Issue April 2021

STEEL+ TECHNOLOGY

01/21

THE TECHNICAL MAGAZINE FOR IRON AND STEEL PROFESSIONALS AROUND THE WORLD

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GREEN TRANSFORMATION

Ambitious greenfield project for a large-scale, fossil-free steel plant in Sweden

MINIMILLS

Acciaieria Arvedi Italy to increase capacity by an upgrade of the ESP line

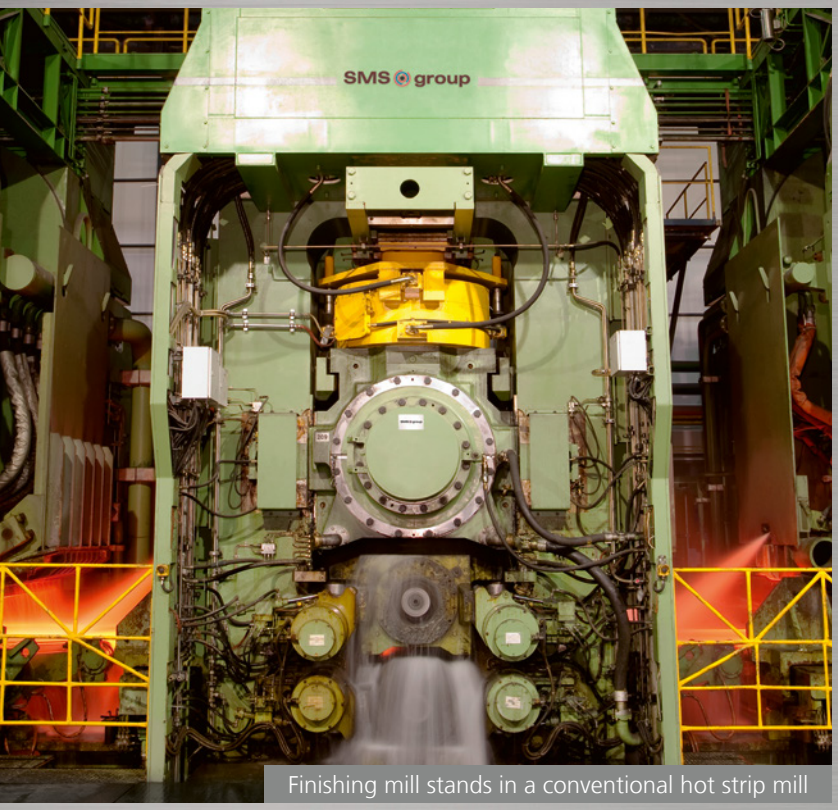
STRIP PROCESSING LINES

Galvanized hot or cold strip? An investigation of the environmental impact

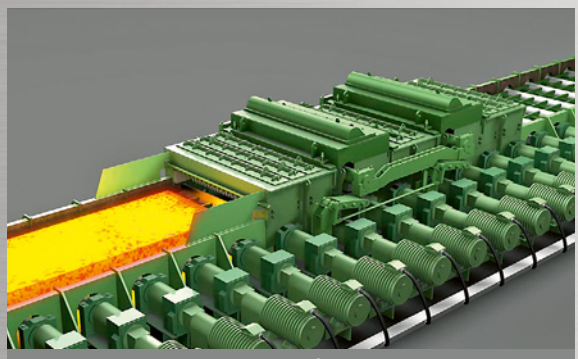
STEEL APPLICATION

Lighter, stronger, more ductile: modern steels for automotive manufacturers

WHO KNOWS THE SECRET OF HOT STRIPS?



Finishing mill stands in a conventional hot strip mill


Primary descaler of hot strip mill


Efficient fluid system for descaling

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Steel in the time of the pandemic and beyond

Arnt Hannewald, Dipl.Ing.
Editor

The Covid-19 pandemic has lasted just over a year now and, fortunately, the severe global economic crisis initially feared has not materialised. Industrial companies in many countries have adjusted to the changed conditions. Repeated lockdowns continue to pose every new challenges to globalised value chains.

Steel companies depend on the functioning of large international flows of goods. Without a reliable international supply of raw materials – such as iron ore and coal, oil and gas – profitable steel production is inconceivable. Despite all adversities, the steel industry has never stopped supplying the world with this vital and sustainable material – steel. There is no standstill, and many companies even have intensified their development activities in order to be able to offer new, even more efficient steels in the future.

In this issue, we cover two main areas among the comprehensive mix of stories and news. First, we present four case studies on how mini mills are repositioning themselves. In the field of flat production, we report on the comprehensive modernisation project pursued by Accieria Arvedi in Italy and on the mill expansion project at Big River Steel in the USA. And, for the production of long products, two completely new mini mills with future-oriented technologies have started operation in China and in Florida (USA).

The second main topic in this issue is strip processing, especially the production of metal coated strip. We dive into this complex of topics, featuring current examples of innovative technical solutions for the production and the different application areas of metal coated coils for automotive and packaging applications, for example.

From today's perspective, there is no doubt that the steel industry will survive the Covid-19 pandemic. With ambitious goals in mind, steel companies are repositioning themselves for the next big challenge: the green transformation.

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MIDREX Technologies, Inc.

Leadership transitions at ArcelorMittal

Aditya Mittal (Picture: ArcelorMittal)

Lakshmi N. Mittal, previously chairman and CEO of ArcelorMittal, will become executive chairman. Aditya Mittal is the company's new chief executive.

Commenting, Lakshmi Mittal said: "Despite the obvious challenges of 2020, ArcelorMittal starts 2021 in a position of comparative strength. Having achieved some key strategic targets, this seems like the right moment to transition to executive chairman." In this position, Lakshmi Mittal will remain fully involved in the company.

Aditya Mittal, as chief executive, will be taking on the effective day to day running of the company. Aditya Mittal joined Ispat International in 1997 from Credit Suisse where he worked in the investment banking division. His first task was to oversee the IPO of Ispat International on the New York Stock Exchange.

Lakshmi Mittal founded what became ArcelorMittal in 1976 when he built a greenfield rolling mill in Indonesia. An early believer in the benefits consolidation could bring to the steel industry, he took his first international step in 1989 with the lease and subsequent acquisition of a steel company in Trinidad & Tobago. In 2004 Lakshmi Mittal combined his two steel businesses, Ispat International and LNM Holdings to form Mittal Steel, while at the same time agreeing to merge with International Steel Group of the United States. In 2006 Mittal Steel and Arcelor agreed to merge to create ArcelorMittal.

ArcelorMittal

Benteler appoints new chief restructuring officer

Michael Baur (Picture: Benteler)

Michael Baur has been appointed as chief restructuring officer of the Benteler Group. As the third member of the executive board, he will support the operational implementation of the restructuring process.

The Benteler Group initiated a comprehensive transformation process at the end of 2018. In 2020, the restructuring was further intensified and accelerated. The successful signing of the refinancing agreement with the financing partners and shareholders was an important milestone at the end of the year and sent a clear signal that the restructuring program is taking effect. The company's financing is secured until the end of 2024. Arno Haselhorst, Michael Baur's predecessor as chief restructuring officer, played a key role in negotiating with financing partners and achieving the agreement.

Arno Haselhorst decided to leave the company, handing over to Michael Baur for the next phase of the transformation, which will focus on the operational implementation of the restructuring measures already in place.

Benteler

Contura appoints president and chief financial officer

Contura Energy, supplier of metallurgical products for the steelmaking industry, has announced promotions within the executive leadership team following the company's long-term succession planning process.

Andy Eidson has been promoted to president and chief financial officer. He will continue his existing duties as chief financial officer along with new responsibilities as president. Additionally, the board voted unanimously to promote Roger Nicholson to executive vice president, chief administrative officer, general counsel and secretary, and Dan Horn to executive vice president of sales.

Contura Energy

New managing director at Hertwich Engineering

Gerold Keune has joined Hertwich Engineering GmbH, a company of SMS group, as the new managing director and head of sales. Based in Braunau am Inn, Austria, Hertwich Engineering is a leader in machinery and plants for the aluminium industry, including recycling technologies for aluminium scrap. Prior to joining Hertwich, Gerold Keune was

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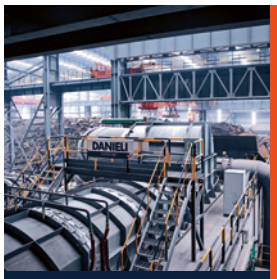

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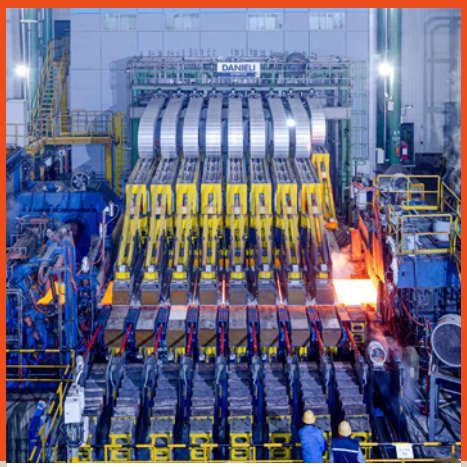
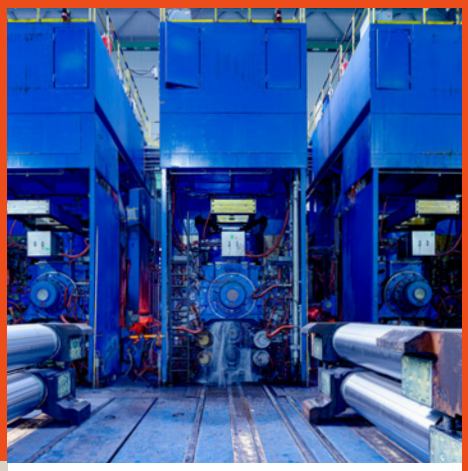


Q-HEAT FLAT INDUCTION-TEMPERATURE CONTROL



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in charge of sales and operations at KHD, a global supplier of plants and machinery for the cement industry. With over 25 years of experience in international mechanical and plant engineering, Gerold Keune will place particular emphasis on expanding the technological leadership of Hertwich Engineering by further internationalization and promoting service activities.

Hertwich Engineering

HGH Group names new president

HGH Group has promoted Vincent Leboucher to president of the company, succeeding Thierry Campos, who has stepped down after twenty years on the position of president.

HGH has been an expert in infrared technology for over 40 years. Since 1982, HGH designs, develops, assembles and sells electro-optics systems and software for security, defense, oil and gas, energy and various industrial applications. HGH's head office is located in Igny near Paris-Saclay, France.

Thierry Campos' major achievements as president included the launch of the wide-area surveillance product line and the development of the international sales function in Asia and North America.

In his new role, Vincent Leboucher will drive the HGH Group toward continued and global growth across the surveillance and test & measurement industries. He also plans to strengthen the company's customer support and service offering.

HGH

Nucor announces executive changes

In line with Nucor's succession planning process, Daniel R. Needham was promoted to executive vice president, following Craig A. Feldman's announcement to retire as executive vice president.

Craig A. Feldman plans to retire in June of this year after 35 years of service with Nucor and The David J. Joseph Company (DJJ). He began his career as a brokerage representative for DJJ in 1986. When DJJ was acquired by Nucor in 2008, Craig A. Feldman was promoted to president of DJJ in 2013 and became a vice president and general manager of Nucor. He was promoted to executive vice president of Nucor in 2018 and continued to serve as president of DJJ until the end of last year.

Daniel R. Needham, the recently appointed executive vice president of bar and rebar fabrication products, began his career with Nucor in 2000 as controller at Nucor Steel Hertford County. He later served as general manager of Nucor Steel Utah and was elected vice president in 2016. In 2019, Daniel R. Needham was promoted to vice president and general manager of Nucor Steel Indiana.

Nucor

Liberty Steel strengthens its board

Liberty Steel, part of GFG Alliance, has strengthened its board with the appointment of Denise Timns as an executive director and Monica Middleton as a non-executive director.

Denise Timns is the chief human resources officer for GFG Alliance, having joined the group in March 2016. She has over 20 years of experience in specialist and generalist HR roles, having been in senior HR positions within the commodity trading sector.

Monica Middleton has 30 years' experience across a diverse range of blue-chip companies and SMEs, helping to deliver impactful business, marketing and communications strategies. Her focus over the past eight years has been on organisations which pursue a blend of financial, environmental and social imperatives.

GFG Alliance

Liberty Steel makes appointments to lead European operations

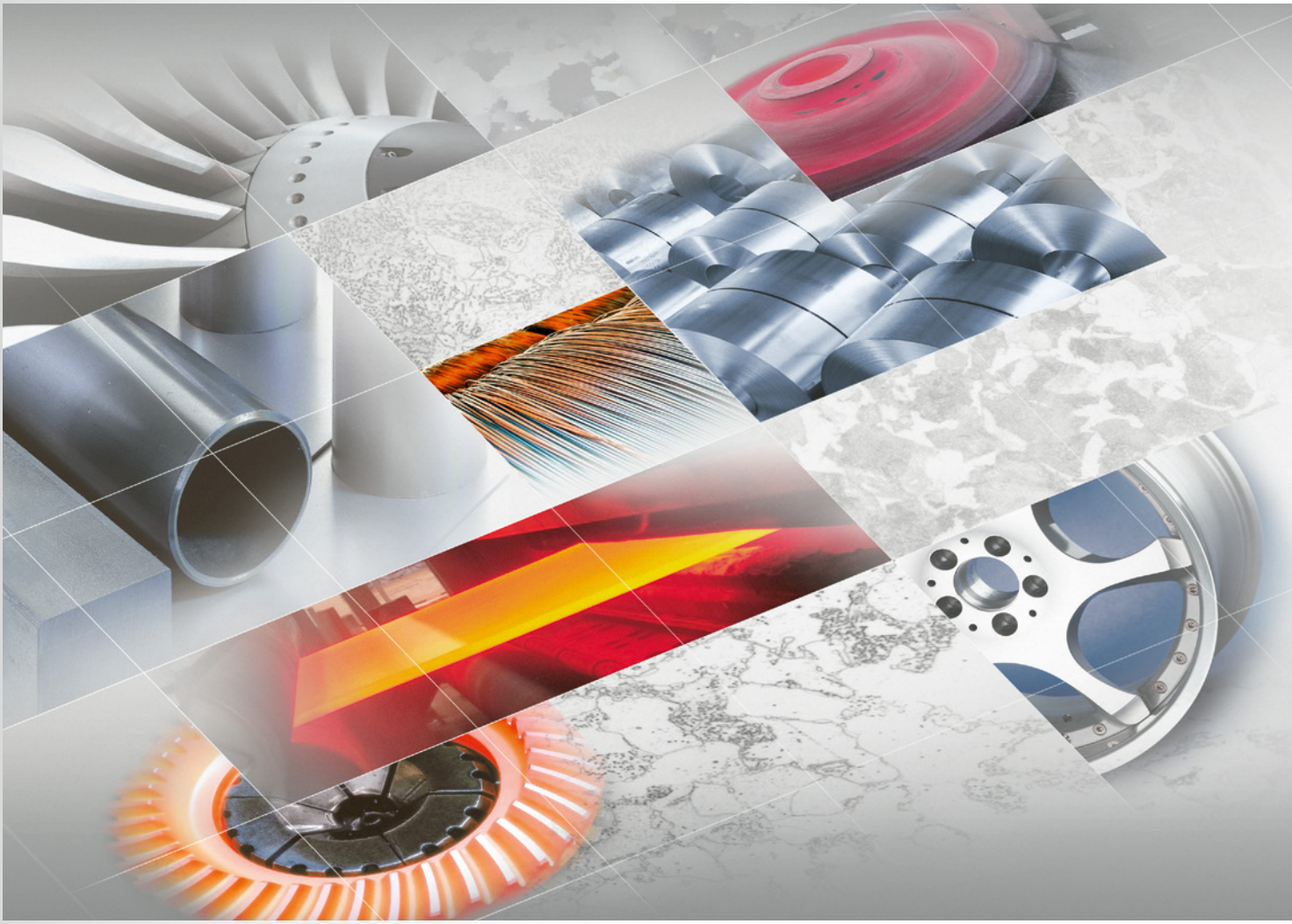
Renaud Moretti has been appointed as CEO Liberty Downstream Synergies and Colin McGibbon as CEO Liberty France.

These appointments have been made to strengthen Liberty Steel's European management team. Both Renaud and Colin will report to Roland Junck, Liberty Steel's president for the UK and Europe.

Renaud Moretti will be responsible for the overall management of the company's downstream steel mills in Europe, which include the Liberty Magona plant in Italy and Liberty Liège-Dudelange's three plants in Belgium and Luxemburg. Moretti has almost twenty years of experience within the steel industry and was most recently CEO of NLMK's Europe Strip.

HEAT TREATMENT MEETS METALLURGY

Steel Treatment in Perfection



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Colin McGibbon will be responsible for the overall management of the company's French Greensteel businesses, Liberty Ascoval and Liberty Rail Hayange. Colin McGibbon has more than twenty years' experience in the metals industry, most recently as the Chief Operating Officer of the SLN Nickel Company in New Caledonia (Eramet Group).

GFG Alliance

Executive changes at NLMK

NLMK has announced appointments to various executive positions within NLMK Group.

Tatyana Averchenkova has been appointed to the position of NLMK Lipetsk managing director. Prior to the appointment, Tatyana served as NLMK Group vice president for operational efficiency. Vyacheslav Vorotnikov, who has held the position since 2019, will be taking on the role of adviser to the CEO.

Irene Spitzberg is NLMK's new vice president for technology development. In this role, she will focus on the development and implementation of a long-term development strategy for new products and new process technologies. She will lead the Group's international team of engineers and researchers in Russia and Europe.

Cornelius Louwrens has been appointed CEO NLMK Europe Strip Products, which includes NLMK La Louvière, NLMK Strasbourg and NLMK Manage Service, all part of NLMK Belgium Holdings. Previously Cornelius held the position of CTO NLMK International.

NLMK

Montan-Stiftung-Saar appoints executive for newly created cross-divisional "Transformation" function

The Montan-Stiftung-Saar trust has appointed Jonathan Weber as managing director, chief operating officer, of SHS – Stahl-Holding-Saar GmbH & Co. KGaA and as a member of the board of management of Aktien-Gesellschaft der Dillinger Hüttenwerke and Saarstahl AG.

Jonathan Weber will assume the newly established cross-divisional "Transformation" function and will drive forward the implementation of the transformation. This carries with it the responsibility to continue developing the future-oriented program of Saarland's steel industry which ensures a result-oriented target portfolio that includes new business models as well as a competitive internal set-up, especially with regard to costs and processes.

Jonathan Weber's joins SHS from thyssenkrupp Steel Europe, where he has been managing director and chief financial officer of the electrical steel business unit since 2019.

SHS – Stahl-Holding-Saar

Kilian Rötzer (Picture: SMS group)

New head of corporate communications and marketing at SMS group

Kilian Rötzer will take over as head of corporate communications and marketing at the SMS group, reporting directly to CEO Burkhard Dahmen.

The position brings together the previously separate areas of corporate communications and marketing to ensure a uniform global presence towards all target groups. The core task of the newly established team will be to communicate more strongly in particular the project expertise in the growth areas of decarbonization, hydrogen and recycling for the global metals industry.

Kilian Rötzer comes from thyssenkrupp, where he was responsible for corporate communications, marketing and governmental affairs for the global steel business for eight years.

SMS group

SSAB hires senior advisor

Karl-Petter Thorwaldsson, former president of the Swedish Trade Union Confederation, LO, is to join SSAB as senior advisor.

In his new role, Karl-Petter Thorwaldsson will strengthen SSAB's government rela-

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PRIMETALS
TECHNOLOGIES

Karl-Petter Thorwaldsson (Picture: SSAB)

tions and public affairs in Sweden, the Nordic countries and at the EU level. The recruitment is a step in SSAB's ambition to lead the green transformation in the steel industry, which requires good, close dialogue between industry and society in general. Karl-Petter Thorwaldsson will report directly to Martin Lindqvist, SSAB's president and CEO.

SSAB

Restructuring officer leaves Swiss Steel Group after target achievement

Josef Schultheis, chief restructuring officer, has stepped down from the executive board of Swiss Steel Group as planned.

Since joining the company in August 2020, the departing chief restructuring officer Josef Schultheis had been driving the transformation to turnaround on an interim basis as a full member of the group's executive board. With his experience, Swiss Steel Group was able to counter the drastic effects of the COVID-19 crisis more effectively and identified various additional potentials under his leadership. In particular, he was largely responsible for the negotiations on the financing concept and played a key role in driving forward its implementation.

Swiss Steel Group

Appointment of new CEO ArcelorMittal Europe

Following the announcement that Aditya Mittal has become CEO of ArcelorMittal, the company has made new appointments to its management team in Europe.

Geert Van Poelvoorde has been named CEO of ArcelorMittal Europe, having been CEO ArcelorMittal Europe – Flat Products since 2014. He succeeds Aditya Mittal in the role of CEO ArcelorMittal Europe.

Yves Koeberle succeeds Geert Van Poelvoorde as CEO ArcelorMittal Europe – Flat Products, with immediate effect.

Geert Van Poelvoorde succeeds Aditya Mittal as CEO of ArcelorMittal Europe (Picture: ArcelorMittal)

ArcelorMittal

REPUBLIC OF SOUTH AFRICA

Transalloys commissions converter refining plant

Transalloys has taken a new 27 t CLU® converter refining plant from Swedish UHT – Uvån Hagfors Teknologi AB into operation at their plant in eMalahleni, located 100 km east of Pretoria.

The company uses the plant for refining high-carbon ferromanganese (HCFeMn) to medium-carbon ferromanganese (MCFeMn) products. The first heat was processed in September 2020 and the complete ramp-up of production was reached by mid-October 2020. Due to travel restrictions as a result of the COVID-19 pandemic, both the commissioning and operator training had to be done remotely from the UHT office in Sweden.

The CLU® converter refining equipment with level 1 and level 2 process control features a top lance and submerged tuyeres to allow for a combined blowing practise which has proven advantageous for ferromanganese refining.

UHT – Uvån Hagfors Teknologi

Control room of the refining plant at Transalloys (Picture: UHT)

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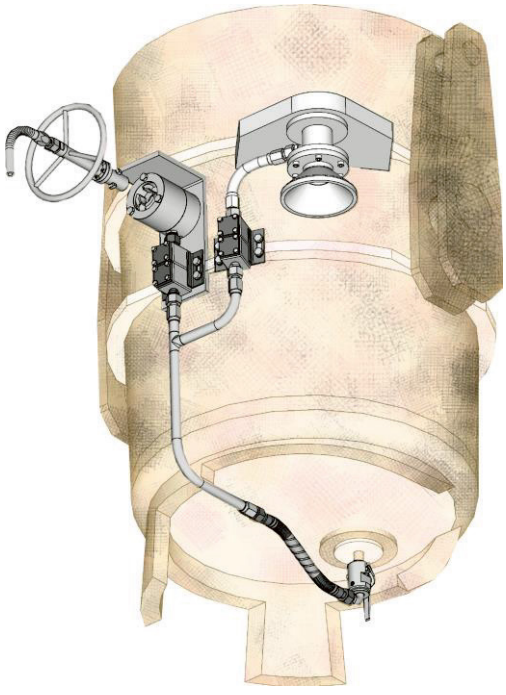

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CANADA

Rio Tinto teams up with Paul Wurth and SHS – Stahl-Holding-Saar on low-carbon iron

Rio Tinto, Paul Wurth and SHS – Stahl-Holding-Saar have signed a Memorandum of Understanding to explore the production of a low-carbon steel feedstock.

The partnership will explore the viability of transforming iron ore pellets into low-carbon hot briquetted iron (HBI), a low-carbon steel feedstock, using green hydrogen generated from hydro-electricity in Canada.

Iron Ore Company of Canada (IOC), in which Rio Tinto holds a majority interest, will supply high-grade iron ores and expertise in mining, processing and pelletizing. Paul Wurth brings expertise in plant building and process knowledge in the fields of highly efficient hydrogen generation and Midrex® direct reduction plants. SHS brings deep iron and steel making expertise.

The parties will conduct a feasibility study into the potential development of industrial-scale low-carbon iron production in Canada, utilizing the combined expertise of the three partners across the entire steel value chain. The feasibility study is scheduled for completion in late 2021, with an investment decision on a hydrogen-based direct reduction plant at industrial scale expected to follow thereafter.

Paul Wurth, SHS – Stahl-Holding-Saar, Rio Tinto

Stelco commissions pig iron caster

Stelco has successfully commissioned the new pig iron caster at its Lake Erie Works facility, providing the capability of casting up to 1 million t/year of pig iron.

The addition of the pig iron caster to Stelco's operations further supports the company's tactical flexibility strategy and will allow it to fully capitalize on increased capacity resulting from the recently completed blast furnace upgrade project.

"The commissioning of the pig iron caster completes the most recent of our many strategic investments in Stelco since mid-2017, that have modernized our facilities, diversified our product mix, and positioned Stelco to succeed in various market cycles," stated Alan Kestenbaum, Executive Chairman and Chief Executive Officer of Stelco.

With the expansion of electric arc furnace production in North America, the demand for iron units is placing increased pressure on the existing supply of scrap steel, making pig iron an increasingly highly valued commodity in the production of EAF steel. Stelco's new pig iron caster enables it to access this market and enhances its complete suite of products ranging from pig iron, to semi-finished steel, to hot-rolled sheet, to high value-added cold-rolled and coated products, as well as advanced high strength steels. This optionality will allow Stelco to maximize production and pursue markets that yield the highest rate of return for its stakeholders.

Stelco

USA

ArcelorMittal and Nippon Steel sign agreement to build EAF

ArcelorMittal has signed a definitive agreement with Nippon Steel to build an electric arc furnace at AM/NS Calvert in Alabama.

AM/NS Calvert a 50:50 joint venture between ArcelorMittal and Nippon Steel. Construction of the 1.5 million t/year capacity EAF will commence in 2021. The facility will come on stream in the first half of 2023. Commenting, Brad Davey, CEO, ArcelorMittal North America, said: "This is an important project for AM/NS Calvert which builds additional flexibility to its slab sourcing and will increase its responsiveness to short lead time orders."

ArcelorMittal, Nippon Steel

Nucor to build tube mill in the Midwest

Nucor Corporation has announced plans to build a tube mill in the Midwest. The new tube mill will have the capacity to produce approximately 250,000 t/year of hollow structural section (HSS) tubing, mechanical steel tubing and galvanized solar torque tube.

Products from the new tube mill will capitalize on investments Nucor has already made in the Midwest including a plate mill, galvanizing line and hot roll expansion. The new tube mill is a continuation of Nucor's focus on growth and commitment to sustainability and environmental stewardship,

increasing Nucor's product offerings for construction, infrastructure and renewable energy in the expanding solar market in the United States.

Nucor's Tubular Products (NTP) Group was formed in 2016 when Nucor entered the tube market with the acquisitions of Southland Tube, Independence Tube Corp. and Republic Conduit. Today, NTP consists of eight tubular facilities that are strategically located in close proximity to Nucor's sheet mills as they are a consumer of hot-rolled coil.

Nucor

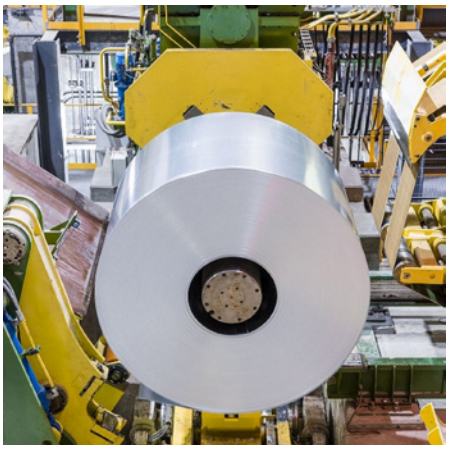
Nucor Steel Gallatin grants FAC for new pickling and galvanizing line

SMS group has received the final acceptance certificate from Nucor Steel Gallatin for the supplied pickling and galvanizing line.

The new pickling and galvanizing line in operation at Nucor Steel Gallatin in Ghent, Kentucky, features "heat-to-coat" technology. SMS group's supply scope included engineering, process technology, furnace technology, pickling and galvanizing technology as well as electrical and automation systems. The "heat-to-coat" technology for hot strip galvanizing is characterized by the compact and operator-friendly U-shape design, the turbulence pickling system, the high-power inductive heating system, the FOEN® galvanizing equipment and the Drever after-pot cooling system.

The line is designed to produce 500,000 t/year of pickled and galvanized hot rolled steel strip. It has a maximum capacity of 180 t/h and can handle cross sections of up to 6.35 mm thickness and up to 1,854 mm width. As early as during the commissioning phase, 70% of the designed capacity could be reached. Given this promising production result, Nucor will be capable of exceeding the designed line capacity during 2021.

SMS group



Production of galvanized steel strip in the "heat-to-coat" process (Picture: SMS group)

USA

Nucor Plymouth invests in billet welding and spooling line

Nucor Steel awarded Danieli the order for a new billet welder and spooler line to be installed at Plymouth, Utah.

The combination of billet welding and spooling technologies maximize the yield because of the endless production process. Thanks to this upgrade the line will process 250,000 t/year of rebar from #3 to #8, in compact coils up to 5.5 t. The project also includes the extension of the existing reheat furnace to be executed by Danieli Centro Combustion to allow billet discharging at a higher temperature and in line with the mill. Commissioning of the newly upgraded line is expected to take place in the last quarter of 2021.

Danieli

TMS International acquires Stein

TMS International, provider of outsourced industrial services to steel mills, has acquired the business and assets of Stein, LLC and Stein Steel Mill Services, LLC, headquartered in Cleveland, Ohio.

