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STEEL+ TECHNOLOGY

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Decarbonisation and digitalisation

Arnt Hannewald, Dipl.Ing.
Editor

The rush for "fossil free steel" is in full swing. The first car manufacturers are already staking their claims to assure the coming supply of "green steel" and to be able to offer cars in a few years' time that are proved to be made predominantly of fossil free or ex-carbon materials. At the same time, the question is increasingly being asked: What exactly is fossil free steel?

Initially – not so long ago – only the CO_2 emissions associated with the actual production of the crude steel were considered, which are now referred to as Scope 1 emissions. Accordingly, the Scope 1 balance of the production route via electric arc furnaces turns out better than that of integrated works producing hot metal with conventional coke-fired blast furnaces and steel with basic oxygen furnaces.

In the meantime, there is a tendency to take a more differentiated view. On the one hand, it has turned out that the blast furnace's CO_2 emissions could indeed be reduced considerably if hydrogen were injected as a reducing agent and the proportion of the fossil coke was reduced accordingly. There are also attempts to process sponge iron and scrap directly in the blast furnace. If the blast furnace could then perhaps be fed with non-fossil coke (i.e. biomass like char coal), the carbon footprint of the blast furnace route would have to be much smaller than it is now.

On the other hand, how are things at electric steel mills? If scrap is melted down in an electric arc furnace, does it then actually produce fossil-free steel? A few question arise, for example whether the melting operation is powered by fossil-free electricity. If not, Scope 2 emissions would have to be taken into account for power consumption. Also, many meltshops use NG fired lances or side-wall burners in the EAF. These would mean considerable Scope 1 emissions that are directly included in the carbon footprint.

Most importantly, what kind of scrap and other feedstocks are processed here? In most cases, the scrap is not at all "fossil free" because it was formerly produced releasing the known proportions of CO_2 emissions per tonne of steel or iron. The use of scrapped Thomas steel or even cast iron from the 20th century could therefore be subject to significant Scope 3 emissions. (Incidentally, this question also arises for converter steelworks).

From these considerations it becomes obvius that "fossil-free steel" should finally be clearly defined if the term is to be more than just an empty phrase in marketing language. "Decarbonisation and digitalisation" are enormous challenges. That is why it is also the main topic of our conference HÜTTENTAG ("Mills' Day"), which is to take place on 4 November – a real gathering again – in Essen, Germany. Save this date and register your participation in time.

Arnt Hannewald

Steel application

Steel distribution

Columns

Cover picture:

Morgårdshammar AB

Outokumpu appoints head of communications

Outokumpu has appointed Päivi Allenius as vice president – group communications. She will be based at the headquarters in Helsinki.

Before joining Outokumpu, Päivi Allenius headed group communications and marketing at FCG Finnish Consulting Group as well as external communications and stakeholder relations at Tieto.

Outokumpu

Päivi Allenius is the new head of Outokumpu's group communications
(Picture: Outokumpu)

ASK Chemicals Group appoints Chief Financial Officer

Hubert Windegger has joined the management of ASK Chemicals as Group Chief Financial Officer (CFO). He succeeds Anders Wester, who left the company in February 2021.

Hubert Windegger will be responsible for the areas finance, controlling, digitalization & IT. He has held various management positions at Dow Chemical in Europe, including a recent stint at Trinseo Europe, where he contributed his financial expertise as Division CFO.

ASK Chemicals

Leadership promotions at Butler

Steel Dynamics has announced leadership promotions at the Butler Flat Roll Division and the Flat Roll Steel Group.

Jordan Breiner has been promoted to vice president of Steel Dynamics and general manager Butler Flat Roll Division. He has led the Butler Flat Roll Steel Division since June 2014 and was named its general manager in 2017.

William T. (Tommy) Scruggs is now vice president of Steel Dynamics and commercial general manager of the Flat Roll Steel Group. Prior to his promotion, Scruggs served as the commercial general manager of the Flat Roll Steel Group.

Steel Dynamics, Inc.

Salzgitter appoints new CEO

Gunnar Groebler has taken over the positions chairman of the executive board and chief executive officer of Salzgitter AG from Prof. Dr.-Ing. Heinz Jörg Fuhrmann.

Prof. Fuhrmann retired, as planned, upon expiry of his employment contract. Gunnar Groebler has been a member of the executive board since May 17, 2021.

Prior to joining Salzgitter AG, Gunnar Groebler held executive positions at Vattenfall, most recently as a member of the executive group management team in charge of the business area wind energy.

Salzgitter AG

Gunnar Groebler is the new chairman of the executive board and chief executive officer of Salzgitter AG
(Picture: Salzgitter AG)

Liberty Steel Group appoints specialist board directors to navigate Greensill collapse

Liberty Steel Group has appointed four experienced board directors who will lead and accelerate the restructuring and refinancing of Liberty in order to protect and maximize creditor and stakeholder value.

The appointments represent a step forward in Liberty's response to the collapse of its principal lender, Greensill Capital. Lib-

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erty is prudently managing cash across its global operations to ensure it has adequate funding for its current needs while its refinancing is completed.

The new appointments joined the Liberty board with immediate effect, forming a new Restructuring & Transformation Committee (RTC) which will be led by an independent Chief Restructuring Officer (CRO), and include an independent Chief Transformation Officer (CTO), a Chief Governance Officer (CGO) and a newly appointed Chief Financial Officer (CFO). Both CRO and CTO roles are independent interim roles brought in for a special purpose to restructure and refinance the group. CRO and CTO roles are paid fees and are not employees of the company.The RTC will be given full autonomy to restructure Liberty's operations to focus on core profitable units, and either fix or sell underperforming units. It will support stakeholder engagement and work with the Liberty board and its adviser panel to negotiate an amicable solution with Greensill's administrators and other stakeholders.

Liberty Steel Group

Sandvik fills management position

Christophe Sut has been named president of the Sandvik manufacturing solutions business area segment.

In addition to this, Christophe Sut has been appointed as a new member of the Sandvik group executive management team. The appointments will be effective no later than 1 January 2022.

Christophe Sut joins Sandvik from ASSA ABLOY Global Solutions, where he has served as head and executive vice president since 2016.

Sandvik

Christophe Sut will take on leading positions at Sandvik (Picture: Sandvik)

Management reorganization at Klöckner subsidiaries

Klöckner & Co Deutschland GmbH and Becker Stahl-Service GmbH, both subsidiaries of Klöckner & Co SE, have reorganized their managements.

Klöckner & Co Deutschland GmbH has appointed Bernhard Weiß as its new CEO. He takes over from Sven Koepchen, who will be moving into a cross-functional role, where he will be responsible for the expansion of the higher value-added business in EU-Europe.

Becker Stahl-Service GmbH has appointed Francois-David Martino as its new CEO. Apart from implementing the new Group strategy at Becker Stahl-Service GmbH, Francois-David Martino will focus on expanding the product and processing portfolio as well as technical expertise in manufacturing. Furthermore, Christina Kolbeck has been named the new CFO of Becker Stahl-Service GmbH in addition to her role as CFO of Klöckner & Co Deutschland GmbH.

Klöckner & Co

Nucor CEO elected chairman of AISI

Nucor Corporation's president and chief executive officer Leon Topalian has been selected to serve as chairman of the American Iron and Steel Institute (AISI) Board of Directors.

"It is an exciting time for our industry with member companies making significant investments to grow and modernize facilities. I look forward to working with members to engage policymakers on several issues important to our industry, including infrastructure spending, trade enforcement, and making steel the sustainable engineering and construction material of choice now and in the future," said Leon Topalian.

John Brett, CEO of ArcelorMittal North America, and Chuck Schmitt, president of SSAB Americas, were elected vice chairmen.

Nucor Corporation

Steel Dynamics, Inc. names new board chairman

Mark D. Millet, one of the founders of U.S. steelmaker Steel Dynamics, Inc. and the company's president and chief executive officer, will also serve as the chairman of the board following the resignation of Keith E. Busse.

Pursuant to Steel Dynamics, Inc. governance policies, Keith E. Busse, also a founder of the company, has stepped down as the chairman of the board to ensure an orderly transition of board leadership and will remain a director of the board. James C. Marcuccilli will remain the company's lead independent director.

Steel Dynamics, Inc.

Nickel Institute elects new chairperson

The executive committee of the board of directors of the Nickel Institute has elected as chairperson Tina Litzinger, vice president, Marketing, Sherritt International Corporation.

Tina Litzinger's appointment is for a one-year term, renewable for a second year. Tina Litzinger succeeds Dan Chandler who has left the nickel industry.

Tina Litzinger is currently responsible for Sherritt International Corporation's joint venture and wholly-owned sales and marketing teams for sales of commodity nickel, cobalt and fertilizer by-products. She is also vice chair of the Cobalt Institute, a member of the London Metal Exchange Cobalt committee as well as a member of Women in Mining Canada and the Institute of Corporate Directors.

Nickel Institute

Montan-Stiftung-Saar announces personnel changes at boards level

Markus Lauer, new member of the executive management of SHS, and new member of the board of management and chief financial officer of Dillinger and Saarstahl (Picture: Saarstahl)

Tom Niemann, newly appointed member of the executive management team of SHS and of the board of management of Saarstahl AG (Picture: Saarstahl)

Montan-Stiftung-Saar has initiated further personnel changes in the management bodies of AG der Dillinger Hüttenwerke (Dillinger), Saarstahl AG and SHS – Stahl-Holding-Saar with the aim of realigning the Saarland steel industry for the future.

The management team under the leadership of board chairman Dr. Karl-Ulrich Köhler is being expanded to drive innovative solutions to the major challenges of the transformation, realign the portfolios and boost competitiveness. The supervisory bodies adopted the following specific resolutions:

The supervisory boards of SHS, Saarstahl and Dillinger have appointed Markus Lauer as a member of the executive management team of SHS and as a member of the board of management and chief financial officer of Dillinger and Saarstahl. Markus Lauer has been employed by the SHS Group for more than 20 years and has headed the finance departments of Dillinger and Saarstahl simultaneously since 2014.

In addition, Tom Niemann has been appointed as a member of the executive management team of SHS and as a member of the board of management of Saarstahl AG and chief sales officer. Tom Niemann is a sales and marketing specialist with a focus on digitalization and strategy in the metals and steel sectors.

Following the departure of Martin Baues from the companies, Dr. Karl-Ulrich Köhler took on the duties of chief technical officer of Dillinger and Saarstahl until further notice. Dr. Klaus Richter, to date the chief sales officer of Saarstahl, is slated to take over as chief technical officer of Dillinger and Saarstahl in this autumn until the end of his term of office.

Saarstahl

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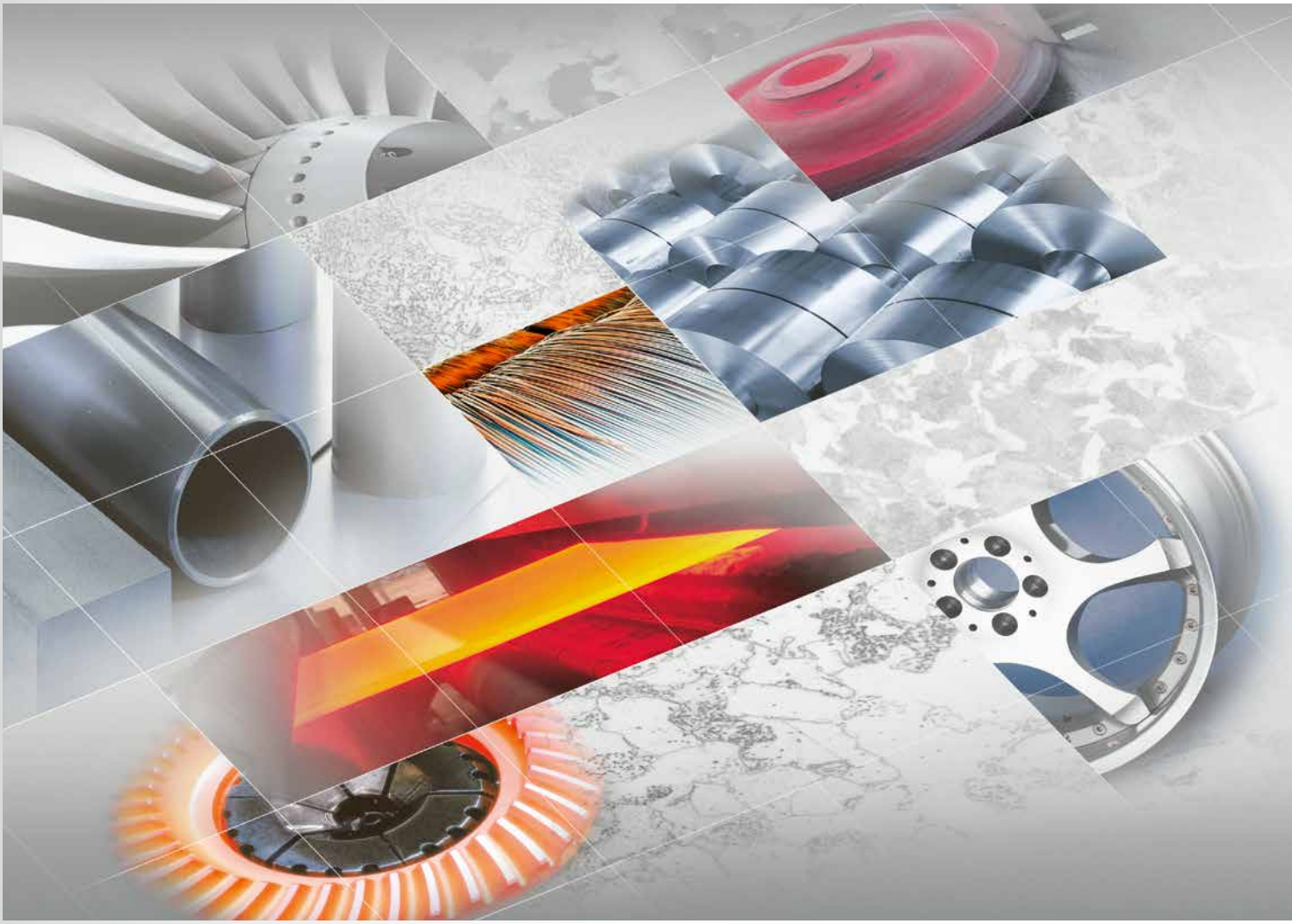

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Changes in SSAB's group executive committee

Håkan Folin, executive vice president and chief financial officer, is leaving SSAB to pursue his career with another company. In addition to holding these positions, Håkan Folin has been a member of SSAB's group executive committee since 2013. Prior to this, he held a number of important roles globally at SSAB. Martin Lindqvist, president and CEO at SSAB: "Håkan Folin has played an important role in the development and execution of the company's strategy and in building a financially strong SSAB. He has also been involved in acquisitions such as IPSCO and Rautaruukki." The recruiting process to find a successor is underway.

SSAB

New CEO of Swiss Steel Group

The board of directors of Swiss Steel Group has appointed Frank Koch as chief executive officer effective July 1, 2021.

Now that key milestones in the realignment of the Swiss Steel Group have been reached, the current CEO Clemens Iller has decided to leave the company, thus also enabling a fresh start for the management of the group. Frank Koch joins Swiss Steel Group from German steel producer GMH Group (Georgsmarienhütte), where he has been CEO for the last three years.

Swiss Steel Group

Frank Koch is the new head of Swiss Steel Group (Picture: Swiss Steel Group)

ALGERIA

Algerian Qatari Steel begins processing of iron ore to sponge iron

Algerian Qatari Steel (AQS) has started up its 2.5 million t/year Midrex® direct reduction plant supplied in a consortium of Midrex Technologies and Paul Wurth.

The plant is capable of producing both hot and cold DRI and is equipped to transfer and charge hot DRI to the nearby AQS steel mill to take advantage of the retained heat. The AQS Bellara Steel Complex includes as the main production units the Midrex direct reduction plant, with a rated annual capacity of 2.5 million t; two EAF melt shops, with total annual production capacity of 2.2 million t; and three rolling mills, with total annual production capacity of 2 million t of reinforcing bars and wire rods. The second phase of the investment program will be devoted to the production of other types of special steels used in many industries, bringing the production capacity to more than 4 million t/year.

Midrex Technologies, Paul Wurth

The new Midrex plant has a rated production capacity of 2.5 million t/year (Picture: Midrex Technologies)

EGYPT

El Masria Steel upgrades reheating furnace

A reheating furnace at El Masria Steel has been upgraded with technology from Danieli Automation and Danieli Centro Combustion.

All existing burners for the preheating, heating and soaking zones have been replaced with new burners, providing additional thermal capacity to achieve the target furnace productivity and operational flexibility. The new combustion system with field instrumentation features a new recuperator for energy recovery from waste gases and a new automation system. The target of 25% fuel consumption saving was even exceeded resulting in significant financial benefits and reduced environmental impact.

Danieli

CHINA

Baosteel to revamp automatic roll shop

Baowu Steel Group has awarded Tenova two contracts for the revamping of a fully automatic roll shop for its silicon steel plant at Baoshan Iron and Steel, in Baoshan, Shanghai.

View of an automated roll shop (Picture: Tenova)

In 2008, Pomini Tenova supplied a fully automatic roll shop with five roll grinders and two auto loaders for the cold rolling mill of the group's stainless steel branch. Now the previous roll shop will be transferred to the Baoshan Silicon Plant, where the customer is expanding its production of non-grain oriented silicon steel coils.

The scope of the contract includes the disassembly and relocation of five Pomini roll grinders and two Pomini automatic loaders and the revamping with a complete automation system. Moreover, latest features such as a new inspection system with eddy currents and creeping waves for on-line roll surface and subsurface defect inspection, a new continuous profile compensation and the innovative Pomini process monitoring system will be integrated, as well as Tenova Edge for advanced machine condition monitoring and predictive maintenance. The project is scheduled for completion in summer 2022.

Tenova

Benxi grants FAC for hot-strip mill modernization

Benxi Iron & Steel has issued the final acceptance certificate to SMS group for the successful modernization of their 1,700 mm No. 1 hot-strip mill.

The objective of this project was to bring the mill's production capacity and the production range – by adding high-strength steels – up to the requirements of the hot-strip market. As a key part of the modernization, three CVC®plus (Continuously Variable Crown) work-roll bending and shifting systems have been installed in the finishing stands F2 to F4, complete with the

One of the finishing mill stands of Benxi Iron & Steel's hot strip mill after the revamp (Picture: SMS group)

associated valve technology. The optimization measures performed on the rolling stands F2 to F4 comprised not only the mill stands themselves but also the inter-stand areas. Improved guides and new work-roll cooling systems have been installed on the entry sides of all three stands.

Further, the back-up roll balancing systems in the finishing stands F1 to F7 have been upgraded by replacing the emulsion-based balancing hydraulics with oil hydraulics. This measure involved the replacement of the cylinders and the complete control system, including the connecting pipes and the piping within the stands. In addition, in stands F1 and F5 to F7, the work-roll locking systems on the operator side have been replaced by a reinforced design.

SMS group

Changzhou Dongfang upgrades rolling mill

Changzhou Dongfang Special Steel contracted Danieli for a rolling mill upgrade of its bar mill in the Jiangsu province.

The project carried out by Danieli Service China comprised the supply of a full set of new cartridges for the 16-stand mill. The upgrade has led to an enhancement of the product quality and to higher efficiency thanks to fewer mill stoppages. Furthermore, the design and the quality of the Danieli cartridges supplied allow easy maintenance and lower maintenance costs.

Danieli

Tangshan Ganglu orders wet electrostatic precipitators

Tangshan Ganglu Iron & Steel has contracted SMS group for the supply of two wet electrostatic precipitators for two BOF converters.

The scope of supply of SMS group as engineering, procurement and construction (EPC) contractor comprises the two precipitators, adaptation of the water supply and treatment system, erection/installation and technical support during the commissioning process.

Wet electrostatic precipitators separate solid particles from the process gas. For this purpose, spray electrodes fed with rectified negative high voltage emit electrons. These electrons move to the collecting electrodes and, on their way, collide with gas molecules and dust particles. Due to the resulting attachment of the electrons to the dust particles, the particles are negatively charged and transported by the existing electric field to the grounded collecting electrodes to which they adhere. The collecting electrodes are cleaned with water.

SMS group

Wet electrostatic precipitator of the type to be installed at Tangshan Ganglu (Picture: SMS group)

Guilin Pinggang issues FAC for electric arc furnace and

Guilin Pinggang Iron and Steel has issued the final acceptance certificate (FAC) for an electric arc furnace with a tapping weight of 120 t and a 120-t twin ladle furnace supplied by Primetals Technologies.

The EAF Quantum is designed to handle scrap steel of varying composition and quality. The electrical energy requirement of the electric arc furnace is relatively low because the scrap is preheated. The unit combines proven elements of shaft furnace technology with an innovative scrap charging process, an efficient preheating system, a new tilting concept for the lower shell, and an optimized tapping system.

Primetals Technologies supplied the complete mechanical and electrical pro-

cess equipment for the new EAF furnace and the twin ladle furnace. The balance of plant auxiliary equipment and services were provided by a local design institute.

Primetals Technologies

The new EAF with doghouse complies with latest environmental standards
(Picture: Primetals Technologies)

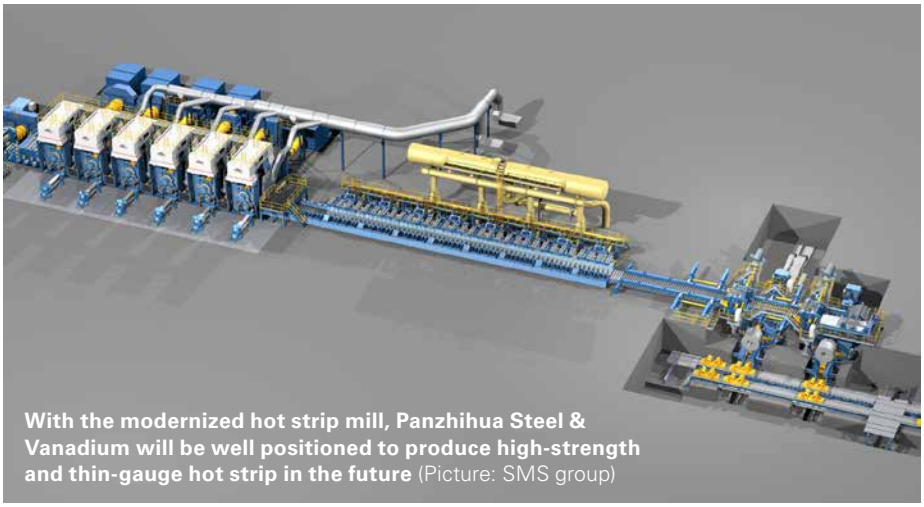
Panzhihua Steel & Vanadium to modernize wide hot-strip mill

Panzhihua Steel & Vanadium has awarded SMS group the order for an extensive modernization of their 1,450 mm hot strip mill in Panzhihua, Sichuan Province.

The revamping of the mill is intended to significantly improve plant availability and expand the production range to include thin-gauge strip. The annual production capacity will be raised from currently 2.4 million t to at least 3 million tons.

The SMS group project scope includes the finishing mill, a laminar cooling system and a downcoiler group, which will all be completely renewed. SMS will supply the engineering and the main components. A new seven-stand finishing mill will be erected behind the existing finishing mill. Also, the coiler area consisting of two downcoilers will be completely replaced.

The modernization activities for the complete mill will be carried out during only two shutdowns. During the first shut down, which is scheduled for September 2021, the laminar cooling line will be replaced and a roller table bridge installed



With the modernized hot strip mill, Panzhihua Steel & Vanadium will be well positioned to produce high-strength and thin-gauge hot strip in the future (Picture: SMS group)

behind the existing finishing mill. With this roller table bridge installed, it will be possible to perform the foundation work for the new finishing line while the plant is in operation.

During the second shut down in July 2022, the new finishing mill will be installed directly behind the existing mill together with the new coiler area. At the same time, the existing mill will be dismantled and the entry equipment relocated. The first hot strip is scheduled to be rolled in October 2022.

SMS group

Shagang to receive low-carbon gas plant as part of gas-supply agreement

Existing air separation units in China (Picture: Air Liquide)

Air Liquide and Jiangsu Shagang Group have signed a new long-term agreement for the supply of industrial gases in Zhangjiagang City, Jiangsu province.

Under a 20-year-long contract, Air Liquide will build, own and operate a new state-of-the-art air separation unit (ASU) with a daily capacity of 3,800 t of oxygen on the site in Zhangjiagang, where it already operates two other ASUs. When the new unit starts up at the end of 2023, it will bring the total installed oxygen capacity to over 8,000 t per day on the site.

The new ASU will be equipped with an innovative proprietary solution that allows for the storage of up to 60 MW of energy per day, enabling flexibility in the grid and contributing to a higher reliability of gas supply. Replacing old assets installed on the customer site, and using an incremental proportion of low-carbon energy, this new ASU will contribute to a lower carbon footprint.

Air Liquide

Sinopec Shashi Steel Pipe Works invests in new spiral pipe plant

The pipe forming station is the centrepiece of the spiral pipe plant (Picture: SMS group)

Sinopec Shashi Steel Pipe Works has placed an order with SMS group for the supply of a spiral pipe plant for its facility in Jingzhou.

The plant will be designed for both submerged arc and MAG (metal active gas) welding. The machine will use arc welding technology developed by SMS. The new plant will produce spiral tubes for oil and gas applications within the 508 mm to 2,032 mm diameter range, with a maximum wall thickness of 25.4 mm and a length of 15 m. Commissioning is planned to take place in the fourth quarter of 2021.

The plant will be able to produce pipes in an online and in an offline process: the pipe can be either directly finish-welded on the machine or tack-welded at a three to four times higher speed and finish-welded later on separate finish-welding stands. The PERFECT arc® welding technology includes features to record and evaluate the measurement data and comes with the latest generation of laser line scanners for the precise advancement of the welding head and for measuring the welding profile right in the machine.

In the offline process, the welding parameters are adapted automatically to the welding/forming speed. In addition, state-of-the-art drive and hydraulic systems make the machine highly energy-efficient.

