °C
- 11890 gunning and repair compounds
- 11900 Steel mill wear material
- 11910 ramming, casting and vibrating masses
- 11915 ramming, spraying and casting compounds
- 11920 Stoppers and spouts
- 11930 Continuous castings, refractory
- 11940 Immersion tube, monota immersion spout
- 11950 Technical ceramics
- 11960 High-alumina bricks (andalusite, bauxite, corundum, mullite, sillimanite bricks)
- 11970 Torpedo mixer stones
- 11980 Tundish masses
- 11985 Pouring compounds, cement-free, for blast furnace tapping troughs
- 11990 Vermiculite
- 12000 Thermal insulation materials, asbestos-free
- 12004 Vacuum formed parts
- 12005 Vacuum formed parts, without ceramic fibers
- 12010 Wollastonite

- 12020 Zircon nozzles
- 12030 Zircon containing stones
- 12040 Zircon sand / flour)

17.04. Processing of refractory materials

- 12050 Processing of used refractory materials
- 12060 Testing of FF materials

17.05. Machines for refractory construction

- 12070 break-out hammers, pneumatic and hydraulic, for electric furnaces, converters, ladles and troughs
- 12071 Excavation robots
- 12075 Chipper
- 12080 Converter tap hole repair vehicles
- 12095 Converter lining devices
- 12100 Manipulators for FF masses
- 12110 Ladle spraying machines
- 12118 Pumping machines for refractory materials
- 12120 Pumping machines for refractory materials
- 12130 Centrifugal machines for FF-masses
- 12140 Spraying machines for FF materials
- 12150 Tamping plants, autom., for ladles

17.06. Refractory construction

- 12160 lining of all kinds of furnaces
- 12170 Firing chambers
- 12175 Refractory anchors
- 12180 Refractory construction
- 12190 Refractory ramming mixes
- 12200 Suspended ceilings

17.07. Services

- 12204 Training - Refractory
- 12205 Refractory maintenance at operating temperature
- 12206 Refractory systems

18 Machinery and plant engineering

- 12210 Plant engineering, general
- 12220 CAD design
- 12230 Engineering and technical assistance
- 12240 beams, columns, shafts
- 12250 Industrial Engineering
- 12258 Standard parts for cutting and punching tool construction
- 12260 Cleaning and cleaning materials
- 12270 Second-hand machines (purchase and sale)
- 12280 Special constructions
- 12285 Heat exchangers
- 18.01. Mining equipment, machines and supplies**
- 12290 Plants and machines for underground mining
- 12300 Bucket elevators
- 12309 Conveyor systems
- 12310 Conveying plants and machines
- 12330 Mine support profiles

18.02. Chemical plants and accessories

- 12350 Tank and apparatus construction
- 12360 Liquid gas - storage stations
- 12370 Gas tanks
- 12390 Acid chimneys
- 12400 Acid and chemical resistant plants and equipment
- 12410 Nitrogen production plants

18.03. Steam generation plants and equipment

- 12425 Exhaust gas technology
- 12430 Waste heat boilers
- 12440 Steam filters
- 12450 Steam boilers, general
- 12460 Pressure boilers
- 12470 Hydrazine removal
- 12480 Pulverized coal firing systems

18.04. Foundry equipment, machinery and supplies

- 12354 Casting ladles
- 12500 Molding machines
- 12530 Foundry equipment, machines and supplies
- 12535 Foundry tools
- 12540 Foundry consulting and engineering
- 12542 Foundry software
- 12550 Core shooters
- 12560 fettling machines
- 12570 Robots
- 12580 Sand mixers
- 12586 Melting furnaces, inductive
- 12590 Shaking ladles
- 12592 Crucible tongs
- 12605 Vacuum investment casting plants-super alloys
- 12607 Vacuum investment casting plants with cold crucibles for titanium or titanium alloys

18.05. Power plants and power stations

- 12610 Power plants and power stations, steam
- 12620 Power plants and power stations, electric

18.06. Ventilation plants and equipment

- 12630 Blowers
- 12635 Industrial fans
- 12650 Air conditioners, general
- 12660 Air conditioners for heat plants
- 12670 Air conditioners for crane lances, crane bridges, etc.
- 12690 Expansion joints
- 12700 Ventilation ducts
- 12710 Ventilation systems and equipment, general
- 12720 Natural ventilation
- 12730 Induced draught systems and equipment
- 12740 Ventilators

18.07. Water treatment plants, equipment and accessories

- 12750 Chemical water treatment
- 12760 Pressurized water plants and accumulators
- 12770 Filtering plants for circulating water
- 12780 Rubber compensators

- 12790 Cooling towers
- 12793 Cooling water / circulating water systems
- 12796 Magnetic filters
- 12800 Press water additives
- 12810 Water treatment systems
- 12830 Water demineralization, treatment and recycling
- 12840 Water recooling systems
- 12846 Water filtration

18.08. Other plants

- 12848 Chillers
- 12850 Slag granulation hoses
- 12860 Slag recycling plants (also slag granulation plants)
- 12862 Slag granulation plants
- 12870 Lube oil plants

18.09. Maintenance

- 12880 Spare parts and consumables
- 12890 Maintenance, general
- 12892 Maintenance organization
- 12894 Maintenance systems
- 12896 Repair, overhaul and modernization of machine tools
- 12900 Maintenance of large gear units
- 12920 Maintenance of continuous casting plants for ingots and slabs
- 12930 Maintenance of continuous casters for ingots and billets
- 12950 Repair of ingot molds
- 12960 Repair of ingot molds
- 12964 Cooling system cleaning
- 12970 Ladle repair, FF
- 12980 Repairs, spare parts
- 12983 Software for maintenance
- 12990 Preventive maintenance
- 13000 Heat exchanger cleaning
- 13010 Condition based machine maintenance