Stein is a leading provider of high-quality services to steel producers throughout the U.S. Its full-service operations provide metal producers with the flexibility and resources to handle a wide range of steel mill processing services such as slag removal and metallics reclamation, scrap handling, scrap management, recycling, raw material screening, material handling, and maintenance and repair services. Stein is family-owned with more than 60 years in the industry and has approximately 500 employees that are joining TMS.

TMS

Ulbrich unveils new 20-high rolling mill

At its Wallingford, CT location, Ulbrich Stainless Steels & Special Metals has installed a new 20-high rolling mill.

At Wallingford, Ulbrich produces cold-roll precision strip and foil for over 160 alloys of stainless steels and special metals. With the additional capacity, Ulbrich can now provide an even higher level of service which enables them to support greater new product development business for the future.

The new rolling mill can handle a wide range of thicknesses with a technically advanced automatic gauge control and shape control system to closely monitor real time variations of thickness and flatness throughout the length of each coil that is rolled.

Ulbrich Stainless Steels & Special Metals

BANGLADESH

Bashundhara Group orders minimill

Bashundhara Group has placed an order with Danieli to supply a MIDA endless-casting rolling minimill for the production of 1 million t/year of rebar and wire rod.

The new Danieli MIDA endless casting rolling minimill will be installed at the Bashundhara industrial park in Mirsarai, nearby Chittagiong. Danieli will apply its patented Digimelter and QLP-DUE® – Danieli Universal Endless – technologies. The startup of the new minimill is expected by early 2023.

Scrap will be continuously melted by a 100 t Digimelter, which will operate at a productivity of 150 t/h. Featuring a Q-One power unit, a Q-Melt intelligent controller and ECS continuous scrap charging, the Digimelter will run the melting processes automatically, in a stable and adaptive way, with minimal impact on the electric network. The single-strand FastCastPlus machine equipped with high-performance oscillator and the newly patented Octocaster mould will deliver endless billets to the mill at casting speeds exceeding 7 m/min. The rolling mill consisting of 20 AC-driven housingless stands in H and V configuration will feed two lines for bars in bundles and for wire rod. Danieli Automation equipment and process control systems will guarantee continuous and reliable production.

Danieli MIDA endless casting rolling minimills are said to be among the most energy-efficient, green and competitive plants to produce long products.

Danieli

CHINA

HBIS TangSteel New District implements production management system

HBIS TangSteel New District (former HBIS Laoting Steel) and PSI have signed the go-live acceptance of the PSImetals modules planning/scheduling, production, quality, order dressing, as well as some PSI developed project-specific components for a new production facility.

PSImetals and the new plant were commissioned simultaneously and covered the entire process chain of current flat production facilities from sales to production. This includes order and line scheduling, order dressing, quality design and execution, steelmaking and hot rolling operation management, yard management, loading and shipping.

HBIS TangSteel New District will start operation of its "Special Steel Sale & Production Platform", a newly built production mill for long products in 2021. It covers a new melt shop and a rolling mill with two rod, two wire and one section rolling lines. The platform is also based on PSImetals, but is being implemented by the HBIS IT team.

PSI

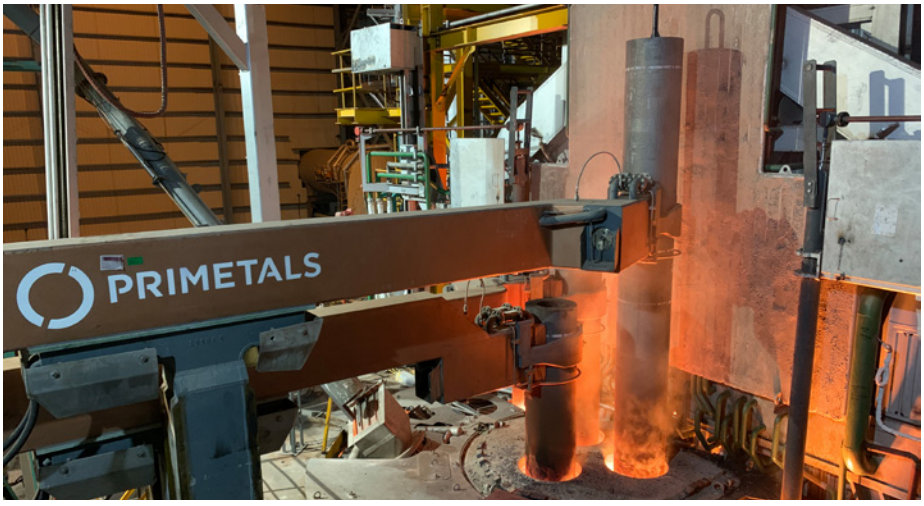
Wuzhou Yongda starts operation of EAF and ladle furnace

An EAF Quantum electric arc furnace and a ladle furnace supplied by Primetals Technologies have started production at a greenfield project of Wuzhou Yongda Special in Wuzhou city, in Guangxi Zhuang Autonomous Region.

The EAF Quantum and the twin ladle furnace are part of a greenfield project for the production of stainless steels. Primetals Technologies supplied the complete mechanical and electrical process equipment and the automation technology. This included the automated scrap yard management, the automated charging process, automation of oxygen injection and sand refilling, as well as the Level 2 automation which makes the plant ready for Industry 4.0. A basic data package for dedusting equipment was also part of the project.

The EAF Quantum furnace is designed to handle scrap steel of very varied composition and quality. It combines proven elements of shaft furnace technology with an innovative scrap charging process, an efficient preheating system, a new tilting concept for the lower shell and an optimized tapping system.

Primetals Technologies



Roof with electrodes of the EAF Quantum furnace (Picture: Primetals Technologies)

CHINA

Xingcheng Special Steel orders continuous caster to produce 1,200 mm round blooms

Jiangyin Xingcheng Special Steel Works Co. (JYXC), based in Jiangyin, Jiangsu Province, has placed an order with SMS Concast for a three-strand jumbo bloom caster.

The new curved continuous bloom caster with a nominal radius of 18 m will be designed to produce a wide range of rounds from 600 up to 1,200 mm in diameter, in highly demanding steel grades ranging from bearing through to stainless steels. These grades are demanded by the forging and large-bearing industries for the production of bearings and shafts for green technologies, such as wind power mills, for example.

The jumbo caster will be equipped with advanced SMS Concast technologies such as INVEX molds, CONFLOW stopper mechanisms, CONSTIR electromagnetic stirrers as well as dynamic mechanical soft reduction (DMSR) and dynamic spray cooling. In addition, surface heaters will assure that no cracks are generated during unbending of the blooms. Beyond that, advanced software solidification models will support a simplified and reliable decision-making process to ensure process stability. Commissioning of the caster is scheduled for the end of May 2021.

SMS group

RSB® reducing & sizing blocks from Kocks in Chinese bar rolling lines

The 100th RSB® reducing & sizing block supplied is in operation at Jiangsu Yonggang (Picture: Kocks)

Seven bar mills in China haven been equipped with a RSB® reducing & sizing block recently , some more have been ordered

Steel company	Type	Bar diameter	Commissioning
Nanjin I & S	500++ /4	50 - 160 mm	October 2020
Henan Jiyuan I & S	300++ / 4	12 - 42 mm	November 2020
Jiangsu Yonggang Group	370++ / 4	16 - 100 mm	November 2020
Guangdong Shaoguan I & S (Baowu Group)	300++ / 4	15 - 50 mm	November 2020
Hunan Valin Xiangtan I & S	370++ / 5	16 - 100 mm	November 2020
Shijiazhuang I & S (Shigang)	500++ / 4	40 - 160 mm	November 2020
Shijiazhuang I & S (Shigang)	370++ / 4	13 - 60 mm	January 2021
Jiangsu Lihuai I & S	500++ / 4	70 - 160 mm	Scheduled for Feb.2022
Linyi I & S	370++ / 4	13 - 60 mm	Scheduled f. early 2022

A growing number of Chinese bar steel producers use the 3-roll RSB® reducing & sizing blocks of the 5.0 design from Friedrich Kocks in their rolling mills behind the roughing or intermediate trains, especially in the production of SBQ grades.

The RSB® reducing & sizing blocks achieve the final bar dimensions in a gradual, stepless process. They are suitable for thermomechanical rolling at low temperatures. The blocks can be fitted with a Size Control System (SCS®) for fully automatic optimization of the operating parameters in real time, and a remote control system which assures quick size changes. Thanks to the new change system, changing the Kocks 3-roll stands takes no longer than five minutes.

The latest-generation Bamicon RSB® configuration system supports the operator in optimizing the rolling parameters to achieve products of optimum quality. Bamicon also supports in production planning and in setting up and preparing the stands and guides in the roll shops.

Kocks

AZERBAIJAN

Baki Inshaat Senaye completes automation upgrade

Automazioni Industriali Capitanio (AIC) has successfully completed the upgrade of the dividing shear and cut line automation at Baki Inshaat Senaye OJSC in Baku.

AIC's scope of supply included the new electrical and automation control system for the cooling bed entry line. Specifically, the following equipment units were involved: motors and drives for the pinch roll and dividing flying shear, and for the electromagnetic brake apron; a PLC control system to control the shear and the cutting line; engineering and electrical drawings and sensors.

The AIC team was also involved in the site installation and commissioning phases, start-up support and remote assistance.

Automazioni Industriali Capitanio

INDIA

JSW Toranagallu starts up new reheating furnace

Danieli Centro Combustion India completed, according to schedule, the start-up of the new 220 t/h walking-beam reheating furnace at the wire rod mill No. 2 of JSW's Toranagallu site.

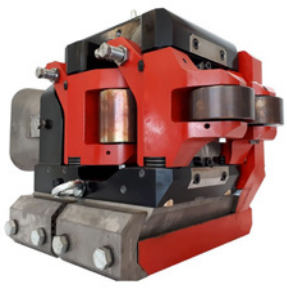
Walking-beam reheating furnace for billets (Picture: Danieli)

In the new furnace, cold billets are reheated with excellent temperature uniformity thanks to tailor-made burners along with the proprietary PHL (Proportional High Low) technology in the combustion control system. Most of the commissioning activities were executed using remote connection (communication and I/O tests). The electrical and automation controls were provided by Danieli Automation India. The furnace dry-out was performed before the start-up of the rolling mill, speeding up the commissioning phase.

Danieli

Viraj Profiles upgrades mill with new guide equipment

Danieli Service has supplied new guide equipment to Viraj Profiles, producer of stainless-steel long products.



Rolling guide for profile rolling (Picture: Danieli)

The scope of supply consisted of entry and exit guides for the intermediate and finishing mill used to roll equal angles and flats. Danieli developed a new series of roller-type entry and exit guides that assure scratch-free finished rolled stock. Thanks to the new roller guides, Viraj Profiles has been able to reduce downtime, resulting in a productivity boost of 25%, and to extend its product portfolio.

Currently, Danieli Service is implementing a new cut-to-length area, fully equipped with in-line straightener and cold shear at Viraj Profiles.

Danieli

PHILIPPINES

Perstima places automation and drives systems order for new tinning line

Tenova has selected ABB to supply and install a comprehensive drives and automation package for Southeast Asia tinplate manufacturer, Perstima, at its new electrolytic tinning and tin-free steel line in Malvar, Philippines.

The new solutions will be operational in June 2021. The project scope includes the ABB Ability™ System 800xA DCS, which integrates control, electrical and communication systems for optimal visibility into all processes for stable production and the efficient use of raw materials and energy, plus the compact, high-performance AC800 PEC controller, with control desks and posts. In addition, ABB will supply its collaborative production management solution for metals to optimize all aspects of process and production planning, asset monitoring and manufacturing execution.

ABB, Tenova

VIETNAM

Hoa Phat hits production milestone with new casting and rolling line

In February 2021, the new Danieli casting and rolling line for high-quality coils in operation at Hoa Phat's Dung Quat location produced its one millionth tonne.

The plant features Danieli quality strip production technology that includes two vertical-curved thin-slab caster strands, a tunnel furnace and a six-stand hot-rolling mill, followed by a strip cooling system, downcoiler and coil-handling process areas. The complete electrical and automation system for all strip process areas, from level 0 to the large-drive system for the hot rolling stands was designed and supplied by Danieli Automation. The line will produce steel coils of low-carbon and medium-carbon LC HSLA grades, in strip widths of 1,250 and 1,500 mm.

Danieli

Hoa Sen Dong Hoi upgrades hot-dip galvanizing line

Danieli Centro Combustion India has received the final acceptance for an improvement project for continuous galvanizing line No. 2 at the Hoa Sen Dong Hoi plant in the Nghe Non province of Vietnam.

Detail view of the hot-dip galvanizing line (Picture: Danieli)

The project has enhanced overall line performance, in particular strip coating quality thanks the installation of Danieli Wean United X-Jet air-knives, and reduced operational costs. Danieli Centro Combustion designed, manufactured and supervised the installation of a wetting system, a movable cooler, a retractable snout, and after-pot cooling up to pass ducts, along with related level 1 automation developed by Danieli Automation. The supplied HNX wetting system prevents zinc vapours from settling on the strip before it is immersed in the zinc pot, thus helping to improve the final quality of the product.

Danieli

CZECH REPUBLIC

Liberty Steel launches tender for hybrid furnaces

Liberty Steel Group has launched the public tender process for Liberty Ostrava's new hybrid furnaces, which will replace the plant's existing four tandem furnaces by 2023.

This is a major step in Ostrava's journey of transformation towards new low-carbon technologies in line with Liberty Steel Group's overall target to become carbon-neutral by 2030.

The tender process is part of Liberty Ostrava's ambitious investment plan to transform its steelmaking operations through the use of two hybrid furnaces, the first of their kind in Europe. The hybrid technology will have a significantly lower environmental footprint, reducing particulate emissions by 60% by 2023 due to a new dedusting plant. Once the 400 kV electricity line has been installed by 2025, carbon emissions will be reduced by 50% as the furnaces will be able to use 70% scrap. Full carbon neutrality will be achieved once the plant has transitioned to using 100% scrap or captures and recycles the CO_2 from its primary units while offsetting residual carbon produced through GFG's peat restoration project in Scotland.

Liberty Steel

FRANCE

ArcelorMittal invests in high-end electrical steel production in Europe

ArcelorMittal is investing EUR 13 million in its Saint Chély d'Apcher plant, which specialises in producing steels for the automotive sector.

The investment means the plant will be able to produce cutting-edge non grain-oriented (NO) electrical steel grades, through production upgrades and new production capabilities, to meet the requirements of the growing electromobility market.

Since 2013, with the construction of a new continuous annealing line, ArcelorMittal Saint Chély d'Apcher has been undergoing a series of transformations to become a leading supplier for the electromobility market, with its iCARe® range of high energy efficiency steels for electromobility, i.e. for automotive e-traction motors. ArcelorMittal's existing NO customers, such as the power generation sector, will also benefit from this upgrade.

ArcelorMittal

Liberty, Paul Wurth and SHS - Stahl-Holding-Saar to develop hydrogen-based steelmaking plant

Liberty Steel Group, part of GFG Alliance, has signed a Memorandum of Understanding (MoU) with Paul Wurth and SHS - Stahl-Holding-Saar (SHS) to assess the building and operating of an industrial-sized, hydrogen-based steelmaking plant at Dunkerque in France.

The pan-European partnership will work together on a project to incorporate a 2 million t/year direct reduced iron (DRI) plant, with an integrated 1 GW capacity hydrogen electrolysis production unit, next to GFG's ALVANCE Aluminium Dunkerque site. The DRI plant will initially use a mix of hydrogen and natural gas as the reductant to produce DRI and hot-briquetted iron (HBI), before transitioning to using 100% hydrogen once the electrolysis production unit is complete. The DRI/HBI produced will primarily be used in the electric arc furnace of Liberty Ascoval in France but any surplus will be used at Liberty's Ostrava and Galati integrated steelworks as well as the SHS-group's Dillinger and Saarstahl plants in Germany.

Liberty has been working with Paul Wurth and SHS on the technical and economic viability of the project since early last year. Now that initial feasibility work has proved successful the partners have signed a MoU which covers two phases: phase 1 will improve the accuracy of the project's commercial and technical feasibility including the reducing gas mix, potential partners (energy supply, hydrogen production and operation, DRI/HBI equipment etc.) and funding opportunities. Phase 2 will deliver the level of detail required (technically and financially) for the effective implementation of the project.

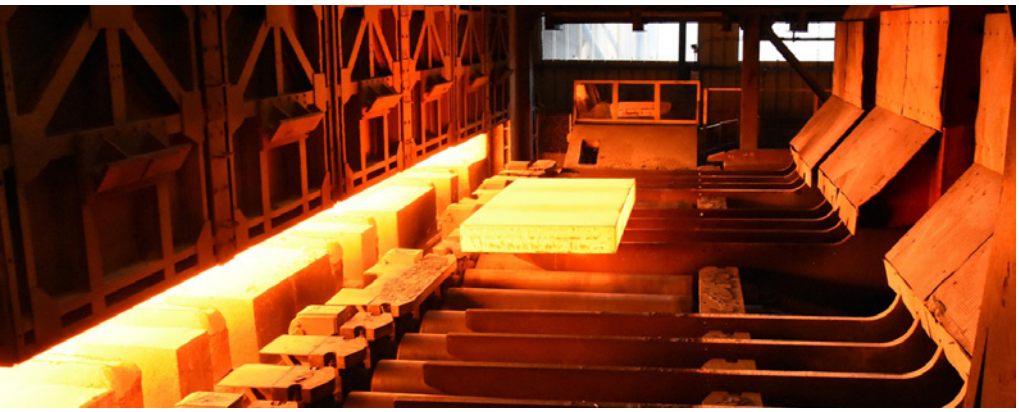
Liberty Steel, Paul Wurth, SHS - Stahl-Holding-Saar

FRANCE

Dillinger France pursues green steel initiative

Under the decarbonization programme of the French industry, Dillinger France, Dunkirk, has been granted state subsidies for the modernization of its pusher furnace No. 2.

Dillinger France, subsidiary of the German Dillinger Group, will use the subsidies granted by the French government to support the project aimed at modernizing the pusher furnace No. 2 of the rolling mill.



Modernization of the pusher furnace at Dillinger France is supported with a government subsidy (Picture: Dillinger)

With this refurbishment project, Dillinger France will be able to increase its slab heating capacity for the rolling of heavy plates, whilst at the same time optimizing energy consumption and CO_2 emissions by installing new "high-performance" burners, a heat recovery system for the waste heat inherent in the flue gas, the limitation of thermal losses, and the utilization of new IT-based furnace operation management models. Recommissioning of the furnace is scheduled for July 2021.

This investment project of Dillinger France is an inherent part of the Dillinger Group's "Green Steel" offensive, which also includes the introduction in August 2020 of steel production based on hydrogen used in the blast furnaces.

Dillinger

Laminoirs des Landes installs new hydraulic shear in plate mill

Laminoirs des Landes has installed and successfully commissioned a hydraulic hot shear supplied by Danieli.

At the company's Tarnos mill, the new shear cuts hot plates (600 - 900°C) of up to 50 mm thickness and up to 3,500 mm widths. After the short and smooth commissioning, the Danieli shear even exceeded the design capability in terms of plate thickness and temperature. It is powered by two, in-house designed hydraulic cylinders fed individually by servo-valves and controlled for position and force. Thanks to the hydraulic knife-angle and knife-gap adjustment systems, the machine is able to perform optimal cuts with excellent edge quality for thick and thin products. An entry pinch-roll combined with a set of measuring rolls guarantees tight tolerances in terms of final plate length. The new shear design reduces maintenance times and the number of spares parts required. The knives and knife holders are interchangeable between top and bottom, and each knife has four cutting edges to extend service life.

Danieli

GERMANY

Salzgitter Flachstahl to build demonstration DRI plant

3D illustration of an Energiron® DRI plant (Picture: Tenova)

Salzgitter Flachstahl GmbH has commissioned Tenova for the construction of µDRAL, a demonstration plant for the production of direct reduced iron (DRI), using up to 100% hydrogen as reducing agent.

The plant is based on the Energiron® technology, a process jointly developed by Tenova and Danieli. It will be installed on the premises of the steel mill at Salzgitter.

The µDRAL will have a nominal production capacity of 100 kg/h and will be operated with hydrogen and natural gas showing the flexibility of the technology in terms of fluctuating availabilities of reducing agents, including 100% hydrogen. The DRI produced by µDRAL will be used both in the blast furnace process to save injected coal and in the electric arc furnace of the Peine plant. Salzgitter pursues this technology as one element to achieve its long-term CO_2 reduction targets, defined in the SALCOS® approach.

Tenova

2 x GSM 250/500 WP (25 to capacity)

GLAMA

performance for high productivity

GLAMA Maschinenbau GmbH
Headquarters:
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Fon: +49 (0) 2043 9738 0
Fax: +49 (0) 2043 9738 50
Email: info@glama.de

GCM 80/450 (8 to capacity)

glama.de

GREECE

ElvalHalcor grants FAC for new aluminium hot strip mill

The FAC was signed by the two contract partners during a virtual ceremony (Picture: SMS group)

ElvalHalcor has granted SMS group the final acceptance for the new four-stand high-performance hot strip mill installed at the Oinofyta facilities near Athens.

During the commissioning, aluminium strips were successfully rolled in thicknesses between 1.8 and 12 mm and widths of over 2.6 m on the new mill. As early as just a few weeks from the commissioning, ElvalHalcor rolled some 70 coils of excellent quality and suitable for a wide range of industrial applications on the new, highly flexible mill in one production shift.

Despite the challenges posed by the COVID-19 pandemic, the specialists from ElvalHalcor and SMS group accomplished the commissioning activities without interruption. With travel restrictions in place, increased use was made of digital communication channels, also involving to a great extent experts based in Germany.

SMS group

ITALY

Cogne Acciai Speciali completes finishing area upgrade

AIC Automazioni Industriali Capitanio successfully completed the start-up phase of the rolling mill at Cogne Acciai Speciali as scheduled in January 2021.

Based on a detailed risk analysis performed with the technical support of the Italian company NECSI, this project focused on the upgrade of the PLC control systems of the finishing area for both wire rod and Garrett lines. The scope of supply included the upgrade of the existing automation and control system replacing the obsolete S5 controllers with Siemens S7-1500 PLC; design, manufacturing, supply, installation and commissioning of the new safety and PLC control cabinets; revamping of network interfaces and the communication between a new PLC and existing control PLCs; and implementation of new Profinet/ProfiSafe network between new PLC Master and new local equipment. Also the engineering of safety fences and access gates was part of the order scope.

AIC Automazioni Industriali Capitanio

The upgrade of the control systems of the finishing area has enhanced efficiency and reliability of production (Picture: AIC)

ArcelorMittal signs investment agreement with Invitalia

ArcelorMittal has signed a binding agreement with state-owned company Invitalia, forming a public-private partnership between the parties.

The investment agreement will result in a recapitalization of AM InvestCo, ArcelorMittal's subsidiary which signed the lease and obligation to the purchase agreement for Ilva's business. Invitalia will invest in AM InvestCo in two tranches. The first investment provides Invitalia with joint control over AM InvestCo, the second one is payable on the closing of AM InvestCo's purchase of Ilva's business, which is subject to the satisfaction of various conditions. At that point Invitalia's shareholding in AM InvestCo would reach 60%. ArcelorMittal will also invest to the extent necessary to retain a 40% shareholding and joint control over the company.

The updated industrial plan agreed between AM InvestCo and Invitalia involves investment in lower-carbon steelmaking technologies, including the construction of a 2.5 million t/year electric arc furnace.

ArcelorMittal

Danieli, Leonardo and Saipem cooperate on green steel

Danieli, Leonardo and Saipem have signed a framework agreement to work together on projects both in Italy and abroad, for the conversion of energy-intensive primary facilities in the steel sector towards sustainable production.

The three companies propose to jointly supply technologies and services aimed at reducing carbon dioxide emissions in the steel production process to create an innovative and sustainable model that is consistent with current environmental regulations and the CO_2 reduction targets stipulated in the Paris Agreement.

The new technological solution involves replacing conventional steel production processes based on blast furnaces with a new process that will use hybrid electric-powered furnaces integrated with direct iron ore reduction plants that apply a methane and hydrogen mixture.

Under the agreement, Danieli will be the contractor for the supply of the direct reduction technological equipment and electric furnaces. Saipem will take charge of on-site construction of the plants, integrating technologies and competences required for the natural gas, hydrogen, and CO_2 capture chains. Leonardo, through its Cyber Security Division, will take on the role of digital and security technological partner for Industry 4.0 integrated solutions aimed at safely optimizing the production processes, as well as for the protection of the physical and digital components (IT/OT/IoT/SCADA). In addition, the proprietary Energiron® technology, jointly developed by Danieli and Tenova based on the direct reduction of iron ore using natural gas or natural gas enriched with hydrogen, will be integrated into the new solution.

Danieli, Saipem, Leonardo

Marcegaglia Palini & Bertoli restore mill housing geometry

Marcegaglia Palini & Bertoli has contracted Danieli Service to restore the accuracy of the mill housing geometry in its plate mill in San Giorgio di Nogaro.

Danieli Service restored the geometrical tolerances by reconditioning the existing backup and work roll chocks, and supplying and installing new DanLiners® wear plates. While the housing geometry was restored by specialized on-site machining, the roll chocks were reconditioned (dimensional and geometrical tolerances) in Danieli workshops.

Installation of new DanLiners® wear plates and of an automatic greasing system has enabled an extension of the equipment life and a reduction of maintenance activities. The project was completed in a period of twelve days, during the December shutdown.

Danieli

Refurbishment of the mill housing in the Marcegaglia plate mill (Picture: Danieli)

ITALY
NLMK Verona places order for VOD plant

Vacuum treatment in a VOD plant for the refinement of steel for advanced requirements (Picture: Tenova)

Tenova has received an order from NLMK Verona for the turnkey supply of a 70 t VOD plant, with level 1 and level 2 automation, a deslagging machine and auxiliary equipment.

The scope of the contract includes engineering, supply, erection of all equipment, supervision of erection, commissioning and training. The new VOD plant will expand the existing production route, which currently includes an electric arc furnace, two ladle furnaces, a vacuum degassing system, a continuous casting plant, and an ingot casting plant.

The new VD/VOD plant will increase the overall production rate of vacuum treated steel and the product range of VOD treated steel. It will provide effective removal of hydrogen, oxygen and/or carbon, based on proven technology and experience.

Tenova

Acciai Speciali Terni to introduce real-time quality qualification system

Acciai Speciali Terni has entrusted Fives with a quality qualification project for its flat stainless steel production facility in Terni.

The project is an essential part of the digital technology improvement plan pursued by AS Terni. Fives has proposed to introduce the digital solution EyeronTM –a real-time quality qualification system that automatically captures and analyzes data from different steel processes to give operators a clear view of the product quality.

Bringing together data from the laboratory, steel making, surface inspection, production orders and quality claims, Eyeron™ replaces the need for separate software tools and allows to smartly track any quality issues by automatic control of the quality of each coil in real time, by recommending coil reassignment based on the end-customer quality target and predicting the occurrence of surface defects based on specific process conditions in upstream lines.

Fives

Acciaierie Venete to modernize rolling mill

Red Ring rolling stand of the type to be supplied to Acciaierie Venete (Picture: Primetals Technologies)

Primetals Technologies has been contracted by Acciaierie Venete S.p.A. for the modernization of the finishing train of the rolling mill installed in Mura.

The project comprises the replacement of eight existing housing-type rolling stands with modern housing-less type Red Ring Series 5 units, which are lighter and more conveniently movable from the rolling line to the workshop and vice versa. The new Red Ring stands will allow significantly shorter change times, and will make the maintenance operations easier and quicker. Existing rolling rolls and guiding equipment will be reutilized.

Primetals Technologies will provide the process technology, the design, the construction and the installation of the new equipment. The supply includes

eight Red Ring RR575 in horizontal, vertical and convertible configurations. The supplied Red Ring stands will have a maximum working roll centerline distance of 785 mm and a roll barrel of 1,000 mm. For one of the two convertible stands, a new gear reduction group will be supplied with a twin selectable exit, apt to drive the stand in either horizontal or vertical configuration. Beside the main eight stands, the supply comprises eight stands as operating spares, each with nucleus, holder, roll gap adjustment system and guide support system. Workshop devices for stand preparation and roll change, connecting roller tables, loop formers, lubrication and hydraulic components, and a set of stainless-steel piping round off the supply. The hot commissioning of the modernized mill is expected to start in August 2021.

Primetals Technologies

LUXEMBOURG

Vow ASA and ArcelorMittal join forces to build biogas plant

Vow ASA, specialist provider of decarbonizing technology, has signed a strategic memorandum of understanding with ArcelorMittal to work on a project to build a biogas production plant that will reduce CO_2 emissions produced during the steelmaking process.

Vow subsidiary ETIA and ArcelorMittal Europe – Long Products will cooperate to build a dedicated biogas plant for the steel industry at ArcelorMittal Rodange in Luxembourg, using ETIA's pyrolysis technology. The cooperation will comprise engineering, business models and financing, and aim to have the Rodange biogas plant operational in 2023.

The biogas will be made using Vow's patented 'Biogreen' pyrolysis technology, which involves heating sustainable biomass at high temperatures. The gases emitted during this process will then be captured and processed into biogas, which will directly replace the use of natural gas in the Rodange plant's rolling mill reheating furnace. By-products such as bio-coal will also be created during the process, and re-used within ArcelorMittal, directly replacing the use of coal.

ArcelorMittal, VOW ASA

POLAND

EJP acquires wire drawing machine producer Italmec

EJP Maschinen GmbH, based in Baesweiler near Aachen, Germany, has acquired a substantial share in Italmec, based in Katowice, Poland.

