Issue April 2022

STEEL+ TECHNOLOGY

01 22

THE TECHNICAL MAGAZINE FOR IRON AND STEEL PROFESSIONALS AROUND THE WORLD

THE WORLD OF FURNACE TECHNOLOGY

for Tube and Wire

WWW.HOMEOFSTEEL.DE

DIGITIZATION

SSAB optimizes digital data flow between its facilities in Finland and Sweden

DECARBONIZATION

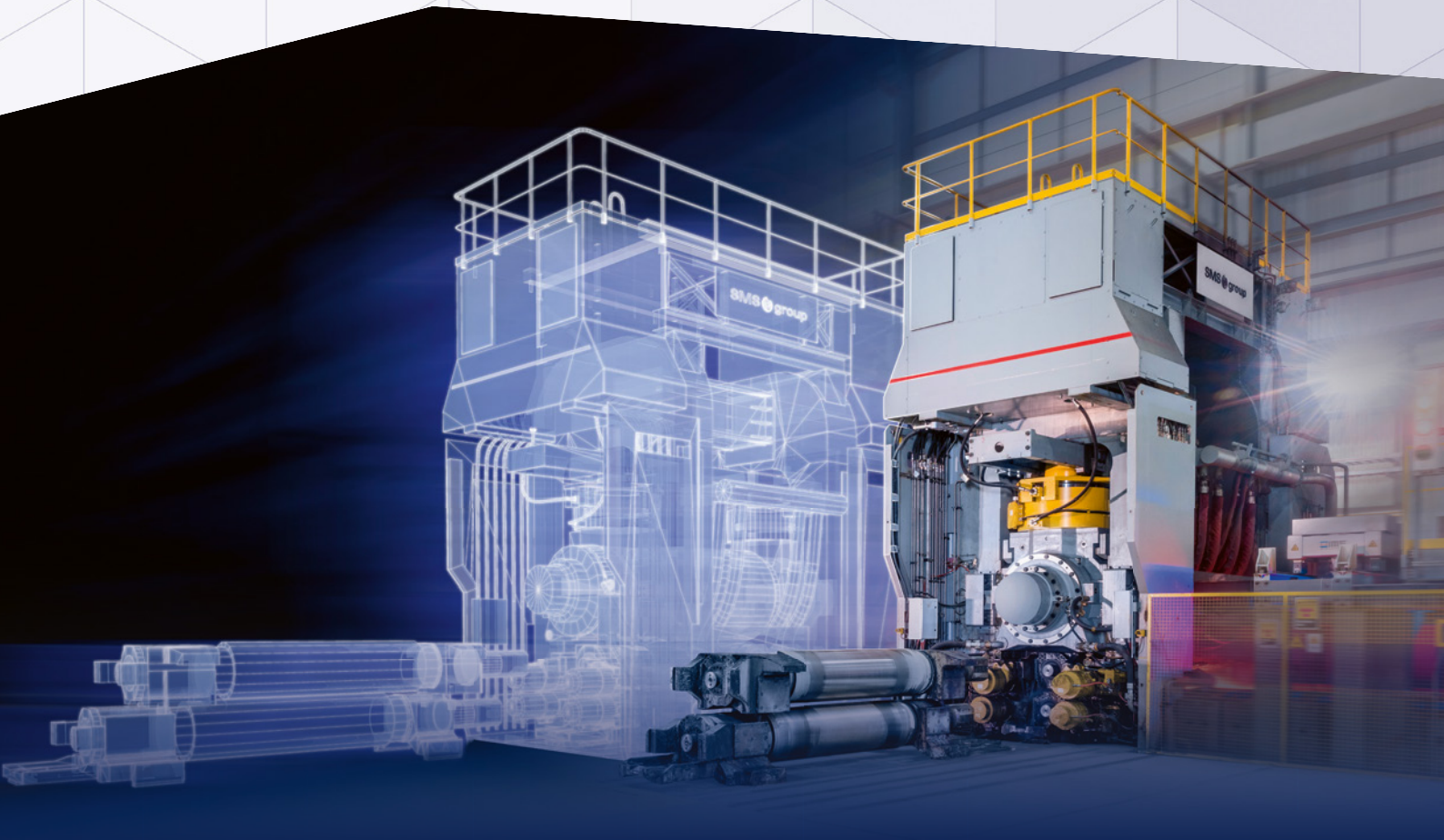
Exchange of emissions data along the value chain

STEEL PROCESSING

Slender lines shape the future in steel-bridge engineering

STEEL DISTRIBUTION

SchwarzwaldEisen relies on mobile warehouse management



WE BRING THE **DIGITAL TWIN** TO LIFE WITH OUR PLUG & WORK INTEGRATION TEST

Fast run-up and stable operation are key for the successful commissioning of your plant. We can use the digital twin of your plant to run our 3D simulations and test the entire automation hardware and software prior to installation on site.
Digital twins perfectly fit into our lifecycle services approach because we use it to also train your future operators upfront and can offer extended remote support for commissioning or performance improvements.

#XPactAutomation

Discover more:
https://www.sms-group.com/plug-and-work/

SMS group

Sustainability – the best way for a better and peaceful future

Arnt Hannewald, Dipl.Ing.
Editor

In view of the Russian invasion of Ukraine, it is difficult to return to business as usual. The outbreak of open warfare in Europe is bringing death and suffering to thousands of people and it is already having an immense economic impact, including on the steel industry. The war situation in Ukraine has hit the country's economy hard, which, together with the embargoes imposed on Russia and the aftermath of the Covid 19 pandemic, is causing increasing turmoil in international supply chains. Without question, steel companies will be adapting their purchasing and distribution networks to the new circumstances in the coming weeks and months.

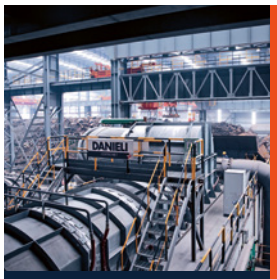
In the current issue of our magazine, we nevertheless turn again to the subjects of the steel industry. In the past weeks and months, numerous steel companies have presented their current strategy on how they will "make themselves fit for the future". Sustainability, decarbonization and digitalization are the topics that are repeatedly mentioned in this context. Many integrated steel mills, especially in the EU, have presented plans to drastically reduce their CO_2 emissions. In many cases, the medium-term goal is to convert the technology from the blast furnace route to melt shop operation. These are major investment projects in which the companies sometimes intend to radically rebuild their production sites. In such projects, it is worth taking a look at other companies that are already very successfully producing steel via the electric arc furnace route. Nucor Corporation is certainly one of these companies. It is no coincidence that in this issue we have two reports on very recent projects of this company: On the one hand, Nucor is building a plate mill in Brandenburg, Kentucky/USA, which, according to those involved, will reach a benchmark in terms of flexibility and OPEX. Another milestone – or challenge – will be the new greenfield sheet mill that Nucor plans to erect in West Virginia. This new strip production site shall have a significantly lower carbon foot print than competitors. Also, this plant will be the first thin-slab casting rolling plant to produce also automotive exposed grades allowing Nucor to operate its new minimill without steel grade limitations. The latter is something that many metallurgists at the integrated mills usually deny.

There are many, many other state-of-the-art developments covered in this issue. All this shows that the steel industry takes its responsibility for a sustainable economy very seriously and is actively committed to our planet. Peace, however, is a prerequisite for this. It is to be hoped that politicians will hurry back to their responsibility for the power of peace and silence the guns as soon as possible. "No more war!" is not an empty phrase from the last century, but an everlasting call.

Arnt Hannewald

DANIELI MIDA HYBRID MINIMILL FOR FLAT PRODUCTS

A Green Steel technology for quality products at competive OpEx



SCRAP MANAGEMENT AND ENDLESS CHARGE

50 kWh/ton saving

DDM - DANIELI DIGIMELTER: THE EVOLUTION OF THE EAF

30 kWh/ton saving

DYSENCASTER® UP TO 6.5 M/MIN CASTING SPEED

DRI HOT CHARGE

100 kWh/ton saving

HYBRID VIA Q-JENIUS

50 kWh/ton saving

DANIELI QSP-DUE

UNIQUE PERFORMANCES USING PATENTED:
DIGIMELTER® DYSENCASTER® QSP-DUE®

Note: energy savings expressed in kWh/ton (1 kWh/ton = 3.6 MJ/ton)

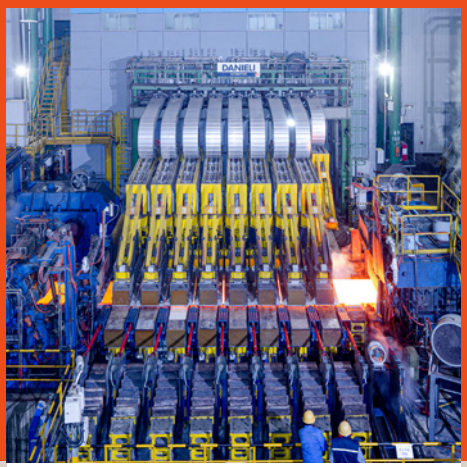
Characterized by Digimelter power and melting intelligence, high-speed high-quality casting, and endless casting-rolling, QSP-DUE® minimills produce up to 3 Mtpy of HRC on a single casting strand.

Featuring the Q-One power unit, Q-Melt intelligent controller and continuous scrap or DRI charge, Digimelter runs the melting processes automatically, in a stable and adaptive way, with minimal impact on the electric network.

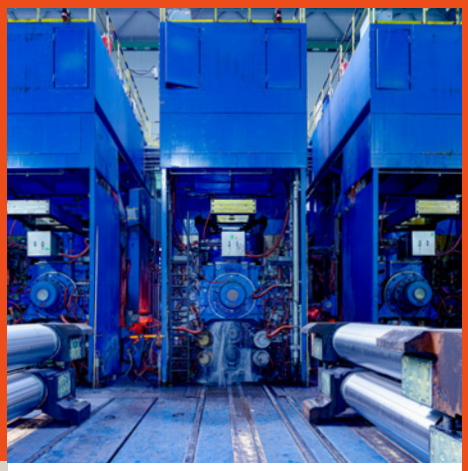
Thanks to the unique flexibility of three rolling modes in a single line, QSP-DUE® technology allows the widest product mix from mild steel IF, ULC, up to AHSS steel grades for automotive applications, in thin gauges down to 0.8 mm as a substitute for cold-rolled strip products.
Coli-to-coil, semi-endless and endless rolling modes make it possible to satisfy continuously changing market requests.

Danieli MIDA minimills are truly green, with the lowest power consumption and CO_2 release.
Also, they are natively hybrid - making use of renewable energies by Digimelter, and use hydrogen for DRI production.

DANIELI



Q-HEAT FLAT INDUCTION-TEMPERATURE CONTROL



WIDE RANGE OF QUALITY HOT-ROLLED STRIP

DIGISAVER DIGITAL PROCESS ENHANCER
20 kWh/ton saving

Additional digital overall plant optimization

DUE@ Three rolling modes. Coil-to-coil, semi-endless, and endless for no steel-grade production limits.

Up to 260 kWh/ton saving.

UNIVERSAL ENDLESS FOR FLAT PRODUCTS

DANIELI
THE COMPETITIVE GREEN STEEL

33 Nucor is building an addvanced greenfield sheet mill on the Ohio River in West Virginia, USA with operations to begin in 2024

Steel technology

21 SSAB optimizes digital data flow between its facilities in Finland and Sweden
Using the cloud-based SMS DataFactory four production sites in two countries are to be interlinked for maximum transparency and decision-making

22 Emissions data along the value chain
Siemens has developed a solution for efficiently retrieving, calculating, and sharing information about the real carbon footprint of products

23 Occupational safety while transporting hot slag

25 Measuring the liquid metal temperature of a blast furnace

26 Integrated solution for the digitalization of complete scrap yards
Preparation of input materials into a "design scrap"

33 Flexible production of heavy and light plates, and jumbo coils
The new Nucor Steel Brandenburg plate mill will combine in a single plant the advantages of plate/Steckel rolling for medium-thin plates, as well as jumbo coiled plates with ingot rolling

38 Manufacturing high quality steel strip with a lower carbon footprint
Nucor is to build a greenfield sheet mill on the Ohio River in Mason County, West Virginia which is scheduled to come on stream in 2024

40 Modernization of the hot strip mill at Salzgitter Flachstahl
The current modernisation is aimed at increasing availability, enabling an expansion of the product range, and reducing operating costs

41 Drives for roller tables at hot rolling plants
Advanced motors for use with frequency inverters to drive roller tables in the steel and rolling mill sector

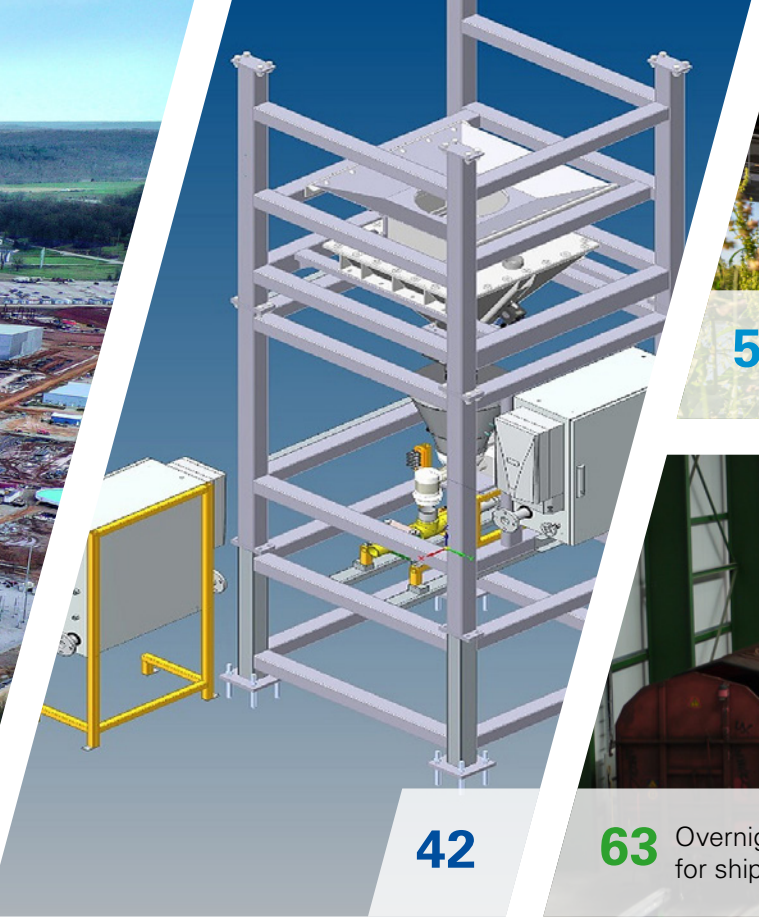
42 ScaleFree Technology
A new method developed, tested and proven to work to reduce scale-related problems from casting to finishing

45 New high-precision flatness measuring system at heavy plate manufacturer Ilsenburger
A system from nokra ensures that all the fine-levelled plates shipped fulfill the special tolerances on flatness specified in EN 10029

50 Expansion joints with exceptional tightness for strip processing lines
Secure sealing of the inert gas atmosphere

52 Wuppermann further expands the production programme in Hungary
The company has commissioned an advanced double-head side trimmer at a strip processing line

53 Successful "remote" commissioning of heavy-load robots for open-die forging
Dango & Dienenthal has online commissioned equipment for a forging plant almost 7,000 km away



57 Slender lines shape the future in steel-bridge engineering

42

63 Overnight, the coils are automatically sorted for shipment the next day

Steel processing

55 thyssenkrupp to booster forging business

56 SLM Solutions and Mahle further the push of additive manufacturing into automotive

57 Slender lines shape the future in steel-bridge engineering
For the new Neckar Bridge thick steel sheets were used for its steel sails, which combine a highly sophisticated function and filigree aesthetics at the same time

Steel distribution

63 Coil transshipment 4.0
German company has introduced a system that automatically picks the coils for truck deliveries

67 Combilift's new electric powerd XLE forklift

68 SchwarzwaldEisen manages automatic and manual storage areas with one system

71 State-of-the-art manufacturing embedded at a sustainable and trimodal logistics hub

For supporting this issue we would like to thank our advertisers:

	Page		Page
Agtos GmbH	37	M.A.T. Malmedie Antriebstechnik GmbH	31
AIST Association for Iron & Steel Technology	35	Messe Düsseldorf GmbH	13
COILTEC Maschinenvertriebs GmbH	32	Micro-Epsilon Messtechnik GmbH & Co. KG	49
Combilift Ltd.	62	Morgardshammar AB	9
Dalmia GSB Refractories GmbH	29	Rudolf Uhlen GmbH	65
DANGO & DIENENTHAL Maschinenbau GmbH	15	Rump Strahlanlagen GmbH & Co. KG	69
Danieli S.p.A.	4,5	Saar-Metallwerke GmbH	72
DMT GmbH & Co. KG	18	SMS group GmbH	2
DVS Media GmbH	24,103	STEULER-KCH GmbH	16,17
GLAMA Maschinenbau GmbH	54	VELCO GmbH	19
GÖCKE GmbH & Co. KG	61	VEM Motors GmbH	59
hpl-Neugnadenfelder Maschinenfabrik GmbH	44	Friedrich Vollmer Feinmessgerätebau GmbH	12
KELLER HCW GmbH	25	Walzengießerei Coswig GmbH	27
Kiro-Nathaus GmbH	20	WS Wärmeprozesstechnik GmbH	11
Friedrich Kocks GmbH & Co. KG	104	Zumbach Electronic AG	47
LOI Thermprocess GmbH	1		

Newly appointed director, Gary E. McCullough (Photo: Commercial Metals Company)

Commercial Metals Company appoints new director

Commercial Metals Company (CMC) has named Gary E. McCullough to the Board of Directors.

Gary E. McCullough currently sits on TransDigm Group Incorporated's Board of Directors and serves as an investor in and advisor to several private entities. He previously served as Chief Executive Officer of ARI Packaging, Inc. Prior to that, he was President and Chief Executive Officer of Career Education Corporation, where he also served on the Board of Directors. McCullough's appointment will bring the total number of directors to 10, nine of whom are independent. He will serve on the Compensation and Finance Committees.

Commercial Metals Company

Advisory Board members for GIFA, METEC, THERMPROCESS and NEWCAST elected

Preparations for the next trade fair quartet GIFA, METEC, THERMPROCESS and NEWCAST, to be held from 12 to 16 June 2023 in Düsseldorf, have started.

The Advisory Board of the Düsseldorf trade fair quartet was established in February 2022. The new President of the foundry trade fairs GIFA and NEWCAST is Dr. Ioannis Ioannidis, CEO and Spokesman of the Board at Oskar Frech GmbH + Co. KG from Schorndorf. Burkhard Dahmen, Chairman of the Board at SMS group in Düsseldorf, was confirmed as President of the METEC international metallurgy trade fair and its accompanying congresses ESTAD and EMC. The new President of THERMPROCESS, international trade fair and symposium for thermo process technology, is Till Schreiter, CEO and President of ABP Induction Systems GmbH from Dortmund. All three candidates were elected unanimously.

Messe Düsseldorf

Management changes at Mechel

Mechel has created a new post of deputy Chief Executive Officer for Mechel PAO's operations and appointed Alexey Lebedev to this new post.

Alexey Lebedev will be in charge of a wide range of issues linked to operational planning and technical development, meeting production plans, product quality, construction and overhauls, labour and industrial safety. He will temporarily coordinate work on his new post with management of the company's transport division. Alexey Lebedev has been Chief Executive Officer of Mecheltrans Management Company since December 2013.

Mechel

Swiss Steel Group appoints additional members to Executive Board

Swiss Steel Holding AG has appointed three additional members to the Executive Board.

CEO Frank Koch explains: "The expansion of the Executive Board is part of the strategy and growth path Swiss Steel Group (SSG) has embarked on. We will significantly optimize our synergy potential on the way to becoming a world-leading specialty steel producer by optimizing and bundling our market and application expertise, our innovation competence and technical know-how with this strengthened cooperation between Group Management and the Business Units."

With Jürgen Alex, Florian Geiger and Patrick Lamarque d'Arrouzat, CEO Frank Koch complements his management team with CFO Markus Böning with three additional experienced steel managers. Jürgen Alex has held various management positions at Deutsche Edelstahlwerke. Florian has held a management position at SSG since 2013 and has been CEO of the Steeltec business unit since January 2020. Patrick Lamarque d'Arrouzat has been CEO of the Ugitech Business Unit since 2009.

Swiss Steel Group

Morgårdshammar
part of the DANIELI group

DANIELI MORGARDSHAMMAR

INTELLIGENT GUIDES & INNOVATION

RX Guide Series -
The automatic guide with online dimension change!

WSG Guide Series -
Taking rolling to new dimensions!

Danieli Group Headquarter
Via Nazionale 41, 33042 BUTTRIO (UD), Italy
Phone: +39 432 1958111
Fax: +39 432 1958289
E-mail: guides@danieli.com
www.danieli.com

Morgårdshammar AB
SE-777 82 SMEDJEBACKEN, Sweden
Phone: +46 240 668500
Fax: +46 240 668501
E-mail: mh@morgardshammar.se
www.morgardshammar.se

Branch Office:
Morgårdshammar AB
Sales office Krefeld
P.O. Box 101552
D-47715 KREFELD, Germany
Phone: +49 2151 81290
Fax: +49 2151 812933
E-mail: office@mh-guides.de

www.danieli.com www.morgardshammar.se

Dr. Klaus Richter, appointed as Member of the Board of Management for the Technology Division of Saarstahl (Photo: Dirk Martin, Saarstahl AG)

Saarstahl names new Chief Technology Officer

The Supervisory Board of Saarstahl has appointed Dr. Klaus Richter as Member of the Board of Management for the Technology Division of Saarstahl with effect from 1 October 2021.

Klaus Richter, for many years head of the company's steel works in Völklingen, has been a member of the Saarstahl Board of Management since 2013 and to date has been responsible for the Sales Division.

In his new responsibility for the Technology Division on the Saarstahl Board of Management and in the management of SHS – Stahl-Holding-Saar (SHS), Klaus Richter is also entrusted with the central task of systematically integrating the two acquired French plants – Saarstahl Rail and Saarstahl Ascoval – into the Saarstahl Group in line with the corporate strategy. This means in particular increasing the production of steel with a carbon-neutral footprint and consequently extending it to Saarstahl's product portfolio, as well as advancing the ecological mobility transformation through the production of quality rails.

Given the additional areas of responsibility of Dr. Richter at Saarstahl Rail and Saarstahl Ascoval, the Chairman of the Board of Management of Dillinger and Saarstahl, Dr. Karl-Ulrich Köhler, intends to maintain responsibility for the time being for the Technology Division at Dillinger.

Stahl-Holding-Saar

NLMK changes staffing in sales and marketing

Mikhail Antonov has joined the NLMK Group leadership team as the new Vice President for Sales and Marketing, replacing Ilya Guschin, who has left the company.

Mikhail Antonov will focus on further sales portfolio optimization, accelerating the development and market launch of new products.

In 2013, Mikhail was appointed CEO of Gazprom Marketing & Trading, where he coordinated the company's operations in North and South America. From 2018 onwards, he was in charge of the Refining business unit at Gazpromneft, where he initiated the Production Management and Reliability Centre project and established Gazpromneft Industrial Innovations, an R&D tech company. Mikhail has an MBA from the London School of Business.

NLMK

New Chief Financial Officer at Nucor

Nucor Corporation has announced the retirement of Jim Frias as Chief Financial Officer, Treasurer and Executive Vice President, naming Steve Laxton his successor.

Steve Laxton, Vice President of Business Development and Strategic Planning, will succeed Jim Frias as Chief Financial Officer, Treasurer and Executive Vice President. Frias and Laxton will work together over the next several months to conduct a seamless transition of CFO responsibilities. Steve Laxton began his career with Nucor in 2003 as General Manager of Business Development and was promoted to Vice President in 2014.

Nucor

Changes on SSAB Board

Annareetta Lumme-Timonen has requested her resignation as member of the Board – it is proposed that Maija Strandberg replaces her.

In consequence of the recent ownership changes in SSAB in Finland, current member of the Board of Directors, Annareetta Lumme-Timonen, has requested her resignation at the upcoming extraordinary general meeting. After having been informed of Annareetta Lumme-Timonen's request, SSAB's Nomination Committee has prepared the matter and decided to propose Maija Strandberg as the new member of the Board of Directors to replace Annareetta Lumme-Timonen. Maija Strandberg is senior financial counsellor in the government ownership steering department at the Finnish Prime Minister's Office Finland. Currently, she is on the boards of Finnair and Neova.

SSAB

WS burners are highly efficient, low-maintenance, and offer unmatched ease of start-up and system integration, thus enabling precise control of your production process.
At WS you get the whole package: economical and reliable burner operation for sustainable production based on decades of experience. In close cooperation with customers, WS designs innovative solutions, already today taking into account potential green fuels of the future, such as renewably generated hydrogen. Thus, ensuring that your heating system is ready for the long term and will meet future emissions regulations and carbon free requirements.

Maximized Energy Efficiency for Steel Strip Furnaces.

Minimized NO_X Emissions: $NO_X < 100\ mg/Nm^3$.

Prepared for the Future of Green Fuels.

GREEN GAS READY®

German Environmental Award 2011

Picture: WS burner REGEMAT® in double-p-tube

Innovative Gas Burner Technology.

FLOX®

WS THERMAL PROCESS TECHNOLOGY

WS Wärmeprozesstechnik GmbH · Dornierstrasse 14 · D-71272 Renningen · Germany
Phone: +49 (71 59) 16 32-0 · Fax: +49 (71 59) 27 38 · E-Mail: ws@flox.com

WS Thermal Process Technology Inc. · 8301 West Erie Avenue · Lorain, OH 44053 · USA
Phone: +1 (440) 385 6829 · Fax: +1 (440) 960 5454 · E-Mail: wsinc@flox.com

flox.com

U. S. Steel names new Senior Vice President and COO of Big River Steel Works

United States Steel Corporation has named Daniel R. Brown Senior Vice President of advanced technology steelmaking and Chief Operating Officer of Big River Steel Works.

Daniel R. Brown, newly appointed Senior Vice President of advanced technology steelmaking and Chief Operating Officer of Big River Steel Works (Photo: Business Wire)

In this role Daniel R. Brown will be responsible for flat roll steel production currently in place and planned in Arkansas utilizing electric arc furnaces, endless strip production, electrical steel and advanced finishing facilities. He will continue to serve as the Chief Operating Officer of Big River Steel, as well as the new mill and continue to report to President and CEO David B. Burritt.

United States Steel Corporation

Sandvik appoints new Chief Financial Officer

Sandvik has appointed Cecilia Felton as Executive Vice President and Chief Financial Officer, CFO, effective February 1, 2022.

Cecilia Felton, who has served as interim CFO since November 1, 2021, will also be a member of the Group Executive Management. Cecilia Felton has been with the Sandvik Group since 2013. She has been Vice President of Group Control since 2018, and previously held the positions as Director of Group M&A and investments as well as Director of Group Business Control at Sandvik. Before joining Sandvik she worked at Ernst & Young in London (2007-2013).

Sandvik

Sandvik announces first three members of the board of Materials Technology business

As previously communicated, the Sandvik Board intends to formally propose the distribution and listing of its business area Sandvik Materials Technology (SMT) at a shareholders' meeting next year.

The target is to complete the listing in the second or third quarter of 2022, subject to shareholder approval. The listing is planned to be made at the Nasdaq Stockholm stock exchange.

As part of this process, the Sandvik Board of Directors has appointed Andreas Nordbrandt as Chairman of the Board of SMT. Additionally, Claes Boustedt and Karl Åberg have been appointed as members of the SMT Board of Directors. Additional members of the SMT Board will be appointed at a later stage to fulfill any requirements and ensure a suitable board composition.

Sandvik

AUSTRIA

Metalshub launches partnership with SMR

Metalshub, the Supply Chain Solution and Data Intelligence Platform specializing in raw materials, has announced a strategic partnership with market research company SMR.

Metalshub and SMR will join forces to expand and promote the price indices for metals and ferro-alloys currently offered by Metalshub. The company was founded in 2016 in Düsseldorf as a tech start-up with the mission to drive digital innovation in the metals industry. Metalshub's digital supply chain solution can help reduce costs and CO_2 emissions. With over 100 subscribers to their price indices, Metalshub offers a wide range of price data (FeMo, Nickel, Manganese Metal Flakes, FeVa, FeTi, FeT, FeCh, FeSi...). Plus, more than 1,300 companies are already using Metalshub, including more than 300 steel mills and foundries that have digitized their purchasing processes with Metalshub.

SMR Group, based in Austria, was established 28 years ago as an independent market research company with the mission to provide market intelligence for the stainless and specialty steel industries.

Metalshub

GERMANY

Andritz and BFI develop new generation of shapemeter roll

Andritz Metals Germany (AMG) and the VDEh-Betriebsforschungsinstitut (BFI) have entered into a collaboration to develop the latest shapemeter roll generation. One focus of the development project will be to use the existing automation infrastructure of the rolling processes in line with Industry 4.0 and the Internet of Things (IoT) for data-driven optimization of shape processes.

The aim is to achieve greater process reliability and production stability to meet higher quality requirements. The new generation will therefore enable measurement

GERMANY

AMG Senior Vice President Processing Service Johannes Kahlen, BFI Managing Director Dr. Matthias Seiler, AMG Vice President Klaus Adelsberger, AMG Managing Director Guido Burgel at the test stand for the shapemeter roll at AMG in Hemer (Photo: Andritz)

and monitoring of five other essential process parameters in addition to traditional shape measurement, which are to be successively integrated into the robust system of the shapemeter roll: strip tension measurement, strip edge detection, strip width and strip position measurement, and monitoring of the strip's temperature profile.

AMG and BFI can look back on a 40-year success story in the development of shapemeter and shape control systems. The AMG-BFI shapemeter roll is the central system used for the production of metal strip in the steel, stainless steel, aluminium, and nonferrous metal industries to ensure consistent high quality.