18.10. Power and work machines

- 13020 Steam turbines
- 13021 Gas turbines
- 13030 Rotary compressors
- 13040 Compressed air equipment
- 13050 Natural gas, gas transmission compressor stations
- 13060 Natural gas HP storage
- 13070 Piston pumps
- 13080 Piston compressors
- 13083 Corrosion resistant pumps
- 13090 Centrifugal pumps
- 13100 Mixing units for all fuel gases
- 13120 Lubrication pumps
- 13130 Screw compressors
- 13150 Turbo compressors
- 13160 Vacuum pumps

18.11. Gearboxes and drive elements

- 13168 Drive elements
- 13170 Drive engineering
- 13174 Valve gearboxes
- 13180 Brakes
- 13190 Brake disc mounting
- 13195 Torque limiter
- 13200 Flange couplings

- 13210 Cardan joints
- 13220 Cardan shafts
- 13230 Gear rollers
- 13240 Gearboxes and drive elements
- 13250 Large gearboxes
- 13255 Chain drives and sprockets
- 13260 Hirth serration
- 13261 Hirth spur gearing
- 13270 Couplings
- 13285 Couplings, flexible, elastic
- 13290 Couplings, mechanical and hydrodynamic
- 13300 Planetary gearboxes
- 13308 Slew drives
- 13310 Safety couplings
- 13318 Spindles
- 13320 Special constructions
- 13350 Shaft-hub couplings (backlash-free)
- 13360 Shaft couplings (rigid)
- 13370 Winding shafts
- 13380 Gear drives
- 13390 Gear wheels
- 13395 Gearbox repairs

18.12. Bearings

- 13400 Slewing rings
- 13404 Elastomeric bearings
- 13406 Spherical plain bearings / rod ends
- 13410 Plain bearings
- 13420 Ceramic-metal compact plain bearings
- 13430 Ball bearings
- 13440 Cam rollers
- 13460 Linear systems
- 13470 Roller bearings
- 13480 Yoke type track rollers
- 13484 Thermal separation
- 13485 Support and guide rollers
- 13490 Rolling bearings
- 13492 High-temperature rolling bearings
- 13500 Roller bearings

18.13. Oil hydraulic systems, equipment and accessories

- 13508 Rotary distributors
- 13510 Rotary feeders
- 13520 Pressure measuring, switching and writing devices
- 13530 Pressure switch
- 13540 High pressure flange connectors
- 13550 Hydraulic systems
- 13560 Hydraulic and shaft seals
- 13570 Hydro gears
- 13580 Hydro motors
- 13590 Hydro pumps
- 13595 Hydraulic accumulators
- 13600 Hydro valves
- 13610 Hydraulic cylinders
- 13620 Oil hydraulic systems, devices and accessories
- 13630 Vibration dampers
- 13640 Servo valves
- 13645 Continuous valves
- 13660 Complete plants, oil hydraulic
- 13670 Water hydraulic

18.14. Control systems and components

- 13680 Shut-off valves

- 13690 Automatic inflow control with distribution gate valves
- 13695 Torque limiters
- 13710 Electro-hydraulic actuators
- 13718 Electro-servo cylinders
- 13720 Multipoint single and multi-purpose regulators
- 13730 Control systems, complete
- 13740 Control valves
- 13760 Actuators
- 13780 Continuous single and multi-purpose regulators

18.15. Piping and accessories

- 13786 Exhaust gas technology
- 13790 Butterfly valves
- 13800 Asbestos-free fabric expansion joints
- 13810 Fittings
- 13820 Flanges
- 13840 Rubber expansion joints
- 13850 High pressure pipe technology
- 13859 Safety valves
- 13860 Expansion joints
- 13890 Pipe break safety valves
- 13900 Pipe swivels
- 13910 Piping and accessories
- 13920 Pipeline construction
- 13930 Piping accessories
- 13940 Check valves
- 13945 Hoses
- 13947 Flexible hoses with ceramic wear protection
- 13950 Plug-in disc gate valves

18.16. Stranding machines

- 13955 Stranding machines
- 13958 Rope making machines

18.17. Tool and model making

- 13956 Mold frames, mold assemblies
- 13960 Materials for model and prototype construction
- 13970 Model and prototype making

18.18. Machine tools

- 13980 Cutting-off machines
- 13990 External thread cutting machines
- 14000 Band sawing machines
- 14010 Bending and straightening machines
- 14015 Slab sawing machines
- 14020 Wire working and processing machines
- 14030 Flow-forming machines
- 14040 Milling machines
- 14060 Spark erosion machines
- 14070 honing and lapping machines
- 14080 Cable sheathing presses
- 14081 Cable sheathing presses (lead and aluminum)
- 14088 Sharpening machines
- 14090 Cold circular saws
- 14095 Hot circular saws
- 14100 Mould processing machines
- 14120 profile and flat shears
- 14130 Shears (standing, flying) for metallurgical operations
- 14140 Shears (standing, flying) for sheet metal working

- 14150 Shearing centers
- 14160 Grinding and polishing machines (also internal)
- 14170 Special machines for chip forming
- 14180 Special machines for chipless forming
- 14190 Special machines for special tasks
- 14195 Concrete sawing machines
- 14200 Stone cutting saws
- 14210 Plate shears
- 14220 Cut-off machines

18.19. Tools

- 14230 Press brake tools
- 14240 Drills
- 14242 Taphole drilling tools
- 14250 Diamond tools
- 14260 Pneumatic tools
- 14280 Carbide (also metal carbide)
- 14290 Tungsten carbide inserts and molded parts
- 14300 Carbide tools
- 14302 HM tipped saw blades
- 14304 HP grinding wheels
- 14306 Saw bands and blades for metallic and non-metallic materials
- 14310 Saw blades for metal
- 14318 Cutters
- 14320 Shear blades
- 14323 Splitting knives and accessories for splitting lines
- 14330 Abrasives and grinding wheels
- 14334 Special tools for die casting industry
- 14336 Cutting wheels
- 14337 Roll grinding wheels
- 14338 Cutting and special tools