This acquisition adds wire drawing machines for ferrous wire to EJP Group's product range, enabling the company to supply complete production lines for the entire process chain from wire rod to finished coil from a single source. Italmec is going to remain the production site within EJP for all wire drawing machines - both for low- carbon and high-carbon steels, such as spring wire.

As early as in spring 2020, EJP had founded EJP WIRE Technology, which supplies machines and related process technology for the pretreatment of wire. In January 2021, EJP finalized the shareholding in WWM Technology Srl. in Conselve, Padua, Italy, which specializes in production equipment for welding wires. EJP utilizes synergies between the wire industry and its traditional focus on rods, tubes and profiles.

EJP Maschinen

Wire drawing machines are now part of the portfolio of EJP Maschinen (Picture: EJP)

EUROPE

RHI Magnesita sells legal entities to Callista Private Equity GmbH

Global refractory supplier RHI Magnesita has sold Norwegian RHI Normag AS and Irish Premier Periclase to Callista Private Equity GmbH.

The two legal entities now sold to Callista predominantly produce magnesia-based products for the fertilizer, animal feed, hydrometallurgical, pulp and paper, environmental and refractory industries.

Callista specializes in the acquisition of non-core group assets and the subsequent optimization of the companies on a standalone basis. As the new shareholder, Callista will pave the way for increasing the competitiveness as well as for a sustainable and successful expansion. In this context, Callista's team will support the company in essential organizational and strategic projects, while the companies' management teams will remain responsible for the daily operational business.

RHI Magnesita

RUSSIA

Metalloinvest boosts HBI production

Metalloinvest has placed two orders to pave the way to boost its HBI production capacity: Mikhailovsky HBI, jointly established by USM and Mikhailovsky GOK (part of Metalloinvest), has signed a contract with Primetals Technologies and consortium partner Midrex Technologies to supply a new hot briquetted iron (HBI) plant to be erected in Zheleznogorsk. In addition, Metalloinvest has launched the modernization of the hot briquetted iron module No.1 at the Lebedinsky mining and processing plant, signing a contract with Tenova.

The new plant in Zheleznogorsk will be designed to produce 2.08 million t/year of HBI, based on the principles of carbon-free metallurgy. Latest design features will ensure reduced energy consumption and environmental impact. The contract includes engineering, supplies and advisory services. The plant will consist of a 7.15 m diameter Midrex shaft furnace, a 19-bay reformer with 280 mm MA-1 reformer tubes and low-NO_x burners. Increased top gas pressure will ensure higher furnace productivity and reduced power consumption. A flue gas hot fan additionally reduces electric power consumption. Also, a hot fines recycling system will be included. The level 1 and level 2 automation systems, including the DRIpax expert system, are also part of the project. Midrex and Primetals Technologies will be responsible for engineering and supply of mechanical and electrical equipment, steel structure, piping, ductwork, as well as for training and advisory services. Start-up is expected in the first half of 2024. The

For the second project, the modernization of the hot briquetted iron module No. 1 (HBI-1) at Lebedinsky GOK, Tenova HYL will provide engineering and consulting services and supply main and auxiliary equipment. The existing HYL technological solution will be supplemented by two modern oxygen injection distributors, as well as an additional boiler for steam generation, an absorber, carbon dioxide extraction pumps, a fuel gas buffer tank and other units. The project is scheduled to be completed by early 2023 and is expected to increase the productivity of HBI-1 plant by more than 10%. At the same time, the metallurgical value of products will improve, with metallization and carbon content increasing.

At Lebedinsky, hot briquetted iron module No. 1 (HBI-1) will be modernized by Tenova HYL (Picture: Tenova)

Primetals, Midrex, Tenova, Tenova HYL

NLMK enhances sustainability of blast furnace operations

NLMK Lipetsk has completed an upgrade of blast furnace No. 4 with a capacity of 2.1 million t/year of pig iron.

The project included an environmental upgrade of the furnace infrastructure. All the dust generated during hot metal production is now captured by a highly efficient dedusting system. The system ensures a purification efficiency of 99.9%, which is in line with the best available technologies. The new equipment also enables more efficient blast furnace gas treatment for it to be utilized as a secondary energy source. Filtered dust will be used in the production of iron-containing briquettes, or fed back into the blast furnace process. As part of the project, the furnace was equipped with a new lining of special refractory blocks that will enhance the resistance of the furnace's internal surface to thermal loads.

NLMK

Severstal orders new rolling mill and commissions rebuilt blast furnace

At Cherepovets, Severstal is going to build a new rolling mill for special steels. The mill will be supplied by Danieli. Recently, Cherepovets has also seen the commissioning of the rebuilt blast furnace No. 3 – a project also handled by Danieli.

The new rolling will be designed to produce 1 million t/year of 5.5 to 32 mm diameter smooth wirerod and coiled bars for the engineering and automotive industries and 8 to 16 mm diameter quenched rebar for construction purposes. Danieli will provide all the technological equipment, automation and advisory services. A walking beam reheating furnace from Danieli Centro Combustion will bring the billets to rolling temperature at a rate of 170 t/h. A single-strand high-speed roughing mill will feed two independent wirerod lines and a garret coiler to produce the bigger diame-

ters. Mill start-up is scheduled for the end of 2022.

Blast furnace No. 3 at the Cherepovets integrated plant has been successfully commissioned after a rebuild with Danieli Corus technology, featuring cooling and lining systems of the "Hoogovens" design. The activities related to this project were revitalized in 2018, after blast furnace No. 3 had been idled and dismantled in 2007. Danieli Corus provided the design, supplied the equipment and performed services for erection and commissioning supervision for the blast furnace and gas cleaning system. The furnace has a useful volume of 3,290 m³. The commissioning of the blast furnace took place as per the original schedule.

Danieli

The rebuilt blast furnace No. 3 at Cherepovets (Picture: Danieli)

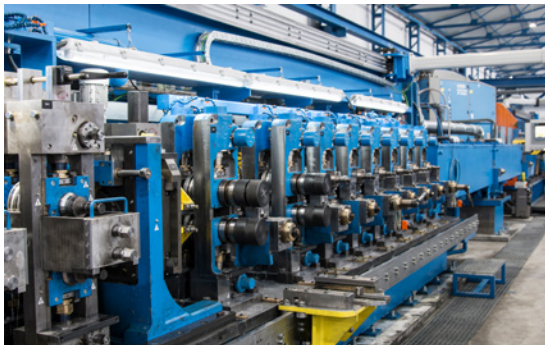
SPAIN

Bornay commissions high-precision tube welding plant

Bornay SL, with its head office in the Spanish town of Ibi, has successfully commissioned an HF (high-frequency) RD 40 tube welding line from SMS group.

The new tube welding line enables Bornay to produce high-quality tubes with round, square or rectangular cross-sections and yield points of up to 1,200 MPa. Diameters produced will range between 10 and 40 mm with wall thicknesses of up to 4.5 millimeters. Squares and rectangulars of up to 30 x 30 mm and up to 40 x 20 mm, respectively, with wall thicknesses of max. 4.0 mm will be produced for use as precision tubes in the automotive industry, but also for furniture, agricultural applications and the structures for solar panel trackers.

SMS group



The 8-stand sizing section of the new tube welding line at Bornay (Picture: SMS group)

SWEDEN

SSAB receives green light for fossil-free steelmaking operations

SSAB Oxelösund has received the environmental permit to convert its steelmaking operations and reduce carbon dioxide activities by 2025.

Use of sponge iron made through Hybrit technology, together with scrap iron as feedstock instead of iron ore and coal, will enable SSAB to reduce emissions in Oxelösund by around 80%. This takes SSAB a step nearer towards fossil-free steel production across all its operations in 2045.

The Hybrit initiative was launched in spring 2016 with the aim to develop the world's first fossil-free ore-based steelmaking technology and offer the first fossil-free steel as early as in 2026. Hybrit Development AB is a joint venture owned by steelmaker SSAB, iron ore producer LKAB and energy company Vattenfall.

SSAB

TURKEY

Tosyali orders EAF, secondary metallurgy facility and continuous slab caster

Tosyali Demir Celik Sanayi has placed an order with Primetals Technologies to supply an EAF Quantum electric arc furnace, a twin vacuum-degassing plant with oxygen blowing and a two-strand slab caster for a flat steel greenfield project in Iskenderun.

The EAF Quantum to be supplied by Primetals Technologies will be designed to produce 2 million t/year of liquid steel and may be operated with a mixture of scrap of varying composition and HBI. The twin vacuum-degassing plant will provide further treatment options and steel quality to the production portfolio of Tosyali Demir Celik. With oxygen blowing possibility, the steel plant will be ready to produce steel grades starting from ULC grades up to high carbon grades, peritectic grades, API grades, dual-phase grades and also high strength low alloyed steel grades. The two-strand continuous slab caster will have a capacity of 2 million t/year of slabs, to be increased to 3.4 million t, and be able to process a wide range of steel grades. The new meltshop is scheduled to be commissioned by the end of 2022.

Primetals Technologies

Interview

With a tradition going back 50 years, VELCO is very optimistic despite of Covid-19

For 50 years VELCO GmbH/Germany has been building a solid reputation as a reliable partner of steel producers and foundries with regard to the refractory application to the steel and refractory industries. STEEL + TECHNOLOGY talked with VELCO's CEO Christian Wolf (CW) about launched machines, procedures and growth of the company that was founded by his father in 1971 and transferred to him in 2004.

Mr. Wolf, when you review the development, how would you describe your company's core competency in just a few words?

CW. Wherever iron or steel is melted, there is a refractory lining to protect the vessel from the hot molten metal. At the contact points arises refractory wear in the form of washouts, cracks, etc. This wear can be repaired by applying a protective layer and thus ensure a longer service life of the system and more operational safety. VELCO machine technology therefore makes a decisive contribution to the smelter. In order to obtain a very good refractory quality in the dry gunning process, pulse-free conveyance and good and even moistening of the gunning material are important. VELCO supplies both rotor and pressure vessel gunning machines for this purpose. We have also developed various types of gunning manipulators for hot repairs in steel and metallurgical plants, which improve working conditions on site and reduce the risk of accidents.

VELCO GmbH is a middle-sized company headquarted in Velbert, Germany in at the south border of the Ruhr industrial area, nearby the cities Düsseldorf, Essen and Wuppertal. Its core competences are the manufacturing of gunning machines for the application of refractory gunning materials and the low wear pneumatical transport of abrasive bulk goods and their injection in the steel industry. Steel plants, foundries, refractory and construction industry value VELCO's competence.

Kurt Wolf (left) founded VELCO in 1971 and transfered the company to his son Christian Wolf in 2004 (Picture: VELCO)

What motivated your father to found VELCO 50 years ago?

CW. As a young man, my father was already familiar with dry gunning technology from the construction industry and mining. Later, as a freelance representative, he was responsible for the sales of gunning compounds and dry gunning machines. At that time Velbert was a center for foundries with which my father was very well networked.

The refractory lining of cupola furnaces (shaft furnaces), in which grey cast iron is produced, has to be repaired daily. This was very time-consuming and exhausting, because earth-moist compound was rammed behind a template.

A better solution was sought for this work. In discussions with the foundry experts and the refractory industry, it was considered whether dry gunning technology could be used here. But the machines available at that time were only suitable to a limited extent.

My father then developed and built an improved a machine in his garage at home.

This was practically the prototype of the VELCO Rotamat and the cornerstone of the company's foundation.

With the introduction of the Rotamat gunning machine in connection with a hydraulic lifting platform also built by VELCO, refractory repairs could now be carried out faster, safer and more cost-effectively. Improvements were also made in procurement and logistics because the refractory materials could now be delivered in big bags or silo trucks.

Gunning robot type MobiGUN when gunning an EAF (Picture: VELCO)

How did the connection to the steel industry come about?

CW. After developing refractory gunning machines and pneumatic conveying systems for the foundry industry in the 1970s, we have expanded our range to include also the steel industry. VELCO then developed the first gunning manipulators. These offer a more efficient repair of a hot aggregate, for example electric arc furnaces, ladles, RH snorkels, converters, etc.

At the same time, the use of a gunning manipulator improves working conditions and safety at work. In addition, the area of application of our pneumatic conveying systems has expanded. We use these to inject carbon fines, lime, alloy carriers as well as residual materials such as filter dust into metallurgical aggregates.

Even though foundries now only account for around 20% of our business, we develop and manufacture injection systems for foundry residues for this branch of industry in order to meet the increased demand for cost savings and environmental protection.

Which recent technical developments do you think are particularly important?

CW. The steel and metallurgical plants are under pressure not only to bring high production output at low costs, but also the aspects of occupational safety and the environmental protection have gained enormous importance in recent years. We support occupational safety with gunning robots which, e.g., are operated from the control station using camera technology.

When thematising the environment, "decarbonisation" and the use of secondary raw materials (organic or recycled products) and, of course, the reduction of residual materials become important. With our pneumatic conveying systems, we can also transport difficult products such as agglomerated filter dust or tangled fibres and blow them into melting furnaces.

We are also continuously working on the further development of dry gunning technology. The modern ULC and NC gunning compounds are very sensitive regarding the addition of water. Over-moistening leads to a decrease in compressive strength. We have therefore developed the GUNMIX® moistening system, in which the water or other binder liquids are atomized using compressed air. In this way, we offer the refractory installer the opportunity to work with little dust using the dry gunning process and to achieve installation quality close to that of "shotcrete".

We have been able to implement remote maintenance for gunning robots for a long time. This is now being transferred to the smaller machines using the latest communication technology. You can see on your smartphone where the machine is

Pneumatical conveying of filter dust (Picture: VELCO)

"Due to lockdowns, we are being slowed down. Much is being shifted to virtual meetings. But not everything can be covered by it. Anyway, we see these difficult times as a challenge."

Cristian Wolf, CEO of VELCO GmbH

and how it works. We are also currently working on a future project for 3D printing concrete.

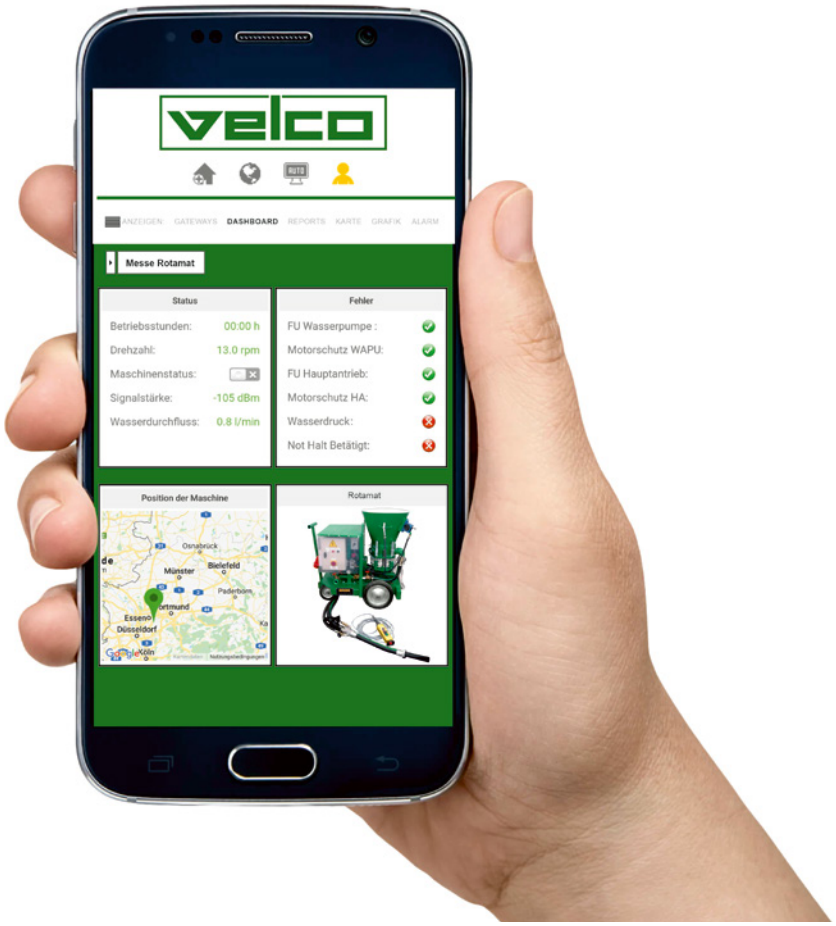
Is the COVID-19 pandemic affecting your business?

CW. In international business and in some cases also domestic, we are being slowed down. Due to lockdowns, projects have been and are still being delayed. Commissioning cannot be carried out completely. Much is being shifted to virtual meetings. But not everything can be covered by it. Anyway, we see these difficult times as a challenge to offer our customers reliable service and we have been able to meet this so far.

What is particularly important to you in the coming years?

CW. Bringing benefits to our customers. For us, this includes innovations, professional advice, prompt service and a big spare parts stock which allows immediate shipment. We rely on solid quality and exclusive production in Germany.

Thank you for the interview.



Today modern VELCO gunning machines can be monitored by smartphone app (Picture: VELCO)

Ambitious greenfield project in northern Sweden

Startup company H2 Green Steel to build large-scale fossil-free steel plant

H2 Green Steel was founded to become a new large-scale steel producer based on a fossil-free manufacturing process. Located in the Boden-Luleå region in northern Sweden, the project will include a giga-scale green hydrogen plant as an integrated part of the steel production facility. After start of production in 2024, H2 Green Steel will strive for an annual production capacity of five million tons of high-quality steel by 2030.

The steel industry is struggling to accelerate the transition to fossil-free steel manufacturing at scale. Startup company H2 Green Steel has announced plans to build a large-scale, greenfield steel manufacturing facility in the Norrbotten region in northern Sweden to enable production of fossil-free steel at a leading cost position. Time sequence of the project is as following:

- Q1 2021: Closing of series A financing €50 million
- Q4 2021: Closing of series B financing €2.5 billion
- H1 2022: Construction stars (pending permits)
- 2024: Production start
- 2026: Full production of 2.5 milllion t of hot- and cold-rolled steel reached
- 2026-2030: Expansion and ramp up to full capacity
- 2030: Yearly production of 5 million t/year of fossil-free steel

An important source of inspiration for the initiative is the groundbreaking HYBRIT project and its founders SSAB, LKAB, and Vattenfall. H2 Green Steel looks forward to a close collaboration with the HYBRIT-founders, sharing the vision to position Sweden at the forefront of fossil-free steel production.

Management team and funding

H2 Green Steel is forming a strong management team with complementary backgrounds and global experience from the steel industry, key customer segments, R&D, digitalisation, financing, and public affairs. Henrik Henriksson, currently CEO of Scania, will lead the company. Alongside him, Marc Bula is one member of the board. The former Chief Commercial Officer of the US steel producer Big River Steel also holds this position at the Swedish start-up company.

This initiative has been developed in close collaboration between investment company Vargas and several strategic and financial investors that are global leaders in sustainability and digitalisation. H2 Green Steel is in the process of closing its series A equity financing of €50 million from a select group of investors, including Vargas, Scania, SMS group, BILSTEIN GROUP, EIT InnoEnergy, Cristina Stenbeck, Daniel Ek, Altor Fund V, and IMAS Foundation.

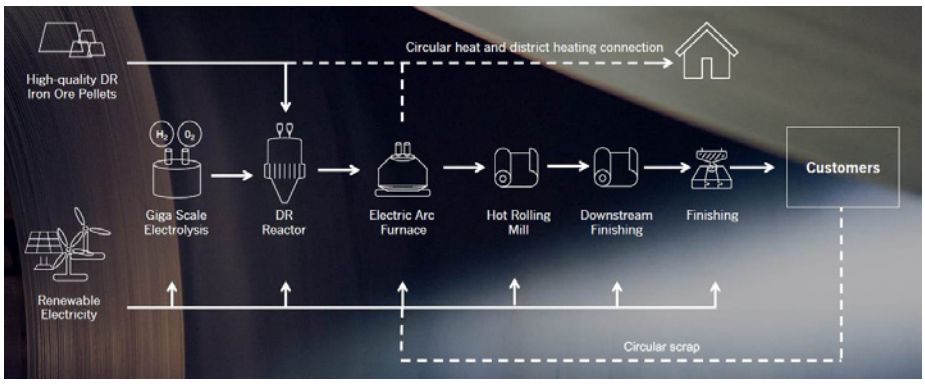
The total financing for the first phase of the project amounts to approximately €2.5 billion, which will be raised through a combination of equity and green project financing. Morgan Stanley, Societe Generale and KfW IPEX-Bank, are acting as financial advisors to H2 Green Steel. Sweco is advising in the engineering and permit process.

A region with unique conditions for fossil-free steel production

H2 Green Steel will be located in the Boden-Luleå region, which also hosts a number of world-class companies and research institutions within the metals and mining industry. The region offers unique conditions for fossil-free steel production with access to abundant energy from renewable energy sources, high-quality iron ore and a large sea port in Luleå. H2 Green Steel is expected to create 1,500 direct jobs in the Norrbotten region, and the project will increase Swedish net export value by around SEK 30 billion. Large scale production starts in 2024.

H2 Green Steel will also contribute to building a knowledge cluster in Norrbotten – where industry, suppliers, municipalities, authorities, and academia work together to accelerate efforts to battle climate change, create new jobs and strengthen Sweden's competitiveness.

H2 Green Steel AB



Plant-concept scheme of the project (Picture: H2 Green Steel)

Acciaieria Arvedi in Cremona, Italy to increase capacity

Upgrade for the Arvedi ESP plant

The Italian steel company modernized the ESP plant and, to feed liquid steel demand, installed a new high-performance Consteel® EAF

The first pioneering Arvedi ESP line at Acciaieria Arvedi, Italy has been operating for 10 years. This plant at the Cremona production site has been the first Endless Strip Production line in the world and started up in 2009. The combined thin slab casting and continuously hot rolling line is linked to a dedicated melt shop for the production of the liquid steel. The upgrade is the first step to raise the overall production capacity of the ESP line to 3 million tons per year. The measures undertaken will also improve product quality.

Upgrade of the ESP line

Acciaieria Arvedi has gathered much experience of how to improve quality and increase productivity and charged Primetals Technologies with the design, supply and execution of the upgrade. The modernization, performed by Primetals Technologies, included changes to the continuous casting machine, resulting in an increase of mass flow, and, consequently production capacity. In this context, the metallurgical length of the line´s caster was elongated to 21.8 meters by adding two caster segments. Provisions for an additional segment 13 were also made. This allows an increase of casting thickness to 105 millimeters, resulting in a mass flow of 450 tons per hour which is probably the highest mass flow for a thin slab casting plant worldwide.

The required space for the additional segments was obtained by moving the first high reduction mill stand R1 downstream of the original R3 to becoming the new R3 stand. The flexibility to increase the metallurgical length, as well as the option to later move the rolling stand R1 to the R3 position, including foundations, was already foreseen in the original plant design of 2006.

> "Thanks to the cooperation between the Tenova project team and the plant personnel of Acciaieria Arvedi, we were able to witness a seamless startup of such an unprecedented machine."
>
> *Silvio Reali, Tenova Senior Vice President.Autorangaben*

All modernization work was carried out during planned shutdowns in December 2019 and August 2020, with the ESP line starting up 3 days ahead of schedule in September 2020. In the first month of operation after re-starting, production exceeded previous levels. Improved automation models will give further support to serve a higher value added products market directly from the ESP line.

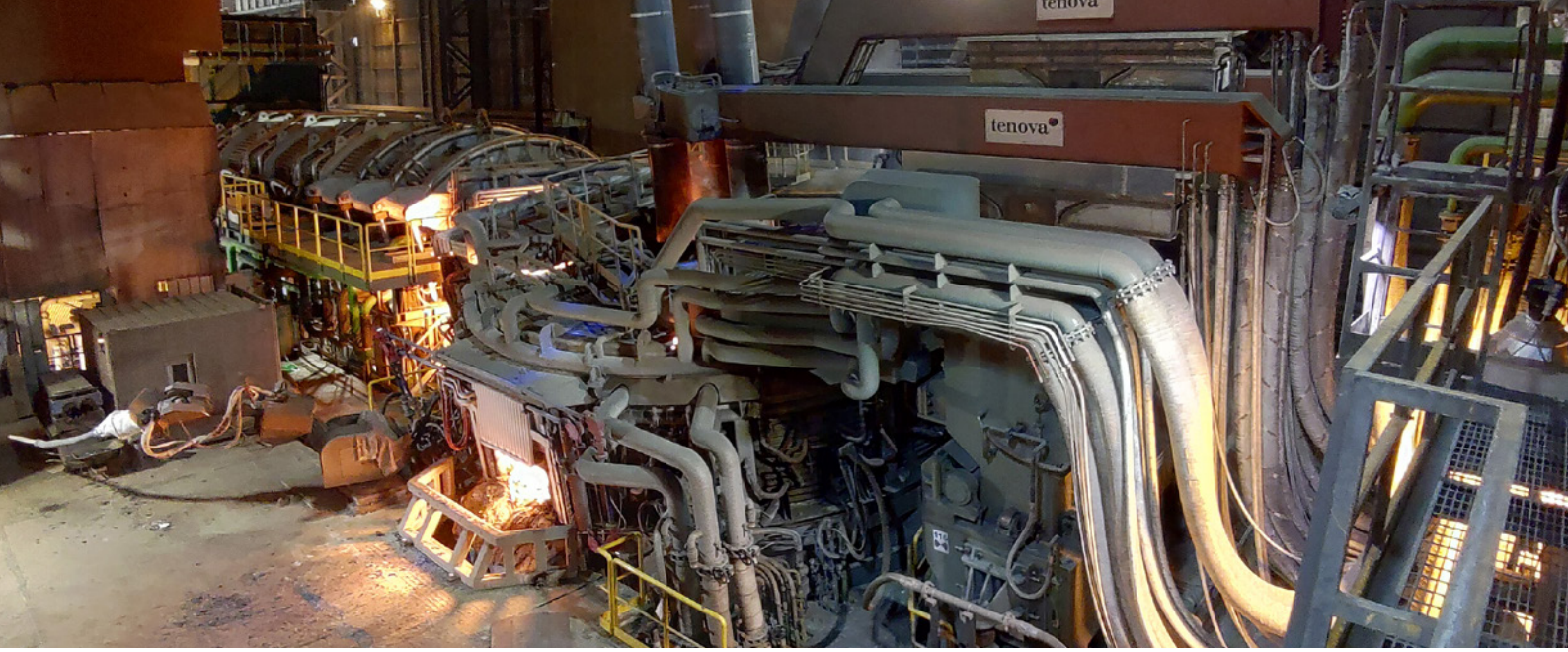
A special crane moves the rolling stand R1 to its new position as R 3 in the Arvedi ESP Line (Picture: Primetals Technologies)

New Consteel® EAF

The EAF of the ESP melt shop also received an upgrade and a ladle size increase. Accordingly, the ladle turret was replaced, with a larger unit, including new software features, etc.

Tenova, a leading company specialized in innovative solutions for the metals and mining industries, was charged to replace the existing Consteel® furnace, originally installed in 2008.

The record-breaking new melting unit has a tapping size of 300 metric tons and is designed to reach a power-on time of 37 minutes with a charge mix including up to 30% HBI or other scrap substitutes. The outstanding productivity performance of the new Consteel® EAF has been designed with the aim to meet the increased



The Consteel® EAF has a tapping size of 300 tons and is designed to reach a power-on time of 37 minutes (Picture: Tenova)

demand of the modernized ESP line of the steel plant.

Being the most productive electric arc furnace in history, this Tenova Consteel® EAF, was started up the at Acciaieria Arvedi on September 17, 2020. (STEEL + TECHNOLOGY had already briefly reported the commissioning in the November 2020 issue.) This output has never been achieved before by a single EAF worldwide, and it is made possible thanks to the proprietary Consteel® continuous charging and melting technology of Tenova, complemented by Consteerer®, an innovative electro-magnetic stirring system, jointly developed with ABB. The furnace has a 9,1 metre diameter shell and is continuously fed by a 4 metre wide Consteel® slip-stick conveyor. The furnace is also equipped with a state-of-the art Level 1 and Level 2 automation package.

During a very quick ramp-up phase, after just a few days from the start-up, the furnace was already operating on three shifts achieving high production rate and performances.

Primetals Technologies, Tenova

Expansion project achieved successfully in Arkansas, USA

Big River Steel doubles capacity

Big River Steel successfully started up the second phase of its Arkansas-based scrap metal recycling and flat-rolled steel production facility. The phase two expansion budgeted at US$ 716 million will double Big River Steel's production capacity to 3 million metric tons annually

"When describing the success of our phase two construction efforts, I am extremely proud to be able to use my five favorite words: 'ahead of schedule' and 'under budget.' This achievement is a testament to the hard work and can-do attitude of our employees," said Dave Stickler, Big River Steel's chief executive officer.

In 2017, Big River Steel began operations at its US$ 1.3 billion scrap metal recycling and flat-rolled steel production facility supplied by SMS group. Since then, Big River Steel has provided steel to over 225 customers in the automotive, energy, construction and agricultural industries. Based on its early success, Big River Steel completed its phase two expansion to enhance its product capabilities, further improve the efficiency of operations, and serve as the base for incremental expansion projects targeted at the most demanding steel grades, including steel grades used in hybrid and electrical vehicles.

Originally slated to be commissioned on January 27, 2021, the new plant equipment were brought on line in November 2020 – more than two months early and are already being used to produce high-quality steels. With a team of experienced steel technicians and a phase two layout consistent with the mill's existing footprint, Big River Steel plans an aggressive ramp-up to reach rated capacity in less than five months. Once rated capacity is reached, Big River Steel will produce close to 5,000 tons of steel per employee per annum, up almost 66% from the already world class 3,000 tons of steel per employee currently produced.