SMS group

Tangshan Heavy Plate grants FAC for caster upgrades

Tangshan Heavy Plate has issued Primetals Technologies the final acceptance certificate (FAC) for three Mold Expert systems for the continuous casters at the Laoting plant in the Tangshan region.

Improved breakout prevention thanks to the new mould control system (Picture: Primetals Technologies)

Before the order was placed, Primetals Technologies had run and supported a six-month test installation on one of the casters. Apart from preventing breakouts, the system also transmits alerts in the event of abnormal casting conditions and evaluates the behaviour and distribution of the mould powder.

Primetals Technologies China commissioned the new systems on site with online support from experts at Primetals Technologies Austria. Despite travel restrictions, the project was realized within just three months. The systems provide data for process optimization and support the operator in his work. The software can be easily scaled to meet the customer's specific needs. In the standard configuration, each Mold Expert system is deployed with one computer for measuring tasks and a separate client PC. However, to fulfil the customer's wishes and requirements in this specific project, a "slim-line" version of the system was implemented with the entire software installed on just one computer in the operator room for each continuous caster.

Primetals Technologies

TimkenSteel to sell Chinese subsidiary to Daido Steel

TimkenSteel Corp. has signed a purchase agreement with Daido Steel (Shanghai) Co. with the intent to sell its TimkenSteel (Shanghai) Corporation Limited subsidiary.

Daido and TimkenSteel have enjoyed a long relationship and have collaborated on everything from technical assistance to product development in order to support customers in Asia and the United States. "With this arrangement, Daido will move from a valued supplier to a key authorized distributor of TimkenSteel products in China," stated Mike Williams, president and chief executive officer for TimkenSteel.

TimkenSteel

Weifang Special Steel installs new reducing & sizing block

Commissioning of the new reducing & sizing block in Weifang (Picture: KOCKS)

Weifang Special Steel has issued to Friedrich Kocks the final acceptance certificate for the successful commissioning of the 3-roll reducing & sizing block (RSB®) in 5.0 design.

Weifang Special Steel mainly produces quality wire and welding rods, as well as quality bar steel for the automotive industry. The RSB® 5.0 produces SBQ within a diameter range from 18.0 to 60.0 mm at rolling speeds up to 18 m/s. In addition to the RSB®, a water cooling section including integrated process software for temperature controlled rolling was supplied. The KOCKS 3-roll technology enables Weifang to achieve reliable and consistent SBQ production of premium quality with perfect surfaces and closest tolerances to meet the high demands of the market. The second RSB® in 5.0 design for Weifang Special Steel is ready to be shipped and will be commissioned before the end of 2021.

KOCKS

Wusteel signs maintenance service contracts for plate casters

HBIS Wusteel has placed orders with Primetals Tangshan Technology Services (PTTS) to supply maintenance services for three continuous casters in the steel plants No. 1 and No. 2 in Wuyang, Henan province.

The aims of the agreement are to increase equipment lifetime and improve product quality. The initial term of the maintenance contracts is ten years. PTTS, established in September 2017, is a joint venture between Primetals Technologies and HBIS Tangsteel. The company provides comprehensive technology-based services in off-line maintenance, equipment refurbishment, condition monitoring, as well as operational support for slab casters of Tangsteel and other customers. The company with its approximately 500 employees uses proprietary Primetals Technologies maintenance technologies and know-how.

Primetals Technologies

Zenith Changzhou to modernize wire rod mill

Zenith Steel has awarded SMS group the order to upgrade the wire rod mill at its Changzhou works to a combined wire rod mill. With this modernization, Zenith aims to widen its portfolio to include round bars and maximize the rolling speed for small-

er-diameter products. Currently, the wire rod mill produces 780,000 t/year of wire rod from dia. 11.5-26.5 mm in commercial steel grades. As part of the modernization various equipment along the mill will be replaced and new equipment installed, such as combined and rotary shears, a shiftable water cooling line, a 320/5 PSM® (Precision Sizing Mill), a high-speed wire rod shear and a pinch roll unit with laying head. The pouring reel line will accommodate two walking beam conveyor lines, cooling fans and cooling hoods for the in-line treatment of coils. The addition of the new pouring reel will enable Zenith to extend its current bar-in-coil range from dia. 16-42.5 mm. In the future, it will even be possible to roll product of dia. 50 mm for special applications. Additionally, the company will be able to produce heavy compact coils of up to 2.3 t. To this end, bearing, spring, high-carbon, pre-stressed wire, alloy and tool steels will be added to the range of processed steel grades.

SMS group

PAKISTAN

Amreli Steels issues FAC for rolling mill

Primetals Technologies has received the final acceptance certificate for a bar mill supplied to Amreli Steels Ltd., a rebar steel producer based in Karachi.

The new rolling mill is designed to produce around 400,000 t/year of reinforcing steel and round bars. It will triple the production capacity of Amreli Steels. The mill can roll up to 75 t/h of steel bar at a maximum rolling speed of 13 m/s.

The productivity of the plant is maximized by rolling bars with diameters of between 8 and 10 mm in four-slit mode, and diameters between 12 and 14 mm in two-slit mode. Primetals Technologies designed the plant and supplied the processing equipment starting from the

Four-slit rolling at the new bar mill of Amreli Steels (Picture: Primetals Technologies)

billet discharging system at the reheating furnace. The scope of supply also included hot cropping and emergency shears, a heat-treatment Pomini Quenching System (PQS) installed downstream of the last stand of the finishing mill, and a pinch roll and hot dividing shear in front of the cooling bed. Primetals Technologies also supplied the guides, lubrication and hydraulic systems, basic automation, motors, drives and the power supply system.

Primetals Technologies

AUSTRIA

RHI Magnesita and Calix execute MOU to advance CO_2 reduction

RHI Magnesita has executed a memorandum of understanding with Australian technology company Calix Limited.

The MOU covers the development of a Calix Flash Calciner for use in the production of refractory materials, which will enable CO_2 separation for either utilization or storage. Under the terms of the MOU, Calix and RHI Magnesita have agreed to undertake studies up to and including basic front-end engineering and design for a commercial-scale demonstration facility at an RHI Magnesita site.

Calix has been processing magnesite, the main raw material in the production of refractories, since 2013 in its Bacchus Marsh facility for water treatment products. The application of Calix's technology to refractory products has been the subject of pilot scale test work during 2020, with larger scale test work currently underway.

RHI Magnesita

BELGIUM

ArcelorMittal Gent starts production of metallic coating

ArcelorMittal has opened a new production line for Magnelis® metallic coating in Europe at the ArcelorMittal Gent mill, in addition to Liège, Avilés, and Bremen.

Launched in 2011, Magnelis® is a unique metallic coating that protects steel against corrosion for decades. Sidgal 1 line of ArcelorMittal Gent will enlarge the range of Magnelis® coated steel. The coating reduces the environmental footprint of manufactured products thanks to lower use of raw materials and natural resources, a reduced zinc run-off during the product's life, and an increased lifetime of the finished product. An environmental product declaration is available.

ArcelorMittal

For the modernization of the descaler, new accumulators have been installed
(Picture: NLMK)

NLMK Clabecq upgrades plate mill

NLMK Clabecq, producer of thin premium steel plates, has commenced the modernization of its mill.

The revamping of the plate rolling mill includes installing a new descaling system and modernizing the four-stand finishing mill. As the first step, three accumulators dedicated for the new pump room have been installed. The accumulators will serve the new descaler, which is scheduled to be installed during the summer maintenance shutdown.

NLMK

BOSNIA

ArcelorMittal Zenica to replace converter

ArcelorMittal Zenica has placed an order with Primetals Technologies to replace the vessel of BOF converter No. 2 and supply associated equipment.

The current BOF converter No. 2 at ArcelorMittal Zenica (Picture: Primetals Technologies)

The converter replacement will be executed in an open consortium with Serbian company GrappS as installation partner. Primetals Technologies will be responsible for engineering and manufacturing the new 125 t BOF converter and for the project management. An optimized design will increase the vessel volume.The scope of supply includes the BOF vessel, the trunnion ring, the Vaicon Link 2.0 suspension system, bearings and housings and the tilting drive coupling. The lining machine and the detachable bottom exchange device will be modified. In addition, Primetals Technologies will provide the transport to site (Delivery-at-Place) DAP, training on site, and advisory services for erection and commissioning as well as for cold and hot commissioning. The Serbian partner company will be responsible for dismantling the current converter, preassembly of the new equipment and mechanical erection execution. Start-up of the converter is expected by the end of 2022.

Primetals Technologies

CZECH REPUBLIC

Trinecké Železárny upgrades bar-in-coil line

Trinecké Železárny has installed an innovative pinch-roll unit with a Morgårdshammar guide to improve the stability of its bar-in-coil line.

Thanks to the installation of a new fully-automatic pinch-roll unit from Danieli

and Morgårdshammar RX intelligent guides, quick size changes are now possible with minimal operator intervention at the Trinecké Železárny bar-in-coil line. The system is remotely adjusted for each rolling campaign within a wide range of rolled products, including 15 to 50 mm rounds, squares and hexagonal cross-sections. Perfect guidance of the bar is provided by the highly advanced and automatically operated RX roller guide system, which dynamically adjusts itself during rolling.

Danieli

FINLAND

Outokumpu commits to more stringent climate target

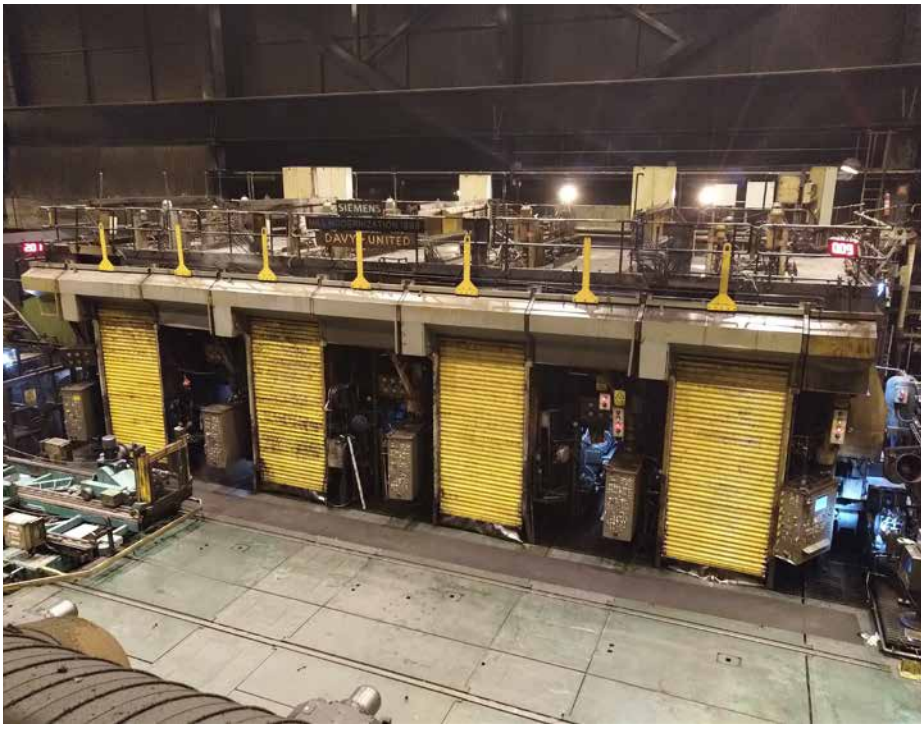
Outokumpu commits to the 1.5°C objective according to the Science-Based Targets (SBT) initiative, clearly raising its earlier climate objectives.

In addition, the company is establishing an advisory council to support its sustainability work. With these measures, Outokumpu updates its sustainability strategy. The new council will bring an external holistic view to the company's continuous sustainability development.

The amount of the company-specific CO_2 emission reductions will be determined during the approval process with the SBT organization. The new reduction target will not affect the earlier announced capital expenditure in 2021–2022. Outokumpu's long-term climate target is to reduce its direct and indirect CO_2 emissions as well as those of its supply chain to reach carbon neutrality by 2050. It has reduced its emissions by increasing the share of recycled material in stainless steel production to more than 90%. In addition, the company has increased the share of low-carbon electricity in its energy consumption, improved energy efficiency and reduced transport emissions.

Outokumpu

SSAB to modernize process automation for tandem cold rolling mill in Hämeenlinna



The tandem cold rolling mill in SSAB Hämeenlinna is to receive new process automation (Picture: SSAB)

Primetals Technologies has received an order from SSAB to modernize the existing Level 2 process automation of the tandem cold rolling mill in Hämeenlinna.

Primetals Technologies will supply new server, operating system and database solutions operated on an ESX hardware platform acting as a virtual machine. Some of the user software will be migrated and the rolling model modernized. Primetals Technologies' scope of supply and performance includes replacing the operating system and inter-process communication via a new middleware and modernizing the database solution. Also a new Level 2 operator control and monitoring system, a test and simulation environment plus testing tools will be provided. The refurbishment is scheduled to be completed within just a few days during a planned shutdown in November 2021.

SSAB

SSAB and VR Transpoint sign contract on rail transport

The contract between SSAB and Finnish freight logistics company VR Transpoint aims to halve transport emissions in the rail transport of steel coils and iron ore pellets in Finland.

VR Transpoint and SSAB have already cut transport emissions by 16% compared to 2018 levels. The goal over the next three

years will be reached partly by switching transport from road to rail and by developing and updating the train rolling stock and road transport fleet. In addition, railroad electrification will improve efficiency.

Most of the iron ore pellets come from Sweden but significant quantities also reach SSAB Raahe by rail from Russia. Raahe makes hot-rolled strip and plate products. What is known as the megatrain transports accounts for a significant share of the steel coils transported daily from Raahe to Hämeenlinna, where the steel is processed further. Export products go by rail from Hämeenlinna to the ports. Under the contract, VR Transport and SSAB will plan new rolling stock for rail transport to enable the transport of increasingly greater loads.

SSAB

Emissions from the transport of steel products and raw materials for steelmaking are planned to be cut significantly (Picture: SSAB)

FRANCE

ArcelorMittal and Air Liquide join forces to accelerate the decarbonization of steel production

ArcelorMittal and Air Liquide have signed a memorandum of understanding with the objective of implementing solutions to produce low-CO_2 steel in Dunkirk.

The two companies are joining forces to transform the steel production process through the development of innovative solutions involving low-carbon hydrogen and CO_2 capture technologies. In the context of the Paris Agreement and the European Commission's Green Deal, and in line with Air Liquide and ArcelorMittal's commitments to energy transition, the project will reduce yearly CO_2 emissions from ArcelorMittal's steel-making facilities in Dunkirk by 2.85 million t by 2030. Air Liquide and ArcelorMittal have jointly applied for large projects funding under the Important Project of Common European Interest (IPCEI) scheme for hydrogen. Funding from European and/or French schemes supporting decarbonization is key to the implementation of the project. ArcelorMittal is ready to implement an innovative production unit on its Dunkirk site, combining two steel production technologies, DRI production unit and submerged arc furnace.

ArcelorMittal

Saarstahl takes over Ascoval and Rail Hayange from Liberty Steel Group

Saarstahl and its parent company SHS – Stahl-Holding-Saar (SHS) confirm that they have obtained an agreement from Liberty Steel France Holding for the take-over of Liberty Ascoval and Liberty Rail Hayange.

With the broad support of the parties concerned and the official representatives, SHS and Saarstahl have proposed an industrial concept for the Ascoval and Hayange plants that ensures the economic and social security and further development of the two French sites.

"Our project aims to integrate a new rail market into Saarstahl's commercial and industrial strategy, to diversify our portfolio (electric arc furnace blooms and rails) and to access a new production technology (electric arc furnace). This project is fully aligned with the strategy of our Saarland Group, both in terms of strengthening competitiveness and structural transformation," said Dr. Karl-Ulrich Köhler, chairman of Saarstahl's management board.

Stahl-Holding-Saar (SHS)

Sam Montreau makes use of machinery hiring service

Recently, the Sam Montreau plant of the Riva Group had to stop the production due to a breakdown in an ESS rolling mill stand. Danieli Service supported the client, delivering a courtesy machine.

D-SWAP is a new Danieli Service offering for long-product mill users to reduce plant downtimes caused by unexpected problems or breakdowns, as well as scheduled plant refurbishments. In case of unplanned events or during an overhauling activity of a machine or part of it, Danieli Service supports customers by providing courtesy machinery as a replacement for original ones, making the functionality of the production line possible again.

Presently this service is available from Danieli Headquarters and can serve customers within Europe in just three days, with components and machinery for long-product rolling mills such as ESS mandrels and cantilever stands, fast-finishing block mandrels, and pinch rolls. In the near future the same service will be made available for customers worldwide through the Danieli manufacturing and service center network.

Danieli

GERMANY

ArcelorMittal Hamburg to implement AI solutions in steel production

ArcelorMittal Hamburg has commissioned the AI company Smart Steel Technologies to introduce its SST Platform including SST Casting AI and SST Rolling AI software products.

The platform will be integrated live with all relevant data sources from the melt shop, continuous caster and rolling mill. The AI solutions serve to optimize the continuous casting process and the rolling mill through automated monitoring, prediction and live recommendations to fine-tune every aspect of production and to eliminate any inefficiency. ArcelorMittal Hamburg will now apply AI-based optimization to both, the continuous casting process and to the rolling mill. This will lead to permanent improvements in quality and efficiency. The live data and AI platform will also serve as a basis for further data-driven optimization.

ArcelorMittal

ArcelorMittal to accelerate CO_2 reduction strategy and leverage hydrogen grid

ArcelorMittal is planning to build a large-scale industrial plant for the direct reduction of iron ore and electric arc furnace -based steelmaking at its site in Bremen, as well as an innovative DRI pilot plant in addition to an electric arc furnace in Eisenhüttenstadt, following the announcement of the planned expansion of Germany's hydrogen infrastructure.

Using green hydrogen, up to 3.5 million t/year of steel could be produced at the Bremen and Eisenhüttenstadt sites by 2030, with significantly lower CO_2 emissions.

"With our concept for the transformation of the plants in Bremen and Eisenhüttenstadt, we are accelerating the implementation of carbon-neutral steel production. These projects have the potential to have a significant impact in reducing CO_2 emissions, in line with the European Union's climate commitments," said Reiner Blaschek, CEO of ArcelorMittal Flachstahl Deutschland.

Meanwhile, the German government announced the intention to fund ArcelorMittal Germany's transformation strategy for the production sites in Bremen, Eisenhüttenstadt and Hamburg as part of the "Important Projects of Common European Interest (IPCEI)".

ArcelorMittal

Becker Stahl-Service modernizes slitting line

Danieli Fröhling has completed the successful revamp of the shear and the exit guide at Becker Stahl Service.

For this project, Danieli Fröhling supplied a new gearbox and a fully automatic mandrel changing device. All the new equipment was designed in-house and pre-assembled at the Danieli Fröhling workshops in Meinerzhagen. The revamped slitting shear is now equipped to cut 50% thicker strips and features a fully automatic changing head. The production diameter of the mandrel can be changed in three minutes, down from previously five minutes. This means that Becker Stahl can now change the mandrel diameter, coil by coil, without affecting production.

Danieli Fröhling

thyssenkrupp Steel, HKM and Port of Rotterdam jointly investigate setting up hydrogen supply chains

thyssenkrupp Steel, HKM and Port of Rotterdam will explore hydrogen import opportunities via Rotterdam (The Netherlands) as well as a possible pipeline corridor between Rotterdam and thyssenkrupp Steel's and HKM's steel sites in Duisburg.

In the course of their transformation paths towards climate-neutral steelmaking, thyssenkrupp Steel and HKM are going to require large and increasing quantities of hydrogen to produce steel without coal. The Port of Rotterdam is already investigating the import of hydrogen from a large number of countries and regions all over the world. Green hydrogen is a sustainable alternative to coal, oil and natural gas. Vast imports of hydrogen are necessary if Europe and Germany want to reduce CO_2 emissions and become climate-neutral by 2050, while maintaining its strong industrial backbone. Rotterdam is also setting up a carbon transport and storage system, Porthos, which is also being considered as a CO_2 storage site for the production of blue hydrogen by the "H2morrow steel" project, which includes thyssenkrupp Steel as partner as well.

thyssenkrupp Steel, HKM

HKM places order for feasibility study on syngas plant

With the aim to improve the CO_2 balance of their steel plant operations located at Duisburg-Huckingen, Hüttenwerke Krupp Mannesmann (HKM) has chosen Paul Wurth, a company of SMS group, for concept engineering and budget calculation services for an Ecoloop syngas generation and injection plant at their blast furnaces "A" and "B".

The utilization of syngas (a mixture of carbon monoxide and hydrogen) in the blast furnace allows decreasing the portion of fossil reductants and thus reducing CO_2 emissions in the hot metal production process. HKM intends to generate 13,000 Nm³/h of syngas out of solid recovered fuels (SRF). For this purpose, around 45,000 t/year of recycled high calorific plastic materials and waste wood chips will have to be processed and delivered to HKM in Duisburg.

On site, the generation of syngas will rely on the Ecoloop technology, developed by the German company of the same name. Ecoloop BBV-reformers (bio-based gasification) will be assembled in a battery arrangement. The reformers are gasifiers with wood and lime as reaction moving bed.

The entire syngas generation plant, for which Paul Wurth provides engineering services, will mainly consist of the receiving and storage station for the solid recovered raw material; the subsequent transport, mixing and dosing devices up to the syngas reformer battery; about 100 integrated syngas reformers; syngas cooling, compression and transport to the new coke oven gas compressor station; dust-free transport of ashes; related EIC system; and civil works.

In parallel to the ongoing feasibility studies, Ecoloop is running tests in their pilot plant in Lauingen, Germany, aimed at further optimizing the syngas quality. HKM's objective is to start operating the new syngas generation plant in 2023.

Paul Wurth

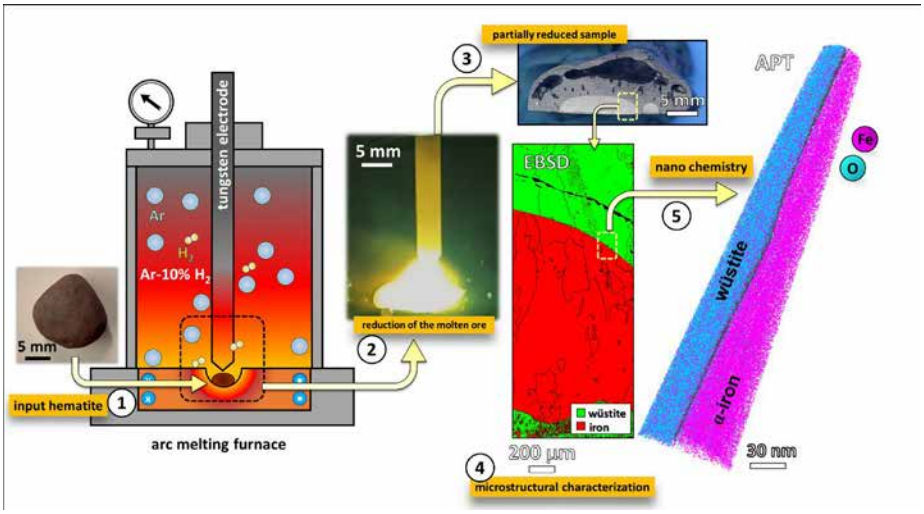
Metalshub closes financing round following a successful year

Metalshub, digital trading and price intelligence platform for the metals industry, has raised US $ 11 million in a Series A financing round.

The investment follows a record year in which Metalhub's turnover has increased fivefold and where Metalshub has published its first price indices. Large enterprise customers like Outokumpu, Saarstahl, Dillinger and Swiss Steel Group have moved their raw materials purchasing onto the Metalshub platform, highlighting the need for an industry specific purchasing and supply chain solution. Dr. Sebastian Kreft, co-founder of Metalshub: "2020 exceeded our expectations. Digital adoption has taken a quantum leap in the metal industry." Also benefiting from trends like the rally on steel mill raw materials, the Metalshub platform has experienced soaring demand." Metalshub was launched in 2017.

Metalshub

Max Planck Institute investigates route to produce green steel through hydrogen plasma



Flow sheet showing the principle of iron ore reduction based on hydrogen plasma (Picture: MPIE)

A team of Max Planck Institute for Iron Research has been investigating a green steel production route based on hydrogen plasma.

The Max Planck research team has been exploring the possibility to use hydrogen plasma for the reduction of iron ore instead of coke or reformed natural gas. Their latest investigations show that the thermodynamics and kinetics of the hydrogen plasma reduction of iron ores provides an alternative route for the production of green steel. The scientists published their latest findings in the journal Acta Materialia.

"Using pure hydrogen instead of coke or reformed natural gas to reduce iron ore can be one way to save CO_2 emissions. However, the chemical reaction using pure hydrogen requires an external supply of energy to proceed. The use of hydrogen plasma instead allows us to conduct the reduction reaction with less energy", explains Dr. Isnaldi Souza, postdoctoral researcher at the MPIE and first author of the publication.

Max-Planck-Institut für Eisenforschung (MPIE)

Max Planck Institute presents AI-based prediction of mechanical behaviour of materials

Max Planck researchers have presented a new deep neural network for predicting the mechanical behaviour of materials.

For more than 300 years, scientists have known how to cast the underlying physics into mathematical formulations. However, solving these equations used to be very time-consuming, especially as systems have been becoming increasingly more complex.

Now, scientists from the Max Planck Insitute for Iron Research and DeepMetis, a Berlin-based venture specialized in artificial intelligence, have used deep neural networks to calculate local stress in complex materials and this, up to 8,300 times faster than a standard solver would do. "Our latest work shows how all these calculations can be replaced by machine learning. Instead of solving the equations directly, we developed a neural network that can learn the physics and predict correct answers to complex and nonlinear mechanics questions simply by looking at a large set of data", explains Dr. Jaber Rezaei Mianroodi, head of the Max Planck research group. The latest results of the research have been published in the journal npj Computational Materials.

Max-Planck-Institut für Eisenforschung (MPIE)

Salzgitter takes next step on the road to low-CO_2 steelmaking

As part of its SALCOS low-CO_2 steel production project, Salzgitter has commenced work on µDRAL, a demonstration plant for the production of direct reduced iron. Supplier and technology partner of the plant is Tenova.