18.20. Clamping technology

- 14380 Clamping hydraulics
- 14400 Clamping elements
- 14401 Clamping tools, screws

18.21. Components

- 14410 Seals
- 14412 Seals with high chemical and thermal resistance
- 14420 Rotary seals for feeding gases or liquid media
- 14430 Cooling water circulation units for continuous casting-rolling lines
- 14440 Nozzles (also blow-off and descaling nozzles)
- 14450 Pistons
- 14460 Metal hoses
- 14470 Buffers (rubber and cellular buffers)
- 14480 Stuffing box packings
- 14490 Wear plates

18.22. Operating fluids

- 14500 Solid lubricants
- 14510 Industrial oils
- 14520 Cooling lubricants

18.23. Tribology

- 14522 Dosing and monitoring equipment for lubricants

- 14523 Oil circulation systems for bearing and gear lubrication
- 14524 Two-line grease lubrication systems for metallurgical plants and rolling mills
- 14525 Special lubricants
- 14526 Central lubrication systems
- 14527 Machines for degreasing and lubrication

18.24. Services

- 14528 Service for compressors and turbines
- 14529 Mechanical processing of hydraulic parts

19 Transport and storage technique

- 14530 Engineering and technical assistance
- 14535 Hot material conveyors
- 14540 Transport and logistics for industrial residues
- 14545 Hot material conveyors
- 14548 Transport
- 14550 Transport technology

19.01. Metallurgical plant vehicles

- 14560 Slab, bloom and billet transporters, rubber tires
- 14570 Coil transport systems
- 14580 Coil transporters
- 14590 Steel mill vehicles, general
- 14600 Metallurgical plant vehicles, track-bound
- 14605 Air cushion vehicles-FTS
- 14610 Slag ladle transporters
- 14620 Slag transporter
- 14630 Scrap transport trailers with weighing equipment
- 14640 Steel mill vehicles

19.02. Rail vehicles

- 14650 Diesel locomotives
- 14660 Railroad wagons
- 14670 Self-propelled wagons

19.03. Track technology

- 14680 Turntables and transfer cars
- 14684 Track technology
- 14690 Shunting systems

19.04. Trackless vehicles

- 14700 Trailers
- 14705 Trucks and trailers
- 14720 Electric industrial trucks
- 14730 Electric trucks
- 14734 Electric four-way sideloaders
- 14740 Driverless transport systems
- 14742 Driverless transport systems for steel and aluminum coils
- 14750 Forklifts and cross stackers
- 14760 Rubber-tired heavy-duty transport vehicles
- 14810 Heavy-duty tractors
- 14820 Telescopic excavators
- 14822 Transport systems for coils

19.05. Continuous conveyors

- 14830 Conveyors (general)

- 14840 Pneumatic conveyors
- 14850 Vibratory conveyors
- 14860 Vertical conveyors
- 14880 Steep conveyors
- 14890 Continuous conveyors for bulk material
- 14900 Continuous conveyors for piece goods
- 14910 Conveyor belts and screws
- 14920 Trough chain conveyors

19.06. Cranes

- 14930 Slewing cranes
- 14940 Casting cranes
- 14945 Crane systems, automatic
- 14946 High capacity automatic cranes
- 14950 Cranes, hoists and accessories, general
- 14955 Crane service
- 14960 Overhead travelling cranes
- 14970 Gantry cranes
- 14980 Bracket cranes
- 14990 Buffers
- 14992 Vacuum lifting devices for heavy industry
- 14993 Automatic stacking devices (vacuum lifting devices)

19.07. Scales

- 14997 Bundle and coil scales
- 15000 Batching and blending scales
- 15010 Track and truck scales
- 15020 Crane scales
- 15030 Roller table scales
- 15040 Scales for continuous weighing
- 15041 Scales for alloying elements
- 15042 Scales for pig iron
- 15043 Scales for scrap
- 15044 Scales for static weighing
- 15045 Scales for stationary weighing
- 15050 Weighing systems for ladle turrets and ladle cars
- 15060 Load cells
- 15080 Weighing systems for silos

19.08. Storage and retrieval systems

- 15090 Bund high-bay warehouse
- 15100 Container staging systems
- 15110 Labeling systems
- 15120 Lattice girder storage systems
- 15130 Manual overhead conveyors
- 15134 Aerial work platforms
- 15140 Storage technology and automation systems for sheet metal, long goods and stacking boxes
- 15141 Storage technology and automation systems for sheet metal, long goods and stacking boxes
- 15150 Storage and retrieval systems
- 15155 Storage systems for coils
- 15160 Storage and racking systems
- 15164 Long goods order pickers, high rack stackers
- 15170 Marking systems
- 15180 Pallets and cassettes
- 15188 Vertical elevators (paternosters)
- 15190 Stacker cranes
- 15193 Traversers and turning devices
- 15195 Honeycomb racking systems

19.09. Warehouse organization

- 15198 Labels
- 15200 Identification
- 15208 Warehouse logistics
- 15210 warehouse organization)