Jim Bell, chief executive officer of BRS Construction Advisory Group LLC, commented, "Being able to successfully complete a $700 million construction project in the face of the COVID pandemic is a tremendous accomplishment. The entire Big River Steel family is extremely proud of what we have accomplished."

New systems installed an commissioned

Also for the mill expansion SMS group supplied the mechanical equipment, the electrical and automation systems, and the digitalization technology,. i.e. the mill's second electric arc furnace, ladle metallur-

The commissioning team after the successful start-up of the second phase. Face masks were taken off only during the photo shooting (Picture: SMS group)

gical station, thin-slab continuous caster, tunnel furnace and hot strip downcoiler

Now, with the second construction stage completed, Big River Steel operates two electric arc furnaces and two twin-ladle furnaces. The steelworks has also been equipped with a further gas cleaning system as part of the project.

The CSP® plant has seen the addition of a second casting strand, a second tunnel furnace and another downcoiler. Big River Steel's CSP® plant produces up to 1,930 millimeters wide coil, making it one of the widest CSP® plants in the world.

SMS group's PQA® (Product Quality Analyzer) system is a central element of the process automation implemented in the first phase and it is equally so in the automation of the newly added units and systems. PQA® monitors, documents and assures quality along the complete production process down to the finished cold strip.

Most of the hot coil produced in the CSP® plant is processed into high-grade cold strip in the downstream coupled pickling line/tandem cold mill (PLTCM). As part of the expansion, another coil preparation station was added to the entry end of the PLTCM, and the adjacent continuous galvanizing line received an additional downcoiler at the exit end. For all newly installed plants, SMS group supplied the mechanical equipment and the X-Pact® electrical and automation systems, including level 3.

Big River Steel's Flex Mill® is the world's only LEED (Leadership in Environmental and Energy Design) certified steel production facility. With an industry leading carbon emissions factor of only 0.125, Big River Steel is at the forefront of the effort to provide steel consumers with "green steel." Since commissioning of the that time new mill in December 2016, Big River Steel has been producing high-quality steels, including tube grade sheet for pipeline construction, silicon steels for a wide range of uses in energy generation and electric motor manufacturing, and advanced high-strength steels for the U.S. automotive industry.

U. S. Steel to acquire remaining equity of Big River Steel

United States Steel Corporation (U. S. Steel) has exercised its call option to acquire the remaining equity (50.1%) of Big River Steel for approximately US$ 774 million from cash on hand. The transaction is subject to satisfaction of customary closing conditions, including antitrust approval.

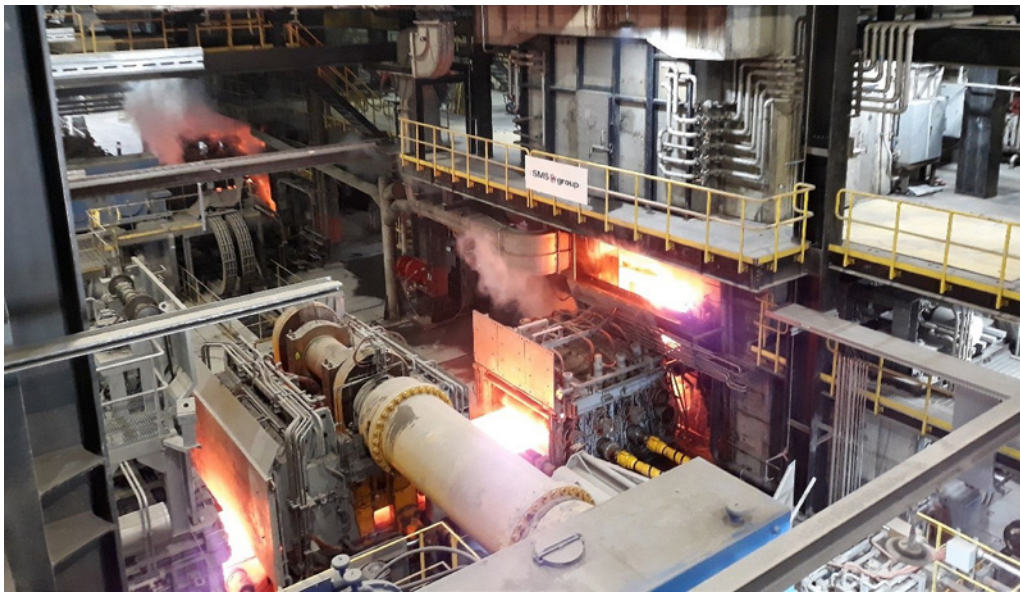
> "With Big River Steel, we can offer customers the high performance, innovative steel products they expect from U. S. Steel's scientists and application engineers made through a state-of-the-art, environmentally sustainable and efficient mini mill process."
>
> *David B. Burritt, President and Chief Executive Officer of U. S. Steel*

Big River Steel offers high-quality products and services to discerning customers in the automotive, energy, construction, and agricultural industries. Big River Steel's advanced manufacturing technology and skilled operators combined with U. S. Steel's product development capabilities and intellectual property have allowed Big River Steel to produce eleven advanced U. S. Steel grades, including substrate for its XG3™ grade of Generation 3 advanced high-strength steels (AHSS). That will ultimately increase U. S. Steel's competitiveness in a broader range of automotive applications to better serve strategic customers. This will increase U. S. Steel's ability to supply automotive manufacturers with the materials they need to not only meet automobile passenger safety requirements but also significantly reduce weight and emissions to meet future vehicle fuel efficiency (CAFE) standards, all made through an ultra-low-carbon emission production process. These same products are also a "greener" solution for customers who are increasingly focused on sustainability within their supply chains.

U. S. Steel's assistance to Big River Steel in developing a wider range of steel grades, including grades predominately made by integrated producers, shall demonstrate the power of the world competitive "Best of Both" integrated and mini mill steelmaking technology strategy.

Validating the future role of Big River Steel's proven sustainable steelmaking technology will play in meeting U. S. Steel's commitment to reduce greenhouse gas emissions intensity across its global footprint by 20%, as measured by the rate of carbon dioxide equivalents emitted per ton of raw steel produced, by 2030 based on 2018 baseline levels. Big River Steel will also increase the steel recycling intensity within U. S. Steel's footprint.

Big River Steel, U. S. Steel, SMS group



No. 2 CSP® casting strand with pendulum shear (Picture: SMS group)

Preheated scrap is charged continuously into the 40-t Fastarc EAF (Picture: Danieli)

Danieli MIDA minimill starts at Nucor Steel Florida

Endless casting and rolling operations right from the first heat

The consistent start-up of this plant validates once more the full reliability of the MIDA endless casting and rolling process. The 40-tons EAF meltshop is equipped with scrap preheating and continuous charging system. It is the fourteenth minimill featuring Endless Casting-Rolling ECR technology for long products in operation worldwide

On December 18th, thanks to the joint efforts of Danieli and Nucor teams, Nucor Steel Florida safely started on schedule, melting, casting and rolling in endless mode from the first heat.

Located in Frostproof, Florida, USA, the new MIDA minimill has a rated capacity of 380,000 short tons (345,000 t) per year and will produce rebar ranging from #3 to #11 (diameter 9.5 to 35.8 mm) in straight bars up to 20 m (60 ft), and spooled coils up to 5 tons. Featuring the latest energy-saving and environmentally friendly melting, the MIDA casting and rolling technologies significantly reduce the overall CO_2 emissions thanks to the absence of the reheating furnace.

With the Florida minimill, Nucor will satisfy the regional demand of steel rebar, recycling the scrap available in the area and reconfirming the Endless Casting and Rolling solution as a proven solution for a sustainable steel production.

Nucor Steel Florida is the fourteenth Danieli MIDA minimill featuring Endless Casting-Rolling ECR technology for long products in operation worldwide – second for the Nucor group – and fourth in the USA.

In January 2020, the first MIDA minimill for Nucor, Sedalia, Missouri also started up quickly, having the endless casting and rolling operations in place on third day and a "more than 1 km" long billet produced on the fifth day.

The consistent start-up of this plant validates once more the full reliability of the MIDA endless casting and rolling process, which gives steelmakers the possibility to achieve a total transformation costs from 5 to 10 % lower than a traditional minimill.

Plant design and configuration

The MIDA endless casting-rolling process route includes the Danieli ECS® scrap preheating and continuous charging system, able to feed hot scrap continuously into a 40-t, side-charging, Fastarc AC EAF; and then a ladle furnace ensures the proper refining of the steel.

A single-strand, high-speed continuous casting machine is the core of the endless casting-rolling section. It is equipped with the Danieli Fast Cast Cube (FCC) and a 130 mm x 130 mm square section Power-mould copper tube directly connected, through a 4 MW induction furnace, to an 8 + 8 stands ultra-compact rolling mill.

The finishing facilities consist of an apron roller line, for the larger sizes, the Danieli-patented Direct Rolling and Bundling system (DRB) for the smaller range and a spooler line based on the "K-Spool" technologies, able to produce coils from rebar #3 to #8 in coils up to 5 tons.

The latest Danieli technologies for an environmentally friendly and energy saving plant are also applied to the auxiliary units, which include the fumes treatment plant, based on a pulse-jet bag filter, the water treatment plant, and the Danieli heavy duty technological and maintenance cranes serving the whole plant, from the scrap yard to finished products handling.

Danieli

Reduced working costs, low CO_2 emissions, record-braking productivity

Minimill for green steel products in China

The new minimill at Guilin Pinggang has started up steelmaking and rolling facilities. The meltshop comprises a Quantum electric arc furnace and a twin ladle furnace. The Twin MIDA® endless casting and rolling plant will produce 1.3 million tons per year of rebar and wire rod in an energy-efficient and sustainable way.

Guilin Pinggang Iron and Steel Co., Ltd. is privately owned Chinese steel company located in Pingle near Guilin city in Guangxi Province. The new production facilities of the enterprise have an annual production capacity of approximately 1.3 million metric tons, and produce rebars, wire rod and other steel elements for the growing demand of the construction industry.

An electric arc furnace with a tapping weight of 120 metric tons and a 120 metric ton twin ladle furnace were started-up in December 2020. Primetals Technologies supplied the complete mechanical and electrical process equipment for the new EAF and the twin ladle furnace. The balance of plant equipment and services was provided by a local design institute.

The EAF Quantum can be charged with many different kinds of steel scrap. It combines proven elements of shaft furnace technology with an innovative scrap charging process, an efficient preheating system, a new tilting concept for the lower shell, and an optimized tapping system. This achieves very short tap-to-tap times.

The electric energy consumption is considerably less than that of a conventional electric arc furnace. Together with the lower consumption of electrodes and oxygen, this gives an overall advantage in the specific conversion cost of around 20 percent. In comparison to conventional electric arc furnaces, total CO_2 emissions can also be reduced by up to 30 percent per metric ton of crude steel.

Endless casting-rolling plant with highest single-strand productivity

For the new minimill Danieli supplied a Twin-MIDA ECR® Endless Casting and Rolling plant to produce rebar and wirerod in an energy-efficient and sustainable way. The plant has been started up smoothly and now it is ramping-up at a fast pace.

Danieli plants featuring Danieli Universal Endless DUE technology utilize a short induction heating system for billet temperature equalization (no reheating) and ensure the highest plant yield and constant quality along the entire finished rolled stock.

The FastCast caster continuously feeds the mills with endless 190-mm square billets at high speed. The two mills consist of 20 housingless stands each and produce respectively 10 to 28-mm-dia rebars and 6 to 12-mm-dia wirerod. The UFG Ultra Fine Grain process guarantees high-quality products for reliable construction purposes, whilst allowing considerable alloy savings. Patented DRB Direct Rolling and Bundling permits the cutting of rebar to final length directly off the last stand.

Danieli Automation supplied the advanced full process control system ensuring timely synchronization of two casting strands and related rebar and wirerod mills, and core power equipment.

The sum of the installed Danieli technologies allows the most competitive CapEx and OpEx. Danieli manufactured all the technological equipment at Danieli quality workshops in Italy and China, and provided advisory services. According to Danieli this is the minimill with the highest single-strand productivity in the world.

Primetals Technologies; Danieli

First ladle tapped at new EAF Quantum by Primetals Technologies for Guilin Pinggang, China (Picture: Primetals Technologies)

New stands assure lower OPEX in general

Bar mill started-up after modernization at Stahlwerk Annahütte, Germany

The intermediate rolling train has been equipped with two Red Ring Series 5 stands. The new stands offer shorter change times and prolonged lifetime of wear components. Mill operation and maintenance activities are benefited

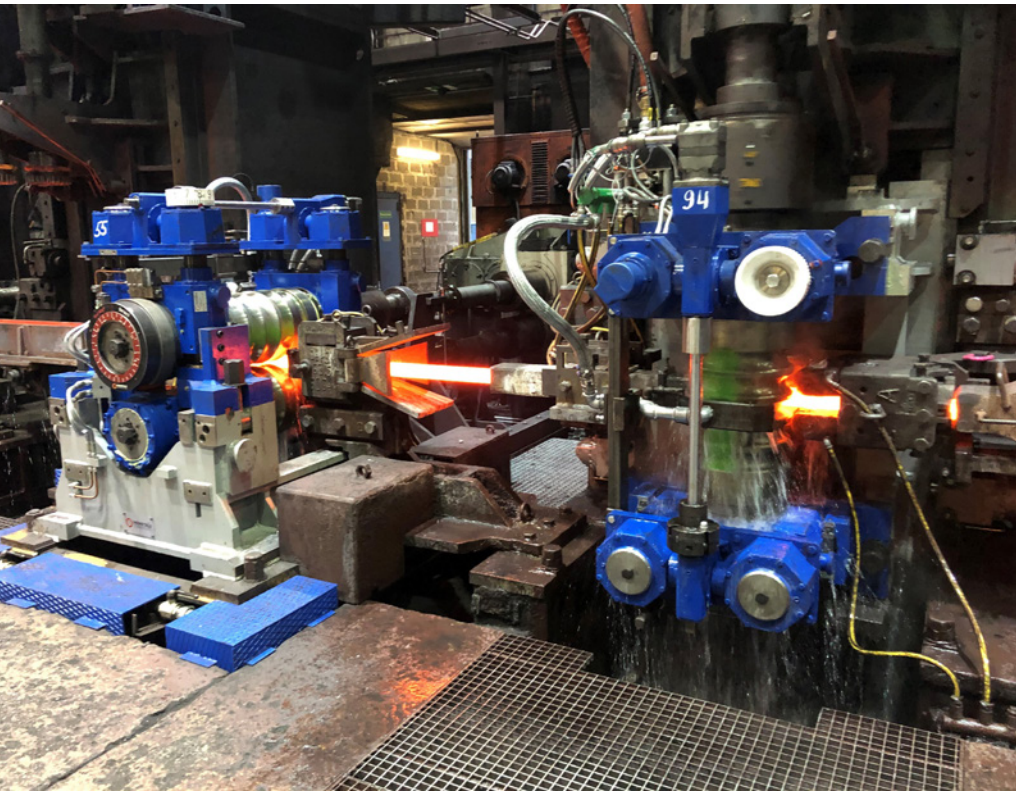
In August, Primetals Technologies finished a revamping project of the long rolling mill at Stahlwerk Annahütte Max Aicher GmbH & Co. KG (Stahlwerk Annahütte) in Ainring-Hammerau, Bavaria, Germany. The project encompassed the modernization of the intermediate rolling train by replacing two existing Red Ring Series 1 stands with the latest design, Red Ring Series 5 stands. These stands allow for shorter change times and offer a prolonged lifetime of wear components. Mill operation and maintenance activities are benefited.

For the modernization project, Primetals Technologies provided the engineering of process technology, as well as design services. Two Red Ring Series 5 stands RR545 in H/V configuration were installed at the intermediate train. Other equipment supplied included:

- two stand-by stands,
- the retrofit of the stand lubrication system to allow quick connection/disconnection during stand change operations,
- encoder systems for gap adjustment,
- workshop systems, especially for stand preparation and roll change, particularly compatible with both Red Ring Series 1 and 5, as well as with other existing stands.

In addition, the new equipment was adapted to the existing mill, in order to minimize installation time. Engineering services for other equipment, advisory services to erection and commissioning, and training services rounded off the scope.

The long rolling mill at Stahlwerk Annahütte has a design production capacity of 240,000 metric tons per year. It processes square billets with dimensions of 160x160 and 178x178 millimeters. Steel grades include carbon, quality, alloyed and non-alloyed steels. Finished products are thread and plain round bars with diameters ranging from 12 to 75 millimeters. The original rolling mill had been installed by former Pomini SpA (now Primetals Technologies) in 1973. The Red Ring stands Series 1 were still perfectly working, its replacement with Series 5 is intended to improve the flexibility of operation, by reducing the change times and extending the lifespan of main wear components.



New Red Ring Series 5 stands by Primetals Technologies in the intermediate train of the long rolling mill of Stahlwerk Annahütte Max Aicher GmbH & Co. KG in Ainring-Hammerau, Bavaria, Germany (Picture: Primetals Technologies)

Lived tradition for almost 500 years

The history of Stahlwerk Annahütte began in 1537, when iron mining and working activities started. Since 1975, when it became part of the Max Aicher group, the company has gradually specialized and has become an important European producer of thread bars and quality bars for automotive and industry applications. It is the leading global supplier of thread bars used in pre-stressed concrete manufacturing, rock anchoring, mining, tunneling and other geotechnical applications.

Red Ring is a registered trademark of Primetals Technologies in certain countries.

Primetals Technologies

4.1 million tons per year for a wide range of quality flat products

HBIS Laoting successfully commissions high-performance hot strip mill

The product mix of the plant supplied by SMS group includes, besides low-alloy carbon steels, high-strength automotive grades, weather-resistant structural and container steels, pipe grades, boiler and pressure vessel steels and steels for use in ship and bridge construction

The new high-performance hot strip mill supplied by SMS group has successfully started production at HBIS Laoting Iron & Steel Co. Ltd. in China. With this facility, HBIS Group, a leading steel producer in China, has set up a new, ultra-modern production facility for flat products at the Laoting location.

The high-performance hot strip mill has an annual capacity of 4.1 million tons and produces hot coils with widths of up to 1,900 millimeters. Final thicknesses range between 1.2 and 25.4 millimeters. The product mix includes, besides low-alloy carbon steels, high-strength automotive grades, weather-resistant structural and container steels, pipe grades, boiler and pressure vessel steels and steels for use in ship and bridge construction.

The hot strip mill comprises main equipment as following:

- a roughing mill descaler,
- a slab-sizing press,
- a two-high reversing roughing mill,
- a four-high reversing roughing mill with attached edger,
- a mandrel-less coilbox,
- a crop shear,
- at the finishing end a descaler,
- a seven-stand finishing mill and
- a laminar cooling system.

Three downcoilers produce straight-edged coils of finished hot strip. Downcoiler No. 3 has been specifically designed for the challenging task of coiling thick, high-strength strips.

The described system configuration provides HBIS Laoting maximum flexibility in planning and production. For example, the slab sizing press in the entry area of the hot-strip roughing mill enables a width reduction of up to 350 millimeters.

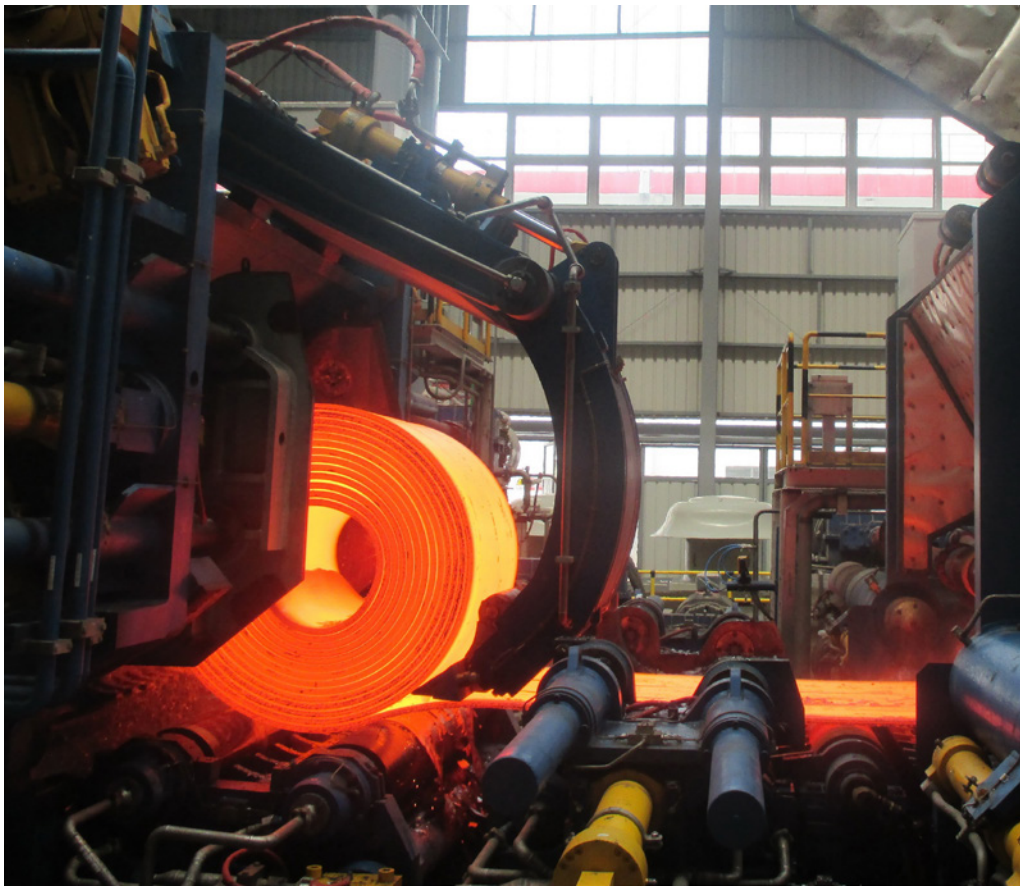
The two high-performance roughing stands allow a high degree of flexibility in the distribution of pass reductions. The finishing stands come with rolling forces of 52 MN (F1 - F4) and 40 MN (F5 - F7). All stands - equipped with hydraulic roll gap adjustment – achieve tightest tolerances.

For optimum profile, contour and flatness of the strip, the stands are equipped with the proven CVC®plus system (Continuously Variable Crown) with integrated work roll bending.

A laminar cooling line of the latest generation in the exit area of the finishing mill provides high flexibility and a wide range of cooling rates in setting the required mechanical properties for all grades and dimensions within narrow tolerances. The higher flow rates in the rear part of the cooling section also facilitate the production of multi-phase steels.

HBIS Laoting Iron & Steel is very satisfied with the rapid commissioning process and the excellent quality of the hot strip mill.

SMS group



The transfer bar is coiled in the mandrel-less coilbox, where the temperature losses of the inner windings are extremely low (Picture: SMS group)

Heat treatment of heavy plate

Highly flexible cooling enables wider product range

A prerequisite for optimal product properties of the plates is high temperature uniformity during both plate heating and the tempering process that follows quenching. For this purpose, German heavy plate producer Ilsenburger Grobblech GmbH uses besides two state-of-the-art roller hearth furnaces a new X-Roll® MultiFlex-Quench (MFQ). At this plant, any cooling strategies – from extremely slow cooling to fast quenching with freely selectable cooling-stop temperature can be implemented

On November 23, 2020, Ilsenburger Grobblech GmbH successfully heated the first heavy plate in its heat-treatment furnace No. 1, followed by the subsequent successful cooling in the new X-Roll® MultiFlex-Quench (MFQ) supplied by SMS group. Thanks to the closely coordinated and targeted collaboration during the assembly and cold commissioning phases, production of the "first plate" could take place eight days before the originally scheduled challenging deadline.

The MFQ plant is part of a new, energy-efficient heat-treatment line supplied by SMS group to the Salzgitter Group subsidiary. With the extremely flexible cooling strategies enabled by the now commissioned new quench, Ilsenburger Grobblech GmbH is now able to expand its product range to also include particularly demanding grades.

Homogeneous cooling down to the desired temperature

With the X-Roll® MultiFlex-Quench, SMS group has established a new and innovative cooling technology in the market, providing significantly more options than conventional cooling lines. By means of switchable pressure ranges any cooling strategies from extremely slow cooling to fast quenching with freely selectable cooling-stop temperatures can be implemented. Thanks to the variable settings, the MFQ enables a significantly larger product portfolio than conventional quenches. The plates are hydraulically clamped by roller guides, ensuring optimal flatness, especially of thinner plates.

A prerequisite for homogeneous cooling and optimal product properties of the plates is high temperature uniformity during both plate heating and the tempering process that follows quenching. For this purpose, SMS group supplied two state-of-the-art roller hearth furnaces, which both feature energy-efficient heating systems and modern low-NO_x burners for low-emission operation.

In addition, SMS group is supplying an X-Roll® MultiFlex® Leveler T for the heat treatment plant. While providing proven functions, this new leveler type sets new standards in terms of final flatness and residual stress distribution in the material. Among other things, new back-up rolls for maximum load transfer were developed specially for this machine type and tested on SMS's own test stand. The quick-acting leveling roller adjustment system enables – in addition to variable strategy selection to effectively remove even complex flatness deviations – the application of the E-mode (Extended-Roll-Mode), which greatly increases the leveling range of the machine. The functionality range of the X-Roll® MultiFlex – Leveler T is rounded out by a bending system with the possibility of specific leveling gap adjustment, a system for load balancing of the individu-

The first plate on the new X-Roll® MultiFlex-Quench was produced on 23 November 2020 (Picture: SMS group)

ally driven main drives as well as a highly dynamic main adjustment system.

A complete set of technologies from a single source

Besides the X-Roll® MultiFlex-Quench, the X-Roll® MultiFlex – Leveler T and the two furnaces, the SMS group supplies include a shot blaster, a primer line and a water-treatment plant, all complete with X-Pact® electrical and automation systems. Powerful X-Pact® process models, including a material model, ensure the correct setting of the equipment and the achievement of the desired material properties. The scope of supply also includes ancillary equipment such as the plate conveyor system, the cooling beds, and the plate feeding and centering equipment.

The new heat treatment line will process more than 200,000 tons of heavy plate per year. It is designed to handle plate in thicknesses between 5 and 175 millimeters and widths up to 3,500 millimetres. The between 4 and 24-metres-long plates will weigh up to 28 tons. The material grades to be processed will include high-strength carbon steels, highly wear-resistant steels, steels for offshore and pressure vessel applications as well as case-hardened and quenched/tempered steels.

Equipped with an energy-efficient heating system, the roller hearth furnace supplied by SMS group is characterized by low emissions (Picture: SMS group)

SMS group

Innovation in seamless tube production

4th generation of PQF® plants boosts productivity with low investment costs

It represents a quantum leap for the production of seamless tubes. The SMS group experts have succeeded in achieving a 30 percent increase in output with the fourth generation of PQF® (premium quality finishing) plants. This gain is not only possible with new plants; existing PQF® plants can also fully benefit from this with a low-investment upgrade

SMS group has once again lived up to its motto and high standards as "leading partner in the world of metals" with its fourth generation of PQF® plants. At the same time, the new plant and upgrade solution is characterized by a considerable cost reduction per ton of tube and substantially higher profitability for tube producers, who are able to gain a significant competitive edge as a result. Achieving such a high production capacity and plant performance in the manufacture of high-quality PQF® tubes has not been possible until now.