The plant has a production capacity of 2,500 kg/day and can be operated flexibly with variable proportions of natural gas and hydrogen (0 – 100%). Production will commence in the first half of 2022. The direct reduced iron will initially be used in the blast furnace to reduce the amount of pulverized injection coal, as well as in the electric arc furnace at the Peine plant. Tenova is the supplier and technology partner in this project.

Building the new direct reduction plant is the next step towards the realization of SALCOS. The shift in steelmaking at Salzgitter AG to hydrogen-based processes is expected to be completed in several stages by 2050 at the latest.

Salzgitter AG, Tenova

Groundbreaking for the new DRI plant (Picture: Salzgitter)

Rasselstein puts new production management system into operation

thyssenkrupp Rasselstein has renewed its production management systems with technology from PSImetals.

In the course of this project, approximately 50 plants were renewed with the PSImetals system. PSImetals implemented the modules Production, Quality, Logistics, Planning and Order Scheduling as part of the Production Execution@Tinplate Manufacturing project. Currently, around 1,000 employees are working with PSImetals in three shifts.

thyssenkrupp

thyssenkrupp Steel Europe to revamp burner technology in a continuous galvanizing line

Tenova LOI Thermprocess has received another order from thyssenkrupp Steel Europe for the installation of new burners at the continuous galvanizing line located in Bochum.

The upgrade of burner technology is performed with a view to an increase in production capacity of high-strength steels (AHSS) for the automotive industry and to lowering emissions and energy consumption. The new burners will reach NO_x-emission levels lower than 140 mg/Nm³ during production. In addition, Tenova will upgrade the heating system in order to enable an increase in target strip temperatures to more than 900°C.

Tenova

A state-of-the-art heating system in a galvanizing line (Picture: Tenova)

Vanilla Steel takes next step in expanding its marketplace for industrial materials

Launched in 2020, Vanilla Steel is building a secondary market for excess steel, i.e. material that is in overstock and has no direct customer attached to it.

Vanilla Steel facilitates transactions, enables smart matchmaking, removes manual and tedious tasks with automation and saves time by reducing the negotiation period. Through weekly online auctions, steel suppliers can find the right buyers in a competitive bidding process. Vanilla Steel is already present in 50 countries with more than 100 steel suppliers who have listed 90,000 t of steel during its first year of operation.

Vanilla Steel has now received new funding which will enable it to recruit new talents to support growth, expand to new geographies and invest in new product functionalities.

Vanilla Steel

ITALY

Acciaierie Venete to upgrade rolling mill

Acciaierie Venete has awarded AIC Automazioni Industriali Capitanio the order to upgrade its rolling mill in Mura.

As part of the modernization of the finishing rolling mill in Mura, AIC Automazioni Industriali Capitanio will design, develop and supply new equipment and software. The project will be implemented in two stages. The supply scope for AIC comprises the upgrade of the existing panels and switchboards, PLC software development based on Rockwell automation components, a new HMI system, engineering and the electrical drawings. AIC will also be involved in the supervision of the installation and commissioning activities and provide start-up support and remote assistance.

AIC Automazioni Industriali Capitanio

GIVA performs test with a 30% natural gas/hydrogen blend in steel forging plant

A first test of a 30% natural gas/hydrogen blend in steel forging operations was performed in Rho in the province of Milan at the Forgiatura A. Vienna plant.

The trial involved the use of the hydrogen/gas mix to heat the furnaces of the Forgiatura A. Vienna plant and was successfully carried out on site after a series of studies and laboratory tests. The companies involved in the initiative were: Snam, an energy infrastructure company and developer and promoter of the project; RINA, a multinational inspection, certification and engineering consultancy, which handled the engineering analyses and laboratory phase; and steel forging company GIVA, which made Forgiatura Vienna available for the field test.

The use of the hydrogen and natural gas blend did not require any plant modifications and had no impact either on the equipment used (industrial burners) or on the characteristics of the final heat-treated product. It is estimated that the permanent use of a 30% green hydrogen blend, fuelled by renewables, on the total gas consumed by the three GIVA Group's steel forging plants for its industrial processes would lead to a significant reduction in CO_2 emissions.

GIVA Group

Marcegaglia to receive new control system for Sendzimir mill

Flat steel producer Marcegaglia has contracted Danieli Automation for the technological upgrade of its 20-high Sendzimir mill at its Gazoldo degli Ippoliti works.

State-of-the-art control room in a cold rolling mill (Picture: Danieli)

A new technological, IOT-compliant automation system, developed by Danieli Automation, will replace the existing controller. Based on the Danieli Automation HiPAC platform, the new, automation system will include HGC and AGC controls, roll crown and IR shifting controls, speed master and flatness controls. The new control system, which will be interfaced with the existing automation, will also feature a new advanced diagnostics system.

The mill is part of a larger stainless steel complex. It rolls 1,500-mm-wide stainless steel strip. The upgrade is scheduled to be completed by the end of 2021.

Danieli

Rubiera Special Steel orders new mechanical dry pumps and ingot grinding machines

Danieli has received two orders from Rubiera Special Steel (RSS) in Casalgrande: for the supply and installation of two new sets of mechanical dry pump systems for degassing stations, and for two ingot grinders.

The degassing stations are based on vacuum lid degassers (VLD), so the vacuum cover fits directly in the ladle, minimizing the system volume. This application requires perfect process control to minimize the slag foaming during pump-down. All VLD systems are connected through a specially arranged suction line to a vacuum pump consisting of steam ejectors. RSS is going to replace the existing steam ejectors pumps with a new, dry mechanical pump system. Not only new mechanical dry pumps will be installed but also a dust separator and textile filter to remove the dust coming from the process gas, all necessary shut-off and control valves, and a new automatic foaming slag control system to be installed on the existing vacuum cover. The first mechanical dry pump is scheduled to start up in August 2021, the second one in January 2022.

The two new grinders ordered by Rubiera Special Steel will feature technologically advanced multi-product grinding tables to process special steel polygonal, multifaced, round and square ingots of up to 120 t. The machines will be equipped with belt-driven spindles and the Danieli Hi-Grind removal control system. The skid-mounted hydraulic machinery will reduce installation and piping connection time. The new grinders are scheduled to be fully operational by early 2022.

Danieli

FAM Ferriera Alto Milanese orders new control panels for bar-in-coil mill

FAM Ferriera Alto Milanese has contracted AIC Automazioni Industriali Capitanio to supply new control panels for the bar-in-coil rolling mill in Caronno Pertusella (VA).

The new equipment will reduce future maintenance costs, improve troubleshooting and increase system flexibility. The scope of supply includes new control panels, replacement of the existing CPU and node, engineering and electrical drawings, PLC software development based on Rockwell ControlLogix and a HMI control system upgrade.

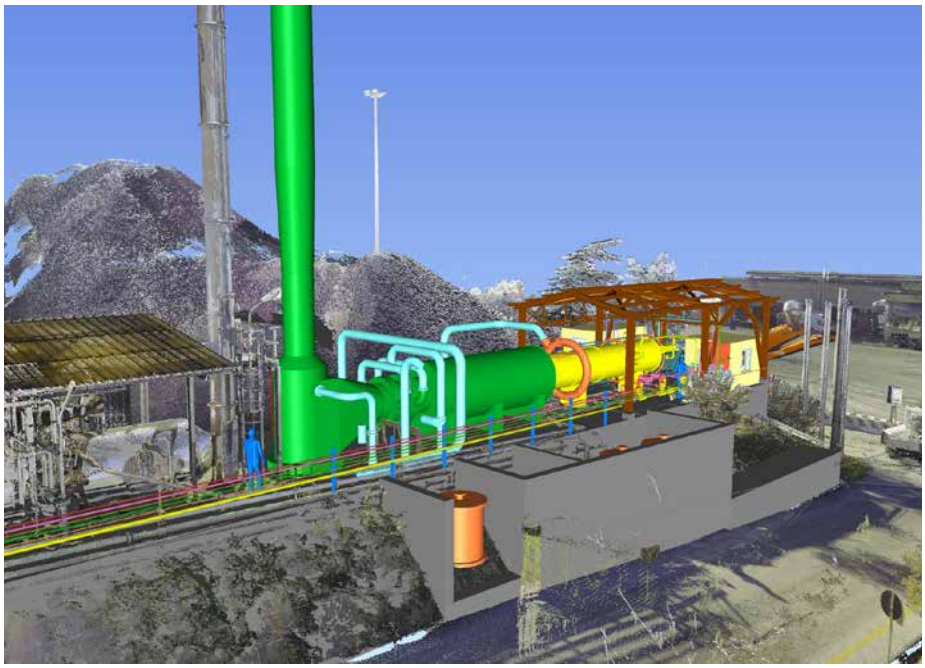
AIC Automazioni Industriali Capitanio

Paul Wurth and Italiana Coke to test new CO_2 reducing technology

Italiana Coke and Paul Wurth, a company of SMS group, have signed an agreement to install a test facility for assessing a newly developed low-CO_2 technology at Italiana Coke's production site in Cairo Montenotte (Savona).

The project is aimed at validating the feasibility of an innovative process Paul Wurth developed to generate CO_2-neutral hot syngas from coke plant by-products by dry reforming. The subsequent utilization of syngas (a mixture of carbon monoxide and hydrogen) in the blast furnace allows decreasing the portion of fossil reductants and thus reducing CO_2 emissions in the hot metal production process, with competitive operating costs and no CO_2 taxation incurred.

Paul Wurth, Italiana Coke



The planned test facility for syngas generation (Picture: Paul Wurth)

SLOVENIA

Acroni to modernize plate mill with new cycloconverter drives

SIJ Acroni has engaged Primetals Technologies to replace the existing cycloconverter drive control for the upper and lower motors on the plate mill's roughing stand at the Jesenice production site.

The goal of the project is to maintain availability and secure the supply of spare parts. Primetals Technologies' scope of performance includes supplying two VarioVerter cycloconverter controllers, replacing the field control units, electrical assembly, and integration into the plate mill's existing basic automation control system, thereby largely leaving the interface situation unchanged.

Installing the new VarioVerter also takes account of a request from the customer: should a synchronous motor be damaged, the customer would later like to have the opportunity of temporarily running the plate mill with a DC motor using the supplied drive control components. Installation work will not add any extra days to the annual winter shutdown and is due for completion in January 2022.

Primetals Technologies

Cycloconverter controller system of the type installed at the Acroni plate mill
(Picture: Primetals Technologies)

SPAIN

ArcelorMittal to build new DRI and EAF installations to reduce carbon footprint of Spanish operations

ArcelorMittal has signed a memorandum of understanding with the Spanish Government that will see a €1 billion investment in decarbonisation technologies at ArcelorMittal Asturias' plant in Gijón.

ArcelorMittal will introduce new manufacturing processes that contribute to a considerable reduction of CO_2 emissions. It will also further intensify its R&D capabilities in Spain to support the new project and innovation requirements.

At the heart of the plan is a 2.3-million-t green hydrogen direct reduced iron (DRI) unit, complemented by a 1.1-million-t hybrid electric arc furnace (EAF). This starts the transition of the Gijón site away from the BF-BOF steelmaking route to the DRI-EAF route. The new DRI facility and EAF meltshop are planned to be in production before the end of 2025.

The Gijón DRI will also feed the company's Sestao plant, situated approximately 250 km from Gijón, where production is already entirely from the electric arc furnace route.

ArcelorMittal

Siderúrgica Sevillana renews electrical equipment

Automazioni Industriali Capitanio (AIC) has supplied new the electrical cabinets to Siderúrgica Sevillana.

The order placed by Siderúrgica Sevillana included the design and supply of electrical cabinets and auxiliary equipment of the electric arc furnace area. All parts of the equipment were assembled, tested, certified and delivered to the customer's plant within three weeks from the placement of the order and successfully commissioned.

AIC Automazioni Industriali Capitanio

SWEDEN

Hybrit project takes next steps on the road to fossil-free steelmaking

SSAB, LKAB and Vattenfall have decided to establish an industrial-scale Hybrit production plant, following the completion of test production of sponge iron at the Luleå pilot plant. In addition, the building of a storage facility for fossil-free hydrogen has commenced.

The Hybrit pilot plant in Luleå has completed test production of sponge iron, demonstrating that it is possible to use fossil-free hydrogen gas instead of coal and coke to reduce iron ore. Production has been continuous and of

good quality. Next to the direct reduction pilot facility, SSAB, LKAB and Vattenfall have commenced building a rock cavern storage facility for fossil-free hydrogen gas on a pilot scale.

As a next step, the three joint venture companies have decided to start industrialization of the Hybrit technology in Gällivare, where a production plant for fossil-free sponge iron – from feedstock to steel – is being planned.

Hybrit

TURKEY

Habaş A.S. places to upgrade hot strip mill

Habaş A.S. has awarded SMS the order to expand the hot strip mill at its Aliağa site near Izmir. The rolling mill, supplied and commissioned by SMS, has been in operation since 2014.

The flexible SMS concept provides for an upgrade in several stages. For the current upgrade, Habaş has ordered a second roughing stand with attached edger and a third downcoiler. SMS group company AMOVA GmbH is going to supply the equipment connecting to the existing pallet transport system and additional transportation equipment. With this project, Habaş intends to boost the mill capacity to 4.5 million t/year. As well as carbon steels, the product range will include HSLA steels, pipe grades and multi-phase steels. The mill will be able to process slabs of up to 225 mm thickness, up to 2,100 mm width and up to 12 m length, and produce hot strip between 700 and 2,100 mm wide and between 1.2 and 25.4 mm thick. The new edger and the new downcoiler will be of the same design as the existing units. All the new units will be seamlessly integrated into the existing X-Pact® automation system. Commissioning of the upgraded rolling mill is scheduled for early 2023

SMS group

The hot strip mill of Habaş is being expanded to include a further roughing stand (Picture: SMS group)

BRAZIL

ArcelorMittal Vega to expand cold mill complex

ArcelorMittal Vega has awarded SMS group the order to expand the flat rolling mill complex in São Francisco do Sul, supplied by SMS group in 2003.

With this project, ArcelorMittal Vega intends to boost the mill's capacity by 640,000 t/year and add ultra-high-strength steel strip for the automotive industry to its portfolio. To this end, the existing pickling line/tandem cold mill will be modified, and a new universal annealing and hot-dip galvanizing line as well as a new recoiling and inspection line will be integrated into the facility.

ArcelorMittal Vega's flat rolling complex will undergo comprehensive expansion (Picture: SMS group)

SMS group will supply the mechanical and process-technological equipment and supervise the installation and commissioning activities. Part of the equipment will be integrated into existing facilities and systems.

The pickling line/tandem cold mill supplied by SMS in 2003 underwent its first expansion in 2010, also by SMS. Now, the tandem mill is going to receive a fifth stand, which will be integrated directly ahead of the existing cold mill. Thanks to the additional roll stand, it will become possible to roll strip of a maximum initial thickness of 6.0 mm. Currently, the maximum initial thickness is 4.8 mm.

The additional 640,000 t/year produced will be refined in the new universal annealing and hot-dip galvanizing line mainly into high-strength steel grades for automotive structural components. A high-performance annealing furnace will be supplied by SMS group company Drever International. For further treatment of the strip, the line will include a skin-pass mill, a stretch-leveller, a horizontal roll coater, a recoiling and inspection line with an integrated side trimmer, an inspection station and an oiling machine. Commissioning of the new and modified lines is scheduled for 2023.

SMS group

Gerdau to install electrode-control systems at seven plants in Brazil

Seven Gerdau plants in Brazil will fit their electric arc furnaces with the Danieli Automation Q-REG electrode regulator system.

Q-REG provides not only control of electrodes based on a dedicated HiPAC high-performance process controller, but also fast data acquisition and processing to analyze process parameters in real time, such as arc stability, arc coverage and radiation index per electrode. Furthermore, Q-REG features advanced diagnostic tools enabling a deeper insight into every heat and the behaviour of main process parameters, including visualization of circular diagrams and variable trends.

Danieli

Gerdau Ouro Branco upgrades wire rod mill with new roller guides

Gerdau selected Danieli Service Brazil to supply intelligent roller guides for its wire rod mill in Ouro Branco.

The new roller guides have been installed in the last passes of the sizing block, where high-speed operation requires perfect product guiding and stability. The supplied SRW roller "light guides" are about 40% lighter than the previous ones. They provide improved stability of the wire rod process and longer lifetime of the rollers. The Danieli MH roller guides are "intelligent-ready", which means that specifically designed sensors can be easily installed and integrated into the 4.0 automation control system to monitor and predict performances. The supply included the Smart Eye digital camera-based system for precise setting and alignment of the roller guides, supporting operators in the configuration and fine-tuning of the guides in the workshop and in the mill. Danieli MH intelligent roller guides can process any diameter ranging from size 5.5 to 21.5 mm.

Danieli

The old and new roller guides installed in the wire rod mill of Gerdau Ouro Branco (Picture: Danieli)

CANADA

Algoma Steel receives government financial support for transformation to green steel

The Government of Canada's commitment of up to CAN$ 420 million in financial support marks another significant milestone for Algoma Steel to decarbonize its flat-rolled steel production.

The support is intended to facilitate Algoma Steel's proposed transformation to electric arc furnace steelmaking. The funding will enable the company to purchase state-of-the-art equipment to support its transition to EAF production. This process is expected to cut greenhouse gas (GHG) emissions by more than 3 million t/year by 2030, making a meaningful contribution to achieving Canada's climate goals.

Algoma Steel

Algoma Steel and Legato Merger sign definitive merger agreement

Algoma Steel and Legato Merger Corp., a special purpose acquisition company, have entered into a definitive merger agreement that will result in Algoma becoming a publicly listed company with its common shares traded on the Nasdaq stock market.

As a publicly traded company, Algoma will continue to execute its growth strategies under the leadership of Algoma's current management, with a board of directors that will include six directors designated by Algoma, three directors designated by Legato and one jointly nominated.

Michael McQuade, CEO of Algoma, commented, "The proposed transaction will provide Algoma with investment capital and an enhanced capital structure to support further transformative investments. We continue to evaluate our strategic options, including the potential for a substantial investment in electric arc furnace steelmaking".

The transaction is expected to close in the third quarter of 2021, subject to the approval of Legato stockholders and the satisfaction or waiver of certain other customary closing conditions, including approvals from the Nasdaq and the Toronto Stock Exchange.

Algoma Steel, Legato Merger

CHILE

CAP explores feasibility to decarbonize iron ore mining and steelmaking operations

Compañia Siderúrgica Huachipato S.A. (CSH) and Paul Wurth Italia S.p.A., a company of the SMS group, have signed a technological cooperation agreement to explore the viability for transitioning CAP steelmaking operations towards the production of low-CO_2 steel in Chile along the complete value chain.

Compañía Siderúrgica Huachipato (CSH) facilities in Chile (Picture: SMS group)

This partnership joins Chile's leading mining and steelmaking companies affiliated to the CAP Group and Paul Wurth. CAP is the leading producer of iron ore and pellets on the America Pacific coast, the largest steel producer in Chile, and the most important steel processor. The parties to the agreement undertake to jointly conduct a feasibility study for a technological roadmap towards low-CO_2 steel feedstock. The transition plan aims at setting up immediate measures to reduce the CO_2 footprint of CSH's operations by introducing the use of renewable energy and hydrogen combined with highly efficient technologies. This transformation process will thus lead to a product portfolio for green steel grades. Thomas Hansmann, Chief Technology and Operations Officer of Paul Wurth says: "Chile is likely to offer perfect conditions for the use of renewable energy and hydrogen to be introduced into the value chain of both mining and steelmaking operations."

Paul Wurth

USA

ArcelorMittal makes first investment through its carb-free innovation fund

ArcelorMittal has completed its first XCarb™ innovation fund investment since launching the initiative in March 2021. The company has invested an initial $10 million in Heliogen, a renewable energy technology company which focuses on 'unlocking the power of sunlight to replace fossil fuels'.

Heliogen's technology will harness solar energy by using a field of mirrors which will act as a multi-acre magnifying glass to concentrate and capture sunlight. The sunlight will then be subsequently con-

verted into heat (HelioHeat™), electricity (HelioPower™) or clean fuels (HelioFuel™). All three Heliogen products have the potential to be applicable to the steelmaking process and support the steel industry's transition to carbon-neutrality. The heat could be used to increase the temperature of air blown into a blast furnace, offsetting the use of fossil fuel.

In addition to this initial investment, ArcelorMittal and Heliogen have signed a Memorandum of Understanding which aims to evaluate the potential of Heliogen's products in several of ArcelorMittal's steel plants.

ArcelorMittal

WORLD

Statement by OECD Steel Committee

At its 89th session held virtually in March 2021, the OECD Steel Committee held in-depth discussions on the global steel market situation and outlook, challenges facing the global steel industry, and policy approaches to ensure a level playing field in the sector.

The COVID-19 pandemic has had a negative impact on the global economy in general, and on the steel market in particular. In its March 2021 Economic Outlook, the OECD forecasts world GDP to rebound by 5.5% in 2021 and 4% in 2022. The effects of the pandemic have been significant for the steel industry, with major steel-producing economies experiencing significant contractions in steel production in 2020. While steel prices declined in 2020, they have recently increased as steelmaking capacity idled during the heights of the pandemic could not be brought online quickly enough to meet recovering steel demand and restocking activity. While steel prices have turned around recently, the sharp increase in raw material prices observed over the past year has worked to weaken average profit margins in the steel industry.

Global steel demand is expected to recover only partially in the near term, with the level of finished steel demand in 2021 expected to remain below pre-pandemic levels. The latest available data from the OECD show that global steelmaking capacity increased to 2,453.2 million t in 2020. In addition, the gap between global steelmaking capacity and crude steel production increased to 625.4 million t in 2020. The Committee noted deep concerns that a number of planned capacity increases are premised on expectations of strong increases in future demand, with many investments being supported by governments and not driven by market considerations. Several of these investments are cross-border in nature. This creates a significant risk of exacerbating the excess capacity situation, and raises the likelihood of supply further overshooting the true needs of the market.

State-owned enterprises (SOEs) account for a significant portion of global crude steelmaking capacity. While concentrated in certain geographies, SOEs have global reach through their engagement in international trade and investment. With the activities of SOEs in domestic and international steel markets potentially creating market distortions, members of the Committee agreed to advance their work in this area with two key objectives: first, to better understand the market context of cross-border investments by SOEs and the financial conditions of the relevant firms and, second, to shed light on the financing of SOEs and support measures provided to them.

The Committee also discussed the state of its work on building a database of subsidies in the steel sector, with members reaching consensus on moving forward to the next phase of the project. Members agreed to resume collecting subsidy data on the world's largest steel producing jurisdictions, including jurisdictions where recent data on increasing production has raised concerns about potential government support. This work represents a major step towards improving transparency on support measures for steel producers and will feed into future analytical work examining the impacts of these measures on global steel markets.

OECD

Job cut to secure the German sites of the plant maker

SMS group with positive outlook for 2021 after challenging year 2020

Despite a sharp decline in order intake SMS group confirmed their growth strategy particularly with a more stable development in service business and the digitalization segment. Anticipting a market recovery in 2021 the group expects a significant rise in business activities

SMS group particularly felt the impact of the coronavirus pandemic in its business with new plants. In the 2020 financial year, order intake fell by around 40 percent compared to the previous year to EUR 1,885 million. The order backlog declined to EUR 3,028 million what is still a high level. At EUR 2,745 million, sales were 6.5 percent down on the previous year. The 2020 result was impacted by the consequences of the coronavirus pandemic and by provisions for the restructuring measures in Germany. As a result, SMS closed the financial year with a clear loss: EUR -165 million pre-tax.

Net liquidity, on the other hand, was bolstered by around 4 percent to EUR 863 million. Investments more than doubled compared to the previous year, totaling EUR 83 million.

After having acquired the remaining shares in Paul Wurth S.A. in April 2021 SMS group is now in a position to offer the entire range of technologies relevant to the decarbonization of metallurgical processes. SMS group CEO Burkhard Dahmen says: "With our wide range of 'bridge' technologies developed for the decarbonization of the industry, we can support our customers in every phase of the transformation to climate-neutral steel production. This applies to both existing plants and the development of new ones."

Figures of the financial year 2020 of the SMS group

Financial year	2019	2020	Change
Order intake	3,154 million €	1,885 million €	- 40.2%
Order backlog	3,850 million €	3,028 million €	- 21.4%
Sales	2,935 million €	2,745 million €	- 6.5%
Pre-tax result	64 million €	- 165 million €	- 229 million €
Adj. pre-tax result*	85 million €	- 39 million €	- 124 million €

* without restructuring efforts

Besides decarbonization, the Digitalization, Automation and Technical Service businesses remain the key drivers of new orders. The service business particularly proved considerably more stable recently. There is a growing trend toward integrated service packages, for example in the form of performance-based agreements. In addition, the 2020 financial year saw an expansion of the service business via strategic buyouts: the acquisition of Vetta Tecnologia S.A. now enables SMS to offer its customers energy management solutions for the highly complex production chains in the metals industry.

For the coming years, SMS expects its core business of metallurgical plant construction to see stable development, though remaining short of its pre-pandemic level. Many customers are currently reviving projects that had been put on hold and investing in new plant technology. SMS group's regional focus, which assures greater proximity to markets, has already been bearing fruit.

For the current financial year, SMS expects order intake to rise clearly and sales to return to the level of 2019. To strengthen the competitiveness of the German sites and adjust the cost structure to the lower level of capacity utilization, personnel costs will have to be cut by approximately another EUR 100 million.

For the next three years, SMS forecasts a significant recovery in its business, driven in particular by digitalization projects, the further expansion of the service business and the market launch of the joint ventures Primobius (battery recycling) and BOXBAY (port logistics).

Dahmen: "We see that we have chosen the right growth strategy and that it will continue to be successful as we emerge from the pandemic. We are determined to return to our path of profitable growth in the current financial year."

"With our wide range of 'bridge' technologies developed for the decarbonization of the industry, we can support our customers in every phase of the transformation to climate-neutral steel production. This applies to both existing plants and the development of new ones."