19.10. Components

- 15220 Slings equipment
- 15230 Loading and unloading equipment
- 15240 Sheet metal package tongs
- 15250 block pushers, extractors
- 15270 Bunker discharge aid
- 15280 Bunker and silo equipment
- 15290 Coil and sheet metal packaging
- 15300 Coil tongs
- 15310 Permanent magnets
- 15320 Electrical equipment for cranes etc.
- 15330 Electric hoists
- 15333 Distance measuring devices for cranes
- 15335 Labels
- 15340 Conveyor belt cover
- 15350 Conveyor belt scraper
- 15360 Conveyor devices and equipment
- 15370 Conveyor belt splices
- 15380 Conveyor belt vulcanizing equipment and material
- 15390 Grippers and tongs
- 15400 Handling machines
- 15410 Lifting clamps, safety lifting clamps
- 15420 Industrial robots, metallurgical, sensor controlled
- 15430 Chains
- 15431 Sprockets
- 15440 Tipping eyes, tipping shackles
- 15450 Crane wheels
- 15455 Crane ropes
- 15460 Storage yard equipment
- 15470 Laser distance measuring devices for cranes
- 15480 Load lifting belts
- 15490 Lifting magnets and equipment
- 15500 Magnetic brakes
- 15510 Magnets, magnet systems
- 15511 EGIS safety device for electric lifting magnets
- 15520 Wheels
- 15530 Corrosion, friction and wear protection
- 15540 Bulk containers
- 15550 Pulleys
- 15555 Safety device for electric load lifting magnets
- 15560 Separation magnets
- 15570 Silos for FF-masses
- 15580 Silos for bulk materials
- 15590 Handling plants for bulk materials
- 15600 Deflection rollers
- 15610 Packaging technology
- 15620 Wear protection coatings with aluminum oxide ceramics
- 15630 Wear protection coatings with rubber
- 15632 Wear protection technology
- 15635 Track-bound tippers
- 15640 Wagon tipper
- 15650 Hot transport and cooling hoods for steel ingots
- 15652 Weighing systems for steel production

19.11. Operating materials

- 15660 Lubricants

19.12. Packaging technology

- 15662 Automated packing stations for coils and long goods
- 15664 Packaging materials

20 Electrical engineering and automation

- 15670 Electromechanical actuators
- 15680 Engineering and technical assistance
- 15690 Technical translations and documentation

20.01. Electrical equipment for metallurgical plants and rolling mills

- 15700 Workplace design systems
- 15720 Three-phase motors
- 15730 Electrical equipment for metallurgical plants and rolling mills
- 15740 Electrical equipment for rolling mills
- 15750 Large electrical installations, complete
- 15760 Power supply systems for mobile consumers
- 15770 Spring cable reels
- 15780 Spring hose reels
- 15785 Radio remote controls
- 15788 Radio systems
- 15790 Radio control systems
- 15800 Gear motors
- 15810 DC motors
- 15820 High current cables and lines, water cooled
- 15830 Cables and wires
- 15840 Cables, cable reels and accessories
- 15850 Motorized cable reels
- 15860 Low voltage switchgears and installations
- 15870 Switchgears
- 15880 Slip ring bodies
- 15890 Fuse systems
- 15900 Heavy current capacitors
- 15910 Plugs and socket-outlets
- 15920 Power converters (frequency converters)
- 15930 Power supply systems (movable and also busbars)
- 15940 transformers (also for industrial furnaces)
- 15960 AC and intercom systems
- 15962 High voltage feeders and contacts

20.02. Control and automation systems

- 15967 Electrical, instrumentation and control engineering, general
- 15968 Installations for anisotropic control technology
- 15970 Automation, general
- 15980 Automation plants for ore and fine ore
- 15990 Automation plants for blast furnaces
- 16000 Automation plants for industrial furnaces, general
- 16010 Automation plants for cold rolling mills
- 16020 Automation plants for coking plants
- 16030 Automation systems for steel mills
- 16035 Automation systems for blast furnaces

- 16040 Automation systems for hot rolling mills and tube mills
- 16041 Automation systems for hot rolling mills
- 16050 Automation plants and process control systems in metallurgical plants and rolling mills
- 16055 Automation of strip processing lines
- 16060 Automatic detection systems
- 16063 Strip guiding systems
- 16070 Data transmission equipment and systems
- 16080 Industrial television technology
- 16090 Information and communication systems
- 16100 Identification
- 16110 Customized complete systems
- 16120 Guidance systems (inductive) for vehicles
- 16130 Control systems (by image processing) for vehicles
- 16140 Control and automation systems, general
- 16150 Positioning systems for cranes
- 16160 Process automation
- 16162 Process automation for strip processing lines
- 16170 Process automation for continuous steel casting plants
- 16180 Process automation for metallurgical plants
- 16190 Process control systems
- 16192 Process control with infrared detectors
- 16200 Process optimization
- 16202 Process optimization with weighing systems
- 16205 Shopfloor systems
- 16210 Control systems, complete
- 16220 Control stations for metallurgical and rolling mill plants
- 16230 Control systems, electrical
- 16240 Control systems, electronic
- 16250 Control systems for press water tanks
- 16260 Control systems, hydraulic
- 16270 Control systems, infrared
- 16280 Power supplies for automation and control
- 16290 Networking
- 16293 Video technology
- 16295 Weighing systems for process automation in steelworks

20.03. Data processing

- 16300 Analog devices and accessories
- 16305 Archiving
- 16310 Production and machine data acquisition BDE/MDE
- 16320 Data acquisition devices and systems
- 16330 Data processing
- 16338 Digital image processing
- 16340 Digital devices and accessories
- 16350 Expert systems
- 16355 Manufacturing Execution System (MES)
- 16360 Turnkey system solutions, hardware \ 057software
- 16380 X-Window Terminal

20.04. Software

- 16390 Simulation software
- 16393 Software for archiving, document management and workflow

- 16395 Software for order processing, warehouse and test certificate management
- 16400 Application software
- 16410 Software for slitting lines
- 16415 Enterprise resource planning system for metal and steel trade
- 16420 Software for production planning and control
- 16430 Software for statistical process control and quality assurance
- 16440 Technical calculation programs
- 20.05. Maintenance**
- 16450 Machine diagnostics
- 16460 Maintenance and inspection

21 Measuring and testing technique

- 16470 Gas measuring instruments for degreasing plants
- 16472 Gas measuring devices for metal degreasing plants
- 16480 Gas measuring devices for metal cleaning plants
- 16488 Multichannel measuring systems