The 4th generation 7-inch PQF® is able to roll 200 tubes per hour (Picture: SMS group)

Michael Wilms, vice president seamless tube plants at SMS group - Contact: michael.wilms@sms-group.com

Economic benefits and new market opportunities

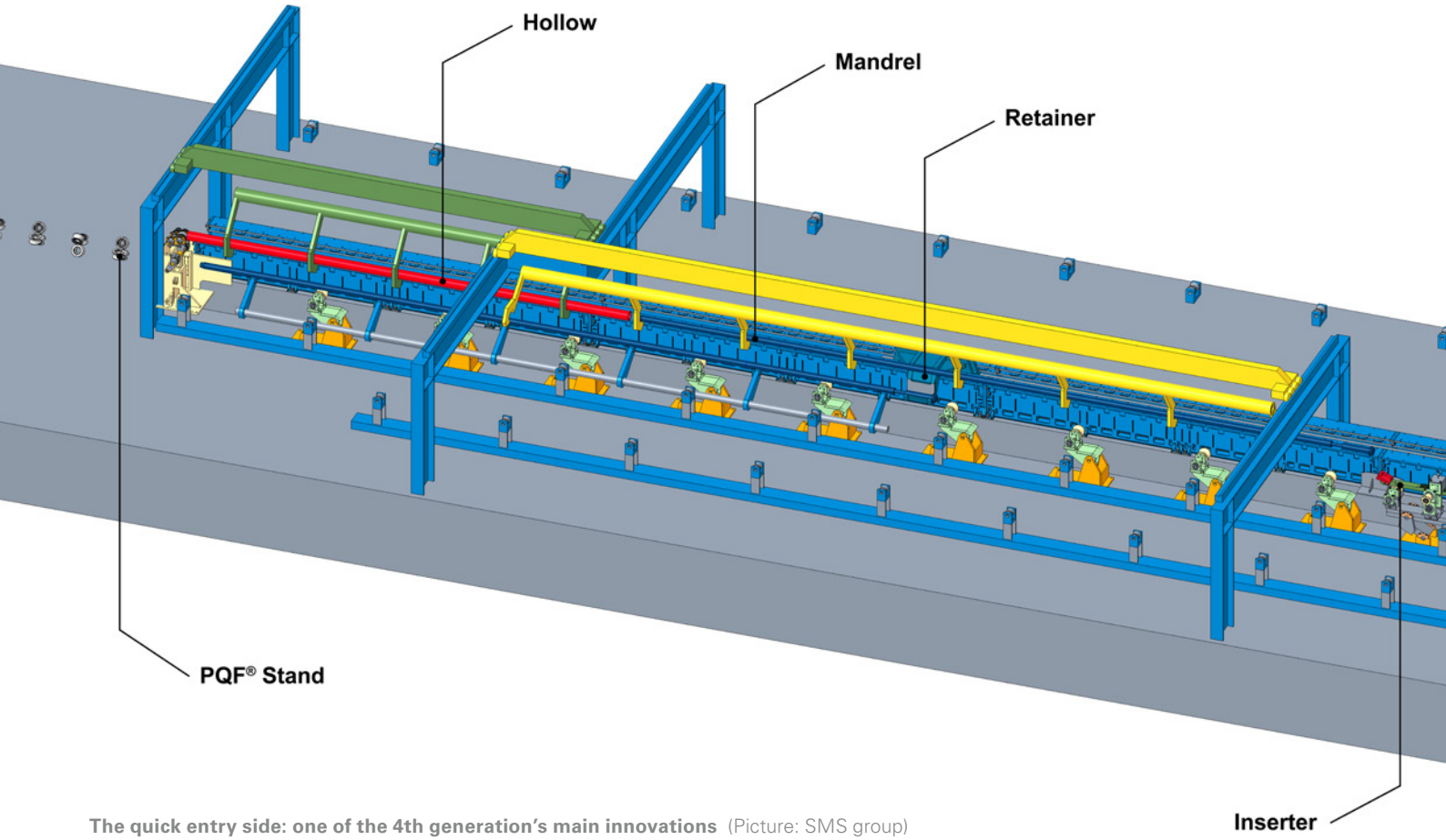
For the plant owner, the increase in productivity certainly has positive effects. Here are two possible scenarios:

- A 30 percent higher production capacity with the same production time and manpower means an increase from 500,000 to 650,000 tons per year. This creates new opportunities for sales and a fast return on investment.
- The performance enhancement is used to produce the same quantity of PQF® tubes in less time than before. Due to the minimal time required, working shifts and human resources can be adapted accordingly.

Depending on the market situation and capacity utilization, plant owners can either produce more tonnage or a set target tonnage in a shorter time using the same manpower. In both cases, cost efficiency is higher and tube producers can respond adequately to volatile market and price situations.

The standard of the future

Around 40 million tons of seamless tubes are produced worldwide every year, around half of them in high-grade PQF® quality. The main customer is the oil and gas industry, which uses OCTG tubes preferably made using the PQF® process. The reason: As the conditions for extracting fossil energy deposits become more and more extreme, the tubes must meet correspondingly high



The quick entry side: one of the 4th generation's main innovations (Picture: SMS group)

quality and load requirements. A smaller proportion of the PQF® tubes produced is used in the field of structural engineering. This may change with the fourth generation of PQF® plants or the upgrade solution.

The lower manufacturing costs make seamless tubes an interesting choice for other applications, such as engineering.

It is also to be expected that existing, old equipment for seamless tubes will be replaced by state-of-the-art, digitalized PQF® plants of the fourth generation, as conventional seamless tube lines cannot viably compete with the high-precision PQF® quality nor with the new productivity boost.

In terms of their lifecycle assessment and sustainability, plant owners also benefit from the fourth generation of PQF® plants. The reason is that the total amount of energy required does not increase – as one would otherwise expect – in direct relation to the growth in production. On the contrary, less energy is required per ton of tube produced. This mainly results from the fact that the energy consumption of the secondary operating facilities and administrative facilities remains constant with the increase in production.

Significant five-second reduction in cycle time

The main innovations include the arrangement of a quick entry side with the inline insertion of the mandrel in the pierced billet.

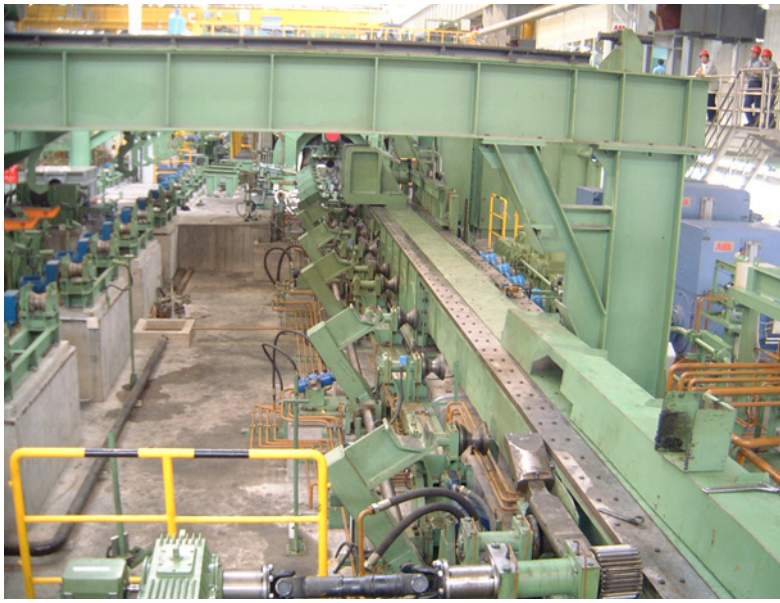
In conjunction with the highly efficient configuration of the retaining system, the cycle times are reduced by between four and five seconds. This means that a cycle time of around 20 seconds per tube – and even up to a peak of 18 seconds – is now possible instead of a cycle time of 24 seconds. A 7-inch PQF® is therefore able, for example, to roll 200 tubes per hour; a 10 ¾-inch PQF® can achieve 150 tubes per hour.

Another new feature is the chocks design in the PQF® rolling mill that help to simplify roll assembly and dismantling. The roll and shaft are separate from each other and are no longer made of one part. This reduces tool costs considerably and reduces the necessary operating stands inventory. A special, newly developed grooved profile between the roll and shaft replaces the previous cylindrical coupling and ensures reliable torque transmission.

> "We are convinced that our new generation of PQF® plants represents a really unique and highly attractive offer for tube manufacturers all over the world. Of course, the huge increase in capacity and productivity also ensures a faster return on investment."
>
> *Thomas Maßmann, Executive Vice President Long Products, SMS group*

Higher speed also means higher productivity – but what effect does this have on quality? The consistently high quality and precision levels of PQF® tubes are ensured by the rolling technologies and performance module from SMS group. These include the advanced,

Conventional seamless tube lines cannot viably compete with the high-precision quality and the productivity boost of the latest PQF® generation (Picture: SMS group)



View of the entry side of a PQF® plant: inserter (front right in the picture) and retainer (rear centered in the picture) (Picture: SMS group)

digital inline technologies as part of Industry 4.0: For example, the CaliView® measuring system, developed by SMS group, enables the fast inline calibration of all longitudinal rolling mills and thus guarantees perfect alignment of the pass line. Equipped with the LASUS® Multiscan and SecControl® systems, the wall thicknesses of the tubes produced can be individually measured and controlled. Furthermore, CARTA® neo supports process engineers with the monitoring, analysis, and intelligent control of all quality parameters.

Faster return on investment with stable investment expenditure

With regard to new plants, the investment in a fourth-generation PQF® remains the same. Additional investments are only required for some equipment areas in the line, because furnace and saw capacities, for example, need to be increased. Even in the case of an upgrade, the financial outlays are manageable. These mainly concern adjustments to the cycle times and capacity extensions in the peripheral line equipment.

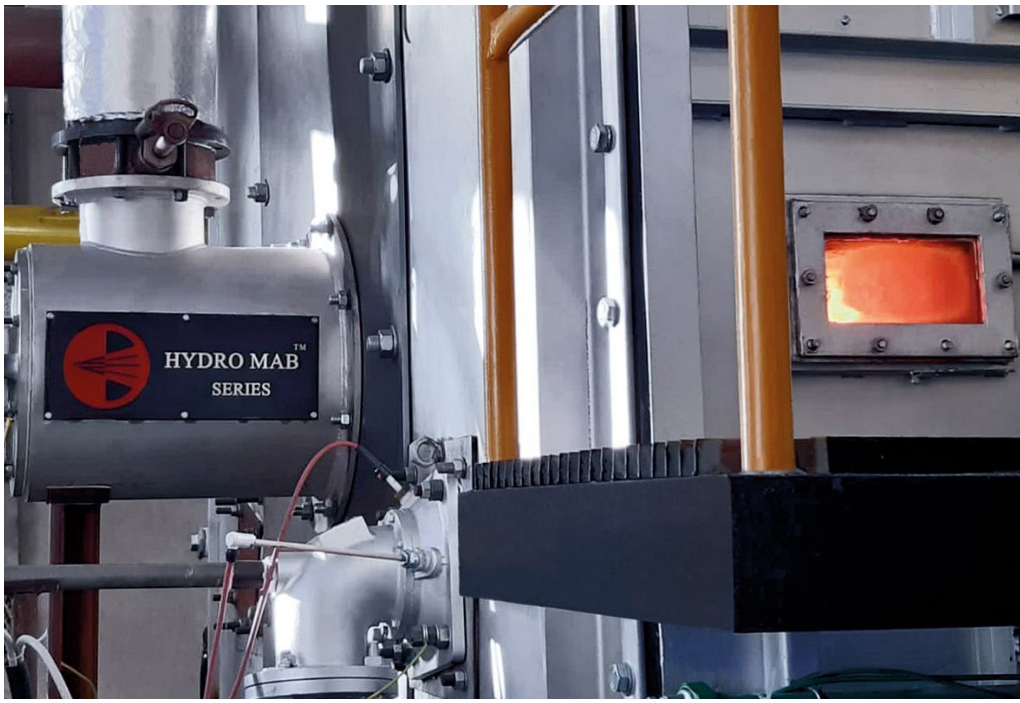
HYDRO MAB multi-air burner to take a step ahead in green steel

The new hydrogen multi-air burner operates with a methane and hydrogen mixture to reduce CO_2 emissions

Through recent decades CO_2 emissions of industrial furnaces and heat treatment plants have been reduced by increasing thermal efficiency. Nowadays, the use of hydrogen in combustion processes could bring the steel industry towards full decarbonization.

Computational Fluid Dynamics (CFD) simulations and laboratory tests led the Danieli Centro Combustion R&D team to the development of HYDRO MAB – a new hydrogen multi-air burner – as the answer for burning a natural gas/hydrogen mixture that results in further CO_2 reduction. In addition to CO_2 reduction, HYDRO MAB burners maintain the lowest levels of NO_x emissions and the optimal flame pattern.

Danieli



The new HYDRO MAB multi-air burner operates with a methane and hydrogen mixture (Picture: Danieli)

Green transformation of rolling mills, heat treatment plants and strip processing lines

If one takes a holistic view of the intended transformation to CO_2-free steel production, then the entire value chain – from the mine to the end product steel – should be included. It is well known that the production of hot metal accounts for by far the largest share of carbon dioxide emissions in steel production. Therefore, efforts to decarbonise the steel industry focus on the CO_2-free production of crude steel. However, not an insignificant amount of fossil fuels has also been used in the downstream operations to date, for example natural gas in a wide variety of reheating and annealing furnaces. Steel companies and plant manufacturers have therefore long since made it their objective to include this area in decarbonisation as well. In this small special, STEEL + TECHNOLOGY shows some current developments that can help to eliminate the remaining 10% or so of carbon dioxide emissions attributable to so-called downstream processes in the medium term as well.

Biomaterial sidestreams to replace fossil fuels in industrial furnaces

The Energy4HYBRIT prefeasibility study, part of SSAB's plan to be fossil free by 2045, has been completed. SSAB Raahe mill in Finland acted as the reference in the project.

SSAB investigated the use of fossil-free energy sources, primarily biomaterial sidestreams, to replace fossil fuels in certain steelmaking processes, for example rolling processes. The prefeasibility study indicates that it would be possible to replace a significant amount of fossil fuel consumption with felling and other bio-based sidestream components at SSAB's Raahe mill in Finland.

"Regarding biofuels, the project studied the possibilities of collecting, transporting and utilizing, for example, various felling and other bio-based sidestreams from the Baltic Sea Region. The results of the prefeasibility study were positive and the most promising technical solutions based on these results will be developed in follow-up projects currently being planned. The Raahe site will act as the reference site in these projects," says Harri Leppänen, Director, Environment and Safety at SSAB.

The University of Oulu and VTT studied and modeled all energy flows at the mill as part of the prefeasibility study. The prefeasibility study was carried out by SSAB with Gasum, Neste and St1 and was supported by Business Finland. The energy companies were studying the use and availability of alternative energy sources.

Ironmaking accounts for around 90% of SSAB's carbon dioxide emissions. The Energy4HYBRIT prefeasibility study and the planned follow-up projects based on it will focus on the 10% of carbon dioxide emissions remaining after the reduction of iron ore, originating in numerous other steelmaking processes than ironmaking.Together with its partners in the HYBRIT initiative, LKAB and Vattenfall, SSAB aims to create a fossil-free value chain, from the mine to the end-product.

SSAB

Flameless, smart and hydrogen fuelled – SmartBurner from Tenova enabling decarbonization of industrial furnaces

Tenova is ready to supply megawatt-size flameless combustion systems burning any mixture of natural gas and hydrogen, up to 100% hydrogen, integrated with Tenova's advanced digital solutions

Tenova marks a new milestone in the decarbonization of steel production: its TSX SmartBurner for reheating furnaces is now ready to be installed in industrial plants with potentially zero carbon dioxide emissions, working in a full range of hydrogen and natural gas mixtures. It is the first flameless burner of a megawatts family that has been tested with 100% of hydrogen successfully.

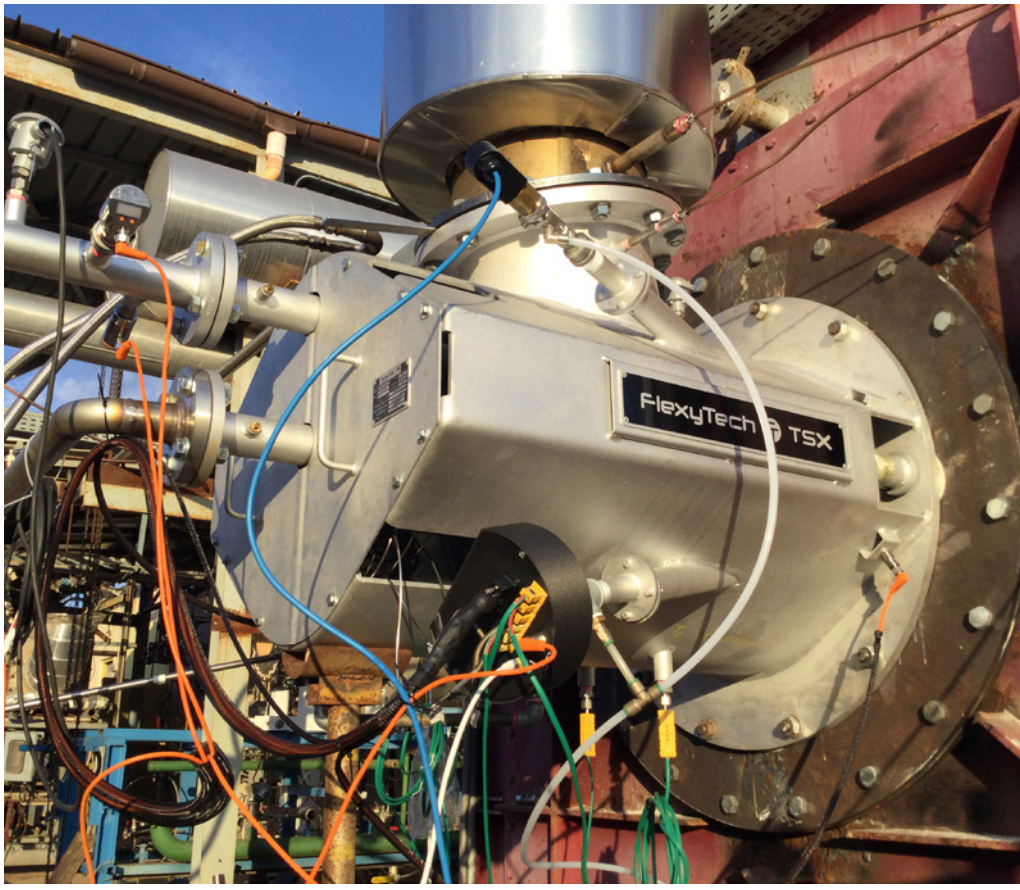
The long tradition of Tenova in flameless leading-edge combustion technology allows to maintain NO_x emissions well below the next future strictest limits – releasing less than 80 mg/Nm³ at 5% of oxygen with furnace at 1250°C – also working with 100% hydrogen and maintaining an optimal heat transfer uniformity within the furnace. The quantity of hydrogen can be simply regulated through the burner control logic, allowing steel producers to adapt the fuel mixture to contingent needs without any mechanical intervention.

Tenova's hydrogen flameless combustion system is equipped with the novel Smart Burner Monitoring System (SBMS), which permits to monitor and optimize the burner's performance, operation and maintenance thanks to a network of embedded sensors connected to the Tenova Digital infrastructure, through secure connection protocols and intrinsic system reliability.

The data collected are post-processed locally on an edge computing unit and remotely on Tenova Cloud, to monitor the status of the burner and implement breakthrough approaches to inspection, maintenance and tuning, also reducing safety risks related to on-site operations.

"This outstanding achievement paves the way to a significant reduction of the carbon footprint of hot rolling processes without compromising productivity, while leaving steel producers total flexibility to modify the percentage of hydrogen through a simple change in the control software settings. This is not the only reason why we call our burners "smart": thanks to our sensor system technology, we will be able to support our customers remotely to guarantee optimal performances for each burner", affirmed Antonio Catalano, Tenova EVP and Head of Digital Transformation. "Moreover, the SmartBurner Industrial IoT platform represents the cornerstone of the next generation of industrial combustion systems. The most cutting-edge, sustainable technology based on solid experience and extensive know-how: this is what we offer to our customers".

Tenova



The new SmartBurner is a megawatt-size flameless combustion system burning any mixture of natural gas and hydrogen (Picture: Tenova)

Tinplate production in Belarus reached important milestone

Miory Steel produced first cold strip coil

On August 6, 2020, the first coil was successfully rolled at Miory Steel (MMPZ - Miorskij Metalloprokatnyi Zavod). Final thickness of 0.45 millimetres was reached after seven passes.

The new reversing cold rolling mill is part of the completely new, integrated and expandable production complex for the manufacture of tinplate, which was built in Miory in the north of Belarus. SMS group supplied the essential production equipment for the new facility, including the complete rolling and strip processing lines and the X-Pact® electrical and automation systems.

In the first stage of expansion, equipment for an annual capacity of 150,000 tons was implemented. It serves Miory Steel to produce tinplate grades T1, T2, T3, DR7 and DR8 as well as thin sheet grades CQ and DQ. In the course of further expansion, capacity is planned to be increased to 240,000 tons. With its rolled products, Miory Steel meets the needs of the packaging industry as well as the demand for cold rolled thin sheet. The majority of the production is intended for export, especially to Russia and other CIS countries (Commonwealth of Independent States) and to the European Union.

The reversing cold rolling mill was built in six-high design, provided with the proven CVC®plus technology (Continuously Variable Crown) from SMS group. It was also configured in the new high-performance design. This means that the rolling mill can be operated with particularly slim work rolls with a minimum diameter of 260 millimeters. This enables high pass reductions to be achieved with comparatively low rolling forces. CVC®plus in combination with work and intermediate roll bending, multi-zone cooling and the dry-strip system (DS system) ensure all requirements for strip quality in terms of thickness, flatness and surface are fulfilled. In order to enable later capacity increase, the flexible mill design allows conversion into a Compact Cold Mill (CCM®).

Besides the reversing cold rolling mill, SMS group supplied plant equipment as following:

- electrolytic cleaning section,
- batch annealing furnace,
- two-stand combined reduction/skin pass mill (DCR mill),
- electrolytic tinning line,
- coil packaging line,
- sheet packaging line.

SMS group also supports Miory Steel in the implementation of the necessary operator expertise. This is of particular importance, as the new plant produces tinplate for the first time in Belarus.

The ultra-modern plant is provided with the integrated X-Pact® MES 4.0 production planning system from SMS digital. As an integral solution, X-Pact® MES 4.0 includes planning, support, optimization, delivery and shipping, quality control, and reporting functions. The system fits seamlessly into the X-Pact® automation, being also part of the supply scope for all plants of the production facility.

This enables optimized utilization of the plant production capacities, while simultaneously reducing stocks, as well as complete material tracking. Furthermore, production scenarios can be simulated in advance and secured delivery dates be determined accordingly. Coil Yard Management takes care of coil tracking from the incoming warehouse through the various intermediate storage facilities ahead of the production lines to the finished coils or sheets to be delivered to the end customer.

Now that the first coil has been rolled on the reversing cold rolling mill, the other plants will be put into operation step by step according to the production flow.

SMS group

This ultra-modern cold strip production facility has been established for Miory Steel in the north of Belarus (Picture: SMS group)

Metal coated steel strip produced at Wuppermann Staal Nederland. B.V. in Moerdijk (Picture: Wuppermann AG)

Galvanized hot or cold strip? An investigation of the environmental impact

Heat-to-Coat galvanizing process saves CO_2

Where the areas of application for galvanized hot strip and galvanized cold strip overlap, the CO_2 balance shows an advantage of the Wuppermann process

Wuppermann Group has commissioned the renowned Fraunhofer Institute for Environmental, Safety and Energy Technology (UMSICHT) to investigate the environmental impact of the Wuppermann Group's Heat-to-Coat strip galvanizing process and to compare it with the conventional cold strip galvanizing process. The Fraunhofer Institute prepared a life cycle assessment according to DIN EN ISO 14040 and evaluated the environmental effects as climate impact in kg CO_2 equivalents per kg hot-dip galvanized steel strip (kg CO_2-eq./kg). The result: Where the areas of application for galvanized hot strip and galvanized cold strip overlap, i.e. where it is technically possible to use both cold-rolled and hot-rolled steel for an application, the CO_2 balance shows an advantage of the Wuppermann process.

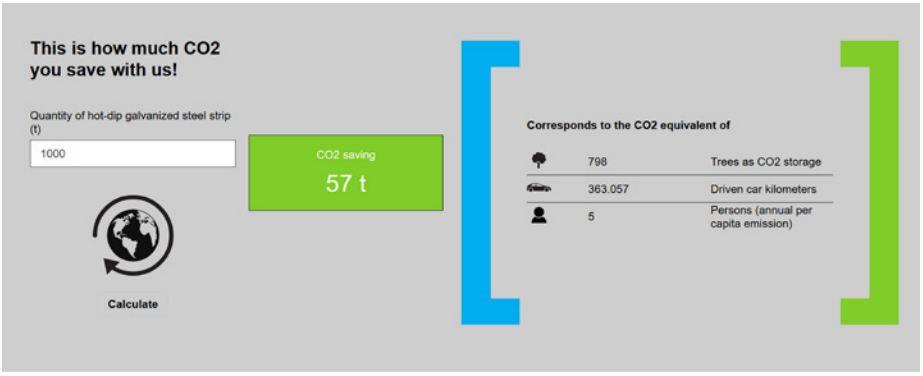
The galvanizing processes including after-treatment cause 0.126 kg CO_2 eq/kg at the Moerdijk (NL) site and 0.105 kg CO_2 eq/kg CO_2 emissions at the Judenburg (AT) site. The reference process causes CO_2 emissions of 0.183 kg CO_2-eq/kg. This results in a CO_2 saving of 31% at the Moerdijk site and 43% at the Judenburg site. Included in here are the emissions from the production of the zinc and electricity consumed. Not included in this so-called gate-to-gate consideration is the environmental impact of the input material hot strip.

With an annual galvanizing volume of approximately 600,000 tons, this results in CO_2 savings of 34,200 tons at the Moerdijk site. In Judenburg, the savings amount to

> "The Fraunhofer Institute's proof of the CO_2 advantage of the Wuppermann galvanizing process therefore helps not only Europe but also our customers to achieve their climate targets."
>
> *Johannes Nonn, Spokesman of the Executive Board of Wuppermann AG*

reductions – is the electrical energy required for pickling and galvanizing. Additionally, also the production of the origin zinc is a major contributor.

For the third and newest strip galvanizing line in the Wuppermann Group's network at the Gyor site in Hungary, the life cycle assessment will be carried out as soon as sufficient and meaningful data are available.



CO_2 calculator from Wuppermann to determine individually how much CO_2 can be saved (Picture: Wuppermann AG)

4,680 tons with a galvanizing output of approximately 60,000 tons.

"We are pleased with the verification that our special Heat-to-Coat process emits less carbon dioxide than conventional galvanizing processes on the market. There are two main reasons for this: Firstly, in contrast to the standard process, we do not use fossil fuels but only electricity for heating. Secondly, we are able to avoid the energy intensive annealing, whereby our maximum temperature is about 450°C, instead of 750°C," says Karsten Pronk, Technical Managing Director of Wuppermann Staal Nederland B.V.

This means that every improvement in the energy mix towards renewables leads directly to a reduction in the CO_2 footprint of the Heat-to-Coat galvanizing process. The main contributor of CO_2 emissions of the Wuppermann process – and thus the most important lever for further emission

Visible at one click: CO_2 calculator determines savings in strip galvanizing

A CO_2 calculator on the company's website now determines how much CO_2 per ton of hot-dip galvanized strip steel customers can actually save individually. With the new CO_2 calculator customers and interested parties can now determine individually how much CO_2 they are saving per ton of hot-dip galvanized steel and what CO_2 equivalents this corresponds to – for example, how many trees would have to be planted to compensate for the corresponding amounts of CO_2.

"We are proud of the good ecological balance of our strip galvanizing," says Johannes Nonn, Spokesman of the board of management at Wuppermann AG. "By illustrating the concrete savings, the CO_2 calculator on our website can be used as a basis for decisions on sustainable steel purchasing".

Methodology. The primary data of Wuppermann AG was collected on the basis of a process questionnaire by Fraunhofer UMSICHT. Secondary data for the representation of upstream and downstream processes are taken from the life cycle assessment databases GaBi SP 40 and ecoinvent 3.3. Data sets for the production of galvanized sheet by means of cold strip galvanizing (coating weight: Ø 275 g/m²), for the production of cold-rolled steel strip, and for the production of hot strip serve as reference data sets. The balancing follows the methodical approach of the worldsteel organisation. In order to achieve the best possible and neutral comparability, the site-specific data from Wuppermann is adjusted to the data of the reference process. The zinc coating thickness is determined as a guiding parameter: Linear adjustment of the zinc quantity and the zinc slag WSN to Ø 275 g/m².

Wuppermann AG

Continuous galvanizing lines

HBIS Tangsteel starts up special aluminium-silicon coating technology

With two new continuous galvanizing lines the Chinese company has expanded production capacity of metal coated high-strength steel strip by 650,000 tons per annum. Processed grades are mainly supplied to the automotive industry.

Recently, HBIS Tangshan Iron and Steel Group Co. Ltd. (HBIS Tangsteel), a Chinese steel producer, has started production with two continuous galvanizing lines (CGL) installed as part of the expansion of cold rolling mill No. 2 at its Tangshan plant in Hebei Province. The lines were erected in a new hall alongside the existing cold rolling mill, which has been in production since the beginning of 2015. A special aluminium-silicon coating technology package was implemented on one line.

Cold rolling mill No. 2 comprises a coupled tandem pickling line, a continuous annealing line and a galvanizing line. The mill has an annual capacity of 1.8 million metric tons of high-strength cold strip, and also produces high-quality steels for the Chinese automotive industry. The two galvanizing lines now supplied by Primetals Technologies are part of the second expansion stage to create production capacities for these high-quality steel grades.

The lines process not only grades for vehicle body parts but also aluminium-coated hot-forming steel. Primetals Technologies was responsible for the engineering, manufacturing and supply of the mechanical, electrical and process technology equipment for the lines.

- CGL 5 has a capacity of some 250,000 metric tons per annum. It processes cold strip in widths ranging from 850 to 1,300 millimetres, and thicknesses from 0.18 to 1.5 millimetres.
- CGL 6 is able to galvanize 400,000 metric tons of cold strip per annum in widths ranging from 850 to 1,600 millimetres, and thicknesses from 0.5 to 3 millimetres. It also offers the possibility of coating the cold strip with an aluminium-silicon alloy.

Entry and exit speeds of both lines amount to 250 metres per minute, while processing speeds reach 180 meters per minute. The new lines were integrated into the existing quality control system of the cold rolling mill plant. They were implemented on schedule with sequencing the start-up of GI and then Al-Si coatings productions within a three months period. Primetals Technologies also supervised the assembly and commissioning of the lines.

HBIS Tangsteel is part of the Hesteel Group, formerly Hebei Iron and Steel Group (HBIS). With an annual production of around 47 million metric tons in 2018, it is one of the largest steel producers in China.

Primetals Technologies

Continuous galvanizing lines CGL 5 and CGL 6 for the cold rolling mill of HBIS Tangsteel in Tangshan, Hebei Province, China (Picture: Primetals Technologies)

Advanced strip handling equipment from hpl-Group

Positive interim result after more than 40 years of experience in the design and manufacture of strip processing lines

The principle of a strip processing lines sounds simple. A strip wound onto a coil, is de-coiled at the beginning of the line and moved through various process parts to be re-coiled at the end of the line. However, the technical components are of considerable importance. This is especially true for controlled strip drives, where a constant strip tension and a precise guide lead to a constant speed, which is essential for accurate processing.