Burkhard Dahmen, CEO of SMS group

SMS group

HYFOR pilot plant under operation

The next step for carbon free, hydrogen-based direct reduction

Successful first tests of HYFOR were performed at the pilot plant at the voestalpine site in Donawitz, Austria. It's a unique process using iron ore concentrate fines with 100% particle sizes smaller than 0.15 mm

In April, the hydrogen-based fine-ore reduction (HYFOR) pilot plant developed by Primetals Technologies was commissioned at the voestalpine site in Donawitz, Austria. First tests were successful. Test with various iron ore concentrates will continue to collect a sound data basis. Use of 100% hydrogen as reduction agent reduces the CO_2 footprint close to zero. The HYFOR pilot plant employs the world´s first direct reduction process for iron ore fines concentrates from ore beneficiation, not requiring any agglomeration like sintering or pelletizing. This reduces CAPEX and OPEX costs. HYFOR represents the only process worldwide capable of processing iron ore concentrate fines with 100% particle sizes smaller than 0.15 mm, and a wide variety of ores, e.g. hematite and magnetite, supplied by different customers of Primetals Technologies worldwide. The direct reduction plant will come in a modular design, allowing for a tailor-made scaling for customers for all sizes of steel plants.

First tests have been successfully executed in April and May 2021 The scale of one test run is in the range of processing of 800 kg iron ore. The HYFOR pilot plant shall be operated for at least two years in multiple campaigns to test various ore types and to evaluate the optimal process parameters for the next scale up step. Smooth operation assumed, a hot briquetting unit will be added to verify the hot briquetting step as well as the HBI quality to be expected from the HYFOR technology.

Primetals Technologies has developed the world´s first direct reduction process for iron ore concentrates not requiring any agglomeration like sintering or pelletizing. Primetals Technologies can resort to the comprehensive experience from the earlier Finmet/FINORED and FINEX development and plant installations. The new technology can be applied to all ore types (hematite and magnetite) and particle sizes of up to 100% smaller than 0.15 mm. As primary reduction agent, the new process uses 100% hydrogen from renewable energy or alternatively hydrogen-rich gases from other gas sources like natural gas pyrolysis or conventional steam reformers. This results in a low or even a zero CO_2 footprint. The direct reduction plant will come in a modular design, making it available for all sizes of steel plants. The product is hot DRI for direct hot transport and feed to the downstream melting like EAF or Hot Briquetted Iron (HBI) for being sold to the market.

The use of DRI/HBI is expected to continue to grow due to the need to the strong demand to decarbonize the steel sector and the growing number of electric arc furnaces in service worldwide. Currently, all available technologies require agglomeration, like pelletizing to produce DRI or HBI. An additional challenge steel producers face, is the reduced quality of iron ore, resulting in the need to beneficiate the iron ores. In order to progress to a CO_2-free steel production, a process using mainly hydrogen is most desirable. The new HYFOR process developed by Primetals Technologies takes care of all the above considerations.

The HYFOR pilot plant consists of three parts: a preheating-oxidation unit, a gas treatment plant and the actual reduction unit. In the preheating-oxidation unit, fine ore concentrate is heated to approx. 900°C

HYFOR direct reduction pilot plant for iron ore fines located at the voestalpine site in Donawitz, Austria
(Picture: Primetals Technologies)

and fed to the reduction unit. The reduction gas, 100% hydrogen, is supplied over the fence from a gas supplier. A dry dedusting system takes care of dust recycling to prevent emissions from the processes involved. The hot direct reduced iron (HDRI) leaves the reduction unit at a temperature of approx. 600°C before its cooled down and discharged from the HYFOR pilot plant.

The next step will be the addition of a Hot Briquetting Testing facility to produce Hot Briquetted Iron (HBI).

The aim of the HYFOR pilot plant is to verify this break-through process and to serve as a testing facility to provide the data basis for upscaling the plant size to an industrial-scale prototype plant as the next development step.

This project is funded by the Climate and Energy Fund and is carried out under the program "Energieforschung". For further information: www.klimafonds.gv.at, www.energieforschung.at

Primetals Technologies

Hydrogen-based direct reduction technology

voestalpine holds patent for carbon-neutral pre-material used in green steel production

voestalpine has developed an industrial scale process for carbon-neutral steel production without the use of fossil carbon and secured the intellectual property rights to the process from the European Patent Office. Specifically, the patent covers the production of sponge iron (DRI or HBI) in a direct reduction process using green hydrogen and biogas

Europe's climate goals are facing the steel industry with profound technological challenges. The political objective of achieving climate neutrality by 2050 can only be met with new production technologies. "We are convinced that transforming Europe's steel industry is only possible when we all pull together. We are focusing on cooperation and dialogue with all stakeholders," stresses Herbert Eibensteiner, Chairman of the Management Board of voestalpine AG.

The process developed by voestalpine uses green hydrogen and biogas in the direct reduction process. In addition to carbon neutrality, the process offers other advantages. For example, the biogenic carbon allows carburization of the sponge iron, for efficient melting in the electric arc furnace.

The patent is valid in all major European steel manufacturing countries and specifically covers the production of sponge iron (DRI or HBI) using green hydrogen and biogas in the direct reduction process.

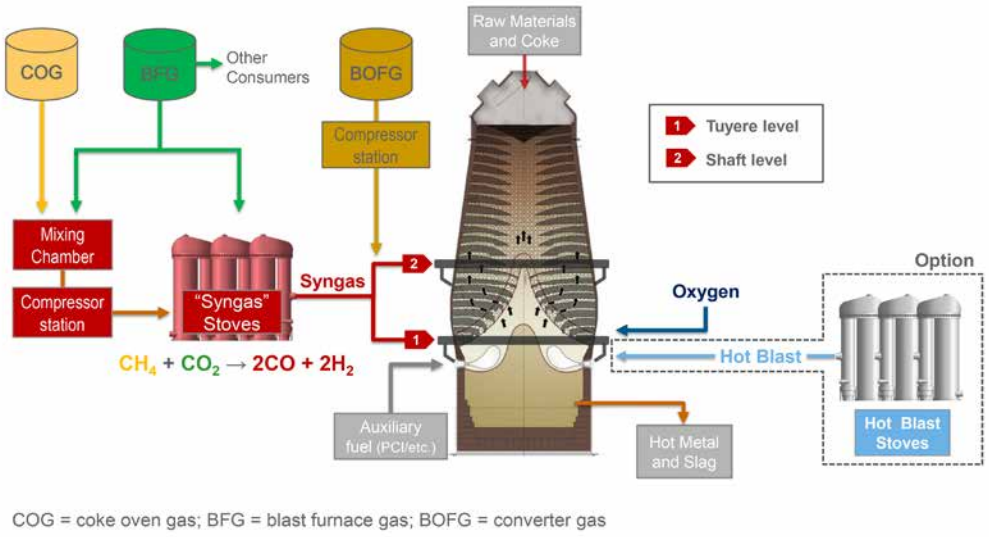
voestalpine will grant patent licenses for the carbon-neutral prematerial used in steel production and plans to work with the license holders to transfer the necessary know-how.

voestalpine is continuously investing in the research & development of new product solutions and processes. Over 700 voestalpine employees at more than 70 Group companies worldwide are researching, testing, and bringing new product solutions to the market on an ongoing basis. The Group has already registered more than 3,200 patents for technologies and products, and current research is focused on digitalization and sustainability.

voestalpine AG

voestalpine's step-by-step plan for decarbonisation

voestalpine began establishing various bridging technologies and researching alternative production processes years ago. With "greentec steel", the voestalpine Group is pursuing an ambitious step-by-step plan to decarbonize steel production:
In a first step, the gradual switch from the coal-based blast furnace route to a green electricity-based electric steel route is planned. In addition to scrap, hot metal in liquid form and hot-briquetted sponge iron (HBI) are the most important input materials for the future CO_2-neutral production of high-quality steel. In this way, CO_2 emissions from steel production in Linz and Donawitz could be significantly reduced by around 30% by 2030. This corresponds to a saving of around 3 to 4 million tonnes of CO_2 per year. The hybrid concept forms the basis for the hydrogen-based transformation.
In the long term, the Group aims to successively increase the use of green electricity and green hydrogen in the steel production process and thus achieve CO_2-neutral production by 2050. To this end, voestalpine is already conducting intensive research into breakthrough technologies that will enable CO_2-neutral steel production based on green electricity and green hydrogen in the long term, such as the H2FUTURE pilot plant.



General principle of Paul Wurth's dry reforming process (Picture: Paul Wurth)

Paul Wurth, Dillinger and Saarstahl join forces on development of dry reforming technology

"Green steel" initiative: cutting BF carbon emissions by using H2Syngas

With "H2Syngas", Saarstahl and Dillinger have joined with Paul Wurth, a Luxembourg engineering company belonging to the SMS group to use their own process gases and significant quantities of hydrogen in the blast furnace process. The associated pilot plant, which is being built in cooperation with Paul Wurth, is scheduled to begin operating this year. With this innovative technology, the steel companies are further reducing their carbon emissions and taking the next important step toward carbon-neutral steel production. H2Syngas is a part of the cross-border hydrogen project in the Saar region

As part of the joint H2Syngas project, the steel companies intend to continue working with Paul Wurth to develop the technology of using own process gases for a blast furnace of ROGESA Roheisengesellschaft Saar mbH, a subsidiary of Dillinger and Saarstahl. The new so called dry reforming process developed by Paul Wurth enables the gas produced in the coke ovens to be converted into a hot reduction gas, or "syngas". This gas is enriched with hydrogen and then used as a reducing agent for the reduction of iron ores. Injecting the hot reducing gas into the blast furnace leads to a significant reduction in coke consumption and thus to a reduction in carbon emissions.

"The use of process gases for metallurgical purposes makes it possible to cut carbon emissions by up to 12 percent," explains Dr. Karl-Ulrich Köhler, Chairman of the Board of Management of Dillinger and Saarstahl. "By using hydrogen, we can further improve and actually nearly double the potential reduction of carbon. The creation of an adequate energy infrastructure is a precondition for this." Köhler added: "With the H2Syngas innovation project, we are rigorously pursuing the path toward green steel production."

H2Syngas is one of the leading projects of the cross-border hydrogen project in the Saar region, which is seeking IPCEI funding from the German government. The aim of the individual projects is to establish a green hydrogen economy in Saarland, France and Luxembourg. The various sub-projects are collectively initiating a sustainable transformation process in the industry and in the mobility sector. The emission-free technologies that are emerging from this are driving structural change in the border region. As industrial customers, the Saarland steel companies Dillinger and Saarstahl are playing a key role here in the strategic development.

The first phase of the project will involve construction of a pilot plant to test the dry reforming process on a small scale. For the

> "With the H2Syngas innovation project, we are rigorously pursuing the path toward green steel production."
>
> *Dr. Karl-Ulrich Köhler, Chairman of the Board of Management of Dillinger and Saarstahl*

Dry reforming produces hydrogen-rich synthesis gas for the blast furnace process

The dry reforming process allows the conversion of coke oven gas into a hot reducing gas or syngas that is injected in the blast furnace at tuyere or shaft level. The mixture of coke oven gas and blast furnace gas is compressed and heated-up in a regenerative heat exchanger of similar design than a traditional hot stove. At high temperature, the methane contained in the coke oven gas will react with the CO_2 contained in the blast furnace gas to produce hydrogen and carbon monoxide. The injection of this hot reducing gas into the blast furnace entails a significant reduction in coke consumption. Such use of steelmaking gases for metallurgical purposes rather than for thermal purposes, translates into a significant reduction in CO_2 emissions of up to 12%. The use of hydrogen can further improve and almost double the CO_2 saving potential.
The cooperation agreement with steel partners Dillinger and Saarstahl provides Paul Wurth the opportunity to test the dry reforming process under industrial-like conditions, which will boost the development of the new technology. For Dillinger and Saarstahl, the future full-scale implementation of this technology will considerably decrease the carbon footprint and allow taking a next step forward towards green steel production.

Paul Wurth

development and construction of this pilot plant the Luxembourg Ministry of Economy awarded Paul Wurth a grant under the applicable R&D aid scheme. The pilot plant is scheduled to be begin operating in the summer of 2021. In the next project phases, the process will be further developed to semi-industrial and later to industrial scale with support from public funding. The aim is for larger quantities of synthesis gas to be produced and injected into a blast furnace.

Dillinger, Saarstahl, Paul Wurth

HBI processing was successfully tested in a blast furnace of the Kakogawa steelworks in Japan (Picture: Kobe Steel)

Green transition of integrated iron and steel works

Processing of HBI in blast furnace successfully verified

Kobe Steel has successfully tested the processing of hot briquetted iron (HBI) in a regular blast furnace. The CO_2 emissions from the blast furnace operation could be significantly reduced

Kobe Steel, Ltd. announces that it has successfully demonstrated the technology that can reduce a significant amount of CO_2 emissions from blast furnace operations, combining the technologies of Midrex in the engineering business and the blast furnace operation technology in the iron and steel business. This achievement is a result of the integrated efforts of the Kobe Steel Group (also known as the KOBELCO Group) leveraging its diverse businesses. The demonstration test was conducted for a month at a large blast furnace (4,844 m³) of the Kakogawa Works in Hyogo Prefecture, Japan, in October 2020.

The quantity of CO_2 emissions from the blast furnace is determined by the reducing agent rate or the quantity of carbon fuel (coke, PCI etc.) used in blast furnace ironmaking. In relation to the hot metal produced, the amount of fuel is referred to as the reducing agent rate (RAR – kilograms of reducing agent per tonne of hot metal produced). In the demonstration test, it was verified that reducing agent rate could be stably reduced from 518 kg/t_{HM} to 415 kg/t_{HM} by charging a large amount of hot briquetted iron (HBI) produced by the MIDREX® Process. The results indicate that this technology can reduce CO_2 emissions by approximately 20% compared to a conventional method.

In addition, the world's lowest level of coke rate (239 kg/t_{HM}) has been achieved in the demonstration test of this technolo-

Specific CO_2 emissions of the blast furnace (Source: Kobe Steel)

Blast furnace technology	CO_2 emissions
Commen coke-fired blast furnace (BF)	1.8 t of CO_2 per t of hot metal produced
BF carged with 30% HBI (Scope 1 + 2)	1.4 t of CO_2 per t of hot metal produced
with Scope-3 emissions of HBI included	1.6 t of CO_2 per t of hot metal produced

gy. The company sees it as a promising solution that could become readily available in the near future at a lower additional cost compared to other CO_2 reduction measures. KOBELCO Group is considering offering the technology worldwide as a licensed product

Cost assessment for CO_2 savings and performance indicators

When calculating the CO_2 reduction cost while processing HBI in the blast furnace, the costs of HBI are compared with the savings in iron ore and reducing agents (reductant). In addition, there are conversion and other costs. The amount of CO_2 saved results from the amount of reducing agents saved (multiplied by the respective CO_2 emission factor).

The key technologies utilized for this achievement are:

- technologies of Midrex for HBI manufacturing in the engineering business
- advanced pellet production technology,
- HBI charging technology for blast furnaces,
- blast furnace operation technology utilizing Artificial Intelligence (AI).

All of these technologies are developed by the KOBELCO Group as generic solution technologies applicable to various blast furnaces.

This CO_2 reduction solution technology shall be improved while further reducing CO_2 emissions and achieving lower costs for CO_2 reduction. Beyond efforts to reduce emissions from our facilities, KOBELCO group will strive to contribute to the acceleration of CO_2 reduction through introducing this solution to blast furnaces around the world.

The success of the demonstration test on an actual blast furnace has made a significant step forward in providing low CO_2 steel products to customers. As moving forward with environmental efforts on the scale of the whole supply chain, the group will establish production and sales systems and define the terms and conditions for sales to provide customers with low CO_2 steel products that offer new added value.

The mission of the KOBELCO Group is to develop and establish technologies that can reduce CO_2 emissions as quickly as possible and at the lowest possible cost in order to proceed with the initiatives to create a green society toward the goal of achieving carbon neutrality in 2050.

The MIDREX® Process is the leading direct reduced iron (DRI) making process, which produces approximately 80% of the world's direct reduced iron with natural gas (approximately 60% of the world's direct reduced iron at large). The MIDREX® Process uses natural gas as the reductant and pellets made of iron ore as the source of iron to make DRI through the reduction process in the shaft furnace. In comparison to the blast furnace method, the MIDREX® Process can reduce CO_2 emissions by 20 to 40%. There are over 90 MIDREX modules worldwide.

Kobe Steel, Ltd.

Dr. Arnd Köfler, CTO of thyssenkrupp Steel, and Bernd Fleschenberg, COO of TSR Recycling, signing the Letter of Intent
(Picture: thyssenkrupp)

Reduction of CO_2 emissions through recycling

Pre-processing of scrap for use as burden in the blast furnace

In an effort to strengthen the circular economy, the German recycling company TSR and the steel producer thyssenkrupp Steel will enter into cooperation. The basis is an innovative preparation technology developed by TSR, in which a high-quality recycling product is made from common scrap. The reconditioned scrap, i.e. a high-quality recycling product, is to be tested for further processing in the blast furnaces of thyssenkrupp Steel

The development of the pre-processing technology and the optimization of the recycling product will be the scope of a joint research project. Thereby, this measure complements the hydrogen-based transformation path pursued by thyssenkrupp Steel.

Scrap content in the production of high-quality primary steel is currently limited – especially due to its varying and inhomogeneous mix of materials. However, the new technology is expected to possibly increase the recycling rate in steel production.

The TSR process is intended to make an innovative product from common consumer scrap. The composition and properties of the recycled product can be precisely designed. The challenge consists in removing some undesired attended non-ferrous materials by innovative separation, so that the product is then suitable as a certified raw material (burden) for the blast furnace process.

> "Together with TSR, we are launching a promising project. We strengthen a circular economy that conserves its resources, and we intensify our efforts to reduce CO_2 emissions."
>
> *Dr. Arnd Köfler, CTO thyssenkrupp Steel*

Through the use of the recycled product with a very high iron content, the amount of reducing agents in the blast furnace can be reduced. This results in a reduction of CO_2 emissions. The use of one ton of the recycled product is expected to save about one ton of CO_2.

Scrap-conditioning plant scheduled to start-up in 2022

By testing the new recycling product, TSR and thyssenkrupp Steel intend to gain knowledge about its use in the blast furnace. Based on these findings, the product is to be optimized in order to obtain ideal properties for processing in the blast furnaces of thyssenkrupp Steel. To this end, an industrial-scale production plant will be built to supply the blast furnaces of thyssenkrupp Steel in Duisburg with the recycling material. The proximity between the steel mill and TSR's location in Duisburg, one of the largest scrapyards in Germany with an area of well over 130,000 m², also offers considerable logistic advantages.

After a successful test phase it is planned to agree upon and ensure the long-term supply of the thyssenkrupp Steel's Duisburg steel mill from TSR's site. Currently, the production plant is scheduled to go into operation in the autumn of 2022.

Sample of the valuable recycled raw material for usage in the blast furnace
(Picture: thyssenkrupp)

TSR Recycling, thyssenkrupp Steel Europe

SMS supports SULB on the path to energy-efficient steel production with a holistic optimization project (Picture: SMS group)

Energy-efficient and low-carbon steelmaking through digitalization

Optimizing energy efficiency in integrated steelworks SULB in Bahrain

The Saudi Arabian steel company SULB is aiming to utilise the potential for energy savings in steel production and reduce greenhouse gas emissions. To this end, it is working closely with SMS digital, Vetta and Midrex

SULB operates an integrated steelworks in Hidd, Bahrain. This steel complex covers the complete production chain from direct reduction to finish-rolled products. A key asset of the mill is the flexible combi-caster, designed to produce a wide range of cast formats and sizes, ranging from billets to heavy beam blanks. In 2011, SMS supplied the complete equipment for the steelworks on a turnkey basis as a minimill with an annual capacity of 850,000 tons of steel. In 2012, a 1.5 million tons-per-year MIDREX® Direct Reduction Plant was added to the complex.

In 2020, SULB initiated the Energy Audit project with the support of Tamkeen, a public authority helping industries and businesses in Bahrain. The objective of the project is to improve energy efficiency through increasing plant operational efficiency and making full use of secondary energy and residual heat. The long-term strategy for reducing GHG emission will also be outlined. In order to achieve these objectives and to secure successful positioning in the global market, SULB has entered into a consulting project with the above-mentioned SMS companies.

SMS has set up a consulting team made up of its top process and metallurgy specialists from its various plant technology areas, energy experts and specialists in AI-based digitalization. Other partners in the project – alongside SMS digital and SMS group – are Vetta, an SMS group company specialized in energy management and related solutions, and Midrex Technologies, the world leader in direct reduced iron technology. Only this unique, concerted approach by all partners involved and their in-depth and highly focused expertise enables a holistic investigation and implementation of solutions that will allow SULB to tap the full scope of energy savings opportunities.

Phase 1: quick assessment

As early as in spring 2020, when the "Quick Assessment" (Module A of the cooperation agreement) was performed, SULB took a first key step in making its operations more efficient and, as a result,

more cost-effective. The aims of that first phase of the project were to identify the focus areas and specific measures to reduce the energy consumption, including natural gas, electricity and process gas.

Along the complete production chain, fifty measures were identified. A full host of levers were proposed, from the use of smart management systems via adaptation of processes to an improved product mix. For every identified measure, a comprehensive and detailed description, a qualitative assessment of the underlying energy savings potential and the associated implementation effort were provided. An implementation plan was set up, including the milestones on the path to SULB's strategic energy-efficiency goal.

> "The analysis of the data with the support of AI algorithms together with process expertise and deep expertise in energy management by our subsidiary Vetta, the Brazilian Centre of Competence within the SMS group, enables deeper insights into anomalies, patterns and interactions to identify potential savings and optimisation opportunities than was previously possible. In this way, we can contribute to the resource-saving use of energy sources and consumables."
>
> *Bernhard Steenken, President & CEO SMS digital GmbH*

Phase 2: in-depth analysis and implementation

With Module B "Deep Dive Analysis and Implementation", the second phase of the project has been kicked off. This phase will see SULB and SMS digital draw up a strategy to achieve a fast and significant Return on Investment.

Module B concentrates on four areas: direct reduction plant, electric arc furnace and ladle furnace, heavy-section mill and integrated energy management. Vetta, for example, will play a key role in the analysis and proposition of an integrated energy management system. The company will evaluate the energy-related key performance indicators (KPIs) of the complete works, derive conclusions and make recommendations as to how energy efficiency can be improved. This analysis will form a key element for the implementation of a digital solution for intelligent energy management.

For the direct reduction plant, Midrex will show how the MIDREX H_2 technology can help reduce the carbon footprint via the use of green hydrogen, paving the way for a step-wise transition to emission-free steelmaking. Midrex will support SULB via remote-monitoring of the MIDREX plant via the Remote Professional Services (RPS) option to help make operation of the MIDREX direct reduction plant more energy- and cost-efficient.

All Module B activities will be performed via real-time data transfer connections by requesting data via remote access. First measures will be completed in early February 2021, while others will be implemented successively until mid-2021. After completion of all project measures, SULB will be able to achieve significant cost savings as a result of lower consumption of natural gas and electricity. It will be a pioneer in the region with its smart and highly efficient steelworks.

Conclusion

The project cooperation combining various competence areas of SMS assures that SULB can work with a partner of broad-based competence and expertise in the technological domain, in digitalization and in energy management. This powerful combination enables SULB to meet the growing challenges of the market successfully.

SMS group

Plant technology

The peculiarities of the AC-EAF short circuit test

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

The only method to correctly determine the impedances of AC electric arc furnaces is the single-phase short circuit test („diptest" with two electrodes at a time) measured on the primary side of the furnace transformer. A three-phase short circuit test („diptest" with three electrodes), on the contrary, only determines one average impedance, not one per phase. A measurement on the secondary side is significantly distorted by induction into the voltage measurement loops and is not useful and in short circuit condition the error is largest [5].

The IEC 60676 „Industrial electroheating equipment – Test methods for direct arc furnaces", Edition 3.0, 2011-11 defines what the short circuit test shall determine: „Resistance and Reactance values of the high current system are determined...". Generally this is correct but also obscure because the standard does not define an equivalent electrical circuit and does not consider the transformer delta connection.

What is measured by dipping two electrodes at a time (12, 23, 31) into the liquid steel? The line-line voltages, the line (loop) currents and the loop active powers. From these values loop impedances

$$\underline{Z}_{\mu\nu} = R_{\mu\nu} + j\, X_{\mu\nu}$$

are computed. Just one loop exists actively at a time, that's why this is called a single-phase condition. The impedance $\underline{Z}$ is a complex number with the real part resistance R and the imaginary part reactance X. To use complex algebra is admissible because of the sinusoidal conditions during a short circuit. The loop impedances include the transformer and serial reactor impedances. They are transformed into three star impedances and then transformer and serial reactor impedances are subtracted. Eventually the star impedances are transformed to the secondary side. In this way a calculative equivalent circuit is established which merges three different configurations of the high current system into one. One may ask what the meaning of the determined star impendances is. This will be analyzed in the following.

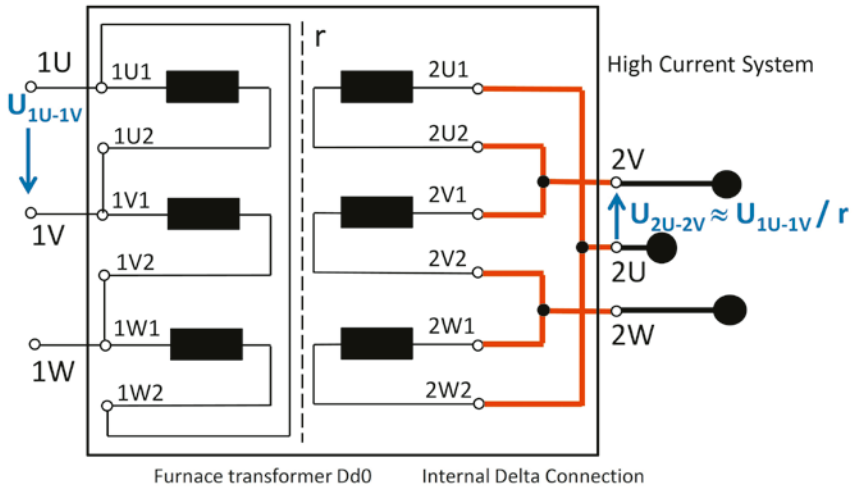


Figure 1. Furnace transformer with internal delta connection (Picture: BSE)

Dirk Riedinger, Badische Stahl-Engineering GmbH, Kehl, Germany – Contact: dirk.riedinger@bse-kehl.de

Internal and external delta connection of the furnace transformer

Furnace transformers are almost always delta connected to reduce the currents inside the transformer (delta currents are smaller by a factor 1.732 compared to the line currents). The type of delta connection plays a significant role for the interpretation of the short circuit test results determined according to IEC 60676. Furnace transformer secondary connections are either internal or external deltas (vector group Dd0 for internal, Diii0 for external connection). The difference between both delta connections is depicted in **figures 1 and 2**.