21.01. Measuring and testing technology, general

- 16490 Automation and metrology, color measurement
- 16500 Pressure transducers
- 16508 Corrosion testers
- 16510 Metrology
- 16511 Measuring magnetism
- 16520 Measuring and testing systems, general
- 16530 Measuring and testing systems, general
- 16540 Measurement value acquisition
- 16550 Measured value processing
- 16552 Measuring and test equipment identification labels
- 16553 Measuring equipment and test status identification labels
- 16560 Radioactivity warning systems
- 16564 Recorder systems, paperless
- 16566 Pre-warning of melt breakthroughs and residual wall thickness measurement on refractory linings
- 16568 Roll gauges

21.02. Measurement of physical properties

- 16570 Distance measuring system
- 16580 Distance sensors for positioning and length measurement (laser, ultrasonic, optical, inductive and capacitive)
- 16581 Distance sensors for positioning and length measurement (magnetostrictive)
- 16590 Bath mirror measurement in converter
- 16600 Bath mirror control
- 16608 Strip thickness control (AGC)
- 16610 Strip sag measuring device
- 16612 Strip flatness measurement
- 16613 Strip flatness control
- 16615 Strip guiding system
- 16620 Tape tension measuring systems

- 16625 Tension measuring system for driven S-rolls
- 16630 Width measuring devices
- 16640 Strain gauges and measuring strips
- 16645 Strain measuring systems
- 16650 Strain and mass flow measuring systems
- 16652 Dressing degree and mass flow measuring systems
- 16660 Thickness measuring systems and devices
- 16670 Thickness gauges
- 16680 Distance switches and measuring devices (optical, acoustic and inductive)
- 16690 Torque measuring devices for S-rollers
- 16700 Torque measuring device
- 16710 Speed measuring devices
- 16720 Flow meters
- 16721 Flow measuring devices, capacitive, e.g. for coal injection
- 16730 Flow monitoring
- 16740 Diameter measurement
- 16750 Electrical measurement of mechanical quantities
- 16755 Electronic measuring system for hydraulic and lubricating oils
- 16770 Form measurement
- 16780 Level measuring devices
- 16790 Level control
- 16800 Level control
- 16810 Gas measuring instruments
- 16815 Oxygen sensors for waste gas
- 16820 Equipment and chemicals for waste water control
- 16830 Speed measuring devices
- 16850 Infrared switch
- 16860 Infrared radiation pyrometer
- 16861 Infrared radiation thermometer with scanner
- 16870 Infrared radiation pyrometer with scanner
- 16871 Infrared Radiation Thermometer
- 16875 Infrared thermography
- 16877 IR camera - infrared based slag detection
- 16878 Cameras, furnace cameras
- 16879 Cast iron temperature measurement
- 16880 Insulating capillary
- 16890 Force measuring devices for tension and compression
- 16891 Force measurement and weighing systems
- 16892 Force measuring systems
- 16900 Cooling water monitoring
- 16910 Length measuring devices for tubes
- 16920 Linear encoders
- 16930 Linear encoders (also for ways and distances)
- 16940 Linear encoders, ultrasonic (also for ways and distances)
- 16950 Length and speed measuring systems (optical)
- 16960 Laser speed and length measuring systems
- 16970 Conductivity and pH meters
- 16980 Mass flow meters
- 17000 Measurement of refractory linings (in operating condition)
- 17010 Measuring devices for electrical quantities
- 17020 Measuring machines

- 17030 Measurement printers
- 17033 Microstructure/roughness measurement
- 17035 Surface crack detection
- 17040 Opto-electronic measuring instruments
- 17050 Flatness measuring devices
- 17057 Profile measuring devices
- 17060 Profile measuring systems (non-contact)
- 17080 Pyrometer
- 17090 Pyrometer tubes
- 17100 Ratio pyrometer
- 17105 Inline concentration measurement of liquids
- 17110 Probes for liquid pig iron
- 17120 Tube measuring equipment
- 17130 Coating thickness gauges
- 17133 Coating thickness control
- 17135 Layer thickness control
- 17138 Slag detection with infrared
- 17140 Slag detectors
- 17160 Forging measurement
- 17180 Vibration measuring devices
- 17190 Rope testing equipment for round and flat steel ropes (rope belt conveyors)
- 17200 Dust measuring equipment
- 17210 Equipment for radiation measurements
- 17220 Systems for nuclear radiation measurement (input control)
- 17230 Immersion thermocouples
- 17250 Temperature measurement equipment
- 17255 Temperature profile measuring systems
- 17260 Thermocouples
- 17270 Thermocouple protection tubes
- 17274 Thermographic measurement
- 17280 Thermal conductivity measuring systems
- 17290 Rolling mill force measuring systems
- 17300 Rolling mill measuring systems
- 17310 Resistance thermometers
- 17320 Line scan cameras
- 17322 Non-destructive thickness measurement of refractory linings (during furnace shutdown)
- 17325 2-color pyrometer with fiber optics

21.03. Quality management

- 17340 3-D profile measurement of rails and other profiles
- 17341 3-D profile measurement of weld seams
- 17345 Pickling bath monitoring
- 17350 Breakdown early detection
- 17352 Breakdown early detection and monitoring
- 17360 Breakdown monitoring
- 17365 Chrome bath monitoring
- 17368 Roller emulsion control
- 17370 In-line surface inspection, optical
- 17380 Measuring instruments for quality management
- 17384 Mold control
- 17390 Length, speed and profile measuring systems
- 17400 Hole detection
- 17408 Surface inspection
- 17409 Surface inspection systems
- 17410 Surface inspection
- 17415 Surface inspection of strip steel
- 17426 On-line measurement of oils and waxes
- 17430 On-line surface inspection, optical
- 17432 On-line surface quality inspection, optical

- 17440 On-line roughness measurement
- 17445 Systems for quality data acquisition and processing

21.04. Quality control

- 17446 Strip edge inspection
- 17447 Strip steel surface inspection, automatic and complete
- 17448 Strip steel surface inspection, automatic and complete
- 17450 Quality control, visual
- 17460 Testing services