For precise strip processing, such as for annealing and degreasing, the critical design factors of steel industry strip processing lines are: strip drive speed, tension control and having a precise strip guide. At the same time customized cycle-times and storage specifications must be observed. Control of the cycle requires millimeter accuracy in the movement of the strip, with simultaneous precise regulation of the specified tension, without which strip quality would be impaired.

hpl-Group, based in northwest Germany, has specialized in the customized design of strip handling assemblies for more than 40 years, in cooperation with well known process part manufacturers, and OEMs. Lines have been designed incorporating design features unique to individual customer requirements, including for difficult to handle materials, such as high-alloy steels and stainless steels. hpl processing lines are capable of operating across a wide range of materials including: steel, stainless steel, copper, aluminium, coated metals and special materials, with strip widths ranging from 100 mm to 1,750 mm and strip thicknesses from 0.035 mm to 7 mm.

Initial design phase

The design process starts with an understanding of the available space, accepting that this may be quite limited due to the requirements of automation and the need to integrate with existing product flows. The first step is to map the overall site, using state-of-the-art 3D laser technology. These results provide the basis for the following planning and development phases. This detailed and sophisticated advance work is an essential part of creating a bespoke solution. Once the initial design is completed, based on a needs analysis, the project moves to manufacture and assembly. hpl are able to manage the entire project and beyond into maintenance if required.

Requirements on strip processing lines

As a cassette recorder requires a constant tape speed for playing good music, a constant strip speed is essential for getting the highest quality of processed steel strip. Any downtime in continuously running processing lines can lead to a high and expensive scrap rate. In addition to these requirements for optimal strip flow, the requirements for strip handling technology have changed a lot. Even though an operator, or the line supplier, may prefer to use the strip processing line for only a few strip qualities and grades, steel strip suppliers worldwide are currently faced with the challenge of processing a wide range of strip materials efficiently.

The motto 'higher, faster, further' seems to have developed in the direction

The high-performance strip processing lines of the hpl-Group handle every type of strip (Picture: hpl-Neugnadenfelder Maschinenfabrik GmbH)

The focus is always on a centered, continuous and material-adapted strip flow, both in single and in multi-strip operation (Picture: hpl-Neugnadenfelder Maschinenfabrik GmbH)

of 'thinner, faster, wider' when considering today's requirements for strip flow, where the highest priority is clearly placed on the gentle treatment of the surfaces and edges of the strip. Strip guide drive units face an ever greater challenge from the continuously increasing ratio of tension versus speed, generated by an increasing range of strip widths and thicknesses, as well as specific strip tensions. The drive and gear combinations used in strip processing lines with integrated strip tension measurements, are designed in such a way that the lines are able to meet the customer specification whilst requiring low energy consumption. Energy efficiency and sustainability of drive technology is a high priority for customers engaged in strip processing. When operated in continuous, 24-hour mode, the main motors in the de-coiling and re-coiling area enable optimal utilization of input power. At temporarily higher speeds, such as during a coil change, or pick-up cycle, the motors are operated within the controlled overload range. In the interests of sustainability, heat recovery from the large drive packages can now be used to regulate the temperature of the operating establishment.

The pneumatic actuators and the consumption points of all assemblies, are integrated into the line design in such a way that compressed air is reduced to a minimum. Hydraulics are required in approximately 90% of all strip processing lines, due to coil weights of up to 35 t and the resistance of the strip itself. The hydraulics are also optimized for environmental sustainability, for example by means of frequency-controlled motors on the pumps. In addition to this requirement for management of cost and resources, a focus is maintained on line performance. The strip processing lines, which together with the strip processing zone can extend to more than 100 m in length, are supervised by a minimum number of operators.

During 'normal operation' without any coil changes, the operator can carry out all activities on the line in a pre-set time. Change-over times are limited by strip storage capacity, meaning that a smooth operation, with a high degree of automation, is required when changing coils, or sleeves in the de-coiling or re-coiling areas, as well as partially for feeding paper in the strip intermediate layers. This includes for example, sensor-assisted scanning of coil diameter in the area of the coil car, on which basis its precise position is calculated, thus ensuring an automated coil feed, or coil removal from the reel mandrels without any complications. The transition devices and strip forwarding units can be switched on and off using a sequential function chart programme, for guiding the strip to the strip connecting zone, for punching, or welding. This enables operators to take care of further handling steps synchronously. Cycle time studies can be prepared for this purpose.

Due to wide-ranging strip and line parameters, many strip processing lines require safety and quality-relevant accessories. These accessories include automatic cutting gap adjustments on the shears, air transfer tables for very thin foils with a thickness of for example 35 µm, strip centering systems for aligning the strip position, strip detection systems with brake and control units, or special devices facilitating the winding of initial wraps. In addition to the standard portfolio of assemblies, there is a focus on new and customized developments. Special concepts are currently being developed for incorporating lines into existing halls, in which no changes are to be made to the foundations. Here, the customer requirement has resulted in a solution, which does not require the classical coil cars. The coil handling function has been transferred to the de-coiler and re-coilers equipped with a coil lifting mechanism. An additional benefit was that the complete strip carry over system above the coiler was also no longer required and the strip could consequently run on a more streamlined line.

These creative and constructive ideas realized by the engineering team are also to be observed in the digital aspects of line operation. The strip processing lines are equipped with standard inspection systems, measuring the strip and winding quality, and with data acquisition systems that combine all integrated sensors, for example for speed, temperature, tension, length and vibrations, which are remotely transferred to a computer. Such collection and analysis of important data, creates transparency and a constant exchange between customers and the control technology partners, for continuous improvement and further development.

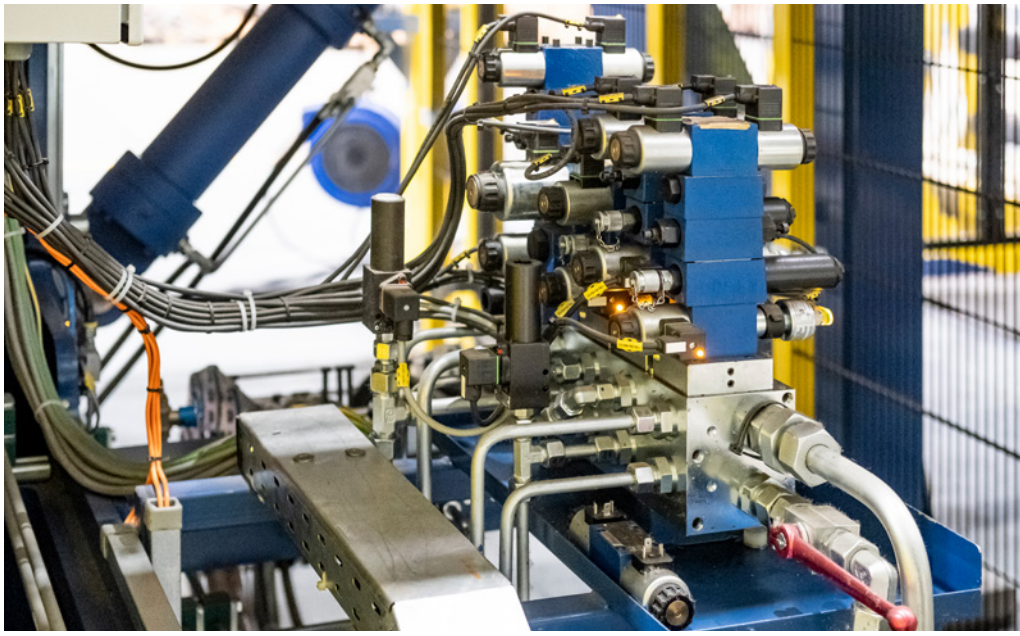
The functional principle for strip processing is similar to that for tape cassettes, where only a sophisticated and precise strip flow leads to the best results, as specified by the user. However, whereas tape cassettes have been overtaken by digital media, steel strip will keep running into the future, with new trends integrated into processing lines.

Safety and control

The customized, turn-key solutions provided by hpl meet market requirements for the performance of parts and of line safety, relying on know-how concerning the development of sophisticated safety concepts, to ensure operator safety and high quality strip production. Safety is assured through risk assessment, an assessment of the performance level, integration with mechanical systems and connection to online control. Based on this theoretical input, state-of-the-art protective devices with integrated gates and light grids, are coordinated in such a way that the continuous operation of the strip processing line is not interrupted at any time during the coil change in the de-coiling and re-coiling zone.

Dangerous tripping hazards are excluded at the outset by means of underfloor coil cars equipped with automatically retractable anti-tipping devices, as well as floor-level, walkable pit covers. Safe entry to the line area is assured where required. Strip transfer units are designed in such a way that there is no need for manual intervention by an operator. Due to the extensive visualizations of the set and actual values of the most important line parameters, such as speed and strip tension, the operator has a comprehensive overview of the process parameters at all times and can intervene, if required, by triggering a safety shutdown at the push of a button.

Maintenance work can be carried out easily and quickly by the operator or the hpl service team using easily accessible maintenance points, whilst during service activities, the focus is always on ensuring that other lines in the factory continue producing without interruption in a safe working environment. Longer, expensive production interruptions are therefore excluded right from the start.



Customized, state-of-the-art hydraulics ensure a high performance level for the safety of the operator (Picture: hpl-Neugnadenfelder Maschinenfabrik GmbH)

Conclusion

The functional principle for strip processing is similar to that for tape cassettes, where only a sophisticated and precise strip flow leads to the best results, as specified by the user. However, whereas tape cassettes have been overtaken by digital media, steel strip will keep running into the future, with new trends integrated into processing lines. Forward looking processes, such as strip changes on the fly, or the processing of future oriented materials, such as aluminium and magnesium, will play an increasingly important role.

Customer requirements are always different, but with intensive design work, the desire for more efficient strip producing processes, of ever higher quality, can be met. The hpl-Group meets these requirements with an overall project concept that has broadened its horizon from being a strip handling expert to a genuine partner that keeps the strip process running and a clear focus on innovative ideas and know-how.

hpl-Neugnadenfelder Maschinenfabrik GmbH

News brief

British Steel invests in efficiency improvement at Skinningrove

British Steel has made an investment in its special profiles mill in Skinningrove to create a further processing and inspection facility on site.

The facility gives the operators the ability to carry out edge grinding, buffing, cold sawing and mitre cutting, on site, with the installation of two new saws and an automated grinding machine. Previously, further processing was undertaken by a third party. David Hogg, Plant Manager Special Profiles, said: "Since November, we have seen a reduction in the time that products are waiting to be processed. By removing the need to move material off site, we have greatly improved the efficiency and predictability of operations, resulting in us offering a more responsive service to our customers." In order to operate the facility, new employees have also been taken on to operate the equipment and carry out inspections of material.

British Steel

Three case studies from Europe and North America

Meeting customer requirements for quality and productivity through automated surface inspection

One of the foremost solutions for automatic surface inspection in the metals industry is AMETEK Surface Vision's SmartView® system. A fully customizable, easy-to-use system, it combines powerful software with state-of-the-art camera technology and high-intensity lighting to detect, classify and visualize surface defects

The demands on steel manufacturers continue to increase, with customers expecting higher quality products that are certified defect-free. This is especially true for high-specification markets such as the automotive and aerospace industries. Additionally, most manufacturers are looking to increase productivity without any accompanying decline in quality, and with less scrap product.

The key to meeting these goals is an effective, automated surface inspection solution. Installed at a key location (or locations) in a steel mill, this can provide a rapid return on the investment made, helping to optimize product quality and yield.

Manual inspection systems are unable to adequately inspect fast-moving steel strips, particularly in the heat and smoke of a steel mill environment. Slowing the line for inspection means slowing production, while inspecting at the end of the process is too late to avoid production of scrap product. An automated solution is a far superior alternative.

The foremost solution for automatic surface inspection in the metals industry is AMETEK Surface Vision's SmartView® system. A fully customizable, easy-to-use system, it combines powerful software

Arania reported a 12% reduction in customer potential claims in the first nine months using SmartView, along with excellent customer feedback (Picture: Arania)

with state-of-the-art camera technology and high-intensity lighting to detect, classify and visualize surface defects.

Supported by AMETEK Surface Vision's expert application engineering services, it delivers a range of significant benefits, including flexibility, ease of use, and reliable performance.

Providing an automated solution for steel cold rolling inspection

The SmartView system is used by steel manufacturers around the world. One such customer is ARANIA S.A., a manufacturer of cold-rolled steel based in Spain.

Many of their products are used in the manufacture of automotive components, so high quality is essential. The company's primary goal in selecting an automated inspection system was to assure their automotive customers around the world that the delivered material met the highest quality requirements.

ARANIA's products range between 0.2 mm and 8 mm in thickness, with widths from 14 mm to 800 mm and coil outside diameters between 850 mm and 2,000 mm, and different surface finishes. The inspection solution would need to be able to cope with all these variations in the size and finish of the steel product.

AMETEK Surface Vision's team determined that inspection at the ARANIA facility would be best served by an installation at the skin pass mill. This is a quarto mill workspace with a radio isotope gauge for thickness measurement, using antioxidant thixotropic oils and precision surface finish work rolls to deliver high-quality final products.

While the skin pass process only modifies the material thickness by a very small amount, its main purpose is to produce the required final surface finish and to modify mechanical properties, at the same time providing good control over thickness profile and strip shape.

The SmartView installation was equipped with a high-intensity compact LED light beam, high-speed 4K 160 MHz linescan camera technology, the latest SmartView SPU sensor processing units hardware, and SmartView 7.2 software.

The optical configuration provided 0.2 mm x 0.2 mm pixel resolution, constantly recorded as streaming video on two 3 TB hard disk drives to ensure 30 hours of video buffer. An AMETEK Surface Vision air knife was also applied to ensure the camera optics were kept free of contamination.

The successful implementation of this system has been a key element in ARANIA's full traceability program, which provides assurance to its automotive industry customers. The steel manufacturer reported a 12% reduction in customer potential claims in the first nine months using SmartView, along with excellent customer feedback.

This has given ARANIA a clear advantage in the industry and allowed them to consolidate their market position.

Preventing steel strip breakages with surface inspection

Automated surface inspection can also be used to help prevent steel strip breakages. Leading steel manufacturer Ternium S.A. operates 17 sites across the Americas, and already had SmartView installed on the Pickling Line Tandem Cold Mill (PLTCM) at its Pesqueria plant in Monterrey, Mexico. The PLTCM line receives hot rolled coils which are threaded into the line then pickled using hydrochloric acid. Rolling capacity is 6,000 tons per day.

AMETEK Surface Vision had provided a system using four cameras, two each side, installed in bright field mode just after the pickling process. It was intended as a standalone system to monitor surface quality and provide coil traceability, so had no direct communication with the line's programmable logic control (PLC) system.

Once fully operational, the plant began to experience strip breakages – some of these caused significant damage to the mill equipment. Although the defects responsible for the breakages were correctly identified and classified by SmartView, there was no mechanism in place to safeguard the mill's mechanical integrity and process continuity.

Ternium and AMETEK Surface Vision worked in partnership to create a solution. SmartView's classification tool was used to

At Ternium Pesqueria plant in Monterrey, four cameras, two each side, are installed in bright field mode just after the pickling process. (Picture: Ternium)

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DVS MEDIA

identify defects on a gradient of severity, alerting operators to significant problems.

Although manual inspection was also in place, the steel strip passed in front of the inspector at a speed of 300 meters per minute, so it was impossible to inspect the whole surface by human eye alone.

By connecting SmartView to the plant's PLC, the system was able to trigger a signal whenever it detected a sever defect under certain strip thickness conditions. This enabled the PLC to track the defect along the line, reducing speed just before the first mill bite to minimize any damage.

A visual and acoustic alarm was also added, ensuring the operator was alerted to severe defects even when the inspector was distracted. Since implementation of this system – which was a modular upgrade of the existing inspection system – Ternium has experienced a steady decline in the frequency of strip breakages.

Improving results at US metal processing plants

Heidtman Steel, a metal processor based in Toledo, Ohio (USA), processes hot-rolled, cold-rolled, galvanized, and galvannealed steel for a diverse range of industries. As a toll processor, it handles materials from many other companies.

Heidtman Steel had inspection systems in place on its pickling lines at the Butler and Granite City facilities. However, this equipment was old, expensive to upgrade, and service was difficult to obtain. The company wanted to replace each of these aging systems with a new one that had a smaller footprint, easier to use and maintain, and has adequate service support. To meet customer requirements and provide accurate, clear inspection reporting and data, Heidtman Steel chose SmartView Inspection System to replace its prior one.

The SmartView Inspection System was installed at the end of the pickle line, just before the oiling process, at both the Butler and Granite City locations. The pickle lines were selected because this is the part of the process which adds the most value and cost to the material. SmartView was installed in a configuration at each site to handle the varying pass-line movement.

> "We have proof of the quality of material that we are receiving, and can understand if our pickle lines are causing any defects or if these come from the incoming material."
>
> *Chris Theurer, Inspection Specialist at Heidtman Steel*

The new system collects the inspection files in a database connected to a server. The central company database, which stores all the inspection data, can then be accessed by any Heidtman Steel staff using the Open Network Inspection Viewer (ONIV) software.

Chris Theurer, Inspection Specialist at Heidtman Steel's facility in Cleveland, said: "With SmartView, we get specific defect locations and images that are present on the material being processed through the pickle lines. This data helps us support our customer claims and material rejections. We have proof of the quality of material that we are receiving, and can understand if our pickle lines are causing any defects or if these come from the incoming material." Heidtman Steel is now benefiting from more effective data to resolve customer claims and prove material quality.

Conclusion

These are just three examples of how automated surface inspection has had a measurable, positive impact on operations at a steel mill. Line speeds and mill conditions make manual inspection difficult, if not impossible, so an automated system is the only realistic way to meet the challenges of increased quality and productivity.

An effective system alone is not enough; it must be supported by expert engineering services that understand the mill processes and can identify the key point for inspection. Installed properly, an automated surface inspection system can add significant value to mill operations, improve customer satisfaction, and optimize steel production yields.

AMETEK Surface Vision

Eddy current testing instrument of the latest generation from Rohmann GmbH

Addition to the ELOTEST PL600 family of instruments for non-destructive testing

"ELOTEST PL600" is a technological development from Rohmann. The family business in Frankenthal in Germany has been developing and marketing eddy current testing instruments and accessories for non-destructive materials testing for 43 years now. But what can PL600 do? Which advantages does it offer to the user?

In particular in fully and semi-automated production lines, different materials testing processes take place at the same time. Whereas parts have to be tested for differences in hardness at the beginning, they may have to be tested for cracks in the downstream production process. For this purpose, previously, several instruments were integrated into the line.

Test trolley ELOTEST HST 3, with 64 sensors for the detection of partial hard spots on heavy plates
(Picture: Rohmann)

The modular design of the PL600 makes it possible to combine testing for cracks and heat treatment as well as testing for material mix-up and grinding burn, so that a single testing instrument is sufficient for a wide range of applications in several stations. The instrument is fully integrated into the line by wide-ranging I/O functions with a fieldbus connection.

The "Super-Finisher Mode" is a special application for the inline inspection of rolling elements with functions such as the integrated parts recognition, wear protection monitoring and the sorting of parts. "Multiplex" is designed for a great diversity of applications with parameter and sensor multiplex for up to 64 virtual mux channels per eddy current testing module. The "EMDC" technology – electromechanic distance compensation – serves to keep a constant distance between the sensor and the part being tested. It is used for non-circular parts and for parts with complex geometries.

The "FastSort" mode serves to sort parts quickly with 1, 4 or 8 frequencies, with harmonic analysis as an option. This mode is used to determine material properties, differences in hardness and/or geometric variations. "Q-Sort" makes an exact fingerprint of the material properties at up to 24 sample points, including the harmonic analysis with automated parts recognition and a teach-in function. "Mean-Sort" is applied in microstructure testing with up to 8 frequencies. An average value is calculated over a longer test period (e.g. for long products).

ELOTEST PL600 – digital eddy current testing instrument, suitable for all types of eddy current testing
(Picture: Rohmann)

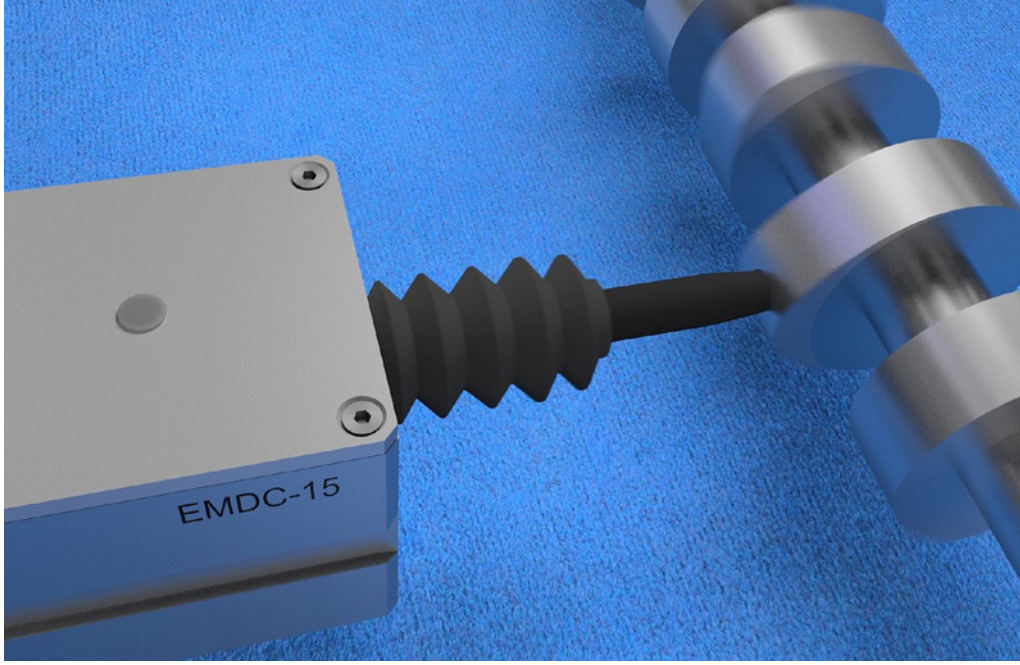
"Eddy+" is a patented, unparalleled test method. It has been developed for the recognition of partial hard spots on heavy plates. 960 sensors are used in specially designed testing systems, 64 sensors are used with the mobile testing trolley for materials testing. The sensors are also developed and manufactured by Rohmann.

The automatic filter adaption, depending on the testing velocity, several evaluation thresholds per virtual Mux channel and the internal distance compensation are just a few more features of the digital testing instrument. The "EloLine" software for long products, also developed by Rohmann, or

"ScanAlyzer" for recording and evaluating eddy current data can be run on a separate computer.

ELOTEST PL600 has been complemented with a 19" (PL600/R) and a more compact 9.5" (PL600/RC) remote version for integration in automated systems. The operation of the two remote devices takes place via an external touch screen. The Remote Client Software connects the two instruments with another computer in a network. The 19" versions (ELOTEST PL600 and PL600/R) are provided with a total of 16 slots, the 9.5" version (PL600/RC) is provided with a total of 7, while one channel is always provided with the standard configuration.

A licensing system, specially conceived for the ELOTEST PL600 family of instruments, means that the client only has to pay for the technical function required for the actual testing task. The inline instruments are thus available at an attractive starting price. As the ELOTEST PL600 can be adapted and modified or upgraded at any time, it is a valuable investment for the future.



EMDC – electro-mechanic distance compensation (Picture: Rohmann)

Rohmann GmbH

AFRICA

SSAB to supply steel for photovoltaic solar parks

SSAB is among the parties involved in an international solar park project in Angola. SSAB Borlänge and SSAB Arendal will supply the steel to build the park.

The first step in this project was the conclusion of an agreement with the Swedish Export Credit Corporation (SEK) financing the transaction, which is guaranteed by the Swedish Export Credit Agency (EKN). To ensure that EKN could act as guarantor of the Angolan government, one of the conditions was the use of several Swedish suppliers. SSAB's role in the project involves supplying around 6,000 t of steel during the first half of 2021.

The potential for more business depends on how well the first part goes. The American lead supplier will make an evaluation based on how well the commitments have been met and how secure the funding is. Each supplier will be evaluated and measured on its ability. The involvement of EKN to guarantee the financing gives Swedish suppliers a good chance with regard to the next stage.

The photovoltaic solar park is one of seven different solar panel projects, two larger ones close to the Angolan capital of Luanda and five smaller projects in rural areas. The total capacity will be 370 MW.

SSAB

CHINA

Anhui Anhuang Machinery orders fully automatic forging line

SMS group is going to supply a fully automatic closed-die forging line for pistons to Anhui Anhuang Machinery, based in Anqing in the Chinese province of Anhui.

Fully automatic 25-MN forging line with automatic walking beam system, die spraying unit and die holder, and induction heating system (Picture: SMS group)

Thanks to this forging line, Anhui Anhuang will be one of the first automotive suppliers in the field of massive forming in China capable of manufacturing pistons for cars and trucks in a fully automated process. Commissioning of the line is scheduled for the second quarter of 2022.

The 25 MN forging line to be delivered consists of a fully automatic eccentric closed-die forging press of type MP 2500 and an ELO-FORGE L induction heating system from SMS Elotherm for heating the forging blanks. The closed-die forging press will be equipped with an automatic walking beam, a die spraying unit, and a die holder with quick-change system. Important features of the forging press will be the electro-hydraulic clutch-brake system and the programmable ejectors for each forging operation.

The fully automated forging line makes for high cost efficiency. Car pistons can be forged in a cycle time of less than four seconds. The flashless precision-forging process also saves material and energy costs during production: only the exact amount of material required to forge a piston without cutting scrap is heated and used. Machining is reduced thanks to the high dimensional accuracy of the forged parts. The spraying manipulator developed by SMS is mounted on the rear side of the press, providing clear access to the die space. The spraying and drying times for each individual forging operation can be programmed individually.

The induction heating system from SMS Elotherm has a capacity of 800 kW enabling the forging blanks to be heated to a temperature of 1,220°C. With a throughput of around 2 t/h and a cycle time of 2.2 s, the modular heating system works in perfect harmony with the SMS forging line. The material feed system and the fully automatic discharge unit are integral parts of the plant concept.

SMS group

EUROPE

MicroStep Europa builds new competence center

At the end of 2021, MicroStep broke ground for its new competence center, close to its existing location in Dorsten in Northern Germany.

As a second branch in addition to its headquarters in Bavaria, MicroStep Europa,

manufacturer of plasma, laser, oxyfuel and waterjet cutting systems, operates its Competence Center North in Dorsten. A new building to be erected in the vicinity of the existing complex will include a demonstration center with more than 800 m² of space, where the company is going to present live a large selection of its technology range. A further around 500 m² are intended for office space, training and meeting rooms. Visitors will have the opportunity to experience the four different cutting technologies (plasma, laser, oxyfuel, waterjet) as well as automation solutions live in action. The inauguration of the new building is scheduled for autumn 2021.

Further investments are planned at the MicroStep headquarters in Bavaria.

MicroStep Europa

MicroStep broke ground for its new competence center, close to its existing location in Dorsten in Northern Germany (Picture: Giesers Stahlbau GmbH)

thyssenkrupp to be delivered forging line

Schuler has completed the internal assembly for a 16,000 t Farina press line to be supplied to thyssenkrupp Gerlach.

After the test run at the manufacturing facility in Suello, Italy, the components with a total weight of 1,700 t will make their way to the customer's forging plant in Homburg, Germany. Production is scheduled to start in 2022.

Schuler acquired the Italian press manufacturer Farina in 2018. The Farina GLF series presses cover forces from 750 to 16,000 t. They feature a novel direct drive concept without connecting rods, which reduces the machine height compared to conventional presses.

Schuler

The Farina press lines of the GLF series feature a novel direct drive concept without connecting rods (Picture: Schuler)

thyssenkrupp launches specialist auto body company

thyssenkrupp Automotive Body Solutions is a new business unit specializing in body assembly solutions and the production of lightweight body components for auto industry customers.

The new unit has been created from the splitting up of the System Engineering business unit, which previously combined various automotive engineering businesses at thyssenkrupp under one roof. The newly formed Automotive Body Solutions business unit is part of thyssenkrupp Automotive Technology, the automotive supply and service segment of the thyssenkrupp group.

Its expertise ranges from development to prototyping, tooling and line construction to the in-house production of body parts. In its new structure the company has five development and production locations in Germany and a further six in other countries. Assembly lines for tooling, prototyping and bodymaking are developed and produced in Lockweiler (Saarland) and Burghaun (Hesse), while the sites in Heilbronn, Mühlacker and Weinsberg (Baden-Wuerttemberg) develop and produce lightweight body solutions for vehicles.

Falk Nüßle, CEO of thyssenkrupp Automotive Body Solutions: "As an independent bodymaker we can take a more entrepreneurial approach and respond more quickly to market requirements. We are combining our know-how in conventional assembly line construction with our expertise in the production of body components to offer our customers tailored and proven solutions for all aspects of body production from a single source."

thyssenkrupp AG

MIDDLE EAST

Perma-Pipe International expands production capacities

Perma-Pipe Middle East and Perma-Pipe India. have procured and installed large-capacity production lines for surface preparation, heating and coating for a wide range of piping materials and specialty shapes.

The new facilities will serve the oil and gas, and water transmission industries at the existing facilities in Fujairah, UAE, and Gandhidham, India. The new capabilities are referred to as "FAB-COAT" custom coatings. Each facility has two new, large-capacity production lines with hot air circulation ovens for heating blast-cleaned pieces, and both dry powder and liquid coating application lines.