To date, three successful generations of AMG-BFI shapemeter rolls have been developed and marketed internationally, known as the shape:tronic system (AMG) and the BFI shapemeter roll (BFI). The first generation of the shapemeter roll, introduced in 1976, has been continuously adapted to meet changing customer requirements in shape measurement. In order to efficiently contribute practical experience and customer know-how to the next stage of further development, both companies have decided to collaborate even more closely.

Ralf Gutsche, department manager for shapemeter rolls at AMG, says: "We are looking forward to working even more closely with BFI to combine our experience and develop the shapemeter roll product further."

Colin Goffin, commercial project manager at BFI, adds: "The new proprietary generation of the shapemeter roll will combine the best of previous BFI shapemeter rolls – the high shape accuracy of the BFI pocket roll (2nd generation) and a closed roll surface, as is the case with the BFI axial measuring roll (3rd generation). In addition, the shapemeter roll will integrate further process parameters. This provides a very big advantage to our customers."

Andritz Metals Germany (AMG), VDEh-Betriebsforschungsinstitut (BFI)

"Bright World of Metals" from 12 to 16 June 2023 in Düsseldorf

The four trade fairs GIFA, METEC, THERMPROCESS and NEWCAST for foundry technology, castings, metallurgy and thermo process technology will be held in Düsseldorf from 12 to 16 June 2023. Registration for the event has just started.

"Our trade fair quartet is well known as the gateway to the world markets. Here, decision-makers, experts, suppliers to and users in these industries can obtain a complete overview, exchange ideas and design trends for the markets of the future," says Friedrich-Georg Kehrer, Global Portfolio Director at Messe Düsseldorf GmbH, the organizer of the event. The four trade fairs (GMTN) address the following industries and technologies:

GIFA, the 15th International Foundry Trade Fair with Technical Forum, will cover foundry and melting plants, including refractory technologies, moulding and core making, sand preparation and reclamation, gating and feeding, control systems and automation, environmental protection and waste removal and other topical issues.

METEC – International Metallurgical Trade Fairs with ESTAD Congress forms an integral part of the trade fair quartet. Equipment for iron, steel and non-ferrous metal production will be presented alongside casting technology, rolling mills and processing lines – in the light of current ecological and economic challenges.

THERMPROCESS will feature technology trends and solutions revolving around the production and operation of industrial furnaces, heat generation plants and thermal processes.

NEWCAST is the world's leading trade fair for castings and their wide-ranging use in vehicle manufacturing, aviation and aerospace application, machine and plant manufacturing.

The trade fairs are supported by VDMA (Association of German Mechanical and Plant Engineering). Also partnering with the event are the Foundry Chemistry Industry Association (IVG e.V., Laatzen), the Confederation of the German Foundry Industry (BDG e.V., Düsseldorf), the German Foundrymen's Association (VDG e.V., Düsseldorf) as well as The European Foundry Association (CAEF, Düsseldorf).

Messe Düsseldorf

FRANCE

Celsa France invests in digital systems for EAF control

Tenova Goodfellow Inc. has received an order from Celsa France for the supply of an iEAF® technology platform using the NextGen® system for their 150 t scrap top charge AC furnace in Boucau.

The scope of supply will include Tenova's NextGen® hardware for upstream off-gas measurement, which is the first critical step for enabling the software solutions needed for net energy and melting-rate control with iEAF® technology. Also included are optical temperature and velocity measurement systems, HMI for the process data, and optimization support. Engineering, installation and commissioning of Tenova's digital platform technologies is scheduled for late spring 2022.

Tenova

FINLAND

Outokumpu further increases share of wind power in its electricity procurement

Outokumpu has signed another 10-year power supply agreement for renewable wind power with Gasum.

This new deal is an addition to the earlier wind power agreement with Gasum, announced in September 2021. According to the agreement, deliveries will begin in the summer of 2023.

Increasing the share of low-carbon electricity is one of the most important ways for Outokumpu to achieve its ambitious climate targets. Outokumpu's sustainability strategy and climate targets were updated in May 2021. Increasing the share of low-carbon electricity is one of the key elements in Outokumpu's roadmap towards achieving carbon neutrality in its own operations by 2050.

Outokumpu

Billet welding machine for endless rolling
(Photo: Danieli)

ITALY

Ferriere Nord brings on stream new billet welder

Ferriere Nord (Pittini Group) has started up its new billet welder for endless rolling supplied by Danieli.

The billet welder for Ferriere Nord is of a new, patented design, enabling significantly shorter cleaning operations. Furthermore, the welder features a cartridge concept applied to the welding clamps which now can be replaced quickly and easily, allowing off-line maintenance in the workshop instead of onboard. A new current-control system speeds up welding time and improves homogeneity of the welding joints. The new billet welder went into operation at Ferriere Nord in January 2022 during a three-week maintenance shut-down of the plant.

Danieli

Primetals Technologies divests bar and wire rod mill division

Primetals Technologies entirely transferred its shares of Primetals Technologies Italy S.r.l., Marnate (Italy) to Callista Private Equity GmbH, a financial investor with registered office in München (Germany).

As part of the transaction Primetals Technologies Italy S.r.l. will be renamed to POMINI Long Rolling Mills S.r.l. (Pomini). The intellectual property of Primetals Technologies Italy is entirely transferred to Pomini. Primetals Technologies and Callista Private Equity have agreed to continue collaborating for certain types of long rolling mills, WinLink plants, and in the field of mini mills for long products on a project-by-project basis.

Primetals Technologies now executes its in-house key product offerings for long rolling business under the lead of its two centers of competence: for long rolling mills in Sutton, Massachusetts, USA, with the focus on wire rod mills, bar in

ITALY

coil lines, combination mills including wire rod, bar in coil and straight bar outlet, high speed rebar mills, non-ferrous rolling mills for copper, and aluminum mills; and for electrics & automation for long rolling mills in Erlangen, Germany, supported by the regional entities in Poland, Russia, India, China, and the USA. Engineering, research and development, and project management for long rolling mills will be concentrated at Sutton.

Primetals Technologies

Tenova and Snam cooperate on decarbonization

Energy infrastructure operator, Snam, and Tenova, have agreed to work together over the next three years to design integrated solutions based on the use of green hydrogen.

Both companies plan joint strategic studies and market analyses to implement specific infrastructure and metals production systems by using green hydrogen. Snam will provide its expertise in hydrogen technologies as well as transport, while Tenova will contribute its know-how in combustion systems for reheating and heating treatment, and in electric arc furnaces. As part of the collaboration, tests will be conducted in a laboratory currently under construction at Tenova's headquarters in Castellanza, Varese, complemented by installations and production tests on industrial sites. The aim is to develop a ready-to-use solution for our customers, directly at their production sites.

Snam is a leading operator in natural gas transport and storage, with an infrastructure enabled for the transition to hydrogen. The company runs a transport network of approximately 41,000 km between Italy, Austria, France, Greece and the UK as well as major gas storage capacities. Besides transport and storage, it is also one of the main operators in LNG regasification. Snam has also a presence in Asia, Middle East and North America.

Tenova, Snam

NORWAY

Tata Steel to cease production at Fredrikstad

Tata Steel intends to cease the its manufacturing operations at its service center Norsk Stål Tynnplater AS in Fredrikstad while retaining the legal entity and local sales force.

The service center uses steel from Tata Steel IJmuiden (The Netherlands) to further process into hot-dip galvanised and cold-rolled commodity products with the focus on the industry sector.

The proposal to cease manufacturing operations at Fredrikstad has been made following a detailed review of the distribution activities in the Nordics. The majority of the products are sold to customers in Sweden and Tata Steel believes that serving those customers directly from the Halmstad site in Sweden, allows the company to serve them even better.

Tata Steel

SWEDEN

SSAB plans new Nordic production system and to bring forward the green transition

SSAB's Board has taken a policy decision to fundamentally transform Nordic strip production and accelerate the company's green transition. The decision was taken against the background of strongly growing demand for fossil-free steel.

The plan is to replace the existing system with new mini-mill technology, which will result in a broader product program and improved cost position. The ambition is to largely eliminate carbon dioxide emissions around 2030, 15 years earlier than previously announced. However, to achieve this ambitious target, the necessary infrastructure, access to fossil-free electricity in particular, must be in place in time.

The recent decision means a transformation of SSAB's other Nordic production sites during the next ten years, considerably fast-

SWEDEN

er than the earlier objective of 2045. The first step will be to develop a more detailed transformation plan for each production site. The order of site transformation will depend, among other things, on the availability of the necessary infrastructure, in particular access to competitive electricity. The plan means all SSAB's emissions will be largely eliminated at the beginning of the next decade, which will mean an emission reduction of more than 8 million tonnes of carbon dioxide a year, compared with present levels. Under the new plan, Luleå and Raahe will be transformed into cost-effective mini-mills, with electric arc furnaces and rolling mills. Borlänge and Hämeenlinna will be further developed in line with the new production processes.

SSAB

Fagersta Stainless starts up new soaking furnace

Danieli Centro Combustion has supplied an innovative soaking furnace to Fagersta Stainless in just seven months. After a quick start-up the fully electrical soaking furnace for long products reached full operation within four weeks.

The new furnace is used between the induction reheating furnace and the rolling mill to equalize billet temperature. To achieve the process requirement and promote decarbonization, the furnace is fully powered by electrical resistance. The resistance coils developed and tested at the Danieli research center are installed along the entire length of the furnace roof and walls. They maintain the furnace chamber at temperatures of up to 1,250°C, an exceptionally high temperature for this heating technology. Despite the high temperatures dry rolls are installed, which further reduces energy consumption.

The new soaking furnaces at Fagersta Stainless in Sweden (Photo: Danieli)

Temperature control is performed by a silicon-controlled rectifier that allows very accurate zone-temperature tuning. In addition, the insulation system mainly composed by fiber, guarantees low inertia and high reactivity of the furnace, which is capable of heating up and cooling down quickly at 200°C/h gradients.

The furnace was engineered, manufactured and assembled on time, as required by the customer, in order to perform the commissioning during the summer shutdown.

Danieli Centro Combustion

UNITED KINGDOM

Tata Steel completes refurbishment of lime-making kiln

The refurbishment of a major lime-making kiln at Tata Steel's Shapfell site in Cumbria, UK, will allow for the more efficient and sustainable supply of critical steelmaking material to the Port Talbot steelworks.

Tata Steel manufactures lime at its Cumbrian facility from UK-quarried limestone. Lime is used to improve the quality of steel as well as removing impurities during steelmaking. The investment to reline Shapfell's Kiln 4 took ten months to complete and allowed it to start producing again after being mothballed since 2016.

The kiln is lit using new technology in conjunction with a company called

UNITED KINGDOM

Secatherm. A hot gas blower system which is used to give increased control while at the same time providing both reduced and cleaner emissions has been installed. New technology, including airflow monitoring, will allow Tata Steel to understand and control the combustion and energy efficiency of the kiln to save on overall energy use and costs.

Tata Steel

UKRAINE

ArcelorMittal halts production at its Ukrainian steelmaking operations

ArcelorMittal has idled its steelmaking operations in Kryvyi Rih, Ukraine in order to ensure the safety and security of people and assets.

ArcelorMittal has been evaluating the situation on a daily basis and production had previously been reduced with the plant operating at a technical minimum (approximately one-third of its normal production levels). The process to idle all blast furnaces commenced on 3 March. ArcelorMittal is deeply concerned about the situation in Ukraine and the threat to their employees and the entire Ukrainian population.

ArcelorMittal

Metinvest temporarily suspends its production facilities in Mariupol

Metinvest Group has put some equipment of the Ilyich Iron and Steel Works and Azovstal in suspension mode.

This decision was made by Metinvest's crisis response center to ensure the safety of its employees and preserve the equipment. Azovstal suspended its operations in the coke shop, desulphurisation shop, blast furnace and BOF shops and in the plate, rail and structural mills. MMKI will suspend operations at the sinter plant, blast furnace and BOF shops, the 1700 HSM and 3000 plate mill, and the cold rolling mill.

Metinvest

Enhancing production efficiency and safety through machine learning

SSAB optimizes digital data flow between its facilities in Finland and Sweden

Using the cloud-based SMS DataFactory four production sites in two countries are to be interlinked for maximum data transparency and data-driven decision-making

Nordic steel producer SSAB Europe has awarded SMS digital with an order covering the transnational networking of digital solutions for a stronger exchange between its four production sites in Finland and Sweden. Using the cloud-based SMS DataFactory, the steel producer will benefit from an improved, holistic flow of information of all plant data across the four locations Luleå and Borlänge in Sweden as well as Raahe and Hämeenlinna in Finland. SSAB is thus reaching an important milestone in the digitalisation towards the "learning steel mill". SMS will have completed the unified networking of all these sites at SSAB in the second quarter of 2023.

SMS DataFactory can be used as a data hub for seamless access to systems such as predictive plant monitoring, production planning as well as for quality and energy management. In particular, this allows to improve output and expand the product portfolio.

The heart of the solution is the SMS DataFactory which has been in use by several leading steel producers under the name SMS QuinLogic PDW. It will provide SSAB a holistic view of the production locations, combined with an intelligent exchange of multi-site findings, and thus make the locations "digital ready".

"To make our complex production lines "digital ready", we need a deep understanding of all plants and processes in addition to comprehensive IT know-how. With SMS we selected a strong partner who has a deep understanding of both sides," says Sakari Pahkala, Head of Strategic Automation and Digitalization Development at SSAB Europe.

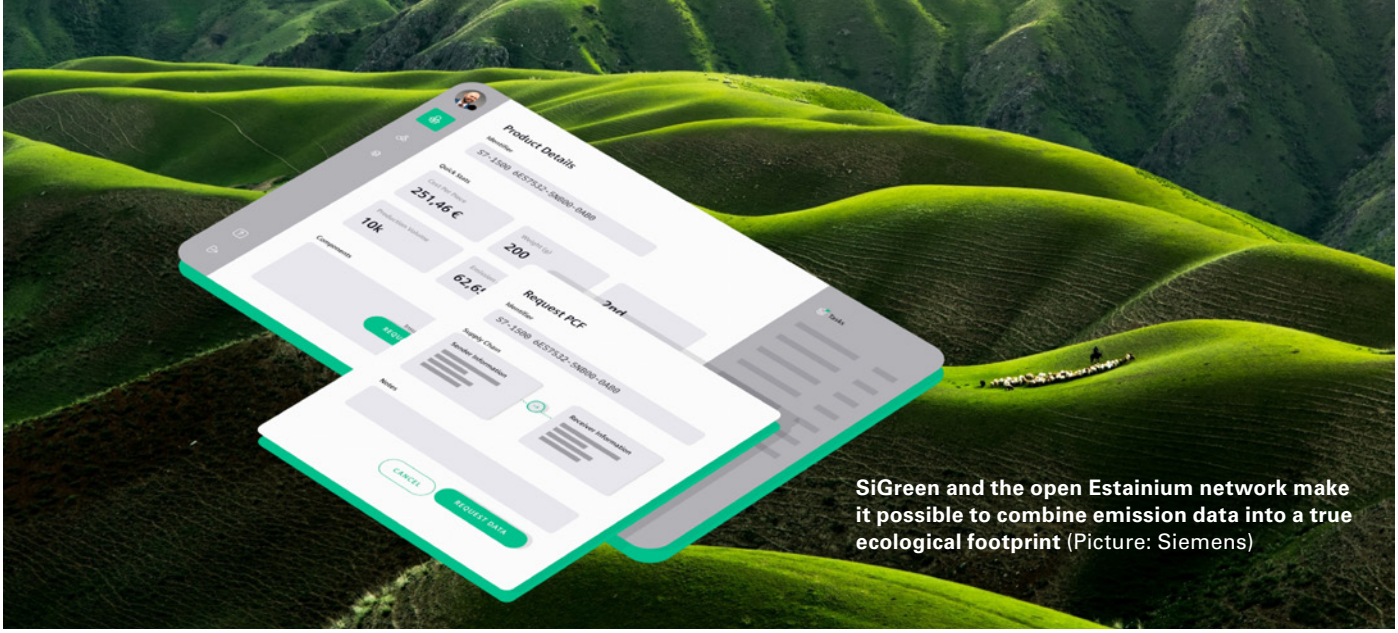
Activities will start at the Hämeenlinna site in Finland, followed by Borlänge, Raahe and finally Luleå. For linking the locations with each other, the next step will be to set up the IT and cloud infrastructures.

> "To make our complex production lines "digital ready", we need a deep understanding of all plants and processes in addition to comprehensive IT know-how."
>
> *Sakari Pahkala, Head of Strategic Automation and Digitalization Development at SSAB Europe*

"This project again underlines the significance of digital applications. Installing the digital package will offer SSAB the opportunity to benefit from substantial savings in valuable resources and thus ensure competitive advantages. This is achieved by converting multi-dimensional data into information and information by interpreting into options for increasing plant performance," says Prof. Dr. Katja Windt, Member of the Managing Board and Chief Digital Officer of SMS group GmbH.

SMS group

The SMS DataFactory makes data from the plant automation system available for AI-supported planning, maintenance, quality assurance or energy management applications (Picture: SMS group)



SiGreen and the open Estainium network make it possible to combine emission data into a true ecological footprint (Picture: Siemens)

Determine the true carbon footprint of products

Exchange of emissions data along the value chain

Siemens has developed a solution for efficiently retrieving, calculating, and sharing information about the real carbon footprint of products. The system makes CO_2 footprints of products reliably traceable along the entire supply chain

In light of the fact that the supply chain accounts for the largest share of the ecological footprint of products, the decarbonization of industry is a challenge which must be tackled by all the stakeholders together. As a leading provider of automation technology and industry software, Siemens has for the first time launched a solution for the efficient query, calculation and transfer of information on the actual Product Carbon Footprint (PCF). SiGreen now makes it possible to exchange emission data along the supply chain and combine it with data from a company's own value creation in order to obtain a product's true carbon footprint. To achieve this, Siemens has initiated the open, cross-industry Estainium network with the aim of enabling manufacturers, suppliers, customers and partners to exchange trustworthy PCF data. With SiGreen supporting companies in tracking their Product Carbon Footprint, they can take targeted reduction measures providing a quantifiable effect. CO_2 management thus supports companies on their way towards carbon neutral production and helps them to transform sustainability into a decisive competitive edge.

Cedrik Neike, Member of the Managing Board of Siemens AG and CEO Digital Industries: "All our customers share the desire to reduce the carbon footprint of their products. But to do so, they first need to know exactly the CO_2 emissions of their supply chain. And they need to know which adjustments can save them the most CO_2. SiGreen and Estainium enable them to do just that. It allows us to bring much-needed transparency to supply chains while protecting the confidentiality of the data. This technology can bring us a big step closer to our goal: a carbon neutral industry."

Precise data is a key prerequisite for effectively achieving the emission targets in the value chain. With SiGreen, Siemens has successfully developed an application for the efficient acquisition of real data collected where emissions are actually produced, i.e. in the corresponding steps along the supply chain. To calculate the carbon footprint, SiGreen makes use of real data rather than industrial average values. Product Carbon Footprints thus become a measurement and control instrument – and can be actively reduced by applying targeted improvement measures.

The supply chain accounts for a major proportion of product-related emissions. To measure and reduce this Product Carbon Footprint (PCF), cooperation across frequently complex, cross-industry supply chains is a must. With this in mind, Siemens has initiated the Estainium network for the exchange of Product Carbon Footprints among manufacturers, suppliers, customers, and partners.

Its Distributed Ledger provides a high level of data protection: The innovative Distributed Ledger Technology (DLT) supports the creation and exchange of Verifiable Credentials, thus ensuring the trustworthiness of the information shared. The data provided is verified in order to enable the trustworthy aggregation of a carbon footprint across the supply chain – without the companies involved having to disclose data of strategic relevance, for example details of their own supply chains. To verify the values reported by a supplier, customers can subject them to a so-called Verifiable Proof against the corresponding Credential via the IDUnion blockchain. And since no centralized storage takes place, each of the parties maintains full data sovereignty. Simplifying the communication with partners in the supply chain and optimizing the calculation of a company's own emissions can significantly reduce the effort required to determine a CO_2 footprint compared to other approaches available on the market.

Siemens Digital Industries

The Hot Box Mover transports the container in which the hot slag from the furnace has been poured, to the slag dumping area (Picture: TML Technik GmbH)

Material flow and material logistics

Raising occupational safety while transporting slag

The Hot Box Mover is a remote-controlled special vehicle with chain drive for transporting special containers

Till date it is necessary for persons to work in hot areas, to remove the hot slag from under the electric arc furnace by driving slag pot carriers into the pit to pick up the mainly round shaped slag pots, into which the slag is poured. In some cases, slag splashes out of the slag pot. In other plants, the slag is poured directly on to the floor, picked up and carried off by wheel or crawler loaders. That could now be a thing of the past.

The prototype of the Hot Box Mover has recently been set up and cold tested and is now ready for use and the first field tests in a steel mill with our customer AGS. It transports the container (Hot Box) in which the hot slag from the furnace has been poured, to the slag dumping area. If longer distances need to be covered, the Hot Box Mover brings the container to an intermediate parking space where a terminal tractor takes over.

This leads to a massive achievement of occupational safety, because the operator controls the machine by a radio remote control that has a camera monitor from a safe distance. The electro-hydraulic drive assures that the machine can be precisely controlled.

Further advantages of Hot Box Concept are as followign:

- eliminate antiquated OTR equipment that is no longer acceptable in today's environment,
- eliminate tipping of liquid slag in open pits,
- eliminate safety hazards associated with transport of liquid slag within steel plants,
- progress to a fully autonomous solution – removing operators from dangerous activities,
- eliminate the slag pit areas – discharge slag directly at points of processing,
- eliminate explosions and fires,
- eliminate all emissions,
- increase metallic recovery,
- increase metallic quality,
- eliminate oxy cutting,
- add value to the plant through reduced service fees and additional improvements in total cost of ownership.

In a second development phase, the Hot Box Mover will drive autonomously: In response to a starting signal, it will drive to, pick up the Hot Box and deliver it to a designated area where the slag will be automatically discharged at the processing area.

> "The fact that a TML machine can be used for intralogistics transport tasks is certainly new for many customers. We are known for breaking out the refractory lining with the Unidachs and for spraying unshaped refractory material with the Shooter, in the metallurgical industry. However, the know-how that we have in the hot area fitted perfectly with the development of the Hot Box Mover: We know how to optimally protect all components from the effects of intense heat. "
>
> *Christof Mikat, Managing Director, TML Technik GmbH*

TML Technik GmbH

DO YOU ALREADY KNOW OUR **GERMAN-LANGUAGE** SISTER MAGAZINE?

steel production
application technology
innovation + management
steel processing
steel distribution

LinkedIn

YOU CAN FIND ALL THE INFORMATION AT
WWW.HOME-OF-STEEL.DE/STAHLTECHNIK-EN

DVS MEDIA

New pyrometer CellaCast PX with modern IO-Link interface (Picture: Keller HCW GmbH © Can Stock Photo / SergeyNivens)

Measuring the liquid metal temperature of a blast furnace

New pyrometer CellaCast PX with modern IO-Link interface technology

The infrared temperature measurement method has meanwhile established itself in steel plants and foundries for measuring the temperature of liquid metal. For this purpose, Keller Infrared Temperature Solutions offers the CellaCast measuring system a unique measuring method

By means of a CSD (Clean Surface Detection) function and in conjunction with high-resolution optics, the two-color pyrometer is able to determine precisely the correct temperature of the liquid icon and steel in the runner of a blast furnace or cupola furnace from a distance of up to 30 m despite the slag and oxide on top of the surface.

The new pyrometer model CellaCast PX 80 is equipped with state-of-the-art IO-Link interface technology. In accordance with IEC 61131-9, IO-Link devices create transparency and continuous communication from the field bus level to the highest automation level. As an open interface, IO-Link can be operated into all common automation systems such as Profibus, Profinet or Ethernet and thereby solve one of the still largest problems of bus specific device interfaces. The commissioning of IO-Link devices is extremely simple, reliable and cost-effective due to the use of standardized cables with M12 screw connections. Software integration into the control system is also simple thanks to the standardised device description file IODD (IO Device Description). Rightly, the IO-Link interface is called the industry's USB interface for controlling machinery and equipment.

Several measured values, diagnostic information for demand-oriented maintenance, information on operating states or fault messages can be transmitted in parallel via IO-Link. The central parameterization of the devices from the highest level of process control contributes to operational safety can be set dynamically during operation. With the classic 0(4)-20 mA signal It is also possible to implement and retrofit the CellaCast PX 80 in existing plants.

KELLER HCW GmbH, Ibbenbüren, Germwany

Raw materials

Integrated solution for the digitalization of complete scrap yards

Pre-processing of input materials into a "design scrap" facilitates the production of high-quality steel products. A modular structured, holistic solution has been developed for the preparation, identification and separation of scrap

Primetals Technologies and Sicon recently signed a cooperation agreement concerning the development of holistic solutions for the digitization of complete scrap yards. Primetals Technologies specializes, among other things, in optical scrap identification and the automation of production processes and logistics. Sicon is a specialist in the processing, analysis and sorting of scrap. For the production of high quality steel grades, steel producers usually need solutions to all these issues, as well as a scrap composition matched to the end product. This "design scrap" allows a greater amount of scrap to be used in higher quality grades. This means that, when transforming a scrap yard into a digitalized and thus "smart" scrap yard, an integrated solution from Primetals Technologies and Sicon saves a lot of work at the implementation stage and enables the processing of input materials for the production of high-quality steel products.

Holistic solutions enable identification, processing and sorting of input materials for the production of high quality products (Picture: Sicon)

Demand-oriented preparation of input materials for high-quality end products

Primetals Technologies and Sicon have been cooperating for some time, especially with steel producers, to automate and digitalize processes related to scrap handling. Due to the continuously growing demands on the steel grades produced, the optical detection of foreign materials in scrap and the complete automation of logistics processes are becoming increasingly important in addition to the chemical purity and pre-sorting. As part of the cooperation, both companies are now developing holistic solutions for the digitalization of complete scrap yards. The solution portfolio covers the complete chain from the delivery of scrap to the feeding of the melting units. Interfaces between different modules are standardized. Data and information can be used across all solutions. This saves steel producers time and effort in defining and programming interfaces and in coordinating implementation. Depending on the project requirements, individual modules can be selected and, if necessary, added at a later date.

There is great interest in such solutions, especially in the steel industry, in connection with measures to reduce CO_2 through increased use of scrap. The first preliminary projects for precious metal smelters for the optical detection of foreign elements in scrap and the complete optical and chemical characterization of scrap pieces are already underway. For some time now, Primetals Technologies has offered solutions for the optical detection of foreign materials in scrap, storage location management and intelligent, fully automated transport systems.

Primetals Technologies; Sicon

AFRICA: EGYPT

Egyptian Steel reports performance results of endless casting rolling minimills

Featuring the Danieli endless casting rolling process, the two twin minimills at Egyptian Steel in Beni Suef and Al Ain Al Sokhna have been producing quality rebar at high performance levels since their start-up in 2016 and 2017, respectively.

After a short initial learning and fine-tuning phase, the two sites scored impressive results, including 36 heats/day, 900 heats/month, 1,813 t/day on a single-strand caster, 60 heats in a 47-hour sequence and 14.79 km of single endless cast and rolled billet. The Al Ain Al Sokhna minimill recently adopted the latest Danieli QLP innovation, the Octocaster mould, to further enhance productivity and reduce operational costs. The octagonal-section mould applied to a 165-mm square casting section has been operating at speeds of up to 8 m/min. The final target of 9 m/min will be achieved during the next few months thanks to the installation of upgraded mill gearboxes and motors. Octocaster allowed Egyptian Steel to further improve its record billet length, which now is 16.62 km.

Danieli

THE AMERICAS: CANADA

ArcelorMittal confirms go-ahead with decarbonization project in Hamilton

ArcelorMittal is making a major investment to transition the Hamilton plant from the blast furnace-basic oxygen furnace steelmaking production route to the direct reduced iron (DRI) – electric arc furnace (EAF) production route.

The investment will reduce annual CO_2 emissions at ArcelorMittal's Hamilton, Ontario operations by approximately 3 million t, which represents approximately 60% of emissions. At the heart of the plan is a 2.5 million t capacity DRI facility and an EAF facility capable of producing 2.4 million t of high-quality steel through its existing secondary metallurgy and secondary casting facilities. Modification of the existing EAF facility and continuous casters will also be undertaken to align

THE AMERICAS: CANADA

productivity, quality and energy capabilities between all assets in the new footprint.

The investment was contingent on support from the governments of Canada and Ontario, which will invest CAD400 million and CAD500 million, respectively. This secures project funding and firms up the investment. The project is scheduled to be complete by 2028, although ArcelorMittal is looking for opportunities to accelerate the project timelines.

ArcelorMittal

THE AMERICAS: USA

CC Metals and Alloys expands production

Mining and metals company CC Metals and Alloys (CCMA) has completed the investment in the modernization of one of its submerged arc electric furnaces.

A leading producer and supplier of high-grade ferrosilicon alloys, elements essential in the manufacturing of iron and steel, CCMA operates utilizing three submerged arc electric furnaces to produce various types of ferrosilicons. The company modernized one of its three furnaces that had previously been idle since April 2019. The project will raise CCMA's output to 85,000 t/year, marking an 18% increase.

CC Metals and Alloys

Commercial Metals to build micro mill

Commercial Metals Company (CMC) plans to construct another state-of-the-art micro mill geographically situated to primarily serve the Northeast, Mid-Atlantic, and Mid-Western United States markets.

CMC believes that the location and capabilities of the planned facility will significantly augment CMC's scale in the Eastern U.S. and synergistically complement its existing operational footprint. CMC is currently in the site selection process and exploring several suitable options.

The new micro mill will be lower in both energy consumption and greenhouse gas emissions compared to traditional steelmaking processes. Once the project is completed, CMC expects that nearly a third of their North American steel output will be produced in a micro mill.

Commercial Metals Company

EVRAZ Steel to install new EAF cooling system

EVRAZ North America has placed an order with the Systems Group for the installation of Spray-Cooled™ equipment at its steelmaking facility located in Pueblo, Colorado.