21.05. Services

- 17470 Metrology services

22 Materials testing

- 17473 Destructive and non-destructive materials testing

22.01. Non-destructive materials testing

- 17480 Consulting, execution, equipment
- 17490 Image processing, barcode readers
- 17500 Demagnetization equipment
- 17510 Internal pressure testing equipment
- 17520 Corrosion testing
- 17530 Measuring and testing machines
- 17536 Training and certification for NDT
- 17540 Ultrasonic testing equipment/machines
- 17560 Non-destructive testing of round and flat steel cables
- 17570 Non-destructive pipe testing equipment
- 17580 Non-destructive material testing equipment, general
- 17589 Non-destructive material testing equipment, acoustic
- 17590 Non-destructive material testing equipment, electromagnetic
- 17620 Non-destructive material testing equipment, optical
- 17630 Non-destructive materials testing with X-rays
- 17640 Non-destructive materials testing with acoustic emission analysis
- 17650 Non-destructive materials testing equipment with ultrasound
- 17660 Non-destructive materials testing
- 17664 Non-destructive materials testing with fluorescent and red/white penetrant methods
- 17665 Non-destructive material testing with fluorescent and red/white test method
- 17670 Non-destructive materials testing with coupling agent-free ultrasonic excitation
- 17680 Non-destructive materials testing, optoelectronic
- 17690 Non-destructive materials testing (service)

22.02. Strength testing, endurance testing

- 17698 Fixtures for tensile testing
- 17700 Stress analyses and reliability tests on machines and components
- 17710 Consulting, execution, equipment
- 17720 Fatigue testing machines

- 17730 Hardness testers
- 17740 Hardness testing equipment
- 17750 Machines for tensile test preparation
- 17760 Friction and wear testing machines
- 17770 Crack testing machines
- 17780 Pipe testing presses
- 17790 Torsion testing machines
- 17800 Universal testing machines for tension, compression, bending and tensile tests

22.03. Technological testing methods, testing service

- 17810 Chemical analyses
- 17820 Grain size analysis
- 17830 Mechanical-technological testing
- 17840 Metallographic testing
- 17850 Technological testing
- 17852 Technological testing, microscope image analysis
- 17860 Deep drawing testing machines for sheets and strips
- 17870 Conversion of conventional universal testing machines to electronic measurement with data processing
- 17880 Roll testing (concentricity, eccentricity)

22.04. Destructive material testing

- 17888 Corrosion testing
- 17890 Machines for the production of notched bar impact specimens

22.05. Fatigue testing

- 17896 Testing of safety valves in operating condition

22.06. Damage analysis

- 17898 Damage analysis

23 Analysis and laboratory equipment

- 17900 Engineering and technical assistance

23.01. Sampling and sample preparation

- 17910 Gas probes, gas sampling probes
- 17915 Sampling
- 17920 Sampling equipment
- 17940 Sample punching
- 17950 Sample transport
- 17960 Sample preparation
- 17970 Sample preparation for X-ray fluorescence analysis
- 17980 Sample preparation for OES and XRF (X-ray testing)
- 17990 Sample preparation machines
- 18000 Spectrometer sample preparation with remelting equipment
- 18010 Punching tools for samples

23.02. Analytical equipment

- 18020 Analytical instruments
- 18022 Devices for inline concentration measurement of liquids
- 18025 Analyzers for oxygen measurement

- 18027 Automated analyzers for process control and wastewater management
- 18030 Automation equipment for analysis and laboratory
- 18040 Gas analyzers
- 18048 Laser induced fluorescence
- 18050 Laser plasma spectrometer
- 18059 Mass spectrometers
- 18060 Conductivity and pH measuring instruments
- 18070 Oil-in-water monitoring in the laboratory and in industry
- 18080 Optical emission spectrometers
- 18090 O2 analyzers
- 18100 Plasma spectrometers
- 18105 X-ray diffractometers
- 18110 X-ray fluorescence spectrometer
- 18120 X-ray fluorescence spectrometers, portable
- 18130 Oxygen probes
- 18138 Heavy metal analysis in water, laboratory, field, process and online
- 18140 Nitrogen analyzer system for direct determination
- 18150 Nitrogen probes
- 18160 Hydrogen analysis system for direct determination
- 18170 Hydrogen probes
- 18180 Accessories for analytical technology

23.03. Laboratory equipment, general

- 18190 Analytical standards
- 18200 Analytical reference material
- 18202 Equipment for sample preparation for OES and XRF (X-ray testing)
- 18210 Calibration samples
- 18220 Annealing boxes
- 18230 Laboratory furnaces
- 18240 Laboratory equipment
- 18250 Laboratory automation
- 18260 Shuttles
- 18264 Shuttles and HF crucibles for C+S determination
- 18270 Spectral samples
- 18280 Crucibles

23.04. Metallography

- 18290 Services
- 18300 Metallography equipment
- 18310 Metallographic laboratories
- 18320 Metallographic testing

- 18375 Secondary exhaust gas cleaning systems
- 18376 Sintered exhaust gas cleaning systems
- 18377 Desulfurization of sinter flue gases
- 18378 Exhaust gas cleaning for pellet plants
- 18380 Waste heat boiler
- 18390 Aerosol separation
- 18400 Treatment of dusts from steel mills and foundries
- 18410 Electrostatic precipitator
- 18420 Dedusting and gas cleaning
- 18430 Dedusting plants and accessories, general
- 18440 Dedusting filters and plants (cassette, cartridge, round, bag, pocket filters, etc.)
- 18450 Denitrification plants
- 18460 Denitrification catalysts (DENOX)
- 18470 Fine dust removal for sinter plants
- 18480 Filter media
- 18490 Gas recovery plants
- 18500 Fabric filters
- 18510 Casting shop dedusting
- 18515 Blast furnace exhaust gas cleaning
- 18520 Hot gas filtration
- 18530 Industrial vacuum cleaners
- 18535 Catalytic plants
- 18536 Catalyst service
- 18540 Compact air cleaner
- 18550 Laser Clean Box
- 18560 Air filters (also in-line filters)
- 18570 Multicyclones and cyclones
- 18580 Afterburning, catalytic
- 18590 Afterburning, thermal
- 18600 Wet dust collectors
- 18608 Wet dedusting systems
- 18610 Wet fine dust removal for sinter plants
- 18615 Wet electrostatic precipitators
- 18620 Wet cleaning plants
- 18630 Flue gas desulfurization for boiler and sinter plants
- 18640 Flue gas cleaning plants for waste and hazardous waste incinerators
- 18650 Dust collectors
- 18660 Dust measuring devices
- 18670 Dust recovery plants
- 18690 Thermal exhaust air purification
- 18693 Dry exhaust gas cleaning plants
- 18700 Dry dedusting plants (also rotary flow dedusters)
- 18710 Dry cleaning plants
- 18720 Venturi dust collectors
- 18728 Central exhaust systems
- 18730 Central dust extraction plants