Perma-Pipe now offers high quality internal and external custom coatings to meet their customers' project-specific needs and for many different shapes and sizes such as line pipe, vessels, prefabricated pipe spools, bends, tees, flanges, valves, skids, reducers, fittings, aluminium panels and a number of other shaped and sized steel pieces for a wide range of industry applications.

Perma-Pipe Middle East FZC has already been successful in securing first sizable orders for the recently commissioned facility to apply internal and external fusion bonded epoxy anti-corrosion coatings.

Perma-Pipe International Holdings

Salzgitter wins order for pipeline project

The Salzgitter Group has won a major supply contract for approximately 160,000 t of longitudinally welded pipe and pipe bends for a major pipeline project in the State of Qatar.

The order was placed with the 100% Salzgitter AG owned international trading subsidiary, Salzgitter Mannesmann International GmbH. The company is responsible for all project coordination and execution steps, in addition to being responsible for monitoring the overall supply chain. The longitudinally welded pipes will be produced by Europipe GmbH, Mülheim, which is a joint venture of Salzgitter and Dillinger (AG der Dillinger Hüttenwerke). The pipe bends will be produced by the Mülheim pipe-bending plant of Salzgitter Mannesmann Grobblech GmbH. Production for the pipes and bends commenced in early 2021.

Salzgitter AG

USA

Nucor to build new metal panels manufacturing facility

Nucor Corporation is building a third TrueCore manufacturing facility to be located in Brigham City, Utah.

Nucor Corporation acquired TrueCore in 2019. It is part of Nucor Buildings Group division. The new facility is expected to be operational in 2022. It will manufacture insulated wall and roof panels using state-of-the-art continuous line equipment.

TrueCore produces insulated metal panels that are used as exterior walls, interior partitions, ceilings and roofs in the cold storage, commercial and industrial construction markets. The panels are produced in thicknesses ranging from 50 to 200 mm and widths up to 1,115 mm.

Nucor Corporation

Feeding a world in crisis

The increased demand for packaging steel

When the COVID-19 pandemic hit Europe in 2020, consumers quickly became concerned about food supply chains. Many of them turned to canned food. The unprecedented demand for cans posed significant challenges for canmakers and fillers. To help them meet the challenge, ArcelorMittal immediately put a plan in place to step-up production of steels for packaging while protecting workers and customers.

The lockdowns implemented in Europe meant that there were significant disruptions to the food supply chain. At the same time, global demand for canned food reached unprecedented levels very quickly. That required an immediate response from canmakers, fillers, and steelmakers such as ArcelorMittal. "The long lead times and lack of flexibility offered by overseas producers were not an option, so most canmakers turned to local packaging steel suppliers such as ArcelorMittal," says Stéphane Tondo, ArcelorMittal's chief marketing officer (CMO) for packaging and electrical steels. "That meant ArcelorMittal's mill teams had to quickly adjust our production lines so they could meet the demand."

Tinplate coil yard at ArcelorMittal Asturias (Picture: David Laurent / ArcelorMittal)

Proximity to customers provides flexibility

Thanks to its network of mills in France, Spain, Belgium, and Italy – ArcelorMittal was able to respond very fast while achieving a high level of flexibility for canmakers and fillers. Working from home, the Packaging sales team were in daily contact with their major customers and the mills to ensure the right material was available. "ArcelorMittal's mills are already geographically close to major canned food producers which is a major advantage," says Stéphane Tondo. "The mills are also able to back each other up, ensuring that we continued to produce the steels our customers needed."

ArcelorMittal's relationships with customers have been strengthened because of the crisis. "Our customers have been very loyal during the past few months and put their trust in ArcelorMittal," says Stéphane Tondo. "We would like to thank them for their support and note that our flexibility and responsiveness will continue in the future – crisis or no crisis."

Stéphane Tondo also recognises the extra efforts made by ArcelorMittal's people: "ArcelorMittal's Packaging team were very flexible and clearly understood the pressures that were on customers. The salespeople worked at full speed to make sure that communication with customers was clear. Their satisfaction was the main priority for everyone. And in the mills, our employees showed great commitment to ensuring we were producing quality steels safely."

There was increased focus on sanitation at all stages of the supply chain notes Stéphane Tondo: "ArcelorMittal's mills already have very stringent requirements with respect to the hygiene of packaging steels. But we also had to implement physical distancing measures and install extra handwashing facilities to keep our people safe and avoid product contamination. Gloves and masks were also quickly distributed to our staff."

Rethinking the global supply chain

The COVID-19 crisis will cause many canmakers and fillers to re-examine their supply chains and their service to customers. "ArcelorMittal's local presence in Europe is a major advantage for these businesses," says Stéphane Tondo. "Only a local supplier with the flexibility and presence of ArcelorMittal can offer the level of service customers require in a crisis such as this. We offered short lead times and late specifications, enabling customers to quickly respond in a rapidly evolving market situation. That is simply impossible with an overseas steel supplier."

The crisis has focussed consumer attention on the food supply chain and helped them to rediscover canned food and its benefits. "Sales of food packaged in steel increased significantly," notes Stéphane Tondo. "Tomatoes are a perfect example. Consumers discovered how versatile, nutritious, and tasty canned food is. We expect this trend to endure for the foreseeable future."

ArcelorMittal

Stéphane Tondo, ArcelorMittal's chief marketing officer for packaging and electrical steels (Picture: ArcelorMittal)

First fully electric vehicle, a Made in Turin product

Robots for the production of the New 500 Fiat and the mobility of the future

Comau has designed and deployed the manufacturing lines dedicated to the structural parts of FCA's first fully electric vehicle, a Made in Turin product. Comau worked alongside FCA and Fiat brand in reengineering the body to house the battery and transmission of the iconic vehicle. A total of 187 next-generation robots were used to build the New 500. The robots were equipped with custom-designed handling systems for the electric vehicle including a special 3D-printed gripper.

Comau is proud to have participated in the production of the New 500. The company has provided FCA and the Fiat brand with advanced automation solutions and its know-how in the development of innovative industrial processes to produce FCA's first fully electric vehicle, a Made in Turin product.

The path started symbolically in July 2019 with the installation of the first Comau robot, which initiated the production line of the new full-electric model inside FCA's historic Mirafiori plant. A total of 187 Comau robots were then integrated in the different phases of the car manufacturing process, thanks to the collaboration of a team of Comau experts who worked side-by-side the automaker's designers to optimize the work lines in an excellent example of smart manufacturing. The team also needed to adapt the systems to a new body design of an iconic car while responding to the technical characteristics of a full-electric vehicle.

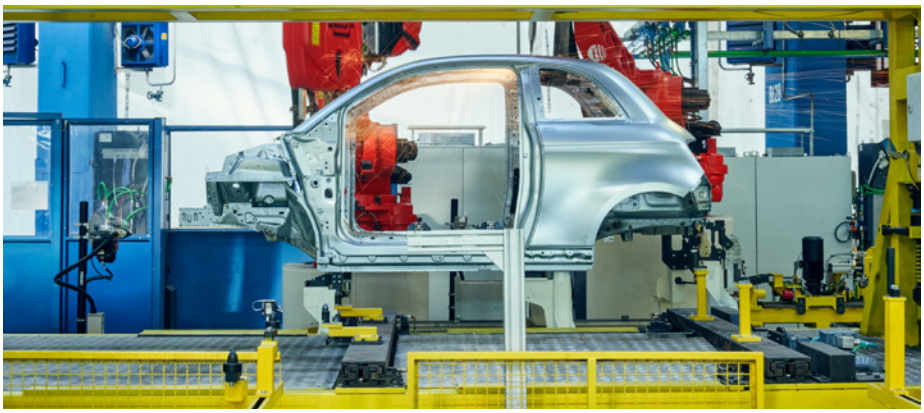
In particular, Comau has developed and equipped the body assembly lines dedicated to processing the structural parts of the New 500, including the front and rear floors, the bodysides and the framing, which are assembled and welded to give shape to the complete body of the car.

Each robot has been fully equipped by Comau to efficiently carry out all the special processes an electric car requires – from custom-designed handling systems and grippers to a special 3D printed end-effector for moving body components.

Comau has also integrated the lines with advanced vision systems to control the quality of the adhesive dispensing system, both during processing and at the end of the cycle. In order to optimize and speed-up inline tool changes, an articulated magazine system was designed to provide the robots with the different types of tools required to perform each application in a fast and easy way.

In addition, Comau has intervened in the design of the robotized line for the final assembly. After the bodyshop, which is used to form the body of the New 500, and the painting and surface treatment phases, all the internal parts are assembled and the single components of the car are optimized.

Andrew Lloyd, Chief Operating Officer Electrification of Comau emphasized: "Our experience and global leadership in the industrial sector, together with the skills gained in the field of electrification and digitalization, support the creation of highly innovative, flexible and tailor-made technological solutions. This approach allows Comau to develop projects that look to the future of mobility and renewable energy sources, such as the New 500 full-electric, thus responding to the needs of an industrial system in continuous evolution and the demands of an end consumer increasingly attentive to sustainability".



The car body was reengineered to house the battery and transmission of the iconic vehicle (Picture: Comau)

Comau Comau, a member of the FCA Group, is a worldwide leader in delivering advanced industrial automation products and systems. Its portfolio includes technology and systems for electric, hybrid and traditional vehicle manufacturing, industrial robots, collaborative and wearable robotics, autonomous logistics, dedicated machining centers and interconnected digital services and products able to transmit, elaborate and analyze machine and process data. Headquartered in Turin, Italy, Comau has an international network of 7 innovation centers, 5 digital hubs, 8 manufacturing plants and employs more than 9,000 people in 14 countries. A global network of distributors and partners allows the company to respond quickly to the needs of customers, no matter where they are located throughout the world. Through the training activities organized by its Academy, Comau is also committed to developing the technical and managerial knowledge necessary for companies to face the challenges and opportunities of Industry 4.0.

Comau

Lighter, stronger, more ductile

Modern steels offer a range of benefits for automotive manufacturers

Lightweight steel construction plays an important role in automotive engineering. In the chassis area, for example, micro-alloyed HSLA steel is being replaced by stronger multiphase steel. The growing trend toward higher strength is also seen in structural components, for instance in the use of third-generation multiphase steel for cold-formed parts. For hot-formed structural components there is increased interest in steels in the 2,000 MPa strength range, such as BENTELER BTR2000

Stricter regulatory requirements, improved sustainability, reduced climate impact, lower costs: The demands facing today's automotive industry are all driving research into new materials. Nevertheless, steel remains the material of choice for chassis and structural components. Compared to aluminium, magnesium and fiber-reinforced plastics, steel is very cost-efficient and is available globally. Cold-formed products made from micro-alloyed steel are state of the art for chassis components. Alloyed manganese-boron and multiphase steels are generally used for structural components. The manganese-boron alloyed steels are processed by an austenitizing treatment in a furnace followed by press hardening in a forming tool, which is usually water cooled. This results in a completely martensitic microstructure. In addition, cold-formed multiphase steels are increasingly used in the structural area, which often enable the components to be produced more cost-effectively.

In both areas described above, a trend towards the use of higher strength steels is discernible. With chassis components, multiphase steels are gaining importance and for cold-formed structural components it's third generation multiphase steels. For hot-formed structural components, the focus is on manganese-boron alloyed steels with tensile strength values above 1,900 MPa.

This article provides an overview of the trends in the use of new high-strength steels at BENTELER Automotive, a leading global partner for the automotive industry. To do this, we will examine the potential areas where new steels can be used for chassis and structural components.

Steels for chassis components

In contrast to structural components used in body-in-white, chassis components (**figure 2**) are generally made from hot-rolled steels. This is mainly due to the specific requirements regarding stiffness, noise, vibration, harshness and corrosion resistance. Plus, hot-rolled materials are more cost-effective than cold-rolled steels. The corrosion resistance of chassis components is ensured by cathodic dip coating downstream of the forming process, sometimes with additional measures such as pickling or subsequent waxing. In some cases, coil-coated steels are also used. However, the formation of pores during welding is a challenge.

The various steels available are described in the so-called „banana diagram" (**figure 3**), It shows the relationship

Figure 1. High-strength steels can save weight of chassis components like rear axles (Picture: BENTELER)

Martin Holzweissig, Serge Reitz, Andreas Frehn, BENTELER Automobiltechnik GmbH, Paderborn, Germany – Contact: martin.holzweissig@benteler.com

Table 1. Mechanical properties of tested cold forming materials for structural applications according to the steel suppliers

Material	Type	R_{P02} [MPa]	R_m [MPa]	A_{80}	A_{50} ASTM	A_{50} JIS
1	1050-DH	700 - 820	1050 - 1180	≥ 14%	≥ 14%	≥ 15%
2	1180-DH	850 - 1060	1180 - 1330	≥ 13%	≥ 13%	≥ 14%
3	980-CH	605 - 845	980 - 1085	-	≥ 19%	-
4	950-TWIP	450 - 6000	≥ 950	≥ 45%	-	-
5	980-TRIP	600 - 750	≥ 980	-	-	≥ 25%
6	1180-TRIP	≥ 850	≥ 1180	-	-	≥ 14%
7	980-TRIP	600 - 750	980 - 1100	-	-	≥ 21%
8	1180-TRIP	850 - 1100	1180 - 1300	-	-	≥ 14%
9	1470-DP	≤ 1400	≥ 1470	-	-	≥ 5%
10	1180-DH	850 - 1050	1180 - 1350	≥ 13%	-	-
11	980-DH	700 - 850	980 - 1180	≥ 13%	≥ 14%	≥ 14%
12	980-CH	780 - 950	980 - 1140	≥ 10%	-	-
13	1180-CH	900 - 1150	1180 - 1350	≥ 7%	-	-
14	980-DP	590 - 740	980 - 1130	≥ 10%	≥ 11%	≥ 11%

between tensile strength and elongation determined in quasi-static tensile tests.

Until now, chassis components have been primarily made from micro-alloyed steels or C-Mn steels with tensile strength values below 400 MPa. This results in heavy components with high wall thicknesses. In recent years, however, steels with tensile strength values above 600 MPa have been gaining in importance. These allow the production of lighter components with reduced wall thicknesses. The following steel grades are currently used in the chassis area:

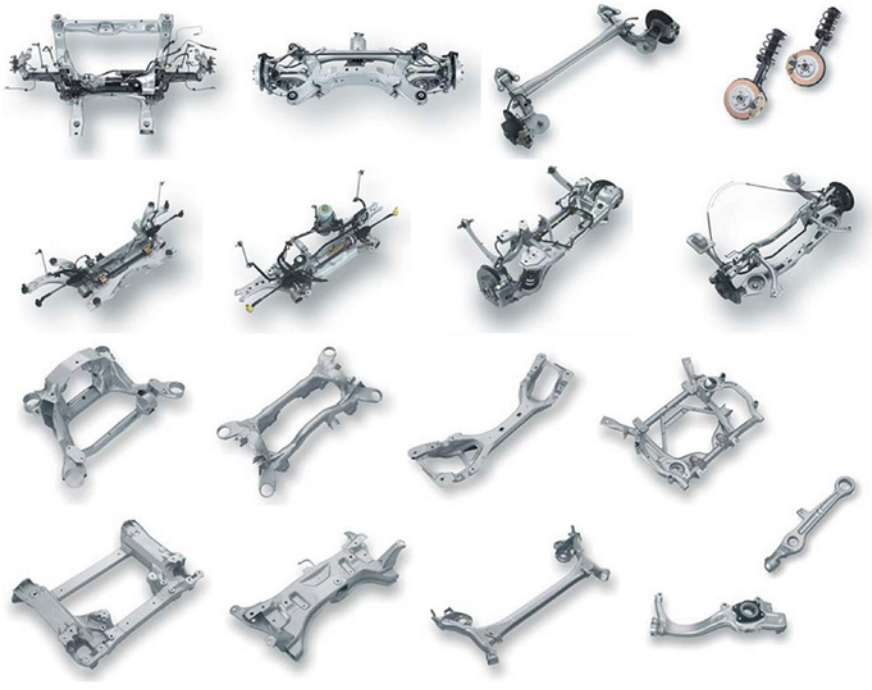


Figure 2. Chassis components and modules produced by BENTELER (Picture: BENTELER)

Microalloyed high-strength (HSLA) steels. Most commonly used for chassis components, HSLA steels are available in a wide strength range. They are produced by a thermomechanical treatment during hot rolling in combination with a special alloying concept using micro-alloying elements (Nb, Ti. V). VDA standard VDA239 defines steels ranging from 300 MPa to 700 MPa in yield strength, while DIN EN 10149-2 extends this to 960 MPa. In chassis components, these steels are mainly used in a yield strength range between 300 and 500 MPa; values of up to 700 MPa are common for components with higher strength requirements. A major advantage of these steels, apart from the advantageous ratio between strength and formability, which is enough for many components, is their worldwide availability. They are available in almost all regions of the world either conformant to European or comparable regional standards and differ only slightly in quality. If tighter wall thickness tolerances are required (e.g. for torsion profiles in rear axles), these grades can also be obtained from thin slab casting or medium strip mills.

These steels are currently developed in two directions. On the one hand, they are optimized for cutting, e.g. by reducing the P and S contents and minimizing hardness deviations in the microstructure. This

results in a smoother cutting edge in conventional (single-stage) shear cutting. The reduced number of cracks at the edges during subsequent forming also leads to longer life in component testing. On the other hand, material concepts based on an even finer, purely ferritic, grain structure are being developed to improve the cuttability and hole-expansion behavior. The latter is often a weak point of conventional steels. Unfortunately, these developments are not yet covered by existing standards and therefore only represent local solutions of individual steel manufacturers.

Multiphase steels. Multiphase steels have been used in chassis components for several years. In the chassis area, ferritic-bainitic (FB) steels, dual-phase (DP) steels and complex-phase (CP) steels play the most important role. Transformation-induced-plasticity (TRIP) steels, on the other hand, are very difficult to produce and rarely found in the market.

FB steels are currently the most relevant multiphase steels for chassis components. Their alloying concept is similar to that of micro-alloyed steels and their two-phase structure is created by controlled cooling during the hot rolling process. The relevant standards list such materials with tensile strength levels of 450, 600 and 780 MPa, as well as some individual developments in the 980 MPa range. The great advantage of these steels is their improved cuttability and the increased hole expansion ratio compared to the micro-alloyed grades. The use of these steels is particularly successful for control arms where punched holes often have to be widened, and defined collar heights need to be achieved. Also, they are increasingly used in torsion profiles for rear axles or in front axle beams.

Compared to FB steels, DP steel, with its ferrite and martensite phases, plays only a minor role in the chassis area. This is due in part to the low yield strength of the standard DP600 grade, which can also be achieved with a lower-priced micro-alloyed steel. In addition, the strong hardening that characterizes these steels is often not taken into account in the design, so that the use of these steels is usually ruled out early in the development process. Furthermore, the hole expansion ratio is significantly reduced compared to FB steels. However, these steels are interesting for special applications where the semi-finished product is not a sheet but a welded tube, e.g. for torsion profiles. The tube forming process increases the yield strength, which is relatively low for DP steels, and the good formability is maintained.

In contrast to FB and DP steels, complex-phase steels, originally developed for structural applications, consist of three phases (ferrite, bainite, martensite). These combine high yield strength with almost equally high tensile strength. They are currently mainly used for components where high buckling strength is needed or that have a function in crash load situations. Examples include control arms and cross struts. These steels are available in the 780 to 980 MPa strength range and are already used in series production. However, CP steels in the strength range of 980 MPa require high pressing forces especially at higher wall thicknesses. They are also sensitive to cracking at the cut edges during forming. Which is why some steel manufacturers modify the typical multi-phase concept to an almost single-phase bainitic concept. While this significantly improves the hole-expansion behavior while retaining the other relevant mechanical properties, it also results in different alloying and microstructure concepts. Direct replacement of these steels in global projects therefore requires renewed approval and component tests.

Cold-formed steel grades for structural components

Lightweight structural components can be cold formed using modern third generation high-strength steels (AHSS). These are available in a wide range of strength levels up to the typical hot forming grades. Galvanized grades are also available, offering improved corrosion resistance over hot-formed steels. Compared to conventional first generation AHSS, third generation AHSS offer weight reduction due to their improved elongation values at the same strength levels. This is mainly achieved by optimized alloying and manufacturing concepts. These are aimed at stabilizing the retained austenite in the microstructure so that the microstructures consist of bainite, tempered martensite, retained austenite and ferrite. The mechanical properties are adjusted by the respective phase proportions. For example, an increased portion of retained austenite in the microstructure leads to increased ductility.

In general, third generation AHSS have the potential to replace first generation AHSS for structural components, as the new steels have a higher residual ductility after cold forming. This higher ductility also allows a higher number of stiffening elements to be integrated in the geometry of body-in-white parts, resulting in thinner and therefore lighter components.

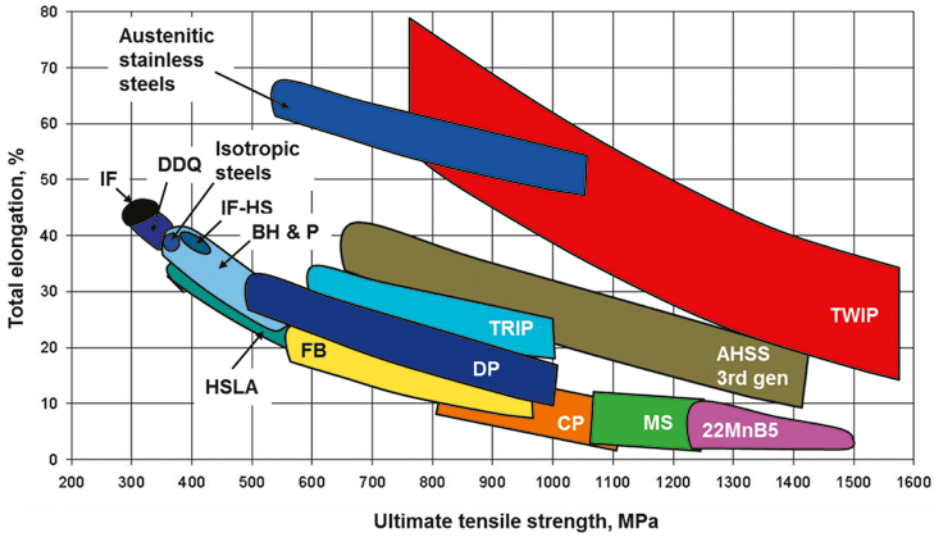


Figure 3. Steel classification according to ultimate tensile strength and total elongation (Picture: BENTELER)

Table 2. Mechanical properties of 22MnB5 and BTR2000 after austenitization and subsequent press-hardening and partially e-coating (determined at BENTELER)

	22MnB5	22MnB5 (KTL)	BTR2000	BTR2000 (KTL)
R_{p02}	1020 MPa	1140 MPa	ca. + 25 %	ca. + 30 %
R_m	1600 MPa	1520 MPa	ca. + 25 %	ca. + 20 %
A_{30}	8,7 %	9,0%	ca. ± 0 %	ca. ± 0 %
α	51°	52°	ca. ± 0 %	ca. ± 0 %
α_{1mm}	68°	70°	ca. ± 0 %	ca. ± 0 %

These cold forming grades offer high potential but there is a lack of documented comparison. We therefore investigated 13 uncoated cold-formable third generation AHSS with a view to their suitability for structural components. A list of the steels tested is shown in **table 1**. All had a thickness of t=1.4 mm. The results obtained were compared to reference material CR590Y980T-DP (No.14).

In the first step, the microstructure, mechanical properties and flow behavior were investigated. With the latter results and the material cards supplied by the steel manufacturer, cold forming simulations using Autoform were carried out. Forming tests were also carried out on a B-pillar geometry. For these tests a transfer tool die with four forming stages at a set total forming force of 1600 tons was used. Approximately ten B-pillars were produced from each material.

In addition, FEM crash simulations of a drop tower test were carried out. For these, a closing plate made of 1.00 mm CR330Y590T-DP-UC-U was fixed to the B-pillar.

In the forming tests, only one material, 1470-DP, showed failure during forming, which had been predicted by simulations. Compared to the reference material, the crash simulations showed a noticeable weight reduction for some materials while retaining the same crash performance. For example, the 1180-DH achieved a weight reduction of 8% compared to the reference material.

In addition, after the forming process, the springback scatter on the components was measured at 27 points for all investigated steels using GOM ATOS III Triple Scan in a non-tensioned state. Furthermore, the scan results were compared with the springback simulation results at the same points. The permissible tolerance deviation was ± 0.50 mm. Considerable deviations of the measuring points from the permissible tolerances were shown for most of the materials examined. In addition, the deviations increased with increasing strength of the materials (**figure 4**).

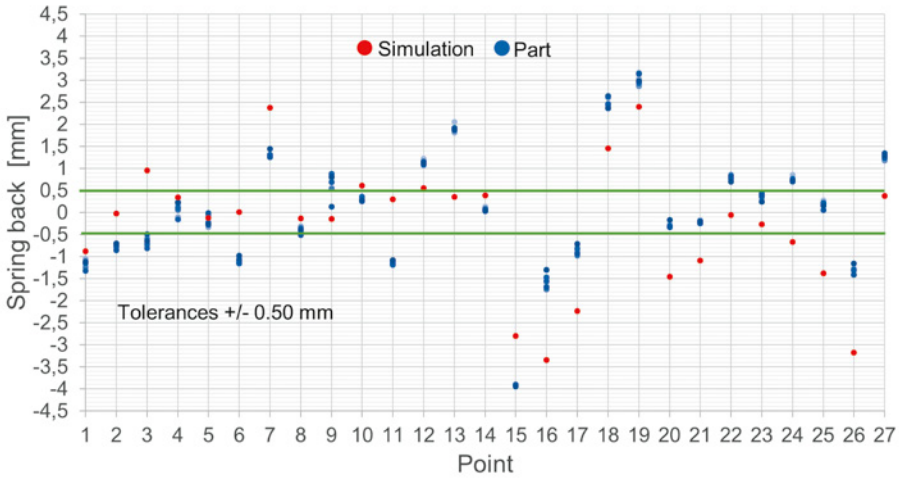


Figure 4. Comparison of the spring back of 1180-DH determined at BENTELER (Picture: BENTELER)

The known prediction difficulties of springback are often attributed to kinematic hardening effects. These are not considered in the isotropic hardening models usually used in the material cards provided by steel suppliers. Better results can be obtained by using kinematic strain hardening models such as the Yoshida-Uemori model.

Today, the coexistence of cheaper first generation AHSS and more expensive third generation AHSS is evident. Many steel suppliers also indicate that this will remain so. Although some OEMs are already using the new steels for some applications, it remains to be seen whether the new third generation steels will prevail on the market.

Hot-formed steel grades for structural components

The demand for higher strength hot-forming steels is increasing. The goal is to lower structural component weight by reducing wall thickness. To meet this requirement, BENTELER's metal processing specialists developed BTR2000, a hot forming steel with tensile strengths in the range of 2,000 MPa . The tensile strength is increased by approx. 25% compared to conventional hot forming steels and thus offers high potential for lightweight construction.

In the following, BTR2000 is compared to the standard hot forming grade, 22MnB5. The mechanical properties of 22MnB5 and BTR2000 were determined in tensile and bending tests, both in the press-hardened as well as in the press-hardened and e-coated condition. These are summarized in **table 2**. BTR2000 has higher values of yield strength and tensile strength than 22MnB5 in both conditions. Furthermore, the coating process heat treatment results in an increase of the yield strength and a simultaneous decrease in tensile strength. Although BTR2000's strength values are significantly higher than 22MnB5 (approx. 25%), the ductility given by the total elongation (A_{30}) and the bending angle (α / α_{1mm}) is similar. BTR's similar ductility and high increase in strength can be attributed to its finer microstructures that come from alloying with nio-

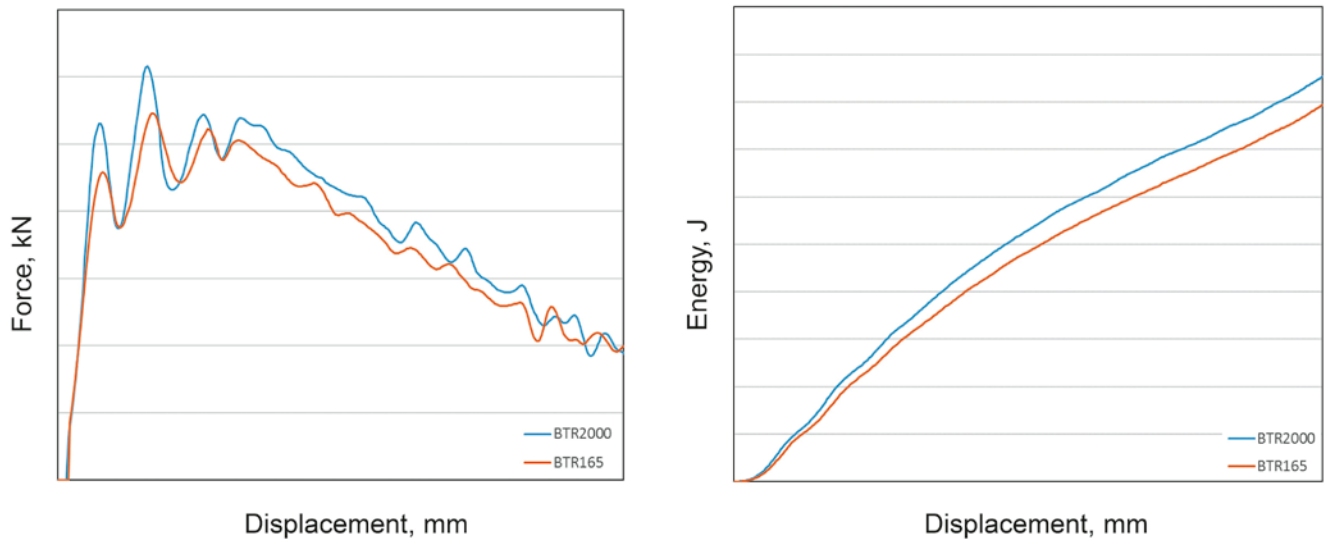


Figure 5. Force-Displacement and Energy-Displacement curves resulting from a pole crash test of bumper systems for 22MnB5 and BTR2000, respectively determined at BENTELER (Picture: BENTELER)

bium. Finer microstructures lead to higher strength and ductility values. Niobium, which combines with carbon to form niobium carbides, restricts austenite grain growth during the austenitizing process. This provides a higher nucleus density, which eventually leads to finer martensitic structures after press hardening. A significant consequence of these finer structures is increased yield strength as well as tensile strength, hardness and bending forces according to the Hall-Petch relationship. At the same time, the fine microstructures exhibit good ductility, which is represented by the total elongation and the bending angles.