Where exactly is the difference? Evidently the main difference is in the voltages at the high current system. Consider that the primary side voltages U_{1U-1V}, U_{1V-1W} and U_{1W-1U} are measured. On the secondary side, the voltages are exemplarily, transformer losses neglected:

- internal delta (**figure 1**):
  $U_{2U\text{-}2V} \approx U_{1U\text{-}1V} / r$
- external delta (**figure 2**):
  $U_{2U\text{-}2V} \neq U_{1U\text{-}1V} / r$
  because
  $U_{2U1\text{-}2U2} \approx U_{1U\text{-}1V} / r$
- secondary delta impedances:
  $Z_{\Delta intern} << Z_{\Delta extern}$

The meaning of the star impedances $\underline{Z}_{1U}$, $\underline{Z}_{1V}$, $\underline{Z}_{1W}$ determined by the standard is as follows.

- With internal delta connection the phase impedances of the furnace consisting of transformer tubes, high current cables, electrode arms and electrodes are determined in good approximation.
- The system with external delta connection is different because there the primary side (grid) line-line voltages correspond with the secondary voltages inside the delta and not with the voltages between the phases. Thus the phase impedances of the furnace (high current cables, electrode arms and electrodes) can not be determined separately. Only combined delta and phase impedances, the so called „star replacement impedances", can be determined.

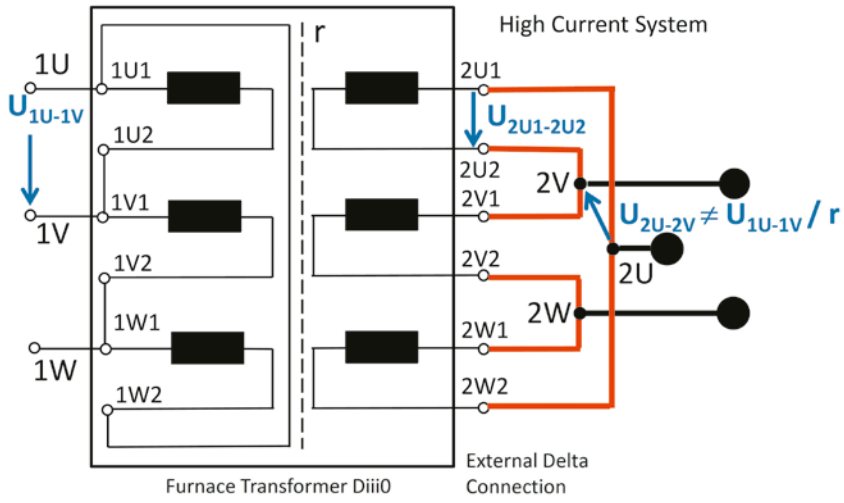


Figure 2. Furnace transformer with external delta connection (Picture: BSE)

Equivalent circuit for the combination transformer + furnace

The actual existing electrical circuit is represented by **figure 3** which consists of lumped and decoupled impedance elements. Figure 3 contains the impedance elements

- $\underline{Z}_1$, $\underline{Z}_2$, $\underline{Z}_3$: phases of the furnace (cables, arms, electrodes; transformer tubes with internal delta),
- $\underline{Z}_{S12}$, $\underline{Z}_{S23}$, $\underline{Z}_{S31}$: secondary side external delta,
- $\underline{Z}_{P12}$, $\underline{Z}_{P23}$, $\underline{Z}_{P31}$: transformer delta impedances, can include a serial reactor,
- $\underline{Z}_{P1}$, $\underline{Z}_{P2}$, $\underline{Z}_{P3}$: supply lines or serial reactor.

If an external delta is installed then the impedances $\underline{Z}_{S12}$, $\underline{Z}_{S23}$, $\underline{Z}_{S31}$ have significant values. With internal delta connection these impedances are zero because they are included in the transformer impedances (test report). Thus, the internal delta connection can be neglected. By merging secondary and primary side impedances in **figure 3**, the primary side circuit for the external delta connection is established, **figure 4**.

The circuit of **figure 4** is visible looking from the grid side and is also effective for single phase conditions. Six decoupled impedance elements remain. With external delta connection the impedance elements $\underline{Z}_{P12t}$, $\underline{Z}_{P23t}$, $\underline{Z}_{P31t}$ contain the secondary delta ones. After subtracting the symmetric transformer impedances the generally asymmetric delta impedances remain. There is no possibility to separately determine the six impedances (so also the phase impedances of the furnace) with the test method according to IEC 60676. To do this, the measurement of the delta

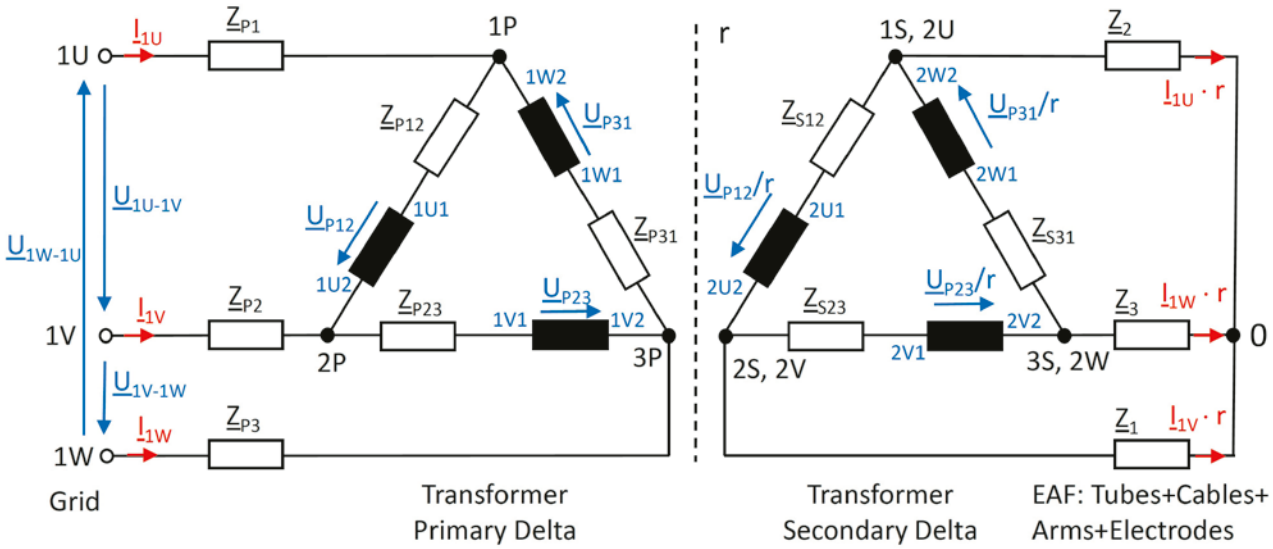


Figure 3. Complete equivalent circuit of transformer (Diii, Dd) and furnace (Picture: BSE)

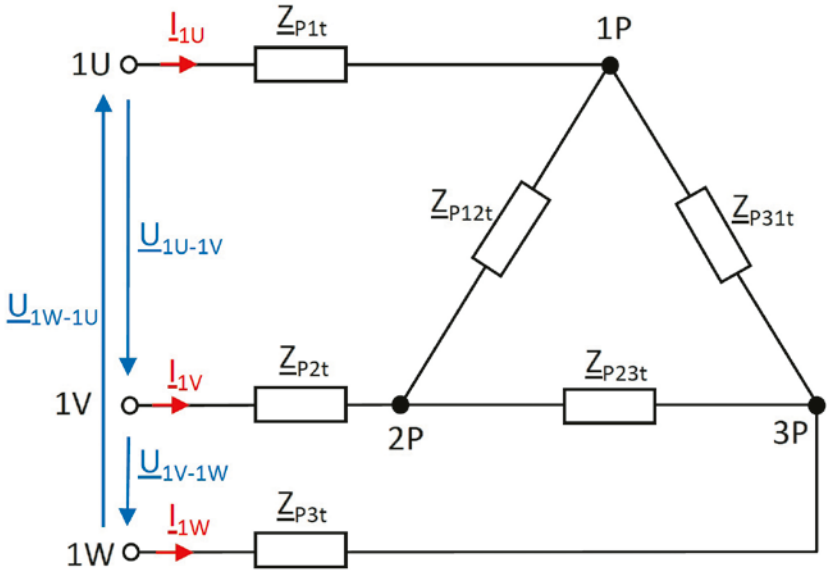


Figure 4. Merged circuit for external delta connection

currents would be required. This is not practicable. Eventually, by applying delta-star transformation, the circuit of **figure 4** can be transformed into the star circuit of **figure 5**. Then the secondary side impedances of interest are calculated (in mOhm).

The starpoint „1" of the circuit of **figure 5** is not the bath starpoint „0" inside the furnace anymore (**figure 3**) and the three impedances $\underline{Z}_{1U}$, $\underline{Z}_{1V}$, $\underline{Z}_{1W}$ are not the phase impedances of the furnace with external delta. Note that **figure 5** represents one single configuration of the high current system. The measurements according to IEC 60676 result in a circuit like **figure 5** as well but this is a calculatory merger of three different configurations of the high current system. Deviations from the real impedances of the circuit of figure 5 result, which are analysed in the following. The geometry of the external delta connection can contribute to a symmetrization of the high current system because the reactance is determined by the geometry. How this occurs exactly, can not be determined by the measurement defined by IEC 60676. This is only possible with a suitable computation method. BSE has developed such a simulation tool, the Finite Network Method (FNM) [1 – 4]. FNM allows the best possible simulation of the

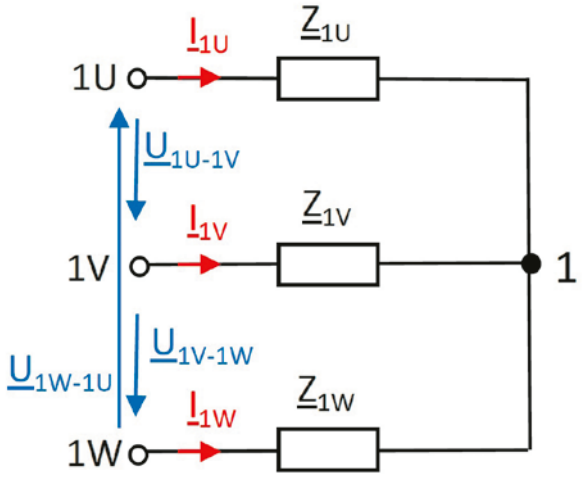


Figure 5. Star-replacement-circuit for external delta connection

electrical properties of high current systems because the eddy current (current displacement) effects are considered. Only by doing so, realistic simulations and thus the perfect layout of the geometry is possible. The FNM theory was established by Prof. Dr.-Ing. habil A. Farschtschi (former chair of theoretical electrical engineering at TU Chemnitz, Germany).

Influence of the electrode arm positions

The three times single phase diptest results in three different configurations of the high current system from which only one star circuit with three impedances is calculated. Ideally, there would be only one configuration, the so called „standard configuration". However, this is not possible in reality since one electrode at a time shall not lead an arc. Raised electrode arms change the inductive couplings and therefore the eddy currents in the high current system. These changes can be computed with the FNM simulation. The following simulation scenarios are presented.

Simulation 1. three-phase short circuit with equal electrode lenghts, so the „standard configuration" (**figure 6**). Evaluation according to the circuits of **figures 3, 4, 5**.

Simulation 2. three single-phase short circuits with one electrode raised by 800 mm at a time, like with the real conduction of the test (**figure 7**), evaluation according to the standard.

Simulation 3. three single-phase short circuits in standard configuration, evaluation according to the standard.

The comparison of simulations 2 and 3 with simulation 1 determines the deviations resulting from

- three different single phase configurations and electrode arm positions,
- the influence of changed inductive couplings.

Impedances of transformer and serial reactor are not contained in the results.

Simulation 1: three-phase, standard configuration

The phase impedances of the high current system $\underline{Z}_1$, $\underline{Z}_2$, $\underline{Z}_3$ and the delta impedances of the secondary side external delta $\underline{Z}_{S12}$,

$\underline{Z}_{S23}$, $\underline{Z}_{S31}$ are separately computed with FNM according to the circuit of **figure 3**. Then these are transformed according to **figure 4 and figure 5**. This computation is the basis for a comparison with the results of the single-phase short circuit tests according to the IEC 60676 method.

Impedance elements for figure 6.

Phases:

$\underline{Z}_1$ = 0.298 + j 2.303 mOhm (front)
$\underline{Z}_2$ = 0.289 + j 1.465 mOhm (middle)
$\underline{Z}_3$ = 0.299 + j 2.289 mOhm (rear)

External delta connection:

$\underline{Z}_{S12}$ = 0.0453 + j 0.550 mOhm
$\underline{Z}_{S31}$ = 0.0433 + j 0.579 mOhm
$\underline{Z}_{S23}$ = 0.0321 + j 0.349 mOhm

Star replacement impedances (figure 5):

$\underline{Z}_{1U}$ = 0.3102 + j 2.4327 mOhm
$\underline{Z}_{1V}$ = 0.3048 + j 1.6802 mOhm
$\underline{Z}_{1W}$ = 0.3106 + j 2.4254 mOhm
$\underline{Z}_{av}$ = 0.3085 + j 2.1794 mOhm
Asymmetry X: 34.5%

The result of the computation are the real short circuit impedances of the high current system, as seen from the primary (grid) side. To be comparable, the short circuit impedances have to be determined for a certain configuration of the high current system, the "standard configuration". This is the configuration with equal electrode lengths.

Simulation 2: single phase, real execution

In this way, the short circuit test according to IEC 60676 is executed in reality. One electrode arm at a time is raised by 800 mm and does not lead electrode but eddy currents. How do the different arm positions influence the result? The loop voltages and currents are simulated with FNM (complex values) exactly as they are measured. The resulting three loop impedances are transformed into the star impedances of interest.

Electrode 1 raised (figure 7, left)

$\underline{U}_{1U\text{-}1W}$ = -130 + j 225.2 V
(loop voltage)
$\underline{I}_{1U\text{-}1W}$ = -58358.4 + j 22969.9 A
(loop current)
$\underline{Z}_{1U\text{-}1W}$ = 0.61386 + j 4.10 mOhm
(loop impedance)

Electrode 2 raised (figure 7, middle)

$\underline{U}_{1V\text{-}1W}$ = -130 + j 225.2 V
$\underline{I}_{1V\text{-}1W}$ = 41915.06 + j 31733.6 A
$\underline{Z}_{1V\text{-}1W}$ = 0.6138 + j 4.907 mOhm

Electrode 3 raised (figure 7, right)

$\underline{U}_{1U\text{-}1V}$ = 260 + j 0 V
$\underline{I}_{1U\text{-}1V}$ = 9212.3 – j 61661.3 A
$\underline{Z}_{1U\text{-}1V}$ = 0.6162 + j 4.1245 mOhm

Star-Impedances

$\underline{Z}_{1U} = (\underline{Z}_{1U\text{-}1V} - \underline{Z}_{1U\text{-}1W} + \underline{Z}_{1V\text{-}1W}) / 2$
= 0,3081 + j 2,466 mOhm
$\underline{Z}_{1V} = (\underline{Z}_{1U\text{-}1V} + \underline{Z}_{1U\text{-}1W} - \underline{Z}_{1V\text{-}1W}) / 2$
= 0,3081 + j 1,659 mOhm
$\underline{Z}_{1W} = (-\underline{Z}_{1U\text{-}1V} + \underline{Z}_{1U\text{-}1W} + \underline{Z}_{1V\text{-}1W}) / 2$
= 0,3057 + j 2,441 mOhm
$\underline{Z}_{av}$ = 0,307 + j 2,189 mOhm
Asymmetry X: 36.9%
Deviations of the reactances:
ΔX_{1U} = + 1,37%
ΔX_{1V} = - 1,29%
ΔX_{1W} = + 0,64%

These are the impedances that can really be determined by a measurement. The influence of the different arm positions already has a significant effect in the optimum short-circuit test, especially on the unbalance, which is measured to be 2.37% too large in absolute terms. This deviation already reduces the accuracy of an examination of a design asymmetry. Really performed short circuit tests will have larger errors resulting from the execution of the test on the one hand (e.g. different electrode lengths, bad dipping) and from errors of the measurement equipment (CT's, PT's) on the other hand.

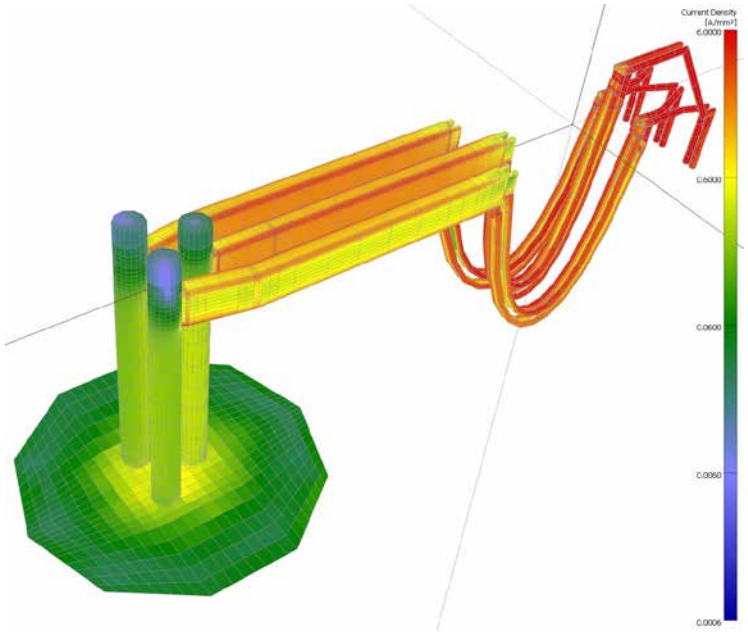


Figure 6. High current system with external delta connection in standard configuration, equal electrode lengths (Picture: BSE)

Symmetry of high current systems is a design requirement because symmetry results in favourable equal arc properties on average. FNM is the suitable tool for a targeted layout, as simple approximations do not allow a reliable layout of high current systems.

Simulation 3: single phase, like standard configuration

These simulated configurations can not be established in reality.

Electrode 1 currentless

$\underline{U}_{1U\text{-}1W}$ = - 130 + j 225.2 V
$\underline{I}_{1U\text{-}1W}$ = - 58406,3 + j 22968.4 A
$\underline{Z}_{1U\text{-}1W}$ = 0.61466 + j 4.0969 mOhm

Electrode 2 currentless

$\underline{U}_{1V\text{-}1W}$ = - 130 + j 225.2 V
$\underline{I}_{1V\text{-}1W}$ = 42246.6 + j 32141.3 A
$\underline{Z}_{1V\text{-}1W}$ = 0.61931 + j 4.8587 mOhm

Electrode 3 currentless

$\underline{U}_{1U\text{-}1V}$ = 260 + j 0 V
$\underline{I}_{1U\text{-}1V}$ = 9237.7 - j 61702.8 A
$\underline{Z}_{1U\text{-}1V}$ = 0.61702 + j 4.1214 mOhm

Star-Impedances

$\underline{Z}_{1U} = (\underline{Z}_{1U\text{-}1V} - \underline{Z}_{1U\text{-}1W} + \underline{Z}_{1V\text{-}1W}) / 2$
= 0.3108 + j 2.442 mOhm
$\underline{Z}_{1V} = (\underline{Z}_{1U\text{-}1V} + \underline{Z}_{1U\text{-}1W} - \underline{Z}_{1V\text{-}1W}) / 2$
= 0.3062 + j 1.680 mOhm
$\underline{Z}_{1W} = (-\underline{Z}_{1U\text{-}1V} + \underline{Z}_{1U\text{-}1W} + \underline{Z}_{1V\text{-}1W}) / 2$
= 0.3085 + j 2.417 mOhm
$\underline{Z}_{av}$ = 0.3085 + j 2.1795 mOhm
Asymmetry X: 35.0%

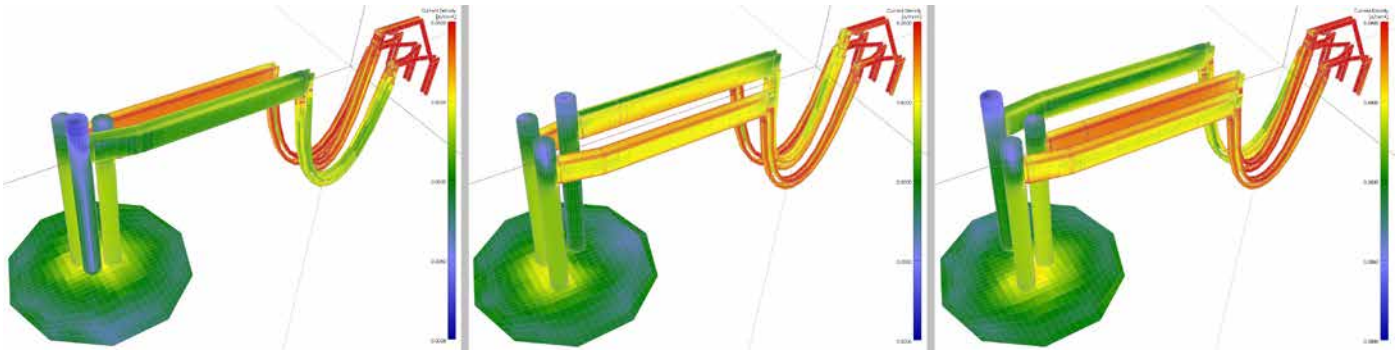


Figure 7. High current system with one respective electrode raised (from left: 1 – 2 – 3) (Picture: BSE)

(+ 0.47% absolute)
Deviations of the reactances:
$\Delta X_{1U} = + 0.36\%$
$\Delta X_{1V} = - 0.02\%$
$\Delta X_{1W} = - 0.34\%$

The outcome is interesting because it shows that three single-phase short circuits principally result in the same values as the computation via the circuits of the figures 3, 4, 5. Thus, the principal correctness of the IEC 60676 method is confirmed and the circuit of **figure 5** is valid as a merger of the results of three measurements.

Conclusion

The correct determination of the short circuit reactances of electric arc furnaces needs to apply three single-phase measurements on the primary side of the furnace transformer. The problems of measuring and performing the short circuit test have been discussed in detail elsewhere [3, 5]. By means of FNM simulations this article explains, which impedances (reactances) can really be determined considering the different delta connections of arc furnace transformers, especially the external delta closure. The optimal practically possible result is compared to the real impedances and thus the unavoidable deviations are determined.

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Reliable repair of refractory at the electric arc furnace

Using the gunning manipulator the repair is quicker and the operational safety is improved

Lucchini Industries Steel Plant in Lovere, Italy is using a new gunning manipulator at their electric arc furnace. It was supplied and installed by VELCO, Germany and their Italian partner Sidertrading. The gunning manipulator PNEUTOP is parking close to the furnace in a special structure. For the gunning repair, the gunning manipulator is picked up by the overhead crane and lowered from the top into the furnace.

The PNEUTOP is connected to a pressure vessel machine, which is feeding the manipulator and placed approx. 40 m away. The refractory gunning material is supplied in big bags that are filled into the pressure vessel by a filling hopper. Via a radio remote control the operator moves the lance to the desired location, starts and stops the pressure vessel machine and controls the gunning water flow.

For the gunning repair, the gunning manipulator is set from top down into the EAF (Picture: VELCO)

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In the Dilovası meltshop of Çolakoğlu the existing VD (Vacuum Degassing) plant has been upgraded to a VOD (Vacuum Oxygen Decarburization) plant (Picture: Primetals Technologies)

Secondary metallurgy

Super-sized VOD plant in operation at Çolakoğlu in Turkey

Turkish steel producer Çolakoğlu Metalurji A.S. modernized their meltshop to enable the production of special steels, like IF grades, ULC grades or stainless steels. The VOD (Vacuum Oxygen Decarburization) plant was upgraded from an existing VD (Vacuum Degassing) plant. With a heat size of 295 metric tons, the VOD is the largest worldwide

Çolakoğlu Metalurji A.S. (Çolakoğlu) operates an electric steel plant in Dilovası, in the west of Turkey. The main products of the plant are slabs for further processing in a hot rolling mill, and billets for producing reinforcing steel bars and steel rock bolt. The Çolakoğlu steel making plant, one of the largest in the world, was supplied by Primetals Technologies and has been in operation for several years.

The latest modernization project marks another milestone for Çolakoğlu. The VOD (Vacuum Oxygen Decarburization) plant was upgraded from an existing VD (Vacuum Degassing) plant. Equipment supplier and lead contractor Primetals Technologies received the Final Acceptance Certificate for this modernization project in December 2020.

With a heat size of 295 metric tons, the VOD is the largest worldwide. The aim of the modernization project was to enable the production of special steels, like IF grades, ULC grades or stainless steels. VOD treatments allow the production of special steels with very low carbon content. This helps Çolakoğlu to broaden its product range and enter additional markets. Immediately after start-up, for the first time in Turkey, stainless steel grades 304 and 304L were produced with the aid of the new VOD plant.

For the VOD plant for Çolakoğlu, Primetals Technologies was responsible for the engineering and supplied all the core components. These included, for example, valve stands, the oxygen blowing lance system as well as filters and a filter cleaning system installed before vacuum pumps.

The scope also encompassed the modernization of the existing automation system. The level 2 system including process models was modernized in order to operate the VOD plant. Additionally, all required instrumentation of the equipment was supplied.