24.02. Waste water treatment

- 18740 Waste water plants, grease separators, chemical pumps
- 18750 Waste water treatment
- 18755 Waste water treatment, thermal
- 18756 Wastewater treatment for wastewater containing oil and grease
- 18760 Wastewater treatment plants
- 18770 Chemical water treatment
- 18774 Evaporation plants
- 18790 Wastewater treatment plants
- 18800 Recirculation systems
- 18802 Recirculating water treatment
- 18810 Solvent recovery plants
- 18820 Neutralization and detoxification plants

- 18830 Sludge dewatering, mobile
- 18840 Sludge dewatering, stationary
- 18842 Water management

24.03. Regeneration plants

- 18870 Regeneration plants for pickling solutions
- 18880 Acid resistant collection cups and wall coatings with DIBt test mark
- 18890 Sand regeneration plants

24.04. Recycling and waste disposal

- 18900 Exhaust air purification
- 18910 Remediation of contaminated sites
- 18920 Plants for the recycling of raw materials (dusts)
- 18921 Plants for the recycling of residual materials
- 18922 Car recycling plants
- 18923 Electric arc dust recycling
- 18925 Biological exhaust air treatment
- 18930 Soil and groundwater remediation
- 18940 Flaring plants, thermal afterburning
- 18970 Injection plants for filter dust
- 18975 Injection plants for alloy and residual materials using oxygen burners
- 18980 Storage of substances hazardous to water
- 18990 Oil and grease removers
- 18997 Radioactive substances
- 19000 Residue-free vibratory grinding
- 19005 Slag processing (slag transport and recycling)
- 19009 Chimney construction
- 19010 Chimneys (also sheet metal chimneys)
- 19020 Separation of non-ferrous metals
- 19045 Plants for preparation and recycling of metallurgical residues
- 19050 Other disposal plants
- 19060 Recycling of residual materials (ashes, slags, dusts, sands)
- 19070 Rolling mill slag de-zincification
- 19072 Dezincification of metallurgical dusts
- 19080 Recovery of recyclable materials
- 19090 Fluidized-bed drying of steel mill sludges

24.05. Components

- 19110 Separators (gasoline, benzene, oil, water)
- 19114 Aerators and agitators
- 19120 Emulsion splitting plants
- 19130 Injection plants for processed, oil-containing mill scale sludges
- 19140 Injection plants for Carbo Fer
- 19150 Injection plants for PE granules
- 19160 Heat exchangers

24.06. Operating materials

- 19170 Activated carbon
- 19180 Lignite coke
- 19190 Oil binder
- 19200 Lubricants

24.07. Services

- 19210 Exhaust gas measurements
- 19220 Chemical and mineralogical analysis
- 19230 Emission measurements
- 19232 Simulation software for exhaust gas measurement with design and optimization of exhaust systems

24 Environmental protection and disposal

- 18330 Consulting and measurement
- 18340 Engineering and technical assistance

24.01. Dedusting and gas cleaning

- 18342 Exhaust gas technology
- 18348 Oxygen sensors for exhaust gas
- 18350 Exhaust systems
- 18360 Exhaust gas cooling systems
- 18362 Exhaust gas cooling with heat recovery
- 18370 Exhaust gas cleaning systems

25 Occupational safety and ergonomics

- 25.01. Occupational safety**
- 19240 Occupational safety clothing
- 19260 Respiratory protection masks
- 19263 Fire blankets for welding work made of textile fabric
- 19266 Fire blankets and containers
- 19270 Gas detectors
- 19280 Heat protective clothing
- 19285 High temperature resistant and fireproof textile products
- 19289 Protective glass
- 19290 Industrial protective glass
- 19300 Light curtains for accident prevention and other applications
- 19305 Soldering protection mats made of textile fabric
- 19310 Furnace sight glass Neotherm®
- 19320 Safety edges
- 19330 Safety mats
- 19340 Welding protection glass Athermal®
- 19350 Welding accessories
- 19360 Dust measuring devices

- 25.02. Noise protection devices**
- 19368 Hearing protection
- 19370 Noise reduction
- 19380 Industrial noise protection
- 19390 Noise protection devices
- 19400 Noise monitoring
- 19410 Level recorder
- 19420 Sound insulation
- 19430 Sound level meter
- 19432 Sound insulation

26 Other products

- 19440 Aluminium and zinc slug production

- 26.01. Foundry products**
- 19450 Stainless steel mold casting
- 19460 Stainless steel shell mold casting
- 19470 Stainless steel centrifugal casting
- 19490 Investment casting by the lost wax process
- 19500 Cast iron with spheroidal graphite (ductile iron)
- 19510 Cast iron with lamellar graphite (gray cast iron)
- 19520 Cast iron shape casting
- 19530 Continuous cast iron
- 19540 Chilled cast iron
- 19550 Heat resistant cast iron
- 19560 Gravity die casting
- 19570 Copper and copper alloy castings
- 19580 Light metal castings
- 19590 Machine mold casting
- 19610 Acid resistant castings
- 19630 Centrifugal casting
- 19640 Heavy metal casting
- 19660 Steel casting
- 19670 Wear-resistant casting