The project includes new spray-cooled electric arc furnace equipment and a complete engineering package that covers a laser scan of the entire melt shop, design and layout of all the piping, and engineering of the required infrastructure changes.

The Spray-Cooled™ equipment will cover 100 percent of EVRAZ Pueblo's furnace cooling needs, to include the roof, elbow, and sidewall. The EAF sidewall will include a sloped hot face to help protect the refractory brick, burner blocks, and slag door area and will supply water directly to the oxy-fuel burners, slag door, and EBT auto-sander, minimizing water hoses and connections. The roof will be a new steep cone design for cooling optimization and extended lifetime.

The Systems Group

Falkonry, ArcelorMittal and CESMII collaborate on strip break classification system

AI software provider Falkonry has been selected for an innovation project by CESMII institute together with ArcelorMittal Nippon Steel Calvert and ArcelorMittal Global R&D.

The project was selected under the CESMII Roadmap Projects RFP3 initiative which aims to accelerate the adoption of sustainable and smart manufacturing practices in production operations.

Falkonry is collaborating with ArcelorMittal to develop a strip break classification system in their Calvert, AL cold rolling tandem mill. One of the issues in the cold rolling of sheet steel, strip breakage, results in yield loss due to line stoppage, re-work, and may also cause damage to equipment. The objective of this project is to automatically classify strip break events using time series AI and machine learning (ML), and provide their explanations from time series data. Once the cause is determined using these explanations, corrective measures can be implemented to prevent repeat occurrences of strip breakage, thereby improving production efficiency. Falkonry's time series AI will analyze the tandem rolling mill's operational data and provide actionable insights directly to teams in the steel mill.

Falkonry, ArcelorMittal, CESMII

THE AMERICAS: USA

KME Special Products & Solutions acquires Roser Technologies

KME Special Products & Solutions GmbH (KME Special), Germany-based suppliers of customer-specific copper and copper alloy products for continuous casting technologies, has acquired Roser Technologies, Inc (RTI), a US-based provider of continuous caster maintenance services.

The transaction expands the existing service offerings of KME Special in continuous caster maintenance services in North America. RTI brings strong maintenance and service experience in designing, manufacturing, and refurbishing of caster mould and segment components, joining with KME Special's market leading portfolio of copper mould technology for the ferrous and non-ferrous casting industries. RTI also adds a growing and profitable portfolio of custom-designed parts and specialty services through its Vertical Seal division, which includes bearings, bushings, and sleeves for rolling mills, primarily within the steel and power industries. The acquisition enables KME Special Products & Solutions to offer the entire value chain in copper moulds for continuous casting, from customer specific design, manufacturing and coating to maintenance and refurbishing, including technical consulting, process optimization and a growing portfolio of digital services.

KME Special Products & Solutions

Nucor plans major expansion of sheet mill capacity

Nucor Corporation will build a new state-of-the-art sheet mill in Mason County, West Virginia, and expand the product capabilities of its Crawfordsville, Indiana steel sheet mill by adding a construction grade continuous galvanizing line and prepaint line.

The new mill in Mason County is expected to have the capacity to produce three million t of steel annually. The new mill will be equipped to produce 2,130-mm sheet

THE AMERICAS: USA

products, and among other features, will include a 1,930-mm tandem cold mill and two galvanizing lines. Galvanizing capabilities will include an advanced high-end automotive line with full inspection capabilities as well as a construction-grade line. Construction is expected to take two years pending permit and regulatory approvals.

At Crawfordsville the continuous galvanizing line will have a capacity of 300,000 t/year and the prepaint line a capacity of 250,000 t/year. This investment further expands Nucor's existing galvanizing and prepaint capabilities, which include recently added continuous galvanizing lines at its sheet mills in Arkansas and Kentucky, and the acquisition of a prepaint line at its Arkansas sheet mill.

Nucor

U. S. Steel to build new steelmaking facility in Osceola, Arkansas

United States Steel Corporation is going to build a new steel production facility featuring two electric arc furnaces with 3 million t/year of advanced steelmaking capability in Osceola, Arkansas.

The new steel mill will be located close to U. S. Steel's Big River Steel plant. The new optimized steel production facility is expected to feature two electric arc furnaces with 3 million t/year of advanced steelmaking capability, a state-of-the-art endless casting and rolling line, and advanced finishing capabilities. This first use of endless casting and rolling technology in the United States brings significant energy, efficiency, and capability enhancements to the company's operations. Project completion and full operation is anticipated by 2024. Upon completion, this project will apply to become LEED® certified.

U. S. Steel

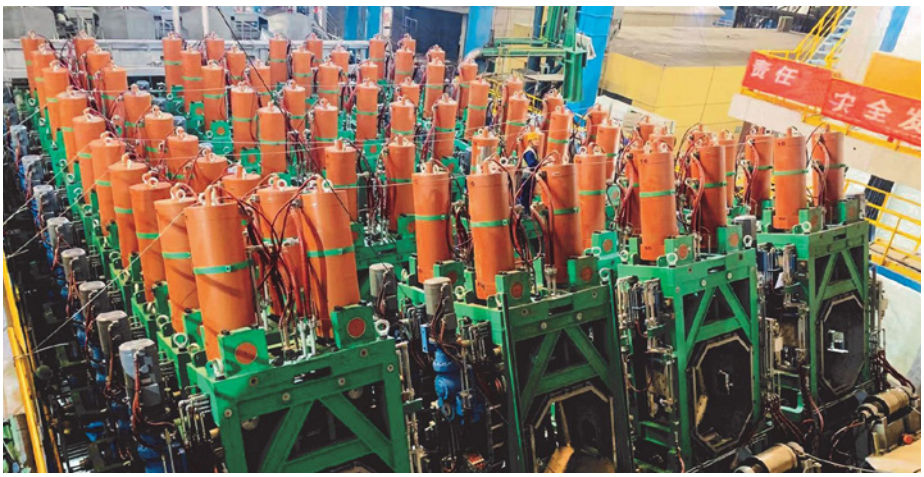
ASIA: CHINA

Chengde Jianlong and Jiangsu Yonggang build new jumbo bloom casters

Chengde Jianlong and Jiangsu Yonggang have chosen Danieli jumbo bloom-casting technology to meet the growing worldwide demand for components by the power-generation industry.

Danieli will supply 18-m radius casters designed to produce 700 to 1,200 mm diameter rounds. Total production capacity of the casters will exceed 1 million t/year. Danieli jumbo caster technology foresees the intensive use of electromagnetic stirring systems – mould, strand and final – that ensure best internal quality. The combined application of the innovative, patented "Q-DTC – Dual Temperature Control system" and new withdrawal and straightening modules will guarantee smooth product unbending for highest surface quality, and safe and reliable operations during the casting process. Jiangsu Yonggang will receive a four-strand caster and Chengde Jianlong a three-strand caster. Start-up of the casters is scheduled for the first quarter of 2022.

Danieli



Installation of a four-strand bloom caster
(Photo: Danieli)

Shanxi Taigang Stainless Steel issues FAC for reducing & sizing block

Friedrich Kocks GmbH & Co KG has received the final acceptance certificate from Shanxi Taigang Stainless Steel for the supplied 3-roll reducing & sizing block.

The new RSB® 370++/4 in 5.0 design is part of the modernization and upgrade of the existing stainless steel rolling mill. It processes various austenitic, martensitic and ferritic stainless steel, duplex and nickel-based alloys, producing rounds within a 16 up to 100 mm diameter range.

Kocks

ASIA: CHINA

Yukun I&S orders direct casting-rolling equipment for bar and wirerod production

Private Chinese steelmaker Yukun I&S, based in Yuxi, Yunnan Province, has placed an order with Danieli for the supply of new casters and new rolling mills for bars and wirerod.

The Danieli supply will consist of the technological equipment for four, 7-strand high-speed casting machines (28 casting strands) and seven rolling mills arranged in three nearby bays, for direct casting-rolling. The casters will produce 165-mm quality billets from liquid steel supplied by Yukun ironmaking plants, and provide the new rolling mills with hot billets for hot-charge practice. The rolling mills will feature horizontal and vertical SHS stands. Plant start-up is expected by 2023.

Danieli

Baosteel Zhanjiang to build hydrogen-based DRI facility

Sinosteel Engineering & Technology has contracted Tenova for the design and supply of a hydrogen-based 1 million t/year direct reduction plant.

The ENERGIRON® DRI facility will be installed at Baosteel Zhanjiang Iron & Steel in the Guangdong Province. It will mainly use hydrogen as reducing gas with the possibility to mix it with natural gas and coke oven gas. Designed to have the capability to capture and sell CO_2 on the commercial market, the plant will further reduce overall plant CO_2 emissions and provide an additional revenue stream for the plant operations. The ENERGIRON® technology is a joint development by Tenova and Danieli.

Tenova

ASIA: INDIA

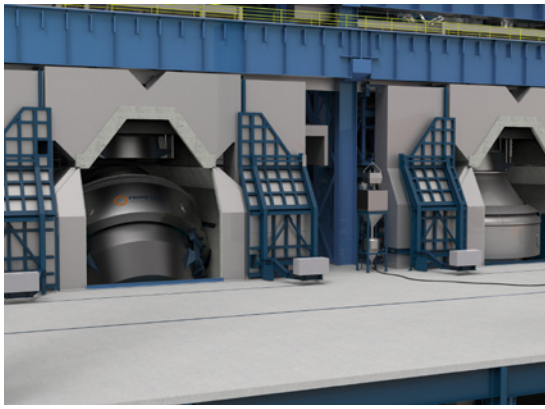
JSW Steel orders converter melt shop

JSW Vijayanagar Metallics Limited, a wholly owned subsidiary of JSW Steel, has placed an order with Primetals Technologies to supply equipment for its new steel melt shop No. 4 in Vijayanagar, Toranagallu. The order includes two BOF(LD)-converters, two ladle furnaces, gas cleaning and dedusting systems, two slab casters as well as Level 1 and Level 2 automation systems.

The new melt shop is part of a major project of JSW Steel to expand its JSW Steel Vijayanagar facility's production capacity. Primetals Technologies will be responsible for engineering, supply of equipment, and advisory services for erection and commissioning.

The two 350-ton-BOF(LD)-converters will feature the maintenance-free Vaicon lamella suspension system, water cone and barrel air cooling and will be equipped with slag stoppers, including the thermographic automatic slag identification system SlagMon, quick exchange type oxygen blowing lances and the Lomas converter off-gas analyzing system. A dry-type gas cleaning system will reduce dust content to 10 mg/Nm³ at the stack. A steam-type heat recovery system will improve energy efficiency, the secondary dedusting system will provide low work zone and roof top emissions. The two 350-t ladle furnaces will be equipped with copper-plated electrode arms and the Melt Expert electrode control systems.

The two 2-strand continuous slab casters will be designed to produce slabs in a width range of 900 to 1,650 mm at thicknesses of 220 and 260 mm. The casters will be fully equipped with advanced technology packages. Latest design for on-line slab quality assessment are also provided. The melt shop and the casters are also equipped with features to make them ready for Industry 4.0.



3D-image of the converters for JSW
(Photo: Primetals Technologies)

Primetals Technologies

ASIA: VIETNAM

Hoa Phat orders another two blast furnaces for the Dung Quat project

Hoa Phat Dung Quat Steel has placed an order with Danieli Corus for the design and supply of two blast furnaces for the Dung Quat steel complex II.

The two blast furnaces, with a working volume of 2,500 m³, will form the heart of the new integrated steel plant. Both furnaces will be equipped with the Danieli Corus high-conductivity cooling and lining design based on copper-plate coolers and graphite refractories. In addition to the blast furnaces, level 2 process automation systems, pulverized-coal injection systems and part of the hot-blast systems are included in the contract scope. This new project will add 5.6 million t/year of liquid steel to Hoa Phat's annual production capacity – with 5 million t/year currently being produced at the Dung Quat steel complex I that was recently completed.

Danieli Corus

Flexible production of heavy and light plates, and jumbo coils

The new benchmark heavy-plate mill project at Nucor Steel Brandenburg

The tendency toward green power-generation investments, especially hydro-power and wind-power, is offering new development opportunities for the steel plate market as well. Heavy plates 3" – 14" (76.2 mm – 355.8 mm) final rolled thickness are interesting products for plate mills to remain innovative and competitive. The new Nucor Steel Brandenburg plate mill will combine in a single mill the advantages of plate/Steckel rolling for medium-thin plates, as well as jumbo coiled plates with ingot rolling

Nucor Corporation is the largest steel producer in the United States with a total steel production over 22.4 million short tons in 2020 [1]. Headquartered in Charlotte, North Carolina, Nucor also is North America´s largest recycler with more than 20 million short tons of scrap melted in their electric furnaces every year. The company employs over 27,000 people at different plant and facilities primarily located in North America [2].

As part of the strategy to establish itself as steel plate market leader, on October 23, 2020, Nucor broke ground for one of the single-largest investments in the history of the company.

The 1.7-billion-dollar new plate mill will be located at the Buttermilk Falls Industrial Park along the Ohio River in Brandenburg, Kentucky, the core of America´s largest plate consuming region [2]. The 1.5 million-square foot operation will provide Nucor with 1.2 million short tons of annual capacity for steel plate production and allow it to produce 97% of the grades commercially available in US market [3, 4].

Nucor contracted renowned supplier Danieli for the new Brandenburg plant technological core, the new hot-rolling plate mill, as well as the new steel melt-shop. Danieli also is Nucor´s partner in the massive expansion project at its Nucor Steel Gallatin mill in Ghent, Kentucky.

The new plate mill will start up later in 2022 and with the creation of new 400 full-time jobs will support economy and strengthen Nucor's relationship with the local community as well [4].

Production flexibility in heavy plates, light plates and coiled plates

Designed with a 175 inches (4,450 mm) width, the new Nucor Steel Brandenburg plate/Steckel mill will be among the widest plate mills in the world. The first challenge of the new rolling line is serving an extremely diversified market with over 500 different plate formats and grades required by leading consuming sectors, such as engineering construction and infrastructure (A36, Gr50, A514, 400F, 450F, 500F), pressure vessel (A516 Gr70), offshore engineering construction (API 2W/2h9 and pipelines (API X70-X100).

The 2 reversible mills stand layout equipped with coiling furnaces can deliver 3 hot rolled products:

- heavy plates with thicknesses from 3" – 14" (76.2 mm – 355.8 mm) and a hot-rolled widths from 60" – 170" (1,524 mm – 4,318 mm) mainly obtained rolling 12" slabs and cast ingots with thickness from 17" – 36" (432 mm – 914 mm) and weight up to 50 short tons (45.4 t),
- light plates with thickness from 3/16" – 3" (4.8 mm – 76.2 mm) and hot-rolled widths from 60" – 170" (1,524 mm – 4,318 mm) obtained rolling continuous cast slabs with thicknesses from 8" – 12" (203 mm – 305 mm) and weights up to 80 short tons (72.5 t),

Arial view of the Nucor Brandenburg construction site in January 2022 (Picture: Danieli)

Enrico Zambon, Danieli Germany; Paulo da Costa, Lorenzo Lusina, Danieli & C. Officine Meccaniche, Buttrio, Italy; Marco Mossutti, Danieli Automation, Buttrio, Italy – Contact: e.zambon@danieli.it

Jumbo coiled plate may way up to 60 short tons (54.4 t) (Picture: Danieli)

- coiled plates with thicknesses from 3/16" – 1.25" (4.8 mm – 31.8 mm) and a hot-rolled widths from 60" – 125" (1,524 mm – 3,175 mm) up to 60 short tons (54.4 t) obtained from continuous cast slabs.

World's largest HRC products

With 125" (3,175 mm) as maximum hot-rolled width and 60 short tons (54.4 t) as maximum weight the new plate mill will produce the world's largest hot-coiled products, with the advantage of producing homogeneous heavy lots to maximize transportation efficiency at the same time.

The second challenge for the new production line is ensuring a premium plate quality for the entire diversified product mix, with special focus on:

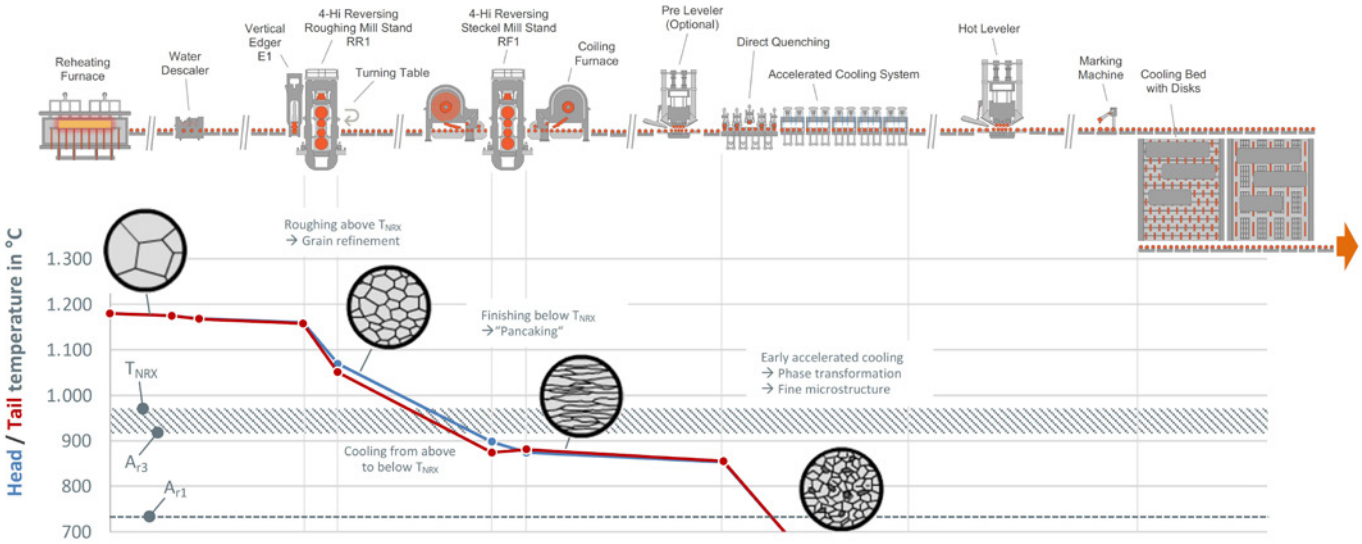
Mechanical properties: The plate mill is designed to meet the most demanding international standards in terms of mechanical properties. The main tool to hit the goal is represented by the customized rolling mill layout. The two horizontal mill stands plus the action of heavy vertical edger can apply an extremely powerful reduction on very thick semi-products, such as 8" – 12" (203 mm – 305 mm) continuous cast slab (203 mm – 305 mm), up to 36" (914 mm) utilizing cast ingots, enabling a wider spectrum of reduction strategies and leading to an optimal refined microstructure.

Weldability: Achievement of optimal mechanical properties, such as strength, elongation and toughness, will take place in conjunction with a controlled amount of C-equivalent content into the chemistry, to ensure a good final product weldability as well.

Automatic process control functions such as the Thermo-Mechanical Controlled Process (TMCP), with an advanced plate cooling system (Exstream II) and intelligent modules, such as Q3-Intelligence supporting microstructure-based engineering are the key technological tools that will be used.

Geometrical precision: Technological solutions, such as Hydraulic Actuating Gap Control (HAGC) with profile and flatness set-up and adaptation models, implemented in the Level 2 automation system are part of the design. Additionally, the front running EVO 6 multi-cassette plate-leveling technology will be provided for plates with superior flatness, within ¼ ASTM standards.

Surface condition: A three-point, high-pressure water-descaling system for a designed maximum impact factor over 290 lb/in2 (2.0 N/mm²) is incorporated as a tool to control as-rolled plate surface condition, particularly important for post-processes such as normalization, quench & tempering, corrosion protection coatings and painting.



Temperature chart of the thermo-mechanical control process (Picture: Danieli)

Real thermo-mechanical control process

The application of the thermo-mechanical control process (TMCP) is mandatory for high-quality, engineering construction grades, as well as for all grades delivered to post-heat treatment process. During the engineering stage specific attention was paid to tools for boosting the beneficial TMCP effects:

Layout: Two separate, reversing mills stand in Reversible Rougher Stand (RRS) + Heavy Vertical Edger (HVE) configuration, positioned 360 ft (110 m) away from Reversible Finishing Steckel Stand (RFSS), to guarantee contemporaneous operations between the two machines and multipiece management.

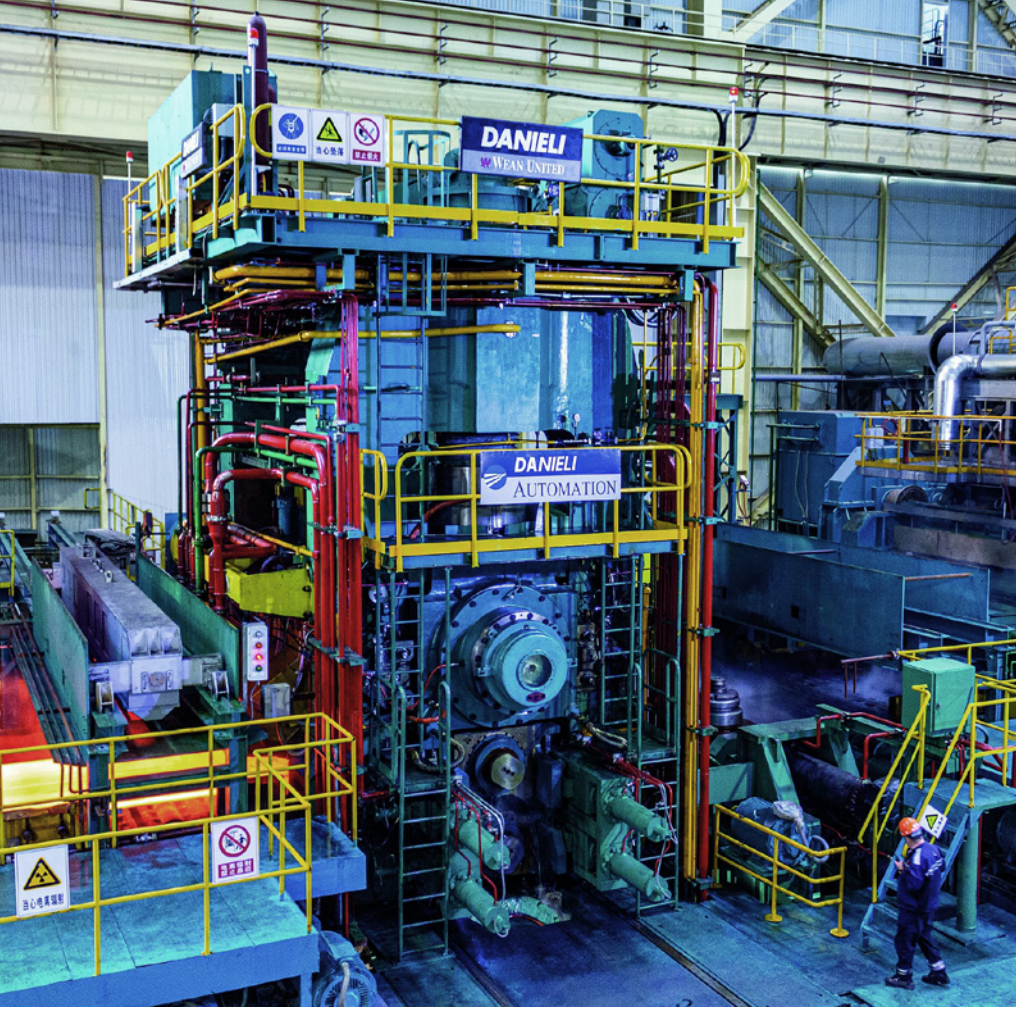
Different work roll dimension: The 2-stand layout permits different work-roll diameter selection for the two horizontal stands. RRS have 44" (1120 mm) work-roll diameter to privilege heavy draft and reductions during roughing stage, while RFSS with a 38.6" (980 mm) diameter design optimizes final profile and flatness control.

Thermo-mechanical controlled process management and multi-piece rolling management: The availability of automatic L2 functions for the TMCP as well as the four-piece simultaneous management combines the process quality benefits with optimized production rate.

Advanced cooling concept

The eight-meter-long direct quenching (DQ) section works with pressurized water provided by booster pumps. It consists of four zones, divided by hydraulic activated pinch rolls. Each zone is equipped with two top-cooling headers and two bottom-cooling headers, as well as proportional valves, individually controlled by the Level 2 cooling model. The maximum operating water flow of the whole DQ system is over 38,000 gpm (8705 m³/h) at a pressure of five bar. The headers are equipped with flat fan nozzles configured to optimize the water distribution on the material's surface.

Downstream the DQ system, the laminar accelerated controlled cooling (ACC) system is installed over a length of 80 ft. (24.32 m). Sixteen cooling units, each one consisting of one U-tube top header and two spraying bottom headers, provide a



Plate/Steckel mill 3500 at Jiangyin Xingcheng Special Steel (Picture: Danieli)

total flow rate of over 50,000 gpm (11487 m³/h). The flow of each unit is regulated by proportional valves (one top, one every 2 bottom) for optimal cooling control by the Level 2 automation. The combination of DQ+ACC offers high flexibility in the definition of the cooling strategies for both strips and plates, enabling production of a wide range of steel grades [5].

Hot plate leveler for ¼ ASTM standards flatness

Leveling is a mechanical process consisting of a series of bending cycles applied to the material, mainly to stretch it over its plastic limit, eliminating undesired material waves, relaxing stresses and mechanical tensions introduced by upstream operations, such as rolling and cooling processes [6].

When the product mix required is sufficiently wide in terms of dimensions and grades to be processed with one leveling pass, a single cassette geometry becomes insufficient for the overall production [6].

Considering the mix of problematic thin formats such as 3/16" (4.7 mm), as well as heavy gauges, Danieli introduces in this project the EVO/6, the consolidated leveling technology with specific reference to the utilization of the multi-cassette design.

The machine will start up with an 11-roller cassette, specifically indicated for thin-gauge production, and can be upgraded easily in future with a second 9-roller cassette for medium-thick products up to 4" (100 mm) in thickness. The target flatness level is within ¼ ASTM standards.

Industry 4.0-ready Automation system

The contract scope includes Danieli advanced process control and automation systems with Industry 4.0 technologies, as well as the main and auxiliary electrical equipment. The process control systems (Level 2) of meltshop and plate/Steckel mill area are based on virtualized client/server configurations, and feature the latest, field-proven Danieli models for automatic setup, developed to achieve the best quality liquid steel, plate and coil products, thanks to short-term and long-term self-tuning technology. Each phase of the process, from scrap melting or slab/ingot rolling to coil handling or daughter plate piling, is controlled and continuously monitored to guarantee the overall production cycle.

Level 2 process control key features included in the mill package are the thermo-mechanical rolling management, for plate quality enhancement, in connection with the multi-piece rolling management, a function that permits a crucial optimization of the production rate, especially during thermomechanical rolling campaigns.

The Q3 Intelligence module provides real-time plant and area key plant indicators (KPI) and dashboards, as wells as advanced reporting and business analytic functionalities. A very large amount of raw data is continuously acquired from a wide range of heterogeneous sources in the mill, such as intelligent sensors and instrumentation, process data loggers and automation systems of the different areas. These data are synchronized, stored in a centralized repository and transformed into useful information and knowledge, for user-friendly in-depth analysis and process optimization. In addition, the Danieli Q3 Intelligence provides the platform for further Industry 4.0 available technologies, such as machine-learning based predictive tools.

The Danieli condition monitoring system monitors the main equipment health with smart sensors, and thanks to its specific technology it is even able to detect micro-defects and early signs of component deterioration. Thanks to the real-time updated situation, it is possible to identify problems quickly, improve equipment reliability and reduce maintenance costs.

References

[1] Nucor source, 12 February 2021
[2] Leon Topalian, speech Nucor Brandenburg Groundbreaking ceremony on October 23rd, 2020
[3] Crystal Staley, "Nucor Breaks Ground on 400-Job Steel Mill in Brandenburg" dated 23/10/2020
[4] Nucor Speech Nucor Brandenburg Groundbreaking ceremony on October 23rd, 2020
[5] DaNews 183, Enrico Zambon – "Nucor selects Danieli for new Plate Steel Mill Complex"
[6] DaNews 184, Enrico Zambon – "Successful commissioning progress for Danieli EVO/5 Multi-Cassette Levelers in Shandong Rizhao Iron and Steel"
[7] DaNews 183, Marco Mossutti – "Nucor selects Danieli for new Plate Steel Mill Complex"
[8] DaNews 183, Paulo da Costa – "Nucor selects Danieli for new Plate Steel Mill Complex"
[9] 7th Rolling conference Graz 2016, Enrico Zambon – "Modern Plate/Steckel Mills: recent developments for new levels of flexibility and competitiveness in the market"

The equipment control system (Level 1) features a user-friendly operator interface and automatic control of regulation loops and operating sequences, to minimize operator manual activities. The equipment control platform is based on the high-performance Danieli HiPAC system for the time-critical technological control functions, and on standardized PLCs for the auxiliary control functions and sequences. Remote I/O units are connected to the PLCs via industrial Ethernet fieldbuses, allowing reduced installation and maintenance costs.

The innovate operator interface is designed according to the 3Q concepts, with the ergonomic SCADA human-machine interface running on thin client stations, "soft" pulpit control desks integrating smart operator assistants (OA), KPI displays (API/PPI) and local control stations on field [7].

EAF adaptive process control

Reducing process variability is a challenge to the EAF operation, linked extensively to the diversity of the raw materials and different operating patterns of the EAF teams. Q-MELT is the response from Danieli, with proven results in several successful installations around the world. Q-MELT makes use of a statistical approach to identify process deviations in real time from several process data. The extracted data makes it possible to identify the expected process behavior and, by means of the comparison between real-time and expected trends, the system performs adaptive process control, acting either in the electrical and/or chemical profiles.