BTR2000's high strength and ductility level make it suitable for use in energy absorbing components, which is why cross members for bumper systems were made from it. As a reference, cross members were also made from 22MnB5. Both bumper systems did not have a closing plate to achieve high deformation during the crash test. Furthermore, the Pole Crash Test was used, as high deformation occurs and high tensile and bending loads are superimposed, which is particularly critical.

Given the critical test conditions, early failure of the components was expected. Nevertheless, both materials withstood the test and showed no cracks during the pole crash test. Therefore, it can be concluded that both materials offer sufficient ductility for high energy absorption of the bumper system.

The force-displacement and energy-displacement curves determined in the pole crash tests are shown in Figure 5. The force-displacement curves show a higher force absorption of the BTR2000 compared to 22MnB5. In detail, a 15% higher force is measured for the BTR2000. The maximum force absorption is measured for both materials at the same displacement just before the bending of the cross beam starts. The higher force absorption can be attributed to BTR2000's higher yield and tensile strength, which results in a delayed deformation of the cross member. However, the increased force level of only 15% compared to the 25% increase in strength is due to the mixed tensile and bending loads that occur and geometric factors that are incorporated in the pole crash test.

The energy-displacement behavior of BTR2000 is about 8% higher than that of 22MnB5. The higher energy absorption of BTR2000 is due to the constantly higher force level (**figure 5**). In addition to the higher forces, BTR2000 showed no failure in the pole crash test, indicating good ductility of the material.

BTR2000's higher force and energy absorption compared to 22MnB5 in the pole crash mean that the component thickness of hot formed parts can be reduced while maintaining crash performance. In the case of the hot-formed cross member described above, simulations of pole crash tests and bumper-to-bumper crash tests revealed a potential reduction in sheet thickness from t=1.8 mm (22MnB5) to t=1.6 mm (BTR2000) with the same intrusion levels.

Conclusions

New advances in steel technology are playing an important role in modern automobile construction. In the chassis and structural area, higher strength steels allow component wall thickness to be reduced and thereby save weight. Multiphase steels often replace microalloyed steels in the field of chassis components. Recently, however, the use of third generation multiphase steels that offer higher strength and better formability has increased. For hot-formed structural components, manganese-boron steels are being used. BTR2000 from BENTELER uses innovative processing and alloying concepts to extend these benefits even further. Its significantly improved ductility and high tensile strength mean that manufacturers can continue to fulfil stringent crash requirements while meeting the environmental standards of today and tomorrow.

Combilift launches new Aisle Master Order Picker

Optimised warehouse logistics

Combilift officially launched the latest addition to its product portfolio in a virtual press conference on February 3rd. The NEW Aisle Master-OP (AME-OP) is a stand-on electric powered model that combines the advantages of a narrow aisle articulated forklift and an order picker for versatile operation in warehousing applications.

> "One Aisle Master can be used for multiple applications – narrow aisle operation, truck to rack handling, bulk picking and item order picking."
>
> *Martin McVicar, CEO of Combilift*

The development of this model was influenced by customer feedback – as has often been the case with Combilift's innovations – as well as the recent soaring growth of e-commerce. "Customers already using the Aisle Master for space saving, storage and efficiency in their warehouse asked if we could redevelop the Aisle Master to meet their ever-growing demand for order picking customised orders", said Combilift CEO Martin McVicar.

Research and development carried out in 2019 and 2020 has created the Aisle Master-OP, a main feature of which is the step-through operator compartment which has design copyright protection (European Design Registration No. 002676809-0001), across multiple markets in 4 continents. The low floor height of just 280 mm enables convenient, single step access from both sides of the truck which speeds up order picking compared to the operator having to get in and out from a seated position. The AME-OP truck has all the key advantages of the conventional Aisle Master - indoor/outdoor operation for loading/offloading and for stock replenishment at other times during shifts when order picking is not required.

The Aisle Master-OP is available in a number of variants, with lift capacities from 1,500 kg to 2,500 kg, lift heights of up to 12.1 m, and can operate in aisles as narrow as 1,650 mm. It features a patented chain steering system (EU Patent No. 3008008), which allows the truck to articulate more than 205°, and an inline drive motor and front drive axle, all of which enable narrower aisle operation.

The multifunctional programmable joy stick control lever in the operator compartment, which includes controls for the hydraulics and traction, is adjustable to enable comfortable and ergonomic working conditions for operators of all sizes. The Operator Presence Detection floor pad engages the parking brake automatically when the operator steps off the truck to carry out order picking.

"Before we officially launch any new model, Combilift carry out extensive field testing on customer's sites, and this was the case with the Aisle Master-OP", said Martin McVicar. The AME-OP is now a production model within Combilift, with units currently in build for customers in the United States and in New Zealand – one of which is Sorted Logistics based in Christchurch New Zealand, a third party logistics provider and freight forwarder who will be receiving eight AME-OP units shortly.

"This is a major innovation in the warehousing sector", added Martin, "and the versatility to use the one Aisle Master for multiple applications - narrow aisle operation, truck to rack handling, bulk picking and item order picking - will result in strong demand for this new product in our home and export markets around the world.

Combilift

The low floor height of just 280mm enables convenient, single step access from both sides of the truck (Picture: Combilift)

QR-Code linking to a video on YouTube

USA

Contractors Steel takes over Borrmann Metal Center

Contractors Steel, a portfolio company of UPG Enterprises LLC, has acquired Borrmann Metal Center, a leading light structural and specialty metal service center.

Founded in 1919, Borrmann Metal Center helped pioneer metal warehousing, sales, and distribution on the west coast. Over the years, Borrmann has grown into a leader in the market. The acquisition expands Contractors Steel's footprint in the Southwestern United States and Mexico and increases its breadth of product offerings in previously untapped markets, including aerospace. Together with Borrmann, Contractors Steel will now offer a wider range of heavy structural and metal products to better serve customers in the greater Los Angeles, San Diego, Las Vegas, Phoenix, and surrounding markets.

UPG Enterprises

Mill Steel Co. in third generation family ownership

At Mill Steel Co., the ownership has been successfully transferred from current CEO and Chairman David Samrick to President Pam Heglund and the current executive team.

The transition will be seamless for Mill Steel's customers, suppliers and business partners. Heglund will continue to direct the executive leadership team along with the nearly 400 associates.

Founded in 1959 by Harry Samrick, Mill Steel Co. is one of North America's premier flat-rolled steel suppliers. Headquartered in Grand Rapids, Michigan, Mill Steel operates five service center locations. Under David Samrick's direction, the company has experienced 12% growth annually since 1976. Pam Heglund is the granddaughter of founder Harry Samrick.

Mill Steel

Norfolk Iron & Metal acquires Cd'A Metals

The Coeur d'Alenes Company (Cd'A Metals), a full-line metal service center headquartered in Spokane, Washington, has been acquired by Norfolk Iron & Metal (NIM) of Norfolk, Nebraska.

The acquisition complements NIM's market coverage as well as expands their product line and processing capabilities. Heritage Capital Group, a mergers & acquisition firm with offices in Jacksonville, Florida, and Savannah, Georgia, acted as exclusive financial advisor to Cd'A Metals.

Cd'A Metals specializes in distributing a broad range of metal products, including various grades of stainless steel, aluminum, wear resistant steel, as well as ornamental iron. With three locations, Cd'A Metals is one of the largest metal distribution companies in the Inland Northwest.

NIM is a family-run, full-line steel service center and one of the nation's largest carbon steel distributors. Headquartered in Norfolk, Nebraska, the company has 13 locations across the U.S., with warehouses stocked with plate and sheet steel, structural and mechanical tubing, merchant bar products, beams, and rebar. In 2018, NIM acquired Metalwest, a leading processor and distributor of non-ferrous and carbon flat rolled metal products.

Heritage Capital Group

EUROPE

Böllinghaus Steel donates major sum to hospital in Portugal

Böllinghaus Steel has made a significant donation of EUR 55.000 to the Centro Hospitalar in Leiria. Böllinghaus Steel has had a production facility in Vieira de Leiria since 1996.

The donation will be used to support the hospital, its health care workers and patients affected by the COVID-19 pandemic, through the purchase of critical equipment and supplies for the fight against the virus.

"Our company has a strong bond with the region of Leiria, and we feel a deep sense of gratitude for the healthcare professionals and first responders serving our community. True to our corporate culture, we aim to help each other as much as we can in these challenging times. Solidarity is the response we need now and we feel a deep responsibility to help the community that has supported us for almost 25 years," explained Hartwig Härtel and Nina Härtel, Managing Directors of Böllinghaus Steel.

Böllinghaus Steel

Klöckner & Co expects improved income in 2021 after decline in 2020

The adverse effects on markets resulting from the COVID-19 pandemic led to a decline in Klöckner & Co's sales by around 19% to EUR 5.1 billion in fiscal year 2020. For fiscal year 2021, despite the ongoing pandemic, Klöckner & Co expects a significant rise in real steel demand and consequently a considerable increase in sales.

The Surtsey transformation project limited the negative impact on operating income (EBITDA) before material special effects to a decrease of 10% from EUR 124 million to EUR 111 million. Additionally affected by EUR 59 million in restructuring expenses, the net loss was EUR 114 million, compared with a net loss of EUR 55 million in the prior year.

By contrast, due to extremely strict net working capital management, operating cash flow was once again strongly positive at EUR 161 million, compared with EUR 204 million in the prior year. As a result of the strong cash flow, net financial debt was reduced from EUR 445 million to EUR 351 million. At 40%, the equity ratio was again very solid as of the reporting date. (December 31, 2019: 41%).

The Group has not only further accelerated digitalization but also implemented accompanying as well as additional restructuring measures within the framework of the Surtsey transformation project. As part of these measures, more than 80% of the planned reduction in the workforce by a total of some 1,200 positions in Europe and the USA has already been implemented.

Digital sales increased considerably to 45% in the fourth quarter (Q4 2019: 32%). A significant contribution to this large increase came from Kloeckner Assistant, an AI-driven software application for automated processing of quote requests and orders.

Klöckner & Co

thyssenkrupp Materials Services launches e-commerce platform

To better serve changing customer needs, thyssenkrupp Materials Services has further expanded its online offering in the UK.

Since the end of January 2021, customers in the UK market have access to the Steelbay Exchange online shop. At the click of a mouse, they can purchase off the shelf mild steel coils and plates around the clock. The products are all available from stock to supply thyssenkrupp Materials UK customers within a few days. In addition, smaller quantities are offered, enabling them to optimize the efficiency of their warehousing.

thyssenkrupp Materials Services is a mill-independent materials distributor and service provider with around 480 locations – 271 of them warehousing locations – in over 40 countries. Terry Sargeant, CEO of thyssenkrupp Materials UK, explains: "Steelbay Exchange allows our customers to easily digitalize their purchasing and innovate their business for current and future success."

An important element is the omnichannel approach, which offers customers cross-channel access to products and services. By providing all desired channels, customers can place orders via individual customer portals, EDI interfaces, apps as well as online shops.

For the development of Steelbay Exchange, thyssenkrupp Materials Services relied on its own expertise: In just seven months, technical experts from thyssenkrupp Materials UK and the Digital Transformation Office in Essen, Germany, succeeded in building a fully functional e-commerce platform. The store also serves as a blueprint for other units of the globally positioned materials distributor and service provider.

thyssenkrupp Materials Services

STEEL SUPPLIERS INTERNATIONAL

SUPPLIER FOR THE INTERNATIONAL STEEL INDUSTRY FROM A TO Z

1	Raw materials, auxiliary materials and operating materials
2	Raw material pretreatment
3	Iron making
4	Steelmaking
5	Continuous casting
6	Near net shape casting
7	Hot rolling
8	Forging, extrusion
9	Powder metallurgy
10	Cold rolling
11	Surface treatment
12	Production of bright steel and wire
13	Production of tubes/pipes
14	Sheet metal processing
15	Steel products
16	Furnace and energy technology
17	Refractory technology
18	Machinery and plant engineering
19	Transport and storage technique
20	Electrical engineering and automation
21	Measuring and testing technique
22	Materials testing
23	Analysis and laboratory equipment
24	Environmental protection and disposal
25	Occupational safety and ergonomics
26	Other products
27	Consulting, planning and services
28	Steel in civil engineering
30	Service concerning steel materials, in general

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THE INTERNATIONAL STEEL INDUSTRY FROM A TO Z

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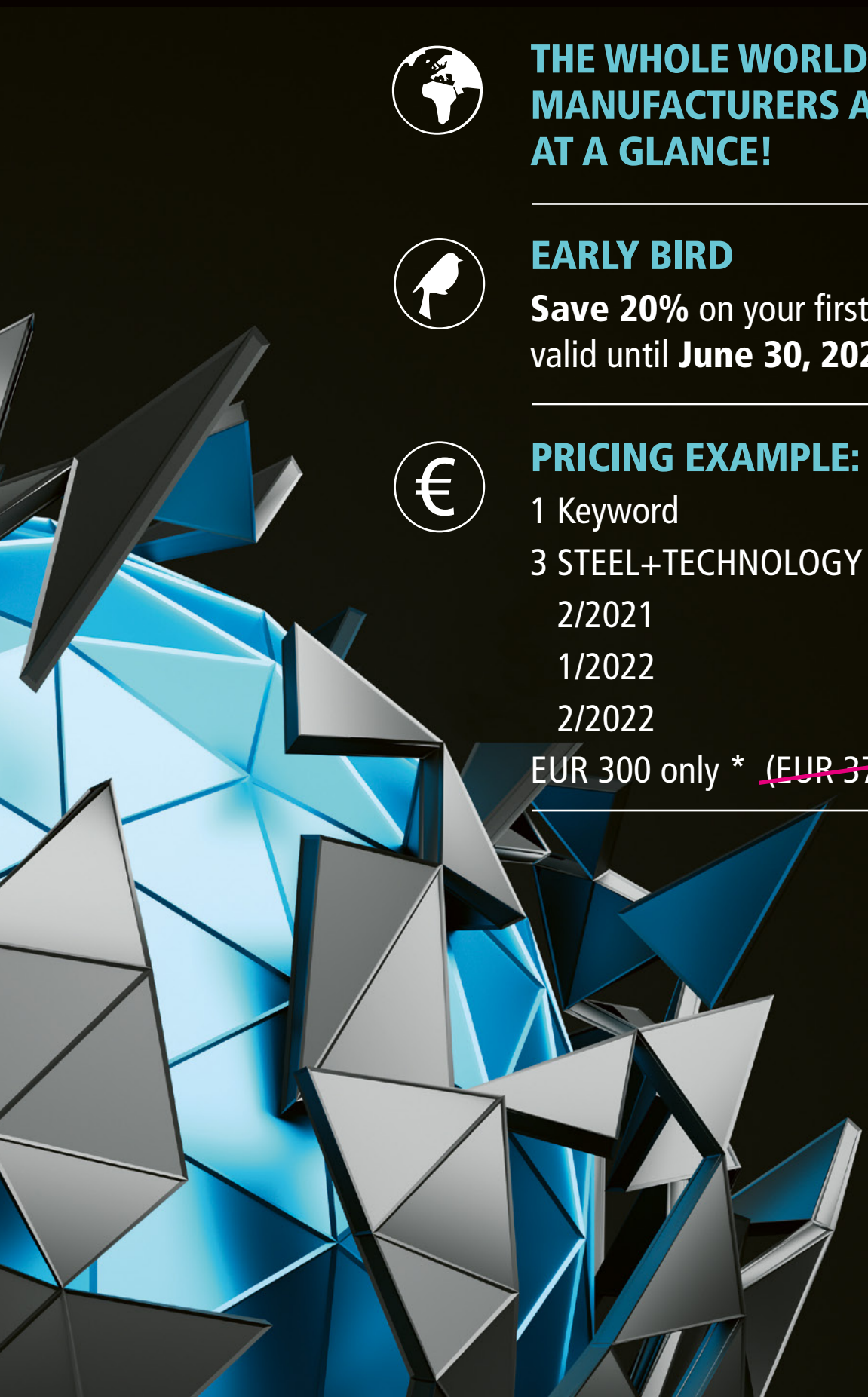

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DVS MEDIA

03 Melting Plants and Equipment

03.02 Melting and Holding Furnaces, Electrically Heated

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45141 Essen/Germany
☎ +49 201 1891-1
E-Mail: service-loi@tenova.com
Internet: www.loi.tenova.com

04 Melting Plants and Equipment

04.01 Plants, Equipment and Tools for Lining in Melting and Casting

930 Mixers and Chargers for Refractory Mixes

Refratechnik Steel GmbH
Refratechnik Casting GmbH
Am Seestern 5, 40547 Düsseldorf, Germany
☎ +49 211 5858-0
E-Mail: steel@refra.com
Internet: www.refra.com

Calderys Deutschland GmbH
In der Sohl 122, 56564 Neuwied
T: 02631/8604-0, F: 02631/8604-270
germany@calderys.de

05 Plants and Machines for Moulding and Coremaking Processes

05.04 Carburization Agents

1680 Coke Breeze, Coke-Dust

Karl Diederichs GmbH & Co. KG
Luckhauser Str. 1-5, 42899 Remscheid
T: 02191/593-0, F: 02191/593-165
info@dirostahl.de, www.dirostahl.de

08 Plants and Machines for Moulding and Coremaking Processes

08.02 Moulding and Coremaking Machines

3223 Multi-Stage Vacuum Process

Befesa Steel Services GmbH
Balcke-Dürr-Allee 1
40882 Ratingen
T: +49 2102 1001-0
F: +49 2102 1001-195
befesa.steel.services@befesa.com
www.befesa-steel.com

Clever & Co. Maschinenfabrik GmbH
Laubenhof 14, 45326 Essen
T: 0201/83574-0, F: 0201/83574-44
info@clever-co.de
www.clever-co.de

09 Melting Plants and Equipment

09.01 Basic Moulding Sands

3630 Chromite Sands

DANGO & DIENENTHAL Maschinenbau GmbH
Hagenstr. 103, 57072 Siegen
T: +49 271 401-0, F: +49 271 401-4210
www.dango-dienenthal.de

3720 Silicia Sands

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office@greenblock.at, +43 660 380 90 11
Brennschneidanlagen bis 2m Dicke
für Schrott und Adjustage
www.greenblock.at

10 Melting Plants and Equipment

10.01 Moulding Sand Conditioning

4470 Aerators for Moulding Sand Ready-to-Use

Maschinenfabrik Gustav Eirich GmbH & Co KG
Walldürner Str. 50, 74736 Hardheim, Germany

Egon Evertz K.G. (GmbH & Co. KG)
Birkenweiher 60 - 80, 42651 Solingen
T: +49 212 22311-0, F: +49 212 22311-149
info@evertz-group.com
www.evertz-group.com

12 Casting Plants and Equipment

532 Covering Agents

FRIEDRICH KOCKS GMBH & CO. KG
Neustr. 69, 40721 Hilden
T: +49 2103 79 00, F: +49 2103 5 12 49
sales@kocks.de, www.kocks.de

13 Melting Plants and Equipment

13.02 Die Casting and Accessories

5670 Diecasting Lubricants

Küttner GmbH & Co. KG, Essen/Germany
info@kuettner.com, www.kuettner.com

HEITRONICS Infrarot Messtechnik GmbH
T: +49 611 97393-0, F: -26
www.heitronics.com

HELLING GmbH
Spökerdamm 2, 25436 Heidgraben
T: +49 4122 922-0 F: +49 4122 922-201
info@helling.de
www.helling.de

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Franziusstr. 84, 44147 Dortmund
T: +49 231 982333-0 F: +49 231 982333-82
info@lungmuss.de
www.lungmuss.de

5750 Hydraulic Cylinders

R+W Antriebselemente GmbH
Hattsteinstraße 4, 63939 Wörth am Main
T: +49 9372 9864-0
F: +49 9372 9864-20
www.rw-kupplungen.de
info@rw-kupplungen.de

RHI Magnesita
Kranichberggasse 6, 1120 Vienna, Austria
T: +43 50213-0, F: +43 502 13-6213
office@rhimagnesita.com
rhimagnesita.com

Rohmann GmbH
Wirbelstrom-Prüfgeräte und -Systeme
Carl-Benz-Str. 23
D-67227 Frankenthal
T: +49 6233 3789-0, F: -79
info@rohmann.de
www.rohmann.de

5790 Piston Lubricants

STEIN INJECTION TECHNOLOGY GmbH
Hagener Str. 20-24, 58285 Gevelsberg
T: +49 2332 75742-0
F: +49 2332 75742-40
stein@sit-gmbh.net, www.sit-gmbh.net

Sudamin Rohstoff GmbH
Sonnenwall 64, 47051 Duisburg
T: +49 203 31866-0, F: +49 203 31866-90
info@sudamin-rohstoff.com
www.sudamin-rohstoff.com

5876 Multi-Stage Vacuum Process

TOTAL Deutschland GmbH
Vertriebsdirektion Schmierstoffe
Jean-Monnet-Str. 2, 10557 Berlin
T: +49 30 2027-6787
F: +49 30 2027-796634
www.total.de/industrie

TML Technik GmbH
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T: +49 2173 957[illegible]100
T: +49 2173 957[illegible]400
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TopTec Spezialmaschinen GmbH
Breithornstr. 10, 81825 München
T: +49 89 42720550
info@toptec-germany.de
www.toptec-germany.de

17 Melting Plants and Equipment

7398 Heat Treatment and Drying

Ventilatorenfabrik Oelde GmbH
Robert-Schuman-Ring 21
59302 Oelde
T: +49 25 22 75-0, F: -2 50
info@venti-oelde.de, www.venti-oelde.de

20 Melting Plants and Equipment

20.02 Measuring and Control Instruments

9230 Immersion Thermo Couples

MINKON GmbH
Heinrich-Hertz-Str. 30-32, 40699 Erkrath, Germany
☎ +49 211 209908-0 🖷 +49 211 209908-90
E-Mail: info@minkon.de
Internet: www.minkon.de

9310 Laser Measurement Techniques

POLYTEC GmbH
76[illegible] Waldbr[illegible], Germany
☎ +[illegible]7243 604-0 🖷 +49 7243 69944
E-Mail: [illegible]@polytec.de
Internet: www.polytec.de

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Wellweg 97, 31157 Sarstedt
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mail@venjakob-ut.de
www.venjakob-umwelttechnik.de

VIB GmbH
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44799 Bochum
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F: +49 234 971 90 88
vib@vib-bochum.de
www.vib-bochum.de

WOMA GmbH | Kärcher Group
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www.woma-group.com

WIKUS - Sägenfabrik
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F: +49 5663 500-57
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XOM Materials GmbH
Ackerstr. 14-15
10115 Berlin
www.xom-materials.com
T: +49 30 555 7970 10

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, licker-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)
3490 bloom and billet adjustments
3500 Heat exchangers
3503 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-superalloys
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 Slinging equipment
15230 Loading and unloading equipment
15240 Sheet metal package tongs
15250 block pushers, extractors
15270 Bunker discharge aid
15280 Bunker and silo equipment
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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
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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
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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
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17341 3-D profile measurement of weld seams
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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. Mai 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

24 Environmental protection and Entsorgung

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
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

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, in general

20135 Processing services

30.01. Joining

20178 Soldering

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12 Refractory technology

Refractory products, general 11520

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Preview of the autumn 2021 issue:

Technology to reduce CO_2 emissions from BF operations

A new technology that can reduce a significant amount of CO_2 emissions from blast furnace operations, combines the direct reduction technologies of Midrex and the blast furnace operation technology of Kobe Steel. The demonstration test was conducted for one month at a large blast furnace of Kobe Steel at the Kakogawa Works in Hyogo Prefecture, Japan.

Green steel steel production enabled by digitalization

SULB operates an integrated steelworks Bahrain. This steel complex covers the complete production chain from direct reduction to finish-rolled products, designed to produce a wide range of billets and heavy beam blanks. In 2020, SULB initiated an energy audit project with the objective to increase plant operational efficiency and make full use of secondary energy and residual heat. The long-term strategy for reducing GHG emission is also to be outlined.

The peculiarities of the AC-EAF short circuit test

The short circuit reactances of EAFs are very characteristic values which significantly influence the operational behaviour and which are determined by applying a standardized measurement method. Based on the complete electrical equivalent circuit consisting of transformer and furnace it is shown which impedances are really determined depending on the secondary side transformer connection. The results point out exemplarily which principal, i.e. unavoidable, errors are involved in the short circuit test of AC electric arc furnaces.

VOD plant upgraded from VD plant at Çolakoglu in Turkey

Turkish steel producer Çolakoglu modernized the meltshop to enable the production of special steels. The VOD (Vacuum Oxygen Decarburization) plant was upgraded from an existing VD (Vacuum Degassing) plant. VOD treatments allows production of special steels with very low carbon content. With a heat size of 295 metric tons, the VOD is the largest worldwide.

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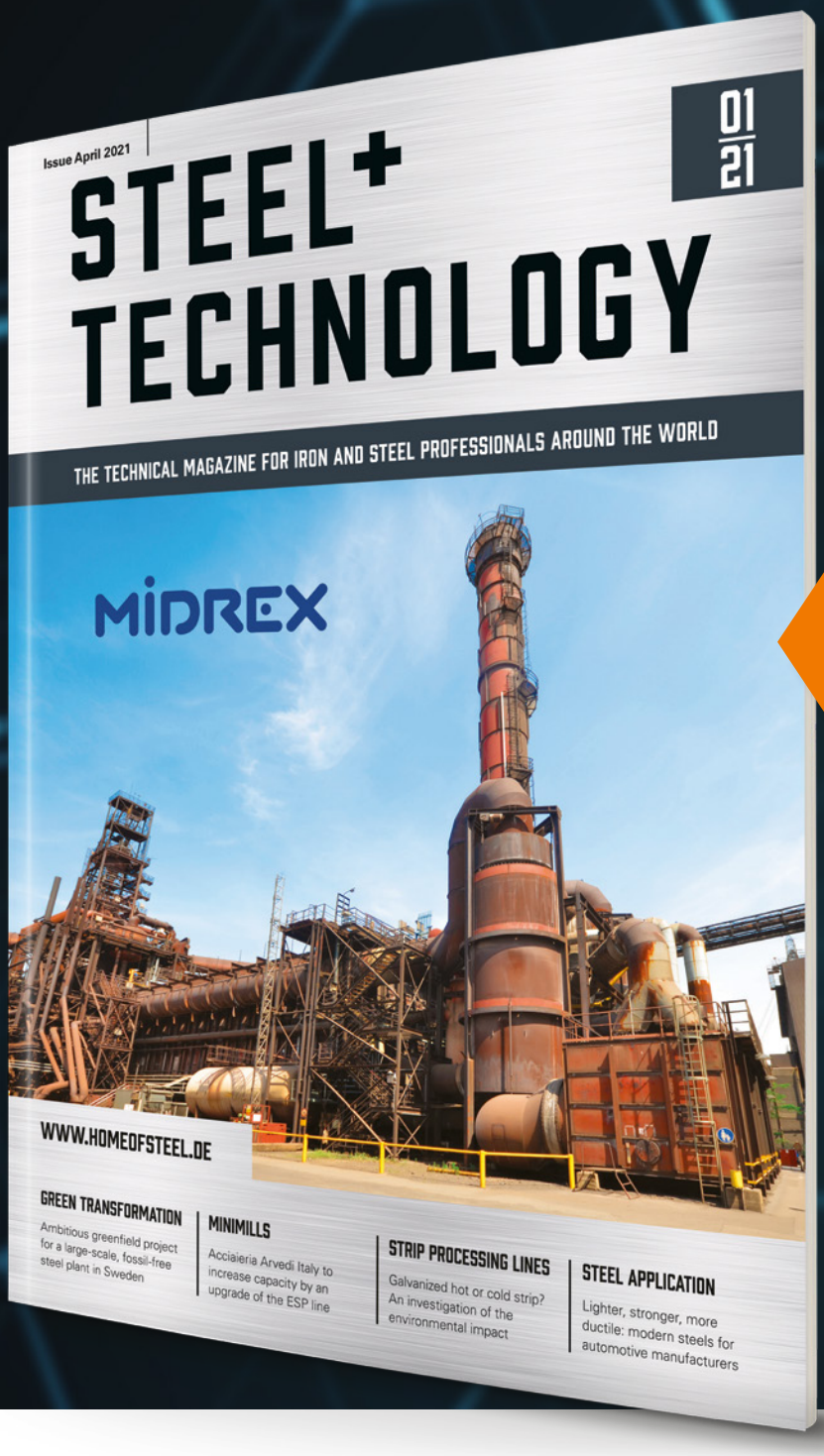

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