Primetals Technologies

Green mill concept

Highly advanced wirerod mill at Acciaierie Bertoli Safau in Italy

The ABS QWR 4.0 wirerod mill marks the implementation of the Danieli intelligent plant design, a revolution in plant management and post-processing analysis. Based on Danieli green mill concept, enhanced mill utilization factor and industry 4.0 process controls, it is the new benchmark wirerod mill for special steels

With the implementation of QWR 4.0 Quality Wirerod mill at Acciaierie Bertoli Safau S.p.A. (ABS), Danieli has redefined the identity of the rolling mills, with innovative equipment and process approach for operational performance and environment sustainability, guaranteeing the highest product quality standards.

Located in the Cargnacco industrial area of Udine, Italy, the new mill produces 500,000 t/year of special steel wirerod from 5.0 to 25 mm diameter at finishing speeds of up to 400 km/h. The top-quality wirerod products manufactured by ABS will be supplied to the Italian and European markets.

According to Danieli this is the first and only mill in the world where mill management is based on the "zero-man-on-the-floor" approach, the whole process is remotely controlled. During production and size changes all mill activities are automatically performed thanks to a strong automation control which makes it possible to have no operators on the field.

The implemented technologies allow the minimization of processing costs, such as energy consumption, section-changing time and personnel by fully applying the concepts of Industry 4.0, which also improve operator and operational safety. Only 14 operators are required for each shift.

The SHS 4.0 housingless stands are fully electrified to comply with the "Green Mill" concept. A fully automatic, quick-changing system applied to the entire installed equipment – stands, fast-finishing block, shears, pinchrolls, waterbox and laying head – allows size/mill changes in just 8 minutes, improving considerably the mill utilization factor.

The new Danieli Centro Combustion low-scale, energy-saving walking-beam furnace redefines reheating process standards by improving yield, while reducing carbon footprint (0.32% scale formation and NO_x emissions under 35 ppm).

The automated in-line heat treatment setup changes are performed by Level 2 control system within the digital control room, significantly reducing the human factor effects and minimizing the interbillet time. The profile/section measuring gauges (Hi-Section, Hi-Profiles and Hi-Gauge) along with the optical tension control system guarantee accurate rolling control, tight dimensional tolerances and surface quality.

Energy-efficient Q-Heat induction heater maximizes productivity and improves material quality, controlling scale formation. The temperature monitoring devices throughout the entire rolling process and the specific layout development make it possible to achieve a strong thermo-mechanical rolling for unique, superior-quality products.

The SHS 4.0 housingless stands are fully electrified to comply with the "Green Mill" concept (Picture: Danieli)

Scrap-to-melt automation system to improve meltshop performance

Danieli Scrap to Melt (DSTM) is the Danieli answer to reduce operating costs and CO_2 emissions by processing and controlling the scrap before the direct loading into the EAF. The innovative and patented DSTM technology, developed by Danieli Centro Recycling, is the result of combining and integrating three processes of scrap treatment: densification, cleaning and chemical control. The combination of these processes makes it possible to separate the processed scrap into batches,

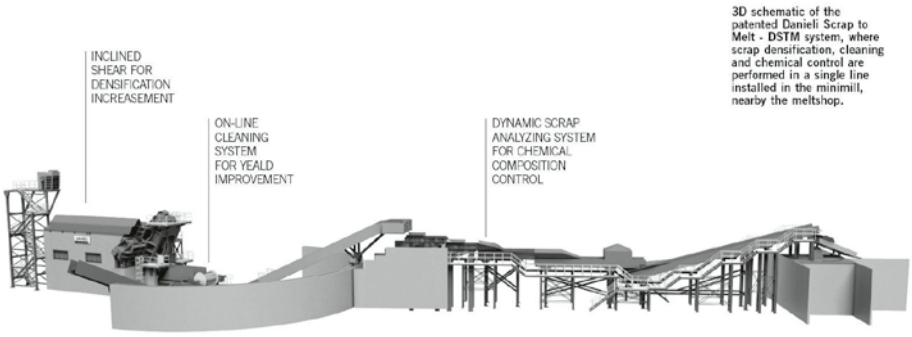
based on the meltshop chemical composition requirements.

In the first step, densification, incoming scrap is processed using shears and/or shredders to achieve the proper charge density prior to melting. The solution designed for the ABS meltshop foresees installation of a new, Danieli Inclined Shear to provide high production rates and the capability to cut special steel returns.

Next, the sheared material is cleaned, and inert elements are removed by in-line vibrating conveyor. Non-ferrous contents are separated from the charge material by the action of a drum magnet.

In the final step, to control the furnace charge chemistry the Danieli Analyzer detects the chemical concentration of the alloys like Cu, Ni, Cr, or Mn, and integrates the feedback to categorize the scrap by its chemical concentration, thereby improving melting efficiency and reducing CO_2 emissions.

The production cycle is automatic and continuous, and no operator control is required after charging of the scrap, ensuring high performances and reliability. The Danieli Scrap to Melt system can be seen as a new milestone in green circular economy.



Schematic of the Danieli Scrap to Melt system (Picture: Danieli)

Cybersecure by design

Cyberattacks are a daily occurrence, and the attacks on technology-driven industrial plants represent a threat to the steel sector, too. In the past, OT-Operational Technology networks' isolation ensured plant safety, but today, with Industry-4.0 innovations and inherently connected automation systems, cyberisks increase exponentially.

The new ABS QWR4.0 is a technologically advanced, I4.0-driven wirerod mill plant hence the need to run protected automation systems, cybersecure by design. The specialized Danieli Automation cybersecurity team designed and implemented a specifically tailored eco-system that ensures compliance to the latest cybersecurity standards.

Among the implemented system there is the "continuity of service" via a high-availability, highly virtualized IT environment and a remote backup system with geographical redundancy for full resilience in case of attack or disaster. Physical LAN segregation between the plant's major systems (i.e. IT, OT, Voice/CCTV and BMS) was conceived and intensive use of the VLANs was implemented to enhance segmentation between access and data flows among the systems.

Data flow control by both hardware and software to detect anomalous behavior were installed along with fieldbus network, monitoring and securing by using new technologies and design approaches.

The sum of these efficient Danieli Automation solutions will ensure ABS a continuous and safe operation from hacker attacks. Such systems can be implemented also to existing plants. Feasibility assessments can be conducted remotely.

Danieli

Rolling mill technology

Intelligent guides and bearing monitoring system for bar and section mills

The technological development pervading the metals market over recent years has brought new concepts to the technology of rolling guides. Through the introduction of sensors and actuators, roller guides have been transformed from merely mechanical devices that guide rolled sections to a feedback system for the rolling process

Intelligent guides may be considered the greatest example of Industry 4.0 applied to rolling mills. The Morgårdshammar brand – through Danieli MH Rolling System and DIGI&MET – is ready to launch several patented packages on the market:

RollX and Wide Smart Guides (WSG). Automatic, motorized guides for any kind of rolling mill for the production of steel bars up to wire rods. MH is able and ready to supply a complete series of motorized guides for rolling mills to make them "Smart, digital and safe (operators are not necessary on the front line).

BMS for guides. Bearing Monitoring System (BMS) to detect the speed of guide rollers by means of sensors mounted on roller supports and in this way to control the condition and performance of bearings and rollers during the production process. The Bearing Monitoring System can be applied to all standard MH guides, both new and used, and to the new series of motorized guides.

BGR. Blooming roller guides (BGR) fitted with load cells to detect if the guide is perfectly aligned with the roll groove. In addition, BGRs can better align and monitor the bar turning device on the basis of the information sent by the sensors mounted on the guides. These two aspects (alignment and bar turner monitoring) ensure a final high-quality product without having to downgrade the first billets produced.

Intelligent guide packages are a manufacturing revolution. By receiving real feedback on each billet, managers can act in a predictive way and re-consider standard rolling mill production.

In 1944, Morgårdshammar patented the first roller guide, and now the MH Guide System is the first patented automatic roller guide series!

The guide system can be equipped with HMI to provide a safer work environment for all operators in pulpits arranged along the rolling mill. Intelligent guides control material size, wear, speed and alignment by means of constant force control that is maintained throughout rolling. This will result in less roller wear, longer bearing service life, reduced maintenance and a longer service life in the mill.

These guides can provide more than 23 hours of continuous rolling, with constant monitoring of the following parameters:

- rolled section size in every stand where an intelligent guide is installed,
- detection of groove wear in rolling lines to ensure quality and tolerance of the final product,
- tensile stress in the mill.

These intelligent guides, which can be set up in less than one second, will significantly improve overall equipment efficiency. The high degree of flexibility of these intelligent guides that make it possible to roll different products without guide changes or rolling line stoppages is one of the major benefits of this solution.

Return on investment is very fast: approcimately one year on average for each plant. Also, the auto-setting function reduces the risk of cobbles, and the reduction in the number of worn parts will cut fixed warehouse costs, making the product advantageous in terms of maintenance as well.

Just one click on the control desk to completely set up a rolling mill. This is the concept of Danieli Intelligent Guides.

These intelligent guides can be set up in less than one second (Picture: Morgårdshammar)

Morgårdshammar

Ultra flexible technology for thin-gauge HRC production

Celebrating achievements of Shougang Jingtang sophisticated hot strip mill

A unique plant the in world producing hot rolled coil in an unlimited range of steel grades, in coil-to-coil, semi-endless and endless mode. It has been designed, constructed and commissioned despite the obstacles of the pandemic. With a monthly output exceeding the design level the plant has achieved full production

A new milestone in thin-slab casting and rolling has been achieved by Danieli QSP-DUE® technology, operating now in China. A celebratory event took place on July 2nd at the premises of Shougang Jingtang Iron & Steel (SGJT) in Caofeidian industrial area, Tangshan city, Hebei province, China. There, SGJT has been successfully operating the world-first thin-slab rolling plant, which is flexibly producing quality-strip products in three rolling modes.

Shougang Jingtang produces 2.1 million t/year of hot-rolled coils in a wide mix of steel grades and strip dimensions, from 0.8- to 12.7-mm-thick and from 900- to 1,600-mm-wide.

The Danieli QSP-DUE® plant has reached nearly 190,000 tons per month of productivity – equivalent to about 2.3 million tons on yearly basis – exceeding its design capacity, with true endless production for up to 97% by weight within each casting and rolling sequence, and about 90% of the overall production below 2.5 mm thickness. Also, casting sequence duration is in excess of 14 hours, with cruise speed of 5.4-5.5 m/min for low-carbon grades and 5.2 m/min for weather-resistant grades. Additionally, up to 37 heats cast in 24 hours, equivalent to about 7,800 tons, or the caster throughput of 6.4 t/min, represents a world record in thin-slab casting.

The unique ability of the QSP-DUE® technology is to perform in coil-to-coil, semi-endless and endless rolling modes, selecting the most suitable process in accordance with the high-quality requirement of various steel grades and strip dimension, optimizing at the same time yield, energy consumption and OpEx. This is something completely new, even compared with the latest generation of plants limited to pure endless capability. Furthermore, slab widths can be changed up to 250 mm during casting.

Recent developments in thin-slab casting and rolling plants are focused on endless production, which means a rigid connection between the caster and the mill, so that the buffer function is weakened, the temperature increases, and evenness is strengthened. No buffer between caster and mill could result in high costs due to lost production time during mill roll changes, and longer casting sequences cannot be realized.

Instead QSP-DUE® technology includes an 80-m long tunnel furnace between caster and mill to solve the problems of slab-temperature unevenness, and to create a buffer for mill roll changes. At SGJT online work-roll change during production is regularly performed, without having to interrupt the casting sequence. The tunnel furnace makes it possible to perform the switch-over between the three rolling modes, underscoring its role as a key equipment to maximize plant flexibility.

The single-strand vertical-curved thin-slab caster produces slabs reduced from 130 mm mould-exit thickness to 110 mm, using Danieli dynamic soft-reduction. SGJT is the world's first plant to produce hot-rolled coils starting from 110-mm-thick slabs. The ability to provide the mill with slabs of such thickness is reflected in a remarkable increment in the reduction ratio from slab-to-strip, for the production of coils with outstanding quality.

Furthermore, coil-to-coil, semi-endless and endless rolling modes are an intrinsic benefit of QSP-DUE® technology to optimize the energy consumption according to the final strip gauge.

A capital innovation of QSP-DUE® is to eliminate the use of fossil fuel in all the steps from caster to rolling mill. The tunnel furnace always has been regarded as a polluting part of the process. The new generation of QSP-DUE® eliminates traditional gas heating, operating the furnace with a mix of induction heaters and electrical radiant panels, thus eliminating the direct emission of CO_2.

During the event, Shougang Group General Manager Mr. Zhao MinGe claimed: "The world's first Multi-Mode Continuous Casting and Rolling production line, MCCR, has gone through an extraordinary journey from design, construction, commissioning and operation to a monthly output of more than 188,800 tons in May this year, exceeding the design level and achieving full production".

Danieli

Shougang Group General Manager Zhao MinGe expressed his fullest and utmost satisfaction with the ultra flexible casting and rolling production line (Picture: Danieli)

Digitisation tool to unlock lost potentials

Optimization service for cold rolling mills to gain productivity, quality and yield

Digital solution combines real time, remote expert insight with continuous monitoring and advanced data analytics. The new ABB Ability™ Performance Optimization Service for cold rolling mills provides opportunities to reach new levels of operational performance through technology, boosting their processes and profitability

ABB has launched its new ABB Ability™ Performance Optimization Service for cold rolling mills, offering steel, aluminium and other metals manufacturers opportunities to reach new levels of operational performance through technology, boosting their processes and profitability.

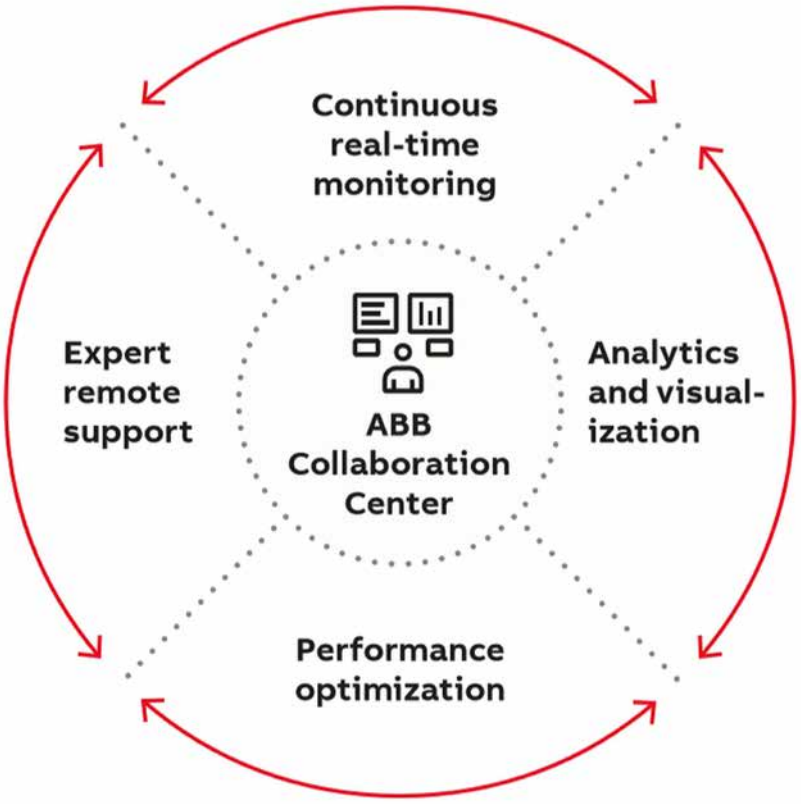
The new service – part of ABB's metals digital portfolio and Collaborative Operations for Metals suite – combines continuous performance monitoring using ABB Ability™ Data Analytics for cold rolling mills, with real time support from ABB experts. ABB will work alongside customers with the vision of continuing to transform the metals industry.

> The timeline and chronological analysis capability identifies deterioration, or other trends, at a glance
>
> *Andreas Vollmer, Global Technology Manager, ABB Metals*

The data analytics component uses process-specific algorithms based on a century of metals domain expertise to collect high frequency data from mill control systems and discover trends, benchmarks and other performance factors, sending alerts to operators and maintenance when opportunities to optimize performance are identified.

Alongside this, ABB experts are available to provide onsite or offsite support, recommending actions to ensure the mill maintains its performance targets against key performance indicators (KPIs) for productivity, quality and yield. Leveraging the collective strengths of metals producers and ABB experts, access to dashboards is shared, enabling all parties to drill down to individual coil level.

In addition, ABB experts can provide customers with detailed reports at regular intervals describing areas for improvement, identified trends, or problem areas found in historical data, allowing for continuous improvement over time.



Priciple of Collaborative Operations for metals (Picture: ABB)

Digital solution combines real time, remote expert insight with continuous monitoring and advanced data analytics

"Our deep understanding of the pain points experienced by cold rolling mill operators is the foundation of this solution," said Andreas Vollmer, Global Technology Manager, ABB Metals. "For example, the timeline and chronological analysis capability identifies deteriora-

tion, or other trends, at a glance. This highlights the root cause of issues in real time against any KPIs to the last coil, as well as enabling secondary analysis of KPIs chronologically for any coil."

"This is our most advanced performance optimization technology yet, with greater capabilities to automatically detect, analyze, predict and prevent failures than existing solutions," said Nilabja Ash, Global Product Manager, Metals Service, ABB Metals. "It has the potential to significantly improve the ability to spot trends and relationships between different process parameters, overcome quality issues, reduce unscheduled downtime, and reach higher levels of productivity, quality, yield in cold rolling mills than ever before."

Key benefits include continuous collaboration and access to experts; increased productivity through improved asset performance and reduced downtime; higher yield and quality resulting from immediate corrective action when problems occur; reduced risk of equipment failure; the ability to leverage insights across the enterprise and reductions in wastage, energy and other costs.

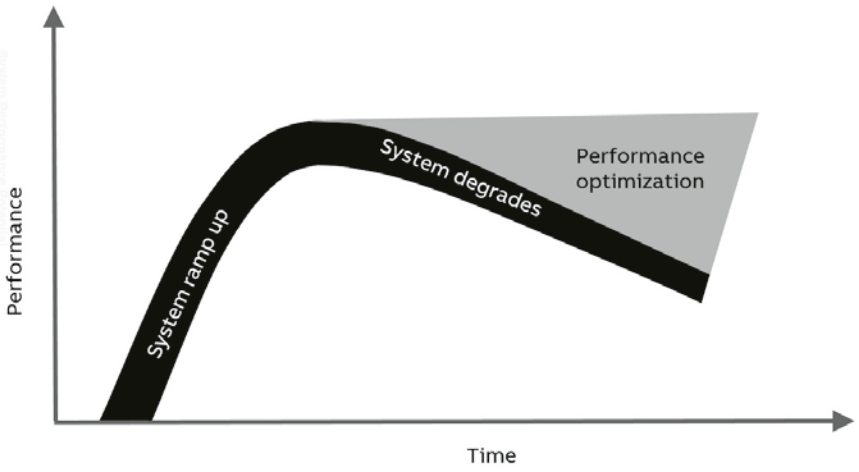


ABB Ability™ unlocks hidden potentials (Picture: ABB)

ABB Metals

Forging

Heavy-duty manipulators for forging press and ring rolling mill

Dango & Dienenthal will supply two manipulators to a roller bearing factory in Xuzhou, China. The heavy-duty robot included in the scope of delivery will be one of the most powerful of its kind in the world

XREM, a subsidiary of thyssenkrupp rothe erde, is going to produce seamlessly rolled rings for large rolling-element bearings on its new mill. The production line will include several chamber-type forging furnaces, an open-die forging press that will produce the ring blanks, and a ring-rolling mill facility incorporating several intermediate reheating furnaces for the rolling stock, and, finally, a heat treatment facility.

The two machines to be supplied by Dango & Dienenthal will perform all handling operations for the blanks and the rings – from the acceptance of the cut ingots up to and including the delivery of the finished rings to the heat treatment facility.

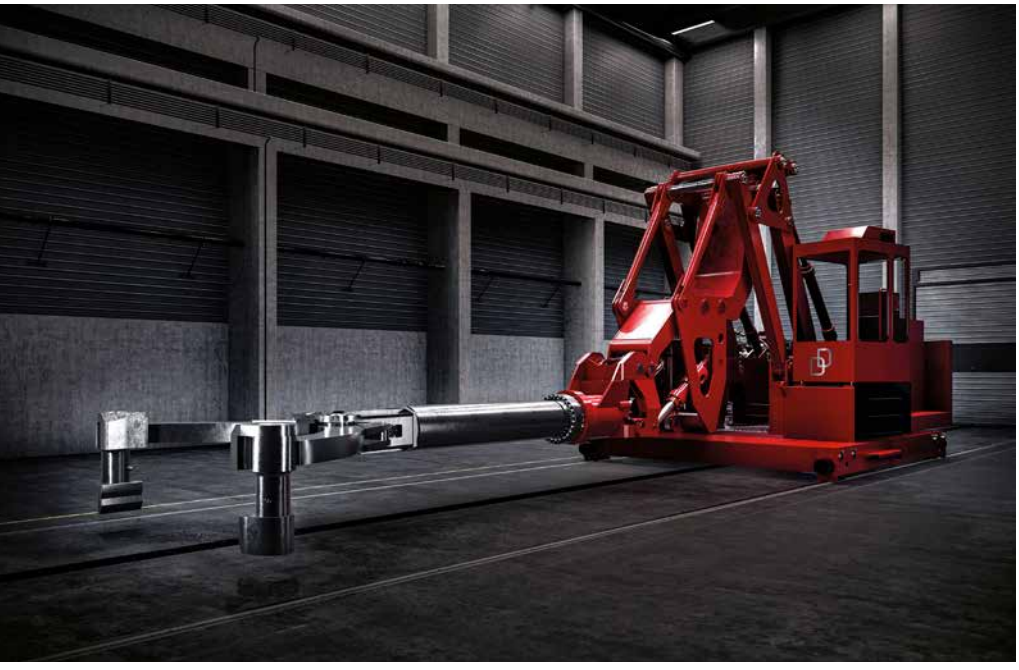
A unique feature of this project is that all planning activities and negotiations during the summer and autumn of 2020 were performed in online meetings.

Heavy-duty robot SLR 150 H

The heavy-duty robot of the SLR 150 H series to be supplied to XREM will combine two functions within one machine: Firstly, as a heavy-load robot, it will perform the handling of the forging ingots between the transfer tables, the chamber furnaces and the open-die forging press. Thanks to the pre-programmed sequences of motion, very short transfer times will be achieved. And, secondly, during the forging process, the robot will operate as a forging manipulator at the open-die forging press.

Designed for a payload of 150 kN, this robot will be one of the most powerful machines of its kind ever built in the world. As a rail-bound machine, the manipulator will handle the forging ingots and position them in the press with the highest precision. Operation of the manipulator during the forging process will be via remote control from the control room of the forging press. While operating as a forging manipulator, the robot will be coupled with the control system of the press.

Arno Dienenthal, one of the Managing Partners of Dango & Dienenthal Maschinenbau GmbH, is convinced that his company received this order last but not least due to a previous, very successful reference: "For many years, a similar robot – also with a payload of 150 kN – has been in operation at thyssenkrupp rothe erde in Dortmund, Germany. The good experience made with our heavy-duty robot over so many years was certainly a supporting argument for the customer to decide in favor of Dango & Dienenthal again. Another reason for XREM to choose us as their partner in a project of such scope was most likely our experience and good reputation as a supplier of machinery for rolled ring production."



A heavy-duty robot of the SLR series, equipped with tongs designed for ingot handling (Picture: Dango & Dienenthal Maschinenbau GmbH)

Mobile transport manipulator MTM 600

After completion of the forging process, the mobile transport manipulator MTM 600 will take over the pre-punched ring blanks and place them in the ring rolling mill – via intermediate reheating in a chamber furnace, if required. Then, after completion of the rolling process, the manipulator will take the finish-rolled rings to the cooling beds.

The Diesel-powered machine will be designed also for a payload of 150 kN. Its gripping tongs will be able to handle rings with diameters of up to 2,600 mm.

Both machines will be ready for delivery to XREM in early 2022.

Dango & Dienenthal Maschinenbau GmbH

CHINA

Physis to install new electric motor lamination press

Electric motor manufacturer Physis, located in Nignbo, has ordered a lamination press from Schuler.

The Smartline SA315S, with a press force of 315 t and a bed width of 2.7 m, will be able to process coil gauges of 0.2 mm and less. The thinner the laminations, the lower the eddy current losses and the better the efficiency of the electric motors become. In one step, the laminations are pressed and interlocked into packets which will later form the core of the electric motor. To make the Smartline's slide work within tolerances of hundredths of a millimeter, the control electronics of the bottom dead center checks the position of the upper die during every stroke and makes adjustments when necessary. Schuler will manufacture the components for the press at its Chinese production site in Dalian. Installation of the machine is scheduled for September this year.

Schuler

Chinese electric motor manufacturer Physis has ordered a new press for lamination stamping (Picture: Schuler)

EUROPE

ArcelorMittal launches new range of corrosion resistant rails

ArcelorMittal Europe – Long Products has launched RailCor® – a new range of corrosion resistant rails, available in four specific solutions to meet the most demanding customer requirements.

RailCor®, developed by ArcelorMittal Global R&D, has been undergone accelerated corrosion tests and, for more than two years, under the most severe conditions on real tracks. Two of the four solutions are designed to offer long-term protection in severe environments. A third one protects rails against corrosion by stray currents. The fourth solution is ideal for low-corrosion envi-

Rail with anti-corrosion coating (Picture: ArcelorMittal)

ronments or during shipment and storage.

RailCor® meets the most demanding standards as ISO 12944-5:2018 (Protective paint systems for steel structures), ISO 4624:2016 (Paints and varnishes – pull-off test for adhesion) and ISO 2063-1:2017 (Specifies requirements for the protection of iron and steel surfaces against corrosion by applying thermal-sprayed metallic coatings of zinc, aluminium or their alloys). In addition, RailCor® offers increased rail service life, a considerable reduction in rail track maintenance and rail replacement costs. The ends of the rails remain uncoated on delivery to facilitate handling, welding, and drilling.