During the process control, the electrical and off-gas measures permit quick access to the real-time process data, enabling the Q-MELT to act in case of deviations to the expected best practice. The intervention of the Q-MELT can be seen during the refining phase on the control of the decarburization or control of the steel bath oxidation. The application detects whether the decarburization process is proceeding at the expected rate or the profile requires some adjustments, by automatically adjusting the oxygen injection in order to hit the final carbon and temperature targets without over-oxidizing the heat.

The end-point target is reached from the first valid cartridge sample measurement onward, where the Q-MELT tracks the bath carbon / temperature / dissolved oxygen thanks to its integrated process models. This information is presented in the interface screen where the operator can check for the correct evolution of the end-point temperature, carbon and oxygen conten (ppms), until the tapping phase [8].

Secondary metallurgy control

Being part of a strategic approach "from scrap to liquid steel", the secondary metallurgy Level 2 permits timely synchronization between ladle metallurgy furnace (LMF), vacuum tank degasser (VTD) and casting machine. In a modern steelmaking plant, coordination between plant units is done by mathematical models, which, by several suggestions, inform the operators in the critical path to be adopted. The twin LMF and twin VTD at Nucor Brandenburg share a common pulpit, equipped with Danieli's secondary metallurgy management models, which are embedded in the Level 2 automation.

The critical path is defined with consideration of the requests from the caster, regarding both time and superheat. This information serves as input data to the LMF in order to establish the working points and practice that will make it possible to arrive at the targets.

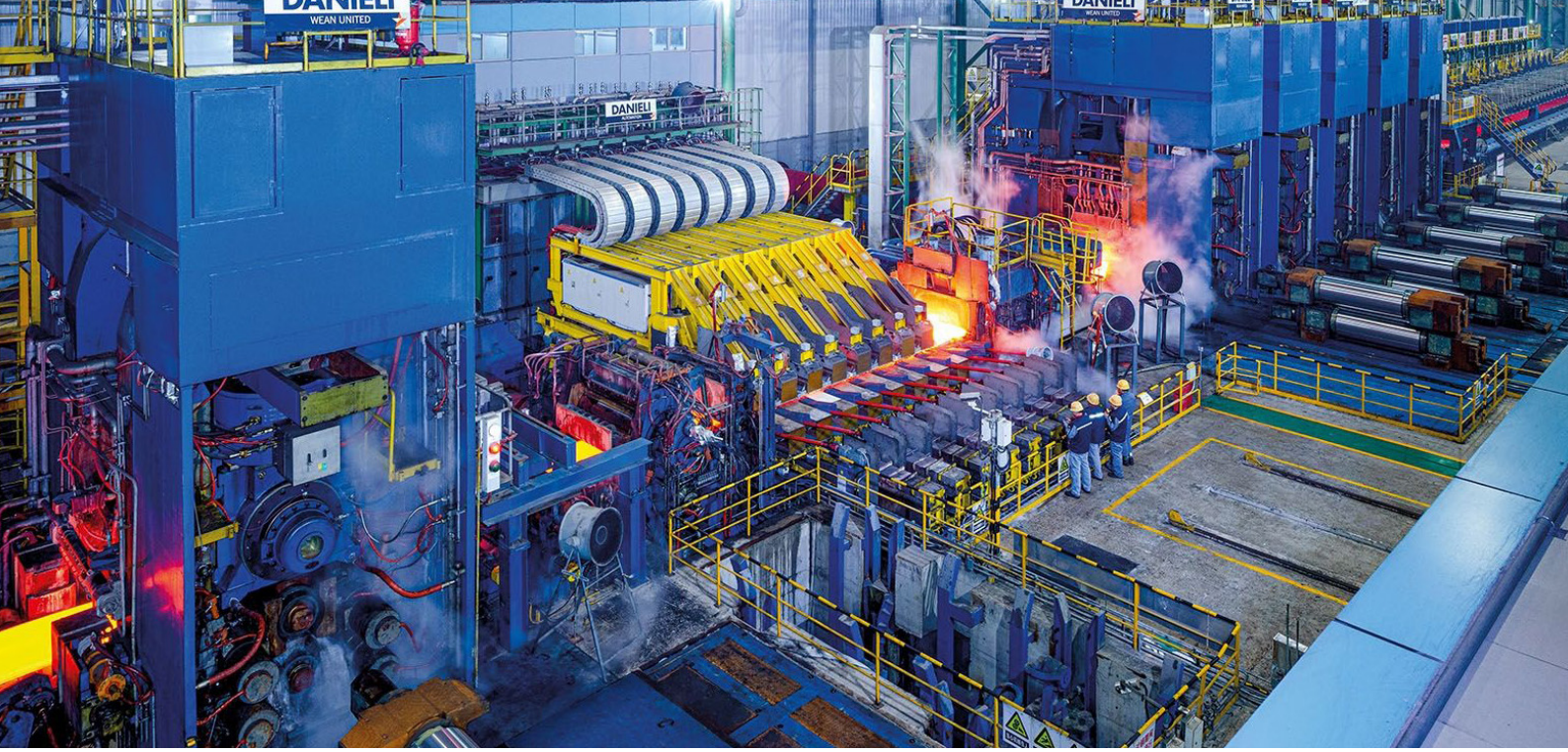
At the arrival of each new ladle to the LMF, the automation defines the operation practice, which also interfaces with the materials library in order to define the materials to be used in each practice step.

On the VTD, aside from the control of the pump-down time and deep vacuum treatment, the anti-foaming slag technological package makes it possible to have an automatic control to avoid slag overflowing from the ladle during vacuum. The anti-foaming slag (Q-AFS) makes use of radar technology to analyze the progression of eventual slag foaming, and, in case of risk of overflowing, nitrogen is automatically injected into the tank, causing the slag to decline due to the increase of pressure inside the tank. In this way, overflowing due to late reaction from operators is avoided. On the other side, productivity is increased by avoiding the excessive pump-down time that may follow the operators' over-reaction [8].

Conclusions

Steel plates, despite being some of the oldest steel industry products, are continuously reiterating their absolute importance to social development. The consolidated global tendency in green power generation investments, especially hydro-power and wind-power, is offering new opportunities for such products and technologies. The new plate mill in Nucor Steel Brandenburg, based on EAF meltshop technology is going to combine 3/16" (4.76 mm) thin plates, 60 short tons (54.4 t) jumbo coiled plates and 14" (355.8 mm) heavy plates production into a single mill, realizing an outstanding combination of product flexibility, product quality and energy efficiency.

Danieli, leader in EAF and plate/Steckel rolling technologies, offers solutions in terms of layout development, Exstream II cooling system, and EVO/6 levelers, supported with advanced process control, and automation systems with Industry 4.0 technologies.



Danieli QSP-DUE® technology allows coil-to-coil, semi-endless and endless modes to be performed in a single line (Picture: Danieli)

Manufacturing high quality steel with a lower carbon footprint

Nucor to build new, state-of-the-art sheet mill in West Virginia, USA

With an investment of about US$ 2.7 billion, Nucor is building a greenfield sheet mill on the Ohio River in Mason County, West Virginia with operations to begin in the second half of 2024

Already in September 2021 Nucor Corporation decided the construction of a new state-of-the-art sheet mill. The new mill should be geographically situated to serve customers in the Midwest and Northeast markets, the two largest sheet consuming regions in the U.S.. The new strip production site should have a significantly lower carbon footprint than nearby competitors.

"This greenfield sheet mill complements Nucor's existing operations, allowing us to more effectively service customers in the region, and grow our core business, while creating substantial value for our shareholders. Consistent with Nucor's long-established strategy for profitable growth, this expansion of our product capabilities will enable us to provide a superior value proposition to our customers," said Leon Topalian, President & Chief Executive Officer of Nucor Corporation. "This mill will allow us to competitively meet the growing need that many of our customers, particularly in the automotive market, have for high quality steel with a lower carbon footprint."

The new sheet mill is expected to cost approximately US$2.7 billion and have the capacity to produce three million tons of steel annually. The mill will be able to produce hot-rolled sheet products with downstream processing. Galvanizing capabilities will include an advanced high-end automotive line with full inspection capabilities as well as a construction-grade line.

At that starting phase of the project, Nucor evaluated locations in Ohio, Pennsylvania, and West Virginia. Once state and local incentives, permitting and other regulatory approvals are received, construction was expected to take two years. Additional sites in Northern West Virginia are also under consideration for a transload and processing facility.

West Virginia selected to be the location of the new production site

In January 2022 Nucor announced that it will build its new state-of-the-art sheet mill in Mason County, West Virginia. The West Virginia location on the Ohio River provides Nucor with important transportation and logistics advantages. When fully operational, the new mill will employ approximately 800 full-time teammates.

"Following a thorough process to determine the right location for our state-of-the-art, greenfield sheet mill, we are thrilled to make this significant investment in West Virginia and enhance our presence in this important region,"

"Our new sheet mill in Mason County will have unmatched capabilities that will enable the continued expansion of high-quality, low carbon steels, building on our industry-leading offerings," said Leon Topalian, President and Chief Executive Officer of Nucor Corporation.

As announced earlier, the new sheet mill will be equipped to produce 84-inch (2,100 mm) sheet products, and among other features, will include a 76-inch (1,900 mm) tandem cold mill and two galvanizing lines. Galvanizing capabilities will include an advanced high-end automotive line with full inspection capabilities as well as a construction-grade line.

Frontrunning technological equipment from Danieli for hot strip mill and the cold mill complex

On 23rd March 2022 Nucor Corporation entrusted Danieli with a giant volume of orders valued in excess of US$ 650 million. A major part of this package comprises the quality hot-strip, and cold-strip technology for the new greenfield installation in Mason County, West Virginia.

Hot strip mill. The QSP-DUE® Danieli Universal Endless plant will produce 3.0 million short tons per year of quality hot-rolled strip in the widest range of steel grades and most flexible way; strip dimensions up to 2,100 mm wide and from 0.8 to 25.4 mm thick. Danieli QSP-DUE® technology allows coil-to-coil, semi-endless and endless modes to be performed in a single line. This will be the first thin-slab casting rolling plant to produce also automotive-exposed grades, allowing Nucor to operate without steel grade limitations. Danieli endless casting-rolling is an energy-saving operation fitting with Nucor's green steel approach.

The plant will be managed by Danieli Automation's advanced process technologies and artificial intelligence. Q3 pulpits will support Nucor Steel operators in supervising fully automated plants, making use of big-data analysis and Q3 manufacturing execution systems. Robotized solutions will increase plant safety according to "zero-men on the floor" concept.

Cold strip mill. Also the order for main equipment for the cold-strip complex was awarded to Danieli. A new pickling line and tandem cold mill (PLTCM) and a temper mill will process 2.3 million short tons per year hot-rolled strip, 0.80- to 6.35-mm-thick, up to 1,982-mm-wide, into 0.25- to 3.05-mm-thick cold-rolled strip for both construction and automotive products.

The pickling line will be characterized by patented Turboflo® technology for highly efficient scale removal and high- and adjustable-turbulence on both strip surfaces at speeds up to 250 m/min. Coupled with the pickling line, a five-stand tandem cold-mill mill featuring Danieli original 6-hi optimized shaped roll technology (OSRT) to ensure the best strip flatness, thickness control and performance stability at speeds up to 1,200 m/min.

A 0.45 million short tons per year stand-alone temper mill to improve material formability, flatness and surface finish grades in dry and wet tempering modes will complete the Danieli supply for this new cold-mill complex.

Danieli Automation will provide advanced process control systems to supervise operations, running the lines in automatic mode, guaranteeing quality and production consistency. The startup of these plants will begin in mid-2024, with operation by the end of 2024.

SMS group to supply the equipment for the melt shop

Nucor has awarded SMS group, Inc. the contract to supply the complete melt shop for the new facility to be built in Mason County, West Virginia. The cope includes technology as following:

- two 190 metric ton DC EAF,
- two twin ladle furnaces, and
- two vacuum tank car degasser facilities.

The mechanical supply includes several safety-related auxiliaries, the proprietary SMS bottom anode system, two mechanical vacuum pumping systems, and a unique equipment layout designed to minimize crane movement. The electrics and automation supply includes an advanced Level 2 system. All equipment is to be supplied "digital ready", for incorporation into a data driven system.

As the facility is intended to enabele Nucor to expand their portfolio in the automotive market, the vast experience in supplying liquid steel intended for such grades was a determine factor in the selection of SMS group. Project completion is anticipated by 2024 with hot commissioning beginning in the second half of 2024.

Fives group to supply galvanizing lines

Nucor awarded Fives a contract for both a vertical and horizontal galvanizing line, each capable of 500,000 tons per year. The first one will produce steel coils for automotive applications, while the second one will produce steel for the construction market.

"We choose Fives to supply our galvanizing lines due to their specialized technical knowledge, dedicated customer focus and commitment to the mission of highly operational equipment," says John Farris, Vice President & General Manager of Nucor Steel West Virginia.

"We thank Governor Jim Justice, Secretary Mitch Carmichael and the West Virginia Department of Economic Development, Speaker of the House of Delegates Roger Hanshaw, Senate President Craig Blair, and local officials in Mason County for their partnership and support of this project," said John Farris, Vice President & General Manager of Nucor Steel West Virginia. "We look forward to breaking ground in Mason County and partnering with colleges and universities on workforce development programs, supporting veterans' organizations and local food pantries, and working with opioid recovery programs that will provide meaningful pathways to jobs."

"The green and digital economy is being built with steel, and Nucor, as one of the cleanest steel makers in the world, is poised to be able to meet these unique opportunities," concluded Topalian.

Nucor / Danieli / SMS group / Fives group

On 23rd March 2022 Nucor Corporation entrusted Danieli with a giant volume of orders valued in excess of US$ 650 million (Picture: Danieli)

Rolling mill technology

Modernization of the hot strip mill at Salzgitter Flachstahl

This hot strip plant has been in operation since 1963 and an intensive technology partnership has enabled the plant to be kept up to date for 60 years. The current modernisation is aimed at increasing availability, enabling an expansion of the product range, and reducing operating costs

Salzgitter Flachstahl GmbH, a company of the Salzgitter group, has placed an order with SMS group to modernize the hot strip mill in Salzgitter in the finishing mill area. The hot strip mill has been in operation since 1963 and an intensive technology partnership has enabled the plant to be kept up to date for 60 years to meet the ever-growing demands of the market environment.

> "There is a continuous trend in hot-rolled products toward stronger steel grades with smaller final thicknesses and larger widths at the same time. The demands on strip quality are also growing. "
>
> *Thomas Rothe, head of hot strip rolling mill at Salzgitter Flachstahl GmbH*

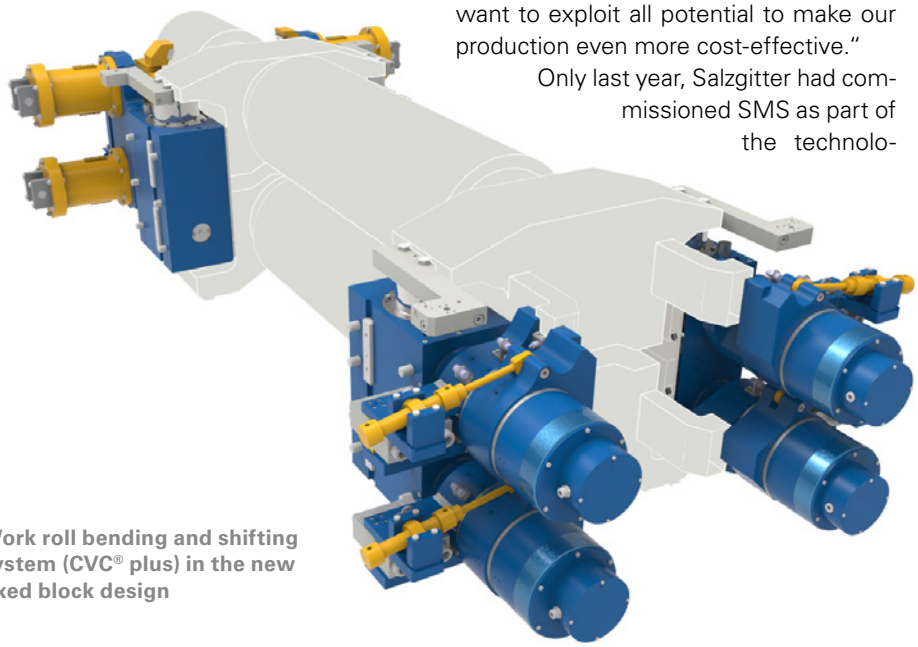
The hot strip mill is equipped with four furnaces for slab reheating, primary descaler, slab sizing press and a roughing stand with attached edger. The transfer bar is cropped in a drum shear and descaled in the secondary descaler. Rolling to hot strip thickness takes place in the seven stand finishing mill. All millstands are in 4-high design. In the strip cooling system, the hot strip is cooled down to coiling temperature. Three downcoilers are available for winding up the hot strip. The hot strip mill rolls strips in the width range from 2,020 to 900 millimeters and in the thickness range from 25 to 1.5 millimeters. The annual capacity is approximately 4 million tons.

Thomas Rothe, head of the hot strip rolling mill in the hot flat steel department at Salzgitter Flachstahl GmbH, says: "On the part of the market, we are faced with a wide range of requirements. There is a continuous trend in hot-rolled products toward stronger steel grades with smaller final thicknesses and larger widths at the same time. The demands on strip quality are also growing. At the same time, we want to exploit all potential to make our production even more cost-effective."

Only last year, Salzgitter had commissioned SMS as part of the technology partnership to modernize downcoilers 1 and 2 in order to significantly reduce the maintenance expenditure in this area. The most recent order concerns the finishing mill and comprises the revamp of the CVC® work roll bending and shifting system (Continuously Variable Crown) on several mill stands, especially on the stands F5 to F7. These so-called adjustment systems play an essential role in the setting of the quality characteristics, in particular of strip profile and flatness during the rolling process. The CVC® adjustment systems of the more recent design extend the setting possibilities.

Instead of the previous design with movable bending blocks, a fixed-block design is now used. During the work roll bending and shifting process, there is also less friction. This reduces wear and maintenance and increases plant availability.

The revamp of stands F5 to F7 additionally includes a replacement of the lifting rails based on a new structure. In addition to the design and supply of equipment, the scope of the SMS group also includes necessary millstand machining and the implementation of the revamp. Erection and commissioning of the new equipment is scheduled for autumn 2022.



Work roll bending and shifting system (CVC® plus) in the new fixed block design

SMS group

Robustness in proven quality by VEM made in Germany

Drives for roller tables at hot rolling plants

Roller table motors of the ARC series for use with frequency inverters to drive transport and work roller tables in the steel and rolling mill sector

Roller table motors of the series ARC and ARB have been demonstrating their function capabilities and reliability under often-extreme ambient conditions for many decades. Based on this experience, VEM has developed several variants of roller table motors, which are each adapted to the special requirements of modern drive technologies for use in conjunction with a frequency converter. The motor windings are designed specifically for converter-fed operation. In contrast to a classic roller table motor design with soft torque characteristic and long blocking times, roller table motors for converter-fed operation feature a specially tailored characteristic, as is typical for a double squirrel-cage rotor. This ensures reliable synchronous operation with grouped drives, even under changing loads, which in turn is a prerequisite for high rolling quality. The roller table motor in compact size deserves special attention: It comes either with horizontal or vertical cut flange, depending on the client's requirements. These drives have a large torque despite their small size and are used in hot strip mills.

Made for toughest demands

The motors are designed as cast iron constructions and can be adapted to specific project demands. The drive elements of the mill and driving tables in rolling mills are subjected to particularly exacting electrical and mechanical demands. They cope with a diversity of operating modes, such as continuous, intermittent and short time duty, as well as start-up, braking and reversing functions. Furthermore, the motors withstand the high ambient temperatures arising from the molten steel and the overloads, which may occur if jammed stock blocks the transport system. Exposure to water have to be expected frequently, and this needs to be taken into account by the mechanical design of the motor. VEM roller table motors are ideally prepared to handle all such extreme operating conditions.

Versatile applications – individual adaptation

With regard to their mechanical design, the motors are available either as robust grey-cast constructions with horizontal/vertical ribbing, in versions with self- or forced ventilation as series IE3-A4.R/A4.F or in a non-ventilated version as series IE3-A41O, or else based on a ring-ribbed housing in the case of series ARC and ARB. In converter-fed operation, the operating speeds can be matched perfectly to the individual drive requirements. As control is realized primarily in the lower frequency range, project-specific adaptation of the windings and the use of a frequency converter with automatic voltage boost or field-oriented control are recommended. The windings are designed specifically for converter-fed operation. They are based on windings for thermal class 155. Designs for thermal class 180 are also possible as an option, for example as a means to increase the frequency of switching operations. For existing installations, it is still possible to choose the heavy-duty series ARB, which is designed specifically for mains operation and can withstand a blocking period of several minutes without damage due to soft torque characteristic, additional heat sinks on the rotor.

VEM Sachsenwerk, Dresden, Germany

The motors of the the ARC series are designed for reliable synchronous operation with grouped drives (Picture: VEM)

Hot rolling and hot metal forming

ScaleFree Technology to reduce scale and scale related imperfections

Although there have been significant studies conducted by various steel mills, and at the EU level, no proper technology by these parties has been developed which would solve the problems associated with scale. ScaleFree technology, as the name suggests, is a new technology developed, tested and proven to work to reduce scale-related problems extending from casting to finishing

Within the process of making steel, regardless of shape, size or material, the process creates scale. Being a kind of iron oxide, scale occurs on the surface when steel is heated to temperatures above 600°C while being exposed to oxygen, i.e. air. The problems caused by scale start immediately after its formation and may compound during the downstream rolling and forming processes.

The formation of scale begins when the surface of a steel billet, shell, slab, bar etc. is heated to high temperatures and exposed to oxygen. High temperature is required to enable the reaction of oxygen to the steel, thus forming scale (or oxides). Depending on the process and material conditions, scale formation, and resulting yield losses have been typically reported to be between 2-4% but, in some cases, actual losses may be much higher than that.

Thus, the cost of yield losses due to the formation of scale is significant. However, as the formation of scale is inherent to the process of making steel, steel producers have grown accustomed to accepting these losses. ScaleFree technology has been proven to reduce scale formation from up to around 45% and, in some cases, up to 90%.

Yield loss is not the only problem associated with scale. Other major problems which affect the product quality are rolled-in scale defects. Scale by its nature is harder than the hot piece of steel being formed. If it is left on the surface of the steel when the billet, shell, slab etc. is rolled, the scale penetrates the surface causing pits, scratch, cracks, or surface defects. As the billet, shell, slab etc. is then elongated, the size of these defects is multiplied by the elongation and can stretch up to the entire length of the final product. The result is significantly poor surface quality with potentially a complete loss, and the whole piece needs to be recycled.

In addition to the surface defects of the products, the scale may also stick to and damage the surface of the rolls or forming tools. When this happens, not only the rolls stamp markings on the product, i.e. causing repetitive surface damage. Also the surface of the rolls is damaged by the scale, and actually the rolls are degraded and their tool life is reduces, which results in an increase of tooling costs.

The limitations of common descaling methods

The industry standard solution is descaling. Descaling is the process where a hot billet, shell, slab etc. leaving the furnace is blasted with high-pressure water to remove the scale. This solution works but has its limitations. The first problem is lack of efficiency. It has been reported that descaling by water is not effective with the more specialty steels. As a result, more expensive higher-pressure descalers have been installed in the attempt to overcome this obstacle. The second, perhaps more significant problem is heat loss. Because the surface of the steel is blasted with water, this cools the surface down; with a lower

Loose porous standard application (left) compared to a clean tight dry film (right) of ScaleFree coating (Picture: DMK Oy)

temperature it becomes harder to roll in multiple passes. That's why billets, shells, slabs etc. are typically descaled only once, and otherwise, the drop of the surface temperature would relate to serious difficulties during rolling. This is problematic because during each rolling pass, the surface is elongated, allowing for additional new scale to form.

While not all steel-forming processes require it, in some processes the steel product is sandblasted or pickled to remove scale and other surface defects. This process, depending on the level of surface quality, entails an additional cost, which, in some cases, can be significant. Depending on the pickling technology being used, the cost can vary between 12-15 Euro per ton.

ScaleFree technology has become a gamechanger

The solution to all of these problems is ScaleFree technology. ScaleFree technology consists of two components: the equipment and a coating product. These are applied as following: The ScaleFree equipment is installed at a place where scale formation is at its lowest, typically right after the casting or descaling process. The ScaleFree equipment then sprays the ScaleFree coating onto the hot billet, shell, slab etc. forming a 5-80 µm thin protective layer on the surface. The ScaleFree layer then inhibits the formation of scale by significantly reducing the interaction of oxygen with the steel surface. The ScaleFree coating further reacts only with the existing surface scale to turn it into a lubricating paste. This results in a protective layer being formed on top of the steel so that:

- the billet, shell, slab etc., can be reheated with only a limited amount of new scale being formed,
- rolling loads are reduced which then improves tool life,
- scale pickup on the rolls is reduced, further improving tool life,
- rolled-in scale defects are also minimized, thus improving surface quality,
- pickling costs shrink since the method improves pickling efficiency,
- sandblast costs are reduced due to improved surface quality.

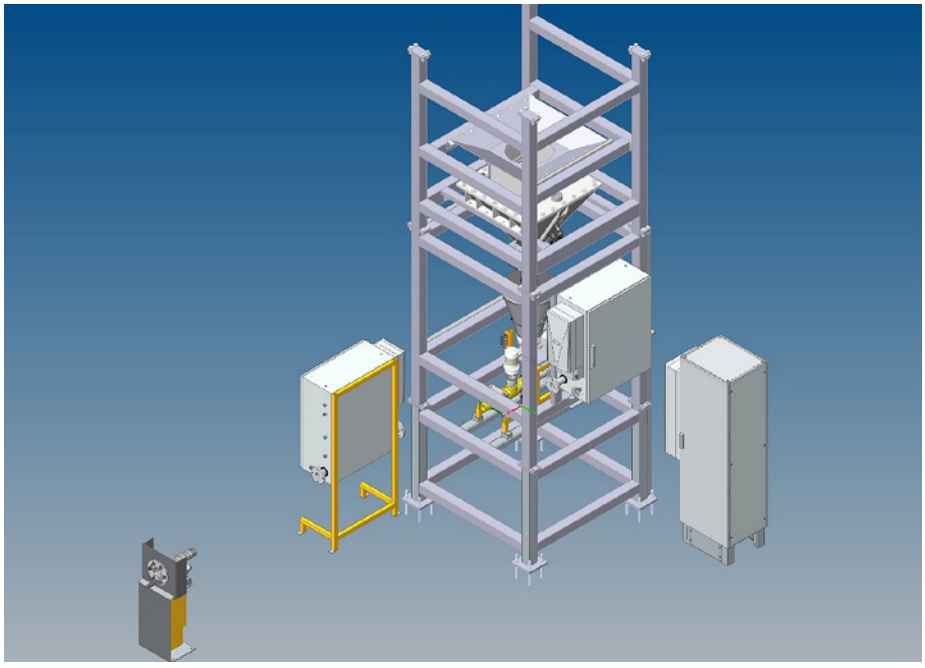
The benefits of ScaleFree technology are significant. Scale related yield losses can be reduced by 33%, which sums up to savings of some million Euros annually. Pickling efficiency can be increased by 25%, resulting in reduced operating cost. Besides these direct financial savings, also improved quality, increased efficiency and value-added prime yield are further benefits. Investing in ScaleFree technology is both financially and technically sound.

Case study: seamless tubes

In seamless tube mills, two critical areas have been neglected: deoxidation and lubrication of the mandrel bar. Deoxidation remains a critical process within the seamless-tube manufacturing process. When a round billet is pierced, scale formation starts immediately inside the newly formed shell. This scale, if not handled correctly, will cause serious problems throughout the rest of the process. Typically, immediately after piercing, the loose scale is blasted out through the shell via a method referred to as scale blowout. Immediately after that, deoxidation powder is blown through. This powder interacts with the scale and turns it into a lubricating liquid. The shell is then transferred to the next process where a graphite-coated mandrel is inserted into the shell and together they are rolled in the rolling process.

The amount of powder which is blown has drastic consequences for the final pipe quality: too little powder, and the scale is not melted, while the Operator risks having significant wall thickness variation and rolled-in scale defects. If too much powder is added, the added mass can cause serious cold bits to form on the mandrel, stopping the process altogether. Therefore, it is critical that the deoxidation powder is properly applied.

DMK has just delivered a state-of-the-art deoxidation system. It allows for the handling and injection of powder to be located further away from the powder nozzle than ever before. The spray has been optimized using high-level 3D printing techniques. But, the most important feature, is the dosing accuracy. Where current and previous systems boast an accuracy of ±10-20%, the DMK system boasts an accuracy ±6% which can be further improved, if process conditions allow, to ±1,5%. This improvement not only saves the mill money in deoxidation powder consumption but permits having a tighter control of the amount of powder being dosed. Having better control of the deoxidant powder allows for the operator to have a tighter control of the entire process and therefore allows the operator to improve product quality, consistency, overall efficiency and savings due to improved prime yield.



Deoxidation system with overhead crane loading and climate control cabinets (Picture: DMK Oy)

Mandrel-bar lubrication. The other significant, and often under-engineered, process in many seamless-tube mills is the Mandrel-Bar Lubrication (MBL) system. After piercing, the shell is transferred to the front of the rolling mill where a coated mandrel is inserted. The mandrel is coated with a graphite lubricant by the MBL system. This coated mandrel serves as a mould, allowing for the rolling mill to elongate the shell along the length of the mandrel setting the shell ID and forming a pipe.

As the graphite lubricant layer is situated between the mandrel and shell ID, its role as a lubricating layer and insulation layer are critical. If there is significant variation in the graphite layer, risks arise. The graphite layer works as a form of insulation for the mandrel to reduce thermal cycling. Thermal cycling is the repetitive cycle of heating and cooling of a work piece, in this case the mandrel. If the surface of the mandrel suffers from significant thermal cycling, the mandrel will wear out faster, significantly increasing tooling costs for production.