27 Consulting, planning and services

- 19695 Hot tapping under pressure
- 19700 Fittings service
- 19710 Training and further education of welding personnel
- 19715 Consulting, planning and services
- 19720 Consulting services
- 19721 Consulting for optimization of weighing systems
- 19730 Consulting service
- 19731 Procurement, eProcurement
- 19734 blended learning
- 19740 Services, quality assurance
- 19750 Emission measurements
- 19760 Energy consulting
- 19770 Energy saving
- 19780 Energy service (optimization, recovery, supply)
- 19790 Decoating
- 19792 Spare parts for commissioning
- 19794 Commissioning
- 19810 Engineering services (also commissioning of metallurgical plants as well as conveyor and drive technology plants)
- 19815 Engineering problem solving
- 19820 Maintenance organization
- 19822 Cooling and boiler water treatment
- 19824 Lean management
- 19825 Leak sealing under operating pressure
- 19830 Logistics consulting
- 19832 Logistics services, steel logistics
- 19840 Contract annealing
- 19850 Contract annealing (own mobile annealing facilities)
- 19860 Management consulting
- 19875 On-site machining (milling, drilling, turning, grinding, etc.)
- 19880 Assembly and maintenance
- 19890 Marketing services
- 19892 Offline Maintenance
- 19893 Online Maintenance
- 19895 Quality management consulting
- 19900 Experts
- 19910 Cutting and welding consulting
- 19920 Welding research and education
- 19930 Simulation studies and software
- 19935 Software for metalworking
- 19940 Supplier of spare parts, equipment and accessories for the steel industry, general
- 19950 Radiation
- 19952 Radiation protection
- 19955 supply chain management
- 19960 Digitalization consulting
- 19970 Software solutions for digitalization
- 19980 Digitization analysis
- 19990 Technical translations and documentation
- 20000 Training and commissioning of metallurgical plants
- 20005 Management consulting
- 20010 Leasing of electronic measuring equipment, data technology and computers
- 20015 Continuing education
- 20016 Continuing education - refractory
- 20020 Certifications

28 Steel in civil engineering

- 28.01. Software for building and construction**
- 20050 Cad software

- 28.02. Steel in building construction**
- 20058 Structural steel
- 20070 Hall gates
- 20086 Pipelines

- 28.03. Steel in civil engineering**
- 20100 Offshore technology
- 20106 Tubes
- 20108 Micropiles
- 20110 Anchorages
- 20112 Sheet piling

30 Service concerning steel materials

- 20135 Processing services


- 30.01. Joining**
- 20178 Soldering

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STEEL TECHNOLOGY

EAF upgrade at specialty steel works

Schmiedewerke Gröditz announce the completion of a milestone. The 50-t electric arc furnace has been modernised. At the German specialty steel producer in Saxony, the new water-cooled roof and the complete flue gas duct including dust chamber and recooling circuit were successfully replaced and recommissioned. Some of the most important design parameters of the EAF plant are milestones in engineering.

Sonic cleaning of exhaust systems

Exhaust systems in steelworks are exposed to high dust loads at high temperatures, causing dust to build up in individual components. The known consequences of these deposits are increased pressure losses, greatly reduced heat transfer, unbalanced fans, clogged filters, etc., resulting in reduced productivity and even damage. Cleaning is therefore carried out at regular intervals. If the plant has to be shut down for cleaning, production downtime is usually the result. In order to keep the production plant clean at all times, permanently installed sonic horns can be used to remove dirt from the system by means of sonic pressure while the process is running.

DIGITALIZATION

Order management with AI-supported software

GLA-WEL GmbH, an entrepreneurial, medium-sized metal processing company based in Melle, Lower Saxony, Germany, relies on AI-powered software for order management. The solution enables the job shop to successfully automate customer orders and enquiries and increase efficiency. Incoming orders from customers vary greatly and can include up to 100 different items. It used to take several hours to enter such an order manually. With the newly implemented AI-based software, this can now be done in an average of three minutes through intelligent automation.

CIRCULAR ECONOMY

Sustainability as a key material attribute

With the launch of Circle Green, Outokumpu has done more than just officially introduce a product line made of CO₂-reduced stainless steel. The international stainless steel group has also underlined its commitment to sustainability. At the heart of Circle Green is a collaboration with customers with two main objectives: To validate the product carbon footprint and to significantly intensify the circular flow of materials.

Place your ad in the next issue before **12 March 2024**
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For currently valid prices see Price List No. 2, effective January 1st 2023.

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Printing

D + L Printpartner GmbH
Schlavenhorst 10
46395 Bocholt, Germany

STEEL + TECHNOLOGY is printed with the highest environmental standards.

Terms of Delivery

STEEL + TECHNOLOGY is published four times a year and is available on subscription. The price for a one-year subscription for print and e-paper is 60.00 € incl. shipment (VAT not included). Subscriptions will be renewed for the next 12 months, unless DVS Media GmbH receives a written cancellation 6 weeks prior expiration. VAT calculated in accordance with EC legislation. Single copy: 35.00 € excl. shipment

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ISSN (Print) 2628-3859

ISSN (Online) 2628-3867

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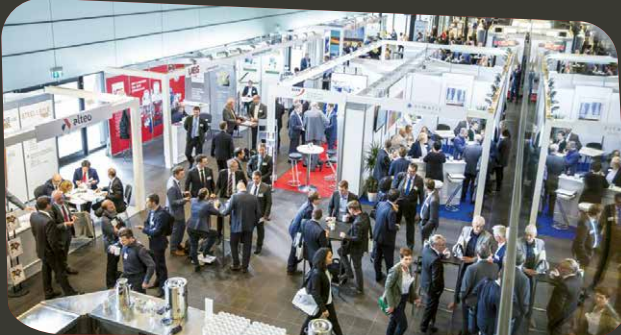


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