ArcelorMittal

ArcelorMittal acquires Dortmunder Blankstahl

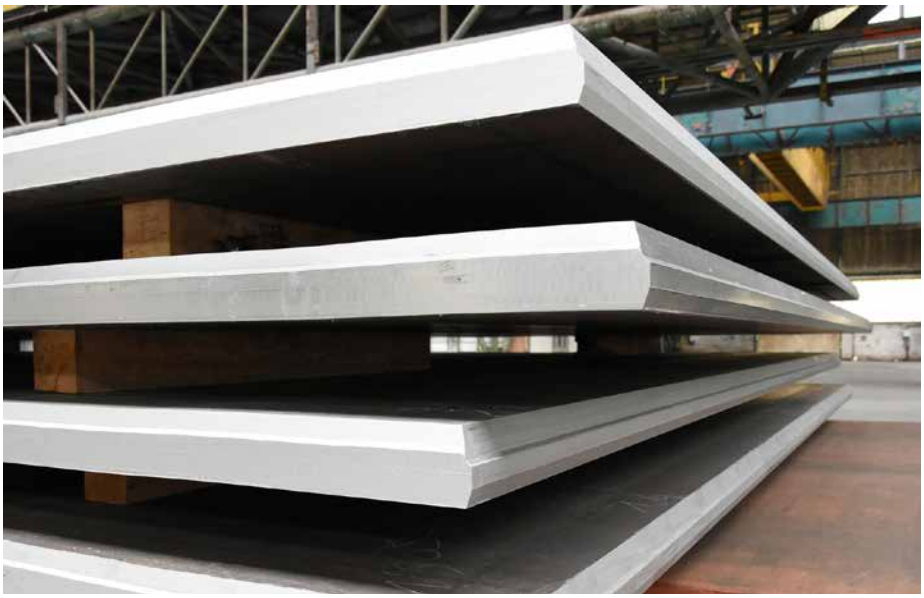
ArcelorMittal has bought Dortmunder Blankstahl, a company of the Ruhrstahl group, as part of a transferring restructuring process.

"The bright steel production complements our portfolio in wire processing. We now cover an additional part of the value chain for our wire solutions division", comments Lutz Bandusch, vice president ArcelorMittal Europe – Long Products. Dortmunder Blankstahl has been an established manufacturer of bright steel products for over 45 years. It will be integrated into ArcelorMittal group as ArcelorMittal Dortmund.

ArcelorMittal

Dillinger France produces plates for offshore wind turbines on new milling line

With the investment in a new edge milling line at Dillinger France in Dunkirk, Dillinger has taken another important step in pursuing its offshore wind strategy.



With this forward-looking investment Dillinger strengthens its offshore wind strategy (Picture: SHS – Stahl-Holding-Saar)

Like two other edging machines operated by Dillinger, the one newly installed at the Dunkirk location is used for preparing plate edges for welding. With these high-precision machines, Dillinger meets the increasingly demanding requirements of wind power operators.

Commenting on this investment, Markus Lauer, Président Directeur Général of Dillinger France and member of the board of management of Dillinger, says: "Dillinger is a major European player in the offshore wind power market. In order to strengthen our position in this segment, we have made significant investments in the Dillinger France site in Dunkirk over the past three years. The funds were used to renovate a furnace, purchase a conveyor crane for the exceptionally large dimensions of plate for wind turbines, create additional workshop space and install the new edge milling line."

SHS – Stahl-Holding-Saar

Kjellberg introduces new cathodes for plasma cutting

Kjellberg has added HiFinox cathodes to its range for plasma cutting of stainless steel and aluminium.

The new HiFinox cathodes for the Kjellberg plasma power sources provide excellent quality of the cut: bright cut metal surfaces, narrow kerfs and significantly less dross. The cathodes can be used for stainless steel and aluminium from 1 to 6 mm thick.

Thanks to the new cathode design, the optimized production process and the new, patent-pending, technology, cathode lifetime is increased considerably. The low backburn of the cathodes guarantees a consistently high cutting quality. The new cathodes can be used as standard with all current plasma power sources of the Kjellberg Q, Smart Focus and HiFocus series.

Kjellberg Finsterwalde

The new long-life cathodes provide very good results in plasma cutting of stainless steel and aluminium sheet. (Picture: Kjellberg Finsterwalde)

Benevenuta orders forging press

Benevenuta is going to add a 2,500-t press equipped with an energy recovery system to its range of forging machines (Picture: Schuler)

Benevenuta & C. S.p.A. has ordered a 2,500-t forging press from Farina, an affiliate of Schuler. The press will be used to produce hot-forged steel components for the automotive industry.

At its Forno Canavese site near Torino Benevenuta produces parts used in suspension systems, transmissions, engines and brakes in passenger cars as well as tractors, trucks and earth moving machinery. The press force of the production lines ranges from 1,200 to 2,500 t.

The new 2,500-t forging press from Farina will be equipped with a kinetic energy recovering system (KERS). While with conventional hot forging presses, a large portion of the energy is converted into heat that dissipates into the environment, with KERS, the total energy from the flywheel can be used for the forging process. Similarly, the energy released during the braking process is supplied to the flywheel.

Schuler

NLMK supplies heavy plate for wind power project

NLMK DanSteel has supplied heavy plate for an offshore wind farm project in the Bay of Saint-Brieuc, Brittany.

The plate will be used to manufacture components for wind turbine towers for the Saint-Brieuc Bay wind farm, covering an area of 75 km². This wind farm will consist of 62 wind turbines. It is scheduled for launch in 2023. Leveraging the benefits of a recent capacity upgrade, NLMK DanSteel is planning to actively expand its product offering for the wind power sector.

NLMK

SLM Solutions launches new software for metal 3D printing

The new software solution enables support-free 3D printing of complex metal components (Picture: SLM Solutions)

SLM Solutions has added a new product called Free Float to its portfolio. The technology empowers the creation of metal components with previously impossible designs while massively reducing supports and, in some cases, removing them completely. Since the 1990s, support structures have been an inherent part of the 3D printing process. However, often, the design of the main component was limited due to the support structures needed to build them, and support structures could be a substantial section of the overall part volume. Supports also need to be removed later during the post-processing phase and increase material usage. In 2017, a first glimpse at what would become Free Float was discovered as a by-product of a research project. After rigorous research and development, its unique vector technology now establishes thermal management that significantly decreases net build time while simultaneously enhancing part quality. The basic subscription to Free Float comes free of charge and, following SLM Solutions' open architecture philosophy, Free Float was designed to be retrofittable on many previously built SLM systems. Sam O'Leary, CEO of SLM Solutions: "With the launch of Free Float, you can design bolder, freer, and with fewer limitations."

SLM Solutions

Mercedes-Benz to start using green steel in vehicles in 2025

Mercedes-Benz AG has taken an equity stake in H2 Green Steel – a Swedish start-up – as a way to introduce CO_2-free steel into production cars.

H2 Green Steel was founded in 2020, aiming to build a large-scale fossil-free steel production facility in northern Sweden. "With an equity stake in H2 Green Steel, Mercedes-Benz is sending an important signal to accelerate change in the steel industry and increase the availability of fossil-free steel. As a preferred partner of the start-up, we will be launching green steel in various vehicle models as early as 2025," says Markus Schäfer, member of the board of management of Daimler AG and Mercedes-Benz AG.

Together with its steel suppliers, Mercedes-Benz is retooling its supply chain to focus on the prevention and reduction of CO_2 emissions rather than compensation.

Mercedes-Benz AG, H2 Green Steel

Volvo and SSAB to collaborate on vehicles of fossil-free steel

Volvo Group and SSAB have signed a collaboration agreement on research, development, serial production and commercialization of vehicles to be made of fossil-free steel.

SSAB aims to start supplying the market with fossil-free steel at a commercial scale in 2026. Development of a fossil-free value chain from mine to finished steel products will take place within the framework of the HYBRIT initiative, which SSAB has been driving with LKAB and Vattenfall since 2016. A pilot plant has been in place since August 2020 and this will soon start to produce smaller volumes of sponge iron made using hydrogen. This will be used to make the steel for use in this collaboration.

Volvo will start manufacturing the first concept vehicles and machines with steel from SSAB using hydrogen already in 2021. Plans are for smaller-scale serial production to start during 2022 and for a gradual escalation towards mass production to follow. Volvo and SSAB will also work together in research and development to optimize the use of steel in Volvo's products with regard to weight and quality.

SSAB, Volvo

MIDDLE EAST

DP World achieves milestone with new container high bay store system

DP World, together in a joint venture with SMS group, has successfully completed the first 10,000 container moves in the BoxBay high bay store system at the Jebel Ali Port, Dubai. This milestone demonstrates that the new technology concept works.

BoxBay is a patented automated container handling system that stores containers up to eleven stories high in steel racks. It delivers more than three times the capacity of a conventional yard. The system is designed to run automatically and enables any container to be accessed individually without moving any other.

Traditionally containers are stacked one on top of the other in rows, meaning many containers have to be moved to access containers lower down in the stacks. BoxBay is designed to be fully electrified and can be powered by solar panels on its roof. Completion of the first 10,000 container moves in the test facility demonstrates that the concept works in practice. The technology behind BoxBay was originally developed by SMS group for the handling of metal coils that weigh as much as 50 t in racks as high as 50 m.

DP World, SMS group

The new high bay store system for containers will be demonstrated to the public during "EXPO2020" in Dubai in October 2021 (Picture: SMS group)

USA

AFG Holdings acquires Maass Flange Corporation

AFG Holdings has acquired Maass Flange Corporation, a leading manufacturing supplier of stainless and nickel alloy flanges.

Maass Flange Corporation represents the North American assets of Maass Global Group, which is a third-generation family company, headquartered in Essen, Germany, focused on alloy, stainless steel and high nickel flange production and complementary products. This aligns well with AFG Holdings' business focus on carbon flanges, creating combined bundling opportunities through a unified supply chain. The entity will be called Ameriforge LLC and will be led by Alex Maass. The acquisition includes all Houston-area facilities, Canada and Mexico. Ameriforge can now offer everything from carbon and high yield to specialty alloys – along with complementary products over a broad spectrum of material grades and dimensions.

AFG Holdings

Atlas Tube invests in new technology for connection of tubular columns

Atlas Tube, a division of Zekelman Industries, has acquired the Shuriken™ Structural Nut Keeper. Shuriken allows for fast and cost-effective erection of field-bolted HSS column splices and connections.

Ted Goldstein, P.E., the inventor of Shuriken and the founder of Tubular Connections LLC., is originally from New York. In 2018, he moved to Japan. There, he was inspired to create Shuriken to reduce the cost and carbon footprint of steel construction. "HSS columns are the norm in Japan thanks to their efficiency and excellent seismic performance," Goldstein said. "I knew the U.S. could benefit from a wider use of HSS, but welded splices were a problem. That drove me to lower the installed cost of HSS by developing Shuriken."

Atlas Tube will offer Shuriken technology to simplify column splices and other one-sided connections. Goldstein will be working with Atlas Tube's marketing and commercial teams to create awareness among engineers, fabricators and designers in the structural steel community and help grow the U.S. market for HSS.

Atlas Tube

Stainless steel is extensively used for various applications, including medical instruments (Picture: Böllinghaus Steel)

Steel application

The use of stainless steel in the field of medical technology

Today, stainless steel is extensively used for various applications, including those that can have an impact on human health. It is used in many hospitals, medical practices and rescue services. Stainless steel has played a significant role in medical safety in hospitals for decades and it is also widely used in the field of medical technology

In these operational areas, stainless steel can be directly exposed to the human body; for example, in medical instruments and implants, which are expected to function without adversely affecting the pharmaceutical compositions they come into contact with and are also expected to be easily sanitized. For example, stainless steel is a commonly used material for fixation instruments that help repair bone fractures. Special requirements are imposed on the surface of these implants.

Instruments designed for medical applications must comply with strict standards and manufacturing requirements. The simplicity of the cleanliness and sterility of stainless steel surgical instruments and devices is a clear illustration of how this material protects our health.

The benefits of stainless steel

In the context of increasing antibiotic resistance, it has never been more critical to make sure that surfaces and tools in all patient facilities can be easily cleaned and sanitized.

The use of stainless steel in medical technology has the advantage that body tissue does not react chemically with the medical instruments.

Stainless steel surfaces can be better sanitized than other materials and need lower concentrations of disinfectant to provide the level of hygiene required by law, in addition safeguarding the environment by limiting wastewater discharges.

Moreover, stainless steel is convincing for its corrosion resistance, antibacterial properties, hygiene, good formability, strength, manufacturing precision and recyclability.

The material does not discolour and can be produced as chemically inert, safe, smooth and inabsorbent surfaces that can be completely cleaned and disinfected without deterioration or corrosion.

Corrosion resistance

The material's high corrosion resistance is one of the key factors that make stainless steel particularly suitable for the manufacture of medical devices, thus reducing the risk of infection from rust or other surface defects.

Corrosion resistance is not an intrinsic material property, but constitutes the behaviour of the material due to its interaction with the environment and the material's surface.

The corrosion resistance of stainless steel is ensured by a passive surface film that can be regarded as a barrier between the alloy and the environment. This passive film is a continuous, non-porous surface layer that, under normal conditions, automatically regenerates when it is destroyed. More precisely, stainless steel is, passivated when a clean surface is exposed to an outside medium which can provide sufficient oxygen to build a surface layer of chromium-rich oxide.

Corrosion resistance can be additionally optimized by alloying steel with both chromium and nickel.

Polished stainless steel

Medical instruments as well as implants have smooth and mostly extremely polished surfaces. Polished surfaces provide better corrosion resistance and a chemically clean surface with optimal surface roughness.

To conclude

The application of stainless steel in surgical devices, medical instruments and surgical implants is safe for public health. It is based on decades of intensive experience and is regulated by international standards. Through choice of the right types of steel and proper design and manufacture of the equipment needed, stainless steel is safe for human health in medical environments.

We are pleased that our industry has helped to keep hospitals clean, minimizing the spread of infections and ultimately saving countless lives.

About Böllinghaus Steel: Böllinghaus Steel is a producer of high-quality stainless steel profiles. Whether standard profile or custom-made, Böllinghaus Steel manufactures stainless steel profiles of proven quality for the highest customer satisfaction.

Böllinghaus Steel

News brief

USA

Rocky Mountain institute convenes six global banks to decarbonize steel

Several top lenders to the steel sector – Citi, Goldman Sachs, ING, Société Générale, Standard Chartered, and UniCredit – have come together to define common standards of action for decarbonizing steel through a collective climate-aligned finance agreement.

The banks have formed the Steel Climate-Aligned Finance Working Group, facilitated by the Center for Climate-Aligned Finance of Rocky Mountain Institute (RMI), with the goal of crafting an industry-backed agreement before the United Nations Climate Change Conference in November 2021 (COP26). The agreement would create a level playing field for measuring progress against steel sector climate targets, as well as a platform for supporting the sector's decarbonization.

Low-carbon technologies exist across many industries. However, for the steel sector, which emits roughly 7% of global energy emissions and is heavily coal-dependent, commercially viable alternatives are still at an early stage. The sector's carbon intensity raises expectations of and from financial institutions to support its decarbonization.

The working group, led by ING and co-led by Société Générale, comprises senior representatives from each bank's metals and mining teams. It will forge the scope, emissions pathways, methodologies, and governance structure of the collective climate-aligned finance agreement in collaboration with existing initiatives. The working group is part of the Net-Zero Steel Initiative (NZSI), comprising some of the world's largest steel producers and suppliers. The RMI Center for Climate-Aligned Finance will facilitate engagement between the working group and NZSI to ensure the objectives of steelmakers and lenders are aligned.

Rocky Mountain Institute

GreenCoat RWS Pro BT is easy to maintain and cost effective throughout its lifecycle. It offers a beautiful matt appearance to meet high design aesthetics for rainwater systems (Picture: SSAB)

Colour coated steel

The new GreenCoat RWS – for superior and sustainable rainwater systems

To meet the global demand for sustainable building material that also provides enhanced performance, SSAB enlarges its GreenCoat® colour coated steel rainwater system product range by introducing GreenCoat RWS Pro BT with a beautiful matt appearance. It features a Bio-based Technology (BT) coating made with Swedish rapeseed oil instead of fossil oils and is unique on the market

When it rains, it pours. GreenCoat RWS products for rainwater systems can handle the strongest storms with the least maintenance and still look amazing. They come in a wide selection of colors and appearances.

GreenCoat RWS color coated steels by SSAB provide beautiful aesthetics, superior quality and environmental benefits for any half-round and rectangular gutter system. They have a double-sided coating system that offers excellent protection against corrosion (RC5) and mechanical wear to withstand even the harshest weather. They also have high flexibility and formability, which allows them to be shaped in virtually any way.

Sustainable building trends

Current building trends show that the demand for sustainable materials is on the rise. To address these trends and their increase worldwide, the new GreenCoat RWS Pro BT offers builders a level of sustainability found nowhere else on the market, featuring a substantial portion of Swedish rapeseed oil instead of fossil oil in the coating. The result is a high performance, very formable and easy to maintain building product.

Steel is also one of the few materials that offer a 100% closed recycling loop. This means that it can be used repeatedly and efficiently, without affecting its properties or performance – and without creating hazardous waste. Steel is also easy to repurpose and reuse, making it a perfect choice for cost-efficient and durable rainwater systems.

"Sustainability is no longer a choice among architects and builders. With our premium GreenCoat® color coated steels, we provide the most sustainable products with superior technical properties for the building industry," says Olavi Huhtala, Executive Vice President SSAB Europe at SSAB Group.

Developed together with partners

GreenCoat RWS Pro BT is the result of extensive product development collaboration involving consumer feedback, observing test results, and utilizing the expertise of our partners. The end-result is a product that combines the vision to deliver high performance for greener living. The involved partners were: Ruukki Construction (Finland), Plannja AB (Sweden), Lindab AB (Sweden), Budmat Bogdan Wiecek (Poland) and Bratex Dachy (Poland).

GreenCoat RWS color coated steels comply with current REACH regulations and are fully free of chromates.

SSAB

Trademark for carbon neutral steel

ArcelorMittal launches XCarb™ initiatives

ArcelorMittal launches the new brand XCarb™, signalling its commitment to producing carbon neutral steel. The groundbreaking 'XCarb™ green steel certificates' offer customers Scope 3 emissions reductions. The 'XCarb™ recycled and renewably produced' pioneering customer product is manufactured with a carbon footprint as low as 300kg of CO_2 per tonne. The third component is the 'XCarb™ innovation fund'

ArcelorMittal announced the launch of "XCarb™" initiatives in the spring. This is part of the company's commitment to reach the net zero target by 2050. With the new "XCarb™" label (synonymous with ex carbon), the Group aims to identify all products and steelmaking activities that enable reduced, low or zero CO_2 emissions, as well as broader initiatives and green innovation projects that target demonstrable progress towards carbon neutral steel. Starting with three initiatives, "XCarb™ green steel" certificates will enable steel processors and end-users to reduce their Scope 3 emissions. "XCarb™ recycled and renewably produced" is a new label for sustainably recycled steel. And the "XCarb™ Innovation Fund" is intended to finance climate protection projects.

Commenting, Aditya Mittal, CEO, ArcelorMittal, said: "Climate change is an overwhelming societal priority. At ArcelorMittal, we have an important role to play in helping society deliver the objectives of the Paris Agreement and are determined to lead our industry's transition to carbon neutral steel." He added: "We have the scale, resources and technological prowess to make a significant impact, and have already identified the routes to carbon neutral steelmaking through our Smart Carbon and Innovative DRI pathways."

The brand underlines the commitment to carbon neutral steel (Picture: ArcelorMittal)

XCarb™ green steel certificates. Across the ArcelorMittal Europe – Flat Products operations, the company is investing in a broad range of initiatives to reduce carbon emissions from the blast furnace. These initiatives range from their flagship Smart Carbon projects, such as Torero (transforming biomass into bio-coal to replace the use of coal in the blast furnace) and Carbalyst (capturing carbon-rich blast furnace waste gas and converting it into bio-ethanol, which can then be used to make low-carbon chemical products) to capturing hydrogen-rich waste gases from the steelmaking process and injecting them into the blast furnace to reduce coal use.

These effort-intensive investments result in considerable CO_2 savings, which can be passed onto customers in the form of the steel industry's first-ever certification scheme. CO_2 savings are aggregated, independently assured, and then converted into XCarb™ green steel certificates using a conversion factor that represents the average CO_2 intensity of integrated steelmaking in Europe. The scheme therefore provides customers with the opportunity to buy certificates attached to their physical orders of steel, enabling them to report a reduction in their Scope 3 carbon emissions in accordance with the GHG Protocol Corporate Accounting and Reporting Standard. The company anticipates it will have 600,000 tonnes of equivalent green steel tonnes available by the end of 2022.

XCarb™ recycled and renewably produced. This initiative has been designed for products made via the electric arc furnace route using scrap steel. Recycled and renewably produced means that the physical steel was made with recycled material (scrap) using renewable electricity, giving it an extremely low CO_2 footprint that can be as low as approximately 300 kg of CO_2 per tonne of finished steel when the metallics are 100% scrap. This customer offer is for both flat and long products. The electricity used in the steelmaking process is independently verified, with a 'Guarantee

> "Our launch of XCarb™ initiatives brings the full breadth of our decarbonisation activity together under a single umbrella brand"
>
> *Aditya Mittal, CEO ArcelorMittal*

of Origin' given that it is from renewable sources.

XCarb™ innovation fund. ArcelorMittal has launched an innovation fund which will invest up to US$100 million annually in groundbreaking companies developing pioneering or breakthrough technologies that will accelerate the steel industry's transition to carbon neutral steelmaking. To be eligible for funding, companies will have to be developing technologies which support ArcelorMittal on its journey to decarbonise. The technology also needs to be commercially scalable.

The fund will be governed by an investment committee, comprising senior executive management members from functions and segments across the company's global operations and chaired by the CEO. The 'XCarb™ innovation fund' will invest in a diversified portfolio of companies to ensure it captures the best and most important technologies under development.

Aditya Mittal said: "Our launch of XCarb™ brings the full breadth of our decarbonisation activity together under a single umbrella brand. It aims to demonstrate to stakeholders the diverse range of initiatives we are undertaking in pursuit of our 2050 net zero goal while also providing our customers with solutions which help them address their own carbon reduction targets, demonstrating the important role steel has to play in a future, circular economy."

ArcelorMittal

EUROPE

Salzgitter's steel trade unit combines corporate and e-shop websites

Salzgitter Mannesmann Stahlhandel has combined the corporate homepage and the e-shop's website into a joint web presence at: www.salzgitter-mannesmann-stahlhandel.de.

The new web presence allows Salzgitter customers much swifter and more structured access to product information and order options that now seamlessly dovetail on the joint platform. Following a single-click login, customers can switch directly from product descriptions in the shop to the order process, or vice versa, from the website to the product information which they require for components and structures.

Customers already using the e-shop can also view the inventory on the new website and have the order data directly incorporated into their own systems via digital interfaces offered as an add-on to the online shop.

Salzgitter AG

Ruukki Construction plans commercial sale of fossil-free steel building products

Ruukki Construction, a subsidiary of SSAB, is committed to offering its customers building products made from fossil-free steel based on the HYBRIT technology from 2026 on.

HYBRIT is a joint venture initiative of SSAB, LKAB and Vattenfall. The use of fossil-free steel is part of Ruukki's new sustainability strategy. The plan is to launch fossil-free building products at a commercial scale on the market in 2026. Before then, Ruukki aims to pilot the use of fossil-free steel together with selected customers.

"Ruukki is committed to developing an offering to help their customers to reduce carbon emissions, and will look for customers to partner with to create a fossil-free value chain until the end of the lifecycle of a building," says Sami Eronen, President of Ruukki Construction.

Ruukki Construction

New CEO of Klöckner & Co presents growth strategy

Guido Kerkhoff, who has taken over from Gisbert Rühl as CEO of Klöckner & Co as planned, has presented the company's growth strategy "Klöckner & Co 2025: Leveraging Strengths".

The central objectives of the strategy include accelerated customer growth, comprehensive expansion of its own product and service portfolio as well as expansion of its partner network to become the leading digital platform for steel and other materials in Europe and the Americas. There will be a growing focus on automating the internal value chain and linking the digital and physical side of the business more closely through the pooling of key digital and IT competencies under one management. An additional innovation hub of the digital unit kloeckner.i will be established in the USA.

In June 2021, following the successful restructuring of the business in France, Bernhard Weiß joined the group management board, assuming responsibility for all EU activities. He also takes over the management of Klöckner & Co Deutschland in addition to France.

Klöckner & Co

Australian manufacturer receives special model

Combilift's 60,000th truck delivered

The Irish manufacturer Combilift recently marked a further milestone when its 60,000th unit came off the production lines at the company HQ in Monaghan and was shipped to the other side of the world

The customer taking delivery of this special forklift is Metroll, a leading Australian manufacturer and supplier of steel building products including roofing, cladding, rainwater, structural and fencing. Metroll has branches across the country, and the new Combi-CB3000 will be a further addition to its fleet of 13 Combilifts that are operating throughout the Metroll Group, with another 10 already on order. These range from 3t multidirectional units to a highly customised 10t model.

Combilift number 60,000 will be working at the site in Toowoomba and has been fitted with features such as 4.9m triplex mast with a 3050mm spreader to safely and easily manage the long loads that are typically handled by Metroll.

According to Metroll Operations Manager Vic Josephs "Like most businesses we are very busy and we're also growing at a significant rate, so space has become a premium resource. With this unit we can utilise our space more efficiently whilst at the same time operating safely. Safety is of paramount importance. This forklift allows our machinery to get into tighter spaces and for us to space our racks more closely together to maximise factory floor space."

Combilift CEO and Co-Founder Martin McVicar commented: "This is a great achievement for Combilift, particularly as almost every truck we manufacture is a one-off, designed for specific and individual requirements. There are very few other companies, if any, that can offer this level of customisation whilst manufacturing in such volume. The first half of this year has been by far the best in our 23 year history for the number of orders we have received – not just for Combi-CB models but across our complete product range."

Chris Littlewood, Country Manager of Combilift Australia said: "The Combi-CB 3t model is the most popular unit in the Australian market and accounted for 50% of the machines we sold in the year ending March 2021. So we are particularly pleased that it is one of our customers in this country that has been able to receive this landmark machine."

Following the successful collaboration with Metroll in Australia, Combilift now also supplies its trucks to the company's Californian based operations too. "We have often found that a recommendation from one country leads to sites elsewhere adopting the same material handling processes with our products," said Martin McVicar. "So we'd like to congratulate Metroll on taking delivery of our 60,000th truck, and thank them for their continued support over the years."