Furthermore, significant variation in the coating will result in variation of the elongation of the shell and the resulting wall thickness, thereby affecting pipe quality. Moreover, if there is not enough graphite on the mandrel, the risk is high that the shell will stick to the mandrel, causing production to stop. Additional risks include damage to the rolls, the rolling mill and to the mandrel itself. It is therefore critical that the graphite lubricant be properly applied to the mandrel with a proper MBL system.

With many of the presently used MBL systems, the graphite is pumped through airless nozzles. The problem with airless nozzles is two part: first, the spray fan is fixed, and, second, atomization is dependent on the flow rate. Neither of these options allow for good control of the spraying of the lubricant on the mandrel. With a fixed spray fan, the Operator has no ability to optimize the spray pattern for different-size mandrels, or allowing for over or under application of the lubricant. With too small a spray fan, portions of the mandrel risk being left exposed and uncoated. With too large a spray fan, lubricant is lost as it is sprayed past the mandrel, creating variation in the lubricant layers. In both cases, the spray fan will not coat the mandrel properly.

The second problem, and probably the more significant one, is the atomization of the lubricant droplets. Atomization of the lubricant is the transformation of the liquid graphite into a fine spray of tiny droplets or even a very fine mist. With airless nozzles the atomization is controlled by the flow of lubricant through the nozzle. Therefore, if the Operator wants to increase the atomization, the Operator needs to increase the flow rate, if the Operator increases the flow, the Operator risks flooding the mandrel bar with too much graphite.

Another key issue with many MBL systems is the manner in which they are pumped. Some systems use air-driven diaphragm pumps, or piston pumps. Diaphragm pumps do not give a good even flow while piston pumps wear out, due to the diamond like hardness of graphite. Strong pulsation and uneven flow cause even further problems with the application of lubricant through airless nozzles.

Conclusion

The DMK MBL system (Design Management Konsulting Oy) consists of air-assisted nozzles driven by positive displacement-metering pumps with "Pulse Free" linear flow. Air-assisted nozzles allow the DMK MBL system to both atomize and adjust the fan width for each mandrel size without replacing nozzles and at different flow rates. This allows for exceptional lubricant adhesion and reduces drying time significantly, thus providing excellent lubrication and thermal properties. In addition, the positive displacement pump that DMK uses allows the operator to adjust the flow on the fly with high accuracy output. These key features place the DMK MBL system a large step ahead of current systems and provides the customer with the reliability, control, and high-quality production required in today's highly competitive markets.

ScaleFree technology has been tested with major companies within the steel industry and is currently being implemented in locations around the globe. Design Management Konsulting Oy (DMK), is looking for new locations and interested partners to further implement ScaleFree technology.

Design Management Konsulting Oy (DMK Oy), Kangasala, Finland

Quality management

New high-precision flatness measuring system at heavy plate manufacturer Ilsenburger

At Ilsenburger Grobblech GmbH, a system from nokra measures and documents the flatness of fine-levelled plates. The nokra system ensures that all plates shipped fulfill the special tolerances on flatness specified in EN 10029. To achieve the high measuring accuracy required for this challenging task, the almost 30-m-long facility uses laser light-section sensors of the most advanced design and performs the flatness measurements on the static plate.

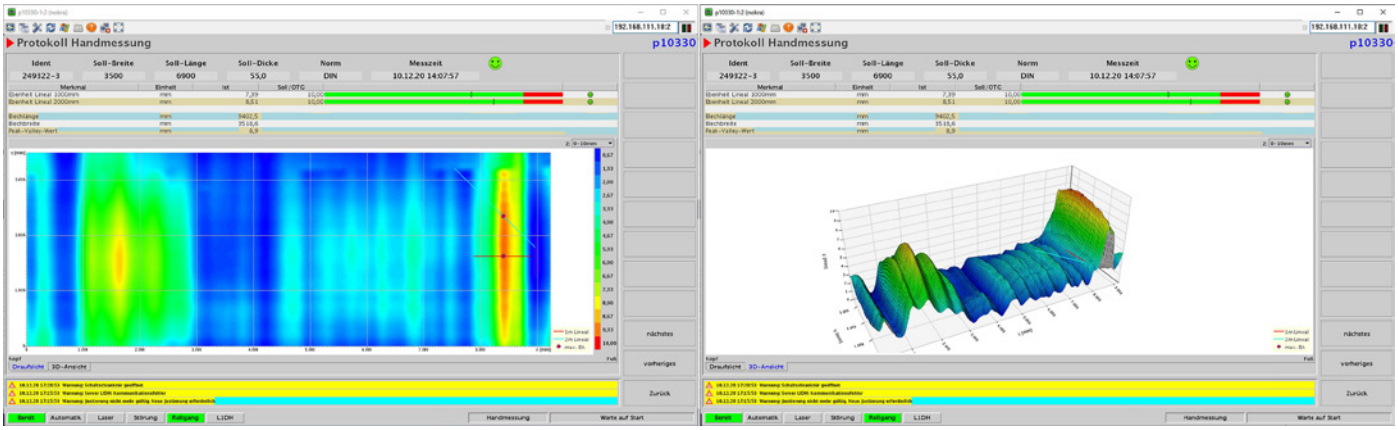
With its new, recently commissioned heat-treatment line, Ilsenburger Grobblech GmbH (ILG) has strengthened its position as supplier of high-strength, fine-levelled plates. These products are used in truck-mounted telescopic cranes, for example. For these applications, special high-strength properties are needed to guarantee that the cranes are safe even when they are working at maximum payload. At the same time, the plates must be of impeccable flatness to ensure smooth extension and retraction of the telescopic jib. Up to 24,500 mm long and 3,550 mm wide plates of thicknesses ranging between 5 and 175 mm are heat-treated and levelled in a newly built production hall, which covers an area of about 31,000 square meters.

Installed downstream of the leveller, an automatic, high-precision measuring system from nokra documents the flatness of the plates before shipment. The system measures the height profile of each individual plate with ultrahigh precision, evaluates the flatness based on the criteria specified in EN 10029 and generates a test certificate.

EN 10029 specifies the maximum allowable deviation from flatness for fine-levelled plates based on the distance measured between the plate placed on a flat surface and a straight edge. For a straight edge of 1,000 mm long, the maximum allowable distance is 3 mm, for a 2,000 mm straight edge, it is 6 mm. To be on the safe side, the project team of Ilsenburger Grobblech specified a maximum allowable deviation from flatness to be measured by the new system of only 2 mm for the 1-m straight edge and of only 3 mm for the 2-m straight edge. Another essential factor in the decision-making process was that the supplier would have to conduct MSA type-1 and type-3 studies to provide proof of the system's capability to measure within these extremely tight tolerances with sufficient accuracy.

With almost 30 meters in length, the flatness measuring system installed downstream the new RM 5 levelling machine is the largest measuring system ever built by nokra (Picture: Ilsenburger Grobblech GmbH)

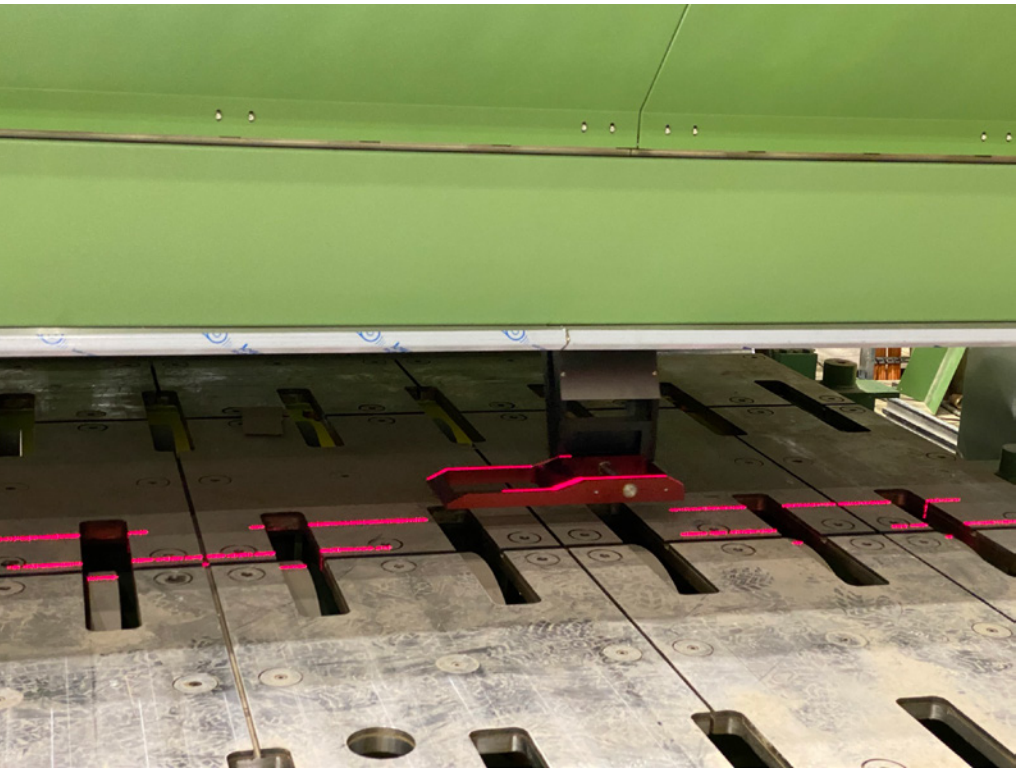
Rolf Simon, project engineer, Ilsenburger Grobblech GmbH, Ilsenburg, Germany; Günter Lauven, managing director, nokra Optische Prüftechnik und Automation GmbH, Baesweiler, Germany – Contact: info@nokra.de



In the control room, the flatness distribution is visualized as a 2D view (left) or 3D view (right) as well (Picture: Ilsenburger Grobblech GmbH)

The selection process

These were the main reasons why the project team had generally ruled out a solution based on manual measurements. Manual measurements are prone to errors, very time-consuming, based on random checks only and, last but not least, would have been very costly. Consequently, optical measurements were the only viable choice. The ILG project team had examined various systems based on laser triangulation. Most of these systems operate with a stationary measuring bridge arranged above a roller table, taking the measurements while the plate is travelling below. Even when complemented by additional measurements, these systems would have been unable to compensate the plate's oscillations on the roller table with sufficient precision. None of these systems would have been able to pass the MSA tests for the tolerances specified. In addition, the fact that the measuring system was to be installed close to the leveller posed another challenge. Therefore, the system would have to be able to compensate the vibrations resulting from the levelling process. Therefore, ILG was looking for a system that would perform the measurements on still plates and would use a measuring table decoupled from the vibrations of the levelling machine.



After the flatness measurement of the calibrated reference part, the current position of each laser sensor is calculated and recorded in a common machine coordinate system (Picture: Ilsenburger Grobblech GmbH)

The solution

nokra GmbH soon recognized that a fundamentally different approach was needed and proposed a system based on the use of laser light-section sensors. Such a system, which nokra had implemented before at several other plate rolling mills, would be able to reliably measure plate flatness within the tolerance range specified by the customer. While conventional stationary systems measure the moving plate, the nokra system would use a travelling measuring unit that would scan the plate lying still on a precisely aligned gauging table. With this system arrangement, nokra was able to demonstrate in an MSA that the system was qualified to perform the flatness measurements with the necessary accuracy.

In April 2018, SMS group, as general contractor for the heat-treatment line project, awarded nokra the order to supply and commission the measuring system that was to be installed downstream of the new RM 5 levelling machine. With almost 30 meters in length, this was to become the largest measuring system built by nokra so far.

A special challenge of the project was that the system had to be operational at a rather early stage of the project to be able to provide the flatness measurements necessary to conduct the final acceptance

tests for the new levelling machine. Those tests were to be based on results from 500 plates. This, too, would have been unfeasible for a manual measuring method.

The technology

The nokra system is based on the laser light-section process. It uses sensors developed specifically for this application. These sensors are integrated into a gantry-type frame which moves down the complete length of the plate on high-precision rails embedded in the foundations.

Nine light-section sensors of nokra's alpha.VR series project laser lines onto the surface of the plate. The laser lines run across the complete width of the gauging table. nokra delivered the system with pre-calibrated sensors. Therefore, the system was ready for use without on-site calibration. The measuring range of the sensors assures that the system can provide the required measuring accuracy for the specified tolerances. To rule out any interference between adjacent sensors, the sensors are arranged with an offset of 150 mm.

While the gantry is travelling along the plate, the cameras arranged at an angle within the sensor units capture their respective lines projected on the plate surface. The height data, which is used to calculate the flatness, is derived from the angle at which the cameras "see" the lines on the plate surface. To obtain a complete height profile, a magnetic sensor captures position data of the gantry as it moves along the plate.

The plates discharged from the leveller run on height-adjustable disc rollers onto the gauging table. The perfectly level gauging table guarantees that the measuring precision of the system is not affected by any unevenness of the table. Laser tracker measurements have confirmed that the system is able to reliably measure deviations from flatness below the maximum allowable deviation of 2 mm. Given the thus confirmed measuring capability, the flatness of the gauging table can be verified at any time simply by having the gantry travel down the empty table and measure its flatness. The software is programmed to automatically skip the apertures and slots for the disc rollers in the table.

When the plate has reached the measuring position, it is stopped and the disk rollers are lowered to deposit the plate safely on the gauging table. For the measurement, the gantry travels down the complete length of the plate scanning its height profile. The sensors in the gantry recognize the plate end and automatically stop the measurement. After the gantry has travelled back to its starting position, the disc rollers are moved upwards to discharge the plate from the gauging table.

The gantry travels at a speed of 0.5 m/s. Thanks to this fairly high speed, the measurement of a 24-m-long plate takes just 50 s. The sensors measure at a frequency of 200 Hz. At 0.5 m/s, the system generates a complete transversal height profile every 2.5 mm of the plate length.

Rolf Simon, Project Engineer Electrical Systems, Ilsenburger Grobblech GmbH
(Picture: Ilsenburger Grobblech GmbH)

The new heat-treatment facilities at Ilsenburger Grobblech are accommodated in a complex of three new buildings covering an area of 31.290 square metres
(Picture: Ilsenburger Grobblech GmbH)

The sensor equipment

The system is designed for plate temperatures of up to 500°C. The lower side of the gantry-type measuring frame and the components on the frame are protected with heat shields made of stainless steel. The laser sensors are mounted in encapsulated protective housings, which are actively temperature-controlled by means of a heating/cooling unit. The system uses ambient air to cool the cooling circuit back down.

Ambient air is blown between the heat shields and the laser sensors across the complete width of the gantry to minimize the effect of heated air rising up from the plate and the gauging table. At the same time, this reduces the ingress of debris and dust into the gantry equipment. Narrow-band filters protect the optical equipment against extraneous light effects.

While in the parking position, the gantry is safely protected against collisions, for example, with the bay crane, by a garage of very sturdy design built by SMS. Also while in this position, the sensors are protected by heat shields against thermal radiation from below.

Alignment

The system's measuring precision is verified at regular intervals. This is done by means of an automated procedure during which a calibrated reference part made of anodized aluminium is moved through the measuring ranges of all the sensors. Once this procedure is completed, the current position of each laser sensor is calculated and recorded within a common machine coordinate system.

The alignment check is part of the automated measurement procedure: when there is uncertainty about the accuracy of the alignment, the nokra system sends out a corresponding notice which triggers the process control system to perform an alignment check before the measurement of the next plate starts.

Installation and commissioning

Factory acceptance testing at the nokra facilities in Baesweiler together with ILG and SMS was conducted with the system operating along a several meter long measuring path. The system was accepted without reservation. During the tests, the

machine also demonstrated that it is "steelmill proof".

Installation of the system at Ilsenburg progressed smoothly with acceptance testing of the measuring equipment in cooperation with ILG und SMS starting as early as at the end of 2020. Final acceptance was granted soon thereafter at the beginning of 2021. The performance criteria for the final acceptance, including MSA type-1 and type-3 studies to confirm the system's measuring capability, were fulfilled at the first attempt. For the MSA studies, eight measurement tracks distributed over the plate surface were defined and the respective flatness values compared.

In the MSA type-1 study, the repeatability of measurements, expressed as the Cg index, and of the systematic deviation, expressed as the Cgk index, are determined. For the calculation of the Cgk index, the values measured by the system along the defined tracks were compared with the corresponding values measured with a laser tracker and verified.

For the 1-meter straight edge, a Cg index above 2.94 and a Cgk index above 1.75 were determined. For both indexes, minimum attainable values of 1.33 had been specified by the customer. For the 2-meter straight edge, a Cg index of 4.39 and a Cgk index of 3.07 were determined. Also in this case, the minimum attainable values specified had been as low as 1.33.

In the MSA type-3 study, which is used to determine the system's repeatability and reproducibility (%R&R), 25 plates from production were measured two times each along the previously defined tracks. From these results, the repetition and reproducibility of the measurements, expressed in percentage, were calculated. While the value specified by the customer was <30%, the actual value achieved by the system was just 6.79% with the 1-meter, and 7.09% with the 2-meter straight edge. Thus, it could be proved in both studies that the measurements are clearly within the allowable tolerance ranges.

The process

nokra designed the HMI to the customer's specifications. The standard view for the operator in the control room is a 2D display of the flatness distribution. In accordance with EN 10029, the values for the 1-meter straight edge are shown as red, and for the 2-meter straight edge as blue lines. In both cases, the position of the greatest deviation from flatness is marked as a red dot. If the operator wants to get a more detailed view, he can simply switch to a 3D display.

nokra has also implemented a traffic light system, as requested by ILG. This enables the operator to see at a glance whether plate flatness is within or outside the allowable tolerance limits.

In the event that a plate does not meet the required tolerances, it can be reversed back into the levelling machine and re-levelled, provided that the microstructure is suitable for immediate re-levelling. Otherwise, it will first be heat-treated one more time.

Bottom line

The measuring system was fully operational and the FAC issued several weeks ahead of the tests for the final acceptance of the levelling machine. Thus, the performance tests could be conducted as planned on 500 plates.

The flatness measuring system has been in automatic three-shift operation since early February 2021, when the new quench became operational. It is linked with the process control system, which transmits the operating signals to the measuring system and receives the measured data as feedback. There has been just one issue ever since the measuring system came on stream. It could be quickly resolved by replacing an existing sensor with a pre-calibrated new one.

The system has proved extremely maintenance-friendly. Lubricating certain mechanical drive components and changing filters in the heating/cooling circuit are the only regular maintenance activities required. The alignment of the system is a fully automatic process performed without any manual intervention.

Outlook

For the future, it is planned to implement direct feedback of the measured flatness values to the levelling machine to enable the automatic setting of the levelling parameters in the event a plate must be levelled a second time. In addition, the stored flatness data will be used to optimize the overall levelling process. Based on the good experience with the new measuring system, ILG plans to install a second one in the existing No. 1 finishing shop.

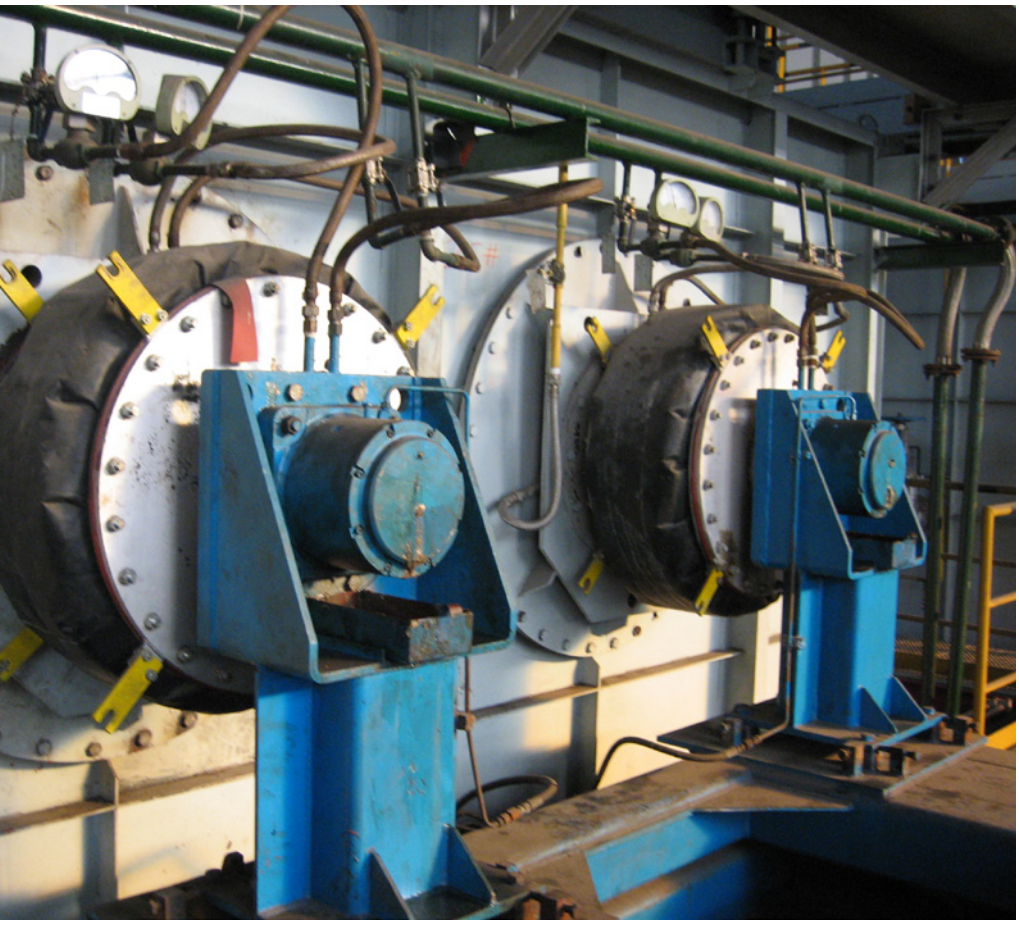
Secure sealing of the inert gas atmosphere

Expansion joints with exceptional tightness in strip processing lines

In cold rolling mills, continuous galvanizing lines and continuous annealing lines require a very high level of tightness in order to reliably seal off the inert atmosphere of hydrogen and nitrogen that is present in certain sections of the annealing furnace. Frenzelit GmbH has developed different versions of fabric expansion joints meeting the highest requirements with regard to temperature range, clearance, pressure range and media in these applications.

Pre-rolled strips are further processed in continuous annealing or galvanizing lines. Here the steel strips receive their required material properties by means of a targeted microstructural transformation effected by a sophisticated annealing and cooling procedure. While passing through the plant, perfect alignment of the strip at all times is key. Steering rolls guide and deflect the strip – in the accumulator sections, but also in the furnace and in the cooling zone. The steering rolls are each equipped with a pair of fabric expansion joints to compensate for lateral movements, some of which can be 200 to 250 mm.

Here the expansion joints do not function as part of a pipeline where a medium flows through, as is often the case. Instead they are provide a flexible seal to the outside with a more or less stationary atmosphere inside the furnace. In addition to the high temperatures in the area of the expansion joint, another challenge is the tight installation space along with its complex geometry and folds. To ensure that the installation is gas tight, the bearing – including the bearing plate – must be pulled on both sides of the rolls in order to insert the expansion joint, which was built and tested for tightness in the workshop, and bolted to the furnace wall on one side and the bearing plate on the other.



Fabric expansion joints compensate for the movements of the steering rolls that centrically guide the steel strip through the furnace (Picture: Frenzelit GmbH)

"Nekal tightness" is a quality criterion for the tightness of expansion joints defined by the RAL Gütegemeinschaft Weichstoff-Kompensatoren e.V. (The Quality Association for Fabric Expansion Joints) – of which Frenzelit is a member. The steering roll expansion joints fully meet this criterion. This qualitative test method can detect leaks through a bubble method using foam-forming Nekal® liquid.

Double expansion joint for higher hydrogen content

Another area of continuous annealing or strip galvanizing lines in which Frenzelit expansion joints are used is the rapid cooling section. Double expansion joints are used here to seal the significantly higher hydrogen content within the inert gas atmosphere, while the hydrogen content in the furnace area of the steering rolls described above is no more than five to fifteen percent. Leaks in the rapid cooling line as a result of the higher hydrogen content in the gas can have even more serious consequences if the medium leaks over time and accumulates in other ways. This is why the expansion joints must do more and ensure even greater process reliability.

How to make plants tight for hydrogen use?

"In modernization projects the first thing we do is take a look at the installation situation on site and provide a clear assessment of what is possible and what is not. In other words, where conversion work and flange modifications are necessary, whether a double expansion joint is a better solution than the existing one, etc. Incidentally, our experience shows that leakages most frequently occur at the flange connection and rarely in the bellows. The prerequisite for this, however, is proper design by the manufacturer. In an emergency, if possible, we check the situation on site. Then we build and deliver the replacement expansion joint as quickly as possible. After all, we are talking about system availability – and this means real money."

Stefan Puchtler, General Manager Expansion Joint Division at Frenzelit GmbH

Frenzelit offers solutions with double expansion joints for this reason – with an inner metal or fabric expansion joint and an outer fabric expansion joint. The inner expansion joint shields the higher hydrogen content. There is a slight overpressure between the expansion joints in order to keep the oxygen out of the system so that no ambient air can penetrate from the outside and destroy the process through oxidizing reactions. The interior space that is created between the two expansion joints is flushed with nitrogen. Leaking nitrogen to the outside means less risk for the environment than hydrogen; leaking nitrogen to the inside also has a less negative effect on the process than oxygen.

This double expansion joint solution requires a high level of design expertise to ensure that the functionality is guaranteed in the long term. Frenzelit precisely designs the fold geometry of the two fabric expansion joints so that they can interlock without obstructing each other. In addition, reinforcements in the form of pipe rings are necessary to prevent certain materials from collapsing or ballooning.

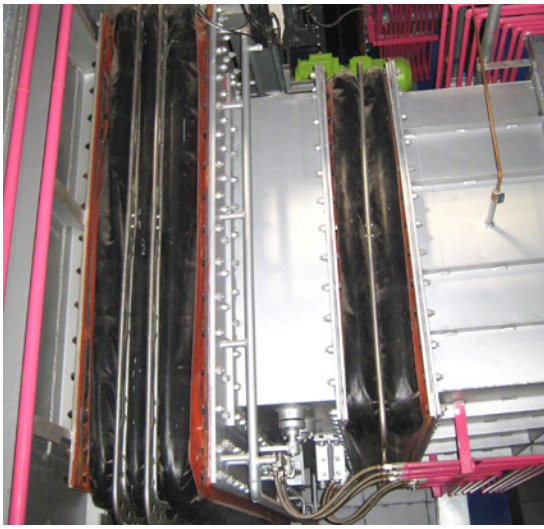
In a class of their own: "snout bellows"

The top tier of expansion joints used exclusively in strip galvanizing lines are the so-called "snout bellows", which are positioned in front of the zinc bath. When the strip leaves the furnace it runs through a kind of "snout" – a nozzle dipping into the molten zinc with the steel strip passing through. The submerged nozzle ensures the exclusion of oxygen and prevents the inert gas atmosphere from escaping. The strip comes out the other side and is pulled vertically upwards, where excess zinc is blown off with so-called air knives in order to achieve the desired coating thickness. Then the zinc-coated strip cools down during the vertical ascent.

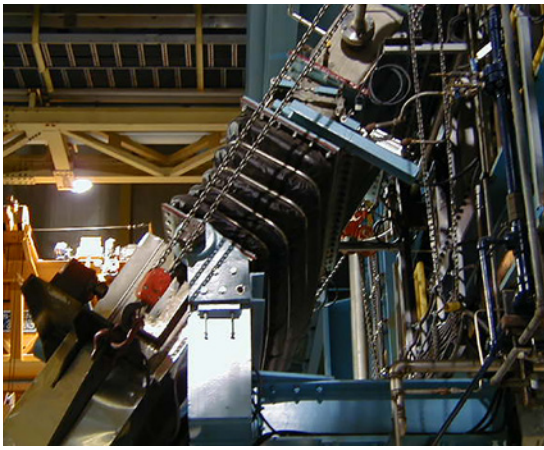
The expansion joint is the connection here between this "snout" mounted on an inclined trestle and the fixed furnace outlet. In order to renew the zinc bath regularly, the nozzle must be pulled back far while it is still hot; the expansion joint compensates for this movement of approx. 400 to 1,400 mm so that the entire structure does not have to be completely dismantled every time.

Such a complex expansion joint consists of ten to twelve layers of fabric, including fabric insulating layers and special sealing layers. This makes it resistant to the high application temperatures of approx. 400 to 650°C that can occur in the furnace areas around the expansion joint. Apart from the combination of the various fabric materials, the expansion joint achieves its high level of tightness through special joining processes that Frenzelit uses. The company typically also supplies all of the parts required for assembly so that the expansion joint is completely ready to install and only the flange screw connection has to be carried out on site. Under these conditions, all of the three compensator versions presented here have a service life of between six and fifteen years, depending on the application, load and maintenance of the component.

Frenzelit GmbH



Double expansion joints with inner and outer fabric expansion joints are used in the rapid-cooling section (Picture: Frenzelit GmbH)



Snout bellows consisting of up to twelve layers of fabric are used exclusively at entry of the zinc pot of continuous galvanizing lines (Picture: Frenzelit GmbH)

The new ASC side trimmer is used for trimming pickled as well as galvanised steel strips with zinc or zinc-magnesium coating (Picture: Wuppermann)

New side trimmer

Wuppermann further expands the production programme in Hungary

Wuppermann has commissioned an advanced double-head side trimmer at a strip processing line at their production site in Györ, Hungary. With the recent extension this flat products plant has improved the overall quality level of its products

The family-owned company Wuppermann produces surface-finished flat products at its Györ site in Hungary. Wuppermann Hungary Kft. has recently commissioned an advanced ASC double-head side trimmer in the outlet area of the combined pickling and hot-dip galvanising line. ASC stands for Automatic Scrap Chopper. At its Dutch site Wuppermann Staal Nederland B. V. in Moerdijk the company has already had gained good experience with the ASC double-head side trimmer.

With the new side trimmer, the flat products plant in the Hungarian port of GyÖr-Gönyü improves the overall quality level of its products in terms of flatness and evenness. The steel strip can now be used in other areas with particularly high demands on the flatness of the material, for example by steel service centres for the production of panels with laser cutting quality or in switch cabinet construction.

The new ASC side trimmer is used for trimming pickled as well as galvanised steel strips with zinc or zinc-magnesium coating. The production range is trimmed strip widths from 700 to 1,600 mm and strip thicknesses between 1.00 and 6.00 mm.

The new trimming unit was developed for operation in a continuously operating strip processing line and is characterised by a very precise mode of operation combined with reliable and cost-effective operation.

With the twinblade cutterhead system from SMS group, Wuppermann can significantly reduce processing costs required for knife resharpening and save material at the same time: Compared to the conventional system, the Twinblade cutterhead system with two cutting edges - instead of one so far - is twice as efficient. If one edge is worn, the knife can still be used. It is simply turned over after loosening the knife clamping piece. Until then, the clamping piece protects the second, still unused cutting edge. The second cutting edge can then continue to work.

Wuppermann

News brief

New Gunning robot for electric arc furnace

Customized programs for automatic refractory repair

Velco GmbH supplied the newest model of a gunning robot for electric arc furnace to a steel plant in the Middle East. The features of the new model are:

- Electro-mechanical lifting (no hydraulic required)
- Layout adopted to customer layout
- Gunning machine with capacity regulation
- Automatic water control station
- Customized auto gunning programs

The unit has a new auto gunning interface. The operator uses a touch panel showing the refractory brick lining. He can individually select and save different gunning programs defining the areas to be gunned. Moreover the operator can select the gunning rate and the water share. Depending on the refractory wear, resp. number of heats, the operator selects the program to be used. It is no longer required to leave the pulpit for the gunning job. Hence operational safety is increased. The robot can be equipped with a CCTV camera for inspection and recording of the gunning job.

Velco GmbH

Open-die forging

Successful “remote” commissioning of heavy-load robots

Dango & Dienenthal has commissioned manipulators and heavy-duty robots for a forge online for the first time remotely. In the process, programmers control the new machine from almost 7,000 km away. This not only saves the expense of travelling, but also gives the customer the certainty that the machines meet his requirements even before they are shipped

As Dango & Dienenthal (D&D) supplies more and more fully automated heavy-load robots and manipulators, machine programming plays a critical role in commissioning. Previously, it was customary for future users to visit the supplier’s plant for a preliminary acceptance inspection of the finished machines. This way, they could satisfy themselves that the machines met the contractually agreed specifications. In exceptional circumstances, preliminary factory acceptance and factory commissioning can be a viable alternative.

To ensure that the preliminary acceptance processes take place under realistic conditions, D&D replicates the situation on the user’s premises directly at the Siegen plant. This way, the company not only demonstrates the functionality of the individual components of the machines, but also their integration into the customer’s process.

Recently, D&D recreated to scale the future environment of two SLR heavy-load robots with a transfer table, two furnaces and a quenching bath in the Siegen plant. Local specialists of the project partner, who was responsible for the automatic control system, tested all functions remotely from their laptops and programmed different sequences and missions. In the process, they watched the movements of the SLR via a webcam. A D&D employee could have intervened at any time if necessary.

Other specialists were also involved in the acceptance process, such as electricians and hydraulic engineers. It was important for them to check the mechanical design as well as the electrical and hydraulic installation of the new machine in detail. For this reason, one of D&D’s employees wore AR glasses that transmitted their images along with imported data. If the future users wanted to see individual parts of the installation in detail, they could direct the employees in Siegen to the appropriate places.

The future environment of the heavy-load robots was simulated at the engineering works (Picture: Dango & Dienenthal)

During the acceptance process, D&D proved that all contractual conditions had been met, such as the cycle times for transferring the workpieces from the furnaces to the quenching bath. In addition, the programmers were assured long before on-site commissioning that the control system also met their expectations.

Ilias Gintikas, the responsible project manager at D&D, sums up the situation: “In this case, the effort required for factory acceptance was indeed higher than it would have been if acceptance had taken place in the presence of the future user at our plant. But we are pleased that we were able to provide our customer with a solution in an exceptional situation.”

Dango & Dienenthal Maschinenbau GmbH, Siegen, Germany

GLAMA

Tools for your productivity

GLAMA Maschinenbau GmbH
Headquarters:
Hornstraße 19 D-45964 Gladbeck / Germany
Fon: +49 (0) 2043 9738 0
Fax: +49 (0) 2043 9738 50
Email: info@glama.de

GLAMA USA Inc.
91 Karl Street, Berea, Ohio 44017
Fon: +1 877 452 6266
Email: sales@glama-us.com
Toll Free: 877-GLAMA66

glama.de

The huge 160 MN forging press (middle) is the centrepiece of the new mechanical forging line (Picture: thyssenkrupp)

thyssenkrupp to booster forging business

Advanced forging line in Homburg/Saarland starts production

With an 80 million Euro investment in a new forging facility for truck chassis components thyssenkrupp takes an important step in growing and diversifying the company's product portfolio. The new production line marks also a significant contribution to ongoing efforts to increase energy efficiency in production

thyssenkrupp's new forging line at the Homburg site (thyssenkrupp Gerlach) in Germany's Saarland region has started producing the first sample parts for truck chassis components in September. Despite many unexpected challenges caused by Covid-19, the project has been full-on track. This production expansion with 80 million euros spent in the last two years represents the most significant single investment ever made at thyssenkrupp's Homburg site and a substantial step in the expansion of the product portfolio. For many years, the plant in Homburg has been the most efficient production site in thyssenkrupp's global forging network. The production of powertrain-independent truck chassis components is part of the company's strategy to open up new markets and product segments in the light of future e-mobility developments.

The centrepiece of the new highly automated and digitized forging line in Homburg is a 16,000-ton forging press measuring nearly 15 meters in height (without frame and damping system). The new line can produce 360,000 forged components per year and will be able to make different large-scale products. In addition, the new line will be the next step in the ongoing efforts to reduce energy consumption in production. Requiring significant investments and smart ideas, the energy consumption per ton of produced products was reduced by 40 percent over the last ten years at the Homburg plant. With the new line, the plant will further develop energy efficiency leadership in forging.

thyssenkrupp has manufactured forged components at the Homburg site since 1947. With a roughly 750-strong workforce, it is one of the region's larger employers. The new investment will secure employment at the production site for the upcoming years. Construction of the world's most advanced forging line started in February 2020.

thyssenkrupp Forged Technologies

160 MN forging press made by Farina

With a press force of 16,000 tons (160 MN), provided by a 800 kW drive, a total weight of around 1,850 tons and a stroke of 600 mm, this forming machine is considered the largest mechanical forging press in the world, according to the manufacturer Schuler and its Italian subsidiary Farina. Thanks to the Scotch Yoke design, the press with a total height of 14 meters is much smaller than conventional ones. This also enables high off-centre loads, a high number of strokes and an extraordinary high precision. From the outside, the GLF type machine looks like a conventional press including the flywheel, clutch and crown gear. However, in its heart, the Scotch Yoke directly works in the slide, which is the reason for the compact design.

Schuler

Technology partnership for 3D metal printing

SLM Solutions and Mahle further the push of additive manufacturing into automotive

The collaboration formalizes the existing cooperation between the two companies and will enable OEMs and Tier 1 suppliers to utilize metal Additive Manufacturing in serial production

In late December 2021, SLM Solutions announced its cooperation with Mahle, one of the world's leading automotive suppliers and development partners from Stuttgart, Germany. Mahle will utilize SLM Solution's systems to empower OEMs and Tier 1 suppliers to fulfil their need for metal Additive Manufacturing in serial production. By joining forces, the two companies are improving the speed and quality of automotive components in both prototype and serial production.

The components will be printed with aluminium and stainless-steel alloys, which are remarkably resilient, corrosion resistant, and topology optimized to reduce overall weight. Structures that are too complex for conventional manufacturing methods are easily produced while still adhering to the strict quality standards of the automotive industry.

"3D printing for mobility just makes sense," comments Sam O'Leary, CEO of SLM Solutions. "Our cooperation with Mahle revolutionizes the production of automotive components by making them better, stronger, and lighter, not to mention more climate-neutral."

Mahle's strategic 3D printing center in Stuttgart will play a crucial part in strengthening its role as the leading development partner for OEMs by revolutionizing the pace of prototype production. The new center will reduce production time from several months to just a few days, thereby simultaneously accelerating the drive towards climate-neutral mobility. The focus will rest primarily on components from the fields of thermal management, mechatronics, and electronics.

"The development of new systems and components has to be much faster today than it was a few years ago, especially when it comes to solutions for sustainable CO_2-neutral drive systems," says Michael Frick, Chairman of the Mahle Management Board (ad interim) and CFO. "With our new 3D printing center and SLM Solutions as a technology partner, Mahle is once again stepping up the pace in its strategic fields, for example, E-mobility."

This collaboration formalizes the existing cooperation between the two companies. Around the world, an estimated 120 SLM Solutions systems for automotive applications are already running at OEMs and Tier 1 suppliers. A dedicated Application Engineer from SLM Solutions will support Mahle at every step of the journey, from prototyping to series production and the production of manufacturing equipment.

SLM Solutions

Mahle's strategic 3D printing centre in Stuttgart will revolutionize the pace of prototype production (Picture: SLM Solutions)

Slender lines shape the future in steel-bridge engineering

Neckar Bridge in perfect form thanks to longitudinally profiled plates

The new Neckar Bridge is both an iconic entrance to the German city Stuttgart and a pioneering engineering achievement. It owes this status to its innovative design as a steel sails bridge with a span of almost 80 metres. Thick steel sheets were used for its steel sails, which combine a highly sophisticated function and filigree aesthetics at the same time

Being part of the Stuttgart 21 infrastructure project, within the scope of which Stuttgart's main station is undergoing reconstruction and the associated railway complex reconfigured, the new bridge is also an element of the Paris-Munich-Budapest main line. Its location derives from the largely underground redesign of the existing rail routing on the Neckar, a sensitive choke point. As a result of the conversion of the existing terminal station into a low-level through station, the track route now takes on a new orientation, at 90° to the original layout. This is also the reason for the replacement of the existing bridge over the Neckar with a new structure for the city's urban rapid transit rail system (the "S-Bahn") and for long-distance rail traffic. At a length of 345 and a width of 25 metres, the new four-track railway bridge over the Neckar has spans of 77 and 74 metres. At its highest point, it is located 15 metres above the river's normal water level. On the west side, the bridge superstructure divides, entering at this point two separate tunnels: for the S-Bahn, the tracks lead to the new underground station, while long-distance rail traffic reaches the new main station via the second tunnel.

Steel sails replace cables

The new Neckar Bridge consists of a seven-span continuous beam. Striking steel sails identify the two main spans, above the river. Four spans are suspended by steel sails and tension ties-chords on nine steels masts. sbp developed a longitudinal support structure consisting of three hollow-box steel girders for the steel-reinforced concrete composite structure. This is immovably carried on three rows of main piers in the longitudinal direction at the outer sides and at the middle of the superstructure and is supported by the steel sails. In this way, the slender new supports absorb the enormous horizontal braking forces which can occur on this four-track railway bridge. The sbp engineers' aim was to achieve a visually lightweight and transparent bridge design despite the span of nearly 80 metres and the loads and forces imposed by a four-track railway. The precondition for this was a top support structure featuring tension ties, which run downwards from masts. Unlike cable-stayed bridges of similar design, sbp instead selected not cables but an arrangement of steel plates, thus interpreting anew the model of a classical self-anchored suspension, or tension ties-chord, bridge with rigid tension ties. Groups of plates consisting of two vertical plates joined to surrounding end plates form the tension ties and mastheads of all the sails. Following the principle of the inversion of an arched support structure, sbp resolved the tension ties into sails. Philipp Wenger, Technical Director at sbp, explains the underlying concept: "In the arch, the vertical forces from the substructure are transmitted via the arch tangents in the form of compressive forces. If this principle is inverted, the arch tangents become tension ties loaded purely by tensile forces." He adds: "For this reason, a relatively thin cross-section expanding in a slight trumpet-shape at the bottom, converging in a taper in the upward direction and then becoming increasingly thicker, was selected for this inverse arch." This means that the maximum stress ratio in the entire sail is equal, as a result of the differing thicknesses of the steel plates throughout the entire length. In all, a total of eighteen half-sails of identical geometry were welded together to create the nine

The sbp engineers aimed for a visually lightweight bridge structure, despite the span of nearly 80 metres (Picture: schlaich bergermann partner/Andreas Schnubel)

Constuctors of the new Neckar bridge

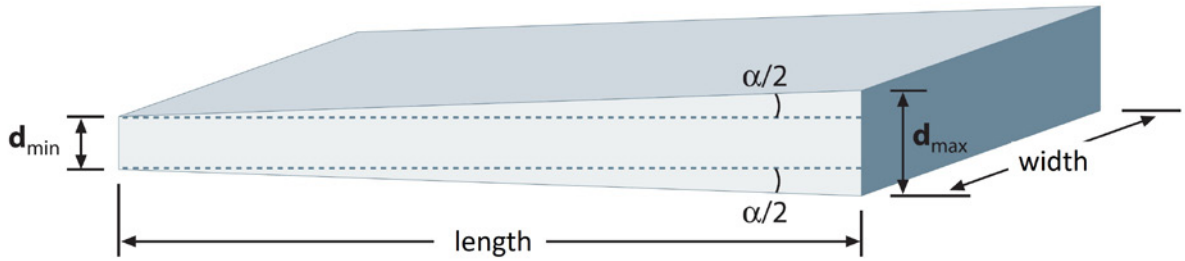
The design of the new Neckar Bridge originates from the renowned independent engineering consultancy schlaich bergermann partner (sbp), of Stuttgart. Founded in 1980, the consultancy, now with a total of 190 employees, earns some 40 percent of its turnover from bridge engineering projects. The inception of the consultancy's history is marked by the design of Munich's Olympic stadium roof, the starting point for many subsequent lightweight structures. With the Second Hooghly River Bridge in India, sbp designed in the 1980s the cable-stayed bridge with, at that time, the world's largest span. The sbp design for the cable-net roof of the Mercedes-Benz Arena in Stuttgart also ushered in the start of the success story of this roof pattern. Innumerable construction projects around the entire world bear witness to the consultancy's power of engineering innovation; sbp is now globally represented - in New York, São Paulo, Shanghai, Paris, Berlin and Madrid – in addition to the parent organisation in Stuttgart. The company has received the highest distinction in bridge engineering, the German Bridge Design Prize, no less than five times. This award, donated by the German Association of Consulting Engineers (VBI) and the Federal Chamber of Engineers, is presented in recognition of the most elegant, most innovative and, simultaneously, most sustainable new or modernised bridge structures. And the new Neckar Bridge may well be on track to continue this series!

sails that distinguish this bridge. The sails bear the forces exerted largely in the form of a membrane and have been produced using plates of thicknesses varying across the sail surface.

Bespoke tailoring in longitudinally profiled plates

For every tension ties structure of the two outer girders, two wedge-shaped longitudinally profiled plates, the thickness of which increases from 35 millimetres to 90 millimetres, were welded together to plate groups. These were then longitudinally joined to 10.5-metre long elements with a thickness of 70 to 180 millimetres. For the central, significantly more heavily stressed sails, plate groups of up to 250 millimetres in thickness and consisting of the higher-strength grades S460ML and S460QL were needed. Since the longitudinally profiled plates could be supplied only in normalised delivery condition (S460NL, for example), recourse was made to milled-to-shape plates for these tension ties. The use of longitudinally profiled plates was a virtually obvious step for sbp for the tension ties spanned visually like a sail canvas for load transmission and with a cross-section tapering downward. "We were aware, of course, that these plates would be a possible solution to implement variable thicknesses and also exhaustively exploit potential cost benefits", remembers Frank Schächner, Administrative Director at sbp. "The invitation to tender had, as always, to be product-neutral", he adds. The contractor commissioned by Deutsche Bahn for the construction of the new bridge, Max Bögl, of Neumark, nonetheless selected these very special plate profiles supplied by Dillinger. Thanks to their variably adjustable thickness in the longitudinal direction during the rolling process, longitudinally profiled plates permit optimum adaptation of the plate profile to structural-analysis, design and production-related needs. Featured in Dillinger's product range since 1983 and continuously refined and further developed since then, such plates now possess references throughout Europe for their successful use in bridge and surface civil engineering. Their potentials for specific profile-creation have also proven their worth for the design of extremely long rotor blades for wind turbines. Available in all cases from Dillinger as single bevel, double bevel or multiple bevel variants, longitudinally profiled plates eliminate the need for the otherwise unavoidable cost-intensive and time-consuming machining and welding together of series of smaller individual plates. That reduces not only material usage but also the weights needing to be transported and installed. By economising on welds, they in addition reduce not only production and inspection times, but also welding costs. Despite their complex production and the

Striking steel sails identify the two main spans above the river (Picture: schlaich bergermann partner/Frank Schächner)



Longitudinally profiled plates supplied by Dillinger are available with variably adjustable thickness across their length (Picture: Dillinger)

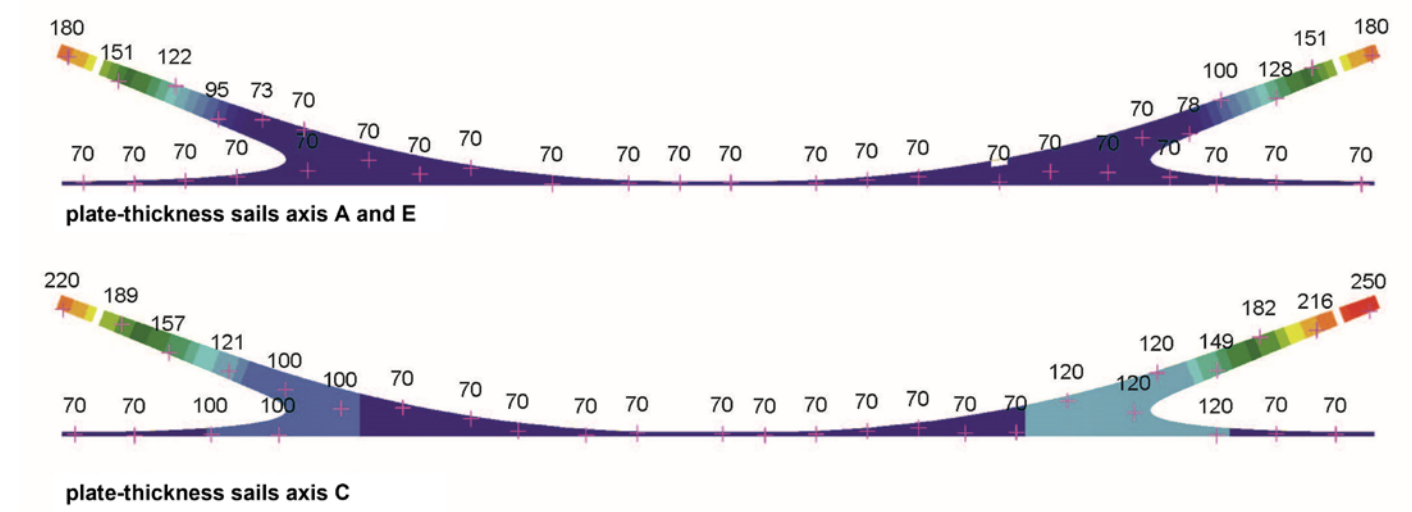
associated higher overheads, the bottom line is, nonetheless, cost-savings of up to 10 percent. Fewer welds and the ability of positioning them in less stressed areas assure in addition safer designs that are significantly less susceptible to metal fatigue.

Not concrete – innovative steel!

In the construction of the new Neckar Bridge, a further aspect spoke more generally for the use of Dillinger heavy plate. The bridge is located in Stuttgart's mineral spa protection zone: Bad Cannstatt is, after Budapest, Europe's most important mineral-water spa, yielding 44 million litres each day. The new bridge is located in the core zone of the geological strata bearing the artesian (confined) mineral water at very high pressure. In order to preclude any damage to the confining bed and therefore leakage of mineral water, the project had to be prevented from disturbing the natural pressure conditions prevailing here. Correspondingly severe restrictions were therefore imposed during the foundation and construction periods. For this reason, the longitudinal support structure was also implemented – contrary to the original planning – using steel rather than concrete. This made it possible to reduce the bridge's deadweight by a good 20 percent, with the result that significantly less weight needed to be diverted into the ground of the site. Europe's leading producer of heavy plate, Dillinger, supplied a total of 1,600 tonnes of steel to Max Bögl – in the form, in particular, of special steels in large plate thicknesses and formats. Of this quantity, 169 tonnes were accounted for by longitudinally profiled plates of structural steels grades S355J2+N, S355N and S355NL for the tension ties. Primarily thermomechanically (TM) rolled steel, including more than 30 tonnes of heavy, extremely large-format plates of grade S460ML, was used for the longitudinal and transverse beams, the masthead plates and the non-variable-thickness components of the sails. The large formats of these TM plates made it possible to significantly reduce the number of welds necessary and, additionally, to save weight, thanks to the higher strength of this steel. At the same time, its low carbon equivalent assured excellent working properties, weldability and toughness, with the result that it contributed just as much to the safety of the design as to the cost-effectiveness of the project.

The critical masthead connection

A great challenge to design and production was presented by the fixing of the vertical masthead slabs, up to 250 millimetre in thickness and consisting of S460QL, to the masthead plates. Thanks to the pattern of forces flowing between the sails and the masts, the mastheads, to which the



The modelling illustrates the plate thickness distribution of the longitudinally joined groups of plates (Picture: Schlaich bergermann partner)

tension ties connect on both sides, were particularly critical points. Plate thickness and the high-strength fine-grained structural steel supplied by Dillinger necessitated not only agreement in individual cases but also special approval by German Railways, since the rail authority's codes and standards permitted only a maximum plate thickness of 100 millimetres. For the sbp experts it was therefore essential to prove the necessary fatigue strength of these heavily loaded welds by means, inter alia, of extensive structural and Charpy V-notch energy tests on finite-element volumetric models. For the circumferential butt weld completed low-notch on this basis, the large-format plates were firstly preheated to nearly 500° C and carefully protected against cooling throughout the complex welding process. In Philipp Wenger's view, the new Neckar Bridge is of exemplary character for modern steel-bridge engineering: "The combination of such high mechanical strength, thicknesses and shaping of the steels to boost properties for the same stress levels has never before occurred in this form." In his estimation "… comparable plates with thicknesses of up to 250 millimetres have never yet been used in such quantities and using such preparation and installation methods, even abroad." For Frank Schächner, too, the future-orientated advantages of the new knowledge gained for steel-bridge engineering are readily apparent: "Thanks to the selection of an efficient support structure, paired with the use of high-strength steels, the Neckar Bridge represents a new dimension in sustainability and cost-efficiency."

Dillinger

The masthead weld required sophisticated heat treatment (Picture: Max Bögl GmbH & Co. KG)

BMW Group to add new press shop at South Carolina plant, USA

BMW Group will invest more than $200 million to construct a 219,000 square foot press shop at its South Carolina plant.

The investment includes more than 200 new jobs. The new press shop, which will start production in the summer of 2024, will take raw coils of steel, cut them into blanks, and stamp sheet metal parts for BMW X models. Those components include hang-on parts such as the vehicle's four doors, fenders, exterior body sides, and lift gate.

A state-of-the-art press shop requires manufacturing jobs with advanced-level training. More than 45 Plant Spartanburg associates are currently training at BMW Group press shops in Leipzig, Germany, and Swindon, UK. These associates also train with partners from the Schuler Group, that manufactures automated servo press lines for all BMW Group plants.

Since 1992, the BMW Group has invested nearly $12 billion in its South Carolina factory. BMW Manufacturing is the largest BMW Group plant in the world, producing more than 1,500 vehicles each day and 433,810 vehicles in 2021, a record. The factory has an annual production capacity of up to 450,000 vehicles and employs more than 11,000 people.

BMW Group

ResponsibleSteel's Standard incorporated into CRU's Emissions Analysis Tool

ResponsibleSteel, the steel sector's first global multi-stakeholder certification and standard initiative, and CRU Group have signed a Memorandum of Understanding (MOU) which includes the integration of the ResponsibleSteel Standard into CRU's Emissions Analysis Tool.

The CRU Emissions Analysis Tool is a digital platform that compares emissions across global value chains. The tool compares asset level sustainability data which will now include acknowledgement that a

steel site has been audited and passes the rigorous standards laid out in ResponsibleSteel's certification programme.

The integration of ResponsibleSteel published information on ResponsibleSteel certification status into the CRU Tool will increase stakeholders understanding of sustainability efforts in the steel sector, allow comparability across the sector and along supply chains and provide transparency of where improvements are taking place.

CRU

thyssenkrupp Materials Services extends contracts of Executive Board members

The Supervisory Board of thyssenkrupp Materials Services resolved the early reappointment of Martin Stillger to the segment's Executive Board for another five years. In addition, the Board approved the extension of the contract of Daniel Wodera, Chief Financial Officer of thyssenkrupp Materials Services, by a further five years.

The appointments give the Executive Board a strong mandate for the strategic transformation path launched in 2019 with "Materials as a Service". By extending the mandates the Supervisory Board is sending a clear signal that they remain convinced of this path.

Martin Stillger, who has been Chairman of the Executive Board of Materials Services since 2019, has also been appointed Chief Executive Officer at the same time. Daniel Wodera joined the Executive Board as CFO in September 2019.

thyssenkrupp Materials Services

Coil transshipment 4.0

How “Asterix” and “Obelix” enhance delivery reliability

Responding to the growing demand for just-in-time logistics services, forwarding company Robert Schmitz has introduced a system that automatically picks the coils for the next day’s truck deliveries the night before. The beating heart of the new, recently commissioned coil store is the advanced technical warehouse management system developed by 3tn. This system unloads the wagons, optimizes coil storage, speeds up truck loading and assures on-time delivery, within a one hour time frame

Rail port operator Robert Schmitz, specializing in semi-finished steel coils, receives around 60 to 70 wagon loads of steel coils per day from European rolling mills. The coils are delivered by truck to steel processors within a radius of 50 to 100 kilometers from Hagen, Germany, the location of the rail port.

A new coil transshipment center was built on the Robert Schmitz premises to enable maximum automation of activities such as train unloading, coil storage and, most importantly, truck loading, enhancing the efficiency of the entire transshipment process. At the same time, optimal storage conditions were to be established for coils. Here, particular attention had to be paid to the fact that truck loading activities are not evenly distributed across the day. 20 to 25 trucks have to be loaded in an extremely short time during the morning rush hour in particular. After unloading the cargo at, let’s say, six in the morning at the destination, they are back between 7:30 and 8 a.m. to pick up the next load.

Automatic picking during the night

This is how the idea came about to pre-pick the coils the night before and place them close to the truck loading area so the cranes would only have to cover short distances in the morning. In addition, coil storage was to be optimized to the effect that, even though the coils are stored in up to three layers, the required coil can be accessed directly by the crane without any reshuffling. The ultimate goal was to employ automatic cranes that would speed up coil unloading, storage and picking. Automatic cranes unload the wagons much faster because they steer more accurately than operator-driven cranes. Another benefit is that no aisles have to be provided between the individual coil rows, maximizing the available storage space. Moreover, with operations being performed automatically, it is no longer necessary for any employees to enter the storage area. This saves time and improves safety. The only process that still cannot be completely handled without human operators is loading the coils onto the trucks, first, because every truck is different and, second, because a human operator has to check that the cargo is properly secured.

3tn had already implemented similar TWMS/metals projects at other steel companies. Whereas previous projects only

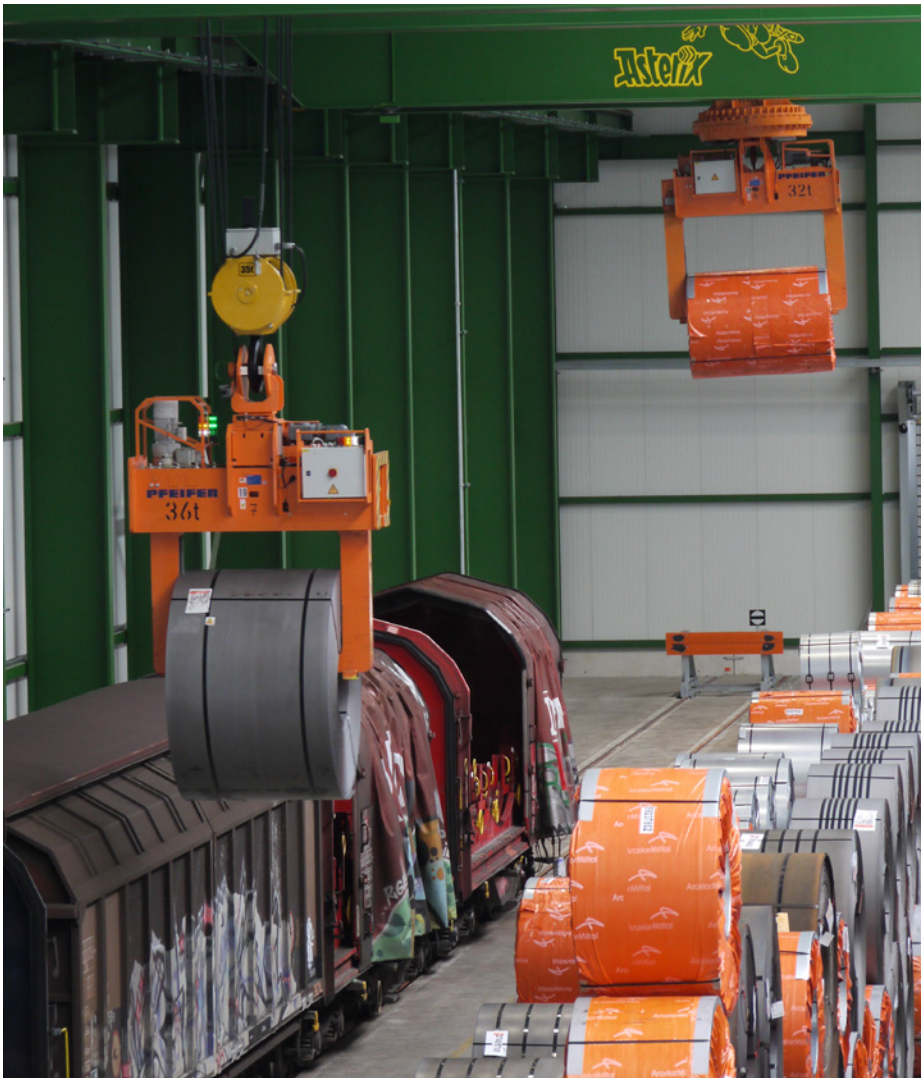
In the new coil logistics facility, TWMS/metals provides maximum automation of train unloading, coil storage and truck loading activities (Picture: 3tn)

Hans-Georg Schmitz, managing director, Robert Schmitz Spedition GmbH & Co. KG GmbH, Hagen, Germany; Thorsten Tönjes, managing director, 3tn Industriesoftware GmbH, Dortmund, Germany – Contact: toenjes@3tn.de

Wire rod forwarder for three generations

Robert Schmitz Spedition GmbH & Co. KG is a medium-sized, family-run company in Hagen, Germany. As a rail port with its own rail connection, over 200,000 m² of storage space and its own fleet of vehicles, the company, which was founded over 90 years ago and is run by the third generation of the Schmitz family, stores and transports wire rod, coils and slit strip with unit weights of up to 35 tons within a radius of 100 km from Hagen.
In addition to this, the 60 employees offer comprehensive IT solutions for transport and warehouse logistics between rolling mills and recipients, including with interfaces to warehouse management systems.
The logistics and forwarding company, which operates throughout Europe, usually unloads more than 250 wagons per week arriving from European rolling mills in block trains weighing up to 1,200 tons.