The makers of the Combilift 60000 (Picture: Combilift)

The QR code links to a YouTube video about the 60,000th Combilift forklift (https://youtu.be/eEulGnhl_4U)

Combilift

Digitisation

The future of steel trading is digital

To meet the increasingly more complex and individual needs of the customers while withstanding the high-cost pressure and international competition, new solutions and methods are needed in steel trading. Digitalization provides the right answers: It enables intelligent networking of the complete material flow in steel trading companies, making it more sustainable and efficient

Traditional steel trading is transforming: The former link between steel plants and manufacturing companies whose sole task was to supply a manageable variety of materials in large quantities is becoming more and more of a service provider and manufacturing partner. The customer demands are becoming higher and more individual, the position sizes are decreasing, while the number of orders rapidly raises. Even shorter delivery times are standard; delays and quality defects are rarely tolerated. Steel traders must take on more and more processing steps for their customers – at the same time, they face high marginal and cost pressures to compete internationally. Many companies are searching for new methods and solutions to make them viable for the future under these challenging conditions.

Data acquisition and data analysis is the basis

Digitalization is a strategy for success to achieve this goal. Technologies and concepts from Industry 4.0 also provide enormous potential to steel trading: From the raw materials order down to the shipment of the finished order to the customers, today all value-added processes can be linked together, consistently managed and intelligently optimized without paper. Detailed acquisition and analysis of all relevant data is the basis for recognizing and utilizing potential. The goal is to make the entire material flow faster, more flexible, resource-friendly and efficient.

Seamless communication is of particular importance in the digital networking of various processes and machines. This is made possible through suitable interfaces, for example, between a higher-level ERP system such as SAP, Infor or Microsoft Dynamics, and individual machines' con-

From the raw materials order down to the shipment of the finished order to the customers, today all value-added processes in steel trading can be linked together, consistently managed and intelligently optimized (Picture: KASTO Maschinenbau GmbH & Co. KG)

With the robotic handling system KASTOsort, KASTO provides a solution that enables the automation of upstream and downstream manufacturing processes (Picture: KASTO Maschinenbau GmbH & Co. KG)

trol systems. One example of this is storage: Many steel traders already rely on fully automated bar stock storage systems that offer benefits such as high storage density, rapid access times, and maximum inventory transparency. They are controlled and managed via a warehouse management system. The software optimizes the processes in and around the warehouse, thus making intralogistics faster, more reliable and efficient. A seamless connection to the respective host system ensures a consistent communication structure that significantly increases transparency and efficiency.

Unleashing the potential of the intralogistics

The WMS provides users with numerous functions such as the management of orders, batches, remnant pieces and cut-pieces, a permanent inventory as well as the option to flexibly apply various in-out strategies and order picking principles. Comprehensive statistic and analysis tools monitor the utilization of the entire system as well as the individual components. As a result, the full potential of the intralogistics can be unleased: Redundant travel distances or unnecessary waiting periods are avoided. Furthermore, possible changes can be simulated and tested in advance and without the risk. KASTO, the specialist in storage, sawing and handling technology, developed the warehouse management system, KASTOlogic, for its systems and it is specially designed to meet the demands in bar stock and sheet metal storage.

With KASTOlogic, users can consistently manage and monitor not only the processes in the warehouse itself; they can also manage and monitor upstream and downstream logistic and processing steps. Even manually operated warehouse areas can be integrated into the system using the app KASTOlogic mobile. The application enables the user to transfer all procedures such as storage and stock transfers, picking orders, shipment and inventory data via smartphone or tablet to the warehouse management system. Transparency and traceability are at the same level as in automatic software-controlled warehouses. KASTOlogic mobile can be used to implement even a so-called "Pick-by-Crane" system easily: The user utilizes the app to commission a connected indoor crane to automatically position the desired keyboard-operated storage and removal procedures using the respective coordinates.

Digital sawing technology minimizes waste

Sawing technology plays a central role with the increasing range of processing in steel trading. To meet the customer wishes, most steel traders have various machines in their portfolio that can perform straight and mitre cuts on a wide variety of materials and dimensions. Digitalization offers great potential to increase efficiency in this area as well. For instance, KASTO developed the software KASTOoptisaw for its sawing machines. This software ensures that the stored bar stock and sawing machine are ideally assigned to the respective cutting orders with regard to the different machine parameters such as kerf width and minimum remnant piece length. Because often companies store bars, tubing, and profiles with various lengths and different mitre angles based on previous orders of the same material. Thanks to KASTOoptisaw, they can be used up with minimum waste – which lowers costs and saves space in the warehouse since the best use is made of the material, and fewer remnant pieces must be returned to storage.

To automate the material flow in steel trading and make it particularly cost-effective, sawing machines with manipulators and conveyor technology can be seamlessly connected to automated warehouse systems and supplied with the needed materials. The sawing procedure itself also runs autonomously with the correspond-

KASTO developed the WMS, KASTOlogic, for its systems and it is specially designed to meet the demands in bar stock and sheet metal storage
(Picture: KASTO Maschinenbau GmbH & Co. KG)

The assistance system VisualAssistance simplifies remote maintenance
(Picture: KASTO Maschinenbau GmbH & Co. KG)

ing equipped machine. Thus, highly integrated systems are created that are connected seamlessly in a continuous supply chain. KASTO is an expert, particularly in regards to the realization of such combined warehouse-sawing systems – in addition, with the robotic handling system KASTOsort, KASTO provides a solution that enables the automation of upstream and downstream manufacturing processes. For example, industrial robots can independently remove, deburr, chamfer, centre and cut threads, mark and imprint, weigh, sort, de-stack and pick orders. Depending on the customer requirements, the robot control system is combined with the saw control system, warehouse management system or existing enterprise resource planning system. The user can also control and monitor this work step via a central interface and benefits from an ideally coordinated process chain.

Remote control using smart glasses

Digitalization enables helpful tools even when it comes to maintenance and repair. KASTO developed the assistance system, VisualAssistance, for its machines and systems. This system uses the concept of Augmented Reality to simplify remote maintenance. The core component is an interactive app for tablets, smartphones or smart glasses. Customers can connect with service staff via video and audio stream. Users and technicians share the same visual field in real time. It makes mutual understanding significantly easier and helps to quickly identify individual system components and possible malfunctions. The app also makes it possible for KASTO experts to provide visual assistance and for example, show markings in the live video. While the customer carries out the maintenance or repair on-site on the saw or warehouse, they are provided all the information needed directly on their display. If the customer uses smart glasses, both hands are free – making work even easier. The KASTO service technicians are on-site virtually and direct the employees as needed. As a result, extensive training or expensive trips are often unnecessary.

Well-equipped for upcoming tasks

Steel trading cannot ignore digitalization and networking. The benefits accompanied by new technologies are too great: More flexibility to respond to individual customer wishes and fluctuating order quantities. Higher performance to remain a reliable supplier even at capacity peaks. Material and cost efficiency to structure their own company economically and competitively. And ergonomically to relieve employees and to avoid errors and accidents. All of this helps steel trading companies to ideally meet the current and future challenges.

KASTO Maschinenbau GmbH & Co. KG

Planned extension to the production facilities of Jacob Bek (Picture: engel & haehnel architektur)

EUROPE

Jacob Bek invests in capacity expansion

Steel distributor Jacob Bek is further expanding its capacities in the service area and investing in a new multi-strip cut-to-length line.

For this purpose, the company, which is an affiliate of thyssenkrupp Materials Services and part of thyssenkrupp Schulte, is building another production hall in the Ulm Donautal industrial estate. The groundbreaking ceremony was held in June 2021. The project is scheduled for completion by summer 2022

With this investment, Jacob Bek is strengthening its core business and thus offering its customers a broader range of services. The new multi-strip cut-to-length line thus complements the extensive service capabilities and follows the "Materials as a Service" strategy of thyssenkrupp Materials Services with customized solutions.

thyssenkrupp Materials Services

NLMK launches online slab shop

NLMK has launched an online platform for slab sales, enabling customers to buy slabs in small batches starting from 60 t up to 2,400 t.

Manufacturers of flat rolled products often have a need for small volumes of semi-finished steel products made of special steel grades. It is difficult to meet these needs in the commodity market due to technical limitations on the minimum batch production. So rolled products manufacturers are forced to produce the required slabs themselves or place orders for excess volumes.

At NLMK, online orders with the same parameters are now combined into a single lot for production. Each client of the service can form a request for any product range of the required volume or join an already created request.

NLMK

USA

Mill Steel acquires Prassas Metal Products

Mill Steel, distributors of flat-rolled carbon steel, has purchased commercial assets of Prassas Metal Products.

Prassas is a Los Angeles-based steel trading and stocking distributor of pre-painted and coated coil products. This deal strengthens Mill Steel's geographic footprint with additional sourcing opportunities and greater reach in the Southeastern United States. Mill Steel will immediately assume steel processing and supply to Prassas customers, upholding existing contracts.

Mill Steel

Norfolk Iron & Metal to name new parent organization

Norfolk Iron & Metal, a full-line steel service center, has announced the creation of NIM Group, a new parent identity for each of its brands: Norfolk Iron and Metal, Metalwest, and Cd'A Metals.

In December 2018, Norfolk Iron acquired Metalwest, a processor and distributor of carbon and non-ferrous flat-rolled metal products with eight locations across the USA. Norfolk Iron expanded again in December 2020, with the acquisition of Cd'A Metals, a service center and supplier with three locations serving the inland Northwest of the USA.

"With NIM Group providing many of the corporate functions for our operating brands, our commercial teams can focus on expanding our product and geographic reach in support of future growth," says Arnie Robinson, NIM Group president and COO. The creation of the new parent identity provides a structure that will support continued growth of existing geographies as well as future acquisitions.

NIM Group

Zekelman Industries to build fully automated warehouse

Zekelman Industries is going to build a fully automated warehouse at its Wheatland Tube facility in Warren, Ohio. The facility is scheduled to begin operating in December 2022.

The new warehouse will convey pipe from the production lines of the manufacturing facility into the warehouse storage system. From there, pipe is automatically moved out of storage to an enclosed truck loading area with minimal team interaction. The touchless product handling enabled by these automated systems will significantly increase safety and shipping capacity, while eliminating product damage.

Zekelmann Industries

STEEL SUPPLIERS INTERNATIONAL

SUPPLIER FOR THE INTERNATIONAL STEEL INDUSTRY FROM A TO Z

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

01 Raw materials, auxiliary materials and operating materials

01.05 Metals and alloys

Alloys 380

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02 Raw material pretreatment

02.04 Pelletising plants

Conveying plants for pellets 797

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02.05 Sintering plants

Sinter hot material conveyors 822

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03 Iron making

03.01 Blast furnaces

Heat recovery systems 1150

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03.02 Direct reduction plants

Direct reduction plants 1160

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DRI hot material conveyor 1172

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04 Steelmaking

Equipment for steelmaking plants 1668

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Steel mill plants and equipment 1698

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Steel mill equipment 1699

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04 Steelmaking

04.04 Electric steel plant

Electric arc ladle furnaces 1875

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04.07 Secondary metallurgy

Equipment for chemical heating 2028

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Internet: www.loi.tenova.com

Argon purging equipment 2030

LOI Thermprocess GmbH
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45141 Essen
Germany
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Fax: +49 201 1891-321
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

Ladle metallurgical plants 2080

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Fax: +49 201 1891-321
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Internet: www.loi.tenova.com

Secondary metallurgical plants 2110

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45141 Essen
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Fax: +49 201 1891-321
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

Steel degassing plants 2120

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45141 Essen
Germany
Tel.: +49 201 1891-1
Fax: +49 201 1891-321
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

Steel desulfurization plants 2130

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45141 Essen
Germany
Tel.: +49 201 1891-1
Fax: +49 201 1891-321
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

T+P lance equipment 2140

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Germany
Tel.: +49 201 1891-1
Fax: +49 201 1891-321
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

04.08 Tertiary metallurgy

Vacuum degassing equipment 2144

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Germany
Tel.: +49 201 1891-1
Fax: +49 201 1891-321
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Internet: www.loi.tenova.com

04.09 Components

Deslagging machines 2150

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

Burning machines for ladles 2175

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

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

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

Charging machines (trough and tongs) 2230

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

04.09 Components

Oxygen nozzles 2580

LOI Thermprocess GmbH
Am Lichtbogen 29
45141 Essen
Germany
Tel.: +49 201 1891-1
Fax: +49 201 1891-321
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

04.10 Steel works materials

EBT taphole plugging compound 2735

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

Ladle slide sand 2880

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

07 Hot rolling

07.05 Bar and wire rod mills

Reducing and sizing mills 3940

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

Reducing and sizing mills 3944

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

Bar and wire rod mills 3950

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

Bar mills 3960

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

Rolling mills for long products 3970

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

08 Forging, extrusion

08.03 Components

Forging manipulators 5150

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

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

Forging manipulators, rail-mounted 5155

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

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

Forging robots 5160

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

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

Transport manipulators 5180

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57072 Siegen
Germany
Tel.: +49 271 401-0
E-Mail: contact@dango-dienenthal.de
Internet: www.dango-dienenthal.de

10 Cold rolling

10.01 Cold rolling mills

Strip, sheet, cold and metal rolling mills 5490

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

10.04 Annealing lines

Annealing lines 5670

LOI Thermprocess GmbH
Am Lichtbogen 29
45141 Essen
Germany
Tel.: +49 201 1891-1
Fax: +49 201 1891-321
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

11 Surface treatment

11.04 Surface treatment plants

Strip edge trimming 6270

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

Strip processing and finishing lines 6280

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

Shot peening 6390

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

Blasting plants 6565

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

11.05 Aluminizing, tin plating, galvanizing

Hot dip galvanizing lines 6630

LOI Thermprocess GmbH
Am Lichtbogen 29
45141 Essen
Germany
Tel.: +49 201 1891-1
Fax: +49 201 1891-321
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

13 Production of tubes/pipes

13.01 Tube rolling mills

Pipe rolling mills with planetary cross rolling mill 7360

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

Stretch-reducing mills 7390

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

Tube bending machines 7520

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

Tube straightening machines 7544

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

16 Furnace and energy technology

Furnace optimization
(conversion to low NOx combustion) 10170

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Germany
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Internet: www.loi.tenova.com

16.02 Forging furnaces

Forging furnaces 10230

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Germany
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Fax: +49 201 1891-321
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Internet: www.loi.tenova.com

16.03 Roller Hearth Continuous Furnaces

Roller Hearth Continuous Furnaces 10260

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45141 Essen
Germany
Tel.: +49 201 1891-1
Fax: +49 201 1891-321
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Roller hearth and walking beam furnaces 10270

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Germany
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Fax: +49 201 1891-321
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

16.05 Top-hat furnaces

Top-hat furnaces 10310

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Germany
Tel.: +49 201 1891-1
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Internet: www.loi.tenova.com

16.07 Hardening and tempering equipment

Carburizing furnaces 10355

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Germany
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Fax: +49 201 1891-321
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Internet: www.loi.tenova.com

16.08 Heating furnaces and heat treatment plants

Continuous furnaces 10408

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Co-step furnaces 10410

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Bogie hearth furnaces 10430

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Fax: +49 201 1891-321
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Internet: www.loi.tenova.com

Chamber furnaces 10460

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Germany
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16.08 Heating furnaces and heat treatment plants

Roller hearth and walking beam furnaces 10510

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Germany
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Pusher-type, roller and rotary hearth furnaces 10540

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Germany
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Fax: +49 201 1891-321
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Internet: www.loi.tenova.com

Heat treatment plants 10560

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E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

Heat treatment furnaces (continuous and discontinuous) 10562

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45141 Essen
Germany
Tel.: +49 201 1891-1
Fax: +49 201 1891-321
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

Heat treatment furnaces for batch operation, open heated 10570

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45141 Essen
Germany
Tel.: +49 201 1891-1
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Internet: www.loi.tenova.com

16.09 Bath furnaces

Aluminum melting furnaces 10580

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Germany
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Internet: www.loi.tenova.com

18 Machinery and plant engineering

Plant engineering, general 12210

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Internet: www.loi.tenova.com

18.06 Ventilation plants and equipment

Air conditioners for heat plants 12660

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

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

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

18.10 Power and work machines

Vacuum pumps 13160

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Germany
Tel.: +49 201 1891-1
Fax: +49 201 1891-321
E-Mail: loi@tenova.com
Internet: www.loi.tenova.com

19 Transport and storage technique

Hot material conveyors 14535

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

19.05 Continuous conveyors

Conveyors (general) 14830

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

19.06 Cranes

Cranes, hoists and accessories, general 14950

WILBERS LIFTING GmbH
Luxemburger Str. 61
48455 Bad Bentheim - Gildehaus
Germany
Tel.: +49 5924 25539-0
E-Mail: info@wilberslifting.de
Internet: www.wilberslifting.de

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

19.10 Components

Electrical equipment for cranes etc. 15320

WILBERS LIFTING GmbH
Luxemburger Str. 61
48455 Bad Bentheim - Gildehaus
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Tel.: +49 5924 25539-0
E-Mail: info@wilberslifting.de
Internet: www.wilberslifting.de

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

19.10 Components

Lifting magnets and equipment 15490

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Luxemburger Str. 61
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Tel.: +49 5924 25539-0
E-Mail: info@wilberslifting.de
Internet: www.wilberslifting.de

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

20 Electrical engineering and automation

20.02 Control and automation systems

Automation systems for hot rolling mills and tube mills 16040

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

Automation systems for hot rolling mills 16041

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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

Infrared switch 16850

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

Infrared radiation pyrometer 16860

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

Infrared Radiation Thermometer 16871

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

Cast iron temperature measurement 16879

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

Profile measuring systems (non-contact) 17060

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

Pyrometer 17080

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

Ratio pyrometer 17100

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

Rolling mill measuring systems 17300

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

2-color pyrometer with fiber optics 17325

KELLER HCW GMBH
Carl-Keller-Str. 2 - 10
49479 Ibbenbüren
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Tel.: +49 5451 85-0
Fax: +49 5451 85-310
Internet: www.keller.de

21.03 Quality management

Surface inspection 17410

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40721 Hilden
Germany
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Internet: www.kocks.de

24 Environmental protection and disposal

24.01 Dedusting and gas cleaning

Exhaust gas cooling systems 18360

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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. Mai Services
17470 Metrology services

22 Materials testing

17473 Destructive and non-destructive materials testing

22.01. Non-destructive materials testing

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

22.02. Strength testing, endurance testing

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

22.03. Technological testing methods, testing service

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

22.04. Destructive material testing

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

22.05. Fatigue testing

17896 Testing of safety valves in operating condition

22.06. Damage analysis

17898 Damage analysis

23 Analysis and laboratory equipment

17900 Engineering and technical assistance

23.01. Sampling and sample preparation

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

23.02. Analytical equipment

18020 Analytical instruments
18022 Devices for inline concentration measurement of liquids
18025 Analyzers for oxygen measurement
18027 Automated analyzers for process control and wastewater management
18030 Automation equipment for analysis and laboratory
18040 Gas analyzers
18048 Laser induced fluorescence

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

23.03. Laboratory equipment, general

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

23.04. Metallography

18290 Services
18300 Metallography equipment
18310 Metallographic laboratories
18320 Metallographic testing

24 Environmental protection and Entsorgung

18330 Consulting and measurement
18340 Engineering and technical assistance

24.01. Dedusting and gas cleaning

18342 Exhaust gas technology
18348 Oxygen sensors for exhaust gas
18350 Exhaust systems
18360 Exhaust gas cooling systems
18362 Exhaust gas cooling with heat recovery
18370 Exhaust gas cleaning systems
18375 Secondary exhaust gas cleaning systems
18376 Sintered exhaust gas cleaning systems
18377 Desulfurization of sinter flue gases
18378 Exhaust gas cleaning for pellet plants
18380 Waste heat boiler
18390 Aerosol separation
18400 Treatment of dusts from steel mills and foundries
18410 Electrostatic precipitator
18420 Dedusting and gas cleaning
18430 Dedusting plants and accessories, general
18440 Dedusting filters and plants (cassette, cartridge, round, bag, pocket filters, etc.)
18450 Denitrification plants
18460 Denitrification catalysts (DENOX)
18470 Fine dust removal for sinter plants
18480 Filter media
18490 Gas recovery plants
18500 Fabric filters
18510 Casting shop dedusting
18515 Blast furnace exhaust gas cleaning
18520 Hot gas filtration
18530 Industrial vacuum cleaners
18535 Catalytic plants
18536 Catalyst service
18540 Compact air cleaner
18550 Laser Clean Box
18560 Air filters (also in-line filters)
18570 Multicyclones and cyclones
18580 Afterburning, catalytic
18590 Afterburning, thermal
18600 Wet dust collectors
18608 Wet dedusting systems
18610 Wet fine dust removal for sinter plants
18615 Wet electrostatic precipitators
18620 Wet cleaning plants
18630 Flue gas desulfurization for boiler and sinter plants
18640 Flue gas cleaning plants for waste and hazardous waste incinerators
18650 Dust collectors
18660 Dust measuring devices
18670 Dust recovery plants
18690 Thermal exhaust air purification
18693 Dry exhaust gas cleaning plants
18700 Dry dedusting plants (also rotary flow dedusters)
18710 Dry cleaning plants
18720 Venturi dust collectors
18728 Central exhaust systems
18730 Central dust extraction plants

24.02. Waste water treatment

18740 Waste water plants, grease separators, chemical pumps
18750 Waste water treatment
18755 Waste water treatment, thermal
18756 Wastewater treatment for wastewater containing oil and grease
18760 Wastewater treatment plants
18770 Chemical water treatment
18774 Evaporation plants
18790 Wastewater treatment plants
18800 Recirculation systems
18802 Recirculating water treatment
18810 Solvent recovery plants
18820 Neutralization and detoxification plants
18830 Sludge dewatering, mobile
18840 Sludge dewatering, stationary
18842 Water management

24.03. Regeneration plants

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

24.04. Recycling and waste disposal

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

24.05. Components

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

24.06. Operating materials

19170 Activated carbon
19180 Lignite coke
19190 Oil binder
19200 Lubricants

24.07. Services

19210 Exhaust gas measurements

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

25 Occupational safety and ergonomics

25.01. Occupational safety

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

25.02. Noise protection devices

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

26 Other products

19440 Aluminium and zinc slug production

26.01. Foundry products

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

27 Consulting, planning and services

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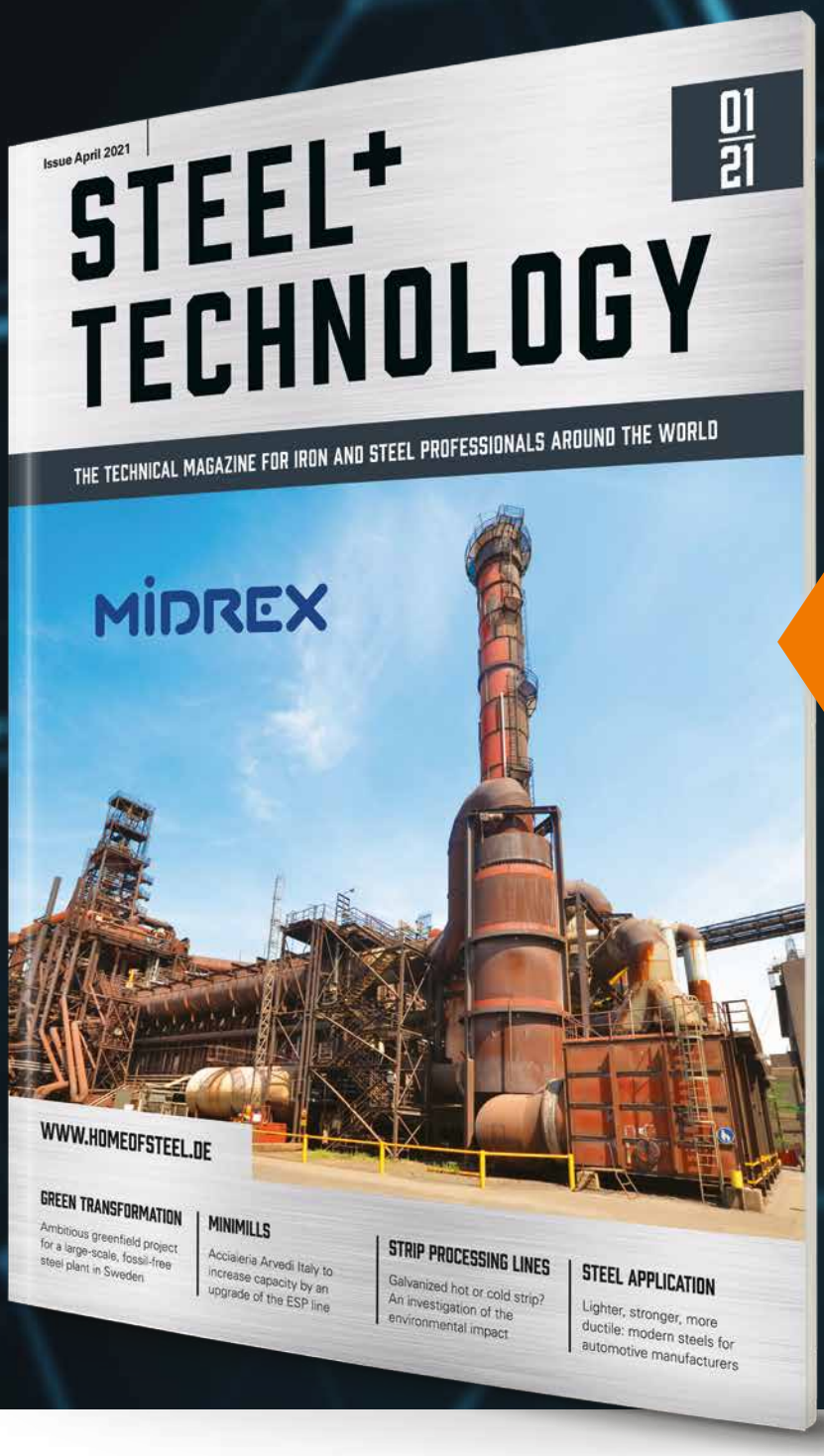

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