Robert Schmitz Spedition GmbH & Co. KG



While travelling along the train, Asterix measures the positions, widths and outside diameters of the coils using two 2D laser scanners (Picture: 3tn)

involved in-house wagons, in other words known wagons of more or less the same type, very different types of wagons from 15 European steelworks have to be dealt with at Schmitz. For the layout of the system, this meant that it would have to be able to handle a great number of wagon types and coils with different forms of packaging, code numbers and data structures. Another challenge was that the coil data received from the dispatchers via electronic channels is not always complete and information about the coil dimensions may be missing or wrong.

TMWS/metals technical warehouse management systems from 3tn are in operation at many rolling mills worldwide, including customers of Schmitz. 3tn proposed a solution to Schmitz specifically tailored to the functions performed at the rail port in Hagen. The system optimizes and controls the transport and storage operations, visualizing the current storage situation in realistic, intuitive real-time displays.

Two automatic cranes, each with a payload of 35 t, are in operation in the new coil handling area: Asterix – the faster and, because of its integrated laser gauge, smarter one of the two – and Obelix. They both receive their maneuvering orders from TWMS/metals.

Speedier unloading

When a train has arrived in the storage building, the wagon hoods are opened and Asterix starts travelling along the train measuring the positions, widths and outside diameters of the coils using two 2D laser scanners, generating an image of the position of each individual coil. The position and geometrical data transmitted by the laser gauge form the basis for the fully automatic unloading and storage of the coils. Asterix measures the weight of every coil it lifts up from a wagon. After the plausibility of the measured data has been checked, the coil is taken straight to the main store. In exceptional cases where the data is not plausible, the 3tn WMS sends the coil to an interim store area. These outliers are later reviewed by the operators. Were coils mixed up? Are the coil data incorrect? As soon as the situation has been clarified and the data corrected, the 3tn WMS triggers the automatic transfer of the coil into the main store.

When the first half of the train has been unloaded, the hoods are shifted to the other side. The coils that are then visible are also scanned by the crane. Then the cargo is checked visually. Are the coils properly packed? Are the coils damaged? Are the labels in place? Any signs of corrosion? Any ingress of water?

Optimal storage

TMWS/metals selects the most appropriate storage place for each individual coil considering the current situation in the store, storage restrictions and optimization criteria. Furthermore, the system selects the storage location for each coil with a view to how the loading process can be speeded up as much as possible: coils to be dispatched in just a few hours are placed near the loading zone without any interim storage, while others are taken to areas of the hall that are further away.

At the end of the workdays, the operators start the automated pre-picking processes. All coils scheduled to be shipped the next day are placed in the loading lane next to where the trucks will pull up for loading so they can be accessed directly. If no more space is available, the WMS places the respective coils on top of other coils nearby – as the last layer. This allows the trucks be loaded the next day without any reshuffling of coils.

Speedier loading

When the operators come to work the next morning, they find a 3D display of the storage area on the screens on the shop floor and in the control room. Coils to be shipped the same day are shown in regular blue, those to be shipped on the next day in dark blue. Those scheduled for the next three to five days are shown light blue.

As soon as the first trucks have left the hall, the coils to be shipped next are automatically moved closer to the loading lane. Coils to be shipped by rail are placed in a dedicated area near the tracks. Consequently, the cranes only have to cover very short distances during train loading, too.

As the trucks come in very different designs, automatic truck loading is not feasible with reasonable effort. Therefore, the cranes automatically take the coils dispatched for delivery by truck from the store to a transfer point. There, the manual remote control takes over on-the-fly and places the coil on the trucks.

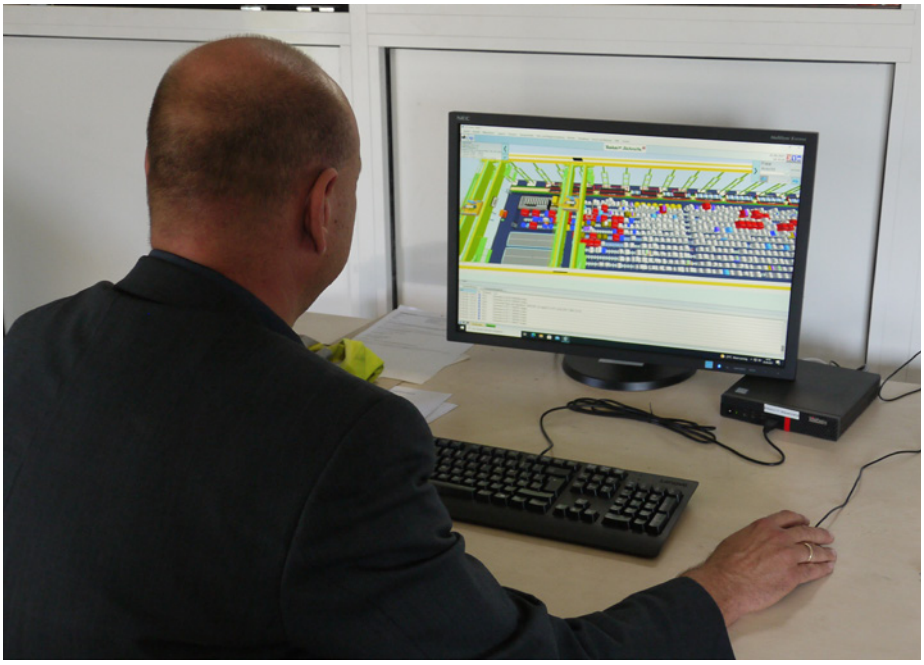
This on-the-fly change from automatic to manual remote-controlled operation provides the advantage that the crane does not have to be stopped. The same applies to the empty crane. The crane driver can drive straight into the warehouse; the automatic operation then takes over without any stop in between.

Harmonized software and hardware

The cranes provided by Schmitz are fitted with manual drive technology. 3tn and its automation subsidiary GIPA supplied all key components for the crane automation, developed the PLC software and commissioned the automation systems. Moreover, the floor-installed safety systems and the software for the floor PLC were also provided by 3tn and GIPA.

When the measuring technology was installed and the cranes were ready to go on stream, 3tn installed the software systems and commissioned them in close cooperation with the other companies involved – the crane manufacturer, the laser measuring system provider and the company responsible for establishing the data interfaces with the existing IT systems at Schmitz.

The new playback mode developed by 3tn facilitated the systems' run-in and learning phase: All crane movements were recorded during automatic operation at night. These recordings could later be replayed – at normal speed or in fast-forward – to quickly identify and eliminate causes of inefficient crane movements or unnecessary evasion maneuvers. This optimization was possible because both cranes use the same tracks and the travelling orders for the cranes are scheduled to be as efficient as possible by avoiding interference between the two.



The current situation in the coil store is displayed to the operator in 3D (Picture: 3tn)

After pre-picking, the coils called up for truck dispatch are stored right by the trucks (Picture: 3tn)

Bottom line

The new system is an important technological milestone in the history of the Schmitz company. The system has been working very dependably since the first day after the parameterization, accelerating processes in the new storage and dispatch area and enhancing delivery reliability.

The automatic unloading of wagons and the storage and picking of coils by the automated cranes saves a lot of time compared to manual crane operation. By optimizing the coil placement in the store, the number of crane movements and the associated risk of coil damage have been greatly reduced. The operating team has a clear view of the storage status at all times.

While two employees would usually take three to four hours to pre-pick the coils for shipments the next day, the new system performs this task fully automatically. When the workday ends at 5 p.m. it starts picking the coils from the store and placing them in the correct order in and near the loading area.

In the morning, when the next shift starts, all of the coils are optimally positioned for the truck loading process. Loading is much faster than before, even during the busiest hours, and waiting times are minimal. Consequently, Schmitz is generally able to deliver the coils within a time tolerance of just one hour.

Dispatch and storage activities have become much easier and much safer in the new hall: The risk of a crane picking the wrong coil is essentially completely ruled out as the automated material tracking system also controls the manual coil moves. Time-consuming searches for coils have become a thing of the past because, now, the current storage status is known exactly at all times.

Safety has also been taken to a new level during the unloading, storage and removal of coils, primarily because no human operator needs to access the actual coil store.

The future

Transporting coils on trucks over longer distances is expected to become increasingly complicated. The approval processes are very complex already, especially for coils weighing 25 tons or more. Therefore, rolling mills will increasingly use train transport and facilities like rail ports. This means that trucks will primarily be used to cover the "last mile".

This will make transport by train to rail ports near the steel processors' facilities increasingly more attractive for steel logistics and, last but not least, support the shift of cargo transport from road to rail. A challenge Schmitz is already well positioned to meet with its new automatic storage facility.

3tn Industriesoftware GmbH

Material handling

Launch of Combilift's new XLE model

In line with the growing demand for electric powered equipment, this multidirectional forklift with up to 5-ton lift capacity, combines emission-free operation with powerful performance for a wide range of industries and applications

Irish materials handling specialist Combilift has officially launched its latest product, the Combi-XLE, as a further addition to its impressive range of electric models.

The original engine powered XL C-Series model was developed to address the requirements of tough working environments such as those in the timber, concrete and steel sectors. The new Combi-XLE incorporates the same key design features as its earlier counterpart such as high ground clearance, large cushioned front and rear tyres and a spacious cab, allowing smooth operation on semi rough terrain whilst offering a high level of driver comfort.

With sustainability ever higher on the agenda, Combilift further helps its customers achieve their environmental goals with its versatile "3 forklifts in 1" models, which work inside and out, reducing fleet size and thereby their carbon footprint. A hallmark of all Combilift products is the ability to increase storage capacity without expanding the size of a facility, resulting in lower energy usage and associated costs such as heating, lighting and maintenance, which is of significant benefit to the environment and the workforce. Noise pollution and carbon emissions, which can impact on the health and well-being of people as well as wildlife, is also no longer an issue thanks to electric power. Drivers, employees and visitors on site appreciate the quiet operation, as do neighbouring residents and businesses, particularly in urban areas.

The Combi-XLE incorporates up-to-the-minute technology such as the patented all-wheel traction that reduces tyre wear, load swing and enhances braking. Also included is a newly developed, patented Eco-Steer System which provides a smaller turning radius and improved user experience. Since Electric powered trucks do not have traditional combustion engines, or hydraulic transmissions, there is no longer any need to check and top up engine fluids / lubricants, resulting in longer intervals between services, ultimately saving costs. The use of toughened, eco-friendly water-based paint also dramatically reduces the amount of Volatile Organic Compounds (VOCs) during build.

3 forklifts in 1 – counterbalance, side loader, reach truck – and AC electric powered, too
(Picture: Combilift)

"The technology we have incorporated into the Combi-XLE means that its performance is equally on a par with diesel or LPG powered forklifts when it comes to handling very bulky and heavy loads, whilst of course offering a greener operation," said Combilift CEO and Co-Founder Martin McVicar. "We made our first electric C-Series over 18yrs ago, and now over 60% of the trucks we manufacture are electric, with availability in almost all models across our range. As more and more of our customers are opting for electric power it is obvious that they are as committed to sustainability and a circular economy as we are."

At Combilift's own manufacturing facility, features such as daylighting technology - LED lights with individual PIR sensors, solar panel energy and rainwater harvesting are all aimed at conserving natural resources and decreasing energy consumption. 92% of all components used in the truck assembly are 100% recyclable and the company is also on track to save over 473 tons of CO_2 by using carbon neutral wood chip instead of gas for heating within the factory.

Combilift

At the company's headquarters, an automated storage system ensures the fast and efficient storage and retrieval of steel products up to six metres long (Picture: KASTO)

All storage areas at a glance with a single click

SchwarzwaldEisen relies on mobile warehouse management

Manage and operate automatic and manual storage areas with a single system – at SchwarzwaldEisen this is reality. Two KASTO solutions make this possible: the warehouse management system, KASTOlogic, and the intelligent app, KASTOlogic mobile. These two solutions enable the German steel distributor to simplify and accelerate its processes, minimise the error rate and track all batches seamlessly

With the motto "We love steel", Schwarzwald-Eisenhandel GmbH & Co.KG – abbreviated as SchwarzwaldEisen – has evolved into the leading steel distributor in Baden, Germany. The roots of the fourth-generation family-operated company date back to 1870. Since 1966, the headquarters is located in Lahr; SchwarzwaldEisen has other facilities in Freiburg in Breisgau, Bad Säckingen and Karlsruhe. With subsidiaries in Baden-Württemberg, Rhineland-Palatinate and Switzerland, the specialist is active at a cross-regional level and continues to expand with new locations. The group turns over approximately 120,000 tonnes of material per year.

"We focus firmly on organic growth and a decentralised organisation," explains Steffen Marco Auer, who manages the activities of SchwarzwaldEisen together with his brother Ingo Auer and Alexander Hatt as the managing directors. "Instead of operating one major facility, we have several regionally active sites that are close to the customer, enabling fast and flexible deliveries." Efficient communication between the individual regional locations and well-organised logistics are essential requirements for the operation of such a network. "That is why we try to structure all subsidiaries according to a similar principle to utilise proven processes, to use technologies across all sites, and to standardise interfaces while keeping them at a minimum," continues Auer.

> "With this system, we can flexibly manage both, the automated bar stock storage system and our manually operated metal sheet storage, too."
>
> *Steffen Marco Auer, one of the two managing directors at SchwarzwaldEisen*

This approach is also evident in the storage technology. SchwarzwaldEisen puts its trust in KASTO Maschinenbau GmbH & Co. KG as the preferred partner in this area. For about eight years at the headquarters in Lahr, an automatic bar stock storage system from the UNICOMPACT 3.0 series provides quick and efficient storage and removal of sections, tubes and bar materials, which are up to six metres in length. SchwarzwaldEisen offers its customers a range of goods consisting of around 10,000 products, mainly construction steel, stainless steel, and aluminium. "Approx. 70 to 80 per cent of the orders for sectional steel are semi-processed" reported Managing Director, Auer. It is prepared according to the customer specifica-

tions using in-house machinery in Freiburg and then dispatched. For bar stock with a length of up to 6 metres, the KASTO system supplies the product needed using an operating gantry crane (OGC) with short access times based on the principle "materials to operator" at one of two removal stations. However, the company stores metal sheets in a separate, manually operated storage area.

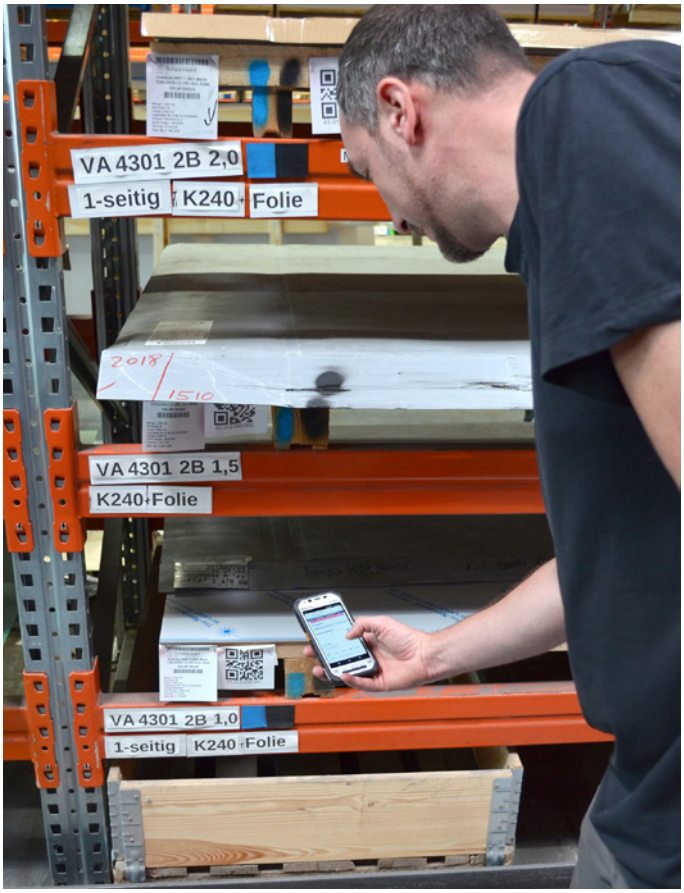
Steffen Auer outlines the challenges by stating, "Our customers expect us to provide fast, error-free and trackable deliveries". "To ensure this, we depend on a simple, clear and reliable control system for our entire material flow." SchwarzwaldEisen relies on the goods management system (GMS), eNVenta used across all of its sites. The storage system in Lahr is linked to it via an interface created specifically for this purpose – the same as two other automatic KASTO storage systems in the sites at Karlsruhe and Westerwald. "This ensures a standardised order management and a high level of inventory transparency," explains Auer. The GMS transfers the respective order data electronically to the warehouse management system, KASTOlogic, which then triggers the removal of the required products at the respective site. All processes can be tracked seamlessly, operational and assignment errors can be virtually eliminated.

Manual storage was prone to errors

In the past, the manually and paper-managed metal sheet warehouses looked quite different recalls Auer: "Due to the broad product range, mix-ups occurred, for example, employees removed the wrong sheets or incorrect quantities – and in the end, the customer did not always receive what was ordered." It was not always easy to locate the required goods in the long rows of shelves. Therefore, those responsible at SchwarzwaldEisen searched for a possibility to integrate these storage areas into the intelligent electronic control system. "To achieve this goal, we compared two competitors, and quickly selected KASTO," stated Auer. This decision was not based solely on the proximity to the specialists for sawing and storage technology with headquarters located just a few kilometres away from Achern. "Of course, it is an advantage to collaborate with partners in the region, who can be onsite quickly if needed," the Managing Director emphasised. "However, KASTO's extensive technical competence and willingness to provide a solution tailored to our particular situation was equally important to us."

Together with the steel distributor, the KASTO experts thoroughly assessed the conditions onsite and in the entire company and developed a solution to display all storage areas in a standardised and consistent control system. One of the tools used was KASTOlogic mobile, a platform-independent and mobile version of KASTOlogic. The software makes it possible to use the essential functions of the warehouse management system on mobile devices such as tablets and smartphones – independent from permanently installed operator panels which are available in the automatic storage system, UNICOMPACT. "For instance, with this system, we can flexibly manage the bar stock

Steffen Marco Auer, one of the two managing directors at SchwarzwaldEisen, is convinced the company will reap long-lasting benefits (Picture: KASTO)



Workers can scan the QR or barcode at the shelves to confirm the removal or trigger a follow-up order (Picture: KASTO)

Mobile devices can be used to get access to the order and product data at any time (Picture: KASTO)

storage system regardless of the location," Steffen Auer explains. "But more importantly: We are now able to manage our manually operated metal sheet storage with KASTOlogic."

Order and product data always within reach

Thanks to KASTOlogic mobile, the warehouse employees have access to the order and product data at any time. When removing the sheets, the system directs the user to the respective storage location and specifies the required quantity. The shelves are equipped with QR and barcodes. For instance, when the users scan them with the mobile device, they can confirm the removal or trigger a follow-up order if the inventory is getting low. All information is available both in the warehouse management and the goods management system – customised interfaces make this possible. Auer summarises by saying, "The result is a standardised, controllable, and seamless, transparent material flow." "We have fewer errors when picking the orders, we can work faster and more efficiently, and individual batches can be followed up and tracked seamlessly."

With the new warehouse management concept, KASTO proved itself to be both a machine supplier and a solutions provider. "KASTO provided us a customised, software-based system that works completely independently from the existing storage systems and can be scaled for other sites as needed – a remarkable achievement," Auer stated. The concept is impressive in every aspect – so impressive that SchwarzwaldEisen wants to implement it at its other sites as well. "As stated, we try wherever possible, to simplify and standardise processes and avoid unnecessary interfaces," Auer says. "It helps us to become even more efficient and transparent across all sites." If an ordered product is not in stock at a specific facility, it is found in the system quickly and can be delivered to another site when necessary. "Ultimately, we are not the only ones who benefit from this organisation; above all, our customers profit from it – that is the main thing for us," exclaims the Managing Director.

The service is also impressive

Another benefit of the KASTO system for those responsible at SchwarzwaldEisen is the high degree of availability. "Both the storage system and the control system can be serviced remotely. If needed, KASTO can access the software and clear malfunctions quickly and easily at any time." Thanks to the proximity, the service experts can be onsite at short notice – "an additional bonus that not every manufacturer can provide," Auer finds. In addition to the impressive technology and the attractive price-performance ratio, the excellent partnership with KASTO was a pivotal factor to continue along the path embarked on together. "We are extremely satisfied with the collaboration and certain that both companies will reap long-lasting benefits."

KASTO Maschinenbau

Coils weighing up to 25 t are fed automatically at the entry section of the line (Picture: Knauf Interfer)

New blank cutting line brought on stream at Knauf Interfer

State-of-the-art manufacturing embedded at a sustainable and trimodal logistics hub

Lightweight construction and electromobility are driving the development of increasingly complex car components featuring high strength levels and optimum crash behaviour. As a result, the requirements concerning the manufacturing of primary products have significantly increased. In parallel, the CO_2 footprint of the entire supply chain has increasingly come into focus. The Knauf Interfer Group commissioned a new blank cutting line at its Duisburg site – one of the most prominent logistics locations in Europe

Knauf Interfer Automotive Blanks GmbH produces engineered semi-finished products amounting to approximately 45,000 t per year for industrial customers as well as for the leading manufacturers and Tier 1 suppliers of the automotive industry. All standard alloys and grades, including ultra-high-strength steels, are processed – essential building blocks with regard to lightweight construction, which, in turn, is a prerequisite for weight-reduced vehicles that consume less fuel and, as a result, emit less CO2. They are primarily used to produce structural and crash components that are used, for example, in the side impact protection elements of electric vehicles, A and B pillars, and other structures used in vehicle construction. Cutting is carried out via a modern machine fleet, which was expanded in 2020 to include one of the largest blank cutting systems in Germany. The planning and execution of the system was carried out by Knauf Interfer itself, with the support of automation experts, and took less than a year – despite pandemic-related restrictions.

Strong, yet flexible

The line, which went into operation a few months ago, is the central production unit of the plant located in the heart of the Port of Duisburg. The core machine is a state-of-the-art high-performance press that boasts

The line's core unit: a high-performance blanking press with capacity of 1,300 t (Picture: Knauf Interfer)

a pressing force of 1,300 metric tons. The machine is characterized by its extraordinary dimensions and its high degree of flexibility. As a result, particularly large tools and workpieces can also be accommodated. The machine can accommodate coils of up to 25 tons and with widths between 300 and 1,600 millimetres. Precise positioning also allows for the technically difficult processing of discontinuously rolled sheet metals that are used in the production of weight-optimized components. While the company's own tools are used, tools provided by customers are also utilized, for example, in contract manufacturing in order to alleviate capacity bottlenecks. Contour, shape, and curve blanks as well as trapeziums and parallelograms that have angles between +30° and -30° can be produced, even when using ultra-high-strength steels that are thicker than 2 millimetres – ideal for the future strength requirements of structural components. The periphery, which also includes a high-performance straightening system capable of straightening steels of up to 1,900 MPa, is also of corresponding dimensions.

The entire process is fully automated, from the intake of the raw material and the stacking of the finished blanks to the deposit. Nesting is also computer-assisted and optimized on the basis of CAD data. As a result, the arrangement of the pieces significantly reduces the amount of scrap, which is also made available in a fully automated manner for high raw material utilization during the course of the production process.

Integrated manufacturing and supply chain

Not only does the blanking line serve as a technical highlight, it is also the linchpin of a multistage value-adding process. Depending on customer requirements, the process ranges from component development and design to toolmaking, material procurement, and production to delivery. In terms of material procurement, customers benefit from the physical proximity to the stocked steel service centres and the cold rolling mill of the Knauf Interfer Group. In addition, primary materials are procured directly on a trimodal basis and can be stored or temporarily stored on site in Duisburg at capacities of 50,000 metric tons.

With regard to logistics, the geographical advantages of the trimodal location come into play. Logistical pre-carriage and onward carriage can be carried out via barge, truck, or rail. Thanks to its location in Europe's largest inland port, in addition to its proximity to three rail routes and direct motorway access, the site is ideally situated to supply primary materials and subsequently deliver the semi-finished products to their destinations via the shortest possible routes and with the lowest possible CO_2 footprint. Its proximity to the major European steel producers and processors, its direct location in the most prominent import ports of the EU, as well as its position at the end of the new Silk Road reduce logistics-related CO_2 emissions to the lowest possible levels. By the same token, the costs associated with the transportation of primary materials are extremely low, which is not only good for the environment, but also reduces up-front costs. In addition, thanks to nesting, even small amounts of scrap can be directly reintroduced into the raw material cycle by means of the "scrap island" on the opposite side of the site, without the need for lengthy transport routes.

"Due to its characteristic recyclability and its use in lightweight construction, steel, as a material, makes a valuable contribution to reducing mobility-related CO_2 emissions," says Dr. René Gissinger, COO/CTO of the Knauf Interfer Group. "As such, the upstream and downstream production stages and transport must also be taken into account in the overall consideration. The trimodal logistics available at our site enable us to choose the optimal route for each supplier and customer," he adds.

Additional milestone in the automation and digitalization strategy

Thanks to its high level of automation, the blank cutting system is suitable for 3-shift operation. Not only does the system represent efficiency and cost-effectiveness, but it also ensures the highest level of precision and quality. "The successful implementation of this system marks another milestone in the Knauf Interfer Group's company-wide automation and efficiency strategy," says Gissinger, "through which we will continue to pursue the path to becoming a digital supply chain manager in our role as a multi-material processing company."

Knauf Interfer Group

STEEL SUPPLIERS INTERNATIONAL

SUPPLIER FOR THE INTERNATIONAL STEEL INDUSTRY FROM A TO Z

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

01 Raw materials, auxiliary materials and operating materials

01.05 Metals and alloys

380 Alloys

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

02 Raw material pretreatment

02.04 Pelletising plants

797 Conveying plants for pellets

AUMUND Fördertechnik GmbH
Saalhoffer Str. 17
47495 Rheinberg, Germany
☎ +49 2843 720
E-Mail: metallurgy@aumund.de
Internet: www.aumund.com

02.05 Sintering plants

822 Sinter hot material conveyors

AUMUND Fördertechnik GmbH
Saalhoffer Str. 17
47495 Rheinberg, Germany
☎ +49 2843 720
E-Mail: metallurgy@aumund.de
Internet: www.aumund.com

03 Iron making

03.01 Blast furnaces

1150 Heat recovery systems

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

03.02 Direct reduction plants

1160 Direct reduction plants

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

1172 DRI hot material conveyor

AUMUND Fördertechnik GmbH
Saalhoffer Str. 17
47495 Rheinberg, Germany
☎ +49 2843 720
E-Mail: metallurgy@aumund.de
Internet: www.aumund.com

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

04 Steelmaking

1668 Equipment for steelmaking plants

DANGO & DIENENTHAL Group
Hagener Str. 103
57072 Siegen, Germany
☎ +49 271 401-0
E-Mail: contact@dango-dienenthal.de
Internet: www.dango-dienenthal.de

GUILD International
7273 Division Street
Bedford, OH 44146, USA
☎ +1 440-232-5887
E-Mail: sales@guildint.com

1670 Engineering and technical assistance

WEEBOTEC GmbH
Lingenstr. 12-14
45472 Mülheim an der Ruhr, Germany
☎ +49 208 49538-700
🖷 +49 208 49538-799
E-Mail: info@weebotec.de
Internet: www.weebotec.de

1698 Steel mill plants and equipment

WEEBOTEC GmbH
Lingenstr. 12-14
45472 Mülheim an der Ruhr, Germany
☎ +49 208 49538-700
🖷 +49 208 49538-799
E-Mail: info@weebotec.de
Internet: www.weebotec.de

1699 Steel mill equipment

DANGO & DIENENTHAL Group
Hagener Str. 103
57072 Siegen, Germany
☎ +49 271 401-0
E-Mail: contact@dango-dienenthal.de
Internet: www.dango-dienenthal.de

04.04 Electric steel plant

1875 Electric arc ladle furnaces

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

04.07 Secondary metallurgy

2028 Equipment for chemical heating

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

2030 Argon purging equipment

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

2080 Ladle metallurgical plants

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

2110 Secondary metallurgical plants

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

2120 Steel degassing plants

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

2130 Steel desulfurization plants

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

2140 T+P lance equipment

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

04.08 Tertiary metallurgy

2144 Vacuum degassing equipment

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

04.09 Components

2150 Deslagging machines

DANGO & DIENENTHAL Group
Hagener Str. 103
57072 Siegen, Germany
☎ +49 271 401-0
E-Mail: contact@dango-dienenthal.de
Internet: www.dango-dienenthal.de

2175 Burning machines for ladles

WEEBOTEC GmbH
Lingenstr. 12-14
45472 Mülheim an der Ruhr, Germany
☎ +49 208 49538-700
🖷 +49 208 49538-799
E-Mail: info@weebotec.de
Internet: www.weebotec.de

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

DANGO & DIENENTHAL Group
Hagener Str. 103
57072 Siegen, Germany
☎ +49 271 401-0
E-Mail: contact@dango-dienenthal.de
Internet: www.dango-dienenthal.de

2230 Charging machines (trough and tongs)

DANGO & DIENENTHAL
BETTER VALUES.

DANGO & DIENENTHAL Group
Hagener Str. 103
57072 Siegen, Germany
☎ +49 271 401-0
E-Mail: contact@dango-dienenthal.de
Internet: www.dango-dienenthal.de

04.09 Components

2580 Oxygen nozzles

tenova
LOI THERMPROCESS

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

04.10 Steel works materials

2735 EBT taphole plugging compound

WEEBOTEC

WEEBOTEC GmbH
Lingenstr. 12-14
45472 Mülheim an der Ruhr, Germany
☎ +49 208 49538-700
🖷 +49 208 49538-799
E-Mail: info@weebotec.de
Internet: www.weebotec.de

2880 Ladle slide sand

WEEBOTEC

WEEBOTEC GmbH
Lingenstr. 12-14
45472 Mülheim an der Ruhr, Germany
☎ +49 208 49538-700
🖷 +49 208 49538-799
E-Mail: info@weebotec.de
Internet: www.weebotec.de

07 Hot rolling

07.05 Bar and wire rod mills

3940 Reducing and calibrating mills

KOCKS
Know-how for tomorrow

Friedrich KOCKS GmbH & Co. KG
Neustraße 3
40721 Hilden, Germany
E-Mail: sales@kocks.de
Internet: www.kocks.de

3944 Reducing and sizing mills

KOCKS
Know-how for tomorrow

Friedrich KOCKS GmbH & Co. KG
Neustraße 3
40721 Hilden, Germany
E-Mail: sales@kocks.de
Internet: www.kocks.de

3950 Bar and wire rod mills

KOCKS
Know-how for tomorrow

Friedrich KOCKS GmbH & Co. KG
Neustraße 3
40721 Hilden, Germany
E-Mail: sales@kocks.de
Internet: www.kocks.de

3960 Bar mills

KOCKS
Know-how for tomorrow

Friedrich KOCKS GmbH & Co. KG
Neustraße 3
40721 Hilden, Germany
E-Mail: sales@kocks.de
Internet: www.kocks.de

3970 Rolling mills for long products

KOCKS
Know-how for tomorrow

Friedrich KOCKS GmbH & Co. KG
Neustraße 3
40721 Hilden, Germany
E-Mail: sales@kocks.de
Internet: www.kocks.de

07.10 Components

4430 Decoilers and rewinders

GUILD
INTERNATIONAL
World Leader in Coil Processing Equipment

GUILD International
7273 Division Street
Bedford, OH 44146, USA
☎ +1 440-232-5887
E-Mail: sales@guildint.com

08 Forging, extrusion

08.03 Components

5150 Forging manipulators

DANGO & DIENENTHAL
BETTER VALUES.

DANGO & DIENENTHAL Group
Hagener Str. 103
57072 Siegen, Germany
☎ +49 271 401-0
E-Mail: contact@dango-dienenthal.de
Internet: www.dango-dienenthal.de

GLAMA
Maschinenbau GmbH

Glama Maschinenbau GmbH
Hornstr. 19
45964 Gladbeck, Germany
☎ +49 2043 9738-0
🖷 +49 2043 47268
Internet: www.glama.de

5155 Forging manipulators, rail-mounted

DANGO & DIENENTHAL
BETTER VALUES.

DANGO & DIENENTHAL Group
Hagener Str. 103
57072 Siegen, Germany
☎ +49 271 401-0
E-Mail: contact@dango-dienenthal.de
Internet: www.dango-dienenthal.de

Glama Maschinenbau GmbH
Hornstr. 19
45964 Gladbeck, Germany
☎ +49 2043 9738-0
🖷 +49 2043 47268
Internet: www.glama.de

5160 Forging robots

DANGO & DIENENTHAL Group
Hagener Str. 103
57072 Siegen, Germany
☎ +49 271 401-0
E-Mail: contact@dango-dienenthal.de
Internet: www.dango-dienenthal.de

Glama Maschinenbau GmbH
Hornstr. 19
45964 Gladbeck, Germany
☎ +49 2043 9738-0
🖷 +49 2043 47268
Internet: www.glama.de

5180 Transport manipulators

DANGO & DIENENTHAL Group
Hagener Str. 103
57072 Siegen, Germany
☎ +49 271 401-0
E-Mail: contact@dango-dienenthal.de
Internet: www.dango-dienenthal.de

10 Cold rolling

10.01 Cold rolling mills

5490 Strip, sheet, cold and metal rolling mills

hpl-Neugnadenfelder Maschinenfabrik GmbH
Spangenbergstr. 20
49824 Ringe/Neugnadenfeld, Germany
☎ +49 5944 9301-0
E-Mail: info@hpl-group.de
Internet: www.hpl-group.de

10.04 Annealing lines

5670 Annealing lines

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

11 Surface treatment

11.04 Surface treatment plants

6270 Strip edge trimming

hpl-Neugnadenfelder Maschinenfabrik GmbH
Spangenbergstr. 20
49824 Ringe/Neugnadenfeld, Germany
☎ +49 5944 9301-0
E-Mail: info@hpl-group.de
Internet: www.hpl-group.de

6280 Strip processing and finishing lines

hpl-Neugnadenfelder Maschinenfabrik GmbH
Spangenbergstr. 20
49824 Ringe/Neugnadenfeld, Germany
☎ +49 5944 9301-0
E-Mail: info@hpl-group.de
Internet: www.hpl-group.de

6390 Shot peening

AGTOS Gesellschaft für technische Oberflächensysteme mbH
Gutenbergstr. 14
48282 Emsdetten, Germany
☎ +49 2572 96026-0
🖷 +49 2572 96026-111
E-Mail: info@agtos.de
Internet: www.agtos.de

6565 Blasting plants

AGTOS Gesellschaft für technische Oberflächensysteme mbH
Gutenbergstr. 14
48282 Emsdetten, Germany
☎ +49 2572 96026-0
🖷 +49 2572 96026-111
E-Mail: info@agtos.de
Internet: www.agtos.de

11.05 Aluminizing, tin plating, galvanizing

6630 Hot dip galvanizing lines

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

13 Production of tubes / pipes

13.01 Tube rolling mills

7360 Pipe rolling mills with planetary cross rolling mill

Friedrich KOCKS GmbH & Co. KG
Neustraße 3
40721 Hilden, Germany
E-Mail: sales@kocks.de
Internet: www.kocks.de

7390 Stretch-reducing mills

Friedrich KOCKS GmbH & Co. KG
Neustraße 3
40721 Hilden, Germany
E-Mail: sales@kocks.de
Internet: www.kocks.de

13.04 Finishing lines for tubes

7520 Tube bending machines

DANGO & DIENENTHAL Group
Hagener Str. 103
57072 Siegen, Germany
☎ +49 271 401-0
E-Mail: contact@dango-dienenthal.de
Internet: www.dango-dienenthal.de

7544 Tube straightening machines

DANGO & DIENENTHAL Group
Hagener Str. 103
57072 Siegen, Germany
☎ +49 271 401-0
E-Mail: contact@dango-dienenthal.de
Internet: www.dango-dienenthal.de

14 Sheet metal processing

14.03 Welding technology

8120 Strip welding machines

GUILD International
7273 Division Street
Bedford, OH 44146, USA
☎ +1 440-232-5887
E-Mail: sales@guildint.com

8205 Laser welding machines

GUILD International
7273 Division Street
Bedford, OH 44146, USA
☎ +1 440-232-5887
E-Mail: sales@guildint.com

8210 Laser beam welding machines

GUILD International
7273 Division Street
Bedford, OH 44146, USA
☎ +1 440-232-5887
E-Mail: sales@guildint.com

8220 MIG, MAG and TIG \ 057TIG welding torches

GUILD International
7273 Division Street
Bedford, OH 44146, USA
☎ +1 440-232-5887
E-Mail: sales@guildint.com

8257 Rolling seam resistance welding equipment

GUILD International
7273 Division Street
Bedford, OH 44146, USA
☎ +1 440-232-5887
E-Mail: sales@guildint.com

8330 Welding machines, general

GUILD International
7273 Division Street
Bedford, OH 44146, USA
☎ +1 440-232-5887
E-Mail: sales@guildint.com

8360 Welding accessories, general

GUILD International
7273 Division Street
Bedford, OH 44146, USA
☎ +1 440-232-5887
E-Mail: sales@guildint.com

8380 Butt welding machines, electric

GUILD International
7273 Division Street
Bedford, OH 44146, USA
☎ +1 440-232-5887
E-Mail: sales@guildint.com

8400 Resistance welding equipment

GUILD International
7273 Division Street
Bedford, OH 44146, USA
☎ +1 440-232-5887
E-Mail: sales@guildint.com

16 Furnace and energy technology

10170 Furnace optimization (conversion to low NOx combustion)

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

WS Wärmeprozesstechnik GmbH
Dornierstr. 14
71272 Renningen, Germany
☎ +49 7159 1632-0
🖷 +49 7159 2738
E-Mail: ws@flox.com
Internet: www.flox.com

10190 Rational use of energy

WS Wärmeprozesstechnik GmbH
Dornierstr. 14
71272 Renningen, Germany
☎ +49 7159 1632-0
🖷 +49 7159 2738
E-Mail: ws@flox.com
Internet: www.flox.com

16.02 Forging furnaces

10230 Forging furnaces

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

16.03 Roller Hearth Continuous Furnaces

10260 Roller Hearth Continuous Furnaces

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

10270 Roller hearth and walking beam furnaces

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

16.05 Top-hat furnaces

10310 Top-hat furnaces

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

16.07 Hardening and tempering equipment

10355 Carburizing furnaces

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

16.08 Heating furnaces and heat treatment plants

10408 Continuous furnaces

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

10410 Co-step furnaces

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

10430 Bogie hearth furnaces

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

10460 Chamber furnaces

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

10510 Roller hearth and walking beam furnaces

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

10540 Pusher-type, roller and rotary hearth furnaces

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

10560 Heat treatment plants

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

10562 Heat treatment furnaces (continuous and discontinuous)

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

10570 Heat treatment furnaces for batch operation, open heated

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

16.09 Bath furnaces

10580 Aluminum melting furnaces

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

16.13 Components

10890 Natural gas burners

WS Wärmeprozesstechnik GmbH
Dornierstr. 14
71272 Renningen, Germany
☎ +49 7159 1632-0
🖷 +49 7159 2738
E-Mail: ws@flox.com
Internet: www.flox.com

11010 Regenerative burners

WS Wärmeprozesstechnik GmbH
Dornierstr. 14
71272 Renningen, Germany
☎ +49 7159 1632-0
🖷 +49 7159 2738
E-Mail: ws@flox.com
Internet: www.flox.com

11020 Recuperative burners

WS Wärmeprozesstechnik GmbH
Dornierstr. 14
71272 Renningen, Germany
☎ +49 7159 1632-0
🖷 +49 7159 2738
E-Mail: ws@flox.com
Internet: www.flox.com

11070 Radiant tube burners

WS Wärmeprozesstechnik GmbH
Dornierstr. 14
71272 Renningen, Germany
☎ +49 7159 1632-0
🖷 +49 7159 2738
E-Mail: ws@flox.com
Internet: www.flox.com

18 Machinery and plant engineering

12210 Plant engineering, general

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

18.06 Ventilation plants and equipment

12660 Air conditioners for heat plants

FrigorTec GmbH
Hummelau 1
88279 Amtzell, Germany
☎ +49 7520 914820
E-Mail: info@frigortec.com
Internet: www.frigortec.com

12670 Air conditioners for crane lances, crane bridges, etc.

FrigorTec GmbH
Hummelau 1
88279 Amtzell, Germany
☎ +49 7520 914820
E-Mail: info@frigortec.com
Internet: www.frigortec.com

18.10 Power and work machines

13160 Vacuum pumps

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

19 Transport and storage technique

14535 Hot material conveyors

AUMUND Fördertechnik GmbH
Saalhoffer Str. 17
47495 Rheinberg, Germany
☎ +49 2843 720
E-Mail: metallurgy@aumund.de
Internet: www.aumund.com

19.05 Continuous conveyors

14830 Conveyors (general)

AUMUND Fördertechnik GmbH
Saalhoffer Str. 17
47495 Rheinberg, Germany
☎ +49 2843 720
E-Mail: metallurgy@aumund.de
Internet: www.aumund.com

19.06 Cranes

14950 Cranes, hoists and accessories, general

WOKO Magnet- und Anlagenbau GmbH
Theodor-Heuss-Str. 57
47167 Duisburg, Germany
☎ +49 203 48275-0
🖷 +49 203 48275-25
E-Mail: woko@woko.de
Internet: www.woko.de

19.10 Components

15320 Electrical equipment for cranes etc.

WOKO Magnet- und Anlagenbau GmbH
Theodor-Heuss-Str. 57
47167 Duisburg, Germany
☎ +49 203 48275-0
🖷 +49 203 48275-25
E-Mail: woko@woko.de
Internet: www.woko.de

15490 Lifting magnets and equipment

WOKO Magnet- und Anlagenbau GmbH
Theodor-Heuss-Str. 57
47167 Duisburg, Germany
☎ +49 203 48275-0
🖷 +49 203 48275-25
E-Mail: woko@woko.de
Internet: www.woko.de

20 Electrical engineering and automation

20.02 Control and automation systems

16040 Automation systems for hot rolling mills and tube mills

Friedrich KOCKS GmbH & Co. KG
Neustraße 3
40721 Hilden, Germany
E-Mail: sales@kocks.de
Internet: www.kocks.de

16041 Automation systems for hot rolling mills

Friedrich KOCKS GmbH & Co. KG
Neustraße 3
40721 Hilden, Germany
E-Mail: sales@kocks.de
Internet: www.kocks.de

21 Measuring and testing technique

21.02 Measurement of physical properties

16850 Infrared switch

KELLER HCW GMBH
Carl-Keller-Str. 2 - 10
49479 Ibbenbüren, Germany
☎ +49 5451 85-0
🖷 +49 5451 85-310
Internet: www.keller.de

16860 Infrared radiation pyrometer

KELLER HCW GMBH
Carl-Keller-Str. 2 - 10
49479 Ibbenbüren, Germany
☎ +49 5451 85-0
🖷 +49 5451 85-310
Internet: www.keller.de

16871 Infrared Radiation Thermometer

KELLER HCW GMBH
Carl-Keller-Str. 2 - 10
49479 Ibbenbüren, Germany
☎ +49 5451 85-0
🖷 +49 5451 85-310
Internet: www.keller.de

16879 Cast iron temperature measurement

KELLER HCW GMBH
Carl-Keller-Str. 2 - 10
49479 Ibbenbüren, Germany
☎ +49 5451 85-0
🖷 +49 5451 85-310
Internet: www.keller.de

17060 Profile measuring systems (non-contact)

Friedrich KOCKS GmbH & Co. KG
Neustraße 3
40721 Hilden, Germany
E-Mail: sales@kocks.de
Internet: www.kocks.de

17080 Pyrometer

KELLER HCW GMBH
Carl-Keller-Str. 2 - 10
49479 Ibbenbüren, Germany
☎ +49 5451 85-0
🖷 +49 5451 85-310
Internet: www.keller.de

17100 Ratio pyrometer

KELLER HCW GMBH
Carl-Keller-Str. 2 - 10
49479 Ibbenbüren, Germany
☎ +49 5451 85-0
🖷 +49 5451 85-310
Internet: www.keller.de

17300 Rolling mill measuring systems

Friedrich KOCKS GmbH & Co. KG
Neustraße 3
40721 Hilden, Germany
E-Mail: sales@kocks.de
Internet: www.kocks.de

17325 2-color pyrometer with fiber optics

KELLER HCW GMBH
Carl-Keller-Str. 2 - 10
49479 Ibbenbüren, Germany
☎ +49 5451 85-0
🖷 +49 5451 85-310
Internet: www.keller.de

21.03 Quality management

17410 Surface inspection

Friedrich KOCKS GmbH & Co. KG
Neustraße 3
40721 Hilden, Germany
E-Mail: sales@kocks.de
Internet: www.kocks.de

24 Environmental protection and disposal

24.01 Dedusting and gas cleaning

18360 Exhaust gas cooling systems

LOI Thermprocess GmbH
Schifferstraße 80
47059 Duisburg, Germany
☎ +49 203 80398-900
🖷 +49 203 80398-901
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

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

19.11. Operating materials

15660 Lubricants

19.12. Packaging technology

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

20 Electrical engineering and automation

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

20.01. Electrical equipment for metallurgical plants and rolling mills

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

20.02. Control and automation systems

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

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

20.03. Data processing

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

20.04. Software

16390 Simulation software
16393 Software for archiving, document management and workflow
16395 Software for order processing, warehouse and test certificate management
16400 Application software
16410 Software for slitting lines
16415 Enterprise resource planning system for metal and steel trade
16420 Software for production planning and control
16430 Software for statistical process control and quality assurance
16440 Technical calculation programs

20.05. Maintenance

16450 Machine diagnostics
16460 Maintenance and inspection

21 Measuring and testing technique

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

21.01. Measuring and testing technology, general

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

21.02. Measurement of physical properties

16570 Distance measuring system
16580 Distance sensors for positioning and length measurement (laser, ultrasonic, optical, inductive and capacitive)
16581 Distance sensors for positioning and length measurement (magnetostrictive)
16590 Bath mirror measurement in converter
16600 Bath mirror control
16608 Strip thickness control (AGC)
16610 Strip sag measuring device
16612 Strip flatness measurement
16613 Strip flatness control
16615 Strip guiding system
16620 Tape tension measuring systems
16625 Tension measuring system for driven S-rolls
16630 Width measuring devices
16640 Strain gauges and measuring strips
16645 Strain measuring systems
16650 Strain and mass flow measuring systems
16652 Dressing degree and mass flow measuring systems
16660 Thickness measuring systems and devices
16670 Thickness gauges
16680 Distance switches and measuring devices (optical, acoustic and inductive)
16690 Torque measuring devices for S-rollers
16700 Torque measuring device
16710 Speed measuring devices
16720 Flow meters
16721 Flow measuring devices, capacitive, e.g. for coal injection
16730 Flow monitoring
16740 Diameter measurement
16750 Electrical measurement of mechanical quantities
16755 Electronic measuring system for hydraulic and lubricating oils
16770 Form measurement
16780 Level measuring devices
16790 Level control
16800 Level control
16810 Gas measuring instruments
16815 Oxygen sensors for waste gas
16820 Equipment and chemicals for waste water control
16830 Speed measuring devices
16850 Infrared switch
16860 Infrared radiation pyrometer
16861 Infrared radiation thermometer with scanner
16870 Infrared radiation pyrometer with scanner
16871 Infrared Radiation Thermometer
16875 Infrared thermography
16877 IR camera - infrared based slag detection
16878 Cameras, furnace cameras
16879 Cast iron temperature measurement
16880 Insulating capillary
16890 Force measuring devices for tension and compression
16891 Force measurement and weighing systems
16892 Force measuring systems
16900 Cooling water monitoring
16910 Length measuring devices for tubes
16920 Linear encoders
16930 Linear encoders (also for ways and distances)
16940 Linear encoders, ultrasonic (also for ways and distances)
16950 Length and speed measuring systems (optical)
16960 Laser speed and length measuring systems
16970 Conductivity and pH meters
16980 Mass flow meters
17000 Measurement of refractory linings (in operating condition)
17010 Measuring devices for electrical quantities
17020 Measuring machines

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

21.03. Quality management

17340 3-D profile measurement of rails and other profiles
17341 3-D profile measurement of weld seams
17345 Pickling bath monitoring
17350 Breakdown early detection
17352 Breakdown early detection and monitoring
17360 Breakdown monitoring
17365 Chrome bath monitoring
17368 Roller emulsion control
17370 In-line surface inspection, optical
17380 Measuring instruments for quality management
17384 Mold control
17390 Length, speed and profile measuring systems
17400 Hole detection
17408 Surface inspection
17409 Surface inspection systems
17410 Surface inspection
17415 Surface inspection of strip steel
17426 On-line measurement of oils and waxes
17430 On-line surface inspection, optical
17432 On-line surface quality inspection, optical
17440 On-line roughness measurement
17445 Systems for quality data acquisition and processing

21.04. Quality control

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

21.05. Services

17470 Metrology services

22 Materials testing

17473 Destructive and non-destructive materials testing

22.01. Non-destructive materials testing

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

22.02. Strength testing, endurance testing

17698 Fixtures for tensile testing
17700 Stress analyses and reliability tests on machines and components
17710 Consulting, execution, equipment
17720 Fatigue testing machines
17730 Hardness testers
17740 Hardness testing equipment
17750 Machines for tensile test preparation
17760 Friction and wear testing machines
17770 Crack testing machines
17780 Pipe testing presses
17790 Torsion testing machines
17800 Universal testing machines for tension, compression, bending and tensile tests

22.03. Technological testing methods, testing service

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

22.04. Destructive material testing

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

22.05. Fatigue testing

17896 Testing of safety valves in operating condition

22.06. Damage analysis

17898 Damage analysis

23 Analysis and laboratory equipment

17900 Engineering and technical assistance

23.01. Sampling and sample preparation

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

23.02. Analytical equipment

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

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

23.03. Laboratory equipment, general

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

23.04. Metallography

18290 Services
18300 Metallography equipment
18310 Metallographic laboratories
18320 Metallographic testing

24 Environmental protection and disposal

18330 Consulting and measurement
18340 Engineering and technical assistance

24.01. Dedusting and gas cleaning

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

20135 Processing services

30.01. Joining
20178 Soldering

ORDER FORM

This is how your entry looks like:

04 Steelmaking

04.10 Steel works materials

2735 EBT taphole plugging compound

WEEBOTEC

WEEBOTEC GmbH
Lingenstr. 12-14
45472 Mülheim an der Ruhr, Germany
☎ +49 208 49538-700
🖷 +49 208 49538-799
E-Mail: info@weebotec.de
Internet: www.weebotec.de

Circulation: 5,000 copies
Frequency: 2 issues per annum
Language: English

Our entry should be published under the following numbers from the list of products:

1.	5.	9.	13.
2.	6.	10.	14.
3.	7.	11.	15.
4.	8.	12.	16.

For further keywords please use a separate sheet.

Ad rate: The price of your entry depends on the number of keywords.

Number of keywords	Cost per keyword/per annum (in EURO)*
1 – 5	250.00
6 – 10	230.00
11 +	220.00

☑ The entries in the STEEL SUPPLIERS INTERNATIONAL take place in each case with a term of 12 months until they are cancelled. Discontinuation will be accepted at the end of a subscribtion year considering 6 weeks notice. Deadline is the 15th of March & September.

☑ Please send the order form with your logo (jpg-file) to:
Katrin Küchler · P: +49 211 1591 146 · steelsuppliers@dvs-media.info

We hereby order:

Company

Street Address – P.O. Box

Postal Code, City

Phone

E-mail Adress Internet

Signature

* The prices are subject to VAT.

Preview of the autumn 2022 issue:

Steel technology

Decarbonation of steel production

CO_2 capture at the direct reduction plant further reduces the emissions, which can be abated even more with the future availability of green hydrogen. Carbon capture and utilization (CCU) will evolve in carbon direct avoidance (CDA). Danieli Digital Melter technology, coupled with the ENERGIRON through direct charge of hot DRI, makes it possible to connect green electricity directly to the furnace feeders.

Renewable biocarbon materials to be used for steel production

Renewable, CO_2-negative raw materials are feasible to replace fossil fuels in the steel industry. Cleantech innovator Aymium has closed a financing for its further expansion backed by leading international steel and metals companies.

Climate-neutral future of blast furnace operations

The next phase of tests for the large-scale use of hydrogen in hot metal production has begun at thyssenkrupp Steel. This involves hydrogen injection at all tuyères of blast furnace No. 9 in Duisburg, Germany. In addition, a pilot plant for hydrogen-based DRI production is being built.

Steel distribution

Klöckner & Co commits to ambitious climate targets and aims for net zero emissions by 2040

The near-term climate targets adopted by the company validated as science-based by the Science Based Targets initiative (SBTi). As part of the company's own long-term ambition, Klöckner & Co additionally aims to reduce directly controllable emissions to net zero by 2040 (Scope 1, Scope 2 and Scope 3 emissions under direct influence). The company is already carbon neutral today by compensating the currently unavoidable Scope 1 and 2 emissions

More speed in the supply chain using the AI solution "Pacemaker"

thyssenkrupp Materials Processing Europe has developed an AI-based software that ensures a smooth flow of materials and reduced resource consumption. This helps to increase supply security, reduce inventories and thus increase production output.

STEEL+ TECHNOLOGY

Publishing house
DVS Media GmbH
PO Box 10 19 65, 40010 Düsseldorf, Germany
Aachener Straße 172, 40223 Düsseldorf, Germany
Phone +49 211 1591-0
Fax +49 211 1591-150
E-mail media@dvs-media.info
Internet www.dvs-media.eu
www.homeofsteel.de
Management Dirk Sieben

Editorioal board
Dipl.-Ing. Arnt Hannewald (responsible)
Phone +49 211 1591-232
E-mail arnt.hannewald@dvs-media.info

Advertising
Markus Winterhalter (responsible)
Phone +49 211 1591-142
E-mail markus.winterhalter@dvs-media.info

Katrin Küchler
Phone +49 211 1591-146
E-mail katrin.kuechler@dvs-media.info

Henning Schneider
Phone +49 211 1591-223
Mobile +49 151 74414657
E-mail henning.schneider@dvs-media.info

Claudia Wolff
Phone +49 211 1591-224
Mobile +49 173 6632808
E-mail claudia.wolff@dvs-media.info

For currently valid prices see Price List No. 1, effective January 1st 2019.

Reader Service
DVS Media GmbH
Phone +49 6123 9238-242
Fax +49 6123 9238-244
E-mail dvsmedia@vuservice.de

Graphic design
Maximilian Schmitz
Phone +49 211 1591-141
E-mail maximilian.schmitz@dvs-media.info

Printing
W. Kohlhammer Druckerei GmbH + Co. KG
Augsburger Straße 722
70329 Stuttgart, Germany
Internet www.kohlhammerdruck.de

STEEL + TECHNOLOGY is printed on chlorine-free bleached paper.

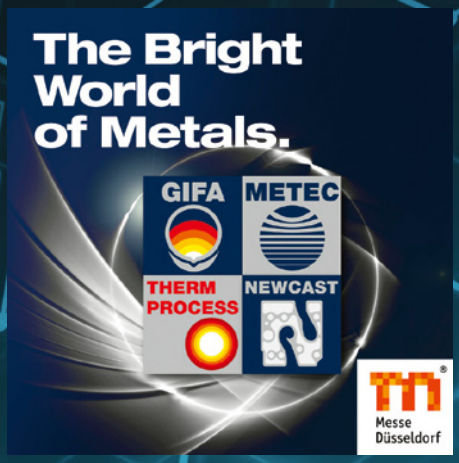
Terms of Delivery
STEEL + TECHNOLOGY is published two times a year and is available on subscription. The price for a one-year subscription for print and e-paper is 55.00 € incl. shipment (VAT not included). Subscriptions will be renewed for the next 12 months, unless DVS Media GmbH receives a written cancellation 6 weeks prior expiration. VAT calculated in accordance with EC legislation.

Single copy:
35,00 € excl. shipment

ISSN (Print) 2628-3859
ISSN (Online) 2628-3867

Reach TOP decision-makers directly + precisely before, at and after

METEC 2023 !



Your gateway to the **world market**

Top-class **„Business to Business“** meetings

78,000 visitors from more than **120 countries**

PLAN your METEC 2023 advertising print + online presence in the leading trade media NOW:

Contact the Publisher

DVS Media GmbH
Aachener Straße 172
40223 Düsseldorf, Germany

Markus Winterhalter (Head of Advertising)
P: +49 211 1591-142
E-Mail: markus.winterhalter@dvs-media.info

Henning Schneider
P: +49 211 1591-223
E-Mail: henning.schneider@dvs-media.info

Katrin Küchler
P: +49 211 1591-146
E-Mail: katrin.kuechler@dvs-media.info

Claudia Wolff
P:+49 211 1591-224
E-Mail: claudia.wolff@dvs-media.info

Contact our representatives

Switzerland
Rico Dormann
Media Consultant Marketing
Moosstr. 7
CH-8803 Rüschlikon
P: +41 44 7208550
F: +41 44 7211474
E-Mail: dormann@rdormann.ch

Great Britain & Ireland
Mike Kirk
12 Emerald Walk, Kings Hill
GB-West Malling, Kent ME 19 4FY
P: +44 1732 52 21 74
F: +44 7957 36 51 49
E-Mail: mj.kirk@btinternet.com

Bavaria & Austria
Verlagsbüro Hubert Hunscheidt
Echerschwang 50
86975 Bernbeuren
P: +49 8860 92 22 327
F: +49 8860 92 22 328
Mobile: +49 1577 / 1751343
E-Mail: hunscheidt@t-online.de

USA
4M Media & Marketing
Charlotte Mitchell
737 Fort Salonga Road
Northport, NY 11768
P: +1-516-205-5197
E-Mail: charlotte@4m-media.com
E-Mail: cokesgermany@icloud.com

DVS MEDIA

IT'S MORE THAN JUST A MACHINE.

KOCKS rolled®

focused
RELIABILITY

unique
SPECIALISTS

ingenious
BELIEF

Do you want more?

WE MAKE YOUR PRODUCT GOLD

KOCKS